university of groningen

IAAP

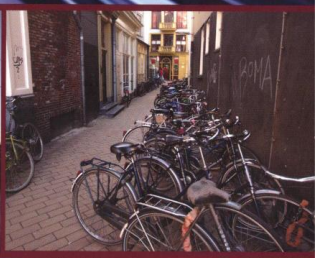
umcg

ICTTP 2012

The 5th International Conference on Traffic and Transport Psychology
29-31st August 2012, Groningen, The Netherlands

ABSTRACT BOOK





www.icttp2012.com

Welcome

When we three years ago, led by our deceased chairman Professor Rothengatter, submitted a tender to organise the 5th ICTTP, we did not have the faintest idea about how much would happen in between. In February 2010 Talib Rothengatter died unexpectedly and the formal scientific chair of Transport and Environmental Psychology was removed. However, the group members maintained their cooperation within the Department of Psychology of the University of Groningen and we accepted the invitation by the Board of the ICAP Working Group 13 (Traffic and Transport Psychology) to organize ICTTP-5 anyway, on our personal authority. So, it is a great honour for us to have you all here in the vibrant city of Groningen to attend an inspiring conference with colleagues from about all relevant disciplines that we can think of.

The city of Groningen is what we call a nice provincial capital, a relatively small city of about 186.000 citizens. As a lively university city Groningen has the youngest average population (mean age is about 36.5 years) in the Netherlands. It also has a long and turbulent history, which becomes evident from the historic warehouses, courts and buildings. In 2005 Groningen was proclaimed the city with the best city centre in the Netherlands because of its charm. We urge you to experience all of this while you are here. So please explore and enjoy the historic city centre of Groningen!

Currently, over 50.000 students are registered at the Hanze Hogeschool (University of Applied Sciences) and the University of Groningen altogether, where they can choose amongst almost 200 courses. The University of Groningen itself has nine faculties, divided over 150 buildings scattered around the city and close surroundings. The University is the third biggest university in the Netherlands, after the universities of Amsterdam and Utrecht. Furthermore, our University is almost 400 years old (Founded in 1614), so in two years' time we commemorate our 400 Year existence, four centuries of the second oldest University of the Netherlands (after the University of Leiden).

The 5th ICTTP conference focuses on the interaction between theory and practice, which is especially important because of the relevance of transport and traffic psychology for society. The conference provides a platform for communication between young and established researchers, but also between scientists and practitioners. The ultimate aim of this conference is to provide impetus and provide a common basis for the future of research in traffic psychology, which is aimed towards the next generation of traffic psychology researchers. In European Universities over 200 PhDs are involved in research regarding traffic and transport psychology. They will be the ones that decide the future research agenda in this area. The 5th ICTTP conference in Groningen will hopefully be remembered by them as an exciting starting point.

– Karel Brookhuis, Ben Veeke-Evers, Linda Steg, Anne Tanja Lind & Dick de Waard
Organising Committee, ICTTP-2010

university of groningen

umcg

IAAP

smarteye

SCIENCEPLUS

ST Software
simulator systems

SCHUHFRIED
passion for psychology

Photography: Maarten de Waard & Alzbeta Talarovicova
Design: Ben Lewis-Evans
Printing: Grafimedia

Ben Lewis-Evans, University of Groningen, The Nether
Linda Steg, University of Groningen, The Netherlands
Ayca Berfu Unal, University of Groningen, The Nether
Dick de Waard, University of Groningen, The Netherl

Scientific Committee

Samuel Charlton, University of Waikato, New Zealand
Birgitta Gatersleben, University of Surrey, UK
John Groeger, University College Cork, Ireland
Marjan Hagenzieker, SWOV, The Netherlands
Marieke Martens, TNO, The Netherlands
Natasha Merat, University of Leeds, UK
Björn Peters, VTI, Sweden
Bryan Porter, Old Dominion University, VA, USA
Michael Regan, INRETS, France
Jens Schade, Technical University Dresden, Germany
Erik Verhoef, VU University (Amsterdam), The Netherl

Additional support & organisation

GRONINGEN CONGRESBUREAU
CONGRES? ER GAAT NIETS BOVEN GRONINGEN!

http://www.groningencongres

CONTENTS

Keynote Speakers

Prof Frank McKenna, Department of Psychology, University of Reading & Perception and Performance, UK.

How should we think about the three E's - education, engineering and enforcement?
9:00 - 10:00, Blauwe zaal, 29th August

Dr. Frank McKenna has a BSc from the University of Glasgow and a Ph.D from University College London. He started his research career in Cambridge investigating human error and accident involvement and has spent more than twenty years working and publishing in the area. He sits on the editorial board of the international journal Accident Analysis and Prevention, is a member of the Parliamentary Advisory Council for Transport Safety and sits on advisory boards for the AA motoring trust, and the Royal Society for the Prevention of Accidents.

Prof Satoshi Fujii, Department of Urban Management, Kyoto University, Japan

Psychological strategies for attitude and behaviour change in mobility management
9:00 - 10:00, Blauwe zaal, 30th August

Dr. Satoshi Fujii is a professor of transportation planning and behavioural-psychological analysis of transportation in the Department of Urban Management at Kyoto University. He has been engaged in the research on attitude and behaviour of transportation and has worked on soft measures to change attitude and behavior of travel from car use into sustainable transportation modes. His research also includes travel demand modeling, cognitive decision making, and social dilemmas. He is currently an executive director of Corporation of Japanese Conference on Mobility Management, a chief editor of IATSS Review, and a member of editorial boards of Behaviormetrika, Journal for Transportation and Land-Use, and Journal of Human Environmental Studies.

Prof. Serge Hoogendoorn, Delft University of Technology, The Netherlands

Tracing Traffic Dynamics: With innovative traffic data to a better theory

9:00 - 10:00, Blauwe zaal, 31st August

Dr. Serge Hoogendoorn is chair of the Traffic Management, Transport & Planning department of the Delft University of Technology and Professor of Traffic Flow Theory and Simulation, a staff member of the TRAIL Research School on Transport and Logistics, a freelance consultant for different Dutch firms and agencies, the chair of the Network Management foundation and a staff member of the Expert Centre for Traffic Management. In addition to being the author of over 100 journal publications, 50 book chapters and 150 conference papers. His research involves theory, modelling and simulation of traffic and transportation networks, focusing on innovative approaches to collect detailed, microscopic traffic data and the use of these data to underpin the models and theories.

T2013 International Conference 25-28 August 2013
Brisbane, Queensland, Australia

20th International Council on Alcohol, Drugs and Traffic Safety Conference

25-28 August 2013 Brisbane Convention and Exhibition Centre, Brisbane, Queensland, Australia

T2013 will present a global forum at which all those involved in Road Safety and Injury Prevention, Research, Policy, Education and Enforcement, particularly from the fields of Drugs and Alcohol, can meet with researchers, academics and professionals to discuss and present on the latest work being undertaken in these areas.

The conference themes will provide a great opportunity for a broad range of presentations, workshops, symposia and discussion, and dedicated programs will be offered for young scientists, early career researchers, students and those from low and middle income countries.

Designed to encourage a strong program of both industry and academic presentations, keynote speakers will be drawn from both Australia and overseas, and bring new and innovative research and practice to the conference.

For more information: **www.t2013.com** or contact via email: **t2013@qut.edu.au**

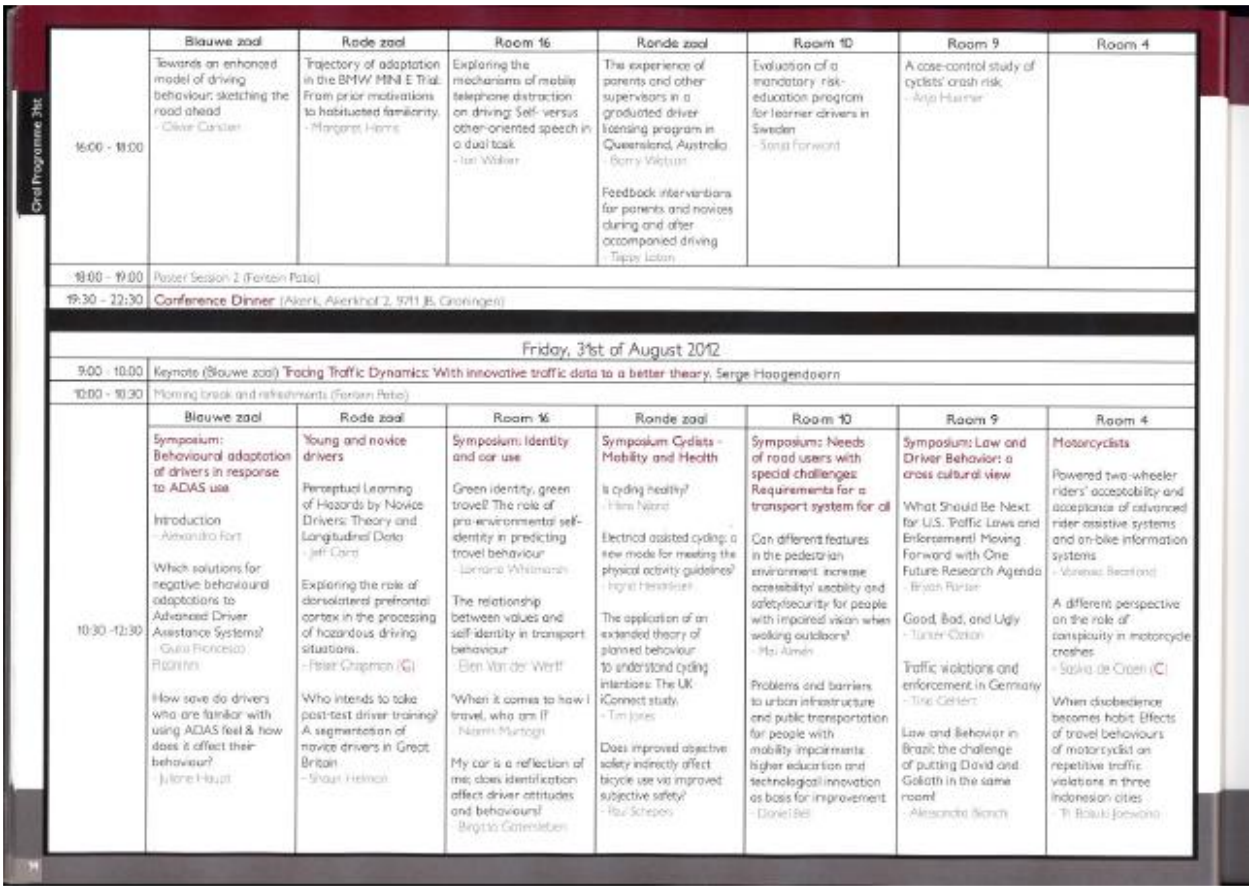
Who should attend:

