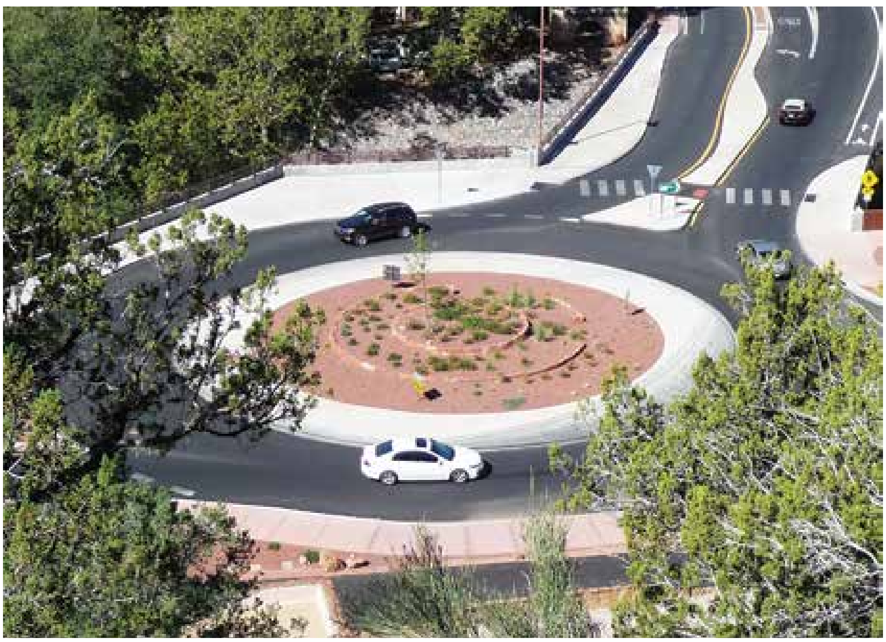
Unconventional Loadings on the SR 179 Oak Creek Bridge

by Christopher A. Labye, AECOM



Completed SR 179 Oak Creek vehicular bridge. Photo: Steve Boschen.

State Route (SR) 179, in Sedona, Ariz., traverses a uniquely scenic area visited by hundreds of thousands of tourists each year. As the main route connecting the business and residential communities of greater Sedona, SR 179 is also an important intercity link for residents, commuters, and commercial traffic of the Sedona/Verde Valley region.

To address anticipated traffic volumes, improvements to SR 179 included the enhancement of the roadway by improving traffic, pedestrian, and bicycle movements. Part of the overall enhancement of the corridor included the replacement of an existing bridge over the perennial Oak Creek. Because of tight right-of-way constraints, the new bridge needed to incorporate a large portion of a new roadway roundabout within the first span of the three-span, precast, prestressed, concrete box girder structure.

Unusual Design of Girders

The 178-ft-long bridge is comprised of three spans with lengths of approximately 62, 57, and 55 ft. Placing the roundabout in span 1 adjacent to the more-conventional roadway configuration in spans 2 and 3 introduced several design challenges.

To address the structural load disparities, an expansion joint was placed at the first pier to mitigate structural incompatibilities that would have been introduced with continuity. Because the deck in span 1 varies in width from 146 ft at abutment 1 to 126 ft at pier 1, the first eight (of 24 total) BIII-48 box beams are splayed.

The unique superstructure configuration of splayed box beams with variable skews at pier 1 was complicated further by live load configurations. The roundabout in span 1 requires traffic to traverse the span in both longitudinal and transverse directions—potentially allowing several heavier axles of trucks to align along the box beams in a way that could not be accounted for using traditional AASHTO distribution factors. The splayed box beams, therefore, were analyzed using two distinct sets of live load considerations:

- Traditional analysis using AASHTO-prescribed distribution factors
- Tailored live load vehicle that simulated the presence of live load configurations traversing the bridge in a transverse direction

To simulate the loads in the transverse direction, truck patterns across the bridge were modeled with AutoTURN to ascertain potential locations of point loads. CONSPAN was then used to simulate behavior using these point loads with wheel loads conservatively acting on the box beams that were traversed.

Ultimately, the traditional load from the HS-20 truck governed; however, this unusual bridge superstructure configuration does highlight the need for load considerations for bridge structures that accommodate unusual geometry not necessarily covered by the AASHTO design specifications.

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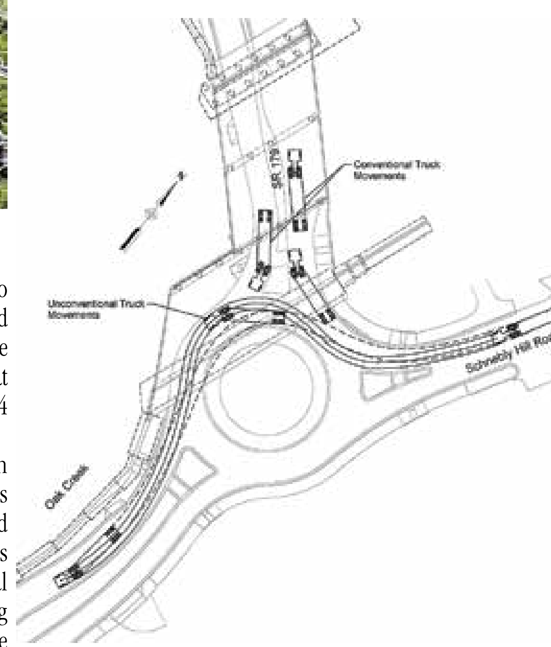

Unconventional live load configurations are shown. Figure: AECOM.

EDITOR'S NOTE

A more detailed description of this bridge is available at www.aspirebridge.org. Click on "Resources."