PUTTING RESEARCH TO WORK **BRIEF**

Heavier Rail Cars Strain Wisconsin's Timber Bridges

Since the early 1990s, railroad companies have dramatically increased the number of 286,000-pound rail freight cars they use. These railcars replace their most recent predecessors of 263,000 pounds, and represent an increase in load of almost 9% to be borne by rail bridges around the state. Wisconsin DOT owns and manages about 600 miles of railroad lines, a system that includes over 200 bridges, most of which are 40 to 80 years old.

What's the Problem?

Many of these rail bridges are reaching their design load capacities, and confront continued wear, decay and aging. In the best of circumstances, WisDOT's bridges would require maintenance attention. With the added stress of larger freight cars, the need for maintenance, repair and even replacement of some structures becomes more pressing.

Research Objectives and Methodology

This research sought to evaluate a sample of bridges to determine their condition and repair or reconstruction needs, and use this information to project maintenance needs for bridges across the state-owned system. Investigators inspected bridges to assess their current condition, load-carrying capacity, and remaining useful life, and produced recommendations for repair and for retrofit to accommodate heavier freight car traffic.

WisDOT and Wisconsin & Southern Railroad Company selected 26 bridges in the Milwaukee and Monroe areas for inspection. All were originally constructed between 1900 and 1965. Of these, three bridges were steel structures, two were timber and steel bridges, one was a simple span of reinforced concrete, and the remaining 20 were all-timber structures. The timber bridges were pile trestle structures (as were the two timber-steel spans), and all but one was an open-deck bridge.

Two-person crews that focused on current conditions and deficiencies inspected the bridges. The inspectors used a rating system to make recommendations for repair priorities. Their field inspection notes, photographs, repair requirements, and recommendations were included as a supplement to the study.

Researchers assessed the load-carrying capacities of the bridges using data in inspection reports and bridge plans. They then applied two loads—the 286,000-pound car load and an industry standard load—to each bridge, and analyzed these test results to produce two levels of load ratings: a normal rating, which represents load levels that the structure can be expected to support on a regular, day-to-day basis, and a maximum rating, which is the load level at which the structure can be expected to begin sustaining damage and suffer a reduced service life.

Results

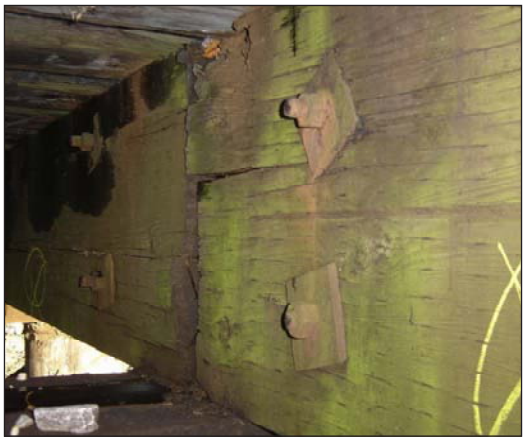
Based on inspections and analysis, investigators found that the six bridges constructed of steel and concrete can accommodate sustained 286,000-pound railcar traffic. The steel was in fair to good condition, and these six bridges can remain in service with regular maintenance and inspection.

Investigators concluded that the timber bridges, however, would all suffer damage or aggravate existing damage under sustained 286,000-pound railcar loads. The projected service lives of the majority of these bridges in their present condition were five years or less, with five of these at two years or less. For many of the bridges, repairs (some which are relatively minor) will extend service lives 10 to 50 years. Though particular problems included horizontal shear and bending, the more serious problem throughout the system proved to be overloading piling on timber trestles. Expected heavy loads are very near the intended design capacities of the piles; furthermore, actual pile capacity may be less than

Investigator

"Some bridges need repairs, while others should be scheduled for replacement. We have an extended window of approximately five to 20 years to accomplish these repairs and replacements."

–Jeffrey Koch
Westbrook Associated Engineers
jkoch@westbrookeng.com



The most serious problems facing WisDOT's timber rail bridges concern piling, including pile settlement. Note the daylight showing between the pile and cap of the timber bridge at left (page 16 of the final report). In addition, beams on the timber bridges evaluated in this study frequently showed decay at the pier caps, as seen at right (page 8 of the final report).

Project Manager

"We're using this study to evaluate what problems exist on our rail system, what work needs to be done, and what the priorities are."

–Frank Huntington
WisDOT Railroads and Harbors Section
frank.huntington@dot.state.wi.us

design capacity due to poor spacing of piles, which results in uneven load distribution and pile settlement.

One-third of the concrete and steel bridges studied had been recently rehabilitated, but less than 10% of the timber bridges had been. Based on this maintenance history, researchers anticipate this study's findings to apply more accurately to the timber bridges throughout the state system than to the steel and concrete bridges. Over the next five years, these 26 bridges will require $2.93 million in repair and rehabilitation to reach a condition capable of sustaining continuous 286,000-pound loads. Extrapolated to the entire system, WisDOT could be facing $24.2 million in needed repairs and upgrades to its railroad bridges.

Implementation and Benefits

This study will assist the department in prioritizing bridge repair and rehabilitation needs for these 26 bridges over the next five years. The study will also aid in prioritizing future condition studies of bridges throughout the state system based on bridge type.

Further Research

Inspection of bridges not included in this study will be required to accurately assess bridge repair needs throughout the state railroad system. Because car weights tend to increase every 20 years or so, the already aged timber bridges, even with repairs now and in the future, may eventually need to be replaced. Further research on timber bridges' projected service lives could help clarify this point.

This brief summarizes Project 0092-05-13, "Impact of Railcar Weight Change on Wisconsin Bridges," produced through the Wisconsin Department of Transportation Research, Development & Technology Transfer Program, 4802 Sheboygan Ave., Madison, WI 53707.

James McDonnell, WisDOT Research and Communication Services

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CTC & Associates LLC
ctcandassociates.com