Accelerated bridge construction used over Manhan River

The Manhan River bridge replacement project in Easthampton, Mass., came with a strict time line. As part of the Massachusetts Department of Transportation's Accelerated Bridge Construction (ABC) initiative, the contract required that the bridge be closed for no more than six months, with a penalty if construction took longer.

That would have been a tough deadline to meet had the project used a conventional cast-in-place concrete deck design, says Ben Cota, production engineer for JP Carrara & Sons in Middlebury, Vt., but it wasn't a problem because the designer used a modified version of precast concrete northeast deck bulb tees.

"The advantage of choosing a custom-sized precast concrete northeast deck bulb-tee design is definitely accelerated construction," Cota says. "It minimizes any cast-in-place the contractor has to do."

The bridge features one span of eight 95 ft (29 m) long deck bulb-tees. Each beam weighs110 kip (50 tonnes), with a 5 ft (1.5 m) wide, 8 in. (200 mm) thick top flange.

"Typically, a bulb tee would only have a 4 ft (1.2 m) wide, 4 in. (100 mm) thick flange," Cota says, but the project features a full deck beam, so they customized the design with a wider flange to eliminate the additional form system. "The beams sit only a few inches apart and only need a small closure pour between them," he says.

Strain gauges are being installed for long-term health monitoring of the Manhan River Bridge in Easthampton, Mass. Courtesy of J. P. Carrara & Sons Inc.

Full deck New England bulb tees are shown on the Manhan River Bridge in Easthampton, Mass. Courtesy of J. P. Carrara & Sons Inc.

Carrara cast mockups of the top flange prior to construction to demonstrate the viability of the design. "We tested a variety of methods and selected the most efficient means to ensure there were no problems," Cota says.

The use of deck bulb tees helped reduce time and complexity in construction; however, accommodating the tight schedule wasn't the only challenge on the project. Carrara's team also had to meet extremely tight restrictions on differential camber between adjacent deck beams.

Typically, tolerances of ± ¾ in. (19 mm) are common, but this project demanded a tolerance of no more than ± ¼ in. (6 mm), Cota says. "I think that provision concerned a lot of potential producers." Even so, Carrara was not deterred.

To meet the criteria, the precaster performed additional self-imposed quality control measures. "So many factors can influence differential camber," he says. Concrete consistency, curing conditions, and storage all become crucial with specifications as strict as these. "It required diligent quality control from the moment the beams were poured until they were delivered."

Just in case all that diligence didn't pay off, the team established a backup plan to add pressure to any beams that were out of tolerance during storage. Happily, Cota says, they didn't have to use it. The beams met the camber tolerance specifications, and the project didn't just meet the deadline—it beat it by more than a month.

"This was a new form and shape and we faced tough tolerances, but we proved that we could do it," Cota says, "and we look forward to doing more projects like this one in the future."

—Sarah Fister Gale

View a video of the erection of the Manhan River Bridge in Easthampton, Mass., at http://www.easthamptonchamber.org/index.php/news/article/deck_bulb_tee_beams_installed_8_1_13.

NEXT beam bridges slide into place in New York

In September 2013 construction workers slid a massive 80 ft (24 m) precast concrete bridge span into place in the middle of a torrential rainstorm. Crews began demolition of the existing structure that evening, and the new span was in place early the next morning. The placement was part of a $10.2 million accelerated bridge construction project to replace twin bridges over Interstate 84 in New York.

Replacement bridges are resting alongside the existing bridges on Interstate 84 over Dingle Ridge Road in southeastern New York.
Courtesy of Dailey Precast.

The project, a cooperative effort by New York Department of Transportation (NYDOT), HNTB, Yonkers Contracting Company, and Dailey Precast, employed northeast extreme tee (NEXT) beams, which are super-sized double tees for greater strength and shallower depths while dramatically reducing construction time. The double tees each feature 7 ft (2.1 m) long stainless steel plates cast into the end diaphragms to facilitate sliding, says Jared Stellar, quality control manager for Dailey Precast.

"The plates were polished to a mirror finish to reduce the friction coefficient," he says. "It was the most unique feature of the project."

Once the contractor completed the slide, flowable fill was injected beneath the beams and supported by wing walls, making them ground-supported slabs.

"This is the first project to use a slide-in approach to accelerated bridge construction," Stellar says. "Even with the downpour, we met our deadlines."

And those deadlines were tight. The slides were done on two successive Saturday nights, with each bridge demolished and replaced in a 20-hour closure of the road underneath. The first slide took 10 hours to complete, and the second took less than four.

"We performed several trial pushes prior to construction so we knew it would work," Stellar says.

Indeed, the slide was a relatively easy part of the project. The biggest challenge was getting the beams from Dailey's plant in Vermont to the project site in New York, more than two hours away. "The beams were close to capacity for the roads, so there was a lot of planning and escorts involved," he says.

Because the project site had limited space, Dailey couldn't deliver the beams early. Yet if they waited, they risked shipping delays due to rain restrictions or other traffic-related limitations.

To minimize risk, they worked with a local trucking company to establish drop-off points so they could get the beams close to the project site in the days leading up to construction and then deliver them to the site as they were needed.

By using the precast concrete NEXT beams and the slide-in approach, the team was able to cut time and costs dramatically. NYDOT estimates that the project would have taken two full construction seasons to complete, with a temporary bridge at an additional cost of more than $1.5 million.

"This was a great solution for this project," Stellar says. "It was well thought out, the design worked, and there weren't any hiccups."

—Sarah Fister Gale