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# BOOK OF ABSTRACTS





ID 1018 R

**FUTURE AIRPORT STRATEGIES**

Main Author:

**Nathalie LENOIR** (*Ecole Nationale de l'aviation Civile*)**Abstract:**

In air transport, the evolution of traffic depends upon many economic factors, and on the way in which the markets participants respond to those factors. Although airlines are the main actors, the airports are by no means passive, and their strategies will also have an impact on airline behaviour and route development. Our methodology analyzes the potential evolution of airport strategies in the next decade and its impact on the distribution of traffic at airports, using a typology of airports that has been designed for this purpose. It shows in particular that diversification strategies, which are usually reserved for large firms, can also be successfully applied to smaller airports.

**Keywords:**

Air Traffic Management, Airlines, Airports, Aviation, Strategies.

ID 1674 R

**ASSESSING THE EFFICACY OF ADAPTIVE AIRPORT STRATEGIC PLANNING: RESULTS FROM COMPUTATIONAL EXPERIMENTS**

Main Author:

**Jan KWAKKEL** (*Delft University of Technology*)**Abstract:**

Airport development is increasingly difficult. One of these difficulties stems from uncertainty about future developments. Currently, airport development relies on Airport Master Planning (AMP). The goal of AMP is to provide a detailed blueprint for how the airport should look in the future, and how it can get there. However, among others because of the uncertainty about e.g. future demand, Master Plans often perform poorly. Alternatives to Airport Master Planning have emerged in the literature. The central idea of these alternatives is to have a plan that is flexible and over time can adapt to the changing conditions under which an airport must operate. We call such an approach Adaptive Airport Strategic Planning (AASP). However, AASP has not yet been applied in practice. One important reason for this lack of application is that its efficacy has not yet been established. In this paper, we apply Exploratory Modeling and Analysis, which uses computational experiments, to assess the efficacy of AASP across a large range of possible futures, for the case of Amsterdam Airport Schiphol. The results show that, given the same uncertainties, the range of outcomes from the adaptive plan is smaller than that of the Master Plan. So, the adaptive plan will expose an airport less to negative outcomes. These findings together suggest that AASP minimizes the downside risk without significantly reducing the upside potential. As such, AASP should be preferred to AMP for airport strategic planning.

**Keywords:**

Adaptive Policy, Airport Strategic Planning, Uncertainty, Exploratory Modeling and Analysis.

ID 2185 R

**EFFECT OF CREDIT RATINGS ON AIRPORT FINANCING AND MANAGEMENT**

Main Author:

**Koichiro TEZUKA** (*Faculty of Education and Regional Studies, University of Fukui*)

Co-author(s):

**Kazusei KATO** (*College of Economics, Nihon University*)

**Joyce LOW** (*National University of Singapore*)

**Abstract:**

This paper analyzes the effect of airport ownership structure on management efficiency as reflected through their credit ratings. A game-theoretical model is proposed to examine the role of credit ratings in mitigating the moral hazard problem of public-owned airports. The analytical results derived from the model are then used to supplement a supporting case study. Notwithstanding the fact that the less competitive environment of a public-owned entity and its credit ratings might bring some welfare loss, this research concludes that public-owned airports have some advantages.

**Keywords:**

Airport, Ownership, Revenue Bond, Credit Rating, Incentive Contract, Moral hazard, Hidden Action, Management Efficiency.

ID 2897 R

**VALUATION TECHNIQUES FOR AIRPORT INVESTMENTS: MAXIMIZING VALUE THROUGH FLEXIBILITY**

Main Author:

**Álvaro COSTA** (*Faculdade Engenharia do Universidade do Porto (FEUP)*)

Co-author(s):

**Mário COUTINHO DOS SANTOS** (*Faculdade de Economia e Gestão Universidade Católica Portuguesa*)

**Rui NEIVA** (*Faculdade de Engenharia da Universidade do Porto*)

**Carlos CRUZ** (*Instituto Superior Técnico*)

**Abstract:**

Investing in large transport infrastructures, as is the case of airports, is a risky venture subjected to all kind of uncertainties. Traffic volatility is one of the major concerns to airport authorities, public policy makers, regulators, and other stakeholders. Traditional airport planning paradigms, based on master plans and forecasts, seem inadequate to deal with a highly volatile environment in terms of economic, technological, and technical conditions. To try to overcome those sources of uncertainty concepts like flexible design of projects has arisen. To be successful in highly competitive and uncertain markets, airports have to be (dynamically) adaptable to changeable engineering systems, and create reliable links to the air transport value chain. This research focus on the analysis of the economic value of flexible airport design under a real options approach, which provides a framework to fill in the limitations of traditional valuation models, like the standard net present value. The analysis was conducted using a model developed by the authors, which was empirically implemented in a sample of Portuguese airports, to estimate the value underlying the flexibility in the design of different airport subsystems. The model can be regarded as a support system, able to help decision makers and project managers in strategic and tactical decisions regarding airport infrastructure project design, execution and management. The model uses both the free cash flow model, which requires an estimation of financial leverage of the project, and the more recent capital cash flow model, adequate for projects with high levels of financial leverage and/or variable capital structure.

**Keywords:**

Real Options, Uncertainty, Flexibility, Airport Design, Project Evaluation.



MON 12<sup>th</sup> (11:15 - 12:30, Session A1.1) Room AVII

ID 3210 R

**STRATEGIC FLEXIBLE PLANNING AND REAL  
OPTIONS FOR AIRPORT DEVELOPMENT IN INDIA**

Main Author:

**Hans HUBER** (*IIT-Bombay*)

**Abstract:**

With market liberalization established airports regularly had to face greater uncertainties with regards to their planned investments. However, airport authorities as well as private stakeholders (through international consortia) continue to invest in ever larger and more capital intensive infrastructures. With traffic forecasts having a legacy of being grossly inaccurate, major uncertainties regarding these long-term investments arise. In contrast to such practice, both literature and empirical evidence suggest that airport development should be undertaken in incremental steps, avoiding over-commitment of funds and being able to adapt to a changed environment, including changed patterns of competition. This research will highlight exemplary scenarios that characterize paths of airport development in India. A decision tree analysis will provide a helpful tool to identify those paths for airport development that will minimize uncertainty and prove more effective in fostering robust and efficient growth for the Indian air traffic system as a whole.

**Keywords:**

Airport development, Usage flexibility, Sunk costs.

MON 12<sup>th</sup> (14:00 - 15:15, Session A1.2) Room AVII

ID 1355 R

**RECONSIDERING THE REGIONAL AIRPORT  
NETWORK IN NORWAY**

Main Author:

**Gisle SOLVOLL** (*Bodø Graduate School of Business*)

Co-author(s):

**Terje MATHISEN** (*Bodø Graduate School of Business*)

**Abstract:**

A network of regional airports with short runways was established in Norway from the end of the 1960's to provide communications between rural towns and the main airports in the larger cities. Today, the transport services provided at these regional airports are less competitive due to considerable upgrade of road infrastructure. This article discusses a way to meet these challenges by reducing the number of regional airports. An example is given from Northern Norway where plans exist to replace three small regional airports with one medium sized airport. The joint airport is expected to remove the need for state subsidised flights (PSO-routes), reduce security upgrade costs and give lower fares and direct flights to more destinations. A reduction in the number of airports would require some sort of infrastructure improvements as compensation to municipalities for giving up their local airport.

**Keywords:**

Regional airports, Social efficiency, Regional development.

MON 12<sup>th</sup> (14:00 - 15:15, Session A1.2) Room AVII

ID 1374 R

**EXPLORING NETWORK EFFECTS OF POINT-TO-POINT NETWORKS: AN INVESTIGATION OF THE SPATIAL ENTRY PATTERNS OF SOUTHWEST AIRLINES**

Main Author:

**Xiaowen FU** (*Faculty of Business, Hong Kong Polytechnic University*)

Co-author(s):

**Jia YAN** (*Washington State University*)

**Tae OUM** (*University of British Columbia*)

**Abstract:**

This paper explores network effects in Point-to-Point airline networks by examining the spatial entry patterns of Southwest airlines during the 1990-2006 period. Estimation results from a spatial probit model reveal clear spatial dependence in profitability across different routes served by the carrier. Detailed investigation suggests two main sources of network effects, namely: (1) airport and regional presence, and (2) substitutability of markets. Findings of the paper suggest also that the network effects embedded in Southwest's Point-to-Point network have many distinguishing features as compared to those identified in a typical Hub-and-Spoke network. This study brings some fresh insights on airline network effects in general, as well as explains the pattern of aggressive network expansions of LCCs in particular.

**Keywords:**

Network Effects, Airline Entry, Low Cost Carriers,

MON 12<sup>th</sup> (14:00 - 15:15, Session A1.2) Room AVII

ID 1951 R

**THE PROPAGATION OF DELAYS IN A NETWORK OF AIRPORTS: THE APPROXIMATE NETWORK DELAYS MODEL**

Main Author:

**Amedeo ODONI** (*Massachusetts Institute of Technology*)

Co-author(s):

**Kerry MALONE** (*TNO*)

**Abstract:**

This paper is concerned with the propagation of delays within a large network of major airports. As more airports in the United States and in Europe become more congested, it also becomes increasingly likely that delays at one or more airports will spread to other parts of the network. We describe an analytical queuing and network decomposition model developed to study this complex phenomenon. The Approximate Network Delays (AND) model computes the delays due to local congestion at individual airports and, more important, captures the "ripple effect" that leads to the propagation of these delays. The model operates by iterating between its two main components: a queuing engine (QE) that computes delays at individual airports and a delay propagation algorithm (DPA) that updates flight schedules and demand rates at all the airports in the model in response to the local delays computed by the QE. The QE is a stochastic and dynamic queuing model that treats each airport in the network as a  $M(t)/Ek(t)/1$  queuing system. The AND model is very fast computationally, thus making possible the exploration at a macroscopic level of the impacts of a large number of scenarios and policy alternatives on system-wide delays. It has been implemented for a network consisting of the 34 busiest airports in the continental United States. The model provides insights into the complex interactions through which delays propagate through the network and the often-counterintuitive consequences of these interactions. For example, it shows how the propagation of delays tends to "smoothen" daily airport demand profiles, push more demands into late evening hours, and result in local delays which are smaller than what they would have been with the original demand profiles. (...).

**Keywords:**

Airport delays, Network of airports, Delay propagation.

ID 3175 R

**CONTINUOUS CONNECTIVITY MODEL FOR THE EVALUATION OF HUB-AND-SPOKE OPERATIONS**

Main Author:

**Yonghwa PARK** (*Inha University*)

Co-author(s):

**Sangyong LEE** (*Incheon International Airport Corp.*)**Kwang EUI YOO** (*Korea Aerospace University*)**Abstract:**

The deregulation of the air transport industry in Europe and the United States led airlines to reconfigure their networks into hub-and-spoke systems. Recent movements toward Open Skies in the Asian aviation market are also expected to prompt the reformation of airlines' networks in the region. A fine connectivity index is a crucial tool for airlines and airport authorities in the estimation of the degree of hub operations. In this regard, this paper suggests a new index, the Continuous Connectivity Index (CCI), for measuring the coordination of airlines' flight schedules and applies it to the Asian aviation market as well as the European and American markets. The CCI consists of three components: (i) temporal connectivity to readily identify long haul flight connections, which is related to the application of a continuous linear function, the new MCT (Minimum Connect Time) and the MACT (Maximum Acceptable Connect Time), (ii) spatial connectivity to differentiate the attractiveness by applying the de-routing effect with a continuous linear function, and (iii) relative intensity to reflect the effect of direct flight frequency on transfer routes. The CCI is evaluated by examining the casual relationship through regression analyses using two dependent variables: the number of transfer passengers and the transfer rate. Compared with Danesi's index and Doganis' index, the CCI had a higher coefficient of determination, implying a strong causal relationship with the dependent variables.

**Keywords:**

Connectivity, Hub-and-Spoke, Airline Networks, Transfer Passengers.

ID 3196 R

**AN OPTIMIZATION MODEL FOR THE EXPANSION OF AN AIRPORT NETWORK**

Main Author:

**António ANTUNES** (*Department of Civil Engineering, University of Coimbra*)

Co-author(s):

**Miguel SANTOS** (*Department of Civil Engineering, University of Coimbra*)**Abstract:**

Air transport has been growing at a fast pace for several decades. This has led to severe airport congestion problems everywhere in the world and, particularly, in the largest airports. In the short term, these problems can be dealt with through demand management measures. However, in the long run, they will be difficult to address without building new airports and/or expanding the capacity of existing airports. In this article, we introduce an optimization model aimed at helping air transport authorities in making these types of decisions. The model assists in determining the expansion actions to apply to a network of airports, while complying with a given budget. The objective is to maximize the total revenue passenger kilometers traveled within the airport network, taking into account the capacity of the airports and the impact of travel costs upon demand. The type of results that can be obtained through the application of the model is illustrated for a small size network.

**Keywords:**

Airports, Capacity Expansion, Air Transportation, Optimization Model.

ID 1019 R

**SINGLE OR DUAL TILL FOR AIRPORTS ? A TWO-SIDED MARKET ANALYSIS**

Main Author:

**Estelle MALAVOLTI** (*TSE (ENAC)*)**Abstract:**

Big airports profits are more and more often coming from commercial activities such as retailing. However, commercial services are relatively far from the original mission of the airport: providing airlines with aviation services such as ground handling, terminal management or airside operations, and being regulated for that because of an obvious dominant position with respect to airlines. For this reason, one can advocate for the separation of the two activities, i.e. for a dual till approach, in which only the aeronautical activity is regulated. We, instead, suggest that a single till regulation, in which the total profit of the airport is examined, is relevant because it allows to take into account the externalities existing between retailing and aeronautical services. Using a two-sided market approach (Armstrong 2006, Rochet-Tirole 2003, 2006), we show that the airport is a platform which makes the shops and the passengers meet. The retailing activity depends on how many passengers are circulating and connecting at the airport, as well as the time they spent in the airport, while passengers value the least connecting time as possible. We show that the aeronautical tax can be either higher or lower under single till depending on whether the impact of the passengers demand or of the waiting time is the more important for the shops.

**Keywords:**

Two-sided market, Network externalities, Air transport economics.

ID 1203 R

**MANAGING AIRPORT CONGESTION: FROM THEORY INTO POLICY PRACTICE**

Main Author:

**Michael MADAS** (*Athens University of Economics and Business*)

Co-author(s):

**Konstantinos ZOGRAFOS** (*Athens University of Economics and Business*)**Abstract:**

A substantial amount of research work has been documented in the literature with the aim to review and critically assess alternative approaches, instruments, and strategies aiming to deal with airport congestion through the allocation of scarce airport slots. The proposed instruments and strategies introduce various combinations of market-oriented or pure pricing allocation instruments in conjunction with administrative rules, measures, and procedures. Despite the comprehensive amount of research in this field, attempts to translate such measures into policy practice were very few and fragmented due to industry inertia and voices doubting the actual necessity or effectiveness of congestion management initiatives. Another major reason behind this stagnancy seems to be the lack of guidance as to how these instruments and measures can be integrated and implemented within an overall strategic policy framework for the allocation of scarce airport capacity. The objective of this paper is twofold: i) to provide quantitative evidence and justify the real need and motivation behind the adoption of a new congestion management regime, and ii) to formulate a policy roadmap that will guide the implementation process for a new congestion management regime at different types of airports.

**Keywords:**

Airport slot allocation, Congestion management, Policy implementation.

MON 12<sup>th</sup> (15:30 - 16:45, Session A1.3) Room AVII

ID 1527 R

**A COMPARISON OF THE APPROACHES ADOPTED TO REGULATING AIRPORTS IN IRELAND AND NEW ZEALAND**

Main Author:

**Margaret ARLASTER** (*ATRS*)

**Abstract:**

Recent discussion on whether airports can be considered 'natural monopolies' and warrant economic regulation mainly relates to larger economies where market circumstances often exert some constraint on the degree of market power that a major airport has. The economic characteristics of the aviation markets in the smaller economies of Ireland and New Zealand are likely to give rise to significant market power of the major airports in those countries. The issues associated with economic regulation of airports in smaller economies is examined through the experience of these two countries, which have some similar market characteristics but which have used very different approaches to economic regulation of their airports. Ireland has applied price caps to aeronautical charges at its largest airport, Dublin. New Zealand has recently amended its light handed approach to the regulation of its major airports. The approaches and experiences with regulation in each case are discussed.

**Keywords:**

Airports, Regulation, Ireland, New Zealand.

MON 12<sup>th</sup> (15:30 - 16:45, Session A1.3) Room AVII

ID 2211 R

**WHEN THE SHOE DOESN'T QUITE FIT: REGULATING LARGE COMMERCIAL AIRPORTS WITH EXPANDING ROLES**

Main Author:

**Stephen APPOLD** (*Kenan Institute of Private Enterprise, University of North Carolina*)

Co-author(s):

**Douglas BAKER** (*Queensland university of Technology*)

**Abstract:**

Airports, whether publicly or privately owned or operated fill both public and private roles. They need to act as public infrastructure providers and as businesses which cover their operating costs. That leads to special governance concerns with respect to consumers and competitors which are only beginning to be addressed. These challenges are highlighted both by shifts in ownership status and by the expansion of roles performed by airports as passenger and cargo volumes continue to increase and as nearby urban areas expand outward towards airports. We survey five ways in which the regulatory shoe doesn't quite fit the needs. Our findings suggest that, while ad hoc measures limit political tension, new governance measures are needed.

**Keywords:**

Airport, Privatization, Regulation, Airport Cities.



ID 1311 R

**SOLUTION THE AIRPORT CHECK-IN COUNTER ASSIGNMENTS PROBLEM**

Main Author:

**Chi-Ruey JENG** (*Shu-Te University*)

Co-author(s):

**Tay-Lin HWANG** (*Chang Jung Christian University*)**Sin-Siang WANG** (*National Central University*)**Abstract:**

The market of air transportation suffered severe impact since the depression of global economy and the external environment effect in recently. How to find the way to survive will become the most important task of airlines. Airline passengers typically spend a great deal of time in check-in process, especially during peak hours. This process significantly affects passenger perception of service quality. Thus, how to utilize check-in counters efficiently at airport passenger terminals is a major concern of airport operators and airlines. Since, counter assignments in airport system play a very important role. Efficient counter assignment will be not only to replace time-consuming of manpower allocation but also to advance operational efficiency of counter. The objective of this research is to establish the operating pattern for airport check-in counter assignments by minimizing the operational cost from the perspective of airline in addition to the service level of passengers with considering the use of KIOSK machine and regular/part-time duty counter personnel. According to the experiment result and sensitivity analysis by using the real airport operation data can find that to allocate part-time duty counter personnel and use KIOSK machine can significantly reduce counter operation cost and improve the service level of passengers. The market of air transportation suffered severe impact since the depression of global economy and the external environment effect in recently. How to find the way to survive will become the most important task of airlines. Airline passengers typically spend a great deal of time in check-in process, especially during peak hours. This process significantly affects passenger perception of service quality. (...).

**Keywords:**

Check-in counter, KIOSK, Service level, Airport.

ID 1334 R

**ANALYSIS OF CRITERIA FOR REDUCED-SPACED PARALLEL RUNWAY APPROACHES: THE APPLICATION OF PRM/SOIA IN SÃO PAULO AIRPORT**

Main Author:

**Claudio ALVES****Abstract:**

In order to increase arrival rates at many of today's heavily congested airports, simultaneous approaches are conducted on parallel runways. For many years, the FAA has recommended simultaneous independent instrument approach operations only for those parallel runways with a minimum distance of 4300 feet. Nowadays, new criteria have been developed to increase the use of parallel runways, one of these procedures, called PRM/SOIA (Precision Runway Monitor/Simultaneous Offset Instrument Approach), make simultaneous approaches possible in systems of runways spaced as close as 750 feet. On October 26, 2004, San Francisco International Airport (SFO) implemented a PRM/SOIA landing system reportedly allowing the airport to increase the capacity of runways in inclement weather conditions up to twenty-five percent. This research, using a computer simulation tool, analyzes simultaneous approaches procedures in closely-spaced runways, addressing the potential benefits of the implementation of PRM/SOIA at São Paulo/Guarulhos International Airport (GRU) along with the influence at other airports inside the same terminal airspace (São Paulo Terminal Area – TMA-SP). Simulation results indicate that 45 to 51% decreases in total airborne flight delays associated with flights under instrumental rules (IFR) can be achieved at the TMA-SP with PRM-SOIA usage at GRU. We also achieved an 18% increase in the arrivals capacity of TMA-SP. However, the simulation results also show increases in delays both in the departure procedures (ground queue at a specific airport) and in the airborne approaches of flights bounded to a specific airport at TMA-SP.

**Keywords:**

Runway capacity, Airport, Saturation.

ID 2086 R

**EVALUATION OF PASSENGER FLOW LINES IN INTERNATIONAL AIRPORT TERMINALS**

Main Author:

**Daisuke FUKUDA** (*Tokyo Institute of Technology*)

Co-author(s):

**Seitaro MATSUO** (*Tokyo Institute of Technology*)**Tsuyoshi HATORI** (*Tokyo Institute of Technology*)**Abstract:**

Airport terminals offer a wide variety of functions for both departing and arriving passengers. How best to offer hospitality to passengers, including visitors from abroad, is a major concern of airport managers. Given multiple functions, comprehensive evaluation of airport passenger terminals is crucial for planning, designing, and managing airport performance. The typical evaluation methods of airport terminal performance, however, have not included passenger perspectives, particularly the physical aspects of passenger flow lines in airport terminals. This study focuses on airport passenger flow lines inside international terminal facilities and develops a flow line evaluation index that considers some physical characteristics of terminal facilities. The proposed framework can help airport planners and managers design and operate terminals in manners that are favourable from the perspective of passengers. We apply the proposed index to the data collected in various airport terminals in the world. The surveyed items are weighed based on the judgments of airport experts to conduct comprehensive evaluation. The multidimensional scaling is also applied to visualize various terminal functions and passenger perspectives systematically.

**Keywords:**

Airport terminals, Evaluation, Multidimensional scaling, Passenger flow line.

ID 2865 R

**A NEW SOLUTION APPROACH FOR THE AIRPORT GATE ASSIGNMENT PROBLEM FOR HANDLING OF UNEVEN GATE DEMANDS**

Main Author:

**Hakki GENÇ****Abstract:**

Airport Gate Assignment problem increases its importance with the growing demand on airport transportation. An efficient gate assignment that satisfies constraints specific to the airport has an important role in the revenue obtained from the airport operations. Besides, if an appropriate objective function is chosen, it may increase customer satisfaction by decreasing passenger walking distances within the airport and reduce the probability of bus transfers that may occur between airplane parking aprons and airport terminal. Constructing performance measures heavily depends on the needs of the operation control unit. Designing and weighting the objectives uniquely defines the problem at hand. Because of this, formulation and solution of airport gate assignment problems can vary quite a lot. In this work the Airport Gate Assignment Problem (AGAP) is formulated as to minimize the vacant time duration of the gates. That is to say, the algorithm tries to assign planes as to fill up the (preferred) gates as much as possible. The objective of the allocation can be supervised by maximizing the revenue obtained. Previous work carried on the subject can be investigated in many sub-categories: Single Objective Problems – Multi Objective Problems; Greedy Search Routines – Evolutionary Computation Methods; Deterministic Approaches – Stochastic Approaches; Single Time Slot Models – Multiple Time Slot Models, etc. One can easily extend this classification with respect to objective functions used or mathematical models imposed. The common aspect for all these solution approaches is that they do not credit for the distribution of gate allocation demand throughout the day. But there is relatively considerable accumulation for certain time durations in a complete day. (...).

**Keywords:**

Gate assignment problem, Prime time, Heuristic assignment algorithms.

MON 12<sup>th</sup> (17:00 - 18:15, Session A1.4) Room AVII

ID 2868 R

**IMPROVING ON AIRPORT'S GROUND HANDLING**

Main Author:

**Katalin BITE** (*BUTE-Faculty of Transportation Engineering  
Department of Transport Economics*)

**Abstract:**

An integrated RFID and GIS system serves as the foundation of the unified identification and tracking for passenger, staff, luggage and freight, ground handling equipment. It includes the identification and tracking of all moving objects on the airport, thus enabling the operative management of business processes, the detection of errors and potential security breaches (e.g. unauthorized access). The costs associated with the loss of luggage, delays caused by late passenger can be reduced or avoided. The service level of the airport increases, while the associated costs are reduced and the ground handling of airports can be improved.

**Keywords:**

RFID, Ground Handling, GIS, Benefit.

TUE 13<sup>th</sup> (08:15 - 09:30, Session A1.5) Room AVII

ID 1100 R

**AIRLINE MERGER AND MARKET STRUCTURE  
CHANGE IN JAPAN: A CONDUCT-PARAMETER AND  
THEORETICAL-PRICE APPROACH**

Main Author:

**Jun MIZUTANI** (*Osaka University of Commerce*)

**Abstract:**

In 2003, the domestic air transportation market in Japan changed from tripoly with All Nippon Airways (NH), Japan Airlines (JL) and Japan Air System (JD) to duopoly with NH and the new Japan Airlines (JJ), the result of the merger of JL and JD. This paper empirically examines the merger effects on the market competition structure using conduct parameter and theoretical price approaches. One might say that the merger changed the market structure because Stackelberg competition with NH as a leader and JL and JD as followers had been developed before the merger, and Cournot competition with NH and JJ developed after the merger.

**Keywords:**

Airline industry, Merger effects, Cournot competition, Stackelberg competition.

ID 2036 R

**AIRLINES' COMPETITIVE POSITIONING USING  
MULTIPLE CORRESPONDENCE CLUSTER ANALYSIS**

Main Author:

**Chieh-Hua WEN** (*Feng Chia University*)

Co-author(s):

**Wei-Ying CHEN** (*Feng Chia University*)**Abstract:**

Due to the recent recession of the world economy, the number of international air travellers has substantially decreased. Consequently, many airline companies have failed to remain in aviation industries. By proper market positioning, airline companies can recognize major strengths and weaknesses within their services. This paper investigates competitive positioning for international airlines by using a positioning technique that integrates a multiple correspondence analysis with cluster analysis. The multiple correspondence analysis can illustrate the relative positions of airlines, service attributes and travellers' characteristics in a perceptual map. Cluster analysis is a complementary technique that clearly identifies competitive groups of airlines and key service attributes associated with these competing carriers. This study empirically examines the international airlines serving the Taipei-Tokyo and Taipei-Osaka route and collects data from air travellers with diverse cultural backgrounds. The results of the multiple correspondence analyses reveal the competitive positions of five airlines in a two-dimensional map. Two closely located on the perceptual map Japanese carriers, Japan Asia and Air Nippon Airways, mostly attracts Japanese, male, high-income and business travellers. Another competing group consists of Eva and Cathay Pacific Airways, in which most customers are Taiwanese, female, middle-income and nonbusiness travellers. With a unique position in the map, because China Airlines set a lower ticket price than the other airlines, its core customers are low-income travellers. Based on the results, managerial strategies are composed for the airlines in order to maintain their competitive advantage. (...).

**Keywords:**

Airline, Service quality, Multiple correspondence analysis, Cluster analysis.

ID 2232 R

**OPERATION COST CONTROL STRATEGIES FOR  
AIRLINES**

Main Author:

**Pei-Chi SHAO** (*Department of Transportation and Communication Management Science, National Cheng Kung University*)

Co-author(s):

**Yu-Hern CHANG** (*National Cheng Kung University*)**Abstract:**

The purpose of this study is to explore the ranking of international airlines operation cost control strategies based on empirical studies of an international full-service airlines operation in Taiwan. Cost control has become more and more important for airlines in recent years, especially after experiencing a severe increase in crude oil prices and the 2008 serious financial crisis. In this study, the criteria and strategies were extracted from questionnaires answered by airline industry experts and evaluated using fuzzy Delphi method. Then the cost control strategies were ranked using the analytic hierarchy process (AHP). The findings of this study can provide international full-service airlines with five key criteria for the operational cost control including fuel cost reduction policy, employee' productivity improvement, flight operations, aircraft maintenance cost reduction, and operation procedure simplification. By ranking these potential cost reduction strategies, we identified the top ten significant strategies out of twenty-one that branched out of their upper five criteria. They include: (1) optimizing aircraft fleet dispatch, (2) conducting fuel hedging strategies, (3) improving aircraft fuel saving performance, (4) reducing the dead weight of an aircraft, (5) optimizing flight speeds using the efficient cost index, (6) scheduling reasonable flight hours for flight crew, (7) correcting en route flight plans and alternate airports, (8) increasing direct ticket sales, (9) encouraging employees to provide cost-control strategies, and (10) replacing old aircraft. Therefore, this study uncovered airlines operation cost-control strategies and ranked them in order to establish guidelines for international airlines on the distribution of operational resources. (...).

**Keywords:**

Airline, Operation cost control, Fuzzy Delphi, Analytical hierarchy process.

TUE 13<sup>th</sup> (08:15 - 09:30, Session A1.5) Room AVII

ID 2390 R\*

**STRATEGIC MANAGEMENT IN THE AIRLINE BUSINESS: THE ENTERPRISE SUSTAINABILITY RISK MANAGEMENT CONCEPTUAL MODEL**

Main Author:

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Co-author(s):

**Triant FLOURIS** (*Dean, School of Aviation Sciences*)

**Abstract:**

The Enterprise Sustainability Risk Management (ESRM) conceptual model applied to the strategic management of the airline business offers a road map, which provides a contextual framework for those businesses serious about addressing the challenges and opportunities of sustainable development. This study aims to make a contribution to the literature on strategic risk management by deploying an enterprise risk management based perspective and a systematic approach for airline businesses. The Enterprise Sustainability Risk Management Framework is designed to provide guidance to managers on how to establish a holistic and systematic sustainability risk management process that generates the risk indicators, risk sources, objectives, and reporting systems needed to ensure the effective handling of sustainability risks and improved overall organizational performance and value.

**Keywords:**

Airline management, Business and management, Risk, Risk management, Strategic management, Sustainability, Value. JEL Classification Codes: M100, M140, M190.

TUE 13<sup>th</sup> (09:45 - 11:00, Session A1.6) Room AVII

ID 1780 R

**THE AIRFARE EFFECTS OF AIRLINE ALLIANCES ON COMPLEMENTARY ROUTES**

Main Author:

**Li ZOU** (*Embry-Riddle Aeronautical University*)

Co-author(s):

**Tae OUM** (*University of British Columbia*)

**Chunyan YU** (*Embry-Riddle Aeronautical University*)

**Abstract:**

This paper investigates the impacts of complementary alliance on airfares. The conventional wisdom argues that complementary airline alliances reduce airfares for passengers on the flowthrough routes as a result of the elimination of double marginalization and efficiency gain. On the other hand, complementary alliances help improve connecting services through one-stop check-in, better schedule coordination, etc., such that passengers are willing to pay higher prices for the enhanced services. That is, complementary alliances have both positive and negative effects on airfares for flow-through tickets that counteract each other. The net impact, therefore, is uncertain, a priori. Our theoretical model shows that the overall effects of complementary alliances on airfares depend on the relative strengths of the airfare reducing effects due to cooperative pricing setting and the increased willingness to pay for services improvements. Our empirical analysis based on data from the North trans-Pacific markets in October 2007 finds that member airlines of Star Alliance and Skyteam Alliance appear to charge significantly higher prices for through-tickets than the sum of segment fares on complementary routes, whereas for oneworld Alliance members, the upward and downward effects on airfares seem to counterbalance each other. Moreover, the price markup for through ticket is higher for business passengers than for leisure passengers.

**Keywords:**

Complementary Alliances, Airfare, Double Marginalization.



TUE 13<sup>th</sup> (09:45 - 11:00, Session A1.6) Room AVII

ID 2224 R

**IMPACT OF OPERATIONAL PERFORMANCE ON AIR CARRIER COST: EVIDENCE FROM U.S. AIRLINES**

Main Author:

**Bo ZOU** (*National Center of Excellence for Aviation Operations Research, Institute of Transportation Studies, UC Berkeley*)

Co-author(s):

**Mark HANSEN**

**Abstract:**

Delay cost to airlines is an important component in the economic impact of flight delays. Different from many existing studies, this study employs a total cost approach to estimate the relevant cost. Recognizing delay is per se part of the volatility of flight time, we develop two sets of operational performance metrics to characterize this volatility, from different perspectives. The first set considers delay and buffer, while the second one bases upon the relationship between actual and scheduled flight time. The relationship between airline operational performance and cost are examined by estimating airline cost functions that include these performance metrics as arguments. Estimation results confirm the anticipated impact of operational performance on airline cost. The potential savings to airlines that would result from improved operational performance are estimated, and these are compared with previously published estimates.

**Keywords:**

Operational performance, Flight time volatility, Airline cost structure, Translog model, US Airlines.

TUE 13<sup>th</sup> (09:45 - 11:00, Session A1.6) Room AVII

ID 2300 R

**OPTIMAL DIFFERENTIATION AND NUMBER OF AIRLINE FARE TYPES**

Main Author:

**Christiaan BEHRENS** (*VU University Amsterdam*)

Co-author(s):

**Eric PELS** (*VU University Amsterdam*)

**Abstract:**

In order to maximize profits and strengthen market position airlines use yield management. Product differentiation in airline economics, offering different fare types, different prices, services and qualities, is an important element of yield management. In this paper we address the strategic behavior of airlines regarding product differentiation using a non-localized competition random utility model. Here, the airlines are explicitly assumed to differentiate products in terms of price, quality, and number of fare types. The theoretical optimal patterns of product differentiation as well as the effects on airline profits and social welfare in a duopolistic market are analyzed. The purpose of the analysis is twofold: to make trade-offs in product differentiation explicit and subsequently studying the underlying factors of this trade-off. The analysis shows that airlines have an optimal number of variants (fare types) which is dependent on the underlying price-quality game, cost factors, the relative valuation of quality and the interfirm and intrafirm unobserved heterogeneity. Furthermore, we find that the patterns of product differentiation, as encountered in the real world, can only be explained in the random utility framework under strict assumptions about unobserved heterogeneity at the demand side of the model (not earlier indicated in the literature).

**Keywords:**

Discrete Choice Theory, Product Differentiation.

TUE 13<sup>th</sup> (09:45 - 11:00, Session A1.6) Room AVII

ID 2376 R

**AIRLINE PROFIT ESTIMATION MODEL IN CASE OF PURCHASING NEW SLOTS FOR ROUTE NETWORK EXPANSION**

Main Author:

**Danica PAVLOVIC**

Co-author(s):

**Milica KALIC** (*Faculty of Transport and Traffic Engineering, Univ. of Belgrade*)

**Abstract:**

If an airline today wants to operate at certain airport it is necessary to possess an airport slot. Therefore, the quality of service of an airline in a sense of number of routes and frequencies will depend on the allocation of slots at congested airports. The model and algorithm presented in this paper are developed with the goal to create a new flight schedule that consists of all flights already operated by an airline as well as the flights assigned to new slots (purchased at the secondary market), where the airline's revenues should be maximized while all the assumptions and the operational constraints must be satisfied. The model outputs are: the new flight schedule, estimation about the number of years needed to refund the initial outlay for purchasing the new slots and the number of potential connections that airline could realize if it introduces the new slots.

**Keywords:**

Airport slots, Airline profit, Decision-making model.

TUE 13<sup>th</sup> (09:45 - 11:00, Session A1.6) Room AVII

ID 2777 R

**ON THE EQUIVALENCE OF CONGESTION PRICING AND SLOT AUCTIONING AT CONGESTED AIRPORTS**

Main Author:

**Leonardo BASSO** (*Civil Engineering Department, Universidad de Chile*)

**Abstract:**

This paper analyzes the slot-auction approach to management of airport congestion. The rationale for the approach is that first-best pricing leads to tolls that are differentiated across carriers and therefore seems to be hard to implement; the hope is that slot-auctioning would lead to the first-best while avoiding the problems of perceived unfairness. By using an airline duopoly model with general demand and cost conditions, I show that slot-auctioning will not necessarily lead to the efficient outcome, contrary to previous results in the literature. Specifically, I show that: (i) slot auctioning does not lead to the exit of carriers that would be active in the first-best yet, if a carrier exits, the remaining carrier can and will exert market power (unless it has none), leading to social welfare losses (ii) even if slot auctioning does not lead to market foreclosure, it will not be efficient unless airlines have no market power, or are completely symmetric (iii) slot auctioning might lead to outcomes that are worse from a welfare point of view than doing nothing.

**Keywords:**

Airport congestion, Congestion pricing, Slots, Slot Auctions.

TUE 13<sup>th</sup> (11:15 - 12:30, Session A1.7) Room AVII

ID 2040 R

**EVALUATION OF PRIORITY QUEUE DISCIPLINES FOR AIRCRAFT OPERATIONS IN NEXTGEN**

Main Author:

**Tasos NIKOLERIS** (*UC Berkeley*)

Co-author(s):

**Mark HANSEN**

**Abstract:**

This paper develops a queueing model for aircraft landings at a single runway under trajectory-based flight operations. The situation is expected to arise in the Next Generation Air Transportation System. Aircraft are assigned scheduled times of arrival, which they meet with some normally distributed stochastic error. The Clark approximation method is employed to derive estimates for the mean and variance of queueing delays. Next, the efficiency of queue disciplines that give priority to aircraft capable of flying 4D trajectories with high precision is investigated. It is found that under certain conditions it is possible to obtain significant delay savings for equipped aircraft, without increasing total delay for the system.

**Keywords:**

NextGen, Trajectory-based operations, Queueing model, Best-Equipped-Best- Served.

TUE 13<sup>th</sup> (11:15 - 12:30, Session A1.7) Room AVII

ID 2217 R

**DETERMINATION OF DELAY FACTORS IN DOMESTIC PASSENGER FLIGHTS USING AHP TECHNIQUE**

Main Author:

**Abdolreza REZAAE ARJROODY** (*TRANSPORTATION RESEARCH INSTITUTE*)

Co-author(s):

**Fardad SARKESHIKI** (*Tarh Mandegar Aria Consulting Engineers*)

**Khalil ZAMANI** (*Transportation Research Institute, Tehran, Iran*)

**Abstract:**

Currently, the issue of delays of flights is one of the important and considerable issues in flights, which caused the reduction of desirability of air voyages and widespread dissatisfaction of passengers around the World. It has numerous and various causes. In addition, in accordance with studies performed throughout the World, considerable costs are incurred by flight companies, airports and passengers because of it. The important point is that the delays in air transportation is a very complicated and multi-dimensional issue and phenomenon, the understanding of which requires researches in the field of determination of the main factors in its occurrence and evaluation of them, taking into account various conditions. Some issues are indicated below for the determination of causes and factors effective on the occurrence of flight delays in Iran. Naturally, such selection cannot be made only on the basis of imaginations and personal views, but decisions should be taken on this issue on the basis of scientific methods with the application of all effective factors. Six distinct data bases are found out on the basis of the above and existing papers and documents. Finally, an Analytic Hierarchy Process was achieved on the basis of a combination of these sources to determine factors with effects on the occurrence of flight delays, taking into account the objective of project. It is noteworthy that Analytic Hierarchy Process (AHP) is the performed scientific process, which is a flexible, powerful and simple technique used for taking decisions in conditions, where conflicting decision making criteria make it difficult to select from among options. (...).

**Keywords:**

Delay Factors, Domestic Passenger Flights, AHP Technique.

TUE 13<sup>th</sup> (11:15 - 12:30, Session A1.7) Room AVII

ID 2366 R

**DECISION SUPPORT SYSTEM FOR AIRLINE  
SCHEDULE RECOVERY**

Main Author:

**Slavica DOZIC** (*University of Belgrade, The Faculty of  
Transport and Traffic Engineering*)

Co-author(s):

**Milica KALIC** (*Faculty of Transport and Traffic  
Engineering, Univ. of Belgrade*)

**Obrad BABIC** (*University of Belgrade, The Faculty of  
Transport and Traffic Engineering*)

**Abstract:**

The airline schedule recovery problem is problem that dispatchers at the Airline Operations Centre (AOC) face on daily basis. The consequences of flight schedule disturbances are flight delays, flight cancellations, passenger loyalty loss, etc., which lead to additional airline costs. In order to reduce negative effects of flight schedule disturbance, induced by meteorological conditions, aircraft failure, etc. a decision support system for handling airline schedule recovery problem is developed aiming to assist the decision makers in handling disturbances in a real time. This system is based on a heuristic algorithm which generates a list of different feasible schedules ordered according to the value of an objective function. The possibilities of decision support system are illustrated by real numerical example that concern middle size European airline's flight schedule.

**Keywords:**

Daily Operational Flight Schedule, Airline Schedule Recovery, Disturbance, Decision Support System.

TUE 13<sup>th</sup> (11:15 - 12:30, Session A1.7) Room AVII

ID 2492 R

**A FLIGHT SCHEDULING AND FLEET ASSIGNMENT  
MODEL**

Main Author:

**Daniel CAETANO** (*Universidade de São Paulo*)

Co-author(s):

**Nicolau GUALDA** (*Escola Politécnica da Universidade de  
São Paulo*)

**Abstract:**

The main objective of this paper is the proposition of a model to optimize the network to be served by an airline, solving, in an integrated way, the flight schedule definition and the fleet assignment problems. The model includes specific operational constraints like takeoff and landing slots and limited flexibility on airport options due to a traffic mainly composed by passengers. The model was successfully applied to a Brazilian regional airline case, which resulted in a complete schedule and provided information to support decisions on new possible flights or other aircraft type utilization.

**Keywords:**

Flight scheduling, Fleet assignment, Linear programming, Tactical planning.

TUE 13<sup>th</sup> (11:15 - 12:30, Session A1.7) Room AVII

ID 2775 R

**EFFICIENT UTILIZATION OF AIRPORT CAPACITY UNDER FREQUENCY COMPETITION**

Main Author:

**Vikrant VAZE** (*Massachusetts Institute of Technology*)

Co-author(s):

**Cynthia BARNHART** (*Massachusetts Institute of Technology*)

**Abstract:**

Demand often exceeds capacity at the congested airports. Various strategic slot control mechanisms are used to bring demand and supply in balance. Given a slot allocation strategy, the profitability of an airline depends not only on its own schedule but also on competitors' schedules. We propose a game-theoretic model of airline frequency competition under slot constraints. The model is solved to obtain a Nash equilibrium using a successive optimizations approach, wherein individual optimizations are performed using a dynamic programming-based technique. The model predictions are validated against actual frequency data, which indicates a close fit to reality. We use the model to evaluate different slot allocation strategies from the perspectives of various stakeholders. The most significant result of this research shows that, a small reduction in total number of slots translates into not only a substantial reduction in airport congestion and delays, but also a considerable improvement in airlines' profitability.

**Keywords:**

Airlines, Competition, Airport, Congestion, Profitability, Game theory, Nash equilibrium.

TUE 13<sup>th</sup> (14:00 - 15:15, Session A1.8) Room AVII

ID 1263 R

**BURNOUT AND WORK ENGAGEMENT AMONG TAIWANESE FLIGHT ATTENDANTS: THE APPLICATION OF JOB DEMANDS-RESOURCES MODEL**

Main Author:

**Shu-Chuan CHEN** (*Dept. of Aviation Service Management, Aletheia University*)

Co-author(s):

**Ching-Fu CHEN** (*Dept. of Transportation & Communication Management Science, National Cheng Kung University*)

**Abstract:**

This study investigates the relationships between antecedents and consequences of flight attendant's burnout and work engagement using a sample of 305 Taiwanese flight attendants. The Job Demands-Resources (JD-R) model is applied to construct the antecedents while flight attendant's health problems and turnover intention are chosen as the consequences. The results reveal that job demands positively relate to burnout while job resources positively relate to work engagement but negatively relate to burnout. In addition, burnout is detrimental to health, which directly induces turnover intention. However, elevating the levels of work engagement efficaciously reduces flight attendant's turnover intention.

**Keywords:**

Job Demands-Resources model, Burnout, Work engagement, Health, Turnover intention, Flight attendants.



TUE 13<sup>th</sup> (14:00 - 15:15, Session A1.8) Room AVII

ID 1624 R

**BURNOUT AND ISOLATION AMONG FLIGHT ATTENDANTS: A TEST OF THE JOB DEMANDS-RESOURCES MODEL**

Main Author:

**Ya-Ling KAO** (*Department of Transportation and Communication Management Science, National Cheng Kung University*)

Co-author(s):

**Ching-Fu CHEN** (*Dept. of Transportation & Communication Management Science, National Cheng Kung University*)

**Abstract:**

Flight attendants are typically characterized as being engaged in 'emotional labour,' which is defined as the effort, planning, and control needed to express organizationally desired emotions during interpersonal transactions. Emotional labour is always stressful and may result in negative job outcomes or health problems. Therefore, drawing on the main propositions of the JD-R model, together with the results of previous research on flight attendants, this study empirically investigates the relationships among job demands, job resources, burnout, colleague isolation, health problems and job performance. A self-administered flight attendant questionnaire is designed to collect empirical data from individuals working at Taiwanese airlines. The hypotheses model is tested using structural equation modelling (SEM). The results of this study confirm that burnout mediates the relationship between job demands and health problems, and that colleague isolation mediates the relationship between job resources and job performance. The empirical implications of the results are also discussed in detail.

**Keywords:**

Job demands-resources model, Burnout, Colleague isolation, Job performance, Flight attendants.

TUE 13<sup>th</sup> (14:00 - 15:15, Session A1.8) Room AVII

ID 2576 R

**COMMUNICATION SKILLS: A MANDATORY COMPETENCE FOR GROUND AND AIRPLANE CREW TO REDUCE TENSION IN EXTREME SITUATIONS**

Main Author:

**Ana VIEIRA** (*Instituto Tecnológico de Aeronáutica (ITA)*)

Co-author(s):

**Isabel DOS SANTOS** (*Universidade de Taubaté*)

**Abstract:**

The main objective of the present work paper is to discuss the relevance of developing communication skills beyond technical communication among different levels of airplane operations, particularly, during a flight under extreme situations. Conclusions obtained so far have pointed out the urgency of inserting the subject "Communication as a social interaction skill: theory and practice" into the curricular disciplines of Aviation schools, regarding communication and social skills as a fundamental requirement for the graduates to obtain the necessary discernment for becoming active professionals in the aviation industry. At the basic stage of their education, the graduates should essentially receive knowledge on nontechnical issues, which could provide them with a concern about the universe in which their profession is performed, and with the ability to overcome future adversities, always prioritizing safety in the flights. In order to achieve a broader debate on this subject, the present research has been defined as a qualitative approach, and guided by incidents reported in the United States through the ASRS (Aviation System Safety Report), as well as reports of accidents provided by The National Transportation Safety Board (NTSB) and Centro de Investigação e Prevenção de Acidentes (CENIPA, Brasil).

**Keywords:**

Airplane Operations. Communication Skills. Flight Safety. Managing Risks.

TUE 13<sup>th</sup> (14:00 - 15:15, Session A1.8) Room AVII

ID 2861 R

## **AIRLINE CREW SCHEDULING IN THE BRAZILIAN CONTEXT**

Main Author:

**Wagner GOMES** (*Escola Politécnica da Universidade de São Paulo*)

Co-author(s):

**Nicolau GUALDA** (*Escola Politécnica da Universidade de São Paulo*)

### **Abstract:**

This paper treats the Crew Scheduling Problem (CSP), important part of the airlines operational planning. The CSP is usually divided, in the literature, into two subproblems, formulated and solved sequentially: Crew Pairing Problem (CPP) and Crew Rostering Problem (CRP). This decomposition is justified by its combinatorial nature, but it does not provide a global treatment to the CSP, in terms of cost and quality of final solution. Therefore, the state of the art involves the integrated solution of CSP, with both subproblems (CPP and CRP) solved simultaneously. The problem, however, is NP-Hard. The methodology proposed in this paper aims to obtain an integrated solution of the CSP through a hybrid genetic algorithm associated with a depth-first search procedure, taking into account the proper crew legislation. The methodology was tested, with success, to solve instances related a network of a Brazilian airline.

### **Keywords:**

Air transportation, Airline crew scheduling, Metaheuristic, Hybrid genetic algorithm, Depth-first search.

TUE 13<sup>th</sup> (15:30 - 16:45, Session A1.9) Room AVII

ID 1301 R

## **STRUCTURAL ANALYSIS OF VLJ AIR TAXI CUSTOMER PREFERENCES**

Main Author:

**Andreas WITTMER** (*University of St. Gallen*)

Co-author(s):

**Tim BÖTTGER** (*University of St. Gallen*)

### **Abstract:**

The arrival of very light jets (VLJ) also sparked new business models including models for VLJ air taxi operators. Those operators rely on the expected low acquisition and operating costs of VLJ's to provide on-demand, point-to-point air transport services at a competitive price. However, at present, the success of those emerging air taxi services is still to be realized. One of the critical success factors of the emerging VLJ air taxi services will be their ability to generate superior customer value in comparison to other means of transport. The objective of this study is to gain insights into the structure of customer preferences of potential passengers of VLJ air taxi operators. The Kano model was used to analyze perceived customer value factors. The structural analysis showed the different ways each factor influences the preferences of the potential customers. Risk factors such as safety and reliability are taken for granted. Benefit factors such as sympathy and mileage program are not important factors for potential air taxi passengers. But time has a linear impact on customer value depending on the fulfillment based on the expectation. Price, flexibility, network, comfort and service positively influence customer preference.

### **Keywords:**

Air taxi services, Very light jets, Customer value, Customer preferences.

ID 1302 R

**IMPACT OF AIRLINES' ENVIRONMENTAL PROTECTION POLICIES ON PASSENGERS CHOICE OF AIRLINE**

Main Author:

**Andreas WITTMER** (*University of St. Gallen*)**Abstract:**

Climate change is one of the most serious problems the world faces today. The aviation industry has been in the spotlight for its contribution to global warming. Yet this has not brought the demand for air travel to a halt. The rising demand has been met by governments imposing regulations and international organizations issuing recommendations. Airlines have adapted to this eco-minded trend. Passengers are given the opportunity to offset their CO<sub>2</sub> emissions. Furthermore, airlines have engaged in corporate environmental responsibility to reduce their impact on global warming. This begs the question whether passengers are fully aware of the efforts taken by airlines to protect the environment and if this knowledge influences potential customers in choosing a certain airline. This paper discusses the topic by taking the case of Swiss International Air Lines (SWISS) passengers at Zurich Airport. It was found that passengers are not fully aware of the efforts taken by the airline. But passengers are interested in an airlines environmental responsibility and it was found that the airlines action is appealing to customers. However, the price plays an important role for passengers when choosing an airline also when it is more environmentally responsible. Furthermore, there is a relation between the environmental activities of an airline and the brand image. The brand of the airline is strengthened, if it is engaged in environmental activities and communicates them efficiently to passengers.

**Keywords:**

Customer value, Airlines, Environment, Emissions.

ID 1454 R

**SUSTAINABILITY OF FEEDER AND SHORT-HAUL AIR TRANSPORTATION SYSTEMS IN INDIA: EMERGING ISSUES AND FUTURE PERSPECTIVES**

Main Author:

**Kodanda BOLLAKAYALA** (*National Aerospace Laboratories, Bangalore, India*)**Abstract:**

The period 2003-08 is characterized in India as very promising for air transport, while the recent recession has put it under distress. However, the Indian Government has taken a decision, to modernize 32 non-metro airports and renovate 125 un-utilized regional airports, as well as introducing in the future, production of smaller capacity aircraft, there by to boost civil aviation industry. This paper will focus on these developments and a need for feeder and short-haul regional air transport network and its operational sustainability. Regional air services can augment better connectivity and will bring air connectivity into a reality, thereby help in further growth of aviation and economy because of multiplier effects (benefits) associated with air transport. The existing common phenomenon of small ratio of air time to total journey time taken to accomplish the short-haul air travel needs to be looked into by improving ground accessibility to/from existing and proposed new airports with rapid high capacity surface transport. The logistics, feeding each mode is necessary to perform a seamless journey and to promote 'sustainable transport system that meets the transport and other needs of the present without compromising the ability of the future generations to meet their needs'. This paper addresses the following 'emerging issues' having effects and impacts on feeder and short-haul regional air transport operations; (i) economic-political scenario and driving forces of air travel demand in recent days, (ii) multi-modal transport and challenges associated with short-haul air travel for seamless journey, (iii) aviation infrastructure, emerging concept of airport city/ Aerotropolis, and human resources development (iv) regulatory and policy intervention, (v) tourism development/ leisure travel, low-cost fares, etc. (...).

**Keywords:**

Sustainability, Short-haul regional air travel, New civil aviation policy, Regional economies/airports/ airlines, Multi-modal transport, Civil aviation infrastructure development, Air transport demand, Degree of air network connectivity.

TUE 13<sup>th</sup> (15:30 - 16:45, Session A1.9) Room AVII

ID 2031 R

**THE IMPACT OF DIRECT AIR TRANSPORTATION LINK CROSS TAIWAN STRAITS ON AIR PASSENGER TRANSPORTATION OF CHINA MAINLAND, TAIWAN, HONG KONG AND MACAO**

Main Author:

**Wang LU** (*Center of Aviation Safety Technology CAAC*)

Co-author(s):

**Liu YUMEI** (*Science and Technology Research Center for China aviation*)

**Li HONGTAO** (*Science and Technology Research Center for China aviation*)

**Zhu YAOWEN** (*Science and Technology Research Center for China aviation*)

**Abstract:**

With the trend of global trade to be an integral whole, the requirement of economic development and the change of political situation between China mainland and Taiwan, the air transportation cross the Taiwan Strait will be open gradually. The opportunities and challenges have been taken by the adjustment of cross-strait air transport policy and the realization of the normalization of air transportation. Taken air passengers transportation as an example, firstly, this paper reviews the history of cross-strait air transportation and the operation under the cross-strait air transport policy in each period. Secondly, due to the change of cross-strait air passenger transport flow influences on the air transportation cost of relevant carriers and the throughput of relevant airports, we analyze the impact of the cross-Straits direct air transportation links on airlines and airports of not only China mainland and Taiwan, but also Hong Kong & Macao, the previous transit airports. Finally, due to the particularity and significance of the cross-strait air transport policy for the market, we introduce a dummy variable to explain it and to analyze its impact on the air transportation in different periods quantitatively.

**Keywords:**

Direct air transportation link, Air passenger transportation, Air passenger traffic demand.

TUE 13<sup>th</sup> (15:30 - 16:45, Session A1.9) Room AVII

ID 2647 R

**FACTORS AFFECTING INTENSIONS OF BUSINESS AND LEISURE PASSENGERS: AN EMPIRICAL INVESTIGATION OF CHINA LOW-COST AIR SERVICE**

Main Author:

**Yu-Chiun CHIOU** (*National Chiao Tung University*)

Co-author(s):

**Yen-Heng CHEN** (*National Chiao Tung University*)

**Ming-Te WANG** (*Kainan University*)

**Abstract:**

This paper employs structural equation modelling approach to investigate and compare the factors affecting the behavioural intentions of business and leisure passengers in the context of low-cost air service. The empirical results on the passengers of the Spring Airlines, the first China low-cost carrier, show that discrepancies between these two types of passengers do exist, suggesting the marketing strategies should be differentiated. The estimated results show that, for business passengers, service quality has the largest effect on behavioural intentions, followed by servicescape, indicating that business passengers not only value service quality but also the spatial environment. In contrast, for leisure passengers, service value is found to have the largest effect on behavioural intentions, implying the effectiveness of a low-fare policy. However, it is worth noting that service quality still exerts the second largest effect, implying that even in the context of low-cost air service, airlines still have to devote themselves to improving service quality to attract greater patronage of business and leisure passengers.

**Keywords:**

Low cost carriers, Business passengers, Leisure passengers, Structural equation modelling.

TUE 13<sup>th</sup> (17:00 - 18:15, Session A1.10) Room AVII

ID 1371 R

**REVENUE SHARING WITH MULTIPLE AIRLINES AND AIRPORTS**

Main Author:

**Xiaowen FU** (*Faculty of Business, Hong Kong Polytechnic University*)

Co-author(s):

**Anming ZHANG** (*University of British Columbia*)

**Gavin YANG** (*Sauder School of Business, University of British Columbia*)

**Abstract:**

This paper investigates the effects of concession revenue sharing between an airport and its airlines. It is found that the degree of revenue sharing will be affected by how airlines' services are related to each other (complements, independent, or substitutes). In particular, when carriers provide strongly substitutable services to each other, the airport has incentive to charge airlines, rather than to pay airlines, a share of concession revenue. In these situations, while revenue sharing improves profit, it reduces social welfare. It is further found that airport competition results in a higher degree of revenue sharing than would be had in the case of single airports. The airport-airline chains may nevertheless derive lower profits through the revenue-sharing rivalry, and the situation is similar to a Prisoners' Dilemma. As the chains move further away from their joint profit maximum, welfare rises beyond the level achievable by single airports. The (equilibrium) revenue-sharing proportion at an airport is also shown to decrease in the number of its carriers, and to increase in the number of carriers at competing airports. Finally, the effects of a 'pure' sharing contract are compared to those of the two-part sharing contract. It is found that whether an airport is subject to competition is critical to the welfare consequences of alternative revenue sharing arrangements.

**Keywords:**

Concession revenues, Revenue sharing, Airport competition, Airport-airline vertical cooperation, Non-atomistic carriers.

TUE 13<sup>th</sup> (17:00 - 18:15, Session A1.10) Room AVII

ID 1483 R

**THE IMPACT OF FLIGHT DELAYS ON PASSENGER DEMAND, YIELDS AND WELFARE**

Main Author:

**Martin DRESNER** (*University of Maryland*)

Co-author(s):

**Rodrigo BRITTO** (*University of Maryland*)

**Augusto VOLTES** (*Universidad de Las Palmas de Gran Canaria*)

**Abstract:**

U.S. airline passengers increasingly have access to flight delay information from online sources. As a result, air passenger travel decisions can be expected to be influenced by delay information. In addition, delays affect airline operations, resulting in increased block times on routes and, in general, higher carrier costs and airfares. This paper examines the impact of flight delays on both passenger demands and airfares. Delays are calculated against scheduled block times as well as more idealized feasible flight times. Based on econometric estimations, welfare impacts of flight delays are calculated. We find that flight delays on a route reduce passenger demand and raise airfares, producing significant decreases in both consumer and producer welfare. Since producer welfare effects were estimated to be three to four times as large as consumer welfare effects, we conclude that from an economic efficiency rationale, airlines should be required to pay for the bulk of flight delay remediation efforts.

**Keywords:**

Flight delays, Airfares, Consumer welfare.



TUE 13<sup>th</sup> (17:00 - 18:15, Session A1.10) Room AVII

ID 2021 R

**CITIES IN THE AIRPORTS? SHADOW: UNDERLYING INTERESTS AND DISCRETIONARY POWER IN AIRPORT-REGION DEVELOPMENT**

Main Author:

**Timothy DONNET** (*Airport Metropolis Project - Queensland University of Technology*)

Co-author(s):

**Robyn KEAST** (*Airport Metropolis Project - Queensland University of Technology, Australia*)

**Abstract:**

The previously distinct boundary between airports and their cities has become increasingly blurred as new interests and actors are identified as important stakeholders in the decision making process. As a consequence airport entities are more than ever seeking an integrated existence with their surrounding regions. While current planning strategies provide insights on how to improve and leverage land use planning in and around airports, emerging challenges for implementing and protecting these planning ideals stem from the governance shadows of development decisions. The thesis of this paper is that improving the identification, articulation and consideration of city and airport interests in the development approval process (between planning and implementation) can help avoid outcomes that hinder the ability of cities and their airports to meet their separate/mutual long-term objectives. By applying a network governance perspective to the pilot case study of Brisbane, analysis of overlapping and competing actor interests show how different governance arrangements facilitate (or impede) decision making that protects sustainable 'airport region' development. Contributions are made to airport and city development decision makers through the identification and analysis of effective and ineffective decision making pathways, and to governance literature by way of forwarding empirically derived frameworks for showing how actors protect their interests in the 'crowded decision making domain' of airport region development. This work was carried out through the Airport Metropolis Research Project under the Australian Research Council's Linkage Projects funding scheme (LP0775225).

**Keywords:**

Airport development, Governance, Airport region, D

TUE 13<sup>th</sup> (17:00 - 18:15, Session A1.10) Room AVII

ID 2405 R

**MEASURING THE IMPACT OF AIRLINES' DOMINANCE, INTER - AIRPORT COMPETITION AND LOCAL GOVERNMENTS ON THE EFFICIENCY OF ITALIAN AIRPORTS**

Main Author:

**Davide SCOTTI** (*University of Bergamo*)

Co-author(s):

**Nicola VOLTA** (*University of Bergamo*)

**Abstract:**

The aim of this paper is to investigate how the process of progressive liberalization and privatization have influenced Italian airports efficiency. The analysis is applied to a dataset composed by 38 airports, for which inputs and outputs have been collected, over the period 2005-2008, with a direct investigation. Efficiency is estimated using a parametric approach. We find that the stronger is the dominance of a single carrier, the lower is the efficiency of Italian airports. Furthermore Italian airports result less efficient if local governments have a significant presence in the ownership structure and if indirect competition is high. We can infer some policy recommendations from the above evidence. First, the link between dominance and inefficiency suggests that Italy needs a regulation scheme that encourages a greater efficiency in managing airports and an airport policy no longer dependent on Alitalia's destiny. Second, the Italian government should speed up the privatization process. This may also lead to a reduction in the spare capacity observed in small and medium Italian airports. Last, an incentive regulation providing adequate earnings to private investments in the sector will help the entry of private agencies in the ownership structure of airports.

**Keywords:**

Airports efficiency, Stochastic distance function, Airports competition.

TUE 13<sup>th</sup> (17:00 - 18:15, Session A1.10) Room AVII

ID 2909 R

**MULTICRITERIA PERFORMANCE ANALYSIS OF THE EUROPEAN AIR NAVIGATION SERVICE PROVIDERS**

Main Author:

**Gustavo CALEGARO** (*Universidade Federal do Rio de Janeiro*)

Co-author(s):

**Elton FERNANDES** (*COPPE/UFRJ*)

**Abstract:**

Air Traffic Management (ATM) is a subject of great complexity, given the extent of the various factors that define the sector's performance mainly as it pertains to guaranteeing safe, regular and efficient flights. One fundamental element of ATM is the organization responsible for the traffic control which provides airspace control services. Different types of organizations work currently in this area, from wholly state-owned to private/public partnerships. In Europe, although each country is responsible for its own portion of airspace, there is a trend to jointly manage air traffic through a comprehensive information management system and collaborative decision-making procedures, both of which help to optimize resources toward a single sky. This also helps to improve efficiency in the use of airspace and airports. The objective of the present article is to increase awareness about the air traffic control performance of organizations in the European Union, using the support of Data Envelopment Analysis (DEA) and statistical inferences. DEA is a multi-criteria methodology used for comparing performance among organizations or other kind of observation units. The results reveal the position of these organizations with respect to the efficiency frontier according to some adopted criteria. The present analysis points out the efficient organizations and the paths that those outside the efficiency zone should take. Thus, this study is significantly pertinent, bearing in mind that there are estimations indicating that European airspace will need to accommodate the equivalent of twice the current number of flights in few years and will, therefore, need to optimally manage the available resources, to be able to meet the traffic demands without compromising safety, regularity and a good cost-benefit relation. (...).

**Keywords:**

Air traffic control, Air transport efficiency, Multi-criteria Analysis.

WED 14<sup>th</sup> (08:15 - 09:30, Session A1.11) Room AVII

ID 1700 R

**THE IMPACTS OF AIRCRAFT INCIDENT ON THE UNIT OPERATING COSTS OF CIVIL AIRCRAFT**

Main Author:

**Olja COKORILO**

Co-author(s):

**Slobodan GVOZDENOVIC**

**Natasa BABACEV**

**Petar MIROSAVLJEVIC** (*University of Belgrade*)

**Abstract:**

Over the years, increasing attention has been paid to the aircraft accident and incident prevention. Of all the consequences generated from commercial flights, aircraft accidents and incidents have significant impacts on humans, aircraft damage, third part damages and infrastructure. However, the impacts of aircraft accidents and incidents are a world-wide issue and have drawn significant attention in the global community. This research aims to evaluate the impacts of aircraft incident, based on the estimation of incident costs, on aircraft operating costs, involving European regional flight routes for civil aircraft. The paper firstly presents the method of assessing the aircraft unit operating costs. The aircraft incidents have impacts on unit costs, which are shown on example of aircraft landing stage, with point in landing gear failure. The incident costs of aircraft vary by value of spare type and aircraft category, depending on the caused damages. The implications of aircraft incident costs (due to landing gear failure) on the corresponding effects on unit operating costs were measured, involving regional aircraft B737-300. Paper presents originally developed mathematical model that is applied to simulate aircraft annual utilization by considering the incident costs effects on aircraft unit operating costs. It was found that the aircraft incident costs have influence on process of optimal range of the aircraft unit operating costs determination, depending on the route distance, aircraft types and the forecasted annual utilization.

**Keywords:**

Aircraft unit operating costs, Incident costs, Annual utilization,

ID 2371 R\*

**THE MANAGEMENT OF REPUTATION RISK AND AIRLINE SUSTAINABILITY**

Main Author:

**Ayşe KUCUK YILMAZ** (*Anadolu University, School of civil Aviation, Turkey*)

Co-author(s):

**Triant FLOURIS** (*Dean, School of Aviation Sciences*)**Abstract:**

Corporate reputation is one of the most critical management topics in strategic airline management as reputation has a direct link to sales. Corporate reputation is impacted by company value drivers. Furthermore, reputation drivers can create value to a company. Also, every crisis is unique and every company is different. For these reasons, crisis and specifications of the company should be considered by management to be linked to an effective reputation risk strategy. The management of a company's reputation should be taken into consideration very seriously by air transportation (airline and airport) managers. This paper's main research question is: "how fundamental is the integration of the management of reputation risk with the enterprise risk management (ERM) function of an airline?" The article argues that the integration of the management of reputation risk with enterprise risk management (ERM) functions in the airline can help airlines, just like other industry participants, achieve high triple bottom line concept based performance (financial, social and environmental) and develop a clear understanding of the industry's competitive dynamics. Leading global airlines are concerned across economic, social, and environmental parameters in their quest for sustainability. Implementing a triple bottom line concept in the management of an airline supports a company's reputation. We assume that environmentally friendly management (based on the holistic management concept focusing on the economic environment, social environment, and the natural world environment) and sustainability based efforts help accomplish the ultimate goal of airline business sustainability. (...).

**Keywords:**

Airline, Business and management, Enterprise risk management, Management, Reputation, Risk, Sustainability.

ID 2401 R

**WIDER ECONOMIC BENEFITS OF AIR TRANSPORT: ESTIMATING CONSUMER SURPLUS FOR GERMANY**

Main Author:

**Thomas BRAUN** (*European Center for Aviation Development - ECAD GmbH*)

Co-author(s):

**Richard KLOPHAUS** (*Worms University of Applied Sciences - Center for Aviation Law and Business*)  
**Andreas LUEG-ARNDT** (*Association of German Chambers of Industry and Commerce (DIHK)*)

**Abstract:**

In addition to the direct, indirect, and induced impact of air transport there exist wider economic benefits, also referred to as catalytic impact. Surveys provide data on direct effects. Input-output analysis has been used by a multitude of studies to estimate indirect and induced impact. In contrast, quantifying the wider economic benefits beyond this multiplier impact is considered a difficult task. Obviously, one of the key economic benefits from the transport of passengers and freight by air is consumer surplus, i.e. the difference between the consumer's willingness to pay and the actual airfare and freight rate respectively. In theory, consumer surplus is a convincing monetary measure of the welfare that passengers and shippers gain from air transport. However, a practicable method for implementation is needed. The paper proposes the use of average price elasticities of air transport demand to estimate consumer surplus. The approach also requires the specification of average prices and sales volumes in the air transport markets under consideration.

**Keywords:**

Air transport, Economic catalytic impact, Consumer surplus analysis.

ID 3004 R

**EVOLUTION OF INTERNATIONAL PASSENGER TRAFFIC BETWEEN BRAZIL AND EUROPE**

Main Author:

**Ana LUIZA SOUZA** (UFRJ)

Co-author(s):

**Thais BALTER** (UFRJ)

**Ivy MACHADO** (UFRJ)

**Elton FERNANDES** (COPPE/UFRJ)

**Abstract:**

The process of ongoing globalization and the reduction of trade barriers between countries have substantially transformed the structure of Air Transport in Brazil, resulting in greater competition and participation of international companies in the market. This process has had great impact on the structure of supply of services for Brazilian international air transport. European Union has significant importance in the current economic conjuncture. This article shows the evolution of the scenario of International Air Transport in Brazil and discusses the future prospects of the European participation in that market. We use statistical inference and graphical analysis to assess the market, considering the political and economic scenario since 1999. Data were collected from the Flight Schedule (HOTRAN), a document published by the National Civil Aviation Agency (ANAC) which provides information about flight schedules in Brazil, and from Airports Council International (ACI). This paper considers only direct flights linking the Brazilian airports to other airports in European. The results show the situation of Brazilian airlines on the region stage, showing the evolution of their participation in the axis Brazil- European.

**Keywords:**

Airlines, Air transport, Evolution, Brazil-Europe market, Scenario.

ID 3244 R

**AIR TRANSPORTATION POLICY FOR SMALL COMMUNITIES: LESSONS FROM THE U.S. EXPERIENCE**

Main Author:

**Alda METRASS MENDES** (MIT Portugal Program / FEUP)

Co-author(s):

**Richard DE NEUFVILLE** (Engineering Systems Division, Massachusetts Institute of Technology)

**Abstract:**

The last decades have witnessed a global trend toward airline deregulation, which has significant impacts on national policies regarding air accessibility to smaller communities. One important result of this liberalization is that carriers are no longer constrained to serve routes, and may thus neglect service to less profitable destinations with lower traffic. Economic deregulation can therefore have detrimental effects on smaller communities. The United States has dealt with this issue through its Essential Air Service program. Its experience suggests lessons for other countries. U.S. policies have been reasonably successful in sustaining basic air service to smaller communities over the past thirty years of deregulation. Moreover, they have done so relatively effectively and efficiently. A large-scale analysis of the U.S. experience, and three case studies of the communities of Columbia and Jefferson City (Missouri), Rutland (Vermont), and Merced (California) demonstrate this phenomenon. The results show overall gains in efficiency, mostly attributable to the US policy of encouraging competition between air carriers seeking to provide service to small communities. The major flaw in the U.S. arrangements seems to be that the policies have not kept up with changing conditions since deregulation in 1978.

**Keywords:**

Aviation policy, Deregulation, Small communities, Essential Air Service.

ID 2045 R

**THE CONSTRUCTIVE NON-CONFORMITIES OF THE RUNWAY SYSTEMS IN BRAZILIAN AIRPORTS REGARDING SAFETY RULES**

Main Author:

**Francisco MEDEIROS**

Co-author(s):

**Anderson CORREIA** (*Instituto Tecnológico de Aeronautica*)

**Abstract:**

This work presents a study aiming to show alternatives for the elimination or management of construction non-compliances in the runway systems of Brazilian airports. Taking into consideration that the solution to such non-compliances involves, in some cases, the implementation of actions of technical and financial complexity, this work endeavors to approach the following issue: "How to reach acceptable levels of safety while eliminating or managing non-compliances related to construction risks in the Brazilian airport runway systems?" Among the several conclusions reached through this research, one is worth highlighting: the Brazilian airport system's overrun, undershoot and veer-off rates are equivalent to those in the developed world. This does not mean that civil aviation in Brazil is more or less safe, but it suggests that, considering the size and type of aviation operation, as well as the period selected for this study, the rates for the events in focus are equivalent to those in the European study used as a reference in this work.

**Keywords:**

Airports, Airport safety, Airport runway systems, Ri.

ID 2604 R

**FAA PAVEAIR – AN INTERNET AIRPORT PAVEMENT EVALUATION AND MANAGEMENT PROGRAM**

Main Author:

**Albert LARKIN** (*Federal Aviation Administration*)

**Abstract:**

By the fall of 2010, the Federal Aviation Administration (FAA) is scheduled to complete a three year effort to create an internet-based airport pavement evaluation and management program. This program, titled FAA PAVEAIR, shall, using appropriate existing pavement evaluation databases, provide a pavement evaluation and management web-based application that will also function on stand-alone personal computers by running a local web server such as an Internet Information Server (IIS). The program shall have the equivalent functionality of MicroPAVER version 5.3. The FAA PAVEAIR program shall be specifically designed to function in Internet Explorer version 6.0 and above web browsers on the client side. This version of FAA PAVEAIR will be compatible with other FAA pavement software applications and continue to meet the expectations and demands of pavement management system users. FAA PAVEAIR will support simultaneous entry of inspection data into PAVEAIR by multiple users. The FAA envisions that an implementation of FAA PAVEAIR containing data for General Aviation and International Airports will ultimately reside on a server located at the William J. Hughes Technical Center in Atlantic City International Airport, New Jersey. This server will also contain FAA PAVEAIR data for FAA Airport Improvement Program (AIP) projects. This paper discusses the development and testing of FAA PAVEAIR as a nondestructive testing method for airport pavement evaluation and management. It is expected that FAA PAVEAIR will be distributed for implementation by any other interested agencies or users.

**Keywords:**

Pavement management system, Pavement evaluation, Nondestructive testing.

ID 3124 R

**APPLICATION OF MULTICRITERIA DECISION AID TO VIRACOPOS INTERNATIONAL AIRPORT PROJECT**

Main Author:

**Antonio CARLOS MARQUES** (*UNICAMP\_Faculdade de Engenharia Civil*)

Co-author(s):

**Maria GALVES** (*University of Campinas - School of Civil Engineering, Architecture and Urban Design*)

**Abstract:**

The purpose of this paper is to present the results of a case study on the application of the Multicriteria Decision Aid (MCDA) to the decision of implementing an industrial airport park within the site of Viracopos International Airport in Campinas – São Paulo – Brazil. This is a huge project that aims at transforming Viracopos into the biggest and busiest airport in Latin America, considering both cargo and passengers, and as such, will conceivably bring up significant environmental, social and economic impacts to the affected area. The decision has arisen resistance and controversy among the many stakeholders. MCDA was chosen to simulate the decision because of its logic of structuring and of evaluating complex and conflicting problems, and of dealing with objective as well as subjective aspects in a decision context. The outcomes of the MCDA application to this project revealed interesting convergence of opinions towards a more attractive alternative, as well as significant behavioral changes on the part of stakeholders. It is expected that one of the major contributions of this study is that specialists and decision makers consider using the MCDA methodology to support their analysis of alternatives involving the role of airports and their impacts on urban lives, as well as the assessment of possible future problems involving urban environmental and transport planning and decision making.

**Keywords:**

Airport, Industrial airport, Multicriteria decision aid, Viracopos .

ID 1399 R

**ASSESSMENT OF EFFICIENCY OF GREEK AIRPORTS**

Main Author:

**Sofia KALAKOU** (*National Technical University of Athens*)

Co-author(s):

**Voula PSARAKI** (*National Technical University of Athens*)

**Abstract:**

In this paper the efficiency of Greek airports is assessed using Data Envelopment Analysis (DEA). First, appropriate inputs and outputs describing airport primary airport functions are identified. Then the technical characteristics of the airports are assessed in terms of the movements served in 2007. Two functional areas are considered: the landside and the airside. In each case, different inputs and outputs are used and alternative DEA models are applied. The paper reports on pure technical efficiency, scale efficiency, airport potentiality and peer airports. The time period when the inefficient airports will become efficient is estimated. The airports that serve more movements are found to be more efficient than those that serve fewer movements. Moreover cases where specific improvements in the passenger building enhance airport efficiency are indicated. Furthermore it is shown that the airside is better managed. The majority of airports have adequate terminal infrastructure to accommodate passenger traffic for the next 20 years.

**Keywords:**

Data Envelopment Analysis, Airport efficiency, Benchmarking.

ID 1710 R

**TRAVEL TIME VARIABILITY AND AIRPORT ACCESSIBILITY**

Main Author:

**Paul KOSTER** (*VU University Amsterdam, Department of Spatial Economics*)

Co-author(s):

**Eric KROES** (*Significance*)**Erik VERHOEF** (*Department of Spatial Economics, VU University Amsterdam*)**Abstract:**

This paper analyses the costs of access travel time variability for individual air travelers. Reliable access to airports is important for air travelers since it is likely that the costs of missing a flight are high. First, the determinants of the preferred arrival times at airports are analyzed, including trip purpose, type of airport, flight characteristics, travel experience, type of check-in, need to check-in luggage. Second, the willingness to pay (WTPs) for reductions in early arrival time at the airport, late arrival time, access travel time and the probability to miss a flight are estimated using a stated choice experiment. The results indicate that the WTPs are relatively high, which is partially due to the low cost sensitivity of air travelers. Third, a model is developed to calculate the costs of variable travel times for air travelers going by car, taking into account travel time costs, scheduling costs and the costs of missing a flight. In this model the value of reliability for air travelers is derived taking anticipating behavior into account. Results of the numerical exercise show that the costs of access travel time variability for business travelers are between 3-36% of access travel costs and for nonbusiness travelers between 3-30% where these numbers strongly depend on the time of the day.

**Keywords:**

Value of reliability, Scheduling, Travel time variability, Airport accessibility, Airport choice.

ID 2013 R

**PERFORMANCE COMPARISONS BETWEEN MAJOR US AND EUROPEAN AIRPORTS**

Main Author:

**Amedeo ODONI** (*Massachusetts Institute of Technology*)**Abstract:**

This paper compares scheduling practices, runway system capacity, air traffic delays, and flight schedule reliability at major airports in Europe and in the United States (US). The comparisons are based on the study of operations at the 34 busiest airports in the United States with those at the 34 busiest airports in Europe using extensive data from 2007 and 2008 flights. Major differences were found in several critical respects with important implications for aviation policy-makers on the two sides of the North Atlantic. In general, US airports achieve higher capacities, in terms of aircraft movements, than their European counterparts by using visual separation procedures, when weather permits, and by not placing slot constraints on the number of movements that can be scheduled at airports. European airports, on the other hand, limit air traffic delays and increase schedule predictability by using slot controls and by determining the number of available slots with reference to airport capacities under instrument meteorological conditions. A few exceptions to the above exist on both sides of the North Atlantic.

**Keywords:**

Airports, Capacity, Delay, Schedule reliability, Schedule predictability.

WED 14<sup>th</sup> (11:15 - 12:30, Session A1.13) Room AVII

ID 2318 R

## **BENCHMARKING OF AIRPORTS - A CRITICAL ASSESSMENT**

Main Author:

**Hans-Martin NIEMEIER** (*University of Applied Sciences Bremen*)

Co-author(s):

**Vanessa LIEBERT** (*University of Applied Sciences Bremen*)

### **Abstract:**

Performance measurement of airports serves different purposes. While the management perspective focuses mostly on partial processes the policy perspective of regulators and politics focuses on the overall productivity and efficiency. These different perspectives are reflected also in the methods. Partial measures are popular with management, but might be misleading and need careful interpretation. Total measures are mainly used to assess overall performances, but demand sophisticated methods such as DEA, SFA or pricebased index approaches and the knowledge of the airport production technology. The latter is especially often missing as required inputs and outputs are often not available. Further, for deriving comparable results, the operating environment of airports needs to be carefully considered because inefficiencies are not only caused by management decisions but also due to the operating environment. So far, most studies failed to provide conclusive answers to questions on the effects of privatization on the airports performance or size effects. Other aspects such as the effects of regulation and competition were hardly covered although it is well known that the type of regulation (cost versus incentive regulation) or regional competition is more important than ownership. This paper provides a literature review on the scope, methods and results of studies on the productivity and efficiency assessment of airports. It aims in particular to critically evaluate the limitations for a deeper understanding of the production process of airports.

### **Keywords:**

Airports, Efficiency, Productivity, Benchmarking, Literature review.

THU 15<sup>th</sup> (08:15 - 09:30, Session A1.14) Room AVII

ID 1091 R

## **REAL TIME AIRLINE SCHEDULE RECOVERY WITH AN ENVIRONMENTAL CONSIDERATION**

Main Author:

**Chi-Ruey JENG** (*Shu-Te University*)

### **Abstract:**

This study applies a method of inequality-based multiobjective genetic algorithm (MMGA) for real-time airline schedule recovery in response to the schedule disruption of short-haul, quick turnaround flights with an environmental consideration. The MMGA approach, which combines a traditional genetic algorithm with a multiobjective optimization method, can deal with multiple objectives in the same time, and then explores the optimal solution. The airline schedule recovery problem is traditionally solved by mathematical modeling techniques that always require a precise mathematical model. However, airline operations involve too many factors that must be considered dynamically, making a precise mathematical model will be very difficult to define in time. Empirical study based on a real-world airline flight schedule demonstrates that the proposed model can recover a disrupted schedule within about 3 CPU minutes which is more sufficient for real-time operation control. Consequently, can be employed as a real-time decision supporting tool for practical complex airline operations to save operation cost, increase passengers' convenience and reduce air pollution. Keywords: Disruption Management, multiobjective optimization, genetic algorithms, schedule recovery, method of inequalities.

### **Keywords:**

Disruption Management, Multiobjective Optimization, Genetic Algorithms, Schedule Recovery, Method of Inequalities.



ID 1737 R

**THE TURBO FAN AIRCRAFT POLLUTION CHARGES MITIGATION STRATEGY**

Main Author:

**Petar MIROSAVLJEVIC** (*University of Belgrade*)

Co-author(s):

**Slobodan GVOZDENOVIC**  
**Olja COKORILLO****Abstract:**

The air transport industry development analysis, indicate that transport demand will continue to increase in near future. The environmental implications which follow transport demand are significant, in terms of air pollution and climate change. The environmental impacts might act as an air transport industry constraint to growth. The increasing attention and concern for future climate changing produce different measures for air transport industry development steering. It is essential that air transport industry development is managed in an appropriate manner, to achieve sustainable development. The one of measure for managing air transport industry development is pollution charges introduced by Switzerland and Sweden. The research presented in paper is sets of operational procedures implementation to reduce turbo fan passenger aircraft emission in space around airport, as well as related pollution charges. The space around airport under pollution is defined according by LTO (landing and take-off) cycles, established by ICAO, as well as pollution measurement method. Also, ICAO published emission pollution calculation method and data base-Engine Exhaust Emissions Data Bank. The ICAO method of emission pollution measurement is base for pollution charges. Generally, ICAO method find relation between emission pollution and engine characteristic (emission index), fuel flow and time in mode (time spent in taxi, take off initial climb, approach and landing). The pollution charges increase airline direct operating costs. The mathematical model based on aircraft performance model, presented in paper for aircraft 767300, can be use as airline tool, for airline pollution charges mitigation or cancellation. (...).

**Keywords:**

Aircraft pollution, Emission charges, Continuous descent, De rated take off.

ID 2742 R

**ESTIMATION OF HISTORICAL AVIATION CO<sub>2</sub> EMISSIONS**

Main Author:

**Arturo BENITO** (*Polytechnic University of Madrid*)

Co-author(s):

**Alberto BLANCH** (*Innaxis Institute*)  
**Ricardo HERRANZ** (*Innaxis Institute*)**Abstract:**

The European Directive 2008/101/EC, including aviation in the European Emissions Trading Scheme (ETS), was approved on November 18, 2008, defining the main features of the system to be entered into force starting 1st of January 2012. The aim of the rule is to keep CO<sub>2</sub> emitted by all operators landing at and taking off from European airports at the level of a predetermined base year. This base year emission level is legally defined as the average of CO<sub>2</sub> emissions on the 2004, 2005 and 2006 years. Then, it raises the problem of calculating emissions made in the past and verifying the level of accuracy of the result. The philosophy of emissions trading is based on a cap and trade mechanism to start the granting of free permits and the trade of the rest of amounts. Therefore, a correct quantitative base is of paramount importance for the performance of the system and has great economic repercussions. This paper discusses the different alternatives to model the emissions for the base year estimation and cover the existing data gaps while keeping the calculation within a reasonable level of accuracy. Some improvements with respect to existing methodologies are suggested in order to improve the process of working with a huge data base of several million flights, as EUROCONTROL uses for emission inventory. A methodology to cover data gap and calculate their magnitude is also proposed. The last part of the paper advises on ways of action in case of changes in the geographical scope of the problem either by increasing the EU members or by building agreements with other countries with similar emissions trading mechanisms.

**Keywords:**

Aviation emissions trading, Emissions modelling, European ETs.

THU 15<sup>th</sup> (08:15 - 09:30, Session A1.14) Room AVII

ID 2754 R

**SUSTAINABILITY AND AIR TRANSPORT: ZURICH AIRPORT CASE STUDY**

Main Author:

**Philipp FRÖHLICH** (*Verkehrsconsulting Fröhlich*)

**Abstract:**

The research goal was to evaluate the environmental sustainability of Zurich Airport. The method used was to compare the environmental costs to the economic and social benefits generated by the airport. The analysis was completed on both the regional and global levels. The results show that Zurich Airport air transport generates more economic value than environmental and social costs.

**Keywords:**

Airports, Air transport system, Sustainability, Case study, Cost benefits study.

THU 15<sup>th</sup> (08:15 - 09:30, Session A1.14) Room AVII

ID 2815 R

**DESIGNING A MARKET MODEL TO ANALYSE TRADABLE NOISE PERMIT SCHEMES FOR AIRPORTS**

Main Author:

**Astrid GUEHNEMANN** (*Institute for Transport Studies, University of Leeds*)

Co-author(s):

**John NELLTHORP** (*Institute for Transport Studies, University of Leeds*)

**Richard CONNORS** (*Institute for Transport Studies, University of Leeds*)

**Abstract:**

Despite considerable improvements in the development of quieter aircraft, noise is still a major environmental concern around airports and a limiting factor for their extension. Innovation and adoption for noise abatement technologies are long-term solutions, and current practice shows that administrative measures are costly for both operators and institutional stakeholders. Furthermore, they have negative impacts on airline operations, limiting growth. In order to find an optimal solution for this problem it is necessary to analyse other instruments available from the economic theory. This paper presents ongoing work from the European Commission co-funded MIME project which has the aim to assess the efficiency of market based solutions to tackle noise problems at airports. These instruments should on the one hand be effective in reducing noise and on the other hand allow airlines and airports to choose the least costly noise mitigating solutions. The focus of the MIME project is on studying whether tradable noise permits could be introduced effectively to fulfil these expectations. A central part of this analysis is a market model which will be used to simulate the impacts of different permit scheme designs on noise levels, abatement costs for airlines and finally on airline operations and their business models. In the first part of our paper we identify those attributes of permit schemes that are crucial for the functioning of the market and their effectiveness. Different permit schemes are discussed based on an overview of existing applications of permit trading systems in order to identify the main elements that need to be incorporated in the market model. The definition of a noise permit is crucial for the scheme design and its efficiency, as it implicitly circumscribes degrees of freedom that operators have to adopt noise reduction measures/behaviour. (...).

**Keywords:**

Tradable permits, Airport noise, Market model.

ID 2570 R

**THE AGGREGATED AND DISAGGREGATED  
RELATIONSHIP BETWEEN AIR FREIGHT AND  
MERCHANDISE TRADE**

Main Author:

**Franziska KUPFER** (*University of Antwerp*)

Co-author(s):

**Hilde MEERSMAN** (*University of Antwerp*)

**Evy ONGHENA** (*Universiteit Antwerpen*)

**Eddy VAN DE VOORDE** (*University of Antwerp*)

**Abstract:**

During the past 30 years, air cargo has evolved from a by-product to a potential profit centre for airlines. However, the success in the air cargo business depends on a number of factors. The evolution of world merchandise trade and particularly, the trade in high-value goods, is one of the determinants of the demand for air freight services. This paper provides an insight into the relationship between air cargo and merchandise trade on an aggregated as well as on a disaggregated level. Special attention is paid to the air cargo flows between major regions. By combining several levels of the air cargo market, this paper explains part of the economic rationality behind the air cargo market structure. The results of this paper will lead to a better knowledge of the air cargo sector, not only by academics but also by industry actors.

**Keywords:**

Air cargo, Time series modelling, Regional air freight flows.

ID 2574 R

**THE AIRPORT CHOICE OF CARGO OPERATORS**

Main Author:

**Franziska KUPFER** (*University of Antwerp*)

**Abstract:**

In air transport research, some time has already been dedicated to the study of how passengers choose their airports as well as to the airport choice of passenger airlines. However, much less research has been carried out with regard to cargo operators and their choice of airports. This paper is a step towards better understanding the relationship between air cargo operators and airports. In the first section the market environment of air cargo is sketched to position the research in the general field of air transport. Air cargo traffic developments as well as a categorization of air cargo are presented. Furthermore, the main subjects of this research are introduced: the airlines and airports. Subsequently, a literature review about airport choice is carried out, revealing the airport choice process and important factors which influence the airport choice of cargo carriers. The choice factors can be clustered in six groups: restrictions, time factors, cost factors, market factors, strategic factors and the perception of airport quality. Concluding, the study suggests that more in depth research should be carried out in the field of the airport choice of air cargo carriers. It is recommended that the focus of this research is laid on freighter operators, meaning the all-cargo divisions of combination carriers as well as the all-cargo carriers but excluding integrators due to their different business model. Finally, the results of this study and further research in this topic will help to better comprehend how air cargo carriers choose their airports and ultimately how airports can form their strategies to attract air cargo carriers.

**Keywords:**

Air cargo, Airport choice, Cargo airline, Airport.

ID 2703 R

**RISK ANALYSIS FOR SHORT-TERM CARGO COLLAPSES AT EUROPEAN AIRPORTS**

Main Author:

**Aaron SCHOLZ** (*Karlsruhe Institute of Technology (KIT) - Institute for Economic Policy Research (IWW)*)

Co-author(s):

**Benedikt MANDEL** (*MKmetric - Gesellschaft für Systemplanung mbH*)  
**Axel SCHAFFER** (*Karlsruhe Institute of Technology (KIT)*)**Abstract:**

In the past decades air cargo volumes have strongly been linked to trade growth and have even outpaced the growth rate of worldwide GDP between 1.5 and 2 times. Freight tons transported by air rose between 1995 and 2007 by more than 5% per year. Things changed dramatically in the second half of 2008. The worldwide decline of industrial production and a strong reduction of international trade volumes hit the logistics business in general and the inter-continental/long-distance air cargo business in particular. The slump has affected all European airports but their magnitude differs significantly. Derived from these observations, the objective of the paper is twofold: first, to identify the importance of each airport for the entire European air cargo network and second, to analyse the impacts on the total network volumes in case of demand changes at single airports. The methodology used in the present paper is based on the Input-Output philosophy. A matrix representation of inter-market relations, in our case of air freight origin-destination data, is applied. The input matrix has been developed in the WORLDNET research project (6th Framework programme of the European Commission) by the consultants of MKmetric. It includes all cargo flows to (destination Europe), from (origin Europe) and within Europe for the year 2005. Under ceteris paribus restrictions, the Input-Output representation allows analysing how dependent each airport is on all other airports both as customer of their exports as well as supplier of their imports. In a first step, output coefficients are calculated which show the percentage of airport *i*'s total exports that is delivered to airport *j* (Ghosh matrix). (...).

**Keywords:**

Air freight, Cargo transport, Network analysis, Input-output analysis, Risk analysis.

ID 2902 R

**AIR CARGO LOGISTICS CENTERS: TECHNICAL INDICATORS FOR NEW PROJECTS IN THE METROPOLITAN AIRPORTS SYSTEM OF MEXICO**

Main Author:

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**David RIVERO** (*Instituto de Ingeniería, Universidad Nacional Autónoma de México*)**Abstract:**

This work presents some results of a research on logistics centers for air cargo in the Metropolitan Airports System of Mexico (MASM), which is composed of the international airports of Mexico City, Toluca, Puebla and Querétaro (Antún et al., 2009). This project was supported by the Program on Logistics Competitiveness (PROLOGYCA) of the Economy Ministry of the Federal Government. Mexico was the country with the larger movement of air cargo in Latin America in 2008. The International Airport of Mexico City (IAMC) was el number two, according the amount of the air cargo movement, after the airport of Sao Paulo Guarulhos (GRU). In an international comparison, the IAMC had the place 43 (now July 2009, it has the place 49). The analysis of technical characteristics of Air Cargo Terminals within airports (first and second lines) and Logistics Centers for Air Cargo in third line out of the airports, were based on a benchmarking of logistics process operations of air cargo in leading airports in Asia: Hong Kong (HKG), Seoul (INC), Shanghai (PDG), Tokyo Narita (NRT), Singapore (SIN), Taipei Taoyuan (TPE), Bangkok Suvarnabhumi (BKK) y Kuala Lumpur (KUL). Technical parameters for the design of new projects of Air Cargo. (...).

**Keywords:**

Air cargo terminals air cargo logistics centers.

ID 1344 R

**MODELLING AND SIMULATION OF VARIABILITY AND UNCERTAINTY IN SHIP INVESTMENTS: IMPLEMENTATION OF FUZZY MONTE-CARLO METHOD**

Main Author:  
**Okan DURU**

Co-author(s):  
**Shigeru YOSHIDA** (*Kobe University*)  
**Emrah BULUT**

**Abstract:**

This paper investigates fuzzy Monte-Carlo simulation method for analysis of ship investment projects. Investment analysis has several approaches such as traditional net present value method, multi-criteria decision methods. The proposed method does not execute judgmental factors of investment, but it ensures decreasing uncertainty on variables. Income and cost variables are transformed to fuzzy sets and simulations are performed according to probabilities of fuzzy intervals. Probability of loss is assessed for several conditions. Empirical works are reported for Panamax size bulk carriers in different financing particulars. Results indicated effects of term length, loan size and different freight market conditions including historical simulation, optimistic and pessimistic scenarios.

**Keywords:**

Fuzzy Monte-Carlo (FMC), Ship investment, Project default.

ID 1345 R

**FUZZY TIME SERIES METHODS FOR SHIPPING FREIGHT MARKETS**

Main Author:  
**Okan DURU**

Co-author(s):  
**Shigeru YOSHIDA** (*Kobe University*)

**Abstract:**

This paper investigates predictive performance of fuzzy time series analysis methods for dry bulk freight market practice. Time series analysis is conventionally used for modelling univariate and multivariate data series. However, classical time series analysis has several limitations such as stationarity, normality etc. Particularly for non linear dataset, difficulties exist in time series practice. Fuzzy time series analysis is first suggested by Song and Chissom (1993a, b) and it is a time-invariant method for modelling. Rather than classical methods, there are no prerequisites like stationarity and normality, and there is no necessity for treatment of missing data. Fuzzy time series methods are applied to dry bulk freight market and results are reported.

**Keywords:**

Fuzzy time series, Freight market, Dry bulk shipping.

ID 1763 R\*

**DEVELOPMENT OF PREDICTION MODELS FOR CONTAINER TRAFFIC**

Main Author:

**Gianfranco FANCELLO** (CIREM - University of Cagliari)

Co-author(s):

**Claudia PANI** (CIREM - University of Cagliari)**Paolo FADDA** (CIREM - University of Cagliari)**Patrizia SERRA** (University of Cagliari)**Marco PISANO** (CIREM - University of Cagliari)**Abstract:**

The purpose of the work described in this paper is to construct and implement prediction models for optimizing container handling in particular at Cagliari's Terminal Container. Prediction models are based on heuristic algorithms such as neural networks and classification and regression trees and evolutionary algorithms such as Genetic Algorithms (GA) and Ant Colony Optimization (ACO). These models form part of a Web Oriented Decision Support System, for real time external data acquisition (GPS information, weather information, etc.), providing operators with the information processed in real time. The most commonly used parameter for assessing terminal performance is productivity, namely the number of containers handled in the unit of time considered. This parameter can be associated with the terminal as a whole, or with the ship, the stevedores, each vehicle used, the single operator and related to different time intervals (year, month, week, day, hour and shift). Usually the hourly average is considered for monitoring operations and identifying shortcomings. The rate at which operations are performed can significantly reduce turn round time and thus minimize the loss of productivity associated with the ship's time in port. Because of the complexity of analyzing decision-making processes two sublevels are defined, that differ for type of decision and time horizon: (...)

**Keywords:**

Sustainable port operations, Environmental impact, Systems approach to environmental assessment, Bunkering operations.

ID 2321 R

**UNCERTAINTY OF MARITIME TRANSPORT DEMAND AND GRAIN TRADE: A GRAVITY MODEL ANALYSIS**

Main Author:

**Tsz YIP** (Hong Kong Polytechnic University)

Co-author(s):

**Tsz YIP** (Hong Kong Polytechnic University)**Shirley ZHAO** (Hong Kong Polytechnic University)**Abstract:**

This paper investigates the seaborne trade flow using a gravity model approach. According to the theory of economics, the uncertainty of maritime transport demand is fundamentally caused by the imbalance between the supply and demand of seaborne transport. The supply of maritime transport capacity is the tonnage of vessels provided. The seaborne demand is derived from the commodities needing carriage by sea. Because the demand for maritime transport varies in response to the seaborne trade, the demand is inevitably affected by the world economy and the demand in fact changes quickly. On the other hand, it takes a long time to increase the supply of seaborne transport capacity. Therefore, in order to plan tonnage supply and avoid shortage or excess of transport capacity, predictions of demand for maritime transport service is more practical and important. Prior studies on maritime transport have been concerns on the supply side, but this study is on the demand side. This research focuses on the grain trade which is one of the three major dry bulks transported by sea. A gravity model is developed by selecting variables, such as GDP, of 11 major grain trading countries over 11 years (1996-2006). The model is statistically good and the results provide managerial implications for the shipowners to allocate the capacity. The empirical model is further used to determine trade displacement effect of a particular country on others.

**Keywords:**

Maritime transport, Gravity model, Grain trade, Bu.

MON 12<sup>th</sup> (11:15 - 12:30, Session A2.1) Room 5A

ID 3149 R

**ANALYSIS AND SIZING OF A COAL EXPORT SYSTEM THROUGH SIMULATION**

Main Author:

**Edson TREVISAN** (*University of Sao Paulo*)

Co-author(s):

**Afonso CELSO MEDINA** (*University of Sao Paulo*)

**Rui CARLOS BOTTER** (*University of Sao Paulo*)

**Abstract:**

A coal export terminal aims to handle up to 40 million ton per annum (Mtpa) of mineral coal. The product will be transported by rail from a mine to the terminal located in Nakala, and then exported by ship. The project is scheduled in 3 phases, according to the production capacity: 15, 25 and 40 Mtpa. In order to perform the system sizing for each phase, a simulation discrete event simulation model was developed, so that results such as queue times and demurrage costs could be analyzed. The simulation model considers the arrival of trains, the stockyard and equipment dynamics and the export system. Several layouts were developed and simulated, varying parameters such as train capacity, stockyard size, number of berths, equipment rate and demand. Decisions related to the best layout configuration for each phase involves the previous or/and the subsequent phase, as well as operational and capital expenditure. The use of simulation methodology has succeeded in providing useful information for the system assessment.

**Keywords:**

Coal terminal, Discrete event simulation, Project of ports and harbour.

MON 12<sup>th</sup> (14:00 - 15:15, Session A2.2) Room 5A

ID 1599 R

**PORTS' COMPETITION UNDER PRODUCT DIFFERENTIATION AND UNCERTAINTY: GOVERNMENTS' SIMULTANEOUS MOVES**

Main Author:

**Hsiao-Chi CHEN** (*Department of Economics, National Taipei University*)

Co-author(s):

**Shi-Miin LIU** (*Department of Economics, National Taipei University*)

**Tsung-Chen LEE** (*Department of Economics, National Taipei University*)

**Tae WOO LEE** (*Kainan University*)

**Abstract:**

This paper investigates governments' optimal facility investments and ports' optimal pricing under service differentiation and uncertainty settings, considering both additive and multiplicative uncertainty types. It also examines how ports' equilibrium prices are induced by their facilities, marginal costs, service substitution degree, as well as uncertainty conditions. By introducing two-stage game-theoretic models, we show that, in additive uncertainty, the difference of optimal facilities under uncertainty and no uncertainty is completely determined by the mean stochastic demand. However, this difference under multiplicative uncertainty also depends on factors such as ports' marginal costs, service substitution degree, and the variance of stochastic demand. Moreover, we discover that variances of uncertainty cannot affect governments' optimal facility investments under additive uncertainty, but the opposite could be true under multiplicative uncertainty.

**Keywords:**

Port competition, Service differentiation, Sequential game, Additive uncertainty, Multiplicative uncertainty.

ID 1661 R

**SOME EFFECTS OF HINTERLAND INFRASTRUCTURE PRICING ON PORT COMPETITIVENESS: CASE OF ANTWERP**

Main Author:

**Raimonds ARONIETIS** (*University of Antwerp*)

Co-author(s):

**Paresa MARKIANIDOU** (*University of Antwerp*)**Hilde MEERSMAN** (*University of Antwerp*)**Tom PAUWELS** (*University of Antwerp*)**Marc PIRENNE** (*University of Antwerp*)**Eddy VAN DE VOORDE** (*University of Antwerp*)**Thierry VANELSLANDER** (*University of Antwerp*)**Ann VERHETSEL** (*University of Antwerp*)**Abstract:**

Now, more than ever, issues of port competitiveness are important, also in a context of containerized cargo. In a survey conducted amongst major shipping lines, the quality of hinterland connections is the second most important criterion for competitiveness of a port after the cost factor. However, most seaports, major as well as smaller, are often affected by congestion on those hinterland links. This paper tries to assess some of the effects that infrastructure pricing can have on the competitiveness of the seaports. It is essential to identify the determinants of port competitiveness. In order to do that, a total of 30 literature sources were reviewed. Some older sources were reviewed, but the main attention is on the most recent literature. We focused on the criteria that other authors identify as important and also on the methodology that they use. (...)

**Keywords:**

Seaports, Port competitiveness, Hinterland transport, Congestion, Infrastructure pricing, Mode choice.

ID 1713 R

**CONTAINER PORTS COMPETITION UNDER PRODUCT DIFFERENTIATION AND UNCERTAINTY: GOVERNMENTS' SEQUENTIAL MOVES**

Main Author:

**Tae WOO LEE** (*Kainan University*)

Co-author(s):

**Tsung-Chen LEE** (*Department of Economics, National Taipei University*)**Shi-Miin LIU** (*Department of Economics, National Taipei University*)**Hsiao-Chi CHEN** (*Department of Economics, National Taipei University*)**Abstract:**

This paper examines governments' optimal facility investments and ports' optimal pricing under service differentiation and uncertainty settings. We construct a two-period sequential game, in which governments 1 and 2 determine their facility investments at the beginning of the first and the second periods respectively and ports choose their service prices at the end of each period. It is found that government 1 may not have the first-mover advantage. Governments' optimal facility investments are positively correlated with their expected market demand and competing ports' marginal costs, but are not affected by variances of stochastic demand (or cost). Differences of governments' facility investments between uncertainty and no uncertainty are also investigated. Finally, we analyze how ports' equilibrium prices are affected by their facility levels, marginal costs, service substitution degrees, as well as uncertainty conditions.

**Keywords:**

Port competition, Service differentiation, Sequential game, Uncertainty.



ID 1859 R

**CONTAINER PORT COMPETITION AND  
COMPLEMENTARITY IN SUPPLY CHAIN SYSTEMS:  
EVIDENCE FROM PEARL RIVER DELTA**

Main Author:

**Jasmine SIU LEE LAM** (*Nanyang Technological  
University*)

**Abstract:**

Container shipping plays an important role for many supply chain systems through its ability to add spatial value to the cargo. Embedded within the container shipping system are competitive elements as well as complementary aspects in inter-container port relationships. The paper aims to examine these relationships through a thorough investigation of the calling patterns of container shipping services in order to understand the dynamics of competition and complementarity which exist among container ports. Specifically, empirical evidence will be sought from China's Pearl River Delta where the analysis will identify the routes and markets where competition or complementarity exists, participants involved, and the extensity and intensity of such relationships between the container ports of Hong Kong and Shenzhen. The investigation shows that apart from container port competition, inter-port complementarity also accounted for a significant share of changes to shipping capacity affected. The paper hopes to draw policy and decision makers' attention to the benefits offered from inter-container port complementarity in order to advance the competitive position of container ports, particularly in the Pearl River Delta.

**Keywords:**

Port complementarity, Port competition, Supply chain, Container shipping, Pearl River Delta.

ID 2739 R

**AN ANALYSIS OF PORT DEMAND: THE IMPORTANT  
FACTORS FOR THE PORT COMPETITIVENESS**

Main Author:

**Mariko FUTAMURA** (*Tokyo Woman's Christian University*)

**Abstract:**

In recent years, severe competition among international ports has held all over the world. For example, among East Asian ports, Chinese ports have increased their power, and the market share of Japanese ports has decreased. Japanese Government tries to make their ports competitive, and plans "super hub port projects" and choose the ports. But the main efforts are left to individual "super hub port", so they will have to choose their service level or investment level etc. So this paper tries to examine key factors of competitive success among ports. When we think of the port competition, we should not only try to compete with the foreign ports, but also need to compete with local ports. If there are two ports in the same region, even if a ship has some containers for both ports, it will choose one "good port". This "good port" means attractive port for shippers and consequently equal to the competitive port. But to be the "good port", what kind of factors will be needed? Traditional research on port choice uses questionnaire-based qualitative data; meanwhile in this research we will use available quantitative data. The Gravity model will be applied to the demand function and port specific characteristics will be added. For these factors, we plan to use port area and number of terminal.

**Keywords:**

Port choice, Port competitiveness, Infrastructure.

ID 3320 R

**PORTS FACE INADEQUATE CAPACITY, EFFICIENCY AND COMPETITIVENESS IN A DEVELOPING COUNTRY: CASE STUDY INDIA**

Main Author:

**Prakash GAUR** (*Department of Transport and Regional Economics - University of Antwerp*)

Co-author(s):

**Shivani PUNDIR** (*Centre for Environmental Planning and Technology (CEPT)*)

**Tarun SHARMA**

**Abstract:**

India on a high economic growth path faces a sharp increase in cargo throughput at the ports. Indian Ports are handling about 723 MMT of cargo in 2008-09 and are growing very fast. Government of India is making efforts to increase the capacity of Indian ports to meet the growing demand, since, the Indian exports/imports are typically carried through trans-shipment centers in Colombo, Singapore and Dubai. The major ports function under common decision maker because of their institutional structure resulting in no competition between them. Though major programme and measures have been initiated to increase the capacity of ports, but the immediate need to increase the efficiency in port operations is lacking. This paper highlights that how the ports in a developing country should increase their capacity from Effective Capacity to Potential Capacity and further to Absolute Capacity. Indian ports need to enhance their efficiencies at par with their international counterparts on all the parameters. This paper develops an efficiency index for Indian ports and recommends institutional cooperation among ports to achieve Potential Capacity and learn from best international practices to achieve Absolute Capacity.

**Keywords:**

Effective Capacity, Potential Capacity, Absolute Capacity, Institutional Cooperation, Port Efficiency and Port Performance Index .

ID 1723 R

**CONSTRUCTS IN PORT EFFECTIVENESS RESEARCH**

Main Author:

**Mary BROOKS** (*Dalhousie University*)

**Abstract:**

Almost all of the past effort in port performance measurement has focused on the technical performance of port assets such as land, cranes, berths, and labour; that is, it has focused on their efficiency. Very little port performance research has focused on whether the inefficiencies or inadequacies of ports have created problems for users that require the injection of more assets or the application of performance improvements to improve service delivery. Users are in the best position to determine if the port, and its tenants and partners, are able to deliver the services required. If the delivery of services does not match expectations, the port does not deliver a value proposition to its customers, and is therefore seen as ineffective. The objective of this research paper is to examine how users evaluate port effectiveness and identify those constructs of relevance to that evaluation. The three user groups are defined as carriers, cargo interests and suppliers of services at the port to the first two. As this phase of the research is focused on the development of effectiveness constructs and the survey instrument in one geographic market, it is our intention to validate these findings in other geographic markets in the future research program. The study team developed an on-line survey instrument and delivered it to Canadian port users with the assistance of eight industry organizations. The findings of the research are based on the contributions of 57 decision-makers with port usage experience, many of whom fit into more than one group of users. The study concludes that the evaluative criteria influencing users' perceptions of satisfaction, competitiveness and service delivery effectiveness are different, and so while the determinants of these constructs have considerable overlap, they are different constructs. (...).

**Keywords:**

Port performance, Effectiveness, Evaluation, Constructs.

ID 1799 R

**THE ECONOMIC IMPORTANCE OF THE SAUDI ARABIAN PORTS**

Main Author:

**Mohammed ALDAGHEIRI** (*Qassim University*)**Abstract:**

The Kingdom of Saudi Arabia is considered to be the world's main oil exporting country. The Saudi government, therefore, has to have efficient, fully equipped ports that are capable of functioning effectively. The demands of commerce encouraged the early development of roadsteads, precursors to ports and harbours, which soon became hubs of social and trading activity. Indeed, until the advent of air travel, the ports of Saudi Arabia represented the only practicable channels of physical interchange between the Kingdom and the outside world. Following the discovery of oil in the 1930s, investment in ports and terminals capable of handling ocean-going tankers has been crucial to the country's wellbeing. Now the Saudi Ports have become major contributors to Saudi economy and a link between the national and international economy. Therefore, this paper aims to identify the level of ports in Saudi Arabia and their important characteristics.

**Keywords:**

Ports, Industrial Port, Commercial Port, Economy, And Saudi Arabia.

ID 2853 R

**GOVERNANCE AND EFFICIENCY OF MEDITERRANEAN CRUISE TERMINALS**

Main Author:

**Assunta DI VAIO** (*University of Naples "Parthenope"*)

Co-author(s):

**Francesca MEDDA** (*University College London*)**Lourdes TRUJILLO** (*Universidad de Las Palmas de Gran Canaria, Spain*)**Abstract:**

Over the past 25 years the cruise industry has witnessed considerable growth. The increasing size and passenger capacity characterizes the maritime industry, e.g. new vessels can accommodate more than 3000 passengers. Cruise production is concentrated in the hands of a few players, in fact, 77% of capacity (calculated in terms of berths) belongs to the top five world cruise companies (Carnival Corporation & PLC, Royal Caribbean Cruise Line Ltd, Star Cruises Ltd – NCL, Louise Cruise Lines and MSC Crociere S.p.A.). During the growth phase of the cruise industry, the Mediterranean has gained an increasingly competitive position. It has become one of the top destinations chosen by cruise companies for its position, temperate climate, historical-artistic resources, and political stability, but the importance of Mediterranean cruise ports also depends on services that ports offer to the cruise shipping enterprise. Moreover, the features of ports and passenger terminals have attracted cruise companies to this area and they have also influenced the decision of cruise operators to invest in cruise infrastructure. The characteristics of the partnerships between Port Authorities, Cruise Terminals and Cruise Companies play a significant role in investment and management decisions of every shipping player. Cruise shipping lines in this context are faced with a make or buy decision to directly control some specific operations and to obtain preferential port spaces in order to gain competitive advantage over cruise competitors. The aim of the paper is to measure the impacts on performance of cruise terminals when public-private partnership is implemented. Despite the spread of public-private partnerships in the management of cruise terminals, there are few studies dedicated to this topic. (...).

**Keywords:**

Cruise terminals, Efficiency, Performance.

ID 2985 R

**DIAGNOSTIC PERFORMANCE IN PORT MANAUS – AM**

Main Author:

**Nelson KUWAHARA** (*Federal University of Amazonas - UFAM*)

Co-author(s):

**Jose TEIXEIRA DE ARAÚJO N** (*UFAM*)

**Poliana CARDOSO** (*UFAM*)

**Márcia HELENA VELEDA MOITA** (*UFAM*)

**Rita DUARTE**

**Abstract:**

This paper seeks to identify the attributes of paralysis and its influence on the performance of port operations performed in the shipping cabotage in Manaus. The firms located in the Industrial Pole of Manaus - PIM demand for an efficient logistics system to ensure that their products are competitive in the global market. The performance of these enterprises logistics system is based on the ports that represent the main element of the supply chain. Operations examined in these charts represent on average 46% of gross operating the terminal. The results generated from the level of importance, pointed out that the owners are primarily responsible for stoppages of operation, then the terminal points with 32%, other 11% (or agent does not define) and finally the OGMO ( 9%).

**Keywords:**

Water Transport, Amazon, Optimization and efficiency in harbours.

ID 3405 R

**MACROECONOMIC CONDITIONS, REGULATORY CHANGES AND NOISE: ARE MANAGERS EFFECTIVELY RESPONSIBLE OF PORT'S EFFICIENCY?**

Main Author:

**Angela BERGANTINO** (*Università degli Studi di Bari - Dipartimento di Scienze Economiche e Metodi Matematici*)

Co-author(s):

**Enrico MUSSO** (*University of Genoa*)

**Abstract:**

This paper provides an estimation of the impact of exogenous factors – such as governance regimes and local socio-economic conditions – and managerial capacity, cleared of statistical noise, on the efficiency of ports. We implement a three stage DEA procedure following the approach of Fried et al. (2002), using a panel of European ports, observed over a ten year period. By using in the second stage of the analysis a stochastic framework model, we are able to identify the determinants of input-specific efficiency differentials across ports. The outcome shows that, in general, governance related factors and other external elements predominate on the managerial skills in determining efficiency conditions of ports: performances change significantly by controlling for factors considered outside direct ports' managers control. The procedure helps to gain further insights on the evolution of the port industry in the EU and to define strategies for improving operational performance of ports, passing through governance and regulatory framework.

**Keywords:**

Ports, Efficiency, Regulation, Multi-step DEa.

ID 1085 R

**NORTHERN OPPORTUNITIES: A STRATEGIC REVIEW OF CANADA'S ARCTIC ICEBREAKING SERVICES IN LIGHT OF RETREATING SEA ICE**

Main Author:

**James PARSONS** (*School of Maritime Studies, Marine Institute of Memorial University*)

Co-author(s):

**John DINWOODIE** (*University of Plymouth Business School, School of Management*)**Mike ROE** (*University of Plymouth*)**Abstract:**

Climate change presages increasingly ice-free waters in the Canadian Arctic and scope for a fundamental reconfiguration of Asia-Europe and Asia-US East Coast supply chain networks via the Northwest Passage and other Arctic routes. Retreating sea ice will continue to significantly impact the annual re-supply of goods to northern communities, the development of natural resource projects, cruise ship and adventure tourism activity, and the fishing industry. A review of the infrastructure required to support expectations of increased Arctic shipping and Panamax ships traversing the Canadian Arctic is imperative. Even today, the vast geography of the Arctic poses significant challenges in supplying support networks in remote locations. To support future developments, the capabilities of the Canadian Coast Guard (CCG) icebreaker fleet and the private sector will be crucial. While the private sector continues to build new icebreaking cargo ships with the aim of independent shipping operations in ice covered waters on a year round basis, the CCG fleet of Arctic icebreakers is old and in need of replacement. Canada's largest icebreaker, the Louis S. St-Laurent, was built in 1969 and is not scheduled to be replaced until 2017. Under the present allocation of CAD \$750M, the replacement icebreaker will not be capable of year round operations in the Canadian Arctic. In her 2007 Status Report, the Auditor General of Canada stated concerns pertaining to the CCG vessel replacement plan, formally referred to as Fleet Renewal Plan 2006 to 2030, in that it was outdated and unrealistic especially in light of planning to build ten vessels by 31 March 2011 when a minimum lead time of five years would be required to procure the vessels, of which no mention was made to Arctic icebreakers but rather to offshore fishery research and patrol vessels. (...).

**Keywords:**

Global supply chain strategy, Northwest Passage, P

ID 1453 R

**POLICYMAKING ON WATERSIDE INDUSTRIAL SITES. AN EMPIRICAL STUDY FOR FLANDERS**

Main Author:

**Tom PAUWELS** (*University of Antwerp*)

Co-author(s):

**Ann VERHETSEL** (*University of Antwerp*)**Eddy VAN DE VOORDE** (*University of Antwerp*)**Thierry VANELSLANDER** (*University of Antwerp*)**Abstract:**

A pertinent question in a country confronted with high demand from various sources for scarcely available land is how to generate the highest social value from existing space. In such a setting, moreover, growing environmental awareness and economic efficiency make inland navigation an attractive option. This will inevitably translate into a greater need for waterside industrial sites (i.e. sites with cargo transfer via inland waterways). The present research paper proposes a methodology whereby government can prioritize investment decisions in additional waterside land and applies the approach to the situation in Flanders. Public policy is, after all, concerned with providing sufficient space for economic activities while ensuring optimal spatial and functional allocation and taking adequate account of future trends and developments. A number of scenarios are proposed along which the future inland navigation market may evolve given a number of policy assumptions. The Freight Model Flanders allows one to simulate future freight flows by mode (i.e. road, rail and inland waterways) and freight category. When combined with a survey-based quantitative analysis, it is possible to arrive at a prioritization between regions in respect of additional investment in the availability of waterside land. This paper discusses with the quantitative aspects of a study entitled "Policy for the supply of waterside industrial sites and waterside transshipment locations", which was carried out at the request of the Flemish Government.

**Keywords:**

Inland navigation, Waterside industrial sites, Transport policy, Spatial planning, Flanders, Land-use.

ID 1776 R

**TOWARDS A NEW GOVERNANCE SCHEME FOR THE ITALIAN PORTS**

Main Author:

**Claudio FERRARI** (*University of Genova*)

Co-author(s):

**Enrico MUSSO** (*University of Genoa*)**Abstract:**

The port reform law nr. 84/1994 marks the starting point of a lucky season for the Italian port industry. The law, that introduced in Italy the landlord port authority model, happened in a stage of great reforms concerning the Italian transport industry, supported and sometimes forced by similar EU initiatives, all characterized by a new organizational scheme of the infrastructural momentum and a privatization process of the production of the transportation service. That season produced its best results in Italy just in the port industry while in other transport modes it is still barely able to be fully applied, such as the rail sector and urban transports. The changes introduced by the law determined in a few years a real national port industry renaissance: Italian ports became again the leaders in the Mediterranean both as gateway ports and as transshipment ports: the port of Gioia Tauro, where the operations started just a few months after the law approval, in 1997 equalled the traffic of the Spanish port of Algeciras and the following year it became the first transshipment port in the Mediterranean (and the 15th in the world in the container sector). Surely the law voted in 1994 was positive for the Italian ports, anyway its 15 years enforcement has shown several critical aspects and weaknesses. The opportunity of reflecting on the governance structure of ports and on the changes affecting the whole logistics chain of transport is given by the relative and absolute loss of position of Italian ports in respect to their competitors both of the North European range and of the South European range (and also the ports of Northern Africa will compete fiercely in the next future). (...).

**Keywords:**

Port governance, Landlord port authority, Port regulating scheme.

ID 2288 R

**ARE EVOLUTIONS OF TRANSPORT SUPPLY THROUGH MEDITERRANEAN SEA COMPATIBLE WITH GOALS OF LAND-TRANSPORT POLICIES IN EUROPE?**

Main Author:

**Olivier KLEIN** (*Laboratoire d'Economie des Transports*)

Co-author(s):

**Lisa SUTTO** (*Ministry of Sustainable Development*)**Abstract:**

The paper briefly describes the European transport policy in favour of modal shift and the efforts of the western Mediterranean ports to improve and secure access to their hinterlands. Railway and to some extent inland waterway play a key role in these strategies. The paper then discusses the main functions of Mediterranean ports: the crossing of a strait, an hub in a maritime container-routing network, supplying a hinterland and logistical operation area. It underlines the current trend towards relocation of logistical activities to some ports on the Mediterranean south coast. The development of Tangier's port activity is the best illustration of such a situation. These relocated logistical activities imply that many containers arriving from Asia are emptied in Africa before the goods are shipped to Europe by a route involving a maritime link. They also imply a southward extension of the Mediterranean "European logistics space," resulting in the spread of European standard packaging: the EUR-pallet. Basing on this finding, we firstly analyse such evolutions as a window of opportunity for the development of a specific transport supply between Mediterranean south shore and Europe that would be based on a new type of container: the 45' Palletwide, compatible – unlike the ISO shipping container – with the dimensions of the EUR-pallet. Secondly, we assess the possible consequences on inland transport modal shift of the "45'PW containerization" of a part of European ports traffic. Concerning this point, the paper highlights that the part of traffic that is not logistically operated in the European port areas presents more favourable characteristics for inland intermodal transport. (...).

**Keywords:**

Mediterranean, Modal shift, Intermodal transport, 45' Pallet Wide containers, Port logistical activities, European transport policy.

ID 2698 R

**CONCESSIONING IN SEAPORTS: CHANGING PRACTICES, CHANGING MARKET POWER?**

Main Author:

**Maria FELICIANA MONTEIRO** (*Universidade de Antuérpia*)

Co-author(s):

**Thierry VANELSLANDER** (*University of Antwerp*)**Eddy VAN DE VOORDE** (*University of Antwerp*)**Raimonds ARONIETIS** (*University of Antwerp*)**Abstract:**

The market power of port authorities has changed dramatically over the last few decades. Ports are important nodes in supply chains, but their role is determined rather by the big shipping companies and the powerful terminal operators that are active in it, than by the port authorities that govern them. One of the few trump cards left to port authorities is their concession policy. Port authorities can differentiate themselves through various concession characteristics: duration, price, throughput, value added and investment requirements, etc. At the same time, concessions are more and more considered to be cost or revenue elements. From the terminal operator's side, they appear to be important selection criteria when deciding to locate a terminal at a certain location in a specific port. From the port's side, concessions are an increasing source of income, especially as further liberalization forces port authorities to be financially self-sustaining, and as other sources of income are under pressure. This paper verifies in an empirical way to what extent concessions are an increasing source of cost and revenue to respective players. It is also analysed how strongly concessions are used as a means of diversification by port authorities in specifying their characteristics. It is checked whether a learning process can be discerned. This exercise is set up with the help of a number of case studies, which are spread geographically and in the nature of the cargo. This way, the paper allows getting more insight into concessioning and the way it is used as a strategic weapon by the different players involved in ports. Lessons are drawn which are of use to academics as well as to port practitioners. (...).

**Keywords:**

Concessions, Seaports, Market Power, Port Authorit.

ID 1279 R

**A BERTH SCHEDULING POLICY WITH A VARIABLE COST FUNCTION**

Main Author:

**Mihalis GOLIAS** (*University of Memphis*)

Co-author(s):

**Hercules HARALAMBIDES** (*Center for Maritime Economics & Logistics (MEL), Faculty of Economics, Erasmus University Rotterdam*)**Abstract:**

This paper presents a new mathematical formulation for the berth scheduling problem. The objective is to simultaneously minimize the total cost of vessels' late departures and waiting time, and maximize the benefits from vessels' early departures. It is assumed that different vessels, belonging to the same or different liner shipping companies, have different contractual agreements, and thus different cost functions. We discuss the applicability and advantages of nonlinear cost functions, vis à vis the linear ones commonly used in the literature. A genetic algorithm based heuristic is proposed to solve the resulting problem and a number of computational examples are presented to critically assess the proposed berth scheduling policy and evaluate the effect of the assumed cost function on the spread and distribution of the total cost among all vessels.

**Keywords:**

Marine Container Terminals, Berth Scheduling, Cost Function, Metaheuristic Optimization.

ID 1671 R

**THE DOUBLE LOAD-FACTOR PROBLEM OF RO-RO SHIPPING**

Main Author:

**Harald HJELLE** (*Molde University College*)**Abstract:**

Maritime transport is regarded the most environmentally friendly mode of transport in many policy papers and has received a lot of government support for moving cargo transports from road to sea. Most assessments of energy use and related carbon emissions in mode-choice settings have been based on energy use per deadweight tonnage figures for the maritime modes, thus giving a very favourable picture for the sea-based alternatives. Whereas this may be relevant for bulk shipping, the situation is quite different for Ro-Ro shipping – which is the most relevant alternative for intra-continental transports. The trucking industry has been subjected to a number of regulations, effectively cutting back on emissions per ton transported over the past decades. Through six generations of EUROengine- standards and gradually stricter fuel quality regulations, much has been improved since the 1980s. In the same period much less has happened with respect to technical advances with environmental impact affecting Ro-Ro shipping. This could be attributed to the kind of regulatory environment these sectors have been subjected to, where the trucking industry is under control of national regulations – whereas the maritime shipping industry has comparatively fewer and looser environmental regulations, implemented through a slow moving international regime. Through representation of a number of realistic intra-European multi-modal trade links, with different mixes of modes of transport – energy use and emissions from these various chains are presented. The outcome of these cases is not very favourable for the maritime transport alternatives. Apart from the factors related to the (lack of) technological progress mentioned above, the main problem seems to be “the double load factor problem” of Ro-Ro shipping. (...).

**Keywords:**

Ro-Ro Shipping, Maritime Transport, Multimodal Freight Transport, Environment, Emissions, Load factor.

ID 1886 R

**ERGONOMIC INTERVENTION AT LOADS STORAGE AND TRANSFER ON VESSELS OF AMAZON STATE**

Main Author:

**Nelson KUWAHARA** (*Federal University of Amazonas - UFAM*)

Co-author(s):

**Rita DUARTE****Márcia HELENA VELEDA MOITA** (*UFAM*)**Abstract:**

Amazon State waterway transportation has weaknesses, especially with regard to the conditions of vessels that, in general, are unsuitable for transporting people and cargoes. In many cases, they navigate with the number of passengers and loads over capacity, and transport both of them in the same deck. These conditions are not in accordance with laws determinations of the waterway transportation sector, so resulting in risks to users of that transport mode. According to the Ministry of Defense norms, passengers should not share the same deck with loads. The Labor Ministry also states that the decks should be kept clean and clear, with an area of movement allowing the safe passage of workers. The loads freight on the same deck of passengers occurs, among other reasons, because the boats do not have a suitable place to store products. Holds of vessels usually do not support the amount of transported cargoes, what makes shippers to put the surpluses loads stacked randomly in the middle of the deck, blocking the movement of people. The holds also do not attend the peculiarities of some transported goods, because some fruits must be kept at low temperature to prevent damage, some should be kept at an airy place. Every load has its specificity. The main deck - the only one allowed to carry cargoes, besides the hold, in accordance with Ministry of Defense standards - in most cases it is not organized to receive the transported products. The waterway mode of transport is responsible for almost the entire basic supply of Amazon basin. Most cities of Amazon state have the water transportation mode as the only means of transporting. Given the importance of this type of transport for the region, it is necessary that the used vessels to be in accordance with the laws determinations of the waterway transportation sector and with the ergonomic norms, what generally does not occur. (...).

**Keywords:**

Vessels, Loads storage and transfer, Ergonomics.



ID 2348 R

**COLD CHAIN IN THE SHIPPING INDUSTRY: BULK VERSUS CONTAINER IN THE BANANA TRADE**

Main Author:

**Giulia ARDUINO** (*DIEM, Università degli Studi di Genova*)

Co-author(s):

**Francesco PAROLA** (*Parthenope University*)**Abstract:**

Since the last few decades the reefer transportation market has been increasing due to the constant demand growth. Despite the recent global crisis affecting households in terms of purchasing power, cold chain shipments still represent basic products for human consumption. Products such as flowers and pharmaceuticals, traditionally transferred by air, are now shipped via sea due to the advantages given by new technologies on maritime transportation. Therefore, the reefer sector is currently one of the most promising markets of the overall shipping industry. During the last twenty years the reefer shipping sector has been characterized by a gradual changing process, leading from specialised vessels to reefer containers. In fact, the reefer bulk fleet has experienced an irreversible decline, while the reefer container fleet has shown a continuous growth. Some evidences of this trend emerge from the strategic behaviour of global ocean carriers like Maersk Line and MSC. These players are gaining market power in cold chains by investing in services for reefer containers and also by offering the conditions to attract perishable cargo from the air industry. This paper investigates the current major aspects shaping the reefer shipping industry in order to understand the economic drivers inducing competition between bulk and containers. Therefore, a twofold analysis has been developed. First, an overview of the reefer market, including the demand for refrigerated products and the supply of reefer capacity given both by containership fleet and by conventional reefer fleet. Second, a specific case of the banana trade has been carried out for knowing all service costs along the cold chain. (...).

**Keywords:**

Reefer, Bulk, Container, Shipping industry, Cold c.

ID 2726 R

**A STUDY OF YARD TRUCK DYNAMIC PLANNING AT A CONTAINER TERMINAL**

Main Author:

**Branislav DRAGOVIC**

Co-author(s):

**Park NAM KYU** (*Me*)**Ju YOUNG KIM****Romeo MESTROVIC****Abstract:**

At a container terminal, a set of yard trucks (YTs) is usually assigned to a specific quay crane (QC) until the work is completed. In this process, YTs return to the QC after delivering the containers. Containers are transported from the quay to the storage yard and vice versa by YTs, in which YTs are used for transfer operations. We focus on the operational management of the dynamic transfer equipment deployed between the quay and the container yard, during the container unloading/loading process at a given number of ships according to a previously planned berth schedule. These investigations address the issues such as the performance criteria and the model parameter to propose an operational method of YTs assigned to a QC based on real-time positioning and increases the terminal efficiency. Also, we are developing alternative simulation based approaches to current and improved models. Improved model based on real-time positioning transfer system looks as the most promising practical technique to support decisions for the YTs deployment problem. Numerical results and computational experiments are reported to evaluate a study on the improvement of the operation efficiency in Korea Container Terminal.

**Keywords:**

Dynamic planning system, Yard truck, Container terminal.

ID 1023 R

**LONG-TERM PLANNING OF A CONTAINER PORT TERMINAL UNDER DEMAND UNCERTAINTY AND ECONOMIES OF SCALE**

Main Author:

**Antonio NOVAES** (*Federal University of Santa Catarina*)

Co-author(s):

**Bernd SCHOLZ-REITER** (*Bremen University*)**Vanina M. DURSKI DA SILVA** (*Federal University of Santa Catarina*)**Hobed ROSA** (*Federal University of Santa Catarina*)**Abstract:**

This paper deals with a container port capacity expansion problem in which the projected demand shows a relatively high level of uncertainty. An important characteristic of most capacity expansion problems is the recognition of economies of scale when considering infrastructure investments. In many problems, backlogging of demand is not permitted and since the demand tends to increase on the long run, excess capacity will be usually observed in certain periods of time. In our analysis, the objective is to minimize the net present value of investments on ship berths along the lifespan of the project, plus ship costs and berth operating costs. Ship waiting times are estimated with an appropriate queuing model. In the literature concerning container terminals, an Erlang queue  $M/M/c$  is usually assumed, where  $c$  is the number of berths working in parallel. In the last years container ship size has been steadily increasing, and this trend is likely to continue in the future. With increasing costs, ship waiting times must be kept within reasonable limits. Ship waiting times are introduced in the model as constraints which are based on best maritime practices among leading container terminals of the world. Adopting a continuous time representation, the optimization model assumes stochastic demand evolution and employs a Dynamic Programming formulation in order to find the best epochs to install new berths. Finally, the model is applied to the container terminal of the port of Rio Grande, south of Brazil.

**Keywords:**

Port planning, Capacity expansion, Dynamic programming.

ID 1146 R

**COMPETITION AND HORIZONTAL INTEGRATION IN MARITIME FREIGHT TRANSPORT**

Main Author:

**Pedro CANTOS SÁNCHEZ** (*Universitat de València*)**Abstract:**

This paper develops a theoretical model for freight transport characterized by competition between means of transport (the road and maritime sectors), where modes are perceived as differentiated products. Competitive behavior is assumed in the road freight sector, and there are constant returns to scale. In contrast, the freight maritime sector is characterized by oligopolistic behavior, where shipping lines enjoy economies of scale. The market equilibrium where the shipping lines behave as profit maximizers, provides a first approximation to the determinants of market shares, profits, and user welfare. We then characterize the equilibrium when horizontal integration of shipping lines occurs, with and without further economies of scale. An empirical application to the routes Valencia- Antwerp and Valencia-Genoa uncovers that the joint profit of the merged firms and social welfare always increase. However, user surplus only increases when economies of scale are significantly exploited.

**Keywords:**

Freight transport, Shipping lines, Horizontal integration.

ID 1362 R

**BRINGING ECONOMIES OF SCALE IN MEGA CONTAINERSHIPS TO PORTS**

Main Author:

**David GUILLERMO CARRILLO MURILLO** (*Universität Karlsruhe (TH), Institut für Wirtschaftspolitik und Wirtschaftsforschung*)

Co-author(s):

**Giulia ARDUINO** (*DIEM, Università degli Studi di Genova*)**Abstract:**

The growth in freight transportation during the last decade has been linked with the economic advantages of allocating production in Far East sites with cheap hand labour. Therefore, a trend of using more and more containers has been observed in transportation and just about everything we see or set on our hand on spent time in a container. In fact, more than sixty percent of global trade in value travels in containers. As a consequence, the concentration of freight flows through containerisation has become an important issue for shipping liners. One of their reactions consisted in the strategy to employ mega containerships capable of carrying more than eleven thousand containers on the routes to the Far East. As a result, a new segment of the container market has been launched by Maersk Line, the first shipping company pioneer of these practices with the construction of mega vessels of these dimensions in 2006. A question rises on the convenience to participate to this segment of market on the overcoming years. The present paper aims to understand the economic interests of Port Authorities in accommodating this type of new ships, and to investigate the potential growth of this new market. Consequently, a twofold analysis has been developed. First, an overview of the market including global container operators, current and future fleet and the analysis of the main routes operated until now. Second, the economic benefits that this new market brings to Port Authorities have been calculated for two ports. Results will show the port fees per container and the total revenues for a Port Authority as well as the share of these revenues Bringing Economies of Scale in Mega Containerships to Ports that contributes for the return of capital invested. (...).

**Keywords:**

Container, Post-panamax, Port Authority, Port tariff, Port cost, Mega container vessel, Containerisation.

ID 2155 R

**A NON-STRUCTURAL TEST FOR COMPETITION IN THE CONTAINER LINER SHIPPING INDUSTRY**

Main Author:

**Christa SYS** (*University College Ghent - Faculty of Applied Business*)

Co-author(s):

**Hilde MEERSMAN** (*University of Antwerp*)**Eddy VAN DE VOORDE** (*University of Antwerp*)**Abstract:**

This paper examines the competitive conditions of the containerised liner shipping industry. The degree of competition prevailing in this industry will be assessed using the H-statistic proposed by Panzar and Rosse (1987). The properties of this non-structural methodology (e.g. using firm level data, robustness in small samples, no need to specify a relevant market, etc.) make it an excellent framework for assessing the degree of competition in the containerised liner shipping industry. The empirical specifications are based on an unbalanced panel of data regarding a sample of 18 major liner operators covering the period 1999-2008. The fact that we have found a significantly positive unscaled value of the Hstatistic means that the hypothesis can be rejected that the containerised liner shipping industry market structures correspond to a neoclassical monopolist, collusive oligopolist or conjectural-variations short-run oligopolist.

**Keywords:**

Containerised liner shipping industry, Competition, Panzar-Rosse model.

TUE 13<sup>th</sup> (09:45 - 11:00, Session A2.6) Room 5A

ID 3230 R

**FREIGHT RATES AND THE MARGINS OF INTRA-LATIN AMERICAN MARITIME TRADE**

Main Author:

**Gordon WILMSMEIER** (*Transport Research Institute - Edinburgh Napier University*)

Co-author(s):

**Inmaculada MARTÍNEZ ZARZOSO** (*Universidad Jaume I, Spain and Georg-August Universität*)

**Abstract:**

This paper focuses on the analysis of the relationship between maritime trade and transport cost in Latin America. The analysis is based on disaggregated (SITC 5 digit level) trade data for intra Latin maritime trade routes over the period 1999-2004. The research contributes to the literature by disentangling the effects of transport costs on the range of traded goods (extensive margin) and the traded volumes of goods (intensive margin) of international trade in order to test some of the predictions of the trade theories that introduce firm heterogeneity in productivity, as well as fixed costs of exporting. Recent investigations show that spatial frictions (distance) reduce trade mainly by trimming the number of shipments and that most firms ship only to geographically proximate customers, instead of shipping to many destinations in quantities that decrease in distance. Our analyses confirm these findings and show that the opposite pattern is observed for ad-valorem freight rates that reduce aggregate trade values mainly by reducing the volume of imported goods (intensive margin).

**Keywords:**

Transport costs, Maritime trade, Latin America, Sectoral data, Competitiveness .

TUE 13<sup>th</sup> (11:15 - 12:30, Session A2.7) Room 5A

ID 1354 R

**A MULTI CRITERIA DECISION MAKING APPROACH TO THE ANALYSIS OF SHIP LENGTH FACTOR IN THE STRAIT OF ISTANBUL**

Main Author:

**Tuba KECECI** (*Istanbul Technical University*)

Co-author(s):

**Cemil YURTOREN** (*Istanbul Technical University, Faculty of Maritime*)

**Abstract:**

The Strait of Istanbul is an 'S' shaped narrow channel of difficult nature with heavy currents, which is complex and irregular, and with sharp turns. Due to these characteristics, it is considered one of the most critical waterways in the world. The density of maritime traffic has increased from around 4500 ships passing annually in 1936, when Montreux Convention was signed to regulate navigation in the Straits, to an average of 54000 vessels per year recently. The increase of traffic density has led to rise in the number of maritime casualties. In order to cope with that problem Maritime Traffic Regulations in the Turkish Straits was established in 1994 and revised in 1998. In the regulation the concept of large vessel came to the fore and it is defined in the definitions & abbreviations: Article 2. When considering the increase in length of vessels passing through the Strait of Istanbul, the question 'What is a large vessel?' becomes intriguing. This paper investigates what a large vessel is in terms of length factor in the Strait of Istanbul. In this study experts from VTS, pilot captains of the Strait of Istanbul and experienced captains are consulted. AHP method is utilized to identify the quantitative importance of each efficient and some future works are suggested due to findings.

**Keywords:**

Maritime traffic management criteria, Decision making, AHP model, The Strait of Istanbul.

TUE 13<sup>th</sup> (11:15 - 12:30, Session A2.7) Room 5A

ID 1733 R

## DERIVING MARITIME TRANSPORT DEMAND

Main Author:

**Jeroen PRUYN** (*Delft University of Technology*)

### Abstract:

Triggered by the last crisis of 2007 and the huge amount of ships on order, for which no work exists in 2010 or is expected to exist in the coming 10 years, the question rose, how much inefficiency is actually present in the maritime trade. To research this we looked the many trade models that exist. Unfortunately the most common way to determine transport demand is either through a random function or just taken as fixed. Our model derives transport demand from a macro economic model, which represents the world through 17 countryblocks. The country blocks were chosen in such a way, that they can be easily identified as the important maritime trade areas. The import and export figures calculated with this model are reworked into trade in tons for the three markets of wet bulk, dry bulk and container/general cargo.

### Keywords:

Macro-economic model, International trade, Gaming, World shipping.

TUE 13<sup>th</sup> (11:15 - 12:30, Session A2.7) Room 5A

ID 2471 R

## OPERATION-BASED OPTIMIZATION OF SHIP DESIGN FOR DRY BULK VESSELS

Main Author:

**Shun CHEN** (*TU Delft*)

Co-author(s):

**Koos FROUWS** (*Delft University of Technology*)

### Abstract:

One of the most important decisions for the dry bulk ship-owners building a new vessel or buying a ship is to determine how big a vessel should be. Ship owners surely intend to obtain an optimal ship size, either minimizing transport costs per ton or maximizing profits per day. However, most of the past studies devoted their attention to the size growth of container vessels, while questions like what are the determinants behind the size growth of dry bulk carriers, what are important restrictions and risks for large vessels, and how to determine the optimal ship size on a particular trade, have not been investigated systematically in the past. Therefore, our paper attempts to build an interactive logistics scheme including three basic systems, namely the design model, the shipping system and the shore logistic system, based on the technical-economic analysis for determining optimum ship's main dimensions at the basic design stage for ship owners when they build a new ship and for determining optimal solutions to logistic system for steel makers to import iron ore in the dry bulk shipping market. The tools used in the paper vary from a conceptual vessel design model calculating the optimal ship dimensions given the deadweight within a logistical reality till Monte Carlo simulation of port-sea systems in order to sketch the impact of the shore based facilities, including the ore-storage melting-furnace system on ship size. The whole optimization process is completed within the Crystal Ball software by embedding Microsoft Solver to deal with the design solution. The proposed methodology provides a tool to analyze problems in ship design, ship operation and logistics system and show the required flexibility in the decision-making for different parties. (...).

### Keywords:

The optimum ship size, Dry bulk vessels, Monte Carlo Simulation, Logistic system.

ID 1552 R

**MONITORING CONTAINER FLOWS: THE LINK BETWEEN TRADE AND MARITIME FLOWS**

Main Author:

**Paresa MARKIANIDOU** (*University of Antwerp*)**Abstract:**

This paper explores the link between maritime flows and trade from a macro-economic modeling perspective. The aim is to translate the output of structural forecasting models, particularly export and import values or volumes into maritime cargo flow projections. The justification for such an investigation derives from the lack of structural approaches within the maritime field, despite the plethora of sophisticated economy and trade models. Consequently there is yet no direct link between structural changes in the world economies and maritime cargo flows, more specifically the traditional maritime markets i.e. dry bulk, liquid bulk and containers. In consideration of the limitations of any forecasting exercise it is however believed that such an approach adds value to direct market players namely port authorities and liner companies by allowing the monitoring of potential traffic and volumes respectively. This knowledge assists in decision making processes concerning for the liner companies operational issues i.e. vessel size utilization or frequency and investment planning issues for the port authorities i.e. dredging or construction of a new terminal among others. In this paper the preliminary steps will be described with the aim of attaining constructive contributions from the early stages of this research in progress. The structure of the paper is as follows. The first part consists of a literature review leading to a criteria based methodology for the selection of the most appropriate model for maritime applications. The second part establishes the first steps towards a tool, linking the output of the selected model and the maritime flows, in particular the container flows, followed by a suggestion for its application on a specific case study in the last part of the paper. (...).

**Keywords:**

Container flows, Forecasting, Trade.

ID 1646 R

**EVOLVING PATTERNS OF TRANSSHIPMENT ACTIVITIES AND CONTAINER FLOWS IN THE EASTERN MEDITERRANEAN - NINE YEARS LATER**

Main Author:

**Isam KAYSI** (*American University of Beirut*)

Co-author(s):

**Maya KASSAB** (*American University of Beirut*)**Farah MNEIMNEH** (*American University of Beirut*)**Abstract:**

This paper examines the structure of Eastern Mediterranean container shipping, with a focus on transshipment activities. Such characterization is mostly unavailable in existing references for the Eastern Mediterranean region, limiting the ability of researchers and policy makers to engage in container shipping analysis and multimodal freight planning in that region. The first author presented a paper at the 2001 WCTR Conference that addressed these issues and which has been widely requested and sought in the region. The analysis presented in this paper is meant to be a follow-up to the previous research to track the evolving structure of transshipment activities in this region, and similarly considers three aspects of the Eastern Mediterranean transshipment context (i) regional ports and their characteristics, (ii) industry structure and shipping routes, and (iii) projected growth trends. Historical trends in container traffic handled at transshipment ports in the region are identified, and trend-line projections developed. The objective is to provide estimates of the overall level of container shipping and handling activity at the region's ports. These estimates represent an important input to strategic intermodal freight mobility planning studies of the region, and can also provide a basis for assessing the reasonableness of particular container traffic scenarios at existing as well as proposed port terminals in the region. With anticipated growth in container traffic globally and increasing importance of transshipment in the economics of shipping line operations, several ports in the Mediterranean have been investing in aggressive development and improvement of container handling capabilities. (...).

**Keywords:**

Transshipment, Container Flows, Mediterranean.

TUE 13<sup>th</sup> (14:00 - 15:15, Session A2.8) Room 5A

ID 1834 R

**PORT SECTOR SUSTAINABILITY REPORTING: THE CASE OF THE PORT OF GENOA**

Main Author:

**Simona SANGUINETI** (*Università di Genova*)

Co-author(s):

**Claudio FERRARI** (*University of Genova*)

**Elena MORCHIO** (*University of Genova*)

**Abstract:**

The role played by firms has been evolved with a social and environmental dimension of management, beside the economic and financial ones, in a framework of increasing attention to sustainable development. Consciousness keeping pace with a necessary communication politics of this new social role, firms have increasingly adopted corporate sustainability reporting principles. The logistics and transportation sector has a variety of impacts affecting the economic, environmental, and social dimensions of society in positive as well as negative ways. With the steady increase of trade flows and maritime and port traffic, getting goods (and people) to and from their respective destinations while containing negative externalities presents a major challenge for ports around the world. Planned together with Genoa provincial administration, present study aims at creating a sustainability framework report for the port of Genoa, to satisfy the information needs of external and internal stakeholders (employers, shareholder, customers, supplier, associations, local authorities, communities) in terms of social and environmental performance of the port, meant as the community of different actors involved in the rendering of the port service. The work is mainly based on the "G3" Guidelines, i.e. the so-called "Third Generation" of the GRI's Sustainability Reporting Guidelines, launched in October 2006, with special attention to the Logistics and Transportation Sector Supplement. The Supplement content was developed to be globally applicable to all organisations regardless of their size or specific range of activities within the logistics and transportation sector (e.g., express or mail services) that use single or multiple modes of transportation to move goods, primarily for logistical purposes. (...).

**Keywords:**

Ports, Sustainability reporting.

TUE 13<sup>th</sup> (14:00 - 15:15, Session A2.8) Room 5A

ID 2293 R

**MARITIME LOGISTICS HUB IN CONCEPT AND PRACTICE**

Main Author:

**Dong-Wook SONG** (*Heriot-Watt University*)

Co-author(s):

**Hyung-Sik NAM** (*Heriot-Watt University*)

**Abstract:**

Since the hub-and-spoke concept was introduced to the aviation market after the US airline deregulation in the late 1970s, it becomes a primary distribution model employed by leading international logistics companies such as DHL, UPS and FedEx. This pattern drives the companies to consolidate shipments on the large scale at major terminals (i.e., hub) and to redistribute the smaller scale of shipments to their respective destinations via radial links (i.e., spoke). Container ports, with the application of the same concept to maritime sector, have assumed an important role in global logistics and supply chains and evolved to a global distribution channel node from the traditional loading and discharging function. In the field of maritime logistics and supply chains, however, the hub concept has been often introduced in various terms in accordance with functionality, for example, logistics centre, logistics zone, freight terminal, distribution centre, and warehouse. Such a heterogeneous terminology on the concept of maritime logistics hub seems still in usage by practitioners and academics alike. Having recognised this rather ambiguous concept and definition in the literature, this paper attempts to define the hub concept directly applicable to maritime logistics by systematically synthesising the existing studies and to examine the evolutionary pattern of maritime logistics hubs, defined in this paper as container hub ports, in the Far East. When analysing the pattern, this paper utilises the flying geese paradigm as a theoretical framework. As maritime transport (i.e., shipping and ports) plays a significant role in international trade, a flying geese model would be a useful tool to understand the developmental pattern of the maritime industry in the context of maritime logistics hubs. (...).

**Keywords:**

Logistics Hub, Container Hub Port, Flying Geese Model, Northeast Asia.

TUE 13<sup>th</sup> (14:00 - 15:15, Session A2.8) Room 5A

ID 2365 R  
**SUSTAINABLE PORT DEVELOPMENT IN THE  
NETHERLANDS - FRAMEWORK FOR A  
COMPREHENSIVE APPROACH APPLIED TO  
AMSTERDAM PORT**

Main Author:  
**Sander DEKKER**

**Abstract:**

Sustainable development is presently a major critical issue, also for the maritime sector. Seaports require sustainable solutions for the challenges they are facing: increasing demand for space, expanding energy needs, growing mobility (trade and traffic) and the effects of climate change. The ultimate goal from a sustainability point of view is to address these challenges in such a way that a balance is found between social, ecological and economic interests. A comprehensive approach taking into account smart (here: integrated and costeffective) solutions is called for. In the present paper, we introduce a framework for such an approach. With this framework, port management can be supported in realizing its ambitions regarding the three tracks 'use of space', 'energy needs' and 'mobility', and in anticipating changing circumstances with smart solutions. The framework is demonstrated with an application to Amsterdam port. The results of this application are used to situate the proposed framework and to recommend issues for port management and further development of the framework.

**Keywords:**

Port development, Sustainability, Comprehensive planning.

TUE 13<sup>th</sup> (15:30 - 16:45, Session A2.9) Room 5A

ID 2638 R  
**THE HETEROSCEDASTIC EXTREME VALUE MODEL  
APPLICATION TO THE CRUISING PRICING STRATEGY  
MANAGEMENT**

Main Author:  
**Mauro CATALANI** (*University of Naples"Parthenope"*)

**Abstract:**

Main objective of the paper is to evaluate the pricing strategy of a cruise shipping company by passenger demand elasticity application. The approach focuses on passengers behavior choosing between different classes on board a cruise ship. It is important to specify that we are in presence on board of different level of service and pricing configuration as class (category). Infact the cruise ships can have many different pricing class subdivided as regard the cabin deck location and ship accommodation (inside–outside or foreward–aft). In this sector, we assist also to a great market development of demand in the main world areas as Caribbean, Mediterranean , North Europe, Alaska, Asia etc . In the paper the methodology will be based on a RP survey on board a cruise ship leader operating in Northern Mediterranean (Catalani M. and Wild 2000). This will consent to analyze the passenger behavior with different nationality, employment, qualification, income, age, choosing classes. The survey will be integrated by an analysis based on passenger comment form on board of a post panamax cruise ships as regard entertainment, quality of food and beverage, embarkation procedure, itinerary etc . From the RP survey and the comment form kindly given by the crusing ship will be tested two econometric model based on multinomial logit model and heteroscedastic extreme value approaches to explain the passenger behaviour ( McFadden D. 2000, Bhat C. 1995 , Ben Akiva M. and Walters J. 2002). The parameters estimates will consent us to determine a probabilistic criterion across passengers of choice between different classes on board and direct and cross price elasticity demand computation in front of changing pricing. (...).

**Keywords:**

Cruise, Shipping, Competition, HEV.



ID 2796 R

**ANALYSIS OF SANTA CATARINA'S PORT  
INFRASTRUCTURE DURING THE XXTH CENTURY**

Main Author:

**Isa ROCHA** (*Universidade do Estado de Santa Catarina*)

Co-author(s):

**Leandro VIDAL** (*Universidade do Estado de Santa Catarina*)**Lucas FERREIRA** (*Universidade do Estado de Santa Catarina*)**Abstract:**

The state of Santa Catarina (located in the south of Brazil) stands out in the Brazilian economy due to its precociousness and dynamism of the industrialization and exportation of industrialized products. Until the beginning of the 1970's, the exportations from Santa Catarina were predominantly composed by lumber mostly original from the forests of the plateau, whose outflow happened mainly via railroad to the Atlantic ports of São Francisco do Sul and Itajaí, or via river in the countryside of the south American territory (Uruguai river) up to the Prata basin. Gradually the industrialized products started to appear on the agenda of state exportations and nowadays the state presents important international industrial insertion, helped by a strategic regional organization of the network of transport infrastructure (sea, land and air). The research characterizes the evolution of the ports in Santa Catarina throughout the XXth century, aiming at finding evidence of the relation existing between the port network system and the exporting industrial areas original from the centers of European immigrants. For that purpose, the category of socio-spatial formation (M.Santos) and the interpretations of the Brazilian economic development of I. Rangel, as well as the studies of Santa Catarina's geography of A. Mamigonian e V. Peluso Jr were used. The field surveys carried out on the port areas in Santa Catarina enabled the construction of a data bank associated with regional thematic maps that raised the main problems existing nowadays. The port infrastructure of Santa Catarina was slowly determined, since the colonial period, through the existence of various ports. (...).

**Keywords:**

Infrastructure, Ports, Santa Catarina.

ID 3142 R

**INDIA – BRAZIL - SOUTH AFRICA TRADE FLOWS AND  
AGENDA FOR MARITIME TRANSPORT SERVICES**

Main Author:

**Alexandre BARRA** (*National Confederation of Industry*)

Co-author(s):

**Wagner CARDOSO** (*National Confederation of Industry*)**Cristina PESSOA****Mariana CASTELLANI****Abstract:**

The main purpose of this article is to analyze maritime transport services among the India – Brazil – South Africa (IBSA) countries and to evaluate their impacts on the trilateral trade. Imbalances in trade flows tend to increase costs of services being offered. A more intense trilateral trade will favour economies of scale in transport services. Several steps can contribute to reduce transport costs. Greater efficiency in the port terminals of the three countries should be promoted to reduce transit time. The main intra-IBSA freight transshipment operations should be concentrated in a South African port. For this purpose, a cargo storage structure should be set up next to the selected port (e.g. Durban) which would then concentrate cargo to be used by Brazilian and Indian companies to their hub ports. Such advances will ensure greater efficiency, transparency and predictability to trade, reducing the cost of intra-bloc exports and imports. In addition, involved governments should, in partnership with other public and private agents, seek to reduce structural asymmetries in their maritime sectors.

**Keywords:**

Maritime transport, Trade flows, India – Brazil - South Africa (IBSA) Forum.

ID 3177 R

**ANALYSIS OF MULTI-MITIGATION SCENARIOS ON MARITIME DISRUPTIONS**

Main Author:

**Raja GURNING** (*Australian Maritime College (AMC), University of Tasmania, Australia*)

Co-author(s):

**Stephen CAHOON** (*Australian Maritime College*)**Abstract:**

In the wheat supply chain, maritime operations have an essential role due to the critical linkages that connect the global transport of this large density and complex freight task (Craighead et al. 2007). Past research shows that an increase in maritime logistics risk is a major limiting factor in the efficient movement of grain from the producer (wheat farmers) to global wheat markets. Maritime logistical risks are wide-ranging and include the uncertainty in vessel arrivals, inventory levels of grain at the port, variety of wheat consignments that arrive, and the impact of a low rail car unloading rate. Other factors that can cause supply disruptions are uncertainty in demand, quality, and performance of maritime logistic services. These significant factors could subsequently create severe disruptive events in the supply chain process of wheat trading. This paper assesses four major mitigation strategies (inventory and sourcing mitigation, contingency rerouting, recovery planning, and business continuity planning) to determine their suitability for managing potential disruptions in the wheat supply chain. A Markovian-based methodology is the prime means used to evaluate the mitigation strategies which will be done in the context of wheat transport from Australia to Indonesia. As a result, the four-stage continuous time period of the Markov chain application enables the measurement and prediction of supply chain costs and time functions in relation to disruptive events to be determined. This may assist entities along the wheat supply chain to be better prepared both when attempting to manage maritime disruptions as well as when re-evaluating their supply chain operation planning in regards to mitigating future maritime disruptions. (...).

**Keywords:**

Multi-mitigation scenarios, Maritime disruptions, Wheat supply chain.

ID 1013 R

**PORT CHOICE MODEL OF TRANSSHIPMENT CARGO USING SYSTEM DYNAMICS**

Main Author:

**Park NAM KYU** (*Me*)

Co-author(s):

**Lim CHAE KWAN** (*Me*)**Abstract:**

The aim of this paper is to identify impacting factors that have been affecting the increase of transshipment cargoes of port of Busan and to identify forecasted result using system dynamics. To clarify the reason why T/S cargoes have increased in the port of Busan, several steps are made as follows: The first step is to make a quantitative model for explaining the development of T/S cargoes during the last decade. To define dependent and independent variables for multiple regressions after testing variable significance is the second step. For this, data collection and the accuracy of validation have been done by the direct interview with the experienced officials in shipping companies of both domestic and foreign country. After validating the model with collected data, the final step is to find variables which are explaining the model the most. In conclusion, 2 variables were clearly identified as core factors that explain well the development of T/S cargoes in the port of Busan: 'Mohring effect' and total cost. It is strongly recommended, by an empirical study, that an incentive scheme be changed to a way which more feeder vessels rather than mother vessels can reduce their direct costs to call in the port of Busan. Based on regression analysis, sensitivity model for transshipment cargo is useful for dynamic forecasting in changing cost factor and mohring factor with time series.

**Keywords:**

Northeast Asia, Transshipment Port, Choice of Transshipment Port, Incentive, Busan Port Authority, Simulation, SD(System Dynamics).

TUE 13<sup>th</sup> (17:00 - 18:15, Session A2.10) Room 5A

ID 1251 R

## **CLASSIFICATION OF CONTAINER PORTS ON THE BASIS OF NETWORKS**

Main Author:

**Yong-An PARK** (*Research Fellow at Korea Maritime Institute*)

Co-author(s):

**Francesca MEDDA** (*University College London*)

### **Abstract:**

The objective of the paper is to address the problem of port classification. Differently from previous analyses, we examine the agglomeration effect of ports in the regions where they operate and the relationship between ports and other nodal infrastructures such as airports. We thus develop an innovative classification for container ports based on a combination of the shipping network concept and the inland network concept.

### **Keywords:**

Port, Container, Shipping, Inland Network, Agglomeration, Intermodal Transport.

TUE 13<sup>th</sup> (17:00 - 18:15, Session A2.10) Room 5A

ID 1727 R

## **A SYSTEMS APPROACH TO ASSESSING THE ENVIRONMENTAL IMPACT OF BUNKERING OPERATIONS IN PORT**

Main Author:

**John DINWOODIE** (*University of Plymouth Business School, School of Management*)

Co-author(s):

**Xiang SUN** (*University of Plymouth Business School*)

**Harriet KNOWLES** (*University of Plymouth Business School*)

**Sarah TUCK** (*University of Plymouth Business School*)

**James BENHIN** (*University of Plymouth Business School*)

### **Abstract:**

This paper appraises the usefulness of a framework which is accessible to port authorities to assess the potential environmental impact of bunkering operations. Increasing numbers of ship movements generate more frequent routine bunkering operations in ports but few formal approaches exist for assessing their environmental impact, which potentially, could be significant. A systems approach highlights inputs and outputs that define processes in the environmental assessment, identified in a process modelling technique. At a strategic level, primary processes are defined which affect the environmental assessment of present and future bunkering operations and their potential impacts. Later, tactical service processes define the integrity of processes that guarantee service level and quality. Finally, operational processes define outputs. This approach facilitates planning of more sustainable bunkering operations in ports. A case study is based on Falmouth Harbour Commissioners (FHC) which regulates much of Falmouth Harbour and hosts the UK's largest offshore marine bunkering operation. The approach proceeds by defining the local problem, system boundaries and function and variable flows, and identifying strategic, tactical and operational processes undertaken in the environmental assessment. Falmouth has recently recorded a three-fold rise in the number of vessels calling, and a 50% rise in the volume of fuel sold as more vessels take onboard low-sulphur fuel for use in the English Channel and other EU designated Sulphur Oxide Emissions Control Areas. (...).

### **Keywords:**

Sustainable port operations, Environmental impact, Systems approach to environmental assessment, Bunkering operations.

TUE 13<sup>th</sup> (17:00 - 18:15, Session A2.10) Room 5A

ID 1890 R

**CAPACITY OR PRICE? AN EMPIRICAL INVESTIGATION OF COMPETITION IN LINER PASSENGER SHIPPING**

Main Author:

**Ioannis TSAMOURGELIS** (*Deptm of Shipping Trade and Transport University of the Aegean*)

Co-author(s):

**Maria LEKAKOU** (*University of the Aegean*)  
**Fotios KARLIS** (*DEPARTMENT OF SHIPPING TRADE AND TRANSPORT, UNIVERSITY OF THE AEGEAN*)

**Abstract:**

In liner shipping ship owners decide the kind of ships they will employ in terms of their carrying capacity, speed and qualitative characteristics. Clearly this decision is subjected to the requirements of the specific market in terms of the characteristics of the market they operate and the prevailing conditions of competition. Then, at some second stage, they bring these “quantities” to market and they engage in Bertrand like price competition, while they have full and intertemporal access to information relating to other operators’ market shares per category of passengers and vehicles. This competition theoretically should end up in a Bertrand like outcome with prices equal to marginal cost generating the competitive solution with the proviso that either of the ship owners can not satisfy more demand than they are producing for in the first stage. However, as Kreps and Scheinkman (1983) have shown this Bertrand like competition may end up in Cournot outcomes due to the form of the game they are engaged. In this paper we suggest a procedure that identifies whether a duopoly game in liner shipping follows Kreps and Scheinkman ending up in Cournot outcomes or it is simply a Bertrand game while investigate Stackelberg related alternatives. More specifically since prices in liner-coastal shipping remain constant for long periods of time and do not present significant variance the test for Bertrand outcome will be based on the approximation of price relative to marginal cost difference (Lerner index). However if Cournot outcome proves to be robust than the Kreps Scheinkman hypothesis will be true indicating that the strategic variable upon which competition is performed is not prices but the type of ship they decide to invest. (...).

**Keywords:**

Cournot outcome, Passenger shipping, Maritime comp.

WED 14<sup>th</sup> (08:15 - 09:30, Session A2.11) Room 5A

ID 1686 R

**KNOWLEDGE-BASED STRATEGY FOR MARITIME LOGISTICS VALUE: AN INTER-ORGANISATIONAL RELATIONSHIP PERSPECTIVE**

Main Author:

**Dong-Wook SONG** (*Heriot-Watt University*)

Co-author(s):

**Eon-Seong LEE** (*Heriot-Watt University*)

**Abstract:**

Maximising maritime logistic value becomes one of the significant strategic goals that maritime operators (i.e. port operators, shipping lines and freight forwarders) want to achieve. The value is referred to as how well a maritime logistics system responds to customer demands, which is largely reflected in operational efficiency and service effectiveness. Despite its significance to sustainable competitiveness, existing literatures have yet clarified, in a systematic way, what kind of strategic directions should be taken so as to accomplish such a business objective. Drawing from central strategic management theories and practices, this paper aims to investigate the effectiveness of a knowledge-based strategy in enhancing maritime logistics value. This paper develops a conceptual framework that ensures the positive relationships between channels of knowledge acquisition, knowledge acquisition and maritime logistics value. An inter-organisational relationship approach, such as social network embeddedness and co-opetitive relationship, will be adopted when investigating those relationships possibly in presence among maritime operators. The proposed relationships are empirically examined through both an explorative case study and a Delphi analysis of an industry sector. Propositions and strategic implications for maritime operators will be then suggested.

**Keywords:**

Maritime logistics value, Knowledge acquisition, Social networks, Co-opetition.

ID 1716 R

**VERIFYING LINER SHIPPING ALLIANCE'S STABILITY BY APPLYING CORE THEORY**

Main Author:

**Dong YANG** (MFI, University of Southern Denmark)

Co-author(s):

**Xiaoning SHI** (Institute of Information System, University of Hamburg)**Miaoqia LIU** (Center for Maritime Economics and Logistics, Erasmus University)**Abstract:**

The core is a vital concept in cooperative game theory and has been widely used in the analysis of the alliances' stability. Generally speaking, when cost functions are continuous functions of the output, the severity of empty core decreases as the size of the market increases. However the liner shipping industry is an exceptional case due to its characteristic of 'lumpy transport'. The core is periodically empty as transport demand increases, and this feature is affected by the discontinuities of the marginal cost of the liner carriers. This paper focuses on economic performance and stability of the liner shipping alliances, where business cooperation is realized by pooling mega vessels. Deploying mega-ships has certain influence on the shipping alliance and can change the conditions of non-empty core of shipping market. The core's condition lies on the fact that a stable alliance depends, not only on its potential profitability, but also on none of the members can be at an advantage better off by forming any sub-coalition. To demonstrate the core situation in liner shipping alliance, a cost function is firstly identified on the basis of two assumptions regarding cooperation: 1) pooling vessels and 2) deploying mega-ships, if needed. Taking demand curves and cost functions as basis, the conditions of shipping market core are then observed. The difference between pre-alliance conditions and post-alliance conditions is emphatically discussed. As another important part of this study, a case study with three liner carriers is conducted in order to show the possible operating slot intervals of member carriers in forming the alliance to avoid the empty core from carriers' perspective. (...).

**Keywords:**

Liner shipping alliance, Cost function, Core, Mega-ship, Stability.

ID 1810 R

**MARKET SEGMENTATION AND POSITIONING FOR OCEAN CARRIERS: THE TAIWAN-SOUTH CHINA ROUTE**

Main Author:

**Chieh-Hua WEN** (Feng Chia University)

Co-author(s):

**Wei-Wei LIN** (Feng Chia University)**Abstract:**

This paper explores market segmentation and competitive positioning for ocean carriers, illustrating the relative positions of ocean carriers and key service attributes by customer segments. This study establishes segments for ocean carriers' major customers (i.e., freight forwarders) by using factor analysis and cluster analysis, which can reveal customers' profiles and needs. For each segment, correspondence analysis, a multivariate statistical approach that graphically indicates carriers' relationships in a low-dimensional map, can identify the competitive positions of ocean carriers. An e-mail and postal mail survey was conducted among Taiwan freight forwarders who had provided services between Taiwan and South China. Factor analysis categorized service attributes of ocean carriers into four underlying latent factors: service performance, reputation/knowledge, freight charge/response, and information technology/communication. Two-step cluster analysis further divided the customers into two distinct segments. For each segment, correspondence cluster analysis created perceptual maps that revealed the relative positions of ocean carriers and their key strengths and weaknesses of services. In addition, each segment identified different competitive groups of ocean carriers that were located in close proximity to each other and shared similar attribute profiles. This paper concludes with managerial implications and directions for future research.

**Keywords:**

Market segmentation, Brand position, Cluster analysis, Correspondence analysis, Ocean carrier.

WED 14<sup>th</sup> (08:15 - 09:30, Session A2.11) Room 5A

ID 1833 R

**EMERGENCE OF COMPETITION IN RAILWAY'S SECTOR IN GERMANY AND EUROPE : WHAT LEARNING CAN BE DRAWN FROM THE THESIS OF WALTER EUCKEN : THE FORMATION OF CARTELS AND AGREEMENTS IN MARITIME TRANSPORT, DOCTORAL THESIS, BONN, 1914**

Main Author:

**Laurent GUIHÉRY** (*LET - University of Lyon*)

**Abstract:**

The transport sector is undergoing profound change in Europe at the present time, in particular rail transport. Faced with the threat of global warming, the annoyance of noise, pollution from cars and heavy goods vehicles (HGV), urban congestion and the problems of road safety, rail travel offers new appeal for a move from road to rail, for passengers as well as for goods. Formerly presented as a typical example of natural monopoly in the theoretical literature on public economy, it has been decided, under the impetus of the European Community and of pioneering countries (in particular Sweden), to separate the business of transport from the management of the infrastructure and, in order to reduce the level of public subsidies, to open the exploitation of rail transport to competition. The network, on the other hand, remains in the regulated framework of natural monopoly (Guihéry, 2004), which can be managed by public authority – directly (RFF – France) or more indirectly (Germany via the subsidiary company DB Netz part of DB AG holding ; the United Kingdom with Network Rail, a private company but under the control of the Office of Rail Regulation (O.R.R.)). New European rules have therefore been created concerning market access for new entrants to the market (Burlando, C., Guihéry, L., (2005a), in respect to safety regulations and the interconnections between the different Member States of the Union (for example, the ERTMS standards), on the reciprocity of rules governing competition between European countries, rules on pricing for use of the infrastructure, on taking into account public service missions (European Directives on Public Service Obligation and on the decentralisation of regional passenger services (Guihéry, (2005b). (...).

**Keywords:**

Germany, Transport Policy, XIXth century, Maritime.

TUE 13<sup>th</sup> (11:15 - 12:30, Session A3.1) Room 1.03

ID 1750 R

**THE LOCATION AND PRICING OF MASS TRANSIT STATIONS**

Main Author:

**Moez KILANI** (*University of Lille 3*)

Co-author(s):

**Stef PROOST** (*KULeuven*)

**André DE PALMA** (*Ecole Normale Supérieure de Cachan*)

**Abstract:**

This paper presents an analytical model for the optimal location and pricing of one or more mass transit stations in a monocentric city. We compare location and pricing decisions for transit stations by a public agency, a private monopoly and a duopoly where each private operator controls the location and pricing of one station. Analytical as well as numerical results are derived for different distributions of residential density.

**Keywords:**

Mass transit , Station location , Competition betw.

ID 2163 R

**EVALUATION OF CONSTRUCTION OF URBAN RAPID TRANSIT COORDINATED WITH DEVELOPMENT OF RESIDENTIAL AREA**

Main Author:

**Shoujiro KAMITOMO** (*Japan Railway Construction, Transport and Technology Agency*)**Abstract:**

Recently, development of railway has become more and more important to enhance urban appeal and promote urban activation. To improve the urban function with railway, it is important to coordinate railway construction with development of residential area. Tsukuba Express (hereinafter referred to as "TX") opened in Aug 2005 is a newly constructed line under the new law (hereinafter referred to as "the Unification Act") which aims to promote coordination between development of residential area and railway construction. The development of transfer station, station plaza and new housing land based on the Unification Act and improvement of transportation convenience, such as speed-up of train, have vitalized the local economy along the TX line and its ridership has been increasing steadily since it opened. This paper describes the development system of urban railway coordinated with development of residential area and railway business, and the ex-post evaluation of TX including the factor analysis on a high number of passengers and diversified effects of close coordination with relevant bodies.

**Keywords:**

Express railway Development system Improvement o.

ID 2192 R

**OPINIONS OF INTERMODAL TRANSFER FUNCTIONS OF URBAN RAILWAY SYSTEMS: A CASE STUDY OF DELHI METRO**

Main Author:

**Sadayuki YAGI** (*Japan Research Institute*)

Co-author(s):

**Katsuhide NAGAYAMA** (*Value Planning International, Inc.*)**Abstract:**

Actual ridership of urban railway systems recently developed especially in the developing world tends to be lower than forecast. While low ridership is caused by several factors, this research focuses on intermodal transfer functions at railway stations, identifying current problems and vital issues of intermodal transfer functions at railway stations. Taking the Delhi Metro System as a case study, this paper presents the result of a Questionnaire Survey, which was conducted to identify satisfaction levels of Metro users and non-Metro users in terms of intermodal transfer facilities and services along with their improvement needs. Metro stations were classified into four groups based on the characteristics of each station. A representative station was selected from each group and the Survey was conducted around this station. Improvement needs that were revealed in the Survey imply several significant measures for strengthening the intermodal mobility of the Metro. Those include not only physical improvement of railway stations such as a barrier-free system but also improvement of intermodal facilities including user-friendliness of transport facilities (e.g., pedestrian walks, parking lots), enhancement of the convenience level for transferring activities by improving physical conditions (e.g., shorter walking distance for transfer), and provision of safe and comfortable waiting space for transferring passengers. Furthermore, over half of the Metro users residing in suburban areas desire the improvement of feeder bus services in terms of service accessibility, frequency, and operational punctuality. These proved to be the vital points to strengthen the intermodal functions of the overall public transport network in Delhi. (...).

**Keywords:**

Railway, Transfer Function, Intermodality, Opinion Survey, Delhi Metro.

TUE 13<sup>th</sup> (11:15 - 12:30, Session A3.1) Room 1.03

ID 2864 R

## RELIABILITY AND DELAY IN LRT OPERATION IN CALGARY

Main Author:

**Chan WIRASINGHE**

Co-author(s):

**Namali SIRISOMA**

**D. MORGAN** (City of Calgary, Calgary, Alberta, Canada)

### Abstract:

Due to many issues in LRT operations, the target headway is not achieved regularly. Trains are often delayed, and the level of service is not considered satisfactory by many passengers. Calgary Transit's Light Rail Transit (LRT) system consists of around 44km of double-line rail track, which operates from Crowfoot to Somerset - Bridlewood and from the City centre to McKnight - Westwinds. From 10th St. SW to 3rd St. SE, both lines operate in a free fare zone. Many at-grade railway crossings are present in the free fare zone; and, all the intersections are signalized, allocating the higher right of way to the LRT system. To improve the reliability of the LRT system in Calgary operational problems are analyzed including delay distribution at end and time points, actual to planned headway ratios at selected stations, and inter-station delays, and recommendations made regarding improvements to the schedule and operational procedures.

### Keywords:

Delay, Demand distribution, Headway ratio.

TUE 13<sup>th</sup> (11:15 - 12:30, Session A3.1) Room 1.03

ID 3257 R

## THE AMSTERDAM NORTH SOUTH LINE: EXPLAINING COST OVERRUNS AND TRAFFIC SHORTFALLS

Main Author:

**Mig DE JONG** (TU Delft)

### Abstract:

Internationally, major transport infrastructure projects are plagued by cost overruns, delays and benefit shortfalls. These problems are explained in different ways, including technical explanations, psychological explanations and political-economic explanations, which all lead to different solutions. The explanations have primarily been tested statistically. To further our knowledge on the processes to which these explanations are applicable, a case study is examined: The Amsterdam North South Line. The North South Line (Noord-Zuidlijn) is a new metro link that is currently under construction. This project already suffers from cost overruns of over 120%. After the last major cost overrun was reported, the alderman resigned. An independent committee was installed, that was assigned to advise the board of aldermen how to continue. This committee, chaired by former minister Veerman resulted in a clear advice: continue building. However, this advice appears to be little robust. Studying the North South Line it appears that a positive image of the situation is consciously created in order to get funding approved. We can recognize the 'salami technique' to feed cost overruns step-by-step, bit-by-bit to citizens and representatives and the systematic overestimates of the benefits of the North South Line. The number of passengers is overestimated, because growth expectations of the past are still being used, although these have not been realised. Furthermore, the travel timesaving is estimated too high, because extra travel time to the underground metro stations was not considered. (...).

### Keywords:

Amsterdam, Benefit Shortfalls, Cost Benefit Analysis, Cost Overruns, Explanations for Failure, Megaproject, Metro, North South Line, Strategic Misrepresentation .



TUE 13<sup>th</sup> (14:00 - 15:15, Session A3.2) Room 1.03

ID 1520 R

**A STUDY OF OPTIMUM RAIL TRACK ACCESS ALLOCATION BETWEEN FREIGHT AND PASSENGER TRAIN IN JAPAN**

Main Author:

**Shigeki OZAWA** (*Institute of Transportation Economics*)

**Abstract:**

This study reveals that the current rail track access allocation (slot allocation) system in Japan cannot maximize social surplus and causes deadweight loss, especially in congested sections. Deadweight loss is estimated with an actual case in this study. The problem is due to a specific rail way company having priority access to rail tracks and that company acts to maximize profits under the situation. This study concludes that a neutral body is required to adjust slot allocation.

**Keywords:**

Rail track access, Slot allocation, Vertical separation, Deadweight loss.

TUE 13<sup>th</sup> (14:00 - 15:15, Session A3.2) Room 1.03

ID 1533 R

**RAILWAY CAPACITY ANALYSIS: METHODOLOGICAL FRAMEWORK AND HARMONIZATION PERSPECTIVES**

Main Author:

**Evangelia KONTAXI** (*University of Rome La Sapienza*)

Co-author(s):

**Stefano RICCI** (*Sapienza - University of Rome*)

**Abstract:**

The paper deals with capacity analysis techniques and methodologies for railway systems management and provides an accurate description of the methods classified by sector of interest, with a particular attention to point out all factors having a direct relation to the obtained results (input / output comparison analysis). The results are summarised in a comparison framework including quantitative elements useful for the planning of railway capacity analysis. Railway capacity has always been an attractive issue due to its relevance. In this paper all types of capacity will be defined: Theoretical Capacity (TC), Practical Capacity (PC), Used Capacity (UC), and Available Capacity (AC). The global aim of the research is to offer a technical manual including of overview and descriptions of the first branch of all Italian methods elaborated from 1950 till today. Synthetic and analytical methods, methods of optimization, simulation methods and their environments are compared and developed.

**Keywords:**

Capacity, Techniques, Tools, Perspectives.

TUE 13<sup>th</sup> (14:00 - 15:15, Session A3.2) Room 1.03

ID 1584 R

**RAIL PATRONAGE MANAGEMENT ? EFFECTIVENESS  
IN PRACTICE, AND NEW THEORETICAL FRAMES**

Main Author:

**Chris HALE** (*University of Queensland - Centre for  
Transport Strategy*)

**Abstract:**

The paper discusses the emerging discipline of rail demand management or “demand smoothing”. Many passenger rail systems have lacked active management of passenger demand levels for an extended period now. This has largely resulted in excessively peak-loaded rail systems that struggle to deal with overcrowding during morning and afternoon commutes, while carrying unviable levels of patronage outside of commute markets and periods. Rail demand management is re-emerging as an important discipline in which passenger demand levels are actively managed, in order to deliver “smoother” patronage levels across the day and week. Potential areas of strategy and action include: better tracking and management of passenger flows; efficient pricing structures; encouragement of off-peak travel; peak surcharges; customer outreach; and “responsive and responsible” planning, service and infrastructure measures on the supply-side. In the European approach, mass transit passenger demand is generally quite actively managed. By contrast, a less interventionist and active approach tends to prevail in many New World systems (in the USA or Australia for example). These contrasts are explored in the paper. Findings from UQ's recent extended research efforts in rail demand management are summarized, then broadened into recommendations for rail operators and transit agencies seeking to develop a more enlightened, effective approach to passenger demand levels. Practical measures and approaches for delivering “smoother” demand levels are identified.

**Keywords:**

Rail demand management, Mass transit, Passenger rail economics, Rail benchmarking, Peak period.

TUE 13<sup>th</sup> (14:00 - 15:15, Session A3.2) Room 1.03

ID 1585 R

**PRACTICE REVIEWS IN PEAK PERIOD RAIL DEMAND  
MANAGEMENT ? MUNICH AND WASHINGTON DC**

Main Author:

**Chris HALE** (*University of Queensland - Centre for  
Transport Strategy*)

**Abstract:**

The paper reviews current rail peak demand management approaches in Munich and the Washington DC metropolitan areas, through a practice review approach. Munich and the Washington DC metropolitan area offer two different cases in the management of rail passenger demand in peak periods and beyond. By reviewing a range of strategies in use and under consideration, a broader picture emerges of the potential options and solutions available. In the Washington DC metropolitan area, the Metro rail system links the District of Columbia with activity centres and suburban park and ride-dominated stations in Maryland and Virginia. The Metro system, as a late twentieth-century vintage subway/commuter rail network, is seen as a leader for US transit in terms of scale, the quality of network design and planning, and popularity with riders. Lessons drawn from DC Metro on rail demand management approaches are indicative of best-practice in the USA at present. In Munich, the U-Bahn is a new-generation metro-style urban rail network, which is complimented by the more suburban oriented “S-Bahn” - of a longer-distance, more radial-style configuration. Munich's transport planners are proactive in their tracking of passenger flows and their actioning of a variety of measures that have produced surprisingly “smooth” passenger flows that avoid the “excessive peaks” of many other major rail systems. This is perhaps partially a contributor to the strong overall financial outcomes for mass transit in Munich. In addition, the network characteristics of the Munich rail systems are notable, in that there are a number of popular destination/origin stations, and the system is not over-reliant on a small number of major inner city stations. (...).

**Keywords:**

Passenger rail, Demand, Demand management, Mass transit planning, WMATA, Munich, MVV, U-Bahn, DC Metro.

TUE 13<sup>th</sup> (14:00 - 15:15, Session A3.2) Room 1.03

ID 3365 R

**THE COMPETITIVE EFFECTS OF ENTRY IN THE RAILWAY SECTOR WITH DIFFERENTIATED SERVICES AND PARTIAL REGULATION**

Main Author:

**Angela BERGANTINO** (*Università degli Studi di Bari - Dipartimento di Scienze Economiche e Metodi Matematici*)

Co-author(s):

**Marco ALDERIGHI**

**Abstract:**

The aim of this research is to provide some insights on the process of passenger rail transport liberalization when services are differentiated. In particular, the paper will focus on the impact of new entry in the high-speed services (HS) segment when the traditional service is characterised by service obligations for the incumbent. On the one hand we show that the entry of new operators in the more profitable segments of the HS services (known in the literature as cream-skimming) in the presence of imperfectly substitutable services (traditional and high-speed) and of regulatory constraints binding only for traditional services, leads, in general, to beneficial effects for consumers. The entry of new operators limits the incumbent that, in absence of competition, would be induced to keep prices in the non regulated market above the monopoly level in order not to damage the traditional market. On the other hand, however, the introduction of competition can create problems for the funding of service obligations. In the view of the recent developments in the literature we discuss different modes for financing the non-remunerative services (general taxation, perequative fund, reserved rights) and we evaluate their effects. We comment different cases depending on whether the minimum service is directly allocated to the incumbent; it is assigned by auction or, eventually, it is imposed to all operators.

**Keywords:**

Rail, Liberalization, Partial regulation, Asymmetr.

TUE 13<sup>th</sup> (15:30 - 16:45, Session A3.3) Room 1.03

ID 1193 R

**A GEOGRAPHICALLY WEIGHTED REGRESSION BASED ANALYSIS OF RAIL COMMUTING AROUND CARDIFF, SOUTH WALES**

Main Author:

**Simon BLAINEY** (*Transportation Research Group, University of Southampton*)

Co-author(s):

**John PRESTON** (*Transportation Research Group*)

**Abstract:**

Journey to work data from the 2001 census at ward level is used together with data on a range of socio-demographic variables, rail service levels and bus stop locations to develop and calibrate conventional regression models of the propensity to travel to work by rail in the area around Cardiff, South Wales. The best-performing models are then recalibrated using Geographically Weighted Regression (GWR), allowing local variations in the effect of the independent variables on rail demand to be mapped using GIS, investigated and incorporated in the modelling process. Flow level models of rail demand within the case study are then calibrated, and different methods for incorporating spatial parameter variations in these models are tested. Some conclusions are drawn about possible reasons for the spatial variations in rail use that have been identified, and the implications for demand forecasting for new stations and lines are discussed.

**Keywords:**

Railway station, Geographically Weighted Regression, Demand model.

ID 1476 R

**BACKGROUND FACTORS EXPLAINING TRAIN CHOICE IN EUROPEAN LONG-DISTANCE TRAVELLING**

Main Author:

**Cornelis GOEVERDEN** (*Delft University of Technology, Transport&Planning*)

Co-author(s):

**Bart VAN AREM** (*Delft University of Technology*)**Abstract:**

Long distance travel is not well developed in transport research. Though its volume is small in terms of journey numbers (1-2%), it is substantial in terms of person kilometres. A rough estimation suggests that the share of long distance travel could be about 50%. Moreover, long distance travel is growing relatively fast, in particular travelling by the energy-inefficient modes airplane and car. Both modes have by far the highest shares for either the medium distances (car) or the very long distances (airplane). The shares for train and bus are modest with 13% and 6% respectively. The European Commission observes an increasing imbalance in modal use and aims to increase the market shares of sustainable modes, in particular the train. Efficient policy for achieving this goal needs understanding about modal choice in long distance travelling. Most studies on modal choice examine the influence of modal attributes. However, other factors play a role as well. These can be indicated as background factors. The paper analyses the influence of background factors on modal choice. The focus is on train choice. Based on data from the Dateline-project, a survey on long distance travelling by residents of the European Union, the impact of 17 background variables on train choice is examined by binary logistic regression. All variables proved to have statistically significant impacts, though the explanatory power varies largely between different variables. Most powerful variables are, in decreasing order: number of participants in journey, car ownership, size of the destination city, home country, the need to cross a national border, employment status, gender, size of the home city, and distance. (...).

**Keywords:**

Modal choice, Long distance travel, Train, Binary logistics.

ID 1744 R

**THE CHOICE OF RAIL, ACCESS MODE AND DEPARTURE STATION: THE IMPACT OF TRAVEL TIME UNRELIABILITY**

Main Author:

**Martijn BRONS** (*Institute for Prospective Technological studies (JRC-IPTS)*)

Co-author(s):

**Piet RIETVELD** (*VU University / Department of Spatial Economics*)**Abstract:**

This study analyses the impact of travel time unreliability on choice behaviour of the rail passenger, based on Dutch data at the 4-digit post code level. Adopting a customer-oriented approach, the paper studies a variety of choices in different stages of the door-to-door rail journey, viz. the choice to travel by rail or car, the choice of access mode and the choice of departure station. Furthermore, the study analyses and compares the impact of different travel time unreliability indicators, including measures based on travel time variety, size of delay, and punctuality. In order to analyze the choice behaviour of rail passengers, the study uses a combination of binary and nested logit modelling. The estimation results show that travel time unreliability has a significant impact on the choice for rail as a transport mode, that differences in travel time unreliability among railway stations have an important impact on the choice of departure station, and that high travel time unreliability of the rail trip is associated with a low share of public transport as an access mode. Furthermore, it is found that unreliability measures based on travel time variation capture the passenger's perception of unreliability better than measures based on the size of the delay or the probability of delays, such as currently used in most countries to measure railway reliability performance.

**Keywords:**

Travel time unreliability, Rail transport, Discrete choice modelling, Multimodal transport.

TUE 13<sup>th</sup> (15:30 - 16:45, Session A3.3) Room 1.03

ID 2373 R

**EXPLORING THE INTERMODAL PASSENGER  
TRANSFER OF HIGH SPEED RAIL SYSTEM**

Main Author:

**Yung-Hsiang CHENG** (*Department of Transportation and  
Communication Management Science, Taiwan, ROC*)

**Abstract:**

Intermodal seamless transportation plays an essential role to the success of a High Speed Rail (HSR) system's operation. This study aims to investigate the intermodal passenger transfer of Taiwan's high-speed rail system from the policy planner's and the passengers' perspectives. First, this study applies the Fuzzy Analytic Hierarchy Process (FAHP) based on relevant experts' opinions to analyze HSR passengers' intermodal transfer behavior from a policy planner's perspective in order to find an improvement strategy. Second, correspondence analysis is adopted to observe possible transfer patterns and concerned service attribute variables when selecting the HSR feeder transportation system from the passengers' perspective. This study adopts three main categories of HSR stations to analyze a passenger's intermodal transfer behavior. The findings of this study are summarized as follows. The FAHP analysis indicates passenger convenience and urban planning integration are the two most important factors for HSR passenger transfers to the final destination. In regards to the passengers' perspectives, most passengers tend to use private vehicles instead of public transportation, indicating that the public transportation service for HSR transfer needs to be further improved. Several policy suggestions are included, which could be useful for the decision makers of transportation systems' planning, the central government, and the local authority so as to derive a comprehensive HSR intermodal planning strategy for a more integrated transportation system.

**Keywords:**

High Speed Rail system, Transfer, Correspondence  
Analysis, Analytic Hierarchy Process.

TUE 13<sup>th</sup> (17:00 - 18:15, Session A3.4) Room 1.03

ID 2199 R

**THE IMPACT OF THE PARTLY-OPENED KYUSHU  
SHINKANSEN**

Main Author:

**Hideaki TAKAHARA** (*Japan Railway Construction,  
Transport and Technology Agency*)

**Abstract:**

In Japan, high-speed rail network reaches about 2,200km. The whole line of the Kyushu Shinkansen is 260km long and connects Hakata and Kagoshima-Chuo in Kyushu Island. The southern half of this line from Shin-Yatsushiro to Kagoshima-Chuo which has great effect to reduce journey time opened in March 2004. With the completion of the southern-half line, the journey time between Shin - Yatsushiro and Kagoshima-Chuo reduced from 2h 5min to 35min, a saving of about 1h 30min. As a result, the number of railway passengers increased to twice or more, and the number of commuter pass users increased to ten times or more compared to before opening. In this way, the project brought major benefits to inter-regional transportation. This paper describes the effects of the partly-opened Kyushu Shinkansen, especially the change of transportation, the influence on passengers and economic impact on tourism.

**Keywords:**

The change of transportation the influence on pas.

ID 2801 R

**STRUCTURING AND EVALUATION OF THE RAILROAD CONNECTION BETWEEN SÃO PAULO METROPOLITAN REGION AND VIRACOPOS INTERNATIONAL AIRPORT**

Main Author:

**Juliana WATANABE** (UNICAMP)

Co-author(s):

**Maria GALVES** (University of Campinas - School of Civil Engineering, Architecture and Urban Design)

**Luiz CORREIA** (UNICAMP)

**Isis SARTORI** (UNICAMP)

**Abstract:**

The need to distribute flights in the Southeast region of Brazil brought some issues, such as the feasibility of transportation infrastructure necessary to bridge nucleus population and the airports. Among some discussions, projects like high speed railroad constructions stood out as a modal solution of high capacity and performance, however, there are a few matters to be solved, among others, whether there is the need of a high speed system, known as bullet train, or an inferior speed system would be enough to assure efficiency. The objective of this paper is to structure and evaluate the railroad connection between São Paulo Metropolitan Region and Viracopos International Airport, in Campinas, State of São Paulo. This decision problem was addressed by the Multiple Criteria Decision Aiding methodology, which can be divided into three interacting phases: structuring, evaluation of the alternatives and recommendation. Structuring involved the following steps: characterization of the decisionmaking context, identification and structuring of fundamental objectives, selection of attributes and assignment of levels to the attributes for each alternative (i.e. bullet train, express train and existing bus system). The evaluation phase was undertaken using the Multi-Attribute Value Function (MAVF) in the additive form. This method encompasses the construction of a value function for each attribute and the assessment of scaling constants. The global evaluation results show that the express train is the most feasible alternative.

**Keywords:**

Rail transport, Multiple Criteria Decision Aiding, São Paulo Metropolitan Region, Viracopos International Airport.

ID 3277 R

**TRANSFORMATION OF HIGH-SPEED RAIL STATIONS TO MAJOR ACTIVITY CENTERS: LESSONS FOR CALIFORNIA**

Main Author:

**Cornelius NUWORSOO** (California Polytechnic State University)

Co-author(s):

**Elizabeth DEAKIN** (UC Berkeley)

**Abstract:**

This paper presents findings from domestic and international case studies of developments around high-speed rail stations and derives from these findings some lessons for station area development for California's high-speed rail system. The paper reviews the case for high-speed rail as a complement to air and highway systems in addressing congestion and providing needed additional services as the population of the State continues to grow. Review of domestic and international experiences reveals that well-planned station-area developments can result in desirable impacts on the communities served including: a) good intermodal connections – convenient access and ease of transferring between local and regional transport systems and modes, facilitated by the creation of multi-modal stations; b) physical improvements – increased and/or upgraded development of residential, retail, work and cultural land uses within walking distance of station areas; c) economic improvement – generation of economic activity and benefit as agglomeration economies take place; and d) social improvement – creation of vibrant activity centers or hubs for social interaction and recreation. Together these changes would result in significant reduction in negative environmental impacts, locally and beyond. These desirable impacts may be harnessed in planning for high-speed rail stations in California through the creation of activity hubs with coordinated transportation and land use, urban design, and multimodal access and circulation. Designs would be similar to transit-oriented development but also accommodate travelers arriving or departing stations by auto (including rental cars). (...).

**Keywords:**

High-speed rail, Station-area development, Intermodal connections, Activity centers, Improvement, Physical, Economic, Social .

ID 1480 R

**BUS ARRIVAL TIME ESTIMATION USING EXISTING SIGNAL DATABASE & SHOCK WAVE THEORY**

Main Author:

**Md. RAHMAN**

Co-author(s):

**Lina KATTAN** (*University of Calgary*)**Chan WIRASINGHE****D. MORGAN** (*City of Calgary, Calgary, Alberta, Canada*)**Abstract:**

Intersection delays are one of the major sources of uncertainty in real-time bus arrival time estimation. Only a few studies have included signal delay in estimating bus arrival time. In this paper, a new approach is developed to incorporate intersection delays in bus arrival time estimation. The approach integrates information from: 1) an existing signal database, 2) estimated speed of shockwaves created by a red signal and 3) bus speed available from GPS tracking. From the online access to a signal timing plan, the exact signal phasing of any fixed signalized intersection is known in real time. Hence, the signal phase and elapsed time of that phase can be determined. In addition, the developed framework assumes that traffic conditions as well as bus speed are known or can be determined. Estimated bus travel time between a bus stop and a signalized intersection is divided into two parts: 1) cruising travel time and 2) travel time in queue. Cruising travel time is defined as the bus travel time required to join the backward propagating shockwave from the traffic light. Travel time in queue is obtained from the estimated delay in the queue. Two illustrative numerical examples show that this approach can incorporate the intersection delay well in real-time bus arrival time estimation.

**Keywords:**

Bus arrival time, Existing signal database, Shockwaves.

ID 2542 R

**MEASURING THE EFFICIENCY IN GERMAN PUBLIC BUS TRANSPORT**

Main Author:

**Raimund SCHEFFLER** (*Institute of Transport Economics*)

Co-author(s):

**Florian ALLROGGEN** (*Institute of Transport Economics*)**Robert MALINA** (*Institute of Transport Economics*)**Abstract:**

This paper quantifies the technical efficiency of German bus companies and elaborates on the main factors influencing their performance. Efficiency is measured with a stochastic production frontier. We test for the impact on efficiency of ownership structure and participation at tendering. Furthermore, we investigate the influence on efficiency when a bus company is a part of a multi-product enterprise. The results yield insights how public bus companies might improve their performance in order to cope with the changing market environment. The analysis shows that the German public bus market exhibits low technical efficiency. The mean technical efficiency of the investigated bus companies is around 87 percent. Bus companies with participation at tendering show a significantly higher mean efficiency than other companies. The ownership structure has no influence on technical efficiency.

**Keywords:**

Stochastic Frontier Analysis, Production Function, Public Transport, Efficiency Analysis.

ID 3019 R

**EVALUATION OF THE DELHI BUS CORRIDOR:  
LESSONS LEARNT AND RECOMMENDATIONS FOR  
IMPROVEMENT**

Main Author:

**Dario HIDALGO** (*EMBARQ, The WRI Center for Sustainable Transport*)

Co-author(s):

**Madhav PAI** (*EMBARQ, The WRI Center for Sustainable Transport*)**Abstract:**

Bus rapid transit (BRT) has extensive applications in South and North America, Europe and the Far East, but it is a novel concept for South Asia. One of the initial projects in India, the Delhi Bus Corridor, has been controversial: media outlets highlighted problems for the general traffic and safety, while user surveys showed improved perception by bus users, bicyclists and pedestrians. The discussion of the benefits and problems of the corridor has been mostly based in perceptions and prejudices. The authors conducted an independent evaluation to contribute with technical arguments to this discussion and to provide suggestions for the corridor improvement. The results were also intended to contribute to the understanding of the BRT concept in the Indian context. The authors conclude that the Delhi bus corridor has improved people mobility along the initial stretch, but requires significant performance, safety and overall quality enhancements. The project only comprised major changes in infrastructure but lacked of integrated implementation of service plans, technologies and operations. User and community education was also insufficient. In addition to ongoing improvements, the authors identified the need to: i) establish a quality improvement program measuring the system performance, ii) focus on improving reliability and comfort; and iii) reevaluate the bus service plans to provide a better match of the supply and demand. The authors also recommend using median bus lanes with strong segregation as the preferred option for bus priority in Delhi. The bus corridor in Delhi provides invaluable experience for the enhancement of transit facilities and services in India and beyond. (...).

**Keywords:**

Transit, Bus systems, BRT, India, Delhi.

ID 1076 R

**EVOLUTION OF ACTIVE MODE MOBILITY IN FRANCE**

Main Author:

**Régis DE SOLERE** (*Ministry of Ecology / CERTU*)**Abstract:**

In France, the extraordinary development of the car which took place during the period 1950 - 1990 and the almost total failure to take walking and cycling into account in transport planning at that time led to a decline in their use. Walking as a practice, however, started to stabilize during the nineties. The first decade of the 21st century has been marked by a stabilisation in the number of journeys made using human-powered transport modes (walking, cycling) in France. Given the decline in these modes over the previous decades, such a stabilisation represents a major turning point. Furthermore, it is a trend confirmed by all household travel surveys carried out in recent years. More restrictive environmental and economic factors, ever greater traffic congestion, and voluntarist transport policies (such as the implementation of self-service bike-hire schemes) are other factors that also explain this change. However, if we look beyond this combined trend for all human-powered modes, we can see that walking and cycling each have different usage patterns, which need to be analysed if we are to gain a better understanding of existing margins for progress. First, let's consider walking. It may sound like a cliché, but this is a predominantly female mode of transport that is frequently used for shopping, strolling for pleasure and travelling to one's place of study. It is a mode that is used in urban areas in particular. In France, schemes such as the Code de la rue ("Rules of the Street") will serve to encourage its use in dense urban zones, but it is also important to promote walking for short journeys in areas where there are few constraints on car use. Let's now turn to cycling. (...).

**Keywords:**

Active modes, Walking, Cycling, Bicycle, Mobility, Modal share, Journey, User, Household travel survey.



ID 1567 R

**INSIGHT FROM OPERATION OF A CAMPUS-BASED BICYCLE SHARE SCHEME**

Main Author:

**Geoff ROSE**

Co-author(s):

**Mark RICHARDSON** (*Monash University*)**Abstract:**

The term 'bicycle sharing' is used to describe the provision of bicycles for public use. This concept started with relatively simplest programs and has developed through the use of more advanced technology to secure and monitor the bicycles. High profile systems in Paris, Lyon and Montreal are attracting international attention. In 2009 Monash University in Melbourne Australia, launched Australia's first Bicycle Share Scheme (BSS). This is the first scheme in the world to be launched in a jurisdiction where use of a bicycle helmet is mandatory. With funding from the University, the scheme was designed and developed by students and has run on the university's Clayton campus since February, 2009. The initial phase of the BSS is a pilot which provides 58 share bicycles to 200 registered students who live in student residential accommodation on one side of the campus. The scheme is intentionally 'low tech' with a manual locking mechanism controlling access to individual bikes. Special bike parking rails are located in pods throughout the residential accommodation area and also throughout the campus. The paper provides insight into how the university campus has been used as a living laboratory for the study of transport issues. The paper describes the role that industrial design students played in developing the scheme and examines insight from an evaluation of the scheme's operation undertaken by civil engineering students as part of a transport planning subject. A combination of observational surveys and an on-line questionnaire were used to understand usage patterns and highlight emerging issues. While the scheme was deployed to primarily assist access to campus, the survey results highlight the bicycles are being used off campus for a range of travel purposes including accessing high frequency public transport services. (...).

**Keywords:**

Bicycle sharing, Evaluation, Safety, Travel behavi.

ID 1824 R

**USING LATENT ATTITUDINAL VARIABLES FOR MEASURING CARPOOLING PROPENSITY**

Main Author:

**Gonçalo CORREIA** (*Faculdade de Ciências e Tecnologia da Universidade de Coimbra*)

Co-author(s):

**João DE ABREU E SILVA** (*Instituto Superior Técnico*)  
**José MANUEL VIEGAS** (*Centro de Sistemas Urbanos e Regionais (CESUR), Instituto Superior Técnico (IST)*)**Abstract:**

The increase of urban traffic congestion has called for the study of alternative forms of supply for mobility of people. One is carpooling, a system in which a person shares his private vehicle with one or more persons in commuter trips. In theory, these systems could lead to great reductions in the use of private vehicles; however, in practice they have been obtaining limited success. One of main reasons for this is the psychological barrier associated with riding with strangers and loosing the flexibility associated with using one's private vehicle as a single occupant driver. However the effect of these issues is sometimes hard to determine as they reveal subjective attitudes which are not easy to determine. In order to study the effect of these variables on carpooling propensity, a stated preference web survey was conducted in the Lisbon Metropolitan Area (Portugal), collecting the rating of several attitudinal questions in a likert scale and completing the information with sociodemographic data. A simultaneous estimation of the attitudinal factors and the probabilities of choice was conducted through a Structural Equations Model (SEM) allowing concluding that these attitudes have an important influence in the decision to carpool and that the positive aspects that it entails may overcome the negative ones if properly used to set up carpooling schemes.

**Keywords:**

Carpooling, Discrete Choice Model, Exploratory Factor Analysis, Structural Equations Model, Latent Variables.

ID 2383 R

**ALTERNATIVE PERSONAL TRANSPORTATION:  
BRIDGING THE GAP BETWEEN CARS AND  
SUSTAINABLE TRANSPORT**

Main Author:

**Mark RICHARDSON** (*Monash University*)

Co-author(s):

**Geoff ROSE****Abstract:**

It is clear that we are reaching a tipping point in terms of the ability of the automobile to sustainably fulfil its function as a primary provider of personal powered mobility. There is a large gap however, between other forms of more sustainable transport, such as walking, cycling and public transport, and the affordances provided by the car. For a culture accustomed to the conveniences of automobility, it will be difficult to find a direct replacement that provides the speed, carrying capacity, comfort, weather protection and personal safety of a car. Nevertheless, an increasingly diverse range of alternatives are becoming available, promising to provide more diverse transport opportunities. Alternative vehicles have been developed and produced by niche manufacturers for decades, but have not enjoyed mainstream popularity. This is likely to change in years to come, given the climatic, social and financial issues facing society. Until recently, the major automotive Original Equipment Manufacturers (OEMs) have not demonstrated a clear ambition to design and manufacture alternative vehicles, but new trends are emerging in the concept vehicles at the major international motor shows. This paper provides an overview of some of the issues likely to impact on the personal transport sector and summarises how the major automotive OEMs have been approaching the development of alternative vehicles in recent years.

**Keywords:**

Alternative vehicles, Concept cars, Vehicle design, Sustainable transport, Future design, Microcar, Personal mobility device.

ID 3136 R

**HOW CARSHARING AFFECTS THE TRAVEL  
BEHAVIOURS OF HOUSEHOLDS?**

Main Author:

**Louiselle SIOUI** (*École Polytechnique de Montréal*)

Co-author(s):

**Catherine MORENCY** (*Polytechnique Montreal*)**Martin TRÉPANIÉ** (*École Polytechnique de Montréal*)**Abstract:**

Increasingly, cities are aiming towards higher levels of sustainability, by trying to reduce the negative impacts caused by an extensive use of private cars (pollution, congestion). Among various strategies, many efforts are put to promote the use of alternative modes of transportation such as public transit, walking or cycling. Nevertheless, some trips will always depend on car due to their nature or spatio-temporality. For these car dependent trips, carsharing appears to be an ingenious solution, both from an individual and collective point of view. While we have seen an increasing interest in this mode both from the research and practical fields, only few studies exist on the collective benefits of carsharing systems. Analyzing socio- demographic features of users and better assessing their overall travel behaviours is a strategic issue. It first is a requirement for carsharing enterprises for development purposes: they need to know who their users are, how they travel with the shared cars and how it fits within the overall travel behaviours of their households. It also is necessary for political and financial reasons: in fact, estimations of positive effects on CO<sub>2</sub> emissions, car ownership, and congestion, for instance, can help in the recognition process of carsharing as a sustainable transportation mode. Obviously, the use of carsharing does not affect only the modal choices of the carsharing user, but must also affect the travel behaviours, namely mode choice, of the other members of his household. It is then necessary to gather information on travel behaviours on members and their household. (...).

**Keywords:**

Carsharing, Origin-Destination survey, Travel beha.

ID 1043 R

**TRAVELERS' SENSITIVITY TO PUBLIC TRANSPORT RELATED PLANNING MEASURES**

Main Author:

**Peter VAN DER WAERDEN** (*Eindhoven University of Technology*)

**Abstract:**

This paper presents the findings of a study of travelers' sensitivity to sixteen public transport related planning measures. Travelers who use the car or the bike for their regular trips are invited to indicate if certain planning measures might stimulate them to change travel mode in favor of the bus. Three answers were available: Yes, I will change to public transport; Yes, I will consider a change towards public transport; and No, I will not change my current mode choice. The study was carried out in the Eindhoven region, the Netherlands. The data of 896 respondents could be used for the analyses that are described in this paper. It appears that an improvement of the connection to trains and extension of the service in the morning and the evening might trigger travelers to the bus. The effect is significantly influenced by personal characteristics, especially gender and the fact that the traveler rarely uses public transport. Small differences are found regarding the characteristics of regular trips.

**Keywords:**

Public Transport, Planning measures, Ordinal regression.

ID 1358 R

**ANTICIPATING BEHAVIOR OF PUBLIC TRANSPORT USERS TO TRAVEL TIME RELIABILITY**

Main Author:

**Mark LIJESSEN** (*VU University*)

**Abstract:**

We analyze the behavior of public transport users when confronted with an expected delay. Some travelers may reschedule their trips and hence avoid an increase in their schedule delay costs. We build a general model for travelers anticipating to delays in the case of discrete departure time choice, common in public transport. We solve the model for the case of exponentially distributed delays. Public transport travelers fully offset the incurred schedule delay costs in the case of a deterministic delay and largely offset these costs if delays are stochastic. We use empirical route level delay data from ten busy train routes in the Dutch Randstad area to illustrate our results. The numerical results suggest that ignoring anticipating behavior would lead to an overestimation of the welfare costs of delays of 2.4 to 5.4 percent, despite the fact that delays are relatively low in our study area. The overestimation of welfare costs of unreliability may lead to an inefficiently high level of investments in projects and measures aimed at preventing delays.

**Keywords:**

Reliability, Punctuality, Public transport, Anticipating behavior.

ID 1495 R\*

**SPECIAL BUS SERVICE FOR WOMEN IN DHAKA CITY, BANGLADESH**

Main Author:

**M. SHAFIQ-UR RAHMAN** (*Jahangirnagar University, Bangladesh*)**Abstract:**

Transport environment of Dhaka City, the capital of Bangladesh, is characterized by traffic congestion and delays, inadequate traffic management, high accident rates, and the public transport crisis. Dhaka is one of the least motorized cities of the world, which has very limited amount of buses as public transport and not able to meet the public transport mode demand. Though buses are the cheapest mode, they are inadequate in numbers and mostly remain over-crowded which is not accessible for many people particularly for the elderly or disabled and the women. Consequently, women are facing many problems while travelling by bus or have to look other alternative mode such as rickshaw or taxi which is very expensive compared with bus service. Considering the travel problems of the women the Bangladesh Road Transport Corporation (BRTC), the government owned bus service providing agency, had provided 'women bus' service in the early 1980s to provide bus services only for the women as a part of its social welfare activities. However, the operation was stopped immediately after some days of its inauguration because it was not profitable. Again, 22 buses for women were launched by BRTC in 2004, which also could not survive for various reasons. Whatever, again in July 2008 only 5 buses have been launched for women in one route. The purpose of this research is to explore the existing route, frequency, and service quality of the special bus service for women or the 'women-only bus'. Moreover, it will investigate why in the past the 'women-only bus' service could not survive and what could be learnt from the previous failure. The research will provide guidelines for improving the bus service to overcome the existing transport problems of the women. (...).

**Keywords:**

Women-only bus, Sitting service, Local bus, Conductors.

ID 2826 R

**A SURVEY OF PASSENGER REQUIREMENTS ON PRE-TRAVEL/TRAVEL INFORMATION IN THE PUBLIC TRANSPORT OF THE CITY OF ZAGREB**

Main Author:

**Luka NOVACKO** (*Faculty of Transport and Traffic Sciences, University of Zagreb*)

Co-author(s):

**Ivana CAVAR** (*Faculty of Transport and Traffic Sciences, University of Zagreb*)**Danijela BARIC** (*Faculty of Transport and Traffic Sciences, University of Zagreb*)**Abstract:**

Real-Time Passenger Information (RTPI) Displays have been recently introduced at the tram and bus stops/stations in the City of Zagreb. This represents a significant step forward in the pre-travel information services for public transport passengers. Based on a survey the paper analyses the satisfaction of travellers with the existing TIS (Traveller Information Services), and additional pre-travel/travel information requirements. The results of the survey emphasise the form and information attributes which are required by passengers in each phase before and during the journey. In the first part of the paper, public transport system in Zagreb and different technologies of providing passenger information are described. The public transport network consists of 15 tram lines and 130 bus lines. In 2008 around 204,000,000 passengers travelled by tram and 94,000,000 by public bus transport. Travellers are informed via the Internet, call centres and radio stations at home, and over 147 RTPI displays at the tram/bus stations. In the second part the purposes of the survey and data collection techniques are described. The results of the survey are presented in the third part and as conclusion, recommendations for more user-friendly pre-travel/travel information systems are provided. The survey was composed of four major queries. The first question considered the satisfaction level of passengers and information reliability of the new installed RTPI displays. The second had the purpose of getting an overview of current passenger information perception and the third one had the goal to determine which form and information attributes are the most reliable in the each phase of travelling. (...).

**Keywords:**

Real-Time Passenger Information (RTPI) Displays, Survey, Pre-travel/travel information.

ID 3051 R\*

**ANALYSIS OF SUBWAY USER'S PROFILE IN FORTALEZA CITY TO POTENTIAL INTEGRATION AMONG TRANSPORTATION MODES**

Main Author:

**Flávio CUNTO** (*Universidade Federal do Ceará*)

Co-author(s):

**Waldemiro NETO** (*Universidade Federal do Ceará*)**Maria MOREIRA** (*Universidade Federal do Ceará*)**Ana MAIA** (*Universidade Federal do Ceará*)**Abstract:**

Fortaleza City is now the fifth largest capital of Brazil in terms of population according latest statistics (2.550.000 inhabitants), and has a fleet of 615,527 vehicles. This growth took place without a proper planning of land use and provision of an adequate transport infrastructure. The result is the impairment of mobility conditions of population, with recurrent traffic jams and hence increases in travel time. The rapid growth observed in the auto fleet was not accompanied by changes on the transportation system to mitigate the impacts of such growth such as the integration of different transportation modes and transportation facilities in the city for trains, cars, buses, and bicycles. Fortaleza's Public Metro Company - Metrofor was created in order to take over and modernize the operation of the transport of commuter trains in Fortaleza, to meet the demand of the Metropolitan Region of Fortaleza - RMF integrated with the various modes of transport. The integration of transport systems is considered as one of the ways to promote increased urban mobility, because in some cases increases travel options, reduces costs and can also reduce traffic problems in urban roads. In order to minimize the impacts of proposed changes on the daily lives of passengers, Metrofor conducted in April 2009 in the city of Fortaleza, a survey in all train stations along the South and West line, to establish a socio-economic profile for potential metro users. (...).

**Keywords:**

Integration of transport systems, User's Profile, Accessibility.

ID 1753 R

**USING THE IBUS SYSTEM TO PROVIDE IMPROVED PUBLIC TRANSPORT INFORMATION AND APPLICATIONS FOR LONDON**

Main Author:

**A. WONG** (*University of Southampton*)

Co-author(s):

**Nick HOUNSELL** (*University of Southampton*)**Abstract:**

iBus is Transport for London (TfL)'s new GPS-based Automated Vehicle Location System. The System has been rolled out to the contracted fleet of 8,000+ buses across London, with the aim of improving bus regularity and punctuality through improved bus fleet management and giving vehicles priority at traffic signals. The System is also being integrated with the ("Countdown") real-time passenger information system at bus stops, to provide improved predictions of vehicle arrivals, and to deliver real-time ("next stop") signage and voice announcements for on board passengers. The implementation of iBus also provides an opportunity to derive other improved public transport information and applications for London, including profiles of typical journey and bus stop dwell times for management and operational reporting. Dwell times, for example, form an important component in overall bus journey times, and their variability can impact significantly on the effectiveness of systems such as SCOOT to provide bus priority, as well as on overall service performances. The ability to derive typical dwell times therefore helps TfL to optimise the effectiveness of SCOOT (and associated vehicles detectors) in providing bus priority, and their values have potentially wider use in public transport operations, traffic management and simulation modelling. For example, they could provide an improved understanding of the expected delay of vehicles bus stops (and the knock-on impact on other traffic), and help predict more effectively the expected journey times for buses (and other vehicles) in London.

**Keywords:**

Public transport, Automated vehicle location, Transit operations, Bus priority, Urban traffic control, Fleet management, Bus stop design, Real-time passenger information, Operator headway, Bus performance, Dwell time.

ID 2054 R

**FAST FORWARD: MEASURING OUTCOMES OF VALUE-ORIENTED PUBLIC TRANSIT ADVERTISING**

Main Author:

**Alex BITTERMAN** (*Rochester Institute of Technology*)

Co-author(s):

**Daniel HESS** (*University at Buffalo, State University of New York*)**Abstract:**

Branding, marketing, and advertising play important roles in influencing travel behavior and shaping public opinion about public transit. Over the past five years, marketing efforts in North America have increasingly featured messages that promote the value of riding public transit. These campaigns underscore a somewhat broader marketing effort that seeks to distinguish public transportation as a better value than commuting by automobile, a position that is bolstered by a weak international economy, a spike in fuel prices, and growing public awareness and concern about environmental issues. Scholarly analysis of public transit marketing—including advertising and branding—has been limited; a scarce availability of reliable data presents difficulties for researchers. The differences between marketing in the public and private sectors create an uneven basis for rigorous comparison of advertising practices in sectors of the transportation industry. In addition, for many transit managers, marketing falls outside the realm of necessary operations and becomes unimportant relative to other more principal tasks. The unmet need for critical examination of public transportation marketing efforts leaves the efficacy of transit marketing efforts untested, which is evidenced by both a gap in academic literature that distills best practices but also the gap in professional practice that demonstrates a reluctance to spend scarce resources on marketing activities. Because of this complex landscape, the long-term value of public transit marketing relative to marketing efforts across other transportation sectors is unclear. This study examines the proliferation of value-oriented advertising messages, environmental brand designs, and vehicle livery across public and commercial transportation sectors. (...).

**Keywords:**

Public transit, Branding, Marketing, Advertising.

ID 2467 R

**CHOOSING AN APPROPRIATE TECHNOLOGY FOR GUIDED SURFACE TRANSIT SYSTEMS: A COMPARATIVE ANALYSIS OF 6 SURFACE TRANSIT SYSTEMS**

Main Author:

**Jeong-Hwa AN** (*INRETS*)**Abstract:**

Comparison of different transit systems is a complex and uneasy work, especially for guided surface transit systems that offer almost equivalent services for users. So, careful analyzers should take into account not only some advantageous aspects of systems separately but also combination of every evaluation criteria under systemic approach in order to recognize better differences between one system and another ones. However, we find this kind of analysis hard to achieve for the reason of veiled information even if this step is indispensable to select appropriate systems at the moment of transport planning. In this paper, we compare 6 guided surface transit systems (e.g. tramway on tyres and on steel wheels, trolleybus and other intermediate transport systems) to better understand their different characteristics and, furthermore, to better implement them at any urban context. This is also a reflection on our daily public transport problems for decision makers to make an harmonious decision with other stakeholders for complex transport projects. The key innovation of this paper is the use of real data and the comparison of whole spans of surface transit systems now being in vogue under the currently more deteriorated environmental and economical circumstances. On using the ELECTRE method of multicriteria analysis (MCA) with information obtained from transport authorities and operators of certain cities, we carry out our research as objective as possible vis-à-vis diverse local contexts in order to find reasonable and acceptable results. This paper first presents a general panorama of guided surface transit. After that, we carry out a comparative analysis of these 6 surface transit systems using ELECTRE method. (...).

**Keywords:**

Guided surface transit system, MCA, ELECTRE, Capital and operating costs, Comparative analysis, Public transport.

ID 3373 R

**AUTOMATED TRANSPORT IN URBAN ENVIRONMENTS: AN INNOVATIVE OPPORTUNITY FOR A HISTORICAL AREA OF ROME**

Main Author:

**Antonio MUSSO** (*Sapienza - University of Rome*)

Co-author(s):

**Cristiana PICCIONI** (*Sapienza - University of Rome*)**Laurence BANNERMAN** (*Saba Italy S.p.a.*)**Abstract:**

The historical central area of Rome is site of high archaeological and architectural value with great tourist attractiveness, and at the same time, a place of numerous residential and business-related activities. In order to preserve this outstanding and valuable area also assuring the territorial and services accessibility, the provision of innovative public transport modes, alternatives to the conventional ones, can represent a driving force for improving mobility in historical and high-density urban areas. This paper deals with the results of a preliminary study, carried out by Sapienza University of Rome and Saba Italia, aimed at investigating the opportunities offered by the application of an automated transportation system for connecting the Villa Borghese urban hub to Piazza del Popolo, one of the main Rome historical squares, by a 700 m long link. In particular, the first research phase focussed on the analysis of individual and tourist collective transportation demand. The second phase has been addressed on the analysis of the main existing and planned Personal Rapid Transit (PRTs) as well as Automated People Movers (APMs), in order to evaluate the most suitable system for the Rome case.

**Keywords:**

Urban transportation, Automated People Mover systems, Personal Rapid Transit systems, Historical sites.

ID 3406 R

**THE EFFECT OF OD TRIP DISPERSION VERSUS CONCENTRATION IN EXPRESS SERVICE DESIGN**

Main Author:

**Homero LARRAIN** (*Universidad Diego Portales*)

Co-author(s):

**Ricardo GIESEN** (*Pontificia Universidad Católica de Chile*)**Juan CARLOS MUÑOZ** (*Pontificia Universidad Católica de Chile*)**Abstract:**

In public transit systems with high demand levels, the use of express bus services that serve only a subset of stops along certain routes would seem to be a promising alternative given the benefits they offer to both users and operators. In actual practice, express services in systems such as Transmilenio (Bogota, Colombia), Transantiago (Santiago, Chile), and Metro Rapid (Los Angeles, CA) have proven to be highly appealing. This raises the question about when express services are a reasonable option. Previous work has focused on how some characteristics of the demand structure of a corridor affects the benefits that express services can yield, showing that the load profile shape and the average trip length are crucial. This work presents some evidence that also the dispersion of the demand among different OD pairs (keeping the load profile and the total number of trips constant) affects the potential benefits of express services. As expected the more concentrated the demand into few OD pairs, the more cost savings that can be obtained. To answer this question we developed a methodology to generate OD matrices that share all relevant attributes but differ in variability among OD flows. Thirteen matrices were generated and their optimal sets of bus services with their respective frequencies were obtained. Using the coefficient of variation as a measure of matrix variability, we confirmed that more demand variability (i.e. more flow concentration) gives room to more express services and lower social costs.

**Keywords:**

Express Services, Bus Rapid Transit (BRT), Network Design, Route Design, Public Transport.

ID 1059 R

**THE EFFECT OF ANTI-SLIP DEVICES ON PEDESTRIAN SAFETY DURING WINTERTIME**

Main Author:

**Glenn BERGGÅRD** (*Luleå University of Technology, Sweden*)**Abstract:**

Every winter, more than 100,000 pedestrians in the Nordic countries receive medical treatment as a result of falls on slippery surfaces. Also, the risk of injury reduces the interest in outdoor activities during the wintertime. Pedestrians injured in single-pedestrian accidents on icy and snowy surfaces experience more serious injuries than pedestrians injured on other surfaces. Other studies also show that the cost for health care and health insurance for injuries from single-pedestrian accidents on icy and snowy surfaces is of the same magnitude as the costs for injuries from all other road transport accidents. Thus, there is a need for measures to reduce single-pedestrian injuries and improve the access to safe walking all year round. Different countermeasures can be used to prevent a person from slipping and sliding when walking outdoors during the wintertime. Countermeasures can relate to the use of individual 'equipment,' services provided by the community directed towards vulnerable road-user groups or the public at large, and policy changes in winter-maintenance practices. The aim of the study is to develop knowledge regarding walking safety for pedestrians during the wintertime using one individual measure, the use of anti-slip devices. Methods have been developed to register different aspects of walking outdoors on slippery surfaces (in the wintertime) and the effect of using walking aids such as anti-slip devices. Laboratory test were conducted on seven occasions to develop test methods, to test anti-slip devices using the methods and to assess the test methods. Different surfaces were chosen to simulate the variation in winter maintenance standards on walkways: snow on ice, sand on ice, gravel on ice, salt on ice and pure ice. (...).

**Keywords:**

Fall accidents, Pedestrians, Exposure, Anti-slip d.

ID 2201 R

**CYCLISTS? TRAVEL BEHAVIOUR, FROM THEORY TO REALITY**

Main Author:

**Alvaro FERNANDEZ-HEREDIA** (*Universidad Politécnica de Madrid*)

Co-author(s):

**Andres MONZON** (*Universidad Politécnica de Madrid*)**Abstract:**

A lot of cities are experiencing an increase of cycling in their daily urban trips. This produce benefits for all citizens and many decision-makers are designing policies to improve bike use. However, this is not possible without a cycling demand management policy, which should be based on the scientific knowledge of cyclist behaviour key factors. In the scientific literature we can find many references about factors affecting bicycle use. They are oriented either to show qualitative analysis, where bike factors assessment are made; or they present discrete choice models where bike factors are evaluated in order to the final user choice. Both research lines provide important information on cyclist behaviour knowledge. However they are not enough to explain all the explanatory factors to use bikes. Some factors influencing cycling use are of psychosocial type and they are not included in the econometrics models normally used. This paper presents a research done to improve cycling demand forecast. For this research we have made an internet based survey in the Madrid University Campus, where a public bike system is expected to be implemented. In this survey we have collected more than 3,000 responses, including objective and subjective factors for the trip to the University. Based of the outputs of the survey several models have been adjusted for forecasting cycling demand. We have used social science techniques like covariance structural equation modelling. These techniques are based on the use of latent variables and they consider the relationships among them. The results emphasize the importance of experience for using bicycle for daily mobility. The explanatory factors have been ranked in four groups: convenience, pro-bike factors, physical limitations and external limitations. (...).

**Keywords:**

Bicycle, Travel behaviour, Urban transport, Demand.



TUE 13<sup>th</sup> (08:15 - 09:30, Session A4.5) Room 5B

ID 2399 R

**PEDESTRIAN AND CAR DRIVERS' ROAD SAFETY  
AUDIT IN URBAN ARTERIALS: CASE STUDY "CITY OF  
VOLOS"**

Main Author:

**Athanasios GALANIS** (*University of Thessaly*)

**Abstract:**

Improving the pedestrian walking safety and convenience is an important issue for the promotion of walking as a sustainable transport mode in urban areas. Furthermore, the pedestrian – vehicle drivers' interaction is related with the level of service of the pedestrian urban environment. In this paper, we audited the pedestrians' walkability in the city of Volos, which is a typical medium scale Greek city. The study took place in "Iasonos street", an urban arterial, 860m long, located in the center of the city, during normal traffic flow conditions. The methodology of the walkability audit consisted of four steps. In the first step of the auditing procedure, was the selection and training of the auditors' team. In the second step, the auditors selected data of the existing pedestrian infrastructure of the street and created a detailed drawing. In the third step, the auditors implemented a checklist in the selected road segments and crosswalks of the street. In the fourth step, the auditors counted the pedestrians traffic flow and walking behavior, especially their illegal one walking across the street or midblock crossing the street out of crosswalk. After the data collection and the checklist implementation, the results of specific indicators of the pedestrian infrastructure are presented. The auditors finally graded specific characteristics of a walkable road segment and intersection in terms of walking convenience, road safety, personal safety and aesthetics.

**Keywords:**

Pedestrians, Checklist, Safety audit, Walkability, Road segments, Crosswalks.

TUE 13<sup>th</sup> (09:45 - 11:00, Session A4.6) Room 5B

ID 1408 R\*

**RELIABILITY ANALYSIS OF PUBLIC TRANSIT SYSTEM**

Main Author:

**Md. ISLAM**

Co-author(s):

**Upali VANDEBONA** (*University of New South Wales*)

**Abstract:**

Reliability is considered as an important indicator of level of service in public transport systems. Due to unreliable the level of service is adversely affected by an increase in waiting time, late or early arrivals at destinations and missed connections. The reliability analysis of bus transit, covered in this paper, is based on numerical estimation of the range of headway variations when a bus route consists of multiple stops. A number of simulations are conducted to determine the variation of performance of bus operation due to the variation of departure headways. The headway variation in one stop creates a knock-on effect on downstream stops. The average waiting time at stops is used as an indicator of operational performance. Simulation results show that the distribution of passenger waiting times widens as the headway variation increases. Spread of waiting time as well as average waiting time of passengers' increases when bus capacity is limited compared with a system where the bus capacity is unlimited. Irregular headways lead to the absence of services at the scheduled time, which results high passenger loads for subsequent buses. Such peaks in passenger demand result in buses becoming full to capacity, and bypassing certain stops. Thus, average waiting time is increased with limited bus capacity. Simulation also reveals that the average waiting time increases further along the route.

**Keywords:**

Reliability, Dispatch headway, Waiting time.

ID 1460 R

**OVERGROUND RAPID TRANSIT SYSTEMS (BRT/BHLS/TRAMWAYS) IN FRANCE: SCOPE OF APPLICATION AND POLICY CHOICES**

Main Author:

**Sébastien RABUEL** (*Certu*)**Abstract:**

The last three decades have seen the return of tramways to major urban areas in France. These systems have become widely popular due to their performance and their urban requalification potential. The use of such systems continues to grow, including in average-size urban areas. At the same time, the "Bus with a High Level of Service" (BHLS) concept is also growing in popularity. The BHLS is a rapid transit system inspired by the U.S. Bus Rapid Transit (BRT) with its "system approach" but adapted to the French context : narrow streets, high density, street sharing and mass transit function already delivered by metro or tramway. As with tramway, the BHLS includes more than just a rolling stock but also a specific infrastructure and some operating conditions that guarantee a high level of service. Whilst the financial situation facing local authorities is leading to a streamlining of investments, some average-size urban areas are questioning the economic suitability of tramways, especially where the BHLS is able to meet demand (less than 2,500-3,000 pass./hour/direction). Therefore, the "tramway vs. BHLS" debate rages on in the technological and political spheres, as well as among local residents, despite the fact that there is a clear difference between the two systems in terms of cost, capacity, urban integration, etc. After an international review on semantics on rapid transit systems, the aim of the paper is to detail the strengths and weaknesses of tramway and BHLS in the French context. Using regulations, technical characteristics, simple economics and experiences, the paper draws the conditions under which each system is suitable.. (...).

**Keywords:**

Tramway, LRT, Bus, Bus with a high level of service, BHLS, France.

ID 1935 R

**COST-SAVING PROPERTIES OF SCHEDULE COORDINATION IN A SIMPLE TRUNK-AND-FEEDER TRANSIT SYSTEM**

Main Author:

**Karthikgeyan SIVAKUMARAN** (*University of California, Berkeley*)

Co-author(s):

**Yuwei LI** (*UC Berkeley*)**Michael CASSIDY** (*University of California, Berkeley*)**Samer MADANAT** (*University of California, Berkeley*)**Abstract:**

The paper explores how the coordination of vehicle schedules in a public transit system affects generalized costs. We consider an idealized system that delivers its users to a common destination by requiring each to transfer from a feeder- to a trunk-line vehicle. Continuum models are used first to analyze cases in which the trunk-line vehicle schedule is given exogenously. We find that when feeder vehicles are dispatched in coordination with this exogenous trunk-line schedule, the reduction in user cost often outweighs the added cost to the feeder operation. In cases when the frequencies of trunk and feeder services can be established jointly, the models show that coordination can be Pareto-improving, meaning that operator and user costs both diminish. Conditions that give rise to these cost savings are specified. Practical implications are discussed.

**Keywords:**

Continuum approximation, Schedule coordination, Feeder transit, Trunk transit.

ID 2959 R

**IMPROVING TRANSIT SERVICE CONNECTIVITY: THE APPLICATION OF OPERATIONS PLANNING AND CONTROL STRATEGIES**

Main Author:

**Bassel YOUNAN** (*AECOM*)

Co-author(s):

**Nigel H.M. WILSON** (*Massachusetts Institute of Technology*)**Abstract:**

The continuing shift of activities from city centers to other parts of the metropolitan area is resulting in increasingly dispersed origination patterns. Providing direct public transportation service for these dispersed demand patterns is very expensive if not infeasible for any transit agency. That is why most agencies rely on the willingness of their passengers to transfer between routes or services to complete many of their trips. However, transfers usually reduce the attractiveness of transit. Transfer coordination initiatives can reduce the disutility of transfers in transit networks by minimizing the expected waiting times of transferring passengers. This paper presents operations planning and control models aimed at improving connectivity on a transit corridor with multiple transfer stops. The operations planning model involves the simultaneous application of two planning strategies: changing the terminal departure time and inserting slack time, and aims at coordinating transfers at selected transfer stops along the corridor. The operations control model determines under what conditions holding a vehicle at a transfer stop for an incoming connecting vehicle is an appropriate strategy. The results of testing both models on a hypothetical corridor are also explored, along with the sensitivity of the decision variables and model results to various exogenous factors. On the planning side, results show that there is a high threshold for introducing slack time into the schedule and that the greatest benefits from schedule coordination are attained when the variance of vehicle arrival times is small and the headway on the analysis corridor is long. On the control side, transfer demand is the driving factor behind any holding recommendation. (...).

**Keywords:**

Transfer coordination, Operations planning strategies, Operations control strategies, Network connectivity, Schedule coordination, Realtime dispatch.

ID 3360 R

**RAPID TRANSIT NETWORK DESIGN USING SIMULATED ANNEALING**

Main Author:

**Mostafa MOLLANEJAD** (*Sharif University of Technology*)

Co-author(s):

**Shahab KERMANSHAHI****Yousef SHAFABI** (*Civil Eng. Dept. Sharif University of Technology*)**Mahmood ZANGUI** (*Sharif University of Technology*)**Abstract:**

Rapid Transit Network Design (RTND) is a relatively new type of Transit Network Design (TND) that aims to find the best set of rapid transit routes. It considers special characteristics of rapid transit routes, and can thus fully exploit the potential of transportation networks for creating them. In this study, a meta-heuristic algorithm is proposed for RTND, namely a simulated annealing algorithm (SA), which has been adapted for RTND. The objective of the algorithm is to maximize rapid transit network coverage. For achieving this goal, the route generation procedure first specifies a set of candidate routes. Some practical assumptions are made about the conditions of an acceptable route in this step. Next, SA is applied to perform the search process through the candidate set. Some innovative approaches are applied in order to speed up the SA algorithm. The algorithm is implemented in C# and a benchmark problems is used to evaluate its efficiency. Comparison between this algorithm and three previous studies proves the reliability and effectiveness of the method. Moreover, the most important aspect of this method is that it depicts excellent efficiency and accuracy as a practical method for being used for large-scale networks.

**Keywords:**

Rapid transit, Network design, Simulated annealing.

TUE 13<sup>th</sup> (11:15 - 12:30, Session A4.7) Room 5B

ID 1072 R  
**PLATFORM HEIGHT, DOOR WIDTH AND FARE COLLECTION ON PUBLIC TRANSPORT DELAYS: A LABORATORY STUDY**

Main Author:

**Rodrigo FERNANDEZ** (*Universidad de los Andes, Santiago - Chile*)

Co-author(s):

**Pablo ZEGERS** (*Universidad de los Andes, Santiago - Chile*)

**Gustavo WEBER** (*Universidad de los Andes - Santiago, Chile*)

**Alvaro FIGUEROA** (*Universidad de los Andes - Santiago, Chile*)

**Nick TYLER** (*University College London*)

**Abstract:**

Public transport vehicles spend a significant proportion of their travel time stopped at stops for boarding and alighting passengers. In some cases this range from 30 to 50% of the journey time. This time is called dwell time. The dwell time depends on the amount of passengers boarding and/or alighting at each stop, besides with operational characteristics such as platform height, number and size of doors of the vehicle, fare collection method, internal layout of vehicles, among others. The dwell time has been described as a linear function of the number of boarding and alighting passengers as the main explanatory variables plus parameters which represent the abovementioned characteristics. Examples of these parameters are the average boarding and alighting time per passenger, the lost time for opening and closing doors, and additional delays for other causes. We have studied dwell time functions and its parameters in the case of buses since 1995 in Chile and Britain by means of data collected on the street. Our results indicates that the dwell time also depend on the occupancy of the vehicle, the bulk of passenger wishing boarding or alighting, the platform overcrowding, and the amount of passengers which can be stored from the platform and the fare collection point inside the vehicle. In contrast with these and many other studies, this paper presents values of average boarding and alighting times obtained from real-scale experiments made at the Pedestrian Accessibility and Movement Environment Laboratory (PAMELA) of University College London.. (...).

**Keywords:**

Public transport, Buses, Bus stops, Traffic operat.

TUE 13<sup>th</sup> (11:15 - 12:30, Session A4.7) Room 5B

ID 1135 R\*  
**HIGH CAPACITY TRANSIT OPERATIONAL BENEFITS**

Main Author:

**Sittipan SITTIKARIYA** (*DKS Associates*)

Co-author(s):

**Mark YAND** (*DKS Associates*)

**Abstract:**

The purpose of this study is to develop comprehensive transit treatment strategies to enhance transit quality of service in terms of transit travel time, transit reliability, and collision reduction. The transit treatment strategies were proposed to Pierce Transit to implement bus rapid transit on State Route 7 in Tacoma, Washington State (USA). The bus rapid transit route would cover approximately 13-mile-long corridor. The transit preferential treatments include transit stop consolidation, parking control policy, in-lane transit stop, Business Access Transit (BAT) lane, queue jump and Transit Signal Priority (TSP) as well as other innovative treatments. With recommended preferential transit treatments, Pierce Transit could decrease transit travel time up to 48%, or 32 minutes during PM peak, on the highest demand existing transit route. In addition it demonstrated that safety, one of the most critical transit qualities of service, has been significantly improved. We estimated that a passenger of improved transit service would be less likely to be involved in a collision in comparison to a passenger of a regular passenger car (63% reduction in collision and 43% reduction in fatality).

