Laboratory Investigation of Iowa ABC Connection: Cass County HWY 92 Lateral Slide Bridge

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Abstract

Accelerated Bridge Construction (ABC) has become increasingly popular among state departments of transportation (DOT) as the duration of traditional bridge construction has become increasingly more unacceptable to the traveling public and businesses that have adopted "just-in-time delivery" practices. Simply stated, the inconvenience of additional time and money spent traveling due to traditional bridge construction has created a demand and this demand justifies the pursuit of accelerated construction methods. To date several DOT's have carried out ABC projects with varying levels of success. Methods and lessons learned from these projects are being circulated through various publications including those from the Federal Highway Administration, state DOT's, and university researchers. Even so, there is a significant void in the pool of knowledge for ABC construction, especially regarding the connection details, design, and performance. Additional studies are required to fully understand how current methods perform as well as how they can be improved. Plans by the Iowa DOT are underway to remove and replace a bridge using accelerated construction methods in Cass County, Iowa on Hwy 92. The overall objective of this study is to assess the performance of one of the connections being proposed for this reconstruction project.

Critical components to any ABC project are precast/prefabricated elements that can be constructed offsite or off the roadway then moved into place; in the case of the HWY 92 project, one of the precast elements includes precast abutment footings. Void forms constructed from corrugated metal pipe (CMP) are located in the abutment footing at the locations of driven steel H-piles. After the piles have been driven, this element will be lowered into place encompassing the piles and the void form grouted solid. It is this connection (the interface between piles, grout, and CMP) that was evaluated through laboratory testing. Moreover, an assessment of varying shear connector types and configurations for use between the steel pile and grout was completed.

Nine full cross-sectional-scale specimens, 11 ft. long to accommodate replication of girder positions, were constructed at the Iowa State University structures lab. Each specimen was constructed identically with the CMP void forms and H-pile sections with the only difference being that three specimens each consisted of a different shear connector configuration between the pile and void form grout: 1) shear stud connectors, 2) threaded bar and nuts, and 3) no shear connector. For all tests, the specimen was equipped with strain and deflection gages placed in strategic locations for data collection during loading; all loads were applied through the pile section. This presentation will focus on the results obtained for ultimate capacity of the connection and the long-term performance under cyclic loads.

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