



ACCELERATED BRIDGE CONSTRUCTION  
UNIVERSITY TRANSPORTATION CENTER

<b>UTC Project Information</b>	
Project Title	Optimization of Advanced Cementitious Material for Bridge Deck Overlays and Upgrade, Including Shotcrete
University	FIU
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Funding Source(s) and Amounts Provided (by each agency or organization)	ABC-UTC Funds: \$105,000 FIU Match Funds: \$52,500
Total Project Cost	Total Funds: \$157,500
Agency ID or Contract Number	Accelerated Bridge Construction University Transportation Center (ABC-UTC) 69A3551747121
Start and End Dates	06/01/2019 – Active
Brief Description of Research Project	<p>Deterioration of bridge deck is a major issue for bridge owners. The need for cost-effective and durable rehabilitation methods has been documented by many researchers. The primary causes of deck deterioration include vehicle traffic, environmental effects (i.e. freeze-thaw, salt spray), and maintenance practices (snow plows, de-icing chemical treatments). Deterioration is featured by delamination, cracking, corrosion of reinforcing steel, abrasion, scaling, and other mechanisms. UHPC overlays are gaining in popularity as a rehabilitation material due to the high compressive strength, higher tensile capacity compared to normal strength concrete, low permeability, and low shrinkage. UHPC also has a high early strength that allows for reduced lane closure and construction time. Current research has shown that UHPC bonds well to normal strength concrete, both in direct tension test and shear test. Shrinkage stresses do not appear to be a significant design concern either. UHPC has also been shown to mitigate corrosion activity. Almost the entire research conducted on the use of UHPC for bridge deck repair has dealt with placing UHPC as a thin overlay over the top surface. In many instances the bottom of bridge deck also demands repair. This study will look at the use of UHPC for repair of bridge deck both from top and bottom and address other missing knowledge gaps, including the following:</p> <ul style="list-style-type: none"> <li>▪ Determining the section capacity of the composite section between UHPC deck overlay, deck normal strength concrete, and bridge girder.</li> </ul>

	<ul style="list-style-type: none"> <li>▪ Hydro-blasting and other methods of removing deteriorated concrete and surface preparation may result in a varying thickness of overlay to attain design grades. What is the effect of such variation on the overlay performance?</li> <li>▪ How does the roughness of the interfacial surface between UHPC and normal strength concrete impact moment capacity? What is the optimum interfacial surface roughness?</li> <li>▪ Overlays are typically considered for the top surface of the deck, especially in northern climates where de-icing salts are applied. Deterioration may also be found on the bottom of the deck, particularly in coastal areas where salt-spray occurs. Repair techniques should be developed for the deteriorated bottom face of bridge decks. Can shotcrete be used for repairing the bottom of bridge deck?</li> <li>▪ UHPC mix designs typically contain 2% steel fibers, but some applications have been documented with different percentages. What is the effect of iterating steel fiber content?</li> <li>▪ Fatigue or cyclic loading research is lacking. Only one study has been identified to date that included cyclic loading [4]. More data is needed for the cyclic loading behavior on UHPC overlays.</li> <li>▪ The higher tensile capacity of the UHPC may allow the material to be placed over expansion joints on a single span or as a link slab at intermediate supports. Covering the joints will reduce the level of maintenance needed for the joint. The advantages of reduced joint maintenance would be beneficial to bridge owners.</li> <li>▪ What needs to be done to extend the use of shotcrete to the case of UHPC? Very recently limited work has been reported in Europe in shotcrete using UHPC by</li> </ul> <p>The objective of this study is to investigate the various parameters involved in optimizing the design of UHPC overlays and to develop design and construction guidelines for UHPC overlays.</p>
<p>Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here</p>	<p>FHWA has invited research team to give a presentation at an upcoming workshop; details to follow</p>
<p>Impacts/Benefits of Implementation (actual, not anticipated)</p>	<p>The impacts will be tracked and reported once they are identified.</p>
<p>Web Links</p> <ul style="list-style-type: none"> <li>• Reports</li> <li>• Project website</li> </ul>	<p><a href="https://abc-utc.fiu.edu/research-projects/fiu-research-projects/optimization-of-advanced-cementitious-material-for-bridge-deck-overlays-and-upgrade-including-shotcrete/">https://abc-utc.fiu.edu/research-projects/fiu-research-projects/optimization-of-advanced-cementitious-material-for-bridge-deck-overlays-and-upgrade-including-shotcrete/</a></p>