


## STORM SEWER BEDDING AND BACKFILL FOR PRECAST CONCRETE BOX

NTS

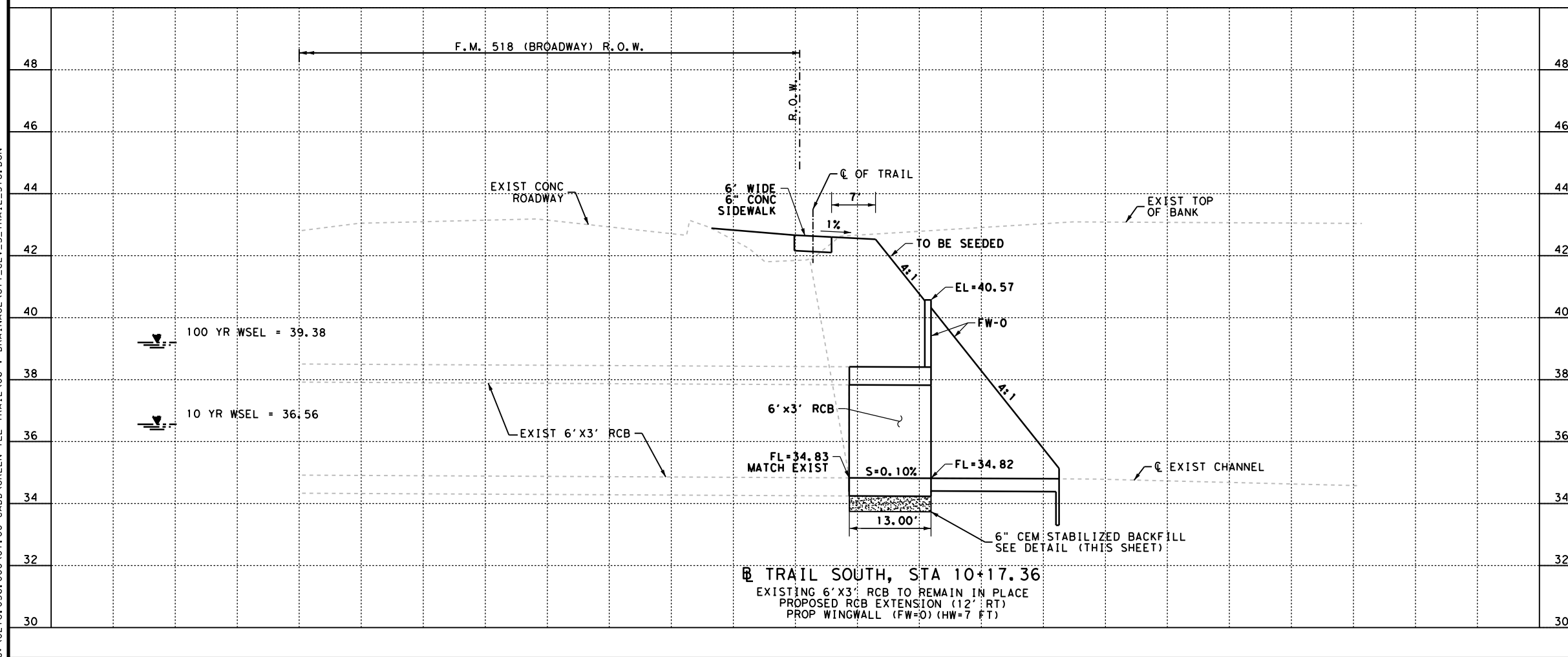
SCALE: 1" = 20' (H)  
SCALE: 1" = 4' (V)



A horizontal graphic scale bar with alternating black and white segments. It is marked with the numbers 0, 10, and 20 at the bottom.


NOTES

1. UTILITIES SHOWN ARE BASED ON VISUAL OBSERVATIONS AND DESIGN SURVEYS AND MAY NOT INCLUDE ALL EXISTING UTILITIES LOCATED ALONG PROJECT'S SUBSURFACE UTILILITY INVESTIGATIONS. NO FIELD PERFORMED ANY CONFLICTS NOTED BETWEEN EXISTING UTILITIES AND PROPOSED ROADWAY WORK ARE SUBJECT TO VERIFICATION BY THE ENGINEER AND UTILITY OWNER. CONTRACTOR WILL VERIFY ALL UTILITIES PRIOR TO ANY CONSTRUCTION.
2. SHAPE RIPRAP TO CONFORM TO DITCH GRADING.
3. SEE DETAIL SHEET "BOX CULVERT SUPPLEMENT" FOR WINWALL AND HEADWALL DIMENSIONS.



NO.	DATE	REVISION	APPROV.

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**GREEN TEE TERRACE  
BIKE & PEDESTRIAN TRAIL**

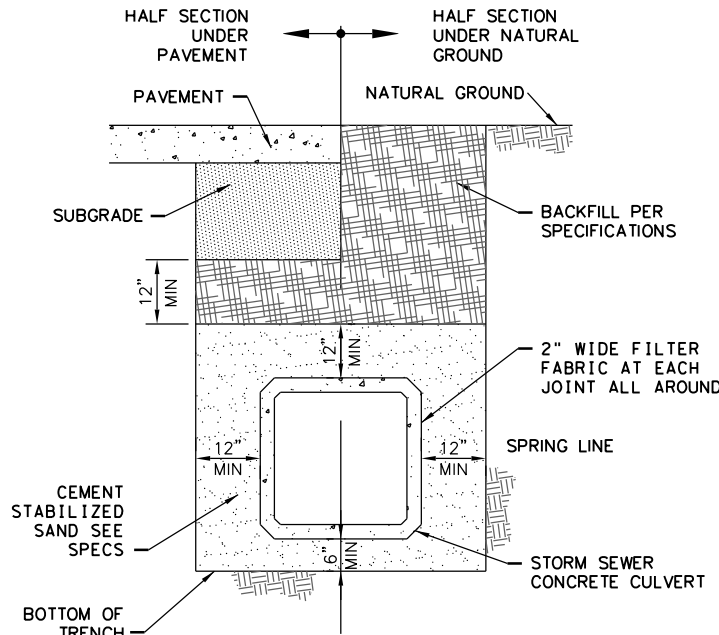
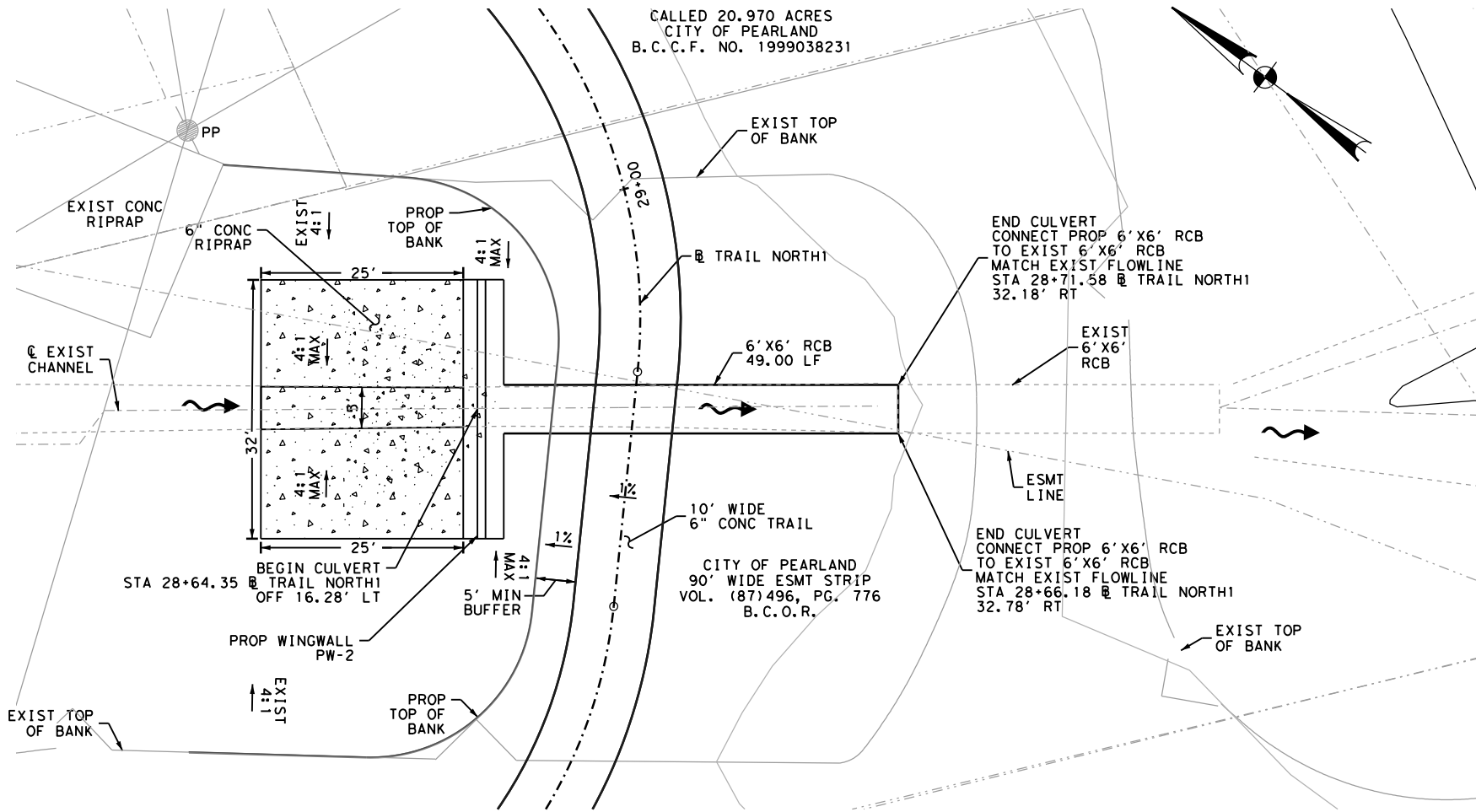
CULVERT LAYOUT  
FM 518

SHEET 1 OF 1

FED. RD. DIV. NO.	PROJECT NO.		SHEET NO.
6			73
STATE	DIST.	COUNTY	
TEXAS	HOU	BRAZORIA / HARRIS	
CONT.	SECT.	JOB	HIGHWAY NO.
0912	31	291	VA

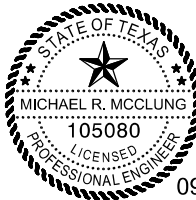
### NOTES

1. UTILITIES SHOWN ARE BASED ON VISUAL OBSERVATIONS AND DESIGN SURVEYS AND MAY NOT INCLUDE ALL EXISTING UTILITIES LOCATED ALONG PROJECT. NO SUBSURFACE UTILITY INVESTIGATIONS WERE PERFORMED. ANY CONFLICTS NOTED BETWEEN EXISTING UTILITIES AND PROPOSED ROADWAY WORK ARE SUBJECT TO VERIFICATION BY THE ENGINEER AND UTILITY OWNER. CONTRACTOR WILL VERIFY ALL UTILITIES PRIOR TO ANY CONSTRUCTION.
2. SHAPE RIPRAP TO CONFORM TO DITCH GRADING.
3. SEE DETAIL SHEET "BOX CULVERT SUPPLEMENT" FOR WINGWALL AND HEADWALL DIMENSIONS.
4. CONTRACTOR TO GRADE SLOPE 4:1 MAX.