Academics, researchers and practitioners in the areas of:

- Public Health
- Law
- Medicine
- Economics
- Law Enforcement
- Public Policy
- Education
- Human Factors and Psychology

CADTS CARRS ihbi NHTSA

www.t2013.com



Oral Programme 31st

	Blauwe zaal	Rode zaal	Room 16	Ronde zaal	Room 10	Room 9	Room 4
16:00 - 18:00	Towards an enhanced model of driving behaviour: sketching the road ahead - Oliver Carsten	Trajectory of adaptation in the BMW MINI E Trial. From prior motivations to habituated familiarity. - Margaret Harris	Exploring the mechanisms of mobile telephone distraction on driving: Self- versus other-oriented speech in a dual task - Ian Walker	The experience of parents and other supervisors in a graduated driver licensing program in Queensland, Australia - Barry Watson Feedback interventions for parents and novices during and after accompanied driving - Tippy Lotan	Evaluation of a mandatory risk-education program for learner drivers in Sweden - Sonia Forward	A case-control study of cyclists' crash risk - Anja Haemer	
18:00 - 19:00	Poster Session 2 (Fontein Patio)						
19:30 - 22:30	Conference Dinner (Alerk, Akerkhof 2, 9711 JB, Groningen)						

Friday, 31st of August 2012

9:00 - 10:00 Keynote (Blauwe zaal) 'Facing Traffic Dynamics: With innovative traffic data to a better theory, Serge Hoogendoorn

10:00 - 10:30 Morning break and refreshments (Fontein Patio)

	Blauwe zaal	Rode zaal	Room 16	Ronde zaal	Room 10	Room 9	Room 4
10:30 -12:30	Symposium: Behavioural adaptation of drivers in response to ADAS use Introduction - Alessandro Fort Which solutions for negative behavioural adaptations to Advanced Driver Assistance Systems? - Guido Francesco Pasinihi How save do drivers who are familiar with using ADAS feel & how does it affect their behaviour? - Juliane Haupt	Young and novice drivers Perceptual Learning of Hazards by Novice Drivers: Theory and Longitudinal Data - Jeff Caird Exploring the role of dorsolateral prefrontal cortex in the processing of hazardous driving situations. - Peter Chapman (C) Who intends to take post-test driver training? A segmentation of novice drivers in Great Britain - Shaun Helman	Symposium: Identity and car use Green identity, green travel? The role of pro-environmental self-identity in predicting travel behaviour - Lorraine Whitmarsh The relationship between values and self identity in transport behaviour - Ellen Van der Werff 'When it comes to how I travel, who am I? - Noemi Muntaga My car is a reflection of me; does identification affect driver attitudes and behaviours? - Birgitta Gatersleben	Symposium Cyclists - Mobility and Health Is cycling healthy? - Hans Nanne Electrical assisted cycling: a new mode for meeting the physical activity guidelines? - Ingrid Hendriksen The application of an extended theory of planned behaviour to understand cycling intentions: The UK iConnect study. - Tim Jones Does improved objective safety indirectly affect bicycle use via improved subjective safety? - Roo Schepers	Symposium: Needs of road users with special challenges: Requirements for a transport system for all Can different features in the pedestrian environment increase accessibility, usability and safety/security for people with impaired vision when walking outdoors? - Mai Almén Problems and barriers to urban infrastructure and public transportation for people with mobility impairments: higher education and technological innovation as basis for improvement - Daniel Bell	Symposium: Law and Driver Behavior: a cross cultural view What Should Be Next for U.S. Traffic Laws and Enforcement? Moving Forward with One Future Research Agenda - Bryan Porter Good, Bad, and Ugly - Turner Clinton Traffic violations and enforcement in Germany - Tina Gehlert Law and Behavior in Brazil: the challenge of putting David and Goliath in the same room! - Alessandra Bianchi	Motorcyclists Powered two-wheeler riders' acceptability and acceptance of advanced rider assistive systems and on-bike information systems - Vanessa Beanland A different perspective on the role of conspicuity in motorcycle crashes - Saskia de Craen (C) When disobedience becomes habit: Effects of travel behaviours of motorcyclist on repetitive traffic violations in three Indonesian cities - Th. Bakti Joewono

When disobedience becomes habit: Effects of travel behaviours of motorcyclist on repetitive traffic violations in three Indonesian cities

Joewono, T.B.[1], Tarigan, A.K.M., & Susilo, Y.O.
Graduate Program, Parahyangan Catholic University, Indonesia[1]

Recent studies suggest that traffic violations have certain relationships with personal travel behaviours and increase the risk of accidents as well. While explanations of traffic violations and travel behaviours were extensively reported from developed countries' experience, little is understood about the implications of travel behaviours to traffic violations in the developing world's setting where motorcycle's users are growing very rapidly and well known as aberrant road users. This study has an aim to explore the effects of travel behaviour on traffic violations utilising datasets from three metropolitan cities in Indonesia (Bandung, Yogyakarta and Surabaya). Based on questionnaire surveys among Indonesian motorcyclists with sample size of a thousand in each city, an analysis was completed using structural equation modelling methodology. This study reports that the way people travel for their everyday mobility with motorcycle has positive and significant influence on the construct of repetitive traffic violations. Analysis shows that motorcyclists who commute for longer trips are more frequent to violence against over speeding. On the other hand, repetitive helmet use's violations are statistically influenced by shorter trip patterns. Study also classified several actions of disobedience that are very frequent as a habit of motorcyclist.

Judging the approach speed of motorcycles and cars under different lighting conditions

Gould, M.[1], Poulter, D. R., Helman, S. & Wann, J. P.
Royal Holloway, University of London, United Kingdom[1]

The ability to accurately judge the approach speed of a motorcycle is critical in order to avoid right of way collisions at junctions. Research has shown that individuals consistently judge the time to contact (ttc) of a motorcycle to be later than that of a car (Horswill et al., 2005). Furthermore, individuals are extremely poor at judging the speed of solo headlight motorcycles in night-time conditions, but a tri-headlight configuration on a standard motorcycle frame can improve the accuracy of speed judgements (Gould et al., 2011). We measured the accuracy of adult drivers' judgements of simulated vehicle approach in a virtual city environment across a range of ambient lighting conditions. An adaptive (best-PEST) psychophysical procedure was used to determine threshold for discrimination between two vehicles approaching at different speeds. Stimuli were presented sequentially, with observers asked to judge which vehicle was travelling faster. Results demonstrated that individuals were significantly more accurate when judging the speed of the car compared to the solo headlight and tri-headlight motorcycles across all lighting levels. However, participants were significantly more accurate at judging the speed of the tri-headlight motorcycle compared with the solo headlight motorcycle in the lower lighting levels (early night and night). Research supported by the UK EPSRC.

Motorcyclists' intention to exceed the speed limit on roads limited to 90 km/h: mediating and moderating factors of the behavioural intention

Eyssartier, C.[1]
CETE de l'Ouest-DES, France[1]

Sarthe is one of the French departments most concerned by motorcycle accidents and it seems that speeding, mainly on roads limited to 90 km/h, is one of the main causes.

The model generally used to understand risk-taking is that of planned behaviour (Ajzen, 1985). In addition, factors such as the group norm (Elliott, 2010), sensation seeking (Jonah, 1997), self-identity (Watson, Tunnicliff, White, Schonfeld and Wishart, 2007) and group identification (Elliott, 2010) seem to have an influence on the motorcyclist's intention to carry out this behaviour. The aim of this study was to propose an extended planned behaviour model concerning the motorcyclist's intention to exceed the speed limit on a road limited to 90 km/h.

305 motorcyclists in Sarthe answered a questionnaire distributed on the web. The tested model explains 42% of their behavioural intention to exceed the speed limit. The results show that the group norm and sensation seeking mediate the attitude-behavioural intention relation. On the other hand, driving experience does not moderate the relation between the mediating factors and the behavioural intention. In conclusion, strategies for action and the limitations of the research will be presented.

Symposium - Highly Automated Driving

Friday 31st of August, 13:30 - 15:30 - Blauwe zaal

Who Guides Who in Haptic Guidance!

Boer, E.R.[1], Della Penna, M., Abbink, D., Mulder, M., & van Paassen, M.M.
Entropy Control Inc, United States[1]

Lateral haptic guidance is a form of driver support in which torques on the steering wheel communicate the direction of control the system deems optimal based on a controller model of the individual driver. These system are grounded in the principle that the driver adopts a high admittance that amplifies these guidance torques such that the human-system combination controls the car accurately and effortlessly. In addition to the guidance torques, these systems often add asymmetric stiffness around the desired steering angle to inform and protect the driver from deviations relative to the system's ideal control. While this guidance plus stiffness approach yields highly encouraging results, one drawback is that drivers have no clear means to communicate that their intent conflicts with the system's intent. Currently, most systems simply limit the strength of their forces such that the driver can always override them by either adopting a high stiffness to block system guidance or by pushing against the system guidance and through the system's stiffness. In this paper, we provide theoretical and experimental support for an algorithm that utilizes the contact torque profile between system and driver generate torques to enable fluid intent communication between driver and system.

