



Innovative Modular High Performance Lightweight Decks for Accelerated Bridge Construction



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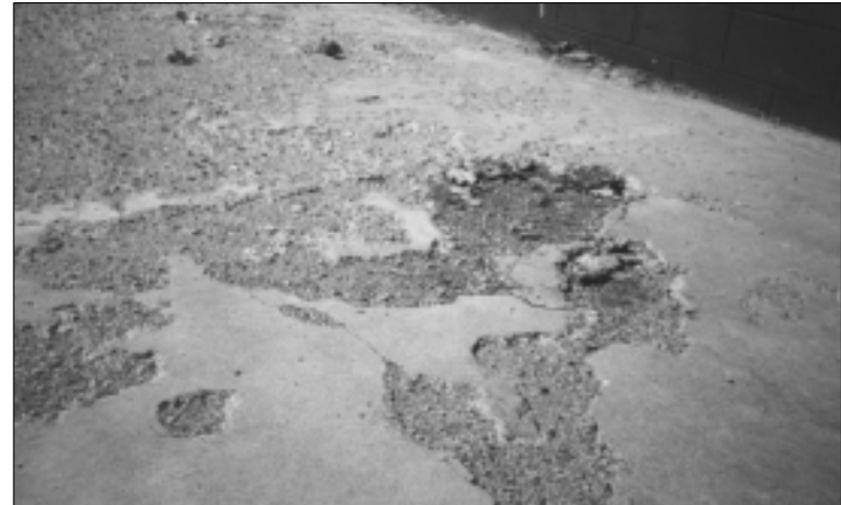
Outline

- Introduction and Problem Statement
- Research Objectives
- Work Plan and Methodology
- Result and Discussion
- Implementation and Technology Transfer

Deterioration & Maintenance Concerns for US Bridges

US Infrastructure challenges:

- 12% structurally deficient
- 16% functionally obsolete
- Many because of decks
- Live load increases
- Cost of repair
- Delays/downtime for construction



Current Needs and Associated Challenges

Current Needs:

- Repair and rehabilitation of aging and deficient bridges
- Deck replacement
- Widening, modification of substructure

Deck Challenges:

- Strength & serviceability
- Selfweight
- Durability & integral riding surface
- Service life increase
- Cost
- Construction-related delays



