

**UHPC Overlay at Three Bridge Interchange in Elsmere, DE**

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Bridge Rehabilitation involving  
Machine-Paved UHPC Overlay

April 15, 2019

**Extended Abstract**

The 'Elsmere UHPC Bridge Overlay' project features three Delaware Department of Transportation (DelDOT) owned bridges (BR 1 600, BR 1 601, BR 1 604) located within the SR 141 and SR 2 interchange near Elsmere, DE, or a few miles west of Wilmington, DE. Two of the bridges (BR 1 600 and BR 1 601) have a 180-ft long two-span continuous steel superstructure. The third bridge has a varying length simple span steel superstructure with an approximate average span of 80-ft (BR 1 604).

These structures were constructed in 1973 and the steel superstructures are in good condition. However, two aging original bridge decks, at BR 1 601 and BR 1 604, and one prematurely delaminating silica fume concrete overlay, at BR 1 600, require rehabilitation to ensure long term serviceability. In addition, the bridges have failing transverse roadway joints and reconstructed abutment end diaphragms, and significant areas of spalled and delaminated concrete at the abutment stems.

This rehabilitation project will repair all defective concrete components, relocate the transverse abutment bridge joints away from and off of the bridge superstructures, and seal and protect the bridge decks with an UHPC overlay. The objective of this effort is two-fold: to significantly reduce future maintenance costs (and future traffic impacts) on these structures and significantly increase their remaining service life.

Second International Interactive Symposium on Ultra-High Performance Concrete  
Extended Abstract (no paper submission)

DelDOT is sensitive to traffic impacts at this heavily used commuter interchange, increasing the complexity of this project beyond the scope of using an innovative, yet promising, overlay material. Ramp closure durations, traffic detour signage, and road-user costs were studied in equal measures to deck preparation techniques, machine-paver capabilities, and UHPC on-site batch production. As such, UHPC rapid strength gain offers a critical time advantage compared to conventional overlays and falls in-line with DelDOT's program-wide focus on Accelerated Bridge Construction (ABC) techniques.

The maintenance-of-traffic (MOT) plan dictates bridge construction staging on the SR 141 mainline, a collector-distributor road and a ramp. The MOT phases and construction schedule were developed to alleviate critical traffic disturbances upon completion with consideration of the material's sensitivity to temperature and vibration. Ambient air temperatures (time of year), time of day, and external heating requirements are carefully specified to ensure optimal UHPC workability, placement, finishing and curing.

The UHPC overlay material will be placed in two (2) different nominal thicknesses: 2 7/8" at BR 1 600 and 1 1/4" at BR 1 600 and BR 1 604. At BR 1 600, hydrodemolition will remove the existing failed silica fume overlay and clean the top mat of deck reinforcement of all existing concrete. The 2 7/8" average thickness of UHPC overlay will engage the existing top mat of deck reinforcement. At BR 1 601 and BR 1 604, a 1 1/4" average thickness will be removed from the original existing deck without exposing the existing top mat of reinforcement. At all three bridges, the UHPC overlay material will be placed to match the existing roadway profile.

Construction will begin at the start of the 2020 construction season and it is anticipated to be completed within the calendar year.



**Project Location Map - UHPC Overlay at Three Bridge Interchange in Elsmere, DE**