Driver assistance and cognitive processes – Are they always positively linked!

Muhrer, E.[1], Reinprecht, K.R., & Vollrath, M.V.
Technical University Braunschweig, Germany[1]

Nowadays, nearly every modern car is equipped with several driver assistance systems. Despite this extensive technical support of the driver, an adequate perception and processing of relevant information is required for safe driving. To examine the corresponding impact of assistance systems, 30 subjects (15 male, 15 female, age: M = 28.0, SD = 11.9) were investigated in a fixed based driving simulator. The drivers completed a one-hour route in an urban scenario, while half of them were supported by an ACC Stop & Go. Additionally, all drivers had to perform a visually distraction task. This was to examine if assisted drivers tend to engage more in secondary tasks than unassisted drivers, which is often mentioned as an automation effect in the literature. Driving and gaze behavior and the engagement in the distraction task were analyzed. Results show that drivers did not engage more in the distraction task when driving with system. However, it was found that

When disobedience becomes habit: Effects of travel behaviours of motorcyclist on repetitive traffic violations in three Indonesian cities

Tri B. Joewono[1]*, Ari K.M. Tarigan[2], and Yusak O. Susilo[3]

[1]*Graduate Program,*
Parahyangan Catholic University,
Jl. Merdeka 30 Bandung, 40117, Indonesia
Tel: +62 22 4202351; Fax: +62 22 4200691
E-mail: vftribas@unpar.ac.id

[2]*International Research Institute of Stavanger (IRIS)*
Prof. Hanssensvei 15, Postboks 8046, 4068 Stavanger, Norway
Tel: +47 51875000; Fax: +47 51875200
E-mail: ari.tarigan@iris.no

[3] *Department of Transport Science*
School of Architecture and the Built Environment
KTH Royal Institute of Technology
Teknikringen 10, 10044 Stockholm, Sweden
Tel:+46(0)87909635 ; Fax:+46(0)87907002
E-mail: Yusak.Susilo@abe.kth.se

*Corresponding author

Article submitted to 5th International Conference on Traffic and Transport Psychology, Groningen, The Netherlands, August 29-31, 2012

Abstract

Recent studies suggest that traffic violations have certain relationships with personal travel behaviours and increase the risk of accidents as well. While explorations of traffic violations and travel behaviours were extensively reported from developed countries' experience, little is understood about the implications of travel behaviours to traffic violations in the developing world's setting where motorcycle's users are growing very rapidly and well known as aberrant road users. This study has an aim to explore the effects of travel behaviour on traffic violations utilising datasets from three metropolitan cities in Indonesia (Bandung, Yogyakarta and Surabaya). Based on questionnaire surveys among Indonesian motorcyclists with sample size of a thousand in each city, an analysis was completed using structural equation modelling methodology. This study reports that the way people travel for their everyday mobility with motorcycle has significant influence on the construct of repetitive traffic violations. Analysis shows that motorcyclists who commute for longer trips and more frequent are more frequent to violence. But, the findings cannot be generalized for different cultural background. This study reveals the different city has different result, where it has a possible reasoning as different cultural background.

Keywords: motorcyclist, violations, & travel behaviour.

1. Introduction

Urban traffic in many cities in developing world shows an almost chaotic condition in term of congestion and accident (see for example Gwilliam (2002) or Hickman, Fremer, Breithaupt, & Saxena (2011) for detail discussion regarding urban traffic in developing world). Besides as a result of weak design and quality of road infrastructure and facilities, the attitudes and behaviours of road users are also believed to strongly influence the traffic condition. It is very common to have a very long traffic jam, as an example when traffic signal is breaking for a short of time, but the problem becomes more difficult as many people do not follow the basic rule to give way to others. Every driver or motorcyclist wants to be the first and do not care about other road users. The attitude of road users for disobeying traffic sign or road marking also creates significant traffic problems, such as parking in the prohibited road lane that creates road bottleneck. Many motorcyclists do dangerous overtaking or move in a rush even in very narrow space between cars. These attitudes result many accidents, from car or motorcycle damaged only up to fatal accident. As a result, road accidents become a major problem in many developing cities, where the majority of victims are pedestrians and cyclists (Hickman et al., 2011).

The situation and problem of urban road in developing world can be differentiated from developed countries in term of the existence of motorcycle. The high share of motorbikes in the modal split is a special phenomenon in some Southeast Asian countries, such as Indonesia, Malaysia, Vietnam, or Thailand (Kaltheier, 2002). For example, approximately 80-90% of the households in the Vietnamese metropolis of Ho Chi Minh City have access to a motorcycle (Ministry of Transport Japan, 2000). In Indonesia, there are 52.4 million units of motorcycle out of 70.7 million units of motorized vehicle in the year of 2009 (Statistics Indonesia, 2009). The existence of motorcycle creates significant impacts to road performance and accident rate. It is caused by a fact that motorcyclists have an especially poor safety record when compared to other road user groups (Clarke, Ward, Bartle, & Truman, 2004). Study from Taiwan shows that on average, motorcyclists had approximately a three times higher fatality risk than non-motorcycle drivers after adjusting for the driving mileage (Chang & Yeh, 2006). In the UK, motorcyclist killed and serious injury (KSI) rate, per million vehicle kilometers, is approximately twice that of pedal cyclists and over 16 times that of car drivers and passengers. Motorcyclists make up less than 1% of vehicle traffic but their riders suffer 14% of total deaths and serious injuries on

Britain's roads (DETR, 2000). In Indonesia, motorcyclists gave the highest share in the number of accident, as reported by Indriastuti & Sulistio (2010), that based on data recorded in 2007 there were 57,080 motorcycle accidents (about 68% of all type of accidents) all over Indonesia. In Thailand, Hossain & Iamtrakul (2007) also reported that motorcycles have established itself as the prominent cause of death and injury to the Thai people, especially young generation, where statistics in 2005 suggests that number of motorcycle accidents has increased from 53,732 (36.8% of the total accidents) in 2002 to 78,830 (42.33% of the total accidents).

Moreover, motorcyclist behaviours are judged as have different attitudes and behaviours from other road users, especially in developing countries. It is underlined by Tunnicliff's statement (2006) that to reduce motorcycle-related fatalities, there is an urgent need to consider motorcyclists as distinct from other road users. The reason was provided by Rowden, Watson, Wishart, & Schonfeld's study (2009) that risk-taking behavior by motorcyclists has been shown to contribute to a substantial proportion of road crashes in Australia and abroad. Based on study from India, Dandona, Kumar, & Dandona (2006) reported that the reasons for the motorized two-wheeled vehicles have a high risk of road injuries are significant unlicensed driving, low helmet use, high rate of traffic law violation by these riders, and poor vehicle condition of this vehicle. Motorcyclists' behaviors and risks in road are also believed to be influenced by its excessive number in road. Two possible explanations for the association between high sales volumes of motorcycle and mortality rates of motorcyclist are increased exposure from more extensive use of motorcycles when they are new, and inexperience with motorcycle riding or with specific motorcycle (Paulozi, 2005). The other reason for the high number of accident by motorcyclist is provided by Chang & Yeh (2007), that young and male motorcyclists were more likely to disobey traffic regulations, and that young riders also had a higher tendency towards negligence of potential risk and motorcycle safety checks. They also stated that least riding experience as an additional factor, i.e. poor driving skills and less experience. On the other side, Musselwhite, Avineri, Susilo, & Bhattachary (2011) found that motorcyclists themselves tend to note that the vulnerability of being on a bike creates the danger, which is largely overcome by experience and skill of the rider, while losing none of the thrill; and motorcyclists tend to view safety in terms of being able to handle the bike, knowing its limitations and capabilities. These kinds of motorcyclist behaviours and attitudes seem to be difficult to be handled by promoting

licences only. Even though there is an age limit by law in Indonesia to obtain licence to riding motorcycle, i.e. 17 years old, but it is very easy to find legal motorcyclist with risky behaviour, e.g. dangerous overtaking. These practices result an image for motorcycle as a sort of careless road users. Moreover, concern has been expressed that traditional motorcycle license training programs do not sufficiently address such behavior (Rowden, Watson, Wishart, & Schonfeld, 2009).

Most of the accident can be directly contributed to the human factor, while it would be wrong to equate this with driver error, since drivers often deliberately deviate from optimally safe performance for a myriad of reasons (Rothengatter, 1997a). It has already accepted that disobediences, errors, and road violations are the main reason of traffic accident, such as by Rothengatter (1997a), Yagil (1998), Rimmö & Åberg (1999), or Forward (2006, 2009a), among others. Thus, it shows a need to have a deep study regarding the motive behind the dangerous behaviors and attitudes by motorcyclist. Study by Watson, Tunnicliff, White, Schonfeld, & Wishart (2007) in Australia indicated that risky motorcycle rider intentions were primarily influenced by attitudes and sensation seeking, while safer intentions were influenced by perceived behavioral control. Many studies show that risky attitudes of road users are suitable to be explored by studying disobedience and violations (see discussions provided by Rothengatter, 1997a; Underwood, Chapman, Wright, & Crundall, 1997; Yagil, 2005; or Forward, 2006, 2009b, among others). Thus, a successful approach to road safety might include a focus on reducing the commission of violations by influencing drivers not to deviate deliberately from safe practises (Parker & Manstead, 1996).