### STORM SEWER BEDDING AND BACKFILL FOR PRECAST CONCRETE BOX

SCALE: 1" = 20' (H)  
SCALE: 1" = 4' (V)  
0 10 20



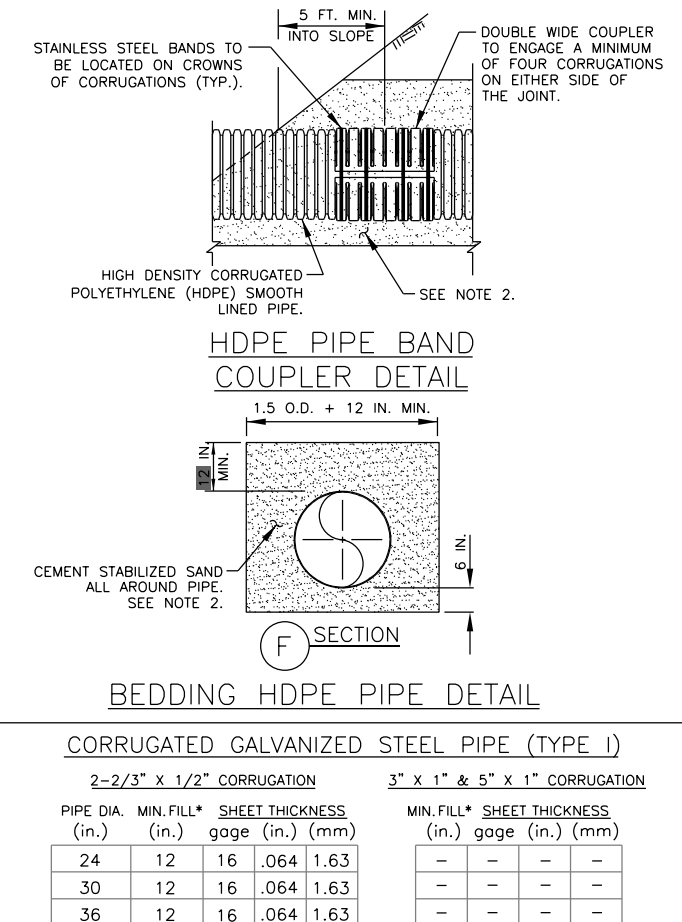
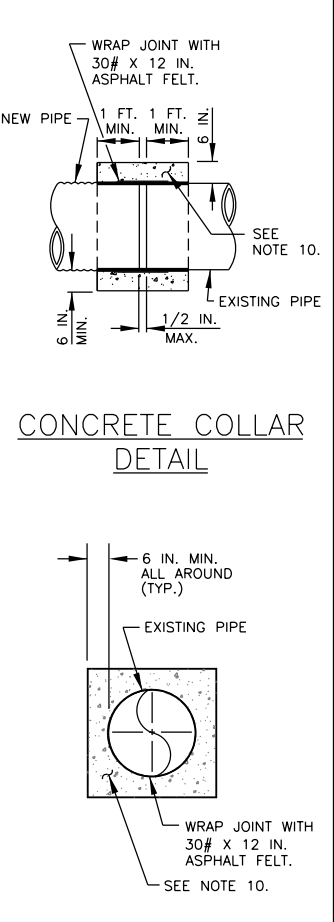
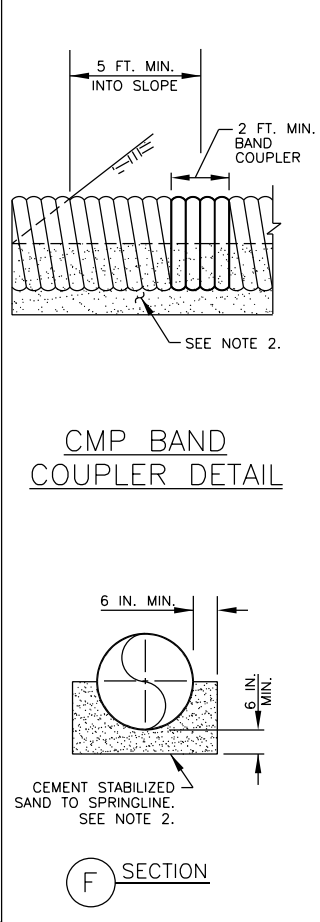
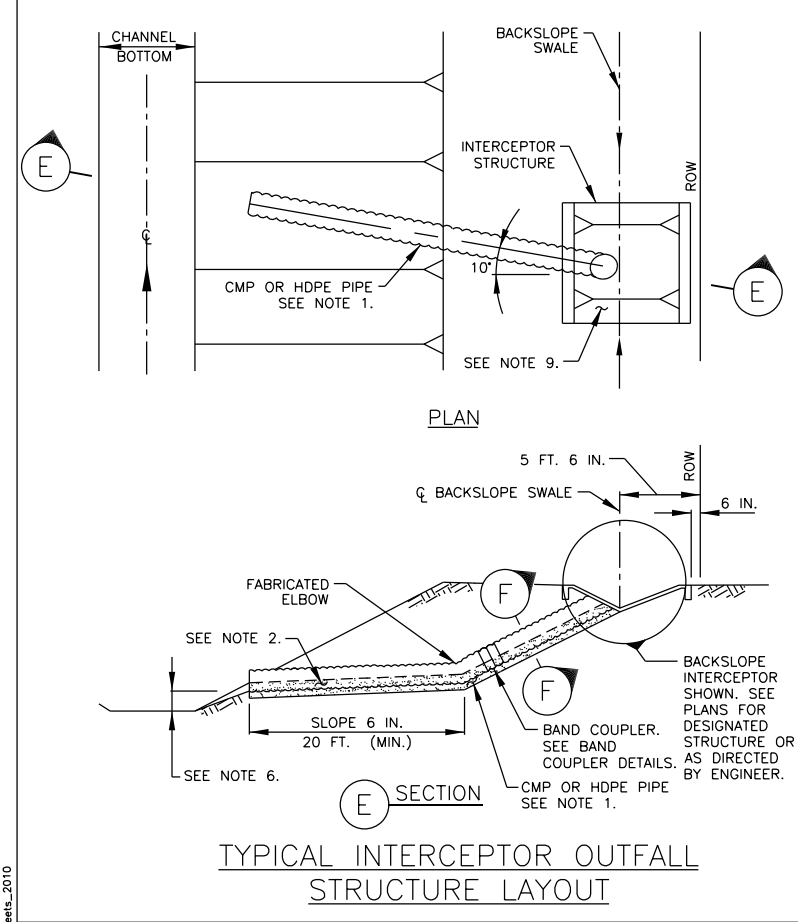
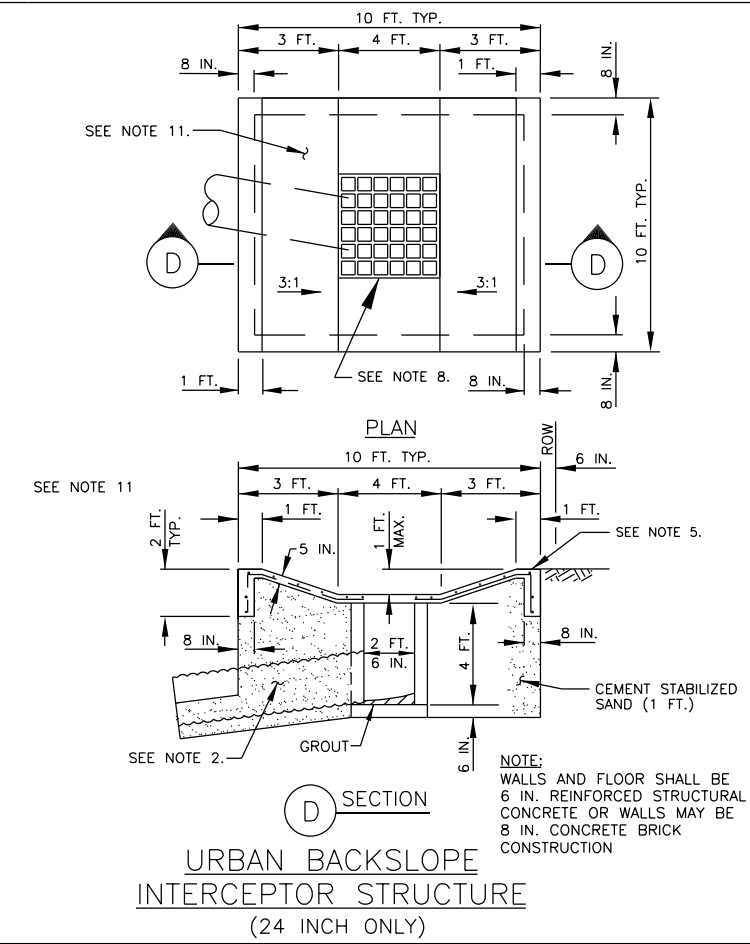
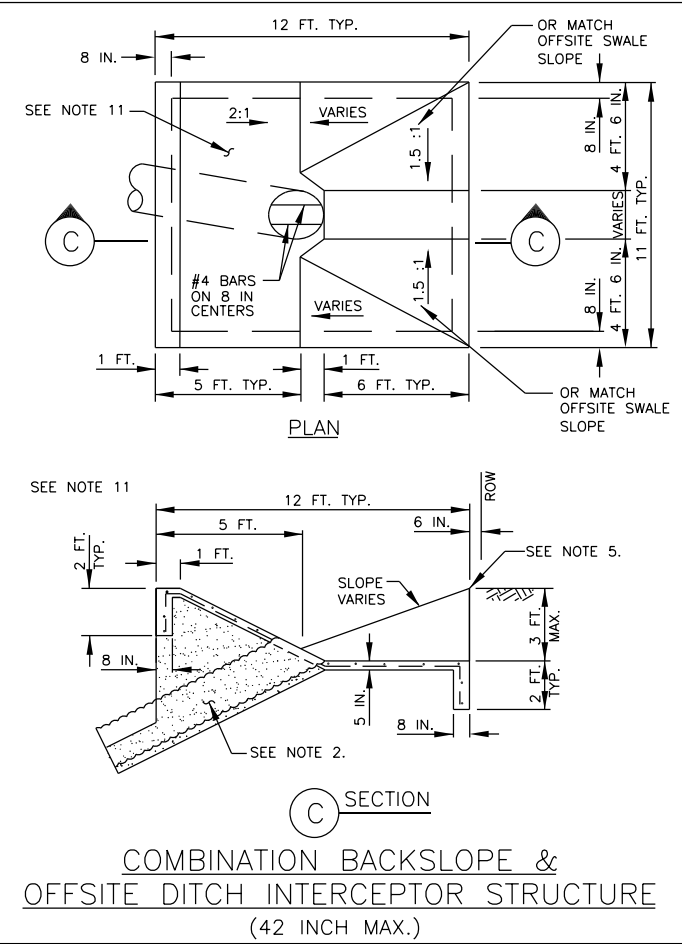
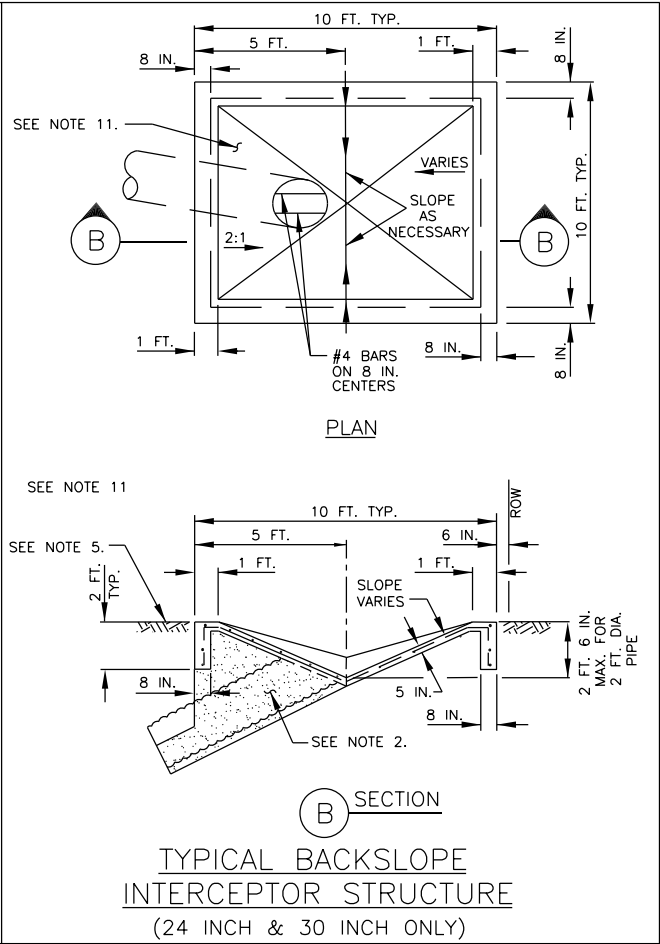
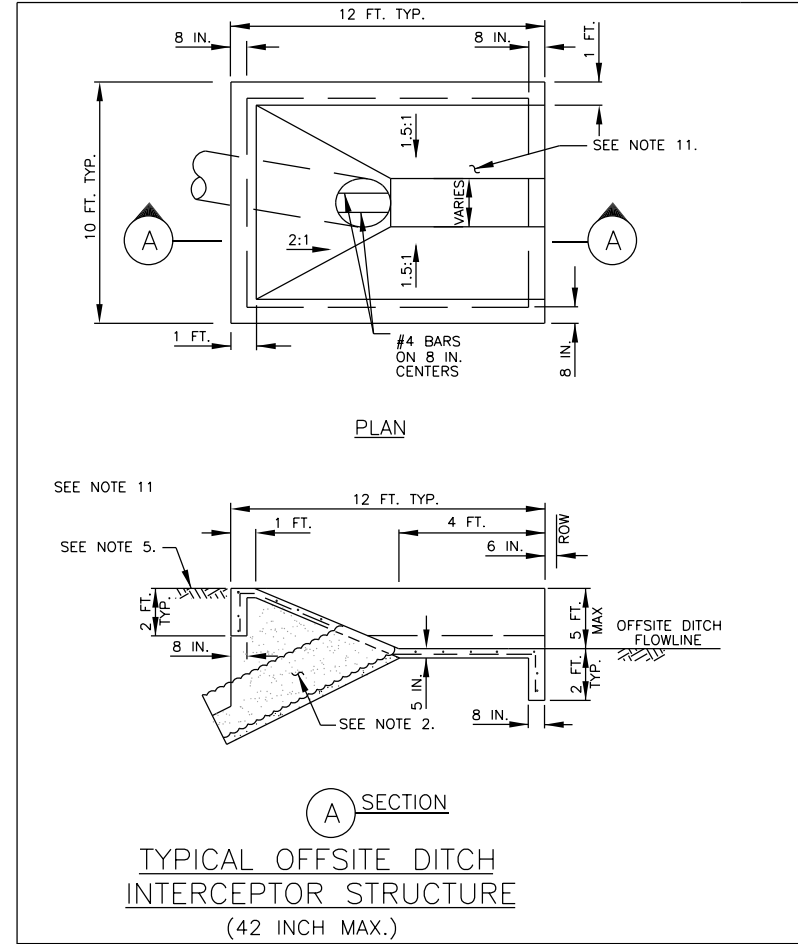
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BIKE & PEDESTRIAN TRAIL**

### CULVERT LAYOUT TRAIL NORTH STA 28+65

SHEET 1 OF 1			
FED. RD. DIV. NO.	PROJECT NO.		SHEET NO.
6			74
STATE	DIST.	COUNTY	
TEXAS	HOU	BRAZORIA / HARRIS	
CONT.	SECT.	JOB	HIGHWAY NO.
0912	31	291	VA



CORRUGATED GALVANIZED STEEL PIPE (TYPE I)					
2-2/3" X 1/2" CORRUGATION					
PIPE DIA. (in.)	MIN. FILL* (in.)	SHEET THICKNESS gage (in.)	SHEET THICKNESS (mm)		
24	12	16	.064	1.63	
30	12	16	.064	1.63	
36	12	16	.064	1.63	
42	12	16	.064	1.63	
48	12	16	.064	1.63	
3" X 1" & 5" X 1" CORRUGATION					
PIPE DIA. (in.)	MIN. FILL* (in.)	SHEET THICKNESS gage (in.)	SHEET THICKNESS (mm)		
24	12	16	.064	1.63	
30	12	16	.064	1.63	
36	12	16	.064	1.63	
42	12	16	.064	1.63	
48	12	16	.064	1.63	

\* MINIMUM DEPTH OF COVER ABOVE TOP OF PIPE, MAXIMUM DEPTH OF COVER ABOVE TOP OF PIPE IS 20 FEET.

