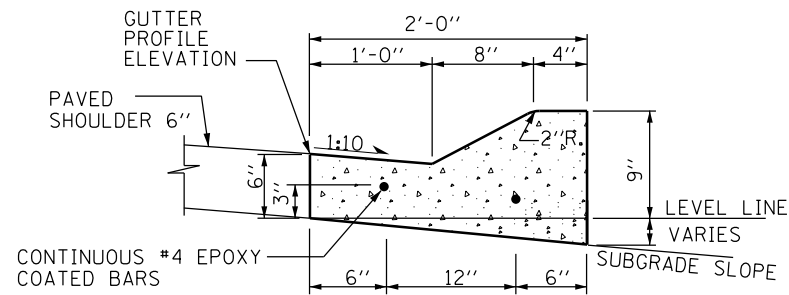


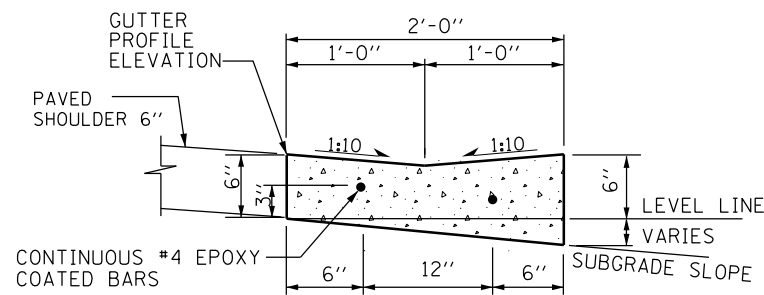
Tollway Standard Drawing Revisions

Section B	Drainage Structures, Curbs, Curbs & Gutter and Ditches	
	Standard	Modification Summary Effective 03/01/2013
	All Sheets	Illinois Tollway Standard Logo Inserted In Title Block.
	B28	Gutter Transition at Traffic Barrier Terminal Type T1 (Special).
		Gutter Transition Revised from 10'-0" to 6'-0".
		Type G2 and G3 Modified Gutter Revised from 90'-0" to 87'-0".
	B29	Gutter Transition at Traffic Barrier Terminal Type T1-A (Special).
		Gutter Transition Revised from 10'-0" to 6'-0".
		Type G2 Modified Gutter Revised from 65'-0" to 62'-0".

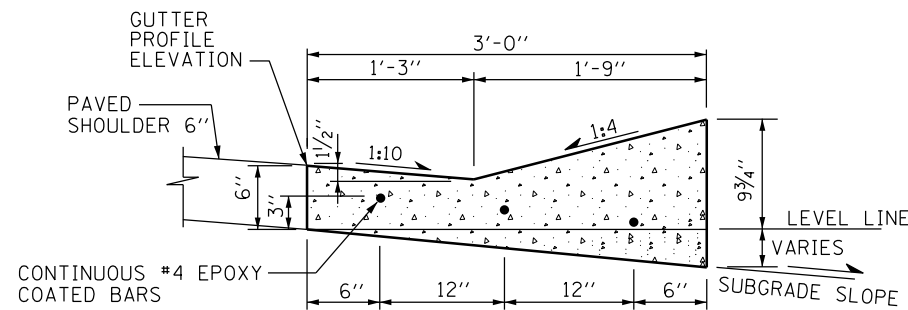
	New Sheet
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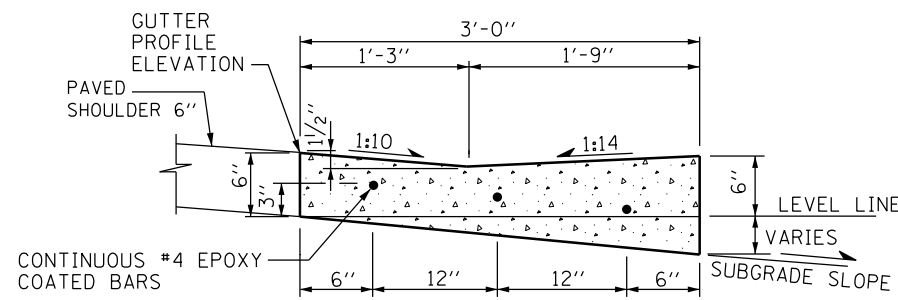
TYPE G-2 GUTTER



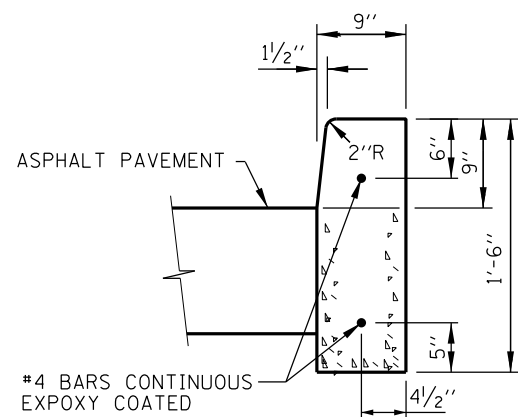
TYPE G-2, MODIFIED GUTTER



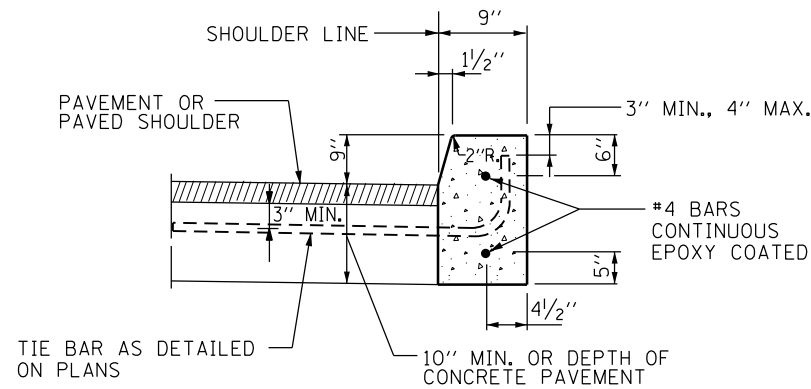
TYPE G-3 GUTTER



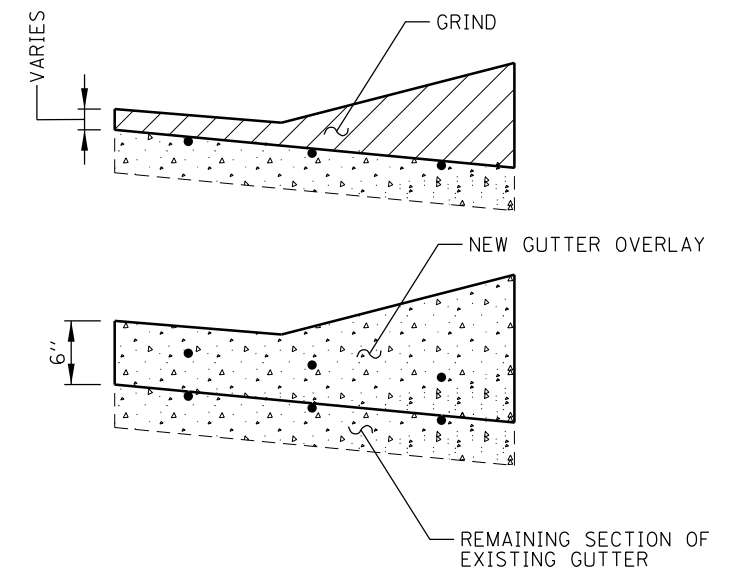
TYPE G-3, MODIFIED GUTTER



ADJACENT TO FLEXIBLE PAVEMENT



ADJACENT TO PCC PAVEMENT



CONCRETE GUTTER OVERLAY

NOTES:

- FOR TYPE C CURB TRANSITIONS, THE LEADING ENDS OF CURB IN THE DIRECTION OF TRAFFIC SHALL BEGIN FLUSH WITH ADJACENT PAVEMENT OR SHOULDER SURFACE AND TRANSITION TO FULL HEIGHT AT THE RATE OF ONE INCH VERTICAL TO ONE FOOT HORIZONTAL.
- | GUTTER TRANSITION DETAILS | STANDARD DRAWING |
|--|------------------|
| TRAFFIC BARRIER TERMINAL TYPE T1 (SPECIAL) | B-28 |
| TRAFFIC BARRIER TERMINAL TYPE T1-A (SPECIAL) | B-29 |
| TRAFFIC BARRIER TERMINAL TYPE T5 AND T10 | B-2 |
| TRAFFIC BARRIER TERMINAL TYPE T6 | B-3 |
- ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENT (V:H).
- REINFORCEMENT STEEL SHALL BE ACCURATELY PLACED AND FIRMLY HELD IN THE POSITION SPECIFIED USING EPOXY COATED STEEL CHAIRS. CHAIR SPACING SHALL NOT EXCEED, 4'-0".
- GUTTER REINFORCEMENT SHALL BE PLACED 3" ABOVE BOTTOM OF GUTTER FOLLOWING THE SUBGRADE SLOPE.
- OTHER GUTTER AND CURB TRANSITION DETAILS WILL BE SHOWN ON THE PLANS.
- CONTINUOUS #4 BARS SHALL BE LAPPED A MINIMUM OF 2'-0" IN ACCORDANCE WITH THE LATEST IDOT-BRIDGE MANUAL.
- FOR CONCRETE GUTTER OVERLAYS, CRACK CONTROL JOINTS SHALL BE PLACED AT LOCATIONS OF UNDERLYING JOINTS AND WORKING CRACKS.

TYPE "C" CURB

(RAMP TOLL PLAZAS ONLY)

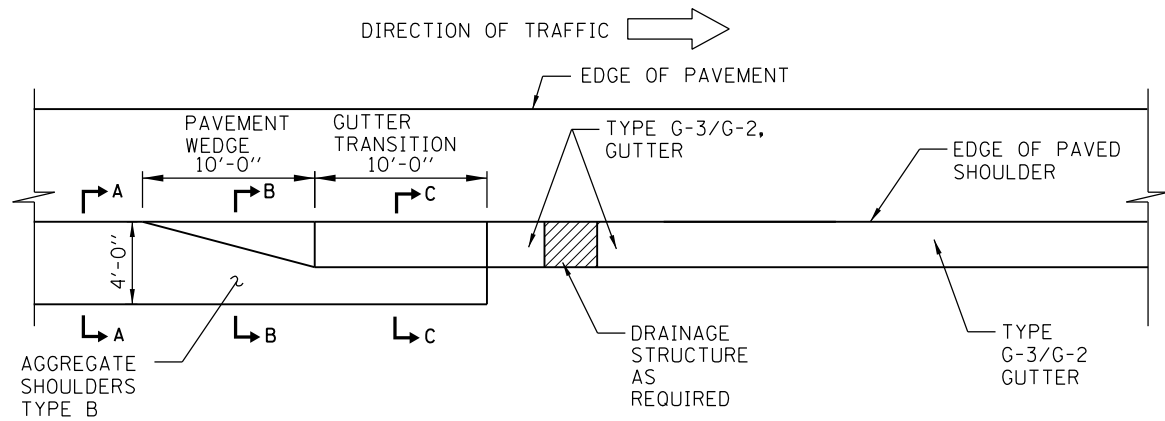


DATE	REVISIONS
2-7-2012	REVISED NOTES
11-1-2012	ADDED CONCRETE GUTTER OVERLAY MODIFIED GUTTER CONTROL JOINT SPACING

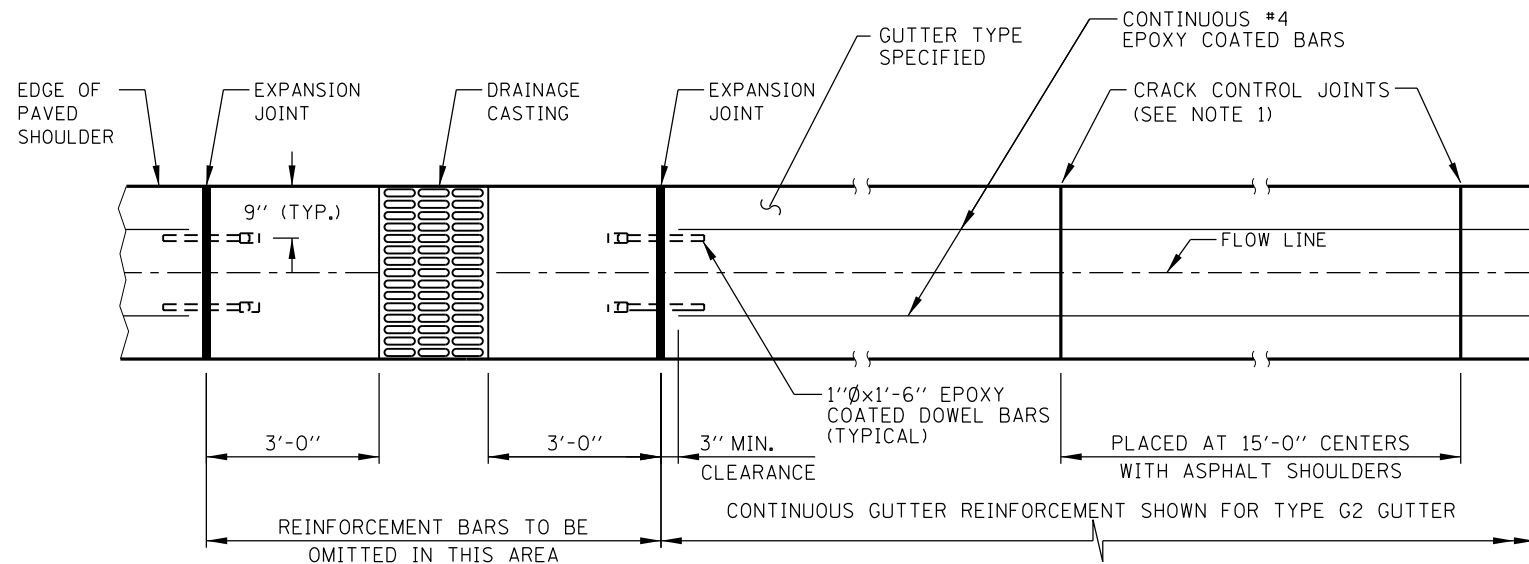
GUTTER AND CURB DETAILS

STANDARD B1-05

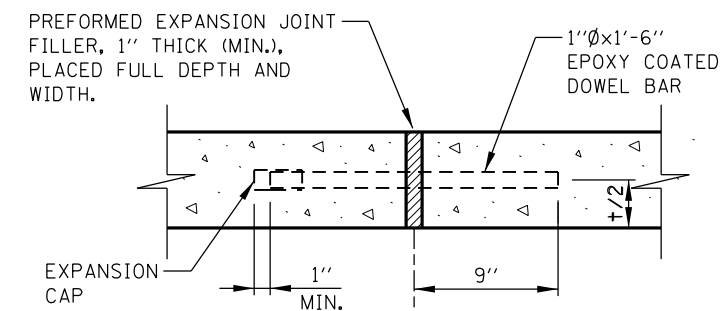
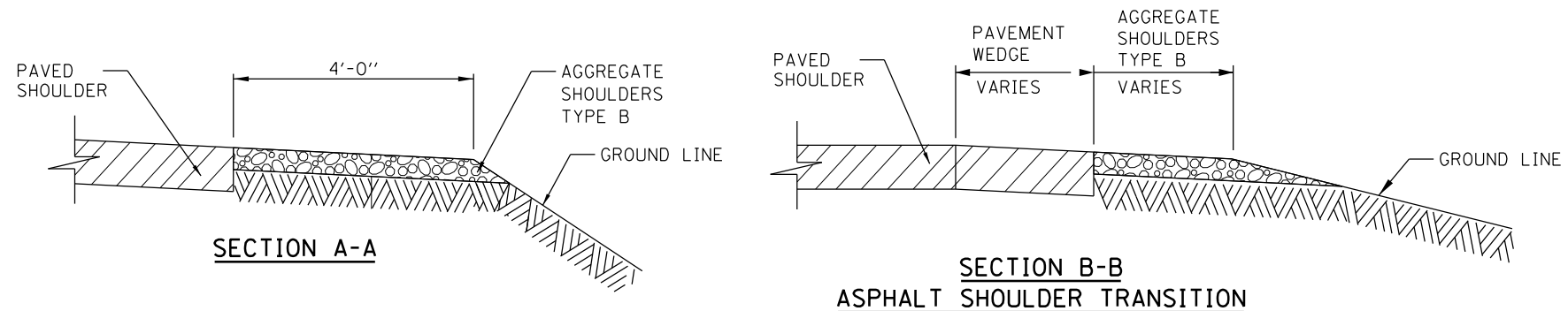
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 2-7-2012...



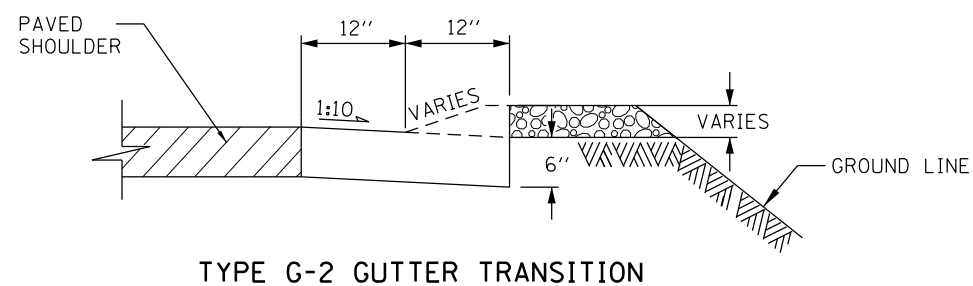
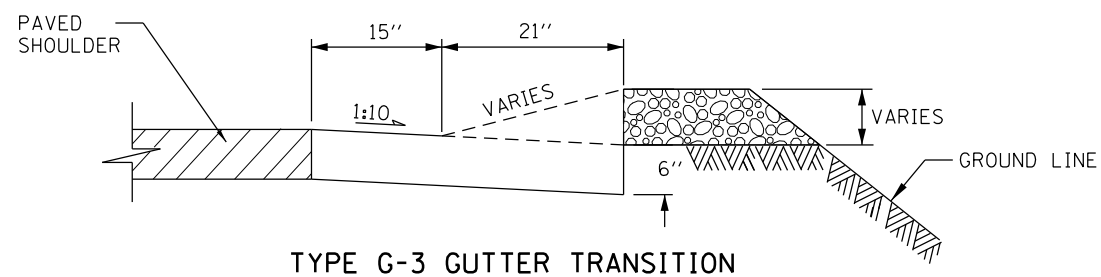
GUTTER TRANSITION TERMINATION



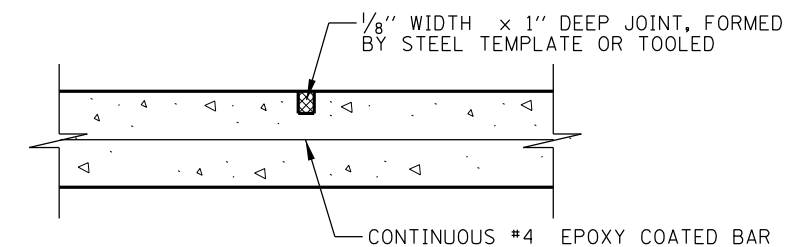
GUTTER PLAN



EXPANSION JOINT



SECTION C-C



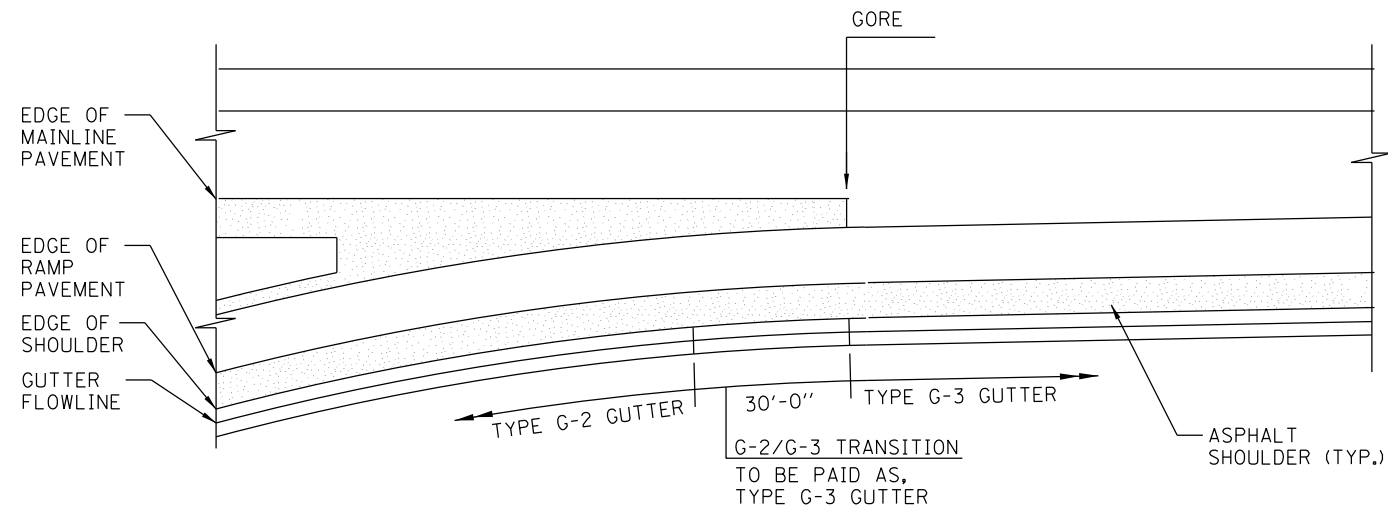
CRACK CONTROL JOINT

EXPANSION-CRACK CONTROL JOINTS TYPE G-3/G-2 GUTTER

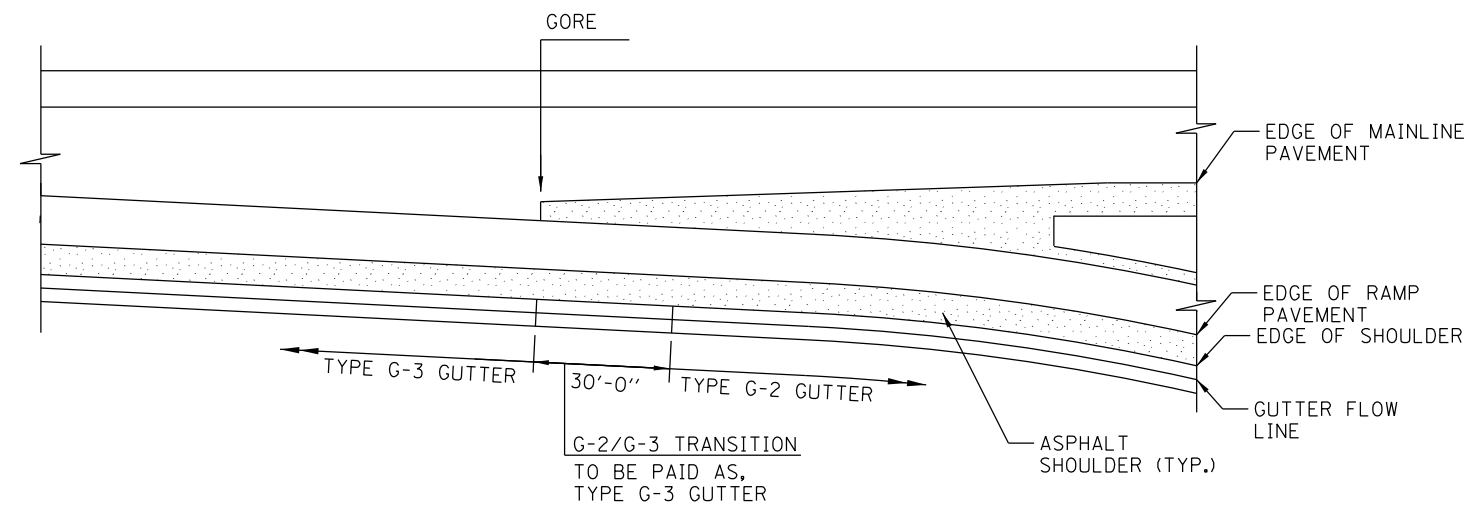
NOTES:

- GUTTER CRACK CONTROL JOINTS TO ALIGN IN PROLONGATION WITH PCC SHOULDER JOINTS WHERE EXISTING.
- SEE SHEET 1 OF THIS SERIES FOR NOTES.





GUTTER TRANSITION AT ENTRANCE RAMP TERMINALS



GUTTER TRANSITION AT EXIT RAMP TERMINALS

GUTTER TRANSITION NOTES:

1. PROVIDE 1" EXPANSION JOINT WITH PREFORMED JOINT FILLER BETWEEN TRANSITION SECTION AND WINGWALL.
2. SEE STANDARD B3 FOR GUTTER TRANSITIONS AT BRIDGE APPROACH.
3. ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENT (V:H).
4. REINFORCEMENT STEEL SHALL BE ACCURATELY PLACED AND FIRMLY HELD AT THE POSITION USING EPOXY COATED CHAIRS. CHAIR SPACING SHALL NOT EXCEED 4'-0".
5. GUTTER REINFORCEMENT SHALL BE PLACED 3" ABOVE BOTTOM OF GUTTER FOLLOWING SUBGRADE SLOPE.
6. CONTINUOUS #4 BARS SHALL BE LAPPED A MINIMUM OF 2'-0" IN ACCORDANCE WITH THE LATEST IDOT MANUAL.

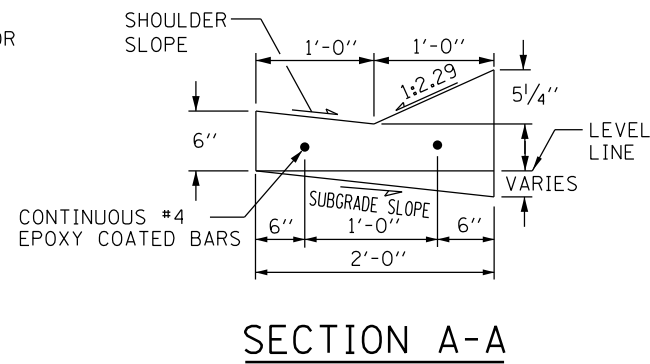
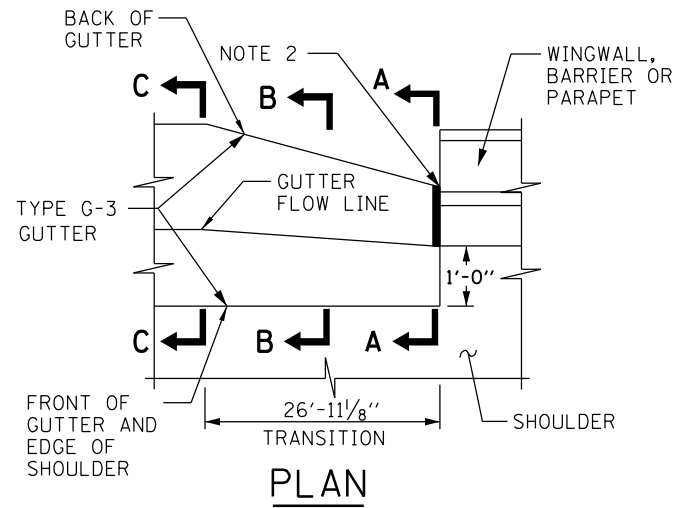

 APPROVED CHIEF ENGINEER DATE 2-7-2012 ...

DATE	REVISIONS
6-1-2009	REVISED NOTES, MODIFIED G2/G3 GUTTER TRANSITIONS
9-1-2009	ADDED GUTTER TRANSITION TERMINAL DETAIL
3-1-2010	RELOCATED GUTTER TRANSITION DETAIL TO STANDARD B28, REVISED NOTES
	REVISED TYPE G-3, G-2 GUTTER AT BRIDGE APPROACH
2-7-2012	REVISED NOTES

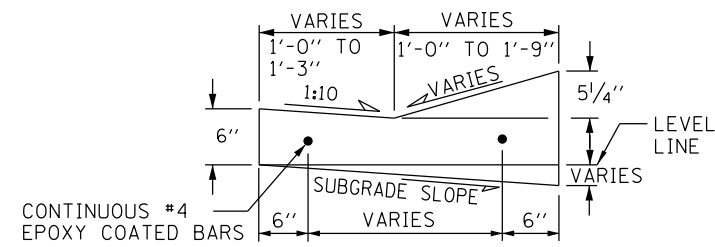


TYPE G-2 AND G-3
GUTTER TRANSITIONS

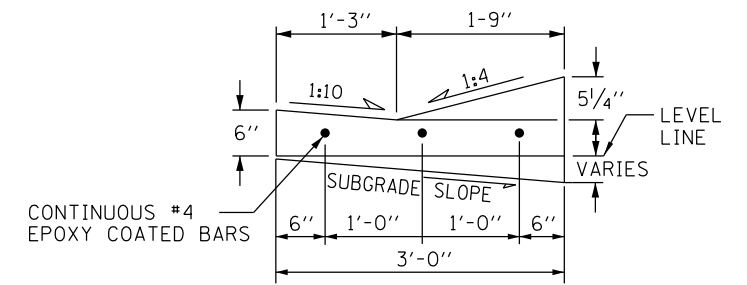
STANDARD B2-04



SECTION A-A

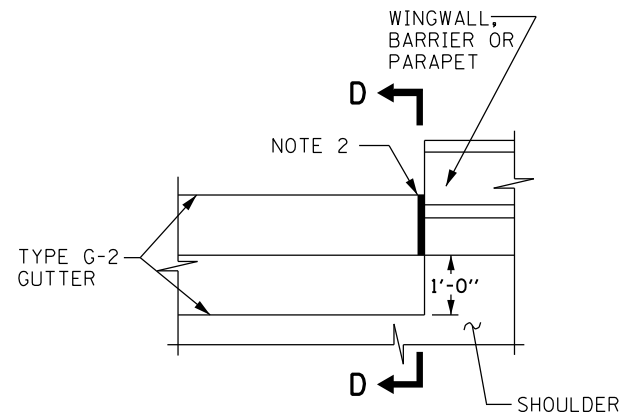


SECTION B-B

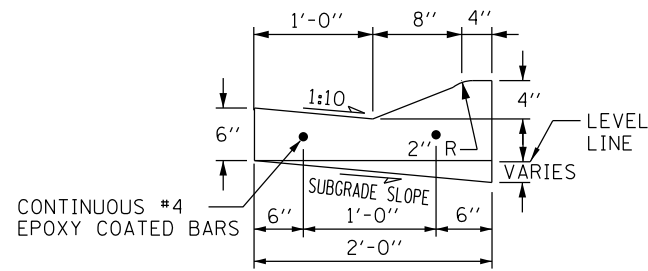


SECTION C-C
NORMAL TYPE G-3 GUTTER

TYPE G-3 GUTTER TRANSITION AT BRIDGE DEPARTURE



PLAN

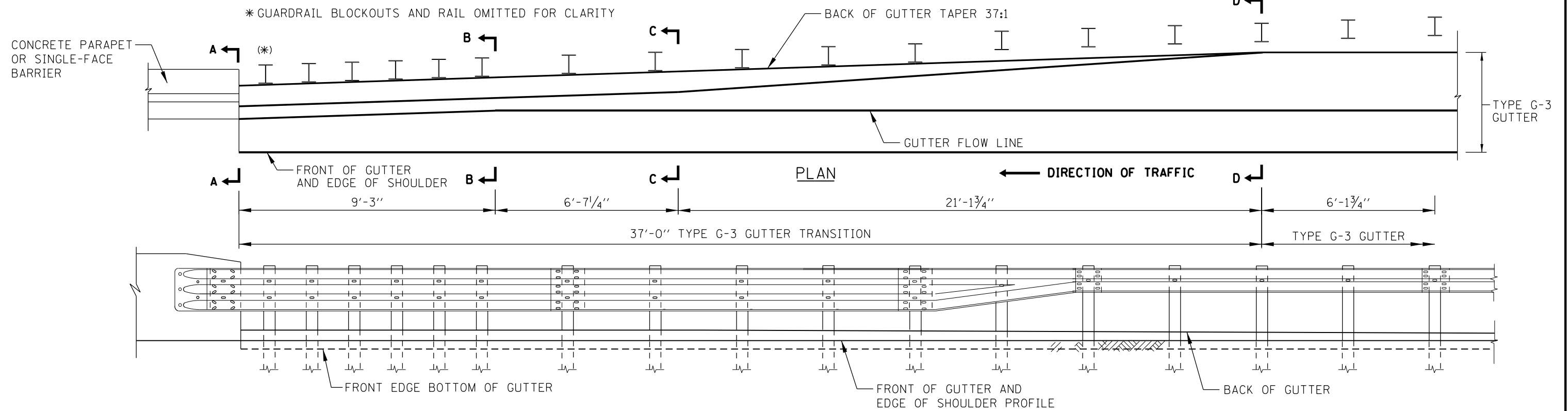


SECTION D-D
NORMAL TYPE G-2 GUTTER

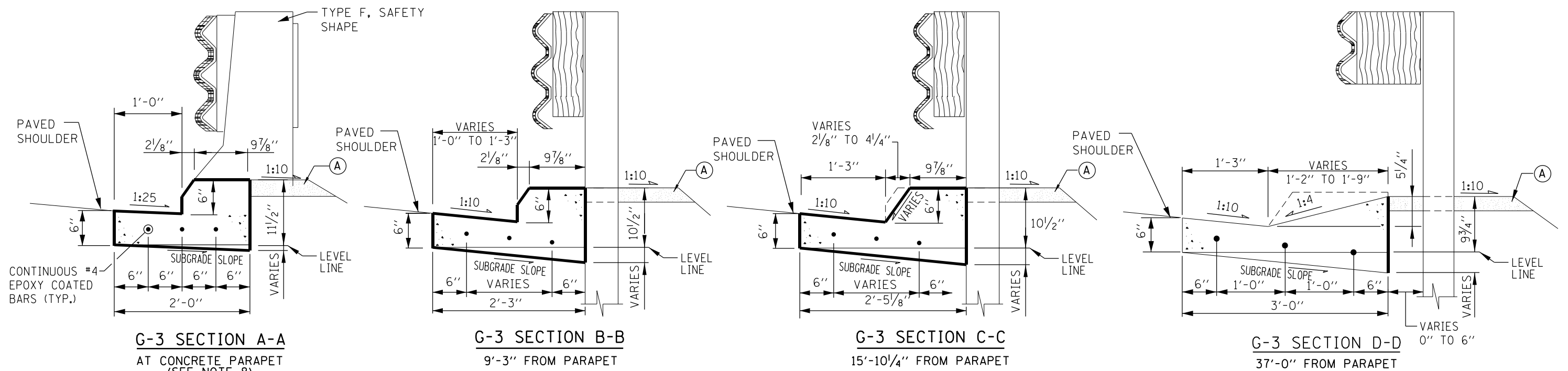
TYPE G-2 GUTTER AT BRIDGE DEPARTURE

NOTE:
SEE SHEET 1 OF THIS SERIES FOR NOTES.