Recent studies suggest that traffic violations have certain relationships with personal travel behaviours and increase the risk of accidents as well. Most of the studies, as far as the authors aware, are employed data from developed city. Driver behaviour has been studied in relation to visual search, field dependency, perceptual style, attitudes, risk perception, sensation seeking, attribution, lifestyle, and workload, as a determinant of road user behaviour (Gregersen & Berg, 1994 in Rothengatter, 1997b). Besides workload of the driver, the difficulty in driving is also already studied. Driving task difficulty is inversely related to the difference between driver capability and driving task demand, where drivers appear to be able to make judgements of task

difficulty easily and to behave in such a way as to keep the level of task difficulty within target boundaries (Fuller, 2005). Furthermore, Al-Madani & Al-Janahi (2002) argued that driver's personal characteristics, i.e. driver's year of education, gender, monthly income, and nationality, are primarily associated with their understanding capabilities and not with their accident involvement rates, while Rothengatter (2002) reported several studies regarding the relation between the differences among individual with the accident or risky behaviour.

Literatures explained variety of drivers' behaviour as a result of different type of workers. Salminen & Lähdeniemi (2002) found haste is the most important risk factor in traffic during working hours according to the sales and marketing staff and construction workers. Di Milia (2006) found that there are different behaviours of drivers between shift workers and non-shift workers in driving distance and level of sleepiness, as a result of work schedule that governed the travel agenda, which severe sleepiness has been linked to driving impairments and is therefore of concern for the safety. Walton (1999) stated that the biased attitudes of truck drivers may be qualitatively different from those found in samples of car drivers, where interestingly it was found that truck drivers are found to evaluate other road user negatively.

In the relation with the type of vehicle or trip purpose, study conducted by Newnam, Watson, & Murray (2004) found that certain psychological processes appear to influence people in a different way when driving a work vehicle in comparison to driving a personal vehicle. Chang & Yeh (2007) found that light motorcycle riders had more violation behaviours than moped riders, while young motorcycle riders were more likely to violate the law and be negligent of potential risk and motorcycle examination. They also found that male riders were more likely than female riders to violate, and young riders were at a higher accident risk.

In term of the influence of gender and age with driver behaviour, several studies have found a consensus regarding different behaviour between male and female or between young and old people on the road. Male and female drivers who intend to violate perceive greater consensus for their chosen behaviour from men of the same age as themselves whereas for non-intenders it depends on the context (Forward, 2009a). Male and female non-intenders receive the greatest support from people older than themselves, while for women drivers this applies both to

speeding and dangerous overtaking although for men it only applies to speeding. Yagil (1998) found that younger drivers and male drivers express a lower level of normative motivation to comply with traffic laws than do female and older drivers. The finding was emphasised by Williams & Shabanova (2003), which shows that when all crashes were considered, both the youngest and oldest drivers were most likely to be responsible for deaths in their crashes. Besides as a driver, different behaviour between male and female can also be found as a passenger of public transport. Study by Ulleberg (2004) regarding passengers' willingness to address unsafe drivers shown that males seemed to perceive more negative consequences of addressing unsafe drivers, to be less confident in their ability to influence an unsafe drivers, to be more likely to accept risk taking from other drivers, and perceive less risk than females.

Furthermore, Charlton et al. (2006) found evidence for a reduction in driving distances and an increase in avoidance of specific driving situations as a function of age. Raitanen, Törmäkangas, Mollenkopf, & Marcellini (2003) found that reduction in driving among elderly persons as a compensatory strategy was evident in the frequently reported avoidance of various traffic situations. Many older drivers have attempted to minimize any travel under conditions that are threatening and/or cause discomfort and conversely have attempted to restrict their travel to conditions perceived as safe and/or comfortable (Langford & Koppel, 2006).

Another aspect of travel behaviour is the characteristics of travel, such as the mileage people travelled or length of experience where it shows the exposure of the road users. Study by Forward (2009b) shows that past behaviour and descriptive norm make a unique contribution towards the prediction of intention to violate. She also found that the effect of age and annual mileage were significant with regard to speeding indicating that young drivers and those who use the car regularly are more likely to speed. For infractions such as exceeding the speed limit that are heavily enforced by police and that are also commonly committed by drivers, the most important common link between being caught and being involved in crashes could simply be the amount one drives (Cooper, 1997). Forward (2006) found that drivers usually find speeding acceptable although this was also related to a context, since speeding on a major road was more acceptable than on a minor one. Related to the mileage, driving skills is believed as a function of

experience. Driving skills bears some resembles to a factor described as self-efficacy; hence, confidence about own ability was related to a high degree of control (Forward, 2006).

The other aspect of road user's attitude is driving with anger. It is a common impression that driving anger is a real phenomenon, where one particular reason in driving angers is the suggestion that it may be directly related to accident liability (Underwood, Chapman, Wright, & Crundall, 1999). They also found that anger was more likely to be reported on congested journeys, where this was confounded by the fact that journeys with higher traffic density ratings were also of greater distance and took longer to complete, so there was more opportunity for anger provoking events to occur. Lajunen, Parker, & Stradling (1998) investigated how demographics (age, sex) and exposure (estimated annual mileage) related to the amount and types of anger experienced in traffic, where it was found that younger drivers and low mileage drivers were more likely to exhibit all three types of driving anger, but no differences between male and female drivers were found. Shinar (1998) stated that aggressive behaviour is more common among drivers of lower socio-economic levels. Parker, Lajunen, & Stradling (1998) show that aggressive driving behaviour was particularly associated with relatively positive (or less negative) beliefs and attitudes in relation to the initiation of an aggressive driving episode. Rimmö & Åberg (1999) found that it was unequivocally shown that the sensation seeking subscales were differentially related to the DBQ-SWE violations and mistakes factors and that the DBQ-SWE factors were found to be more closely associated with traffic offences and accidents, beyond that of exposure (total mileage).

While explorations of traffic violations and travel behaviours were extensively reported from developed countries' experience, little is understood about the implications of travel behaviours of motorcyclist to traffic violations in the developing world's setting where motorcycle's users are growing very rapidly and well known as aberrant road users. This study has an aim to explore the effects of travel behaviour of motorcyclist on traffic violations utilising datasets from three metropolitan cities in Indonesia (Bandung, Yogyakarta, and Surabaya). Structural equation modelling is employed, where several hypotheses considered here are as follows. First, the way people travel (i.e. trip purpose, trip frequency, trip distance, or travel time) influence type of violence they involved. The reason is that people with higher exposure tend to have more

violations. Different culture, which is represented by city, also differentiates type of violence since each culture is argued to have different travel behaviour as well. This is the second hypothesis. Third, each city has different type of frequent violence, which is presented as have different factor loading. It is argued that each city has specific characteristic of road environment, which determines different type of violence.

2. Method

2.1 Questionnaire

The questionnaire was developed to collect a variety of information regarding motorcyclist's behaviours and attitudes in riding motorcycle in urban areas, which originated from research by Joewono (2010). The questionnaire consisted of six sections. The first section elicited information regarding general social demographic of the motorcyclist with ten questions, i.e. age, gender, marital status, position in family, education, job, family structure, income, expenses, and house ownership. Section two consisted of ten questions also which explored the travel characteristics of the motorcyclist, i.e. trip purpose, number of accompany, number of usage, average distance per trip, average distance per day, average travel time per trip, average travel time per day, motorcycle ownership, reason to use motorcycle, and usage for intercity trip.

Sections three comprised three parts with 14 items to explore the impact of the external factors in influencing motorcyclist to the frequency of violation, such as road environment, vehicle, and environment. Road environment examined traffic condition, width and number of lane, road alignment, road side, road sign and marking, and pavement condition. In the part of vehicle factor, there were four questions, i.e. type and capacity of engine, motorcycle age, motorcycle modification, and maintenance. Environmental part examined weather, time of day, police blocking for investigation, and passenger or accompany. The participants were required to respond to the items on a five-point scale from very often to violate (1) to never to violate (5).

The internal factors were explored in section four to gauge participants' perception towards the impact of factors that comes from inside the motorcyclist to the frequency of violation. In this section, the participants were also required to respond on a five-point scale from very often to

violate (1) to never to violate (5). Five items were available, i.e. when in a hurry, attitude in riding motorcycle, level of obedience, clothing style, and environmental awareness.

Fifth section elicited the type of violations, type of habits, and type of norms when participants were riding motorcycle. 17 items were employed to explore type of violations, 15 items for type of habits of motorcyclist, and 6 items for type of norms. The last section explored type of effect and type of decision the motorcyclist usually do after involved in violation. Six items were provided to the respondents. The participants were also required to rate on four-scale from very often (1) up to never (4) in the fifth and sixth sections.

2.2 Participants

A total of 3000 motorcyclists recruited from three cities, i.e. Bandung, Yogyakarta, and Surabaya to participate in the study. An equal sample size was selected for each city, i.e. 1000 respondents per city. It was set based on Israel (1992), where the minimum sample size was 400 for the population size more than a hundred thousand units and 5% level of precision. As a fact, number of motorcycle in the City of Bandung in 2006 was 448.651 units (BPS Bandung, 2007), in the City of Yogyakarta was 256.224 units in 2007 (BPS Yogyakarta, 2009), while, number of motorcycle in the City of Surabaya in 2010 was 3.122.901 units (Kompas, 2011).

Participants were recruited by the surveyors in variety of public areas, such as terminal, bus or paratransit stops, mall, schools, or offices and approached passengers personally to ask them kindly to fill in the questionnaires. Participants were selected only who rides motorcycle by her/himself, not as a passenger of accompany.