FOR LARGER PIPE SIZES SEE: STORM SEWER AND RIPRAP DETAILS SHEET

INTERCEPTOR STRUCTURE DETAIL NOTES:

- INTERCEPTOR OUTFALL PIPES WITHIN THE HCFC RIGHT-OF-WAY SHALL BE CMP OR HDPE PIPE IN ACCORDANCE WITH SPECIFICATION SECTION 02642- CORRUGATED METAL PIPE, HIGH DENSITY POLYETHYLENE (HDPE) PIPE IN ACCORDANCE WITH SPECIFICATION SECTION 2505-HIGH DENSITY POLYETHYLENE, OR APPROVED EQUAL. USE TABLE BELOW FOR CORRUGATED GALVANIZED STEEL PIPE.
- PROVIDE AND PLACE CEMENT STABILIZED SAND IN ACCORDANCE WITH SPECIFICATION SECTION 02321-CEMENT STABILIZED SAND AND SECTION 02316 - STRUCTURAL EXCAVATING.
- EXCAVATION, FILL AND BACKFILL FOR STORM SEWER OUTFALLS SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02316-STRUCTURAL EXCAVATING AND BACKFILLING.
- CONCRETE SHALL BE STRUCTURAL CONCRETE IN ACCORDANCE WITH SPECIFICATION SECTION 03310-CONCRETE.
- INTERCEPTOR STRUCTURES:
  - ADJUST LENGTH AND WIDTH IN FIELD AS NECESSARY.
  - 2- FEET DEEP X 8-INCH WIDE TOE ALL AROUND THE STRUCTURE.
  - STEEL REINFORCING-#4 BARS (GRADE 40) AT 12 INCHES ON CENTER EACH WAY.
  - ANY INTERCEPTOR OUTFALL PIPE LARGER THAN MAXIMUM SIZE INDICATED REQUIRES A SEPARATE DETAIL.
  - MATCH TOP OF CONCRETE WITH NATURAL GROUND.
- IN DETENTION BASINS, SET FLOWLINE OF OUTFALL AT TOE OF THE SLOPE. IN CHANNEL, USE ELEVATION INDICATED IN THE TABLE OR 1 FOOT ABOVE NORMAL WATER LEVEL WHICH EVER IS HIGHER.
- SEE CONCRETE CHANNEL LINING DETAIL SHEET FOR CMP OUTFALL DETAILS THROUGH CONCRETE CHANNEL LINING.
- CONCRETE PAD AROUND TYPE "B" INLET: PAID FOR AS CONCRETE INTERCEPTOR STRUCTURE PER UNIT PRICE SCHEDULE. TYPE "B" INLET BOX, COH DWG. NO. 02632-02 WITH GRATE TOP, VULCAN FOUNDRY COMPANY, V-4880-1 OR APPROVED EQUAL, APPROX. 489 SQ.IN. OPENING.
- BACKSLOPE SWALE AND INTERCEPTOR STRUCTURE ELEVATIONS AND LOCATIONS SHOWN ON THE PLANS ARE APPROXIMATE. FINAL ELEVATIONS AND LOCATIONS SHALL BE FIELD VERIFIED BY THE ENGINEER PRIOR TO INSTALLATION.
- STRUCTURAL CONCRETE WITH #4 BARS (GRADE 40) 12 INCH O.C. EACH WAY - FOR COLLARS ONLY.
- EPOXY CLEAN WATER CLEAR CHOICE LOGO BUTTON ON INTERCEPTORS. LOCATION TO BE DETERMINED BY THE ENGINEER.

THIS DETAIL SHEET HAS BEEN PREPARED FOR USE ON HCFC PROJECTS OR PROJECTS TO BE MAINTAINED BY THE HCFC WHEN COMPLETED BY OTHERS. AN ENGINEER WHO INCORPORATES THE DETAILS ON THIS SHEET BECOMES RESPONSIBLE FOR ITS USE IN THE END PRODUCT IN ACCORDANCE WITH RULE §137.33 (b) AND (c) OF THE TEXAS STATE BOARD OF REGISTRATION FOR PROFESSIONAL ENGINEERS.

STATE OF TEXAS  
MICHAEL R. MCCLUNG  
105080  
LICENSED PROFESSIONAL ENGINEER  
09/17/18

PIPE OUT FALL IN CHANNELS	
BOTTOM WIDTH	PIPE OUTLET INVERT
6 FEET ≤ BW ≤ 20 FT	1 FOOT ABOVE FLOWLINE
20 FEET < BW ≤ 60 FT	AT TOE OF SLOPE
BW > 60 FT	AT TOE OF SLOPE

DATE	APPR	DESCRIPTION	REV

CITY OF PEARLAND, TEXAS  
GREEN TEE TERRACE HIKE & BIKE TRAIL  
INTERCEPTOR STRUCTURE DETAILS

PREPARED: [Signature]  
CHECKED: [Signature]  
APPROVED: [Signature]

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RPS

9900 Northwest Freeway  
Houston, Texas 77092

DATE: 12-21-2010  
SCALE: NTS

75

DATE: \_\_\_\_\_  
FILE: \_\_\_\_\_

- ① The wall heights shown will be rounded to the nearest Foot for bidding purposes.
- ② Concrete volume shown is for box culvert curb only. For curbs using the RAC standard, quantities shown must be increased by a factor of 2. If Class "S" concrete is required for the top slab of the culvert, the curb concrete shall also be Class "S". Curb concrete is considered part of the Box Culvert for payment.
- ③ Concrete volume shown is total of wing, footing, culvert toewall (if any), anchor toewall (if any) and wingwall toewall. Riprap apron, culvert and curb quantities are not included.
- ④ Regardless of the type of culvert shown on this sheet, the Contractor shall have the option of furnishing cast-in-place or precast culverts unless otherwise shown elsewhere on the plans. If the Contractor elects to provide culverts of a different type than those shown on this sheet, it shall be the Contractor's responsibility to make the necessary adjustments to the dimensions and quantities shown.

This sheet is a supplement to the Box Culvert standards. It is to be filled out by the culvert specifier and provides dimensions for the construction of the Box Culvert Wingwalls and Safety End Treatments.

An Excel 97 spreadsheet to assist in completing this table can be downloaded from the Bridge Standards (English) web page on the TxDOT web site. The completed sheet shall be signed, sealed, and dated by a licensed Professional Engineer.

Skew Angle = 0° for SW-0, FW-0, SETB-CD, SETB-SW-0, and SETB-FW-0 standards.  
30° Maximum for Safety End Treatment

SL:1 = Horizontal:1 Vertical  
Side Slope at culvert for Flared or Straight Wingwalls. Channel Slope for Parallel Wingwalls.  
Slope shall be 3:1 or flatter for Safety End Treatments.

T = Box Culvert Top Slab Thickness. Dimension can be found on the applicable Box Culvert Standard.

U = Box Culvert Wall Thickness. Dimension can be found on the applicable Box Culvert Standard.

C = Curb Height.

See applicable wing or end treatment standards for calculations of Hw, A, B, Lw, Ltw, Atw, and Total Wingwall Area.

Hw = Height of Wingwall.

A = Distance from Face of Curb to End of Wingwall (Not applicable to Parallel or Straight Wingwalls).

B = Offset of End of Wingwall (Not applicable to Parallel or Straight Wingwalls).

Lw = Length of Longest Wingwall.

Ltw = Length of Culvert Toewall (Not applicable when using Riprap Apron).

Atw = Length of Anchor Toewall (Applicable to Safety End Treatment only).

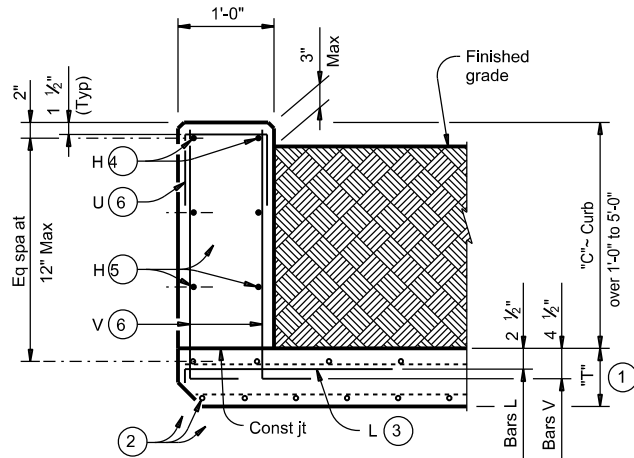
Total Wingwall Area = Wingwall area in S.F. for two wingwalls (one structure end) if Lt or Rt.

Area for four wingwalls (two structure ends) if Both.



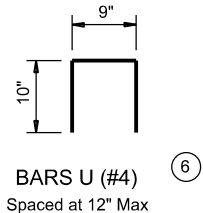
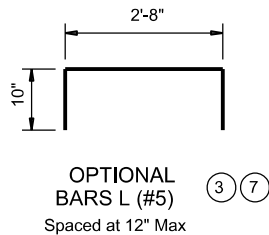
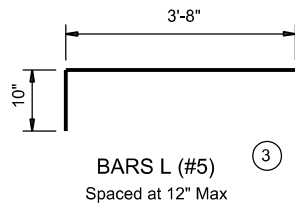
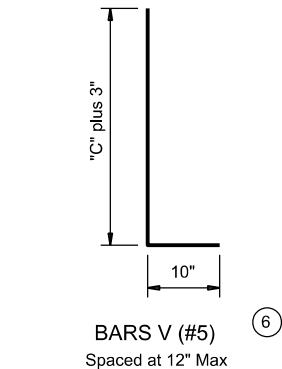
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DATE:  
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### TYPICAL SECTION

Used for curbs over 1'-0" to 5'-0"



- ① "T" is equal to the culvert top slab thickness. For precast boxes with slabs less than 7" thick, see SCP-MD standard for additional details.
- ② Adjust normal culvert slab bars as necessary to clear obstructions.
- ③ Place bars L as shown. Tilt hook as necessary to maintain cover.
- ④ Place normal culvert curb bars H(#4) as shown. Adjust as necessary to clear obstructions.
- ⑤ Additional bars H(#4) as required to maintain 12" Max spacing.
- ⑥ Replace normal culvert curb bars K with one bar U and two bars V as shown spaced at 12" Max. Adjust length of bars V as necessary to maintain clear cover.
- ⑦ Optional bars L are to be used only for precast box culverts with 3'-0" closure pour.
- ⑧ Quantities shown are for Contractor's information only. Quantities are per linear foot of curb length. The value in table can be interpolated for intermediate values of curb height, "C". Quantity includes bars K (when applicable).

TABLE OF ESTIMATED CURB QUANTITIES ⑧		
Curb Height "C"	Conc (CY/LF)	Reinf Steel (Lb/LF)
1'-0"	0.037	8.9
1'-6"	0.056	14.3
2'-0"	0.074	15.4
2'-6"	0.093	17.7
3'-0"	0.111	18.8
3'-6"	0.130	21.2
4'-0"	0.148	22.2
4'-6"	0.167	24.6
5'-0"	0.185	25.6

**CONSTRUCTION NOTES:**  
Adjust reinforcing steel as necessary to provide 1 1/4" cover.  
For vehicle safety, top of the curb must not project more than 3" above the finished grade.

**MATERIAL NOTES:**  
Provide Grade 60 reinforcing steel.  
Provide Class "C" concrete (f'c = 3,600 psi) minimum for curbs.

**GENERAL NOTES:**  
Designed according to AASHTO LRFD Bridge Design Specifications.  
These extended curb details have sufficient strength to allow for future retrofit of Type T631 or T631LS railing. These details are suitable for use with PR1, PR2 and PR3 type rails. These details are not suitable for the mounting of other rail types. For new construction using T631 or T631LS railing, use the T631-CM standard.  
This Curb is considered as part of the Box Culvert for payment.

Cover dimensions are clear dimensions, unless noted otherwise.  
Reinforcing bar dimensions shown are out-to-out of bar.



