Best Bridge with Spans Greater Than 135 feet (Co-Winner)

**DESIGN CHALLENGE:**
Use the most economical design possible to create a 527.5-foot replacement bridge spanning a viaduct containing three railroad tracks and a major highway. A haunched, steel-plate girder design was originally designed, with no modifications to the profile-grade line, vertical-clearance limits, width or substructure location allowed in any alternative proposals. A 52-degree skew complicated the design.

**US-30/N-92 Clarks Viaduct**
Clarks, Neb.

**PRECAST SOLUTION:**
Designers value-engineered the original design to feature a four-span precast concrete structure (with spans of 100, 151, 148 and 128½ feet). This change saved approximately $100,000 in construction costs.

To match the original steel-girder depth, NU 1100 girders with a 43.3-inch depth, modified to 50 inches, were used. The girders’ top flange was narrowed from 4 to 2 inches in width to save weight. The concrete used in the modified NU-1100 girders had a release strength of 6,500 psi and 28-day strength of 8,500 psi. The deck consisted of an 8-inch uniform slab haunched at the supports with a 28-day strength of 4,000 psi.

To overcome excessive negative moments over the piers, a haunched section was created by first creating a cast-in-place haunched beam over the top of the pier cap. The haunched beam gave the superstructure extra depth at the piers and reduced the concrete stress due to negative moment in the bottom flanges of the girders. Each haunched beam was 4 feet wide, 25’8” long and tapered in height from a minimum thickness of 2 feet at the centerline of the pier to 6 inches at the ends of the beam. The ends of the girders overlap 2 feet onto the haunched beam.

The four 1 1/8-inch-diameter, high-strength threaded rods embedded in the girders were coupled through a bolted connection to make the girders continuous due to deck weight. Once the threaded rods were connected, concrete was cast over the entire area of the haunched beam to the girders’ tops. The haunched beam acted compositely with the pier block as well as the deck slab to resist the negative moments due to deck slab weight, superimposed dead load and live load. To minimize the effects of the heavy skew, the Clarks Viaduct was designed without the use of transverse pier diaphragms.

**Engineer:** Tadros Associates LLC, Omaha, Neb.

**Owner:** Nebraska Department of Roads, Lincoln, Neb.

**General Contractor:** Hawkins Construction Co., Lincoln, Neb.

**Precaster:** Concrete Industries Inc., Lincoln, Neb.

**Judges’ Comments:**
“This is an extremely innovative solution that allows girders to be extended in their span range. The use of cast-in-place girders at the bents and the provision for full continuity of the girders for both deck and live loads is efficient. It’s a very innovative solution to stretch beams out a very long way. This solution pushes the limits with regard to slenderness and wide-girder spacing. We think we’ll see a lot more of this in the future.”