New Box Beam Bridges For I-195 In Providence

J.P. Carrara and Sons, Middlebury, VT, supplied 40 skewed end prestressed box beams, up to 80 feet long, for the South Street Main Bridge, and 81 prestressed box beams plus 2 fascia beams, 43 feet long, for Ramp EI. All precast product was cast with HPC concrete, specified by the Rhode Island DOT for durability; in addition, for the first time on a project of this magnitude, Carrara used SCC admixtures to incorporate its casting and appearance advantages.

They also supplied 59 granite clad precast pier panels, the largest being 14’-3” x 14’-10”, and which weighed 70,000 lbs. These were used as exposed stay in place forms for the bridge over the Providence River, which can be seen in the accompanying photo, taken 6-05-05. In addition to the vertical dowel connections from the footings, protruding epoxy coated rebar tie the panels into the total construction.

This was a very large bridge project overall for precast. Schuylkill Products supplied 157 box beams, 45” deep, ranging from 48’ to 101’ long, for approach spans to the main Providence River bridge. Other project credits go to Maguire Engineers, and Cardi Corporation, G.C.
In the early 1970's a unique splice girder bridge was constructed in New York State carrying I-88 over an interchange at Oneonta. The girder section cast by Schuylkill Products, Inc. was a modified 63" deep AASHTO I Beam. Modifications were made to the end blocks of the beams to accommodate the post-tensioning anchorages. The end block is shown in Figure 1 at the left end of the girder. The final span is made up of two separate girders, each approximately 70 ft long, that are erected on a bent and post tensioned to form one continuous girder, about 140 ft long.

This structure is unique in the type of splice that was used. The individual girders were match cast at the splice using precision steel bulkheads. Dowels were then used for alignment with an epoxy used to seal the joint similar to today's modern trapezoidal segmental girder bridges. The dowels can be seen in Figure 2. Notice the space between girders prior to tensioning to allow space for duct splicing. This space is taken up during the post-tensioning phase (one end of the girder is fixed and the other is on a temporary sliding bearing which can accommodate the large movement during post-tensioning). After post-tensioning procedures were complete and the epoxy cured the bent was removed.

This structure designed and constructed in the early 1970's is still in service today.

A present era project fabricated by SPI for B. Anthony Construction Corporation was built some 30 years after the project in Oneonta. The girders were design as modified New England Bulb Tees. SPI substituted the PCEF Bulb Tee with modified end blocks to accept the post-tensioning anchorage system. The individual girders were approximately 81 ft long each with the total structure length being about 162 ft. The girders were erected by Marikina Construction Corp.

The structure has a couple of differences from the structure in Oneonta. First this structure has a center bent that is permanent, verses the Oneonta structure in which the bent was removed. The second significant difference is in the splice. The structure at Oneonta used a match cast splice with steel dowels and epoxy sealing the splice. This structure uses shear keys cast into the splice ends of the girders with a field cast closure pour sealing the splice.

New York DOT currently has in place a high-strength high-performance concrete specified for use in all girders. Spliced girder design represents an economical means to extend the span length of precast, prestressed girders in conjunction with the high strength concrete. Extending the range of P/S girders has been a focus of the FHWA and has resulted in two recent meaningful publications. The first is NCHRP Report 517: Extending Span Ranges of Precast Prestressed Concrete Girders. The second recent publication of significance for the designer is contained in the PCI Bridge Design Manual. Chapter 11 was revised in June 2004 to include the latest design recommendations and research. [PCANY will be holding two full-day Design Workshops on the PCI Bridge Manual early in 2006; the fee to attend will include a copy of the Manual.]

Efficient use of this not-so-new design procedure can economically extend the range of prestressed concrete girders into the range previously occupied by steel or segmental concrete box girders, as so clearly shown in the following article.
Bridge Replacement Wins PCI Award for Bayshore Concrete Products, Figg Engineering, NJDOT, and George Harms Construction Co.

Numerous time- and money-saving design and construction steps were implemented to insure that the twin bridges could be built within budget yet be built to last 100 years. The bid documents were significantly more detailed than is typically the case, enabling the contractor to work directly from them rather than from shop drawings that it would have to create. They included details of rebar bends, geometric geometry, and tendon stressing. For certain elements – the more complex piers and superstructure segments with expansion joints or deviations in their tendon configuration – the documents included the details of those elements as well as electronic files with integrated three-dimensional color drawings.

The southbound side of New Jersey’s Rt. 35 opened for traffic in June ’04, only 15 months from issuance of notice to proceed, and the northbound side will open in September ’05, eight months ahead of schedule. These are incredibly short time frames, considering the bridge’s facts: 3971’ in length, a 440’ match cast main span (an American record) at a minimum vertical clearance of 110’, two secondary spans of 330’ each, approach spans that vary from 142’ to 150’, and 22 precast piers for each of the twin structures. Bayshore Concrete Products Corp. cast all segments in their facility in Cape Charles, VA, and barged them to the site for direct installation.

Approximately 38,000 cy of high durability, high performance 8,000 psi concrete was used to manufacture the precast segments. The piers were constructed from precast concrete hollow box sections that were post-tensioned together. Concrete piers as tall as 100’ were erected in one day, a benefit of segmental technology. Typical precast superstructure segments are 9’-4” in length, and ranged from 40’ to 45’-11” in width and 10’-1” to 21’-1” in height, creating a slender arching appearance, especially in the main spans. A total of 927 superstructure box girder segments were used.

Information for this article came from Bayshore Concrete Products, Figg Engineering, and Civil Engineering Magazine, June 2005.
**FUTURE EVENTS CALENDAR**

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<tr>
<td>September 23-26</td>
<td>NPCA Industry Outlook Conference, Sarasota, FL</td>
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<td>October 11, 2005</td>
<td>PCANY Meetings with NYS DOT Materials and Structures, Albany NY</td>
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<td>October 10-13, 2005</td>
<td>NOWRA Convention, Cincinnati, OH</td>
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<td>October 18, 2005</td>
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<td>Full Day Workshops on PCI Bridge Design Manual, latest edition</td>
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