

PROJECT SPOTLIGHT

NEXT beams meet constraints of Sand Hill Bridge

The original Sand Hill Bridge in Middlebury, Vt., arched elegantly over the Middlebury River, framing a local swimming hole below, but after nine decades the structure was falling into disrepair. Surveys showed that the structure no longer met local safety and design standards and was too narrow to support sidewalks, which created unsafe conditions for pedestrians. The gorge edges had also become weathered and weakened over the years, putting further stress on the structure.

Designers were tasked with creating a new structure that was wider and longer than the original but still reflected the arched design that locals had come to love. The new bridge



The Sand Hill Bridge over the Middlebury River in Middlebury, Vt., is under construction. J. P. Carrara and Sons was the precaster for the project. *Courtesy of J. P. Carrara & Sons Inc.*

With nowhere to build a temporary bridge, the new Sand Hill Bridge in Middlebury, Vt., needed to be constructed quickly. It upgrades a 90-year-old structure over the Middlebury River. *Courtesy of J. P. Carrara & Sons Inc.*



also had to be built as quickly as possible to minimize effects on traffic because there was no place to add a temporary bridge and the nearest alternate route was 30 mi (50 km) away.

The designers chose a precast concrete design using north-east extreme tee (NEXT) beams to meet these constraints. “Precast lent itself to this project because the main goal was to get it up as fast as possible,” says Joe Carrara of J. P. Carrara and Sons, the precaster for the project.

He says that the unique design and layout of the project location over the deep gorge made engineering a challenge.

“Because the bridge consists of almost all precast concrete elements, the design and layout of the structure was almost like a 3-D puzzle,” says Lauren Chervinsky, project engineer for VHB Engineering, the design consultant for the Vermont Agency of Transportation. “As designers, we needed to fully understand how each piece of the puzzle was going to fit together to ensure that what we were putting on paper could actually be built.”

Carrara and VHB worked together on the engineering of the bridge to ensure that all the pieces would come together in the field. The final design included 54 total components, including 7 footings, 5 abutment walls, 12 arch segments, 6 approach slabs, 4 NEXT beams, 16 fascia panels, and four massive wing walls.

Many of the pieces required slight variations in slope and depth, necessitating a unique form for each. To ensure that the arches met the exacting design requirements, Carrara’s team surveyed the pieces weekly as they cured to monitor and adjust the dunnage and account for any creep that occurred. “That allowed us to match all of the pieces up within tolerances,” Carrara says.

To add further efficiencies to the construction, Carrara’s team cast curtain walls into the NEXT beams in the plant after the beams were in the prestressing bed.

The NEXT beams span above the decorative precast concrete arch that supports only its own dead load, says Mike Weigand, project manager for Carrara. “By adding the curtain walls in the plant, we eliminated the need to do a closure pour at the abutments in the field,” he says.

That step enabled the team to complete the work within the 45-day closure time and deliver a structure that the community loves.

“We beat the schedule by at least a week,” Weigand says. “You could never do that with a cast-in-place design.”

—Sarah Fister Gale

I-84 bridge replacement takes days instead of months

Replacing interstate highway bridges can typically take months, or even a year or more, using traditional construction methods. However, with accelerated bridge construction using precast concrete, bridge replacements can take place in as little as 48 hours.

One such project in the summer of 2014 involved the replacement of the two Interstate 84 (I-84) bridges over Marion Avenue in Southington, Conn.

“The Connecticut Department of Transportation [ConnDOT] wanted to replace the bridges in as quick a window of time as possible since I-84 is very busy at that location,” says Troy Jenkins, chief engineer for Cressona, Pa.-based Northeast Prestressed Products LLC, the precaster that was chosen for the project.

ConnDOT decided that the existing I-84 bridges, which had been built in 1964, were too rusted and deteriorated to repair. Problems included diagonal and longitudinal cracks as well as exposed reinforcement.

In planning the \$6 million replacement project, ConnDOT selected accelerated bridge construction for the first time in their state.

ConnDOT selected Palmer, Mass.-based Northern Construction Services LLC as the primary contractor. Over several months from late 2013 to mid-2014, Northern fabricated the new bridge spans in staging areas adjacent to the bridges.

In terms of the precast concrete portions of the project, Northeast Prestressed built 20 Prestressed Concrete Committee for Economic Fabrication bulb-tee beams, each of which was 47 in. (1200 mm) deep and 102.5 ft (31.2 m) long.

“Each beam contained 21.8 yd³ (16.7 m³) of concrete,” Jenkins says. The other precast concrete portion of the project involved 16 approach slabs, which included 9.1 yd³ (7.0 m³) of concrete for each slab.

ConnDOT scheduled the section of I-84 to be closed from 9 p.m. Friday, June 27, 2014, to 5 a.m. the following Monday.

Work began with demolition of the existing bridges. The new spans were then set in place on the existing abutments. These superstructures were moved into place from the nearby staging areas using self-propelled, motorized transporter units, which are platform vehicles that can lift and carry large structures, such as bridge sections.

The project progressed so smoothly that one lane of the highway was reopened at 4:30 p.m. and the other at 8:30 p.m. Sunday, eight and a half hours ahead of schedule.

The project was so successful that ConnDOT plans to use accelerated bridge construction for road and rail bridge replacements for many future projects. Projects have already been planned for bridges in Bridgeport, Norwalk, and Stamford.

—William Atkinson 