Every day from 20 through 29 September 2010, ten surveyors deployed in six areas of Bandung, i.e. Ujung Berung, Gede Bage, Tegalega, Bojonegara, Cibeunying, and Karees. These six areas were administrative areas of Bandung City. In each area, the surveyors selected public facilities to distribute the questionnaire. The surveyors for questionnaire distribution in the City of Yogyakarta were also deployed to several public facilities in each area, such as Tegalrejo, Jetis, Gondokusuman, Gedongtengen, Danurejan, Wirobrajan, Ngampilan, Gondomanan, Pakualaman, Kraton, Mergangsan, Umbulharjo, Mantrijeron, and Kotagede. Survey in Yogyakarta took place

from 22 September through 1 October 2010, where at the same time survey was conducted in the City of Surabaya as well. The City of Surabaya consisted of five administrative areas, i.e. the Center of Surabaya, North Surabaya, South Surabaya, East Surabaya, and West Surabaya.

Questionnaire was distributed by three different teams of surveyors. The qualification of the surveyors were bachelor student in major university in each city. In average, each surveyor collected from 10 to 15 answered questionnaires per day, which meant that each surveyor was able to collect approximately 100 answered questionnaires. This survey provided a reward or a gift for the respondents after they had completed the questionnaire. The average time spent for filling in the questionnaire was approximately 20 min. The roughly estimate of success rate of approaching potential respondents willing to complete the questionnaire was around 90%, by calculated the number of approaches they made to motorcyclist and the number of motorcyclist who filled in the questionnaire completely.

After reviewing the completeness of the filled questionnaire, it was found that only 983, 980, 978 sets can be used for further analysis for the dataset of Bandung, Yogyakarta, and Surabaya, respectively. In fact, there were some non-response variables in some questions. The number of non-response in each variable for Bandung' dataset was varies from zero up to 33, which meant at most, 33 respondents (3.4%) missed to answer the question. In the city of Yogyakarta, the maximum number of non-response was 59 (6%), while in the city of Surabaya, there were 20 missing-responses (2%). Thus, to manage the missing value as a result of non-response, an average imputation method was applied. An average imputation method was simple, which resulted the same mean value while reduce the variance (Stopher, 2012). It was applied as it was judged as appropriate for this situation where the number of non-response was really small. The method reduced the standard deviation of each variable between zero up to 0.025, where the averages of reducing standard deviation were 0.00143 (Bandung), 0.00255 (Yogyakarta), and 0.00153 (Surabaya).

Descriptive statistics of the participants in this study are presented in Table 1, while Table 2 provides descriptive statistics of the participants' travel behavior. Table 1 shows the age of the motorcyclists in these three cities, where around 80% of them are in the age of productive

people. Similar percentage can be found for Yogyakarta and Surabaya, while higher number of young motorcyclists (17-29 years old) can be found in Bandung. Around four percent of the respondents as motorcyclist are younger than 17 years old. Around three percent of motorcyclists are senior citizen (50 years old or older), while in Yogyakarta have more senior citizens ride motorcycle.

Respondents in Bandung have higher proportion of male than female and single than married. Around 80% of the respondents are male in Bandung, while around 60% of the respondents are male in Yogyakarta and Surabaya. The three cities have similar percentage of single person (60%). It is interesting to notice that the distribution of the status of the respondents at home is similar in these sample cities, namely as husband (around 25% up to 28%) and as a child (around 45 up to 55%). It is also important to note the similarity of education of the respondents, where people with senior high school as their highest education is dominant (50%) and followed by undergraduate (around 30%). Thus, it can be roughly summarized that motorcyclists in these three cities are single and male person which have status as husband or child at home.

The occupations of the motorcyclists have different proportion among cities. Motorcyclists in Bandung are dominated by student (52%) and followed by private employee and enterpreneurship with similar percentage (17.7). Similar pattern with Bandung can be found from respondents in Yogyakarta. Students dominate the motorcylists in this study (39.9%) and followed with private employee (25.2%) and enterpreneurship (19.6%). In the city of Surabaya, the majority of the motorcylists have occupation as private employee (42.1%), while students have the second and third highest proportion (27.8% and 16.8%).

Since the respondents are motorcyclists, it is easily understood that the highest number of type of driving license owned by respondents are SIM C (driving license designated only for motorcyclists). 68.1% of the respondents in Yogyakarta own only one driving license, i.e. SIM C, while 56.4% and 41.9% of the respondents in Surabaya and Bandung own only SIM C. Higher percentage of people who own more than one driving license is found in Bandung (41.9%). In Yogyakarta and Surabaya, there are 17.8% and 21.0% of them who have multiple driving license. It is important to notice the existence of respondents who ride motorcycle while

they do not have any driving license, where it violates the regulation in Indonesia. As an information, 17 years old is the below limit to have a driving license as motorcyclist in Indonesia. Almost 15% of respondents in Surabaya ride motorcycle without driving licence. It is followed by Yogyakarta (12.9%) and Bandung (7.5%).

Travel behaviors of the motorcyclists in these sample cities are provided in Table 2. Trip purposes of the motorcylists are dominated with working and studying. Studying is the trip purpose with the highest proportion in the City of Bandung (37.4%). 31.6 % of the respondents ride motorcycle for working (37.4%) and sight seeing (19.4%). Yogyakarta and Surabaya have similar pattern of the proportion of trip purpose, where the highest is trip purpose for working. It is followed with studying and sight seeing. Higher proportion for working is found in Surabaya (54.5%) when it is compared with Yogyakarta (42.3%). 28.6% and 22% of them ride motorcycle for studying in the City of Yogyakarta and Surabaya. Around 16% of the motorcyclists have trip purpose for sight seeing in both cities.

Respondents in these three cities have similar pattern in term of frequency of usage per day. Thirty to fourty percent of the respondents travel using motorcycle twice a day, while around twenty to thirty percent travel more than four times per day. Majority of them travel three times per day or less with percentage around 60 for Yogyakarta, 70 for Bandung, and 75 for Surabaya.

Similar order can be found in travel distance per trip in these three cities, although it have different percentage. More people in Yogyakarta travel longer distance than the other two cities. 47.3% of respondents travel more than four kilometers in Yogyakarta, while only 38.3% and 31.8% of respondents in Bandung and Surabaya do the same travel distance. The second highest travel distance is one up to two kilometers per trip, namely 29.8% for Surabaya, 21.3% for Bandung, and 17.9% for Yogyakarta. Moreover, in term of travel time per trip, around 85% of the respondents spend one hour or less for traveling per trip.

+++ Insert Table 1 & Table 2 around here +++

2.3 Method of analysis

A structural linear regression model is tested in this study using AMOS (Arbuckle & Wothke, 1999). Figure 1 provides structural relationships for several constructs of violations, travel behaviors, and impacts. The figure illustrates the hypotheses testing, including factor analysis. Seven hypotheses are tested, as appear in Figure 1, namely:

H_1: violation of norms is related to violation of habits

H_2: violation of habits is related to violation of regulations

H_3: travel behavior is related to violation of norms

H_4: travel behavior is related to violation of habits

H_5: violation of norms is related to impacts

H_6: violation of habits is related to impacts

H_7: violation of regulations is related to impacts

The factor analysis consists of analysis of the attributes of violations, impacts, and travel behaviors. The construct of violations is represented by the construct violations of norms, violations of habits, and violations of regulations. Each construct is explained by several attributes, i.e. 17 attributes for violations of regulations, 15 attributes for violations of habits, 6 attributes for violations of norms, 7 attributes for impacts, and 5 attributes for travel behaviors.

The motive for explaining the construct of violations with three constructs in this study is the observation that the action to violate does not always relate with formal rule or regulations. As a fact, there are several un-written norms but in reality it is followed by community. As an example, it is commonly accepted for people to slow down their car or motorcycle when they pass mosque, church, or any other religious building in the area of residential. In the other side, at present, there are many actions that can be categorized as violation to common logic which is a new habit for motorcyclist. As an example, it becomes common for motorcyclist to not giving a way to other road users by pushing their motorcycle even when other road user is in manuever to turn. This action for not giving a way does not violate regulations, as it is not regulated in formal traffic regulation in Indonesia, while it violates basic rule in traffic engineering. It does not violate norm, as the action for not giving a way in road happens just in recent years. Thus, as a result of the observation for daily activity in several urban road, it is important to differentiate

type of violations into several constructs to model the real behavior of motorcyclist in Indonesian urban roads.

+++ Insert Figure 1 around here +++

3. Modelling

The structural relationships are analyzed using three datasets, i.e. datasets from Bandung, Yogyakarta, and Surabaya. Table 3 summarizes the multiple fit statistics for each model. The χ^2 of each model is rejected at 5%. As the model χ^2 is affected by sample size, specifically if the sample size is large, thus the value of χ^2 may lead to rejection, even though differences between observed and predicted covariance are slight (Kline, 2005). Thus, a normed chi-square (χ^2/df) is applied, where value lower than 5 can be judged as reasonable fit. Model using dataset from Yogyakarta has the lowest value (4.199), while model of Bandung and Surabaya have bigger value, as much 6.367 and 6.563, respectively. Based on normed chi-square, model of Yogyakarta has better fit than Bandung and Surabaya. Models of Bandung and Surabaya can be classified as acceptable as its values are not far from 5. The root-mean-square residual (RMR) of these models are 0.049, 0.048, and 0.036, which is near to zero as a perfect fit. The values of goodness of fit index (GFI) of these models are close to one, i.e. 0.871, 0.856, and 0.904. It means the models are fit. Similar findings can be found on adjusted goodness of fit index (AGFI) and comparative fit index (CFI), where imply that the models are fit. The root-mean-square of approximation (RMSEA) of these models are quite small, namely 0.074, 0.075, and 0.057, hwere the value in a range of 0.05 to 0.08 means that the model shows a reasonable error of approximation. Based on those statistical indices, it can be concluded that these three models are a reasonable good approximation of the data.