Innovative modular bridge deck options for Accelerated Bridge Construction

Research Objectives



Aluminum Deck



UHPC-HSS/FRP Deck



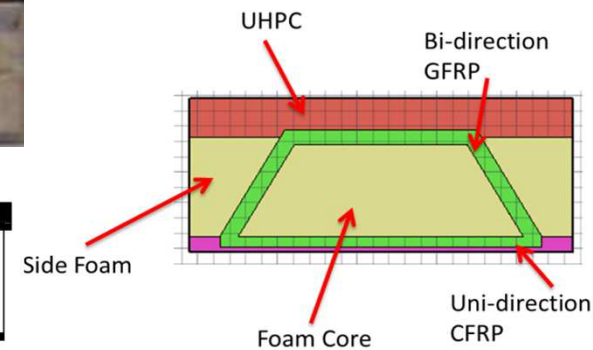
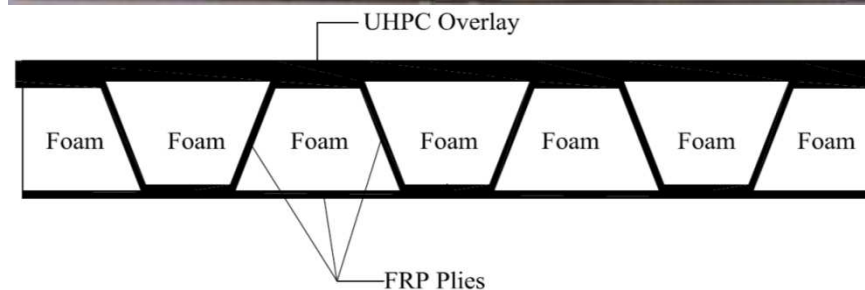
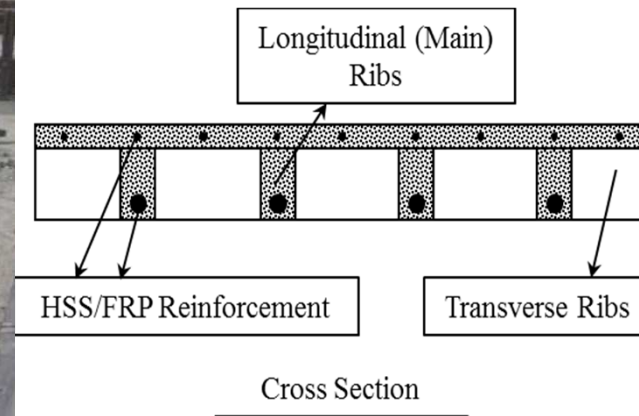
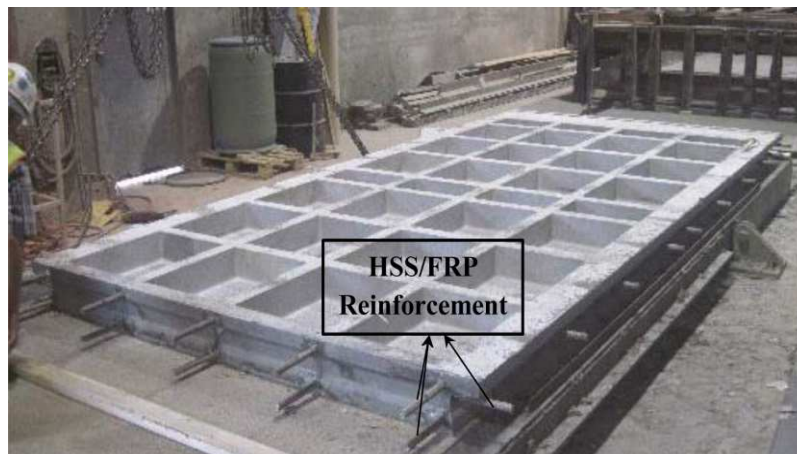
UHPC-FRP Sandwich Deck

Investigated Deck Systems (with FDOT)

- Easy and rapid deck replacement
- Partial rehabilitation
- Bridge widening
- Enhance service life

Work Plan

Developing Three Lightweight and low-Profile Prefabricated/Precast Modular Bridge Deck Systems



Methodology

1: Literature Review: Bridge deck inventories in multiple states, determination of several configurations, potential rehabilitation and widening needs (FIU, UCF, UAB)

2: Preliminary Design and Optimization: Finite element modeling of UHPC-HSS and UHPC-FRP deck systems using previous and ongoing work (UCF)