**Keywords:**

Bus rapid transit, Operational benefits, Business access transit lane, Transit signal priority.

ID 1165 R

**REGULAR-INTERVAL TIMETABLES: THEORETICAL FOUNDATIONS AND POLICY IMPLICATIONS**

Main Author:

**Panos TZIEROPOULOS** (EPFL-LITEP)

Co-author(s):

**Daniel EMERY** (EPFL-LITEP)**Jean-Daniel BURI** (EPFL-LITEP)**Abstract:**

Opting for operations according to a regular-interval (cyclic) timetable was initially motivated by operational concerns: repeating a given pattern through daily operations both increases the infrastructure capacity (and, thus, the network productivity) and smoothes out the operational tasks (which does not only lightens the personnel stress, but is also expected to have positive impacts on safety). Then, separation between infrastructure management and train operations required by European regulations since the beginning of the 90s, and the progressive introduction of competition in the train operations business push more and more infrastructure managers to apply regular-interval scheduling of the train paths. Due to its periodical nature, operation with regular-interval timetables exhibits a set of specific properties. Those are particularly both interesting and hampering in the case of so-called coordinated timetables, where requirements of symmetry are further added to those induced by periodicity. In real life, regular-interval timetable properties translate into significant implications for: a) the quality of service, as seen by the passengers' side; b) the set of constraints, as seen from the operators' side; c) the geographical and functional distribution of investment, as seen from the policy side (state owned infrastructure managers). The paper starts by developing the theoretical foundations of regular-interval timetables. It then shows how the fundamental relations generate a set of peculiar properties and, further, how those properties are related to the level of service, operation constraints, and investment philosophy. It shows explicitly the advantages and disadvantages of those properties for all stakeholders. (...).

**Keywords:**

Regular-interval timetable, Coordinated regular-interval timetable, Transport policy shift.

ID 1680 R

**HOW 'GOOD' IS URBAN BUS ELECTRONIC FARE COLLECTION DATA?**

Main Author:

**Markus HOFMANN** (Institute of Technology Blanchardstown)

Co-author(s):

**Simon WILSON** (Trinity College Dublin)**Peter WHITE** (University of Westminster)**Abstract:**

In recent years there is clear trend towards the utilisation of Electronic Fare Collection (EFC) data. The automatic storage of data supported the decision making process in many other industries since the early 90s. The analysis are often complex and exceed the creation of revenue related reports which was one of the original purposes of EFC systems. However, very little research has been carried out on the quality of such data especially in systems where human involvement is part of the recording process. Many European systems require the interaction of the bus driver to identify the bus stop when passengers board. Although more and more systems are nowadays equipped with Automatic Vehicle Location (AVL) systems the majority of operators still have to operate without such technological advances. This paper analyses EFC data from a network where AVL data was not available. Three different aspects are investigated: Is the entered location of the bus stop correct? Is there a fatigue factor of bus drivers throughout the day? Furthermore a Monte Carlo simulation demonstrated to what extent wrongly recorded data influences EFC analysis results. The results of this paper are promising as the conclusion with regard to data quality is that although the recorded data is not complete it is accurate.

**Keywords:**

Public transport, Data quality, Electronic fare collection data.

TUE 13<sup>th</sup> (14:00 - 15:15, Session A4.8) Room 5B

ID 1056 R

**CENTRALIZE VS. DECENTRALIZE ZONING STRATEGIES FOR METROPOLITAN PARATRANSIT SYSTEMS**

Main Author:

**Luca QUADRIFOGLIO** (Texas A&M University - Zachry Dept. of Civil Engineering)

Co-author(s):

**Chung-Wei SHEN** (Texas A&M University)

**Abstract:**

ADA paratransit systems are dial-a-ride services providing public transportation to disabled customers. In large metropolitan areas, these services might adopt zoning strategies to simplify their management. The objective of this paper is to provide a more in-depth evaluation and comparison between centralized and decentralized zoning strategies. We develop a simulation model to evaluate the effect of zoning strategies on the productivity and service quality for the ADA paratransit service in Houston, Texas. Three decentralized zoning strategies are compared to a centralized no-zoning strategy. Results show that the decentralized "Four-zone" strategy, as opposed to the centralized no-zoning strategy, needs a fleet larger by 17 percent, its empty trip miles are larger by 11 percent, values for the passenger trips per vehicle revenue hour are lower and its average waiting time is 3.7 percent lower.

**Keywords:**

Paratransit, Zoning strategies, Simulation.

TUE 13<sup>th</sup> (14:00 - 15:15, Session A4.8) Room 5B

ID 1230 R

**MOTORIZED TWO-WHEELERS: CONTRASTING ASPECTS, RECURRING PROBLEMS AND SOLUTIONS FOR MORE COMPREHENSIVE URBAN TRANSPORTATION**

Main Author:

**Antonio MUSSO** (Sapienza - University of Rome)

Co-author(s):

**Maria VITTORIA CORAZZA** (Sapienza - University of Rome)

**Abstract:**

Powered Two-Wheelers – PTWs are very popular modes both in developed and industrialized Countries, nevertheless, despite their considerable use, they tend to be ignored in transportation organization and planning; as a consequence, poor safety level, environmental concerns, no proper knowledge of riders' behavior and motivation, along with the lack of comprehensive policies in which two-wheelers are integrated within a balanced mobility system, are recurring problems due to the underestimation of their role in the city traffic. Case studies of London, Hanoi, Rome and Bogotá, which have extensive use of motorcycle/mopeds, are presented, stressing commonalities and peculiarities. The need of a proper assessment of the role of two-wheelers in the urban mobility management is the core of the lesson learned from all the case studies. To overcome such a barrier three main lines of actions are recommended: revision of the decision process, both at institutional and at regulatory levels; technical progress to develop more efficient safety measures and cultural challenge involving decision makers, road users, planners and designers.

**Keywords:**

Two-wheelers, Mobility planning, Safety, Environment, London, Hanoi, Rome, Bogotá.

ID 1536 R

**TAXICAB REGULATION AND URBAN RESIDENTS' USE AND PERCEPTION OF TAXI SERVICES: A SURVEY IN EIGHT CITIES**

Main Author:

**Richard DARBÉRA** (*Latts CNRS*)**Abstract:**

Taxicab regulation and urban residents' use and perception of taxi services: a survey in eight cities Several market failures would justify some forms of price control and entry regulation in the taxicab industry. Unfortunately, history shows that very often the taxi regulators get captured by taxi operators' lobbies and fail to adapt their regulation to changing market conditions. Hence, faced with a sclerotic service supply, several cities and countries have thoroughly deregulated their taxi industry... only to gradually bring back some elements of regulation later on. Since the late 1960s academics have at length debated the pros and cons of price and entry regulations for the taxi market, either using very simplified models of selected segments of the market or referring to empirical data comparing service supply before and after deregulation in one or in several case studies. Because of the paucity of available data on the demand side, most of these empirical studies generally only consider the supply side, overlooking the impact of regulation or deregulation on taxi use and on the perception of taxi services by their clients. We have selected eight capital cities with contrasting regulatory systems and carried out a survey among their residents to understand why and how they use taxis and to collect their opinion about the quality of the service provided. Some 3200 respondents answered about 40 questions. Taxi use varies greatly from one city to the other, both in terms of trip frequency and of trip purposes. A statistical analysis of the results enabled us to draw some conclusions about the impacts of various elements of taxicab regulation on the mobility of urban residents. (...).

**Keywords:**

Taxi regulation policy mobility.

ID 2772 R

**SHORT DISTANCE URBAN TRIPS: COMPARISON OF THE IMPACTS OF DIFFERENT TRANSPORT MODES**

Main Author:

**Ana FARIA** (*Instituto Superior Técnico*)**Abstract:**

The main objective of the present work is to develop a methodology that allows determining indicators to compare short distance urban trips (urban trips were assumed to be less than 3 km) using different transport modes such as soft modes (only walking was considered), public transports (bus and metro) and private cars, taking into account internal costs (time and distance) and external costs (energy consumption, CO<sub>2</sub> and local pollutants emissions). The methodology adopted consists in doing in situ measurements for all transport modes (walking, bus, metro and car) using a portable laboratory developed for this purpose which allows monitoring pedestrians' trips in terms of route, time and distance. For estimating the external costs (energetic and environmental impacts) the authors used the EMEP CORINAIR methodology which allows taking in consideration cold start emissions. In urban settings, considering short distance trips cold start emissions assume a very important role since a substantial number of trips are mainly done under these conditions. The methodology developed was applied to a case study in the city of Lisbon. Results allowed the authors to conclude that in the situations where it is easy to park (low demand scenario) the private car presents the best ratio distance / time but when there is a high parking pressure, car is the worst transport mode. Walking only is competitive with other transport modes for very short distance trips (below 1 km) while metro trips tend to have a good relation distance – time but only for longer trips (above 2.5 km). Relatively to the energetic and environmental analysis, the private car has always the higher energy consumption and emissions per trip. (...).

**Keywords:**

Transport modes, Short distance urban trips, Energetic and environmental analysis.

TUE 13<sup>th</sup> (15:30 - 16:45, Session A4.9) Room 5B

ID 1681 R

**INTERNATIONAL COMPARISON OF DOMESTIC  
INTERCITY MOBILITY BY PUBLIC TRANSPORTATION**

Main Author:

**Taro ARATANI** (*Department of Transportation Engineering  
Graduate School of Science and Technology Nihon  
University*)

Co-author(s):

**Tomoyuki TODOROKI** (*CST, Nihon University*)

**Abstract:**

It is said that improvement of intercity transportation offered by air and high-speed rail network services, in turn, improves convenience. However, if only some intercity transportation services become convenient, the service gaps between intercity motilities could widen. Thus, focusing on mobility service fairness, it is essential that the disparity between intercity mobility services be narrowed. The present study proposes using Data Envelopment Analysis (DEA) in calculating two indices of service level: individual mobility and population, and we compare the regional disparity of domestic intercity mobility of Japan with that of other countries. These results aid in the discussion and evaluation of the current regional disparity as well as the future improvement of the intercity transportation services.

**Keywords:**

Public transportation service, Intercity transportation, International comparison, Mobility, Data Envelopment Analysis (DEA).

TUE 13<sup>th</sup> (15:30 - 16:45, Session A4.9) Room 5B

ID 2022 R

**THE ART OF GOVERNMENT OF MEGA URBAN  
TRANSPORT PROJECTS**

Main Author:

**Sophie STURUP** (*Australasian Centre for Governance and  
Management of Urban Transport*)

**Abstract:**

Mega urban transport projects (MUTPs) are increasingly being used in urban environments to ameliorate the problem of congestion. However, a number of issues with regard to mega projects have been identified. The seemingly institutionalised over estimation of economic benefits and persistent cost over runs, could mean that the wrong projects are selected, and that the projects that are selected cost more than they should. The articulation of problems in a form, for which MUTP is the solution leads to poorly integrated projects that lack public acceptance. Studies to date have produced a number of solutions to these issues, including the various methods for the inclusion of the private sector in project provision and various methods for inclusion of the public in consultation on the development and implementation of projects. However the issues have shown significant intractability in the face of these solutions. This paper will provide initial findings from a study into the 'art of government' of MUTPs based on three Australian case studies from Melbourne, Perth and Sydney. Using Foucault's conceptualisation 'art of government' within the broader theory of 'governmentality' the study attempts to identify the amalgam of knowledge, technology and rationality generated within MUTPs. The purpose is to shed light on the intractability of the issues that have been identified and why good ideas to solve them have been less than fully successful.

**Keywords:**

Governmentality Mega Urban Transport Projects Fo.



ID 2550 R

**OPTIMAL EMERGENCY EVACUATION GUIDANCE FOR TRANSPORTATION FACILITIES**

Main Author:

**Chih-Yuan CHU** (*National Central University, Taiwan*)**Abstract:**

The paper proposes a method for designing optimal evacuation guidance systems in complex building spaces. A visibility graph is used to analyze the geometry of the building in a manner consistent with actual human behavior. An algorithm for generating a simplified visibility graph and finding candidate sign locations is designed assuming polygonal obstacles. After a shortest path algorithm is executed on the graph, the optimal evacuation sign installation locations and the associated evacuation direction information can then be found by calculating the best routes from all origins to the exit. The guidance systems designed by the proposed method have three features. First, all pedestrians are covered by the guidance system. Second, after a pedestrian finds the first sign, the evacuation direction information is provided unambiguously without requiring any judgment on the part of the pedestrian. Third, the guidance allows a pedestrian to evacuate to the closest exit via the shortest path. After the optimal guidance system is determined, a cellular automata pedestrian model is used to evaluate the performance of the guidance system and identify the bottlenecks of the current geometry and evacuation guidance design. A by-product of this research is an improved method of calculating static fields in cellular automata simulations. Finally, an example based on a transportation terminal is presented to validate the methodology.

**Keywords:**

Cellular automata, Emergency sign, Evacuation guidance, Pedestrian simulation, Static field, Visibility graph.

ID 3071 R

**INFORIO, FOCUSGROUP SESSIONS TO TEST POTENTIAL FOR A PERSONAL REAL TIME TRAVEL INFORMATION CONCEPT FOR PUBLIC TRANSPORT**

Main Author:

**Warner VONK** (*Harmen Hilbrandt Vonk (father)*)

Co-author(s):

**Robert HULLEMAN** (*City of Almelo, NL*)**Abstract:**

This paper describes the development of a market research method in order to establish the potential demand for a Personal Real Time Travel Information (PRTTI) concept applied to public transport (PT) in Rio de Janeiro, called InfoRio. In order to receive personal travel information on PT services the customer must register via internet or by sending an SMS. A few minutes before his trip he will receive a SMS informing him the dynamically estimated time of arrival of his bus service at his desired bus stop. The Triade model – a model that establishes the motivation, capacity and opportunity of customer segmentations to buy or use a service – has been adapted to travel behavior in order to identify the market segments and has been tested in a pilot survey. The following segmentations were identified: (1) non users of InfoRio service; (2) choice users that will deliberate over the received information (3) habit users that will include the information in their travel behavior. A focus group session is used to get better insight in the customer segment with the highest score on the Triade scale, which confirmed their interest in using the service. Due to the low number of respondents – nine out of forty— we cannot give indications about potential market size. The main benefit they attributed to the service is that it increases the reliability of the bus service and as a consequence they can better plan their activities. We concluded that the developed method, consisting out of a revealed preference survey and followed by focus group sessions with the segmentation groups, gives a good insight in the market potential of a new service and is easy to execute. Future surveys should have more respondents and focus group sessions with all segmentation classes should be executed to develop a detailed profile of the potential market of InfoRio. (...).

**Keywords:**

Advanced Travel Information Systems, Public Transport Service Quality, Market Research Method.

TUE 13<sup>th</sup> (15:30 - 16:45, Session A4.9) Room 5B

ID 3183 R\*

**PERCEPTION OF MOTORCYCLE INFRASTRUCTURE,  
PROVISION AND USE IN ABUJA CITY**

Main Author:

**Abimbola ODUMOSU** (*Chartered Institute of Logistics and Transport [CILT] London*)

Co-author(s):

**Aminu YUSUF** (*Chartered Institute of Logistics and Transport [CILT] London*)

**Bayero FARAH** (*Chartered Institute of Logistics and Transport [CILT] London*)

**Abstract:**

Against the background of the banning of motorcycle use in Abuja metropolis, in Nigeria by the authorities, this study examined the peoples' perception on the acceptability of commercial motorcycle as a means of intra-city mobility in Abuja metropolis. Questionnaire administration techniques were employed to extract information on provision and use of motorcycle for commercial purposes in Abuja metropolis. Findings from the study revealed that the level of infrastructural provision for motorcycle in Abuja metropolis is zero. Even in the surrounding satellite settlements where the motorcycle operators were allowed to operate, the infrastructural facilities were not available. Also the levels of accident do not relate to the total number of the motorcycles in use in Abuja city. In addition, majority of users prefer the continuous existence of commercial motorcycle in Abuja city. Finally, recommendations were made on how best to handle issues of users' acceptability, infrastructural provision and motorcycle operation in Abuja city, the administrative capital of Nigeria, in terms of safety.

**Keywords:**

Infrastructure, Motorcycle, Accident, Safety.

TUE 13<sup>th</sup> (17:00 - 18:15, Session A4.10) Room 5B

ID 1161 R

**SPUTNIC - MEETING NEW CHALLENGES FOR PUBLIC  
TRANSPORT**

Main Author:

**Bertil HYLÉN** (*VTI Transport Research*)

**Abstract:**

SPUTNIC (Strategies for Public Transport in Cities) has been a project funded by the European Commission under the 6th Framework Programme. SPUTNIC has been dedicated to the challenges facing local and regional public transport systems in transition, especially those in central and Eastern Europe. These challenges include the emergence of a competitive environment, changing institutional frameworks and increasingly scarce financial resources. SPUTNIC has been coordinated by UITP, International Union of Public Transport. The author has been engaged in SPUTNIC Working Group Market Organisation. This working group has focused on effective cooperation of public transport actors, tariff optimisation and integration, innovative financing and funding, incentive contracts and monitoring systems which improve system quality and reduce costs. (...)

**Keywords:**

Contracts, Incentives, Monitoring, Public Transport.

ID 1809 R

**APPLICATION OF NEW ALGORITHMS IN A TRANSIT ASSIGNMENT PROBLEM FOR CONGESTED PUBLIC TRANSPORT SYSTEMS**

Main Author:

**Carlos MELO** (*Department of Transport Engineering, Pontificia Universidad Católica de Chile*)

Co-author(s):

**J. ENRIQUE FERNÁNDEZ** (*Department of Transport Engineering, Pontificia Universidad Católica de Chile*)**Joaquín DE CEA** (*Department of Transport Engineering, Pontificia Universidad Católica de Chile*)**Abstract:**

The use of a class of bush-based algorithms for the solution of user equilibrium (UE) traffic assignment problem is studied. In particular the analysis considers the use of a particular formulation of the transit assignment problem, which promises to produce highly precise solutions by exploiting the property of acyclic UE flows. In the first stage of this work, we discuss and implement the Origin-Based Algorithm (OBA) in the diagonalization procedure for solving the transit assignment problem for congested public transport systems based on the formulation of De Cea and Fernández. A detailed analysis of the behaviour of OBA in this context is performed. It is found that the efficiency of OBA directly applied to congested transit assignment problems is not superior to traditional Frank-Wolf methods combined with diagonalization. The orientation of new developments for the improvement of OBA efficiency in the solution of congested transit assignment problems is discussed.

**Keywords:**

User equilibrium, Transit assignment, Origin-based algorithm.

ID 1832 R\*

**A NEW MULTICLASS MULTIMODAL COMBINED MODEL FOR PASSENGER MARKET SHARE ESTIMATION IN ECONOMIC CIRCLES**

Main Author:

**Shuang LI** (*School of Transportation, Southeast University, Nanjing*)

Co-author(s):

**Wei DENG** (*School of Transportation, Southeast University, Nanjing*)**Yisheng LV** (*Institute of Automation, Chinese Academy of Sciences, Beijing*)**Abstract:**

This paper presents a multiclass multimodal combined model for passenger market share estimation between main cities in an economic circle. An economic circle consists of more than one closely adjoining central cities and their influence zones, such as Yangtze River Delta in China. People may choose private car or public transit, such as intercity bus or train, to finish a trip. Mode choices of passengers are modelled in combination with flow assignment in a multimodal transportation network with deterministic travel demand. The multi-modal transportation network is composed of a highway network and a railway network. Travelers of a class perceive their generalized cost as a weighting of travel time and travel cost. Generalized travel cost model considers road congestion on the highway network as well as congestion and capacity effects on public transit network. Private cars and intercity buses run on the highway network with asymmetric cost interactions. We assume that stochastic user equilibrium governs the route choice of car users in the road network, while a deterministic user equilibrium principle governs which kind of public transport services will be chosen in the public transit network. And a logit model is used to determine passenger's choices of car or public transit. A variational inequality formulation is proposed to capture all the components of the proposed model in an integrated framework. The model provides an alternative to existing travel mode forecasting models. The MSA algorithm is presented to solve the model. A multimodal transportation network between two cities is presented to illustrate the proposed methodology.. (...).

**Keywords:**

Metropolitan travel modes forecasting, Multiclass multimodal combined model, Mode choice, Traffic network equilibrium, Variational inequality.

TUE 13<sup>th</sup> (17:00 - 18:15, Session A4.10) Room 5B

ID 2970 R

### **MODELLING THE IMPACT OF WEATHER ON ACTIVE TRANSPORTATION**

Main Author:

**Sheyda SANEINEJAD** (*University of Toronto*)

#### **Abstract:**

This study introduces a weather sensitive mode-choice model developed using a combined database of travel activity and the corresponding historical hourly weather conditions in the city of Toronto. Weather features integrated in the model include categories of temperature ranges, wind speed, and four precipitation conditions. Two sub models are also developed in order to study the impact of the interaction between weather conditions and different age and gender groups on active transportation mode choice. Results of this research confirm that the impact of weather on active modes of transportation is significant enough to deserve attention at the research, data collection and planning levels. From a policy perspective, these results can significantly help with more successful active transportation promotional policies. Additionally, by highlighting some of the behavioural differences between pedestrians and cyclists, this paper can contribute to better and more effective policies and infrastructure provision. Lastly, through analysis of the impact of weather on all other modes of travel this research provides an area of improvement for future travel surveys collected for Toronto and other regions

#### **Keywords:**

Active transportation, Mode choice modelling, Impact of weather conditions.

TUE 13<sup>th</sup> (17:00 - 18:15, Session A4.10) Room 5B

ID 3006 R\*

### **DIAL-A-RIDE ROUTING SYSTEM: THE STUDY OF MATHEMATICAL APPROACHES USED IN PUBLIC TRANSPORT OF PEOPLE WITH PHYSICAL DISABILITIES**

Main Author:

**Valter SOUSA** (*Faculdade de Tecnologia de São José dos Campos*)

Co-author(s):

**Luiz TOZI** (*Instituto Tecnológico de Aeronautica*)

**Irineu DE JR** (*Irineu de Brito*)

#### **Abstract:**

In this paper we present a model to dial-a-ride transportation for people with disabilities in the city of São José dos Campos, a technological center located 91 km from São Paulo, and implement an algorithm for routing. It was used as a method, the study of transport and the Problem Dial-a-ride (DARP) and the implementation of Parallel Insertion Heuristic. We developed a program in Excel and Visual Basic to simulate real applications, resulting in the insertion of 56% of them. Thus, we intend to cooperate with the case study of the mathematical approaches used in routing the transport of persons with disabilities by providing a better service and thereby improving the quality of their lives.

#### **Keywords:**

Dial-A-Ride. Heuristics. Transportation Systems. h.

TUE 13<sup>th</sup> (11:15 - 12:30, Session B1.1) Room 0.07

ID 1238 R

**ASSESSING THE INTEGRATED SCHEDULING OF  
MANUFACTURING AND TRANSPORTATION SYSTEMS  
ALONG GLOBAL SUPPLY CHAINS**

Main Author:

**Enzo FRAZZON** (*Bremer Institut für Produktion und  
Logistik GmbH at the University of Bremen*)

Co-author(s):

**Thomas MAKUSCHEWITZ**

**Bernd SCHOLZ-REITER** (*Bremen University*)

**Antonio NOVAES** (*Federal University of Santa Catarina*)

**Abstract:**

Seeking for benefits related to country-specific advantages and the expertise of excellent partners supply chains often embrace globally distributed manufacturing systems. These locally obtained benefits might be impaired as a result of the unbalanced integration of manufacturing and transportation systems. Indeed, due to longer transportation lead-times and potential perturbations in manufacturing processes, this integration is even more important in global supply chains. This paper presents a generic approach for the integration of production and transportation scheduling along global supply chains and compares its performance with a sequential approach. The generic approach is based on the integrated production and transportation scheduling problem (PTPS). The results of the computational analysis demonstrate that the proposed integrative approach outperforms the sequential one. Even though the outcome is based on mathematical programs with limited capabilities in regard to the number of scheduled orders, it provides solid motivation and support for the forthcoming development of heuristics for integrating manufacturing and transportation scheduling.

**Keywords:**

Scheduling, Transportation, Manufacturing, Global Supply Chains.

TUE 13<sup>th</sup> (11:15 - 12:30, Session B1.1) Room 0.07

ID 1260 R

**BAD LOCATIONS, BAD LOGISTICS?**

Main Author:

**Jan HUSDAL** (*Moreforskning Molde*)

Co-author(s):

**Svein BRÅTHEN** (*Møreforskning Molde / Molde Research  
Institute*)

**Abstract:**

Transportation networks, and in particular road networks are an integral part of supply chains, and in regions with sparse networks this road network becomes very important. How are the supply chains of companies located in sparse transportation networks affected by transportation disruptions? What are typical disruptions in certain locations or for certain types of business, and how do businesses and carriers counter supply chain disruptions? This chapter is based on a 2009 study from Norway, aimed at investigating how businesses and freight carriers located in sparse transportation networks are affected by and relate to supply chain disruptions. The study indicates that transportation-dependent businesses seek a vertical integration of a freight carrier into their supply chain, while freight carriers establish flexible solutions to meet the contingent needs of different businesses. The study also develops a new framework for the categorization of supply chains, and introduces the notion of the constrained supply chain.

**Keywords:**

Supply chain risk, Sparse transportation networks, Road transportation, Transportation disruption, Freight carriers, Risk management.

TUE 13<sup>th</sup> (11:15 - 12:30, Session B1.1) Room 0.07

ID 1736 R

**A MODEL FOR IDENTIFICATION OF THE SUPPLY CHAIN INFORMATION GAPS TO BE REDUCED BY USING THE SMART TRANSPORTATION MANAGEMENT SYSTEMS**

Main Author:

**Vahid MIRZABEIKI**

**Abstract:**

The purpose of this paper is to create a model for identification of the supply chain information gaps to be reduced by using the Smart Transportation Management (STM) systems. The information gap is considered as the difference between the value level of the supply chain information and support level of the STM systems for the supply chain information. Literature studies are conducted to identify the elements of the STM systems and the valuable types of information for transportation and material handling of products in a supply chain. Empirical studies by using interviews and documentations as sources of empirical data are conducted to show how the model could be applied. Interviews with different actors of Swedish industrial supply chains (suppliers, manufacturers, logistics service providers, retailers and customers) are conducted to identify the value of different types of information in a supply chain. Interviews with logistics managers of Swedish industrial and retailing companies and reviewing the documents of companies are accomplished to find the support level of the STM systems for different supply chain information types. The result of this study is useful for information operators of companies to identify the information gaps that could be reduced by using the STM systems. This paper is useful as a decision support for practitioners to develop the STM systems according to the value of the information that such systems support for actors of the supply chains.

**Keywords:**

Smart transport management (STM) systems, Supply chain (SC), Supply chain information types (SCITs), Information support, Transportation.

TUE 13<sup>th</sup> (11:15 - 12:30, Session B1.1) Room 0.07

ID 1958 R\*

**HYBRID ORGANISATION GOVERNANCE MODELS FOR INTEGRATED OCEAN CARRIERS**

Main Author:

**Michele ACCIARO** (*Erasmus University Rotterdam - Center for Maritime Economics and Logistics (MEL)*)

**Abstract:**

The development of the market for third party logistics service provision has opened the possibility for ocean carriers to integrate along the supply chain and expand the scope of their activities beyond port-to-port ocean transportation. The level of integration observable in the industry is though variable and a clear understanding of the rationale that may lead an ocean carrier to integrate vertically along the supply chain is the subject of an intense academic debate. The present paper aims at providing an alternative approach to the problem using the paradigms developed within the field of transaction cost economics to explain organisation governance structures. The paper highlights the role of bilateral dependency in the determination of the adequate alignment between the type of transactions and the organisation governance forms and provides the background for further empirical testing.

**Keywords:**

Transaction cost economics, Liner shipping, Container logistics. Introduction The importance of third-party logistics service provision also referred to a.

TUE 13<sup>th</sup> (11:15 - 12:30, Session B1.1) Room 0.07

ID 2873 R\*

**REVERSE LOGISTICS STRATEGIES IN A FRENCH CONTEXT: A THEORETICAL PERSPECTIVE**

Main Author:

**Marlène MONNET** (CRET-LOG)

**Abstract:**

Purpose – To illustrate how theoretical approach to the stakeholders and to the supply chain management can contribute to the analysis of the reverse logistics strategies. To underline some of the strategic behaviours of the actors involved in the French context of Electric and Electronic Equipment Waste (WEEE) recycling. Design/methodology/approach – is based on forty interviews with experts in the implementation of the reverse logistics system and in the statutory context of the WEEE. The literature review also depends on data collecting (legislative texts, business press, topical documents, and internal documents). Findings – Major findings show that the French context of WEEE recycling is characterised by clashing interests, uncertainties and the absence of a consensus. The relational quality between the stakeholders appears as essential, as for instance, political relationships. Then, the logistics service provider develop an interesting strategy in the reverse logistics system, by introducing economic and quality criteria of service in this context. We conclude by discussing future research directions: to look for the levers to the relational skills, to study collective environmental strategies, to discuss the influence of the institutionalization in the management of the supply chain in the context of sustainable development. Research limitations/implications – The main methodological limitations are linked with our contextualized research, then we suggest to broaden future researches to other kind of waste and to other countries than France. Other limitations are connected with the objectives of our research to focus on the stakeholders theory and the supply chain management approach. (...).

**Keywords:**

Reverse logistics strategies, Stakeholders, Supply chain management, Sustainable logistics, French context of waste recycling.

TUE 13<sup>th</sup> (14:00 - 15:15, Session B1.2) Room 0.07

ID 1284 R

**SIMULATION OF LOGISTICS IN FOOD RETAILING FOR FREIGHT TRANSPORTATION ANALYSIS**

Main Author:

**Hanno FRIEDRICH** (Universität Karlsruhe (TH), IWW)

**Abstract:**

Logistic systems are crucial to understand the conversion of economic activity into freight transportation. However, until recently, transportation models did not explicitly consider logistics. But still, transportation models do not include the emergence of complex logistic structures characterized by economies of scale. In most cases only the choice of lot sizes and transportation paths represents the logistic part of these models. Fixed costs are generally transformed into variable cost. This paper shows that it is also possible to model complex logistic structures for the purpose of transportation analysis. The paper starts with a literature review of freight transportation models, focusing on the question of which logistic aspects they include. It will be shown that the emergence of logistic locations is not yet part of freight transportation models. A description of the SYNTRADE simulation model shows how this can be addresses. It is able to simulate the emergence and dynamic development of warehouse structures in the food retailing sector for Germany. The results show significant congruence between the modeled and the real spatial warehouse structures. SYNTRADE includes a detailed logistic optimization of food retailing companies as well as simplified optimizations of adjacent logistic systems. Thus, the model can describe dependencies between logistic systems, which are important to explain differences of warehouse structures. The modeling of forward looking decisions in the simulation enables SYNTRADE to avoid local optima on the level of individual companies. Thus, the dependencies on the overall system state, which is not unique in freight transportation, can be limited. (...).

**Keywords:**

Commodity transport modeling, Freight transport mo.

ID 1428 R

**PERSPECTIVES OF FOOD SUPPLY CHAIN-TRACEABILITY**

Main Author:

**Henrik RINGSBERG** (*Inst. for design Sciences, dep. packaging logistics*)

Co-author(s):

**Gunilla JÖNSON** (*Dep. of design Sciences, div. packaging logistics*)**Abstract:**

Several different perspectives exist on the importance of food supply chain traceability and why it is scientifically investigated. These include the assessment of food security and quality preservation, economic, logistic, supply chain management, and information technical. Because of this, the concept of food supply chain traceability is defined in many different ways, depending on the scientific area of the research perspective used for investigation. This makes the concept and the scientific value of food supply chain traceability sometimes hard to understand theoretically. Thus, it is of great importance to position the concept theoretically and in relation to other scientific research areas. The purpose of this paper is to examine how food supply chain traceability can be theoretically positioned in academic supply chain research. Purpose of this paper The paper is based on a literature review of definitions and perspectives of food supply traceability, and of the concepts and definitions used within the paradigm thinking found in relevant scientific articles and books. Design/methodology/approach: Findings: The results show that food supply chain traceability is pre-paradigm research and further suggests that it should be treated as a "physical representational space" in scientific theory. The results also verify that food supply chain traceability is a complex research field, which is studied by using several perspectives in different research areas, especially logistics. It is PERSPECTIVES OF FOOD SUPPLY TRACEABILITY RINGSBERG, Henrik; JÖNSON, Gunilla 12th WCTR, July 11-15, 2010 – Lisbon, Portugal 2 important to clarify the perspective that has been applied when making suggestions concerning logistics development. (...).

**Keywords:**

Food supply chain traceability, Scientific theory, Literature study.

ID 1472 R

**THE INTEGRATION OF CONTROL SYSTEMS FOR THE SUPPLY CHAIN AND TRANSPORTATION DOMAINS**

Main Author:

**Trond FOSS** (*SINTEF Technology and Society*)**Abstract:**

This paper describes some of the results up till now of the research project INTRANS supported by the Research Council of Norway. The paper focuses on the results related to the integration of control systems in the Supply Chain (SC) domain and the transport domain. By control system in the SC domain is meant any system that supports the decision takings in the SC and by control system in the transport domain is meant any system that supports the monitoring and management of a transport network, e.g. a road network. The paper looks upon the integration from an interoperability point of view and describes the three different types of interoperability, Contractual, Functional and Technical interoperability, providing complete interoperability. The paper takes the role model and functions defined in the ARKTRANS – The Multimodal ITS framework architecture as the starting point and combines it with the Supply Chain Operations Reference (SCOR) model. The paper describes how complete interoperability can be achieved by a common role model for the two domains, a common set of core functions for the two domains and a common information architecture. The paper also introduces the intelligent goods as a crucial link between the two domains as well as playing an important role in the decision taking in the SC domain and the monitoring and management of transport in the transport domain. Finally the technical interoperability is described. The main objective of the paper is to propose a way forward to link and integrate the SC and transport domain for the benefit of the stakeholders in both domains concerning a more effective, secure and reliable transport of goods.

**Keywords:**

Interoperability, Transport, Supply chain, Intelligent goods, Role model, Control system.



TUE 13<sup>th</sup> (14:00 - 15:15, Session B1.2) Room 0.07

ID 2205 R

**MULTICRITERIA METHODOLOGY FOR COLD SUPPLY CHAIN MANAGEMENT: AN APPROACH**

Main Author:

**Pablo ZUBÍA ALOY** (*ITENE -Instituto Tecnológico del Embalaje, Transporte y Logística*)

Co-author(s):

**Vicente CLOQUELL BALLESTER** (*Universidad Politécnica de Valencia - Departamento de Proyectos de Ingeniería*)

**David MOYA RAMIREZ** (*ITENE -Instituto Tecnológico del Embalaje, Transporte y Logística*)

**Andrea ESTEVE DE SANTOS** (*ITENE -Instituto Tecnológico del Embalaje, Transporte y Logística*)

**Abstract:**

The aim of this paper is to establish the multicriteria decision methodology as a useful tool for the selection of temperature control technologies in the different stages of the cold chain. For this purpose, two different approaches are studied: cold chain requirements and multi-criteria methodologies with similarities to the problem. The relationship between them takes the first step to obtain a modelling solution for this problem. It is widely known that the key point of any cold supply chain is the control of the temperature during the different stages that form the chain. Unfortunately, the selection of temperature control systems is usually made by taking into account just economical factors instead of using a multi factor criterion. Thus, the selected option turns into a short-time solution that must be redesigned later or even substituted by another technology to accomplish with the requirements that were not taken into account during the selection process. Commonly, there is not such revision and the companies get a semi-operative multi-problematic temperature tracking system not trusted by the workers and whose potential is partially – if not fully missed. To avoid this situation, this paper presents the first step in the design of a multi-criterion decision methodology. This is achieved by giving a brief description of a typical cold supply chain, with peculiarities and legal requirements, complemented with a synthetic recompilation of the different temperature control & RFID technologies developed during the last years. (...).

**Keywords:**

Logistics, Multiple Criteria Decision, RFID, Cold Chain, Supply Chain, Traceability.

TUE 13<sup>th</sup> (14:00 - 15:15, Session B1.2) Room 0.07

ID 2645 R

**INDUSTRY LOGISTIC MODEL IMPLEMENTATION BY MULTIPLE OBSERVATION FROM THE SAME SHIPPER**

Main Author:

**Mauro CATALANI** (*University of Naples"Parthenope"*)

**Abstract:**

A company has to optimize its production in order to maximize its profit especially in a short time. This means its penetration in a production weaving factory which involves very efficient companies whose products and services highly meet all the customers' needs. Logistics' costs and transport is the most important element because it is a factor of the process since it contributes to optimize it. Choosing the typology of transport to use depending by the shipper-carrier interaction. The parameters which influence the choice of the transport by the shipper are: availability, rapidity, efficiency and security. The attempts to reduce dead times and increase the rapidity of all the processes of the company, are very considerable. Nowadays the margins, to reduce them further, are part of the logistic stream. Among the various signs testifying the will of the companies to pursue such objectives, there is the Justin-Time philosophy, with its most important member Lever Fabergè of Pozzilli whose strategies will be analyzed according to the choices made using directly specific carriers. As a matter of fact Lever Fabergè, with the drastic reduction of mid-span supplies, made the transport efficiency one of the key elements, in order to set about its products at a national and international level. As a consequence there are more frequent deliveries but in reduced quantity and also the programs complying requested. The importance of a prompt and welltimed delivery gives to the supplier the responsibility of choosing the most reliable transport. But the factor which leads to a reappraisal of the transport role, is the concept of the integrated logistics according to which transport represents one of the main activities of the company logistic system, for the impact it has on the level of service and for the cost it requests. (...).

**Keywords:**

Industry, Logistic, Model, Lever.

TUE 13<sup>th</sup> (15:30 - 16:45, Session B1.3) Room 0.07

ID 2420 R

**THE ROLE OF MANUFACTURERS IN THE APPAREL SUPPLY CHAIN: THE CASE OF SOURCING FROM CHINA**

Main Author:

**Liang-Yun WANG** (*University of Paris-East*)

**Abstract:**

Most studies on supply chain management in the apparel industry emphasize the role of retailers, e.g. brand chain stores, department stores or hypermarkets. This project focuses on the manufacturing process, the process of creating finished products from raw materials. We conducted interviews with Chinese manufacturers, commercial intermediaries (Hong Kong and Taiwan), and western buyers. We analyzed the process from textile procurement to apparel delivery, with an emphasis on the Incoterms (International Commercial Terms) and transportation time. From 1980s, the companies in newly industrialized countries, such as Hong Kong, Taiwan, and South Korea, moved their production chain to China and became intermediaries between Chinese manufacturers and western buyers. A complete vertical integration in the industrial clusters in China can reduce the transportation time of fabric and other intermediate products. Subcontractors in China usually sell the goods on Incoterms FOB, giving western buyers the latitude to organize international transportation.

**Keywords:**

Apparel industry, Textile industry, Supply chain, China, Transportation, Manufacturer.

TUE 13<sup>th</sup> (15:30 - 16:45, Session B1.3) Room 0.07

ID 2820 R

**LINKS BETWEEN PRODUCTION SYSTEMS AND TRANSPORT: THE EXAMPLE OF GERMAN AND FRENCH INDUSTRIES**

Main Author:

**Michele GUILBAULT** (*Paris-Est University, INRETS, SPLOTT*)

Co-author(s):

**Marie LEBAUDY** (*INRETS*)

**Elisabeth GOVERNAL** (*INRETS*)

**Barbara LENZ** (*DLR e. V. German Aerospace Center*)

**Sebastian SCHNEIDER** (*DLR - Institute of Transport Systems*)

**Abstract:**

Changes in transportation are closely linked to the economic and logistical characteristics of the production system. The aim of this paper is, on the basis of data on the economic context and surveys conducted in France (the 1988 Shipper survey and the 2004 ECHO survey) and in Germany (the 2005 DLR survey), to show the major changes that have occurred in the two countries at both micro- and macro-economic levels and how these have affected transport demand. The first level of analysis relates to changes in the economic fabric. In particular, we have demonstrated the growing proportion of small and medium-sized firms at a time when large production units, which are those that are best able to concentrate their freight and use modes other than the road, are becoming fewer and fewer. At the same time, economic links are becoming more complex and, in the case of France, we have shown the increasing role played by wholesale traders in the distribution of goods. The constant reduction in transport costs and the opening up of markets is another structural factor whose impacts in both France and Germany we have also analysed. In addition to these economic changes, the internal modes of production of firms have also changed. Production is becoming more diversified and Just-in-time practices are spreading. The fragmentation of freight flows is thus occurring both in space and in time, which also has a major effect on the characteristics of the flows generated by firms and changes in transport. In the case of all these changes we have attempted to show the differences and similarities between the ways transport has changed in the two countries.

**Keywords:**

Changes in transport, Production concepts, Intra-firm transport, France, Germany.

ID 1389 R

**FLEET REROUTING STRATEGIES WITH REAL-TIME TRAFFIC INFORMATION**

Main Author:

**Jaume BARCELO** (*Universitat Politècnica de Catalunya, CENIT*)

Co-author(s):

**Arturo OROZCO** (*UPC*)**Abstract:**

The design and evaluation of City Logistics applications requires an integrated framework in which all components could work together. Therefore, City Logistics models should account for vehicle routing applications and fleet management models capable of including also the dynamic aspects of the underlying road network, namely when ICT applications are taken into account. This paper develops a methodological proposal based on an integration of vehicle routing models and real-time traffic information. In the computational experiments conducted in this paper, a dynamic traffic simulation model has been used to emulate the actual traffic conditions providing, at each time interval, estimates of the traffic state on each link of the road network that are then used, by a real time fleet management system, to determine the optimal dynamic routing and scheduling of the fleet.

**Keywords:**

Real-time traffic information, Time-dependent travel times, Dynamic vehicle routing, Tabu search.

ID 1660 R

**KNOWLEDGE OF REAL TIME POSITION OF VEHICLES AND ITS IMPACT ON THE IMPROVEMENT OF INTERMODAL DRAYAGE OPERATIONS**

Main Author:

**Alejandro ESCUDERO SANTANA** (*Grupo Ingeniería de Organización. Universidad de Sevilla*)

Co-author(s):

**Jesús MUÑUZURI SANZ** (*Grupo Ingeniería de Organización. Universidad de Sevilla*)**Ron VAN DUIN** (*Delft University of Technology*)**Luis GERARDO ONIEVA GIMÉNEZ** (*Grupo Ingeniería de Organización. Universidad de Sevilla*)**José GUADIX MARTÍN** (*Grupo Ingeniería de Organización. Universidad de Sevilla*)**Abstract:**

The intermodal transport chain can become more efficient by means of a good organization of the drayage movements. Drayage in intermodal container terminals involves the pick up or delivery of containers at customer locations. There are some works on centralised drayage management, but most of them consider the problem only from a static and deterministic perspective. The main objective is normally the assignment of transportation tasks to the different vehicles, often with the presence of time windows. The work we present here considers the knowledge of the vehicles' real-time position, which permanently enables the planner to reassign tasks in case the problem conditions change. This exact knowledge of position of the vehicles is possible thanks to a geographic positioning system by satellite (GPS, Galileo, Glonass). This additional data are used to dynamically improve the solution.

**Keywords:**

Intermodal transport, Drayage, Real time assignment, Stochastic Transit Time.

MON 12<sup>th</sup> (11:15 - 12:30, Session B2.1) Room A1V

ID 1679 R

**MODELING AND OPTIMIZATION OF A TWO LEVEL LOGISTICS SYSTEM BY MEANS OF THE CONTINUUM APPROXIMATION**

Main Author:

**Jose DEL CASTILLO** (*Transportation Research Group, University of Seville*)

**Abstract:**

This work introduces a model for the analysis of a logistic network. The network comprises two levels: a regional level and a local level. The products are transported from a central warehouse to a series of regional warehouses. From these warehouses, they are further distributed to the customers who are distributed over a number of zones within each region. The model considers a cost structure for the regional warehouses and for the transportation from the central warehouse to the final customers. The model allows finding the optimum configuration that minimises the total cost. This configuration is given by the number of zones per region and the number of regional warehouses. The methodology applied to solve the optimisation problem is based on replacing the set of customers by a continuum which is defined in terms of aggregated or averaged characteristics. Likewise, the costs of the routes from the warehouses to the customers are estimated by means of such a continuum approximation.

**Keywords:**

Logistics, Continuum approximation, Route planning.

MON 12<sup>th</sup> (11:15 - 12:30, Session B2.1) Room A1V

ID 2850 R

**FREIGHT DEMAND MICROSIMULATION IN THE U.S**

Main Author:

**Amir SAMIMI**

Co-author(s):

**Abolfazl MOHAMMADIAN** (*University of Illinois at Chicago*)

**Kazuya KAWAMURA**

**Abstract:**

Passenger transportation planning has been performed in the well-known four step framework for almost a half-century. The same approach has been employed by the researchers for freight movement modeling. However, the functionality of this approach is questioned for freight studies. The main reason for the misleading results is attributed to the absence of the crucial role of the firms, as the decision making agents. Similar to the passenger travel behavior studies, research on the freight movement modeling is becoming more behavioral, by incorporating the supply chain concepts in it. Drastic changes in the behavior of the decision makers in the freight transportation systems motivate the researchers to change the modeling approach and keep the reliability and efficiency of the freight transport systems. Firms' behavior in forming the supply chains is the missing component of almost all the current models. In this paper, a behavioral activity-based freight movement microsimulation has been introduced, and the data needs are elaborated. The proposed framework has five modules which are Firm Generation, Supply Chain Replication, Shipment Forecasting, Logistics Planning, and Network Analysis. The data needs are also discussed and the available datasets in the U.S. are explained. In order to gather needed information on the commodities shipping process, which otherwise would be unavailable, an affordable establishment survey is also included.

**Keywords:**

Fright Modeling, Supply Chain, Freight Data Needs, Freight Survey.

ID 3326 R

**A METHODOLOGY FOR REAL-TIME DATA FUSION, GEOREFERENTIATION AND ANALYSIS OF ROAD TRAFFIC DATA REPORTED BY MULTIPLE SOURCE**

Main Author:

**Ricardo PINTO** (ESRI Portugal)

Co-author(s):

**José SOUSA** (ESRI Portugal)**Gabriel PESTANA** (INOV)**Abstract:**

Traffic congestions are nowadays a major problem in most countries. Businesses that use roads as means of transport are specially affected by this growing problem. Specifically for freight carries, traffic congestions are considered as a "serious" to "critically serious" problem for their business. Indeed, a timely delivery of merchandize is central to the quality of services provided, and consequently, to a long-term success. However, to guaranty a timely delivery of merchandize is a difficult task. Route optimization is fundamental, as are short delivery windows. But any significant alteration to traffic conditions can contribute to delays of one or more deliveries, proving chosen routes as wrong, and leading to noncompliance of pre-established delivery windows. Therefore, having up-to-date information about the current state of traffic conditions contributes to an improvement of carrier businesses by means of real time adjustments to transport routes and delivery plans. One approach is to provide drivers with up-to-date information about localized traffic congestions, combined with alternative route suggestions. For this purpose, this paper presents a methodology for a real-time data fusion, georeferentiation and analysis of road traffic data reported by multiple sources. A geographic and ontological data clustering process is introduced, followed by traffic impact estimation and data accuracy analysis algorithms. This methodology is being tested on a web-based prototype for fleet drivers in Portugal, which integrates updated traffic information with remote map and routing services.

**Keywords:**

Accuracy Analysis, Alternative Route Suggestion, Data Clustering, Data Fusion, Georeferentiation, Impact Estimation, Real-time Traffic Management.

ID 1275 R

**ECONOMIES OF SCALE EFFECTS IN COMMODITY TRANSPORT MODELS: THE CASE OF MODAL COMPETITION IN HINTERLANDS**

Main Author:

**Gernot LIEDTKE** (Karlsruhe Institute of Technology (KIT) - Institute for Economic Policy Research (IWW))

Co-author(s):

**David GUILLERMO CARRILLO MURILLO** (Universität Karlsruhe (TH), Institut für Wirtschaftspolitik und Wirtschaftsforschung)**Tilman MATTEIS** (IWW, Karlsruhe Institute of Technology)**Abstract:**

This paper develops an approach for mapping economies of scale and supply- demand interactions within the hierarchical transport modelling framework. The competition between different modes for hinterland transportation is studied: Truck transportation is assumed to be a homogeneous service regardless of who will carry out the task, whereas intermodal transport is seen as consisting of slightly different services. The problem is formulated as a two stage choice problem using a nested-logit framework: The upper level deals with shippers' choices between truck and intermodal transport. Relating to intermodal transport, shippers choose between different terminals. The market for terminal services is mapped as monopolistic competition. The terminals are located in space according to the Free- Economic- Energy approach. Having reached an equilibrium in shippers' choices and terminal location patterns, exogenous parameters are adjusted to influence shippers' and terminal operators' choices. Two effects occur. Firstly, economies of scale caused by a higher workload of the remaining terminals are likely to be realised. Secondly, the distance to the next terminal increases for the majority of consumers. It is analysed which effect will prevail and to what extend the remaining terminals will be able to absorb the former customers whenever an intermodal service is ceased.

**Keywords:**

Economies of scale, Free economic energy, Freight transport, Dynamic demand supply interactions, Dynamic transport modelling, Meso logistics, Colloidal structures, Clusters, Discrete choice theory.

ID 1497 R

**ANALYSIS OF ACTIVITY BASED COSTING (ABC) IN OUTBOUND LOGISTICS COST OF MANUFACTURING COMPANIES IN A DEVELOPING ECONOMY**

Main Author:

**Olukayode OYESIKU** (*Tai Solarin University of Education, Office of the Vice Chancellor*)

Co-author(s):

**Bambo SOMUYIWA** (*CMILT, Ladoke Akintola University of Tech., Ogbomoso, Oyo State Nigeria*)**Abstract:**

The total cost of satisfying customer demand which is significant surprisingly not always fully understood by organizations. Attempts to reduce the cost of individual logistics activities in isolation often lead to greater total logistics costs. This could be attributed to the fact that traditional accounting systems that tend to focus around understanding product costs rather than customer costs. It is in this regard that at the level of the firm, attempts must be made to integrate outbound logistics system so as to holistically minimize total logistics costs within the context of Activity-Based Costing (ABC). The paper adopted a case study approach, utilising detailed and sectionalized questionnaires as data collection instrument from twenty manufacturing companies located in southwest of Nigeria based on multistage techniques. The questionnaire elicited primary data on components of outbound logistics that were related to cost for the period of 2002-2006 and were analysed using a software application that was packaged and designed for the study. The paper revealed that the cost model is highly trustworthy and the accuracy corresponds to the purpose with the cost model, which it can facilitate estimation of cost, rationalities and restructuring principles, benchmarking with competitors, pricing and appropriate supply of resources. The model allocates resources and costs down to each profit centre where available and then down to the cost per order on an annual basis. The findings further revealed that the most important consideration in any organization is how much insight a company has in its cost and that profit can be maximized and customers' requirements met, if the cost bill of manufacturing company is controlled. (...).

**Keywords:**

Outbound Logistics Cost, Developing Economy, Manuf.

ID 1808 R

**POTENTIAL FOR INTERNAL AND EXTERNAL COST REDUCTION BY INTERNALLY AND EXTERNALLY CO-LOADING OUTBOUND FLOWS**

Main Author:

**Tom VAN LIER** (*VUB MOSI-T (Free University of Brussels)*)

Co-author(s):

**An CARIS** (*Hasselt University - Transportation Research Institute*)**Huub VRENKEN** (*Vrenken Transport & Economics*)**Cathy MACHARIS** (*Vrije Universiteit Brussel (Free University of Brussels)*)**Abstract:**

This paper calculates the potential for reducing internal and external transport costs for a company with three neighboring distribution centers (DC's), each specialized in a specific product category and each using a separate planning system. Most of the outbound flows are currently still transported by truck, with only a marginal portion transported by rail and Short Sea Shipping. One way to achieve more sustainable logistics, besides implementing a further modal shift towards more sustainable transport modes, is through aiming for further, more systematic bundling of trucked outbound freight flows, both internally within the company and externally with other shippers. In this study, two options for increased coloaded are therefore analysed. First, internal co-loading within the company with the objective to increase the fill level of the trailers/containers under current planning restrictions is studied. To this purpose, a discrete event simulation is performed to evaluate a scenario where outbound product flows are brought together in a crossdock located on site next to the three DC's. Both internal and external transport cost savings of the resulting freight bundling potential are calculated. Secondly, the potential for external logistic cooperation with another shipper is analysed.

**Keywords:**

Sustainable logistics, Discrete event simulation, External costs.

ID 2161 R

**AN ANALYSIS OF ECONOMIC IMPACTS OF LOGISTICS ACCESSIBILITY ON MANUFACTURING PRODUCTION**

Main Author:

**Hidekazu ITO** (*Kwansei Gakuin University*)**Abstract:**

This paper constructs a manufacturing production function incorporating logistic accessibility to analyze costs of product logistics, which are expected to be more efficient in the future, and a theoretical model to estimate the elasticity of manufacturing output with respect to logistic accessibility. We examine the economic impact of inter-prefectural logistic accessibility on production activity based on the theoretical model and by using time series cross-sectional data for the case of Japan. The result shows that the production function has increasing returns to scale, which positively affects manufacturing production activity when logistic accessibility is taken into account. Also, the estimated elasticities show that the extent of impacts of cost improvements in the transportation of intermediate goods and of finished goods on production activity is confirmed to differ across manufacturing sectors. This enables us to distinguish between manufacturing sectors that are significantly impacted by cost improvements in the inbound transportation of intermediate goods and sectors that are highly impacted by cost improvements in the outbound transportation of finished goods. The empirical analysis supports transportation efficiency strategies and relocation strategies for factories and warehouses in manufacturing sectors from the viewpoint of trends in production base location for input goods as well as trends in market base location for output goods, as seen in the Weber location-production problem.

**Keywords:**

Logistic Accessibility, Inbound and outbound shipping costs, The Weber locationproduction problem, Japan.

ID 2350 R

**PUBLIC UTILITY FLEET MANAGEMENT: ACTIVITY BASED COSTING METHOD APPLICATION**

Main Author:

**Aleksandar MANOJLOVIC** (*University of Belgrade Faculty of Transport and Traffic Engineering*)

Co-author(s):

**Olivera MEDAR** (*Faculty of Transport and Traffic Engineering, University of Belgrade*)**Dragana DRENOVAC** (*University of Belgrade Faculty of Transport and Traffic Engineering*)**Snezana FILIPOVIC** (*University of Belgrade Faculty of Transport and Traffic Engineering*)**Abstract:**

Public companies' fleets are often composed of several hundreds of vehicles of different categories. Within the complex organization structure, the fleets are providing support for the company's core activities. The vehicles are used by company's departments for different purposes, i.e. such departments represent users of Fleet department's vehicles and services. The vehicles of the same categories used by different users significantly vary in matter of travelled distances, hours in operation and costs. Activities' costs give impression of the effectiveness of fleet resource usage and to what extent important activities contribute to the services' costs. Those information represent a key issue in the decision-making process on eventual restructuring of the Fleet Department or while outsourcing some of the activities.

**Keywords:**

Fleet management, Large vehicle fleet, Activity based costing, Cost efficiency.

ID 1764 R

**SHORT-MEDIUM TERM PARAMETER STABILITY IN A NATIONAL FREIGHT DEMAND MODEL: AN EMPIRICAL INVESTIGATION**

Main Author:

**Jose HOLGUIN-VERAS** (*Rensselaer Polytechnic Institute*)

Co-author(s):

**Ivan SARMIENTO** (*Universidad Nacional de Colombia*)**Ellen THORSON** (*The City College of New York*)**Carlos GONZALEZ** (*Rensselaer Polytechnic Institute*)**Ivan SANCHEZ** (*Rensselaer Polytechnic Institute*)**Abstract:**

This paper conducts an empirical investigation on the temporal stability of parameters of freight demand models in the short-medium term. The analyses are based on seven national freight origin-destination samples conducted by the Colombian government during the years 1999 to 2005. The paper studies the stability of the parameters of freight generation, freight distribution, and empty trip models. Typical formulations of these models were calibrated using the cross-sectional data corresponding to each year. Then, to identify time-dependent effects models were estimated using a panel formulation with fixed effects. The results indicate the presence of statistically significant time-dependent effects on all freight generation models (production and attraction), as well as on the freight distribution model estimated with loaded vehicle trips. In contrast, the parameters of the freight distribution models based on commodity flows and the ones for the empty trips were found to be stable overtime. The reason may be related to the fact that the commodity flows reflect production-consumption patterns that are much slower to change overtime than vehicle trips that are the result of short term logistic decisions on the part of the carriers. The stability of the parameters of empty trips is also related to the stability of production-consumption patterns. This is because the percentage of empty trips—which is related to the parameters of the models—is directly determined by the degree of asymmetry of the commodity flow matrix, as the more asymmetric the matrix is the larger the percentage of empty trips. Since the parameters of the empty trip models are related to the percentage of empty trips, a stable percentage of empty trips lead to stable parameters. (...).

**Keywords:**

Parameter stability, Freight demand models, Colomb.

ID 1205 R

**OPTIMIZATION MODEL OF TRUCK CARGO SPACE BASED ON THE CONCEPT OF SUSTAINABLE DEVELOPMENT**

Main Author:

**Marcin HAJDUL** (*Institute of Logistics and Warehousing*)

Co-author(s):

**Piotr CYPLIK** (*Poznan University of Technology*)**Lukasz HADAS** (*Poznan University of Technology*)**Abstract:**

Sustainable development assumes that it is possible to organize current needs in the way which is not eliminating possibility of organizing the same needs in the future. It is the ability to maintain balance of a certain process or state in any system. In business activities it is the ability to maintain balance between three areas: economical, ecological and social. What is more, in the age of rapid economic changes companies are forced to continuously search for ways of cost rationalization. For manufacturing and distribution companies reduction of logistics costs and in particular transport ones is most important. It must be remembered that transport processes in a company function within a big organism, i.e. the national or regional transport system. Thus, inefficiency of one element of a certain system can have a negative impact on the other one. Several methods (among others DRP, JIT, TQM, ECR, CPFR, TOC, Business Process Reengineering (BRP), Business process management (BMP), Trillium Model, Change management, Capability Maturity Model Integration (CMMI), Benchmarking, Six Sigma, Process Improvement and Management (PI&M), Rational Unified Process (RUP), Zachman Framework) were developed to support efficient organization of transport, warehousing and inventory management processes. The majority of methods, however, do not consider the correlation between mentioned logistics processes. Additionally, all methods recommend focusing on internal company processes, and strictly within a particular range (e.g. transport or warehousing). A short-term economic account and customer requirements are becoming a leitmotiv of any business activity. Nevertheless, there are no methods, algorithms or tools that solve the above described trade-off relations problem comprehensively. (...).

**Keywords:**

Transport processes, Co-modality, Efficient planning, Small &amp; medium enterprises, Distribution systems, E-platforms.



ID 1206 R

**TRANSPORT SYSTEM VIRUS ANALYSIS (TSVA) ?  
PROBLEMS IDENTIFICATION AND ANALYSIS MODEL  
IN DISTRIBUTION SYSTEMS**

Main Author:

**Marcin HAJDUL** (*Institute of Logistics and Warehousing*)

Co-author(s):

**Piotr CYPLIK** (*Poznan University of Technology*)**Lukasz HADAS** (*Poznan University of Technology*)**Abstract:**

Identification and analysis of problems occurring in complex distribution systems is a very crucial stage in the process of improving these systems. Effective distribution systems nowadays are a key to the success for this type of companies. On the basis of distribution system problem identification and analysis tools known from the subject literature (among others ASIS model, Ishikawa (fishbone) diagrams, impact wheels, current reality tree, risk assessment mapping tools (FMEA), cause and effect diagrams, Suzuki (ABCD), Multicriteria, SWOT), the Authors of this paper proposed their author's identification and analysis model of problems occurring in organization of transport processes within distribution systems. The proposed model is a specific hybrid of solutions known from the literature. This model has been developed and successfully used within the frames of a project aimed at improving the distribution system of one of the Polish big clothes distributor. Problem identification and analysis model of organization of transport processes in distribution companies developed within this project has been called Transport System Virus Analysis (TSVA) for the reason of results presentation specific character. In this paper basic assumptions and methodology of the model developed by the Authors have been included. Additionally, in the practical part the Authors present an example of TSVA model adoption for problem identification and analysis in the distribution system of one of the Polish companies.

**Keywords:**

Transport system, Co-modality, Efficient planning, Analyses, Distribution systems, Virus.

ID 1791 R

**OPTIMIZING HAZARDOUS MATERIALS LOGISTICS:  
TAKING VARIOUS PERSPECTIVES INTO ACCOUNT**

Main Author:

**Martin TRÉPANIÉ** (*École Polytechnique de Montréal*)

Co-author(s):

**Marie-Hélène LEROUX** (*École Polytechnique de Montréal*)**Nathalie DE MARCELLIS-WARIN** (*École Polytechnique de Montréal*)**Bruno DEBRAY** (*INERIS*)**Brigitte NEDELEC** (*INERIS*)**Abstract:**

In this paper, we explore authorities' and firms' conflicting views more in depth. We demonstrate how hazmat accidents can impact the public and why risk reduction measures must be taken. We present two methodologies that have been developed to optimize hazmat related choices throughout the logistic chain. While the first methodology is a multi-criteria decision analysis process heavily focusing on risk reduction (authorities' point of view), the second methodology is an operational research model adopting firms' point of view, with cost reduction as the main focus. Both methodologies allow logistics options to be ranked and with such different aims, ranking results tend to differ between the two approaches. Results can be used during negotiations between the two parties and we show how these two methodologies are interconnected.

**Keywords:**

Hazardous materials, Hazmats logistics freight t.

ID 2059 R\*

**SEPARABLE CROSS DECOMPOSITION FOR THE ALLOCATION-DISTRIBUTION PROBLEM IN THE IRP**

Main Author:

**Ricardo ACEVES-GARCÍA** (*Universidad Nacional Autónoma de México*)**Abstract:**

The Inventory-Routing Problem (IRP) involves a central warehouse, a fleet of trucks with finite capacity, a set of customers, and a known storage capacity. The objective is to determine when to service each customer, as well as what route each truck should take, with the least expense. IRP is a NP-hard problem this means that searching for solutions can take a very long time. A three-phase strategy is used to solve the problem. In the idealization of the strategy, the need to define algorithms that would solve more manageable problems in an easy and implementable way was every present. Thus in the second phase we uses Separable Cross Decomposition [1] to solve an Allocation-Distribution Problem, and a algorithm is obtained that produces a solution for two transport subproblems and their solution algorithms have a low order of complexity,  $O(n^3)$ . And the result is a very efficient algorithm for large cases of the IRP.

**Keywords:**

Cross Decomposition, Inventory, Routing.

ID 2846 R

**THE E-NEGOTIATION AS A TOOL FOR LOGISTICS OPTIMIZATION IN AN INDUSTRIAL DISTRICT**

Main Author:

**Annamaria TISO** (*Politecnico di Bari*)**Abstract:**

The aim of this work is to find an optimal solution to operational planning of freight transportation in an industrial district. More specifically, we propose an architecture that drives agents, that is firms in the industrial district, to negotiate in logistics field to minimize the total transportation and environmental costs. The idea is to achieve logistics optimization setting up a community made of district enterprises. We address the situation in which a centralized coordinator helps the agents to reach an agreement, while preserving a satisfactory level of system efficiency and fairness. The implemented algorithm uses the fuzzy aggregation criteria to improve the logistics system performance. The objectives are: maximizing customer's satisfaction, and minimizing the number of trucks needed. A fuzzy clustering algorithm (FCM) and a Fuzzy Inference System (FIS) are thus proposed to achieve these objectives. The proposed framework can be used to provide real time solutions to complex practical logistics and negative environmental impacts.

**Keywords:**

Industrial districts logistic, Inter-firms relationship, Fuzzy multi-agent systems, Negotiation.

MON 12<sup>th</sup> (17:00 - 18:15, Session B2.4) Room AIV

ID 1902 R

**PALLETFLOW - DEVELOPMENT OF AN INTELLIGENT AND INNOVATIVE INTERMODAL TRANSPORT SYSTEM BASED ON PALLETIZED- AND UNIT-LOAD CARGO IN EUROPE**

Main Author:

**Christian FLOTZINGER** (*University of Applied Sciences Upper Austria*)

Co-author(s):

**Friedrich STARKL** (*University of Applied Sciences Upper Austria*)

**Gerald ASCHAUER** (*University of Applied Sciences Upper Austria*)

**Abstract:**

Within the field of cargo transport multimodal transport in general and in particular the bimodal rail-road processes have so far contributed rather insignificantly to the reduction of road traffic volume. This is the result of limited capacities concerning terminals, the necessity of special reloading devices entailed by high investment costs and time losses handling the cargo, as well as wide-spread scepticism regarding adherence to delivery dates, traceability of consignments and flexibility of intermodal transport. The research project PalletFlow has the goal to develop and implement an intelligent and innovative rail-road transport system based on pallets and unit-load cargo in order to eliminate these problems. PalletFlow combines the carrier-specific advantages of rail (main leg) and truck transport (collection and distribution on the pre- and post-carriage) with the quick and economical reloading process by fork-lift trucks as well as the benefits of a neutral service centre and an innovative business model for the customer.

**Keywords:**

Modal shift, Competitive rail-road transport, Low-cost reloading, Market-driven multimodal solution.

MON 12<sup>th</sup> (17:00 - 18:15, Session B2.4) Room AIV

ID 2700 R

**LONG HAUL TRUCKS DYNAMIC ASSIGNMENT WITH PENALTIES AND TIME WINDOWS**

Main Author:

**Antonio LIMA FILHO** (*Escola Politécnica da Universidade de São Paulo*)

Co-author(s):

**Nicolau GUALDA** (*Escola Politécnica da Universidade de São Paulo*)

**Abstract:**

Long haul transportation system operational planning implies to solve a capacitated dynamic network optimization problem, aiming to perform the freight movements in an efficient and effective way, utilizing the available transportation capacity. This work employs an approximate adaptive dynamic programming to solve this kind of problem, introducing a network modeling to manage demands not attended, time windows and heterogeneous fleets. The adopted dynamic programming procedure involves solving each stage of the problem considering a concave estimate of the future stages value for each configuration of vehicles / locations. This approach greatly reduces the quantity of involved variables, allowing the utilization of more realistic mathematical models on a longer planning horizon. The method replaces advantageously real world empirical strategies and optimization techniques applied only to the next planning period. Results from a successful application of the model are presented.

**Keywords:**

Long haul truck transportation, Network flow optimization, Adaptive Dynamic Programming.

ID 2799 R

**SHIPPERS' MODE CHOICES AND LOGISTIC CONSTRAINTS**

Main Author:

**Cecilia CRUZ** (*University of Cergy-Pontoise, MRTE & Paris-Est University, INRETS, SPLOTT*)

Co-author(s):

**Michele GUILBAULT** (*Paris-Est University, INRETS, SPLOTT*)**Abstract:**

Modal approach is a recurring topic in literature. The supply approach is useful to understand technical specificities and economic characteristics of different modes and to emphasize competition and complementarities. Our approach is somewhat different. Our investigation is driven by the following postulate that the type of products to transport and the economic characteristics of a mode are not sufficient to explain mechanisms of modal choice. Indeed, they result from stakeholders' choice. Stakeholders opt for a mode according to transported good, but also according to economic constraints of production. Data from a national survey on freight transport ("ECHO Survey") carried out in 2004 among 3,000 French establishments are particularly geared to deal with the demand-supply interactions. Environmental concerns are becoming increasingly important in transportation practices. Thus what is the real potential of "sustainable" modes? Modal choice will be analysed from two points of view: the first one, differences in the hierarchy of criteria modal choice and the second one, the real possibilities of shift between modes and conditions. Indeed, we see that production constraints are not the same according to what mode of transportation is used. The integration of the production system is increased and transport takes part in it. This suggests that there is a concerted process to choose how transport shipments involve shippers and their different economic partners. It is shown that the forms of modal choice are an indication of the involvement of economic actors. The main lessons about modal practices of shippers are firstly, that the possibilities of shift are scarce and secondly, that these shifts are mainly internal to road. (...).

**Keywords:**

Freight, Mode choice, Transport demand, Production systems.

ID 3305 R\*

**AN EFFICIENT HEURISTIC METHOD FOR THE HUMP YARD MANAGEMENT PROBLEM**

Main Author:

**Djellab HOUSNI** (*SNCF I&R*)

Co-author(s):

**Cédric MOCQUILLON** (*EURODECISION*)**Abstract:**

In this paper, we describe the hump yard management problem. The characteristics and particularities of French hump yard problem are discussed. An efficient heuristic procedure is outlined that first constructs an initial solution according to the characteristics of the problem and then try to improve it by a guided neighborhood search. Computational results show that our approach is capable of getting realistic and good solutions for large scale real instances within few minutes.

**Keywords:**

Hump yard, Freight transport, Sequencing, Sorting, Optimization, Local search.

TUE 13<sup>th</sup> (08:15 - 09:30, Session B2.5) Room AIV

ID 1475 R

**EFFICIENCY AND PERFORMANCE IN THE BRITISH RAIL FREIGHT INDUSTRY BEFORE AND AFTER PRIVATISATION**

Main Author:

**Jonathan COWIE** (*SEBE/TRI, Edinburgh Napier University*)

**Abstract:**

This paper briefly outlines the main changes brought about by the Railways Act 1993 with regard to the rail freight sector and then examines development of the sector since that time. It finds that although rail freight levels have increased, these in the main have been as a result of changes that have occurred outside of the industry. It also finds little evidence of new operator entry into the rail freight business despite the removal of legal barriers to operation. The paper then gives an overview of the main medium and longer term effects of rail freight reform, principally through a literature review on US railroad deregulation, before examining productivity and scale effects within the British industry since privatisation. What it finds is that in the case of the former productivity has been rising from negative values at the start of the period reviewed, and economies of scale whilst significant should not be viewed as a major barrier to entry and hence do not account for the low level of entry that has occurred since privatisation. The over-riding conclusion is that policy needs to do more and be more innovative in incentivising the industry otherwise long term decline could very quickly set back in.

**Keywords:**

Rail freight, Productivity, Privatisation, US railroad deregulation.

TUE 13<sup>th</sup> (08:15 - 09:30, Session B2.5) Room AIV

ID 1438 R

**A COMPREHENSIVE ANALYSIS OF THE LOGISTICS SECTOR IN TURKEY TO IDENTIFY THE REQUIREMENTS FOR TECHNOLOGICAL IMPROVEMENT**

Main Author:

**Emel AKTAS** (*Istanbul Technical University, Industrial Engineering Dept.*)

Co-author(s):

**Fusun ULENGIN** (*Dogus University*)

**Sule ONSEL** (*Dogus University Industrial Engineering Department*)

**Berrin AGARAN** (*Dogus University*)

**Abstract:**

Supply Chain Management is a management philosophy developed after realizing the necessity of coordinating the firms in order to increase profitability and survive in the market under the circumstances of rough and rapidly increasing global competition. According to this philosophy, all the processes from raw material procurement to final product sales and all the players who take place in these processes are the links of a chain. The success of the supply chain depends on the success of the each member across the chain, however the success of individual participants itself does not mean a successful SCM application is achieved. Hence the paper aims at analyzing the basic actors of the logistics sector in Turkey; namely logistics service providers, logistics service customers, the equipment and hardware providers, and logistics information system providers to reveal the snapshot of each party and to point out the gaps regarding requirements of different sectors and offered services. A field study involving face-to-face interviews with all of the 428 companies operating in the logistics sector as customers, service providers, information systems providers or equipment A comprehensive analysis of the logistics sector in Turkey to identify the requirements for technological improvement ULENGIN, Fusun; AGARAN, Berrin; AKTAS, Emel; ONSEL, Sule; KABAK, Özgür 12th WCTR, July 11-15, 2010 – Lisbon, Portugal 2 providers was performed for the research. (...).

**Keywords:**

Logistics service providers, Logistics service customers, Logistics equipment and hardware providers, Logistics information systems providers, Turkey.

TUE 13<sup>th</sup> (08:15 - 09:30, Session B2.5) Room AIV

ID 1843 R

**CONCEPTS, MODELS AND METHODS FOR RAIL  
FREIGHT AND LOGISTICS PERFORMANCES: AN  
INCEPTION PAPER**

Main Author:

**Marin MARINOV**

Co-author(s):

**Thomas ZUNDER** (Newcastle University)

**Dewan ISLAM** (NCL)

**Abstract:**

The traditional railfreight service has changed. It is believed that logistics concepts will improve rail freight systems performances. New concepts are proposed, studies and projects are undertaken, and new systems for railfreight are developed. If railfreight is to break back into markets by employing logistics concepts, it has to rapidly adapt to changing political measures, economic trends and market conditions. It is therefore a field where reliable, efficient and updated models and tools are required to help railfreight operators improve their operational efficiency and rationalize their tactical planning decisions. The objective of this paper is therefore to present innovative railfreight and logistics concepts; to report on the existing literature for railfreight tactical management and hence to identify some of the main issues and obstacles in railfreight and logistics performances.

**Keywords:**

Rail Freight, Logistics, Models, Planning, Decision-Making, Performance Assessment.

TUE 13<sup>th</sup> (08:15 - 09:30, Session B2.5) Room AIV

ID 1911 R

**CONTRIBUTION TO THE EVALUATION OF THE  
FEASIBILITY OF COMBINED PASSENGER/GOODS  
URBAN TRANSPORT SOLUTIONS: SOME SCENARIOS  
BASED ON A MEDIUM –SIZE CITY'S CASE STUDY**

Main Author:

**Anna TRENTINI** (ENSMP - Ecole Nationale Supérieure  
des Mines de Paris)

**Abstract:**

Nowadays, in a sustainable urban development point of view, cities are looking for instruments and policies to ensure an efficient and effective urban mobility for both passengers and goods. Indeed, optimizing passengers and goods flow in the urban area while reducing the externalities linked to direct mobility's improvements, become more and more stressing. Although it is commonly argued that the transport of passengers and freight interact with each other strongly in the urban environment, it is quite difficult to design and manage an infrastructural network other than the road, which allows a smooth sharing of passengers and goods. Furthermore, there is lack of theoretical and experimental studies evaluating the possibility of introducing shared passenger-goods urban transport solutions. The aim of this paper is to explore this issue. Firstly, the existing shared solutions are identified, as a result of a survey of the experiences developed in cities. Secondly, a qualitative evaluation of the feasibility to adopt those solutions in a medium size city is carried out, according to the following criteria: the adaptability to different distribution schemes and the compatibility to different goods. A devoted section describes the experimental approach used to deduce the qualitative evaluation. Thirdly, with an inductive reasoning we move from a set of specific facts to establish a whole concept for city transport system, in order to ensure a smooth cohabitation of passengers and goods in urban transport. Finally, based on the adoption of some shared solutions in two different urban transport systems: that of La Rochelle and of London, the translation of the concept in real life is proposed. (...).

**Keywords:**

Sustainable urban mobility, Combined passenger/goo.

TUE 13<sup>th</sup> (08:15 - 09:30, Session B2.5) Room AIV

ID 2065 R

**STUDY OF TERRITORY ACCESSIBILITY TO DEFINE DISTRIBUTION OF COMPRESSED NATURAL GAS (CNG) IN CARGO VEHICLES. APPLICATION TO THE DEPARTMENT OF CALDAS (COLOMBIA)**

Main Author:

**Diego ESCOBAR GARCIA** (UNIVERSIDAD NACIONAL DE COLOMBIA SEDE MANIZALES)

Co-author(s):

**Francisco JAVIER GARCIA OROZCO** (UNIVERSIDAD NACIONAL DE COLOMBIA SEDE MANIZALES)

**Diana MARIA CARDENAS** (UNIVERSIDAD NACIONAL DE COLOMBIA SEDE MANIZALES)

**Abstract:**

The potential demand for natural gas determined in eight towns of the Department of Caldas (Colombia), raises a problem related with determining the optimal location for gas compression station which allows to carry this product in cargo vehicle. To this end was held a geographical and geostatistical study, oriented to define Integral Accessibility, based on distance, travel time, optimal path and transport costs. An assessment of the variables associated with the network was conducted, including road type, road condition, vulnerability to partial or total closure of the track and weighted consumption of natural gas. The results obtained for different routes were compared to obtain the average travel times and the average cost of distribution from different sources, the optimal location for the distribution center was define and the study is completed with considerations of inventory and scheduling travel routes which are including in the set of logistics decisions of this project.

**Keywords:**

Accessibility, Geographic information systems, CNG, Logistics, Transportation.

TUE 13<sup>th</sup> (09:45 - 11:00, Session B2.6) Room AIV

ID 1792 R

**INCORPORATING THE DRIVERS OF CHANGE IN LOGISTICS SERVICES INTO FREIGHT TRANSPORT MODELS**

Main Author:

**Lorant TAVASSZY** (TNO / Delft University of Technology)

Co-author(s):

**Kees RUIJGROK** (University of Tilburg)

**Igor DAVYDENKO** (TNO, TU Delft)

**Abstract:**

When observing the freight transport system we see that changes in production, trade, inventories and transportation are all driven by logistics principles. At the same time, our freight models are not yet ready to predict the effects of the major changes that will take place in logistics systems in the future. In this paper we review the recent freight modelling literature and develop a research agenda for freight models, which incorporates two dimensions of logistics performance: service quality and costs. We discuss the main determinants that shape logistics networks according to these two dimensions and discuss alternatives for modelling changes in freight transport demand, using spatial equilibrium models, explicit choice models and hypernetwork models. Each of these categories has its own stream of research studies, that has largely developed in separation from each other and use a variety of modelling methods and data sources. We evaluate these approaches with respect to their possibilities to describe the integrated logistics networks of the future. We conclude the paper with a discussion of possible paths in freight modeling research towards integrating these two lines of thinking.

**Keywords:**

Freight transport modeling, Logistics, Supply chain management, Spatial equilibrium modeling, Hypernetworks.

TUE 13<sup>th</sup> (09:45 - 11:00, Session B2.6) Room AIV

ID 1051 R

**THE STATE OF LOGISTICS IN SOUTH AFRICA:  
INFRASTRUCTURE AND THE ENVIRONMENT ?  
REVERSING THE DECLINE**

Main Author:

**Jan HAVENGA** (*Department of Logistics, University of Stellenbosch*)

Co-author(s):

**Zane SIMPSON** (*University of Stellenbosch*)  
**Joubert VAN EEDEN** (*Department of Logistics, University of Stellenbosch*)

**Abstract:**

The purpose of this research is to measure the cost of logistics in South Africa, determine the major cost drivers and assist both the country to manage those drivers and logisticians to manage logistics in this context. The measurement is on an industry and national level and can therefore relate logistics input with GDP as well as with industry-level turnover. The research use a quantitative approach, based on a gravity-orientated freight flow model, a road transport cost model (road transport costs are not available in South Africa), actual transport costs for other modes, a warehousing cost survey and an inventory delay calculation (to inform warehousing cost calculations and inventory financing costs) for the economy. Research pitfalls are highlighted and guidelines given for the application of the research approach in other economies. It is proved that logistics cost for South Africa can be measured in an extensive model and cost drivers are identified. The model is also backdated for six years to enable the analysis of trends. Understanding the drivers and trends enable the development of specific areas that can be considered by industry and managed by government on a macro-economic level. The results highlight the fallable structure of South Africa's freight transport industry with the majority of long distance transport provided by road. Some of the key challenges resulting from the status quo are the unsustainably high freight transport costs, ineffective transport infrastructure investment and planning, and the marginalisation of the developing portion of the South African economy.. (...).

**Keywords:**

Logistics costs, Transport costs, Sustainable transports, Externalities.

TUE 13<sup>th</sup> (09:45 - 11:00, Session B2.6) Room AIV

ID 2588 R

**ESTIMATION OF THE BENEFITS OF SHIPPERS FROM  
A MULTI-MODAL TRANSPORT NETWORK**

Main Author:

**Gernot LIEDTKE** (*Karlsruhe Institute of Technology (KIT) - Institute for Economic Policy Research (IWW)*)

Co-author(s):

**Hanno FRIEDRICH** (*Universität Karlsruhe (TH), IWW*)  
**Patrick JOCHEM** (*Universität Karlsruhe (TH)*)  
**Daniel KEULTJES** (*Universität Karlsruhe (TH), IWW*)  
**Stefan SCHRÖDER** (*Universität Karlsruhe (TH), IWW*)

**Abstract:**

This paper estimates the shippers' reactions and their economic benefits from a multimodal transport network called LOGOTAKT. For this purpose, an econometric shipper model is being estimated in which the major factor influencing logistics decisions – the balance between warehouse and storage cost – is explicitly taken into account. The functional form is being deduced from the first order condition of Total Logistics Cost function minimization. Transport cost is expressed in form of a complex function depending on order size and the transport distance in order capture the effect of economies of scale in transportation. It is estimated based on empirical data of distribution obtained from two major German companies. Simulations show that the new multimodal transportation system has a significant impact on shipment size distributions changing them in favor of smaller shipments. This leads especially to significant reductions in warehouse costs. Finally, some implications of the analytical results on transport policy are provided: To achieve further modal shift from road to rail, public financial support and the regulatory framework must put railways into the position to consolidate shipments and to exhaust economies of scale.

**Keywords:**

Freight transport logistics shipment size Warehouse Cost Economic Order Quantity Model mode choice.



TUE 13<sup>th</sup> (09:45 - 11:00, Session B2.6) Room AIV

ID 3065 R

**DEVELOPING A CONCEPTUAL FRAMEWORK OF INTERNATIONAL LOGISTICS CENTERS**

Main Author:

**Jun DU** (*Gothenburg University*)

Co-author(s):

**Rickard BERGQVIST** (*Logistics and Transport Research Group, Department of Business Administration, School of Business, Economics and Law, Gothenburg University*)

**Abstract:**

strategic management, management processes, macroprocesses, transit management agencies.

**Keywords:**

International Logistics Centre, Logistics Centre, International Transportation, Public-Private Collaboration.

TUE 13<sup>th</sup> (09:45 - 11:00, Session B2.6) Room AIV

ID 3165 R

**EFFICIENT AND GREEN LOGISTICS OF AUTOMOBILE PARTS IN URBAN AREAS**

Main Author:

**Toshinori NEMOTO** (*Hitotsubashi University*)

**Abstract:**

Recently, Japanese automobile manufacturers are trying to procure parts by the so-called Milk Run logistics at most of their foreign factories even if road traffic conditions in urban areas are not favorable to perform frequent deliveries. Through a survey of Japanese automobile manufacturers in Bangkok, Thailand, it was revealed that the Milk Run logistics is being operated to achieve frequent procurement of small-lot parts, and is synchronized with the manufacturing process to reduce inventories. By introducing the Milk Run logistics, automobile manufacturers can have full control of the procurement process, resulting in the reduction of the number of trucks dispatched and CO<sub>2</sub> emission as well.

**Keywords:**

Automobile manufacture, Thailand, parts procurement, just in time, Milk Run, Third party logistics, Consolidation, Real-time monitoring, Environmental impacts.

TUE 13<sup>th</sup> (11:15 - 12:30, Session B2.7) Room AIV

ID 2396 R

## **OVERVIEW OF MAJOR BRAZILIAN AIR CARGO TERMINALS**

Main Author:

**Anderson CORREIA** (*Instituto Tecnológico de Aeronautica*)

Co-author(s):

**João LUIZ FORTES** (*Instituto Tecnológico de Aeronautica*)

### **Abstract:**

This paper brings up an overview of the four largest Brazilian air cargo terminals: São Paulo, Campinas, Manaus, and Rio de Janeiro International Airport, which processes more than 60 % of air cargo operations in Brazil. The analysis is done through three aspects: (1) an analysis of their current cargo processing capacity, (2) the current and growing demand scenario, (3) and the possible improvement alternatives. The methodology used to estimate the cargo capacity was developed by INFRAERO (federal company that manages the 67 major Brazilian airports). Data has been collected in these four airports in order to apply this methodology, including: dimensions and layout of terminal components, degree of mechanization, duration of storage, mix and flow characteristics of cargo, and general procedures. Current cargo volumes were obtained in order to evaluate the utilization of these terminals. In addition to that, official demand forecasts have been collected in order to evaluate necessary investments, if necessary. Finally, several improvement alternatives were proposed to accommodate future cargo demand at these air cargo terminals. These alternatives range from changes in lay-out, processes and procedures, to investments in new terminal areas. The results indicate that significant capacity can be added to these terminals, with little money spending; in this case, current and short term demand might be accommodated in these terminals. For future demand, however, long-term new investments will be necessary, especially for São Paulo and Viracopos Airport.

### **Keywords:**

Air Cargo Terminal, Capacity, Demand Forecast.

TUE 13<sup>th</sup> (11:15 - 12:30, Session B2.7) Room AIV

ID 1062 R

## **TRAFFIC INFORMATION AND DYNAMIC VEHICLE ROUTING IN FORWARDING AGENCIES**

Main Author:

**Sascha WOHLGEMUTH** (*Technische Universität Dortmund, Fakultät Maschinenbau, Lehrstuhl für Verkehrssysteme und -logistik*)

### **Abstract:**

This paper considers a routing and scheduling problem of forwarding agencies handling less-than-truckload (LTL) freight. On the one hand, the performance of these companies is influenced by unknown customer orders, increasingly received shortly before the actual pickup. On the other hand, the transport times between two consecutive points in a route sometimes vary significantly. The objective is to avoid lateness of orders and increase equipment utilization. In the following we present an approach using a look ahead capability for travel times and anticipation of customer orders.

### **Keywords:**

Dynamic vehicle routing, Anticipation, Pickup and delivery, Forwarding agency, Less-than-truckload freight, Varying travel times, Unknown customers, Clustering, Tabu search.

TUE 13<sup>th</sup> (11:15 - 12:30, Session B2.7) Room AIV

ID 1170 R

**ISSUES ON ELOGISTICS APPLICATIONS AND PLATFORMS FOR SMES**

Main Author:

**Marin MARINOV**

Co-author(s):

**Thomas ZUNDER** (Newcastle University)

**Dewan ISLAM** (NCL)

**Abstract:**

A concise and precise definition of eLogistics is proposed in this paper, as follows: 'a set of activities based on using ICT systems and tools, as well as the Internet, as the main communication medium in order to maintain logistics processes'. The acceptance and applicability of the proposed definition in the transport and logistics field is explored through a comprehensive online survey. The knowledge and understanding of eLogistics among different stakeholders is also examined. The research explores in particular how small and medium enterprises view eLogistics. Throughout this research, we attempt to analyse the usage of eLogistics applications and hardware platforms, and identify the current trend and possibilities of eLogistics system. It is an interim paper and further research is ongoing which will explore the issues and questions raised.

**Keywords:**

ELogistics, Information and Communication Technologies, ICT, Logistics, Transport, Trends,

TUE 13<sup>th</sup> (11:15 - 12:30, Session B2.7) Room AIV

ID 2956 R\*

**ENABLERS OF ADVANCED TRANSPORTATION MANAGEMENT**

Main Author:

**Gunnar STEFANSSON** (Chalmers University of Technology)

**Abstract:**

The purpose of this paper is to determine and analyze the effects of Advanced Transportation Management (ATM) setups on transport operations and the consequential environmental impacts. To prepare the paper, a literature study was conducted, looking for relevant up to date literature within the fields. Based on the literature, a conceptual model was built that was then used for data collection. The data collection was carried out by interviewing representatives from companies and organizations that are considered experts in various aspects of advanced transportation management setups. The approach was to identify the impacts of different components of the conceptual model; Smart Freight, Smart Vehicle and Smart Infrastructure and see the potential benefits it will bring to transport operations. This approach was used to identify the main benefits and drawbacks of using the functionality of ATM setups, such as dynamic routing, automatic identification, dynamic traffic information, etc. The effects were then analyzed and the main impacts on transport operations and the environment recognized.

**Keywords:**

Logistics, Advanced transportation management, Smart goods, Smart vehicle, Information technology.

TUE 13<sup>th</sup> (11:15 - 12:30, Session B2.7) Room AIV

ID 3039 R\*

**DESIGN OF AN INTEGRATED PLATFORM AND LOGISTICS CENTERS FOR MAJOR TRANSPORT CORRIDORS OF NORTHEAST BRAZIL**

Main Author:

**Waldemiro NETO** (*Universidade Federal do Ceará*)

Co-author(s):

**Ricardo PESSOA** (*Universidade Federal do Ceará*)

**Dmontier ARAGÃO JÚNIOR** (*Universidade Federal do Ceará*)

**Nadja GLHEUCA DA SILVA DUTRA** (*Universidade Federal do Ceará*)

**Marcos ALBERTIN** (*Universidade Federal do Ceará*)

**Abstract:**

Studies conducted in 2009 by the Brazilian Institute of Geography and Statistics (IBGE) show that the Northeast region of Brazil has the largest volume growth of national agricultural production, all because of the large amount of land not yet cultivated, increasing productivity and climate favorable. However, consumption (whether internal or external) stumbles into the barriers of logistics infrastructure, with the predominance of the road, which, although responsible for transporting most of the products (about 60% taxes), has poorly maintained. Likewise, ports are presented with problems of capacity and services, railways with low density and, in some regions, the complete absence of infrastructure. These factors result in a loss of competitiveness of products in foreign markets and higher prices domestically. In 2007, in partnership with FINEP (Financier of Studies and Projects of the Ministry of Science and Technology), some federal universities in the Northeast of Brazil gathered in a study to develop an integrated platform and logistics centers to major transportation corridors. So longed to design and supply a base containing geospatial data and information from the main logistical infrastructure (with the capabilities of terminals and routes) and the production arrangements (AP) for agriculture in the region. This article aims to present a logistical tracking system developed for the APs (current) along with the demands of their auxiliary chains. This system will thus identify the best alternatives for each multimodal transport specific demand.. (...).

**Keywords:**

Goods transportation, Transport Multimodal, Agro business.

TUE 13<sup>th</sup> (14:00 - 15:15, Session B2.8) Room AIV

ID 1104 R

**INTERNATIONALISING EUROPEAN RAIL FREIGHT SERVICES**

Main Author:

**Yu BAI**

Co-author(s):

**Olav SOLEM** (*Norwegian University of Science and Technology*)

**Abstract:**

European consignors long for seamless end-to-end rail international services, which are unfortunately not a viable business choice yet along many international freight corridors. The present paper aims to develop a theoretical ground for why rail freight operators mostly confine their service provision to national boundaries and show little interest to actively expand their transport operations to neighbouring states. A case study is conducted to investigate in-depth two rail operators' international transport operating mode choices, as well as the rationality behind. Four measurements are extracted from the decision making process and are linked to variables of transaction cost theory and industrial network approach. An operating mode decision matrix, built from these measurements, explicates the decision-making process of the rail operators. The study argues that when integrated, the two theoretical approaches can explain the logic behind the operating mode decisions by rail freight operators.

**Keywords:**

Goods Transport, Transaction Cost, Network, Rail, Internationalise.

ID 1167 R

**INTEGRATED DISTRIBUTION SYSTEM OF STATE-OWNED COMPANIES**

Main Author:

**Nahry YUSUF** (University of Indonesia)

Co-author(s):

**Sutanto SOEHODHO** (University of Indonesia)**Abstract:**

The proposed model is aimed to optimize distribution system of Public Service Obligation State-Owned Company (PSO-SOC). The particular issue considered in the proposed model is related to the split of the demand into public (subsidized) demand and commercial one. Hence, the term ' multi-commodity ' in this model refers to types of product and types of users of the product as well. In the context of user satisfaction, both types of user are treated differently. Subsidized demands have to be fully satisfied, while the commercial ones are satisfied in case of excess plant capacity exists. The other issue is the integration of distribution sub-systems of the affiliated companies into one system. It is intended to maximize profit of the system, rather than that of each affiliated company as a sub system. In order to integrate the system, we propose the total capacity on main resource (raw material) of all plants as the upper limit of the production capacity of the system, and the amount of main resource which could be supplied by each plant as the upper limit of aggregate production capacity on each plant. Disaggregate capacity of each plant, that is the capacity with respect to the type of product, now is becoming a decision variable. Furthermore, the variables which are involved in our proposed model are production cost , transportation cost, warehouse cost, as well as negative revenue. The objective of the model is to minimize all such costs. Solution of the model is approached by network representation. Some dummy links and nodes are added to the physical distribution network to represent all the variables of the model. In order to guarantee the equivalency of total supply and total demand, we add either Excess Supply Control Sub Network or Excess Demand Control one into our basic network representation, depending on which condition exists at the beginning of the optimization process. (...).

**Keywords:**

Public Service Obligation State-Owned Company, Multi-commodity, Integrated distribution system.

ID 2178 R

**EFFICIENT INTERMODAL PRE AND POST HAULAGE**

Main Author:

**Rickard BERGQVIST** (Logistics and Transport Research Group, Department of Business Administration, School of Business, Economics and Law, Gothenburg University)

Co-author(s):

**Sönke BEHREND**S (Division of Logistics and Transportation, Chalmers University of Technology)

**Abstract:**

The demand for inland freight transport in Europe is mainly met by road transport leading to unsustainable impacts such as air pollution, greenhouse gas emissions and congestion. Since rail transport has lower externalities than road transport, a modal shift from road to rail is an accepted policy goal for achieving a more sustainable and competitive transport system. However, intermodal road-rail transport is mainly competitive for long distance transports and as a consequence the potential for modal shift is limited. The cost-efficiency of road-rail intermodal transport is particularly sensitive to pre and post haulage (PPH) costs since this activity typically has a larger cost mass compared to its share of the total distance of the transport chain. For intermodal transportation over shorter distances, e.g. below 300 km and where there is substantial PPH activities in both ends of the chain, the competitiveness of the intermodal transport system compared to direct road is low. Improving the efficiency of the PPH activities is therefore of outmost importance for the competitiveness of the intermodal transport system. This paper looks into the issue of improving the cost-efficiency of an intermodal transport chain by implementing an innovative and flexible legal framework regarding the PPH activities in the chain. By extending the legal framework with exceptions for longer vehicles in the pre and post haulage the cost efficiency can be greatly improved. The purpose of such a framework is to allow and enable for PPH of 2\*40 foot or even 2 semi-trailers using only one vehicle in the context of Swedish regulatory framework. Within the existing framework there are some degrees of freedom given that the cargo is divisible. (...).

**Keywords:**

Intermodal transport, Combined transport, Pre- and post haulage, Drayage, Modal shift.

TUE 13<sup>th</sup> (14:00 - 15:15, Session B2.8) Room AIV

ID 2186 R

## **HOW CAN INDIAN RAILWAYS SERVICE THE STEEL SECTOR BETTER?**

Main Author:

**G RAGHURAM** (*IIM Ahmedabad*)

Co-author(s):

**Rachna GANGWAR** (*Indian Institute of Management, Ahmedabad*)

### **Abstract:**

The focus of this paper is on how Indian Railways can service the steel sector better. The steel sector is a core sector, with railways playing a critical role in its logistics. The paper examines the changing industry structure and brings to light the increased need for transportation. Traditionally, crude and finished steel making was done in the same location by big producers having integrated plants. Now the industry has a large number of producers who primarily focus on crude steel making or finished steel making, necessitating the need for transporting crude steel to the finished steel makers. Even within finished steel making, there could be levels of value addition where the output of one finished steel maker could become the input for another. This has implications for the transporters including Indian Railways in formulating their strategies. Further, based on the growth projections of the steel sector and a possible increased share of rail transport, Indian Railways need to strategize for a six fold increase in traffic. This could be upto 1 billion tons of originating traffic by 2019-20. The paper examines the current issues in rail transport for the steel sector and proposes strategies under the dimensions of infrastructure, technology and systems. These include assessment of origin/destination flows of steel and raw material, thrust towards increased axle loading of wagons, improvement in wagon design, leveraging containerized movement of finished steel, use of advanced technologies in tracking wagon and rake movements, improved supply chain coordination with customers and suppliers, and utilizing empty spaces in steel carrying wagons.

### **Keywords:**

Indian Railways, Steel Industry, Rail Transport, Logistics.

TUE 13<sup>th</sup> (14:00 - 15:15, Session B2.8) Room AIV

ID 2555 R

## **LOGISTICS AND VALUE-ADDED SERVICES PROVIDED BY MARITIME COMPANIES**

Main Author:

**Jasmine SIU LEE LAM** (*Nanyang Technological University*)

### **Abstract:**

The increasing need for shipping companies to offer logistics and value-added services is driven by factors such as globalisation and growing demand from customers. The study firstly aims to analyse shippers' requirements on logistics and value-added services, then the various practices and status of such services offered by the world's top thirty shipping lines and their affiliated logistics service providers. The nature and extensiveness of logistics services offered will be discussed. The study also aims to examine shippers' expectation on the service attributes of logistics solutions and compare these service attributes to maritime companies' understanding of these expectations. Data and information from both primary and secondary sources are examined and used to draw empirical evidence. While the major maritime companies are in line with shippers' requirements in terms of the type of logistics functions offered, perceptual differences between shippers and shipping firms exist with regards to logistics service attributes. When maritime firms review their directions and strategies of their logistics and value-added services, they may take into consideration the competencies involved, competition from rival shipping firms and third-party logistics providers, as well as other external factors. Useful insights and recommendations can be drawn for maritime firms, shippers, logistics service providers and other relevant parties.

### **Keywords:**

Logistics services, Value-added services, Shipping lines, Maritime, Service attributes.

ID 1262 R

**THE IMPACT OF ROAD CHARGES ON EFFICIENCY, MODAL SPLIT AND CLIMATE BALANCE OF LONGER AND HEAVYER TRUCKS**

Main Author:

**Claus DOLL** (*Fraunhofer-Institute for Systems and Innovation Research (ISI)*)

Co-author(s):

**Enrico PASTORI** (*Trasporti e Territorio (TRT)*)**Davide FIORELLO** (*Trasporti e Territorio (TRT)*)**Abstract:**

In May 2008 the Community of European Railways and Infrastructure Companies (CER) commissioned a study on the long-term impacts of extra long and extra heavy vehicles (LHVs) on climate gas emissions. The study has contributed to the ongoing debate at European and Member State level on relaxing current weight and size limits and the entailed impacts on modal split particularly in combined road-rail transport<sup>1</sup>, on safety and on the environment including global warming. In this paper we review the results of current studies and field test experiences. We describe in detail the approach and the key findings of the CER study, saying that in the medium run modal split effects will counter-balance the higher environmental efficiency of LHVs and that there is a considerable risk that this negative climate balance persists in the long run. We further supplement the extend of the assessment by running two additional scenarios on alternative road pricing schemes. These were defined by the additional investments required on the Trans-European Road Network to safely accommodate LHVs and by the external costs of road haulage. We find that pricing measures are well suitable for preventing form negative side effects of increasing truck weight and size limits.

**Keywords:**

Intermodal freight transport, Modal split, Efficiency, Climate change.

ID 2584 R

**SUBCONTRACTING RELATIONSHIPS IN FRENCH ROAD HAULAGE : THE SHARE OF PARTNERSHIP**

Main Author:

**Olivier GAVAUD** (*Cete de l'Ouest*)**Abstract:**

Today road haulage is France's most important transport mode, proving its ability to meet shippers' demands. Road haulage has several success factors, some of which are technical (for example, the speed and density of the motorway and road network). Others are economic (the low price or road transport). Last but not least, relationships among road hauliers play a major role in competitiveness. Among other factors, the opportunity that large companies have to subcontract with very small ones, with very low fixed costs and great flexibility, is often quoted as a major advantage. The ECHO survey, conducted in France in 2004, provides information on 10 000 shipments made by 3000 shippers. For each shipment, the survey gives details about the shipper, the shipment itself, and each company providing transport or logistics services for that shipment. The survey allows us to analyze subcontracting, by showing us each stage at which a shipment is contracted to the next carrier. This analysis reveals the frequency of subcontracting in France, and gives us the opportunity to study why subcontracts are made. Of course, some of the subcontracts are mainly cost driven. However, others aim at using the specialized skills of a particular haulier (a frequent service to a given destination, for example). Finally, the aim of some subcontracts is to increase transport chain efficiency. The usual transport segments are studied : single parcel delivery service, parcel delivery service, less than truck load, full truck load. The share of shipments and the number of tonnes which fall under the purview of subcontracting are studied. For each transport segment, subcontracting is described in terms of size of companies involved, services provided, and the reason for subcontracting. (...).

**Keywords:**

Road haulage, Subcontracting, Partnership.

ID 1319 R

**CHALLENGES IN INTERMODAL LOGISTICS NETWORKS AND TERMINALS - A NORWEGIAN VIEWPOINT**

Main Author:

**Øivind STOKLAND** (*SINTEF Technology and Society*)

Co-author(s):

**Astrid BJØRGEN SUND** (*SINTEF Technology and Society*)**Torbjørn NETLAND** (*SINTEF Technology and Society*)**Abstract:**

Based on case studies in Norwegian transport industry, this paper identifies challenges for intermodal logistics networks and terminals. In order to make intermodal transportation a success, the transport chain must have seamless interconnectivity between the transportation modes. Today's intermodality in Norway is far from seamless. By reducing transaction costs at the transfer points, the terminals can ensure seamless interconnectivity and improve efficiency in the transportation chain. Findings from the case studies identified the following main challenges: (1) Improving cooperation between the actors in the intermodal logistics network, (2) Improving communication of train and freight information to customers regarding arrival, loading/unloading window and deviations from plan, (3) Improving IT-system interconnectivity and information sharing in general, (4) Improving the efficiency of terminal operations in general, (5) Developing cooperative depot management, and finally (6) Automation of manual check points in the material flow.

**Keywords:**

Intermodal freight transport, Logistics networks, Terminals, Challenges.

ID 1734 R

**EFFICIENCY OF INTERMODAL PORT HINTERLAND FLOWS: A CASE STUDY OF UK RAIL OPERATIONS**

Main Author:

**Allan WOODBURN** (*University of Westminster*)**Abstract:**

Port hinterland links are increasingly seen as the principal bottleneck in global seabased supply chains, with their costs often outweighing the maritime costs for long distance flows despite the land-based leg(s) generally being over a relatively short distance. The significant long-term growth in global trade prior to the global economic downturn in 2008 has put substantial pressure on land-based transport infrastructure. Greater attention is now being focused on the efficiency and cost of hinterland operations, both to enhance supply chain performance and reduce the environmental and societal impacts of freight movements. As the first part of the paper demonstrates, the UK intermodal rail freight market has been growing strongly. Greater use of rail is generally seen as beneficial, but there is little reliable, disaggregated data in the UK or other countries to allow a thorough assessment of rail's current performance to be undertaken. In an attempt to allow an evidencebased analysis of this market, a representative survey of more than 550 container trains serving the four key deep-sea ports was conducted by the author in 2007. The survey collected a large volume of original information relating to train capacity and load factors at a disaggregated level. This paper presents the findings from an analysis of capacity provision and reveals considerable differences in the utilisation of intermodal train services. It then concludes with an assessment of the potential supply chain and wider environmental and societal benefits that could result from improvements in the efficiency of intermodal rail freight, together with discussion of the achievability of such improvements. The empirical data analysed in this paper provide a stronger basis for supply chain decision making and public policy formulation to make port hinterland flows more efficient and sustainable through a combination of 'soft' (e. (...).

**Keywords:**

Intermodal Freight Transport, Rail Freight Efficiency, Containerisation, Freight Transport Policy.



MON 12<sup>th</sup> (11:15 - 12:30, Session B3.1) Room 0.07

ID 1966 R

**INTERMODAL TRANSPORT IN BELGIUM: WHAT WITH THE PORT OF ZEEBRUGGE?**

Main Author:

**Ethem PEKIN** (*Vrije Universiteit Brussel*)

Co-author(s):

**Ellen VAN HOECK** (*Vrije Universiteit Brussel*)

**Cathy MACHARIS** (*Vrije Universiteit Brussel (Free University of Brussels)*)

**Abstract:**

This paper describes a geographic information system-based location analysis model, developed to analyse the characteristics of the Belgian intermodal terminal landscape. The model, which originally takes the port of Antwerp into account, is extended to include the port of Zeebrugge. Based on the transportation costs, the model compares intermodal transport with unimodal road transport. After visualising the current intermodal terminal landscape, the model handles various scenarios. Highlighting the market areas of intermodal terminals, the model is used as a policy support tool to come to an integrated vision on the future development of intermodal transport in Belgium.

**Keywords:**

Intermodal policies, Intermodal terminals, GIS model.

MON 12<sup>th</sup> (11:15 - 12:30, Session B3.1) Room 0.07

ID 2848 R

**THE POSSIBILITIES OF INTERMODAL TRANSPORT IN PRACTICE: A CASE STUDY FOR COLRUYT**

Main Author:

**Tom VAN LIER** (*VUB MOSI-T (Free University of Brussels)*)

Co-author(s):

**Ethem PEKIN** (*Vrije Universiteit Brussel*)

**Cathy MACHARIS** (*Vrije Universiteit Brussel (Free University of Brussels)*)

**Abstract:**

This paper analyses the question whether it is strategically interesting for a company to choose for intermodal transport. A feasibility study has been carried out for the company 'Colruyt' to give an answer to this question. The transportation cost of different flows of goods, from the Port of Antwerp to the distribution centers of Colruyt, has been calculated, by road and by intermodal transport. This feasibility study has been complemented with an analysis done with the LAMBIT-model (Location Analysis Model for Belgian Intermodal Terminals) to determine the location of the optimal intermodal terminal for the different distribution centra (Halle and Ghislenghien). Finally a calculation of the external costs has been carried out to compare the external costs of transport by road and those of intermodal transport. This analysis shows the external costs Colruyt could avoid when choosing for intermodal transport instead of road only.

**Keywords:**

Intermodal transport, LAMBIT, External costs.

ID 3264 R

**FACTORS OF COMPETITIVENESS OF PASSENGER AIRLINES IN THE CARGO MARKET**

Main Author:

**Vasco REIS** (*Instituto Superior Técnico*)

Co-author(s):

**Rosário MACÁRIO** (*IST*)**Abstract:**

The emergence of adverse factors, such as: volatility of oil prices, economic recession or imposition of new safety and security measures, have thrown the air transport sector into turmoil in both passenger and freight markets. The negative environment is leading airlines looking for alternative sources of revenues, passenger airlines are no exception and the air cargo market may provide a non-negligible alternative. In average, this market accounts for fifteen percent of passenger airlines. Furthermore, many international routes are only profitable due to the cargo business. However, this market has evolved towards a highly competitive configuration, with passenger airlines revealing considerable difficulties in competing head to head with other players. Based on the current patterns of demands for freight transport service, the authors defend that intermodality may prove being an adequate strategy for passenger airlines fostering their competitiveness in the air cargo market. The authors then identify two factors that could improve the performance of intermodal transport services and, thus, support passenger airlines' competitiveness. These factors result from an analysis to the source of performance of intermodal transport services. One of the factors is the fitness of the transport service. The fitness has five basic dimensions, being: physical, logical, liable, financial and relational. Three dimensions have already been fairly achieved by the air transport sector; yet, two – the physical fitness and the relational fitness – are still to be accomplished. Therefore, these two dimensions materialise the potential factor of competitiveness of passenger airlines. (...).

**Keywords:**

air transport, Cargo, Fitness, Agent based.

ID 2424 R

**LONGER COMBINATION VEHICLES - SOLUTION TO SUSTAINABLE PRE AND POST HAULAGE IN SWEDEN?**

Main Author:

**Violeta ROSO** (*Chalmers University of Technology*)

Co-author(s):

**Kenth LUMSDEN** (*Chalmers University of Technology*)**Magnus KJELL** (*Chalmers University of Technology*)**Karl WESTERLUND** (*Chalmers University of Technology*)**Abstract:**

Reduced energy consumption, optimization of the usage of the main strength of different modes, reduction of congestion on road networks, and low environmental impacts are considered as the main advantages of intermodal (road-rail) transport. However, there are disadvantages such as unease of monitoring due to complexity of the transport chain or high cost for pre-and post haulage. Recently sustainability has received increasing attention and with it also the role that logistics concepts can play in making transport more sustainable. One of these concepts is a concept of Longer Combination Vehicles, i.e. vehicles of up to 35 m in length, which might be good solution for pre and post haulage. This concept has potential to improve performance of intermodal transport in Sweden; however the same is not allowed by the regulations. Purpose of this paper is to investigate how to improve intermodal freight transports with use of long vehicles; from environmental and economic perspective. This study should support the recent discussions on whether the traffic regulations regarding the length of the vehicles should be investigated. Data for the study are collected through interviews, field observations and internal documents. The results indicate that the use of Longer Combination Vehicles would decrease the number of trips per route and therefore lower the environmental effect on the route. However, to achieve transport cost savings the utilization rate should be high.

**Keywords:**

Intermodal freight transport, Longer combination vehicles, Environment, Fuel consumption, Sweden.

ID 2543 R

**INTERMODAL DECISION MAKING IN BRAZIL**

Main Author:

**Brunno GONÇALVES** (*Universidade Federal do Rio de Janeiro*)

Co-author(s):

**Márcio D'AGOSTO** (*Federal University of Rio de Janeiro*)**Abstract:**

This article presents a stated preference experiment developed to model logistics decision making on a strategic planning level to select road or intermodal alternatives for general cargo transport in Brazil. It starts from the premise that this kind of decision making involves a tradeoff among logistics cost, service level attributes and a subjective attribute related to the "Brazilian road transport culture", in other words, the natural tendency of cargo owners to use truck transportation. From the modal split model calibrated, it was possible to formulate a utility function that when incorporated into a multinomial logit model showed a good representation of Brazilian transport of general cargo, 87% of which is carried by road and 13% by intermodal transport. The sensitivity analysis of the attributes of the utility function calibrated showed the relative importance of the logistics cost, service level and modal tendency attributes, verifying their possible impacts on the relative uses of road and intermodal transport. The results showed that logistics cost is the main attribute considered when making a strategic choice among different alternatives for hauling general cargo in Brazil, so that an intermodal alternative costing 20% less than the pure truck alternative can capture 100% of demand.

**Keywords:**

Intermodality, Intermodal decision making, Stated preference experiment, General cargo in Brazil.

ID 2565 R

**NEW PERSPECTIVES ON SUSTAINABLE URBAN FREIGHT DISTRIBUTION: A POTENTIAL ZERO EMISSION CONCEPT USING ELECTRIC VEHICLES ON TRAMS**

Main Author:

**Niklas ARVIDSSON** (*Gothenburg University*)**Abstract:**

This paper aims to analyse the potential use of trams and Electric distribution vehicles (EDVs) as cargo carriers in intermodal urban freight distribution. Transporting goods in urban areas, where most logistics chains start or end, is an activity that increasingly generates severe problems for all stakeholders, for instance, local authorities, the logistic industry, customers, as well as the society in general. New transport solutions are necessary in order to decrease traffic congestion, noise and traffic pollution, e.g., emissions of greenhouse gases and other pollutants in urban areas. Furthermore, distribution activities are not only the foundation of our society, but the cause of environmental and social problems as well. A possible solution to these problems is to transform the current freight distribution system within cities, for example by favouring the enhancement of intermodal transport alternatives, i.e. combining road and rail transport. Information has been collected through a literature review and interviews in Amsterdam and from these results a conceptual model is presented, as well as a potential zero emission scenario using electric vehicles on trams in Gothenburg.

**Keywords:**

Light rail, Tram, Electric distribution vehicles, EDV, Transport efficiency, Sustainability, Urban freight distribution, Intermodal city freight distribution, Urban rail freight transport.

ID 2747 R

**SCENARIOS OF THE NORTHWEST TRANSPORT CORRIDOR FOR THE BRAZILIAN CENTRE WEST AGRICULTURAL HARVEST DISTRIBUTION**

Main Author:

**Elton FERNANDES** (COPPE/UFRJ)

Co-author(s):

**Cesar NEVES** (COPPE/UFRJ)**Marcia BRAGA** (COPPE/UFRJ)**Eliane BRITO** (COPPE/UFRJ)**Marcela RUBERT** (COPPE/UFRJ)**Vinicia CARDOZO** (COPPE/UFRJ)**Abstract:**

This paper discusses the distribution chain of the centre west agricultural harvest. It analyses the possible transport savings in the centre west agricultural harvest distribution throughout fluvial and ocean ports located in the Brazilian North Region. Therefore it considers ongoing transport infrastructure projects of the so called Northwest Transport Corridor. Actually the region exports its production throughout almost all the Brazilian main ports. The methodology consists of the analysis of existing and projected routes for the distribution of the agricultural harvest, as well as the analysis and design of Actual Scenarios (2008) and the, 2015, 2020, 2025 and 2030 Scenarios. The five scenarios were analyzed under two perspectives: the first without interventions and the second with infrastructure interventions in the Corridor. The transport system service level variables investigated were: transport costs, transport flow and emission of CO<sub>2</sub>. The discussions show possible transport impacts, identify distribution routes, such as the Teles Pires-Tapajós waterway, and the Vilhena/Uruaçu railway, as well as the most viable options for cost savings, and some minor environment impacts.

**Keywords:**

Logistics, Transportation and agricultural harvest.

ID 2804 R

**INTERMODAL ROAD-RAIL TRANSPORT IN SWEDEN- ON THE PATH TO SUSTAINABILITY**

Main Author:

**Rickard BERGQVIST** (Logistics and Transport Research Group, Department of Business Administration, School of Business, Economics and Law, Gothenburg University)

Co-author(s):

**Jonas FLODEN** (School of Business, Economics and Law at University of Gothenburg)**Abstract:**

Intermodal road-rail freight transport has long been seen as playing a key role in reducing CO<sub>2</sub> emissions from freight transport. The reduction of CO<sub>2</sub> emission is of great importance to reduce the greenhouse effect and create a sustainable society. However, the full potential of intermodal transport for CO<sub>2</sub> reduction remains to be determined. At first glance, the intermodal transport market has showed modest growth compared to other modes of transport, such as direct road. However, there are segments of the intermodal market, in particular in the road-rail segment that has shown significant growth during the last decade. This article looks at the potential for intermodal road-rail transport and describes the remarkable journey that has taken place in the hinterland road-rail segment, especially in Scandinavia. Furthermore, it includes a brief examination of how current trends affect the role and development of intermodal road-rail transport. Stakeholders currently face new challenges as a result of the current financial crisis and global recession, however, this article identifies a significant long-term potential for modal shift related to the competitiveness of the road-rail intermodal transport segment. This article also outlines the trends that are likely to realise the identified potential for modal shift and the road-rail intermodal market in Scandinavia. Based on previous research, a study has been conducted in Sweden on the potential reduction of CO<sub>2</sub> from intermodal transport. The potential of intermodal freight transport has been determined, the associated CO<sub>2</sub> reduction estimated and the potential effect of future trends in the industry has been examined.. (...).

**Keywords:**

Intermodal transport, Modeling, Sustainability, Combined transport, Dryports, Terminals, Terminal handling.

MON 12<sup>th</sup> (15:30 - 16:45, Session B3.3) Room 0.07

ID 1212 R

**A SYSTEM OF MODELS FOR THE ANALYSIS OF THE FREIGHT CORRIDOR BETWEEN ITALY AND CHINA: PARAMETRIC VS. NON PARAMETRIC TRADE GRAVITY MODELS**

Main Author:

**Vittorio MARZANO** (*Università di Napoli Federico II - Dipartimento di ingegneria dei trasporti*)

Co-author(s):

**Fulvio SIMONELLI** (*University of Naples "Federico II" - Depart.of Transp.Engineering "L.Tocchetti"*)

**Mariano GALLO** (*Dipartimento di Ingegneria - Università del Sannio*)

**Abstract:**

This paper proposes a system of models for analyzing the freight container corridor between Italy and China and, from a broader standpoint, the appraisal of the potential impacts of new trade patterns between the two Countries on the economy of Italian regions. The system of model is made up by a gravity model, for estimation of trade exchanges in quantity between Italy and China, and by a port choice model for the identification of the logistic and transport patterns of import/export flows between Italy and China, with specific reference to the entry/exit ports. The paper deals in detail with the first model stage, i.e. the trade gravity model. In more detail, the kernel of the research focuses specifically on different types of estimated gravity models, following both panel-data parametric and non parametric regression approaches: the outcomes of the two different approaches are presented and contrasted, providing for interesting results both from the theoretical and the practical standpoints. Then, a brief review of the port choice model is finally reported.

**Keywords:**

Italy - China freight flows, Gravity model, Kernel regressions, Regression trees.

MON 12<sup>th</sup> (15:30 - 16:45, Session B3.3) Room 0.07

ID 1919 R

**MODELLING CORRIDOR NETWORKS IN INTERMODAL BARGE TRANSPORT**

Main Author:

**An CARIS** (*Hasselt University - Transportation Research Institute*)

Co-author(s):

**Cathy MACHARIS** (*Vrije Universiteit Brussel (Free University of Brussels)*)

**Gerrit JANSSENS** (*Hasselt University - Transportation Research Institute*)

**Abstract:**

In this paper the design of the service network in intermodal barge transport is studied. The network of inland barge terminals is modeled to demonstrate potential cooperations in a corridor network. Cooperation between inland terminals leads to bundling of freight flows in the hinterland of major ports. A service network design methodology for intermodal barge transport is developed and applied to the hinterland network of the port of Antwerp in Belgium. Selected cooperation schemes are simulated by means of a discrete event simulation model for intermodal barge transport and compared with simulation results of bundling in the port area. Cooperation between inland terminals offers an opportunity to attain economies of scale, but may not be perceived as a sole solution for reducing waiting times of inland barges at sea terminals. A combination of bundling measures in the port area and in the hinterland may be necessary to improve the intermodal transport chain.

**Keywords:**

Inland navigation, Corridor network, Hinterland, Service network design, Simulation.

ID 2712 R

**IMPROVING RAIL FREIGHT MODELLING IN SWEDEN**

Main Author:

**Inge VIERTH** (VTI)

Co-author(s):

**Gerhard TROCHE** (Royal Institute of Technology  
Stockholm (KTH))**Nicklas LORD** (VTI)**Abstract:**

Transport models are used as decision-support tool by a wide range of actors. One important field is infrastructure investments and policy where decisions are often both long-term and connected with high capital expenditures. At the same time current national freight transport models show shortcomings. It is especially difficult to use the models on geographically disaggregated level. Problems are first and foremost related to the modelling of rail freight, due to the specific characteristics and complexity of its production system. The Swedish Road Transport Research Institute (VTI) together with the Railway Group of the Royal Institute of Technology Stockholm (KTH) have therefore started a project with the aim to improve the modelling of rail freight (benefitting even the modelling of intermodal transport, where rail is involved). The three-year project RAILTRAM (Improvement of Rail Transport Modelling) is carried out at the Centre for Transportation Studies (CTS) Stockholm. The overall research question behind the project is: How can the modelling of rail freight be improved by combining the Swedish national logistics model LOGMOD and the disaggregated rail freight cost model EVARAIL? LOGMOD is based on an aggregatedisaggregate- aggregate approach, it is a module within the new national Swedish national transport model system and covers all modes of transport. The paper breaks down this overall research question into a number of sub-questions and presents an outline for a modelling approach, addressing specific areas of improvement. The solutions presented may be useful for improvement of other freight transport models as well.

**Keywords:**

Transport model, Logistics model, Rail freight, Intermodal, Transport policy decision support-tool.

ID 2808 R

**MODELLING A STRATEGIC TRANSPORT INTERCITY FREIGHT NETWORK INCLUDING EXTERNAL COSTS. A REAL APPLICATION**

Main Author:

**Victor CANTILLO** (Universidad del Norte)

Co-author(s):

**Luis MARQUEZ DIAZ** (Universidad Pedagógica y  
Tecnológica de Colombia)**Abstract:**

A relevant issue for freight transport system interregional strategic modelling is to include external costs as part of a policy that supports the mechanisms for managing and pricing to achieve the social optimum. A freight transport model including external cost was developed and applied to the Colombian intercity intermodal strategic network. The model considers equilibrium between the phases of distribution and traffic assignment, in both national and interregional levels. Each link of the network includes internal costs: time and operation, and external costs: congestion, accidents, air pollution and CO<sub>2</sub> emissions. For the calculation of marginal costs on the freight transport network two approaches were used. First, it is assumed that an additional unit of demand does not affect the equilibrium of the transport network, and then the marginal cost is estimated as the sum of marginal costs on the links of the shortest path. The second approach assumes that an additional unit of demand changes the network equilibrium and, consequently, the marginal costs are estimated by calculating the difference between the two equilibrium scenarios. Both approaches were applied on seven selected routes covering the most important freight transport corridors in Colombia. We found that the methods produce the same results. Average external costs were rated equal to 0.014 US\$/ton-km for highways, 0.000105 US\$/ton-km for water transport and 0.0016 US\$/ton-km for rails. In highways external costs are equivalent to 37% of internal costs, in railways 12% and in inland waterways they represent only 1%.

**Keywords:**

Freight Transport Modelling, External Costs.

MON 12<sup>th</sup> (15:30 - 16:45, Session B3.3) Room 0.07

ID 3186 R

## ON MODELLING MOTORWAYS OF THE SEA

Main Author:

**Nicola SACCO** (*DIMSET - University of Genoa*)

Co-author(s):

**Angela DI FEBBRARO** (*DIMSET - University of Genoa*)

**Simone RUBINO** (*DIMSET - University of Genoa*)

**Davide ROSSI** (*DIMSET - University of Genoa*)

### Abstract:

By now, the continuous increase in freight transport demand has clearly put into evidence that road networks can not constitute the unique way to manage freight transportation. In this framework, an alternative to road transportation, indicated, after the European Union definition, as Motorways of the Sea (MoS), has to be investigated in order to understand its potential performance from the point of view of economic costs, travelling times, environmental impact, and so on. Then, the aim of this paper is to design a MoS network model, essentially consisting of a graph, able to take into account both ground and maritime links among a set of seaports, and to identify the cost functions characterising the links, as well the non-additive costs characterising the paths, so as to state and solve a shortest path problem on such a complete network. Finally, a case study relevant to the Mediterranean Sea is presented.

### Keywords:

Ground Transportation Networks, Motorways of the Sea, Shortest Path Problem, Non-additive Costs.

MON 12<sup>th</sup> (17:00 - 18:15, Session B3.4) Room 0.07

ID 2200 R

## CONTAINER TRAIN OPERATORS IN INDIA: PROBLEMS AND PROSPECTS

Main Author:

**G RAGHURAM** (*IIM Ahmedabad*)

Co-author(s):

**Rachna GANGWAR** (*Indian Institute of Management, Ahmedabad*)

### Abstract:

In India, railways is under the control of the government which is the sole provider of the infrastructure, operations and regulatory functions. Private participation, though very limited, was largely in the domain of infrastructure creation. In January 2006, in a landmark initiative to introduce competition in the container operations segment, the Ministry of Railways allowed the entry of private and public sector operators to obtain licences for running container trains on the Indian Railways (IR) network. Until then, the Container Corporation of India, a subsidiary of IR, was the monopoly operator of container trains in India. This initiative was the first significant move of its kind where private parties were allowed to make entry in the domain of railway operations with direct customer interfacing. The response to the policy was good and 15 new entrants obtained licences to run container trains. Due to lack of clarity or inconsistency in matters pertaining to haulage charges, maintenance of wagons, transit guarantees from IR and terminal access charges, operators started feeling skeptical about the viability of the business. This paper examines the current policy environment from the point of view of business viability for Container Train Operators and brings out issues related to licensing, pricing, terminals, maintenance, and service levels.

### Keywords:

Indian Railways, Container Train Operators, CONCOR, Policy Issues.

MON 12<sup>th</sup> (17:00 - 18:15, Session B3.4) Room 0.07

ID 2855 R

### **MODAL CHOICE IN EUROPE ? A LITERATURE REVIEW FROM THE TRANSPORT CUSTOMER'S PERSPECTIVE**

Main Author:

**Jonas FLODEN** (*School of Business, Economics and Law at University of Gothenburg*)

Co-author(s):

**Fredrik BÄRTHEL** (*School of Business, Economics and Law at University of Gothenburg*)

**Edith SORKINA** (*University of Gothenburg, School of Business, Economics and Law*)

#### **Abstract:**

The choice of transport service is a key issue in understanding the transport market and designing a competitive transport system. The customers' choice of transport service is based on a number of factors that are considered and weighted against each other. For a transport service provider, e.g. a forwarder or a haulier, it is of key importance to understand which factors are important to the customer. Several studies have investigated the determining factors for the choice of a transport service. A review of the studies has been made in this research in order to compare and synthesize the previous findings on transport service choices. The review focuses on studies published in the English and Scandinavian languages after the year 1990. It includes studies on European conditions where the actual opinion of the transport customer has been studied through interviews and surveys, and does not include modelling approaches or analyses based on statistical data of the transport service choice. It is a fact that the knowledge about the transport service choice lies with the person making the decision. Although, studying the attitude of these people is often more challenging than other approaches, it is our opinion that these studies come closest to revealing the reasons for the transport service choice. The review includes a short overview of the studies and the methods used. (...)

#### **Keywords:**

Transport service choice, Modal choice, Europe, Sweden, Literature review, Mode selection.

MON 12<sup>th</sup> (17:00 - 18:15, Session B3.4) Room 0.07

ID 2858 R

### **THE EFFECT OF FAST TRANSHIPMENT TECHNOLOGY ON THE POTENTIAL FOR INTERMODAL FREIGHT TRANSPORT**

Main Author:

**Sönke BEHREND**S (*Division of Logistics and Transportation, Chalmers University of Technology*)

Co-author(s):

**Jonas FLODEN** (*School of Business, Economics and Law at University of Gothenburg*)

#### **Abstract:**

Traditionally, intermodal transport has a medium to high market share for large flows over long distances while the short and medium distances (less than 500km) mainly remain a domain of the road transport sector. In order to allow intermodal transport to compete in the medium distance and high quality market segment, alternative network operations that allow for an intensification of rail services and expansion of geographical coverage are needed. Intermodal liner trains that operate in corridor network designs with intermediate stops between start and end terminals are regularly advocated by intermodal transport researchers as a means to compete with all-road transport on small volumes and short distance markets. Innovative transshipment technologies facilitating fast and efficient transshipments are a necessity for intermodal liner trains since the conventional terminals are not appropriate for intermediate terminals where freight volumes are low and train dwelling times need to be short. The purpose of this paper is to analyse the transshipment unit cost's effect on the modal shift potential of intermodal liner trains based on fast and efficient transshipments. In a theoretical case study the cost and potential modal share for an intermodal liner train on a corridor in Sweden is analysed. The method is based on modelling a competitive situation between traditional road transport and intermodal road-rail transport. The results confirm that in theory intermodal liner trains can provide competitive services on short and medium transport distances in case transshipment costs are kept low. Fast and efficient transshipment technologies can open business opportunities for operators and cost savings potential for shippers in a market segment which is dominated by road transport. (...)

#### **Keywords:**

Intermodal transport, Modal shift, Modelling, Rail transport, Transshipment technology.



ID 3204 R

**MODELLING THE BUNDLING OF INTERMODAL RAIL FLOWS FROM/TO SEAPORTS**

Main Author:

**Ekki KREUTZBERGER** (*Research Institute OTB, Delft University of Technology*)

Co-author(s):

**Rob KONINGS** (*Research Institute OTB, Delft University of Technology*)**Cees WITTEVEEN** (*Research Institute OTB, Delft University of Technology*)**Abstract:**

In 2008 the OTB Research Institute of the Delft University of Technology carried out the design of rail bundling concepts for the port of Rotterdam. The central background was the concern of the port authority how to manage future magnitudes of rail transport on restricted number of tracks, in particular after the opening of Maasvlakte 2. Starting from an O/D-matrix the question was whether to bundle flows in line, hub-and-spoke, or different feeder models, also distinguishing between alternative location types (e.g. with so-called corridor-neutral or corridor-specific hubs) and physical alternatives, like rail-rail exchange by means of container transshipment or wagon (group) shunting. For all bundling solutions, namely bundling concepts imbedded in bundling scenario's, we analysed the performances, for instance number of full-trainload or partial trains, capacity effects or costs per load unit. On the basis of a multi-criteria analysis we could identify and distinguish promising bundling solutions from less promising ones. Colleague researchers from the Erasmus University used the results to, in a second step, design innovative steering and management concepts for future rail port operations. This paper gives an outline of the policy and the service network design challenge in practice, in this framework explains the relevance of large trainloads and appropriate bundling of flows, and then describes the steps to be taken to model the bundling and identify "best" bundling solutions. Such identification will be based on direct, generalised or social costs, and be the result of optimisation, heuristic or enumerative procedures. (...).

**Keywords:**

Intermodal, Rail, Freight, Bundling, Network design, Hub-and-spoke, Seaports.

ID 3205 R

**INTERMODAL RAIL FREIGHT TWIN HUB NETWORK ANTWERP/ROTTERDAM (IRTHNAR). THE SETUP OF A NEW EUROPEAN RESEARCH PROJECT**

Main Author:

**Ekki KREUTZBERGER** (*Research Institute OTB, Delft University of Technology*)**Abstract:**

Most intermodal flows are too small to be transported in direct trains. This is – maybe surprisingly – even the case for the flows from and to large nodes like Rotterdam and Antwerp. Consequently, they need to be bundled "complexly", as in hub-and-spoke, line or feeder networks. The complex bundling provides economies of bundling, scale and scope, cumulating in large trainloads, high frequencies and a high network connectivity, also for small(er) flows. The Twin-hub concept extends this idea to international bundling: Rotterdam organises flows also from Belgium, Antwerp also from the Netherlands. Acknowledging the feature of port competition, a promising configuration is to let Antwerp flows travel in Rotterdam trains to regions, where Rotterdam is (potentially) well represented; and Rotterdam flows in Antwerp trains to regions where Antwerp (potentially) has a strong position. This and a few major infrastructural requirements, such as the building of a hub terminal Rotterdam, is the subject of the project. The paper describes the policy and research challenges, and the actions of the project, and first results. The paper begins with the presentation of a "bundling theory". This covers multiple angles of bundling, one of the core issues of the transport sector, and provides in the understanding of relevant operational, performance and policy interactions. The bundling theory has played an important role when developing the Twin-hub concept.

**Keywords:**

Intermodal, Rail, Freight, Bundling, Network design, Hub-and-spoke.

TUE 13<sup>th</sup> (08:15 - 09:30, Session B3.5) Room 0.07

ID 1877 R

### **INTERMODAL COST FUNCTION:A PRACTICAL TOOL APPLIED TO EUROPE FREIGHT CORRIDORS**

Main Author:

**Monica GROSSO** (*University of Antwerp*)

#### **Abstract:**

Intermodal transport is becoming more and more relevant in the European transport agenda, being considered a valuable option to road transport. The benefits that intermodal transport can provide are related both to environmental impacts and to cost aspects. On a European level the policy measures that have been taken and are currently developed focus on the implementation and support of this mode of transport while from the business point of view intermodal transport is not yet considered very appealing. The purpose of this paper is to provide an analysis of the total intermodal cost function, taking into account the internal cost elements. When considering an intermodal journey several cost items need to be taken into account: the transport cost itself, the transshipment cost, the managerial costs related to the entire door-to-door service. In the present paper a European intermodal corridor will be analysed. The focus will be on the intermodal corridor starting from the Port of Antwerp, in Belgium and ending in Basel, in Switzerland. The study aims at analysing the structure of a traffic corridor starting from this port and ending in one region/area in the centre of Europe. A methodology has been developed which is based on four steps. First a review of the literature about intermodal cost functions has been considered and used as a framework for the elaboration of the intermodal cost function presented. As a second step an analysis of traffic flows for a specific destination from the aforementioned port has been carried out. Subsequently the calculation of internal costs has been developed through the use of a calculation tool specifically improved for the paper purpose. (...).

#### **Keywords:**

Intermodal transport, Intermodal cost function, Traffic flows, Practical tool.

TUE 13<sup>th</sup> (08:15 - 09:30, Session B3.5) Room 0.07

ID 1979 R

### **SUCCESS FACTORS FOR DEVELOPING VIABLE MOTORWAYS OF THE SEA PROJECTS IN EUROPE**

Main Author:

**Deepak BAINDUR** (*Instituto Superior Técnico*)

Co-author(s):

**José MANUEL VIEGAS** (*Centro de Sistemas Urbanos e Regionais (CESUR), Instituto Superior Técnico (IST)*)

#### **Abstract:**

Establishing a European wide high quality shipping links and integrating them with the trans- European Transport networks has been the vision of the European Commission (EC) to reduce land transport congestion under the Motorways of the Sea (MoS) concept. However, in spite of strong political backing and favourable policy initiatives, MoS projects have met with limited success. Establishing Motorways of the Sea is complex because of its International scope and involvement of a number of public and private stakeholders with conflicting objectives and goals. The paper attempts to identify critical factors for establishing viable MoS projects. The paper reviews the development of the MoS concept to understand the expectations of the EC and the concerns of the important stakeholders. The present status of these policy actions is reviewed and their possible effect on the performance of MoS projects is estimated. Case studies of Short Sea Shipping initiatives in different parts of Europe and the world are reviewed to learn from their successes and failures. This knowledge is applied to find critical factors for the success of MoS projects in the European context.

#### **Keywords:**

Short Sea Shipping, Freight Transport Policy, Motorways of the Sea concept,

ID 2242 R

**SPATIAL LOCATION OF INLAND TERMINALS: AN EXTENDED FREE ECONOMIC ENERGY APPROACH**

Main Author:

**David GUILLERMO CARRILLO MURILLO** (*Universität Karlsruhe (TH), Institut für Wirtschaftspolitik und Wirtschaftsforschung*)

Co-author(s):

**Gernot LIEDTKE** (*Karlsruhe Institute of Technology (KIT) - Institute for Economic Policy Research (IWW)*)**Abstract:**

Freight transport systems are generally characterised by economies of scale and thus, generating multiple market equilibria. In order to map the dynamic interactions on customers' and producers sides, the Free Economic Energy (FEE) model has been developed. It conciliates the concepts of distribution (entropy), market forms (monopolistic competition) and costs to map network effects. In this paper the FEE model is extended to geographical analysis of freight transport. The expansion focuses on the location patterns of logistics nodes such as hinterland terminals. This approach is presented in this paper progressively, starting with the enlargement to one dimension and following with the accession to two dimensions. In both dimensions, two possible market forms are combined, namely, monopolistic competition and cost minimisation as borderline situations for the producers and customers. The model explains the distance between terminals, the equilibrium number of remaining terminals and the equilibrium size of terminals. All achieved solutions are expressed in function of fixed and variable cost and a heterogeneity parameter. The Spatial FEE extension has been validated with data on the German inland terminals. Using regional data, the heterogeneity parameter determining the transport customers' choices and the characteristics of the market equilibria has been estimated. An application case identifies those regions with lacking or oversupply of intermodal facilities and services as well as the market situation that the region is facing. Based on the empirical study, conclusions are given concerning the calibration process, the model extensions and further model applications.

**Keywords:**

Free economic energy, Meso-structures, Dynamic states, Product diversity, Freight transport, Hinterland, Port, Economic choices, Cluster formation, Entropy, Monopolistic competition.

ID 2980 R

**THE INFLUENCE OF TRAFFIC ON WATERWAYS APPS FOR ECONOMIC AND SOCIAL DEVELOPMENT OF WESTERN AMAZON**

Main Author:

**Nelson KUWAHARA** (*Federal University of Amazonas - UFAM*)

Co-author(s):

**Andressa OLIVEIRA MARQUES** (*UFAM*)**Rita DUARTE****Márcia HELENA VELEDA MOITA** (*UFAM*)**Abstract:**

The transport system is essential for the promotion of economic development of a country. Ballou says that the best transport systems contribute to increased market competition, ensuring economies of scale in production and reduce prices of goods. The transport system of a country is planned according with their geographical characteristics. In the case of Brazil, because it is a continental country and rich in waterways, provides developing regions with vast natural resources available, but still failed to achieve desired levels of growth, due their planning process does not include equally all regions. In this context, the water transport is highlighted by presenting its various economic and social advantages, to have low cost and less polluting. In the Amazon region, which has the largest watershed of the country and of the world, this modality is not structured properly, because are many obstacles that hinder their development such as inadequate ports, lack of security on ships, poor supervision by the responsible agencies, among others. Such difficulties can be observed in the flow of production is mainly done by boat, production systems and settlements, known as Local Production - APLs, the states of the Western Amazonia, for example, the APLs of the farming town of Tabatinga in the state of Amazonas, beekeeping in the city of Sing in Roraima, wood and furniture in the city of Ariquemes in Rondonia, due process have difficulty in shifting loads, because the shift is deficient. (...).

**Keywords:**

Water Transport, Local Production Arrangements, Western Amazon.

TUE 13<sup>th</sup> (08:15 - 09:30, Session B3.5) Room 0.07

ID 3268 R

**A STUDY OF MANUFACTURED GOODS TRADE AND TRANSPORTATION TRENDS FOR ASIA**

Main Author:

**Manouchehr VAZIRI** (*Sharif University of Technology*)

Co-author(s):

**Elahe KHADEMI** (*Sharif University of Technology*)

**Abstract:**

Transportation plays an important role in production, trade and consumption of goods. Freight facilitation enhances international trade. In this study, trend of manufactured goods trade distribution among major Asian countries was analyzed using relevant national socio-economic, geographical and transportation characteristics. The objective of the study was to determine possible relations between international manufactured goods trade and transportation trends within Asia continent. The relevant time-series data were extracted from centralized and international databases. The manufactured goods trade information, using the UN classification of SITC, covered the period 1965-2005. The national geographical and socio-economic characteristics included gross domestic product, population, area and landlocked variables. For transportation characteristics, the study focused on three regional transportation networks covering and connecting the selected countries. The first network consisted of highway, rail and sea modes, HRS network. The second network consisted of highway, rail, sea and air modes, the multimodal network, MM network. The last network was a hypothetical network that only allowed freight to be transported by air, taking into account the shortest air distance between any two transportation nodes, AR network. Trading centre of each country was assumed to be its capital. After collecting the pertinent data and creating the database for the study time span, gravity and linear programming models were developed. The models facilitated identifying possible relations between trade and transportation. (...).

**Keywords:**

Freight transport modeling, regional trade modeling, gravity modeling, linear programming, Elasticity and sensitivity analyses.

TUE 13<sup>th</sup> (09:45 - 11:00, Session B3.6) Room 0.07

ID 1537 R

**A MULTIMODAL NETWORK DESIGN PROBLEM FOR DOMESTIC CONTAINER TRANSPORTATION WITH SHORT SEA SHIPPING**

Main Author:

**K. I. WONG** (*National Chiao Tung University*)

Co-author(s):

**Paul T.-W. LEE** (*Department of Logistics and Shipping Management, Kainan University*)

**W. Y. SZETO** (*Department of Civil Engineering, University of Hong Kong, Hong Kong*)

**W. Y. SZETO** (*Department of Civil Engineering, University of Hong Kong, Hong Kong*)

**Abstract:**

With the growing importance of logistic in a green and environmental friendly way, it is widely accepted that short sea shipping (SSS) is a mean to divert the freight traffic from congested corridor in local communities as well as to reduce environmental costs. It can also relieve the problem of traffic congestion and investment on road construction and maintenance. This paper considers a multimodal transportation model for domestic container cargos, in which the flow of container cargos moving between foreign seaports and domestic cities can be transported via domestic seaports using SSS and inland by truck. We propose a two-level strategy in evaluating the various government policies to encourage or regulate the usage of SSS. While the objective of the freight carriers is to minimize its transportation cost, the government could internalize the external cost and invest on the transportation network with considering the cost to the society. A case study with the Taiwan network is performed to illustrate the benefit and performance of the model.

**Keywords:**

Container Cargo, Intermodal Transportation, Short Sea Shipping, Trucking.

TUE 13<sup>th</sup> (09:45 - 11:00, Session B3.6) Room 0.07

ID 2015 R

**A STUDY ON THE DEMAND FEASIBILITY OF MOBILE HARBOR**

Main Author:

**Park NAM KYU** (*Me*)

Co-author(s):

**Sang CHEOL SUH** (*Caleb*)

**Abstract:**

The purpose of the paper is to suggest the possibility of modal shift by developing mobile harbour (MH) with container crane on board for container transport. As technical specification of MH, it has 8~15 knots speed, 250TEU laden capacity, 5 meters draft, 50 meters LOA, 26 meters breadth, 30 moves handling rate capacity per hour. With the specification, the strong point of MH is to reduce port time of mother ship by implementing cross docking handling system alongside mother ship or feeder ship. Furthermore, due to the crane on board, the berthing place will be expanded, i.e. MH is able to approach general cargo handling berth without dedicated quay crane. Other benefit of MH is to replace container road haulage with SSS(short sea shipping). Despite of MH's slow speed compared to road truck, it has a little advantage of distance within short range.

**Keywords:**

Mobile Harbour, Economic Analysis, Modal Shift.

TUE 13<sup>th</sup> (09:45 - 11:00, Session B3.6) Room 0.07

ID 2272 R

**OPTIMIZATION AND SIMULATION OF OPERATING STRATEGIES FOR CONTAINER TERMINALS**

Main Author:

**Jan KAFFKA** (*Lehrstuhl VSL / TU Dortmund*)

**Abstract:**

TU Dortmund University developed a simulation suite for the Container Terminal Dortmund GmbH seated in the largest inland port in Europe located in Dortmund. This suite focuses on modelling processes, resources and strategies for container terminals and enables to optimize a terminal with simulation. The aim is to optimize the terminal by determining the best mix of operating strategies for crane control, stacking area, handling area and resource management. To achieve this, the current situation of the terminal and different future scenarios for operating the terminal were modelled with the simulation suite.

**Keywords:**

Logistics, Intermodal freight transport, Simulation, Optimization, Container terminal, Crane control, Operating strategy, Inland port.

TUE 13<sup>th</sup> (09:45 - 11:00, Session B3.6) Room 0.07

ID 2953 R

**DEVISING A MULTIMODAL TRANSPORTATION NETWORK FOR THE AMAZON REGION UNDER A REGIONAL ECONOMIC GROWTH APPROACH**

Main Author:

**Cristiano ALMEIDA** (*Federal University of Paraiba*)

Co-author(s):

**Yaeko YAMASHITA** (*Center for Personnel Training in Transportation - Ceftru/ University of Brasilia*)

**Abstract:**

The relationship between transport and economic development has been studied for years. In Brazil, especially in the Amazon Region, such matter began in the 70s with the creation of several economic development plans and projects. However, due to many factors, such as the incompatibility between the proposed models of transport planning and territorial planning, the expected results were not achieved. In that perspective, this paper aims at designing a multimodal cargo transportation network that enables goods to be efficiently carried in a region. This network was developed using the available natural resources and it stimulates regional economic growth and development based on the Growth Pole and Development Pole Theory, and Graph Theory, which are widely used in network transportation studies. Consequently, three networks, related to three different scenarios – status quo, investment in transportation infrastructure, and the strategic scenario – have been devised and analyzed considering the operating costs of transportation and their spatial configuration.

**Keywords:**

Transportation network, Economic development, Growth pole theory, Graph theory.

TUE 13<sup>th</sup> (09:45 - 11:00, Session B3.6) Room 0.07

ID 3364 R

**AN INVESTIGATION OF DIRECT AND INDIRECT DEMAND FOR TRANSPORT AND LOGISTIC SERVICES IN TRANSITION COUNTRIES: METHODOLOGICAL AND EMPIRICAL ISSUES. THE CASE OF ALBANIA**

Main Author:

**Angela BERGANTINO** (*Università degli Studi di Bari - Dipartimento di Scienze Economiche e Metodi Matematici*)

**Abstract:**

This paper investigates the factors influencing firms' choice with relation to both alternative transport services and outsourcing logistic service to third parties and the value of freight transport service attributes for operators localised in a transition country. We use two original datasets. One collected from a sample of Albanian manufacturing companies, the second created by collecting data through an adaptive stated preference experiment from a sample of specialised logistics operator localised in Albania. Both represent unique database for a geographical context which is jet largely unknown. Models set up are based on Random Utility Theory. The data on manufacturing companies is analysed using a simple Logit framework to obtain insights in firms' behaviour in relation to the organisation of transport services and their preferences towards third party logistics. The second set of data is analysed using a Mixed Logit model to capture heterogeneity of tastes among operators. We estimate individual preferences and trade-off values for the key choice variables: cost, time, frequency and reliability. The empirical results suggest that for Albanian operators frequency and savings in voyage time are the most relevant factors in choosing among alternative services. The valuation of the attributes, however, varies significantly among operators, supporting the use of Mixed Logit approach. We find also that operators have no a priory reluctance towards new services which imply a modal shift.

**Keywords:**

Transition countries, Stated preferences, Mixed lo.

ID 1022 R

**BARRIERS AND OPPORTUNITIES FOR NIGHT TIME DELIVERIES IN URBAN CONTEXT : A FRENCH CASE STUDY**

Main Author:

**Delaitre LOIC** (*Ecole des Mines de Paris*)

Co-author(s):

**Mangaretto REYNAL** (*Franprix Leaderprice*)**Abstract:**

In supply chain management, the last miles are pointed out because they represent one of the most critical part of the whole chain regarding costs, times, quality of service and overall performances. City logistic is different from general logistics because of unique characteristics and constraints which creates a complex system. The resulting problems, such as emissions of pollutants, greenhouse gasses, noise and congestion, are the consequences of the interaction of each actor. Within this framework, local authorities, with their role of project catalyst, begin to integrate urban freight transport in the global urban mobility strategy. To optimize the development of urban traffic, it is necessary to integrate all various ways of freight transportation. The objectives generally identified are: - To reduce congestion and increase mobility; - To reduce pollution and noise levels to contribute towards reaching the Kyoto targets, and improve the life conditions of the city inhabitants; - To favor the development of city centre activities. From a stakeholder point of view, one way to improve the global system of transport in city is to deliver the goods during the night to avoid the lost of time due to congestion and more precisely during the peak hours. Few experiments in this field have been conducted and night time deliveries seem to be efficient but still require a change in the organization at warehouse, retailers and carriers levels. These changes have supplementary costs which have to be evaluated in order to check the profitability of night time deliveries not only from a stakeholder point of view, but also from local authorities point of view. In this paper, we propose an overview and an analysis of the main projects of night time deliveries in Europe and in the United States. (...).

**Keywords:**

City logistics, Night deliveries, Urban freight movements, Mass marketing.

ID 1242 R

**RELEVANT ATTRIBUTES IN OVERNIGHT GOODS DELIVERY: RESEARCHERS', TRANSPORTERS' AND RETAILERS' PREFERENCE IN URBAN DISTRIBUTION**

Main Author:

**Leise OLIVEIRA** (*Federal University of Minas Gerais*)

Co-author(s):

**Aneliza DE SOUZA BRAGA** (*Federal University of Minas Gerais*)**Bárbara RIBEIRO ALVES ABREU** (*Federal University of Minas Gerais*)**Abstract:**

This paper introduces an exploratory research to identify the attributes required to accomplish the overnight goods delivery in urban areas from the point of view of researchers, transporters and retailers. The identification of preferences is important to assess the impacts of the policies provided for the overnight delivery that are being deployed in most urban centers. The urban goods distribution represents ¼ of the total traffic in the city and a reality that every society must learn to live with this problem, because without it there would be no economic activity. Policies such as just-in-time, delivery points and overnight distribution being practiced by different sectors of industry and commerce as a strategy to ensure growth and competitive advantage of their products. An urban logistics policy is one way to reduce the impacts of urban distribution, which seeks to reduce the diseconomies of the logistic process within a city. However developing policies for urban logistics requires breaking paradigms and behavior change among those involved in urban distribution, seeking innovative solutions that improve the supply chain. This paper brings to the discussion of urban distribution, assessing the behavior of those involved in overnight distribution process. The analysis was performed using a stated preference technique, that working issues such as delivery time, extra costs and improving service level. Results showed the divergent views among researchers, transporters and retailers about the strategies that should be implemented to reduce the impacts of growing demand for urban goods distribution. Furthermore, the results guide future works done by researchers and urban planners. (...).

**Keywords:**

Overnight Delivery, Stated Preference.

MON 12<sup>th</sup> (11:15 - 12:30, Session B4.1) Room 1.02

ID 2535 R

**NIGHT-TIME DELIVERY AS A POTENTIAL OPTION IN BELGIAN URBAN DISTRIBUTION: A STAKEHOLDER APPROACH**

Main Author:

**Sara VERLINDE** (*Ghent University*)

Co-author(s):

**Wanda DEBAUCHE** (*Belgian Road Research Centre*)

**Annelies HEEMERYCK** (*Vrije Universiteit Brussel*)

**Cathy MACHARIS** (*Vrije Universiteit Brussel (Free University of Brussels)*)

**Ellen VAN HOECK** (*Vrije Universiteit Brussel*)

**Frank WITLOX** (*Ghent University*)

**Abstract:**

This paper investigates the public support for night-time delivery in Belgian cities. Encouraging, or even imposing night-time deliveries are possible measures for governments in order that urban traffic does not get jammed completely and that goods still can be delivered efficiently. But there are also some downsides to delivering at night such as noise nuisance caused by loading and unloading trucks, the need for an increased availability of the receiver and some liability issues. Therefore assessing the attitude of all stakeholders involved towards shifting urban deliveries to the off-peak hours is useful in order for the policy-makers to decide what position to take in respect to night deliveries. This paper presents the multi-actor multi-criteria analysis (MAMCA) (Macharis, 2004) as the appropriate tool for measuring public support for night-time delivery in urban surroundings as it enables to incorporate the views of different stakeholders, in this case the receiver, the transport sector, society as a whole and the employee, and their criteria. These stakeholders were interviewed on their attitude towards five different scenarios in which the time periods for deliveries and/or the accompanying measures differ. The findings suggest that the public support for an overall implementation of night-time deliveries is rather low. But at the same time, the research shows there is some room for implementation in Belgian cities, but only if the time period, the type of business and the accompanying measures are carefully selected.

**Keywords:**

Night-time deliveries, Off-peak deliveries, Urban freight, City logistics, Stakeholder approach, Multi-criteria analysis, Multi-actor multi-criteria analysis.

MON 12<sup>th</sup> (14:00 - 15:15, Session B4.2) Room 1.02

ID 1329 R

**DEMAND AND ROUTING MODELS: AN APPROACH FOR SIMULATING THE URBAN GOODS MOVEMENTS**

Main Author:

**Antonio POLIMENI** (*DIMET - University Mediterranea of Reggio Calabria*)

Co-author(s):

**Antonino VITETTA** (*DIMET - University Mediterranea of Reggio Calabria*)

**Abstract:**

This paper presents a method to analyse goods movement simulation in urban/metropolitan areas. Urban goods movements involves two components: demand in terms of urban goods movements and vehicle routing with constraints (time windows, number of vehicles, ...). To analyse demand we consider a multi-step model, while to analyse goods movements a Vehicle Routing Problem with Time Windows (VRPTW) is formalized. In the demand analysis, goods movements are evaluate considering a macro-levels approach, which this approach goods movements are analysed from upper macro-levels (commodity and vehicle level) to the path choice model. At the last macro-level of demand analysis is considered a path model, and the one-to-one and the one-to-many approaches are evaluate. In details, the one-to-one approach allows to evaluate the path cost and the path probability; the one-to-many approach allows to optimize the vehicle routes. In the oneto- many approach, the optimization is performed applying a genetic algorithm for which some procedures are proposed for the solution evolution. A real case application is designed to detect the paths and the stops of some vehicles (2-6 tons) to deliver dairy products at retailers in a city. The observed paths are optimized using the proposed procedure.

**Keywords:**

City Logistics, Goods movement, Vehicle routing problem, Genetic algorithm.



ID 1757 R

**APPROXIMATION MODEL TO ESTIMATE JOINT MARKET SHARE IN OFF-HOUR DELIVERIES**

Main Author:

**Jose HOLGUIN-VERAS** (*Rensselaer Polytechnic Institute*)**Abstract:**

The main objective of this paper is to develop an approximation model to estimate the joint carrier-receiver response to off-hour delivery policies. The model's main intent is to bypass the need to use more complex approaches that require expensive data for model calibration. Having access to such approximation models would make it easier for transportation agencies and metropolitan planning organizations to analyze and design off-hour deliveries programs and policies. In its first part, the paper discusses carrier-receiver interactions concerning delivery time decisions, and the conditions under which both carrier and receivers would agree to off-hour deliveries. Some of the key findings are that: the typical receivers would participate only if provided with a financial incentive that cover the costs associated with the off-hour operations; and that the off-hour delivery operation would only be profitable if a large number of receivers switch to the off-hours. The latter provides an important piece of information to support the development of the approximation model introduced in the paper. The proposed model estimates the joint market share in off-hour deliveries by computing the joint probability that all receivers in a typical tour of length  $M$  agree to off-hour deliveries, the probability that the carrier operation is profitable, and finally the joint market share. The model's inputs are the probability that a typical receiver would participate in off-hour deliveries, the statistical distribution of tour lengths, and the probability that the carrier operation is profitable for a given number of receivers. The results indicate that the model provides the same results than other more complex methodologies for the practical range of values of receiver participation. (...).

**Keywords:**

Off-hour delivery policies, Freight planning.

ID 2248 R

**AN ANALYSIS OF URBAN FREIGHT TRANSPORT BEHAVIOR USING A PROBE CAR SYSTEM -A CASE STUDY OF KEIHANSHIN AREA IN JAPAN -**

Main Author:

**Takayoshi YOKOTA** (*Kyoto University*)

Co-author(s):

**Dai TAMAGAWA** (*Kyoto University*)**Abstract:**

The paper presents the results and findings obtained from a probe car survey in the Keihanshin area, Japan, which was conducted during October 2009. In this survey, 300 trucks from 21 different transport operators participated. The results show that short trips from major cities like Osaka, Kobe, and Sakai that have less than 10 km straight-line distance have low average straight-line velocity below 20 km/h. They also show that drivers tend to prefer highways if travel distance becomes longer, and once they decide to use highways, they keep to their routes including using the highways despite travel time substantially varying. These findings will contribute to constructing a freight vehicle behavior model.

**Keywords:**

Urban freight transport, Probe car system, Highway, Case study.

ID 2752 R

**DEMAND MODELS FOR THE ESTIMATION OF URBAN GOODS MOVEMENTS: AN APPLICATION TO THE CITY OF ROME**

Main Author:

**Antonio COMI** (*Tor Vergata University of Rome - Dept. of Civil Engineering*)

Co-author(s):

**Agostino NUZZOLO** (*Tor Vergata University of Rome - Dept. of Civil Engineering*)**Umberto CRISALLI** (*Tor Vergata University of Rome - Dept. of Civil Engineering*)**Silvia GALUPPI** (*Tor Vergata University of Rome - Dept. of Civil Engineering*)**Abstract:**

This paper presents a specific modelling system which simulates the commodity, delivery and vehicle goods movements, developed in order to support ex-ante assessment of city logistics measures. A review of models developed to simulate the urban freight transport demand is also reported. The review analysis highlights the limits of models for the ex-ante assessment of city logistics measures. For this reason this paper proposes a new modelling system made of different steps approaching problems related to: quantity OD flows, service-type OD flows, delivery OD flows, delivery OD flows for delivery time and vehicle type, and vehicle OD flows. This modelling system has been specified and calibrated using some surveys carried out in the inner area of Rome, where more than 500 truck drivers and more than 600 retailers have been interviewed.

**Keywords:**

Urban goods movements, Urban freight demand, Urban.

ID 2835 R

**USE OF SIMULATED ANNEALING TO ESTIMATE A PEAK-HOUR O-D MATRIX FOR URBAN FREIGHT DELIVERIES**

Main Author:

**Jesús MUÑUZURI SANZ** (*Grupo Ingeniería de Organización. Universidad de Sevilla*)

Co-author(s):

**Pablo CORTÉS ACHEDAD** (*Grupo Ingeniería de Organización. Universidad de Sevilla*)**Luis GERARDO ONIEVA GIMÉNEZ** (*Grupo Ingeniería de Organización. Universidad de Sevilla*)**José GUADIX MARTÍN** (*Grupo Ingeniería de Organización. Universidad de Sevilla*)**Abstract:**

Urban freight transport has barely incited any modelling efforts when compared to passenger cars and public transport, which is mainly due to the lack of available data and the complexity of the delivery route patterns and the involved decision making. We present here a modelling approach consisting of a demand model followed by an entropy maximisation procedure to estimate an origin-destination matrix for urban freight transport vehicles, both for B2B and home deliveries, during the morning peak hour. This approach requires relatively few data inputs in comparison with other existing models, and represents an initial step towards the inclusion of freight delivery models in overall urban transport planning. The application of the model is illustrated with a case study in the city of Seville, with its efficiency proved by the validation of the results using actual traffic counts.

**Keywords:**

Transportation, City logistics, Origin-destination matrix, Urban freight, Entropy maximisation.

ID 1027 R

**INTEGRATING GOODS IN PUBLIC TRANSPORT : THE CASE OF PARIS**

Main Author:

**Delaitre LOIC** (*Ecole des Mines de Paris*)

Co-author(s):

**Jerome ISSENMAN** (*ENSMP RATP*)**Danard JOEL** (*RATP*)**Cedric DE BARBEYRAC** (*Samada Monoprix*)**Abstract:**

Goods transportation has not been considered by transport operators since the beginning of public transport. However, it seems that the transport system of cities would be optimized if flows of goods and passengers are managed together with a unique responsible. Pooling resources (stations, tram or metro ...) is the keyword to optimize and to improve the flows of goods and people in urban areas. Unfortunately, the logistic of goods are not yet integrated in a transport operator. It could be easily explained because it is not clear that the operator can effectively provide this service with existing resources. To integrate logistics services, it is question therefore to analyze and to modify the current transportation system where goods, parcels and pallets can be handled without any difficulty. An interesting approach is to combine logistics to the matter of accessibility to transport spaces for persons with reduced mobility (PRM) because it is fully integrated in the work of replenishment, rehabilitation or improvement of stations, bus stops, tramways, bus and metro. Based on the approach to open transport spaces to PMR, we develop a methodology for integration of logistics in an urban transport operator. This article revolves around the description of infrastructures and skills, according to the dichotomy Logistics - Cargo / Transport - Passengers, the evaluation of supply and demand, in terms of logistics, for the identified areas and the selection of sites potentially suitable for urban logistics. Finally, we specify our research with a concrete case which is the RATP in Paris intramurals.

**Keywords:**

City logistics, Freight and passage flows, Public transport.

ID 1455 R

**THE USE OF RAIL TRANSPORT AS PART OF THE SUPPLY CHAIN IN AN URBAN LOGISTICS CONTEXT**

Main Author:

**Jochen MAES** (*University of Antwerp*)

Co-author(s):

**Thierry VANELSLANDER** (*University of Antwerp*)**Abstract:**

In Western Europe, the rail freight industry has been liberalized during recent years. The number of actors multiplies, the network connections of railroad and intermodal logistics companies grow and new actors enter the market. A directive called for separated accounting structures between the network provider and the operational activities. The right to privately operate, at first international and afterwards national freight trains came later. The liberalization had a major impact on the former state-owned monopolistic rail companies (the incumbents) and logistics actors calling at them. New market possibilities arose, but more actors now need to collaborate. This paper explores new logistics concepts in Western Europe, involving rail transport, now being in the trial - or investigation phase. This paper deals with the use of rail transport as part of the supply chain in an urban logistics context. The link will be made between two research subjects: the economic and ecologic viability of rail or intermodal transport, and the logistics capacity problems in an urban context, the latter of which is a growing research stream. First, a brief overview of the European railway market will be given. The difference between the European short-distance rail freight organization and American short-haul services will be described. Second, the concept of a new smart supply chain involving rail, developed by Deketele et al., will be given. The theory of the concept was put in to practice in Belgium by Procter and Gamble. This will be highlighted shortly. Afterwards, the concept of the modern supply chain involving rail will be compared to the actual supply chain of the French retail group Monoprix. (...).

**Keywords:**

Innovation in logistics, Urban logistics, Rail transport, City distribution, Intermodal transport.

ID 1731 R

**CASE STUDIES OF VAN USE IN LONDON**

Main Author:

**Jacques LEONARDI** (*University of Westminster, Dept. for Transport Studies*)

Co-author(s):

**Julian ALLEN** (*University of Westminster, Dept. for Transport Studies*)**Michael BROWNE** (*University of Westminster*)**Abstract:**

Two case studies on van use in London were developed. The approach is the collection of coherent datasets at company level that are linking together business observations, vehicle fleet data, the logistics activities on delivery rounds, distance and load with energy use and CO2 impact dimensions. The objectives of urban freight sustainability measures are to apply new vehicle and logistics organisation concepts for deliveries, and the objective of a 'beforeafter' evaluation is to assess their detailed impacts on business, transport and environment. Here, only the 'before' situation and its impacts are recorded. An adapted methodology for before-after assessments was set-up for urban freight deliveries. We obtain reference values, against which potential future efficiency improvements could be compared and evaluated. The two companies are a large UK parcel service and a large Business to Business commercial firm. The comparison illustrates the rather different level of CO2 per item and per kg that has been achieved by the two companies. Of course, this is a reflection of the rather different nature of each operation. Whereby one company has a round structure that requires vehicle distance travelled of 44 miles per day and the other has a much lower typical daily round distance – this is the result of two factors (a) a greater stem mileage for Case Study 2 and secondly a rather higher drop density for Case Study 1). Given the broadly similar load factors by weight achieved by each company in the operations surveyed, the analysis highlights the importance of assessing the distribution network design when considering ways to achieve lower energy use per unit delivered. It also demonstrates the need for care in assuming average values of energy use for apparently similar types of operation. (...).

**Keywords:**

Urban freight, Sustainable distribution, Survey me.

ID 2800 R

**A SIMPLE LOGISTICAL MANAGEMENT SYSTEM FOR LIMITED-ACCESS ZONES FOR GOODS VEHICLES IN MEDIUM-SIZED CITIES**

Main Author:

**Fabio BALLINI** (*Centro Iteuniversitario di Ricerca Trasporti -University of Genova*)

Co-author(s):

**Riccardo BOZZO** (*Department of Electrical Engineering, University of Genoa*)**Riccardo GENOVA** (*Transport Research Center - University of Genoa*)**Simonetta MIGLIACCIO** (*Transport Research Center - University of Genoa*)**Rinaldi GIANLUCA** (*City Council of La Spezia - Italy*)**Abstract:**

The municipal planning and management of logistics for goods delivery is certainly more difficult for smaller and medium-size cities, as compared to larger cities, from both an economic standpoint and with regards to available resources. On the other hand, the adverse effects induced by goods vehicles are equally as evident: higher levels of congestion, which often leads to double parking and illegal use of public places for unloading and loading, and higher levels of air and noise pollution. This paper will study a system currently being considered for the loading and unloading of goods in an urban context in the Italian city of La Spezia. The solution is based on an information system through which: 1. Carriers can register and acquire a personal parking permit; 2. The carrier can access real-time information on available parking spaces via the web, phone or information panels; 3. A sensor will register the vehicle's arrival in a parking space and will issue the driver with a ticket stating the time of arrival, which must be displayed; 4. The sensor registers the departure of a vehicle from a parking lot and calculates the fee; 5. The fee will be calculated based on a set of variable fees depending on the time of day, the day of the week and the location of the parking space in relation to the historic centre, etc. The first four points above are related to the pilot project that will be operational by the end of 2011. Point number 5 is focused on offering guidance in regards to the political decision process and involves all stakeholders, such as professional transport operators, small businesses, etc. (...).

**Keywords:**

Urban goods movement, Logistics systems, Management.

ID 3038 R

**CO2 REDUCTION FOR UGM : IS IT POSSIBLE TO REACH THE FACTOR 4 BY 2050?**

Main Author:

**Jean-Louis ROUTHIER** (*LET, University of Lyon*)

Co-author(s):

**Christian AMBROSINI** (*LET-Université de Lyon*)

**Jesus GONZALES-FELIU** (*University of Lyon*)

**Abstract:**

In this paper, we propose an appraisal of combinations of several public policy measures that seem to be the most probable by 2050, for urban goods movement (UGM). The proposed scenarios follow the trends of transportation long-term issues in France and introduce the specificity of the urban geography in freight-related trips. The considered trips are those classical for freight distribution in urban areas plus those related the household purchasing behaviour. A simulation method that combines several land-use and transport interaction (LUTI) models is also proposed, in order to estimate the gains of each scenario respect to the current situation (the emissions calculated on 2006 surveyed data for the city of Lyon). Finally, we present a set of suggestions in order to reach the factor 4 for UGM and if it is realistic.

**Keywords:**

Urban goods movement, Greenhouse gas, Sustainability, Factor 4.

ID 1144 R

**A HOLISTIC APPROACH TO CHALLENGES IN URBAN FREIGHT TRANSPORT PLANNING**

Main Author:

**Maria LINDHOLM** (*Chalmers University of Technology, Division of Logistics and Transportation*)

Co-author(s):

**Sönke BEHREND**s (*Division of Logistics and Transportation, Chalmers University of Technology*)

**Abstract:**

Freight transports in urban areas are still not well understood and there is no widespread methodology specifically aimed at the analysis and planning of such areas. To achieve urban sustainability, new models for the management of freight movements within city limits are warranted, in which municipal authorities play a pro-active role. The purpose of this paper is, firstly, to analyse the current state of freight transport in urban areas, and secondly, to identify possible shortcomings of current urban freight transport planning practices. This paper contributes to laying the groundwork for designing strategies and solutions to overcome the challenges involved in securing the mobility of goods and reducing unsustainable impacts from freight transport. A holistic approach was taken and in-depth interviews with 40 local actors and stakeholders were conducted in four cities around the Baltic Sea. The interviews represented authorities and other organisations connected with urban freight transport. The cities differ in size, economy, and history as well as political and cultural frameworks. A common characteristic of the cities, though, is the strong role the ports and logistics activities play. The study shows that there is a lack of a holistic understanding of the implications of freight transport in urban areas. Interaction and cooperation of all involved actors is necessary, but lacking, i.e., actors from the public and private sector. All these actors seem to be expecting initiatives to come from elsewhere. On the one hand, city governments expect businesses to set up new logistics services suited to the emerging needs of the customers and retailers. On the other hand, logistics providers wait for municipalities to initiate (and subsidize) new services before starting a business, which may prove unprofitable and highly risky. (...).

**Keywords:**

City logistics, Sustainable transport, Transport planning, Urban freight transport.

ID 1324 R

**NEW URBAN FREIGHT ISSUES FOR THE PARIS REGION: RESULTS OF RECENT CONSULTATION PROCESSES WITH BUSINESS ORGANIZATIONS**

Main Author:

**Laetitia DABLANC** (*INRETS (French National Institute for Transport and Safety Research)*)

Co-author(s):

**Diana DIZIAIN** (*University Paris I Sorbonne*)  
**Hervé LEVIFVE** (*City of Paris*)**Abstract:**

The Paris region (called Ile-de-France) is one of twenty-two French regions, and is among the largest and most developed metropolitan areas in Europe. It is currently confronting major economic, environmental, and institutional challenges. One of these is "Grand Paris," the creation of a unified metropolitan government for the City of Paris and neighbouring municipalities. In this changing context, freight and logistics activities have been acknowledged as major contributors to the region's economic well being that nonetheless have negative environmental effects such as noise, air pollution, and CO2 emissions. To manage freight transport more sustainably, the City of Paris and the Ile-de-France region (more recently) have engaged in consultation processes with freight transport firms, carriers' organizations, and shippers' associations. Other stakeholders such as rail, waterway, and port infrastructure managers and chambers of commerce also participated. This article describes these consultation processes and assesses their successes and failures. We examine processes at different levels in the Paris region's institutional framework: the local level, with the "neighbourhood councils" organised in the city of Paris's individual districts; the municipal level, with the Paris Delivery Charter experience (2006-2009); and the regional level, through the Ile-de-France Regional Council's recent experiences with freight consultation. We describe the relationships between these different processes, showing how they have benefitted from one other and sometimes overlapped. We analyse the difficulties encountered when conducting negotiations and implementing partnerships with the freight and logistics sectors in a complex urban environment. (...).

**Keywords:**

Consultation process Freight transport Local tra.

ID 1889 R

**A METHODOLOGICAL DECISION FRAMEWORK FOR THE DEVELOPMENT OF FREIGHT VILLAGES WITHIN THE GLOBAL LOGISTIC SYSTEM**

Main Author:

**Dimitrios TSAMBOULAS** (*National Technical University of Athens*)

Co-author(s):

**Kleopatra TATSI** (*Department of Transportation Planning and Engineering, School of Civil Engineering, National Technical University of Athens*)**Abstract:**

The continuous evolution of production processes at an international level, the globalisation of markets and the need to ensure ever-greater competitiveness, have significantly influenced the freight market today. Thus, in order to guarantee effective management of supply and distribution chains and make them more resilient, the creation of technologically advanced and efficient instruments to support logistic systems is essential. Today, this role is played by the freight villages and logistic centres, which will require large public and private investments. On the other hand, due to their complexity and the need to follow the market requirements and demand, it is certainly one of the most ambitious and important infrastructure initiatives in the region, where they are located. Their creation is also influenced by the development of logistics at world level, which are affected by a combination of macroeconomic, business and consumer trends. From the macroeconomic point of view, the increasing globalisation of flows of goods, the relocation of production units and the increasing specialisation of production markets have generated the lengthening of freight movement distances. The scope of the proposed methodology is to provide a common framework for the development of a freight village or logistics center network, taking into consideration al, the above. It sets the priorities for developing freight villages based primarily on geo-political, demographic and regional dimensions. In addition, the proposed methodology takes into account the different factors affecting decision-making. (...).

**Keywords:**

Freight Villages, Transport logistics, Evaluation.

MON 12<sup>th</sup> (17:00 - 18:15, Session B4.4) Room 1.02

ID 3017 R

**SCENARIOS OF COMMERCIAL ZONING TO REDUCE IMPACTS OF FREIGHT MOVEMENT IN A CITY**

Main Author:

**Frédéric HENRIOT** (LET)

Co-author(s):

**Jean-Louis ROUTHIER** (LET, University of Lyon)

**Abstract:**

In this paper, we propose an original approach which could help the policy makers and the urban planners to make decisions concerning the development or preservation of different kind of retail establishments. The decisions could be taken by having a good knowledge on the impacts of freight movement which are generated on upstream by the stores. This research provides the modelling of impacts of freight transport in town and is part of the program development of model Freturb. Based on french Urban Goods Movement surveys, we use data on goods entering the shops. Those data allows us to build a table of conformity between retail establishments of various scales, considering the quantity of goods reported to number of jobs. In other words, how many small shops, in a given activity and in a given number of jobs, does it take to replace a hypermarket or a supermarket, and vice versa? The contribution of this research is mainly situated in terms of methodology and in providing unpublished data on the consumption of households in a city through the goods supplied by retail establishments. It is thus possible to built scenarios of change in the distribution of various forms of retail trade and to forecast their impact on the urban goods movement.

**Keywords:**

Urban goods movement, Commercial zoning, Retail activity, Forecasting, Sustainability.

MON 12<sup>th</sup> (17:00 - 18:15, Session B4.4) Room 1.02

ID 3055 R

**URBAN FREIGHT TRANSPORT IN REGULATIONS AND PLANNING IN NINE AREAS OF BRITANNY**

Main Author:

**Sophie SÉBILLE** (Laboratoire RESO)

**Abstract:**

With the increase of power of the local authorities, especially with regards to movement of urban goods, we decided to focus on the manner in which local authorities in the area of Brittany planned the implementation of regulations and infrastructure. This research studies nine towns in Brittany, namely: Rennes, Saint-Malo, Saint-Brieuc, Lannion, Morlaix, Brest, Quimper, Lorient and Vannes.

**Keywords:**

Urban freight transport, National law and research, Local authority planning and infrastructure, Modelisation, Collective action.

ID 1081 R

**DATA ALLOCATION AND APPLICATION FOR TIME-DEPENDENT DELIVERY IN URBAN AREAS**

Main Author:

**Jan EHMKE** (*Technische Universität Braunschweig*)

Co-author(s):

**Dirk CHRISTIAN MATTFELD** (*Technische Universität Braunschweig*)**Abstract:**

In this paper, allocation and application of empirical traffic data for time-dependent delivery in urban areas are considered with respect to their usage. We discuss telematics based data collection and reason how to convert raw empirical traffic data into data sets for route planning. The data sets provided are integrated into time-dependent route planning approaches, considering customer time slots. So far, varying traffic flows are not considered in time slot management for e.g. attended home delivery. We compare the data sets regarding usefulness for time-dependent delivery in terms of a real data city logistics example. The resulting itineraries are expected to meet the customers' requirements regarding reliability and service quality of deliveries. Nowadays, city logistics service providers have to consider dynamics within logistics processes, e.g. shorter delivery times, higher schedule reliability and delivery flexibility. The focus is on concepts for fast and reliable transportation of goods in terms of cost-efficient and environmentally acceptable pickup and delivery routes. Additionally, city logistics service providers compete against other road users for the scarce traffic space of inner cities. In conurbations, traffic infrastructure is often used to capacity. Route planning in urban areas demands for time-dependent travel time estimates, based on empirical traffic data for every route as key input. Recently, such data arises from telematics based vehicular communication networks. In order to benefit from modern data collection, time-dependent travel time estimates have to be allocated and integrated into time-dependent route planning approaches. Whereas static route planning is well studied, time-dependent route planning forms a field of potential research. (...).

**Keywords:**

Time-Dependent, Traveling Salesman Problem, Attended Home Delivery, Floating Car Data, Vehicle Routing, City Logistics, Information System.

ID 1457 R

**CHARACTERISTICS AND TYPOLOGY OF LAST-MILE LOGISTICS FROM AN INNOVATION PERSPECTIVE IN AN URBAN CONTEXT**

Main Author:

**Roel GEVAERS** (*University of Antwerp - Dpt. TPR*)**Abstract:**

Logistics are undergoing constant and increasingly rapid changes: when assessing the sector, ecological as well as sustainable issues are more and more taken into account. Firstly, the awareness of the need for sustainable innovative concepts for urban distribution, for example to deal with urban distribution externalities, is growing. Secondly, attention is paid more and more to one of the most important yet problematic parts of the supply chain: the "last mile". In most cases, the last-mile part is the least efficient part of the supply chain due to the high degree of "empty running". The last mile is "ICT-sensitive" and, as a result, a lot of capital investments need to be made also to bridge the last mile satisfactorily. Furthermore, basically the high degree of "not-at-home deliveries" implies extra (high) costs. In this article, innovative concepts for urban distribution and "the last mile", that have significant positive impacts on logistics performance looking to economics as well as to the environment, will be identified. Those concepts can be technical as well as process-related. In the first part of the paper, the "problematic nature" of urban distribution and the last mile, will be described more in detail. Furthermore the different typologies to classify the different last mile delivery methods are shown. The focus in this article will be on the business-toconsumer (B2C) market. When assessing the B2C market, several innovative best practices can be mentioned, for example the introduction of collection points. Characteristics and typology of last-mile logistics from an innovation perspective in an urban context Roel Gevaers, Eddy Van de Voorde & Thierry Vanelslander 2 In the second part of the paper, the aforementioned problems of the last mile will be used to analyze the last mile in an attempt to list up the significant characteristics, which can have important effects on efficiency and costs when implementing innovations. (...).

**Keywords:**

Last-mile logistics, Urban distribution, Innovation, Green logistics, Characteristics of the supply chain.



TUE 13<sup>th</sup> (08:15 - 09:30, Session B4.5) Room 1.02

ID 2481 R

**MANAGEMENT OF THE EVOLUTION OF CITY LOGISTICS ORGANISATION**

Main Author:

**Dominique BREUIL** (EIGSI)

**Abstract:**

Due to the large variety of independent stakeholders, City logistics may be considered as a adaptive and context sensitive System of Systems (SoS), even though it is embedded in a larger one at the city level. The five basic conditions which characterise a SoS (operational and managerial independence, evolutionary development, emergent behaviour and geographic distribution) may be identified in Urban Freight Transportation (UFT) organisations ; some basic behavioural characteristics may be observed in UFT just like in other SoS such as the difficulties to communicate due to several and quite different governances, to define and share a common understanding between all participants or the non interoperability between systems and organisations or else the sometimes chaotic (unpredictable) nature of the traffic and goods circulation, etc. Then SoS engineering principles and methodologies should apply to UFT design. In this communication we propose to examine how systemic and organisational approaches can lead to a better control over the management and the continuous engineering of UFT organisations.

**Keywords:**

City logistics, Control of changes, Urban freight .

TUE 13<sup>th</sup> (08:15 - 09:30, Session B4.5) Room 1.02

ID 2764 R

**AN EMPIRICAL ANALYSIS OF RESULTS OBTAINABLE FROM CITY LOGISTICS MEASURES**

Main Author:

**Antonio COMI** (Tor Vergata University of Rome - Dept. of Civil Engineering)

Co-author(s):

**Francesco RUSSO** (University Mediterranea of Reggio Calabria)

**Abstract:**

This paper presents an ex-post assessment review of city logistics measures. The recalled measures are classified and analysed in terms of involved actors, temporal reference scale and results obtained in different cities around the world. In order to analyse measures before their implementation for an ex-ante assessment of reachable impacts, in literature some modelling systems have been proposed. In the paper, recalling the modelling system developed by authors some results and indications obtained by calibration and validation phases are given.

**Keywords:**

City logistics, Urban freight transport, Urban fre.

TUE 13<sup>th</sup> (08:15 - 09:30, Session B4.5) Room 1.02

ID 2883 R

### **HOW IS OWN ACCOUNT TRANSPORT WELL ADAPTED TO URBAN ENVIRONMENTS?**

Main Author:

**Cecilia CRUZ** (*University of Cergy-Pontoise, MRTE & Paris-Est University, INRETS, SPLOTT*)

#### **Abstract:**

Own account transport is commercially invisible but its importance in urban freight is significant: it represents half of deliveries. Generally research efforts focus mainly on third-party transportation because data is more available in spite of a lack of urban data. Nevertheless, the organization of transport by a shipper is not the same than third-party transport. The products transported, the constraints, the demand of transport are different. This analysis shows that own account transport is well-adapted to urban areas because of the density of deliveries and an increase of the number of establishments of the shipper who extends its areas of customer and makes profitable its fleet.

#### **Keywords:**

Urban freight, Own account transport, Density of deliveries, Time delivery.

TUE 13<sup>th</sup> (09:45 - 11:00, Session B4.6) Room 1.02

ID 1467 R

### **URBAN FREIGHT DISTRIBUTION: WHICH FUTURE FOR THE ACTION OF LOCAL AUTHORITIES**

Main Author:

**Daniele PATIER** (*Laboratoire d'Economie des Transports*)

#### **Abstract:**

Industry and retail logistics operations are analysed from a long time. "Urban logistics" appeared only in the 90s. The analysis of the urban logistics is highly complex due to the number of its components, as numerous as diverse, but however totally inter-dependent: housing environment, town planning, economic activities, urban management, regulations, transport and logistics. Transport and logistics are essential for a city: delivering shops and residents to maintain economic activities. Within this framework, public local authorities need to know actions they can develop to anticipate, in an optimal way, the urban distribution change in the coming 10 - 20 years, in order to reach a high quality urban logistics. Even if changes may appear in the current logistic organisation, the aim is to create value and employment. More and more pressures have an influence on urban logistics. Logistics organisations need to be more efficient in order to satisfy more customers, integrating new technologies of communication and data exchange. Cities must take up this challenge and find ways to better perform services offered while taking into account all town planning and environmental rules. In all cities, land cost is a major problem to uphold logistics activities. The objective of a 20 % greenhouse gas effect decrease by 2030, recommended by the Kyoto agreements, introduces a heavy brake and seems in the current context, difficult. It is urgent to elaborate a strategy for future logistics taking account all these pressures. In this context, public authorities need to know actions they can develop to anticipate, in an optimal way, the urban distribution change in the coming 10 - 20 years, in order to reach a high quality urban logistics. (...).

#### **Keywords:**

Urban logistic, Forecasting.

TUE 13<sup>th</sup> (09:45 - 11:00, Session B4.6) Room 1.02

ID 1525 R

**INVESTIGATING THE LIMITS OF RESTRICTIVE POLICIES FOR URBAN FREIGHT TRANSPORT: THE CASE OF VICENZA (ITALY)**

Main Author:

**Laetitia DABLANC** (INRETS (French National Institute for Transport and Safety Research))

Co-author(s):

**Sandrine VILLE** (University of Lyon)

**Dina RAKOTONARIVO** (INRETS)

**Jesus GONZALES-FELIU** (University of Lyon)

**Abstract:**

For over fifteen years, the subject of urban logistics has preoccupied many, including public decision-makers. This paper seeks to identify the limits beyond which regulations restricting vehicle access to limited traffic zones may be sanctioned for abuse of power. Here, we present the case of Vicenza (Italy), which has implemented very restrictive regulations. Based on this case study, certain lessons can be drawn for others urban areas in Europe.

**Keywords:**

Urban logistics, Local policy, Regulations, Urban distribution centres, Competition.

TUE 13<sup>th</sup> (09:45 - 11:00, Session B4.6) Room 1.02

ID 1761 R

**OPTIMAL DISTRIBUTION OF FINANCIAL INCENTIVES TO FOSTER OFF-HOUR DELIVERIES IN URBAN AREAS**

Main Author:

**Jose HOLGUIN-VERAS** (Rensselaer Polytechnic Institute)

Co-author(s):

**Michael SILAS** (CNA Corporation)

**Abstract:**

The main objective of this paper is to develop mathematical formulations to gain insight into the best way to distribute financial incentives to receivers to maximize participation in off-hour deliveries. Secondary objectives include understanding how different market segments influence off-hour delivery operations, and understanding on how policy design will increase participation in off-hour deliveries. The mathematical models developed in this paper serve as guidelines to optimally distribute financial incentives. In general, it was found that the optimal incentives depend on: (1) the class elasticity to off-hour deliveries; (2) the average number of class tours per receiver; (3) the tour elasticity; (4) the cost to move tours to the off-hours; (5) the revenues collected from penalties; and (6) the inverse off-hour delivery market share. It was also found through the numerical experiments conducted that tours can be shifted to the off-hours when receivers are given incentives to accept off-hour deliveries. It was also found that larger revenues collected for giving incentives translates into larger amounts of off-hour delivery tours shifted. For the penalties considered, the numerical experiments demonstrated that all penalties considered are effective at generating a budget for OHD incentives, but have different implications that should be considered before implementation.

**Keywords:**

Off-Hour Deliveries, Urban areas, Financial incent.

TUE 13<sup>th</sup> (09:45 - 11:00, Session B4.6) Room 1.02

ID 2580 R

**INTERNALISING THE EXTERNAL COSTS OF LIGHT AND HEAVY GOODS VEHICLES IN LONDON: A PROBLEM FOR URBAN GOODS MOVEMENT POLICY**

Main Author:

**Michael BROWNE** (*University of Westminster*)

Co-author(s):

**Julian ALLEN** (*University of Westminster, Dept. for Transport Studies*)

**Alan MCKINNON** (*Logistics Research Centre, Heriot-Watt University*)

**Maja PIECYK** (*Logistics Research Centre, Heriot-Watt University*)

**Abstract:**

This paper discusses freight transport activity levels in London. It also presents the results of an analysis of the extent to which the taxes paid by light and heavy goods vehicles (LGVs and HGVs) operating in London cover their environmental, congestion and infrastructure costs through taxes and charges. This analysis was based on vehicle activity levels and costs in 2008. It is estimated that LGV and HGV activity in London in 2008 generated approximately £0.6 billion in nationally-levied fuel duties and road taxes (this comprised fuel duty, VAT on fuel and Vehicle Excise Duty). In addition to these nationally imposed duties and taxes, several other London-specific taxes and charges are also imposed on LGV and HGV operations. These include taxes and charges arising from the London Congestion Charging Scheme, the London Low Emission Zone, the London Lorry Control Scheme penalty charges, parking and loading penalty charges, moving traffic penalty charges, and bus lane penalty charges. It is estimated that in 2008 these London-specific taxes and charges totalled £0.2 billion for LGVs and HGVs. The two most important elements of these charges were parking and loading penalty charges and the London Congestion Charging Scheme (which accounted for 56% and 38% of the total London-specific taxes and charges paid by all goods vehicles). By comparison, it is estimated that the total external costs of all LGV and HGV operations in London in 2008 are estimated at £0.4 billion when congestion costs are excluded, and £1.8 billion when congestion costs are included. (...).

**Keywords:**

Urban freight transport, Light goods vehicles, Heavy goods vehicles, External costs, London.

TUE 13<sup>th</sup> (09:45 - 11:00, Session B4.6) Room 1.02

ID 2845 R

**IMPACT OF E-ECONOMY ON URBAN FREIGHT TRANSPORT AND LOGISTICS**

Main Author:

**Seraphim KAPROS** (*University of the Aegean-Department of Shipping, Trade and Transport*)

Co-author(s):

**Amalia POLYDOROPOULOU** (*University of the Aegean*)

**Maria ANTONOPOULOU** (*University of the Aegean*)

**Abstract:**

This paper assesses the impact of Information and Communication Technology (ICT) applications on the logistics performance. ICT offer significant possibilities for improvements in the transport systems efficiency, it is however quite difficult to estimate their "real" impact. Based on a field survey, the paper develops a model explaining the factors affecting the performance of freight distribution systems and the relative impact of ICT. The research is focused on operational characteristics of logistics. The pilot case particularly focused on the impact of a specific ICT category, this of "fleet and freight management" applications. The model examines the ICT impact on the average occupancy rate of vehicles, which represents a common standard objective of logistics optimisation. The model results show that the ICT use allows an increase of the average occupancy rate of vehicles by 5.176%. This impact is quite important, considering the strong competition in the freight transport and logistics sector.

**Keywords:**

Information Communication Technologies, Logistics, Freight distribution, Transport modelling.

ID 1057 R

**UNINTENDED ENVIRONMENTAL IMPACTS OF NIGHTTIME URBAN FREIGHT LOGISTICS POLICIES**

Main Author:

**Nakul SATHAYE** (*University of California, Berkeley*)

Co-author(s):

**Samer MADANAT** (*University of California, Berkeley*)**Robert HARLEY** (*University of California, Berkeley*)**Abstract:**

In recent years, the reduction of freight vehicle trips during peak hours has been a common policy goal. To this end, policies have been implemented to shift logistics operations to nighttime hours. The purpose of such policies has generally been to mitigate congestion and environmental impacts. However, the atmospheric boundary layer is generally more stable during the night than the day. Consequently, shifting logistics operations to the night may increase 24-hour average concentrations of diesel exhaust pollutants in many locations. This paper presents realistic scenarios for two California cities, which provide diesel exhaust concentration and human intake estimates after temporal redistributions of daily logistics operations. Estimates are made for multiple redistribution patterns, including from 07:00-19:00 to 19:00-0:700, similar to daytime congestion charging policies, and from 03:00-18:00 to 18:00-03:00, corresponding to the PierPASS program at the ports of Los Angeles and Long Beach. Results for these two redistribution scenarios indicate that 24-hour average exhaust concentrations would increase at most locations in California, and daily human intake is likely to worsen or be unimproved at best. These results are shown to be worse for inland than coastal settings, due to differences in meteorology. Traffic congestion effects are considered, using a new graphical method, which depicts how off-peak policies can be environmentally improving or damaging, depending on traffic speeds and meteorology.

**Keywords:**

City Logistics, Off-Peak, Nighttime Operations, Truck Traffic, Freight Policy, Atmospheric Dispersion.

ID 1058 R

**UNINTENDED IMPACTS OF INCREASED TRUCK LOADS ON PAVEMENT SUPPLY-CHAIN EMISSIONS**

Main Author:

**Nakul SATHAYE** (*University of California, Berkeley*)

Co-author(s):

**Arpad HORVATH** (*University of California, Berkeley*)**Samer MADANAT** (*University of California, Berkeley*)**Abstract:**

In recent years, the reduction of freight truck trips has been a common policy goal. To this end, policies aimed at influencing load consolidation, load factors and increasing maximum truck weight limits have been suggested and implemented, resulting in higher gross vehicle weights. The purpose of such policies has generally been to mitigate congestion and environmental impacts. However, trucks cause most of the damage incurred by highways pavements. The supply chain associated with pavement maintenance and construction releases significant air emissions, raising the question of whether increased vehicle weights may cause unintended environmental consequences. This paper presents case examples with estimated emissions resulting from shifts in load consolidation and increased maximum weight. These examples indicate that increased load factors in local and long-distance freight movement can cause significant increases in emissions of certain pollutants. Emissions associated with pavement construction are also found to increase as a result of pavement design specifications that account for heavier trucks.

**Keywords:**

City Logistics, Life-Cycle Assessment, Green Logistics, Load Consolidation, Truck Weight.

ID 1754 R

**GREEN FREIGHT ? EVERY PENNY COUNTS?**

Main Author:

**Tomas LEVIN** (*SINTEF Technology and Society, Transport Research*)

Co-author(s):

**Astridbjorgen SUND** (*SINTEF Technology and Society, Transport Research*)**Abstract:**

At present there is a strong focus on making freight transport more green, that is more climate friendly. In Norway there has been a significant push towards more rail and sea based freight transport as these modes are commonly perceived as more climate friendly. In the public debate rail is said to be climate friendly because most of Norway's electricity comes from hydroelectric plants. Another deeply rooted argument is that rail has better energy efficiency than alternative modes. One problem with these views is the lack of detail and knowledge about how freight transports are conducted. Road transport is a necessity for bringing the goods to its final destination, thus terminal handling is required. Rail and sea born freight transport must always been in combination with road transport to be able to serve every business or household. The Green Freight project<sup>1</sup> aims a creating methodology and a toolset to make freight transport climate and environmentally friendly throughout the logistic network including terminals. Freight forwarders, freight owners and governmental agencies have teamed up to find a way to create an environmental accounting scheme that promotes greenification of freight transport from a bottom-up approach. One of the key findings in the work package focusing on user needs documents that there is a quest for knowledge and tools for climate impact analysis at company level. The focus is not on great infrastructure projects that may or may not come, but on measures that are under control of single firms in the freight industry. The goal is to focus on energy efficiency and to keep all operators on their toes when it comes to moving freight as climate friendly as possible. (...).

**Keywords:**

Climate, Freight emissions, Intermodality, Termina.

ID 1941 R

**ENERGY EFFICIENCY AND ENVIRONMENTAL PERFORMANCE OF MARITIME LOGISTICS CHAINS: ESTIMATING THE CURRENT SITUATION ? MAJOR CHALLENGES AND POSSIBLE PITFALLS**

Main Author:

**Bjørn ASBJØRNSLETT** (*NTNU*)

Co-author(s):

**Haakon LINDSTAD** (*NTNU*)  
**Torstein MØRKVE** (*DNV*)**Abstract:**

A prerequisite for being able to identify and implement measures for global improvement of energy efficiency and environmental performance in a maritime logistics chain is a comprehensive and uniform way of calculating the greenhouse gas (GHG) emissions and energy consumption, the GEEC® of the chain. The main objective of this paper is to shed light on challenges and potential pitfalls involved in estimating the efficiency of maritime logistics chains, with special focus on energy consumption and CO<sub>2</sub> emissions, to be able to establish a benchmark against which the effects of improvement measures can be compared. The approach is based on both looking at the vessel in isolation and taking the maritime logistics chain, in which the vessel is an important link, as points of departure.

**Keywords:**

Benchmark, Energy efficiency, Carbon emissions, Supply chain, Vessel.

MON 12<sup>th</sup> (11:15 - 12:30, Session B5.1) Room 5C

ID 2665 R

**ENVIRONMENTAL IMPACTS OF THE OPTIMIZATION OF GOODS DELIVERY PROCESS**

Main Author:

**Boussier JEAN-MARIE** (EIGSI)

Co-author(s):

**Ion LUMINITA** (EIGSI)

**Abstract:**

The main objective of our works is the specification and design of a software tool for the management of a fleet for goods distribution in small and medium sized cities. This paper focuses on the modelling of the management process of the sharing the parking places between private cars and vans for goods delivery. The activity-based model and multi-agent paradigm have been chosen in order to capture the interactions between the transportation network users. The end-user can simulate scenarios in agreement with local traffic regulations, the capacity of the infrastructure and the routing alternatives. A study case shows the environmental benefits after the implementation of a strategy for places sharing.

**Keywords:**

Goods delivery, Agent-based simulation, Modelling, City logistics, Environmental impacts.

MON 12<sup>th</sup> (14:00 - 15:15, Session B5.2) Room 5C

ID 1959 R

**CORPORATE PRACTICE TOWARDS SUSTAINABLE LOGISTICS**

Main Author:

**Heike FLÄMIG** (Hamburg University of Technology)

Co-author(s):

**Christof HERTEL** (Hamburg University of Technology)

**Abstract:**

In an economy, which is based on spatial division of labour, the logistics function gain on importance. Freight transport is a growing sector worldwide. It is seen as the connector and facilitator of the globalised world economy. Unfortunately it is also a – still rising – main-driver for climate change. A growing number of multinational companies releases Corporate Social Responsibility (CSR) reports and invests money in the ecological and social optimisation of their production processes and their products. Still missing is an analysis, if this is also the case for the transport and logistics operation. This paper presents empirical findings of how companies govern their business on an economic basis and why and how they handle social and ecological issues in logistics. The analysis shows that for sustainable logistics self-mechanisms in the economy, as well as governance frameworks are necessary. It will be distinguished that an important step towards sustainable logistics is to manage transport in a multi-dimensional manner.

**Keywords:**

Sustainability, Greening Logistics, Freight Transport, CO2 Emission, CSr.

ID 1960 R

**THE INFLUENCE OF INFORMATION AND COMMUNICATION SYSTEMS (ICS) ON SUSTAINABLE LOGISTICS ? RFID AND THE ?AUTONOMY? OF SUBJECTS**

Main Author:

**Heike FLÄMIG** (*Hamburg University of Technology*)

**Abstract:**

Modern information and communication systems (ICS) contribute to a steady and dynamic increase of the spatial division of labour among firms. In the context of economic and social transformations, modern ICS (e.g. internet-based technologies, GPS, RFID) are shaping the supply of goods in terms of quantities, of temporal and spatial organisation. The resulting increase in complexity of logistic networks complicates the coordination and control of transport chains. Up to now, physical and information logistics are often handled as separate fields of activity. However, more efficient communication and effective provision of the required information are essential for the management of value chains. And the overarching research question is whether a paradigm shift in the application of modern ICS allows for a sustainable organisation of the physical flow of goods. This paper therefore discusses the influence of modern ICS on the spatio-temporal organisation of the physical flow of goods through the use of different control systems (e.g. push vs. pull). It reveals the changing prominence of distribution operations (storage, consolidation, cross docking, etc.), the types of logistical nodes (distribution centre, transshipment point, harbour, etc.) and the choice of logistic locations as well as the resulting traffic generation in time and space. The analyses show an interrelation between the dominant control schemes of a supply chain, the effect of ICS and their impact on the spatial structure of production, the generation of traffic and the environment. A conceptual framework for this interrelation is developed on the basis of a new understanding of the role of communication and information elements within logistical systems. (...).

**Keywords:**

RFID, Production system, Value chain, Transport, Sustainability.

ID 2181 R

**MANAGING INFORMATION FLOWS FOR AN OPTIMISED AND MORE SUSTAINABLE SUPPLY CHAIN**

Main Author:

**Patrick WILLEMS** (*VUB, Group T*)

Co-author(s):

**Cathy MACHARIS** (*Vrije Universiteit Brussel (Free University of Brussels)*)

**Geert WAEYENBERGH** (*Group T University College leuven*)

**Bart VANNIEUWENHUYSE** (*TRI-VIZOR*)

**Alex VAN BREEDAM** (*Antwerp University, TRI-VIZOR*)

**Abstract:**

A logistics manager has to deal with different choices. Firstly, he needs to make a trade-off between efficiency (costs) and effectiveness (customer service) in his logistics related decisions. Currently however, a third dimension is becoming more and more important: sustainability. In order to improve substantially and simultaneously the three key dimensions one should collaborate to bundle freight flows. Information transparency and visibility within and across supply chains are key issues which help improve supply chain performance, whilst nurturing collaboration across the supply chain in order to come more cost-efficient, more effective and more sustainable. Studies of collaboration between supply chain actors illustrate that the sharing of information alone is not enough to ensure an improved, and thus more sustainable supply chain. Information sharing must be preceded by collaboration incentives and mutual trust. The literature on collaboration focuses on the link of information sharing with strategic relationship building approaches and is not providing guidance regarding practical (technical) implementation to improve demand/supply synchronisation. In this paper we want to explore the structure and processes involved in demand management and information flows within different supply chains, in order to establish the nature of information sharing practices. Furthermore we want to identify other factors that could play an important role in the improved management of information flows.

**Keywords:**

Sustainability, Horizontal collaboration, Information and Communication Technology (ICT).



ID 2690 R

**THE LOGISTICAL LEVERAGES OF LOCAL FOOD SUPPLY CHAIN'S PERFORMANCE IN TERMS OF SUSTAINABILITY**

Main Author:

**Blanquart CORINNE** (INRETS)

Co-author(s):

**Amelie GONCALVES** (INRETS)**Abstract:**

Local food supply chains seem now to be considered as a serious alternative to global ones in terms of sustainability. A lot of initiatives are developed and they often are associated with economical, social and environmental benefits. The main objective of this paper is to discuss the reality of these advantages. They are notably considered as a way to relocate or maintain agricultural activities, particularly in suburban areas. They are also supposed to be able to restore the connection between producers and consumers and to promote an alternative agricultural model based on "greener" production methods and the reduction of transport distances (the "food miles"). However, several studies have shown the limits of these models. Firstly, many important retailers have developed short food supply chains, questioning the local food system as an alternative business model. Moreover, it needs specific resources that many producers can't always offer. Secondly, an inadequacy between consumer's and producer's expectations can be observed, and many initiatives aren't based on collective approaches but on individual actions. Thirdly, these models aren't always based on alternative producing models (as organic agriculture) and the limitation of distances isn't always a factor of reduction of greenhouse gases. The paper tries to assess the performance of local food systems and the logistic leverages that could improve that performance. Long food chains have demonstrated the importance of logistic as a means to improve performance, and we can wonder how the improvement of the logistic organization of short food systems could increase their economical, social and environmental performance. (...).

**Keywords:**

Short food supply chains, Performance, Fruit and vegetable baskets.

ID 2732 R

**ACTIONS FOR MORE SUSTAINABLE FREIGHT TRANSPORT ? A COMPARISON BETWEEN THEORY AND PRACTICE**

Main Author:

**Vendela SANTÉN** (Division of Logistics and Transportation, Chalmers University of Technology)

Co-author(s):

**Magnus BLINGE** (Chalmers University of Technology, division for Logistics and Transportation)**Abstract:**

To cope with the negative impacts from the transport sector there is a need for actions striving toward a sustainable development. To understand the complex area of sustainability and to avoid creating one problem by solving another, a holistic view needs to be taken. The purpose of this article is to compare the theory and practice in the field of future sustainable actions in the logistics system. Actions appearance in the literature and its implementation today and importance for the future are investigated among practitioners in the logistics system. Results from both a literature review and interviews provide an aggregated picture of the situation today, highlighting differences among actors, the relationship between actions and its contribution to the four principles of sustainability. This article argues that in order to contribute to all principles of sustainability not only one type of action is enough; a reduction of transport, traffic and emissions from the vehicles is needed in conjunction with governmental actions.

**Keywords:**

Actions, Freight transport, Future, Holistic view, Logistics, Sustainability.

ID 1720 R

**BULK SHIPPING VIA THE NORTHERN SEA ROUTE VERSUS VIA THE SUEZ CANAL: WHO WILL GAIN FROM A SHORTER TRANSPORT ROUTE?**

Main Author:

**Halvor SCHOYEN** (*Vestfold University College*)

Co-author(s):

**Svein BRÅTHEN** (*Møreforskning Molde / Molde Research Institute*)**Abstract:**

The sailing distance via the Northern Sea Route (NSR) from a Northwest-European port to the Far East is approximately 40% shorter as compared to via the Suez Canal. Due to NSR uncertainty in schedule reliability it should primarily be explored for bulk shipping (tramp) rather than for liner shipping. A more than doubling of the vessel fuel efficiency may appear as one of the drivers for exploring the NSR for commercial transits. A major disadvantage with the NSR is its seasonality. Summer operations on the NSR may already today be profitable. Additional shipping routes may give more flexibility, and the NSR route choice option may facilitate supply chain agility and adaptability. Russian political impediments and custom clearance appear to represent the main present uncertain and decisive planning issues; whereas technical and nautical issues encountered by the vessels' crew and ship managers during the period of the voyage itself may represent comparably less challenges.

**Keywords:**

Northern Sea Route, International bulk shipping, Green logistics, Energy efficiency, Supply chain.

ID 2241 R

**ANALYSIS OF DIMINSHING SUPPLY ON AND POLICY MEASURES FOR THE SMALL INLAND WATERWAYS**

Main Author:

**Edwin VAN HASSEL** (*University Antwerp*)

Co-author(s):

**Edwin VERBERGHT** (*University Antwerp*)**Abstract:**

This paper deals with the causes of the decreasing number of small inland ships on the North Western European waterways. Also different policy measures to deal with the diminishing of the small inland fleet are analyzed within the Flemish context. The average loading capacity of the European inland navigation fleet is increasing through the use of bigger ships. There is a tendency to build more profitable and bigger ships, and as a result lesser small ships are being built. Therefore, the average age of the small inland ships has increased significantly and these ships are threatened to disappear from the market in the near future. Due to the increase in ship size, bigger ships can only sail on the large waterways. Hence, a significant part of the existing inland waterways network can not be served. Without intervention by the government and/or market changes, customers on these small waterways risk to lose their river transport and to be forced to shift to another mode or to delocalize their activity. The objective of the 2001 white paper "European transport policy for 2010: time to decide" was to shift the transport volumes from road haulage towards other, more sustainable modes such as inland navigation. A reactivation and strengthening of the small inland waterways can play a vital role in dealing with congestion, emission reduction and other external costs. This subject is a major issue for policy makers in the Netherlands, Belgium (Flanders) and France. This paper analyzes three different policy scenarios to deal with these problems specified to a Flemish context. The first scenario, government does nothing in aiding the fleet or in improving the infrastructure. In the second scenario, the infrastructure becomes adjusted for larger ships with 1500 ton loading capacity. (...).

**Keywords:**

Sustainability, Inland navigation, Freight transport, Policy, Fleet, Naiades, Mode shift, Innovation.

ID 2430 R

**CO-MODALITY – THE SOCIO-ECONOMIC EFFECTS OF LONGER AND/OR HEAVIER VEHICLES FOR LAND-BASED FREIGHT TRANSPORT**

Main Author:

**Anna MELLIN** (*VTI-Swedish National Road and Transportation Research Institute*)**Abstract:**

The European Union legislation limits the size of road vehicles used for international freight transport to 18.75 m and 40 tonnes. Other dimensions are accepted for domestic services as long as vehicle combinations are based on the so-called European Modular System. Sweden allows combinations up to 25.25 m and 60 tonnes in domestic transport. This paper presents the results from a Cost Benefit Analysis of a case where Sweden limits the vehicle dimensions in domestic transport to the European size. The results show that using smaller vehicles leads to higher costs for society in terms increased transport costs, increased environmental and accident costs. even when transfers to rail are included. The investments in the road network (including bridges) are recouped after a short period. The paper then goes further and discusses the future demand of even larger road and also includes rail vehicles. For road it is mainly a question of stretching the length and weight within the European Modular System. Experiences in countries outside of Europe and from the Swedish survey indicate that the main aspects of larger vehicles are traffic safety, infrastructure wear, environmental impacts and transport costs. The effects are dependent on where these vehicles are allowed and possibilities for modal shift. For trains no extreme changes are expected.

**Keywords:**

Vehicle dimensions, Cost-benefit analysis, Co-modality, Longer and heavier vehicles.

ID 2571 R

**CAPTURING PREFERENCE HETEROGENEITY OF TRUCK DRIVERS' ROUTE CHOICE BEHAVIOR WITH CONTEXT EFFECTS USING A LATENT CLASS MODEL**

Main Author:

**Tao FENG** (*Eindhoven University of Technology*)

Co-author(s):

**Theo ARENTZE** (*Eindhoven University of Technology*)  
**Harry TIMMERMANS** (*Urban Planning Group, Eindhoven University of Technology, The Netherlands*)

**Abstract:**

This paper aims at investigating the heterogeneous characteristics among truck drivers in route choice preferences. A latent class model incorporating membership functions is employed to examine differences between segments of drivers. A stated choice experiment designed for identifying route choice behavior of truck drivers provides the data for model estimation. The effects of road pricing and environmental bonus are examined considering context dependency. Results reveal that the latent class model outperforms the multinomial logit models in terms of goodness-of-fit and discrimination of segments. Drivers of light trucks care more about congestion than those of heavy trucks, and are highly sensitive to road pricing and slightly sensitive to a road bonus. Drivers of heavy trucks are more sensitive to road category and urban area than drivers of light trucks, and are insensitive to bonus and slightly sensitive to high pricing.

**Keywords:**

Route choice behavior, Heterogeneity, Freight transport, Latent class model, Context effects.

ID 2937 R

**A LOGISTICS MODEL FOR PRODUCTION AND DISTRIBUTION OF SUGARCANE ETHANOL IN BRAZIL**

Main Author:

**Eric GONZALES** (*University of California, Berkeley*)

Co-author(s):

**Lindsay MILLER** (*University of California, Berkeley*)**Avery COHN** (*University of California, Berkeley*)**Abstract:**

Demand is growing worldwide for alternatives to fossil fuel energy sources. Ethanol produced from sugarcane is receiving attention as a viable fuel source, especially in Brazil where production has doubled since 2001 in response to a strong domestic market and rapidly growing demand for exports. This paper presents an analytical model which uses continuous approximation to relate the costs and greenhouse gas emissions associated with the logistics of transporting raw sugarcane and distributing ethanol based on the properties of the land, infrastructure, vehicles, and production facilities. The model provides insights into the design of the logistics system and the associated greenhouse gas emissions if companies seek only to minimize costs. Model outputs are compared to existing sugarcane ethanol production in Brazil, and the implications of developing new production regions in different parts of the country are explored.

**Keywords:**

Biofuels, Brazil sugarcane ethanol, Ethanol logistics, Greenhouse gas emissions, Continuous approximation.

ID 1128 R

**ASSESSMENT OF THE TRAFFIC IMPACTS AND GAS EMISSIONS OF LARGE FREIGHT VEHICLE RESTRICTION SCHEMES IN METRO MANILA**

Main Author:

**Jun CASTRO** (*University of the Philippines School of Urban and Regional Planning*)

Co-author(s):

**Mario DELOS REYES** (*UP School of Urban and Regional Planning*)**Abstract:**

This paper investigates the impacts to traffic and the environment of large freight vehicle restrictions in Metro Manila. Vehicle flows and emissions are estimated for a range of alternative schemes of large truck restrictions on urban roads. Traffic flows in the road network are approximated by a user-equilibrium traffic assignment model. The vehicles on the road are modeled as a line source which approximates the effects of many vehicles moving along a road as a line; emitting a defined amount of pollution, per unit of time, along its length. Three types of pollutant emissions were estimated; i.e. CO, NO<sub>x</sub>, and SPM. With the aid of GIS, particularly in setting-up the transportation network and in data manipulation and visualization, the alternative schemes are compared and analyzed for two spatial areas; i.e. region-wide and area-specific areas. The results of the study show that the existing large freight vehicle restriction policy in Metro Manila is not very effective from a regional point of view, although if viewed from an area-specific scale, the policy may be effective in reducing traffic and environmental impacts. From a region-wide perspective, abolishing the existing large truck vehicle restriction would lead to lower traffic and environmental impacts because heavy trucks would be free to use direct and shorter routes. For the area-specific analysis, the effects of various alternatives on freight regulation were assessed for three zones to determine their impacts on localized traffic and pollutant emissions. The analysis reveals that the effectiveness of the scenario is dependent upon the area, with each scenario having mixed traffic and environmental impacts. (...).

**Keywords:**

Large freight vehicle restrictions, Traffic impact, Vehicle emission, GIs.

ID 1672 R

**MODELLING FUTURE CO<sub>2</sub> EMISSIONS FROM ROAD FREIGHT TRANSPORT – THE CASE OF GREAT BRITAIN**

Main Author:

**Maja PIECYK** (*Logistics Research Centre, Heriot-Watt University*)

Co-author(s):

**Alan MCKINNON** (*Logistics Research Centre, Heriot-Watt University*)**Abstract:**

The transport sector is responsible for around a quarter of world energy-related greenhouse gas emissions. Globally, road freight transport has been growing more rapidly than road passenger transport and this is expected to continue for the foreseeable future (Kahn Ribeiro et al., 2007). As a result of this growth the energy used by trucks is expected to increase by nearly 150% by 2050, as compared to 2000 level (WBCSD, 2004). This causes a great deal of concern about future growth in CO<sub>2</sub> emissions from road freight transport, particularly in the light of the recently announced UK and European targets to reduce carbon emissions by 80% compared to 1990 level, by the year 2050. In order to achieve these ambitious targets it is important to have a reliable baseline forecast of CO<sub>2</sub> emissions from road freight transport, i.e. a so-called business-as-usual (BAU) scenario, as well as a good understanding of factors influencing the level of emissions. Typically, forecasting studies assume close relationships between Gross Domestic Product (GDP) and tonne-kms and between tonne-kms and CO<sub>2</sub> emissions and produce macro-level forecasts with limited disaggregation of results. This paper presents an alternative approach to the forecasting of future CO<sub>2</sub> emissions from road freight transport. Based on an analytical framework linking economic growth and CO<sub>2</sub> emissions through a series of key logistics variables and ratios, a spreadsheet forecasting model was developed and operationalised with data for Great Britain. Projections of future changes in the key logistics and freight transport parameters derived from a large-scale Delphi survey were used to produce the BAU forecast for the period 2007-2020. (...).

**Keywords:**CO<sub>2</sub> emissions, Road freight transport, Great Britain, Modelling, 2020.

ID 1970 R

**A FRAMEWORK TO ACHIEVE A LOW CARBON SUPPLY CHAIN FOR HI-TECH PRODUCTS**

Main Author:

**Ali PAZIRANDEH** (*Lund University*)

Co-author(s):

**Sten WANDEL** (*Lund University*)**Abstract:**

Globalization, high customer service level and short life cycle have lead to an increase in the Green House Gas (GHG) emissions. At a global level, freight movement accounts for nearly one third of the entire transportation energy consumption, which in turn was 23% of the energy related Green House Gas (GHG) emissions in 2004 (IPCC 2007). In 2007 the IPCC stated that in order to avoid dangerous climate change, developed economies must reduce GHG emissions by 80-95% by 2050 (CDP 2008). Therefore companies and governments are increasingly paying attention to this challenge. The aim of this paper is to present a framework for designing and operating a supply chain for hi-tech products in order to achieve freight transport with low CO<sub>2</sub> emissions by 2050. The challenge within this research is that the hi-tech products have a high value per kilo, which means that the transportation cost is only a small percentage of their total cost. Besides, these products have a life cycle of only a few months, high customer service levels, and are most often produced in low wage countries and consumed globally. Less carbon emissions can be achieved in many ways such as, combining transportation modes in sequence and/or in parallel and thereby use less unsustainable transport. For example, intermodal transportation in sequence could be shipments by sea from China to Dubai and by air from Dubai to Europe, and intermodal transportation in parallel could be sea for long lead time orders, Trans Siberian Rail for medium, and air as emergency last minute shipments.. (...).

**Keywords:**

Sustainable, Supply Chains, Parallel Transport Modes, Carbon Emissions, Far East to Europe.

ID 2425 R

**CARBON IMPLICATIONS OF RETURNING UNWANTED GOODS ORDERED ONLINE**

Main Author:

**Julia EDWARDS** (*Logistics Research Centre, Heriot-Watt University*)

Co-author(s):

**Alan MCKINNON** (*Logistics Research Centre, Heriot-Watt University*)**Tom CHERRETT** (*Transport Research Group, Southampton University*)**Fraser MCLEOD** (*Research Fellow, Transport Research Centre, Southampton University*)**Liyong SONG** (*School of Traffic and Transportation, Beijing Jiaotong University*)**Abstract:**

Typically online product return rates are high, and generally much higher than those for conventional retailing. For example, some product categories, such as clothing, have 35-40% of online orders returned as 'unwanted'. Potentially, online retailers have to contend with significant levels of returns and offer consumers several different returns-route options. Normally unwanted goods can be sent back by post, courier pick-up or, in the case of multi-channel retailers, via one of their shops. While some retailers stipulate their chosen returns method, others allow online shoppers to choose their preferred returns channel, though in many cases, the customer has to pay for the cost of return carriage. Such economic considerations may influence the choice of returns method selected by a consumer. This paper examines the return of unwanted online orders from a carbon perspective. Using a spreadsheet carbon audit model, carbon dioxide (CO<sub>2</sub>) emissions for a variety of representative returns scenarios are calculated. This model has been calibrated using data from leading parcel carriers in the UK, national personal travel surveys and collection / delivery point (CDP) data specific to West Sussex. In particular, the research considers the possible variations to carbon emissions from customers returning goods: to their nearest post office or alternative CDP; directly to a store (in the case of multi-channel retailers with a high-street presence); or for courier collection, as part of an outbound home delivery round. The use of different types of motorised transport is also assessed. (...).

**Keywords:**

Carbon emissions Unwanted returned goods Online .

ID 2518 R

**CO<sub>2</sub> EMISSIONS OF EUROPEAN SUPPLY CHAINS : IMPACT OF LOGISTICAL CHOICES**

Main Author:

**Christophe RIZET** (*INRETS / DEST*)

Co-author(s):

**Michael BROWNE** (*University of Westminster*)**Jacques LEONARDI** (*University of Westminster, Dept. for Transport Studies*)**Eric CORNELIS** (*University of Namur (FUNDP) - Transportation Research Group (GRT)*)**Abstract:**

Freight transportation system is critical to economic activity but it carries significant environmental costs, notably GHG emissions and climate change : energy use and corresponding CO<sub>2</sub> emissions is increasing faster in freight transport than in other sectors and this increase is primarily the result of increased trade. This paper compares the transport activities, associated energy consumption and CO<sub>2</sub> emissions of different supply chains for a range of products in three European countries: Belgium, France and United Kingdom. Among the products considered are furniture and fruits & vegetables. For each of these products, different supply chains, involving more or less transport activity and associated energy consumption are analysed in each country. The comparison highlights some of the main factors that influence GHG emissions for different supply chains and illustrates how they vary according to product and country of final distribution. In more detail, the paper addresses the main differences between the supply chains of these products namely, the origin of their sourcing, the logistical organisation between production and retail and different types of retail outlet. The origin of the sourcing impact is mainly related to distance. The impact of the logistical organization between raw material and retail on GHG emissions is mainly linked to the mode and vehicle choice, to the itinerary, load factor. As for retail, the consumer trip emissions, between his home and the retail outlet, are also an important part of the whole supply chain emissions. We consider the whole supply chain, from production to consumption : attention is put on the mobility behaviours of consumers purchasing the studied products during their shopping and dropping back home activities related to these products. (...).

**Keywords:**Supply chains, CO<sub>2</sub> emissions, Logistics,

ID 1132 R

**PROMOTING EFFECTIVE GOODS DISTRIBUTION THROUGH ROUTE OPTIMIZATION AND COORDINATION TO ATTENUATE ENVIRONMENTAL IMPACT,**

Main Author:

**Girma GEBRESENBET** (Swedish University of Agricultural Sciences)

**Abstract:**

Goods transport has steadily intensified in the last decades and its impact on environment increases analogously. Particularly, goods distribution in towns contributed not only to the negative environmental impact, but also creates congestion. The tendency of frequent deliveries in small parties of goods is growing in the contemporary distribution system following the principle of just in time, JIT. And thus vehicles are partially loaded and the number of vehicles per kilometre increases. The current paper presents the study made on the food distribution in and around Uppsala town of Sweden, to map out the system and to investigate the possibilities and hindrances of co-ordinated distribution to promote an economically effective and environmentally sustainable distribution system. The project was conducted with close collaboration between universities, municipality and thirteen producing and distributing companies. The methods employed include conducting series of seminars, field measurements on distribution performance, conduct overall distribution simulation and optimisation, route optimisation in terms of sequences of delivery and distance, and computation of emissions. It was a participatory form of project where the main actors, i.e., producers and distributors actively participated particularly in the seminars where co-distribution constraints, field measurement results and possible solutions were discussed. The measured parameters were time (driving, loading, unloading, motor-idling, resting, exact time of delivery for each customer, start and end of distribution), load rate of vehicles in terms of weight and volume, transport distance, routes of distributions, vehicle's speed, and geographical locations of producers and delivery points. (...).

**Keywords:**

Food distribution, Route optimization, Coordination.

ID 2302 R

**CAPACITY UTILIZATION OF VEHICLES FOR ROAD FREIGHT TRANSPORTATION**

Main Author:

**Ole KVEIBORG** (Department of Transport, Danish Technical University)

Co-author(s):

**Megersa ABATE** (DTU Transport)

**Abstract:**

This paper discusses a central aspect of freight transportation – capacity utilization and empty running of commercial freight vehicles. It provides an overview of the literature on these topics and groups the contributions into two segments according to their analytical approach and origin of research. The first approach looks at utilization based on economic theories such as the firms' wish to maximize profitability and considers how different firm and haul (market) characteristics influence utilization. The second approach stems from transport modelling literature and its main aim is analyzing vehicle movement and usage in transport demand modelling. A strand of this second group of contributions is the modelling of tripchain and its implication on the level of capacity utilization. A key lesson from the reviewed studies is that it is important to take into account the commercial activity that initiates vehicle movements to evaluate performance. It appears that there is room for further enrichment of the modelling exercise by incorporating information regarding the operator to give a stronger behavioural basis for the vehicle movements and utilization. The paper provides an overview of the different approaches and discusses the potential combination of the two approaches. It also highlights relevant new areas where our knowledge is limited.

**Keywords:**

Freight transportation, Capacity utilization, Use optimization,

TUE 13<sup>th</sup> (08:15 - 09:30, Session B5.5) Room 5C

ID 3255 R

### **THE OPTIMIZATION OF FREIGHT CAPACITY IN THE SOUTH AFRICAN AUTOMOTIVE INDUSTRY**

Main Author:

**Gideon HORN** (*Nelson Mandela Metropolitan University*)

#### **Abstract:**

South Africa has the longest road network of any country in Africa. Its national road network currently covers 7 200 km and eighty percent of all freight carried in South Africa is done so by road. Unfortunately, it is estimated that between 15 and 20 per cent of all heavy vehicles travelling on South African roads are overloaded. Damage to roads as a result of overloading leads to higher maintenance and repair costs and shortens the lifespan of roads. This places a burden on the government which ultimately carries the costs of repair due to careless and inconsiderate overloading of vehicles. On the other hand, movement imbalances in the form of freight forwarding vehicles which are not loaded to its full capacity, are also very costly. This paper is based on a current study that is aimed at correcting these movement imbalances and to optimize the utilization of transport capacity between the country's main economic corridors. The main objectives of the paper are to:

- indicate how available data are used to improve imbalances and the visibility of supply chain inefficiencies for stakeholders
- illustrate the cost benefits of a web portal that advertises spare capacity to potential users
- explain the road freight strategy that is currently followed in South Africa.

#### **Keywords:**

Movement imbalances, Overload damage, Capacity uti.

MON 12<sup>th</sup> (11:15 - 12:30, Session C1.1) Room AllI

ID 1786 R

### **MESOSCOPIC SIMULATION CONCEPT FOR TRANSPORT CORRIDORS**

Main Author:

**Mihails SAVRASOVS**

#### **Abstract:**

A transport corridor is a (generally linear) tract of land in which at least one main line is provided for transport, whether it is a road, rail or canal facility. In this article under transport corridor we will understand a road which connects two geographical points. The need of research and analysis of the transport corridors is mainly connected with wish to locate bottlenecks of the corridor and to estimate different characteristics, for example, the average speed along the corridor, the average travel time etc. The main tasks of this article is to show advantages and disadvantages of microscopic simulation and macroscopic simulation, to make an overview of the existing mesoscopic models and to present a concept of new mesoscopic traffic model which is developed for transport corridor simulation with the acceptable level of output results exactness on the base of the earlier used mesoscopic model.

#### **Keywords:**

Transport corridor, Mesoscopic model, Simulation.



ID 1866 R\*

**ESTIMATING CAPACITY AND VEHICLE EQUIVALENT UNIT BY MOTORCYCLES AT ROAD-SEGMENTS IN URBAN ROAD**

Main Author:

**Nguyen Y** (*Civil and Environmental System Engineering*)**Abstract:**

Heterogeneous traffic with the predominance of motorcycles is very common in many cities in Southeast Asian countries, where motorization has developed speedily in the last few decades. While many developed countries confront troubles relating to vehicle traffic, Southeast Asian countries in general and Vietnam in particular are facing a serious situation in respect to the high volume of motorcycle traffic and congested motorcycle flows. Therefore, passenger car equivalent (PCE) concept becomes hard to be suitable in traffic dominated by motorcycles in these countries. Hence, it would seem to make more sense in such case that the motorcycle is considered as the basic vehicle in this traffic flow. In order to account for other categories of vehicles in the traffic flow, the concept of motorcycle equivalent unit (MCU) value at urban road segment was introduced. This paper investigates the methodology of MCU at road-segments in motorcycle dependent city. A methodology based on PCE approach previously developed by Chandra et al. (2003) is presented in this research. This methodology illustrates a more accurate method of MCU in mixed traffic flow by considering the characteristics of moving vehicles such as velocity and an effective space. In which, the effective space of each kind of vehicle is computed under considering influences of velocity, physical size of the subject vehicle and the surrounding motorcycles. The proposed methodology was applied to field data collected at twelve road-segments located in Hanoi city, Vietnam. The field data indicated that the effective space of each vehicle varies by the speed of moving vehicle, and MCU value increases slightly corresponding with the lane number of each urban road during the peak hour. (...).

**Keywords:**

Capacity, Motorcycle Equivalent Unit, Road Segment.

ID 2092 R

**SIMULATING MOTORBIKE DOMINATED TRAFFIC**

Main Author:

**Marc Miska** (*University of Tokyo*)

Co-author(s):

**Shinji TANAKA** (*The University of Tokyo*)**Abstract:**

Mixed traffic, where motorbikes dominate the traffic composition (more than 70%) like in Vietnam, Malaysia, or Thailand, is difficult to simulate microscopically with well established simulation tools, since they are mostly designed for a lane based network, and motorbikes in these countries do not follow any lanes. From a macroscopic perspective it is difficult to establish the correct passenger car equivalent for motorbikes, and those found in literature a varying significantly. Recently, it has been proposed that passenger car equivalents in developed countries (mainly car and truck traffic) are depending on the speed in the road section and we think that in non-lane based traffic situations the composition of vehicles inside a road section is another major factor. Since observations are rare and costly, we have decided to first develop a microscopic simulation model for mixed traffic, which we can calibrate with road segment and intersection video footage from Hanoi, Vietnam and based on this to investigate possible factor that influence the passenger car equivalent. To calibrate the model we have used several hours of video footage from Hanoi, Vietnam. Among the available video were intersection observations, videos for saturation flow-rate detection and videos that show queuing and dispersion of the mixed traffic at signal control installations. Calibrated with parts of this footage, we compare our model to the other video material available.

**Keywords:**

Motorbike, Microscopic, Traffic, Simulation.

ID 3118 R

**DEVELOPMENT OF MOTORCYCLE RUNNING SIMULATION MODEL UNDER MIXED TRAFFIC FLOW AND ITS VERIFICATION**

Main Author:

**Tetsuhiro ISHIZAKA** (*Nihon University*)

Co-author(s):

**Atsushi FUKUDA** (*College of Science and Technology, Nihon University*)**Abstract:**

The objective of this study is to develop the motorcycle running simulation model under mixed traffic flow in Asian countries. The running behaviour of motorcycle was modelled by using the concept of the potential which show the topographical probability of motorcycle running on road. The running behaviour on the motorcycle running simulation model was verified in comparison with actual running behaviour under mixed traffic flow. It was concluded that the motorcycle running simulation model has been capable to demonstrate detailed running behaviour of motorcycle.

**Keywords:**

Motorcycle, Simulation model, Mixed flow.

ID 3217 R

**IMPACTS OF INFRASTRUCTURE, TIMETABLE AND PERTURBATIONS IN OPERATION OF DOUBLE-TRACK RAILWAY LINES WITH MIXED TRAFFIC**

Main Author:

**Olov LINDFELDT** (*Royal Institute of Technology Stockholm (KTH)*)**Abstract:**

Delays play a central role in railway operation. They are of great importance both for customers and operators. They are direct measures of quality and reliability and hereby also an important factor for the competitiveness of the entire railway. Indirectly, the delays also affect quantitative factors such as capacity, i.e. the number of trains that can be (practically) operated. For these reasons, analysis of delays and delay propagation is an essential part of railway operations research. The upcoming deregulation of railway traffic means that completely mixed traffic can be foreseen on the Swedish railway network. This article shows how the delays on a double-track railway line, operated with mixed traffic, are affected by infrastructure, timetable and primary delays. Experimental design, simulation and response surface metamodelling are applied in a multi-factor simulation experiment with nine factors. The combination of simulation and experimental design makes it possible to draw general conclusions from a limited number of simulated variants and this type of multi-factor analysis is essential to an understanding of the railway as an operational system. The derived metamodels may also be used in different types of planning processes. The metamodels show that speed and frequency factors have a great impact on delays. Freight train speed and the frequency of service of high-speed trains in particular turned out to be important. Perturbation factors, i.e. entry delays, were found to affect the delays less. Neither does the distance between adjacent overtaking stations in itself affect the delays. (...).

**Keywords:**

Double-track, Timetable, Railway operation, Railway capacity, Experimental design, Simulation, Delays, Reliability .

ID 1396 R

**MODELING PEDESTRIANS' MOVEMENT ON ROAD-CROSSING ENVIRONMENT**

Main Author:

**Carlos PRETTO** (*Federal University of Rio Grande do Sul*)

Co-author(s):

**Helena CYBIS** (*Universidade Federal do Rio Grande do Sul*)

**Abstract:**

In this paper, we address the problem of modelling the pedestrian road-crossing task, using multi-agent techniques. The model presented in this paper has been devised to provide a sound representation of the interaction between pedestrians and a more realistic approach for the interaction between pedestrians and vehicles. The model represents pedestrian's behaviour patterns at road crossing, regarding the decisions about where and when to start crossing the road. From this point of view, an attempt has been made to develop a model which considers both vehicular and pedestrian traffic. This paper identifies the impact of the step-by-step decision process of the pedestrians in the traffic flow of vehicles. Models with a non realistic step-by-step process, the pedestrians have a rouge impact on the traffic flow. Models with a well calibrated step-by-step process have the impact of pedestrians in the traffic flow is attenuated.

**Keywords:**

Pedestrian, Crosswalk, Agent simulation.

ID 2053 R

**MICROSCOPIC PEDESTRIAN SIMULATION CONSIDERING HETEROGENEITY**

Main Author:

**Marc MISKA** (*University of Tokyo*)

Co-author(s):

**Shinji TANAKA** (*The University of Tokyo*)

**Abstract:**

Living in a dense populated area as Tokyo, Japan, makes it necessary to integrate pedestrian movements into planning and operation decisions. Limited space and fear of stampedes during evacuations determine now construction plan boundaries. While work so far has neglected the heterogeneity of crowds, this paper investigates and models different pedestrian types crossing a high density intersection in downtown Tokyo, Japan. Based on a 24 hour video observation, parameters for different user groups have been extracted and used in a microscopic simulation model. Additionally, this paper offers a conceptual model for group movements in a crowd. Since not enough data could be collected, the validation of the model remains for future work.

**Keywords:**

Pedestrian, Microscopic, Heterogeneity, Simulation.

MON 12<sup>th</sup> (14:00 - 15:15, Session C1.2) Room AllI

ID 2160 R

**A COMPARISON OF METHODS FOR TRANSFERRING LOGIT MODELS OF GAP-ACCEPTANCE BEHAVIOUR**

Main Author:

**Riccardo ROSSI** (*University of Padua - Department of Structural and Transportation Engineering*)

**Abstract:**

Alternative methods for transferring Logit models of gap-acceptance behaviour are implemented and compared in this study using experimental data collected at two priority intersections. The effectiveness of model transfer is evaluated on the basis of several indicators proposed in the literature regarding travel demand applications of transferability, and the results are compared to those obtained by locally estimating the model in the application context. The main conclusion is that the accuracy of the transferred models is generally similar to that of the locally estimated ones, and that the method known as Combined Transfer Estimation performs best among the tested approaches. These results are not significantly affected by the size of the sample of observations used for model transfer.

**Keywords:**

Priority intersections, Gap-acceptance behaviour, Model transfer.

MON 12<sup>th</sup> (14:00 - 15:15, Session C1.2) Room AllI

ID 2254 R

**A DISCRETE CHOICE MODEL OF PEDESTRIAN GAP ACCEPTANCE BEHAVIOUR ON UNSIGNALISED URBAN ROAD SECTIONS**

Main Author:

**Tianjiao WANG** (*Transportation Research Group, School of Civil Engineering and the Environment, University of Southampton*)

Co-author(s):

**Michael MCDONALD** (*University of Southampton*)

**Pengjun ZHENG**

**Jianping WU** (*University of Southampton*)

**Abstract:**

Current traffic microsimulation tools are usually of limited use for evaluating the operations of pedestrian-involved systems, especially under unsignalised conditions, due to insufficient understandings of Pedestrian-Vehicle Interaction (PVI) behaviour. The purpose of this paper is to develop a simulation model for pedestrian gap acceptance behaviour on a two-way-two-lane unsignalised urban road section. This paper first proposes a framework for incorporating pedestrian objects into existing traffic microsimulation. Then within the framework, the pedestrian gap acceptance behaviour is analysed and modelled using a discrete choice approach. A field study was conducted to collect the data of pedestrians' decisions and various possible influencing factors using a set of synchronised video cameras on a typical unsignalised urban road section. This data was used to calibrate and validate the proposed model. The initial results with the model are appealing when considered in combination of simplicity and accuracy. The results can be used to supplement existing guidelines for pedestrian-involved problems, or to form a knowledge base for incorporating pedestrians into existing vehicle-dominated microsimulation models in a more realistic way.

**Keywords:**

Pedestrian, Gap acceptance, Discrete choice, Simulation.

ID 2713 R

**OPPORTUNITIES AND THREATS OF EMPIRICAL RESEARCH ON DRIVER BEHAVIOUR DURING SIGNAL CHANGE INTERVALS**

Main Author:

**Axel WOLFERMANN** (*Technische Universität Darmstadt, Verkehrsplanung und Verkehrstechnik*)**Abstract:**

The performance of signalised intersections is determined to a large extent by the signal change intervals. The determination of an optimum duration of signal change intervals requires reliable data on the driver behaviour. The same applies to the development of realistic simulations of the driver behaviour during the signal change intervals. Up to date models still rely on kinematic models which do not sufficiently reflect the random characteristic of the underlying parameters or the factors influencing them systematically. Results from empirical studies on driver behaviour depend to a large extent on the survey methodology and the specific situation of the surveys. It is unfeasible to take all factors influencing the driver behaviour into account at the same time. Conclusions from surveys consequently have to be interpreted with care. The empirical research conducted as part of a project on the influences of intergreen times on the capacity of signalised intersections (InSignIs; BOLTZE, WOLFERMANN 2009) and presented in this article underlines this observation. This article summarises the opportunities and threats connected to empirical research. The awareness of data accuracy, general validity, and error sources is paramount to deduct adequate conclusions from empirical data. Special attention is paid to survey layout and stratified sampling. Examples underline the central statements.

**Keywords:**

Empirical research, Driver behaviour, Signal chang.

ID 1261 R

**COMPARISON OF TIME HEADWAY DISTRIBUTIONS IN DIFFERENT TRAFFIC CONTEXTS**

Main Author:

**Ha HUNG** (*The French National Institute for Transport and Safety Research, INRETS*)**Abstract:**

This paper concerns the modeling of time headway distributions on the A6 Motorway in France. The aim of the work is to compare these distributions in different contexts such as type of lane, traffic flow, period of the day and change of cross-profile. In order to interpret and to distinguish the different contexts and behaviors, the composite time headway distribution Generalized Queuing Model and the best simple model, the Log-normal Model, are calibrated. In addition, the statistical analysis of a series of events is applied to understand the time headway process. The distribution of instantaneous speeds enriches such interpretations in several cases. The results show a significant goodness-of-fit of the composite time headway distributions with most samples. The Log-normal Model provides also good adjustments for many samples particularly on the middle and fast lanes. Consequently, the sensitivity of the parameters of these models is yielded according to the contexts.