ELEVATION



GUTTER TRANSITION NOTES:

1. SLOPE TO MATCH ADJACENT SHOULDER SLOPE (TYPICALLY 4%).
2. THE TYPE G-3 GUTTER TRANSITION SHALL BE PAID FOR PER FOOT FOR CONCRETE GUTTER TYPE G-3.
3. PROVIDE 1" EXPANSION JOINT WITH PREFORMED JOINT FILLER BETWEEN TRANSITION SECTION AND WINGWALL OR BARRIER WALL.
4. INSTALLATION ON CURVED WINGWALLS SIMILAR.
5. FOR DETAILS OF ANCHOR INSTALLATION TYPE T6 SEE TOLLWAY STANDARD C9 (TRAFFIC BARRIER TERMINAL, TYPE T6).
6. GUTTER TRANSITIONS SHALL BE CONSTRUCTED TO FIT THE STANDARD LOCATION OF THE ANCHOR INSTALLATION TYPE T6.
7. ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENT (V:H).
8. GUTTER SECTION SHOWN AT BARRIER WALL TO MATCH VERTICAL PROFILE OF TYPE F SAFETY SHAPE. MODIFY GUTTER FACE TO MATCH OTHER PARAPET PROFILES.
9. CONTINUOUS #4 BARS SHALL BE LAPPED A MINIMUM OF 2'-0" IN ACCORDANCE WITH THE LATEST IDOT BRIDGE MANUAL.

LEGEND

- (A) AGGREGATE SHOULDERS SPECIAL, TYPE C

APPROVED: *Paul Kovacs* CHIEF ENGINEER DATE 2-7-2012

TYPE G-3 GUTTER TRANSITION AT TRAFFIC BARRIER TERMINAL, TYPE T6

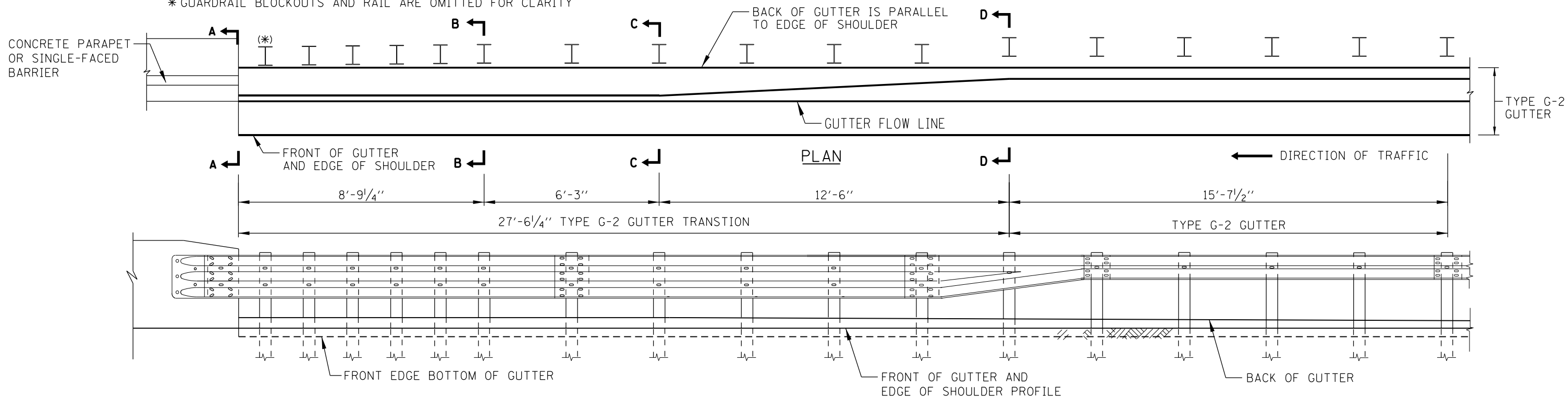


DATE	REVISIONS
6-1-2009	MODIFIED BARRIER TERMINAL DETAILS
3-1-2010	REVISED NOTES
1-1-2011	REVISED G-2/G-3 GUTTER TRANSITION DETAILS, REVISED NOTES
2-7-2012	REVISED NOTE 8
	REVISED GUTTER

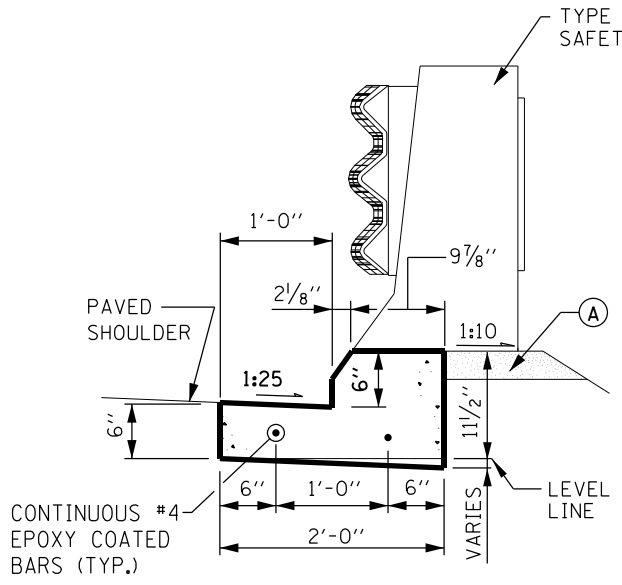
TYPE G-2/G-3 GUTTER TRANSITION AT TRAFFIC BARRIER TERMINAL, TYPE T6

STANDARD B3-04

* GUARDRAIL BLOCKOUTS AND RAIL ARE OMITTED FOR CLARITY

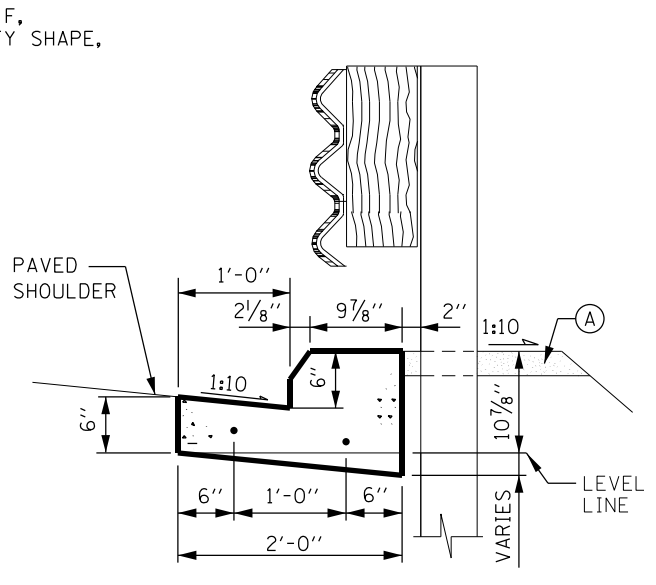


ELEVATION

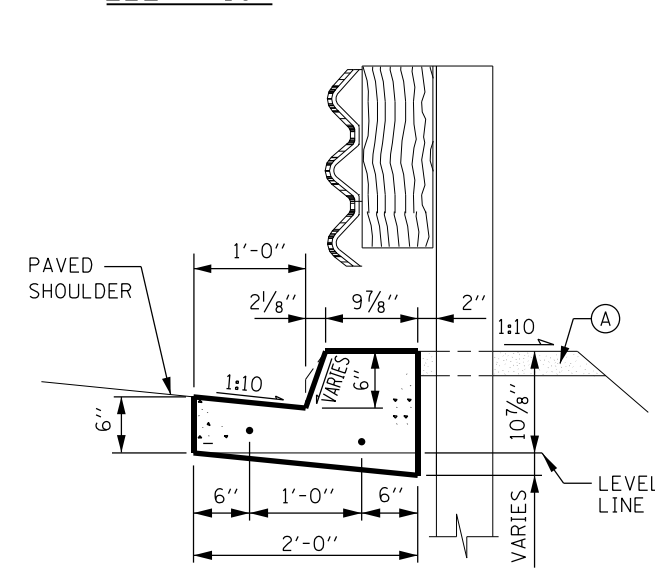


**G-2 SECTION A-A
AT CONCRETE PARAPET**

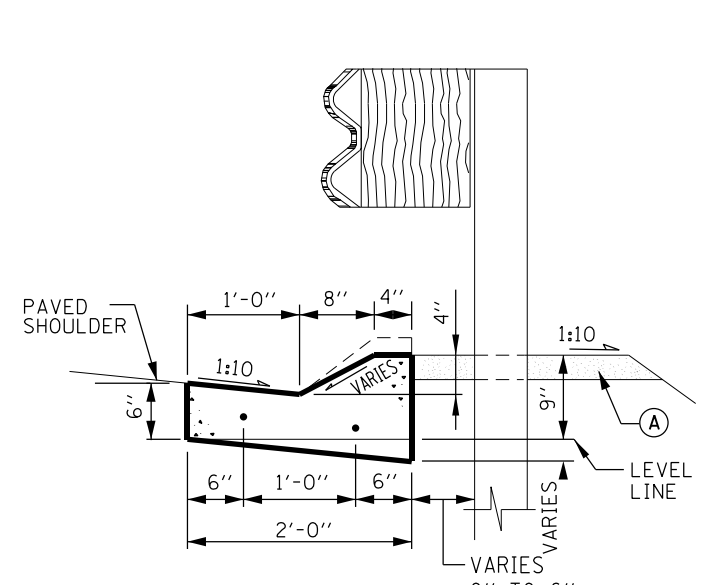
(SEE NOTE 8)



**G-2 SECTION B-B
8'-9 1/4" FROM PARAPET**



**G-2 SECTION C-C
15'-0 1/4" FROM PARAPET**



**G-2 SECTION D-D
27'-6 1/4" FROM PARAPET**

NOTES:

1. SEE SHEET 1 OF THIS SERIES FOR GUTTER TRANSITION NOTES.
2. THE TYPE G-2 GUTTER TRANSITION SHALL BE PAID PER FOOT FOR CONCRETE GUTTER TYPE G-2.

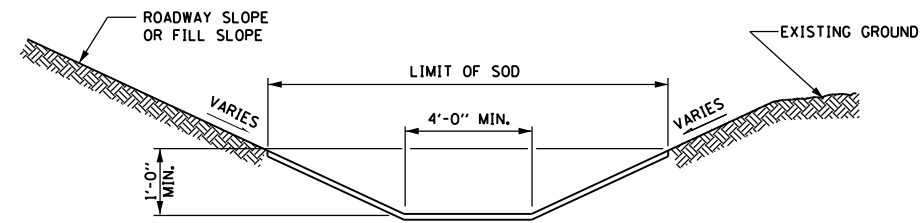
LEGEND

- (A) AGGREGATE SHOULDERS SPECIAL, TYPE C

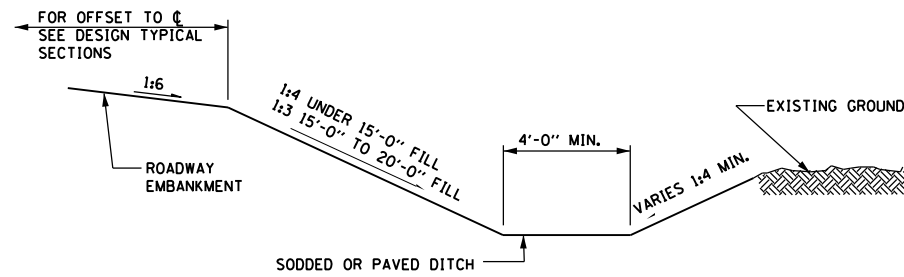
TYPE G-2 GUTTER TRANSITION AT TRAFFIC BARRIER TERMINAL, TYPE T6

APPROVED: *Paul Kovacs* DATE 2-7-2012
CHIEF ENGINEER

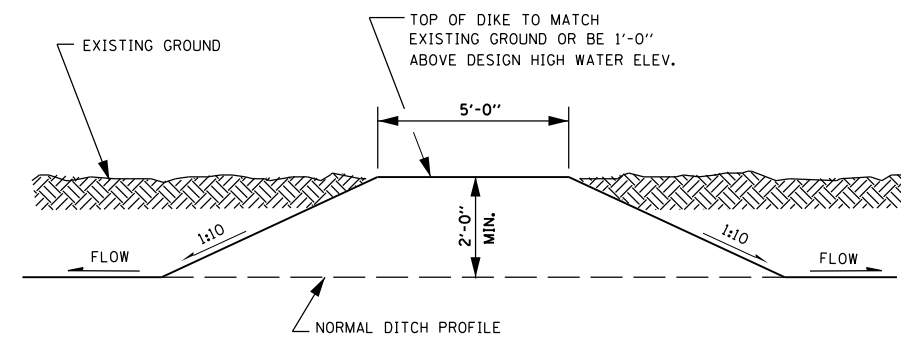
TYPE G-2/G-3 GUTTER TRANSITION AT TRAFFIC BARRIER TERMINAL, TYPE T6
STANDARD B3-04



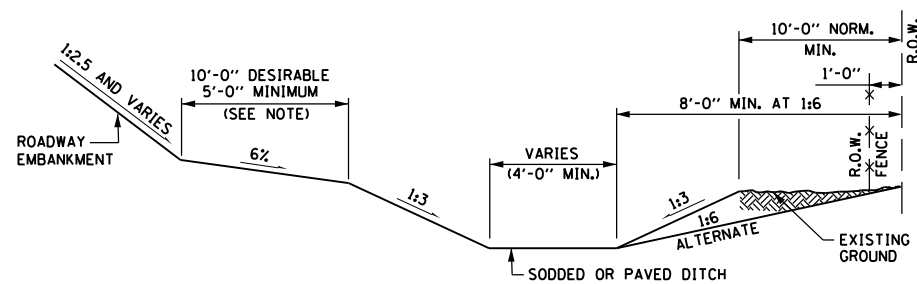
SODDED DITCH



**EMBANKMENT UNDER 20 FEET IN HEIGHT
TOE OF EMBANKMENT DITCHES**



SIDE DITCH DIKE



**EMBANKMENT
OVER 20 FEET IN HEIGHT**

NOTES FOR EMBANKMENT DITCHES:

1. WIDTH AND SLOPE MAY VARY DEPENDING ON SOIL CONDITION OR R.O.W. REQUIREMENTS.
2. THESE SECTIONS APPLY TO A DESIRABLE SECTION FOR NEW CONSTRUCTION. HOWEVER, THE WIDTH AND SLOPES MAY VARY DEPENDING ON SOIL CONDITIONS OR R.O.W. CONSTRAINTS.
3. ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENT (V:H).

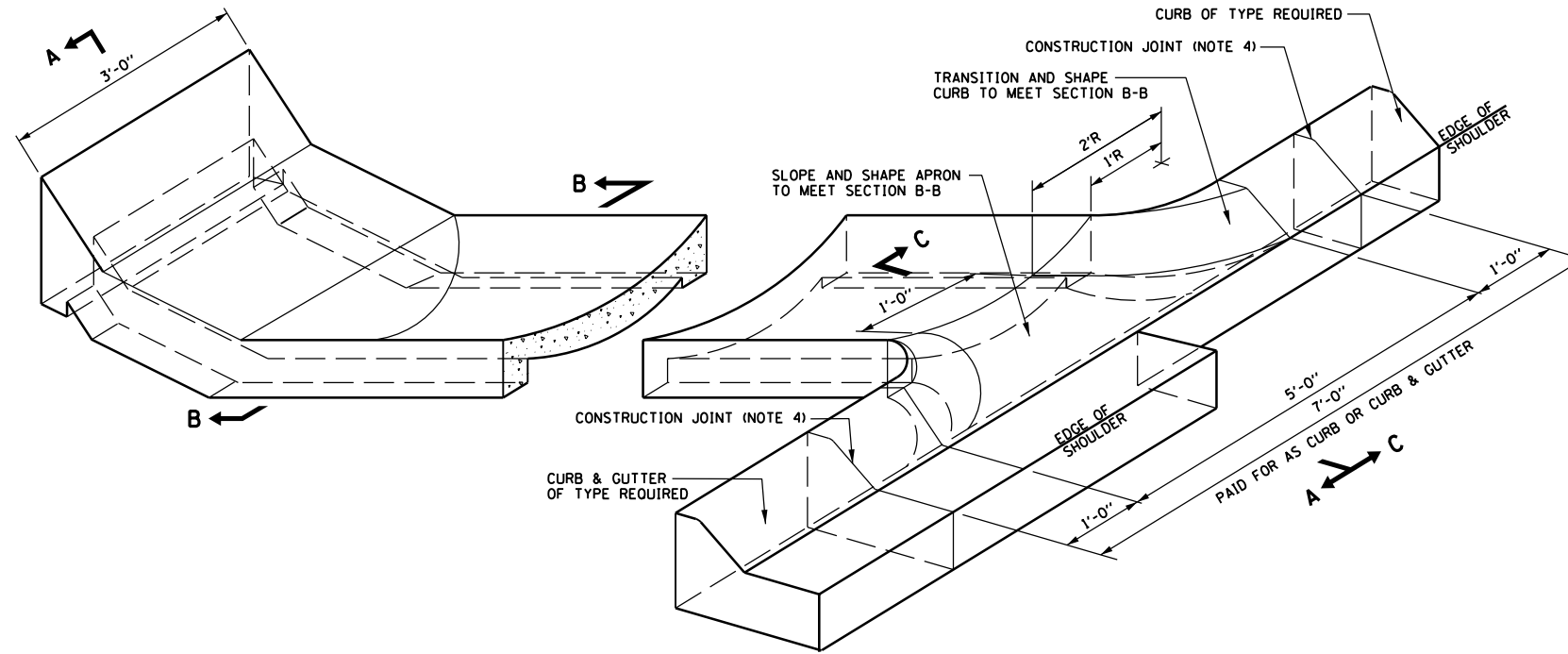
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 6-1-2009

DATE	REVISIONS
6-1-2009	REVISED NOTES

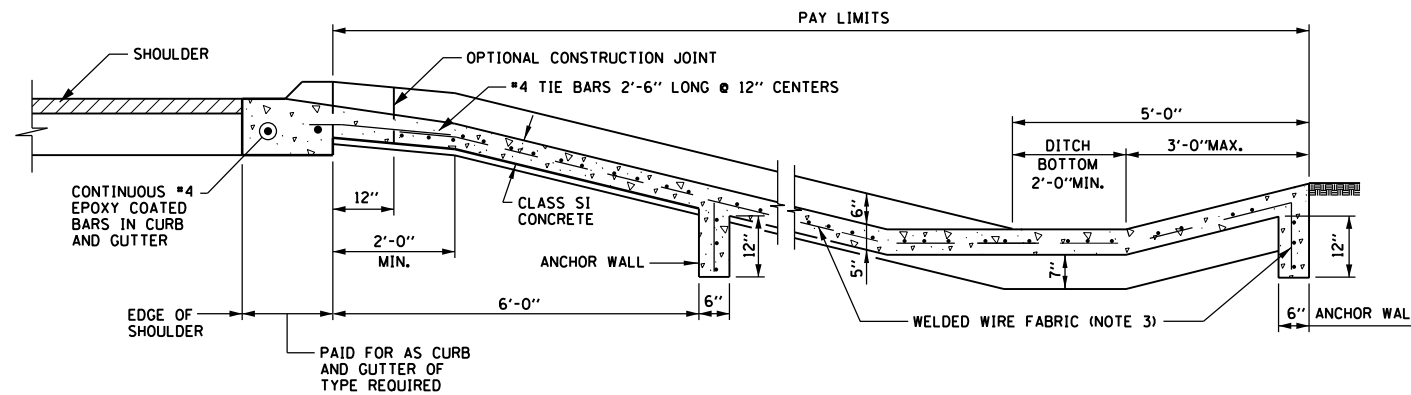
Illinois Tollway

DITCHES AND DITCH DIKE

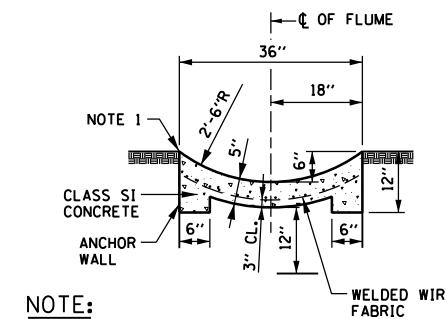
STANDARD B4-01



HALF PLAN



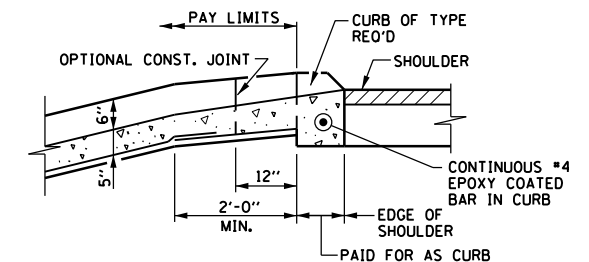
SECTION A-A
ADJACENT TO CURB & GUTTER



NOTE:

0.62 C.Y. CONCRETE / L.F.

SECTION B-B



SECTION C-C
ADJACENT TO CURB

CONCRETE FLUME

NOTES:

1. CONCRETE FLUMES SHALL BE CONSTRUCTED FLUSH WITH THE ADJACENT EXISTING OR PROPOSED SURFACES.
2. CLASS SI CONCRETE SHALL BE USED THROUGHOUT.
3. WELDED WIRE FABRIC SHALL BE EPOXY COATED 6x6 W4xW4, 58 LBS. PER 100 SQ. FT.
4. #4 EPOXY COATED TIE BARS 2'-6" LONG AT 12" O/C SHALL BE PROVIDED AT ALL CONSTRUCTION JOINTS.
5. EPOXY COATED EXPANDED METAL FABRIC OF EQUIVALENT STRENGTH MAY BE USED IN LIEU OF WELDED WIRE FABRIC SUBJECT TO ENGINEER'S APPROVAL.
6. THE LOCATION OF THE ANCHOR WALL MAY BE ADJUSTED AS DIRECTED BY THE ENGINEER.
7. THE MATERIALS AND CONSTRUCTION OF THE CONCRETE FLUME SHALL CONFORM TO THE APPLICABLE PORTIONS OF THE STANDARD SPECIFICATIONS.
8. ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENT.

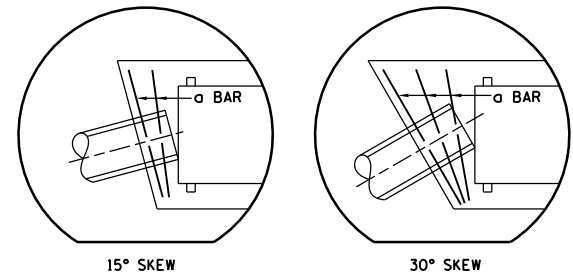
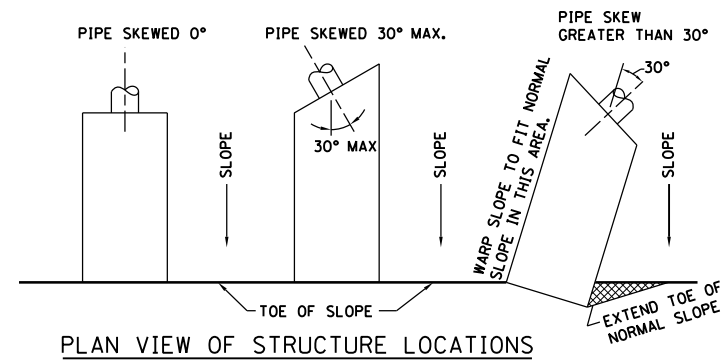
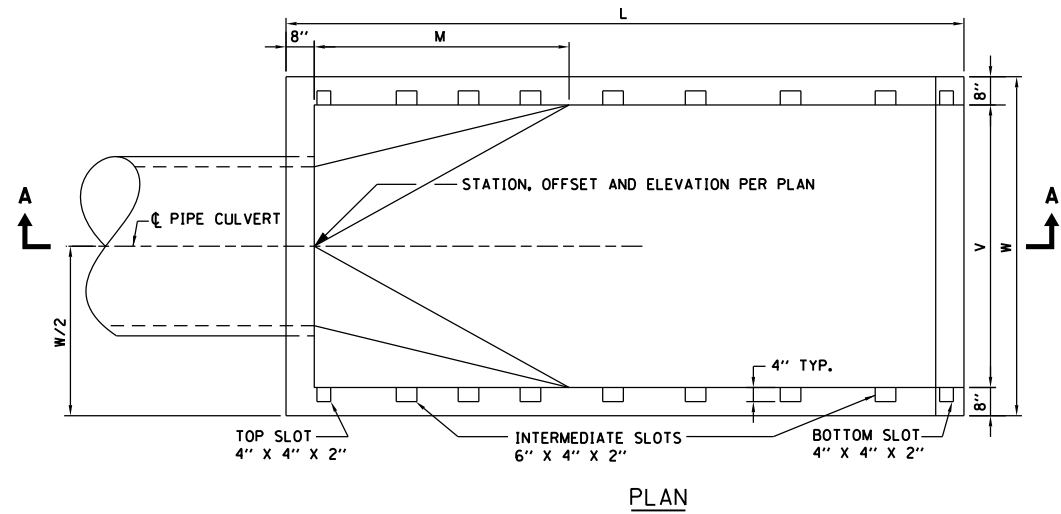
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 2-7-2012

DATE	REVISIONS
2-7-2012	REVISED NOTES

Illinois Tollway

CONCRETE FLUME DETAILS

STANDARD B5-01

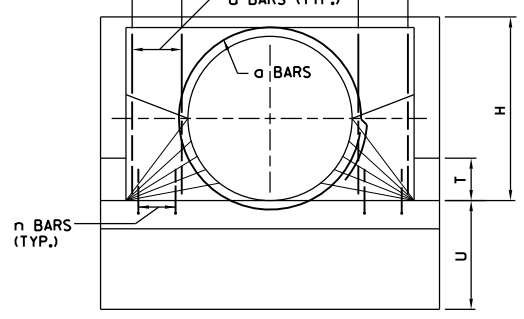


NOTES:

ADDITIONAL 'A' BARS SHALL BE FURNISHED AND PLACED BY THE CONTRACTOR. THE ADDITIONAL BARS ARE NOT INCLUDED IN THE LISTED QUANTITIES BUT WILL BE PAID FOR AS REINFORCING STEEL. (EPOXY COATED)

1 ADDITIONAL BAR REQUIRED FOR EACH 15° SKEW OR FRACTION THEREOF.

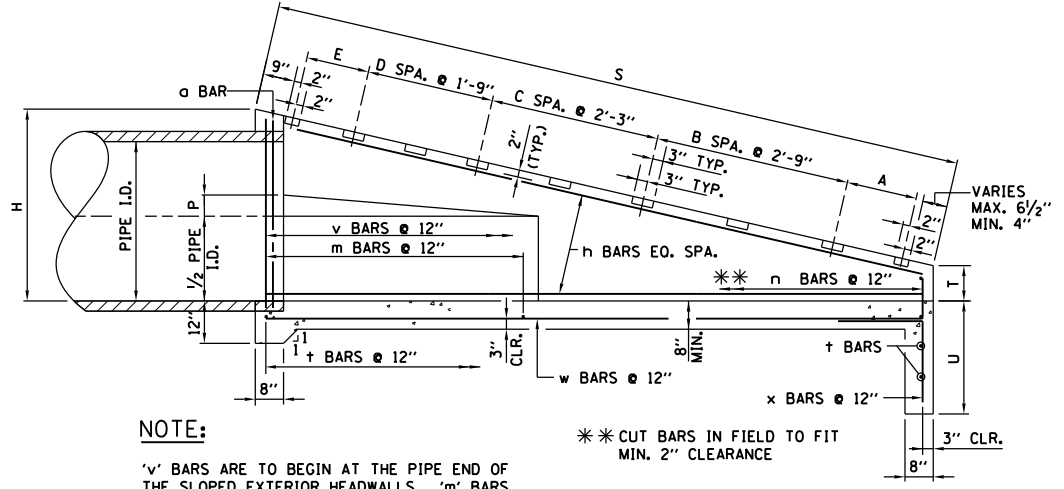
PIPE DIA'S 18", 24", & 30" 1 SPA.
 PIPE DIA'S 36", 42", & 48" 2 EQ. SPA.



FRONT ELEVATION

NOTES:

1. SLOPED HEADWALL TYPE III SHALL BE CONSTRUCTED FLUSH WITH EXISTING OR PROPOSED SLOPE.
2. CLASS SI CONCRETE SHALL BE USED THROUGHOUT.
3. ALL REINFORCEMENT BARS SHOWN SHALL BE EPOXY COATED.
4. BAR BENDING DETAILS ARE DIMENSIONED OUT TO OUT OF BARS.
5. ALL EXPOSED EDGES SHALL HAVE A 3/4" - 45° CHAMFER. CHAMFER ON VERTICAL EDGES SHALL BE CONTINUED A MINIMUM OF ONE FOOT BELOW THE FINISHED GROUND LINE.
6. COVER FROM THE FACE OF CONCRETE TO FACE OF REINFORCEMENT BAR SHALL BE 3" FOR SURFACES FORMED AGAINST EARTH AND 2" FOR ALL OTHER SURFACES UNLESS OTHERWISE SHOWN.
7. CARE SHALL BE EXERCISED IN REMOVING ANY LENGTH OF EXISTING PIPE SO THE REMAINING PIPE IS UNDAMAGED AND FULLY FUNCTIONING.
8. FOR DIMENSIONS AND QUANTITIES FOR ONE HEADWALL SEE SHEET 2 (OF 3) IN THIS SERIES.
9. FOR STEEL GRATING DETAILS SEE SHEET 3 (OF 3) IN THIS SERIES.
10. ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT.

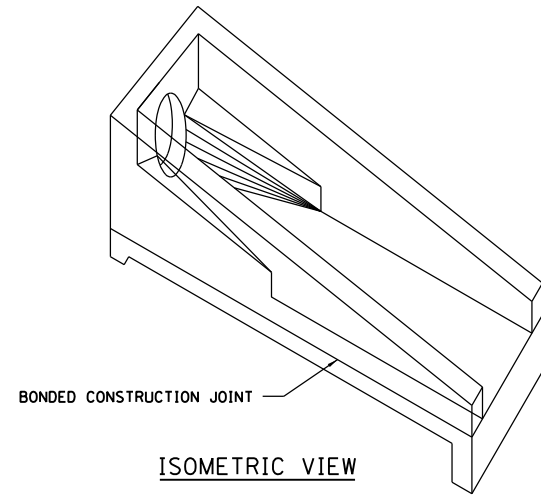


NOTE:

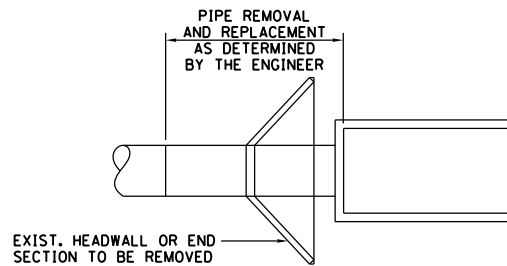
'v' BARS ARE TO BEGIN AT THE PIPE END OF THE SLOPED EXTERIOR HEADWALLS. 'm' BARS ARE TO BEGIN AT THE PIPE END OF THE SLOPED INTERIOR HEADWALLS.

