

Full Depth UHPC Waffle Bridge Deck Panels

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Need for Innovation

Bridge engineers are seeking new ways to build better bridges, reduce work zone travel delays, and improve repair techniques thereby reducing maintenance. Additionally, owners are challenged with replacing critical bridge components (particularly bridge decks) during limited or overnight road closure periods. Precast panels manufactured from UHPC can provide significant durability improvements to bridge decks due to the high strength, extremely low permeability, and improved connection details inherent in the system. The use of this innovation will result in reduced construction time for new and rehabilitated bridges, the ability to upgrade the load-carrying capacity of existing bridges, and improved durability of bridge decks.

Project Overview

Coreslab Structures (Omaha), Inc. will demonstrate waffle design modular panels on a bridge project in Wapello County, Iowa. The bridge deck panels will be manufactured with ultra-high performance concrete (UHPC) and installed with field cast UHPC joints which fully develop the joint reinforcement for bridge deck continuity. The demonstration bridge is 33'2" wide by 60' long, consisting of 14 waffle slabs. A specific instrumentation plan will be developed to evaluate the structural performance of the bridge using strain, deflection, and acceleration sensors.

Project Status

The project is currently in the design validation and testing phase. Two panels have been produced and shipped to Iowa State University to undergo fatigue and ultimate loading tests. Final panel design will be completed in spring 2010, followed by panel fabrication. Construction of the demonstration bridge is planned for summer 2010.

Project Team

Coreslab Structures (Omaha), Inc.
Lafarge North America, Inc.
Iowa DOT
Iowa State University
Wapello County, Iowa



Final Setup of the Phase 1 Specimen

The panels are cast in an inverted orientation to allow the driving surface to be cast into the demonstration bridge panels with the use of a form liner.



Placing the UHPC

The UHPC is placed with a specially designed bucket, which aligns the steel fibers in the longest direction of the panel. This helps to increase the flexural strength of the panels.



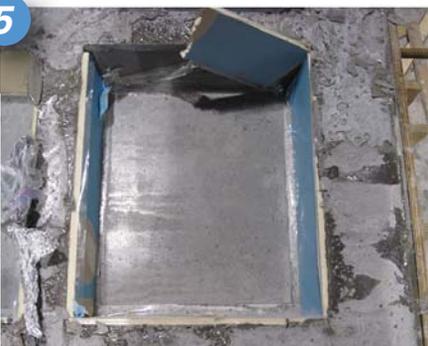
Setting the Pans

The form is filled with UHPC and then the pans are set as an assembly. By placing the pans as an assembly, the panels can be cast substantially faster and with less chance of error.



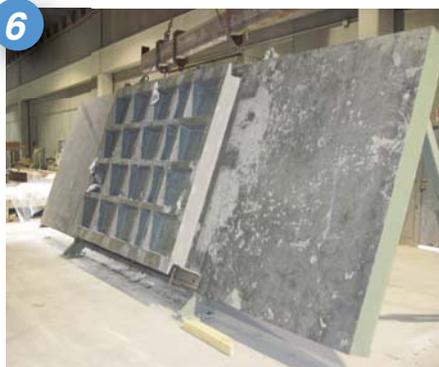
Side Forms and Pans Removed

The side forms and pans are removed once the UHPC reaches 5000 psi compressive strength to allow the UHPC to shrink unrestrained.



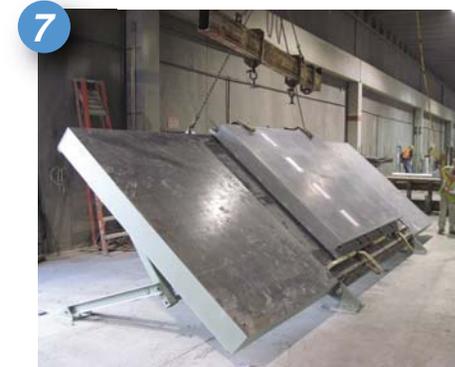
Expanded View of the Void

The exposed areas of UHPC are covered with plastic to prevent moisture loss during the curing process. All areas covered with plastic are on the underside of the bridge, increasing the aesthetic quality of the final product.



Panel Rotated to the Vertical Position

The panel is rotated to the vertical position by the casting bed to reduce the handling stresses on the piece.



Panel Rotated Back to Horizontal

The panel is now in the orientation it needs to be to be placed on the bridge, and can be handled from the edges, eliminating the need for lifting devices in the wearing surface.



Panel Ready to be Transported

The panel is now ready to be transported to the steam curing area, where it will be heated to 190°F for 48 hours. Then it will be ready to be shipped.