**Keywords:**

Time headway, Traffic context, Free vehicle, Follo.

ID 2475 R

**DATA ACQUISITION CONCEPT FOR SIMULATIVE ANALYSES OF TRAFFIC FLOW OPTIMIZING ADAS**

Main Author:

**Stefan DETERING** (*Institute for Traffic Safety and Automation Engineering*)

Co-author(s):

**Eckehard SCHNIEDER** (*Institute for Traffic Safety and Automation Engineering*)**Lars SCHNIEDER** (*Institute for Traffic Safety and Automation Engineering*)**Abstract:**

In recent years initial proposals have been presented for advanced driver assistance systems (ADAS) which are to optimize traffic flow globally by means of the interaction of autonomous vehicles. This kind of ADAS is hereinafter referred to as traffic assistance system (TAS). For the design, optimization and evaluation of these TAS investigative simulations are necessary. These investigations hold their own set of particular requirements, including the simultaneous consideration of microscopic and macroscopic behavior. Therefore, in this paper a two-level approach for calibration and validation of traffic simulations is presented. Previous calibration and validation methods utilized either microscopic or macroscopic measurement data. Therefore, this contribution presents a new measurement concept that is needed to gather the required data for the suggested two-level approach for calibration and validation. This concept advocates simultaneous data acquisition sourced in both a vehicle (microscopic) and an overall traffic (macroscopic) perspective. First microscopic measurement results obtained by an equipped vehicle are presented. Compared to the current state of the art, the application of the two-level approach for calibration and validation with the gathered microscopic and macroscopic measurement data will enhance the possibilities to investigate the efficiency of TAS and yield results which are characterized by a higher degree of confidence.

**Keywords:**

Driver behavior, Simulation, ADAS, Traffic flow, Optimization, Data acquisition.

ID 2491 R

**TWO-DIMENSIONAL INVESTIGATION OF TIME HEADWAYS FOR BETTER REALISM IN MULTILANE TRAFFIC FLOW MODELLING**

Main Author:

**Banihan GUNAY** (*University of Ulster*)

Co-author(s):

**Gokhan ERDEMIR****Abstract:**

Existing car following theories assume that each vehicle is influenced directly by the one in front which is true only where lane discipline is extremely ideal and lanes are very wide. Real traffic, however, may pose a more complex picture. The paper, based on preliminary observations, is an attempt to explore the issue in detail for the first time. Below a certain value of same lane time headways, fewer numbers of drivers are willing to keep short headways with the neighbouring lane vehicles. This may mean that except light flow traffic, where the offside lane is primarily used for overtaking, considerable amount of drivers prefer to pass or lag behind the vehicle in the adjacent lane, rather than driving side by side. In addition to its safety concerns, especially in relatively narrow lanes, this issue may have capacity implications. Hence, existing traffic flow models may require further adjustments.

**Keywords:**

Lateral psychological friction, Lateral pick up effect of headways.

ID 2615 R

**A METHODOLOGY FOR DEPICTING DRIVERS' TIME HEADWAY PREFERENCES THROUGH ANPR TECHNOLOGY**

Main Author:

**Banihan GUNAY** (*University of Ulster*)**Abstract:**

Car following behaviour has road safety implications. The idea of identifying those vehicles that were captured being in a close-following instance through Automatic Number Plate Recognition (ANPR) technology was the motive of the research. The present paper attempts to investigate whether meaningful interpretation of time headways is possible when vehicle identities are taken into account. Using a set of ANPR data collected in Thurles, Republic of Ireland, a number of empirical observations, which deserve further attention, were made. It was found that the distribution of headways with respect to time was more skewed towards the left compared with the overall distribution of all data which had no particular reference to the vehicle identities. It was also interesting to show preliminarily that the standard deviation of the time headways (with vehicle identities taken into consideration) was smaller than the spread of the randomly picked headways from the overall population. As a result, we highlight the need for further research to explore the issue more from both academic studies' and enforcement bodies' points of view.

**Keywords:**

Number plate recognition, Safety, Close following.

ID 3007 R

**CALIBRATING WALKER MODELS: A METHODOLOGY AND APPLICATIONS**

Main Author:

**Mario CAMPANELLA** (*Delft University of Technology*)**Abstract:**

In this paper we present a generic methodology for calibrating walking models. Applying the methodology to the Nomad walker model improved substantially the quality and significance of the parameters. This methodology aims to describe all aspects of the parameter estimation process of walker models, while making it applicable to the calibration of any walker model. The base of the methodology is the simultaneous calibration of several aspects of pedestrian traffic to improve the robustness and generic application of the model. We investigated the impact of combining different flow configurations, estimating parameters for groups of pedestrians, using errors of pedestrian state variables in the optimisation and introducing prior information about the parameters.

**Keywords:**

Calibration methodology, Pedestrian modelling, Walker models.

ID 1031 R

**DEVELOPMENT OF A DELAY EQUATION VALID FOR MOVEMENTS WITH SHORT LANES AND BASED ON THE WEBSTER'S MODEL FOR TRAFFIC LIGHTS**

Main Author:

**Gonçalo SANTOS** (*IST, Technical University of Lisbon*)

Co-author(s):

**Álvaro SECO** (*Science and Technology Faculty, University of Coimbra*)**José NEVES** (*IST, Technical University of Lisbon*)**Abstract:**

The presence of a short lane at an intersection regulated by traffic lights directly influences the movement's saturation flow. It can be verified that the saturation flow falls off during the green time period when the last vehicle stored in the short lane crosses the stop line. This variation in saturation flow is not considered in Webster's delay equation developed in 1958. To overpass this issue, some authors tried to arrange simple adaptations to the design process, based on the referred equation. However, these methodologies could differ from the values that minimize the intersection delay, because Webster's expression is not valid for the specific problem of movements with short lanes. This paper describes the development of an expression that resulted from the adaptation of Webster's delay model to movements with short lanes. It starts by explaining the important steps of the work of Webster concerning to the delay equation and then focuses on the adaptation of the deterministic and stochastic terms of his expression. The result is a new expression, valid for under-saturated conditions, that allows the estimation of delay for movements with short lanes. It can be verified that Webster's equation is a particular case of this new expression.

**Keywords:**

Traffic lights, Short lane, Delay, Webster.

ID 1725 R

**SIMULATIONS OF VEHICULAR TRAFFIC BY CELLULAR AUTOMATA**

Main Author:

**Janina JABLONSKYTE** (*Kaunas University of Technology*)**Abstract:**

In this paper there are studied simulation of traffic flow in urban environment, there are made microscopic traffic flow simulation models of streets' crossroad. The behaviour of cellular automata (CA) models is analyzed due to indexes as queue lengths at crossroads with traffic signals, flow rates, average velocities on different roads. The following indicators characterize traffic situations in a road network.

**Keywords:**

Traffic flow, Cellular automata.



ID 2014 R

**LANE CHANGING PATTERNS OF BANE AND BENEFIT: OBSERVATIONS OF AN UPHILL EXPRESSWAY**

Main Author:

**Anthony PATIRE** (*UC Berkeley*)

Co-author(s):

**Michael CASSIDY** (*University of California, Berkeley*)**Abstract:**

A mechanism is unveiled by which congestion forms and persists near the base of a 3-lane, uphill expressway segment, causing significant reductions in output flow. Vehicular lane-changing (LC) is key to the mechanism, particularly LC induced by speed disturbances (SDs) that periodically arose in the expressway's median and center lanes. Early in the rush, when flow was relatively low in the shoulder lane, drivers could readily migrate toward that lane to escape from oncoming SDs. The shoulder lane thus acted as a 'release valve' for the high vehicular accumulation created by the SDs. The mandatory decelerations visited upon vehicles caught in these early-rush SDs were therefore short-lived. The release valve failed only later in the rush, when demand in the shoulder lane increased. In these later stages, LC induced by the SDs became disruptive. The decelerations imposed by SDs spread laterally, and a persistent queue formed in all lanes. Once the queue engulfed the approach to the hill, vehicles arrived to its base at low speeds. This impeded vehicle ascent; output flow dropped by about 10%; and this state of affairs persisted for the remainder of the rush. The more conspicuous details of this mechanism were observed in loop detector data measured over many days at the site, and are consistent with observations previously made at other sites. More subtle details became visible by examining thousands of vehicle trajectories extracted from a series of eleven roadside video cameras. Many of the subtleties are compatible with an existing theory of multi-lane traffic. All of this suggests that the present findings can be generalized to other uphill expressway segments. Practical implications are discussed. (...).

**Keywords:**

Expressway, Congestion, Uphill, Bottleneck, Speed disturbance, Lane-changing.

ID 2976 R

**MODELLING INTELLIGENT SPEED ADAPTATION**

Main Author:

**Ioanna SPYROPOULOU** (*National Technical University of Athens*)

Co-author(s):

**Benjamin HEYDECKER** (*Centre for Transport Studies, University College London*)**George YANNIS** (*National Technical University of Athens, Department of Transportation Planning and Engineering*)**Abstract:**

This study aims at incorporating the ISA system into a simulation model and at identifying the system effects on a small network. The simulation model that has been selected is SIGSIM, which is a simulation tool based on Gipps' car-following model. Gipps' model is of a microscopic nature and forms the basis of several simulation tools. The methodology that has been followed involves a simulator experiment at TRL to identify several parameters of driver behaviour when using ISA systems. Following this the investigation of Gipps' model parameters and the manipulation of the experiment results to resemble and represent Gipps' model parameters took place. Last, the identification of the code in SIGSIM where such parameters can be changed or manipulated, and the simulation of several scenarios were performed. The effects of the use of the different ISA system functionalities are identified through measures of operational performance, and results indicate that the effect of the system on the road network mainly depends on the functionality of the ISA and on the traffic flow conditions. The intervening ISA demonstrated the highest performance, and as the traffic flow increased from light to heavy flow the effect of the system was reduced.

**Keywords:**

Intelligent speed adaptation, Modelling, Speed limiter, Microsimulation, Intelligent transport systems.

ID 3228 R

**PASSING RATES TO MEASURE RELAXATION AND IMPACT OF LANE-CHANGING IN QUEUE**

Main Author:

**Soyoung AHN** (*Arizona State University*)

Co-author(s):

**Aurélien DURET** (*Université de Lyon, ENTPE-INRETS, Laboratoire de Ingénierie Circulation Transports LICIT*)**Christine BUISSON** (*Université de Lyon, ENTPE-INRETS, Laboratoire de Ingénierie Circulation Transports LICIT*)**Abstract:**

Passing rate measurements of backward-moving kinematic waves in congestion are applied to quantify two traffic features; a relaxation phenomenon of vehicle lane-changing and impact of lane-changing in traffic streams after the relaxation process is complete. The relaxation phenomenon occurs when either a lane-changer or its immediate follower accepts a short spacing upon insertion and gradually resumes a larger spacing. A simple existing model describes this process with few observable parameters. In this study the existing model is reformulated to estimate its parameter using passing rate measurements. Calibration results based on vehicle trajectories from two freeway locations indicate that the revised relaxation model matches the observation well. The results also indicate that the relaxation occurs in about 15 seconds and that the shoulder lane exhibits a longer relaxation duration. The passing rate measurements were also employed to quantify the post-relaxation impact of multiple lane changing maneuvers within a platoon of 10 or more vehicles in queued traffic stream. The analysis of the same datasets shows that lane-changing activities do not induce a long-term change in traffic states; traffic streams are perturbed temporarily by lane-changing maneuvers but return to the initial states after relaxations.

**Keywords:**

Passing rate, Lane-changing maneuvers, Relaxation.

ID 1222 R\*

**EVALUATION OF LEVEL OF SERVICE THROUGH CONGESTION ON URBAN ROAD LINKS**

Main Author:

**Sanjaykumar PATEL** (*Civil Engg. Department, L.D. College of Engineering, Govt. of Gujarat, India*)**Abstract:**

India has the second largest road network (4.25 million km) in the world, second only to the USA (6.75 million km). Presently, there are nearly 45 million vehicles in India and about 2.5 million are added every year. The volume of traffic on roads increases at the rate of 12% per annum. The rapid urbanization and growth of private vehicle ownership have caused an increase in road traffic congestion and degradation of level of service in most of the urban areas in India. All these roads do not follow the standard lane dimensions. Capacity augmentation and improvement in the Level of Service is normally achieved by widening existing roads. Due to the encroachment of abutting lands & non-availability of land, in many situations only partial widening of roads has taken place. In this paper, the objective is to understand the traffic congestions on such roads in terms of road congestion and level of service characteristics; and thereby explore the benefits, if any, from such an increase in road width. The effect of encroachments and on street parking on congestion level has been quantified.

**Keywords:**

Speed-Flow Relationship, Traffic Congestion, Model.

TUE 13<sup>th</sup> (08:15 - 09:30, Session C1.5) Room AIII

ID 1295 R

## **SPATIOTEMPORAL ANALYSES OF TRAFFIC FLOW RELATIONSHIPS**

Main Author:

**Kenneth KUHN** (*University of Canterbury*)

Co-author(s):

**Alan NICHOLSON** (*University of Canterbury*)

### **Abstract:**

Empirical data from the Tokyo Metropolitan Expressway show how relations between traffic flow, density and speed evolve as the data are aggregated spatially and temporally. Considering larger geographic areas or longer time frames consistently reduces scatter associated with fundamental traffic flow relationships, according to quantitative results presented here. We argue that econometric results largely explain the somewhat counterintuitive finding. The relatively strong explanatory power of traffic flow relationships in aggregated data stems from correlations between observations of traffic on adjacent links and at adjacent points in time, as well as loop detector observational error. The data actually support a stronger claim that estimates of flow across a large area based on the aggregate fundamental diagram outperform estimates based on the summation of terms from link-specific fundamental diagrams. This result again matches econometric findings.

### **Keywords:**

Traffic flow theory, Macroscopic fundamental diagram, Data aggregation.

TUE 13<sup>th</sup> (08:15 - 09:30, Session C1.5) Room AIII

ID 1939 R

## **DISCRETE THERMODYNAMICAL MODELLING OF TRAFFIC STREAMS**

Main Author:

**Milan KRBALEK** (*Czech Technical University of Prague*)

### **Abstract:**

We present some important results of a robust statistical analysis applied to freeway traffic data measured by induction double-loop detectors. We demonstrate that the fundamental microscopical quantities of traffic flow (e.g. clearance distribution, mental strain coefficient, spectral rigidity and so on) massively depend on an actual position of the traffic sample in the fundamental diagram (traffic flux vs. traffic density). Furthermore, we show that clearance distribution and spectral rigidity of the celebrated Nagel-Schreckenberg model (NaSchmodel) do not correspond to realistic traffic behaviour, although such a model, as well known, reproduces most of macroscopical traffic phenomena accurately. Exploiting the brand new knowledge on local thermodynamical features of vehicular streams we introduce thermal-like variant of the cellular NaSch-model which is powerful in both microscopical and macroscopical analysis of traffic.

### **Keywords:**

Traffic Modelling, Microscopical Structure of Traffic, Random Matrix Theory.

ID 2284 R

**EXPERIMENTAL OBSERVATIONS IN FREEWAY MERGES WITH RAMP METERING CONTROL**

Main Author:

**Nikolas GEROLIMINIS** (*University of Minnesota*)

Co-author(s):

**Anupam SRIVASTAVA** (*University of Minnesota*)**Panos MICHALOPOULOS** (*University of Minnesota*)**Abstract:**

An accurate density monitoring along a stretch of a freeway can be a useful piece of information to evaluate congestion levels, understand multiple traffic phenomena and develop efficient control strategies. While values of density near capacity are quite stable, bottleneck capacity has stochastic variations and a control strategy based on constant predetermined flow thresholds is likely to underload the freeway or, conversely, lead to traffic congestion. Following a different approach that attracted strong interest from Regional Transportation Management Center (RTMC) in Minnesota, we explore alternatives in developing the Next Generation strategy for the Twin Cities Metropolitan area freeway systems by focusing on density rather than flow. In the first part of the paper, we show empirical evidence in favor of the capacity drop phenomenon, we provide a methodology based on phase diagrams to quantitatively estimate the level of the drop, we investigate whether implementation of control strategies has an effect on the value of this capacity drop. In the second part of the paper, we develop a methodology to estimate densities with space and time based on data from loop detectors. The methodology is based on solving a flow conservation differential equation (using LWR theory) with intermediate (internal) freeway mainline boundaries, which is faster and more accurate from previous research using only external boundaries. To capture the capacity drop phenomenon into a first-order model we utilize a fundamental diagram with two values of capacity and we provide a memory-based methodology to choose the appropriate value in the numerical solution of the problem. Results compared with microsimulation of a long freeway stretch show that this model produces more reliable and accurate results than previous theories. (...).

**Keywords:**

Capacity drop, Freeway merge, Ramp metering, LWR t.

ID 2579 R

**WAVE PROPAGATION NUMERICAL SOLUTION FOR HIGHER ORDER MACROSCOPIC TRAFFIC MODEL IN THE PRESENCE OF INHOMOGENEITIES**

Main Author:

**Dong NGODUY** (*Institute for Transport Studies, University of Leeds*)**Abstract:**

In general, the higher order macroscopic traffic model consists of partial differential equations (PDEs) that are of hyperbolic type. Accordingly, the standard well-posed theory of the hyperbolic system and corresponding numerical solutions are applied straightforwardly. In the presence of in-homogeneities such as on-and off-ramps, the higher order model has a form of PDEs with stiff source terms (i.e. high inflows and outflows at on-and off-ramps). It has been reported that attempt to use the standard solutions for such PDEs with stiff source terms may result in incorrect propagation speeds of discontinuities. To this end, this paper is aimed to introduce a novel method, namely, wave propagation, to simulate the higher order macroscopic traffic model in the presence of in-homogeneities. The proposed method is of Godunov-type finite volume method which adopts Riemann problems to determine the cell interface fluxes at each time step. In this paper, the source terms are augmented in the Riemann solutions to determine the propagation waves arising in the Riemann problems. The performance of the wave propagation method in traffic flow simulations is investigated in comparison with the existing methods via numerical examples. It is found that the proposed method is more accurate than the others under the same mesh size.

**Keywords:**

Higher order macroscopic model, Riemann solutions, Wave propagation, Stiff source terms.

ID 1092 R

**MEASUREMENT MODELS AND CONSISTENCY ANALYSIS OF STOP-START WAVES AT SIGNALIZED INTERSECTIONS**

Main Author:

**Rong-Han YAO** (*School of Transportation and Logistics, Dalian University of Technology*)**Abstract:**

Stop and start waves are two special cases of shock waves. According to the different speed-density relationships describing traffic flows, this paper presents various stop-start wave models at signalized intersections based on the shock wave model deduced from hydrodynamics. Then, this paper develops the measurement model of stop-start waves based on kinetic equations by analyzing the kinetic characteristics of neighbor vehicles in a platoon of vehicles in the process of propagation of stop-start waves. It is found that the two kinds of models can transform mutually by the relationships among traffic flow parameters. Subsequently, the theoretical consistency of stop and start waves is explained. Furthermore, the stop-start wave model based on kinetic equations is validated and the consistency of stop waves and start waves is analyzed by the survey data from some typical road segments in the city of Dalian, China. And the means of the observed stop-start wave velocities from the different survey locations are compared. Finally, the methods and steps for calibrating those parameters and processing those independent variables are remarked for the two kinds of stop-start wave models. The findings of this paper include: 1) stop-start waves at signalized intersections have the theoretical and observational consistency; 2) the stop wave is slower than the start wave; 3) the measurement method based on kinetic equations is effective; and 4) its measured independent variables can be gotten from detectors. Thus, the model can be applied in traffic engineering practice.

**Keywords:**

Traffic engineering, Traffic flow, Stop-start waves, Measurement model, Kinetic equation.

ID 1967 R

**BEFORE-AFTER STUDY OF SIGNALIZED INTERSECTIONS WITH VISUAL CYCLE IN THE CITY OF SÃO CARLOS, BRAZIL**

Main Author:

**Barbara BEZERRA** (*Departamento de Transportes EESC/USP*)

Co-author(s):

**Antonio CLÓVIS PINTO FERRAZ** (*Departamento de Transportes EESC/USP*)**Luciana MARIA GASPARELO SPIGOLON** (*Departamento de Transportes EESC/USP*)**Jorge TIAGO BASTOS** (*Departamento de Transportes EESC/USP*)**Abstract:**

The main purpose of this paper is to compare the common traffic lights (CTL) versus traffic lights with visual cycle (TLVC) to green and red phase, and assess their effects on road safety. The comparison among CTL and TLVC is justified by the fact that there are no studies on the effect of TLVC with respect to its performance in terms of traffic safety. An observational before-after study was conducted to evaluate the safety in a period of one year before and one year after the implementation of the TLVC. This study used a comparison group of two intersections without the treatment. The results indicate that no conclusions can be built about the safety effect of the TLVC on safety with the data available.

**Keywords:**

Before-after study, Traffic lights with countdown time, And traffic safety.

ID 2202 R

**APPROXIMATE DYNAMIC PROGRAMMING FOR  
MULTIPLE INTERSECTION CONTROL**

Main Author:

**Chen CAI** (*National ICT Australia*)

Co-author(s):

**Tung LE** (*University of New South Wales and NICTA*)

**Abstract:**

In this paper we propose a distributed control method based on approximate dynamic programming for traffic networks. A closed-form linear function is used to map state to scalar quantity as an approximation to the look-up table presentation of exact quantities used in dynamic programming. This substantially reduces computational requirement and makes the proposed method conforming to real-time operation. Temporal-difference learning is used to improve approximation at real-time. A cellular automation model is used to describe traffic dynamics in road networks. We show in numerical experiments that the proposed approach significantly improves control performance from optimised fixed-time plans in a range of test scenarios. Indicator for control performance is weighted sum of vehicle delays and stops.

**Keywords:**

Approximation, Dynamic programming, Distributed control.

ID 2359 R

**REAL TIME INTERVENTION IN TRAFFIC SIGNALS  
USING FIXED-TIME AND TRAFFIC RESPONSIVE  
SIGNAL CONTROL STRATEGIES**

Main Author:

**Dimitris SERMPIS**

**Abstract:**

The aim of this study is twofold. First, to describe the interventions in the traffic signal programs using fixed-time signal control strategies and to estimate the effect of these offand on-line changes on traffic and on the messages being displayed on the Variable Message Signs. The second aim is to describe the traffic responsive operation that has been developed by the ATMC by using the specific characteristics of the hardware at its disposal (detectors, traffic controllers), how this has been applied to intersections that present substantial variation in the incoming traffic flows and the effect of these traffic responsive signal control strategies on traffic in terms of traffic flow, average vehicle speed and resulting traffic conditions. Finally, the implications of the travel times being displayed on VMS due to the adaption of traffic responsive signal control strategy are considered.

**Keywords:**

Signal control strategy, Traffic responsive, On-line signal control changes, VMS, Travel times.

MON 12<sup>th</sup> (11:15 - 12:30, Session C2.1) Room All

ID 2760 R

## PERFORMANCE POTENTIAL OF SIGNALIZED ARTERIALS AND INTERSECTIONS

Main Author:

**Nathan GARTNER** (*University of Massachusetts Lowell*)

Co-author(s):

**Rahul DESHPANDE** (*University of Massachusetts Lowell, USA*)

**Chronis STAMATIADIS** (*University of Massachusetts Lowell*)

### Abstract:

Intersection capacity is a scarce resource which needs to be allocated economically. Traffic control at signalized intersections involves balancing competing demands of conflicting traffic streams for limited capacity at the intersection. Similarly, progression schemes on two-way arterial streets involve a compromise between the demands of opposing and competing traffic streams along the arterial. In both cases there is a tradeoff between the performance advantages that each traffic stream can enjoy and there is a need for a tool to assess the performance potential of the signals. This phenomenon is akin to tradeoffs in production capabilities of economic systems that gives rise to the well-known Production Potential Frontier. We introduce similar concepts for signalized intersections and coordinated arterial streets. We call them the Transition Potential Frontier (TPF) and the Progression Potential Frontier (PPF), respectively. We then introduce a number of criteria to assess the performance of signalized intersections and arterials using the Level-of-Service (LOS) concept. These criteria lead to rational design and evaluation procedures which are essential in obtaining the best performance from the traffic signals.

### Keywords:

Traffic Signals, Signal Control, Coordination, Quality of Progression, Level-of-Service.

MON 12<sup>th</sup> (14:00 - 15:15, Session C2.2) Room All

ID 1867 R

## PREDICTION OF TRAIN RUNNING TIMES AND CONFLICTS USING TRACK OCCUPATION DATA

Main Author:

**Rob GOVERDE** (*Delft University of Technology*)

Co-author(s):

**Dirk VAN DER MEER** (*Technical University Delft, faculty of Civil Engineering and Geosciences*)

**Ingo HANSEN** (*TU Delft*)

### Abstract:

In order to reduce delays in a railway system and to prevent them from propagating through the network, a train dispatcher can apply dispatching actions, for example by changing the location of a planned overtaking, or cancelling a train connection. When deciding which dispatching measure to apply, the dispatcher needs to estimate the consequences in advance. This asks for the possibility to predict the train traffic in the near future (e.g. one hour ahead), based on the current state of the railway system. This is complicated, since running times of trains are affected by complex dependencies between trains caused by the infrastructure and the timetable, and their stochastic behaviour. Consequently, existing train delays may increase or decrease during a train run, making it difficult to predict more accurately the running times of a delayed train and the consequences for other trains affected by its delay. Moreover, dispatchers need real-time predictions, so only little time is available for performing the necessary calculations. The delay propagation model presented in this paper uses stored historic track occupation data, thus exploiting past information about specific train runs for actual predictions. The parameters for this model have been determined by statistical inference of historical track occupation data stored by ProRail, the Dutch infrastructure manager. The data, containing the occupation and release times of individual infrastructure elements at an accuracy of one second, has been prepared using the recently developed software TNV-Conflict [see Daamen et al., 2009]. Each dependency between the delays of trains using shared routes over the infrastructure leads to a new model parameter, expressing the influence at current and near-future train operations. (...).

### Keywords:

Running time prediction, Delay propagation, Track occupation data, Train conflicts.

ID 2382 R

**SIMULATION MODEL OF RAILWAY JUNCTION BASED ON PETRI NETS AND FUZZY LOGIC**

Main Author:

**Sanjin MILINKOVIC** (*University of Belgrade - Faculty of transport and traffic engineering*)

Co-author(s):

**Slavko VESKOVIC** (*University of Belgrade - Faculty of transport and traffic engineering*)**Milan MARKOVIC** (*University of Belgrade - Faculty of transport and traffic engineering*)**Milos IVIC** (*University of Belgrade - Faculty of transport and traffic engineering*)**Norbert PAVLOVIC** (*University of Belgrade - Faculty of transport and traffic engineering*)**Abstract:**

Railway tracks with junction have lower safety, railway track capacity is limited, and they also require specific traffic management. When determining optimal infrastructural and technological solutions for junction, it is essential to evaluate its parameters for various volumes of traffic, operating conditions, junction design and safety conditions. Complex traffic systems, like junctions, cannot be accurately described in detail by using analytical or graphical methods. Thus, a simulation model is proposed where junction systems are modeled by High Level Petri Nets. Petri Nets formalism is an effective and advantageous way to develop model for simulating processes on railway junction including safety requirements, train spacing, timetable and infrastructure data. Tokens represent trains, and places represent track sections. Model enables experimenting with input data (infrastructure design, train spacing, timetables, etc.). Each type of section is represented by subnet module, and model is created by connecting modules according to junction system section plan. Input data (timetable, train specification, and track parameters) are imported to model from an external database. Simulation results are stored in database and then presented as data tables, animation of track occupancy and train diagram (time – distance diagram). Train delays in model are calculated by fuzzy logic system. (...).

**Keywords:**

Railway, Junction, Petri nets, Fuzzy Logic, Simulation model.

ID 2508 R

**LUKS ? ANALYSIS OF TRACKS AND JUNCTIONS**

Main Author:

**David JANECEK** (*Verkehrswissenschaftliche Institut der RWTH Aachen*)

Co-author(s):

**Frederic WEYMANN** (*Verkehrswissenschaftliche Institut der RWTH Aachen*)**Abstract:**

In the context of railway operation, infrastructure and timetables are heavily related to each other. Every change in the infrastructure may affect the quality of service, or will even result in an unusable timetable. On the other hand, updates of the timetable may result in an unacceptable infrastructure utilisation, yielding to the necessity of track reconstruction. As infrastructure changes are time and cost-intensive, various methods exist to evaluate the quality of either an infrastructure layout or a timetable, given the other one. Depending of the precision of the available data, different approaches are feasible. In the case of a long-term analysis, when merely rough traffic flow information is at hand, methods of the queuing theory are used. Mid-term analysis, which considers single infrastructure changes or compares different possible timetables, is done with simulative approaches. Finally, short-term questions like small changes to the current schedule are answered by constructive methods. For all of these approaches, particular software tools exist. This paper introduces the software tool LUKS, which is to the best of our knowledge the first integrated tool for all these three approaches. Based on detailed tracks and station layouts and a more or less accurate timetable, the different LUKS modules help infrastructure experts to determine the possible quality of service for a certain time horizon. Thanks to the sophisticated calculation of running and blocking times, the timetable construction turns into an interactive task with real-time conflict detection. The analytical parts of LUKS are based on the established tools ANKE und SLS and use different queuing theoretical methods. (...).

**Keywords:**

Analysis, Infrastructure, Railway operation, Simul.



ID 2816 R

**ROBUSTNESS AND DELAY REDUCTION OF  
ADVANCED TRAIN DISPATCHING SOLUTIONS UNDER  
DISTURBANCES**

Main Author:

**Giorgio MEDEOSI** (*Department of Civil and  
Environmental Engineering, University of Trieste*)

Co-author(s):

**Francesco CORMAN** (*Transport and Planning  
Department, Delft University of Technology*)**Andrea D'ARIANO** (*Dipartimento di Informatica e  
Automazione, Università degli Studi Roma Tre*)**Giovanni LONGO** (*Dept. of Civil and Environmental  
Engineering, University of Trieste*)**Abstract:**

Railway traffic is normally managed on the basis of a detailed plan of operations in order to optimize the use of infrastructure capacity by distribution of suitable time margins that can absorb minor delays. However, during operations major disturbances may influence the timetable feasibility and real-time adjustments of train timing and orders are required to assure compatibility with the real traffic situation and to limit delay propagation. This task is currently performed manually by dispatchers, while simple automated conflict detection and resolution systems are adopted to identify and solve train conflicts locally. Recently, innovative decision support systems have been developed to optimally reschedule trains in complicated railway areas with dense traffic and multiple delayed trains. In this paper the performance of such a system (ROMA) is evaluated, with regard to the robustness of its train dispatching solutions, by investigating the effects of small stochastic variations in input data on the quality of the dispatching solutions. An original simulation setup is proposed in which ROMA first computes train schedules that minimize delays in case of perturbed operations, and the resulting solutions are then validated by means of the microsimulation tool OpenTrack. Small stochastic variations are considered when evaluating a dispatching solution in order to simulate errors in input data. Robustness of the solutions is measured as variability of output delays for each scenario under the inserted stochastic phenomena. In most of the cases a First In First Out strategy is not able to solve conflicts without causing delay propagation. (...).

**Keywords:**

Railway operations, Rescheduling, Stochastic micro.

ID 3219 R

**A STOCHASTIC MODEL FOR SWITCHING TIMES FOR  
TRAINS WITH POWERED FREIGHT WAGONS**

Main Author:

**Andreas TANNER** (*TU Berlin*)

Co-author(s):

**Kay MITUSCH** (*University of Karlsruhe*)**Abstract:**

FlexCargoRail is a technology project aiming to increase efficiency of freight railway operations, particularly, the segment of transport on the last mile and shunting operation. The basic idea is to enhance rail cars with rechargeable battery-powered engines and remote control, thus allowing to switch cars without use of a shunting engine. In this paper we provide an OR model aimed at measuring the savings potential of this technology. We find that this innovation is likely to become profitable. Moreover, we can determine an optimal share of FlexCargoRail cars in the whole fleet. For several parameter values it turns out that this innovation is likely to be profitable already at a low share, so that the conditions for its introduction seem to be particularly good.

**Keywords:**

Railway operation freight traffic .

ID 1298 R

**EVALUATION OF SIGNAL COORDINATION FOR  
PEDSTRIAN AND VEHICULAR FLOWS**

Main Author:

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Nagoya University*)

Co-author(s):

**Meng LI** (*Department of Civil Engineering, Nagoya  
University*)**Hideki NAKAMURA** (*Department of Civil Engineering,  
Nagoya University*)**Winnie DAAMEN** (*Department of Transport and Planning,  
Faculty of Civil Engineering and Geosciences, Delft  
University of Technology*)**Abstract:**

Existing signal control strategies do not consider pedestrian flows in optimizing signal parameters, which may impose significant delays on pedestrians. The objective of this study is to investigate the rationality and efficiency of pedestrian coordination. A Japanese numerical case study is analyzed. Field survey is conducted to collect the geometric characteristics, signal timings and vehicular traffic condition information. The performance of signal coordination for vehicular traffic and pedestrian traffic is estimated by using the microscopic traffic simulation program AIMSUN and the microscopic pedestrian simulation program NOMAD in a parallel approach. It is concluded that the coordination for pedestrian flows could significantly reduce the overall pedestrian delay. It was found that coordinating the major pedestrian flow in the case study led to a 15% reduction in the average pedestrian delay. However, this reduction is much lower than what can be achieved for the vehicular traffic under the optimized signal offset. It is because that the efficiency of signal coordination for pedestrian flows is dependent on several factors, such as the variations of pedestrians' desired speed, densities of pedestrian flows, link lengths between intersections and signal cycle length.

**Keywords:**

Coordination, Pedestrian, Platoon dispersion, Microscopic simulation.

ID 1407 R

**BEHAVIOR AND CONSCIOUSNESS ANALYSES ON  
EFFECT OF SEPARATED TRAFFIC SIGNAL CONTROL  
FOR PEDESTRIANS**

Main Author:

**Koji SUZUKI** (*Nagoya Institute of Technology*)

Co-author(s):

**Motohiro FUJITA** (*Nagoya Institute of Technology*)**Abstract:**

Fatal traffic accidents in Japan occur about five thousand a year, and the value is on a declining trend, recently. On the other hand, the proportion of fatal accident of elderly people is increasing yearly and the percentage of fatal accidents while walking is also high. Moreover, as for the site of accidents, it is shown that about half of accidents occurred at intersections or near the intersections as reported by National Police Agency (2009). Because of this situation, it is required to implement the countermeasures for pedestrians' safety at intersections. In recent years, it has been introduced the separated traffic signals for pedestrians, which are temporally-separated the right-of-way of pedestrians from that of turning vehicles, in order to reduce the traffic accidents in which cars turning right or left hit pedestrians crossing the intersections as shown in the manual of JSTE (2006). It is expected that this signal control significantly improves the traffic safety because it removes the opportunities of traffic conflicts between vehicles and pedestrians in principle. However, this control induces the longer waiting time than unseparated-type traffic signal control due to an increase in the number of exclusive phase for a limited cycle length. As a result, there is concern that both the decrease in traffic efficiency and the increase in risky behaviors such as ignoring a traffic light are induced by the longer waiting time. As the existing researches for this signal control, Sasaki et al (2002). evaluated the effectiveness of the system, which separates the right-of-way of pedestrians from that of vehicles by using a push-button signal, through questionnaire and observation and revealed that this signal control contributes to bring a sense of ease for elderly people and children. (...).

**Keywords:**

Separated Traffic Signal Control for Pedestrians,

ID 1864 R

**ADEQUACY OF OPERATION AND DELAYS AT SIGNAL CONTROLLED CROSSINGS WITH AND WITHOUT PEDESTRIAN DETECTION**

Main Author:

**John PARKIN** (*University of Bolton*)**Abstract:**

Vehicle and pedestrian detection offered by 'Puffin' type control at signal controlled mid-block crossings is recommended by the UK Department for Transport for new installations and refurbishments of existing signal controlled crossings. Puffin type control uses on-crossing detection to vary the green time and uses waiting area detection to cancel demand if pedestrians move away after calling a pedestrian stage. A survey of delays over fifty cycles caused to pedestrians and vehicles at three Puffin and three Pelican crossings (without pedestrian detection) with matched attributes has been conducted. Pedestrian arrival times, time of demand request, pedestrian crossing times and vehicle delays were recorded. Observations have been collected on pedestrians' behaviour relating the time when they called for a pedestrian stage, the time of the invitation to cross and the time at which they actually crossed. Analysis of the data shows that there is an increase in delay to pedestrians and vehicles at Puffin crossings when compared with equivalent Pelican crossings. The increase in vehicle delay results from the generally longer time to return to a green signal aspect for motor traffic after a pedestrian green aspect. The data show that this additional time is not required for pedestrians to clear the crossing. The suggestion is that the flashing amber period of a Pelican, which occurs after the green period for pedestrians, performs this function adequately. Even under the high vehicle flow conditions which obtained during the survey periods, significant non-compliance in pressing the button to create a demand was observed at Puffins (maximum 28%), and this was more than at Pelicans (maximum 23%). (...).

**Keywords:**

Pedestrians, Signal control.

ID 2290 R

**SELF-ORGANIZATION OF PEDESTRIAN FLOW WITH A GAME THEORY BASED MICROSCOPIC SIMULATION**

Main Author:

**Miho ASANO** (*Nagoya University*)

Co-author(s):

**Takamasa IRYO** (*Kobe University*)**Masao KUWAHARA** (*Institute of Industrial Science, The University of Tokyo*)**Abstract:**

This study aims to analyze a self-organization of a pedestrian flow with a game theory based microscopic simulation so as to propose controlling strategies that can realize smoother pedestrian movements. It is known that a pedestrian flow containing different directions of movements can be self-organized under certain conditions and the self-organization can be utilized to improve the level of service of pedestrian facilities. To investigate the selforganization, this study adopts a microscopic simulation that incorporates game theory to describe pedestrian decisions in their movements. It is revealed that, in an intersection with four-direction streams, putting obstacles in a certain alignment can promote the selforganization of pedestrians and improve their average travel times.

**Keywords:**

Pedestrian simulation, Self organization, Game theory.

MON 12<sup>th</sup> (15:30 - 16:45, Session C2.3) Room All

ID 2484 R

**PEDESTRIAN TRAFFIC MANAGEMENT: A NEW EVACUATION MODEL**

Main Author:

**Mario MARINELLI** (*Politecnico di Bari*)

Co-author(s):

**Mauro DELL'ORCO** (*Politecnico di Bari*)

**Abstract:**

Some recent tragic events in overcrowded situations, as well as the terrorist threat, have highlighted the importance of the availability of good models for pedestrian behaviour under emergency conditions. Existing approaches to crowd models are generally macroscopic or microscopic. In the first case, the crowd is considered to be like a fluid, so that its movement can be described through differential equations. In the second case, the collective behaviour of the crowd is the result of interactions among individual elements of the system. In this paper, we propose a microscopic model of crowd evacuation that incorporates the fuzzy perception and anxiety embedded in human reasoning. A Visual C++ application was developed to evaluate the outcomes of the model. The model was tested in scenarios with presence of fixed obstacles and fire. The simulation result was compared to those obtained by other existing models and it seems to be quite satisfactory.

**Keywords:**

Pedestrian behaviour, Fuzzy logic, Micro-simulation modelling, Evacuation management.

MON 12<sup>th</sup> (17:00 - 18:15, Session C2.4) Room All

ID 2120 R

**A FRAMEWORK FOR ANALYZING OPERATIONS CONTROL INTERVENTIONS ON METRO TRANSIT LINES USING AUTOMATICALLY COLLECTED OPERATIONAL AND PASSENGER TRAVEL TIME DATA**

Main Author:

**André CARREL** (*University of California at Berkeley*)

Co-author(s):

**Rabi G. MISHALANI** (*The Ohio State University*)

**Nigel H.M. WILSON** (*Massachusetts Institute of Technology*)

**John P. ATTANUCCI** (*Massachusetts Institute of Technology*)

**Abstract:**

Operations control, the task of implementing the timetable in daily operations on a metro line, plays a key role in service delivery, as it determines the quality of the service as provided to passengers. Despite its critical importance, it is one of the most poorly understood aspects of rapid transit operations. This paper proposes a new framework for the study of rail operations control, which builds on the integration and analysis of data from multiple sources and on background knowledge about operations control. The framework takes into account the decision environment in which operations control takes place and acknowledges that the reliability of the resulting service depends on many factors endogenous to it, aspects previously not recognized in a comprehensive manner by researchers and practitioners alike. As part of the framework, it is shown how analysts can make use of automatically generated operational and passenger data, which are increasingly available and accessible to transit agencies and allow for addressing questions in operations control from multiple perspectives. As a result, this paper takes a distinctly different approach than previous research, which has relied heavily on modeling and on simplifying assumptions about the objectives and constraints of operations control on a metro line. (...).

**Keywords:**

Rapid transit, Rail operations control, Operational data analysis, Research framework, Service stability and reliability, Performance measurement, Disruption management and recovery, Automated data, Passenger travel times.

MON 12<sup>th</sup> (17:00 - 18:15, Session C2.4) Room All

ID 2357 R

### **A PRACTICAL APPROACH FOR DESIGN OF BUS SIGNAL PRIORITY STRATEGY**

Main Author:

**Rui WANG** (*Yokohama National University*)

Co-author(s):

**Sunghyu BAEK** (*Dept of Civil Eng., Yokohama National University*)

**Toshiyuki OKAMURA** (*Yokohama National University*)

**Fumihiko NAKAMURA** (*Dept of Civil Eng., Faculty of Eng, Yokohama National University*)

#### **Abstract:**

In this paper, we propose the application of Door Open and Closure Information (DOCI) in design of Bus Signal Priority Strategy (BSPS) for urban signalized intersections. Current BSPS methods most likely involved location information collected by vehicle detector or GPS (Global Positioning System) technologies only. It is difficult to take the uncertainty of bus dwell time on bus stops in proper considerations. The proposed design is validated by a practical case study through microscopic traffic simulation. The results show that, with no unbearable burdens on other traffic modes, our proposed method can significantly improve the delays of buses at a signalized intersection located in Seoul, South Korea.

#### **Keywords:**

Bus priority, Signalized intersection, Traffic simulation.

MON 12<sup>th</sup> (17:00 - 18:15, Session C2.4) Room All

ID 2414 R

### **A SYSTEMATIC APPROACH TO BUS SIGNAL TIMING IN BUS PASSIVE PRIORITY**

Main Author:

**Yohee HAN** (*University of Seoul*)

Co-author(s):

**Youngchan KIM** (*University of Seoul*)

#### **Abstract:**

This paper designed a practical method of bus signal timing with PASSER and Transyt-7F in order to enhance bus travel speed. We had focused on bus progression control out of bus passive priority to minimize bus travel time, because car travel time was very different with bus travel time for bus dwell time. Purposes of this method are maximizing a bus bandwidth and minimizing a change of car delay time, so that we divided this practical method into three steps. First was a step of estimating bus travel time after considering bus dwell time and bus running time included acceleration/deceleration time. Second was maximizing a bus bandwidth with PASSER in order to increase probability of bus non-stop at intersections. Third was minimizing a car delay time without a change of bus bandwidth by using slack green on Transyt-7F. To evaluate of this combined use, we simulated the bus exclusive lane on median at Goyang-si on VISSIM. This systematic approach had a good effect as the result that bus travel time reduced and car delay time slightly increased.

#### **Keywords:**

Bus signal timing, Passive priority, Combined use, Bandwidth, Slack green.

ID 2603 R  
**INTEGRATING TIMETABLE RECOVERY AND ROLLING STOCK RESCHEDULING**

Main Author:

**Ángel MARÍN** (*Politechnical University of Madrid*)

Co-author(s):

**Luis CADARSO** (*Universidad Politécnica de Madrid*)

**Abstract:**

During daily operations of a railway network incidents may cause the railway traffic to deviate from the planned operations. In this situation new plans must be designed in order to operate under the new conditions and to recover network operations to the usual plan once the incident has finished. In this work, timetable and rolling stock rescheduling are addressed in an integrated way. The incidence may become the planned timetable inefficient or even impossible to operate. Thus, a new service schedule must be designed minimizing some operator and passengers costs. As far as the timetable is changed the rolling stock assignment must be revised. The rolling stock rescheduling assigns the different material types to the previous redefined services and decisions about the aggregation and disaggregation of the convoys in the depot stations are taken. We illustrate our model using computational experiments drawn from RENFE (the main Spanish operator in suburban trains of passengers) in Madrid, Spain.

**Keywords:**

Rolling Stock Rescheduling, Timetable Recoverability, Integration.

ID 3075 R  
**ANALYTICAL AND EMPIRICAL INVESTIGATIONS OF THE EFFECT OF BUS DRIVERS' REACTIONS TO SCHEDULES ON TRANSIT OPERATIONS RELIABILITY**

Main Author:

**Rabi G. MISHALANI** (*The Ohio State University*)

Co-author(s):

**Yuxiong Ji** (*The Ohio State University*)

**Mark R. MCCORD** (*The Ohio State University*)

**Abstract:**

This paper presents an investigation and quantification of the effect of bus drivers' reactions to schedules on transit operations reliability following both analytical and empirical treatments. Understanding drivers' behavior would be useful for developing simulation tools, designing bus schedules, evaluating transit operations reliability, and developing real-time control strategies. Two hypotheses are investigated: (i) drivers may lengthen (shorten) the dwell times at stops (including time-points and other stops) if buses arrive early (late), and (ii) drivers may slow down (speed up) along the roadways between consecutive stops if buses are ahead of (behind) the schedule with the intent of maintaining the schedule. The investigation begins with the development of an analytical model followed by an empirical study. In the developed analytical model, the effect of drivers' reactions to the schedule at bus stops is represented by the covariance between the arrival time deviation from the schedule and dwell time with respect to the same stop. The ability of drivers to lengthen (shorten) the dwell times when buses arrive early (late) is reflected in a negative magnitude of this covariance. Similarly, the effect of drivers' reactions along the roadways between consecutive stops is represented by the covariance between the departure time deviation from a schedule with respect to a stop and the bus travel time between that stop and the next downstream stop. The ability of drivers to adjust speeds according to the schedule is reflected in a negative magnitude of this covariance. However, it is also recognized that drivers' reactions to the schedule may be constrained by factors such as heavy passenger demand at stops, traffic congestion, limited bus parking space at stops, and roadway geometry constraints. (...).

**Keywords:**

Transit reliability, Holding, AVL, Schedules.

TUE 13<sup>th</sup> (08:15 - 09:30, Session C2.5) Room All

ID 3035 R

### TURN SPECIFIC VS. LINK BASED TRAVEL TIMES

Main Author:

**Elmar BROCKFELD** (DLR-Institute of Transport Systems)

Co-author(s):

**Alexander SOHR** (DLR - Institute of Transport Systems)

**Thorsten NEUMANN** (DLR-Institute of Transport Systems)

**Günter KUHNS** (DLR-Institute of Transport Systems)

#### Abstract:

Floating car data (FCD) meanwhile is a widely available and affordable data source. The given GPS data – delivered in frequencies of some seconds or sometimes only a few minutes – are typically matched to some digital road network and mainly the traffic variables travel time or travel speed are calculated out of it, yielding current values for each link in the road network with at least one observed GPS position. With regard to route planners or navigation systems for example, the information could be even more precise as there is typically no distinction drawn between different turning directions at intersections. Taking the according and presumably varying travel times into account might result in improved navigation solutions. This contribution quantifies the travel time variations regarding different driving directions at several junctions in the German city of Berlin. For this purpose, GPS positions delivered by a fleet of about 4000 taxis covering some months of data are used. Traffic data are decomposed and the resulting turn specific travel times are compared.

#### Keywords:

Traffic data collection, Floating car data, Probe vehicle data, Travel times, Travel speeds, Turn-dependence.

TUE 13<sup>th</sup> (08:15 - 09:30, Session C2.5) Room All

ID 3044 R

### NETWORK OPTIMIZATION WITH DYNAMIC TRAFFIC INFORMATION AND TOLLING: A PROBABILISTIC MODEL AND ECONOMIC ANALYSIS

Main Author:

**Thai PHU NGUYEN** (Université Paris-Est/ UMR LVMT)

Co-author(s):

**Fabien LEURENT** (Université Paris Est)

#### Abstract:

A model is developed for traffic network subject to recurrent congestion and incidental disturbances on link travel times with the presence of dynamic traffic information, and two classes of users respectively informed and uninformed. This traffic assignment model is bilayered every informed user chooses his route for the short run in any circumstance, whereas every non-informed user chooses his route on for the long run an average basis. In addition to to dynamic traffic information service, congestion pricing with various tolling strategies like no-tolling, flat tolling or dynamic tolling is also integrated to the model. This model allows us to analyze the combined operation of two traffic demand management tools as well as the interplays between these tools with recurrent congestion, non-recurrent congestion and users' behaviors. The model is applied for a two-parallel-link network with one O-D pair and linear travel time functions and additive random disturbances. Analytical formulae and numerical investigation show that the benefits from such combined traffic management system split into three parts: benefit from information and benefit from congestion pricing and benefit from joint operation. The complementarities are highly efficient at high equipment rate with dynamic tolling.

#### Keywords:

Dynamic Traffic Information, Multi-class Traffic Assignment, Bi-layer Equilibrium, User Optimum, System Optimum, Congestion pricing.

ID 3080 R

**SYSTEM AUTOMATIC TRAFFIC MONITORING TO OBTAIN THE MATRIX O/D: CASE STUDY IN BRASILIA-DF, BRAZIL**

Main Author:

**Adriel LOPES** (*Universidade de Brasília*)

**Abstract:**

This paper proposes the use of computational vision and artificial intelligence techniques to vehicle counting and tracking in a multiple street scenario, using optical character recognition to link the same car in two different observation posts using the license plate. Besides counting and tracking, the system also classifies vehicles in four different classes: trucks, buses, van and cars. With the identification of vehicles and their classifications arise tools to plan and manage transportation data with actual road behavior. Allowing us to obtain a traffic system consistent with the reality of the urban. With Automatic Traffic Monitoring was able to get a Matrix O / D, quickly, efficiently and with little manpower.

**Keywords:**

Matrix O/D, Computational Vision, Artificial Intelligence, Transportation planning.

ID 3104 R

**A SIMPLE DATA FUSION METHOD FOR INSTANTANEOUS TRAVEL TIME ESTIMATION**

Main Author:

**Rattaphol PUEBOOBPAPHAN** (*University of Twente*)

**Abstract:**

Travel time is one of the most understandable parameters to describe traffic condition and an important input to many intelligent transportation systems applications. Direct measurement from Electronic Toll Collection (ETC) system is promising but the data arrives too late, only after the vehicles complete their trip. There are several existing models with varying degree of success to indirectly estimate travel time from loop detector. The performance of these models depends significantly on the variation of traffic condition. By closely looking at the time-series of the estimated travel time with the actual travel time, the error was found to follow a specific pattern for each traffic condition. The goal of this research is to develop a simple data fusion between loop detector data and ETC data to make more accurate estimation of instantaneous travel time on expressway corridor. With the error pattern for each traffic condition in mind, it is possible to develop a simple fusion method that can improve the accuracy of travel time estimate even under sparsely distributed detectors.

**Keywords:**

Travel time estimation, Instantaneous travel time, On-line estimation, Data fusion, Electronic toll collection, Detector data.



ID 3258 R\*

**NEIGHBOR LINKS TRAVEL TIME ESTIMATION**

Main Author:

**Mohamed ELESANEY** (*University of British Columbia*)

Co-author(s):

**Tarek SAYED** (*Department of Civil Engineering, The University of British Columbia*)**Abstract:**

In our previous research, the concept of travel time neighbourhood was introduced. The term "neighbours" describes nearby segments that have similar characteristics and are subject to similar traffic conditions in a road network. A framework was developed for travel time estimation on a road network using sparse travel time data. Specifically, the purpose was to estimate travel times on links not covered with sensors by using their travel time relationships with neighbour links. Herein lies a potential solution to the problem of having partial network sensor coverage caused by a small sample of probe vehicles, or a limited number of detectors. The proposed framework can be described by four modules: identification of link neighbours, choice of the modelling technique, application entity (e.g. link or corridor), and source of neighbour links travel time data. In this research, the impact of the probe vehicles' sample size on the proposed framework was analyzed. A case study was applied to the downtown Vancouver road network in British Columbia using a VISSIM micro-simulation model. The simulation model was calibrated and validated using real-life traffic volumes and travel time data. Three different levels of probe vehicles market penetration were tested: 1%, 3%, and 5%. As well, three methods were proposed to fuse link historical data and real-time neighbours' data. The accuracy of the proposed methodology was assessed by the Mean Absolute Percentage Error (MAPE). In general, the average MAPE was between 12.7% and 16.2% for the three tested market penetration levels. Assigning weights according to the variances of link historical data and real-time travel time estimates was shown to outperform the other two fusion methods. (...).

**Keywords:**

Travel time estimation, Neighbour links, Micro-simulation.

ID 1204 R

**A SIMULATION-BASED OPTIMIZATION FRAMEWORK FOR URBAN TRAFFIC CONGESTION MANAGEMENT**

Main Author:

**Carolina OSORIO** (*Transport and Mobility Laboratory, EPFL*)

Co-author(s):

**Michel BIERLAIRE** (*Transport and Mobility Laboratory, EPFL*)**Abstract:**

Microscopic simulators embed numerous traffic models that make them detailed and realistic tools appropriate to perform scenario-based or sensitivity analysis. This realism leads to nonlinear objective functions with no available closed form and containing potentially several local minima. As nonlinear, stochastic and evaluation-expensive models, their integration within an optimization framework remains a difficult and challenging task. We believe that in order to perform both fast and reliable simulation optimization for congested networks, information from the simulation tool should be combined with information from a network model that analytically captures the structure of the underlying problem. This paper presents a surrogate that combines the information from a calibrated microscopic traffic simulation model of the Lausanne city center (Dumont and Bert, 2006), with an analytical queueing network model (Osorio and Bierlaire, 2009a) that resorts to finite capacity queueing theory to capture the key traffic dynamics and the underlying network structure, e.g. how upstream and downstream queues interact, how this interaction is linked to network congestion. This network model, which consists of a system of nonlinear equations, has been successfully used in past work to solve traffic signal control problem (Osorio and Bierlaire, 2009b). We integrate this surrogate within a derivative-free (DF) trust region optimization framework (Conn et al., 2009a). Resorting to a DF algorithm is particularly appropriate for noisy problems where the derivatives are difficult to obtain and often unreliable. This is also the case when the evaluation of the objective function is computationally expensive, or when the simulation source code is unavailable. (...).

**Keywords:**

Traffic control, Simulation-Optimization, Metamodel, Queueing.

TUE 13<sup>th</sup> (09:45 - 11:00, Session C2.6) Room All

ID 1274 R

**TRAFFIC FLOW MODELING AND OFFSET OPTIMIZATION IN URBAN ROAD NETWORKS WITH AN ENHANCED CELL TRANSMISSION MODEL AND GA**

Main Author:

**Jannis ROHDE** (*Institute of Transportation and Urban Engineering, TU Braunschweig*)

**Abstract:**

The Cell Transmission Model (CTM) by Daganzo was enhanced in order to deal with signalized multi-lane junctions. In combination with an offset optimization algorithm based on genetic algorithms and a graphical user interface, the enhanced CTM was applied to a test area in Hannover, Germany. The thus optimized traffic control proved a significant improvement of traffic flow considering reduction of travel time and number of stops.

**Keywords:**

Traffic Flow Modeling, Offset Optimization, Cell Transmission Model, Genetic Algorithm.

TUE 13<sup>th</sup> (09:45 - 11:00, Session C2.6) Room All

ID 1684 R

**SPEED MANAGEMENT STRATEGIES AND DRIVERS' ATTITUDE IN THAILAND**

Main Author:

**Kunnawee KANITPONG**

Co-author(s):

**Piyapong JIWATTANAKULPAISARN**  
**Wootichai YAKTAWONG**

**Abstract:**

In Thailand where speeding on highways and roads has been a key contributing factor in road traffic crashes, considerable efforts to control vehicle speeds have been made, mostly involving speed law enforcement. However, the fact that speed limits are very often violated on a large scale in Thailand suggests the need for implementing more effective speed management strategies such as automatic speed camera, increasing speeding penalty, and smart vehicle design to control vehicle speeds. While the effectiveness of such measures depends mainly on how well they could lead drivers to change speeding behavior, public acceptability is also vital as a key to sustainability of most speed management programs. This paper attempts to identify public acceptability of speed management measures, both currently implemented and under consideration, in the context of Thailand. In doing so, data from the questionnaire surveys based on a random sample of 2180 drivers in Thailand including a wide range of individual characteristics of respondents and their attitudes to select speed management schemes are analyzed using an econometric technique. In particular, we introduce a simplified methodological framework to develop a better understanding of factors that explain drivers' attitudes towards speeding behavior and alternative speed management strategies. Findings from this research provide several important implications that could improve the current practices of speed management in Thailand.

**Keywords:**

Speed management, Public acceptability, Attitude.

ID 1855 R

**PRE-ANALYSIS FOR TRAFFIC PREDICTION IN METROPOLITAN FREEWAYS**

Main Author:

**Carlo LIBERTO** (*Italian National Agency for New Technologies, Energy and the Environment*)

Co-author(s):

**Gaetano VALENTI** (*Italian Agency for New Technologies, Energy and the Environment (ENEA)*)**Roberto RAGONA** (*Italian Agency for New Technologies, Energy and the Environment (ENEA)*)**Serena BUTERA** (*La Sapienza University of Rome*)**Abstract:**

In this paper we report the results from a preliminary analysis of traffic data provided by a probe vehicle system (PVS) operating on the Italian national scale and consisting of a large fleet of privately-owned vehicles. The focus of the present work is to reveal the emergence of spatio-temporal traffic patterns and investigate the interaction between neighboring road-links in both standard and critical conditions. We study the application of cross-correlation and clustering methods to travel speed time series related to the "Rome ring road" (GRA – "Grande Raccordo Anulare"). This analysis has improved significantly our understanding of traffic dynamics and hence our capability to formulate accurate and realistic travel-time forecasting models.

**Keywords:**

Probe vehicle system, Clustering techniques, Cross-correlation analysis.

ID 1936 R

**A METHODOLOGY TO ESTIMATE POSSIBLE GAINS FROM REAL TIME CHANGES IN ROAD NETWORK TOPOLOGY**

Main Author:

**Rute GERALDES** (*Instituto Superior Técnico*)

Co-author(s):

**José MANUEL VIEGAS** (*Centro de Sistemas Urbanos e Regionais (CESUR), Instituto Superior Técnico (IST)*)**Abstract:**

Assuming the possibility of topological changes (changes in street's ways of traffic flow and turning's prohibitions) in a road network in real time and the hypothesis that such changes can be beneficial to manage traffic incidents, a methodology was created to estimate the possible gains deriving from this approach. In order to estimate the gains, two major advances are needed. We need to find out the best (or at least a rather good) network topology to bring quick relief for each incident situation, which in turn requires that we can evaluate different topologies based on the effects of those changes over the network. It can be seen as bringing together an outer process that searches for the optimal topology and an inner process to evaluate each topological configuration. In this paper we describe both step by step. The outer process is supported on Matlab multiobjective genetic algorithm toolbox with custom fitness, creation, mutation and crossover functions, programmed for this specific purpose. The inner process is supported on Aimsun's microsimulator, dynamic traffic assignment model and traffic management actions, along with some extra scripts developed specifically for this analysis. Basically the fitness function in the Matlab genetic algorithm calls Aimsun, or more precisely, calls an Aimsun script that loads a given network and executes all the steps needed to simulate an incident with consequent topological changes as a response to it (given as inputs) and to evaluate that network performance.

**Keywords:**

Traffic Incidents, Urban Road Congestion, Network Topology Optimization, Micro Simulation, Multi-Objective Genetic Algorithms.

TUE 13<sup>th</sup> (09:45 - 11:00, Session C2.6) Room All

ID 2538 R

**A STUDY ON ESTIMATION OF PROBABILISTIC CHANGING TRAVEL TIME BASED ON BAYESIAN STATISTICS**

Main Author:

**Makoto KASAI** (*Tokyo University of Science*)

Co-author(s):

**Hisao UCHIYAMA** (*Tokyo University of Science*)

**Abstract:**

The travel time predicted with high accuracy provided by the ITS (the Intelligent Transportation Systems) supports them to make rational decision. Most past methods for the estimation, however, deal with travel time as a stationary event, that is, they do not take it into account of the non-stationary flow state under the influence on irregular case as traffic accidents. The paper suggests the necessity of method to estimate travel time under the nonstationary flow state by following three steps: 1) to assume that travel time is treated as stochastic event, 2) to extract probabilistically future estimated travel time distribution from a huge number of past days' travel paternal data recorded and accumulated and 3) to update the distribution with observational result of non-stationary conditional factors.

**Keywords:**

Travel Time Prediction, Non-stationarity, Bayesian Statistics, ITS.

TUE 13<sup>th</sup> (11:15 - 12:30, Session C2.7) Room All

ID 1025 R

**OPTIMAL RAMP METERING OPERATIONS WITH PROBIT-BASED IDEAL STOCHASTIC DYNAMIC USER OPTIMAL CONSTRAINTS**

Main Author:

**Hooi LING KHOO** (*Universiti Tunku Abdul Rahman*)

Co-author(s):

**Qiang MENG** (*National University of Singapore*)

**Abstract:**

An understanding of drivers' route choice behavior on the expressway-arterial network is important in the ramp metering efficiency studies. Field studies have shown that drivers divert to alternative routes after the installation of ramp metering on the network. An efficient ramp metering rate scheme should be determined by considering the drivers' route choice behavior. This paper proposes an optimal ramp metering scheme that adopts the probitbased ideal stochastic dynamic user optimal (p-SDUO) model to describe the drivers' route choice behavior. The probit-based model is chosen in light of its capability to overcome the limitations in logit-based model. The p-SDUO is formulated as a fixed point problem which is solved by using the method of successive averages (MSA). A modified cell transmission model (MCTM) is used to simulate the traffic propagation on the network. MCTM is appropriate for this study since it can capture the horizontal queue and shockwaves; fulfill first-in-first-out principle and model dynamic traffic interactions across multiple links. A nonlinear optimization model, with p-SDUO as constraints, is developed to optimize the ramp metering operation. The objective of the model is to find the optimal ramp metering rate scheme that minimizes the total travel time of the expressway-arterial network. The proposed model is tested with an illustrative case study of I210W expressway-arterial network in Pasadena, California. A comparison study of no-metering and with-metering case is carried out. The results show that the proposed model could find a better solution compared to the initial one. There is significant number of drivers diverted from the expressway to the arterial streets when the ramp metering is installed. (...).

**Keywords:**

Ramp Metering, Stochastic Dynamic User Optimal, Cell Transmission Model, Probit Model, Genetic Algorithms.

TUE 13<sup>th</sup> (11:15 - 12:30, Session C2.7) Room All

ID 1103 R

**ASSESSMENT OF A DYNAMIC MANAGED LANES OPERATION**

Main Author:

**Simon COHEN** (INRETS)

Co-author(s):

**Maurice ARON** (INRETS)

**Régine SEIDOWSKY** (INRETS)

**Abstract:**

This paper presents the assessment of a managed lanes operation tested on the motorway network of the Paris region. The trial consists of opening the hard shoulder dynamically to traffic so as to increase the capacity of the section during high demand periods. The prime objective of the operation is to reduce traffic congestion created by a serious recurrent bottleneck. The evaluation is based on a before-after study. It describes the impact on traffic efficiency, environment and safety.

**Keywords:**

Managed lanes, Traffic efficiency, Congestion, Environmental impact, Safety..

TUE 13<sup>th</sup> (11:15 - 12:30, Session C2.7) Room All

ID 2159 R

**DYNAMIC LANE USE MANAGEMENT AT ISOLATED INTERSECTIONS WITH DEMAND RESPONSIVE SIGNAL CONTROL**

Main Author:

**Yingying MA** (Tongji University)

Co-author(s):

**Ying ZENG** (Tongji University)

**Xiaoguang YANG** (Tongji University)

**Abstract:**

In urban areas, the fluctuation of traffic demand at peak hours usually results in traffic congestions, especially at signalized intersections. However, it seems that this kind of congestions can be avoided because only a few directions are oversaturated at the intersection, and others are usually far from saturated. When the fluctuation is small, the problem can be solved by using a demand responsive signal control strategy. But sometimes when the fluctuation is big, only changing the signal control strategy will not work as well as expected. In this paper, a new solution that combines the dynamic lane-use and demand responsive signal control strategy of an isolated intersection is proposed to decrease the risk of traffic congestion and make better use of the capacity of road facilities. A programmable integrative model of lane-use and signal timing is built and solved. A case study is given with microscopic simulation to validate the model. The simulation results show that the proposed model is effective, especially for some "tide traffic" cases whose traffic operation will have little improvement by only modifying the signal timings.

**Keywords:**

Traffic management, Traffic control, Dynamic lane-use management, Demand responsive signal.

TUE 13<sup>th</sup> (11:15 - 12:30, Session C2.7) Room All

ID 2554 R\*

**EVALUATION OF AN AREA METERING CONTROL METHOD USING THE MACROSCOPIC FUNDAMENTAL DIAGRAM**

Main Author:

**Toshio YOSHII** (*Kyoto University*)

**Abstract:**

This Paper proposed an effective area metering control method applied for urban expressway road networks. The control is carried out using the relationship between aggregated traffic flow and aggregated traffic density at a designated road network area, which is one of the Macroscopic Fundamental Diagram ("MFD", thereafter). It is expected that the concept of MFD is introduced to traffic control measures in oversaturated urban road networks. We established an area metering control method based on the MFD concept and verified the effect of the method by applying it to Hanshin Expressway road network using a dynamic traffic simulation. As a result, it was shown that the area metering control method can successfully keep the area traffic density at a moderate level and can achieve high flow in the area. Also, it is shown that the method has high potential to reduce the total travel time.

**Keywords:**

Control, Applications, Metering, Macroscopic, Urban freeway, Oversaturated network.

TUE 13<sup>th</sup> (11:15 - 12:30, Session C2.7) Room All

ID 2923 R

**EVALUATION METHOD OF DYNAMIC TRAFFIC OPERATION AND A CASE STUDY ON VARIABLE CHANNELIZATION FOR MERGING SECTIONS**

Main Author:

**Sungjoon HONG** (*The University of Tokyo*)

Co-author(s):

**Shinji TANAKA** (*The University of Tokyo*)

**Masao KUWAHARA** (*Institute of Industrial Science, The University of Tokyo*)

**Abstract:**

This paper presents an evaluation method of dynamic traffic operation. The method is to use two traffic simulation models of different scales for analyzing the effect of the operation on the local area and the whole road network systematically. As a case study using the method, variable channelization is tested for Tokyo Metropolitan Expressway, which is an urban expressway network. The result shows that, even if a channelization scenario which seems to be the optimum for a subject local section, it can negatively affect the whole network. Therefore, the method is considered to be effective, and it is expected that the method can be adopted for the evaluation of dynamic channelization, which changes the channelization automatically according to the traffic condition.

**Keywords:**

Dynamic Traffic Operation, Variable Channelization, Merging Section, ITs.

ID 1940 R

**APPLICATION OF THE MICROSCOPIC MODELS AS A PART OF THE DECISION SUPPORT SYSTEM AT ALL STAGES OF TRANSPORTATION SYSTEM EVOLUTION**

Main Author:

**Elena YURSHEVICH****Abstract:**

This paper refers to the consideration of a problem related to urban transport system (UTS) operation and management on the basis of the Decision Support System (DSS). Considering the DSS as a complex system, which consists of a data management system, a users' interface system, a knowledge-based management system, a model management system [3]. The main attention is being paid to the latter. The model management system represents a repository of models, used for consideration of different scenarios of UTS planning and functioning, and may include different types of UTS models: the models based on macroscopic, mesoscopic and microscopic approaches. This paper considers the role of the microscopic models in DSS: what tasks can be solved by them, what kind of data they need, data requirements, what kind of results they can provide and use at different levels of decision making. For example, the experience of application of microscopic models is demonstrated for solving of some transport system problems in Riga.

**Keywords:**

Urban transport system, Decision support system, Modelling, Simulation, Optimisation, Microscopic simulation tools.

ID 1971 R

**ATMA ALMELO – THE DEVELOPMENT AND IMPLEMENTATION OF A MULTI-OBJECTIVE TRAFFIC MANAGEMENT DECISION TOOL**

Main Author:

**Robert HULLEMAN** (*City of Almelo, NL*)**Abstract:**

In policy documents concerning Transport sustainability plays an important role. Main goal is to achieve a transport system that is fast, clean, safe, quite and reliable. Further the transport system should contribute to the main goals concerning the emission of CO<sub>2</sub> and energy use. One of the ways to achieve all of this is through a better utilization of the existing infrastructure, for instance using traffic management measures. However, it is not really known if all these goals can be reached, but also how these goals relate to each other and what measures should be taken to actually achieve all of this. When the project started the main focus was on network efficiency in terms of travel times, delay etc. Other goals were considered but not as a main objective, more as a constraint. Traffic management was evaluated in terms of network efficiency, and one was satisfied when traffic safety, noise or air pollution had not become worse. In ATMA these constraints have become objectives. It is studied how the objectives can actually be quantified in a workable manner, what the effects of specific measures are for the all goals, how reliability and the robustness of networks can be determined, and how a transport network can be optimized using multiple objectives. Further it is studies how traffic control can be improved, for instance using a distributed control, or an anticipatory control framework. A consortium consisting of four knowledge institutes (University of Twente, Delft University of Technology, TNO and SWOV) and two companies (Vialis en Goudappel Coffeng) was formed. Initially also Siemens and Logica CMG were member of the consortium but they decided to withdraw. Pilotregion initially was the province of Brabant. (...).

**Keywords:**

Traffic network management Multi objective decisi.

TUE 13<sup>th</sup> (14:00 - 15:15, Session C2.8) Room All

ID 2041 R

**TRAFFIC SIGNAL OPTIMIZATION WITH CONDITIONAL TRANSIT SIGNAL PRIORITY FOR CONFLICTING TRANSIT ROUTES**

Main Author:

**Alexander SKABARDONIS** (*University of California Berkeley*)

Co-author(s):

**Eleni CHRISTOFA** (*University of California, Berkeley*)

**Abstract:**

Transit Signal Priority (TSP) is a strategy that has been extensively used to improve transit operations in urban networks. However, none of the existing signal control systems has been able to effectively address issues such as the impact of TSP strategies on auto traffic or the provision of priority to transit vehicles traveling in conflicting directions at traffic signals. There is a need to develop a TSP system that explicitly accounts for vehicle occupancy and the impact of the signal timings on the cross-street traffic while addressing the issue of conflicting transit routes in a systematic way. A traffic responsive signal control system for signal priority on conflicting transit routes that incorporates vehicle occupancy is presented. The signal control system provides signal timings that minimize the total delay of a single intersection, while assigning weights to the vehicles based on their occupancy. The system presented is tested through simulation at a single intersection located in Athens, Greece. The intersection under consideration is characterized by heavy auto and transit traffic and nine bus lines traveling in conflicting directions. The results indicate that using the developed optimization process substantial reductions in the transit users' delay and the total person delay at the intersection can be achieved with only small increases in the delays of the auto users.

**Keywords:**

Transit Signal Priority (TSP), Signal control systems, Delay, Mathematical models.

TUE 13<sup>th</sup> (14:00 - 15:15, Session C2.8) Room All

ID 2981 R\*

**THE PCU VALUES OF MOTORCYCLES AT THE BEGINNING OF A GREEN PERIOD AND IN A SATURATION FLOW**

Main Author:

**Tzu-Chang LEE** (*Imperial College London*)

Co-author(s):

**John POLAK** (*Imperial College London*)

**Michael BELL** (*Imperial College London*)

**Marcus WIGAN** (*Imperial College London*)

**Abstract:**

The aim of this study is to estimate the Passenger Car Unit (PCU) values of motorcycles in two traffic environments: at the beginning of a green period and in a saturation flow. Motorcycles are able to undertake both lane-based and non-lane-based movements in mixed traffic. Hence their PCU values cannot be adequately measured simply by their headways. In addition, their PCUs could vary according to the traffic context of urban networks, which makes their PCU estimation even more complex. This study employed the flow rate method to estimate motorcycle PCU values, with the help of a recently developed agent-based simulation model, which is capable of representing the characteristic movement patterns of motorcyclists. An experiment was designed to conduct a systematic analysis, in which four conditioning variables were considered: the advanced stop line, the number of lanes, the width of lanes and the proportion of motorcycles. The simulation results showed that at the beginning of green periods, the key factor affecting the PCU values was the number of motorcycles able to filter to the head of the queue. However, in saturation flow, the key factor was the opportunity for motorcycles to move alongside another vehicle in the same lane. An ex-post analysis was conducted using a regression model to fit the simulation results. This model indicated that the PCU values of motorcycles at the beginning of green periods are averagely 0.237 lower than those in multiple-lane saturation flows. In addition, the PCU values decrease 0.143 with every 1.0 m increase of the lane width. PCU values for motorcycles in different traffic conditions are suggested using this model.

**Keywords:**

PCU, PCE, Motorcycle, Mixed traffic, Microsimulation model, Road capacity.



ID 3010 R

**SIGCOM3: A TRAFFIC SIGNAL OPTIMIZATION MODEL FOR ISOLATED INTERSECTIONS IN MIXED TRAFFIC CONDITIONS**

Main Author:

**Juan ENRIQUE COEYMANS-AVARIA** (Pontificia Universidad Católica de Chile)

Co-author(s):

**Juan HERRERA** (Pontificia Universidad Católica de Chile)  
**Gonzalo CORTES-NANNIG** (Transport Engineering and Logistics Department Pontificia Universidad Católica de Chile)**Abstract:**

The need of updating the series of SIGCOM programs, now in its third version, is in accordance with the continuous improvements that any program has to have to be valid. Like its predecessors, SIGCOM 3 delivers the optimal cycle length and the optimal green time split for an isolated intersection controlled by a traffic light. The objective function in the optimization process is selected by the user among multiple options that the program offers as performance indicators. As a first approach, the work done by von Mühlenbrock (2005) was revised, to corroborate the important progress contributed, on one side, by incorporating studies done in Chile on estimating capacity and prediction models of lane selection, as well as writing this program in Visual Basic.Net, which offers a much more friendly interface with the user. The most commonly used performance indicators for measuring a intersection are the number of stops, the delays and a combination of the two. In this version of SIGCOM, the expressions that measure these indicators have been modified, replacing Allsop formulas (1971) by Akcelik formulas (1981). The expressions found by Akcelik work even under high level of traffic demand, which was a limitation in the first two versions of this program. The above mentioned Akcelik formulas (1981) for the number of stops and delay consider a term which includes the length of the overflow queue, which corresponds to the number of vehicles that stay at the intersection after a green light has finished. This concept was studied in depth in this study and a correction was made in the way this value was interpreted and calculated. Undoubtedly, this constitutes a relevant contribution of this study. (...).

**Keywords:**

Traffic signal, Traffic simulation, Traffic signal optimization, Isolated intersection.

ID 1539 R

**ENVIRONMENT-RESPONSIVE TRAFFIC CONTROL**

Main Author:

**Manfred BOLTZE** (Technische Universitaet Darmstadt)

Co-author(s):

**Sven KOHOUTEK** (Technische Universitaet Darmstadt)**Abstract:**

This article describes some fundamentals for an environment-responsive traffic control. It starts with a brief description of the needs to consider environmental aspects in urban traffic control, focusing on noise, particular matters (PM), and nitrogen oxides (NOx). Respective current regulations by law in Europe and Germany are explained. Comparing the regulations for the improvement of air quality and for noise reduction, important similarities and differences are pointed out. In this context, it must not be neglected that short-term measures (regarding air pollution) will possibly have only minor impacts on the urban traffic-borne background pollution. As a consequence, there has to be a detailed investigation of appropriate situations where rigorous short-term restrictions provide better results than static restrictions with many regulatory exceptions. The acceptance of the different types of measures by the road users is another point which has to be considered. In the next section, the idea of a dynamic traffic control is introduced, which takes into account not only the traffic situation, but also the current environmental situation. The basic aim of this dynamic control is to minimize restrictions to those times, situations, and locations when and where they are really needed. Systematically, the different options of dynamic measures to influence traffic volumes and traffic flow are analyzed. This includes measures • to meter the accessing traffic streams to certain parts of the network, • to shift traffic volumes within the network by influencing the route choice, • to prioritize crossing arterials against each other, • to shift congestion within one arterial, and • to prioritize traffic streams within one intersection. (...).

**Keywords:**

Traffic management, Dynamic traffic control, Envir.

ID 2011 R

**TRAFFIC MANAGEMENT MODEL TO FLOODED REGIONS: CASE STUDY IN STREAM VILARINHO IN BELO HORIZONTE (BRAZIL)**

Main Author:

**Leise OLIVEIRA** (*Federal University of Minas Gerais*)

Co-author(s):

**Rodrigo AMARAL BONATTI** (*Federal University of Minas Gerais*)**Nilo DE OLIVEIRA NASCIMENTO** (*Federal University of Minas Gerais*)**Farney AURELIO ALCANTARA** (*Federal University of Minas Gerais*)**Abstract:**

During the months from November to March, heavy and located rains occur in the Metropolitan Region of Belo Horizonte. Due to the sinuous topography of this region and the high rate of soil sealing, the watercourse of the city often does not include the rapid rise in the volume of water transported, coming to overflow and flood their respective flood plains, usually occupied by men. When floods occur, the traffic of this region is directly affected, causing major traffic jams due to the interruption of roads. This paper presents a traffic management model that allows to quantify the impact of traffic disruption due to flooding on roads, estimating the diseconomy caused by increase in travel time, fuel consumption, among others. Moreover, alternative routes will be research when a particular road is flooded or in imminent risk of flooding. The methodology includes research on traffic conditions in this region in normal weather. Subsequently, a virtual model will be developed to simulate the traffic in this region. In this model, knowing the spots of flooding in the region, scenarios will be simulated with disruption due to flooding, to analyze the new traffic conditions and the operation of the alternative routes suggested by the model. Moreover, the increments are calculated in travel time, fuel consumption, environmental impacts, and, consequently, economic impacts.

**Keywords:**

Flooding, Traffic Engineering, Simulation.

ID 2528 R

**AN OPEN-SOURCE BASED GIS AND SIMULATION SOFTWARE: A CASE STUDY FOR CONTINGENCY PLANNING IN MICROREGIONS**

Main Author:

**Paulo ALMEIDA** (*CEFET-MG / Centro Federal de Educação Tecnológica de MG, Brasil*)

Co-author(s):

**Tuffi NETO** (*Cefet/MG*)**Renato RENATO** (*Cefet/MG*)**Gray GRAY** (*Cefet/MG*)**Abstract:**

Traffic analysis by means of discrete event simulation is being more and more used to find good solutions to traffic problems. A geographic information system (GIS) is a software application which can process and analyze spatial data. Integrating a simulation tool and GIS gives more flexibility to deal with the spatial data consumed and generated by simulations. The main goal of this work is to present a traffic simulator developed in Java and integrated to a GIS tool. A case study conducted in Belo Horizonte, Brazil, is shown, along with the analysis of a contingency plan to a street interdiction situation. Some contingency situations in the given region were tested in simulation to find alternate solutions to the problem. Statistical results are presented to assure the adequability of the approach and the useful features it can provide the traffic operation personnel.

**Keywords:**

Microscopic traffic simulator, Geographic information.

TUE 13<sup>th</sup> (15:30 - 16:45, Session C2.9) Room All

ID 2693 R

**FREIGHT LOCOMOTIVE RESCHEDULING AND UNCOVERED TRAIN DETECTION DURING DISRUPTIONS**

Main Author:

**Keisuke SATO** (*Railway Technical Research Institute*)

Co-author(s):

**Naoto FUKUMURA** (*Railway Technical Research Institute*)

**Abstract:**

This paper discusses optimization of freight train locomotive rescheduling under a disrupted situation in the daily operations in Japan. In the light of the current framework of dispatching processes that passenger railway operators modify the entire timetables, the adjusted timetables are distributed to a freight train operator. We solve the locomotive rescheduling problem for the given adjusted timetable in which we change the assignment of the locomotives to the trains as required considering a periodic inspection of the locomotives. The uncovered train detection problem that selects unassigned trains of less importance is solved if the rescheduling has failed. We formulate the two problems as integer programming problems and solve them by column generation. Our simple speeding-up technique named set-covering relaxation is applied to the rescheduling problem that has set-partitioning constraints. Numerical experiments using a real timetable, locomotive scheduling plans and major disruption data in the highest-frequency freight train operation area reveal that satisfactory solutions are obtained within around 30 seconds. The set-covering relaxation speeds up the computation time by a factor of six at a maximum.

**Keywords:**

Locomotive rescheduling, Uncovered train detection, Set partitioning, Set-covering relaxation, Column generation.

TUE 13<sup>th</sup> (15:30 - 16:45, Session C2.9) Room All

ID 2817 R

**ENVIRONMENTAL TRAFFIC MANAGEMENT - IMPROVE AIR QUALITY WITHOUT SACRIFICING MOBILITY**

Main Author:

**Sebastian ALTHEN** (*Siemens AG*)

**Abstract:**

The demand for mobility has risen dramatically during the past 50 years, and is expected to continue. Exploding numbers of commercial and private vehicles travel a vast number of kilometres, a significant part of it within urban areas. Especially in the fast-growing megacities of today, where road traffic infrastructure size is limited and the building topology often prevents proper ventilation, the population density is high and severely affected by permanent air pollution. On the other hand, the availability of mobility is an economical and socio-economical factor, and heavily restricting traffic is neither desired nor feasible. This situation calls for innovative approaches to dynamically preserve an efficient balance between mobility and the environment. Motorized road traffic represents a major source of urban air pollution, among others for NO<sub>2</sub> and PM<sub>10</sub>. With general regulations in place that constitute hard limits to the maximum daily and yearly averages, traffic remains one of the few air pollution sources that can actively be influenced in short- and mid-term time scales. The European Union introduced important regulations and directives with respect to the maintenance of ambient air-quality in 2005, including limits for concentrations of particular matter. Since many cities could not comply with the regulations in first place, the limits are not lowered in 2010, but closer attention to compliance with the regulation is being paid. Further, the limitation of PM<sub>2.5</sub> and NO<sub>2</sub> has been introduced, intensifying the challenge for the cities to find viable solutions for the right balance of Mobility and the Environment.

**Keywords:**

Environmental Traffic Management, Air Quality, Mob.

TUE 13<sup>th</sup> (17:00 - 18:15, Session C2.10) Room All

ID 2030 R

**COMPARING FLOATING CAR DATA AND  
CARSHARING GPS DATA FOR TRAVEL TIME  
ASSESSMENT**

Main Author:

**Catherine MORENCY** (*Polytechnique Montreal*)

Co-author(s):

**Pierre LOUSTAU** (*École Polytechnique de Montréal*)

**Vincent GRASSET** (*École Polytechnique de Montréal*)

**Martin TRÉPANIÉ** (*École Polytechnique de Montréal*)

**Abstract:**

With the increasing problems of traffic congestion in urban areas, transportation planners need better tools to assess its evolution through the years. Travel time measures on road networks provide key information to identify critical spots of congestion and evaluate the scale of this phenomenon across the area. Many technologies are currently available to measure travel time at specific locations (license plate matching, loop detectors, bluetooth device matching). Traditionally, at larger scale, travel time is estimated with the help of mandated floating cars (probe vehicle) that run through the road network. Nowadays, ad-hoc –or randomly collected—data can be obtained from GPS devices aboard individual cars and commercial vehicles. However, each of these ways of collecting data suffers from limitations; cumulating the information they provide seems like a relevant approach and this starts by comparing the measures they can output. This paper presents a comparison of travel time measure between two data collection means for the same locations in an urban area: GPS and floating cars. GPS data come from a carsharing company operating in the Montreal, Canada area. GPS traces are collected anonymously in some of the vehicles, without any path supervision (members were doing their usual trips). On another hand, a specialized firm operated floating car data on fixed routes. The Quebec Ministry of Transportation process has collected this data through the years in the context of a travel time evaluation. For modelling purposes, floating car routes were fragmented in one kilometre road links. Incidentally, some carsharing vehicles equipped with GPS devices were driven on parts of the floating cars routes. (...).

**Keywords:**

Floating car data, Carsharing GPS data, Travel tim.

TUE 13<sup>th</sup> (17:00 - 18:15, Session C2.10) Room All

ID 2392 R

**QUALITY OF FLOATING CAR DATA**

Main Author:

**Alexander SOHR** (*DLR - Institute of Transport Systems*)

Co-author(s):

**Elmar BROCKFELD** (*DLR-Institute of Transport Systems*)

**Sascha KRIEG** (*DLR - Institute of Transport Systems*)

**Abstract:**

Meanwhile, Floating Car Data (FCD) is a widely available and affordable data source for traffic surveillance. The German Aerospace Center, Institute of Transportation Systems (DLR-TS) receives FCD from taxi-fleets ranging from 300 to 4000 vehicles from various German and European cities since the year 2002. To extract common traffic variables like travel times or travel speeds and generate traffic information out of it, the raw GPS data of the vehicles are matched to a digital road network. However, compared to data from inductive loops, where each vehicle passing a loop generates data and the whole traffic flow is covered, the FCD represent only singular measurements. Thus, they are very noisy (especially when passing signalized intersections) and typically need to be aggregated to yield useful information. This means, a single delivered value is not very reliable and does not necessarily represent the state of the traffic flow on the according street segment. Data from some vehicles have to be aggregated and smoothed for some time interval and/or space to obtain reliable traffic information.

**Keywords:**

Floating Car Data, Traffic Management, Fleet-Size, Sample-Interval, Data- Quality, Aggregation, Quality-Definition for FCD.

TUE 13<sup>th</sup> (17:00 - 18:15, Session C2.10) Room All

ID 2469 R

### ENGINEERING OF CAR2CAR INTERACTIONS BY MEANS OF COLORED PETRI NET ROAD MODELS

Main Author:

**Matthias HÜBNER** (*Institute for Traffic Safety and Automation Engineering*)

Co-author(s):

**Eckehard SCHNIEDER** (*Institute for Traffic Safety and Automation Engineering*)

#### Abstract:

This contribution presents a new approach to traffic flow optimization on highways by means of vehicle sided rule-bases. Regarding present traffic, global traffic dynamics, expressed by state variables as density and flow as well as phenomena as traffic jams, is a direct consequence of the microscopic behavior of the vehicles. The latter depends on the driver's behavior that additionally diverges from vehicle to vehicle. A homogenization shall be a remedy to unintentional behavior of traffic according to Helbing, D. (1997). This may be realized by means of common vehicle sided rule-bases. For this purpose driver's behavior is initially not considered and autonomously driving vehicles are assumed. Every vehicle possesses an exact positioning system, robust longitudinal and lateral control, as well as an ad-hoc network adapter designated to car2car communication. The major objective in this article is presenting a fundamental concept for the engineering of a common vehicle-sided rule-base. Based on the formal concept of vehicle classes and clusters, which are roughly speaking groups of spatially allocated vehicles, rule bases are developed by implementing the standard consensus algorithm for the coordination of the microscopic variables velocity and longitudinal distance (see Hübner et al. (2009a)). Decision-making is realized by spatial discretization of the highway to permissible positions, which are formally represented by means of Petri nets. Its places refer to permissible positions, whereas its transitions denote possible interactions (see Hübner, M., Lück, T. and Schnieder, E. (2009b)). Due to the introduction of different vehicle classes, it is reasonable to model the vehicle-vehicle-interactions by means of colored Petri Nets with a common places' capacity that equals one. (...).

#### Keywords:

Multi agent systems, Automatic control of traffic, Cooperative control.

TUE 13<sup>th</sup> (17:00 - 18:15, Session C2.10) Room All

ID 3096 R\*

### DEVELOPMENT OF INTELLIGENT TRAFFIC LIGHTS USING MULTI-AGENT SYSTEMS

Main Author:

**Vitor NAVARRO** (*Centro Universitário Senac*)

Co-author(s):

**Allan VITAL** (*Centro Universitário Senac*)  
**Fabrizio J. BARTH** (*Centro Universitário Senac*)

#### Abstract:

The goal of this paper is to develop an intelligent traffic light controller to optimize the flow of a given region roads. The behavior of each traffic light controller is implemented by an intelligent agent able to act autonomously and communicate with other agents aimed at collaborative decisions and actions into a region's traffic. The concepts of intelligent agents and multi-agent systems have been applied, partitioning the control of roads and regions across types of agents. In addition, the solution was created based on three parts: the simulator, the multi-agent systems and the agent framework. The results of the simulations with the prototype showed their strengths and weaknesses, and despite his inefficiency, it showed too the development potential of the proposed solution.

#### Keywords:

Intelligent Traffic Light Control, Multi-Agent Systems, Traffic Engineering.

ID 1052 R

**SIMULATION, IMPLEMENTATION AND EVALUATION OF A DEDICATED LANE ON AN URBAN MOTORWAY**

Main Author:

**Judith PRINCETON** (*French national Institute of Transportation and security (INRETS)*)

Co-author(s):

**Simon COHEN** (*INRETS*)**Abstract:**

The A1 motorway connects the Charles-de-Gaulle Airport to Paris and is one of the busiest roads in France. In order to cope with the reduction of taxi supply in the centre of Paris during the morning peak period, the Regional Highways Authority has decided to allocate the inner-left lane to taxis and buses from 7 to 10 am. Prior to the implementation a macroscopic simulation had been performed for an a priori evaluation of the operation. Input data were collected and consisted only of macroscopic traffic variables: flows, speeds and density. The study compares the simulation results with data measured after implementation. It shows how macroscopic simulation may be used efficiently in a priori assessment of managed lanes operations. Real traffic conditions were analyzed in two stages to take into account the shortterm effect of the strategy and mid-term changes in driver behaviour with enforcement control being applied. The key findings of the study indicate the occurrence of a new bottleneck at the upstream end of the dedicated lane shown by both simulation and on-site measurements with the same congestion pattern. However, simulated travel times are lower than real ones due to drivers' poor compliance with the operation despite penalties. A comparison between data before and after the enforcement control took effect shows a 3-10 minute travel time saving for a 200 vph switch from the dedicated to the general purpose lanes. Since taxis do not have a priority access to the slip road toward the city, they still get stuck in the pre-existing congestion at the downstream end of the dedicated lane. So the actual goal of the operation is not achieved. Nevertheless, the simulation results fit well with the measured data, which highlights the relevance of properly calibrated macroscopic models in a priori evaluation of managed lanes operations. (...).

**Keywords:**

Bottleneck, Calibration, Congestion, Dedicated lane, Evaluation, Macroscopic simulation, Validation, Traffic management, Travel times.

ID 1511 R

**RESEARCH ON APPLICATION PROSPECT OF TOLL BUS LANE IN CHINA**

Main Author:

**Dawei PAN** (*School of Transportation, Southeast University, Nanjing*)

Co-author(s):

**Wei DENG** (*School of Transportation, Southeast University, Nanjing*)**Fei SHAO** (*School of Transportation, Southeast University, Nanjing*)**Abstract:**

In the Metropolitan of China, the situation of the general-purpose lane congested while the bus lane relatively idle is often occurred during the time of peak hour, the excess capacity of the bus lane doesn't effectively used. Making use of the excess capacity by opening them to car pools is a method that can effectively mitigate traffic jams and improve the operating efficiency of the road. In order not to influence buses' operation in bus lanes, the congestion pricing is needed to regulate the volume of car pools in bus lanes. The paper illustrate the condition and the method for implementation of the toll bus lane, analyze travelers' travel choice mode which is affected by the toll rate, and then proposes bi-level model, in which the lowest average people cost and maximum road operating efficiency are the upper-layer objective model and the user equilibrium is the lower-layer objective model. The objective function of the model was solved by an advanced heuristic solution algorithm based on sensitivity analysis.

**Keywords:**

Excess capacity, Toll bus lane, Bi-level model, Heuristic solution algorithm, Sensitivity analysis.

ID 2513 R

**AN ANALYSIS OF REFORMING BY OFF-PEAK FEE DISCOUNT FOR ETC TO REDUCE HIGHWAY CONGESTION**

Main Author:

**Takaji SUZUKI** (*Chukyo Univ.*)

**Abstract:**

This study analyses discounts on highway fee for the off-peak commuting with ETC as the application of the traditional bottleneck congestion model in order to consider self-select fee system and post payment related to historical usage. The ETC off-peak commuting discounts improves efficiency of road system due to utilization of off-peak capacity of highway so as to shift traffic demand from open road to highway, by contrast, ETC peak commuting discount which has been in place in Japanese highway. Furthermore, ETC off-peak commuting discount plus that is depend on historical highway usage is an effective measure to give an incentive for usage of ETC device, restraining aggravation of road congestion.

**Keywords:**

Electric Toll Collection, Self-select fee system, Bottleneck congestion.

ID 3265 R

**EVALUATION OF TOLLWAY OPERATIONS USING VISSIM**

Main Author:

**Kayitha RAVINDER** (*Central Road Research Institute*)

Co-author(s):

**Errampalli MADHU** (*Central Road Research Institute*)

**S. GANGOPADHYAY** (*Central Road Research Institute*)

**Abstract:**

ITS (Intelligent Transport Systems) in India has a significant role to play because of the massive highway construction program presently being implemented under the National Highway Development Program (NHDP) in the country and the most of urban links in various cities in India. Mostly these projects are under taken on the basis of BOT/BOOT etc, thus the massive toll collection systems are going to operate on these projects spreading all over the India once these infrastructure projects are open to the traffic in near future. Considering this, there is an urgent need for studying various toll collection systems and their capabilities in reducing the congestion on toll roads. This paper mainly focuses various toll collection methods/operations in reducing the congestion in urban /intercity toll corridors. This paper also reviews the various types of toll collection systems practicing globally and as well in India and also focuses on various toll way operations showing each method's capability in reducing the congestion on urban/intercity corridors. The objective of the present study is mainly to optimize number of toll collection booths using the Simulation technique (VISSIM 4.10) under each toll collection method namely manual, semi-automatic and automatic to minimize total delay of entering traffic.

**Keywords:**

Evaluation, Tollway Operations, Simulation, Congestion reduction, Mixed traffic.

ID 1412 R\*

**A TRAFFIC SIGNAL SPLIT OPTIMIZATION USING THE TIME-SPACE DIAGRAM**

Main Author:

**Ponlathep LERTWORAWANICH****Abstract:**

Traffic signals are the main devices for controlling traffic to guarantee the safe crossing of opposing streams of vehicles and pedestrians. As traffic demand increases, signal operations become more important. Efficient signal controls lead to less congestion and smooth operations while poor signal controls could result in severe congestion or even a network gridlock. Dynamic controls, where signal parameters are automatically optimized to the change of traffic demand monitored by detectors, become important. In this study, a simple split optimization method is developed. The proposed methodology is based on the notion of minimizing delay per cycle. Traffic dynamics at signalized intersections are represented on time-space diagrams using the shockwave theory and information from detectors installed upstream of intersections. Splits are incrementally adjusted so that the delay per cycle is gradually minimized. Unlike most algorithms, the proposed method can manage traffic even when queues extend beyond detector locations. Simulation experiments on a single fixed-cycle-length intersection with five demand scenarios are conducted to demonstrate efficiency of the developed algorithm. It is found that in case of fixed demand the proposed method can optimize splits, which eventually converge to the optimal fixed-time signal settings. For the variable demand case, the result indicates that the algorithm can correctly adjust splits in response to the change of demand. The proposed algorithm has demonstrated itself to be a potential split optimization for an adaptive signal control system.

**Keywords:**

Signal control, Split.

ID 1425 R

**ROBUST QUEUE-BASED TRAFFIC SIGNAL CONTROL**

Main Author:

**Hong LO** (*The Hong Kong University of Science and Technology*)

Co-author(s):

**Lin XIAO** (*The Hong Kong University of Science and Technology*)**Abstract:**

Traffic signal remains an active research topic for many years. A critical aspect of traffic signal analysis is modelling a signal plan's delay performance, in particular when traffic arrivals are stochastic. In this study, based on the reliability framework in Lo (2006), we develop a robust control scheme for general arrival distributions while considering the effects of residual queue from a previous cycle. The proposed strategy incorporates the notion of a "queue-based signal switching rule" into the probabilistic or reliability framework. Instead of aiming to minimize vehicle delay directly, this control scheme aims to maintain vehicle queues within permissible ranges. While doing this, the expected delay is also reduced. Some numerical results are included to demonstrate the benefit of this approach as compared with Webster's approach and our earlier reliability-based approach.

**Keywords:**

Robust control, Reliability, Traffic signal control.



ID 2346 R\*

## FRAMEWORK FOR EVALUATING ECONOMIC IMPACT OF TRAFFIC SIGNALS

Main Author:

**Ashish CHANDRA** (*Colin Buchanan and Partners, London, UK*)

Co-author(s):

**David CARRIGNON** (*Colin Buchanan and Partners*)

**Keith FIRTH** (*Colin Buchanan and Partners*)

### Abstract:

In recent years there has been a sustained debate on the role of traffic signals in major cities. There is growing concern that there are too many traffic signals in London and that they cause unnecessary delays, particularly outside peak hours. Typically, aside from road safety, the form of junction control, and thus the use of traffic signals, is based on an evaluation of worst case, peak traffic flow conditions alone, without consideration to the impact over the complete day, week or year. This approach, although comprehensive in minimising queues and delays (and thus road user costs) during peak conditions, fails to differentiate the operational requirements and benefits during other times of the day. The present paper attempts to inform the debate on the use of traffic signal control and how alternative methods of control can be evaluated and where and when they might be implemented. It explores the options of introducing part-time control in the form of flashing amber signals, used widely in other European countries, as well as complete removal of traffic control regulations akin to shared space.

### Keywords:

Traffic signals, Shared Space, Economic Impact of .

ID 2717 R

## MULTI-OBJECTIVE REINFORCEMENT LEARNING FOR TRAFFIC SIGNAL COORDINATE CONTROL

Main Author:

**Houli DUAN** (*Department of Automation, Tsinghua University*)

Co-author(s):

**Zhiheng LI** (*Department of Automation, Tsinghua University*)

**Yi ZHANG** (*Department of Automation, Tsinghua University*)

**Shengchao YIN** (*Department of Automation, Tsinghua University*)

### Abstract:

In this paper, we propose a new multi-objective control algorithm based on reinforcement learning for urban traffic signal control, named multi-RL. A multi-agent structure is used to describe the traffic system where vehicles are regarded as agents. Reinforcement learning algorithm is adopted to predict the overall value of optimization objective given vehicles' states. The policy which minimizes the cumulative value of optimization objective is regarded as the optimal one. In order to make the method suitable to various traffic conditions, we also introduce a multi-objective control scheme in which optimization objectives are selected according to the real-time traffic state. The Optimization objectives include the number of vehicle stops, the average waiting time and maximum queue length of the next intersection. In addition, we also introduce the priority control of buses and emergent vehicles into our model. The simulation results indicate that our algorithm could perform more efficiently than traditional traffic light control methods.

### Keywords:

Traffic Signal Control, Multi-Agent System (MAS), Reinforcement Learning, Multiobjective Control.

WED 14<sup>th</sup> (09:45 - 11:00, Session C2.12) Room All

ID 3148 R

**TEMPORAL DIFFERENCE LEARNING-BASED  
ADAPTIVE TRAFFIC SIGNAL CONTROL**

Main Author:

**Samah EL-TANTAWY** (*Toronto ITS Centre and Testbed,  
Department of Civil Engineering, University of Toronto*)

Co-author(s):

**Baher ABDULHAI** (*Toronto ITS Centre and Testbed*)

**Abstract:**

Traffic congestion negatively affects our society, economy, and the environment. In most dense urban areas, transportation networks are operating near capacity for extended peak periods, due to the population growth and the limited resources for infrastructure expansions. As a result, numerous ITS strategies rapidly emerged to better utilize the existing infrastructure. Adaptive traffic signal control is a promising technique to alleviate traffic congestion. This paper focuses on the development of an adaptive traffic signal control method using Reinforcement Learning (RL) as one of the efficient approaches to solve such stochastic control problem. A generic RL engine is developed for acyclic-variable-phasing sequence adaptive traffic signal control and applied to an isolated traffic signal control case. Paramics, a microsimulation simulation platform, is used to evaluate several Temporal Difference (TD) learning methods on a major intersection in Downtown Toronto using actual observed traffic data. The performance of TD approaches is analyzed and contrasted to an optimized pre-timed control strategy as a benchmark.

**Keywords:**

Adaptive Signal Control, Reinforcement Learning, Temporal Difference. Q-Learning, SARSA, Eligibility Traces.

WED 14<sup>th</sup> (11:15 - 12:30, Session C2.13) Room All

ID 1436 R

**AN ANT COLONY OPTIMISATION (ACO) ALGORITHM  
FOR SOLVING THE LOCAL OPTIMISATION OF SIGNAL  
SETTINGS (LOSS) PROBLEM ON REAL-SCALE  
NETWORKS**

Main Author:

**Luca D'ACIERNO** (*Department of Transportation  
Engineering, 'Federico II' University of Naples*)

Co-author(s):

**Mariano GALLO** (*Dipartimento di Ingegneria - Università  
del Sannio*)

**Bruno MONTELLA** (*Department of Transportation  
Engineering - 'Federico II' University of Naples*)

**Abstract:**

In this paper we propose an Ant Colony Optimisation (ACO) algorithm for optimising the signal settings on urban networks following a local approach. This problem, also known as LOSS (Local Optimisation of Signal Settings), has been widely studied in the literature and can be formulated as an asymmetric assignment problem (Cascetta et al., 2006). The problem consists in optimising the signal settings of each intersection of an urban network as a function only of traffic flows at the accesses to the same intersection, taking account of the effects of signal settings on costs and on user route choices. The proposed ACO algorithm is based on two kinds of behaviour of artificial ants which allow the LOSS problem to be solved: traditional behaviour based on the response to pheromones for simulating user route choice, and innovative behaviour based on the pressure of an ant stream for solving the signal setting definition problem. Our results on a real-scale network show that the proposed approach allows the solution to be obtained in less time but with the same accuracy as in traditional MSA approaches.

**Keywords:**

Ant Colony Optimisation, Signal settings, Stochastic assignment.

ID 1484 R

**RESPONSIVE SIGNAL CONTROL FOR RUSH HOUR TRAFFIC IN AN ARTERIAL**

Main Author:

**Shahadat HOSSAIN** (*University of Calgary*)

Co-author(s):

**Lina KATTAN** (*University of Calgary*)**Abstract:**

In recent decades, traffic congestion has become a serious problem in major metropolitan areas causing delays, pollution, reduced road safety and degradation of infrastructure. Congestion is mainly concentrated on critical urban arterials that carry high volumes of traffic are mostly managed by traffic lights. To obtain optimality, these traffic control devices should be able to respond to traffic demand and adapt to the likely changes in network conditions. The primary goal of this study is the development of a traffic responsive control strategy to accommodate traffic fluctuations on an urban arterial. Case-based reasoning (CBR), a computational problem-solving paradigm in artificial intelligence (AI), was used to develop a software plug-in, which we have called RESSICA (Responsive Signal Control for Arterial). RESSICA uses an optimal mapping algorithm as an optimization technique with the main control objective of minimizing total vehicular delays, thereby increasing throughput. The developed framework was intensively tested in Quadstone Paramics, a micro-simulation software package, during AM rush hour for Barlow Trail, a major arterial in Calgary, Canada. The performance of RESSICA was compared with existing actuated/pre-timed control strategies. The results show that RESSICA outperformed the existing traffic signal control, in terms of reducing delays, travel times and stops.

**Keywords:**

Case-based reasoning, Signal plan, Traffic pattern, Re-computation, RESSICA.

ID 2209 R

**APPLICATION OF ADVANCED ANALYSIS TOOLS FOR FREEWAY PERFORMANCE MEASUREMENT**

Main Author:

**Alexander SKABARDONIS** (*University of California Berkeley*)

Co-author(s):

**Pantelis KOPELIAS** (*Attikes Diadromes S.A.*)**Fanis PAPANIMITRIOU** (*Attikes Diadromes S.A.*)**Eleni CHRISTOFA** (*University of California, Berkeley*)**Abstract:**

The paper describes the application of freeway performance measurement system (PeMS) to the Attica Tollway, a 70 Km urban motorway in Athens, Greece to obtain freeway performance measures and provide estimation and prediction of travel times under recurrent and non-recurrent (incident related) congestion. Travel time reliability measures also are estimated from the field data and compared with predictions from recently developed analytical models.

**Keywords:**

Freeway performance measurement, Archive data user service (ADUS), Data warehouse, Travel time variability, Incidents, Mathematical models.

ID 2776 R

**A PROACTIVE TRAVEL TIME BASED RAMP METERING ALGORITHM FOR AN ISOLATED RAMP**

Main Author:

**Saeid SAIDI** (*University of Calgary*)

Co-author(s):

**Lina KATTAN** (*University of Calgary*)**Colin HARSCHNITZ** (*University of Calgary*)**Abstract:**

This paper focuses on the design of a proactive ramp metering control on an isolated ramp. The developed approach exploits the use of vehicle probe travel time data as the main input parameters to the ramp metering control algorithm. The problem is formulated with the objective of minimizing total system vehicular travel time and includes: 1) travel time on the freeway, upstream and downstream of the ramp; and, 2) the wait time on the ramp. The Cell Transmission Model (CTM) and shockwave analysis are used to predict the travel time on the freeway. Delays on the ramp are obtained based on deterministic queuing theory. The developed approach is tested using Quadstone Paramics' microsimulation model on an isolated ramp on Highway 2 in Calgary, Canada. The developed algorithm is analyzed under various traffic conditions on the freeway and ramp. In addition, a sensitivity analysis is conducted to examine the performance of the developed algorithm for various values as the ramp input parameters: percentages of penetration of probe data and estimation step intervals. The results of the analysis are promising, showing the effectiveness of developing ramp metering control algorithms based on travel time data from vehicle probes.

**Keywords:**

Adaptive Ramp Metering, Proactive Ramp Metering, Cellular Probe, CTM, Travel Time, Freeway Control.

ID 2886 R

**EXPLORATORY STUDIES ON NETWORK OPERATION OF FUZZY SIGNAL CONTROLLERS**

Main Author:

**Maria ALICE JACQUES** (*Universidade de Brasília*)

Co-author(s):

**Michelle ANDRADE** (*Universidade de Brasília*)**Marcelo LADEIRA** (*Universidade de Brasília*)**Abstract:**

Urban road systems usually present characteristics that require traffic control along their major roads, usually referred to as arterial network control. Fuzzy signal controllers (FSC) have proven to be effective in traffic control at isolated intersections, according to previous studies. Therefore, the evaluation on the suitability of using FSC at intersections belonging to arterial network is relevant so as to improve traffic operation on this road type. This paper presents exploratory studies aiming to evaluate the use of FSC, originally designed for isolated operations on intersections located in arterial networks. Aspects such as controllers' adaptive capability and suitability for network operation and impact of intersections' spacing on controller responses are analyzed. The results show the adaptive capability of the FSC considered for arterial network control, as well as promote cooperation among these controllers – this is a promising strategy. The impact of intersections' spacing on controller response and traffic performance is also demonstrated.

**Keywords:**

Fuzzy signal controller, Network control, Network operation.

ID 1288 R

**AN INTEGRATED OPTIMIZATION MODEL FOR SIGNAL TIMING PLAN AND LANE ALLOCATION DESIGN**

Main Author:

**Wenteng MA** (*Citilabs*)

Co-author(s):

**Alberto BRIGNONE** (*Citilabs*)**Abstract:**

Signal timing and lane allocation are most important settings at signalized intersections to control the operation. Efficiently operated traffic signals and reasonably designed lane markings can reduce congestion and bring about significant payoffs in time and energy benefits. The design of signal timing plan and lane allocation pattern should be complementary to each other; however, existing research works have been concentrated on signal optimization, and few of them considered the impact of lane allocation pattern. This paper proposed an optimization model for the integration design of signal timing plan and lane allocation pattern at signalized intersections. A Genetic Algorithms (GA) model is developed and validated with the Cube transportation software suites. A fully optimized intersection design, including cycle length, phase durations, phase sequence, permitted movements, lane allocations, and shared movements, can be generated according to the assigned traffic flows and geometric properties at the intersection. A set of constraints are set up to guarantee feasibility of the optimal signal timing plan and lane allocation pattern design.

**Keywords:**

Signal Optimization, Lane Pattern Optimization, Genetic Algorithm.

ID 2188 R

**A NEW ONLINE CONTROL STRATEGY FOR SIGNALIZED URBAN SUB-NETWORKS**

Main Author:

**Tobias POHLMANN** (*Technische Universität Braunschweig - Institut für Verkehr und Stadtbauwesen*)

Co-author(s):

**Bernhard FRIEDRICH** (*Technische Universität Braunschweig - Institut für Verkehr und Stadtbauwesen*)**Abstract:**

Different Adaptive Traffic Control Systems (ATCS) for traffic signal control in urban networks have been developed over the past years and even decades, e.g. SCOOT, SCATS, BALANCE and MOTION. The improvement of traffic modeling techniques and increasing computing power promote enhancement and further development of sophisticated ATCS systems. This paper presents the prototype of a newly developed ATCS and the results of a microsimulation study assessing its performance. The strategy is designed for use in interconnected urban sub-networks containing several signalized intersections. It optimizes signal plans and coordination patterns of consecutive time intervals of 15 minutes. These signal plans can then be used at intersection level as continuously updated fixed time plans or even as framework plans in traffic responsive controllers. Four modules are executed once per time interval: forecasting of detector counts, demand estimation, cycle length and green split optimization, and offset optimization. The modules are described in this paper with emphasis on the latter.

**Keywords:**

Adaptive traffic control system, Signal plan optimization, Offset optimization, Genetic algorithm, Cell transmission model.

ID 2889 R

**USE OF GENETIC ALGORITHM FOR FUZZY SIGNAL CONTROLLER DESIGN ? AN EXPLORATORY STUDY**

Main Author:

**Maria ALICE JACQUES** (*Universidade de Brasília*)

Co-author(s):

**Felipe LABANCA** (*Universidade de Brasília*)**Paulo SÉRGIO SOUZA JR.** (*Universidade de Brasília*)**Marcelo ASARI** (*Universidade de Brasília*)**Abstract:**

The fuzzy signal controller considered in this study is activated by traffic and its internal programming is based upon fuzzy logic by making use of the fuzzy extension principle. Each controller element can be implemented in different ways. The elaboration of the controller project is therefore hampered by the sizeable number of options available in defining its components. This study proposed the use of Genetic Algorithms (GAs) so as to conduct a search for an option that can be better adjusted to the prevailing control situation. Tests with the GA proposed involved different traffic volume levels to be controlled and proved the instrument's effectiveness.

**Keywords:**

Vulnerability, Mode choice, Cost-benific analysis, Logsum measure.

ID 3243 R

**ADDITIONAL BENEFIT OF ITCS DATA USED IN ROAD TRAFFIC CONTROL SYSTEMS**

Main Author:

**Christian GASSEL** (*Dresden University of Technology*)

Co-author(s):

**Juergen KRIMMLING** (*Dresden University of Technology*)**Abstract:**

Urban agglomerations are facing increasing traffic demand with telematics to save high transport quality for both - public transport and motorized individual transport. On the one hand public transport operators use ITCS to locate and dispatch the vehicle fleet. On the other hand road traffic control systems monitor road traffic conditions and derive measures to improve road traffic flow. So far these systems are working separately in principle. In Dresden, Germany, the responsible institutions combined ITCS data of a pure public transport surface system with the urban road management system to figure out the benefits for public transport and road traffic. For demonstration purposes one of the heaviest charged traffic corridors of Dresden (North-South Route, 48000 cars daily) was chosen. In addition to road traffic, several light rail transit (LRT) lines are operating along that corridor with up to 45000 alighting and boarding passengers at the stops per day. Using new interfaces between ITCS and the urban traffic management system the road traffic model of North-South Route was enlarged by the exact state of public transport. In further processing these data are transferred to the traffic control centre being handled by the Dresden Road Department. With the aim of the multimodal traffic model the control centre has extended options to switch traffic lights fulfilling high transport quality of public transport and road traffic. For the sake of balanced prioritization of transport modes, the traffic light priorities are adjusted according to LRT scheduled deviation. Consequently, LRT vehicles being late expect a higher priority. (...).

**Keywords:**

Energy efficiency, Traffic control, ITs.

ID 1378 R

**COMPUTER AIDED CAPACITY MANAGEMENT LIFE CYCLE SUPPORT FOR TRANSIT SYSTEMS**

Main Author:

**Martin HOFFMANN** (VIA, RWTH Aachen)

Co-author(s):

**Alexander KUCKELBERG** (VIA, RWTH Aachen)**Abstract:**

In the context of railway operation, capacity management commonly denotes the spatiotemporal allocation of infrastructure resources to a train movement, also called a trajectory. A couple of trajectories finally set up a schedule. This task is increasingly supported by computer aided systems like scheduling systems, trajectory request web portals and schedule simulation tools to evaluate different aspects of the intended schedule. This understanding is an unfounded restriction of infrastructure capacity usage to a narrow time horizon. Finally the available and manageable infrastructure capacity is the consequence of long term planning and development. Roughly speaking, capacity management starts with the evaluation of expected traffic flow and design of model schedules and traffic. With these model schedules, different infrastructure layouts may be evaluated with respect to their operational and economical suitability. Identifying best fitting infrastructure layouts for expected traffic needs far in advance allows reconstruction, rebuilding or restructuring actions, which usually requires a couple of years and high investment costs. According to this the infrastructure and traffic analysis phase is an essential but commonly unconsidered one within the capacity management process. The concrete scheduling process – denoted as capacity management (introduced above) – uses the capacity provided by the available infrastructure. As an additional comprehension the real time usage of infrastructure extends the meaning of capacity management. This extended understanding of capacity management can be named as the life cycle of (infrastructure) capacity. As indicated before different tools exist to support single phases and tasks within this life cycle, using specific algorithms and data models. (...).

**Keywords:**

Life cycle, Network planning, Model train, Data structure, Tool support.

ID 2926 R

**EVALUATION OF THE PERFORMANCE OF LIGHT SPEED ENFORCEMENT SYSTEMS**

Main Author:

**Ana BASTOS SILVA** (Departamento de Engenharia Civil da FCT Universidade de Coimbra)**Abstract:**

Road accident rates in urban areas are still a serious problem, and speeding continues to be the leading factor for this situation. To tackle this problem a number of mitigation measures have emerged over time aimed at reducing circulation speeds, among which are included the Red-light enforcement systems. The implementation of such systems has become common practice in Portugal, given the ease of installation and effectiveness demonstrated in reducing speed. Consequently, this type of systems has expanded rapidly across the country with applications covering both the urban and rural areas. They sometimes have some popular opposition, but have gained a great level of acceptance by road management authorities. Therefore, this paper focuses on evaluating the effectiveness of these speed control systems. The assessment is supported by a real database actually achieved by taking the speed distribution at three sites that had these type of systems, accompanied by the registration of video images. The analysis of data collected allowed, firstly, to assess the differential variation of the speeds associated with the system, the non-compliance rates and, moreover, to perceive the behavior patterns of drivers due to the presence of the system.

**Keywords:**

Controlling speeds, Traffic calming, Driver behaviour.

ID 2334 R

**MICROSCOPIC FUZZY URBAN TRAFFIC SIMULATION WITH VARIABLE DEMAND**

Main Author:

**Masashi OKUSHIMA** (*The University of Tokushima*)

Co-author(s):

**Takamasa AKIYAMA** (*Kansai University*)**Madhu ERRAMPALLI** (*Central Traffic Research Institute*)**Abstract:**

Some microscopic traffic simulations on urban road network are developed up to now. However, the effect of urban transport policy in the local city is influenced with the complex interaction of automobile traffic and public transport traffic. Particularly, behaviours of vehicles should be described with the fuzziness of the subjective recognition and operation. On the other hands, the trip makers are influenced by various transport policies in terms of mode choice behaviour. The change in mode choice behaviour and number of public transport mode users would eventually affect traffic flow conditions on road network. Modal split and traffic conditions of a network are interrelated. Therefore, the present study mainly aims to integrate mode choice model and microscopic traffic simulation model based on fuzzy logic. In the study, the fuzzy logic based mode choice model is proposed. The proposed mode choice model and the existing microscopic traffic simulation model are combined. The developed model has been applied on real urban network to demonstrate the effectiveness of the installation of LRT system. Finally, it is helpful for evaluation of transport policy that the fuzzy logic based microscopic traffic simulation with modal choice model has been constructed.

**Keywords:**

Microscopic Traffic Simulation, Mode Choice, Fuzzy Reasoning, LRT.

ID 2517 R

**A STUDY ON SERVICE SUPPLY PLANNING OF INTER-REGIONAL TRANSPORTATION NETWORK WITH THE HELP OF MULTI-OBJECTIVE OPTIMIZATION METHOD**

Main Author:

**Naoki OKUNOBO** (*Tokyo University of Science*)

Co-author(s):

**Munenori SHIBATA** (*Railway Technical Research Institute*)**Hisao UCHIYAMA** (*Tokyo University of Science*)**Shintaro TERABE** (*Tokyo University of Science*)**Abstract:**

Recently, the need to reduce carbon dioxide (CO<sub>2</sub>) emissions is an important concern. The purpose of this study is to propose a new evaluation method for the inter-regional transportation using a couple of indices of convenience of movement as well as CO<sub>2</sub> emissions, to show the effect of a flexible service supply measures. Using genetic algorithm (GA), the authors propose an evaluation system for service supply combinations of interregional transportation network where the goal is to reduce CO<sub>2</sub> emissions. Simulated results suggest that flexible service will effectively reduce the environmental impact of CO<sub>2</sub> emissions.

**Keywords:**

Inter-Regional Transportation, CO<sub>2</sub> Emissions, Genetic Algorithm.



ID 2711 R

**QUANTIFYING THE FULL RELIABILITY BENEFITS OF ROAD NETWORK IMPROVEMENTS**

Main Author:

**Maaïke SNELDER** (TNO)

Co-author(s):

**Lorant TAVASSZY** (TNO / Delft University of Technology)**Abstract:**

Assessing travel time reliability and the robustness of networks (especially road networks in major urban areas) is becoming more important as networks become more vulnerable. Especially in the Netherlands, the interconnectivity of networks of different scale is low and the level of usage is high, which leads to low spare capacities for unfavorable conditions. Also, the number of incidents is high and increasing. The Randstad area, lying between Amsterdam, The Hague, Utrecht and Rotterdam, experiences about 1750 incidents a year with a clearance time of over one hour. Already small disturbances can cause major disruptions on large parts of the network. As such we can expect that major benefits could be gained from measures that improve the stability of operating conditions of the road network under unfavorable circumstances. In 2008 the Dutch Ministry of Transport, Public Works and Water Management published the "MobiliteitsAanpak" (Mobility Approach) (Ministry of Transport, Public Works and Water Management, 2008). This policy document proposes investments in the Dutch road, rail, regional public transport and waterways network to improve travel times and their reliability and reduce negative external effects of transport. By assignment of the Dutch Ministry of Transport TNO evaluated the benefits of the Euro 30bn's worth of investment in the road network between 2020 and 2028. New in this analysis was that, in addition to travel time gains, we assessed the full reliability benefits of transport projects, where, next to the small travel time variations we also included the effects of major disruptions, where the robustness of the transport network is critical. Traditionally benefits related to improved travel time reliability were assessed using crude rules of thumb which are not related to the present or the future state of the network. (...).

**Keywords:**

Robustness of road networks, Travel time reliability, Benefits of robustness measures for road networks.

ID 2771 R

**INTEGRATED MULTIMODAL CORRIDOR ANALYSIS USING A MICROSIMULATION MODELING FRAMEWORK**

Main Author:

**Sarah ZIEMS** (Arizona State University)

Co-author(s):

**Bhargava SANA**  
**Ram PENDYALA****Abstract:**

This paper presents a detailed description of a recent study to microsimulate a mixed highway – light rail corridor in the Greater Phoenix region of Arizona in the United States. The multimodal corridor is 20-miles long and includes a light rail line running in mixed highway traffic along major arterials with numerous intersections. Starting with a full travel demand model for the entire region, the study focuses on performing a detailed subarea analysis for the light rail corridor. The TRANSIMS microsimulation model is used in this study, although the lessons learned from this experience can be translated to any other microsimulation modeling exercise. The paper describes how the subarea analysis is conducted, how the subarea network is enhanced with greater detail to be consistent with a microsimulation approach, and how the model was implemented in an iterative fashion to achieve stability in the outputs. The calibration procedures adopted in the study, and the data used for model calibration, are described in detail. Finally, the calibrated model is applied to test the impacts of alternative operational strategies along the corridor to demonstrate how the model can be used in a practical multimodal operational planning context.

**Keywords:**

Microsimulation Model, Multi-modal Corridor, Subarea Analysis.

ID 2974 R

**TRAVEL FUNCTIONS ON ARCS FOR DYNAMIC TRAFFIC ASSIGNMENT MODELS IN URBAN NETWORKS**

Main Author:

**Gloria LONDOÑO** (*Instituto de Ingeniería, Universidad Nacional Autónoma de México*)

Co-author(s):

**Angélica LOZANO** (*Instituto de Ingeniería, Universidad Nacional Autónoma de México*)**Abstract:**

This paper presents an analysis of the travel time functions of arcs, which has appropriated characteristics for being incorporated to dynamic assignment problems in urban networks with a variation to the Wardrop user equilibrium (1952). The approach is focused to the analysis of the dynamic traffic assignment in urban networks, where the arcs have different physical and operative characteristics, and hence different travel functions, for the estimation of the traffic conditions in a network on the short term. A review of literature, on dynamic assignment models and travel functions used by dynamic equilibrium models, is carried out. The review of the conceptual framework on the modeling of time dependent networks by means an analytic approach, offers several proposals (Boyce et al., 1995; Chen, 1998; Ban et al., 2005, 2008, etc.); in some of such proposals the problem is formulated as an optimization mathematical program. Although travel functions on arcs are critical components of dynamic assignment models, there is limited research on it. Usually, the authors use dynamic theoretical functions with their analytical proposals, whose results can not be realistic. The travel functions to be analyzed are flow dependent for two types of roads, those with controlled access and those controlled by traffic lights. Functions BRP, Akcelik and Webster are among the analyzed travel functions. Then, the features of a real network are described. This network is composed of arterial road corridors in Mexico City, with different travel functions on arcs. An analysis of several travel functions on arcs is carried out for this network using a user equilibrium assignment model, solved by means Frank-Wolfe algorithm, initially for a static condition, which is subsequently modified to introduce the dynamic component. (...).

**Keywords:**

Travel time functions of arcs, Dynamic traffic assignment, User equilibrium, Frank-Wolfe algorithm.

ID 1704 R

**SENSITIVITY ANALYSIS BASED APPROACH FOR VULNERABILITY ANALYSIS OF LARGE-SCALE ROAD NETWORK**

Main Author:

**Agchai SUMALEE** (*Hong Kong Polytechnic University*)

Co-author(s):

**Paramet LUATHEP** (*Department of Civil and Structural Engineering, The Hong Kong Polytechnic University*)  
**Hung-Wai HO** (*The Hong Kong Polytechnic University*)  
**Fumitaka KURARUCHI** (*Gifu University*)

**Abstract:**

Vulnerability analysis is vital in strategic transport network planning to cope with the impacts from natural or malevolent events. Traditionally, an assessment of network vulnerability is a highly computational-intensive operation. This paper proposes a sensitivity analysis-based (SA) approach to improve the computational efficiency and allow for the large-scale application of network vulnerability analysis. Different vulnerability indicators could be used by the proposed method. For illustrative purpose, this paper adopts the relative accessibility index (AI), which follows the Hansen integral index, as the network vulnerability measure for evaluating the socio-economic impact from road (or link) capacity degradations or closures. Under network disruption, links with a large change of AI are more critical. Critical links are then identified by ranking the links in accordance to the change of AI. The proposed method only requires a single calculation of network equilibrium condition that extremely relieves the computational burden and storage requirement of the traditional approach. The networks of Sioux Falls city and Bangkok metropolitan area are used to demonstrate the feasibility and efficiency of the proposed technique. Network managers and policy-makers can use the proposed scheme as a decision-supporting tool for identifying critical links. By improving the critical links or constructing new by-pass roads (or parallel routes) as a preventive action, the overall vulnerability of the network could be reduced.

**Keywords:**

Vulnerability analysis, Sensitivity analysis, Large-scale.

ID 1932 R

**REAL TIME CHANGES OF ROAD NETWORK TOPOLOGY AS AN APPROACH TO MITIGATE THE EFFECTS OF INCIDENTS IN URBAN CONGESTION**

Main Author:

**Rute GERALDES** (*Instituto Superior Técnico*)

Co-author(s):

**José MANUEL VIEGAS** (*Centro de Sistemas Urbanos e Regionais (CESUR), Instituto Superior Técnico (IST)*)**Abstract:**

Noting the importance of incidents in urban congestion and looking for ways of reducing their impact, and after review of past efforts in this area, it has become clear that major efforts have a common idea, giving information about the incident and network status to the drivers. But after a first promising and good acceptance phase of the idea, recent reported experiments and studies seem to show that practical results are not as good as expected. This is due mostly to two facts. First, the information has no value if there aren't alternative paths because the network has no extra capacity. Second, the drivers use the information in their own best interest to achieve a user optimum, which is known to be different from the system (network) optimum. This paper reports on an alternative approach. We assume that the technology is available to achieve almost perfect information on the state of the road network in real time, as well as on variable message panels that allow variable signs or messages of any kind (text or picture), and with this we treat the road network as other kind of networks where the external shape (morphology) is fixed, but the topology can be changed. Variable message signs permit us to change the way (direction of flow) of the streets and turning prohibitions in a similar way to what switches and valves do in other kinds of networks. (...).

**Keywords:**

Traffic Incidents, Urban Road Congestion, Network Topology, Simulation.

ID 2029 R

**IMPROVING NETWORK RELIABILITY VIA INCIDENT MANAGEMENT**

Main Author:

**Alan NICHOLSON** (*University of Canterbury*)

Co-author(s):

**Glen KOOREY** (*University of Canterbury*)**Susan MCMILLAN** (*University of Canterbury*)**Abstract:**

Network reliability has become a major issue, due to increasing traffic congestion and the adverse impact on road users, especially those who have embraced the just-in-time philosophy. Traffic incidents (e.g. accidents) are a major contributor to a lack of reliability, and there is thus an increasing interest in improved incident management. This paper describes a study involving linking a microsimulation model (S-Paramics) with the SCATS traffic signal control software, to assess the benefits of adjusting traffic signal timings to mitigate the effects of incidents. While a case study indicates that the benefits of using SCATS as an incident management tool are not large, it is concluded that linking traffic signal control and microsimulation software appears to be a promising approach for developing incident management plans to improve network reliability.

**Keywords:**

Network reliability, Incident management, Microsimulation, Adaptive signal control.

ID 2146 R

**SPATIAL BENEFIT INCIDENCE OF ECONOMIC EFFECTS OF ROAD NETWORK INVESTMENTS -CASE STUDIES UNDER THE USUAL AND DISASTER SCENARIOS-**

Main Author:

**Keisuke SATO** (*Railway Technical Research Institute*)

Co-author(s):

**Atsushi KOIKE** (*Tottori University*)**Lorant TAVASSZY** (*TNO / Delft University of Technology*)**Toshiyuki MONMA** (*National Institute for Land and Infrastructure Management*)**Abstract:**

Road networks can be considered to be local public goods. Hence, their spatial benefit incidence should be equal to their cost burden in each region. An analysis of benefit incidence should include not only the usual scenario but also a disaster scenario, because the redundancy effect is expected to reduce the amount of economic damage incurred during a disaster. Our research group has developed a Spatial Computable General Equilibrium model (RAEM-Light), which can be applied to small spatial regions. The model has some innovative features and can explicitly describe the spatial behavior of producers and consumers. It is endogenously determined by using econometric production and consumption functions. The model does not depend on input-output data and is therefore well suited for analyzing detailed areas where official input-output data are not available. This paper focuses on a road network in the Chugoku area in Japan. The RAEM-Light model was applied to analyze the development and maintenance stages of road networks under a usual and a disaster scenario for an existing road network and a proposed new network. The benefit incidence under the usual scenario showed the spatial incidence of the economic effects of road investment, including spill-over effects. The benefit incidence under the disaster scenario showed the spatial incidence of economic effects as a reduction in economic damage. These two spatial benefit incidences differed with the measurement viewpoint even within the same stage, indicating that the regional cost burden will also differ, depending on the investment aim. (...).

**Keywords:**

Road Network Investment, Spatial Benefit Incidence, Spatial Computable General Equilibrium.

ID 2838 R

**ASSESSING NETWORK VULNERABILITY USING CBA AND THE LOGSUM MEASURE**

Main Author:

**Alex ERATH** (*ETH Zurich*)**Abstract:**

Motivation In normal state transport networks serve as a backbone of our society carrying passenger and freight traffic. As a result of sudden events such as natural hazards parts of the network may be out of function for a certain time causing either certain regions to be cut off or leading to substantial deviations which increase travel time and distance and may lead to mode and destination choice shifts. However, current research of transport network vulnerability mostly considers only failure induced route choice shift (deviations) including additional travel time and costs. Especially when assessing multiple link failures (e.g. caused by a flood) mode and destination choice shift and trip suppression become more relevant. Objectives The aim of the paper is to present how demand reactions to transport network failures beyond deviations can be modeled within the classical four step transport model framework and evaluated by the Logsum measure for national networks (> 20'000 links) within reasonable computation time. The results are then compared to the classical cost benefit analysis (CBA) that is mainly based on valuating additional travel time and distance. Methods and Implementation Basis of the analysis is the Swiss National Transport Model. As presented in earlier research, the failure induced demand reaction can be evaluated with sufficient accuracy using subnetworks (limited sections of the complete network which are cut out of the full network including the internal and the transit demand of this section) which substantially reduces the computation intensity of the problem. Instead of assuming inelastic demand, we use the available mode and destination choice models to expand the considered demand reaction caused by network degradation. (...).

**Keywords:**

Vulnerability, Mode choice, Cost-benefit analysis, Logsum measure.

MON 12<sup>th</sup> (15:30 - 16:45, Session C3.3) Room 1.07

ID 2507 R

**MEASURING CONCENTRATION IN LESS-THAN-TRUCKLOAD NETWORKS**

Main Author:

**Anne PAUL** (*University of Cologne, Department of Business Policy and Logistics*)

**Abstract:**

An efficient and service-oriented transportation network is a necessary resource for successful less-than-truckload operations. The design, as well as the evaluation, of transportation networks is mainly driven by quantitative in particular cost-oriented measures, such as transport and transshipment costs. Spatial network centrality is often neglected in transportation network design, even though network centrality is at the root of many aspects of network performance, for instance schedule reliability and terminal congestion. This paper suggests modifications of the Gini-based network concentration index as well as the hubbing concentration index from the passenger airline context to the less-than-truckload road transportation context. The modified indices assess the concentration of a less-than-truckload network and allow incorporating centrality in a structured way into transportation network design. They provide aggregated information on structural aspects of a network and are thus a starting point for network evaluation and further examination. This paper presents a comparison of network scenarios, which illustrates how the indices provide relevant information for network design decisions.

**Keywords:**

Network configuration, Network design, Spatial concentration, Centrality, Less-than-truckload transportation.

MON 12<sup>th</sup> (15:30 - 16:45, Session C3.3) Room 1.07

ID 2779 R

**LOADING TRAFFIC ON BOTTLENECKS NETWORK: AN EVENT BASED APPROACH**

Main Author:

**Nicolas WAGNER** (*Université Paris-Est, LVMT, Ecole des Ponts ParisTech*)

**Abstract:**

This paper deals with the Dynamic Network Loading Problem. A general formulation is presented for which existence and uniqueness is guaranteed under five physically sound assumptions on the arc travel time models. An efficient computation method is then proposed and applied to networks of bottlenecks. Two important features of the approach are: (1) assuming that demand is described by piecewise linear cumulated volumes on each routes, the computation is exact; (2) time is treated continuously. Numerical illustrations are given.

**Keywords:**

Traffic loading, Dynamic traffic modelling, Bottleneck congestion.

ID 3005 R

**DIAGNOSTIC AND TREATMENT OF THE "SPLIT BRAIN" OF AN ISLAND: TRAFFIC ANALYSIS OF EL-CARMEN CITY**

Main Author:

**Angélica LOZANO** (*Instituto de Ingeniería, Universidad Nacional Autónoma de México*)

Co-author(s):

**Alejandro GUZMÁN** (*Instituto de Ingeniería, Universidad Nacional Autónoma de México*)**Francisco GRANADOS** (*Instituto de Ingeniería, Universidad Nacional Autónoma de México*)**Rodrigo ALARCÓN** (*Instituto de Ingeniería, Universidad Nacional Autónoma de México*)**Juan PABLO ANTUN** (*Laboratorio de Transporte y Sistemas Territoriales, Instituto de Ingeniería, Universidad Nacional Autónoma de México (UNAM)*)**Abstract:**

El-Carmen is a city into an island within an ecological reserve area (mangrove area) and near an important petroleum oil field, in the Golf of Mexico. The city has over 166 thousand habitants. Split-brain is the result when the corpus callosum connecting the two hemispheres of the brain is severed to some degree. El-Carmen City has two parts, which are connected just by two ways; the Airport split the city. The parts, as the brain hemispheres, are specialized. The west part has the majority of the service-land-use; the market, offices, schools and the Port are located there, also the offices and facilities of PEMEX (Mexican Petroleum Company) and companies of services which are related to petroleum extraction; almost there are not free plots. Instead the east part has mainly residential land use and has many available plots for a future urban development. The island is connected with the continent by means of to bridges, one on the west and the other in the east extreme points. The Port and the Airport are important for the country; they can not be relocated. The city exists because them. The motorization rate is high and it is growing rapidly. Almost 33% of the trips use private car. As a consequence, there a large quantity of trips between the two parts of the city, but there are just to ways for connecting them. One is a road with a large amount of in transit vehicles. (...).

**Keywords:**

Traffic analysis, Traffic assignment, Land use.

ID 3022 R

**A BAYESIAN MULTINOMIAL-POISSON SIMPLIFIED MODEL FOR NETWORK TRAFFIC INFERENCE BASED ON LINK COUNT DATA**

Main Author:

**Luis CARVALHO** (*Boston University*)

Co-author(s):

**Felipe LOUREIRO** (*Universidade Federal do Ceará*)**Abstract:**

Given a network where traffic counts are observed on a selected set of links, we consider the problem of estimating traffic intensities between origin-destination (OD) pairs in this network. We adopt a Bayesian approach and set independent Poisson prior distributions on the number of trips generated on a given time interval between each OD pair. Trips are further assigned to routes in the network according to a multinomial distribution where route choice proportions are defined by a SUE model. Given the complexity in the likelihood function, we derive a hybrid Markov chain Monte Carlo algorithm that samples asymptotically from the posterior distribution and thus enables the joint inference of mean OD pair and network flows. We discuss theoretical aspects of the model, including its relation to previously studied models and the adequacy of the assumed prior distribution, and practical issues such as computational efficiency. We illustrate our method on well known example networks, compare estimates with other methods, and finish by presenting directions for future research.

**Keywords:**

OD matrix estimation, Bayesian statistics, Posterior inference, MCMC methods.

MON 12<sup>th</sup> (15:30 - 16:45, Session C3.3) Room 1.07

ID 3146 R

## **TOWARDS A COMPLETE EVACUATION DEMAND AND SUPPLY MODELING AND MANAGEMENT PROCESS**

Main Author:

**Hossam ABDELGAWAD** (*Dept of Civil Engineering, University of Toronto*)

Co-author(s):

**Baher ABDULHAI** (*Toronto ITS Centre and Testbed*)

### **Abstract:**

In this paper, we introduce a complete set of integrated tools for modeling and managing transportation systems under emergency evacuation scenarios. The main contributions of the proposed system are 1) it comprehensively models evacuation trip generation, mode split, evacuation schedule, trip distribution and trip assignment in a systematic and integrated fashion 2) it generates an optimized multimodal evacuation plan by combining transit-evacuation and auto-evacuation. The proposed model is applied to a hypothetical large-scale evacuation of the City of Toronto and selected results from the implementation are presented for each mode to illustrate the capabilities of the full system. This paper focuses on the integration of the different demand and supply modeling aspects of the system. Detailed presentation of the individual components of the system and their corresponding results are beyond the scope of this paper for space limitations. However, proper references to the necessary details are provided.

### **Keywords:**

Emergency evacuation, Optimization, Demand managem.

MON 12<sup>th</sup> (17:00 - 18:15, Session C3.4) Room 1.07

ID 1729 R

## **THE STOCHSTIC CELL TRANSMISSION MODEL BASED DYNAMIC JOURNEY TIME RELIABILITY ANALYSIS**

Main Author:

**Agachai SUMALEE** (*Hong Kong Polytechnic University*)

Co-author(s):

**Tianlu PAN** (*The Hong Kong Polytechnic University*)

**William H.K. LAM** (*Hong Kong Polytechnic University*)

### **Abstract:**

This paper proposes a framework for estimating/predicting the distribution of dynamic stochastic journey time and assessing the journey time reliability. Due to the stochastic nature of the cumulative inflow and outflow profiles, the paper devises a sampling process to estimate the probability mass function (PMF) of the link travel time. This sampling process extends the deterministic dynamic travel time estimation method, i.e. cumulative inflow to outflow matching method based on the first-in-first-out (FIFO) discipline, to the stochastic case. The PMF of the journey time is then estimated by extending the nested delay operator to the stochastic case based on the conditional probability. The paper also proposes a method to fit the estimated PMF of the journey time to a class of statistical distribution to determine its skewness, which is useful in the analysis of journey time reliability. The proposed algorithm is applied to estimate the stochastic journey time on a freeway corridor from the stochastic cumulative inflow and outflow profiles generated from the stochastic cell transmission model proposed by Sumalee et al. (2010). This methodology is tested with two empirical studies: (i) predictions of traffic state and travel time distribution for one short freeway segment in California (using the data from the PeMS database) and (ii) travel time reliability analysis (e.g. The Buffer Time Index) for a long expressway corridor of Hanshin expressway (between Osaka and Kobe) in Japan.

### **Keywords:**

Dynamic journey travel time distribution, Relative frequency, Probability mass function, Skewness, Buffer time index.

ID 2489 R

**ROUTES MANAGEMENT IN COMPLEX RAILWAY JUNCTIONS: METHODOLOGY AND TOOLS FOR OPTIMIZING OPERATION AND LAYOUT**

Main Author:

**Alessandra LIBARDO** (*IUAV University of Venice*)

Co-author(s):

**Agostino CAPPELLI** (*IUAV University of Venice*)**Giorgio SALERNO** (*University of Florence*)**Abstract:**

This paper describes the methodology used to create a model for supporting the definition of an efficient timetable given a station layout. The objective is to assess the capacity of the physical infrastructure in terms of simultaneous movements in a defined time horizon. A computational procedure (software SNJ) is formalized to perform a morphological analysis of junctions themselves. It returns an indicator of capacity (mean number of possible safe movements) and the list of the n-tuples capable to saturate the station. In a stable state condition different combinations of n-tuple activations could return very different levels of capacity. Following the identification of a mathematical formulation (model SLC) and a solution algorithm, a software is implemented (coded in APL) for being able to face capacity problem in any complex layout. The Station Layout Computing (SLC) model described in the paper, allows to find the optimal solution in terms of activation frequency of each n-tuple satisfying the timetable demand efficiently, i.e. in the shortest possible period of time. The computational analysis evaluates the performance of a realistic station layout under real operational conditions. It allows to determine the combination of n-tuples that provides the highest number of train movements in the time horizon, respecting all scheduled frequencies (respecting scheduled frequencies on all lines). This solution optimizes the layout utilization, sets additional feasible movements and proves layout reliability. Such a reliability is assessed through the leftover time values that can be used to deal with operating variances or perturbations (uncertainly of arrivals, prolongations in the stopping). (...).

**Keywords:**

Ailway junction, Station capacity, Layout optimization, Traffic management, Support timetable.

ID 2709 R

**MULTI-METHOD ANALYSIS FOR THE ASSESSMENT OF RAILWAY OPERATION ON THE WESTERN PART OF ROME'S RAILWAY NODE**

Main Author:

**Stefano RICCI** (*Sapienza - University of Rome*)

Co-author(s):

**Alessio DICEMBRE** (*Sapienza - University of Rome*)**Abstract:**

In the paper an assessment of railway operation on the western part of Rome's railway node is presented; the actual situation and possible future scenarios are analysed. A comparison among results given by different methods for carrying capacity evaluation and simulation models is described. The required input data and the different levels of detail that they can reproduce are explained.

**Keywords:**

Railway, Carrying capacity, Operation, Synthetic and analytical methods, Simulation.



MON 12<sup>th</sup> (17:00 - 18:15, Session C3.4) Room 1.07

ID 2762 R

## HIGH-SPEED TRAINS IN SWEDEN – A GOOD IDEA?

Main Author:

**Kjell JANSSON** (*Royal Institute of Technology Stockholm (KTH)*)

Co-author(s):

**Bo-Lennart NELLDAL** (*Royal Institute of Technology Stockholm (KTH)*)

### Abstract:

The demand for both passenger and freight rail transport in Sweden has never before been higher than in the year 2008. There is now serious lack of capacity and big delays, and need for massive investment in rail. High-speed trains may be a way to relieve track congestion, reduce travel times and improve the environment through less air and car travel. The Swedish National Rail Administration has initiated a number of studies on the value of highspeed trains over the last years. The Swedish government has initiated a study that was finished 14th of September 2009 and suggested to build a separate high speed tracks in Sweden. The paper describes the main findings of the study and the models employed. The latter is of importance since two models gave significantly different results, even though both showed a positive socio-economic net return. The cost-benefit calculations have also been subject to skepticism. These skepticisms are also described and commented.

### Keywords:

Track congestion, Improve the environment, Swedish .

TUE 13<sup>th</sup> (08:15 - 09:30, Session C3.5) Room 1.07

ID 1487 R\*

## ENTERPRISE TRANSPORT NETWORK EDITING IN TRANSPORT MODELING SOFTWARE

Main Author:

**Minhua WANG** (*Citilabs*)

### Abstract:

Traditionally, transport network editing with Transport Modeling software has been performed at a single user basis, in which input data and output data, whether the data is in file format (e.g., .net, .lin or .csv) or in file based database (e.g., Access database), are stored locally and access and used by a single user. With the growth of the amount of data and the complexity of multimodal transport networks required to support transport planning and modeling studies, and with the growth of demands for enterprise network coding and integration with GIS, many transportation agencies have moved the transport planning and modeling studies into an enterprise wide environment. When data sharing and data pooling in an enterprise environment are necessary requirements for transport modeling, single user based modeling practice becomes problematic due to the following enterprise operational requirements: • Maintain a single repository for network data and modeling data for access by multiple users • Allow multiple users to edit the same network data • Allow multiple users to access the same modeling data • Implement enterprise wide security policy on data maintenance, data access and data management • Allow automatic synchronization of network changes among modeling data • Manage scenarios in an enterprise environment to allow sharing of model scenarios • Integrate with enterprise GIS system for better network data It has been widely demanded in the transport modeling user community that a transport modeling software should support transport network editing within an enterprise environment. This paper will review the common transport network editing practice in the existing transport modeling software and to propose a solution to enable enterprise network editing with the transport modeling software. (...).

### Keywords:

Transport Modeling Network Editing GIS Data Mod.

TUE 13<sup>th</sup> (08:15 - 09:30, Session C3.5) Room 1.07

ID 2443 R

**A PETRI-NET BASED APPROACH FOR THE INTERDEPENDENCE ANALYSIS OF CRITICAL INFRASTRUCTURES IN TRANSPORTATION NETWORKS**

Main Author:

**Nicola SACCO** (*DIMSET - University of Genoa*)

Co-author(s):

**Angela DI FEBBRARO** (*DIMSET - University of Genoa*)

**Abstract:**

The paper deals with the problem of estimating the indirect consequences of safety and security accidents in the so-called transportation Critical Infrastructures (CIs), i.e., those assets consisting of systems, resources, and/or processes whose total or partial destruction, or even temporary unavailability, has the effect of damaging or significantly weakening the efficiency and the normal functioning of a Country. In this framework, the aim of this paper is to define a methodology for estimating the costs deriving from the "chain-effect", which characterizes many CIs, in terms of reachability/non reachability of some network nodes. In doing so, a modelling approach based on Petri Nets (PNs) is proposed, being them a suitable formalism to predict the behaviour of a whole transportation network as a consequence of particular events occurring in it. In the paper, after introducing and discussing the PN models of transportation CIs, a case study is described and discussed.

**Keywords:**

Critical Infrastructures, Transportation Networks, Interdependence Analysis.

TUE 13<sup>th</sup> (08:15 - 09:30, Session C3.5) Room 1.07

ID 2578 R

**LOCATION-BASED SERVICE FOR IN-VEHICLE ROUTE GUIDANCE WITH REAL TIME TRAFFIC INFORMATION**

Main Author:

**Saeed NADI** (*GIS Lab., Surveying and Geomatic eng. Dept., University of Tehran*)

Co-author(s):

**Mahmoud REZA DELAVAR** (*GIS Laboratory, Center of Excellence in Geomatics Eng. and Disaster Management,*)

**Abstract:**

This paper intends to model the determination of best path in transportation networks with real-time and stochastic traffic information. Although real world in-vehicle route planning problems are dynamic and real-time traffic information is among the most important and essential criteria for drivers during route selection, most current systems have been based on static algorithms. In this paper, the theoretical concepts of real-time in-vehicle route planning are discussed and a model is proposed. In the modeling process, a location based service (LBS) for in-vehicle route guidance system using real-time traffic information is proposed and implemented in a mobile GIS environment.

**Keywords:**

Location based service, Route planning, Real-time traffic information.

TUE 13<sup>th</sup> (08:15 - 09:30, Session C3.5) Room 1.07

ID 2932 R

**COLLECTING AND IMPLEMENTING EMPIRICAL  
PROCUREMENT AND LOGISTICS DATA IN  
TRANSPORT MODELS**

Main Author:

**Ute IDDINK** (TU Dortmund University, Chair of  
Transportation Systems and Logistics)

**Abstract:**

Compared to passenger transportation modelling, the field of freight modelling is relatively unexplored. To improve the basis for modelling transport operations, the knowledge about logistics in production networks and supply chains has to be enlarged. Hence, a research project analysing the relationship between procurement/logistics aspects and induced traffic has been accomplished. In a first step an empirical survey was initialised. Suppliers of the German automotive industry were asked about their company's business data (e.g., number of staff, turnover), produced products, procurement strategies, daily traffic volume as well as their transport organization. The surveyed data were analysed descriptively and by statistical tests. Hence, a lot of figures could be deduced and were implemented in a theoretical model. In addition several kinds of different clusters have been generated to distinguish magnitudes of companies. In general the model uses surveyed statistic distributions concerning the procurement characteristic of companies in the automotive industry. Finally the confirmed statistical interdependencies between different variables provide the improvement of input data for transport models because they contain logistical aspects to deduce generated traffics.

**Keywords:**

Transport modelling, Logistics, Procurement, Empirical survey.

TUE 13<sup>th</sup> (08:15 - 09:30, Session C3.5) Room 1.07

ID 3301 R

**OPTIMUM LOCATION OF MOTORWAY  
INTERCHANGES: CONCESSIONAIRES' PERSPECTIVE**

Main Author:

**António ANTUNES** (Department of Civil Engineering,  
University of Coimbra)

Co-author(s):

**Hugo REPOLHO** (Universidade de Coimbra)

**Richard CHURCH** (Department of Geography - University  
of California, Santa Barbara)

**Abstract:**

In this paper we present an optimization model aimed at assisting toll-motorway concessionaires when they deal with motorway interchange location problems. The decisions are assumed to be made from the toll-motorway concessionaires' perspective, with the objective of maximizing profit. The model is based on existing hub location models. Road users choose to travel through the existing road network or recurring to some motorway segments according to the routes' attractiveness. Routes' attractiveness is measured by travel costs, which are calculated based on a model which comprises four cost components: vehicle operating cost, accident costs, user time costs and tolling costs. A route choice model is used to predict the traffic flow travelling through the motorway. The long-term and hardly reversible nature of road design decisions justifies the inclusion of a section dedicated to a stochastic approach. The usefulness of the model is illustrated through two case studies.

**Keywords:**

Motorway interchanges location, Hub location, Optimization models, Route choice model, Stochastic models.

ID 1576 R

**A CASE STUDY ON STANDARD-SETTING PROCESS OF MINI VEHICLES: PUBLIC-PRIVATE INTERDEPENDENCE FOR AUTOMOBILE SAFETY IN JAPAN**

Main Author:

**Yuichi MURAKAMI** (*The University of Tokyo, the faculty of law*)

**Abstract:**

A mini vehicle in Japan, owing to its regulated size and its energy-saving advantages, has been exempted from certain taxes and obligations. In February 1994, a global trend of standard harmonization encouraged the government of Japan to work on a regulatory standard revision and to ask an industry union to examine the same. Mini vehicle manufacturers, on the one hand, opposed it because it appeared technically unfeasible to them owing to its conventional standardized size and engine displacement. On the other hand, the manufacturers of middle-sized cars and some foreign dealers opposed it for the fear that their potential customer flow would be diverted to mini vehicles, a neighbouring but tax-relieved vehicle type. After the standard is tightened, engineers in the mini vehicle industry made significant efforts and have finally accomplished it. In such a regulatory standard-setting process, public-private interdependence (collaboration) is now one of the common policy methods in Japan, especially in controlling the quality of technical standards for appropriate up-to-date regulation. This paper finds 'interdependence' in that the government, as a regulator, asks manufacturers and other research institutes for highly technical information and makes efforts to attain its policy goal—automobile safety—by means of managing the standard-setting process, utilising the mechanisms of conflicts, competition, and coordination in regulatees in the private sector. The government can take advantage of the incentives of stakeholders who are eager for standard harmonization and technology development.

**Keywords:**

Public-private collaborative governance, Technical standard setting, Standard harmonization, Quality control of safety regulation, Policy process management, Mini vehicle, Automobile safety.

ID 1687 R

**SECONDARY SAFETY PERFORMANCE OF VEHICLES IN FLEET: THE ROLE OF VEHICLE MASS**

Main Author:

**Reza TOLOUEI**

**Abstract:**

There are two distinct safety performance aspects for a vehicle that is involved in a two-car crash: "Protectivity Performance" which is linked to the injury risk to the occupants of that vehicle, and "Aggressivity Performance" which is linked to the injury risk that the vehicle imposes to the occupants of the other vehicle. Current methodologies that estimate protectivity and aggressivity performance of vehicles based on all-injury two-car crash data have the main disadvantage that the estimates for the vehicle involved in two-car crashes are influenced by the injury risk in the colliding vehicle. This is mainly due to the lack of data on non-injury crashes. This paper introduces an alternative methodology to estimate the relative safety performance of makes and models in crashes. The introduced methodology overcomes the disadvantage associated with the previous methodologies that use all-injury crash data by introducing two independent indices. Protectivity Performance Index (PPI) is defined as the proportional difference in the absolute driver injury risk between a given make and model and the mean make and model in fleet, and Aggressivity Performance Index (API) is defined as the proportional difference in the imposed absolute driver injury risk by a given make and model and that by the mean make and model in fleet when involved in similar crashes with similar vehicles. PPI and API were estimated for popular makes and models in 2000-2004 Great Britain vehicle fleet before and after controlling for the effect of mass proportion of the colliding vehicles, which contributes to crash severity. The results showed that when mass proportion is controlled, many makes and models in the dataset that previously showed a significantly different safety performance than the average do not have a significantly different performance. (...).

**Keywords:**

Secondary Safety, Vehicle Protectivity, Vehicle Aggressivity, Vehicle Mass.

ID 1898 R

**EFFECT OF VEHICLE CHARACTERISTICS ON CRASH SEVERITY: PORTUGUESE EXPERIENCE**

Main Author:

**Guilhermina TORRAO** (*Universidade de Aveiro, Departamento de Engenharia Mecanica*)

Co-author(s):

**Margarida COELHO** (*Universidade de Aveiro, Departamento de Engenharia Mecanica*)  
**Nagui ROUPHAIL** (*ITRE, NC State University*)**Abstract:**

Road accidents and the resulting public health impacts is a critical issue in Portugal where mortality rates from vehicle crashes exceed the European Community average. Reductions in traffic fatalities and injuries, as well as transport-generated emissions are currently problems of global interest and represent two very important factors in setting national transportation policy. Reports from the Portuguese National Authority for Road Safety show that, in 2009, 737 individuals lost their lives in road crashes, and 2624 persons were seriously injured, from a total population of 10,627,250. This research explores the conditional probability of crash severity levels for the population of crashes resulting in injuries and/or fatalities. Real world crash data were collected from the Portuguese Police Republican National Guard crash records for the Porto metropolitan area, for the period 2006-2008. From a total of 1925 gathered report crashes, vehicle technical data was available for 314 crash observations. This study has the main purpose of developing a comprehensive database and analysis methodology taking into account the vehicle characteristics effects on crash severity. Ultimately, the goal is the development of a crash-severity prediction model with application to crash analysis and prevention. In this paper, the effect of vehicle characteristics, such as weight, engine size, wheelbase and registration year (age of vehicle) were analysed with data mining methodology to extract patterns from the predictors and relate them to the dependent variables, including the number of injuries and fatalities in a crash, or a crash severity index. The research presented in this paper targeted at studying the effect of the vehicle characteristics on its occupants injuries and/or fatalities. (...).

**Keywords:**

CART, Crash, Engine Size, Injured, Killed, Vehicle, Weight, Wheelbase.

ID 2127 R

**IMPACTS OF TRANSPORTATION ENERGY POLICY ON FUEL CONSUMPTION AND TRANSPORTATION SAFETY**

Main Author:

**Chun KON KIM** (*Korea Institute for Industrial Economics & Trade (KIET)*)**Abstract:**

The purpose of this paper is to explore the impacts of transportation energy policies on traffic safety through policy simulations. Considering the changes in vehicle miles traveled (VMT) and in vehicle stock composition as a result of policy changes, we examine the impact on traffic accidents from those changes in terms of the number of traffic accidents, traffic fatalities, and total accident costs. Here we are primarily concerned with the following policy alternatives: Fuel tax, mileage based VMT tax, Pay-as-you-drive (PAYD) and Pay-at-the-pump (PATP) insurance premium policy, and Corporate Average Fuel Economy (CAFE) standards regulations. By fully integrating three interrelated economic demand decisions – size of vehicle stock, use of the vehicle stock, and energy efficiency – it can predict short-run, long-run, and dynamic effects of a policy change. The results show that the share of light trucks will keep increasing in the future in all policy alternatives and that fuel consumptions will decrease compared to the baseline scenario in all scenarios except VMT tax policy. The results also show that the fatality rates per vehicle miles traveled will decrease but CAFE policy result in more fatalities and higher fatality rates compared to the baseline scenario. The results may provide guidance as to which would improve energy dependency while reducing undesirable side effects related to traffic safety. The outcome of this research provides a set of specific results comparing policy scenarios in a consistent manner. The results will provide guidance concerning whether the policy option would improve energy dependency while reducing undesirable side effects such as environmental problem and safety problem of motor-vehicle travel. (...).

**Keywords:**

Transportation energy, Policy simulation, Two-vehicle crashes, Traffic safety, Pay-as-you-drive (PAYD), Pay-at-the-pump (PATP), Corporate Average Fuel Economy (CAFE), VMT tax, Fuel Tax.

MON 12<sup>th</sup> (11:15 - 12:30, Session C4.1) Room AVI

ID 2526 R

**ACCIDENT EXTERNALITY AND VEHICLE SIZE -  
EVIDENCE FROM SWEDISH COLLISION ACCIDENTS**

Main Author:

**Gunnar LINDBERG** (*Swedish National Road and  
Transport Research Institute*)

Co-author(s):

**Lina JONSSON** (*Swedish National Road and Transport  
Research Institute*)

**Abstract:**

Vehicle mass is a crucial factor for the distribution of injuries between occupants in involved vehicles in a two-vehicle crash. A larger vehicle mass protects the occupants in the vehicle while on the same time inflicts a higher injury risk on the occupants in the collision partner. This mass externality can be internalized to reach a situation where the drivers choose vehicle mass based on the social optimum instead of a private optimum that ignores the negative effects that a large vehicle mass has on the injury risk in presumptive collision partners. Using a database including collision accidents in Sweden involving two passenger cars during five years, the influence of vehicle mass on the injuries and thereby the accident cost in both vehicles is explored. The database contains information on road infrastructure, vehicle characteristics including vehicle mass and characteristics of the occupants in the vehicles including their injuries. To get a measure of the accident cost the Swedish official economic valuation of slight injuries, severe injuries and fatalities are applied. In each accident the two involved vehicles are divided into the lighter vehicle and the heavier vehicle and the effect of weight is examined separately for the two groups. The accident cost that falls on the lighter vehicle increases with the mass of the heavier vehicle and decreases with own mass. Given that a vehicle is the heavier one in the crash, neither the own mass nor the mass of the lighter vehicle significantly affect the accident cost. The expected external accident cost is calculated and it is shown to increase rapidly with vehicle mass. (...).

**Keywords:**

Accident Cost, Collision Accidents, Vehicle Mass,  
Insurance, External Accident.

MON 12<sup>th</sup> (14:00 - 15:15, Session C4.2) Room AVI

ID 1473 R

**THE IMPACTS OF DRIVING BEHAVIORS ON TRAFFIC  
SAFETY IN CASE OF EVACUATION**

Main Author:

**Huizhao TU** (*Grontmij Nederland BV*)

Co-author(s):

**Guus TAMMINGA** (*Grontmij Netherlands BV*)  
**Hans DROLENGA** (*Grontmij Netherlands BV*)

**Abstract:**

The driving behaviour of travellers has been found to be different in case of emergency conditions compared to normal traffic conditions. In this paper, we show how this different driving behaviour has an impact on traffic safety. 8 scenarios with different parameter settings such like speed limit, acceleration rate, mean time headway and minimum gap distance has been conducted in an S-Paramics microscopic simulation model framework to investigate this impact. The results demonstrate that the reduction both in time headway and in minimum gap distance significantly increase the unsafe traffic flows. It is also found that increasing in speed limits and acceleration rate play a smaller role in traffic safety.

**Keywords:**

Evacuation Driving Behaviour Traffic Safety Gap.

ID 1955 R

**VOLUNTARY TEST USE OF ALCOHOL INTERLOCKS IN FINLAND**

Main Author:

**Karel CAPEK** (*Ramboll Finland Ltd.*)

Co-author(s):

**Jarkko NIITYMÄKI** (*Ramboll Finland Ltd.*)**Jukka-Pekka PITKÄNEN** (*Ramboll Finland Ltd.*)**Johanna NYBERG** (*Ramboll Finland Ltd.*)**Abstract:**

This study focuses on two main aspects of alcohol interlock devices installed in vehicles: technical performance of these devices as well as experience with using these devices. Results of this study are based on voluntary use of alcohol interlocks by both professional and non professional drivers in several organizations and transport companies. The study consisted of questionnaires and interviews before using the alcohol interlocks and after several months of their use. At the beginning of the test period, over 80% of participants expected that alcohol interlocks would cause problems in practice. After the test period, the share of participants with this opinion dropped to 65%. Concerning the experience with using the devices, the participants mostly criticized the warming up periods of the interlock devices varying from 15 seconds to 2 minutes. Some users also indicated embarrassment when performing breath tests in public. Still, all the test users interviewed after the tests were ready for the increase in the use of alcohol interlock devices, and the majority of users supported voluntary use of the device. Overall, results of the study indicate positive attitude of drivers to use alcohol interlock devices in vehicles despite being aware of minor practical issues. The fact that some participants were ready to demand the devices as standard equipment in all vehicles also suggests that people recognize benefits of these devices in traffic safety.

**Keywords:**

Alcohol interlock, Traffic safety, Safety equipment.

ID 2085 R

**VEHICLE DRIVER'S DOMAIN FOR DRIVING ATTENTION ALLOCATION ANALYSES**

Main Author:

**Shih-Hsuan HUANG** (*Institute of Traffic and Transportation, National Chiao Tung University*)

Co-author(s):

**Jinn-Tsai WONG** (*Institute of Traffic and Transportation, National Chiao Tung University*)**Abstract:**

The increasing number of roadway accidents has led researchers to focus on accident-prone scenarios to get a clearer picture of the accident occurrences through accident chain. However, such scenarios explain the conditions and mechanism of a collision rather than its true cause. To fill the gap between occurrence and causality, analyzing individual drivers' attention allocation processes is vital for clarifying the nature of accidents. Noting that driving is a continuous process of information collection, drivers need to allocate attention to different objects to perceive useful information. Attention misallocation can be seen as the missing link between an accident-prone scenario and the occurrence of an accident. Modeling drivers' attention allocation in different conditions is a major step in identifying the external information drivers perceive and react to. The purpose of this research is to analyze the process of driving attention allocation through the divided attention model. Moreover, the concept of the vehicle driver's domain is proposed. By identifying the risk level of threats to safety in each type of vehicle driver's domain, the central allocation policy of attention resources can be identified.

**Keywords:**

Mental process, Attention allocation, Distraction.

ID 2640 R\*

**USING CELLULAR PHONE WHILE DRIVING IN THE HIGHWAYS AS A THREAT TO ROAD SAFETY IN BANGLADESH**

Main Author:

**M. SHAFIQ-UR RAHMAN** (*Jahangirnagar University, Bangladesh*)

Co-author(s):

**Kasphia NAHRIN** (*Jahangirnagar University, Bangladesh*)**Abstract:**

Terrible losses of lives and injuries with consequent property damages resulting from road traffic accidents have now emerged as a serious issue in Bangladesh, which affecting the community personally, socially and economically. The road safety situation of the country has been deteriorating by many factors; however, mostly for road users error. Researches indicate that the using cellular phone while driving create the inherent distraction which may cause accident. The number of cellular-phone-related crashes is increasing globally with the growing number of cellular phones in use. However, information of cellular-phone-related crashes in Bangladesh is not available. Over the last few years the number of cellular phone use of the country increased rapidly and thus also increased the use of cellular phone while driving. This may create a serious road safety problem, particularly in the highways, if it is not considered seriously and not taken necessary steps for tackling. Based on the questionnaire survey of the drivers, the paper explores the pattern of cellular phone use while driving in the highways of Bangladesh and their perception about it's use while driving as an issue of road safety problem. It was found that about 70% of the drivers in Bangladesh often use cellular phone while driving on highways. Almost all the respondents mentioned that this does interrupt concentration of driving which may create accident. About 40% of the drivers had experience of having an accident in their driving career. Those had accident because of using cellular phone while driving; the majority of them are till often using it while driving. One of the keys for tackling road safety issues, particularly the distractions due to using cellular phones while driving, is to educate the drivers about all distractions and increase their awareness generation. (...).

**Keywords:**

Helper, Rickshaw, Auto-rickshaw, Truck, Tempo.

ID 3155 R

**DRIVERS? MENTAL BURDEN REDUCTION EFFECTS OF THE OPENING THE EXPRESSWAY IN MOUNTAINOUS AREA**

Main Author:

**Kunihiro KISHI** (*Faculty of Engineering, Hokkaido University*)

Co-author(s):

**Keiichi SATO** (*Hokkai School of Commerce*)**Abstract:**

In Hokkaido, Japan, we are often required to pass mountainous area during intercity traveling. As for Nissho Pass, Route 274 whose maximum altitude is over 1,000 meters, there are many sharp curves and steep angles. Therefore it is very severe situation for drivers. In winter, because of icy road surfaces, many traffic accidents have occurred and drivers feel mental burden a lot. The Doto Expressway between Tokachi-Shimizu and Tomamu was opened in October 2007. Now we can travel between central Hokkaido and eastern Hokkaido without passing Nissho Pass. It seems that drivers' mental burden reduction effect has recognized by the opening of the Doto Expressway. The purpose of this study is to analyze drivers' mental burden reduction effects of the opening of the Doto Expressway. This study clarifies how drivers evaluate improvement of safety by opening of the Doto expressway. This study proposes the Index of Mental Burden for Driving (IMB) for evaluation of drivers' mental burden. IMB is the index whose explaining variables are curve, gradient and road width; it quantifies the relation between mental burden for driving in a mountainous area and road structures. This study applied Kishi's Logit PSM (KLP) for analyzing the value of safety. It is improved from Price Sensitivity Measurement (PSM), and is based on willingness to pay and can analyze the "reasonable price" from the viewpoint of marketing research.

**Keywords:**

Mental burden, Expressway, IMB, KLP.



ID 1685 R

**ANALYSIS OF MOTORCYCLE ACCIDENT COST IN THAILAND BY WILLINGNESS-TO-PAY METHOD**

Main Author:

**Kunnawee KANITPONG**

Co-author(s):

**Preeeda CHATURABONG****Piyapong JIWATTANAKULPAISARN****Abstract:**

It is well known that the accident costs need to be estimated to understand the existing problem and to perceive a major economic impact of road accident. In addition, the accident cost can be used in the process of road planning and the development of road safety policy. In many developing countries including Thailand, the road accident cost has been traditionally evaluated by the Human Capital Method. This approach, however, has a shortcoming of underestimating the accident cost by the fact that it focuses only on the economic effects of the loss of life and does not account for the value of enjoyment of life forgone. In this study, another alternative method which is the Willingness-To-Pay method (WTP) was selected to evaluate the accident cost. WTP method or the value of risk change is used to estimate the value that individuals would pay for reducing the risk of loss of life. The Contingent Valuation (CV) method is adopted in this study to determine the WTP. In this paper, the cost due to motorcycle accident was focused because the motorcycle crash is the biggest portion among all type of vehicle crashes in Thailand. The questionnaire survey was designed to determine the amount of money that each motorcycle user would pay to reduce the risk of loss of life from motorcycle accident. In this study, a total of 1,015 motorcycle users in Bangkok and surrounding areas were interviewed. The results show that the Value of Statistical Life (VOSL) and the Value of Statistical Injury (VOSI) are in the range of 5.5 to 7 million baht and 2.6-3.4 million baht, respectively. The age, gender, occupation, income, and behavior of helmet use are significant factors affecting the willingness to pay of motorcycle users to reduce the fatality risk. (...).

**Keywords:**

Willingness-To-Pay, Accident cost, Motorcycle, Soc.

ID 1722 R

**RISK PROFILES OF ELDERLY DRIVERS WITH ACCIDENTS - IMPLICATIONS FOR INTERVENTION AND POLICY**

Main Author:

**Uwe KLEINEMAS** (*Centre for the Cultures of Ageing at the University of Bonn*)

Co-author(s):

**Georg RUDINGER** (*Centre for the Cultures of Ageing at the University of Bonn*)**Abstract:**

Rising life expectancy as well as the low birth rate is leading to an aging society, which is already noticeable. This will become more prevalent in future decades. This can be linked with a relative increase of elderly drivers. More and more elderly people are leading active lifestyles and undertaking leisure activities. Cars are very important to them since they provide consistent mobility and independence. However, it is important to realize that a reduction in physical and psychological performance might relate to the process of aging and influence the fitness to drive. This brings the issue of accident risks of elderly drivers into focus. The research study PROSA, granted by the Federal Highway Research Institute, intended to investigate the influence of age-related losses on accident risk in a differentiated way. The Centre for the Cultures of Ageing (ZAK) at the University of Bonn examined health-related and psychological profiles of elderly drivers, who were involved in a car accident. There was a focus on their impact on the derivation of intervention measures. 180 elderly drivers with a minimum age of 65 years from Greater Bonn who have had a car accident in the last five years were interviewed. The participants were questioned about individual impairments, personality traits, driving and accident history. In addition, a sub-sample of 50 took part in a medical examination, traffic-related psychological diagnostic and an on-road-driving-test. The results point out that age itself is not a predictor for individual performance and accident risk. There are rather specific combinations of age-correlated losses and illness which seem to lead to a raised risk. This heterogeneity should be focused on interventions as well as within future research. (...).

**Keywords:**

Elderly Drivers, Risk Profiles, Intervention, Road.

ID 1981 R

**ANALYSIS OF RISK BEHAVIOUR OF A BRAZILIAN DRIVERS SAMPLE**

Main Author:

**Barbara BEZERRA** (*Departamento de Transportes EESC/USP*)**Abstract:**

The objective of this paper was to conduct a survey, using a questionnaire, about the Brazilian driver risky behavior and analyze it. This questionnaire was implemented in October 2009 and achieved 192 drivers of different age groups. It contains questions of open and closed types, with the use of semantic scale, arranged to better meet the research needs. The questionnaire is divided into five parts. The first refers to the driver identification (gender, age, time of driver license, education level, and city). The second part was asked which of the behaviors listed in item the answerer practices while driving. In third part was asked to carry out a pair wise comparison between risky behaviors while driving, indicating which would be more risky (talking on the phone, talking on the phone with voice mail, looking at advertisements and billboards, operating the stereo, sending and reading text messages, and talking with passengers in the car). In the fourth part the driver responds to questions that characterize aggressive or risky attitudes in traffic (traffic tickets received in the last two years, traffic accidents involvement, seat belts use, alcohol and driving, speed limit respect, travelled distance, number of hours spent driving, the importance of cellular phone and attitudes when receiving text messages while driving). The fifth part consists in risk attitudes ordinance (drunk driving, driving talking on the phone, driving reading or receiving text messages). The results show consistence with official statistics, which was made by the respondent' stratification by gender and later comparison of accidents, risk behavior and exposure level. That indicates that using this kind of survey could be a tool to draw measures and took decisions by police makers in road safety. (...).

**Keywords:**

Driver behavior, Risk, Questionnaire.

ID 2531 R

**NEUROPSYCHOLOGICAL ASSESSMENT OF OLDER DRIVERS: REVIEW AND SYNTHESIS**

Main Author:

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Co-author(s):

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The examination of older drivers with neuropsychological tests represents a current area of investigation regarding demographic aging. The major research challenges have been to understand the cognitive changes that lead to impaired driving performance and high crash risk on the elderly, as well as to develop reliability and validity assessment methods to identify these older driver's problems. This paper focuses the psychological assessment of older drivers including data from the use of neuropsychological tests. We conducted a literature review with forty empirical studies reporting associations between cognitive tests and crash records and/or on-road driving measures. Despite impairments on specific cognitive functions may increase the probability of risky driving in the elderly, is still lacking a solid consensus on which tests psychologists should use to predict driving safety. Since there are no known papers with systematic empirical studies held in Portugal in the field of neuropsychological assessment of older drivers, we present preliminary findings from an ongoing investigation. Results highlight several significant correlations between specific neuropsychological tests and on-road driving measures. More specifically, older drivers with diminished driving performance were significantly disadvantaged on integrated aspects like divided attention, visuospatial abilities, executive functioning and eye-hand-pedal coordination speed. (...).

**Keywords:**

Neuropsychological assessment, Older adults, Automobile drivers, Safety and road prevention.

ID 3313 R

**THE DEVELOPMENT OF A NEURAL NETWORK MODEL TO IMPROVE THE RELIABILITY OF THE DEMAND/EFFORT MODEL FOR EVALUATING HIGHWAY S**

Main Author:

**Bong-Jo CHUNG** (Korea Expressway Corporation, Expressway & Transportation Research Institute)

Co-author(s):

**Seongkwan LEE** (Expressway & Transportation Research Institute)

**Jae-Soo GHANG** (Korea Expressway Corporation)

**Myeong-Soon JANG** (Hanyang University)

**Abstract:**

Traffic accidents on highways are likely to happen when there is an unbalance in the complex relationships among the key elements such as road geometries, driver related factors, and mechanical performances. The Demand-Effort Model (DEM), which evaluates highway safety, can be explained by the unbalance, which occurs when the level of requests on the driver's attention to the road environment exceeds that of the response from the driver. This study suggests a new model that improves the reliability of the current DEM through a reinterpretation of physiological signals with the help of the Neural Network Model (NNM). The data were collected from 149 subjects, who drove test vehicles on the Yongdong, Honam, and Seohaean Expressways in Korea. Three important results could be drawn from the recursive tests as follows; 1) Only 5 out of 10 parameters of the physiological signals which are currently used were proven to be meaningful through the Normality Test, Cluster Analysis, and Mann-Whitney Analysis. 2) The revised DEM, which internally uses the NNM, showed more reliable results than the existing DEM. Group 1, which is based on the new DEM, showed 80% accuracy in measuring the level of the driver's efforts, however, that of Group 2, based on the current DEM, was 74.3 %. 3) Field tests on the Honam Expressway showed a lower 'correction rejection' with the new DEM (40.5%) than the old DEM (58.8 %). The DEM is designed as a quick and easy way to determine highway safety prior to a minute road safety audit (RSA) by a professional audit team. (...).

**Keywords:**

Demand-Effort Model, Neural Network Model, Highway Safety.

ID 1379 R

**REGIONAL ANALOGY BETWEEN TRAFFIC ACCIDENTS AND SOCIOECONOMIC DEVELOPMENT**

Main Author:

**Felipe SOUSA** (Consórcio Univias)

**Abstract:**

This article aims to study the relation between traffic accidents in highways and regional socioeconomic variables in order to identify the factors which contribute to the increase of accidents. First, the 1028 km managed by Univias and their high relevance in the economy of the State of the Rio Grande do Sul are presented once 2 millions people are directly reached by these roads. After, it is described how the road environment is formed to explain its resultant urban problems and the fails of road safety. Using data of 7 cities of Univias system, the behavior indicated by the literature was confirmed in the biggest cities, where the increase of the accidents is inversely proportional to the economical. However, for medium and small cities the opposite behavior was evidenced. Therefore, the State must pay a special attention to medium and small cities for ensuring the security of the traffic, pedestrians and the local socioeconomic development.

**Keywords:**

Traffic accidents, Urbanism, Roadway, Socioeconomic.

ID 1688 R

**SOCIO-SPATIAL INEQUALITIES IN ROAD TRAFFIC RISK AND DAILY TRAVEL IN ADOLESCENCE**

Main Author:

**Pascal POCHET** (*LET - ENTPE*)

Co-author(s):

**Mouloud HADDAK** (*UMRESTTE (INRETS)*)**Idlir LICAJ** (*UMRESTTE (INRETS)*)**Dominique MIGNOT** (*INRETS*)**Judit VARI** (*INRETS - UMRESTTE*)**Eliette RANDRIANTOVOMANANA** (*Inrets (Umrestte) - Modys*)**Abstract:**

Social inequalities play a role in road traffic injuries, but this issue has been given scarce attention in France. More precisely, the high number of injuries among adolescents is generally explained by behavioral factors. However, epidemiological studies in Great Britain and Sweden suggest that there is an "over-risk" for children and adolescents among the poor and in deprived neighborhoods. This exploratory study aims at testing the hypothesis of the existence of social and spatial inequalities in road traffic injury patterns, concerning the 14-17 years old. Further analysis of household travel surveys and statistical files of road traffic injuries in the Lyons' urban region have been conducted. Injuries appear more frequent for the residents of deprived areas. These inequalities appear to be linked to the contrasting conditions of daily mobility of adolescents of the two types of places of residence, and partly related to socio-spatial inequalities. Methodological questions are then discussed in order to obtain deeper understanding of this problem.

**Keywords:**

Road injury, Daily travel, Walk, Bicycle, Motorised two-wheeler, Car, Youth, Gender, Social inequality, Income per consumption unit, Spatial inequality, Deprived area.

ID 2016 R

**ANALYSIS OF TRAFFIC ACCIDENTS SEVERITY IN ALMADA, PORTUGAL USING ORDERED AND UNORDERED RESPONSE MODELS**

Main Author:

**João DE ABREU E SILVA** (*Instituto Superior Técnico*)

Co-author(s):

**Silvia SHRUBSALL** (*Instituto Superior Técnico*)**Abstract:**

This study aims at determining the factors that most affect urban road safety in Almada (a municipality located in the Lisbon Metropolitan Area), Portugal, as well as at launching further research that supports safety investment decisions in the face of a limited systematic application of safety measures in the national context. For this purpose, a sample of around 1850 reported injury accidents that occurred in the Municipality of Almada between 2004 and 2008 have been analyzed. The dataset consists of several types of accidents, including those involving pedestrians, both on urban roads and urban/suburban freeways. The available variables cover a wide breadth of aspects that could influence the severity of road accidents. They include: (1) accident specific variables, such as: driver, passenger and pedestrian characteristics, type of maneuver, type of vehicles, weather conditions (2) road specific variables: pavement conditions, functional classification and physical characteristics of the road segment where the accident took place, road signs, (3) variables describing the traffic conditions (e.g. if the accident took place at peak hours); and (4) variables describing the surrounding environment, particularly land use characteristics and patterns. Both ordered and unordered response models were built to analyze the assembled data. Their results are discussed at two levels. The first is related with the statistical assumptions of the built models, i.e. whether these assumptions are met and, if not, what changes in the models specification are required to overcome the identified issues. The second is related with the policy implications that derive from both models, once statistical assumptions have been met. (...).

**Keywords:**

Road safety, Road accident analysis, Ordered response models, Unordered response models, Lisbon Metropolitan Area.

MON 12<sup>th</sup> (17:00 - 18:15, Session C4.4) Room AV1

ID 2325 R

**HIGHER INJURY RATES IN DEPRIVED AREAS: WHAT IS THE INFLUENCE OF THE NEIGHBOURHOOD?**

Main Author:

**Sylvanie GODILLON** (INRETS)

**Abstract:**

In 2004, for the first time World Health Day, organised by World Health Organisation, was focused on the theme of road safety. This day showed that road safety is a public health subject and tried to advocate a "systems approach" to road safety, which takes into consideration the key aspects of the system: the road user, the vehicle and the infrastructure. Even though road safety has improved continuously since the 1970s, all people have not benefited to the same extent. Recent researches indicate that the accident rate propensity differs considerably between different socio-economic groups and between inhabitants of different neighbourhoods: health inequalities exist in term of traffic safety. This research aims to explore the links between socio-spatial inequalities and traffic safety. Do inhabitants of deprived neighbourhoods are more injured in traffic accidents than other inhabitants? What factors could be explained this health inequality? How measure the influence of the characteristics of neighbourhood?

**Keywords:**

Traffic safety, Urban planning, Deprived areas.

TUE 13<sup>th</sup> (08:15 - 09:30, Session C4.5) Room AV1

ID 1693 R

**INVESTIGATION OF ROAD NETWORK EFFECTS ON CHOICE OF DRIVING SPEED**

Main Author:

**Adam TOROK** (KTI Institute for Transport Sciences Non Profit Ltd.)

Co-author(s):

**Janos JUHASZ** (KTI Institute for Transport Sciences Nonprofit Ltd.)

**Tamas BERTA** (KTI Institute for Transport Sciences Non Profit Ltd.)

**Abstract:**

Human factor plays the most determinant role in traffic accidents. However, in order to improve safety, not only this element of the road transport system should be considered. The road and/or environment are influencing that behaviour as well, but they can be modified quicker than drivers' behaviour, and their effect can also be demonstrated. Decisions of the drivers are influenced by environmental impacts. Some of these impacts are planned, deliberate stimuli, being a part of the telematic systems of traffic control. In this paper the measure of road vehicles speed were analyzed on certain road sections which can be characterized by different design speed and construction parameters. Methods of mathematical statistics have been used to prove the hypothesis; the driving speed chosen by the driver depends heavily on the characteristics of the road section and the actual traffic on it. The aim of the authors is to prove this hypothesis.

**Keywords:**

Road safety, Driver behaviour, Choice of driving speed.

ID 2208 R

**PERSONALITY, RISK AVERSION AND SPEEDING: AN EMPIRICAL INVESTIGATION**

Main Author:

**Stephen GREAVES** (*University of Sydney*)**Abstract:**

Evidence suggests that in addition to demographics, there are strong relationships between facets of drivers' personality (e.g., aggression, thrill-seeking, altruism), aversion to risk and self-reported measures of driving behaviour, particularly speeding. However, evidence is muted by the reliance on people to self-report driving behaviour and how this compares to what is observed in the field. This paper reports on a study of 133 drivers in Sydney, who are asked to complete a short survey to develop their personality and risk aversion profiles and self-reported speeding behaviour. A Global Positioning System (GPS) device is then installed in their vehicle for a 10 week period as part of a major investigation of driving behaviour from which empirical measures of speeding are derived based. Among the most pertinent findings are: 1) the tendency for drivers to both under and over-estimate their propensity to speed, 2) significant heterogeneity in speeding with a small, but notable number of drivers exceeding the limit for more than 20 percent of the distance driven, 3) weak relationships between the personality/risk-aversion measures and actual speeding, and 4) the suggestion that different personality traits appear to influence behaviour in different situations both from self-reported and actual speeding behaviour.

**Keywords:**

Personality, Speeding, GPs.

ID 3021 R

**ASSESSMENT METHODOLOGY FOR THE INDUCTIVE AND FORCIBLE TRAFFIC SAFETY MEASURES THROUGH SPEED-UTILITY-BASED FRAMEWORK CONSIDERING SPEED RECOGNITION STRUCTURE OF DRIVER**

Main Author:

**Hirofumi YOTSUTSUJI** (*Graduate School of Engineering, Kobe University*)

Co-author(s):

**Hideyuki KITA** (*Kobe University*)**Abstract:**

Various errors contained in driver's recognition of driving speed and decision-making of speed choice in curves on the road carry unsafe driving with accident risks. This paper deals with traffic safety measures involving both the forcible safety measures that errors contained in speed recognition structure are prevented before the errors occur, and the inductive safety measures that a return to safety-speed condition is stimulated swiftly in speed perception structure even though the errors occur. In addition, on the purpose of the assessment of these safety measures, this paper provides an assessment methodology considering both speed recognition structure and speed choice behavior of each driver. In the proposed methodology, the speed recognition structure of the driver in the curve section consists of the subjective and objective speeds involving both target speed and approaching speed. And the speed perception structure model representing the perceptual relationship between the subjective and objective approaching speeds is constructed through optic-flow theory used in the area of the visual psychology research, because almost driver uses visual information under the driving situation. Meanwhile the speed choice behavior is modeling as the discrete speed choice model through speed-utility-based framework, on the assumption of the tradeoff relationship between both utilities for moving fast and safe. This speed choice model is expressed with the latent class logit model based on the speed utility function of the approaching speed being subject to the target speed, considering driver's risk-aversion attitude. (...).

**Keywords:**

Traffic Safety, Inductive Safety Measures, Forcible Safety Measures, Assessment Methodology, Speed Recognition Structure, Speed Perception Structure, Discrete Speed Choice, Speed Utility, Optic-flow Theory.

ID 3072 R

**SETTING SPEED LIMITS IN RURAL AND INTERURBAN TWO-LANE HIGHWAYS**

Main Author:

**Gonçalo CORREIA** (*Faculdade de Ciências e Tecnologia da Universidade de Coimbra*)

Co-author(s):

**Ana BASTOS SILVA** (*Departamento de Engenharia Civil da FCT Universidade de Coimbra*)**Abstract:**

Over the last years and mainly after the 1980's it has been assumed that the design of the road infrastructure should consider an integrated set of requirements such as the surrounding road environment and the presence and characteristics of its users. This change on the philosophy of road design has been accompanied by the increase importance with setting the most adequate legal speed limits for each type of stretch, having in consideration the lateral road occupation and the presence of vulnerable users. This concern is particularly relevant for managing inter-urban roads which cross different environments. The present paper presents an updated state of the art on this subject, namely on the approaches that have been pursued by several countries for supporting their legal speed limits for each kind of road environment. The article continues by presenting an overview of setting speed limits in Portugal and presents two models recently developed by the authors, capable of objectively supporting the process of defining the adequate speed limit levels throughout the full length of a rural or interurban two-lane highway: (i) multiple regression model (ii) a multinomial logit (MNL) discrete choice model. The explanatory variables were collected to describe the functional and physical characteristics of the different stretches of the road and its surrounding environment. The practical application of this model is tested through its application in a case-study (a rural two-lane road), completed by a critical comparative analysis of the results of existing models.

**Keywords:**

Speed management, Speed limits, Road safety, Controlling speed.

ID 3169 R

**DEVELOPING SPEED MANAGEMENT PROGRAM FOR IRAN**

Main Author:

**Hamidreza BAHRAMIAN** (*Head of Air Transportation Department of Transportation Research Institute*)

Co-author(s):

**Shahin SHABANI** (*Transportation Research Institute, Tehran, Iran*)**Khalil ZAMANI** (*Transportation Research Institute, Tehran, Iran*)**Abstract:**

Speed of vehicles in roads, is a main traffic parameter. But it should be noted that safety issues are the most important problems of excessive speed, i.e. driving too fast for conditions. According to worldwide studies, about 25 to 35 percent of accident fatalities are due to excessive speed. Investigations in Iran have shown that about 30 to 40 percent of road victims are killed or injured due to excessive speed. Upon importance of the role of speed control in reducing negative safety issues of roads, especially rural roads, nowadays so much efforts are made in many developed or even developing countries. These efforts are generally concentrated on the field of control, surveillance and enforcement of vehicular speed while the approach of these efforts is coordinately progressed to the same objectives. Almost in all cases it was noted that proposed goals, strategies, actions and countermeasures should be developed in the form of instructions, usually called "Speed Management Program". In fact Speed Management is a complex problem. It involves many factors including public attitudes, driver behavior, vehicle performance, roadway characteristics, enforcement strategies, court sanctions, and speed zoning. This program includes Engineering, Education, Enforcement and Evaluation process to control speed of vehicles. Generally in all Speed Management Programs, there is an interest in how to best determine and set reasonable and safe speed limits and to effectively enforce them. Because of vast problems due to large amounts of road accidents and fatalities, conclusive officials' determination has been set to improve road safety in Iran. (...).

**Keywords:**

Speed, Management, Program.

TUE 13<sup>th</sup> (09:45 - 11:00, Session C4.6) Room AVI

ID 1003 R

**ANALYSIS OF THE SAFETY CHARACTERISTICS OF UNSIGNALIZED INTERSECTIONS**

Main Author:

**Mohamed ABDEL-ATY** (*University of Central Florida*)

Co-author(s):

**Kirolos HALEEM** (*University of Central Florida*)

**Abstract:**

This study is concerned with using multiple approaches for analyzing safety at unsignalized intersections. This was investigated by analyzing total crashes, one of the most frequent crash types at unsignalized intersections (angle crashes) and crash injury severity. Some of the developed methodological techniques in this study are considered recent and have not been extensively applied. Massive data collection effort was conducted, and resulted in collecting around 2500 unsignalized intersections from six counties in Florida. The first analysis dealt with applying the Bayesian updating concept for better crash prediction. This was investigated by updating the coefficients of the probabilistic negative binomial (NB) models. Different non-informative and informative prior structures using the NB and log-gamma distributions were attempted. The log-gamma distribution showed the best prediction capability. The second analysis dealt with analyzing crash injury severity using the binary probit framework. The important factors found in the fitted probit models were the logarithm of the annual average daily traffic "AADT" on the major road, and the speed limit on the major road. It was found that higher severity probability is always associated with a reduction in AADT, as well as an increase in speed limits. Finally, a recently-developed data mining technique (the multivariate adaptive regression splines or MARS) was used, which is capable of yielding high prediction accuracy. MARS was used to analyze angle crashes. MARS yielded the best prediction performance while dealing with continuous responses. Additionally, screening the covariates using random forest technique before fitting a MARS model was very encouraging. (...).

**Keywords:**

Negative Binomial Model, Reliability, Bayesian Upd.

TUE 13<sup>th</sup> (09:45 - 11:00, Session C4.6) Room AVI

ID 2198 R

**ANALYSES ON THE LANE CHOICE BEHAVIOR FOR EVALUATING TRAFFIC SAFETY MEASURES AT SIGNALIZED INTERSECTIONS WITHOUT RIGHT-TURN-ONLY LANE ON ARTERIAL ROADS**

Main Author:

**Kojiro MATSUO** (*Graduate School of Engineering, Toyohashi University of Technology*)

Co-author(s):

**Yasuhiro HIROBATA** (*Department of Architecture and Civil Engineering, Toyohashi University of Technology*)

**Abstract:**

At signalized intersections without right-turn-only lane on two-lane (per one direction with left-hand traffic) arterial roads, the significant number of rear-end accidents might be caused by frequent and sudden lane changes of the straight-through vehicles to pass the right-turn vehicles waiting for right turn chance. To discuss traffic safety measures at such places, this paper, basing on data obtained at signalized intersections on National Route 1 in Toyohashi, JAPAN, analyses traffic flow and vehicle behavior. Firstly, by using the data from traffic flow counts, it was confirmed that the frequency of lane changes is significantly correlated with the number of rear-end accidents. Secondly, by using the data from video observation conducted at the segment of two signalized intersections, it was found that a certain number of straight-through vehicles change their running lane at the segment far before the intersection. From this result, it was suggested that the drivers of the straight-through vehicles always consider the possibilities of the presence of the right-turn vehicles in the downstream segment. Due to this assumption, factors affecting the lane choice behavior were finally examined by estimating the disaggregate lane choice behavior model. The differences in behavior between standardized vehicles and heavy vehicles were also discussed.

**Keywords:**

Traffic Safety, Rear-end Accidents, Lane Changes, Lane Choice Behavior.



TUE 13<sup>th</sup> (09:45 - 11:00, Session C4.6) Room AVI

ID 2303 R

**APPLICATION OF SIMULATION-BASED TRAFFIC  
CONFLICT ANALYSIS FOR HIGHWAY SAFETY  
EVALUATION**

Main Author:

**Hong YANG** (*Rutgers, The State University of New Jersey*)

Co-author(s):

**Kaan OZBAY** (*Rutgers University*)

**Bekir BARTIN** (*Rutgers, The State University of New Jersey*)

**Abstract:**

Highway safety evaluation is one of the critical processes for identifying transportation system performance. The capabilities of common used safety assessing methodologies such as naïve before-after comparisons, safety audit, and statistical modelling, etc, are limited due to historical data availability, observation periods, or observer' experience, and so on. Other than these traditional methods, it has been recognized that the development of traffic conflict techniques in conjugate with micro-simulation model could also offer a potentially innovative way for conducting safety assessment of traffic systems even before safety countermeasures are actually implemented. So in this paper, the application of this new method on highway safety analysis is further investigated. In the meanwhile, most of recent developed safety indicators are reviewed. Inspired by these potential safety indicators in support of traffic conflict analysis, a new time-based indicator is proposed. And the procedure describing the imputation procedure is presented. As an extension of previous study, the new indicator is tested under two different highway models to further highlight its performance. Other than the capability of capturing real crashes' temporal distribution feature showed in previous study, the comparative results also successfully identified the spatial distribution feature of real crash; especially highlight the most dangerous locations. Thus it is suggested that the new indicator has the capability to be applied for simulation-based safety analysis.

**Keywords:**

Traffic conflict, Safety evaluation, Simulation model, TCT.

TUE 13<sup>th</sup> (09:45 - 11:00, Session C4.6) Room AVI

ID 2849 R

**COMPARATIVE ANALYSIS OF JUNCTION SAFETY IN  
EUROPE**

Main Author:

**George YANNIS** (*National Technical University of Athens, Department of Transportation Planning and Engineering*)

**Abstract:**

In Europe about 25% of road accident fatalities occur at junctions of various types, with the higher percentage (34%) being observed in the United Kingdom and the lower (<10%) in Greece. The objective of this research is the analysis of road safety related parameters in European road junctions through the use of the EU CARE database with disaggregate data on road accidents as well as of other international data sources (OECD/IRTAD, Eurostat, etc.). Time-series data from 16 EU countries over a period of 10 year (1997-2006) are correlated with basic safety parameters, such as junction geometric design, vehicle type, area type, gender of the driver, and weather and lighting conditions. During this period an overall decrease of almost 25 percent in traffic accident fatalities in junctions was observed, with values ranging between a decrease of 60% for France and an increase of 35% for Greece. The results of the analysis allow for an overall assessment of the road safety level in the European road junctions in comparison to the remaining road network, providing thus useful support to decision makers working for the improvement of safety in the European road network.

**Keywords:**

Junctions, Road accident data, Road safety, European countries.

TUE 13<sup>th</sup> (09:45 - 11:00, Session C4.6) Room AVI

ID 3141 R

**BENEFIT-COST ANALYSIS OF ROUNDABOUTS IN A BRAZILIAN CITY REGARDING TO THE NUMBER AND SEVERITY OF TRAFFIC ACCIDENTS ? A CASE OF STUDY**

Main Author:

**Barbara BEZERRA** (*Departamento de Transportes EESC/USP*)

Co-author(s):

**Magaly NATÁLIA PAZZIAN VASCONCELOS ROMÃO** (*FATEC/Jaú*)

**Antonio CLÓVIS PINTO FERRAZ** (*Departamento de Transportes EESC/USP*)

**Abstract:**

This paper has the objective to analyze the benefit-cost of building roundabouts as a traffic safety infrastructure measure in Jaú city, Brazil. The chosen places have priority over other intersections because they have data available to analyze the before-after situation. Jaú city has the database with information from 2000 until 2007, as well as the dates of construction's implementation. It was made a research on the accident database of the Jaú Secretary of Transport. After this research, the cost-benefit analysis was calculated using a methodology described by Hauer (1997). The percentage of reduction in the number of accidents found in this study is in accordance which is founded in the literature, around 50% of reduction in accidents and severity (Várhely, 1996). In contradiction, other studies founded that the introduction of roundabouts reduces the severity of accidents, but increase the number of property damage accidents until 73% (Elvik and Vaa, 2004). In this study of case was found that the number of property damage accidents and severity of accidents were reduced with roundabouts. However, some disclaimers must be made with these results: it was used the naive before-after studies approach, so the percentages of reduction could be related to other factors not only to roundabouts, the vehicle flow was not considered, and as the sites was chosen due the high rates of conflicts which could have bring bias to the sample.

**Keywords:**

Roundabout, Traffic safety, Benefit- cost.

TUE 13<sup>th</sup> (11:15 - 12:30, Session C4.7) Room AVI

ID 1266 R

**EXPLORING THE POTENTIAL OF DATA MINING TECHNIQUES FOR THE ANALYSIS OF ACCIDENT PATTERNS**

Main Author:

**Carlo PRATO** (*Department of Transport, Technical University of Denmark*)

Co-author(s):

**Shlomo BEKHOR** (*Transportation Research Institute, Technion - Israel Institute of Technology*)

**Ayelet GALTZUR** (*Transportation Research Institute, Technion - Israel Institute of Technology*)

**David MAHALEL** (*Transportation Research Institute, Technion - Israel Institute of Technology*)

**Joseph PRASHKER** (*Transportation Research Institute, Technion - Israel Institute of Technology*)

**Abstract:**

Research in road safety faces major challenges: individuation of the most significant determinants of traffic accidents, recognition of the most recurrent accident patterns, and allocation of resources necessary to address the most relevant issues. This paper intends to comprehend which data mining techniques appear more suitable for the objective of providing a broad picture of the road safety situation and individuating specific problems that the allocation of resources should address first. Descriptive (i.e., K-means and Kohonen clustering) and predictive (i.e., decision trees, neural networks and association rules) data mining techniques are implemented for the analysis of traffic accidents occurred in Israel between 2001 and 2004. Results show that descriptive techniques are useful to classify the large amount of analyzed accidents, even though introduce problems with respect to the clear-cut definition of the clusters and the triviality of the description of the main accident characteristics. Results also show that prediction techniques present problems with respect to the large number of rules produced by decision trees, the interpretation of neural network results in terms of relative importance of input and intermediate neurons, and the relative importance of hundreds of association rules. (...).

**Keywords:**

Traffic accidents, Data mining, Clustering analysis, Decision trees, Neural networks, Association rules.

ID 1381 R

**METHODOLOGY FOR PRIORITIZING ACTIONS FOR ROADWAY SAFETY**

Main Author:

**Felipe SOUSA** (*Consórcio Univias*)

Co-author(s):

**Gabriela BOFFO** (*Consórcio Univias*)**Carlo DA SILVEIRA FRAMARIM** (*Consórcio Univias*)**Sidnei RIGO** (*Consórcio Univias*)**Abstract:**

This paper aims to suggest a method for prioritizing security actions in a road system using as case study the net managed by Univias System. In order to achieve this aim, a literature review on the traffic accident context in Brazil is carried out. Through this, Univias index of accidents is compared with to what happen in the international context. The profile of these accidents is detailed with the description of the frequency occurrence, accident types and gravity, and involved vehicles. The methodology used in this study determined the critical points which must be ameliorated and the 19 accident locations. The treatments given to two of these locations are also presented as well as the project and effected actions of engineering, with before and later photos. Finally, the effectiveness of the method was confirmed by the accident reduction.

**Keywords:**

Safety, Accident index, Engineering solutions.

ID 1569 R

**APPLICABILITY OF A KOREA HIGHWAY SAFETY EVALUATION MODEL COMPARED TO THE CRASH PREDICTION MODULE OF IHSDM**

Main Author:

**Euncheol KIM** (*University of Incheon*)**Abstract:**

Roadway safety is crucial because traffic accidents create huge social and economic losses. For more effective and accurate roadway diagnosis, various studies are being conducted. Interactive Highway Safety Design Model(IHSDM), SafetyAnalyst, and MicroBENCOST are developed systems based through efforts. Notably, Crash Prediction, Policy Review, and Design Consistency modules in IHSDM not only evaluate safety of highway designed but also predict the number of accidents on existing and new roads and support experts' roadway safety evaluation efforts. In Korea as well, researches on the development of Korean highway safety evaluation models (KHSEM) including development of AMF were conducted. Thus, models for intersections and roadway segments were built. The predictability of the KHSEM and the applicability of IHSDM CPM in Korean highways were evaluated by applying them to the same segments. IHSDM CPM reflects more roadway geometric elements, while KHSEM focuses more on environmental elements of roadway by reflecting Korea's rural highway characteristics; for example, an examination of accident data on segments of two different National highways that passes Jeollabuk-do (Jeonbuk) and Gyeonggi-do indicated that accidents were more caused by roadside environment factors. Thus, compared with the IHSDM CPM, the prediction by the KRSDM proved to be closer to actual accidents, while the IHSDM CPM indicated no particular risks in the target segment with a general roadway geometrics. This suggests that the IHSDM CPM is more universal, but that the KRSDM is more effective in predicting accidents in Korean roads.

**Keywords:**

IHSDM, KHSEM, Safety Assessment, Applicability , Crash Analysis.

TUE 13<sup>th</sup> (11:15 - 12:30, Session C4.7) Room AVI

ID 1583 R

**RESEARCH ON IDENTIFICATION OF FREEWAY  
BLACK SPOTS AND ACCIDENT INDUCED FACTORS**

Main Author:

**Xianghai MENG** (*Harbin Institute of Technology*)

Co-author(s):

**Li MEI** (*Harbin Institute of Technology*)

**Guan ZHIQIANG** (*Harbin Institute of Technology*)

**Abstract:**

In order to improve the objectivity and fairness of identifying black spots and elements, three correlative methodologies are developed. Firstly, an approach for segment division based on dynamic clustering algorithm is proposed, which can be used to separate a highway into a series of subsections according to the appearance of accidents. Then, a self-organizing neural network model is established to identify the black spots from these subsections. Lastly, a methodology based on discrete multi-variable algorithm combined with rough set theory is presented to determine the accident induced factors of these black spots. The results show that (1) the segment division based on dynamic clustering algorithm can describe objectively the concentration and dispersion of accidents, (2) the neural network model can quickly identify the black spots and the corresponding results are reasonable, and (3) the methodology to identify the prominent accident causes can be used to establish a set of evaluation criteria and then to determine the accident induced factors of a black spot.

**Keywords:**

Segment division, Black spot identification, Accident induced factor identification, Dynamic clustering algorithm, Self-organizing neural network, Rough set theory.

TUE 13<sup>th</sup> (11:15 - 12:30, Session C4.7) Room AVI

ID 1629 R

**DEVELOPMENT OF A SAFETY PERFORMANCE  
FUNCTION FOR KOREAN EXPRESSWAYS**

Main Author:

**Hochan KWAK** (*Department of Civil and Environmental Engineering, Seoul National University*)

Co-author(s):

**Dong-Kyu KIM** (*Department of Civil and Environmental Engineering, Seoul National University*)

**Seung-Young KHO** (*Department of Civil and Environmental Engineering, Seoul National University*)

**Shin HYOUNG PARK** (*Dept. of Civil and Environmental Engineering, Seoul National University*)

**Abstract:**

Traffic accidents have long been a major issue, especially in developed countries. Accident prediction models, also known as safety performance functions, have recently received substantial attention for their use in estimating the expected number of accidents on road sections in order to determine priority sites for safety improvements. The purpose of this paper is to develop a safety performance function for Korean expressways. Goodness-of-fit tests are performed to specify the model structure and to select variables included in the model and, based on the test results, the safety performance function for Korean expressways is formulated as a negative binomial model. The model developed in this paper shows that traffic accidents on Korean expressways may occur most often on sections of road where traffic flows can increase discontinuously, such as those with a small number of lanes near on-ramp interchanges or tollgates and on sections of mainstream expressways with a higher percentage of truck traffic. Cumulative scaled residuals are plotted to evaluate the fitness of the proposed model. The results of this paper can be used as a tool in the safety evaluation of expressways in Korea in order to choose areas for implementation of accident countermeasures.

**Keywords:**

Safety performance function, Expressways, Priority site, Negative binomial model, Traffic accident, Cumulative scaled residual.

TUE 13<sup>th</sup> (14:00 - 15:15, Session C4.8) Room AVI

ID 1268 R

### **MAPPING PATTERNS AND CHARACTERISTICS OF FATAL ROAD ACCIDENTS IN ISRAEL**

Main Author:

**Carlo PRATO** (*Department of Transport, Technical University of Denmark*)

Co-author(s):

**Shlomo BEKHOR** (*Transportation Research Institute, Technion - Israel Institute of Technology*)

**Victoria GITELMAN** (*Ran Naor Road Safety Research Center, Technion - Israel Institute of Technology*)

#### **Abstract:**

This paper intends to provide a broad picture of traffic accidents in Israel by uncovering their patterns and determinants in order to answer an increasing need of designing preventive measures, addressing particular situations and targeting specific social groups. The analysis focuses on 1,793 fatal accidents occurred during the four-year period between 2003 and 2006, and applies data mining techniques with the objective of extracting from the data relevant information about accident patterns and major factors without a-priori assumptions about the expected outcome of the study. Kohonen neural networks reveal five accident patterns: (i) single-vehicle accidents of young drivers; (ii) multiple-vehicle accidents between young drivers; (iii) accidents involving either motorcycles or bicycles; (iv) accidents where elderly pedestrians crossed in urban areas; (v) accidents where mostly young children and teenagers cross roads in small villages. Feed-forward back-propagation neural networks validate clustering results and indicate that demographic characteristics of both victims and drivers are the most relevant determinants. Other significant factors are road conditions, time of day, traffic control systems and degree of urbanisation at the location of the accident.

#### **Keywords:**

Accident patterns, Cluster analysis, Kohonen networks, Feed-forward back-propagation neural networks.

TUE 13<sup>th</sup> (14:00 - 15:15, Session C4.8) Room AVI

ID 1969 R\*

### **A TOOL FOR DYNAMICALLY PREDICTING INCIDENT DURATIONS, SECONDARY INCIDENT OCCURRENCE, AND INCIDENT DELAYS**

Main Author:

**Asad KHATTAK** (*Old Dominion University, VA, USA*)

Co-author(s):

**Xin WANG** (*Old Dominion University, VA, USA*)

**Hongbing ZHANG** (*Old Dominion University, VA, USA*)

#### **Abstract:**

Understanding the characteristics of incidents can help decision-makers select better operational strategies. Using roadway inventory and traffic incident data, provided by the Hampton Roads Traffic Operations Center (TOC), traffic incidents were analyzed. Using the data, a practical online prediction tool (DSD-Duration-Secondary incident-Delay) was developed based on statistical models for incident duration, secondary incident occurrence, and associated delays. The tool can dynamically predict the duration of an incident (given that one has occurred), the chances of secondary incidents, and associated delays in real-time. The tool relies on available inputs about the roadway conditions, and incident information, e.g., location, time of day, and weather conditions. The tool can aid incident management by generating information about primary and secondary incidents and help effectively assign incident management resources.

#### **Keywords:**

Secondary incident, Primary incident, Incident dur.

TUE 13<sup>th</sup> (14:00 - 15:15, Session C4.8) Room AV1

ID 2194 R

### **IDENTIFYING HAZARDOUS LOCATIONS BASED ON SEVERITY SCORES OF HIGHWAY CRASHES**

Main Author:

**Shin HYOUNG PARK** (*Dept. of Civil and Environmental Engineering, Seoul National University*)

Co-author(s):

**Dong-Kyu KIM** (*Department of Civil and Environmental Engineering, Seoul National University*)

**Seung-Young KHO** (*Department of Civil and Environmental Engineering, Seoul National University*)

**Sungmo RHEE** (*Department of Civil and Environmental Engineering, Seoul National University*)

#### **Abstract:**

Identifying hazardous locations is an essential step for safety improvement programs or projects since it provides decision makers with logical and scientific basis in the allocation of budgets and other resources in a cost-effective manner. There have been numerous studies conducted to develop suitable methods for identifying hazardous locations; however, the majority of them did not consider spatial interactions (e.g. spatial dependency and spatial heterogeneity) which complicatedly appeared in accident analyses. With improvements of Geographical Information Systems (GIS) technology, it is possible to use various spatial analysis tools on traffic safety studies. Of those, Geographically Weighted Regression (GWR) and Kernel Density Estimation (KDE) are applied to perform this research. GWR is used to verify the effect of spatial dependency and spatial heterogeneity on the outbreak of traffic accidents. The role of the KDE in this study is displaying crash-clustered area under the consideration of an appropriate bandwidth and kernel function which determine extents and severity levels of accidents. This paper aims to develop a method for identifying hazardous locations based on severity scores of highway crashes. The method developed in this paper is applied to real-world data of Korean expressways. The results imply the necessity of examining spatial dependency and spatial heterogeneity in accident analyses and exploring hazardous locations based on crash severity. (...).

#### **Keywords:**

Bandwidth, Kernel density estimation, Geographically weighted regression, Hazardous locations, Highway crashes.

TUE 13<sup>th</sup> (14:00 - 15:15, Session C4.8) Room AV1

ID 3000 R

### **SAFETY OF RURAL ROADS IN GERMANY**

Main Author:

**Juergen STEINBRECHER** (*University of Siegen*)

Co-author(s):

**Torsten SCHUBERT** (*University of Siegen*)

#### **Abstract:**

Road safety has improved considerably in Germany in the past four decades. But rural roads are still the main problem. 61% of the fatalities occur on rural roads and the risk of being involved in a fatal accident on rural roads is more than four times higher than on motorways. The main problems on rural roads are driving accidents, leaving the carriageway and collisions with oncoming traffic. 30% of the fatalities occur in a collision with trees and nearly 20% of all killed persons on rural roads are young male drivers between 18 and 24 years. There is an extensive range of measures responding to these problems and improving road safety on rural roads in Germany. The road safety management system comprises black spot management, network safety management, road safety inspections and road safety audits. This enables road authorities to identify the road sections where safety improvement measures are expected to have the best efficiency. A large-scale test investigates the effects of overtaking lanes and speed surveillance over long distance. First results show that speed monitoring measures are able to improve road safety. Actually a reviewing process of the guidelines for the design of rural roads is running, based on the "self-explaining road" - concept. The paper gives detailed information about accident data on rural roads, an overview about the German safety management system and presents some specific measures improving road safety on rural roads.

#### **Keywords:**

Rural roads, Road safety.

TUE 13<sup>th</sup> (14:00 - 15:15, Session C4.8) Room AVI

ID 3153 R

**USE OF SECONDARY INDICATORS IN THE ANALYSIS OF RURAL ROADS ACCIDENTABILITY? BY ROAD POLICE? A CASE STUDY IN BRAZIL**

Main Author:

**Barbara BEZERRA** (*Departamento de Transportes EESC/USP*)

Co-author(s):

**Anderson MORAES** (*FATEC*)

**Magaly NATÁLIA PAZZIAN VASCONCELOS ROMÃO** (*FATEC/Jaú*)

**Antonio CLÓVIS PINTO FERRAZ** (*Departamento de Transportes EESC/USP*)

**Abstract:**

This paper is based on a pilot study about comparative analysis of road safety indicators, such as – use of helmets, use of seat belts, drinking and driving, vehicle conditions and speeding – and road “accidentability”. But, unfortunately data about speeding and driver experience was not available for this study. The segments of road that were selected are on the scope of Road Military Police of Jaú, State of Sao Paulo, Brazil. The period of analysis was from January 2008 to August 2009. The indicators were obtained through the database of infractions of the Road Military Police of the State of Sao Paulo. And the absolute number of accidents in these sections was obtained in the accident database from the same institution. The main objective was analyzed driver behavior of the segments under scrutiny, using the indicators developed. The results showed the relation among secondary road safety indicators and the number of accidents, victims and severity. This work also is a tentative to show the utility of secondary road indicators and the ways to obtain it with the tools at hand, the database from Road Military Police, with negligible costs and time consuming.

**Keywords:**

Indicators, Road safety, Accidentability.

TUE 13<sup>th</sup> (15:30 - 16:45, Session C4.9) Room AVI

ID 1126 R

**DESIGN OF SHARED-USE SIDEWALKS TO AVOID CROSSING CONFLICTS BETWEEN BICYCLES AND MOTOR VEHICLES AT SMALL INTERSECTION**

Main Author:

**Hidekatsu HAMAOKA** (*Akita University*)

**Abstract:**

In Japan, one common bicycle facility is the shared-use sidewalk for bicyclists and pedestrians. By the analysis of traffic accidents between bicycles and motor vehicles, it is found that almost half of these accidents consist of the crossing conflict at the inflow section of the arterial roads with the smaller road. By the analysis of bicycles and motor vehicles movements, it is found that the running path of the bicycle in the sidewalk influences significantly. In order to evaluate the safety, the model was developed by utilizing the data of bicycles and motor vehicles' moving behavior. From this model, it is found that changing the running path of the bicycle is more effective than decreasing their speed up to 5km/h. This result could contribute to consider the design of the sidewalk.

**Keywords:**

Traffic accident, Bicycle, Shared-use sidewalk.

ID 1293 R

**RISK PERCEPTION OF PEDESTRIANS AT MIDBLOCK CROSSINGS IN BRAZIL**

Main Author:

**Mara DIOGENES** (*Laboratório de Sistemas de Transportes – LASTRAN*)

Co-author(s):

**Luis ANTONIO LINDAU** (*Laboratório de Sistemas de Transportes – LASTRAN*)**Abstract:**

Pedestrians face a greater risk of being injured on a traffic crash than vehicle occupants. In Brazil, they represent about 24% of all traffic fatalities. Risk perception techniques can be used in defining proactive countermeasures that take into account pedestrians' needs and behaviors. Our study evaluates the pedestrian safety at midblock crossings using modeling techniques to represent the relationship between risk factors and risk perception. It includes film simulation of pedestrian midblock crossings and data collection of road and crossing characteristics in the city of Porto Alegre, the southernmost state capital of Brazil. In controlled simulation conditions, pedestrians and experts rated twenty one midblock crossings after observing pictures and watching film clips. The regression model indicates that the perceived risk is influenced by a combination of interactive risk factors, such as the presence of busways and bus stops, road width, parking permission, presence of a marked crosswalk and traffic signal, and volume of pedestrians. The results of this study are very useful to improve the safety of pedestrians in Porto Alegre and are likely to be transferable to other cities in Brazil where traffic and transit operate under similar conditions.

**Keywords:**

Pedestrians, Midblock crossings, Risk evaluation, Risk perception.

ID 1758 R

**THE SAFETY OF ELDERLY BICYCLISTS**

Main Author:

**Charlotta JOHANSSON** (*Department of Civil, Mining and Environmental Engineering*)**Abstract:**

Demographic changes show that the absolute number and portion of the population in Europe that can be categorized as older or very old will continue to grow over the next several years. One aim should be to keep them active and healthy for as long a time as possible. Exercise, for example cycling, plays an important role in this context but data shows that the elderly bicyclists are overrepresented in crashes when compared with their exposure to traffic. Senior cyclists' needs and preferences should be a base for developing a safe and joyful cycling environment. This project uses in-depth crash data analysis, questionnaires with senior cyclists, and questionnaires with experts to identify potential for improving elderly bicycling. Elderly bicyclists have a significantly higher risk than younger age groups. The consequences are significantly more severe for elderly bicyclists compared to other age groups and increase with vehicle speeds. Elderly bicyclists are significantly more involved in crashes when intending to turn left compared to other age groups. 22% of elderly in fatal crashes intend to turn left compared to 8% for adults and 14% for children. As expected, elderly bicyclists are significantly more often impaired by bad sight and/or bad hearing as well as being impaired from taking medication in crashes compared to other age groups. Elderly bicyclists are less often in a hurry (5%) in crashes compared to other age groups (11%). Elderly bicyclists obey traffic rules no more and no less than other age groups. In darkness (incl. dawn and dusk), non-elderly adult bicyclists are significantly more often involved in crashes (37%) than elderly (11%). The most stated safety-increasing measure according to the senior cyclists is construction of more cycle tracks. (...).

**Keywords:**

Elderly Bicyclists, Safety, Health.



TUE 13<sup>th</sup> (15:30 - 16:45, Session C4.9) Room AVI

ID 2830 R

## ROAD INFRASTRUCTURE AND SAFETY OF POWER TWO WHEELERS

Main Author:

**George YANNIS** (*National Technical University of Athens, Department of Transportation Planning and Engineering*)

### Abstract:

Power Two Wheelers (PTWs) safety risk factors are examined in relation to the road infrastructure characteristics and the extent and magnitude of their influence to the PTW accidentology is discussed. In view of the above, a variety of published articles, European and international research reports and other public studies have been collected and analyzed with respect to specific road infrastructure characteristics such the type of the area and location of the accident, the road geometry and roadside installations, issues of lighting and visibility, collision type and road surface condition. Analysis results indicate a significant number of factors that contribute to the increase PTW accident risk, for example accidents occurring inside urban areas, or at the vicinity of extreme road geometries such as severe bends and high gradients. Moreover, disharmonic alignment design and maintenance defects emerged as critical in the present study. The paper also addresses several interdependencies between different risk factors. Finally, the paper provides a discussion on the importance of each risk factor revealed with respect to the existing literature dedicated to the specific factor, as well as the need for further research.

### Keywords:

Power Two Wheelers, Road safety, Infrastructure, Risk factors.

TUE 13<sup>th</sup> (15:30 - 16:45, Session C4.9) Room AVI

ID 3200 R

## ADDED RISK IN CASE OF RAIN:SOME RECENTS RESULTS FOR FRANCE

Main Author:

**Ruth BERGEL-HAYAT** (*INRETS*)

Co-author(s):

**Maurice ARON** (*INRETS*)

**Hugues RATTAIRE** (*INRETS, INSA*)

**David DOUCET** (*CETE Normandie-Centre*)

**Eric VIOLETTE** (*CETE Normandie-Centre*)

### Abstract:

This paper provides some results demonstrating the impact of rain on road safety for France. The risk of injury accident and the added risk in case of rain are estimated for several types of injury accidents which occurred in France for the period 1995-2008. Estimations cover the whole of France, in average and according the category of network and element of the road. These results are relevant as they will contribute to implement specific road safety measures. The risk of injury accident in case of rain is defined as the number of injury accidents per vehicle-kilometre by rainy conditions. The added risk in case of rain is defined as the ratio of the risk of injury accident by rainy conditions divided by the risk of injury accident by no rain. As the number of vehicle kilometres is partly unknown, the rain duration is used in this paper in the place of the number of vehicle-kilometres by rainy conditions. An approximation of the added risk is thus derived. For computing these estimations, two data sources related to injury accidents and rain duration were used: the BAAC (the French Injury Accident File) and Météo-France. In addition, the changes in the added risk in case of rain over the period 1995-2008 are described with the help of time series analysis techniques. The results are commented in relation with more detailed results obtained for the Haute-Normandie region in France, and recommendations for improving the computation method are given.

### Keywords:

Time series analysis, Road safety, Injury accidents, Accident risk, Added risk, Rain.

TUE 13<sup>th</sup> (17:00 - 18:15, Session C4.10) Room AVI

ID 1074 R

**ONTOLOGY BASED APPROACH FOR AN EUROPEAN  
WAYSIDE TRAIN MONITORING SYSTEM**

Main Author:

**Andreas SCHÖBEL** (*Vienna University of Technology*)

**Abstract:**

Due to the automation and centralisation of railway operation the demand for train monitoring systems arises to guarantee operational safety in times of liberalisation of the railway market. The motivation for wayside train monitoring has its origin in national considerations and regulations. Accordingly monitoring systems are designed for national use, but the market of railway undertakings is not limited to national borders anymore. By exchanging measured data of wayside train monitoring devices across national borders, an improvement of availability and safety in rail traffic on the European corridors seems to be achievable. Beyond different thresholds for measurements used by different infrastructure managers an ontology based method of describing fault states and their dependencies remains the same. The realisation of monitoring measures may be national specific, but the opportunity for cross border data exchange seems to be possible. Therefore a concept was developed which shall allow application of the national driven approach on the European freight corridors.

**Keywords:**

Train monitoring, Interoperability, Safety related fault states.

TUE 13<sup>th</sup> (17:00 - 18:15, Session C4.10) Room AVI

ID 1224 R

**IMPROVING SAFETY OF SHUNTING MOVES**

Main Author:

**Daniel EMERY** (*EPFL-LITEP*)

**Abstract:**

Collisions against parked vehicles are regularly related to shunting routes that are formally permitted but unexpected are regularly involved in practice. Drivers or shunters bear only part of the responsibility, as signaller's mistakes and inaccurate track side signalling are often contributing causes. Such collisions cause normally no fatalities. They induce nevertheless high costs in rolling stock and infrastructure repairing and can reduce significantly the capacity, or even the availability, of a station, especially when main lines are impacted. After defining the case of permitted but unexpected shunting routes, some shunting collisions against parked vehicles are discussed, keeping in mind the confidence and the supervision principle. Then, a list of proposals on both procedures and equipment is presented. Among them, the use of the digital radio GSM-R is specially highlighted. GSM-R, connected with local interlocking, makes it possible to display on the DMI the tracks circuits on the permitted shunting route that are occupied. Without using GSM-R, blinking of shunting signals to make aware of an occupied track section is probably a fair improvement in shunting moves safety for Switzerland.

**Keywords:**

Signalling, SPAD, Shunting, Railway safety, Accide.

ID 1683 R

**DEVELOPMENT OF RAILWAY SAFETY IN FINLAND**

Main Author:

**Anne SILLA** (*VTT Technical Research Centre of Finland*)**Abstract:**

This study reviewed the development of railway safety in Finland from 1959 to 2008. The data for national analysis were mainly collected from the statistics of the Finnish railway operator (VR Group Ltd.), the Finnish Rail Administration, (RHK) and, for the international comparison, from the Eurostat database and the European Railway Agency's Public database of safety documents. The results showed that the level of safety has greatly improved over the past five decades. This positive development was owed to the use of new technology and the new procedures to protect railway employees working on the tracks. Furthermore, the number of road users killed at level crossings has diminished due to the installation of barriers and the construction of overpasses and underpasses at the crossings with dense traffic, the removal of the level crossings and an improvement of conditions such as visibility at the crossings. However, the number of trespasser fatalities has not seen a similar reduction. At the European scale, the level of railway safety in Finland is around the average based on the number of accidents per million train-km. The main plans for the future include the removal of 1,500 level crossings by 2025 and involving communities in the safety work related to railway trespassers to decrease the large amount of trespassing accidents.

**Keywords:**

Railways, Safety.

ID 2324 R\*

**TOWARDS THE DEVELOPMENT OF A TRANSPORTATION RISK ANALYSIS TOOL FOR DANGEROUS SUBSTANCES (TRANS) IN FLANDERS, BELGIUM**

Main Author:

**Frank WITLOX** (*Ghent University*)

Co-author(s):

**Genserik RENIERS** (*Antwerp University, Antwerp Research Group on Safety and Security (ARGoSS) and Hogeschool-Universiteit Brussels*)**Dirk LAUWERS** (*cGhent University, Institute for Sustainable Mobility (IDM)*)**Abstract:**

In this paper we introduce a new method to assess the relative safety of different transport routes when transporting dangerous goods. This method, called TRANS (an acronym for Transport Risk ANalysis tool for dangerous Substances), is based on the assessment of a semi-quantitative likelihood grade and a quantitative consequence grade. Our approach is as follows. First, a transport route is divided into a number of segments where surrounding criteria and infrastructure-related criteria for segmentation are found to be unchangeable. The latter criteria are pre-determined by an expert panel consisting of participants from industry, government and universities. Second, in order to determine the likelihood grade of a segment, a number of relevant parameters are fixed per transport mode (i.e., road, railway, inland waterway, and pipeline) by the same expert panel. These parameters are then used by the TRANS-user to perform a multi-criteria analysis and to assess a likelihood grade from 1 to 10. Using these user-friendly (and rather simple) parameters the risk analysis proves to be very helpful to explain to users and to be understandable by non-experts (e.g. policy makers). Third, to further determine the consequence grade of a segment, a 1% lethality zone is calculated (depending on the type and amount of hazardous substance transported) for a certain transport route, as well as the number of people possibly being affected (i.e., the number of people disposed to the risk) within a 1% lethality effect distance. This calculation is carried out by using the 'EFFECTS' software available at TNO (The Netherlands). The number of affected people is then translated into a consequence grade from 1 to 10. (...).

**Keywords:**

Hazardous transportation, Risk analysis, Safety, F

ID 1034 R

**A STUDY ON VISIBILITY OBSTRUCTION RELATED  
CRASHES DUE TO FOG AND SMOKE**

Main Author:

**Mohamed ABDEL-ATY** (*University of Central Florida*)

Co-author(s):

**Al AHAD EKRAM** (*University of Central Florida*)

**Helai HUANG** (*University of Central Florida*)

**Abstract:**

Research efforts on weather effects have been concentrated on snow or rain related crashes, however, there is a lack of good understanding of crashes occurring under fog/smoke (FS). This study presents a comprehensive examination on FS related crashes using crash data in Florida (2003-2007). A two-stage research strategy was implemented so as to 1) examine FS crash characteristics with respect to temporal distribution, influential factors and crash types, and 2) estimate the effects of various factors on injury severity given a FS crash has occurred. The morning hours in the months of December to February are the prevalent time for FS crashes. Compared to crashes under clear-visibility conditions, the FS crashes tend to result in more severe injuries and involve more vehicles. Head-on and rear-end crashes are the two most common crash types in terms of crash risk and severe crashes. These crashes occurred more prevalently on higher speed, undivided, no sidewalk and two-lane rural roads. Moreover, FS crashes tend to occur more likely at night without street light, which also leads to more severe injuries.

**Keywords:**

Fog and Smoke, Visibility, Crash risk, Injury Severity.

ID 1559 R

**INFLUENCE OF PAVEMENT CONDITION, SURFACE  
DRAINAGE, TIRE TREAD AND VEHICLE SPEED ON  
THE HYDROPLANING PHENOMENON**

Main Author:

**Luciano BUCHARLES** (*University of Sao Paulo*)

**Abstract:**

In a forensic analysis, the establishment of hydroplaning as the cause of a traffic accident is not an easy task, as it might seem at a first moment. The simple presence of water on the asphalt pavement surface, at the moment of the accident, is not a guarantee that hydroplaning has occurred. The investigation must collect information from both the vehicle and the road, aiming at a more adequate analysis of the real cause of an accident. The micro and macro texture characteristics of the pavement, as well as the condition of the tires, are decisive factors for the occurrence of hydroplaning. Thus, responsibility for an accident can be not only attributed to the driver, but also to the roadway agency responsible for the maintenance of the highway conditions above the recommended safety limits. This paper presents a discussion of the main factors and also a case study of a forensic hydroplaning analysis.

**Keywords:**

Highway safety, Forensic analysis, Hydroplaning, Pavement condition, Vehicle speed.

ID 2078 R

**MULTIPLE TRAFFIC SAFETY BEHAVIOR  
ENCOURAGED BY THE COLORED PAVEMENT:  
THEORETICAL FRAMEWORK AND EMPIRICAL  
VALIDITY**

Main Author:

**Toshiaki AOKI** (*Tohoku Institute of Technology*)

**Abstract:**

Aoki(2009) reported that colored pavement would encourage safe driving for drivers on both non-colored and colored roads. Aoki, however, does not elaborate on the mechanisms present in that effect. Hence, this study, referring to psychological theories, aims to verify the psychological processes involved in the effects of colored pavement on safe driving.. Based on both mere exposure theory and brand priming theory, the following hypotheses are set: After people drive on colored pavement many times, understanding the meanings of the pavement, they would develop positive responses to the colored pavement(H1), and would drive safer than before(H2). Encountering the colored pavement regularly,would enhance their awareness of safety while driving(H3). As a result, drivers who drive in colored zones habitually would begin to drive safer than before, even on non-colored roads(H4). In order to test the above reasoning, I conducted a questionnaire survey on residents who live in an area where colored pavement has been introduced, measuring select psychological variables. The survey reveals that the colored pavement encourages residents to drive safely not only in the colored zones, but also out colored zones. Hence the safe driving effect of colored pavement was confirmed again. Furthermore, conducting a structural equation modelling revealed that the model based on the above reasoning was supported statistically. Hence, it can be concluded that the colored pavement could be one of the most economical and effective countermeasures for safe driving.

**Keywords:**

Road safety, Brand priming effect, Mere exposure effect, Safe driving, Colored pavement.

ID 2368 R

**FACTORS THAT INFLUENCE THE LEVEL OF  
ACCIDENT SEVERITY IN VEHICLE CRASHES: A CASE  
STUDY OF ACCIDENTS ON KOREAN EXPRESSWAYS**

Main Author:

**Sunghee PARK** (*Department of Civil and Environmental Engineering, Seoul National University*)

Co-author(s):

**Shin HYOUNG PARK** (*Dept. of Civil and Environmental Engineering, Seoul National University*)

**Dong-Kyu KIM** (*Department of Civil and Environmental Engineering, Seoul National University*)

**Kyung SOO CHON** (*Seoul National University*)

**Abstract:**

For the years from 2004 through 2008, 1,381 people were killed, and 5,925 people were injured due to vehicle crashes on expressways in Korea. While accidents on expressways make up only 1.7% of total vehicle crashes on all roads in Korea, the ratio of fatalities to crashes on expressways (113 people per 1,000 crashes) is more than three times higher than the ratio for all roads in Korea. This indicates that the severity of expressway crashes is relatively higher than that of crashes that occur on other types of roads. The goal of this study is to identify the most influential factors that determine the severity of accidents on Korean expressways. In this study, the factors that influence the level of accident severity were investigated using crash data from Korean expressways. These data are categorized into three levels of accident severity(level A/B/C), and an ordered probit model was used to determine the ordinal nature of the severity categories. Also, statistical tests were performed on the parameters based on robust standard errors to draw unbiased interpretations from the estimated parameters. Some of the factors that are expected to increase the level of accident severity on expressways include dozing off, speeding, tire failures, pedestrian violations, twocar accidents, cars hitting pedestrians, more than four cars involved in an accident, stopping or parking on the shoulder of the road, work-zone areas, and left curves that have a radius of more than 500 m. (...).

**Keywords:**

Vehicle crash, Accident severity, Influential factor, Ordered probit model, Robust standard error.

ID 3280 R

**EXPERIMENTAL DESIGN DEFLECTION DISTANCES OF LONGITUDINAL BARRIERS IN KOREA**

Main Author:

**Seongkwan LEE** (*Expressway & Transportation Research Institute*)

Co-author(s):

**Seunglim KANG** (*U-City Research Institute in Yonsei University*)**Daeyoung JANG** (*Expressway & Transportation Research Institute*)**Jaewoong JOO****Abstract:**

Longitudinal barriers are fairly common safety features that are installed within the median and at the outside of the shoulder along with the traveled way. They are installed to prevent an errant vehicle from entering a median or a roadside area that would be more severe than impacting the longitudinal barrier. Actually there are three sorts of barriers such as roadside barriers, median barriers, and bridge railings. Although more focus has recently been given to the end-treatments of the barriers and to the new designs for transition sections between two barriers which have different stiffness in strength, it is still important to develop the barriers that have proper heights, proper strengths, and that utilize cost-effective materials without trading off any amount of safety that is expected of them. To evaluate the crashworthiness of the longitudinal barriers, full-scale vehicle crash tests are requisite in general. With the tests, we can check the structural adequacy, the occupant risk and the post-impact vehicle trajectory of the barriers. In Korea, emphases are still laid on the necessity for the construction of new highways to cope with the overcrowded traffic in urban areas. However, we cannot afford to secure the adequate space to be designated as a clear zone that is necessary for a longitudinal barrier because of the limited space in the area. This limitation in Korea makes it important to know the design deflection distances (DDD) of the respective safety barriers. However, ignorance and lack of understanding of the DDD in Korea makes longitudinal features that are adjacent to the fixed objects such as lightings and utility poles easy to find. (...).

**Keywords:**

Traffic Safety, Longitudinal Barrier, Design Deflection Distance, Vehicle Crash Test.

ID 1177 R

**PROFESSIONAL DRIVERS AS ROAD USERS IN THE URBAN ENVIRONMENT**

Main Author:

**Charlotta JOHANSSON** (*Department of Civil, Mining and Environmental Engineering*)

Co-author(s):

**Peter ROSANDER** (*Luleå University of Technology, Sweden*)**Abstract:**

Few international studies have so far been conducted in terms of professional drivers' speed compliance in urban areas, and even fewer on professional drivers' compliance with rights of way at pedestrian crossings. The project began with a literature review to identify existing knowledge on the role of professional drivers in traffic. The municipalities of Luleå, Piteå, Kalix and Älvsbyn in Sweden were contacted for information about the project and for cooperation in the selection of study sites. Speed measurements with a handheld laser were conducted in the urban environment with the focus on commercial vehicles such as buses, trucks, freight services, taxis and service vehicles. In parallel with the speed measurements, video recording was conducted for observational studies of yielding behaviour at pedestrian crossings in the urban environment, with the focus on commercial vehicles. Professional drivers as a group are not clearly distinguished from other drivers regarding compliance with speed limits and, when they differed from other drivers, it was in a negative way. Bus drivers and taxi drivers drove faster than other drivers at sites with maximum speed limit of 30 km/h, and the tendency was that taxi drivers also drove faster on roads with maximum speed limit of 50 km/h. Professional drivers are much like other drivers. This averages that it is common that the relevant rules not are followed, two to three out of ten drivers do not give priority to pedestrians at marked pedestrian crossings. This also applies to professional drivers.

**Keywords:**

Raffic safety, Urban traffic, Professional drivers, Pedestrians, Bicyclists.

ID 2295 R

**EFFECTIVENESS OF MARITIME SAFETY POLICY INSTRUMENTS - CASE STUDY ON THE GULF OF FINLAND**

Main Author:

**Jenni KURONEN** (*Centre for Maritime Studies/University of Turku*)

Co-author(s):

**Annukka LEHIKOINEN** (*University of Helsinki/ Department of Biological and Environmental Sciences*)**Ulla TAPANINEN****Abstract:**

The aim of this paper is to evaluate maritime safety policy instruments with the focus on the Gulf of Finland. The Gulf of Finland is a shallow and ecologically vulnerable sea area with dense passenger and cargo traffic. The share of oil transports is over 50% of all cargo transports. The worst case scenario would be a collision of an oil tanker and a passenger ship, which could have devastating consequences both for human lives and for environment. New policies to prevent an accident from happening are developed and suggested in many maritime safety issues and at many levels (international, regional, national). Maritime safety is an issue concerned with multiple perspectives and disciplines, such as those dealing with technical, societal, economic, cultural and environmental aspects. It poses a challenge for society and decision makers: how to use limited resources so that the best benefit with the lowest costs is achieved? In addition, decision makers are typically faced with a flood of information, in which the comparability of results is poor and uncertainties high. The fact that we don't know how the future development of the global and regional economy, industries, infrastructure and environmental policies will proceed, brings even more challenges. The purpose of this paper is to present both qualitative and a quantitative means to evaluate the effectiveness of policy instruments in order to give tools for decision makers: what kind of efforts would most likely minimize the risks at maritime traffic with reasonable costs? (...).