## EXTENDED CURB DETAILS

FOR BOX CULVERTS WITH CURBS OVER 1'-0" TO 5'-0" TALL

ECD

FILE: ecdstd1.dgn	DN: GAF	CK: TxDOT	DW: TxDOT	CK: GAF
©TxDOT February 2010	CONT	SECT	JOB	HIGHWAY
REVISIONS	0912	31	291	VA
03-16: General Notes added T631-CM.	DIST	COUNTY		SHEET NO.
	HOU	BRAZORIA / HARRIS		77

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DATE:  
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TABLE OF DIMENSIONS & REINFORCING STEEL  
(Wings for One Structure End)

Dimensions					Variable Reinforcing				Estimated Quantities <sup>(3)</sup> per ft of wing length (2-Wings)	
Maximum Wingwall Height Hw	W	X	Y	Z	Bars J1		Bars J2		Reinf (Lb/Ft)	Conc (CY/Ft)
					Size	Spa	Size	Spa		
2'-6"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	33.73	0.248
3'-0"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	37.07	0.261
3'-6"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	37.74	0.273
4'-0"	2'-5"	1'-0"	9"	7"	#4	1'-0"	#4	1'-0"	38.41	0.285
4'-6"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	41.75	0.330
5'-0"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	45.09	0.343
5'-6"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	45.75	0.355
6'-0"	3'-2"	1'-6"	1'-0"	7"	#4	1'-0"	#4	1'-0"	46.42	0.367
7'-0"	3'-8"	1'-9"	1'-3"	7"	#4	1'-0"	#4	1'-0"	52.77	0.414
8'-0"	4'-2"	2'-0"	1'-6"	8"	#5	1'-0"	#4	1'-0"	60.19	0.486
9'-0"	4'-8"	2'-3"	1'-9"	8"	#4	6"	#4	6"	81.49	0.535
10'-0"	5'-2"	2'-6"	2'-0"	8"	#5	6"	#4	6"	97.25	0.584
11'-0"	5'-8"	2'-9"	2'-3"	8"	#6	6"	#5	6"	133.65	0.634
12'-0"	6'-2"	3'-0"	2'-6"	9"	#7	6"	#5	6"	162.29	0.721
13'-0"	6'-8"	3'-3"	2'-9"	11"	#7	6"	#5	6"	178.80	0.856
14'-0"	7'-2"	3'-6"	3'-0"	1'-0"	#8	6"	#5	6"	216.78	0.959
15'-0"	7'-8"	4'-0"	3'-0"	1'-1"	#9	6"	#6	6"	283.06	1.068
16'-0"	8'-2"	4'-6"	3'-0"	1'-3"	#9	6"	#6	6"	297.02	1.234

TABLE OF WINGWALL REINFORCING  
(2-Wings)

Bar	Size	No.	Spa
D	#5	~	1'-0"
E	#4	~	1'-0"
F	#4	~	1'-0"
G	#6	4	~
M	#4	4	~
P	#4	~	1'-0"
R	#5	6	~
V	#4	~	1'-0"

TABLE OF ESTIMATED CULVERT TOEWALL QUANTITIES

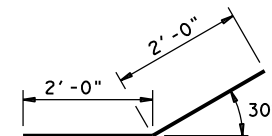
Bar	Size	No.	Spa
L	#4	~	1'-6"
Q	#4	1	~
Reinf (Lb/Ft)			2.45
Conc (CY/Ft)			0.037

WING DIMENSION CALCULATIONS:

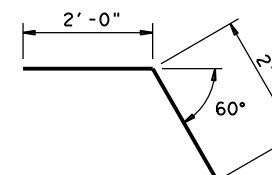
Formulas: (All values are in Feet)  
 $Hw = H + T + C - 0.250'$   
 $A = (Hw - 0.333') (SL)$   
 $B = (A) \text{ Tangent } (30^\circ)$   
 $Lw = (A) \div \text{Cosine } (30^\circ)$   
For Cast-in-place culverts:  
 $Ltw = (N) (S) + (N+1) (U)$   
For Precast culverts:  
 $Ltw = (N) (2U+S) + (N-1) (0.500')$   
Total Wingwall Area (Two Wings ~ S.F.) =  $(Hw + 0.333') (Lw)$

Hw = Height of Wingwall  
SL:1 = Side Slope Ratio (Horizontal:1 Vertical)  
Lw = Length of Wingwall  
Ltw = Culvert Toewall Length  
N = Number of Culvert Spans

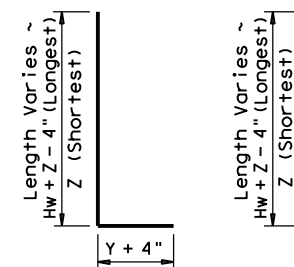
See applicable box culvert standard for H, S, T, and U values.



BARS D

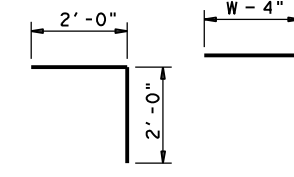


BARS R



BARS J1

BARS V

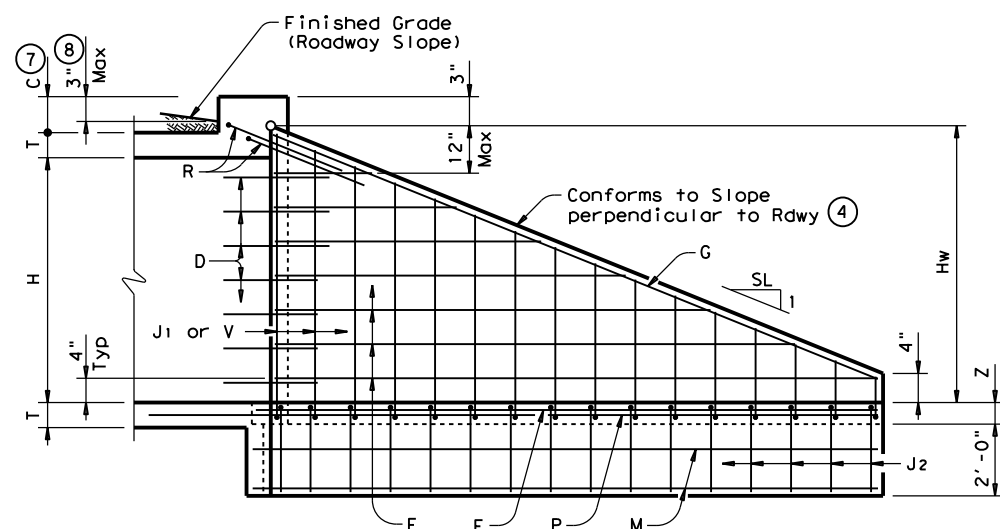


BARS L

BARS J2

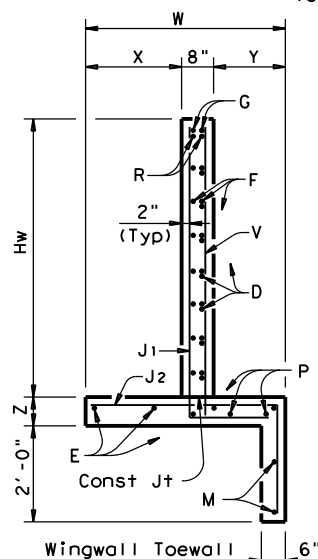
GENERAL NOTES:

Designed according to AASHTO LRFD Specifications.  
All reinforcing steel shall be Grade 60.  
Synthetic fibers listed on the "Fibers for Concrete" Material Producer List (MPL) may be used in lieu of steel reinforcing in riprap concrete unless noted otherwise.  
All concrete shall be Class "C" and shall have a minimum compressive strength of 3600 psi.  
All reinforcing bars shall be adjusted to provide a minimum of 1 1/4" clear cover.  
When structure is founded on solid rock, depth of toewalls for culverts and wingwalls may be reduced or eliminated as directed by the Engineer.  
See BCS sheet for additional dimensions and information.  
The quantities for concrete and reinforcing steel resulting from the formulas given on this sheet are for Contractor's information only.

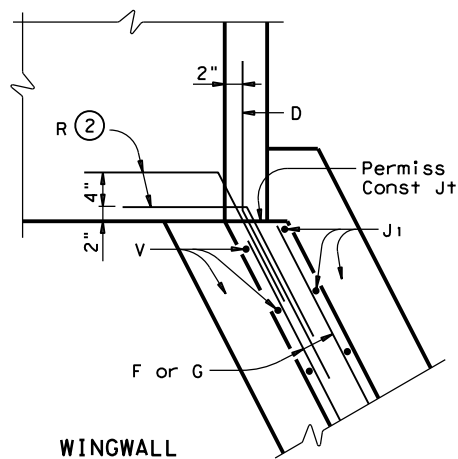


INSIDE ELEVATION

(Showing reinforcing. Culvert and Culvert Toewall reinforcing not shown for clarity.)

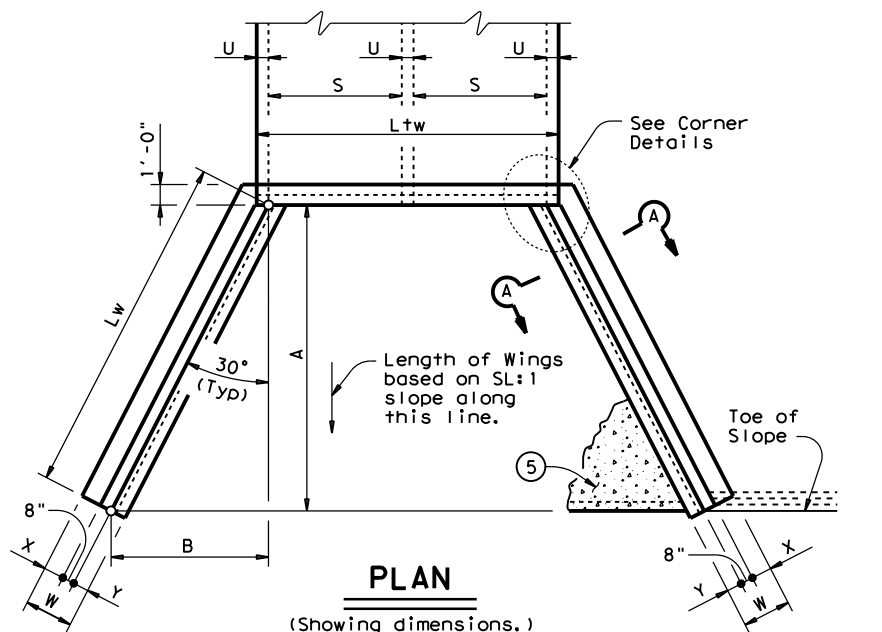


SECTION A-A



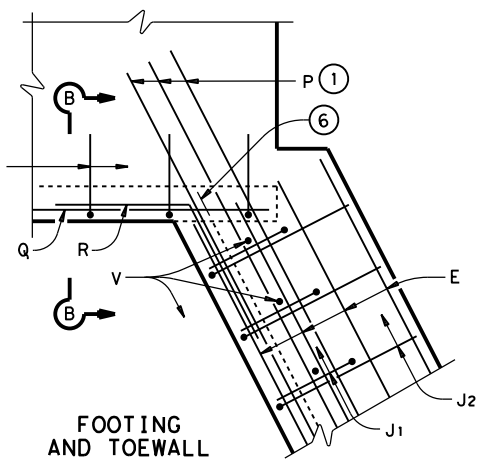
CORNER DETAILS

(Culvert and Culvert Toewall reinforcing not shown for clarity.)

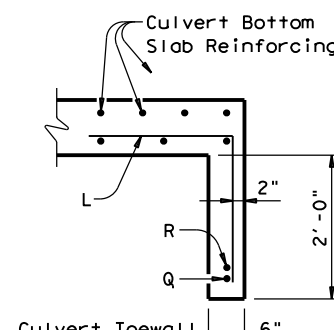


PLAN


(Showing dimensions.)



FOOTING AND TOEWALL



SECTION B-B<sup>(5)</sup>

 <b>Texas Department of Transportation</b>				<b>Bridge Division Standard</b>	
<div>CONCRETE WINGWALLS WITH FLARED WINGS FOR 0° SKEW BOX CULVERTS</div>					
<div>FW-0</div>					
FILE: fw-0slide.dgn	DN: GAF		CK: CAT	DW: TxDOT	CK: GAF
©TxDOT February 2010	CONT	SECT	JOB	HIGHWAY	
REVISIONS	0912	31	291	VA	
11-10: Add note for synthetic fibers.	DIST		COUNTY		SHEET NO.
	HOU		BRAZORIA / HARRIS		78



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DATE: FILE:

TABLE OF DIMENSIONS & REINFORCING STEEL  
(Wings for One Structure End)

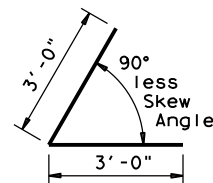
Dimensions					Variable Reinforcing		Estimated Quantities per ft of wing (2-Wings)	Estimated Quantities per ft of Toewall (1-Toewall)
	W	X	Y	Z	Bars J1	Bars J2		
Maximum Wingwall Height Hw					Size	Spa	Reinf (Lb/Ft)	Conc (CY/Ft)
2'-6"	2'-10"	10"	1'-0"	7"	#4	1'-0"	48.64	0.406
2'-9"	2'-10"	10"	1'-0"	7"	#4	1'-0"	49.31	0.424
3'-0"	2'-10"	10"	1'-0"	7"	#4	1'-0"	49.98	0.444
3'-3"	2'-10"	10"	1'-0"	7"	#4	1'-0"	53.32	0.462
3'-6"	2'-10"	10"	1'-0"	7"	#4	1'-0"	53.98	0.480
4'-0"	3'-2"	1'-2"	1'-0"	7"	#4	1'-0"	55.77	0.532
4'-6"	3'-2"	1'-2"	1'-0"	7"	#4	1'-0"	59.77	0.568
5'-0"	3'-9"	1'-7"	1'-2"	7"	#4	1'-0"	63.45	0.632
5'-6"	3'-9"	1'-7"	1'-2"	7"	#4	1'-0"	67.46	0.668
6'-0"	4'-4"	2'-0"	1'-4"	7"	#5	1'-0"	80.67	0.730
6'-6"	4'-4"	2'-0"	1'-4"	7"	#5	1'-0"	85.05	0.768
7'-0"	5'-0"	2'-3"	1'-9"	8"	#5	1'-0"	92.15	0.864
7'-6"	5'-0"	2'-3"	1'-9"	8"	#5	1'-0"	96.54	0.902
8'-0"	5'-6"	2'-8"	1'-10"	8"	#5	6"	139.04	0.962
8'-6"	5'-6"	2'-8"	1'-10"	8"	#5	6"	144.47	1.000
9'-6"	6'-0"	2'-10"	2'-2"	9"	#5	6"	156.93	1.136
10'-6"	6'-5"	3'-0"	2'-5"	9"	#6	6"	196.27	1.234
11'-6"	7'-2"	3'-6"	2'-8"	11"	#6	6"	230.13	1.438
12'-6"	7'-8"	3'-9"	2'-11"	1'-0"	#7	6"	283.41	1.592
13'-6"	8'-2"	4'-0"	3'-2"	1'-2"	#8	6"	348.72	1.804
14'-6"	8'-10"	4'-5"	3'-5"	1'-4"	#9	6"	432.94	2.046
15'-6"	9'-6"	4'-10"	3'-8"	1'-6"	#9	6"	489.52	2.302
16'-0"	9'-11"	5'-0"	3'-11"	1'-7"	#9	6"	505.72	2.448

