Index 400-289 Concrete Box Culvert Details

Design Criteria

AASHTO LRFD Bridge Design Specifications; ***Structures Design Guidelines (SDG); FDOT Design Manual (FDM)***

Design Assumptions and Limitations

Designs for box culverts shown in this Index are to be produced only by computer analysis, utilizing the Department's ***LRFD Box Culvert Program***. Designs are to be limited to the live loads and dimensional restraints shown in the General Notes of this Index and to the fill on the barrel(s), as shown in the Contract Plans.

Where depth of fill over the culvert(s) vary, design culvert based on the depth of fill at the center of the inside and outside lanes and ensure design is adequate for the controlling case.

Headwalls with skew angles less than -50° or greater than +50° require special design authorization. In these cases, other design options should be considered. Contact the District Drainage Engineer to obtain authorization.

At the contractor's option, Index 400-292 Standard Precast Concrete Box Culverts may be substituted for Index 400-289 cast-in-place box culverts unless specifically prohibited by a plan note. See also the ***Standard Plans Instructions*** Index 400-292.

Plan Content Requirements

In the Structures Plans:

For box culvert extensions with skewed joints at the connection location, consider providing additional reinforcing parallel to the joint for the full width of the culvert to ensure proper load paths for transverse forces. Provide details for these additional reinforcing bars in the plans and manually add these bars to the reinforcing bar list.

Complete the following "Box Culvert Data Tables" and include them in the plans. See ***FDM*** 115 for more information regarding use of Data Tables.

Work these data tables with the FDOT Mathcad ***LRFD Box Culvert Program*** and Index 400-289.

Fill in tables using the “Include” Key-In Utility in MicroStation and line1.prn thru line6.prn files located in the program root directory.

Use Structures Site Menu>Text>Table Data, which uses "Chart_TTF" Text Style and True Type Font FDOT Mono.

Complete Notes 1 thru 8.

In Note 6 of the Data Table show Differential Settlement (ΔY) and Effective Length (L) for single curvature deflection where significant long-term settlement is anticipated and precast box culverts are not specifically excluded. See Index 400-291 (Sheet 5) for details. If precast box culverts are specifically excluded, delete Note 6.

If a box culvert extension is required, investigate the constraints and condition of the existing structure to determine whether a Type I and/or Type II Connection Detail is appropriate for each Structure/Bridge Number within the project. Contact the District Structures Design Engineer (DSDE) to obtain concurrence with the recommended Connection Detail. Based on concurrence from the DSDE, in Note 7 of the Data Table specify either "Type I ", "Type II", or "Type I or Type II" for each Structure/Bridge Number within the project. If no box culvert extension is required, delete Note 7.

Type II Connections are generally less expensive and faster to construct than Type I Connections, but provide less longitudinal moment resistance. It is recommended that only Type I connections be specified when significant transverse settlement is anticipated under the extension, or when the face of the existing culvert headwall is severely damaged.

For box culverts meeting the definition of a bridge structure (See ***FDM*** 265) include the Bridge Number in the plans and the Load Rating Sheet per ***SDG*** 3.15.14.

When box or bridge culverts require phase construction, separate the steel and concrete quantities by phase and add the bar splice lengths required at the joint to the calculated bar quantities (SDM 4.3.10). Consider adding a plan detail showing the construction joint and minimum lap lengths.

For box culverts that do not require traffic railings delete the bar bending details in the “Box Culvert Data Tables” cell. When Single-Slope traffic railings are required add the thickness ‘PT’ (see Index 400-289, Sheet 5, Detail “I”) to the V bar length from Index 521-427 or 521-428 and show the dimension in the bar bending diagram on the “Box Culvert Data Tables” sheet. For other traffic railings or parapets, substitute the appropriate anchorage bar for the V bar shown and add length PT to maintain cover and embedment. When supplemental transverse bars are required, add a note with the required bar size, length and spacing. Add the transverse bars to the Summary of Quantities for Box Culvert reinforcing. Note: V or other anchorage/railing bars are included in the cost of the traffic railing or parapet.

