Structural Characterization of a UHPC Waffle Bridge Deck and Connections

Description

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Abstract :

The AASHTO strategic plan in 2005 for bridge engineering identified extending the service life of bridges and accelerating bridge construction as two of the grand challenges in bridge engineering. These challenges have the objective of producing safer and more economical bridges at a faster rate with a minimum service life of 75 years and reduced maintenance cost to serve the countryâ€™s infrastructure needs. Previous studies have shown that a prefabricated full-depth precast concrete deck system is an innovative technique that accelerates the rehabilitation process of a bridge deck, extending its service life with reduced user delays and community disruptions and lowering its life-cycle costs. Previous use of ultra-high performance concrete (UHPC) for bridge applications in the United States has been considered to be efficient and economical because of its superior structural characteristics and durability properties.

Full-depth UHPC waffle deck panel systems have been developed over the past three years in Europe and the United States. Subsequently, a single span, 60-ft long and 33-ft wide prototype bridge with full-depth prefabricated UHPC waffle deck panels has been designed and built for a replacement bridge in Wapello County, Iowa. The structural performance characteristics and the constructability of the UHPC waffle deck system and its critical connections were studied through an experimental program at the structural laboratory of Iowa State University (ISU). Two prefabricated full-depth UHPC waffle deck (8 feet by 9 feet 9 inches by 8 inches) panels were connected to 24-ft long precast girders, and the system was tested under service, fatigue, overload, and ultimate loads. Three months after the completion of the bridge with waffle deck system, it was load tested under live loads in February 2012.

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The measured strain and deflection values were within the acceptable limits, validating the structural performance of the bridge deck. Based on the laboratory test results, observations, field testing of the prototype bridge, and experience gained from the sequence of construction events such as panel fabrication and casting of transverse and longitudinal joints, a prefabricated UHPC waffle deck system is found to be a viable option to achieve the goals of the AASHTO strategic plan.

Subject : Waffle Slabs
Group : Ultra-High Performance Concrete (UHPC)
Category : Completed Projects

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