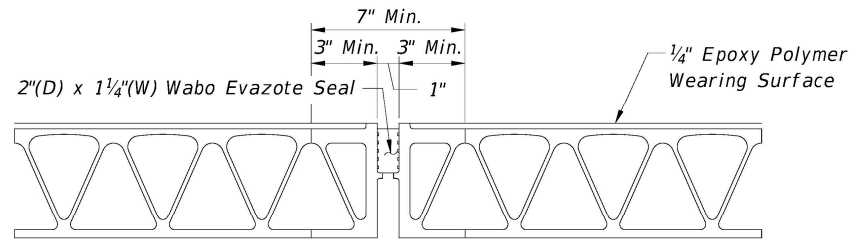
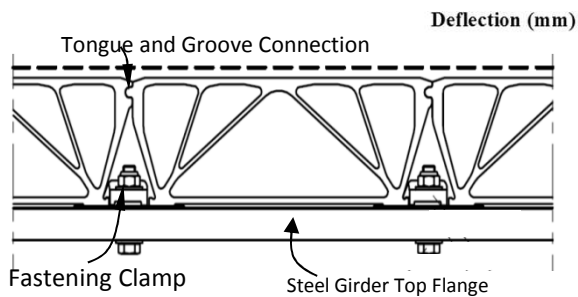
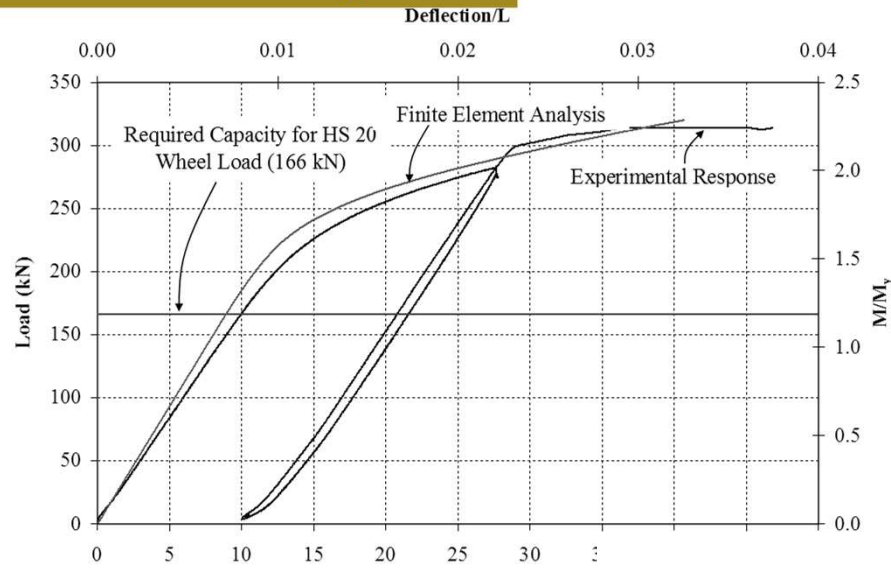
3: Bond and Interface Investigations: Small-scale experimental tests to calibrate analytical models of the interface behaviors between UHPC and HSS or FRP bars (first two decks) and between FRP laminates and UHPC (hybrid deck) (FIU, UCF)

4: Experimental Work on Connections and Precast Modules: Component connection tests, building bridge superstructure models using the three proposed systems and testing them under AASHTO truck loading ,Heavy Vehicle Simulator (HVS) (using Accelerated Pavement Testing (ATP) facility) (FIU) and Extending the research for larger spacing

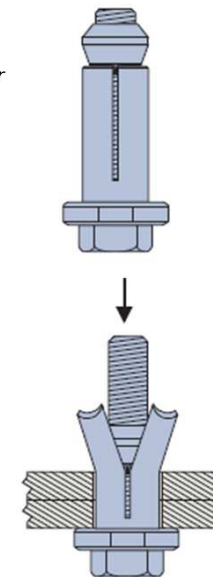
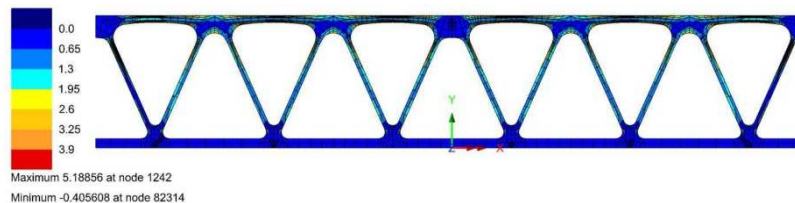
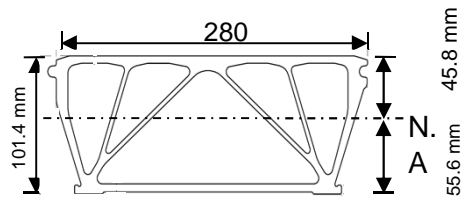
5: Design Guidelines and Implementation Plan: Calibrating analytical models, developing design guidelines for each of the three deck systems (UCF, UAB)