+++ Insert Table 3 around here +++

Futhermore, Table 4 presents error variances of each estimated parameters. The variances of errors are represented by the numbers at the tail of arrows (Klem, 2000). In this article, the error variances of observed and unobserved variables are represented by notation of δ_i, as appears in Figure 1. 36% and 39% of the variance in travel behavior is explained by the model based on

dataset from Bandung and Yogyakarta, respectively. Using data from Surabaya, 79% of the variance in travel behavior is explained. From three construct of violations, violations of habits has the strongest effect than violations of norms and violations of regulations. It is the case for all cities. Around 90% of the variance of violations of habits can be explained by the model. For the construct of impact, the model is able to explain 88%, 86%, and 87% of the variance for the case of Bandung, Surabaya, and Yogyakarta.

All attributes in the model for all dataset are statistically significant. In the model from Bandung's dataset, the attributes of the construct of travel behavior have an error in a range from 0.437 up to 0.838. A range of error from 0.144 up to 0.249 is found in the attributes of the construct of impact, while an error from 0.257 up to 0.404 is found in the construct of violations of norms. The attributes of the construct of violations of habits range from 0.243 up to 0.500, while a range of error for the attributes of the violations of regulations is 0.304 up to 0.559.

Using dataset from Surabaya, the attributes of the travel behavior have a quite high error, where it is also the case for Yogyakarta. The construct of impact is explained by four attributes with an error as much as 0.149 up to 0.269 for Surabaya's dataset, and a range from 0.113 up to 0.234. Two attributes of the violations of norms in the model using dataset of Surabaya have an error as much as 0.139 and 0.185, while three attributes are found using dataset of Yogyakarta with a range of error from 0.194 up to 0.324. The attributes in the construct of habits have a range from 0.280 up to 0.526 for Surabaya and 0.249 up to 0.617 for Yogyakarta. A ranges of error from 0.340 up to 0.704 and 0.315 up to 0.722 are found in the attributes of the construct of violations of regulations.

+++ Insert Table 4 around here +++

The hypotheses in this study are tested by investigating the regression weights, where the results are presented in Table 5. All hypotheses are found to be significant at 5%. The first hypothesis states that the construct of the violation of norms is positively related to violations of habits. The hypothesis is significantly supported by data from these three cities. It explains the fact that people tend to do negative action when they are already getting used to violate norm. As many

norms was naturally not written, which results any violations will end without any sanction, except moral or cultural sanction, such as older people get angry. The finding implies that people who do not breaking the norm, will tend to refuse to involve in action of something uncommon.

In line with the first hypothesis, the hypothesis that violation of habits positively influences the violation of regulations is also significantly supported by data at 5% for dataset from Bandung and Yogyakarta and at 10% for dataset from Surabaya. The model seems able to explain that people tend to violate formal regulations when they are getting used to have the negative habits. The negative habits, in fact, do not violate formal rule or any norm, but just doing something that uncommon. In the beginning it is only uncommon, but after someone knows that others doing the same thing without any negative impact and they follow to do the same thing. After that, it becomes habit for many motorcyclists. Thus, based on those two hypotheses, it can be summarised that people who have a good appreciation to norm will tend to be a polite and careful motorcyclist. When s/he is polite and careful in road, s/he will also have a good respect to formal rule or regulation.

Furthermore, the third hypothesis states that travel behavior is negatively influence the violation of norms. The hypothesis is only supported significantly by data from Bandung, while it is not the case for the other two datasets. Based on Bandung's dataset, it is found that less frequent or less experience motorcyclists in Bandung tend to violate community's norms. Different result can be found in the fourth hypothesis, i.e. travel behavior is related to violation of habits. Positive relation can be found in Bandung, while negative relation appears in Surabaya and Yogyakarta. Motorcyclist in Bandung with more experience, which is shown by more frequent and longer travel time or distance, seems to have a habit to do an action that break common or basic attitude in road. On the contrary, motorcyclist in Surabaya and Yogyakarta who have more experience tend to have better habit in the road. It shows a fact that many motorcyclists in Bandung have a tendency to be a follower to other's action, i.e. negative action.

It is hypothesized, as the fifth, that the construct of violation of norms is positively related to impacts. Data from Bandung and Yogyakarta support the hypothesis, while the relation cannot be found in Surabaya. The sixth hypothesis states that the construct of violation to habits is

positively related to the construct of impacts. All datasets support the model significantly. Different result is found in the relation between the construct of violation of regulation to impact. Significantly positive relation exists when the relation is analysed using dataset from Bandung, while dataset from Surabaya and Yogyakarta cannot support the relation significantly.

+++ Insert Table 5 around here +++

Furthermore, Table 6 provides the regression weights for significant attributes which explains the construct. Seven out of 17 attributes of violations to traffic regulation are found significant in Bandung, Surabaya, and Yogyakarta, where the attributes are the same with different loading weights. The loading weights for Bandung's dataset range from 0.615 (crossing zebra-cross) up to 0.778 (disobeying traffic sign). The lowest and the highest loading weights for the attributes are different for the city of Surabaya and Yogyakarta, while the attributes are the same. Attribute with the lowest loading is riding motorcycle without complete document (i.e. 0.592 in Surabaya and 0.518 in Yogyakarta) and the highest is modify the plate number (i.e. 0.805 in Surabaya and 0.873 in Yogyakarta).

Different pattern can be found in the attributes which explains the construct of violation as an habit. Seven out of 15 attributes are found significant in Bandung's model, while ten attributes are found significant in the model using dataset from Surabaya and Yogyakarta. Significant attributes in Bandung are different from the rest two cities, while Surabaya and Yogyakarta has exactly the same significant variables even with different value of weights. The attribute of using sidewalk when riding motorcyclecle is found significant with the lowest loading in Bandung, while the attribute of pushing motorcyclecle in a narrow space between cars has the highest loading. In Surabaya, the lowest and the highest loading are overtaking from the left (0.526) and racing in urban road (0.696). In Yogyakarta, the lowest loading is as much as 0.498 (smoking when riding motorcycle) and 0.765 (pushing motorcycle in a narrow space between cars).

In the construct of violation to community norm, there are three out of six attributes which are found to be significant in Bandung and Yogyakarta. Only two are found significant in Surabaya. The attributes are the same for all city, while the loading weights are different. The attributes are

speeding in residential area, have no respect to other road users, and turning on the motorcycle when passing the alley. Speeding in residential area has a loading weight as much as 0.659, 0.720, and 0.607 in the city of Bandung, Surabaya, and Yogyakarta, respectively. Have no respect to other road users has a weight as much as 0.715, 0.795, and 0.691 for Bandung, Surabaya, and Yogyakarta. The attribute of turning on the motorcycle when passing the alley is found significant only in Bandung (0.525) and Yogyakarta (0.521).

The same four attributes in the construct of impact of violation are found significant in the three models. The weight of the attribute of escaping when involving violations is the lowest (0.527) in the model of Yogyakarta, while the highest is experiencing accident (0.657). Experiencing accident is also the attribute with the highest loading (0.659) in the city of Surabaya, while the lowest is hit and run (0.570). On the contrary, the attribute of hit and run is found as the attribute with the highest loading in the city of Bandung (0.749). The attribute of caught by police has the lowest weight in Bandung (0.665).

Two attributes are found significant in Surabaya and Yogyakarta (travel time per day and travel distance per trip). The attribute of travel time per day has a loading as much as 0.408 and 0.714 for the model of Surabaya and Yogyakarta, while the attribute of travel distance per trip has a loading as much as 0.970 and 0.402. Four attributes are found significant in Bandung, i.e. travel time per day (0.696), travel distance per trip (0.872), travel distance per day (0.914), and travel time per trip (0.539).

+++ Insert Table 6 around here +++

4. Discussion

Three structural equation models are developed to investigate the relationships between constructs of travel behaviour, violations, and impacts. Three type of violations' construct are proposed. Several attributes are employed to explain the construct. By comparing the three models, it can be found there are general pattern of relationships among construct as well as attributes in explaining the construct. In the same time, it can be found also a uniqueness of motorcycle users' behaviour in urban road.

This study contributes in providing basic information regarding the psychological aspects of motorcyclist from the point of view of civil engineers. The findings provide a novel knowledge from the context of motorcyclist in developing country. As stated by Rothengatter (2005) that traffic psychology can contribute in two ways to improve road safety, i.e. it can develop training programs, or more generally, interventions that increase the willingness to adaptation. This study is an effort to improve the traffic condition, where common engineering approach cannot solve. It is in line with the statement from Tunnicliff (2006) that it facilitates the understanding of safety issues from a motorcyclist perspective and provides important information on factors influencing safe and unsafe rider intentions and behaviours.

Motorcycle has been claimed as a risky mode of transport. This study reveals the abstract's background about the visible congestion as well as risky and reckless behaviour in urban road.

In this study, travel behaviour was tested as a proxy to explain the exposure of drivers. The findings show that it is able to show the significant influence of travel behaviour to violations. People who have a good respect to norm then s/he can be expected to have a good habit. People with a responsible and mature habit can be hoped to violate less. It is interesting to note that people with lower travel experience tend to be more frequent in involving violation. On the other side, the finding cannot be generalized for all cultural background. In the city of Bandung, the reverse relation is found, i.e. people with higher experience in road tend to involve more violations. Thus, the effect of experience will differently influence people in involving violations.

Based on the findings, more study can be planned to explore in a deeper way the type of action to change users' habit to be more positive. As an example, Houston (2007) found that only universal laws appear to be effective at protecting young motorcyclist, because partial coverage statutes are difficult to enforce, age-based helmet requirements undermine the certainty of punishment for non-compliance. Williams & Shabanova (2003) state the importance of restricting young beginning drivers from transporting passengers. These kind of findings are needed to be explored using dataset from developing countries like Indonesia.