** CUT BARS IN FIELD TO FIT MIN. 2" CLEARANCE

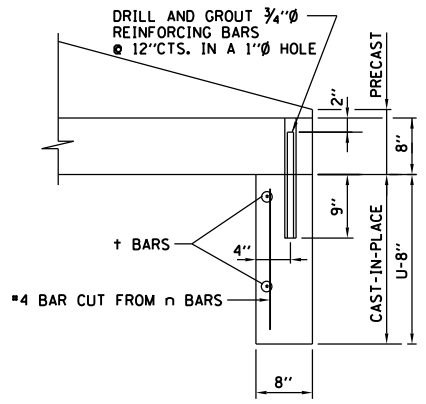
SECTION A-A



ISOMETRIC VIEW



INSTALLATION DETAIL



PRECAST CONNECTION DETAIL



DATE	REVISIONS
1-1-2011	REVISED NOTES
2-7-2012	DELETED TWIN PIPE DETAILS, DELETED PIPE DIA. 18", 24", 30" FOR 1:4 AND 1:6 SLOPES, DELETED SIDE PIPE DESIGN

HEADWALL TYPE III
 18"-24"-30"-36"-42"-48"
 FOR 1:4, 1:6, AND 1:10 SLOPES

STANDARD B6-03

APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 2-7-2012

GRATE DIMENSIONS AND QUANTITIES IN
ONE HEADWALL TYPE III END ENTRANCE 1:4 SLOPE

INSIDE PIPE DIAMETER	GRATES		BARS FOR ONE GRATE				HEADWALL GRATES (LBS.)	
	NUMBER REQUIRED	TYPE REQ'D.	BAR NO. 1		BAR NO. 2		EACH GRATE	TOTAL
			BARS REQ'D.	LENGTH	BARS REQ'D.	LENGTH		
36"	6	B	2	6'-7"	11	1'-10½"	103	608
	-	-	-	-	-	-	-	
42"	6	A	2	7'-1"	12	2'-4½"	121	705
	-	-	-	-	-	-	-	
48"	2	A	2	7'-7"	13	2'-4½"	119	941
	6	B	2	7'-7"	13	1'-10½"	108	

GRATE DIMENSIONS AND QUANTITIES IN
ONE HEADWALL TYPE III END ENTRANCE 1:6 SLOPE

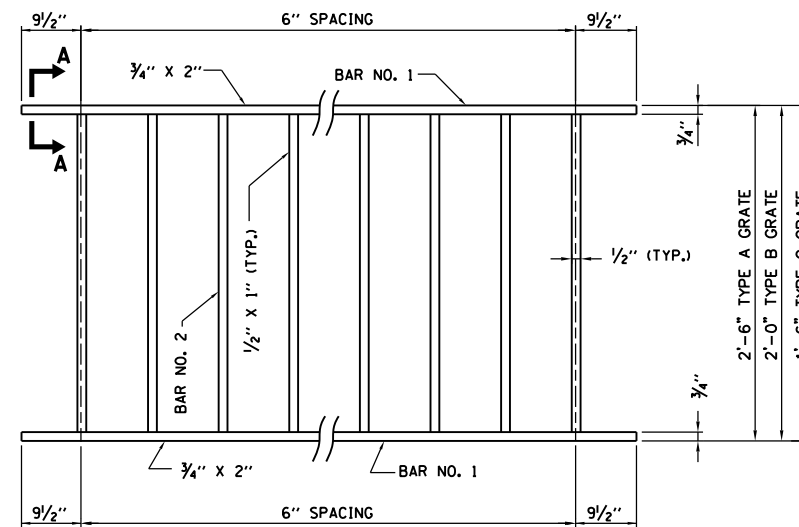
INSIDE PIPE DIAMETER	GRATES		BARS FOR ONE GRATE				HEADWALL GRATES (LBS.)	
	NUMBER REQUIRED	TYPE REQ'D.	BAR NO. 1		BAR NO. 2		EACH GRATE	TOTAL
			BARS REQ'D.	LENGTH	BARS REQ'D.	LENGTH		
36"	2	A	2	6'-7"	11	2'-4½"	112	860
	7	B	2	6'-7"	11	1'-10½"	103	
42"	6	A	2	7'-1"	12	2'-4½"	121	1126
	5	B	2	7'-1"	12	1'-10½"	100	
48"	8	A	2	7'-7"	13	2'-4½"	130	1278
	2	B	2	7'-7"	13	1'-10½"	119	

GRATE DIMENSIONS AND QUANTITIES IN
ONE HEADWALL TYPE III END ENTRANCE 1:10 SLOPE

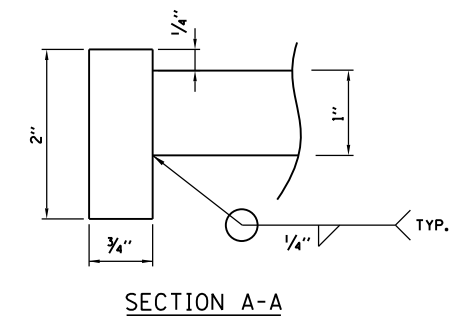
INSIDE PIPE DIAMETER	GRATES		BARS FOR ONE GRATE				HEADWALL GRATES (LBS.)	
	NUMBER REQUIRED	TYPE REQ'D.	BAR NO. 1		BAR NO. 2		EACH GRATE	TOTAL
			BARS REQ'D.	LENGTH	BARS REQ'D.	LENGTH		
18"	8	B	2	3'-7"	5	1'-10½"	53	414
	1	C	2	3'-7"	5	1'-4½"	48	
24"	9	B	2	4'-7"	7	1'-10½"	69	747
	2	A	2	4'-7"	7	2'-4½"	63	
30"	12	B	2	5'-7"	9	1'-10½"	86	1110
	2	C	2	5'-7"	9	1'-4½"	78	
36"	16	B	2	6'-7"	11	1'-10½"	103	1535
	-	-	-	-	-	-	-	
42"	13	B	2	7'-1"	12	1'-10½"	111	2043
	7	C	2	7'-1"	12	1'-4½"	100	
48"	19	B	2	7'-7"	13	1'-10½"	119	2443
	2	A	2	7'-7"	13	2'-4½"	108	

NOTES:

- ALL STRUCTURAL STEEL SHALL BE AASHTO M270, GRADE 36.
- GALVANIZING SHALL BE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS.
- FOR PLACEMENT OF GRATES, SEE SHEET 1 (OF 3) IN THIS SERIES.
- ALL TABLE DIMENSIONS AND QUANTITIES ARE FOR SINGLE PIPE CULVERT HEADWALLS.
- ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENT (V:H).



TYPICAL GRATE



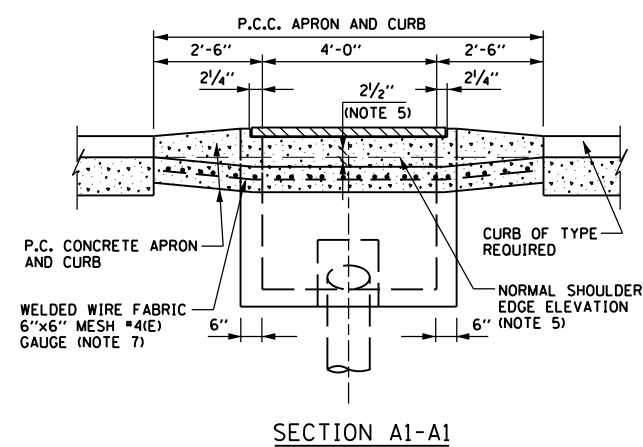
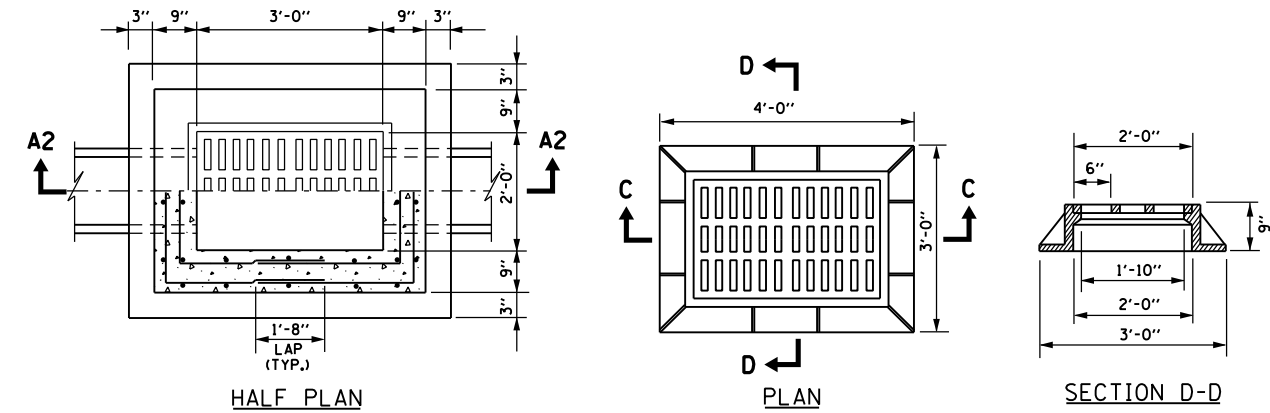
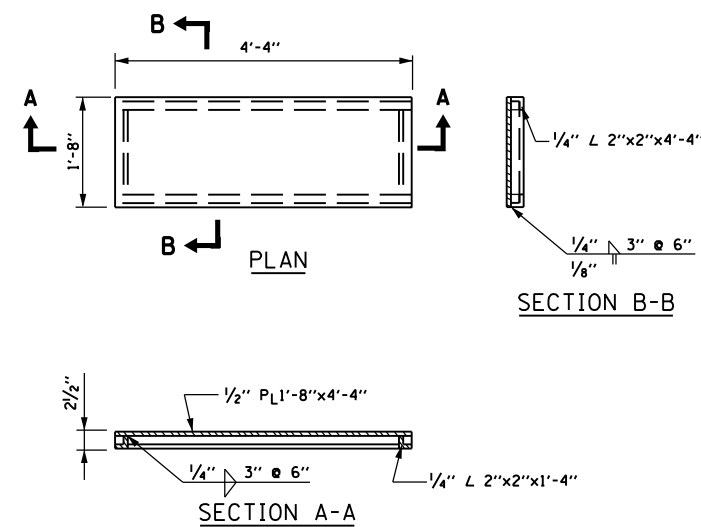
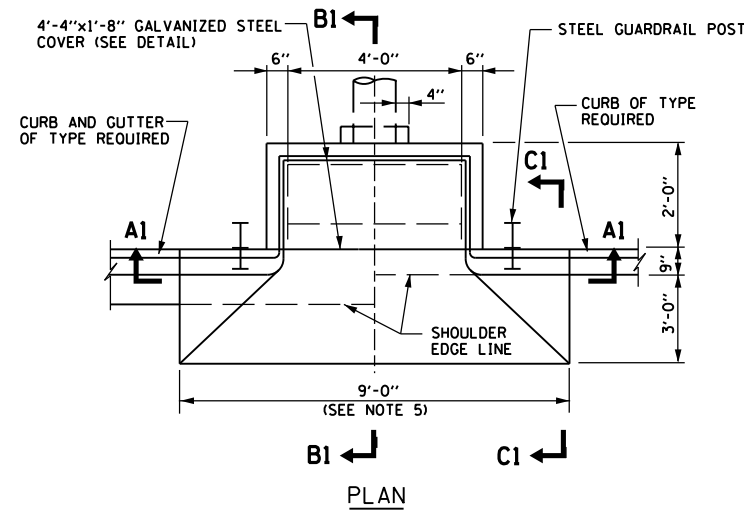
SECTION A-A



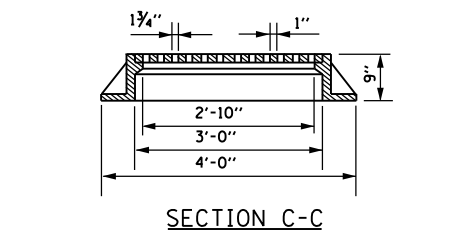
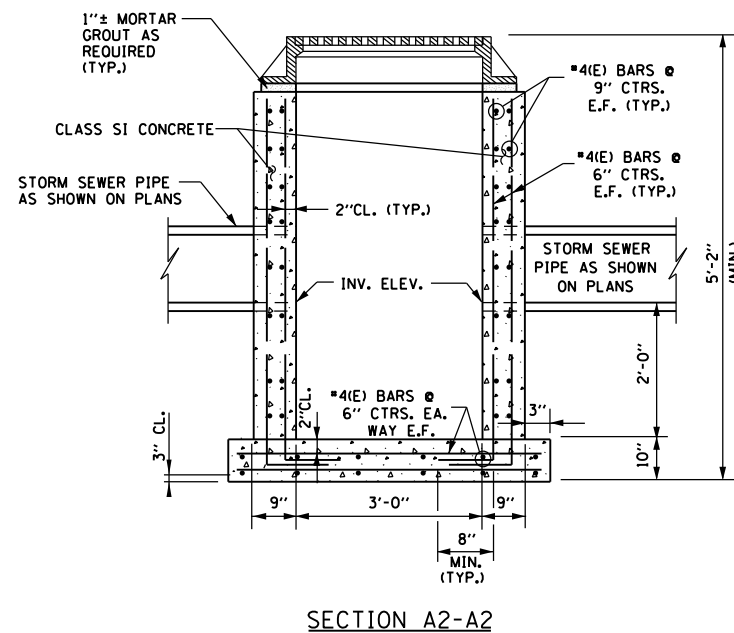
HEADWALL TYPE III
18"-24"-30"-36"-42"-48"
FOR 1:4, 1:6, AND 1:10 SLOPES

STANDARD B6-03

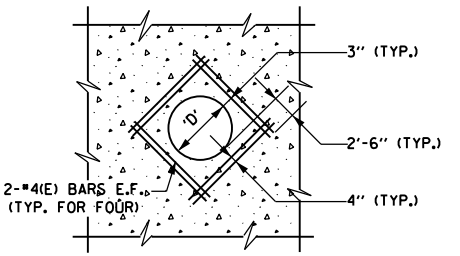
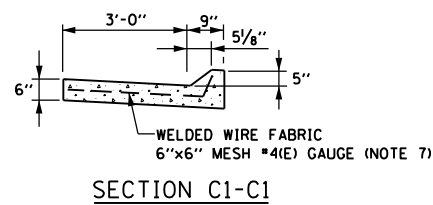
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 2-7-2012



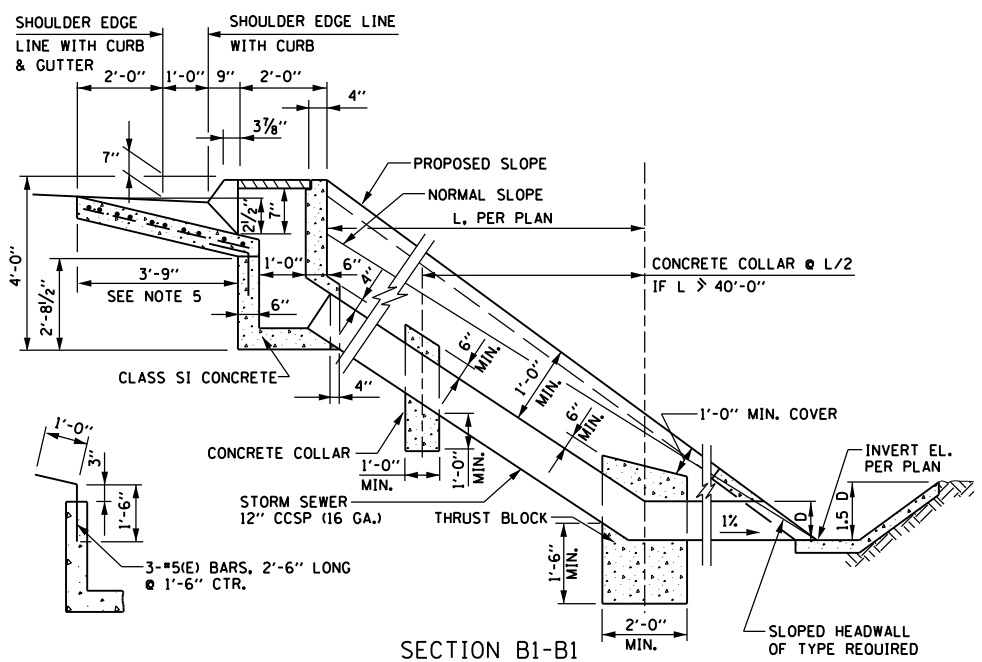
GALVANIZED STEEL COVER DETAIL



FRAME AND GRATE DETAIL



TYPICAL REINFORCEMENT AROUND STORM SEWER PIPE



BAR INSTALLATION DETAIL

SLOPE DRAIN INLET

NOTES FOR SLOPE DRAIN INLET:

1. THE LOCATION OF THE SLOPE DRAIN INLET SHALL BE AS SHOWN ON THE PLANS OR AS DIRECTED BY THE ENGINEER. THE INLET MUST BE LOCATED IN THE FIELD TO CLEAR THE POST SPACING OF EXISTING OR PROPOSED GUARDRAIL. WHERE CONDITIONS REQUIRE THAT THE SLOPE DRAIN INLET BE LOCATED ADJACENT TO A GUARDRAIL ANCHOR INSTALLATION, THE SLOPED DRAIN INLET MUST BE CONSTRUCTED OUTSIDE THE LIMIT OF THE ANCHOR INSTALLATION.
2. INLET CONSTRUCTION EXCLUSIVE OF P.C.C. APRON SHALL BE COMPLETED PRIOR TO SHOULDER OVERLAY. CONSTRUCTION OF P.C.C. APRON SHALL FOLLOW SHOULDER OVERLAY.
3. THE MATERIALS AND CONSTRUCTION OF THE INLET SHALL CONFORM TO THE APPLICABLE PORTIONS OF THE STANDARD SPECIFICATIONS AND THE SPECIAL PROVISIONS.
4. THE CONCRETE CURB WITHIN THE P.C.C. APRON WILL TRANSITION TO MATCH THE SHAPE OF ABUTTING CURBS.
5. INCREASE NORMAL SHOULDER SLOPE WITHIN LIMITS OF P.C.C. APRON AND SHAPE TO DRAIN INTO INLET OPENING. THE INLET OPENING SHALL BE 2 1/2" BELOW THE NORMAL SHOULDER EDGE ELEVATION.
6. GALVANIZED STEEL COVER PLATE SHALL CONFORM TO THE REQUIREMENTS OF THE STANDARD SPECIFICATIONS. GALVANIZING SHALL BE IN ACCORDANCE WITH ASTM A123 (AASHTO M111).
7. EXPANDED METAL FABRIC OF EQUAL STRENGTH MAY BE USED IN LIEU OF WELDED WIRE FABRIC SUBJECT TO ENGINEER'S APPROVAL.
8. PRECAST CONCRETE UNITS FOR SLOPE DRAIN INLET WILL BE ACCEPTABLE PROVIDED THEY MEET ALL THE REQUIREMENTS SHOWN ON THIS DRAWING. FABRICATION DRAWINGS SHOWING PIPE OPENINGS, REINFORCEMENT AND OTHER PERTINENT DIMENSIONS WILL BE REQUIRED FOR EACH UNIT, FOR APPROVAL BY THE ENGINEER PRIOR TO FABRICATION.
9. REINFORCEMENT BARS AND WELDED WIRE FABRIC DESIGNATED (E) SHALL BE EPOXY COATED.

NOTES FOR CATCH BASIN TYPE B:

1. THE LOCATION OF THE CATCH BASIN SHALL BE AS SHOWN ON THE PLANS OR AS DIRECTED BY THE ENGINEER.
2. FOR MATERIALS AND CONSTRUCTION REQUIREMENTS OF THE CATCH BASIN, REFER TO THE STANDARD SPECIFICATIONS.
3. FRAME AND GRATE FOR CATCH BASIN TYPE B SHALL BE NEENAH FOUNDRY COMPANY TYPE R-3455C OR APPROVED EQUAL.
4. AT LOCATIONS WHERE EXISTING UNDERDRAINS AND/OR STORM SEWER PIPES ARE TO BE CONNECTED TO THE NEW CATCH BASIN, THE REMOVAL OF EXISTING PIPES, FURNISHING OF NEW PIPE SECTIONS OF THE SAME SIZE AND OTHER MATERIALS NECESSARY FOR THE CONNECTIONS SHALL BE INCIDENTAL TO THE COST OF CATCH BASIN TYPE B.
5. PRECAST CONCRETE UNITS FOR CATCH BASIN WILL BE ACCEPTABLE PROVIDED THEY MEET ALL THE REQUIREMENTS AS SHOWN ON THIS DRAWING. BASE EXTENSION OF 3" NOT REQUIRED FOR PRECAST UNITS. FABRICATION DRAWINGS SHOWING PIPE OPENINGS, REINFORCEMENT AND OTHER PERTINENT DIMENSIONS WILL BE REQUIRED FOR EACH UNIT, FOR APPROVAL BY THE ENGINEER PRIOR TO FABRICATION.
6. REINFORCEMENT BARS DESIGNATED (E) SHALL BE EPOXY COATED.

Paul Kovacs

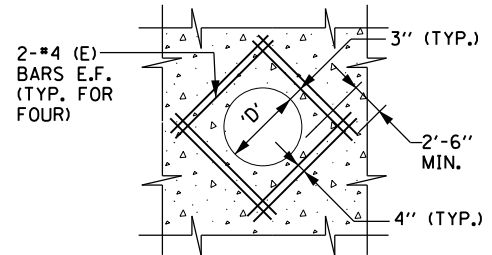
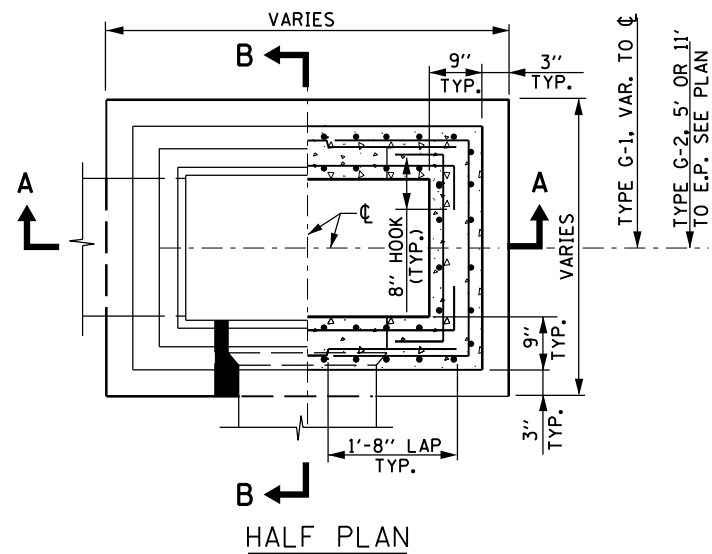
APPROVED CHIEF ENGINEER DATE 2-7-2012

DATE	REVISIONS
2-7-2012	REVISED REINFORCEMENT BARS

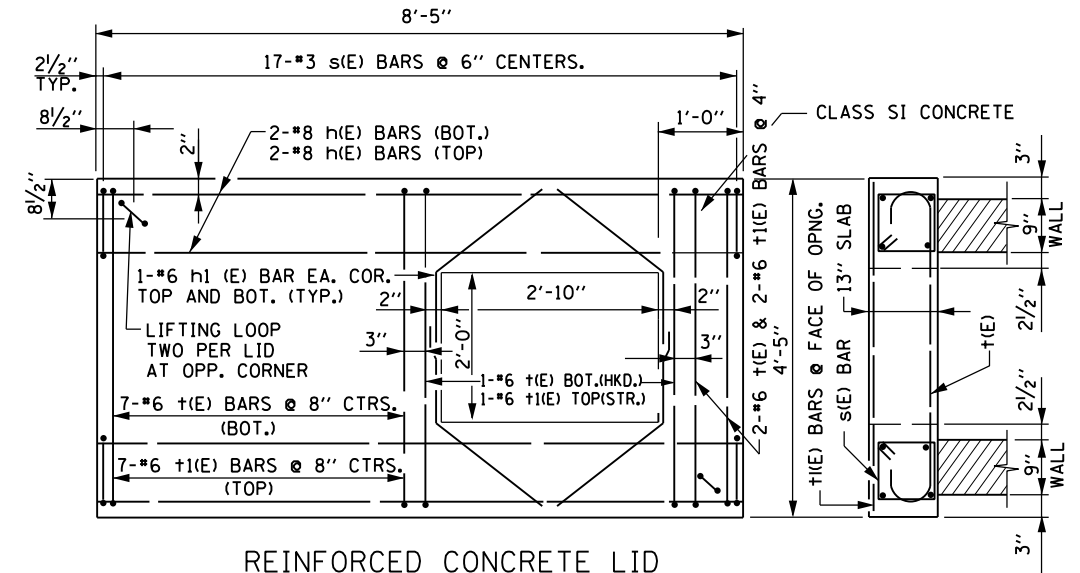


CATCH BASIN TYPE B AND SLOPE DRAIN INLET

STANDARD B7-01



TYPICAL REINFORCEMENT AROUND STORM SEWER PIPE

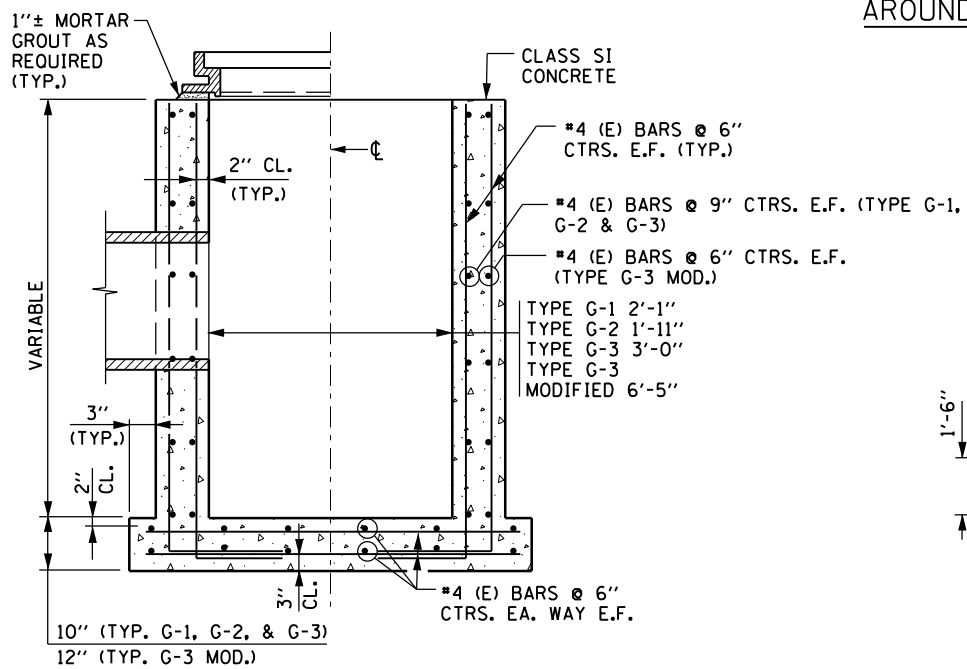


REINFORCED CONCRETE LID

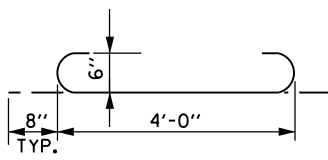
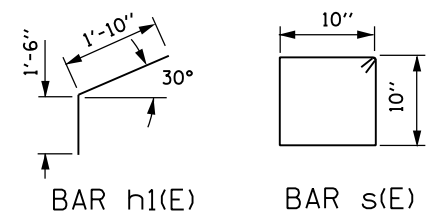
DRAINAGE STRUCTURE TYPE G-3, MODIFIED

NOTES:

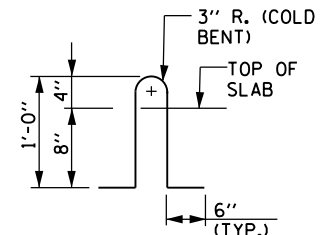
1. PRECAST CONCRETE UNITS WILL BE ACCEPTABLE PROVIDED THEY MEET ALL THE REQUIREMENTS AS SHOWN ON THIS DRAWING. BASE EXTENSION OF 3" NOT REQUIRED FOR PRECAST UNITS. FABRICATION DRAWINGS SHOWING PIPE OPENINGS, REINFORCEMENT AND OTHER PERTINENT DIMENSIONS WILL BE REQUIRED FOR EACH UNIT, FOR APPROVAL BY THE ENGINEER PRIOR TO FABRICATION.
2. CATCH BASINS TYPE G-SERIES SHALL BE USED IN THE SWALE ON THE HIGH SIDE OF SUPERELEVATED PAVEMENT.
3. CATCH BASINS TYPE G-2 SHALL BE USED ALONG RAMPS WHERE G-2 GUTTER IS PROVIDED.
4. CATCH BASINS TYPE G-3 SHALL BE USED WHERE G-3 GUTTER IS PROVIDED.
5. CATCH BASINS TYPE G-3 MODIFIED SHALL BE USED IN PAVEMENT SECTIONS AND ON THE LOW SIDE OF SUPERELEVATED PAVEMENT.
6. CATCH BASINS TYPE G-3 MODIFIED SHALL BE PROVIDED WITH A REINFORCED CONCRETE SLAB TOP AS DETAILED ON THIS DRAWING.
7. TYPE S FRAME AND GRATE SHALL BE NEENAH R-3338-F MODIFIED BY THE ADDITION OF THE FOURTH SIDE OF THE FRAME, OR APPROVED EQUAL.
8. TYPE G-2 FRAME AND GRATE SHALL BE NEENAH R-3508-A2 OR APPROVED EQUAL.
9. TYPE G-3 FRAME AND GRATE SHALL BE NEENAH INLET FOR ROLLTYPE CURB R-3501-U OR EAST JORDAN IRON WORKS 10004 OR APPROVED EQUAL.
10. TYPE G-3, MODIFIED FRAME AND GRATE SHALL BE NEENAH INLET FOR ROLL TYPE CURB SPECIAL R-3501-U1 OR APPROVED EQUAL.
11. TYPE G-2, MODIFIED FRAME AND GRATE FOR ROLL TYPE CURB R-3508-B2 OR APPROVED EQUAL.
12. MORTAR OR SEALER SHALL BE USED WHEN A PRECAST REINFORCED CONCRETE LID IS USED.
13. REINFORCEMENT BARS DESIGNATED (E) SHALL BE EPOXY COATED.



