Porter Creek Bridge

by Farshad Mazloom, Kie-Con

Aerial view of stage I construction, with new girders flanking the existing bridge. All Photos: Kie-Con.

Porter Creek Bridge was advertised for public bid based on a single-span, cast-in-place concrete box-girder bridge in December of 2012. Contract was awarded in early 2013 with a tight contract schedule, not considering the anticipated heavy rain during the winter season. The bridge was opened to traffic in 2014.

The new bridge was designed to replace a five-span concrete bridge built in 1935. The precaster proposed using seven, 78-in.-deep by 160-ft-long wide flange girders. These girders are, to date, the longest non-spliced precast concrete girders in California. The precast concrete girder solution eliminated the need for any falsework in the creek, which is an environmentally sensitive habitat. This solution allowed the bridge work to continue during the annual environmental-hold period, which starts on October 15 of every year. A major key to the success of the project was how quickly the calculated decision was made by the general contractor, owner, and engineer to approve the value-engineering proposal for the bridge.

All girders set for stage II, after removal of the old bridge.

Design

During the value-engineering design phase, it was discovered that the girders had to travel under an existing historical monument just 1 mile west of the bridge; this tight headroom was the major factor in determining maximum height of the girders. Once the girder height was determined, it was just a matter of simple calculations to design the quantity of girders

Stage II truck waiting to offload.

needed for the bridge.

A detailed study of the transportation route was done by the transportation company in order to ensure the stability of the girders during shipping. California is known for its short and tight radius freeway ramps. The routing to the project site consisted of

- 7 miles of narrow and winding minor roads,
- 100 miles of seven major congested freeways, and
- numerous on and off ramps.

It was determined that ramps along the route have a 10% cross slope. Analysis was done to ensure that these girders did not become unstable as they enter and exit the freeway ramps. The wide flange girders have a greater lateral moment of inertia, as well as having their center of gravity toward the bottom of the girder.

At the precaster's option, all 56 of the 0.6-in.-diameter prestressing strands were designed as straight strands, with 18 strands debonded for lengths up to 40 ft. The amount of prestressing force in the Porter Creek girders necessitated 6 ksi concrete at time of transfer and 9 ksi concrete at final. A self-consolidating concrete was used for these girders, which reached a strength over 6.5 ksi in 10 hours and exceeded 10 ksi in 7 days.

During design, the precaster and designer increased the gap between the end of the girders and vertical face of the abutment back walls to 6 in., which also reduced the girder length to 159 ft. This provided more field tolerance which was needed due to the extreme length of these girders. The 6-in. gap was then filled with cast-in-place concrete, as were the end diaphragms. The majority of the reinforcement used in the girders was welded-wire reinforcement.

Transportation, Installation

Four girders were initially shipped to the site, with two installed on each side of the old bridge. One of the exterior girders was directly under a power line. This required a well-detailed plan established by the general contractor and coordinated with the power company. The power line was de-energized during the installation of the girders. The deck was cast on the two pairs of girders, which allowed traffic to be shifted onto the new structures for the second stage of construction. During the second phase, the old bridge was demolished and the final three girders were installed to complete the final structure. Stay-in-place steel pan forms were used to support the deck slab. A

Setting last girder for stage II.

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EDITOR'S NOTE

For more information on the Porter Creek Bridge, see the October 2014 article published in Concrete Products at www.concreteproducts.com/features/8608-bulb-tee-sunset-kie-con-ushers-california-wide-flange-girder-into-mainstream-specs.html