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A study on effects of creep and shrinkage in high strength concrete bridges

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Abstract

The last three decades have been marked by remarkable growth of high strength concrete applications in building and bridges. Both types of construction will benefit from the positif effetcs such as reductions in member sizes and amount of reinforcement, when using high strength concrete. However, bridges are often made with long spans resulting in significant dead weight which combined with the creep and shrinkage properties of concrete, leads to significant deformation and loss of prestressing force in the long term. In this study, the effects of creep and shrinkage of high strength concrete used for prestressed concrete bridge girder is investigated. The aim is to quantify the loss of prestress in high strength concrete bridge and to find justfications on increasing usage of high strength concrete for bridges. A continuous-span bridge built using span by span method (movable scaffold system) is chosen as a case study. Three grades of concrete strength are investigated, 40 MPa, 80 MPa, and 100 MPa, each representing normal, moderately high and high strength concrete. These are grades that can be routinely produced by concrete industry without significant alteration in current production/process technology. As part of this study, a literature survey has also been conducted. It suggests that high strength concrete requires modification of current creep and shrinkage code (applicable only for normal concrete). Thus, the initial part of this study deals with determination of proper creep and shrinkage code. Then, a finite element analysis of the bridge case is performed. The result indicates that reduction in girder size and amount of prestressing is not simply governed by concrete strength, but by the comlplex effects of strength, creep and shrinkage behavior of high strength concrete.

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