

Merit Award: Medium Span

S.R. 417 SOUTHERN CONNECTOR EXTENSION RAMP A/I-4



The SR 417 Southern Connector Extension Ramp A over I-4 bridge provides the final link of this six mile limited access toll connector road between Central Florida's GreeneWay around Orlando and Interstate 4. This heavily skewed bridge posed both engineering and construction challenges. The design for this bridge was accomplished using independent and staggered columns at each pier to support the twin steel box girder bridge. This 4-span structure is horizontally curved over two-thirds of its length at a radius of 1,273'.

Explanation of Design Concept

The grade-separated structure is a 628'-long ramp with four spans that carry two lanes of traffic, and twin steel box girders with composite concrete deck. Single columns independently support the two box girders at each of the three intermediate piers. To accommodate the skew between this ramp and Interstate 4, the columns were staggered at each of the three intermediate piers. Because of the curve, the stagger varies from 22' to 35', causing the span lengths to differ for the two boxes. For the left box the spans are 157', 204', 181' and 86', and the spans for the right box are 122', 213', 184' and 108'.

To stagger the columns, the two steel box girders were framed together with full depth steel plate girder diaphragms at

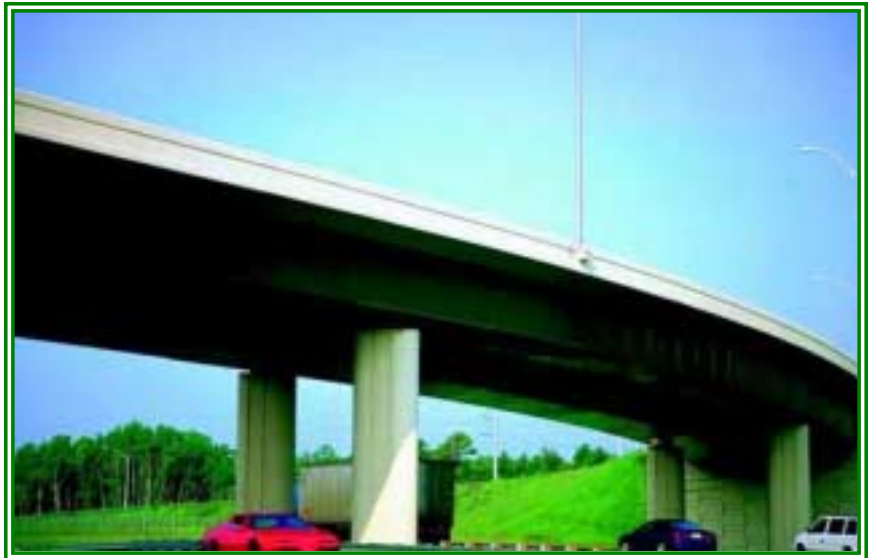


the support points, midspan of span 1, and at third points of spans 2 and 3. Single multi-rotational bearings were used at each support for each of the box girders. This system allows the box girders to deflect longitudinally and rotate transversely at each of the intermediate support points. To resist this transverse bending, torsionally strong steel box girders are used, which makes the entire bridge superstructure act as a large horizontal frame, pin-supported at the abutments and pier columns. The box girders are 6' deep and 12' wide at the top of the webs.

The steel box girders were fabricated in six field sections and bolted field splices used between sections. The size of the field sections was specially designed in order that they could be trucked from the fabrication yard to the job site. Limiting values for length, width and weight were set at 130', 15', and 55 tons, respectively. Due to the curvature of the boxes, the sections with wider top flanges were limited by the width, while the sections with smaller top flanges were limited by length. The larger negative moment sections of the piers were also limited by weight. Sections varied from 80' to 128' in length, from 13' to 15' in width, and the heaviest field section weighed approximately 50 tons.

PROJECT ECONOMICS

Cost savings for this curved steel box girder bridge were realized on several levels. Preliminary studies were undertaken to determine the cost advantages of a twin box structure versus 4 individual steel plate girders. Even with a 10% premium placed on the steel box girders, the twin steel box girders were shown to be more cost effective. With the superstructure utilizing longer and lighter spans, the foundation costs were minimized. In addition, the superstructure acting as a large pin-supported horizontal frame, the substructure was greatly



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Owner:
FDOT-Turnpike District

Designer:
URS Greiner Inc., Tampa, FL

General Contractor & Erector:
Hubbard Construction Company, Orlando, FL

Detailer:
Tensor Engineering, Indian Harbor Beach, FL
(NSBA Affiliate Member)

Fabricator:
PDM Bridge Corporation (NSBA Member)

simplified. This brought savings in both materials and construction time of the foundations. The erection of the superstructure was also simplified, with only two boxes to be set over busy Interstate 4.

AESTHETICS

The twin steel box girder bridge type was chosen not only for its economic benefit, but also because of its aesthetic appeal. The steel superstructure was painted a hunter green, with the remaining elements, including the MSE walls, given a tan finish in order to match the colors of an adjacent community development.