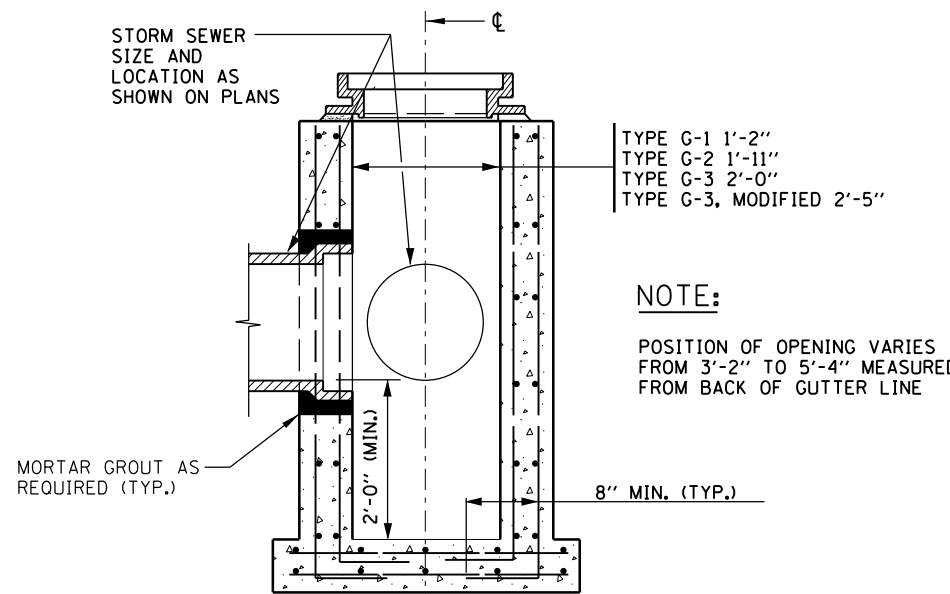
SECTION A-A



LIFTING LOOP TO BE 1/2"Ø x 270 KSI STRANDS TO BE BURNED AFTER PRECAST CONCRETE LID IS SET IN PLACE



LIFTING LOOP DETAIL



SECTION B-B
CATCH BASIN TYPE "G" SERIES

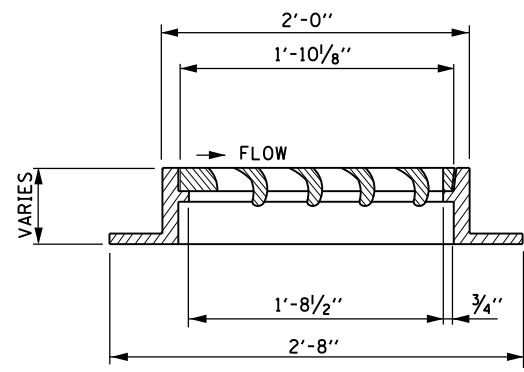
NOTE:
POSITION OF OPENING VARIES FROM 3'-2" TO 5'-4" MEASURED FROM BACK OF GUTTER LINE

APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 6-1-2009

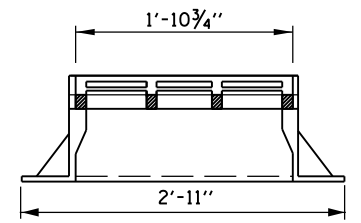


DATE	REVISIONS
6-1-2009	DELETE REINF. CONC. LID TYPE S FRAME & GRATE
2-7-2012	REVISED REINFORCEMENT BARS
11-01-2012	ADDED TYPE G-2, MODIFIED FRAME AND GRATE
	MODIFIED PIPE BELL DETAIL

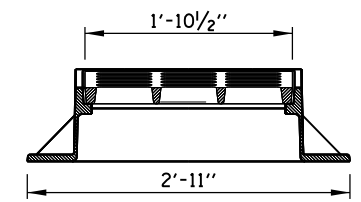
CATCH BASINS TYPES G AND TYPE G MODIFIED, FRAMES AND GRATES TYPE G-2, G-3 & G-3 MODIFIED



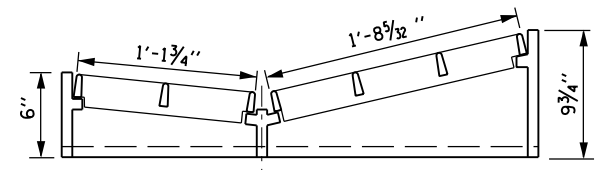
SECTION T-T



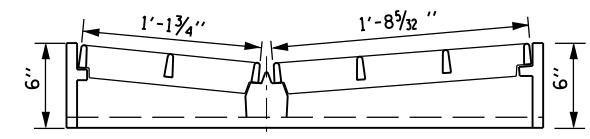
SECTION Y-Y



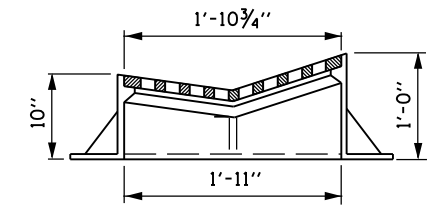
SECTION S-S



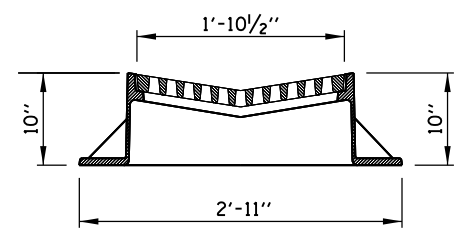
SECTION U-U



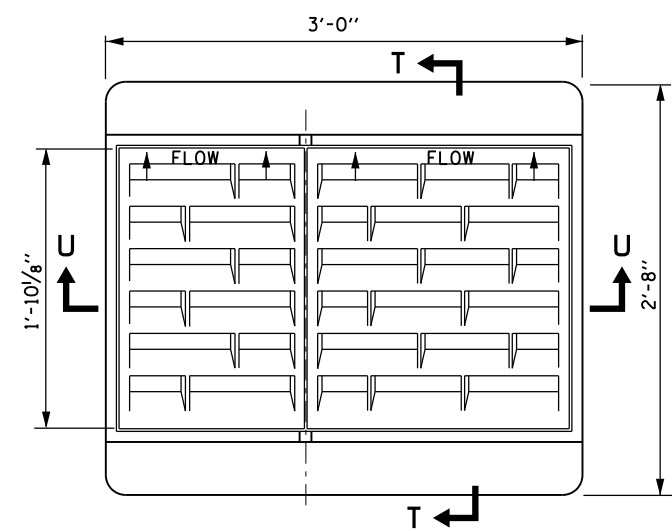
SECTION W-W



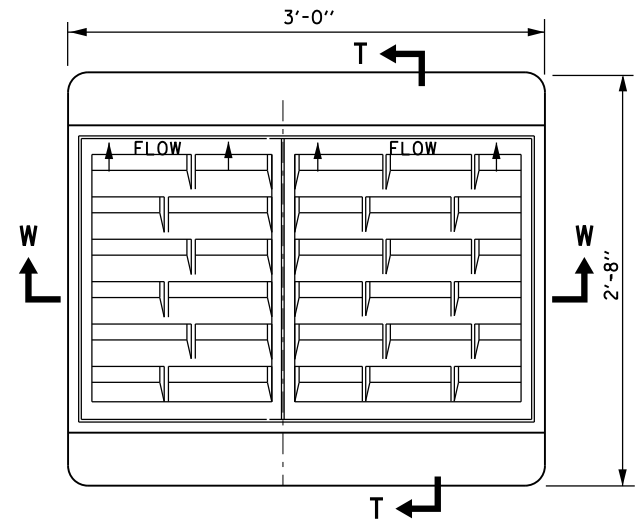
SECTION Z-Z



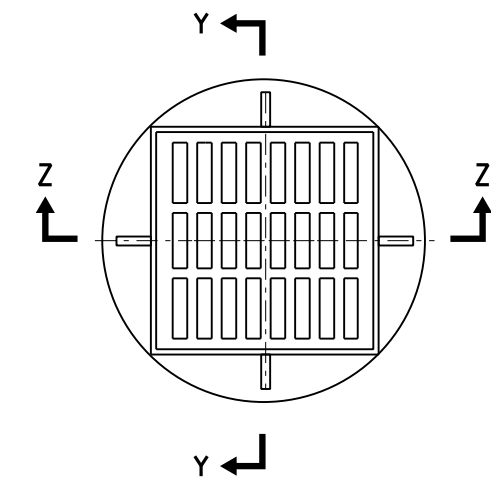
SECTION V-V



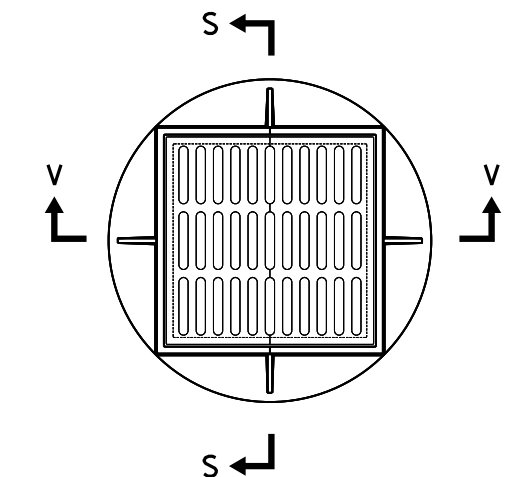
TYPE G-3 FRAME & GRATE



TYPE G-3, MODIFIED
FRAME & GRATE



TYPE G-2 FRAME & GRATE



TYPE G-2 MODIFIED
FRAME & GRATE

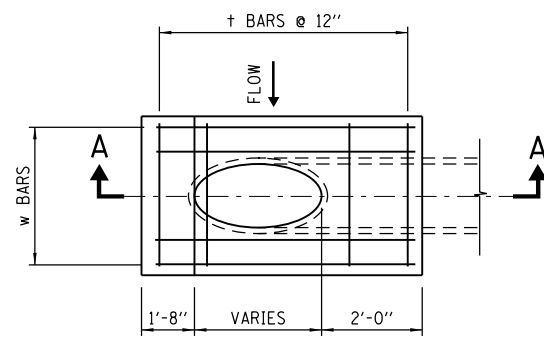
NOTE:
SEE SHEET 1 OF THIS SERIES FOR NOTES.

APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 6-1-2009

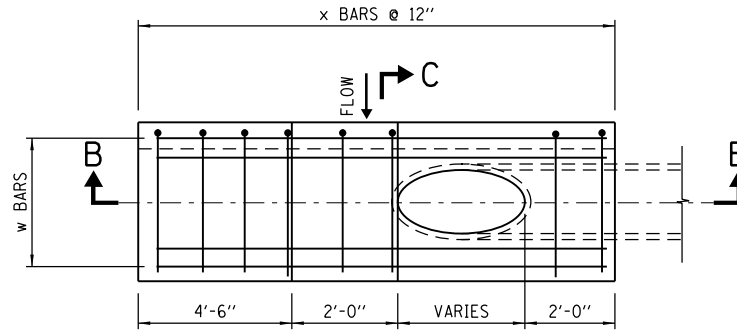
Illinois Tollway

CATCH BASINS TYPES G AND TYPE G MODIFIED, FRAMES AND GRATES
TYPE G-2, G-3 & G-3 MODIFIED

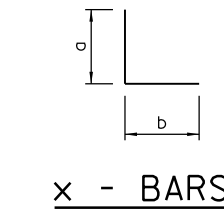
STANDARD B8-03



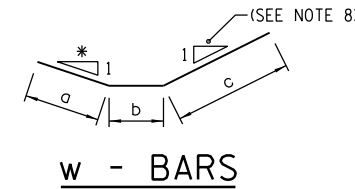
PLAN



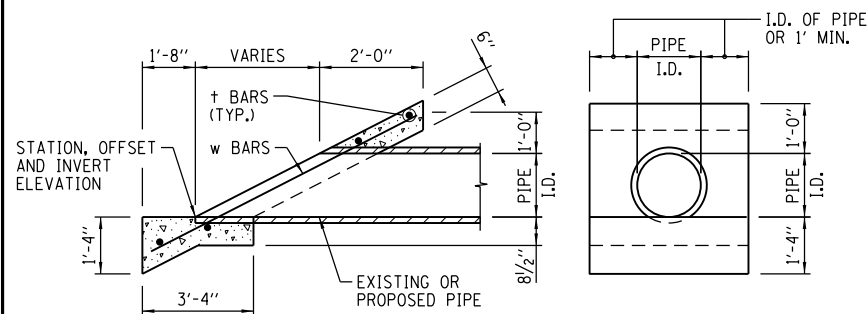
PLAN



x - BARS

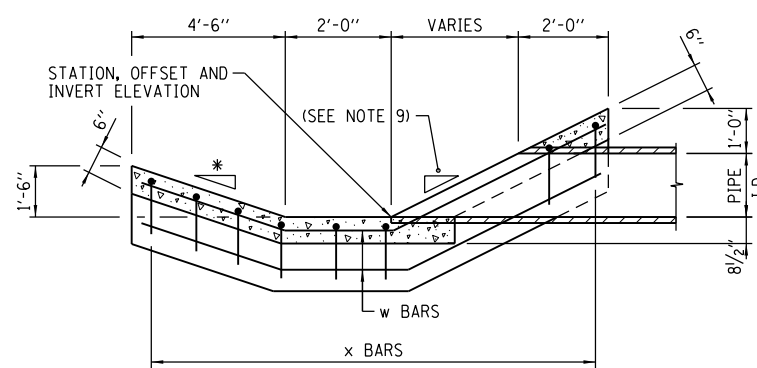


w - BARS



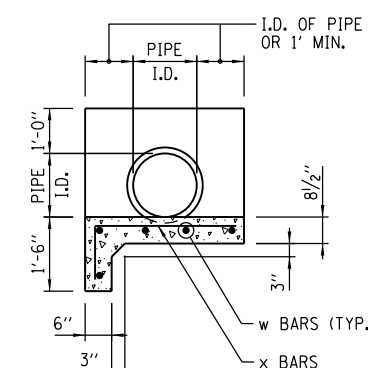
SECTION A-A

ELEVATION



SECTION B-B

* MATCH EXISTING OR PROPOSED SLOPE



SECTION C-C

NOTES:

- SLOPED HEADWALL TYPES I AND II SHALL BE CONSTRUCTED FLUSH WITH EXISTING OR PROPOSED SLOPE.
- CLASS SI CONCRETE SHALL BE USED THROUGHOUT.
- ALL REINFORCEMENT BARS SHOWN SHALL BE EPOXY COATED.
- BAR BENDING DETAILS ARE DIMENSIONED OUT TO OUT OF BARS.
- ALL EXPOSED EDGES SHALL HAVE A 3/4"-45° CHAMFER. CHAMFER ON VERTICAL EDGES SHALL BE CONTINUED A MINIMUM OF ONE FOOT BELOW THE FINISHED GROUND LINE.
- COVER FROM THE FACE OF CONCRETE TO FACE OF REINFORCEMENT BARS SHALL BE 3" FOR SURFACES FORMED AGAINST EARTH AND 2" FOR ALL OTHER SURFACES UNLESS OTHERWISE SHOWN.
- CARE SHALL BE EXERCISED IN REMOVING ANY LENGTH OF EXISTING PIPE SO THE REMAINING PIPE IS UNDAMAGED AND FULLY FUNCTIONING.
- ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENT.
- TYPES I AND II SLOPED HEADWALLS TO BE USED ONLY FOR SLOPES STEEPER THAN 1:3. DIMENSIONS AND QUANTITIES SHOWN ARE BASED ON A 1:2 SLOPE.
- I.D. DENOTES INSIDE DIAMETER OF PIPE. O.D. DENOTES OUTSIDE DIAMETER OF PIPE.

TABLES FOR REINFORCEMENT AND QUANTITIES FOR ONE HEADWALL TYPE I

PIPE I.D.	REINFORCING BARS			DESIGN NO.	INSIDE DIA. OF PIPE	CONC. 1 HDWL.	REINF. BARS. 1 HDWL.
	MARK	NO. & SIZE	LENGTH				
6"	+6	4-#4	2'-0"	F-6-2	6"	0.4 C.Y.	20 #
	w6	4-#4	4'-9"				
12"	+12	4-#4	2'-6"	F-12-2	12"	0.5 C.Y.	25 #
	w12	4-#4	5'-10"				
15"	+15	4-#4	3'-3"	F-15-2	15"	0.6 C.Y.	25 #
	w15	4-#4	6'-5"				
18"	+18	4-#4	4'-0"	F-18-2	18"	0.7 C.Y.	25 #
	w18	4-#4	7'-0"				

SLOPED HEADWALL TYPE I

TABLES FOR REINFORCEMENT AND QUANTITIES FOR ONE HEADWALL TYPE II

PIPE I.D.	REINFORCING BARS						DESIGN NO.	INSIDE DIA. OF PIPE	CONC. 1 HDWL.	REINF. BARS. 1 HDWL.
	MARK	NO. & SIZE	LENGTH	a	b	c				
12"	+12	8-#4	3'-6"	2'-6"	1'-0"	---	E-12-2	12"	1.1 C.Y.	45 #
	w12	4-#4	10'-3"	4'-3"	2'-0"	4'-0"				
15"	+15	8-#4	4'-3"	3'-3"	1'-0"	---	E-15-2	15"	1.2 C.Y.	50 #
	w15	4-#4	10'-9"	4'-3"	2'-0"	4'-6"				
18"	+18	8-#4	5'-0"	4'-0"	1'-0"	---	E-18-2	18"	1.3 C.Y.	55 #
	w18	4-#4	11'-3"	4'-3"	2'-0"	5'-0"				

SLOPED HEADWALL TYPE II

APPROVED: *Paul Kovacs* CHIEF ENGINEER DATE 2-7-2012

DATE	REVISIONS
2-7-2012	REVISED REINFORCEMENT BARS, TABLES



SLOPED HEADWALLS TYPE I AND TYPE II

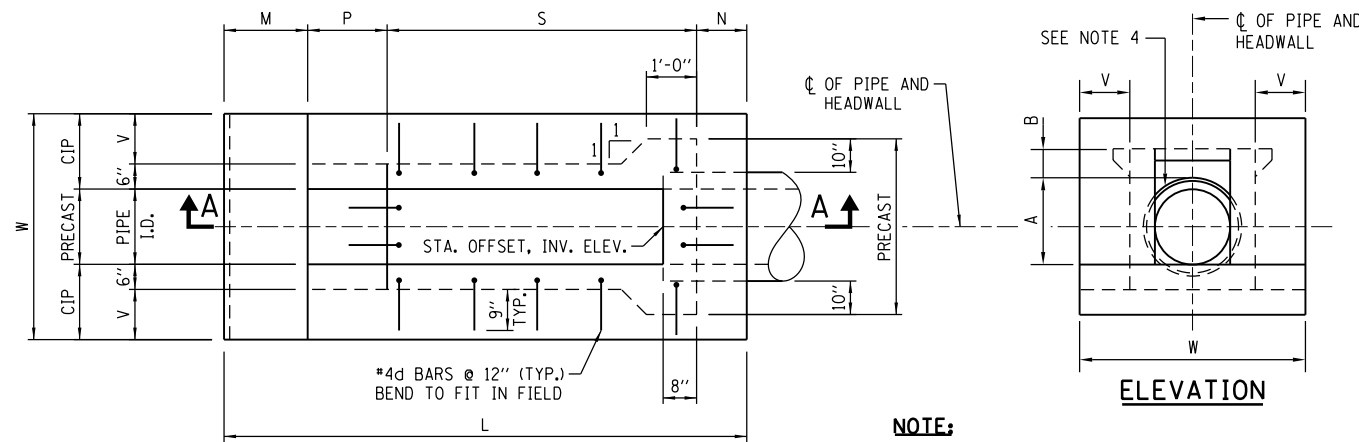
STANDARD B9-01

DIMENSIONS AND QUANTITIES FOR ONE SLOPED HEADWALL TYPE III

	PIPE I.D.	DIMENSIONS										PRE CAST CONC. CU. YD.	CAST-IN-PLACE CU. YD.	WELDED WIRE FABRIC SQ. YD.	REINF. STEEL				
		A	B	C	N	M	P	S	L	V	W				MARK	SIZE	NO.	LENGTH	LBS.
1 TO 3 SLOPE	6"	9"	2 3/4"	1'-9 3/4"	1'-0"	1'-8"	1'-6 3/4"	2'-11 1/4"	7'-2"	1'-0"	3'-6"	.19	.51	2.67	d6	#4	12	2'-0"	16
	12"	1'-3 1/2"	2 3/4"	2'-4 1/4"	1'-0"	1'-8"	1'-6 3/4"	4'-6 3/4"	8'-9 1/2"	1'-0"	4'-0"	.36	.65	3.80	d12	#4	14	2'-0"	19
	15"	1'-6 1/2"	2 3/4"	2'-7 1/4"	1'-0"	1'-8"	1'-6 3/4"	5'-3 3/4"	9'-6 1/2"	1'-0"	4'-3"	.47	.73	5.13	d15	#4	16	2'-0"	21
	18"	1'-10"	2 3/4"	2'-10 3/4"	1'-0"	1'-8"	1'-6 3/4"	6'-2 1/4"	10'-5"	1'-0"	4'-6"	.61	.80	5.65	d18	#4	18	2'-0"	24
	21"	2'-1"	2 3/4"	3'-1 3/4"	1'-0"	1'-9"	1'-6 3/4"	6'-11 1/4"	11'-3"	1'-3"	5'-3"	.74	1.0	7.42	d21	#4	22	2'-0"	29
	24"	2'-4 1/2"	2 3/4"	3'-5 1/4"	1'-0"	2'-0"	1'-6 3/4"	7'-9 3/4"	12'-4 1/2"	1'-6"	6'-0"	.86	1.24	8.80	d24	#4	24	2'-0"	32
	27"	2'-7 1/2"	2 3/4"	3'-8 1/4"	1'-1/2"	2'-3"	1'-6 3/4"	8'-6 3/4"	13'-6"	1'-9"	6'-9"	1.03	1.53	12.35	d27	#4	24	2'-0"	32
	30"	2'-11"	2 3/4"	3'-11 3/4"	1'-3"	2'-6"	1'-6 3/4"	9'-5 1/4"	14'-9"	2'-0"	7'-6"	1.22	2.00	15.08	d30	#4	26	2'-0"	35

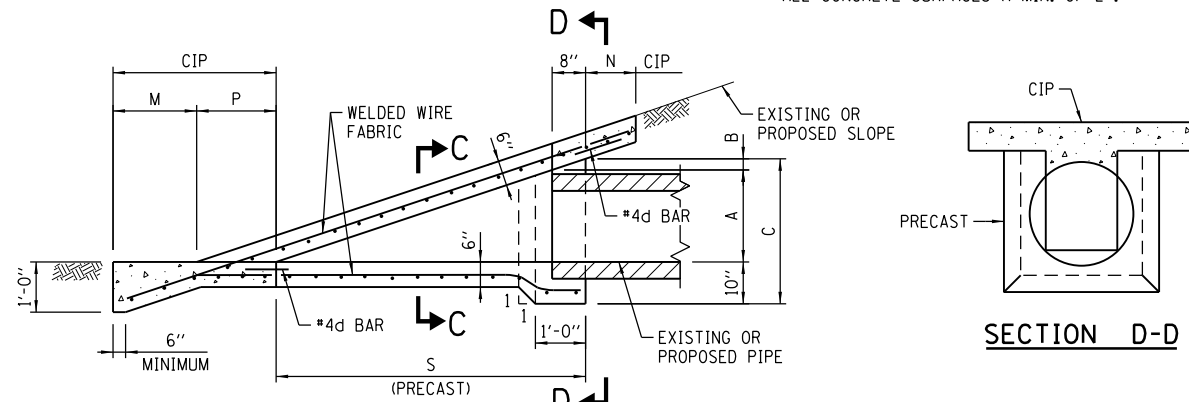
	PIPE I.D.	DIMENSIONS										PRE CAST CONC. CU. YD.	CAST-IN-PLACE CU. YD.	WELDED WIRE FABRIC SQ. YD.	REINF. STEEL				
		A	B	C	N	M	P	S	L	V	W				MARK	SIZE	NO.	LENGTH	LBS.
1 TO 4 SLOPE	6"	9"	2"	1'-9"	1'-0"	1'-8"	2'-1"	3'-8"	8'-5"	1'-0"	3'-6"	.21	.57	3.27	d6	#4	12	2'-0"	16
	12"	1'-3 1/2"	2"	2'-3 1/2"	1'-0"	1'-8"	2'-1"	5'-10"	10'-7"	1'-0"	4'-0"	.44	.75	4.58	d12	#4	16	2'-0"	21
	15"	1'-6 1/2"	2"	2'-6 1/2"	1'-0"	1'-8"	2'-1"	6'-10"	11'-7"	1'-0"	4'-3"	.57	.83	5.66	d15	#4	18	2'-0"	24
	18"	1'-10"	2"	2'-10"	1'-0"	1'-8"	2'-1"	8'-0"	12'-11"	1'-0"	4'-6"	.73	.93	7.57	d18	#4	22	2'-0"	29
	21"	2'-1"	2"	3'-1"	1'-0"	1'-9"	2'-1"	9'-0"	13'-10"	1'-3"	5'-3"	.89	1.16	9.83	d21	#4	24	2'-0"	32
	24"	2'-4 1/2"	2"	3'-4 1/2"	1'-0"	2'-0"	2'-1"	10'-2"	15'-3"	1'-6"	6'-0"	1.12	1.45	12.51	d24	#4	28	2'-0"	37
	27"	2'-7 1/2"	2"	3'-7 1/2"	1'-1/2"	2'-3"	2'-1"	11'-2"	16'-7"	1'-9"	6'-9"	1.32	1.77	13.28	d27	#4	30	2'-0"	40
	30"	2'-11"	2"	3'-11"	1'-3"	2'-6"	2'-1"	12'-4"	18'-2"	2'-0"	7'-6"	1.58	2.14	18.77	d30	#4	32	2'-0"	43

	PIPE I.D.	DIMENSIONS										PRE CAST CONC. CU. YD.	CAST-IN-PLACE CU. YD.	WELDED WIRE FABRIC SQ. YD.	REINF. STEEL				
		A	B	C	N	M	P	S	L	V	W				MARK	SIZE	NO.	LENGTH	LBS.
1 TO 6 SLOPE	6"	9"	1 1/2"	1'-8 1/2"	1'-0"	1'-8"	3'-0"	5'-3"	10'-11"	1'-0"	3'-6"	.29	.71	4.11	d6	#4	16	2'-0"	21
	12"	1'-3 1/2"	1 1/2"	2'-3"	1'-0"	1'-8"	3'-0"	8'-6"	14'-2"	1'-0"	4'-0"	.60	.96	7.27	d12	#4	22	2'-0"	29
	15"	1'-6 1/2"	1 1/2"	2'-6"	1'-0"	1'-8"	3'-0"	10'-0"	15'-8"	1'-0"	4'-3"	.79	1.07	8.91	d15	#4	26	2'-0"	35
	18"	1'-10"	1 1/2"	2'-9 1/2"	1'-0"	1'-8"	3'-0"	11'-9"	17'-5"	1'-0"	4'-6"	1.03	1.20	10.95	d18	#4	28	2'-0"	37
	21"	2'-1"	1 1/2"	3'-0 1/2"	1'-0"	1'-9"	3'-0"	13'-3"	19'-0"	1'-3"	5'-3"	1.29	1.51	14.00	d21	#4	34	2'-0"	45
	24"	2'-4 1/2"	1 1/2"	3'-4"	1'-0"	2'-0"	3'-0"	15'-0"	21'-0"	1'-6"	6'-0"	1.59	1.89	15.49	d24	#4	38	2'-0"	51
	27"	2'-7 1/2"	1 1/2"	3'-7"	1'-1/2"	2'-3"	3'-0"	16'-6"	22'-10 1/2"	1'-9"	6'-9"	1.90	2.30	21.82	d27	#4	40	2'-0"	53
	30"	2'-11"	1 1/2"	3'-10 1/2"	1'-3"	2'-6"	3'-0"	18'-3"	25'-0"	2'-0"	7'-6"	2.27	2.79	26.60	d30	#4	44	2'-0"	59



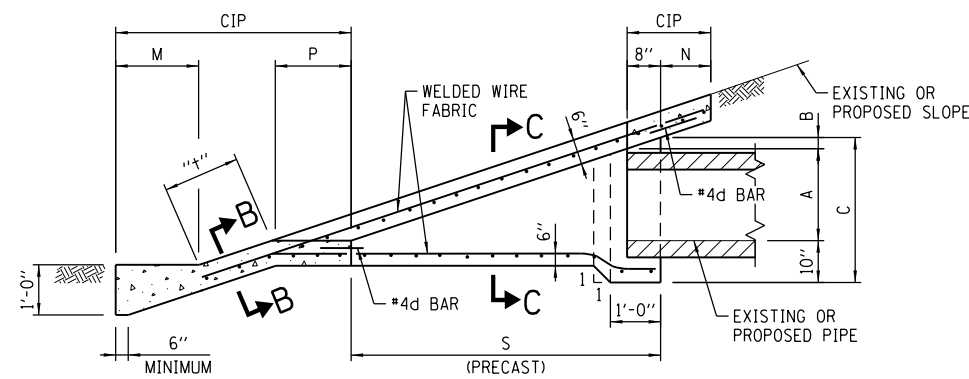
PLAN - SLOPED HEADWALL

NOTE:
EACH #4d BAR SHALL BE PLACED SUCH THAT IT WILL PROJECT 9" INTO THE CAST IN PLACE (CIP) CONCRETE AND IT SHALL BE 3" BELOW THE TOP SURFACE. HOOKS IN THE PRECAST SECTION SHALL BE TIPPED TO CLEAR ALL CONCRETE SURFACES A MIN. OF 2".

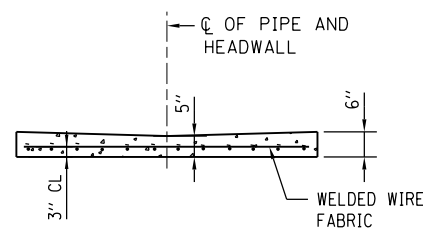


**SECTION A-A
(FOR PIPE AT DITCH FLOW LINE)**

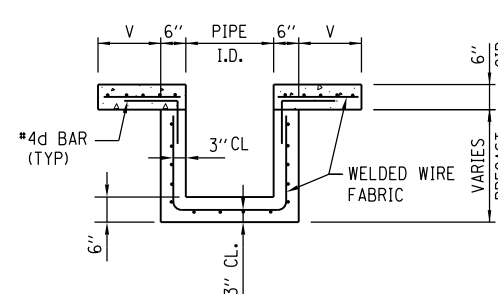
SECTION D-D



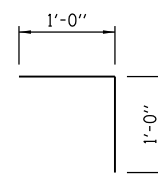
**SECTION A-A
(FOR PIPE ABOVE DITCH FLOW LINE)**



SECTION B-B



SECTION C-C



BAR #4d

NOTES:

- THE CAST IN PLACE (CIP) SLOPED HEADWALL SHALL BE CONSTRUCTED FLUSH WITH EXISTING OR PROPOSED SLOPE.
- CLASS SI CONCRETE SHALL BE USED THROUGHOUT.
- WELDED WIRE FABRIC SHALL BE EPOXY COATED 6x6-W4xW4, 58 LBS. PER 100 SQ.FT.
- ALL REINFORCEMENT BARS SHOWN SHALL BE EPOXY COATED.
- BAR BENDING DETAILS ARE DIMENSIONED OUT TO OUT OF BARS.
- COVER FROM FACE OF CONCRETE TO FACE OF REINFORCEMENT BAR SHALL BE 3" FOR SURFACES FORMED AGAINST EARTH AND 2" FOR ALL OTHER SURFACES UNLESS OTHERWISE SHOWN.
- PRECAST UNIT USE IS OPTIONAL. THE ENTIRE STRUCTURE MAY BE CAST IN PLACE.
- AFTER THE PRECAST SLOPED HEADWALL HAS BEEN PLACED, THE SPACE BETWEEN THE HEADWALL AND PIPE SHALL BE COMPLETELY FILLED WITH AN APPROVED NON-SHRINK GROUT WITH A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 5000 PSI. THE COST FOR FURNISHING AND PLACING THE GROUT SHALL BE INCIDENTAL TO SLOPED HEADWALLS.
- THE SLOPED HEADWALL DETAILS SHOWN ON THIS DRAWING ARE FOR USE ONLY WITH PIPES HAVING DIAMETER OR SPAN OF 30" OR LESS.
- QUANTITIES FOR CONCRETE, WELDED WIRE FABRIC, AND REINFORCING STEEL SHOWN IN THE SCHEDULES OF QUANTITIES ARE BASED ON A "V" DIMENSION OF 0'-0" AND A 1:2 SLOPE.
- ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENT (V:H).
- I.D. DENOTES INSIDE DIAMETER OF PIPE. O.D. DENOTES OUTSIDE DIAMETER OF PIPE.

DATE	REVISIONS
6-1-2009	ADDED TABLE INFORMATION
	ADDED DIMENSION NOTATIONS TO SLOPE HEADWALL
3-1-2010	REVISED NOTES
1-1-2011	REVISED NOTES
2-7-2012	REVISED NOTES

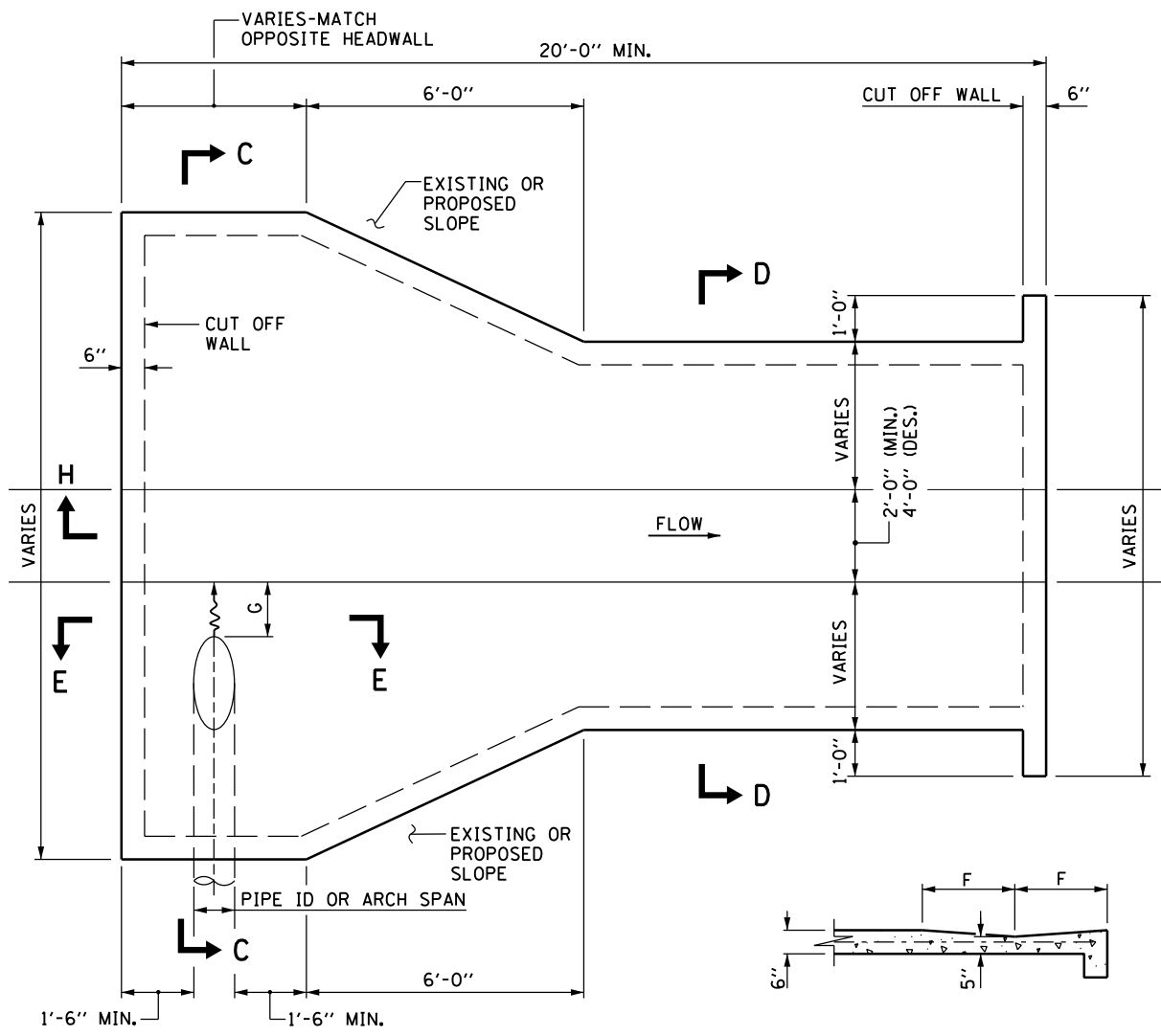


**SLOPED HEADWALLS
TYPE III DETAILS**

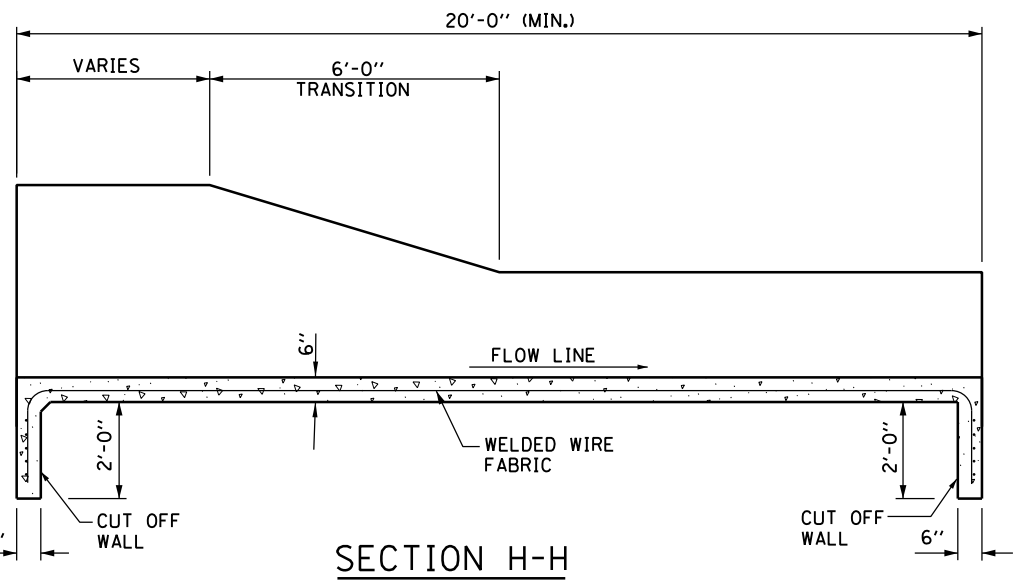
STANDARD B10-05

NOTES:

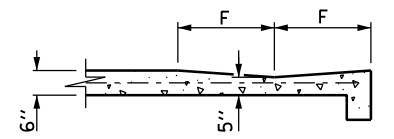
1. THE SLOPED HEADWALL TYPE IV SHALL BE CONSTRUCTED FLUSH WITH EXISTING OR PROPOSED SLOPE.
2. THE SLOPED HEADWALL DETAILS SHOWN IN THIS DRAWING ARE FOR USE ONLY WITH PIPES HAVING AN INSIDE DIAMETER OR ARCH SPAN OF 18" OR LESS.
3. CLASS SI CONCRETE SHALL BE USED THROUGHOUT.
4. WELDED WIRE FABRIC SHALL BE EPOXY COATED 6"x6" W4xW4, 58 LBS. PER 100 SQ. FT.
5. QUANTITIES FOR CONCRETE HEADWALLS (CLASS SI) AND WELDED WIRE FABRIC SHOWN IN THE SCHEDULES OF QUANTITIES ARE BASED ON THE FOLLOWING:
 - A. DIMENSION "C" IS 0'-0".
 - B. DIMENSION "H" IS PIPE I.D. OR ARCH SPAN.
 - C. PAVED DITCH LENGTH IS 20'-0".
 - D. PAVED DITCH BOTTOM SHALL MATCH EXISTING OR PROPOSED DITCH (2'-0" OR 4'-0").
 - E. BACKSLOPE AND FORESLOPE ARE THE SAME. ADJUSTMENT TO QUANTITIES FOR HEADWALLS WITH DIMENSIONS OR BACKSLOPE/ FORESLOPE COMBINATIONS OTHER THAN ABOVE SHALL BE INDICATED ON THE PLANS.
 - F. THE QUANTITIES ARE SHOWN FOR INFORMATION ONLY.
6. ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENT.



