Establishing Continuity with Precast Concrete Components

by Dr. Henry G. Russell

Continuity over the intermediate supports of multispan bridges may be used:

- to provide a continuous structure for superimposed dead and live loads, and
- to eliminate expansion joints.

The former requires full-depth section continuity involving both negative and positive moment connections. The latter can be achieved with either full-depth section continuity or deck-only continuity; often called a link slab.

For bridges with a cast-in-place concrete deck, negative moment continuity can be accomplished using reinforcement in the deck. Providing negative moment continuity with non-composite precast concrete components is more challenging but solutions that emulate cast-in-place construction have been used as described in the following examples.

Route 103 over the York River

In the Route 103 Bridge over the York River in York, Maine, positive moment continuity was established by extending the strands beyond the ends of the precast concrete beams and bending them upwards into the cast-in-place concrete diaphragm. A 7-in.-thick concrete deck was cast on the beams prior to making the continuity connections. The No. 8 reinforcing bars used to provide negative moment continuity extended from the end of the deck at the interior supports. The negative moment connection over the piers was then made using mechanical couplers because the closure was not wide enough to allow for tension lap splices.

Route 103 Bridge over the York River showing bars extending from the deck. Photo: Vanasse Hangen Brustlin.

Sibley Pond Bridge

The Sibley Pond Bridge in Canaan-Pittsfield, Maine, utilized a full positive and negative moment connection over the piers. A special detail for the positive moment connection was developed using a steel end plate and ASTM A706 weldable reinforcement. The steel plate was cast flush with the end of each precast concrete girder and anchored into the girder using two No. 9 bars welded to the inside face of the plate. Two No. 9 reinforcing bars with a 90-degree hook were welded to the outside face of each plate. Overlapping hooked bars from beams on opposite sides of the pier formed the positive moment connection using a cast-in-place concrete diaphragm.

Negative reinforcement was extended out of the ends of the precast concrete beams. The negative moment connection was made using mechanical couplers to field splice the reinforcing bars between adjacent precast concrete beams at the piers. This required the precaster to align the bars from adjacent beams to tight tolerances to ensure the couplers would line up.

Upton Road over Bear Creek

The Upton Road over Bear Creek Bridge, Jackson County, Ore., was Oregon's first continuous-deck, precast concrete, bulb-tee bridge. The bridge is on a horizontal alignment that transitions from a tangent to a curve using straight beams. Consequently, reinforcing bars projecting from the top flanges of the precast concrete bulb tees in adjacent spans are not parallel. To provide the negative moment continuity, bars with 90-degree hooks on both ends were lap spliced with the bars projecting from the top flanges.

Link Slab

With the link slab approach, the longitudinal deck reinforcement is extended into the link slab and spliced in a similar manner to the previous examples. Continuity is established for both top and bottom deck bars. Two important details of the link slab are to provide a bond breaker between the deck and a portion of the precast concrete beams and to ensure that no shear connections are provided between the link slab and the beams. This provides a greater length to accommodate the rotation at the ends of the precast concrete girders. A

Sibley Pond Bridge showing the use of mechanical couplers. Photo: Parsons Brinckerhoff.

EDITOR'S NOTE

More information about the three projects described in this article is available as follows:

- *Route 103 Bridge over the York River:* ASPIRE *Spring 2011, p. 46.*
- *Sibley Pond Bridge: Proceedings of the PCI 2012 Convention and National Bridge Conference, Paper No. 39.*
- *Upton Road over Bear Creek Bridge: Proceedings of the PCI 2012 Convention and National Bridge Conference, Paper No. 24.*