A next time
New design in bridge beams opening some eyes

A new prestressed concrete bridge beam is on the market.

The first Northeast Extreme Tee (NEXT) beams were produced by Dailey Precast of Shaftsbury, Vt., in February 2010 for the New Bridge over the York River in York, Maine. The NEXT Beam is a robust double-tee for bridges, which offers these advantages:

- **Durability**
  - It has 2 in. of concrete cover;
  - All under-deck surfaces can be readily inspected; and
  - There is an open cross section.

- **Economy**
  - Same form is used for all lengths and depths;
  - No staged pouring is needed;
  - No void form is needed;
  - Flange width is adjustable to readily accommodate various roadway widths; and
  - It readily accommodates utilities.

- **Accelerated construction**
  - The top flange provides a ready platform for deck work and a ready form for the cast-in-place concrete deck pour; and
  - The top flange also can be used as the deck itself.

The beam details were developed by a consensus task group of owners, industry and academia at the Precast/Prestressed Concrete Institute Northeast (PCINE), and this was essential to success. Complete standard details for the NEXT Beam are published on the PCINE website. (www.pcine.org).

The NEXT Beam comes in two styles:

- **F (Form) Beam** has a 4-in. top flange that acts as a form for the eventual cast-in-place concrete deck. Typical cast-in-place deck and associated bridge rail details will work. Since the F Beam top flange is just a form, the top flanges are not joined longitudinally.

- **D (Deck) Beam** has an 8-in. top flange that acts as the bridge deck. An overlay of asphalt can be applied as a wearing surface, or, perhaps for low-volume, low-speed roads, the flanges can be driven upon directly. The D Beam top flanges are joined...
longitudinally with a closure pour to ensure composite action among the beams.

Conceptually, the F Beams can be used in the same fashion as other multibeam bridge systems: simply supported or continuous (for live load) units bearing on neoprene pads at piers and abutments, with a traditional cast-in-place deck. A key NEXT Beam advantage over adjacent box beams is that the NEXT Beam flange width is adjustable. Therefore, the flange width and number of beams can be tailored to readily accommodate any roadway width.

The D Beam is intended for rapid bridge replacement where the goal is to reopen the bridge quickly. The D Beam top flange is a built-in deck and thereby avoids the curing time required for cast-in-place concrete, though the closure pours will indeed be cast-in-place.

The PCINE standard NEXT Beam details reflect the following features:

- The standards are based on 0.6-in.-diam. strand, though the NEXT Beam can be adapted to ½-in. and ⅝-in. special strand;
- The span can be up to approximately 90 ft and can be longer as a transverse member;
- The NEXT Beam standards feature beam reinforcing, typical strand arrangement, end diaphragm details and sample details for integral abutments and pier continuity;
- Various software packages have been readily adapted for NEXT Beam design, including PG Super and PS Beam; and
- The current skew recommendation is 30° maximum (AASHTO skew), but it may be possible to exceed this skew angle.

**East-coast feel**

In New England, four precast companies participated in development of NEXT Beam standards, including Dailey Precast, the producer of the first beams. Each of the NEXT Beam projects let so far has had multiple bidders. With such fabricator interest, pricing will be competitive. Initial cost comparisons demonstrate that NEXT Beams are very competitive with other bridge systems. In some cases, superstructure cost savings can be as much as 30%, depending upon span length.

Bridge owners are greeting the arrival of the NEXT Beam with considerable enthusiasm. They appreciate the improved
durability, competitive cost and design flexibility of the NEXT Beam. Already, the New York State DOT (NYSDOT) and Maine DOT have let projects using the NEXT Beam. All other New England states are open to its use, and in the Mid-Atlantic, owners also have shown interest. Of note, the Pennsylvania Department of Transportation (PennDOT) published a standard drawing in March 2010 for the F Beam (modified to reflect PennDOT design practices), and the New Jersey DOT (NJDOT) has expressed interest in the D Beam for rapid bridge replacement.

Foremost, the NEXT Beam is envisioned as a stringer (i.e., a beam system parallel to traffic), as demonstrated in the first NEXT Beam project in Maine. The project includes two NEXT Beam bridges, the New Bridge over York River and the Station 44 bridge. Designed by Vanasse Hangen Brustlin Inc., the New Bridge will have two 55-ft and five 80-ft F Beam spans, all continuous. Note that on this project the NEXT Beam structure was the low-cost alternative in comparison with Northeast bulb tees. Both of these structure types were designed and permitted in Maine DOT’s contract documents.

The versatile NEXT Beam also can be readily used transverse or skewed to the supported roadway, as in the case of the Queens Boulevard Bridge over Van Wyck Expressway that was let by the NYSDOT in February this year. Designed by Hardesty & Hanover LLP of New York, this project features a very wide, sharply skewed bridge over the wide, heavily used Van Wyck Expressway.

The Queens Boulevard bridge supports will be three walls that run parallel to the expressway below—two abutment walls at the expressway edges and one multicolumn center pier in the median. The NEXT Beams bear upon these walls, spanning transversely across the expressway and skewed with respect to Queens Boulevard. Both simple-span and two-span continuous beams are utilized, designed to act as a simple span under dead load and continuous under live load. The High Bridge Team of Lancaster, Pa. (High Steel Structures Inc. and High Concrete Group LLC) has been chosen by the contractor, ECCO III Enterprises, to supply the NEXT Beams for this project pending contract award by the state of New York.

According to NYSDOT Regional Structures Engineer Harold Fink, P.E., the NEXT Beam was chosen because of lower costs than comparable structure types and superior ability to accommodate utilities.

“The Queens Boulevard over the Van Wyck Expressway carries many utilities, and the NEXT Beam provides flexibility to support utilities in any bay,” commented Fink. “The soffit eliminates the need for deck forms, and the shape is fully accessible for inspection access as opposed to a box beam. Because of these reasons, the NEXT beam is one of the top choices for spans up to about 80 ft—LRFD strength II loading.”

“This efficient option will require minimal or no temporary shoring, resulting in lower construction costs,” added David Tuckman, P.E., principal associate for Hardesty & Hanover. “This option creates a highly redundant system. If a section of the NEXT Beam is damaged, its load path will be redistributed amongst the adjacent tee beams and will not result in structure failure.”

The NEXT Beam also was considered as an alternative solution for the NJDOT’s Rte. 52 causeway bridge. A value-engineering study showed that the NEXT Beams were suitable and 30% more cost competitive than the designed superstructure; however, they were not utilized because of the additional time and cost associated with the redesign. This again indicates, however, that in design-build projects and future design-bid-build projects, the NEXT Beam will provide a cost-effective alternative for bridges with spans less than 90 ft. 

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