**Keywords:**

Maritime safety, Policy instruments, Bayesian networks, Evaluation, The Gulf of Finland.

ID 2683 R

**CALGARY TRANSIT SAFETY ASSESSMENT: EMPLOYEES' PERCEPTIONS**

Main Author:

**Abul AZAD** (*University of Calgary*)

Co-author(s):

**Richard TAY** (*University of Calgary*)**S.c. WIRASINGHE** (*University of Calgary*)**Stephen HANSEN** (*University of Calgary*)**Abstract:**

Although work-related driving has been a topic of research interest in recent years, relatively less attention has been devoted to public transit operator. In the City of Calgary, Calgary Transit has a responsibility to not only provide a safe and secure public transportation to its users but also a safe workplace for its employees. This study aims to determine the role of safety within a public transit organization from its employees' perspective. A well established Safety Climate Questionnaire – Modified for Drivers (SCQ-MD) was administered to 110 bus drivers to its applicability to the public transit sector. It included 35 items representing six SC factors: communication, work pressures, relationships, driver training, management commitment, and safety rules. These six SC factors appeared to exhibit good internal consistency, with high degree of reliability coefficients ranging from 0.86 to 0.94. The bus drivers rated driver training, safety rules and management commitment as relatively more satisfactory than relationship, work pressure and communications. One way analyses of variances revealed that the SC factors are strongly related to employees' bus driving experience and collisions involvement but not their age, gender; or traffic violations.

**Keywords:**

Safety Climate, Safety, Calgary Transit, Bus Drivers.

ID 2734 R\*

**INTRODUCTION OF A DUAL ANALYSIS ON HEAVY GOODS VEHICLES? INJURY ACCIDENTS IN HUNGARY**

Main Author:

**Tamás BERTA** (*Institute for Transport Sciences Non-profit Ltd.*)**Abstract:**

It is a common aim of the member states of the European Union to reduce the number of casualties and those caused by road transport. When we talk about road transport, it is usual to emphasize the role of automobiles, admitting that the volume of freight traffic having professional drivers behind the wheel is permanently increasing. Until now there has been paid much more attention in Hungary to lower pollution and emission level of the freight transport contrary to road safety issue. To complement the presently observed lack of attention, the paper provides the in depth analysis of injury accidents caused by heavy goods vehicles in Hungary in 2008. In this study beside the statistical analysis of heavy goods vehicles' accident data, a comprehensive investigation of police traffic accident reports has also been carried out.

**Keywords:**

Road safety, Freight transport, Dual analysis, In .

ID 3281 R

**SAFELY MANAGEMENT OF FLEET OPERATIONS IN COMPLEX AND CRITICAL INFRASTRUCTURES**

Main Author:

**Gabriel PESTANA** (*INOV*)

Co-author(s):

**Augusto CASACA** (*INESC/IST*)**Tiago SILVA** (*INESC/IST*)**Isabel REBELO** (*ANA- Aeroportos de Portugal*)**Mário NUNES** (*INESC/IST*)**Otto WEBER** (*INFORM Gmb*)**Abstract:**

Safety of surface movements and the efficiency of airport operations should be managed as a whole. However, it is not unusual to find scenarios where both services are performed independently. With the advent of mobile computing and with the dissemination of location-based services, improvements to the way airports monitor ground movements are expected. It is also expected a higher level of integration between the airport systems. The integration of airport systems with sensor related networks of mobile devices create in fact a consistent view about airport ongoing operations, enabling airport stakeholders to take better operational decisions based on up to the minute information. Improvements within the wireless sensor network area enable European transport policy and in particular airport stakeholders to benefit from solutions capable to provide reliable situation awareness related to surface movements, complemented with real-time alerts about safety occurrences within the spatio-temporal context they occur. Indeed, airport stakeholders started to request new and more integrated tools to improve the management of surface movements according to A-SMGC requirements while maintaining the required level of safety. This paper presents the AAS platform and how it meets some of the A-SMGCS functional requirements.

**Keywords:**

Location-based services, Sensor data fusion, Ground traffic management, A-SMGCS.



ID 1265 R

**PERFORMANCE EVALUATION OF ADAPTIVE GROUP-BASED SIGNAL CONTROL THROUGH A FIELD TEST IN JAPAN**

Main Author:

**Keshuang TANG** (*Institute of Industrial Science, the University of Tokyo*)

Co-author(s):

**Nan KANG** (*Department of Civil Engineering, Nagoya University*)**Hideki NAKAMURA** (*Department of Civil Engineering, Nagoya University*)**Abstract:**

The group-based signal control approach (GA) refers to such a control pattern that the controller is capable of separately allocating time to each signal group instead of stage. It is a consensus that GA is more efficient in terms of operational performance than the conventional stage-based signal control approach (SA) predominantly applied in Japan, particularly if adaptive control is applied. In order to investigate the applicability of adaptive GA in Japan, one intersection was recently selected as the field test site by Universal Traffic Management Society of Japan (UTMS). Utilizing the data collected at the test intersection before and after the implementation, this study evaluated the operational and safety performance of adaptive GA. Operational traffic flow characteristics, including start-up loss time (SULT), clearance loss time (CLT), and saturation flow rate (SFR), were first measured and compared between before and after. It was found that SULT and CLT increased averagely by 0.6s and SFR however remained stable after the implementation of adaptive GA. Based on those measured parameters, capacity and delay were then estimated. It was found that capacity of the intersection slightly ascended by 3%, and the total average delay was considerably improved by 24% after using the adaptive GA. In addition, a new methodology based on Traffic Conflict Technique was developed to evaluate safety performance of GA during intergreen intervals. (...).

**Keywords:**

Adaptive group-based signal control, Operational performance, Intergreen interval, Traffic conflict, Before-and-after study.

ID 1411 R

**DEVELOPMENT OF A ROAD COLLISION WARNING INFORMATION MODEL VIA TELEMATICS DEVICES ON SMART ROADS**

Main Author:

**Jeongah JANG**

Co-author(s):

**Hyunsuk KIM****Eunmi PARK** (*Mokwon university*)**Abstract:**

The primary purpose of this research is to develop a road collision warning information (RCWI) model using telematics devices on SMART roads. This paper focuses on the effect of real-time, environmental/incident-hazard information using telematics devices for invehicle unit advisory systems, and suggests a detection and estimation model using new IT technologies at signalized intersections for collision warning. Signalized intersections pose safety and operational challenges. For instance, dangerous situations may arise such as a failure to stop in time for, or blatantly running, a red light accelerating through a yellow light, or abruptly stopping in the middle of an intersection. This paper presents the development of a road collision warning model for vehicles travelling in phase change using real-time vehicle speed and the time between multiple point detectors. For an evaluation of this model, VISSIM was used to create multiple detection situations in real-time, various inflow-volumes, changes in the remaining times for a green light period, and road design speeds. In our results, about 0.8 - 2.3% of the entire traffic flow was classified as collision warning vehicles, while 35.8% was classified as collision warning vehicles during a yellow signal. This research considers that new service applications for increasing safety at signalized intersections are possible. The road collision warning information model may directly contribute to providing such safety for overall vehicle users on SMART roads.

**Keywords:**

Smart roads, ITS, Telematics, Collision warning, Real-time traffic detector.

WED 14<sup>th</sup> (11:15 - 12:30, Session C.13) Room AVI

ID 1977 R

## ROAD ?ACCIDENTALITY? IN BRAZIL

Main Author:

**Barbara BEZERRA** (*Departamento de Transportes EESC/USP*)

Co-author(s):

**Antonio CLÓVIS PINTO FERRAZ** (*Departamento de Transportes EESC/USP*)

**Jorge TIAGO BASTOS** (*Departamento de Transportes EESC/USP*)

### Abstract:

This paper contains an overview of road accidentality in Brazil, by means of total and updated accident indexes, comparisons with values from other countries, and national values evolution over time. A critical analysis of the problem through actions and facts that have occurred or still occur in the country is also presented. Examples of these facts are the mandatory seat belt usage, the advent of the new Brazilian Traffic Code, the "Lei Seca" (zero tolerance for alcohol and driving), and the fleet growth (especially motorcycles). The problem for the main individual transportation modes is analyzed (car and motorcycle). The conclusion is that accidentality in traffic is a serious current problem in Brazil. Therefore, striking actions should be implemented to prevent this situation to deteriorate in the future.

### Keywords:

Accidentality, Brazilian traffic, And traffic safety data evolution.

WED 14<sup>th</sup> (11:15 - 12:30, Session C.13) Room AVI

ID 2521 R

## POSITIVE EXTERNALITIES FROM ACTIVE CAR SAFETY SYSTEMS - AN EMPIRICAL ANALYSIS

Main Author:

**Andreas MATTHES** (*University of Technology Dresden*)

### Abstract:

This paper aims at broadening the theoretical justifications of traffic safety regulation. In a simple theoretical model we show that externalities occur when a driver's safety actions lower the probability that other drivers cause traffic accidents or a driver's safety actions lower the damages occurring in the case of other drivers causing accidents. Based on a large dataset of traffic accidents in Germany we show that the second sort of externalities is in fact empirically relevant for the case of antilock-brakes and electronic stability programmes. Thus, the demand for these active car safety systems would likely be suboptimally low in an unregulated market.

### Keywords:

Regulation, Driving Safety, Externalities, Transport.

WED 14<sup>th</sup> (11:15 - 12:30, Session C.13) Room AV1

ID 3278 R

**TRAFFIC SAFETY: INTERNATIONAL STATUS AND STRATEGIES FOR THE FUTURE**

Main Author:

**Dinesh MOHAN** (*Indian Institute of Technology - Delhi*)

**Abstract:**

The World Health Organization released Global Status Report On Road Safety: Time For Action in July 2009. This report focussed on fatalities due to road traffic injuries worldwide. Here we analyse the data to understand the fatality trends by national income and modal shares of traffic in different societies. Less than 50% of the countries have reported fatality rates close to the WHO estimates. While more high income countries seem to have reported rates close to WHO estimates than low income countries, it is interesting that both low- income and high-income countries can have under reporting and realistic reporting. Therefore, it appears that is not necessary to have high income levels to develop reliable reporting systems as commonly assumed. The data indicate that even in countries that have similar incomes, fatality rates and patterns can be different. It appears that factors other than income levels, car and road design, and policing influence fatality rates per-capita for each country. Recent studies suggest that there are similar variations in fatality rates among cities within countries which cannot be explained by income levels, vehicle technology or basic road design. Much more work will have to be done in this area before the variability in crash rates can be explained satisfactorily. In the absence of more reliable data and identification of risk factors for each city or country, it is not possible to give very specific country based countermeasures for road safety. It would be adequate at present to focus on measures that have international validity and are known not to have negative side-effects. (...).

**Keywords:**

Safety, Cities, Income, Fatality rates.

MON 12<sup>th</sup> (11:15 - 12:30, Session C5.1) Room 1.03

ID 1079 R

**AN ANALYSIS ON ACCEPTABILITY OF AN INFORMATION PROVIDING SYSTEM FOR ROAD TRAFFIC TRAVEL TIME & ADVICE**

Main Author:

**Ryosuke ANDO** (*TTRI (Toyota Transportation Research Institute)*)

Co-author(s):

**Masayoshi KAWAI** (*TTRI (Toyota Transportation Research Institute)*)

**Noriyasu KACHI** (*Toyota Transportation Research Institute*)

**Abstract:**

By using the historical data collected from the probe-vehicles in Toyota City, a travel time information providing system for the road users has been developed. This study aims at to discuss its acceptability, usability, effects et al. by a questionnaire investigation and a monitor investigation. At first, the questionnaire investigation was implemented in October 2008 to know whether the similar systems had been used by referring to a famous system in Japan and an integrated information system in Toyota City. Then the monitor investigation was conducted in February and March 2009 to know the change of the monitors' evaluation and to discuss the direction updating the system.

**Keywords:**

Travel Time Information Providing System, Acceptability, User Needs, Monitor Investigation.

MON 12<sup>th</sup> (11:15 - 12:30, Session C5.1) Room 1.03

ID 1577 R

**TRAVEL TIME VARIATION AND TRAVEL TIME  
RELIABILITY INDEXES**

Main Author:

**Hiroshi WAKABAYASHI** (*Faculty of Urban Science, Meijo University*)

**Abstract:**

Reliability is an emerging demand for a transportation service under: 1) Increase in the time value, 2) Increased pervasiveness of economic activities related to "Just in Time" production and inventoryless sales, 3) Increased economic efficiency in speed and accuracy related to economic activity, and; 4) Increased demands on people's time. This paper includes (1) actual observation of travel time variation, (2) its modeling, and (3) development of travel time reliability indexes for both user and administrator sides, and they will be compared with many indexes proposed so far.

**Keywords:**

Travel time reliability, Travel time variation.

MON 12<sup>th</sup> (11:15 - 12:30, Session C5.1) Room 1.03

ID 2093 R

**DISTRIBUTIONS OF VARIABILITY IN TRAVEL TIMES  
ON URBAN ROADS – A LONGITUDINAL STUDY**

Main Author:

**Susilawati SUSILAWATI** (*ISST-Transport Systems University of South Australia*)

Co-author(s):

**Michael TAYLOR** (*ISST - University of South Australia*)  
**Somenahalli SEKHAR** (*School of Natural and Built Environments - University of South Australia*)

**Abstract:**

Reliability is an important factor in route choice analysis and is a key performance indicator for transport systems. However, the current parameters used to measure travel time variability may be not sufficient to fully represent reliability. Better understanding of the distributions of travel times is needed for the development of improved metrics for reliability. A comprehensive data analysis involving the assessment of longitudinal travel time data for two urban arterial road corridors in Adelaide, Australia demonstrates that the observed distributions are more complex than previously assumed. The data sets demonstrate strong positive skew, very long upper tails, and sometimes bimodality. This paper proposes the use of alternative statistical distributions for travel time variability, with the Burr Type XII distribution emerging as an appropriate model for both links and routes.

**Keywords:**

Travel time reliability, Travel time distribution,

ID 2345 R

**TRAVEL TIME MODELLING DATA COLLECTION**

Main Author:

**Ivana CAVAR** (*Faculty of Transport and Traffic Sciences, University of Zagreb*)**Abstract:**

The paper describes the procedures for GPS/GPRS data collection with the aim of improving urban travel time modelling process. Data were collected from multiple sources and then fused based on common attributes. Three primary sources are GPS/GPRS vehicle data, meteorological and road infrastructure data. GPS/GPRS data include log time (time at which the record is generated expressed in UTC), vehicle ID (identification number of the vehicle/GPS device), X coordinate (X coordinate of GPS track), Y coordinate (Y coordinate of GPS track), speed (speed of the vehicle acquired from GPS in km/h), course (angle at which the vehicle is travelling with reference to the North), GPS status (3 values that indicate accuracy) and engine status (indicates whether the vehicle's engine was turned off or on). Meteorological and Hydrological Service data include air and ground temperature, rain, visibility, air pressure, wind, snow etc. and GIS database infrastructure data that include road link and sublink IDs as well as length, road category, direction, beginning and end coordinates, name etc. These data were cleansed and map-matching procedure was carried out. All the data were collected on the same urban area during the same time period for better understanding of transportation activities. Fused data have been analysed and factors are derived as the main carriers of input information for the travel time modelling in urban areas. The idea is to identify the main elements that affect the travel time and congestion in the urban area so they could be built into the model to achieve a satisfying level of prediction accuracy. The paper describes the procedures for GPS/GPRS data collection with the aim of improving urban travel time modelling process. (...).

**Keywords:**

Data collection, GPS/GPRS, Travel time modelling.

ID 2715 R

**ESTIMATING ROUTE TRAVEL TIME VARIABILITY FROM LINK DATA BY MEANS OF CLUSTERING**

Main Author:

**Wouter CHARLE** (*CIB / Verkeer & Infrastructuur, Katholieke Universiteit Leuven*)

Co-author(s):

**Francesco VITI** (*CIB / Verkeer & Infrastructuur, Katholieke Universiteit Leuven*)**Chris TAMPÈRE** (*CIB / Verkeer & Infrastructuur, Katholieke Universiteit Leuven*)**Abstract:**

Accurate route travel time estimation is today one of the most challenging problems in traffic theory. This research proposes a novel method for the estimation of route travel time distributions, based on historical link travel time observations. Central in the development of this framework is the distinction between (cheap) off-line storage and computations and (expensive) on-line computations. For that it is important to minimize the on-line computational effort of calculating a route travel time histogram. The key elements in the method are correlations in link travel time fluctuations and a clustering algorithm. Tests on the Belgian road network show that 1) the clustering method is on-line computationally efficient while keeping the off-line storage under control, 2) that it can accurately estimate route travel time distributions and 3) that it can be applied successfully for route reliability estimation.

**Keywords:**

Travel time variability, Clustering, Data mining, Route information.

ID 1901 R

**DETECTING AND CORRECTING MAP-MATCHING ERRORS IN LOCATION-BASED INTELLIGENT TRANSPORT SYSTEMS**

Main Author:

**Nagendra VELAGA** (*Department of Civil and Building Engineering, Loughborough University*)**Abstract:**

Map-matching (MM) algorithms integrate the data from positioning sensors (such as GPS) with a digital map in order to identify firstly, the road link on which a vehicle is travelling from a set of candidate links; and secondly, to determine the vehicle's precise location on that segment. Due to errors in positioning sensors, digital maps and the map-matching process, MM algorithms sometimes fail to identify the correct road segment from the candidate segments. This phenomenon is known as mismatching. Identification of the wrong road link could mislead users and may degrade the performance of the ITS services and reduce their efficiency. Therefore, the main objective of this paper is to improve a topological mapmatching (tMM) algorithm by error detection, correction and performance re-evaluation. Errors in a tMM algorithm are determined using data (62,887 positioning points) collected in three different countries (UK, USA and India). After map-matching, each mismatched case was examined to identify the primary causes of the mismatches and a number of strategies were developed to correct these mismatches enabling enhancement of the tMM algorithm. An independent dataset (5,256 positioning points) collected in and around Nottingham, UK, was employed to re-evaluate the performance of the enhanced tMM algorithm. The result suggests that the enhanced tMM algorithm correctly identified road segments 97.8% of the time. With the same positioning data, the success rate was found to be 96.5% before the enhancement. The enhanced tMM algorithm developed in this research is simple, fast, efficient and easy to implement. Since the accuracy offered by the enhanced algorithm is found to be high, the developed algorithm has potential to be implemented in real-time location-based ITS applications. (...).

**Keywords:**

Map-matching, GPS, Location-based ITS services, Genetic Algorithm.

ID 2066 R

**REAL-TIME TRAFFIC OBJECT DETECTION TECHNIQUE BASED ON IMPROVED BACKGROUND DIFFERENCING ALGORITHM**

Main Author:

**Yingying ZHANG** (*Department of Automation, Tsinghua University*)

Co-author(s):

**Danya YAO** (*Department of Automation, Tsinghua University*)**Lihui PENG** (*Department of Automation, Tsinghua University*)**Chenyao GENG** (*Department of Automation, Tsinghua University*)**Abstract:**

Background differencing is the major algorithm for real-time object detection, which is widely used in traffic data collection and incident detection techniques. The speed of this method in object detection usually heavily depends on the size of the images and the number of the objects. This paper presents an improved background differencing technique, which draws several crossing lines in the interested region and detections are accordingly performed on these lines. A real-time object detection system built on this method significantly improves the speed of the system. An object detection experiment for real traffic scene is conducted to compare the speed and accuracy between traditional and improved background differencing techniques. Effects on the size of the crossing lines are discussed in this paper as well.

**Keywords:**

Grid processing, Improved background differencing, Motion detection.

ID 2141 R

**ASSESSMENT OF TRAFFIC DETECTION IN A HIGHWAY NETWORK**

Main Author:

**Marc MISKA** (*University of Tokyo*)

Co-author(s):

**Shinji TANAKA** (*The University of Tokyo*)**Abstract:**

The mobility demand of our society increased rapidly in the last decades. To ensure accessibility the traffic infrastructure needs to be used more efficiently. One way to achieve this is dynamic traffic management (DTM). Vital for the DTM cycle is traffic data collection to enable the feedback loop to traffic operations. Roadside detection is nowadays the most common way of traffic data collection, but probe vehicle data, GSM data and vehicle to infrastructure communication are getting more and more momentum. With the new variety in data collection methods, research on data fusion, to combine different data sources to better traffic state information, it is important to have a detection plan, which is cost efficient and designed to serve the policy of the road authority. To analyse the detection efficiency of a network or to develop guidelines for detection placement planning, several aspects have to be taken into account. The costs of the detection equipment are vital, and should include not only the purchase costs, but also the maintenance costs and equipment life-cycle. With the budget for detection equipment installation and maintenance being usually the limiting factor, an evaluation should indicate an area specific level of detection (LOD) that is possible inside this budget. The LOD is representing the overall coverage of the network, but especially the area wide data availability for reliable incident detection, travel time estimation, traffic control and traveller information systems. Such data availability and also reliability depends on the detection equipment. In this paper we propose a framework that introduces demand and supply functions for traffic information throughout a network, which allow an objective assessment of the detection system and can be used to optimise the detection plan for the network. (...).

**Keywords:**

Detection, Optimisation, Assessment, Highway.

ID 2147 R

**INVESTIGATING THE PERFORMANCE OF AUTOMATIC COUNTING SENSORS FOR PEDESTRIAN TRAFFIC DATA COLLECTION**

Main Author:

**Hong YANG** (*Rutgers, The State University of New Jersey*)

Co-author(s):

**Kaan OZBAY** (*Rutgers University*)**Bekir BARTIN** (*Rutgers, The State University of New Jersey*)**Abstract:**

There has been an increasing need to obtain high-quality pedestrian counts for many transportation studies. Traditional data collections cannot satisfy the extensive data collection requirements such as long term and high accuracy. Advancements of sensor technologies in recent years have been promoting the development of automatic devices to automate pedestrian counting process. A number of pedestrian counters are now commercially available but their accuracy under urban environmental settings is still not well-known. Thus, this study aims to shed light on the understanding of the field performances of two infrared pedestrian counters by performing rigorous pair-wise comparisons. It finds that both sensors were systematically undercounted the actual pedestrian traffic and one sensor outperformed the other one in most cases. The magnitude of errors varied from sites to sites and the reasons are different. It also finds the potential of deploying infrared counters for intersection use.

**Keywords:**

Pedestrian counters, Infrared counters, Pedestrian traffic, Data collection.

ID 2228 R

**CATEGORIZING U-BIKE SERVICE AND ASSESSING ITS ADOPTABILITY UNDER IT-BASED CITY**

Main Author:

**Youn TAIK LEEM** (*Dept. of Urban Engineering, Hanbat National University*)

Co-author(s):

**Jae-Yeong LEE** (*Daejeon Development Institute*)**Tae HEON MOON** (*Dept. of Urban Engineering, Gyeongsang National University, Gajwa-dong, Jinjoo-si, Gyeongnam, Korea*)**Abstract:**

Bicycle is one of the most important eco-friendly transport mode which can cope with global warming and ICTs (information and communication technologies) on bicycles became a dominant factor for success to the spread of bicycles to public. In this paper, conceptualization and classification of U-bike services are fulfilled and its adoptability was examined using AHP method. Group capabilities technique was invited to eliminate bias on appraisal. 12 U-bike services were conceptualized to u-bike information system, u-bike cycling services u-bike and transit system, u-public bike system and u-bike management and additional services system. By AHP process to evaluate the order of priority, economic factors such as profitability has revealed as more important ones than policy factors and technology factors. U-service with highest of adoptability was 'bike and ride' service which can link bicycle to public transportation. 'Prevention system from abandonment and theft' and 'public bike system' similar to Velib system in Paris are also considered to very important services in U-city. These services are expected to eliminate the reasons of current limitation on using bicycles. Conceptualization and adoptability of U-bike services based on scientific methods can contribute the adaptation of bicycle as a eco-friendly transportation mode in U-City.

**Keywords:**

U-bike service, U-city, Conceptualization, Adoptability, AHP method.

ID 1410 R

**DYNAMIC RESPONSE RECOVERY TOOL FOR ROADING ORGANISATIONS**

Main Author:

**Frederico PEDROSO** (*University of Canterbury*)

Co-author(s):

**Andre DANTAS** (*University of Canterbury*)**Erica SEVILLE** (*University of Canterbury*)**Sonia GIOVINAZZI** (*University of Canterbury*)**Abstract:**

Natural and man made disasters have been increasingly affecting societies world wide. Damage range from deaths to business disruptions and can impact regional and local development at different scales. In this respect, response needs to be quickly and effectively deployed in order to reduce life and economic losses. The complex environment of disaster management can overwhelm organisations and decision-makers; therefore, generate poor response and resource usage. General recommendations and optimum resource deployment strategies can facilitate decision-making and ultimately reduce social / economic impacts. Hence, a decision support system, namely Dynamic Response Recovery Tool, is proposed in this paper according to a number of findings gathered from previous experiences in observing emergency exercises and performing game simulations as well as a logistics conceptualization of physical resource deployment during disaster situations. The proposed system is to be assessed in future research endeavours using a specific method in order to confirm its efficiency and applicability in real scenarios as well as to identify design shortcomings before an operational version can be developed and deployed for roading organisations.

**Keywords:**

Transport Systems, Emergency Management, Decision-



ID 1512 R

**ASSESSING THE IMPACT OF VEHICLE COMMUNICATIONS ON TRAFFIC PERFORMANCE**

Main Author:

**Nagui ROUPHAIL** (*ITRE, NC State University*)**Abstract:**

The principal objective of this research was to assess the potential mobility benefits derived from implementing a ubiquitous transportation network, driven by ubiquitous sensors that can communicate information between vehicles and between the fixed infrastructure and vehicles. The selected assessment method was computer simulation. The research team categorized the impacts of u-Transportation at three hierarchical levels: operational, tactical, and strategic. It then defined appropriate tools and performance measures of the impacts for each level. DYNASMART-P (DS-P) was selected as the appropriate meso-scopic simulation tool for the strategic level assessment and AIMSUN was proposed as the microscopic simulation tool for the operational and tactical levels. The work presented herein focuses on the findings from the meso-scopic simulator. Using DS-P, two pilot test studies were carried out. From these it was determined that traveller information was instrumental in reducing congestion caused by road incidents or flooding events. It was also shown that having access to pre-trip information might not always be beneficial if it is not updated en-route, especially in large networks where traffic conditions may change between the departure time and the time an impacted area is reached. The study also demonstrated that higher u-Transportation market penetration rates will be needed as the spatial and capacity reduction scope of the event becomes more severe. However, the study also indicated that system-optimal protocols, which emulate V2I information systems, yielded larger travel time differentials between diverted and non-diverted vehicles, and therefore the potential for ignoring recommendations for alternative routes. (...).

**Keywords:**

Ubiquitous Transportation, Vehicle communication, Mesoscopic simulation, DYNASMART-P, Incident, Intelligent Transportation Systems (ITS), And Traveller information.

ID 1811 R

**A STUDY OF HIGHWAY DRIVERS' DEMAND OF REAL-TIME TRAFFIC INFORMATION FOR MAIN TRAVELLING HIGHWAYS AND ALTERNATIVE ROUTES**

Main Author:

**Ke-Hong CHEN**

Co-author(s):

**Rong-Chang JOU****Abstract:**

A computer-aided survey was designed and conducted face-to-face with highway drivers in Taiwan to gauge the demand for and reasonable pricing of customized real-time traffic information in the event of three different traffic conditions. Bivariate ordered probit models were estimated to investigate factors that significantly influence the demand for traffic information both for main highways and secondary alternative routes. The results indicated that the demand for traffic information for non-recurring conditions was the strongest of the factors investigated. Basic information was the main type of information requested for normal and recurring conditions, whereas dynamic travel time prediction was the main type of information requested for non-recurring conditions. The estimation results from bivariate ordered probit models showed that by providing node-to-node information and encouraging a greater willingness to pay for information the demand for traffic information about main highways and secondary alternative routes will increase. Finally, the significant and positive correlations of models imply that the greater the demand for traffic information about main highways, the greater the demand for information about secondary alternative routes.

**Keywords:**

Customized real-time traffic information, Pricing, Bivariate ordered probit model.

ID 2317 R

**FREEWAY COOPERATIVE MERGING AND LANE CHANGING THROUGH V2I AND V2V COMMUNICATION**

Main Author:

**Eunmi PARK** (*Mokwon university*)**Abstract:**

The ubiquitous transportation system is a decentralized system with individual vehicular sensor nodes while the existing ITS is a centralized system in which all the data collected are sent to ITS center and all the control actions taken by the center. In ubiquitous transportation system environment, the individual vehicular nodes become a sensor and a processor at the same time, which means they are acting like small individual centers. The 2-way communication environments make more efficient control for individual vehicles possible and furthermore make it possible to monitor the individual vehicle's decisions on route choice or whatever and coordinate them to achieve the system optimal. This paper proposes a freeway cooperative merging and a cooperative lane changing schemes, which takes advantage of vehicular sensor network and V2V(Vehicle to Vehicle), V2I(Vehicle to Infra) 2-way communication environments of the ubiquitous transportation system. Algorithms for the cooperative merging and the cooperative lane changing are developed. Field tests are performed for the cooperative merging and the lane changing schemes. And simulation experiments are made to evaluate the algorithms. The proposed schemes are expected to significantly improve safety and productivity of freeway system

**Keywords:**

Cooperative Merging, Cooperative Lane Changing, VII, V2V Communication.

ID 2520 R

**SYSTEM FOR CONTROLLING ACTIVITIES OF HIGHWAYS CONCESSIONARIES**

Main Author:

**Claudio MARTE** (*Universidade de São Paulo - USP*)

Co-author(s):

**Maria ROSILENE ROSI** (*Instituto de Pesquisas Tecnológicas do Estado de São Paulo - IPT*)**Alex SALETA SALETA** (*Agência Reguladora dos Transportes do Estado de São Paulo - ARTESP*)**Abstract:**

The state of Sao Paulo has much of its road network being operated by concessionaries, in which go through more than 60% of the state medium daily volume. It's important to bring out that 93% of cargo transportation is done through the road system and the Conceding Power is responsible for supervising the operation carried out by the concessionaries. A lot of ways of action are used by the Regulatory Agency for Public Services Transport Delegates of Sao Paulo State – ARTESP , that is the organ undertaken by Conceding Power in order to inspect the concessionaries operation, such as: checkouts "in loco" inspection by outsourced staff, requirement for regular highway event reports and the concessionaire performances in these events, among others. (...)

**Keywords:**

ITS, RM – ODP, Highway concession, Regulatory activities, Support system, TMC (Traffic Management Center), Regional Data Warehouse.

ID 1416 R

**SELF-ADAPTING PREDICTION MODEL FOR TRAFFIC FLOW STATUS**

Main Author:

**Satu INNAMAA** (*VTT Technical Research Centre of Finland*)**Abstract:**

The purpose of the study was to develop a method for making a self-adapting short-term prediction model for the flow status. The model was based on field-measured travel time data and self-organising maps. The test site was Ring Road I in the Helsinki metropolitan area. The forecasts were based on the outcomes of previous moments when the traffic situation was similar to the present. The forecast was set to the most common outcome in the cluster of these similar samples. The model was allowed to work online and its performance was studied. The proportion of correct forecasts was 93.8–96.3% over the entire trial period and 80.9–82.3% in congested conditions for the model in normal weather and road conditions. The average daily change in the proportion of correct forecasts was positive over the whole trial period: +0.3–0.4%. Two naïve comparison models were made. Both comparison models performed considerably poorer than the self-adapting model.

**Keywords:**

Prediction, Traffic flow status, Self-organising map.

ID 1448 R

**INFLUENCE OF REAL-TIME INFORMATION PROVISION TO TAXI DRIVERS ON TAXI SYSTEM PERFORMANCE**

Main Author:

**Wen SHI** (*The University of Hong Kong*)

Co-author(s):

**Co TONG** (*University of Hong Kong*)**S.c. WONG** (*The University of Hong Kong*)**Abstract:**

This paper assumes that all taxi drivers adopt a profit maximization strategy when searching for customers. Some taxi drivers are provided with real-time information on customer and taxi queue lengths at all taxi stands while others have no information at all. The questions to be investigated are: (1) will equipped taxi drivers earn a higher profit compared to the uninformed taxi drivers? (2) What is the impact of real-time information provision to a portion of all the taxi drivers on the overall taxi system performance? To find answers to these questions, a case study is conducted by assuming a hypothetical linear city with a single city centre, ten taxi stands and twenty residential zones. A discrete-event dynamic simulation model is adopted to simulate the movements of taxis and to estimate various taxi system performance characteristics, such as taxi operation profit and customer waiting time. The time period simulated is a 3-hour morning commute. The taxi fleet size, fare structure, taxi operation cost and customer demand pattern are all assumed given. The simulation model is Influence of real-time information provision to vacant taxi drivers on taxi system performance Wen Shi; C. O. Tong; S. C. Wong 12th WCTR, July 11-15, 2010 – Lisbon, Portugal 2 used to investigate the variation of taxi system performance with the proportion of informed taxi drivers in the taxi fleet.

**Keywords:**

Public transport, Taxi, Information provision, Customer-searching strategy.

ID 2095 R

**OD VOLUME VARIATION AND ITS PREDICTION BASED ON URBAN EXPRESSWAY ETC-OD DATA**

Main Author:

**Hiroaki NISHIUCHI** (*Nihon University*)**Abstract:**

This paper presents characteristics of OD volume variation using ETC-OD Data and propose stochastic short-term OD volume prediction model applying Bayesian Network. Since Electronic Toll Collection (ETC) system is installed at tollgates of expressways in Japan, Drivers with an ETC on-board unit in their car do not have to stop at tollgates and the payment is done electronically when the vehicle passes the sensors. In addition penetration of ETC users smoothly reached to 80% in case of Metropolitan Expressway in Japan. This means the system is collecting 80% of dynamic OD volume data in expressway network every time. Therefore this research focusing on OD volume variation which was difficult to collect the data until now, and stochastic short-term OD volume prediction model is proposed by applying Bayesian Network. Results of OD variation analysis shows that several patterns of OD pairs' location can identify characteristics of OD volume variation, and it also shows proposed OD volume prediction model can make it predict better results than historical average OD volume for target OD pairs.

**Keywords:**

OD Volume Variation, Short-term OD Volume Prediction, ETC-OD Data, Bayesian Network.

ID 2411 R

**A METHOD TO GENERATE AND CLASSIFY TENTATIVE TRAIN SCHEDULES FOR KEEPING TIME TO SEARCH AN OPTICAL PLAN IN COMPUTER-AIDED TRAIN RESCHEDULING**

Main Author:

**Shunichi TANAKA** (*The University of Tokyo*)

Co-author(s):

**Kenji CHIGUSA** (*The University of Tokyo*)**Masaki FUKUCHI** (*The University of Tokyo*)**Takafumi KOSEKI** (*The University of Tokyo*)**Abstract:**

Train rescheduling is often needed when train operation disordered by train accidents, natural disaster, and so on. This task generically depends on the experiences and personal decision of the professional dispatchers. They do not have quantitative criteria for evaluating goodness of their operation and their task is therefore substantially difficult. Thus, operators have requested a computer-aid system. The authors propose a computer-aided train rescheduling system. This system consists of two parts, one part is for creating plans and another is for evaluating the plans. This paper deals with a method generating possible train operation plans. Train rescheduling needs many steps for reacting events timely after a disruption. If you have to start the rescheduling plan right after an accident, you have no time to investigate possible plans carefully. Hence, authors insert a tentative train diagram between the time of the accident and start of the executing rescheduled plan. The best choice of tentative diagrams depends on the interval length between the accident and the start of recovery actions. However, you must prepare ready-made patterned operational candidates in advance because the tentative plan must be immediately selected and applied just after an accident. In this paper, authors discuss appropriate methods related to train rescheduling on directional quadruple tracks.

**Keywords:**

Train rescheduling, Computer-aid system, Passengers' flow.

MON 12<sup>th</sup> (17:00 - 18:15, Session C5.4) Room 1.03

ID 2979 R

## **ROADMAPPING ITS AND ICT TO IMPROVE MOBILITY GAPS IN THE NORTH-WEST EUROPEAN REGION**

Main Author:

**Paulus ADITJANDRA** (*Centre for Transport Research, University of Aberdeen*)

Co-author(s):

**Brian MASSON** (*Centre for Transport Research, University of Aberdeen*)

**John D NELSON** (*Centre for Transport Research, University of Aberdeen*)

### **Abstract:**

Mobility management is at the heart of the low carbon future. Whilst globally significant nations are racing to set the target to meet reductions in greenhouse gas emissions from transport by 2050, technology and travel demand reduction are thought to be the ultimate solutions. However, it is less clear how this will fit with the current and projected demand of travel. The research question addressed in this study is to gain insights into how Intelligent Transport Systems (ITS) and Information and Communication Technology (ICT) can be used to promote mobility management over the next 25 years using the North West European region as a case study. The detailed objective is to have a better understanding on how ITS/ICT can contribute to improve the (so-called) 'first and last miles' of local journeys thus reducing the "mobility gap". A questionnaire methodology is used to capture four objectives; current experience of ITS/ICT procurement/deployment/evaluation; future technology requirements; consideration of a variety of future technology scenarios; and anticipated challenges in achieving the future requirements. Local authorities, public transport operators and transport consultancies are the major respondents across 7 North West European nations. The analysis shows that the Public Transport (Management) and Environment ITS policy themes are the stated top priorities to play a role in improving mobility gaps across different organisation types. Real-time information that reflects the importance individuals place on time was highlighted as the key aspect that all stakeholders wish to address. Furthermore, the trends of first and last mile solutions in different regions may differ to meet local needs. (...).

### **Keywords:**

ITS applications, Technology roadmap, First and last mile, North-West Europe.

TUE 13<sup>th</sup> (08:15 - 09:30, Session C5.5) Room 1.03

ID 2539 R

## **TRAFFIC DATA PLATFORM BASED ON THE SERVICE ORIENTED ARCHITECTURE (SOA)**

Main Author:

**Louis CALVIN TOUKO TCHEUMADJEU** (*German Aerospace Center (DLR)*)

Co-author(s):

**Sten RUPPE** (*German Aerospace Center (DLR)*)

**Elmar BROCKFELD** (*DLR-Institute of Transport Systems*)

**Younes YAHYAOU** (*Institute of Transportation Systems - German Aerospace Center*)

### **Abstract:**

The DLR Traffic Data Platform (TDP) that is currently being developed by the German Aerospace Center (DLR) is an autonomous decentralised ITS system for distributed intelligent traffic data management and dissemination. Of course, there are many possibilities to design the architecture of such a traffic data platform where service oriented architecture (SOA) has been chosen for the current design of the TDP. In this paper the SOA design aspect of the TDP will be analysed and presented. The TDP as service provider is able to store, manage, aggregate, process and fuse traffic data from different sources like floating car data (FCD), loop detector data, remote sensing, video sensors and traffic relevant radar data into common traffic states and supply them as services to the TDP clients or service consumers who need these data to realize telematic services. The TDP is designed to support not only "online" traffic information but also services like multimodal routing for example. Having all these data in a single platform and making it available by providing standardised ubiquitous access, research and the development of new methods as well as the enhancement of existing methods such as data fusion, traffic state estimation, quality evaluations and innovative telematic services could be facilitated. Thus, the TDP contributes to more effective research in the field of traffic management.

### **Keywords:**

Traffic data collection, Floating car data, Probe vehicle data, Loop detector, Data fusion, Travel time, Traffic model, Congestion management, Video, Remote sensing, Service oriented architecture.

TUE 13<sup>th</sup> (08:15 - 09:30, Session C5.5) Room 1.03

ID 2795 R

**TRAFFIC SAFETY TECHNOLOGIES AND PRIVACY - A QUALITATIVE STUDY**

Main Author:

**Brita GJERSTAD** (*IRIS (International Research Institute of Stavanger)*)

Co-author(s):

**Christin BERG** (*IRIS (International Reserach Institute of Stavanger) and Municipality of Stavanger*)

**Abstract:**

The paper to be presented focuses on drivers' acceptance for traffic safety technologies. A number of technologies are being developed in order to assist the driver. The technologies are expected to reduce the number and severity of traffic accidents. Still, the systems are not necessarily accepted among drivers. As several of the relevant technologies register and store personal information, we pay particular attention to privacy. It is the aim to learn more about how drivers think of technologies that may threaten their privacy, and how they deal with dilemmas concerning safety, driving, and personal freedom. The analysis is based on ten in-depth interviews with drivers. Five drivers have used ISA (Intelligent Speed Adapter) for a test period of 17 months, and five drivers use alcoholock while driving company cars. The interviews are data from an ongoing project on traffic safety technologies and privacy, financed by The Norwegian Public Road Administration. The analysis indicates that privacy is an issue, although not necessarily recognized as a matter of privacy. Drivers seem positive towards safety technologies although they state disadvantages and awareness of privacy issues.

**Keywords:**

Road safety, Technology, Privacy.

TUE 13<sup>th</sup> (08:15 - 09:30, Session C5.5) Room 1.03

ID 2866 R

**CAN MOBILE MILLENNIUM HANDLE CONGESTION PRICING**

Main Author:

**Sarah STERN** (*UC Berkeley*)

**Abstract:**

The Internet's adaptability to the mobile world is impacting the transportation cyberphysical system at a very fast pace. In the last five years, cellular phone technology has leapfrogged several attempts to monitor traffic with dedicated infrastructure systems. Today, Global Positioning System (GPS) enabled smartphones are increasingly becoming a prevalent data source for traffic monitoring systems which allow users to collectively supply and receive real time traffic information. Mobile Millennium is a pilot project representative of this new type of technology and allows the general public to partake in bettering traffic conditions on their daily commute. One of the problems tackled by this research is to know: Can the Mobile Millennium system deter congestion enough to prevent the need for congestion pricing or will it need to be adaptive in case congestion pricing becomes a larger priority for policy makers? A research trip to Finland allowed this problem to be analyzed and the following proposal was written.

**Keywords:**

Congestion pricing, GPS, Privacy, Traffic.

ID 3133 R

**COVARIATES OF A LATENT CLASS MODEL OF HEURISTIC ACTIVITY-TRAVEL SCHEDULING CHOICES UNDER MULTIPLE SOURCES OF UNCERTAINTY AND TRAVEL INFORMATION**

Main Author:

**Zhongwei SUN** (*College of Architecture and Urban Planning, Chongqing University*)

Co-author(s):

**Theo ARENTZE** (*Eindhoven University of Technology*)  
**Harry TIMMERMANS** (*Urban Planning Group, Eindhoven University of Technology, The Netherlands*)

**Abstract:**

Current activity-based models of transport demand do not take uncertainty into account. It is a theoretical limitation when these models are used for short-term transport management. Travellers have to make their activity-travel choices in the context of multiple unexpected events and adjust their original plans accordingly during the implementation of their activity-travel plans. Moreover, information provision may be relevant in this context as well. Most previous research on travel information has either dealt with the importance of travel information in reducing uncertainty and the corresponding willingness to pay or with the effects of travel information on simple, mostly uni-dimensional travel choices. This work is motivated by the belief that only by considering this increased complexity ultimately dynamic activity-based models that also take travel information, route choice and activity rescheduling behaviour into account can be developed. To that end, a latent class model has been formulated which captures travellers' heterogeneity in terms of their attitudes towards uncertain events. Heterogeneity is represented by the different heuristics applied by travellers. In this sequel, membership of the latent classes and therefore decision styles is estimated as a function of household characteristics. To estimate the model, an interactive- web based travel simulator was developed. Two aspects will be discussed in this paper: decision model that utilizes decision style heuristics and covariate variable latent class model extension that includes household socio-demographic characteristics. (...).

**Keywords:**

Route choice, uncertainty, activity-travel rescheduling, decision styles, risk attitudes .

ID 3267 R

**VIDEO INCIDENT DETECTION SYSTEM FOR ADVANCED TRAFFIC MANAGEMENT SYSTEMS – A CASE STUDY**

Main Author:

**Kayitha RAVINDER** (*Central Road Research Institute*)

**Abstract:**

It is obvious that innovative efforts are needed on a massive scale to cope with the management of traffic operations. Intelligent Transportation Systems (ITS) is one such option offering innovative and cost effective solutions for achieving maximum capacity out of the existing highway facilities thereby enhance traffic safety. To demonstrate the benefits which can accrue by deploying ITS for traffic management, some pilot studies have been taken up and illustrated in this paper. The efficacy of video incident detection system for advanced traffic management system under Indian traffic conditions where there is high incidence of non-adherence to lane discipline has been explained. In this study, video image processing using Citilog software has been applied on one urban section for traffic incident detection and measurement of traffic parameters like traffic flow. From this study, it was evident that that VIDS can be implemented to assess the traffic congestion with a reliable degree of accuracy.

**Keywords:**

VIDS (Video Incident detection System), Advanced Traffic Management System (ATMS), Intelligent Transportation Systems (ITS).

TUE 13<sup>th</sup> (09:45 - 11:00, Session C5.6) Room 1.03

ID 1610 R\*

**TRUCK DRIVERS' ROUTE CHOICE BEHAVIOR AND INFLUENCE OF AN IN-CAR NAVIGATION SYSTEM: ANALYSIS OF MOVEMENT TRACKING DATA**

Main Author:

**Theo ARENTZE** (*Eindhoven University of Technology*)

Co-author(s):

**Tao FENG** (*Eindhoven University of Technology*)

**Abstract:**

Existing in-car navigation systems are not well adapted to the specific requirements truck drivers impose on routes. This paper reports the results of a field experiment that was conducted to test a new navigation system for trucks. A sample of 100 truck drivers participated in the experiment where they used the new system first in a tracking mode only and next in a full navigation mode for a period of two and a half months in total. During this period drivers kept a diary where they indicated the times and reasons why they deviated from routes suggested by the system. We analyze the diary data and GPS data logged by the system to investigate compliance with and influence of the new navigation system on route choice. The results suggest that the new navigation system for trucks has significant impacts on routes, the most important of which is a shift from use of smaller roads towards larger roads with beneficial consequences in terms of both efficiency and environment. Deviation from suggested routes occurs relatively frequently and for different reasons by drivers of heavy and lighter trucks. Performance of the system and benefits for environment may be increased when route advice is differentiated between heavy and lighter transport.

**Keywords:**

Freight transport, Route choice, Route guidance, Compliance.

TUE 13<sup>th</sup> (09:45 - 11:00, Session C5.6) Room 1.03

ID 1698 R

**INFLUENCE OF ADVANCED TRAVEL TIME INFORMATION ON DRIVERS ROUTE CHOICE BEHAVIOR AT EXPRESSWAYS**

Main Author:

**Yukimasa MATSUMOTO** (*Meijo University*)

Co-author(s):

**Hiroshi MATSUI** (*Meijo University*)

**Masami TAKAHASHI** (*Meijo University*)

**Koji NODA** (*Toyota National College of Technology*)

**Abstract:**

Travel time information affects drivers' route choice behaviour, and is therefore regarded as one of the effective measures to ease traffic congestion. We conducted the questionnaire survey about travel time information at Service Areas (SA) and Parking Areas (PA) on the expressways around Nagoya City in Japan. The questionnaire mainly consisted of questions about the consciousness and the needs of drivers for travel time information and their route choice behaviour. It reveals that approximately 80% of drivers accept  $\pm 10$  minutes error of travel time information. When an increase or a decrease arrow was added to travel time information, it had a considerable influence on their route choice behaviour. As a result, it was clarified that the display of the arrow on travel time information had possibility to relieve traffic congestion effectively.

**Keywords:**

Travel Time, Allowable Error, Route Choice, Expressway.



ID 1703 R

**THE EFFECTS OF INCREASING WORKLOAD ON DRIVERS' EYE MOVEMENT**

Main Author:

**Yan YANG** (*School of Civil Engineering, University of Southampton*)**Abstract:**

In recent years, the increasing use of in-vehicle information systems (IVISs) has become a growing safety concern because such IVISs compete with driving tasks over limited visual and cognitive resources, therefore cause higher drivers' workload, which in turn may affect driving performance negatively. Eye movement measurements were found to be sensitive to the workload increased by in-vehicle secondary tasks. As an indicator for both drivers' vision impacted by external reasons (e.g. environmental changes) and drivers' demands influenced by internal factors (e.g. mental workload increasing), the drivers' eye movement while performing concurrent tasks have been investigated in this paper. The results show that auditory and visual tasks have different effects on drivers' eye movement. In visual tasks, driver deviation of gaze angle and percent of time looking at in-vehicle display increased, while the percent of time spent on windscreen, on mirrors, frequency of mirrors checking as well as saccade duration and saccade amplitude decreased, which suggest the higher visual workload and reflect the location effect of the display. Especially, the significant decrease in the frequency on mirrors checking is an indication of drivers compromising the information intake in extra visual workload. While when performing auditory tasks, on the contrary, there were significant increases in blink percentage, blink frequency and a minor increase in blink duration. It is also observed that drivers' horizontal and vertical gaze angles are sensitive measurements for task type and mental workload. According to these findings, a framework for detecting and predicting workload is established. This work suggested the potential developing a real-time tool of monitoring and predicting drivers' mental workload based on the eye-movement measurements. (...).

**Keywords:**

Eye movements, IVIS, Driving behaviour, Workload, Road safety, Eye gaze angle, Visual searching strategy, Saccade

ID 1773 R\*

**INFORMATION RELAYING SYSTEMS AND DRIVER PERCEPTION: EXPERIMENTAL ANALYSIS OF VARIABLE MESSAGE SIGNS USING CAGLIARI EYE TRACKER**

Main Author:

**Gianfranco FANCELLO** (*CIREM - University of Cagliari*)

Co-author(s):

**Grazia CARTA** (*University of Cagliari*)**Paolo FADDA** (*CIREM - University of Cagliari*)**Abstract:**

Variable Message Signs (VMS) are electronic traffic signs used on roads to alert motorists of incidents or obstructions such as traffic congestion, accidents or roadworks. These devices are becoming increasingly important in road transportation and in some countries they are also used to provide information about speed limits on a specific road segment (not yet in Italy). The first important study concerning driver perception and comprehension of VMS in Italy was conducted by our research unit. The findings indicated the general indifference of drivers towards reading messages and difficulties in remembering the text, but provided no insight into driver perception. The aim of this paper is thus to investigate driver perception using an eye tracker (headmounted Mobile Eye). A sample of individuals, divided into different age groups, fitted with the Cagliari University Eye Tracker, were monitored on a given urban route where two different panels (text and text-pictogram) have been installed. Using this instrument it was possible to analyse driver behaviour with respects to the Variable Message Signs. The Eye Tracker tracks drivers' gaze and produces at the end of the test a gaze plot showing eye gaze point patterns (saccadic eye movements). Using a specific analysis software it has been possible to examine the visual activities of subjects during task execution, discriminating between objects considered visual distractions and those regarded as "receptor signals", in this case the VMS. Using the eye tracker it will be possible to establish whether drivers see panel or not and for how long their gaze remains fixed on the VMS. The findings of this study will also provide guidelines for the correct use and installation of these panels. (...).

**Keywords:**

Urban transport safety, Variable Message Signs, Eye Tracker, Human machine.

TUE 13<sup>th</sup> (09:45 - 11:00, Session C5.6) Room 1.03

ID 3221 R

**CONGESTION INDICATORS FROM THE USERS?  
PERSPECTIVE: ALTERNATIVE FORMULATIONS WITH  
STOCHASTIC REFERENCE LEVEL**

Main Author:

**Carlos MORAN TOLEDO** (KTH)

Co-author(s):

**Haris KOUTSOPOULOS** (KTH)

**Abstract:**

Congestion causes delays and environmental impacts. Policy makers and transport planners have used congestion indicators for monitoring traffic conditions in urban areas. These indicators require defining a reference level of congestion (based for example on free flow conditions). In most cases reported in the literature this reference point is constant and typically corresponds to speed limits. This paper proposes a methodology for the definition of congestion indicators that takes into consideration the preferences and variability across the individual commuters and hence, develops congestion indicators from the users of the system point of view. An analytical approach is developed pointing out that, as expected, for certain simple distributions of desired speed (i.e. triangular) some indicators are biased. A case study using a microscopic simulation model to study a small, dense, and very congested urban network in Stockholm illustrates the impact of applying this new definition in the calculation of congestion indicators. The results of the case study illustrate the bias of existing methods and identify indicators that are less sensitive to the distribution of the reference speed among drivers.

**Keywords:**

Congestion Indicators Stochastic variables Proba.

TUE 13<sup>th</sup> (11:15 - 12:30, Session C6.1) Room 1.02

ID 1010 R

**MULTI-OBJECTIVE DECISION-AID TOOL FOR  
PAVEMENT MANAGEMENT SYSTEMS**

Main Author:

**Adelino FERREIRA** (Department of Civil Engineering,  
University of Coimbra)

Co-author(s):

**Susana MENESES** (Technology and Management High  
School of Oliveira do Hospital, Coimbra Polytechnic  
Institute)

**Abstract:**

This paper presents the development and implementation of a Multi-Objective Decision-Aid Tool (MODAT) tested with data from Oliveira do Hospital's Pavement Management System (OHPMS). Nowadays, the OHPMS Decision-Aid Tool uses a deterministic section-linked optimization model with the objective of minimizing the total expected discounted costs over the planning time-span while keeping the road pavements within given quality standards. The MODAT uses a multi-objective deterministic section-linked optimization model with three different possible goals: minimization of agency costs (maintenance and rehabilitation costs); minimization of user costs; and maximization of the residual value of pavements. This new approach allows the Pavement Management Systems (PMS) to become an interactive decision-aid tool, capable of providing road administrations with answers to "what-if" questions in short periods of time. The MODAT also uses the deterministic pavement performance model used in the AASHTO flexible pavement design method that allows closing of the gap between project and network management. The information produced by the MODAT is shown in maps using a Geographic Information System. In this application, the Knee point, that represents the most interesting solution of the Pareto frontier, corresponds to an agency costs weight value of 5% and an user costs weight value of 95%, demonstrating that user costs, because are generally much greater than agency costs, dominates the decision process.

**Keywords:**

Road Assets, Pavement Management System, Pavement Performance Models, Optimization Model, Maintenance & Rehabilitation.

ID 2012 R  
**ESTABLISHMENT OF A SKID RESISTANCE AND  
 MACROTEXTURE MAINTENANCE PROGRAM IN  
 DIFFERENT ROAD ENVIRONMENTS, BASED ON A  
 COST-BENEFIT ANALYSIS**

Main Author:

**Ana FERNANDES** (IST, Technical University of Lisbon)

Co-author(s):

**José NEVES** (IST, Technical University of Lisbon)

**Abstract:**

Many countries have in their Pavement Management Systems, maintenance programs for functional properties of road pavements – skid resistance and macrotexture. However, most of them do not differentiate environments with distinct traffic, geometry and weather characteristics. The main purpose of this paper is to present the methodology and the main results of PhD research at Technical University of Lisbon (IST). This study deals with the problematic of establishing different threshold values, monitoring schedules and rehabilitation techniques in dissimilar road environments. This target will lead to an increment of traffic safety without, necessarily, increasing costs. The first stage of this work consisted of applying different traffic characteristics, road geometry and weather conditions to road environments, using a cluster analysis. After that, the expected value of road crashes in different road scenarios was modelled with a Poisson Regression using also pavement condition as covariate. These results were fundamental to establish threshold values for the International Friction Index (IFI). Using equations that relate the evolution of skid resistance with traffic accumulated, it was possible to predict the remaining time until reach the threshold values established in the previous task of this study for each traffic condition. Complementing these results with a Cost-Benefit Analysis, the final output of this research work was a skid resistance and macrotexture maintenance program that offers the best moment of action as well as the rehabilitation technique most economically advantageous for each road environment under specific traffic conditions, to ensure a durable and a safe pavement surface. (...).

**Keywords:**

Skid resistance, Macrotexture, Road safety, Pavement management, Cost-benefit analysis.

ID 2333 R  
**DETERMINATION OF THE EFFECTIVE RAILWAY  
 TRACK LENGTH TO BE MAINTAINED BY ONE  
 TAMPING MACHINE**

Main Author:

**Rui SANTOS** (IST)

Co-author(s):

**Paulo TEIXEIRA** (IST, Technical University of Lisbon)

**Abstract:**

Railways are facing an increasing demand challenge and the construction of new lines is evident in a worldwide scale. Furthermore, in the railway sector the development of effective technological solutions depends on achieving optimum infrastructure design, and less expensive solutions in a life cycle perspective. This perspective includes finding a cost efficient way on how to perform maintenance over the whole life cycle, especially in respect to the usage of heavy maintenance resources. Defining in the early design phase the optimum number of machines to use, based on a projection of the interventions that the track will require, is a research field that will, for sure, contribute to the above mentioned needs. Planning maintenance on tracks has been a developing area, leading to avoidance of disruptions on train traffic, damages on vehicles and higher costs by inefficient usage of the track components. Based on this, the research for a most cost effective maintenance plan has been directed towards finding a degradation theory for sections of the track and then assigning the interventions according to this plan. The implementation of these findings in a linear extensive infrastructure, such as railways, could be used to define a more effective maintenance plan, assess the efficiency of using the intervention means and thus deliver an adequately estimate the necessary means to produce track maintenance. This paper aims at the development of a methodology that defines the optimum length of track that would undergo maintenance works by one track maintenance tamping machine. The methodology proposed follows a recommended track quality standard, taking into account the execution capacity of a tamping machine in a scenario where the intervention schedule is optimized in a long term perspective. (...).

**Keywords:**

Railways, Track maintenance, Maintenance planning, Predictive maintenance, Tamping machines, Machinery capacity, Simulated annealing.

TUE 13<sup>th</sup> (11:15 - 12:30, Session C6.1) Room 1.02

ID 2814 R

**COMPUTATIONAL INTELLIGENCE METHODS FOR HIGHWAY INFRASTRUCTURE MANAGEMENT SYSTEMS**

Main Author:

**Gloria BELTRAN** (*Universidad Nacional Autonoma de Mexico - Universidad Nacional de Colombia*)

Co-author(s):

**Miguel ROMO** (*Universidad Nacional Autonoma de Mexico - Instituto de Ingenieria*)

**Abstract:**

Given the need to explore innovative ways to address road condition evaluation problems, this work provides an overview of some promising methods of analysis, based on computational intelligence techniques. A non conventional methodology that combines different fields of knowledge is proposed to help making decisions for highway management systems and road condition evaluation. Artificial Neural Networks and Fuzzy Logic are proposed to assess road performance of existing flexible pavement highways and to identify rehabilitation alternatives, based on non-destructive testing data collected along the road.

**Keywords:**

Highway performance, Fuzzy logic, Artificial neural network, Non-destructive testing, Flexible pavements.

TUE 13<sup>th</sup> (14:00 - 15:15, Session C6.2) Room 1.02

ID 1524 R

**TACTILE AND AUDIBLE EFFECTS OF TRANSVERSE RUMBLE STRIPS ON TWO-LANE RURAL HIGHWAY IN THAILAND**

Main Author:

**Kittichai THANASUPSIN** (*Department of Civil Engineering, King Mongkut's University of Technology North Bangkok*)

**Abstract:**

Rural highways in Thailand experience high rate of motor vehicle related accidents. This rate is increasing each year. Main causes of accident include aggressive driving such as tailgating and speeding, drowsiness, and intoxication. Transverse rumble strips (TRS) have been used to alert inattentive drivers by providing tactile and audible warning. However, proper magnitude of noise and vibration produced by the rumble strips has been limitedly studied. In general, excessively high level of noise and vibration can cause nuisance to people in communities located along the rural highway. On the other hand, subordinate tactile and audible warning produced by the rumble strips may not be notified by inattentive drivers. This study was aimed to investigate the tactile and audible warning produced by different configuration of rumble strips installed on two-lane highway. The eighteen different patterns of rumble strips with different thickness, width of each strips, and gap between strips, were examined. The rumble strips were tested with a test vehicle, which was a pickup truck at different speeds. It was found that as speed of vehicles passing over the TRS increase, the roadside sound and in-vehicle sound also increase. On the other hand, changes in in-vehicle vibration decrease as vehicle speed increase. Considering the thickness of TRS, thicker TRS caused bigger change in in-vehicle sound and in-vehicle vibration. The DOR's configuration TRS seems to provide adequate in-vehicle sound difference and in-vehicle vibration difference for driver to be clearly notified. In comparison with Department of Rural Roads's (DOR) configuration TRS, the TRS with 25 cm-gap (W10G25T0.5) seems to be more efficient in terms of speed reduction and making bigger change in in-vehicle vibration. (...).

**Keywords:**

Rumble strips, Tactile and audible effects.

TUE 13<sup>th</sup> (14:00 - 15:15, Session C6.2) Room 1.02

ID 1789 R

**AN OPTIMAL NUMBER DESIGN MODEL OF SERVICE WINDOWS FOR THE RSA FACILITIES ON EXPRESSWAYS**

Main Author:

**Kazuya AOKI** (*R&D Center, PASCO Corporation*)

Co-author(s):

**Kouji YAMAMOTO** (*Shimizu Construction Office, Tokyo Regional Office, Central Nippon Expressway Co.Ltd.*)

**Kiyoyuki KAITO** (*Frontier Research Center, Osaka University*)

**Kiyoshi KOBAYASHI** (*Graduate School of Management, Kyoto University*)

**Abstract:**

This paper focuses upon the optimal number of service windows for Rest and Service Area (RSA) facilities on expressways. The arrival phenomena of the customers to the service facilities are formulated as mixed Poisson processes, and a novel methodology was proposed to decide the optimal number of service windows to satisfy the service level under a given condition by forecasting the queuing process. The arrival events of the customers, which are subject to the mixed Poisson processes, are represented as the probabilities of excesses over the threshold using log database of service time for each window. However, when a queue occurs in service facilities, the arrival rates cannot be directly measured from the log data. We developed a methodology to estimate the maximum likelihood rates of deviation from the average arrival probability applying Monte-Carlo simulation based upon the occupancy data of the facilities in busy periods. Furthermore, the simulation model is formulated to investigate the optimal number of windows, which is designed to keep the efficient service levels. Finally, the practical availability was investigated based on the case of the service windows for RSA facilities on the Tomei-Expressway in Japan.

**Keywords:**

Mixed Poisson processes, Queue, Optimal number design model, RSA facilities, Monte-Carlo simulation.

TUE 13<sup>th</sup> (14:00 - 15:15, Session C6.2) Room 1.02

ID 3016 R

**OPTIMAL CONDITION SAMPLING OF INFRASTRUCTURE NETWORKS**

Main Author:

**Rabi G. MISHALANI** (*The Ohio State University*)

Co-author(s):

**Prem GOEL** (*The Ohio State University*)

**Dunke ZHOU** (*The Ohio State University*)

**Cheng CHEN** (*The Ohio State University*)

**Abstract:**

In response to the developments in inspection technologies, infrastructure decision-making methods evolved whereby the optimum combination of inspection decisions on the one hand and maintenance and rehabilitation decisions on the other are determined based on an economic evaluation that captures the long-term costs and benefits. Recently, sample size has been included in inspection, maintenance, and rehabilitation (IM&R) decision-making as a decision variable when considering a single facility. While, the question of dealing with a network of facilities in making IM&R decisions has been addressed in the literature, this treatment does not consider condition sampling whereby each facility could require a different set of sample sizes over time. This paper presents a methodology developed to address the network level problem whereby the uncertainty due to condition sampling is captured and its related decision variables included in the IM&R decision-making process.

**Keywords:**

Infrastructure, Inspection, Condition sampling, Uncertainty, Maintenance and rehabilitation, Networks.

TUE 13<sup>th</sup> (15:30 - 16:45, Session C6.3) Room 1.02

ID 1296 R

**PAVEMENT NETWORK MAINTENANCE OPTIMIZATION  
CONSIDERING MULTIDIMENSIONAL CONDITION DATA**

Main Author:

**Kenneth KUHN** (*University of Canterbury*)

**Abstract:**

A growing body of research seeks to optimize the selection and scheduling of maintenance, repair and rehabilitation activities for networks of sections of pavement. Such research typically relies on a composite condition index, a one-dimensional and often discrete measure of the overall structural health and/or serviceability of pavement. Pavement can suffer from a large number of related but distinct distresses. Difficulties associated with unobserved heterogeneity have hampered efforts to accurately model deterioration via composite condition indices. At the same time, optimization techniques used in pavement management have been shown both to be sensitive to deterioration model specification and to become computationally intractable as condition data increase. This research describes how approximate dynamic programming can be used to manage a large network of related sections of pavement each one of which may be plagued by a number of different distresses. Approximate dynamic programming mitigates the curse of dimensionality that has haunted distinct Markov decision problem formulations of the infrastructure management problem and limited their complexity. A computational study illustrates how the proposed approach leads to more sophisticated maintenance decision rules, which can be used to ensure the suggestions of pavement management systems more closely match engineering best practices.

**Keywords:**

Pavement management, Infrastructure management, Deterioration modelling.

TUE 13<sup>th</sup> (15:30 - 16:45, Session C6.3) Room 1.02

ID 2536 R

**ESTIMATION OF CONDITION-DEPENDENT  
MAINTENANCE EFFECTIVENESS FOR  
TRANSPORTATION INFRASTRUCTURE  
MANAGEMENT USING EXTENDED KALMAN FILTER**

Main Author:

**Chih-Yuan CHU** (*National Central University, Taiwan*)

**Abstract:**

This paper proposes a procedure for estimating nonlinear dynamic performance models using panel data. Dynamic models that combine performance prediction and maintenance effectiveness are required for state-of-the-art life-cycle cost optimization techniques such as adaptive control. In addition, major maintenance generally takes place only when in-service facilities are near the point of failure. Records of maintenance effectiveness collected from such facilities depend on the pavement condition. To account for this dependence and estimate unbiased maintenance effectiveness, interactions between variables are included using nonlinear models. The relationship between maintenance effectiveness and the current facility condition was found to be polynomial in numerical examples. It was also demonstrated that imposing physical constraints on the maintenance effectiveness based on the actual observations improved the data fit significantly and generated more reasonable models.

**Keywords:**

Infrastructure performance modeling, Dynamic models, Maintenance and rehabilitation, Nonlinear state-space models, Extended Kalman filter.

ID 2551 R

**A METHODOLOGY FOR ADDRESSING USER COSTS WHILE PLANNING PAVEMENT REHABILITATION INTERVENTIONS IN HIGHLY TRAFFICKED ROADS**

Main Author:

**João MORGADO** (*CESUR, IST*)

Co-author(s):

**José NEVES** (*IST, Technical University of Lisbon*)

**Abstract:**

Making decisions regarding pavement maintenance planning involves several issues. This paper describes a methodology developed to support decisions where there are multiple objectives to be satisfied within this context. Those objectives are, usually, agency cost minimisation and pavement quality maximisation. However, the concerns for road user effects, could take to the inclusion of other objectives such as the minimisation of user costs. This type of costs is particularly relevant when analyzing upper hierarchy road segments where the traffic levels are higher and the chances of traffic disruptions occur at work zones are also higher. The methodology presented in this paper was developed specifically to allow a reliable way to include road user effects in the decision-making process, including them as attributes of the alternatives, as in a multi-criteria analysis basis. Using as case study the intervention in an urban motorway, several alternatives were compared considering attributes such as works' duration and travel time increase in addition to, of course, agency cost. The appraisal of the available alternatives using the proposed methodology allowed a more systematic comparison and decision between them, confirming this procedure as a valid way of addressing different and divergent objectives.

**Keywords:**

Pavement, Maintenance and rehabilitation, User costs, Work zone.

ID 3355 R

**DEVELOPMENT OF A MACHINE VISION SYSTEM FOR INSPECTION OF RAILROAD TRACK COMPONENTS**

Main Author:

**J. EDWARDS** (*University of Illinois at Urbana-Champaign*)

Co-author(s):

**Esther RESENDIZ** (*Computer Vision and Robotics Laboratory*)

**Luis FERNANDO MOLINA** (*University of Illinois at Urbana*)

**John M. HART** (*Computer Vision and Robotics Laboratory, Beckman Institute for Advanced Science and Technology*)

**Steven V. SAWADISAVI** (*National Railroad Passenger Corporation (Amtrak)*)

**Narendra AHUJA** (*Computer Vision and Robotics Laboratory, Beckman Institute for Advanced Science and Technology*)

**Christopher BARKAN** (*University of Illinois at Urbana*)

**Abstract:**

North American Railways and the United States Department of Transportation (US DOT) Federal Railroad Administration (FRA) require periodic inspection of railway infrastructure to ensure the safety of railway operation. This inspection is a critical, but labor-intensive task resulting in large annual operating expenditures and it has limitations in speed, quality, objectivity, and scope. A machine vision approach is being developed to automate inspection of specific components in the track structure. The machine vision system consists of a video acquisition system for recording digital images of track and custom designed algorithms to identify defects and symptomatic conditions from these images, providing a robust solution to facilitate more efficient and effective track inspection. The main focus of the system is the detection of irregularities and defects in wood-tie fasteners, rail anchors, and turnout components. An experimental on-track image acquisition system has been developed and used to acquire video in the field of different track classes. The machinevision algorithms use a global-to-local component recognition approach, in which edge and texture-based detection techniques are used to narrow the search area where components are likely to be detected. (...).

**Keywords:**

Railway, Computer Vision, Track inspection, Sleeper Fastening System, Switch Component, Turnout.

ID 1035 R

**AIR PASSENGER AND AIR CARGO DEMAND FORECASTING: APPLYING ARTIFICIAL NEURAL NETWORKS TO EVALUATING INPUT VARIABLES**

Main Author:

**Shih-Yao KUO** (*Dept. of Aviation Service Management, Aletheia University.*)

Co-author(s):

**Shu-Chuan CHEN** (*Dept. of Aviation Service Management, Aletheia University*)**Abstract:**

The aviation industry relies strongly on air traffic demand forecasting to develop operating strategies, including those related to destinations and routes, fleet planning and routing, and human resources. Time series analysis, gravity models, grey theory and artificial neural networks are common tools for air traffic demand forecasting. This study employed artificial neural networks to forecast the air passenger and air cargo demand from Japan to Taiwan. All input variables were collected based on a literature survey, market analysis and preliminary evaluation. The factors which influence air passenger and air cargo demand were identified, evaluated and analyzed in detail by applying artificial neural networks. The results reveal that some factors influence both passenger and cargo demand, and the others only one of them. The employed population in Japan and per capita income (PCI) in Taiwan influence both air passenger and air cargo volume. Flight movement from Tokyo (NRT) to Taipei (TPE), PCI in Taiwan, and foreign exchange rate are the three most important factors for air passenger volume, while the economic growth rate in Taiwan is the most important factor for air cargo volume. By using a neural network, a novel forecasting model that considers actual air passenger and air cargo demand was established, and the results show that it is an accurate tool to forecast air traffic demand. In addition, the valuable data that can be obtained from the model may be a good reference for air carriers and government authorities.

**Keywords:**

Artificial neural networks, Air passenger, Air cargo, Forecast.

ID 1305 R

**TRAFFIC FLOW FORECAST, POTENTIAL ACCESSIBILITY AND CATCHMENT AREAS IN THE CONTEXT OF TRANSPORT INVESTMENT POLICY IN POLAND (CASE OF A2 LODZ-WARSAW MOTORWAY)**

Main Author:

**Piotr ROSIK** (*Institute of Geography and Spatial Organization PAS*)**Abstract:**

The construction of the A2 motorway linking the Polish and German capitals is one of the key investment projects in the Eastern Europe. At present Warsaw suffers from the lack of high-speed road connection to the European motorway network. Currently, the existing part of the A2 is between Nowy Tomysl (55 km west of Poznan) and Strykow near Lodz (length of about 250 km). The "missing" section from the Polish-German border in Swiecko to Nowy Tomysl (106 km) is being constructed since the July 2009 under a PPP scheme and is planned to be finished before the end of 2011. The another missing A2 section, and probably the most important one, is 94 km Strykow-Konotopa linking Lodz and Warsaw – two largest Polish cities. This section will be built using public funds. According to GDDKiA (General Directorate for National Roads and Motorways) the road will be finished before June 2012 when Poland, together with Ukraine, is to host the European Football Championship. Most of the A2 Lodz-Warsaw traffic forecasts are based on the current network state and traffic flows on national roads which are parallel to A2 section – DK2 (Lowicz-Warsaw section) and DK8 (Wroclaw-Warsaw). Although extrapolation is the most usual method of forecasting, one should take into account also the induced traffic level and the shortest path algorithm between the origin and destination. For that reason, the traffic forecast has been conducted using three scenarios which have different underlying assumptions. These assumptions are in accordance with the shortest path algorithm and the data from the Warsaw Traffic Study (WBR 2005). The forecast has been made for the years 2012 and 2020. The A2 Lodz-Warsaw construction is assumed to be completed in 2012. (...).

**Keywords:**

Road traffic, Traffic flow, Catchment area, Accessibility, Transport policy, Poland.



TUE 13<sup>th</sup> (09:45 - 11:00, Session D1.1) Room 5C

ID 1945 R

**TRAFFIC FORECAST: CAPACITY CONSTRAINTS AND UNCERTAINTY**

Main Author:

**Anna MATAS** (*Universitat Autònoma de Barcelona*)

**Abstract:**

Traffic forecasts provide essential input for the appraisal of transport investment projects. However, according to recent empirical evidence, long-term predictions are subject to high levels of uncertainty. This paper quantifies uncertainty in traffic forecasts for the tolled motorway network in Spain. Uncertainty is quantified in the form of a confidence interval for the traffic forecast that includes both model uncertainty and input uncertainty. We apply a stochastic simulation process based on bootstrapping techniques. Furthermore, the paper proposes a new methodology to account for capacity constraints in long-term traffic forecasts. Specifically, we suggest a dynamic model in which the speed of adjustment is related to the ratio between the actual traffic flow and the maximum capacity of the motorway. This methodology is applied to a specific public policy that consists of suppressing the toll on a certain motorway section before the concession expires.

**Keywords:**

Traffic forecast, Uncertainty, Toll motorways.

TUE 13<sup>th</sup> (09:45 - 11:00, Session D1.1) Room 5C

ID 2255 R

**SYSTEM DYNAMICS - LONG TERM FORECASTING OF ROAD TRAFFIC VOLUMES**

Main Author:

**Nuno MARTINS** (*TIS.pt*)

Co-author(s):

**José MANUEL VIEGAS** (*Centro de Sistemas Urbanos e Regionais (CESUR), Instituto Superior Técnico (IST)*)

**Abstract:**

Traditional traffic volume forecasting models (multivariate linear regression models, calibrated over historical series of traditional variables, such as GDP, car ownership and fuel prices), although generally accepted and suitable for short and medium term projections, are unable to successfully incorporate in their mechanisms and results the direct and indirect interactions (feedback loops) between variables. It was precisely the major role of these interactions in a long term forecasting model, as well as the recent raising of "new" variables, generated by the current conditions and circumstances over energetic and environmental issues, that led us to develop a new traffic volume forecasting model, based on a system dynamics framework. Consequently, we designed and calibrated "new" interactions and implications between traditional and new variables, such as emission of green house gases, evolutions of vehicle technology (alternative propulsion vehicles vs. internal combustion engine vehicles), their impact on the vehicle fleets and the introduction of bio-fuels in the market. This sort of models allows us to comprehend in which ways, in a long term horizon, is it expectable for the road traffic volumes to affect and to be affected by these new variables and how these feedback loops will work together, creating a cross-limitation effect that will drive the model to an internally balanced evolution, made possible by the use of system dynamics.

**Keywords:**

System dynamics, Forecasting model, Long term fore.

ID 2354 R

**A FORECASTING MODEL FOR LONG DISTANCE TRAVEL IN GREAT BRITAIN**

Main Author:

**Joyce DARGAY** (*Institute for Transport Studies*)

Co-author(s):

**Stephen CLARK** (*ITS, University of Leeds*)**Daniel JOHNSON** (*University of Leeds*)**Jeremy TONER** (*ITS, University of Leeds*)**Mark WARDMAN** (*Institute for Transport Studies*)**Abstract:**

This paper summarizes the work carried out on the development of a model to forecast longer distance travel by car, rail, coach and air in Great Britain by British residents. The aim of the model is to examine the effects on long distance travel of possible future developments in transport supply as well as changes in economic, demographic and social factors and a range of policy measures. The forecasts are made to 2030. Long distance travel is defined as trips of 50 miles or more one-way. In addition to the four modes, long distance travel is broken down into five journey purposes: business, commuting, leisure day trips, visiting friends and relatives (VFR) and holiday, and two distance bands: 50 to less than 150 miles, and 150 miles and greater. The base values for the model are taken from the National travel Survey (NTS) of Great Britain for the years 2004 to 2006. The forecasting model is a dynamic, elasticity driven system of demand equations. Demand, in terms of person miles per capita, is related to travel costs, travel time and the socioeconomic and demographic characteristics of the population by a set of elasticities. Substitution between modes is captured through cross-elasticities for travel costs and time. The elasticities used in the model are derived from new empirical evidence based on both aggregate and disaggregate data. A Base Case is defined to produce a 'most-likely' projection of long distance travel, annually, to 2030. The model is used to examine the impacts of a number of specific policy/supply-side scenarios. The scenarios considered include road user charging and various assumptions regarding air and rail fares, motoring costs and car fuel efficiency. (...).

**Keywords:**

Long distance travel, Travel demand elasticities, Travel demand forecasting.

ID 3001 R

**HIGH SPEED RAILWAYS DEMAND FORECASTING: ITALIAN CASE STUDY**

Main Author:

**Pierluigi COPPOLA** (*Dept. of Civil engineering - "Tor Vergata" University of Rome*)

Co-author(s):

**Moshe BEN-AKIVA** (*Massachusetts Institute of Technology*)**Ennio CASCETTA** (*Federico II University of Naples*)**Andrea PAPOLA** (*Università di Napoli Federico II - Dipartimento di ingegneria dei trasporti*)**Vito VELARDI** (*NET Engineering Spa*)**Abstract:**

Recent High Speed Rail (HSR) investments in Italy, together with the entrance in the HSR market of a new private operator, competing with the national railways operator, create the conditions in the Italian national transportation market, for a unique case study to investigate the behavior of long-distance passengers. In this paper we present the framework that we developed to forecast the national passenger demand for different Italian macroeconomic, transport supply, and HSR marketing scenarios.

**Keywords:**

Mode/service choice model, Induced Demand, Competi.

ID 1420 R

**ESTIMATION OF A MODE CHOICE MODEL FOR LONG DISTANCE TRAVEL IN THE PORTUGUESE NATIONAL TRANSPORT MODEL**

Main Author:

**Michiel DE BOK** (*Faculdade de Engenharia da Universidade do Porto*)

Co-author(s):

**Álvaro COSTA** (*Faculdade Engenharia do Universidade do Porto (FEUP)*)**Sandra MELO** (*Faculdade de Engenharia da Universidade do Porto*)**Vera PALMA** (*Faculdade Engenharia do Universidade do Porto (FEUP)*)**Abstract:**

This paper describes the calibration of the mode choice model in the Portuguese National Transport Model (PoNTraM). PoNTraM represents the supply and demand of medium and long distance travel within Portugal. The mode choice model for conventional modes is estimated on a large scale long distance travel survey. The model was extended with High Speed rail parameters calibrated to exogenous elasticity targets. HSR is a significant planning alternative in Portugal and a typical project that fits into the scope of a national model long distance travel. The results provide detailed elasticities and cross elasticities for long distance travel in Portugal for car, train and bus travel. This contributes to the empirical literature in long distance travel survey. The demand elasticities from the calibrated model is validated with elasticities from empirical studies in the literature. We show that the elasticities and cross elasticities for the conventional modes (car, rail and bus) are comparable to the elasticities found in literature.

**Keywords:**

Demand models, Long distance travel, High speed rail, Elasticities, Portugal.

ID 1591 R

**A JOINT MODEL OF DESTINATION AND MODE CHOICE FOR URBAN TRIPS: A DISAGGREGATE APPROACH**

Main Author:

**Seyedehsan SEYEDABRISHAMI**

Co-author(s):

**Yousef SHAFABI** (*Civil Eng. Dept. Sharif University of Technology*)**Abstract:**

Trip destination and mode choice are highly influenced by travelers' perceptions and behaviors; selecting a destination and a vehicle for a trip are two interdependent problems. This article presents and applies a disaggregate joint model for traveler destination and mode choice. The choice model uses fuzzy set and probability theory to deal with the uncertainty embedded in travelers' perceptions and behaviors. The model is structured as a decision tree in which fuzzy and non-fuzzy classification of influential variables regarding destination selection and mode choice expand the tree. Probability theory is utilized to extract choice probabilities from the decision tree. The most influential explanatory variables among all of the variables categorized for travelers' household, trip, and living zone specifications are selected based on minimizing the fuzzy entropy value. An aggregation method is designed to provide aggregate estimates for transportation planning based on a disaggregate choice model. A data set containing travelers' information from more than 9000 households in Shiraz, a large city in Iran, is used for model construction and evaluation. When compared with actual travel demand, the model's aggregate estimates of trip generation, distribution, and modal split indicate acceptable accuracy in terms of learning and the model is accurate enough to provide meaningful information and to enable generalization of the model's findings.

**Keywords:**

Destination, Disaggregate, Fuzzy decision tree, Joint model, Mode choice.

ID 1607 R

**A STUDY ON THE MARKET SEGMENTATION OF INTER-REGIONAL TRIPS WITH THE CONSIDERATION OF PASSENGERS' LATENT PREFERENCE FOR TRANSPORTATION MODES**

Main Author:

**Munenori SHIBATA** (*Railway Technical Research Institute*)

Co-author(s):

**Daiki OKUDA** (*Railway Technical Research Institute*)

**Abstract:**

The study focuses on mode choice behavior on inter-regional trips, because interregional express train network is highly expected to play an important role for developing low carbon society by getting demand back from other modes which consume fossil fuels. Firstly, the paper indicates most travellers are mode captive, recognize only one transportation mode as an alternative on their mode choice behavior and latent preference factors have highly impact on the generation of mode captive. Thus, the paper tries to develop PLCS (Parameterized Logit Captivity and Selectivity) model to describe mode choice behavior more accurately, which can segment the inter-regional transportation market appropriately.

**Keywords:**

Inter-Regional Transportation, Mode Captive, PLCS Model, Market Segmentation.

ID 1823 R

**THE DEVELOPMENT OF AIRPORT CHOICE MODELS USING STATED PREFERENCE DATA: AN EAST MIDLANDS CASE STUDY**

Main Author:

**Lisa DAVISON** (*Loughborough University*)

Co-author(s):

**Tim RYLEY** (*Loughborough University*)

**Abstract:**

Stated choice models have been developed across a variety of aviation applications including flight choice, airline choice, airport choice, and whether to fly or not. In the context of airport choice, the focus of this paper, models can determine the value individuals put on attributes such as parking and retailing, distance and travel time from home, available flight destinations, flight cost and their expectation of queues at the airport, and the trade-off values at which individuals would choose an alternative, competing airport. This is of paramount importance to airports and airlines; examples include route and facility development and customer service offers. Airports need to know the effect on their infrastructure, parking and retail revenues of each carrier or destination offering. They also need to know what reduces passenger desire to fly from their airport (perhaps to another competing airport), and the factors that reduce revenue per passenger. This paper examines data from an air travel household survey conducted in the East Midlands region of the United Kingdom during Autumn 2007 and Spring 2008 (after a pilot survey in August 2007). Air travel survey questionnaires were posted out to residents of the following East Midlands Local Authority areas: Northampton, North East Derbyshire, Hinckley & Bosworth, Newark & Sherwood and Nottingham. The resultant sample consists of 605 households. The East Midlands air travel survey questionnaire contains a vast array of variables relating to air travel attitudes and behaviour, together with background socioeconomic and transport information. It also includes two stated preference experiments, the first relating to the air flight choice of respondents for a low cost journey to the respondents' preferred destination (one of the eight presented). (...).

**Keywords:**

Airport, Choice, Modelling.

TUE 13<sup>th</sup> (11:15 - 12:30, Session D1.2) Room 5C

ID 2291 R

**CONSIDERING LATENT ATTITUDES IN MODE CHOICE:  
THE CASE OF SWITZERLAND**

Main Author:

**Ricardo HURTUBIA** (*Ecole Polytechnique Fédérale de Lausanne*)

Co-author(s):

**Bilge ATASOY** (*Ecole Polytechnique Fédérale de Lausanne*)

**Aurelie GLERUM** (*Ecole Polytechnique Fédérale de Lausanne*)

**Anne CURCHOD** (*Ecole Polytechnique Fédérale de Lausanne*)

**Michel BIERLAIRE** (*Transport and Mobility Laboratory, EPFL*)

**Abstract:**

The paper presents the preliminary results of a recent study on mode choice for Switzerland, where psychometric indicators about attitudes and perceptions were collected. The attitude against public transportation is modeled and included as an explanatory variable in the choice model.

**Keywords:**

Discrete choice, Latent variable, Mode choice.

TUE 13<sup>th</sup> (14:00 - 15:15, Session D1.3) Room 5C

ID 1044 R

**MODELING THE COMBINED CHOICE OF ENTRANCE  
AND PARKING IN ENCLOSED BUSINESS AREAS**

Main Author:

**Peter VAN DER WAERDEN** (*Eindhoven University of Technology*)

**Abstract:**

This paper described a study concerning car drivers' entrance and parking choice in the context of business areas. For employees of the Eindhoven University of Technology a combined entrance and parking choice model is presented. It appears that the most optimal structure of the nested logit model consists of entrance choice at the highest level and parking choice at the lowest level. With a McFaddens' pseudo R-squared value of 0.336 the model performs quite well. The choice of entrance is significantly influenced by the distance between entrance and workplace, location of the entrance vis-à-vis the workplace, and the direction when leaving the campus area. The choice of parking is significantly influenced by the number of parking spaces, the available type of vegetation surrounding the parking, the distance between entrance and parking, and the distance between parking and workplace. All effects are as expected.

**Keywords:**

Parking, Entrance, Business areas, Nested logit.

ID 1422 R

**MOBILITY RIGHTS FOR URBAN ROAD PRICING: A MODELLING ANALYSIS WITH A SYSTEM DYNAMICS APPROACH**

Main Author:

**Davide FIORELLO** (*Trasporti e Territorio (TRT)*)

Co-author(s):

**Francesca FERMI** (*TRT Trasporti e Territorio (TRT)*)**Angelo MARTINO** (*TRT trasporti e territorio (TRT)*)**Silvia MAFFII** (*TRT trasporti e territorio (TRT)*)**Abstract:**

One criticism concerning road pricing concerns undesired equity impacts on low income groups, especially when transport alternatives (e.g. public transportation) are missing or poor. A promising approach to tackle this criticism is setting quantified physical constraints in the form of "mobility rights" evenly allocated to travellers and granting the permission to transfer these "rights" to other agents. This way, low mobility groups, often correspondent to low income groups, can enjoy a monetary benefit from higher mobility groups. In the year 2005, a strategic system dynamics model was developed to provide quantitative estimations of the impact of alternative road pricing and mobility rights schemes in the case of the city of Genoa (Italy). The model is now being extended and refined within the European research project DEMOCRITOS. This paper, after providing the key theoretical elements under the mobility rights concept, provides details on the features of the model, with special reference to the simulation of travelling choices concerning overall individual mobility in a given time span instead of a decisions related to single trips. The modelling of long-term impacts, in particular land-use, is also addressed.

**Keywords:**

Road Pricing, Mobility Rights, System Dynamics, Strategic Modelling.

ID 1630 R

**ESTIMATING RECREATIONAL CYCLISTS' PREFERENCE ON BICYCLE ROUTE FACILITY - EVIDENCE FROM TAIWAN**

Main Author:

**Pei-Chun CHEN** (*National Cheng Kung University*)

Co-author(s):

**Ching-Fu CHEN** (*Dept. of Transportation & Communication Management Science, National Cheng Kung University*)

**Abstract:**

This paper aim to examine recreational cyclists' preference on bicycle route facility attributes using stated preference analysis in Taiwan. The logit models is employed to estimate the relative influences of facility attributes on bicycle route choice behaviour. The multinomial logit model with interactions and latent class logit are estimated to account for heterogeneity in the preference of facility attributes for bicycle route. In addition, recreational specialization is taken into account when predicting bicycle route choice for particular group. The latent class model is estimated with recreational specialization in segment membership that allow for testing latent heterogeneity in bicycle route and facility attributes. The results indicate that bicycle facility attributes such as toilet and simple maintain equipment, tourist information center, attraction, and bike path in bicycle route facility exhibit significant effects on recreational cyclists preferences. Results of latent class model reveal that high level of recreational specialization cyclists are more likely than low recreational specialization cyclists to choice challenge and endurance grading route.

**Keywords:**

Recreational cyclist, Heterogeneity, Latent class logit, Stated preference.

TUE 13<sup>th</sup> (14:00 - 15:15, Session D1.3) Room 5C

ID 2680 R\*

**ALTERNATIVE PARK & RIDE MODELLING  
APPROACHES TO METROPOLITAN AREAS**

Main Author:

**Isabel PIMENTA** (*VTM - Consultores em Engenharia e Planeamento*)

**Abstract:**

Park & Ride (P&R) choice is a key issue in planning for urban transport systems. Recent experience has been highlighting the increasing importance of this demand segment both on the road and on the public transport system. Therefore, the inclusion of P&R choice in multimodal modelling is mandatory as a mean to ensure adequate support to integrated metropolitan transport planning. Park & Ride offers a number of choices to individuals and the full set of choices is extremely difficult to arrange in a practical and large scale model like a metropolitan area. This full model is more likely to be adopted when refining the design of P&R sites and associated PT services. Practical large-scale applications rely on simplifications of the decision process that result from the most likely type of usage of these facilities. In fact, the realism of the simplification plays a key role in defining the best approach to model P&R choice and one can imagine two types of solutions under these conditions: In one case, P&R can be visualised as an extension of the car network; In another, as one of the PT network. The author presents the advantages and pitfalls of modelling P&R choice in metropolitan areas using both approaches, based on recent experience.

**Keywords:**

Park & Ride, Choice Model, Public Transport, Model.

TUE 13<sup>th</sup> (14:00 - 15:15, Session D1.3) Room 5C

ID 3168 R

**TRAVEL DEMAND MODELING IN TWO NATIONS AT  
'PEAK' INFRASTRUCTURE CONSTRUCTION**

Main Author:

**Gregory NEWMARK** (*UC Berkeley*)

**Abstract:**

While tremendous research has explored travel demand models, there is a paucity of research on their role in the actual practice of transportation planning. This paper seeks to address this lacuna by focusing on a qualitative analysis of travel demand modeling in three small countries: Portugal, Israel, and the Netherlands. This research explores both the state of modeling and more importantly the uses to which those efforts are applied. The data collection is grounded in interviews with the modeling stakeholders in each nation. This paper provides case specific insights to the modeling practice of the studied countries, but finds much wider appeal in chronicling distinct implementations of this core transportation planning technology.

**Keywords:**

Travel Demand Modeling, Portugal, Israel.

TUE 13<sup>th</sup> (15:30 - 16:45, Session D1.4) Room 5C

ID 1504 R

**MOTORCYCLE OWNERSHIP: A TIME-SERIES INVESTIGATION**

Main Author:

**Paraskevi MIHALAKI** (*School of Civil Engineering, National Technical University of Athens, Greece*)

Co-author(s):

**Matthew KARLAFTIS** (*National Technical University of Athens*)

**Abstract:**

In this paper we discuss modeling issues in the context of motorcycle ownership using a 12-year monthly time series dataset from Athens, Greece. The models developed provide information on variable elasticities that affect ownership, a topic that has not been investigated in the literature. Results suggest that motorcycle ownership largely depends on socioeconomic factors and fuel price variations; for example, increases in personal per capita income and fuel prices increase motorcycle ownership, while unemployment increase may be connected to increased motorcycle ownership as well.

**Keywords:**

Motorcycle Ownership, Transport Economics.

TUE 13<sup>th</sup> (15:30 - 16:45, Session D1.4) Room 5C

ID 2463 R

**CAUSAL RELATIONSHIP BETWEEN MOTOR VEHICLE OWNERSHIP AND GDP**

Main Author:

**Tien-Pen HSU**

**Abstract:**

This paper investigated the causal relationship between motor vehicle ownership and GDP. Due to the high motorcycle ownership in some countries, in this paper, both car ownership and motorcycle ownership were investigated separately. The causality was examined using the data of both Taiwan and Japan. The Granger-causality technique was adopted. When applying the Granger technique, the error-correction model, the ADF test and the co-integrating relationships test were carried out. It was found that there is a unidirectional causality from motorcycle ownership to the GDP, for Taiwan as well as for Japan. This causality indicates that motorcycle ownership enhances the growth of the GDP. However, this finding is reversed for car ownership. This study found that there is a unidirectional causality from GDP to car ownership for Taiwan, meaning that the higher the GDP the higher the car ownership in Taiwan. There is no causality relationship between car ownership and GDP for Japan, probably due to some policy constraints on owning a car in Japan. Our analysis will be useful for checking the policy on motor vehicles and to understand their relationship to a country's economic development.

**Keywords:**

Causal relationship, GDP, Motorcycle ownership, Car ownership, Granger's technique.



TUE 13<sup>th</sup> (15:30 - 16:45, Session D1.4) Room 5C

ID 2708 R

**ANALYSIS OF CURRENTLY USED MODELS IN SWEDEN FOR LONG-DISTANCE PUBLIC TRANSPORT AND POSSIBLE WAYS TO IMPROVE**

Main Author:

**Kjell JANSSON** (*Royal Institute of Technology Stockholm (KTH)*)

Co-author(s):

**Harald LANG** (*Royal Institute of Technology Stockholm (KTH)*)

**Reza MORTAZAVI** (*Dalama University*)

**Odd LARSEN** (*Molde University College*)

**Abstract:**

For assessment of infrastructure measures and for finding appropriate ways to reduce environmental and climate damages etc., forecast models are indispensable tools. The aim of such models is, for assumed transport supply and policy measures, to forecast demand for various modes and calculate consumer surplus and other data that are inputs to a costbenefit analysis. An important task for a model is in this context to take into account all lines and modes as correctly as possible. In Sweden the passenger transport model that is predominantly used for assessment of transport policy measures is comprised of a combination of one network model for travellers' line choice within each "main" mode and a structured logit model for the choice between these modes. An alternative model that is also applied in Sweden is a network model that handles all lines and modes simultaneously. In this paper we present the present status of a project finished in June 2010 aiming to assess the pros and cons of these two modelling approaches, including some tentative judgments and ideas on how to improve passenger transport models. The result is recommendations on how to go forward in order to proceed in modelling of long distance travel. Note that we exemplify with the concrete Swedish models in actual use, in order to illustrate the general ideas. Since we exemplify with the concrete Swedish case we use the commercial software names where these are part of the models. The principles behind the models and softwares illustrated by these examples should be of wide general interest. (...).

**Keywords:**

Long distance public transport, Forecast models, Infrastructure, Cost-benefit analysis, Transport policy, Network model, Logit model.

TUE 13<sup>th</sup> (15:30 - 16:45, Session D1.4) Room 5C

ID 2964 R

**ADDITION TO CAR USE AND DYNAMIC ELASTICITY MEASURES IN FRANCE**

Main Author:

**Roger COLLET** (*INRETS (French National Institute for Transport and Safety Research)*)

Co-author(s):

**Mathieu DE LAPPARENT** (*INRETS*)

**Laurent HIVERT** (*INRETS (French National Institute for Transport and Safety Research)*)

**Abstract:**

This article presents a microeconomic analysis of the annual mileage travelled by French households with their personal cars, defining their automobility. To feature car use dependence, the rational addiction model of Becker et al. (1994) is applied on a panel dataset, drawn from the French "Car Fleet" survey over the period 1999-2001. Importantly, the estimates show that the assumption of addiction to car use cannot be rejected. Furthermore, the model yields realistic kilometric-price and income elasticities of household automobility, for both the short and the long runs.

**Keywords:**

Transportation, Car use, Consumption, Addiction, Panel, GMm.

TUE 13<sup>th</sup> (15:30 - 16:45, Session D1.4) Room 5C

ID 3012 R

**METROPOLIS HASTINGS-WITHIN-GIBBS SAMPLING  
ESTIMATION OF HYBRID CHOICE MODELS: AN  
APPLICATION TO VEHICLE CHOICE**

Main Author:

**Ricardo ALVAREZ-DAZIANO** (*Université Laval*)

Co-author(s):

**Denis BOLDUC** (*Laval University*)

**Abstract:**

Using stated data on both vehicle purchase decisions and environmental concerns, we analyze the practical feasibility of a Bayesian estimator for hybrid choice models (HCMs), which are discrete choice models with endogenous latent explanatory variables. We show that the Bayesian approach for HCMs is methodologically easier to implement than full information simulated maximum likelihood because the inclusion of latent variables translates into adding independent ordinary regressions; and also because forecasting and deriving willingness to pay measures is straightforward. Our empirical results coincide with a priori expectations, namely that environmentally-conscious consumers are aware of the dangers of climate change and oil dependency; their concerns about the role of transportation in global warming change their consuming behavior, and they are willing to pay more for sustainable solutions (low-emission vehicles) despite potential drawbacks (such as a reduced refueling availability). The model outperforms standard discrete choice models because it not only incorporates pro-environmental preferences but also provides tools to build a profile of eco-friendly consumers.

**Keywords:**

Hybrid choice model, Latent variables, Pro-environmental preferences, Discrete choice, Gibbs sampling.

TUE 13<sup>th</sup> (17:00 - 18:15, Session D1.5) Room 5C

ID 1508 R

**GENERATING THE UNIVERSE OF URBAN TRIPS FROM  
A MOBILITY SURVEY SAMPLE WITH MINIMUM  
RECOURSE TO BEHAVIORAL ASSUMPTIONS**

Main Author:

**José MANUEL VIEGAS** (*Centro de Sistemas Urbanos e Regionais (CESUR), Instituto Superior Técnico (IST)*)

Co-author(s):

**Luis MARTÍNEZ** (*CESUR, Instituto Superior Técnico*)

**Abstract:**

For any kind of statistical analysis of trip matching algorithms, working on the samples of mobility surveys is hopeless as these typically cover not much more than 2% of travellers. The usual inference process works on a discrete representation of the territory (zones) and simply replace each trip in the sample by as many equal trips as the corresponding multiplicative coefficient  $N$  (inverse of the sampling coefficient). This paper presents an innovative application of the mobility surveys data (with geo-referenced information) as an alternative to Activity-based procedures using discrete choice models. We introduce some principles of fuzzy logic inference processes, which allow the production of a synthetic population of trips with a continuous representation of trips in space and in time. The proposed procedure uses a statistical approach to trip dispersion, using a Monte Carlo Simulation process, based on the survey data and the land use characteristics in order to preserve the mobility patterns observed in the survey. The procedure was applied to the Lisbon Metropolitan Area (LMA) and the results show a good match with the original data, but with a greater, more realistic space and time coverage. The results suggest a significant added value of this approach for the modelling of transport modes requiring space and time matching that cannot be correctly modelled with the traditional discrete representation of the territory as well as for estimation of traffic loads in low hierarchy arcs of the network.

**Keywords:**

Mobility survey, Activity-based models.

ID 1550 R

**WEIGHTING METHOD OF HOUSEHOLD TRAVEL SURVEY TO ALLEVIATE DISCREPANCIES IN TRANSPORT PLANNING MODELS**

Main Author:

**Robert CHAPLEAU** (*École Polytechnique de Montréal*)

Co-author(s):

**Daniel PICHE** (*École Polytechnique de Montréal*)**Abstract:**

The Montreal Region has maintained the tradition over the last 40 years of conducting large scale (5% sample of the household universe of the Greater Montreal Area) so-called Origin- Destination travel surveys. Every 5 years, about 65,000 households are subjected to a CATI (Computer Assisted Telephone Interview) method in which every trip made by each member of the household is characterized in terms of origin, destination, purpose, departure time, travel modes, bus routes taken, car ownership, status, etc... The information is interactively validated, and trip ends, junction points (subway or railway stations), bridges, freeways, monuments, trip generators and residences are geo-coded. This type of survey is usually fundamental for a large set of transit and roadway simulation projects. In the past, several weighting factors were independently determined for household, persons and trips, thus creating diverse inconsistencies. The available reference databases consist of total population demographic distribution by 5-year cohorts and enumeration of private households, for about 100 municipal sectors. To acknowledge the fact that personal travel behaviour is conditioned by household structure, age, and residence location, and to investigate possible biases in the observed sample, the weighting method utilizes an iterative proportional fitting algorithm (Furness type growth factor method) to respect the household composition distribution and a simplified 5-behavior-typical-cohort demographic distribution. The weights are also constrained to some specific variation, and the method application results in about 7,000 different weighting factors preserving the coherence and consistence between household and population surveyed travel behaviour. (...).

**Keywords:**

Household travel survey, Origin and Destination, Population behaviour, Weighting method, Iterative proportional fitting, Montreal case.

ID 2123 R

**REPEATED RANDOM VARIATION IN SIMULATIONS OF SPATIAL SEARCH**

Main Author:

**John ABRAHAM** (*HBA Spectro Incorporated*)**Abstract:**

In search algorithms that use random utility theory it is important that random components of utility be stored, so that if elements of behaviour are reconsidered during the search they are evaluated consistently. Directly storing each random component can easily overwhelm computer memory when many individuals, activity patterns, preference-commonality and destinations are considered. This paper describes a system for effectively managing and assigning random components from a pool, to obtain a rich simulation of choice across multiple dimensions of land use and transport behaviour incorporated preference commonality between individuals and alternatives. In spatial choices, zones are aggregations of potential destinations. To avoid biases due to arbitrary zone boundaries, it is important that individual (sub-zonal) destinations be considered, or that extreme value theory be used to assign appropriate random variation components to zonal aggregations. This paper describes options for treating zonal destinations appropriately in a simulation model given random utility theory.

**Keywords:**

Destination choice, Choice simulation, Random vari.

ID 2278 R

**AN ATTRACTIVENESS-BASED MODEL FOR SHOPPING TRIPS IN URBAN AREAS**

Main Author:

**Charles RAUX** (*LET, University of Lyon*)

Co-author(s):

**Jesus GONZALES-FELIU** (*University of Lyon*)**Jean-Louis ROUTHIER** (*LET, University of Lyon*)**Abstract:**

This paper presents a modelling approach to characterise private car shopping trips in a city logistics point of view, in order to connect these movements with those belonging to urban freight distribution in the supply chain. The proposed modelling framework is a two-step procedure articulated as follows. First, an attraction model estimates the number of private car shopping trips arriving to each section of a given urban area. Second, a catchment area model relates the shopping trip destinations with the household locations. The model is calibrated using the data of both a database of the commercial activities and the recent household trip survey made in 2006 in Lyon urban area (France). We present the main results issued of the various simulations as well as several application examples and proposals, most of them made in a public policy perspective.

**Keywords:**

Urban goods movement, Shopping trips, Simulation, Catchment area model, Attractiveness.

ID 2487 R

**THE DETERMINANTS OF LONG DISTANCE TRAVEL: AN ANALYSIS BASED ON THE BRITISH NATIONAL TRAVEL SURVEY**

Main Author:

**Joyce DARGAY** (*Institute for Transport Studies*)

Co-author(s):

**Stephen CLARK** (*ITS, University of Leeds*)**Abstract:**

This study analyses of the determinants of long distance travel in Great Britain using data from the 1995-2006 National Travel Surveys (NTS). The main objective is to determine the effects of socio-economic, demographic and geographic factors on long distance travel. The estimated models express the distance travelled for long distance journeys as a function of income, gender, age, employment status, household characteristics, area of residence, size of municipality, type of residence and length of time living in the area. A time trend is also included to capture common changes in long distance travel over time not included in the explanatory variables. Separate models are estimated for total travel, travel by each of four modes (car, rail, coach and air), travel by five purposes (business, commuting, leisure, holiday and visiting friends and relatives (VFR)) and two journey lengths (<150 miles and 150+ miles one way), as well as the 35 mode-purpose-distance combinations. The results show that long distance travel is strongly related to income: air is most incomeelastic, followed by rail, car and finally coach. This is the case for most journey purposes and distance bands. Notable is the substantial difference in income elasticities for rail for business/commuting as opposed to holiday/leisure/VFR. In addition, the income elasticity for coach travel is very low, and zero for the majority of purpose-distance bands, suggesting coach travel to be an inferior mode in comparison to car, rail and air. Regarding journey distance, we find that longer distance journeys are more income elastic than shorter journeys. For total long distance travel, the study indicates that women travel less than men, the elderly less than younger people, the employed and students more than others, those in 1- adult households more than those in larger households and those in households with children less than those without. (...).

**Keywords:**

Travel demand modelling, Long distance travel, Income elasticities.

ID 1333 R

**COMPUTATIONAL STUDY OF ALTERNATIVE METHODS FOR STATIC TRAFFIC EQUILIBRIUM ASSIGNMENT**

Main Author:

**Zhong ZHOU** (*Citilabs*)

Co-author(s):

**Alberto BRIGNONE** (*Citilabs*)**Michael CLARKE** (*Citilabs*)**Abstract:**

Traffic equilibrium problem, also known as the traffic assignment problem, is the core of many important transportation models. The traditional Frank-Wolfe (FW) algorithm has been criticized for its slow convergence speed to approach high precision level. Recently, various traffic equilibrium algorithms have been developed in literature. Basically, they can be classified into three main categories, i.e. link-based algorithms, path-based algorithms and origin-based algorithms, depending on the solution variables adopted in the problem. These new algorithms are expected to fulfill the requirement of the implementations of more advanced and comprehensive transportation models and analysis, which desire rapid convergence speed and highly precise equilibrium solutions. Nowadays, distributed computing is getting popular in many fields, due to the increasing power of the computer hardware. Multiple machines, machines with multiple processors, or processor with multiple cores become more widely available and more affordable in recent years. Therefore, it is also desired to examine the possibility and efficiency of incorporating the power of distributed computing with the newly developed algorithms in order to further improve the performance of solving traffic equilibrium problems. In this paper, a new computational study of alternative traffic equilibrium algorithms is conducted. Comparing with the results in literature, our implementation with a proprietary data process enables the applicability of the algorithms on real size networks in planning practice. The numerical study shows that the improved link-based algorithms and path-based algorithms we implemented are able to reach highly precise equilibrium solution in modest computational time. (...).

**Keywords:**

Traffic equilibrium problem, Improved link-based algorithm, Path-based algorithm, Origin-based algorithm, Distributed computation.

ID 1439 R

**AN OPTIMISATION MODEL AND ALGORITHMS FOR SOLVING THE MULTIMODAL NETWORK DESIGN PROBLEM IN REGIONAL CONTEXTS**

Main Author:

**Mariano GALLO** (*Dipartimento di Ingegneria - Università del Sannio*)

Co-author(s):

**Bruno MONTELLA** (*Department of Transportation Engineering - 'Federico II' University of Naples*)**Luca D'ACIERNO** (*Department of Transportation Engineering, 'Federico II' University of Naples*)**Abstract:**

In this paper we focus on the multimodal network design problem that consists in designing jointly road and transit systems, assuming elastic demand at least at the mode choice level. We refer to regional contexts where a planner may have financial resources to be invested for improving the mobility of a wide area and have to decide how these resources should be allocated between transit and road systems. We propose an optimisation model for solving the problem, whereby we introduce an objective function that takes into account different objectives of the problem (reduction in user costs, reduction in external costs, etc.) and all constraints to be considered (budget constraints, capacity constraints, assignment constraints, etc.). We then propose a meta-heuristic solution algorithm for solving the problem and test it on a trial and a real-scale network.

**Keywords:**

Multimodal network design, Elastic demand, Transportation, Scatter search.

ID 1609 R

**APPLICATION OF BAYESIAN MODEL FOR ROUTE CHOICE MODELING**

Main Author:

**Chun-Wei CHEN** (*Department of Communications and Transportation Management, National Cheng Kung University*)

Co-author(s):

**Chun-Hsiung LIAO** (*Institute of Telecommunications Management and Department of Communications and Transportation Management, National Cheng Kung University*)**Abstract:**

The study applies the concept of Bayesian game to the route choice problem when network travelers are maximizing the degrees of satisfaction by choosing the routes and modes. The advanced traveler information system (ATIS) nowadays offers travelers the benefits such as improving travel experience, reducing travel time and uncertainty and improving the traffic safety. The reliability of travel time provided by ATIS has the effect on travelers' route choice. But, the market of ATIS device is relatively low and its users may or may not follow the information and instruction provided by the system. Hence, there is the presence of information heterogeneity among travelers which arises from the imperfect information on other travelers' preferences and types. A Bayesian Model is exploited to analyze the impact of heterogeneity on travelers' route choices. We find that the ATIS information should be more complete and perfect if the types of travelers have indeed heterogeneity. Either, it provides difference of information if travelers are similar in real life. Finally, strategic equilibrium of travelers is the optimal solution with the shortest travel time, and equilibrium traffic performance is thus efficient.

**Keywords:**

Route choice, Bayesian model, Information set generation, Traveler heterogeneity,

ID 2207 R

**THE APPLICATION OF OD FLOW ESTIMATION MODEL FROM OBSERVED LINK TRAFFIC FLOW : EMPIRICAL EVIDENCE IN TAINAN CITY**

Main Author:

**Hao-Ching HSIA** (*Department of Urban Planning, National Cheng Kung University*)**Abstract:**

This study aims at establishing an origin-destination (OD) flow estimation model. The model originates from observed link traffic flow for solving problems traditional model faced and providing a practical tool for transportation planners. The advantages of the model developed in this study include: 1) the integration of dummy traffic zones and actual road network is sufficient; 2) all the inner-inner, inner-outer, outer-inner and outer-outer OD traffic volume can be calculated at the same time; 3) the OD traffic volume is described as a function of the trip production only, and 4) the difference between estimated and measured link traffic volumes is minimized. In order to confirm the practicability of this concept, link traffic flow data on the actual road network was collected in Tainan city. A numerical experiment was conducted to examine the reliability and validity of the proposed model from the viewpoint of accuracy of estimated OD traffic volumes.

**Keywords:**

Origin destination flow estimation model, Observed link traffic flow, Trip production.

ID 2621 R\*

**NEW INSIGHTS FOR PANEL DATA ANALYSIS**

Main Author:

**Stephane HESS** (*University of Leeds*)

Co-author(s):

**Andrew DALY** (*Rand Europe & University of Leeds*)**Abstract:**

In recent years it has become much more common for models of travel behaviour to be estimated on 'panel data': data containing several responses from each individual surveyed. The classic context is that of Stated Choice (SC) experiments, in which respondents are repeatedly asked to indicate what their choice would be across a range of different choice tasks. However, other contexts can also yield repeated observations from each respondent, such as for example travel diary data in a Revealed Preference (RP) context. The availability of multiple observations for each respondent can be a considerable advantage, not only leading to a reduction in the required number of respondents (and hence cost), but also providing the analyst with information on behaviour by the same respondent in different settings. The use of panel data has also greatly improved analysts' ability to study variations in sensitivities and hence behaviour across respondents. While the availability of multiple observations per individual can thus have certain advantages, it also poses a number of important issues at the modelling stage. Initial work was mainly concerned with the influence of panel data on a model's error structure, and especially the estimation of robust standard errors for model parameters. Recent work on the other hand has focussed primarily on how the presence of multiple choices per respondent should be taken into account in the representation of taste heterogeneity, with key contributions by Revelt & Train (1997) and Hess & Rose (2009). The trend towards dealing with the repeated choice nature of the data solely through the specification of random taste heterogeneity has as its main implication a growing reliance on Mixed Logit, with reduced interest in accommodating correlation structures or attempting to link tastes to socio-demographic information. (...).

**Keywords:**

Panel data, Discrete choice, Random utility.

ID 2682 R

**SAMPLING OF ALTERNATIVES IN MULTIVARIATE EXTREME VALUE (MEV) MODELS**

Main Author:

**Cristian GUEVARA** (*Universidad de los Andes, Chile*)

Co-author(s):

**Moshe BEN-AKIVA** (*Massachusetts Institute of Technology*)**Abstract:**

When the number of alternatives in a choice-set is huge, sampling is unavoidable. In 1978 Daniel McFadden showed that consistent estimation under sampling of alternatives is possible if the true model is Logit; that is, if the errors of the random utilities are independent and identically distributed (iid) Extreme Value. However, the iid assumption might be easily broken in models with large choice-sets. For example, in residential location, dwelling-units are expected to be correlated depending on proximity. This paper extends McFadden's result to MEV models, a class of closed-form discrete choice models that allows for different degrees of correlation between alternatives. A methodology to achieve consistency, asymptotic normality and relative efficiency is proposed and deployed for all MEV models and then illustrated using a Monte Carlo experimentation and real data for the Nested Logit model, an important member of the MEV class. Experiments show that the proposed methodology is practical, that it is substantially better than an uncorrected model, and that it yields acceptable results, even for small sample sizes. The paper finishes with a synthesis and an analysis the impact, limitations and potential extensions of this research.

**Keywords:**

Sampling of Alternatives, MEV, GEV models.

ID 1139 R

**DEPARTURE TIME CHOICE WITH TIME ALLOCATION MODEL: EMPIRICAL CASE ANALYSIS OF RAIL-USE COMMUTERS IN THE CENTRAL TOKYO**

Main Author:

**Hironori KATO** (*University of Tokyo*)

Co-author(s):

**Hirohisa KAWAGUCHI** (*Oriental Consultants Company Limited*)**Abstract:**

This paper aims to formulate a departure time choice model based on a time allocation model and analyze it with empirical data. Data on urban rail commuters are used for empirical analysis. Although our model follows the theoretical framework presented by Small (1982), our approach is not based on discrete-choice modeling, which is used in Small's paper. The model assumes continuous time choice in which an individual maximizes his/her utility under the constraints of time and monetary budgets. As our model explicitly incorporates the utilities stemming from sleeping hours and in-home or out-of-home leisure, the individual's preference of these activities can be analyzed directly. For example, the results of empirical analysis show that married individuals obtain higher marginal utility from sleeping time. Additionally, our survey included the SP survey about the dynamic fare system. The results of empirical analysis show that the fare level at the arrival time or at the time of starting work influence the individual's marginal utility with respect to the schedule delay of arrival, starting work, and sleeping.

**Keywords:**

Departure time choice, Time allocation model, Urban rail transit.

ID 1208 R

**DEVELOPMENT AND ESTIMATION OF A SEMI-COMPENSATORY MODEL INCORPORATING MULTINOMIAL AND ORDERED-RESPONSE THRESHOLDS**

Main Author:

**Sigal KAPLAN** (*Faculty of Civil and Environmental Engineering, Technion – Israel Institute of Technology*)

Co-author(s):

**Shlomo BEKHOR** (*Transportation Research Institute, Technion - Israel Institute of Technology*)  
**Yoram SHIFTAN** (*Technion-Israel Institute of Technology*)**Abstract:**

Semi-compensatory models represent a two-stage choice process consisting of an elimination-based choice set formation upon satisfying criteria thresholds and a utility-based choice. Current semi-compensatory models assume a purely non-compensatory choice set formation and hence do not support multinomial criteria that involve trade-offs among attributes at the choice set formation stage. This study proposes the development and estimation of a semi-compensatory model that incorporates both multinomial-response and ordered-response criteria. The model development includes the proposition of a novel behavioural paradigm which involves a hybrid compensatory non-compensatory choice set formation process, followed by compensatory choice. The behavioural paradigm is represented by a mathematical model that accommodates a combination of multinomial-response and ordered-response thresholds and a utility-based choice. The proposed semicompensatory model is applied to a stated preference experiment of off-campus rental apartment choices by students. Results demonstrate the applicability and feasibility of incorporating multinomial-response thresholds into the semi-compensatory framework.

**Keywords:**

Simplification by aggregation, Multinomial cut-offs, Two-stage model.



ID 1579 R

**TO TRAVEL OR NOT TO TRAVEL: A STUDY OF ISLANDERS' TRIPS TO THE MAINLAND**

Main Author:

**Sara LEVY** (*Radboud University Nijmegen*)

Co-author(s):

**Costas PANOU** (*University of the Aegean*)**Abstract:**

Utility-based measures of Accessibility are being increasingly adopted in transport literature. These measures are usually derived from discrete choice models of mode and/or destination choices. We argue that, in the case of insular areas, the focus on mode or destination choice is not adequate. We develop a new approach, focused on the decision of individuals of whether to travel, for a set of specific purposes and a given set of available trip alternatives. Insular accessibility is thus measured on the basis of the expected maximum utility that an individual can derive from a set of travel-related alternatives, including the option to cancel or postpone a trip. Data was collected by means of a survey carried out in the Greek island of Chios, located in the North Aegean Sea. Findings suggest that travel choice and mode choice are two different decision processes, although not independent. Unlike mode choice, the travel choice seems to be unaffected by the travel time of the available trip alternatives. Price of the trip, as well as trip purpose, strongly influences both decisions. This approach yields a richer measure of accessibility that adheres more properly to the context of inter-island travelling.

**Keywords:**

Utility, Accessibility, Discrete Choice Model, Travel choice.

ID 2410 R

**INTER-TEMPORAL VARIATION IN THE MARGINAL UTILITY OF TRAVEL TIME AND TRAVEL COST**

Main Author:

**Maria BÖRJESSON** (*Centre for Transport Studies, Royal Institute of Technology*)**Abstract:**

The marginal disutility of time and cost are key parameters in most forecasting models used for applications. Since valuation of infrastructure investments requires prediction of travel demand for future evaluation years, it is important to know how the marginal disutilities of time and cost develop over time. Using two identical stated choice experiments conducted with an interval of 13 years, 1994 and 2007, we estimate the inter-temporal variation in marginal utilities of travel time and cost. We find that the marginal disutility of time has remained constant across the samples. The marginal disutility of cost has, on the other hand, decreased. The decrease of the marginal disutility of travel cost is explained by income increases. We find little evidence to support recommendations on changing the travel time parameter in travel demand forecasting models, but clear evidence to support a recommendation that the income elasticity of the cost parameter should be assigned the relevant income elasticity of the value of travel time.

**Keywords:**

Marginal utility of travel time, Marginal utility.

ID 3031 R

**IMPACT OF WALKING DISTANCE ON  
ATTRACTIVENESS OF TRANSIT USE**

Main Author:

**Mohammad HOSSAIN**

Co-author(s):

**S.c. WIRASINGHE** (*University of Calgary*)

**John DOUGLAS HUNT** (*University of Calgary*)

**Abstract:**

Stated preference data are used to investigate the impact of walking distance on the attractiveness of transit use. These data were obtained in experiments of mode choice comparing transit and other options under ranges of values for walking distances and other relevant attributes. A total of approximately 800 observations were collected in November and December of 2008. These were used to estimate the parameter values for a range of different utility functions in logit models. The results show that the 'per block' sensitivity to walking distance is significantly greater when the total walking distance is less than 2 blocks rather than more than 2 blocks, and that person age and vehicle ownership also have significant impacts. Some of these findings are novel while others are consistent with work done previously, and these findings have some implications for both theory and practice.

**Keywords:**

Transit Attractiveness, Mode Choice, Walking Distance, Walking Time, Transit Service, Stated Preference, Logit Modelling.

ID 1141 R

**FORECASTING MODE CHOICE IN PRESENCE OF  
INERTIA AND SHOCK EFFECT: THE CASE OF  
TRANSANTIAGO IMPLEMENTATION**

Main Author:

**Maria FRANCISCA YANEZ CASTILLO** (*Pontificia  
Universidad Catolica de Chile*)

Co-author(s):

**Elisabetta CHERCHI** (*University of Cagliari*)

**Juan DE DIOS ORTUZAR SALAS** (*Pontificia Universidad  
Catolica de Chile*)

**Abstract:**

Demand forecasting is a fundamental element of medium to long term transport planning, and modelling the choice of mode is a key element of this process. Most modelling work has been based on cross-sectional data, but this data structure does not allow one to correctly ascertain how choices evolve over time. Models that fail to account for temporal effect (such as habit and inertia) might severely overestimate demand as well as user benefits due to new policies, leading the administration to take wrong decisions about their implementation. The use of panel data constitutes a good alternative but, up to now, most work reported in the literature has focused on model estimation; indeed, problems associated with applying panel models in prediction have been hardly tackled. This paper discusses the theoretical and practical problems involved in forecasting demand using panel models and in particular analyses the role of the temporal effects. Our results provide empirical evidence that a model considering temporal effects dominates traditional models not only in terms of explaining the real phenomena (estimation), but also in predicting future demand. However, forecasting requires predicting all elements (attributes and temporal effects) that were found relevant during model estimation, and the presence of some temporal effects may be questionable in middle/long term applications as they depend on each particular case.

**Keywords:**

Temporal effects, Panel data, Prediction capability.

ID 1517 R

**A SIMULATION PROCEDURE FOR MEASURING SHARED TAXIS POTENTIAL: AN APPLICATION TO THE LISBON METROPOLITAN AREA**

Main Author:

**José MANUEL VIEGAS** (*Centro de Sistemas Urbanos e Regionais (CESUR), Instituto Superior Técnico (IST)*)

Co-author(s):

**Luis MARTÍNEZ** (*CESUR, Instituto Superior Técnico*)  
**Gonçalo CORREIA** (*Faculdade de Ciências e Tecnologia da Universidade de Coimbra*)  
**António ANTUNES** (*Department of Civil Engineering, University of Coimbra*)**Abstract:**

This paper presents a simulation procedure to assess the market potential for the implementation of a new shared taxi service in Lisbon. This study is part of a broader project which intends to define and simulate a set of new intermediate transport modes and services in this region in order to enhance urban mobility sustainability and improve accessibility. The proposed shared taxi service has a new organizational design and pricing scheme which aims to use the capacity in traditional taxi services in a more efficient way. In this system a taxi acting in "sharing" mode offers lower prices to its clients, in exchange for them to accept sharing the vehicle with other persons who have (time and space) compatible trips, while also increasing the revenue for the operator. The paper establishes an agent based simulation model in which a set of rules for space and time matching between the shared taxis and passengers is identified which considers a maximum deviation from the original route and then presents an algorithm that seeks to optimize different objective functions such as minimum cost per passenger.km, maximum revenue per vehicle.km, minimum passenger total time in vehicle, minimum vehicle idle time. An experiment for of the Lisbon road network will be presented for a proof of concept of the simulation model.

**Keywords:**

Shared taxis, Innovate transport modes, Simulation, Transport demand modeling.

ID 1987 R

**MULTIMODAL INTER-REGIONAL ORIGIN-DESTINATION DEMAND ESTIMATION: A REVIEW OF METHODOLOGIES AND THEIR APPLICABILITY TO NATIONAL-LEVEL TRAVEL ANALYSIS IN THE U.S**

Main Author:

**Lei ZHANG** (*University of Maryland*)

Co-author(s):

**Chenfeng XIONG** (*University of Maryland*)  
**Dilya YUSUFZYANOVA** (*University of Maryland*)**Abstract:**

Since the passage of the Intermodal Surface Transportation Efficiency Act (ISTEA) in 1991 in the U.S., a significant number of state highway agencies in the U.S. have started to develop and implement state-wide travel demand models to meet policy and legislative development needs. Current and future multimodal freight flows are available from the Freight Analysis Framework (FAF), developed by the Federal Highway Administration, U.S. Department of Transportation (USDOT), to analyze national freight policy. On the passenger travel front, multimodal interregional origin destination data are still lacking. The lack of this multimodal passenger interregional origin destination data limits USDOT's ability to conduct quantitative analysis for infrastructure investment and operational effectiveness needs. The proposed Multimodal Transportation Analysis System (MTAS) is an attempt to develop this data and a host of other analytical functions. Drawing from previous academic research and practical projects around the world, this paper reviews several methodologies for multimodal interregional origin destination demand estimation at the national level, including: (1). Direct demand models; (2). Trip-based and activity-based travel demand models; (3). Mathematical and statistical models based on network information such as traffic count data; (4). Compilation of various survey, ticket sales, and other datasets into a consistent OD matrix; (5). Updating an existing OD matrix based on new information. The applicability of these methodologies to the proposed MTAS in the U.S., as well as their data requirements, is discussed.

**Keywords:**

Origin-destination matrix estimation, National travel demand model, Intercity transport, Multimodal Transportation Analysis System, National travel survey, Trip-Based, Tour-Based, Activity-Based, And Microsimulation analysis.

ID 2369 R

**AN INTEGRATED APPLICATION OF ZONING FOR MOBILITY ANALYSIS AND PLANNING: THE CASE OF PARIS REGION**

Main Author:

**Luis MARTÍNEZ** (*CESUR, Instituto Superior Técnico*)

Co-author(s):

**Ariane DUPONT-KIEFFER** (*INRETS - DEST*)**José MANUEL VIEGAS** (*Centro de Sistemas Urbanos e Regionais (CESUR), Instituto Superior Técnico (IST)*)**Abstract:**

In most transport planning studies one of the first steps is the definition of a zoning scheme with which the study area is divided and the corresponding space is disaggregated. There are no clear rules on how to carry out this operation in an optimal way, and the dominating practice is to do it based on experience, trying to mix a certain degree of within-zone homogeneity and the convenience of using administrative borders as zone limits. Firstly, this paper starts by presenting a set of quality criteria for a general zoning scheme and an algorithm that constructs an initial zoning based on a sample of geo-referenced trip extreme points and improves it in successive steps according to those criteria. This kind of zoning fits perfectly well to traffic assignment purposes. But this paper will investigate an improvement of this approach in order to give a better understanding of the mobility determinants and its externalities on the environment. In doing so, the new zone is determined not only by the trips generation and distribution but also constrained by other indicators. In our case, we have selected a combination of the following: 1/ air pollution emissions, 2/ population density, 3/ work and study density and 4/ public transport accessibility. The integration of these 4 indicators allows us not only to picture the mobility within the region and to identify at the very precise level the main zones of activities and traffic exchanges. This integration relates the picture to the land use and the clustering of the economic activities location at a very discrete level. Furthermore, it relates the density of the mobility in dense, large and economically dynamic urban area to its externalities in terms of air pollution. (...).

**Keywords:**

Zoning, Transport demand modelling, Policy design and assessment.

ID 2875 R\*

**TRAVEL GENERATION MODEL BASED ON HOME THROUGH CROSS-CLASSIFICATION TECHNIQUE IN THE MUNICIPALITY OF PALMIRA, COLOMBIA**

Main Author:

**Ciro JARAMILLO MOLINA** (*Universidad del Valle*)

Co-author(s):

**Jackeline MURILLO HOYOS** (*Universidad del Valle*)**Liliana URQUIZA MONTEALEGRE****David JACOB MOSQUERA****Abstract:**

The process of transportation planning have to be understood as a collection of activities related one to another, that have the aim of optimize the the interpretation and explanation of behavior of variables that participate into building of model. The work methodology was started with the zonification of areas relatively homogeneous called TAZ. Subsequently, with the collected data from the municipality through of Origin-Destination Household Survey, the average income for each TAZ and the percentage of household on each income range, on this stage were estimated, in the making of graph relating the average income by TAZ and the percentage of families by income range, the interpolation method of Cubical Tracer was used, the vehicle holding by family for each income range, the number of trip by household by day for each income range with vehicle holding, the number of total trip by day generated on each TAZ were calculated, and finally, the trip purpose categories: work, studies and others; were generated. The technique of crossed classification is very useful for studying the quantity of generated trip on household for each trip purpose, with the exception of that for validate this technique is necessary rely on all the base information as historical data and other samples that allow to check the sound index of technique. In conclusion, the technique of crossed classification shows some difficulty on the incorporation and interrelation of newly variables, limits the precision of estimation of future demands but the stability of supposed relations is acceptable. conditions of mobility of people and in turn, to improving the life quality of citizens. (...).

**Keywords:**

Generation, Trip, Forecast, Demand, Transportation.

ID 2878 R

**COMPARING DIFFERENT SPATIAL DATA ANALYSIS TO FORECAST TRIP GENERATION**

Main Author:

**Cira PITOMBO** (*Technical University of Lisbon*)

Co-author(s):

**Antonio JORGE SOUSA** (*Technical University of Lisbon*)**Mark BIRKIN** (*University of Leeds*)**José ALBERTO QUINTANILHA** (*Escola Politécnica da Universidade de São Paulo*)**Abstract:**

Objects in the space are related, however the fundamental concept in geography is that nearby objects share more similarities than objects which are far apart. Thus, the localization of objects and a geographic base is very important for spatial data analysis. Spatial data analysis is a quantitative study of objects located in the space. Therefore, formal techniques allow to find the spatial existing patterns and to measure relationships, considering the spatial localization of the objects. The urban trips studies are influenced by spatial attributes, such as: residential and socioeconomic activities densities, proximity between traffic zones, the transportation network, etc. Thus, the consideration of the spatial attribute in urban trips forecast models is a reasonable way, taking account that the involved variables have geographic localization and spatial patterns. The main proposal of this work is to compare two different formal techniques of spatial data analysis to forecast urban trip production and attraction for transportation mode and trip purpose in Sao Paulo Metropolitan Area, Brazil. In the present work, a multivariate geostatic technique (kriging with external drift - KED) and Geographically Weighed Regression (GWR) were used. A methodology with joint application of Principal Component analysis (PCA) and the two spatial data analysis techniques was proposed to extract the independent variables and prevent multicollinearity problems. Analyzing the results, the two techniques are efficient for urban trips generation analysis, therefore both spatial data analysis take into account socioeconomic variables as jobs density, number of automobiles, average income for traffic zone, etc. (...).

**Keywords:**

Kriging with external drift, Geographically Weighed Regression, Spatial correlation, Trip generation, Travel forecast models, Spatial patterns.

ID 1176 R\*

**FACTORS ASSOCIATED WITH TRAFFIC VOLUME AND VEHICLE KILOMETERS TRAVELED BY VEHICLE TYPE ON INTERCITY EXPRESSWAYS**

Main Author:

**Masayoshi TANISHITA** (*Chuo University*)**Abstract:**

This paper analyzes the factors associated with traffic volume and vehicle kilometers traveled (VKT) by vehicle type on distance-based tolled intercity expressways. Toll price and other elasticities were estimated via a monthly time series regression model considering residual autocorrelations, non-stationarity, and structural change. Three major results were obtained: (1) In addition to toll price, income and fuel price also affect car use, and the elasticities are almost the same as in preceding studies, although they vary among expressways. (2) For trucks, fuel price does not affect usage, and Index of industrial production elasticities are almost proportional to the average trip length. (3) The elasticities of traffic volume and VKT differ. This implies that average trip length is also affected by these factors.

**Keywords:**

Toll and fuel price elasticities, Vehicle type, Intercity expressway.

ID 1549 R

**THE RE-OPENING OF THE ANCIENT SILK ROAD AS A ROUTE TO PEACE IN THE MIDDLE EAST: ESTIMATION OF ECONOMIC COSTS AND PEACE DIVIDENDS**

Main Author:

**Alexandrina SCORBUREANU** (*Ecole Normale Supérieure du Cachan, Centre Economie Sorbonne and Università degli Studi di Verona, Dip. di Scienze Economiche*)

Co-author(s):

**André DE PALMA** (*Ecole Normale Supérieure de Cachan*)

**Nathalie PICARD** (*Université de Cergy-Pontoise (cedex, France)*)

**Federico PERALI** (*Università degli Studi di Verona (Verona, Italy)*)

**Abstract:**

This study reports results from the research conducted to analyze the order of magnitude of time and economic loss generated by restrictions imposed on the movement of goods within and beyond Palestinian boundaries. A disaggregated itinerary choice analysis is undertaken for three of the most used itineraries connecting major locations in the West Bank and Israel: Jenin-Ramallah, Jenin-Haifa and Ramallah-Ashdod, for two political scenarios, good time and bad time and two alternative routes on each itinerary, "risky" and "safe". The good and bad months are identified from data using techniques of latent clustering. The safe alternative on each itinerary is the route with a low variability of travel times, whereas the risky route is characterized by high variability of travel times. This last option will be typically chosen by risk-loving agents. It is estimated that risk-neutral agents prefer the risky alternative: i) whenever the probability of good time is lower than 0.4, for trips between Jenin and Ramallah and between Ramallah and Ashdod, ii) it is always preferred by agents traveling between Jenin and Haifa. Using a numerical experiment calibrated on data collected through on-eld interviews, it is estimated that the politically unstable situation generates on average 36% travel time loss on the safe routes and 71% time loss on the risky routes in bad times compared to good times. (...).

**Keywords:**

Political economy, International conflicts, Travel demand, Route choice, Risk aversion.

ID 1856 R

**SPATIAL ANALYSIS OF LONG-DISTANCE MOBILITY IN FRANCE**

Main Author:

**Richard GRIMAL** (*SETRA/CSTR/DE Economie des Transports et Trafic*)

**Abstract:**

In this article, we will focus on spatial analysis of long-distance mobility of individuals living in France, trips abroad included, which we define in our study as more than 80 km bird-eye travels. We will be mainly interested in describing quantitative characteristics of longdistance mobility of individuals, through the indicator of yearly individual long-distance trip frequency, and also trip modal distribution, with respect to the place of housing, depending on a typology of territories. We will study the influence of two main parameters: urban size and location within the urban area. Considering this latter criterium, we will make a distinction between town centres, nearby suburbs and further peripheric housing areas<sup>1</sup>. In relation with French town organization, we can then assume that urban density usually grows with the urban size and also from peripheric to central areas. Our analysis of data coming from the National Personal Travel Survey realized in 20082, surprisingly shows that both intensity and characteristics of long-distance mobility strongly vary with respect to these typological territorial criteria, in such a way somehow comparable with daily urban innermobility, if we consider modal share. We will be especially interested in trying to give interpretation to the specificities of long-distance mobility of the inhabitants of the urban area of Paris, considering trip frequency, or modal share, for instance, through the assumption that long-distance mobility is somehow influenced by usual practices and needs in shortdistance regular mobility, which tends itself to be strongly linked to urban density and position within the urban area. Regular short-distance mobility needs and constraints, indeed, strongly tend to influence the level of car ownership, but also the intensity and modalities of car use, and has thus indirect effects on long-distance mobility. (...).

**Keywords:**

Long-distance individual mobility Trip frequency,

ID 1905 R

**ALTERNATIVE WORK ARRANGEMENTS: CURRENT TENDENCIES, MODELING APPROACHES, AND IMPACT ON TRAVEL IN MAJOR METROPOLITAN REGIONS**

Main Author:

**Peter VOVSHA** (*Parsons Brinckerhoff*)

Co-author(s):

**Eric PETERSEN** (*Cambridge Systematics*)

**Abstract:**

The paper proposes a conceptual framework and analyses the current tendencies and approaches to modelling work arrangements that affect commuting patterns in major metropolitan regions in US. It is argued that the traditional approach focusing on a "typical" urban commuter — i.e. a full time worker with a fixed workplace to which he or she has to commute every workday according to a fixed schedule — does not reflect the significant changes observed in the dynamic world today. Work arrangements are parameterized across multiple dimensions including full-time vs. part-time status, number of commuting days per week, frequency of telecommuting, schedule flexibility, and others. Previously suggested approaches to modelling more complicated work arrangements are discussed. A general approach for modelling work arrangements in the framework of a regional Activity- Based travel model is suggested. Estimation results are presented based on a rich dataset of more than 14,000 workers obtained from the Household Travel Survey for the Chicago metropolitan region undertaken in 2007. Possible ways to include this model in an activitybased travel model system are discussed.

**Keywords:**

Work arrangements, Commuting, Telecommuting, Flexible schedule, Activity-based model.

ID 2307 R

**AN ASSESSMENT OF THE HIGH-SPEED RAILWAYS INTERCONNECTIVITY IN SOUTH-WEST EUROPE THROUGH ACCESSIBILITY MEASURES: REGIONAL CASE STUDY**

Main Author:

**Maria PRICE** (*Oxford University Center for the Environment, Transport Studies Unit*)

**Abstract:**

This paper proposes an approach to the assessment of the interconnectivity level of the high-speed railways in South-West Europe using an accessibility measure. It defines accessibility as the ability for a destination to be reached by using a transport mode at different scales (local, regional, national, international). The accessibility assessment uses a gravity model with variables such as population, travel and waiting times, fares and service frequencies. The innovation of this paper is that it seeks to examine the extent to which the opportunity and possibility to access the high speed rail network by public transport can affect its level of interconnectivity and accessibility on a regional level. It uses such study to also explain whether the existence of the high-speed services has a positive or regressive impact to regional transport. The studied areas are the Spanish provinces of Catalonia, known as Girona, Lleida and Tarragona, each of which have or are scheduled to have high-speed stations.

**Keywords:**

High-speed railways, Public transport, Regional accessibility, Spain.

ID 1367 R

**IMPACT OF TRANSPORT MODELS ON CONNECTIVITY OF VEHICULAR AD-HOC NETWORKS**

Main Author:

**Ivan WANG-HEI HO** (*Imperial College London*)

Co-author(s):

**Robin NORTH** (*Imperial College London*)**John POLAK** (*Imperial College London*)**Kin LEUNG** (*Imperial College London*)**Abstract:**

Vehicular Ad-Hoc Networks (VANETs) are attracting considerable research and commercial interest with promising applications in a number of areas including cooperative vehicle-highways systems, sensor networks and safety systems. However, due to high speed and variable driver behaviour, automotive ad-hoc networks will behave in fundamentally different ways to the most prevalent models in Mobile Ad-Hoc Network (MANET) research. Previous work in MANETs usually assumes that the mobile nodes move randomly with an unconstrained mobility model and it is clear that a random mobility model is not adequate to represent the major characteristics of real-world vehicle motions, and may therefore lead to unreliable results. Recent studies of VANETs have attempted to introduce macro- and micro-mobility constraints to model vehicle motions, but they usually focus on modelling the mobility of generic private vehicles. Given the potential for the co-ordinated deployment of network nodes on centrally-managed fleet vehicles, it has become important to model the characteristics of a VANET featuring vehicles of different types, with systematically different behaviour patterns. In this paper, we study the connectivity of mobile ad-hoc networks that consist of buses moving in urban area, and examine the implications for transport-related services. Buses have a unique set of behaviour characteristics, such as fixed routes, schedules, bus stops, specific priorities, etc., which gives rise to distinct impact on node connectivity in the communication network. Through extensive simulations based on real bus routes in central London, we demonstrate the impact of the locations of stops and the prevailing traffic patterns on node connectivity (including the distributions of contact duration and inter-contact time between buses), and explore its implication on the design of a dissemination system to capture and disseminate data. (...).

**Keywords:**

Vehicular Ad-hoc Networks, Inter-bus Communication.

ID 1529 R

**INTEGRATING THE CONCEPTS OF RELATIVE UTILITY AND PROSPECT THEORY CURVATURE TO REPRESENT**

Main Author:

**Junyi ZHANG** (*Graduate School for International Development and Cooperation, Hiroshima University*)

Co-author(s):

**Zhuo WANG** (*Graduate School for International Development and Cooperation, Hiroshima University*)**Harry TIMMERMANS** (*Urban Planning Group, Eindhoven University of Technology, The Netherlands*)**Akimasa FUJIWARA** (*Graduate School for International Development and Cooperation, Hiroshima University*)**Abstract:**

This study attempts to integrate the concepts of relative utility and prospect to represent the context dependence in travel choice behavior. Relative utility argues that utility is only meaningful relative to some reference point(s) and it conceptually allows the existence of multiple reference points. Prospect theory argues that people's decisions tend to be more sensitive to losses than to gains, where gains and losses are defined with respect to a reference point. One of the disadvantages of the prospect theory is that only one single reference point is usually adopted and there is no clue how to specify the reference point. On the other hand, even though the concept of relative utility could accommodate nonlinear utility structures, no study has been done to capture the non-linearity caused by people's asymmetric responses to gains and losses. The effectiveness of the integrated model is confirmed using an SP data with 1872 samples on the joint choice of departure time and driving route under the provision of dynamic travel information, collected in Beijing of China in May 2008.

**Keywords:**

Relative utility, Prospect, Gain and loss, Departure time and route choice, Beijing.



THU 15<sup>th</sup> (09:45 - 11:00, Session D1.10) Room 5C

ID 1714 R

**SIMULATED ANNEALING TECHNIQUE APPLIED TO MIXED LOGIT ESTIMATION**

Main Author:

**Alfonso ORRO** (*University of La Corunha*)

Co-author(s):

**Julio BRÉGAINS** (*University of La Corunha*)

**Benito PÉREZ-LÓPEZ** (*University of La Corunha*)

**Abstract:**

In this work, and as an alternative to the traditional maximization techniques based upon gradients, the Simulated Annealing technique is applied to estimate a mixed logit model for transport mode choice. The method is applied to a specific case with real survey data, in order to analyze and discuss its advantages and drawbacks.

**Keywords:**

Mixed Logit, Travel Behaviour, Simulated Annealing.

THU 15<sup>th</sup> (09:45 - 11:00, Session D1.10) Room 5C

ID 1869 R\*

**ROLE OF TRAVEL INFORMATION IN SUPPORTING TRAVEL DECISION ADAPTION: EXPLORING SPATIAL PATTERNS**

Main Author:

**Xin WANG** (*Old Dominion University, VA, USA*)

Co-author(s):

**Asad KHATTAK** (*Old Dominion University, VA, USA*)

**Abstract:**

How consumers acquire and use dynamic traveler information to adjust their travel behavior is a key component of Intelligent Transportation Systems (ITS). The association between information acquisition/adjustments and various socioeconomic and contextual factors can be captured in traditional statistical models, known as global model which yields one overall set of coefficients as the estimate. However, the associations may vary across space, more specifically, people living in different spatial locations may have different information acquisition patterns and they may respond differently to dynamic information, which cannot be captured in global model. This study uses Geographically Weighted Regression (GWR) - a local model as an alternative, to answer: 1) which factors are associated with traveler information acquisition and decision adaption; 2) whether these associations are the same over the entire study region and 3) how these associations distribute spatially. A traditional logistic regression model referred to as the global model is also presented to compare. The results show locallybased model can capture spatial variance by producing a set of mapable parameter estimates and their significance levels (t-statistics), which continuously vary over space. It indicates that GWR provides a more complete picture of information acquisition/use by capturing how correlates vary over space. The implications of the results for ITS are discussed.

**Keywords:**

Geographically weighted regression, Global model, Local model, Spatial deviation, Travel decision, Traveler information.

THU 15<sup>th</sup> (09:45 - 11:00, Session D1.10) Room 5C

ID 2975 R

### **LARGE-SCALE AGENT-BASED TRAVEL DEMAND OPTIMIZATION**

Main Author:

**Konrad MEISTER** (*Institute for Transport Planning and Systems, ETH Zurich*)

Co-author(s):

**Michael BALMER** (*Institute for Transport Planning and Systems, ETH Zurich*)

**Francesco CIARI** (*IVT - ETH Zurich*)

**Andreas HORNI** (*Institute for Transport Planning and Systems, ETH Zurich*)

**Marcel RIESER** (*Institute for Transport Systems Planning and Transport Telematics, TU Berlin*)

**Rashid WARAICH** (*IVT - ETH Zurich*)

**Kay W. AXHAUSEN** (*IVT - ETH Zurich*)

#### **Abstract:**

This paper presents the application of the agent-based transport simulation toolkit MATSim-T to a large-scale scenario of Switzerland. The scenario is called large-scale because ca. 6 million synthetic persons, "agents", are simulated on a high-resolution network model with >1 million links. MATSim-T is able to compute a relaxed state of the simulation system within 60 iterations of the learning-based solution procedure with regard to mode choice, car route choice and choice of activity timing. This is achieved by applying improved optimization algorithms in the replanning stage. A genetic algorithm is used for times and mode choice optimization of activity plans, together with an efficient implementation of time-dependent shortest path search for route choice. The improvements of the behavioral model reported in this paper are focused on the scoring function which can process individualized parameters for measuring the quality of all-day activity plans. Combined with disaggregate input data for population and land use, it was possible to build a heterogeneous and thus more realistic scenario. Furthermore, four modes of transport (car, public transit, bike, walk) are considered in the presented application. The generalized cost of the car option is determined by a queue simulation of traffic flow. (...).

#### **Keywords:**

Agent based transport simulation, Large-scale system optimization, MATSim, Parallel computing, Activity plans, Multi-modal traffic model, Switzerland.

TUE 13<sup>th</sup> (17:00 - 18:15, Session D2.1) Room AIV

ID 1433 R

### **IMPROVED REPRESENTATION OF HOUSEHOLD DECISIONS IN THE ALBATROSS MODEL SYSTEM: TESTS OF VALIDITY AND SENSITIVITY**

Main Author:

**Harry TIMMERMANS** (*Urban Planning Group, Eindhoven University of Technology, The Netherlands*)

#### **Abstract:**

The authors have completed re-designed the Albatross model system to better represent household decisions. In this paper, this new version and the previous version are compared in terms of a set of validity measures and in terms of a sensitivity analysis, based on a scenario of increased participation of women in the workforce. Results suggest that there is not much difference between the two models in terms of validity. However, the new model shows much higher sensitivity to the scenario.

#### **Keywords:**

Recreation, Travel behavior, Dynamics.

ID 1462 R

**SIMULATING THE EFFECTS OF LIFE TRAJECTORY DECISIONS ON TRANSPORT MODE CHOICE: VALIDATION RESULTS**

Main Author:

**Harry TIMMERMANS** (*Urban Planning Group, Eindhoven University of Technology, The Netherlands*)

Co-author(s):

**Marloes VERHOEVEN** (*Eindhoven University of Technology*)**Abstract:**

The study of the dynamics of activity patterns across different time horizons is high on the research agenda in activity-based analysis. Mostly qualitative research has indicated that life course events such as moving house or a new job may trigger or force individuals and households to reconsider their activity-travel behaviour, leading sometimes to changes. Attempts of modelling this process in transportation research are still scarce however. Of one the few exceptions is Beige (2008), who has estimated a hazard model to that effect. In our previous research, we have explored the feasibility of developing Bayesian networks to capture the direct and indirect effects of life trajectory events on the dynamics of activitytravel patterns in general and transport mode choice in particular (Verhoeven et al., 2005, 2006, 2007). The present paper will further develop this line of work and discuss the results of some validation tests. In particular, we will examine the ability of a Bayesian belief network, learned from retrospective survey data, to successfully simulate (i) the occurrence of life course events; (ii) the interval times between events, (iii) the sequence of onedimensional and multi-dimensional careers embedded in life trajectories and (iv) observed transport mode choice.

**Keywords:**

Life trajectory, Activity-travel behaviour, Bayesian belief networks.

ID 1739 R

**THE EFFECTS OF TRAVEL RELATED CHANGES ON HOUSEHOLDS' DYNAMIC BUDGET ALLOCATION DECISIONS**

Main Author:

**Gamze DANE** (*Eindhoven University of Technology*)

Co-author(s):

**Theo ARENTZE** (*Eindhoven University of Technology*)**Dick ETTEMA** (*Faculty of Geosciences - Utrecht University*)**Harry TIMMERMANS** (*Urban Planning Group, Eindhoven University of Technology, The Netherlands*)**Abstract:**

During the last decade, models have been developed to understand how activity-travel patterns are organized in space and time. However, monetary budgets are not included in these models. Yet, the allocation of monetary budgets is important to understand the precedence of activities. In addition to these models of activity-travel demand, several micro-economic models exist which consider the allocation of time and money budgets to activities but these do not consider activity generation at episode level and, hence, direct implications for travel cannot be deduced. Therefore, in this paper, we propose an approach for modeling dynamic time and monetary allocation decisions of households in the context of dynamic activity based models of transport demand. It offers a framework for analyzing and modeling households' responses to changing land use and transport policies and to potential shifts in exogenous factors such as cost and income changes. We introduce the model and discuss the properties of it.

**Keywords:**

Time budget, Monetary budget, Activity based model, Dynamics.

ID 1840 R

**AN EVOLUTIONARY MODEL FOR HOUSEHOLD INTERACTIONS IN DAILY ACTIVITY SCHEDULING**

Main Author:

**Ahmed MOSA**

Co-author(s):

**Noboru HARATA** (*University of Tokyo*)**Nobuaki OHMORI** (*Urban Transport Research Unit, Department of Urban Engineering, University of Tokyo*)**Abstract:**

Household members interact in many ways during their daily activity and travel related decision-making. Individuals undertake both independent and joint activities and travel as part of their overall daily activity-travel patterns. The joint activity pursuits are often motivated by social factors such as desire for companionship and altruism (i.e., enabling activity participation of the mobility-constrained), or by resource constraints (i.e., limited vehicle availability). Undertaking joint activities with household and/or non-household members introduces strong linkages among the activity-travel patterns of the individuals involved. Consequently, the activity-travel patterns of all household members become inter-dependent. As a result during the past few years, there have been a significant number of studies aimed accommodate household interactions in daily activity and travel models. In this paper, we develop a more comprehensive theory and model of household interactions. We propose a strategic negotiation model that takes into account the passage of time during the negotiation process itself in order to solve the problem of task allocation and coordination for joint participation between members of the household. The model considers situations characterized by complete information. Using this negotiation mechanism the individuals have simple and stable negotiation strategies that result in efficient agreements without delays. We propose that the individuals decide on a mechanism that will find an agreement that must, at the very least, give each individual his/her conflict utility and under, these constraints maximize some social-welfare criterion. Further, we demonstrate the proposed negotiation mechanism by a system for bilateral negotiations in which artificial agents are generated by an evolutionary algorithm (EA). (...).

**Keywords:**

Household Interactions, Negotiation model, Evolutionary algorithms.

ID 1910 R

**A MODEL FOR WORK ACTIVITY SCHEDULES WITH SYNCHRONIZATION FOR MULTIPLE-WORKER HOUSEHOLDS**

Main Author:

**Peter VOVSHA** (*Parsons Brinckerhoff*)

Co-author(s):

**Surabhi GUPTA** (*Parsons Brinckerhoff*)**Abstract:**

This paper presents a hybrid discrete choice-duration model for work activity scheduling with interactions between workers in a multiple-worker household. The model operates in discrete space with a fine level of temporal resolution. Main innovative component relates to intra-household interactions that are expressed in coordination and synchronization mechanisms between the workers. The model was estimated based on a large Household Travel Survey in the San Francisco Bay Area. The estimation results confirmed strong intrahousehold interactions including synchronizations for outbound and inbound commute as well as creating overlaps of available time windows for joint activities before and after work. Relative strength of the synchronization mechanisms proved to be a function of the person characteristics and household composition.

**Keywords:**

Time of day choice, Activity schedule, Departure time, Intra-household interactions.

ID 1561 R

**WELL-BEING AND ACTIVITY-BASED MODELS**

Main Author:

**Maya ABOU ZEID** (*American University of Beirut and Massachusetts Institute of Technology*)

Co-author(s):

**Moshe BEN-AKIVA** (*Massachusetts Institute of Technology*)**Abstract:**

Instruments such as the Experience Sampling Method and the Day Reconstruction Method have been applied to measure happiness by activity type and shown that happiness varies significantly by activity type and socio-economic group. The relationship between happiness and activities has also been supported by models of time allocation to activities. We pursue this line of research to investigate the relationship between happiness and activity participation. The overriding hypothesis is that activities are planned and undertaken to maintain or enhance subjective well-being. We present both an empirical and a theoretical analysis to support this hypothesis and develop a framework for its application to enhance activity-based travel demand models. The empirical analysis consists of the development of structural equations models of activity participation and well-being using data from a web-based cross-sectional survey of a sample of commuters. The models reveal significant correlations between well-being and behavior for different types of activities: higher propensity of activity participation is associated with greater activity happiness and greater satisfaction with travel to the activity, thus supporting our study hypothesis. The theoretical analysis consists of the development of a modeling framework and measures for the incorporation of well-being within activity-based models of travel demand. The motivation is that activity pattern models have been specified in ad-hoc ways in practice as a function of mobility, lifestyle, and accessibility variables. We postulate that well-being is a driver of activity patterns and propose the use of well-being measures as indicators of the utility of activity patterns (in addition to the usual choice indicators) within a random utility modeling framework. (...).

**Keywords:**

Activity-based models, Happiness, Subjective well-being.

ID 1604 R

**AN ACTIVITY-BASED APPROACH FOR ESTIMATION OF PASSENGER O-D TRIP MATRIX AND ACTIVITY PATTERNS**

Main Author:

**William H.K. LAM** (*Hong Kong Polytechnic University*)

Co-author(s):

**Yiliang XIONG** (*The Hong Kong Polytechnic University*)**Abstract:**

The trip-based traffic assignment models are commonly employed for solving the origindestination (O-D) trip matrix estimation problems so as to reproduce the observed traffic counts. However, travellers may have different activity patterns that would affect their destination and path choices. These activity patterns would therefore have significant impacts on the O-D trip matrix estimation from traffic count data. In this paper, an activitybased transit network equilibrium model is proposed to ensure that the estimated passenger O-D trip matrices are consistent with the passenger activity/travel choices. A nested logit model is employed to capture simultaneously the passenger's behaviour on activity and travel choices in transit network. The parameters of the nested logit model and the passenger O-D matrix are estimated simultaneously using passenger count data and other relevant information. A sensitivity-based algorithm is proposed for solving this simultaneous estimation problem. Numerical experiments on a small transit network are used to illustrate the features and merits of the proposed model.

**Keywords:**

Activity pattern, Trip chain, Passenger O-D trip matrix estimation.

ID 1980 R

**THE VALIDITY OF ASSUMING ONLY ONE ACTIVITY PER OUT-OF-HOME LOCATION IN ACTIVITY-BASED DEMAND MODELS CONSTRUCTED FROM TRIP-BASED SURVEY DATA**

Main Author:

**Mohammad KHORGAMI** (UCL)

Co-author(s):

**Peter JONES** (UCL)

**Helena TITHERIDGE** (UCL)

**Abstract:**

Over the last decade, several efforts have been made to develop operational models of full-day activity-travel patterns. Given the lack of local activity-based surveys, most activity-travel demand models are developed using conventional travel diaries, using trip-based survey data as a proxy for out-of-home activity data. In particular, this assumes that the traveller only takes part in one activity per non-home destination; but this assumption has not been questioned in the literature. The analysis reported in this paper uses data from the 2000 UK National Time Use Survey (TUS) to evaluate the validity of this assumption. Respondents in the TUS record their 'primary' activities for each 10 minute interval over a 24 hour period of time, with no limit on the number of successive primary activities that can be recorded at the same location, without an intervening travel activity. In addition, respondents are asked to record any secondary activities, that take place in parallel with the primary activity(ies). The analysis finds that there is an average of 1.26 primary activities per (non-home) stop, and 0.34 secondary activities – making an average of 1.6 activities per stop. The paper then focuses on cases where there are multiple primary activities at the same stop. It defines one 'main' activity at each location, to mirror the reporting of the 'main' trip purpose in a travel diary. Since we do not know on what basis a respondent selects their 'main' trip purpose where there are multiple primary activities at one stop, we explore four alternative definitions: (i) the activity with the longest duration, (ii) the first activity carried out at each location, (iii) a hierarchical selection, based on some notion of activity importance, and (iv) a random selection of 'main' activity. (...).

**Keywords:**

Out-of-home activities, Trip purposes, Secondary activities, Time use survey, Travel diaries.

ID 2718 R

**A JOINT TOUR-BASED MODEL OF VEHICLE TYPE CHOICE, TOUR LENGTH, PASSENGER ACCOMPANIMENT, AND TOUR TYPE**

Main Author:

**Karthik KONDURI** (Arizona State University)

Co-author(s):

**Rajesh PALETI** (The University of Texas, Austin)

**Ram PENDYALA**

**Chandra BHAT** (The University of Texas, Austin)

**Abstract:**

This paper presents a joint model of tour type (purpose), tour length, passenger accompaniment, and vehicle body type choice to simultaneously model several choice dimensions critical to tour-level activity-based travel demand model development. Over the past several years, travel demand modeling has moved into the era of activity-based models in which tours are the unit of analysis. When individuals undertake tours, there are a range of choice decisions that are made. This paper explores the simultaneity in the decision process associated with four choice dimensions, all of which are of much interest to travel modelers. The simultaneous choice model is capable of accounting for correlations among unobserved attributes that may be shared across choice dimensions thus accommodating error correlation structures. The model is an advanced econometric model that is estimated using new techniques that have only recently been introduced in the travel modeling literature.

**Keywords:**

Joint model, Discrete-continuous model, Tour-based.

ID 3140 R

**TOWARDS AN ACTIVITY-BASED APPROACH FOR ESTIMATING TRAVEL DESTINATIONS**

Main Author:

**Shan JIANG** (*Massachusetts Institute of Technology*)

Co-author(s):

**Filipe RODRIGUES** (*Universidade de Coimbra*)**Ana ALVES** (*Universidade de Coimbra*)**Francisco PEREIRA** (*Universidade de Coimbra*)**Joseph FERREIRA** (*Massachusetts Institute of Technology*)**Abstract:**

Transportation demand models rely heavily on destination information. The activity-based model especially requires high resolution and disaggregated information of activity destinations. Recent developments in spatially-detailed, GIS-based data sources are making it practical to consider new methods for modeling urban activity in ways that can facilitate travel demand estimation. Massive amounts of data on land use, points of interest, public events, urban sensing, etc. are becoming available online. These data, together with modern techniques for geo-processing and data fusion, offer new possibilities for deriving activity destinations. In urban settings, such analyses can also link travel patterns with different activity patterns in ways that can be usefully incorporated into models of land use and transportation interactions. This paper develops and analyzes data fusion and estimation methods that use such data to estimate the location and size of the urban activity destinations, which are key to activity-based land use and transportation modeling. The methods are developed and illustrated using six towns in the Boston metropolitan Area, USA, as examples. Data sources include online derived points of interest from Yahoo!, proprietary business establishment data, Census Block and Census Block Group boundary data, and census employment data. (...).

**Keywords:**

Machine Learning, Data Fusion, Points of Interest, Activity-Based Modeling, Four- Step Modeling, Land-Use and Transportation Interaction, Destination Estimation, GIs.

ID 3184 R

**URBAN SEGREGATION AND DAILY ACTIVITIES, AN INTERNATIONAL COMPARISON**

Main Author:

**Ravalet EMMANUEL** (*LET*)**Abstract:**

Limiting areas frequented by urban dwellers in places of residence, as does implicitly the traditional analysis of segregation by focusing solely on the residential dimension, causes a twofold reduction in the analysis of this phenomenon: spatial because daily mobility and therefore the spaces used are significantly different within the same city and between cities, socially, because the analysis is then limited to the household, thus blurring the differentials between individuals (men/women, youth/adult ...). We are therefore interested in urban segregation, understood as the simultaneous consideration of "immobile" residential segregation and mobile segregation approached by individual travel behaviors. The description of the nature and location of activities carried out thus complement the study of socio-economic specializations of residential space. We opted for a comparative approach lead from very different urban contexts: Niamey, Puebla, Lyon and Montreal. This diversity has imposed an important contextualization work but also an alignment of empirical material used (transport household surveys available in the four cities). It has also forced the initial development of a strategy of systematic analysis, carried out identically in all four cities. The consideration of such diversity is then the necessarily exploratory nature of such work, depending on existing statistical data. Some results, showing both the commonalities and differences between cities, are presented around the themes of activities carried out (type and location). We identify sensitive populations, and the ranking of factors explaining the nature of activities shows the dominance of the economic dimension in the two southern cities and socio-demographic factors in the North. (...).

**Keywords:**

Urban segregation, Travel behaviors, Daily activities, Household trip survey, Niamey, Puebla, Lyon, Montreal.

ID 1307 R

**A HEURISTIC APPROACH FOR CONSTRUCTING PERSONALIZED TRANSPORTATION NETWORKS: A SUPERNETWORK APPROACH**

Main Author:

**Harry TIMMERMANS** (*Urban Planning Group, Eindhoven University of Technology, The Netherlands*)

Co-author(s):

**Feixiong LIAO** (*Eindhoven University of technology*)**Theo ARENTZE** (*Eindhoven University of Technology*)**Abstract:**

For accessibility analysis, an integrated view encompassing the networks for public and private transport modes as well as the activity programs of travellers is essential. In earlier research, the supernetwork has been put forward by the authors as a suitable technique to model the system in such an integrated fashion. An essential part of a supernetwork model for multi-modal and multi-activity travel planning is the personalized transportation network. This is an under researched topic in the academic community. This paper attempts to develop a heuristic approach to construct personalized transportation networks for an individual's activity program. In this approach, the personalized network consists of two types of network extractions from the original transportation system, namely the public transport network (PTN) and the private vehicle network (PVN). PTN is composed of selected public transport connections based on an individual's preferences related to walking distance, transfer times, fare and time cost, etc.; whereas the PVN is constructed on the Constructing Personalized Transportation Networks In Multi-State Supernetworks basis of optimal routes of the considered private vehicles in a hierarchical road network based on multi-attribute link costs functions. Two cases are presented to illustrate that the PTN and PVN can represent an individual's attributes and perceptions appropriately and be applied in large-scale applications for analyzing land-use and transport systems.

**Keywords:**

Supernetwork, Multi-modal and multi-activity trips, Accessibility analysis, Heuristic approach, Personalized networks.

ID 1715 R

**PARAMETER ESTIMATION OF A DYNAMIC NEED-BASED ACTIVITY GENERATION MODEL**

Main Author:

**Linda NIJLAND** (*Eindhoven University of Technology*)

Co-author(s):

**Theo ARENTZE** (*Eindhoven University of Technology*)**Harry TIMMERMANS** (*Urban Planning Group, Eindhoven University of Technology, The Netherlands*)**Abstract:**

Several activity-based models made the transition to practice over the last decade. However, modelling dynamic activity generation and especially, the mechanisms underlying activity generation are not well incorporated in the current activity-based models. This paper describes a first step in estimating the parameters of a needbased activity generation model. A survey was carried out to collect activity data for a typical week and a specific day among an adequate sample of individuals. The diary data include detailed information on activity history and future planning. Furthermore, person-level needs on relevant dimensions were measured using Likert scales. Estimation of the model involves a range of shopping, social, leisure and sports activities, as dependent variables, and socioeconomic, day preference, and need variables, as explanatory variables. The results show that several person, household, and dwelling attributes, and person-level needs influence activity-episode timing decisions in a longitudinal time frame and, thus, the frequency and day choice of conducting the social, leisure and sports activities.

**Keywords:**

Activity-based modelling, Dynamic activity generation, Travel-demand modelling, Estimation.



ID 1790 R

**ENHANCING COOPERATION THROUGH INTERACTION AND COMMUNICATION IN AGENT-BASED JOINT ACTIVITY-TRAVEL SCHEDULING**

Main Author:

**Harry TIMMERMANS** (*Urban Planning Group, Eindhoven University of Technology, The Netherlands*)

Co-author(s):

**Huiye MA** (*Eindhoven University of Technology*)**Theo ARENTZE** (*Eindhoven University of Technology*)**Abstract:**

This paper considers making decisions on whether to cooperate with other participants in agent based joint activity scheduling. Several characteristics of the scheduling process must be addressed: participants may not have complete information about the schedules of the others involved; the effectiveness of interaction/communication may not be known a priori; and interaction/communication has some associated cost. The paper adopts a novel probabilistic representation of other agents' beliefs about the actions selected for their own or for the joint activity, given incomplete information. Agents can use this representation to make four kinds of decisions: communicating information relevant to other group member(s), asking for information from other member(s), undertaking actions to cooperate with others, and inquiring actions from others. Several decision-theoretic mechanisms are presented, which include a set of rules for reasoning about the utility and credit of actions and communications, and the cost incurred. It was tested using a multi-agent system on activity travel scheduling with configurations that varied agents' uncertainty about the world and the cost of cooperation. In all cases, agents using the decision-theoretic mechanisms to decide whether to cooperate outperformed agents using other mechanisms in terms of utility.

**Keywords:**

Activity travel scheduling, Cooperation, Multi-agent simulation, Decision making.

ID 1838 R

**A SHARED FRAILTY SEMI-PARAMETRIC MARKOV RENEWAL MODEL FOR TRAVEL AND ACTIVITY TIME-USE PATTERN ANALYSIS**

Main Author:

**Tai-Yu MA** (*Transport Economics Laboratory (LET), University of Lyon*)

Co-author(s):

**Iragãe JOLY** (*Grenoble Applied Economic Laboratory, University of Pierre Mendès France*)**Charles RAUX** (*LET, University of Lyon*)**Abstract:**

This study investigates the influence of observed explanatory factors and unobserved random effect (heterogeneity) on episode durations of travel-activity chain. A shared frailty semiparametric proportional hazard model is proposed to estimate the transition hazard of travel/activity states. The proposed model is applied on the travel and activity episode duration analysis during evening work-to-home commute using the household travel survey data collected in the city of Lyon in France in 2005-2006. The empirical results provide useful insights for the determinants of travel and activity episode durations for evening work-to-home commute.

**Keywords:**

Time-use, Activity duration, Markov renewal model, Shared frailty, Heterogeneity.

ID 2214 R

**TRAVEL AND ACTIVITY TEMPORAL RHYTHM OVER A WEEK: RESULTS FROM THE BMW SURVEY IN BELGIUM**

Main Author:

**Tai-Yu MA** (*Transport Economics Laboratory (LET), University of Lyon*)

Co-author(s):

**Fabien WALLE** (*Transportation Research Group (TRG), University of Namur*)**Charles RAUX** (*LET, University of Lyon*)**Eric CORNELIS** (*University of Namur (FUNDP) - Transportation Research Group (GRT)*)**Abstract:**

The longitudinal analysis of travel behaviour has been an important research issue in transportation research. It provides detailed information about the variability of travel behaviour and effective transport policy decision making support for transport demand management. The analysis based on one-day travel survey data has been argued for its underlying assumption of habitual travel behaviour. As it is well-known that travel behaviour varies on a daily or weekly rhythm, numerous studies have been conducted to elucidate the temporal rhythm and spatial distribution of travel behaviour. Previous studies for multiday travel behaviour have provided some empirical evidence on the variability of travel behaviour. The progress in travel-activity behaviour analysis has developed many approaches to explore travel-activity patterns and determine temporal rhythm of activity participation. Generally, these methods can be regrouped into three classes. The first one utilizes time-space prism to determine travel and activity space-time path, reflecting individual's tempo-spatial constraints and the variability of travel-activity patterns with respect to individual's sociodemographic and geographical characteristics [1]. The second class applies duration modelling techniques to determine the effects of related covariates on multiple interepisode durations of travel-activity behaviour based on multiday travel survey [2]. The third class utilizes descriptive statistics to explore day-to-day variability of travel behaviour and individual's time use characteristics [3]. (...).

**Keywords:**

Travel, Time-use, Activity duration, Variability, Weekly behaviour, Survey.

ID 1285 R

**MYTIS: THE ARCHITECTURE**

Main Author:

**Nuno M. GOMES ROCHA** (*FEUP*)**Abstract:**

This paper presents the software architecture of myTIS (where the TIS excerpt stands for traveller information system). myTIS is an application to help commuters and noncommuters, in a personalised environment, to plan and assist them during their daily trips in public transport modes. It is expected to run both in smart/mobile phones and in a web server. Sustainable city growing is only possible sustained in an effective public transport network. This is leading to a tendency, especially in developed countries, to encourage their population to use public transport modes. So it is going to pressure mass transport companies to reach a door-to-door level, in order to become a substitute to private car. This will require higher levels of communication between companies and users to increase and facilitate inter-modality. myTIS initial applicability is reduced to lower mobility or handicapped groups by providing them important assistance during their daily trips, however the increasing transport network complexity could turn it into a useful tool for every one displacement. myTIS is a multi-agent based architecture forming a triangle. In one vertex are mass transport companies managing data. Another is formed by the rolling stock, inputting actualized data to the system. In the top vertex is the user, receiving information and generating data. This paper will start with a feature division based in a previous paper on the theme. This will be followed by software architecture solutions with potential applicability to the system and its benefits/weakness. Super-structure presentation will precede the sub-module connections and communication. Future work and conclusions will finish the paper. (...).

**Keywords:**

Route finding, Multi-modal public transport network.

ID 2100 R

**TOUR-BASED ANALYSIS OF MULTI-DAY GPS DATA**

Main Author:

**Yun ZHANG**

Co-author(s):

**Peter STOPHER** (*The University of Sydney*)**Qingjian JIANG****Abstract:**

The purpose of this research is to understand travel patterns by applying tour-based analysis and using sociodemographic variables to characterise travel patterns to explore new opportunities of developing activity-based and tour-based models. The data used in this research is from an Australian panel where 47 households provided GPS data for a period of 28 days, with a total of 89 persons. This paper presents the results of a basic tour analysis of the above data, which includes the distribution of tours and trips per day, tour duration and the starting times by trip purpose, followed by a summary of important considerations when dealing with tour-based data. We further introduce an extended tour classification, based in part on work initially done by O'Fallon and Sullivan (2009), where a set of twelve tour classifications are put forward, based on a hierarchy of trip purposes of work, education, shopping, and other. With the application of the new tour classification, we present the findings concerning the relationship between the purpose of the tours, the composition of the tours (simple or complex tours) and the characteristics of the day (weekend or week day), sociodemographic characteristics, such as employment or education status, and the stages in the family life cycle. Overall, for one of the first times, multi-day GPS data were used for tour based analysis. The findings of this paper enrich the current understanding of tour patterns and provide significant insight into multi-day travel, which may yield fruitful explanations of tour-based travel to build improved tour choice models.

**Keywords:**

Tour-based analysis, Activity-based analysis, GPS .

ID 2274 R

**TOWARDS MICROSIMULATION OF PASSENGER AND FREIGHT TRANSPORT COMPETITION: ADVANCES IN SYNTHETIC POPULATION GENERATION AND SIMULATION OF THE BEHAVIOUR OF FREIGHT ACTORS**

Main Author:

**Jérémy PIOTTE** (*FUCaM (Facultés Universitaires Catholiques de Mons)*)

Co-author(s):

**Johan BARTHELEMY** (*University of Namur (FUNDP)*)**Eric CORNELIS** (*University of Namur (FUNDP) - Transportation Research Group (GRT)*)**Bart JOURQUIN** (*Louvain School of Management*)**Philippe TOINT** (*University of Namur (FUNDP) - Transportation Research Group (GRT)*)**Abstract:**

Competition of freight transport and passenger traffic on the road infrastructure is an increasingly important problem. The approach considered in this paper is that of disaggregate modelling using multi-agents systems. We focus on two aspects of this methodology: synthetic population generation for passengers' agents and behaviour' simulation of the freight transportation actors. Each of these challenges is covered as follow: firstly the existing approaches are discussed, then the proposed technique is detailed and finally validation and computational results are presented.

**Keywords:**

Microsimulation, Multi-agents systems, Synthetic population, Time dependant origin-destination matrices, Freight and passengers transports.

WED 14<sup>th</sup> (11:15 - 12:30, Session D2.4) Room A1V

ID 2749 R

**ROAD FREIGHT TRANSPORT DEMAND IN SPAIN: A PANEL DATA MODEL**

Main Author:

**José BAÑOS PINO** (DEPARTAMENTO DE ECONOMÍA. UNIVERSIDAD DE OVIEDO)

Co-author(s):

**Rosa AZA** (UNIVERSITY OF OVIEDO. SPAIN.)

**Pelayo GONZÁLEZ** (UNIVERSITY OF OVIEDO)

**Manuel LLORCA** (UNIVERSITY OF OVIEDO)

**Abstract:**

International trade has been widely studied in the economic literature. However, in spite of being an important sector, domestic trade has not been analysed in a comprehensive way. This paper presents a model of the demand of road transport of goods in the domestic traffic of the Spanish Autonomous Communities between 1999 and 2008. Demand functions based on the gravity model are estimated. The panel model with fixed effects estimated in this paper is used to predict future trade flows as well as CO2 emissions.

**Keywords:**

Transport demand, Gravity model, Panel data, Fixed effects, Spanish Autonomous Communities.

WED 14<sup>th</sup> (11:15 - 12:30, Session D2.4) Room A1V

ID 2922 R

**PLANNING CONSTRAINED DESTINATION CHOICE MODELING IN THE ADAPTS ACTIVITY-BASED MODEL**

Main Author:

**Joshua AULD** (University of Illinois at Chicago)

Co-author(s):

**Abolfazl MOHAMMADIAN** (University of Illinois at Chicago)

**Abstract:**

This paper describes a set of destination choice models estimated using a recent survey from the Chicago region and a previously developed model of the timing of activity planning decisions. The household travel survey data is used to estimate both a standard multinomial logit destination choice model, and a set of conditional choice models under certain assumptions about the activity planning process, where the choice set is constrained by what has already been planned in the schedule. Then, each model is applied to a set of destination choice data collected in a recent activity-travel survey. The performance of each model is evaluated and the impacts of using the planning-constrained model in place of the standard model on the accuracy of the results estimated. The use of a model where the destination choices are conditioned on what has already been planned in the each individual's activity-travel schedule could improve the accuracy and policy sensitivity of the model results.

**Keywords:**

Destination Choice, Activity Planning, Choice Set Formation.

THU 15<sup>th</sup> (08:15 - 09:30, Session D2.5) Room A1V

ID 1053 R

**A PATH ANALYSIS OF SOCIAL NETWORKS, ICT USE AND SOCIAL ACTIVITY-TRAVEL PATTERNS IN THE NETHERLANDS**

Main Author:

**Harry TIMMERMANS** (*Urban Planning Group, Eindhoven University of Technology, The Netherlands*)

Co-author(s):

**Pauline VAN DEN BERG** (*Eindhoven University of Technology*)

**Theo ARENTZE** (*Eindhoven University of Technology*)

**Abstract:**

Face-to-face social activities are responsible for an important part of travel demand and are therefore important for transport planners to take into account. Social activities and the involved travel are likely to be influenced by the use of new information and communication technologies (ICT's), as these ICT's offer new possibilities for social interaction. Moreover, social activities and the travel for these activities can emerge from the individuals' social networks. Although international transportation researchers have recognized the relevance of social trip generation and the impacts of social networks and ICT on activity travel patterns, empirical studies on this matter are scarce. The purpose of the paper is to add to our understanding of social travel demand by analyzing the relationships between personal characteristics, properties of the built environment, social networks, ICT use and social activity-travel patterns. Using path analysis, hypotheses on these links are tested. The analyses are based on data collected in 2008 in the Eindhoven region in the Netherlands among 747 respondents, using a two-day social interaction diary and a questionnaire. The paper presents the results of the path analysis and discusses the implications of the findings for transport planning and modeling.

**Keywords:**

Social activities, ICT, Social networks, Activity-travel behavior, Path analysis, Structural equation modeling.

THU 15<sup>th</sup> (08:15 - 09:30, Session D2.5) Room A1V

ID 1676 R

**HABIT FORMATION AND AFFECTIVE RESPONSES IN LOCATION CHOICE DYNAMICS**

Main Author:

**Qi HAN** (*Eindhoven University of Technology*)

Co-author(s):

**Theo ARENTZE** (*Eindhoven University of Technology*)

**Harry TIMMERMANS** (*Urban Planning Group, Eindhoven University of Technology, The Netherlands*)

**Abstract:**

This paper discusses the development of a dynamic agent-based model which simulates how agents search and explore in non-stationary environments and ultimately develop habitual, context-dependent, activity-travel patterns. In this paper, we specifically focus on how emotional values, beliefs and aspirations can be incorporated in these models. Next, through an illustrative case study, we will show how these can be integrated in an agent-based micro-simulation to model dynamic decision making under uncertainty and illustrate that people try to avoid higher uncertainty in their location choice. Simulations indicate that solutions generated by the model are sensitive to rational and emotional considerations in decision making in well-interpretable ways. Our approach is scalable in the sense that it is applicable to study areas of large size (e.g., region wide).

**Keywords:**

Habit formation, Emotional value, Location choice, Learning.

ID 1795 R

**DYNAMIC OF CAR OWNERSHIP AND CAR USE IN FRANCE SINCE THE 1960S**

Main Author:

**Sophie ROUX** (INRETS - DEST)

Co-author(s):

**Jimmy ARMOOGUM** (INRETS-DEST)**Jean-Loup MADRE** (INRETS - DEST)**Abstract:**

Transportation has experienced extraordinary growth during the last century and still evolves throughout the twenty-first century. To clarify the changes to come, studies of the history of past habits and behaviors are essential. The knowledge of mobility in France is partly based on National Travel Surveys (NTS). In the past these surveys have been conducted five times (1966-67, 1973-74, 1981-82, 1993-94 and 2007-08), which gives five photographs of mobility for households living in France. The definitions and principles of these surveys haven't been modified since the beginning which makes the measurement of structural changes easier. The goal of this paper is to analyze the behavioral changes related to the motorization since the 1960s. The analysis of changes will be focused on the evolution of household motorization (non-motorized, with one car and multi motorized) and the number of driving license holders since the 1960s.

**Keywords:**

Motorization, Car ownership, Car use, Driving license, Behaviour, Dynamic, Surveys.

ID 1849 R

**ON MODELING HETEROGENEITY IN SOLO AND JOINT ?WITH WHOM? TRIP MAKING**

Main Author:

**Ahmed MOSA**

Co-author(s):

**Ali HEIKAL****Adel ABDELMAKSOU****Abstract:**

Complex behaviour patterns in the activity-travel based modelling system would include joint activities and travel participations. Activities and travel involving multiple persons from the same household or their wider society would arise as a result of a collective decision process that requires its participants to fit periods of joint activity-travel engagement into individual schedules while considering their own needs along those of other persons. There is an increasing realization that such household interdependencies have to be accommodated explicitly within comprehensive activity-based models. Currently, most of the existing activitybased models of transport demand typically assume an individual decision-making process. The main objective of this study is to empirically investigate individuals' solo versus joint "with whom" travel participation. This was based on two-day activity and travel diary data from Cairo, Egypt. The proposed modelling approach entails the modelling of the decision of household members to participate in travel as (1) solo, (2) joint with only household members, (3) joint with only non-household members, and (4) joint with combinations of household and non- household members. In order to achieve the study objective, a mixed logit model was developed. The proposed modelling framework is distinguished from previous related studies in several capabilities. First, it accommodates heterogeneity in responsiveness to solo and joint "with whom" travel participation. Therefore, intra-individual variations in joint travel participation could be accommodated, where some of prior literature assumed homogeneity in responsiveness to attributes of solo and joint alternatives across individuals. (...).

**Keywords:**

Household interactions, Activity based modelling, Activity diary survey, Mixed logit models, Taste heterogeneity.

THU 15<sup>th</sup> (08:15 - 09:30, Session D2.5) Room AIV

ID 2007 R

**MOBILITY, ACCESSIBILITY AND ACTIVITY PARTICIPATION: A COMPARATIVE ASSESSMENT OF METHODS TO IDENTIFY RURAL TRANSPORT DISADVANTAGE**

Main Author:

**Md. KAMRUZZAMAN** (University of Ulster)

Co-author(s):

**Julian HINE** (University of Ulster)

**Abstract:**

Traditionally, transport disadvantage has been identified using accessibility analysis although the effectiveness of the accessibility planning approach to improving access to goods and services is not known. This paper undertakes a comparative assessment of measures of mobility, accessibility, and participation used to identify transport disadvantage using the concept of activity spaces. A 7 day activity-travel diary data for 157 individuals was collected from three case study areas located in rural Northern Ireland. A spatial analysis was conducted to select the case study areas using criteria derived from the literature. The criteria are related to the levels of area accessibility and area mobility which are known to influence the nature of transport disadvantage. Using the activity-travel diary data individuals weekly as well as day to day variations in activity-travel patterns were visualised. A model was developed using the ArcGIS ModelBuilder tool and was run to derive scores related to individual levels of mobility, accessibility, and participation in activities from the geovisualisation. Using these scores a seven-factor ANOVA with a full factorial interaction between the factors was conducted using the general linear model (GLM) to identify patterns of transport disadvantage. This study found a positive association between mobility and accessibility. Despite a number of groups were identified as transport disadvantaged using the indicators of both mobility and accessibility in space and time, the levels of participation in activities of the identified groups did not vary significantly when compared to the advantaged groups. This suggests that participation in activities is a matter of survival in life. (...).

**Keywords:**

Accessibility, Mobility, Participation, GIS, Travel Behaviour, Transport Disadvantage.

THU 15<sup>th</sup> (09:45 - 11:00, Session D2.6) Room AIV

ID 1477 R

**TRAVELLING TO SCHOOL IN THE NETHERLANDS AND IN FLANDERS**

Main Author:

**Cornelis GOEVERDEN** (Delft University of Technology, Transport&Planning)

Co-author(s):

**Enne BOER** (TUDelft, Faculty CiTG, Dept. Transport and Planning)

**Abstract:**

School travel is highly neglected in transport science. It contributes little to today's most envisaged transport problems but it generates its own problems. The paper presents results of a study on travel behaviour of pupils travelling to primary and secondary schools. The study focuses on two aspects: home-to-school distances and modal choice. Analyses are performed for two countries, the Netherlands and Flanders. Educational policies and geographic conditions are similar in both countries. Differences in findings might be the result of differences in socio-cultural factors. Descriptive analyses demonstrate significant differences in distance distributions and modal splits in the two countries. In Flanders, distances to primary schools are on average considerably larger than in the Netherlands. Distances to secondary schools are more similar. The bicycle is the dominant mode for Dutch pupils at both shorter and longer distances (<5 km and >5 km). Flemish pupils use the bicycle predominantly at shorter distances. They are travelling larger distances more frequently by car, even to secondary schools, and they are more inclined to use public transport. Analyses of influencing variables for both home-to-school distance and modal choice prove that these are mainly explained by 'hard' factors, like locations of home and school for distances and quality of the transport modes for modal choice. However, other factors play a role as well. Their role appears to be larger for the Flemish than for the Dutch. Gender in particular is a significant variable for explaining modal choice of the Flemish. Boys are more inclined to use the bicycle than girls, while the latter more frequently use public transport. (...).

**Keywords:**

School, Home-to-school distance, Modal choice, International comparison.

ID 1897 R

**THE PSYCHOLOGY BEHIND ROAD PRICING:  
IDENTIFICATION OF SOCIO-COGNITIVE FACTORS  
INDUCING CHANGES IN ACTIVITY-TRAVEL BEHAVIOR**

Main Author:

**Mario COOLS** (*Transportation Research Institute, Hasselt University*)

Co-author(s):

**Kris BRIJS** (*Transportation Research Institute, Hasselt University, Belgium*)

**Elke MOONS** (*Transportation Research Institute, Hasselt University, Belgium*)

**Davy JANSSENS** (*Transportation Research Institute, Hasselt University, Belgium*)

**Geert WETS** (*Transportation Research Institute, Hasselt University, Belgium*)

**Abstract:**

The overall final objective of this study is to investigate the effect of road pricing on people's tendency to adapt their current travel behaviour. In order to reach this goal, a two-stage hierarchical model is estimated, concentrated around the concept of public acceptability. The research was conducted in Flanders, the Dutch-speaking region of Belgium, by means of an interactive stated adaptation survey, administered on the internet, involving 300 respondents. It is found that behavioural changes themselves are not dependent on the perceived acceptability of road pricing. In addition, earlier findings concerning the acceptability of push measures are validated, and the relevance of using latent factors rather than aggregate indicators is illustrated.

**Keywords:**

Road pricing, Socio-cognitive factors, Acceptability, Activity-travel behaviour, Stated adaptation experiment.

ID 2229 R

**MODELLING THE DYNAMICS BETWEEN SOCIAL  
NETWORKS AND ACTIVITY-TRAVEL BEHAVIOR:  
LITERATURE REVIEW AND RESEARCH AGENDA**

Main Author:

**Fariya SHARMEEN** (*Eindhoven University of Technology*)

Co-author(s):

**Theo ARENTZE** (*Eindhoven University of Technology*)

**Harry TIMMERMANS** (*Urban Planning Group, Eindhoven University of Technology, The Netherlands*)

**Abstract:**

Social networks are evidently dynamic; they evolve continuously. Our circle of friends, neighbours and contacts keeps changing with our age and lifecycle events (e.g. marriage). So do our beliefs about our (cognitive) environment, later translated into our activity-travel behaviour. To understand long-term behaviour and decision changes, it is imperative to understand these patterns in a dynamic setting. In this paper, we review the state of the art in travel behaviour research related to social networks and put forward our research concept for a project that is part of a larger research program which aims at developing dynamic activitybased models.

**Keywords:**

Dynamic, Social Network, Activity Travel Behaviour, Literature Review.



ID 2499 R

**TRIP CHAINING AND ITS IMPACT ON TRAVEL BEHAVIOURS**

Main Author:

**Catherine MORENCY** (*Polytechnique Montreal*)

Co-author(s):

**François VALIQUETTE** (*École Polytechnique de Montréal*)**Abstract:**

Historically, trips were at the basis of the main transportation models. With the increasing complexity of travel and the increasing capacities of technological and mathematical tools, models are being updated to more efficiently represent the underlying logics of travel behaviours. Activity-based models and the examination of entire trip chains have now become the focus of model development. This paper builds on large-scale travel survey data and proposes various contributions to the body of knowledge regarding trip chaining behaviours. In the Montreal Area, large scale travel surveys are conducted approximately every five years since 1970. These surveys provide rich data on the travel behaviours of around 5% of the residing population. In 2003, some 70 000 households were surveyed, providing socio-demographic details on themselves and the people they gather as well as spatio-temporal information on every trip made during a particular weekday. These data have the potential to reveal how people schedule their daily out-of-home activities and how this schedule translates into sequences of trips. This paper is twofold. It first proposes a typology of trip chains based on activity type at the destination. Anchor points, loops, embedded chains and dominant activities are defined and used for classification purposes. A hierarchical classification of simple and complex trip chains is derived and used to measure the occurrence of typical trip chaining behaviours among the active population. Indicators defining trip chains are also proposed such as dominant/secondary activity duration ratio, complexity level, eccentricity with respect to anchor point or trip length / activity duration ratio. (...).

**Keywords:**

Trip chains, Typology, Travel behaviours, Travels.

ID 2721 R

**ANALYZING WEEKLY ACTIVITY-TRAVEL BEHAVIOR FROM BEHAVIORAL SURVEY AND TRAFFIC DATA**

Main Author:

**Francesco VITI** (*CIB / Verkeer & Infrastructuur, Katholieke Universiteit Leuven*)

Co-author(s):

**Chris TAMPÈRE** (*CIB / Verkeer & Infrastructuur, Katholieke Universiteit Leuven*)**Marie CASTAIGNE** (*University of Namur*)**Fabien WALLE** (*Transportation Research Group (TRG), University of Namur*)**Abstract:**

Trips are the necessary links between activities, involving the movement from one activity location to the next, and, as such, are strongly correlated with activity timing and the chosen mode of transport. With the aim of linking measured daily traffic with travellers' weekly activity patterns, in this study we work on two complementary views of weekly mobility: the longitudinal disaggregate behavioural aspects over the week and the transversal aggregate measure of traffic for each day of the week. A sample of individuals had been selected within a study area around the city of Ghent, Belgium, and their activities and movements have been recorded and categorized with a behavioural survey. In parallel, traffic flows have been measured during the same weeks on the same area using loop detector and pneumatic tube data. By comparing the two datasets specific daily traffic patterns could be directly related to the weekly scheduling of individuals' activities, both on day-to-day and on a within-day basis. It was found that, although home-work trips are the majority on workdays they represent only less than ¼ of all daily trips. On weekends work-related trips are reduced to 5%; however, the total number of trips on Saturdays does not reduce considerably, which suggests that other purposes become much more important (e.g., shopping, sport activities). These trends are in line with the analysis of traffic flow data, where on Saturdays the total daily demand is comparable to a weekday, but the OD flow patterns are significantly different over the day. (...).

**Keywords:**

Activity-travel patterns, Behavioral survey, Traffic.

MON 12<sup>th</sup> (11:15 - 12:30, Session D3.1) Room AVIII

ID 1094 R

**IDENTIFICATION OF MONETARY TRAVEL TIME VALUATIONS FROM TRAVEL INFORMATION SEARCH PATTERNS**

Main Author:

**Harry TIMMERMANS** (*Urban Planning Group, Eindhoven University of Technology, The Netherlands*)

**Abstract:**

Motivated by the notion that data needed for the estimation of travelers' valuation of travel time (savings) is scarce, we put forward the idea that these valuations may be derived from observed travel time information searches. First, we derive a theoretical model of traveler behavior under uncertainty and information availability, which unambiguously links a traveler's decision whether or not to acquire information to his or her travel time valuation. In theory, this model provides the opportunity to derive travel time valuations from information search. Then, empirical analyses are performed, based on an artificial dataset. The empirical analyses show that information search can indeed be used to empirically identify travel time valuations: estimated parameters for monetary costs and travel time savings are statistically indistinguishable from true values for the majority of generated datasets. Although estimated travel time valuations appear to be below the true value, the differences between the two are small and mostly insignificant.

**Keywords:**

Value of time, Information acquisition, Discrete c.

MON 12<sup>th</sup> (11:15 - 12:30, Session D3.1) Room AVIII

ID 1133 R

**DEPARTURE TIME CHOICE EFFECTS OF CONGESTION CHARGES WITH AND WITHOUT TIME DIFFERENTIATION**

Main Author:

**Ida KRISTOFFERSSON** (*Royal Institute of Technology Stockholm (KTH)*)

**Abstract:**

This paper uses a simulation model to compare traffic and welfare effects of modifications in the charging schedule currently in use in Stockholm. In particular, a step toll is compared to its flat counterpart at two charging levels. The increments between steps are also increased in a peaked step toll scenario. In the model, car users have the possibility to respond to congestion charging by changing departure time, route or switch to public transport. Travel times are calculated using mesoscopic traffic simulation. The current step toll reaches the highest social surplus estimate in model predictions, but differences in traffic effects between the current step toll and its flat counterpart are rather small. Furthermore, results show that demand changes occur in the model to a considerably greater extent for trips with low value of time. The differences in welfare effects is for that reason large for different trip purposes, indicating the importance of accounting for heterogeneous trips when modelling effects of congestion charges.

**Keywords:**

Congestion Charging, Departure Time Choice, Time Differentiation, Schedule Flexibility, Traffic Simulation.

ID 1323 R

**THE TIME FACTOR IN VALUE OF HEADWAY TIME STUDIES**

Main Author:

**Thor-Erik HANSSEN** (*Bodø Graduate School of Business*)**Abstract:**

In stated choice studies, respondents' preferences are revealed by means of hypothetical choice situations. However, our preferences are affected by our recollection of prior experiences and evidence suggests that the amount of time having passed since an experience took place affects how it is recollected. When designing a stated choice study, a decision has to be made on where to approach the sample. This choice will affect how long it is since the respondents last experienced a situation similar to the hypothetical choice situations used in the survey and, as a consequence, how the respondents remember that experience. In turn, this can affect their stated preferences and the results of subsequent model estimations. The article applies a stated choice experiment distributed to two split samples differed only with respect to interview location. The aim is to assess whether the length of the time lag between respondents last travel experience with a transport mode influence their valuation of headway time. The results indicate that respondents value headway time higher when interviewed onboard ferries, shortly after experiencing the adverse effects of headway, i.e. prolonged waiting time, than they do when interviewed at home. A suggested implication is that the effect of interview location on calculated value of headway time should be taken into consideration when value of travel time studies are designed.

**Keywords:**

Value of travel time savings, Stated choice, Headway time, Interview location.

ID 1377 R

**TRAVEL-TIME RELIABILITY IMPACTS ON RAILWAY PASSENGER DEMAND: A REVEALED PREFERENCE ANALYSIS**

Main Author:

**Piet RIETVELD** (*VU University / Department of Spatial Economics*)**Abstract:**

Travel-time reliability is an important attribute of a transportation system and has been studied in many situations. In this paper we study the impact of travel time reliability on trips made by railway passengers. Unlike most of the studies in this area, which make use of stated preference survey data, we make use of a revealed preference dataset obtained by measuring the railway reliability and the number of season-ticket holders on the Dutch railway network. We make use of six travel time reliability indicators, including the standard deviation and the 80th minus the 50th percentile of travel time. Our results indicate that the 80th minus the 50th percentile indicator best explains the fluctuations in the number of season-ticket holders. A 10 per cent improvement of the indicator results in a 1.47 per cent increase in the number of season-ticket holders.

**Keywords:**

Reliability, Value of travel time, Railway reliability, Revealed preference.

MON 12<sup>th</sup> (11:15 - 12:30, Session D3.1) Room AVIII

ID 2306 R

**A MODEL OF DEPARTURE TIME CHOICE WITH LATENT CLASSES AND PEAK-HOUR AVOIDANCE REWARDING**

Main Author:

**Eran BEN-ELIA** (*Centre for Transport and Society, University of the West of England*)

Co-author(s):

**Michel BIERLAIRE** (*Transport and Mobility Laboratory, EPFL*)

**Dick ETTEMA** (*Faculty of Geosciences - Utrecht University*)

**Abstract:**

In this paper attempt to apply a continuous framework based on utility maximization (as a first stage) through optimization algorithms. The problem is specified as a schedule-delay decision. The traveler maximizes his/her utility (of time ) which is dependent on the travel time to work, the schedule delay – early and late in relation to his preferred departure time, the time dependent reward and the other factors relating to the traveler as mentioned above. Another interpretation of this framework can be through Prospect Theory, given that the preferred departure time can be used as a proxy for a reference point, the schedule delays can be regarded also as gains or losses in relation to the reference point. The results of the continuous model are compared to those obtained from the discrete model. It is postulated that the goodness of fit of the former would be significantly larger, allowing to capture a greater part of the day-to-day and between-subjects variance. This is a work in progress and we are expecting to have significant results by the deadline for paper submission.

**Keywords:**

Discrete choice, Departure time choice, Latent class, Rewards.

MON 12<sup>th</sup> (14:00 - 15:15, Session D3.2) Room AVIII

ID 1096 R

**TRAVEL BEHAVIOR RELATED DETERMINANTS OF MENTAL MAP QUALITY: AN EMPIRICAL STUDY**

Main Author:

**Harry TIMMERMANS** (*Urban Planning Group, Eindhoven University of Technology, The Netherlands*)

**Abstract:**

This paper presents the results of an empirical study into mental map formation and the role of travel behavior and sociodemographic factors as determinants of mental maps. Data on stated mental map types and quality, revealed mental map quality, travel behavior and sociodemographics are collected for 576 students of Eindhoven University of Technology, and relations are examined using a variety of univariate, bivariate and multivariate analyses. A number of results are obtained. For example, our analyses support results obtained in a recent study into the role of travel mode-choice as a determinant of revealed mental map quality: traveling by means of active modes, requiring active navigation of the traveler, leads to higher quality mental maps. We find strong effects for both the car and bicycle modes (relative to using the more passive bus-mode). In addition, a range of other new findings is reported. For example, there appears to be a rather strong correspondence between stated mental map quality and actual, revealed quality. This correspondence, however, is relatively weak among men (who overestimate their mental map quality when compared to women), Architecture students (who underestimate the quality of their mental map when compared to students at other departments) and residents of Eindhoven (who underestimate the quality of their mental maps relative to non-residents).

**Keywords:**

Mental map, Travel behavior, Mode choice.

ID 2172 R

**AN INTEGRATED APPROACH ANALYZING THE HOUSEHOLD VEHICLE TYPE CHOICE, TRAVELLING DISTANCE, AND HOLDING DURATION BASED ON A COPULA MODEL**

Main Author:

**Masashi KUWANO** (*Graduate School of Engineering, Hiroshima University*)

Co-author(s):

**Akimasa FUJIWARA** (*Graduate School for International Development and Cooperation, Hiroshima University*)**Junyi ZHANG** (*Graduate School for International Development and Cooperation, Hiroshima University*)**Makoto TSUKAI** (*Hiroshima University*)**Abstract:**

The objectives of this study are twofold: 1) to develop an integrated approach analyzing the vehicle type choice, annual travelling distance, and holding duration by simultaneously consider the correlations between the three behaviours, and 2) to demonstrate the changes in CO2 emissions under different taxation policies. In order to develop the integrated approach, focusing on stages of vehicle usage and vehicle ownership, this study proposes a Copula-based Multivariate Survival (CMS) model of holding duration and annual travelling distance. A Paired Combination Logit (PCL) is applied in order to model the vehicle type choice, and then the estimated PCL model is further incorporated into the CMS model. An empirical analysis was carried out by using a data set collected in the Chugoku region of Japan, 2006. Model estimation results empirically confirmed the effectiveness of the suggested approach. The estimation results also showed that the vehicle holding duration has the negative correlations with expected utilities of vehicle type choice and with vehicle usage. Through the simulation analysis about vehicle-related taxes, it was clarified that to increase fuel tax is the most effective in to reducing the CO2 emissions, followed by auto tax and weight tax at the vehicle inspection. Moreover, it was observed that the increases in acquisition tax contribute to increase CO2 emissions.

**Keywords:**

Integrated approach, Vehicle type, Annual travelling distance, Holding duration, Copula.

ID 2212 R

**FROM MOBILITY MANAGEMENT AND MULTILEVEL MODELLING TOWARDS MODELLING MOBILITY AND MULTILEVEL MANAGEMENT**

Main Author:

**Thomas VANOUTRIVE** (*University of Antwerp - Ghent University*)

Co-author(s):

**Laurent VAN MALDEREN** (*FUCaM (Facultés Universitaires Catholiques de Mons)*)**Bart JOURQUIN** (*Louvain School of Management*)**Isabelle THOMAS** (*Université Catholique de Louvain-la-Neuve (UCL)*)**Ann VERHETSEL** (*University of Antwerp*)**Frank WITLOX** (*Ghent University*)**Abstract:**

Governments worldwide aim to decrease the number of Single Occupant Vehicle (SOV) users to reduce traffic congestion and other transport-related problems. The according policies are often termed Mobility Management (Europe) or Travel/Transportation Demand Management (USA) to stress that the focus is on demand management in stead of infrastructure supply. Policy makers often target the home to work travel and as a consequence, employers and their employer transport plans play a significant role in the Mobility Management debate. However, researchers often pay little attention to the workplace, and the promotion of SOV-alternatives there. The Belgian questionnaire Home To Work Travel now enables us to fill this gap because the acquired database takes as viewpoint the workplace. This dataset contains workplace characteristics like size, economic sector and work regimes. However, also contextual factors influence employee travel behaviour. Multilevel regression models allow to incorporate variables both at the workplace and at higher levels (e.g. municipality; city-region). By modelling these different scales simultaneously, contextual factors can be separated from compositional ones. In other words: the central research question is whether the modal split on a worksite is caused by its location in a given area, or by the workplace characteristics itself? (...).

**Keywords:**

Mobility management, Transportation demand management, Employer transport plans, Commuting, Multilevel modelling, Belgium.

ID 2641 R

**LOCATION EFFECTS ON TRIP GENERATION:  
EVIDENCE FROM MADRID METROPOLITAN AREA**

Main Author:

**Lissy LA PAIX** (*Centro de Investigación del Transporte, TRANSyT- UPM.*)

Co-author(s):

**Andres MONZON** (*Universidad Politécnica de Madrid*)**Elisabetta CHERCHI** (*University of Cagliari*)**Abstract:**

The relationship between land use and travel patterns has been studied in a number of cases, using several methods - aggregate and disaggregate approaches - and different focuses - trip frequency, automobile use, vehicle miles travelled and so on. Definitely, travel is generated by the need to undertake activities and obtain services, and there is a general consensus that urban components affect travel behaviour. However researches are still needed to better understand which components of the travel behaviour are affected most and by which of the urban components. This paper studies the effect on trip frequency, public transport and private vehicle dependency of socio-economic, transport and land use characteristics. In particular the land use is defined in terms of type of neighbourhoods and types of dwellers. Methodological attributes are also included to test the effect of the type of survey, namely trip-based versus activity-based survey. Using a data-base from a survey conducted in 2006 and 2007 in Madrid, ordered probit models are estimated to analyse the effect of neighbourhood type and socio-economic characteristics on trip frequency, public transport and private vehicle use. Our results show that the characteristics of the neighbourhoods are important to explain the trip frequency but the effect is quite different depending on the mode used for the trips. Our results confirm that living in low density increases the propensity to use the private vehicles, while it does not seem to have an impact on the propensity to make internal trips, i.e. with origin and destination in the same area. We also found that there is a positive correlation between the number of trips and the number of stops but only if the trips are made with the private vehicles while are not significant for the public transport. (...).

**Keywords:**

Ordered probit models, Land-use, Trip frequency, Auto-oriented lifestyle.

ID 2738 R

**MOBILITY CULTURE IN URBAN AREAS - A  
COMPARATIVE ANALYSIS OF GERMAN CITIES**

Main Author:

**Thomas KLINGER** (*Goethe-University Frankfurt am Main*)

Co-author(s):

**Martin LANZENDORF** (*Goethe-University Frankfurt am Main*)**Jeffrey R. KENWORTHY** (*Goethe-University Frankfurt am Main*)**Abstract:**

The aim of this paper is to combine the rather 'objective' urban form with the rather 'subjective' attitude and lifestyle approach to develop and test empirically a theoretical and integrated framework, the mobility culture approach, for the analysis of metropolitan areas. We derive a set of objective and subjective indicators for assessing the mobility culture of cities. With the sample of 44 German cities, we apply the indicators empirically and derive six clusters with distinct 'mobility cultures'. Eventually we discuss the profiles of the specific mobility cultures with a focus on the interdependence between objective and subjective data. With the empirical case study we want to show the usefulness of the mobility culture theory both for empirical work and for policy applications. The paper is structured as follows. After reflecting both strands of research (section 2) this paper draws upon the mobility culture concept, which tries to bridge the explanatory gap by including both, objective parameters like urban form and aggregate socio-economic variables as well as subjective characteristics such as travel behavior and mobility-related attitudes and preferences. The term urban mobility cultures encompasses both material and symbolic elements of a transport system as part of a specific socio-cultural setting, which consists of mobility-related discourses and political strategies on the one hand and institutionalized travel patterns and the built environment on the other hand (Deffner et al. 2006: 16, Götz and Deffner 2009). The concept will be discussed in section 3. In section 4 we operationalize the theoretical approach of urban mobility cultures by choosing a set of 25 indicators, which reflects the particular elements of the concept. (...).

**Keywords:**

Mobility culture - travel behavior - attitudes - I.

ID 2038 R\*

**A STABILITY TEST OF SPATIAL INTERACTION MODELS IN SEOUL PUBLIC TRANSPORT SYSTEM REFORM**

Main Author:

**Chansung KIM** (*The Korea Transport Institute*)

Co-author(s):

**Sung-Mo SUNG** (*The Korea Transport Institute*)**Seung-Il SHIN** (*Seoul Development Institute*)**Dongjoo PARK** (*University of Seoul*)**Abstract:**

Various urban transport policies have an effect on urban transit riderships. This study reports metropolitan subway ridership patterns affected by an enormous change in bus routes and transfer discount fare policy between subway and bus mode conducted by Seoul city in July 1st of 2004. In an effort to see the difference of ridership patterns between the before and the after fare change policies, two data sets are prepared and spatial interaction models incorporating accessibility are used. On a daily basis, an origin-destination trip table of May of 2004 is used. On a daily basis, an origin-destination trip table of August-September of 2004 is used as a counter measure. In this study, the stability of spatial interaction models by random shock such as fare change were scrutinized and interpreted in detail.

**Keywords:**

Public transport system reform, Accessibility, Spatial Interaction, Trip distribution, Subway.

ID 2213 R

**TO CYCLE OR NOT TO CYCLE? FACTORS INFLUENCING THE DECISION TO USE THE BICYCLE AS ACCESS MODE TO PUBLIC TRANSPORT**

Main Author:

**Flavia DE SOUZA** (*ITC*)

Co-author(s):

**Milena BODMER** (*UFRJ*)**Mark ZUIDGEEST** (*ITC*)**Mark BRUSSEL** (*ITC*)**Sherif AMER** (*ITC*)**Abstract:**

The role of the bicycle as a feeder mode to public transport (PT) is often neglected by researchers, transport planners and policy makers. In Brazil, previous surveys show that the share of multimodal trips in Rio de Janeiro is quite high. Better understanding the main combinations of modes in the public transport trip chain is relevant when referring to PT trips, because all PT trips require an access trip. The modal share of PT and Non-Motorized Transport (NMT) in Rio de Janeiro indicates a high share of both modes. In this context a better insertion of the bicycle in integration with PT may increase the competitiveness of these sustainable modes, which may lead to a higher quality transport system. This paper presents the preliminary results of a survey conducted with 722 Public Transport users to investigate the main factors influencing the potential for bicycling to PT in two different areas of Rio de Janeiro, Brazil. It is hypothesized that socioeconomic, transport and location factors may influence this potential. By analyzing the frequencies of access mode attributes, barriers and opportunities for bicycling, target groups are defined and the factors affecting each group are presented. Finally, recommendations are suggested in order to reveal the potential for bicycle in the case study areas.

**Keywords:**

Bicycle potential, Access mode, Integration, Public transport, Mode choice.

ID 2341 R

**ASSESSING TRANSIT LOYALTY WITH SMART CARD DATA**

Main Author:

**Martin TRÉPANIÉ** (*École Polytechnique de Montréal*)

Co-author(s):

**Catherine MORENCY** (*Polytechnique Montreal*)

**Abstract:**

Smart card data systems have mainly been considered for their administrative function of collecting revenues and controlling access to the transit network. Smart card is a convenient way of collecting fares, especially when there are multiple modes and operators. But these systems also generate large amount of data regarding the daily use of the transit network. The aim of this study is to develop methods and models to characterize transit loyalty (rider retention) with the help of smart card fare collection system data. The paper characterizes loyalty in relation with some factors, such as "birth date", fare type, and home location.

**Keywords:**

Smart card public transport (transit) transit lo.

ID 2557 R

**IS THE USE OF INFORMAL PUBLIC TRANSPORT MODES IN DEVELOPING COUNTRIES HABITUAL? AN EMPIRICAL STUDY IN DAVAO CITY, PHILIPPINES**

Main Author:

**Marie DANIELLE GUILLEN** (*Transportation Science Society of the Philippines*)

Co-author(s):

**Haruo ISHIDA** (*University of Tsukuba, Urban Transportation Lab., Graduate School of Systems and Information Engineering, Japan*)

**Abstract:**

Many cities of developing countries are characterized by the presence of its unique kind of public transportation often described as informal. It is often noted that the lower income category of people are usually the ones who rely on informal public transport services. There is an assumption that public transport dependency on certain mode is due to the unavailability of modal choice. This is usual explained by the theory of rational behaviour. The theory of planned behaviour or habit is seldom used. Using Davao City, Philippines as the case study area, the paper explored the concept of public transport dependency to the different road-based public transport modes. Empirical results using structural analysis shows that habit is a strong indicator of public transport use in the case study area where half of the household population has vehicles. This indicator is validated by the actual use of public transport modes especially the indigenous and informal types for short-distance trips. Habits are not easily altered as shown in many studies, these findings suggest that careful review of key detailed issues such as the overall quality of service level and the associated items regarding indigenous and/or informal public transport modes is necessary before suggesting specific policy or planning interventions.

**Keywords:**

Habit, Modes, Informal.



ID 2793 R

**THE VALUATION OF RELIABILITY FOR TRANSFER (TWO-LEG) BUS JOURNEYS**

Main Author:

**James COLLINS** (*Parsons Brinckerhoff*)

Co-author(s):

**Pedro ABRANTES** (*Institute for Transport Studies*)**Phani CHINTAKAYALA** (*University of Leeds*)**Abstract:**

In spite of some seminal work into the valuation of travel time reliability in the 1990s (see, for example, Noland and Small, 1995 and Bates et al., 2001) this has led to only a handful of published empirical studies over the past 10 years (Hollander, 2006; Asensio and Matas, 2008). One particular problem that has received virtually no attention in the literature is how passengers weigh up and respond to the reliability of the different legs of complex public transport journeys. In this context, the reliability of one leg can have a very significant impact on total travel time due to the risk of a missed connection so it is likely that passengers will rate reliability even higher than for a single leg journey. This paper reports the results of a stated preference survey aimed at understanding passengers' behavioural responses to the reliability of a two legged urban bus journey in an urban context involving a transfer or interchange at a central station. An initial focus group was held to try to gain an insight into bus user and non-user attitudes and responses to reliability for this kind of journey. As a result we developed the hypothesis that individuals will ensure that they do not miss their connection at the interchange point, and thus reliability of the first leg of a trip can be measured by the extent to which individuals will choose to depart earlier instead of having shorter mean journey and wait times. An online stated preference (SP) study was developed and implemented to measure the willingness to trade between expected wait time/journey time and reliability. Two main ways of measuring reliability have been proposed in the literature: the mean-variance approach which considers individuals trade off standard deviation of travel time against mean travel time; and the schedule disutility approach which assumes individuals trade off mean journey time against expected earliness or lateness at the destination. (...).

**Keywords:**

Reliability, Interchange, Transfer, Schedule Disutility, Timetabling.

ID 1397 R

**THE ROLE OF ATTITUDES TOWARD THE CHARACTERISTICS OF BICYCLE COMMUTING ON THE CHOICE TO CYCLE TO WORK AT VARIOUS DISTANCES**

Main Author:

**Eva HEINEN** (*Delft University of Technology*)

Co-author(s):

**Kees MAAT** (*Delft University of Technology*)**Bert VAN WEE** (*Delft University of Technology*)**Abstract:**

This paper analyses the influence of the attitudes towards bicycle characteristics (e.g. convenient, cheap, health) on the decision of being a commuter cyclist and on the decision to cycle to work every day. We assume that when the commute journey intensifies, either by distance or frequency, the attitudes towards cycling are more positive. Factor analyses revealed three underlying attitudinal factors towards cycling to work: awareness, direct tripbased benefit and safety. The decision to cycle to work is influenced by the factor 'direct tripbased benefit' at all distances, whereas the factor 'awareness' is only influential at long distances. The decision to cycle every day to work is again affected by the factor 'direct benefit'. The factors 'safety' and 'awareness' are important on shorter distances. Having a cycling habit increases the likelihood to cycle and to cycle with a higher frequency. The explaining power of the models on the bicycle mode choice is high. These findings indicate that attitudes and other psychological factors have a relatively strong impact on the commute bicycle mode choice.

**Keywords:**

Bicycle use attitudes travel distance mode choi.

ID 2530 R

**CHILDREN'S TRAVEL BEHAVIOUR AND ITS IMPLICATIONS FOR THEIR HEALTH**

Main Author:

**Roger MACKETT** (*University College London*)**Abstract:**

Children's travel behaviour is different from that of adults in several ways, for example, they have less choice about where they go, because parents control many of their trips, and they are often not allowed to travel unescorted by an older person, so there tend to be interdependencies with other people's travel. There have been a number of changes in the factors that influence children's travel behaviour in recent years, including the development of car-oriented lifestyles, increased numbers of mother in employment, and changes in attitudes towards children's independent mobility. The purpose of this paper is to examine the nature of children's travel behaviour, and the implications of this for their volumes of physical activity and so for their health. The paper draws upon research carried out in projects carried out at the Centre for Transport Studies at University College London on children's travel and physical activity. The paper commences by considering the nature of children's travel and how it differs from that of adults. Trends in children's travel and the influence of factors such as the effects of increasing separation of home and school and children's independent mobility are considered. The impacts of children's travel patterns on traffic and on their health are discussed. Having shown that the trends in children's travel behaviour are causing reductions in their volumes of physical activity, a number of actions being adopted in Britain to try to reverse the trends, are described. Conclusions are drawn in terms of the implications for policy and how some of the difficult issues raised in the paper can be addressed.

**Keywords:**

Children, Travel behaviour, Health, Physical activity.

ID 2623 R

**UNDERSTANDING WALKING AND CYCLING: INTERIM FINDINGS FROM A MULTI-METHOD APPROACH TO INVESTIGATE HOUSEHOLD DECISION MAKING IN RELATION TO SHORT JOURNEYS IN URBAN AREAS**

Main Author:

**Tim JONES** (*Oxford Brookes University*)**Abstract:**

It is widely recognised that an increase in walking and cycling for short journeys in urban areas could help to reduce traffic congestion, improve the quality of the urban environment, promote improved personal health, and contribute to a reduction in carbon emissions. This paper reports interim findings from an ongoing 3-year UK Research Council funded study (commenced October 2008) titled 'Understanding Walking and Cycling' (UWAC) which investigates travel behavior in relation to short journeys in urban areas in England. The study adopts an innovative multi-method approach which includes; large-scale social surveys of households across four cities in England that vary in relation to demographic characteristics and level of supportive measures for walking and cycling; measurement of the built environment and analysis of the spatial network; and finally, in depth-qualitative investigation of households using an ethnographic approach and a range of methods including observation, in-depth ('sit-down') interviews, 'go-along' interviews (or accompanied trips), mobility inventories, mapping exercises and reflexive accounts of everyday travel using diaries. This paper focuses specifically on the rationale behind the methods used to uncover rich accounts of travel decision making and journey experience. Interim findings are presented which demonstrate how ethnographic approaches can provide more detailed and nuanced accounts of everyday travel. The results provide an empirical insight into the complexities of everyday travel, specifically in relation to the decision making strategies adopted in relation to short journey making and the actual lived experience of those journeys. The paper will conclude with reflection on the strength of adopting a multi-method approach to understanding travel behaviour. (...).

**Keywords:**

Walking, Cycling, Household decision making, Ethnography.

ID 2702 R

**MODELING OF REPOSITIONING ACTIVITIES IN BIKE-SHARING SYSTEMS**

Main Author:

**Patrick VOGEL** (*TU Braunschweig*)

Co-author(s):

**Dirk CHRISTIAN MATTFELD** (*Technische Universität Braunschweig*)**Abstract:**

Climate changes, declining inventories of fossil fuels, high space requirements, noise emission and congestion are only a few reasons why conventional cars are in discussion as individual means of transportation in cities. Bikes receive increasing attention in city transportation, mainly because they reach areas in cities that do not have direct access to public transport. Furthermore they do not contribute to congestion or pollution of the environment. The implementation of information systems in traditional bike renting leads to bike-sharing systems providing easy and quick city wide access. Thus, bike-sharing systems have rapidly emerged in major cities all over the world in recent years. The planning and operations of such systems receive attention in academia as well as in practice. However, scientific literature in this field is still rather scarce. Recent articles focus on mainly practical advises. Some analyze bike-sharing data to get insights into customer behavior and for predicting the future number of rentals. A common issue observed in modern bike-sharing systems is imbalance in the spatial distribution of bikes over time caused by one-way use and short hiring times of bikes. The availability of bikes (= probability of successful bike rental) decreases nonlinearly with the number of requesting customers in the system. The active repositioning of bikes to stations of potential customer requests supports the objective of maximizing the availability of service. Spatiotemporal modeling of repositioning activities for bike-sharing systems is a complex decision support task, which involves extensive data analysis or customer surveys to determine bike demand at stations and creating a suitable optimization model. (...).

**Keywords:**

Bike-sharing systems, Repositioning activities, System dynamics.

ID 2825 R

**PEDESTRIAN GAP ACCEPTANCE FOR MID-BLOCK STREET CROSSING**

Main Author:

**George YANNIS** (*National Technical University of Athens, Department of Transportation Planning and Engineering*)**Abstract:**

This research aims to investigate pedestrians traffic gap acceptance for mid-block street crossing in urban areas. In particular, two aspects of pedestrians crossing behaviour at midblock locations are examined, namely the size of traffic gaps accepted by pedestrians and the decision or not to cross the street, as well as the related determinants. For this purpose, a field survey was carried out at an uncontrolled mid-block location in the centre of Athens, Greece. In this survey, pedestrians crossing decisions were videotaped in real traffic conditions. At the same time, the speed of incoming vehicles was measured by means of speed guns. The data collected included the number and the size of traffic gaps rejected or accepted by pedestrians, the related waiting times and number of crossing attempts, the vehicle's speed, as well as individual characteristics (gender, age etc.). A lognormal regression model was then developed in order to examine the effect of various parameters on pedestrian gap acceptance, defined as the size of traffic gaps accepted by pedestrians. It was found that pedestrian's gap acceptance was better explained by the distance from the incoming vehicle, rather than its speed. Moreover, the presence of illegally parked vehicles (which may affect pedestrians' visibility), the size of the incoming vehicle and the presence of other pedestrians were found to have important effect on the size of traffic gaps accepted by pedestrians. A binary logistic model was also developed in order to examine the effect of the traffic gaps available and of other parameters on the decision of pedestrians to cross the street or not. The modeling results reveal that this type of crossing decision is largely defined by the distance from the incoming vehicles and the waiting time of pedestrians. (...).

**Keywords:**

Pedestrian, Mid-block crossing, Gap acceptance, Lo.

TUE 13<sup>th</sup> (08:15 - 09:30, Session D3.5) Room AVIII

ID 1045 R

**CAR DRIVERS' PREFERENCES REGARDING PARKING AT INDUSTRIAL PARKS: A STATED CHOICE APPROACH**

Main Author:

**Peter VAN DER WAERDEN** (*Eindhoven University of Technology*)

**Abstract:**

This paper presents the results of a study on car drivers' preferences regarding parking facilities at industrial parks. An internet based questionnaire is set up to collect car drivers' importance scores regarding various parking choice related aspects. In addition, a stated choice experiment is set up to investigate car drivers' preferences in more detail. It appears that parking costs, ease to find a free parking space, distance between parking and final destination, and safety of the car driver are important aspects for car drivers when choosing a parking space. The average importance scores are related to the personal characteristics gender, age, and education. The stated choice experiment mainly confirms these findings.

**Keywords:**

Parking, Industrial parks, Stated choice.

TUE 13<sup>th</sup> (08:15 - 09:30, Session D3.5) Room AVIII

ID 2367 R

**TOWARDS A BETTER UNDERSTANDING OF MODAL CHOICES FOR LEISURE TRIPS**

Main Author:

**Veronique VAN ACKER** (*Ghent University, Department of Geography*)

Co-author(s):

**Patricia MOKHTARIAN** (*University of California Davis, Civil and Environmental Engineering*)

**Frank WITLOX** (*Ghent University*)

**Abstract:**

Most studies on the link between the built environment and travel behaviour use objective or "hard" variables to estimate and model this relationship. For example, the built environment is usually characterized by such variables as population density, land use mix, jobs-housing balance and accessibility. Recently, an increasing number of researchers argue in favour of including more subjective or "soft" variables as well. After all, it is possible that different travel patterns exist within socio-economically and socio-demographically homogeneous population groups. Transport behavioural analysts have been aware of this for some time, and many studies discuss the role of attitudes in travel behaviour decisions. However, these studies tend to neglect the link with the built environment. Only recently, subjective variables were introduced in empirical work on the relationship between the built environment and travel behaviour. Most of these studies focus on the subjective perception of the built environment and the inclusion of location attitudes only, resulting in models that both take account of the objective and subjective characteristics of the built environment. Expanding the analysis to also include both objective and subjective personal characteristics (i.e., stage of life, gender and lifestyles) and travel characteristics (i.e., car availability, general travel attitudes and specific travel mode attitudes) is the purpose of this paper. Moreover, we are aware of the increasing complexity of travel models due to issues such as residential self-selection, mediating variables such as car ownership, and bidirectional relationships between attitudes and behaviours. The aim of this paper is to unravel these complex relationships using structural equations models, and to discuss the added value of including subjective variables into the analysis. (...).

**Keywords:**

Attitudes, Lifestyles, Self-selection, Modal choice, Leisure, Structural equations models.

ID 2803 R

**MODELLING TRAVEL WELL-BEING AND MODE CHOICE BEHAVIOR**

Main Author:

**Amalia POLYDOROPOULOU** (*University of the Aegean*)

Co-author(s):

**Susana LIMÃO** (*EPFL*)**Camila GARCIA** (*Instituto Superior Técnico*)**Nikolaos LITINAS** (*University of the Aegean*)**André DUARTE** (*TU-Delft*)**Abstract:**

The present paper attempts to incorporate the concept of happiness or subjective well-being (SWB) in travel decisions. It aims at understanding the travel well-being of individuals and modelling the relationship between satisfaction/happiness and travel decision making. The research is based on an on-line survey launched between November 30, 2008 and April 20, 2009. The survey incorporated innovative Stated Preferences experiments capturing two different aspects of subjective well-being: (1) The notion of level of comfort regarding two modes of transport, namely car and metro, is represented via the presentation of cartoons. This level of comfort may also reflect part of the trip-specific well-being as it is perceived by travellers. (2) Indicators of the expected level of happiness with the chosen mode are recorded after each mode choice experiment. The paper presents, on the one hand, the estimation of a transport mode choice model taking into account just the trip specific well-being, along with other explanatory variables. On the other hand, a hybrid choice model is developed, which incorporates the indicators of happiness as indicators of the overall utility of the mode, together with the stated choice indicator. This model structure significantly improves the goodness of fit in comparison with the first estimated model. The conclusions to be drawn may contribute to an enhanced understanding of the transport market demand and thus to the improvement of strategic decisions to be made by policy makers.

**Keywords:**

Transport Surveys, Travel Well-being, Subjective Well-being, Mode Choice Models, Trip-specific Happiness, Hybrid Choice Model.

ID 2913 R

**THE IMPACTS OF LAND USE AND URBAN FORM ON TRAVEL BEHAVIOR: A PARCEL-LEVEL DESTINATION CHOICE MODEL APPLIED TO SOUTHEAST FLORIDA**

Main Author:

**Abdulnaser ARAFAT** (*University of Florida*)

Co-author(s):

**Ruth STEINER** (*University of Florida*)**Siva SRINIVASAN** (*University of Florida*)**Abstract:**

The coordination between land use and transportation has been the focus of several research studies. Land use and transportation research identify the relationship between land use and transportation as being bi-directional: the impact of transportation on land use (captured via the accessibility measure); and the impact of land use on transportation (captured via land-use descriptors such as diversity, density, design, destinations and distance). The focus of this research is on the latter effect. In this context, discrete-choice models have been used to capture the effect of traveler demographics, transportation-network and other spatial variables on the choice of destinations for various trip purposes. However, many of these studies have focused on modeling destination choices at the coarser spatial resolution of Traffic Analysis Zones (TAZs) and have incorporated relatively fewer land-use descriptors in their models. The main purpose of this paper is to study the impact of land use and urban form on destination choice for shopping activities using discrete choice models. Land parcels will be used as the spatial resolution of the destination choices. The research will employ the regional travel survey data from Southeast Florida (Miami-Dade, Broward, and Palm Beach Counties) and very detailed parcel level land use data from the region. Several land use and urban form indices will be used including the density, land use mix, accessibility, connectivity and distance.

**Keywords:**

Destination Choice Modeling, Land use and transpor.

TUE 13<sup>th</sup> (08:15 - 09:30, Session D3.5) Room AVIII

ID 2938 R

**EFFECTS OF URBAN FORM, DENSITY AND LAND VALUE ON URBAN MOBILITY IN LARGE METROPOLITAN AREA: ISTANBUL, TURKEY**

Main Author:

**Darcin AKIN** (*GEBZE INSTITUTE OF TECHNOLOGY*)

Co-author(s):

**Mehtap CELIK** (*Gebze Institute of Technology*)

**Abstract:**

Relationship between the urban transportation system and city form is always of an interest by many researchers. It is very well known that this relationship is a two-way interaction. Spatial interaction on the urban land among different levels of subcenters and the city centre is made possible through the transportation system. If accessibility is improved for a particular land through the expansion of the current transportation system, the interaction between that part and the rest of the city increases based on the characteristics of the transport system provided. To understand this relationship between the urban form and the transportation system, in this paper, it is attempted to investigate the effects of urban structure (form, density and land value) on urban mobility in the city of Istanbul, Turkey. It is concluded that people living in city centers or urbanized areas present different transport behaviors than those living in suburbs or rural areas due to the differences in the level of service provided by the transportation system.

**Keywords:**

Travel survey, Mobility, Trip rate, Urban form, Density, Land value, Istanbul.

TUE 13<sup>th</sup> (09:45 - 11:00, Session D3.6) Room AVIII

ID 1696 R

**BUILT ENVIRONMENT AND ACTIVE TRAVEL BEHAVIOR OF CHILDREN: RESULTS OF A BAYESIAN BELIEF NETWORK**

Main Author:

**Astrid KEMPERMAN** (*Eindhoven University of Technology*)

Co-author(s):

**Harry TIMMERMANS** (*Urban Planning Group, Eindhoven University of Technology, The Netherlands*)

**Abstract:**

In this study the participation of children in walking and bicycling activities for all purposes, and the relation with socio-demographic and environmental characteristics is examined. Specifically, a Bayesian belief network is proposed that derives and represents all direct and indirect relationships between the variables. Detailed individual travel data, including all walking and bicycling trips from a random sample of 4293 children in the primary school age category in the Netherlands are investigated. The participation in active travel behaviour has a direct relationship with all trip characteristics such as travel time and distance, and trip purpose. Furthermore active travel behaviour is related to the age of the child and the car possession of the household. The degree of urbanization has a strong direct influence on mode choice and therefore is an important explanatory variable for walking and bicycling of children. All the other environmental characteristics have an indirect influence on travel mode choice; they are directly related to the urban density level.

**Keywords:**

Children, Physical activity, Walking and bicycling, Bayesian belief network.

ID 1796 R

**BEHAVIOURAL RESPONSES TO PAYD: AN EMPIRICAL STATED CHOICE STUDY IN THE NETHERLANDS**

Main Author:

**Jasper KNOCKAERT** (*Department of Spatial Economics, VU University Amsterdam*)

Co-author(s):

**Jessie BAKENS** (*Department of Spatial Economics, VU University Amsterdam*)**Erik VERHOEF** (*Department of Spatial Economics, VU University Amsterdam*)**Michiel BLIEMER** (*Delft University of Technology*)**Abstract:**

Pay as you drive (PAYD) is a form of road pricing that focuses on differentiating the insurance cost in order to better match the actual risk of driving a car. It is well known that this risk is closely related to driver behaviour, both through the annual distance driven as well as through other behavioural dimensions such as speed, time of day, etc. The traditional annual insurance fee largely fails to reflect these behavioural variations. As technological possibilities to monitor car driver behaviour in great detail become available, insurance companies get interested in the possibilities to stimulate drivers to change their behaviour such as to result in a reduction of insurance claims. But there is also a potential general welfare improvement to be expected when marginal transport costs better match (external) damage costs. In order to study behavioural responses to differentiated PAYD insurance schemes, a conjoint choice experiment was conducted in the Netherlands. The experiment involved about 250 car drivers with a high risk profile (age<26y). Each of the participants was presented with nine fictitious choice situations carrying three travel alternatives for a trip. Each choice situation consisted of two alternative car trips and one public transport travel option. Also the option was available to choose for a different transport mode or not to travel at all under the given circumstances. The presented car travel alternatives were specified using a number of pricing and safety related attributes, including fuel cost, insurance cost, travel time, road type and speeding. (...).

**Keywords:**

Conjoin choice experiment, Discrete choice, Pay as.

ID 2472 R

**DEVELOPMENT OF BEHAVIOURAL MODELS OF TRAVEL FOR METROPOLITAN AREAS**

Main Author:

**Padmini GUDIPUDI** (*IIT Bombay*)

Co-author(s):

**Sunder LALL DHINGRA** (*Indian Institute of Technology - Bombay*)**Abstract:**

Urban population in India is growing rapidly from the last two decades; from this metropolitan cities are worst hit due to fast trends of urbanization. Because of urbanization the crisis pertaining to metropolitan areas is role of transport. To overcome transportation problems proper mass transportation facilities are required, to provide new transport facilities study of commuters behaviour is an important aspect. More number of attempts has been made by the researchers to develop integrated urban activity and mass transport models for metropolitan areas. But these were not explored fully for metropolitan areas. For study region Pune, (India) population density increased clustering and land use mix, infill development of vehicle traffic can reduce public costs. At the same time, income growth encourages car ownership, followed by a modal shift from public transport to road oriented transport mode. Discrete choice models for vehicle ownership models and mode choice models are developed for Pune metropolitan area. Car and Two wheeler (TW) ownership models are developed using Revealed preference (RP) data obtained from HIS data of Pune. Data base is prepared for Mode choice using skims extracted from the CUBE for Pune network and based on Home Interview Survey (HIS) data. Mode choice model is developed using that data set. Types of alternative modes considered in the preparation of mode choice model are walk, car, TW and Public transport (PT). Though all the models have logical and statistical significance prediction success tables are written to find out the goodness of fit of the models developed. From the prediction success tables of the models it was observed that goodness of fit of the model is satisfactory. (...).

**Keywords:**

Revealed preference (RP), Stated Preference (SP), Vehicle ownership Models, Mode choice models, Prediction success table.

ID 2737 R

**THE INFLUENCE OF SOCIAL TIES ON SOCIAL AND RECREATIONAL ACTIVITY PARTICIPATION AND TRAVEL OF VARIOUS ETHNIC GROUPS IN THE NETHERLANDS**

Main Author:

**Dick ETTEMA** (*Faculty of Geosciences - Utrecht University*)

**Abstract:**

A well established literature has demonstrated the relationship between size and composition of social networks and engagement in social and recreational activities and travel. However, less attention has been given to the issue of how the influence of social networks on activity participation differs between individuals from different backgrounds. The paper addresses this issue in the context of differences between ethnic groups. First, the potential roles of various types of social networks for engagement in social/recreational activities are discussed and differences in this respect between ethnic groups, discussed in the literature, are discussed. Next, using a Dutch data set of activity engagement in social/recreational activities of different ethnic groups in the Netherlands, the influence of involvement in different social networks (family, friends, associations) on the participation in social/recreational activities is investigated by estimating ordered logit models for ethnic groups separately. Special attention is given to the role of inter-ethnic contacts. The results suggest that interactions with friends and family and associational membership are more important for individuals from ethnic minorities than for native Dutch to facilitate engagement in social activities such as seeing a play, sightseeing and visiting a restaurant. For sports, differences are less pronounced. Inter-ethnic contacts generally increase engagement in social-recreational activities, although the effect is not equally clear for all ethnic minorities.

**Keywords:**

Travel, Activities, Social networks, Recreation, S

ID 2744 R

**WHOM TO HANG OUT WITH: AN ANALYSIS OF COMPANY IN SOCIAL AND RECREATIONAL ACTIVITIES**

Main Author:

**Dick ETTEMA** (*Faculty of Geosciences - Utrecht University*)

**Abstract:**

Over the past decade there has been an increasing interest into to role of social interactions and social networks for activities and travel. This coincides with a growing awareness that social and recreational trips make up a considerable share of total mobility and deserve more attention in order to understand trends in mobility. Given this trend remarkably little attention has been given to the investigation of the choice of company for social and recreational activities and travel. This paper contributes to filling this gap, by presenting estimation results of models of company choice for social activities, shopping, sport and recreation and cultural activities, based on activity diary data collected in 2007 in the Netherlands. Specific attention is given to the influence of urban form and accessibility of services on company choice. The estimation results suggest that accessibility of facilities has an impact on company choice. However, the mechanisms seem to differ between activity types. For social activities, shopping and sports/recreation, it seems that better access to facilities leads to more joint activity participation, presumably because coordination between involved parties in time and space becomes easier. In other cases (social and cultural activities), close access to facilities seems to lead to a higher probability of single activity engagement, possibly since impulsive activities (usually single) are easier to implement and pooling of facilities is not necessary.

**Keywords:**

Social activities, Company, Urban form.



ID 1912 R

**DO THEY TRAVEL TOO MUCH? A DEFINITION OF EXCESS TRAVEL AND A CASE STUDY OF EXCESS TRAVELLERS IN TYNE AND WEAR, UK**

Main Author:

**Anna FRASZCZYK**

Co-author(s):

**Corinne MULLEY** (*Institute of Transport and Logistics Studies, University of Sydney*)**Abstract:**

Excess travel is a concept that has been the focus of research in the last 30 years. Excess travel recognises that for some people there is some utility from their travel itself and this has led to a recent renaissance of interest in this theory with developments in empirical research on the value of time (VOT) which currently assumes travel is all disutility. Whilst the literature has concentrated on non-work trips, this paper reports a study on commuting behaviour where it might be expected to find less excess travellers. The excess travel research based on commuting reported here aims: to review existing definitions of excess travel and present a new improved one; identify if excess travellers exist at all and if so, are there differences between excess travellers and non-excess travellers in terms of their attitudes to travel and socio-economic characteristics. The research is based on two different methods of identifying excess travellers and both show a small number of excess travellers in their commute. A better understanding of excess commuting is a pre-requisite to encourage improvements in sustainable transport patterns of commuting and for public transport providers to market excess travel time into activity time with potential to create extra revenue. This paper is based on a pilot study and a small sample of respondents. The aim of this stage was to test ideas and verify analysis which will be used in the main study.

**Keywords:**

Excess commuting, Generalised cost, Excess traveller.

