STRUCTURAL BUILDING COMPONENTS MAGAZINE (FORMERLY WOODWORDS)
June/July 2001

"If You Can Imagine It -- We Can Build It" by Melinda Caldwell

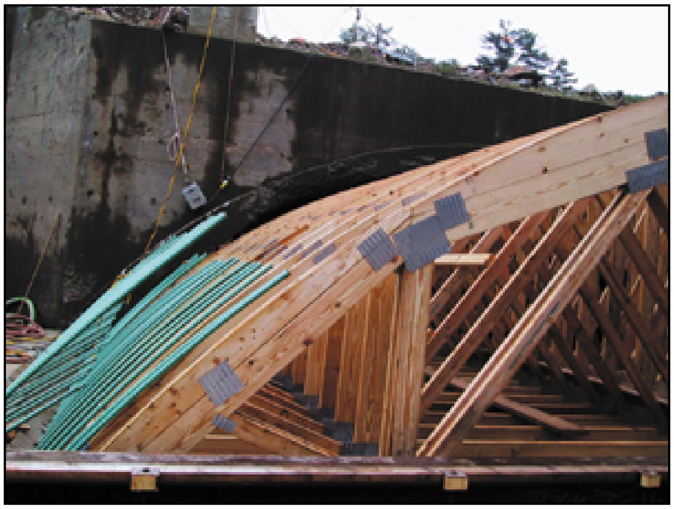
Have you ever encountered a project that seemed so challenging you couldn't help thinking it had you “over a barrel”? Fred Kenison, P.E., Assistant Bridge Engineer for R.S. Audley, Inc., a contracting company in Bow, New Hampshire, can probably sympathize—quite literally.

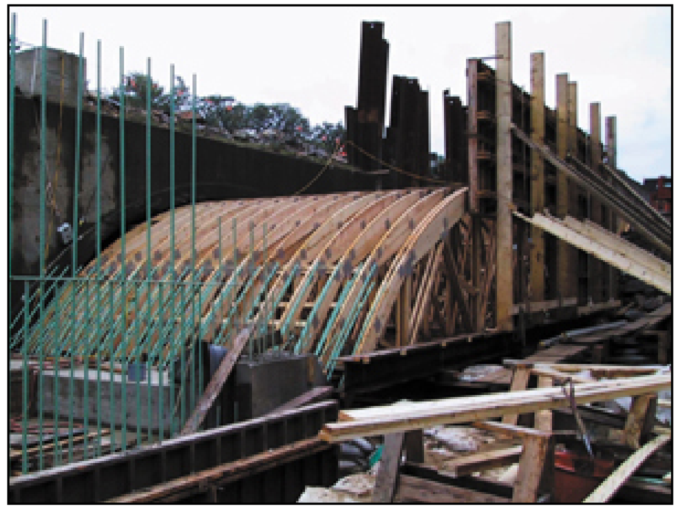
THE PROJECT

Last spring, Kenison was part of a team charged with adding a lane to each side of a stretch of the Maine Turnpike, a toll section of I-95, which is a major interstate highway that runs from Florida to Maine. This project included two locations where the lane addition required the extension of a barrel arch culvert—one in the northbound lane and one in the southbound lane. Making the project even more complicated was the fact that the extension of the concrete barrel arch was positioned over water.

So Kenison and his colleagues began brainstorming ideas for designing the concrete falsework that would be needed to complete this portion of the project. They needed to develop a true-radius arch with a span of 40 feet over water. The main hurdle? To find a material with which to build the falsework that could withstand the massive loads of the concrete but that was still lightweight enough to be removed by hand after the concrete cured. They also needed to try to keep the workers out of the water as much as possible. The engineers played with concepts involving steel angles, but the steel was too heavy to be easily removed. Then they experimented with diagonal structures built out of wood that started looking more and more like trusses. It was then that Kenison knew it was time to call Stan Sias, Engineered Wood Products Manager for LaValley Building Supply Inc. in Newport, New Hampshire.

Kenison had worked with Sias on truss orders for some smaller, residential construction, but he had never discussed this type of project with a truss manufacturer before. Their initial conversations included a lot of “what if's” and “can you's,” but in the end Sias had the answer that Kenison wanted to hear: It was indeed possible to create a round-top, barrel arch truss to use as concrete falsework for this project. And LaValley's staff was up for the challenge.