PLAN

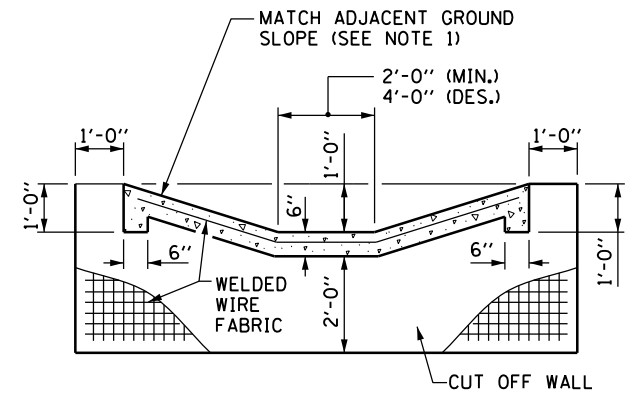


SECTION H-H



SECTION E-E

$F = \frac{1}{2} (\text{PIPE ID OR ARCH SPAN}) + 1'-6" (\text{MIN.})$

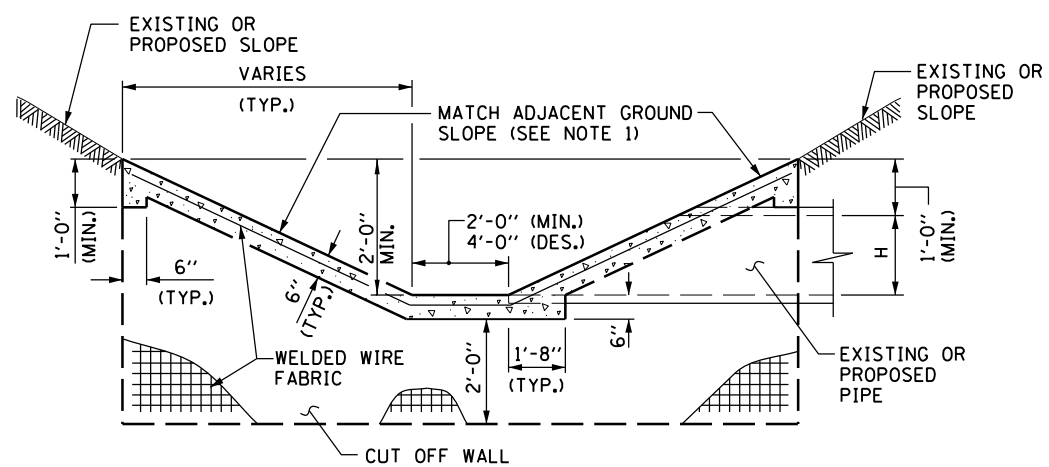


SECTION D-D

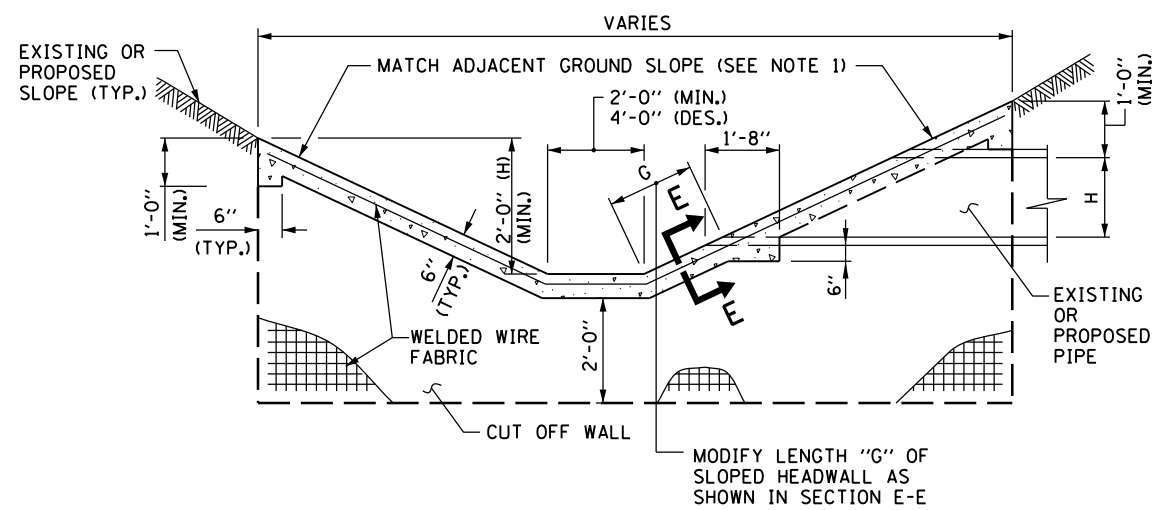
QUANTITIES FOR SLOPED HEADWALLS TYPE IV

(SEE NOTE 5)

SLOPE	PIPE DIA.	CONCRETE HEADWALLS (CLASS SI)	CONCRETE HEADWALLS (CLASS SI)	WELDED WIRE FABRIC (SQUARE FEET)	WELDED WIRE FABRIC (SQUARE FEET)
		(CUBIC YARDS) 2'-0" BOTTOM	(CUBIC YARDS) 4'-0" BOTTOM	(2'-0" BOT.)	(4'-0" BOT.)
1:3	6"	5.41	6.45	239	295
	12"	5.61	6.64	251	307
	15"	5.80	6.84	262	318
	18"	6.01	7.05	274	330
1:4	6"	6.68	7.03	297	353
	12"	6.93	7.97	312	368
	15"	7.19	8.23	327	383
	18"	7.47	8.51	343	399
1:6	6"	9.26	10.30	414	470
	12"	9.63	10.67	437	493
	15"	10.02	11.05	459	515
	18"	10.42	11.46	483	539



**SECTION C-C
DETAIL FOR PIPE AT DITCH FLOW LINE**



**SECTION C-C
DETAIL FOR PIPE ABOVE DITCH FLOW LINE**

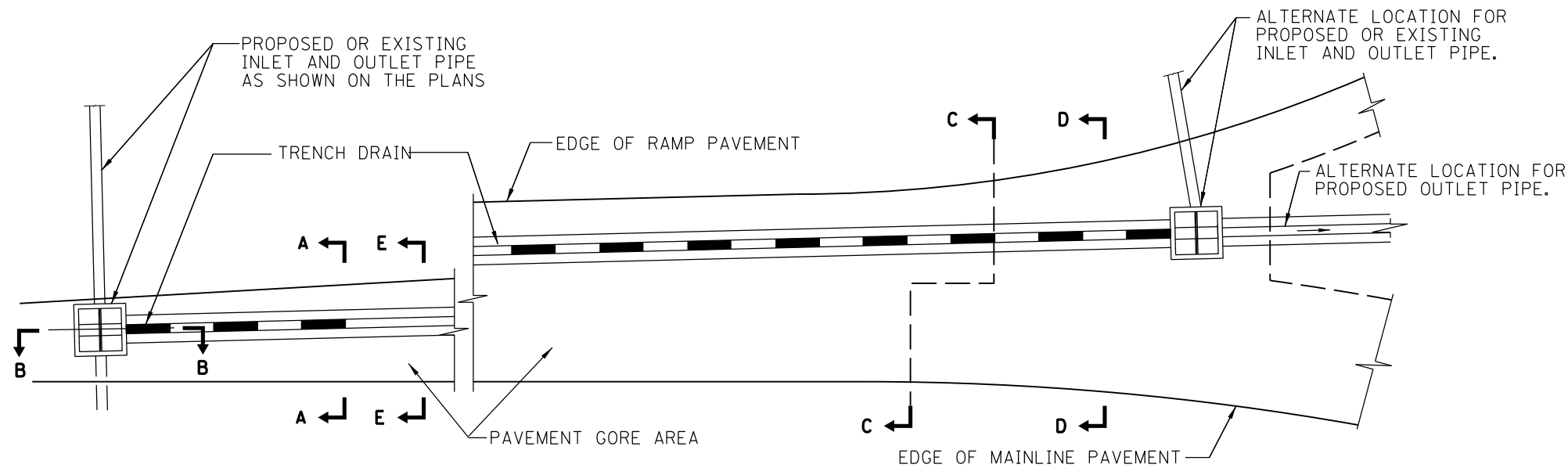
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 1-1-2011

DATE	REVISIONS
5/10/07	CHANGES TO NOTES 5 AND 6
1-1-2011	REVISED NOTES
2-7-2012	REVISED NOTES

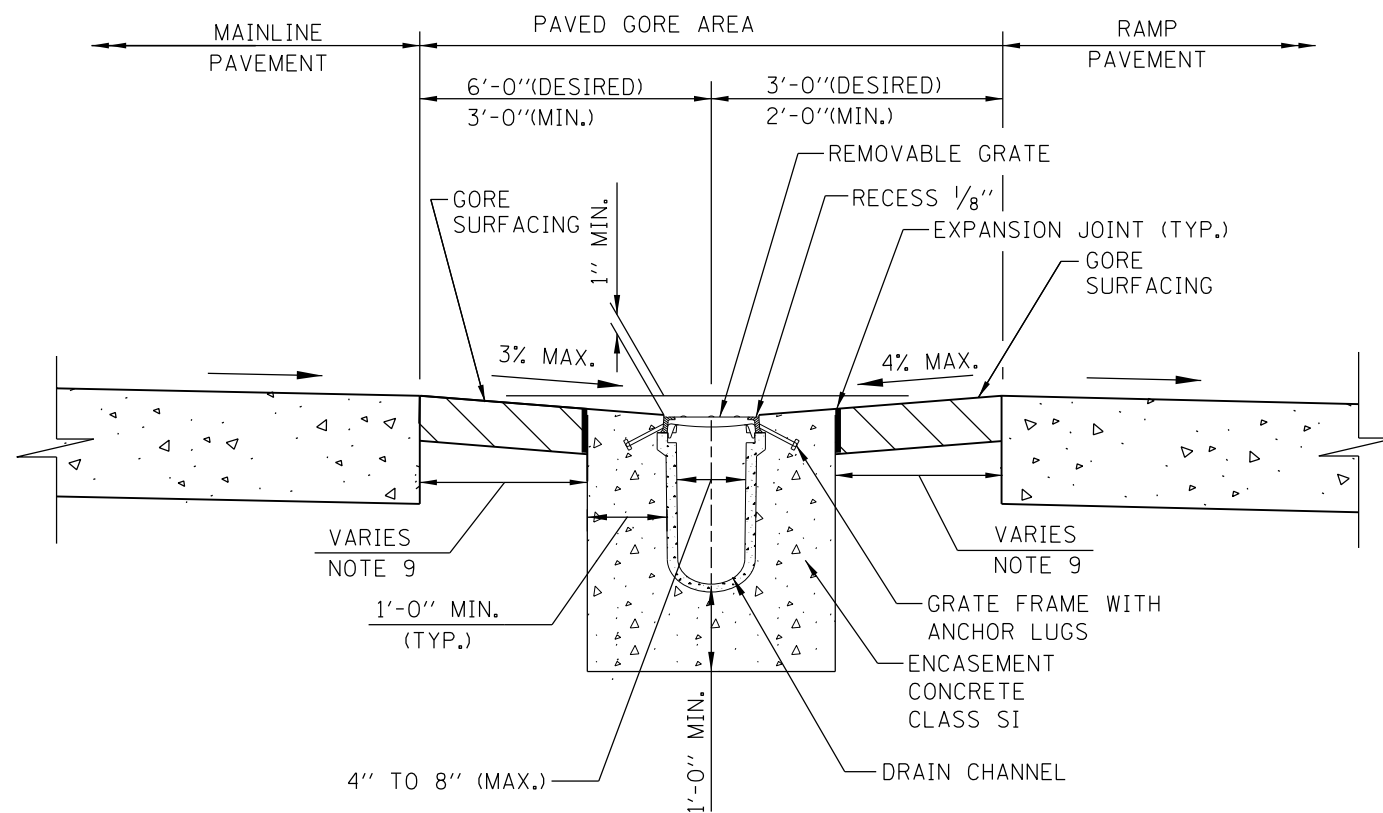
Illinois Tollway

SLOPED HEADWALLS TYPE IV DETAILS

STANDARD B11-03



PLAN



SECTION A-A
DRAIN CHANNEL INSTALLATION

NOTES:

1. OUTLET PIPES AND PREFORMED CHANNEL INVERTS SHALL BE SLOPED AT 0.6% OR STEEPER TOWARD OUTLET REGARDLESS OF THE SURFACE SLOPE.
2. TRENCH DRAIN MAY BE STUBBED DIRECTLY INTO DRAINAGE STRUCTURES OR OUTLET PIPES MAY BE USED TO CONNECT TRENCH DRAIN TO DRAINAGE STRUCTURES.
3. A CLEAN-OUT PORT COMPATIBLE WITH THE MANUFACTURED SYSTEM SHALL BE PROVIDED FOR TRENCH DRAINS AT THE UPSTREAM END AND AT INTERVALS NOT TO EXCEED 100 FEET. THE CLEAN-OUT SHALL HAVE A REMOVABLE LOAD RESISTANT COVER OR GRATE.
4. TRENCH EXCAVATION MUST ALLOW FOR A MINIMUM OF 12 INCHES OF CONCRETE TO BE PLACED UNDER AND ALONGSIDE THE TRENCH DRAIN CHANNEL SYSTEM.
5. THE FINISHED LEVEL OF CONCRETE MUST BE APPROXIMATELY 1/8" ABOVE THE TOP OF THE DRAIN CHANNEL.
6. TRENCH DRAINS SHALL BE IN ACCORDANCE WITH THE MANUFACTURERS DETAILS AND SPECIFICATIONS.
7. PROVIDE 1" EXPANSION JOINT WITH PREFORMED JOINT FILLER BETWEEN PAVED SHOULDER AND TRENCH DRAIN ENCASEMENT.
8. ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL PLACEMENT (V:H).
9. WHEN THE CONCRETE ENCASEMENT FOR TRENCH DRAIN IS WITHIN 6' OF THE PAVEMENT, REPLACE THE GORE SURFACING WITH CLASS SI CONCRETE 9" DEPTH; PAY ITEM: PORTLAND CEMENT CONCRETE SHOULDER (9").

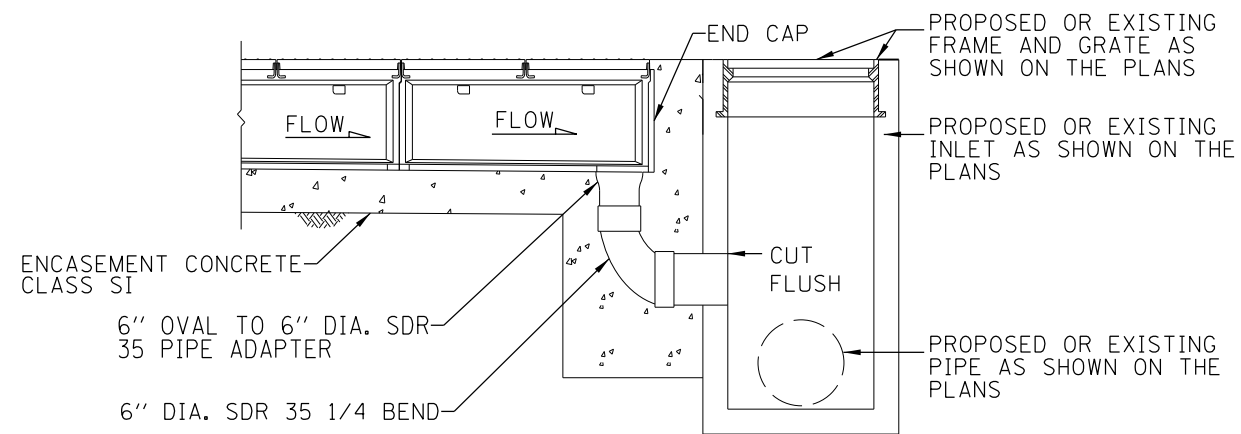


DATE	REVISIONS
2-1-2011	DELETED SLOTTED DRAIN ADDED TRENCH DRAIN
2-1-2013	REVISED MAINLINE SHOULDER GRADE

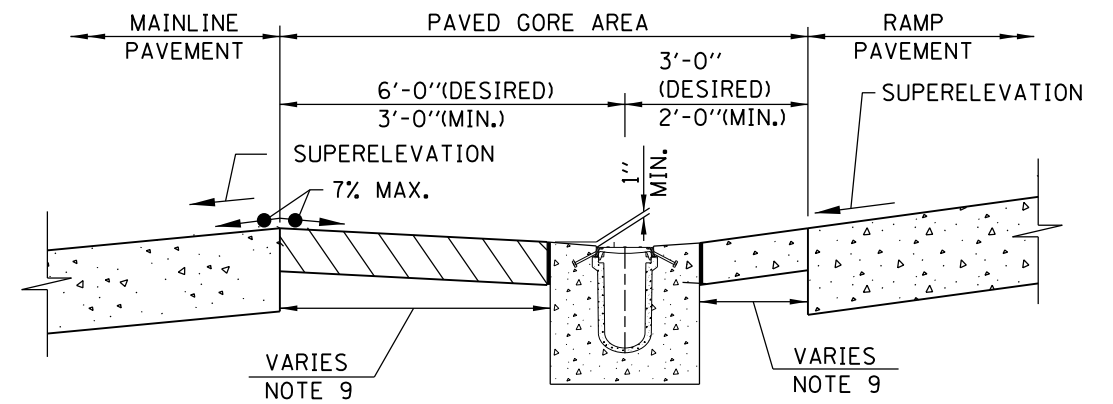
TRENCH DRAIN DETAIL

STANDARD B12-03

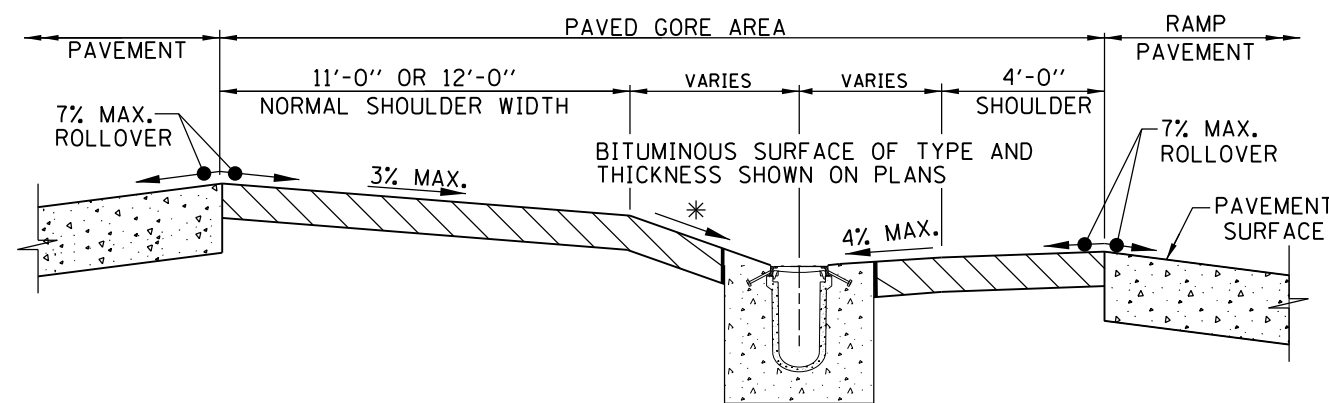
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 1-1-2011



SECTION B-B
PIPE OUTLET TO DRAINAGE STRUCTURE

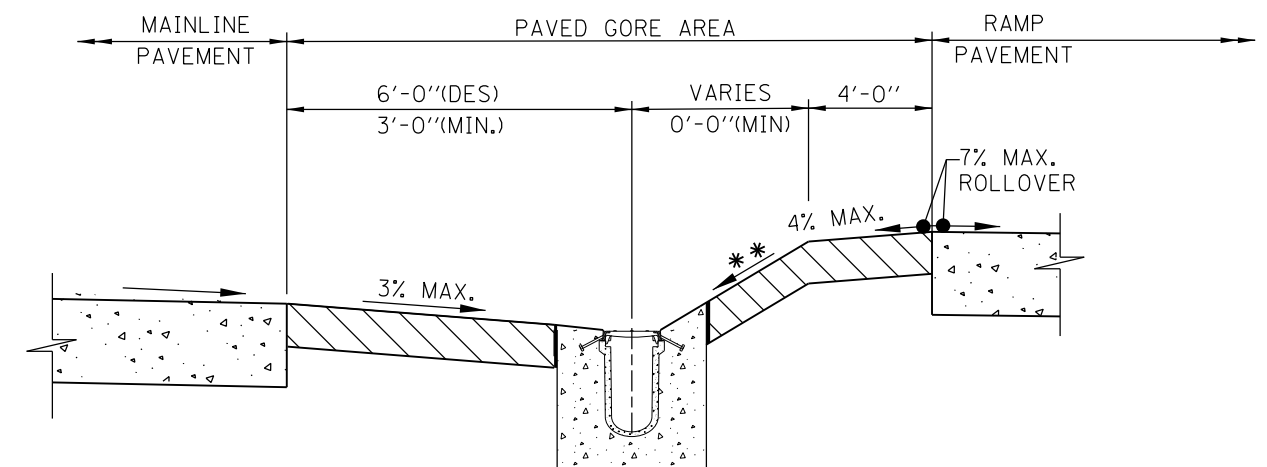


SECTION E-E
RAMP ON OUTSIDE OF
SUPERELEVATED MAINLINE SECTION



SECTION D-D

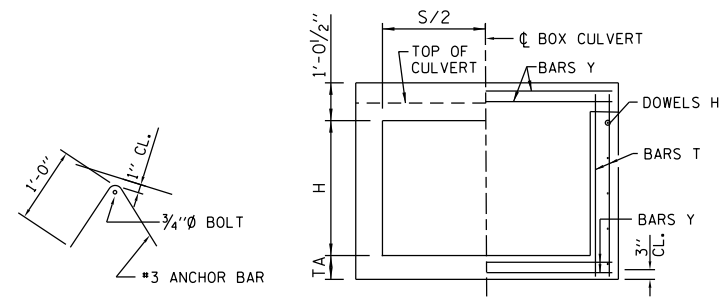
* 1:10 MAXIMUM FOR NEW CONSTRUCTION
1:4 MAXIMUM FOR REHABILITATION



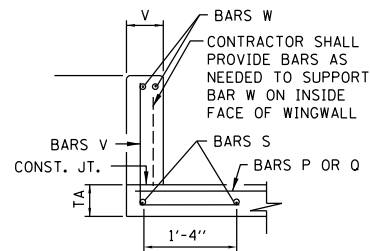
SECTION C-C

** 4% DESIRABLE FOR NEW CONSTRUCTION
1:10 MAXIMUM FOR NEW CONSTRUCTION
1:4 MAXIMUM FOR REHABILITATION

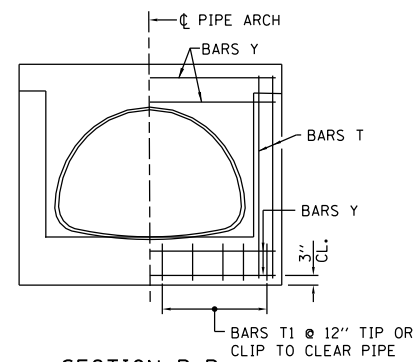




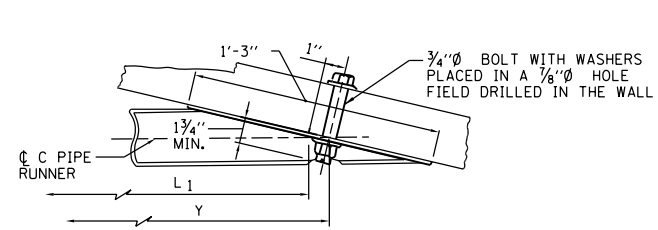
SECTION D-D



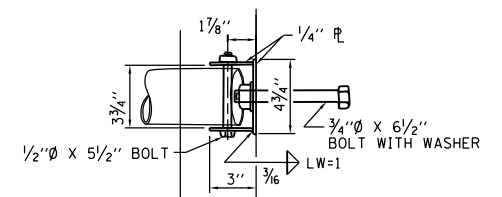
SECTION A-A



SECTION B-B



SECTION AT WING



PLAN AT HEADWALL

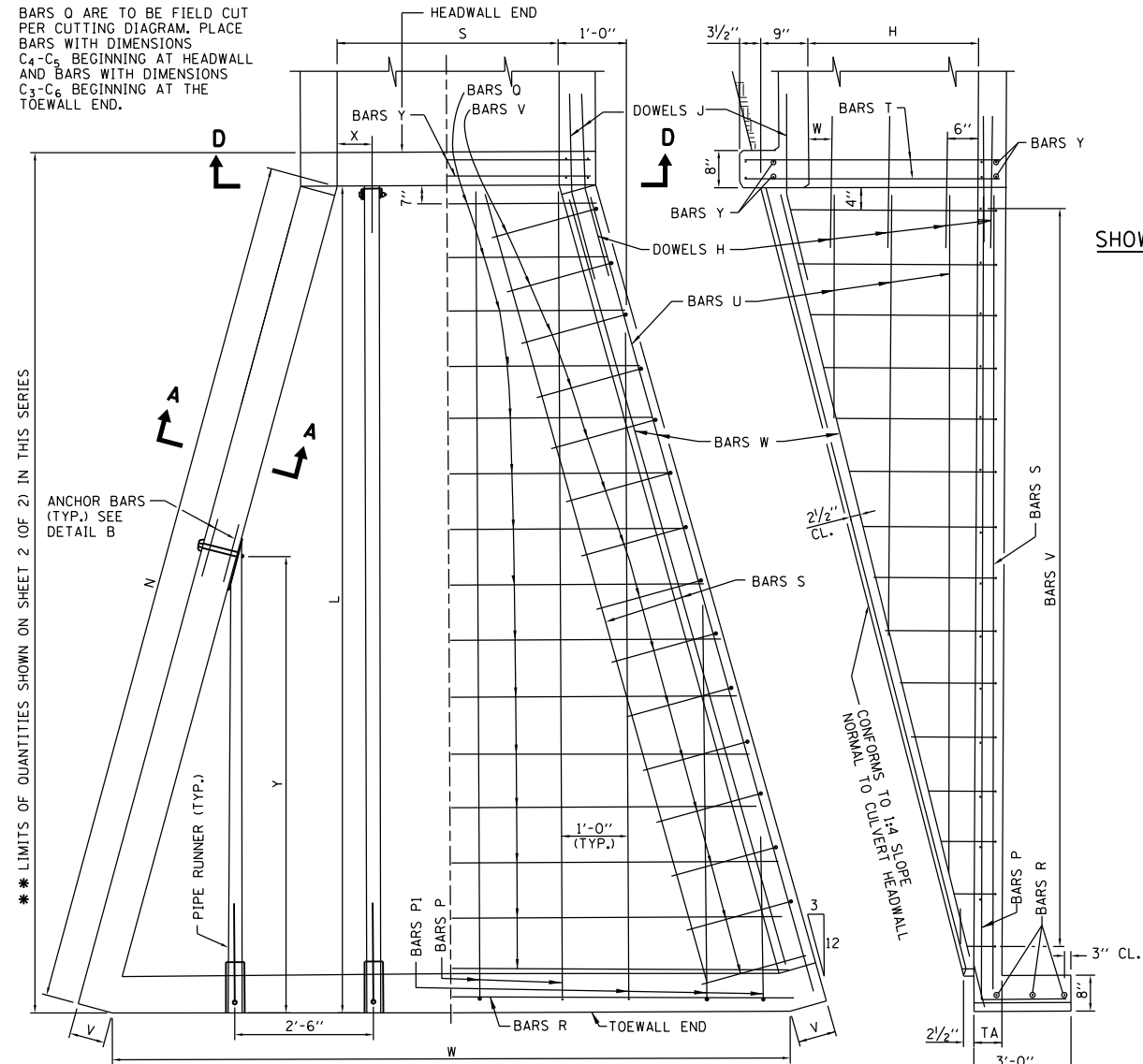
ANCHOR BARS
CONTRACTOR SHALL PROVIDE 2-#3 ANCHOR BARS PER SIDEWALL BOLT.

DETAIL B

NOTE:
BARS O ARE TO BE FIELD CUT PER CUTTING DIAGRAM. PLACE BARS WITH DIMENSIONS C₁-C₂ BEGINNING AT HEADWALL AND BARS WITH DIMENSIONS C₃-C₆ BEGINNING AT THE TOEWALL END.

S = DESIGN SPAN
H = DESIGN HEIGHT

NOTE:
DOWEL BAR J & H NOT REQUIRED WITH EXISTING BOX CULVERTS PROVIDING THE REINFORCING FROM THE EXISTING BOX IS EXTENDED INTO THE NEW CONCRETE A MINIMUM OF 1'-3".



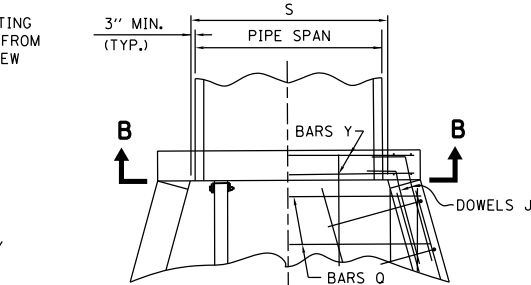
HALF PLAN SHOWING DIMENSIONS

HALF PLAN SHOWING REINFORCING BARS

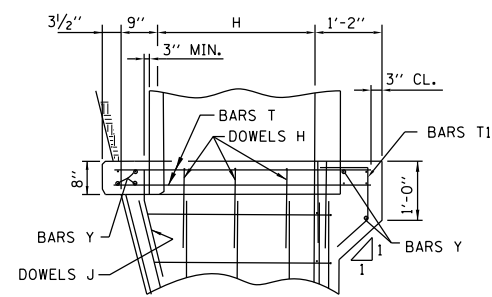
ELEVATION PARALLEL TO BARREL

** DOWEL BARS EXTENDING INTO THE CONCRETE BOX CULVERT ARE INCLUDED IN THE QUANTITIES

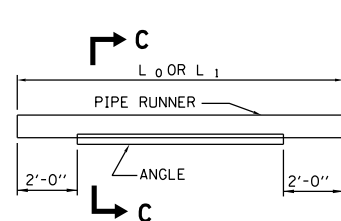
BOX CULVERT DETAILS



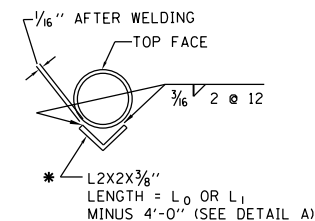
HALF PLAN SHOWING DIMENSIONS
HALF PLAN SHOWING REINFORCING BARS



ELEVATION PIPE ARCH DETAILS

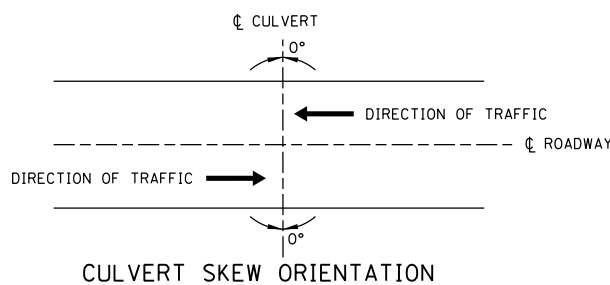


DETAIL A PIPE RUNNER DETAILS

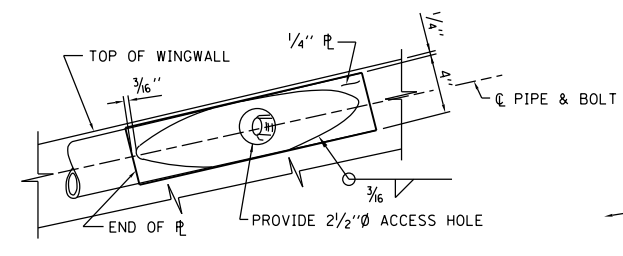


SECTION C-C

***NOTE:**
WHERE L₀ OR L₁ EXCEEDS THE FOLLOWING LENGTH, THE PIPE RUNNER SHALL BE STRENGTHENED OVER THE MIDSPAN AS SHOWN.
PIPE LENGTH 12'-8"
3"Ø, SCH. 40

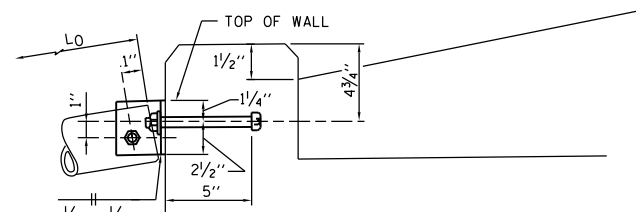


CULVERT SKEW ORIENTATION

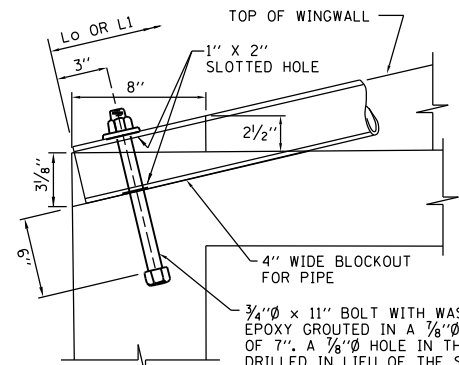


ELEVATION AT WING

NOTE:
PIPE O.D. IS THE PIPE RUNNER OUTSIDE DIAMETER.



