1996 Merit Bridge Award: Medium Span Ramp Y at I-95 Davie Boulevard Interchange

*Please note that red text denotes an AISC member

Project Team

Designer:
Beiswenger, Hoch & Associates, Inc.
North Miami Beach, FL

General Contractor & Fabricator:
Balfour Beatty Construction, Inc.

Erector:
Derr Construction Co. *

Owner:
Florida Department of Transportation, District IV

Project Data

Steel wt./sq. ft. of deck:
47 lbs.

Cost:
1.6 million

Steel Tonnage:
438

Judges Comments:

"The double curvature and single box design creates a beautiful but economic design"

A CONTINUOUS COMPOSITE SINGLE BOX STEEL GIRDER BRIDGE with a cast-in-place concrete deck proved to both economical and attractive in a new connection from Broward Boulevard to I-95 in Fort Lauderdale. The three-span bridge crosses several roadways and has a double (reverse) curvature with a 2 degree curve to the left at the beginning of the bridge and a 4 degree curve to the right at the end of the bridge.

The bridge features a trapezoidal box girder with a 9'-deep web. Two intermediate columns are 6' in diameter with a footing supported by 18" square prestressed concrete piles. At both ends of the bridge, the superstructure is supported on stub abutments with wrap-around proprietary retaining walls. Single circular pot bearings have been utilized as intermediate supports.

While the problem of transverse live load distribution does not arise in the case of a monobox, the load factor design for the box girder was still not a straightforward process. Besides the shear lag of the wide bottom flange, the main problem was designing the stability of the compressed elements of the box. Therefore, the stability of the webs throughout its length and bottom flange when in a zone of negative bending moments had to be investigated. To solve the problem, the designers conducted their own studies in shear lag and stability. The stability study was based on second order theory and was used to check the design based mainly on the Report No. FHWA-TS-80-205 for the design of long-span box girder bridges.

In order to reduce tension, the single box girder was positioned, with respect to the bridge cross-section, to achieve a center of gravity of the dead load as close as possible to the shear center of the box. This ensured minimum torsion. However, torsional moments existed and were transmitted by the box to both ends of the bridge. Hence, special end

cross-beams attached to diaphragms were provided to transfer the torsional moments to the abutments. Crossbeams also served to anchor negative vertical reactions.

For stability reasons, and to avoid weld cracking during transport and erection, lateral bracings were provided at the top flange level. To prevent distortion of the box, internal truss diaphragms at 22' maximum were provided. Also, top and bottom struts were staggered between the truss diaphragms.

The bottom flanges of the box wee stiffened in the zone of negative moment by providing longitudinal stiffeners. Tension members, including girder splices, were designated as fracture critical members. The field splices were located near inflection points on either side of the piers. The maximum fabricated box length was 133' and weighed about 89 tons.

Because of the bridge's prominent location in a heavily traveled area, aesthetics were very important. The combination a single box girder in reverse curvature along with constant depth and a long span contributed greatly to visually pleasing appearance. The wrap-around retaining walls at both ends of the bridge further enhance its appearance.