THE MANUFACTURING PROCESS

After consulting with the chief engineer at the regional office of Alpine Engineered Products, Sias provided preliminary designs for field review. One minor change was requested from the original design. This change allowed for the steel bearing beams to be placed above the water line of the stream running through the existing culvert. At this point, Kenison placed an order for 34 trusses for the project. LaValley designed the components to be placed two feet on center and to support a load that ranged from 900 pounds per lineal foot (plf) at each end to 400 plf in the middle—not exactly your everyday roof or floor truss loads.

Designing for the load capacity was the easy part for LaValley. The real challenge came into play when it was time to figure out how to fabricate the circular fillers that would be plated on top of the straight top chord sections to make it a true, rounded arch. The key was to develop a template that could be used to cut the circular pieces uniformly as they needed to be perfectly consistent truss to truss and had to match the radius of the existing culvert.

Sias said that developing the solution to this manufacturing challenge was a “real team effort,” as a number of people at LaValley got involved in the problem solving. To create the necessary template, the CAD draftsman plotted full-scale rafter sections using AutoCAD, which were then used to make a full-scale pattern. The pattern was used to create a jig that was slightly bigger than the arch and acted as a “shadow line” along which the carpenter could roll the Skil saw. According to Sias, the method “worked remarkably well” and they were able to maintain the required consistency for all 34 trusses.

THE INSTALLATION

With the project complete on LaValley's end, Kenison and his crew went to work at the jobsite to prepare for the installation. First, H-piles were positioned as bearing points for the bridge extension. Then the crew set the trusses in place and covered them with two layers of form plywood. The entire forming process took about two weeks. This timeframe included placing re-bar on top of the plywood. At this point, the falsework was ready for the concrete.

According to Kenison, pouring the concrete around this type of falsework, whether it is constructed with trusses or by stick-framing, is an exercise in symmetry. Because the falsework is designed to carry certain loads in certain areas, the crew couldn't pour the concrete directly on top of the form and allow it to run down the sides. Instead, the crew had to bring the concrete load up over the falsework symmetrically, working their way up evenly on both sides until the concrete met in the center. The concrete was poured 20 inches deep at the springline and 12 inches deep at the center. After the concrete had cured, Kenison and his crew were able to pull out almost every single truss in tact, fulfilling one of the main goals of the project.

THE BENEFITS

In addition to bearing the necessary load and being lightweight enough to remove easily, Kenison noted that he and the bridge crew enjoyed a number of other benefits by using trusses for this project rather than stick-framing the falsework:

- Because of the location of the barrel arch and the fact that it was over water, workers would have had to spend much more time in the water in a stick-framing situation. This was not a popular idea with the workers or the Department of Environmental Protection.
- The trusses offered a consistency in design and fabrication that could not have been achieved with stick-framing, as framing on site is a less convenient and less controlled environment.
- Knowing that the trusses were specifically engineered to handle the known loads of the concrete for this project provided extra peace of mind for everyone working on the site.
- Cycle time was an important factor in this project due to permitting issues. Using trusses rather than stick-framing the falsework saved Kenison and his team close to a month of crew time. While the trusses may have cost more than a bundle of lumber, the money saved in crew time easily exceeded the extra cost.

“I can't think of another, better way we could have accomplished this project so quickly and easily,” remarked Kenison. “We saved a ton of time on the project, and stripping out any other falsework would have been a nightmare.”

And how did Sias and the crew at LaValley fare? They enjoyed some benefits of their own from this unusual project.

“It might have been our first time doing round trusses, but it was a neat experience for everyone to build something different and challenging,” stated Sias. “From the design department to the plant to the yard to the delivery crew, everyone was excited about this job. We're using photos from the project in some marketing pieces for LaValley and the round trusses really get people's attention. Even our employees want pictures to show their family and friends. Our new motto is, ‘If you can imagine it—we can build it.’ The whole project was great for morale.

“Plus,” continued Sias, “this was a profitable job for LaValley that turned out to be a bright spot for the contractor in the grand scheme of this highway project. You can't ask for a better ending than that.

SBC HOME PAGE