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FAST FACTS:

Carbon Fiber Reinforced Polymer Strands

Project Location: Detroit, Michigan

Agency: Michigan DOT

URL: aii.transportation.org
*(*select *Carbon Fiber Reinforced Polymer Strands)*

Project Name: Pembroke Avenue over M-39 Superstructure Replacement

Project Description: Replacement of an existing pre-stressed I-beam superstructure with a side-by-side pre-stressed box beam superstructure, transversely post-tensioned with CFRP tendons, and containing CFRP deck reinforcement.

Project Purpose And Need: In 2011, the Michigan Department of Transportation reconstructed a three-mile segment of the depressed urban freeway M-39 in the cities of Detroit and Southfield. As part of that project, several local roadway bridges over M-39 were replaced or rehabilitated. Many of the bridges were simple span configurations with open joints and severe steel deterioration due to years of exposure. MDOT chose a bridge connecting two neighborhoods in which to replace the superstructure with durable, non-corrosive CFRP deck reinforcement and CFRP transverse post-tensioning tendons. The deck reinforcement required little concrete cover, and the post-tensioning tendons did not have to be grouted in the duct.

Overall Budget/Cost Estimate:

Engineer's estimate for the bridge - $1,868,800
Contractor's bid amount - $2,100,000

What was unique about this project?

The use of CFRP materials for deck reinforcement and transverse post-tensioning.

Describe Traditional Approach:

The traditional approach on a similar structure is typically to use epoxy-coated reinforcement for the deck and uncoated 7-wire pre-stressing steel tendons for the transverse post-tensioning, which requires grouting to protect the tendons after stressing.

Describe New Approach:

The new approach uses unconventional non-corrosive materials that are anticipated to require less life cycle maintenance when compared to traditional materials.

Top Innovations Employed:

- CFRP deck reinforcement
- CFRP transverse post-tentioning tendons

Primary Benefits Realized to Date:

- Performs comparably to steel in the finished product in terms of material handling, structural erection, constructability, etc.
- Lower anticipated life cycle cost for CFRP.
- Corrosion-free (not just corrosion-resistant).
- Cost to implement offset by maintenance savings. In addition, the cost of CFRP is decreasing.

Other Benefits Realized/ Expected:

- Reduced maintenance and rehabilitation work translates to increased worker and motorist safety.
- The use of CFRP also means that cost savings stay in the roadway user's pocket in the form of less delay (and related fuel consumption) plus reduced vehicle wear and tear.

Project Start Date/ Substantial Completion Date:

May 2011 - August 2011

Affiliations:

C.A. Hull (bridge contractor)

StressCon Industries (pre-stressed box beam fabricator)

Tokyo Rope/Tokyo Rope USA (CFRP pre-stressing strand and mild reinforcement manufacturer)

Autocon Composites, Inc. (CFRP NEFMAC grid deck reinforcement manufacturer)

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