5. Conclusions

This study reports that the way people travel for their everyday mobility with motorcycle has significant influence on the construct of repetitive traffic violations. Analysis shows that motorcyclists who commute for longer trips and more frequent are more frequent to violence. But, the findings cannot be generalized for different cultural background. This study reveals the different city has different result, where it has a possible reasoning as different cultural background.

Even though general relationship's pattern can be developed to explain different cultural background, but uniqueness of the city can also be revealed. It shows a need to have a specific approach to each city. It means that traffic regulation cannot be generalized to the whole users in any city in Indonesia. But, unique approach should be proposed. It is further task in managing urban traffic in developing country likes Indonesia.

Acknowledgment

Authors thank to the Directorate General of Higher Education, Ministry of National Education, Republic of Indonesia for providing fund to complete this research under the scheme of Competence Grant for the second year, based on the decree of Director for Research and Community Services No. 285/D3/PL/2010 dated 24 February 2010. This article is a part of the research entitled "Development of Traffic Psychology in Urban Traffic Management in Indonesia." Authors also express their appreciation to all parties who have provided assistances in completing this research as well as writing the article.

References

Arbuckle, J.L., and Wothke, W. (1999) Amos 4.0 User's Guide. Small Water Corporation, Chicago, Ill.

Badan Pusat Statistik (BPS Kota Bandung). (2007). Bandung Dalam Angka 2007. Badan Perencanaan Pembangunan Daerah Kota Bandung dan Badan Pusat Statistik Kota Bandung. Bandung.

Badan Pusat Statistik (BPS Yogyakarta). (2009). Number of Motorcycle and Motor Vehicle in the Province of Yogyakarta. Online http://yogyakarta.bps.go.id/ Accessed 7 March 2012.

Chang, H-L., and Yeh, T-H. (2006). Risk Factors to Driver Fatalities in Single-Vehicle Crashes: Comparisons between Non-Motorcycle Drivers and Motorcyclists. Journal of Transportation Engineering, 132(3), 227- 236.

Chang, H-L., and Yeh, T-H. (2007). Motorcyclist accident involvement by age, gender, and risky behaviors in Taipei, Taiwan. Transportation Research Part F 10, 109-122.
Charlton, J.L., Oxley, J., Fildes, B., Oxley, P., Newstead, S., Koppel, S., & O'Hare, M., (2006). Characteristics of older drivers who adopt self-regulatory driving behaviours. Transportation Research Part F 9, 363-373.
Clarke, D.D., Ward, P., Bartle, C., and Truman, W. (2004). In-depth Study of Motorcycle Accidents, Road Safety Research Report No. 54, Department for Transport, London.
Cooper, P.J., (1997). The relationship between speeding behavior (as measured by violation convictions) and crash involvement. Journal of Safety Research 28(2), 83-95.
Dandona, R., Kumar, G.A., and Dandona, L. (2006) Risky behavior of drivers of motorized two wheeled vehicles in India, Journal of Safety Research 37, 149-158.
Department of Environment, Transport and the Regions (DETR) (2000) Tomorrow's Roads – Safer for Everyone: The Government's road safety strategy and casualty reduction targets for 2010, DETR report, HMSO, London.
Di Milia, L., (2006). Shift work, sleepiness, and long distance driving. Transportation Research Part F 9, 278-285.
Forward, S.E. (2006). The intention to commit driving violations – a qualitative study. Transportation Research Part F 9, 412-426.
Forward, S.E. (2009a). An assessment of what motivates road violations, Transportation Research Part F 12, 225-234.
Forward, S.E. (2009b). The theory of planned behaviour: the role of descriptive norms and past behaviour in the prediction of drivers' intentions to violate. Transportation Research Part F 12, 198-207.
Gregersen, N.P., & Berg, H.Y. (1994). Lifestyle and accidents among young drivers. Accident Analysis & Prevention 26, 297-303.
Gwilliam, K., (2002). Cities on the Move. World Bank. Washington, D.C.
Hickman, R., Fremer, P., Breithaupt, M., and Saxena, S. (2011). Changing Course in Urban Transport: An Illustrated Guide, Asian Development Bank & Deutsche Gesellschaft für Internationale Zusammenarbeit, Metro Manila.
Hossain, M., and Iamtrakul, P. (2007). Medical investigation of motorcycle accidents in Thailand**.** Journal of the Eastern Asia Society for Transportation Studies 7, 2770-2785
Indriastuti, A.K., and Sulistio, H. (2010) Influencing factors on motorcycle accident in urban area of Malang, Indonesia. International Journal of Academic Research 2(5), 252-255.
Israel, G.D. (1992). Determining sample size, PEOD6, Agricultural Education and Communication Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville
Joewono, T.B. (2010) Development of Traffic Psychology in Urban Traffic Management in Indonesia (*Pengembangan psikologi lalulintas dalam manajemen lalulintas perkotaan di Indonesia*). Research Report of Competence Grant. Ministry of National Education. Bandung. (in Indonesian)
Kaltheier, R.M. (2002). Urban Transport and Poverty in Developing Countries: Analysis and Options for Transport Policy and Planning, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, Eschborn.
Kompas. (2011). Surabaya, Oh Surabaya yang Macet. Online http://travel.kompas.com/read/2011/07/23/07594563/Surabaya.Oh.Surabaya.yang.Macet Accessed 7 March 2012

Klem, L. (2000) Structural Equation Modeling. In Grimm, L.G. and Yarnold, P.R., Reading and Understanding More Multivariate Statistics. American Psychological Association, Washington, D.C.

Kline, R.B. (2005) Principles and Practice of Structural Equation Modeling, 2nd ed., Guildford Press, New York.

Lajunen, T., Parker, D., & Stradling, S.G., (1998). Dimensions of driver anger, aggressive and highway code violations and their mediation by safety orientation in UK drivers. Transportation Research Part F 1, 107-121.

Langford, J., & Koppel, S., (2006). Epidemiology of older driver crashes – Identifying older driver risk factors and exposure patterns. Transportation Research Part F 9, 309-321.

Ministry of Transport Japan, (2000). Urban Transport Development – Final Report, Chapter 13; 08/2000, S. 13-2. PADECO.

Musselwhite, C.B.A., Avineri, E., Susilo, Y.O., & Bhattachary, D., (2011). Public attitudes towards motorcyclists' safety: A qualitative study from the United Kingdom. Accident Analysis and Prevention, doi: 10.1016/j.aap.2011.06.005

Newnam, S., Watson, B., & Murray, W., (2004). Factors predicting intentions to speed in a work and personal vehicle. Transportation Research Part F 7, 287-300.

Parker, D., & Manstead, A. (1996). The social psychology of driver behaviour. In Semin, G.R., & Klaus, F. (Eds.) Applied Social Psychology (198-224), Sage, London.

Parker,D., Lajunen, T., & Stradling, S., (1998). Attitudinal predictors of interpersonally aggressive violations on the road. Transportation Research Part F 1, 11-24.

Paulozi, L.J. (2005). The role of sales of new motorcycles in a recent increase in motorcycle mortality rates. Journal of Safety Research 36, 361-364.

Raitanen, T., Törmäkangas, T., Mollenkopf, H., & Marcellini, F., (2003). Why do older drivers reduce driving? Findings from three European countries. Transportation Research Part F 6, 81-95.

Rimmö, P-A., & Åberg, L. (1999). On the distinction between violations and errors: sensation seeking associations. Transportation Research Part F 2, 151-166.

Rothengatter, T. (1997a) Errors and violations as factors in accident causation. In Rothengatter, T. and Vaya, E.C. (Eds.) Traffic and Transport Psychology: Theory and Application. Elsevier Science Ltd, Oxford.

Rothengatter, T. (1997b). Psychological aspects of road user behavior. Applied Psychology: An International Review 46(3), 223-234.

Rothengatter, T. (2002). Drivers' illusions – no more risk. Transportation Research Part F 5, 249-258.

Rothengatter, T. (2005). Traffic psychology and road safety: separate realities. In Underwood, G. (Ed.) Traffic & Transport Psychology: Theory and Application. Elsevier Science Ltd, Amsterdam.

Rowden, P., Watson, B., Wishart, D., and Schonfeld, C. (2009). Changing motorcycle rider safety attitudes and motives for risk taking: process evaluation of a rider training intervention. Proceedings of the 2009 Australasian Road Safety Research, Policing and Education Conference: Smarter, Safer Directions, 10-12 November, Sydney.

Salminen, S., & Lähdeniemi, E., (2002). Risk factors in work-related traffic. Transportation Research Part F 5, 77-86.

Shinar, D., (1998). Aggressive driving: the contribution of the drivers and the situation. Transportation Research Part F 1, 137-160.

Statistics Indonesia (Badan Pusat Statistik Indonesia) (2009). Number of motorized vehicle 1987-2009. Online http://www.bps.go.id/tab_sub/view.php?tabel=1&daftar=1&id_subyek=17&notab=12 Accessed 1 March 2012.

Stopher, P. (2012) Collecting, Managing, and Assessing Data using Sample Surveys. Cambridge University Press. Cambridge.

Tunnicliff, D.J. (2006). Psychosocial factors contributing to motorcyclists' intended riding style: An application of an extended version of the theory of planned behaviour. Master thesis. Queensland University of Technology. Brisbane.

Ulleberg, P., (2004). Social influence from the back-seat: factors related to adolescent passengers' willingness to address unsafe drivers. Transportation Research Part F 7, 17-30.

Underwood, G., Chapman, P., Wright, S., and Crundall, D. (1997). Estimating accident liability. In Rothengatter, T. and Vaya, E.C. (Eds.) Traffic and Transport Psychology: Theory and Application. Elsevier Science Ltd, Oxford.

Underwood, G., Chapman, P., Wright, S., and Crundall, D. (1997). Anger while driving. Transportation Research Part F 2, 55-68.

