

# Above-Grade, Below Estimate

BY MATT JOHNSON, P.E.



TransSystems

## ONCE IN A GREAT WHILE, SOMETHING ACTUALLY COSTS LESS THAN ESTIMATED.

In early July 2006, the low bid for a 785-ft steel viaduct in southeast Omaha, Neb. came in at \$7.4 million—or 6.4 percent—under the engineer's estimate (this price also included sewer line and manholes). When completed this September, the new viaduct will connect 13th Street with Gibson Road, crossing over the main-line tracks of the Burlington Northern Santa Fe railroad, which lead into the railroad's Omaha yard. It will provide access to an industrial area currently served by an at-grade crossing that closes frequently, resulting in blocked vehicle back-up and delayed emergency vehicles.

## Structural Overview

The viaduct is a two-lane, four-span structure primarily measuring 55.5 feet in width, with the first span flaring further out to accommodate a right turn lane for exiting the viaduct. The four span lengths measure 172.5 ft, 220.25 ft, 220.25 ft, and 172.5 ft. The south side of the viaduct has an attached 10-ft trail with level landings to accommodate American Disabilities Act requirements.

The superstructure consists of a welded-plate, five-girder cross section, with girders spaced on 12-ft centers, except for span 1, where an additional girder line accommodates the turning lane. Skew for the two abutments are about 12° and 38° left ahead. The three piers have no skew.

The concrete deck is a constant 8 in. thick, plus a 0.5-in. sacrificial wearing surface. Pedestrians are protected by a full concrete barrier with an attached steel handrail on top between the trail and traffic lanes. An aesthetic welded-wire fabric fence borders the outside of the trail.

The substructure components consist of expansion abutments and three-column frame piers. The piers have column diameters

of 4.5 ft and are supported on piles and pile caps. Piles also support Abutment No. 2, but three 4.5-ft-diameter shafts drilled into a bluff support Abutment No. 1 to reduce vibration and the risk of slope failure of the bluff.

The National Steel Bridge Alliance ran a preliminary design during the initial project phase. TranSystems designed the final structure, using AASHTO-LRFD third

edition, 2004, and DESCUS software was used to design of the curved girders. The maximum live-load deflection—caused by the standard AASHTO truck and lane load combination—occurs in the outside girder of span 1 and is about 3.25 in.

**Hybrid Steel Superstructure**

The superstructure is a continuous, hybrid, welded-plate girder design fabricated entirely of weathering steel by PDM Bridge. Positive and negative moment flanges are 50 and 70 ksi steel, respectively. Flange sizes range from 1x18 in to 2x24 in. Webs generally are 8 ft deep with the exception of span 4. In this area the viaduct crosses a spur track serving a local business. The railroad's overhead clearance requirements dictated a web-depth reduction to 6.5 ft over this track. The web thickness is 0.75 in. for the deeper sections and 0.625 in. for the shallower section over the track.

Field splices were designed to limit the maximum section to 142 ft. PDM Bridge has the option of adding additional splices to accommodate shipping.

Since the viaduct is a curved structure, the diaphragms serve as primary members according to AASHTO criteria. The diaphragm spacing was held to a maximum of 25 ft for the outside girder, and the diaphragms follow a radial configuration, resulting in a spacing of about 22.5 ft at the inside girder. TranSystems designed the diaphragms as K-frames with a top chord and diagonals, each being 5x5x1/2-in. angles. The bottom chord is a MC10x28.5 channel section. The pier diaphragms have slightly heavier sections.

The girders rest on pot bearings at each of the three piers and TFE fabric pads at the abutments. Strip seals at each abutment accommodate expansion. MSC

*Matt Johnson is a senior project engineer with TranSystems.*

**Owner**

City of Omaha, Neb.

**Consultant/Designer**

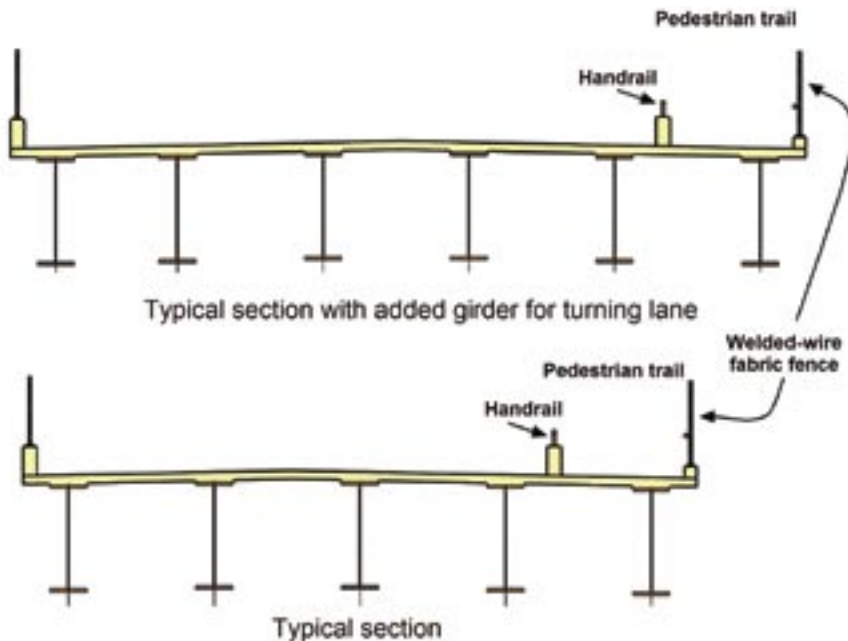
TranSystems, Omaha

**Fabricator**

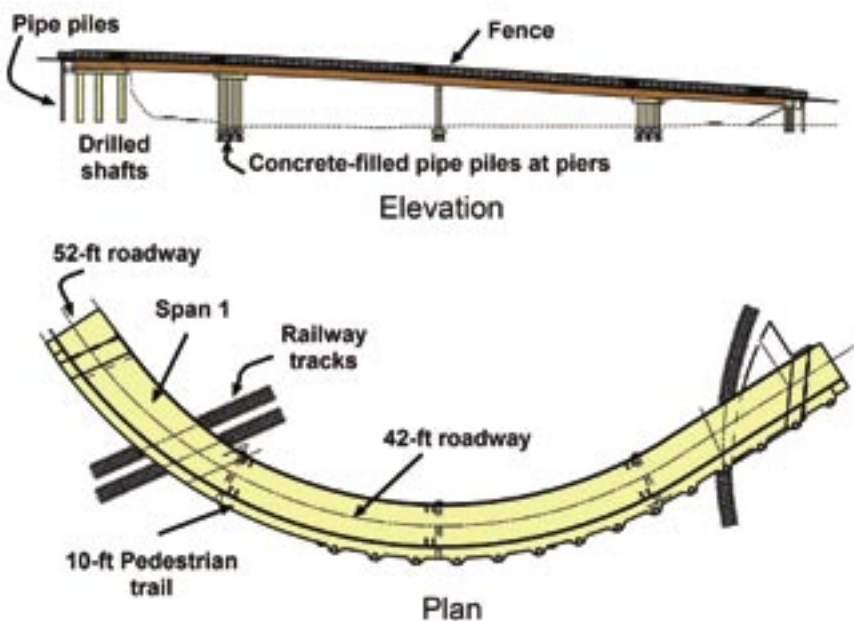
PDM Bridge, Eau Claire, Wis. (AISC member)

**Contractor**

Hawkins, Omaha



The hybrid weathering steel welded plate girders are typically 8 ft deep.



The viaduct includes a pedestrian trail along one side that complies with ADA requirements.