A Bridge From Two Flatcars

by Paul Huijing

Intelligent reuse allows an access driveway to cross a 38-foot span without damaging the stream below

After acquiring a 13-acre parcel of land in partial exchange for a spec house I'd built, I began to explore my options for dividing the property within the town zoning rules. It was a simple matter to create two new building lots from the original plot, but one of them was on the opposite side of an intermittent stream, with access provided by an old farm culvert. I considered upgrading the culvert to create a safe driveway, but there was another, more creative possibility: The owner of an adjoining parcel on the other side of the stream had a potentially buildable lot, but it was accessible only from my property. So we agreed to a financial partnership in which I would provide access to his site as well.

How to Cross the Stream

Massachusetts has strict stream-crossing guidelines, and we had only two practical options. The first was to install an open-bottom arch culvert, which would not disturb

Figure 1. While an open-bottom arch culvert might have worked for the stream crossing, it would have had a greater impact on the stream and was aesthetically less pleasing than the flatcar bridge.

the streambed. These arches are typically manufactured off-site and installed on a poured concrete foundation. The approach ramps are usually retained with precast concrete blocks stacked to form walls.

One drawback of this approach is that it's difficult to neatly transition these rectangular blocks into the semicircular culvert. The resulting industrial look did not appeal to me (**see Figure 1**).

Another problem is that the cost of the arch rises dramatically as the span increases. The narrowest crossing point available was 28 feet wide, meaning that this span would push the economic limits. To be at all cost-effective, the foundation would

Figure 2. After rough-grading the access to the stream crossing (above), the excavation contractor dug trenches for setting the concrete abutments (right). He leveled the bottoms with stone fill and gravel, then placed a series of interlocking pre-cast blocks (far right).

have to be flush with the wetland boundary, and this would increase the chance of damage to the wetlands.

A better option. I encountered the second approach while searching on the Internet, where I learned of a Colorado company called Paragon Bridge Works (970/737-1174, prsx.com), which converts retired railroad flat cars into vehicular bridges. I liked the way the sample bridges looked, and thought that such a bridge would be an added selling feature for my project.

Another benefit of the rail-car bridge was its ability to handle the span with ease. This was a key feature for my site, because it allowed me to cross the stream at a location that lined up with the existing farm road. At about 32 feet, the wetlands were too wide for the arch culvert at this location and would have required a costly and time-consuming wetlands fill and replication. The longer rail-car span also enabled me to set the bridge foundation further from the wetland boundary, minimizing the chance of disturbance to the conservation area and speeding the approval process.

I estimated the overall cost of the arch-culvert bridge and the rough driveway leading up to it to be $57,000. The cost for the rail-car bridge added about $10,000, but the aesthetic and technical advantages made me decide that this was the way to go.

Figure 3. At grade, the abutments transition from plain rectangular blocks to blocks with a precast faux-stone face. Note the silt fences in the background.

Engineering and Site Prep

Once the crossing method was established, I worked with a civil engineer and Paragon Bridge Works to design a bridge that had the details I wanted and also met fire department and zoning requirements. I paid Paragon to strip and paint the bridge and to weld on brackets for mounting the bridge rail. I also purchased wood for the deck and rail from the company, because the brown pressure-treated wood they were offering was much better looking than the green-colored product available in my area at the time.

After placing the order for the bridge, I installed erosion controls, had them inspected by the local conservation commission, then began clearing trees and removing stumps. We were almost done with the tree clearing when Hurricane Hanna dumped $7^1/_2$ inches of rain on the area over the course of two days. The erosion controls passed the test, dispersing this huge amount of rain and preventing damage to the stream environment.

With the trees and stumps out of the way, we graded the rough driveway up to the bridge and excavated the trenches for the abutments. Thanks to an existing culvert on the farm road, we were able to reach the far side of the stream without arranging for a temporary bridge or other access.

Getting the abutments level and square is critical, so we took extra care with this part of the job. The interlocking precast concrete blocks used as abutments for the bridge were formed from waste concrete by a concrete plant in town. The blocks were set in three courses, with the bottom course set on a stone base below the frost line (**Figure 2, page 2**). We used plain block for the buried courses, but specified a decorative cast-stone pattern for the face of the above-grade course (**Figure 3**). The whole process of installing the abutments took about one day per side.

Setting the Rail Cars

On the day we placed the bridge, an all-terrain crane was set up on the site and the truck carrying the bridge backed into place (**Figure 4**). We used the cargo tie-down hooks on the bridge to lift the two rail-car sections — each of which weighed approximately 11,000 pounds — and placed them side by side, so that angle brackets welded to the ends of the rail-car sections rested on rubber pads on top of the abutments.

We were pleased to find that the positioning of our abutments was accurate enough that the bridge did not need any shims.

Figure 4. The painted rail cars arrived by truck, along with pressure-treated lumber for the rails and deck. Note the welded brackets on the top flatcar for attaching rail posts (A). The truck backed into place (B), where a large crane stood ready to place the 11,000-pound rail cars onto rubber isolation pads on the concrete abutments (C, D).

Figure 5. Native red oak 6x6 and 8x8 posts were attached to the predrilled brackets along the sides of the bridge, then the pressure-treated rail was attached. Wood planking and an oak curb completed the project.

After the position of the bridge was verified, we fastened the welded angle brackets to the abutments with expansion anchors, and the two rail-car units were welded together from beneath at the quarter points, using steel angle provided by the bridge company. This part of the job went very quickly: The crane charge was $2,600 for about three hours at the site, but hoisting the bridge into place took only about an hour.

Finishing Up

With the bridge itself in place, we built up the approach ramps, using some of the abundant boulders found on the site to line their sides. We didn't put the final decking on the bridge until we had backfilled the opposite side ramp. While this limited the bridge's load capacity somewhat, it allowed us to use the structure for construction equipment without damaging the final wood decking.

After the driveway was finished, my carpenters installed the decking and rails (**Figure 5**). The posts for the rail were locally milled red oak 6x6s and 8x8s, which were predrilled using a template and fastened to the bridge brackets with galvanized bolts. I added an 8x8 curb to help prevent vehicles from striking the rail.

In order to highlight my development project, I arranged for a local paper to cover the installation of the bridge. They thought it was an interesting event and featured it on the cover. The bridge has become a minor landmark in town and has succeeded in creating an upscale image for the building lots.

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