

estimate of the value of its bridges, CalTrans adds together the values of all bridges in its network.

Summary

In this article we have briefly summarized two methods for tracking the value of infrastructure assets. Either method would meet the requirements of GASB 34.

Many engineers and public works directors may view asset management and GASB 34 requirements as merely an academic exercise or as an activity that may be handled by their agency's financial officer. However, we would urge public works professionals and engineers to become engaged in the financial reporting of the value of the infrastructure assets they manage. Valuing assets over time (regardless of the method used) reflects how well infrastructure stewardship responsibilities were performed. The outcome could have significant implications on future resources allocated to the management of infrastructure.

The perpetual inventory method (as well as other depreciation-based methods) is a fairly simple approach to satisfying GASB 34 requirements. This method, however, provides only very aggregate, policy-level information. CalTrans's method, although a more complex process, clearly provides information that is more useful to infrastructure asset managers and decision makers. The CalTrans example demonstrates that the process of capitalizing transportation infrastructure assets can be based on sound engineering practices, using asset-by-asset condition information to build a value estimate for an agency's transportation infrastructure network.

References

Barbara M. Fraumeni, "Strategies for Measuring Productive Highway Capital Stocks," presented to the Transportation Research Board Conference for Information Requirements for Transportation Economic Analysis, Irvine, California, August 1999.

Andrew C. Lemer, "Asset Management: The Newest Thing or Same-old, Same-old?" *APWA Reporter*, June 2000.

Paul D. Thompson and Richard W. Shepard, "AASHTO Commonly Recognized Bridge Elements: Successful Applications and Lessons Learned," presented to the National Workshop on Commonly Recognized Measures for Maintenance, Scottsdale, Arizona, June 2000. •

Table 2 Bridge Valuation Calculation

Element	Calculation	Current Element Value (\$)
Concrete deck	300 m ² x 0.5 x \$600	90,000
Steel girder	[(61 m x 1.0) + (34 m x 0.75) + (5 m x 0.5)] x \$3,500	311,500
Abutment	24 m x 1.0 x \$7,700	184,800
Column	4 x 1.0 x \$9,000	36,000
Joint seal	24 m x 0.0 x \$556	0.00
Total Current Value of Bridge		622,300

Salvaging railroad flatcars as low-cost bridges

This article is the first of three exploring bridge replacement alternatives.

DEFICIENT and deteriorating bridges are creating major problems for both state and local highway agencies throughout the nation. Iowa is no exception. Iowa has significantly more bridges per capita than most states, which stresses the available tax dollars for implementing needed bridge replacements and repairs.

According to the 1999 Bridge Inventory in the November 1999 issue of *Better Roads*, 21,057 bridges—nearly 84 percent of Iowa's total—are located on Iowa's secondary road system. Of these secondary road bridges, 31 percent are rated as substandard. Therefore, much of the responsibility for bridge replacement falls to Iowa's county agencies, making it necessary to develop cost-efficient, durable, and easy-to-install options for low-volume roads.

One possible solution

Wayne Klaiber, professor of civil and construction engineering at Iowa State University (ISU), Terry Wipf, professor of civil and construction engineering and bridge engineer at ISU's Center for Transportation Research and Education, Jim Witt, county engineer for Cerro Gordo and Winnebago counties, and Thomas Threadgold, a structural engineering graduate student at ISU, conducted a study sponsored by the Iowa Highway Research Board on a low-cost bridge alternative that uses salvaged railroad flatcars (RRFCs) as bridge superstructure.

The research team determined that salvaged RRFCs are a "safe and feasible bridge alternative" to aid Iowa counties in constructing short-span bridges for low-volume roads.

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Construction of the Tama County RRFC bridge.
Photo courtesy of the Tama County engineer's office.

An overview of salvaged RRFC bridges

Salvaged RRFCs form the superstructure of the bridges. RRFCs are available in various lengths, making it possible to construct bridges of different lengths. The cars can also be joined to create varying bridge widths before being placed on standard abutments. Commonly, the driving surface of the bridge consists of timber planks and metal grating. Salvaged RRFC bridges can be constructed with or without guardrails, depending on location.

