For more information contact: Bill Stone (573) 526-4328

Research Summary


Polyurethane Foam Infill for Fiber-Reinforced Polymer (FRP) Bridge Deck Panels

Polyurethane Foam Infill for Fiber-Reinforced Polymer (FRP) Bridge Deck Panels

The deterioration of our nation's infrastructure is an almost daily news item that attracts passionate political, economic, and socio-economic discussions. A leading cause of this deterioration is the policy, adopted by the majority of state highway agencies during the 1960's, which involves the application of deicing salts on state roads during winter months to reduce traffic accidents, injuries, and fatalities. An unfortunate side effect of this policy is that deicing salts attack the steel embedded in reinforced concrete bridges, leading to premature deterioration.

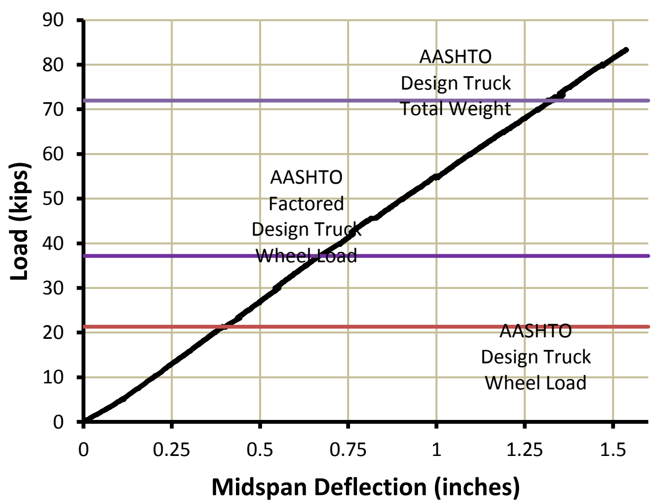
Although still in their infancy, fiber-reinforced polymer (FRP) bridges have shown great promise in eliminating corrosion concerns and meeting (or exceeding) FHWA's goal of 100-year life spans for bridges. While FRP bridges are cost-effective in terms of life cycle analyses, the combination of higher initial costs and limited state DOT budgets has restricted their use. One area that has shown some headway is the use of FRP for bridge decks, focusing on the location where the majority of corrosion-related damage normally occurs. However, initial costs still hamper widespread use of this approach.

FRP bridge deck panels offer superior corrosion resistance, at one-fifth the weight of reinforced concrete. However, current FRP bridge deck panels typically rely on an intricate geometric honeycomb system between the top and bottom layers of the sandwich panel. This labor-intensive honeycomb construction triples the cost of FRP panels compared to reinforced concrete. Although cost-effective in terms of longevity of the bridge and overall reductions in weight, the lower initial cost of reinforced concrete precludes the use of FRP bridge decks in the majority of situations.

Working with a composite manufacturing company and Bayer MaterialScience, the research team developed a novel FRP bridge deck configuration that incorporates a new two-part, thermoset, polyurethane resin. This combination of simplified configuration and manufacturing with the new resin system has resulted in a bridge deck panel that is very nearly competitive with reinforced concrete on a initial cost basis.

Full-scale and component testing of the FRP deck panels has confirmed their ability to support the required AASHTO design loads and service conditions, including fatigue loading and environmental effects such as UV radiation, moisture, and freeze-thaw cycles.

Full Scale Load Test



Load-Deflection Plot during Full Scale Test

Novel FRP deck configuration and resin system is very nearly competitive with reinforced concrete on an initial cost basis.

Project Information

PROJECT NAME: Polyurethane Foam Infill for Fiber-Reinforced Polymer (FRP) Bridge Deck Panels

PROJECT START/END DATE: August 2011—May 2014

PROJECT COST: $120,000

LEAD CONTRACTOR: Missouri University of Science & Technology

PRINCIPAL INVESTIGATOR: Dr. Jeffery Volz

REPORT NAME: Polyurethane Foam Infill for Fiber-Reinforced Polymer (FRP) Bridge Deck Panels

REPORT NUMBER: cmr 14-016

REPORT DATE: June 2014

Project Manager

ANDREW HANKS, P.E.

Formerly Senior Research Analyst
Currently Aviation Programs Manager
MoDOT - Multimodal Operations
105 W. Capitol Avenue, P.O. Box 270
Jefferson City, MO 65102-0270
Phone: (573) 751-7478
Email andrew.hanks@modot.mo.gov