Result and Discussion

Aluminum Deck Systems

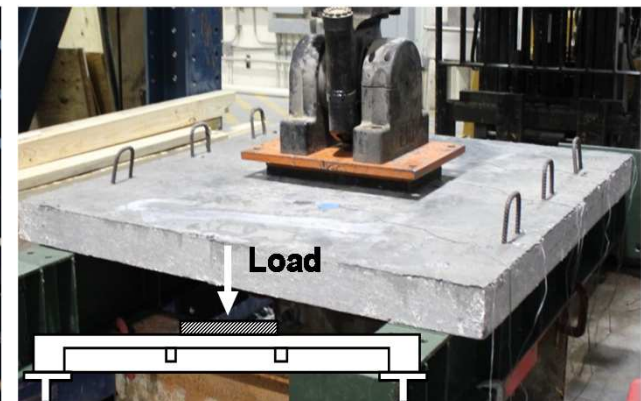
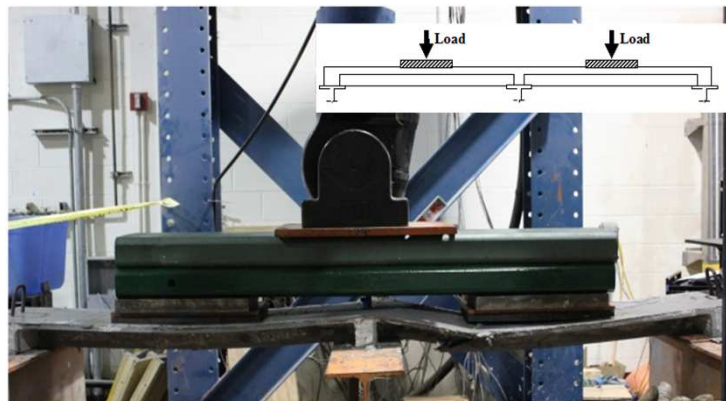
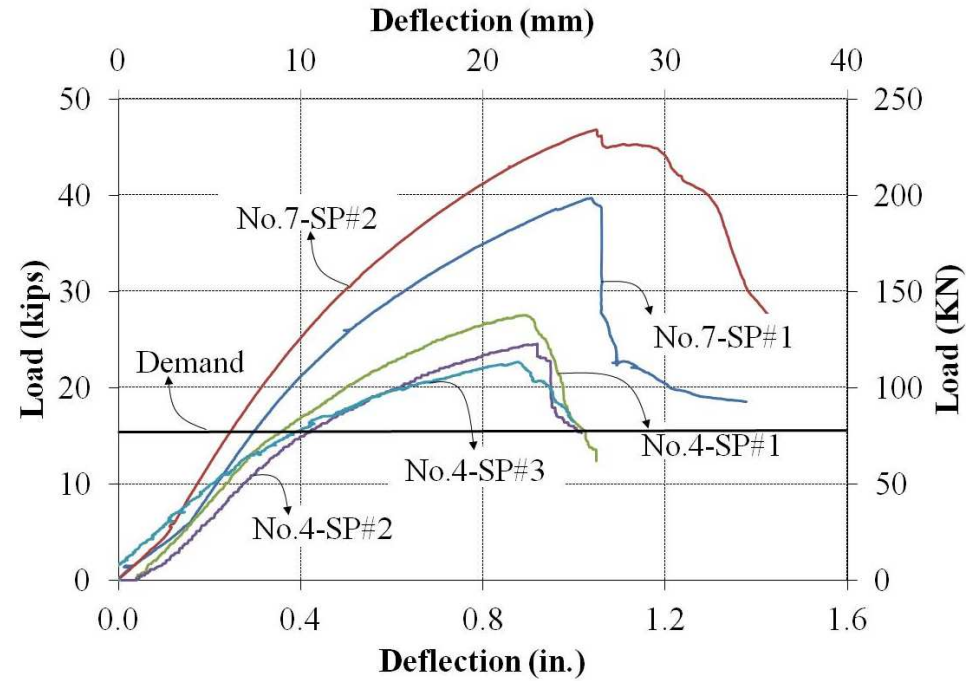
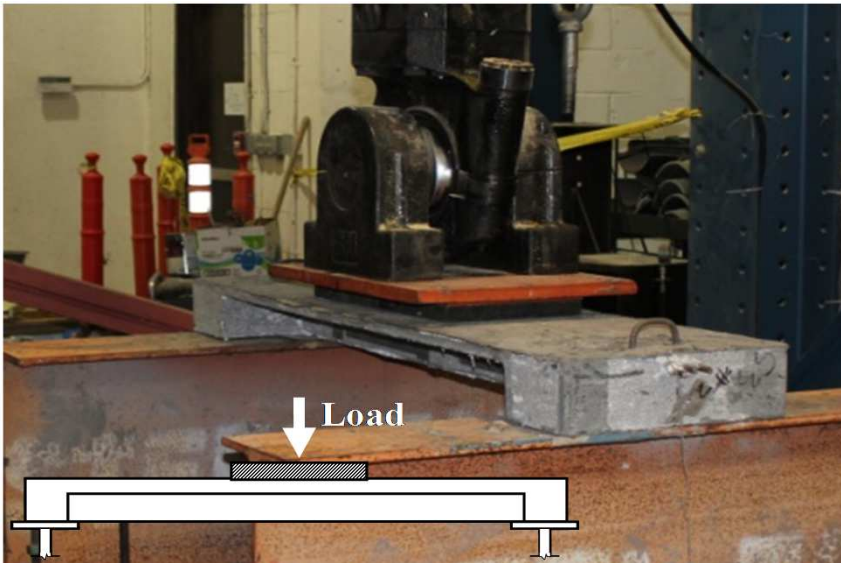