ELEVATION AT HEADWALL



SECTION THRU TOEWALL

NOTE:
BARS V, P1 AND U ARE TO BE FIELD CUT PER CUTTING DIAGRAM. PLACE ONE-HALF THE BARS IN OR NEAR EACH WINGWALL BEGINNING WITH THE SHORTEST BARS V AND BARS P1 AT THE TOEWALL END AND LONGEST BARS U AT THE BOTTOM OF THE WALL.

GENERAL NOTES:

- ALL CONCRETE SHALL BE CLASS S1.
- ALL EXPOSED CONCRETE EDGES SHALL HAVE A 3/4" X 45° CHAMFER. CHAMFER ON VERTICAL EDGES SHALL BE CONTINUED A MINIMUM OF ONE FOOT BELOW FINISHED GROUND LEVEL. COVER FROM THE FACE OF CONCRETE TO THE FACE OF REINFORCEMENT BARS SHALL BE 2", UNLESS OTHERWISE SHOWN.
- CONCRETE QUANTITIES SHOWN ON SHEET 2 (OF 2) IN THIS SERIES ARE FOR REINFORCED CONCRETE BOX CULVERT SECTIONS AND ADDITIONAL CONCRETE REQUIRED IN HEADWALLS FOR PIPE OR ARCH CULVERT SECTIONS SHALL BE ADDED TO THESE QUANTITIES.
- THIS STANDARD MAY BE USED FOR CULVERTS WITH SKEW OF 0° ± 7.5°. AS SHOWN PER CULVERT SKEW ORIENTATION ON THIS SHEET.
- DESIGN: SAFETY PIPE RUNNERS ARE DESIGNED FOR A TRANSVERSING LOAD OF 1,800 POUNDS AT YIELD AS RECOMMENDED BY RESEARCH REPORT 280-1, SAFETY TREATMENT OF ROADSIDE CROSS DRAINAGE STRUCTURES, TEXAS TRANSPORTATION INSTITUTE, MARCH 1981.
- ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENT (V:H).
- FOR EROSION PROTECTION SEE STANDARD B19.



DATE	REVISIONS
6-1-2009	REVISED NOTES
3-1-2010	REVISED EROSION PROTECTION AND NOTES
2-7-2012	TABLE QUANTITIES REVISED

SAFETY END TREATMENT FOR SINGLE CULVERTS
0° SKEW 1:4 SLOPE H ≤ 4'

STANDARD B13-03

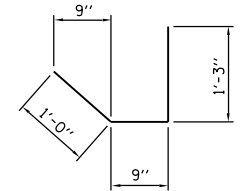
APPROVED: *Paul Kovacs* CHIEF ENGINEER DATE 6-1-2009

CULVERT SIZE	TABLE OF DIMENSIONS							TOTAL QUANTITIES ONE END			PIPE RUNNERS FOR ONE END - SIZE 3" O.D.			
								CONC.	RE-BAR	PIPE RUNNER	HEADWALL PIPE		WINGWALL PIPE	
	S x H	L	N	V	W	TA	X	Y	CU. YD.	LBS.	FT.	NO.	L ₀	NO.
3 x 2	10'-10"	11'-2"	7"	8'-5"	6"	0'-3"	--	3.0	346	22.16	2	11'-1"	0	--
3 x 3	14'-10"	15'-3 1/2"	7"	10'-5"	6"	1'-6"	10'-10"	4.6	489	37.50	1	15'-2"	2	11'-2"
4 x 2	10'-10"	11'-2"	7"	9'-5"	6"	0'-9"	--	3.4	372	22.16	2	11'-1"	0	--
4 x 3	14'-10"	15'-3 1/2"	7"	11'-5"	6"	2'-0"	12'-10"	5.0	521	41.50	1	15'-2"	2	13'-2"
4 x 4	18'-10"	19'-5"	7"	13'-5"	6"	0'-9"	11'-10"	7.0	727	63.00	2	19'-4"	2	12'-2"
5 x 2	10'-10"	11'-2"	7"	10'-5"	6"	1'-3"	5'-10"	3.7	397	34.16	2	11'-1"	2	6'-0"
5 x 3	14'-10"	15'-3 1/2"	7"	12'-5"	6"	1'-3"	9'-10"	5.4	554	50.50	2	15'-2"	2	10'-1"
5 x 4	18'-10"	19'-5"	7"	14'-5"	6"	1'-3"	13'-10"	7.4	765	67.17	2	19'-4"	2	14'-3"
6 x 3	14'-10"	15'-3 1/2"	7"	13'-5"	6"	1'-9"	11'-10"	5.8	583	54.67	2	15'-2"	2	12'-2"
6 x 4	18'-10"	19'-5"	7"	15'-5"	6"	0'-6"	10'-10"	8.0	800	80.33	3	19'-4"	2	11'-2"
7 x 3	14'-10"	15'-3 1/2"	7"	14'-5"	6 1/2"	2'-3"	13'-10"	6.5	614	58.83	2	15'-2"	2	14'-3"
7 x 4	18'-10"	19'-5"	7"	16'-5"	6 1/2"	1'-0"	12'-10"	8.8	635	84.33	3	19'-4"	2	13'-2"
8 x 4	18'-10"	19'-5"	7"	17'-5"	7"	0'-3"	9'-10"	9.6	871	97.50	4	19'-4"	2	10'-1"

PIPE ARCH AND ELLIPTICAL PIPE CULVERTS

FOR PIPE ARCH OR ELLIPTICAL PIPE CULVERTS SELECT APPROPRIATE "S" & "H" FROM SIZES SHOWN. ADD THE FOLLOWING ADDITIONAL BARS:

- (a) 1 ADDITIONAL Y BAR
- (b) #4 - T1 BARS @ APPROX. 12" CTS. (NO. = S + 2)



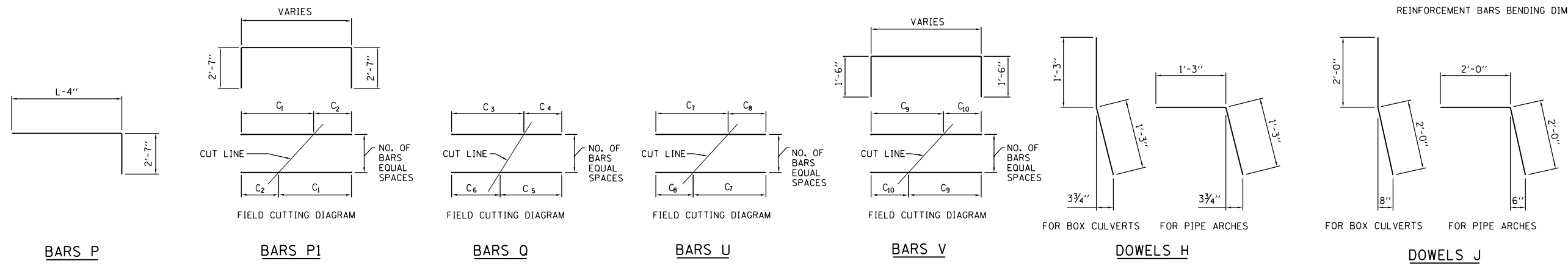
T1 BARS

THE WEIGHT OF THE ADDITIONAL BARS AND THE ADDITIONAL QUANTITY OF CONCRETE IN THE HEADWALL SHALL BE ADDED TO THE QUANTITIES SHOWN.

CULVERT SIZE	TABLE OF REINFORCING STEEL FOR ONE END																														
	DOWEL H #4 @ 12"		DOWEL J #6		BARS P #4 @ 12"		BARS P1 #4 @ 12"			BARS Q #4 @ 12"						BARS R 3-#4	BARS S 4-#4	BARS U #4 @ 12"			BARS V #4 @ 12"			4 BARS W	BARS Y 8-#5	BARS T 8-#5 BOX CULVERT	BARS T 8-#5 PIPE ARCH				
	NO.	LENGTH.	NO.	LENGTH.	NO.	LENGTH.	NO.	C ₁	C ₂	LENGTH.	NO.	C ₃	C ₄	C ₅	C ₆	LENGTH.	LENGTH.	LENGTH.	NO.	C ₇	C ₈	LENGTH.	NO.	C ₉	C ₁₀	LENGTH.	SIZE	LENGTH.	LENGTH.	LENGTH.	LENGTH.
3 x 2	6	2'-6"	4	4'-0"	4	13'-1"	2	8'-4"	4'-4"	17'-10"	5	8'-8"	4'-2"	6'-2"	6'-8"	12'-10"	8'-9"	10'-10"	2	8'-7"	4'-5"	13'-0"	10	2'-9"	6"	6'-3"	#5	10'-4"	3'-8"	3'-2"	3'-8"
3 x 3	8	2'-6"	4	4'-0"	4	17'-1"	3	12'-4"	4'-4"	21'-10"	7	10'-8"	4'-2"	7'-2"	7'-8"	14'-10"	10'-9"	15'-0"	3	12'-8"	4'-5"	17'-1"	14	3'-9"	6"	7'-3"	#5	14'-6"	3'-8"	4'-2"	4'-8"
4 x 2	6	2'-6"	4	4'-0"	5	13'-1"	2	8'-4"	4'-4"	17'-10"	5	9'-8"	5'-2"	7'-2"	7'-8"	14'-10"	9'-9"	10'-10"	2	8'-7"	4'-5"	13'-0"	10	2'-9"	6"	6'-3"	#5	10'-4"	4'-8"	3'-2"	3'-8"
4 x 3	8	2'-6"	4	4'-0"	5	17'-1"	3	12'-4"	4'-4"	21'-10"	7	11'-8"	5'-2"	8'-2"	8'-8"	16'-10"	11'-9"	15'-0"	3	12'-8"	4'-5"	17'-1"	14	3'-9"	6"	7'-3"	#5	14'-6"	4'-8"	4'-2"	4'-8"
4 x 4	10	2'-6"	4	4'-0"	5	21'-1"	4	16'-4"	4'-4"	25'-10"	9	13'-8"	5'-2"	9'-2"	9'-8"	18'-10"	13'-9"	19'-1"	4	16'-9"	4'-5"	21'-2"	18	4'-9"	6"	8'-3"	#6	18'-7"	4'-8"	5'-2"	5'-8"
5 x 2	6	2'-6"	4	4'-0"	6	13'-1"	2	8'-4"	4'-4"	17'-10"	5	10'-8"	6'-2"	8'-2"	8'-8"	16'-10"	10'-9"	10'-10"	2	8'-7"	4'-5"	13'-0"	10	2'-9"	6"	6'-3"	#5	10'-4"	5'-8"	3'-2"	3'-8"
5 x 3	8	2'-6"	4	4'-0"	6	17'-1"	3	12'-4"	4'-4"	21'-10"	7	12'-8"	6'-2"	9'-2"	9'-8"	18'-10"	12'-9"	15'-0"	3	12'-8"	4'-5"	17'-1"	14	3'-9"	6"	7'-3"	#5	14'-6"	5'-8"	4'-2"	4'-8"
5 x 4	10	2'-6"	4	4'-0"	6	21'-1"	4	16'-4"	4'-4"	25'-10"	9	14'-8"	6'-2"	10'-2"	10'-8"	20'-10"	14'-9"	19'-1"	4	16'-9"	4'-5"	21'-2"	18	4'-9"	6"	8'-3"	#6	18'-7"	5'-8"	4'-2"	5'-8"
6 x 3	8	2'-6"	4	4'-0"	7	17'-1"	3	12'-4"	4'-4"	21'-10"	7	13'-8"	7'-2"	10'-2"	10'-8"	20'-10"	13'-9"	15'-0"	3	12'-8"	4'-5"	17'-1"	14	3'-9"	6"	7'-3"	#5	14'-6"	6'-8"	4'-2"	4'-8"
6 x 4	10	2'-6"	4	4'-0"	7	21'-1"	4	16'-4"	4'-4"	25'-10"	9	15'-8"	7'-2"	11'-2"	11'-8"	22'-10"	15'-9"	19'-1"	4	16'-9"	4'-5"	21'-2"	18	4'-9"	6"	8'-3"	#6	18'-7"	6'-8"	5'-2"	5'-8"
7 x 3	8	2'-6"	4	4'-0"	8	17'-1"	3	12'-4"	4'-4"	21'-10"	7	14'-8"	8'-2"	11'-2"	11'-8"	22'-10"	14'-9"	15'-0"	3	12'-8"	4'-5"	17'-1"	14	3'-9"	6"	7'-3"	#5	14'-6"	7'-8"	4'-2"	4'-8"
7 x 4	10	2'-6"	4	4'-0"	8	21'-1"	4	16'-4"	4'-4"	25'-10"	9	16'-8"	8'-2"	12'-2"	12'-8"	24'-10"	16'-9"	19'-1"	4	16'-9"	4'-5"	21'-2"	18	4'-9"	6"	8'-3"	#6	18'-7"	7'-8"	5'-2"	5'-8"
8 x 4	10	2'-6"	4	4'-0"	9	21'-1"	4	16'-4"	4'-4"	25'-10"	9	17'-8"	9'-2"	13'-2"	13'-8"	26'-10"	17'-9"	19'-1"	4	16'-9"	4'-5"	21'-2"	18	4'-9"	6"	8'-3"	#6	18'-7"	8'-8"	5'-3"	5'-8"

NOTE:

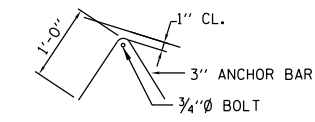
REINFORCEMENT BARS BENDING DIMENSIONS ARE OUT TO OUT.



SAFETY END TREATMENT FOR SINGLE CULVERTS 0° SKEW 1:4 SLOPE H ≤ 4'

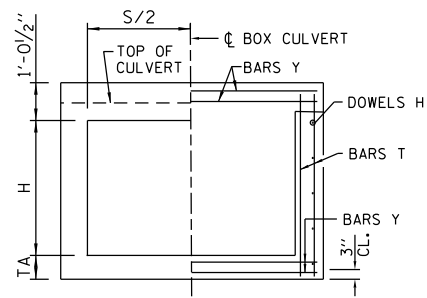
STANDARD B13-03

APPROVED: *Paul Kovacs* CHIEF ENGINEER DATE 6-1-2009

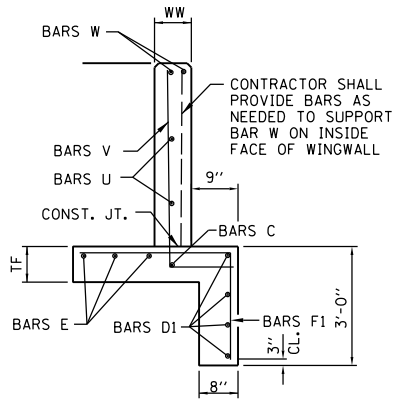


ANCHOR BARS
 CONTRACTOR SHALL PROVIDE 2 #3 ANCHOR BARS PER SIDEWALL BOLT

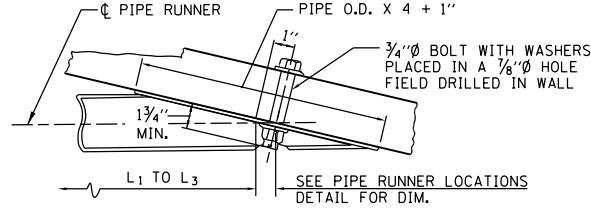
DETAIL B



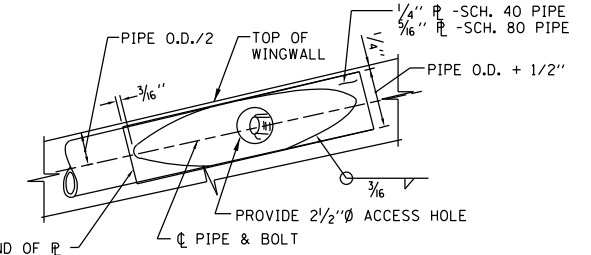
SECTION F-F



SECTION A-A

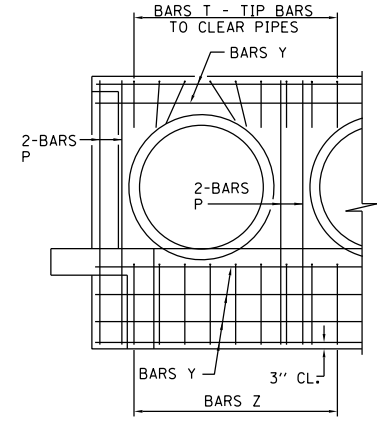


SECTION AT WING

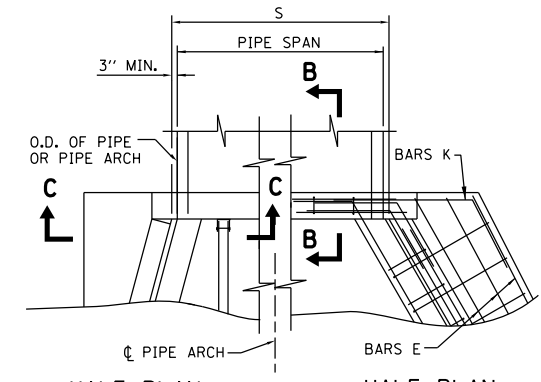


ELEVATION AT WING

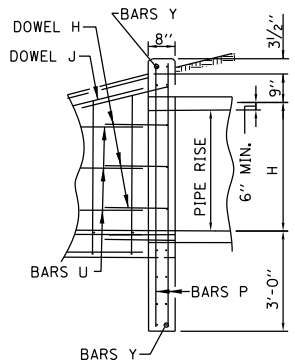
NOTE:
 PIPE O.D. IS THE PIPE RUNNER OUTSIDE DIAMETER.



SECTION C-C

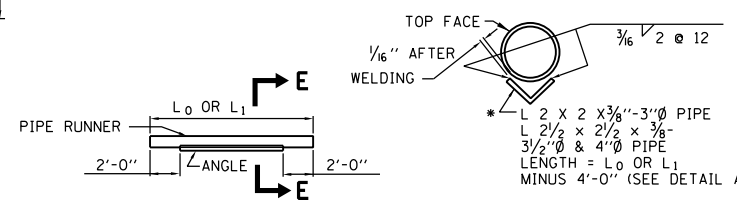


HALF PLAN SHOWING DIMENSIONS **HALF PLAN SHOWING REINFORCING BARS**



SECTION B-B

FOR PIPE AND PIPE-ARCH CULVERTS



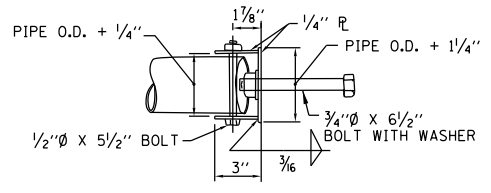
DETAIL A

SECTION E-E

NOTE:
 * WHERE L₀ OR L₁ EXCEEDS THE FOLLOWING LENGTH THE PIPE RUNNER SHALL BE STRENGTHENED OVER MIDSPAN AS SHOWN.

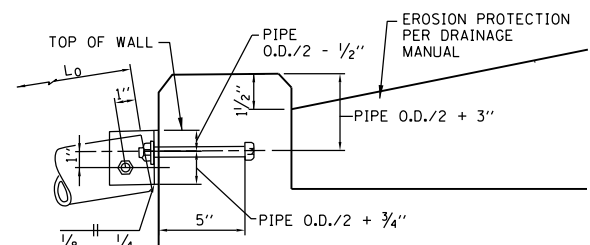
PIPE	LENGTH
3"Ø, SCH. 40	12'-8"
3 1/2"Ø, SCH. 40	17'-3"
3 1/2"Ø, SCH. 80	22'-1"
4"Ø, SCH. 40	22'-6"
4"Ø, SCH. 80	29'-4"

PIPE RUNNER DETAILS

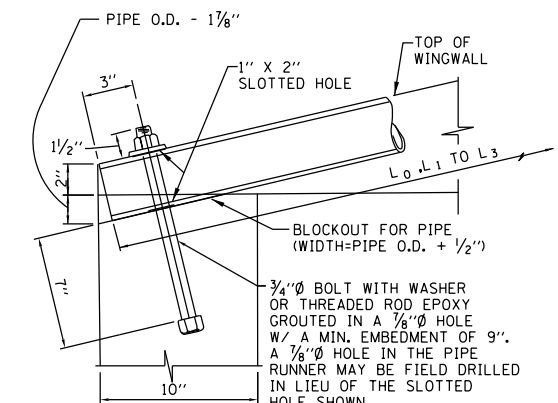


PLAN AT HEADWALL

NOTE:
 A 3/4"Ø X 9 1/2" BOLT WITH ADDITIONAL R WASHER PLACED IN A 1/8"Ø HOLE DRILLED THROUGH THE HEADWALL OR A 3/4"Ø X 8" THREADED ROD EPOXY GROUTED IN A 1/8"Ø HOLE WITH A MINIMUM EMBEDMENT OF 6 5/8" MAY BE USED IN LIEU OF CAST-IN-PLACE BOLT SHOWN.



ELEVATION AT HEADWALL



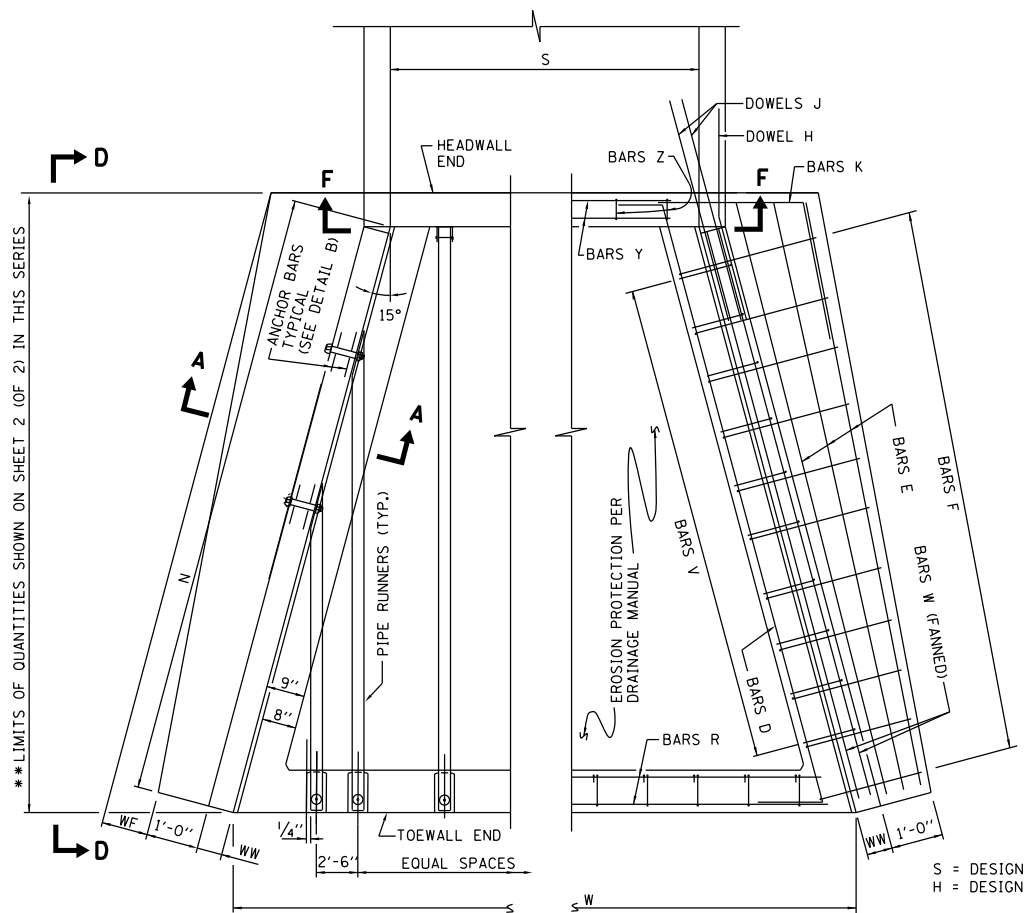
SECTION THRU TOEWALL

GENERAL NOTES:

- ALL CONCRETE SHALL BE CLASS SI.
- ALL EXPOSED CONCRETE EDGES SHALL HAVE A 3/4" x 45° CHAMFER. CHAMFER ON VERTICAL EDGES SHALL BE CONTINUED A MINIMUM OF ONE FOOT BELOW FINISHED GROUND LEVEL. COVER FROM THE FACE OF CONCRETE TO THE FACE OF REINFORCEMENT BARS SHALL BE 2", UNLESS OTHERWISE SHOWN.
- CONCRETE QUANTITIES SHOWN ON SHEET 2 (OF 2) IN THIS SERIES ARE FOR REINFORCED CONCRETE BOX CULVERT SECTIONS AND ADDITIONAL CONCRETE REQUIRED IN HEADWALLS FOR PIPE OR ARCH CULVERT SECTIONS SHALL BE ADDED TO THESE QUANTITIES.
- THIS STANDARD MAY BE USED FOR CULVERTS WITH SKEW OF 0° ± 7.5%; AS SHOWN PER CULVERT SKEW ORIENTATION ON THIS SHEET.
- DESIGN: SAFETY PIPE RUNNERS ARE DESIGNED FOR A TRANSVERSING LOAD OF 1,800 POUNDS AT YIELD AS RECOMMENDED BY RESEARCH REPORT 280-1, SAFETY TREATMENT OF ROADSIDE CROSS DRAINAGE STRUCTURES, TEXAS TRANSPORTATION INSTITUTE, MARCH 1981.
- ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENT (V:H).
- FOR EROSION PROTECTION SEE SHEET B19.

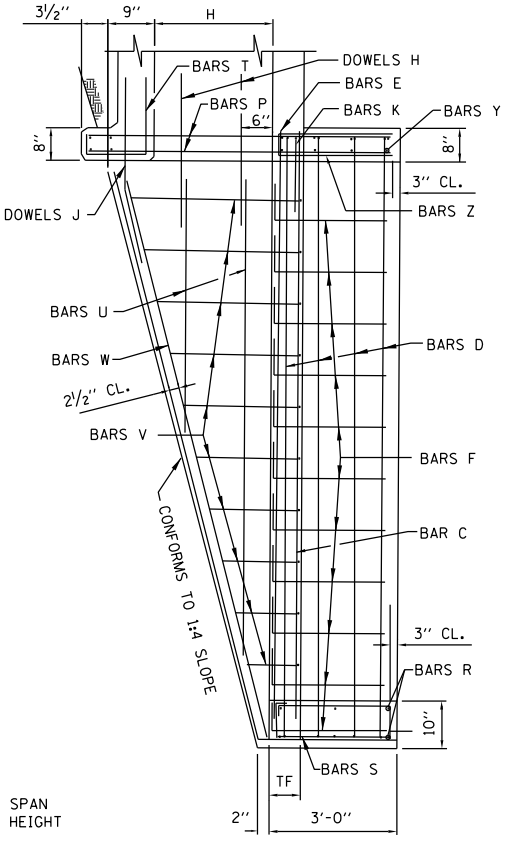
NOTE:
 BAR F & V TO BE FIELD CUT PER CUTTING DIAGRAM. PLACE BARS WITH DIMENSIONS C₂, C₆ BEGINNING AT HEADWALL & BARS WITH DIMENSIONS C₁, C₅ BEGINNING AT THE TOEWALL END.

NOTE:
 DOWEL BAR J & H NOT REQUIRED WITH EXISTING BOX CULVERTS PROVIDING THE REINFORCING FROM THE EXIST. BOX IS EXTENDED INTO THE NEW CONCRETE A MIN. OF 1'-3".

