Structural Engineering Guidance No. 11-02

**Date:** January 28, 2011

**Distribution:** All Engineering Resources

**SUBJECT:** AASHTO LRFD CONCRETE BOX CULVERT DESIGN IMPLEMENTATION

**Contact:** Gregory Sanders/Darren Kemna/Boyd Denson

**EPG Status:** Submitted

**Standard Plans Status:** Submitted and Approved

**Standard Drawings Status:** To Be Completed

**Effective Date:** April 1 Letting

**Expiration:** Phased Out as Each Grouping of Concrete Box Culvert Standard Plans And Standard Drawing Revisions Are Completed

In planned agreement between the Engineering Policy Group and Bridge Division to meet an effective April 1 letting for when all new concrete box culvert designs shall be required to be in accordance with the AASHTO LRFD Bridge Design Specifications, we have submitted the following document revisions to the Engineering Policy Group for approval which will serve to expedite and effect this implementation. This implementation is compliant with FHWA Policy Memorandum, issued June 28, 2000, “*announcing its* [FHWA] *decision regarding a transition time frame for the use of Load and Resistance Factor Design (LRFD) for the design of new bridges* [and culverts] *on Federal-aid funded projects*.”

New concrete box culvert designs shall include:

District concrete box culvert designs

Bridge Division concrete box culvert designs

New and replacement concrete box culvert designs

Rehabilitation concrete box culvert designs, i.e. extensions, modifications

Special concrete box culvert designs

Standard and nonstandard concrete box culvert designs

The following Standard Specification has been revised to be in compliance and submitted for approval to be effective with the April 1 letting:

Sec 1049 Precast Concrete Box Culverts

The following Standard Plans have been revised (or are required to be removed) to be in compliance and approved to be effective with the April 1 letting:

703.10-703.16 REVISED Concrete Single Box Culvert details

703.17 REVISED Concrete Single Box Culvert designs

703.37 REVISED Concrete Box Culvert Exterior Wing Reinf.

703.40-703.44 REMOVED Concrete Double Box Structure details

703.45 REMOVED Concrete Double Box Structure designs

703.80-703.84 REMOVED Concrete Triple Box Structure details

703.85 REMOVED Concrete Triple Box Structure designs

The following Engineering Policy Guide articles have been revised to be in compliance and submitted for approval to be effective with the April 1 letting:

1. REVISED EPG 750.7 Non-Hydraulic Considerations
2. REVISED EPG 751.8 LRFD Concrete Box Culverts (formerly called EPG 751.8 LFD Culverts)
3. REVISED EPG 751.50 Standard Detailing Notes
4. REVISED EPG 1049 Precast Concrete Box Culverts
5. ADDED TO EPG 750.7 Non-Hydraulic Considerations “*Reference Guide SBC For Laying Out and Plan Reporting Details of Concrete Single Box Culverts (SBC) Using Missouri Standard Plans for Highway Construction”* for district use.

The following Standard Drawings will be removed from the MoDOT webpage until revised to be in compliance, and will NOT be effective with the April 1 letting unless revised on a case-by-case basis (See Development Section for drawing files until revised):

1. REMOVED until revised - Double Box Culvert Drawings
2. REMOVED until revised - Triple Box Culvert Drawings
3. REMOVED until revised - Guardrail Attachment Drawings

The following programs and help guide used to estimate concrete box culvert concrete and steel quantities, and produce a barbill have been updated to be in compliance, and effective with the April 1 letting (For internal use only):

1. UPDATED *Single Box Culvert Quantities LRFD* v 4.0
2. UPDATED *Double Box Culvert Quantities LRFD* v 4.0
3. UPDATED *Triple Box Culvert Quantities LRFD* v 4.0

(These programs will be made available. For software support, contact John Gahagan for installation support and Daren Kemna for application support.)

Several items worth noting and some that will need to be addressed on a case-by-case basis for compliance and for plans turn-in to meet the effective April 1 letting:

1. Revised Concrete Single Box Culvert Standard Plans have been developed for use by districts. The Engineering Policy Group will be downloading the new Standard Plans for Single Concrete Box Culverts to the MoDOT website found at http://www.modot.mo.gov/business/standards\_and\_specs/futurestandardplans.htm
2. Revised Concrete Double and Triple Box Culvert Standard Plans are in development and will be made available upon completion. Anticipated completion dates are June and December, respectively.
3. Until such time, the existing Standard Plans sheets will be required to be removed effective with the April 1 letting. Engineering Policy Group will make these available for current jobs awarded and local entities and partners that may still want to reference them and use them as part of their contract documents.
4. Until such time, all new DBC and TBC designs will need to be performed without the benefit of standard culvert designs. LRFD concrete box culvert design programs and design aids will be made available:
5. In-House Design Programs:

*Single Box SAP Design*

*Double Box SAP Design*

*Triple Box SAP Design*

See New Software Update:

T:\br-proj\A\_Development\DS Software Updates\LRFD Box Culverts\_SAPExcel/08-010-DSSU 012811 Single Double and Triple Box SAP Design Programs

In-House Design Aid for New Programs:

*Box Culvert Design Procedure for Standard Plans*

(Primary source document for program instruction)

Concrete box SAP design programs will be made available for download upon request. For software support, contact John Gahagan for installation support and Daren Kemna for application support.

No 1 Thru No. 5 Design Aids are located on the DS *LRFD Design Website*

1. Design Aid: SAPandExcel Box Culvert Design Issues
2. Design Aid: Box Culvert Design Flowchart
3. Design Aid: LRFD Culvert SAP Model
4. Design Aid: Triple Box Design Example
5. Shelved projects with concrete box culverts will need to be brought into compliance unless either preliminary engineering funding or preliminary engineering work was initiated prior to October 1, 2010. There two things to consider:
6. If the bridge job predates the deadline criteria, then all Standard Specifications and Standard Plans used as part of the design and which are required to be used as part of the bidding and construction shall be documented in the contract documents referencing the last effective editions that were used for the box culvert design prior to those effective for the April 1 letting.
7. Otherwise, all concrete box culvert designs must be made to be in compliance with this guidance.
8. Bridge Division consultants should be informed through transmittal of this guidance. Current consultant jobs with concrete box culverts should be reviewed for compliance.
9. Precast concrete box culvert modified or special designs will need to be reviewed in accordance with AASHTO LRFD Bridge Design Specifications. American Concrete Pipe Association (ACPA) software BOXCAR 3.1 is available for internal use only. This program is the latest version and uses 2007 AASHTO LRFD Bridge Design Specifications.
10. LRFD precast concrete box culvert optional substitution permitted by Sec 733 has been addressed with the Standard Specifications revision which will now reference ASTM C 1577 for LRFD precast concrete box culvert bidding and construction.
11. Precast concrete box culvert producers and suppliers will be informed of MoDOT’s AASHTO LRFD Concrete Box Culvert Design Implementation plan by letter from the Engineering Policy Group.
12. It was recommended to Engineering Policy Group that FHWA be informed of this implementation plan.

Suggestions and recommendations concerning this guidance or procedure should be directed to the Development Section for review and updating the Engineering Policy Guide.