Yagil, D. (1998). Gender and age-related differences in attitudes toward traffic laws and traffic violations. Transportation Research Part F 1, 123-135.

Yagil, D. (2005). Drivers and traffic laws: A review of psychological theories and empirical research. In Underwood, G. (Ed.) Traffic & Transport Psychology: Theory and Application. Elsevier Science Ltd, Amsterdam.

Walton, D., (1999). Examining the self-enhancement bias: professional truck drivers' perceptions of speed, safety, skill and consideration. Transportation Research Part F 2, 91-113.

Watson, B., Tunnicliff, D., White, K., Schonfeld, C., and Wishart, D. (2007). Psychological and social factors influencing motorcycle rider intentions and behavior. ATSB Research and Analysis Report Road Safety Research Grant Report 2007-04, Centre for Accident Research and Road Safety Queensland University of Technology, Brisbane.

Table 1 Desriptive statistics of the respondents

Characteristics		Proportion		
		Bandung (n=983)	Yogyakarta (n=980)	Surabaya (n=978)
Age	Younger than 17 years old	3.8	4.2	3.1
	17-29 years old	64.4	49.3	49.1
	30-39 years old	20.2	25.6	33.9
	40-49 years old	8.7	12.1	10.1
	50-59 years old	2.6	7.3	3.3
	60 years old or older	0.2	1.4	0.5
Gender	Male	82.1	62.8	57.2
	Female	17.9	37.2	42.8
Marital status	Single	65.4	61.1	58.5
	Married	34.6	38.9	41.5
Status at home	Husband	28.2	25.0	25.7
	Wife	6.3	13.0	14.6
	Childs	55.0	48.3	45.9
	Relatives	3.5	3.6	4.4
	Friends	2.7	3.2	5.3
	Others	4.3	7.0	4.1
Education	Elementary or lower	1.9	2.4	1.0
	Junior high school	7.4	8.2	6.1
	Senior high school	48.6	48.4	51.9
	Diploma	7.4	8.9	7.8
	Undergraduate	30.9	28.7	29.7
	Graduate	3.7	3.5	3.5
Occupation	Students	52.0	39.9	27.8
	Civil servants /soldiers	6.9	8.0	7.1
	Private employee	17.7	25.2	42.1
	Entrepreneurship	17.7	19.6	16.8
	Housewives	3.4	4.7	4.3
	Retired / unemployment	2.3	2.7	1.9
Type of driving license owned	Not owned	7.5	12.9	14.9
	For common and utility car (SIM A)	2.8	1.2	7.1
	For truck and bus (SIM B)	0.3	0.1	0.6
	For motorcycle (SIM C)	47.4	68.1	56.4
	More than one driving license	41.9	17.8	21.0

Table 2 Descriptive statistics of travel behaviors of motorcyclists

Characteristics		Proportion		
		Bandung (n=983)	Yogyakarta (n=980)	Surabaya (n=978)
Trip purpose	Sight seeing	19.4	16.6	15.8
	Working	31.6	42.3	54.5
	Studying	37.4	28.6	22.0
	Visiting friends or relatives	2.5	3.9	1.9
	Religion activities	0.8	0.7	1.0
	Others	8.1	7.9	4.7
Frequency per day	Once time	18.0	11.2	16.4
	Two times	36.3	31.3	39.7
	Three times	16.6	18.0	19.3
	Four times	8.0	9.7	6.5
	More than four times	21.1	29.8	18.1
Travel distance per trip	Less than one kilometer	9.8	5.5	8.1
	1 - 2 km	21.3	17.9	29.8
	2 - 3 km	19.5	15.9	18.3
	3 - 4 km	11.2	13.4	12.1
	More than four kilometers	38.3	47.3	31.8
Travel time per trip	Less than 15 minutes	17.1	14.7	11.5
	15 - 30 minutes	40.5	51.0	43.4
	30 minutes - 1 hour	30.9	22.1	29.0
	1 - 2 hours	7.3	6.8	9.7
	2 - 3 hours	0.9	2.1	3.4
	More than three hours	3.3	3.2	3.1

Table 3 Goodness of fit indices

Indices	Statistics		
	Bandung	Surabaya	Yogyakarta
χ^2	1706.240	1778.517	1234.390
df	268	271	294
p-value	0.000	0.000	0.000
χ^2/df	6.367	6.563	4.199
RMR	0.049	0.048	0.036
GFI	0.871	0.856	0.904
AGFI	0.843	0.827	0.886
CFI	0.870	0.835	0.901
RMSEA	0.074	0.075	0.057

Table 4 Error variances

		Bandung			Surabaya			Yogyakarta		
		Est.	S.E.	Sig.	Est.	S.E.	Sig.	Est.	S.E.	Sig.
δ_{50}	Travbehav	.640	.053	.000	.213	.122	,081	.609	.280	.029
δ_{53}	Norm	.221	.021	.000	.199	.019	.000	.137	.016	.000
δ_{51}	Habit	.100	.014	.000	.109	.014	.000	.109	.013	.000
δ_{52}	Regulation	.353	.033	.000	.373	.038	.000	.250	.030	.000
δ_{54}	Impact	.122	.012	.000	.140	.015	.000	.127	.014	.000
δ_{9}	Rearview	.550	.029	.000	.506	.029	.000	.382	.023	.000
δ_{4}	Zebracross	.438	.021	.000	.550	.028	.000	.461	.024	.000
δ_{3}	Obeysign	.304	.017	.000	.381	.021	.000	.381	.020	.000
δ_{11}	Turnonlamp	.495	.026	.000	.671	.033	.000	.461	.025	.000
δ_{13}	Platenumber	.559	.031	.000	.539	.031	.000	.410	.025	.000
δ_{24}	Other	.334	.017	.000	.340	.016	.000	.315	.015	.000
δ_{32}	Sidewalk	.366	.018	.000						
δ_{25}	Music				.500	.024	.000	.469	.022	.000
δ_{26}	Smoke				.409	.020	.000	.516	.024	.000
δ_{27}	Phone				.352	.018	.000	.372	.018	.000
δ_{28}	Chatting				.407	.020	.000	.429	.021	.000
δ_{1}	Document	.543	.027	.000	.704	.034	.000	.722	.034	.000
δ_{2}	Standhelmet	.500	.027	.000	.526	.028	.000	.617	.031	.000
δ_{23}	Suddenly	.279	.013	.000	.280	.014	.000	.282	.014	.000
δ_{21}	Reckless	.339	.017	.000	.289	.015	.000	.299	.015	.000
δ_{20}	Racing	.386	.020	.000	.376	.020	.000	.384	.020	.000
δ_{18}	Leftovertake	.284	.015	.000	.488	.023	.000	.340	.017	.000
δ_{19}	Pushingmc	.243	.014	.000	.364	.019	.000	.249	.014	.000
δ_{38}	Speedresd	.289	.016	.000	.185	.014	.000	.235	.014	.000
δ_{37}	Unrespect	.257	.016	.000	.139	.015	.000	.194	.014	.000
δ_{36}	Alley	.404	.020	.000				.324	.017	.000
δ_{39}	Accident	.234	.013	.000	.252	.016	.000	.232	.014	.000
δ_{40}	Police	.249	.014	.000	.241	.015	.000	.230	.014	.000
δ_{41}	Hitrun	.144	.009	.000	.149	.008	.000	.113	.007	.000
δ_{44}	Escape	.287	.017	.000	.269	.016	.000	.234	.012	.000
δ_{49}	Timeday	.683	.034	.000	1.067	.127	.000	.587	.277	.034
δ_{46}	Distrip	.486	.039	.000	.115	1.001	.909			
δ_{48}	Timetrip	.838	.040	.000				1.508	.148	.000
δ_{47}	Distday	.437	.050	.000						

Note: Est. = estimate; S.E. = standard error

Table 5 Regression weights

Relationships	Bandung			Surabaya			Yogyakarta		
	Est.	S.E.	p-value	Est.	S.E.	p-value	Est.	S.E.	p-value
Habit ← Norm	1.057	.067	.000	.612	.053	.000	.910	.076	.000
Habit ← Travel behavior	.048	.022	.027	-.112	.030	.000	-.097	.044	.029
Impact ← Norm	.325	.096	.000				.369	.087	.000
Impact ← Habit	.234	.072	.001	.539	.052	.000	.219	.060	.000
Regulation ← Habit	.268	.039	.000	.202	.053	.000	.248	.041	.000
Norm ← Travel behavior	-.050	.024	.035						
Impact ← Regulation	.097	.025	.000						

Note: Est. = estimate; S.E. = standard error

Table 6 Standardized regression weights

Factors and Attributes	Loadings		
	Bandung	Surabaya	Yogyakarta
Violation to regulation			
zebracross	.615	.690	.773
obeysign	.778	.799	.786
rearview	.726	.803	.865
standhelmet	.728	.773	.738
turnonlamp	.728	.670	.810
platenumber	.762	.805	.873
document	.641	.592	.518
Violation as an habit			
other	.706	.555	.558
music	-	.574	.530
smoke	-	.570	.498
phone	-	.638	.605
chatting	-	.574	.563
suddenly	.584	.561	.571
reckless	.682	.677	.630
racing	.681	.696	.697
pushingmc	.799	.662	.765
leftovertake	.741	.526	.633
sidewalk	.582	-	-
Violation to norm			
speedresd	.659	.720	.607
unrespect	.715	.795	.691
alley	.525	-	.521
Impact of violation			
accident	.689	.659	.657
police	.665	.655	.637
hitrun	.749	.570	.654
escape	.703	.630	.527
Travel behavior			
timeday	.696	.408	.714
disttrip	.872	.970	.402
distday	.914	-	-
timetrip	.539	-	-

Figure 1 Structural relationships