

PROJECT SUMMARY REPORT

0-7088: Develop Closure Joint Materials Specification and Evaluate Performance for Side-by-Side Accelerated Bridge Construction (ABC) Superstructure Systems

Background

The need for faster rates of infrastructure construction and repair continues to increase as population growth (especially in Texas) in large, urban areas continues, bringing with it more traffic congestion and driver delays. To help to address these concerns, accelerated bridge construction (ABC) has become increasingly popular in recent years. Although large structural components can be fabricated or cast off-site and lifted into place, there is still a critical need to connect these components on-site, and to do so in an expedition manner that is consistent with the goals of ABC technologies. This project focuses solely on the development of ultra-high-performance concrete (UHPC) used in closure pours that are designed to gain strength rapidly, thus maintaining the strict construction schedule (and early opening to traffic) essential to bridges constructed or partially replaced using ABC techniques.

What the Researchers Did

This project involved the use of innovative materials and mixture proportions that are intended to provide high early strengths to facilitate accelerated bridge construction, while ensuring that good long-term durability is also achieved. Mixtures including rapid-setting, fiber-reinforced concrete (RSFRC) and ultra-high-performance concrete (UHPC) were developed by the Performing Agency and evaluated in the laboratory (materials and full-scale structural testing) and on outdoor exposures to fully characterize the critical fresh, hardened, structural, and durability properties that are need for closure pour connections. Based on the findings of the literature review and laboratory/exposure site tests, candidate UHPC

mixtures were selected for full-scale structural testing. By developing a wide range of mixtures with varying rheological properties, strength gain characteristics, and toughness values, the Performing Agency developed a suite of mixtures from which TxDOT may select for any given closure pour connection, thereby increasing the potential reach and impact of this project's findings. Lastly, ABC projects in Amarillo and Bryan districts were evaluated and monitored during the course of the project.

What They Found

Based on the findings of this comprehensive research project, significant knowledge and insight has been gained into the use of innovative materials, such as UHPC and RSFRC, in closure pour applications. Various UHPC and non-UHPC mixtures were evaluated in the laboratory, on

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outdoor exposure sites, in full-scale structural testing, and most importantly, in real-world applications in ABC bridge projects in Amarillo and Bryan districts. The data generated in the comprehensive laboratory and structural tests should provide a wealth of information that can be used to increase and improve the use of UHPC in accelerated bridge construction applications.

Like any emerging topic, more research is needed to better understand this unique material and its potential applications in accelerated bridge construction, as well as other applications where the unique properties of UHPC can be applied. Perhaps the most useful information can be derived from the continuous monitoring of the ABC bridges in Amarillo and Bryan districts to confirm and document the long-term performance. The research team will continue to evaluate and monitor outdoor exposure site specimens into the future, and knowledge gained and data generated in future monitoring will be communicated to TxDOT.

What This Means

This research helped to advance the state-of-the-art and current practice related to the use of UHPC in closure pours in accelerated bridge construction applications. The extensive small-scale laboratory testing, exposure site testing, full-scale structural evaluations, and monitoring of long-term performance of closure pours in Texas bridges has helped to show the technical and practical benefits of UHPC in future ABC projects. It is hoped that future work with UHPC will build

on the research done under this project and will help to meet the future needs of Texas bridges.

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