

in one piece and placed in the forms. Additional longitudinal reinforcing bars were used in the webs and bottom slabs of the girders to address lifting and handling operations. To allow quicker girder removal from the forms, stresses were checked considering only the reinforcing steel, allowing the bottom flange tendons to be stressed in the yard later once the required concrete strength was achieved.

Shipping of the girders (maximum weight of 340 kips) was by multi-axle trucks to the construction site about 40 miles from the fabrication yard. Girders were shipped at night to arrive early in the morning so that placement could occur during lane closure windows.

Girder segments were supported at each end by steel shoring towers and, at the ends of the units, by an abutment or pier. Segments initially spanned over permanent piers and were adjusted to the necessary elevations. Bearings were then grouted in at the permanent piers and 2-ft, cast-in-place closure joints that accommodated construction tolerances were made between segments. Post-tensioned diaphragms were cast at the piers to tie the two-girder system


together and transmit loads to the bearings.

One of the continuous post-tensioning tendons was stressed in each web prior to casting a lid slab, which closed the top of the boxes for torsional rigidity. This initial post-tensioning prevented cracking in the closure placements when the 4¾-in. lid slab was subsequently cast on permanent metal deck forms. Thereafter, the remaining three post-tensioning tendons were stressed. After post-tensioning and grouting was completed, shoring was removed and the girders were ready for placing the deck slab as with any other composite continuous girder system.

Summary

The design and construction of the SR 417 and Boggy Creek Road interchange has introduced a new girder type to the state of Florida. Where curved structures are required and aesthetics are important, the PCI U-girder provides an alternative to the steel trapezoidal box girder, increasing competition and allowing for more competitive pricing. This new system brings the advantages of standard precast concrete construction, including durability, quality and speed of construction, and

minimal disruption to the area below the bridge, to curved concrete U-girders.

Mr. Donald W. Budnovich, resident engineer for CFX comments, "The Central Florida Expressway Authority is excited to provide our customers and the Central Florida Region a more efficient means to enter the Orlando International Airport through the construction of this interchange. The innovative design employing the post-tensioned curved concrete U-girders, provides a durable and cost-effective project that we expect will serve Central Florida for decades to come." 

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EDITOR'S NOTE

For more information on the design consideration used for this project, see the article on p. 30.

AESTHETICS COMMENTARY

by Frederick Gottemoeller



Multi-level, high-speed interchanges between limited access roadways can be visually confusing places. Cars are moving fast along continuously curved paths, and paths merge and split as they go. The piers and abutments of the various bridges limit drivers' views of the paths ahead. Even if their views meet the minimum sight distances set by safety criteria, drivers are still left with a sense of unease about what lies ahead. If some of the intervening piers and abutments can be eliminated, drivers can better see through the interchange, alleviating their unease.

So, the first benefit of the precast concrete curved U-girders at Boggy Creek is that they allow longer spans and thus fewer piers. The piers are set well back from the edges of the under-passing roadways. The piers themselves, for the most part, use single stems that have minimal effect on the view. Drivers can see a long way ahead, with no interference from intervening piers. As an additional benefit they can better enjoy the passing landscape.

The second benefit of the precast concrete curved U-girders is that they are seen as one long, continuous curved girder. In a high speed highway environment, visually simpler is almost always visually better. The pier details enhance this result. The girders sit up above the pier caps on low concrete blocks. From many angles you can actually see sky between the bottom of the girder and the top of the pier caps (See cover photo). The bearings are so small compared to the length of the pier caps that the girders seem to be supported on pinheads. The full sweep of the girders is visible. They almost look like they are floating on air.

As a further enhancement, coating the girders with a color that contrasts with the piers and deck emphasizes the curvature and continuity of the girders. To top it all, the color chosen is an excellent complement to the lush Florida vegetation.

High-level flyover ramps are always the most prominent feature of these interchanges. It is always worthwhile to give some thought and, yes, even spend some money, to improve their appearance. The appearance of the whole interchange will benefit. And where, as here, the interchange is a gateway to a whole region, improving the appearance of the interchange will enhance visitors' impression of the entire region.