ID 2150 R

**ANALYSIS OF ACTIVITY-TRAVEL BEHAVIOUR IN THE CONTEXT OF DEVELOPING COUNTRIES**

Main Author:

**Saladi SUBBARAO** (*IITBombay*)

Co-author(s):

**K. V. RAO** (*IIT Bombay*)**Abstract:**

From the past few decades, concentration on activity based modelling has increased due to inconsistencies and disadvantages of four step traditional trip based modelling. Behaviourally oriented activity based modelling approach has the ability to model individual activity behaviour and interactions within households. This approach to travel demand analysis views travel as a derived demand. The purpose of activity based model is to predict which activities will be conducted, where, when, for how long, with whom, and with which transport mode. Activity based approach requires a survey instrument that can collect detailed timeuse data and other details of activities for estimation and analysis of the models. Activity diaries in place of the traditional questionnaires are necessary in this regard. Developed countries have been using sophisticated activity diaries and innovative administration methods over the past few decades for analyzing behavioural activity patterns of the people. But researchers hardly concentrated on designing an activity diary and analysis of activity and travel changing behaviour of people from developing countries. This study focuses on designing of new survey instrument called activity diary and drawing distributions and summaries of activity-travel patterns for developing countries context. Mumbai and Pune metropolitan regions from India are selected as the study areas. A pilot survey is conducted to assess the suitability of the instrument. Main survey will be carried out after necessary modifications have been done in the instrument. Data obtained from the instrument is to be used for analyzing activity patterns of the people and the distributions obtained from the analysis will be useful for understanding the differences between activity changing behaviour of people in developing and developed countries. (...).

**Keywords:**

Developing countries - Activity based modelling - Activity diary - Activity patterns.

TUE 13<sup>th</sup> (11:15 - 12:30, Session D3.7) Room AVIII

ID 2725 R

**DRIVERS OF CHANGE IN TRAVEL PATTERNS-  
STOCKHOLM 1986-2004**

Main Author:

**Kandice FULTS** (*Royal Institute of Technology Stockholm  
(KTH)*)

Co-author(s):

**Maria BÖRJESSON** (*Centre for Transport Studies, Royal  
Institute of Technology*)

**Abstract:**

This paper reports research on the travel pattern changes over 19 years in the Stockholm region and the influences of these changes. The study is implemented by comparing two large-scale travel surveys carried out in Stockholm County from 1986-87 and 2004. By use of statistical and econometric methods, this study analyzes changes in various dimensions of travel patterns, while controlling for changes in external factors, such as automobile accessibility, residence location, employment status and other socioeconomic indicators. Particular focus is given to how travel in different lifecycle groups (defined by gender, age and household composition) has changed. The findings show that while travel distance has increased overall, it increases at a higher rate for females than her male counterpart. In other words, women's travel behavior has become more similar to men's which explains the overall trend increase in travel distance. Interestingly, it is mostly women that increase automobile usage, since primarily single women have increased car accessibility between the years and a larger number of couples have two cars rather than one in the household. The share of automobile and public transit trips for both females and males has increased while little change in trip frequency is observed over the data collection years.

**Keywords:**

Gender, Commute trips, Household travel, Automobile saturation, Travel survey.

TUE 13<sup>th</sup> (11:15 - 12:30, Session D3.7) Room AVIII

ID 2836 R

**AN INTRA-HOUSEHOLD ASSESSMENT OF LAND USE  
AND ACTIVITY-TRAVEL BEHAVIOR PATTERNS IN  
CALIFORNIA**

Main Author:

**Konstadinos GOULIAS** (*University of California*)

Co-author(s):

**Seo YOUN YOON** (*University of California Santa Barbara*)

**Abstract:**

At the core of land use and transportation interactions we find relations between spatial distribution of activity opportunities properly weighted by the impedance of reaching these opportunities and time allocation by individuals to activities and travel. Availability of opportunities changes with time and space (e.g., retail store spatial distribution in a city and opening and closing hours). Individuals' ability to reach them also varies with windows of possible engagement in activities within the daily schedule that are also influenced by the transportation systems status (e.g., free flow, congested, and so forth). Observed activity patterns are a function of the spatial distribution of activity opportunities, the level of service of the transportation system, and of the scheduling modalities followed by individuals (e.g., task allocation within households). To answer questions about land use policy potential to change travel behavior we need to first understand and describe the complex relationships among time allocation and travel of individuals within households, the role played by the spatio-temporal activity opportunity distributions surrounding them, and the transportation systems. In this paper, using data from the entire state of California, we present a statistically estimated and tested model system that shows the role land use and infrastructure play (i.e., using accessibility indicators) in behavioral decision making effecting a variety of behavior patterns in time use, resource allocation, and activity allocation of household members considered jointly in the same model system. Accessibility in this case study is defined as the ease with which a person reaches opportunities weighted by the amount of opportunities that can be reached. (...).

**Keywords:**

Time-space prism accessibility, Land use, Time allocation, Intra-household interaction, Structural equation model.

TUE 13<sup>th</sup> (11:15 - 12:30, Session D3.7) Room AVIII

ID 3090 R

**TRAVELLING TO WORK OR JUST FOR FUN?  
EXPLORING DIFFERENCES IN PERCEPTIONS AND  
ATTITUDES BY TRAVEL MODES**

Main Author:

**Gabriela BEIRAO** (*Universidade do Porto, Faculdade de Engenharia*)

Co-author(s):

**José S. CABRAL** (*Faculdade de Engenharia, Universidade do Porto*)

**Abstract:**

This paper examines the effect and relative contribution of attitudinal factors and demographic variables in explaining mode choice behavior and to test for differences in journeys for work or for leisure/ shopping. Results show that for work journeys all respondents evaluate the performance of public transport service quality attributes worse than for other trips. Also, public transport users overall satisfaction and service quality evaluation is lower for work trips. Moreover, they seem to be less likely to recommend that mode of transport to a friend or relative. As expected car users perceived the performance of public transport must worst than regular public transport users. The most important aspects of the service that are being provided below the desired standards are: cost, waiting time, on-time performance, comfortable stops and frequency. Also, results show that attitudinal data is very important in explaining mode choice behavior. Car dependence, need for control and cost emerged as the most important attitudinal variables in explaining mode choice whether the journey is for work or for leisure/ shopping. However, individuals making a leisure trip are more sensible to travel stress. Moreover, car availability strongly influences mode choice.

**Keywords:**

Mode choice, Journey purpose, Travel behavior, Service quality, Public transport, Car.

TUE 13<sup>th</sup> (14:00 - 15:15, Session D3.8) Room AVIII

ID 1308 R

**THE EFFECT OF DAILY ACTIVITY PATTERNS ON  
CRASH INVOLVEMENT**

Main Author:

**Wafa ELIAS** (*Technion-Israel Institute of Technology*)

Co-author(s):

**Yoram SHIFTAN** (*Technion-Israel Institute of Technology*)

**Abstract:**

The main purpose of this study is to analyze the effect of daily activity and travel patterns on the risk of crash involvement. To this end, we develop a model that integrates daily activity and travel choices in a single framework, recognizing that these variables affect the risk of crashes. This model can therefore provide predictions of the expected changes in risk levels from the implementation of measures that affect the daily activity patterns and the socio-economic characteristics of the population. The empirical analysis makes use of data collected during a household survey that included crash information and trip diaries. The model is applied in a case study of an Arab village in Israel to analyze various transportation policies. The results of this research show that in addition to an individual's demographic and socio-economic characteristics, his or her daily activity and travel patterns also have an impact on the risk of being involved in accidents. The case study showed the potential of this framework for analyzing the effect of various social and transportation policies on road safety. To the best of our knowledge, this is the first time such relationships have been tested by using a disaggregate model and the first time activity-based models have been used to analyze exposure to the risk of road crashes.

**Keywords:**

Daily activity patterns, Crash involvement, Risk.

TUE 13<sup>th</sup> (14:00 - 15:15, Session D3.8) Room AVIII

ID 2180 R

**STATED ADAPTATION SURVEY OF HOUSEHOLD  
ACTIVITY SCHEDULING UNDER MODIFIED TRAVEL  
CONDITIONS – FIELD WORK AND MODEL RESULTS**

Main Author:

**Claude WEIS** (*Institute for Transport Planning and  
Systems, ETH Zurich*)

**Abstract:**

The paper reports on current research in a project aiming to explore new approaches for analysing and forecasting travel demand induced by changes in generalised costs of travel and activity participation. 250 respondents are administered a five-day travel diary. From the reported data one day is selected for further analysis. The conditions of that day are changed using pre-defined heuristics based on the household characteristics, to attain significant changes in the generalised costs of the reported trips. The households are faced with these changes in face-to-face interviews. All household members are asked to state how the implied changes would have affected their activity scheduling on the specified day, that is to adapt their reported schedule to the new conditions. The data will allow the computation of detailed discrete choice models of activity scheduling. The results are expected to reflect the effects of the various changes in generalised costs on activity generation as well as destination and mode choice. The results will be applied in MATSim, an agent-based micro-simulation software developed at the Institute for Transport Planning and Systems (IVT) at ETH Zurich and the TU Berlin. The application will allow the validation of the model results and the evaluation of aggregated effects of measures changing generalised costs, as well as their repercussions on the transport system and the resulting feedback effects, thus allowing the assessment of total induced demand and a comparison to the results from earlier aggregated models. This paper will focus on the description of the field work, which to our best knowledge is new in its approach, and will report preliminary results of the respondents' reactions to the implied changes. (...).

**Keywords:**

Stated adaptation survey, Activity scheduling, Travel behaviour modelling.

TUE 13<sup>th</sup> (14:00 - 15:15, Session D3.8) Room AVIII

ID 2928 R

**MOBILITY CHARACTERISTICS OF DIFFERENT  
POPULATION GROUPS IN A LARGEMETROPOLITAN  
AREA: ISTANBUL, TURKEY**

Main Author:

**Darcin AKIN** (*GEBZE INSTITUTE OF TECHNOLOGY*)

Co-author(s):

**Mehtap CELIK** (*Gebze Institute of Technology*)

**Abstract:**

In this study, we attempted to answer the questions of who moves most and who moves least in the city of Istanbul. We presented the results of a comprehensive data collection effort regarding the characteristics of households and the household members as well as their trip productions and travel patterns in the metropolitan city of Istanbul, Turkey. Representation of the data for different socio-economic groups living in the city of Istanbul was quite high because all housing units in the database were randomly selected (PPS) based upon the population of all 986 neighborhoods in 32 districts plus the neighboring town of Gebze at the east boundary of Istanbul. Based on the results of the analyses, people who work make less home based-school and other-purpose trips but make more non-home based trips, compared to people with no-work. The highest total trip rate belongs to males, the senior citizens (>64 years old), people with post graduate education, with no job, with a valid driving license, and people living in a house allocated due to their official duty. The highest trip length belongs to males, middle age people (31-45 ages), people with postgraduate education, with job, with a valid driving license, and living in a house allocated due to their official duty.

**Keywords:**

Travel survey, Mobility, Trip rate, Population groups, Who moves most, Istanbul.

TUE 13<sup>th</sup> (14:00 - 15:15, Session D3.8) Room AVIII

ID 2990 R

**UNDERSTANDING NEIGHBOURHOOD DESIGN  
IMPACT ON TRAVEL BEHAVIOUR: APPLICATION OF  
SEM TO THE BRITISH MICRO-ANALYSIS DATA**

Main Author:

**Paulus ADITJANDRA** (*Centre for Transport Research,  
University of Aberdeen*)

Co-author(s):

**Xinyu CAO** (*University of Minnesota, Twin Cities*)  
**Corinne MULLEY** (*Institute of Transport and Logistics  
Studies, University of Sydney*)

**Abstract:**

The objective of this study is to explore whether changes in neighbourhood characteristics bring about changes in travel choice. Residential self-selection is a concern in the connections between land-use and travel behaviour. The recent literature suggests that a longitudinal structural equations modelling (SEM) approach can be a powerful tool to assess the importance of neighbourhood characteristics on travel behaviour as opposed to the attitude-induced residential self-selection. However, the evidence to date is limited to particular geographical areas and evidence from one country might not be transferrable to another because of differences in land-use patterns and land-use policies. The paper is to address the gap by extending the evidence using British data. The case study is based on the metropolitan area of Tyne and Wear, North East of England, UK. An SEM is applied to 219 respondents who reported residential relocation within the previous 8 years. We found that neighbourhood characteristics do influence travel behaviour after controlling for selfselection. For instance, the more people are exposed to public transport access, the more likely they drive less. Neighbourhood characteristics also impact through their influence on car ownership. A social environment with vitality also reduces the amount of private car travel. These findings suggest that land-use policies at neighbourhood level can play an important role in reducing driving.

**Keywords:**

Longitudinal analysis, Neighbourhood characteristics,  
Residential self-selection.

TUE 13<sup>th</sup> (14:00 - 15:15, Session D3.8) Room AVIII

ID 3157 R

**ACCESSIBILITY AND COGNITION: THE EFFECT OF  
TRANSPORTATION MODE ON SPATIAL KNOWLEDGE**

Main Author:

**Andrew MONDSCHIEIN** (*UCLA Institute of Transportation  
Studies*)

Co-author(s):

**Evelyn BLUMENBERG** (*UCLA School of Public Affairs*)  
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**Abstract:**

Spatial behavior and decision-making require knowledge of the urban environment, including opportunities available and the means to reach them. Thus, variations in spatial knowledge can result in radically different levels of effective accessibility, despite similar locations, demographics and other factors commonly thought to influence travel behavior. Cognitive maps, which develop primarily through wayfinding and travel experience, are individuals' repositories of spatial knowledge. This paper examines whether differences in cognitive maps can be explained, in part, by variations in travel mode. Adults were surveyed in two Los Angeles neighbourhoods with relatively low auto use and high transit use. The data show that spatial knowledge does indeed vary with previous experience with travel modes.

**Keywords:**

Cognitive mapping, Accessibility, Travel mode.

TUE 13<sup>th</sup> (15:30 - 16:45, Session D3.9) Room AVIII

ID 1147 R

## VALIDATION OF COMPLEX AGENT-BASED MODELS OF SOCIAL ACTIVITIES AND TRAVEL BEHAVIOUR

Main Author:

**Nicole RONALD** (*Eindhoven University of Technology*)

Co-author(s):

**Harry TIMMERMANS** (*Urban Planning Group, Eindhoven University of Technology, The Netherlands*)

### Abstract:

Recent travel forecasting models are based upon the fact that travel is derived from the activities in which people participate. The underlying architecture of these models are becoming more behavior- and individual-driven, and as a result, researchers are now looking towards agent-based modelling techniques for model development. This move provides new challenges with respect to validation. We describe a validation process, developed using techniques from transport modelling, agent-based modelling, and social simulation, for a complex model of joint social activity generation and scheduling. The tests focus on the activities predicted by the model, in particular when and where, and measure the extent of their similarity with theory, expert opinion and data collected in Eindhoven. We provide a recommendation of how agent-based travel behaviour models can be validated and the resources required.

### Keywords:

Activity-based modelling, Validation, Social networks, Agent-based modelling.

TUE 13<sup>th</sup> (15:30 - 16:45, Session D3.9) Room AVIII

ID 1309 R

## THE IMPACTS OF THE SEGREGATION WALL ON TRAVEL BEHAVIOR IN THE PALESTINIAN TERRITORY

Main Author:

**Wafa ELIAS** (*Technion-Israel Institute of Technology*)

Co-author(s):

**Yoram SHIFTAN** (*Technion-Israel Institute of Technology*)

### Abstract:

This study examines the affects of the Israeli political decision to construct a separation wall in the West Bank. This wall resulted in the closure of main roads, divided regions and cities from each other, and cuts off public transportation lines for a number of communities which the Wall isolates. Additionally, the separation wall blocks access to destinations that exist outside the borders of the west bank, especially in Israel, where a considerable number of job opportunities exist. The main objectives of this study are: first, to examine the impacts of the segregation wall on Palestinian daily travel behavior, including: travel time, number of trips, travel modes, travel destinations and travel purposes. The second objective is to identify changes in accessibility to various activities including work, leisure and shopping. The third objective is to examine how changes in mobility and accessibility influence people's standard of living, well being, and welfare. The final objective attempts to highlight the travel behavior differences between the Palestinians and Arab Israeli minority, who also suffer from State discrimination but still have the freedom to move and travel within and outside the Israeli borders (except most of the Arab countries). For the research's purpose three Palestinian communities affected by the wall construction were selected: Qalqilya, Jayyus, and Aida Camp, in addition to Majd Al-Krum which is an Israeli Arab town. This study utilized a descriptive data analysis and comparative method was applied to explore the various impacts of the wall construction on travel behavior. Data collection based on the survey includes 183 Palestinian households from the West Bank and 101 Arab Israeli households. (...).

### Keywords:

West Bank, Palestine Territory, Travel Behavior, Separation Wall.

TUE 13<sup>th</sup> (15:30 - 16:45, Session D3.9) Room AVIII

ID 1523 R

**RE-EXAMINING TRAVEL CHOICE BEHAVIOR BASED ON A SCOBIT MODEL**

Main Author:

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**Harry TIMMERMANS** (*Urban Planning Group, Eindhoven University of Technology, The Netherlands*)

**Akimasa FUJIWARA** (*Graduate School for International Development and Cooperation, Hiroshima University*)

**Abstract:**

Aiming at relaxing an unrealistic assumption made in the traditional logit and probit models, this study explores the applicability of an alternative binary choice model, named Scobit model, in the travel behavior analysis. In case of the binary choice situation, the dominant logit and probit models implicitly impose the assumption that individuals who are invariant between the two choice alternatives (i.e., choice probability is 0.5) are most sensitive to changes in the independent variables than people with a clear preference for one of the choice alternatives. This is because both the logistic and normal density functions are symmetric about zero. However, this assumption has not been tested when applying these models. In reality, the probability level at which independent variables have their maximum impact on a change in choice probability is not necessarily 0.5. The Scobit model could relax this assumption by simply introducing a skewness parameter, where allows the model to include the logit model as a special case. With the Scobit model, it is also expected that marginal effects of explanatory variables could be measured in a more proper way. This study confirmed the effectiveness of the Scobit model using several types of travel choice data, including travel mode choice, pre-trip information acquisition behavior, departure time choice behavior, and tourism participation behavior. Especially, the Scobit model is more powerful in representing the heterogeneity in travel choice behavior than the traditional logit model.

**Keywords:**

Travel choice behavior, Scobit, Logit, Marginal effects, Heterogeneity.

TUE 13<sup>th</sup> (15:30 - 16:45, Session D3.9) Room AVIII

ID 2119 R

**INDUCED TRAFFIC GROWTH THROUGH THE LOOKING GLASS: A COMPARISON OF MICRO-ECONOMIC AND SYSTEMS-BASED EXPLANATIONS OF TRAVEL BEHAVIOUR AND GOVERNANCE RESPONSES TO URBAN MOTORWAY DEVELOPMENT**

Main Author:

**Michelle ZEIBOTS** (*Institute for Sustainable Futures, University of Technology, Sydney*)

**Abstract:**

This paper examines two different explanations using different theoretical frameworks to account for the phenomenon known as induced traffic growth. The first explanation is framed in terms of micro-economic theory and shows that under some conditions, induced traffic growth can undermine the economic benefits arising from urban motorway development as the additional traffic can erode travel time savings for existing traffic so that congestion returns until a new equilibrium is reached. But this explanation has a limited capacity to explain how and why traffic interacts with the rest of the urban system. The second explanation framed in terms of systems theory renders induced traffic growth as a form of positive system feedback — which if allowed to continue would eventually destroy the system. By tracking the path of decisions needed to complete the feedback loop, it is shown that information passes between a soft-system — or decision-making system, usually located within government transport agencies — and a hard-system — the transport network that provides access for people. Critical to this explanation is a misunderstanding on the part of transport decision-makers controlling the soft-system as to what the addition of road space actually does to service levels on the hard system that is controlled by a confluence of material factors.

**Keywords:**

Induced traffic behaviour, Micro-economics, System.

TUE 13<sup>th</sup> (15:30 - 16:45, Session D3.9) Room AVIII

ID 2566 R

**SERVICE TRAFFIC ? AN ENTREPRENEURIAL VIEW ON TRAVEL BEHAVIOUR**

Main Author:

**Paul HEBES** (*Institute of Transport Research, German Aerospace Center*)

Co-author(s):

**Julius MENGE** (*Institute of Transport Research, German Aerospace Center*)

**Barbara LENZ** (*DLR e. V. German Aerospace Center*)

**Abstract:**

Services become more and more important in industrialized countries. Yet, very little is known about the traffic initiated by the provision of these services. Particularly, the role of firms is an unexplored field of research. However, to know how firms influence travel behaviour is crucial for practitioners and modelling commercial transport as a whole. The paper provides new perspectives on how companies affect travel behaviour, covering the field of service traffic. We use two different empirical datasets (two German surveys) to reveal crucial predictors which allow insight into the entrepreneurial impact on travel characteristics and patterns. Applying cluster analysis and logistic regression modelling it is shown that internal structure, internal process and external structure factors have a significant impact on travel patterns and behaviour.

**Keywords:**

Service traffic, Travel behaviour, Company.

TUE 13<sup>th</sup> (17:00 - 18:15, Session D3.10) Room AVIII

ID 1316 R

**AN IMPLICIT C-LOGIT ASSIGNMENT MODELS: THE CAPACITY OF FLOW REPRODUCTION ON REAL SYSTEMS**

Main Author:

**Antonino VITETTA** (*DIMET - University Mediterranea of Reggio Calabria*)

Co-author(s):

**Francesco RUSSO** (*University Mediterranea of Reggio Calabria*)

**Abstract:**

The route choice model on a transportation system can be separated into two sub-models: choice set generation and choice of the alternatives given the choice sets. For choice set generation several models can be used; the more common mono- or the multi-set approach. For route choice the more common models are Logit and Probit. This paper proposes the specification of the general problem of route choice and reports the D-C-Logit model proposed recently for implicit assignment. The problem of choice set generation in the literature is solved with a fixed choice set or considering all the loop-less routes. In this paper a general model is proposed and numerical results are reported in order to ascertain how this sub-model affects the final results for user choice. In relation to the route choice the D-C-Logit model is reported. It combines several positive features found in the literature for choice set generation and choices from a given choice set: generation of a set of alternatives with a selective approach; calculation of the route choice probability in a closed form; simulation of the overlapping effect among alternative routes; computation of just one tree for each origin avoiding explicit route enumeration.

**Keywords:**

Route Choice, Assignment.



TUE 13<sup>th</sup> (17:00 - 18:15, Session D3.10) Room AVIII

ID 1677 R

## HOW BEST TO EVALUATE MOBILITY MANAGEMENT PROJECTS: CAN PSYCHOLOGICAL THEORY HELP?

Main Author:

**Michael CARRENO** (*Transport Research Institute/Edinburgh Napier University*)

Co-author(s):

**Tom RYE** (*Napier University*)

**Janina WELSCH** (*ILS*)

**Sebastian BAMBERG** (*Universität Bielefeld*)

**Pernilla HYLLENIUS** (*Trivektor Traffic AB*)

### Abstract:

In order to persuade both policy makers and practitioners to adopt mobility management (MM) strategies there is a need for these decision makers to accept, understand and be able to predict (with confidence) their likely effectiveness. To satisfy these requirements there is a need for a greater understanding of how MM interventions affect individuals' modal choice decisions and robust evaluation techniques that will allow any behavioural changes to be observed. This paper considers three key questions, namely; [1] Do mobility management type interventions work?, [2] How do MM interventions work? and [3] How best to measure their effects? The paper then suggests practical solutions as to how these issues can be addressed, in the form of a new standardised evaluation resource: MaxSUMO, which contains advice on the use of more robust evaluation methods (e.g. randomised controlled type designs) and the inclusion of theoretical diagnostic procedures based on a new theoretical behavioural change model (MaxSEM) to measure individuals' stage positions (their susceptibility to change behaviour) and stage movement (progression towards actual behavioural change). To illustrate the benefits of including psychological-based attitudinal and perceptual measurement questions in MM interventions, an overview of a theoretical based randomised controlled personalised travel planning intervention study conducted in Hammersmith, UK, is also presented.

### Keywords:

Mobility Management, Behavioural change, Evaluation methods, Modal choice.

TUE 13<sup>th</sup> (17:00 - 18:15, Session D3.10) Room AVIII

ID 1913 R

## A COMPETING HAZARD MODEL OF HOUSEHOLD VEHICLE TRANSACTION BEHAVIOR WITH DISCRETE TIME INTERVALS USING MULTIVARIATE COPULA MODEL

Main Author:

**Taha HOSSEIN RASHIDI**

Co-author(s):

**Abolfazl MOHAMMADIAN** (*University of Illinois at Chicago*)

### Abstract:

Vehicle ownership has been the subject of many earlier studies, which have adopted a variety of econometric frameworks at both aggregate and disaggregate choice modeling level. Car manufacturers, oil companies, Metropolitan Planning Organizations (MPOs) and environmental agencies are among many organizations interested in using accurate aggregate and/or disaggregate vehicle ownership models. Among various modeling approaches, dynamic disaggregate models such as competing duration-based models, seem to provide better modeling fit with more effective forecasting capabilities relative to other vehicle ownership modeling frameworks. This is in large part due to their capability in jointly modeling transaction timing and type. Traditionally transaction timing has been overlooked in the commonly used static vehicle ownership models despite the significant role it plays in explaining vehicle ownership behavior. Transaction failure timing, like many other time related failures such as unemployment duration, is modeled by using duration risk based models. Additionally, the decision about transaction type is typically assumed to be independently made; therefore, independent timing models are developed for each transaction type. In other words, the inclusion of inter-correlation among the error terms of the vehicle transaction type decisions is typically ignored in the competing duration models due to the significant computational burden that it imposes on the model. This study aims to introduce a joint transaction type and timing model at the disaggregate level using a discrete competing proportional hazard model. The inter-correlation among multiple transaction types is modeled in this study by utilizing a copula density function to approximate the multivariate probability density function among the transaction types' error terms. (...).

### Keywords:

Competing duration model, Hazard-based formulation.

ID 2142 R

**MAX - NEW TOOLS FOR EVALUATING MOBILITY MANAGEMENT**

Main Author:

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Co-author(s):

**Janina WELSCH** (ILS)

**Pernilla HYLLENIUS** (Trivector Traffic AB)

**Tom RYE** (Napier University)

**Michael CARRENO** (Transport Research Institute/Edinburgh Napier University)

**Abstract:**

This paper describes a set of tools developed to assist in the planning, implementation and evaluation of Mobility Management (MM) programs. The MAX project, co-funded as part of DG TREN's 6th Research Framework Programme, developed guidance in four areas, including: travel awareness campaigns, quality management, and integrating MM and land use planning. The fourth area of guidance, and subject of four new tools, was MM assessment and evaluation. The tools described include a decision-support system for prioritizing appropriate MM measures, a conceptual model for understanding stages of behaviour change, and tools that standardize monitoring and evaluation as well as provide a repository for their results.

**Keywords:**

Mobility management, Evaluation, Sustainable transport, Travel behaviour.

ID 3321 R

**CHANGES IN COMMUNITY PERCEPTIONS RESULTING FROM A BEFORE AND AFTER EVALUATION OF A ?TRAVELSMART? PROGRAM IN S. AUSTRALIA**

Main Author:

**Yun ZHANG**

Co-author(s):

**Peter STOPHER** (The University of Sydney)

**Belinda HALLING** (ND)

**Abstract:**

The research this paper presents is from the TravelSmart Households in the West project, which was implemented in Western Adelaide, South Australia by the South Australian Department of Transport, Energy and Infrastructure (SA DTEI). On ground delivery was conducted through a contract with the firm of Steer Davies Gleave (SDG). The project targeted a geographically large and diverse area, comprising 4.5% of the total Adelaide metropolitan area and 13% of its population and engaged 22,101 households to reduce their car use. The primary aim of this project was to reduce transport-related greenhouse gas emissions through travel behaviour. In this paper, we present a study where before and after surveys were conducted to evaluate to what extent this project impacted the community's perceptions with respect to travel behaviour change, that is, not to evaluate their behaviour change, but to see if the TravelSmart Project impacted their attitudes and beliefs about use of car and alternatives to the car. The before survey was conducted prior to the commencement of TravelSmart in 2005, where 391 respondents participated. In 2007, the same respondents were contacted and an after survey was conducted using the same survey instrument. The results show that in the before survey, inadequate public transport did not get mentioned as one of the most cited disadvantages of reducing car use while in the after survey, public transport has come into the minds of both the TravelSmart participants and the non-participants. Moreover, an analysis of attitudinal statement scales shows that, compared to the 2005 survey, the TravelSmart Project has contributed to some degree of attitude change. Particularly, evidence was found that TravelSmart participants have significantly increased their willingness to reduce car use. (...).

**Keywords:**

Travel behaviour change, Data collection, Percepti.

ID 1117 R

**REWARDING OFF-PEAK RAILWAY COMMUTING: A CHOICE EXPERIMENT**

Main Author:

**Jessie BAKENS** (*Department of Spatial Economics, VU University Amsterdam*)

Co-author(s):

**Jasper KNOCKAERT** (*Department of Spatial Economics, VU University Amsterdam*)**Erik VERHOEF** (*Department of Spatial Economics, VU University Amsterdam*)**Abstract:**

Travelling by train is often considered as a possible alternative for commuting by car, to relieve extremely congested road networks. For this to be a solution to road congestion in the Netherlands, however, either train capacity during peak hours should be expanded or more current peak train passengers would have to be willing to travel during off peak hours. This paper considers the modelling of the departure time choice of Dutch train commuters and their willingness to reschedule their trip to off-peak hours when given a positive price incentive. In a conjoint choice experiment the scheduling costs of a large group of frequent train commuters is studied. The choice considerations of commuters in this setting are amenable to cross-nested logit and mixed logit estimations. The analysis shows that a positive price incentive can be an effective strategy and policy instrument to potentially increase the number of commuters travelling by train under a given capacity constraint. We show that the estimation of scheduling costs crucially depends on the way the scheduling choice of commuters is modelled within the discrete choice framework.

**Keywords:**

Public transport, Schedule delay costs, Stated Preference Experiment, Discrete Choice Models.

ID 1587 R

**IMPLEMENTATION OF BICYCLE SHARING SYSTEM WITH TRADABLE PERMITS AUCTION AND BEHAVIOR ANALYSIS**

Main Author:

**Yusuke HARA** (*School of Urban Engineering, University of Tokyo*)

Co-author(s):

**Eiji HATO** (*School of Urban Engineering, University of Tokyo*)**Abstract:**

This study implements the bicycle sharing system with tradable permits in Yokohama Minato-Mirai Area, Japan. Tradable permits is the rights that users take bicycle sharing system on some time of day and their auction system shifts the load from system administrator by encouraging free sales transaction between users. We first explore relations between the trade behavior and frequency of visiting the area. Then we formulate users' trade behavior of future decision-making under uncertainty by discrete choice model. The estimation results indicate that permits attributes such as weekday or weekend, morning or afternoon have an effect on transaction behavior. Finally, it reveals schedule effect utility function is nonlinear and it has 2 jumping point.

**Keywords:**

Bicycle sharing system, Auction, ITS, Discrete choice model.

ID 2323 R

**ROAD PRICING VS. PEAK-AVOIDANCE REWARDS: A COMPARISON OF TWO DUTCH STUDIES**

Main Author:

**Eran BEN-ELIA** (*Centre for Transport and Society, University of the West of England*)

Co-author(s):

**Taede TILLEMA** (*Faculty of Spatial Sciences - University of Groningen*)**Dick ETTEMA** (*Faculty of Geosciences - Utrecht University*)**Abstract:**

In recent years, researchers and policy-makers have paid more and more attention to road pricing. Several examples of attempts to implement road pricing in Europe include: the congestion charge in London, the introduction of the German Maut system for lorries, the successful experiment in Stockholm, and the unsuccessful experience in Glasgow. Today, the introduction of some kind of road pricing, is considered in many European countries, either at the urban scale or at the national scale. However, in The Netherlands, rewards for avoiding driving in the rush-hour have been suggested as an alternative – second-best – congestion management strategy to road pricing. Psychologists suggest that rewards are more efficient in the long run in sustaining wanted behaviour compared to ‘punishments’. The implications (e.g., the effectiveness, acceptability) of road pricing and rewarding strategies are currently being studied. The Dutch government decided to implement a nation wide kilometre charge, starting with a charge for lorries in 2012 and with a differentiated (i.e. by time, place or environmental costs) kilometre charging system for cars and trucks in 2018. In parallel, pilot projects have been undertaken to investigate the effectiveness of rewarding systems as well. In this paper we intend to compare the road pricing and rewarding system both with respect to their effects on commuter behaviour and regarding their applicability in different contexts. We do this on the basis of two different and independent empirical data sets. Regarding road pricing, we make use of a stated preference study (SP) among car commuters, undertaken in 2004. By the help of a structured survey, respondents were presented with a time-differentiated kilometer charge. (...).

**Keywords:**

Road-pricing, Rewards, Peak avoidance, Commuting,

ID 3119 R

**THE ROLE OF ATTITUDE AND PURCHASE POWER IN BRAZILIAN URBAN TRANSPORT BEHAVIOUR**

Main Author:

**Jaime WAISMAN** (*SISTRAN Engenharia*)

Co-author(s):

**Humberto DE PAIVA JUNIOR** (*UFABC*)**Abstract:**

The revision of the study “The motivation of the new Brazilian urban population transport profile – Image and opinion survey of the Brazilian urban transport” published by the Ministry of Cities in 2003, has allowed the development of a cause-and-effect behavioural model using the multivariate analysis technique called SEM (structural equation modelling). This model connects the urban transport user socio-economic characteristics and attitudes relating to the system quality with their modal choice. As result of ten Brazilian cities survey, the behavioural model showed the supremacy of the socio-economic characteristics over attitudes as explaining variables of transport behaviour. On the other hand, in specific cases, attitudes can be useful to explain the behaviour of user segments. These results confirm the structural heterogeneity of transport users’ behaviour, but does not mean that aggregate model transferability is impossible.

**Keywords:**

Transport Behaviour, Transport Survey, Structural Equations, SEM.

ID 3170 R

**INVESTIGATING THE ROLE OF SOCIAL NETWORKS IN START TIME AND DURATION OF ACTIVITIES: A TRIVARIATE SIMULTANEOUS ECONOMETRIC MODEL**

Main Author:

**Juan CARRASCO** (*Department of Civil Engineering, Universidad de Concepcion, Chile*)

Co-author(s):

**Khandker M. NURUL HABIB** (*Department of Civil and Environmental Engineering, University of Toronto*)

**Abstract:**

In the context of improving our understanding and modeling capabilities of activity scheduling processes in travel behaviour, this paper explores the role of social networks in the start time and duration of social activities. The study is performed using a trivariate joint econometric model, which is capable of capturing the correlation among unobserved influential factors causing endogeneity of these three key decisions. The model captures not only the relevance of socio-demographic variables, but also of the social network dimension of with whom travellers perform social activities. A particular relevant case is the role of travel time to the social activities, which has a positive effect on longer durations and late start times, and which acts as a link between these two basic dimensions (start time and duration) of activity scheduling. The results confirm the relevance of the social context in the episode temporal characteristics, illustrating aspects that future activity-based travel demand models should incorporate these to be able to capture the socializing side of mobility decisions.

**Keywords:**

Social networks, Duration, Start time, Social activities, Activity-based approach .

ID 1546 R

**DEMAND, PRICE AND WELFARE EFFECTS OF TRAFFIC INFORMATION: STRATEGIC INTERACTIONS BETWEEN ROAD OPERATION AND PROVISION OF INFORMATION IN A NON-CONGESTIBLE NETWORK**

Main Author:

**Sergejs GUBINS** (*VU University Amsterdam, Department of Spatial Economics*)

Co-author(s):

**Erik VERHOEF** (*Department of Spatial Economics, VU University Amsterdam*)

**Thomas DE GRAAF** (*VU University Amsterdam, Department of Spatial Economics*)

**Abstract:**

This paper models strategic interactions between a product supplier, a provider of information about product quality, and end users, in the context of road transportation. Using a game-theoretical analysis of suppliers' pricing strategies, we assess the social welfare effects of traffic information under various road markets with different ownership regimes. The results show that in this context, the distortive welfare effect of monopolistic information pricing appears small to negligible. Collusion of the road operator and information provider yields higher social welfare than independent pricing by two firms. The intuition behind this result resembles that behind the welfare effects of double marginalization, but it is not exactly the same, as traffic information is not strictly complementary to road use.

**Keywords:**

Willingness to pay for information, Private road operator, Private information provider, ICT.

ID 2091 R

**IDENTIFYING DRIVER TACTICS FOR INTERACTING WITH A REAL-TIME TYRE INFORMATION SYSTEM**

Main Author:

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Co-author(s):

**Min QIU** (*UWA*)

**Abstract:**

This paper investigates the sensitivity and preference heterogeneity of individuals in respect of a new Real-Time Tyre Information System (RTTIS). By using the attitudinal indicator, a latent class model framework is developed. Estimates for a three-class model are discussed in detail to illustrate the potential of this approach in characterising the customer segments and preferences for an innovative vehicle technology. The results offer clear evidence of the preference heterogeneity across classes. The analysis further shows that the survey response duration has a strong explanatory power with respect to class membership.

**Keywords:**

Latent class model, Preference heterogeneity, Survey response duration, Real-time tyre information system.

ID 3161 R\*

**TRAVELER'S INFORMATION CHOICE BEHAVIOR IN RESPONSE TO TRANSIT INFORMATION SERVICES**

Main Author:

**Zhiwei YANG** (*Center for Transportation Research, Dalian University of Technology*)

Co-author(s):

**Shengchuan ZHAO** (*Dalian University of Technology*)

**Xun ZHANG** (*School of Transportation and Logistics, Dalian University of Technology, Dalian, China*)

**Abstract:**

Transit information services have been provided in many cities in China, however, traveller's information choice behaviour under such services remains uninvestigated. This paper examines traveller's information choice behaviour in response to transit information services, based on the data collected from a Stated Preference survey with transit travellers in Dalian, China. The paper begins with an evaluation of the influential factors of travel information choice behaviour for transit traveller, and then analyzes the needs of travel information aspects, under the conditions of different personal attributes and information services. A binary logit model of travel information choice behaviour is proposed to analyze the relationships among the influential factors. The results indicate that personal characteristics (gender and age, etc.) and accessibility to information media play a key role in affecting travel information choice behaviour. The paper finally proposes a few functional design considerations for traveller's information services.

**Keywords:**

Transit information services, information choice behaviour, binary logit model, Dalian.

ID 3190 R

**A SIMULATION FRAMEWORK FOR THE ASSESSMENT OF THE IMPACT OF ADVANCE TRAVELER INFORMATION SYSTEMS ON USERS? CHOICE AND BEHAVIOR**

Main Author:

**Eftihia NATHANAIL** (*University of Thessaly*)

Co-author(s):

**Giannis ADAMOS** (*University of Thessaly*)

**Charalampos PETAMIDES** (*University of Thessaly*)

**Abstract:**

The large mobility demand and the rare supply of the appropriate road infrastructure - both in urban networks and freeways, cause congestion problems, which affect the smooth travelling of road users who face mainly travel delays in their daily trips. Recently, much attention has been paid in developing Advanced Traveler Information Systems (ATIS) as an effective way to inform drivers to make route choices and avoid traffic congestion. It is obvious that both the way traffic affects road users behavior or reaction, as concerns mode, or route change and ATIS influences driver behavior and the way drivers adopt the information provided by ATIS, are important issues in attempting to understand and predict driver behavior. Such understanding is usually based on the development of models that capture and analyze user behavior in the presence of information, varying in type, mode, and content. The purpose of this paper is to investigate and analyse the effect ATIS may have on travellers, by evaluating, at the same time, the impact of ATIS in drivers' decisions. Towards this direction, a platform is developed to collect and process data which lead to the development of driver behavior models. More particularly, the present paper is the first of two papers designated to modelling drivers' behavior and assessing the impacts of alternative information systems. Furthermore, the structure of the models as it is affected by the parameters used, and the population groups, is presented and discussed. Also, following a literature review, the framework of the research is established and the experimentation and some preliminary results are expressed. (...).

**Keywords:**

Advanced Traveler Information Systems, route choice, modal choice, driver behavioural models.

ID 3285 R

**TRAVELLERS WELL-BEING MEASURING AND DYNAMIC FACIAL EXPRESSION RECOGNITION**

Main Author:

**Thomas ROBIN** (*TRANSP-OR, EPFL*)

Co-author(s):

**Michel BIERLAIRE** (*Transport and Mobility Laboratory, EPFL*)

**Javier CRUZ** (*Ecole Polytechnique Federal de Lausanne*)

**Abstract:**

We propose a dynamic facial expression recognition framework based on discrete choice models (DCM). We model the choice of a person who has to label a video sequence representing a facial expression. The originality is based on the explicit modeling of causal effects between the facial features and the recognition of the expression. The model is composed of two parts. The first part captures the evaluation of the facial expression within each frame in the sequence. The second part determines which frame triggers the choice. The model is estimated using videos from the Facial Expressions and Emotions Database (FEED). Labeling data on the videos have been obtained using an internet survey available at <http://transport2.epfl.ch/videosurvey/>. The prediction capability of the model is studied in order to check its validity.

**Keywords:**

Discrete choice, Dynamic, Latent model, Facial expression recognition, Video.

ID 1903 R

**A DISSIMILAR PATHS-SEARCH ALGORITHM FOR EN ROUTE MULTI-ACTIVITIES**

Main Author:

**Yeon-Jeong JEONG** (*Seoul National University*)

Co-author(s):

**Dong-Kyu KIM** (*Department of Civil and Environmental Engineering, Seoul National University*)**Changho PARK** (*Department of Civil and Environmental Engineering, Seoul National University*)**Abstract:**

With the growing interest in quality-of-life issues, activities en route from an origin to a destination have become more varied and extensive. A driver often performs required or desirable activities on her or his chosen route at various "points of interest" (POIs), such as gas stations, restaurants, department stores, and banks. The driver must decide whether or not to perform an activity at a POI, and, if that decision is positive, he or she must consider multiple information elements to decide where to perform the activity. Two of the most important information elements that must be considered are the relative price of an item at a POI and the additional travel cost (time and money) to get to the POI. The relative price can be defined as the difference between the price at a POI and the minimum price in the network, while the additional travel cost can be defined as the difference between the travel cost to get to the POI and the travel cost associated with the shortest path. This study aims to develop a dissimilar paths-search algorithm for en route multi-activities and verify the efficiency of the algorithm by using a real-world network. The proposed algorithm provides users with multiple alternative paths based on route information and POIs information until users choose their optimal path. To develop the path-search algorithm for en route multiactivities, we used the sum of the relative prices at the POIs and the cost of the route that included the POIs. We considered dissimilarity among alternative paths to provide a variety of information that drivers wish to have. Also, to improve the efficiency of search time, we reconstructed a network based on travel cost constraints and developed a candidate set of alternative paths by executing the shortest-path search algorithm only once. (...).

**Keywords:**

Points of interest, Dissimilar paths, Multi-activities, Relative price, Candidate set.

ID 2039 R

**A ROUTE CHOICE MODEL BASED ON EVOLUTIONARY GAME THEORY CONSIDERING THE TRAVEL TIME RELIABILITY AND TRAFFIC IMPEDIMENTS**

Main Author:

**Naohiro UCHIYAMA** (*Kyoto University, Department of Urban Management*)**Abstract:**

In this study we built a route choice model considering travel time reliability and traffic impediments including traffic accidents. Based on evolutionary game theory, we built the model to identify a route that a dispatcher chooses in consideration of the change of the daily route travel times and the situation of the traffic impediments using measured data. The evolutionary game theory is a game theory which is formulated in dynamics and analyzes the distribution and the change of the combination of strategies. We used a model of Roth & Erev(1995) given as a representative of models that assumed trial and error learning. With the model that we built, we performed two case studies. One case study is that standard deviation of some routes goes down to 2/3, and the other case study is that the charge of toll road is half. As a result, the combination of route choice strategies changed significantly.

**Keywords:**

Freight transport, Route choice model, Evolutionary game theory, Travel time reliability.



ID 2055 R

**A TOTALLY DISAGGREGATE ROUTE CHOICE/TRAFFIC ASSIGNMENT MODEL FOR THE IDENTIFICATION OF ROAD INFRASTRUCTURE USERS**

Main Author:

**Timothy SPURR** (*Département des génies civil, géologique et des mines École Polytechnique de Montréal*)

Co-author(s):

**Robert CHAPLEAU** (*École Polytechnique de Montréal*)

**Abstract:**

The planning of transportation infrastructure is also an exercise in determining how best to distribute costs and benefits among a particular population. A new freeway, for example, confers significant mobility benefits to those who use it, but subjects the population immediately adjacent to a large amount of noise, pollution and disruption of local activities. One of the goals of a professional transport planner, then, is to determine who benefits from and who pays for an existing or proposed transport facility. The identification of these two populations contributes to a better-informed discussion about transportation policy. The present research aims to identify those who benefit from and those who pay for existing heavy road infrastructure in the Greater Montreal Area using a totally disaggregate information-based approach. A large sample of revealed preference data on the usage of major bridges (8 583 observations) paints a precise picture of the demand for these facilities. Road transport supply is characterized by a detailed digitized street network which includes every street in the metropolitan area (over 100 000 links). A simple model of the interaction between supply and demand estimates the distribution of costs and benefits of urban road travel throughout the population. The analysis reveals the relationship between consumption and the time price of transport and illustrates the roles played by different levels of government in the consumption patterns of urban commuters. It is shown that a predictive model which reproduces nearly three quarters of observed facility choices generates indicators of equity comparable to those computed using the observed behaviour. (...).

**Keywords:**

Traffic assignment, Route choice, Transportation planning, Equity.

ID 2756 R

**IDENTIFICATION OF DISCRETE CHOICE MODELS WITH LATENT VARIABLES: THE ROLE OF CONSTRAINTS IN SEQUENTIAL AND SIMULTANEOUS ESTIMATION**

Main Author:

**Sebastián RAVEAU** (*Pontificia Universidad Católica de Chile*)

Co-author(s):

**Juan DE DIOS ORTUZAR SALAS** (*Pontificia Universidad Católica de Chile*)

**Maria FRANCISCA YANEZ CASTILLO** (*Pontificia Universidad Católica de Chile*)

**Abstract:**

The formulation of hybrid discrete choice models, including both observable alternative attributes and latent variables associated with attitudes and perceptions has become a topic of discussion in recent years. Even though there have been developments related to model estimation the parameter identifiability issue has not been treated yet, but it is known that as the model estimates are not unique, it is necessary to impose some constraints in the estimation. In this paper we analyse the impact of different normalization criteria on the recovery of model parameters in a simulated environment. We identify advantages and disadvantages related to different normalizations, especially when arbitrary values are used on the constraints.

**Keywords:**

Hybrid discrete choice models, Latent variables, Identifiability.

WED 14<sup>th</sup> (11:15 - 12:30, Session D3.13) Room AVIII

ID 3229 R

**INVESTIGATING THE CHANGES IN TRAVEL DEMAND OF THE OLDER POPULATION IN THE GREATER TORONTO AREA, 1986-2006**

Main Author:

**Ruben MERCADO** (*University of Toronto*)

Co-author(s):

**Eric MILLER** (*University of Toronto*)

**Abstract:**

This paper provides a descriptive analysis of demographic aging and the changes in travel behaviour of the older population in the Greater Toronto and Hamilton Area (GTHA) in the Province of Ontario, Canada, from 1986-2006. The changing travel dynamics of the past and current groups of elderly population is examined in terms of out-of-home trip-making and primary mode of travel. These travel demand trends are analyzed in relation to age groupings that differentiate the baby boomers and the elderly as well as by trip purpose or activity. The paper reflects on these trends in regards to transport research and policy implications in an aging society.

**Keywords:**

Travel behaviour, Elderly, Trends, Aging, Canada.

THU 15<sup>th</sup> (08:15 - 09:30, Session D3.14) Room AVIII

ID 1611 R

**THE INFLUENCES OF EVALUATION CHANGES FROM DIFFERENT WORLD-OF-MOUTH CHANNELS ON THE ACCEPTANCE INTENTION OF ETC POLICY BY HIGHWAY USERS IN TAIWAN**

Main Author:

**Rong-Chang JOU**

Co-author(s):

**Chih CHENG CHEN** (*Graduate School of Social Informatics, Yuan Ze University*)

**Ju-Ching KE** (*Department of Civil Engineering, National Chi Nan University, Taiwan*)

**Abstract:**

Word-of-mouth, as refer to the passing of information from person to person, is an important marketing strategy for product promotion. Besides, information disseminated through media is so common in nowadays' life and, thus, their comments of a commodity or service, as well as the information exchanged by face to face interaction, might affect people's final choice eventually. In this study we focus on how the contents disseminated through different word-of-mouth channels(face to face communication and electronic media which includes the conventional media and the Internet) about the electronic toll collection(ETC) system, a new toll collection service in Taiwan, affect the acceptance intention of highway drivers on it. Through the collected survey data about the evaluations of highway drivers before and after this system been implemented from different channels, we investigate how the evaluation changes influence their acceptance intention of the ETC system. After the estimation of structural equation models, we find that the evaluation changes by word-of-mouth from electronic media and face to face directly, and the "perceived easy to use" and "social norm" indirectly, affect the acceptance intention of ETC system on highway drivers in Taiwan. Accordingly, we suggest that, as pushing a new transportation policy, if the government could use the media and the word-of-mouth to raise people's evaluation of the policy well, which then might help its acceptance level.

**Keywords:**

Electronic media, Word-of-mouth, Electronic toll collection(ETC), Structural equation model.

ID 1659 R\*

**MODELLING THE LANE CHANGING DECISION OF HEAVY VEHICLE DRIVERS**

Main Author:

**Sara MORIDPOUR****Abstract:**

Lane changing manoeuvres of heavy vehicles have significant influence on surrounding traffic characteristics due to the physical effects that the heavy vehicles impose on surrounding vehicles. These effects are the result of heavy vehicles' length, size, weight and the limitations in their manoeuvrability. This paper presents an exclusive fuzzy logic lane changing decision model for heavy vehicle drivers on freeways. The freeway trajectory data which is used in this study is under heavy traffic conditions. The trajectory data is used to develop the lane changing decision model for heavy vehicle drivers. To examine the efficiency of the heavy vehicle drivers' lane changing decision model, the number of estimated lane changing manoeuvres of heavy vehicles are compared to the observed number of heavy vehicle lane changing manoeuvres in real world. Furthermore, the estimated traffic flow characteristics are compared to the observed traffic flow characteristics in real world through microscopic traffic simulations. The obtained results show that the new fuzzy logic lane changing decision model could replicate the observed lane changing decisions of the heavy vehicle drivers better than the current lane changing decision models. In addition, using an exclusive heavy vehicle lane changing decision model could increase the accuracy of the microscopic traffic simulations in estimating the microscopic traffic flow characteristics.

**Keywords:**

Lane changing decision, Heavy vehicles, Heavy traffic conditions.

ID 1807 R

**COMPANY CARS AND MOBILITY BEHAVIOUR: 3 TYPES OF COMPANY CAR USERS**

Main Author:

**Astrid DE WITTE** (*Vrije Universiteit Brussel, MOSI-T*)

Co-author(s):

**Cathy MACHARIS** (*Vrije Universiteit Brussel (Free University of Brussels)*)**Abstract:**

The last two decades, the phenomenon of company cars has become very popular. In Belgium, the use of company cars has evolved from being a status symbol for board members and a necessary means for employees who have to make a lot of professional displacements, to a common practice in the composition of the salary package and a popular incentive to attract motivated personnel. This evolution has mainly been triggered by the fiscal advantageous treatment of company cars and the heavy tax burden on labour forces, making it often more interesting for the employer to grant a company car instead of a salary increase leading to the same monetary benefit for the employee. As a result, half of the new car registrations are nowadays made in the name of a company and company cars account for 10% of the Belgian car fleet. In many cases, an employee can use his/her company car for both professional and private displacements. In addition, most costs related to the use of a company car are beard by the employer, turning the company car into a nearly free way of travelling for the employee. Previous researches have already established that the yearly amount of kilometres driven with a company car is significantly higher than that of private cars (e.g. De Witte et al., 2009). Consequently, the rising phenomenon of company cars and its impact on our daily mobility can no longer be ignored. The objective of this paper is to analyse the mobility behaviours induced by the use of company cars in order to make policy recommendations for a more sustainable mobility. To this end, a survey was conducted among Flemish-speaking company car users to learn more about their company car use and travel motives. (...)

**Keywords:**

Company cars, Mobility behaviour.

ID 2549 R

**THE IMPACT OF COMPANY CARS ON TRAVEL BEHAVIOUR**

Main Author:

**Katrien RAMAEKERS** (*Hasselt University - Transportation Research Institute*)

Co-author(s):

**Geert WETS** (*Transportation Research Institute, Hasselt University, Belgium*)**Astrid DE WITTE** (*Vrije Universiteit Brussel, MOSI-T*)**Cathy MACHARIS** (*Vrije Universiteit Brussel (Free University of Brussels)*)**Eric CORNELIS** (*University of Namur (FUNDP) - Transportation Research Group (GRT)*)**Marie CASTAIGNE** (*University of Namur*)**Xavier PAULY** (*Université de Namur, Groupe de Recherche sur les Transports*)**Abstract:**

The last two decades, the phenomenon of company cars has become very popular in Belgium due to their favourable fiscal treatment. Given the high number of registrations and the current use of company cars in the wage policies of the companies, the impact of company cars on our daily mobility can no longer be ignored. Up to now, researches on mobility and travel behaviour in Belgium did not focus in particular on the phenomenon of company cars. But as they actually are a form of nearly free transport that can be used not only for professional, but also for private trips, it can not be ignored that they influence our mobility landscape. Findings from a recent study (Cornelis et al., 2007) indicate that the annual amount of kilometres covered by company cars is higher than that of private cars. However, no distinction between professional and private kilometres could be made. The main objective of this research is to provide more insight in the impact of company cars on travel behaviour. Since existing data sets were not available, a survey was organised to collect the necessary data (Castaigne et al., 2009). Both employees with and without a company car were asked to fill in a questionnaire, asking for their mobility behaviour in general and their mobility behaviour on a reference day in particular. Based on the collected data, comparisons are made between employees with a company car and employees without a company car. (...).

**Keywords:**

Company cars, Travel behaviour.

ID 2822 R

**CELL PHONE USE AND TRAFFIC CHARACTERISTICS**

Main Author:

**George YANNIS** (*National Technical University of Athens, Department of Transportation Planning and Engineering*)**Abstract:**

The objective of this research is the analysis of the impact of cell phone use on vehicle traffic speed and headways. For this purpose, a field survey was carried out in real traffic conditions, unlike most related studies that are based on either questionnaire responses or driving simulator experiments. In particular, traffic data were recorded on a four-lane urban arterial segment by means of a video camera and a speed gun. Linear regression models were developed for the analysis of the effect of cell phone use and other variables on traffic speed and time / space headways. It was found that vehicle speed is increased for young drivers (aged 18-25 years), male drivers and taxi drivers, and decreased for older drivers (>55 years) and for drivers using their cell phone while driving. Vehicle's time headways were not found to be affected by cell phone use. However, headspaces, estimated as the product of vehicle speed and time headways, were found to be decreased for drivers using their cell phone, young drivers and older drivers. Moreover, headspaces increased with the difference in speed and in headway of the vehicle ahead. Overall, drivers between 25-55 years old are associated with larger space headways regardless of the use of cell phone, possibly due to a combination of adequate driving experience and skills. Cell phone use results in lower speeds, suggesting a driver's compensatory effect on the distraction caused by the cell phone use, an effect also identified in previous research. This distraction is also reflected in the reduced space headways associated with cell phone use for all drivers. The reduction is more pronounced when the speed and headway difference between successive vehicles was not significant in the first place, as is the case for vehicle platoons. (...).

**Keywords:**

Cell phone, Driving, Speed, Headways, Regression.

ID 1075 R

**ANALYSIS OF POWERED TWO-WHEELERS MOBILITY IN FRANCE**

Main Author:

**Régis DE SOLERE** (*Ministry of Ecology / CERTU*)**Abstract:**

Powered two-wheelers (PTWs) represent an attractive alternative to the car. They allow those who live and/or work in the city to retain their independence, and provide a rapid means of transport; furthermore, they can be easily parked (often illegally) very close to the user's final destination, and are cheaper to acquire and maintain than a car. These advantages are, however, counterbalanced by high accident rates, conflicts with other road users, and noise and air pollution. Knowledge about users of powered two-wheelers and the journeys they make using these vehicles on weekdays in urban areas is of particular importance in light of increasing traffic congestion in urban areas on the one hand, and the high accident rates associated with this mode of transport on the other. The analysis presented here highlights un certain number of interesting points: - few journeys are made using PTWs in urban areas in France (around 1.5% of all journeys on average), but these journeys concern a significant number of people (around 3% of all users); - this mode of transport is used more in urban areas in south-eastern France: the modal shift here for PTWs is three times higher than in urban areas elsewhere in France; - PTW users travel a lot: the average number of journeys they make each day is higher than for the rest of the population; - users of mopeds (i.e. PTWs with an engine displacement of less than 50 cc) are generally young (school pupils and students) and male (75% of all moped users); "typical" users of motorcycles (i.e. PTWs with an engine displacement of 50 cc or more), on the other hand, are men aged between 25 and 50 in full-time employment, in an "intermediary" or liberal profession or in an executive post; - PTWs are most often used to get to work or to one's place of study; - the average distance of a journey made using a PTW is between 5 and 6 kilometres, which is similar to the average distance of a journey made by car or urban public transport. (...).

**Keywords:**

Powered-two wheelers, Mobility, Journey, User, Household travel survey.

ID 1571 R

**THE IMPACTS OF A NEW RAILWAY: TRAVEL BEHAVIOUR OF RESIDENTS IN NEW STATION PRECINCTS**

Main Author:

**Carey CURTIS** (*Curtin University*)

Co-author(s):

**Doina OLARU** (*The University of Western Australia*)**Abstract:**

This paper reports associations between transit oriented development (TOD) characteristics and behaviour of households following the construction of a new suburban railway through southern Perth, Western Australia. Three precincts have been selected for comparison representing the different development opportunities ranging from potentially congenial configurations of railway station precincts, containing a variety of shops, services, and other attractions to station precincts acting primarily as origin stations or transit interchanges. Drawing on a quasi longitudinal study, examining behaviours before and after the railway opened, we measure the degree to which TOD has resulted in residents reducing their motorised travel and substituting car travel with public transport within the region and walking or cycling within the local neighbourhood. We report on overall travel behaviour change and also drill down to the detail of individuals and households to examine the associations between household characteristics and their location and travel behaviour.

**Keywords:**

Travel behaviour, Transit oriented development, Accessibility.

ID 3003 R

**MODELLING MULTI-ATTRIBUTE REFERENCE  
DEPENDENCE IN A COMMUTING CHOICE  
EXPERIMENT: DOES ONE SIZE FIT ALL?**

Main Author:

**Amanda STATHOPOULOS** (*Trieste University*)

Co-author(s):

**Stephane HESS** (*University of Leeds*)**Abstract:**

In contrast with the standard normative theory, empirical findings indicate that decision makers are sensitive to departures from reference points rather than states. The associated idea that value is generated from comparisons with reference points is one of the most solid and appealing findings to extend axiomatic views of choice behaviour. Several tests of predictions from the reference dependent preference framework have been carried out in experimental economics, and to a smaller extent in a choice modelling setting, to date. These empirical applications of referencing choice behaviour have left a series of unresolved questions. The most prominent shortcomings concern; the lack of a multi-attribute trading context, the use of homogenous modelling approaches and hypotheses for each type of attribute studied and not exploring the possibility of multiple reference points. This paper presents a practical application where multiple attributes of a different nature are modelled, allowing for gain-loss asymmetry, non-linearity, relative-absolute changes in utility and different reference points. The data used to carry out these tests is drawn from a choice experiment on intra-mode commuting choices of train and bus users in the UK. It is shown that allowing for reference effects and decreasing sensitivity improves modelling results, in particular when differentiated according to the nature of each considered attribute. The importance of modelling trading affected by reference effects should not be underestimated given the potential impacts on results later used for measuring welfare and assessing the effectiveness of policies. The consequences of the reference-dependent trade-offs modelled in this paper are reflected in the effect they have on wtp/wta measures. (...).

**Keywords:**

Choice modelling, Discrete choice experiment, Reference effects, Non-linearity, Gain/loss deviations, Commuting.

ID 3172 R

**CHANGING RURAL–URBAN ACCESSIBILITY  
LINKAGES: LONG-DISTANCE TRAVEL BEHAVIOR  
OVER TWO DECADES IN THE PHILIPPINES AND ITS  
IMPLICATIONS ON URBAN TRANSPORT SYSTEMS**

Main Author:

**Jerry OLSSON** (*Dept. of Human and Economic Geography, Univ. of Gothenburg*)**Abstract:**

The spatial interaction of rural and urban areas is strengthening in developing countries. This development put pressure on urban transport systems and on road capacity along urban-rural corridors. However, our understanding of rural people's long-distance travel behaviour and changes throughout time and space are rudimentary. The paper's aim is to investigate how individuals and households rural-urban long-term travel behaviour is influenced by improved road accessibility and concentration of opportunities to cities and urban areas. Based on a longitudinal household survey from 1990 to 2008, this is investigated in a Philippine rural area, previously characterized by poor road accessibility. Preliminary findings show that over time more people are travelling to long-distance destinations, more people are travelling more often and more people are travelling more often in privately owned vehicles. Among the individuals, around one fourth, still wants to increase their travel frequency. While the ability to return home earlier has improved due to improved road accessibility, this does not compensate for the increase in additional travellers and travel frequency. Finally, it is possible that the changing mobility behaviour would have taken place despite the improvements in physical accessibility because of the development in the concentration of opportunities to major cities.

**Keywords:**

Rural-urban linkages, Accessibility, Mobility behaviour, Long-distance, Long-term.

ID 3263 R\*

**ATTITUDINAL ANALYSIS OF FACTORS INFLUENCING OUT-OF-CITY TRAVEL**

Main Author:

**Harikrishna MADHAVAN** (*Indian Institute of Technology - Roorkee*)

Co-author(s):

**Rajat RASTOGI** (*Indian Institute of Technology - Roorkee*)**Abstract:**

Attitudes and perceptions of travellers have been found to influence the trip making behaviour of travellers with respect to their choice of mode and destination. The attribute preferences of out-of-city travellers from two cities in India were studied. The travel attributes considered were 'Travel Cost', 'Travel Time', 'Privacy', 'Comfort', 'Accessibility', 'Intercity Connectivity' and 'Safety'. Three methods viz. mean scores, Scaling theory of successive categories and factor analysis were adopted for analysis. It was observed that higher importance to 'safety' and 'privacy' was attributed by mode users across the distance bands considered. It was noted that as the distance of travel increased, 'travel time' and 'travel cost' found place amongst the influencing variables. The ease of travel characterised by 'privacy', 'comfort' and 'intercity connectivity' were found to have an important role in travel for distance between 250 km and 1000 km. Upgrade services in travel modes were found to be selected by users when the travel distance increased beyond 1000km. An understanding of hierarchy of preferences is necessary for designing a sustainable transportation system.

**Keywords:**

Attitudinal Variables, System variables, Scaling theory, Factor Analysis, Out-of-city travel, India .

ID 1235 R

**GREEN TRAVELLERS? EXPLORING THE SPATIAL CONTEXT OF SUSTAINABLE MOBILITY STYLES**

Main Author:

**Stewart BARR** (*University of Exeter*)

Co-author(s):

**Jan PRILLWITZ** (*Utrecht University*)**Abstract:**

The promotion of environmentally sustainable transport (EST) amongst individual citizens has become a major priority for national and local authorities seeking to tackle congestion, environmental pollution and traffic noise. At this level, a range of models and approaches has been developed for understanding travel behaviour, amongst them the 'mobility styles' paradigm, in which researchers have applied segmentation techniques to explore the presence of different attitudinal and behavioural population groups, that might be targeted to influence behaviour change. Such an approach has become mainstreamed in the United Kingdom (UK), where social marketing approaches, based on segmentation, are being adopted to promote environmentally responsible 'lifestyles'. However, in recent years the rationale for promoting sustainable travel options has shifted towards the issue of global climate change, thus expanding the role of personal travel choices from the local to the global environmental context. Climate change evidently presents a new set of challenges for travel behaviour researchers because of its complex and sometimes contested scientific basis. However, this paper will argue that climate change also presents a major challenge for those attempting to promote behavioural change using a single mobility styles approach because of the ways in which it transcends the spatial and motivational contexts for travel behaviours. Using data gathered as part of a UK Economic and Social Research Council (ESRC) project on sustainable travel, the paper will demonstrate the conflicts that emerge when exploring daily travel behaviour and travel practices for short-breaks and vacations. This is problematised through using a single mobility styles approach, which is based on daily travel behaviour. (...).

**Keywords:**

Travel behaviour, Mobility styles, Sustainable lif.

THU 15<sup>th</sup> (08:15 - 09:30, Session D3.16) Room AVI

ID 2609 R\*

**A JOINT MODEL FOR VEHICLE TYPE AND FUEL TYPE**

Main Author:

**Stephane HESS** (*University of Leeds*)

Co-author(s):

**Mark FOWLER** (*Resource Systems Group, inc*)

**Thomas ADLER** (*Resource Systems Group, inc*)

**Aniss BAHREINIAN** (*California Energy Commission*)

**Abstract:**

In the face of growing concerns about greenhouse gas emissions, there is increasing interest in forecasting the likely demand for alternative fuel vehicles. This paper presents an analysis carried out on stated choice data collected in California, looking at respondent's preferences in a joint vehicle type choice and fuel type choice experiment. Our study recognises the fact that this choice process potentially involves high correlations that an analyst may not be able to adequately represent in the modelled utility components. Importantly, we further hypothesise that the standard Nested Logit model is incapable of capturing the full extent of correlation patterns in such a multi-dimensional choice process, and that a Cross-Nested Logit structure may be more appropriate. Our empirical analysis and a brief forecasting exercise produce evidence to support these suspicions. The findings from this paper are not just of interest in the context of the demand for alternative fuel vehicles but are also relevant for the analysis of multi-dimensional choice processes in general.

**Keywords:**

Discrete choice, Alternative fuel, Cross-nested lo.

THU 15<sup>th</sup> (08:15 - 09:30, Session D3.16) Room AVI

ID 2675 R

**EXPLORING TRAVELLERS' REACTIONS TO CARBON REDUCTIONS POLICIES IN FRANCE : RESULTS OF AN INTERACTIVE STATED RESPONSE SURVEY**

Main Author:

**Patricia LEJOUX** (*Transport Economics Laboratory*)

Co-author(s):

**Charles RAUX** (*LET, University of Lyon*)

**Abstract:**

This paper reports the findings of an Interactive Stated Response Survey, conducted on a small sample of households in France that examined carbon rationing scenarios for transport, involving either a carbon tax or tradable personal carbon allowances. Changes in travel behaviour that are envisaged preferentially by households are identified, with the resources and constraints at stake for these behaviour changes. Household attitudes towards the carbon tax and personal carbon allowances are analysed. Finally, a typology of the households is drawn up, based upon the strategies they employ in response to the scenarios.

**Keywords:**

Climate change - travellers reactions - carbon red.



ID 3117 R

**THE POWER AND VALUE OF "GREEN" IN  
PROMOTING SUSTAINABLE TRAVEL BEHAVIORS**

Main Author:

**Joan WALKER** (*UC Berkeley*)

Co-author(s):

**David GAKER** (*UC Berkeley*)

**Yanding ZHENG** (*UC Berkeley*)

**Abstract:**

In light of the recent trends of sustainable behaviour and "GREEN" technology, we set out to determine whether providing travellers with information regarding their environmental impact could be used to influence their transportation decisions. Our results from the transportation realm are consistent with broader findings from behavioural economics research in that we found that informing respondents of the environmental impact of their choices significantly shifts them toward more sustainable behaviours. Further, we were able to calculate the "Value of 'GREEN'" from both an experiment where subjects had to select which route they would take and an experiment which had subjects report which car they would likely buy upon graduation. We obtain results from two separate experiments and estimate our average subject is willing to pay 25 cents per pound of CO<sub>2</sub> savings in a route choice scenario and 15 cents per pound when buying a car, with 99 percent of our subjects willing to pay something between zero and one dollar per pound of reduced emissions. We also present an experiment to test whether this value of "GREEN" is consistent across trip type and frequency and whether people respond differently depending on how environmental information is presented.

**Keywords:**

Sustainable, Discrete Choice, GHg.

ID 3308 R

**EXPLORING INNOVATIVE POLICY FRAMES FOR  
ACHIEVING BEHAVIOURAL CHANGE TO LOW  
CARBON TRANSPORT**

Main Author:

**Abigail BRISTOW** (*Loughborough University*)

Co-author(s):

**Alberto ZANNI** (*Loughborough University*)

**Phani CHINTAKAYALA** (*University of Leeds*)

**Mark WARDMAN** (*Institute for Transport Studies*)

**Abstract:**

This paper considers innovative policies that could provide a policy framework to encourage the deep cuts in carbon emissions that will be required from the transport sector in the long run. The key measures considered are personal carbon trading and carbon taxes applied to personal travel and domestic energy consumption. We bring together evidence from a small but growing number of studies of personal carbon trading in the UK and Sweden. Particular attention is given to an innovative research study undertaken by the authors in the UK in 2008 with 287 respondents in the South East of England and Cardiff, Wales. This study investigated both acceptability and behavioural change in response to a proposed personal carbon trading scheme or a carbon tax covering personal travel and domestic energy. Stated choice experiments were developed to explore preferences with respect to aspects of scheme design and their influence on acceptability. Whilst carbon footprint data was used as a basis from which to explore behavioural response to price and the different schemes with respect to both domestic energy consumption and transport. Here we examine findings from this research and other studies that have explored acceptability and or behavioural change in response to personal carbon trading or carbon taxes. The paper aims to explore two issues: firstly, evidence on the factors that influence acceptability and secondly behavioural response. To date the, albeit limited, evidence suggests that such policies could be designed to achieve public acceptability. (...).

**Keywords:**

Personal carbon trading, Carbon tax, Acceptability, Behavioural change.

ID 1456 R

**THE INFLUENCE OF DISCOUNT AIRLINES ON TRAVEL BEHAVIOUR OF YOUNGSTERS: RESULTS OF A STATED CHOICE EXPERIMENT**

Main Author:

**Anna GRIGOLON** (*Eindhoven University of Technology*)

Co-author(s):

**Astrid KEMPERMAN** (*Eindhoven University of Technology*)**Harry TIMMERMANS** (*Urban Planning Group, Eindhoven University of Technology, The Netherlands*)**Abstract:**

This paper reports the results of an additive, non-linear, main-effects-only model of portfolio choices of youngsters. The portfolio model concerns the combined choice of destination type, transport mode, duration, accommodation and travel party for leisure trips/vacations. The model also includes several contextual and attribute variables for specific transport modes. Using stated choice experiment data as input, the estimated results indicate that the model performs satisfactory. In substantive terms, it seems that transport mode predominantly influences the portfolio choices. Most attributes are not significant for the current sample size of 154 respondents. The attributes that are significant tend to amplify the specific image and role of transport modes in general and discount airlines in particular.

**Keywords:**

Recreation, Travel behaviour, Dynamics.

ID 2500 R

**MODELLING CHOICE OF AIRPORT AND ACCESS MODE**

Main Author:

**Venu GARIKAPATI** (*IIT Bombay*)

Co-author(s):

**K. V. RAO** (*IIT Bombay*)**Abstract:**

As the economy of a region grows rapidly, it requires rapid modes of transport like air travel. This requires large infrastructural facilities like airports. These facilities involve huge construction cost and thus proper planning has to be done. Modelling Air travel demand at disaggregate level is a new concept in India as airport trips are not given much importance in traditional travel demand forecasting. This study focuses on development of disaggregate models for airport trip purpose, airport choice and access mode choice of airport travellers. The prediction of air passenger and access mode choice decisions for travel to and from the airport forms a key analytical component of airport landside planning, as well as airport system planning. In view of the large demand of Mumbai Metropolitan Region (MMR) and the congestion at existing Mumbai airport, there has been a proposal for second airport in MMR. At this juncture the traveller would have an option to choose between two airports, assuming that similar airlines fly from both the airports. An airport choice model has been developed to study the behaviour of domestic air travellers, with regard to different attributes like access time to the airport, announced delay at the airport and new airport charges. Similarly, an Access mode choice model has been developed with emphasis on attributes like travel time, travel cost, level of comfort of the mode chosen to travel to the airport. For developing these models, a combined Revealed Preference (RP) and Stated Preference (SP) survey experiment was conducted in which the present airport trip details are enquired from the respondent and various hypothetical options were presented to him by varying the levels of attributes of his present trip. (...).

**Keywords:**

Airport Trip Purpose, Airport Choice, Access Mode Choice, Revealed Preference (RP), Stated Preference (SP).

ID 2626 R\*

**AN ANALYSIS OF THE IMPACT OF NON-LOGIT BEHAVIOUR ON LOGIT MODEL ESTIMATION**

Main Author:

**John ROSE** (*ITLS - University of Sydney*)

Co-author(s):

**Stuart BAIN** (*University of Sydney*)**Stephane HESS** (*University of Leeds*)**Abstract:**

Stated choice experiments are commonly used in a range of disciplines, including transport, to elicit responses about the preference behaviour of a population sample. Whilst there are many econometric models that may be used to analyse such stated preference behaviour, one widely used method is the Mixed Multinomial Logit (MMNL) model. The main advantage of this particular model is that it allows for the marginal utility coefficients in estimated models to be distributed randomly across the respondent population, and can therefore account for taste heterogeneity within a population. An assumption implicit in the use of a model (such as MMNL) is that respondents behave in a 'logit' type fashion. That is, respondents are assumed to be both consistent (they do not change their behaviour whilst completing the survey) and also full-traders (their behaviour is based on trading off between the full set of alternatives and not a dominating subset of the alternatives). In practice however, it may be difficult to satisfy these assumptions. Respondents may exhibit inconsistent behaviour through learning or fatigue effects at the beginning and end of the survey instrument respectively (see e.g., Rose and Black 2006). Furthermore, it is impossible to guarantee that respondents won't simply refuse to trade-off between one or more of the presented alternatives (see e.g., Hess et al. in press), or act in a lexicographic manner in terms of how they treat the attributes (see e.g., Salensminde 2002). Accepting that a respondent population may exhibit such behaviours, the question becomes one of the impact of such 'non-logit' behaviours on estimated models. Exactly how robust are commonly used survey instruments when these different types of behaviours are present within a sample population to a greater or lesser degree is, surprisingly, not yet known. (...).

**Keywords:**

Mixed logit, Non-trading.

ID 2642 R\*

**MODELLING THE ROLE OF ATTITUDES IN ELICITING INDIVIDUALS' PREFERENCE ACROSS LIBERTY, PRIVACY AND SECURITY**

Main Author:

**Dimitris POTOGLOU** (*RAND Europe*)

Co-author(s):

**Andrew DALY** (*Rand Europe & University of Leeds*)**Stephane HESS** (*University of Leeds*)**Bhanu PATRUNI** (*RAND Europe*)**Thomas ADLER** (*Resource Systems Group, inc*)**Abstract:**

Contemporary developments of discrete choice models explicitly interface the influence of individuals' attitudes and perceptions - known as latent variables, with choice outcomes (Ben-Akiva et al. 1997; Bolduc et al. 2005). However, these methodologies have not been easily transferred to general practice, mainly because of the complexity of the model estimation task. This paper extends previous research and reports on the influences of attitudes on individuals' preferences in a stated choice experiment when considering different levels of security in the context of travelling on UK's national rail network. Attitudes, life-cycle characteristics or perceptions of individuals are not directly observable, but are rather referred from other variables called indicators. In this paper, we examine the role of two latent variables: level of individuals' concern and level of distrust. Each latent variable was identified through two sets of indicators obtained from the Westin-Harris Index methodology. The analytical framework in this study is the Integrated Choice Latent Variable model, which explicitly incorporates the role of latent variables in the choice model through a structural equation component. Findings suggest that incorporation of latent variables significantly improve the explanatory power of the models and provide better insight on individuals preferences, especially in difficult to quantify concepts such as the case of privacy and liberty.

**Keywords:**

Attitudes, Integrated choice, Latent variable modeling.

THU 15<sup>th</sup> (09:45 - 11:00, Session D3.17) Room AVI

ID 2766 R

**TRAVEL TIME RELIABILITY ON AIRPORT GROUND ACCESS**

Main Author:

**Bianca ALVES** (*Department of Transport Engineering of the Polytechnic School of the University of Sao Paulo*)

Co-author(s):

**Orlando STRAMBI** (*Escola Politécnica da Universidade de São Paulo*)

**Abstract:**

The paper discusses the importance of travel time reliability in the choice of mode for ground access to the São Paulo International Airport. A stated preference survey was conducted with residents travelling to international destinations; revealed preference data about the trip to the airport as well as about the air travel and socio-economic data were also collected. Each individual provided ranking responses on three sets of four alternatives, one for each of the modes considered: auto, taxi, the existing bus service, and a new proposed express train linking the airport to the central area of São Paulo. Attributes describing each mode were cost, average travel time and travel time reliability, expressed as a safety margin, which was defined as the time period allocated by the individual for arriving at the airport at the preferred time. Data were used to estimate discrete mode choice models, considering nesting of alternatives, and inertia and panel effects. The best fit was obtained with a Mixed- GEV model taking into account correlation between public transport alternatives and the panel effect. A safety margin ratio, giving the relative importance of the safety margin to the average travel time, remained fairly stable, around a value of 2, across the different model specifications and structures. This result indicates that travellers value safety margin around two times more than they value average travel time. Furthermore, for the specific case of ground access to airports under highly unreliable travel times, the value of reliability was found to be higher than those reported in the literature for other types of trips.

**Keywords:**

Travel behaviour, Travel time reliability, Airport ground access.

TUE 13<sup>th</sup> (11:15 - 12:30, Session D4.1) Room 1.04

ID 1797 R

**ANALYSIS BIASES DUE TO SURVEY NON RESPONSE IN THE FRENCH NATIONAL TRAVEL SURVEY 2007-08**

Main Author:

**Sophie ROUX** (*INRETS - DEST*)

Co-author(s):

**Jimmy ARMOOGUM** (*INRETS-DEST*)

**Abstract:**

While nonresponse results in a reduced sample size, a more important concern of researchers is the possible impact of nonresponse bias. Bias is introduced when those that do not respond to the inquiry are systematically different from those that do respond on key estimates. In this circumstance, as the above section describes, the response mechanism is "confounded" with characteristics of the sample units. For example, if nonrespondents tended to take more trips, or longer trips than respondents, the estimates of travel produced from only survey respondents will be too low and not representative of the whole population (only those that responded). Getting the advantage that for the last French National Travel Survey (FNTS) 2007-2008 the sample was drawn directly from the census and the list of new residences built since the census, and therefore we have lots of information about respondent and non-respondent to the different survey instruments in the FNTS. We will quantify these biases by using auxiliary information in different calibration that we will produce.

**Keywords:**

Travel Survey, Nonresponse, Bias, Calibration on margins.

ID 2252 R

**THE POTENTIAL OF COMBINING ESTABLISHED HOUSEHOLD SURVEY INSTRUMENTS IN ORDER TO OBTAIN BETTER LONG-DISTANCE TRAVEL DATA FOR EUROPE**

Main Author:

**Tobias KUHNIMHOF** (*Institute for Transport Studies, University of Karlsruhe*)

Co-author(s):

**Joerg LAST** (*STRATA GmbH - Data and Information Management*)

**Abstract:**

Along with the dynamic development of international and domestic tourism and long-distance travel there is increasing demand for comprehensive and reliable data from different stakeholders. The prevailing data situation in Europe, however, is unsatisfactory as the available data on long distance travel is very fragmentary, not harmonized and not comparable. This paper presents the strengths and weaknesses of established and new survey instruments in Europe. Based on this comparison the paper proposes to combine the established survey instruments in order to achieve a higher level of reliability and comparability of long distance travel data in Europe. In Europe, the different stakeholders ranging from the tourism business and central banks to the transport sector have established their own traditions of surveying the long distance travel data relevant for them. Household surveys generally represent a key source of information as they allow for insights into individual decision making. Many European countries have been conducting household travel surveys with focus on everyday travel on the national level for several decades (hereafter: National Travel Surveys). Some have supplemented these surveys with specific surveys on long distance travel. Moreover, household surveys tailored for the needs of the tourism sector are being conducted by the private industry (e.g. world tourism monitor) as well as in compliance with the EU directive on the collection of statistical information in the field of tourism (hereafter: EU Surveys on Tourism Demand). Based on a quantitative analysis of survey data the paper discusses the strengths and weaknesses of established survey instruments and innovative survey designs to capture long distance travel data, specifically from the perspective of the transport sector. (...).

**Keywords:**

Long Distance Travel Surveying, Tourism Surveying,

ID 2444 R

**THE MIXING OF SURVEY MODES: APPLICATION TO LYON WEB AND FACE-TO-FACE HOUSEHOLD TRAVEL SURVEY**

Main Author:

**Patrick BONNEL** (*ENTPE*)

Co-author(s):

**Caroline BAYART** (*ENTPE*)

**Abstract:**

As response rates with all traditional modes (face-to-face, telephone and postal) are declining, it becomes difficult to carry out efficient households travel surveys. Non respondents probably have different behaviour from those who agree to be interviewed. To reduce this bias of non-response, we initiated a project of a web survey in parallel of the household travel survey conducted in face to face in Lyon in 2006. The idea is to propose to those households who refuse to respond or are not contactable after a certain number of attempts to respond by the web. The two main objectives of this research are to test the feasibility of a web survey for non-respondents and compare mobility results of both survey modes. We focus on the main bias often meet with this new media: on-line respondents belong to specific categories. After a description of the population who answered on-line, we characterize its travel pattern and estimate a selection bias.

**Keywords:**

Household travel surveys, Web surveys, Mixed modes surveys, Data comparability, Response rate, Sampling coverage, Design issues, Selection bias.

ID 2595 R

**HOUSEHOLD TRAVEL DEMAND SURVEYS IN FRANCE  
- TELEPHONE / FACE-TO-FACE: CONSEQUENCES ON  
MOBILITY INDICATORS**

Main Author:

**Nicolas MERLE** (French Ministry of Sustainable  
Development / CETE Nord Picardie)

**Abstract:**

The paper deals with the different methodologies of household travel demand surveys in France and the consequences on mobility indicators of telephone surveys compared to face-to-face surveys. For a few years in France, the share of households who cannot be reached on the phone has increased, due to two main reasons: a rising share of people owning only a mobile phone, and households changing for a new phone operator (consequently the phone number cannot be obtained in the historic operator phone user file). For instance, in the Lille urban community, the share of households without phone increased from 6% in 1998 to 22% in 2006. On average in France, this share has increased by 1% per year over the past 10 years. At the same time, new methodologies of household travel demand surveys have been developed in France: since a few years, telephone has been used for surveys in midsized cities and also in the rural parts around large urban centres. Using the most recent face-to-face surveys undertaken in France (in Toulouse and Montpellier 2003, Lille and Lyon 2006, Rouen 2007, etc.), the research shows that households who don't own any landline have different mobility patterns than households with a phone. On average, the mobility of "landline holders" in terms of number of trips per day is equal, but their use of transport modes is different: they travel more by car, but less by public transport means and walking. Consequently, there is a risk of overestimating car mobility and underestimating public transport use. Among those people, a diversity of profiles can explain these differences: one of them is people who replaced a landline by a mobile phone. They are mostly young households, students, and are more mobile than the average population, particularly on foot and by public transports. (...).

**Keywords:**

Household travel demand surveys – Telephone/Face-to-face – Mobility analysis – Mobility patterns.

ID 3215 R

**REVIEW OF TRAVEL SURVEY USEFULNESS**

Main Author:

**Peter ENDEMANN** (Planungsverband Ballungsraum  
Frankfurt / Rhein-Main)

**Abstract:**

Behavioural travel surveys are highly meaningful in the context of planning and policy formulation at different levels and a wide range of transport issues. There are numerous surveys undertaken all over the world, but survey purposes and the potential usefulness for everyday application in research and practice is not often clearly laid out and could be strengthened. Surveys serve for a variety of purposes far beyond the most obvious modelling issue. Moreover, given the difficulty of generating funds for quite expensive surveys, there is a necessity to bundle survey activities. Furthermore, large and mostly cost-intensive national travel surveys (NTS) can serve for multiple reasons and bear even the advantage that regional or local add-ons to the sample size allow comparability as they respect the same design and methodology. The paper shows that in general, several national household travel surveys do fulfil a strategic objective in terms of statistical requirement, mobility patterns, evaluation and planning of the national transport infrastructure network and policy formulation. Therefore, mostly data feed the respective transport model or serve as some relevant key indicators. In this first part, it will be shown that only few surveys go beyond this point and conceive the travel survey as an instrument using a holistic approach which is of greater benefit for all. Furthermore, it is rarely the case that additional institutions benefit from organising add-ons to the national sample size if it is possible. With this respect, some insights from the German National Travel Survey will be helpful. (...).

**Keywords:**

Travel Survey Benefits, Survey Marketing, National (Household) Travel Surveys, Urban & Regional Planning.

TUE 13<sup>th</sup> (14:00 - 15:15, Session D4.2) Room 1.04

ID 1028 R  
**ENHANCING TOOLS FOR INTELLIGENT  
TRANSPORTATION SYSTEMS APPLICATIONS:  
MATCHING DATA ACQUIRED BY DRIVING  
SIMULATOR AND TRA**

Main Author:

**Roberta DI PACE** (University of Naples)

Co-author(s):

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**Fulvio SIMONELLI** (University of Naples "Federico II"-  
Depart.of Transp.Engineering "L.Tocchetti")

**Mariano PERNETTI** (Second University of Naples,  
Department of Civil Engineering.)

**Abstract:**

Among ITS (Intelligent Transportation Systems) applications, a relevant interest has been devoted in recent years to ATIS (Advanced Travellers Information Systems). The prediction of travellers' route choice, in a context in which they are provided with information by different systems (VMS; route guidance; in car navigation systems), includes the study of travellers' compliance. In order to be effective, ATIS require appropriate levels of travellers' compliance with the dispatched information (Bifulco et al., 2007). However, travellers' compliance strictly depends on the accuracy of the information and the latest is mainly perceived by the travellers with reference to recurrent traffic conditions, where the discrepancy between the suggestions received by ATIS and the actual travel times can be easily experienced. It is worth noting that putting in place accurate ATIS is not only a technological matter but also (maybe mainly) a modelling issue, provided that the ATIS-information design problem is, in recurrent traffic conditions and for dynamic and predictive ATIS, a typical anticipatory-route-guidance problem (Crittin et al., 2001). The design of an accurate information system is obtained not only by advanced technologies but also by complex implementations of iterative procedures. In any case, in order to reach high-accuracy performances, it is required the availability of proper simulation models where the effect of the information accuracy on the compliance with information is explicitly and endogenously modelled. (...).

**Keywords:**

ATIS, Travel Simulator, Driving Simulator, Route choice.

TUE 13<sup>th</sup> (14:00 - 15:15, Session D4.2) Room 1.04

ID 1207 R  
**UNRAVELING SEMI-COMPENSATORY CHOICE: DATA  
COLLECTION BASED ON TWO-STAGE DECISION  
PROTOCOLS**

Main Author:

**Sigal KAPLAN** (Faculty of Civil and Environmental  
Engineering, Technion – Israel Institute of Technology)

Co-author(s):

**Shlomo BEKHOR** (Transportation Research Institute,  
Technion - Israel Institute of Technology)

**Yoram SHIFTAN** (Technion-Israel Institute of Technology)

**Abstract:**

The present study proposes a two-stage procedure to collect data about semi-compensatory choice processes in a digital economy environment. At the first stage, individuals form their viable choice set by specifying a set of tolerated criteria thresholds. At the second stage, individuals choose their most preferred alternative. The digital economy environment allows seamless tracking of the two-stage choice protocols without interfering with the natural choice process and without introducing problems related to comprehension bias, narrative inconsistency and misinterpretation of the choice protocols. The procedure is accompanied by a questionnaire collecting personal information that can be associated to threshold selection. The procedure is applied to off-campus apartment rental choices by students in order to demonstrate its capability to retrieve tolerated criteria thresholds and choice outcomes from cross-sectional data in a choice situation entailing many alternatives and multiple criteria. Results show the importance of elimination-based choice set formation, the distribution of threshold selection across the population, the characteristics of the considered choice sets, and the linkage between the choice set formation and the choice.

**Keywords:**

Two-stage elicitation, Thresholds, Direct elicitation,  
Decision protocols.

TUE 13<sup>th</sup> (14:00 - 15:15, Session D4.2) Room 1.04

ID 2289 R

**QUALITATIVE ANALYSIS OF COMMUTERS' RESPONSES TO REWARDS FOR RUSH-HOUR AVOIDANCE**

Main Author:

**Eran BEN-ELIA** (*Centre for Transport and Society, University of the West of England*)

Co-author(s):

**Dick ETTEMA** (*Faculty of Geosciences - Utrecht University*)

**Hennie BOEIE** (*Utrecht University*)

**Abstract:**

which is based on rewarding frequent car commuters to avoid the rush hour, using monetary incentives. Analyses of the quantitative data gathered in various Spitsmijden projects have revealed much of the factors influencing car users' responses to rewards, their decision to participate and the order of magnitude of rush hour travel reduction. However, questions remained regarding participants motivations to participate and avoid the rush hour, and how their behaviour and motivations develop throughout the reward period. This paper describes the use of qualitative research methods (semi-structured interviews) that were applied to tackle these questions. Interviews held with 12 participants were coded and analysed using the MaxQDA software package. The analyses suggest that participants' motivations and behaviour are not stable and that a process takes place in which the rewarding gradually leads to behavioural change. Although the reward is the initial motivation to enrol and avoid the peak, many find travel options that are in themselves rewarding, leading to intrinsic motivation to sustain the behaviour. Some eventually choose a single new travel option (stabilisers), while others optimise their choice using dynamic traffic information (flexibles). Those who do not find attractive alternatives to avoid the peak do not develop intrinsic motivation and fall back to their old behaviour when the reward ends (relapsers). (...).

**Keywords:**

Behaviour-change, Congestion, Motivation, Qualitative research, Rewards, Semi-structured interviews, Rush-hour avoidance, Mobility.

TUE 13<sup>th</sup> (14:00 - 15:15, Session D4.2) Room 1.04

ID 2630 R\*

**COST EFFECTIVE METHODS FOR ASSESSING DEMAND ON LRT SYSTEMS**

Main Author:

**Ana GARÇÃO** (*VTM Consultores*)

**Abstract:**

Light Rail Transit (LRT) is a form of urban rail public transportation where generally, vehicles are a derivative of the traditional tram, designed to have a greater passenger capacity and speed (but not as high as in a metro system), and a greater level of comfort. LRT systems seem to be a very attractive option for urban public transport, considering their role in promoting energy-efficient and environmentally-friendly transport through a high quality image. In order to analyze the Cost Effective Methods for Assessing Demand on LRT Systems, the author based his study on a data collection of trip characteristics, of two different projects of different types of LRT systems available in Portugal, on which has been involved. Data collection is a crucial stage in the planning and implementation of a study. There are various data collection techniques that can be used such as, using available information, observing, interviewing, etc. Attending to the experience of the author, if data collection is superficial or incomplete, data analysis becomes difficult, therefore, the most important thing in the time of collecting data to a specific study, is to understand which method better fits attending to the main objective of a cost effective and time-saving solution. In this actual economical situation, the public transport sector is quite affected, especially among the private companies in this sector. Above-mentioned facts lead to the necessity of optimizing the data that we have (equally for primary and secondary sources) in a prompt form, in budget wise and of the available time. Therefore, we have a tendency to check at global levels of demand, resorting to agile methodologies, wrapping the mobilization of human resources of significant dimension in a period of reduced time. (...).

**Keywords:**

Urban Rail Public Transportation, Light Rail Systems, Data Collection, Cost effectiveness, Demand.



TUE 13<sup>th</sup> (14:00 - 15:15, Session D4.2) Room 1.04

ID 2759 R

**CNET AND APT – A COMPARISON OF TWO METHODS FOR MEASURING MENTAL REPRESENTATIONS UNDERLYING ACTIVITY-TRAVEL CHOICES**

Main Author:

**Oliver HORENI** (*TU Eindhoven*)

**Abstract:**

This paper presents and compares the potential of online versions of two interview techniques (APT and CNET) which have been developed for measuring mental representations underlying activity-travel choices. The comparison is based on the results of a first online survey administered in the Netherlands. Resulting mental representations for a simple activity-travel task are analysed and compared. Conclusions for further investigations are drawn.

**Keywords:**

Mental Representations, Online interview, Laddering.

TUE 13<sup>th</sup> (15:30 - 16:45, Session D4.3) Room 1.04

ID 2082 R\*

**LARGE-SCALE ADVANCED TRAVEL SURVEY USING GLOBAL POSITIONING SYSTEMS : A CASE OF KOREA**

Main Author:

**Sangho CHOO** (*The Korea Transport Institute*)

Co-author(s):

**Hyangsook LEE** (*Department of Civil and Environmental Engineering, Rutgers, The State University of New Jersey*)

**Hyungon SUNG** (*The Korea Transport Institute*)

**Abstract:**

Household travel diary survey is generally conducted in order to obtain travel data used for transportation planning that had ordinarily been collected by mail-in/mail-back surveys, faceto- face interview, or telephone interview. However, the reliability of the collected data from the survey may be questioned because, with the method of travel diaries, many of the trips are not properly reported. In other words, as respondents usually draw up their travel diaries after all the trips they took during the day, specific details regarding such trips rely excessively on their memories. For this reason, data such as trip departure and arrival times and locations may not be reported in detail, and information regarding less important trips may be omitted. In former studies, Park (2002), Wolf et al. (2003), Stopher et al. (2005) and Stopher and Greaves (2007) discussed these problems appeared in traditional travel diary surveys. To increase the data reliability, this study suggests a new survey method using cutting-edge telecommunications, by developing Global Positioning System (GPS)-installed Personal Digital Assistants (PDAs). A state-of-the-art travel survey was conducted for selected 2,739 households residing in Jeju City on Jeju Island, the southern-most island of Korea. We also surveyed 30% of the households with traditional travel diary to compare results of both survey methods for the total number of trips and the trip distribution by trip purpose and transportation means, respectively. In conclusion, the cutting-edge survey method using GPS system is expected to significantly increase the efficiency and the reliability of the travel survey hence improve travel forecasting results in various aspects. (...).

**Keywords:**

Travel survey, Cutting-edge telecommunications, Global Positioning System (GPS).

ID 2182 R

**DEVELOPMENT AND IMPLEMENTATION OF A GPS/INTERNET-BASED DESIGN FOR LONGITUDINAL BEFORE-AND-AFTER TRAVEL BEHAVIOUR STUDIES**

Main Author:

**Stephen GREAVES** (*University of Sydney*)**Abstract:**

This paper details the development and implementation of a technological solution to support a longitudinal (10 week) study of driving behaviour in Sydney, Australia. The aim of the study was to facilitate, predict and detect changes in driving and encourage safer driving practices through kilometre-based charges that varied based on the drivers themselves and how much, when and how they drove (specifically speeding). The study comprised a five-week 'before' period of monitoring to establish how motorists drove normally, followed by a five-week 'after' period of monitoring in which charges were levied and changes assessed. Financial incentives were then paid to motorists for any reductions in charges between the two five-week periods. The data requirements of the study were intense: 10 weeks of detailed driving usage information (Vehicle Kilometres of Travel, times, speeds and speeding, origins/destinations and routes) together with additional information on trip purpose, who was driving and the number of passengers without unduly burdening participants. The solution used Global Positioning System (GPS) technology to derive the driving usage information and provide the basis for an Internet-based survey, in which participants were able to view their trips from the previous day and provide the additional trip information in a straightforward Google-map style interface. An additional feature of the study was the wireless transmission of the GPS data in near real-time for processing enabling the quality of data to be regularly assessed and any problems/issues attended to quickly as well as providing the basis for the update of the Internet survey in a timely manner. The paper details implementation of the approach for the 148 motorists participating in the study and includes an assessment of the quality of data and reaction of participants to providing data for this length of time gathered through exit interviews. (...).

**Keywords:**

GPS, Prompted-Recall, Longitudinal surveys, Before-and-after surveys.

ID 3322 R

**COMPARING GPS AND PROMPTED RECALL DATA RECORDS**

Main Author:

**Peter STOPHER** (*The University of Sydney*)

Co-author(s):

**Christine PRASAD** (ND)**Jun ZHANG** (ND)**Abstract:**

Global Position System (GPS) devices as a substitute for conventional travel diaries have been considered for some time in the past. However, only in the past year or so has a serious effort been made to trial replacement of travel diaries with GPS. Apart from the refinements in the technology to obtain sufficiently accurate measurements of position and to have battery power that will last sufficiently long, the major barrier to the widespread adoption of GPS as a means of undertaking household travel surveys is the information required for travel demand modelling that is not collected by the GPS device. GPS devices are, of course, very accurate at recording the time and positional characteristics of travel. However, the GPS device cannot record modes of travel used, trip purposes, or number of occupants in private vehicles, all of which are important attributes normally acquired in a household travel survey. Some researchers have developed interactive GPS devices, in which respondents are asked to either respond to questions asked on a PDA screen about these non-GPS characteristics of travel or, in a simpler process for the respondent, to press certain buttons on a GPS device that record the mode and purpose. Such procedures are possibly useful, but have to rely on the memory of the respondent to enter such data at the time of travel, somewhat undermining the low burden and non-reliance on respondent memory of the passive GPS device. The alternative approach, and the one that is the focus of this paper, is to develop software processes that are able to deduce, with sufficient accuracy, the missing data from a combination of the GPS records, other data collected from respondents, and data available in GIS records. (...).

**Keywords:**

GPS, Prompted Recall Survey, Data Collection.

ID 3323 R

**CONDUCTING A HOUSEHOLD TRAVEL SURVEY WITH GPS: REPORTS ON A PILOT STUDY**

Main Author:

**Peter STOPHER** (*The University of Sydney*)

Co-author(s):

**Laurie WARGELIN** (ND)**Abstract:**

For the past decade, GPS devices have been used increasingly as a means to validate household travel surveys and more recently as a means to determine response to travel behaviour change policies. However, although several papers have put forward arguments that GPS is now ready to be used as a potential substitute for conventional travel surveys, there has been somewhat of a reluctance to proceed in this direction. This paper describes such an effort. In late 2008, a team of consultants was put under contract by the Ohio Department of Transportation to conduct a GPS survey of households in the Greater Cincinnati area of southwest Ohio, northwest Kentucky, and southeast Indiana. A pilot survey was conducted in March-April 2009, and this paper reports on the outcome of that pilot study. At the time of writing this paper, the main study is underway, with a goal of having at least 3,000 households use GPS devices for a three-day period within the 12 months from mid- August 2009 to mid-August 2010. In this paper, the procedures for recruitment of households, delivery and collection of GPS devices, and the rates of completion of the survey are described. A prompted recall survey, using a web-based survey is also described. The purpose of the web-based prompted recall survey is to collect sufficient data to allow improvement and addition to existing processing software, so that the GPS data will provide sufficient information to allow travel demand models to be estimated, as well as informing various policy issues. Preliminary results from the pilot survey indicate some issues with completion of the GPS task and also with the prompted recall survey. These issues have suggested the use of variable incentives in the main survey to improve overall response levels and significant changes to the prompted recall survey, which have been implemented. (...).

**Keywords:**

Household travel survey, GPS, Pilot survey, Trip r.

ID 1387 R

**A KALMAN-FILTER APPROACH FOR DYNAMIC OD ESTIMATION IN CORRIDORS BASED ON BLUETOOTH AND WIFI DATA COLLECTION**

Main Author:

**Jaume BARCELO** (*Universitat Politècnica de Catalunya, CENIT*)

Co-author(s):

**Lidia MONTERO** (*Technical University of Catalonia*)**Laura MARQUES** (CENIT)**Carlos CARMONA** (CENIT)**Abstract:**

From the point of view of the information supplied by an ATIS to the motorists entering a freeway of one of the most relevant is the Forecasted Travel Time, that is the expected travel time that they will experience when traverse a freeway segment. From the point of view of ATMS, the dynamic estimates of time dependencies in OD matrices is a major input to dynamic traffic models used for estimating the current traffic state and forecasting its short term evolution. Travel Time Forecasting and Dynamic OD Estimation are thus two key components of ATIS/ATMS and the quality of the results that they could provide depend not only on the quality of the models but also on the accuracy and reliability of the measurements of traffic variables supplied by the detection technology. The quality and reliability of the measurements produced by traditional technologies, as inductive loop detectors, is not usually the required by real-time applications, therefore one wonders what could be expected from the new ICT technologies, as for example Automatic Vehicle Location, License Plate Recognition, detection of mobile devices and so on. A simulation experiment is proposed prior to deploy the technology for a pilot project. The simulation emulates the logging and time stamping of a sample of equipped vehicles providing real-time estimates of travel times for the whole population of vehicles and OD pattern of the equipped vehicles are considered real-time estimates of the dynamic OD pattern for the whole population of vehicles. The main objective of this paper is to explore the quality of the data produced by the Bluetooth and Wi-Fi detection of mobile devices equipping vehicles to estimate time dependent OD matrices. (...).

**Keywords:**

Travel Time, Origin Destination Matrices, Estimation Prediction, ATIS, ATM.

TUE 13<sup>th</sup> (17:00 - 18:15, Session D4.4) Room 1.04

ID 1461 R

## THE ROLE OF SMARTCARD DATA IN PUBLIC TRANSPORT

Main Author:

**Peter WHITE** (*University of Westminster*)

### Abstract:

The provision of smartcard systems in urban public transport is expanding rapidly. In addition to operational and marketing benefits, they provide a wide range of data on system usage. At the aggregate level, total ridership can be measured more precisely, and components such as demand by time of day analysed. Anonymised disaggregate data can be used to examine origin-destination patterns, extent of interchange and variations in trip rates per cardholder. However, a number of limitations exist, including data quality, whether exit as well as entry to the system is recorded, and the degree to which comprehensive data on all operators in the same area is obtained. There is still a role for manual data collection, to complement that from smartcards, and identify factors such as ultimate origin & destination, journey purpose, etc. These issues are examined with reference to a number of practical examples in Britain.

### Keywords:

Smartcards, Trip rates, Interchange, Data quality.

TUE 13<sup>th</sup> (17:00 - 18:15, Session D4.4) Room 1.04

ID 2716 R

## LEVERAGING DATA OF A MULTI-MODAL AND MULTI-OPERATOR SMART CARD AUTOMATIC FARE COLLECTION SYSTEM FROM THE PERSPECTIVE OF A REGIONAL TRANSIT AUTHORITY

Main Author:

**Ka KEE ALFRED CHU** (*Agence métropolitaine de transport*)

Co-author(s):

**Daniel BERGERON** (*Agence métropolitaine de transport*)

### Abstract:

Public transit actors have specific data needs as they target various aspects of public transit planning and management. A regional transit authority, due to the nature of duties it assumes, is highly involved in the collection, assembling, storage, processing, analysing, exchange and distribution of transport and mobility data. Meanwhile, the smart card automatic fare collection (AFC) system, often multi-modal and interoperable among transit operators in a region, provides a continuous source of detailed activity data within a transit network. This paper demonstrates the use of three types of transactional data generated by a smart card AFC system, namely sales, fare validation and verification data, from the perspective of a regional transit authority. The results, based on currently available data, would help to refine the financial mechanism, better manage fare products, extend the understanding the travel and purchase behaviour of users and improve transit service planning. The types of analysis can be generalized to other transit agencies with access to similar data.

### Keywords:

Public transit, Smart card, Data analysis, Planning, Finance.

TUE 13<sup>th</sup> (17:00 - 18:15, Session D4.4) Room 1.04

ID 2988 R

**PUBLIC TRANSPORT OD MATRIX ESTIMATION FROM SMART CARD PAYMENT SYSTEM DATA**

Main Author:

**Marcela MUNIZAGA** (*Universidad de Chile*)

Co-author(s):

**Carolina PALMA** (*Transantiago*)

**Pamela MORA** (*Universidad de Chile*)

**Abstract:**

Many cities in the world have incorporated information technology to their public transport systems, and continue advancing along these lines. Santiago, Chile is not an exception, and the new public transport system Transantiago has introduced GPS bus location and smartcard payment systems. However, this particular case has some characteristics that make it particularly interesting for passive data collection: most payments are made by smartcard, therefore a very high percentage of boarding transactions are recorded in a huge Transactions database and all buses are equipped with GPS device that generates an even bigger Positions database. These characteristics, which are not yet present in other transport systems, will most likely be the standard in the future. This represents an excellent opportunity for public transport planners, as cards (users) can be followed through the system to identify their travel patterns. This source of information has so much space-time detail that once processed would permit analyzing not only mean attributes at any desired level of time-space disaggregation, but also variance and regularity of behaviour. This paper describes the data and some of the potential applications, and shows some preliminary results. A method is proposed to estimate boarding and alighting bus stops, and to estimate travel time and time assigned to activities between trips. The method is applied to a sample of the database. Some preliminary results and the success rates are shown.

**Keywords:**

Public transport, OD matrix, Passive data collection.

WED 14<sup>th</sup> (08:15 - 09:30, Session D5.1) Room 1.04

ID 1616 R

**IMPROVING ACCESSIBILITY MEASUREMENT COMBINING TRANSPORT MODELLING AND GIS ANALYSIS: TWO EXAMPLES FROM FRANCE AND GERMANY**

Main Author:

**Aurélie MERCIER** (*Laboratoire d'Economie des Transports*)

Co-author(s):

**Thomas STOIBER** (*Technische Universität München*)

**Abstract:**

Dealing with two case studies, the first in the German RheinMain region and the second in the Lyon Metropolitan area, two methodologies are presented to measure accessibility. Both approaches combine classical transport modelling techniques with GIS based data and network analysis. With a focus on supporting local and regional decision makers, different indicators are used in order to derive and pre-evaluate planning measures as well as to demonstrate location qualities depending on the quality of transport supply and traffic flow.

**Keywords:**

Accessibility, Geographic information system, Transport model.

ID 1653 R

**SEMI-AUTOMATIC IMPUTATION OF LONG-TERM  
ACTIVITY-TRAVEL DIARIES USING GPS TRACES:  
PERSONAL HISTORIES VERSUS AGGREGATE  
CONDITIONAL PROBABILITY TABLES**

Main Author:

**Anastasia MOISEEVA**

**Abstract:**

The new generation of dynamic models of activity-travel demand requires multi-day or multiweek activity-travel data. A combination of modern GPS technology and a prompted recall instrument may be a powerful tool to reduce respondent burden and collect such multi-week data of travel behavior. The authors have developed such a system, called TraceAnnotator which was designed for automatic imputation of various facets of activity-travel patterns from GPS tracers. The core of the system developed is a Bayesian belief network that classifies the outcome variables of interest, using a network of input variables. This means that the interpretation of the GPS traces of any new respondent is based on the aggregate conditional probability tables that the system learned on the basis of the previously processed respondents/cases. However, in case of multi-day data collection, the history of every respondent is also collected. This implies that learning can be based on the continuously updated conditional probability tables, aggregated across respondents, or on the personal histories of respondents or on a combination of both. This paper will discuss the results of these alternative approaches to impute transport modes and activity types for multi-week activity-travel diary data using GPS technology.

**Keywords:**

Multi-day GPS tracers, Personal data, Aggregate data, Learning algorithm.

ID 1772 R

**MOSART: AN INNOVATIVE GIS-T PROJECT FOR  
PLANNING SUSTAINABLE MOBILITY**

Main Author:

**Aurélie MERCIER** (*Laboratoire d'Economie des  
Transports*)

**Abstract:**

In the context of spatial and environmental constraints coupled to a need for dynamic transport/land use analysis, the paper presents the innovative modelling platform "MOSART". In a first version, MOSART has been implemented as a Geographical Information Systems in Transportation producing accessibility analysis. It has been moved to an innovative modelling platform for planning sustainable mobility introducing gravity-based analysis in a second version. Combining analysis on both urban speed issues and land-use patterns from an access-based point of view, MOSART presents a new approach of transport and land-use policies assessment.

**Keywords:**

Accessibility, Geographical Information Systems for Transportation, Transport modelling.

ID 2829 R

**INTEGRATING COMPUTATIONAL INTELLIGENCE,  
MICROSIMULATION AND SEMAPHORIC REGULATION  
INTO CONVENTIONAL GIS SOFTWARE**

Main Author:

**Paulo ALMEIDA** (*CEFET-MG / Centro Federal de  
Educação Tecnológica de MG, Brasil*)

Co-author(s):

**Fernando DE OLIVEIRA** (*Centro Federal de Educação  
Tecnológica de Minas Gerais - CEFET-MG - Brazil*)**Fernando BERNARDES DE OLIVEIRA** (*Centro Federal  
de Educação Tecnológica de Minas Gerais - CEFET-MG -  
Brazil*)**Gray GRAY** (*Cefet/MG*)**Abstract:**

Traffic flow management and control has become a serious problem for large cities around the world, because of the increasing amount of circulating vehicles and the lack of infrastructure and modern technology available to traffic agencies. An efficient semaphore planning strategy can guarantee a safe and regular vehicle flow, avoiding traffic jam and delays. Besides that, it can contribute to safe transportation, to pollution emission minimization and to drivers and pedestrians' satisfaction. However, semaphoric regulation is a difficult task to accomplish, mainly if a specific region has high vehicle flow rates and a lot of semaphores to be simultaneously regulated. Moreover, conventional techniques have become obsolete and are very ineffective to modern demands and actual traffic conditions. This paper focuses the development of an integrated software environment, composed by a GIS module, a computational intelligence based semaphoric regulation tool and a microsimulation engine, all of them encapsulated into an open architecture platform to perform, validate and test semaphoric planning. GIS module allows importing of existing traffic network digital documents into the software environment, selecting of specific regions inside a city to be studied and execution of effective simulation without needing to redraw street map and traffic details. To perform semaphore regulation, an immune system inspired on clonal selection principle, called CLONALG (CLONal selection ALgorithm), is applied and effectively tested. (...).

**Keywords:**

Traffic Lights, Computational Intelligence, CLONALG, GIS, Simulation.

ID 3099 R

**RESULTS OF THE UTRACS INTERNET-BASED  
PROMPTED RECALL GPS TRAVEL SURVEY:  
EMPIRICAL ANALYSIS OF THE ACTIVITY PLANNING  
PROCESS**

Main Author:

**Joshua AULD** (*University of Illinois at Chicago*)

Co-author(s):

**Martina FRIGNANI** (*University of Illinois at Chicago*)**Abolfazl MOHAMMADIAN** (*University of Illinois at  
Chicago*)**Abstract:**

This paper presents the results of an internet-based prompted recall activity-travel survey using GPS data collection combined with a short activity preplanning and scheduling survey. Besides collecting traditional activity-travel diary data, this survey also collects basic information about activity planning and the scheduling process. Since aging is a growing concern among transportation planners, this survey has a special focus on the elderly population with half of the survey sample consisting of elderly households. Respondents carried a portable GPS device for 14 consecutive days and at the end of each day uploaded the collected data to a website where the activity-travel survey questionnaires were answered. Results indicate that the quality of the data collected is good and that the response rates were satisfactory considering the commitment involved in participation. The results reinforce previous findings that GPS surveys have an improved ability to capture trips which are frequently under-reported and provide valuable data about the activity planning and scheduling process itself. The survey, while collecting the standard household travel survey type questions, also collected data regarding the activity planning and scheduling process. Data regarding the planning process, including spatial, temporal and interpersonal flexibilities and planning horizons for the activity itself as well as plan horizons for various attributes of the activity, were all reported during the prompted recall portion of the survey. Altogether, the survey should provide important information regarding the nature of the activity-travel planning process.

**Keywords:**

Activity-Travel Survey, GPS Data Collection, Prompted Recall, Activity Planning.

ID 1138 R

**CAR-FOLLOWING ANALYSIS USING DGPS DATA  
BASED ON GM1 MODEL**

Main Author:

**Jinhwan JANG** (*Korea Institute of Construction  
Technology*)

Co-author(s):

**Sangchul BYUN** (*KICT*)  
**Jusam OH** (*KICT*)

**Abstract:**

This paper estimates GM1 model parameters using DGPS data of probe vehicles on a multilane motorway in Korea. Applications of this research can be seen in traffic simulation models, such as CORSIM and Paramics that use car following models to simulate traffic flow and to predict operational performance characteristics of roadways. The GM1 model parameters estimated in this study are compared with those of some existing studies. As a result of the comparison, the sensitivity ( $\alpha$ ) is much higher than the existing ones and the reaction time (T) is similar to them. Even though the parameters were estimated from limited car following data, it could be highly regarded as the first case in which GM car following model parameters were estimated using DGPS data on the real highway in Korea.

**Keywords:**

Car Following Analysis, DGPS (Differential Global Positioning System), Simulation, GM1 Model.

ID 1185 R

**USING GPS DATA FROM A SAMPLE OF PRIVATE  
CARS FOR MODELLING THE URBAN TRAFFIC**

Main Author:

**Sergio MITROVICH** (*ENEA*)

**Abstract:**

This paper is focused on the development and use of the analytical and statistical methods needed for transforming raw GPS data, recorded from a large sample of private vehicles, into a source of information suitable as input for traffic models or for noise and air pollutant emission models, as well as for short-term travel time prediction models, and in general to improve the understanding of traffic and travel patterns existing in a city and in the wider surrounding region. The first part of the paper describes the main steps of the data treatment process and the algorithms which can be used for different applications and in different operating conditions (i.e. sampling period, density of equipped vehicles, polling time intervals, etc.). The second part of the paper reports about the results of a trial application: a full week test, related to Florence (a medium-large Italian city) province and surrounding urban area, is examined and discussed to demonstrate the practical potential of this new approach in understanding and modelling urban traffic performances.

**Keywords:**

Floating Car Data, Traffic Analysis, Traffic Management.



ID 1486 R

**MERGING AFC, APC, GPS AND GIS-T DATA TO GENERATE PRODUCTIVITY INDICATORS AND TRAVEL DEMAND MODELS IN PUBLIC TRANSIT**

Main Author:

**Robert CHAPLEAU** (*École Polytechnique de Montréal*)

Co-author(s):

**Bruno ALLARD** (*École Polytechnique de Montréal*)**Abstract:**

Public transport service planning has, for a long time, been determined by a limited amount of relevant data and travel demand knowledge. The cost of maintaining a large and consistent amount of onboard surveys has been prohibitive. Emerging technologies implementations such as APC (Automatic Passenger Counting), AFC (Automatic Fare Collection by Contactless Smart Cards), GPS (Global Positioning System) location at a regular 4-second intervals, and GIS-based operational databases are frequently observed. Very often, taken separately, each of the data sources lies. Authors regularly report data recovery rates as poor as 25 to 75%. This fact is also confirmed by our own experience. In that context, the actual research is an attempt to realise the convergence of the four tools in order to provide coherent, consistent, and complete ridership information merging for several corridors. The archived databases for the case of Montreal, where more than 200 vehicles are equipped with independent APC, GPS and Smart Cards systems, are scrutinized for the development of intelligent algorithms to deduct correct and complete information: imputation of GPS signal loss and spatial identification of the weak GPS signature, correction of double counting from the passenger sensors, imputation of the most probable alighting stop of the riders, etc. Combined visualization techniques (GIS maps, pseudo-geo-time-space diagram) and dataset processing contribute to an enriching procedure where all relevant attributes are determined to measure productivity factors and level of service. The demonstration of and experimentation with the processing of huge datasets are part of the exercise where some kind of data synthesis is sought for the future. (...).

**Keywords:**

AFC, APC, GPS, Smart card, Public transit, Montreal, Archived data.

ID 2017 R

**FUZZY TRAVEL BEHAVIOUR MODEL WITH SPATIAL INFORMATION TO EVALUATE PUBLIC TRANSPORT POLICY**

Main Author:

**Takamasa AKIYAMA** (*Kansai University*)**Abstract:**

The public transport policy in local city is discussed in the study with fuzzy travel behaviour model. In terms of database, the person trip (PT) survey for urban area has been made every ten years. The database has been accumulated for over forty years concerning with activities and travel behaviour. It is often used to consider the future transport planning. Since the travel behaviour is reported with zone to zone in the trip survey, the spatial distribution cannot be specified precisely. The integration of travel behaviour model and geographic information system (GIS) is proposed. The algorithm to specify the activity spots of individual trip makers with spatial information of GIS. In travel behaviour modelling, the engineering data can be modified involving precise spatial information of trip maker. Even in the traditional modelling such as logit model, the advantage of combination between trip database and GIS information is to estimate the travel behaviour accurately. Furthermore, fuzzy logic based model with GIS information is proposed to estimate the travel behaviour in terms of description of human decision as well as accurate description of travel behaviour. In particular, the modal choice model can be proposed to estimate the impact of public transport policy to the urban traffic. The pricing policy and environmental taxes are mainly discussed for future transport planning in the local city. It is concluded that the impact of transport policy can be evaluated precisely with fuzzy logic based model with GIS information.

**Keywords:**

GIS, Fuzzy reasoning, Travel behaviour, Modal choice, Person trip survey.

ID 2810 R

**GIS BASED MODEL FOR ESTIMATING THE NUMBER OF BUS PASSENGERS**

Main Author:

**Ryoko FUNAOTO** (*Saitama University*)

Co-author(s):

**Kunihiro SAKAMOTO** (*Saitama University*)**Masaru YAJIMA** (*Saitama University*)**Jyunichi YAMAGISHI** (*Area Market Structure Laboratory Co., Ltd.*)**Hisashi KUBOTA** (*Saitama University*)**Abstract:**

This study develops the BPE model (Bus stop Passenger Estimate model) which calculates the number of passengers at each bus stop to examine the optimal bus stop position with combining existing data of GIS (Geographic Information System). As a case study, the BPE model was developed with the multiple regression analysis for a bus route in suburban area city, Hidaka city. The bus enterprise introduces a new system that enables us to accurately grasp the present number of bus users with a unit of bus stops. In addition the analysis uses other new system named AMS system (Area Market Simulator system), which is a developed function of GIS and helps us to make micromesh data. In the case two types of model are made; one is commute hour model and another is non-commute hour model. The BPE model is developed by using population, bus frequency, and distance from home to railway station. The both type models are significant. The BPE model forecasts the number of passenger for alternative routes. This BPE model will be helpful to the bus enterprises and the municipalities for the route maintenance.

**Keywords:**

Public transportation, Bus service, GIS.

ID 1652 R

**ESTIMATION OF DYNAMIC TRAFFIC DENSITIES FOR OFFICIAL STATISTICS BASED ON COMBINED USE OF GPS AND LOOP DETECTOR DATA**

Main Author:

**Yinyi MA** (*Erasmus University Rotterdam*)

Co-author(s):

**Jan VAN DALEN** (*Erasmus University Rotterdam*)**Chris DE BLOIS** (*Statistics Netherlands*)**Jo VAN NUNEN** (*Erasmus University Rotterdam*)**Abstract:**

Traffic density is one of the important variables to identify traffic states. Traffic management and traffic control require real-time estimation of traffic density as an input for large spatial and temporal coverage of the road network. Statistics Netherlands as a national data collection institute publishes quantified traffic data, among others to support policy makers. In this paper, we aim to validate the usage of GPS information for traffic statistics. The density definition is applied for modelling, and by combining loop detector and GPS data we take the advantages of both data sources. However, the adoption of GPS data is seriously hampered by the fact that few vehicles are equipped with GPS transponders. GPS-collected data thus represent only a limited part of the whole traffic for a delineated area and specific time slots. In our model, travel time of GPS vehicle is an essential concept to get the time boundary of density measurement. Finally, the estimated dynamic density is scaled up to the whole road network to be used for official statistics. GPS data collection has the marked advantage that traffic data are captured automatically at highly frequent rates. As such, it provides dynamic information and offers opportunities to reduce administrative burdens. Furthermore, GPS data collection opens the door to other relevant application areas.

**Keywords:**

Traffic Density Estimation, Traffic Population Estimation, GPS Sample Data, Loop Detector Data, Official Statistics.

ID 2075 R

**DETERMINATION OF CERTAIN OPERATIONAL CHARACTERISTICS OF TRAFFIC ON THE TRACKS FOR PURPOSES OF MODELING, USING GPS**

Main Author:

**Diego ESCOBAR GARCIA** (UNIVERSIDAD NACIONAL DE COLOMBIA SEDE MANIZALES)

Co-author(s):

**Francisco JAVIER GARCIA OROZCO** (UNIVERSIDAD NACIONAL DE COLOMBIA SEDE MANIZALES)**Jorge EDUARDO HURTADO GOMEZ** (UNIVERSIDAD NACIONAL DE COLOMBIA SEDE MANIZALES)**Abstract:**

The accelerated development in the field of instrumentation and the popularization of its use is permeating all fields. This global trend consists in the instrumentation of vehicles and also the road infrastructure, through the installation of equipment in public and private vehicles, as well as the installation of different types of sensors on the road infrastructure. At international levels this system is used to improve traffic circulation in the cities, public transport services through the modeling of new routes, and control system for vehicles. This phenomenon is also taking place in Colombia regarding alarm systems, and recovery and vehicle tracking in taxis, bus transportation in Bogotá, the state security vehicles throughout the country, and in some public urban transport vehicles in various cities, among them Manizales. The Avatrack GPS system, implemented a few years ago in Colombia is providing vehicle monitoring services, with applications that include control of speed limits, positioning access, and location tables in real time via Internet. In Colombia there are more than 10 operators offering this service. There are multiple applications of vehicle instrumentation, where vehicle monitoring clearly stands out, and provides vehicle information in real time regarding on – off detection, open – closed door sensing, amount of cargo or amount of product, among other data. Work is also being done on the monitoring of people for academic, operational and security purposes. However an application aimed at determining operational characteristics of road networks has not been done. It can have great applications in processes of network calibration and modelling. (...).

**Keywords:**

Monitoring, GPS, Modeling, Vehicles, Traffic.

ID 2720 R

**TRAFFIC FLOW ESTIMATES INFERRED FROM MOBILE PHONE NETWORKS**

Main Author:

**Noelia CACERES SANCHEZ** (Transportation Engineering, Faculty of Engineering, University of Sevilla)

Co-author(s):

**Luis ROMERO** (Transportation Research Group, University of Sevilla)**Jose DEL CASTILLO** (Transportation Research Group, University of Sevilla)**Francisco BENITEZ** (Faculty of Engineering, University of Sevilla, Spain)**Abstract:**

Traffic volume is the main parameter to quantify transportation demand. Accurate measurements of volumes are essential for the successful implementation of traffic management. The development of models to infer traffic volume data constitutes an important step in the construction of automatic tools for such purposes. Different methodologies and techniques have been developed to estimate traffic volumes. The most common examples are based on time series, historical average, neural networks or nonparametric regression models, using data collected by fixed count stations (e.g. loop detectors), which have cost and coverage limitations. Recently, mobile phone systems appeared as a complementary solution to fixed stations for increasing coverage areas and accuracy without requiring expensive infrastructure investment. Mobile phone systems include processes which automatically keep databases updated with phone location. In the case of an on-call phone, its location information is updated at the base station (cell) to which the phone is connected. For billing purposes, the system also records parameters related to the call, such as start time/end time, duration or identity of the originating cell. Additionally, when a phone with a call in progress moves from one cell to another, the call must be handed over to the new cell in order to provide uninterrupted service. This transference is controlled by the handover process which inserts a record into the databases to update them with content consisting of phone-ID, cell identity or timestamp, among others. (...).

**Keywords:**

Mobile phones, Traffic flow, Volume data, Traffic monitoring.

ID 2891 R

**WEB-APPLICATION FOR A GIS-BASED TRAFFIC DATABASE**

Main Author:

**Juergen STEINBRECHER** (*University of Siegen*)

Co-author(s):

**Christoph HELMERT** (*Software-Kontor Helmert, Aachen, Germany*)**Kathrin HENNINGER** (*Software Kontor Helmert, Aachen, Germany*)**Abstract:**

Traffic census data still poses the basis for decision taking processes in traffic circulation and environmental planning. Only in few cities the data gathered is systematically archived and it rarely is made accessible for other internal administrative departments or external traffic planning companies. This although in almost all major German cities a comprehensive pool of traffic census data is available, that has been collected over numerous years. This data normally is accessible to selected planning specialists only. Today the internet offers an uncomplicated platform to make all traffic census data easily accessible for planning specialist as well as to the broader public. In addition it offers the possibility to monitor traffic development measures. For concrete projects people affected by the measure can be included in the planning process and the decision making data base can be communicated directly and transparently.

**Keywords:**

Traffic census data base, Traffic census, Automatic counting, Manual counting, Web-based traffic counting data base.

ID 1675 R

**MAKING OUR MOBILITY MORE INTELLIGENT- A FRAMEWORK FOR A PERSONALISED REAL-TIME MULTIMODAL TRANSPORT INFORMATION SYSTEM**

Main Author:

**Harry TIMMERMANS** (*Urban Planning Group, Eindhoven University of Technology, The Netherlands*)

Co-author(s):

**Jianwei ZHANG** (*Urban Planning Group, Department of Architecture, Building and Planning, Eindhoven University of Technology*)**Theo ARENTZE** (*Eindhoven University of Technology*)**Abstract:**

In recent years, traveller information services have found increasing popularity in the consumer market. These services support route planning, navigation and location-based services using static and dynamic database services on both commercial and non-commercial terms. It is expected that the next generation of traveller information systems, will be based on real-time transport information from multiple sources and in addition support personalised planning, in terms of user travel preferences. In this paper, which is part of the i-Tour project, funded by the European Commission, we propose a framework for developing a personalized multimodal traveller information system which is capable of providing user-tailored travel advice in real-time environments, monitoring persons' activity schedules and incrementally learning user preferences from their response patterns. To implement this system, a supernetwork representation will be employed to model the multimodal transport system. Then, a complex set of conditions including personal preferences, real-time information and activity schedules will be taken into account to specify generalized cost functions that include environmental impacts. Personalized optimal route advice will be provided using routing algorithms.

**Keywords:**

Multimodal transport, Personalisation, Advanced traveller information system.

ID 1827 R\*

**TRANSPORT CONCEPTS FOR THE 21ST CENTURY:  
COGNITIVE INFORMATICS' INFLUENCE ON  
FORECAST JUDGMENT**

Main Author:

**Dawn RUSSELL** (*The Pennsylvania State University*)

Co-author(s):

**Gunnar STEFANSON** (*Chalmers University of  
Technology*)**Mary BETH WATSON-MANHEIM****Abstract:**

This paper communicates the impact of the last works of one of the founders of transportation research, Marvin L. Manheim, and demonstrates the transformational influence of his forward thinking nature. The paper begins with a tribute to Professor Manheim and his extraordinary contributions to the field of transportation research. The paper goes on to explain how his last works on cognitive informatics represent transformational thinking in transportation research. Using examples from forecast model development and forecast model use in public sector transport and from supply chain management in the private sector, we explore the complexity of today's decision-making environment and show how the concept of cognitive informatics is a suitable response to the challenges of effective decision-making in today's environment. Finally, this paper suggests a research agenda, based upon the cognitive informatics foundation, which could transform the discipline of transportation research with the same pivotal impact of Professor Manheim's early works.

**Keywords:**

Cognitive Informatics, 21st Century, Information t.

ID 1846 R

**EXPLORING THE IMPACTS OF IN-HOME VIRTUAL  
ACTIVITIES ON DAILY ACTIVITY AND TRAVEL  
BEHAVIOR: AN ANALYSIS USING CAIRO ACTIVITY  
AND TELECOMMUNICATION DIARY DATA 2006**

Main Author:

**Ahmed MOSA**

Co-author(s):

**Nobuaki OHMORI** (*Urban Transport Research Unit,  
Department of Urban Engineering, University of Tokyo*)**Noboru HARATA** (*University of Tokyo*)**Abstract:**

The boom in telecommunications technologies is expected to have great impact on the lifestyles of the individuals and their households and also on transportation system. Recent advances in information and communication technologies (ICTs) make it possible to conduct activities virtually, thus obviating the need for physical travel, at least for some types of activities. Further, ICT use may contribute towards reducing urban congestion and air-quality problems (by replacing travel with virtual activities); on the other hand they may also generate significant additional and induced travel due to increased connectivity and access to resources. Thus empirical insights on how the growing ICT use affects travel patterns and vice-versa have important application for planning, travel demand forecasting, and urban environment. So far, however, in transport research the effects of ICTs have mainly been analyzed by focusing on e-activity, especially e-shopping and telecommunicating. Although these studies allow essential insights, there is still no complete picture that shows the interrelationships between ICT use and individual activity and travel behavior. Further, to our knowledge, little attention has been directed to the understanding of how ICT affect activity participation and travel patterns of individuals in Egypt. The objective of this study is to investigate the effects of ICT on household members' daily activity-travel patterns using empirical activity and telecommunication diary survey conducted in Greater Cairo Region, in Egypt. In this paper, activity participation and travel behavior are compared between two population groups, those currently with Internet access at home and those without Internet access at home. (...).

**Keywords:**

Information and Communication Technologies, Physical activity participation, Activity-Telecommunication diary survey, Structural equations modelling, Virtual activity participation, Cairo activity-travel behaviour.

WED 14<sup>th</sup> (08:15 - 09:30, Session D6.1) Room 0.03

ID 2423 R

**MOBILE ICTS AND MOBILITY. A CRITICAL REVIEW OF LITERATURE**

Main Author:

**Anne AGUILERA** (*Université Paris Est LVMT*)

Co-author(s):

**Caroline GUILLOT** (*Université Paris Est LVMT*)

**Abstract:**

The question of the relationship between the diffusion of communication tools and the physical mobility of individuals is not new and arose with the arrival of the fixed telephone and, more recently, the development of the Internet and especially the e-commerce. The extraordinary diffusion of individual and especially portable communication tools, like the mobile phone, has recently given a new impetus to this topic in the fields of transportation economics, geography and sociology. This article proposes a critical synthesis of the questions that have been explored by the literature, from the debate between complementarity and substitution to more recent analyses in terms of individuals' activity schedules and social networks. The conclusion discusses some issues that we think should be better explored.

**Keywords:**

Mobile phone, ICT, Mobility, Substitution, Complementarity.

WED 14<sup>th</sup> (08:15 - 09:30, Session D6.1) Room 0.03

ID 2628 R

**ICTS AS TOOLS OF INTENSIFICATION OF TRAVEL TIME USE RESULTS OF A QUALITATIVE STUDY BASED ON FRENCH WORKERS**

Main Author:

**Leslie BELTON CHEVALLIER** (*Laboratoire Ville, Mobilité, Transport*)

**Abstract:**

The increasing use of ICTs –and especially mobile ones – strengthens the assumption of a diversified range of activities being performed in car, in train, in bus, in plane, etc. Technological mobile devices such as handphones, smartphones, PDAs, laptops, Wifi and many others allow individuals to do many tasks everywhere. These evolutions traditionally comfort the hypothesis of intensification of travel time. But how do people use their travel time and how do they use ICTs within? According to the uses and practices of a representative sample of French workers, ICTs allow performing in a different way activities formerly performed. They also enable people to communicate easily but these uses highly depend on the context of the travel (length, distance, purpose, mode, steps, personal and professional settings, etc.).

**Keywords:**

Mobile ICTs, Flexibility, Ordinary travel, Time travel, Context.

TUE 13<sup>th</sup> (11:15 - 12:30, Session E1.1) Room 1.05

ID 1272 R

**ECONOMIC IMPACT OF TRANSPORT  
INFRASTRUCTURE, EDUCATIONAL ATTAINMENTS  
AND THE NUMBER OF INVENTIONS ON REGIONAL  
EFFICIENCY**

Main Author:

**Jochen SIEGELE** (*Universität Karlsruhe (TH)*)

Co-author(s):

**Jeanette STOHR** (*Universität Karlsruhe (TH)*)

**Abstract:**

The endowment with region-specific production factors such as infrastructure, human capital and technological capabilities is considered highly significant for the regional economic performance. This paper aims to identify the relative importance of these factors, which we refer to as potential factors in the following, for the economic performance of 261 European NUTS2 regions and to give a first insight into the regions' efficiency in using them. It can be assumed that potential factors affect different types of regions differently. Therefore, the first step foresees a clustering of the regions according to their population density. After the clustering the correlation of the aforementioned factors with the regional economic performance is analysed. First results confirm the presumed positive (and mostly significant) correlation of all three factors for each cluster. Despite the generally positive correlation of the considered factors with the regional performance, investments to strengthen these factors will not automatically push the regional economy. First, the strict causality from investments in potential factors to regional economic performance is not always conclusive and, second, effects strongly rely on the initial situation. Investments that remove constraints for growth will entail much stronger impacts compared to other investments. Against this background, the paper intends to analyse the conditions under which investments into potential factors might generate the desired regional growth effect. Therefore, the study continues with a bottleneck analysis that compares potential production with the observed performance. Further investments into potential factors could indeed increase the competitiveness of regions that use their potential factors more efficient than average. (...).

**Keywords:**

Regional cluster, Production potential, Efficiency.

TUE 13<sup>th</sup> (11:15 - 12:30, Session E1.1) Room 1.05

ID 1417 R

**BRAZILIAN RAILWAYS: AN APPLICATION OF COST  
ANALYSIS**

Main Author:

**Aline LANG** (*University of Canterbury*)

Co-author(s):

**Adelaida FONSECA** (*University of Brasilia*)

**Abstract:**

It is widely argued that rail transport is cheaper, safer and more sustainable than using the road transport. Nevertheless, the Brazilian railway system faces many problems such as right-of-way invasion, critical level crossing and logistical bottlenecks. The use of techniques like the Economic Analysis of Projects is essential to help the decision makers to better allocate financial resources for transportation projects. However, cost analysis methods are not generally used for infrastructure investments, especially in developing countries such as Brazil. This paper aims to present a method to support the identification, evaluation and prioritization of Railway projects that may contribute to address currently observed problems. The research applies a cost analysis technique, which was found suitable to analyze projects, without a need for expensive data collection neither complex models to produce satisfactory results. The method proved to be simple and efficient in meeting planning needs and helping the decision making.

**Keywords:**

Brazil, Railways, Cost analysis, Economic impacts.

TUE 13<sup>th</sup> (11:15 - 12:30, Session E1.1) Room 1.05

ID 2062 R

**EXAMINATION OF RECENT DEVELOPMENTS IN DBFO PUBLIC PRIVATE PARTNERSHIP TRANSPORTATION PROJECTS IN NORTH AMERICA**

Main Author:

**Hiroyuki ISEKI** (*University of New Orleans*)

Co-author(s):

**Rebecca HOUTMAN** (*University of New Orleans*)

**Abstract:**

With continuous demand for transportation infrastructure and chronic funding shortfalls faced by governments, public-private partnerships (PPPs) for infrastructure provision have garnered increasing attention in recent years in both the United States and abroad. High profile PPP concession deals, like the leases of the Chicago Skyway and Indian Toll Road, have raised concerns in the U.S. about the protection of public interests in PPP projects, and ignited heated debates about the desirability of PPPs, which are partly driven by ideology and by vested interests, but also by questionable decisions in previous PPPs. While public agencies at the local, regional, state/province, and federal levels are interested in identifying successful PPP arrangements in the best public interest, the considerable variety and complexity of PPP deals, combined with numerous local factors unique to each project, have made the development of a successful PPP evaluation framework especially challenging. In order to fill this gap in the knowledge of appropriate PPP approaches for transportation infrastructure projects, we examine two recently closed Design-Build-Finance-Operate (DBFO) PPP deals in Canada and the U.S.: 1) British Columbia's Golden Ears Bridge, and 2) Texas State Highway, Segments 5 and 6. The main objective of this paper is to gauge the adjustments that public agencies have been making to improve the performance of DBFO projects based on past experiences in the field. Specifically, we discuss the following as critical factors to be treated with particular consideration in DBFO cases: 1) responsibility for pre-construction and construction risks, 2) asset valuation, traffic demand risk, and revenue risk, 3) non-compete provisions, 4) facility performance standards, 5) terms for early termination, and 6) preserving public and political acceptance. (...).

**Keywords:**

Public private partnerships, Highway financing, Design-build-operate-finance, North America.

TUE 13<sup>th</sup> (11:15 - 12:30, Session E1.1) Room 1.05

ID 2577 R

**IMPACT ANALYSIS OF HIGH SPEED RAIL ON INDUSTRIAL LOCATION: AN EMPIRICAL STUDY OF JAPAN SHINKANSEN**

Main Author:

**Ji HAN** (*University of Tokyo*)

Co-author(s):

**Yoshitsugu HAYASHI** (*Nagoya University*)

**Yuan QUAN** (*Nagoya University*)

**Peng JIA** (*Nagoya University*)

**Abstract:**

Due to the rising priority and vast investment on high speed rail in infrastructure construction world widely, it has become increasingly necessary to make an appropriate assessment of the impacts on regional economy and more importantly to develop strategies and policies toward a sustainable development. This paper looks at the impacts of Shinkansen on industrial location in Japan. Differing from the previous research, we highlight the investigation of both socioeconomic factors and physical determinant through an empirical industrial location model and multivariable stepwise regressions based on statistical data. The results indicate that during the period of 1990-2000, the dominant driving force of industrial location has changed from industrial transaction interdependence to population consumption demand. The elasticity of accessibility to Shinkansen network has also shown an increasing trend from 1990 to 2000. Further expansion of Shinkansen lines would encourage the development of several industries like real estate, commerce and services, etc., hence contribute to the regional economic structure formation.

**Keywords:**

High speed rail, Shinkansen, Industrial location, Accessibility.



TUE 13<sup>th</sup> (14:00 - 15:15, Session E1.2) Room 1.05

ID 1071 R

**THE IMPACT OF THE EU-US OPEN SKIES AGREEMENT ON PASSENGER NUMBERS AT LONDON AIRPORTS**

Main Author:

**David PITFIELD** (*Loughborough University*)

**Abstract:**

The advent of the EU-US Open Skies Agreement has been widely anticipated. A number of consequences have been predicted, for example, impacts on fares, on passenger volumes, choice and on consumer welfare. Airline costs are also predicted to fall as a result of increased competitiveness and increased cooperation among airlines. In the short period since the implementation of the Agreement, it is relatively easy to assess the supply-side changes that have been made, but more difficult to make wider judgements. For example, can traffic growth be attributed to Open Skies and does airline and alliance market power result in less fare flexibility with consequently less influence on passenger volumes? This paper offers some insight into the data that will be required to make these and other wider judgements and discusses some methodological difficulties. Early estimates of the impact on passenger numbers are given using times series analysis focusing on London airports in particular London Heathrow.

**Keywords:**

EU-US Open Skies, Impacts, London Airports, Passen.

TUE 13<sup>th</sup> (14:00 - 15:15, Session E1.2) Room 1.05

ID 1745 R

**INTERDEPENDENCE AMONG TRANSPORT INFRASTRUCTURE PROJECTS ? A CHALLENGE FOR COST-BENEFIT ANALYSIS**

Main Author:

**Eckhard SZIMBA** (*Universität Karlsruhe (TH) - IWW*)

Co-author(s):

**Werner ROTHENGATTER** (*University of Karlsruhe (TH)*)

**Abstract:**

Transport (infrastructure) master plans – at regional, national or supra-national level – comprise a set of infrastructure measures. The financial crisis has stimulated national governments to develop fiscal stimulus packages, in several cases including transport infrastructure investment projects. In many countries the infrastructure projects are subject to an evaluation procedure to select the best projects or to set priorities according to economic criteria. Usually the evaluation methods follow the ›with/without‹ principle, i.e., the costs and benefits of a project are calculated for a base case without the project and compared with the results including the project for a future time period. This presupposes that the projects are independent of each other. However, it is just the characteristics of a transport network that the links are interdependent and, as infrastructure projects add new or improve existing links, this also holds for the projects to be evaluated. Some infrastructure projects might be characterised by substitutive interdependence, while others might interact in a synergetic context. Thus, benefits and costs of a project are strongly dependent on the existence/non-existence of other projects. This paper intends to tackle this issue by firstly stating the nature of the formal problem by a dynamic mixed integer programme and secondly elaborating a heuristic method using a network algorithm and reducing the complexity of the combinatorial problem.

**Keywords:**

Assessment, Interdependence, Cost-benefit analysis, Transport infrastructure, Project appraisal, Transport infrastructure package, Trans-European Networks.transport policy, Substitutability, Complementarity,

TUE 13<sup>th</sup> (14:00 - 15:15, Session E1.2) Room 1.05

ID 2125 R

**IMPROVEMENT OF INFRASTRUCTURE MAINTENANCE TECHNOLOGY AND GROWTH OF AGGREGATED ECONOMY**

Main Author:

**Tomoki ISHIKURA** (*The University of Tokyo*)

**Abstract:**

Investment to infrastructure increases the needs of maintenance as well as accumulating the stock. Improvement of the management technologies regarding sensing, deterioration forecasting and asset management reduce the cost of maintenance. Therefore the improvement of infrastructure maintenance technology will increase the share of other expenditure. It contributes to higher level of utility of aggregated economy from a point of view of macroeconomics. Asset management of infrastructure stock, in general, aims to minimize life cycle cost of maintenance of an asset. However, this paper focuses on the macroeconomic effect of the maintenance technology. This paper develops an economic growth model where infrastructure maintenance technology explicitly influences to deterioration of infrastructure stock. Expenditure share of investment (private capital and infrastructure respectively), consumption and maintenance is controlled to achieve optimal growth path. The numerical analyses derive some implications about the relationship between the technological improvement of infrastructure maintenance and growth rate of the economy. Optimal fiscal policy with regard to allocation between investment to new infrastructure and maintenance expenditure for existing infrastructure is also analyzed.

**Keywords:**

Infrastructure Maintenance, Economic Growth, Deterioration Control.

TUE 13<sup>th</sup> (14:00 - 15:15, Session E1.2) Room 1.05

ID 2540 R

**DYNAMICS OF THE CO-MOVEMENT BETWEEN STOCK AND MARITIME MARKETS**

Main Author:

**Oral ERDOGAN** (*Bilgi University*)

Co-author(s):

**B. KARAHASAN** (*Istanbul Bilgi University*)

**Mehmet SENGOZ** (*Istanbul Bilgi University*)

**Kenan USE** (*Turkon Holding*)

**Abstract:**

This study aims to explain the existence of a conditional correlation between maritime markets and stock markets. In such an understanding, observing the existence and level of the relationship will help market participants to make their financial decisions more accurately. By using a Constant Correlation Model with time varying modification and checking for the applicability of a DCC setting on the weekly returns of Dow Jones Index and Baltic Dry Index, we find out that correlation dynamics exhibit important time varying pattern. Our conclusion is that stock market investors should be aware of the degree of the conditional correlation between stock markets and freight markets, and hence of risk spillovers, at the time of their investment.

**Keywords:**

Freight rates, Stock markets, Multivariate volatility modeling.

TUE 13<sup>th</sup> (14:00 - 15:15, Session E1.2) Room 1.05

ID 2650 R

**EUROPEAN MARITIME SPACE WITHOUT BARRIERS:  
A COST BENEFIT ANALYSIS APPROACH IN THE  
IMPACT ASSESSMENT**

Main Author:

**Andrea TEDESCHI** (*Università Commerciale L.Bocconi*)

Co-author(s):

**Carlo VAGHI** (*Università Commerciale L.Bocconi*)

**Giuseppe SICILIANO** (*Università Commerciale L.Bocconi*)

**Abstract:**

All major policies issued by the European Commission (EC) undergo an "Impact Assessment" (IA) process, which is developed on behalf of the Commission, following a number of guidelines proposed in specific EC's documents. IA is a key tool to ensure that Commission initiatives and EU legislation are prepared on the basis of transparent, comprehensive and balanced evidence, and it has to be considered as an aid to political decision-making, not a substitute for it. In the words of the EC, IA "helps to identify the main options for achieving the objectives and analyses their likely impacts in the economic, environmental and social fields. It outlines advantages and disadvantages of each option and examines possible synergies and trade-offs". An integrated approach for IA was introduced by the EC in 2002. It consists of a balanced appraisal of all potential impacts of a new legislation (economic, social, environmental), and is "underpinned by the principle of proportionate analysis, whereby the depth and scope of an impact assessment, and hence the resources allocated to it, are proportionate to the expected nature of the proposal and its likely impacts". IA is an activity that may include a number of methodologies and tools; as such, it is not aimed at gathering a unique quantitative indicator of the impacts of policy measures, but at a set of different indications, not necessarily of a quantitative nature (which is the objective of e.g. Cost-Benefit Analysis), which define the various effects of the actions. In the case presented in this paper, which concerns the implementation of an internal free market in the maritime transport sector, the Cost-Benefit Analysis (CBA) is one of the tools included in the overall IA procedure. (...).

**Keywords:**

Impact assessment, Common maritime space, Administrative procedures, Measures, Policy option, CBA, Time costs.

TUE 13<sup>th</sup> (15:30 - 16:45, Session E1.3) Room 1.05

ID 1271 R

**EVALUATING ROAD SAFETY MEASURES: ANALYZING  
DIFFERENCES BETWEEN SOCIO-ECONOMIC  
EVALUATION METHODS IN TERMS OF EFFECTS  
INCLUDED, BASIC ASSUMPTIONS, AIMS AND GOALS**

Main Author:

**Fredriek VAN MALDEREN** (*Vrije Universiteit Brussel*  
(Free University of Brussels))

Co-author(s):

**Klaas DE BRUCKER** (*HUB*)

**Koen VAN RAEMDONCK** (*Vrije Universiteit Brussel* (Free  
University of Brussels))

**Cathy MACHARIS** (*Vrije Universiteit Brussel* (Free  
University of Brussels))

**Abstract:**

Appropriate measures need to be taken in order to reduce the number of victims on our roads. To select these road safety measures, it is preferable to use socio-economic evaluation methods with a multi-objective approach such as social cost benefit analysis and (multi-actor) multi-criteria analysis. Considering the limited budgets available to society and government, the most appropriate measures can be chosen using this kind of assessment tools. In this contribution, the basic assumptions, aims and goals, as well as the main advantages and disadvantages of different evaluation methods are presented. Next, the differences in terms of effects included and outputs obtained are analyzed for the costeffectiveness analysis, the social cost-benefit analysis and the (multi-actor) multi-criteria analysis, using a case study. The fact that multiple methodologies (yielding multiple outcomes) are available might perhaps confuse the decision maker a little bit in selecting the most appropriate measure. The main recommendation of this paper is the need to develop a decision tree in order to select the most appropriate evaluation method.

**Keywords:**

Road safety, Socio-economic evaluation methods, (Multi-Actor) Multi-Criteria Analysis, Social Cost-Benefit Analysis.

TUE 13<sup>th</sup> (15:30 - 16:45, Session E1.3) Room 1.05

ID 1814 R

**A LIAISON BETWEEN A SYSTEM DYNAMICS MODEL AND A NETWORK-BASED TRANSPORT MODEL - ADVANTAGES FOR HOLISTIC PROJECT ASSESSMENT AND CHALLENGES**

Main Author:

**Markus KRAFT** (Karlsruhe Institute of Technology (KIT) - Institute for Economic Policy Research (IWW))

Co-author(s):

**Eckhard SZIMBA** (Universität Karlsruhe (TH) - IWW)  
**Michael KRAIL** (Fraunhofer-Institute for Systems and Innovation Research (ISI))

**Abstract:**

The broad and multi-dimensional impacts of transport policy strategies can, among other options, be assessed by a System Dynamics model or by the application of a network based transport model. Each assessment option has specific advantages and disadvantages. Coupling these models, in order to be able to make use of the intrinsic features of each model type however, raises certain methodological and technical challenges, since for example data structures and forecast horizon (dynamic forecasts by a System Dynamics model versus static forecasts by a network-based transport model) are strongly different among these model types. The current paper is devoted to the matter of how these two types of models can be linked with each other, by drafting data interchanges and the main challenges.

**Keywords:**

Impact assessment, Transport model, Transport policies, System Dynamics model, Model linkage.

TUE 13<sup>th</sup> (15:30 - 16:45, Session E1.3) Room 1.05

ID 1839 R\*

**"IAN THOMPSON REVISITED: THE PLANNING OF THE METROS OF BOGOTÁ AND PANAMÁ**

Main Author:

**Roberto AGOSTA** (AC&A S.A.)

**Abstract:**

In 1983 Ian Thompson, Chief Transportation Economist of the Comisión Económica para América Latina of the United Nations, published a paper named "Algunos aspectos de la justificación socioeconómica de los ferrocarriles metropolitanos en América del Sur", where he reviewed the planning process and the evaluation of the metro systems up to that moment. The paper analyzed several original aspects of the process like the accurate accountability of costs and benefits. With a few exceptions, the construction of new Metro systems in Latin America had been stopped since the time of the paper and a new system was introduced, the Bus Rapid Transit (BRT) which have many of the possibilities of the Metro with a much lower investment cost. At the present time (September 2009), there are two main Metro projects in the area, in Bogotá and Panama City, both in the phase of planning and evaluation. Both projects will have a huge impact in their cities, specially in terms of transportation, but also in other aspects, like the employment, environment, social, financial, economic and urban development and Bogotá by its own hand have in Transmilenio one of the most successful experiences in BRTs in the whole world. The author is working for the Interamerican Development Bank in the Bogotá and the Panamá metro projects and in this paper he review the points of views of Ian Thompson in the justification of the criteria used in the evaluation of this new metro systems and also the similarities and differences between the two projects as important case studies for the region.

**Keywords:**

Metro Bogotá Panamá Evaluation.

ID 2968 R

**THE IMPORTANCE OF PUBLIC TRANSPORT. THE SOCIETAL EFFECTS DELINEATED**

Main Author:

**Peter BAKKER** (*KiM Netherlands Institute for Transport Policy Analysis*)**Abstract:**

What are the costs and benefits of public transport to society? Are all costs and benefits fully incorporated in the standard system for assessing the societal effects of public transport investments: cost-benefit analysis (CBA)? Are all policy goals, with respect to public transport, properly addressed in a CBA? The public transport debate in the Netherlands often focuses on the question of whether the benefits of public transport receive sufficient attention in the standard system for assessing the societal effects of investments. Recently, the KiM Netherlands Institute for Transport Policy Analysis and CPB Netherlands Bureau for Economic Policy Analysis studied this question. This paper presents the study's main findings. The study aims to help ensure that expectations regarding public transport and CBA results are more attuned to one another. The study first illustrates to what extent public transport in general contributes to accessibility, quality of life and social participation. The view that emerges from present transport use is primarily based on analysis of the Netherlands National Transport Survey and is completed with results of previously published studies. Unsurprisingly, public transport acquires its greatest share in mobility during rush hour periods to urban areas; in fact, during these periods public transport is used for approximately 40% of journeys longer than ten kilometres. The problems related to traffic jams are also at their most acute in these areas; however, convincing (more) people stuck in traffic jams to switch to public transport is by no means an easy task. Despite these traffic jams, travelling by public transport would take at least twice as much time for 90% of all car users during rush hours. (...).

**Keywords:**

Public transport. Cost benefit analysis. CBA. Valu.

ID 2983 R

**EFFECTS OF THE INTERNAL CONSTRAINTS OF TRANSPORTATION SYSTEMS - ON EXAMPLE OF STATISTICAL DISTRIBUTION OF PURCHASING POWER OF HOUSEHOLDS - ON THE RELIABILITY OF FORECASTS**

Main Author:

**Thomas MACOUN** (*Institute for Transportation Science*)

Co-author(s):

**Harald FREY** (*Institute for Transportation Science*)**Ulrich LETH** (*Institute for Transportation Science*)**Abstract:**

The expansion of infrastructure networks and the benefits expected of these networks are subject to a number of system effects. At first, feedback effects appear which are often not taken into account by narrow spatial, temporal and causal system boundaries in the models currently in use and in the evaluation methods. Examples are the exclusion of inter-modal alternatives, of reactions to the settlement structures or of other concurring infrastructure projects. Beside these system effects increasingly logistical functions can be observed in the trends of transport systems in industrial countries, arising from saturation tendencies. Parts of the system or (depending on system boundaries) greater combined systems show logistical functions due to their capacity limits, limits in resources or endogenous limits like saturation trends (e.g. in the motorization level or the trip length). These saturation tendencies can be explained by both ecological and biological control systems. The mobility behaviour of road users is characterized by increasing mileage. This behaviour is determined by the general (legal, social, energetical, etc.) framework. A large proportion of the driving forces for traffic behavior are unconscious. They are influenced by man's poor ability to grasp system effects. Beside those effects which are immanent in any system as for example the law of diminishing marginal utility, increasingly new "system limits" for the mobility behavior – ultimately derived from resource limits – arise. A more rational aspect is introduced by the availability of financial resources of households for transportation (public and private transport) – for example as a share of the CPI (Consumer Price Index). (...).

**Keywords:**

Motorization, Saturation tendencies, Energy prices, Motor fuel, Oil price, Household expenditures.

ID 1005 R

**ASSESSING THE PERFORMANCE OF ITS IN CITIES**

Main Author:

**Andrea RICCI** (*ISIS - Institute of Studies for the Integration of Systems*)

Co-author(s):

**Suzanne HOADLEY** (*Polis*)

**Maurizio TOMASSINI** (*ISIS - Institute of Studies for the Integration of Systems*)

**Ioannis KAPARIAS** (*Imperial College London*)

**Konstantinos ZAVITSAS** (*Imperial College London*)

**Abstract:**

This paper introduces an EU project, called CONDUITS, which reviews ITS in cities today, provides an outlook on ITS developments tomorrow and establishes a set of key performance indicators (KPI). The KPI system to be developed is meant to comprehensively reflect a cities transportation situation. Therefore concepts to quantify improvements in traffic efficiency, traffic safety, environmental aspects as well as land use and the integration of disadvantaged population groups through ITS investments are considered. The robustness and usefulness of the KPI system will be tested through case studies in Paris and Rome. The project consortium (listed at the end of this paper) consists of 9 European partners (five major European cities, two universities, an SME and a European networking organisation) and an Israeli technical centre. CONDUITS stands for Coordination Of Network Descriptors for Urban Intelligent Transportation Systems.

**Keywords:**

Intelligent transport systems, Urban mobilitt.

ID 1459 R

**LONG-TERM DEVELOPMENT OF EXPRESS COACH SERVICES IN BRITAIN**

Main Author:

**Peter WHITE** (*University of Westminster*)

Co-author(s):

**Derek ROBBINS** (*Bournemouth University*)

**Abstract:**

Express coach services compete for longer distance market with car and rail, and largely cater for the leisure, tourism and VFR market. Britain deregulated its express coach system in 1980, and it is now opportune to examine long-term impacts of that change. The initial impacts were reviewed at the 1986 WCTR (Robbins & White 1986) but such impacts do not necessarily match long-term outcomes. Monitoring of the British system has been conducted by examining service changes and data on ridership, together with financial performance of the main operator groups and technical press coverage. It can be shown that a dominant position has been retained by the major operator (National Express), with a continued decline in the role of smaller independent operators in the all-year-round daily network. However, new competition has emerged from other large groups (most notably Stagecoach 'Megabus' in 2003). The paper analyses the operating and marketing strategies of the new operator and contrasts these strategies with those adopted in the 1980s. Implications for the future development of the network in Britain are outlined.

**Keywords:**

Express coach, Deregulation, Competition, Pricing, Long-distance, Britain.

ID 1721 R

**DEVELOPMENT OF THE COMPOSITE INDICATOR  
CHARACTERISING THE URBAN PUBLIC TRANSPORT  
SYSTEM**

Main Author:

**Irina PTICINA**

Co-author(s):

**Irina YATSKIV**

**Abstract:**

In this research the possibility of developing the composite indicator characterising the urban system of public transport (urban public transport quality index - UPTQI) is considered. The development of the composite indicator in terms of the initial data describing the urban public transport system (TS) currently operating in German cities (EUROSTAT) is presented with respect to two moments of time. Some variants of OECD algorithm realisation for developing the composite indicator have been applied. Special attention has been paid to the methods of changing missed data and their impact on the composite indicator value. As a result, this work shows an alternative of constructing the composite indicator characterising urban public transport system, serving as a basis for drawing comparison between urban public transport system quality in various cities, and for assessing the influence of various characteristics and the selected methods of changing missed data on the overall estimate.

**Keywords:**

Public transport system, Quality index, Composite indicator, Weights, Imputation of missing data.

ID 1765 R

**DEVELOPMENT OF AN ENVIRONMENTAL  
PERFORMANCE INDEX FOR THE GERMAN  
TRANSPORT SYSTEM**

Main Author:

**Regine GERIKE** (*Technische Universität München*)

Co-author(s):

**Julia FRIEDEMANN**

**Udo BECKER**

**Abstract:**

This paper develops an environmental performance index for the German transport system: the Transport-Environment index - TEX. This index has two main aims: Firstly, to allow a holistic appraisal of the total environmental development of the transport sector over a specific time period by combining individual indicators into a single annual index; secondly, to allow for a comparison of different environmental impacts caused by the transport system, including as far as possible upstream and downstream processes. A distance-to-target approach is used to normalise and aggregate the indicators the TEX is composed of. An additional weighting step is included. The last section shows the exemplary application of the developed index for the German transport system. The data basis and methodology are explained; the empirical results are presented. The results show significant differences in the development of different environmental fields. A great deal of success has been achieved in reducing the number and severity of traffic accidents. However, energy consumption and greenhouse gas emissions have remained stable or even increased. The overall development of the index relies heavily on the weighting of the different indicators, and thus on the assumed environmental priorities.

**Keywords:**

Environment, Indicators, Evaluation, Germany.

MON 12<sup>th</sup> (11:15 - 12:30, Session E2.1) Room 0.02

ID 3162 R

### **CONGESTION AND ACCESSIBILITY: WHAT'S THE RELATIONSHIP?**

Main Author:

**Andrew MONDSCHIEIN** (*UCLA Institute of Transportation Studies*)

Co-author(s):

**Stephen BRUMBAUGH** (*UCLA*)

**Brian TAYLOR** (*UCLA Institute of Transportation Studies*)

#### **Abstract:**

This paper conceptually and empirically explores the complex relationship between congestion and accessibility. While congestion alters individual access to opportunities, its effects vary significantly across people, places, and time, variations that remain relatively understudied. This paper begins by proposing a conceptual framework with three components. First, congestion can constrain mobility and thus indirectly reduce accessibility. Second, congestion is associated with agglomerations of activity and with increased accessibility. Finally, congestion is in part a phenomenon of perception and behavior, cognitively altering an individual's choice set of destinations and altering actual access to opportunities. Congestion and individual travel data for the Los Angeles region are used to explore the localized spatial relationship between congestion and accessibility. As the multifaceted framework suggests, congestion does not have a uniform effect on accessibility, but varies substantially by neighborhood. Some neighborhoods appear to be more "congestion adapted" than others by allowing high levels of activity participation despite high levels of congestion. To account for personal characteristics such as income that may influence the spatial analysis, this paper also constructs a model of the number of daily trips as a function of an array of personal and household characteristics. Residuals from the model suggest that place-based neighborhood effects explain the relatively higher levels of travel by residents found in the "congestion adapted" neighborhoods. (...).

#### **Keywords:**

Accessibility, Congestion, Travel behavior.

MON 12<sup>th</sup> (14:00 - 15:15, Session E2.2) Room 0.02

ID 1771 R

### **A STUDY OF MOBILITY INDICATOR FOR TRANSPORTATION EQUITY OF ROAD NETWORK IN SOUTH KOREA**

Main Author:

**Sue KYOUNG LEE** (*Department of Civil and Environmental Engineering, Seoul National University*)

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**Changho PARK** (*Department of Civil and Environmental Engineering, Seoul National University*)

**Sungmo RHEE** (*Department of Civil and Environmental Engineering, Seoul National University*)

#### **Abstract:**

The main purpose of this paper is to develop a new indicator for regional equity analysis which is considered in transportation facility investment. At first, regional equity is defined as an index related to mobility which considers moving capability on the existing road facilities. Secondly, mobility indicator is introduced by using the performance measure of inter-regional traffic network as „Service Quality“. Service quality is average speed by inter-region network considering modes. Mobility indicator for one origin is the sum of service qualities classified by origin. This is different from Regional Backwardness which is determined by concerning social indices such as road density, population growth and regional income. This is the only indicator when regional equity is evaluated in transportation field. In this paper, mobility indicators of road network in Korea are estimated. In comparison with Regional Backwardness, the gaps between two index ranks are found. It shows Regional Backwardness could not consider the direct impact of transport facilities. Consequently, a mobility indicator is meaningful in regional equity analysis in transportation investment, and it could be used in transportation plan properly.

#### **Keywords:**

Equity, Mobility indicator, Performance measure of network, Backwardness.



ID 2004 R\*

**THE CONTRIBUTION OF SALES PEOPLE  
SATISFACTION TO THE GENERATION OF SALES IN A  
MODERN RAILWAY DISTRIBUTION CHANNEL: CASE  
STUDY GREECE**

Main Author:

**Panagiota KOURI-TOYAS** (*WCTR Member*)

**Abstract:**

The basic aim of this paper is to evaluate the operating and working environment of sales people and servicecapas, as well as to access sales people feelings and satisfaction in order to identify the elements that are important for them in generating sales. Before explaining the hypothesized relationships in more depth, first will be presented the servicescapes typology, which helps to explain when the servicescape is likely to play an important role in determining customer and employee attitude towards the service provision. Following the hypotheses, the study and corresponding results will be presented. Managerial implications and recommendations will conclude the article. The objectives of this paper will be met by evaluating and analyzing the results of a study, generated at the sales points of the Hellenic Railway Operator, places that are very complicated in terms of organization and the customers' contribution is limited. Sales people had to be interviewed in order to be extracted in details, the elements and parameters that are related to their working environment and to the generation of sales from their point of view. Concluding, the results of the study will be presented, the parameters that influence sales people behaviour will be identified and analysed and particular proposals will be made.

**Keywords:**

Customer satisfaction, Employee satisfaction, Servicescape, Conceptualisation, Operationalisation.

ID 2008 R

**METROPOLITAN ACCESSIBILITY AND  
TRANSPORTATION SUSTAINABILITY: COMPARATIVE  
INDICATORS FOR POLICY REFORM**

Main Author:

**Jonathan LEVINE** (*University of Michigan*)

Co-author(s):

**Qing SHEN** (*Tongji University*)

**Qingyun SHEN** (*University of Michigan*)

**Joe GRENGS** (*University of Michigan*)

**Abstract:**

Transportation outcomes have traditionally been evaluated with measures of mobility, including highway level-of-service, travel speeds, and person-hours of delay. This focus on mobility neglects the implications of the consensus view within the field that transportation is consumed not for its own sake, but in order to reach destinations. Viewed in this way, mobility is merely one means to achieving access. Another means is through proximity. Yet mobility and proximity exist in tension with each other, and it is unclear which exerts the larger influence on accessibility. This paper examines accessibility among 38 of the 50 largest metropolitan regions in the United States. By conducting a path analysis, paired comparisons, decomposition of metropolitan accessibility into its constituent parts, this study reveals the determinants that contribute to high overall accessibility at the metropolitan scale. We find that high residential density best explains high metropolitan accessibility, suggesting substantial transportation benefits can be derived through land-use policy.

**Keywords:**

Accessibility, Proximity, Transportation, Land use, Urban form.

ID 2068 R

**IMPACT ON THE ACCESSIBILITY AND COSTS OF OPERATION BY THE INSERTION OF NEW TRANSPORT INFRASTRUCTURE IN THE SOUTH CENTRAL REGION OF THE DEPARTMENT OF CALDAS (COLOMBIA)**

Main Author:

**Diego ESCOBAR GARCIA** (UNIVERSIDAD NACIONAL DE COLOMBIA SEDE MANIZALES)

Co-author(s):

**Francisco JAVIER GARCIA OROZCO** (UNIVERSIDAD NACIONAL DE COLOMBIA SEDE MANIZALES)

**Jorge EDUARDO HURTADO GOMEZ** (UNIVERSIDAD NACIONAL DE COLOMBIA SEDE MANIZALES)

**Abstract:**

The project "STUDIES FOR THE DEVELOPMENT OF LAND MANAGEMENT AND TECHNICAL STUDIES FOR THE ROAD SYSTEM OF THE CENTRAL SOUTH REGION OF THE DEPARTAMENTO DE CALDAS", currently under implementation by the Universidad Nacional de Colombia is taking into account the integral design of road interventions established by the State Administration, having traffic characterization, and accessibility as some of the of the key inputs for proper planning. The transport infrastructures, as they modify the conditions of territory accessibility, are a key element in regional development policies, since new investments could contribute not only to mitigate the current problems but also could focus on empowerment of disadvantaged regions, thus achieving a dual purpose. On the other hand, transport and communication infrastructures reduce the space cost of distance and influence location and accessibility, contributing to the modification of the settlements and economic structure of a region. Undoubtedly most activities in a territory are directly related to the capacity of transportation of people and goods, and therefore to the efficient communication between different geographical areas.. (...).

**Keywords:**

Accessibility, GIS, Geostatistics, Transportation, Costs, Infrastructure.

ID 2070 R

**IMPACT OF THE NEW ROAD INFRASTRUCTURE IN THE CITY OF MANIZALES (COLOMBIA) IN TERMS OF ACCESS TIME IN A PRIVATE VEHICLE AND PUBLIC TRANSPORTATION**

Main Author:

**Diego ESCOBAR GARCIA** (UNIVERSIDAD NACIONAL DE COLOMBIA SEDE MANIZALES)

Co-author(s):

**Francisco JAVIER GARCIA OROZCO** (UNIVERSIDAD NACIONAL DE COLOMBIA SEDE MANIZALES)

**Luis ricardo VASQUEZ** (UNIVERSIDAD NACIONAL DE COLOMBIA SEDE MANIZALES)

**Abstract:**

In the last decade, the city of Manizales has incorporated substantial changes in its urban road infrastructure. Those changes have the common purpose to provide faster and comfortable mobility channels to the people by improving the connections in all geographical directions. In this research, the global mean accessibility conditions offered by the urban road network between the years 2000 and 2009 are evaluated. The road networks used by private vehicles and public urban transit (PUT) are studied separately. The curves of global mean accessibility are drawn by analyzing the obtained data for each one of the given transportation modes and its evolution in the last decade. The results point toward an improvement in motorized accessibility in those periods of more infrastructure development. The chronological analysis of changes in private vehicle and public urban transit networks prove how the private mode has been highly benefited over the public urban transit in terms of global mean accessibility.

**Keywords:**

Accessibility, Public urban transit, SIG, Traffic.

MON 12<sup>th</sup> (14:00 - 15:15, Session E2.2) Room 0.02

ID 3034 R

**A DESIGN MODEL FOR THE BUS BRIDGING PROBLEM**

Main Author:

**Esteve SANCHO** (*Universitat Politècnica de Catalunya*)

Co-author(s):

**Ángel MARÍN** (*Politechnical University of Madrid*)

**Abstract:**

Public Transportation, Commuters' Satisfaction,  
Developing country

**Keywords:**

Bus operations, Transit modelling, Integer linear programming.

MON 12<sup>th</sup> (15:30 - 16:45, Session E2.3) Room 0.02

ID 1105 R\*

**DEEP-SEA PORT PERFORMANCE IN THE HAMBURG-  
LE HAVRE RANGE: BENCHMARKING AND DATA  
ENVELOPMENT ANALYSIS**

Main Author:

**Bart WIEGMANS** (*tu delft*)

**Abstract:**

In this paper, the focus is on answering the following research question: 'How efficient are deep-sea ports in the Hamburg-Le Havre range compared with each other?' Input-oriented (and output-oriented) DEA results demonstrate that the deep-sea port of Vlissingen is perfectly efficient and also that the port of Amsterdam is quite efficient. Furthermore, the Dutch deep-sea ports are the most efficient ports in the HLH-range. Finally, relatively smaller deep-sea ports (with a market share of about 5 per cent, such as Amsterdam, Vlissingen, and Zeebrugge) are relatively more efficient than larger deep-sea container ports (such as Antwerp, Hamburg, and Rotterdam). For European port policy this might suggest that subsidies should be limited to further increase efficiency. A level playing field could contribute to increased efficiency of deep-sea port operations and to lower port subsidies by the governments of Belgium, Germany, and the Netherlands.

**Keywords:**

Deep-sea ports, Efficiency, Benchmarking, DEa.

ID 1432 R

**PERFORMANCE INDICATORS IN THE FREIGHT TRANSPORTATION SECTOR ? THE CASE OF THE GREEK MARKET**

Main Author:

**Eleni MARIA PAPADOPOULOU** (*Department of Applied Informatics, University of Macedonia*)

**Abstract:**

The concept of supply chain management embraces the activities of transportation and logistics that are generally provided by carriers (ocean, air, railway carriers, truckers), freight forwarding companies, and/or third party logistics providers that intermediate in the movement of goods from shipper to consignee. There are some critical milestones throughout the transportation process that have to be successfully managed, so that the intermediaries provide leveraged performance to the services users. The aim of this study is to identify the critical transportation performance measures and indicators, and to rate their significance in the Greek market through a survey, according to the members of the Association of International Freight Forwarders and Logistics Enterprises of Greece (IFFAG&L), an association member of FIATA (International Federation of Freight Forwarders Associations).

**Keywords:**

Freight Forwarder, Third Party Logistics Provider, Performance Measurement, Performance Indicators, Transportation, Logistics.

ID 1778 R

**ANALYSIS OF EFFICIENCY OVER TIME USING DATA ENVELOPMENT ANALYSIS TECHNIQUES: THE CASE OF INTERSTATE PASSENGER COACH TRANSPORT COMPANIES IN BRAZIL**

Main Author:

**Carlos EDUARDO EDUARDO** (*MKMBR Engenharia Ambiental*)

Co-author(s):

**Francisco MARTINS** (*Tribunal de Contas da União*)

**Francisco GILDEMIR GILDEMIR** (*Universidade Federal do Ceará*)

**Marcelo PEREIRA QUEIROZ MARCELO** (*Agência Nacional de Aviação Civil*)

**Abstract:**

The present work uses Data Envelopment Analysis - DEA to evaluate the technical and operational efficiency of companies engaged in interstate passenger coach services in Brazil. The evaluation encompasses the years 2004, 2005 and 2006 and involves 102 coach companies that only operate interstate routes over distances greater than 75 km in Brazil. The variables selected are: i) product: passenger-kilometers (turnover); ii) inputs: distance traveled in kilometers (representing fuel consumption), fleet of vehicles (invested capital) and drivers (labor). The study employed the BCC optimization model to compensate for the varied sizes of the transport companies analyzed, with an orientation directed at reduction of inputs. The result was the identification of groups of efficient companies both large and small that can serve as benchmarks for the inefficient companies. Its could assist the regulating authority in determining the targets to be achieved by the inefficient companies in order to place themselves as near as possible to the efficiency frontier or even become part of it. The regulatory authority could also use them as an indicator to define a yardstick competition for regulation purposes.

**Keywords:**

Data envelopment analysis, Efficiency, Interstate .

ID 2391 R

**COMPARISON OF EFFECTS THROUGH DATA ENVELOPMENT ANALYSIS: A TEST ON A LIGHT RAIL TRANSIT**

Main Author:

**Corrado RINDONE** (*Mediterranea University of Reggio Calabria*)**Abstract:**

An internal transport planning process is affected by the objectives to be pursued to implement strategies which respect constraints. Starting from analysis of the current situation, in the plan a set of strategies to adopt is identified such as to respect all constraints. Effects of alternative scenarios may be simulated and evaluated by applying a system of models. They are represented by means of performance measurement that may be compared with objectives and constraints before and after implementation of planned interventions. In this paper evaluation methods to compare effects within the strategic urban transport planning process are focused. The economic efficiency criterion is adopted to measure the capacity of a Decision Making Unit (DMU) in creating a production process that combines production factors to obtain one or more products. Methods to measure efficiency in production can be classified into: parametric methods, based on the hypothesis that the production function is known; non-parametric methods, based on comparison among performances of production units to construct a frontier with non-requirement of an explicit a priori determination of relationships between output and inputs. In this paper a non-parametric method, Data Envelopment Analysis (DEA), is adopted to compare effects of alternative planning scenarios in strategic urban dimensions. At each scenario is associated a DMU that creates a virtual production process in which input variables (e.g. resources needed to implement scenario interventions) are combined to obtain output variables. In this paper, outputs are assumed the effects generated after implementation of interventions (e.g. effects on mobility after implementation of infrastructures and services). (...).

**Keywords:**

Efficiency, DEA, Comparison, Transportation planning.

ID 3103 R

**FREIGHT TRANSPORT DETOURS**

Main Author:

**Johan WOXENIUS** (*University of Gothenburg, Dept. of Business Administration*)**Abstract:**

From the perspective of a transport service buyer and at the abstraction level of material flows, all transports travel directly from product supplier to product customer. In reality, however, the directness of transport services depends on factors such as geography, available infrastructure, temporary conditions, shippers' qualitative preferences, the economy of and practical possibilities for consolidation and access to return flows. This work examines detours by structuring and elaborating upon the causes of freight transport detours and briefly analysing their effect. Detours are divided into supply chain, logistics and freight transport detours respectively and most attention is paid to the last kind of detour. Freight transport detours are divided into physical, political, commercial, operational and non-planned causes for detours. The first two stipulate the system environment in which the focused actors, transport service providers, decide upon detours. Operational causes are subject to internal decision making whereas commercial and non-planned causes are both external and internal to transport service providers. The work is qualitative and is presented as a work-in-progress; therefore, coherent quantitative evidence is still lacking.

**Keywords:**

Detour, Distance, Efficiency, Freight transport, Key performance indicator.

ID 1426 R

**HOW CAN EUROPEAN GOVERNMENTS STIMULATE THE PURCHASE OF ENVIRONMENTALLY FRIENDLY VEHICLES? A MULTI-ACTOR MULTI-CRITERIA ANALYSIS**

Main Author:

**Kenneth LEBEAU** (*Vrije Universiteit Brussel*)

Co-author(s):

**Laurence TURCK SIN** (*Vrije Universiteit Brussel*)**Cathy MACHARIS** (*Vrije Universiteit Brussel (Free University of Brussels)*)**Abstract:**

This paper makes use of the multi-actor multi-criteria analysis (MAMCA) methodology in order to investigate how governments in EU Member States can stimulate consumers in buying environmentally friendly vehicles using car taxation policies. Four commonly used taxation policies are evaluated: tax reductions for vehicles with alternative fuel systems (hybrids, electric vehicles, LPG, CNG, biofuels...), incentives based on the level of CO2 emission, financial incentives for vehicles equipped with a particulate matter filter and finally scrapping premiums for customers who replace their vehicle with a more environmentally friendly one. With the use of the MAMCA approach, these common trends are evaluated on the basis of 4 criteria: the economic impact, the environmental impact, the social impact and the level of transparency. Thanks to the MAMCA approach, the point of view of 5 different stakeholder groups is taken into account. These stakeholders include the users, the government, non-governmental organizations, experts from the automotive industry and specialized academic researchers. The results of this analysis show that scrapping premiums are considered the best option in the attempt to green the car fleet, as it replaces old and polluting vehicles with environmentally friendly types. Next up are the incentives for alternative fuel systems, followed by the CO2 emission based incentives and the particulate matter based incentives.

**Keywords:**

Car taxation, Environmentally friendly vehicles, MAMCa.

ID 1847 R

**A FRAMEWORK FOR STRATEGIC SUSTAINABILITY ASSESSMENT OF EUROPEAN TRANSPORT POLICIES**

Main Author:

**Angelo MARTINO** (*TRT trasporti e territorio (TRT)*)

Co-author(s):

**De STASIO CLAUDIA** (*TRT Trasporti e Territorio*)**Abstract:**

Background: In current practice of transport policy three weaknesses can be identified: firstly, the links between existing modelling tools and sustainability indicators are inadequate. Secondly, the existing modelling toolbox is incomplete, especially with respect to the impact of transport policies on regional economic growth, on social equity and on local environmental quality. Finally, measures are often addressed in isolation, without a full understanding of interdependencies between them. Methodology: REFIT is a research project co-funded by the European Commission within the Sixth Framework Programme that tries to repair these weaknesses producing a comprehensive methodology for assessing the impact of various transport policies and strategies on sustainability. The objective of the REFIT study is to develop a comprehensive assessment framework that links European transport policy objectives and indicators to the growing pool of tools and expertise accumulated within various European research projects. The framework is based on the application of modelling tools to produce a wide set of output, which in turn are processed to derive an array of indicators belonging to different domains. Within the REFIT study, TRANS-TOOLS and TREMOVE Europe-wide transport models have been combined with three models created ad-hoc for calculating specific indicators to cover the economic, the environmental and the social dimension of transport system sustainability: (i) the economic module addresses the linkages between transport and economy, mainly in terms of the effects of transport policy measures on regional GDP or employment; (ii) the environmental module, deals with health impacts of air-pollution and traffic noise; (iii) the social module handles the effects of policies on the social dimension looking at aspects like the distribution of costs and benefits. (...).

**Keywords:**

Integrated Assessment, Transport Policy, Sustainability, Indicators, Modelling.

MON 12<sup>th</sup> (17:00 - 18:15, Session E2.4) Room 0.02

ID 2547 R

## **COMPARING BRAZILIAN AND AMERICAN RAILWAYS WITH DEA**

Main Author:

**Brunno GONÇALVES** (*Universidade Federal do Rio de Janeiro*)

Co-author(s):

**Márcio D'AGOSTO** (*Federal University of Rio de Janeiro*)

**Marcos LINS** (*Federal University of Rio de Janeiro*)

**Silvio SANTOS** (*Federal University of Santa Catarina*)

### **Abstract:**

To evaluate the performance of Brazilian railways and establish productivity goals, the National Land Transport Agency (ANTT) monitors a set of pre-selected indicators. In this article we propose the use of data envelopment analysis (DEA) as an alternative for Brazilian railway performance evaluation, to enable systematic and comparative analysis of the efficiency of concessionaires. To exemplify the method, we present an applied study comparing the efficiency of six Brazilian railroad companies and five American railroad companies, in terms of operational and financial results obtained along this decade. The results show that the DEA method is effective to measure the relative efficiency of these railroads and indicate the areas for improvement for the underperformers.

### **Keywords:**

Data Envelopment Analysis (DEA), Railways performance, Brazilian railways, American railways.

MON 12<sup>th</sup> (17:00 - 18:15, Session E2.4) Room 0.02

ID 2839 R

## **TOWARD IN-DEPTH ANALYSIS OF TRAIN PUNCTUALITY DATA**

Main Author:

**Jouni PAAVILAINEN** (*Tampere University of Technology, Department of Business Information Management and Logistics*)

Co-author(s):

**Riikka SALKONEN** (*Tampere University of Technology*)

### **Abstract:**

Punctuality (on-time performance, schedule adherence) is one of the most important success factors for a railway traffic system. Despite the importance of punctuality, there seems to be a lack of broad understanding when it comes to the formation of punctuality. Within a railway traffic system, delays concatenate easily, that is, a single delay is likely to cause many other delays, so-called secondary delays. To date, most of the studies related to delays have examined only stations and station-like systems. However, especially within a single-tracked infrastructure—as in Finland—a notable portion of secondary delays takes place outside stations. Thus, the examination of delay concatenation should be done by considering the whole network. This paper first describes the current practices and challenges related to the analysis of train punctuality data for Finnish railways. Railway organizations in Finland record a lot of punctuality-related data, but with the current data and methods, one is able to allocate primary delays only to their causes. Secondary delays are not analyzed. Considering this, it is also impossible to identify which of the primary delays are the most critical ones. Hence, the research question of this paper is: "How can we analyze train punctuality data more efficiently and systematically in order to gain an understanding about the most critical delay concatenation phenomena?" With actual motion data from Finnish railways, we prove that at least the most explicit delay chains can be identified and mapped, and this information can be used, for example, for allocating delays to their real causes, and developing a more robust timetable. We thus argue that this kind of examination can be made and, more importantly, should be made. (...).

### **Keywords:**

Railway traffic system, Punctuality, Delay propagation, Primary delays, Secondary delays, Statistical methods, Data mining, Performance measurement.

MON 12<sup>th</sup> (17:00 - 18:15, Session E2.4) Room 0.02

ID 2914 R

## **THE RELEVANCE OF STRATEGIC ASSESSMENT OF URBAN MOBILITY NETWORKS**

Main Author:

**Camila GARCIA** (*Instituto Superior Técnico*)

Co-author(s):

**Rosário MACÁRIO** (*IST*)

### **Abstract:**

The good performance of the urban mobility systems (UMS) is one of the necessary conditions to a competitive city. Besides quality of life and business, cities require a UMS that fulfills all its displacement needs, ranging from people to goods. In this sense is clear that the UMS has to embody a multimodal structured and integrated mobility network whose configuration should be according to the needs of the city. However, this is a theoretical vision of the urban mobility network (UMN) planning. In practice, the interventions made in the network are performed in order to meet specific needs of the city, without considering its main vocation. In this way, this paper discusses the relevance of strategic assessment of urban mobility network as a mean of guarantee the conciliation of both visions of the UMN planning. This discussion is preceded by the identification of the urban network planning problem, followed by a discussion about the strategic planning of the urban mobility system planning, to finally argue the relevance of the strategic assessment of urban mobility network.

### **Keywords:**

Sustainability, Planning, Mobility Network, Strategic Assessment.

MON 12<sup>th</sup> (17:00 - 18:15, Session E2.4) Room 0.02

ID 3018 R

## **PARKING PROBLEMS AT THE UC CAMPUS: SETTING THE RESEARCH AGENDA**

Main Author:

**Eduardo BARATA** (*GEMF - FEUC*)

Co-author(s):

**João FERREIRA** (*Faculty of Economics, University of Coimbra*)

**Luís CRUZ** (*GEMF - FEUC*)

### **Abstract:**

This study underscores the importance of adopting integrated parking management policies that ensure not only more rational use of the available parking spaces, evenly balancing supply and demand and bringing in revenues to cover the parking facilities costs, but also the improved attractiveness of alternative transportation modes. Parking supply and demand flows within the UC campus are estimated. The results indicate that the parking facility is underpriced and that there is overcrowding. To reflect critically on these issues and identify research areas to address their socio-economic implications, a survey regarding the characterization of campus commuters and their travel options is presented. Finally, some policy proposals theoretically-engaged but pragmatically-oriented, are discussed.

### **Keywords:**

Parking, Parking Policy, Campus, Travel Mode, Public Transport.



TUE 13<sup>th</sup> (08:15 - 09:30, Session E2.5) Room 0.02

ID 1134 R

**CONSISTENCY BETWEEN STATE ROAD NETWORK PLANNING AND RENEWED FEDERAL GUIDELINES OF ACCESSIBILITY**

Main Author:

**Florian HEINITZ** (*Erfurt University of Applied Sciences*)

**Abstract:**

This paper reports on recent methodological developments to address mutual requirements and to solve possible conflicts of objectives between spatial planning and road network investment at federal state level in Germany. On the one hand, the renewed "Federal Guidelines of Accessibility for an Integrated Network Design" (RIN) suggest an assessment of air-line speeds in given central-place grids, consequently developing standards and priorities to overcome service level deficits. On the other hand, the state-run road construction administration pursues an agenda of infrastructural and organizational measures to enhance the network. The focus here is on adapting physical capacities to the occurring load pattern, seeking a minimum of the running costs while complying with transport safety and environmental regulations. The theoretical part of the paper proposes a unified, constraint-based planning model, whose formal description is given. The study region chosen for the practical application is the German federal state of Thuringia, in conjunction with an existing integrated transport supply-demand model. After undertaking a policy analysis for the period 2005 – 2025 we will demonstrate our modelling approach, aimed at accomplishing a consistent improvement strategy and thus giving an adequate decision support for the state authorities.

**Keywords:**

Road Network Planning, Spatial Planning, Central Place Theory, Accessibility, Consistency, Search Algorithm, Transport Modelling.

TUE 13<sup>th</sup> (08:15 - 09:30, Session E2.5) Room 0.02

ID 2166 R

**PERFORMANCE INDICATORS FOR URBAN PUBLIC TRANSPORT SYSTEMS WITH A FOCUS ON TRANSPORT POLICY EFFECTIVENESS ISSUES**

Main Author:

**Marco DIANA** (*Politecnico di Torino - DITIC*)

Co-author(s):

**Cinzia DARAIO** (*University of Bologna - CIEG*)

**Abstract:**

The present paper reviews the methodologies that have been proposed to assess the performances of urban public transport systems, in order to identify possible research gaps. An evaluation framework is proposed to adequately address the specificities of public transport as a field of intervention of public powers, that make it different from other subsidized sectors such as health care or education. According to such framework, it is found that efficiency issues are the most studied ones, dealing with various aspects of service production with a managerial perspective, whereas customer-related quality issues have come into play in more recent years. However, the paper argues that the point of view of policy makers does not necessarily coincide with any of these two. Related transport policy effectiveness issues have been less consistently studied and probably need to be pushed up in the research agenda. The paper ends by proposing a preliminary set of new transport effectiveness indicators to properly evaluate the contribution of transit to improve a transport system on three of the aspects that are usually at the core of any policy action, namely accessibility improvement, modal diversion and environmental impacts.

**Keywords:**

Public transport, Performance evaluation, Effectiveness indicators.

TUE 13<sup>th</sup> (08:15 - 09:30, Session E2.5) Room 0.02

ID 2168 R

**APPLICATION OF DATA MINING TECHNIQUES TO CONGESTION DATA ANALYSIS : THE CASE OF SAPPORO URBAN AREA**

Main Author:

**Mikiharu ARIMURA** (*College of Science and Technology, Nihon University*)

Co-author(s):

**Tohru TAMURA** (*Dept. of Civil Engineering and Architecture Muroran Institute of Technology*)

**Toshiyuki NAITO** (*Transportation Department Docon Co., Ltd.*)

**Hironobu HASEGAWA**

**Abstract:**

This study aims to identify mid- and long-term characteristic congestion trends in the urban area by classifying time-series data collected at sensor-installed points using the k-means method as which a major unsupervised clustering technique, and to support measure planning for each point using the results obtained from the classification. In this study, temporally and spatially characteristic congestion patterns were extracted from a large amount of congestion data obtained from sensors installed at approximately 2,200 locations across Sapporo urban area where has heavily and snowy weather condition. The identification of regular congestion patterns that occur at certain locations and hours is expected to facilitate support for the planning of traffic measures that require temporal and spatial consideration. As the result of this study, congestion trends and congestion-point distributions which are including of summer and winter seasons were then classified into a number of patterns, allowing the selection of effective measures and the identification of targets for countermeasures.

**Keywords:**

Road Performance Measurement, ITSs, Data Mining, Clustering Analysis.

TUE 13<sup>th</sup> (08:15 - 09:30, Session E2.5) Room 0.02

ID 2474 R

**ANALYSIS OF THE OPERATIONAL PERFORMANCE OF EUROPEAN URBAN RAIL TRANSPORT NETWORKS – PRODUCTION EFFICIENCY AND EFFECTIVENESS**

Main Author:

**António LOBO** (*Faculdade de Engenharia da Universidade do Porto*)

Co-author(s):

**António COUTO** (*Faculdade de Engenharia da Universidade do Porto*)

**Abstract:**

This paper focuses on the analysis of the operational performance of a number of European metro systems by adopting a production function approach. To begin with, this study analyses the estimate of the inputs elasticities of the optimal production function. Next, it studies the efficiency and effectiveness levels of each company, by analysing service supplied and demand characterizing indicators, respectively. For these two purposes, stochastic production frontier models have been applied. Due to the fact that production effectiveness is influenced by the social-economic environment of the urban areas on which the metro systems operate, the influence of these external effects on effectiveness is estimated by regressing the effectiveness results on external variables. In addition, internal effects on effectiveness are evaluated.

**Keywords:**

Metro systems, Production, Stochastic model, Efficiency, Effectiveness.

TUE 13<sup>th</sup> (08:15 - 09:30, Session E2.5) Room 0.02

ID 2857 R

### **MEASURING RAILWAY TRAFFIC PUNCTUALITY FROM THE PASSENGER PERSPECTIVE**

Main Author:

**Riikka SALKONEN** (*Tampere University of Technology*)

Co-author(s):

**Jouni PAAVILAINEN** (*Tampere University of Technology, Department of Business Information Management and Logistics*)

#### **Abstract:**

Punctuality is an important success factor for railway traffic systems, and it is one that largely affect on passengers. Measuring punctuality in railways has many different applications. It can provide a measurement of quality, and can be used for example in individual investment projects or in scheduling. This article discusses punctuality from the point of view of the passenger and also discusses the current state of research on the subject. Previous studies made by the authors have noted that the customer's point of view is inadequately studied in railway traffic and that punctuality has been neither extensively measured nor systematically monitored from the passenger's perspective. Accordingly, this study focused on measuring the experienced punctuality of passengers rather than that of trains. Nowadays, customer management is increasingly important in all fields. Railway actors have to be able to follow how railway customers' punctuality evolves from the customers point of view. While development of punctuality measurements in Finland has been slow, this is also the norm in the international field. Methods of measuring punctuality in most countries are simple, concentrating solely on measuring the deviation of scheduled stops and counting the percentage value of punctual trains. Also, threshold values of punctuality vary between countries and common uniform measurement methods are missing. The main goal of this study is to explain the usefulness of punctuality measurements that take passengers into account. First, the article provides a general outline of punctuality measurements based on a literature review, followed by a brief discussion of the different possibilities for measuring punctuality. (...).

#### **Keywords:**

Train punctuality, Punctuality measurements, Quality of service.

TUE 13<sup>th</sup> (08:15 - 09:30, Session E2.5) Room 0.02

ID 3182 R\*

### **ELECTRE APPROACH FOR MODELING PUBLIC DECISION MAKING BEHAVIOR ON TRANSPORTATION PROJECT SELECTION PROCES**

Main Author:

**Murat KARACASU** (*eskisehir osmangazi universitesi*)

#### **Abstract:**

Transportation projects consumes public resources, therefore public involvement in decision making process is essential in developed countries. Determining final decisions together with public is also of importance for realizing support and advocacy for implementing transportation projects from policy makers' point of view. Decision support methods are useful to obtain public's opinions. In this respect, the ELECTRE method is examined in such a case in Eskişehir, Turkey. Public's approval of two different types of public bus operation system, one run by municipal authorities and one run by private agencies are sought. The important findings are outlined based on obtained results.

#### **Keywords:**

Decision support system, transportation planning, Electre method, public participation.

ID 1112 R

**IMPACT ASSESSMENT OF CO<sub>2</sub> EMISSION LIMITS OF CARS IN GERMANY AND EUROPE**

Main Author:

**Wolfgang SCHADE** (*Fraunhofer Institute Systems and Innovation Research (ISI)*)**Abstract:**

In its 4th Assessment Report the Intergovernmental Panel on Climate Change (IPCC) concludes that the risk of climate change with temperature increases of 4-5°C until 2100 has grown substantially and recommends strong actions to curb greenhouse gas emissions (GHG) until 2020 [IPCC 2007]. In the EU the transport sector is the major sector that showed growth of GHGs in the last years. One of the most promising measures to bring down the GHG emissions of transport is to define emission limits for new vehicles [Markewitz/Matthes 2008, ISI et al. 2008]. These emission limits should not be static but have to follow a reduction path such that car manufacturers could anticipate the requirements for future cars as they are facing significant lead times in the development of new engines and cars. This paper presents and analyses different assessments of the introduction of binding CO<sub>2</sub> emission limits of cars. The assessments cover both the estimation of CO<sub>2</sub> savings as well as the transport and economic impacts. The focus of analysis will be on transport and economic impacts. Studies for Germany and for the EU level will be taken into account. The analysis applies both partial models and the integrated assessment model ASTRA. Based on the partial models it can be estimated that the full user cost of car users (i.e. the fixed cost of car purchase plus variable cost) are reduced by the CO<sub>2</sub> limits [ISI et al. 2008]. In other words, well-designed climate policy will decrease total user cost of car users. This is in line with the findings obtained by the ASTRA model for Germany and Europe that over a short period car transport is reduced compared with a reference case with no CO<sub>2</sub> limits, but over the medium to long-term the rebound effect of reduced variable cost increases the modal-share of car transport [Markewitz/Matthes 2008, Schade et al. (...)].

**Keywords:**

CO<sub>2</sub> limits cars, Climate policy, Transport policy, Abatement cost, Abatement benefit, Impact assessment, 2030, Germany, Europe.

ID 1245 R

**THE EFFECT OF NEGLECTING USERS' COSTS ON THE SPATIAL STRUCTURE OF PUBLIC TRANSPORT SERVICES**

Main Author:

**Sergio JARA-DIAZ** (*Universidad de Chile*)

Co-author(s):

**Antonio GSCHWENDER** (*UNiversidad de Chile*)**Meisy ORTEGA** (*Universidad de Chile*)**Abstract:**

It has been shown recently that the presence of a stringent financial constraint translates into an implicit reduction of users' time value in the design of public transport systems, inducing a less than optimal bus frequency and larger than optimal bus size. This conclusion was achieved with a microeconomic model for a single line only. When multiple lines are allowed in the context of an urban network, different spatial pattern of services can be envisioned, i.e. direct services (no transfers) or corridors (transfers are needed). The objective of this paper is to consider the spatial structure of services in the cost model, in order to study the impact of neglecting users' costs (i.e. their time). This is done through the analysis of four simple though illustrative networks. First, the optimal structure of lines is investigated, searching for the combination of lines, frequencies and vehicle sizes that minimize total costs for operator's and users'. Then the same problem is solved accounting for operators' costs only. The results show that, when all costs are accounted for, direct services are more likely to be the preferred outcome only when, for given time values, demand is sufficiently high. When only operators' costs are considered, the preferred outcome would be direct services under all circumstances, with lower frequencies. These results are explained in terms of fleet size requirements and both in-vehicle and waiting times associated to each objective.

**Keywords:**

Public transport, Spatial structure, Users costs,

ID 1254 R

**META-ANALYSIS OF VALUE OF TRAVEL TIME SAVINGS: EVIDENCE FROM JAPAN**

Main Author:

**Hironori KATO** (*University of Tokyo*)

Co-author(s):

**Masayoshi TANISHITA** (*Chuo University*)**Tomohiro MATSUZAKI** (*Chuo University*)**Abstract:**

This paper examines the value of travel time saving (VTTS) in Japan with a meta-analysis. 216 VTTSs estimated in 68 peer-reviewed papers on travel behavior in Japan from 1979 to 2003 are used for the meta-analysis. First, the basic characteristics of VTTSs are analyzed from the viewpoints of purpose of travel, weekday/ weekend day, type of data, urban/interurban, and attribute of travel. Then, the regression analyses are conducted with all VTTS estimates, with VTTS estimates of urban travels, and VTTS estimates of inter-urban travels. The estimation results show that the VTTS estimated with stated preference data is lower than the VTTS estimated with revealed preference data; the VTTS of business travel is higher than the VTTSs of home-to-school, private, and leisure travels; the VTTSs of access/egress time, wait time, and transfer time are higher than the VTTS of in-vehicle time. They also show that the VTTS on weekdays is not significantly different from that on weekend days; The VTTS of urban travel is not significantly different from that of inter-urban travel. In terms of travel mode, the characteristics depend on whether it is urban travel or inter-urban travel.

**Keywords:**

Value of travel time saving, Passenger transportation meta-analysis, Japan.

ID 1320 R

**THE COST OF CONGESTION DUE TO ROAD ACCIDENTS: PEANUTS COMPARED TO THE VALUE OF LIFE?**

Main Author:

**Koen VAN RAEMDONCK** (*Vrije Universiteit Brussel (Free University of Brussels)*)

Co-author(s):

**Fredriek VAN MALDEREN** (*Vrije Universiteit Brussel (Free University of Brussels)*)**Cathy MACHARIS** (*Vrije Universiteit Brussel (Free University of Brussels)*)**Abstract:**

This paper examines the economic costs of road accidents, and the congestion costs more specifically. In order to calculate these congestion costs two important input variables, the value of travel time and the lost vehicle hours, are needed. First, the value of travel time, and some difficulties in valuating this value of time, will be discussed. Many variations occur when valuating this, amongst others because of the type of the vehicle or traveller, the occupancy of the vehicle, the region and the travel motif. Even if sufficient quality data is provided, there will still be uncertainty about the estimates for the value of travel time. Thereafter, the lost vehicle hours (VHL) are being studied in more detail. This indicator shows the delays incurred by vehicles because of congestion and delayed traffic flows. However, the calculation of the VHL itself is quite complicated: quality input data is needed, and to collect this data there is a need for reliable measurement systems. At this moment, there are no such measurement systems in Belgium or Flanders. Therefore this paper will not focus on the calculation of the lost vehicle hours, but on some different methodologies for the calculation of lost vehicle hours and the description of the data needed to perform the calculations. The next chapter will cover the costs incurred by the time lost due to congestion and traffic delays because of road accidents. By valuating these time losses, the cost of "being in a traffic jam" will be calculated. Multiplying the value of time and the lost vehicle hours, which were discussed before, results in the congestion costs. This calculation is followed by a thorough discussion in which the restrictions of the calculations and the used data are commented. (...).

**Keywords:**

Congestion costs, Value of travel time, Lost vehicle hours.

MON 12<sup>th</sup> (11:15 - 12:30, Session E3.1) Room 1.04

ID 1403 R

### **DOES MOTORWAY BUILDING SAVE TIME**

Main Author:

**Nicholas LOW** (*GAMUT, The University of Melbourne*)

#### **Abstract:**

In this paper we argue that investment in transport infrastructure in developed economies cannot be justified by an appeal to economic benefit arising from travel time saved. We examine the case of the City Link freeway expansion in Melbourne, Australia. We argue that transport infrastructure policy can best be explained as 'path dependent'. Infrastructure policy, for decades heavily dominated by expenditure on roads at the expense of every other form of transport, is a policy setting that is 'locked in' by its capacity to deliver increased power and influence to the state apparatus that produces it.

#### **Keywords:**

Infrastructure investment Melbourne, Australia t.

MON 12<sup>th</sup> (14:00 - 15:15, Session E3.2) Room 1.04

ID 1437 R

### **COMMUTING TIME CHANGES FOLLOWING RESIDENTIAL RELOCATIONS AND JOB RELOCATIONS**

Main Author:

**Jan-Erik SWÄRDH** (*Swedish National Road and Transport Research Institute*)

#### **Abstract:**

This paper focuses on empirical analysis of commuting time changes for workers who relocate residence, relocate job, or combine both residence and job relocation. A large register data set of individuals on the Swedish labor market, including travel times, is studied. Workers are not necessarily seeking to decrease their commuting time when they relocate job and/or residence. In fact, the average commuting time is longer after a relocation than before, thus suggesting that workers trade between a better job, a better residence and commuting time. The paper also presents results from a set of econometric models suggesting that commuting time changes differ substantially with respect to socio-economic characteristics as well as with respect to the part of the distribution of commuting time change that is analyzed.

#### **Keywords:**

Commuting time, Commuting time changes, Relocations, Register data, Longitudinal, Quantile regression.

ID 1440 R

**WILLINGNESS TO ACCEPT COMMUTING TIME FOR YOURSELF AND FOR YOUR SPOUSE: EMPIRICAL EVIDENCE FROM SWEDISH STATED PREFERENCE DATA**

Main Author:

**Jan-Erik SWÄRDH** (Swedish National Road and Transport Research Institute)

Co-author(s):

**Staffan ALGERS** (Royal Institute of Technology Stockholm (KTH))**Abstract:**

In this study, Swedish stated preference data is used to derive estimated values of commuting time (VOCT). Both spouses in two-earner households are individually making trade-offs between commuting time and wage; both with regard to their own commuting time and wage only, as well as when both their own commuting time and wage and their spouse's commuting time and wage are simultaneously changed. Thus, we are able to compare how male spouses and female spouses value each other's commuting time. When only ones own commuting time and wage are attributes, the empirical results show that the estimated VOCT is plausible with a tendency towards high values compared to other studies, and that VOCT does not differ significantly between men and women. When decisions affecting commuting time and wage of both spouses are analyzed, both spouses tend to value the commuting time of the wife highest. For policy implications, this study provides additional support for the practice of valuing commuting time higher than other private travel time. In addition, if VOCT were to be gender specific, the value might be higher for women than for men in two-earner households.

**Keywords:**

Value of time, Commuting, Value of commuting time, Stated preferences, Two-earner households, Gender differences, Mixed logit.

ID 1702 R

**REDUCING MORTALITY RISKS BY PUBLIC POLICY MEASURES – DOES LIFE YEARS SAVED INFLUENCE WILLINGNESS TO PAY?**

Main Author:

**Lena NERHAGEN** (Swedish National Road and Transportation Research Institute - VTI)

Co-author(s):

**Chuan-Zhong LI** (Uppsala University)**Abstract:**

Although the value of reducing mortality risks and that of reducing life year losses are closely related to each other, the valuation literature seems to treat them rather separately resulting in conflicting value estimates. While the former is more concerned with saved statistical lives from accidents, the latter is more directed to the lost life years due to air pollution etc. In this paper, we attempt to conduct an integrated valuation study for both types of values in the same choice experimental design. We formulate an econometric model which simultaneously takes into account both mortality risk reduction and life year loss. The results indicates that conditional on given remaining life years upon survival, the marginal willingness to pay is constant for each statistical life saved, which indicates strong scope effect. The marginal value per extra life year, however, is a diminishing function of the number of life years. We have also examined the effect of other covariates such as the respondents' characteristics (e.g. gender and age), their selfconfidence in making choices, and possible categorical behavior on the final value estimates.

**Keywords:**

Value of statistical life, Value of life years, Stated preference, Choice experiment.

ID 1934 R

**VALUATIONS OF TRAVEL TIME VARIABILITY IN SCHEDULING VERSUS MEAN-VARIANCE MODELS**

Main Author:

**Jonas ELIASSON** (*Centre for Transport Studies, Royal Institute of Technology*)

Co-author(s):

**Joel FRANKLIN** (*KTH Royal Institute of Technology*)  
**Maria BÖRJESSON** (*Centre for Transport Studies, Royal Institute of Technology*)**Abstract:**

The standard method to estimate valuations of travel time variability for use in appraisal is to estimate the parameters of a reduced-form utility function, where some measure of travel time variability (such as the standard deviation) is included. A recently discovered problem with this approach is that the obtained valuation will in general depend on the standardized travel time distribution, and hence cannot be transferred from one context to another. Instead, we test another recently suggested approach: estimating a scheduling model and then deriving an implied reduced-form expression, which can be used for appraisal. The valuations implied by the scheduling model turn out to deviate substantially from a reduced-form model estimated on the same sample. We conclude that the scheduling model – in the way it is usually interpreted and estimated – is not able to capture the entire disutility of travel time variability. Hence, although it can be shown that scheduling and reduced-form models are "theoretically equivalent", they are apparently not "empirically equivalent". We hypothesize that the derivation of reduced-form models from an underlying scheduling model omits two essential features: first, the notion of an exogenously fixed "preferred arrival time" neglects the fact that most activities can be rescheduled given full information about the travel times in advance, and second, disutility may be derived from uncertainty as such, in the form of anxiety, decisions costs or costs for having contingency plans. Finally, we report our best estimates of the valuation of travel time variability for public transit trips, for use in applied appraisal.

**Keywords:**

Value of time, Value of reliability, Travel time value.

ID 2375 R

**PREDICTING TRAVEL TIME VARIABILITY FOR COST-BENEFIT-ANALYSIS**

Main Author:

**Stefanie PEER** (*Department of Spatial Economics, VU Amsterdam*)

Co-author(s):

**Carl KOOPMANS** (*VU Amsterdam*)  
**Erik VERHOEF** (*Department of Spatial Economics, VU University Amsterdam*)**Abstract:**

Unreliable travel times cause substantial costs to travelers. Nevertheless, they are not taken into account in many cost-benefit analyses (CBA), or only in very rough ways. This paper aims at providing simple rules on how variability can be predicted, based on travel time data from Dutch highways. The paper uses two different concepts of travel time variability. They differ in their assumption on information availability to drivers. The first measure is based on the assumption that for a given road link and given time of the day interval expected travel time is constant across all working days (rough information: RI). In the second case, expected travel times are adjusted by day-specific factors such as weather conditions or weekdays (fine information: FI). For both definitions of variability, we find that differences in mean travel time are a good predictor of differences in variability. On average, longer delays are associated with higher variability than shorter delays. However, the derivative of travel time variability with respect to delays is decreasing in delays. For longer delays, the relation between the travel time and variability becomes linear. It can be shown that these results relate to differences in the relative shares of observed traffic regimes' (free-flow, congested, hyper-congested). For most CBAs, no information on the relative shares of the traffic regimes is available. A non-linear model based on mean travel times can be used as an approximation.

**Keywords:**

Travel Time Reliability, Cost-Benefit-Analysis.



ID 2553 R

**TIME VALUES IN PUBLIC TRANSPORT**

Main Author:

**Alexander CHLAO**

Co-author(s):

**Vlastimil MELICHAR****Abstract:**

The role of public transport in our personal and working life is essential and influences not only persons who regularly use public transport but also the users of private cars and others. Although public transport time issues tend to be associated mainly with time spent in a vehicle during the journey, it is evident that the total time related to the use of public transport is much more complex. A particular feature of public transport is that walk and wait time can represent a significant addition to generalised costs and that savings in these types of time can be expected to be valued more highly than IVT (in-vehicle-time) savings. Thus the value of time in public transport should be examined in term of split by time of walking, access time, wait time and headway and in-vehicle-time. Public transport use also involves walking to and from services or transfer between vehicles or modes. Consideration of time issues in solving problems of public transport can bring not only better and more sustainable solutions but can also improve the image of public transport in wide society and help this way to solution of global problems in a transport sector.

**Keywords:**

Marginal congestion costs, Value of time, In-vehicle-time, Walk time, Access time, Wait time and headway, Public transport, Transport users, Transport users decisions.

ID 2699 R

**IS CONGESTION CHARGING EFFICIENT? AN ASSESSMENT OF EXPERIENCES IN EUROPE**

Main Author:

**Charles RAUX** (*LET, University of Lyon*)

Co-author(s):

**Stéphanie SOUCHE** (*Laboratoire d'Economie des Transports*)**Damien PONS** (*LET, University of Lyon*)**Abstract:**

The apparent success of both the London Congestion Charging Scheme (Leape, 2006; Santos and Fraser, 2006) and the Stockholm trial in 2006 (Eliasson, 2008), followed by a durable implementation in 2007, fosters the interest of other cities in the world toward urban road pricing. Moreover, the debate about the economic efficiency of these schemes has been subject to some controversies (Prud'homme and Bocarejo, 2005; Mackie, 2005; Raux, 2005; Prud'homme and Kopp, 2006; Eliasson, 2009), which cast some doubt on the inherent efficiency of congestion charging as predicted by the theory. This is why it is of some interest to review in depth these two experiences, perform a comprehensive economic assessment of their impact, and compare them to the road pricing scheme in Oslo (since 1991). Our methodology of assessment is mainly based on the standard static congestion model, which has proved its robustness is estimating time savings by road users and hence economic gains from decongestion, when compared to other estimations in the literature. However we show that the evaluations are strongly sensitive to a series of factors which include: • the calculation of speed on the road network before and after implementation of congestion charging, • the inclusion of marginal time savings which multiplied with a high level of traffic yields an important increase of decongestion gains, • the estimation of economic gain from improved trip duration reliability, for which estimation methods are not stabilised, • the depreciation rate and duration of infrastructures and public transport vehicles, • the inclusion of costs of public funds, i.e. marginal costs and opportunity costs of public funds. (...).

**Keywords:**

Congestion charging, Economic evaluation, Cost-benefit analysis.

ID 2798 R

**ESTIMATION OF EFFICIENCY ON THE REGULATED TRANSPORTATION COACH OPERATOR IN BRAZIL BY STOCHASTIC FRONTIER OF COBB-DOUGLAS AND TRANSLOG FUNCTIONS**

Main Author:

**Francisco MARTINS** (*Tribunal de Contas da União*)

Co-author(s):

**Francisco GILDEMIR GILDEMIR** (*Universidade Federal do Ceará*)

**Carlos ROCHA** (*Universidade de Brasília*)

**Carlos ARAÚJO** (*MKMBR Engenharia Ambiental Ltda.*)

**Marcelo PEREIRA QUEIROZ MARCELO** (*Agência Nacional de Aviação Civil*)

**Abstract:**

The theme about efficiency and productivity of companies that act in regulated industries have been extensively discussed in literature. In Brazil, there are just a few studies about the analysis of efficiency and productivity of interstate passenger coach transportation (TRIP). In this sense, this paper has three main objectives: to choose between the Cobb-Douglas and Translog functions which is the best function to measure the technical efficiency on TRIP for the period of 2004-2006; to compare the efficiency scores among the companies of TRIP; and to make an analysis of the efficiency dynamic on TRIP and the factors that contributed for the gains and losses of the efficiency. The results indicate a loss of efficiency during the years analyzed and this loss is probably due to the expansion of the capacity installed by acquisition of new buses. On the other hand, the concern of the operators with the fuel consumption is latent and a possible source of efficiency gains. There had been changes in positions of companies during the years, what suggests a strategic behavior in terms of a possible competitiveness of companies. The suggestions are made with the objective to improve the model, to treat the possible problem of multicollinearity and to analyze the strategic behavior among companies in specific transportation lines.

**Keywords:**

Regulated industries, Estimation of efficiency, Stochastic frontier, Cobb-douglas function, Translog function, Transportation coach operator.

ID 3093 R

**PUBLIC ECONOMICS FOR INFRASTRUCTURES IN PPPS**

Main Author:

**Alain BONNAFOUS** (*LET Lyon*)

**Abstract:**

During the twentieth century, the trend that seemed to be emerging in many countries was towards a certain distribution of roles whereby transport operations were assigned to the private sphere and infrastructure to the public sphere. Over the past twenty years, however, growth in the use of PPPs for new infrastructures has signalled a significant change which completely redefines the issues of public economics in the field of transport policy. This communication is based on a research programme of LET, running over several years on public economics of PPPs. It examines to what extent it is necessary to change the way that government uses socio-economic and financial analysis to solve three of the main issues of transport policy: 1) Regulation and casting between public sphere and private operators: Because the private operator's charges include the remuneration of his own capital and therefore allow him to make a profit, the choice of a PPP needs more subsidies if we assume that the Internal Rate of Return (IRR) for the project will be the same for both a public and a private operator. The PPP option is only justified when this assumption is not relevant and under specific conditions. It would be fair to assume that private operators are capable of improving the IRR of the operation, either through better control of operating costs, lower investment costs, short construction lead times or a combination of these profitability factors. It is necessary to formalise the effect of this improvement on the subsidy rate in order to determine the specific conditions under whose the private issue is the best one. 2) Assessment and Investments planning: We begin by showing that when projects are financed by both users (toll revenues) and taxpayers (subsidies), it is socially beneficial to plan these investments on the basis of the net present value (NPV) provided by each unit of public money invested. (...).

**Keywords:**

PPP, Programming, Financing, Pricing.

MON 12<sup>th</sup> (15:30 - 16:45, Session E3.3) Room 1.04

ID 3198 R

**COMPETITION & PRICING BETWEEN INLAND & SEA TRANSPORT: EVIDENCE FROM GREECE**

Main Author:

**Evangelos SAMBRACOS** (*University of Piraeus*)

**Abstract:**

The transport problems (such as congestion, environment, inefficiency and cost) have led to an examination of competition between different modes in Inland Regions. Particularly, there is a need nowadays to examine the issue of competition between short sea shipping and road freight transport, especially from the pricing aspect. The approach to the problem has mainly been focused on increasing urban supply to meet demand better. However, a failure to consider pricing, cost, and the subsidization physical restrictions affects the shape of supply systems. The connection between Patra (a major Greek import area) with West Attica (the biggest Greek industrial centre) provides an appropriate case study as pricing issues, as well as other physical restrictions (i.e. due to Corinth Canal), have to be considered in order to both identify & estimate the factors that can make sea transport more competitive in comparison mainly with road transport. The paper also examines the externalities associated with both road & sea transport, i.e. the costs of transport modes' use, the revenues and the relevant social cost / benefit, in order to provide a viable solution for the promotion of short sea shipping in the transport chain.

**Keywords:**

Market Competition, Inland/ Sea transport, Short Sea Shipping.

MON 12<sup>th</sup> (17:00 - 18:15, Session E3.4) Room 1.04

ID 1121 R

**ROAD TRANSPORT EXTERNALITIES AND ECONOMIC POLICIES**

Main Author:

**Georgina SANTOS** (*Smith School of Enterprise and the Environment and Transport Studies Unit, University of Oxford*)

Co-author(s):

**Hannah BEHRENDT** (*University of Oxford*)

**Laura MACONI** (*University of Oxford*)

**Tara SHIRVANI** (*University of Oxford*)

**Alexander TEYTELBOYM** (*University of Oxford*)

**Abstract:**

Road transport imposes negative externalities on society. These externalities include environmental and road damage, accidents, congestion, and oil dependence. The cost of these externalities to society is in general not reflected in the current market prices in the road transport sector. An efficient mobility model for the future must take into account the true costs of transport and its regulatory framework will need to create incentives for people to make sustainable transport choices. This paper discusses the use of economic instruments to correct road transport externalities, but gives relatively more weight to the problem of carbon emissions from road transport, as this is particularly challenging, given its global and long-term nature. Economics offers two types of instruments for addressing the problem of transport externalities: command-and-control and incentive-based policies. Command-and-control policies are government regulations which force consumers and producers to change their behaviour. Incentive-based policies function within a new or an altered market. Governments have many effective economic instruments to create a sustainable road transport model. These instruments can be used separately or together, but their implementation will be necessary in the nearest future.

**Keywords:**

Road transport externalities, Corrective charges, Cap-and-trade, Scrappage schemes, Subsidies.

MON 12<sup>th</sup> (17:00 - 18:15, Session E3.4) Room 1.04

ID 1875 R

**APPLICATION OF SYSTEM DYNAMICS SIMULATION METHOD IN EVALUATION OF TOTAL BENEFITS OF CHINA RAILWAY INVESTMENT**

Main Author:

**Jicheng QU** (*School of Economics and Management, Beijing Jiaotong University*)

Co-author(s):

**Xiaoyan LIN** (*School of Economics and Management, Beijing Jiaotong University*)

**Abstract:**

System dynamics adopts system simulation method on long-term dynamic simulation, which is not restrained by the higher order nonlinear describing equation and incomplete data. This method also provides friendly interface for man-machine interaction. This paper establishes a system dynamics model based on the combination of regional economy-traffic system with system dynamics theory, tests the validity of the proposed model, and proves the practicability and popularization value of applying the system dynamics method in the evaluation of the total benefits of railway investment.

**Keywords:**

System dynamics, System simulation, Flow diagram, Regional economy-traffic system.

MON 12<sup>th</sup> (17:00 - 18:15, Session E3.4) Room 1.04

ID 2437 R

**A PRIORI EVALUATION OF TRANSPORTATION PROJECTS**

Main Author:

**Tatiana CUCU** (*School of Industrial Systems Engineering*)

**Abstract:**

This paper proposes one approach for evaluation of efficiency of an urban transportation service in a multi actors and multi criteria framework. A priori analysis is intended for clarifying options, by reducing uncertainty and, more generally, by providing information about the alternatives in their specific context. Firstly, a diagnosis phase based on hierarchical ascending classification is performed for grouping actors in agreement with pertinent criteria that they have selected. The evaluation of the main impacts is based on the aggregate probability to use the service by users of transportation network. For it, stated preferences are collected from a representative sample size and an algorithm based on Fuzzy Logic allows us to obtain the probability to use a new transportation service. The robustness analysis for evaluating behavioural changes in agreement with external criteria is studied with Taguchi's method. The search of an optimum solution is done with Doehlert's framework and consists in defining a combination levels of criteria for the best satisfaction of the requirements and constraints of the ones (urban planners, traffic engineers) and the exigencies of the others (users, residents).

**Keywords:**

A priori evaluation, Transportation service, Use rate, Stakeholders, Stated preferences.

ID 2646 R

**APPLICATIONS OF TRANSPORT ECONOMICS AND IMPERFECT COMPETITION**

Main Author:

**David MEUNIER** (*Université Paris-Est LVMT Ecole des Ponts ParisTech*)

Co-author(s):

**Emile QUINET** (*Ecole nationale des ponts et chaussées (ENPC), Paris (France)*)**Abstract:**

The great majority of analyses made in transport economics use, explicitly or, more often, implicitly, the common assumption of perfect competition. This is the case, for instance, when infrastructure projects are evaluated using the mere sum of the surpluses of transport users and providers. Even when putting aside the question of externalities such as noise, safety or environmental quality, the real chain of economic interactions that takes place in transport provision or downstream of transport provision is not taken into account. Surely enough, describing and simulating this chain could be quite complex. Nevertheless, it is not uninteresting to try to estimate if it does make a big difference or not to make this approximation. The paper makes such an attempt for two broad kinds of applications of transport economics: Transport pricing: building on a generic formulation of imperfect competition pricing behaviour that encompasses a broad range of competition situations, and taking the railway case as a benchmark, simulation results give an idea of the order of magnitude of optimal tariff variation when perfect competition is assumed as compared to « real » competition situation. These results are completed and somewhat mitigated by observations on the final welfare impact of this discrepancy. Project assessment: the consequences of imperfect competition situations are analysed, first, for transport provision, discussing the diverse levels of representation of economic interactions that are used in usual project assessment. Second, we use both theoretical and heuristic formulations of the interactions that take place within simple chains of economic actors downstream of transport provision. (...).

**Keywords:**

Imperfect competition, Pricing, Project assessment.

ID 3325 R

**REFERENCE SCENARIO FORECASTING A NEW APPROACH TO TRANSPORT PROJECT ASSESSMENT**

Main Author:

**Kim SALLING** (*Department of Transport, Technical University of Denmark*)

Co-author(s):

**Steen LELEUR** (*Department of Transport, Technical University of Denmark*)  
**Britt SKOUGAARD** (*Department of Transport, Technical University of Denmark*)**Abstract:**

This paper presents a new approach to transport project assessment in terms of feasibility risk assessment and reference class forecasting. Normally, transport project assessment is based upon a cost-benefit approach where evaluation criteria such as the net present value and the benefit cost ratio are obtained. Recent research has however proved that substantial inaccuracies are present when obtaining the monetary input to the cost-benefit analysis, particularly as concerns the construction costs and demand forecasts. This paper proposes a new approach in order to address these inaccuracies in a so-called reference scenario forecasting (RSF) frame. The RSF is anchored in the cost-benefit analysis (CBA); thus, it provides decision-makers with a quantitative mean of assessing the transport infrastructure project. First, the RSF method introduces uncertainties within the CBA by applying Optimism Bias uplifts on the preliminary construction cost estimates. Hereafter, a quantitative risk analysis is provided making use of Monte Carlo simulation. This stochastic approach facilitates random input parameters based upon reference class forecasting, hence, a parameter data fit has been performed in order to obtain validated probability distribution functions. The latter have been placed and ultimately simulated on the inaccuracies of determining demand forecasts, i.e. leading to the travel time savings and ticket revenues of the project. Finally, RSF makes use of scenario forecasting where trend scenarios such as economic growth and level of cross-border integration are investigated. (...).

**Keywords:**

Decision support systems, Reference class forecasting, Optimism Bias, Risk analysis, Costbenefit analysis, Reference scenario forecasting.

TUE 13<sup>th</sup> (08:15 - 09:30, Session E3.5) Room 1.04

ID 1001 R

**HIGHWAY MAINTENANCE MARGINAL COSTS: WHAT IF THE FOURTH POWER ASSUMPTION IS NOT VALID?**

Main Author:

**Shadi ANANI** (*Greater Amman Municipality*)

Co-author(s):

**Samer MADANAT** (*University of California, Berkeley*)

**Abstract:**

Highway maintenance marginal costs have been estimated in the literature using the perpetual overlay indirect approach. This approach uses the equivalent single axle load (ESAL) as the unit for traffic loading, which implies that pavement deterioration caused by an axle is proportional to the fourth power of the axle weight. This paper answers the following question: how inaccurate are maintenance marginal cost estimates when a highway agency uses ESAL? We find that the inappropriate use of ESAL does not affect the sum of maintenance marginal cost prices paid by all vehicles, but it affects its distribution among vehicles, which reduces efficiency and equity.

**Keywords:**

Marginal cost, Highway maintenance, Traffic loading units.

TUE 13<sup>th</sup> (08:15 - 09:30, Session E3.5) Room 1.04

ID 1310 R

**COST-BENEFIT ANALYSIS AND DEMAND UNCERTAINTY: THE HIGH-SPEED RAIL NETWORK IN SPAIN**

Main Author:

**Javier CAMPOS** (*University of Las Palmas*)

Co-author(s):

**Aday HERNANDEZ** (*UNIVERSITY OF LAS PALMAS*)

**Abstract:**

High-speed rail (HSR) is undoubtedly regarded as one of the most significant technological breakthroughs in passenger transportation developed in the second half of the 20th century. However, building, maintaining and operating HSR lines is very expensive, involves a significant amount of sunk costs and may substantially compromise both the transport policy of a country and the development of its transport sector for decades. For these reasons evaluating HSR projects deserves a closer look, where the technological hype is adequately balanced against the inevitable uncertainty that dominates demand figures. Under these premises the aim of this paper is to build on the current CBA methodology for the appraisal of HSR projects, and develop some new indicators about the circumstances under which such proposals might be socially worthwhile. Our approach departs from traditional CBA but changes its perspective: since demand uncertainty is the critical variable to accept or reject most projects, we transform the traditional  $NPV > 0$  acceptance criterion into „demand-driven criteria“ and obtain different values for this critical demand under alternative simulated scenarios. Our analysis is illustrated with examples from the Spanish HSR network, currently one of the most ambitious projects in the world.

**Keywords:**

High-speed rail (HSR), Cost-Benefit Analysis (CBA), Demand uncertainty.

TUE 13<sup>th</sup> (08:15 - 09:30, Session E3.5) Room 1.04

ID 1514 R

**HOW IMPORTANT ARE ENVIRONMENTAL FACTORS  
IN THE CASE FOR HIGH SPEED RAIL? A  
COMPARISON OF THE UNITED KINGDOM AND SPAIN**

Main Author:

**Esther GONZÁLEZ-GONZÁLEZ** (*Department of  
Geography, Urban and Spatial Planning, University of  
Cantabria*)

Co-author(s):

**Greg MARSDEN** (*Institute for Transport Studies, University  
of Leeds*)  
**Andrew SMITH** (*Institute for Transport Studies - Leeds  
University*)

**Abstract:**

High Speed Rail (HSR) offers the potential to provide enhanced regional connectivity within Europe whilst countering the increase in short-haul flights. The reduced emissions of HSR compared with short-haul air trips is an important part of the argument for an expanded network yet such an assessment is only partial in its consideration of the full range of environmental impacts. There are substantial financial and natural resource costs of constructing HSR and, to better understand the degree to which the environment is indeed important in the decision-making process this paper reviews the processes for assessing the benefits of HSR and reviews and their practical impacts, using four case studies. The paper begins by setting the policy context for High Speed Rail with some introductory statistics on the current state and proposed expansion of the European network. Next, the paper reviews and contrasts appraisal practice in the UK, Spain and at a pan-European level to consider the key stages and components of ex-ante project appraisal. The paper then reviews four case studies (two each from the UK and Spain) to explore the economic case for HSR and within this the importance of environmental benefits in the final decision. The degree to which the environmental impacts of HSR have influenced route selection is also identified. The paper concludes that the economic case for the reviewed HSR schemes is typically not strong relative to other potential investments in transport. (...).

**Keywords:**

High Speed Rail, Appraisal methods, Environmental factors, Decision-Making.

TUE 13<sup>th</sup> (08:15 - 09:30, Session E3.5) Room 1.04

ID 2165 R

**SOFTWARE TOOL AND MODEL FOR ECONOMIC,  
ENVIRONMENTAL AND SOCIAL IMPACT  
ASSESSMENT OF ROAD PROJECTS**

Main Author:

**Konsta SIRVIO** (*Sirway*)

Co-author(s):

**Sari JUSI** (*FinnOC Ltd*)

**Abstract:**

Feasibility studies are prepared during the planning phase of road projects in order to evaluate the viability of projects. This is further simplified to economic appraisal and calculation of Economic Internal Rate of Return (EIRR). When EIRR is greater than the current discount rate the project is economically viable. Current EIRR calculations in road projects are basically including the following components : i) Vehicle Operating Costs (VOCs), ii) Travel Time Costs, and iii) Costs for Accidents. There have been discussions of adding environmental factors to these calculations but it has been proved to be difficult. Hence EESAR (Environmental, Economic and Social Assessment of Road Projects) Project was started in year 2007. Main goal of the Project is to incorporate socio-economic dimensions to project planning and post evaluation. Post evaluation is often totally neglected after the project implementation. In phase I EESAR model is developed mainly for rural roads. This Study uses the Sustainable Livelihoods Approach (SLA) as a theoretical approach to assess the impacts of roads and improved access to markets and services in people's livelihoods and in reducing their vulnerability and poverty. The Sustainable Livelihoods Approach focuses on people and tries to identify the constraints and opportunities that people face in making their living, based on their own definitions of these constraints and opportunities. It takes a wider perspective on poverty, recognising that poverty is not only about income and monetary assets, or the lack of them, but that it is also manifested in the lack of access to health services and education, vulnerability and exposure to risks, and lack of voice and power. (...).

**Keywords:**

Environmental impacts, Social impacts, Infrastructure projects, Impact assessment, Sustainable Livelihood Approach.

TUE 13<sup>th</sup> (08:15 - 09:30, Session E3.5) Room 1.04

ID 3262 R

### **COST-BENEFIT ANALYSIS AND THE OPTIMAL TIMING OF ROAD INFRASTRUCTURES**

Main Author:

**Pedro GODINHO** (*Faculty of Economics of the University of Coimbra*)

Co-author(s):

**Joana DIAS** (*Faculty of Economics of the University of Coimbra*)

#### **Abstract:**

Standard cost-benefit analysis (CBA) is based on a static setting, allowing one to conclude whether or not a new infrastructure should be built, but not allowing one to conclude if it would be more advantageous to build it right now or in the future. Since the resources available to society are limited, knowing the best timing for such infrastructures is, perhaps, as important as knowing if they should be built. In this paper, we analyze the application of real options analysis within a cost-benefit framework, in order to find the best timing for starting the construction of road infrastructures. The optimal timing of investments has been, in recent decades, the subject of great interest in the context of corporate finance, leading to the development of real options analysis. There are several applications of real options analysis to transport infrastructures but, despite such contributions, the incorporation of real options analysis in a CBA framework is still in its early stages. This paper provides a contribution to the incorporation of real options analysis into the CBA framework. We define a model of the expected net present value of a road infrastructure, with two sources of uncertainty: gross domestic product growth and fuel prices. Both these variables are assumed to be stochastic, so we resort to Monte Carlo simulation for the implementation of the model. We also propose a methodology to estimate the thresholds that define the optimal starting time for the infrastructure. We apply the developed model to a real infrastructure currently under development, and analyse the rules that define the optimal timing for starting its construction. (...).

#### **Keywords:**

Cost benefit analysis, Real options analysis, Road infrastructure investments.

TUE 13<sup>th</sup> (09:45 - 11:00, Session E3.6) Room 1.04

ID 1130 R

### **DOES PASSENGER TRANSPORT MODES INTERNALIZE THE EXTERNAL COST THEY PRODUCE? THE CASE STUDY OF THE MADRID-SEVILLE CORRIDOR**

Main Author:

**Francesca PAGLIARA** (*University of Naples Federico II*)

Co-author(s):

**Jose MANUEL VASSALLO MAGRO** (*Departamento de Transportes. ETSI Caminos Canales y Puertos. UPM*)

**Raffaele LIA** (*University of Naples Federico II*)

#### **Abstract:**

The objective of this paper is to evaluate how much interurban passenger transport modes internalize the external costs they produce in order to calculate the efficient charge that the users would have to pay. This analysis is relevant since it affects the competitiveness of the different transport modes in the corridor. For this research the case study of the Madrid– Seville corridor in Spain has been chosen since several transport modes compete in this origin-destination pair. The research carries out a balance between the marginal external costs per user produced by each transportation mode and the charges that the users currently pay. The gap between the social marginal cost and the fare paid by the users will give us the extra-charge per passenger that each transportation mode would have to pay to internalize the external cost they produce. We found that that, unlike what many people think, the rail mode does not internalize all the external cost it produces whereas the road modes do it. This happens because even though the road modes pollute more, they also pay much more due to large discriminatory fuel taxes.

#### **Keywords:**

Transport externalities, High Speed Rail, Road transport, Transport charging, Madrid-Seville corridor.



ID 1828 R

**ASSESSMENT OF TIME SAVINGS**

Main Author:

**Cornelis GOEVERDEN** (*Delft University of Technology, Transport&Planning*)

Co-author(s):

**Bart VAN AREM** (*Delft University of Technology*)**Abstract:**

Assessing the values of time is an important topic in transport research. Time values are used for estimating the benefits of projects that aim to reduce travel times, and for predicting travel choices. The assessment of values of time is generally based on observed or stated human choices. The resulting values are basically correct for predicting future choices, but it is a question whether they can also be used for the estimation of the societal benefits of travel time reducing projects: the individual motives behind actual choices might be not compatible with the collective objectives. The paper addresses this question. The value of time is the ratio of the marginal utilities of time and money. The argumentation in the paper focuses on the utility component. The main approach is to discuss the relation between the marginal utility of travel time and prosperity in a theoretical way, and to compare this relation to the observed relation between the actually used values of time and prosperity. The analysis is done for both working time and non-working time, relevant for saved time in business/commercial transport and private transport respectively. For both types of time, the actual time values are positively correlated with prosperity. For working time, a clear negative relation between the marginal utility of travel time and prosperity is theoretically argued, while this relation is unclear for non-working time. The negative relation for working time is based on the assumption that saved time is spent on production and that the marginal utility of production decreases when total production volume (and consequently prosperity) increases. The assumed negative relation is supported by studies in happiness science. (...).

**Keywords:**

Value of time, Prosperity, Time budget, Happiness.

ID 1895 R

**DO COST-BENEFIT ANALYSES INFLUENCE TRANSPORT INVESTMENT DECISIONS? EXPERIENCES FROM THE SWEDISH TRANSPORT INVESTMENT PLAN 2010-2021**

Main Author:

**Jonas ELIASSON** (*Centre for Transport Studies, Royal Institute of Technology*)**Abstract:**

Cost-benefit analysis (CBA) for transport investments is particularly useful for situations where a large number of investments has to be ranked against each other. This study draws on the experiences from the making of the Swedish National Transport Investment Plan 2010-2021. We study how CBA results were used in the process of shaping the investment plan and what influence they had on investment decisions. We show that there is a fairly strong correlation between the benefit-cost ratio of an investment and its probability to be included in the plan by the planning administrations. The correlation is strongest for low and moderate benefit-cost ratios. For investments directly pointed out by politicians, however, there is no such correlation. Further, we explore whether "fairness" considerations or methodological deficits of the CBA can explain the discrepancies between CBA ranking and what is eventually included in the plan. By interviewing planners and decision-makers about how CBA was used in the process, we clarify what role CBA actually plays in the planning process. We also test how robust CBA outcomes are in terms of scenario assumptions and relative valuations of different types of benefits. Finally, we identify the most important areas for improvement of the CBA state-of-practice methodology.

**Keywords:**

Cost-benefit analysis, Appraisal, Transport planni.

TUE 13<sup>th</sup> (09:45 - 11:00, Session E3.6) Room 1.04

ID 1918 R

### THE VALUE OF TIME AND EXTERNAL BENEFITS IN BICYCLE COST-BENEFIT ANALYSIS

Main Author:

**Maria BÖRJESSON** (*Centre for Transport Studies, Royal Institute of Technology*)

Co-author(s):

**Jonas ELIASSON** (*Centre for Transport Studies, Royal Institute of Technology*)

#### Abstract:

We estimate the value of time gains, different cycling environments and additional benefits in cost-benefit analysis of cycling investments. Cyclists' value of travel time savings turns out to be high, considerably higher than the value of time savings on alternative modes. Cyclists also value other improvements highly, such as separated bicycle lanes. As to additional benefits of cycling improvements in the form of health and reduced car traffic, our results do not support the notion that these will be a significant part in a cost-benefit analysis, contrary to some earlier studies and beliefs. As to health effects, cyclists seem to take these largely into account when making their travel choices, so it would be double-counting to add total health benefits to the analysis once the consumer surplus has been correctly calculated. As to reductions in car traffic, our results indicate that the cross-elasticity between car and cycle is low, and hence benefits from traffic reductions will be small. However, the valuations of improved cycling speeds and comfort are so high that it seems likely that improvements for cyclists are cost-effective compared to many other types of investments, without having to invoke second-order, indirect effects. In other words, the bicycle is perfectly able to be viewed as a competitive mode of travel, rather than primarily a means to achieve improved health or reduced car traffic.