PARTIAL DECK ASSEMBLY AT JOINT



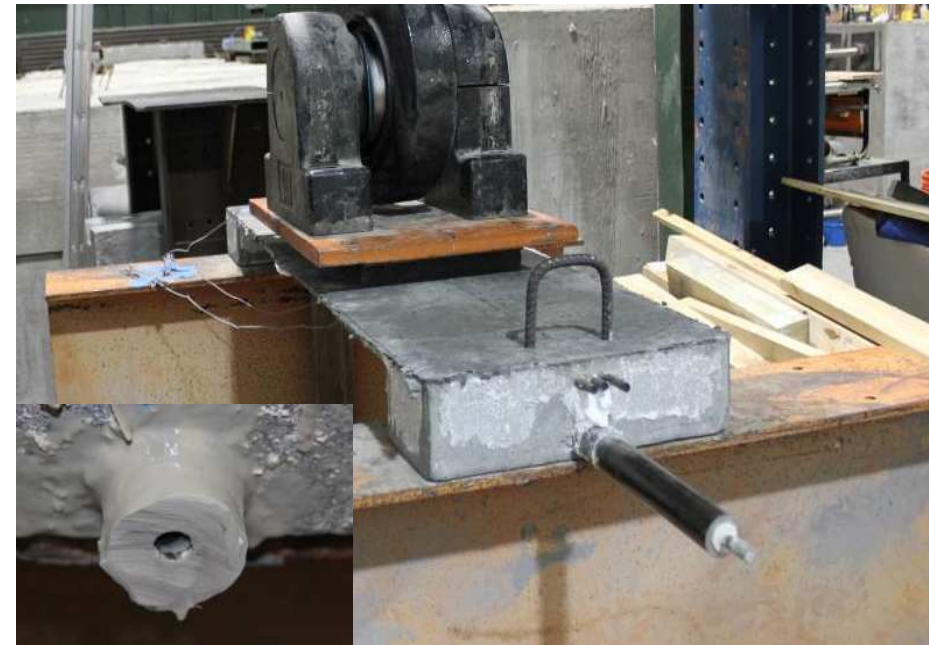
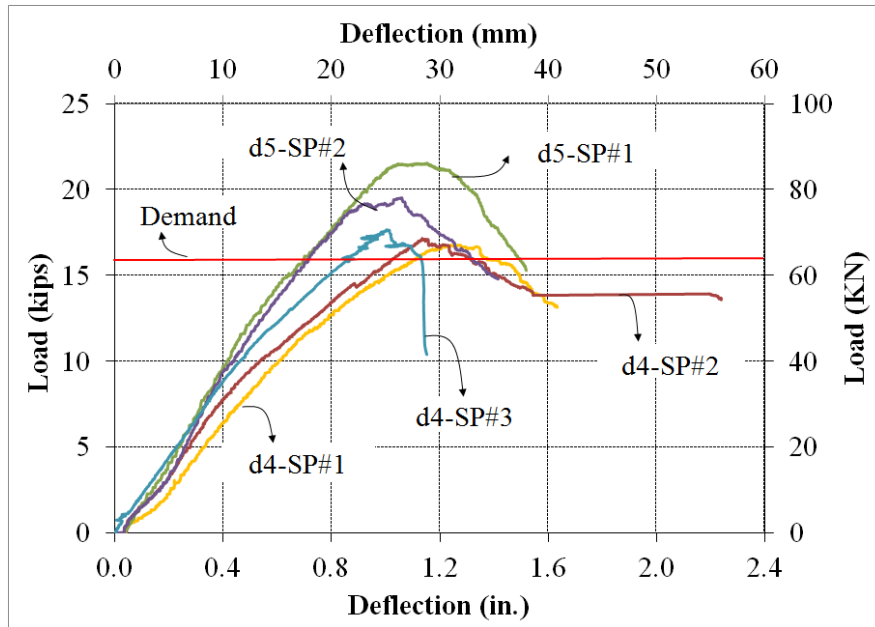
Result and Discussion