TABLE OF WINGWALL REINFORCING (2-Wings)

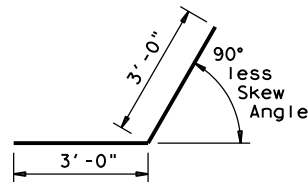
Bar	Size	No.	Spa
D1	#6	~	1'-0"
D2	#6	~	1'-0"
E1	#4	~	1'-0"
F	#4	~	1'-0"
G	#6	~	8"
M1	#4	4	~
P	#4	~	1'-0"
V	#4	~	1'-0"

TABLE OF TOEWALL REINFORCING

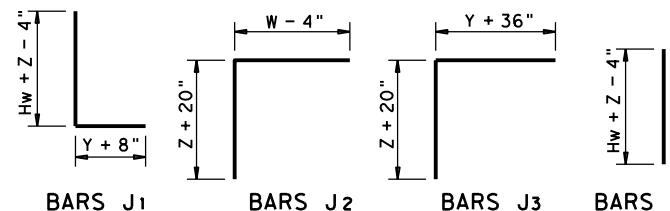
Bar	Size	No.	Spa
J3	#4	~	1'-0"
M2	#4	2	~
E2	#4	~	1'-0"



BARS D1



BARS D2



BARS J1

BARS J2

BARS J3

BARS V

WING DIMENSION CALCULATIONS:

Formulas: (All values are in Feet)

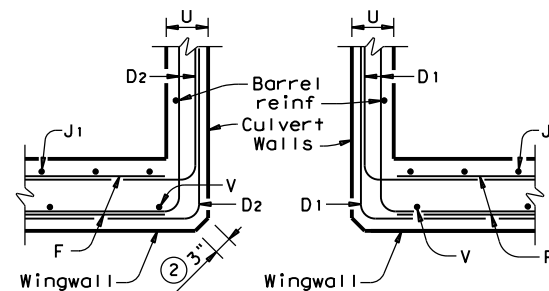
$$\begin{aligned} Hw &= H + T + C \\ Lw &= (Hw) (SL) \div \text{Cosine } \theta \text{ for Ty PW-1} \\ &= (Hw - 1') (SL) \div \text{Cosine } \theta \text{ for Ty PW-2 and } Hw \geq 4' \\ &= (Hw - 0.5') (SL) \div \text{Cosine } \theta \text{ for Ty PW-2 and } Hw < 4' \end{aligned}$$

For Cast-in-place culverts:  
 $Ltw = [(N) (S) + (N + 1) (U)] \div \text{Cosine } \theta$

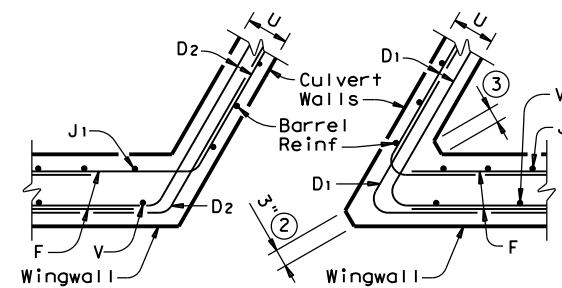
For Precast culverts:  
 $Ltw = [(N) (2U + S) + (N - 1) (0.5')] \div \text{Cosine } \theta$   
Total Wingwall Area (Two Wings ~ SF)  
= (2) (Hw) (Lw) for Ty PW-1  
= (2) (Hw) (Lw) - 6 SF for Ty PW-2 and  $Hw \geq 4'$   
= (2) (Hw) (Lw) - 1.5 SF for Ty PW-2 and  $Hw < 4'$

Hw = Height of Wingwall  
Lw = Length of Wingwall  
Ltw = Culvert Toewall Length  
N = Number of Culvert Spans  
SL:1 = Channel Slope ratio. (Horizontal: 1 Vertical, Usual value is 2:1)  
 $\theta$  = Culvert Skew

See applicable box culvert standard for S, H, T and U values.



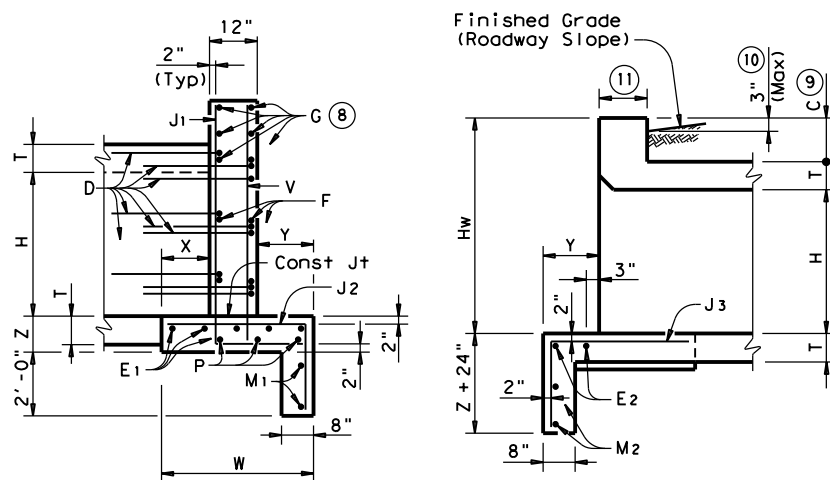
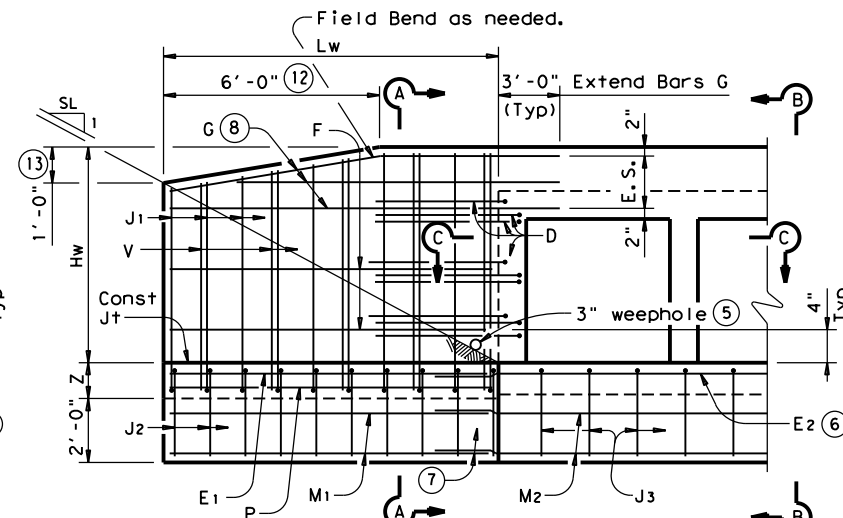
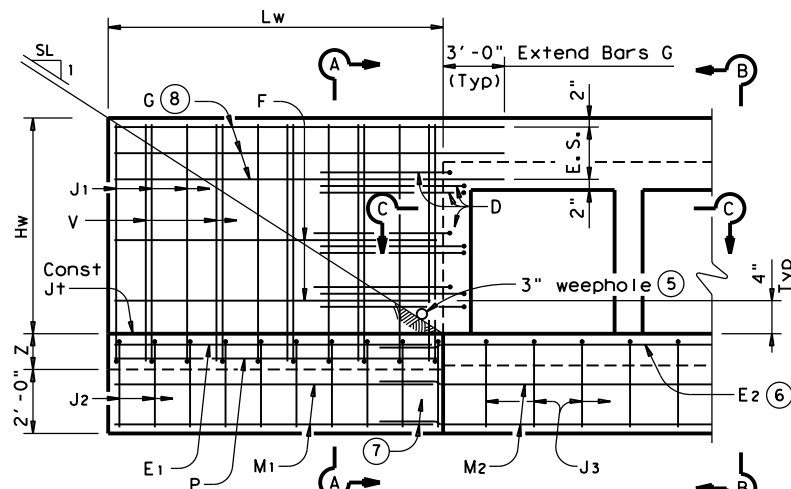
SECTION C-C



SECTION C-C

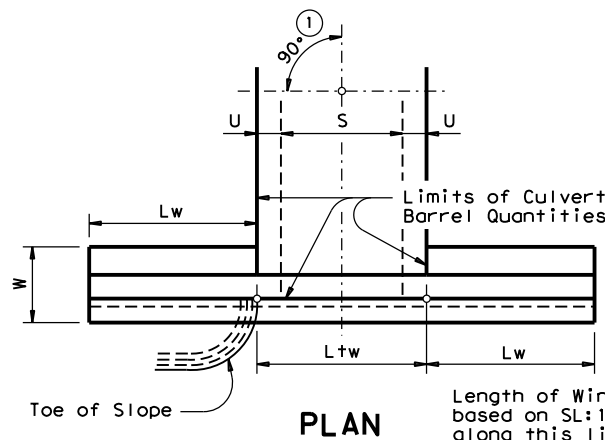
PARTIAL ELEVATION - PW-1

PARTIAL ELEVATION - PW-2

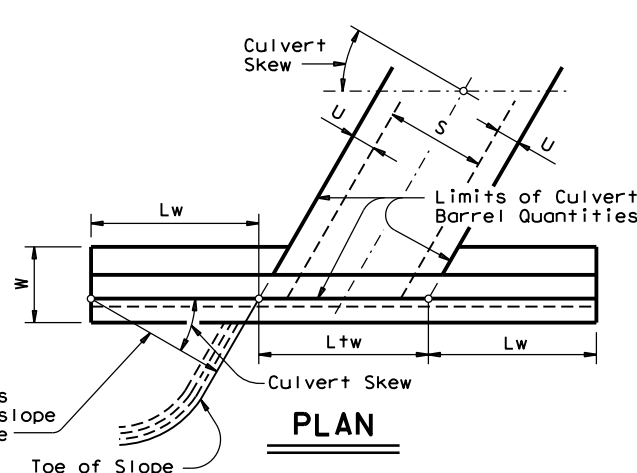


SECTION A-A  
(Showing Wing Reinf)

SECTION B-B  
(Showing Wing Reinf)



DETAILS FOR NON-SKEWED BOX CULVERTS



DETAILS FOR SKEWED BOX CULVERTS  
(Showing 30° Skew)


- Skew Angle = 0°
- At discharge end, chamfer may be 3/4".
- For 15° Skew ~ 1"  
For 30° Skew ~ 2"  
For 45° Skew ~ 3"
- Quantities shown are for two Type PW-1 wings. Adjust concrete volume for Type PW-2 wings. To determine estimated quantities for two wings, multiply the tabulated values by Lw. Quantities shown do not include weight of Bars D.
- Provide weepholes for Hw = 5'-0" and greater. Fill around weepholes with coarse gravel.
- Extend Bars E2 1'-6" minimum into the wingwall footing.
- Lap Bars M1 1'-6" minimum with Bars M2.
- Bars G equally spaced at 8" maximum, place as shown. Provide at least two pair Bars G per wing.
- 0" min to 5'-0" max. Estimated curb heights are shown elsewhere in the plans. For structures with pedestrian rail, bicycle rail or curbs taller than 1'-0", refer to ECD standard. For structures with T6 bridge rail, refer to T6-CM standard. For structures with traffic rail, other than T6, refer to RAC standard.
- For vehicle safety, the following requirements must be met:
  - For structures without bridge rail, curbs cannot project more than 3" above finished grade.
  - For structures with bridge rail, build curbs flush with finished grade.Reduce curb heights, if necessary, to meet the above requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.
- 1'-0" typical. 2'-0" typical when RAC standard is referenced elsewhere in the plans.
- 3'-0" for Hw < 4'.
- 6" for Hw < 4'.

GENERAL NOTES:

Designed in accordance with AASHTO LRFD Bridge Design Specifications.  
Provide Class "C" Concrete (f'c = 3,600 psi Min) and Grade 60 reinforcing steel.  
Provide 1 1/4" Min clear cover to reinforcing steel.  
Depth of toewalls for wingwalls and culverts may be reduced or eliminated when founded on solid rock, when directed by the Engineer.  
See BCS sheet for wingwall type and additional dimensions and information.  
The quantities for concrete and reinforcing steel resulting from the formulas given on this sheet are for the Contractor's information only.

