U.S. Department of Transportation
Federal Highway Administration

Priority, Market-Ready Technologies and Innovations

Fiber-Reinforced Polymer

Problem: Improperly maintained aluminum overhead sign structures create hazards

Overhead sign structures perform a valuable service to the traveling public. They support the signs that make travel safer by informing the driver well before any action is required. If these structures are not properly maintained, however, they can collapse onto the roadway below and create serious driving hazards.

How can collapse of sign structures be prevented?
The best insurance for preventing collapse of overhead sign structures is a comprehensive inspection program. When the New York State Department of Transportation (DOT) launched a sign inspection program in 2000, it found that 10 percent of the State's overhead sign structures were damaged. The most common problem was joint cracking between the internal trussing and the main chords of the sign structure, with some joints totally severed.

What causes cracks in sign structures?
The cause of cracks is difficult to determine and may stem from several factors. Lack of inspection during fabrication can yield poor-quality joint welds. Insufficient construction supervision may result in internal stresses in an overhead sign structure before the sign is attached. The greatest contributor may be that fatigue design was not a code requirement when many trusses were designed in the 1960s.

Putting It in Perspective

A 2002 survey of sign inspection practices at State transportation agencies found the following:

- In several instances, structures have failed and fallen into traffic below.
- Cantilever sign supports have the most problems, according to 54 percent of respondents.
- Problems cited most frequently were weld defects in sign and pole construction and general fatigue cracking.

Solution: Fiber-reinforced polymers repair overhead sign structures quickly and economically

Fiber-reinforced polymer (FRP) composite materials have the potential to revolutionize the repair of sign structures with cracked secondary support members. The Federal Highway Administration (FHWA) has researched the use of FRP for more than 20 years, and FRP has been used on a variety of bridges and other highway structures.

Using FRPs to repair cracked overhead sign structures represents one of the latest applications of these strong and durable materials in maintaining the Nation's aging highway infrastructure. FRPs can provide structural integrity to overhead sign supports and prevent them from failing.

How is FRP used to repair overhead sign structures?
The FRP repair method is relatively quick and economical. It is accomplished by cleaning the damaged area of the sign support thoroughly and wrapping FRP around it. Repairs can be done in place, with only the lanes below the repair area blocked off. A typical repair takes 3 workers 3 hours to complete, at an estimated cost of $3,000 per joint.

Successful Applications: Research shows FRP repairs as strong as welded joints

The New York State and Utah DOTs collaborated on a research program to study the feasibility of using FRP to repair overhead sign structures. Samples of cracked joints were salvaged from overhead sign structures that had been taken out of service. The samples were wrapped with FRP and sent to the University of Utah for tensile strength tests. Results showed that the repaired joints were as strong as if they had been fully welded. A second round of testing is being conducted to determine the effectiveness of FRP in resisting fatigue loads.

As a result of the research, the New York State DOT has developed a specification for using FRP in overhead sign repair. The specification covers restoration of the tensile capacity of secondary sign structural members, such as internal truss diagonals, and not main members, such as longitudinal truss chords. The specification has been approved for a 5-year lifespan with annual inspections of the repair.

Benefits

- Costs less than full structural support replacement.
- Allows repairs to be done quickly.
- Causes less traffic disruption because only lanes beneath repair need to be blocked off.

Additional Resources

Additional information about FRP is available at **www.aashtotig.org/focus_technologies/frp/**.

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