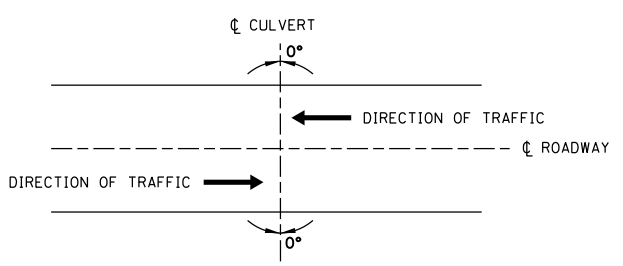


HALF PLAN SHOWING DIMENSIONS **HALF PLAN SHOWING REINFORCING BARS**

FOR BOX CULVERTS



ELEVATION D-D



CULVERT SKEW ORIENTATION

APPROVED: *Paul Kovacs* CHIEF ENGINEER DATE 6-1-2009

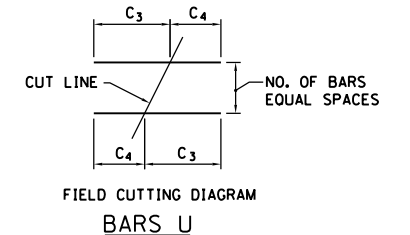


SAFETY END TREATMENT FOR SINGLE AND MULTIPLE CULVERTS 0° SKEW 1:4 SLOPE H ≤ 8'

STANDARD B14-03

DATE	REVISIONS
6-1-2009	ADDED PIPE DIMENSION FORMULA REVISED NOTES
3-1-2010	REVISED EROSION PROTECTION AND NOTES
2-7-2012	REVISED TABLE QUANTITIES

TABLE OF DIMENSIONS												TABLE OF REINFORCING STEEL FOR ONE END																			
H	S	L	WF	WW	TF	N	BARS C 2 REOD.		BARS D 8-#4		BARS E #4 (5)		BARS F			DOWEL H #5 @ 12"		DOWEL J 4-#6		BARS K 2-#5		BARS U #4 @ 12"			BARS V #4 @ 12" CTS.				BARS W 4 REOD.		
							SIZE	LENGTH	LENGTH	NO.	LENGTH	SIZE	NO.	C ₁	C ₂	LENGTH	NO.	LENGTH	LENGTH	LENGTH	NO.	C ₃	C ₄	LENGTH	NO.	C ₅	C ₆	C ₇	LENGTH	SIZE	LENGTH
3'	9'	14'-4"	3"	7"	7"	14'-10 1/8"	#4	15'-2"	17'-2"	4	16'-8"	#4	15	2'-0"	2'-2"	9'-4"	6	3'-0"	4'-6"	4'-0"	3	12'-8"	4'-5"	17'-1"	14	9"	3'-10"	1'-0"	6'-7"	#5	14'-11"
4'	9'	18'-4"	9"	7"	8"	18'-11 3/4"	#4	19'-4"	21'-4"	4	20'-10"	#4	19	2'-0"	2'-8"	9'-10"	8	3'-0"	4'-6"	4'-6"	4	16'-10"	4'-5"	21'-3"	18	10"	4'-11"	1'-0"	7'-9"	#6	19'-2"
5'	5'	22'-4"	1'-3"	7"	8"	23'-1 1/2"	#4	23'-6"	25'-6"	4	25'-0"	#4	23	2'-0"	3'-2"	10'-4"	10	3'-0"	4'-6"	5'-0"	5	20'-11"	4'-5"	25'-4"	22	10"	5'-11"	1'-0"	8'-9"	#6	23'-5"
6'	6'	26'-4"	1'-9"	7"	8 1/2"	27'-3 1/8"	#4	27'-7"	29'-7"	6	29'-1"	#5	27	2'-0"	3'-8"	10'-10"	12	3'-0"	4'-6"	5'-6"	6	25'-1"	4'-5"	29'-6"	26	10"	6'-11"	1'-0"	9'-9"	#6	27'-8"
7'	7'	30'-4"	2'-3"	7"	9"	31'-4 1/8"	#5	31'-9"	33'-9"	6	33'-3"	#5	31	2'-1"	4'-3"	11'-6"	14	3'-0"	4'-6"	6'-0"	7	29'-2"	4'-5"	33'-7"	30	11"	8'-0"	1'-0"	10'-11"	#6	31'-11"
8'	8'	34'-4"	2'-9"	8"	9 1/2"	35'-6 1/2"	#5	35'-10"	37'-10"	6	37'-4"	#6	35	2'-2"	4'-10"	12'-2"	16	3'-0"	4'-6"	6'-6"	8	33'-4"	4'-5"	37'-9"	34	11"	9'-0"	1'-1"	12'-1"	#6	36'-2"



PIPE RUNNERS FOR ONE END								
H	S	SIZE (DIA)	SCHEDULE	NO WINGWALL PIPES	L ₁	L ₂	L ₃	LENGTH (FT.)
3'	9'	3"	40	2	9'-11"	--	--	19.84
4'	9'	3"	40	2	14'-0"	--	--	28.00
5'	5'	3 1/2"	40	4	18'-1"	8'-6"	--	53.16
6'	6'	3 1/2"	80	4	22'-3"	12'-7"	--	69.66
7'	7'	4"	40	6	26'-4"	16'-9"	7'-2"	100.50
8'	8'	4"	80	6	30'-6"	20'-10"	11'-7"	125.83

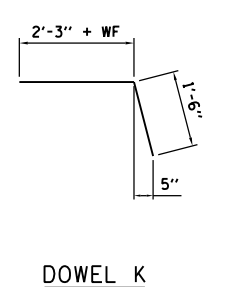
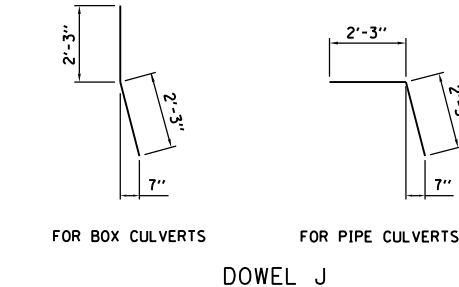
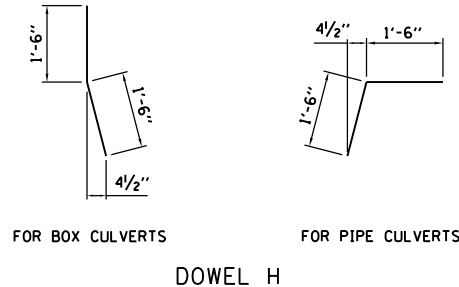
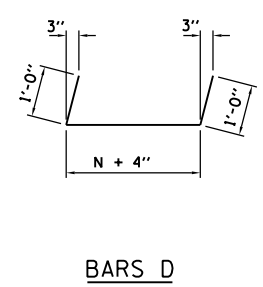
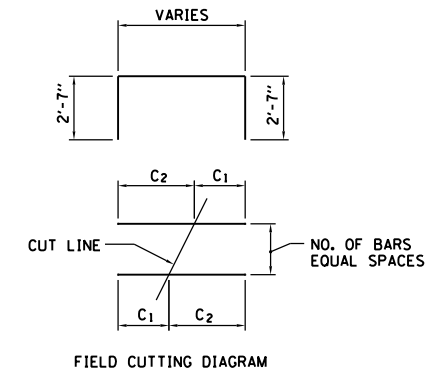


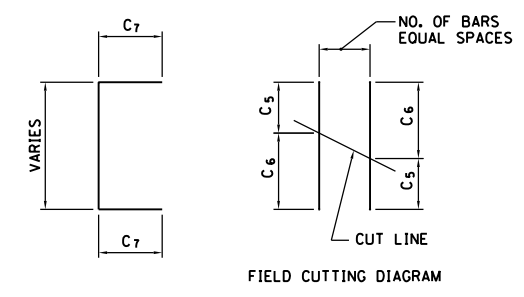
TABLE OF DIMENSIONS			TABLE OF REINFORCING STEEL FOR MINIMUM "S"									HEADWALL PIPE RUNNERS FOR MINIMUM "S"				QUANTITIES FOR MIN. "S" (SINGLE PIPE OR CONC. BOX CULVERT)		INCREASE IN QUANTITIES FOR 1' INCREASE IN "S"					
H	S	W (4)	BARS Y 12-#5		BARS Z #4 @ 12"		BARS R 6-#5		BARS S #4 @ 12"		BARS T #4 @ 12"		BARS P 8-#5		SIZE (DIA.)	SCHEDULE	NO.	L ₀	LENGTH (FT.)	CONCRETE CU. YD.	REIN. BARS LBS.	CONCRETE CU. YD.	REIN. BARS LBS.
			LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.											
3'	9'	16'-8"	9'-10"	9	5'-4"	15'-10"	16	6'-10"	9	3'-0"	6'-8"	3"	40	4	14'-9"	59.00	6.9	898	0.19	29			
4'	9'	18'-9"	9'-10"	9	5'-4"	17'-11"	18	6'-10"	9	3'-0"	7'-8"	3"	40	4	18'-10"	75.33	9.2	1113	0.19	29			
5'	5'	16'-11"	5'-10"	5	5'-4"	16'-1"	16	6'-10"	5	3'-0"	8'-8"	3 1/2"	40	2	23'-0"	46.00	10.9	1198	0.19	29			
6'	6'	20'-1"	6'-10"	6	5'-4"	19'-3"	19	6'-10"	6	3'-0"	9'-8"	3 1/2"	80	3	27'-2"	81.51	14.0	1589	0.19	29			
7'	7'	23'-3"	7'-10"	7	5'-4"	22'-5"	22	6'-10"	7	3'-0"	10'-8"	4"	40	3	31'-3"	93.75	17.5	1905	0.19	29			
8'	8'	26'-4"	9'-0"	8	5'-4"	25'-6"	25	6'-10"	8	3'-0"	11'-8"	4"	80	4	35'-4"	141.33	22.6	2416	0.19	29			

NUMBER OF HDWL PIPE RUNNERS FOR ONE END			
S	No	S	No
10'	4	23'	10
11'	5	24'	10
12'	5	25'	10
13'	6	26'	11
14'	6	27'	11
15'	6	28'	12
16'	7	29'	12
17'	7	30'	12
18'	8	31'	13
19'	8	32'	13
20'	8	33'	14
21'	9	34'	14
22'	9	35'	14

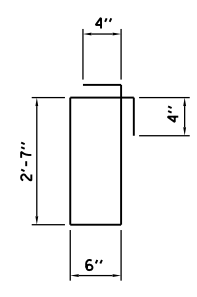
NOTE:
REINFORCEMENT BARS BENDING DIMENSIONS ARE OUT TO OUT.



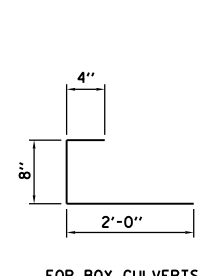
BARS F



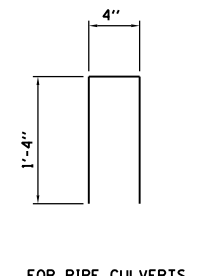
BARS V



BARS S



BARS T



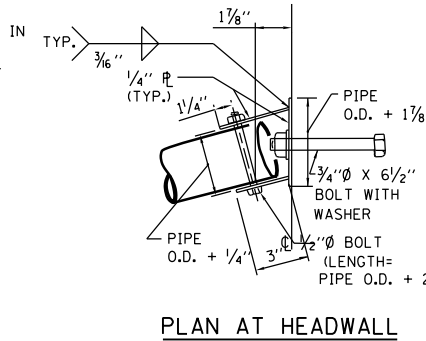
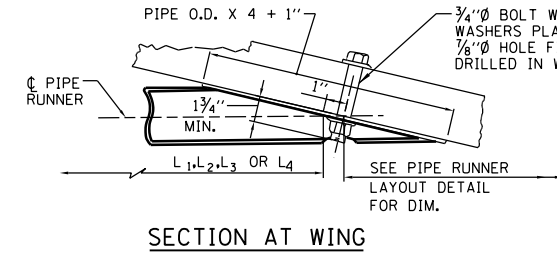
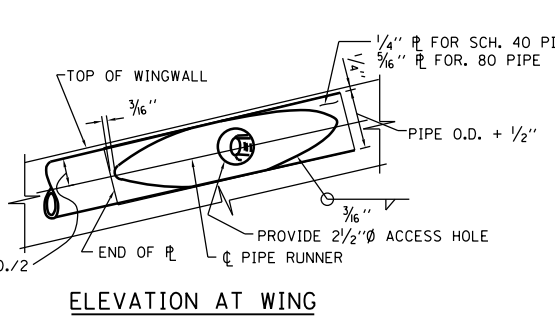
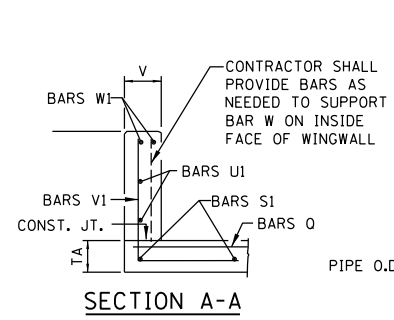
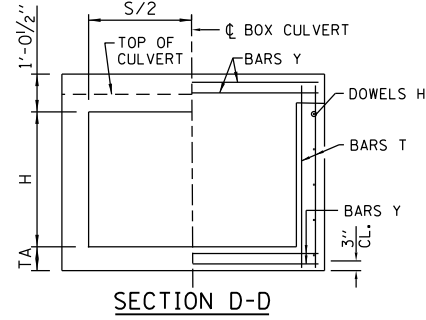
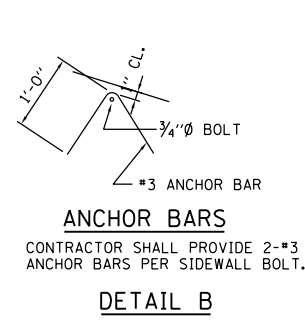
BARS Z

- NOTES FOR TABLE OF DIMENSIONS:
- THE NUMBER OF BARS S, T AND Z SHALL BE INCREASED BY 1 FOR EACH 1 FOOT OF INCREASE IN DIMENSION "S".
 - THE LENGTH OF BARS R AND Y SHALL BE INCREASED BY 1 FOOT FOR EACH 1 FOOT OF INCREASE IN DIMENSION "S".
 - THE NUMBER OF BARS P SHOWN ARE FOR SINGLE SPAN PIPES OR BOX CULVERTS. THIS NUMBER SHALL BE INCREASED BY 4 FOR EACH MULTIPLE OF PIPE OR BOX ADDED.
 - THIS DIMENSION SHALL BE INCREASED BY 1 FOOT FOR EACH 1 FOOT INCREASE IN DIMENSION "S".
 - THE LENGTH OF THIS BAR INCLUDES ONE 1'-6" MINIMUM LAP.

SAFETY END TREATMENT FOR SINGLE AND MULTIPLE CULVERTS
0° SKEW 1:4 SLOPE H ≤ 8'

STANDARD B14-03

Paul Kovacs
APPROVED... CHIEF ENGINEER... DATE 6-1-2009...

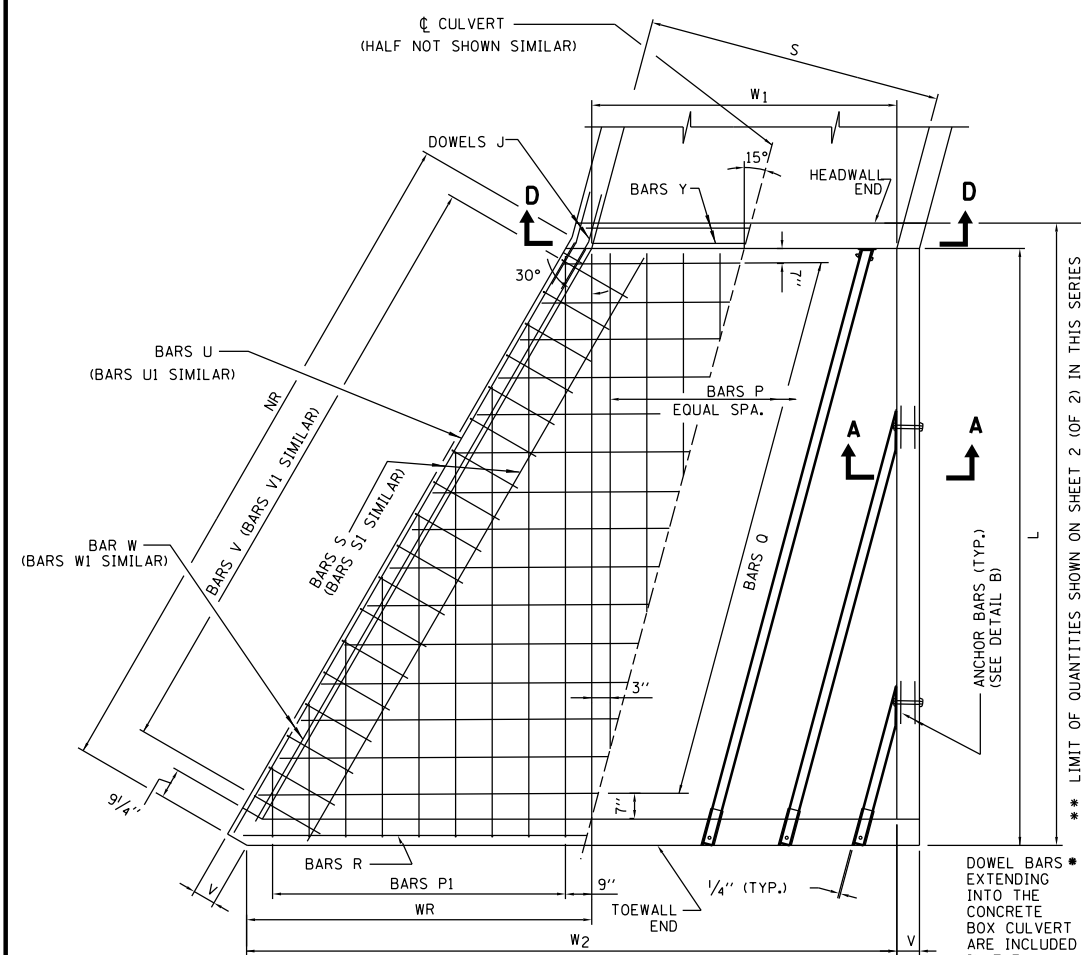
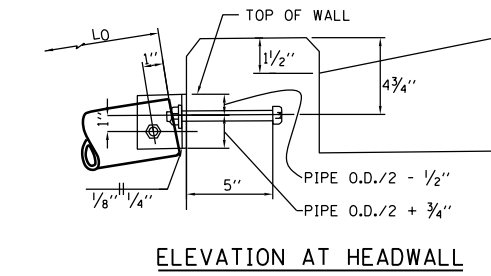
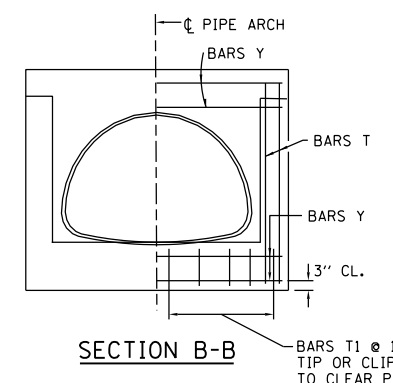


NOTES:
 BARS O, V, AND V1 ARE TO BE FIELD CUT PER CUTTING DIAGRAM. PLACE BARS WITH DIMENSIONS C2 - C3, C9 - C12 BEGINNING AT HEADWALL AND BARS WITH DIMENSIONS C1 - C4, C10 - C11 BEGINNING AT THE TOEWALL END

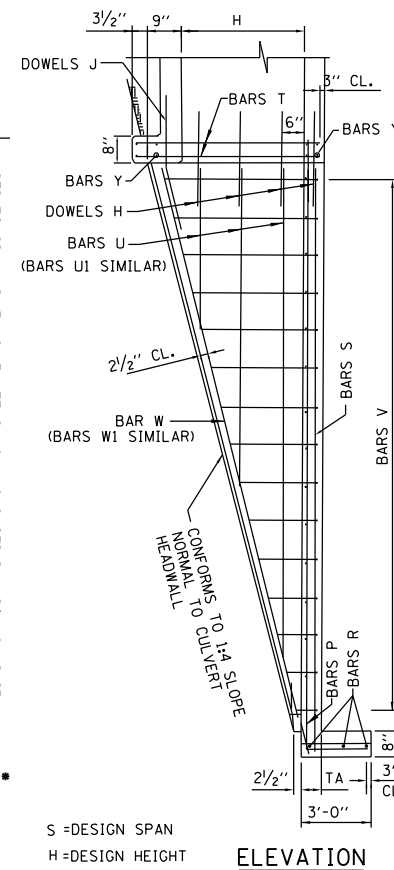
NOTE:
 BARS P1 ARE TO BE FIELD CUT PER CUTTING DIAGRAM. PLACE BARS WITH DIMENSIONS C6 - C7 BEGINNING AT TOEWALL END OF 30° WING AND BARS WITH DIMENSIONS C5 - C8 BEGINNING PARALLEL THE BARS P.

NOTE:
 DOWEL BAR J & H NOT REQUIRED WITH EXISTING BOX CULVERTS PROVIDING THE REINFORCING FROM THE EXIST. BOX IS EXTENDED INTO THE NEW CONCRETE A MIN. OF 1'-3".

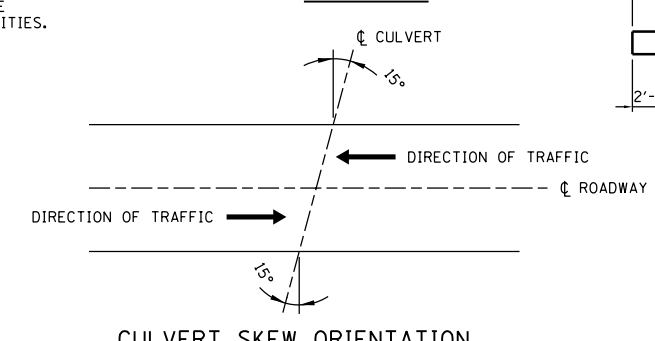
NOTE:
 PIPE O.D. IS THE PIPE RUNNER OUTSIDE DIAMETER



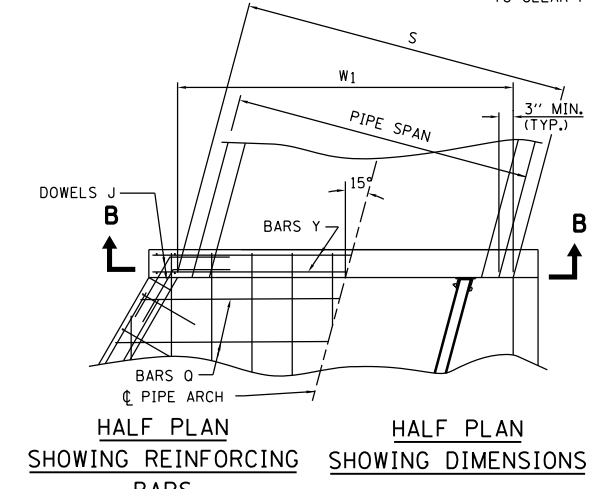
BOX CULVERT DETAILS
 HALF PLAN SHOWING REINFORCING BARS
 HALF PLAN SHOWING DIMENSIONS



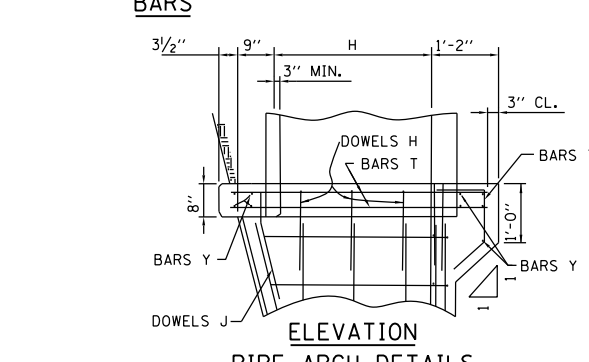
ELEVATION



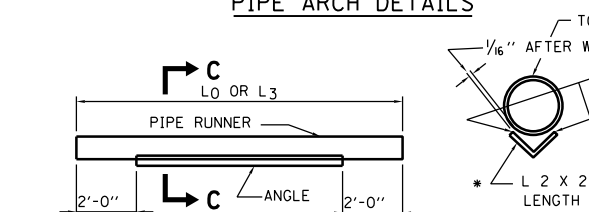
CULVERT SKEW ORIENTATION



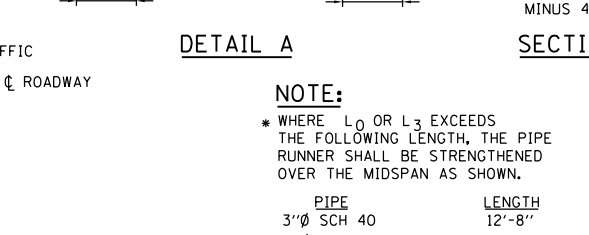
HALF PLAN SHOWING REINFORCING BARS



HALF PLAN SHOWING DIMENSIONS

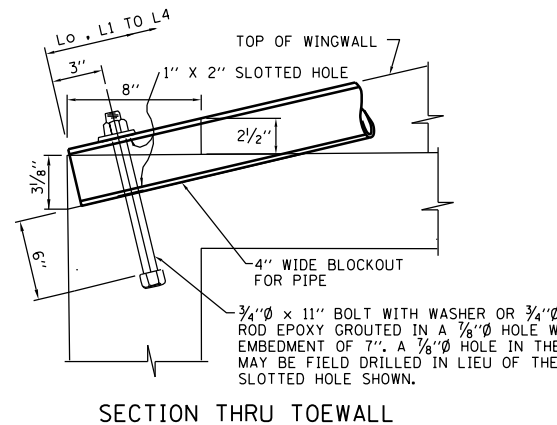


ELEVATION PIPE ARCH DETAILS



NOTE:
 * WHERE L0 OR L3 EXCEEDS THE FOLLOWING LENGTH, THE PIPE RUNNER SHALL BE STRENGTHENED OVER THE MIDSPAN AS SHOWN.

PIPE	LENGTH
3" SCH 40	12'-8"
3" SCH 80	15'-4"



SECTION THRU TOEWALL

PIPE RUNNER DETAILS

GENERAL NOTES:

1. ALL CONCRETE SHALL BE CLASS S1.
2. ALL EXPOSED CONCRETE EDGES SHALL HAVE A 3/4" x 45° CHAMFER. CHAMFER ON VERTICAL EDGES SHALL BE CONTINUED A MINIMUM OF ONE FOOT BELOW FINISHED GROUND LEVEL. COVER FROM THE FACE OF CONCRETE TO THE FACE OF REINFORCEMENT BARS SHALL BE 2", UNLESS OTHERWISE SHOWN.
3. CONCRETE QUANTITIES SHOWN ON SHEET 2 (OF 2) IN THIS SERIES ARE FOR REINFORCED CONCRETE BOX CULVERT SECTIONS AND ADDITIONAL CONCRETE REQUIRED IN HEADWALLS FOR PIPE OR ARCH CULVERT SECTIONS SHALL BE ADDED TO THESE QUANTITIES.
4. THIS STANDARD MAY BE USED FOR CULVERTS WITH SKEW OF 15° ± 7.5°, AS SHOWN PER CULVERT SKEW ORIENTATION ON THIS SHEET.
5. DESIGN: SAFETY PIPE RUNNERS ARE DESIGNED FOR A TRANSVERSING LOAD OF 1,800 POUNDS AT YIELD AS RECOMMENDED BY RESEARCH REPORT 280-1, SAFETY TREATMENT OF ROADSIDE CROSS DRAINAGE STRUCTURES, TEXAS TRANSPORTATION INSTITUTE, MARCH 1981.
6. ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENT (V:H).
7. FOR EROSION PROTECTION SEE STANDARD B19.



SAFETY END TREATMENT FOR SINGLE CULVERTS 15° SKEW 1:4 SLOPE H ≤ 4'

STANDARD B15-03

DATE	REVISIONS
6-1-2009	REVISED NOTES
3-1-2010	MODIFIED CULVERT SKEW DETAIL, REVISED EROSION PROTECTION AND NOTES
2-7-2012	REVISED TABLE QUANTITIES

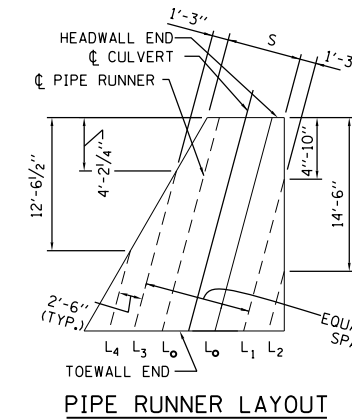
APPROVED: *Paul Kovacs* CHIEF ENGINEER DATE 6-1-2009

CULVERT SIZE (FEET)	TABLE OF DIMENSIONS								PIPE RUNNERS FOR ONE END SIZE 3" DIA.							TABLE OF REINFORCING STEEL FOR ONE END																					
	S X H	L	NR	V	W ₁	W ₂	WR	TA	HEADWALL PIPE				WINGWALL PIPE - ONE PER EACH LENGTH SHOWN				DOWELS H #4 @ 12"				DOWELS J 2-#6 EACH WALL				BARS P #4 - EQUALLY SPACED				BARS P1 #4 @ 12"								
									SCH.	NO.	L ₀	L ₁	L ₂	L ₃	L ₄	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	C ₅	C ₆	C ₇	C ₈	LENGTH	NO.	C ₉	C ₁₀	C ₁₁	C ₁₂	LENGTH
3 x 2	10'-10"	12'-6 1/8"	7"	3'-1 1/4"	9'-4 1/4"	6'-3"	6"	40	2	11'-5"	6'-3"	-	7'-0"	-	3	2'-6"	3	2'-6"	4'-0"	4'-0"	4	13'-1"	3	10'-2"	1'-6"	5'-0"	6'-8"	16'-10"									
3 x 3	14'-10"	17'-1 1/2"	7"	3'-1 1/4"	11'-8"	8'-6 3/4"	6"	40	2	15'-8"	10'-6"	-	11'-3"	-	4	2'-6"	4	2'-6"	4'-0"	4'-0"	4	17'-1"	4	14'-2"	2'-0"	7'-3"	8'-11"	21'-4"									
4 x 2	10'-10"	12'-6 1/8"	7"	4'-1 3/4"	10'-4 3/4"	6'-3"	6"	40	2	11'-5"	6'-3"	-	7'-0"	-	3	2'-6"	3	2'-6"	4'-0"	4'-0"	5	13'-1"	3	10'-2"	1'-6"	5'-0"	6'-8"	16'-10"									
4 x 3	14'-10"	17'-1 1/2"	7"	4'-1 3/4"	12'-8 1/2"	8'-6 3/4"	6"	40	2	15'-8"	10'-6"	-	11'-3"	-	4	2'-6"	4	2'-6"	4'-0"	4'-0"	5	17'-1"	4	14'-2"	2'-0"	7'-3"	8'-11"	21'-4"									
4 x 4	18'-10"	21'-9"	7"	4'-1 3/4"	15'-0 1/4"	10'-10 1/2"	6"	80	2	19'-11"	14'-9"	4'-6"	15'-6"	6'-7"	5	2'-6"	5	2'-6"	4'-0"	4'-0"	5	21'-1"	5	18'-2"	2'-5"	9'-5"	11'-2"	25'-9"									
5 x 2	10'-10"	12'-6 1/8"	7"	5'-2 1/8"	11'-5 1/8"	6'-3"	6"	40	2	11'-5"	6'-3"	-	7'-0"	-	3	2'-6"	3	2'-6"	4'-0"	4'-0"	6	13'-1"	3	10'-2"	1'-6"	5'-0"	6'-8"	16'-10"									
5 x 3	14'-10"	17'-1 1/2"	7"	5'-2 1/8"	13'-8 1/8"	8'-6 3/4"	6"	40	2	15'-8"	10'-6"	-	11'-3"	-	4	2'-6"	4	2'-6"	4'-0"	4'-0"	6	17'-1"	4	14'-2"	2'-0"	7'-3"	8'-11"	21'-4"									
5 x 4	18'-10"	21'-9"	7"	5'-2 1/8"	16'-0 5/8"	10'-10 1/2"	6"	80	2	19'-11"	14'-9"	4'-6"	15'-6"	6'-7"	5	2'-6"	5	2'-6"	4'-0"	4'-0"	6	21'-1"	5	18'-2"	2'-5"	9'-5"	11'-2"	25'-9"									
6 x 3	14'-10"	17'-1 1/2"	7"	6'-2 1/2"	14'-9 1/4"	8'-6 3/4"	6"	40	3	15'-8"	10'-6"	-	11'-3"	-	4	2'-6"	4	2'-6"	4'-0"	4'-0"	7	17'-1"	4	14'-2"	2'-0"	7'-3"	8'-11"	21'-4"									
6 x 4	18'-10"	21'-9"	7"	6'-2 1/2"	17'-1"	10'-10 1/2"	6"	80	3	19'-11"	14'-9"	4'-6"	15'-6"	6'-7"	5	2'-6"	5	2'-6"	4'-0"	4'-0"	7	21'-1"	5	18'-2"	2'-5"	9'-5"	11'-2"	25'-9"									
7 x 3	14'-10"	17'-1 1/2"	7"	7'-3"	15'-9 3/4"	8'-6 3/4"	6 1/2"	40	3	15'-8"	10'-6"	-	11'-3"	-	4	2'-6"	4	2'-6"	4'-0"	4'-0"	8	17'-1"	4	14'-2"	2'-0"	7'-3"	8'-11"	21'-4"									
7 x 4	18'-10"	21'-9"	7"	7'-3"	18'-1 1/2"	10'-10 1/2"	6 1/2"	80	3	19'-11"	14'-9"	4'-6"	15'-6"	6'-7"	5	2'-6"	5	2'-6"	4'-0"	4'-0"	8	21'-1"	5	18'-2"	2'-5"	9'-5"	11'-2"	25'-9"									
8 x 4	18'-10"	21'-9"	7"	8'-3 3/8"	19'-1 1/8"	10'-10 1/2"	7"	80	4	19'-11"	14'-9"	4'-6"	15'-6"	6'-7"	5	2'-6"	5	2'-6"	4'-0"	4'-0"	9	21'-1"	5	18'-2"	2'-5"	9'-5"	11'-2"	25'-9"									

CULVERT SIZE (FEET)	TABLE OF REINFORCING STEEL FOR ONE END																																			
	S X H	BARS O #4 @ 12"					BARS R 3-#4	BARS S 30° WALL 2-#4	BARS S1 0° WALL 2-#4	BARS T 8-#5 BOX CULVERT	BARS T PIPE ARCH	BARS U-ONE PER EACH LENGTH SHOWN #4 @ 12"				BARS UI ONE PER EACH LENGTH SHOWN #4 @ 12"				BARS V #4 - EQUALLY SPACED				BARS V1 #4 - EQUALLY SPACED												
		NO.	C ₁	C ₂	C ₃	C ₄						LENGTH	LENGTH	LENGTH	LENGTH	LENGTH	C ₅	C ₆	C ₇	C ₈	C ₅	C ₆	C ₇	C ₈	NO.	C ₉	C ₁₀	C ₁₁	C ₁₂	LENGTH	NO.	C ₉	C ₁₀	C ₁₁	C ₁₂	LENGTH
3 x 2	5	9'-7"	4'-4"	6'-8"	7'-3"	13'-11"	9'-10"	12'-2"	10'-6"	3'-2"	3'-8"	5'-0"	9'-8"	-	-	4'-4"	8'-4"	-	-	6	2'-9"	6"	1'-6"	1'-9"	6'-3"	5	2'-9"	6"	1'-6"	1'-9"	6'-3"					
3 x 3	7	11'-10"	4'-4"	7'-9"	8'-5"	16'-2"	12'-2"	16'-9"	14'-6"	4'-2"	4'-8"	5'-0"	9'-8"	14'-3"	-	4'-4"	8'-4"	12'-4"	-	8	3'-9"	6"	2'-0"	2'-3"	7'-3"	7	3'-9"	6"	2'-0"	2'-3"	7'-3"					
4 x 2	5	10'-7"	5'-5"	7'-8"	8'-4"	16'-0"	10'-10"	12'-2"	10'-6"	3'-2"	3'-8"	5'-0"	9'-8"	14'-3"	-	4'-4"	8'-4"	-	-	6	2'-9"	6"	1'-6"	1'-9"	6'-3"	5	2'-9"	6"	1'-6"	1'-9"	6'-3"					
4 x 3	7	12'-11"	5'-5"	8'-10"	9'-6"	18'-4"	13'-2"	16'-9"	14'-6"	4'-2"	4'-8"	5'-0"	9'-8"	-	-	4'-4"	8'-4"	12'-4"	-	8	3'-9"	6"	2'-0"	2'-3"	7'-3"	7	3'-9"	6"	2'-0"	2'-3"	7'-3"					
4 x 4	9	15'-2"	5'-5"	10'-0"	10'-7"	20'-7"	15'-6"	21'-4"	18'-6"	5'-2"	5'-8"	5'-0"	9'-8"	14'-3"	18'-10"	4'-4"	8'-4"	12'-4"	16'-4"	10	4'-9"	6"	2'-6"	2'-9"	8'-3"	9	4'-9"	6"	2'-6"	2'-9"	8'-3"					
5 x 2	5	11'-8"	6'-5"	8'-7"	9'-3"	18'-1"	11'-11"	12'-2"	10'-6"	3'-2"	3'-8"	5'-0"	9'-8"	-	-	4'-4"	8'-4"	-	-	6	2'-9"	6"	1'-6"	1'-9"	6'-3"	5	2'-9"	6"	1'-6"	1'-9"	6'-3"					
5 x 3	7	13'-11"	6'-5"	9'-10"	10'-6"	20'-4"	14'-2"	16'-9"	14'-6"	4'-2"	4'-8"	5'-0"	9'-8"	14'-3"	-	4'-4"	8'-4"	12'-4"	-	8	3'-9"	6"	2'-0"	2'-3"	7'-3"	7	3'-9"	6"	2'-0"	2'-3"	7'-3"					
5 x 4	9	16'-3"	6'-5"	11'-0"	11'-8"	22'-8"	16'-6"	21'-4"	18'-6"	5'-2"	5'-8"	5'-0"	9'-8"	14'-3"	18'-10"	4'-4"	8'-4"	12'-4"	16'-4"	10	4'-9"	6"	2'-6"	2'-9"	8'-3"	9	4'-9"	6"	2'-6"	2'-9"	8'-3"					
6 x 3	7	14'-11"	7'-5"	10'-10"	11'-6"	22'-4"	15'-3"	16'-9"	14'-6"	4'-2"	4'-8"	5'-0"	9'-8"	14'-3"	-	4'-4"	8'-4"	12'-4"	-	8	3'-9"	6"	2'-0"	2'-3"	7'-3"	7	3'-9"	6"	2'-0"	2'-3"	7'-3"					
6 x 4	9	17'-3"	7'-5"	12'-0"	12'-8"	24'-8"	17'-6"	21'-4"	18'-6"	5'-2"	5'-8"	5'-0"	9'-8"	14'-3"	18'-10"	4'-4"	8'-4"	12'-4"	16'-4"	10	4'-9"	6"	2'-6"	2'-9"	8'-3"	9	4'-9"	6"	2'-6"	2'-9"	8'-3"					
7 x 3	7	16'-0"	8'-6"	11'-11"	12'-7"	24'-6"	16'-3"	16'-9"	14'-6"	4'-2"	4'-8"	5'-0"	9'-8"	14'-3"	-	4'-4"	8'-4"	12'-4"	-	8	3'-9"	6"	2'-0"	2'-3"	7'-3"	7	3'-9"	6"	2'-0"	2'-3"	7'-3"					
7 x 4	9	18'-4"	8'-6"	13'-1"	13'-9"	26'-10"	18'-7"	21'-4"	18'-6"	5'-2"	5'-8"	5'-0"	9'-8"	14'-3"	18'-10"	4'-4"	8'-4"	12'-4"	16'-4"	10	4'-9"	6"	2'-6"	2'-9"	8'-3"	9	4'-9"	6"	2'-6"	2'-9"	8'-3"					
8 x 4	9	19'-4"	9'-6"	14'-1"	14'-9"	28'-10"	19'-7"	21'-4"	18'-6"	5'-2"	5'-8"	5'-0"	9'-8"	14'-3"	18'-10"	4'-4"	8'-4"	12'-4"	16'-4"	10	4'-9"	6"	2'-6"	2'-9"	8'-3"	9	4'-9"	6"	2'-6"	2'-9"	8'-3"					