DESIGNER NOTES:

Type PW-1 can be used for all applications and must be used if railing is to be mounted to the wingwall.  
Type PW-2 can only be used for applications without a railing mounted to the wingwall.

 <b>Texas Department of Transportation</b>				<b>Bridge Division Standard</b>	
<div>CONCRETE WINGWALLS WITH PARALLEL WINGS FOR BOX CULVERTS TYPES PW-1 AND PW-2</div> <div>PW</div>					
FILE: pwstd01.dgn		DN: GAF	CK: CAT	DW: TxDOT	CK: GAF
©TxDOT February 2010		CONT	SECT	JOB	HIGHWAY
REVISIONS		0912	31	291	VA
11-10: Reinforcing Quantities. 01-12: PW-1 & PW-2.		DIST	COUNTY		SHEET NO.
		HOU	BRAZORIA / HARRIS		79



DATE: \_\_\_\_\_  
FILE: \_\_\_\_\_

SECTION DIMENSIONS					Fill Height (ft)	M (Min) (in)	REINFORCING (in <sup>2</sup> /ft) ②								Lift Weight (Tons) ①
S (ft)	H (ft)	T <sub>T</sub> (in)	T <sub>B</sub> (in)	T <sub>S</sub> (in)			A <sub>S1</sub>	A <sub>S2</sub>	A <sub>S3</sub>	A <sub>S4</sub>	A <sub>S5</sub>	A <sub>S6</sub>	A <sub>S7</sub>	A <sub>S8</sub>	
6	3	8	7	7	<2	-	0.20	0.31	0.22	0.17	0.19	0.19	0.19	0.17	7.9
6	3	7	7	7	2<3	43	0.21	0.24	0.19	0.17	-	-	-	-	7.5
6	3	7	7	7	3-5	39	0.17	0.18	0.17	0.17	-	-	-	-	7.5
6	3	7	7	7	10	39	0.17	0.18	0.19	0.17	-	-	-	-	7.5
6	3	7	7	7	15	38	0.22	0.24	0.24	0.17	-	-	-	-	7.5
6	3	7	7	7	20	38	0.28	0.31	0.31	0.17	-	-	-	-	7.5
6	3	7	7	7	25	38	0.35	0.38	0.39	0.17	-	-	-	-	7.5
6	3	7	7	7	30	38	0.42	0.46	0.46	0.17	-	-	-	-	7.5
6	4	8	7	7	<2	-	0.19	0.34	0.25	0.17	0.19	0.19	0.19	0.17	8.6
6	4	7	7	7	2<3	43	0.19	0.27	0.21	0.17	-	-	-	-	8.2
6	4	7	7	7	3-5	39	0.17	0.21	0.19	0.17	-	-	-	-	8.2
6	4	7	7	7	10	39	0.17	0.20	0.21	0.17	-	-	-	-	8.2
6	4	7	7	7	15	38	0.18	0.27	0.27	0.17	-	-	-	-	8.2
6	4	7	7	7	20	38	0.24	0.34	0.35	0.17	-	-	-	-	8.2
6	4	7	7	7	25	38	0.29	0.43	0.42	0.17	-	-	-	-	8.2
6	4	7	7	7	30	38	0.35	0.51	0.52	0.17	-	-	-	-	8.2
6	5	8	7	7	<2	-	0.19	0.37	0.28	0.17	0.19	0.19	0.19	0.17	9.3
6	5	7	7	7	2<3	43	0.17	0.30	0.24	0.17	-	-	-	-	8.9
6	5	7	7	7	3-5	43	0.17	0.23	0.21	0.17	-	-	-	-	8.9
6	5	7	7	7	10	39	0.17	0.22	0.23	0.17	-	-	-	-	8.9
6	5	7	7	7	15	38	0.17	0.28	0.29	0.17	-	-	-	-	8.9
6	5	7	7	7	20	38	0.20	0.37	0.38	0.17	-	-	-	-	8.9
6	5	7	7	7	25	38	0.25	0.45	0.46	0.17	-	-	-	-	8.9
6	5	7	7	7	30	38	0.30	0.54	0.55	0.17	-	-	-	-	8.9
6	6	8	7	7	<2	-	0.19	0.38	0.30	0.17	0.19	0.19	0.19	0.17	10.0
6	6	7	7	7	2<3	52	0.17	0.32	0.26	0.17	-	-	-	-	9.6
6	6	7	7	7	3-5	52	0.17	0.24	0.22	0.17	-	-	-	-	9.6
6	6	7	7	7	10	43	0.17	0.23	0.24	0.17	-	-	-	-	9.6
6	6	7	7	7	15	39	0.17	0.29	0.31	0.17	-	-	-	-	9.6
6	6	7	7	7	20	39	0.18	0.38	0.39	0.17	-	-	-	-	9.6
6	6	7	7	7	25	38	0.23	0.46	0.48	0.17	-	-	-	-	9.6
6	6	7	7	7	30	38	0.27	0.55	0.57	0.17	-	-	-	-	

② A<sub>s1</sub> thru A<sub>s4</sub>, A<sub>s7</sub> and A<sub>s8</sub> are minimum required areas of reinforcement per linear foot of box length. A<sub>s6</sub> and A<sub>s5</sub> are minimum required areas of reinforcement per linear foot of box width.



(TOP AND BOTTOM SLAB  
JOINT REINFORCEMENT)




Designs shown conform to ASTM C1577.  
Refer to ASTM C1577 for information or details not shown.  
All concrete shall be Class "H" Concrete with a minimum compressive strength of 5,000 psi.  
See SCP-MD standard sheet for miscellaneous details and notes not shown.  
In lieu of furnishing the designs shown on this sheet, the contractor may furnish an alternate design that is equal to or exceeds the box design for the design fill height in the table. Shop plans for alternate designs shall be submitted in accordance with Item "Precast Concrete Structural Members (Fabrication)".

HL93 LOADING

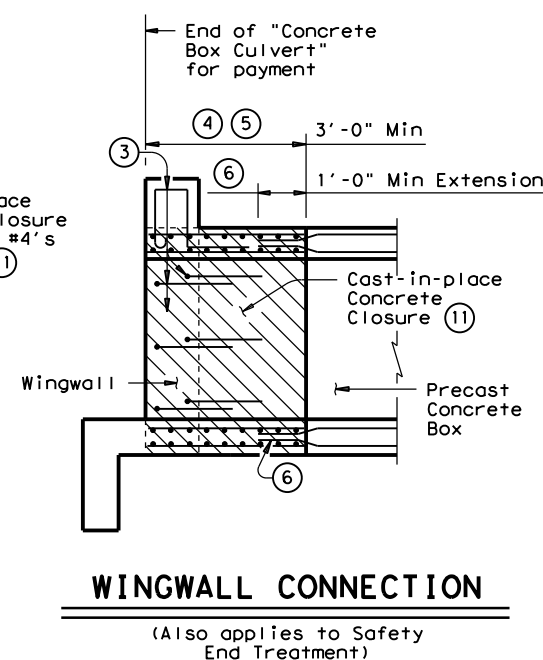
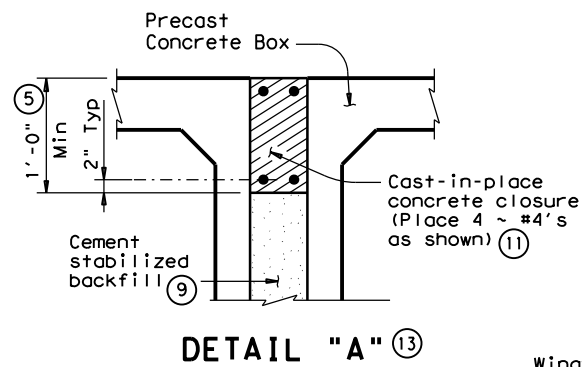
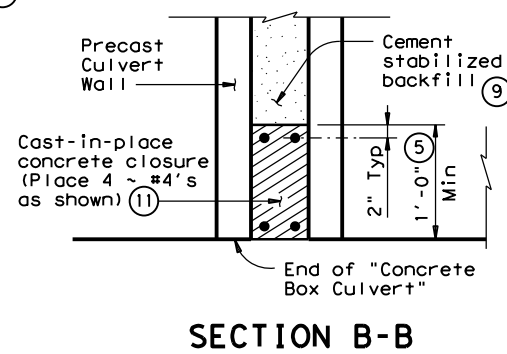
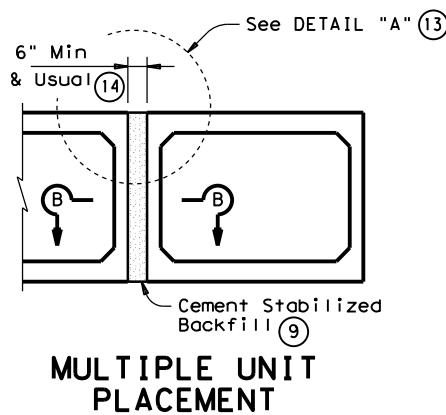


## SCP-6

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 <b>City of Fort Worth</b> February 2010 REVISIONS	CONT		SECT		JOB		HIGHWAY		
	0912		31		291		VA		
	DIST		COUNTY				SHEET NO.		
	HOU		BRAZORIA / HARRIS				80		

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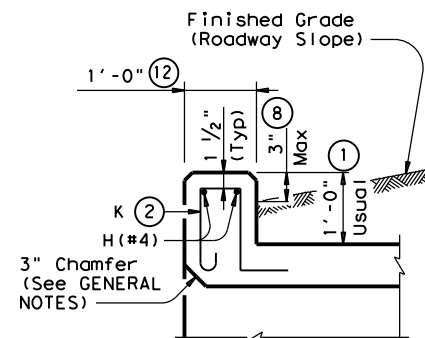
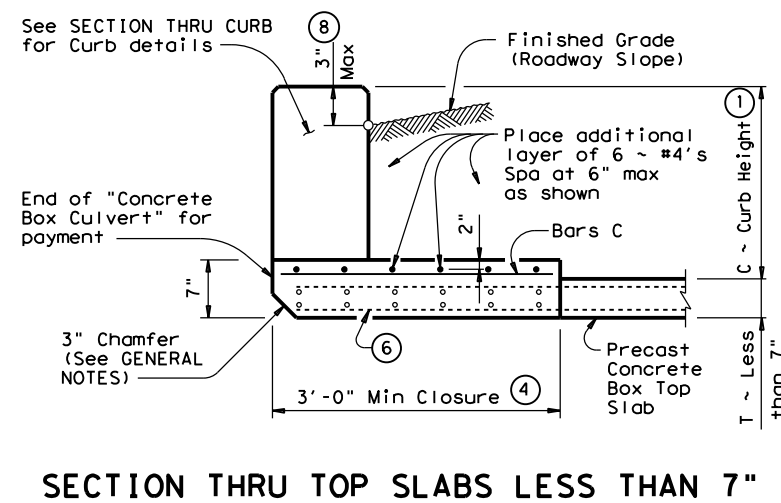
DATE:  
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- 0" min to 5'-0" max. Estimated curb heights are shown elsewhere in the plans. For structures with pedestrian rail, bicycle rail or curbs taller than 1'-0", refer to ECD standard. For structures with T6 traffic rail, refer to T6-CM standard. For structures with traffic rail, other than T6, refer to RAC standard.
- For curbs less than 1'-0" high, tilt Bars K or reduce bar height as necessary to maintain cover. For curbs less than 3" high, Bars K may be omitted.
- Curb, Wingwall or Safety End Treatment reinforcing shall extend into concrete closure. Any reinforcing that does not fit into the closure shall be bent or trimmed as necessary.
- Cast-in-place concrete closure shall be 3'-0" min. Boxes shall be cast short or broken back in the field. All reinforcing in the closure shall be the same size and spacing as in the precast box section. Except where shown otherwise, the cast-in-place closure shall be flush with the inside and outside faces of the precast box section.
- For multiple unit placements the length of the closure for the interior walls may be adjusted as necessary. The length of the top slab, bottom slab, and exterior wall closure shall not be less than 3'-0". See Section B-B detail when interior walls are cast full length.
- Precast box reinforcing shall extend a minimum of 1'-0" into concrete closure (Typ).
- Bands of reinforcing matching the inside and outside face reinforcing shall be placed in the gaps of the top and bottom slabs. A band matching the outside face reinforcing of the wall shall be placed in the gaps of the walls (placed in the outside face only). The bands shall be tack welded to the exposed reinforcing at each point of contact.
- For vehicle safety, the following requirements must be met:
  - For structures without bridge rail, curbs shall project no more than 3" above finished grade.
  - For structures with bridge rail, curbs shall be flush with finished grade.Curb heights shall be reduced, if necessary, to meet the above requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.
- Cement Stabilized Backfill between boxes is considered part of the Box Culvert for payment.
- All curb concrete and reinforcing is considered part of the Box Culvert for payment.
- Any additional concrete and reinforcing required for the closures shall be considered as subsidiary to the Concrete Box Culvert.
- 1'-0" typical. 2'-0" when RAC standard is referred to elsewhere in the plans.
- For multiple unit placement with overlay, with 1 to 2 course surface treatment, or with the top slab as the final riding surface, provide wall closure as shown in DETAIL "A".
- This dimension may be increased with approval of the Engineer to allow the precast boxes to be tunneled or jacked in accordance with Item 476, "Jacking, Boring, or Tunneling Pipe or Box". No payment will be made for any additional material in the gap between adjacent boxes.