#### Keywords:

Bicycle, Value of time, Cost-benefit analysis, Cyc.

TUE 13<sup>th</sup> (09:45 - 11:00, Session E3.6) Room 1.04

ID 2235 R

### ROAD TRANSPORT SOCIAL COSTS IN SPAIN: A NEW RATIONALE FOR PRICING POLICY

Main Author:

**Flordea DI CIOMMO** (*Universidad Politécnica de Madrid-TRANSyT*)

Co-author(s):

**Andres MONZON** (*Universidad Politécnica de Madrid*)  
**Julio COMENDADOR** (*Transport Research Centre-TRANSyT- Universidad Politécnica de Madrid*)

#### Abstract:

Like all EU countries, Spain should design and promote a fair and homogeneous generalized road pricing scheme. Tolls should vary according to infrastructure damage, degree of congestion, risk of accident, and environmental nuisances. An initial study (Spanish road pricing model project: META) of interurban transport pricing has been carried out at national level, considering the valuation of the internal and external costs to define efficient road pricing schemes of different type of roads and appropriate price levels in different interurban road contexts, shifting from a toll for financing infrastructure construction to a toll for recovering social costs. The META project has developed an easy-to-apply pricing methodology, based on a bottom-up approach. The main variable is the AADT -daily flow-applied to accurately estimate generalized road transport costs for each kind of vehicles and each type of road. Based on the current Spanish road network, the META model estimates all social costs: internal costs (fuel, vehicle maintenance, labor, insurance and tax) and external costs (infrastructure, congestion, accident and environmental nuisances). Computed for the 13,156 Km of interurban highways network, the model calculates the costs for each vehicle type (Car, HGV, LGV and bus) and for each road network section following the interurban road characteristics (AADT, capacity and traffic composition for each section of highway network). The two main results of META model for costs in terms of policy implications suggest to moderate the construction of new interurban road infrastructures in Spain and to analyze congestion before to built new metropolitan roads. (...).

#### Keywords:

Road costs estimation, External Costs, Internalization, Roads Pricing.

MON 12<sup>th</sup> (11:15 - 12:30, Session E4.1) Room 0.03

ID 1166 R

**DOES PRIVATE INFORMATION AFFECT THE INSURANCE RISK? EVIDENCE FROM THE AUTOMOBILE INSURANCE MARKET**

Main Author:

**Sara ARVIDSSON** (*Swedish National Road and Transport Research Institute (VTI)*)

**Abstract:**

This paper empirically investigates the effect of policyholders' private information of risky traffic behavior on automobile insurance coverage and ex post risk. It combines insurance company information with private information data that is not accessible to the insurance company and shows that being unable to reject the null of zero correlation is not necessarily consistent with symmetric information in the automobile insurance market. The results are twofold: In contrast to much of the previous work, a positive significant correlation for three groups of policyholders is found, consistent with the adverse selection prediction. Besides, private information about risky traffic behavior increases ex post risk while it both increases and decreases the demand for extensive insurance which supports the hypothesis that adverse and propitious are present simultaneously in this market.

**Keywords:**

Vehicle insurance, Traffic behavior, Information a.

MON 12<sup>th</sup> (11:15 - 12:30, Session E4.1) Room 0.03

ID 1290 R

**ROAD PLANNING THROUGH LONG-RUN MARGINAL SOCIAL COST CHARGING**

Main Author:

**Yuki MISUI** (*Takasaki City University of Economics*)

Co-author(s):

**Toshinori NEMOTO** (*Hitotsubashi University*)

**Abstract:**

In the past decade, there have been many studies concerning the application of short-run marginal social cost (SMC) charging on road use. However, SMC charging has hardly been applied to actual cases and the surrounding situation of LMC charging is almost similar to SMC charging. In this paper, we discuss several issues relevant to SMC charging and propose a new road-planning scheme based on long-run marginal social cost (LMC) charging with a simulation analysis. As the results of the simulation analysis, we revealed the following. - The SMC charging achieves the long-run optimal road capacity efficiently but then the charging requires the abrupt changes of the amount. - The LMC charging with bond (like current toll scheme) is a good choice respect to the equity between generations, but it cannot achieve the long-run optimal level of cost benefit ratio. - The LMC charging is the useful second best alternative to achieve the long-run optimal road capacity moderately with a small loss of cost benefit ratio.

**Keywords:**

Long-run marginal social cost (LMC), Short-run marginal social cost (SMC), Milebased charging, Road capacity optimization.

ID 1332 R

**COST STRUCTURE AND TAX ISSUES IN EFFECTIVE PUBLIC TRANSPORTATION INVESTMENT**

Main Author:

**Zitao ZHANG** (*Department of Civil and Environmental Engineering, Northwestern University*)

Co-author(s):

**Pablo DURANGO-COHEN** (*Department of Civil and Environmental Engineering, Northwestern University*)

**Abstract:**

This paper has taken the initial effort to understand potential pitfalls and complexities that could rise in the public-private collaboration of public transportation investment, and tries to provide recommendations in terms of tax policies and impacts of cost structure in the investment model. By adopting concepts from macroeconomic theory and public finance, we provide a prescriptive framework to illustrate tax variations under different circumstances and emphasize the importance of cost structure, timing of decision-making, and funding adequacy. The idea of using high-speed rail as our model example originates from President Obama's stimulus plan, however, the insights generated from the model is useful in understanding other capital investment problems in transportation field.

**Keywords:**

Cost structure, Tax, Investment, Public-Private Partnerships, Government Incentives, Equilibrium, ARRA 2009.

ID 1363 R

**FINANCING TRANSPORT INFRASTRUCTURE PROJECTS IN ITALY: A CRITICAL ANALYSIS OF THE MAIN APPROACHES**

Main Author:

**Antonio LAURINO** (*Politecnico di Milano*)

Co-author(s):

**Raffaele GRIMALDI** (*Politecnico di milano*)  
**Paolo BERIA** (*Politecnico di Milano*)

**Abstract:**

This paper aims at analysing the methodology used for financing large infrastructure projects in Italy. In particular, it focuses on the Italian highway sector, where in the last years many projects have been launched using new financial instruments. The paper discusses three of these "instruments". The first one is the Project Financing, discussed starting from a general review, analyzing also the different typologies used, the risks involved and their allocation among the various subjects that take part in the PF mechanism. A special case concerns the recently introduced model used for the Italian highways, known as "PF with takeover compensation". There are two other important mechanisms used for financing infrastructure projects in Italy: the exploitation of road demand rigidity and the spreading of the investment over the entire network, favouring larger concessions. We conclude that all these three mechanisms present deep flaws in terms of transparency and of contradiction with economic feasibility criteria (that have to dominate the public investment rationale).

**Keywords:**

Transport, Investment, Infrastructure, Project financing, Highway.

ID 1386 R

**DEBT AND X-INEFFICIENCY IN BRITISH RAILWAY ENGINEERING**

Main Author:

**Jonathan COWIE** (*SEBE/TRI, Edinburgh Napier University*)**Abstract:**

Over the last decade, British railway engineering has come under increased scrutiny, with general perceptions of massive maintenance cost escalations and a general lack of control over these costs. Very little however has appeared in the academic literature on the subject. This paper examines these two issues through an examination of the infrastructure costs over the period 1980 to 2008. This period saw three different infrastructure management regimes in place - the nationalized British Rail (1980 – 1994), the privatized Railtrack (1996 to 1998) and the not for profit Network Rail (2002 to 2008). Infrastructure costs are broken down into operating, signalling and management costs. The results show that in all categories costs have increased since privatisation, but in most cases these increases are considerably short of most of the figures reported in the press. Furthermore, some of these cost increases actually began under the nationalised structure. The one major exception however is management costs, which have rocketed. This is found as clear evidence of x-inefficiency in infrastructure provision, however rising operational costs are found to be due to imperfect competition in sub contractor markets driving up costs. The paper concludes that rail infrastructure provision may well now have the worst of both worlds, with the subsidy of the public sector sustaining imperfect competition in the private sector.

**Keywords:**

Rail infrastructure management, X-inefficiency, Privatisation, Imperfect competition.

ID 1452 R

**THE IMPACTS ASSESSMENT OF REVENUE USE FROM TRANSPORT RELATING TAXES AND CHARGES**

Main Author:

**Monika BAK** (*University of Gdansk*)

Co-author(s):

**Barbara PAWLOWSKA** (*University of Gdansk*)**Abstract:**

This paper aims at providing an overview of possible options related to the use of revenues from transport relating taxes and charges. This is a significant problem in the context of current transport policy instruments implementation, including the internalization of external costs of transport. The analysis on the impacts of transport pricing reforms based on social marginal cost put also great attention into the matter of revenue generated by the implementation of reforms. The question is how to avoid the risk of uneven effects distributed across modes and countries. The structure of the paper is as follows. Firstly an overview of the state of the art from scientific literature. Afterwards, an overview is given on the current practice in EU Member States with regard to raising revenues and the use of revenues from transport related taxes and charges. Then the impacts of various options for the use of revenues are discussed. The authors would like to show possible options and explain advantages and disadvantages of different choices. For the assessment of revenue use impact it is necessary to mention that institutional arrangements and flow of funds have a significant influence on efficiency, equity and acceptability issues. Finally, the main conclusions are summarized. The paper is based on the results of IMPACT project: Internalisation Measures and Policies for All external Costs of Transport coordinated by CE Delft (IMPACT D4, 2008). It was a project carried out in the years 2007-2008 for the European Commission. The central aim of the study was to provide a comprehensive overview of approaches for estimation and internalisation of external cost and to recommend a set of methods and default values for estimating external costs. (...).

**Keywords:**

Revenue use, Transport pricing, Impact assessment.

MON 12<sup>th</sup> (14:00 - 15:15, Session E4.2) Room 0.03

ID 1603 R

**A MULTI-PERIOD INVESTMENT SELECTION MODEL FOR STRATEGIC RAILWAY CAPACITY PLANNING**

Main Author:

**Yung-Cheng LAI** (*National Taiwan University*)

Co-author(s):

**Mei-Cheng SHIH** (*Department of Civil Engineering, National Taiwan University*)

**Abstract:**

The potential growth of the railway traffic is expected to be substantial worldwide; hence railway companies and agencies are looking for better tools to allocate their capital investments on capacity planning in the best possible way. In this research we develop a Multi-period Investment Selection Model (MISM) by using robust optimization and multicommodity flow techniques, and using Bender's Decomposition to solve the problem. Based on the estimated future demand, available budget and expansion options, MISM can determine the multi-period optimal investment plan regarding which portions of the network need to be upgraded with what kind of capacity improvements at each defined period in the decision horizon. Using this decision support tool will help railway companies or agencies maximize their return from capacity expansion projects and thus be better able to provide reliable service to their customers, and return on shareholders' investment.

**Keywords:**

Railway Transportation, Capacity Planning, Decision Support.

MON 12<sup>th</sup> (14:00 - 15:15, Session E4.2) Room 0.03

ID 2129 R

**AN ANALYSIS OF THE DIVERSIFICATION STRATEGIES OF RAILWAY COMPANIES IN JAPAN**

Main Author:

**Hiromi KAMATA** (*Bunri University of Hospitality*)

Co-author(s):

**Hirotaaka YAMAUSHI** (*Hitotsubashi university*)

**Abstract:**

In this paper, the diversification strategies of railway companies in Japan are analyzed by the method of Rumelt (1974). After reviewing previous studies and considering the application of our study, the analysis is conducted. A comparison of the results among companies reveals there is a striking difference between Japan Railways group (JR group) and private railway companies. JR group is diversifying its business, but it appears that the area they specialize in is railway business (main), or at least business with a strong connection with railways. Based on the data, an interregional comparison is conducted and the modal share and population are projected. From this comparison, it is found that the diversification strategy of each company is affected by the environment of each area in which the companies are located. The relationship between profitability and diversification is also considered, but it does not support the findings by Rumelt (1974) and other previous studies.

**Keywords:**

Diversification, Railway company, Rumelt model.

ID 2581 R

**RULES VERSUS DISCRETION IN MODERN ROAD FINANCING**

Main Author:

**Gunnar LINDBERG** (*Swedish National Road and Transport Research Institute*)**Abstract:**

Road infrastructure has traditionally been financed from sources of general taxation, including fuel excise duties, although motorway tolls have a role in some countries. Lately, urban road tolls have been introduced, for example in London and Stockholm, mainly with the focus to curb congestion. In the ongoing review of the EU Transport policy "A sustainable future for transport: Towards an integrated, technology-led and user friendly system" (COM (2009)279) a move towards a more self-financing transport infrastructure system is foreseen as the competition for general tax revenues are increased from other sectors of society. However, the implementation of a common European framework for charging heavy goods vehicles which includes pricing of externalities has been delayed in the council since its presentation in 2008. Numerous possible arguments, as fear of monopoly power of neighbours, for a single Member State to delay the implementation have been discussed in the literature. However, the current judgement of the policy will also depend on the belief of policy makers future actions. Since the pioneering work of Kydland and Prescott (1977) and Barro and Gordon (1983) a variety of studies have examined possible solutions to the commitment problem in monetary policy that results in a high-inflationary policy. Rogoff (1985) showed that to delegate responsibility to a conservative central bank gives an effective solution. This paper analyzes possible future reforms on transport financing by applying the theory discussed above which highlights the dynamic trust problem. New financing and pricing practices in the transport sector is seen to be affected by the same dynamic trust problem. (...).

**Keywords:**

Road pricing, Time-inconsistency.

ID 3223 R

**THE SOCIAL BALANCE OF ROAD AND RAIL TRANSPORT IN HUNGARY**

Main Author:

**István KÖVESDI****Abstract:**

Everybody has experienced the phenomenon when different organisations evaluate the same measure, investment differently. This results from the natural variegation of the viewpoints, which per se cannot be considered as rejected yet. However, those directly concerned, and even those simply interested in the topic, rightly resented that remarkably different figures have been presented, and due to this fact the same transport measure (e.g. an investment) has been judged quite differently by different stakeholders. Orientation has been made difficult since each piece of information resulted from sources, workshops or highly appreciated civil organisations are considered as authentic. Due to this condition, not only the lay outsider but also the contractors became doubtful of the situation. The transport sector has been especially hard hit by this. The growth of mobility, on the one hand, was presented as a requirement of everyday life, as its concomitant, moreover representing a special value, while on the other hand it was considered as an activity causing serious damages that should be profoundly changed in its tendencies. Not contesting the necessity of variegation of opinions, the Hungarian ministry of transport 1 considered that the very moment has come when those domains should be revealed where apparently irreconcilable antagonism can be dissolved and the viewpoints could be drawn near to one another. To this end, the ministry invited experts of Institute for Transport Sciences Non-profit Ltd. (KTI) and of Clean Air Action Group (CAAG; Levegő Munkacsoport) to overview the direct budgetary and social costs and revenues of transport. (...).

**Keywords:**

Transport, Finance, Hungary, 2008, Road, Rail, Public finance, Public balance, Social balance, revenues, expenditures, budget, state property, infrastructure, development, Maintenance, Operation, Externalities, Tax, Fuel excise, VAT.

ID 1189 R

**LAND VALUE CAPTURE POTENTIAL OF THE LISBON SUBWAY: ESTIMATION AND INTEGRATION WITH THE CURRENT FISCAL SYSTEM**

Main Author:

**Luis MARTÍNEZ** (*CESUR, Instituto Superior Técnico*)

Co-author(s):

**José MANUEL VIEGAS** (*Centro de Sistemas Urbanos e Regionais (CESUR), Instituto Superior Técnico (IST)*)**Abstract:**

The aim of this paper is to estimate the value capture potential of the Lisbon subway (Metro) and examine its integration with the current fiscal system in order to develop a new financing scheme for the infrastructure development. This study was developed for the Lisbon Metropolitan Area (LMA) as part of a broader study that intends to develop new land value capture financing schemes for public transportation in the LMA. The paper focuses on the municipality of Lisbon where the subway system mainly operates, although new developments of the system reach other municipalities (Amadora and Odivelas). The paper tries to measure, using spatial hedonic pricing models developed in previous stages of the study, the extent to which access to transportation infrastructure currently is capitalized into house prices market and into the commercial and offices market. A Monte Carlo simulation procedure is used to estimate the market composition of the residential, commercial and office sectors from the census aggregated statistical data available at city block level, leading to an estimate of the value capture potential of the subway in the Lisbon municipality. The potential value capture estimate is then used to estimate an annual tax that could be charged, which is compared with the annual financial cost of the Subway infrastructure. Finally, the estimated tax is compared with the existing municipal land value tax in order to analyze the viability of its integration with the current fiscal system. The results suggest that there is a significant potential of the use of this instrument to finance the Subway infrastructure.

**Keywords:**

Value Capture, Transport Financing, Fiscal Simulation, Real estate, Hedonic price models, Lisbon' subway.

ID 2298 R

**TAXES APPLIED IN CAPTURE OF FINANCIAL SURPLUS GENERATED FOR THE PRIVATE SECTOR BY PUBLIC INVESTMENT IN TRANSPORT PROJECTS**

Main Author:

**Jocilene COSTA** (*Universidade do Minho*)

Co-author(s):

**Daniel ALDIGUERI** (*Center for Personnel Training in Transportation - Ceftru, University of Brasília*)  
**Carlos ROCHA** (*Universidade de Brasília*)

**Abstract:**

The role of public finance is to investigate and discover how the efficaciousness of fiscal policy formulation and implementation by the public sector can be improved. This paper examines the possibility of capturing financial surpluses generated for the private sector by government investments in transport projects, making use of certain elements of public finance, particularly taxes. This type of study is needed to identify supporting elements for determining new investments in transport projects in the light of the current scarcity of resources in most Latin American countries. For many countries, capturing financial resources in this way could be considered as a key to economic growth and it could also serve as a supporting element for urban and/or regional planning. Brazil is the most economically and geographically representative country in South America and accordingly the paper adopts the concepts set out in the Brazilian National Tax Code instituted in 1966. Other aspects examined are the repeated tax reforms that have been carried out in Brazil since the 1940s and the relevant elements of the current Brazilian Federal Constitution promulgated in 1988. The forms of taxation examined are: general taxes, linked taxes and improvement contributions.

**Keywords:**

Public finance Brazilian tax code Financial subsidies.



ID 2329 R

**UNIT ROOT ANALYSIS OF TRAFFIC TIME SERIES IN TOLL HIGHWAYS**

Main Author:

**Antonio SOLIÑO** (*UNIVERSIDAD POLITÉCNICA DE MADRID*)

Co-author(s):

**Antonio L. LARA GALERA** (*UNIVERSIDAD POLITÉCNICA DE MADRID*)**Abstract:**

Often, concession contracts in highways include some kind of clauses (for example, a minimum traffic guarantee) that allow for a better management of the business risks. The value of these clauses may be important and should be added to the total value of the concession. However, in these cases, traditional valuation techniques, like the Net Present Value (NPV) of the project, are insufficient. An alternative methodology for the valuation of highway concession is the one based on the real options approach. This methodology is generally built on the assumption of the evolution of traffic volume as a Geometric Brownian Motion (GBM), which is the hypothesis analyzed in this paper. In this paper, we describe first the methodology used for the analysis of the existence of unit roots (i.e., the hypothesis of non-stationarity) in time series in general. We have used the Dickey-Fuller approach, which is the most widely used test for this kind of analysis. Then we apply this methodology to perform a statistical analysis of traffic series in Spanish toll highways. For that purpose, we use data on the Annual Average Daily Traffic (AADT) in a set of highways. The period of analysis is around thirty years in most cases. The main outcome of the research is that we cannot reject the hypothesis that traffic volume follows a GBM process in Spanish toll highways. This result is robust, and therefore we can use it as a starting point for the application of the real options theory to value toll highway concessions.

**Keywords:**

Toll highway, Concessions, Traffic, Unit root analysis.

ID 2910 R

**FINANCING PUBLIC TRANSPORT INFRASTRUCTURES BY MEANS OF VALUE CAPTURE PROVIDED BY ITS IMPLEMENTATION**

Main Author:

**Hostílio RATTON NETO** (*Universidade Federal do Rio de Janeiro*)

Co-author(s):

**Romulo ORRICO FILHO** (*Federal University of Rio de Janeiro*)**Herlander DA GAMA AFONSO** (*Universidade Federal do Rio de Janeiro*)**Abstract:**

A transport infrastructure is not only a trip provision system but a public facility that generates value for companies and for the society through expanding markets or developing cities, creating another perspective for new investments, as well as its own financing. According to this perspective, the financial earnings resulting from the implementation of transport infrastructure can be captured for its own investment. Given the restrictions of society indebtedness, due to social inequalities, scarcity of resources and insufficient fare collection, with the current financial model for public transport infrastructures, the value capture configures as a strategy to be explored to obtain resources. This paper presents the concept of value capture and its connection and relevance with transport infrastructure financing strategies. Applied to the evaluation of the impacts on the surrounding regions of one of the most significant Brazilian transport projects, the improvement and expansion of Belo Horizonte's metro, the provided value capture outcomes open more realistic perspectives for greater engagement of the Public Sector in such projects.

**Keywords:**

Value Capture, Infrastructure Financing, Public Transportation, Urban Development.

ID 3272 R

**A BAYESIAN MODEL FOR RAIL TRACK GEOMETRY DEGRADATION: A STEP TOWARDS THE ASSESSMENT OF UNCERTAINTY IN RAIL TRACK LIFE-CY**

Main Author:

**António ANDRADE** (*Instituto Superior Técnico*)

Co-author(s):

**Paulo TEIXEIRA** (*IST, Technical University of Lisbon*)

**Abstract:**

A considerably high level of uncertainty in maintenance, renewal and unavailability costs has been pointed out by Infrastructure Managers as one of the major drawbacks of rail track investments. Above all, degradation of rail track geometry is responsible for the greatest part of railway infrastructure maintenance costs. Some approaches have been tried to control the uncertainty associated with rail track geometry degradation at the design stage, though little progress has improved the investors' confidence. Moreover, many studies on rail track life-cycle cost modelling tend to forget the dynamic perspective in uncertainty assessments. In fact, a life-cycle assessment of the uncertainty associated with rail track degradation is needed, quantifying how much the uncertainty in the degradation parameters is reduced as more inspection data is collected after the rail track starts operation. Therefore, a Bayesian model for rail track geometry degradation is put forward, building up a framework to assess the uncertainty in rail track geometry degradation throughout its life-cycle not only at the design stage, but at all life-cycle phases. The model is run using inspection data from Lisbon-Oporto line: adjusting prior probability distributions to the model parameters at the design stage and updating them as inspection data is processed at the operation stage. Uncertainty reduction in geometry degradation parameters is then assessed by computing their posterior probability distributions each time an inspection takes place. Finally, the results show that at the design stage, the uncertainty associated with maintenance cycles is considerably high, but it reduces significantly as more inspection data is collected. (...).

**Keywords:**

Bayesian model, Rail track degradation, Uncertainty, Life-cycle, Maintenance costs.

ID 1198 R\*

**IMPACT OF DIFFERENT MODES OF TRANSPORT INFRASTRUCTURE FINANCING IN A DEVELOPING ECONOMY**

Main Author:

**Cristela DAKILA** (*De La Salle University Manila*)

**Abstract:**

Almost half of funds used for transport infrastructure investment in the Philippines comes from the national government. It relies on tax collection as a major source of funds for transport infrastructure. Indirect taxes like the value added tax remain the most popular way of harnessing funds due to relative ease in collection and dampening effect on consumption of transport services with negative externalities like pollution and congestion. On the other hand, the national government also relies on foreign aid to finance mega transportation projects. A third type of financial mode, imposition of higher direct tax on households across regional income groups, is also a major source of tax revenues. These three financing modes of the national government are alternatively used to fund an equal amount of land transport infrastructure improvements across five different regions in the Philippines. This paper introduces a system-wide approach in impact analysis of three different modes of financing utilized in developing countries like the Philippines – (1) avallment of foreign transfer as in official development assistance funds from donor countries (2) imposition of additional value-added tax on transport services and (3) imposition of higher income tax on households. They represent extreme types of financing in terms of reallocation effects. The first creates minimal price distortion effects since it is a unilateral transfer of funds from the rest of the world to the home country. On the other hand, the second impacts strongly on resource reallocation as it affects pricing of transport services. The third mode looks into the impact of lowering purchasing power of households via higher personal income taxes. (...).

**Keywords:**

Taxes, Foreign transfers, Output, Welfare, General equilibrium.

ID 1989 R

**EFFECTIVENESS AND EQUITY OF FUTURE TRANSPORTATION FINANCING OPTIONS IN THE U.S**

Main Author:

**Lei ZHANG** (*University of Maryland*)

Co-author(s):

**Andrea ROBITAILLE** (*University of Maryland*)**Dilya YUSUFZYANOVA** (*University of Maryland*)**Abstract:**

As vehicle fuel-efficiency and alternative-fuel vehicle sales increase, fuel taxes, without major rate increases, are unlikely to generate the revenue needed to maintain, operate, and grow the extensive surface transportation system in the U.S. With the expiration of SAFETEA-LU at hand, the current U.S. administration faces tough choices regarding how to ensure with a new surface transportation authorization that the surface transportation system is efficient, equitable, and sustainable. The objective of this research is to identify the most effective and equitable portfolio of revenue policies for achieving these revenue goals at the federal and state levels. Our revenue forecasts under various financing options (increased fuel taxes, and vehicle mileage fees) take into account users' responses to policy changes, recognizing that revenue is a function of both tax rates and behavior. It is the recommendation of the American Association of State Highway Transportation Officials and the Transportation Research Board that in the interim the federal gasoline tax is increased 10 cents to ensure the Highway Trust Fund is able to continue to pay out its obligations. Two expert groups recently commissioned by the U.S. Congress both recommend gas tax rate increase as a short-term solution, and vehicle mileage fee as a long-term solution to the transportation financing problem in the U.S. This paper analyzes the revenue and distributional affects (by region, state, income, age, gender, ethnicity etc.) of these proposed transportation financing policy scenarios. The hope is that a better understanding of how various population groups and agencies are affected will lead to the selection of a U. (...).

**Keywords:**

Transportation finance, Pricing and revenue, Gas tax.

ID 2620 R

**PRIVATELY FINANCING INTERMODAL EXCHANGE STATIONS IN MADRID**

Main Author:

**Floriea DI CIOMMO** (*Universidad Politécnica de Madrid-TRANSyT*)

Co-author(s):

**Jose MANUEL VASSALLO MAGRO** (*Departamento de Transportes. ETSI Caminos Canales y Puertos. UPM*)**Pedro SALDAÑA** (*Transport Research Center- TRANSyT*)**Abstract:**

The City of Madrid is putting into operation Intermodal Exchange Stations (IESs) to make connections between urban and suburban transportation modes easier for users of public transport. We find that through the construction of an IES by a concessionaire it is indeed possible to arrive to solutions for the funding of urban transport infrastructure in which private profit and social benefit converge. Commuters save travel time and use better their transfer time. Bus companies diminish their costs of operation. The concessionaire receives revenues generated mainly by fees that urban buses (EMT), regional buses and interregional coaches—also privately operated—pay for using the IES, and by the commercial rents paid by shops and cafeterias inside the IES. The abutters gain in quality of life, society in general benefits from a reduction of emissions, and the government is able to promote these infrastructure facilities without recurring to its scarce budgetary resources.

**Keywords:**

Urban transportation, Modal exchange, Concessionaires, Private and social savings.

TUE 13<sup>th</sup> (08:15 - 09:30, Session E4.5) Room 0.03

ID 1337 R

**THE EFFECT OF THE DISCOUNT RATE IN HIGHWAY CONCESSIONS AWARDED UNDER THE LPVR APPROACH**

Main Author:

**Jose MANUEL VASSALLO MAGRO** (*Departamento de Transportes. ETSI Caminos Canales y Puertos. UPM*)

**Abstract:**

Flexible-term highway concessions are becoming quite popular around the world as a means of mitigating the traffic risk ultimately allocated to the concessionaire. The most sophisticated mechanism within flexible-term concession approaches is the Least Present Value of the Revenues (LPVR). This mechanism consists of awarding the concession to the bidder who offers the least present value of the revenues discounted at a discount rate fixed by the government in the contract. Consequently, the concession will come to an end when the present value of the revenues initially requested has been eventually reached. The aim of this paper is to evaluate the effect that the discount rate established by the government in the bidding terms has on the traffic-risk profile ultimately allocated to the concessionaire. To analyse this effect, a mathematical model is developed in order to obtain the results. I found that the lower the discount rate the larger will be the traffic risk allocated to the concessionaire. Moreover, I found that, if a maximum term is established in the contract, the lower the discount rate, the less skewed towards the downside will be the traffic risk profile allocated to the concessionaire.

**Keywords:**

Concession contract, Tender, Discount rate, Risk allocation, Public-private partnerships, Highway.

TUE 13<sup>th</sup> (08:15 - 09:30, Session E4.5) Room 0.03

ID 1872 R

**TRANSPORT PRICING AND PUBLIC-PRIVATE PARTNERSHIPS**

Main Author:

**Roger VICKERMAN** (*University of Kent*)

Co-author(s):

**Emil EVENHUIS** (*Rebel Group*)

**Abstract:**

Public-Private Partnerships have become a favoured way of introducing private capital into transport projects whilst maintaining an element of public interest. This paper considers the potential conflicts that might arise between the freedom of the private operator within a PPP and other elements of the public sector's transport policy. Specifically it tackles the question of the problems that might arise when the public sector wishes to implement a type of price regulation, for example SMC Pricing, which might appear to limit the freedom of the private interest to maximise its value from the PPP according to the contract. The paper demonstrates theoretically the potential inconsistencies between such policies and suggest ways in which they may be overcome. We first briefly discuss Public-Private Partnerships in transport: what are the defining characteristics and what are the main types that exist in the different modes of transport? Next we consider the economics of Public-Private Partnerships, in particular from the viewpoint of incentives. Subsequently we identify and examine the issues that arise when Social Marginal Cost Pricing is to be incorporated in PPPs as a regulation with regard to pricing in the transport sector. Lastly, we investigate the possibilities of resolving these issues.

**Keywords:**

Pricing, PPP, Contract design, Incentives.

TUE 13<sup>th</sup> (08:15 - 09:30, Session E4.5) Room 0.03

ID 2561 R

## **DO PUBLIC PRIVATE PARTNERSHIPS IMPROVE ROAD SAFETY?**

Main Author:

**Thais RANGEL** (*Centro de Investigación del Transporte (TRANSYT). ETSI Caminos, Canales y Puertos. Universidad Politécnica de Madrid.*)

Co-author(s):

**Jose MANUEL VASSALLO MAGRO** (*Departamento de Transportes. ETSI Caminos Canales y Puertos. UPM*)  
**Blanca ARENAS** (*Automobile Reserach Institute (INSIA)*)  
**Pablo PÉREZ DE VILLAR** (*Spanish Ministry of Public Works*)

### **Abstract:**

Public Private Partnerships (PPPs) are mostly implemented for three reasons: to circumvent budgetary constraints, encourage efficiency and improvement of quality in the provision of public infrastructure. One of the ways of reaching the latter objective is by the introduction of performance-based standards tied to bonuses and penalties to reward or punish the performance of the contractor. One of the most important indicators adopted are defined in terms of the safety performance of the road. The aim of this paper is to identify whether the incentives to improve road safety in PPPs are ultimately effective in improving safety ratios. To that end we have calibrated several econometric models using information of toll motorways in Spain. We found that, even though road safety is highly influenced by variables that are not much controllable by the contractor such as the Average Annual Daily Traffic and the percentage of heavy vehicles in the motorway, the implementation of safety incentives in PPPs has a positive influence in the reduction of fatalities, injuries and accidents.

### **Keywords:**

Public private partnerships, Performance-based indicator, Road safety.

TUE 13<sup>th</sup> (08:15 - 09:30, Session E4.5) Room 0.03

ID 3073 R

## **THE GOVERNANCE FUNCTION OF PUBLIC PRIVATE PARTNERSHIPS IN TRANSPORT INFRASTRUCTURE**

Main Author:

**Andreas KOPP** (*World Bank*)

### **Abstract:**

The paper analyzes the effect of public private partnerships on the governance of infrastructure investment projects. Project costs are uncertain ex ante. The preevaluation of projects allows to identify the future costs of part of the potential projects. Without pre-evaluation of financial intermediaries, accounting costs and budget constraints are instruments to contain the deviation of decisions of government officials from welfare maximization. Apart from a sub-class of low cost projects, costs have to be covered by cost-plus contracts. With private participation, and the pre-evaluation by financial intermediaries, fixed price contracts become optimal. This leads ceteris paribus to an increase in investment in transport infrastructure. As a consequence of the recent financial crisis allocations of fiscal resources to transport infrastructure have been drastically expanded while private capital flows have drained. The paper shows how this can lead to an increase of investments favoring particular interest groups.

### **Keywords:**

Infrastructure, Finance, Principal-agent relations.

TUE 13<sup>th</sup> (09:45 - 11:00, Session E5.1) Room 0.02

ID 1087 R

**OPTIMAL PRICING POLICY IN A TRANSPORT NETWORK WITH BOTH SCALE ECONOMIES AND CONGESTION- CASE STUDY OF NAGOYA METROPOLITA**

Main Author:

**Jiang YING** (*Faculty of Regional Studies, Gifu University*)

Co-author(s):

**Ying YU CAI** (*Faculty of Regional Studies, Gifu University*)

**Abstract:**

Transport pricing depends largely on the cost structure of transport system, which is characterized by three most relevant properties: congestion, economies of scale and capacity constraint. In this paper we investigate in particular the economies of scale in railway transport. And by combining the railway cost functions with increasing returns into a network equilibrium model, we compute the effects of marginal cost pricing schemes on roads and railways. These results indicate that road marginal cost pricing has outstanding effects of driving car users to railways in the long run, while the effects of marginal cost pricing restricted on railways are rather limited.

**Keywords:**

Optimal Pricing, Network, Scale Economies, Congestion.

TUE 13<sup>th</sup> (09:45 - 11:00, Session E5.1) Room 0.02

ID 1255 R

**WELFARE IMPLICATIONS OF PRICE CAP REGULATION COMBINED WITH TOTAL REVENUE CONSTRAINT**

Main Author:

**Hironori KATO** (*University of Tokyo*)

Co-author(s):

**Katsumi TANABE** (*Keio University*)

**Kazuhiro OHTA** (*Senshu University*)

**Abstract:**

This paper assumes the introduction of price cap regulation under the constraints of policy requirements; it highlights the price cap regulation under the condition that the operator's revenue remains constant. A government may impose this when it expects the operators to earn pre-fixed amounts of revenue for repaying their debt. This paper analyzes the mechanism of a proposed pricing system after formulating a simple model. Two prices of a small vehicle and a large vehicle in the expressway service are assumed in the analysis. The theoretical analysis shows that the proposed pricing system leads to the maximization of consumer surplus under the constant-revenue constraint. Then, simple numerical simulations based on the proposed model are presented. The results show that the proposed model works well.

**Keywords:**

Price cap regulation, Constant-revenue constraint, Ramsey pricing.

TUE 13<sup>th</sup> (09:45 - 11:00, Session E5.1) Room 0.02

ID 1277 R

**PUBLIC-PRIVATE PARTNERSHIPS AND MARGINAL COST PRICING AT AIRPORTS: TWO CASE STUDIES FROM THE RESEARCH PROJECT ENACT**

Main Author:

**Claus DOLL** (*Fraunhofer-Institute for Systems and Innovation Research (ISI)*)

Co-author(s):

**Kiril KARAGYOZOV** (*Higher School of Transport ?T.Kableskov?*)

**Abstract:**

International airports are among the few examples of transport infrastructures which can well achieve self-financing. The growing interest of private companies in airport construction and operation is the visible testimony to this fact. However, the financing structures of airports are complex, involving not only traffic, passenger and goods handling, but also non-aviation services, such as retail, car parking or intermodal facilities. The integration of social marginal cost pricing schemes into this organizational structure according to the strategic plans of the European Commission, however, is challenging. This paper investigates whether they comply with a second strategic policy objective at European and national level, which is to foster public private partnerships (PPPs) in transport financing in terms of full cost coverage, risks and incentives. The cases analysed in this paper deal with two sites with very different characteristics: Munich Airport which has been publicly operated since 1991 and the Bulgarian airports Varna and Burgas, which have been managed since 2007 by one concessionaire and whose planning and future development is being accomplished with private capital. The results of both cases showed that self-financing is possible in case congestion costs are considered in the SMCP schemes, and given that air traffic growth rates return to the significant levels prior to the economic crisis. The chapter will discuss the legal implications of congestion pricing at European airports which is violating current EC legislation, as well as the impact of alternative pricing schemes on the environmental performance and technological innovation in aviation.

**Keywords:**

Social marginal cost pricing (SMCP), User charging.

TUE 13<sup>th</sup> (09:45 - 11:00, Session E5.1) Room 0.02

ID 1785 R

**MARGINAL COST OF RAILWAY INFRASTRUCTURE WEAR AND TEAR FOR FREIGHT AND PASSENGER TRAINS IN SWEDEN**

Main Author:

**Mats ANDERSSON** (*VTI - Swedish National Road and Transport Research Institute*)

**Abstract:**

We analyse maintenance cost data for Swedish railway infrastructure in relation to traffic volumes and network characteristics, and separate the cost impact from passenger and freight trains. Lines with mixed passenger and freight traffic, and dedicated freight lines are analysed separately using both log-linear and Box-Cox regression models. We find that for mixed lines, the Box-Cox specification is preferred, while a log-linear model is chosen in the case of dedicated freight lines. The cost elasticity with respect to output is found to be higher for passenger trains than for freight trains. From a marginal cost pricing perspective, freight trains are currently over-charged, while passenger trains are under-charged.

**Keywords:**

Railway, Maintenance, Marginal Cost.

TUE 13<sup>th</sup> (09:45 - 11:00, Session E5.1) Room 0.02

ID 2494 R

**TRACK WEAR AND TEAR COST BY TRAFFIC CLASS: FUNCTIONAL FORM, ZERO-OUTPUT LEVELS AND MARGINAL COST PRICING RECOVERY ON THE FRENCH RAIL NETWORK**

Main Author:

**Marc GAUDRY** (*Université de Montréal*)

**Abstract:**

We address the issue of the allocation of railway track maintenance (wear-and-tear) costs to traffic output classes and consider a very general function relating maintenance cost  $C$  to a set of technical production characteristics  $K$  used to produce traffic output vector  $T$ . We neglect other rail cost categories, such as traffic control and track renewal. The data base pertains to over 1 500 sections of the French rail infrastructure in 1999, representing about 90% of the total network of 30 000 km of lines in regular service. In addition to the maintenance cost  $C$ , it provides by track section 15 technical characteristics (both state  $S$  and quality  $Q$ ) and 4 train traffic outputs  $T$ . Input prices, assumed to be uniform in space, disappear from the analysis, as in other national cross-sectional cases. With database subsets of approximately 1 000 observations, several functional forms are tested: Linear, Log- Log, Trans-Log and Generalized Box-Cox. All are embedded in an unrestricted extension (U-GBC) of Khaled's seminal restricted Generalized Box-Cox (R-GBC) functional specification. The U-GBC architecture, compared with its 4 principal nested variants, turns out to be by far the most appropriate, in particular when some observed zero Traffic sample values are included an issue rather neglected previously in the literature. It appears that several technical characteristics, such as maximum allowed speed and number of switches, are highly significant maintenance cost factors, which gives a hint that derived marginal costs are short term; also, the relation between maintenance costs and traffic is non linear and differs significantly by train category. Implications of different specifications for marginal infrastructure cost charges by traffic type are outlined. (...).

**Keywords:**

Rail track wear-and-tear, Cost function, CES, Trans-Log, Generalized Box-Cox, Zero sample values, Maintenance cost allocation by traffic class, Marginal cost by traffic class, Power axle weight damage laws, Cross-sectional data, Rail line sections, France, Marginal cost pricing.

TUE 13<sup>th</sup> (11:15 - 12:30, Session E5.2) Room 0.02

ID 1325 R

**WHY CONGESTION TOLLING COULD BE GOOD FOR THE CONSUMER: THE EFFECTS OF HETEROGENEITY IN THE VALUES OF SCHEDULE DELAY AND TIME ON THE EFFECTS OF TOLLING**

Main Author:

**Vincent VAN DEN BERG** (*VU university Amsterdam*)

Co-author(s):

**Erik VERHOEF** (*Department of Spatial Economics, VU University Amsterdam*)

**Abstract:**

We analyse the efficiency and distributional impacts of congestion pricing, in the bottleneck model, with continuous heterogeneity in the values of time and schedule delay. With a heterogeneous value of schedule delay, tolling makes the arrival ordering more efficient, and this lowers scheduling costs. If there is not much more heterogeneity in the value of time than in the value of schedule delay, then first-best tolling decreases the generalised price for most users. We find that the consumer surplus losses or gains from first-best tolling are not strictly monotonic in the value of time, because the value of schedule delays also determines such gains or losses. The greatest losses are not incurred by drivers with the lowest value of time, but by users with an intermediate value of schedule delays and the lowest value of time consistent with that value of schedule delays. The lowest values of time are among those who gain most from a public pay-lane. With a private pay-lane, the lowest value of time loses least of all free-lane users; moreover, there are also many pay-lane users that lose more than the lowest value of time.

**Keywords:**

Traffic congestion, Road pricing, Heterogeneity, Distributional impacts, Bottleneck model.



TUE 13<sup>th</sup> (11:15 - 12:30, Session E5.2) Room 0.02

ID 1760 R

**URBAN DELIVERY INDUSTRY RESPONSE TO  
CORDON PRICING, TIME-DISTANCE PRICING, AND  
CARRIER-RECEIVER POLICIES**

Main Author:

**Jose HOLGUIN-VERAS** (*Rensselaer Polytechnic Institute*)

**Abstract:**

The paper develops a set of analytical formulations to study the behavior of the urban delivery industry in response to cordon time-of-day pricing, time-distance pricing, and comprehensive financial policies targeting carriers and receivers. This is accomplished by modeling the behavior of receivers in response to financial incentives, and the ensuing behavior of the carrier in response to both pricing and the receiver decisions concerning off-hour deliveries. The analytical formulations consider both the base case condition, and a mixed operation with both regular hour and off-hour deliveries; two pricing schemes: cordon time of day, and time-distance pricing; two types of operations: single tour, and multi-tour carriers; and three different scenarios in terms of profitability of the carrier operation, which include an approximation to the best case, the expected value, and the worst case. The analyses, both theoretical and numerical, highlight the limitations of pricing-only approaches. In the case of cordon time of day pricing, the chief conclusion is that it is of limited use as a freight demand management tool because: (1) in a competitive market the cordon toll cannot be transferred to the receivers as it is part of the fixed costs; and (2) the structure of the cost function, that does not provide any incentive to the carrier to switch to the off-hours. The analyses of time-distance pricing clearly indicate that, though its tolls could be transferred to the receivers and provide an incentive for behavior change, the magnitude of the expected toll transfers under real life conditions are too small to have any meaningful impact on receivers choice of delivery times. In essence, the key policy implication is that in order to change the joint behavior of carrier and receivers, financial incentives should be provided to receivers in exchange for their commitment to do off-hour deliveries. (...).

**Keywords:**

Urban delivery industry, Cordon time-of-day pricing.

TUE 13<sup>th</sup> (11:15 - 12:30, Session E5.2) Room 0.02

ID 2027 R

**MARKET POWER AND PRICING OVER SPACE IN  
TRANSPORTATION**

Main Author:

**Wesley WILSON** (*University of Oregon*)

Co-author(s):

**Kevin HENRICKSON** (*Gonzaga University*)

**Abstract:**

Railroads produce with a network technology and serve a wide range of shippers (originator or receivers) by hauling a myriad of different commodities from a vast number of locations to other locations. Most of the movements are provided by one railroad, and shippers located over space may not have many other railway options. While for some movements, other modes may be an option, for the vast majority of rail movements, railroads have a cost advantage over alternative modes. In this study, we develop and estimate a model of railroad pricing wherein prices are determined by costs and competitive alternatives of shippers. The model is applied to the pricing of corn movements from locations in the Upper Midwest to the Gulf of Mexico. Originating shippers are located over space, and the set and effectiveness of competitive options varies considerably over space. We parameterize both costs and competitive options and find that the increase in corn based ethanol markets along with truck-barge rates have a commanding influence on railroad rates constrain rail rates by 7.4 and 10.1 percent, respectively.

**Keywords:**

Spatial economics, Railroad, Pricing, Competition.

TUE 13<sup>th</sup> (11:15 - 12:30, Session E5.2) Room 0.02

ID 2240 R

**THE MARGINAL COST RAILWAY RENEWALS: A  
SAMPLE SELECTION MODELLING APPROACH**

Main Author:

**Mats ANDERSSON** (*VTI - Swedish National Road and  
Transport Research Institute*)

Co-author(s):

**Åsa WIKBERG** (*Swedish National Road and Transport  
Research Institute*)

**Andrew SMITH** (*Institute for Transport Studies - Leeds  
University*)

**Phillip WHEAT** (*Institute for Transport Studies - Leeds  
University*)

**Abstract:**

Economic theory advocates marginal cost pricing for efficient utilisation of transport infrastructure. A growing body of literature has emerged on the issue of marginal infrastructure wear and tear costs, but the majority of the work is focused on costs for infrastructure maintenance. Railway renewals are a substantial part of an infrastructure manager's budget, but in disaggregated statistical analyses, they cause problems for traditional regression models from a pile of zero observations. Previous econometric work has sought to circumvent the problem by aggregation in some way. In this paper we work with disaggregate (track-section) data, including the zero observations, but apply censored and sample selection regression models to overcome the bias that would result from estimation using OLS. We derive renewal cost elasticities with respect to traffic volumes and marginal renewal costs using Swedish railway renewal data over the period 1999 to 2007.

**Keywords:**

Railway, Marginal cost, Renewals, Sample selection.

TUE 13<sup>th</sup> (11:15 - 12:30, Session E5.2) Room 0.02

ID 2285 R

**HOW FAIR IS URBAN ROAD TOLL PERCEIVED TO BE?**

Main Author:

**Stéphanie SOUCHE** (*Laboratoire d'Economie des  
Transports*)

Co-author(s):

**Charles RAUX** (*LET, University of Lyon*)

**Yves CROISSANT** (*Université de la réunion*)

**Abstract:**

The interest in the pricing tool, which is associated with the resistance to the pricing regulation, leads us to test whether a road urban pricing is perceived as unfair and if compensation, and what kind of compensation, received a better support. As we have previously studied in the case of a scarce seats in a train and in a car park, we will test different allocation principles by quantity, queuing to evaluate if they received more support than a pur pricing regulation mechanism. We also test different principle of compensation. We use an ordered probit model. Our results show that regulation by means of price or quantity are judged as unfair but the urban road pricing is perceived as less unfair if it allows to make people responsible to pollution or to build new road. Our result underline that compensation can be moral or ethic and can be dissociated to the other form of compensation and takes the role of a reference transaction. They also provide with lights on the socioeconomics impact on the fairness perception of the regulation or compensation principles.

**Keywords:**

Justice, Behaviour, Urban pricing.

TUE 13<sup>th</sup> (14:00 - 15:15, Session E5.3) Room 0.02

ID 1558 R

### WHAT DRIVES GASOLINE TAXES?

Main Author:

**Stef PROOST** (*KULeuven*)

#### Abstract:

Gasoline taxes are the most important tax on car use. The question naturally arises as to what toll would be adopted by a government that responds to the preferences of the public. To address that issue, we begin with the standard Downsian model, where policy is set by the median voter. This model predicts that as long as the median voter is not a car user, he wants high taxes on road use and on road capacity that maximize revenues. Whenever he becomes a driver himself, he wants road user taxes that are lower and only increase to control congestion. We then use panel data for 28 countries and find support for our theory. When the median voter becomes a driver, the gasoline tax drops on average by 20%.

#### Keywords:

Gasoline taxes, Median voter theory, Political economy.

TUE 13<sup>th</sup> (14:00 - 15:15, Session E5.3) Room 0.02

ID 1894 R

### SHOULD THE U.S. MOTOR FUEL TAX BE RETAINED OR REPLACED?

Main Author:

**Lee MUNNICH** (*Humphrey Institute of Public Affairs / University of Minnesota*)

Co-author(s):

**David COYLE** (*Department of Applied Economics / University of Minnesota*)

**Ferrol ROBINSON** (*Humphrey Institute of Public Affairs / University of Minnesota*)

**Zhirong ZHAO** (*Humphrey Institute of Public Affairs / University of Minnesota*)

**Adeel LARI** (*Humphrey Institute of Public Affairs / University of Minnesota*)

#### Abstract:

Two national commissions established by the U.S. Congress advocate replacing the current system of funding transportation based on the gas tax with a new distance-based system of user fees. The State of Oregon has done a pilot project demonstrating a system for transitioning to mileage-based fees by paying the fees at the gas pump. The University of Iowa is currently conducting pilot tests around the country to determine how drivers respond to a mileage-based fee approach using GPS-based technology. While there is a growing consensus among many transportation leaders that the gas tax is no longer a good way of financing the transportation system, there is by no means a public understanding of why this is so. The public assumes that the taxes they pay at the pump are paying for the system, and that whatever funding problems exist with the system are due to waste and inefficiency. This paper will examine the gas tax on the basis of tax policy principles – Efficiency, Equity, Revenue Adequacy and Sustainability, Environmental Sustainability, and Feasibility.

#### Keywords:

Fuel taxes, Transportation funding, Tax policy, VMT fees.

TUE 13<sup>th</sup> (14:00 - 15:15, Session E5.3) Room 0.02

ID 2047 R

**USE OF THE ANALYTIC HIERARCHY PROCESS TO DETERMINE THE TRANSIT FARE SYSTEM**

Main Author:

**Fabiene COSTA**

Co-author(s):

**Carlos NASSI** (*Federal University of Rio de Janeiro*)

**Abstract:**

The transportation fare system influences the mobility of a region and the life quality of its inhabitants. This study aims to determine a region's optimal fare system by using the analytic hierarchy process, based on a survey among transportation experts, divided into three categories: operators, professors/consultants and government officials. The results are presented divided by category and overall, and the performance of the most important relative criteria to establish a fare system is determined. The most important criterion according to all the selected experts was the fare price, with 21.5%. The fare system determined as the best was distance/zone (31.1%) and the worst was a flat fare system (7.2%). In addition, we show the influence of the fare price criterion in each fare system through sensitivity charts and highlight its importance for all three groups of experts to determine the fare system.

**Keywords:**

Pricing Strategies, Transportation Planning, Fare system.

TUE 13<sup>th</sup> (14:00 - 15:15, Session E5.3) Room 0.02

ID 2052 R

**EXAMINING THE LINKAGES BETWEEN ELECTRONIC ROADWAY TOLLING TECHNOLOGIES AND ROAD PRICING POLICY OBJECTIVES**

Main Author:

**Hiroyuki ISEKI** (*University of New Orleans*)

Co-author(s):

**Alexander DEMISCH** (*UCLA Institute of Transportation Studies*)

**Abstract:**

The surge of road pricing projects in the U.S. and around the globe over the past 15 years has been enabled by a variety of new communication and transportation technologies. While all of these technologies increase the efficiency of roadway tolling vis-à-vis manual collection, no "best" configuration has emerged. Rather, optimal configurations depend on the objectives of the tolling effort, such as facility type, geographic scope, desire to price externalities, integration with other operations, and so on. While such policy objectives for road pricing have been examined extensively, little has been written on the explicit links between tolling technology configurations and policy objectives. This paper addresses this gap in the literature through an examination of eight road pricing programs. For each program we evaluate the conduct of the three technical tasks via the nine technology sets in light of six principal policy objectives of road pricing. We find that two policy factors most often determine the type of roadway tolling technologies adopted: (1) the geographical scale of the road network tolled, and (2) the complexity of calculating the fee to be charged. The combination of these two factors can vary greatly – from flat fare tolling on individual facilities, to nationwide road networks priced with dynamic tolls that vary by vehicle class, time of day, and congestion level. We conclude that the challenge to the expanded implementation of road pricing is less about either pricing technologies or the objectives of pricing, but the politically and economically effective linking of the two.

**Keywords:**

Road pricing technologies, Electronic toll collection, Technology policy.

TUE 13<sup>th</sup> (14:00 - 15:15, Session E5.3) Room 0.02

ID 2614 R

### **MODELLING TRADABLE EMISSIONS PERMITS SYSTEM FOR URBAN MOTORISTS**

Main Author:

**Bulteau JULIE** (*Institut d'Economie et de Management de Nantes-LEMNA*)

#### **Abstract:**

This article deals with the feasibility of a tradable emission permit system (TEPs) for urban motorists. The objective is to develop a new microeconomic theoretical model to reduce urban pollution. We suppose that the city's regulating authority sets up a tradable emission permit system based on the number of kilometres covered by private cars. By the use of a Constant Elasticity of Substitution (CES) function, we determine the equilibrium under an environmental constraint and analyse the effects of a TEPs on social welfare. The aim is to find the optimal quantity of permits leading to the desired environmental objective. The analytical and numerical results of the model show the instrument's feasibility and efficiency. An important variable in the model must be taken into account: the knowledge of environmental damage. This variable will clearly influence the tool's success.

#### **Keywords:**

Sustainable mobility, Urban transport, Tradable emissions.

TUE 13<sup>th</sup> (15:30 - 16:45, Session E5.4) Room 0.02

ID 1665 R

### **EVOLUTIONARY FIRST-BEST ROAD PRICING SCHEME IMPLEMENTATION BASED ON STOCHASTIC TRAFFIC FLOW INFORMATION**

Main Author:

**Agachai SUMALEE** (*Hong Kong Polytechnic University*)

Co-author(s):

**Wei XU** (*Nanjing University*)

**Hai YANG** (*Hong Kong University of Science and Technology*)

#### **Abstract:**

Traditionally, to implement the first-best road pricing scheme in a traffic network requires the information on the exact demand function or true origin-destination demand, which, however, is rarely available in practice. To overcome this dilemma, the trial-and-error method has been proposed to find the first-best pricing through an iterative process using the observed traffic volumes. This method guarantees the convergence of tolls and flows to the system optimal state based on the assumption of deterministic traffic conditions. However, in reality, it is very commonly seen that the travel demand and supply change from day to day that induces the variability of link flow and travel time. This paper aims to tackle the question that whether one can use the stochastic flow information to define the first-best marginal-cost toll. Meanwhile, an evolutionary implementation method that iteratively finds the optimal toll pattern according to the observed stochastic link flows is proposed. This algorithm only requests the statistical information of the observed link flows and travel time functions. The proof of the convergence of the iterative algorithm is given. The paper also analyzes the effect of the sampling error of the link flow data on the convergence of the algorithm and theoretically shows that the biases from the flow observation will not affect the convergence of the optimal toll and flow pattern. The numerical tests are provided for the illustration of the algorithm.

#### **Keywords:**

Road pricing, Network uncertainties, Stochastic network, Traffic assignment, System optimum.

TUE 13<sup>th</sup> (15:30 - 16:45, Session E5.4) Room 0.02

ID 1896 R

**THE FUNDAMENTAL STUDY ON THE FEASIBILITY OF INTRODUCING WORKPLACE PARKING LEVY IN JAPAN**

Main Author:

**Satoru KOBAYAKAWA** (*Nihon University*)

**Abstract:**

This study aims to analyze the feasibility of a Workplace Parking Levy (WPL) in Japan. Surveys were conducted on employers and employees of firms in the City of Tachikawa, Tokyo, in order to understand the current situation of commuters using cars where there is mixed use land areas for industrial, commercial, and residential purpose. The employers and employees were asked about commuting conditions of private cars; who owns parking space, who pays parking costs, and which kind of commutation allowances are paid (or received). The employees were also asked their attitudes toward parking levies at the workplace. Finally, the feasibility of introducing WPL in Japan was analyzed by these survey data. According to the questionnaire survey, 58% of firms allow the use of private cars for commuting, and they provide parking space for their employees. Moreover, it was revealed that these Japanese firms have unique financial support systems for commuting allowance. The employers pay travel costs while most firms provide parking space for employees. Therefore, commuters are privileged to use cars for commuting and it would be effective to introduce WPL. In addition, changing the travel allowance system would be an important issue for introducing WPL in Japan.

**Keywords:**

Workplace Parking Levy (WPL), Transportation Demand Management (TDM).

TUE 13<sup>th</sup> (15:30 - 16:45, Session E5.4) Room 0.02

ID 2079 R

**SPATIAL EQUILIBRIUM OF TAXI SPOT MARKETS AND SOCIAL WELFARE**

Main Author:

**Kakuya MATSUSHIMA** (*Graduate School of Urban Management, Kyoto University*)

**Abstract:**

In this paper, how local behavior of agents affects global spatial equilibrium pattern is analyzed, in a matching model with taxis and passengers. There exist thick market externalities in taxi spot markets: the more taxis gather at a market, the more customers will visit the market, and vice versa. There always works the positive feedback mechanism in such ways that as more taxis and customers visit the market to transact the service, transaction costs can be reduced and the market functions more efficiently. In this paper, an equilibrium model of multi spot markets is presented considering both agglomeration mechanism caused by thick market externalities and dispersion mechanism caused by transaction costs. We have shown that there is a possibility of multiple equilibria, and analyzed the social efficiency of the respective equilibria.

**Keywords:**

Thick market externality, Transaction cost, Taxi market.

TUE 13<sup>th</sup> (15:30 - 16:45, Session E5.4) Room 0.02

ID 2101 R

**THE OPTIMAL AREA-BASED NETWORK CONGESTION PRICING PROBLEM: DETERMINING OPTIMAL TOLL LEVEL AND CHARGING BOUNDARY**

Main Author:

**Takuya MARUYAMA** (*Kumamoto University*)

**Abstract:**

The design of a congestion pricing policy clearly determines its performance. Therefore, many studies have attempted to determine the optimal design of various pricing schemes. Cordon-based and area-based congestion pricing are two well-known pricing policies that are designed to alleviate city-center congestion. In cordon-based pricing (cordon-toll), drivers are charged when they cross the cordon boundary, while in area-based pricing (area-toll), the drivers pay a daily charge to enter or drive within a charged area. For these schemes, the toll level and charging boundary must be determined. Cordon-toll has been extensively examined (Zhang and Yang, 2004; Sumalee 2004, 2007; and others), but area-toll has received little attention. This study proposes a framework for designing an optimal area-toll policy and investigates the properties of optimal area-toll. The travel costs for area-toll are expressed using a trip-chain-based network equilibrium model proposed by some of the authors (Maruyama and Sumalee 2007). Innovative part of this paper is optimal design (automatic design) of charging boundary of area-based toll, which was determined (manually) by human-brain in past research. The pricing design model is formulated as a bi-level programming problem and solved using a genetic algorithm. This model was applied to a real-world network in Utsunomiya, Japan. This case study produced several interesting findings: the shapes of the optimal area-toll and cordon-toll areas differ greatly; optimizing the area-toll scheme provides a 50% larger social surplus than the judgmental area. These findings indicate the importance of optimizing the charging boundary and have useful policy implications. (...).

**Keywords:**

Road Pricing, Second-best Pricing, Transportation Network Equilibrium, Genetic Programming, Heuristic Optimization.

TUE 13<sup>th</sup> (15:30 - 16:45, Session E5.4) Room 0.02

ID 3201 R

**RE-EXAMINING THE RESULTS OF THE LONDON CONGESTION CHARGING SCHEME ? A CRITICAL REVIEW**

Main Author:

**Moshe GIVONI** (*Transport Studies Unit - University of Oxford*)

**Abstract:**

The London Congestion Charging scheme was introduced in 2003 alongside a series of other changes to the transport system, most notably improved bus services. The results of the scheme have been reported and evaluated since then in numerous reports and studies from which a consensus appears branding it a success. Following from that numerous cities are now introducing or considering introducing similar schemes. Research on the effects of the scheme usually attributes (often implicitly) all the changes that took place in central London since 2003 to the congestion charging, while the effects of other factors, as well as the effects of trends over time, are not usually (explicitly) considered. In this context, the paper revisits the results of the London Congestion Charging scheme to examine to what degree observed effects (related to congestion and traffic levels, changes in travel behaviour and air pollution) can be fully or partly attributed to congestion charging. Attention is also given to the amount of revenues the scheme generated. While there is no dispute over the theoretical rational for introducing congestion charging, the London scheme reveals that questions can be raised with regard to its practical effectiveness. While the bundling together of congestion charging with other measures, such as improved public transport, is crucial for various reasons, it is difficult to determine the direct contribution of each measure to the changes that took place after congestion charging was introduced. Overall the paper concludes that it is still not clear what is the long term effect of congestion charging and it suggests that other cities should first try to implement other (non-pricing) measures before introducing congestion charging. (...).

**Keywords:**

Congestion charging, Policy package, Transport policy, London.

TUE 13<sup>th</sup> (17:00 - 18:15, Session E5.5) Room 0.02

ID 2418 R

## INCIDENTS AND THE BOTTLENECK MODEL

Main Author:

**Stefanie PEER** (*Department of Spatial Economics, VU Amsterdam*)

Co-author(s):

**Paul KOSTER** (*VU University Amsterdam, Department of Spatial Economics*)

**Erik VERHOEF** (*Department of Spatial Economics, VU University Amsterdam*)

**Jan ROUWENDAL** (*VU University*)

### Abstract:

This paper analyzes the costs of traffic incidents using a bottleneck model. A traffic incident results in queuing because of a sudden drop in road capacity. We derive the equilibrium departure rate. Equilibrium scheduling and queuing costs which are functions of the probability that an incident occurs can then be analyzed.

### Keywords:

Stochastic Bottleneck Model, Incidents, Optimal Capacity.

TUE 13<sup>th</sup> (17:00 - 18:15, Session E5.5) Room 0.02

ID 2545 R

## RAILWAY CAPACITY AUCTIONS WITH DUAL PRICES

Main Author:

**Andreas TANNER** (*TU Berlin*)

Co-author(s):

**Thomas SCHLECHTE** (*Konrad Zuse Zentrum Berlin*)

### Abstract:

Railway scheduling is based on the principle of the construction of a conflict-free timetable. This leads to a strict definition of capacity: in contrast with road transportation, it can be said in advance whether a given railway infrastructure can accommodate { at least in theory } a certain set of train requests. Consequently, auctions for railway capacity are modeled as auctions of discrete goods { the train slots. We present estimates for the efficiency gain that may be generated by slot auctioning in comparison with list price allocation. We introduce a new class of allocation and auction problems, the feasible assignment problem, that is a proper generalization of the well-known combinatorial auction problem. The feasible assignment class was designed to cover the needs for an auction mechanism for railway slot auctions, but is of interest in its own right. As a practical instance to state and solve the railway slot allocation problem, we present an integer programming formulation, briefly the ACP, which turns out to be an instance of the feasible assignment problem and whose dual problem yields prices that can be applied to define a useful activity rule for the linearized version of the Ausubel Milgrom Proxy auction. We perform a simulation aiming to measure the impact on efficiency and convergence rate.

### Keywords:

Railway capacity, Auctions, Mixed integer programming.



TUE 13<sup>th</sup> (17:00 - 18:15, Session E5.5) Room 0.02

ID 2714 R

**OPTIMAL CHARGING STRATEGIES UNDER  
CONFLICTING OBJECTIVES FOR THE PROTECTION  
OF SENSITIVE AREAS: A CASE STUDY FOR THE  
TRANS-PENNINE CORRIDOR**

Main Author:

**Astrid GUEHNEMANN** (*Institute for Transport Studies,  
University of Leeds*)

Co-author(s):

**Andrew KOH** (*Institute for Transport Studies, University of  
Leeds*)

**Simon SHEPHERD** (*University of Leeds*)

**Mary LAWLER** (*Institute for Transport Studies, University  
of Leeds*)

**Abstract:**

Road user charging has been discussed in the literature to reduce local pollution in sensitive areas where general incentives to reduce fuel consumption or use cleaner vehicles cannot sufficiently reduce impacts (i.e. residential areas or National Parks). However, there has been little research on the implication of potentially conflicting objectives in the delivery of road user charging policies when several areas are affected. The key question for this paper is to investigate the interdependencies between the price setting strategies of neighbouring institutions and what the optimal strategy would be if environmental considerations are included. Such a situation can be encountered in the Trans-Pennine corridor where transport networks connecting major agglomerations cross areas of high natural value as well as densely populated conurbations. We selected two transport sensitive areas of different type: the Peak District National Park, as a sensitive ecosystem and area of high recreational value, and the Sheffield Air Quality Management Area (AQMA), as an area with very high population density. Different combinations of user charging between both areas and the surrounding motorways have been analysed. For each combination, cordon charges respectively distance based motorway tolls have been determined that optimise the welfare gains under the objectives given in that scenario, measured by changes in user costs and costs to society, including environmental externalities. Under a global co-operative regulation scenario including all players the overall welfare of the region would be maximised. (...).

**Keywords:**

Road user charging, Environmental costs, Sensitive areas, Air pollution.

TUE 13<sup>th</sup> (17:00 - 18:15, Session E5.5) Room 0.02

ID 3273 R\*

**THE ATTACHMENT TO A SOCIAL FARE : A CASE  
STUDY ABOUT THE « FAMILLES NOMBREUSES »  
RAIL CARD TREATED WITH STATED CHOICE ME**

Main Author:

**Luc BAUMSTARK** (*Laboratoire d'Economie des  
Transports*)

Co-author(s):

**Sandrine DEBORAS** (*Laboratoire d'Economie des  
Transports*)

**Yves CROISSANT** (*Université de la réunion*)

**Damien PONS** (*LET, University of Lyon*)

**Abstract:**

During the past 20 years, public sectors faced many changes and public authorities got to rethink the way they step-in. The European Commission designed new institutional contexts and, as a consequence, all countries had, have, and will have to implement reforms. This is of course still right while taking into consideration the way countries may fulfil their missions and obligations. In France, the strong implication degree of the state constrained to profound re-organisations. Some of the key concerns of these reforms are the planning and the funding of public services. The Altmark judgement is now a reference point and give required guidelines while allocating public funds to a private company in order to run a service of general interest. This recent dislocation compelled historical operators to look into parts of the services they provided which had been "left aside" for years. This is the case of "SNCF", the French rail operator, providing some public services (in accordance with a social mission of global access to mobility) in exchange of compensations. One of the social pricing policy handled by the SNCF is to hold out discounts to large families . However, no changes have been done since the creation of this fare in 1921 but the commercial pricing grid evolved, proposing more kinds of discounts and low fares. Thereby, the distributive effects of the "Familles Nombreuses" fares appear nowadays to be unsure and led-up the SNCF to consider a new pricing strategy. With the "Familles Nombreuses" price, all users enjoy discounts without any constraints in term of travelling period and in term of booking pre-emption. The "SNCF" contemplated the possibility to impose new travel constraints to all "Familles Nombreuses" card holders. (...).

**Keywords:**

Pricing policies, Stated choice methods, Deregulation.

TUE 13<sup>th</sup> (11:15 - 12:30, Session E6.1) Room 1.06

ID 1029 R

### **A PROPOSAL FOR A WORLD DATABASE ON TRANSPORT INFRASTRUCTURE REGULATION**

Main Author:

**Paolo BERIA** (*Politecnico di Milano*)

Co-author(s):

**Marco PONTI** (*Politecnico di Milano*)

**Antonio LAURINO** (*Politecnico di Milano*)

#### **Abstract:**

The paper presents the structure and the concepts at the basis of a database on world transport infrastructure regulation, to be launched. The database will be built promoting a "soft" survey on the world regulatory practices, to be filled by scholars and experts on a voluntary basis. The goal of the database is to stimulate research on best practices and interaction among regulators, regulated and scholars. The work is still under construction. The database structure is ready and the survey is already launched, but incomplete. This paper is a preliminary document which provides a detailed description of the aims and of the database structure, in order to circulate the project and collect suggestions from the academic community. The structure of the paper is as follows. After a presentation of the aims of the work, section 2 provides a literature review on existing databases. Section 3 details the project, describing the characteristics of the survey, the strengths and weaknesses of the approach, the network to be activated. Section 4 is giving more details on the actual structure of the database and of the corresponding survey. Section 5 gives notice of the first results obtained with a preliminary survey and a preliminary review of literature on some selected countries. Conclusions will outline the next steps of the research.

#### **Keywords:**

Transport, Regulation, Investment, Infrastructure, Database, Survey.

TUE 13<sup>th</sup> (11:15 - 12:30, Session E6.1) Room 1.06

ID 1730 R

### **THE EFFECT OF INFRASTRUCTURE INVESTMENTS ON COMMUTING AND LOCAL LABOUR MARKETS: THE CASE OF TWO NORWEGIAN REGIONS**

Main Author:

**Anne GJERDAKER** (*Institute of Transport Economics, Oslo*)

Co-author(s):

**Øystein ENGBRETSSEN** (*Institute of Transport Economics, Oslo*)

#### **Abstract:**

Improvements in infrastructure may facilitate commuting between neighbouring regions, which in turn may stimulate the regional integration of local labour markets. In Norway, the average travel distance to work has increased by more than 20 percent since the mid-1980s, while the average travel time has remained constant. The increase in commuting may be interpreted as a regional integration of labour markets, in response to improved accessibility and increased range. The increase in travel distances has been largest in the peripheral municipalities. Studies of two Norwegian infrastructure projects demonstrate that these investments have led to reduced travel time and increased commuting. This in turn results in a more varied and effective labour market, providing greater opportunities for employment and economic growth, and a better matching of skills in the labour market. In both cases there has been an increase in commuting flows, although to varying degrees. The variation may be explained by the composition of the industry structure and employment opportunities within the two regions. Increased spatial competition may result in redistributive rather than generative growth, especially with regards to the location of service activities. The paper draws on a statistical analysis of commuting flows, settlement and employment patterns at a low level of aggregation. A detailed analysis of commuting between basic statistical units for the years 2001 and 2007 reveals a commuting pattern that is not discernible when using data at the municipality level. The statistical analyses are complemented by interviews with firms and local authorities in selected case study areas. Together, the two data sources provide insights into the local consequences of specific infrastructural investments. (...).

#### **Keywords:**

Commuting, Infrastructure investments, Labour markets, Regional development.

TUE 13<sup>th</sup> (11:15 - 12:30, Session E6.1) Room 1.06

ID 2313 R

**CAUSAL RELATIONSHIPS BETWEEN AIRPORT PROVISION, AIR TRAFFIC AND ECONOMIC GROWTH: AN ECONOMETRIC ANALYSIS**

Main Author:

**Florian ALLROGGEN** (*Institute of Transport Economics*)

Co-author(s):

**Robert MALINA** (*Institute of Transport Economics*)

**Abstract:**

As globalization progresses, air transport as a means of rapid transportation over long distances, is becoming more important to the development of economies. Thus, the availability of air transportation should exert positive effects on economic growth in the vicinity of an airport. In this paper, we present evidence of such positive economic effects and reveal the causal relationships, by using a production-function approach. The econometric estimation is based on a panel data set of major German airports.

**Keywords:**

Airports, Economic effects.

TUE 13<sup>th</sup> (11:15 - 12:30, Session E6.1) Room 1.06

ID 2370 R

**THE EFFECT OF MAJOR NORWEGIAN ROAD INVESTMENTS ON REGIONAL DEVELOPMENT – A STATISTICAL ANALYSIS OF MAJOR ROAD PROJECTS 1990-2005**

Main Author:

**Jon LIAN** (*Institute of Transport Economics, Oslo*)

Co-author(s):

**Joachim RONNEVIK** (*Institute of Transport Economics, Oslo*)

**Abstract:**

This study presents results from a statistical analysis of wider economic benefits of 102 major road projects in Norway completed 1993-2005 and findings from three selected case studies. A quantitative analysis reveals a rather weak relationship between investment level and population development. Effects of infrastructure investments on employment, income and industrial development were not found. Case studies show that linking together regional centres within a travel time of 45-50 minutes may lead to a consolidation of the local supply of services and the local labour market and reduced leakage to nearby larger cities. The success of economic base industries, such as maritime industries, offshore supplies and tourism, is to a large extent determined by international trends rather than local infrastructure projects. Nonetheless, road investments seem to be a necessary requirement for the adoption of contemporary just-in-time production patterns, which rely heavily on road transport.

**Keywords:**

Road investment, Regional impact, Statistical anal.

TUE 13<sup>th</sup> (14:00 - 15:15, Session E6.2) Room 1.06

ID 1252 R

**A QUANTITATIVE TRANSPORTATION PROJECT INVESTMENT EVALUATION APPROACH WITH BOTH EQUITY AND EFFICIENCY ASPECTS**

Main Author:

**Jing SHI** (*Tsinghua University*)

Co-author(s):

**Zhaozhang WU**

**Abstract:**

The motivation of this study is to develop a comprehensive evaluating approach for transportation investment with consideration of both efficiency and equity aspects, since the projects evaluation methods in practice mostly focus on the efficiency evaluation, while lacking transportation equity issues. Transportation infrastructures have great impacts on social and economical development, which may be positive or negative. The investment effects should be evaluated impersonally, with consideration of efficiency, equity, as well as environmental effect. Besides the evaluation of the necessity of the project investment, the priority of different construction projects and their effects on different regions and social groups should also be examined. Proper evaluation is essential to ensure the fairest distribution of social benefit from construction projects. Traditional evaluation methods for transportation projects investment, primarily costbenefit analysis, emphasize economic efficiency such as government's and users' benefits but disregard equity impacts. This may lead to an incomprehensive or even an unreasonable investment decision. This study thus provides an approach on introducing equity impacts into transportation planning process and explores the concepts of various types of equity. Parameters reflecting the differences among different development level regions and social compensation of disadvantage groups are introduced in this paper. Also, an evaluation model on transportation equity is proposed based on Wilson's entropy. This model takes into account the differences of economic levels and income levels among areas, the differences of social-economic benefits' distribution among advantaged and disadvantaged groups, the public recognition of equity, and so on. (...).

**Keywords:**

Transportation investment, Equity, Cost-benefit analysis, Wilson entropy.

TUE 13<sup>th</sup> (14:00 - 15:15, Session E6.2) Room 1.06

ID 1318 R

**TOWARDS MORE EFFECTIVE STRUCTURAL FUNDING – REGIONAL EFFICIENCY IN USING INFRASTRUCTURE AND HUMAN CAPITAL**

Main Author:

**Axel SCHAFFER** (*Karlsruhe Institute of Technology (KIT)*)

Co-author(s):

**Jan RAULAND** (*Karlsruhe Institute of Technology (KIT)*)

**Abstract:**

According the Council Regulation (EC) No 1083/2006 regions eligible for funding from the EU Regional Funds under the Convergence objective between 2007 and 2013 enclose all regions, whose gross regional product (GRP) per capita was less than 75% of the average GRP per capita of the EU-25 between 2000 to 2002. Choosing GRP per capita (based on purchasing power parities) as a yardstick has several implications for the allocation of funds. On the one hand, the clear parting line allows a transparent allocation of funds. Furthermore, regions that benefit the most are, per definition, among the poorest regions in Europe which, in turn, is arguably in line with EU's social objective of regional cohesion. On the other hand, the equity argument generally competes with an efficiency argument that intends to maximize return on public investments. The presented paper deals with the equity-efficiency trade-off and intends to identify eligible regions by taking into account both, the gross regional product per capita and the degree of efficiency. For this purpose we follow a two-step approach. The first step foresees to identify total (output-) efficiency of EU regions (NUTS2-level) by using per-capita-income as output as well as patent applications, human and infrastructure capital as input variables. Following an outlier robust enhancement of the data envelopment analysis (DEA), the so-called order- $\alpha$ - frontier approach,  $\alpha$  percent of the elements are allowed to be located above the efficiency frontiers. The results of this non-parametric approach clearly suggest that regional efficiency is strongly affected by a spatial factor. This is particularly true for the East-West divide, but also holds for the comparison of Northern versus Southern European regions. (...).

**Keywords:**

Region, Efficiency, Infrastructure, DEA, Geoadditi.

ID 1673 R

**EFFECTS OF IMPROVEMENT OF HIGH MOBILITY NETWORKS ON PROGRESS IN SERVICE LEVEL AND CHANGE IN USER BENEFIT IN JAPAN**Main Author:  
**Risa MUKAI**

Co-author(s):

**Akio KONDO** (*Institute of Technology and Science, The University of Tokushima*)**Akiko KONDO** (*Shikoku University Faculty of Management and Information Science*)**Abstract:**

In this study, first, progress in service level for all of Japan due to the improvement of high mobility transport networks from 1960 to 2000 is clarified quantitatively. In this analysis, we pay attention to efficiency and equality of improvement of transport networks over the whole country, and analyze regional difference in progress of service level. Second, change in user benefit due to improvement of high mobility networks is assessed. Finally, influence of improvement of high mobility networks on all of users in Japan is discussed. As a result of the first analysis, it was found that travel cost of air networks decreased greatly from 1960 to 1970. Travel time for every transport mode became less year by year. Second, user benefit of air networks increased from 1970 to 1980 and decreased from 1980 to 1990. The value of railway networks decreased from 1970 to 1980 and increased from 1980 to 1990. And, user benefit of road networks increased year by year. From these results, regarding the effect of improvement of transport networks changed over a 40-year period, valuable information was obtained.

**Keywords:**

High mobility transport networks, Travel cost, Travel time, User benefit, Japan.

ID 2955 R

**INVESTMENT IN TRANSPORT INFRASTRUCTURE IN THE REPUBLIC OF CROATIA**

Main Author:

**Danijela BARIC** (*Faculty of Transport and Traffic Sciences, University of Zagreb*)

Co-author(s):

**Dragan BADANJAK** (*Faculty of Transport and Traffic Sciences, University of Zagreb*)**Luka NOVACKO** (*Faculty of Transport and Traffic Sciences, University of Zagreb*)**Abstract:**

A specific configuration of Croatia with total area of 87,661 km<sup>2</sup> (56,594 km<sup>2</sup> of land) indicates vital importance of transport infrastructure for its development. However, due to exceptional geographical position, transit transport has very important significance in terms of connecting Central Europe with the countries of Southeast Europe. The Pan-European transport corridors which pass through Croatia (Vb, Vc, VII and X) emphasise the above mentioned statement. The basic network of transport infrastructure in Croatia consists of: roads (29,038km), railways (2722km), seaports of national interest, inland waterways, airports and terminals for combined transport. The paper analyses the overall transport infrastructure in Croatia with special emphasis on investment in road and railway network and comparison of models of their funding as well. An investment in building a new transport infrastructure is one of the prerequisites of continued sustainable development. In the past fifteen years, very intensive investments in road infrastructure, particularly motorways, have been carried out. The cycle of investing in Croatian motorways is in its final stage with more than 1000km of the new network. The investment cycle in railway infrastructure is still expected, and it is essential due to infrastructure inadequacy. The main problem is on the Pan-European corridors, where infrastructure must comply with the European standards. It is expected that the investment cycle in railways will last at least 15 years. Building of the motorways is mainly financed from the state budget and concessions. The construction and reconstruction of the railway network which is part of the Pan-European corridors have the funding option through preaccession EU funds. (...).

**Keywords:**

Transport infrastructure, Investments in road and railway network.

TUE 13<sup>th</sup> (15:30 - 16:45, Session E6.3) Room 1.06

ID 1925 R

**RISKS IN PORT CONCESSIONS: A CONTEXTUAL ANALYSIS AND ALLOCATION METHODOLOGY**

Main Author:

**Athena ROUMBOUTSOS** (*University of the Aegean*)

Co-author(s):

**Athanasios (THANOS) PALLIS** (*Department of Shipping, Trade and Transport - University of the Aegean*)

**Abstract:**

The issue of risks and risk allocation is key in the successful application of concessions and other types of private public partnerships (PPP). Transportation in particular, where sunk cost intensive investments are required, is not an exemption. Risks and their allocation has been a topic receiving attention by researchers and practitioners resulting in guidelines for contracting public authorities and concessioners, setting the grounds for successful endeavours. Ports constitute an integral part of transport services that faces infrastructure development issues in combination with emerging need to provide advanced services to diversified users. Private involvement in the provision of port infrastructure and services is becoming common practice with terminal concessions being the dominant market entry mode. This increases risks and their interdependence as PPPs in Ports (P4s) may be described as the outcome of these combined strategies. A contextual methodology is proposed for the analysis of risks in P4s based on the prime parameters defining the P4 setting. The importance of respective strategies on risk development is central in this approach. The contextual methodology is described in terms of its context parameters and applied to generic risk categories, illustrating its applicability in effectively analyzing risks and its potential for appropriate risk allocation associated with the concessioning of port terminals. Cause and effect loop diagrams are used to highlight the impact of contextual parameters on risks and propose risk allocation within the context of P4s. The methodology is proposed as a risk allocation guideline and is considered to assist both port and other respective contracting authorities and private investors in optimising their involvement strategies. (...).

**Keywords:**

Port Concessions, Public Private Partnerships, Risk Allocation, Mapping, Procurement.

TUE 13<sup>th</sup> (15:30 - 16:45, Session E6.3) Room 1.06

ID 2707 R

**ASSESSMENT OF THE INTRODUCTION OF FREIGHT TRAFFIC ON A HIGH SPEED RAIL LINE**

Main Author:

**Diana LEAL** (*Department of Civil Engineering - University of Coimbra*)

**Abstract:**

High speed rail (HSR) investment does not only saves time but also increases the capacity for passengers and freight by providing capacity itself and by freeing existing routes. In those routes characterized by serious bottlenecks, the opportunity to upgrade the existing services is a factor which may well increase the added value of high speed rail. At this time, railway freight transportation presents one of the biggest demands on the competitiveness of many industries and the economy of European countries. The introduction of freight-rail services in the Lisbon – Madrid HSR line will propose new trade markets and new commercial opportunities. The freight-rail systems could provide significant public benefits by cost-effective transportation that is vital to national economic development and sustainability, reducing truck travel congestion and highway costs, providing a critical intermodal link for a very specific international trade, and contribute to improve air quality and fuel efficiency. This paper proposes a methodology for estimating the feasibility of having cargo on HSR Lisbon-Madrid line, involving the connection to sea ports locate at the south coast of Portugal and to the logistic platforms that serve the objective. It is based on a fleet model tool capable of generating scenarios to support strategic options on the high speed rail line. This procedure will allow the identification of preferences and concerns from the most important stakeholders involved and evaluate the scenarios through different eras, improve or change their preferences and include or modify the initial scope of the project. The main idea is to prove that this investment in freight-rail services could provide a critical link in the national intermodal freight transportation system, serving not only trucking and maritime shipping industries, but also supporting the Portuguese intermodal trade and global competitiveness. (...).

**Keywords:**

High-speed rail, Freight-rail service, Lisbon-Madrid connection.

TUE 13<sup>th</sup> (15:30 - 16:45, Session E6.3) Room 1.06

ID 3060 R

**IMPROVING COST-BENEFIT ANALYSIS METHODS WITH PUBLIC ROAD INVESTMENTS**

Main Author:

**Csaba OROSZ** (*Budapest University of Technology and Economics*)

Co-author(s):

**Soroush RASHIDI** (*Budapest University of Technology and Economics*)

**Mattias JUHASZ** (*Budapest University of Technology and Economics*)

**Abstract:**

The aim of the paper is to summarize the lessons and experience collected in recent planning-, construction- and operation practice of public road investments in Hungary. A "mini-project" gave some opportunity to analyze successes and failures in this field for the period 1998-2007. There is a fundamental development compared to the methods used before the democratic changes around 1990. However some common typical mistakes happen as well. Besides the usual problems of "developed countries" [cost overrun, traffic overestimation, operation cost underestimation, double or multiple counting of benefits, etc.], other problems occur frequently. Politics [not policy!] has too big influence with many investments. Megaprojects, too expensive construction projects were implemented in a number of cases. In certain cases, extra costs should be paid to complete projects for unrealistic dates, for election purposes, for cultural or for sport events. Similar things happened in Spain or Portugal as well. The financial crisis (Credit Crunch 2008-) could have caused much less damage to Eastern European Societies if a more economical approach had been used. Typical projects were selected for the three main groups of investment: 1. Constructing new motorways/expressways. 2. Constructing new bypass roads and relief roads. 3. Implementing road rehabilitation. We made reviews concerning the original Cost-Benefit Analyses results of some selected projects. The expected and factual traffic-, investment-, maintenance- and operational characteristics have been collected and analyzed. The results are mostly forecastable, but sometimes however astonishing. Methodological failures have caused considerable loss in efficiency - especially with investment group "1". (...).

**Keywords:**

Road, CBA, Investments, Ex-post evaluation, Lessons learned.

TUE 13<sup>th</sup> (09:45 - 11:00, Session E7.1) Room 1.07

ID 1253 R

**EX POST ANALYSIS OF TENDERED BUS SERVICES IN SWEDEN NEW TITLE: PROVISION OF NON-COMMERCIAL RAILWAY SERVICES IN SWEDEN**

Main Author:

**Jan-Eric NILSSON** (VTI)

**Abstract:**

Subsidised public transport patronage in Sweden has increased with 4,6 percent per year over the last 20 years in spite of fares increasing faster than inflation. The purpose of this paper is to establish possible reasons for this development. Are there, for instance, indications of that the chosen contract format – for instance the use of gross or net cost contracts – systematically affects costs or patronage? Due to patchy and partly incomparable data, definitive conclusions are difficult to draw. The paper therefore also addresses the way in which the responsibility for public transport is organised, in particular the fact that provision of noncommercial railway services is the responsibility of some 15 regional Public Transport Authorities. The tendering processes and contracting formats are not streamlined, designs differ between PTA's and follow-up information about costs and patronage is not stored in a comprehensive way, jeopardising performance benchmarking.

**Keywords:**

Tendering, Public transport, Ex ante and ex post.

ID 2153 R

**EX-POST EVALUATION OF EXPRESSWAY INVESTMENT IN JAPAN -AN EMPIRICAL APPROACH BY USING FIXED EFFECT MODEL-**

Main Author:

**Keisuke SATO** (*Railway Technical Research Institute*)

Co-author(s):

**Atsushi KOIKE** (*Tottori University*)**Toshiyuki MONMA** (*National Institute for Land and Infrastructure Management*)**Kenji HIRAI** (*Fukken.,CO.LTD*)**Abstract:**

The fact that "the road network investment gives the economic effect to our society" is very important assumption for our decision making on expressway development. But the economic effect doesn't have the social positive effect such as increasing productivity and inducing regional development but also the social negative effect such as inducing the outflow of goods consumption from the local city to the big city. Although several examples about these phenomenon have been reported in Japan, most of them have not been recognized objectively in regional scale. In this paper, Fixed-Effect model in Panel Data approach is applied to clarify the social positive effect and the social negative effect by existing expressway development in Japan. Originally, although these kinds of models have been applied in macro economy, it is not enough to recognize the each regional economic condition change. Therefore, this paper clarifies the relationship between expressway development and regional economic change such as following viewpoints in subdivided regional scale. Consequently, this paper proposes the information contributing for the future decision making on expressway development by looking back the past period. • In the case study of Japan, although the accessibility has been improving by expressway development, there is the region which decreases the population. The labor productivity in some industrial zone has been improving by expressway development in the economic expanding period. But in the economic shrinking period, the correlation between road investments and labor productivity change don't have statistic significant. • In the case study of Chugoku-area, "Social Advantage" and "Social Disadvantage" is cleared. (...).

**Keywords:**

Panel Data Analysis, Fixed Effect Model, Expresswa.

ID 2395 R

**AN EX-POST ECONOMIC ANALYSIS OF AN INFRASTRUCTURE PROJECT IN THE PORT OF ANTWERP (BELGIUM)**

Main Author:

**Britt VERGAUWEN** (*University of Antwerp*)**Abstract:**

A social cost-benefit analysis is a good and common method to evaluate large investments in infrastructure projects in an economic way. The purpose of such an analysis is to examine whether the project will benefit to social wealth or not. If the social costs turn out to be larger than the social benefits, then the project should be abandoned. Otherwise, if social benefits are higher than social costs, it would be advisable to proceed with the infrastructure investments. However, cost-benefit analyses are based on forecast figures, which can be different from the real costs and benefits. Forecasts are subject to uncertainty and should be considered with care. Therefore, an ex-post analysis is interesting to make a comparison between forecast and real values. In this paper, an ex-post analysis will be made of the 'Deurganckdock', a Flemish infrastructure project in the port of Antwerp (Belgium). A cost-benefit analysis of this project was carried out in 1996. The paper will have a close look at this analysis, it will compare the original to the actual, ex-post costs and benefits and it will examine the most influencing variables on costs and benefits in particular, such as investment expenses and maintenance costs of the government, environmental costs, traffic forecasts, cost savings for port users, employment during construction and maintenance. Lessons can be drawn with respect to the caution that is needed when estimating ex-ante costs and benefits, and with respect to the cost and benefit elements that are of highest importance in port investment analysis. As such, the results are beneficial to academics as well as business practitioners.

**Keywords:**

Investments, Infrastructure, Cost-benefit analysis, Ex-post analysis, Deurganckdok.



TUE 13<sup>th</sup> (09:45 - 11:00, Session E7.1) Room 1.07

ID 2598 R

## **EX-POST EVALUATION OF RAILWAY INVESTMENTS IN HUNGARY**

Main Author:

**Tibor PRINCZ-JAKOVICS** (*Budapest University of Technology and Economics*)

Co-author(s):

**Tamas MATRAI** (*TeRRaCe Ltd.*)

### **Abstract:**

The aim of this paper is to investigate the possible methods for determining input data necessary for the further development of the CBA methodology. These state of the art methods are currently missing from the Hungarian analysis practices. We will first summarize the main technical and cost data related to actually implemented railway developments, rehabilitations and track constructions of the last 10 years. Sample projects are selected for three main investment types, and then presented as case studies. After carefully reviewing the preliminary Cost-Benefit Analyses of the selected projects, their planned traffic, investment, maintenance and operational properties are collected and compared to actual data. The comparison of Cost-Benefit Analyses is hindered by the fact that they were created on the basis of different guides used over the past ten years. Another problem is that the method of determining specific costs is also varied, a fact that cannot be justified by different price levels. When evaluating the effect of individual investments it can be stated that benefits are primarily due to reduction of passenger time and accident cost. By the modernization of railway lines, stations and structures the capacity of the network will increase, the safety of the railway traffic will improve. However due to those actions the Maintenance Costs and due to higher velocity the Vehicle Operating Costs will also be increasing. With the realization of the most missing network elements the number of the investments of the highest cost efficiency will be decreasing. Cost-Benefit Analyses can help professionals in selecting the most cost effective projects as priorities. The planned investments, together with the renewal and completion of the existing infrastructure, will create a modern high capacity railway network and can also contribute to the economic development of less developed regions in Hungary. (...).

### **Keywords:**

Ex-post evaluation, Traffic study, Railway investments, CBA, Hungary.

TUE 13<sup>th</sup> (09:45 - 11:00, Session E7.1) Room 1.07

ID 2655 R

## **EX-POST EVALUATION OF TRANSPORT INFRASTRUCTURE PROJECTS IN FRANCE: OLD AND NEW CONCERNS ABOUT ASSESSMENT QUALITY**

Main Author:

**David MEUNIER** (*Université Paris-Est LVMT Ecole des Ponts ParisTech*)

### **Abstract:**

France has expressed the will to develop ex-post analyses of great infrastructure projects for almost 30 years. Indeed, the « LOTI » law adopted in 1982 made compulsory ex-post analyses of very big transport infrastructure projects. These analyses were to be made 5 to 10 years after the infrastructure came into operation. Many years have passed before such ex-post studies were effectively made, and many additional years passed again before these studies were of sufficient quality and number so as to allow their analysis. The paper presents the main results of a good number of these ex-post studies, underlining what elements appear to be common and what specific considerations may explain the differences between forecasts or appraisal estimates and the actual outcomes that have been observed. Some advice about the « good practice » that would be needed to improve the quality of these ex-post studies are given, together with international comparisons that refer both to meta-analyses such as Flyvbjerg's and to focussed ex-post analyses. The analysis essentially deals with high speed lines and motorways. Officials, experts and the public do express growing concerns about transport project assessment (governance, green house gases and more generally sustainable development concerns) or more generally about public choice. The paper considers some of these concerns and tries to update and enlarge accordingly the lessons and advice extracted from the ex-post studies.

### **Keywords:**

Ex-post studies, Forecasts, LOTI, Transport infrastructure.

ID 2139 R

**ASSESSING SOCIO-ECONOMIC IMPACTS OF CROSS-BORDER TRANSPORT INFRASTRUCTURE: A CASE OF THE SECOND THAI-LAO MEKONG INTERNATIONAL BRIDGE**

Main Author:

**Piyapong JIWATTANAKULPAISARN**

**Abstract:**

One of the priority infrastructure projects viewed as an instrument to stimulate economic integration among the Greater Mekong Sub-region (GMS) countries is the construction of the Second Thai-Lao Mekong International Bridge between Mukdahan province in Northeastern Thailand and Savannakhet province in Lao PDR, which was opened to traffic in January 2007. This paper has sought to identify the socio-economic impacts of the bridge after the 3 years of its operation, focusing on the assessment of economic development benefits and negative impacts associated with the bridge in the context of Mukdahan. Recent statistics show that there has been a significant improvement in the health of the Mukdahan economy, while indicating no evidence on the widespread of HIV/AIDS and the smuggling of illegal drugs due to greater mobility at the Mukdahan-Savannakhet border. However, the data and statistical tests indicate a real change in accident risks, leading to dramatic increases in the number of accidents and injuries on major highways connecting the bridge to Mukdahan's neighbouring provinces.

**Keywords:**

Cross-border Transport Infrastructure, Mekong International Bridge, Socio-Economic Impacts, Thailand, Lao PDR.

ID 2998 R

**DO COST-OVERRUNS OF ROAD PROJECTS IMPROVE AFTER RE-ORGANIZATIONS? EMPIRICAL EVIDENCES FROM NORWAY**

Main Author:

**James ODECK** (*Department of Civil and Transport Engineering, The Norwegian University of Science*)

**Abstract:**

Reorganizations of authorities in charge of road-planning and construction projects are frequently conducted as a means of reducing cost overruns which are prevalent in transportation projects, yet the transportation literature has seldom investigated the impact of such reorganizations. This paper addresses this question using data from Norway, where the Public Roads Administration charged with the planning and building of roads was reorganized three times in the period 1993 - 2003 with the aim of reducing cost overruns. In the first period, roads were planned and built by the government; in the second period, the roads were planned and built by the government but the building and planning were separated from each other and the building department was accountable to the planning division; in the third period, the construction unit was privatized while the planning department remained a public procurer. The dataset is large and comprises 1,045 road projects, which are classified according to estimated costs. A statistical comparison of cost overruns across these organizational forms reveals several key observations: (1) the magnitudes of cost overruns reduced significantly after road building was outsourced from the government; (2) over the years, cost overruns of larger projects have been reduced while those of smaller projects have increased; and (3) delays in construction time impacts overruns negatively and have been persistent across all periods. Our conclusion is that the government now needs to focus on overruns of smaller projects and on controlling delays in construction.

**Keywords:**

Road construction, Cost estimates, Actual costs, Cost overrun, Reorganization.

TUE 13<sup>th</sup> (11:15 - 12:30, Session E7.2) Room 1.07

ID 3037 R

**MEASURING THE IMPACT OF TRANSPORT PROJECTS  
IN THE EU FRAMEWORK PROGRAMMES**

Main Author:

**Michael SCHMIDT** (ICCR)

**Abstract:**

The paper presents an assessment of the types and the scale of impacts of EU funded transport research. The results are derived from the ongoing SITPRO Plus project, funded by the 7th EU Framework Programme. They are based on a survey of all of the approximately 1000 individual transport projects in the 5th and 6th Framework Programme (FP5 and FP6) and an in-depth study of a sample of 120 of those projects. For this purpose a combination of multiple methods are used, including an internet questionnaire, desk review of project reports, and interviews with project coordinators, European Commission officials and users of the research results. This paper conceptualizes impacts not as a static measure but rather in the form of impact pathways. This is in recognition of the facts that most of the impacts of FP5 and FP6 projects have yet to materialize, and that impacts will occur over a long time span. The research impact pathway provides a framework for understanding how impacts can be expected to occur. It has the following distinct stages: 1. production of research outputs – creation of the “product”; 2. dissemination of outputs – raising the level of awareness about the product; 3. exploitation of outputs – by key intermediaries or end-users of the research; and - much longer term; 4. end impacts on society – on consumers and producers. Having explored the expected impact pathway of research, the paper proceeds to an examination of what is occurring in practice.

**Keywords:**

Transport research, Evaluation, Impact assessment.

TUE 13<sup>th</sup> (11:15 - 12:30, Session E7.2) Room 1.07

ID 3372 R\*

**FROM THE BORDER TO THE CHART: FREIGHT  
SERVICES IN THE PORTUGUESE BALANCE OF  
PAYMENTS STATISTICS**

Main Author:

**João COELHO** (Banco de Portugal)

Co-author(s):

**João VEIGA** (Banco de Portugal)

**André FERREIRA** (Banco de Portugal)

**Abstract:**

As part of the globalisation process, an increasingly integrated and complex global system of production and exchange has emerged. The reduction of restrictions on trade across borders contributed to the increase of movements of resources and goods between countries. In fact, international trade has grown considerably in the last two decades, not only on consumption but also on intermediate goods. The context of globalisation poses great challenges to statisticians, a multiplicity of goods and services are traded in several markets with a variety of companies and using a wide range of modes of transport. Larger distances became closer at lower costs. Against this background, among other items, the Balance of Payments (BoP) records the economic transactions on merchandise freight services undertaken between resident and non-resident companies. The aim of this paper is: i) to present the methodology followed by the Portuguese Central Bank for the data collection and compilation of the merchandise transport services in the BoP statistics, ii) to promote the use of this methodology and also iii) to contribute to a short description of part of the transport activity in Portugal. The main results are presented broken down by mode of transport (sea, air, road and others) and emphasis is given to "fobisation" method used to convert the invoice value of the imported goods from cif to fob basis, obtaining the underlying services (transport and insurance) from import values. Finally, future plans to improve this method according to novel international recommendations are also presented.

**Keywords:**

International transport services, Balance of Payments statistics, Cif-fob adjustment.

ID 1192 R

**ON THE EVALUATION OF THE OPORTO PUBLIC TRANSPORTATION NETWORK (STCP)**

Main Author:

**Maria DO CARMO GUEDES** (*Faculdade de Ciências Universidade do Porto*)

Co-author(s):

**Sérgio SANTIAGO** (*STCP, SA*)**Natália OLIVEIRA** (*STCP, SA*)**Georgi SMIRNOV** (*Faculdade de Ciências Universidade do Porto*)**Abstract:**

A public transportation network serves in adequate way a population if it evolves in time following the existent social reality. Changes made in order to improve service must be analyzed and evaluated. The introduction of modern technology to validate the fare card allowed a quick access to important, although incomplete, data. A data basis with the validation information can be used to construct an origin-destination (OD) matrix which can be used for a service quality analysis. Here it is presented a computer based methodology to evaluate service quality criteria considering what might be interesting for the user. The quality analysis philosophy is the following. First, on the base of automatically gathered data reconstruct the origin-destination (OD) matrix which contains information concerning the number of passengers traveling between zones of a certain region. The OD matrix is used to calculate some criteria characterizing the transportation network quality, such as traveling times, waiting times at a stop or transport occupation. The reconstructed OD matrix always contains errors, which cause errors in the criteria values evaluation. How significant are these errors? A methodology based on statistical analysis for validating the criteria, i.e. for estimating the criteria robustness, is being implemented at the urban bus transport system of Oporto, STCP, allowing the evaluation of the transportation network quality under a number of criteria and guaranteeing rigorous evaluation.

**Keywords:**

Origin-destination matrix, Transportation network quality evaluation, Computational analysis.

ID 1239 R

**ASSESSMENT OF THE INFLUENCE DUE TO A NEW METRO LINE ON THE PROMOTION OF BUSINESS ACTIVITIES AROUND THE STATIONS: A CASE STUDY OF METROSUR IN MADRID**

Main Author:

**Lucía MEJÍA DORANTES** (*TRANSyT. Centro de Investigación del Transporte*)

Co-author(s):

**Jose MANUEL VASSALLO MAGRO** (*Departamento de Transportes. ETSI Caminos Canales y Puertos. UPM*)**Antonio PAEZ** (*McMaster University*)**Abstract:**

The construction of a new public transportation infrastructure in a metropolitan area has a great impact, in many different ways, on the neighborhoods surrounding the stations. The objective of this paper is to evaluate the influence that the construction of a new metro line has on the promotion of businesses (shops, offices and so on) near the stations. To that end, we have analyzed, as a case study, the construction of the new metro line, "Metrosur", in Alcorcon, a municipality at the south east of Madrid. The analysis was carried out through two different approaches: on one hand, we used a "point pattern analysis" to estimate kernel surfaces to analyze the variation in the density of business activities during a period of ten years, from the conception of the line to four years after the line entered into operation. In the second approach, we calibrated a binary logit model to assess the probability that each location has to hold any economic activity taking into account its distance to Metrosur and other location characteristics. We found that the distance to the stations positively impacts the location of a business. Moreover, the paper demonstrates that agglomeration plays an important role in the collocation of economic activities.

**Keywords:**

Metrosur, Business activities, Kernel analysis, Binary logit model, Agglomeration.

TUE 13<sup>th</sup> (14:00 - 15:15, Session E7.3) Room 1.07

ID 1851 R

**LIMOBEL - LONG-RUN IMPACTS OF POLICY PACKAGES ON MOBILITY IN BELGIUM: DEVELOPMENT OF A MODELLING TOOL**

Main Author:

**Inge MAYERES** (VITO (Flemish Institute of Technological Research))

Co-author(s):

**Davy DEWAELE** (FUCaM (Facultés Universitaires Catholiques de Mons))

**Bart JOURQUIN** (Louvain School of Management)

**Ina DE VLIAGER** (VITO)

**Liesbeth SCHROOTEN** (VITO)

**Hans MICHIELS** (VITO)

**Marie VANDRESSE** (Federal Planning Bureau)

**Alex VAN STEENBERGEN** (Federal Planning Bureau)

**Abstract:**

The paper describes a new modelling tool that is currently being developed in the framework of the LIMOBEL project in order to analyse the long-run mobility impacts of policy packages in Belgium. Its aim is to make long-term projections of transport in Belgium and to make a social cost benefit analysis of various policy measures, including pricing instruments, infrastructure changes and regulation. In the modelling tool three existing models are being developed further and linked to each other. The first model is the PLANET2 model, a model for long-term transport projections. It allows for the integration of the two-way interactions between the economy and transport. The second model is the Nodus model, which is being extended in order to cover both passenger and freight transport. E-motion, the third model, is an environmental impact assessment model that consists of an emission model for road, railway and shipping traffic and of an environmental cost model.

**Keywords:**

Long-term transport model, Transport network, Environmental costs, Cost-benefit analysis.

TUE 13<sup>th</sup> (15:30 - 16:45, Session E8.1) Room 1.07

ID 1070 R

**INNOVATIVE PERSPECTIVE OF TRANSPORT AND LOGISTICS**

Main Author:

**Jan BURNEWICZ** (University of Gdansk)

Co-author(s):

**Przemyslaw BORKOWSKI** (University of Gdansk)

**Abstract:**

The need to create and implement innovation in transport results from the continuing low efficiency of many of its technical elements and processes, leading to unsatisfactory levels of productivity, capacity and reliability, waste of time and resources, and higher operating costs. The need for innovation exists both within entire transport systems (of a country or city) as well as within individual modes or forms of transport. Transport innovation processes are the main driving force behind technological progress and increase in service productivity, but they are accompanied by high risk. An innovation-oriented transport company takes a risk that innovations introduced may become a failure, or rejected by the market, or their cost will be higher than originally planned. To main directions of the innovative development of present transport systems belong: intelligent transport system management, carbon neutral transport solutions, alternative fuels and sources of energy, innovative ideas for reducing transport costs, city logistics ideas, new mobility strategies, liveability solutions. In every branch of transport there exist different conditions for the initiation and spreadings of innovations.

**Keywords:**

Alternative fuels, Disruptive technology, Electric cars, Innovation, Innovation risk, Innovative transport, New generation transport infrastructure, Transport development,

TUE 13<sup>th</sup> (15:30 - 16:45, Session E8.1) Room 1.07

ID 1113 R

## **A TRANSPORT SCENARIO FOR EUROPE UNTIL 2050 IN A 2-DEGREE WORLD**

Main Author:

**Wolfgang SCHADE** (*Fraunhofer Institute Systems and Innovation Research (ISI)*)

Co-author(s):

**Nicki HELFRICH** (*Fraunhofer Institute Systems and Innovation Research (ISI)*)

**Anja PETERS** (*Fraunhofer Institute for System and Innovation Research (ISI)*)

### **Abstract:**

In its 4th Assessment Report the Intergovernmental Panel on Climate Change (IPCC) concludes that the risk of climate change with temperature increases of 4-5°C until 2100 has grown substantially and recommends strong actions to curb greenhouse gas emissions (GHG) until 2020. Though world leaders struggle to define a short-term Post-Kyoto policy to reach this goal, they agree that until 2050 the industrialised countries should reduce their GHG emissions by -70% to -80% compared with 1990 (see e.g. EC Communication COM(2009)39, US President Obama and G8 statements). Transport in Europe is currently emitting about 23% of all GHG and 27% of CO<sub>2</sub>. Thus if transport would not at all reduce GHG emissions until 2050 it would mean that any other European sector (e.g. industry, services, housing, energy conversion) would have to reduce to zero GHG emission. Obviously, the burden of GHG reductions has to be shared between the sectors, in particular as transport disposes of significant reduction options as well. In this paper three transport scenarios for the EU27 until 2050 are presented: a Reference Scenario and two so-called 2-degree scenarios. The latter scenarios are embedded into the larger framework of a global GHG emission pathway and a European emission pathway that would achieve to limit global average temperature increase to 2°C (or CO<sub>2</sub> eq. concentrations of 450/400 ppm). This means the transport scenario considers both the European share on the global pathway and the transport share on the European pathway. (...).

### **Keywords:**

Transport scenario, Climate policy, 2050, Europe, -80% CO<sub>2</sub>, Integrated energy and transport scenario, Impact assessment.

TUE 13<sup>th</sup> (15:30 - 16:45, Session E8.1) Room 1.07

ID 1402 R

## **FUEL CONSTRAINTS ON NEW ZEALAND ECONOMY AND FREIGHT TRANSPORT: ANALYSING IMPACTS AND MITIGATION OPTIONS**

Main Author:

**Aline LANG** (*University of Canterbury*)

Co-author(s):

**Andre DANTAS** (*University of Canterbury*)

**Julien MOREL** (*Polytechnic Clermont-Ferrand*)

### **Abstract:**

In the past few years, there has been convincing evidence of future fuel constraints due to supply limitations. The failure to address and plan accordingly to the seriousness of the issue might drastically impact on various national economies around the world. Nevertheless, there is limited knowledge about the impacts of reduced fuel availability to the economy and freight transport, which is essentially overlooked in studies, forecasts and planning. This paper presents the economic analysis of future fuel availability scenarios using Supply Constraint Input-Output models. The New Zealand economy is examined and more specifically the freight transport sector is studied. The paper also investigates potential mitigation options that could be adopted in terms of changes in technology, infrastructure and policy actions to promote sustainable freight transport. The results, achieved by the comparison of different scenarios of fuel constraints and economic growth, indicate that if no actions were taken to mitigate impacts of fuel constraints, and if they persist for several years, the total impacts on the fuel, freight transport and all other sectors would increase significantly and greatly affect the New Zealand economy. In this backdrop, technological mitigation options to reduce impacts of fuel constraints were investigated considering New Zealand's economy and geography. The analysis revealed that improvements of the existing technologies are necessary to provide a positive balance of saved energy.

### **Keywords:**

Fuel constraints, Impacts, Economy, Freight transport.

TUE 13<sup>th</sup> (15:30 - 16:45, Session E8.1) Room 1.07

ID 1717 R

**A LONG-TERM REGIONAL COMPUTABLE GENERAL EQUILIBRIUM FOCUSED ON TRANSPORT ISSUES IN BELGIUM**

Main Author:

**Inge MAYERES** (*VITO (Flemish Institute of Technological Research)*)

Co-author(s):

**Marie VANDRESSE** (*Federal Planning Bureau*)  
**Alex VAN STEENBERGEN** (*Federal Planning Bureau*)

**Abstract:**

The paper describes the set-up of a regional computable general equilibrium model for Belgium and its three regions. The CGE approach allows to model the two-way interactions between transport and the economy in general. The aim is determine both the implications of economic developments on transport use, and the indirect impacts of changes in the transport sector on the economic system and the location of activities, taking into account agglomeration effects. The model will be used to calculate the full welfare impacts of policy changes, taking into account the impacts on all economic agents and not only on the transport sector. The inclusion of different household groups makes it possible to determine the distributional impacts of policies.

**Keywords:**

Regional computable general equilibrium model,  
Agglomeration effects, Transport externalities,  
Distributional analysis.

TUE 13<sup>th</sup> (15:30 - 16:45, Session E8.1) Room 1.07

ID 2006 R

**NARRATIVE MODELLING: CONSTRUCTING PATHWAYS TO THE FUTURE**

Main Author:

**Paul TIMMS** (*ITS, University of Leeds*)

Co-author(s):

**David WATLING** (*ITS, University of Leeds*)

**Abstract:**

This paper introduces a new concept, narrative modelling, in transport modelling and provides a mathematical framework for the operationalisation of this concept. It describes how the purpose of narrative models is to construct alternative pathways to the future in situations which involve a high level of change, either in terms of individual behaviour or in terms of social context. In order to justify the need for a new type of modelling, the paper explains the theoretical defects of traditional transport models in terms of representing such change. In particular, it is argued that traditional transport modelling, with its base in positivist and neo-positivist philosophies of science, takes an –essentialist stance in assuming that there is an essential behaviour of individuals which is both observable and constant over time. Such essentialist assumptions are highly pragmatic for predicting marginal and short-term changes in the transport system, and form the scientific basis of the many computer modelling packages currently in use throughout the world. However, their deficiencies are exposed in situations in which there is an interest in (or indeed a normative requirement for) deep structural change in individual and social behaviour, as is for example required in order to reduce the contribution of transport emissions to global warming.

**Keywords:**

Dynamic transport modelling, Visions, Philosophy, Long term futures, Essentialism.

TUE 13<sup>th</sup> (17:00 - 18:15, Session E8.2) Room 1.07

ID 1069 R

### **A PROPOSED EXTRA INTERNATIONAL AIR TRANSPORT CORRIDOR ALONG THE WORLD'S EQUATORIAL BELT**

Main Author:

**Rockley BOOTHROYD** (*None Retired Professional Engineer*)

#### **Abstract:**

The combination of some recently developed technologies make possible the concept of an inexpensive, environmentally neutral form of intercontinental civil aviation. The main disadvantage of the proposed system is that it would be about 3 times slower than current methods. It is also limited to an air corridor within the world's equatorial belt. It is considered that the concept merits consideration for the air freight market in the first instance with the ultimate intention of providing much cheaper air transport for passengers. The concept originated from an inquiry into the possible use of underutilised flat land in airports which could conceivably also be used for growing algae. Growing algae is one of the most promising approaches we have for finding alternative liquid fuels to replace liquid fossil fuels. The proposed airport-based 'race-course' algae ponds could also be used to cable-launch 100 tonne seaplanes to 1000 m altitude using a development of the Supacat winch used by today's gliding clubs. At a height of 1000m, a suitably designed aircraft would be able to use extensive bands of cumulus clouds for 'cloud hopping'. Geostationary and 'polar' satellites provide real-time data of cloud cover worldwide. By equipping an aircraft with 94GHz doppler radar and a longer wave-length radar, together with instrumentation in the optical range, a pilot can select the most suitable clouds to gain height and collect water. This water is needed to produce the small quantity of supplementary 'hydrogen on demand' for the aircraft. This radar system would allow a pilot to assess and choose local clouds for spatial location of updraft, downdraft, turbulence and any precipitation. (...).

#### **Keywords:**

Air corridor, Cumulus clouds, Meteorological radar, Satellite cloud cover, Sustainable energy, Civil aviation.

TUE 13<sup>th</sup> (17:00 - 18:15, Session E8.2) Room 1.07

ID 1342 R

### **IMPROVING THE VALUE OF TRANSPORT RESEARCH USING ADVANCED WEB TOOLS TO IMPROVE RESEARCH DISSEMINATION**

Main Author:

**Graham CURRIE** (*Institute of Transport Studies, Monash University*)

Co-author(s):

**Alexa DELBOSC** (*Institute of Transport Studies, Monash University*)

**Pauline FORBES** (*Institute of Transport Studies, Monash University*)

#### **Abstract:**

This paper aims to measure the impact of a thematic digital research repository on spreading new knowledge research into the professional transport community using user survey findings for the SORT (Social Research in Transport) Clearinghouse ([www.sortclearinghouse.info](http://www.sortclearinghouse.info)) website and a review of previous research. Research dissemination, the circulation of research findings, has been identified as the easiest way to distribute new knowledge and thematic research clearinghouses such as SORT have been seen as a means to „reinvigorate professional values“ by providing quick access to quality research whilst also maintaining copyright protections to authors and publishers. SORT was developed out of the concern that social research findings in transport were not reaching the wider non-academic professional community. Some 1,777 separate users from 69 countries accessed the site on 3,282 visits in the first 11 months of 2009 for an average visit length of 5 minutes. The user survey of SORT identified that policy/practitioners and consultants were the primary users of the web site (66%) with academics (27%). Most site users apply the research content accessed from SORT for „conceptual“ applications (i.e. to keep informed). A very high share of users cite research evidence in their own published work (27% of academics) supporting previous research suggesting that research clearinghouses add much value to authors, journal editors and publishers. „Instrumental“ use of research (to implement a transport plan, policy or service) represented a minority of uses (20% on average) nevertheless this is considered quite a reasonable outcome from a targeted dissemination approach.. (...).

#### **Keywords:**

Transport research, Research dissemination, Research clearinghouse, Web tools, Research effectiveness.



TUE 13<sup>th</sup> (17:00 - 18:15, Session E8.2) Room 1.07

ID 1499 R

**IMPACT OF THE WORLD ECONOMIC CRISIS ON  
LONG-TERM TRAFFIC GROWTH**

Main Author:

**Werner ROTHENGATTER** (*University of Karlsruhe (TH)*)

**Abstract:**

The World Economic Crisis started in the financial sector and then affected international trade, production and finally employment. Countries with high international trade volume were hit most badly, as for instance Japan or Germany. When it comes to analyze the long-term impacts of the crisis on economic development and transport very simple and highly sophisticated approaches have been presented as well. A most simple hypothesis is based on the expectation that the crisis will only interrupt the development trends, and some years later the trajectories of economic and transport development will bounce back to the old trend lines. Under such optimistic assumptions the OECD has followed that the crisis might only cause a time delay of five years for the expected traffic development. Retrenchment scenarios construct a contrasting picture, which assumes a break of trends in the globalization process and a further decline of growth rates compared with the old trends. Putting both impacts together, the breakdown during the crisis and the reduced growth rates after, leads to a very pessimistic vision for traffic development - while the chances to achieve environmental goals seem to improve. Most experts agree that the real development will lie somewhere in between the optimistic and pessimistic scenarios. A return to the formerly expected economic growth profiles can hardly be expected under the old economic structures. In this paper we therefore construct a consistent economic environment for a positive development prospect, which is based on the assumption of particular technological and behavioral changes. We call it the Schumpeter scenario in memory of Joseph A. Schumpeter who is the founder of the evolutionary economic theory. (...).

**Keywords:**

Possible paths of economic recovery, Structural c.

TUE 13<sup>th</sup> (17:00 - 18:15, Session E8.2) Room 1.07

ID 2503 R

**PASSENGER MOBILITY AND CLIMATE CONSTRAINTS  
IN FRANCE**

Main Author:

**Yves CROZET** (*LET Lyon*)

Co-author(s):

**Hector LOPEZ-RUIZ** (*Laboratoire d'Economie des Transports*)

**Abstract:**

Today, numerous works conclude that transport seems to be completely coupled to economic and export/import growth. Therefore, as a direct consequence of economic development, transport sits today as one of the major final energy consumers and as one of the most important sources of carbon dioxide (CO<sub>2</sub>) emissions. Consequently, this situation of continuous increase in transport clearly poses an environmental problem, especially in the current situation where even though fuel prices have gone up, fuel consumption has stayed high because bigger cars are being bought. Thus, modal shifts towards public transport have been accompanied by reductions in average distances being travelled by cars but with higher consumptions. In this state of matters, a number of exploratory long term transport scenarios have been developed using the TILT (Transport Issues in the Long Term) model. These scenarios are focused on the French economy in order to offer insight on relationships existing between new technologies, market trends, public policy and infrastructure investments. This paper explores how a continued market trend in the vehicle sector is not viable in the long-term future if observed through infrastructure investment needs.

**Keywords:**

Greenhouse gas, Long term, Scenario, Transport, Sustainable development.

ID 2191 R

**A COMPARATIVE ANALYSIS OF METROPOLITAN POLY-CENTRIC EMPLOYMENT GROWTH AND ITS IMPACTS ON COMMUTER TRAVEL PATTERNS**

Main Author:

**Pelin ALPKOKIN** (*Istanbul Technical University*)

Co-author(s):

**John ANDREW BLACK** (*University of New South Wales*)**Yoshitsugu HAYASHI** (*Nagoya University*)**Abstract:**

In the current debate on urbanization, one concern is about the process of urban development resulting in the re-location of firms outside the CBD, in particular to emerging employment centers. The non-mono-centric urban form of employment location, variously termed poly-centric or multi-centric, is defined as a decentralized, but clustered, formation of work agglomerations in sub-centers rather than substantial employment concentrating in one central business district. Such poly-centric urban dynamics have been extensively explored in North American cities, and in some European cities, but this poly-centric employment growth and its impacts on trip profiles appear poorly understood in many developing countries. In this paper, we aim to fill this research gap with illustrative case study findings. Our comparative research covers six case areas from developed and growing metropolitan areas: Bangalore, Istanbul, Jakarta, Shanghai, Sydney, and Tokyo. In selecting suitable case studies we searched for diversity in terms of population size, urban planning regimes, whether the dominant urban spatial structure was centralized or poly-centric, and the broad stage of economic development. We review the past and present land-use and transport master plans to find answers to the research questions of: what are the urban location and transport policy objectives, measures and programs that underpin a decentralized concentration urban configuration?; and how successful have been non-mono-centric policy making? We also apply a methodology to empirically explore how such non-mono-centric dynamics influence the spatial re-structuring of employment cluster formation outside the old central business; and we further analyze the impacts of poly-centric employment agglomerations on trip making, particularly on commuting characteristics. (...).

**Keywords:**

Poly-centric, Sub-centers, Employment Clusters, Developing Cities.

ID 2243 R

**EXCESS TRAVEL IN NON-COMMUTING TRIPS: A REGIONAL CASE STUDY**

Main Author:

**Kobe BOUSSAUW** (*Ghent University - Geography Department*)

Co-author(s):

**Frank WITLOX** (*Ghent University*)**Abstract:**

In recent decades, excess commuting has become a major study topic within the discipline of transportation research (Ma and Banister, 2006). Excess commuting is that share of the commute flow (in terms of physical distance or time distance) that cannot be attributed to the spatial separation between job locations and residential locations of employees. In recent years several authors advanced a spatially disaggregated approach as a tool for studying geographic variations in spatial proximity. When this type of research is conducted on a regional scale, it may contribute significantly to the sustainability of proposed land use developments, and to the detection of regions that are considered vulnerable because of their extreme remoteness. To our knowledge, this research framework has only been applied to study home-to-work commuting. Recently, Horner and O'Kelly (2007) suggested that the study of excess travel for non-professional, but more or less, daily trips could become an interesting extension to this. Examples are innumerable: bringing children to day-care or school, doing the groceries, or going to sports or hobby clubs. The study of non-commuting trips, however, entails considerable methodological problems. For instance the capacity of many of the mentioned facilities is fluid, at least in comparison with employment centres that are characterized by a relatively constant number of jobs. Also, even if many non-professional trips are made frequently, they are not made on a daily basis. Moreover, there are often multiple destinations for one single travel purpose, as is, for example, obviously the case for shopping trips. Based on the spatial distribution of some quasi-daily destination classes and reported trip distances from the Travel Behaviour Survey in Flanders, Belgium (OVG) we want to examine regional variations in excess travel in non-professional trips. (...).

**Keywords:**

Excess commuting, Spatial proximity, Sustainable spatial development, Flanders.

ID 2617 R

**AN URBANISM ORIENTED TOWARDS RAIL IN GERMANY AND FRANCE**

Main Author:

**Gebhard WULFHORST** (*Technische Universität München*)

Co-author(s):

**Hélène PRETSCH** (*Planungsverband Ballungsraum Frankfurt/Rhein-Main*)**Sabina MORKISZ** (*Technische Universität München*)**Alain L'HOSTIS** (*LVMT-INRETS*)**Thomas LEYSENS** (*Université Paris-Est, LVMT, INRETS*)**Vaclav STRANSKY** (*Université Paris-Est, LVMT*)**Abstract:**

Transit oriented development has become a topic of high interest in recent years both for researchers and for practitioners. The French-German project Bahn.Ville 2 has the objective of testing the principles of an urbanism orientated towards rail by means of an implementation on two regional railway lines (St. Etienne – Firminy, Lyon metropolitan region as well as Taunusbahn, Frankfurt/Rhein-Main region). This paper is presenting selected results of this implementation on - innovations in regional planning instruments in France (Schéma de Cohérence Territoriale) and Germany (Regionaler Flächennutzungsplan) and their respective impact on a better integration of land-use and transport, - specific observations on neighbourhood mobility in the station surrounding and propositions for high quality walking environments as well as - the potential of an observation tool designed to support public intervention on landuse and transport around stations. The results constitute three original contributions of the Bahn.Ville 2 project supporting sustainable mobility by an urbanism orientated towards rail.

**Keywords:**

Transit-oriented development, Regional planning instruments, Local neighbourhood mobility, Processes of implementation.

ID 2692 R

**HOW URBAN STRUCTURE CONSTRAINTS SUSTAINABLE MOBILITY CHOICES: COMPARISON OF COPENHAGEN AND OPORTO**

Main Author:

**Cecília SILVA** (*Faculty of Engineering of Oporto University*)

Co-author(s):

**Paulo PINHO** (*Faculty of Engineering of Oporto University*)**José REIS** (*Faculty of Engineering of Oporto University*)**Abstract:**

Urban passenger mobility has undergone significant changes over the past few decades with travel patterns becoming increasingly complex and difficult to predict and manage. From the variety of constraints and motivations influencing travel behaviour, land use and transport systems are believed to offer the baseline exogenous conditions steering travel patterns. Land use raises the need to move in order to participate in disperse urban activities, while the transport system provides the conditions to satisfy these mobility needs. There is an extensive discussion in the literature on the interaction of land use and transport and of their combined influence on mobility patterns. This vast but somehow disarticulated research field has been, so far, unable to built consensus. A number of authors have found inconclusive results while others have found statistically relevant influence within particular circumstances. Several authors have discussed methodological issues within this research field. There is clearly a need for further research in order to shed light on the intricate web of forces between urban structure and travel behaviour to encourage practical implementation of integrated land use and transport policies. This paper discusses the influence of different metropolitan structures on the mobility choices available to their inhabitants. The Structural Accessibility Layer (SAL), developed at our research centre, analyses current land use and transport conditions of two distinct metropolitan areas – Greater Copenhagen and Greater Oporto. This analysis reveals the sustainability of mobility choices made available by each urban structure. Our results also provide evidence of the influence of land use and transport on mobility patterns. (...).

**Keywords:**

Urban structure, Mobility choices, Diversity, Density.

MON 12<sup>th</sup> (11:15 - 12:30, Session F1.1) Room 1.08

ID 2768 R

**DENSITY AND MIXED LAND USE FOR SUSTAINABLE URBAN DEVELOPMENT**

Main Author:

**Nigro MARIALISA** (*Roma Tre University*)

Co-author(s):

**Marco PETRELLI** (*Roma Tre University*)

**Stefano GORI** (*Roma Tre University*)

**Abstract:**

In the last years important changes on urban features strongly modified the quantity and the quality of mobility system: the automobile is considered the only transport mode and the use of transit became more and more unused with strong impacts on environment and sustainability. To develop sustainable urban areas, oriented on transit and on other transport modes such as pedestrian and bicycle, different elements, criteria and policies are analyzed (trips demand concentration, adequate transit network design criteria to improve the "door-to-door" travel times, mixed land use, etc.) and their impact in terms of demand modal split are tested for the case study of the city of Rome. The test results are used for some considerations about the importance of the interaction between land use policy and transportation planning.

**Keywords:**

Sustainable mobility, Land use, Urban transport, Public transport.

MON 12<sup>th</sup> (14:00 - 15:15, Session F1.2) Room 1.08

ID 1986 R

**ENABLING SUSTAINABLE MOBILITIES**

Main Author:

**Robin HICKMAN** (*Transport Studies Unit, University of Oxford*)

**Abstract:**

This paper re-examines the role of urban planning in enabling sustainable mobility. It pulls together a number of developing areas of work, assembling and interpreting the existing evidence on the influence of urban structure at different spatial scales on travel patterns, and the inter-relationships with socio-economic, attitudinal and other contextual characteristics. It includes data analysis using the Great Britain National Travel Survey. The commentary is developed in the light of the developing mobilities literature – covering the social, cultural and experiential dimensions of travel. The end objective in further integrating settlement structure and transport is to move beyond the current discourse, to enable and achieve more sustainable travel patterns, whilst creating attractive areas for living. The development location and transport investment decisions made today are critical; they will influence travel patterns for many years to come. However, the important caveat made is that the integrated planning and transport topic needs to take a much wider perspective, set within a wider understanding of the motivations for mobilities. The paper is placed within the context of climate change, and the need to respond more effectively to strategic policy objectives. It concludes by considering some possible future directions for transport and urban planning, in theory and practice.

**Keywords:**

Urban structure travel mobilities.

ID 1297 R

**DENSITY AND SUSTAINABLE TRANSPORT IN US, CANADIAN AND AUSTRALIAN CITIES: ANOTHER LOOK AT THE DATA**

Main Author:

**Paul MEES** (*Royal Melbourne Institute of Technology*)**Abstract:**

Growing international concern about climate change and insecure oil supplies has refocused attention on the environmental sustainability of urban transport, and the relationship between transport and urban form. The suite of policies known as the 'compact city', or 'smart growth', has emerged as the most popular prescription for reducing automobile dependence. The evidentiary base for the compact city draws heavily on the work of the Australian researchers Peter Newman and Jeffrey Kenworthy, who have compared population density and automobile use in a range of metropolitan areas across five continents. Newman and Kenworthy's conclusions, expressed in the form of a much-reproduced hyperbola, are that density is strongly related to automobile use, with the latter increasing exponentially once urban densities fall below approximately 30 persons per hectare. These conclusions have attracted criticism, particularly from researchers in the United States of America, who argue that density is often a proxy for low incomes (since poorer urban Americans are concentrated in inner areas), and that Americans have shown a marked preference for spacious suburban housing. However, Australian and Canadian cities, while similar in many respects to those of the United States, show significant differences in these key areas: inner-city incomes are not lower than the metropolitan average (indeed, in Australia they are higher), and there is substantial growth in demand for higher-density housing forms. This paper re-examines the data on transport and density in US, Canadian and Australian cities, using census data on mode share for the journey to work, and on the density of 'urbanised areas'. (...).

**Keywords:**

Density, Public transport, Sustainable transport,

ID 2108 R

**EVALUATION OF DEVELOPMENT SCENARIOS TOWARDS SUSTAINABLE URBAN TRANSPORTATION: A CASE STUDY OF PUNE**

Main Author:

**K. V. RAO** (*IIT Bombay*)

Co-author(s):

**Sandhya NADIMPALLI** (*IIT-Bombay*)**Balakrishna KANEMADUGU****Abstract:**

As cities grow exponentially, an effective and sustainable urban transport system for people and goods is a prerequisite for sustainable economic growth. Motor vehicle ownership is growing faster than population, with growth continuing to accelerate even during the height of the economic crisis. However, urban transport systems in most cities are underdeveloped and their transport capacity is insufficient. Literature indicates that the geographic distribution of jobs and population is more crucial in creating drastic changes in travel pattern. Broader definition of sustainability which tends to favour integrated solutions, including improved travel choices, economic incentives, land use changes as well as technological innovation has been studied. Planning for sustainable urban development focuses on improvements in all of these characteristics of the functioning of cities. Land Use initiatives represent a potentially effective tool for coping with the kinds of mobility patterns. An integrated evaluation framework is suggested to incorporate a wide range of sustainability issues into the design process. Pune Metropolitan Area is taken as the study area. The development plan for 2007-2027 is prepared by Municipal Corporation. This work evaluates the impacts of various development scenarios proposed in the development plan on the Transportation infrastructure. The evaluation will be carried out considering the concepts of sustainability by employing the conventional Transportation planning model. Equity issues are addressed in the study by segregating the population into three groups namely: Car owning group, Two-wheeler owning group and no vehicle group based on vehicle ownership. (...).

**Keywords:**

Sustainable urban transportation, Land-use, Development scenarios, Sustainability indices.

ID 2397 R

**THE SPANISH TERRITORIAL CONTEXT : AN ANALYSIS IN LIGHT OF THE EUROPEAN URBAN SUSTAINABLE MOBILITY PLANS .DOC**

Main Author:

**María LÓPEZ-LAMBAS** (*Universidad Politécnica de Madrid*)**Abstract:**

The current land use patterns (low-density, sprawl, etc.) and their impacts on transport and mobility force to the implementation of Urban Sustainable Mobility Plans (USMP) as a strategy to achieve urban sustainable mobility. Those plans already existing in some European countries have been recently implemented in Spain; however, since the core of those strategies lays on the territorial and administrative structure of each country, this is the main aspect that the authors have examined, together with the impact of different policy documents from the European Commission (Action Plan on Urban Mobility, Urban Environment Strategy, etc.) So, in this paper the authors have analyzed the territorial and administrative contexts from countries that could be considered as pioneers in the adoption of USMP, and the role that both mobility and transport issues play on them (if so) and, hence, into the barriers and constraints to implement those plans. Given their similar government structure Italy and Spain are the cases finally selected to make a comparison. To do so, the legal competencies on land use and mobility of the different levels of authorities, have been analyzed showing, in the Spanish case at least, the lack of integration of the USMP in the land use planning, with a remarkable exception: the Law on mobility of the Catalanian regional government. The Italian case, being different since the integration is well defined in the legal realm, fails into practice due in part to the many sectoral planning regulations. As main conclusions, the authors outline the most significant barriers for the implementation of USMP, the need of a compulsory framework to develop integrated land use/transport strategies, the problems that the so called subsidiarity principle entails since this process should be leaded by the highest institutional levels (European Union and National Governments), and some feasible actions that could be taken from the different administrative levels to overcome these constraints. (...).

**Keywords:**

Sustainable urban mobility, Land use planning, Town planning regulations, Territorial integration.

ID 2966 R

**TRUST IN THE PROCESS: INTER-ACTOR TRUST FOR COORDINATED PUBLIC TRANSPORT – LAND USE PLANNING**

Main Author:

**Andrew SWITZER** (*Universiteit van Amsterdam*)

Co-author(s):

**Luca BERTOLINI** (*University of Amsterdam*)**Leonie JANSSEN-JANSEN** (*Universiteit van Amsterdam*)**Abstract:**

Inter-actor trust (or the absence of it) plays an important role in complex planning processes. The concept of trust has received much attention in management science, but surprisingly little in planning literature despite the growing similarities between the two and its increasing importance in ensuring coordination between multiple, heterogeneous actors in delivering developments. This paper aims to explore the role of trust on coordination in transport oriented developments processes, based on literature research and two empirical case studies, the Dutch Stedenbaan programme and the Big Move and Places to Grow plans in Toronto Canada. The results of the research suggest that in both planning contexts trust is an important element in achieving successful outcomes. This said, both institutional contexts have pronounced impacts on the ability for trust to take root. Trust was often identified at a personal level which can bridge institutional differences between organisations, but that can be hindered by a history of distrust between organisations. As in any successful relationship the building of trust between stakeholders seems dependent on a commitment to building a good relationship early and openness throughout. Breaks in trust, so long they are not fatal, can lead to a stronger trust relationship in the long term.

**Keywords:**

Trust, Regional Planning, Transport-Land Use Integration.

ID 1405 R

**RIDERSHIP AND LAND MARKET IMPACTS OF BRT SERVICES: COMPARATIVE EXPERIENCES IN LOS ANGELES, CALIFORNIA AND SEOUL, KOREA**

Main Author:

**Robert CERVERO** (*University of California, Berkeley*)**Abstract:**

Bus Rapid Transit (BRT) has gained popularity as a cost-effective alternative to expensive metro investments, however relatively little is known about its impacts on land-use changes and land values as well as factors that influence ridership. This paper addresses these questions by modeling empirical relationships for BRT services in Los Angeles, California. A direct ridership model is estimated to probe the influences of transit service and neighborhood attributes of BRT services in Los Angeles. The land price effects of BRT services are then explored using hedonic price models. Particular attention is paid to the influences of BRT accessibility and service features (e.g., reliability) on land prices for residential and commercial markets, controlling for neighborhood and contextual factors. In addition, a multi-level discrete-choice model of the influences of introducing BRT services on land-use conversions (e.g., single-family residential to higher density apartments) in Seoul is presented.

**Keywords:**

BRT, Bus Rapid Transit, Land Use, Land Prices, Hed.

ID 2204 R

**TOWARDS AN UNDERSTANDING OF THE IMPACT OF DEFERRING TRANSIT INFRASTRUCTURE**

Main Author:

**Kym NORLEY** (*Faculty of Architecture, Design & Planning*)

Co-author(s):

**Alan PETERS** (*University of Sydney*)**Abstract:**

This paper presents progress on research into the physical and economic sustainability impact of deferring transit infrastructure investment, particularly rail, in urban growth areas. The topic is relevant to growing cities in developed countries, particularly in Australasia and North America, where development has been influenced by the mass availability of the automobile for some eighty years. The paper draws together a number of threads of current GIS-based research into the subject, encompassing urban form and structure, travel patterns, and the use and role of the transit system. It recognises the issue of path dependency in drawing these threads together and describes the basis of the developing methodology. The research is based primarily on a case study within the metropolitan area of Sydney, Australia. The present stage of the research will later translate to the generalised (economic) costs to the potential user population and other stakeholders, and to noneconomic consequences such as loss of amenity and of local environments. The important conclusion from the work to date is that a sound understanding of urban structure – linkages, connectivity and transit orientation at both ends of trips involved (particularly the commute trip) – is fundamental. Consideration of population and employment density is important, but insufficient. Neither does examination of transit-oriented development at one end of the trip offer a complete picture. An understanding of structure at the metropolitan level is essential to the debate on transit-oriented urban form and key to examination of transit-based accessibility and to the factors associated with provision of the necessary infrastructure. (...).

**Keywords:**

Urban structure, Travel patterns, Transit infrastructure, Path dependency, GIS applications.

ID 2327 R

**URBAN STRUCTURE REFORM WITH FUTURE TRANSPORT INFRASTRUCTURES:THE SENDAI METROPOLITAN AREA APPROACH**

Main Author:

**Kazuaki MIYAMOTO** (*Tokyo City University*)

Co-author(s):

**Hiroshi KOJIMA** (*Institute of Behavioral Sciences*)**Kazuyuki AKASHI** (*Institute of Behavioral Sciences*)**Yoshiyuki TOKUNAGA** (*Miyagi University*)**Abstract:**

Socioeconomic situations in urban areas in Japan have been changing significantly, affected by factors such as decreasing population, ageing society and fewer children, financial restriction, urban deterioration, increasing global environmental burdens, etc. There is a lack of precedents for establishment of a future vision for areas where population is forecasted to decrease or stay constant. In particular, in local cities where the population is forecasted to decrease faster than in larger metropolitan areas, planning, and implementation to tackle the emerging issues is urgently requested. Considering such situations, efforts have been made in the Sendai Metropolitan Area, which is the central metropolitan area in Japan's Tohoku Region, to establish an integrated planning approach for transport and land use and to create an institutional setup for its implementation, instead of using a conventional transport planning approach based on a given future land-use distribution. This paper aims to report a series of developments for this new Sendai Metropolitan Area Approach, focusing on the basic concept, analytical method, planning procedures, institutional setup for the implementation, and the policy measures.

**Keywords:**

Integrated Land Use and Transport Planning, Urban Structure Reform, Institutional Setup, Implementation Program.

ID 2548 R

**SPATIALLY VARYING IMPACT OF URBAN RAILWAY ON RESIDENTIAL PROPERTY VALUE IN BANGKOK**

Main Author:

**Varameth VICHENSAN** (*Kasetsart University*)

Co-author(s):

**Kazuaki MIYAMOTO** (*Tokyo City University*)**Abstract:**

That urban rail transit brings large benefit to the adjacent area is well recognized; however, to what extent it has influence over space is still questionable, especially in a city being young in urban railway experience. The purposes of this study are to examine the impact of urban railway on land development with real evidence, in which the land value and building stock are investigated; and to determine the variation of the impact through a spatial hedonic study. The case study is an area along a corridor of BTS railway line, which is Bangkok's the first urban rail transit having been in service for nearly 10 years. The examination of the impact of railway development on the area development found that there has been a rapid increase in the number of buildings and floorspace. This is mainly caused by the urban railway since it is referenced with a parallel road corridor where the railway service is not reached. As a result, the land values along the railway corridor have been assessed to be increasingly high, as compared to the other places in the city. The hedonic study of residential property reveals some influencing factors such as age and station proximity. A spatial hedonic model under the Geographically Weighted Regression framework shows the spatial variation of the coefficients. Station proximity has strong influence to the property value where station access is poor. The result provides useful information in improving railway services such as station access or feeder service.

**Keywords:**

Hedonic, Geographically Weighted Regression, Urban Railway, Bangkok.



ID 3253 R

**EXPLORING ACTIVITY SPACE METRICS ALONG A NEW TRANSIT ORIENTED DEVELOPMENT RAILWAY CORRIDOR**

Main Author:

**Doina OLARU** (*The University of Western Australia*)

Co-author(s):

**Markus BOTTE** (*The University of Western Australia*)**Abstract:**

This paper reports on the relationships between the size of activity spaces (measured by a vector of parametric and non-parametric indicators) and transit-oriented developments (TOD), considered before and after the opening of a new 72km railway corridor in Perth, Western Australia, in December 2007. We examine new geometries of activity spaces (ellipses, super ellipses, Cassini ovals, and bean curves) as well as kernel densities, representing activity spaces of households residing within three unique TOD precincts along the railway corridor. These precincts cover a wide spectrum of TOD features, ranging from mixed land use, with good feeder-bus connections and encouraging pedestrian as well as cycling movements, to transit interchanges, or retrofitted residential areas. After accounting for socio-demographic elements, we noticed a significant difference in the size of the activity spaces by precinct, decreasing with higher citywide accessibility. This was observed in both occasions, before and after the railway opening. The finding holds for most of the metrics used to quantify the activity spaces. Increased access provided by the TOD corridor is reflected in a greater use of the corridor and the city, resulting in larger activity spaces for the precincts further away from the city. It remains to further ascertain whether changes in the activity spaces are due to primarily residential sorting and/or are associated with enhanced access to urban facilities as result of the new developments. With respect to the metrics used for activity spaces, the parametric indicators are highly correlated with each other, but bean curves and kernel densities display the smallest areas. (...).

**Keywords:**

Activity space, TOD, Kernel density, Confidence ellipse, Hyperellipse, Cassini oval, Bean curve.

ID 1884 R

**AN ACCESSIBILITY APPROACH TO RAILWAYS AND MUNICIPAL POPULATION GROWTH, 1840- 1930**

Main Author:

**Aart HUIJG****Abstract:**

In the nineteenth century, railway networks strongly improved accessibility. In this paper we examine the impact of accessibility improvements on municipal population growth in the Netherlands between 1840 and 1930, using census data. By mapping a multimodal transport network and calculating the shortest travel time between all municipalities, we generate an accessibility indicator which is strongly influenced by railway connections. The regressions show that high rail accessibility levels are positively related to municipal population growth from 1880 onwards. The impact of rail accessibility was stronger at the end of the nineteenth century, as industrialization took off. The overall impact of rail on population growth has been modest, however. In our model, crowding and urbanization effects dominate.

**Keywords:**

Cliometrics, Railways, Accessibility, Municipalities, Population growth.

ID 2056 R

**EXPLORING THE CO-DEVELOPMENT OF THE NEW YORK CITY SUBWAY WITH COMMERCIAL AND POPULATION DENSITIES**

Main Author:

**David KING** (*Columbia University*)

**Abstract:**

In the early 20th Century New York City grew rapidly in population and developed area. The subway system also grew rapidly to accommodate this new growth, but also as a concerted effort to decentralize the city away from lower Manhattan. Using parcel level data this paper explores the co-development of the subway system and residential and commercial land uses using Granger causality models to determine if transit growth led residential and commercial development or if subway expansion occurred as a reaction to residential and commercial densities. The results suggest that the subway network developed in an orderly fashion and grew densest in areas where development had already occurred while lagged station densities were a weak predictor of residential and commercial densities. This confirms that subway stations tended to open in areas already served by the system and that network growth often followed residential and commercial development. While the subway network acted as an agent of decentralization, routes and stations were sought in areas with established ridership demand. The implications of land use regulations and transit network density on residential and commercial land uses are discussed as are applications to contemporary transportation and land use planning debates.

**Keywords:**

Transit, New York City subway, Land use, Spatial regression.

ID 2060 R

**VALUE CAPTURE AND TRANSIT ORIENTED DEVELOPMENT: A NEW REVENUE SOURCE FOR RAIL OPERATIONS**

Main Author:

**John RENNE** (*University of New Orleans*)

**Abstract:**

The Obama administration is looking to invest billions into high-speed rail, commuter rail and urban rail across America. However, some states and local governments are hesitant to accept the stimulus funds to build the infrastructure because as governments suffer from a severe economic recession, they are having difficulty in identifying the funds to pay for the operating costs once the rail systems are built. This was the case in 2009 as the Secretary of the Louisiana Department of Transportation announced that the state would not seek stimulus funds to build a commuter rail corridor from Baton Rouge to New Orleans until the state could identify an estimated \$18 million per year in operating funds. Value Capture of property and sales taxes in transit oriented development (TOD) precincts around the railway stations may prove to be a "hidden" source of revenue potential to mitigate this problem. This paper will review possible value capture revenue sources, highlight a case study in Louisiana and recommend policies for using value capture to cover operating costs of rail systems.

**Keywords:**

Transit oriented development, Finance, Value capture.

ID 2087 R

**VALUE CAPTURE IN URBAN MASS TRANSIT CORRIDORS**

Main Author:

**William CAMARGO TRIANA****Abstract:**

Urban peripheries consolidation from mass transit construction project in Bogota, propitious increases in land values on urban lines that are intervened, in which the city hasn't had returns for value capture that make public investments more efficient. This investments, made from public sector in mobility projects of mass transit Transmilenio, have had significant impacts on land offer increase along lines, with important effects in terms of a major land value, that are being exploited by private real estate, without any possibility of investment recovery by public sector. Mass lines projects concretions with an exclusive participation on investments from Nation and District will continue providing new land, without many possibilities of value capture through land management mechanisms, allowing acquiring resources for the city, making required investment for next Transmilenio TM phases in Bogota lower. The trend can be reversed by thinking on transit construction projects as Integral Urban interventions of mayor scale, exceeding line looking and directed to urban pieces, on Urban Development prospect where District through guidelines that Law 388 has defined and have been developed on Territorial Order Plan determine, along with the lines planning that are going to be intervened, the areas that can generate a higher land value and propitiate the mechanisms to enhance all the urban land on the service zone (Lines and Portals). Simultaneously, summoning the private sector for the real estate projects development, previous regulatory control over those areas, for public investment to have an economic return that allows the action from private state under clear rules. Conducive resources generation for the District from the increase of that land value and promote enhanced equity processes for value added benefits, making investments on Mass Transit sustainable and build mechanisms for investments social appropriation that are part of the Development Plans. (...).

**Keywords:**

Value capture, BRT.

ID 2337 R

**ACCESSIBILITY, ACTIVITIES LOCATION AND HOUSING PRICE: A SIMULATION MODEL FOR THE METROPOLITAN AREA OF NAPLES**

Main Author:

**Pierluigi COPPOLA** (Dept. of Civil engineering - "Tor Vergata" University of Rome)

Co-author(s):

**Agostino NUZZOLO** (Tor Vergata University of Rome - Dept. of Civil Engineering)**Abstract:**

Differentiated changes of accessibility across the zones of a study area can have relevant impacts on the land use, particularly on the spatial distribution of households and economic activities: the bigger the accessibility of a zone, ceteris paribus the bigger the utility of locating an activity in that zone (i.e. the bigger the "location utility"). Moreover, changing accessibility may induce changes in the local Economy (e.g. the labor supply) as well as on the housing market, that is the on the housing stock and prices. Particularly the latter effects arises when the differentiated changes in zonal accessibility induces new demand for houses which cannot be satisfied by the present supply. In such cases it would be observed either an increase of the housing stock if there is room for new development or, more often, an increase of housing prices as the result of new equilibrium between housing demand and supply. In the literature, the models aiming at simulating the interaction between zonal accessibility and housing price follow basically two approaches: one based on linear multivariate regression of the average price of the houses in a zone w.r.t. the accessibility and other zonal attribute, e.g. the ratio between the number of residents and the available floorspace; the other estimating jointly the prices and the location of the socio-economic activities, e.g. the households, the private services, etc. ("endogenous prices" approach). In this paper we present an activities location choice model with endogenous price which simulate, using random utility theory, the behavior of different agents of the urban system (i.e. the workers distinguished by income, the economic activities by sector) to estimate the spatial distribution of socioeconomic activities within the study area as well as the impact of differentiated changing accessibility on the housing price . (...).

**Keywords:**

LUTI models, Endogenous housing price, Random Utility theory .

TUE 13<sup>th</sup> (08:15 - 09:30, Session F1.5) Room 1.08

ID 1106 R\*

**A NEW PHASE IN THE ANYPORT MODEL? CASE STUDY OF EFFICIENT SPACE USAGE IN THE PORT OF AMSTERDAM**

Main Author:

**Bart WIEGMANS** (*tu delft*)

Co-author(s):

**Erik LOUW** (*TU Delft*)

**Abstract:**

In this paper, we investigate whether a new phase in port-city development is emerging. We have done this by analysing the present and future spatial developments of the harbour of Amsterdam in the Netherlands in terms of the spatial and environmental policies and the viewpoints of firms. It appears that in the Port of Amsterdam, but also in other ports, the expansion pace of the port area is slowing down, while at the same time the city is expanding in the direction of the port at an increasing speed. In the beginning, this conflict was rather passive, in the sense that the conflict was about how the redevelopment should take place. However, the conflict has evolved further to questioning whether any redevelopment should take place. There appears to be a problematic urban frontier, which is steadily moving into the older parts of still active and vibrant port areas.

**Keywords:**

Port-city interface, Port development, Regulation, Spatial development.

TUE 13<sup>th</sup> (08:15 - 09:30, Session F1.5) Room 1.08

ID 1159 R

**EVALUATION OF THE AIRPORTS ROLE IN THE PROMOTION OF SCALES INTERACTIONS BETWEEN TERRITORIES SPACES LANDSCAPES AND ENVIRONMENTS AND ITS IMPACTS ON THE LAND USE AND OCCUPATION SOURROUNDING BRAZILIAN AIRPORTS AREAS: A CONTRIBUTION TO THE URBAN-ENVIRONME**

Main Author:

**Emmanuel SANTOS** (*Instituto Tecnológico de Aeronáutica*)

**Abstract:**

The research aims to identify and analyze the land use and land occupation in the immediate surrounding areas of the airports located in southeastern Brazil. The various forms and patterns of urban landscapes produced by the land uses and the resulting environments are pointed in their relationship with airport sites. The analysis of these relationships may make it possible to understand the complexities of urban environmental design and landscape present in the process of urbanization expansion related to airport activity.

**Keywords:**

Planning, Airports, Use and Land Use, Environment, Landscape.

ID 1962 R

**LAST MILE LOGISTICS AND SPATIAL STRUCTURE**

Main Author:

**Heike FLÄMIG** (*Hamburg University of Technology*)**Abstract:**

The limited reserve of space and the competition between different functions in urban regions as well as the negative impacts (noise, gashouse emissions) of the environment of logistics nodes are reasons for the suburbanisation of the logistics function outside of towns. Often, the relationship between the presence of the logistics function and the prosperity of cities and their economical and social development are not considered in urban development policy, even though some cities are (only) existing, because of the prominence of the logistical function for this regions. Empirical findings show an interrelation between the type of good and the spatial structure with the spatio-temporal organization of the logistics system and their impacts on the traffic generation and the environment. In the discussion about the impacts of the re-organization of the supply chain in urban regions the need for different delivery chains for different spatial structures, products and services are mostly forgotten. The paper will show the prominence of distribution operations (consolidation, home delivery service, cross docking etc.), the types (distribution center, transshipment point) and choice of logistical locations and infrastructure (regional e-logistics centers, pickup points, etc.) and the connected traffic generation for the prosperity of our cities. The theoretical framework is developed on the basis of a new understanding of the role and the shape of the elements of logistical systems (e.g. the redefinition of vessels, facilities and 'new' modes for freight transport). This model enables to simulate the impacts on the traffic system and the contribution to air emissions depending on a change of type, number and location of distribution nodes (shops, distribution center, pick-up points etc. (...)).

**Keywords:**

Spatial structure, Distribution system, Emissions, Logistics nodes.

ID 3134 R

**VEHICLE MILES TRAVELED AND THE BUILT ENVIRONMENT: EVIDENCE FROM VEHICLE SAFETY INSPECTION DATA IN THE BOSTON METROPOLITAN AREA**

Main Author:

**Mi DIAO** (*Massachusetts Institute of Technology*)

Co-author(s):

**Joseph FERREIRA** (*Massachusetts Institute of Technology*)**Abstract:**

This study examines the relationship between the built environment and vehicle miles travelled (VMT) by taking advantage of a unique dataset of millions of odometer readings from annual vehicle safety inspections for all private passenger vehicles registered in the Boston Metropolitan Area, Massachusetts, U.S.A. With advanced GIS techniques and database management tools, VMT and a set of comprehensive built-environment measures are computed for a statewide 250m\*250m grid cell layer developed by MassGIS (the State's GIS Office). We use factor analysis to extract built-environment and demographic factors that may affect VMT, and integrate the factors into the regression models. Spatial regression techniques are applied to correct spatial autocorrelation. The empirical results suggest that there are significant associations between built environment factors and household vehicle usage. In particular, distance to non-work destination, connectivity, accessibility to transit and jobs play significant roles in explaining the VMT variations across grid cells. The research findings can facilitate the dialogue among regional planning agencies, local government and the public regarding growth management and sustainable regional development strategies and scenarios.

**Keywords:**

Vehicle Miles Travelled, Built Environment, GIS, Vehicle Safety Inspection Data.

ID 3138 R

**BUILT ENVIRONMENT VARIABLES AS A MEAN TO EXPLAIN CAR OWNERSHIP IN MEDIUM SIZE CHILEAN CITIES**

Main Author:

**Alejandro TUDELA** (*Universidad de Concepcion*)

Co-author(s):

**Rodrigo BENAVENTE** (*Universidad de Concepcion*)**Abstract:**

The aim of this work is to study the role of built environment attributes on car ownership in a medium size Chilean city. This work follows up a previous one, which showed that up to 50% of the total utility associated with having at least one car at home can be explained through household attributes, such as household income, family size and number of workers. The studied city was Chillan, which has up to 200 thousands inhabitants. Built environment attributes corresponded to the proportion of land use devoted to economic and non-economic activities, public transport network density and others. Information was obtained from an OD survey, the Inland Revenue Office and the regional office of the Transport Ministry. These variables and household attributes were introduced in a binomial Logit model, with utility function specified linear in coefficients. The dependent variable corresponded to possession of at least one car at home, or not having a car at all. Results show that the inclusion of built environment attributes certainly helps to improve the explanatory power of models. Interaction effects between variables were included to catch up and explain the relationship between location, income and car ownership. Empirical evidence shows that urban growth with poor public transport provision, supported by an income rising, is reinforcing the increase of car ownership indeed. This is a concerning situation for medium size cities, where there are not explicit urban and transport policies oriented to deal with car use, which is linked with car possession. (...).

**Keywords:**

Car ownership, Built environment, Chile medium size cities.

ID 1444 R

**ANALYSIS OF THE SPATIAL AND PERSONAL CHARACTERISTICS THAT INFLUENCE COMMUTING TRAVEL BEHAVIOR**

Main Author:

**Eleni ZACHARAKI** (*Intermediate Managing Authority of Transport / Hellenic Ministry of Transport*)

Co-author(s):

**George GIANNOPOULOS** (*Aristotle University of Thessaloniki, Head-Hellenic Institute of Transport/National Centre for Research*)**Abstract:**

Transportation systems in urban areas are increasingly pressed to serve the growing and dispersed travel patterns, due to the growth of suburban housing development, the emergence of suburban job centers and the segregation of residential and employment sites. This modification of activities' spatial allocation implies a modification to daily travel patterns of individuals and households and mainly, changes to daily commuting behavior in terms of mode choice, travel time, number of trips, trip chaining etc. As this evolution of urban mobility is strongly supported by the massive use of private vehicles, inducing important negative environmental and socioeconomic impacts, a number of policies have been designed to tackle the reverse effects of mobility growth. The main policies in this direction are: • Initiation, diffusion and use of new technologies in the transport sector • Economic measures in order to change travel behavior (e.g. fuel taxation, congestion charging etc) • Land use changes to influence travel behavior (e.g. neotraditional neighborhood design versus suburbanization) The last policy is based on the concept of land use – transport interaction, which has been identified as a research subject in the literature for many decades. Theories on the relationship between the two systems recognize a feed back cycle between the two systems, Analysis of the spatial and personal characteristics that influence commuting travel behavior ZACHARAKI, Eleni; GIANNOPOULOS, George 12th WCTR, July 11-15, 2010 – Lisbon, Portugal 2 based on the assumption that land use not only influences transportation outcomes, but that transportation investments also influence land use decisions. (...).

**Keywords:**

Structural equation modeling, Travel behavior, Density, Diversity, Travel patterns, Mode choice, Activity patterns.

TUE 13<sup>th</sup> (09:45 - 11:00, Session F1.6) Room 1.08

ID 1844 R

### EXPLORING THE SOCIAL STRUCTURE OF CITIES WITH AN AGENT-BASED MODEL

Main Author:

**Rémi LEMOY** (*Laboratoire d'Economie des Transports*)

Co-author(s):

**Charles RAUX** (*LET, University of Lyon*)

**Pablo JENSEN** (*Laboratoire de Physique de l'ENS Lyon, Laboratoire d'Economie des Transports*)

#### Abstract:

The standard Urban Economics model of Alonso, Muth, Mills, describes analytically an equilibrium location of households in urban areas. We present an agent-based model, using simple interactions between agents, and able to reach this equilibrium in a dynamic way. We calibrate a Muth version of this model with realistic values of parameters. The agent-based model allows us to simulate the development of a city by combination of heterogeneous agents, travel time cost and the introduction of several job centers. This tool allows the addition of a wide variety of features to the Urban Economics model to study their effects.

#### Keywords:

Agent-based model, Urban economics, Location choice, Travel time, Polycentric city.

TUE 13<sup>th</sup> (09:45 - 11:00, Session F1.6) Room 1.08

ID 2063 R

### THE IMPACT OF LAND USE FEATURES AND TRANSPORT ACCESSIBILITY ON THE OCCURRENCE OF CRIME IN A UNIVERSITY CAMPUS

Main Author:

**Alice ROSS MORTA** (*Lund University*)

Co-author(s):

**Jun CASTRO** (*University of the Philippines School of Urban and Regional Planning*)

#### Abstract:

Several research works have shown that land use variables and the presence of escape routes significantly contribute to criminal activity in cities. Commercial and mixed use zones are particularly vulnerable to crime, as those areas with major intersections and heavy foot and automobile traffic. This study investigates whether such factors – land use and accessibility – are also important determinants of crime at the micro scale, particularly in a university campus. The site chosen is one of the biggest university campuses in the Philippines, where over the years users have suffered from problems of theft and robbery. In the study, Geographical Information Systems (GIS) and Kernel Density Estimation were used to identify campus crime concentrations (also known as hot spots) and relate these with land use features. Multiple Centrality Assessment (MCA) was then performed to examine street network. Values for degree and closeness centralities were calculated and plotted on digital maps to see whether the more “central” (i.e., connected) street segments are those that are more prone to crime. Our results support the conclusions made from macro-level analyses. First, land use contributes to the possibility of crime in a campus setting. Land use influences the intensity of use of a particular place, with high user density denoting more potential targets for offending. But changes in land use on campus are not necessary; for one, there are no “negative” land uses that encourage or host risky behaviors. Instead, it is recommended that the problem be addressed using mechanisms like space design and surveillance that reduce the vulnerability of campus users to crime. Second, access opportunities are related to campus crime. (...).

#### Keywords:

Campus crime, Accessibility, Land use, GIS, Multiple Centrality Assessment.

TUE 13<sup>th</sup> (09:45 - 11:00, Session F1.6) Room 1.08

ID 2784 R

**DOES "DISTANCE" REALLY MATTER FOR DISTANCE-BASED MEASURES OF GEOGRAPHIC CONCENTRATION?**

Main Author:

**Florence PUECH** (*LET - Université de Lyon, CNRS, ENTPE*)

Co-author(s):

**Pablo JENSEN** (*Laboratoire de Physique de l'ENS Lyon, Laboratoire d'Economie des Transports*)

**Nicolas OVTRACHT** (*Laboratoire d'Economie des Transports, University of Lyon*)

**Valérie THIEBAUT** (*Laboratory of Transport Economics (LET), Lyon*)

**Abstract:**

Distance-based methods have been recently improved to evaluate the geographic concentration of economic activities. For these methods, the measurement of distances between all pairs of establishments is crucial. The Euclidean metric is systematically retained in the economic literature even though the location of activities is clearly constrained by the network (roads) or natural advantages (like rivers). In the article, we discuss the relevance of the Euclidean distance as a proxy of the actual network-based distance at an urban scale. It is shown on the Lyon area (France) that the significant relative geographic concentration or dispersion of stores is systematically underestimated when the Euclidean metric is used.

**Keywords:**

Distance-based methods, M function, Urban network, Location of retail stores.

TUE 13<sup>th</sup> (09:45 - 11:00, Session F1.6) Room 1.08

ID 2882 R\*

**CORRESPONDENCES EVALUATION IN A MIDDLE SIZE CITY IN POOR KNOWLEDGE CONDITIONS... CHANGE BY "TRAFFIC EVALUATION IN A MID-SIZE CITY UNDER POOR KNOWLEDGE CONDITIONS"**

Main Author:

**Jacob SANJUAN** (*Universidad Tecnológica de la Mixteca*)

Co-author(s):

**Pavel MAKAGONOV** (*Universidad Tecnológica de la Mixteca*)

**Liliana SÁNCHEZ** (*UTM*)

**Abstract:**

The increased mobility of people and goods in mid-size cities in Mexico has led to a growth in traffic congestion. To analyze this and other transportation problems it is necessary to obtain data about the daytime and night-time population distribution in a mid-size city, the traffic intensity in the different city zones and the main obstacles in achieving regular traffic flow in urban areas. Simple models and tool-kits have been used and/or adapted to obtain the necessary data in order to determine the following: the discrepancies between the centres of daytime and night-time population distribution, the intensity of transport flows in different parts of the city and to establish nodes and causes of congestion due to people movement. This information will be useful in developing a series of recommendations to improve the urban traffic system in the sample city.

**Keywords:**

Model of urban traffic, Population distribution, Urban traffic network.



TUE 13<sup>th</sup> (11:15 - 12:30, Session F1.7) Room 1.08

ID 1747 R  
**HOUSEHOLD LOCATION CHOICE AND TRAVEL BEHAVIOUR: A REVIEW OF INTERNATIONAL EVIDENCE**

Main Author:  
**Zahid SULTAN** (*Built Environment Research Institute, University of Ulster*)

Co-author(s):  
**Julian HINE** (*University of Ulster*)  
**Jim BERRY** (*Built Environment Research Institute, University of Ulster*)

**Abstract:**

Over the last three decades a growing research literature has been concerned with the relationship between urban form and travel patterns. This research has assumed a heightened importance given concerns about the environmental effects of carbon intensive transport systems, the expansion of travel to work areas and the need to provide housing for growing populations. This paper examines the international research evidence for the factors which drive residential location choice behaviour of households on the one hand, and on the other the travel behaviours of households found in different types of urban/rural contexts. Evidence from existing research clearly shows that land-use planning patterns influence mode choice and patterns of mobility but that residential location choice behaviour is also an important factor which has a long lasting effect on patterns of household travel behaviour. This paper reviews the empirical studies that have been conducted into the effects of density, land-use mix, settlement size, the role of public transport oriented development and neighbourhood facilities on travel behaviour. The paper also examines the importance of household self-selection, habit and attitude and other socio-economic factors which contribute to household mobility patterns and location choice. The paper concludes with evidence based recommendations for policy development.

**Keywords:**

Residential location, Travel Behaviour, Urban form, Density, Mixed land-use, Neighbourhood design.

TUE 13<sup>th</sup> (11:15 - 12:30, Session F1.7) Room 1.08

ID 1802 R  
**RESIDENTIAL DURATION AND TRAVEL DISTANCES IN CHICAGO AND PARIS**

Main Author:  
**Matias GARRETON** (*Université Paris-Est, Laboratoire Ville Mobilité Transport*)

**Abstract:**

The interaction between households' location choices and commuting distances is a key process in understanding urban evolution, sprawl and spatial socioeconomic specialisation. Considering these phenomena, this paper presents a comparative analysis of the Chicago and Paris metropolitan areas, focusing on their household's spatial mobility and developing a competing rationalities approach to interpret their localisation and travel behaviours. Residential duration data is intensively exploited to gain insight on temporal processes with cross-sectional information. The obtained results show a remarkable convergence of global indicators of residential mobility and travel, despite sharp differences among housing markets and transportation modal shares. They also suggest that two decision levels could simultaneously determine households' location and travel choices, one that tends to minimise transport costs and another inclined to obtain a maximal profit of urban opportunities. Finally, the observed differences in the evolution of the Chicago and Paris urban areas support the argument for the implementation of urban planning and redistribution policies at a metropolitan level.

**Keywords:**

Residential duration, Travel distances, Location choice, Household behaviour, Housing market, Urban sprawl, Socioeconomic specialisation.

TUE 13<sup>th</sup> (11:15 - 12:30, Session F1.7) Room 1.08

ID 1914 R

**A BEHAVIORAL HOUSING SEARCH MODEL: A COMBINED HAZARD-BASED AND MIXED LOGIT APPROACH**

Main Author:

**Taha HOSSEIN RASHIDI**

Co-author(s):

**Abolfazl MOHAMMADIAN** (*University of Illinois at Chicago*)

**Abstract:**

Residential location search has been an interesting topic to both practitioners and researchers. The housing search process starts with an alternative formation and screening practice. At this level households evaluate all potential alternatives based on their lifestyle, preferences, and utilities to form a manageable choice set with limited number of plausible alternatives. Then the final residential location is selected among these selected alternatives. This bilateral decision making process can be used for both aggregate resolution zone selection as well as searching the housing market for potential alternative dwelling types. This paper studies a zonal level household housing search behavior. Initially, a household specific choice set is recognized from the entire possible alternatives in the area based on the average household work distance to each alternative. Following the choice set formation step, a discrete choice model is utilized in this study for modeling the household final dwelling zone selection behavior. A hazard-based model is used for choice set formation module while the final choice selection is modeled using a mixed logit formulation with a sample correction factor and deterministic inter-alternative correlation effects. The approach presented in the paper provides a remedy for the large choice set problem typically faced in housing search models.

**Keywords:**

Choice set formation, Hazard-based formulation.

TUE 13<sup>th</sup> (11:15 - 12:30, Session F1.7) Room 1.08

ID 2632 R

**SIMULATING HOUSEHOLD LOCATION CHOICE IN THE LYON URBAN AREA**

Main Author:

**Marko KRYVOBOKOV** (*Laboratory of Transport Economics (LET), Lyon*)

Co-author(s):

**Dominique BOUF** (*Laboratory of Transport Economics (LET), Lyon*)

**Nicolas OVTRACHT** (*Laboratoire d'Économie des Transports, University of Lyon*)

**Pierre-Yves PEGUY** (*Laboratory of Transport Economics (LET), Lyon*)

**Abstract:**

A transportation-land use modelling framework UrbanSim is applied. It includes a system of models, which simulate the distribution of population, jobs, real estate development and real estate prices. The study focuses on the Household Location Choice Model, which is calibrated at spatial units of different geographical levels in order to find an appropriate one. The capacity to predict the future geographical distribution of population is seen as a criterion for the choice of a spatial unit. Thus, residential location choice is predicted for past years with the same model specification at the level of blocks, zones, and municipalities. Two groups of variables are taken into account: location attributes (real estate prices, residential vacancy, and employment accessibility) and household attributes (income and car-ownership status). In comparison with the block-based model, the zonebased and commune-based models not only demonstrate better prediction capacity, but also produce output comparable with evenly split population growth.

**Keywords:**

Transportation-land use modelling, UrbanSim, Household location choice, Spatial units.

TUE 13<sup>th</sup> (11:15 - 12:30, Session F1.7) Room 1.08

ID 2834 R

**MODELLING PERSONS' JOB MOBILITY AND LOCATION CHOICE DECISIONS FOR AN INTEGRATED LAND USE AND TRANSPORTATION MODELLING SYSTEM**

Main Author:

**Muhammad HABIB** (*Department of Civil Engineering, University of Toronto*)

Co-author(s):

**Eric MILLER** (*University of Toronto*)

**Bruce MANS** (*School of Planning, Dalhousie University*)

**Abstract:**

This paper presents a comprehensive modelling framework for representing individuals' continuous decisions of changing jobs over life courses. The key objective of the research is to develop disaggregate econometric models for employment transitions and location choice processes in order to implement persons' longitudinal job mobility behaviour within a dynamic microsimulation-based integrated urban modelling systems. The paper includes two behavioural model components: (1) job mobility model, (2) job location choice model. The models are empirically implemented by using a retrospective survey at the Greater Toronto and Hamilton Area (GTHA). The first component investigates timing of job mobility using competing risk duration modelling approaches for four different event types: switch a job, back to school, short term unemployment, and withdrawal from the labour force. The second component of job location choice is empirically estimated using discrete choice methodology. One of the features of the model is that it examines influence of current employment in making next job location decisions. Additionally, the paper investigates effects of both person-level and household-level attributes on location choice. A random parameter logit model is applied to account for panel heterogeneity effects. These models are expected to be implemented within Integrated Land Use, Transportation and Environment (ILUTE) modelling system, which is recently been updated with comparable disaggregate behavioural residential location models.

**Keywords:**

Job mobility, Location, Competing Risk Hazard, Hierarchical decisions.

TUE 13<sup>th</sup> (14:00 - 15:15, Session F1.8) Room 1.08

ID 1017 R

**JOB ACCESSIBILITY EFFECTS ON ABORIGINAL EMPLOYMENT IN URBAN AREAS**

Main Author:

**Jen-Jia LIN** (*Graduate Institute of Urban Planning, National Taipei University*)

**Abstract:**

This study empirically analyzes the effects of job accessibility on the employment of Taiwan's aboriginal peoples residing in urban areas. The study population is aborigines who migrated to Taipei County from their native locales in 2008. Sample data were collected via a questionnaire survey. Various econometric methods, including the binary logit model, ordered logit model and linear regression model, were employed to analyze job accessibility effects on being employed, employment stability, salary and commuting time, respectively. Study results indicate that car accessibility positively affected monthly salary; motorcycle accessibility and transit headway positively affected commuting time; and raising aggregate accessibility reduced commuting time. However, the relationships between job accessibility and employment stability were insignificant for sample data. The empirical evidence contribute to the knowledge of relationships between access to job and employment for ethnic minorities.

**Keywords:**

Job accessibility, Ethnic minority, Employment.

ID 1219 R

**TRANSPORT AXIS AND SELECTIVE HOUSEHOLDS POLARIZATION: THE CASE OF THE UNDERGROUND LINES IN THE PARISIAN SUBURBS**

Main Author:

**Miguel PADEIRO** (*Laboratoire Ville Mobilité Transports*)**Abstract:**

The starting point for this paper is twofold, including both geographical and theoretical observations. First, since 1970 the Parisian underground network has been encroaching further and further upon the suburbs. No less than 28 new stations were put into service during a thirty-year period. Secondly, accessibility nodes to the city centres are often pointed as attractive to the households and give rise to spatial competitions for residential location. The aim of the paper is thus to identify, characterize and explain the existence of a specific residential attraction around the suburban stations of the "Métropolitain" network, which would preferentially impact certain types of households. By exploring life-cycle position and social classes data, we wish to find out a selective polarization of the neighbourhoods located near the stations. The statistical exploration is based in six iso-accessibility rings with a pedestrian five-minute thickness and put in relationship the indicators with an access time value to the nearest station. Thereby, we show that the resident households polarization predominantly impacts a reduced part of the population, particularly small, young households and, to a lesser extent, upper classes. This selective polarization is actually explained by the structure of the housing stock. In fact, a look at the correlations between households and dwellings characteristics proves that the residential attractiveness is not much more than an adjustment of the households in relation to the existing housing offer. This result, however, does not nullify a specific attractiveness that is revealed through the notion of constraint acceptance. Thus, several households accept to live with less space and they outweigh the constraint by accessible or central location advantages. (...).

**Keywords:**

Paris, Accessibility, Centrality, Suburbs, Household polarization.

ID 1317 R

**LOCATION AND ACCESSIBILITY MEDIATED INFLUENCES ON OFFICE FIRM CLOSURE RATES: A PROPORTIONAL HAZARD MODEL**

Main Author:

**Harry TIMMERMANS** (*Urban Planning Group, Eindhoven University of Technology, The Netherlands*)

Co-author(s):

**Gustavo MANZATO** (*Eindhoven University of Technology*)**Theo ARENTZE** (*Eindhoven University of Technology*)**Dick ETTEMA** (*Faculty of Geosciences - Utrecht University*)**Abstract:**

This paper comprises an exploratory study about the mediated influence of a set of location and accessibility attributes along with firm types on office firm closure. We use a proportional hazard modeling approach, examining the probability that an office firm will go out of business in any given year, conditional on it did not go out of business in the years before. Variables include urbanization levels and regional effects; accessibility to airports, train stations, shopping centers and the roadway network; availability of parking facilities and schools; demographic and economic aspects; effects of agglomeration economies; rent price; and the office firm economic activity type. Most of them presented significance on explaining firm closure. Also, interaction effects between covariates and firm types brought better understanding on firm closure patterns regarding urban characteristics. Assessing firm closure is part of a firm demographic approach to firm dynamics. In turn, this is part of a multi agent system to simulate the co-evolution of firm dynamics and changes in activity-travel patterns.

**Keywords:**

Office firm closure, Hazard models, Firm dynamics, Cox regression.

TUE 13<sup>th</sup> (14:00 - 15:15, Session F1.8) Room 1.08

ID 1463 R

**VALUATION OF ACCESSIBILITY INDEX THROUGH HIGH-RESOLUTION SATELLITE IMAGES AND GEOGRAPHIC INFORMATION SYSTEMS ? A METHODOLOGICAL PROPOSAL**

Main Author:

**Cláudia MACHADO** (*Escola Politécnica da Universidade de São Paulo*)

Co-author(s):

**Rodrigo NÓBREGA** (*Geosystems Research Institute - Mississippi State University*)

**José ALBERTO QUINTANILHA** (*Escola Politécnica da Universidade de São Paulo*)

**Abstract:**

This paper develops a multidisciplinary methodology that aggregates remote sensing products and the resources available in geographic information systems – GIS, for transportation planning. The parameter analyzed is accessibility. Public managers can use accessibility measures in order to promote an appropriate urban planning, mainly the highway network infrastructure and the public transportation system planning. The objective is to build the database to get the commercial and industrial (C&I) accessibility index for Osasco Municipality, located in the Metropolitan Region of São Paulo. The proposed methodology consists in starting from an object-oriented (O-O) classification of the IKONOS II satellite images, to extract the information necessary to estimate the accessibility index. The goal of the O-O classification is to find the commercials and industrial establishments located in the study area. The spatial data are converted and analysed within a GIS environment and a C&I accessibility index is calculated using the parameters obtained from the satellite images. Many studies on accessibility measures have been conducted over the past decades. But, the contribution of this academic work lies in the fact that the accessibility is calculated using data obtained directly from remote sensing satellite images, unlike the conventional method, which uses data coming from field surveys. The proposal of this methodology can be justified based on the fact that it can reduce cost and time spent on field researches or to bring up to recorded data. Thus, it is a convenient alternative to be used in places with no recorded data or with outdated recorded data.. (...).

**Keywords:**

Accessibility, Geographic Information System, Remote Sensing, Transportation System.

TUE 13<sup>th</sup> (14:00 - 15:15, Session F1.8) Room 1.08

ID 2852 R

**AN ACCESSIBILITY APPROACH FOR TRANSPORTATION PLANNING ASSISTED BY A GEOGRAPHIC INFORMATION SYSTEM**

Main Author:

**Walber DA SILVA** (*FLUMINENSE FEDERAL UNIVERSITY*)

**Abstract:**

This paper presents an alternative methodology for transportation planning at the urban context. The methodology is based on the analysis of the harmony between the transportation system and the urban development policies defended by the structure plan of a city. The planning areas are characterized by their land-use and by a refined measure of their accessibility indexes, and the transportation system, by the level of service and capacity of each transportation mode. Both can be actual (analyzed at the first stage of the proposed methodology) or idealized (defined from the guidelines established by the structure plan, analyzed at the second stage). It is also proposed an integrated use of a geographic information system in order to provide tools for spatial analysis and network simulations, besides to allow a better management of the data consulting and updating process. The methodology is tested by means of a case study, and the results demonstrate that it is reliable and provides application simplicity, once compared to the traditional methods. It turns out to be more appropriated to the economic reality of small cities or to those ones with restricted financial resources.

**Keywords:**

Transportation planning, Accessibility, Land-use, Geographic information system.

TUE 13<sup>th</sup> (09:45 - 11:00, Session F2.1) Room 0.03

ID 1542 R

**HISTORICAL VALIDATION OF AN INTEGRATED  
TRANSPORT – LAND USE MODEL SYSTEM**

Main Author:

**Eric MILLER** (*University of Toronto*)

Co-author(s):

**Bilal FAROOQ** (*University of Toronto*)

**Franco CHINGCUANCO** (*University of Toronto*)

**David WANG** (*University of Toronto*)

**Abstract:**

The ILUTE (Integrated Land Use, Transportation, Environment) model system is an agentbased microsimulation model for the Greater Toronto-Hamilton Area (GTHA) in which disaggregate, process-based models of spatial socio-economic processes are used to evolve the GTHA system state from a known base case to a predicted future year end state in oneyear time steps. ILUTE has reached a state of operational implementation in which historical validation runs are being undertaken. A 100% GTA population of persons, families, households and dwelling units has been synthesized for the year 1986. Twenty-year historical simulations (1986-2006) have been run, with model outputs being compared to Canadian Census data and Transportation Tomorrow Survey (TTS) data for 1991, 1996, 2001 and 2006. This paper presents recent findings from these historical validation tests, with particular emphasis on the system's modelling of demographic evolution of the population and of the region's housing market.

**Keywords:**

Integrated modelling, Land use, Microsimulation, Validation.

TUE 13<sup>th</sup> (09:45 - 11:00, Session F2.1) Room 0.03

ID 1651 R

**THE FUTURE OF MOBILITY IN CITIES: CHALLENGES  
FOR URBAN MODELLING**

Main Author:

**Michael WEGENER** (*Spiekermann & Wegener Urban and Regional Research*)

**Abstract:**

Urban development in the last two centuries has been driven by an unprecedented growth in mobility made possible by abundant and cheap energy. Yet this trend will not continue forever. Despite technological innovation, finite fossil fuel reserves will in the long run lead to increasing costs of transport. Moreover, to fight global warming many governments have set ambitious greenhouse gas reduction targets, and to achieve them fossil fuels must become more expensive either through market developments or by political intervention. The paper gives an overview about the drivers, feedbacks and constraints of urban mobility and location in a possible future in which transport energy will no longer be abundant and cheap. It asks whether current urban models are able to adequately model the impacts of significantly higher transport costs and demonstrates by an example how it can be done.

**Keywords:**

Land use, Transport, Environment, Energy, Climate, Lifestyles.

TUE 13<sup>th</sup> (09:45 - 11:00, Session F2.1) Room 0.03

ID 2121 R

## **INCREMENTAL COOPERATIVE DEVELOPMENT OF LAND USE MODELS IN CALIFORNIA**

Main Author:

**John ABRAHAM** (*HBA Spectro Incorporated*)

Co-author(s):

**John DOUGLAS HUNT** (*University of Calgary*)

**Michael MCCOY** (*University of California Davis ULTRANS Institute*)

**Robert A. JOHNSTON** (*University of California Davis ULTRANS Institute*)

**Shengyi GAO** (*University of California, Davis*)

**Eric LEHMER** (*University of California Davis ULTRANS Institute*)

### **Abstract:**

Integrated land use and transport planning models are being developed for the state of California in the USA as well as for the major cities in California. These are being developed to improve planning and plans in the state, in particular in response to recent legislation requiring that planning models and analytical techniques be able to assess the effects of policy choices on land use, auto ownership, vehicle miles traveled, and onroad greenhouse gases (GHGs). The Sacramento model was developed first, and is now on its second iteration of development. The San Diego model benefitted from the experience in Sacramento, with major improvements in the analysis of micro-level location choices in hedonic rent models. The California model dealt with state-wide data inconsistencies, and built a 50m by 50m base parcel layer of building type and building intensity by applying a synthetic allocation approach. The California modeling effort improved calibration techniques for adjusting the dispersion parameters and constants in the underlying logit models. The Los Angeles and San Francisco models began as training efforts for agency staff, with pared-down versions of the statewide model. In 2010 the agencies responsible for the 5 models continue to communicate and work together to further the behavioral representation in the models and the development of the open-source software (called PECAS) that implements the models. (...).

### **Keywords:**

Land use modelling, Integrated modelling, Policy assessment.

TUE 13<sup>th</sup> (09:45 - 11:00, Session F2.1) Room 0.03

ID 2774 R\*

## **LAND-USE AND TRANSPORT INTERACTION MODELLING OF LONDON**

Main Author:

**Olga FELDMAN** (*David Simmonds Consultancy*)

Co-author(s):

**David SIMMONDS** (*David Simmonds Consultancy*)

**Tom SIMPSON** (*David Simmonds Consultancy*)

**Neil RAHA** (*MVA Consultancy*)

**Christopher MILLS** (*Transport for London*)

### **Abstract:**

This paper describes the development of a new land-use/transport interaction (LUTI) model of London and adjoining regions, known as LonLUTI, and considers issues relating to its calibration and potential use. The component models within the LonLUTI model are the London Land-use model (LonLUM), run on DELTA software, and the TfL London Transportation Studies Model (LTS) converted to run on a PC by MVA Consultancy. LonLUTI forecasts through time in one-year steps, starting from a known situation in 2001, the pattern of land-use and economic activity across Greater London, East and South East England. The horizon year is 2026. There are some simultaneous linkages in the model but most of the responses - especially to changes in transport - involve time lags so that the impacts of change emerge gradually over a number of years. The model outputs a database containing the same variables, in the same details, as those input for the base year, so it works in the same way whether starting from an observed or from a forecast situation. The paper discusses the use of previous research in the calibration of the model, and other issues relating to the integration of land-use and transport models and to the assessment of the economic impacts of transport proposals.

### **Keywords:**

Land-use/transport interaction model, London, DELTA, LTS.

TUE 13<sup>th</sup> (09:45 - 11:00, Session F2.1) Room 0.03

ID 2867 R

**SUSTAINCITY: STATE OF THE ART REVIEW OF LANDUSE TRANSPORT MODELLING**

Main Author:

**Nathalie PICARD** (*Université de Cergy-Pontoise (cedex, France)*)

Co-author(s):

**André DE PALMA** (*Ecole Normale Supérieure de Cachan*)  
**Kay W. AXHAUSEN** (*IVT - ETH Zurich*)

**Abstract:**

In the context of the SustainCity project, three European cities (Brussels, Paris and Zurich) will be modelled using the land use microsimulation platform UrbanSim. This platform relies on various models interacting with each other, to predict long term urban development. The aim of this paper is to present the different econometric tools used to estimate these models. The models analyzed here are: Real estate prices, Household location choice, Employment location choice and Real estate development. The associated econometric models are mainly linear regression, binary logit and multinomial (or nested) logit. Employment location choice models receive a special attention in Work Package 2.3 (firmographics). We attach here a particular attention on describing and comparing Real estate price models to Household location choice models (which are described in detail in Work Package 2.2). We start from hedonic approach, especially the seminal work of Rosen (1974), and compare it with discrete choice models, discussing each method's advantages and disadvantages. At the end, some examples of applications of the hedonic models to real estate markets are presented.

**Keywords:**

SustainCity, Econometrics.

TUE 13<sup>th</sup> (11:15 - 12:30, Session F2.2) Room 0.03

ID 1419 R

**APPLICATION OF A LUTI MODEL FOR THE ASSESSMENT OF LAND USE PLANS AND PUBLIC TRANSPORT INVESTMENTS**

Main Author:

**Michiel DE BOK** (*Faculdade de Engenharia da Universidade do Porto*)

Co-author(s):

**Barry ZONDAG** (*Netherlands Environmental Assessment Agency*)  
**Karst GEURS** (*Universiteit Twente*)

**Abstract:**

Integrated land-use and transport interaction models (LUTI) are praised for their ability to evaluate land-use and transport planning in an integrated and consistent modeling system. However, applications of empirically estimated land use models are rare. This paper will present the application of the Dutch national land-use/transport interaction model TIGRIS XL in a recent land-use and transport policy appraisal. This case study concerns integrated transport and land use policy plans for the largest housing development site in the Netherlands. It concerns a doubling of the size of the new town Almere located near Amsterdam. In Almere, about 60 000 dwellings are to be built and 100 000 additional jobs are to be created in the period up to 2030. The land use policy plans consist of different spatial development patterns, each with a tailored public transport investment programs. In addition, a national system of road pricing is assumed to be realized. The combination of land use plans with supportive public transport investment plans makes it a typical planning issue to be evaluated with an integrated land-use and transport interaction model. The evaluation of the case study includes the analysis of effects on population development and job location, mobility and accessibility impacts, including indicators such as modal split, motorway road traffic levels, congestion levels and travel time benefits. The paper shows that the different land-use policy alternatives do not differ strongly in terms of transport and accessibility benefits, mainly due to the road pricing scheme.

**Keywords:**

Integrated land-use and transport interaction models, Land use policy appraisal, Public transport investments.



TUE 13<sup>th</sup> (11:15 - 12:30, Session F2.2) Room 0.03

ID 1830 R

## USE OF MODELLING TOOLS TO DELIVER A SUSTAINABLE TRANSPORT SYSTEM

Main Author:

**Simon SHEPHERD** (*University of Leeds*)

Co-author(s):

**Andrew KOH** (*Institute for Transport Studies, University of Leeds*)

**Pauli PFAFFENBICHLER** (*Austrian Energy Agency*)

**Chandra BALIJEPALLI** (*Institute for Transport Studies, University of Leeds*)

### Abstract:

The Department for Transport in the UK conducted a review of its appraisal process (NATA) during 2007/8 and concluded that there was a need to reduce the effort required in modelling and appraisal of strategies in the early stage of policy design. They suggested that one approach may be to conduct a staged appraisal with an initial filtering of options based on easily available qualitative and quantitative information. This could be in the form of an MCA and that the indicators should be in line with their parallel guidelines on Delivering a Sustainable Transportation System (DaSTS). This paper reports on the enhancements made to the strategic model MARS which is a fast running LUTI model capable of simulating policy over an urban region in less than one minute. Three enhancements are described (i) an automated link has been developed between the traffic assignment model SATURN and MARS which means the MARS speed-flow relationships are now compatible with existing network models and that growth factors from a MARS policy run in a future year may be passed back to the more detailed model; (ii) the MCA in line with the DaSTS challenges or goals has been implemented within the software platform (iii) the interface has been upgraded to include spatial policy variables allowing corridor based policies to be analysed. The model is then applied to two examples – the first demonstrating the spatial policy and MCA functions when applied to the Trolley Bus Scheme for Leeds in the UK, the second demonstrating the optimisation capabilities of the software as a package of policy instruments is found which meet the national targets for CO2 reduction.

### Keywords:

Urban policy, Land use model, Sustainable transport, Policy package Session Track G3/G4 (SIG-10).

TUE 13<sup>th</sup> (11:15 - 12:30, Session F2.2) Room 0.03

ID 2552 R

## FROM GIS-T TO URBAN TRANSPORT POLICIES

Main Author:

**Yves CROZET** (*LET Lyon*)

Co-author(s):

**Aurélie MERCIER** (*Laboratoire d'Économie des Transports*)

**Nicolas OVTRACHT** (*Laboratoire d'Économie des Transports, University of Lyon*)

### Abstract:

This paper, presents a new tool to model and simulate transports policies using access-based indicators. This tool, namely a GIS coupled with a 4 steps transport model, is the result of MOSART program developed in LET (Lyon Institute of Transport Economics, University of Lyon). LET has developed the MOSART project (Modelling and simulating accessibility) to set up a tool to help in decision and town planning, allowing to study the accessibility of populations to services and jobs along the various networks (private car, public transport). After presenting some paradoxical results of accessibility measurement in relation with new public transit offers, the paper tests some public policies change like the set up of a urban toll or a high increase of mobility price due to a fuel tax or a sharp increase of fuel price. This kind of "stress test" on urban mobility might prepare public policies to the effects of potential external shocks on accessibility and therefore on mobility.

### Keywords:

Accessibility, Modelling, Urban mobility, Transport policy, Modal split.

ID 2636 R

**A LUTI MODEL FOR STRATEGIC URBAN PLANNING: IMPACTS ESTIMATION OF A NEW TRANSIT SYSTEM**

Main Author:

**Giuseppe MUSOLINO** (*DIMET-Mediterranea University of Reggio Calabria*)**Abstract:**

The problem of simulating mutual interactions between spatial economic and transport systems has been tackled by the so-called Spatial Economic and Transport Interaction (SETI) models. As literature is very large and involves economics and transportation planning, SETI models may be classified according to the spatial scale of analysis, defining as NETI (National Economy Transport Interaction) models the ones operating at national scale and as LUTI (Land Use Transport Interaction) models the ones operating at urban scale. The paper proposes a LUTI model, which refers to a Multi-Regional-Input-Output (MRIO) framework. The model has two main components: a transport macro-model and a land use macro-model. The LUTI model is an urban specification of a general SETI model, which is designed to capture the dynamics of the processes represented and to integrate them into a multi-level framework. The objective of the paper is to test the applicability of the general SETI model at the urban scale, in order to support land use and transport planning activities in the strategic urban dimensions. Strategic urban planning concerns interventions and policies that affect the use of physical urban structures and that require long times to be implemented. The results of the application show that the defined general framework offers the potentialities to simulate the processes involved within the spatial economic and transport systems in urban areas and that it may represent the core of a decision support system for land use and transport planning activities in the strategic urban dimensions.

**Keywords:**

Spatial economic and transport interaction models, Urban specification and application.

ID 2773 R

**A LAND USE AND TRANSPORT SCENARIO EVALUATION MODEL WITH OPTIMISATION ALGORITHMS AND ACCESSIBILITY AND GREENHOUSE GAS TRADE-OFFS**

Main Author:

**Charles CHEUNG** (*Transport Consultant*)

Co-author(s):

**John BLACK** (*University of New South Wales*)**Ken DOUST****Yuzo MASUYA****Abstract:**

The context for our theoretical research into novel evaluation models for land use and transport scenarios is the move towards a carbon economy. To deliver sustainable transport in the future, and to achieve the greenhouse gas emission targets, the research challenge is to reform the current analytical tools that are used by practitioners to evaluate the benefits and costs of a transport investment scheme to ensure carbon emissions can be captured and accounted for in an appropriate and credible manner. Visioning future scenarios and backcasting is one such promising tool. The model quantifies performance measures or metrics of such scenarios. For urban regions there are trade-offs amongst economic, social and environmental criteria and a holistic assessment framework (Doust and Black, 2009) is extended by combining: a mathematical model to minimize the total amount of travel in distance in the region considering the preference function of journey-to-work travel by applying the optimal commuting assignment problem; the calibration of commuter preference functions for cities of varying size and stages of economic development; and the formulation of visual sustainability metrics based on the concept of a sustainability goal in "environmental sustainability – accessibility space" that estimates greenhouse gas emissions by private transport.

**Keywords:**

Land use and transport, Sustainability framework, Assessment model, Commuting preference function, Optimum commuting assignment.

TUE 13<sup>th</sup> (14:00 - 15:15, Session F2.3) Room 0.03

ID 1064 R

**URBAN LAND USE AND ECONOMIC GROWTH  
MODELLING**

Main Author:

**Noordini CHE'MAN**

Co-author(s):

**Harry TIMMERMANS** (*Urban Planning Group, Eindhoven  
University of Technology, The Netherlands*)

**Abstract:**

Urbanisation and economic growth are strongly related. In urban growth processes, urbanisation is strongly influenced by economic growth and also the economy inequality within the area. Urban growth triggers the dynamics in the urban system which consists of a complex subsystem including multiple actors with different patterns of behaviour at various scales. Therefore, in order to understand this complex system, multi-agent systems which make explicit the decision making process of the various actors may be useful to help and identify the complexity of these processes. Such a model will be a foundation to facilitate town planners and decision makers to identify factors that will contribute to understand the relationship between economic growth and dynamic land use patterns in their region. To this end, this paper will discuss progress in integrating land use modelling techniques with a multi-agent system which is linked with GIS technology for understanding and simulating economic growth in the Klang Valley region in Malaysia.

**Keywords:**

Regional Economic Growth, Multi-Agent, Geographical Information System, Urban Sprawl, Firm Demography.

TUE 13<sup>th</sup> (14:00 - 15:15, Session F2.3) Room 0.03

ID 1637 R

**LAND RENT, TRANSPORT POLICIES AND BUILDING  
CONSTRAINTS**

Main Author:

**Marco PONTI** (*Politecnico di Milano*)

Co-author(s):

**Elena SCOPEL** (*Politecnico University of Milan*)

**Abstract:**

The paper adds a policy variable seldom found in the mainstream literature that focuses generally on land rent generated by transport costs: building constraints, that are by themselves generators of rent. These three variables (transport costs, land rent and building constraints) do obviously interact in very complex way. We try some radical simplification that seems to show a certain number of distributive, and related policy consequences, far from obvious: in particular a) the possible meaning of urban sprawl as an "escape from rent" (with trade-offs between rent and transport costs) and b) the role of "dispersed" (i.e. car-driven) accessibility against concentrated (i.e. public transport driven) solutions, at least in some circumstances. The tools employed are also, at this stage of the research, quite simple (linear graphic relations), in order to state some initial finding. But this is a start-up approach, with a range of theoretical and empirical researches to follow.

**Keywords:**

Land rent, Transport infrastructure, Building constraints, Sprawl, Transport policies.

ID 2000 R

**USING STRUCTURAL EQUATIONS MODELLING TO UNRAVEL THE INFLUENCE OF LAND USE PATTERNS ON TRAVEL BEHAVIOUR OF WORKERS IN MONTREAL**

Main Author:

**João DE ABREU E SILVA** (*Instituto Superior Técnico*)

Co-author(s):

**Catherine MORENCY** (*Polytechnique Montreal*)

**Aurelien DAURIAN** (*Ecole Nationale des Travaux Publics de l'Etat*)

**Kostadinos GOULIAS** (*University of California Santa Barbara*)

**Abstract:**

This paper addresses the relations between travel behaviour and land use patterns using a Structural Equations Modelling (SEM) framework. SEM is a multi equation technique which is particularly suited for the study of complex relations, since it allows modelling the effects of land use patterns on travel behaviour while controlling for self selection bias and effects between endogenous variables. The proposed model structure draws on two earlier models developed both for Lisbon and Seattle which concluded for the existence of significant effects of land use patterns in travel behaviour. This paper is part of a research project which aims to compare results from different cities in North America and Europe, using the same modelling framework and similar travel behaviour and land use data sources. The travel behaviour variables included here are multidimensional and include short term, medium term, and relatively long term mobility and related decisions. Regarding long term decisions the model includes variables such as home location. In the medium terms it includes variables such as car ownership. On the shorter term decisions the variables include the amount of mobility by mode (car, transit and soft modes), both in terms of total kilometres travelled and number of trips. The model also includes a trip scheduling variable, which is the total time spent between the first and last trips to reflect daily constraints in time allocation and travel. (...).

**Keywords:**

Structural Equations Modelling, Transport and Land Use, Travel Behaviour, Montreal.

ID 2145 R

**AN INTEGRATED APPROACH TO SUSTAINABLE TRANSPORTATION, LAND USE AND BUILDING DESIGN; THE CASE OF THE LUOKOU DISTRICT, JINAN, CHINA**

Main Author:

**Nicolae DUDUTA** (*University of California, Berkeley*)

Co-author(s):

**Manish SHIRGAOKAR** (*University of California Berkeley*)

**Elizabeth DEAKIN** (*UC Berkeley*)

**Xinlan ZHANG** (*Jinan Urban Planning and Design Institute*)

**Abstract:**

Due the pace and the scale of urban development in China, the implementation of sustainable urban practices there is an essential step in addressing climate change. Chinese officials are becoming increasingly interested in sustainable practices including transitoriented development (TOD) and green buildings. However, even though the concepts are supported, implementation sometimes falls short of desirable outcomes. In this paper, we present the preliminary results from a collaborative project carried out with planning officials from the city of Jinan (pop. 3.4 million), for a 3.1 km<sup>2</sup> (1.15 mi<sup>2</sup>) district, expected to house 100-130,000 people by 2020. The paper presents a proposed plan for the Luokou district. By integrating transportation, land use, urban design and sustainable building design early in the planning process, our approach identifies opportunities for improving energy efficiency that might have been overlooked by considering transportation, land use and buildings separately. The land use plan provides housing, office and retail employment schools and other public services. The urban design lays out these uses to create walkable neighborhoods and bike and transit access throughout the district. The current sparse, congested street network is replaced with a hierarchy of streets that accommodates all modes. Street widths and building densities are carefully adjusted to maximize the potential for passive solar heating and use of daylight in buildings. Green building designs meet or exceed Chinese energy performance standards (meeting EU standards). The environmental performance of the district is analyzed in both the local and the regional context using traffic micro simulation and building energy evaluation models. (...).

**Keywords:**

Transit oriented development, Urban design, Multimodal street design, China, Developing countries.

TUE 13<sup>th</sup> (14:00 - 15:15, Session F2.3) Room 0.03

ID 2625 R

**A DYNAMIC OPERATIONAL URBAN ECONOMIC  
BASED ON AGENTS' BEHAVIOUR**

Main Author:

**Francisco MARTINEZ** (*Universidad de Chile*)

Co-author(s):

**Alvaro MUÑOZ** (*Universidad de Chile*)

**Abstract:**

The real estate and land use system can be described as a chain of three sub-markets: building development, real estate ownership and residential allocation. This paper develops an economic model of the real estate ownership market, where developers offer new options to investors whom decide what options to buy –differentiated by location and real estate type- and which to sell in a pure exchange and competitive economy. A logit model represents the agents' idiosyncratic differences in their maximizing behavior of the long-term present value of their investments. We prove the market equilibrium exists and is unique under reasonable conditions, and the solution is obtained using a fixed-point algorithm. The model performance is illustrated with simulations of the equilibrium under several scenarios.

**Keywords:**

Real estate market, Equilibrium, Logit.

TUE 13<sup>th</sup> (14:00 - 15:15, Session F2.3) Room 0.03

ID 2905 R

**MODELLING THE EVOLUTION OF OFFICE SPACE  
SUPPLY**

Main Author:

**Bilal FAROOQ** (*University of Toronto*)

Co-author(s):

**Eric MILLER** (*University of Toronto*)

**Murtaza HAIDER** (*Ryerson University*)

**Abstract:**

The spatial and temporal distribution of built-space supply plays an important role in shaping urban form and thus the general travel pattern in an urban area. Within an integrated framework, we are interested in modelling the decisions of a builder in terms of when, where, what type, and how much built-space to build. We present a discrete-continuous model formulation for the built-space supply decisions that are based on expected profit maximization. The framework is applied to estimate a model for supply of new office space in the Greater Toronto Area (GTA) for the duration of 1986 to 2006. To our knowledge, this work is the first that models the where, when, how much, and what type of office space to supply in a single framework at a fairly disaggregate spatial zoning system. The results indicates a risk taker behaviour on the builders' part, while market conditions and supply of resources (labour, construction cost etc.) are also found to be important factors in decision making.

**Keywords:**

Choice Bundle, Discrete-Continuous model, Profit Maximization, Office Space Supply.

TUE 13<sup>th</sup> (15:30 - 16:45, Session F2.4) Room 0.03

ID 1191 R

**ACTIVITIES, TRANSPORTATION NETWORKS AND LAND PRICES AS KEY FACTORS OF LOCATION CHOICES: AN AGENT-BASED MODEL FOR LISBON**

Main Author:

**Luis MARTÍNEZ** (*CESUR, Instituto Superior Técnico*)

**Abstract:**

This paper presents a Multi-agent system that is being developed for the Lisbon Metropolitan Area (LMA) in order to assess the relation of locations of households and firms to their environment characterized by the activities these agents perform on a daily basis, the transportation network and the real estate prices. The paper discusses the framework of the urban system model developed for the Lisbon Metropolitan Area (LMA), describing the different agents and sub-models of the system (discrete choice models and hedonic price models), the data requirements of the model, and sets a first approach to the model validation. The results obtained from the first analysis show a significant impact of accessibility on residential and business location options.

**Keywords:**

Land Use-Transportation Integrated Models (LUT), Agent-based modelling, Urban systems dynamics, Residential location, Business location, Land value and property value assessment.

TUE 13<sup>th</sup> (15:30 - 16:45, Session F2.4) Room 0.03

ID 1774 R

**A MODEL OF INDIVIDUAL TRANSACTIONS IN A HOUSING MARKET FOR LAND-USE MICRO-SIMULATION**

Main Author:

**Atsushi SUZUKI** (*Meijo University*)

**Abstract:**

Housing market has a lot of unique characteristics. Especially, variety of houses is one of the important characteristics of housing market. On the other hand, households who search houses are also various and their preferences for houses depend on attributes of the household. Therefore, housing market can be considered as a matching problem between various types of households and various types of houses. However, existing land-use microsimulations have not expressly treated matching and individual transaction process of housings. The objective of this study is to develop a model of matching and transaction process of housing market for the land-use micro-simulation model. Gale and Shapley Algorithm which was developed for the marriage matching problem in 1962 is applied to the matching problem between households and houses in the local housing markets for the landuse micro-simulation. This paper presents theoretical framework of our housing market model and trial simple simulation with a set of hypothetical data.

**Keywords:**

Interface.

TUE 13<sup>th</sup> (15:30 - 16:45, Session F2.4) Room 0.03

ID 1858 R

**INTEGRATION OF GENETIC AGENTS AND CELLULAR AUTOMATA FOR DYNAMIC URBAN GROWTH MODELLING: A PILOT STUDY**

Main Author:

**Ning WU** (*Department of Land Economy, Cambridge University*)

Co-author(s):

**Elisabete SILVA** (*Department of Land Economy University of Cambridge*)

**Abstract:**

Urban land change phenomena include spatial and a-spatial dynamics. As Holland (1995) suggests "a city's coherence is somehow imposed on a perpetual flux of people and structure". However, it seems that most of the traditional economic and geographic studies tried to separate the two entities associated with land use change, human decision-making and environmental consequences, into two separate models (Sethuram et al., 2008). In order to explore the two fluxes (the spatial and a-spatial dynamics), in this paper we present an integrated model that incorporates ABM, CA and genetic algorithm (GA) to include both spatial and a-spatial dynamics in an urban system in order to supply a new solution for urban studies. In our model, the social economic behaviours of heterogeneous agents (resident, property developer and government) will be regulated by GA and Theory of Planning Behaviour (TpB). With a pilot study conducted with the model we analyzed how the macro level of spatial pattern change (the emergence phenomena) is produced from the interactions of actors at the micro level (the heterogeneous behaviours and interactions between agents, and the discrete spatial dynamics represented by CA).

**Keywords:**

Urban model, Agent based modelling, Cellular automata, Integrated model, Theory of planned behaviour.

TUE 13<sup>th</sup> (15:30 - 16:45, Session F2.4) Room 0.03

ID 1997 R

**A TIME-SPACE HIERARCHICAL FRAMEWORK TO MODEL DYNAMIC URBAN SYSTEMS**

Main Author:

**Francisco MARTINEZ** (*Universidad de Chile*)

Co-author(s):

**Cristian CORTES** (*Universidad de Chile*)

**Abstract:**

Passenger transport modeling has evolved from the study of aggregate flows between origin to destination zones to increasingly more disaggregate behavioral models. Classical approaches were based on the spatial interaction approach (entropy based models), aggregate networks, random utility methods (logit and probit models) and multicommodity traffic assignment. More recently, attention has been paid to the temporal process, particularly on the activities and their spatial-temporal sequence under activitybased and micro-simulation models. A common feature of most of these approaches is the combinatorial problem that arises from the complexity associated to the treatment of time and spatial scales, which lead to two different strategies: aggregate approaches- from meso to macro- compromise on the level of detail in order to calculate micro economic equilibrium based models; on the other extreme, simulation approaches compromise on the equilibrium paradigm in order to develop Montecarlo based models with detailed analysis of humans choices. In this paper, a new paradigm for urban system modeling is proposed, which is based on the structural elements observed on the dynamics of natural complex systems (for example the ecology) that can be used for describing social and economic dynamic systems, generally named as the Panarchy approach<sup>3</sup>. This approach explicitly identifies multiple hierarchies, with two predominant examples in the urban system: time and geography, as well as the more classical differences on individuals' behavior. Daily (or weekly) activities for each individual is associated here with a time scale, from long term (e.g. residence location and job choices), to medium term (weekly shopping and leisure), to short term choices (grocery buying and transport mode and route choice). (...).

**Keywords:**

Hierarchical, Dynamic, Time-space, Logit.

TUE 13<sup>th</sup> (15:30 - 16:45, Session F2.4) Room 0.03

ID 2677 R

**THE DESIGN OF AN INTEGRATED MODEL OF THE URBAN CONTINUUM - LOCATION CHOICES, ACTIVITY-TRAVEL BEHAVIOR, AND DYNAMIC TRAFFIC PATTERNS**

Main Author:

**Ram PENDYALA**

Co-author(s):

**Yi-Chang CHIU**

**Paul WADDELL**

**Karthik KONDURI** (Arizona State University)

**Bhargava SANA**

**Abstract:**

Over the past several decades, there has been a clear shift towards microsimulation approaches in modeling urban systems. This shift has generally taken place along three lines of inquiry. First, in the land use modeling arena, attempts are being made to model market dynamics in the land use markets. Second, in the activity-travel demand modeling arena, emerging models simulate the activity-travel patterns of individuals along the continuous time axis while explicitly accounting for time-space prism constraints and interactions, household interactions and task allocation, and modal availability. Third, in the network modeling arena, dynamic traffic assignment models are seeing increasing interest from the planning community. These three streams of research have largely proceeded along parallel lines with only few attempts to integrate the model streams into a unifying framework. The authors are developing a unifying model design and paradigm which integrates land use microsimulation models, activity-based microsimulation models of travel demand, and dynamic traffic assignment models. The integrated model system, dubbed SimTRAVEL (Simulator of Transport, Routes, Activities, Vehicles, Emissions, and Land), is intended to serve as a platform that would allow the integrated modeling of urban systems in a seamless fashion. In this paper, the authors present a comprehensive overview of the design of SimTRAVEL. The paper includes design considerations that went into the specification of SimTRAVEL, the behavioral paradigms that define the SimTRAVEL approach, and the analytical formulations underlying SimTRAVEL model components. (...).

**Keywords:**

Integrated Modeling, Microsimulation, Activity-Based Demand Model, Land-use.

TUE 13<sup>th</sup> (17:00 - 18:15, Session F2.5) Room 0.03

ID 1294 R

**AN AGENT BASED ESTIMATION METHOD OF HOUSEHOLD MICRO-DATA INCLUDING HOUSING INFORMATION FOR THE BASE YEAR IN LAND-USE MIC**

Main Author:

**Kazuaki MIYAMOTO** (Tokyo City University)

Co-author(s):

**Nao SUGIKI** (Docon Co., Ltd.)

**Noriko OTANI** (Tokyo City University)

**Varameth VICHENSAN** (Kasetsart University)

**Abstract:**

Much development has been realized in land-use microsimulation models that are often used to forecast the changes in the micro-data, e.g., the detailed attributes and location of individual households. However, less attention has been paid in synthesizing the base year micro-dataset. The purpose of this study is to build a system to rationally estimate the microdataset of the base year for land-use microsimulation. This paper presents a result of continued development by incorporating location and housing type choice models into our earlier system, making the micro-data synthesizer comprehensive in that it produces details attributes of household such as its member and age composition, housing type, as well as its spatial location. This system, wherein a Monte Carlo simulation is used, deals with both continuous and discrete attribute variables by agent (i.e., a household in this study). It uses sample data that contain full information on the micro-data to establish the correlation between the attributes and the existing statistical data as the control total in each zone. To reproduce the correlation between continuous attribute variables, independent variables that can be obtained by the principal component analysis of the original variables are introduced and employed as intervening variables. The housing type and location choice are determined by means of Logit models. In addition, the system is composed of several iterative adjustment processes such that the data production satisfies the available control total by attribute. In order to develop the system in a rational and objective manner, an indicator is proposed to evaluate the goodness-of-fit between two micro-datasets. (...).

**Keywords:**

Land Use Model, Micro-Simulation, Household Micro-data, Population Synthesis, Agent-based Approach.



TUE 13<sup>th</sup> (17:00 - 18:15, Session F2.5) Room 0.03

ID 1364 R

**INTRODUCTION OF A CAPACITY SENSITIVE OD MATRIX ESTIMATION PROCESS APPLYING GENETIC ALGORITHM BASED CALIBRATION OF SCGE MODEL**

Main Author:

**Arpad TOROK** (*Budapest University of Technology and Economics*)

Co-author(s):

**Zoltan BOKOR** (*Budapest University of Technology and Economics, Budapest, Hungary*)

**Abstract:**

Handling productivity concentration has been a key issue for economists and solving transportation problems – due to population concentration – has been just as important for engineers for a long time. Representatives of abysmally separated scientific fields tried to solve the efficiency problems of certain areas which can be characterised by lack of capacities, extreme population and productivity density. The continuous development of SCGE (spatial computable general equilibrium) models has made it possible to describe the behaviour of actors playing various roles in geographically closed economic space. Nowadays SCGE models can be applied at acceptable estimation efficiency to evaluate the expected spatial economic structure and the development of a given region. Contrary to the above described models engineers generally focus on satisfying mobility demand to avoid the appearance of bottlenecks. Traditionally, traffic flows are described by OD (origin-destination) matrices. Comparing the mentioned methods, SCGE modelling is a quickly developing science area, but integrating the transportation sector into SCGE models is not comprehensively discussed in current scientific papers yet. Besides, it is necessary to mention that the calibration of these methods is still done with considerable difficulty, considering the high amount and the rare availability of required exogenous parameters. Engineers and traditional urban planning approaches assume that an OD matrix describing mobility demand between zones is constant. (...).

**Keywords:**

Mobility demand estimation, Origin-destination matrix, SCGE model, Genetic algorithm, SCGE model calibration, Supporting the preparation of urban development strategies.

TUE 13<sup>th</sup> (17:00 - 18:15, Session F2.5) Room 0.03

ID 1650 R

**DEVELOPMENT OF MIGRATION AND INTERACTION MODELS BETWEEN REGIONS IN CONSIDERATION OF THEIR MUTUAL RELATIONSHIP**

Main Author:

**Akiko KONDO** (*Shikoku University Faculty of Management and Information Science*)

Co-author(s):

**Akio KONDO** (*Institute of Technology and Science, The University of Tokushima*)

**Abstract:**

In recent years, many rural regions in Japan have been gradually losing vitality due to declining population as well as the falling birthrate and aging population. In this situation, it is necessary to promote population inflow and to stimulate interaction between regions in order to sustain vital regions of the country. These “movements of people” are directly inter-related and is influenced by a variety of factors, including convenience of transportation within and between regions. Therefore, it is important to clarify factors which influence interaction and migration between regions in addition to their mechanism. It is also necessary to analyze their mutual relationship for contributing towards making regional policies. The aim of this study is to clarify mechanisms of migration and interaction between regions, and their relationship quantitatively. In order to achieve this aim, we develop models of migration and interaction between regions in which their relationship is incorporated precisely.

**Keywords:**

Migration, Interaction, Utility Maximization Theor.

TUE 13<sup>th</sup> (17:00 - 18:15, Session F2.5) Room 0.03

ID 2048 R

**CHOICE SET FORMATION FOR LAND-USE MICRO-SIMULATION**

Main Author:

**Keiichi KITAZUME** (*Kansai University*)

Co-author(s):

**Hiroaki INOKUCHI** (*Kansai University*)

**Abstract:**

The current research discusses the issues of choice set formation which are especially important when a land-use micro-simulation model is developed. A questionnaire survey was carried out and represents that many locators usually consider only two or three areas at most as alternatives in location choice. In addition, a trial of land-use micro-simulation indicates that both wide and small aggregation of zone do not always give the most accurate simulation results.

**Keywords:**

Land Use Model, Micro-Simulation, Location Choice.

TUE 13<sup>th</sup> (17:00 - 18:15, Session F2.5) Room 0.03

ID 2332 R

**GOODNESS-OF-FIT EVALUATION METHOD BETWEEN TWO SETS OF HOUSEHOLD MICRO-DATA FOR LAND-USE MICROSIMULATION MODELS**

Main Author:

**Kazuaki MIYAMOTO** (*Tokyo City University*)

Co-author(s):

**Noriko OTANI** (*Tokyo City University*)

**Nao SUGIKI** (*Docon Co., Ltd.*)

**Abstract:**

Land-use microsimulation models deal with detailed attributes of a household and its location which this study calls micro-data. However, less attention has been paid to the method to evaluate the goodness-of-fit between two sets of agent-based micro-data; an estimated and the observed sets of micro-data. At first, this study defines a distant measure between an estimated and the observed micro-data for each household. The goodness-of-fit is measured by the minimum sum of the distances for all households in the study area. Since the calculation cannot be conducted only with a conventional algorithm for an ordinary size of micro-data, an algorithm using GA, especially symbiotic evolution, is developed. The effectiveness of the method has been confirmed with the applications to the Person Trip Survey data in Sapporo Metropolitan Area.

**Keywords:**

Synthetic population, Micro-data, Goodness-of-fit, Microsimulation, Land-use model.

MON 12<sup>th</sup> (11:15 - 12:30, Session F3.1) Room 1.05

ID 1964 R

**THE BUS PUBLIC TRANSPORTATION SYSTEM AND ITS EXTERNALITIES**

Main Author:

**Cristina SINAY** (IME)

Co-author(s):

**Vanda DINHA** (IME)

**Isolina CRUZ** (PET COPPE UFRJ)

**Abstract:**

The accelerated process of urbanization that took place in the last decades in many countries and the car use popularization contributed to a series of problems such as jams, accidents, mobility and accessibility reduction, air, water, soil, sound and visual pollutions which, in turn, declined life quality (PAES, 2006) The urban public transport service, when well planned, correctly dimensioned and supervised reduces the mentioned problems, promoting large cities economic vitality as well as social justice, life quality and efficiency. But when this system is not properly planned, it can cause several negative environmental impacts which require immediate responses for recovery to avoid significant fines established by law. This work has the purpose of identifying the environmental negative impacts caused by the public transportation system which reduce the service environmental sustainability, as a base to compose an environmental management system for such a service.

**Keywords:**

Public transportation, Sustainability.

MON 12<sup>th</sup> (11:15 - 12:30, Session F3.1) Room 1.05

ID 2050 R

**THE IMPACT OF AIRCRAFT NOISE PERCEPTION ON THE URBAN DISCOMFORT**

Main Author:

**Rogéria ELLER** (Technological Institute of Aeronautics)

Co-author(s):

**Protógenes PORTO** (Technological Institute of Aeronautics)

**Abstract:**

Noise generated by aircraft operation affects negatively the quality of life of people living nearby airports, including impacts like high blood pressure, anxiety and depression even considering that the perception of annoyance can be related to subjective factors. This paper shows the results of a survey conducted in Guarulhos, São Paulo, about the perception of aircraft noise annoyance. The results show that aircraft noise annoyance is becoming more important when compared with other sources of urban noise. Mainly the results show that night flights seem to be the major responsible for the discomfort

**Keywords:**

Airports, Aircraft noise, Land use occupation.

ID 2102 R\*

**CNG CONVERSION OF MOTOR VEHICLES IN DHAKA: VALUATION OF THE AIR QUALITY IMPROVEMENT BENEFITS**

Main Author:

**Zia WADUD** (*Bangladesh University of Engineering and Technology*)**Abstract:**

Dhaka has one of the most polluted air among the large cities of the world and motor vehicles are one of the major polluters. There have been some recent initiatives that alleviate the air pollution in the city, among other objectives, although there were no formal estimates for the benefits that can be achieved from the policy. This paper quantifies ex-post the social benefits due to the government initiative that led to widespread conversion of petroleum motor vehicles to CNG vehicles. An impact-pathway model has been developed to relate the changes in emissions resulting from the policy to changes in ambient air quality and resulting number of avoided premature deaths. Because of lack of data, most of the underlying models are simple in nature and therefore have uncertainties associated. Despite the limitation, it is estimated that around 5,200 premature deaths were avoided in Dhaka in 2007 because of the switch from petroleum to CNG vehicles. This amounts to between 0.4% to 7.8% of the GDP of the country, with a best estimate of 1.4%. This indicates that there were substantial social benefits that had resulted from the policy. Results from such models can help policy makers immensely in evaluating strategies to improve the air quality and thus help informed decision making.

**Keywords:**

Motor vehicles, CNG, Air pollution, Benefits analy.

ID 2175 R

**COMPARISON ANALYSIS OF IDLE EMISSION MEASUREMENT PROGRAM IN JABODETABEK INDONESIA**

Main Author:

**Sudarmanto NUGROHO** (*Hiroshima University*)

Co-author(s):

**Fujiwara AKIMASA** (*Transportation Engineering Laboratory, Graduate School for International Development and Cooperation, Hiroshima University Japan*)**Zhang JUNYI** (*Transportation Engineering Laboratory, Graduate School for International Development and Cooperation, Hiroshima University Japan*)**Abstract:**

This paper describes an initial analysis of vehicle inspections and maintenance program for private cars in Jakarta and surrounding cities namely JABODETABEK, as regulated in the 2005 bylaw. The bivariate probit model used to estimate the likelihood of CO and HC emission violations given a set of vehicle characteristics. In order to analyze household's vehicle-type ownership and its usage in Jakarta city, we use person trip data in collected in 2000 and household interview survey in 2009. Data of passenger car emission measured randomly during on-road emission measurements at Jakarta city and surrounding cities Bogor, Depok, Tangerang and Bekasi in 2004, 2005 and 2009. The engine size, fuel system, vehicle maintenance quality and passenger car travelled kilometer per year play a significant role in determining the probability of emission test failure. Vehicle kilometer travelled per year has causal relationship with vehicle-type and its usage. Vehicle type Jeep and SUV were less to use by the households and also have lower probability to pass CO emission test compare to Sedan or passenger car.

**Keywords:**

Inspection and Maintenance, Bivariate Probit, Jabodetabek.

ID 2310 R

**THE BUILT ENVIRONMENT AS A DÉCOR OF UNFOLDING HOUSING CAREERS AND ACTIVITY-TRAVEL PATTERNS: REFLECTION AND RESEARCH AGENDA**

Main Author:

**Aida PONTES DE AQUINO** (*Urban Planning Group, Eindhoven University of Technology, The Netherlands*)

Co-author(s):

**Harry TIMMERMANS** (*Urban Planning Group, Eindhoven University of Technology, The Netherlands*)

**Abstract:**

This paper reviews the existing literature on the relationship between the built environment and travel behaviour. It takes a critical stance and argues that even after discounting those studies that are hampered by methodological flaws most studies did not provide convincing evidence that characteristics of the built environment are causally related to facets of travel behaviour. This is in part due to inherent limitations of fitting functions to survey data, and in part to the fact that some more comprehensive approaches were not always very critical in fine-tuning the approach to the specific aim of the study. Keeping these considerations in mind, most empirical evidence seems to suggest that the causal relationship between the built environment and activity-travel patterns is relatively weak: the built environment is the décor of unfolding housing and activity-travel patterns, not the trigger. Based on this view, it is argued that a more comprehensive conceptual framework is needed to better understand and qualify the relationship between the built environment and activity-travel patterns.

**Keywords:**

Travel choice behavior, Urban form, Self-selection.

ID 2450 R

**PAST AND PRESENT TRENDS OF URBAN TRANSPORT AND RELATED ENERGY CONSUMPTION, GREEN HOUSE GAS AND POLLUTANTS EMISSIONS IN GREATER CAIRO**

Main Author:

**Ali HUZAYYIN** (*Faculty of Engineering, Cairo University.*)

**Abstract:**

The paper is based on a pioneer research project, DRTPC Study Experts. (2009), lead by the first author with active participation of the second. The project was performed through "Plan Blue" in cooperation with the Transportation Programme of DRTPC, Cairo University as acknowledged in the end of the paper. As it appears from its title, the paper focuses on analyzing past evolution of transport demand and supply in Greater Cairo over the last 30 years of the 20th century, utilizing the results of travel demand surveys carried in 1971, 1978, 1987, 1998 and 2001. Demand analysis includes the evolution of daily trips, trip purpose share, modal share and number of cars. Whereas, the evolution of transport supply covers an overview on transport projects implemented over the considered years. Further analysis of more recent trends of 2006/2007 vehicle registration in Greater Cairo by type and size is given. This allowed estimation of energy consumption and cost as well as emissions of green house gases (CO<sub>2</sub>) and pollutants (CO, HC & NO<sub>x</sub>) in absence of actual measures and based on international norms and local experience supported by estimates of travel distance and speed. A comparative analysis of relevant evolution indexes and trends of growth between 1971 and 2001, taking the former as base year, is given. This includes the evolution indexes of urban development (population & urbanized area), those of travel demand (trips), vehicles and private cars and the indexes of the evolution of fuel consumption, CO<sub>2</sub> and pollutants emissions. The analysis aims at revealing the features of increased energy consumption and emissions as related to the drivers of urbanization and transport in this grand metropolis. (...).

**Keywords:**

Transport demand evolution, Energy consumption evolution, GHG emissions evolution, Greater Cairo.

ID 2460 R

**ENVIRONMENT ENERGY ASSESSMENT OF TRIPS (EEBT): AN UPDATED APPROACH TO ASSESS THE ENVIRONMENTAL IMPACTS OF URBAN MOBILITY THE CASE OF LILLE REGION**

Main Author:

**Ariane DUPONT-KIEFFER** (INRETS - DEST)

**Abstract:**

This paper deals with sustainable mobility in an urban context. We investigate the assessment of the impacts of the evolution of travel behaviour (travelled distance and modal choice) in terms of energy consumption and greenhouse gases (GHG) emissions at the local level. Indeed, today, the control of exhausts generated by the mobility within the urban areas is at the core of the environmental policies and the stabilisation of GHG emissions is one of the main goals of 'sustainable development'. To face this challenge in the transport sector, the national government and local authorities need a better understanding of the link between urban development choices, the operation of the different modes of transport systems, and residents and non residents' attitude, and mobility patterns at the local level. (...)

**Keywords:**

Urban mobility - Energy consumption - Pollutant emissions  
- Emissions maps - Diagnosis - Simulation.

ID 2694 R

**DYNAMIC ESTIMATION OF TRAFFIC EMISSIONS IN METROPOLITAN ROAD NETWORKS**

Main Author:

**Vincent AGUILERA** (Université Paris Est)

Co-author(s):

**Megan LEBACQUE** (ENPC)

**Abstract:**

Road traffic is a major source of air pollutants, and there is an increasing need for accurate forecasts of vehicles' emissions. At a national scale, aggregate models are in operation (e.g. COPERT 4 in Europe, MOBILE 6 in the United States [1]). They rely on various statistics on the operating modes and activity of a large fleet of vehicles, divided in broad classes. A large number of inputs such as mileage per vehicle class, average speed per vehicle class and per road type are combined together. By nature, models of this kind do not directly link vehicle's emissions to traffic dynamics. At the extreme opposite, microscopic models estimate emissions by simulating the dynamics of individual vehicles within a local area, during a particular time period. Because such models are generally computationally intensive, their use for large metropolitan areas is, for the time being, excluded in practice. Current methodologies applied on metropolitan networks rely on average vehicle speed on each link of the network. Static traffic assignment models are used to forecast traffic flow rates and vehicles speed on network links. Since congestion changes with the time of day, and because congestion is a major determinant of speed, time-of-day modelling is necessary. Using static models, separate time periods can be considered, but this approach does not capture well the time-continuous reaction of the demand to congestion: while congestion levels increase during the day, more and more routes are being used, and at the same time shifts in departure times can be observed. To better handle the time-space dynamics of trips in a network, various dynamic traffic assignment models have been extended to include traffic emission models. (...).

**Keywords:**

Traffic emissions, Congestion management, Dynamic .

ID 2695 R

**GREENHOUSE GAS EMISSION SCENARIOS OF LAND USE CHANGE USING A LARGE SCALE CONTINUOUS-TIME ACTIVITY-BASED MICROSIMULATION MODEL SYSTEM IN SOUTHERN CALIFORNIA: DESIGN, IMPLEMENTATION, PRELIMINARY FINDINGS, AND FUTURE PLANS**

Main Author:

**Kostadinou GOULIAS** (*University of California Santa Barbara*)

Co-author(s):

**Chandra BHAT** (*The University of Texas, Austin*)

**Ram PENDYALA**

**Yali CHEN** (*University of California, Santa Barbara*)

**Naveen ELURU** (*The University of Texas, Austin*)

**Karthik KONDURI** (*Arizona State University*)

**Abstract:**

The State of California in the United States has recently embarked on an aggressive movement towards reducing greenhouse gas emissions that contribute to global climate change, promoting sustainability, and better managing vehicular travel demand. The recent California State Senate Bill 375 explicitly calls for major metropolitan areas in the state to meet ambitious greenhouse gas emission reduction targets within the next several years. Metro areas are considering a range of policies to meet the emission reduction targets including land use strategies, pricing mechanisms, managed lanes, telecommuting and flexible work hours, enhancement of transit and pedestrian/bicycle modes, and use of technology to better utilize existing capacity. The analysis of these policies, and responding to the mandates of legislative actions such as Senate Bill 375 in California, calls for the adoption of model systems that are able to accurately represent activity-travel patterns of humans in a fine-resolution time-space continuum. The Southern California Association of Governments (SCAG), the metropolitan planning agency for the Southern California region, is moving forward with the development of a comprehensive activity-based microsimulation model system of travel demand to enhance its ability to estimate the impacts of a range of policy measures in response to Senate Bill 375. (...).

**Keywords:**

Microsimulation, Greenhouse Gas Emissions, Land Use.

ID 3208 R

**EXPLORE THE CONNECTION BETWEEN THE BUILT-ENVIRONMENT CHARACTERISTICS, VMT, AND TRANSPORTATION-RELATED CO2 EMISSIONS: CASE STUDY OF AUSTIN, TX**

Main Author:

**Ming ZHANG** (*South China University of Technology (Visiting) / University of Texas at Austin*)

Co-author(s):

**Chunyang ZHANG** (*South China University of Technology*)

**Abstract:**

Between 1980 and 2008, total emissions of the six principal air pollutants in the U.S. dropped by 54 percent; CO2 emissions, however, increased by 32 percent along with 91 percent increase of vehicle miles traveled (VMT); Transportation sector accounts for approximately one-third of the CO2 emissions (USEPA 2009). Three major sources contribute to transportation-related CO2 emissions: vehicle, fuel, and VMT. The US energy bill of 2007 mandating vehicle and fuel efficiency improvement may help reduce CO2 emissions close to the targeted level by 2030. Nevertheless, projected VMT growth will likely wipe out the energy bill savings (Ewing, et al 2008). While it is widely agreed that VMT and the built environmental characteristics are closely related, empirical evidence remains scarce on the extent to which modifying the built environment may reduce VMT as well as CO2 emission. In this study we explore the connection between the built-environment characteristics, VMT, and transportation-related CO2 emissions. Taking the Austin, TX area as an example, the study first derives in GIS the attributes of the built environment in terms of development density, land use mixture, block size, modal connectivity (by driving, biking, and walking), and regional/local accessibility. Next, we geocode trip origins and destinations of the sampled individuals from the 2005 Austin Activity-Travel Survey and derive their trip distances (i.e., VMT) by various travel means. Emission rates of travel are estimated by considering vehicle type and age, travel speed, and cold-starts. In the following step we regress emissions against trip distances as well as the built environmental characteristics. Based on the results, we draw implications for designing zero-carbon communities. (...).

**Keywords:**

CO2 emissions, The built environment, VMT, Community design, Austin, Texas.

ID 1526 R

**URBAN FORM AND BUS RIDERSHIP IN SPANISH CITIES**

Main Author:

**Rocio CASCAJO** (*TRANSyT-UPM*)

Co-author(s):

**Steven FARBER** (*McMaster Institute for Transport and Logistics, School of Geography and Earth Sciences, McMaster University*)**Pablo JORDÁ** (*TRANSyT-Transport Research Centre, Universidad Politécnica de Madrid*)**Antonio PÁEZ** (*McMaster Institute for Transport and Logistics, School of Geography and Earth Sciences, McMaster University*)**Andres MONZON** (*Universidad Politécnica de Madrid*)**Abstract:**

The effect of urban form on mobility is a question with important implications for transportation and land use research and planning. A number of studies have investigated the relationship between mobility and various indicators of urban form while controlling for socio-economic characteristics. A majority of these have been concerned with mobility by private vehicles, although more recently there are also examples of research that explores the relationship between urban form and the use of public transportation. The objective of this paper is to investigate the demand for public transportation in a selection of cities in Spain, from the perspective of urban form (density, metropolitan area, population ratios), and other variables describing the characteristics of public transport supply (density of network and of stops), urban socio-economic profile, and competing and complementary modes (metro, suburban train and auto ownership rates). The paper is based on aggregate bus usage data collected for a number of Spanish cities and metropolitan areas for the years 2003-2007, and the use of autocorrelation models to account for intra-class correlations for multi-year observations of metro areas/cities. The results of the analysis indicate that demand for public transport in Spain is related to the size and population density of the urban area, the supply of bus routes, and the existence of a metro rail alternative. The results also indicate the existence of substantial autocorrelation effects.

**Keywords:**

Public transport, Spain, Urban form, Density, Autocorrelation models.

ID 1788 R

**NEW METROPOLITAN PROCESSES ENCOURAGED BY HIGH-SPEED RAIL: THE CASES OF LONDON AND MADRID**

Main Author:

**Jose MARIA UREÑA** (*Universidad de Castilla la Mancha*)

Co-author(s):

**Maddi GARMENDIA** (*University of Castilla La Mancha*)**Roger VICKERMAN** (*University of Kent*)**Jose MARIA CORONADO** (*Universidad de Castilla La Mancha*)**Vicente ROMERO** (*Universidad de Castilla La Mancha*)**Abstract:**

When High Speed Rail (HSR) was introduced in Europe it was seen mainly as an alternative to air transport between metropolitan areas 400-600 km apart. A few intermediate stations were created in small cities, mainly for security reasons, around 200 km from the metropolises, but also in the hope that these could act as a stimulus to local economies. Whilst early examples in France and Germany have not shown any such outcomes, in other cases, particularly in Spain, long distance commuting and discontinuous metropolitan processes have increased considerably in these cities, processes which have already been described in detail by the authors. More recently, HSR stations have also been created in suburban areas or small cities within the limits of metropolitan areas (up to 100 km), opening up two new metropolitan transportation behaviour possibilities. First, the HSR is used between central and peripheral metropolitan areas as a special new type of suburban metropolitan transport. Secondly, peripheral HSR stations are used to travel to/from other far away places instead of using the central HSR stations or as interchange points between HSR services. The fact that this new type of HSR connection facilitates or reinforces the integration of these small cities or suburban areas at the metropolitan corridor is foreseeable. Besides, the way they are incorporated into metropolitan and national corridors and the characteristics of the aforementioned corridors will have a considerable effect on the opportunities generated by HSR. (...)

**Keywords:**

High-Speed Rail, Metropolitan sub-centres, Small cities, Long-distance commuting, Office decentralization.



ID 2429 R

**A SMALL-SAMPLE APPROACH TO MEASURE ACCESSIBILITY FOR LOCAL SERVICES: A CASE STUDY TO PHARMACIES**

Main Author:

**Ana VASCONCELOS** (*Instituto Superior Técnico*)

Co-author(s):

**Tiago FARIAS** (*IDMEC-IST*)

**Jonathan LEVINE** (*University of Michigan*)

**Abstract:**

This paper intends to define a methodology for the estimation of accessibility indicators for non work destinations, considering a local scale (trips within a distance lower than 2 km), including not only internal costs (time or distance) but also external environmental costs (energy consumption, CO<sub>2</sub> emissions and local pollutant emissions). The methodology for accessibility estimation is based on four steps: measurement of individual accessibility, for a given mode, from origin to a pre-define destination; estimation of the cumulative accessibility for different destinations for each mode individually; estimation of the cumulative accessibility of all transport modes based on modal split information and calculation of external cost of accessibility for motorized modes (energy consumption, CO<sub>2</sub> and local pollutant emissions). A preliminary test case to evaluate the accessibility to pharmacies in Lisbon was developed in order to demonstrate the applicability of the developed methodology.

**Keywords:**

Accessibility, Indicators, Emissions, Energy consumption.

ID 2596 R

**AN INDICATORS SET FOR THE ENVIRONMENTAL ASSESSMENT OF URBAN EFFECTS OF LIGHT RAIL SYSTEMS**

Main Author:

**Luis MIGUEL VALENZUELA MONTES** (*University of Granada*)

Co-author(s):

**Julio SORIA LARA** (*University of Granada*)

**Carlos VILAR CORTES** (*University of Granada*)

**Abstract:**

Several positive effects (environmental urban effects among others) can be produced by light rail system (LRS) development in metropolitan areas. Moreover, these effects are showed to different levels, such as, metropolitan and town level, or in the street where the LRS is proposed. Under this context, understanding better the impact of these externalities in the different spatial levels could be the best way to enhance a suitable integration of this transport system. In this way, assessing the environmental effects in the street where LRS will travel, it can help to develop criteria which permit design the street as a transport public corridor with higher environmental efficiency values. In this way, this paper is presented an indicators set to assess the environmental integration of light rail systems at street (re)design level. Finally, one example of the results of these indicators set will be showed in Metropolitan Area of Granada. This area is located in Andalusia's region in the south of Spain, and during the last years a LRS is being promoted by the regional and local governments.

**Keywords:**

Assessment, Indicators, Light rail, Urban environment.

