Title: Field Performance Evaluation of Multiple Fiber Reinforced Polymer Bridge Deck Systems Over Existing Girders - Phase I&II.
State Job Number: 14715(0)
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Research Agency: University of Cincinnati
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Research Manager: Omar Abu-Hajar
Sponsor(s): Tony Vogel
Study Start Date: 5/3/99
Study End Date: 12/3/04
Study Duration: 67 Months
Study Cost: $1,267,636.00
Study Funding Type: 80 Federal / 20 State

STATEMENT OF NEED:
In recent years, fiber reinforced polymer (FRP) composite deck systems have emerged as a viable alternative to reinforced concrete slabs. The use of such systems to replace existing, deteriorated bridge deck systems offers both economical benefits as well as improved performance.

STUDY OBJECTIVES:
To better understand the performance of the bridges with fiber reinforced polymer (FRP) composite decks, the short-term and the long-term responses of 679 ft., five span bridge retrofitted with four different FRP Panel systems. The research will focus on twin bridges are named Salem Avenue Bridge over The Great Miami River in Dayton, Ohio (MOT-49-1.02). Finally, perform structural health monitoring on the FRP deck.

RESEARCH TASKS:
1. Explore issues related to the constructability of FRP deck systems in long-span bridges.
2. Examine short-term and long-term behavior of FRP deck systems under live loads and environmental effects.
3. Investigate the behavior of FRP deck system under static and dynamic (vehicular) loads.
5. Study load transfer between deck panels and at FRP deck-stringer connections.
6. Provide detailed field data that can be used to improve current design practice and provide guidelines for FRP deck systems.

RESEARCH DELIVERABLES:
The Final Report that includes collected data regarding short and long term monitoring, recommendations, and conclusions.

RESEARCH RECOMMENDATIONS:
- The Impact Factor values for FRP panels are within AASHTO standard specifications.
- The girder dead load stresses are about one-third of those for the reinforced concrete decks.
There is a loss in overall deck stiffness for the FRP panels due to connection details of panels to girders and the loss of composite action.

FRP panels undergo in-plane movements relative to each other and steel girders as well as upward and downward movements due to panels thermal response.

**PROJECT PANEL COMMENTS:**

*Tim Keller:* Based on current findings of FRP research studies, the OSE suspends any further use of FRP materials in bridge deck construction on state system.

*Omar Abu-Hajar:* From field inspection of subject panels, panels in span no. 1 and no. 2 appeared to have no reflective cracking. The driving surface made of sand and epoxy delaminated from panels. Panels to panel butt joints potentially could leak water onto girders causing rusting action in the main girders and cross frames. I like the reduced stresses in girders due to lighter FRP dead loads. There is a concern of having a large thermal gradient in the panels delaminating outer skin from main core material. The thermal expansion properties of the FRP panels are different from the steel girders creating additional stresses at the interface of the two materials. I do not recommend implementation at this time, but at least we now understand the behavior of these panels.

**IMPLEMENTATION STEPS & TIME FRAME:**

None will be recommended.

**EXPECTED BENEFITS:**

There are no tangible benefits at this time.

**EXPECTED RISKS, OBSTACLES, & STRATEGIES TO OVERCOME THEM:**

There is higher risk to adopt the use of FRP panels in our bridge construction methods than just using the classical concrete decks.

**OTHER ODOT OFFICES AFFECTED BY THE CHANGE:**

None applicable

**APPROVED BY:**

Administrator, Office of Structural Engineering: **Tim Keller**

Date: 8/28/2003

Division Deputy Director, Division of Highway Operations: **Tony Vogel**

Date: 9/18/2003