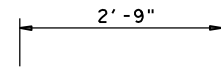
**GENERAL NOTES:**

Designed according to AASHTO LRFD Specifications.  
All closure concrete shall be Class "C" with a minimum compressive strength of 3600 psi and shall be placed according to the Item, "Concrete Substructures".  
Any additional concrete required for the closures shall be considered as subsidiary to the Concrete Box Culvert.  
Refer to the Single Box Culverts Precast standard for details not shown.  
The bottom edge of the top slab closure shall be chamfered 3 inches at the entrance.

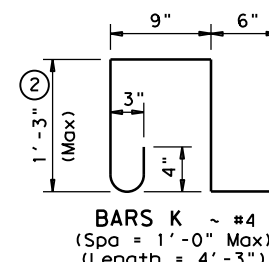


**SECTION THRU CURB**

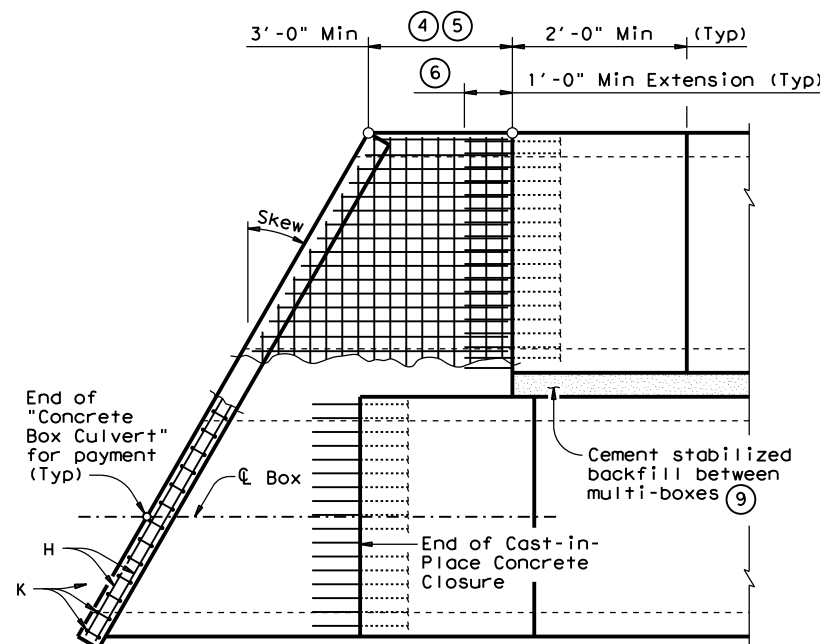
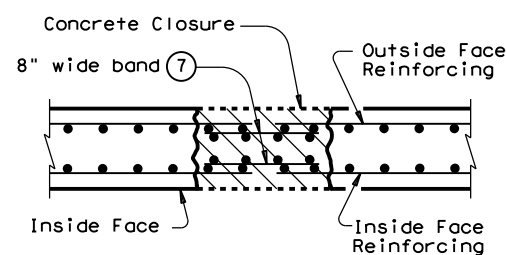
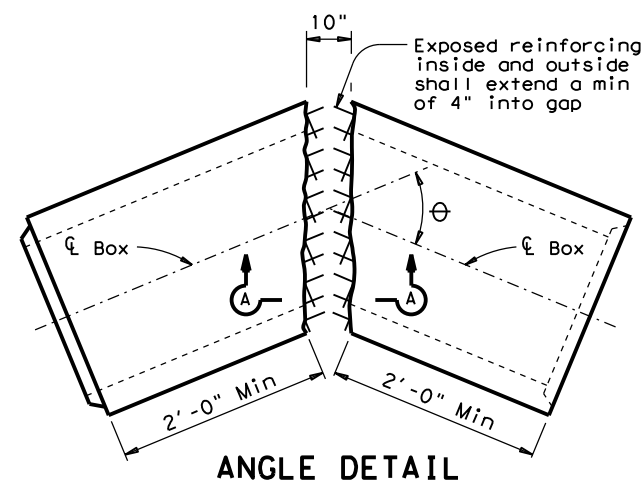
(10) QUANTITIES PER FOOT OF CURB	
Reinforcing Steel	4.18 Lb
Concrete	0.037 CY



BARS C ~ #4  
(Spa = 1'-0" Max)

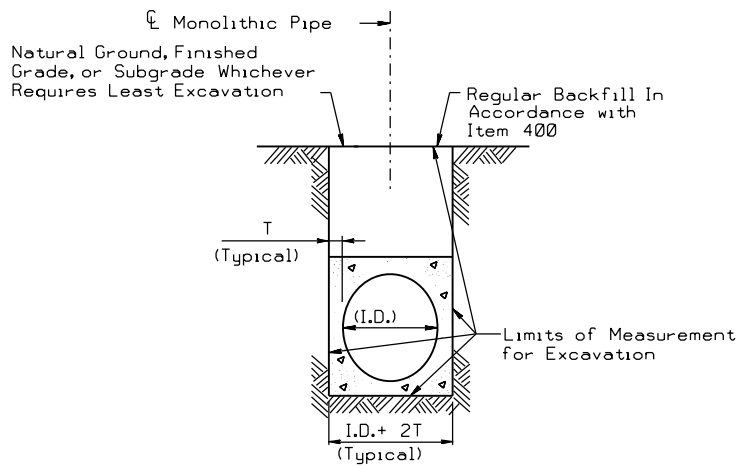


BARS K ~ #4  
(Spa = 1'-0" Max)  
(Length = 4'-3")

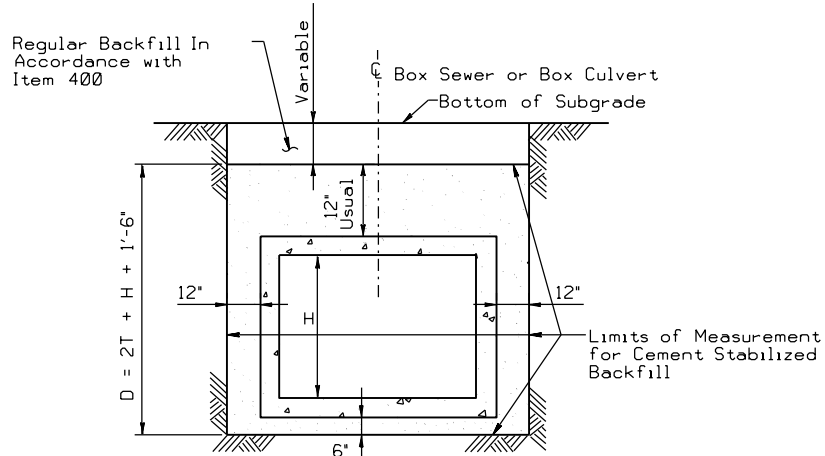


**HL93 LOADING**

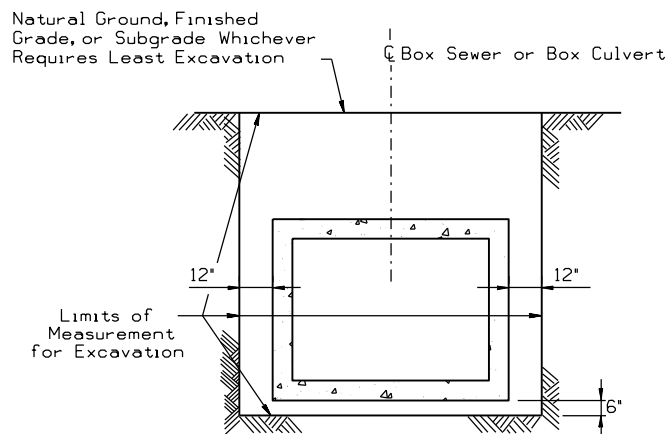
		Bridge Division Standard	
<b>BOX CULVERTS</b>			
<b>PRECAST</b>			
<b>MISCELLANEOUS DETAILS</b>			
<b>SCP-MD</b>			
FILE: scpmdstls.dgn	DN: GAF	CR: LMW	DWG: BWH/TXDOT
©TxDOT February 2010	CONT	SECT	JOB
REVISIONS	0912	31	291
DIST	COUNTY		SHEET NO.
HOU	BRAZORIA / HARRIS		81



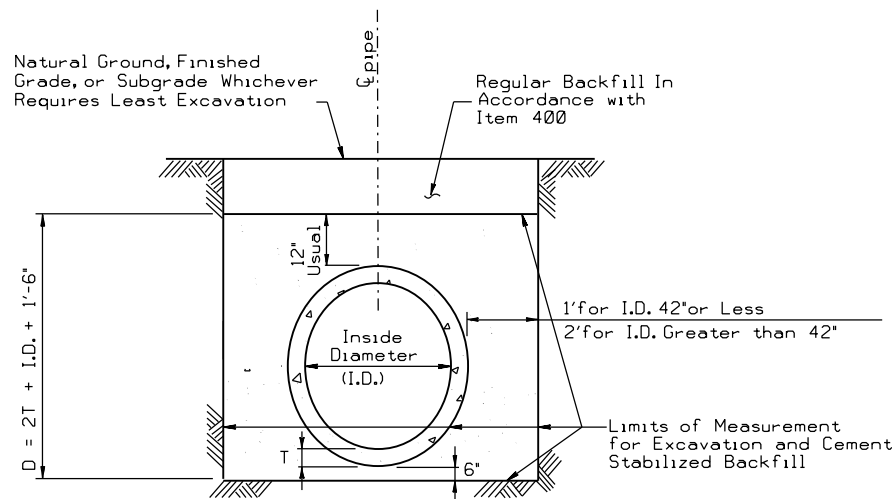
EXCAVATION DETAIL  
MONOLITHIC PIPE  
IN A PAVED OR GRADED AREA



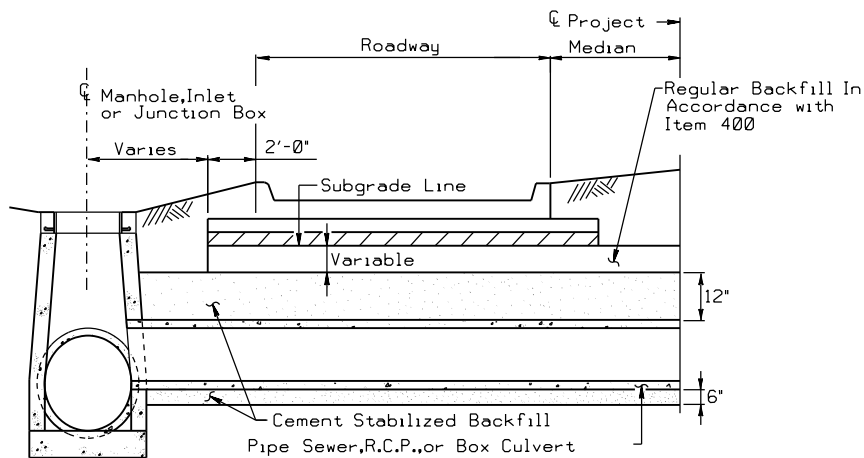
BACKFILL DETAIL  
BOX CULVERTS  
IN A GRADED OR PAVED AREA  
INCLUDING DETOURS \*



EXCAVATION DETAIL  
BOX CULVERTS  
IN A GRADED AREA



EXCAVATION & BACKFILL DETAIL  
REINFORCED CONCRETE PIPE  
IN A GRADED OR PAVED AREA  
INCLUDING DETOURS



BACKFILL DETAIL  
AT MANHOLE, INLET OR JUNCTION BOX

REINFORCED CONCRETE PIPE			
EXCAVATION AND BACKFILL QUANTITIES			
PIPE DIA. IN.	T FT.	CULVERT OR SEWER EXCAVATION IN A PAVED OR GRADED AREA	CEMENT STABILIZED BACKFILL IN A PAVED OR GRADED AREA
		C.Y.PER L.F.PER FT.OF DEPTH	C.Y.PER L.F. OF PIPE
18	0.19	0.144	0.383
24	0.23	0.165	0.478
30	0.29	0.188	0.586
36	0.33	0.210	0.692
42	0.38	0.231	0.808
48	0.42	0.327	1.394
54	0.46	0.349	1.560
60	0.50	0.370	1.731
66	0.54	0.392	1.907
72	0.58	0.414	2.088
78	0.62	0.435	2.275
84	0.67	0.457	2.474

MONOLITHIC PIPE		
EXCAVATION QUANTITIES		
PIPE DIA. IN.	T FT.	EXCAVATION C.Y.PER L.F.PER FT.OF DEPTH
36	0.417	0.142
42	0.458	0.164
48	0.458	0.182
54	0.500	0.204
60	0.583	0.228
66	0.583	0.247
72	0.625	0.269
78	0.625	0.287
84	0.625	0.306

**NOTE:**  
Cement stabilized backfill may be omitted in private driveways as indicated elsewhere in the plans.

Rubber gaskets shall be required for all joints on proposed cross drainage, pipe culverts and proposed storm sewer systems, unless otherwise shown in the plans.

• Backfill with cement stabilized material will be required for all structures under detours unless noted otherwise in the General Notes.