MON 12<sup>th</sup> (17:00 - 18:15, Session F3.4) Room 1.05

ID 1093 R

**THE IMPACT OF LOCAL DEVELOPMENT DENSITY ON HOUSEHOLD LOCATION AND TRAVEL DISTANCE**

Main Author:

**Kazuki NAKAMURA** (*Department of Architecture, University of Cambridge*)

**Abstract:**

This paper is aimed at analysing the impact of development density on demand of household location and travel distance at a neighbourhood level. Land-use transport models have significantly contributed to regional analysis to empirically test the sustainability impacts of spatial and transport policies. However, little research has been made for a micro-scale approach to analyse the impact of neighbourhood design on location and travel. Neighbourhood design could affect local travel distance by changing household location according to local attractiveness. In this paper, empirical analysis is carried out to test the neighbourhood impact of design to introduce different levels of density into local development. A micro-scale land-use model compatible with a regional model is applied to estimating local household location in an urban core and fringe areas in Cambridge, UK. By comparing the estimated household location with the Census data, it analyses households' preferences to local factors associated with density. Then, urban design options are tested with the model for the impacts on household location and travel distance. This analysis shows the different impacts of development density in urban design between the areas.

**Keywords:**

Urban Design and Transport Planning, Neighbourhood Spatial Analysis, Land-use Transport Model, Development Density, Local Household Location and Travel.

MON 12<sup>th</sup> (17:00 - 18:15, Session F3.4) Room 1.05

ID 1409 R

**WELFARE EFFECT OF URBAN TRANSPORT IMPROVEMENT THROUGH RETAIL STORE LOCATION CHANGE: AGGLOMERATION AND DISPERSION**

Main Author:

**Akio KISHI** (*University of Shizuoka*)

**Abstract:**

Emergence of the hollowing-out of an urban centre's commerce through market interactions is not socially optimal if such a situation involves market failure. We particularly investigate two factors of market failure: imperfect competition among retail stores and shopping externality caused by multipurpose (one-stop) shopping. We derive the mechanics generating a divergence between market equilibrium and social optimum by constructing a model. Next, based on the model, we analyze the welfare effects of a transportation improvement and the mechanism by which transportation improvement affects hollowing-out.

**Keywords:**

Hollowing-out, Monopolistic competition, Shopping externality.

ID 1470 R

**GIS BASED URBAN AIR QUALITY MODEL: THE CASE OF NO<sub>2</sub>**

Main Author:

**Youngkook KIM** (*The Ohio State University*)

Co-author(s):

**Sang HO LEE** (*Dept. of Urban Engineering, Hanbat National University*)**Sangmin LEE** (*Korea Transport Institute*)**Abstract:**

Despite improvements in vehicle emission control technology, the rapid growth of vehicle ownership and average trip length during past decades has created an unhealthy air quality in urbanized areas. Traffic emissions are known to be responsible for a substantial share of urban air pollution, such as nitrogen dioxide (NO<sub>2</sub>), carbon monoxide, volatile organic compounds (VOCs), and particulate matters. Pollutants emitted by motor vehicles influence the spatial and temporal patterns of ambient pollution concentrations. Generally, air pollution concentrations are determined by such factors as the formation and destruction of pollutants through chemical and physical reactions, the intensity and duration of emissions, the uptake and assimilation of pollutants by urban vegetation, and meteorological factors inducing chemical reactions and physical dispersion (Derwent & Hertel, 1998; Harrison, 2001; Seinfeld & Pandis, 2006; Takahashi et al., 2005; US EPA, 2000; WHO, 2006). Among these factors, vehicle emissions are considered a key factor to determine the air quality of urban regions. It is reasonable to expect that, as vehicle-kilometres-travelled (VKT) increase, ambient air pollution concentrations will also increase. Since transportation is responsible for a substantial share of urban air pollution emissions, VKT is considered as a better regressor to explain pollution concentrations than other transportation-related variables, such as traffic counts, area of road, distance to major roads, etc. (Jerrett et al., 2007; Kahyaoglu-Koraćin, Bassett, Mouat, & Gertler, 2009; Y. Kim, 2007; Y. Kim & Guldmann, 2008). Integrated air quality modelling systems have been developed in several countries for dense urban regions, where pollutants generated by road traffic tend to be present at high concentrations. (...)

**Keywords:**GIS, NO<sub>2</sub>, Transportation, Land uses, Meteorology.

ID 1701 R

**COST-EFFECTIVE ANALYSIS OF TRAFFIC EMISSION CONTROL: TARGETING STRATEGIES UNDER UNCERTAINTY**

Main Author:

**Lena NERHAGEN** (*Swedish National Road and Transportation Research Institute - VTI*)

Co-author(s):

**Chuan-Zhong LI** (*Uppsala University*)**Abstract:**

Emissions from traffic impose negative effects on human health, and recent evidence indicates that particulate matters (PM) are the detrimental air pollutant that causes most life years lost. To improve the efficiency of resource allocation, various mitigation measures have been proposed for reducing these emissions. However, whether or not the policy instruments are welfare improving, and if yes, how much more efficient they can be remain to be studied. To answer the questions, we need to both assess the economic cost of emission control and the health benefit due to the reduced PM emission by all proposed control instruments. This paper focuses on the cost efficiency for reaching pre-determined emission targets. We are concerned with reducing the concentrations of PM in Stockholm by local policy measures. Contrary to other cost-efficiency studies we have in this study included adaptations in behaviour in addition to the conventional technical measures alone. Since there are different emissions of PM, targeting PM<sub>10</sub> may not be a good indicator of the health benefits. We therefore compare the performance of targeting PM and of targeting years of life lost (YOLL) and found interesting differences. We find that if the ultimate objective is to save lives or say life-years, it should be more appropriate to target YOLL, provided that YOLL can be properly predicted. Moreover, since the collected data on the effectiveness and cost of the policy instruments involve large uncertainty, we have employed a stochastic control model to explore the implications of the degree of uncertainty. We find that the higher fulfilment probability, the larger the marginal cost as expected. Also, for a given fulfilment probability, the more uncertain we are about the true effectiveness parameters, the larger the marginal costs. (...)

**Keywords:**

Emission control, Cost-effective analysis, Human health, Uncertainty, Stochastic control.

MON 12<sup>th</sup> (17:00 - 18:15, Session F3.4) Room 1.05

ID 2884 R\*

**DEVELOPMENT OF MOTORCYCLE DRIVING CYCLE AND ESTIMATION OF EMISSIONS FROM MICRO-SIMULATION MODEL**

Main Author:

**Ravindra KUMAR** (CRRRI MEW DELHI)

Co-author(s):

**Dr. NEERAJ SHARMA CRRRI** (New Delhi)

**B.kanga DURAI** (Central Road Research Institute New Delhi)

**Abstract:**

Traffic micro-simulation has been used in assessing the traffic performance of highway and street systems, transit and pedestrians and other expanded applications in transportation engineering and planning practice. VISSIM is a micro-simulation software that is being used by different regions to analyse multiinteraction of transportation systems. Modelling individual vehicle driving cycle requires the speed of vehicles second-by-second basis. However, very few previous research has been undertaken to calibrate the driving cycle for motorcycle using micro simulation using VISSIM; therefore, it is not yet known how well traffic conditions in local environments can be represented using microsimulation models. Development of driving cycles and estimation of emissions from microsimulation models can be performed on a number of different levels, from individual vehicle emission estimation to citywide emission estimation. The level of details selected for the emission estimation model should correspond to the vehicle that is being modelled. This paper presents the adoptions of the micro-simulation commercial software (VISSIM) and to represent the driving conditions of motorcycles in urban network conditions, taking a short section in Edinburgh as a case study. One test corridor is defined in the Air Quality Management Area (AQMA) of Edinburgh City centre. Data collection using video recording and other secondary sources (e.g. TRL and ECE) have been utilised. The micro-simulation model has been calibrated using goodness of fit expressed as GEH and validated using different sets of real-world data for verification. Finally the analysis presented in this paper considers the potential application of driving cycle data from micro-simulation to provide realistic inputs to a vehicle emissions model capable of estimating emission in along the an Air Quality Management Area in Edinburgh. (...).

**Keywords:**

Micro-simulation, Driving cycle, Motorcycle, Edinburgh.

TUE 13<sup>th</sup> (08:15 - 09:30, Session F3.5) Room 1.05

ID 2124 R\*

**META-REGRESSION OF NDIS AROUND AIRPORTS: EFFECT OF INCOME/WEALTH**

Main Author:

**Zia WADUD** (Bangladesh University of Engineering and Technology)

**Abstract:**

The external costs of aviation noise are an important input in policy assessment for cost-benefits analysis. The Noise Depreciation Index (NDI) is used to capture the externality costs through measuring the depreciation of property prices exposed to aviation noise. Existing NDI estimates from Hedonic Price studies range from no statistically significant effect to a 2.3% decrease in property prices for every dB of increase in noise exposure. This paper summarizes these studies and examines the underlying differences in order to transfer these NDI values to other parts of the world, where NDI estimates are not directly available. The previous meta-analyses of the NDIs are found to be inconclusive, with one study suggesting higher property prices (relative to income) increases the NDI estimates, while another finds no significant effect of property prices (in absolute terms) on NDI. This paper extends previous studies by incorporating a larger number of studies with a larger geographical coverage. We found that higher wealth, expressed in terms of property prices, relative property prices or income, result in higher values of NDI. This means that wealthier households de-value the property prices more than the average in the presence of aircraft noise, which is consistent with the hypothesis that environmental amenities are luxury goods. Studies using linear specification in the Hedonic Price model generally report higher NDI estimates. Studies that control for proximity benefits of airports have consistently higher NDI estimates for different model specifications, although statistically not significant. This indicates the benefits of reducing noise around airports could be higher than previously anticipated. (...).

**Keywords:**

Airport noise, Land devaluation, Meta analysis, Hedonic price modeling.

TUE 13<sup>th</sup> (08:15 - 09:30, Session F3.5) Room 1.05

ID 2378 R

## **ANALYSIS AND PREDICTION OF THE PM10 IN THE CITY OF NAPLES**

Main Author:

**Valerio DE MARTINIS** (*Dipartimento di Ingegneria dei trasporti "L. Tocchetti"-Università degli Studi di Napoli Federico II*)

Co-author(s):

**Roberta DI PACE** (*University of Naples*)  
**Luigi BIGGIERO** (*Università degli Studi di Napoli Federico II*)

### **Abstract:**

This paper focuses on the analysis and modelling of air pollutants concentration in the city of Naples, Italy. The air pollutants concentration is considered to be one of the major problems for human health in urban areas. For this reason, the main sources of air pollution, like traffic and industries, are strictly controlled and different strategies for the traffic monitoring and regulation have been recently adopted. One of the most harmful pollutants to human health is widely considered to be PM10, the cancerous particles with a diameter under 10  $\mu\text{m}$ . With reference to previous studies (Biggiero et al., 2009) the trend over time of PM10 have been investigated. In particular the main endogenous variables have been identified for site forecasting and then the relationships over time have been analyzed and fixed in order to obtain a model for the PM10 itself. Two approaches have been experimented: the ARIMA model and the Artificial Neural Network. Models have been calibrated, validated, and the results have been discussed.

### **Keywords:**

PM10, Traffic strategies, ANN.

TUE 13<sup>th</sup> (08:15 - 09:30, Session F3.5) Room 1.05

ID 2428 R

## **ASSESSING THE ENVIRONMENTAL CAPACITY OF LOCAL RESIDENTIAL STREETS**

Main Author:

**Glen KOOREY** (*University of Canterbury*)

### **Abstract:**

The inherent conflict between the residential amenity and traffic access functions of local streets causes debate on what constitutes a true "local" road. The concept of 'environmental capacity' was developed to identify a suitable maximum traffic volume on such local streets. It was first introduced by Buchanan and Appleyard in separate research in the 1960's. Both authors settled on broad-brush traffic thresholds of 2,000-3,000 vehicles per day. Since then, other research has relied heavily on the original Buchanan and Appleyard findings; this paper investigates that presumption in the present day. A residents' survey was applied to four "local" streets with varying traffic volumes in Christchurch, New Zealand. Residents living on those streets with higher volumes felt that their streets were busier, noisier and less safe. There was also an increasing trend for residents along higher volume streets to have their houses turned away from the street and they tended to have less personal involvement and/or knowledge of their neighbours. In the Christchurch context, a more appropriate environmental capacity would appear to be around 1,500-2,000 vehicles per day. This has implications for local town planning and street network design guidance if true local roads are to be achieved.

### **Keywords:**

Town planning, Local streets, Environmental capacity, Traffic volumes, Liveability, Amenity.

TUE 13<sup>th</sup> (09:45 - 11:00, Session F3.6) Room 1.05

ID 1777 R

**QUANTIFYING THE NEIGHBORHOOD ENVIRONMENT  
QUALITY FOR WALKING**

Main Author:

**Suely SANCHES** (*Federal University of São Carlos*)

Co-author(s):

**Marcos FERREIRA** (*Federal University of São Carlos*)

**Abstract:**

The objective of the research described in this paper was to examine the relationship between built environment factors (representing several dimensions of urban form) and the perceived quality of this environment for walking, at neighborhood level.

**Keywords:**

Non-motorized transportation, Walkability, Neighborhood.

TUE 13<sup>th</sup> (09:45 - 11:00, Session F3.6) Room 1.05

ID 2419 R

**URBAN FORM AND COMMUTING: A CRITICAL REVIEW  
OF LITERATURE**

Main Author:

**Anne AGUILERA** (*Université Paris Est LVMT*)

**Abstract:**

Over the years, extensive literature has highlighted the evolutionary trends of North American and European urban areas towards a less centralized and a more polycentric distribution of people and employment. Consequences for daily mobility, in terms of distance traveled and mode shares are important questions for both researchers and planners who seek ways to reduce greenhouse gas emissions in urban areas. This paper proposes a critical review of literature about the links between urban form, commuting distance and car use. Urban form is defined as the spatial organization of people and jobs within a urban areas. The paper is organized into three parts. In the first part, I question the relationships between urban form and commuting by questioning the relationships between home to work distance and residential location. In the second part, I show how studies that compare commuting patterns in monocentric versus polycentric urban areas produce quite contradictory results. I then propose to explore, in the third part, the links between the form taken by polycentrism and commuting patterns. I conclude with some policy recommendations concerning both urban planning and transportation system.

**Keywords:**

Polycentrism, Commuting distance, Car use.

TUE 13<sup>th</sup> (09:45 - 11:00, Session F3.6) Room 1.05

ID 3052 R

**AGEING IN, AND THROUGH, POLLUTED PLACES: A CONCEPTUAL SPATIAL INTERACTION MODEL**

Main Author:

**John BLACK** (*University of New South Wales*)

Co-author(s):

**Deborah BLACK** (*University of Sydney*)

**Abstract:**

This paper extends traditional land-use and transport modeling by including the interactions between land use (demographics), transport and public health. The issues of event (environmental stressor), time (from cradle to the grave) and place (locations, especially those with their own time-dependent variable of environmental stress) are the basis of a new transport and epidemiological study proposed. Two inter-related areas of environmental sustainability and health require a comprehensive understanding of the effects of long-term global economic development and climate change on: ecosystem sustainability and on human health; emergent pollutants (from transport) and their effects within human communities; the interaction between environment, land use development, and human health; and the management of solutions at local, regional, and global scales. Research studies have not addressed the explicit recognition of time in these two inter-related areas of environmental sustainability and health. Little is known about how environmental risks impact on individuals over time, nor about location - the health differentials are due to individuals' accumulated exposures, differences in environmental stressors after internal migration (e.g., moves to and from the coast and rural areas), or selective mortality. A specific challenge is coping with the inter-related issues of sustainability and population aging because life-time exposure (in different places and locations) to transport environmental stressors and their cumulative affects health and well-being. We show that spatial interaction models can be extended to include the long-term dynamics of change as to how peoples' travel patterns pass through "polluted" places as objects of investigation during their life histories as the body ages. (...).

**Keywords:**

Transport pollution, Health, Spatial models.

MON 12<sup>th</sup> (11:15 - 12:30, Session F4.1) Room 1.13

ID 1065 R

**ASSESSMENT OF DIFFERENT BIOFUEL SUPPORT POLICIES CONSIDERING UNCERTAINTIES OF KEY PARAMETERS**

Main Author:

**Burkhard SCHADE** (*JRC IPTS*)

Co-author(s):

**Tobias WIESENTHAL** (*JRC IPTS*)

**Abstract:**

The aim of this paper is to assess different biofuel support policies with the model BioPOL. The development of the biofuel production depends highly on a set of input parameters which are inherently uncertain. Therefore, we set the focus in this analysis specifically on the way we deal with this uncertainty. BioPOL was developed and applied within the several European projects, among them TRIAS, PREMIA, HOP. BioPOL model is a system dynamic model that is constructed on the VENSIM modelling platform. It is based on a recursive year by year simulation of biofuel demand and supply until 2030. For each set of exogenously given parameters a level of biofuel production is found at which the costs of biofuels equal those of the fossil alternative they substitute, taking into account the feedback loops of the agricultural market and restrictions in the annual growth rates of capacity. The model delivers detailed outcomes for the different types of biofuels with regard to production capacity and produced volumes, costs and well-to-wheel emissions of greenhouse gases. It considers the main production pathways of biofuels, namely first generation biodiesel with rapeseed and sunflower and first generation ethanol with cereals and sugar beet. Furthermore, it includes advanced 2nd generation pathways from ligno-cellulosic feedstock (i.e. ethanol and synthetic diesel BtL). The deployment of biofuels in the transport market depends on a variety of factors, some of which are inherently uncertain such as the outlook on the oil and feedstock prices or trends in advanced biofuel conversion technologies. These uncertainties will need to be taken into account when conducting a model-based assessment of the effectiveness of future biofuel policies. (...).

**Keywords:**

Assessment, Biofuel, System dynamics, Monte Carlo,

ID 1066 R

**IMPACT OF TRANSPORT POLICIES AND THE RENEWABLE ENERGY PACKAGE AND ON THE ENERGY USE OF TRANSPORT**

Main Author:

**Burkhard SCHADE** (*JRC IPTS*)**Abstract:**

The aim of this paper is to describe the impact of transport policies and the renewable energy package on the energy use and the emissions of transport in EU27. The paper is based on the EU project called iTREN2030. In iTREN2030 two transport and energy scenarios are developed applying a set of models, among them the energy model POLES. POLES is a system dynamics model for the development of long-term (2050) energy supply and demand scenarios for the different regions of the world. Besides the energy market it comprises a transport model and a policy sphere. In addition to the complex interrelationships between the energy markets the investigated scenarios cover a long period of time. POLES has been applied in a variety of projects like WETO-H2 (WETO, 2006). This paper refers to work that is currently carried out in the EU project iTREN2030. Within the iTREN2030 project POLES is applied together with the models REMOVE, ASTRA and TRANSTOOLS. The objective of the project is to develop between the models harmonised scenarios covering transport, energy, environment and economy. For this purpose two scenarios were developed: • the reference scenario considering policies already implemented (Reference Scenario) • the renewable scenario considering policies which are likely to be implemented until 2025 (Integrated Scenario) On the transport side the regulation of CO<sub>2</sub> emission for different types of transport vehicles has to be mentioned. On the energy side the renewable energy package is expected to have a major impact on the energy system. The main policy instruments which are investigated are the carbon value (to reduce 20% of the CO<sub>2</sub> emissions until 2020) and the renewable energy support schemes (to increase the renewable share of final demand to 20% until 2020). (...).

**Keywords:**

Renewable energy package, Transport scenarios, Fuel.

ID 1169 R

**RAILWAYS IN THE CONTEXT OF CLIMATE CHANGE: STRENGTHS, WEAKNESSES, OPPORTUNITIES AND THREATS**

Main Author:

**John ARMSTRONG** (*Transportation Research Group*)

Co-author(s):

**John PRESTON** (*Transportation Research Group*)**Abstract:**

Rail is one of the oldest of our mechanised transport modes, having been in existence in something resembling its current form for almost two centuries. Since the early 20th century, its dominant position has largely been ceded to road and air transport, although it has retained a steady volume, if much diminished share, of the overall transport market, with particular strengths in the commuter market in large cities, medium-distance inter-city travel, and bulk freight. In recent decades, the development of high-speed passenger services has enabled rail to compete very effectively with air travel over distances of up to 800km, and to dominate routes such as London – Paris/Brussels and Paris – Lyon. Similarly, the containerisation of freight services has provided rail with a significant advantage in the intermodal market, as it is very well-suited to the movement of large numbers of containers between ports and their hinterlands. The issue of climate change remains somewhat controversial, and presents significant political challenges in terms of convincing political leaders and voters that its long-term consequences merit intervention, with the resulting effects on developed-world lifestyles, within the timescale of the typical electoral cycle. However, there is an increasing scientific consensus that the issue and effects of climate change are real, that human activities are a contributory factor, and that efforts are required both to reduce emissions of greenhouse gases and to mitigate the effects of climate changes that are occurring now, and are likely to continue to occur for at least decades into the future, irrespective of the efforts made now to reduce greenhouse emissions. (...).

**Keywords:**

Rail, Climate change, Energy, Environment, Mitigation, Adaptation.



ID 1264 R

**MEASURES AND INSTRUMENTS FOR EMISSION REDUCTION IN TRANSPORT – FINDINGS FROM THE OTELLO PROJECT**

Main Author:

**Claus DOLL** (*Fraunhofer-Institute for Systems and Innovation Research (ISI)*)

Co-author(s):

**Michael KRAIL** (*Fraunhofer-Institute for Systems and Innovation Research (ISI)*)**Magnus FRÖHLING** (*Institute for Industrial Production (IIP), Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany*)**Michael HIETE** (*Institute for Industrial Production (IIP), Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany*)**Abstract:**

In 2007 the German Federal Ministry for Science and Education (BMBF) launched the research project otello (Development of an Integrated Assessment for National Air Emission Management). The objective of the research is to develop a simulation model for assessing measures and instruments to reduce emissions of air pollutant and CO<sub>2</sub> from transport, industry, electricity and heat supply and residential buildings in Germany until 2020 and their compliance with the EC-directive on National Emission Ceilings (NEC). This paper concentrates on the transport sector, for which the assessment of emission reduction policies is approached by the integrated system-dynamics model ASTRA, capturing the various relationships between demand and supply segments. The core contribution of ASTRA is to quantify the costs and impacts of non-technical and general technical emission reduction policies by transport sector and field of technology on a national level. The model application is supported by a detailed technology database going into the emission reduction potentials of single technical measures by transport mode and sector. For each mode several independent measure and instrument groups have been defined and prioritised by cost effectiveness, where the major challenge was the quantification of interrelations between the different measures. The database then was applied to generate timevariant emission reduction curves, feeding into the ASTRA model. (...).

**Keywords:**

Transport, Electric vehicles, Consumer behaviour, User behaviour.

ID 1450 R

**PASSENGER TRANSPORT AND CO<sub>2</sub> EMISSIONS: AN ANALYSIS OF FRENCH EVOLUTIONS BETWEEN 1994 AND 2008**

Main Author:

**Damien VERRY** (*CERTU*)

Co-author(s):

**Jean-Pierre NICOLAS** (*LET*)**Zahia LONGUAR** (*Transport Economy Laboratory*)**Abstract:**

Environmental concerns are at the very heart of current political debates. Taking account of people's mobility behaviour and knowledge of the resulting carbon dioxide emissions are therefore essential in the combat against the greenhouse effect. Emissions relating to mobility of the French population have been calculated using travel information gathered during the 2007 National Transport Survey. Emphasis on the different socioeconomic factors conditioning mobility behaviour of the individuals surveyed provides better knowledge of mobility trends. It also enables better targeting of carbon dioxide emission reduction policies by better defining their stakes in terms of sustainable development and taking account of their social impacts. In this article, after presentation of the calculation method for these emissions, two major types of mobility, of very different dynamics, will be discussed: local mobility and long distance mobility. The socioeconomic factors explaining individuals' behaviour and the resulting emissions will then be analysed.

**Keywords:**

CO<sub>2</sub> emissions, Greenhouse effect, Socioeconomic analysis, Individual behaviour, 2007-2008 national transport survey, Local mobility, Long distance mobility.

MON 12<sup>th</sup> (11:15 - 12:30, Session F4.1) Room 1.13

ID 1474 R

## **SUPPORTING TOOLS FOR BETTER IMPLEMENTATION OF SUSTAINABILITY STRATEGIES**

Main Author:

**Risa MORIMOTO** (*Toulouse Business School*)

### **Abstract:**

Transport industry today is facing an increasing pressure to improve its sustainability performance. Aviation industry, for example, will be included in European Union Emission Trading Scheme from 2012, therefore effective strategies to reduce their carbon footprint is urgently required. Policies and strategies are set in response to such a growing demand from various stakeholders, yet the progress seems to be slow. This paper uses aircraft manufacturers as an illustrating example to demonstrate why more systematic approaches are urgently needed. Aircraft manufacturers indeed realise the importance of focusing their efforts to incorporate sustainable development policies into their core business strategies. However, this study addresses the scarcity of supporting tools that could be applied in order to implement sustainability strategies more effectively. The main objective of this paper is to demonstrate how aircraft manufacturers can formulate and implement sustainable development strategies in a systematic and traceable manner. The paper emphasises the importance of having a structure in developing sustainable development strategies. Today, the importance of stakeholder analysis, dialogue and engagement is widely recognised in the aviation sector. This paper suggests such stakeholder analyses to be conducted in a more structured and integrated way in view of offering improved support to the ever globalised aircraft manufacturing system in order to effectively define and implement sustainable development strategies. Under the rapidly changing business environment that aviation industry is operating in, the need of a holistic approach to develop sustainable development strategies, such as a systems approach, seems to be well justified. (...).

### **Keywords:**

Sustainable development, Aviation, Sustainability.

MON 12<sup>th</sup> (14:00 - 15:15, Session F4.2) Room 1.13

ID 1647 R

## **PRIMARY AND SECONDARY EFFECTS OF TELEWORKING POLICIES ON HOUSEHOLD ENERGY CONSUMPTION**

Main Author:

**Dujuan YANG** (*Technische Universiteit Eindhoven*)

Co-author(s):

**Theo ARENTZE** (*Eindhoven University of Technology*)

**Harry TIMMERMANS** (*Urban Planning Group, Eindhoven University of Technology, The Netherlands*)

### **Abstract:**

In the transportation literature, the effects of teleworking have been studied primarily in terms of their effect on changing activity-travel patterns. Teleworking has been positioned as a policy to reduce the number of miles travelled and the number of trips. Potentially therefore, teleworking may contribute to a reduction of congestion and emissions. More recently, the discussion on sustainable development in the transportation research literature has been widened to include energy consumption. Increasing energy prices and expected energy shortages are believed to have an impact on travel behaviour. Consequently, the evaluation of teleworking policies should include this wider policy frame of reference. By estimating energy consumption as a function of characteristics of the activity-location, energy consumption related to daily activity-travel patterns can be simulated, at least to some level of detail. The primary and secondary effects of various policy scenarios, including teleworking, can then be evaluated by using an activity-based model to predict household response to the policy of interest. The paper reports the results of a study that was undertaken to examine the feasibility of this approach.

### **Keywords:**

Energy consumption, Activity-travel patterns.

ID 1803 R

**WHICH FACTORS TO EXPLAIN THE SPATIAL EVOLUTION OF CO2 EMISSION LINKED TO URBAN DAILY MOBILITY? THE CASE OF LYON, FRANCE**

Main Author:

**Bouzouina LOUAFI** (*Laboratory of Transportation Economics -University of Lyon*)

Co-author(s):

**Nicolas JEAN-PIERRE** (*Transportation Economy Laboratory*)**Vanco FLORIAN** (*Transportation Economy Laboratory*)**Abstract:**

The alternative modes of the use of automobiles have regained attention on the urban level. Against this background, we look on the spatial context of this attention and look on the agglomeration of Lyon. More specifically, we ask how CO2 emissions that are associated with the everyday mobility have developed until recently? First, we analyze the development of the intensity of CO2 emissions per day that has been estimated in the last two household travel surveys done in the agglomeration of Lyon in 1995 and in 2006. We are interested in the dynamics of mobility of the development that we can observe in the comparison of both surveys. Furthermore, we aim to abstract the linkage of a specific form of mobility (mode of transport and distance) to a specific population group (status, car ownership, residential location). This typology helps us to highlight those groups where emissions rates are significantly higher and where the focus on the emissions reduction should be intensified.

**Keywords:**

CO2 emissions, Household trip survey, Lyon conurbation, Travel behavior, Socio demographic evolution, Technological improvement.

ID 2074 R

**CARBON DIOXIDE EMISSIONS FROM ROAD TRANSPORT IN LATIN AMERICA: CO2 REDUCTION AS A CO-BENEFIT OF TRANSPORT STRATEGIES**

Main Author:

**Lee SCHIPPER** (*Global Metropolitan Studies*)**Abstract:**

We review aggregate trends in CO2 emissions from road transport in Latin America. Comparison with other regions, as well as with automobile ownership and use suggests that road transport the emissions in this region are closely connected to high automobile ownership and use. Examination of detailed estimates of vehicle stocks, use and fuel intensity as well as data from four large metropolises in the region confirms this suggestion. The same data show that it is cars that are the main reason for congestion, high levels of air pollution, and other transport related externalities in urban regions. Thus mitigation of CO2 emissions from urban transport means dealing directly with cars and car use. Widely cited projections of car ownership and use in 2030 suggest that car use will more than triple. Even with a 20% reduction in fuel use and emissions/km, CO2 emissions will be well above present levels. But if the fundamental problems of urban transport that plague Latin America today are addressed, car use will grow by considerably less, restraining CO2 emissions considerably as a co-benefit of transport strategies. A review of the impact of a BRT project in Mexico City shows a reduction of 10% in traffic-related emissions in the BRT corridor even without fuel and emissions being addressed directly. One third of those savings arose because Metrobus riders left cars at home and took the bus. The monetized value of the CO2 externality is small compared to other benefits of Metrobus as a transport project. Thus CO2 reduction can be evaluated as a co-benefit of a transport project. Confronting other large transport externalities such as congestion would likely lead to reductions in car use and greater use of other modes. (...).

**Keywords:**

Latin America, Urban transport, CO2 emissions, Co-benefits.

ID 2107 R

**QUANTITATIVE ANALYSIS OF THE GLOBAL CO<sub>2</sub> EMISSIONS FROM TRANSPORT IN 2050 FOCUSED ON THE EFFECT OF THE MODAL SHIFT TO THE RAILWAY**

Main Author:

**Iwao MATSUOKA** (*Institution for Transport Policy Studies*)**Abstract:**

This study is based on a backcasting approach to reduce CO<sub>2</sub> emissions from the transport sector around the world. Our image of the future for the backcasting study depicts a society where the CO<sub>2</sub> emissions from the transport sector are reduced by 0-50% of the level of the year 2000 and the study further explored a series of policy packages and policy paths in order to reach to such an ideal future. Our target of 0-50% reduction of CO<sub>2</sub> emissions is based on the current political tendency of G8 leaders who declared at the G8 Summit in July 2009 that the G8 countries will reduce greenhouse gas emissions, in aggregate, by 80% or more by 2050. Since our study cover all the transport modes of the whole world, regional targets were derived by equalizing the amount of emissions per capita across the world in 2050. The scenario study was conducted under the rough assumption and estimation with respect to the effects of transport policies and mode share. The different characteristics of the trips of urban and non-urban transport were also taken into account. The analysis is basically carried out for two groups of the countries; developed and developing countries, so detailed circumstances of each country are not considered particularly due to lack of data. The results of our backcasting analysis shows that by improving technology and modal shift, the amount of CO<sub>2</sub> emissions in 2050 can be maintained to the level of the year 2000. Considering the serious increase of inter-city travel demand, particular focus should be applied to the construction of new railways especially in developing countries. Based on the observation of air demand in terms of seat-miles, about 30% of global air demand could be candidates of rail users in 2050. (...).

**Keywords:**CO<sub>2</sub>, Backcasting, 2050.

ID 2189 R\*

**SECTORAL EMISSION REDUCTION TARGETS TO ADDRESS CO<sub>2</sub> EMISSIONS IN THE TRANSPORT SECTOR FOR THE POST-2012 CLIMATE REGIME**

Main Author:

**Atit TIPPICHAJ** (*The Joint Graduate School of Energy and Environment, King Mongkut's University of Technology Thonburi*)

Co-author(s):

**Atsushi FUKUDA** (*College of Science and Technology, Nihon University*)**Hisayoshi MORISUGI** (*The Advance Research Institute for the Science and Humanities, Nihon University*)**Abstract:**

Even transport is widely recognized well that it is one of major GHG emitting sectors and it projects can bring multiple benefits besides GHG mitigation—reducing air pollution, noise, congestion, energy consumption, and so on, but yet transport currently plays a minor role in the post-2012 climate negotiations. This paper therefore aims to address the transport sector in a post-2012 climate regime by introducing a sectoral emission reduction target in the transport sector to key GHG emitting countries for the year 2020. We supposed that major GHG emitting countries will commit to the sectoral target for the medium term commitment, i.e. 2013-2020. Then, scenarios of total CO<sub>2</sub> emission reduction target in the transport sector in 2020, covering from 5% to 30% reductions from the 2005 level were established. We analyzed shares of emission reductions and abatement costs to meet the total targets by using sectoral marginal abatement cost (MAC) curves developed by a computable general equilibrium (CGE) model. The analysis results indicated that the USA will play a crucial role in GHG mitigations in the transport sector as it is most responsible for emission reductions for all scenarios. With having known the optimal emission reduction for each country which minimizes the total abatement cost, fairness and acceptable targets in the transport sector can be set up. Such information would be very useful for negotiating and making decision in the international climate regime as well.

**Keywords:**

Sectoral approach, Marginal abatement cost curve, Transport sector.

ID 2231 R

**CO2 TARGETS FOR NON-FREIGHT TRANSPORT AND HOW THEY CAN BE MONITORED, WITH EXAMPLES FROM ESSEN IN GERMANY AND HONGQIAO / SHANGHAI IN CHINA**

Main Author:

**Artur WESSELY** (TRC Transportation Research & Consulting GmbH)

Co-author(s):

**Jörg SCHÖNHARTING** (TRC Transportation Research & Consulting GmbH)**Katie BINIOK** (TRC Transportation Research & Consulting GmbH)**Stefan WOLTER** (TRC Transportation Research & Consulting GmbH)**Abstract:**

The Federal government in Germany has set itself ambitious climate protection targets, aiming for a 40% reduction in CO<sub>2</sub> emissions (1990 - 2020). In China the government has announced its target of increasing energy efficiency by 45% in the period 2010 to 2020. The question is whether, and if so, how these targets can be applied to transport and to particular places, e.g. regions, towns or parts of a town. There is also the related question of whether these targets can be achieved in the timeframes specified. The article will consider the approaches and measures which may be used to apply the policy targets to the transport of people in specific places. To answer the question whether the target of reducing CO<sub>2</sub> in the two cities can be achieved it is necessary to use a monitoring tool, which will be developed in the co-operative project Shanghai (01LG0514A1). The Dynamic Energy and CO<sub>2</sub> Controller EEC® includes the monitoring of three areas of activity: transport, building usage and renewable energy production. In keeping with the aforementioned targets it delivers (a) information on the current status, (b) a prognosis model and (c) verification of targets. The information on the current situation is drawn from the models outlined using empirical data ("sensor technology"). If, in monitoring the targets, it is shown that the target could be missed there is a way out by introducing other measures. If new measures are defined, the models are adjusted in the three areas of activity and the monitoring is carried out again. (...).

**Keywords:**CO<sub>2</sub> emissions, CO<sub>2</sub> targets, Monitoring tool, Dynamic Energy, CO<sub>2</sub> Controller.

ID 2256 R

**PRECISE EVALUATION OF VEHICLE EMISSION IN URBAN TRAFFIC USING MULTI-AGENT-BASED TRAFFIC SIMULATOR MATES**

Main Author:

**Hideki FUJII** (The University of Tokyo)

Co-author(s):

**Shinobu YOSHIMURA** (The University of Tokyo)**Abstract:**

Recently the global warming issues have been discussed all over the world. 20% of the total amount of CO<sub>2</sub> emitted in Japan is occupied by a transportation sector. In the sector, its 90% is occupied by road traffic. It must be reduced drastically so as to realize a low-carbon society. Various measures have been discussed, and at the same time it is strongly desired to estimate their effects quantitatively. The amount of vehicle emission has been simply calculated through multiplying travel distance or gasoline consumption by an emission coefficient in conventional methods. But such approaches neglect the effects of the interactions among numerous cars. We attempt to estimate precisely the amount of vehicle emission using an advanced traffic simulator. Here, the interactions among various types of cars must be considered, and car behaviors must be modeled precisely. A microscopic traffic simulator is very useful to achieve this purpose. We have been developing an advanced traffic simulator based on an intelligent multi-agent approach. We model any individual element appearing in traffic systems as an intelligent agent, and then model the whole traffic phenomena through the interaction among numerous agents on a virtual road environment. This paper describes a development of the system to evaluate vehicle emission by integrating a detailed database of exhaust gases of various types of cars into MATES. The database employed indicates the correspondence between car driving data and the amount of exhaust gases. By matching the output information of MATES to this database, the amount of momentary emission from each car can be estimated. The total amount of emission in a particular region or the emission history of a particular car is calculated from the momentary emission. (...).

**Keywords:**

Traffic Simulation, Multi-agent Model, Vehicle Emission.

MON 12<sup>th</sup> (15:30 - 16:45, Session F4.3) Room 1.13

ID 2304 R

**LOBBYING AND POLICY INERTIA: BIOFUELS POLICY UNDER UNCERTAINTY**

Main Author:

**Johanna HAMMES** (*Swedish National Road and Transport Research Institute and Centre for Transport Studies*)

**Abstract:**

The present paper studies the effect of uncertainty about the environmental properties of a good (biofuels) on trade policy, in the presence of lobby groups. We construct a political economy model to explain why the biofuels trade policy does not necessarily respond to new information about the emissions arising from the (domestic) production of biofuels. Thus, while it would be optimal from a general welfare point of view to lower the trade tariff on biofuels when it becomes clear that the production of these leads to increased emissions of greenhouse gases, if the government is susceptible to lobbying and the biofuels sector's lobbying effort is intensive enough, it may be that the tariff rate is raised instead in the face of new information. We further show that if new information is available later, when biofuels production has had time to adjust to other support policies in place, the trade policy revision due to new information about the emissions from biofuels production will lead to a higher level of trade protection being afforded to the biofuels sector than had been the case had the same information been available earlier.

**Keywords:**

Biofuels, Lobby groups, Policy inertia, Trade policy.

MON 12<sup>th</sup> (15:30 - 16:45, Session F4.3) Room 1.13

ID 2462 R

**CITIES, MOBILITY AND CLIMATE CHANGE**

Main Author:

**David BANISTER** (*Transport, Studies Unit, University of Oxford*)

**Abstract:**

Societies gain enormous benefits from travel, as economies have become more globalised and as the new communications infrastructure allows international networking and travel at a low cost. There has been a true internationalisation of all activities, and travel forms an essential part of that process. However, this mobility is fuelled by carbon, and there is clear scientific agreement that carbon emissions are affecting the global climate with irreversible long term consequences. Transport is the one sector where a reduction in energy use and emissions is proving to be extraordinarily difficult to achieve despite some success in urban areas. This paper focuses on cities, mobility and climate change, highlighting recent trends in both developed and developing countries. It is argued that the current situation is unsustainable, and that transport must contribute fully to achieving carbon reduction targets. An alternative is presented, based on the sustainable mobility paradigm (Banister, 2008) that looks at ways to reduce the need to travel in cities. The belief that high mobility and technology provides the solution is misplaced, as technological innovation can only get us part of the way to sustainable transport, and this may facilitate more travel. There are opportunities for cities to switch to low carbon transport futures, where vision and action are based on a combination of economic, planning and technological innovations working in mutually supporting ways. Potentially, the future is bright for low carbon transport in cities, but the real question is whether there is the commitment and leadership to follow such a path.

**Keywords:**

Sustainable transport, Cities, Fuel security.

MON 12<sup>th</sup> (15:30 - 16:45, Session F4.3) Room 1.13

ID 2947 R

**THE ROAD FROM COPENHAGEN: FUEL PRICES AND OTHER FACTORS AFFECTING CAR USE AND CO<sub>2</sub> EMISSIONS IN INDUSTRIALIZED COUNTRIES**

Main Author:

**Lee SCHIPPER** (*Global Metropolitan Studies*)

**Abstract:**

Using a unique panel data set of national level car ownership, use, fuel economy and fuel use, we analyze the apparent stabilization of fuel use and CO<sub>2</sub> emissions from cars that set in from the early 2000s. We model the car stock, fuel intensity, and vehicle usage for 9 OECD countries using data from 1973-2007, examining how the relationships between these variables and fuel prices, incomes, and population density have changed over time. We include specifications accounting for unobserved heterogeneity across countries and over time, and also estimate these relationships simultaneously to account for interlinkages between the three. Our first finding indicates that the income elasticity of car ownership appears to decrease with time, suggesting potential saturation in industrialized countries. Second, there is only very weak evidence that fuel prices have driven on-road fuel economy, suggesting that other factors, including policies, may have played a more important role. Third, car usage is driven by the cost of driving, emphasizing the importance of the rebound effect when considering emissions reduction strategies, although these elasticities have decreased over time. From these observations we conclude that fuel economy standards and fuel taxes alone, at least in the levels recently seen, are unlikely to stabilize and reduce emissions in the long run. Transport policy measures designed to internalize variable-cost externalities, such as congestion pricing, are likely to be important additional policies, which also yield CO<sub>2</sub> reductions as a co-benefit. These are key insights in the road from COP15 in Copenhagen, in the search for effective ways to reduce emissions from transport. (...).

**Keywords:**

Transportation policy, CO<sub>2</sub>, Fuel demand, Fuel economy.

MON 12<sup>th</sup> (17:00 - 18:15, Session F4.4) Room 1.13

ID 1143 R

**SUSTAINABILITY IMPACT ASSESSMENT OF PUBLIC ACTIONS AND INNOVATIONS FOR TRANSPORT ISSUES**

Main Author:

**Henriette CORNET** (*Technische Universität München*)

**Abstract:**

Since the early 1990s, the concept of sustainable development has been broadly used in many areas. In the field of mobility, sustainability goes together with new environmentally friendly services and products, behavioral changes and incentive plans coming from the public policies. Because of these multiple aspects, "sustainable mobility" is known as a fairly wide issue, and impact assessments in this field are complex. The paper proposes an integrated impact and sensitivity analysis which merges sustainability aspects of transport (economic, environmental and social aspects) under several scales of consideration. A model has been developed that can be used to assess the sustainability of innovations and/or public actions. The setting-up is initiated with the adaptation of an existing model, the TILT model (Transport Issue in the Long Term) and with the completion of a set of sustainability indicators. Throughout the methodological development of the model, a case study has been considered to test the potential of the impact assessment: Public transport users developed ideas in the field "sustainable mobility" using their daily experience with transportation in the city regions of Munich and Frankfurt in Germany. Beyond the evaluation of ideas that are coming from the case study, the sustainability evaluation system could be used in the future as decision-making assistance by policy makers to encourage sustainable urban mobility, by firms to assess the impacts of their products on CO<sub>2</sub> emissions and the acceptability of the user, or by the users themselves to evaluate the impacts of products and services they want to use on the environment and on their own concerns.

**Keywords:**

Innovations, Public action, Model, Sustainability indicators, Sustainable mobility.

ID 2454 R

**A METHODOLOGY FOR IDENTIFYING LOWER CARBON TRANSPORT SYSTEMS FOR INTER-REGIONAL PASSENGERS: RAIL VS AVIATION**

Main Author:

**Naoki SHIBAHARA** (*Nagoya university*)

Co-author(s):

**Hirokazu KATO** (*Nagoya University*)**Yoshitsugu HAYASHI** (*Nagoya University*)**Abstract:**

The carbon dioxide (CO<sub>2</sub>) emissions reduction policies for the inter-regional passenger transport system highlight two factors: 1) the aviation sector is the slowest to eliminate use of carbon fuels; and 2) aviation is expected to contribute more to greenhouse gas emissions than other transport modes. A methodology for identifying an inter-regional transport system with lower CO<sub>2</sub> emissions is proposed. This study aims to explore the possible changes in life cycle CO<sub>2</sub> (LC-CO<sub>2</sub>) per passenger-km and eco-efficiency indicators including considering travel speed as a result of a shift from aviation to the high-speed railway system (Shinkansen). CO<sub>2</sub> emissions both for Shinkansen and aviation are estimated by applying the life cycle assessment (LCA) method and taking into account dominant parameters such as passenger demand. CO<sub>2</sub> exhausted from aviation and Shinkansen during operation and the additional LC-CO<sub>2</sub> from providing new infrastructure are estimated. First, the sensitivity associated with the number of passengers for a 500-km long corridor is analyzed. The main results are as follows: 1) CO<sub>2</sub> per passenger-km from aviation hardly vary with the number of passengers; 2) LC-CO<sub>2</sub> per passenger-km for Shinkansen is inversely proportional to the number of passengers; 3) LC-CO<sub>2</sub> per passenger-km for Shinkansen is lower than that for aviation for passenger volume of approximately 1,200 or more passengers per day; and 4) for eco-efficiency, the break-even point is more than 2,000 passengers per day. The second analysis considers the distance and travel demand for both aviation and Shinkansen. A possible shift from the current demand for aviation to Shinkansen is compared for each inter-prefectural Origin-Destination (OD) pair. (...).

**Keywords:**

Aviation, Shinkansen high-speed railway, Eco-efficiency indicator, Carbon dioxide.

ID 2736 R

**NEW SOLD CARS IN SWEDEN 2007 - IS A NEW TREND MATERIALIZING**

Main Author:

**Frances SPREI** (*Chalmers University of Technology*)

Co-author(s):

**Sten KARLSSON** (*Chalmers University of Technology*)**Abstract:**

In 2006/2007 in Sweden, climate change was highlighted in the media, oil prices raised transport fuel prices, and policies to reduce CO<sub>2</sub> emissions from personal cars were introduced. How do sales patterns for new cars in Sweden reflect these issues? Traditionally Sweden has had the highest CO<sub>2</sub> emitting new cars in the European Union with the most powerful engines and largest weight. In previous studies we have mapped the changes that occurred in new sold cars in Sweden between 1985 and 2002 through statistical analysis and modelling of sales statistics combined with vehicle characteristics. Our main finding was that 35 % of the enhanced technology and design resulted in a net reduction in fuel consumption. The remaining 65 % served to meet consumer demands such as increased passenger space and improved acceleration. This analysis updated for 2007 shows that while lower fuel consumption has become increasingly important it has still not led to a downsizing, i.e., a reversal of the trend toward improved service attributes such as acceleration capacity and passenger space. Instead the main technological and market change has been a shift toward diesel and ethanol engines. Between 2002 and 2007 43 % of the technical development was offset by the amelioration of service and performance attributes, while 57 % resulted in actual reduced fuel consumption. However, had there not been a shift toward more diesel cars then the offset would have been 70 % instead. Diesel cars, while being more fuel efficient were primarily in the large-car segments, thus not contributing to an actual change in attribute trends. Vehicles with ethanol engines were also mainly present in the upper segments with higher fuel consumption. (...).

**Keywords:**

Specific fuel consumption, Downsizing, Service and performance attributes, Diesel cars, Flex-fuel cars.



ID 3163 R

**A FEASIBILITY STUDY ON CLEAN DEVELOPMENT MECHANISM PROJECT FOR TRANSPORT SECTOR IN KHON KAEN UNIVERSITY, THAILAND: CASE STUDY OF CAMPUS SHUTTLE BUS**

Main Author:

**Thaned SATIENAM** (*Civil Engineering Department, Khon Kaen University*)

Co-author(s):

**Mr. PHONGPHAN TANKASEAM** (*Engineering Faculty, Khon Kaen University, Thailand*)

**Dr. SURACHAI SATHITKUNARAT** (*National Science Technology and Innovation, Policy office (STI), Thailand*)

**Dr.wichuda KOWTANAPANICH** (*Engineering Faculty, Mahasarakham University, THAILAND*)

**Abstract:**

This paper conducts a feasibility study to implement the Clean Development Mechanism project for transport sector in Khon Kaen University. Until now, there is no CDM project from transport sector has been registered by Thailand Greenhouse Gas Management Organization. One of causes is the costs for receiving the Certified Emission Reductions might be higher than the returns from selling of a carbon credit. To encourage CDM project for transport sector, it is feasible to start from the small scale CDM project in boundary and compacted area. The university has several accomplished conditions to implement the transportation project for CDM. The Khon Kaen University recently encounters a huge amount of traffic travelling inside campus that it causes many problems of traffic congestion, traffic accident as well as air pollution emission. To lessen these problems, the campus shuttle bus project has been planned to start to operate in this year. Therefore, this paper proposes the public transportation projects for Clean Development Mechanisms (CDM) to reduce Carbon Dioxide (CO<sub>2</sub>) emission in KCU. The proposed projects consist of 2 scenarios; 1) a substitution of Diesel usage of Song Thaew (a modified pickup truck), an existing public transportation, with alternative fuels and 2) a replacement of an existing Song Thaew by a campus shuttle bus project. (...).

**Keywords:**

Clean Development Mechanism, Carbon Dioxide Emission, Campus Shuttle Bus, Alternative Energies, Khon Kaen University .

ID 3194 R

**AIRLINE CARBON OFFSET: PASSENGERS' WILLINGNESS TO PAY AND REASON TO BUY**

Main Author:

**Joel SHON** (*Tainan University of Technology*)

Co-author(s):

**Jason CHANG** (*National Taiwan University*)

**Tzuoo-Ding LIN** (*National Cheng Kung University*)

**Abstract:**

In the past few years, GHG has become the hottest issues in the transportation sector. Most of the transportation modes are trying to go green via using hybrid technology, alternative fuel, or renewable energies. But for people who take airplanes, especially those cross-continent travellers, there is very limited alternative. As a result, some airlines are providing carbon offset program for travellers to buy back the carbon dioxide they emitted during their trip. Airlines collect the offsets to purchase equivalent certificates or to fund CDM projects to make their trips carbon neutral. The carbon offset program is now popular throughout the world, yet it is still a volunteer program. Only very little number of passengers are purchasing the offset. Hence we would like to find out the passengers' willingness to pay in this study. For those passengers who have the offset buying experiences, we would then examine the major reasons for them to buy. A cross-culture comparison would be analyzed to find out the different responses of passengers of various socio-economic variables.

**Keywords:**

Carbon Offset, Air Transportation, Willingness to Pay Reason to Buy.

TUE 13<sup>th</sup> (08:15 - 09:30, Session F4.5) Room 1.13

ID 1427 R

**MASS TRANSIT DEVELOPMENT AND EMISSIONS:  
HONG KONG CASE STUDY**

Main Author:

**Hong LO** (*The Hong Kong University of Science and Technology*)

Co-author(s):

**Hong-Zhi LIN** (*The Hong Kong University of Science and Technology*)

**F. K. TSANG** (*The Hong Kong University of Science and Technology*)

**Abstract:**

The air pollution and traffic congestion problems arising from urban transportation are widely acknowledged by policy-makers of metropolitan planning organizations (MPO), who usually set out proposals to constrain private car use and/or increase the availability of road space by roadway capacity expansion. However, these measures do not always ensure a decrease in travel congestion and exhaust emission in the long run, due to possible induced demand for travel. Hence, metropolitan transport management strategies often contemplate about developing a high capacity rail system as an efficient and environment-friendly way for urban transportation. However, such a shift in the urban transportation system involves large amounts of investments and social costs. This paper examines the role of urban rail transit in reducing vehicular exhaust emissions as compared with bus services. Using empirical data in Hong Kong, we show that urban rail transit, as compared with bus services, can lead to substantial reductions in emissions. To ascertain the environmental impact of the results obtained, we conduct sensitivity analyses to ascertain the outcomes under different operation scenarios.

**Keywords:**

Environmental externalities, External cost, Railway substitution, Exhaust emission, Monetary valuation.

TUE 13<sup>th</sup> (08:15 - 09:30, Session F4.5) Room 1.13

ID 1573 R

**EVALUATION OF ENVIRONMENTAL IMPROVEMENT  
POLICY IN AN URBAN NETWORK USING ROAD  
TRAFFIC SIMULATION**

Main Author:

**Hiroaki INOKUCHI** (*Kansai University*)

**Abstract:**

In this study, we estimate the CO<sub>2</sub> emissions in an urban road network and evaluate a specific environmental traffic policy in order to investigate the contribution of the transport sector to global environmental problems. We calculate the CO<sub>2</sub> emissions as a function of the running condition of a vehicle, and investigate traffic conditions in an urban road network. In addition, the emission calculation is used to evaluate the effectiveness of urban transport policy by considering the effect on environmental loading.

**Keywords:**

CO<sub>2</sub> emission, Urban transport policy, Traffic simulation.

ID 1990 R

**CONSUMPTION AND POLLUTANT EMISSIONS OF LIGHT DUTY VEHICLES USING ALTERNATIVE FUELS**

Main Author:

**Gonçalo GONÇALVES** (*IDMEC-IST*)

Co-author(s):

**Tiago FARIAS** (*IDMEC-IST*)**Abstract:**

One of the biggest challenges that the transport sector faces currently is to find alternative ways to fuel the vehicles and keep providing the same mobility level. Whatever this new energy source/vector technology is (either biofuels, natural gas, hydrogen, electricity...) it has to be able to address the major environmental concerns. Not only must it contribute to the diversification of energy sources but it also should decrease global GHG emissions and attenuate the levels of local pollution. Fuels that can be used as direct replacement for conventional Diesel or gasoline are particularly interesting as they require minimal changes to vehicle technology and, depending on the fuel, on the distribution network. This is the case of the two fuels analyzed in this work: ethanol and natural gas, that can be used in Otto cycle engines that remain compatible with regular gasoline. The light duty vehicles measured were a flex fuel (gasoline/ethanol) car and a bi-fuel (gasoline/natural gas) car. The two vehicles are monitored during regular operation using a Portable Emissions Measurement System (PEMS). The system was developed around a portable gas analyzer, an on-board diagnostics (OBD) reader, a GPS receiver and a logging computer. All vehicles were measured on the road during regular operation. The laboratory developed was able to monitor the vehicles in real time and measure and record the dynamic profile, topography and tailpipe pollutant emissions with a frequency high enough (1 Hz) that an evaluation of instantaneous emissions of carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>) and unburned hydrocarbons was possible. To compare the different vehicles and fuels the vehicle specific power (VSP) methodology was used, where different operating conditions are grouped in homogeneous bins of similar power demand. (...).

**Keywords:**

Alternative fuels, PEMS, Light duty vehicles.

ID 2133 R

**A STUDY ON INTRODUCING ENVIRONMENTAL TAX IN INTERCITY-TRANSPORT SECTOR AND RE-DISTRIBUTION OF THE TAX REVENUE IN JAPAN**

Main Author:

**Aoto MIMURO** (*Graduate School of Environmental Studies*)**Abstract:**

Deregulation has improved the service level of intercity-transport in Japan. It has brought about increasing transport demand and as the result increasing CO<sub>2</sub> emission from this sector. But, forward low-carbon society, not only improving the service level, but also reducing CO<sub>2</sub> emission is necessary. And introducing environmental tax is expected as one of demand-management policies for reducing CO<sub>2</sub> emission in this sector. On the other hand, being slender and composed by lots of island is a geographical feature of Japan. So the following two points have to be evaluated before introducing the environmental tax in this sector. The first point is who will be encouraged to choose low-carbon transport service and who have to be influenced by the tax. And the second point is how the tax revenue should be re-distributed to each region, so as to reduce the influence of introducing the tax. In this paper, an intercity-transport model will be developed for the impact analysis of the environmental tax. It is based on consumption theory of economics and it is assumed that representative travelers in each region determine their consumption pattern, which includes intercity-transport services. And the tax rate is decided to achieve CO<sub>2</sub> reduction target in intercity-transport sector. And the tax revenue is re-distributed in order to adjust the utility change after the taxation equal in each region. In the impact analysis of the environmental tax, it is assumed that the target of carbon-dioxide emission is 10% reduction from the present level. In the result, the tax rate for achieving this target is \$1.5(\$1=90yen) per liter gasoline. In the regions at the edge of Japan, such as Hokkaido prefecture and Okinawa prefecture, transport demand must be decreased about 15%. (...).

**Keywords:**

Intercity-transport sector, Environmental tax, Redistribution of tax revenue.

ID 2427 R

**IMPORTANCE OF THE LOADING FACTOR IN TRANSPORT CO<sub>2</sub> EMISSIONS**

Main Author:

**Christophe RIZET** (*INRETS / DEST*)

Co-author(s):

**Jean-Loup MADRE** (*INRETS - DEST*)**Michel ANDRE** (*INRETS*)**Jacques LEONARDI** (*University of Westminster, Dept. for Transport Studies*)**Abstract:**

A helpful tool for modelling the relationship between transport activity and CO<sub>2</sub> emissions is the ASIF approach by Fulton and Eads: Here, a functional relationship between transport Activity, modal Share, vehicle energy Intensity and Fuel mix on the one hand and CO<sub>2</sub> emissions on the other hand is modelled. However, the ASIF approach does not account for variation in vehicle loading. As vehicles are often not even close to full load, there is still a lot of idle capacity that could reduce emissions without cutbacks in mobility. Therefore, the paper tries to integrate loading factors into the ASIF approach, discusses where and how higher loading factors could be achieved and finally ends with policy recommendations. The conventional ASIF approach has to be extended by another variable that accounts for vehicle loading or vehicle occupancy. On the one hand, an increase in vehicle loading will reduce the number of vehicle-km necessary to carry a given demand. On the other hand, this increase in vehicle loading will increase fuel consumption, mainly on freight transport but also for passenger trips. These two contradictory effects have to be integrated into the model. There are several determinants that influence vehicle load in freight and occupancy on passenger trips. For freight, the load is limited by vehicle capacity authorized by rules on Weight & dimensions. Characteristics of the demand for freight also affect the load, mainly shipment sizes, type of commodity and packaging (density) and Just in Time practices. Lastly, the vehicle load also depends on the effectiveness of the transport organiser in grouping parcels and small shipments in consolidated loads. For French heavy trucks in 2007, the average load is 11. (...).

**Keywords:**

Load factor, greenhouse gases, Carbon efficiency.

ID 1395 R

**CALCULATION OF CARBON EMISSIONS AT THE GREEK AIRSPACE**

Main Author:

**Ioanna PAGONI** (*National Technical University of Athens*)

Co-author(s):

**Voula PSARAKI** (*National Technical University of Athens*)**Abstract:**

This paper is concerned with the development of a methodology which calculates aircraft carbon emissions based on traffic data. Carbon emissions are calculated across several dimensions to provide input to relevant policy considerations. These include the climb-cruise-descent cycle, the Landing/Take-off (LTO) cycle at the airports, domestic, international and over-flights, carbon emissions per passengerkm. The fuel consumption database EMEP/CORINAIR is employed (EEA, 2006). Emission forecasts for the period 2008-2030 are estimated. Total CO<sub>2</sub> emissions are presently estimated to be 4.5 million tones and are expected to double in size by 2030. CO<sub>2</sub> emissions at Greek airports contribute a 10% share. A ranking list classification of airports and domestic routes in terms of carbon emissions are generated. Potential applications of the proposed study include the comparative "green" assessment of transport modes as well the quantification of the environmental impact of tourism.

**Keywords:**

Aviation carbon emissions, Database EMEP/CORINAIR, Fuel consumption, Landing/Take-off cycle, Emissions per passenger-kilometer, Greek airspace.

TUE 13<sup>th</sup> (09:45 - 11:00, Session F4.6) Room 1.13

ID 1513 R

**CO2 EMISSION ANALYSIS FOR CONTAINERSHIPS  
BASED ON SERVICE ACTIVITIES**

Main Author:

**Dong-Ping SONG** (*Business School, University of Plymouth*)

**Abstract:**

This paper considers the CO<sub>2</sub> emission estimation problem for containerships. As container shipping services are far more regular and standardized than other shipping sector, we argue that it is more appropriate to estimate its fuel consumption and CO<sub>2</sub> emissions using more detailed service activity data rather than the aggregated activity data that have been adopted in most existing literature. We will formulate the CO<sub>2</sub> emission problem for containerships by taking into account its unique characteristics. A detailed service activity-based method and two aggregated activity-based methods are presented to estimate the CO<sub>2</sub> emission index. A case study shows that the CO<sub>2</sub> emission index by the detailed service activity-based method could be significantly different from those by the aggregated activity-based methods. To obtain a more accurate estimation of CO<sub>2</sub> emission from the aggregated method, it necessary to select an appropriate ship speed in the calculation. The emission statistics for the current world containership fleet is then estimated using the aggregated method, and its sensitivity to ship speed and berth time is examined.

**Keywords:**

CO<sub>2</sub> emission, Container shipping, Shipping service route, Fuel consumption, Load factor, Empty container.

TUE 13<sup>th</sup> (09:45 - 11:00, Session F4.6) Room 1.13

ID 1985 R

**LOW CARBON TRANSPORT FUTURES AND WIDER  
MULTI-CRITERIA IMPACTS. A VIEW FROM OXFORD**

Main Author:

**Robin HICKMAN** (*Transport Studies Unit, University of Oxford*)

**Abstract:**

Climate change is a global problem and across the world the transport sector is finding it difficult to break projected increases in carbon dioxide (CO<sub>2</sub>) emissions. A number of studies have developed future scenarios and policy pathways towards lower carbon emissions in the transport sector. This paper develops some of this work to consider the wider sustainability impacts (economic, social and local environmental) of low carbon transport pathways. It reports on research carried out in Oxfordshire (UK). Different packages of measures are selected for Oxfordshire and a scenario developed which optimises low carbon and wider sustainability aspirations. A simulation model is developed to help explore the strategic policy choices and tensions evident for decision-makers involved in local transport planning. The paper argues for a 'strategic conversation' at the sub-regional and city level – based upon future scenario analysis, discussing the priorities for intervention in delivering low carbon and sustainable transport futures. The conclusion made is that a greater focus is required in developing participatory approaches to decision making. Only then will a wider awareness and ownership of potential sustainable transport futures improve, together with a greater acceptance of the need for changes in behaviour.

**Keywords:**

Low carbon transport sustainability impacts policy.

ID 2473 R

**REDUCING ENERGY DEMAND IN TRANSPORTATION - EFFECTS OF ELECTRIC VEHICLES ON CLIMATE GOALS**

Main Author:

**Rainer WITZIG** (*Technische Universität München*)

Co-author(s):

**Gebhard WULFHORST** (*Technische Universität München*)**Abstract:**

The intensifying climate change comes along with the need to reduce greenhouse gas emissions significantly. The transport sector's substantial role in this context leads to the imperative to decrease the fossil energy demand in transportation considerably. The contribution of single actions to reduce energy demand in transport has mostly been modeled in linearly structured scenarios. In consequence, least models consider interactions with counteracting effects, which may occur in reality. In a first step we examine several actions for reducing energy demand in transportation and their effects by means of a qualitative sensitivity analysis. According to this simulation, some measures shape up as worthwhile for more detailed inspections. The changeover from cars with combustion engines to electric vehicles is currently strongly supported by politics. But according to our analysis electric vehicles do not contribute significantly to reduce the total energy demand in transport. We would like to investigate this controversial correlation. Speaking for electric vehicles, there is the comparably low energy demand for the end user and the theoretical option to operate electric vehicles independently of fossil fuels. Also, due to the current electricity price, operational costs driving an electric vehicle would be much cheaper compared to a conventional car. However, this could also result in an increasing vehicle mileage. The future structure of power plants which would be necessary to meet the increasing demand of electricity is another important variable to be analyzed. In turn, these factors would counterbalance today's linear estimations regarding CO<sub>2</sub>-emissions, electricity price and demand of fossil fuels. (...).

**Keywords:**

Energy Demand, CO<sub>2</sub>, Electric Vehicles, Modelling, Simulation, System Analysis.

ID 2750 R

**HIGHWAYS AND NATURAL CATASTROPHES IN SANTA CATARINA (BRAZIL)**

Main Author:

**Isa ROCHA** (*Universidade do Estado de Santa Catarina*)

Co-author(s):

**Aurora BARBOSA** (*Universidade do Estado de Santa Catarina*)**Natan DOLEJAL** (*Universidade do Estado de Santa Catarina*)**Abstract:**

The state of Santa Catarina (located in southern Brazil), due to its geographical position, is constantly affected by several climatic events, such as intense rains, droughts, extreme temperatures, tornadoes and hurricanes, which consequences might not only be deaths but also flooding and landslides on hills placed by roads. Although Santa Catarina stands out as an important industrial area, just like the entire southern region of Brazil, government and enterprise segment disseminate that there is a lack of resources for transport infrastructure investments, preventing a more significant economic growth. Highway transport would be the most dramatic obstacle, as the expenditure with early change of tyres and equipments, excessive consumption of fuel, speed reduction and traffic interruption due to lane problems caused by climatic events increase freight costs in Brazil. Therefore this study analyses the dimensions of the problem, tracing a diagnosis of the main road network in north-south and east-west direction: BRs 101, 116, 282, 280 and 470. It must be highlighted that right after Novembers (2008) rain and landslide catastrophes, a fieldwork on the already mentioned roads was carried through based on landslide spots and high-risk areas surveys, with the respective mapping (identification of geographical coordinates using GPS) and photographic record, resulting on a total of approximately 3.200 km of highways. Santa Catarina feels the difficulties imposed by the natural conditions that compose its landscape. This reality turns highways construction, conservation and maintenance too expensive, especially on the atlantic valleys, where are located many important industrial zones. (...).

**Keywords:**

Natural catastrophes, Highways, Santa Catarina-Brazil, Diagnosis.

TUE 13<sup>th</sup> (11:15 - 12:30, Session F4.7) Room 1.13

ID 1303 R

**STIMULATION OF THE USE OF BIOFUELS IN EUROPE BY MEANS OF BIOFUELS CORRIDORS ON THE TEN-T NETWORK**

Main Author:

**Nina NESTEROVA** (NEA)

Co-author(s):

**Ming CHEN** (NEA)

**Matthijs SCHRAVEN** (NEA)

**Schoemaker JARL** (NEA)

**Abstract:**

The article first defines the current framework of the biofuels development with respect to their technology, policy, controversy and market conditions in order to provide insight into the current and future characteristics of the biofuels industry, main markets, policies and trends. A case study on the feasibility of one possible EU biofuels corridor, from Rotterdam to Constanta, is further described. Four potential biofuels corridor designs (under different scenario's), in which high-blends were determined as vital for achieving EU targets, are compared. The case study includes interviews with key stakeholders on the corridor (including freight operators, oil companies and policymakers at the national and EU level), and data analyses on the transport flows, refuelling infrastructure and biofuels policy in the Member States that are involved in the corridor. Economic feasibility analysis places the concept of biofuels corridors into the wider context, extrapolating the results into a general evaluation of the biofuels corridor approach as a measure of stimulating the use of biofuels in EU road transport. Conclusions and recommendations are finally presented.

**Keywords:**

Biofuels, Biofuels corridor, Transport corridor Rotterdam – Constanta, EU sustainability policy.

TUE 13<sup>th</sup> (11:15 - 12:30, Session F4.7) Room 1.13

ID 1382 R

**A NEW METHOD FOR ASSESSING CO<sub>2</sub>-FOOTPRINTS OF CONTAINER TERMINALS IN PORT AREAS; CASE-STUDIES APPLIED IN THE NETHERLANDS**

Main Author:

**Harry GEERLINGS** (Department of Public Administration, Erasmus University Rotterdam)

Co-author(s):

**Ron VAN DUIN** (Delft University of Technology)

**Abstract:**

At present, the notion is generally accepted that societies have to combat climate change. The reduction of CO<sub>2</sub>-emissions, an important cause for global warming, has become a priority, and consequently there is increasing pressure on governments and industries to come forward with initiatives to reduce CO<sub>2</sub>-emissions. This is highly relevant for the transport sector, as the share of transportation is still increasing, while other sectors are reducing their CO<sub>2</sub>-footprint. The main purpose of this paper is to present a methodology to analyse the CO<sub>2</sub>-emissions from container terminals and gain a better understanding of the CO<sub>2</sub>-emissions by container terminals in port areas. With a better understanding of the CO<sub>2</sub>-emissions, more effective solutions to reduce CO<sub>2</sub>-emissions by container terminals can be identified. The study provides insight into the processes of container handling and transshipment at the terminals and calculates the contribution of these processes to the CO<sub>2</sub>-emissions (or carbon-footprint) of the container terminals. Using these insights, potential solutions to reduce the CO<sub>2</sub> at the terminals are identified and policy proposals are made for the operators of existing terminals and for governments.

**Keywords:**

Container terminals, CO<sub>2</sub>-emissions, Carbon-footprint, Methodology.

TUE 13<sup>th</sup> (11:15 - 12:30, Session F4.7) Room 1.13

ID 2312 R

## THE MARKET FOR ELECTRIC VEHICLES ? WHAT DO POTENTIAL USERS WANT?

Main Author:

**Ole KVEIBORG** (*Department of Transport, Danish Technical University*)

Co-author(s):

**Linda CHRISTENSEN** (*Department of Transport, Danish Technical University*)

**Stefan MABIT** (*Department of Transport, Danish Technical University*)

### Abstract:

This paper investigates some of the factors that influence the potential mass introduction of electric vehicles. The main contribution of the paper is an analysis of how recharging influences the demand. We do this by a joint analysis that includes estimation of a model predicting demand for electric vehicles based upon price, driving range, acceleration, and accessibility to recharging, an in depth analysis of the drivers' need for recharging based on their observed driving patterns found in the National Travel Survey and a GSP based recording of driving behaviour of a sample of drivers in Copenhagen. The final part of the investigation shows that this accessibility to recharging may be one of the most important factors for decision makers to focus on if electric vehicles are expected in larger numbers, but the analysis also shows that this may not be the most important factor when socioeconomic assessments are carried out. The socio-economic assessment shows that the revenue impacts for the government as well as the price of the car and the electricity consumption are still key issues in this aspect.

### Keywords:

Electric Vehicles, Recharging needs, Electric car purchase model.

TUE 13<sup>th</sup> (11:15 - 12:30, Session F4.7) Room 1.13

ID 2336 R

## SYSTEM?BASED ANALYSIS OF DIFFUSION OF ALTERNATIVE DRIVE AND FUELS FOR TRUCKS

Main Author:

**André KÜHN** (*Institute for Economic Policy Research (IWW), Universitaet Karlsruhe (TH)*)

Co-author(s):

**Michael KRAIL** (*Fraunhofer-Institute for Systems and Innovation Research (ISI)*)

### Abstract:

In contrast to the passenger car sector, purchasing decisions of freight forwarders are driven by economic factors by nearly 100 %. Based on a cost analysis, the factors which can clearly be dedicated to different technologies are fuel costs, maintenance costs, investment costs and taxes. The decision to buy a new truck is always accompanied by a cost comparison of each alternative. This leads to a compilation of costs for each technology in terms of negative utility within a Logit-Model. This is realized in a System Dynamics model in dependence to the ASTRA model of the European Union. The main aim is the assessment of environmental policies (tax and toll) towards the diffusion of alternative drives and hence the possibility to influence the truck stock towards sustainable drive technologies. The framework is given by the German truck market as well as the German environmental policy.

### Keywords:

Freight Transport, Alternative drives, Alternative fuels, Road freight traffic, System Dynamics.



TUE 13<sup>th</sup> (11:15 - 12:30, Session F4.7) Room 1.13

ID 2493 R

**A 75% REDUCTION IN CO2 EMISSIONS BY 2050 IN FRANCE: TOWARDS A BIG CHANGE IN GOODS MOVEMENTS?**

Main Author:

**Hector LOPEZ-RUIZ** (*Laboratoire d'Economie des Transports*)

Co-author(s):

**Yves CROZET** (*LET Lyon*)

**Abstract:**

Many studies (BEN-AKIVA, 2008 et alii; McKINNON, 2007; REDEFINE, 1999; LOPEZ-RUIZ, 2009) conclude that freight transport in Europe is defined by a highly concentrated production structure where, over the last two decades, a rise in overall transport distances has been observed. This increase in transport distances is explained by the growing mobility of high value-added products. In this manner, as European authorities decide to reduce overall emission levels, constraints aiming at CO2 reductions will certainly have effects on freight mobility and/or the production/distribution structure. This paper aims at assessing the evolution of freight transport on a European level and looks into how carbon constraints on transport would imply changes in consumption behaviors that will have consequences on freight movements. This paper particularly develops the idea that by assessing the microeconomics of consumer's adaptation strategies, trend changes in European freight movements can be easily deduced.

**Keywords:**

Greenhouse gas, Long term, Scenario, Transport, Sustainable development.

TUE 13<sup>th</sup> (14:00 - 15:15, Session F4.8) Room 1.13

ID 1606 R

**OPTIMIZATION OF PRICING POLICY FOR LOW-CARBON-ORIENTED MULTI-MODAL URBAN PASSENGER TRANSPORT SYSTEM**

Main Author:

**Pi LIANG** (*Nagoya University, Tongji University, Shanghai Maritime University*)

Co-author(s):

**Toshiyuki YAMAMOTO** (*Department of Civil engineering, Nagoya University, Japan*)

**Takayuki MORIKAWA** (*Nagoya University*)

**Abstract:**

Multilevel optimisation programming problem is developed to obtain optimal pricing scheme for low-carbon-oriented multi-modal urban passenger transport system. The model system provides least generalised cost to realise the target modal split in the upper level, while the target modal split is determined in the middle level under the constraints of the limitations of carbon emission, energy consumption, and government investment at the lowest environmental cost. The lower level is the joint traffic flow assignment models of automobile and bus. The workability of the model system is confirmed by a hypothetical simple numerical example.

**Keywords:**

Multilevel programming problem, Modal share, Carbon emission, Energy constraint.

TUE 13<sup>th</sup> (14:00 - 15:15, Session F4.8) Room 1.13

ID 1654 R

## STRATEGIC REACTION OF AIRLINES TO THE ETS

Main Author:

**Estelle MALAVOLTI** (TSE (ENAC))

Co-author(s):

**Julien JENVRIN** (TSE (ENAC))

### Abstract:

The air transport sector is about to enter the European Trading Scheme progressively in 2011. The regulation of the CO<sub>2</sub> emissions means for airlines more costs and a modification of the organization of their market. Our paper proposes a precise model of nonetheless the regulation but also of airlines CO<sub>2</sub> emissions. Our conclusions are twofold. Firstly, although profits are negatively impacted by the introduction of the ETS, a monopoly airline carries more passengers at a lower price. Two opposite effects are at play: the marginal cost increases as polluting becomes costly, which results in an increase of the price. However, there is a second effect that makes the price decreasing: the way the free allowances are given creates a bias towards more activity. We show that more activity is reached at the equilibrium. De facto, more CO<sub>2</sub> is emitted. Nevertheless, we show as well that it is pro table for the airline to buy a new aircraft because the marginal cost decreased. Again more activity is reached at equilibrium but at the cost of less CO<sub>2</sub> emissions.

### Keywords:

Environmental regulation, Cost estimation.

TUE 13<sup>th</sup> (14:00 - 15:15, Session F4.8) Room 1.13

ID 1857 R

## BACK- AND FORECASTING CO<sub>2</sub> EMISSIONS FROM FREIGHT TRANSPORT 2050

Main Author:

**Fredrik ENG LARSSON** (Lund University)

### Abstract:

One of today's major sources of greenhouse gas emissions is the transport sector. According to the latest assessment from the IPCC, transportation accounted for 23% of all energy related greenhouse gas emissions in 2004 (IPCC 2007) having grown by 26% since 1990 (for EU-25). Growth in transport emissions is caused by several factors. Historically, transport volumes have grown with economic development (Tapio 2005, Eurostat 2007) and some therefore argue transport emissions as something we might have to accept in order to achieve desired economic development. Many studies, however, have shown that a decoupling between freight transport work (ton km) and economic activity, as well as freight traffic work (vehicle km) and economic activity, is possible and also feasible (Tapio 2005, Kveiborg and Fosgerau 2007). Nonetheless, there is still a lack of understanding of the complicated interrelation between economic development and freight transport emissions. This paper seeks to investigate this further and extend previous models to explicitly address long term structural shifts in the economy and its effect on the emissions from all transport modes, as observed thus far, to explain the observed development and predict emissions levels for the next ten years. The issue is addressed through a Divisia Index decomposition method, similar to that of, for example, Lashkmanan and Han (1997). The observed increase in freight transport CO<sub>2</sub>-emissions is caused by several factors, and by using a decomposition model we can calculate the relative contributions of each factor over time (Ang and Zhang 2000). Some of these factors are primarily behavior driven whereas others are technology driven. (...).

### Keywords:

Freight transport emissions, Logistics, Carbon footprint, Forecast.

TUE 13<sup>th</sup> (14:00 - 15:15, Session F4.8) Room 1.13

ID 2597 R

## **INTEGRATING BATTERY ELECTRIC VEHICLES INTO THE GERMAN ELECTRICITY MARKET**

Main Author:

**Patrick JOCHEM** (*Universität Karlsruhe (TH)*)

Co-author(s):

**Jan IHRIG** (*Karlsruhe Institute of Technology (KIT) - Institute for Economic Policy Research (IWW)*)

**Heidi GERBRACHT** (*Karlsruhe Institute of Technology (KIT)*)

**Wolf FICHTNER** (*Karlsruhe Institute of Technology (KIT)*)

### **Abstract:**

This paper gives an overview of challenges for integrating electric vehicles (EV) into the German electricity sector. The focus of the paper is on the electricity market in 2030, which has two advantages. Firstly, the higher share of volatile wind power generation makes electricity storage more important. Secondly, trends within the vehicle market in recent years do not make a rapid switch to overwhelming EV power demand likely. Three charging principles are presented: (1) uncontrolled unidirectional, (2) controlled unidirectional, and (3) controlled bidirectional or vehicle to grid (V2G). Especially with regard to the third principle two different electricity markets are illustrated, in which EV might provide their V2G service: the electricity storage market for storing superfluous energy during the night and the control reserve market for stabilizing the grid voltage and frequency. It becomes apparent that EV batteries are better suited to the control reserve market.

### **Keywords:**

Elektric vehicles, Vehicle-to-grid, Germany.

TUE 13<sup>th</sup> (14:00 - 15:15, Session F4.8) Room 1.13

ID 2706 R

## **IMPACTS OF ALTERNATIVE VEHICLE TECHNOLOGIES AND ENERGY SOURCES IN THE PORTUGUESE ROAD TRANSPORTATION SECTOR**

Main Author:

**Patricia BAPTISTA** (*IDMEC-IST*)

Co-author(s):

**Tiago FARIAS** (*IDMEC-IST*)

**Carla SILVA** (*DTEA - IST*)

### **Abstract:**

The transportation sector will face considerable changes in the near future. Accordingly, several scenarios of alternative vehicle technology introduction were studied for Portugal: SC. 1 - BASELINE TREND (8% of LDV fleet displaced); SC. 2 – LIQUID FUELS BASED (70%); SC. 3 – LIQUID FUELS BASED WITH LOWER DIESEL SHARE (70%); SC. 4 – POLICY ORIENTED (44%); SC. 5 – ELECTRICITY POWERED (90%); SC. 6 – HYDROGEN POWERED (90%), for LDV; and SC. 7 – HDV and BUSES (30%) to add the contribution of HDV and buses to the total road transportation sector. Its impacts in terms of energy consumption and CO<sub>2</sub> emissions were assessed, resulting in up to 18 and 24% reduction respectively compared to SC.1 in 2050.

### **Keywords:**

Alternative vehicle technologies and energy source.

ID 1241 R

**SEARCHING FOR SUSTAINABLE TRANSPORT POLICIES**

Main Author:

**Aoife AHERN** (*University College Dublin*)

Co-author(s):

**John CARTY** (*University College Dublin*)**Abstract:**

Energy consumption and carbon dioxide emissions from the transport sector continue to rise, adding to growing concerns about the environmental impacts caused by transport systems and related land-use patterns. Transportation and land-use are a function of one another, therefore it is often hypothesized that changing urban form will result in changes in transport emissions levels. This paper intends to explore further the relationship between urban form and transport carbon dioxide emissions. It is hypothesised in this research that more compact neighbourhoods result in more sustainable communities, with lower transport emissions. The theory is to an extent premised on urban containment, to provide a concentration of socially sustainable mixed uses, that will concentrate development and reduce the need to travel and trip lengths, thus reducing transport emission levels. Using the Census of Population of Ireland 2006 Place of Work - Census of Anonymised Records (POWCAR) Dataset, a transport carbon dioxide emissions vulnerability index will be developed for the greater Dublin area. Comparisons of the index map with regional differentiations in commuting distances, modal shares of non-car travel modes and aspects of infrastructure and population densities clarifies some relationships between transport emissions levels, commuting behaviour and the spatial structure of the greater Dublin area. The results of this research can then be used to assess the transport carbon dioxide emissions of future development plans and therefore allow greater transport sustainability to be achieved through improved design of the location and form of major new development.

**Keywords:**

Transport carbon dioxide emissions, Transport energy consumption.

ID 1351 R

**THE LAND USE AND TRANSPORT RELATIONSHIP IN PERIPHERAL AREAS: POLICY INTEGRATION BASED ON CASE STUDIES**

Main Author:

**Henar SALAS-OLMEDO** (*Universidad de Cantabria*)

Co-author(s):

**Soledad NOGUÉS** (*Universidad de Cantabria*)**Abstract:**

The land use and transport relationship has been largely discussed in both directions. Most empirical research projects have taken metropolitan and central areas as case study areas, where more and more transport infrastructures have been built and where transport management is now the key issue to satisfy travel demand. In fact, there is a general agreement that transport infrastructure shape land use patterns, but they do not necessarily generate an increased rate of development. Peripheral areas within developed countries share some trends, although at a different scale and intensity, with central areas, such as sprawl processes, but they also have some particularities, namely large spatial imbalances, low development and accessibility rates and so on. Consequently, they require an independent approach both in the analysis phase (because of the different behaviour of variables throughout the territory) and in the policy suggestion phase (because of spatial dissimilarities, weaker transport system, socioeconomic and financial difficulties, etc.). In the first section of this paper, we briefly describe the state of the art of the land use and transport relationship with particular reference to peripheral areas; we perform a short review of the numerous tools which have been developed to tackle spatial analysis; and we establish the criteria to choose the case studies, which are Doncaster and Lincoln areas in the United Kingdom. Section 2 deals with the analysis of their internal accessibility and residence-to-work flows, using tools from the graph theory mainly. We complement the analysis with some indicators of city-size distribution and sprawl based on population and land use data to set the basis for particular land use and transport policy suggestions for this kind of areas. (...).

**Keywords:**

LUT policies, Peripheral areas, Land use, Transport planning.

ID 1365 R

**INFRASTRUCTURE COSTS AND URBAN SPRAWL – AN INTERNATIONAL CASE STUDY**

Main Author:

**Stefan KLUG** (*Fraunhofer - ISI*)

Co-author(s):

**Yoshitsugu HAYASHI** (*Nagoya University*)**Abstract:**

Urban dispersion processes in metropolitan areas have led to patterns of suburbanisation and urban sprawl. German agglomerations, which are conventionally characterised by a rather polycentric and dense urban structure, are now facing the challenges of urban scattering towards agricultural areas at the urban fringe. In contrast, Japanese urbanisation has been characterised by a mix of agricultural and urban activities since the 1960s. These processes are inseparably connected with the shift of private mobility from green transport modes to cars. Urbanisation is always accompanied by the development of physical infrastructure, which requires huge investments, determines the structure of a city over long periods of time and cannot be readily adjusted to changing demand patterns. Thus, the impacts of urban sprawl on providing and funding local urban infrastructure represent complex and important issues to be considered in this context. This comparative study, conducted for the metropolitan regions of Nagoya in Japan and Munich in Germany, confirmed the impacts of density and other parameters of urban sprawl on public costs. The saving potential, which was calculated as the cost difference between the most infrastructure efficient and most intensive municipalities, is 85% on average for Munich and 57% for the Nagoya region for sewage, primary schools and local roads.

**Keywords:**

Urban sprawl, Financial impact, Local infrastructure, Public costs, Infrastructure efficiency, Nagoya, Munich.

ID 1443 R

**TIGHT BUDGETS OR ENVIRONMENTAL AWARENESS? THE CHANGING TRAVEL BEHAVIOR OF YOUNG GERMANS**

Main Author:

**Tobias KUHNIMHOF** (*Institute for Transport Studies, University of Karlsruhe*)

Co-author(s):

**Ralph BUEHLER** (*Virginia Tech*)**Dominika KALINOWSKA** (*German Institute for Economic Research - DIW Berlin*)**Abstract:**

For years, researchers, planners, and policy makers have been going to great lengths looking for possibilities to change travel behavior towards more sustainability. Nevertheless, the triumphant success of the automobile that conquered more and more domains of life appeared to be inexorable. This applied to Germany as to most other countries. However, more and more data suggest that this era might be coming to an end. Results from different NTS surveys as well as vehicle registration statistics imply that young Germans today are less auto-oriented than their parents used to be in their young years. The paper sheds light on this largely unforeseen and little investigated development that occurs among the young population in a modern and economically well off country. First, we investigate observed travel behavioral changes of the young population in Germany. Two developments are under focus in this discussion: the diminishing differences between men and women and the rise of multimodal behavior. Second, the paper looks at likely causes for this trend change in young peoples' travel demand. Among possible causes are shrinking mobility budgets because of a changing economic situation of young travelers. Other possible explanations for shrinking auto-mobility by the young are their educational, professional and residential choices and associated mobility needs. These choices of the young may also express a change of mind in that they indicate an increasing environmental awareness.

**Keywords:**

Travel Demand Decreases, Modal Shifts, Young travel behavior.

MON 12<sup>th</sup> (11:15 - 12:30, Session F5.1) Room 0.04

ID 1644 R

**INCENTIVES FOR INNOVATION AND ADOPTION OF  
NEW TECHNOLOGY UNDER EMISSIONS TRADING  
(FULL PAPER)**

Main Author:

**Svante MANDELL** (VTI)

**Abstract:**

common claim in both the public and academic debate is that a tradable emission permits scheme does not provide sufficient incentives for R&D investments. The present paper addresses R&D investments and penetration rates of new technology focusing on the specific characteristics of a tradable permits market. It is shown that a complex dependency between the emissions cap, the market price for emission permits, the price for technology once it is developed and the R&D investment decision add an additional layer to the 'traditional' market failures associated with R&D. Even though the cap and how it is calibrated in response to the introduction of new technology is shown to be of importance both for the level of R&D investment and the technology's penetration rate, we argue that the policy maker's ability to use the cap to counter market failures in the R&D stage is limited. This is due to a dynamic inconsistency problem where the policy maker is unable to credibly commit to a future policy that is more stringent than motivated by efficiency concerns given the then existing technology. Such a policy may not be stringent enough to cover the necessary R&D investments.

**Keywords:**

Tradable permits, Innovation, R&D, Policy, Dynamic inconsistency.

MON 12<sup>th</sup> (14:00 - 15:15, Session F5.2) Room 0.04

ID 1120 R

**ROAD TRANSPORT EXTERNALITIES, ECONOMIC  
POLICIES AND OTHER INSTRUMENTS FOR  
SUSTAINABLE ROAD TRANSPORT**

Main Author:

**Georgina SANTOS** (Smith School of Enterprise and the Environment and Transport Studies Unit, University of Oxford)

Co-author(s):

**Hannah BEHRENDT** (University of Oxford)

**Laura MACONI** (University of Oxford)

**Tara SHIRVANI** (University of Oxford)

**Alexander TEYTELBOYM** (University of Oxford)

**Abstract:**

Road transport imposes negative externalities on society. These externalities include environmental and road damage, accidents, congestion, and oil dependence. The cost of these externalities to society is in general not reflected in the current market prices in the road transport sector. An efficient mobility model for the future must take into account the true costs of transport and its regulatory framework will need to create incentives for people to make sustainable transport choices. Economics offers two types of instruments for addressing the problem of transport externalities: command-and-control, which can be defined as government regulations that force consumers and producers to change their behaviour, and incentive-based policies, which include price controls, such as taxes, and quantity controls, namely cap-and-trade. On top of these economic instruments, and without questioning the fact that to achieve efficiency emitters should pay for the true costs of their actions, we find sufficient evidence in the literature to demonstrate that many other policy instruments can be used in combination with taxes and permits to ensure that the transport needs of the present generation can be met without compromising the ability of future generations to meet any needs of their own. These policies fall into three categories: physical policies, soft policies, and knowledge policies. All three aim to bring about changes in consumers' and firms' behaviour, but in different ways. The key finding is that they can help achieve more efficient levels of externality when used in combination with economic policies, rather than on their own.

**Keywords:**

Sustainable road transport. Corrective charges. Cap-and-trade. Soft policies. Carpooling. Teleworking. Advertising campaigns. Teleworking and teleshopping.

ID 2338 R

**A FRAMEWORK BASED ON STOCK-FLOW MODEL FOR EVALUATING SUSTAINABILITY IN HILLY AND MOUNTAINOUS AREAS**

Main Author:

**Masato MIYATA** (*Nagoya University*)

Co-author(s):

**Shoji TOGAMI** (*Nagoya University*)**Hirokazu KATO** (*Nagoya University*)**Yasuhiro KAWASE** (*Chubu Economic Federation*)**Yoshitsugu HAYASHI** (*Nagoya University*)**Abstract:**

It is important that new political measures be implemented for the hilly and mountainous areas of Japan. This paper proposes a method that examines the stocks in the mountains and general inflow and outflow relationships within/to the region. The study uses a framework for evaluating decaying processes and the overall existing situation. The fieldwork shows the achievability of sustainable conditions by understanding the flow dependency of the usage of stock.

**Keywords:**

Regional Planning, District Planning, Land Use.

ID 2459 R

**AN INTRODUCTION TO URBAN SUSTAINABILITY EVALUATION SYSTEM "SURQUAS" (SMART URBAN AREA RELOCATION MODEL FOR SUSTAINABLE QUALITY STOCK)**

Main Author:

**Takuya TOGAWA** (*Nagoya University*)

Co-author(s):

**Noriyasu KACHI** (*Toyota Transportation Research Institute*)**Yuta SUZUKI** (*Nagoya University*)**Hirokazu KATO** (*Nagoya University*)**Yoshitsugu HAYASHI** (*Nagoya University*)**Abstract:**

In many developed cities, inevitable problems that affect urban sustainability have emerged, such as population aging and population decline, growing budget deficit in public finance, impact of global climate change, and others. Areas of urban sprawl, which have been expanded according to motorization and population growth, pose large infrastructure maintenance cost and environmental load, and such structures do not suit the lifestyle of elderly people. It is therefore necessary to examine urban sustainability in terms of global environmental issues, built-up area maintenance cost and residential quality of life, considering the change in population and its generational constitution. We introduce the model system "SURQUAS" (Smart Urban area Relocation model for sustainable QUALity Stock) for evaluating the sustainability of an urban area from the viewpoint of the triple bottom line (TBL) consisting of environmental, economic, and social aspects. By applying SURQUAS to the Nagoya metropolitan area, the following results are shown. Both Environmental efficiency and Cost efficiency are high in the central portion of the Nagoya central area and the city surroundings. Moreover, they are also high in the areas along the railroad lines. This suggests that shrinking to the central area is one possible efficient urban structure considering TBL. And, the scenario that will be achieved by 2050 due to the urban spatial structure reconfiguration was set, and influence on TBL was analyzed. The results indicate that, in both the mono-centric and poly-centric patterns, the reduction of CO<sub>2</sub> emission and built-up area maintenance cost was achievable. (...).

**Keywords:**

QOL, Environmental load, Infrastructure maintenance cost, Land use, TBL.

ID 2568 R

**A METHOD FOR IDENTIFYING RETREAT AND RE-CONCENTRATION RESIDENTIAL AREAS TOWARD SUSTAINABLE URBAN STRUCTURE BASED ON TRIPLE BOTTOM LINE**

Main Author:

**Noriyasu KACHI** (*Toyota Transportation Research Institute*)

Co-author(s):

**Takuya TOGAWA** (*Nagoya University*)**Yuta SUZUKI** (*Nagoya University*)**Hirokazu KATO** (*Nagoya University*)**Yoshitsugu HAYASHI** (*Nagoya University*)**Abstract:**

The total population reached its peak in the year 2005 but subsequently it started declining in Japan. The current urban structure, which has been sprawled by rapid population growth and motorization, has increased the maintenance cost of unnecessarily expanded built-up area and also increased the environmental load. It is difficult to keep living environment in such the condition. Therefore, compaction policy by restricting inefficient urban area usage is required. However, there is a fear that excessive compaction leads to deteriorate residential quality of life due to congestion and the additional environmental load. Thereby, the examination of suitable urban structure, which is able to improve the land productivity toward higher residential quality of life and to tackle the constraints of global environment and public finance, and its switching process, is needed. This study aims to develop a model system for identification of retreat and re-concentration areas applying the environment and cost efficiency indicators based on the triple bottom line (environment, economic and social aspects) and the feasible conditions for population migration by a logic model. Retreat is defined as restricting the supply of new houses and infrastructure, and re-concentration is defined as the guided migration of population to high-capacity districts with enough infrastructure. Retreat and re-concentration areas are identified according to the following procedure. (...).

**Keywords:**

Sustainability, Triple Bottom Line, Environment Efficiency, Cost Efficiency, Compact Urban Area.

ID 3317 R

**FUTURE RESEARCH PERSPECTIVES IN MOBILITY AND SUSTAINABLE LIVING SPACES – RESULTS OF THE GERMAN FORESIGHT PROCESS**

Main Author:

**Claus DOLL** (*Fraunhofer-Institute for Systems and Innovation Research (ISI)*)

Co-author(s):

**Stefan KLUG** (*Fraunhofer - ISI*)**Abstract:**

In September 2007 the German Federal Ministry of Education and Research (BMBF) launched a 30 month study aiming to identify the most promising topics in several fields of research and technology as well as the potentials for strategic partnerships with a time horizon of 10 to 15 years. The objective of the study was to guide the Ministry in designing forthcoming research programmes and in assessing current proposals with regard to their future orientation. This paper describes the approach and the practical application of the BMBF foresight process, provides perspectives of the German socio-demographic future and - screened against this background - discusses the findings in the broader future fields of "mobility and logistics" and "sustainable living spaces". The results of the research are meant to open the discussion on the orientation of transport research policy in Europe and worldwide.

**Keywords:**

RTD, Foresight, Transport, Mobility, Logistics, Land use, Living spaces, Sustainability, Technology .



MON 12<sup>th</sup> (15:30 - 16:45, Session F5.3) Room 0.04

ID 1258 R

**EVALUATING TRANSPORT AND ENVIRONMENTAL VARIABLES AFFECTING PLAYGROUND USAGE AND THE IMPACT OF CULTURE DIFFERENCES**

Main Author:

**Gila ALBERT** (*Holon Institute of Technology*)

**Abstract:**

The objective of this paper is to evaluate the transport and environmental variables affecting individual usage of playgrounds, with a focus on cultural differences. The paper is based on a survey, which was carried out in Haifa, the third largest city in Israel. The results indicate significant differences between Jewish and Arab populations regarding frequency of playground visits and the extent of playground satisfaction. Differences were also obtained concerning the impact of transport and environmental variables. All of these parameters were found to be more significant among the Jewish population, as this population seems to be more aware of these variables. An analysis of the transport variables shows that the Jewish population considers factors such as playground accessibility, distance to other activities, trip chaining, and parking availability as significantly more essential, compared to the Arab population. The perceived air pollution variable was found to negatively affect frequency of playground visits (only among the Jewish community), as well as the self-satisfaction variable among both communities. Noise was found to adversely affect both the frequency of visits and self-satisfaction in both populations.

**Keywords:**

Playgrounds, Transport and environmental variables, Cultural differences.

MON 12<sup>th</sup> (15:30 - 16:45, Session F5.3) Room 0.04

ID 1313 R

**A MULTI-AGENT PLANNING SUPPORT SYSTEM FOR ASSESSING THE ROLE OF TRANSPORTATION AND ENVIRONMENTAL CONSTRAINTS IN URBAN PL**

Main Author:

**Harry TIMMERMANS** (*Urban Planning Group, Eindhoven University of Technology, The Netherlands*)

Co-author(s):

**Theo ARENTZE** (*Eindhoven University of Technology*)

**Rachel KATOSHEVSKI-CAVARI** (*Israeli Ministry of Interior*)

**David KATOSHEVSKI** (*Ben-Gurion University of the Negev*)

**Abstract:**

This paper reports the results of an analysis of twelve city plans based on environmental-sustainability indicators using a multi-agent model. The plans are based on three main-roads configuration and four types of city scenarios, each representing a different planning concept. The environmental indicators concern pollution from transportation, while the sustainability aspects relate to accessibility to facilities. The model supports planners to identify the best city form considering the selected performance criteria. In this case study, a compact form of a city in terms of main roads, coupled with a mixed land uses performed best.

**Keywords:**

Urban Forms, Transportation, Land-Use, Pollution.

ID 1406 R

**HOW HAS TRAM DEVELOPMENT AFFECTED TO THE CITY DEVELOPMENT?: A HISTORICAL REVIEW OF THE FIRST TRANSIT TRAM IN SEOUL**

Main Author:

**Naesun PARK** (*The University of Tokyo*)**Abstract:**

This paper aimed to find the transit-oriented development prototype of Seoul by studying the correlation of tram development and city development between the late nineteenth and middle twentieth century, when the Western style urbanization and modernization started in Seoul, Korea. From the first-hand literature analysis, this research found the following important results. First tram development succeeded the linear development tradition of Seoul. Unlike the Western zoning system, commercial activities had been appeared according to the major strips since Goryeo Dynasty (918~1392). It was proved that tram development enforced the linear commercial development by comparison and analysis of the land-use map and tram-use map in the 1930s. Secondly, the business mind of the tram development and operation adjusted itself to the land-use and urban demand, and this correlation reinforced the stable increase of tram ridership. Thirdly, there was a tram company which did not stop in analyzing the land-use but directly developed the real estate by itself. Gyeongseong Railway Incorporation (GRI) appreciated the demand for the leisure of Seoulites, who were experiencing the explosive urban expansion. GRI developed a comprehensive leisure area of almost 5,000 square meters at the river side and connected it to the city centre with a tram line. This can be called the first transit-oriented development in Korea. Two limitations, however, can be pointed out regarding to the tram and urban development in Seoul. The public sector could not play an important role under the Japanese colonial rule, and it also could not prepare the coming urban explosion property with a comprehensive long term plan due to the short of human and material resources by consecutive wars. (...).

**Keywords:**

Transit-oriented development, Tram, Urban form, Modernization, Seoul.

ID 1740 R

**OPTIMAL ENVIRONMENTAL POLICY IN AIR TRANSPORT MARKETS**

Main Author:

**Ofelia BETANCOR** (*Universidad de Las Palmas de G.C.*)

Co-author(s):

**M. PILAR SOCORRO** (*Universidad de Las Palmas de G.C.*)**Abstract:**

Air transport services are essential in modern economies though they produce some important negative externalities. Air quality, greenhouse gas emissions, and noise are the main issues. Although most externalities found in air transport have a negative impact, there may be also a positive effect: the so-called impact on the "schedule delay". In this paper we show that the optimal ranking of policies may strongly depend on whether regulators act or do not act in a myopic way. Regulators act in a myopic way when they do not take into account the effects that a particular environmental policy has on other air transport externalities such as changes in the schedule delay.

**Keywords:**

Environmental regulation, Schedule delay, Generalized price, Frequency.

MON 12<sup>th</sup> (15:30 - 16:45, Session F5.3) Room 0.04

ID 1743 R  
**FROM ENVIRONMENTAL CONSTRAINTS TO NETWORK-WIDE ENVIRONMENT-FRIENDLY TRAFFIC PATTERNS: INVERTING THE PLANNING APPROACH FOR SUSTAINABILITY**

Main Author:

**Xin LIN** (CIB / Verkeer & Infrastructuur, Katholieke Universiteit Leuven)

Co-author(s):

**Ben IMMERS** (CIB / Verkeer & Infrastructuur, Katholieke Universiteit Leuven)

**Francesco VITI** (CIB / Verkeer & Infrastructuur, Katholieke Universiteit Leuven)

**Chris TAMPÈRE** (CIB / Verkeer & Infrastructuur, Katholieke Universiteit Leuven)

**Abstract:**

Nowadays, environmental impacts are becoming more and more important in urban network traffic management. However, traditional urban traffic management approaches are predominantly geared towards satisfying the traffic demand, and do not consider the environmental effects in the design phase. Calculation of the generated emissions is usually foreseen after the calculation of traffic volume data via traffic assignment models. This paper describes a new methodology which uses the environmental constraints as key input for defining network wide traffic management strategies. Both flow and environmental impacts are calculated simultaneously instead of evaluating the environmental impacts for a given specific flow pattern. The methodology that allows integrating the traffic and emission models, including the inversion process of utilizing environmental constraints as input for the network traffic management, will be elaborated. On the link level this means that the suggested methodology will adjust the (flow) capacity of a link according to the various environmental constraints that apply. The subsequent flow pattern represents the basis for the design of an environment-friendly traffic network. The key element in the process is the development of a speed-flow diagram on each link based on the relevant environmental constraints. Combining the speed-flow diagrams related to the environmental constraints and the fundamental speed-flow diagram a new (integrated) speed flow diagram will be obtained, addressing all constraints simultaneously. (...).

**Keywords:**

Air pollution, Traffic emission, Network management.

MON 12<sup>th</sup> (17:00 - 18:15, Session F5.4) Room 0.04

ID 1060 R  
**TRANSPARENCY, FLEXIBILITY, SIMPLICITY: HOW TO ACTIVELY IMPROVE PSS IMPLEMENTATION**

Main Author:

**Marco TE BROMMELSTROET** (University of Amsterdam)

Co-author(s):

**Luca BERTOLINI** (University of Amsterdam)

**Abstract:**

There is a growing body of academic literature that deals with the gap between Planning Support Systems (PSS) and daily urban planning practices. In response to the identified bottlenecks for implementation and insights from knowledge management, a new approach for improving PSS implementation was recently proposed. This Mediated Planning Support (MPS) approach is grounded in several theoretical schools, such as knowledge management and cognitive science. This article discusses the testing of this approach in three cases of land use and transport strategy-making in the Netherlands, with the aim to increase the understanding of the added value of the mechanisms that underlie the MPS framework. Methodologically speaking, it utilised workshop specific surveys, a general ex-post survey and participatory observation. Although small-N, the results seem to indicate that MPS does improve several of the bottlenecks of PSS implementation defined in other studies: it provided a better fit between the PSS characteristics and the strategy-making processes, it increased understanding of the possibilities (and limitations) of PSS, it fostered acceptance and improved use (awareness and transparency were not significantly influenced). Important mechanisms for promoting these outcomes include an open constructive critical attitude of both PSS developers and planners, a prototyping process, and placing emphasis on externalisation and internalisation of knowledge. The paper closes with a discussion on the implications for PSS development and planning and will provide directions for further research.

**Keywords:**

Planning Support Systems, Implementation gap, Mediation, User orientation, Land use and transport, Strategy making.

MON 12<sup>th</sup> (17:00 - 18:15, Session F5.4) Room 0.04

ID 1131 R

**EVALUATING REGENERATION IMPACTS OF THE CHANNEL TUNNEL RAIL LINK**

Main Author:

**Francesca PAGLIARA** (*University of Naples Federico II*)

Co-author(s):

**Ennio CASCETTA** (*Federico II University of Naples*)

**Valerio BRANCACCIO** (*University of Naples Federico II*)

**John PRESTON** (*Transportation Research Group*)

**Abstract:**

The term regeneration tends to suggest a broad range of changes including the rebuilding of local economies; an influx of productive investment and new jobs and the development of new property. This paper focuses on regeneration impacts expressed in terms of the economic and land-use effects brought by the introduction of High Speed Rail (HSR) systems. Specifically, the implicit price of HSR accessibility is estimated using regression functions for the housing and office markets using the Channel Tunnel Rail Link in England as a case study. The main outcome of this analysis is that there is a correlation between property prices and distance to the nearest HS station.

**Keywords:**

Regeneration impacts, High Speed Rail, Land-use impacts, Economic impacts.

MON 12<sup>th</sup> (17:00 - 18:15, Session F5.4) Room 0.04

ID 1547 R

**SUSTAINABILITY OF MAJOR URBAN TRAVEL CORRIDORS IN A MULTI-NUCLEATED URBAN REGION: ROLE OF BUS RAPID TRANSIT, HIGHWAY TOLLS AND PARKING CHARGES**

Main Author:

**Ata KHAN** (*Carleton University, Dept. of Civil & Environmental Engineering*)

Co-author(s):

**Shahriar ZARGARI** (*Iran University of Science and Technology*)

**Abstract:**

This paper illustrates the effectiveness of demand management policies in a major travel corridor of a multi-nucleated urban region with an imbalance of housing and employment in satellite communities. By using the example of Ottawa (Canada), the structure of this type of urban form is characterized in terms of mobility problems and opportunities. Demand management policies are investigated for a multimodal travel corridor that features high quality freeway, parallel arterials, and a bus rapid transit (BRT) system. A modelling framework and the constituent models for the estimation of travel demand, fuel consumption and emissions including greenhouse gases are used to test the role of parking charges in the main city centre, bus rapid transit, bus fare and highway tolls in improving system level in-vehicle travel time, and reducing fuel consumption and emissions. Results of sensitivity analysis and effective scenarios are illustrated. Conclusions highlight the findings and suggest policy implications.

**Keywords:**

Multi-nucleated urban region, Sustainable transportation, Travel corridor, Bus rapid transit, Parking charges, Tolls, Travel time, Emissions, Greenhouse gas emissions, Fuel consumption, Environment.

ID 1572 R

**THE CAPACITY OF STATE AND LOCAL GOVERNMENTS TO DELIVER LAND USE TRANSPORT INTEGRATION: AN ANALYSIS OF LAND USE AND TRANSPORT POLICIES IN PERTH AND MELBOURNE**

Main Author:

**Carey CURTIS** (*Curtin University*)**Abstract:**

Reducing the need to travel, particularly where there is reliance on the car as the primary mode of travel has multiple benefits to sustainability. Many cities, including Perth and Melbourne, have been designed with the car as the primary travel mode. Diversifying transport options can be enabled through the integration of land use and transport planning, both to deliver an integrated transport network and to structure land use and activity in cities to provide greater opportunities for walking cycling and public transport use. A policy framework through which this can be achieved is essential. In the last decade Australian planners have renewed interest in planning strategies that integrate of land use and transport to achieve more sustainable travel outcomes. There is a National Charter on Integrated Land Use and Transport Planning and providing access to public transport through integration with land use activity is the key focus of metropolitan planning strategies for Australian cities. Some states have gone further, harnessing the efforts of local government, such as the 'Integrated Transport Planning Partnering Agreement' in Western Australia to improve collaboration. Given this impetus it is reasonable to expect policies at state and local government to reflect the principles of land use transport integration. This paper reports on research findings from a content analysis of land use and transport policies of governments for two Australian metropolitan regions, Perth and Melbourne. Policies are assessed against a set of 'land use transport integration' principles. A comparison is made between the two cities as to the extent of capacity. The analysis also focuses on the vertical integration of policy between state and local government. (...).

**Keywords:**

Land use transport integration, Policy implementation.

ID 2608 R

**INSTITUTIONAL FACTORS IN TRANSPORTATION RESPONSES TO CLIMATE CHANGE MITIGATION: PERSPECTIVES FROM LATIN AMERICA**

Main Author:

**Carolyn MCANDREWS** (*UC Berkeley*)

Co-author(s):

**Elizabeth DEAKIN** (*UC Berkeley*)**Lee SCHIPPER** (*Global Metropolitan Studies*)**Abstract:**

In this research we sought to understand how policy actors in the urban transportation sector in Latin America adopt climate change considerations into their work, including the techniques they use to address it, including analysis, advocacy, and project planning and implementation. Are these practitioners' responses to climate change mitigation a departure from standard practice? Through interviews with transportation practitioners working in Latin America with international organizations and non-governmental organizations, primarily through the World Bank, we found that transportation practitioners in Latin America want to include climate change mitigation as a main objective of urban transportation projects, but encounter four major challenges. These challenges include (1) lack of local political support; (2) constraints imposed by climate change mitigation funding instruments; (3) disjointed transportation and land use planning in metropolitan areas; and (4) lack of support for interventions that slow motorization. Though our interviews centered on practitioners in Latin America associated with the World Bank, additional discussions with practitioners in China and California confirm that these challenges generalize to other regions.

**Keywords:**

Climate change mitigation, Institutions, Transportation planning, Land use planning, Integrated transportation and land use plans, Latin America, Clean Development Mechanism, Global Environment Facility.

TUE 13<sup>th</sup> (08:15 - 09:30, Session F5.5) Room 0.04

ID 1924 R

**LAND-USE TRANSPORT SYSTEMS: COMPARING LOCAL POLICY DYNAMICS IN SWISS AND FRENCH URBAN AREAS**

Main Author:

**Caroline GALLEZ** (*Université Paris-Est, Laboratoire Ville Mobilité Transport (LVMT)*)

**Abstract:**

Since the 19th century, a variety of “ideal” land-use transport systems have been formulated as optimal solutions to urban land-use and transportation problems (Wegener and Fürst, 1999). Today, there is a broad consensus among researchers and transport/urban planning professionals that more coherence and coordination between transport and land-use policies is necessary to achieve sustainable urban development and mobility. This claim derives from evidence that, in Europe, local policies are only successful as regards criteria for sustainable development (the reduction of motorized traffic) when they combine measures for limiting car use in city centres with measures favoring the development of public transportation, densification, and mixed-use urban organization (Pharoah and Appel, 1995; Brög and Erl, 1996). If there is nothing new in the question regarding the interaction between spatial organization and transport, the ideas underlining this concern and the purposes of public policies have deeply evolved over the centuries, particularly as relates to urban planning. In short, we have moved from a concept of “car-shaped cities” to an approach to urban design where guidelines derive from “urbanity” values and the sharing of public spaces. How have local authorities translated the requirements and objectives of national laws? And how have they accounted for the evolution of these global objectives and the increasingly complex issue of coordinating urban development and transportation? What factors explain innovation and continuity in the relationship between land-use planning and transport policies? In this study we focused on the question of political change by comparing the “trajectories” of four urban areas: Geneva and Bern in Switzerland and Strasbourg and Bordeaux in France. (...).

**Keywords:**

Transport and land-use planning coordination, Comparative analysis, Political change, Institutions, Ideas, Interests.

TUE 13<sup>th</sup> (08:15 - 09:30, Session F5.5) Room 0.04

ID 2184 R\*

**NATIONAL SCALE LAND-USE TRANSPORT POLICY MODELLING**

Main Author:

**Anna MAYERTHALER** (*Vienna University of Technology*)

Co-author(s):

**Günter EMBERGER** (*Vienna University of Technology*)  
**Reinhard HALLER** (*Vienna University of Technology*)

**Abstract:**

This paper presents the dynamic land-use transport interaction (LUTI) model MARS (Metropolitan Activity Relocation Simulator) Austria and its applicability for land-use/transport policy modelling. The purpose of the model is to capture the most important feedback mechanisms between the land-use and the transport system on a national scale. The MARS model consist of a transport model, a housing development model, a household location choice model, a workplace development model, a workplace location choice model, as well as a fuel consumption and emissions model. In this paper particular attention was paid to policy scenario modelling with MARS Austria. For this purpose we have chosen three different policy scenarios and compared the results with the base run of the model. The analysis of the model results focuses on the changes in transport behaviour as well as land-use changes that might occur as reaction to the policies. Further we examine which of the tested policies are most effective in reducing CO2 emissions in the transport sector.

**Keywords:**

National LUTI modelling, Policy scenarios, CO2 emissions.

ID 1153 R

**WHAT COULD BE THE COSTS AND BENEFITS OF TRANSPLANTING NEWER TECHNOLOGIES INTO OLDER CARS?**

Main Author:

**Filipe MOURA** (*Centro de Sistemas Urbanos e Regionais (CESUR), Instituto Superior Técnico (IST)*)

Co-author(s):

**José MANUEL VIEGAS** (*Centro de Sistemas Urbanos e Regionais (CESUR), Instituto Superior Técnico (IST)*)**Abstract:**

The transport sector faces multiple challenges including the accommodation of increasing fuel prices and environmental pressures. These hurdles become more important in road transport where cars hold a larger share of final energy consumption and emissions. Although not solved, the situation is improving in general and the question of accelerating the transition to new technologies is dominant. Technological turnover of car fleets is determined by the replacement of older vehicles by new models. Depending on the diffusion of new cars and driving forces for technological change, the total displacement of older technologies can last 10 to more than 40 years. Consequently, there is a delay of potential energy and environmental benefits from more efficient technologies, while obsolete technologies continue to pollute at preceding levels although with some reduction as distances travelled by older cars tend to be smaller. Our research explores one possible alternative to partially overcome this barrier through car organ transplant (COT). This corresponds to extending the car's lifetime while keeping its powertrain and exhaust after-treatment devices technologically upgraded by replacing obsolete components with best available technologies, during its service time. The present paper presents our cost-benefit analysis of performing COT in a mid-sized gasoline car, over a period of 20 years of car ownership. Firstly, we propose a procedure to estimate the potential costs of performing COT. Then, we present the models we developed to estimate those costs and benefits: Total Car Ownership Cost model to evaluate the economic costs of car ownership and a Life cycle Inventory model to calculate the energy and environmental burdens (i. (...).

**Keywords:**

Keywords: Car use, Organ transplant, Technological diffusion, Energy efficiency, Cost-benefit analysis.

ID 1368 R

**SCOOTER LEASING: A CRADLE-TO-CRADLE SOUND STRATEGY?**

Main Author:

**Marisa DE BRITO** (*Delft University of Technology*)

Co-author(s):

**Floris H.J. PETERS** (*Delft University of Technology*)**Abstract:**

This article investigates the application of the Cradle-to-Cradle approach to the electric scooter vehicle, and how the concept of leasing can be used as a means to make it operational. This research is a result of a research project with Eco-Movement, a Dutch firm currently selling electric scooters imported mainly from Asia. Eco-Movement is considering putting in the market its own electric scooter, branded according to the cradle-to-cradle principles. The cradle-to-cradle concept was developed as a counter-tendency to the design of cradle-to-grave products: to design products which are not a burden to the environment but are, among others, made of renewable resources. There is an official cradle-to-cradle design certification process, and Eco-movement has the ambition to obtain the gold cradle-to-cradle certificate for its scooter. This article first describes the Cradle-to-Cradle gold certification requirements and it provides an overview of leasing business models. For the first, we reviewed the literature and for the latter we carried out expert interviews with four passenger mobility industries: the automobile, the electric bicycle, the fueled-powered scooter and the electric scooter. After that, we investigate which type of leasing model could suit Eco-movement cradling ambition, by means of a SWOT analysis. We conclude that, given the circumstances of Eco-movement, putting its own cradle-to-cradle electric scooter in the market, would demand a partnership with an established lease company and with a reverse logistics third party. This however has the risk associated with the low control capability inherent to outsourcing. This in itself hinders the compliance with the requirements of the cradle-to-cradle gold certificate. (...).

**Keywords:**

Cradle-to-Cradle, Gold certification, Product component return, Leasing, Electric scooter, case study.

ID 1421 R

**ESTIMATING THE POTENTIAL OF A LARGE SCALE CAR-SHARING SYSTEM WITH AN AGENT-BASED MICROSIMULATION APPROACH**

Main Author:

**Francesco CIARI** (*IVT -ETH Zurich*)

Co-author(s):

**Michael BALMER** (*Institute for Transport Planning and Systems, ETH Zurich*)

**Kay W. AXHAUSEN** (*IVT - ETH Zurich*)

**Abstract:**

This paper reports on ongoing work aimed to estimate the potential use of car sharing at large scale in urban areas as a mean to mitigate congestion and social exclusion. The methodology used to assess the potential of the system is agent based modelling. An existing open source software, called MATSim-T (Multi-Agent Transport Simulation Toolkit, <http://matsim.org>), has been enhanced within this project to allow the modelling of the car sharing mode. In order to add the car sharing mode to the simulation toolkit a cost structure reflecting the implementation scheme of the system has been defined. The simulated individuals (agents) will have this additional option and will choose it, or not, according to the generalized cost it generates for their schedules (plans). The travelling time for this mode, is analogue to that for car and it is calculated on a congested network, where all cars are simulated, adding realism to the model. The results of a test case for the city of Zurich, a scenario with about 160'000 agents, are reported and discussed.

**Keywords:**

Car sharing, Microsimulation, Agent based.

ID 1593 R

**ON THE POSSIBILITY OF USING A ONE-MAN-DRIVE VEHICLE:TOWARD A NEW KIND OF PUBLIC TRANSPORTATION**

Main Author:

**Fumitoshi MIZUTANI** (*Kobe University, Graduate School of Business Administration*)

Co-author(s):

**Hiroki SAKAI** (*Kobe University, Graduate School of Business Administration*)

**Yusuke SUZUKI** (*Kobe University, Graduate School of Business Administration*)

**Kenichi SHOJI** (*Kobe University, Graduate School of Business Administration*)

**Abstract:**

Based on responses to questionnaires, this study investigates the possibility of using one-man-drive electric vehicles. Our survey results show that while most of those questioned were unfamiliar with the concept of the one-man-drive vehicle, 30% of respondents to whom its use was explained wanted to use it, for a sample average usage range of travel time of about 22 minutes. About 30% of respondents expected the introduction of the new vehicle to improve their opportunities to take trips for daily activities and other purposes. It was determined that the price for one-time use would be about 190 yen, almost the same as for route bus service. While elderly people and housewives would seem to be logical targets as potential users of the new vehicle system, survey results show a lack of willingness among these groups to use the one-man-drive vehicle.

**Keywords:**

Electric vehicle, Personal vehicle, Environment, New transportation mode.



ID 1706 R

**IMPACT OF ALTERNATIVE VEHICLE TECHNOLOGIES AND LAND USE PATTERNS ON LONG TERM REGIONAL ON-ROAD VEHICLE EMISSIONS**

Main Author:

**Nagui ROUPHAIL** (*ITRE, NC State University*)

Co-author(s):

**Haibo ZHAI** (*Department of Engineering and Public Policy, Carnegie Mellon University, Pittsburgh, PA*)**Christopher FREY** (*CCEE Department, NC State University at Raleigh*)**Brandon GRAVER** (*North Carolina State University*)**Abstract:**

The objective of this research is to quantify the impacts of projected changes in vehicle fuels and propulsion technologies, as well as land use development patterns on regional on-road vehicle emissions over a long-term planning horizon. Roadway link-based emissions models have been developed, which utilize modal fuel use and emission rates from multiple sources. The emissions models are coupled with vehicle activity outputs derived from an integrated land use and transportation model (TRANUS) for the purpose of estimating emission inventories and assessing the potential changes in emissions that can accrue from changes in vehicle fuel, vehicle technology and land use development patterns. The results show that the complete retirement of old light-duty vehicle fleet including Tiers 0 and 1 vehicles can reduce emissions of HC, CO, and NO<sub>x</sub> substantially. However, modest improvements in fuel economy may be offset by Vehicle Miles of Travel (VMT) growth and the associated overall average speed reductions. Compared to the suburban-type growth, herein labelled the Business-as-Usual (BAU) land use scenario without penetration of alternative vehicle technologies, the smart-growth (SG) land use model along with modest penetration of alternative vehicles into the vehicle fleet collectively can decrease emissions from on-road mobile sources by as much as 10% or more for all pollutants over a long planning horizon. This finding highlights the potential effectiveness of combined vehicle technology and land use planning tools to reduce emissions from on-road vehicles.

**Keywords:**

Vehicle technology, Land use, Emissions.

ID 1954 R

**CAR DEPENDENCE OR APPETENCE? EXAMINATION OF ATTITUDES TOWARDS SUSTAINABLE MOBILITY IN THE GREEK CASE**

Main Author:

**Dimitris MILAKIS** (*National Technical University of Athens*)

Co-author(s):

**Dimitris PAPAVALSILEIOU** (*National Technical University of Athens*)**Thanos VLASTOS** (*National Technical University of Athens*)**Abstract:**

In this paper we tried to investigate the causes of delay in promoting sustainable mobility policies in Greece. The main question raised is whether these are due to lag in terms of political will or a clear conscious preference of Greek citizens to use their car. For this purpose, we applied methods of social psychology and in particular the Theory of Planned Behaviour in a medium-sized city of Greece, which is expected to build one of the first bicycle networks. According to the results, a strong intention to use the new cycle network was found in the case of Volos. The results comply with the pro-environment attitude, the realization of car related problems and the positive attitudes towards alternative means. On the contrary the symbolic and emotional attitudes towards car were found to be relatively lower, indicating that Greek society tends to be more progressive, regarding the use of alternative means, than the politicians' will. Through the application of TPB, we found that intention is strongly correlated with Perceived Behavioural Control, and less strongly with the attitude. The subjective norm was not a statistically significant factor of influence. It is also noteworthy that habit of car or bicycle use was not found to be a significant parameter of intention explanation.

**Keywords:**

Sustainable mobility policies in Greece, Intention of Greeks to use alternative means, Theory of Planned Behaviour.

ID 1975 R

**ANALYSIS OF TRAM RAILWAY EXTENSION POLICY USING MULTI-AGENT BASED TRAFFIC SIMULATOR AND FINANCIAL ENGINEERING**

Main Author:

**Takafumi SAKURAI** (*The University of Tokyo*)

Co-author(s):

**Hideki FUJII** (*The University of Tokyo*)**Shinobu YOSHIMURA** (*The University of Tokyo*)**Abstract:**

The Kyoto Protocol has been valid for four years and now the world is arguing about after the Kyoto Protocol. The figures of arguments result are still obscure but new protocol will be required higher emission rates for industrial countries than the Kyoto Protocol. Transportation has a big impact on the influence of natural environment and has been required outstanding development especially on energetic efficiency and reducing the emission gas. These requirements bring the public transportation to in the spotlight again at all over the world. Furthermore, developing countries also pay attention for the public transportation as one of the valuable ways for decreasing the traffic congestion not only the reasons come from the global warming issues. Urban traffic policy makers, therefore, need to consider how to combine the existence traffic systems and new traffic systems. The lack of this consideration has huge potential to end with the undesirable results. In our study, we raise the tram railway extension plan in Okayama Prefecture, Japan as an example and discuss its impact for current traffic flows using a Multi-Agent based Traffic and Environment Simulator (MATES). MATES has been developing at our laboratory since 1999 to analyze complex traffic systems and effect of various traffic policies. We have analyzed real traffic phenomena using MATES but we expand and utilize its abilities to measure the economic impacts as a new attempt in this time. In the past, traffic simulators used only for analyzing the traffic flow and recreating the driver's behaviours. Then investment values from new traffic policies were measured another specific calculations or methods. Both topics are strongly tied and have a relationship but often considered separately. (...).

**Keywords:**

Traffic simulator, Multi-Agent, Real option, Traffic flow analysis.

ID 2154 R

**AN INTEGRATED MULTIOBJECTIVE MODEL FOR MAXIMIZATION OF MOBILITY AND EQUITY UNDER ENVIRONMENTAL CAPACITY CONSTRAINTS**

Main Author:

**Tao FENG** (*Eindhoven University of Technology*)

Co-author(s):

**Junyi ZHANG** (*Graduate School for International Development and Cooperation, Hiroshima University*)**Akimasa FUJIWARA** (*Graduate School for International Development and Cooperation, Hiroshima University*)**Harry TIMMERMANS** (*Urban Planning Group, Eindhoven University of Technology, The Netherlands*)**Abstract:**

This paper proposed an Integrated Model which serves a multi-objective optimization problem: the maximization of mobility and Spatial Equity under the constraint of quantitatively specified environmental capacity. As an extension of the Integrated Model suggested previously, this model incorporates equity as an additional optimization objective. The multi-objective model is evaluated by a vector of Pareto-optimal solutions using Dalian city as a case study. To compare model's performance, models with the single objective of equity maximization and mobility maximization are implemented, respectively. The multi-objective model results in less equity than the equity maximization model and a lesser mobility level than the mobility maximization model. Results verified that the proposed multi-objective model can be applied to trade-off between the maximization problems of equity and mobility. Calculated car ownership and emissions at the zonal level provide meaningful references for decision making in environmental evaluation and mobility management.

**Keywords:**

Integrated Model, Multiobjective Optimization, Mobility, Spatial Equity, Accessibility, Environmental Capacity.

ID 2282 R

**POTENTIAL CONTRIBUTIONS OF HIGH SPEED RAIL TO REDUCING CO<sub>2</sub> EMISSIONS IN THE U.S. TRANSPORT SYSTEM BY 2050**

Main Author:

**Yuki TANAKA** (*Institution for Transport Policy Studies*)

Co-author(s):

**Lee SCHIPPER** (*Global Metropolitan Studies*)**Louis THOMPSON** (*Thompson, Galenson & Associates*)**Abstract:**

Since the end of World War II, the passenger transportation system in the United States has been heavily based on the automobile for short haul travel and the airplane for long-haul travel. In this paper, we show that there is a growing potential for high speed rail in the United States caused partly by increasing congestion on the existing network and based partly on the higher speeds and higher service capabilities of new technology, high-speed rail. In defining the potential for high-speed rail over the next 40 years, we used two approaches: first, a bottom-up approach in which the major markets for high-speed rail as defined by the Federal Railroad Administration (FRA) were studied separately based on a projection of the specific demographics and demand patterns of those corridors; and, second, a top down approach in which the overall travel demand market for the United States was stratified into carefully defined distance profiles and demographic groups specific to high-speed rail. We conclude that there is in fact a potential market for high-speed rail in the United States, especially within the four decade time horizon chosen. Additionally we conclude that a 10,300 mile system would carry over 450 million passengers annually and would cost between 210 and \$385 billion to construct. Such a system would moderately reduce carbon dioxide emissions, but would obviously have other benefits including time savings, improved safety, and reduced congestion which in combination could justify the system. We do not conclude that any of these systems should necessarily be built: rather, we conclude that HSR deserves to be taken seriously during the planning of the US transportation network in the coming decades. (...).

**Keywords:**

High-speed rail, Passenger transportation, Auto, Air.

ID 2394 R

**TRADITIONAL BASED INNOVATION: INTEGRATING BICYCLES AND URBAN RAIL TRANSIT IN BEIJING, CHINA**

Main Author:

**Xianmin MAI** (*School of Environmental Studies, Nagoya University*)

Co-author(s):

**Yoshitsugu HAYASHI** (*Nagoya University*)**Yun WANG** (*Graduate School of Environmental Studies, Nagoya University*)**Liuying LU****Xiao LU****Abstract:**

As a measure to mitigate GHG emissions in transport sector, it is necessary to revitalize the traditional non-motorized transport mode of bicycles in many cities of developing countries. In this paper, a traditional based innovation of integrating bicycles and urban rail transit is proposed. This integration enlarges the service area of urban rail transit from comfortable walking distance to comfortable bicycle-riding distance, bringing mutual benefits to these two modes of environmental friendly transport. Beijing city in China is selected as a case city to explore the proposed integrated bicycles and urban rail transit system (BR system), and the bicycle-rail transfer at Wudaokou station of Subway Line 13 in Beijing is selected as a detailed case site. Firstly, the necessity, feasibility and framework of the BR system are presented. Secondly, the existing performance of the BR system is investigated. Thirdly, a bicycle rental company is introduced as a catalyst for the BR system, and its current practice and potential development are discussed. Finally, an action plan to promote the BR system with a catalyst company is brought forward.

**Keywords:**

Integrating, Bicycle, Urban rail transit, Sustainable transport, Beijing.

ID 2455 R

**ARE WE REACHING “PEAK TRAVEL”? TRENDS IN PASSENGER TRANSPORT IN INDUSTRIALIZED COUNTRIES**

Main Author:

**Lee SCHIPPER** (*Global Metropolitan Studies*)

Co-author(s):

**Adam MILLARD-BALL** (*Emmett Interdisciplinary Program in Environment and Resources, Stanford University*)**Abstract:**

Projections of energy use and greenhouse gas emissions for industrialized countries typically show continued growth in vehicle ownership, vehicle use and overall travel demand. This represents a continuation of trends from the 1970s through the early 2000s. This paper presents a descriptive analysis of cross-national transport trends in six industrialized countries (Japan, US, Canada, Australia, Sweden and the UK) providing evidence to suggest that these trends may have halted. Through decomposing passenger transport energy use into activity, mode structure and energy intensity, we show that increases in total activity (passenger travel) have been the driving force behind increased energy use, offset somewhat by declining energy intensity. We show that total activity growth has halted relative to GDP in recent years in the six countries examined. If these trends continue, it is possible that accelerated decline in the energy intensity of car travel, stagnation in total travel per capita, and some shifts back to rail and bus modes, and at least somewhat less carbon per unit of energy could leave the absolute levels of emissions in 2020 or 2030 lower than today.

**Keywords:**Mobility, Mode shares, Fuel, CO<sub>2</sub>, Sustainability.

ID 2560 R

**CONSUMER AND USER PREFERENCES TOWARDS ELECTRIC MOBILITY**

Main Author:

**Anja PETERS** (*Fraunhofer Institute for System and Innovation Research (ISI)*)

Co-author(s):

**Elisabeth DÜTSCHKE** (*Fraunhofer-ISI, Karlsruhe, Germany*)**Claus DOLL** (*Fraunhofer-Institute for Systems and Innovation Research (ISI)*)**Elna SCHIRMMEISTER** (*Fraunhofer ISI, Karlsruhe, Germany*)**Martin WIETSCHHEL** (*Fraunhofer-ISI, Karlsruhe, Germany*)**Abstract:**

Electric vehicles offer advantages compared to traditional vehicles with regard to environmental impact and noise. Aspects which are still critical for a successful diffusion include the maximum range, purchase price and charging duration of electrical vehicles as well as feasible concepts of providing the necessary infrastructure. On the one hand, technological breakthroughs are necessary; on the other hand, knowledge about consumer and user behaviour is crucial to direct development of technology and of general requirements and to enable effective promotion of electric vehicles. Due to the low commercial availability of electric vehicles so far, scientific findings and practical experience on consumer behaviour and needs are rare. In order to explore factors promoting and inhibiting diffusion of electric vehicles as well as feasible and attractive vehicle and mobility concepts, interviews with experts were conducted. Together with conclusions from research on acceptance of technological innovation and from findings on characteristics and behaviour of electric vehicle users from the 1990s, the interview results suggest first answers on questions about user preferences towards electric mobility and provide implications for further research and development.

**Keywords:**

Transport, Electric vehicles, Consumer behaviour, User behaviour.

ID 2666 R

**ESTIMATING THE AMOUNT OF ADDITIONAL MASS TRANSIT NEEDED TO REDUCE CO2 EMISSIONS FROM REGIONAL PASSENGER TRANSPORT IN JAPAN**

Main Author:

**Hirokazu KATO** (*Nagoya University*)

Co-author(s):

**Kei ITO** (*Nagoya University*)**Naoki SHIBAHARA** (*Nagoya University*)**Yoshitsugu HAYASHI** (*Nagoya University*)**Abstract:**

The study assumes the introduction of low CO2 emission transit such as on trunk lines to reduce CO2 emissions from regional passenger transport and aims to estimate the required scale. First, a local transport region in Japan is defined as the unit of analysis in which most common transport is completed. In each region, the target of CO2 emissions from local passenger transport in 2050 is set to 20% of that in 2000. The amount of CO2 exhausted from local passenger transport could be estimated on the basis of technological innovations; thus, the amount of reduction needed to achieve the target can be estimated. Second, the change in CO2 emissions resulting from the introduction of a mass transit system is evaluated, including reduction by replacing private vehicles and the emissions arising from construction and operation of the mass transit system. For this purpose, life cycle assessment is applied. The transit density of each route is estimated from the population density in the densely inhabited district of each local transport region, allowing the transit system that emits the least CO2 per passenger-km to be selected. In addition, the extent of new service and the associated CO2 emission reduction are calculated. A series of calculations yields the lengths of additional mass transit routes required to reduce traffic volume sufficiently to achieve the CO2 reduction target for local passenger transport by 2050.

**Keywords:**

Environmentally sustainable transport (EST), Backcasting, Life cycle assessment, Low-carbon transport system.

ID 2667 R\*

**PERSONAL FACTORS INFLUENCING WALKING AND CYCLING IN URBAN AREAS**

Main Author:

**Miles TIGHT** (*ITS, University of Leeds*)

Co-author(s):

**Helen HARWATT** (*Institute for Transport Studies, University of Leeds*)**Ann JOPSON** (*Institute for Transport Studies, University of Leeds*)**Helen MUIR** (*Institute for Transport Studies, University of Leeds*)**Matthew PAGE** (*Institute for Transport Studies, University of Leeds*)**Abstract:**

Research to further understanding of walking and cycling for everyday local trips is being conducted across four UK urban areas. The research uses an innovative mixed-methods approach involving questionnaires, a range of qualitative research methods (including accompanied trips, ethnographies and interviews), as well as mapping and measurement of built environment factors. A key objective is to develop a better understanding of the personal factors and household interactions that combine to support or form barriers to walking and cycling for short local journeys. This paper reports specifically on the questionnaire findings. Two large sample questionnaires (covering walking and cycling separately) were distributed across each study area to collect individual level data that are being used to investigate how personal preferences combine at a household level to result in travel and mode choice decisions. The questionnaires have a strong theoretical underpinning to ensure a structured approach to identifying personal factors that influence walking and cycling. The Theory of Planned Behaviour (TPB) was chosen to provide this theoretical underpinning. The sampling strategy ensures that a full range of neighbourhood characteristics are surveyed, from the most to the least deprived socio-economic groups. The TPB is a widely used explanatory theory of intentions and behaviour with a proven track record within the transport field and in relation to other behaviours. (...).

**Keywords:**

Walking, Cycling, Personal factors, Transport policy.

ID 2794 R

**EVALUATION OF THE EFFECTS OF ROAD HUMPS ON POLLUTION EMISSIONS**

Main Author:

**João SILVA** (*Instituto Politécnico de Leiria*)**Abstract:**

Traffic calming devices and strategies are generally used in critical locations of the road infrastructure where there is a need to assure that traffic speeds are low or to reduce its demand such as in residential areas. Traffic calming devices perform therefore an important role in assuring not only the safety of all road users but an appraisable and friendly urban environment. In general terms the selection of the type of measure to be applied is based on the desired level of speed reduction. Other factors such as the consequences in noise levels or air pollution are normally not considered or are relegated to a secondary role. Consequently the evaluation is incomplete which can result in solving one aspect of the problem but aggravating other essential issues. While in the past this procedure was standard and acceptable nowadays it is becoming outdated and there are tools that allow a broader approach to the problem. In fact due to the consequences of air pollution to human health, the environment and global warming, the development of evaluation methodologies that incorporate this vital aspect are essential. This work will present an ongoing research that has the goal of improving the knowledge on a particular type of traffic calming device: Road humps. This particular measure, which is usually very effective in reducing traffic speeds, is widely used in several countries. In order to support the research an extensive data collection campaign was done using an instrumented vehicle. It was provided with several instruments that gathered information on the vehicles speed, acceleration (in the three usual axes), pitch, roll and yaw as well as its position using a GPS tracking device. (...).

**Keywords:**

Traffic calming, Road humps, Instantaneous emissions, Air pollution.

ID 1188 R

**BENCHMARKING SUSTAINABLE URBAN MOBILITY: THE CASE OF CURITIBA, BRAZIL**

Main Author:

**Antonio NELSON RODRIGUES DA SILVA** (*UNIVERSITY OF SAO PAULO - SAO CARLOS SCHOOL OF ENGINEERING*)

Co-author(s):

**Hellem MIRANDA** (*UNIVERSITY OF SAO PAULO - SAO CARLOS SCHOOL OF ENGINEERING*)**Abstract:**

Transportation planning is currently being confronted with a broader planning view, which is given by the concept of mobility. The Index of Sustainable Urban Mobility (I\_SUM) is among the tools developed for supporting this new concept implementation. It is a tool to assess the current mobility conditions of any city, which can also be applied for policy formulation. The objective of this work is to test the index performance in a city that is worldwide known by the quality of its transportation solutions, which is Curitiba, Brazil. There are two goals involved in the present study: the first one is to verify if the city can be used as a benchmark of sustainable mobility, and the second one is to evaluate the index itself, or its subjacent assessment method and reference values. The study method relies thus on a careful application of I\_SUM in the city selected. A global I\_SUM value of 0.747 confirmed that the city has indeed very positive characteristics regarding sustainable mobility policies. However, some deficiencies were also detected, particularly with respect to non-motorized transport modes. The application has also served to show that a few I\_SUM indicators were not able to capture some of the positive aspects of the city, what may suggest the need of changes in their formulation. Finally, the index application in parts of the city suggests that the city provides fair and equitable mobility conditions to all citizens throughout the municipal area. That is certainly a good attribute for becoming a benchmark of sustainable mobility, even if it is not yet the ideal model.

**Keywords:**

Sustainable mobility, Curitiba, Indicators, Urban planning.

MON 12<sup>th</sup> (17:00 - 18:15, Session F6.4) Room 1.06

ID 1244 R

**ASLEEP AT THE WHEEL: OIL ADDICTION  
IMPLICATIONS FOR URBAN TRANSPORT**

Main Author:

**Andre DANTAS** (*University of Canterbury*)

Co-author(s):

**Nick BUCHANAN** (*GHD Australia*)

**Abstract:**

This paper assesses the oil addiction implications to urban transport. Two metropolitan areas are compared in terms of urban and regional policy making and actions. The analysis indicates that there may be considerable impacts to well-being, because no specific planning/policy initiatives have been taken to address oil addiction and there is limited knowledge on the potential consequences of oil shortages and/or substantial fuel price increases. There would be various ways to seriously address the oil addiction issue, but it is clear that there will not be any "magic" solutions that will make the problem go away without a long-term vision and coordinated actions from all stakeholders.

**Keywords:**

Peak Oil, Urban Transport Planning.

MON 12<sup>th</sup> (17:00 - 18:15, Session F6.4) Room 1.06

ID 3087 R

**POLICY FRAMEWORK FOR TRANSPORTATION  
ENERGY EMERGENCIES**

Main Author:

**Taihyeong LEE** (*The Korea Transport Institute*)

Co-author(s):

**Gunyoung KIM** (*The Korea Transport Institute*)

**Sungwon LEE** (*The Korea Transport Institute*)

**Abstract:**

Recent exhaustion of fossil fuels and augmentation of energy demand of emerging economies intensify the possibilities of energy emergency in Korea. Since the most energy demands in transportation sector relies on petroleum related products, establishing contingency plan should be required for the intrinsic energy deficiency. It is expected that the international oil price will ascend or fluctuate based not only on the demand of petroleum products but also on the environmental changes of the OPEC (Organization of Petroleum Exporting Countries). Thus, the appropriate and timely contingency plan is indispensable. The purpose of this study is to classify the energy emergency, and to analyze the effectiveness of policy measures, and represents the improvement plan of related detailed readjustment plan exhibiting active and systematic contingency plans. A provisional and long-term contingency plans are proposed for transportation energy emergency. The inter-ministerial cooperation is necessary to effectively implement the contingency plan and to improve the capability of countermeasures for energy emergency in the transportation sector.

**Keywords:**

Energy Emergency, Contingency Plan, Policy Measures, Inter-ministerial Cooperation.

MON 12<sup>th</sup> (17:00 - 18:15, Session F6.4) Room 1.06

ID 3282 R\*

**APPLYING AND EVALUATING POLICIES FOR AIR EMISSIONS REDUCTION IN THE MARITIME TRANSPORT SECTOR: AVAILABLE AND REQUIRED DA**

Main Author:

**Miola APOLLONIA** (*Institute for the Environment and Sustainability, European Commission - Joint Research Centre*)

Co-author(s):

**Biagio CIUFFO** (*European Commission - Joint Research Centre*)

**Abstract:**

Maritime transport is a large contributor to air pollution and green house gases. In addition, the increasing rate of international trade make the problem even more worrying. Precondition for an effective policy strategy to regulate air emissions is their estimations in terms of quantification and localization. Aim of the paper is to provide a meta-analysis of the methodologies and available data sources for the estimation of air emissions from ships. The paper reviews the literature on the main methods for such estimations and compares their results identifying the main limits and challenges.

**Keywords:**

Air Emissions from ships, Maritime transport statistics, Ships data sources.

MON 12<sup>th</sup> (17:00 - 18:15, Session F6.4) Room 1.06

ID 3319 R\*

**BIKEWAYS DESIGN: HOW IT INFLUENCES OPERATION?**

Main Author:

**David PÉREZ BARBOSA** (*Universidad Nacional de Colombia*)

Co-author(s):

**William CASTRO GARCÍA** (*Universidad Nacional de Colombia*)

**Abstract:**

The bicycle use brings many advantages for citizens' mobility and urban life in general, viewed from its environmental, social and economical aspects. Many cities have had successful experiences by implementing solutions that include bicycles as an integral part of the urban mobility. For the development of 'sustainable' cities, pedestrian mobility must have the top priority in mobility planning, followed by an adequate infrastructure that allows cyclists to move in a fast and safe manner. An adequate-designed trail may attract bicyclists, walkers, skaters... every non-motorized form of transport in general. Bogotá has implemented a bikeways network since 1998. This network completes today 350 km and approximately 300,000 people travel on a bicycle every day. This is about 4% of the total amount of trips into the city. Considering 5 basic cyclists needs (safety, comfort, attractiveness, coherence and directness), a characterization and evaluation of infrastructural aspects is made, in order to find the aspects that influence in a negative manner the operation of cycle-routes and suggest low-cost solutions for improving the operational parameters. More cyclists can be attracted when those improvements in infrastructure are implemented. Some common problems have been identified: Road safety, network connectivity, way users' behavior, education, and others as well. The idea is to face these problems and to promote the non-motorized transport and the intermodal transport by providing adequate facilities (and improving the existing ones) for bicycles and pedestrians.

**Keywords:**

Bicycle, Non-motorized transport, Cycle-route, Cycle path.



ID 1061 R

**REPLACING THE PRIVATE MOTOR CAR WITH A MORE ATTRACTIVE PUBLIC TRANSPORT SYSTEM**

Main Author:

**Rockley BOOTHROYD** (*None Retired Professional Engineer*)**Abstract:**

A new and attractive public urban transport system is outlined which appears to be competitive with the private car. The guiding principle used is to integrate public transport with personal transport access using a cheap, small, lightweight (20 kg) personal-access folding scooter which is in the possession of the user at all times so that no parking facilities are needed at any time. When not in use, the folded scooter resembles a suitcase on wheels, similar to the suitcases usually used when traveling at airports. Folding and unfolding of the scooter is quick and easy even for elderly people who would use a tricycle version which would integrate fully with the system. The apparent advantages for this urban transport system include significantly reduced expenditure in household budgets, much reduced traffic congestion, less environmental pollution, reduced fuel consumption and a contribution towards controlling and investigating urban crime. The system is suggested for worldwide application in all climates. For very cold climates such as winter in Toronto or Helsinki, a special oversuit could be worn which is attached with a flexible umbilical heater duct connected to the cooling air from the 1 kW engine. This supplements 100 W of natural body heat with up to 400 W of additional heat. Heating is under the direct control of the rider with a thermostatically-controlled valve. The heating air exits from the rider's suit at 4 points, the wrists and ankles. Ticketing would be fully automated and seat bookings made using either the customer's personal computer or mobile telephone. Access to the system would be through a transport credit card. Billing would be computed automatically and usually rendered via email with direct debiting a likely preferred option of payment. (...).

**Keywords:**

Urban transport, Urban congestion, Urban planning, Urban Renewal, Road business strategy, Personal transport, Fuel conservation, Vehicle emissions.

ID 1067 R

**RESEARCH/DEVELOPMENT SUGGESTIONS RELATED TO MAINTAINING SUSTAINABLE MERCHANT SHIPPING**

Main Author:

**Rockley BOOTHROYD** (*None Retired Professional Engineer*)**Abstract:**

Maintenance of adequately low costs in merchant shipping is vital to the future world economy. Three areas have been identified as of sufficient importance to merit more detailed attention. 1) The development of marine diesel engines for large vessels which would use CWS (coal-water slurry) fuels instead of conventional heavy fuel oil. It is argued in this paper that we now have sufficient technological experience to be reasonably certain of the commercial success of this enterprise. A new design of cylinder head is outlined which is intended to allow those engine components which are vulnerable to damage by CWS fuels to be replaced while the engine remains operating. An adaptation of the variable geometry SEMT-Pielstick combustion chamber is also considered in order to render increased durability for the piston rings and cylinder liners. 2) The further development of parasail technology for wind-assisted propulsion to suit all vessels up to the largest size. The parasail can also be used very conveniently to generate all the electrical power supplies for the ship. It is suggested that this energy is best stored by slight air pressurisation of the hull. 3) The exploitation of this inexpensive way of pressurising the vessel to enable much lighter construction methods to be used in shipbuilding. This would also contribute very significantly in restraining the increasing costs of shipbuilding which is a major component of marine transport costs.

**Keywords:**

Marine diesels, Coal water slurry fuel, Skysails, Kitesails, Shipbuilding, Container ship.

ID 1575 R

**A CASE STUDY ON FCV POLICY IN JAPAN: A METAGOVERNOR'S ROLE AND ITS LIMITS**

Main Author:

**Yuichi MURAKAMI** (*The University of Tokyo, the faculty of law*)

**Abstract:**

'Public-private collaborations' or 'governance networks' have been found indispensable in public policies such as those for introducing and diffusing new advanced technology. In particular, in recent years, policy managers have been required to make efforts with regard to the 'governance of governance' or 'meta-governance'. Comparing with Sørensen and Torfing's recent work on effective and democratic 'meta-governance', this paper researches the R&D policy on fuel cell vehicles (FCVs) in Japan observing how the stakeholders recognize the policy and its feasibility, to find evidence on the conventional theory and to modify it. Furthermore, this paper aims to examine what a 'meta-governor' has to do to attain a certain policy goal, and to analyze endogenous and/or exogenous factors (such as the difficulty in distributing resources appropriately to competing technologies, the vulnerability of the research flow to political tides and personnel reshuffles, etc.) that should be taken into consideration in the policy processes for introducing and diffusing brand-new technology. We conclude that the 'meta-governor' is only a component of the plural 'meta-governance network', which imposes on him the abovementioned limits.

**Keywords:**

Public-private collaborative governance, Governance network, Meta-governor, Introduction and diffusion policy of advanced technology, FCV (fuel cell vehicle).

ID 1632 R

**PLANNING FOR ELECTRIC VEHICLES – CAN WE MATCH ENVIRONMENTAL REQUIREMENTS, TECHNOLOGY AND TRAVEL DEMAND?**

Main Author:

**Michael TAYLOR** (*ISST - University of South Australia*)

**Abstract:**

This paper discusses the feasibility for adopting electric vehicles (EV) for urban transport, replacing conventional private vehicles. Considerations need to be made of the potential greenhouse gas benefits of EV, the ability for EV to be used as direct replacements for present day vehicles, and the infrastructure and power supply implications of a wholesale shift to electric powered private transport. The paper presents the results of a feasibility study conducted for two major Australian cities, Sydney and Adelaide. The overall conclusion is that introduction of current technology electric vehicles could impact significantly on daily journeys made within a 100 km charge range. The case studies show that the large majority of motorised journeys are accomplished within this range, an observation expected to provide a similar result for other Australian metropolitan areas – and perhaps other cities as well. In addition, it must be emphasised that for a maximum benefit from electric vehicles, electricity should be acquired from renewable sources. The study findings should have implications for the adoption of EV technology in other cities around the world

**Keywords:**

Electric vehicles, Travel demand, Energy demand.

TUE 13<sup>th</sup> (08:15 - 09:30, Session F6.5) Room 1.06

ID 2069 R\*

**A METHOD TO IMPROVE URBAN MOBILITY AND REDUCE EMISSIONS OF CARBON IN MEDIUM SIZED CITIES OF DEVELOPMENT COUNTRIES**

Main Author:

**Valter SOUSA** (*Faculdade de Tecnologia de São José dos Campos*)

**Abstract:**

This paper aims to contribute to the management of passenger transport in small and medium-sized cities, through the proposition of a construct that meets the need of integration between the modal bicycle and public transport passengers. This integration enables the improvement in coverage ratios of means of transport, promoting better interaction between individuals, spaces and urban activities. For this we used a case study in São José dos Campos to apply the concepts developed. From the survey data relating to existing bike lanes, bus lines with their respective levels of passenger kilometers (IPK) and distribution of the economically active population in the city, provided by the City Hall, we propose a model for the integration of modes in urban transport.

**Keywords:**

Multimodal integration, Urban public transportatio.

TUE 13<sup>th</sup> (09:45 - 11:00, Session F6.6) Room 1.06

ID 1812 R

**THE POTENTIAL OF ALTERNATIVE FUEL CARS FOR ACHIEVING CO2 REDUCTION TARGETS IN EU27**

Main Author:

**Michael KRAIL** (*Fraunhofer-Institute for Systems and Innovation Research (ISI)*)

Co-author(s):

**Wolfgang SCHADE** (*Fraunhofer Institute Systems and Innovation Research (ISI)*)

**Abstract:**

In order to analyse the potential and suitable incentives to accelerate the diffusion of alternative fuel cars a diffusion model is developed and integrated in the System Dynamics model ASTRA. ASTRA is an integrated macroeconomic, transport and environmental model that is developed for application of sustainability impact assessment of transport and climate policies. Six potential technologies were added to the existing fuel types gasoline and diesel: compressed natural gas (CNG), liquefied petroleum gas (LPG), hybrid, bioethanol (E85), battery electric and hydrogen fuel cells. Based on a detailed analysis of the importance of different characteristics of cars and fuel technologies, a suitable model structure is established. In a bottom-up process all necessary economic drivers are added to total costs representing the major driver of the purchase decision for a certain fuel technology. The calculation considers as well the filling station infrastructure and the tank capacity for each fuel type. Finally, average costs per vehicle-km for each fuel technology provide the quantifiable part of the purchase decision. The simulation of the probability of choosing a certain fuel technology is performed in a discrete choice function. This type of function allows the consideration of qualitative factors like security of certain technologies or the image. In a validation process, these soft factors are quantified by comparing the purchasing behaviour based on costs per technology (diesel and gasoline) and the observed behaviour in time series from 1990 to 2006. The paper demonstrates the potential of alternative fuel technologies for passenger cars by simulating the purchasing decision in the EU27 until 2050. (...).

**Keywords:**

Passenger car, Technology diffusion, Vehicle fleet modelling, System Dynamics, ASTRA, Battery electric cars, Hydrogen cars, Feebate, CO2 pricing, CO2 emission limits.

ID 2355 R

**MEGA TRANSPORT PROJECT FINANCING IN SWEDEN AND DENMARK - DOES FINANCING OUTSIDE THE NORMAL CHANNELS HAVE SUSTAINABILITY IMPLICATIONS?**

Main Author:

**Fredrik PETTERSSON** (*Lund University*)**Abstract:**

Since the early 1990s several high profile Mega transport projects have been constructed in Sweden and Denmark. Today the importance of new investments in transport infrastructure continues to be a very central concern, and many of the projects currently being debated are certainly gigantic in terms of costs as well as impacts on the transport system. The main justifications for investments in new projects may be very different depending on where the proposal is coming from; some actors are for instance promoting new projects mainly for environmental reasons, while others are more concerned with economic development or issues of social concern. All in all it can be asserted that the demand for new investments in infrastructure greatly exceeds the available means allotted through the national state budgets, and thus the question of alternative financing models remains a very important one. Given the gigantic costs associated with many of the projects constructed since the 1990s, a crucial factor enabling the implementation of these projects has been financing models allowing for the raising of the necessary capital without having to go through the normal channels of direct budget capital. Several different models have been tried including the following: projects based on user fees financed by state guaranteed loans; projects financed by long term state guaranteed loans to the national road and rail administrations; co-financing agreements between local/regional public actors and the state; one BOT project and one project financed by land sales. While the financial set up for these large scale projects most often are discussed exclusively in terms of economic performance, this paper will broaden the scope and explore the idea that the financial model also can have implications related to the quest for a more sustainable transport sector. (...).

**Keywords:**

Infrastructure, Financing models, Sustainability.

ID 3147 R

**A DYNAMIC FRAMEWORK FOR THE MONITORING AND ASSESSMENT OF THE URBAN TRANSPORTATION MODES PERFORMANCE**

Main Author:

**Panos PREVEDOUROS** (*University of Hawaii at Manoa*)

Co-author(s):

**Eftihia NATHANAIL** (*University of Thessaly*)**Lampros MITROPOULOS** (*University of Hawaii at Manoa*)**Abstract:**

Growing interest in the environmental performance of transportation sector within the last years, burgeon the need of incorporating sustainability into transportation planning. Although there are multiple view points for assessing modes of transportation, a long-term sustainability-based comprehensive framework for the assessment of the impacts of any urban transportation mode does not exist. Our research efforts attempt to close this void in the state of the art starting with a framework that has its foundations in the over-arching principle of sustainability. The proposed sustainability framework acts as a filter that decomposes the elements of a transportation mode to reveal its sustainability dimensions. The sustainability filter is composed of four layers (environment, technology, energy, and economy), and three controllers (users, legal framework, and local restrictions). The fundamental attributes of vehicle and infrastructure: manufacture of vehicles, construction of infrastructure, and energy (fuels and power), operation and maintenance for both vehicles and infrastructure are decomposed through the Sustainability Decomposition Prism into their sustainability categories. A complete methodology for developing the sustainability categories required, to assess any urban transportation mode, and quantifying energy and emission indicators, is presented. Sample results of emissions and energy requirements for three types of vehicles follow as a case study. The results include well-to-wheel emissions and energy requirements for the manufacture, maintenance, fueling and vehicle operation stages for three different types of vehicles: a conventional gasoline vehicle, a hybrid electric vehicle and a pickup truck. (...).

**Keywords:**

Sustainable transport, Urban modes, Sustainability framework.

ID 1030 R

**A COMPARISON OF RAIL LIBERALISATION LEVELS ACROSS FOUR EUROPEAN COUNTRIES**

Main Author:

**Paolo BERIA** (*Politecnico di Milano*)

Co-author(s):

**Gines DE RUS** (*Universidad de Las Palmas de Gran Canaria (ES) and Universidad Carlos III de Madrid (ES)*)**Emile QUINET** (*Ecole nationale des ponts et chaussées (ENPC), Paris (France)*)**Carola SCHULZ** (*Institute for Economic Policy Research (IWW), Universitaet Karlsruhe (TH)*)**Abstract:**

The paper presents the results of a research on railway regulation and liberalisation in Italy, France, Germany and Spain. The analysed fields of regulation are the relationship between the State and the rail companies, network access conditions by operators, slot allocating and pricing schemes and how public service obligations are defined, paid and regulated. The aim of the paper is to give a comparative overview of the rail regulation from a critical point of view, rather than descriptive. The regulatory frameworks are outlined and then assessed according to their implications on the liberalisation level and on the effective market opening. The conclusions are that the actual level of liberalisation is still scarce and only in some cases the opening level is increasing. Market penetration of newcomers is significant only in niche markets. An issue emerging from the work is the opposing attitude of incumbent railways against liberalisation and the role of decision makers in backing this behaviour. The strategies followed to limit the outcomes of the liberalisation process are different across the country sample. However, all the incumbents argue with the self-referential declaration of efficiency, public service obligations and they claim to be under an excessive and unfair foreign competition. These arguments are yet embedded in legislative, organisational and economic settings supporting these positions like the common ownership of network and services, the permanence of dominant positions and favourable financial conditions.

**Keywords:**

Railways, Liberalisation, Regulation, Europe, Italy, France, Germany, Spain.

ID 1050 R

**RAIL ECONOMIC REGULATION AND THE VERTICAL SEPARATION / OPEN ACCESS DISCUSSION IN SOUTH AFRICA**

Main Author:

**Jan HAVENGA** (*Department of Logistics, University of Stellenbosch*)**Abstract:**

The issues surrounding vertical separation, privatisation and economic regulation have recently resurfaced in South Africa around discussions to create a rail economic regulator. In particular a framework was proposed that has an overarching objective of more efficient and effective rail services. To achieve this, rail economic regulation should be benchmarked internationally and key principles for a regulator should be developed.. Recent events such as reform in rail passenger transport, the development of Gautrain and a new approach for branch lines provided impetus to new proposals for more overarching rail reforms. These reforms propose structural changes to achieve competition, private sector investment and quality improvements which will provide transparency and eliminate crosssubsidisation. Even though various options for reform exists (most importantly vertical integration with third party access or even horizontal separation or vertical separation) vertical separation in freight rail is specifically highlighted as the vision put forward by the National Freight Logistics Strategy. Following deregulation of surface transport services in many countries around two to three decades ago, modal competition was encouraged. The primary objectives were to enable free market principles, to encourage efficiency and effectiveness in surface transport and to allow rail services to become profitable, often to prepare the rail operators for privatisation. Although the approach was generally sound, some specific problems surfaced, indicating that not all the above-mentioned objectives were reached. On the one hand certain bulk freight transport services in low-cost long-haul markets were "captured" by rail due to its nature, but on the other hand traffic that did switch caused structural inefficiencies on a macro-economic scale. (...).

**Keywords:**

Rail liberalisation, Regulation, Vertical separation.

ID 1122 R

**AN ANALYSIS OF VERTICAL SEPARATION OF RAILWAYS**

Main Author:

**Fumio KUROSAKI** (*JR East Consultants Co.*)

**Abstract:**

A number of state railways over the world have experienced railway reform, and vertical separation has been frequently utilized during its process. This study investigated a variety of models of vertical separation, which the railway sector has experienced over the two decades. The result of the study leads to the conclusion that full costs and benefits should be considered upon introducing a form of vertical separation, and that the appropriate form of it depends on the circumstances as well as its objectives.

**Keywords:**

Railway reform, Coordination problems, Open access, Concession, Competition.

ID 1532 R

**EFFECTS OF REGULATORY AND COMPETITION POLICY ON PERFORMANCE: EMPIRICAL ANALYSIS OF THE OECD COUNTRIES' RAIL INDUSTRY**

Main Author:

**Fumitoshi MIZUTANI** (*Kobe University, Graduate School of Business Administration*)

Co-author(s):

**Shuji URANISHI** (*Fukuyama Heisei University, Faculty of Business Administration*)

**Abstract:**

The main purpose of this study is to analyze structural separation policies, especially vertical (i.e. operation-infrastructure) separation and functional (i.e. passenger-freight service) separation. Using the total cost function of a railway organization, we evaluate whether or not vertical separation and/or functional separation can reduce costs. For this analysis, we select 25 railway organizations from 23 OECD countries over the 11 years from 1997 to 2007. Our findings show that because the functional separation dummy has a negative sign with statistical significance, functional separation can reduce the cost of a railway. The vertical separation dummy generally shows a negative sign, indicating that vertical separation tends to reduce rail costs, but some results show that the vertical separation dummy is not statistically significant.

**Keywords:**

Vertical Separation, Functional Separation, Total Cost Function, Railway.

ID 2261 R

**GOVERNANCE OF INNOVATION IN THE EUROPEAN RAILWAY SECTOR**

Main Author:

**Marc LAPERROUZA** (*Swiss Federal Institute of Technology*)

Co-author(s):

**Guillaume DE TILIÈRE** (*BG Consulting Engineers*)**Abstract:**

The European railway sector has undergone major transformations over the past two decades. Domestic reforms have been buttressed by European directives aimed at creating a single European railway market. In this new environment roles have been significantly redistributed, leading to new organizational models. A new and dynamic equilibrium is emerging, to which all railway stakeholders are trying to adapt. The paper looks at the European Rail Traffic Management System (ERTMS) from the innovation perspective. It argues that the concurrent liberalization of the sector and the technical harmonization (via the introduction of a pan-European signaling technology) have fragmented the railway sector on different levels (e.g. technological and organizational). The difficulties in developing and deploying a pan-European standard attest to the necessity of re-thinking innovation processes in the railway sector, particularly when those relate simultaneously to infrastructure management and operations. Among others, a broad consensus/alignment of the stakeholders on the type of performances aimed for (e.g. social, technical, operational, environmental or financial) need to be explicitly integrated in railway innovation models. The article contributes to the analysis of innovation in large technical systems (LTS) by introducing a framework of performance objectives for the governance of innovation in LTS.

**Keywords:**

Railways, Innovation models, Europe, Governance, Performance.

ID 1361 R

**INSTITUTIONAL FRAMEWORK AND PERFORMANCE OF MOBILITY SYSTEMS: A REVIEW OF FUNDING AND FINANCING IN PUBLIC TRANSPORT SYSTEMS**

Main Author:

**Maria SPANDOU** (*Instituto Superior Técnico - CESUR*)

Co-author(s):

**Rosário MACÁRIO** (*IST*)**Abstract:**

The crucial importance of institutional design in the evolution of mobility systems and the relevant socio-economic and environmental implications have been currently the centre of academic attention, primarily in light of the major reform wave that many mobility systems have undergone in the last decade, in order to improve efficiency, promote competitive forces, enhance quality of services and achieve sustainability. The need for institutional redesign or realignment based on renewed functions and tasks that must be translated into organizational structures and relations between authorities, operators and other stakeholders related with the provision of mobility services, is identified as one of the major cornerstones of successful change. Performance assessment constitutes a means of evaluating if the system functions according to expectations or not and, in the urban mobility context, it involves the assessment of the system's individual components, i.e. stakeholders, infrastructure, networks and services. Indeed, a well-implemented performance assessment framework requires a sound institutional base, while at the same time inability to achieve predefined goals and objectives implies, among others, the need for reassessment of the institutional configurations, from a structural, spatial and resources point of view. Accountability plays also an important role in inducing performance improvements and ensuring clear relationships between stakeholders. The purpose of this paper is to provide an interdisciplinary framework that defines the spectrum of institutional setting-performance interaction, doing an in-depth reflection into public transport from an institutional, funding and financing perspective. (...).

**Keywords:**

Funding, Financing, Institutional Design, Performance, Reform, Barriers, Constraints, Public Transport.

ID 1544 R

**INTEGRATED QUALITY MANAGEMENT FOR URBAN TRANSPORT SYSTEMS**

Main Author:

**Manfred BOLTZE** (*Technische Universitaet Darmstadt*)

Co-author(s):

**Heiko JENTSCH** (*Technische Universitaet Darmstadt*)**Abstract:**

Our transport infrastructure is an important locational factor which contributes significantly to the attractiveness of our cities and regions. Because of that, it is a priority task for our society to ensure the functionality of the transport network and its high quality. In our societies, in many areas of production and services quality management procedures are already well established. They became important elements of a successful business management. In traffic and transport such approaches to quality management came up only quite late with increasing privatization and market-orientation. But even in road traffic, which is not shaped by market-oriented supplier-customer-relationships, we already have quite many approaches to ensure the quality. In the case of Germany, we have comprehensive guidelines and normative regulations for many matters of road design and traffic control, especially with regard to traffic safety in the design stage and also during operation. Also in other countries, such as Japan or USA, several instruments of quality management have been established, although they are partly named differently (e.g. performance measurement). All of this contributes to a common understanding of quality and to a high quality. But the efforts to reach a high quality generally are still marked too much by isolated approaches and reaction on pressing deficiencies, intuition and individual knowledge, limitation of available resources, and limitation by available methods and procedures. Instead, by reasons of efficiency, the existing efforts to ensure quality must be brought together to a comprehensive systematic approach of quality management. This contribution describes the objectives of a comprehensive quality management, which primarily are to ensure and to improve the quality. (...).

**Keywords:**

Urban transport, Quality management, Performance m.

ID 2403 R

**INTEGRATED TICKETING IN PASSENGER TRANSPORT AS A CHANCE TO IMPROVE INTERCONNECTIVITY**

Main Author:

**Monika BAK** (*University of Gdansk*)

Co-author(s):

**Przemyslaw BORKOWSKI** (*University of Gdansk*)**Abstract:**

The integrated ticketing is closely connected with interconnectivity of long and short distance passenger transport. The interconnectivity is a topic of the 7 Framework Programme project INTERCONNECT (Interconnection between short and long-distance transport networks) coordinated by Napier University (University of Gdansk is one of the partner in the project), started in June 2009. In the paper authors aim at presenting some assumptions and results of the study using examples of integrated ticketing practice in Poland, Germany and Italy. Effective interconnection results in greater efficiency and reduced environmental impact of passenger transport by encouragement of integration, co-operation and, where appropriate, competition in the provision of services. Effective interconnection requires the provision of integrated networks and services which are attractive and friendly to the users. Therefore, integrated ticketing could be perceived as necessary requirement of better interconnectivity. It allows passengers to use same ticket on different transport modes and/or across different transport operators and in doing so experience a seamless journey. In the paper authors identify potential schemes of integrated ticketing based on existing solutions. Although idea of integrated ticketing is not new there are surprisingly few working examples in world transport sector. Thus while examining current solutions also new potential models for integration of ticketing across and within modes will be discussed. Authors also aim at assessing preconditions and barriers of implementation of above solutions as well as methods and ways to overcome them. The integrated ticketing can be introduced by implementing packages which allow tickets for the whole journey to be purchased in one transaction – seemingly easy method. (...).

**Keywords:**

Transport interconnectivity, Integrated ticketing, Integration of transport systems, Interconnection.



ID 2686 R

**A METHODOLOGY FOR ESTIMATING TRAFFIC FUEL CONSUMPTION AND VEHICLE EMISSIONS FOR URBAN PLANNING**

Main Author:

**Armando CARTENI** (*University of Salerno, Dep. of Civil Engineering*)

Co-author(s):

**Giulio CANTARELLA** (*University of Salerno, Dep. of Civil Engineering*)**Stefano DE LUCA** (*University of Salerno, Dep. of Civil Engineering*)**Abstract:**

Recently the Urban Energy Plan (UEP) has been introduced as a fundamental issue of urban planning activities. UEP is a strategic plan which aims to reduce energy consumptions and pollutant emissions produced by several sectors such as industry, public services, transport system. In such a context the transport system plays a relevant and increasing role, so that a realistic estimation of its impacts should be envisaged as well as strategies/policies to their mitigation should be proposed. Traffic fuel consumptions and pollutant emissions are, usually, simulated through models based on emissions - consumptions indicators and variables describing traffic conditions. Emissions - consumptions indicators are expressed as a function of vehicle speed under normal traffic conditions and yearly travelled distance; traffic conditions are, usually, described by average density and speed. Emissions/consumption per vehicle can be obtained experimentally through tests conducted on real case studies or estimated through specific models. Traffic conditions can be obtained from traffic surveys or from the implementation of transportation models. In the former case, the impacts are simply estimated for the reference scenario and cannot take into account variations of socio-economic contexts, travel demand patterns (origin-destination flows), modal splits and traffic flows on facilities. In the latter case, the impacts of different transport planning options may be simulated and/or different socio-economic scenarios may be implemented. (...).

**Keywords:**

Urban Planning, Traffic fuel consumption, Traffic flows.

ID 3061 R

**METHODOLOGY FOR THE STRATEGIC MANAGEMENT OF TRANSIT BASED ON ORGANIZATIONAL STRATEGIC MACROPROCESSES**

Main Author:

**Luciany SEABRA** (*Universidade de Brasília*)

Co-author(s):

**Pastor TACO** (*Universidade de Brasília*)**Abstract:**

This paper presents a methodology for strategic management of transit based on organizational strategic macroprocesses. The Evaluation of an specific transit agency, responsible for transit system management of Manaus City - AM, attempted to point out reference values for brazilian cities general context. This methodology proved to be an extremely useful management tool on institutional strengthening for transit management agencies.

**Keywords:**

Strategic management, Management processes, Macroprocesses, Transit management agencies.

ID 1164 R

**RESTRUCTURING PATTERNS OF MUNICIPAL OWNERSHIP FOR TECHNICAL INFRASTRUCTURE NETWORKS IN FINLAND**

Main Author:

**Pekka PAKKALA** (*Aalto University - School for Science and Technology*)

Co-author(s):

**Antti TALVITIE** (*Aalto University*)**Maila HERRALA** (*University of Oulu*)**Abstract:**

Many municipalities in Finland are experiencing a shortfall in capital to maintain, rehabilitate and build the technical infrastructure networks for roads, water and sewage, and energy during the present economic downturn. Other municipalities simply are seeking to increase efficiency of service delivery. Capital investments are needed for the aging infrastructure, but the available funds may be insufficient. In many municipalities the technical networks are public monopolies and privatization is not considered as an option because this would require liberalization, unbundling, and even parallel networks for creating a competitive market. Since the technical networks are mostly publicly owned and managed consideration of restructuring the ownership is underway, but research and examples are needed of similar cases. The Finnish State has restructured and downsized the entities it owns, but the municipalities are reluctant for reasons of employment and control. Tekes, "the Finnish Funding Agency for Technology and Innovation" recently funded a research project titled "C-Business" to evaluate the advantages and disadvantages of alternative ownership and management models for municipally owned and managed infrastructure. The objective is to determine the various structures and models in use and describe the benefits, challenges, and prerequisites to restructuring. The research method summarizes the theoretical background literature and uses the interview method as the primary analysis tool. The interviews include the numerous municipal actors, including design consultants and contractors, involved in the technical infrastructure networks. The research project is a cooperative effort between three research institutions and their expertise will add value to the work. (...).

**Keywords:**

Ownership, Governance, Restructuring, Valued added.

ID 1178 R

**DIFFERENT TIERS OF GOVERNANCE IN PORT GOVERNANCE: SOME GENERAL REMARKS ON THE INSTITUTIONAL GEOGRAPHY OF PORTS IN EUROPE**

Main Author:

**Jean DEBRIE** (*INRETS*)**Abstract:**

For the last thirty years, port governance has been marked by a new level of complexity which has resulted in the reshaping of the system of actors involved in the organization of ports. Devolution, which is taking place on most of the world's port ranges has thus altered the public-private division, i.e. the respective roles played by the different tiers of government and private operators in operation and regulation functions. There is an abundant literature on this topic, particularly in economics and management and the work of international organizations. This research has cast much light on the new modes of governance and is now attempting to explain how they are linked to port performance. Models of port governance frequently consider the "public sector" to be a homogeneous entity and rather less research has examined its variety, i.e. the different categories of public sector actors that run the institutional levels that control the ports. The aim of this paper is thus to provide some insights into this question of the institutional geography of ports by identifying the various tiers of government, the functions they perform and how they are linked with each other in a number of ports. It draws on the main findings of research carried out for the French General Directorate for the Sea and Transport that aimed to shed light on public decision-making and the institutional models applied in port governance in 7 European countries and Canada. It therefore examines port statuses and legislation, supervision, monitoring, management and public finance in order to understand the diversity of the public sector presence in port models that are founded on different institutional geographies. (...).

**Keywords:**

Port, Governance, Nstitutional geography.

ID 1199 R

**ACTIVE INFRASTRUCTURE MANAGEMENT**

Main Author:

**Roger TOLEMAN** (*Institute of Transport Studies, Monash University*)**Abstract:**

The existing institutions and organisation of current transport systems are the result of the historical social, political and technological development of institutions and organisations to meet the goals of society. Increasing concern for sustainable transport outcomes is now focussing attention on the level of institutional and organisational change necessary to deliver goals that differ from past priorities. Moving to sustainable transport systems is addressed here in terms of "strong" sustainability. This implies that all the social costs of the network will be directly reflected in use based charges reflecting relevant regulatory requirements, and the organisational system for sustainable transport management should integrate pricing with concerns for safety; reducing emissions to air; reducing greenhouse gases; addressing water runoff and noise; and developing renewable energy sources. Using the principles of Enhanced Producer Responsibility, this paper develops an organisational scenario in which the existing transport system could be developed towards institutions and structures that support sustainable transport outcomes. This approach, termed Active Infrastructure Management (AIM), proposes that transport infrastructure managers assume greater responsibility for the sustainability of their services, with integrated responsibility for charging, management of safety and a range of environmental impacts, which are then reflected in user charges and appropriate entry and operating standards.

**Keywords:**

Sustainable transport, Extended Producer Responsibility, Active Infrastructure Management, Institutions, Transport sector integration.

ID 1930 R

**WITH WHAT CONCESSIONS? THE INFLUENCE OF METROPOLITAN HIGHWAY PUBLIC-PRIVATE PARTNERSHIPS ON SUSTAINABLE SYSTEM MANAGEMENT**

Main Author:

**Chris ZEGRAS** (*MIT, DUSP*)

Co-author(s):

**Chris GRILLO** (*MIT, Dept. of Urban Studies and Planning*)**Abstract:**

Transportation plays a critical role in metropolitan "sustainability," influencing economic efficiency, environmental stewardship, and social equity. Theory suggests metropolitan transportation sustainability may require a strong public-sector role in ensuring inter-modal coordination, proper regulation and pricing, and inter-sectoral policy integration (e.g., land use and development policy). Theory also supports an important possible private sector role in financing, building, and managing transportation infrastructures, which governments have adapted for centuries (e.g., via PPPs). Today, shrinking public budgets, expanding costs, and changing political values enhance the PPP allure. The PPP promise also responds to a history of poor social returns and performance in the metropolitan transportation sector and seeks to leverage private sector motivations to fulfill objectives consistent in many respects with the sustainability agenda. In this paper we examine which institutional strategies may best align the private sector's profit-maximizing and presumed efficiency objectives with government's ostensible social welfare objectives, including the financing of more sustainable metropolitan transportation systems. We ask: does the cooperative system management framework required under the "sustainability" paradigm fundamentally contradict the competitive realities of the market, particularly when private finance and commercial risk are involved? Since PPPs in metropolitan highway infrastructure appear to be on the rise, as do global concerns about the transport sector's impacts on "sustainability," the answer is important. Our review of four metropolitan highway PPPs suggests that coordinating private finance with sustainable metropolitan mobility will be challenged without a public authority of appropriate geographic scope and powers to integrate metropolitan transport (and preferably land use) policy. (...).

**Keywords:**

Public private partnerships, Metropolitan transport.

WED 14<sup>th</sup> (11:15 - 12:30, Session G1.3) Room 0.07

ID 2688 R

**THE 2008 FRENCH PORTS'REFORM, AN ASSESSMENT OF THE STRATEGIC SCHEMES AND CONSEQUENCES ON PORTS ORGANIZATION**

Main Author:

**Marie DOUET** (*Cete Ouest*)

Co-author(s):

**Romuald LACOSTE** (*Cete Ouest*)

**Abstract:**

The 2008 French ports' reform about the seven major ports, which handled 81% of the whole maritime traffic (tons) in 2008 relies upon three main axes: a new managerial structure allowing a closer relationship with local territories thanks to a change in the distribution of seats among regional and national representatives in the supervisory board, a development of the links between the ports and their hinterlands, and a greater involvement of the private sector in the terminal operations. In the new system, the Ministry in charge of transport requested each port to draw up a strategic scheme which will lead its development for the next five years. This standard document is emblematic of the reform because it reflects the outlook of each port on its competitive environment at a precise moment. This paper aims to assess these seven strategic schemes, taking in consideration a few points. The first point investigates the relationships between ports and territories. The location of the port, ie the Atlantic periphery, the Northern Range or the Mediterranean arc, may influence the type of project developed. Since the 2004 decentralization reform, French secondary ports are also working out their own development plans: will the schemes of major ports be in consonance with the programmes of their neighbouring secondary ports and how the intra-range competition might be affected ? How these projects will be able to (re)vitalize hinterlands, particularly since French regional and local representatives, already in charge of land transport, can nowadays act on ports as interfaces in logistic organizations ? The second one deals with the hierarchy of projects by themes: logistics, marine and terminal infrastructures, environment, etc. (...).

**Keywords:**

Ports, Governance, Territories, Competition.

THU 15<sup>th</sup> (08:15 - 09:30, Session G1.4) Room 0.07

ID 1200 R

**TOWARDS A LEGISLATIVE FRAMEWORK TO DELIVER SUSTAINABLE TRANSPORT OUTCOMES**

Main Author:

**Roger TOLEMAN** (*Institute of Transport Studies, Monash University*)

**Abstract:**

In terms of the relationship between humanity and the geophysical sphere, sustainable transport is an issue of steadily increasing importance, both in terms of a developing set of philosophical concepts and the consequential complexities of policy delivery. In this uncertain and changing context, the paper examines the potential of a recent tentative trend towards a greater focus on legislated sustainable outcomes as a framework for policy development – here called the strategic outcome approach. Three examples of this developing approach – from the USA, Great Britain and Sweden – are investigated and evaluated, including identifying the ideal characteristics of the outcome approach; its' role in the political process; impacts on legislative and policy development; the involvement of a wider community in the decision-making process; potential changes in administrative accountability and implementation; and the role of monitoring outcomes. The outcome approach to sustainable transport policy management is still at an early stage of experimentation, and its development may follow a number of different paths. However, an increased emphasis on outcomes can be seen as increasingly congruent with a growing awareness of the increasing need to reform existing regulatory systems and structures.

**Keywords:**

Sustainability, Strategic policy outcomes.

ID 1424 R

**TRANSPORT SUPPLY AND DEMAND MANAGEMENT STRATEGIES WITH RECOURSE CONSIDERATIONS**

Main Author:

**Hong LO** (*The Hong Kong University of Science and Technology*)

Co-author(s):

**Xiaosu MA** (*The Hong Kong University of Science and Technology*)**Abstract:**

The importance of developing sustainable transport and land use systems is widely recognized, when cities have to accommodate the ever increasing housing and travel demands. Meanwhile, the global economy and population growth are subject to change and uncertainty. The planning process, hence, is tasked to make recommendations on long-term large investments and demand management, such as pricing, while having little control over the external environment that the plan must proceed with. To this end, formulating flexible and adaptive transport supply and demand management (TS-DM) strategies is crucial for ensuring sustainable urban development. In this study, the approach of recourse considerations is incorporated in the planning process, which allows for implementation of the TS-DM strategies adaptively over time as the population growth uncertainty is gradually revealed. The formulation takes the form of a multi-stage stochastic program with equilibrium constraints, with the planning horizon being divided into several stages. A numerical example is constructed to illustrate and evaluate the additional benefits of this probabilistic approach under demand uncertainty, as compared with the traditional deterministic approach.

**Keywords:**

Bid-rent process, Transport supply and demand management, Recourse planning.

ID 1876 R

**UPS AND DOWNS OF TRANSPORT GOVERNANCE REFORM: LESSONS FROM THE 4-YEAR REVIEW OF THE SPANISH NATIONAL TRANSPORT PLAN**

Main Author:

**Ángel APARICIO** (*TRANSyT. Universidad Politécnica de Madrid*)**Abstract:**

Governance reform is one of the key areas of activity identified in the National Transport Plan of Spain, approved by the Government in 2005. The reform aimed at: - increasing the relevance of policies based on management of transport services, compared to infrastructure expansion, and - better integrating the objectives of sustainable development within transport policy-making. To achieve an incremental, but continuous move in this direction, three combined instruments were identified: - Empowerment of a consensus-building framework, based on the one hand on public participation processes, by making it easier to the public to enter the debate on transport policy measures and transport infrastructure projects, and on the other hand on a better formalised framework for the institutional dialogue between the Ministry of Transport and its counterparts at regional and local administrations. - Streamlining the decision-making process, by establishing a new technical report regarding new initiatives and proposals by stakeholders on transport policy, which should assess its compatibility with current policies and with the strategic objectives of the National Plan. - Establishing a more objective-oriented management within the Ministry of Transport and its organisations, with a focus on the integration of the objectives of sustainable development, particularly through the implementation of environmental management systems. The outcomes of this strategy, four years later, seem quite heterogeneous. There has been significant progress in the capacity of dialogue of the Ministry of Transport (MoT) with its institutional counterparts, as well as with most of stakeholders in the transport sector. (...).

**Keywords:**

Transport planning, Policy science, Governance.

ID 1186 R

**SOCIAL MANAGEMENT OF STAFF: FORGOTTEN STRATEGIC DIMENSION IN THE DEVELOPMENT OF TRANSPORTATION COMPANIES?**

Main Author:

**Jean-François RÉVAH** (*trans/formation*)**Abstract:**

The 12th World Conference on Transport Research in 2010 is an excellent opportunity to explore the paradoxical situation whereby: a labour-intensive industry shows little interest in its human resources; the majority of staff are attached to their job and committed to performing it well, but are hardly involved in the daily life of the company, and still less in its development. Given the foregoing, this contribution will propose a description and precise diagnosis of the phenomenon under analysis, before detailing solutions already implemented in a number of more advanced enterprises. The commercial, environmental and social challenges of implementing these solutions will be both characterised and underscored. The aim is to outline avenues for operational action, open to the strategic managers of companies in the transportation industry, enabling them to better understand the nature of resistance to change at a time of tough competition, when better understanding and leverage of the human factor is more than ever critical to competitiveness. Although generalisations must be treated with caution, it can be demonstrated that a broad majority of goods or passenger transportation enterprises, as seen by external observers, are characterised by a series of behavioural constants, which give rise to the title of this proposed paper. Such constants, furthermore, raise the following question: Why in these companies is social and labour relations management still conceived as more of a constraint than a lever to better performance? In this respect, the repetitive nature of the phenomena observed makes it possible to affirm that national cultures have a limited effect on the practical realities of labour relations in the transportation industries. (...).

**Keywords:**

Change management.

ID 1370 R

**LEVEL OF SERVICE EVALUATION AT THE ENPLANING HALLS OF MAJOR BRAZILIAN AIRPORTS**

Main Author:

**Giovanna RONZANI BORILLE** (*Aeronautical Institute of Technology - ITA*)

Co-author(s):

**Anderson CORREIA** (*Instituto Tecnológico de Aeronautica*)**Abstract:**

This paper evaluates the level of service at the enplaning halls of major Brazilian airport passenger terminals. The IATA (International Air Transport Association) methodology portrayed at the Airport Development Reference Manual is used to evaluate the necessary area for passengers at the mentioned airport component. To achieve this, current peak-hour movements and passenger characteristics are collected at 17 major airports. Subsequently, necessary versus existing areas is compared for these seventeen airports. This paper has presented that the enplaning halls of major airports in Brazil are a critical element, according to IATA standards. This bottleneck could cause user dissatisfaction and disturb several airport operations. One of the critical airports is São Paulo/Guarulhos airport, since it is the main international gateway in Brazil. In addition to that, São Paulo will host the FIFA Soccer World Cup in 2014. We have provided an alternative to overcome the unacceptable LOS provided at the enplaning hall, which could increment the LOS from "F" to "B" category. Finally, this alternative could be compared to other alternatives, as providing check-in, security inspection or departure lounges areas, which are also operating with low level of services. However, their LOS are not as low as the LOS of the enplaning hall at the mentioned airport.

**Keywords:**

Level of service, Airports, Passenger terminal, Departure concourse.

ID 2090 R

**BOGOTA D.C. POSSIBILITIES FOR REGIONAL TRANSPORT IN THE CAPITAL REGION CONSOLIDATION**

Main Author:

**William CAMARGO TRIANA****Abstract:**

The configuration of regional areas in Colombia's Central Region, recognizes the history of competitiveness and the strong relationships in terms of mobility, employment and population exchange are reflected there. Bogota, Cundinamarca, Boyaca, Meta and Tolima, which represent 60% of the National GDP, have signed an agreement in 2004, in which they are looking to consolidate as the Central Region. Similarly, on a closer scale to a metropolitan area heavily consolidated, but without formal institutions, Bogota and Cundinamarca Department, representing the municipalities of the metropolitan area, endorsed in December of 2008 the agreement signed in 2001, that seeks to institutionalize the Capital Region, formerly the City-Region. This institutional framework is strengthened by the ratification of the agreement, that has within its strategic projects in Bogota's Development Plan 2008- 2012, to operate a regional coordinating body for planning, management and the operation of projects in the Region Capital, to run eight projects managed by local authorities for the Capital Region Development and finally, to put in operation the macro-regional urban project in the area of influence of the Eldorado airport. The consolidation of this package of projects, as well as the dynamics existing in these areas, involve some reflections from the constraints, opportunities and events that enable thought to transcend itself and spaces of articulation and realization of transportation and infrastructure projects, managed together, to enhance the area and improve competitiveness for the benefit of the local residents of these areas.

**Keywords:**

Regional transport.

ID 2114 R

**ONLINE PLATFORM FOR SUSTAINABLE TRAFFIC DATA STORAGE**

Main Author:

**Marc MISKA** (*University of Tokyo*)

Co-author(s):

**Shinji TANAKA** (*The University of Tokyo*)**Abstract:**

Traffic engineers are involved in transport modelling, traffic simulation, operation optimisation and the development of methods to control and analyse traffic itself. New developments for individual traffic, public transport as well as pedestrian movements are the hope to ensure the mobility and accessibility of urban areas, to secure mobility in the less profitable countryside, to increase safety, and to limit the effects on the environment caused by transportation. Around the globe, governments declare goals in each of the mentioned fields, mostly under the umbrella of intelligent transport systems (ITS), to develop a sustainable transportation for everyone (Barcelo et. al., 2010). To trigger the process of traffic data standardisation and to increase the availability of traffic data needed, we have developed an online platform for sustainable traffic data storage. This portal allows data providers and researchers to store there data geo-referenced, and with a minimum set of Meta information to ensure that the data will remain useful. The data, categorised per country and location, can then easily be made accessible to project partners, colleagues, or even the whole community with just a few mouse clicks. The usage of the portal is free of charge. However, the idea behind this portal is not simply the tool, but to gather information about traffic data storage schemes, user's needs and provider's concerns. Only bringing all of them together will lead to a wide-spread acceptance and standardisation. To reach this, all public accessible data is analyzed and fed to an universal translator, who will store the data in a database in single elements and can retrieve it from there in any other known format learned before (as long as the information is available). (...).

**Keywords:**

Traffic data, On-line, Portal, Standard.

TUE 13<sup>th</sup> (17:00 - 18:15, Session G2.1) Room 1.13

ID 1175 R

**A SPATIAL AND TIMEWISE DECISION SUPPORT MODEL FOR DIMENSIONING AND LOCATING URBAN FACILITIES**

Main Author:

**João SOUZA** (*Universidade Federal de Santa Catarina*)

Co-author(s):

**Antonio NOVAES** (*Federal University of Santa Catarina*)

**Abstract:**

The objective of this paper is to present decision support model developed to help the urban planner to dimension and locate urban facilities, as well as to define their expansion phases. This model can be used in several areas such as school systems, hospitals, health centers, fire brigades, telephone centers, ambulance services, police patrol, etc. It is a practical system and it only requires information provided by municipal, state and federal departments of geography and statistics.

**Keywords:**

Urban Management Systems, Urban Planning.

TUE 13<sup>th</sup> (17:00 - 18:15, Session G2.1) Room 1.13

ID 2019 R

**DEFINING THE PUBLIC VALUES IN AIRPORT DEVELOPMENT DECISION-MAKING**

Main Author:

**Timothy DONNET** (*Airport Metropolis Project - Queensland University of Technology*)

Co-author(s):

**Odette VAN DE RIET** (*Delft University of Technology, Netherlands and Kennisinstituut voor Mobiliteitsbeleid (KiM), Netherlands*)

**Abstract:**

Residents, businesses, local, state and national government stakeholders all want to have their say when airports expand or develop. While stakeholder engagement is increasingly a strategy employed for managing the tensions attracted to airport development, different stakeholders have different expectations and demands of airports. This requires different approaches to stakeholder engagement. Identifying the public interests that are at stake in developing airports provides an initial step towards building a platform for selecting and applying stakeholder engagement strategies in airport and more general infrastructure contexts. This paper uses the existing literature of public interests and values to build a general typology of public values for the stakeholders of airport development. A range of semiprivatised and state owned airport case studies from Europe have been used to demonstrate the universal nature of the identified values. The result is a framework that identifies both the substantive and procedural values, separated into local, state/regional and national levels of interest. The typology provides a generalised view of public interests in airport development; however, the public interests identified may be limited to more western oriented societies due to the skew of airport cases reviewed. Contributions are made to the literature with a typology of public values derived from existing knowledge and explored using empirical case examples. The provided typology enables research of airport development decision-making to delineate public interests both within and between stakeholder groups, and helps to explain the different perspectives that stakeholders have towards airport development. (...).

**Keywords:**

Public value, Decision-making, Governance, Airport.



TUE 13<sup>th</sup> (17:00 - 18:15, Session G2.1) Room 1.13

ID 2811 R

### **LONG-TIME AND DECISION-MAKING PROCESS IN TRANSPORT PLANNING**

Main Author:

**Stephanie LEHEIS** (*Université Paris-Est*)

#### **Abstract:**

In order to explore the long time influence on transportation planning, this article dissects the decision-making process of a by-pass project in Marseille, over 80 years. The methodology based on a long-term analysis allows to reconstruct the project story-line and to reveal a double dynamic of flexibility and irreversibility. Our analysis tends to show that we can go beyond the simple comprehension of blockings or progress in time-life project by a succession of conflicts or consensus between the stakeholders. By introducing a interpretation based on several temporalities, reversible and irreversible logics appears in the decision-making process and explain the persistence of a project out of alignment with current needs.

#### **Keywords:**

Decision-making process, Long-term approach, Path dependency, By-pass project, Marseille.

TUE 13<sup>th</sup> (17:00 - 18:15, Session G2.1) Room 1.13

ID 3143 R

### **DECISION MAKING PROCESS IN SUCESSFUL CITY-WIDE BUS REFORMS – SAME STORY REPEATS IN THREE CONTINENTS**

Main Author:

**Madhav PAI** (*EMBARQ, The WRI Center for Sustainable Transport*)

Co-author(s):

**Ashwin PRABHU** (*University College London*)

**Dario HIDALGO** (*EMBARQ, The WRI Center for Sustainable Transport*)

#### **Abstract:**

The objective of this paper is to synthesize information from successful city-wide bus system reforms in three world cities, London (Europe), Sao Paulo (Latin America) and Seoul (Asia). All reviewed systems improved system wide ridership, significantly improved conditions for commuters and produced other positive externalities such as reducing air pollution and improving traffic safety. The reforms were undertaken amidst varying political, economic and social contexts. The main focus of the reviews was to identify the common elements in successful reform processes in an attempt to assist planners and decision makers implementing city-wide bus system reforms. Individual case studies were prepared for each city and are presented in separate documents. The reviews are based on material available on the internet. The following seven aspects or commonalties stood out as the key factors for implementing successful bus system reforms across the three cities. 1. Strong Political Leadership in the Decision Making process 2. Strong local technical institution developing demand based route planning 3. Implementing bus Priority and/or building segregated infrastructure for buses 4. Use of Technology 5. Innovations in contracting and tendering processes 6. Need for managed subsidies to improve quality of service 7. System Performance Monitoring and User Feedback. The paper is divided in three sections. The first section provides a short description and indicator information about the performance of bus systems in each city. The second section examines each of the seven commonalties for each system. The final section summarizes the learning from the three systems. (...).

#### **Keywords:**

City-wide bus system reform, Decision making process.

TUE 13<sup>th</sup> (17:00 - 18:15, Session G2.1) Room 1.13

ID 3195 R

## **DECISION MAKING TOOL FOR THE SELECTION OF URBAN MOBILITY PROJECT**

Main Author:

**Nicolas MALHÉNE** (EIGSI)

Co-author(s):

**Dominique BREUIL** (EIGSI)

### **Abstract:**

Even if Urban Freight Transport (UFT) represents only 20% of urban flows, it generates many forms of pollution such as emissions of pollutants, greenhouse gasses, noise, congestion, etc. In order to limit these significant problems; for instance 40% of CO<sub>2</sub> in cities is due to UFT, cities have to adapt their infrastructures, develop new components, and reorient user behaviour, etc. This means cities have to evolve. Various UFT solutions have been designed and experimented for quite some time now. Different categories of actions including the best of practices relevant to UFT solutions have already been identified. Many of them have been recorded in the European BESTUFS programme (BESTUFS, 2007), in CIVITAS programme and Predit projects (PREDIT, 2008) or even ELTIS data base. Nevertheless the city evolution process cannot be considered through a simple succession of demonstration measures, or stand alone projects. Moreover, UFT does not represent the unique flow in the city and it is necessary to include Urban Passengers Transport (UPT) in the global reflexion. In 2007, European Commission encouraged local authorities to manage the transport network in order to ensure a smooth sharing for passengers and freights. The proposed paper aims at merging different researches developed in the frame of systemic theory and manufacturing management in order to propose principles of a global approach for politicians who have to choose UTF solutions coherent with their city characteristics. This approach guides the evolution of the UFT and the UPT in an integrated way. (...).

### **Keywords:**

Urban Freight Transport, Urban Mobility System, Management of the evolution, Performance, Decision making tool .

WED 14<sup>th</sup> (08:15 - 09:30, Session G2.2) Room 1.13

ID 1187 R

## **A PARTICIPATORY MULTI-CRITERIA APPROACH TO PROMOTE WALKING IN URBAN AREAS**

Main Author:

**Maria GALVES** (University of Campinas - School of Civil Engineering, Architecture and Urban Design)

### **Abstract:**

The aim of this paper is to propose a participatory approach to promote walking in urban areas based on multiple criteria decision aiding (MCDA). This methodology can be divided into three main phases: structuring the decision situation, evaluation of alternatives and recommendation. This paper emphasizes the structuring of a decision situation which could be expressed by the following question: "How can we promote walking in this area of the city?" The elements of the decision context are outlined and a participatory model is proposed. Then the structuring activities are described. Some aspects related to the evaluation and recommendation phases are also discussed. This participatory multi-criteria approach can contribute to enrich decision-making processes related to walking by: improving communication and facilitating negotiation among the actors; promoting the integration of the relevant aspects of the decision situation and its context; creating meaningful alternatives and evaluating the alternatives on the basis of an agreed set of objectives.

### **Keywords:**

Participatory approach, Multiple criteria decision aiding, Walking.

ID 1617 R

**ENHANCED DIALOGUE IN TRANSPORT POLICY  
MAKING: ENABLING CHANGE TOWARDS  
SUSTAINABILITY THROUGH DELIBERATIVE PUBLIC  
ENGAGEMENT**

Main Author:

**Christiane BAUMANN** (*Institute for Sustainable Futures,  
University of Technology Sydney*)

**Abstract:**

This paper investigates the potential of citizen/stakeholder deliberative engagement in the transport planning and decision-making process to enable more substantial change towards sustainability. Responsibilities of transport agencies incorporate the requirement for the planning process to take wider social and environmental impacts into account so as to create effective and acceptable solutions for all stakeholder groups, including citizens as well as the traditional decision elites. However, the formal interactions between planners and decision-makers are often established upon 'second-guessing', where planners do not communicate solutions they think politicians would disapprove of, and politicians — who are trying to anticipate the preferences of citizens/stakeholders — will not support proposals they think will be unpopular. This is often due to a lack of mutual trust and understanding between expert planners/decision-makers and the wider public. This paper therefore explores the potential of citizen/stakeholder deliberative engagement to supplant 'second-guessing', and to produce better decisions by supplementing expert knowledge with practical experience. The paper starts with discussing the weaknesses of expert-based approaches to transport planning and decision-making. It then introduces deliberative engagement as procedure to potentially overcome some of these weaknesses. The second part of the paper consists of an international review of cases of deliberative engagement in the transport sector, highlighting evidence of the effects of enhanced communication in the planning and decision-making process. It then discusses the implications of these examples, identifying factors for successful implementation. (...).

**Keywords:**

Deliberative democracy, Community engagement, Sustainability, Transport, Planning, Decision-making.

ID 2037 R

**PROJECT POLICY AND COMMUNITY CONSULTATION**

Main Author:

**Sophie STURUP** (*Australasian Centre for Governance and  
Management of Urban Transport*)

**Abstract:**

Mega urban transport projects (MUTPs) are increasingly being used in urban environments to produce new transport infrastructure and thereby facilitate a range of policy objectives including improved environmental outcomes and increased accessibility. However, the articulation of problems in a form for which MUTP is the solution, often leads to poorly integrated projects that lack public acceptance. Studies of this phenomenon have recommended various methods for inclusion of the public in consultation on the development and implementation of projects as the solution. Despite these good recommendations, MUTPs continue to show a pronounced imperviousness to genuine public consultation. This paper uses the findings from a study into the 'art of government' (as described by Michel Foucault in his theory of 'governmentality') of MUTPs based on three Australian case studies from Melbourne, Perth and Sydney. The purpose being to shed light on the attraction of MUTPs as a solution to policy problems, and the reasons for the relative imperviousness of project to genuine public consultation

**Keywords:**

Mega project, Governmentality, Public Consultation.

ID 2448 R

**CHARACTERISTICS OF NEIGHBORHOOD TRAFFIC PROBLEMS SPECIFIED BY SILENT GROUP**

Main Author:

**Aya KOJIMA** (*Saitama University*)

Co-author(s):

**Hisashi KUBOTA** (*Saitama University*)

**Abstract:**

Residents often have totally different opinions on neighbourhood traffic issues. This study verified the character of neighbourhood traffic problems, which causes various apprehensions among residents, and its effect on the silent group, aimed at developing the proper participation system. In conclusion it was found that awareness about neighbourhood traffic problems are difficult to share for residents, and the difficulty is related to the complicated extension of locations where residents perceive traffic problems. The character seems to create where the "spiral of silence" occurs. Regarding the problem finding stage of transportation planning, it was suggested the character of neighbourhood traffic problems does not influence the existence of the silent group. However, it was also suggested that the level of awareness about traffic problems relates to the residents' behaviour of silence.

**Keywords:**

Resident participation, Traffic calming project, Questionnaire survey.

ID 2586 R

**DYNAMIC BAYESIAN BELIEF NETWORK FOR THE DEVELOPMENT OF WALKING AND CYCLING SCHEMES**

Main Author:

**Dong NGODUY** (*Institute for Transport Studies, University of Leeds*)

Co-author(s):

**David WATLING** (*ITS, University of Leeds*)

**Paul TIMMS** (*ITS, University of Leeds*)

**Miles TIGHT** (*ITS, University of Leeds*)

**Abstract:**

This paper aims to describe a model which represents the formulation of decision making processes (over a number of years) affecting the step-changes of walking and cycling (WaC) schemes. These processes, can be seen as being driven by a number of causal factors, many of which are associated with the attitudes of a variety of actors, in terms of both determining whether any scheme will be implemented and, if it is implemented, the extent to which it is used. The outputs of the model are pathways as to how the future might unfold (in terms of a number of iterative time steps) with respect to specific pedestrian and cyclist schemes. The transitions of the decision making processes are formulated using a qualitative simulation method, which describes the step-changes of the WaC scheme development in an iterative and interactive manner. In the paper a dynamic Bayesian belief network theory is adopted in a way that each factor will collectively contribute to the transitions so that the influence between and within factors on the dynamic decision making process is taken into account.

**Keywords:**

Bayesian belief network, Causal effects, Walking and cycling (WaC), Dynamic decision making.

ID 1441 R

**THE IMPORTANCE AND DIFFICULTY OF POLICY LEARNING ACROSS CITIES**

Main Author:

**Greg MARSDEN** (*Institute for Transport Studies, University of Leeds*)

Co-author(s):

**Karen FRICK** (*UC Berkeley*)**Anthony MAY** (*Institute for Transport Studies*)**Elizabeth DEAKIN** (*UC Berkeley*)**Abstract:**

Policy transfer analysis seeks to develop understandings of the processes by which knowledge about institutions, policies or delivery systems at one sector or level of governance is used in the development of such elements in another place, sector or level of governance. For example 'Bus Rapid Transit' is transferring rapidly around the globe both as a concept and in various system designs. Whilst it is well understood that policy transfer happens, the processes by which it occurs are far less well researched. This paper draws on two literature reviews and a series of interviews with eleven cities in Northern Europe and North America. The literature reviews have examined the frameworks for studying policy transfer and the paper begins by presenting the key elements of these frameworks. Of particular importance are the motivations for transfer (which can range from rational voluntary learning through to coercive learning where conditions are attached to funding), the agents involved in learning (from the public and private sector), the methods applied in learning and their resultant outcomes. Different methodological approaches which stem from different epistemological traditions are also described. The literature suggests particular weaknesses in understanding the process of transfer, the success of the transfer and, importantly for WCTRS, the transfer of policies between developed and developing countries. Will researching the transfer of transport policies improve the transfer process? MARSDEN Greg, FRICK Karen Trapenberg, MAY, Anthony, DEAKIN, Elizabeth 12th WCTR, July 11-15, 2010 – Lisbon, Portugal 2 The study of eleven cities considered the processes involved in the adoption of policies which were new for the chosen city and which involved a degree of transfer from elsewhere. (...).

**Keywords:**

Policy transfer, Innovation, Urban transport, Policy learning, Implementation.

ID 1978 R

**ESTIMATING IMPACT OF TRANSPORT POLICIES ON MOTORWAYS OF THE SEA PROJECTS**

Main Author:

**Deepak BAINDUR** (*Instituto Superior Técnico*)

Co-author(s):

**José MANUEL VIEGAS** (*Centro de Sistemas Urbanos e Regionais (CESUR), Instituto Superior Técnico (IST)*)**Abstract:**

The main objective of the Motorways of the Sea (MoS) projects is to develop high quality maritime-based intermodal links to bypass congested land transport corridors so that they can provide an alternate competitive means of transport to unimodal road freight transport. The MoS projects are a political initiative of the European Commission (EC) but require the participation of private and public stakeholders. EC has proposed a number of policy measures to promote Motorways of the Sea projects. The need of the hour is to estimate the impact of the proposed policy actions on the performance of the Motorways of the Sea in order to develop effective set of policies to promote MoS on the selected transport corridors. Conventional modeling techniques in Transport policy analysis have used macro-economic modeling techniques. Since freight transport service choice decisions are taken at Company level we argue that micro simulation using an Agent based modeling framework will provide a better framework for Transport policy analysis. We demonstrate that Agent based modeling and simulation is an effective tool to explicitly simulate the dynamics of transport service choice decision making at the operational level and Transport policy decision making at strategic level in the same model. The validation and flexibility of the developed Agent based model is illustrated by presenting a case study in the Atlantic maritime. Simulation results indicate that policy measures that improve efficiency of MoS services are not sufficient to improve market share of MoS services in the Atlantic corridor. These measures must be supported by uniform rules and stricter enforcement of International road freight transport regulations for the success of MoS projects. (...).

**Keywords:**

Short Sea Shipping, Modal competition, Motorways of the Sea concept, Intermodal transport, International road freight transport.

ID 2316 R

**TRANSPORT POLICY IN THE ALPS: ENVIRONMENTAL ISSUES AND TERRITORIAL GOVERNANCE FOR EUROPE**

Main Author:

**Lisa SUTTO** (*Ministry of Sustainable Development*)

Co-author(s):

**Olivier KLEIN** (*Laboratoire d'Economie des Transports*)**Abstract:**

The Alpine space seems to lend itself to the drawing up of coordinated and innovative public policy aiming to reconcile the objectives stemming from some apparently very different representations. Sutto (2009) shows that – concerning the specific field this paper deals with – the transport issue has occupied an essential place in the building of Alpine space policy over the last few years, and indeed continues to do so. After a short historic overview of transport issues in the Alps, the paper focuses on the most recent “alpinisation” of transport policy, i.e. both the progressive definition on a local alpine basis of some common issues and the arrangement of shared means of action. Secondly, it shows that it is by jointly taking into account the development of procedures for defining and implementing these policies, the changes to their ultimate goals and the progressive build-up of formal knowledge associated with them, that the transformation of public policy pertaining to transport in the Alps can be reported on and analysed. Finally, the possible future developments in Alpine transport policy are analysed. The final part of this paper argues that the choice is still open between a specific, environmentally-ambitious policy requiring the “reterritorialisation” of the Alpine policy or the dissolving of issues relating to Alpine crossings in an undifferentiated European transport policy. Indeed, behind these strategies, the choice of a relatively integrated and relatively decentralised territorial governance model is taking shape.

**Keywords:**

Alpine Space, Sustainable Transports Policy, Territorial Governance, Modal Shift.

ID 2485 R

**ACCEPTABILITY OF FREIGHT POLICY INNOVATION FROM A STAKEHOLDER PERSPECTIVE: ROME'S LIMITED TRAFFIC ZONE**

Main Author:

**Amanda STATHOPOULOS** (*Trieste University*)

Co-author(s):

**Eva VALERI** (*Trieste University*)**Edoardo MARCUCCI** (*University Roma Tre, Rome*)**Abstract:**

City logistics initiatives aim to minimize the negative economic and environmental costs of freight movement within urban areas. Within this broad objective, policy schemes need to seek solutions that take the role and needs of different stakeholders and their acceptance of the policy scenarios envisioned into account. Indeed a more sustainable management of the urban area requires a deep knowledge, not only of the traffic and regulatory context, but the problem perceptions and operative constraints of the main stakeholders of the distribution chain. Active consultation among stakeholders is crucial to define more coherent and realistic city logistics policy-mixes. What is more, any pre-existing regulatory context is bound to influence the feasibility of policy innovation as well as the acceptability among the main stakeholders. This paper presents findings from a series of stakeholder consultations in a specific and complex political and urban environment: the Limited Traffic Zone (LTZ) in Rome. In a first stage the main perceived freight problems and preferred policies are mapped by means of expert-panel consultations. The identified core freight policies are then presented to a sample of LTZ operators to explore the behavioural reactions to a shift in the regulatory context on behalf of three main agent types, carriers, retailers and own-account operators. This allows an in depth study of individual acceptance and reactions along with the role of interdependence among urban freight operators in assessing novel policies.

**Keywords:**

City logistics, Urban freight, Stakeholders, Freight policy innovation, Freight decision making, Rome's LTz.

WED 14<sup>th</sup> (09:45 - 11:00, Session G2.3) Room 1.13

ID 2962 R

**CREDIBLE COMMITMENT AND THE POLITICAL PROSPECTS OF CONGESTION PRICING**

Main Author:

**David KING** (*Columbia University*)

Co-author(s):

**Michael MANVILLE** (*UCLA*)

**Abstract:**

Both the political acceptability and the overall efficiency of congestion pricing hinge on the distribution of its toll revenue. As a result, it is now common to assert that many of pricing's practical and political obstacles can be overcome through astute use of the revenue it generates. One implication of this assertion is that the collectors of the toll revenue are unlikely to be its final recipients. But the necessity of revenue recycling raises the potential for a credible commitment problem. The toll revenue will not be distributed until after the tolls are in place, so a revenue recipient must believe that the revenue collector will make good on any promise to deliver the money. In a situation where the recipient does not trust the collector, the agreements required to implement congestion pricing could be undermined. In this paper we outline how the credible commitment problem can affect congestion pricing, and then use survey, interview and ethnographic data from Los Angeles County to illustrate our argument.

**Keywords:**

Congestion pricing, Credible commitment, Transport.

WED 14<sup>th</sup> (11:15 - 12:30, Session G2.4) Room 1.13

ID 1992 R

**MULTI-MODAL AND MULTI-JURISDICTIONAL TRANSPORTATION INVESTMENT DECISION-MAKING: A QUANTITATIVE MODEL FOR THE WASHINGTON DC-BALTIMORE REGION**

Main Author:

**Lei ZHANG** (*University of Maryland*)

Co-author(s):

**Dilya YUSUFZYANOVA** (*University of Maryland*)

**Abstract:**

From a systems operation and planning perspective, it is desirable that all supply decisions are made coordinately to maximize the overall system effectiveness for a pre-determined planning period. Although this goal would be much more achievable if the transportation system in a study region is completely controlled by a centralized welfare-maximizing supply agent, observations in the real world suggest that there are often many decision agents who have dissimilar and sometimes competing objectives. In such an environment some aspects of planning are neglected by individual agencies when they make management decisions for the facilities within their respective jurisdictions. This type of marginalization or even ignorance of system-wide objectives by individual decision-makers gives rise to a common problem in integrated transportation systems management - suboptimal system performance under multiple decision agents with various self-interests. Although this problem can be partially attributed to pure politics that are beyond the control/modeling capabilities of transportation engineers and planners, its extensive impact on transportation system performance and land use efficiency can be studied through modeling techniques. This paper examines the "investment - transportation" interaction from an evolutionary perspective: once a certain set of goals are determined and pursued by policy makers and planners, how these policies drive the transportation investment decisions and network growth. Built upon this recognition of policy dependency, highway network evolution model driven by investment processes is proposed and tested in this paper. Different from existing transportation models that assume exogenous network investment decisions, this model considers transportation network growth as endogenous and supply-side driven. (...).

**Keywords:**

Transportation planning and policy, Institutional.

ID 2263 R

**ARE TRANSPORT POLICIES A MATTER OF  
STAKEHOLDERS OR CITIZENS? THE CASE STUDY OF  
A REGIONAL COUNCIL ?SEARCHING FOR? ITS  
PUBLIC**

Main Author:

**Gourgues GUILLAUME** (UMR PACTE)

Co-author(s):

**Tafere INGRID** (INRETS - EHESS)

**Abstract:**

From 2006 to 2007, regional authorities of the Rhône-Alpes region (France) renewed its Regional Transport Plan (RTP). They organised public meetings and a deliberative device, inherited from the consensus conference. The selection of publics, by the two administrations in charge of these processes, is in the heart of an institutional struggle. The citizen as "stakeholder" is opposed to the citizen as a "layman", the consultation of concerned groups is opposed to the political idea of the use of random drawing, participation is opposed to deliberation. This struggle and the lack of attention to the device's specificity, about its deliberative dimension, blur the impact of each participatory process and the involvement of publics in the reviewing of the RTP.

**Keywords:**

Regional transport plan - participation - stakeholders.

ID 2314 R

**FROM NICHE TO MAINSTREAM: ASSESSING THE  
TRANSFERABILITY OF INNOVATIVE TRANSPORT  
CONCEPTS**

Main Author:

**Mark BEECROFT** (Centre for Transport Research,  
University of Aberdeen)

Co-author(s):

**David JEFFERY** (University of Southampton)

**Abstract:**

Achieving more sustainable urban mobility is a major challenge. Many cities face common problems associated with congestion, particularly at peak times, which compromises the efficiency of transport networks with clear consequences for society, economy and the environment (TRB 1997). This congestion is often associated with a modal split in which the private car dominates and the potential benefits of more sustainable, collective modes are not being realised (Richards 2001). A wide range of potential solutions are available and the EC 7th framework project NICHES+ (New and Innovative Concepts for Helping European transport Sustainability) is examining the potential for a set of twelve innovative transport concepts to be implemented in seven European cities. This paper will focus upon three such concepts: Personal Rapid Transit, Group Rapid Transit and the use of Electric Vehicles in Car Share Schemes. Transferability issues are a key aspect of the process of implementing new transport concepts. This is particularly the case when seeking to translate a successful niche application into a mainstream transport solution. For example, Group Rapid Transit systems have been successfully implemented in 'closed environments' such as university campuses and exhibition centres, but the potential exists to transfer such systems to more open environments, such as city centres. This paper will draw upon a methodology developed and evidence gathered in NICHES+ (NICHES+ 2009) regarding the barriers and success factors associated with transferability. It will present the outcomes of transferability analysis undertaken with European experts in the field such as system providers, consultants, local authority decision makers and academics through workshop discussion and interviews. (...).

**Keywords:**

Innovative transport concepts, transferability.



WED 14<sup>th</sup> (11:15 - 12:30, Session G2.4) Room 1.13

ID 3380 R

**POLITICISATION AS A STIMULUS FOR URBAN TRANSPORT POLICY - THE CASE OF LIGHT RAIL PROJECTS**

Main Author:

**Benoît DEMONGEOT** (*Laboratory of Transportation Economics*)

**Abstract:**

The diffusion of light rail in France highlights a rather original phenomena that can be defined as a politicisation process. Indeed, what used to be a transport-rationale policy solution, the French Standard Tramway, has been attributed with a wider and wider range of qualities: it would trigger urban renewal in deprived areas or derelict city-centres, it would develop shopping and small businesses along its route, it would provide added value for housing, it would embellish historical areas and attract tourists, it would foster civic pride among citizens and competitiveness of the whole city, and even more. More generally, light rail seems to have gained a very privileged status in the global discourse on urban sustainability. In this paper, this evolution is illustrated through many examples of local debates or controversies on light rail projects. It is also discussed in regard of its impact on the expert knowledge field and on current debates related to "communicative rationality" in transport planning.

**Keywords:**

Light Rail Transit, Tramway, Urban Transport Policy, Decision Process, Expertise, Arguments, Politicisation.

THU 15<sup>th</sup> (08:15 - 09:30, Session G2.5) Room 1.13

ID 2044 R

**APPLICATION OF MCDM/A METHODS TO RANKING DIFFERENT VARIANTS OF THE DISTRIBUTION SYSTEM**

Main Author:

**Jacek ZAK** (*Poznan University of Technology*)

Co-author(s):

**Hanna SAWICKA** (*Poznan University of Technology*)

**Abstract:**

The paper presents the methodology of evaluating different variants - development scenarios of the distribution system of goods (dsg). The variants are designed heuristically with the assistance of computer – based object oriented simulation method. Each variant represents an alternative version of dsg, generated through a certain redesign of the existing distribution system. The variants of the dsg are characterized by different measures (characteristics) obtained through the simulation of the operations of each variant. Thus, their evaluation and selection of the most desirable solution is required. In the evaluation process of 5 variants of the distribution system the interests of different stakeholders (owners/ top managers, customers, suppliers, employees and local communities) are taken into account. Economical, social, technical and environmental aspects are considered. A consistent family of criteria is defined to evaluate all the variants – different development scenarios of the dsg. The evaluation of the variants is formulated as a multiple criteria ranking problem, thus all the considered redesign scenarios are ranked from the best to the worst. The methodology of Multiple Criteria Decision Making / Aiding (MCDM/A) is applied. The authors review and analyze a spectrum of MCDM/A ranking methods, including: Electre, AHP, Promethee, UTA and finally select the most appropriate MCDM/A methods that fit best the specific character of the distribution systems' evaluation process. They run computational experiments and present their results. The authors compare the results generated by two MCDM/A methods, i.e. Electre III/IV and Promethee I and draw final conclusions regarding their suitability for the analyzed decision problem. (...).

**Keywords:**

Redesign of the distribution system, Evaluation of variants, Multiple criteria decision making/aiding.

ID 2326 R

**TOOLS FOR HIGH-SPEED RAIL PLANNING  
OPTIMIZATION: PRELIMINARY DEVELOPMENTS OF A  
CASE STUDY**

Main Author:

**Ana COSTA** (*DEC - FCTUC*)

Co-author(s):

**Paulo COELHO** (*University of Coimbra*)**Maria CUNHA** (*Faculty of Sciences and Technology of  
University of Coimbra*)**Herbert EINSTEIN** (*Massachusetts Institute of  
Technology*)**Abstract:**

Following the goal of developing a European high-speed rail (HSR) network, Portuguese authorities decided to link its major cities and establish a high-speed connection to Europe, through Spain's network. Due to the large costs involved and since different feasible and valid alternatives co-exist, the planning stage plays a major role in the project's viability, as it can definitely narrow down the options available and enhance the cost-benefit ratio. Accounting for all the variables and uncertainty in decision-making marks the need for systematic and solid tools to support the process. Risk Assessment and Management for High Speed Rail Systems (RISK) is an international research project of the MIT|Portugal Program addressing these issues. RISK project involves collaboration between several Portuguese Universities and Research Centers and MIT, aiming at combining and integrating different risk dimensions in decision aid tools. This paper presents an overview of the global framework, which is currently in ongoing progress, to support the development of a decision aid tool including risk and uncertainty. Multiple conditions under which performance must be assured in a HSR exist and have an important degree of uncertainty. As worst case scenario design is obviously unsustainable from the economic point of view, these circumstances may be represented by different problems, each with a set of scenarios having different but plausible probability of occurrence. The model's main goal is to obtain a robust and resilient solution, which is not necessarily the one yielding the best performance for a given scenario, but one that performs well for all the scenarios.. (...).

**Keywords:**

High-speed rail, Planning, Optimization.

ID 3029 R

**ASSESSMENT OF HIGH SPEED RAIL PROJECTS:  
SELECTION OF EUROPEAN CASES AND  
RECOMMENDATIONS FROM EVA-TREN RESEARCH**

Main Author:

**Tristan CHEVROULET** (*Iteral Management*)

Co-author(s):

**Christian REYNAUD** (*Nestear*)**Abstract:**

The appraisal of large-scale transport projects is less than reliable : the EU Cohesion Fund programme reveals (2006) that one project in four costs more than 20% above budget, while only one in five stands below + 10%. Some experts even estimate that "nearly 9 out of 10 projects fall victim to significant cost overruns" (Flyvbjerg, 2004). Deviations in cost, duration and environmental impact are especially problematic because such investments usually last several years, yield significant impacts and their costs reach billions of Euros. This paper reviews the main results of the research projects that the European Union has launched to improve the appraisal of large-scale infrastructure dedicated to the Trans- European Networks (TEN). In Europe, such projects are assessed according to two different scales: an environmental impact assessment (EIA) provides an estimation of the effects of the project on humans, fauna, flora and other ecological issues, while an economic analysis attempts to transform all costs and benefits (CBA) of the project into monetary units. However, in practice, the EU countries apply appraisal frameworks that differ considerably in scope, sophistication, methodology and parameter values. Communication of results also differ in a case-by case manner. Based on recent research activities undertaken by EVA-TREN consortium (2006-2008) and on other international inputs, this contribution investigates the causes of deviation between project appraisals and results after the projects have been implemented. It concludes with recommendations for enabling capitalisation and communication of knowledge upon transport appraisal experience over the continent.

**Keywords:**

Infrastructure planning, Project appraisal, Assessment methods, Trans-european networks, International comparison, Cost-benefit analysis, Demand evaluation, Reference class, TEN, HST, HSR, AVE, ICE, TGV, EVA-TREN.

ID 1077 R

**INFRASTRUCTURE PROJECTS AND CONSENSUS BUILDING IN ITALY. THE PUBLIC DEBATE ON “GRONDA DI PONENTE” IN GENOA**

Main Author:

**Pucci PAOLA** (*Politecnico di Milano - DiAP*)**Abstract:**

One central issue for the feasibility of major infrastructures in Italy concerns innovation in consultation procedures which at present are ineffective in guaranteeing the quality, fairness and feasibility of the projects. The search for structured consultation procedures that are repeatable, flexible and able to offer transparency and right of access to the different parties involved when the projects are being defined, must be interpreted not only as a “solution” for building consensus around an infrastructure project and for reducing conflicts, but also as an opportunity for improving the quality of the infrastructure project itself. The need to rethink institutional consultation procedures results from consideration of the utility of institutionalising – i.e. to consolidate them within routine governance processes and to raise them to a further level of broadly shared cultural values and standards – forms of public debate on infrastructure projects that are being planned which must be regulated to guarantee their legitimacy and transparency and the participation of the parties involved. The paper gives a synthetic review of:

- The institutional procedures and consultation processes for the large infrastructure projects in Italy, highlighting the possibilities and the limits of the “legge Obiettivo”, introduced in the 2000 to simplify the process and to guarantee the feasibility of programmed infrastructures;
- The ways in which the institutionalisation of procedures for planning major infrastructure has been addressed in some Italian regional laws (as Toscana, Liguria, Lombardia), modifying the national institutional framework for consensus building in infrastructure projects. (...).

**Keywords:**

Decision making process for new infrastructures financing.

ID 1162 R

**LEARNING IN PLANNING: HOW KNOWLEDGE IS GENERATED AND ACQUIRED IN PLANNING LARGE TRANSPORT PROJECTS**

Main Author:

**Mendel GIEZEN** (*Amidst - University of Amsterdam*)

Co-author(s):

**Luca BERTOLINI** (*University of Amsterdam*)**Abstract:**

There is an implicit marriage between decision-making, knowledge and learning. A decision cannot be made without some general understanding of the subject and the different possibilities of action. Arguably, more knowledge leads to a more balanced decision. Similarly, a well-organized learning cycle leads to a balanced decision-making process. This article explores the way learning is organized in the decision-making process on large transport projects. Characteristic of these projects is that they enter the decision-making process as solutions (Priemus, 2008). Although they are meant as answers to certain problems, they are usually not the product of a comprehensive problem driven search. This means that it is difficult to organize a proper learning cycle within the decision-making. As key hypothesis, we argue that if this learning process is not properly organized, the decision-making process provides unbalanced decisions. Large transport projects are typical examples of complex projects dealing with many interests and conflicts. In addition, they have long decision-making processes and planners and decision-makers are under continuous pressure of speeding the process up. For these reasons, many countries have special laws for such projects. As mentioned in the paragraph, they usually enter the decision-making process as solutions. In general they also have strong and powerful advocates. Although there are many different actors involved in the planning of large transport projects, the process of decision-making can be seen as one organizational structure that is able or not to learn. Large transport projects are special, but at the same time they are archetypical examples of complex large projects. (...).

**Keywords:**

Large Transport Project, Learning, Decision-making.

ID 1315 R

**THE MULTI-ACTOR, MULTI-CRITERIA ANALYSIS (MAMCA) FOR THE EVALUATION OF**

Main Author:

**Cathy MACHARIS** (*Vrije Universiteit Brussel (Free University of Brussels)*)

Co-author(s):

**Bart JANUARIUS** (*Vrije Universiteit Brussel (Free University of Brussels)*)

**Abstract:**

Implementing transport projects leads quite often to controversies. Often there are winners and losers involved when implementing a new transport project. Simply neglecting these stakeholders will not help in implementing faster the proposed solutions as more and more often these people will organize in action groups which can prove to have quite important (legal and media) power. In Flanders, for more than two years on a row, the mobility problems in Antwerp have resulted in a major debate. Several possible solutions and even so different actors were placed against each other. In this paper we show how the Multi Actor, Multi Criteria Analysis (MAMCA, developed by Macharis, 2004) methodology can help in structuring the debate and help to come to good compromises. The MAMCA is a methodology to evaluate different policy options whereby different stakeholders' opinions are explicitly taken into account.

**Keywords:**

Multi Actor, Multi Criteria Analysis, Evaluation of transport projects.

ID 1956 R

**A MULTI-ACTOR MULTI-CRITERIA APPROACH FOR THE INTRODUCTION OF BIOFUELS IN BELGIUM**

Main Author:

**Laurence TURCK SIN** (*Vrije Universiteit Brussel*)

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**Jacques DE RUYCK** (*Vrije Universiteit Brussel*)

**Lara MERTENS** (*Université Catholique de Louvain*)

**Jean-Marc JOSSART** (*Université Catholique de Louvain*)

**Leen GORISSEN** (*VITO*)

**Luc PELKMANS** (*VITO*)

**Abstract:**

The Multi-Actor Multi-Criteria Analysis (MAMCA) is a methodology to evaluate different policy measures whereby different stakeholders' opinions are explicitly taken into account. In this paper, this framework is used to identify a long-term biofuel strategy for Belgium. Five scenarios (fossil fuels, bio-diesel, ethanol, biogas and BTL) are evaluated on several criteria, which have been identified by different actors involved in the biofuel supply chain (feedstock producers, biofuel producers, biofuel distributors, end users, vehicle manufacturers, government, NGOs and North-South organizations). It is found that the Belgian government should focus on bio-diesel (through B10) and ethanol (through E85) when establishing its long-term biofuel strategy. The encouragement of these fuels should however happen in accordance with supportive policy measures to overcome difficulties, facilitate their introduction and ensure market success.

**Keywords:**

Multi-Criteria analysis, Decision making, Biofuels.

ID 1048 R

**THE CLOSURE OF BRANCH RAILWAY LINES IN SOUTH AFRICA: MYOPIA OR OPPORTUNITIES FOR STREAMLINING?**

Main Author:

**Jan HAVENGA** (*Department of Logistics, University of Stellenbosch*)

Co-author(s):

**Zane SIMPSON** (*University of Stellenbosch*)**Abstract:**

The purpose of this research is to inform infrastructure owners on the viability and especially future potential of South Africa's branch lines, and to position logistics practitioners' service offering in this context. A quantitative approach is followed in the research juxtaposing current and future freight transport demand in remote (and/or feeder) areas against the current density and achievable density of a railway. The research revealed that South Africa's state-owned freight logistics provider (the railroad) is currently in a process of rationalising the rail network, which inter alia includes the closing of branch lines – a process that started a few years ago and is currently accelerated in spite of vehement public opposition. This drive is not popular with regional developers due to the further alienation of regional areas from the main economy. Logisticians however seem to have taken an indifferent attitude to this issue, mainly driven by the decline of the railway infrastructure (especially in these remote areas) and different objectives. Logisticians are not expecting railway service levels to improve soon, but cognisance of current increased investments in corridor rail freight infrastructure and its network effects are ignored. Regional freight's low return further contributes to this indifference. Understandably, rural branch lines are easily overlooked in an economy where extremely densified corridors already demand significant attention from role players. The research however warns against a myopic approach to branch lines - while the operation of these lines is not currently economically viable, both from a regional development and logistics cost savings perspective, branch lines can be a viable business in the future, alone, but especially also as part of an integrated network. (...).

**Keywords:**

Branch lines, Rail infrastructure, Future prospect.

ID 2344 R

**DEFINING OF MATRICES FOR ASSESSMENT OF DEVELOPMENT AND EVALUATION OF RAILWAY TRANSPORT BY IDENTIFYING TECHNOLOGICAL AND ECONOMIC FACTORS**

Main Author:

**Marjana PETROVIC**

Co-author(s):

**Vinko JENIC** (*Faculty of Transport and Traffic Sciences, University of Zagreb*)**Drazenko FABIJANIC** (*H? Cargo*)**Abstract:**

Over the recent fifteen years there has been intense discussion in the Republic of Croatia about the need to develop railway transport based on the White Paper – European Transport Policy and EU Directives directing the activities towards separation of the railway transport from the railway infrastructure, opening of the railway transport market, financial consolidation of railway lines, construction of inter-operational Trans-European network of railway lines and raising of transport safety and ecological standards. Apart from huge efforts and changes, the restructuring of the railway companies is progressing relatively slowly and without any major development shifts in comparison to the competitive road transport. The main reasons for such a condition may include the need for high investments into the interoperability of the railway lines network, different legal regulations among member countries (especially noticed in the aspect of transport security, engine staff licensing requirements, needs for the formation of regulatory bodies, raising of the quality of service), shortage of modern qualified management of railway companies, etc. The reason for this is because in small-size European rail companies the majority of national operators in cargo transport fail to qualify for the market competition thus getting even weaker in relation to road competition and becoming “easy prey” for big international rail operators. Big European rail carriers are primarily interested in operating on the Trans- European network of railway lines. (...).

**Keywords:**

Railways, Attractiveness, Availability, Competitiveness, Transport, Development, Assessment, GE and ADL matrices, Technological and economic factors.

ID 3025 R

**GOVERNANCE IN RAILWAY NETWORKS**

Main Author:

**Florian PESCHELT** (*FU Berlin*)**Abstract:**

"Governance in Railway Networks" combines two brand-new analytical frameworks to compare European rail networks. Taking into account the entire scope of individual institutions involved in running a rail network, the paper goes beyond existing research, which is primarily limited to cost structures and economic models. Furthermore, the paper examines various structures of "bound governance", in which public bodies, regulators, operators and manufacturers work and interact according to largely undisputed rules. Preliminary findings suggest that railway networks are run more successfully if a system of bound governance prevails, because little energy is lost in disputes over rules and in hierarchical, behind-the-scenes, powerbased governance. Drawing its conclusions on that basis, this paper introduces a new model of governance structures, in a departure from the entrenched positions in the debate on the separation between infrastructure operations and train operations. It argues that the main concerns of railway reform involve not the separation of infrastructure operators and train operators but the separation of strategic authorities and the operating companies. Five case examples from the United Kingdom, Germany, France, Sweden and Switzerland have been selected to reflect a large but still comparable variety of optional systems of governance. In its preliminary conclusion, this paper finds that the UK's massive legislative and administrative efforts are an example of successful bound governance, as is Switzerland's well-established separation of government strategy and rail operations. The paper is highly critical toward the current German rail privatisation plan (now on hold), which includes no clear separation of responsibilities between the government and the Deutsche Bahn. (...).

**Keywords:**

Governance, Railways, Institutions, Bound Governan.

ID 3048 R

**HOW TO MANAGE RAIL INFRASTRUCTURE IN AN OPEN ACCESS MARKET ? SOME REFLECTIONS FROM EUROPEAN CASES**

Main Author:

**Pierre ZEMBRI** (*University of Cergy-Pontoise*)**Abstract:**

The liberalization of the Rail industry in the EU is still in progress, with various degrees of completion. After a first stage of separation between infrastructure and services, the reform has now been completed for freight services and is now beginning for passenger trains. The choice initially made is to facilitate the entry of newcomers in the market, following the principles of open access: any qualified competitor can apply for train paths, with no particular priority given to incumbent operators. The use of infrastructure requires the payment of track access charges whose levels vary considerably from one country to another. The experience of freight market liberalization shows that newcomers have tried to run longdistance block trains. Some of them were already hauled by the national railways, but many of them correspond to traffic transferred from road or waterways. For instance, overall rail freight traffic has increased from 2000 to 2008 in the United Kingdom and in Germany. The entry of new operators has contributed to an overall growth of the market. In other countries such as France, we observe a severe decrease in traffic figures, despite the entry of nine new operators. Among the barriers to entry that are put forward, the poor quality of train paths and the low residual capacity of the network are frequently mentioned. The responsibility of the infrastructure manager is denounced and, beyond its level, the responsibility of the public authorities who have launched the liberalization process without reshaping the network. However, adapting the network capacity to new forms of use is a long-term task. This paper will try to explore the hypothesis of a gap between the layout of the network, shaped for the exclusive use of a national carrier with a large predominance of domestic traffic, and the demand from new entrants exploring new markets on a continental scale. (...).

**Keywords:**

Rail industry, Infrastructure, Network structure,

ID 1033 R

**STAKEHOLDER CONSULTATION IN ROAD ADMINISTRATION - A LEGAL PERSPECTIVE**

Main Author:

**Campbell DUNCAN** (*Duncan Lawyers*)**Abstract:**

The primary function of roads is to facilitate transport: roads provide a way for people and goods to move from one place to another. However, roads are more than just a part of a transportation network: they are land which is open to and used by people for a variety of purposes. Not all uses are lawful, and not all stakeholders are organised, vocal or articulate, particularly in developing countries. Many uses need not conflict with other uses, but potentially do so. For these reasons, road administration is a complex function, often requiring decisionmakers to evaluate proposals in terms of multiple policy considerations. Good quality decisions are most likely to occur in a regulatory environment which mandates participatory decision making – a process in which stakeholders are identified and consulted and their views are taken into account. The result of a poor decision making process generally is poor decisions, with consequent injustices, misallocation and wastage of resources and deficient action to improve road safety and road network performance. In many countries road administration legislation provides little guidance to road administrators, being brief and lacking procedural detail. Two common failings are conferral of wide enforcement powers that have the potential to be used in a draconian way and imposition of requirements that are onerous and difficult to administer. At least, legislation should: • set out administrators' objectives; • impose specific consultation requirements for some decisions. Effective stakeholder consultation is possible in road administration – even in developing countries – using an appropriate consultation tool.

**Keywords:**

Stakeholders, Functions of the road reserve.

ID 1073 R

**ORGANIZATIONAL CAPACITY IN CROSS-BORDER TRANSPORT INFRASTRUCTURE: EVIDENCE FROM THE GREATER MEKONG SUBREGION**

Main Author:

**Pichai UAMTURAPOJN** (*Department of Civil Engineering, The University of Tokyo*)

Co-author(s):

**Hironori KATO** (*University of Tokyo*)**Abstract:**

Addressing organizational capacity in cross-border transport infrastructure (CBTI) projects is critical to reduce development gap among counterparts. Variety of bureaucratic hierarchy levels of administration is significantly mixed up with responsibilities, incentives, and benefits in both national and subregional levels. The study deals with the East-West Economic Corridor (EWEC) project adopted by the Greater Mekong Subregion Program (GMS), emphasizing in the quantity and quality of organizational capacity throughout the CBTI development. It examines the role of CBTI-related stakeholders towards coordinating organizational structure networks in the transport facilitation context, and discusses associated issues and challenges. Examining the National Transport Facilitation Committees (NTFCs), the study analyzes the progress of coordination between national and subregional counterparts, throughout organizational capacity framework.

**Keywords:**

Organizational capacity, Regional integration, Cross-border transport infrastructure, East-West Economic Corridor, Greater Mekong Subregion.

