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# Influence of warping on stress for restrained concrete slabs: For application to CRCP

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## ABSTRACT

Continuously-reinforced concrete pavement (CRCP) is widely used in transportation system because of its low maintenance requirement. However, the need for large volumes of steel creates a high cost for new construction. The Illinois Tollway is preparing to substantially renovate highways around Chicago and this work seeks to understand how concretes of varying mixture designs can be made thinner by reducing the amount of built-in stress. The experiment examines warping in beams subjected to various degrees of restraint, in an effort to assess effectiveness at reducing warping in continuously reinforced concrete pavements. Value added methodologies such as internal curing with fine lightweight aggregate and topically-applied shrinkage-reducing admixture (SRA) were applied to a controlled concrete mixture design. The experimental program examines the warping of a composite concrete-steel beam with differing degrees of restraint, accomplished through using a 1/4" and ½" steel plate with a 2.5" concrete section . Each beam undergoes seven days of uni-axial warping, subjected to a controlled temperature and humidity environment (23+/-2C and 50 +/- 2 % RH), with a linear variable differential transformer to monitor endpoint deflection. Results indicate that as degree of restraint increases, the associated, or "built-in", stress increases too; however, the deflection decreases by as much as a factor of two between unrestrained and 1/2" restraint. These findings potentially serve as a solution for effectively reducing the amount of concrete necessary for sustained loading associated with CRCP while mitigating warping and stresses associated.

## KEYWORDS

Warp, continuously-reinforced concrete pavement, built-in stress