A historic Vermont bridge gets a second life, thanks to a widening project facilitated by a hydraulic jack side-launching system.

# Wider Load

BY JERRY PFUNTNER, P.E.

**WHEN THE HISTORIC,** 350-ft-long steel truss Checkered House Bridge was built in 1929 across the Winooski River in Richmond, Vt., it replaced yet another historic bridge: an 1800s-era wooden covered bridge that was severely damaged in the Great Flood of 1927.

Over time, however, the massive steel structure had been restricted to increasingly lower load limits. This eliminated a major and convenient option for commercial trucks to service the area—just minutes from Burlington in Chittenden County, the most populated county in the state—for nearly two decades.

After considering various alternatives and public input, the Vermont Agency of Transportation (VTrans) decided to keep the bridge in place and upgrade it to modern standards, which included expanding the curb-to-curb width from 20 ft. to 30 ft.

"The steel trusses are in very good shape, except for the flooring members and decking, so it still has a significant life span," explains Carolyn Carlson, structures project manager with VTrans. "Being able to reuse the bridge for its original intent in its original location definitely came into play."

Carlson has been involved with this bridge since 1990, when the concrete deck was originally considered for replacement. She notes that this is the first time a steel truss bridge of this magnitude has been widened by separating a truss and reattaching it using new steel supports. The project also marks VTrans' second

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- The curb-to-curb width of the bridge was expanded from 20 ft. to 30 ft.
- The entire north truss chord was moved 12 ft, 6 in.
- Ten specially designed 18-in. stroke capacity hydraulic ram systems were placed on the top and bottom chords and at each abutment, and provided carefully monitored constant pressure to nudge the 65-ton north truss on Hilman rollers to its new location.

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design-build project ever and includes the reconstruction and realignment of Route 2, Kenyon Road and Johnnie Brook Road.

The Checkered House Bridge is the state's only Pennsylvania through-truss bridge, which is based on the Pratt truss and characterized by half-length struts or ties in the top, bottom or both parts of the panels. "Part of the challenge was to be able to clearly delineate the original, aged, green historic steel members from the new ones—similar to small homestead farmhouses with distinct additions over time that dot the Vermont landscape," Carlson says. "Rather than a symmetrical look that mimics the original design, there is a visible distinction that preserves and adds to history at the same time."

The design-build team of CHA and Harrison and Burrowes brought in Tallahassee-based Finley Engineering Group (FINLEY) early in the bid process. "Due to the historical significance of the bridge, we had to develop a way to preserve as much of the original truss as possible, maintaining all portals and sway frames, while widening the structure and increasing load carrying capacity," says David Vieni, P.E., project engineer with CHA. The FINLEY-designed jack and roller side-launching system allowed the team to save 80% of the original truss,

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All photos this spread: Jared Katz

The bridge, before the separation.

Erecting the new steel. Approximately 120 tons were added.

reducing the need for additional steel. The 36-month, $13.9 million project is on schedule to have the bridge open for traffic in June 2013. Approximately 120 tons of new steel was added for the widening project.

## Hydraulic Help

FINLEY developed and implemented the concept to widen the truss bridge by cutting and carefully moving the entire north truss chord 12 ft, 6 in. To maintain the historical integrity of the original bridge, nearly all of its steel members were retained and new structural bracing members were installed within the widened portion only.

The innovative falsework and jacking system allowed the north truss to be moved, with lateral support being provided from the south truss system. The south truss was designed to support the entire existing truss bracing members with the aid of the falsework system, which stabilized the eccentric self-weight, wind loading and jacking forces through the many phases of the north truss jacking operation.

The hydraulic side-launch jacking system also helped transport the north truss, facilitated fit-up of the new bracing members and provided a means to adjust the camber of the north truss. The side-launching was completed in 1.5 days, achieving a launching rate of 2 ft per hour.

"When we got started on the project, FINLEY visited the site and proposed the cut and launch idea to the project team," explains Mark Klingbeil, vice president of operations with Harrison and Burrowes. "We all worked together to tweak the concept, and then Jerry went to work on the design and construction sequencing for the move of the north truss."

"There was nothing easy about this project," he continues. "We had to work with old shop drawings that could not be verified until we actually disconnected the north truss. In the end, the old drawings turned out to be fairly accurate and the fit-up pretty routine with the help of the hydraulic rams."

A team of 25 people from the design-build team were all on-site the day of the big move to carefully monitor 10 critical connection points that, when cut free, would expose the truss to potential distortion and twisting. Four transverse beams on both the upper and lower chords were the workhorses for stability for the north and south trusses. Once supports were in place, the north truss was cut free by removing bolts and rivets.

Ten specially designed 18-in. stroke capacity hydraulic ram systems were placed on the top and bottom chords and at each abutment, and provided carefully monitored constant pressure to nudge the 65-ton north truss on Hilman rollers to its new location. Movement had to be carefully orchestrated, and the team had to advance the support brackets for the jacks with every 12 in. of movement.

After doing the heavy work of moving the north truss into position, FINLEY's launching system was kept on-site to help make minor adjustments to get everything in line for the reconnection of the new steel with the relocated north truss. "As we installed new members, we could remove temporary support members," explains Klingbeil.

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The new steel members were installed within the widened portion only to join the two chords in a distinctly visible way, and the corroded floor beams and stringers were replaced. Incorporating the new sections of the structure with the old members was complex. The temporary works design called for clamping existing members with bracketing connections to preserve the old steel members' integrity and used post-tensioning bars to apply a clamping force.

The project team concurs that the design-build process was key to this project's success. It allowed the team to work closely together using creativity and innovation to develop the best design and construction approach to meet the owner's needs in the most effective and safest manner, while providing the optimum value for taxpayers.

"It was like a big puzzle, putting together lots of pieces," recalls Vieni. "There was a lot of anticipation of what could go wrong. In the end, there wasn't a lot to talk about, thanks to the efforts of all involved, and that is a good thing." MSC

**Owner**
Vermont Agency of Transportation

**Structural Engineers**
Finley Engineering Group, Tallahassee, Fla.
CHA, Albany, N.Y.

**General Contractor**
Harrison and Burrowes, Glenmont, N.Y.

**Steel Team**

**Steel Fabricator**
STS Steel, Inc., Schenectady, N.Y. (AISC Member/AISC Certified Fabricator/NSBA Member)

▲ The side-launching was completed in 1.5 days, achieving a launching rate of 2 ft per hour.

▼ New top members.