

# Precast Concrete Pier Shells in Segmental Bridge Design

by Zach Godsell, McNary Bergeron & Associates

In precast concrete segmental balanced cantilever construction, the pier segment is most often produced in a casting yard and erected on bearings and falsework. Alternatively, cast-in-place concrete pier segments have been utilized for longer spans or in areas of high seismicity where a monolithic connection to the column provides a more economical substructure design.

Precast concrete pier shells with cast-in-place diaphragms can be proposed as a substitute for cast-in-place pier segments. Pier shells are a hybrid of fully precast and cast-in-place construction, and combine their typical advantages and disadvantages.

### Advantages

- A monolithic connection is provided between the superstructure and column for incorporating seismic design details. The integral pier column connection also provides overturning stability for the partially erected cantilever.
- Typical segment forms can be used to produce the shell segments in the casting yard. These shells are similar in weight to typical segments.
- The cantilever is a single match-cast unit, so no closure pour is required between the pier segment and first typical segments.

### Disadvantages

- Reinforcing details are complex and have small tolerances. Coupled and headed reinforcement is utilized to

reduce congestion in the diaphragm.

- Diaphragm concrete and reinforcement are placed in difficult conditions at the top of a column.
- The erection speed falls between that of fully precast piers and cast-in-place concrete construction.

### Erection Sequence

With precast pier shells, the fabrication and erection sequence is as follows:

- The pier shell is fabricated in the casting yard using either a unique form or the typical segment form with minor modifications.
- The shell is erected on the column and supported temporarily using falsework. It is positioned for line and grade, and locked into position.
- The diaphragm reinforcing cage is placed in the pier shell. The forms for the diaphragm are secured and the diaphragm cast.

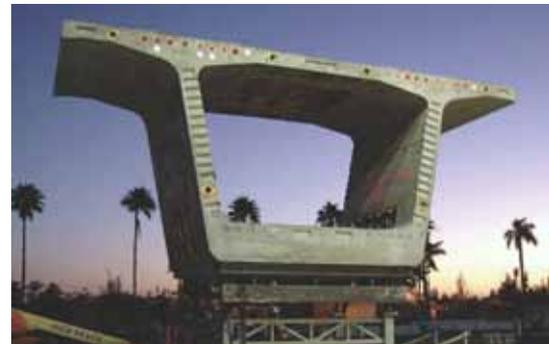
### Conclusion

Pier shells can provide advantages over other methods for precast concrete balanced cantilever bridges, particularly in seismically active areas where an integral pier column connection is required for design.

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### EDITOR'S NOTE

*Pier shells were used in two projects featured in this issue. See The Miami Intermodal Center—Earlington Heights Connector on page 26 and The Westbound Nalley Valley Interchange on page 22.*



*Pier shell segment cast for the MIC-Earlington Heights Connector in Miami, Fla. Photo: McNary Bergeron & Associates.*



*Diaphragm cage installation for the LBJ "High Five" in Dallas, Tex. Photo: McNary Bergeron & Associates.*

*Construction of Ramp SW over I-5 in Tacoma, Wash. Photos: Guy F. Atkinson Construction."*



*Shell segment erection.*



*Diaphragm cage and column reinforcement.*



*Completed diaphragm and monolithic pier connection.*