MEMORANDUM

Texas Department of Transportation

TO: District Engineers **DATE:** December 13, 2002

FROM: Mary Lou Ralls, P.E.

SUBJECT: TxDOT Box Beam Standard Drawings (English)

New prestressed concrete box beam standard drawings with an issue date of December 2002 are posted at the TxDOT web site and available for immediate use. These include:

- Supporting standard drawings for 20, 28, 34, 40-inch deep box beams using 5-inch cast-in-place slab or 2-inch ACP overlay, and
- Substructure and superstructure standard drawings for a 24-foot roadway width using 20-inch boxes with no skew. Substructure and superstructure standard drawings for other roadway widths, beam depths, and skews will be considered in the future.

Attached is a list of key issues for use with these standard drawings.

These and other standard drawings are available from the Bridge Standards (English) web pages in MicroStation® "dgn" and Adobe® Acrobat® "pdf" formats. Please distribute this information to the appropriate district staff and area offices as well as those consulting engineers working on TxDOT projects.

If you have questions or comments concerning these new standard drawings, please contact Michael Hyzak, P.E., at (512) 416-2184 or Jon T. Ries at (512) 416-2191.

Note: Original signed by Mary Lou Ralls

cc: Administration
Division and Office Directors
Directors of Transportation Planning and Development
District Bridge Engineers
Federal Highway Administration
Bridge Division Employees
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Considerations for Box Beam Standard Bridges
Bridge Division, TxDOT
December 13, 2002

The following issues should be considered when using TxDOT's December 2002 Box Beam Standard Drawings.

Advantages/Disadvantages

Box beams are useful for addressing applications where vertical clearance is restricted and for expediting construction. Box beams are typically higher in cost than other conventional prestressed concrete beams due to the complexity of box beam fabrication.

ACP Overlay versus Cast-In-Place Slab

Both Asphalt Concrete Pavement (ACP) overlay and composite cast-in-place slabs are offered as toppings for box beams. However, cast-in-place slabs are recommended because box beams with ACP overlay generally have poorer long-term performance and poorer ride quality. It is recommended that only bridges with low ADT have an ACP-only topping.

Topping with ACP is faster than topping with concrete. However, current Special Provisions to Item 420, "Concrete Structures", have greatly reduced the amount of time needed to construct and open bridges using cast-in-place slabs. Both ACP overlay and cast-in-place slabs require concrete in the shear keys and end diaphragms.

Bridges topped only with ACP require post-tensioning in the transverse direction and a two-course surface treatment applied on top of the box beams prior to placement of the ACP to serve as a moisture barrier.

When widening existing structures, like topping is recommended.

Flares and Horizontal Curves

Box beams are generally not appropriate in flaring situations or horizontal curves and, therefore, the standard drawings do not reflect details for these applications.

Skews

The standard drawings reflect a maximum skew of 30 degrees because box beam bridges built with skews demonstrate beam twist and uneven bearing, especially when topped with ACP.

Bearings

Elastomeric pad sizes have changed in plan area, height, and arrangement of laminations. Also, the method for marking pads has been improved to help ensure pads are installed at the correct location and orientation.

Joints

Some previous box beam bridges had “fixed joints” with an abutment backwall cast directly against the ends of the beams and the space between beam-ends at most interior bents doweled and filled with CIP concrete. Such joints have been replaced by details similar to current prestressed I-beam construction practice. Beam-ends are nominally 3” from the face of an abutment backwall or centerline of bent. Blockouts of 7” x 12” in the beam ends permit the placement of conventional armor or sealed expansion joints where necessary, as well as “poor boy” continuous joints at interior bents. A detail for an optional “fixed” abutment is provided in the form of a simple backer rod with silicone seal that can accommodate a unit length up to 150 feet. In addition, an optional detail for a longitudinally restrained joint is included to provide fixity relative to an interior bent in the rare case of steep grades or long units.

Rail Anchorage

Bridge railing standard drawings no longer include anchorage details for box beam bridges. Therefore, exterior rail anchorage details are provided in the Box Beam Rail Anchorage Details sheets. Rail anchorage hardware for most rail types has been embedded in the beams on slab versions to improve the strength of the connection. On overlay versions, the beam flange thickness has been locally increased to achieve a similar improvement in connection strength.

Beam Fabrication Requirements

PVC pipe blockouts are required in the beam bottom flange to drain residual water in the interior void after casting and to help keep the void dry over time. Two-stage monolithic casting is required to ensure proper consolidation in the bottom flange and monolithic joint behavior between the webs and the flange. Biodegradable forms are not allowed.

Lateral Restraint

Lateral restraint, as illustrated on the 24-ft roadway substructure standard drawings, is provided by earwalls at the ends of the abutments and bents. An alternate means of lateral restraint such as dowels may be required in retaining wall situations where the projecting earwall may be undesirable.