

Ultra-High Performance Concrete Connections for Prefabricated Bridge Elements



Ultra-high performance concrete (UHPC) can provide simple, yet durable connection details that improve upon the fabrication and construction aspects that are needed when building new or rehabilitating existing structures using prefabricated bridge elements.

The use of prefabricated bridge elements has led to the recognition that durable connections are an important part of any successful bridge construction project. This EDC-3 effort focuses on the advantages offered by UHPC as an option for the connection of prefabricated bridge elements.

UHPC is a steel fiber-reinforced, cementitious-based material that provides exceptionally high mechanical and durability related properties. The mechanical properties of UHPC allow for the redesign of connection details in ways that simplify the detailing such that the overall bridge layout and the manner in which the bridge is fabricated and constructed can be improved.

Field casting of UHPC connections between prefabricated components results in a strong connection and addresses the industry's desire to improve upon the durability, fabrication and construction aspects associated with prefabricated bridge elements.

BENEFITS

- ▶ **Accelerated Construction.** UHPC offers durable and simplified details that facilitate the fabrication and construction efforts needed to connect prefabricated bridge elements.
- ▶ **Simplified Connection Details.** UHPC allows for significant simplification to the design of the component connections. Its properties allow for the redesign of common connection details in ways that promote both ease and speed of construction.



WHY USE PREFABRICATED BRIDGE ELEMENTS?

- ▶ Prefabricated bridge elements are structural components of a bridge that are built either offsite, or adjacent to the site, reducing the onsite construction and mobility impact times that can adversely affect the traveling public.
- ▶ Because of their versatility, prefabricated bridge elements can be used to address many constructability issues such as remote site locations, limited construction seasons, material availability, and consistent quality in workmanship.
- ▶ Compared to conventional construction methods, using prefabricated bridge elements is faster, safer, lowers mobility impacts, provides better quality, lowers cost, and is easily adaptable to many site conditions.
- ▶ Use of UHPC between prefabricated concrete components creates a simple, strong and durable connection that will advance the routine use of prefabricated bridge elements.

Ultra-High Performance Concrete Connections for Prefabricated Bridge Elements

- ▶ **Improved Long-Term Performance.** Field casting of UHPC connections between prefabricated components results in a strong connection that provides better long-term performance.



CURRENT STATE OF THE PRACTICE

Technical advancements and policy developments related to UHPC further support agency-owners who routinely make use of prefabricated bridge elements.

Domestic production of the steel fiber reinforcement used in UHPC began in 2013 and is expected to open the door to more agencies that are interested in using UHPC, but were previously hindered by Buy American provisions.

New York is leading the way, with more than two dozen bridges constructed using UHPC for prefabricated bridge elements. Other states that have used UHPC for bridge-related applications include Iowa, Oregon, Montana and New Jersey.

SUPPORT AND AVAILABLE TOOLS

- ▶ EDC-3 Ultra-High Performance Concrete Connections for Prefabricated Bridge Elements Web page: <http://www.fhwa.dot.gov/innovation/everydaycounts/edc-3/connections.cfm>
- ▶ The Federal Highway Administration (FHWA) Highways for LIFE Innovation Webinar Series page includes links to handouts, including TechBriefs and TechNotes, and videos on field-cast UHPC connections: http://www.fhwa.dot.gov/hfl/innovations/uhpc_webinar.cfm
- ▶ Highways for LIFE "UHPC for Precast Bridge Decks and Connections" webinar, recorded June 25, 2013: <https://connectdot.connectsolutions.com/n134083201306>
- ▶ Highways for LIFE "Ultra-High Performance Concrete" webinar, recorded November 18, 2010: <https://connectdot.connectsolutions.com/n134083201011>
- ▶ Highways for LIFE "Field-Cast Ultra-High Performance Concrete Connections for Prefabricated Bridge Elements and Systems" webinar, recorded April 21, 2011: <https://connectdot.connectsolutions.com/n134083201104>
- ▶ Additional information on Prefabricated Bridge Elements is available on the EDC website at <http://www.fhwa.dot.gov/innovation/everydaycounts/edc-2/pbes.cfm>

For additional information, please contact:

Jamal Elkaissi
FHWA Resource Center
720-963-3272
Jamal.Elkaissi@dot.gov

Mark Leonard
FHWA Resource Center
720-963-3747
Mark.Leonard@dot.gov




U.S. Department of Transportation
Federal Highway Administration

Every Day Counts (EDC), a State-based initiative of FHWA's Center for Accelerating Innovation, works with State, local and private sector partners to encourage the adoption of proven technologies and innovations aimed at shortening and enhancing project delivery

FHWA-14-CAI-044