SHEET 1 OF 2

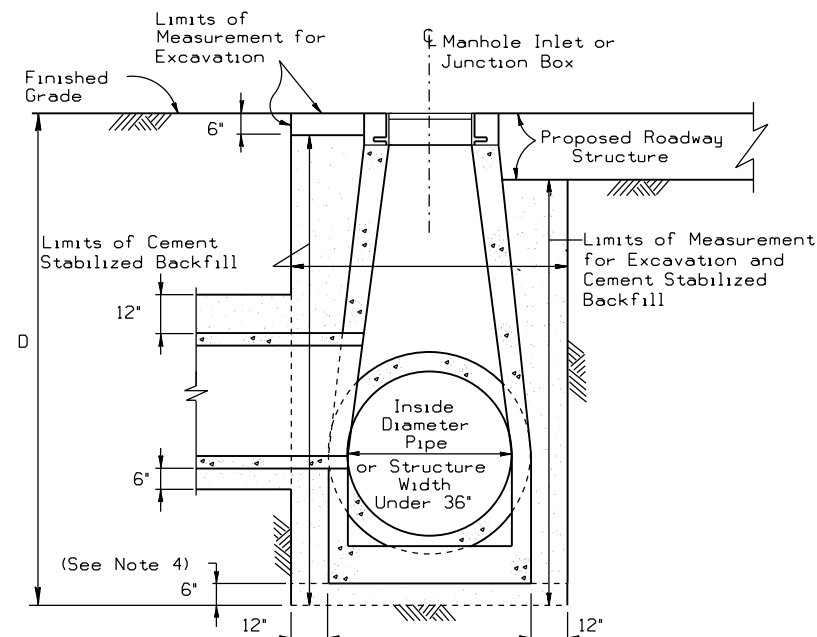
 Texas Department of Transportation  
Houston District

## EXCAVATION AND BACKFILL DIAGRAMS

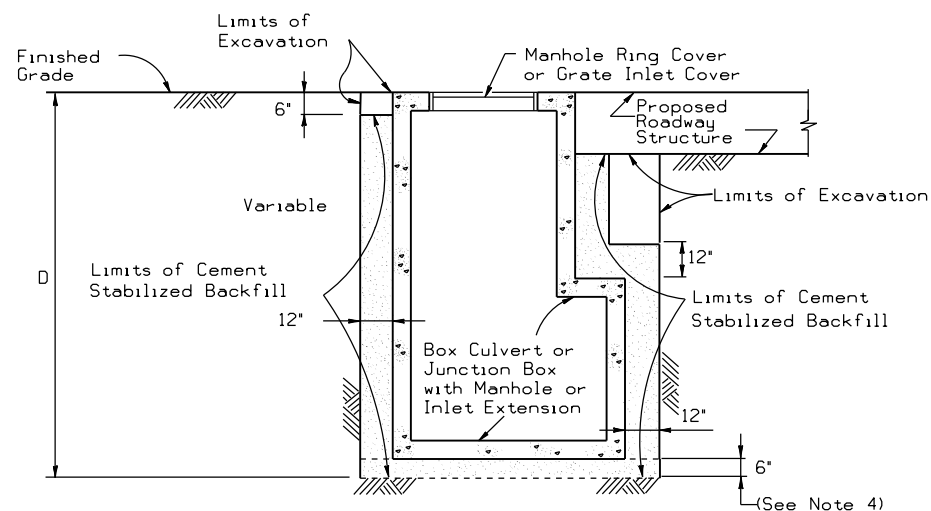
E&BD

D = Depth  
H = Height  
T = Thickness  
R = Radius  
Dia = Diameter

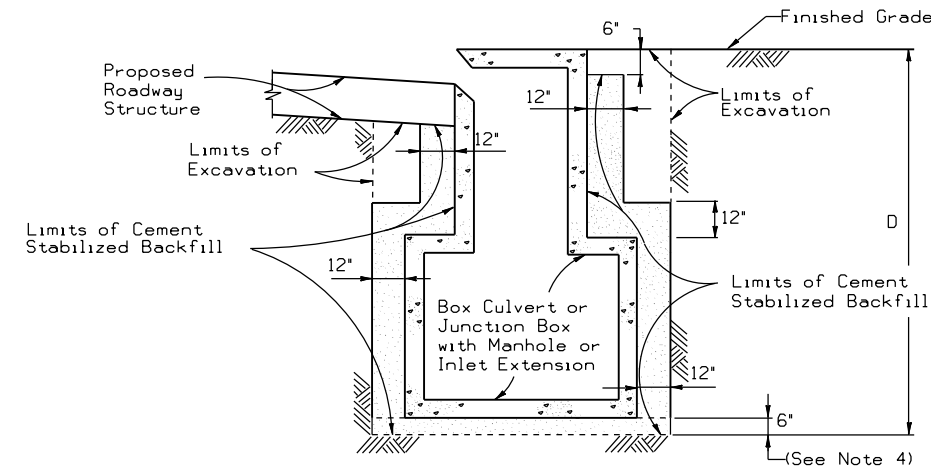
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© TxDOT FEB 2010	DIST	FED REG	PROJECT NO.	SHEET
REVISED 11/05	HOUSTON	6	STP 1702 (291)	MM 82
REVISED 2/2010 Added note to Table 1, Sht 2 of 2.	COUNTY	CONTROL	SECT	JOB
REVISED 6/12	BRAZORIA/HARRIS	0912	31	291
REVISED 9/14				VA



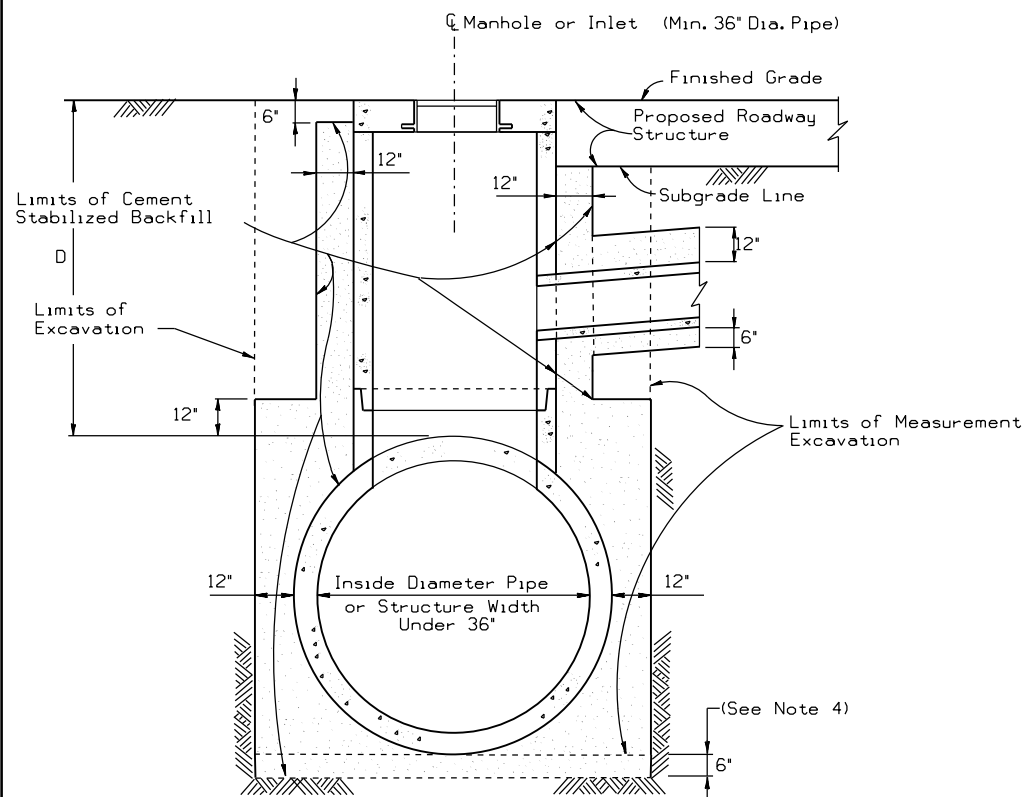
**EXCAVATION AND BACKFILL DETAIL**  
**MANHOLES SMALLER THAN 36 IN.**  
**IN A PAVED OR GRADED AREAS**  
 N.T.S.



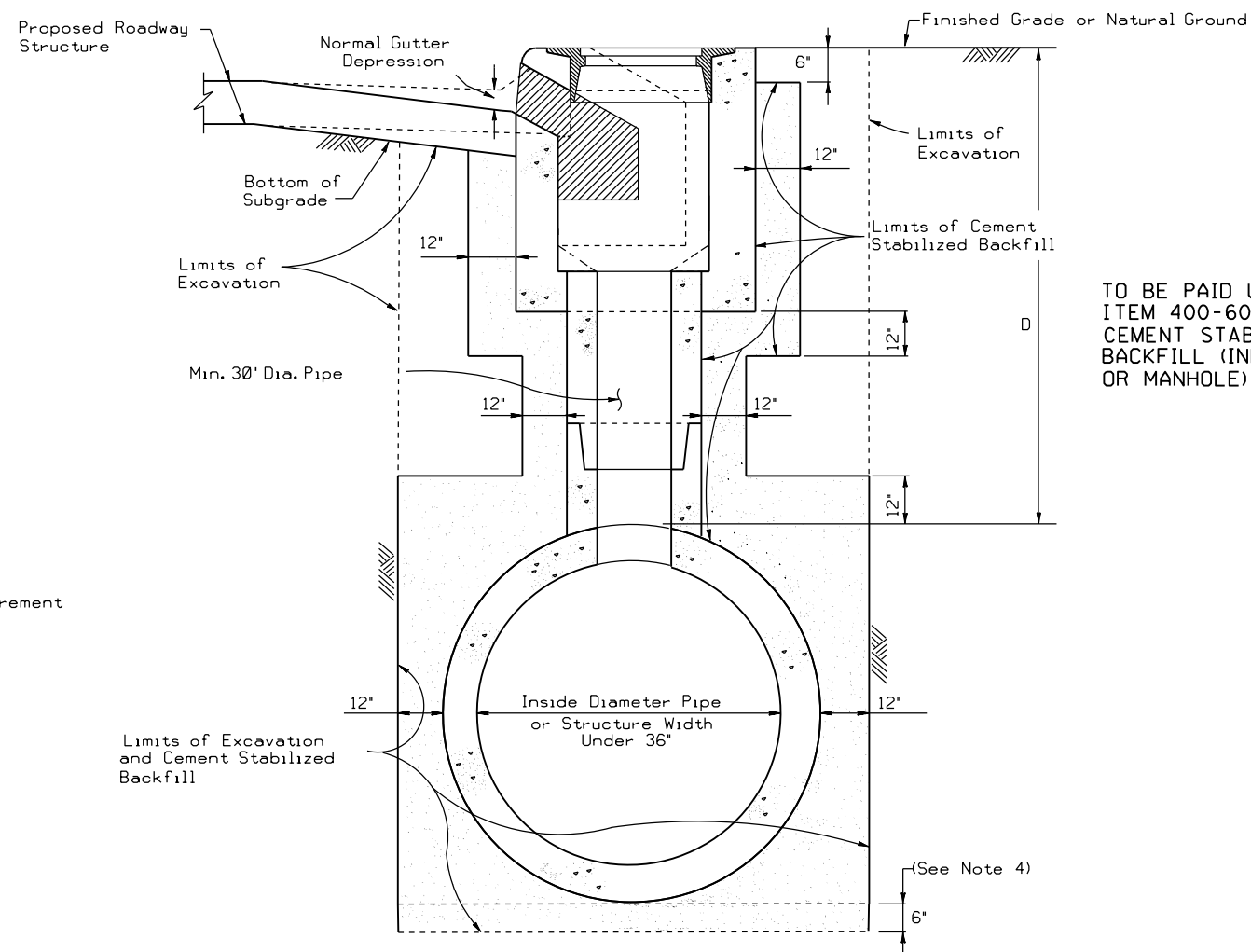
**EXCAVATION AND BACKFILL DETAIL**  
**JUNCTION BOXES IN A**  
**PAVED OR GRADED AREA**  
 N.T.S.



**EXCAVATION AND BACKFILL DETAIL**  
**INLET EXTENSIONS ON A BOX CULVERT**  
**IN A PAVED OR GRADED AREA**  
 N.T.S.



**EXCAVATION AND BACKFILL DETAIL**  
**MANHOLES 36 IN. AND GREATER**  
**IN A PAVED OR GRADED AREA**  
 N.T.S.



**EXCAVATION AND BACKFILL DETAIL**  
**CURB INLETS IN A PAVED OR GRADED AREA**  
 N.T.S.

TO BE PAID UNDER  
 ITEM 400-6009  
 CEMENT STABILIZED  
 BACKFILL (INLET  
 OR MANHOLE)

TABLE I	
SCHEDULE FOR PAY QUANTITIES OF CEMENT STABILIZED BACKFILL (SEE NOTE 1)	
MANHOLE OR INLET DEPTH (D) IN FEET	CEMENT STABILIZED BACKFILL IN CUBIC YARDS
0 through 5	5.75
> 5 through 10	8.25
greater than 10	12.75

**NOTES:**

1. The Contractor is paid a fixed estimated amount for cement stabilized backfill based on depth (D) and Table 1.
2. Proposed roadway structure includes pavement, base and any subgrade.
3. For backfill of intersecting pipes and box culverts, see "Excavation and Backfill Diagram for Pipes and Box Culverts."
4. 6" cement stabilized backfill will be required only for precast units.

SHEET 2 OF 2

**Texas Department of Transportation**  
**Houston District**

**EXCAVATION AND BACKFILL  
 DIAGRAMS**

**E&BD**

D = Depth  
 H = Height  
 T = Thickness  
 R = Radius  
 Dia = Diameter

FILE: STDE1.DGN	DN: TxDot	CK: TxDot	DW: TxDot	CK: TxDot
© TxDOT FEB 2010	DIST	FED REG	PROJECT NO.	SHEET
REVISED 2/2010 Added note to Table 1.	HOUSTON	6	STP 1702 (291)	MM 83
REVISED 6/12	COUNTY	CONTROL	SECT	JOB
REVISED 9/14	BRAZORIA/HARRIS	0912	31	291
REVISED 3/15				VA