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**Acronyms in this issue**

AASHTO	American Association of State Highway and Transportation Officials	Iowa DOT	Iowa Department of Transportation
CTRE	Center for Transportation Research and Education	ISU	Iowa State University
FHWA	Federal Highway Administration	LTAP	Local Technical Assistance Program
		MUTCD	Manual of Uniform Traffic Control Devices

**Bettendorf demonstrates new bridge technology**

BETTENDORF'S new 53rd Avenue bridge is the first in Iowa to use a new bridge mat and deck material called fiber reinforced polymer (FRP). It is also the first bridge in the world to use an FRP deck on prestressed concrete beams with composite action.

- Span 3 has an FRP deck made from prefabricated panels attached to the prestressed concrete beams by steel shear connectors in grout pockets within the deck panels.

*FRP continued on page 2*

**What is FRP?**

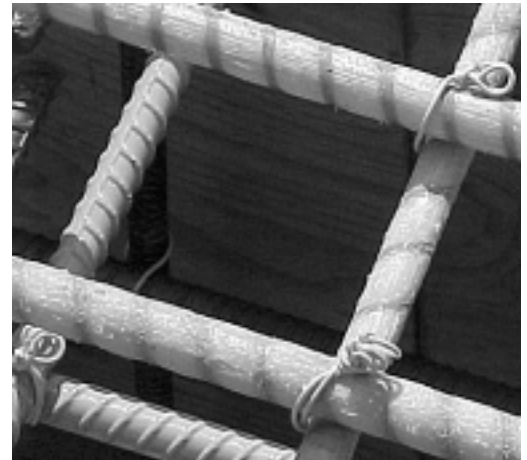
FRP is a lightweight, thermoset resin system reinforced with various types of glass or epoxy fibers. FRP is known for its strength and longevity. It is much lighter than concrete, does not corrode, and is, pound for pound, stronger than steel. FRP is a substance that, until recently, has been used only in the chemical and aerospace industries.

**The Bettendorf bridge**

Bettendorf engineers have designed and built the 53rd Avenue bridge as a demonstration of technology using FRP to replace conventional materials like steel and portland cement concrete. Wally Mook, director of public works in Bettendorf, is pursuing the project to further field research using FRP in bridges.

The bridge has three spans, each with a different configuration of material for the bridge deck.

- Span 1 has a traditional cast-in-place concrete deck, reinforced by two mats (crisscrossed rods that reinforce the concrete structure) of epoxy-coated steel. It is the control section for the FRP research.
- Span 2 is the same as span 1, except that the concrete deck is reinforced by a top mat of FRP reinforcement as a replacement for epoxy coated steel to avoid corrosion.



Top: Span 2's concrete deck is reinforced by a mat of FRP. Bottom: Span 3's FRP deck is placed.

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**The mission of Iowa's LTAP:**

To foster a safe, efficient, environmentally sound transportation system by improving skills and knowledge of local transportation providers through training, technical assistance, and technology transfer, thus improving the quality of life for Iowans.

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**FRP continued from page 1**

In fall 2003, the bridge will start to carry four lanes of traffic. Currently, the city is building approaches and roads to both sides of the bridge.

**Research value**

One of the most important aspects of span 3 is that it is the first time engineers have used an FRP deck in a composite action mode with the concrete beams. Composite action works by using shear connectors (epoxy coated steel bars) grouted into hollow portions of the deck (see photo, middle right). As a result, the deck works with the girders to prevent lateral movement and absorb compressive forces as traffic passes over it. Researchers will test how effective the FRP deck works as a support.

Besides supporting the lateral and vertical movements of the bridge structure, the bridge system lends itself to other testing. Since the three spans are in the same environment and undergo the same traffic loadings, researchers can compare the longevity, maintenance, structure, and oxidation of the three spans.

**Cost**

The FRP deck costs about \$65 per square foot; the concrete deck with the FRP mat, about \$35 per square foot; and the traditional concrete deck with all-steel reinforcement, about \$28 per square foot.

The 53rd Avenue bridge cost over a million dollars to build. The additional cost of the FRP deck was offset by a grant from the Innovative Bridge Research Construction (IBRC), an FHWA initiative that helps local engineers develop bridge innovations.

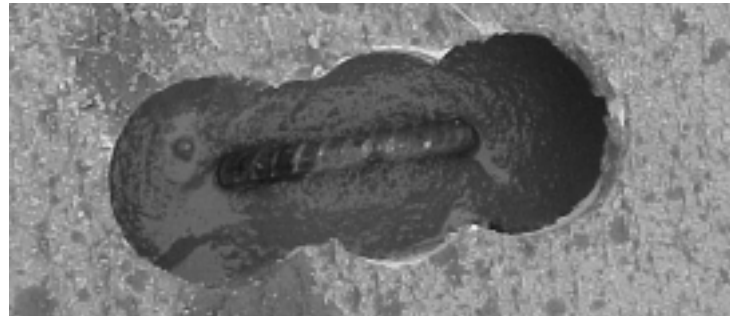
**FRP benefits**

In spite of the high costs associated with FRP, Mook anticipates that its use will save money in the long run, for several reasons.

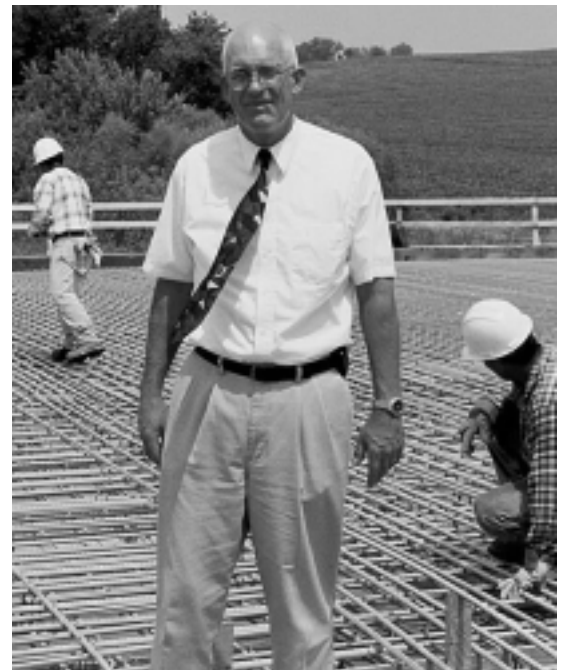
He anticipates reduced maintenance costs and need for deck replacement and/or bridge replacement. Installing prefabricated FRP deck panels takes much less time than constructing traditional decks, saving labor costs and reducing the need for traffic detours during construction, an intangible project cost that can be significant in high traffic areas.

**For more information**

For more information on FRP bridge materials or the 53rd Avenue bridge, go to [www.bettendorf.org/publicworks/ibrc.html](http://www.bettendorf.org/publicworks/ibrc.html) or contact Wally Mook, 563-344-4128. For more information about the IBRC, go to <http://ibrc.fhwa.dot.gov/>. •



Top: Unlike concrete that must be formed on-site, FRP deck slabs are preformed and transported directly from the factory. Middle: The FRP deck is grouted to shear connectors attached to the bridge girders.



Wally Mook, City of Bettendorf public works director, during construction of the 53rd Avenue bridge deck.