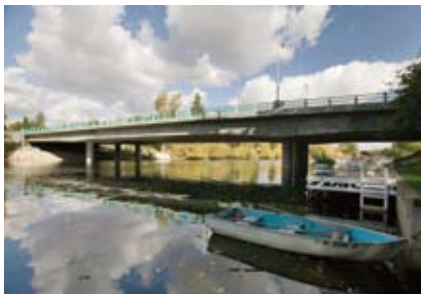
Although precast concrete bulb-tee girders are used most often, unique designs have been created for special situations.

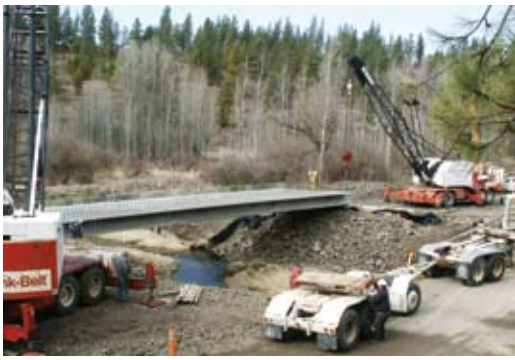
Spokane County Adapts to Project Needs

by Neil Carroll, Spokane County, Washington

The Harvard Road Bridge near Spokane, Washington, features three precast concrete spans to minimize the number of piers. The bridge also spans the adjacent Centennial Trail.



To open up the waterway, the Argonne Road Bridge features cast-in-place concrete box girders, which are used in the end spans and extend over the piers to support the precast concrete drop-in girders in the center span.



The Deep Creek Bridge uses thin-flange precast concrete deck bulb-tee girders with a cast-in-place concrete deck. It is the county's first with integral abutments.

The bridges that we build in Spokane County, Washington, use a variety of precast concrete elements to allow us to be creative in our designs. The majority of the 162 county bridges involve water crossings, with the largest bridges spanning the Spokane River. This presents a variety of challenges. Our definition of a successful project is one that balances the structural, environmental, and functional elements.

Our larger bridges are 450-ft long and incorporate main spans of about 160 ft. These structures are typically continuous for live loads and have been framed with both spliced girders and a combination of cast-in-place concrete box girders and drop-in precast concrete elements. The bridges often are supported on drilled shafts to ensure adequate support for critical scour conditions.

The system that we favor for bridges in the 80- to 120-ft range uses precast, prestressed concrete thin-flange deck bulb-tee girders with a 7-in.-thick cast-in-place deck in a simple-span arrangement. The girders have a top flange width equal to the girder spacing and require a cast-in-place deck. Flange widths are usually in the 6- to 7-ft range. In this system, girder erection is streamlined because welded ties between adjacent girder flanges are not required and difficulties associated with leveling the traditional deck bulb-tee girder are eliminated. In addition, the girder flanges act as the deck formwork. This speeds up construction of the deck, as no wooden forms need to be built or removed. Our contractors appreciate both time-saving aspects. As the owners, we appreciate that the cast-in-place concrete deck eliminates the maintenance associated with joints in the riding surface. We promote this as a plus to our permitting agencies, as a good-faith effort to get projects constructed within tight time windows and to minimize concrete spills into the waterways. The foundations consist of either driven piles or spread footings, depending on geotechnical and scour conditions.

The use of precast concrete represents a significant upgrade during bridge replacement projects. Often, we are replacing older timber bridges that have span lengths of 40 ft or less. After removing the deteriorated bridge, we cut back the banks on both sides to create a larger hydraulic opening. This also allows better blending with the site. We then replace the shorter span bridge with a much longer precast concrete bridge, which keeps the piers out of the water and creates less environmental impact.

Unique Design Examples

Every project is unique, so we use the design approach that is most appropriate. One of our most dramatic projects spans the Spokane River at Harvard Road near the Centennial Trail, a recreational pathway that follows the riverbank. The design, which incorporated the trail's path into its structure, features eight lines of precast, prestressed concrete spliced girders of five segments each.

The Argonne Road Project, constructed in 2004, was built in two stages. The 339-ft-long, three-span bridge used 89.5-ft-long cast-in-place box girders for the end spans. The box girders extended continuously over the piers, and 100-ft-long precast concrete girders were dropped into the center and then post-tensioned to form a continuous structure. This design allowed us to open up the waterway for better viewing and access.

We are currently constructing the Deep Creek Bridge replacement. This 88-ft-long bridge is framed with thin-flange bulb-tee girders composite with a 7-in.-thick cast-in-place concrete deck. The 38-in.-deep girders have flange widths of 6 ft 1¾ in. They were cast in a traditional deck bulb-tee girder form but instead of casting a 6-in.-thick top flange, a 2-in.-thick flange was used. This bridge is our first with integral abutments, and we will be monitoring its performance with an eye toward eliminating bridge bearings in future designs.

At present, we are conducting framing studies for yet another replacement bridge over the Spokane River, using the relatively new Washington State Department of Transportation "supergirders." With contemplated main spans in the 180-ft range, we anticipate reduced substructure costs and a shortened construction schedule.

The options provided by the numerous precast girder shapes available in Washington State allow us a great deal of flexibility as we strive to meet the challenges that we face in creating new bridge designs.

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