UHPC-HSS Deck



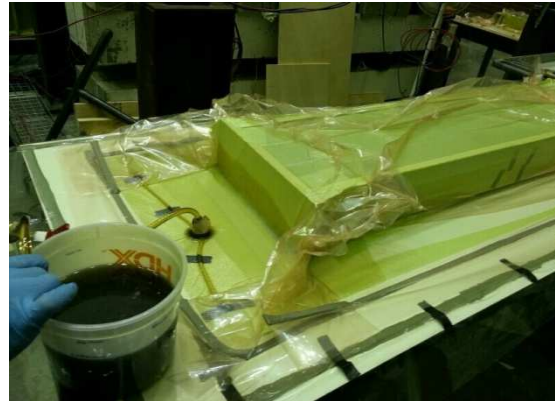
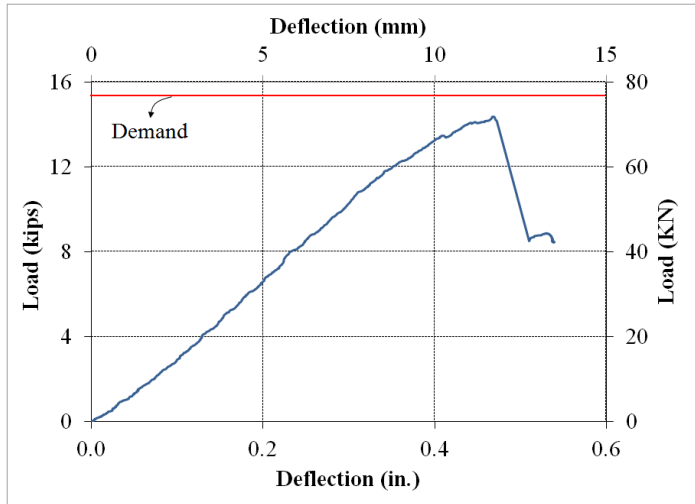
Result and Discussion

UHPC-FRP Deck



Result and Discussion

UHPC-FRP Sandwich Deck



Resin infusion System (VARTM Technique)



Dominant mode of Failure, Shear off and Debonding

Implementation and Technology Transfer

1: Establishing Advisory Board from representatives of State DOTs in the region to review the research plan with an eye on potential implementation in their states

2: Advancing the bridge engineering courses being taught at FIU, UCF, and UAB

3: Presenting the findings through Accelerated Bridge Construction (ABC) Center at FIU

4: Presenting the results at TRB Annual Meeting in Washington, D.C, AASHTO SCOBS, and through journals, including Transportation Research Record

5: Proposed decks along with their guidelines will be offered to FHWA and State DOTs for possible implementation potentially through the Innovative Bridge Research and Deployment (IBRD) Program

THANK YOU!



Questions?