New York Route 367 over Bentley Creek

Village of Wellsburg, New York

Jurors Comments

...brings old iron together with new high tech materials (FRP) to extend the service life of a bridge in this quiet country setting. Innovative concept to extend the life of old steel bridges...

There are approximately 19,000 steel truss bridges in the United States, most of which were built over 50 years ago and have not had the benefit of regular, thorough cleaning. It was not until recently that bridge owners gained an awareness and appreciation for a good inspection and maintenance program. Cleaning structures of de-icing salts and other debris was virtually unheard of in the early years of these structures. Critical structural elements were allowed to deteriorate as a "natural" course of events. Even under these harsh conditions, many truss structures have demonstrated the longevity of steel as a building material by surviving and performing satisfactorily for the better part of the past century.

With an increased effort placed on inspection and load rating, however, some of these bridges have been identified as being structurally deficient and marked for replacement. Because of their age, it is often accepted that these bridges are at the end of their useful life. The project described in this submission provides credible evidence that this is not necessarily true. Though a steel bridge may be 60 years old, the employment of new technology, such as super-light advanced composite decks, can rejuvenate and extend the service life of "tired" steel bridges a point the deck replacement at Bentley Creek illustrates perfectly.

Project Objective

Remove the 14 Ton weight restriction as quickly as possible to satisfy the public's demand for highways without impediments to local commerce.

Project Description

The 1940s vintage bridge carrying New York State's Route 367 over Bentley

Creek in Chemung County found new life with the installation of a lightweight fiber reinforced polymer (FRP) composite deck. Though it was considered a prime candidate for replacement due to its age, condition and 14 ton weight restriction, the service life of the bridge has been extended by an expected 30 years by merely replacing the deck, performing some minor steel repairs and painting the structure.

A 32 psf FRP deck replaced the 170 psf original concrete deck and excessive courses of asphalt wearing surfaces that had been added over the years. Because the new deck is radically lighter than the original deck the bridge load ratings were almost doubled, raising them higher than the original design. This was possible despite the fact that the structural steel had suffered some section loss and corresponding loss of strength. A total dead load of 265 tons was removed.

The deck itself rates much higher than the bridge. It meets a L/800 deflection requirement with an inventory load rating of HS85 (154 tons). Proof tests indicate that the actual load capacity of the deck is even greater than these analytical ratings.

The entire rehabilitation project was conducted by the New York State Department of Transportation's (NYSDOT) in-house maintenance staff over the course of two construction seasons. During 1998, the old deck was removed, areas of extreme section loss were repaired and a temporary steel grate deck was installed. In 1999, after the structure was painted under contract, the temporary deck was removed and replaced by the FRP deck. The deck replacement operation was completed in less than 30 calendar days, proving that rapid installation would be a huge benefit in urban areas where it is especially desirable to minimize disruption to traffic.

Unique aspects of the project

The project was the first application of a FRP deck on a truss bridge on a state highway system. Due to this lack of precedence, many innovations were developed, these included:

• Deck to steel attachment–a pre-cast polymer concrete haunch with a bolted connection between the floor beams and the deck;

• The sizing and design of the deck section to match "existing" thickness so that approach modification was minimized;

• Eliminating the need for using the existing stringers for support; 4. modular deck assembly (6 panels covering a 25' × 141' area);

• Load carrying deck panel splice details;

• FRP curb (behind the steel box beam railing); scupper frames cast into FRP deck;

• FRP sidewalk (which reduced the dead load by 32 tons); and

• Field cut FRP filler panels between the deck and sidewalk to protect the bottom truss chord from water intrusion, prolonging the life of the structure.

Benefits

A deck replacement can be done in much less time than a bridge replacement project, therefore reducing the negative economic effect felt by local users and improves safety. Deck replacement is also done with less environmental impact by eliminating any in-steam channel work and disturbance to vegetated areas. The strategy may be able to be used to save an otherwise obsolete structure. In cases where the structure has historic significance, it can make rehabilitation a feasible alternative when it might not have been previously. A comparison of actual costs to replace a similar truss suggests that there is substantial economic benefits as well. The value of this project was $876,0001 versus $2.3 million for designing and constructing a similarly sized truss replacement.

The benefits of installing a FRP composite deck onto a steel truss bridge are manifold:

• Shortens project development time to implementation;

• Dramatically improves load ratings;

• Removes a hindrance to local com merce;

• Protects structural steel from the weather;

• Improves feasibility of rehabilitating historic structures;

• Short duration, less disruption to traffic, affecting goodwill, economics, and safety;

• Environmentally friendly;

• Cost savings over replacement; and

•Extends service life with minimal effort.

Though the amount of new structural steel was minimal on this project, the successful rejuvenation of this 60 year old truss makes a convincing argument that steel is a very durable and long lasting construction material.

Project Team

Owner:
New York State DOT

Designer:
Wagh Engineers, P.C.

Steel Erector:
New York State DOT Bridge Maintenance

General Contractor:
New York State DOT Maintenance