2022 Mid-Continent Transportation Research Symposium
Ames, Iowa
September 14–15, 2022
intrans.iastate.edu/events/midcon2022/

Laboratory Investigation on the Performance of Noncontact Lap-Spliced Rebar-Reinforced UHPC/HCSC Closure Joints Used in Lateral Slide-In Bridge Construction

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Abstract

Lateral slide-in bridge construction is an emerging and exciting Accelerated Bridge Construction (ABC) technique that aims to reduce the construction time and public inconvenience by building the bridge superstructure off alignment and sliding it laterally to its final position. After completing the sliding process, a closure joint between the super- and sub-structure is sometimes cast to establish continuity between the two to create an integral abutment system. Occasionally, such closure joints are constructed with Ultra-High Performance Concrete (UHPC) with non-contact lap-spliced rebar. However, one of the concerns of utilizing this type of joint is that the relationship between early-age time-dependent strength of the UHPC closure joint is unknown. This results in a question to the field engineer when the bridge should be open for construction or traffic loadings. In addition, there is a need to search for alternatives to UHPC that provides similar levels of performance at a lower cost such as Hybrid Composite Synthetic Concrete (HCSC) which is a polymer-based basalt fiber reinforced structural concrete offering optimized mechanical effectiveness, compatibility with adjacent materials, and complete elimination of degradation. In this project, a laboratory investigation was conducted on the performance of the UHPC / HCSC closure joints reinforced with non-contact lap spliced rebar to determine the time-dependent strength development. HCSC material has been investigated as an alternative to UHPC during the tests. In total, 96 samples with four different designs (i.e. 24 samples each) were tested in the pull-out test. Different design parameters varying between constant (i.e. side cover (C), bar spacing (S), and bar diameter (db)) and changeable (i.e. embedment length (ld) and the splice length (ls)) have been included in those designs. Within each design, three samples have been tested at a certain time point (i.e. 6 hrs., 12 hrs., 18 hrs., 24 hrs., 36 hrs., 48 hrs., 7 days, and 28 days).