Center for Integration of Composites into Infrastructure (CICI)

(Formerly Repair of Buildings & Bridges with Composites - RB2C)
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Extending the Service Life of Bridges with Composite Wraps

Bridge infrastructure in the U.S. is aging. Bridges show their age through crumbing concrete and rough roads due in large part to foregone and/or poor maintenance. Repairs and upgrades are often necessitated because of increasing traffic loads and heavier vehicles. Traditionally, the only way to remedy these problems has been to close all or part of a highway and replacing the entire structure. This process results in huge replacement costs, complicated traffic re-routings and long delays. Researchers at the Center for Integration of Composites into Infrastructure (CICI) have developed tools that allow highway departments to design structures that take save costs by using innovative materials to rehabilitate, rather than replace failing bridges.

Before and after composite wrapping.

Composite wraps, consisting of fiberglass or carbon fiber fabrics saturated with a resin and bonded to concrete members, are being used to repair bridge members that are deficient due to corrosion, decay or even accidents. At CICI, these composite wraps been demonstrated to be highly effective on a number of projects. CICI is working with the West Virginia Department of Transportation – Division of Highways to

develop standard details and specifications to allow practicing engineers to design, install and inspect composite wraps.

Composite wraps can also increase the strength of an otherwise good member. This can enable existing structures to carry higher and heavier loads than they were originally designed accommodate. Installation of the wraps can be done very rapidly with minimal traffic interruption.

> **Economic Impact:** Using composite wraps can extend the lifespan of a structure by a decade or more. Rehabilitation time can be reduced from months to weeks. The result is reduced costs and increased structure life. The cost savings directly impact taxpayers by allowing limited transportation funding to improve more structures at substantially minimized cost.

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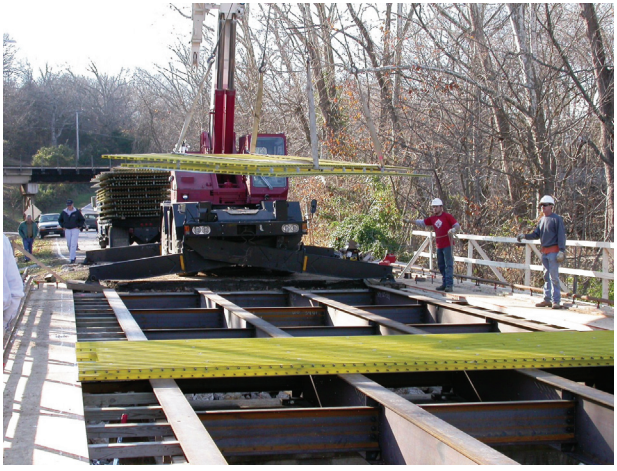
Design Guide for Reinforcing Bridge Decks and Railings with Longer Service Capability

Imagine bridge decks that could last 75 to 100 years in service rather than the current 25 to 40 years. Corrosion is one of the main causes of infrastructure decay. Researchers at the Center for Repair of Buildings & Bridges with Composites are enabling a whole new industry to fill the need for potentially high volumes of fiber-reinforced polymer (FRP) rebar.



Drafting and successful interface with American Association of State Highway and Transportation Officials committee, T-6 will ENABLE the use of FRP reinforcing bars in bridge decks in the USA. This recently adopted design guide is the culmination of many years of research. This work means that previously funded NSF research in the field of fiber-reinforced polymers can now be used to make the Nation's infrastructure more durable and longer lasting.

The document will allow fiber-reinforced polymer producers, as well as state and federal departments of transportation to safely incorporate well-researched design, testing and implementation criteria to new materials for new construction and renovations. Before these guidelines had been published and adopted, there was little or no incentive for state Department of Transportation (DOT) engineers to consider as fiber-reinforced polymers.

> **Economic Impact:** A primary cause of bridge deck deterioration is corrosion of steel rebar. By using noncorrosive FRP rebar the bridge decks will last many years longer and delaying the costly

replacement by decades. This will save taxpayers money by not having to replace the decks and also by reducing delays related to bridge reconstruction. By establishing these national standards on the use of FRP rebar, state highway departments and manufacturers will have clear specifications to provide for the widespread adoption of FRP rebar.

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Preformed Fiberglass Grating Panel Systems (GRIDFORM)

GRIDFORM consists of fiberglass grating panel systems with fiber-reinforced polymer (FRP) plate for stay in place use. These FRP grating panels replace steel rebar in reinforced concrete bridge decks on vehicular bridges. The grating panels are shop fabricated and shipped to the job site ready for installation on the steel bridge girders and the concrete pour. Field installation time for the GRIDFORM panels including the concrete pouring is approximately 25% of normal steel rebar installation and concrete pour. This reduced installation time results in lower field installation costs and less disruption of service for people needing access to the bridge for travel. Additionally, reduced field installation time translates into a lower rate of construction workplace injuries.

GRIDFORM grating panels have become recognized as a viable alternative to traditional steel reinforced concrete bridge decks. The use of GRIDFORM panels meets the Federal Highway Administration's initiative of "Get In and Get Out." The emphasis by FHWA is to reduce the amount of construction time and the concurrent disruption to the traveling public by utilizing new technologies and methods for rapid construction of bridges and roads. The new technology will result in producing the FRP grating panels at the manufacturing site of the FRP grating. This new breakthrough technology has resulted in a new product

line for the Strongwell plant located in Chatfield, Minnesota. Strongwell is promoting this new product line to county and state transportation officials as a time saving alternative to traditional construction materials.

> **Economic Impact:** By using GRIDFORM panels, contractors can reduce construction time by 25%, which directly resulting in lower labor costs saving taxpayer's money through more efficient use of transportation funding. This will also save the traveling public money directly by reducing the closure time needed to replace or repair and existing bridge decks and the time and inconvenience related to associated lane closures and detours.

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