*Commentary: Box Culverts will be included in a Structures Component Plan Set along with all appropriate Standard Plans for Bridge Construction Index sheets (see SDM 3.7). For more guidance on Estimated Quantities Report see **FDM** 902*

BOX CULVERT DATA TABLES

BOX, HEADWALL AND CUTOFF WALL DATA TABLE (inches unless shown otherwise) — Table Date 7-01-09

LOCATION	STRUCTURE /BRIDGE NUMBER	BOX									HEADWALL AND CUTOFF WALL									
		Wc(ft)	Hc(ft)	Tt	Tw	Tb	Ti	#cells	Lc(ft)	Cover	Blhw	Hlhw	Brhw	Hrhw	Blcw	Hlcw	Brcw	Hrcw	SL(deg)	SR(deg)

LEFT SIDE WINGWALLS DATA TABLE (inches unless shown otherwise) — Table Date 01-01-11

STRUCTURE /BRIDGE NUMBER	LEFT END WINGWALL									LEFT BEGIN WINGWALL								
	Rt	Rw	Rh	Rd	SW(deg)	β (deg)	He(ft)	Hs(ft)	Lw(ft)	Rt	Rw	Rh	Rd	SW(deg)	β (deg)	He(ft)	Hs(ft)	Lw(ft)

RIGHT SIDE WINGWALLS DATA TABLE (inches unless shown otherwise) — Table Date 01-01-11

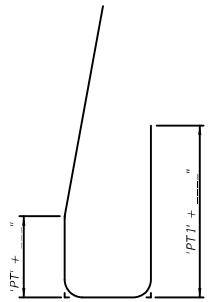
STRUCTURE /BRIDGE NUMBER	RIGHT END WINGWALL									RIGHT BEGIN WINGWALL								
	Rt	Rw	Rh	Rd	SW(deg)	β (deg)	He(ft)	Hs(ft)	Lw(ft)	Rt	Rw	Rh	Rd	SW(deg)	β (deg)	He(ft)	Hs(ft)	Lw(ft)

ESTIMATED CONCRETE QUANTITIES (CY) — Table Date 7-01-13

STRUCTURE /BRIDGE NUMBER	BOX								LEFT END WINGWALL			LEFT BEGIN WINGWALL			RIGHT END WINGWALL			RIGHT BEGIN WINGWALL		
	Left Cutoff Wall	Right Cutoff Wall	Bottom Slab	Walls	Top Slab	Left Head Wall	Right Head Wall	Sub Total	Footing	Wall	Sub Total	Footing	Wall	Sub Total	Footing	Wall	Sub Total	Footing	Wall	Sub Total

MAIN STEEL REINFORCEMENT SPACING (inches) — Table Date 7-01-09

STRUCTURE /BRIDGE NUMBER	BOX														HEADWALLS	CUTOFF WALLS		
	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115, 116...	803	806	809	812



MODIFIED V BAR
(FOR INDEX ___-__)

BAR BENDING DETAIL

NOTES [Notes Date 7-01-14]:

1. Environmental Class -----
2. Reinforcing Steel, Grade -----
3. Concrete Class ----- f'c = ----- ksi
4. Soil Properties:
   Friction Angle -----
   Modulus of Subgrade Reaction -----
   Nominal Bearing Resistance -----
5. Work this Drawing with Standard Plans Index 400-289 and Sheets -----
6. Settlement criteria for Precast Box Culvert option (Index 400-291):
   Long Term Differential Settlement (ΔY) = ------ ft.
   Effective Length for Settlement (L) = ------ ft.
7. Connection Types permitted for Box Culvert Extensions:
   Structure/ Bridge Number XXXXX - _____
   (Type I/Type II/Type I or Type II)
8. Quantities for Type I and Type II Connections include 2 ft. additional payment length beyond Lc for connection to existing box culvert. (See Summary of Box Culvert Quantities box in Plans)

WINGWALL STEEL REINFORCEMENT SPACING (inches) — Table Date 7-01-09

STRUCTURE /BRIDGE NUMBER	LEFT END WINGWALL							LEFT BEGIN WINGWALL							RIGHT END WINGWALL							RIGHT BEGIN WINGWALL						
	401 407(8)	402 (403)	404 (405)	406	409	410	411	501 507(8)	502 (503)	504 (505)	506	509	510	511	601 607(8)	602 (603)	604 (605)	606	609	610	611	701 707(8)	702 (703)	704 (705)	706	709	710	711

WINGWALL NOTE: Bar designations in "( )" are only required for variable height wingwalls.

Payment

Item number	Item Description	Unit Measure
400-2-1	Concrete Class II, Culverts	CY
400-4-1	Concrete Class IV, Culverts	CY
415-1-1	Reinforcing Steel - Roadway	LB