After conducting a survey of bridge engineers in the United States and Canada, Klaiber and Wipf determined that states with large rural populations, such as Oklahoma, Texas, Arkansas, Wyoming, and Montana, are most likely to employ salvaged RRFC bridges on county or private roads. Although California uses salvaged RRFCs to create an emergency bridge system, no states report permanent RRFC bridges on state highway systems.

The Iowa research

Wipf and Klaiber worked with former Tama County Engineer Robert Gumbert to test and analyze Iowa's only salvaged RRFC bridge, located on a rural access road in Tama County. The Tama County bridge consists of two salvaged RRFCs placed side-by-side on timber abutments. Metal grating covers the entire bridge surface, and timber planks spanning the center of the bridge create the driving lane.

According to Gumbert, the Tama County bridge was installed in 1986 to replace a deteriorating bridge. "We looked at the options of closing the road, building a new bridge, installing culverts, or using [salvaged] railroad flat cars. We decided that railroad cars were the best option," Gumbert said.

The research team created computer models and field-tested the Tama County bridge to determine strains in the bridge with and without connections between the flatcars. The field tests indicate that connections have minimal influence on the behavior of the bridge.

Both the theoretical and experimental data collected by the research team suggest that RRFCs are structurally adequate as a bridge superstructure, and that the Tama County bridge is capable of carrying legal Iowa highway loads.

"[During the research team's load testing,] the [Tama County] bridge turned out much stronger than anyone thought it would," Gumbert explains.

Salvaged RRFC bridge safety

Klaiber foresees no difficulty with the use of salvaged RRFC bridges and emphasizes the safety of these structures. "Properly engineered, railroad flatcar bridges are fine structures, and there is no danger to the public," he explains.

Salvaged RRFC bridges employ only railroad cars that have sustained no damage during railroad use and have not reached the age

for mandatory retirement. The cars used in bridge construction have been retired for economic reasons. That is, their repair costs have become exorbitant, or they have been replaced by cars with more cost-effective designs.

Gumbert also expresses the safety of RRFCs. "Railroad flatcars are designed to carry tremendous loads, and that makes them very strong as bridges," he says. Salvaged RRFCs experience significantly reduced loads as bridges than the 50 to 100 tons they were designed for.

Benefits of salvaged RRFC bridges

Salvaged RRFC bridges are low maintenance and can span various lengths. Their primary benefits, however, are low cost and quick installation.

Skipp Gibbs Company, a California company specializing in ready-to-install bridge superstructures, estimates savings between 30 and 70 percent of the cost of conventional bridges. The low cost results from installation speed, ease of design, long life, low maintenance, and length of span.

"Railroad flatcar bridges are cheap, quick, and very strong," Gumbert says of his experience with the Tama County bridge. He estimates the time to install the salvaged RRFC at about a day. The abutments were installed beforehand.

Reactions

Gumbert and the Tama County engineer's office would not hesitate to use RRFC bridges in the future. "Since [the installation of the Tama County RRFC bridge], we have always thought it was an attractive option, but we have not run across another good location," Gumbert says.

According to Gumbert, the public has also reacted favorably to the salvaged RRFC bridge. "The people that use the bridge are happy to have a bridge that is wider and stronger than the previous bridge," he explains.

For more information

For information about Iowa's research, contact Terry Wipf, 515-294-6979, wipf@iastate.edu, or Wayne Klaiber, 515-294-8763, klaiber@iastate.edu. For information on the Tama County bridge, contact the Tama County engineer's office, 515-484-3341.

To obtain a copy of the research team's final report to the Iowa DOT, *Use of Railroad Flatcars for Low-Volume Road Bridges*, funded by the Iowa Highway Research Board, TR-421, or the December 1991 report, *Bridges Constructed from Railroad Cars*, conducted for the Arkansas State Highway and Transportation Department by Thomas J. Parsons of Arkansas State University, contact Stan Ring, CTRE's library coordinator, 515-294-9481, sring@iastate.edu. •