ID 2049 R

**A CASE OF GOOD PRACTICE: EXAMINING THE SWISS 'NETWORK' APPROACH TO SEMI-RURAL PUBLIC TRANSPORT**

Main Author:

**Timothy (TIM) PETERSEN** (*GAMUT Centre, University of Melbourne*)

Co-author(s):

**Paul MEES** (*Royal Melbourne Institute of Technology*)**Abstract:**

Despite increasing pressure to provide alternatives to car travel, semi-rural areas are often considered difficult, if not impossible to serve by public transport. Commentators lament the growth of low density, ex-urban forms that encourage and require use of the car, including rural areas and towns beyond major cities and their immediate suburbs. In such areas, public transport rarely attracts any significant proportion of motorists, and tends to consist of poor quality, welfare-style services. The public transport systems in Switzerland's major cities are often admired as models for public transport in wealthy, densely-populated western cities. Kenworthy & Laube's Millennium Cities database reveals that Zurich has the second highest rate (after Berne) of per capita public transport boardings among Western European cities, even though the entire Canton of Zurich has a population of only 1.3 million. Zurich's public transport authority, the ZVV (Zürcher Verkehrsverbund) indeed offers its population high quality public transport services through a network of high frequency, interconnecting routes within Zurich's dense and compact city core. However, it is sometimes forgotten that the authority also offers high quality public transport well into the much lower-density patchwork of suburban centres, towns and villages within the surrounding canton. The City of Zurich accounts for only 27% of the canton's population, and yet the average journey to work mode share for public transport across the canton is 40.7%. In the canton's most extensive semi-rural area, Zurich's Weinland, the rate for public transport use is lower at around 20%, but still exceeds the share achieved in many U. (...).

**Keywords:**

Switzerland, Semi-rural, Low-density, Public transport.

ID 2780 R

**A MULTI-OBJECTIVE STUDY ON THE IMPROVEMENT OF THE SECONDARY ROAD NETWORK OF THE CENTRO REGION OF PORTUGAL**

Main Author:

**Bruno SANTOS** (*University of Coimbra*)

Co-author(s):

**António ANTUNES** (*Department of Civil Engineering, University of Coimbra*)**Eric MILLER** (*University of Toronto*)**Abstract:**

In the last 25 years, very large investments have been made in Portugal to improve its main road network. In contrast, during the same period, little has been done with regard to the secondary roads. In this paper, we present a study aimed at determining the best way of improving the secondary road network of the Centro Region of Portugal. This is one of the regions of the country where some accessibility problems persist. The study was made using a multi-objective road network planning model. In relation to the road network planning models available in the literature, the one we applied has a number of important, distinctive features. The objectives considered were efficiency (evaluated by four different efficiency measures: average travel speed; weighted travel cost; consumers' surplus gains; and weighted aggregated accessibility), equity (evaluated by the Gini Index), and energy (evaluated by fuel consumption). An overview of the measures used in the past to evaluate road network efficiency and a discussion of the implication of adopting the four measures of efficiency considered are also provided. The results indicate that solutions can be significantly different when using each of the efficiency measures used.

**Keywords:**

Road network planning, Multi-objective optimization, Efficiency measures, Gini index.



ID 2783 R

**BORDER CROSSINGS ALONG THE PAN-EUROPEAN CORRIDOR X: INFRASTRUCTURAL AND PROCEDURAL IMPROVEMENTS AND DERIVED BENEFITS**

Main Author:

**Marios MILTIADOU**

Co-author(s):

**Christos TAXILTARIS**  
**Georgios MINTSIS**  
**Socrates BASBAS****Abstract:**

Transport is a vital economic sector directly related to trade and tourism, as well as regional convergence and cohesion. The presence of international borders along main international transport routes is impeding the smooth movement of passenger and goods, increasing travel times and costs. In this paper the infrastructural and procedural obstacles recorded at all the border stations along the Pan-European Transport Corridor X between Central Europe and Greece, via the former Yugoslavian countries, are presented. These obstacles were recorded through questionnaire-based surveys elaborated by the authors in the periods 2002-03 and 2007-08, in the process of identifying common problems and propose possible common solutions and measures for the facilitation of trans-border traffic. These measures are examined under the prism of a prospective cost-effectiveness analysis. The direct and self-evident benefit of the potential improvements would be the increase of the provided level of service with the reduced travel times, while ultimately the increase of the competitiveness of Corridor X would affect the trips distribution on the international and South-East Europe regional network by shifting traffic from antagonistic routes and/or between modes. Most probably, and as in the cases from the past in Central-Western Europe and recently at the borders of Greece with its neighbouring countries, new land uses at the trans-bordering zones could form additional trip generators (induced traffic), affecting local and regional economies and creating new travel habits and behaviours of local populations.

**Keywords:**

Pan-European Transport Corridors, Cross Borders Improvements, Prospective Cost-Effectiveness Analysis.

ID 2116 R

**NATIONAL TRANSPORTATION POLICIES, FINANCING, AND CO2 POLICIES OF THE UNITED KINGDOM, CANADA, AND SWEDEN: LESSONS FOR THE UNITED STATES?**

Main Author:

**Carrie MAKAREWICZ** (*UC Berkeley*)

Co-author(s):

**Lee SCHIPPER** (*Global Metropolitan Studies*)  
**Elizabeth DEAKIN** (*UC Berkeley*)**Abstract:**

For the United States, rising costs of the transport system and dwindling revenues from traditional but unpopular fuel taxes present a challenge to transport policy. An even greater challenge is to make the transportation system more sustainable, particularly against the rise in carbon dioxide emissions from road vehicles. Most agree that significant changes to transportation policy and revenue sources are needed if the country is to balance revenues and expenditures while reducing transport's CO2 emissions. This will require the reexamination of US transport policy goals, the way CO2 reduction is incorporated into policy, and the assignments of responsibility for action to the national, state, regional, and local levels. As part of a study for the National Transportation Policy Project of the Bipartisan Policy Center, we examined how the United Kingdom, Sweden, and Canada have addressed the same set of transport policy challenges, comparing their policies and practices to current US approaches. We show how transportation objectives, programs, projects and funding levels flow from national policies in each country, and document how each country has embedded climate change concerns within transport policy. Finally, we compare the four countries on economic growth, surface transportation activity by mode, and CO2 emissions to assess the potential impact of specific transport and climate change policies. The three comparison countries have made sustainable development the centerpiece of current policy, and this influences their transport policies in several ways. We document a number of their national policies to support sustainable development, and conclude that these policies have made a significant and positive difference in outcomes. (...).

**Keywords:**

Transportation policy, CO2, Sustainability, Transport finance, Transportation planning, Intergovernmental coordination, Intermodal connectivity.

ID 2173 R

**ATTITUDE OF ADMINISTRATION TOWARDS PUBLIC TRANSPORT - A COMPARISON BETWEEN EAST ASIA AND EUROPE THROUGH MULTINATIONAL OPERATORS -**

Main Author:

**Takeru SHIBAYAMA** (*Research Center for Transport Planning and Traffic Engineering, Vienna University of Technology*)

Co-author(s):

**Hitoshi IEDA** (*The University of Tokyo*)

**Abstract:**

This research compares attitudes of the government towards local public transport in Europe and in East Asia including Japan, South Korea, and China through activities of Multinational Operators for Local Transport Services (MOLTS), which are firms such as Veolia Transport, Arriva, Keolis, and Transdev, as well as through several referential cases. In Europe, due to the EU-level legislation combined with the current general needs for financial compensation, the attitude is affirmative in Europe. South Korean authorities have rather affirmative attitude, with recent transition of the structures. The attitude in Japan is rather negative, with newly introduced de facto open-entry and free-exit regime. In China, the attitude depends on transport mode – it is rather affirmative for metro, while it is not that affirmative for buses.

**Keywords:**

Public Transport, Multinational Operators, Organizational Structure, Transport Policy, Public Administration, Comparative Approach.

ID 2449 R

**NEW SLOVENIAN PUBLIC PASSENGER TRANSPORT REGULATORY REFORM: TOWARDS AN INEFFICIENT SYSTEM**

Main Author:

**Branko KORZE** (*Chair of Law, Faculty of Economics, University of Ljubljana*)

Co-author(s):

**Branko KORZE** (*Chair of Law, Faculty of Economics, University of Ljubljana*)

**Abstract:**

Efficient, innovative, user friendly and environmentally sustainable public passenger transport has recently been subjected to an increasing attention and intense scholarly debate. Numerous European common transport policies, legislative efforts and initiatives, strategies and comprehensive transport development strategies reflect the significance of such an integrated public transport to the national and European welfare. This paper offers a legal and economic evaluation of proposed new Slovenian integrated public passenger transport regulatory reform and a consequent new integrated system of public transport. Latest Slovenian regulatory reform has been induced and inspired by common European transport policy and upon this set of European rules and objectives that should be reached, the new integrated system of public passenger transport has been proposed for the first time in Slovenian modern history. The fact that the current Slovenian public transport is completely chaotically disintegrated, inefficient and environmentally unsustainable presented an ample opportunity for a relevant legal and economic study of the regulatory impacts upon the national economy and welfare. As presented analysis is suggesting the economic, environmental and social benefits of such proposed integrated system would be indeed immense. Yet, the lobbying pressures from different stakeholders and rent seekers endangered the whole project and undermined the legislative attempt and regulatory reform. (...).

**Keywords:**

Public passenger transport, Regulatory reforms, Innovation, Efficiency, Sustainability, Environmental protection, Competition infringements.

WED 14<sup>th</sup> (11:15 - 12:30, Session G3.3) Room 1.03

ID 2899 R\*

**AN ASSESSMENT OF THE EFFICACY OF NIGERIA'S  
DRAFT NATIONAL TRANSPORT POLICY**

Main Author:

**Alban IGWE**

Co-author(s):

**Victor OMOKE** (*Bells university of Technology, Ota, Nigeria*)

**Abstract:**

For the past five years, Nigeria has been toying with the national economy by its failure to bring about an operational transport policy for the country. Therefore there is no clarity in strategic direction, legal responsibilities or liabilities. Moreover the high death toll and property loss due high accident rate amongst others are eating deep into the national economy. To cite and stress the overriding importance of transport policy to national development and the imperatives for sound transport policy, the transport sector accounts for over 10% of America's economic activities, directly employs 4.5 million Americans and estimated to be worth \$1.8 trillion of the United States economy. So given this compelling evidence, Nigeria's current predicament has critical national and global implications. However, more dangers lie ahead if the 2004 Draft National Transport Policy with its deficiencies translates to substantive policy document. Transport efficacy to development can only be founded on well-structured, strategic, contextual and content-rich policy. The lack of clarity in an ill-conceived transport policy will be more detrimental than the current no-policy position. This paper attempts an analysis of the Nigerian Draft Transport Policy using the Structure- Context-Strategy-Content (SCSC) model to ascertain the efficacy (in other words, the suitability and adequacy) of document to deliver desirable outcomes. The analysis of the draft policy with the model yielded 40% result, which translates to inadequacy.

**Keywords:**

Transport policy, Transport efficacy, Structure-Context-Strategy-Content model.

THU 15<sup>th</sup> (08:15 - 09:30, Session G3.4) Room 1.03

ID 1908 R

**IMPROVING THE UTILIZATION OF TRUCK CAPACITY  
AND CHANGING MODAL SPLIT IN REGIONAL  
FREIGHT TRAFFIC TRANSPORTATION- A CASE  
STUDY FOR UPPER AUSTRIA**

Main Author:

**Gerald ASCHAUER** (*University of Applied Sciences Upper Austria*)

Co-author(s):

**Friedrich STARKL** (*University of Applied Sciences Upper Austria*)

**Leonhard HÖFLER** (*University of Applied Sciences Upper Austria*)

**Christian FLOTZINGER** (*University of Applied Sciences Upper Austria*)

**Abstract:**

The rapid growth of the transport sector is significantly affecting the economic region of Upper Austria because of its strongly export oriented industrial structure. Road freight transportation dominates the Modal Split in Upper Austria and road infrastructure is pushed to its limits. Congestion and its negative effects increase. In public discussions, transit traffic is judged to be responsible for the resulting problems of congestion, bottlenecks, etc. However, in reality it is regional freight transportation (defined as having its destination or origin in Upper Austria) which accounts for 76% of road freight transportation in Upper Austria. There is still a lack of investigation into the potential and opportunities associated with the reduction of the transportation volume in regional freight transportation. Through the optimization of truck utilization by using synergy effects as well as finding possibilities for shifting within the modal split, regional freight traffic can contribute to a reduction in traffic volume and in reducing emission of harmful substances.

**Keywords:**

Transport management, Truck utilization, Empty running, Modal shift.

ID 1943 R

**LAUNCHING A POST-CARBON REGIME FOR  
AMERICAN SURFACE TRANSPORTATION:  
ASSESSING THE POLICY TOOLS**

Main Author:

**James DUNN** (*Political Science Department - Rutgers University*)

Co-author(s):

**Anthony PERL** (*Simon Fraser University - Urban Studies Program*)

**Abstract:**

The USA and Canada generate over one-third of the transportation-related emissions of carbon dioxide in the world. Motor vehicles fueled by petroleum produce a majority of these emissions. Several recent policy studies (Cambridge Systematics, 2009; Sperling and Gordon, 2009;) have laid out ambitious agendas for policy changes that will be needed to move North America away from its current petroleum-dependent, carbon-based system of surface transportation. This paper identifies the common elements on these agendas and extends our examination (Perl and Dunn, 2007) of the near to medium-term political feasibility of these policies seen as vital to achieving this goal. It identifies and examines the institutional factors, interest group influence, and economic obstacles that have prevented the adoption of policy tools to reduce petroleum consumption and introduce cleaner energy technologies. Recently some of these barriers have begun to disintegrate. In the USA, the Democrats' victory in the 2006 Congressional election triggered legislation authorizing an increase in the federal fuel economy standard from 27.5 to 35 miles per gallon by 2020. President Barak Obama moved the timetable for achieving that goal forward to 2016. Congress is seriously considering a cap-and-trade bill on carbon emissions that would increase the price of petroleum-based motor fuel. Congress is also under pressure from highway interest groups and state highway departments to increase the federal gasoline tax, since the Federal Highway Trust Fund has run a deficit for two years in a row. As the North American economy recovers from recession, the price of oil has already begun to rebound and will reinforce the message to consumers and auto companies that fuel efficient and alternative fuel vehicles are going to be a growing part of the market. (...).

**Keywords:**

Surface transportation, Automobiles, Fuel economy .

ID 2684 R

**THE EFFECT OF GOVERNMENT POLICY AND  
FUNDING ON SHORT SEA SHIPPING IN SCOTLAND**

Main Author:

**Jason MONIOS** (*Transport Research Institute*)

**Abstract:**

This paper investigates why water freight in Scotland continues to decline despite the favourable policy environment and the availability of government funding. Since we know from the literature which barriers need to be overcome with this funding, the focus of the present research was to look in detail at the process of how government policy and funding are directed towards surmounting these hurdles. This objective was attained by studying the process of planning an intermodal freight service in the Forth Estuary near Edinburgh. Qualitative data was collected through action research and stakeholder interviews, while quantitative data obtained through a feasibility study was then manipulated in scenarios to compare complementary policy measures. These two streams of data were then analysed through a theoretical framework to provide a means by which the current funding system could be analysed and improvements suggested. The application of theoretical approaches from other areas of transport will form an additional contribution to the maritime literature. The results presented in this paper contribute to the literature by revealing issues related to using funding to achieve the aims of government policy. The study identified a number of problems with the way the current Scottish funding system relates to government policy, underlined by the fact that only a small portion of the annual freight grants budget is being spent. The funding system is reliant on ad hoc funding applications, possessing no mechanism for strategic identification of potential projects, and knowledge and responsibility are dispersed across many organisations, hampering cooperation. It was also found that the funding system favours infrastructure whereas a shortfall in operating costs compared to road haulage is the primary factor in preventing modal shift towards short haul services. (...).

**Keywords:**

Maritime policy, Government funding, Subsidy, Modal shift, Intermodal, Short sea shipping (SSS).

THU 15<sup>th</sup> (08:15 - 09:30, Session G3.4) Room 1.03

ID 3024 R

**QUALITATIVE DATA ANALYSIS PROVIDES A BASIS FOR DEVISING A RURAL SCHOOL BUS IN BRAZIL**

Main Author:

**Rejane RIBEIRO** (*University of Brasilia - UnB*)

Co-author(s):

**Reinaldo ESTELLES** (*Center for Personnel Training in Transportation - Ceftru*)

**Abstract:**

One of the constitutive and complementary elements of the right to Education in Brazil is School Transportation. The Center for Interdisciplinary Studies on Transportation of the University of Brasilia – Ceftru/UnB, in partnership with the National Fund for the Development of Education, carried out research aimed at characterizing this type of transportation, focusing on Rural School Transportation (RST) in Brazil. The survey used both quantitative (regarding the operation of the RST system and school access conditions) and qualitative (the stakeholders' perception of the current conditions of RST and the desired conditions for this type of transportation) methods. The Brazilian Ministry of Education, aware of the survey being carried out by Ceftru/UnB, asked for help in establishing the necessary parameters for vehicles to be used for student transportation in rural areas. Thus, associations were established between data on the opinions of RST stakeholders regarding the vehicle and the Brazilian technical standards and specifications for passenger vehicles, allowing for the design of a bus model that is appropriate for the rural environment.

**Keywords:**

Ceftru/UnB research, Perception of stakeholders, Rural school transportation, Rural school bus.

TUE 13<sup>th</sup> (09:45 - 11:00, Session G4.1) Room AIII

ID 1006 R

**DEVELOPING TOOLS TO DESCRIBE AND IMPROVE THE ACCESSIBILITY OF TRANSPORT**

Main Author:

**Daniela CARVALHO** (*Tis.pt*)

Co-author(s):

**Suzanne HOADLEY** (*Polis*)  
**Alexandra RODRIGUES** (*Tis.pt*)

**Abstract:**

The Mediate project<sup>1</sup> will assist public authorities and transport operators in achieving equality of access, by providing a methodology for measuring accessibility in transport, making comparisons with good practice solutions and exchanging knowledge between stakeholders involved. The overriding goal of Mediate is to contribute to the development of inclusive urban transport systems with better access for all citizens. The main tools to be developed within Mediate include a set of indicators to measure public transport accessibility and a self-assessment tool to help cities and transport operators helping to identify where they are on the accessibility scale (low level to high level of accessibility), and what effort (and actions) are required to reach the next step. These tools will enable public authorities, transport operators, policy makers and other relevant stakeholders to identify gaps and areas for improvements, and develop strategies for closing these gaps and accomplish the suggested improvements. The development of a methodology for measuring accessibility is a process. The first step is to define the knowledge base, by reviewing the initiatives and methodological approaches that have been made to describe and measure accessibility to public transport. The challenge is to gather this information and identify common indicators to be used as a basis for a common set of standardised indicators at European level. Examples of good practice will be collected together with data supporting the indicators. The indicators and examples of good practice are input for the development of the self-assessment tool. The selfassessment tool will provide valuable information on possible gaps, give an indication of the actual level of quality of accessibility and make recommendations to improve accessibility. (...).

**Keywords:**

Accessibility, Levels of development, Self assessment.

ID 1350 R

**ACCESSIBILITY TO JOBS AND LABOR MARKET OUTCOMES OF RESIDENTS**

Main Author:

**Qingyun SHEN** (*University of Michigan*)**Abstract:**

The impact of the location characteristics of housing on residents' socio-economic status has been under scholarly investigation for decades. One seminal work is the spatial mismatch hypothesis by John Kain who proposed a theory that the unemployment of inner city residents is to a large extent caused by their isolation from jobs in suburbs. In order to decentralize poverty and to improve the employment outcomes of inner-city residents, the Department of Housing and Urban Development of the United States launched several housing programs (e.g. Moving-To-Opportunity or MTO program, Section 8 Housing, etc.) and allocated billions of dollars to subsidize low-income people to relocate into more affluent suburban communities. However, the impact of these housing programs on the labor market outcomes of subsidy recipients was observed to be limited or unclear. This study attempts to reveal the underlying relationship between housing location and the labor market outcomes of residents by taking a transportation perspective—using transportation accessibility as an indicator of the convenience of housing location. The result of this study suggests that a simple dichotomy of inner-city and suburb in the discussion of housing location impact should be discarded. Instead, accessibility to jobs from the housing location, among other factors, has the real influence on the labor market outcomes of residents. Therefore, government subsidies used to relocate people into suburban housing locations would not efficiently improve residents' labor market outcomes unless the transportation accessibility of those locations is also improved. Such conclusion has important implications for both housing and transportation policies. (...).

**Keywords:**

Accessibility, Housing Location, Employment, Spatial Mismatch.

ID 1766 R

**A TRANSPORTATION AFFORDABILITY INDEX**

Main Author:

**Costas PANOU** (*University of the Aegean*)

Co-author(s):

**George PROIOS** (*University of Aegean*)**Abstract:**

Transportation affordability refers to people's financial ability to access important goods and activities such as work, education, medical care, basic shopping and socializing. Increasing transport affordability can provide large economic and social benefits by reducing burdens and expanding opportunities to disadvantaged people. Increased transport affordability is equivalent to increased income. There are many factors to consider when evaluating transportation affordability, including housing affordability; land use factors that affect accessibility; the quantity, quality and pricing of mobility options; and individuals' mobility needs and abilities. Conventional planning tends to consider a relatively limited range of transport affordability impacts and objectives. More comprehensive analysis can help decision makers better understand affordability impacts and identify more effective strategies for improving transport affordability. However, to take transportation affordability into account there should be practical ways of evaluating it. This paper investigates the concept of transportation affordability and suggests a quantitative index for its measurement. The index calculates affordability based on the tradeoffs that households make between transportation and housing costs. The total transportation costs include the costs for auto ownership, auto use, and transit. The index can be adjusted for any spatial zone (e.g. neighborhood or other) to reflect the average expenditure and the price that inhabitants intend to pay for transportation costs.

**Keywords:**

Sustainable port operations, Environmental impact, Systems approach to environmental assessment, Bunkering operations.

TUE 13<sup>th</sup> (09:45 - 11:00, Session G4.1) Room AIII

ID 2821 R

**ANALYZING THE ENHANCEMENT OF ACCESSIBILITY DUE TO PUBLIC TRANSPORT IMPROVEMENT AND INTENSIVE LOCATION TO URBAN CORRIDORS**

Main Author:

**Hiroyuki TAKESHITA** (*Institution for Transport Policy Studies*)

Co-author(s):

**Hirokazu KATO** (*Nagoya University*)

**Yoshitsugu HAYASHI** (*Nagoya University*)

**Abstract:**

This study aims to evaluate the effects of accessibility enhancement in a whole intended area by concentrative improvement of public transport in urban corridor and gathering population and urban facilities intensively along corridor area. A potential-type accessibility index is applied. Three scenarios are developed: A) Increase the service level of public transport routes along the corridor, B) Equal increase of the service level among the whole areas and C) Land-use development in corridor area. The results indicate that increase of service level of major public transport system brings higher accessibility and equality. Additionally, higher accessibility is brought by land-use development in corridor area with higher service level public transport system.

**Keywords:**

Accessibility, Public transport corridor.

TUE 13<sup>th</sup> (11:15 - 12:30, Session G4.2) Room AIII

ID 1011 R

**BUS RAPID TRANSIT IN URBAN INTRA-CITY PASSENGER MOVEMENT IN METROPOLITAN LAGOS, LAGOS STATE, NIGERIA**

Main Author:

**Kolawole GBADAMOSI** (*Centre for Transport Studies, Olabisi Onabanjo University, Ago Iwoye, Ogun State Nigeria*)

**Abstract:**

The role of effective public transportation system in the economic growth and development of human settlements cannot be overemphasized. The centrally coordinated effort of the Lagos State Government was directed towards resolving fundamental problems facing urban transportation in Lagos state which is somewhat similar to what is being experienced in other locations with outburst population coupled with its attendant problems on spatial interaction. The of promotion of Bus Rapid Transit (BRT) is a veritable option directed at improving the service delivery in the public passenger transport particularly as it affects the most predominant form of transport mode in Nigeria – road transport. The essence is to relieve congestion, enhance mobility, and improve the environment especially with regard to pollution in the Lagos metropolis. Increasing recognition of the need for high-quality transit service to alleviate these conditions has brought about the development of viable alternatives provided with the current efforts in the development of dedicated bus lanes. This was after many trial and errors with Keke Mawa and Okada. The capacity for park and ride tendency of The BRT scheme has fuelled growing demand in urban commuter passenger services which calls for the development of alternative modes as in rail and water transportation services scheme judging from the strategic position of Lagos. The dedicated bus lane provided by the Bus Rapid Transit is highly innovative in the course of finding a lasting solution to the challenges confronting urban passenger transportation in Lagos state. This paper Examines urban transportation situation in Nigeria with reference to Lagos state Bus Rapid Transportation within the two years of intensive operation along designated traffic corridors. (...).

**Keywords:**

Urban , Transportation , Passenger, Bus. Rapid. Transit.

ID 1580 R

**EVALUATION OF BUS NETWORK USING A TRANSIT NETWORK OPTIMISATION MODEL -CASE STUDY ON HIROSHIMA CITY BUS NETWORK-**

Main Author:

**Hiroshi SHIMAMOTO** (*Kyoto University*)

Co-author(s):

**Naoki MURAYAMA** (*Hiroshima University*)**Akimasa FUJIWARA** (*Graduate School for International Development and Cooperation, Hiroshima University*)**Junyi ZHANG** (*Graduate School for International Development and Cooperation, Hiroshima University*)**Abstract:**

As the environmental concerns are recognised to be serious, the importance of public transportation systems has recently been increased because the energy efficiency of public transportation systems is better than that of private cars. However, the number of public transportation users decreasing year by year all over the world. Many of the measures, such as increasing the capacity and introducing off-peak fare, have been taken to increase the number of passengers, but very few of researches or cases paid attention to the network configuration. Therefore, this paper evaluates the existing bus network from the viewpoint of the passengers, operators and system efficiency using the output of the afore-constructed transportation network optimisation model. The transportation network optimisation model is formulated as bi-level optimisation problem whose lower problem is a transit assignment model. Also, since the upper problem is formulated as a bi-level optimisation problem with minimising passengers' and operators' cost, it is possible to evaluate the effects of reducing operators' cost against passengers with this evaluation framework. From a case study using the demand data in Hiroshima City, it was confirmed that the current bus network is close to the pareto front if the total cost of both passengers and operators are adopted as objective functions. It was also confirmed that decreasing the operators cost too much causes not only increasing the passengers' cost but also increasing the inequity among passengers.

**Keywords:**

Bus network evaluation, Transit assignment model, Bi-level optimisation.

ID 1762 R

**TRANSPORT DISADVANTAGE AND PUBLIC TRANSPORT NETWORK CHANGE: A CASE STUDY OF BELFAST**

Main Author:

**Syed BUKHARI** (*University of Ulster*)

Co-author(s):

**Julian HINE** (*University of Ulster*)**Banihan GUNAY** (*University of Ulster*)**Neale BLAIR** (*University of Ulster*)**Abstract:**

The effect of transport disadvantage on levels of participation and access to goods and services is a key policy issue in the design of public transport networks. There is a considerable amount of evidence to suggest anecdotally, at least, that the development of metro style bus operations and high frequency corridors can have a detrimental impact on transport disadvantaged groups, especially where service reduction in deprived areas have been experienced. In Belfast, the public transport network has been transformed into a Metro Service, which is dominated by high frequency corridors. The aim of the transformation was to provide better access and target social needs and to minimise the effects of societal inequalities and communal segregation, which the city has historically experienced. This paper using a GIS Model examines the effect of network change on the city and the newly emerging patterns of improved and deprived accessibility that have been experienced as a result. Findings from the GIS model are based on comparisons of the old City Bus network with the newer Metro Service network, and present an assessment of the spatial impact of network change on different social groups in the city through identification of transport deprived areas pre and post network change.

**Keywords:**

Public Transport Network Change, Transport Disadvantage, Social Exclusion.



TUE 13<sup>th</sup> (11:15 - 12:30, Session G4.2) Room AIII

ID 2342 R

## THE EVOLUTION OF THE RIO DE JANEIRO SUBWAY SYSTEM

Main Author:

**Bruno COSTA** (*Civil Engineering Program - Federal University of Rio de Janeiro*)

Co-author(s):

**Fabiene COSTA**

### Abstract:

Subway systems are the most important means of transportation in the main cities around the world. They generally carry more people than any other system and have a more extensive network, such as in Moscow and Paris (2,475.6 and 1,335.7 million passengers per year and 278.8 and 211.3 km, respectively). However, the subway system does not have the same importance in Rio de Janeiro. Other Latin America cities, like São Paulo and México City, which started building subway systems at the same time as in Rio de Janeiro, have more extensive networks (61.3 and 176.8 km) and carry more passengers per year (611 and 1,417 million, respectively). This article examines the history of the subway in Rio de Janeiro, its operational data (yearly growth of passengers, fleet, kilometers of track, passengers entering stations and daily passenger flow per line) and analyzes its contribution to the mobility of Rio de Janeiro's populace, in light of the population shifts shown in the Rio de Janeiro Metropolitan Area Transport Master Plan. A case study is presented of Botafogo Station, which is located in the south zone of Rio de Janeiro, on Line 1. This case study analyzes whether or not the station have the necessary infrastructure according to international subway station design standards and a minimum service level to meet the new demand generated by the end of 2010. The results suggest this will not occur.

### Keywords:

Transport Planning, Subways.

TUE 13<sup>th</sup> (14:00 - 15:15, Session G4.3) Room AIII

ID 1286 R

## EUROPEAN EXPERIENCE OF TRAVEL PLANS: AN EXPERT PERSPECTIVE

Main Author:

**Lisa DAVISON** (*Loughborough University*)

Co-author(s):

**Marcus ENOCH** (*Loughborough University*)

**Stephen ISON** (*Loughborough University*)

### Abstract:

The current reliance on private vehicles is a major contributing factor to congestion, environmental degradation and energy use. A number of measures, most notably fuel taxes, parking policy, traffic management schemes and more recently road user charging have been implemented in a number of cities as a means of addressing the situation. At the same time 'softer' options, such as travel plans have been applied in an increasing number of cases, in a bid to resolve the issues caused by accessing workplaces, schools and other trip generators by the private car. A travel plan comprises a package of measures tailored to the needs of individual organisations and aimed at promoting greener, cleaner travel choices and reducing reliance on the car. Unlike the traditional approach to counteract transport problems of providing more capacity, travel plans can be relatively quick, inexpensive, effective and a more acceptable option. The aim of this paper is to determine the current situation and future direction with respect to travel plans within a European context. In order to assess the situation in-depth face-to-face and telephone interviews were undertaken with 20 travel plan experts from Europe and the USA. Interviewees were selected based on a careful study of the literature and the authors' detailed knowledge of transport policy and travel plans. Interviewees highlight the need for an action-based approach to ensure that travel plans have an impact, with communication being key to success. They emphasise the need for standardised monitoring and evaluation to assess the cost saving ability of travel plan adoption to organisations, and carbon reduction potential. For the future there is agreement that there will be a growing demand for mobility management measures and the implementation of travel plans and travel plan networks are expected to play an increasing role. (...).

### Keywords:

Travel Plan, Mobility Management, European.

TUE 13<sup>th</sup> (14:00 - 15:15, Session G4.3) Room AIII

ID 1531 R

## **NON-MOTORIZED PUBLIC TRANSPORT: A GLOBAL REVIEW & ANALYSIS OF TRENDS AND ISSUES**

Main Author:

**Mamun RAHMAN** (*Queensland University of Technology*)

Co-author(s):

**Glen D'ESTE** (*Queensland University of Technology*)

**Jonathan BUNKER** (*Queensland University of Technology*)

### **Abstract:**

Over recent decades there has been growing interest in the role of non-motorized modes in the overall transport system (especially walking and cycling for private purposes) and many government initiatives have been taken to encourage these active modes. However there has been relatively little research attention given to the paid form of non-motorized travel which can be called non-motorized public transport (NMPT). This involves cycle-powered vehicles which can carry several passengers (plus the driver) and a small amount of goods; and which provide flexible hail-and-ride services. Effectively they are non-motorized taxis. Common forms include cycle-rickshaw (Bangladesh, India), becak (Indonesia), cyclos (Vietnam, Cambodia), bicitaxi (Columbia, Cuba), velo-taxi (Germany, Netherland), and pedicabs (UK, Japan, USA). The popularity of NMPT is widespread in developing countries, where it caters for a wide range of mobility needs. For instance in Dhaka, Bangladesh, rickshaws are the preferred mode for non-walk trips and have a higher mode share than cars or buses. Factors that underlie the continued existence and popularity of NMPT in many developing countries include positive contribution to social equity, micro-macro economic significance, employment creation, and suitability for narrow and crowded streets. Although top speeds are lower than motorized modes, NMPT is competitive and cost-effective for short distance door-to-door trips that make up the bulk of travel in many developing cities. In addition, NMPT is often the preferred mode for vulnerable groups such as females, children and elderly people. NMPT is more prominent in developing countries but its popularity and significance is also gradually increasing in several developed countries of Asia, Europe and parts of North America, where there is a trend for the NMPT usage pattern to broaden from tourism to public transport. (...).

### **Keywords:**

Non-motorized transport, Public transport, Sustainable transport.

TUE 13<sup>th</sup> (14:00 - 15:15, Session G4.3) Room AIII

ID 2286 R

## **A FRAMEWORK FOR FUTURE DEVELOPMENT OF NEIGHBORHOOD MOBILITY PLANS IN PORTUGAL**

Main Author:

**Gonçalo CORREIA** (*Faculdade de Ciências e Tecnologia da Universidade de Coimbra*)

Co-author(s):

**Elisabete SILVA** (*Department of Land Economy University of Cambridge*)

**José MANUEL VIEGAS** (*Centro de Sistemas Urbanos e Regionais (CESUR), Instituto Superior Técnico (IST)*)

### **Abstract:**

When developing a new urban area, town and transport planners have to establish the type of transport infrastructure and service that best fits the particular site and its future inhabitants. However in the existing urban areas one does not have the advantage of a "blank sheet" start, several restrictions have to be faced if one is to manage mobility geared towards efficiency and people's aspirations. During the last decade Mobility Plans have been developed in many cities of the world. These plans deal with major policy orientations in key subjects such as parking, traffic and land use. But when we zoom in to a closer scale, we face a more detailed mobility situation that many times stays unobserved and unmanaged. Neighborhood Mobility plans are meant to respond to that specific need, detecting localized problems and opportunities and trying to foster them to neighborhood and city agendas, supported with specific proposals of intervention. This paper presents a framework for the development of neighborhood mobility plans, and tests that framework for the neighborhood of Campo de Ourique in Lisbon (Portugal), engaging in a reflection of its importance in solving and taking advantage of specific problems and opportunities of this neighborhood. This is useful in establishing an orientation for future development of these plans as part of Lisbon's Mobility Plan. Some of the conclusions of this study point out to the importance of developing this kind of integrated analysis; it may become a powerful decision making tool that will give policy makers a more accurate knowledge of the actual mobility situation in each neighborhood, allowing to better respond to people's needs and at the same time helping to promote the acceptance of some mobility changes to local citizens. (...).

### **Keywords:**

Mobility Plans, Parking, Traffic, Pedestrian Mobility.

ID 2379 R

**EMPLOYER MOBILITY PLANS: BENEFITS, COSTS AND EFFICIENCY**

Main Author:

**Laurent VAN MALDEREN** (*FUCaM (Facultés Universitaires Catholiques de Mons)*)

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**Bart JOURQUIN** (*Louvain School of Management*)**Isabelle THOMAS** (*Université Catholique de Louvain-la-Neuve (UCL)*)**Frank WITLOX** (*Ghent University*)**Ann VERHETSEL** (*University of Antwerp*)**Thomas VANOUTRIVE** (*University of Antwerp - Ghent University*)**Elien VAN DE VIJVER** (*University of Antwerp - Ghent University*)**Abstract:**

Companies bring a growing attention to the home-to-work journeys of their workers. As an important initiator of travels, they have been encouraged by the authorities to cooperate in order to reduce the negative impacts of car traffic. Employer Mobility Plans (EMPs) have been implemented in a growing number of companies in recent years. These plans represent opportunities to achieve business objectives. Despite important research on commuting traffic, only few papers cope with EMPs. With the help of a survey among Employees Transport Coordinators (ETCs), the aim of this paper is to evaluate the effectiveness and the acceptability of the policy measures included in the EMPs and to assess their benefits at the company level. The preliminary results show that the companies are particularly motivated by the operational benefits an EMP can generate. Even companies that considered EMPs as a constraint have found indirect operational benefits to their implementations. Among these indirect impacts, the ETCs often cited the improvement of the mood of the employees and of the positive image of the company. These results also show that the policy measures are perceived as effective and well accepted by both employees and employers. The EMPs appear thus to be useful to provide social and operational benefits to the companies.

**Keywords:**

Commuting, Employer transport plan, Sustainable commuting.

ID 2627 R

**EFFECTS OF URBAN TRAFFIC-FREE PATHS ON EVERYDAY CYCLING**

Main Author:

**Tim JONES** (*Oxford Brookes University*)**Abstract:**

The UK National Cycle Network (NCN) developed by the transport organization, Sustrans, is a significant policy intervention aimed at encouraging cycling. Around half of the population is purported to live within one mile of the 20,000km Network. Traffic-free paths (separated from the public highway away from motor traffic) form about one third of the Network but account for around 80% of trips. The importance of NCN urban traffic-free paths in encouraging people to cycle is often assumed but despite large aggregate datasets characterising users, there is no research on the effects on the local communities which they serve. This paper presents completed Doctoral research which aimed to identify the contribution of a typical section of NCN urban traffic-free path in encouraging cycling for everyday travel amongst a community living adjacent to this type of intervention. First, the paper outlines the characteristics of the NCN, the philosophy behind the development of urban traffic-free paths and the barriers to cycling which such interventions seek to overcome. Then findings of a controlled cross-sectional survey of two neighbourhoods in a medium size town in the English Midlands (which are demographically similar except that one is located adjacent to a section of NCN urban traffic-free cycle path intervention) are discussed. In conclusion the paper will reveal that provision of NCN urban traffic-free cycle paths alone may be insufficient in encouraging a shift from car to cycling for everyday travel purposes. Furthermore, it will highlight unintended consequences of the development of urban traffic-free paths at the local level. The data from the study corroborates evidence that suggests that a wider co-ordinated multi-faceted approach to promoting cycling is required which combines social marketing with physical measures including; wider speed restrictions in urban areas, investment in high quality cycle facilities and general land use and transport policies that 'advantage cycling' and reduce the convenience of the car. (...).

**Keywords:**

Cycling, National Cycle Network, Traffic-free paths.

TUE 13<sup>th</sup> (15:30 - 16:45, Session G4.4) Room AIII

ID 1026 R

**TRIAL-AND-ERROR METHOD FOR CORDON-BASED CONGESTION PRICING SCHEME WITH PROBIT-BASED SUE CONSTRAINTS**

Main Author:

**Qiang MENG** (*National University of Singapore*)

Co-author(s):

**Zhiyuan LIU** (*National University of Singapore*)

**Abstract:**

An effective toll pattern for the cordon-based congestion pricing scheme aims to levy a toll on each entry of a cordon such that the number of vehicle passing through the entries during a peak hour does not exceed a predetermined entry-specific threshold (a threshold constraint), and free passage on the entry is granted if the hourly traffic volume is strictly less than the threshold. To determine the effective toll pattern with the deterministic user equilibrium constraints, an engineering-oriented trial-and-error method only using entry-specific traffic counts has been recently put forward. Thus, this paper investigates availability of this trial-and-error method for the case that behavior of drivers in route choice obeys the probit-based stochastic user equilibrium (SUE) principle. After building a minimization model for the elastic demand probit-based SUE problem with the threshold constraints, this paper first shows that product of value of time (VOT) and optimal Lagrangian multipliers with respect to the threshold constraints is an effective toll pattern. This paper thus proceeds to rigorously demonstrate global convergence of the trial-and-error in estimating the effective toll pattern with the probit-based SUE constraints. Such availability is finally evaluated by a numerical example.

**Keywords:**

Cordon-based congestion pricing, Elastic demand, S

TUE 13<sup>th</sup> (15:30 - 16:45, Session G4.4) Room AIII

ID 1304 R

**BENEFIT ANALYSIS OF FARE DISCOUNT FOR TRANSFERRING BETWEEN PUBLIC TRANSPORT MODES**

Main Author:

**Cheng-Min FENG** (*Institute of Traffic and Transportation, National Chiao Tung University*)

Co-author(s):

**Cheng-Hsien HSIEH** (*National Chiao Tung University*)  
**Yung-Peng CHEN**

**Abstract:**

Discounts are one of the most important marketing strategies for increasing market share. Promoting mode sharing in public transport contributes to sustainable urban transportation. However, whether fare discount significantly promotes use of public transportation remains controversial. This study analyzes the determinants of travel behaviours for urban commuters in Taipei, Taiwan. After identifying the crucial influences on mode sharing, a nested logit model is estimated to optimise fare discount for passengers transferring between public transport modes as well as to optimise shared financial responsibility of stakeholders benefiting from the fare discount strategy. The analytical results indicate that a positive profit exists if the transfer discount is less than half the bus fare, i.e. seven New Taiwan dollars (NTD) per trip. Excluding the external effects concerned by government, the fare discount strategies result in each public transport operator having negative profit. This implies that the fare discount should be regarded as a policy for mitigating negative externalities rather than a marketing strategy for operators. Moreover, government, mass rapid transit operators and bus operators underwrite the cost of the fare discount at 61.92%, 16.55% and 21.53%, respectively, under the optimal fare discount of four NTD per trip.

**Keywords:**

Fare discount, Nested logit model, Cost-benefit analysis.

TUE 13<sup>th</sup> (15:30 - 16:45, Session G4.4) Room AIII

ID 1385 R

**ROAD USER CHARGING AND IMPLICATIONS FOR TRANSPORT POLICY: FINDINGS FROM THE CURACAO PROJECT**

Main Author:

**Andrew KOH** (*Institute for Transport Studies, University of Leeds*)

Co-author(s):

**Anthony MAY** (*Institute for Transport Studies*)  
**David BLACKLEDGE** (*Transport and Travel Research Limited*)  
**Michaela FIORETTO**

**Abstract:**

This paper reports on the outcomes of a European project, CURACAO, designed to support the implementation of urban road user charging (URUC) as a demand management tool in urban areas. The project did this through engagement with a User Group of cities interested in pursuing URUC to identify the barriers preventing them from doing so. The project reviewed the complete process of setting up a URUC scheme from the setting of objectives, through to scheme design, predicting impacts, achieving acceptability and the implementation process and presented its findings in a State of the Art Report and a Case Studies Report. The State of the Art Report provides evidence collated from research and practice to address a series of 14 themes identified by the User Group, including objectives; scheme design; technology; business systems; prediction; traffic, environmental, economic and equity impacts; appraisal; acceptability; transferability; implementation; and evaluation. The Case Study Report reviewed 16 proposed or implemented schemes in Europe, focusing on pricing objectives, scheme design, the implementation process and scheme results. On this basis, the CURACAO Consortium developed a list of policy recommendations aimed at cities and regional authorities, national governments, and the European Commission. The paper summarises the main findings of the State of the Art Report and the case studies. On this basis, it outlines the policy recommendations which were drawn, and identifies future research needs.

**Keywords:**

Urban transport, Road user charging, Policy implications.

TUE 13<sup>th</sup> (15:30 - 16:45, Session G4.4) Room AIII

ID 1950 R

**THE STOCKHOLM CONGESTION CHARGES ? 4 YEARS ON. EFFECTS, ACCEPTABILITY AND LESSONS LEARNT**

Main Author:

**Jonas ELIASSON** (*Centre for Transport Studies, Royal Institute of Technology*)

Co-author(s):

**Maria BÖRJESSON** (*Centre for Transport Studies, Royal Institute of Technology*)

**Abstract:**

The Stockholm congestion charging system was introduced in January 2006, first as a trial followed by a referendum, then reintroduced as a permanent system in August 2007. The Stockholm system is the third dedicated urban congestion charging system in the world (after Singapore and London). This paper presents results and experiences after nearly three years of operation. The focus is twofold: first, what the effects of traffic, retail, travel times etc. have been after the initial, transient effects have settled down; second, what general lessons can be drawn in terms of e.g. acceptability, traffic management and sustainable transport planning. Some examples of results and questions discussed in the paper: - From a traffic management point of view, the charging scheme was essentially a success: traffic over the charging cordon has dropped around 20%, queueing times in and around the inner city dropped 30-50% during rush hours, emissions in the inner city dropped 10-15%, and the negative impact on ring roads and public transit congestion were much less than feared. The effect on traffic and congestion levels has remained essentially constant during the years of operation. What can be expected in the future? - The share of alternative-fuel cars (which are exempt from charges) have increased dramatically, to the point where the congestion the create may outweigh the benefit of promoting alternative fuels. This is interesting both since it allows us to study the impact of policy measures on vehicle-type choice, and since it creates a "control group" of car drivers not being affected by the charges. - The running cost of the system seems so far to be higher than comparable systems in Norway. (...).

**Keywords:**

Congestion charges, Congestion pricing, Road pricing.

TUE 13<sup>th</sup> (15:30 - 16:45, Session G4.4) Room AIII

ID 2851 R

## **FINANCIAL LAND TOOLS FOR TRANSPORT INVESTMENTS**

Main Author:

**Elena SCOPEL** (*Politecnico University of Milan*)

Co-author(s):

**Francesca MEDDA** (*University College London*)

### **Abstract:**

There is strong evidence showing a clear relationship between transport infrastructure and land value. A literature studies have shown how the construction of transport services raises land and building value of properties that often are owned by few individuals. In this article, a system of land taxation is examined for two reasons. First because, if the infrastructure is funded via a public investment, the land value increase is accrued only to a few beneficiaries in the community, creating a problem of social distribution. Second, because given the limited public budget for building new transportation infrastructure, this taxation can be the most equitable solution to provide financial support for transport investment. This article also analyses different types of land value capture mechanisms, offering an exhaustive panel of financial instruments. It examines, for each tool, the meaning, its aim, application, benefits and disadvantages, suggesting some considerations about their implementations. Then, for each mechanism, it illustrates the principle case studies in the world and it compares them through several indicators, including tax implementation, subjects, duration, and localization on territory. The article shows the application of land value capture tools to the case of Milan, Italy. The city is facing a significant urban development due to the upcoming Expo 2015 as well as to improve mobility problems like congestion. The capture of land value increase is explored as a financial tool to sponsor new transport infrastructure, and the application of the Milan case aims to show the potential and the different facets of the land value capture mechanisms.

### **Keywords:**

Land value capture, Transport investment, Land rent, Milan.

TUE 13<sup>th</sup> (17:00 - 18:15, Session G4.5) Room AIII

ID 1357 R\*

## **A MODEL FOR DEVELOPING OPTIMAL PRICING POLICIES IN PARK-AND-RIDE FACILITIES**

Main Author:

**Konstantinos KEPAPTSOGLOU** (*National Technical University of Athens*)

Co-author(s):

**Matthew KARLAFTIS** (*National Technical University of Athens*)

### **Abstract:**

Park-and-ride facilities are of major importance to the attractiveness and operation of modern transit systems since travellers tend prefer public transportation when they are able to combine its use with their private vehicles. Among those elements examined when developing / operating a park-and-ride facility, is the pricing policy to be established for its users. Indeed, the pricing policy is among those tools that can aid authorities in managing park-and-ride facilities, by providing incentives or discourage parking for various categories of users. In this paper we develop a model for determining the optimal pricing policy for parkand- ride facilities. We then apply the model for a shared-use, park-and-ride facility of the Athens (Greece) Metro network.

### **Keywords:**

Park-and-ride facility, Shared-use, Pricing policy, Pricing scheme, Optimization, Genetic algorithm.

TUE 13<sup>th</sup> (17:00 - 18:15, Session G4.5) Room AIII

ID 2831 R

**CHANGE IN DRIVER'S PREFERENCE FOR PARKING PLACE AFTER THE STRENGTHENED CONTROL OF ILLEGAL PARKING**

Main Author:

**Norio TAJIMA** (*Tokyo Denki University*)

Co-author(s):

**Kazuyuki TAKADA** (*Tokyo denki university*)

**Abstract:**

Illegal parking is one of the factors to cause traffic congestions and traffic accidents. It means that it causes social costs such as loss of time and loss of human resources. In the background of these problems, the Japanese Road Traffic Law (RTL) was amended in 2006 to decrease the number of illegal parking. The main content of this amendment was to consign the role of checking illegally parked vehicles and putting parking tickets on the vehicles to private sectors. National Police Agency of Japan reports that the number of illegally parked vehicles has decreased, and that use of the parking lots has increased. However, more than 50 thousands of vehicles currently illegally park instantaneously in Tokyo. It is necessary to decrease illegal parking thoroughly. Therefore, in this study, change in driver's preference for illegal parking before and after the amendment is analyzed. The questionnaire surveys were conducted before and after the amendment. Binary logit model was applied to estimate parking place choice model. By comparing the elasticity among the estimated models, difference in driver's preference for parking place was clarified.

**Keywords:**

Illegal parking, Parking place choice model, Parking policy.

TUE 13<sup>th</sup> (17:00 - 18:15, Session G4.5) Room AIII

ID 3316 R

**PARKING POLICY EFFECTS ON THE LEVEL OF SERVICE IN URBAN AREAS: A MODELLING APPROACH FOR DECISION MAKING**

Main Author:

**João BERNARDINO** (*TIS.PT - Consultores em Transportes, Inovação e Sistemas, S.A.*)

Co-author(s):

**Maurits VAN DER HOOFD** (*TIS.PT - Consultores em Transportes, Inovação e Sistemas, S.A.*)

**Abstract:**

Parking policy is the most directly available and widely used instrument to manage traffic and parking demand in cities. But the design of policy is subject to difficulties resultant from the complexity of the urban mobility system. Moreover, the emergence of new technologies offers new possible traffic management policy instruments theoretically more economically effective. For both reasons, tools to evaluate the effectiveness and optimal policy design are more needed than ever. This article presents a model framework, based on a System Dynamics approach, aimed to assess the effectiveness of parking policy and identify optimal design. We argue that the approach brings various benefits, and provide indications for its successful wide application in cities. An application to the city of Lisbon is developed, and results are discussed in face of their qualitative generalization and quantitative accurateness and robustness.

**Keywords:**

Parking policy, System dynamics, Urban mobility, Transport demand management.

ID 1114 R

**NETWORK PLANNING FOR MORE EFFECTIVE PUBLIC TRANSPORT IN NZ CITIES**

Main Author:

**John STONE** (*GAMUT Centre, University of Melbourne*)

Co-author(s):

**Paul MEES** (*Royal Melbourne Institute of Technology*)

**Imran MUHAMMAD** (*Massey University, New Zealand*)

**Abstract:**

'Network planning' seeks to design cost-effective public transport services to provide a competitive alternative to the car and meet the growing demand for travel to multiple destinations across the city region. This approach has been successfully adopted in many cities around the world, across a range of sizes and degrees of dispersed suburban development. The key elements of the 'network planning' are: integration of all modes with easy transfers at locations across the city; a clear line structure that is easy for users to learn; direct route alignments with the fastest possible operating speeds and high frequencies where demand is greatest and coordinated timetables elsewhere. This paper reports on research to assess the potential for the network approach to improve the efficiency and effectiveness of public transport in NZ cities. This assessment was done through international benchmarking on a range of urban form and public transport service parameters, and through investigation of current institutions, policies and service patterns for the delivery of public transport in Auckland, Wellington and Christchurch.

**Keywords:**

Public transport, Network planning, New Zealand, International comparisons.

ID 1215 R\*

**A MODELLING FRAMEWORK FOR THE DESIGN OF SUSTAINABLE INTEGRATED TRANSIT SYSTEMS: THE CASE STUDY OF CAMPANIA REGION (ITALY)**

Main Author:

**Vittorio MARZANO** (*Università di Napoli Federico II - Dipartimento di ingegneria dei trasporti*)

Co-author(s):

**Fulvio SIMONELLI** (*University of Naples "Federico II" - Depart.of Transp.Engineering "L.Tocchetti"*)

**Andrea PAPOLA** (*Università di Napoli Federico II - Dipartimento di ingegneria dei trasporti*)

**Abstract:**

The paper proposes a general methodology, applicable to different geographical contexts, for the design of sustainable integrated transit systems (including the minimal transit services definition) through transit market share optimization. The difficulty of this approach is to define proper network design methodologies for an effective maximization of the market share of public transport, that is finding the optimal mix of possible actions (increase in service frequency, new stations, enhanced feeder bus lines and so on). For this aim, the modeling part of the DSS is firstly described and then the network design methodology (including all heuristics adopted for overcoming computationally unfeasible network design procedures) is proposed. Finally, the DSS is applied to some test sites within Campania region (Italy), from the crowded metropolitan area of Napoli to the scarce demand area of countryside towns, by adapting to the specific test site both actions and methodology.

**Keywords:**

Minimal transit service design, Sustainable mobility, Enhancing transit systems.



ID 1893 R

**A DYNAMIC PUBLIC TRANSPORT ASSIGNMENT MODEL WITH STATIC STRATEGIES FOR INCIDENT MANAGEMENT**

Main Author:

**Máximo ALMODÓVAR** (*Escuela Superior de Informática (Universidad de Castilla-La Mancha)*)

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**Eusebio ANGULO** (*Escuela Superior de Informática (Universidad de Castilla-La Mancha)*)

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**Doroteo VERASTEGUI** (*Escuela Superior de Informática (Universidad de Castilla-La Mancha)*)

**Abstract:**

This paper proposes a dynamic transit passenger assignment model as part of a simulation model for public transport networks. The simulation model is based on i) a mixed supply model with capacity constraints, queue models, and fail-to-board estimations, ii) a static user choice model based on a generic strategy generation model and assuming that passengers use the predefined travel strategies under normal situations, and iii) a dynamic transit assignment model for network loading. This model has been tested using real data from the C-5 Line (Madrid regional railways) provided by RENFE Cercanías. Two tests have been used for simulating different transport system configurations and states and evaluating the simulation accuracy. The statistical plots obtained with our testing tool show the system response under some configurations of our model.

**Keywords:**

Dynamic transit assignment, Transit network, Schedule-based, Capacity constraints, Simulation.

ID 2556 R

**AN EVALUATION INDEX OF BUS DIAGRAM TO EQUALIZE ACTIVITY OPPORTUNITY**

Main Author:

**Keiichi KISHINO** (*Kobe University*)

**Abstract:**

While the profit of bus services has been worse, the local government provides the public transport service, which is indispensable to the citizens life, especially in low density population areas. In these areas, it is important to think about equalization of activity opportunity from the view point of fairness when the local government plans the public transport planning. But, the index of scheme assessment that can reflect equalization of activity opportunity is very few. In this research, we proposed a new index that evaluates either bus diagram or public transport plan from the aspect of fairness at the activity opportunity.

**Keywords:**

Local Transport Plan, Securing, Opportunity of Activity.

ID 1341 R

**ENHANCING RAIL CAPACITY USING FREE FARE INCENTIVES TO SHIFT DEMAND PEAKS**

Main Author:

**Graham CURRIE** (*Institute of Transport Studies, Monash University*)**Abstract:**

Major cities worldwide rely on rail to handle large volumes of commuter demand in the morning and evening peaks to efficiently address congestion and environmental concerns. However overcrowding of rail services has now become an endemic problem which acts to reduce attractiveness and constrain growth in rail commuting. New rolling stock and rail lines can address capacity concerns but are costly and can take considerable time to implement. There is a need to find a cheap and quick way to address rail overcrowding. This paper explores the short and medium term outcomes of a new policy measure aimed at managing peak overloading of rail services implemented in Melbourne Australia from March, 2008. The aim of the program was to encourage peak rail passengers to shift travel to trains travelling before the morning peak by offering a free ticket called the 'early bird' ticket which is valid for travellers arriving in the CBD before 7:00a.m. The program costs about \$6M/€ 3.9M p.a. in lost fare revenues (2008) and around 8-9,000 passengers use the free early bird tickets each weekday. Ticket usage is increasing at a rate of 1.7% p.a. while overall rail usage has been relatively stable over the last year. In 2008 a survey found that 23% of free early bird ticket users had shifted their time of travel out of the peak, the equivalent of 2,000 to 2,600 passengers each peak. Previous research in London developed the 'Medium Term Growth Effect' hypothesis which suggests that take-up of pre-a.m. peak travel will take time because passengers need to adjust life styles to enable early commuter travel. Analysis of early bird usage was consistent with this hypothesis since the proportion of all ridership using early bird is increasing by about 1. (...).

**Keywords:**

Travel demand management, Pricing, Rail, Peak pricing, Capacity management.

ID 2740 R

**A TIME-SERIES ANALYSIS ON CHARACTERISTICS OF RAILWAY ROUTE CHOICE BEHAVIOR BY AGE GROUP OF URBAN RAILWAY PASSENGERS**

Main Author:

**Naohiko HIBINO** (*National Graduate Institute for Policy Studies*)

Co-author(s):

**Yoshihisa YAMASHITA** (*Creative Research and Planning Co.,Ltd.*)**Abstract:**

The population in Japan has been declining since 2005. On the other hand, the aged population is growing at a faster pace. The decrease in population and the increase of aging citizens have significant impact on the urban travel demand such as commuting trips. It is therefore necessary to reconsider the railway service system taking into account these new trends. In this study characteristics of route choice of travellers by age groups are analyzed based on transportation census data, which has been collected every 5 year since 1960. The census includes the route from origin zone to destination zone, and also passengers' attributions, such as ages.

**Keywords:**

Urban Railway Planning, Railway Route Choice Behavior, Time-series Analysis, Age Group.

ID 3106 R

**A STUDY ON CHARACTERISTICS OF TRAIN STATION PASSENGER FLOWS FOR TRAIN DELAY REDUCTION**

Main Author:

**Naohiko HIBINO** (*National Graduate Institute for Policy Studies*)

Co-author(s):

**Yoshihisa YAMASHITA** (*Creative Research and Planning Co.,Ltd.*)**Keiji KARIYAZAKI** (*Institute for Transport Policy Studies*)**Shigeru MORICHI** (*National Graduate Institute for Policy Studies*)**Abstract:**

In Tokyo Metropolitan Area, a railway network has been developed to reduce train congestion and impedance of transfers at stations through providing high frequency train operation. In addition, passengers have become able to ride other lines without transferring thanks to the introduction of inter-connected through service, which allows different railway companies to share lines. Unfortunately, negative impacts, notably train delay, are currently caused by the high frequency operation. The train delay is caused by not only the overcrowded train schedules but also the congestions at railway stations. In fact, passengers choose train doors in consideration of crowded condition at the platform as well as the structure of departure and/or arrival stations. An overconcentration to a door of a train often lengthens the dwell time of that train. This study focuses on the passenger flow at station and develops a simulation system to reproduce the complex passenger's walking behaviour taking into account the station facilities. Using this system, the paper describes the acquired knowledge that could be useful to the examination of measures to decreasing train delay.

**Keywords:**

Urban Railway Planning, Train Delay, Passenger's Flow at Railway Station.

ID 1020 R

**PUBLIC URBAN TRANSPORT, TRAVEL BEHAVIOUR AND SOCIAL EXCLUSION - THE CASE OF SANTIAGO DE CHILE**

Main Author:

**Regina WITTER** (*EPFL-ENAC-LASUR*)**Abstract:**

What are the social impacts of a new but problematic public transport system in a city known for its inequalities concerning access to daily activities and participation in urban life? More in detail, what are the implications of a re-regulated transport service, if the city has previously gone through a long period of de-regulated services? Are the changes just related to distorted accessibility conditions, or are there further implications for people's mobility competences and travel behaviour, and what does that mean for the manifestation or dissolution of social inequalities? With a specific regard to those interests, the paper intends to identify how the public urban transport policy and system has affected the dynamics of social inequalities, focusing particularly on the case of Santiago de Chile. There the public transport policy has developed from a de-regulation period in the 1980s to a re-regulation since the 1990s, which has had an important impact on users' travel habits and the citizens' image of public transportation. During the deregulation period the service was characterized by an uncoordinated, private bus-oversupply, complementary to the efficient public metro. In order to suspend the stigmatization of public transportation as 'mode for the poor', the sophisticated 'Transantiago' bus system was implemented in February 2007. Unfortunately, the ambitious project failed, due to a set of technical and social issues. Being aware of the importance of the technical errors, the own research concentrates on the social implications related. So the Transantiago appropriation process by the inhabitants in the first three years of existence is examined. The paper consists of six basic parts: After an introduction into the topic (1), the theoretical framework is exposed, dealing with the so-called motility concept and the risks of social exclusion due to transport (2). (...).

**Keywords:**

Public transport policy, Transport regulation, Social equity.

ID 1479 R

**URBAN TRANSPORT, ENVIRONMENTAL JUSTICE AND HUMAN DAILY ACTIVITY PATTERNS**

Main Author:

**Philine GAFFRON** (*Institute for Transport Planning and Logistics - Hamburg University of Technology*)

**Abstract:**

Emissions from road transport (such as noise, particles and gasses) have been associated with issues of environmental justice in urban areas. The majority of analyses of this issue to date have focussed on identifying potentially or actually affected socio-economic groups by income, education, employment situation and ethnicity. However, in addition to people's residential locations, their daily patterns of time use in conjunction with traffic flows also play a major role in determining their level of exposure to transport emissions. Through analysing time use surveys (TUS) to establish human daily activity patterns (HDAP) in terms of time spent at home, this paper shows that the parameters age and gender are at least as important in identifying groups that are disproportionately affected by road transport emissions in their homes in urban areas as income, education and employment situation.

**Keywords:**

Environmental justice, Time use, Human daily activity patterns, Road traffic patterns, Transport, United Kingdom, Germany, Hamburg.

ID 1545 R

**TELECOMMUTING AS A STRATEGY FOR REDUCING ENERGY CONSUMPTION AND GREENHOUSE GAS EMISSIONS IN MULTI-NUCLEATED URBAN REGIONS**

Main Author:

**Ata KHAN** (*Carleton University, Dept. of Civil & Environmental Engineering*)

**Abstract:**

This paper describes the potential of telecommuting in reducing the consumption of petroleum-based fuels and greenhouse gas emissions in the transportation system of a multi-nucleated urban region. The formation of multi-nucleated urban regions and commuting needs are described. In support of the sustainability objective, telecommuting as a supplemental measure to providing a balance of jobs and housing in satellite community centres is noted. Telecommuting is described in conceptual and operational terms and its potential influence on residential location choice decision is noted. As a part of a case study of telecommuting in the National Capital Area (Canada), a Bayesian decision model is advanced that can explain the acceptance of telecommuting by an employee. Fuel saving and greenhouse gas emissions reduction potential of telecommuting is described and finally conclusions and policy implications are presented.

**Keywords:**

Multi-nucleated urban region, Land use, Information technology, Telecommuting, Urban transportation, Fuel consumption, Green house gas emissions.

ID 2230 R

**IMPLEMENT HUMAN RESOURCES DEVELOPMENT FOR "MACHIZUKURI" AND INTEGRATED TRANSPORTATION POLICY.: A PRACTICE OF**

Main Author:

**Tsutomu DOI** (*Kobe International University*)

Co-author(s):

**Takehiko DAITO** (*Transportation System Studies Laboratory Co., Ltd.*)**Toshimichi MURAO** (*Kyoto Pref.*)**Kenichi SHOJI** (*Kobe University, Graduate School of Business Administration*)**Dai NAKAGAWA** (*Kyoto University*)**Yutaka HONDA** (*Hyogo Pref.*)**Tohru HIGASHI** (*ISSR*)**Abstract:**

Policy measures to counter individual transportation related issues (i.e. pedestrian, bicycles, motor vehicles and public transportations) tend to be insufficient in modern society that has become so complex. A more comprehensive discussion on desirable form of urban regions should take place first, and then transportation policy should be discussed as a means to reinforce and implement the desired city policy. It is essential that, in this process, we holistically discuss transportation systems with multiple modes, and develop a road-map to plan and implement integrated transportation policy. In addition to the accumulation of our knowledge such as travel behavior analysis as well as other theoretical and empirical findings, it is indispensable that as society we raise professionals who coordinate complicated interests of numerous fields involved in the cities. In Japan, unfortunately, it is naive to assume that we have sufficient supply to practitioners who possess organizational background to promote integrated transportation policy with know-how to implement in the communities. "Saisei-Juku" is a non-profit organization that we have established to foster professionals who can carry on integrated transportation policy in synchronization with other efforts for improving our communities. The name could be defined as the Revitalization Private School toward Sustainable Community and Transportation. The School offers various activities such as one-day seminars where participants can learn the latest trends of urban transportation policy. (...).

**Keywords:**

Integrated Transportation Policy Human Resources.

ID 2863 R

**THE MODAL DIVERSION INDUCED BY HIGH QUALITY PUBLIC TRANSPORT: USE OF ATTITUDINAL VARIABLES FOR TRAVELLERS? SEGMENTATION**

Main Author:

**Cristina PRONELLO** (*Politecnico di Torino*)

Co-author(s):

**Valentina RAPPAZZO** (*Politecnico di Torino*)**Abstract:**

Traffic congestion due to excessive car use and its negative impacts on environment and people health really affects the life quality in metropolitan areas. Among possible transport solutions being recently experienced, high quality public transport systems, particularly metro and light rail, are wished to become a concrete alternative to car use. This paper aims at investigating, for different groups of transit users, the rate of modal diversion, from private motorized to collective transport, induced by the new VAL system, introduced in 2006 in the city of Torino. To this extent, an ad hoc survey has been designed and addressed to metro and surface public transport users. The Exploratory Factor Analysis let recognize two latent constructs on which the K-means Cluster Analysis has been applied, allowing to individuate four different clusters: "thrifty and quality focussed", "highly quality focussed", "PT supporters for necessity", and "thrifty and not quality focussed" riders. The travellers' segmentation suggests to invest money in improving public transport quality and image through a proper advertising, in order to get the users to like it and making it perceived as smart and cool. In this way, public transport could attract individuals having high profile status and income. In addition, making private transport more uncomfortable and expensive, through the introduction of strong constraints on parking (reducing parking places) and increasing its cost, could induce to divert car lovers who use it both for sake and out of opportunism.

**Keywords:**

Modal diversion, High service quality, Public transport, Market segmentation, Travel behaviour, Attitudes, Habits, Sustainable mobility, Transport policies.

ID 1553 R

**AN OPTION GENERATION TOOL FOR POTENTIAL URBAN TRANSPORT POLICY PACKAGES**

Main Author:

**Anthony MAY** (*Institute for Transport Studies*)**Abstract:**

Several studies have indicated that option generation - the development of a range of strategic policy options to tackle identified transport problems – is the weakest link in current transport planning practice. Local authorities all too often limit themselves to pre-conceived solutions, focus on supply-side rather than demand-side policies, and are unaware of the potential of novel solutions. This is even more the case for the development of packages of policy instruments, in which each can be expected to support the others by making it more effective or easier to implement. A decision-support tool has been developed, based on the transport policy knowledgebase, KonSULT, which generates possible policy packages. It can do this in one of two ways: by taking a single user-specified policy instrument, and identifying the other policy instruments in KonSULT which might best support it; or by taking a userspecified shortlist of up to ten policy instruments, and identifying those combinations which might perform best in the specified context. In both cases the user specifies whether the emphasis should be on synergy or on the resolution of barriers. The tool then uses a matrix of interaction scores based on the literature and on professional judgment. Further research has since been carried out to provide improved estimates for the synergy interaction scores. The paper describes the development and application of the tool. It reports the results of the further research, and discusses future developments.

**Keywords:**

Urban transport, Option generation, Policy packages, Synergy.

ID 2515 R

**URBAN MOBILITY AND PUBLIC POLICIES AT A CROSSROADS**

Main Author:

**Yves CROZET** (*LET Lyon*)

Co-author(s):

**Gebhard WULFHORST** (*Technische Universität München*)**Abstract:**

How accessibility shapes land use? Giving this title to his founding paper, in 1959, W. Hansen offered us a promising concept to analyse urban dynamics and urban shape. Fifty years later, introducing accessibility measurement within GIS-tools helps us to understand why transportation policies are, in urban areas, at a crossroad. In a large number of European cities, transport policies are about to face major shifts. In places where, some years back, road and highway projects were favoured, other priorities are materialising. Many elected representatives of large cities have opted for the development of public transit and also public bikes. Everything goes as if car mobility had no priority any more, while it still represents the bulk of transportation. In this paper, we use the concept of accessibility defined by Hansen. Directly inherited from cost benefit analysis, i.e. giving an important role to individual time gains, gravity accessibility should now lead paradoxically to a new approach of collective interest and assessment of strategies and measures, based on space usage. Sustainability issues are pushing forward the need of accessibility obtained by improving the urban functions within the catchment areas of pedestrian trips, cycling and transit rather than by increasing the catchment area by higher car speed.

**Keywords:**

Accessibility, Urban mobility, Public policies, Sustainability, GIs.

ID 2722 R

**WILL IT BE POSSIBLE TO ACHIEVE A SIMPLER AND EFFICIENT FARE STRUCTURE? ? CASE STUDY OSLO**

Main Author:

**Kjell JANSSON** (*Royal Institute of Technology Stockholm (KTH)*)

Co-author(s):

**Truls ANGELL** (*Ruter AS*)**Abstract:**

In many cities in the world zone systems are used for public transport fares. Such systems may very well approximately accord with economically efficient pricing. The reason is that zones can vary with size and location so that prices can approximately reflect the social marginal costs of journeys. We believe, however, that many cities use an excessively large number of zones, which is not necessary and complicated for the passengers. In this paper we hope to be able to demonstrate that such a complicated zone systems can be substantially simplified while maintaining or even improving economic efficiency. We will describes how the zone fare structure in the city of Oslo can be improved, but also implementation difficulties including conflicting distribution issues etc. in the political process, The political aim is now to introduce the new system early in 2011. The basis for this paper is a work financed by Ruter AS, the public transport authority in the Oslo region (Oslo and Akershus), Norway. The result of the work is found in Ruter As (2008) and Jansson (2008).

**Keywords:**

Fare structure, Zone system, Efficiency, Integration, Simplification, Distribution, Political process.

ID 3043 R

**PORTUGUESE PUBLIC SECTOR INVOLVEMENT IN URBAN TRANSPORTATION SYSTEMS: A COMPARATIVE AND CRITICAL ASSESSMENT**

Main Author:

**João FERREIRA** (*Faculty of Economics, University of Coimbra*)

Co-author(s):

**Eduardo BARATA** (*GEMF - FEUC*)**Luís CRUZ** (*GEMF - FEUC*)**Abstract:**

The emerging collapse of the mobility paradigm based on the mass use of automobile and high levels of exhaustible resources consumption, as been cited as an additional reason in favour of public transportation systems capable of matching the growing needs of commuting for workplaces and services. In Portugal, the public sector (central and/or local governments) has major historical responsibilities in the supply and management of urban transport systems. Currently, the Portuguese Central Government has significant direct influence concerning the financing and administration of two companies of urban road passenger's transport systems located in high density areas of Lisbon and Oporto. Simultaneously, there are four local governments which decided to create and develop corporations or municipal services with the purpose of implementing public passenger's transportation systems within their own municipalities. Concerning the existing public sector transportation networks and the distinction between local and central government systems involvement, this research paper aims to present a set of indicators in order to improve the knowledge on the impacts of each of these transportation companies, considering different dimensions such as the municipality population, the network size, the quantity and quality of the services provided, the productivity of these transport services and their level of sustainability. This critical and comparative analysis is expected to decisively contribute to a deeper understanding of the current reality of road urban transportation in Portugal.

**Keywords:**

Public Transport, Performance Indicators, Subsidies.

ID 3053 R

**MEGA URBAN TRANSPORT PROJECTS AND RISKS :  
WHAT PLANNING, FINANCING AND EVALUATION CAN  
BE LEARNED ? THE CASE OF A PUBLIC PROJECT  
(MÉTÉOR, MÉTRO LINE 14, PARIS, FRANCE)**

Main Author:

**Geneviève ZEMBRI** (*Université de Cergy-Pontoise (cedex, France)*)

**Abstract:**

The planning, evaluation, financing and construction of mega urban transport infrastructures is characterised by considerable complexity and risks of a social, institutional, political, financial, technical and environmental nature. The aim of this article is to provide a critical assessment of the practices used by players during the planning and construction of the Météor automated metro line in Paris (France). This line is a public project. It is one of the highest performance lines on the Paris metro network. The article shows that the public decision-making process used for Météor can be compared with a closed system. This had consequences on the project results, including the impossibility of respecting the objective of reducing congestion on line A of the regional express network railway (RER) which is saturated as a result of high traffic levels. However, certain other objectives were attained. A critical analysis of the decision-making process and the planning, evaluation and financing practices used by the Météor decision-makers provides a series of conclusions and good practices applicable to public projects, closed public decision-making processes, project evaluations, transport planning and town planning, as well as the design and management of projects.

**Keywords:**

Planning, Financing, Evaluation, Transport infrastructures, Metro, France.

ID 1196 R

**BODY AND THE CITY: THE IMPASSABLE SPACE  
BETWEEN STREETS**

Main Author:

**Giovani ÁVILA** (*Universidade Federal do Rio de Janeiro - COPPETEC*)

Co-author(s):

**Maria DA GLÓRIA BRANDÃO** (*UFRJ*)

**Othon JOSÉ SILVA** (*UFRJ*)

**Abstract:**

While walking by foot is a way to move from one place to another, it is reasonable to take into account that the sidewalks are also an important component of the transportation systems, linking urban equipments. Usually the sidewalk is disregarded, which is a common misunderstanding. Regarding the fact that the sidewalk is used by any kind of people, such as youth, old, healthy, ill, deficient and so on, it's necessary to have in mind that it must be free and adapted to facilitate the locomotion, attending the desired level of service and improve the transportation systems performance as a whole. This paper intends to describe the sidewalk's main problems in the urban accessibility in developing countries, relating them with political decisions and their consequences in short and medium terms. It presents political aspects that should be considered in the decision-making process and also recommends a procedure to rebuild the desired level of service in areas with advanced conurbation stage in developing countries. The metropolitan area of Rio de Janeiro was studied and this case study is presented here, in which several types of government interventions are discussed, their relation to the government policies adopted, their consequences and the results achieved.

**Keywords:**

Urban Transport Planning, Policy and Management.



ID 1554 R

**TRANSFERRING RESEARCH ON SUSTAINABLE URBAN TRANSPORT POLICY INTO PRACTICE**

Main Author:

**Anthony MAY** (*Institute for Transport Studies*)

Co-author(s):

**Greg MARSDEN** (*Institute for Transport Studies, University of Leeds*)**Simon SHEPHERD** (*University of Leeds*)**Abstract:**

It is widely accepted that cities understand what action is needed to achieve greater sustainability in urban transport, but that there are several barriers to the pursuit of such actions. While research is able to suggest ways of overcoming these barriers, the process of transferring research results into practice is itself uncertain. This paper focuses on experience of such policy transfer and on ways of improving the process. The principles of policy transfer are presented, together with a summary of the requirements for effective policy transfer highlighted in case study cities in Europe and North America. The limits on policy transfer are illustrated based on experience in a five year UK research programme, DISTILLATE, which developed decision-support tools designed to help overcome the barriers to sustainable urban transport policy. The programme resulted in a set of 18 decision-support tools, and an overarching web-based tool designed to help local authorities identify the tools which were most appropriate to their needs. The paper considers in detail experience in the dissemination of five of the outputs produced. It compares that experience with the findings of research on the policy transfer process. Recommendations are drawn for further research, and for ways of transferring such research more effectively into practice.

**Keywords:**

Urban transport, Decision-making, Dissemination.

ID 1868 R

**UNCONVENTIONAL FACTORS OF EFFICIENCY IN PUBLIC TRANSPORT. A CASE STUDY AND THEORY**

Main Author:

**Paolo BERIA** (*Politecnico di Milano*)

Co-author(s):

**Raffaele GRIMALDI** (*Politecnico di milano*)**Abstract:**

In this paper we analyse some possible unconventional factors of efficiency in public transport. The occasion for such analysis raises from a case study in the southern Italian region of Sicily. Most of the regional bus service is here historically franchised to some local private bus companies, without tenders or any other form of competition. The structure of the network has never been planned ex-ante, as it is the result of negotiations among bus companies, local and regional authorities. Though this situation is obviously quite far from indications of the regulation theory, it results in a surprisingly efficient system, with very low unit costs. An analysis of this situation is here carried out in the light of the theory of regulated monopolies, in order to understand which factors are forcing those companies to be efficient and which problems this situation may generate. The quality of the offered service is also reckoned. Two factors seem to be most relevant to these results: the relatively low level of subsidies and the fact of having private operators (rather an exception than a rule in Italy). In order to improve their efficiency, those companies also merged together but eventually split again in the last decades, suggesting the presence of possible diseconomies of scale in the sector. Taking for granted that a form of regulation is needed, it is here suggested that regulatory strategies should adapt to this counterintuitive fact, preferring medium sized tenders rather than large ones, not only for granting more contestability, but also for financial reasons.

**Keywords:**

Regulation, Bus, Economies of scale, Public transport.

ID 2020 R

**STRATEGIC CROSS ASSESSMENT MODEL FOR SUSTAINABLE URBAN TRANSPORT UNDER THE DEPOPULATING SOCIETY**

Main Author:

**Masanobu KII** (*Kagawa University*)

Co-author(s):

**Kenji DOI** (*Kagawa University*)

**Abstract:**

One of the central issues in decision making for urban transport is to identify and choose the most sustainable solutions among a wide spectrum of alternatives, involving a large number of stakeholders with multiple, often conflicting objectives. Their objectives range from provision of cost effectiveness transport service, through provision of fair and equitable accessibility to opportunities, to realisation of safe and environmentally friendly mobility style. These can hardly be achieved by a single policy instrument, and therefore require integrated strategies including a) infrastructure provision and management, b) attitudinal measures influencing people's travel behaviours and lifestyles, c) land use measures shaping transit supportive urban structures, and d) pricing.

**Keywords:**

Sustainable urban transport, Compact city, Strategy.

ID 2273 R

**STUDY ON THE FACTORS TO MAKE STREETS LIVELY AND BRIMMING WITH PEOPLE - FIELD SURVEYS ON HISTORIC CITIES AROUND THE GLOBE: KYOTO, FLORENCE, AND SEOUL -**

Main Author:

**Tetsu OBA** (*Kyoto University*)

Co-author(s):

**Ryoji MATSUNAKA** (*Kyoto University*)

**Dai NAKAGAWA** (*Kyoto University*)

**Dongwook PARK** (*Kyoto University*)

**Abstract:**

Due to growing motorization after World War II, streets and their surrounding in Japan have been developed mainly to accommodate automobiles, bringing more vehicles into city centers and causing traffic jams and environmental pollution. This development style has resulted in less vibrancy in a lot of cities, especially historic cities, which have been unable to cope with the ever-increasing automobile traffic. Hence, the charm of cities has decreased significantly. People have recently realized that increasing the charm of streets effectively revitalizes urban cores. The current global trend is that people seek areas with lively streets brimming with people. Despite this trend, there have not been adequate studies to identify important factors necessary to create attractive urban streets full of pedestrians. To understand the current status of streets, we measured the vibrancy of streets in 1) Kyoto, Japan, 2) Florence, Italy, and 3) Seoul, Rep. of Korea using field surveys to quantitatively clarify factors necessary for vibrant streets in each city. The field surveys examined 1) the vibrancy of streets, 2) parking conditions for vehicles along streets, 3) pedestrian zones, and 4) other surrounding factors such as commodity stores, parking lots, and style of road connections. The results indicate that improving pedestrian-centered space positively impacts streets, making them lively and brimming with people, whereas parked vehicles on the streets negatively contribute to vibrant streets.

**Keywords:**

Street, Vibrancy, Pedestrian, Parking condition.

ID 1615 R

**AN ANALYSIS OF THE LEVEL OF EXPENSE BURDEN FOR THE USER OF CAR TRANSPORTATION**

Main Author:

**Yusuke SUZUKI** (*Kobe University, Graduate School of Business Administration*)

Co-author(s):

**Kenichi SHOJI** (*Kobe University, Graduate School of Business Administration*)**Abstract:**

In Japan, the aspects related to road user cost, such as abolishment of the provisional tax on gasoline and tolls on highways, are political issues. However, a discussion regarding the socially preferable level of road user cost has not been conducted thus far. In this paper, we first estimate the external cost of motor vehicles for different regions in Japan. On the basis of the results obtained from this estimation, we consider the mechanism of road user cost that corresponds with the level of external cost of motor vehicles. According to the Pigovian tax theory, road user costs must correspond with the marginal social cost of motor vehicles. In particular, we believe that the optimum level of road user cost is liable to vary from region to region because the external cost in each region varies considerably depending on traffic conditions. In this study, we estimate the external cost of motor vehicles in Japan according to prefecture and vehicle type, taking into account every region's traffic conditions; moreover, we reveal the features of regional external costs of motor vehicles. The remainder of this paper is structured in the following manner. In section 2, we present an outline of automobile-related taxes. In section 3, we first discuss previous studies on external cost and then explain the method used by us for estimating external cost of motor vehicles. Thereafter, based on the equations obtained, we estimate the external costs of motor vehicles using a data set of 47 prefectures in Japan. Finally, based on our results, we consider road user cost in Japan.

**Keywords:**

Car transportation, External cost, Road investment.

ID 2251 R\*

**ACCEPTABILITY OF INTELLIGENT SPEED ADAPTATION. RESULTS FROM A LARGE-SCALE WEB-BASED SURVEY IN BELGIUM AND THE NETHERLANDS**

Main Author:

**Sven VLASSENROOT** (*Ghent University / Delft University of Technology*)

Co-author(s):

**Karel BROOKHUIS** (*Delft University of Technology / University of Groningen*)**Johan DE MOL** (*Ghent University*)**Vincent MARCHAU** (*Delft University of Technology*)**Frank WITLOX** (*Ghent University*)**Abstract:**

Several trials with different types of ISA have shown that ISA can be an efficient and effective way to reduce speed and speeding. In our research we ask the question if there will be acceptability of ISA by the public? Different methods and theories were used to distil the most relevant determinants that could influence acceptability. Based on these determinants a web-survey was held: 6370 individuals responded in Belgium (Flanders region) and 1158 persons in The Netherlands. In our questionnaire the respondents indicated that their own driving behaviour is of great influence on accidents and traffic safety, instead of environmental issues like infrastructure or even other drivers. Even more, the respondents indicated that ITS could be beneficial to support their driving behaviour. It was noted that there is a high market potential for Advanced Driving Assistance Systems (ADAS). 95% of the respondents are in favour of ISA. Seven out of the drivers want to have an informative or warning system. Three out of ten drivers wanted to go even further and choose to have a supportive or even a restricting type of ISA. Drivers would only choose for more restricting systems if the penetration level is high enough.

**Keywords:**

Acceptance, Public Support, Intelligent Speed Adaptation.

ID 2266 R

**LONG TERM AUTOMOBILE OWNERSHIP AND MILEAGE TRENDS BY INCOME CLASS IN FRANCE, 1975-2008**

Main Author:

**Elise BOUCQ** (INRETS)

Co-author(s):

**Jean-Loup MADRE** (INRETS - DEST)**Roger COLLET** (INRETS (French National Institute for Transport and Safety Research))**Laurent HIVERT** (INRETS (French National Institute for Transport and Safety Research))**Abstract:**

For each quartile of income per consumption unit, annual time-series have been estimated from panel surveys, with annual waves of observations since 1974: - INSEE2 Households' "Conjoncture" survey from 1974 to 1994, - panel "Parc-Auto"3 Sofres4 since mid-80's. In these data sources, household behaviour is described through: - car ownership (percentage of households with at least one car, of which percentage of multi-car households, average number of cars per adult over 18, which is the minimum age for driving license in France), - car use (annual mileage per household or per car). The repeated sample structure of data has been used for improving the accuracy of timeseries of variables highly correlated for subsequent years [Cochran, 1977]. In mid-70's, car ownership and use were quite low for the poorest income quartile, but the difference has much decreased with all the three higher income groups, which are more homogeneous. Thus, multi-car ownership, which is mainly structured by geographic and demographic determinants, has slowed down -but not reversed- the social diffusion of automobile. As the curves representing car ownership (number of cars per adult) and car use (annual mileage per household) seem to become quite horizontal during the most recent period, logistic curves have been estimated according to time, then to real income. For each quartile of the distribution of households by income per consumption unit, saturation thresholds are estimated, as well as the date of the point of inflection. The relationship between temporal elasticities (for each quartile) and cross-sectional income elasticities, which can be considered as a measurement of inequality at each point in time, will be discussed [Gardes and Madre, 2005]. (...).

**Keywords:**

Panel, Automobile, Car ownership, Car use, Income inequalities, Saturation, France.

ID 2704 R

**VEHICLE DURABILITY AND COMPULSORY INSPECTION AND MAINTENANCE**

Main Author:

**Junya FUKUMOTO** (Tohoku University)

Co-author(s):

**Yuta GOTO** (Sendai City)**Abstract:**

Vehicle inspection and maintenance (I/M) are generally considered to be indispensable for traffic safety and low environmental damage. Many countries have been managing compulsory I/M programs. However I/M program is not free of cost and drivers must bear the large part of its cost. Therefore, it has been argued repeatedly whether regulations relevant with I/M programs should be tightened or reduced. In this study, we estimate the deterioration curve of vehicles and assess the impact of regulatory reform of Japan's I/M programs. The most distinguished point of this study is estimating the deterioration curves of 67 items comprising vehicles. The results show that the previous estimation results of the social impacts of regulatory reform of Japan's I/M programs by the government committee are possibly overestimation.

**Keywords:**

Vehicle inspection and maintenance, Failure rate, Deterioration, Hazard model.

ID 2917 R

**EFFECT OF GASOLINE PRICES ON VMTs (VEHICLE MILES TRAVELLED): AN EXPLORATORY ANALYSIS OF NORTHERN VIRGINIA TRAFFIC BASED ON GRANGER CAUSALITY**

Main Author:

**Kingsley HAYNES** (*Dean, School of Public Policy, George Mason University*)

Co-author(s):

**Rajendra KULKARNI** (*School of Public Policy, George Mason University*)

**Roger STOUGH** (*George Mason University*)

**Abstract:**

From the 2nd quarter of 2007 onwards through much of the 2008, U.S. consumers experienced an unprecedented hike in gasoline prices. It is believed that this may have changed the travel demand behaviour resulting in less vehicular travel traffic. For example, the U.S. DOT's monthly statistics at the state and national level have shown a net decline of more than 100 billion Vehicle Miles Travelled (VMT) in 2008 compared to 2007. The U.S. DOT statistic is based on a few thousand locations spread across more than tens of thousands of miles of road network. In other words, while such measurements when aggregated to national level may be representative of the travel demand at the national level, it is difficult to gauge how VMTs change at the regional and sub-regional level due to changes in regional gasoline prices. In this paper we propose a novel approach based on a simple but powerful concept of Granger causality. This unique approach will help determine whether the relationship between gasoline prices and VMTs is characterized by simultaneity or there exists a direction of causality such that increased gasoline prices result in reduced VMTs. In the later case, the extent to which VMTs respond to gasoline prices will be determined. For this purpose we use weekly traffic counts on major traffic corridors in the Northern Virginia region as a proxy for the VMTs and determine their relationship with the regional weekly gasoline prices based on the Granger causality. The weekly traffic counts are computed based on actual vehicle counts collected at vehicle sensors throughout the year on major corridors in the Northern Virginia road network. For the first time, we evaluate data from Reversible High Volume Occupancy (RHOV) lanes. (...).

**Keywords:**

Granger causality, Econometrics, VMT, ADMs.

ID 1388 R

**TRANSPORT AND SOCIAL EXCLUSION: WHERE ARE WE NOW?**

Main Author:

**Karen LUCAS** (*Transport Studies Unit, University of Oxford*)

**Abstract:**

The late 1990s and early 2000s witnessed a growing interest amongst UK academics and policy makers in the issue of transport disadvantage and, more innovatively, how this might relate to growing concerns about the social exclusion of low income groups and communities. Early academic studies began to make more explicit the links policy between poverty, transport disadvantage, access to key services and economic and social exclusion (see for example Church and Frost, 2000; TRaC, 2000; Lucas et al 2001; Kenyon 2003; Kenyon et al, 2003; Hodgson and Turner, 2003; Raje, 2003). In 2003, the UK Social Exclusion Unit published its now internationally recognised report on this subject, which subsequently resulted in the development of a set of transport policy guidances to local authorities in England to deliver what is now commonly referred to as accessibility planning as part of their Local Transport Plans (Department for Transport, 2006). Since this time, researchers, policy makers and practitioners in several other countries have become interested in adopting a social exclusion approach to transport planning, largely because of its utility in identifying the role of transport, land use planning and service delivery decisions in creating and reinforcing poverty and social disadvantage. Seven years on from the SEU report, we can begin to reflect on whether adoption of the accessibility planning approach to transport has been successful in encouraging a more socially inclusive transport system in the UK, and/or in addressing the problems of transport related social exclusion. The paper begins by briefly revisiting the basic theories and core definitions which underpin and inform a social exclusion perspective. (...).

**Keywords:**

Transport disadvantage, Social exclusion, UK policy.

ID 2502 R

**TRANSPORT CONSUMPTION INEQUALITIES AND REDISTRIBUTIVE EFFECTS OF TAXES: A COMPARISON OF FRANCE AND THE UK**

Main Author:

**Akli BERRI** (*INRETS*)

Co-author(s):

**Joyce DARGAY** (*Institute for Transport Studies*)**Abstract:**

This paper evaluates household transport consumption inequalities in France and the UK, investigates their temporal dynamics and estimates the redistributive effects of taxes on various commodity categories. A decomposition by expenditure component of the Gini index is applied, using household-level data from repeated cross-sections of expenditure surveys spanning long time periods. The results highlight the effect of car social diffusion. The relative contribution of vehicle use items to total expenditure inequality decreases over time, thus reflecting the more and more widespread use of the car. Moreover, fuel taxes become regressive (i.e. they affect the poor more than the rich), while the progressive character of taxes on the remaining car use commodities weakens with time. Therefore equity issues should not be ignored when designing policies to attenuate the environmental impact of cars. Increasing car use costs, notably fuel prices, through an increase of uniform taxes would be particularly inequitable.

**Keywords:**

Inequality, Transport consumption, Household expenditure surveys, Gini index, Decomposition by component, Redistributive effects of taxes.

ID 2589 R

**SOCIAL IMPACTS OF HIGH SPEED RAIL PROJECTS: ADDRESSING SPATIAL EQUITY EFFECTS**

Main Author:

**Andres MONZON** (*Universidad Politécnica de Madrid*)

Co-author(s):

**Emilio ORTEGA** (*TRANSyT*)**Elena LOPEZ** (*TRANSyT*)**Abstract:**

Equity issues are increasingly included among social impacts of transportation investments. Equity implications take into account the distribution of effects among different societal groups (social equity) or regions (spatial equity). The analysis of the spatial distribution of effects is crucial, as certain transportation investments may contribute to increase imbalances between regions, i.e. negative spatial equity impacts. The planning process of a new high speed rail (HSR) corridor should take into account these equity considerations. HSR specific features make it a serious candidate to result in negative equity impacts. These are mainly the significant differences in commercial speeds between HSR and conventional rail, and the spatial separation between HSR stations. In this context, this paper describes and validates a methodology to assess spatial equity impacts of HSR based in the calculation of accessibility indicators. Accessibility analysis is a special type of spatial analysis technique which is increasingly used to assess spatial equity impacts of transportation investments. The proposed methodology is intended to support transport planners when confronted with the task to optimize efficiency and equity objectives. The validity of the methodology is tested with its application to alternative corridor developments of the Spanish HSR network based on the 2020 scenario included in the Spanish Strategic Transport and Infrastructure Plan 2005-2020 (PEIT). The case study application shows that the results are heavily influenced by the selection of the accessibility indicator, each one providing a complementary perspective on equity measurement. In addition, results highlight the important role played by the selection of the commercial speed. (...).

**Keywords:**

Spatial equity, Social impacts, High speed rail impacts.

ID 2601 R

**PUBLIC TRANSPORT AS A SOCIAL INCLUSION TOOL  
IN RURAL AREAS**

Main Author:

**Sofia MARTINS** (*VTM - Consultores de Engenharia*)**Abstract:**

The territory is not just a set of places. It is also, and more often, a set of movements that connect these places and determine the extent and forms of appropriation of the urban space. The provision of Public Transport services in rural areas of small size is essential for the development of such settlements, enabling people to solve most of their problems of isolation and social exclusion. These are often associated with the lack of transport alternatives that allow them to achieve sustainable patterns of mobility. If in urban areas the policy is to encourage the abandonment of Private Cars in support of Public Transport, in rural areas the trend has been precisely the opposite, under penalty of losing the connection with services and equipment located in nearby towns. The introduction of an alternative mode of transport also allows rural population to increase their quality of life by providing mobility to people who are deprived of their own means, (senior citizens, youth, students, and people without car, among others). Thus, the development of an integrated network of transport in small size rural areas can be seen as a way to improve the mobility of these people, promoting their access to several activities, not just those considered basic, such as health and education, but also to a wide range of others that make up life in society, such as cultural and sports facilities, etc.... This introduction may be linked to the process of regional development and modernization, and the creation of a new mean of Public Transport seen as an active policy of local development and redistribution of social benefits, allowing shorter distances and more accessible travel. Taking into account the effects caused by the lack of Public Transport in areas of low population density - essentially due to the low attractiveness of the traditional Mass Transit market - these proposals are made so as to introduce innovative actions in the treatment given to the collective transport systems, either by creating services originally conceive to carry out other functions (making them more flexible), or creating new services that maximize efficiency and lower costs. (...).

**Keywords:**

Transportation in Rural Areas, Alternative Public Transportation, Demand responsive Transport, Collective taxi, Combined Transport, Feeders.

ID 2663 R

**SOCIAL EQUITY, ACCESSIBILITY AND THE  
TEMPORAL DIMENSION OF PUBLIC SERVICE  
DELIVERY**

Main Author:

**Tijs NEUTENS** (*Ghent University*)

Co-author(s):

**Tim SCHWANEN** (*University of Oxford*)**Matthias DELAFONTAINE** (*Ghent University*)**Abstract:**

In the past two decades urban time policies have been proposed and implemented in many European cities as a complement to traditional spatial planning methods. Such policies seek to provide an answer to the growing number of people facing time problems as a result of an erosion of collective time rhythms and a desynchronization of different time structures of urban life. Particular emphasis is being placed on the reconciliation of opening hours of public service facilities with the travel and activity patterns of citizens in order to increase individual accessibility to urban services. In spite of the increasing relevance of time policies, only limited quantitative research has been conducted about the relationships between opening hours and accessibility. This paper seeks to extend this line of inquiry by exploring if and to what extent the accessibility of public facilities can be ameliorated by redesigning the timetables of service delivery. A method is proposed to optimize the temporal regime of public service delivery in terms of accessibility. The method is illustrated in a case study of accessibility of government offices within the city of Ghent (Belgium). Our findings suggest that by rescheduling the opening hours of public service facilities individual accessibility to service delivery can be improved significantly while preserving social equity. Our study may support urban service deliverers, policymakers and urban planners in defining more 'accessible' and equitable timetables of service provision.

**Keywords:**

Accessibility, Equity, Opening hours, Time geography.

ID 1707 R

**HOW UNEQUAL ARE SUSTAINABLE TRANSPORT POLICIES ?**

Main Author:

**Stéphanie SOUCHE** (*Laboratoire d'Economie des Transports*)**Abstract:**

Using data from the Household Survey, collected for the city of Lyon in 2006, we compare different income inequalities indicators to assess Lyon's current situation. We specifically use the Gini, Theil and Atkinson inequality indicators, calculated by unit of consumption and we compare their results. Our main objective is to evaluate inequality trends and to identify the sensitivity of the indicators. Like Ramjerdi (2006), we want to illustrate that we need an examination of several inequalities measures to make a judgement about equity implication. Compared to the situation of Lyon 10 years ago, our results show an increase in all the inequality indicators (Gini, Theil, Atkinson). That is to say, an increase in inequality between 1995 and 2005, but coherent with the national one. This trend is particularly significant for the Theil and Atkinson indicators. With a Theil indicator with decomposition calculus, our results show that the major part of the Theil level is due to inequalities between income classes.

**Keywords:**

Household survey, Inequality evaluation, Inequality, Urban indicator.

ID 2003 R

**AESTHETICS AND ITS RELATIONSHIP TO SOCIAL SUSTAINABILITY IN URBAN TRANSPORT SYSTEMS**

Main Author:

**Paul TIMMS** (*ITS, University of Leeds*)

Co-author(s):

**Miles TIGHT** (*ITS, University of Leeds*)**Abstract:**

The premise of this paper is that aesthetic issues form an important but generally neglected area of urban sustainability, and in particular of urban transport sustainability. The paper places aesthetics within the commonly-used three-way classification of sustainability involving environmental, economic and social aspects: aesthetics is seen as primarily concerned with social sustainability. Given that this is a potentially very broad issue, much of the paper is taken up with illustrating the various issues involved in the specific contexts of walking and cycling. The structure of the paper is as follows. Firstly, an outline of issues is given concerning the concept of social sustainability. This is followed by an introduction to aesthetic theories which highlights various historical debates about such theories, with such debates generally focusing upon philosophical and ideological questions. These theories are used to examine various aesthetic aspects of city living, including those concerning the built environment (using concepts taken from architectural and planning theory) and, more generally, the contribution of the built environment to the quality of the daily lives and sense of happiness of urban inhabitants. These two overall lines of thinking (aesthetic and social) are then applied to analysing examples of desirable futures (visions) for pedestrian and cyclist modes and the associated images of society that are consistent with these visions. A number of concluding comments are given to confirm the importance of aesthetics and its incorporation in transport planning as an aspect of social sustainability.

**Keywords:**

Walking, Cycling, Visions, Social sustainability, Aesthetics.



ID 2942 R\*

**CAR SURVIVAL IN A NATIONAL CAR FLEET: NON PARAMETRIC AND PARAMETRIC APPROACHES APPLIED TO FRENCH DATA**

Main Author:

**Zehir KOLLI** (INRETS)**Abstract:**

We aim to determine the common demographic conditions and variables that affect light cars survival in the national fleet. The essential aim is to identify which variables determine cars' longevity and to understand how it can be measured. Hence, in this study, our main interrogation can be stated as follows: "can we consider car mileage as a major determinant of cars' longevity?" To give an answer, we adopted a longitudinal analysis based on panel data. Yearly French 'Parc-Auto' waves were linked together from 2000 up to 2006 to make a 7-year panel, with 6795 cars described. Demographic variables like car age, total mileage, car status (i.e., whether the car is unique, main or secondary in the household) and motorization (gasoline or diesel) are used. In order to have an overview on car survival, we consider a new approach by building and comparing Kaplan-Meier survival curves by car age and by average monthly mileage<sup>1</sup>. The idea is to compare car use (measured by the average monthly mileage) with car's life expectancy (measured by age), and then to conclude, for each determinant, (status and motorization)<sup>2</sup> about how intensity of use is linked to car longevity. As we do not have data concerning car scrapping or disappearing from the fleet; all observations are right censored. We show that mortality risk increases for all car categories with age and mileage. Gasoline cars have a better survival rate than diesel cars. Car status is also a major determinant of car survival: secondary cars have better survival rates than main cars or than unique cars. This is explained by the fact that sole cars are used more extensively than main or secondary cars. Bivariate pdf (i.e., probability density functions) described by age (in months) and total mileage (in kilometers) helps to show that this phenomenon has to be related to an extensive use of diesel cars and of cars declared as to be sole in the household (versus 'main' or 'secondary' cars). (...).

**Keywords:**

Car survival, Kaplan-Meier estimator, Car mileage, Beta and Weibull distributions.

ID 3187 R

**A NEW ISSUE FOR TRANSPORT MOBILITY AND ENVIRONMENTAL AGENDA: THE CONFIGURATIONAL FOCUS**

Main Author:

**Ana PAULA BARROS** (UnB, IPEA)

Co-author(s):

**Valério MEDEIROS** (UnB, Câmara dos Deputados, Unieuro)**Maria DA PIEDADE MORAIS** (IPEA)**Abstract:**

This article investigates the use of the configurational variable, which deals with the city form- space relations regarding transportation issues, to study spatial segregation and urban mobility in 4 Brazilian cities (Belém, Manaus, Recife and São Paulo), with a focus in precarious settlements and in the location of social classes in the urban space and their relative degree of accessibility/integration to the city as a whole. The study is part of a bigger project of the Institute of Applied Economic Research (IPEA) called "Characterization and Typology of Precarious Settlements in Brazil" and searches to verify to what extent such settlements are more segregated/isolated in the urban fabric as compared to the other areas of the city. For this purpose, we have used the classification of census tracts prepared by the Centro de Estudos da Metrópole (CEM) of the Ministry of Cities of Brazil (CEM, 2007), based upon microdata from the demographic census of the Brazilian Census Bureau (IBGE), as well as axial maps of these cities, according to the methodological tools of the Theory of the Social Logic of Space, which allows quantifying the configurational variable by means of the so-called "integration value". The confrontation of the information, organized on a Geographical Informational System (GIS), has underpinned a series of interpretations over the existing process of "voluntary" and "involuntary" segregation in such cities, highlighting the importance of the city form-space for urban studies of such nature. The first section presents a general introduction about the themes of precarious settlements, spatial structure of cities and urban mobility, in the light of the urbanization process in Brazil. (...).

**Keywords:**

Urban mobility, Space syntax, Spatial segregation, Accessibility, Integration.

ID 1478 R

**A STUDY ON OPINION AMONG INHABITANTS REGARDING SAKAI CITY LRT PLAN BASED ON A POLL**

Main Author:

**Tadashi ITO** (*Hiroshima Institute of Technology*)

Co-author(s):

**Kouji YOSHIKAWA** (*Osaka Sangyo University*)

**Naoyuki TSUKAMOTO** (*Osaka Sangyo University*)

**Abstract:**

Sakai City has released a plan to construct a new light rail line (6.9 km) as an east-west railway. The residents of Sakai City have various opinions regarding the plan. A new Sakai City mayor was elected in September 2009, and has since declared that the LRT line shall be reconsidered because of the lack of consensus among Sakai City residents. This study intends to analyze the opinions among Sakai City residents before the introduction of the LRT in 2008. It is essential that these kinds of opinions be recorded and then analyzed to find a consensus among the residents regarding the LRT project.

**Keywords:**

Light Rail Transit, Public Transportation Planning, Opinion Poll.

ID 1582 R

**THE RELATIONSHIP BETWEEN TRANSPORTATION ACCESS AND BODY MASS INDEX (BMI) FOR OLDER ADULTS**

Main Author:

**Daniel HESS** (*University at Buffalo, State University of New York*)

Co-author(s):

**Jessica KOZLOWSKI RUSSELL** (*Glasgow Caledonian University*)

**Abstract:**

The impact of built environment characteristics—such as population density, land use arrangements, and access to public transit—on Body Mass Index (BMI) are assessed for 350 older adults (age 50 and older) in Erie County, New York. Socio-demographic data and information about individuals' health is collected using a random survey of older adults; data about the built environment is calculated for the surroundings of each respondent's home using Geographic Information Systems (GIS). A particular focus of inquiry is how frequency of driving and access to public transportation—and the degree to which various urban forms provide support for these mode choices—relate to BMI for older adults. Results suggest that BMI of older adults may be more influenced by personal characteristics—age, sex, physical functionality—and neighborhood socioeconomic factors—share of population within the respondents' census tract that is white, and median household income—than by neighborhood land use and frequency of driving. Access to public transportation—measured by the density of nearby bus stops—does have an inverse and significant relationship with BMI among older adults, suggesting that transportation access may play a greater role in the overall activity levels and BMI of older adults.

**Keywords:**

Older adults, Physical activity, Body mass index (BMI), Obesity, Transportation access, Survey research.

THU 15<sup>th</sup> (08:15 - 09:30, Session G5.4) Room 1.02

ID 3216 R

**WHY SPENDING TWO HOURS A DAY COMMUTING?  
DECISION-MAKING PROCESS OF BECOMING HIGH  
COMMUTER**

Main Author:

**Stephanie VINCENT** (*LaSUR EPFL*)

**Abstract:**

This paper deals with the question of high commuting. Zahavi's conjecture specify commute time is stable although households go further and further in periurban areas to live. However, this conjecture seems to be taken into questions by recent studies (Joly, 2005; Joly, Littlejohn, 2007). Travel time budgets seem to increase for some years, and this increase is especially due to the raise of highly mobile people characterized by particularly high travel time budgets. Moreover, this statistical trend questions travel time reduce as a main determinant of travel. Such statements put into question decision-making process that leads to become what we called "high commuter". What are the determinants of this decision? What is the role played by employment and job career in one hand and family life in an other hand in the decision-making process? Data on travel time budgets were collected in an European study called EuroCities DATTA managed by three teams: LET (Lyon, France), LaSUR (Lausanne, Suisse) and GRT (Namur, Belgique). As part of this study, a sociological qualitative survey was done in the three European countries among high commuters. 10 high commuters were interviewed in each country thanks to a life-story method. Interviewees were chosen according to their commute time, superior to 2 hours a day. They were asked about their practices but although the way they appropriated and perceived travel time. Analysing these data allows us to better understand travel behaviours often considered as irrational by classical approaches.

**Keywords:**

Commute, High mobility, Travel time, Decision-maki.

THU 15<sup>th</sup> (09:45 - 11:00, Session G5.5) Room 1.02

ID 2457 R

**A FEASIBILITY ANALYSIS OF INTRODUCTION OF  
SMALL CAPACITY PUBLIC TRANSPORT SYSTEM IN  
AN AREA WITH SPARSE PUBLIC TRANSPORT  
DEMAND**

Main Author:

**Masayuki FUKUMOTO** (*Nagoya University*)

Co-author(s):

**Yosuke NISHIYAMA** (*Nippon Steel City Produce, Inc.*)

**Hirokazu KATO** (*Nagoya University*)

**Zhuo SUN** (*National University of Singapore, Centre For Maritime Studies*)

**Abstract:**

This study aims to provide highlights for selection of cost-efficient and user-convenient public transport services to sparse demand in rural areas in Japan. As an effective way, smaller capacity public transport systems including demand responsive transport (DRT) are discussed. The estimation system is applied to case study area and several results are got: 1) for passengers, increasing fares are more effective than frequencies and connections of route for residents. 2) Operation costs may be reduced until a certain level of passengers. However for higher demand, necessity for more vehicles may increase the total cost.

**Keywords:**

Demand Responsive Transport (DRT), Bus, Local Public Transport Service, Rural Area.

ID 2567 R

**SAFETY IDEAS IN LAND USE PLANNING AND STREET DESIGN IN CALIFORNIA AND SWEDEN: A STORY OF MULTIMODAL TRANSPORTATION PLANNING**

Main Author:

**Carolyn MCANDREWS** (*UC Berkeley*)**Abstract:**

This paper examines how professional ideas about safety became codified and implemented in design guidelines for subdivisions in Sweden and California. It is interesting that in these two cases, similar professional fields with similar ways of framing the problem of road safety produced different ways of expressing these ideas through policy and intervention. In both cases, rapid urban development provided the opportunity for professionals to work out and implement their ideas, but the logic of safety in the urban built environment was different. In California, and more specifically in the San Francisco Bay Area, creating a safe road transportation system meant creating safe traffic, that is, traffic needed to be organized into homogenous flows and it needed infrastructure appropriate for its higher speeds. Safe traffic was compatible with demands for increased traffic capacity throughout the transportation system. In Sweden, traffic engineers also created homogenous flows of organized traffic, but this was not the recipe for safety. A safe transportation system is one where traffic was appropriate for surrounding activities and land uses. Architects, urban planners, and traffic engineers worked together to create design guidelines that prioritized pedestrian traffic, even within a framework designed to increase capacity for motorized travel and modernize streets and cities. Essentially, the approach created a multimodal transportation system, where cars could go fast on motorways in designated areas, but also one where cars should be slow and managed around residential and commercial areas, schools, and transit stops. This strategy integrated transportation and land use planning to create safe spaces by designing with a sense of how pedestrians (and, by extension bicyclists and other vulnerable road users) would be exposed to hazards. (...).

**Keywords:**

Subdivision design guidelines, Street design, Transport planning.

ID 2582 R

**A MULTI-CRITERIA METHOD FOR EVALUATING EUROPEAN TRANSPORT RESEARCH PROJECTS**

Main Author:

**Lissy LA PAIX** (*Centro de Investigación del Transporte, TRANSyT- UPM.*)

Co-author(s):

**María EUGENIA LÓPEZ-LAMBAS** (*Centro de Investigación del Transporte, TRANSyT- UPM.*)**Abstract:**

Research evaluation has emerged as a "rapid growth industry". Every four years more than 10 billion Euros are allocated to research projects by the European Commission through Framework Programmes. During the last ten years a large number of research projects have been addressed to evaluate other projects. However, some evaluation projects do not take a global view of the project results. The evaluation of research projects in the field of transport should be 'quantified' as follows: Research activities ('outputs', books, conference papers); Research community and society; Contributions to the research culture. In this paper a methodology to evaluate research projects in the field of transport was developed, to measure the effectiveness of European transport research projects during the Fifth (1998-2002) and Sixth Framework Programme (2002-2006). The methodology begins with a selection of projects to be evaluated against a selection of indicators based on the reference framework of European Countries depending on the 'fitness for purpose' regarding transport research projects during the Fifth and Sixth Framework Programme. A multicriteria analysis was applied and the analysis was divided in two parts: rank order and flag model. In fact, the combination of both methods within an integrated framework of analysis can achieve more satisfactory results. The use of our methodology enhances the level of flexibility for the decision making process. The results are divided into two parts: rank and flag model; each of these parts is evaluated disaggregated into four indicators groups. Our main findings are: • The methodology offers a set of techniques for decision-makers in order to analyse the acceptability and priority of choice possibilities in the case of qualitative or mixed data. (...).

**Keywords:**

Scientific evaluation, Multi-criteria assessment, Decision-making support.

THU 15<sup>th</sup> (09:45 - 11:00, Session G5.5) Room 1.02

ID 2673 R

## TRANSPORT INFRASTRUCTURE IMPACT EVALUATION

Main Author:

**Paulo OLIVEIRA** (*Escola Naval*)

Co-author(s):

**Silvia SOARES** (*IST*)

### Abstract:

Complex transport infrastructures are supposed to have a profound impact on the people and societies they are planned to serve. These impacts are, more often than not, difficult to estimate, and particularly difficult to quantify. Impact evaluation is, however, critical to the success of the infrastructure. Incorrect prior evaluations may lead to strong negative externalities, and, in the most severe cases, to the disruption of the local economic and social fabrics. In this article, an impact evaluation scheme is proposed, capable of determining the probabilities associated with each possible external impact, and the effect of project options on these probabilities. Since a cost can be attributed to each available project option, this model can effectively provide the answer to typical analysis questions such as: what is the probability of a given outcome or impact? What is the least cost set of project options capable of achieving a given outcome with a desired probability? For a given maximum cost, what is the project design that leads to minimum negative impacts? An application example is given in the article. The model is based on a combination of a cost based analysis of the portfolio of internal project options, and a stochastic model (discrete-time Markov chain based) of the external environment, capable of capturing the impact of the internal options in the overall external environment. The fundamental idea behind the proposed method is the notion that isolated systems will tend to converge to their nearest stable point. If the stability point corresponding to a given set of options can be determined, it is, thus, reasonably safe to assume that the external situation will tend to that point. (...).

### Keywords:

Markov, Impact, Stability, Strategy, Modelling.

WED 14<sup>th</sup> (08:15 - 09:30, Session G6.1) Room 1.05

ID 1300 R

## ESTIMATION OF PEDESTRIAN CIRCULATION TRIPS IN A TOURIST AREA

Main Author:

**Hiroshi TSUKAGUCHI** (*Ritsumeikan University*)

Co-author(s):

**Upali VANDEBONA** (*University of New South Wales*)

### Abstract:

A methodology for estimation of pedestrian circulation patterns is proposed for application to a tourist area where there is a randomness of the sequence of sites visited by tourists. The simulation method is based on a traffic assignment technique applied in association with a trip chain concept that takes into account the behavior specific to leisure pedestrian activities. This method has been primarily designed to provide meaningful traffic estimates for those responsible for planning and development of pedestrian infrastructure. The methodology can also provide valuable information to third parties that may have commercial interests in such zones. Comparison of the simulation outcomes against flows revealed from a pedestrian survey is presented with the aid of a case study of a historical city in Japan.

### Keywords:

Pedestrian circulation trip, Tourist area, Pedestrian circulation.

ID 1465 R

**A DECISION SUPPORT TOOL (DST) FOR IMPROVING TOURISM SECTOR COMPETITIVENESS**

Main Author:

**Dimitrios TSAMBOULAS** (*National Technical University of Athens*)

Co-author(s):

**Panayota MORAITI****Abstract:**

Transportation plays undoubtedly an important role as lever for the sustainable development and competitiveness of tourism. Despite their inherent link, different motivations drive these two sectors today, and although the transportation industry provides the link between tourism generating and destination regions, the industry's role as a factor in tourism destination choice and development has not been paid the attention it demands. In addition, transportation and tourism studies fail to provide an explicit and holistic framework in which to assess tourists' transportation. Acknowledging the complex interaction between the transportation and tourism sectors, this paper initially identifies main tourist segments, as well as types of tourism destinations, in conjunction to their related mobility and needs in terms of transport facilities, in order to integrate tourist demand and transport supply. In addition, transport concepts, measures and solutions are addressed, as well as a selection of Best Practices, with the overall goal to progress towards the competitiveness of tourism. This information is then employed for the development of a practical and dynamic Decision Support Tool (DST) for Transport related Applications on Tourism, targeted at Tourism and Transport stakeholders, with the scope to provide suitable solutions to transport and tourism problems in a prioritised way. Therefore, the proposed tool is a dynamic repository in which the user can find all possible "combinations" of attributes between tourism demand and transportation supply for a particular tourism scenario, together with a list of value-added transport solutions to remove prioritised barriers to tourism competitiveness. (...).

**Keywords:**

transport, Tourism, Decision Support Tool.

ID 2320 R

**TRANSPORT AND ACCESSIBILITY IN A VISITOR MANAGEMENT STUDY: AN APPLICATION IN ITALY**

Main Author:

**Andrea ROSA** (*Florence School of Regulation*)

Co-author(s):

**Maurizio ARNONE** (*SiTI - Istituto Superiore sui Sistemi Territoriali per l'Innovazione*)**Tiziana DELMASTRO** (*SiTI - Istituto Superiore sui Sistemi Territoriali per l'Innovazione*)**Abstract:**

The paper reports about the method employed for an accessibility study carried out as part of a wider visitor (i.e. tourist) management study. The overall visitor management study included analyses and proposals about Hospitality, Information, Accessibility, and crosscutting issues, and focussed on the area of the Lake Orta in Piedmont, Italy. The methodology employed in the study on accessibility and transport services aimed at collecting relevant data for the area, highlighting the current state of transport services and facilities, and at extracting information to help steer possible tourism related policies. The study used disaggregate measures of accessibility and transport provision which could relate intuitively to daily experiences of tourists as well as of decision makers and stakeholders involved in consultations. Disaggregate measures have been chosen so as to favour communication, keep details, and avoid introducing combination coefficients which might not be transferable in time or space (e.g. for monitoring). Assessments and proposals in the study refer to two elements of accessibility: external accessibility and internal accessibility. The external accessibility assessment depicts or measures the ease of reaching the area from elsewhere by airplane, train, car, bus. The internal accessibility is related to the state of connections by train, bus, boat, or their combination, and the provision of facilities to travel by car, bike and on foot within the area on which the study focussed.

**Keywords:**

Tourism, Accessibility, Visitor management.

ID 2681 R

**ECOTOURISM AND THE TRANSPORT NETWORK: A QUESTION OF SUSTAINABILITY**

Main Author:

**Eden SORUPIA** (*University of the Philippines*)

**Abstract:**

This paper identifies policies and structures which contribute to improve the sustainability of a transport network that serves an ecotourism destination. It looks into the sustainability of the modes available to the public and the level of public transport services, which are deemed important indicators. The experiences and current practices of the Swiss National Park (SNP) in Switzerland and Iguaçu National Park (PNI) in Brazil are analysed as case studies to evaluate and compare strategies that work and why these work. Findings show that although ecotourism destinations support biologically diverse areas, the car remains the major mode to the national parks even with reliable public transport services. This unsustainable travel behaviour can be reversed by changing the balance of transport incentives and disincentives and encouraging mode shift to more sustainable modes.

**Keywords:**

Ecotourism, Sustainable development, Sustainable transport, Transport network, National parks.

ID 2687 R

**A PROCESS MODEL OF TOURISTS? DESTINATION SET CHOICE BASED ON COMBINATION UTILITY OF DESTINATION SET**

Main Author:

**Kuniaki SASAKI** (*University of Yamanashi*)

Co-author(s):

**Kazuo NISHII** (*University of Marketing and Distribution Science*)

**Abstract:**

When planning the transportation in sightseeing area, trip chaining of sightseeing spots is key aspect to understand tourists and attractiveness of sightseeing area. Thinking from the view of travel behaviour analysis, those characteristics are defined as the combination choice of destination and order of visiting. This research focused on those characteristics and proposed a model of process of combination choice of destination. Another aspect we consider in this research is common un-observed factor between sightseeing spots. To consider this problem, we assumed correlations between random terms. This assumption of choice leads to a kind of mixed logit model. As the empirical study of the proposed model, we applied the model to the data of tourism behaviour in Kyoto City in Japan. The result of model estimation showed significant correlation between different three defined categories on sightseeing as the parameter of random term. As a conclusion, we proposed a feasible method to model the combination of destination and to consider the correlation of unobserved factor of sightseeing spots.

**Keywords:**

Tourism behaviour, Combination choice, Heuristic decision rule, Mixed logit model.

ID 1232 R

**TOURISM, MASS EVENTS AND TRANSPORTATION MANAGEMENT: THE RIMINI APPROACH**

Main Author:

**Antonio MUSSO** (*Sapienza - University of Rome*)

Co-author(s):

**Maria VITTORIA CORAZZA** (*Sapienza - University of Rome*)**Abstract:**

A large number of mass events attracting tourists and visitors take place in Rimini every year, but they have negative consequences in terms of traffic congestion. The need to upgrade the local Urban Mobility Plan – UMP - was considered by the local administrators as an opportunity to solve such a problem. The vision behind the Plan was targeted not just at improving vehicular traffic conditions but also at enhancing livability for tourists and residents thanks to the development of an urban rehabilitation process as a framework in which some actions could be implemented to create a more balanced mobility system. Preliminary analyses of the local transportation demand and supply allowed the development of some scenarios for the UMP: some of the planned interventions have been simulated, including the newly planned roads, in order to assess their suitability to the context, namely in terms of impacts on traffic flows, pollution and safety. A proper assessment of the impacts resulting from the planned interventions was of the utmost importance, since the local land use pattern is typical of a densely built environment with important landmarks, and not much could be left to infrastructural interventions. Such concern resulted in planning the crucial so-called “slow mobility” network (bike routes across the whole urban area, road safety improvements, reorganization of parking facilities, etc.) to avoid conflicts in sensitive areas such as the centre and waterfront. The lesson learned from Rimini stresses the need, typical of areas “burdened” with popular events and environmental constraints, to manage traffic problems without disregarding priorities, such as the environment, safety and livability. (...).

**Keywords:**

Traffic, Mobility planning, Safety, Pollution, Urban rehabilitation.

ID 1236 R

**TRAFFIC REGULATION AND PARKING MANAGEMENT OF TOURIST COACHES IN URBAN AREAS: AN OVERVIEW AT EUROPEAN SCALE**

Main Author:

**Antonio MUSSO** (*Sapienza - University of Rome*)

Co-author(s):

**Cristiana PICCIONI** (*Sapienza - University of Rome*)**Abstract:**

In recent years, more and more municipalities have introduced the analysis of tourist transport demand in their own strategies for local mobility systems, focusing on the impacts of tourist coaches circulation and parking operations on the urban environment and its accessibility. Regardless of the city pattern, mobility management of tourist coaches is based on some key factors which affect the planning of dedicated parking areas. This paper focuses on these elements and analyses at European level several tourist coach tour schemes and/or related parking plans. It also provides an overview that describes the peculiarities of the different parking plans in cities of different sizes - from Brussels (140,000 inhabitants) to Rome (2.7 million inhabitants), including Salzburg, Amsterdam, Munich, Barcelona and Paris. Some interesting concepts emerging from such analysis are as follows. Firstly, tourist coach plans generally set parking charges and time-limited occupancy policies that vary on the basis of parking lots typology and supply availability. Secondly, Municipalities managing urban areas equipped with a limited parking supply usually set strict circulation and parking schemes and locate public transport services terminals next to longstay parking areas. Other urban contexts are provided with few parking lots that are well integrated within the public transport network, whereas metropolitan areas generally offer numerous parking lots dislocated both within the peripheral and the inner city, depending on different levels of access and parking conditions. Finally, two common elements are essential to guarantee efficient coach plans. The first deals with plan dissemination; in particular, every Municipality aims at informing coach drivers/operators about urban access conditions and location of parking lots via local signposts and brochures or maps at entry/check points. (...).

**Keywords:**

Parking management, Tourist coaches, Coach plans, Urban areas.



ID 1541 R

**MANAGEMENT OF PEAK DEMAND IN TRANSPORT SYSTEMS ? AN AGENDA FOR RESEARCH**

Main Author:

**Eva KASSENS** (*Michigan State University*)**Abstract:**

This paper is a pioneering effort in developing key concepts for peak demand transport. Peak demands in transport systems occur during mega-events, e.g. the Olympic Games or mass evacuations, which strain the pre-existing transport capacity far beyond its maximum limit. The author defines mega-events in the transport context as follows: a transport mega-event is an extraordinary temporary combination of mass transport flows, requiring the involvement and coordination of all available metropolitan transport modes with different service levels and requiring temporary and long-term modifications to the transport system. Peak demands as analyzed in this paper go far beyond the regular congestion levels, and constitute exceptional levels of passenger demand. Transport agencies have to extensively plan for those peak demands, for which many agencies start their planning efforts from scratch or draw on common practices within the same mega-event group (e.g. evacuations). This paper intends to jumpstart thinking outside the box by cross-comparing transport practices for various mega-events that have relatively little in common. The contribution of this paper is to identify six common key concepts among those different mega-events. Based on these findings the author concludes that these concepts are indeed applicable to any transport mega-event and suggests further inquiry into the field of peak demand transport planning.

**Keywords:**

Peak demand, Transport management, Sport mega events.

ID 2167 R

**A STUDY OF OPTIMIZATION OF EXCURSION TRAVELER BEHAVIOR USING CAR-SHARING IN REGIONAL AREAS**

Main Author:

**Naoto IDA** (*Department of Civil and Environmental Engineering, Hokkaido Institute of Technology*)

Co-author(s):

**Yuji SUZUKI** (*Hokkaido Institute of Technology*)**Tohru TAMURA** (*Dept. of Civil Engineering and Architecture Muroran Institute of Technology*)**Abstract:**

In Japan, regional areas are faced with problems in transportation policy making, a declining birth rate and an aging population. These problems have serious consequences on the sustainability of public transportation operation. The purpose of this study was to investigate the conditions for the introduction of car-share systems in these regions. A tourist area was used in this study where there are expected more car-share users. This study was able to clarify two points: first, a multi-station car-share system could be introduced to sightseeing activities in local tourist areas; second, effective vehicle operation was required to maximize tourist utility. Moreover, tourists' cooperativeness brought higher utility to themselves.

**Keywords:**

Traveler behavior, Car-share system, Multi-agent simulation.

ID 3357 R

**STADIUM: ITS FOR LARGE EVENTS**

Main Author:

**Andrea RICCI** (*ISIS - Institute of Studies for the Integration of Systems*)

Co-author(s):

**Maurizio TOMASSINI** (*ISIS - Institute of Studies for the Integration of Systems*)**Abstract:**

The Project STADIUM\* (Smart Transport Applications Designed for large events with Impacts on Urban Mobility) aims at improving the performance of transport services and systems made available for large events hosted by big cities. The project demonstrates Intelligent Transport System (ITS) applications at three upcoming major events, i.e. the South Africa World Cup (2010), the India Commonwealth Games (2010) and the London Olympics (2012). The India demonstrator is to be deployed and tested during the XIX Commonwealth Games (Delhi 2010) targeting both (i) the Planning of Public Transport services and (ii) the real time supervision of the bus system and its feeder service. Due to the relevance of the minivan transport sector (Para transit) in South Africa, the demonstrator aims to improve its performances through the development of an ITS application supporting a demand-responsive transport service (DRT). The solution proposed is to be implemented on a fleet of minivan taxis and demonstrated in Cape Town during the FIFA 2010 World Cup. The London demonstrator will be deployed and operationally tested during the Games of the XXX Olympics in 2012. The system is based on a visual scene analysis tool to support the monitoring of localised passenger and vehicle congestion and the propagation of congestion across and within multi-modal transport networks. Over and above the activities geared to the demonstrations, the ultimate objective of STADIUM is to provide Local Authorities responsible for transport in candidate cities to host large events with a set of guidelines and specific tools to implement the required traffic management system. These will notably feature an interactive data base to serve as a decision support system at different stages of the decision/planning/implementation process (...).

**Keywords:**

ITS, Large events, Demonstrators, Public transport, Traffic management, Demand responsive transport, Decision support system.

ID 1742 R

**COLLECTIVE PATTERNS UNDER EMERGENCY CONDITIONS: LINKING NON-HUMAN BIOLOGICAL ORGANISMS TO PEDESTRIANS**

Main Author:

**Nirajan SHIWAKOTI** (*Monash University*)

Co-author(s):

**Majid SARVI** (*Monash University*)**Geoff ROSE****Martin BURD** (*School of Biological Sciences, Monash University, Australia*)**Abstract:**

Lack of complementary data under emergency conditions has hindered the progress of quantitative theories and models to simulate the collective dynamics of pedestrians. Previous studies have been limited in this way, but this study attempts to address that gap in data for model development and validation by using empirical data from non-human biological organisms. Experiments with panicking Argentine ants were performed to study collective pedestrian traffic. The experiments were the first to use non-human biological organisms to study the effect of geometrical structures to the collective movement patterns. Based on the experiments, a conceptual framework to model collective forces are presented. The practical applications of the experiments are also discussed. The proposed novel approach suggests a new direction in applying knowledge of the collective dynamical patterns of non-human entities to the collective dynamics of humans, in order to devise sound strategies to aid evacuation.

**Keywords:**

Collective dynamics, Emergency/panic, Pedestrians, Ants, Egress/Evacuation.

ID 2622 R

**INTELLIGENT TRANSPORT SYSTEMS ON EMERGENCY EVACUATION MODELLING**

Main Author:

**Beatriz ROLDÃO** (*VTM Consultores*)**Abstract:**

The combined effects of major changes concerning the physical development of urban areas and the increasing demand for travel lead to greater complexity in the control of transport systems. Transport Systems evolution and the rise of its utilization brought a new meaning to an essential matter: the safety and security of these systems. Cities as a whole must be seen to provide safe and secure environment. This is an issue of great importance nowadays and it is highlighted by the rise of mobility and traffic increase which implies a large amount of people and stakeholders involved. So the transportation systems are associated with a high risk of large scale accidents from natural causes or terrorist attacks, whose risk of occurring is more frequent nowadays. The development and implementation of new technologies demands a higher care for its safety utilization taking some extra precautions and keeping the control of the system. Intelligent Transport Systems (ITS) consists on the application of advanced information and communication technologies in transportation as a way to improve transport systems performance, improving safety and security, time, money, energy consumption and the environment. It is possible to improve the response capability of transportation systems in critical situations by combining network modelling and ITS application design. An emergency situation may involve static analysis (pre-planning or post-planning) or a real time operation enabling a rapid response and an effective evacuation. Towards pre-emptive planning it is possible to develop and test different scenarios and find the best solution, knowing the exact location of the incident. In contrast, facing the challenge of a more dynamic structure, a real time evacuation program supported by a traffic simulation software package allows an automatic definition of evacuation routes given the conditions and location of the incident. (...).

**Keywords:**

Intelligent Transport Systems, Emergency Evacuation Modelling, Evacuation Planning, Traffic Simulation Software, STEMS – Smart Traffic Evacuation Management System,

ID 1240 R

**TRANSPORT FOR THE ELDERLY - WHAT HAPPENS IN RURAL AREAS**

Main Author:

**Aoife AHERN** (*University College Dublin*)

Co-author(s):

**Julian HINE** (*University of Ulster*)**Emer BEGLEY** (*Age Action*)**Abstract:**

This paper describes research work carried out in Ireland and Northern Ireland to review the transport needs of older people in rural areas. The objective of this project was to examine the transport needs of vulnerable older people in our society –older people in rural areas where access to transport services is limited when compared to those living in urban areas. The paper reviews research into the transport needs of older people in rural areas and assesses how well those needs are being addressed in Ireland and Northern Ireland, by examining what types of funding and policies have been put in place in both countries for older people in rural areas. A comparison of the services available is also undertaken, The paper then goes on to describe a series of focus groups undertaken with older people in rural areas to discover their current travel patterns and chart their transport experiences. These focus groups are being carried out both in Ireland and Northern Ireland to establish the transport needs of older people and the shortfalls in the current provision of transport services. Finally, recommendations are made for improvements to transport services and transport strategy. The research argues that these improvements need not be expensive or costly. Through more innovative use of current transport services it may be possible to provide better transport services. Recommendations are made for further research that could involve piloting some of these schemes.

**Keywords:**

Quality of life, Rural transport, Older people, Transport needs.

ID 1491 R

**RELATIONSHIP BETWEEN GENDER AND TRAVEL BEHAVIOR IN MAKING USE OF PUBLIC TRANSPORT IN INDONESIAN CITIES: IS THERE ANY DIFFERENCE AMONG CITIES?**

Main Author:

**Tri JOEWONO** (*Parahyangan Catholic University*)

Co-author(s):

**Melinda TJEENDRA** (*University of New South Wales*)

**Abstract:**

In order to guarantee the success of the provision of public transport, it is imperative to have a deep knowledge regarding the consumer. One of the most important aspects of the consumer is gender. Gender is believed to have a significant role in influencing the decision in making use of public transport, as well as building a different pattern of travelling. This article aims to investigate the relationship between gender and travel behaviour of the user in using public transport in Indonesian cities, i.e. Jakarta, Bandung, and Yogyakarta. The results show that there is significant different of travel behaviour between male and female in making use of public transport. Trip purpose and number of owned driving licence appear as two behaviours that significantly different for male and female in these three cities. Not just travel behaviour, but the perceptions and negative experiences are also different between male and female in these cities.

**Keywords:**

Travel Behavior, Gender, Public Transport.

ID 1821 R

**THE HOSPITAL COSTS OF TRAFFIC ACCIDENTS INVOLVING THE ELDERLY IN TAIWAN**

Main Author:

**Chen TZU-YING** (*Department of Civil Engineering, National ChiNan International University, Taiwan*)

Co-author(s):

**Rong-Chang JOU**

**Chao MING-CHE** (*Department of Civil Engineering, National ChiNan International University, Taiwan*)

**Abstract:**

The purpose of this paper is to examine the relationship between medical treatment costs and length of hospital stay resulting from traffic accidents involving the elderly. The World Health Organization defines "elderly" as people more than 65 years old. The sample for this study consisted of data for the year 2007 collected by the Bureau of National Health Insurance (BNHI), Taiwan. BNHI data used in this study included all cases coded as E810- E819 and E826 using the ICD-9-CM system. This study attempts to develop a model predicting hospital costs based on diagnosis, hospital type and travel mode. The Seemingly Unrelated Regression Equations (SURE) method was applied first to investigate the relationship between medical costs and length of hospital stay. The SURE method shows that the type of injury (for example, Head injury) is statistically significant and has positive effects on medical costs for both car and motorcycle accidents. Due to the insignificance of the dependency between medical costs and length of hospital stay, two separate simple linear regression models are used. The linear regression model shows that in car accidents medical costs for patients 65-69 were lowest, while patients over 80 had the longest hospital stays. In motorcycle accidents, patients over 80 had the highest medical costs. These results suggest that it is economically and medically important for the transportation authorities to focus on preventing certain types of injuries which are particularly serious and costly in the Taiwan elderly.

**Keywords:**

Traffic accidents, Elderly, Medical costs, Length of hospital stay, SURE.

ID 2196 R

**THE EFFECT OF METRO ON THE MOBILITY OF CAPTIVE PUBLIC TRANSPORT RIDER WOMEN**

Main Author:

**Ela BABALIK-SUTCLIFFE** (*Middle East Technical University, Department of City and Regional Planning*)

Co-author(s):

**Bahar ERKOPAN ESER** (*The Ministry of Environment and Forestry, Turkey*)**Abstract:**

Majority of public transport investments in the world are justified on the grounds that they will help improve travel conditions, accessibility and mobility of citizens, and particularly those with limited access or inferior conditions of transport. Of public transport systems, rail-based ones, such as metro and light rail transit, with their high-capacity, high-quality and fast services, as well as their positive images in terms of safety, are often considered as effective tools in increasing mobility and quality of life. Particularly from the point of view of women, urban rail systems are discussed to have significant mobility benefits due to being a safe, secure, easily perceivable and reliable mode. There is an understanding that a good-quality rail transit system can increase women's mobility resources and help them travel to more destinations covering larger urban geographies. This paper summarizes a study that aimed at testing whether mobility levels, that is frequency of tripmaking and variety of destinations traveled to, increase for women who use the metro system in Ankara, Turkey. The analysis, derived from a comprehensive questionnaire, focused on the mobility of women living along the metro corridor, but only women with no access to a private car, hence those with a significant reliance on public transport. The questionnaire also covered perceptions of women regarding the metro and other modes of transport, the outcomes of which need to be considered and addressed in order to enhance the mobility of women users.

**Keywords:**

Women's mobility metro.

ID 1041 R

**THE EFFECTS OF DYSLEXIA UPON PERSONAL TRAVEL: EMPIRICAL RESULTS OF A QUALITATIVE STUDY**

Main Author:

**Deborah LAMONT****Abstract:**

This paper considers access to the transport system for those with dyslexia, with a specific focus upon the role of travel information provision in preventing and facilitating travel by this group. The paper reports results from an in-depth qualitative investigation, which finds the inaccessibility of pre- and in-trip information as insurmountable barriers, excluding dyslexic people from the transport system. The research indicates that the task of planning and undertaking a journey is affected by dyslexia, with this relationship associated with and exacerbated by a lack of appropriate informational support. It is either unavailable, of little use, being difficult to access and decipher. In consequence, the travel choices and travel behaviour of dyslexic people are restricted. These individuals continue to use familiar routes and modes and face limited travel horizons because of an inability to explore available choices and opportunities. The research calls for greater recognition and awareness of dyslexia across the transport industry, particularly within travel information provision, throughout the journey lifecycle. Greater awareness of and support for dyslexia in the provision of travel information services would mean that dyslexic travellers are able to find them more useful, more usable and thus use them more, which could broaden the travel horizons of this group. Owing to this, the paper highlights proposals for transport supply improvements, to facilitate greater inclusion for dyslexic travellers in the transport system.

**Keywords:**

Dyslexia Learning Disabilities Travel Information.

ID 1445 R

**THE GAP IN TERM OF MOBILITY FOR DISABLED TRAVELLERS IN FRANCE**

Main Author:

**Virginie DEJOUX** (INRETS-DEST)

Co-author(s):

**Jimmy ARMOOGUM** (INRETS-DEST)

**Abstract:**

The demographic and social changes that are currently taking place in the developed countries, such as the ageing of the population, the disappearance of local services and the increasing fragmentation of social and family networks are likely to affect the future travel practices of a great share of the population. Also the number of persons who find it difficult to move around without any assistance outside their home could increase. The objective of this paper is to assess travel practices among people with travel's difficulties. Our research is based on the 2007-08 French National Travel Survey (ENTD) with about 20,000 respondent households conducted by the Ministry in charge of transport and the French National Statistics Office (INSEE). Firstly the paper describes the travel practices of disabled travellers and gives the gap in term of number of trips for a typical day, travel budget time and daily distance travelled for these two segment of the population (people with and without difficulties). Secondly we will identify several sociodemographic characteristics that influence the number of trips per day and their travel behaviour, such as age, gender, professional occupation or residential zone.

**Keywords:**

Mobility, Disability, Quantitative survey, behaviour.

ID 1446 R

**MOBILITY BARRIER FOR DISABLED PEOPLE**

Main Author:

**Virginie DEJOUX** (INRETS-DEST)

Co-author(s):

**Jimmy ARMOOGUM** (INRETS-DEST)

**Abstract:**

The aim of this paper is to understand why people with disabilities travel less than people with any difficulty and why they use different transport modes. For that, we had a quantitative and qualitative approach. Our research is based on the National Travel Survey (NTS) that was conducted in France in 2007-2008. Secondly, and to provide in-depth elements for the understanding of situations faced by disabled people, we carried out fifty semi-structured interviews with people who may be experienced difficulties when travelling. We will try to detect difficulties that people may face when they are travelling, by observing separately each mode: walking, car, public and specialized transport.

**Keywords:**

Mobility, Impairment, Large scale survey, Qualitative evaluation.

ID 1759 R

**EVALUATING MEASURES FOR IMPROVING  
ACCESSIBILITY OF PUBLIC TRANSPORT SYSTEMS  
FOR PEOPLE WITH REDUCED MOBILITY**

Main Author:

**Regine GERIKE** (*Technische Universität München*)

Co-author(s):

**Torsten BELTER****Abstract:**

The importance of accessible public transport has grown significantly in the last few years and will continue to grow due to current demographic changes. Measures to improve accessibility for people with reduced mobility are often undertaken without an ex-ante assessment of available alternatives. The goal of this paper is to present a tool that evaluates measures to improve the accessibility of public transport systems. The name of the approach is OBS (Opportunities, Behavior, Satisfaction) and can be described as follows: The first component "Opportunities" (O) addresses the "option benefit" of the transport system. People benefit from the existence of the transport system even if they do not actually make use of it or only use parts of it. The second component "Behavior" (B) describes all aspects related to the actual usage of the transport options as described above in O: The spatial system perspective addresses the utilization of the available destinations (spatial supply); the transport system perspective addresses the utilization of the transport system (transport supply); and the individual perspective covers the impact of the measures on people's travel behavior. The third component "Satisfaction" (S) represents the subjective perception of quality of life and describes how people perceive the transport system. Changes in perception might even appear for measures that do not affect the transport system described in O (e.g., mobility training). The three components O, B and S are described and specified with indicators including costs and benefits for each component. Based on this, a framework for synthesizing the different indicators into a consistent assessment method is developed. (...).

**Keywords:**

Evaluation, Public Transport, Accessibility, People with reduced mobility.

ID 1482 R

**ASSESSING USER LOYALTY AND QUALITY OF  
SERVICE: A VERY DISAGGREGATE APPROACH  
APPLIED TO PARATRANSIT ARCHIVED DATA**

Main Author:

**Marie-Christine DESHARNAIS** (*École Polytechnique de Montréal*)

Co-author(s):

**Robert CHAPLEAU** (*École Polytechnique de Montréal*)**Abstract:**

For paratransit operators of small and medium sized communities offering services dedicated to disabled people, it is a challenge to adapt the offered services to the constantly evolving demand while managing the operating costs of an already expensive system and satisfying the users' needs. Archived operational data that describe observed individual travel behaviour are often preserved by paratransit authorities but remain unexploited. This research capitalizes on a totally disaggregate and object oriented approach to develop systematic procedures aiming to extract valuable planning information from this data source. A one-month data sample is used to assess the extent to which individual characteristics of trips and users as well as operational decisions impact the demand for trips and the quality of service. Data mining techniques, linear regression modelling and spatial representations are used. A key finding is that the activity system structures operational decisions. Paradoxically, the way paratransit service is planned can only lead to a reduction of quality of service for loyal users. This paper also illustrates the potential of complete archived operational data to act as a multi-day travel behaviour survey and as a planning tool. To date, operational archived data offer the best available description to assess observed travel behaviour of paratransit users.

**Keywords:**

Paratransit, Disabled people, Operational archived data, Observed travel behaviour, Multi-day data, Totally disaggregate approach, Loyalty, Quality of service.

ID 2174 R

**STRESS AND FATIGUE OF PROFESSIONAL DRIVERS:  
A CASE IN TAIWAN**

Main Author:

**Yi-Shih CHUNG**

Co-author(s):

**Jinn-Tsai WONG** (*Institute of Traffic and Transportation,  
National Chiao Tung University*)**Wen-Chien YEH****Isaac I. C. CHEN****His-Jenn WU****Abstract:**

To thoroughly investigate the association of driver characteristics and organizational factors with the stress level, sleep quality and burnout level of professional drivers, quantile regression is applied to examine the association over the whole distribution with a special focus on the upper quantiles. The occupational stress level, sleep quality and work-related burnout level are measured using the Effort Reward Imbalance model, the Pittsburgh Sleep Quality Index and the Copenhagen Burnout Inventory, respectively. A total of 1,064 questionnaires were collected from railroad and bus drivers in Taiwan. The results show that most associations evaluated in this study are varied over the whole distribution and either linear or quadratic in shape, which cannot be easily observed using the ordinary least squares method where only average impacts are estimated. Moreover, most results indicate larger covariate effects and wider confidence bands in the upper quantiles. In other words, the covariate effects on drivers in the upper tail could be underestimated if only ordinary least squares were applied. Health problems and carrier types are found to be the most significant covariates explaining drivers' stress level while stress is the most critical covariate for sleep quality and work-related burnout levels. The results suggest the importance of stress reduction programs in professional drivers' health and wellness management.

**Keywords:**

Professional drivers Stress Fatigue Quantile regression.

ID 2193 R

**MOBILITY AND SUSTAINABILITY IN DEVELOPING  
COUNTRIES: BANGALORE CASE STUDY**

Main Author:

**Pelin ALPKOKIN** (*Istanbul Technical University*)

Co-author(s):

**Hirokazu KATO** (*Nagoya University*)**Yoshitsugu HAYASHI** (*Nagoya University*)**Abstract:**

Mobility is one essential condition for economic and social development. However, one of the most crucial issues today is whether, and how well, less developed and developing countries and regions can make good use of the merits of mobility while overcoming or minimizing its drawbacks. Unfortunately, there are certain substantial obstacles blocking the path to economic and social development for these countries due to current conditions of poverty and income disparity, low education, quantitative and qualitative deficiencies in infrastructure and subsequent bottlenecks such as traffic congestion even at the present low levels of traffic volume. It was with these problems in mind that the World Business Council for Sustainable Development (WBCSD) launched a new project entitled "Mobility for Development" (M4D) in 2006, focusing on four cities from four developing countries and regions: India; China; Africa; and Latin America. Under this project, Bangalore, the case area of India, was examined in a research project funded by Toyota Motors Corporation and conducted by our team at Graduate School of Environmental Studies of Nagoya University. We attempted to highlight the internal mechanisms of the positive and negative feedback effects of mobility, including its social implications and its detrimental impacts on the environment with special reference to the Bangalore case study. Bangalore is typical as a rapidly developing mega-city that has long been suffering from a shortage of urban services and urban management. In this paper, we summarize some important findings of this report where the primary aims are to feature the concepts of sustainability and mobility and the associated key definitions such as accessibility, mobility divide and QOL (quality of life); and to suggest a triangular framework for the evaluation of mobility for sustainable development. (...).

**Keywords:**

Sustainable Mobility, Mobility Divide, Quality of Life, And Bangalore .



ID 2496 R

**ROAD (NON)-USERS EQUITY: A LONG WAY HOME!**

Main Author:

**Marie-Soleil CLOUTIER** (*Institut National de Recherche Scientifique-Centre Urbanisation, Culture et société*)

Co-author(s):

**Florence HUGUENIN-RICHARD** (*Institut de géographie et d'aménagement-Paris IV Sorbonne*)

**Abstract:**

The inequality in the distribution of road risk in cities is becoming a real social challenge. Persons with disabilities, children, elderly and people without a car, just to name a few, are more at risk than any other population when it comes to road-related injury and death. This paper has three objectives: to review the concepts of equity and social exclusion under a transportation perspective; to recall inequities related to road risk on the life of vulnerable road users; and to examine how two regional transportation plans (Paris and Montreal) integrated equity concerns in their vision and intended actions. A final discussion will relate those empirical examples to our conceptual model of equity in transport.

**Keywords:**

Equity, Pedestrians, Social exclusion, Urban transportation.

ID 2524 R

**THE IMPACT ON EQUITY OF CHANGES TO ACCESS TO LOCAL FACILITIES**

Main Author:

**Roger MACKETT** (*University College London*)

**Abstract:**

Many of the needs of everyday life are met through the provision of local services such as post offices and public libraries. The level of access to them can have a significant impact on the quality of life. It can also have important implications for equity, since there may be large differences in levels of access between those with different income levels. In Britain there is a policy of rationalising such services, sometimes in order to save money, and sometimes as part of a modernisation programme. However, in developing these re-organisation programmes, the access and equity issues are rarely considered systematically. One way to do this is to use a computer-based tool, such as AMELIA (A Methodology for Enhancing Life by Improving Accessibility), which has been developed in the Centre for Transport Studies at University College London. AMELIA has been designed to test the extent to which transport and other policies influence social inclusion. AMELIA is a user-friendly, policy-oriented interface to a Geographic Information System (GIS). It requires data on the population in the group being considered (the elderly, those in wheelchairs and so on), the destinations that they wish to reach (shops, post offices, health facilities and so on) and how they can travel there. AMELIA can then be used to see how many more (or fewer) of this group can reach the opportunities as a result of the policy actions. In the paper AMELIA is applied to examine the implications of reorganisation programmes for post offices and public libraries in two areas: the London Borough of Tower Hamlets, which is an inner city area with a culturally diverse population and high levels of poverty, and Hertfordshire, a relatively wealthy area with high car ownership and a mixture of urban and rural areas. (...).

**Keywords:**

Access, Equity, Policy, Quality of life, Post offices, Health facilities, Libraries.

ID 1014 R

**IMPLEMENTATION OF THE ROAD ASSETS MANAGEMENT SYSTEM IN SINDH PROVINCE OF PAKISTAN**

Main Author:

**Konsta SIRVIO** (*Sirway*)**Abstract:**

In Asian Development Bank funded project "Sindh Road Sector Development Programme" in 2005-2009 one component was development of Road Assets Management System (RAMS) including Bridge Management System (BMS), Geographic Information System (GIS), Road Maintenance Management System (RMMS) as well as bridge and road data collection. Incorporating the experiences learnt in other similar projects the systems were developed and tailored for the Government of Sindh during 2008-2009 incorporating the existing components thus as the previous road database with minor modifications. The new data systems were used to generate a 5-year maintenance plan for 9,850 km of roads, 1,237 bridges and 10,467 culverts. Around 2 % of the surveyed roads are in very poor, 11 % in poor, 46 % in fair, 33 % in good and 8 % in very good condition, whilst the average IRI is 7.3 for the surveyed road network of 7,479 km. Bridges are generally in better condition as 1 % of the bridges were in very poor, 1 in poor, 6 % in fair, 19 % in good and 72 % in very good condition and 1 % was not evaluated. According to the strategic analysis based on IRI value around 22 Billion Pakistani Rupees (360 Million US Dollars) is required to get the average IRI to 4.5 by the year 2015. For the 5-year maintenance plan around 6.3 Billion Pakistani Rupees should be invested in road maintenance and 1.5 Billion Pakistani Rupees in bridge and culvert maintenance. System development for road assets management is interdisciplinary work with some risk areas. As experiences have shown, implementation of information systems often fail and these experiences from the IT discipline should be taken into consideration when projects like this are planned. (...).

**Keywords:**

Road Asset Management System Road Asset Management.

ID 1036 R\*

**?ESTABLISHMENT OF MANAGEMENT SYSTEM FOR MAINTENANCE ACTIVITIES IN URBAN ROAD NETWORK? CASE STUDY IN BENGHAZI ? LIBYA**

Main Author:

**Jamal BEITELMAL** (*Garyounis University Faculty of Engineering*)

Co-author(s):

**Jamal BEITELMAL** (*Garyounis University Faculty of Engineering*)**Abstract:**

The City of Benghazi, like many cities throughout Libya, is facing a monumental challenge in dealing with aging infrastructure. For pavements in particular, it is observed that they have been deteriorated because of misuse, overuse and mismanagement. The current management system at the Municipality of Benghazi is not tracking down the damages that occur during the design life of the pavement, which makes the decision for the roads maintenance is late or perhaps entirely absent. In many cases in Benghazi, maintenance needs and priorities have not been determined and maintenance has been inadequate which led to minor and major deterioration to many roads which now need minor and sometimes major reconstruction rather than ordinary maintenance operations. Moreover, maintenance activities were performed as a result of user complaints and usually in a random way without planning or management. This type of maintenance practice leads to inefficient spending to maintenance budgets. In conclusion, there is no defined system in implementing maintenance strategies. Therefore, This study aims to initiate a Pavement Maintenance Management System computer program (PMMS) for the city of Benghazi through which it provides a systematic process of maintaining, upgrading and operating the city pavement network and tools to facilitate a more flexible approach that can enable the management team to perform tasks in better, more economically, effectively and of higher quality manner. A computer program has been presented to facilitate the decision making process for the city of Benghazi pavements. A pavement maintenance management system program has been designed within the framework of this study to be applied in the city of Benghazi. (...).

**Keywords:**

Pavement Maintenance Management System (PMMS), Road network.

ID 2277 R

**STRATEGIES IN THE PROCUREMENT OF TRANSPORT INFRASTRUCTURE**

Main Author:

**Athena ROUMBOUTSOS** (*University of the Aegean*)**Abstract:**

The Public-Private Partnership (PPP) method of procurement has been seen by governments as a means to launch investment programmes, which would not have been possible within the available public-sector budget, within reasonable time. Key guidelines in pursuing this form of infrastructure development have been the demonstration of value for money (VfM) for the public sector and affordability for the private. Risk transfer is considered central to the PPP mechanism in terms of definition, contract negotiation, achievement of VfM and overall project success. Risk allocation, however, is carried out between at least two risk-averse agents facing a risk-sharing problem constrained by bounded rationality, stemming from the uniqueness of the undertaking and resulting in incomplete contracting. Most PPP models developed assume a verifiable payment made by the public sector or users to the private party, while they ignore residual value following contract completion. Transport infrastructure projects bear unique characteristics. They are cost intensive investments positioned as natural monopolies, which once built cannot be used alternatively. In addition the life of the investment is in the 50-year range (i.e. longer than the average duration of a PPP contract). This combined with the fact that many PPPs in the transport sector base revenues on tolls (i.e. forecasted traffic volumes) introduces uncertainty. These discrete features of PPP transport projects, i.e. (i) revenue uncertainty and (ii) residual asset value, are modelled as incomplete contracts using game theory. Scenarios are developed based on varying levels of perceived demand uncertainty and residual value. The model is used to predict the possible strategies undertaken by the prime agents, thus providing new insights. (...).

**Keywords:**

Public private partnerships, Incomplete contracts, Game theory, Risk allocation, Procurement strategies.

ID 2832 R

**HIGHWAYS CONCESSIONS - BRAZILIAN VIEW**

Main Author:

**Marcus ROSA** (*Universidade Federal do Rio Grande do Sul*)

Co-author(s):

**Luiz SENNA** (*Universidade Federal do Rio Grande do Sul*)  
**Luis ANTONIO LINDAU** (*Laboratório de Sistemas de Transportes – LASTRAN*)

**Abstract:**

When comparing indicators of Brazilian paved roads and the country logistic cost with those of the other BRIC members and the OECD it is clearly perceived the need for investment, whether public or private, to facilitate the competitiveness of domestic products on the world market. The paved roads network is only 11% of the whole highways network in Brazil, whether in Russia, China and India these numbers represent 80.9%, 81.6% and 47.3% respectively. The combination of 3 factors: the Brazil's economic development, the need for investment in infrastructure and the reduction by 90% in public investment in transport infrastructure over the past 40 years makes of fundamental importance the discussion about the viability of public private-partnership in the country, especially for propound alternatives for funding infrastructure to the state. It is responsibility of the state to choose self-sustainable assets that allow to the private initiative the necessary financial return for infrastructure project's viability. In 1993 it was established by the Brazilian federal government the "Programa de Concessões de Rodovias Federais – PROCROFE", with 14.000km of highways concession that would be transferred to private initiative. In the first stage, in 1995, 5 set of roads segments were transfer totalling 766 km. In 2007, after nine years of discussions has been undertaken the auction of the first phase of the second stage, with 2,600 km of roads divided into 7 set of roads segments. In 2009, the federal government proposed the second phase of the second stage with 680km in 1 concession. The scope of the Brazilian federal program also includes more than 6,500 km of highway concessions bringing some structural changes such as at the bidding design and the contract model, that have been previously used in the last two auctions, in 2007 and 2009. (...).

**Keywords:**

Highways concessions, Regulation, Financial viability.

ID 2895 R

**FREIGHT FLOW ANALYSIS AND ESTIMATION OF PAVEMENT COST REDUCTION BY OVERLOADED TRUCKS UTILIZING WEIGHBRIDGE SURVEY IN THE CENTRAL JAVA REGION**

Main Author:

**Hirohisa KAWAGUCHI** (*Oriental Consultants Company Limited*)

Co-author(s):

**Tomokazu WACHI** (*Oriental Consultants Company Limited*)

**Sadayuki YAGI** (*Japan Research Institute*)

**Abstract:**

The Central Java region is located in the central part of Java Island and contains major inter-regional and intra-regional freight corridors. The Government, however, is not capable of collecting sufficient freight transport data such as weight OD table by commodity types. It is not possible to maintain the roads to a high service level due to use by overloaded trucks and budgetary constraints. This paper proposes a new weighbridge survey method requiring minimum resources by utilizing daily operation of weighbridge stations. Overload analysis based on the survey data revealed that bulky commodities, particularly steel and cement damaged the pavement. The commodity weight OD table estimated by the survey data also revealed that the bulky commodities are transported across Java Island. The methodology for estimating the economic benefit of pavement cost reduction by a transportation project using the survey data was proposed and a case study was conducted for the enforcement of overload regulation and the new freight railway project.

**Keywords:**

Weighbridge, Overload, Freight OD, Pavement cost, Developing countries.

ID 3129 R

**THE TRADE OFF BETWEEN MAINTENANCE AND CONSTRUCTION FOR A ROAD NETWORK**

Main Author:

**Robin DUNLOP** (*DRD Consulting*)

**Abstract:**

Management of a road network is likely to be one of the largest business operations in a nation and hence the investment decisions made will every inhabitant.

The paper outlines the authors experience in developing road asset management by gathering appropriate information on the state of the network, engaging with road users focus groups to obtain information on the cost trade-offs versus levels of serviceability and applying economic analysis on required investment levels. The need to satisfy minimum safety levels and achieve legal requirements also has an effect on required maintenance levels and hence funding requirements. The fine line between the levels of investment in maintenance versus capital expenditure is normally controversial. Experience obtained in New Zealand by cutting back on maintenance funding to a level below a sustainable network resulted in approximately four years time a need to invest four times the amount saved to bring the network back to the original levels of service.

The paper outlines the risks of operating a well maintained road network by neglecting to fund adequate capital expenditure on necessary network capacity resulting in considerable unrest by road users and stakeholders. The conclusion is there should be no surprises to either the government or road users of the trade offs made between maintenance levels and capital expenditure.

**Keywords:**

TUE 13<sup>th</sup> (15:30 - 16:45, Session H2.1) Room 1.08

ID 1021 R

**BETWEEN ENGINEERING AND ANTHROPOLOGY:  
HOW TO COPE WITH THE PLANNING PROCESS OF  
PUBLIC TRANSPORT IN LATIN AMERICAN CITIES**

Main Author:

**Diego HERNANDEZ** (*Universidad Catolica de Chile*)

**Co-author(s):**

**Regina WITTER** (*EPFL-ENAC-LASUR*)

**Abstract:**

Planning and designing an efficient public transport system represents an important but difficult challenge for public authorities. Frequently, the lack of coordination between different public and private stakeholders involved affect serious obstacles. Considering related problems experienced in the city Santiago de Chile, this paper suggests a comprehensive planning approach that integrates diverging interests, such as engineering and social sciences. Accepting the important role of existing planning tools (Origin-Destination surveys leading to mathematical models, purely qualitative studies), further additional methods are taken into consideration, i.e. specific motility surveys and detailed GIS-based observations. The overall goal consists in the development of a comprehensive mobility information system that integrates the various methods and tools and forms a central platform for planners and decision makers in the transport and urban development field. Besides, this exercise offers an adequate opportunity to reflect about the advantages of new technology use, facilitating the process of information collection and analysis.

**Keywords:**

Urban transport planning, Public transport, Latin American Cities.

TUE 13<sup>th</sup> (15:30 - 16:45, Session H2.1) Room 1.08

ID 1101 R\*

**INÉGALITÉ SPATIALE DE L'OFFRE EN TRANSPORT  
URBAIN DE VOYAGEURS PAR BUS À ALGER**

Main Author:

**Lila CHABANE** (*CREAD*)

**Abstract:**

Les services de transport en commun urbain jouent un rôle important dans le bon fonctionnement d'une ville et offrent des possibilités de mobilité aux personnes n'ayant pas de voiture particulière ou un autre choix de mode de déplacement, ainsi ce service public de première ordre ne peut assurer sa mission que s'il est équitablement disponible sur tout le territoire de la ville et pour toute les populations et efficacement opérationnel sur le terrain. Notre recherche a pour objectif de caractériser le service de transport par bus dans sa capacité à répondre équitablement à la demande en déplacement, l'analyse d'un service de transport doit passer par l'évaluation des qualités intrinsèques d'un réseau et d'un mode de transport, ainsi la qualité du service rendu doit reposer sur une véritable pondération de l'offre de transport par la demande qui lui est adressée. Les principales difficultés de déplacements à Alger sont : - Des catégories de populations d'emblé excluent d'accès au réseau de bus tel que les handicapés physiques vu l'habitacle du véhicule (des marches à hauteur pour monter dans le bus, des portes étroites à l'avant et à l'arrière) ou affichant une réticence tel que les personnes âgées et les femmes pour cause de la promiscuité dans le bus (surcharge en plus étroitesse du couloir, ...). - Anarchie dans la prestation de service : vu la faible capacité du bus on constate généralement des bousculades pour monter dans le bus, les voyageurs montent et descendent des deux côtés avant et arrière d'où perte de temps. - Inégalité dans l'accès à l'information : l'usager n'a aucune information sur la configuration du réseau de bus (inexistence d'un plan de réseau qui indique l'itinéraire, les arrêts de bus et inexistence d'abri bus ou de poteau indicateur sur plusieurs lignes) et les horaires de passage, de départ et d'arrivée des bus. (...).

**Keywords:**

Alger, Réseau de transport urbain par bus, Inégalité spatiale de l'offre, Qualité de l'offre. .

ID 1973 R

**ASPP (AREA SPECIFIC PARTICIPATIVE PLANNING)**

Main Author:

**Robert HULLEMAN** (*City of Almelo, NL*)**Abstract:**

The ideal urban transportation mode is always available, reliable, low cost, does not use fossil energy (thus does not contribute to global warming), does not pollute local air and makes no noise. It takes only little space on the road and when parked and is fast for a lot of common trips. And, last but not least, it is healthy to use. This ideal transportation mode is the bicycle and it is astonishing that millions of people living in urban areas never or only rarely use it. During recent years, a new concept for urban planning has been developed in the Netherlands. It is called "Bundling of Qualities" and combines high quality urban planning and design which specifically favours alternatives for private cars in urban mobility, e.g. public transport and active transport (cycling, walking). The idea of Bundling of Qualities is to use urban planning and design to pull people towards public and active transport as well as – at the same time – to push them from the use of their cars. People make new – non private car – mobility choices because they benefit themselves from those choices. I-CE is a Dutch NGO that aims to promote the use of the bicycle as a means of transportation in developing countries, by improving the conditions for bicycle use. These conditions include aspects like directness, safety and comfort. Not only riding the bicycle should be attractive, but also parking it (and finding it on the same spot at the end of the day). Cultural aspects, that hinder bicycle use are addressed as well as political and technical aspects. I-ce cooperates with local NGO's and establishes partnerships with local and regional governments in the developing countries to foster cycling inclusive planning and – most important – transfer Dutch knowledge and expertise to local planners and engineers. (...).

**Keywords:**

Sustainable mobility, Bicycle, Cycling, Inclusive planning.

ID 2132 R

**SUSTAINABLE URBAN TRANSPORT IN CENTRAL AMERICA - A FUTURE WITHOUT THE CAR?**

Main Author:

**Eric SCHREFFLER** (*ESTC*)

Co-author(s):

**Nydia UMANA** (*Urban Transport Technical Unit, City of San Pedro Sula*)**Pedro GARCIA MORENO** (*Urban Transport Technical Unit, City of San Pedro Sula*)**Carolina MATTSSON** (*Koucky & Partners*)**Tom RYE** (*Napier University*)**Michael CARRENO** (*Transport Research Institute/Edinburgh Napier University*)**Abstract:**

Is it conceivable to contemplate a future without the car as the center of an urban transportation system? Can emerging economies grow without concomitant growth in car usage? San Pedro Sula, Honduras, is one city at a critical decision point about the future of transportation and mobility. Will it be a sustainable transport future that balances economic, environmental and social needs or will it be the traditional "predict and provide" approach that attempts to expand the capacity of the road system to meet future travel demand. This paper provides some background into the issue for this Central American city by describing the current urban transport system, current plans for improvement and outlines a process for defining a vision for a sustainable transport future in San Pedro Sula. The paper concludes with a challenge to all cities that currently have low automobile ownership rates to consider a sustainable transport system in order to "thrive" with transport choices for all residents rather than "choke" on congestion and the negative side effects thereof.

**Keywords:**

Sustainable urban transport plan, Accessibility, Mobility, Visioning, Travel choices.

TUE 13<sup>th</sup> (15:30 - 16:45, Session H2.1) Room 1.08

ID 2941 R

**COMPETITION PRICING STRATEGIES FOR PUBLIC TRANSIT IN MIXED OLIGOPOLY CONTEXT ?A CASE STUDY OF CHINA**

Main Author:

**Feifei QIN** (*Molde university college*)

**Abstract:**

By reviewing the existing organizational and operation arrangements of public transit system in China, this paper firstly explored a pricing competition model between profit maximizing operators and consumer surplus maximizing operators on a single route. Under this mixed duopoly market, effects of two widely used policies (fare subsidy and nationalization) on equilibrium fare changes are investigated through diagrammatic and numerical comparisons. Several conclusions from numerical calculations provide useful suggestions on setting policies in this duopolistic market. First, the private duopoly arrangement is more preferable than any mixed duopoly arrangement, as it produces more consumer and social surplus induced by lower equilibrium fares. Secondly, the application of any subsidy scheme can contribute to lowering equilibrium fares, improving consumer surplus and boosting public transit demand, which is in line with the standard results in the extant literature. Thirdly, given a certain amount of subsidies per trip, subsidizing on the low quality operator (bus) can achieve much better efficiency than any other subsidy schemes. Finally, it is noteworthy that in all of the scenarios reported, subsidization rules and the structure of transit market will definitely affect how optimal fares will be set.

**Keywords:**

Mixed duopoly, Subsidies redistribution, Bertrand pricing Game, Nationalized degree.

TUE 13<sup>th</sup> (17:00 - 18:15, Session H2.2) Room 1.08

ID 1493 R

**PERCEPTIONS AND EXPERIENCES REGARDING SERVICE QUALITY IN INDONESIAN PUBLIC TRANSPORT BASED ON GENDER**

Main Author:

**Tri JOEWONO** (*Parahyangan Catholic University*)

Co-author(s):

**Dhany UTAMI NINGTYAS** (*Parahyangan Catholic University*)

**Melinda TJEENDRA** (*University of New South Wales*)

**Abstract:**

Many studies show the importance of the explorations of passenger's characteristics as a basis to develop urban transport policy. This study has an aim to elaborate the difference regarding perception and experience of female and male as a user of public transport in Indonesian cities. The perceptions and experiences are employed to evaluate the service quality index, where level of importance expresses the perception and level of satisfaction expresses the experience. The exploration used data from questionnaire survey, which was distributed in three cities in Indonesia, i.e. Bandung, Jakarta, and Yogyakarta, as a representative of other urban cities in Indonesia. The questionnaire was distributed only among public transport users in 2008. An analysis was conducted by calculating the heterogeneous customer satisfaction index (HCSI). The analysis shows that female tends to be more satisfied than male in experiencing the services, where the index is location specific as a representation of the uniqueness of each city. Analysis also found that each attributes of service quality gives different contribution to the overall satisfaction, for male and female as well as for each city. Female and male are found to rate differently the attributes of service quality.

**Keywords:**

Perceptions, Experiences, Service Quality, Gender, Public Transport.

ID 1518 R

**EXPLORATORY STUDY OF PASSENGERS' SATISFACTION, DRIVER AND BUS SCHEDULING OF THE LAGOS METROPOLIS BUS RAPID TRANSIT (BRT) SCHEME**

Main Author:

**Olukayode OYESIKU** (*Tai Solarin University of Education, Office of the Vice Chancellor*)

**Abstract:**

The significant of public transport of cities in many developing countries lies in the fundamental fact that mobility and accessibility are essential for economic growth and of necessity to provide efficient and effective movement for goods and services. The failure of the public transportation system however and indeed overall transportation system in the cities has led to further marginalisation of the greater majority of the people in these cities and consequently, economic deprivation. The empirical study on which this paper is based was aimed at evaluating the level of passengers' satisfaction of the BRT scheme introduced by mid 2008. About four thousand (4,000) passengers and eighty (80) drivers of the buses in the scheme were interviewed through a self administered questionnaire. Ten (10) major criteria that could determined the passengers' and drivers' satisfaction were identified and measured including: speed, comfort ability, reliability, promptness of buses, availability, relationship with the drivers, ease of waiting time and safety during the trips. With over 100 buses and about 500 drivers along three (3) dominant routes in the city, drivers and buses scheduling are still manually done. This has implications for the route planning, drivers and buses scheduling of the BRT public transport planning and operations. The findings show that though overall about 62% of the passengers were either satisfied or fully satisfied in all these criteria, there is wide variation in the level of satisfaction among the routes. While the buses arrive and depart on schedule on some routes, buses are inadequate and drivers not sufficient in others on some days. Using multivariate analytical methods, the major determinants of continuous use of the BRT scheme are: reliable and stable cheaper fares, comfort, reliability, and availability of the bus services. (...).

**Keywords:**

Bus Rapid Transit, Bus Scheduling, Lagos Metropolitan Area.

ID 1640 R

**USER PERCEPTIONS OF EXPRESS BOATS IN BANGKOK**

Main Author:

**Djoen SAN SANTOSO** (*Saitama University*)

Co-author(s):

**Yusrizal KURNIAWAN** (*Asian Institute of Technology*)

**Vidi FERDIAN** (*Asian Institute of Technology*)

**Ibni ACHIRUDIN** (*Asian Institute of Technology*)

**Bathsukh RENSEND** (*Asian Institute of Technology*)

**Abstract:**

Waterway can be one of the alternative modes for travelers to avoid the traffic jam on the road. However, in the development of transportation sector in many developing countries, this transportation mode has less attention for improvement and development. Bangkok is one of the notorious cities in Asia in terms of traffic jam. Even with the operation of rail mass rapid transit such as BTS Skytrain and MRT system, the traffic congestion is still persistent. This paper tries to look back at the old history when the waterway, as a transportation mode, was the backbone for traveling. The study focuses on the services provided by express boats that operate along the Chao Phraya River in Bangkok. Questionnaire survey and interview were conducted to users of express boats along Chao Phraya River to examine the characteristics of the express boat users and their perceptions on the services. It is attempted to bring out the factors that are considered important from the user perspective based on their experience in using the service. On the overall assessment, majority responded positively on the available services even with its limitations. Constraints related to the operation of the express boat service were also discussed in the paper.

**Keywords:**

Water transportation, Waterways, Express boat, Sustainable transportation, Bangkok, Chao Phraya River.



TUE 13<sup>th</sup> (17:00 - 18:15, Session H2.2) Room 1.08

ID 2227 R

## **EVALUATING BICYCLISTS COMFORT AND SAFETY PERCEPTION**

Main Author:

**Himani JAIN** (TRIPP, IIT Delhi)

Co-author(s):

**Geetam TIWARI**

**Mark ZUIDGEEST** (ITC)

### **Abstract:**

Perception of safety and comfort of bicycle infrastructure is an important factor influencing the use of bicycles. Cyclists can be found all over India. In urban areas presently, mostly captive riders choose to bicycle as no other viable options of travel are available to them. This study discusses perceptions of these captive riders as compared to a group of not yet riding (potential) cyclists. A stated preference survey to estimate the perception of captive users and potential users on cycling was conducted. The perception of risk among captive riders and potential riders does not show much difference as against popular beliefs. Both the captive users as well as the potential users focus on physical safety and the difficulties in crossing the intersections. Differences arise in perception of comfort / attractiveness and barriers. Pedestrians / bus commuters waiting at the curb side lane are considered as predominant barriers (about 28%) by potential users while captive riders are more tolerant to them. Results indicate that perception of safety and comfort are not related to age, gender, type of zone and distance travelled. However, the presence of informal sector on the street side is social security element and attractive for providing services for captive cyclists. The potential users consider informal sector as a barrier, although, lighting seems to be important to them. Results of SP experiment shows potential users perceive slope as bigger threat to bicycle compatibility as compared to captive riders. Captive riders prefer wider roads against the narrow roads preferred by potential cyclists. Land use mix seems to be not a major concern, while low density areas are preferred. (...).

### **Keywords:**

Safety, Captive bicycle users, Potential users, Comfort, Barriers, India.

TUE 13<sup>th</sup> (17:00 - 18:15, Session H2.2) Room 1.08

ID 3032 R

## **THE STRUCTURE OF USERS' SATISFACTION ON URBAN PUBLIC TRANSPORT SERVICE IN NAIROBI**

Main Author:

**Toshiyuki OKAMURA** (Yokohama National University)

### **Abstract:**

The study investigates public transport service attributes that influence overall passengers' satisfaction and ultimately enhancing public transportation ridership in developing countries. An original questionnaire survey to public transport users was designed and conducted in the city of Nairobi, the capital of Kenya, to collect prerequisite information and data to facilitate the analysis. It also provided requisite variables which were used to develop Structural Equation Model (SEM) to elucidate the interrelationship between the observed variables and unobserved variables and their impact to the overall commuters' satisfaction. Unobserved attributes such as Service Quality (SQ), Safety (S) and Travel Cost (TC) were estimated. Level of satisfaction was found to be significantly influenced by Service Quality (SQ), Safety (S), Travel Cost (TC) and the perception on the systems' performance. The study therefore proposed the model to transportation engineers and planners in Nairobi city in the investigation of travel factors that do determine commuters' satisfaction with public transportation services.

### **Keywords:**

Public Transportation, Commuters' Satisfaction, Developing country.

ID 1306 R

**ASSESSMENT OF JEEPNEY IN METRO MANILA FOR DEVELOPMENT OF SPECIFICATIONS AND STANDARDS**

Main Author:

**Riches BACERO** (*National Center for Transportation Studies*)

Co-author(s):

**Karl VERGEL** (*Institute of Civil Engineering*)

**Abstract:**

This research established database of manufacturers and their design specification, compared the parts of the jeepney vehicle using Philippine National Standards and international standards, and determined the condition and design of the vehicle based on the perception and preference of jeepney drivers and passengers. The study revealed that most jeepney manufacturing firms have varied specifications with regard to the capacity, dimensions and weight of the vehicle and similar specification on the parts and equipment of the jeepney vehicle. The parts of jeepney vehicles have similar specifications compared to the 4 out of 5 mandatory PNS and 18 out of 26 UNECE Regulations applicable for jeepney vehicle. Most of the jeepney drivers and passengers want to improve, change and standardize the parts of the jeepney vehicle. It is concluded that the jeepney vehicle can be standardized in terms of design, safety and environmental concerns.

**Keywords:**

Jeepney, Design, Specifications and Standards.

ID 2223 R

**MOTORISED TWO-WHEELERS IN SUB-SAHARAN AFRICAN CITIES: PUBLIC VS PRIVATE USE?**

Main Author:

**Lourdes DIAZ OLVERA** (*Laboratoire d'Economie des Transports - ENTPE*)

Co-author(s):

**Didier PLAT** (*Laboratoire d'Economie des Transports*)

**Pascal POCHET** (*LET - ENTPE*)

**Maidadi SAHABANA** (*Communauté Urbaine de Douala*)

**Abstract:**

In a number of Sub-Saharan African cities, motorized two-wheelers, which are traditionally intended for purely private use, have been appropriated for a commercial activity, the motorbike taxi. This paper has two goals: to study the conditions which have made it possible for motorbikes to become a major public transport mode and to highlight the roles of the motorbike, used as a personal or public transport mode, in daily travel. Our analysis is based on empirical material gathered in quantitative and qualitative surveys in Niamey and Douala. The commercial use of motorized two-wheelers can be explained by the combination of three factors: the dearth of transport supply, the availability of factors of production and the permissiveness of the regulatory framework. Whether used as a private vehicle or a taxi, motorbikes widen access to motorized modes, both in terms of users and travel. The boom in the use of motorbike taxis is due to the fact that they meet needs not satisfied by the other public transport modes. In Niamey, the users of private motorbikes are mainly young male middle-income earners while in Douala the clientele of motorbike taxis consists of young poor working population, mostly women. In both cities, attitudes towards motorbikes are divided between prizing the flexibility of the transport mode and rejecting its dangers. The most pressing needs for research into motorbike, particularly taxis, relate to environmental, social and public health issues, with a view to improving regulation of the activity.

**Keywords:**

Motorized two-wheelers, Personal motorbike, Motorbike taxi, Travel behaviour, Attitude, Public transport supply, Urban transport, Poverty, Niamey, Douala, Sub-Saharan Africa.

ID 2505 R

**THE CONSEQUENCES OF RAPID MOTORIZATION ON URBAN PLANNING IN CHINA**

Main Author:

**Alainna THOMAS** (*UC Berkeley*)**Abstract:**

Car culture has penetrated Chinese society at an extraordinary rate. Municipal governments have built roads, constructed expressways and cleared land to make room for cars. The result is loss of public space, deteriorating air quality, staggering congestion, increased sprawl and reduced quality of life for the majority of residents who remain car-less (Xiao 2007). Further, public transit systems, particularly bus systems, have steadily declined in service because of crowded roads and less investment, meaning less mobility for the working class. Despite the Ministry of Construction's call to make public transit a priority, cities seem to be following a more auto-oriented development path. They may not turn to public transit until they have exhausted all other measures such as building more roads (Yang, 2007). This paper focuses on the consequences of burgeoning car population on urban planning in China, particularly second-tier cities. In the first part, the overall context of motorization is addressed and a brief history of how the government has encouraged auto ownership in China and thus, restricted cities responses to motorization. In the second part, the BRT is described and the decisions made that shaped urban form as well as accessibility and mobility for other modes, such walking and biking. From this project, a new image of the municipal government emerges as an organization of multiple

**Keywords:**

Urban planning, China, Motorization.

ID 2819 R

**NEW VEHICLE CHOICE IN INDIA: HOUSEHOLD CHOICE AMONG MOTORIZED VEHICLE SEGMENTS**

Main Author:

**Ipsita BANERJEE** (*University of California, Berkeley*)**Abstract:**

Spurred by rapid economic growth, personal vehicle ownership in India is increasing at a fast pace. This is changing the relative popularity of the various vehicle segments in the market. We present a survey of new vehicle buyers in Surat, a representative city in western India, to analyze preferences of consumers in the Indian market. Through this survey, we analyze choices made across new and used motorized two-wheelers and cars, and across different car size segments in a single framework. We control for the preferences of different vehicle attributes by the various socio-demographic groups, and for the attitudes and perceptions of the vehicle buyer. Our analysis quantifies a shift, with increasing wealth, from purchase of motorized two-wheelers to that of cars. We also find evidence of the Indian consumers' preference for smaller vehicles, especially for smaller households. Additionally we find that consumers are highly sensitive to operating cost as compared to purchase price of the vehicle. The model estimated can explicitly forecast the mix of the motorized personal vehicle fleet, which can inform policy both at the micro and at the macro level. It can facilitate micro-level planning such as estimation of the number of parking spaces of different sizes. It can also facilitate macro-level policy measures such as the computation of taxes and excise on different vehicle segments based on the knowledge of the factors that drive choice and of the sensitivities of the consumer.

**Keywords:**

Vehicle choice, Vehicle class or size category, Survey, Attitude &amp; perceptions, Factor analysis, Likert scale.

ID 3085 R

**THE DYNAMICS OF METROPOLITAN MOTORIZATION UNDER RAPID DEVELOPMENT: THE BEIJING CASE**

Main Author:

*Chris ZEGRAS (MIT, DUSP)*

Co-author(s):

*Yang CHEN (MIT)***Abstract:**

China is undergoing a major demographic transition of rapid and intense urbanization, coupled with high and sustained economic growth, and changes in consumer behavior and industrial and economic activity. In this paper we attempt to shed light on these recent dynamics in China's capital city, Beijing, by examining household auto ownership in 2001 and 2006. Specifically, we aim to see whether the relative influence of the underlying factors affecting household ownership decisions have been changing, even over this relatively brief period. We examine auto ownership utilizing disaggregate choice models, estimated on household surveys conducted in the two years of interest. First, we estimate separate logit models of household vehicle ownership, using traditional choice model specifications. We then combine the two datasets and use the stability of preference test to assess whether the influence of the same variables has changed over the five year period. Then, for the 2006 data, we include relative location variables to examine the degree to which these also influence household vehicle choice. Finally, we employ latent class models in an attempt to capture discrete attitude and lifestyle preference differences and see whether this improves model performance. The paper offers an example of one of the first disaggregate vehicle ownership models developed in the Chinese context. The range of models employed helps reveal how household vehicle ownership choice processes may be changing over time and, in addition, how choice models can be improved for more accurate forecasting.

**Keywords:**

Motor vehicle ownership, Discrete choice models, C

ID 1328 R

**INEFFECTIVE INTERSECTION CONTROL IN DEVELOPING COUNTRIES - CASE OF DAR ES SALAAM CITY**

Main Author:

*David MFINANGA (University of Dar es Salaam)***Abstract:**

One of the major bottlenecks that exacerbate congestion in road networks is intersections; effective control of which is an important strategy in improving traffic flow. While developing countries have found it hard to adopt sophisticated means of intersection control, they have also abandoned low-cost and effective means of traffic control at intersections and adopted an increasing trend across the continent of overriding traffic signals and instead letting the traffic police officers guide vehicles. This study has compared the performance of two major signalised intersections in Dar es Salaam city in Tanzania when operating under traffic signal and when the traffic police officer is controlling the intersection. Results show that the traffic police officer is not improving the performance of the intersection but rather makes sure that drivers observe traffic rules. The capacity is improved in some approaches and is reduced in others and likewise for the delay. The findings dispute the widely held view that traffic police officers do a better job than the signals while actually simple improvements on signal timing can better improve the performance of the intersection. The paper also includes a review of roundabouts which have become increasingly popular in recent years as simple and low cost forms of intersection control. The performance of three major roundabouts in Dar es Salaam has been analysed and results show that roundabouts can accommodate high traffic volumes without causing excessive delays. The results also show that low-cost improvements on roundabouts, involving minor adjustments in geometry and improved traffic management, can significantly improve their operational performance. (...).

**Keywords:**

Intersection control, Signals, Roundabouts.

ID 1885 R

**ROADWAY AND TRAFFIC CHARACTERISTICS FOR BICYCLING**

Main Author:

**Janice PROVIDELO** (*UFSCar*)

Co-author(s):

**Suely SANCHES** (*Federal University of São Carlos*)**Abstract:**

The promotion of bicycle transportation includes the provision of suitable infrastructure for cyclists. In order to determine if a road is suitable for bicycling or not, and what improvements need to be made to increase the level of service for bicycles on specific situations, it is important to know how cyclists perceive the characteristics that define the roadway environment. The present paper describes a research developed to define which roadway and traffic characteristics are prioritized by users and potential users in the evaluation of quality of roads for bicycling in urban areas of Brazilian medium-sized cities. A focus group discussion identified 14 attributes representing characteristics that describe the quality of roads for bicycling in Brazilian cities. In addition, an attitude survey was applied with individuals to assess their perception on the attributes, along with the importance given to each one of them. The results were analyzed through the method of Successive Intervals Analysis, which allows the transformation of categorical data into an interval scale. The analysis suggests that both the roadway and traffic characteristics related to segments and those related to intersections are important to the survey respondents. The five most important attributes, in their opinion, are: 1) lane width; 2) motor vehicle speed; 3) visibility at intersections; 4) presence of intersections; and 5) street trees (shading). Therefore, the research suggests that to promote bicycle use in Brazilian medium-sized cities, these attributes must be prioritized.

**Keywords:**

Bicycle, Roadway and traffic characteristics, Quality of roads for bicycling, Brazil, Method of successive intervals.

ID 2512 R

**PARKING IN CHINESE CITIES—BARRIERS TO PRICING POLICIES**

Main Author:

**Alainna THOMAS** (*UC Berkeley*)**Abstract:**

China has undergone an unprecedented rate of motorization. It has now surpassed the United States to become the largest auto market in 2010. As a result, cities across China are undergoing profound urban transformations, as elevated expressway and wide arterials are built to meet motorists' demands (Cao 2008). The car has ingratiated itself in Chinese society; municipal governments are facing increased congestion that is costing them millions in lost revenue. Parking supply management, particularly pricing, could help shift auto dependence to more sustainable alternative modes and reduce congestion (Shoup 2005). This paper addresses the barriers to using parking to reduce auto use in Chinese cities. Barriers identified include: (1) lack of parking supply (2) weak regulations and intergovernmental conflicts (3) and weak enforcement. All three are interlinked and must be addressed to make full use of parking as a transportation demand management tool.

**Keywords:**

China, Parking, Pricing barriers.

ID 2654 R

**MEASUREMENT OF DIFFERENCES OBSERVED IN TWO CONTINUES MANUAL VEHICLE COUNT DATA SETS**

Main Author:

**Darcin AKIN** (GEBZE INSTITUTE OF TECHNOLOGY)

Co-author(s):

**Ahmet KOCASLAN** (BIMTAS, Istanbul Metropolitan Municipality)**Aykut TOROS** (Yeditepe University, Istanbul, Turkey and BIMTAS, Istanbul Metropolitan Municipality)**Abstract:**

In this paper, errors associated with manual vehicle counts by two trained personnel are analyzed. Vehicle and occupant counts as well as roadside interviews to collect O-D data are conducted manually for a traffic survey study to determine the movements of goods and passenger traffic through the metropolitan city of Istanbul, Turkey, from east to west and vice-versa, on the 8th (Thursday) and 9th (Friday) of January in 2008 only on exiting lanes of the two major highways (E5/D100 highway, speed limit (SL) = 90 km/hr and E80/TEM highway, SL = 120 km/hr) at four selected locations, two of which were at the east and the other two were at the west borders of the city. When the differences in the two data sets including vehicle counts by two personnel by day of week, time of day, location and flow rate were analyzed, it was seen that peak period counts (morning-noon-afternoon and evening peaks) included the highest differences in percent (equal or over 100%). Night-time counts (between 12-7 am) were the least problematic ones regarding the differences in percent (equal or less than 100%) except at one location on E80/TEM highway at the west exit on Friday night, probably due to a snow blizzard effective from midnight to around 7 am. On the contrary to the expectations, at high-speed and high volume locations no significantly high errors were observed between the counts, probably due to controlled lane drops for the purpose of pulling vehicles from the flowing traffic onto interview locations to conduct roadside interviews. (...).

**Keywords:**

Data collection, Traffic counts, Cordon counts, Vehicle classification, Count errors, Istanbul.

ID 3049 R

**TRAFFIC MANAGEMENT CHALLENGES AND SOLUTIONS FOR EASTERN EUROPEAN CITIES**

Main Author:

**Lajos KIBEDI-VARGA** (Budapest University of Technology and Economics)

Co-author(s):

**Robert VARGA** (Budapest University of Technology and Economics)**Abstract:**

In the beginning of the 90s, most countries in Eastern Europe had political and economical changes, therefore they had to face new opportunities and new problems as well. In the field of surface transport, now focusing on urban transport there were a number of different strategies, concepts and ad-hoc decisions concerning different political goals, transport policies and supporting systems. Since then, for most middle-sized Eastern European cities there was a lack of systematic strategies or there was no urban strategy at all. Realizing these kinds of problems projects receiving EU funding require systematic decisions of different fields of urban development. Special development, reconstruction, revitalization projects with a high budget have to correspond to general strategies of the municipality (integrated urban development strategy, transport development strategy, urban environmental strategy, etc.) This paper is focusing on the transport development strategy of Bekescsaba, a town of county rank and the county seat of Bekes County located in South-East Hungary. The study includes all modes of urban transport covered with traffic counting, surveys for public transport, individual transport modes and households. Road network data and other static data was mostly available, but there was a lack of dynamic data and trends which could also be useful for the next step of the research. Beyond the national practices, some of similarly situated western European cities were analyzed looking for best practice traffic management tools (junctions, parking policies, biking, public transport network, traffic calming, etc.) All of the collected data was an input to a macroscopic transport modeling software. (...).

**Keywords:**

Political and economical changes, Sustainable urban transport development, EU funding, Best practice traffic management tools, Macroscopic transport modelling, Transport development strategy.

ID 1194 R

**URBAN ACCESSIBILITY IN AN INEFFICIENT TRANSPORTATION SYSTEM: CAN TEHRANI HOUSEHOLDS AFFORD THEIR DAILY TRIPS?**

Main Author:

**Setareh ATAIEYAN** (*Laboratoire d'Economie des Transports*)**Abstract:**

Capital and the largest city of Iran, the metropolitan area of Tehran with its approximately thirteen million inhabitants, concentrates about a quarter of Iranian urban population. Mobility is here, as in other cities, a necessity of urban life and an essential condition for enjoying the urban amenities. However, Tehran's urban transportation system does not facilitate this mobility. The under-developed mass transportation network (bus and metro), is far from satisfying the Tehranis' demand: the metro network for example, attracts only 5 % of motorised daily trips (2007). Over the years, the private transportation modes, personal as collective, have confirmed their place as the most used transportation means by Tehranis. However, the using cost of these modes is generally higher than that of public transportation. This causes then an unequal access to the transportation modes for Tehranis according to their financial capacity and thus an unequal access to the city and the urban amenities. The purpose of this paper is to identify the Tehrani households' travel strategies through the analysis of their global budgets. We intend to highlight the households' probable mobility strategies by analysing their transport expenditure and its importance in their monthly budget considering that their financial capacity is most likely to restrict their modal choice.

**Keywords:**

Household budget, Transportation expenditure, Transportation service offer, Tehran, Urban transportation.

ID 1287 R

**TRANSPORT ACCESSIBILITY AND SOCIAL EXCLUSION: A BETTER WAY TO EVALUATE PUBLIC TRANSPORT INVESTMENT?**

Main Author:

**Juan PABLO BOCAREJO SUESCÚN** (*Universidad de los Andes*)

Co-author(s):

**Daniel OVIEDO HERNANDEZ** (*Universidad de los Andes*)**Abstract:**

The project starts from traditional definitions and measurements of transport accessibility and establishes a methodology that enables policy evaluators to involve income levels, primarily of the poorest segment of population, in the assessment of transport-related projects in developing countries. Social Utility evaluation is also suggested to analyze different alternatives of public transport fare structures. The proposed method will be applied to the case study of Bogotá (Colombia). Public transport and road supply are going to be evaluated in areas of the city served by different transportation systems, including local BRT Transmilenio in certain cases. Traditional accessibility is measured using Hansen's gravity indicator and Job market measurements. It is then applied to determine accessibility levels related to activity clusters from each of the selected zones.

**Keywords:**

Accessibility, Social Exclusion, Urban Transport, Developing countries.

ID 1390 R

**A SCOPING STUDY OF TRANSPORT AND SOCIAL EXCLUSION IN THE TSHWANE REGION OF SOUTH AFRICA**

Main Author:

**Karen LUCAS** (*Transport Studies Unit, University of Oxford*)**Abstract:**

To date, the majority of studies of transport and its possible role in the social exclusion of individuals and communities have been conducted within a UK context (e.g. Church and Frost 1999, TRaC, 2000; Lucas et al 2001, Social Exclusion Unit, 2003). Although there have also been a number of European and Australian studies of this issue more recently (e.g. Hurnie, 2006; Currie et al, 2007; Cebollada, 2009). This is in part because the language of social exclusion and its core policy agenda is primarily European. Essentially, the term describes a mutually reinforcing process whereby an individual or whole community becomes 'locked out' of accessing the basic resources with which to secure a reasonable quality of life. The paper explores the same issue in relation to transport policy but in a development context, where it is the majority of the population which is experiencing the extreme hardships that comes from lack of participation in the formal economy and the financial exclusion and social disadvantage that usually ensues from this. The paper describes a scoping study, which was commissioned on behalf of the South African Department of Transportation to explore the potential links between a lack of transport and poverty amongst South African households. It presents the main findings of twelve focus group exercises undertaken with different sectors of the low income population living in rural, urban and urban peripheral areas of the Tshwane (Pretoria) region of South Africa. The primary motivation for the research was to identify and articulate the transport problems that very low income and socially disadvantaged people living in urban, peri-urban and rural contexts in South Africa experience on a daily basis and to demonstrate how this affects their livelihoods and wider life opportunities. (...).

**Keywords:**

Transport poverty, Social exclusion, South Africa.

ID 1852 R

**EXPLANATORY ANALYSIS OF WEEKDAY AND WEEKEND DAILY PHYSICAL-VIRTUAL ACTIVITY AND TRAVEL PATTERNS OF INDIVIDUALS IN CAIRO, EGYPT**

Main Author:

**Ahmed MOSA**

Co-author(s):

**Adel ABDELMAKSOU****Ali HEIKAL****Abstract:**

Activity-based travel demand forecasting is increasingly becoming a mainstream approach to travel demand modelling and has received substantial attention in the past three decades. At the core of activity analysis there are issues related to time allocation by individuals and the role time play in organizing activities within specific periods. In the past, this stream of work attempted to summarize human behaviour in terms of representative behaviour of several relatively homogeneous groups using pattern recognition techniques. Understanding activity engagement and time use patterns, however, may require us to examining the effects of correlates on time allocation behaviour, habit persistence, history dependence, and the impact of changes in the correlates. While most of the studies have focused on weekday activities, out-of-home activities, and physical activity and travel patterns of individuals in developed countries, the aim of this paper is to contribute to the understanding of daily activity and time allocation patterns of individuals in developing country. In this paper, we explore the complex relationships among virtual-physical activity participation and travel patterns of individuals in developing country. Using two-day activity and telecommunication diary survey conducted in Cairo Region, in Egypt, individuals' daily time allocation for virtualphysical activities and travel are analyzed. Essentially, we have adopted two approaches; the first approach is to identify relatively homogeneous behavioural groups using cluster analysis. This is done to reduce the great diversity in individuals' behaviour into a few reprehensive patterns of behaviour using activity and travel indicators. (...).

**Keywords:**

Activity-based modelling, Time use, Virtual and physical activity participation, Mixed logit models.



WED 14<sup>th</sup> (11:15 - 12:30, Session H2.5) Room 1.08

ID 2233 R

**INCOME DATA COLLECTION METHODS AND DAILY TRAVEL ANALYSIS IN SUB-SAHARAN AFRICAN CITIES**

Main Author:

**Pascal POCHET** (LET - ENTPE)

Co-author(s):

**Lourdes DIAZ OLVERA** (Laboratoire d'Economie des Transports - ENTPE)

**Didier PLAT** (Laboratoire d'Economie des Transports)

**Abstract:**

Knowledge of the burden of transport expenditure in the household budget of poor populations seems essential for passenger transport policy formulation in order to improve their travel conditions. In cities of the developing world, a high proportion of the population is poor and equity issues are therefore all the more important. However, the identification of the poor strongly depends on the indicators used and in these cities collection and analysis of income data encounters a number of methodological difficulties. The goal of this paper is to identify the type of data collection which provides the best estimate of individual incomes and how the analysis of travel and inequalities can be enhanced by improving the quality of income data. For this purpose, we have compared the survey methods in three household surveys conducted in Niamey and Douala. The results show that detailed collection of income data from each individual according to its source improves the accuracy of the total income assessment. They also show that inequalities with regard to consumption of transport services appear to be greater when income data is more accurate. The methodological findings of these analyses appear useful for academic work and transport policy appraisal concerning not only developing countries but also countries from the North.

**Keywords:**

Household survey, Survey method, Individual income, Household income, Equity, Travel indicator, Transport expenditure, Concentration curve, Measurement bias, Douala, Niamey.

THU 15<sup>th</sup> (08:15 - 09:30, Session H2.6) Room 1.08

ID 1822 R

**WALK THE LINE: STATION CONTEXT, CORRIDOR TYPE AND BUS RAPID TRANSIT WALK ACCESS IN JINAN, CHINA**

Main Author:

**Chris ZEGRAS** (MIT, DUSP)

Co-author(s):

**Yang JIANG** (MIT)

**Shomik MEHNDIRATTA** (World Bank)

**Abstract:**

This paper focuses on the relationship between bus rapid transit (BRT) station context and corridor type and the distance people will walk to access the system (i.e., catchment area). In China, the station catchment-area radius has always been assumed to be about 600 meters, across all types of corridors and stations. Nonetheless, we would expect the actual catchment areas to vary, in part depending on the walking conditions, which may be affected by both the BRT corridor and specific station characteristics. Understanding such variation and accounting for it in BRT planning and operations could help improve demand forecasts and inform physical and design interventions to increase system ridership. In this paper, we examine station area walking catchment area variation and contributing factors in a particular empirical setting, Jinan China. Specifically, we hypothesize that certain contextual urban form features and station and right-of-way configurations will increase the walk-access catchment area; that is, that urban design influences users' willingness to walk to BRT. We base our analysis on 2,155 user surveys, conducted at 19 BRT stations along Jinan's three existing BRT corridors. The survey included questions on the individual's basic socioeconomic and demographic characteristics as well as approximate trip origins and destinations and walking routes. We derived station area walking distances using a geographic information system (GIS) map. We then used ordinary least squares regression to analyze the influence of aggregate station- and corridor-area characteristics on trip distances, controlling for disaggregate trip and trip-maker characteristics. The results indicate that people walk further to BRT stations on the "integrated-boulevard" corridor when the walking environment has certain features (median transit-way station location, shaded, busy and interesting, better orientation) than otherwise. (...).

**Keywords:**

BRT, Walk access, Built environment, Corridors, China.

ID 2130 R

**DISTANCE, GRADIENT AND BUS SERVICES IN THE CHARACTERISTICS OF COMMUTERS ACCESSING RAIL STATIONS**

Main Author:

**Djoen SAN SANTOSO** (*Saitama University*)

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**Abstract:**

This paper analyzes the distance and gradient in the travel characteristics of commuters using rail transit for their journey to work with specific focus on the utilization of public bus as a feeder to the station. The study is based on the public responses collected from questionnaire survey distributed to residential areas in Hidaka City, Japan. The access trip characteristics to the station are examined in terms distance and gradient with concentration on the provision of the public bus as a feeder. Mode use pattern, distance and gradient from home to the station and to the bus stop, and satisfaction to the bus services were evaluated and discussed. It is expected that the underlying preferences of commuters in accessing transit stations can be understood to provide better policy in improving the public bus and rail transit ridership.

**Keywords:**

Public transport, Small city, Accessibility, Rail station, Japan.

ID 2157 R

**MODAL SHIFT IMPACTS ON PM10 CONCENTRATION NEAR TO BRT TRANSJAKARTA CORRIDORS**

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**Zhang JUNYI** (*Transportation Engineering Laboratory, Graduate School for International Development and Cooperation, Hiroshima University Japan*)

**Abstract:**

Bus Rapid Transit (BRT) system was implemented in Jakarta City in January 2004 which gave impacts on modal shift change from private modes. These modal shift changes from car and motorcycle to BRT reduce the emission intensity of primary pollutants such as NO<sub>x</sub>, PM10 and CO. The objective was to evaluate the BRT system's impact on ambient concentration of PM10 near to BRT's corridors. By using data collected at five continuous ambient air quality monitoring stations near to BRT corridor TransJakarta in 2005, we apply structural equation model which capable to analyze cause-effects relationship among factors in determining PM10 concentration near to BRT lines. Major sources affecting PM10 concentration are likely to be related to motorcycle and diesel vehicles which measures as bus and truck fleet and local wind directions. Minor and negative influences on PM10 concentration come from private cars and other micro-meteorological factors. The results suggest that the park and ride motorcycle system as the access mode to BRT will improve the PM10 concentration near to TransJakarta BRT's lines.

**Keywords:**

TransJakarta Bus Rapid Transit system, PM10, Structural Equation Model.

THU 15<sup>th</sup> (08:15 - 09:30, Session H2.6) Room 1.08

ID 2347 R

**COMPARATIVE EVALUATION BETWEEN ELEVATED AND UNDERGROUND METRO: CASE STUDY - MUMBAI METRO**

Main Author:

**Gajanan SASANE** (*IIT Bombay*)

Co-author(s):

**Sunder LALL DHINGRA** (*Indian Institute of Technology - Bombay*)

**Tanaji GUNJATE** (*Indian Institute of Technology - Bombay*)

**Abstract:**

This paper is a technical study to evaluate the elevated metro (EL) and the underground metro (UG) system to make a rational decision about which is feasible and in what way. The decision will consider all kinds of impacts on the quality of life of the beneficiary as well as those affected directly by the elevated alignment of the said metro. Underground metro plays a pivotal role in decreasing excessive sufferings of the people in the region during the construction phase and the charges of operation and maintenance, as the roads are decongested thus leading to decrease in the vehicle operation cost during operation period. This study proves the economic viability of the underground metro over elevated metro. (US \$1 million = Rs. 48.62 million)

**Keywords:**

Economic evaluation, Underground Metro, Elevated Metro.

THU 15<sup>th</sup> (08:15 - 09:30, Session H2.6) Room 1.08

ID 2386 R\*

**STUDY ON COMMUNITY BUS DEVELOPMENT IN HISTORIC AREA**

Main Author:

**Hui YING** (*College of Transportation Engineering, Tongji University*)

**Abstract:**

Public transport system should be improved by regulating the process of motorization and boosting district development. Community bus is the important part of multi-mode trip-chain. Taking community bus development in Shanyinlu historic area as the study case, this study put forward that reasonable design of community bus line could improve the community neighbourhood attraction, increase the internal trip-chain structure nodes, and promote a more balanced of place attraction strength. The study also found that the considerable demand was exist for community bus from the results of Disaggregate Model.

**Keywords:**

Community bus, Historic area, Trip-chain, SP survey, Disaggregate model.

ID 1400 R

**THE EFFECTS OF INCOME AND FARE VARIATION ON THE DEMAND FOR BUS TRANSIT SERVICES IN BRAZIL**

Main Author:

**Rafael PEREIRA** (*Institute of Applied Economic Research - IPEA/Government of Brazil*)

Co-author(s):

**Carlos HENRIQUE RIBEIRO DE CARVALHO** (*Institute of Applied Economic Research - IPEA/Government of Brazil*)**Abstract:**

The public policies on mass transit and other economic policies have been unable to avoid increasing mass transit costs and urban bus fares, which places a burden on a majority of the population depending on public transit. This study analyzes the variations in urban bus fares and households income and analyzes their effects on the demand of paying commuters in 9 large Brazilian cities between 1995 and 2008. The study shows that a gap between the rise of urban bus fares and the population's income led to a decrease of more than 30% of the paying demand between 1995 and 2003. According to the price elasticity estimated in this study, demand for bus services has exhibited elastic behavior since 2001. Since then, the gradual increase observed in population income seems to buffer against persistent fare increases. The recovery of average household per capita income since then seems to support a reversal of downward trends in the number of paying passengers and increase access to public bus services. The number of paying passengers increased about 9.5% between 2003 and 2008. The evolution of the sector's main costs complement the study, permitting an analysis of the many factors that have caused the continuous increases of bus fares in metropolitan Brazil during this period. The study concludes highlighting some public policies that could provide a better economic environment for the provision of efficient and affordable transit services.

**Keywords:**

Affordability, Transit service, Price elasticities, Transportation costs, Brazil.

ID 1560 R

**EVALUATION OF INTERMODALITY IMPROVEMENT FOR INCREASING THE ATTRACTIVENESS OF BUS RAPID TRANSIT SYSTEM IN JAKARTA, INDONESIA**

Main Author:

**Puspita DIRGAHAYANI** (*Urban Transport Research Unit, Department of Urban Engineering, University of Tokyo*)

Co-author(s):

**Noboru HARATA** (*University of Tokyo*)**Nobuaki OHMORI** (*Urban Transport Research Unit, Department of Urban Engineering, University of Tokyo*)**Abstract:**

This paper attempts to discuss measures to increase the attractiveness of Bus Rapid Transit (BRT) system in Jakarta, Indonesia, through intermodality improvement. Intermodality is defined as the quality indicator of the level of integration allowing at least two different modes to be used in an integrated manner. More intermodality means more integration and complementary between modes. The current BRT system operates with low level of intermodality. Since the beginning, Jakarta intended to establish a trunk-and-feeder BRT network. From network point of view, trunk-and-feeder system is expected to reduce number of operating vehicles on the road and increase the number of trunk lines passengers. While from user point of view, by using a trunk-and-feeder system, passengers who come from outside walking distance of a shelter have to take feeder modes, commonly served by smaller vehicle, to reach the nearest BRT platform along higher density corridors. Accordingly, they must take one or more transfers between modes which require crossing an elevated bridge to access BRT platform on the median of the road. Some studies confirm that the complexity while transferring in an intermodal trips involving BRT impose major attention from users. Furthermore, a trunk-and-feeder network development is typically coupled with "closed" system business structure which requires bus sector reform to provide a functioning feeder system which has become the critical success factor for Bogota's Transmilenio system which gets its 60% of passengers from feeder buses. Unfortunately, such bold measure has not been taken for Jakarta's case.. (...).

**Keywords:**

Intermodality, Transfer, Stated-preference, Cost-benefit analysis.

ID 2276 R

**POTENTIAL OF MODAL SHIFT FOR URBAN DAILY MOBILITY**

Main Author:

**Huong NGUYEN** (EVS EDU)**Abstract:**

Among Asian mega-cities, Hanoi and Ho Chi Minh City can be considered as somewhat specific and singular by high motorcycle dependence for daily mobility and a rather weak part of public transport in the modal split. The present situation can be partly explained by the doi moi impact on urban transition in Vietnam. However from the early of this decade, Vietnam authorities have realized the important role of public transportation: Hanoi then Ho Chi Minh City public transport have been largely improved in terms of bus network lines, higher service quality, fare policy, users' information. In the meanwhile, some transport policy measures aimed to curb the motorbike and car ownership trend and to induce some modal shift to public transport. However one cannot observe a real change in the modal choice of people for these two cities. It is the reason why in-depth research is needed to specify the determinants of modal choice in Vietnamese cities and the potential of modal shift on public transport in a short, medium and large term aiming to change the daily mobility. In this paper, we intend to present the objectives of our on-going research, and the first result i.e. (i) analyzing subjacent logic of people's choice in Hanoi; (ii) analyzing the related factors as well as the effectiveness of policies and solutions given by authorities in Vietnam. Base on these analyses, we would like to introduce some resolutions which authorities can apply to encourage people to choose public transport and result in minimizing the motorcycle use in big cities. To achieve the above research, we will base on observation and statistic transportation data, accompanied with the result got from interviewing households in Hanoi city. (...).

**Keywords:**

Daily mobility, Modal choice, Modal shift, Transport policy, Public transport, Hanoi.

ID 2546 R

**A STUDY ON INTEGRATING PARATRANSIT AS A FEEDER SYSTEM INTO URBAN TRANSPORTATION AND ITS EFFECTS ON MODE CHOICE BEHAVIOR: A STUDY IN BANGKOK, THAILAND**

Main Author:

**Akkarapol TANGPHAISANKUN**

Co-author(s):

**Toshiyuki OKAMURA** (Yokohama National University)**Fumihiko NAKAMURA** (Dept of Civil Eng., Faculty of Eng, Yokohama National University)**Rui WANG** (Yokohama National University)**Abstract:**

Motorized paratransit has continued their dominant function as a feeder in several developing cities due to their services satisfying captive riders in terms of mobility. However, the dissatisfaction with their services especially in the aspects of traffic safety and service images hinder patronage of paratransit and this transport mode has not been systematically considered in the transportation plans. Therefore, more efforts are required in order to promote the solution of integrating paratransit as a feeder into urban transportation, particularly, on the rider side. Personal behavior and attitudes towards the services provided by paratransit and public transport will be important keys for the future development of this solution. This study investigated present choice consideration, influences of personal behavior, and attitudes towards the services of paratransit and public transport on the commuter choice selection. Empirical results revealed that car users prefer to continue driving, while patronage of paratransit combination is decreasing. Car preference and dissatisfaction with comfort and convenience of public transport and paratransit also significantly influence the choice to drive. The pessimism about difficulties and images of the combination of paratransit and public transport modes potentially discourage usage of public transit and paratransit. Moreover, risks of using the combination between paratransit and public transport, especially on traffic accidents and crimes, were found to be a driving factor of selecting public-transport-only and private vehicle alternatives.

**Keywords:**

Paratransit, Integrating, Feeder, Mode choice, Developing countries.

THU 15<sup>th</sup> (09:45 - 11:00, Session H2.7) Room 1.08

ID 2844 R

**TRANSITION IN MODE CHOICE DUE TO  
MOTORIZATION AND IMPROVEMENT OF PUBLIC  
TRANSPORTATION SYSTEM IN JAKARTA**

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Co-author(s):

**Tomokazu WACHI** (*Oriental Consultants Company Limited*)

**Alvinsyah** (*University of Indonesia*)

**Keigo HAMADA** (*Japan International Cooperation Agency*)

**Sadayuki YAGI** (*Japan Research Institute*)

**Abstract:**

The Jakarta metropolitan area of Indonesia with 24 million population is the capital region of one of the emerging countries. Along with economic development, the number of motorized trips, especially, use of motorcycles has been rapidly increasing, and urban transportation problems, such as traffic congestion, are worsening even while the city has introduced a bus rapid transit (BRT) system. A survey revealed the preferences of residents along the BRT corridors, and indicated a transition in mode choice before and after the introduction of the BRT system and the characteristics of these preferences were identified. In addition, through development of a simple multi-nominal logit model, it is revealed that the history of the transition to BRT may affect the future transition to a mass rapid transit (MRT) system.

**Keywords:**

Jakarta, Mode Choice, Trip diary survey, Motorcycle, Developing countries.

WED 14<sup>th</sup> (08:15 - 09:30, Session H4.1) Room 0.02

ID 1088 R

**NEED FOR GOAL-ORIENTED METHOD FOR  
DEVELOPING URBAN TRANSPORT STRATEGIES FOR  
INDIAN CITIES**

Main Author:

**Ashish VERMA**

Co-author(s):

**S. SREENIVASULU** (*CISTUP, IISc Bangalore, Bangalore-560012.*)

**Abstract:**

The development of urban transport strategies can be done by using either bottom-up approach, or top-down approach. The bottom-up approach is based on understanding of the problems as a first step for the strategy development. Typically, the Comprehensive Mobility Plan (CMP) studies are done in India using bottom-up approach. Whereas, the top-down approach is based on a set of goals and objectives as the starting point to develop the urban transport strategies. Mostly, only isolated approaches to solve single or combination of problems are used in most of the Indian cities, which are bottom-up in nature. An integrated or top-down approach which considers different combinations of measures (in infrastructure and traffic management) and their joint impact on the different goal areas (mobility, safety, environment, economy etc.) are fairly not used. One of the reasons is that the responsibilities for the overall transportation system is distributed among many different institutions and not always clearly defined. This paper discusses a new goal-oriented and co-operative method, which will be top-down in nature, for establishing comprehensive urban transport strategies for Indian cities.

**Keywords:**

Top-down approach, Urban transport strategy, Analytical hierarchy process, Multicriteria assessment, Mobility plan, Urban transport measures.

ID 1201 R\*

**WELFARE EFFECTS OF TRANSPORT  
INFRASTRUCTURE IMPROVEMENT ACROSS  
REGIONS IN A DEVELOPING ECONOMY : SCGE  
APPROACH**

Main Author:

*Cristela DAKILA (De La Salle University Manila)***Abstract:**

This paper looks into the impact on welfare of alternative improvements in water, air and land transport infrastructure in a low-income region in the Philippines like Mindanao, using a general equilibrium model. The welfare index used will be equivalent variation. It utilizes a five-region social accounting matrix as database for a spatial general equilibrium (SCGE) model of the Philippine economy subdivided among five regions with Mindanao as focal point. The four other regions are Northern Luzon, National Capital Region, Southern Luzon, Visayas and Mindanao. Each regional economy contains seven production sectors and three household income groups. The paper examines the impact of a 10% increase in capital inputs in Mindanao land transport services sector on welfare, income distribution and transport-intensity of production sectors. These are then compared with an alternative 10% increase in capital inputs in Mindanao water transport services sector and air transport services sector. After which, the Mindanao results are compared with other regions in the rest of the Philippines. In the end, the empirical results will serve as benchmarks in the optimal allocation of resources for transport infrastructure investment within Mindanao and also between Mindanao and the rest of the Philippines.

**Keywords:**

Transport infrastructure, Welfare, Regional social accounting matrix, General equilibrium, Equivalent variation.

ID 1278 R\*

**POLITICS OF RAIL TRANSPORT DEVELOPMENT IN  
DEVELOPING COUNTRIES: CASE OF NIGERIA**

Main Author:

*Joshua ODELEYE (School of Transport, Lagos State University)***Abstract:**

Rail transport in most developing countries, is usually the least developed mode. For instance, in Nigeria the vibrant fortune of rail transport operations and development has been on decline since mid 1970's. This modal failure thus, accounted for its intangible contribution to the logistics of freight movement and distribution across the country. Also, this developmental gap in rail transport in Nigeria is responsible for a significant level of access denial to a safer, affordable and environmentally-friendly mode of transport, to the younger generation of Nigerians. Through a critique of past railways developmental projects and policies, this paper was able to identify the principal factors responsible for the above highlighted deficiencies in the rail transport and its intangible contributions to the socio-economic development of Nigeria. For instance, the remarkable role(s) politics of policies inconsistency and somersault plays, to the detriment of realisation of a vibrant railway system in Nigeria were highlighted accordingly. The paper findings revealed that discontinuity and incoherence in policy implementation by successful governments, policy reversal as well as uncoordinated national transport policy goal and objectives as clogs in the wheel of progress of railways development in Nigeria. The paper further revealed that the attachment of the railways institution to the apron string of the Federal department of Transport immensely contributed to the stunted growth in technologies and operations in the railways. In conclusion, the paper hinged the rapid development of the rail industry in Nigeria on institutional paradigm shift, whereby the rail authority will enjoy a reasonable level of autonomy in decision making, finance and investment in rail operations, infrastructure supply and technological advancement in Nigeria. (...).

**Keywords:**

Rail Transport, Ransport policy, Nstitutional framework, Ubli-Private participation, And Politics of policies inconsistency.

ID 2422 R

**TRANSPORT POLICY DOCUMENTS – COMPOSITION AND SUBSTANCE IN THE CASE OF SMALL COUNTRIES IN TRANSITION**

Main Author:

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Co-author(s):

**Branislav BOŽKOVIĆ** (*Faculty of Transport and Traffic Engineering, University of Belgrade*)**Aleksandar MANOJLOVIĆ** (*University of Belgrade Faculty of Transport and Traffic Engineering*)**Abstract:**

Small countries, especially those in transition, are confronted with serious barriers in implementing comprehensive structure of transport policy strategic documents, as it is defined in a world-wide research and has been accomplished in some developed countries practice. Barriers include institutional incapacities, poor or missing public policies preceding or inter-related to transport policy, incompatibility of political ambition and financial capability, shortened election periods etc. Emerging issues in such circumstances are related to transport policy features (as time frame), composition (as type and number of documents) and constituents (guidelines, objectives, targets, policies, instruments, indicators ...) that are feasible to create and pursue. This paper begins with a description of documents' characteristics of interest and elements necessary to develop consistent and comparable transport policy which can be followed and monitored over the years. It continues with a short overview of transport policy strategic documents as a policy process formal output, and discussion about some national transport policy strategic documents. Attention is paid to barriers that are hard to overcome in small countries in transition (namely countries of the Western Balkans region) like those that delay, obstruct or completely neglect policy process activities or implementation of the adopted documents provisions. Bearing in mind potentials to overcome those barriers we argue about feasible structure and extent of transport policy elements formalised in the documents.

**Keywords:**

Transport policy, Policy analysis, Policy documents, Countries in transition.

ID 2961 R

**REDEFINING COMMERCIAL BUS MODELS IN BRAZIL**

Main Author:

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**Maria GALINDO** (*Universidade de Brasília*)**Heitor NASCIMENTO** (*Universidade de Brasília*)**Willer CARVALHO** (*Universidade de Brasília*)**Marcos ALVES** (*Universidade de Brasília*)**Joaquim ARAGÃO** (*Universidade de Brasília*)**Abstract:**

Currently, Brazilian buses are divided in three categories: city buses, intercity buses and coaches. That categorization results from the understanding that citizens only need to move around urban perimeters. However, the current bus models available do not fully meet legal demands or cater for all of society's demands. Rural workers and students that live in rural areas also must be conveyed in buses and minibuses. Municipal and state directives prohibit employers to convey them in improper vehicles, such as trucks. Social demands, on the other hand, can be illustrated by federal and state programs that provide vehicles to transport students who dwell in rural settings. Accordingly, this paper proposes a new categorization of bus models available in the Brazilian market, which should account for the unique local operating conditions rural buses face, instead of only considering the type of service they provide. Further, a purpose-built vehicle is suggested in order to cater for the needs of rural workers and students. Rural students represent, in average, five million rural school bus riders.

**Keywords:**

Bus models, Rural matters, Rural vehicle category.



ID 1032 R

**INCREASING TRANSPORT RESEARCH CAPACITY IN DEVELOPING COUNTRIES**

Main Author:

**Peter O'NEILL** (*World Bank*)**Abstract:**

The ultimate goal for developing countries is economic self sufficiency so that these nations can play a full part in world economic and trade activities rather than being perpetual recipients of aid. The capability to develop innovative technology is a measure of a nation's ability to progress economically and identifying solutions to local problems, including those in the transport sector, is an important part of the development process. Research is the mechanism for the advancement of knowledge and economic growth is directly linked to investment in research. A UK government report in the mid 1990's concluded that for every £1 million spent on R&D, society in the UK benefited by £20m annually. In developing countries, transport services are a vital component for the social and economic development of poor urban and rural communities. Reliable and sustainable access provided by good roads and efficient transport services enable the benefits from investment in other sectors such as health, education and agriculture to be fully realised. The importance of the provision of transport services is recognised by the World Bank with 23% of its loans allocated to the transport sector. The transport problems in developing countries require local solutions that are inherently different from those in more developed countries. The prevailing road environment is often different with climatic factors having a considerable influence on design and performance. The mix of traffic on both urban and rural roads is different from developed countries and also often differs between developing countries. Motorcycles, pedal cycles and various forms of non-motorised transport compete with cars, trucks and pedestrians for the use of the available road space, resulting in situations in which the most vulnerable road users are often particularly at risk. (...).

**Keywords:**

Developing countries, Transport, Research.

ID 1635 R

**TRANSPORTATION EDUCATION WITH SPECIAL REGARD TO GLOBAL ECONOMIC PROSPECTS**

Main Author:

**Yücel CANDEMİR**

Co-author(s):

**Mehtap HISARCIKLILAR** (*Istanbul Technical University*)**Abstract:**

The economic outlook of the world is in a permanent transition gaining momentum by even greater pace of development of science and technology movement. This brings us to the vector of "knowledge society / knowledge-based economy" where the transport and logistics sectors face new dimensions. There, considering the irreversible nature of transport investments, the importance of research comes into the scene to 1. Minimise the potential damage caused by the wrong investment policies / decisions 2. Maximise the benefits to be produced by well-designed transport & logistics policies. Here two key questions are to be discussed: (1) In what ways can research-based knowledge in education accumulate and be accessible for policy and practice? (2) How can a stronger interaction and interface between research, policy, and practice be achieved so that the impact of research on practice is strengthened? As the knowledge society depends for its growth on the production of new knowledge, its transmission through education and training, its dissemination through information and communication technologies, and on its use through new industrial processes or services, this appears to be an advantage for an effective transportation education and training to be put into effect. However, beginning in the late 20th century and gaining momentum by turning into the new millennium, a process making the transportation issues complex more than ever before and apparently going to be even more so in a more interactive manner with other sectors of the economy as well as other subsectors of transportation as the logistics network gain an increasing concern. Alongside their fundamental mission of initial training, we assume, universities must cater for new needs in education and training stemming from the knowledge-based economy and society. (...).

**Keywords:**

Transportation Education – Interdisciplinarity - Spillover effects – Logistics - Knowledge Society – Creativity – Qualitative and Quantitative Analyses.

ID 1641 R

**FLEET REDUCTION REFORM OF LEBANESE JITNEYS**

Main Author:

**Isam KAYSI** (*American University of Beirut*)

Co-author(s):

**Mona HARB** (*American University of Beirut*)**Amer AL-DOUR** (*American University of Beirut*)**Abstract:**

Jitneys, locally known as *servees*, are the principal providers of public transport services in Beirut, Lebanon. The system is already privately owned and operated, provides affordable service, and has a considerable share of the travel market. However, one of the major challenges is that the current number of jitneys available in the public transport market exceeds the level needed to serve passenger demand, leading to a situation of destructive competition among jitney drivers. In this research, the authors preview some issues associated with the Lebanese public transport sector in general, and specifically the local jitney system, presenting their development as well as their operational and organizational aspects. A framework for proposed jitney reforms in Lebanon was developed including organizational and regulatory reforms, enforcement, restructuring, financial incentives, assistance in market formation of larger organizations, and encouragement of jitney drivers to respond to operating challenges. A survey was conducted including profiling drivers, their status, finances and job satisfaction, vehicle conditions and operations, and status of operating licence. Next, a financial analysis of the results was undertaken to identify the optimal number of jitney operators that could yield a balanced competitive environment; this included determining the relationship between monthly net revenues, ridership rates, and jitney fleet size. The analysis indicated that while the reduced fleet size can still serve demand available for jitneys, fewer jitneys could translate into more profit per remaining driver, and a positive ripple effect on other service and quality aspects of jitney operations. (...).

**Keywords:**

Jitneys, Fleet reform, Enforcement.

ID 2887 R

**SOME MANAGERIAL AND TECHNICAL ASPECTS OF TRANSPORT SECTOR DEVELOPMENT PROJECTS**

Main Author:

**Tengiz GOGELIA** (*Caucasus University, Consultant to multi- and bilateral international aid projects, Tbilisi, Georgia*)

Co-author(s):

**Antti TALVITIE** (*Aalto University*)**Abstract:**

In development projects—like in all transport sector projects—there is only one problem, but it is huge; everything is connected to everything else. In this paper the authors have separated from the whole important issues and practical problems, rarely spoken in aid to developing countries, and addressed them in a hands-on manner. These are: Donor Aid projects Management and Coordination. Authors are of the opinion that the recipient country management is the key for coordination and for the projects to succeed. Therefore the findings and recommendations are focused on ways to strengthen the role of the recipient country in donor aid project management and coordination. Specifically it is recommended that the donor Aid Coordination Unit (ACU) and Project Implementing Unit (PIU) are necessary before the process of establishment of fully competent public administrations in a country can be completed. Development of these units is considered to be part of the overall public service reform process. When such process is not yet completed, it is necessary that the recipient country has institutions/entities staffed with competent local experts to hold “the country reform process memory”. Human Resource Development. Rather often the Technical Assistance projects are oriented on “providing solutions”, ignoring the development of local capacities. Importance of specially selected local experts – “Technical Communication Officers” is recommended. Institutional Functioning. Authors point is that based on ‘process consultation’ model a new approach to institutional consulting is to be promoted in which the Recipient has a key role. It is recommended that the Recipient is the initiator of technical assistance in the projects. (...).

**Keywords:**

Transport sector, Donor coordination, Logical framework, Human resource development, Institutional functioning. .

ID 2219 R

**PRIORITIZATION OF NATIONAL ROAD PROJECTS IN SAUDI ARABIA: FRAMEWORK AND IMPLEMENTATION**

Main Author:

**Isam KAYSI** (*American University of Beirut*)

Co-author(s):

**Hathlool AL-HATHLOOL** (*Ministry of Transport, Kingdom of Saudi Arabia*)**Salem AL-KAHTANI** (*Ministry of Transport, Saudi Arabia*)**Maha WHITEWAY** (*SETRA/CSTR/DE Economie des Transports et Trafic*)**Fadi DARWISH** (*SETRA/CSTR/DE Economie des Transports et Trafic*)**Abstract:**

Road networks play a major role in sustaining and supporting population and economic growth. They need to be constantly maintained, upgraded and expanded subject to budget constraints, hence the need for a prioritization framework which would help determine the order and timescale for implementing the proposed road schemes. This paper presents a prioritization framework which is being applied to proposed nationwide primary and secondary road projects in the Kingdom of Saudi Arabia. It comprises several stages: data collection, identification of the comprehensive set of proposed schemes, project assessment, and project prioritization. The assessment is based on a multi-criteria analysis (MCA) approach, the linear additive model, which evaluates each scheme on a set of criteria derived from the various national goals and objectives of the Saudi authorities. The relative importance of the criteria (the relative weights) is obtained using the Analytic Hierarchy Process (AHP). The whole process is supported by a Geographical Information System (GIS).

**Keywords:**

National road project prioritization, Multi-criteria Analysis, Analytic Hierarchy Process, Geographical Information System.

ID 2257 R

**THE (MIS)MEASUREMENT OF INTERNATIONAL TRADE AND TRANSPORT COSTS**

Main Author:

**Mihalis CHASOMERIS** (*University of KwaZulu-Natal*)**Abstract:**

The United Nations, World Bank, African Development Bank and several researchers use import cif/fob ratios to measure and compare a country's or region's international transport costs. The purpose of this paper is to assess the (mis)measurement of country cif/fob ratios and their use as measures of international transport costs. In this paper, the relationship between annual cif/fob ratios and compositions of imports are examined via correlation analysis. The trade data used in this study are sourced from the International Monetary Fund's International Financial Statistics and Standard International Trade Classification (SITC) data from the World Trade Analyser. The findings show that where the quality of the data is reliable, a country's composition of imports has a significant effect on that country's cif/fob ratios; hence researchers cannot use the ratio as a dependable measure of direct shipping costs. For countries like Malawi, Zimbabwe, the Democratic Republic of the Congo, inaccurate trade data generate inaccurate and unreliable country cif/fob ratios that are neither able to show the country's actual ad valorem shipping costs nor direct costs of transportation. Studies that have used the cif/fob ratios to analyse a country's or region's transport costs may have estimated the levels and trends in international transport costs incorrectly and thus may also misinterpret their impact on trade and economic growth.

**Keywords:**

International transport costs, Import cif/fob ratios, International trade.

ID 2279 R

**INTEGRATED TRANSPORT AND LOGISTICS  
INFRASTRUCTURE DEVELOPMENT FOR NORTHEAST  
ASIA: WITH SPECIAL EMPHASIS ON KOREAN  
PENINSULA**

Main Author:

**Sungwon LEE** (*The Korea Transport Institute*)

**Abstract:**

Northeast Asia is one of the most dynamic regions in the world. Economic development has been rapid in this region and transport and logistics infrastructure development at national level has also been very active in recent years. However, the transport and logistics network is neither sufficient nor well integrated at the international level. The existence of missing links in Korea Peninsula and other parts of the region are the major cause of this lack of transport and logistics integration in the region. But increased economic exchange between South and North Korea could provide a momentum for expediting transport and logistics integration not only in Korean Peninsula but also in the entire region. In the current international environment characterized by globalization and regionalization, transport and logistics system integration is a prerequisite for countries to maintain competitiveness and has become a key factor for sustained employment creation and economic growth. The case of the European Union (EU) provides an excellent example of transport integration that supports economic integration. The EU has been seeking to provide an integrated transport and logistics network throughout Europe by eliminating missing links, alleviating bottlenecks and securing interoperability of the network. A well-integrated transport network in Northeast Asia could also facilitate regional integration and increase economic and cultural exchanges. This paper provides basic facts and statistics regarding transport and logistics developments in Northeast Asia. However, it is extremely difficult to obtain reliable information or data on North Korea. Transport and logistics related data on North Korea are also offered based on information compiled by estimation. (...).

**Keywords:**

Integrated transport network, Integrated logistics.

ID 2426 R

**IMPROVEMENT PLANNING OF RURAL BUS SYSTEM  
WITH DUE CONSIDERATION TO TRIP MAKERS  
WILLINGNESS-TO-PAY: A CASE STUDY IN INDIA**

Main Author:

**Bhargab MAITRA**

**Abstract:**

This paper presents the estimation of willingness to pay values using stated choice data, for various attributes of rural bus services in a developing country context, feed the same for formulation of generalised cost model as a comprehensive measure of user benefits. The generalised cost thus developed is utilised in the improvement planning of the rural bus system by evaluating various proposals that minimise the generalised cost of travel or maximise user benefits without falling short on operational viability and passenger loading.

**Keywords:**

Rural Bus transportation, Generalised cost, India.

ID 3266 R

**TRANSPORTATION SYSTEM MANAGEMNT AT SADAR BAZAR AREA, DELHI**

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Since ages the non-motorised vehicles (Cycle rickshaws, Tangas etc) at walled city of Delhi such as Chandni Chowk, Sadar bazaar, Daryaganj, Azad market area etc, are the main transport modes for goods and passengers especially for short trips. During those times these non-motorised modes were serving efficiently for short trip purposes as traffic was very less. However in current years an increase in users mobility and their needs have been observed due to increase in economic activity and hence these modes are now becoming an extra burden in these areas which were already reeling under the burden of heavy traffic on narrow lanes. From the available data from transportation studies indicate that per capita vehicular trips in a day have increased from 0.45 in 1969 to about 1.0 in 2001. Since 1957 the GDP and the purchasing power of people of Delhi have increased by many folds, the vehicle population in Delhi has also increased to about 55 million. Considering the these problems this study is focused on studying the travel characteristics of cycle rickshwas and its users in scientific manner and proposed suitable alternative mode to cycle rickshaws to relieve the congestion and reduce the air pollution. Present study was focused around the Sadar bazar. However replacing the cycle rickshaws with suitable mode of transport, at other locations of Delhi would require a proper study on traffic management plan, along with socio-economic status of the area and also study of users characteristics should be given due consideration.

**Keywords:**

Cycle Rickshaws, Congestion, Traffic Management, Delhi.

ID 1281 R

**DECARBONISING THE ROAD TRANSPORT SECTOR- POLICY OPTIONS AND POTENTIAL EFFECTS FOR HYBRID AND ELECTRIC PATHWAYS**

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**Georgina SANTOS** (*Smith School of Enterprise and the Environment and Transport Studies Unit, University of Oxford*)**Abstract:**

To investigate the lifecycle energy consumption and emissions of Plug-in Hybrid Electric Vehicles (PHEVs) in China, this paper undertakes a "Well-to-Wheel" (WTW) lifecycle energy consumption and carbon emission analysis for China 2020 using the latest GREET 1.8c.0 model from the US Department of Energy. A variety of energy mixes and two travel patterns for PHEVs are compared in terms of their energy consumption and emissions. The study finds that PHEVs could have substantial potential in terms of energy consumption and GHG emission reductions in China. This benefit in turn could deteriorate if travel distances increased, which will happen as China's car ownership rises and vehicle operating costs go down.

**Keywords:**

Plug-in Hybrid Electric Vehicles (PHEV), Lifecycle Analysis, GREET 1.8c.0, Electric Vehicles Charging.

ID 1492 R

**LOCATION MODEL OF TRANSPORT JUNCTION IN ECONOMIC CIRCLE IN CHINA AND ITS ALGORITHM**

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Co-author(s):

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Transport junction location problem has been a lot of relevant research at home and abroad, but the traditional location model rarely has taken into account the economic influence factor of the cities where the transport junction was located. On the basis of analyzing the internal relation between economic development of cities and transport junction in the economic circle, this paper introduced the six factors that influenced economic development level of cities in the economic circle and developed a Bi-Level programming modal with the minimization of the transportation costs and the junction construction costs, the maximization of economic influence of the cities where the junction was located, and considering the traffic equilibrium on the roads in economic circle. Hybrid niche genetic simulated annealing algorithm was proposed for solving the model quickly, which was programmable and practicability. Thereafter, the validity and practicability of the proposed model were demonstrated by the example of transport junction location in the economic circle of Yangtze River Delta.

**Keywords:**

Economic circle, Transport junction, Location model, Niche genetic simulated annealing algorithm.

ID 2400 R

**SIDEWALK SUSTAINABILITY THROUGH NEEDS ASSESSMENT OF STREET USERS IN ASIAN CITIES**

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**Hitoshi IEDA** (*The University of Tokyo*)**Abstract:**

The concept of sustaining street use has proved elusive, especially in an ever changing landscape that has for the past 60 years catered to private vehicle needs at the expense of other street users (i.e. pedestrians). Studies have however indicated that street user presence has helped decrease crime rates and increased overall city liveability. This research sheds light on the importance of a user-centred approach in the design and improvement of urban spaces, particularly sidewalks. To increase user loyalty, the paper examines the criteria of needs of street users, investigates various attributes that contribute to their need-satisfaction and, through the use of a decision making tool, Analytic Hierarchy Process (AHP), empirically prioritise the needs and need-satisfier attributes of contemporary street users. Attributes which were initially derived from the evaluation of visual archival data will also be assessed for their relevance and applicability within the contemporary urban context. Survey investigations were carried out along the streets of Manila and Bangkok. A total of 250 respondents were gathered. The derived information would prove relevant in effectively and efficiently designing and improving sidewalks for people thereby achieving street space sustainability. The study was able to define street user needs, the hierarchy framework, attributes that define a positive street environment and provide an indicative policy recommendations to improve Asian street space with the end view of encouraging people to use urban spaces more, increasing their participation and, ultimately, eliciting their loyalty.

**Keywords:**

Street user behavior, Non-movement aspect of pedestrian, Street user needs.

hy framework, Sidewalk design and management, Street sustainability, User-centred approach.

ID 2421 R

**AN EXAMPLE OF ECO4: DUAL POWERED LOCO ALP 45DP FOR NORTH AMERICAN MARKET**

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Dual Powered locomotives running both in electric and diesel-electric traction are particularly designed for service in combined traffic such as in large North-American cities and their neighbourhood. Dual Powered locomotives present a special challenge to fit all the high power equipment into a 4 axle locomotive with axle load restrictions of about 30 t / axle. The presented concept contains an electric traction chain on the basis of most modern locomotives and a diesel traction chain consisting of 2 diesel engines equipped back to back to the converter cubicle and operating in 2 independent diesel-electric circuits. To achieve the needed schedule adherence special design and control solutions are applied to reach the requested tractive efforts under all circumstances and to optimize the transition between electric and diesel-electric configurations. Special care is given to economic, environmentally friendly solutions and control concepts, e.g. designs to achieve low emissions & fuel consumption, low losses, use of specific material, minimized track forces, optimized HVAC control and many more.

**Keywords:**

Dual Powered locomotive, Diesel-electric locomotive, Electric locomotive, Environmentally friendly railway solutions, Eco4.

ID 2918 R

**CHARACTERIZING RURAL SCHOOL TRANSPORTATION BY BOAT IN BRAZIL**

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The Brazilian rural school transportation system has characteristics that should be noted and analyzed from the perspective of local reality. Peculiarities from the different regions and rural population resident where the service is provided must be taken into account. Aspects regarding the mode of transport provided and the opinion of riders need to be known in order to improve service operation. Moreover, this information can support administrators in the process of implementing public policies that collaborate with this sector. To that end, we conducted a survey to gather information on the nature and experience of rural school transportation provided by boat in Brazilian localities. A questionnaire was developed in order to carry out a national school transportation survey. This paper focuses on the results obtained in localities that transport rural pupils by boat to school. Semi-structured interviews with riders and on-board surveys were conducted in order to characterize in detail the rural school boat transportation system. This research set out to gather contextualized information because there is not enough data available to support administrators and planners in adopting measures to improve the service provided to riders.

**Keywords:**

Rural school transportation, Transportation by boat, Characterizing.







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