



**Project Information Form**

Project Title	Innovative Modular High Performance Lightweight Decks for Accelerated Bridge Construction
University	Florida International University
Principal Investigator	Amir Mirmiran
PI Contact Information	10555 W. Flagler Street Engineering Center EC 3604 Miami, FL 33174 Tel: 305-348-2522 E-mail: <a href="mailto:mirmiran@fiu.edu">mirmiran@fiu.edu</a>
Funding Source(s) and Amounts Provided (by each agency or organization)	Georgia Institute of Technology (NCTSPM) FIU: \$70,000 UTC + \$70,000 Matching from FDOT UCF: \$70,000 UTC + \$70,000 Matching UAB: \$60,000 UTC + \$60,000 Matching
Total Project Cost	\$200,000 UTC + \$200,000 Matching
Agency ID or Contract Number	DTRT12GUTC12 (NCTSPM 2013-006)
Start and End Dates	11/1/13 – 05/31/15
Brief Description of Research Project	<ul style="list-style-type: none"> <li>• Of the over 605,000 bridges in the U.S., about 12% are structurally deficient and another 16% are functionally obsolete (FHWA 2012). Three out of four structurally deficient bridges have major problems with their decks. The primary objective of the proposed research is to develop innovative modular high performance lightweight deck options that lend themselves to accelerated bridge construction (ABC). Such bridge decks would allow an increase in the load rating of existing bridges and accordingly improve their functionality and service life. The lightweight bridge deck would also allow widening of existing bridges without placing additional dead weight on their substructure.</li> <li>• Given the primary objective of the NCTSPM (i.e., to improve the productivity and management of the U.S. Transportation System in an accountable and measurable way), and the fact that constrained resources are the greatest barrier to achieving this objective, the proposed research addresses two of the fundamental three questions of the 2014-15 solicitation; How do we get most out of the existing transportation systems? And how should we build for the future? The proposed bridge deck systems improve the state of good repair in bridge infrastructure throughout the U.S., thereby improving public safety on their daily commute. This will lead to the next generation transportation infrastructure, which is the first defined NCTSPM research area, as these systems address the fundamental issue of</li> </ul>

maintenance of existing bridge decks, an ongoing challenge with almost every transportation agency in the U.S. The proposed deck options also address durability of deteriorating infrastructure in constant need of rehabilitation.

- The innovative lightweight bridge decks will be modularized and prefabricated with highest quality control and quality assurance during the manufacturing process. The systems would integrate advanced construction materials, including ultra-high performance concrete (UHPC), high-strength steel (HSS), and fiber reinforced polymer (FRP), as appropriate. The systems would also provide options for different arrangements of superstructure, including different girder spacing.

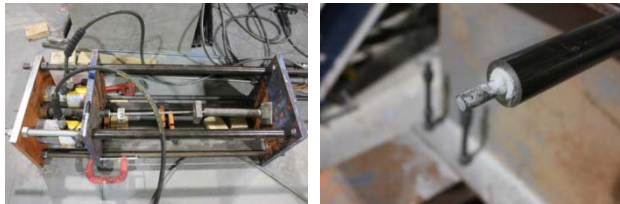
Describe Implementation of Research Outcomes (or why not implemented)  
(Attach Any Photos)

- The Research Team at UAB has started an intense review of available literature on constituent materials used in lightweight deck systems, the uses of composite materials in bridge decks, and the current state of bridge decks across the U.S., current girder/stringer spacing, and potential retrofit needs including deck replacement and bridge widening. This literature review will synthesize available information on materials, design, construction, and overall feasibility in order to guide the experimental testing performed as part of this project.



In Search of Most Suitable Lightweight Deck Systems (courtesy FHWA)

- The Research Team at FIU has completed the optimization and assessment of its experiments on the UHPC-HSS and UHPC-FRP deck systems. Some experiments have also been conducted on bond and interface of UHPC waffle deck system as well as experimental works on connections and precast modules at FIU.



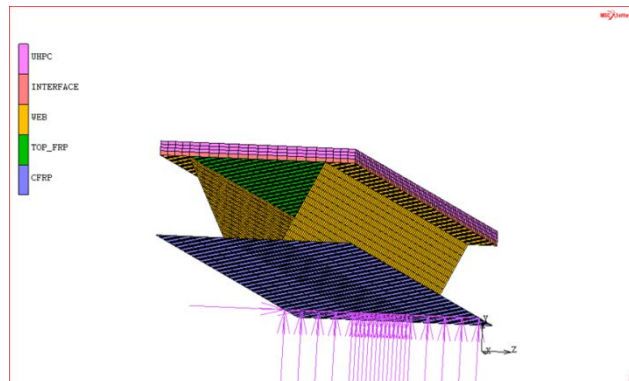
Bond Testing for CFRP Rods

- The Research Team at UCF has conducted FE modeling on UHPC-FRP hybrid sections and compared them with test data to help improve

the sectional behavior.



Samples of Hybrid Decks

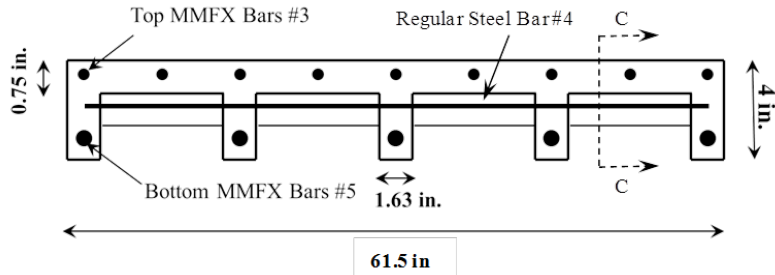


Sample of FE Analysis Results for Hybrid Deck System

- Moreover, the Research Team at FIU and UCF have proposed a test matrix for the accelerated testing of four bridge deck systems using the Accelerated Pavement Testing (APT) in Gainesville, FL, pending approval by FDOT.



Accelerated Pavement Testing Vehicle in Gainesville, FL (courtesy FDOT)



Typical UHPC-HSS Deck Section for the Proposed Accelerated Testing

- Finally, Ms. Sahar Ghasemi, doctoral student at FIU made an oral presentation of the project at the annual NCTSPM conference in Atlanta, GA, in March 2014.



Presentation of Ms. Sahar Ghasemi at NCTSPM, March 2014

<p>Impacts/Benefits of Implementation (actual, not anticipated)</p>	<p>The results of this research project will address the fundamental issue of maintenance of existing bridge decks, an ongoing challenge with almost every transportation agency in the U.S. This research will also have national impact on accelerated construction of all high-traffic and urban bridges that require lightweight deck replacement and/or widening.</p>
<p>Web Links</p> <ul style="list-style-type: none"> <li>• Reports</li> <li>• Project website</li> </ul>	<p><a href="http://nctspm.gatech.edu/pi/innovative-modular-high-performance-lightweight-decks-accelerated-bridge-construction">http://nctspm.gatech.edu/pi/innovative-modular-high-performance-lightweight-decks-accelerated-bridge-construction</a></p>