CULVERT SIZE (FEET)	TABLE OF REINFORCING STEEL FOR ONE END				
	2 BARS W		2 BARS W ₁		BARS Y 8-#5
	30° WALL	0° WALL	30° WALL	0° WALL	
S X H	SIZE	LENGTH	SIZE	LENGTH	LENGTH
3 x 2	#5	11'-6"	#5	10'-4"	3'-11"
3 x 3	#5	16'-2"	#5	14'-5"	3'-11"
4 x 2	#5	11'-6"	#5	10'-4"	4'-11"
4 x 3	#5	16'-2"	#5	14'-5"	4'-11"
4 x 4	#6	20'-11"	#6	18'-7"	4'-11"
5 x 2	#5	11'-6"	#5	10'-4"	6'-0"
5 x 3	#5	16'-2"	#5	14'-5"	6'-0"
5 x 4	#6	20'-11"	#6	18'-7"	6'-0"
6 x 3	#5	16'-2"	#5	14'-5"	7'-0"
6 x 4	#6	20'-11"	#6	18'-7"	7'-0"
7 x 3	#5	16'-2"	#5	14'-5"	8'-1"
7 x 4	#6	20'-11"	#6	18'-7"	8'-1"
8 x 4	#6	20'-11"	#6	18'-7"	9'-1"

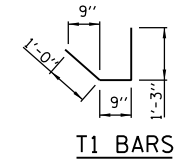
TOTAL QUANTITIES ONE END		
CONC.	RE-BARS	PIPE RUNNERS
CU. YD.	LB.	FT.
3.2	395	36.09
4.9	537	53.08
3.6	426	36.09
5.3	573	53.08
7.4	781	81.17
3.9	446	36.09
5.7	610	53.08
7.9	823	81.17
6.2	635	68.75
8.4	854	101.08
6.8	676	68.75
9.3	903	101.08
10.2	950	121.00



NOTE:

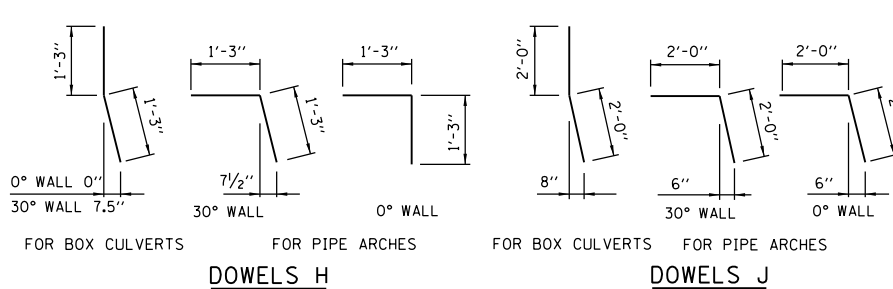
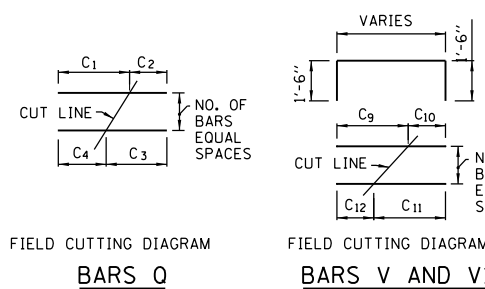
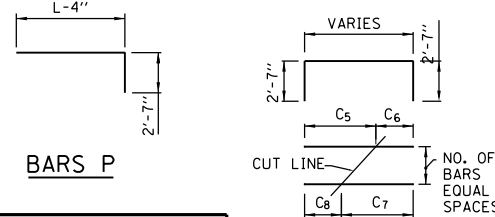
REINFORCEMENT BARS BENDING DIMENSIONS ARE OUT TO OUT.

PIPE ARCH AND ELLIPTICAL PIPE CULVERTS




FOR PIPE OR ELLIPTICAL PIPE CULVERTS SELECT APPROPRIATE "S" & "H" FROM SIZES SHOWN. ADD THE FOLLOWING ADDITIONAL BARS:
 (a) 1 ADDITIONAL Y BAR
 (b) #4-T1 BARS @ APPROX. 12" CTS. (NO. = S + 2)

THE WEIGHT OF THE ADDITIONAL BARS AND THE ADDITIONAL QUANTITY OF CONCRETE IN THE HEADWALL SHALL BE ADDED TO THE QUANTITIES SHOWN.



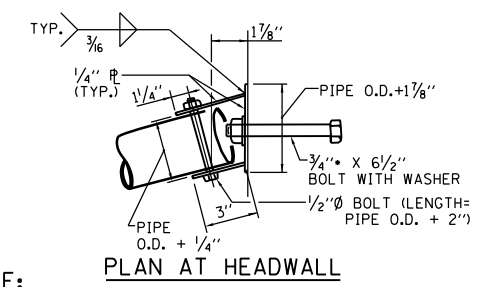
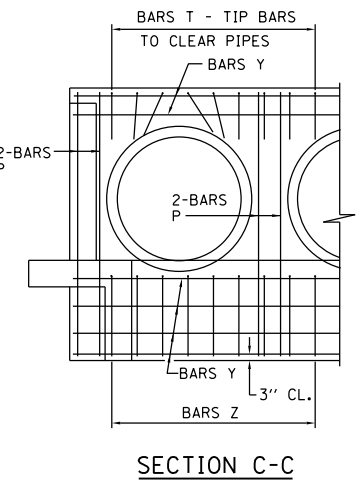
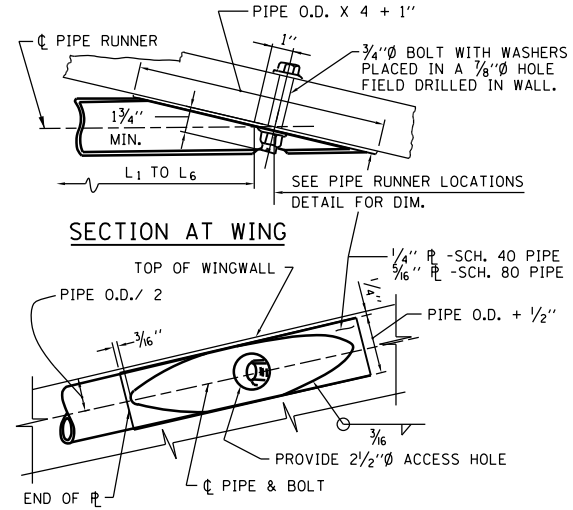
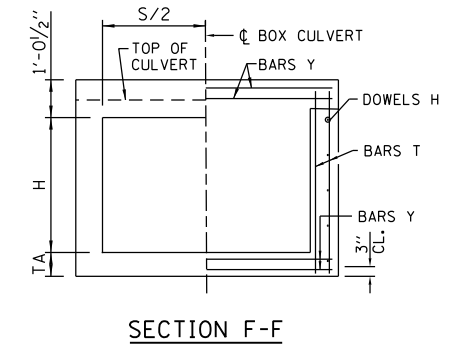
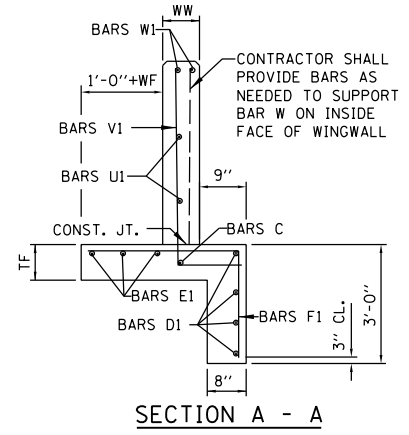
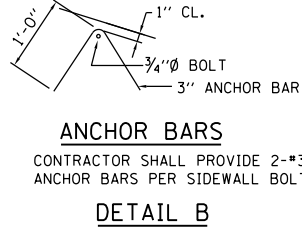
APPROVED.....
Paul Kovacs
 CHIEF ENGINEER
 DATE 6-1-2009

SHEET 2 OF 2

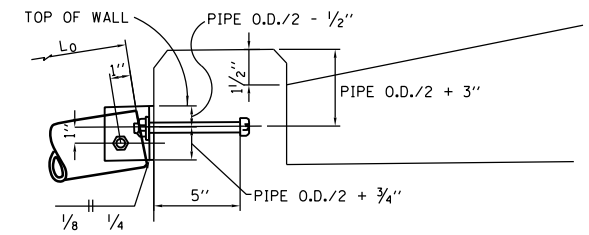


**SAFETY END TREATMENT FOR SINGLE CULVERTS
15° SKEW 1:4 SLOPE H ≤ 4'**

STANDARD B15-03

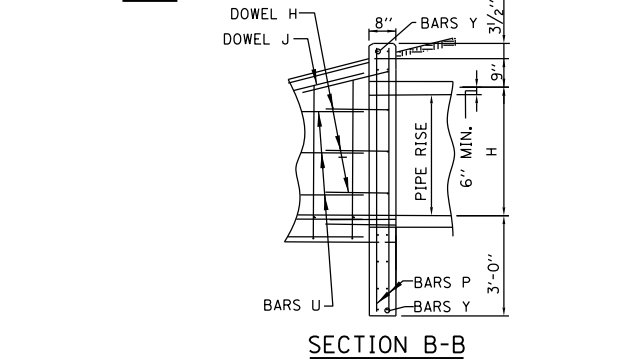
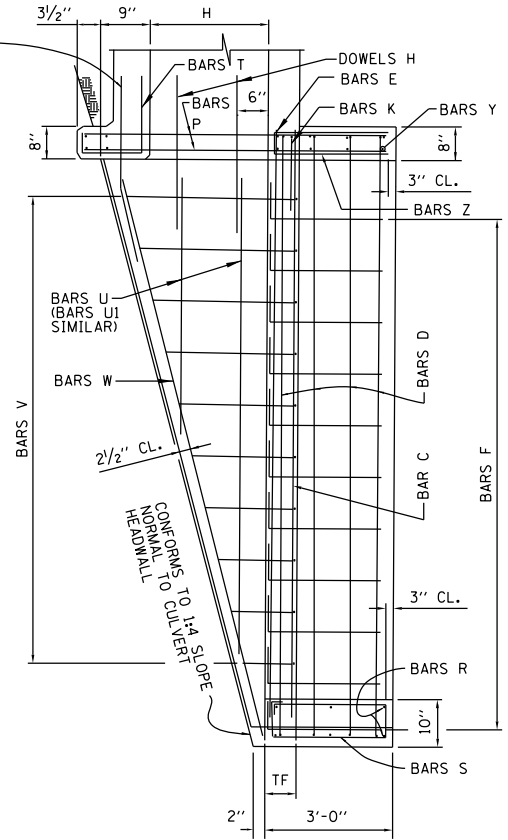
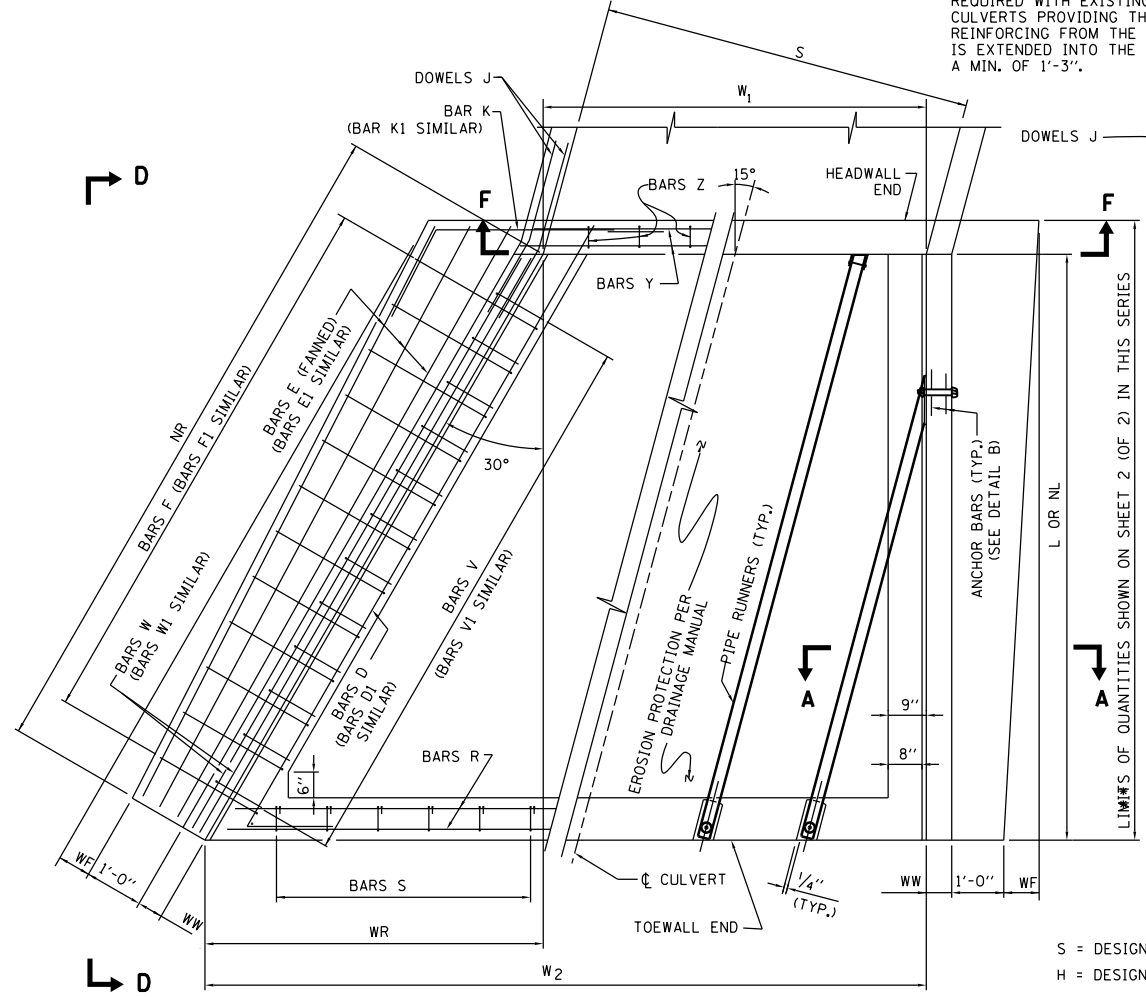
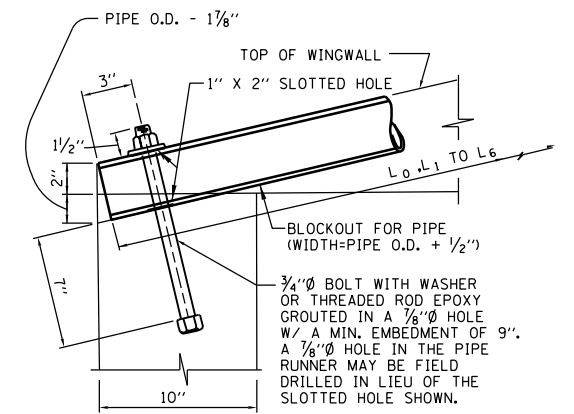
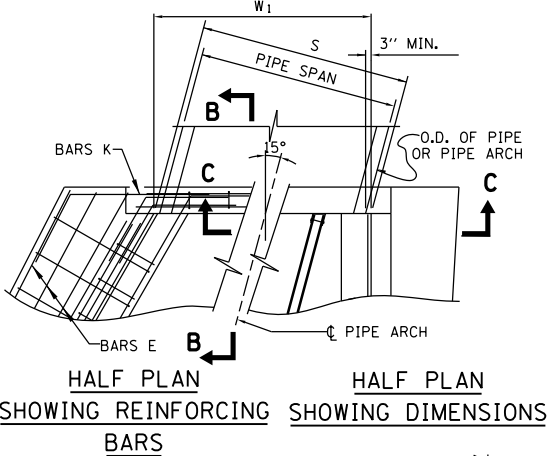


NOTE:
A 3/4" X 9 1/2" BOLT WITH ADDITIONAL WASHER PLACED IN A 1/8" HOLE DRILLED THROUGH THE HEADWALL OR A 3/4" X 8" THREADED ROD EPOXY GROUTED IN A 1/8" HOLE WITH A MINIMUM EMBEDMENT OF 6 5/8" MAY BE USED IN LIEU OF CAST-IN-PLACE BOLT SHOWN.

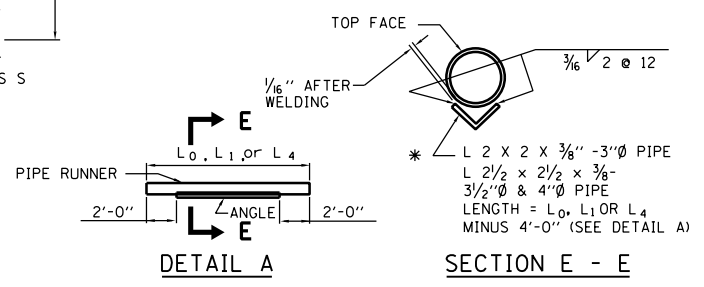


NOTE:
DOWEL BAR J & H NOT REQUIRED WITH EXISTING BOX CULVERTS PROVIDING THE REINFORCING FROM THE EXIST. BOX IS EXTENDED INTO THE NEW CONCRETE A MIN. OF 1'-3".

NOTE:
PIPE O.D. IS THE PIPE RUNNER OUTSIDE DIAMETER.

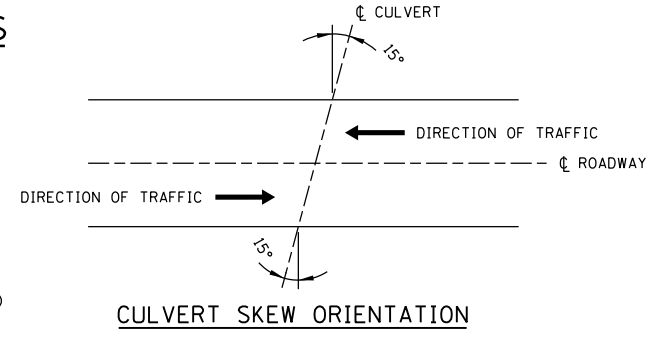


FOR PIPE AND PIPE-ARCH CULVERTS



NOTE:
WHERE L0, L1 OR L4 EXCEEDS THE FOLLOWING LENGTH THE PIPE RUNNER SHALL BE STRENGTHENED OVER MIDSPAN AS SHOWN.

PIPE	LENGTH
3"Ø, SCH. 40	12'-8"
3 1/2"Ø, SCH. 40	17'-3"
3 1/2"Ø, SCH. 80	22'-1"
4"Ø, SCH. 40	22'-6"
4"Ø, SCH. 80	29'-4"



DOWEL BARS EXTENDING ** INTO THE CONCRETE BOX CULVERT ARE INCLUDED IN THE QUANTITIES.

S = DESIGN SPAN
H = DESIGN HEIGHT

GENERAL NOTES:

- ALL CONCRETE SHALL BE CLASS SI.
- ALL EXPOSED CONCRETE EDGES SHALL HAVE A 3/4" X 45° CHAMFER. CHAMFER ON VERTICAL EDGES SHALL BE CONTINUED A MINIMUM OF ONE FOOT BELOW FINISHED GROUND LEVEL. COVER FROM THE FACE OF CONCRETE TO THE FACE OF REINFORCEMENT BARS SHALL BE 2", UNLESS OTHERWISE SHOWN.
- CONCRETE QUANTITIES SHOWN ON SHEET 2 (OF 2) IN THIS SERIES ARE FOR REINFORCED CONCRETE BOX CULVERT SECTIONS AND ADDITIONAL CONCRETE REQUIRED IN HEADWALLS FOR PIPE OR ARCH CULVERT SECTIONS SHALL BE ADDED TO THESE QUANTITIES.
- THIS STANDARD MAY BE USED FOR CULVERTS WITH SKEW OF 15° ± 7.5°, AS SHOWN PER CULVERT SKEW ORIENTATION ON THIS SHEET.
- DESIGN: SAFETY PIPE RUNNERS ARE DESIGNED FOR A TRANSVERSING LOAD OF 1,800 POUNDS AT YIELD AS RECOMMENDED BY RESEARCH REPORT 280-1, SAFETY TREATMENT OF ROADSIDE CROSS DRAINAGE STRUCTURES, TEXAS TRANSPORTATION INSTITUTE, MARCH 1981.
- ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENT (V:H).
- FOR EROSION PROTECTION SEE STANDARD B19.

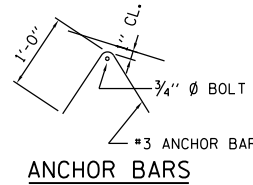
APPROVED: *Paul Kovacs* CHIEF ENGINEER DATE 6-1-2009



SAFETY END TREATMENT FOR SINGLE AND MULTIPLE CULVERTS 15° SKEW 1:4 SLOPE H ≤ 8'

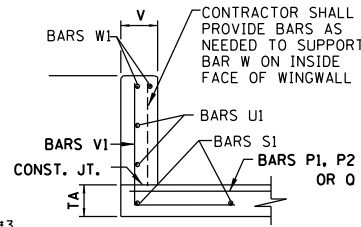
STANDARD B16-03

DATE	REVISIONS
6-1-2009	REVISED NOTES
3-1-2010	MODIFIED CULVERT SKEW DETAIL, REVISED EROSION PROTECTION AND NOTES
2-7-2012	REVISED TABLE QUANTITIES

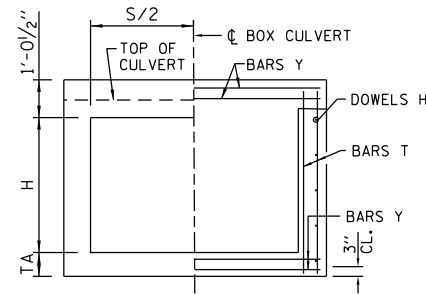


ANCHOR BARS
CONTRACTOR SHALL PROVIDE 2-#3 ANCHOR BARS PER SIDEWALL BOLT.

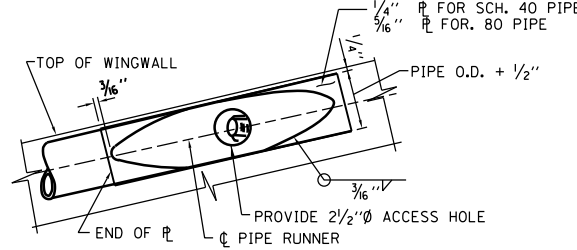
DETAIL B



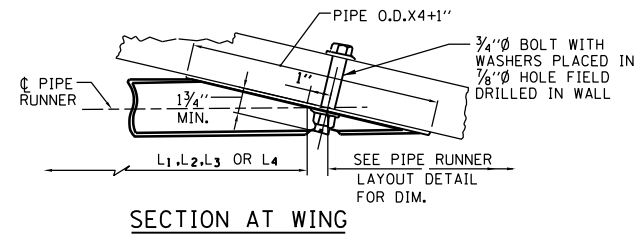
SECTION A - A



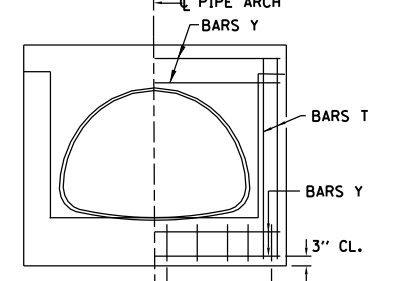
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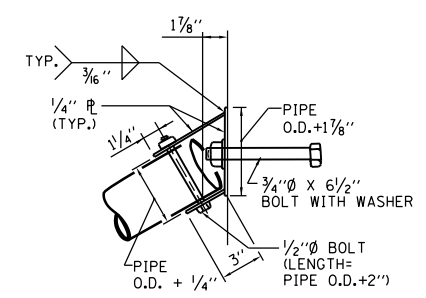
ELEVATION AT WING



SECTION AT WING

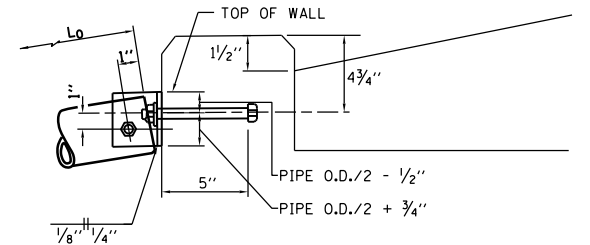


SECTION B-B

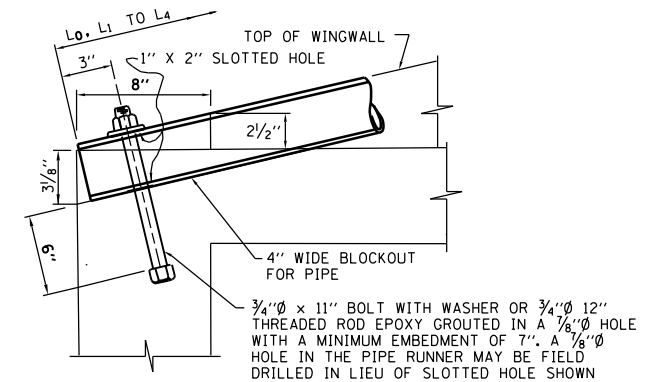


PLAN AT HEADWALL

NOTE:
A 3/4" x 9 1/2" BOLT WITH ADDITIONAL WASHER PLACED IN A 7/8" HOLE DRILLED THROUGH THE HEADWALL OR A 3/4" x 8" TREADED ROD EPOXY GROUTED IN A 7/8" HOLE WITH A MIN. EMBEDMENT OF 6 3/8" MAY BE USED IN LIEU OF CAST-IN-PLACE BOLT SHOWN.



ELEVATION AT HEADWALL

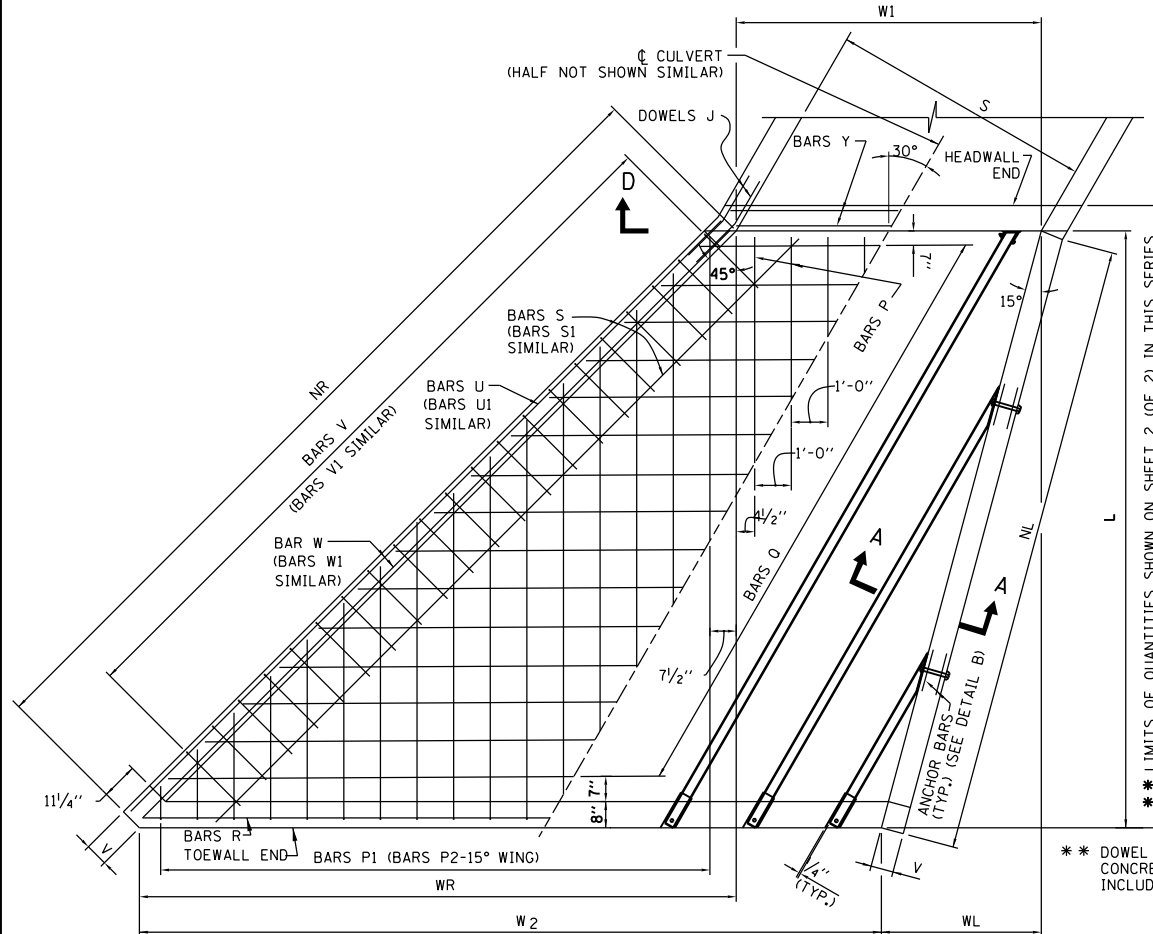


SECTION THRU TOEWALL

NOTE:
BARS O, V AND V1 ARE TO BE FIELD CUT PER CUTTING DIAGRAM. PLACE BARS WITH DIMENSIONS C2-C3 AND C9-C12 BEGINNING AT HEADWALL AND BARS WITH DIMENSIONS C1-C4 AND C10-C11 BEGINNING AT THE TOEWALL END.

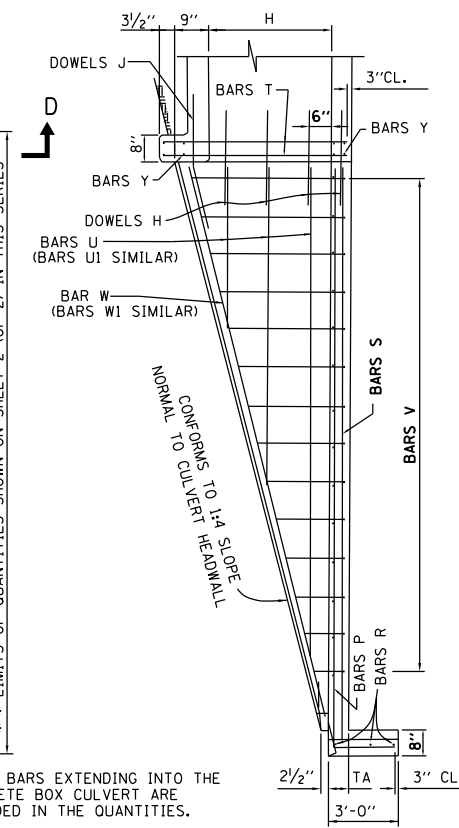
NOTE:
BARS P1 ARE TO BE FIELD CUT PER CUTTING DIAGRAM. PLACE BARS WITH DIMENSIONS C6-C7 BEGINNING AT THE TOEWALL END OF 45° WINGWALL AND BARS WITH DIMENSIONS C5-C8 BEGINNING PARALLEL TO THE P BARS. PLACE BARS P2 PARALLEL TO THE P BARS BEGINNING WITH THE SHORTEST BARS AT THE HEADWALL END OF THE 15° WINGWALL.

NOTE:
DOWEL BAR J & H NOT REQUIRED WITH EXISTING BOX CULVERTS PROVIDING THE REINFORCING FROM THE EXIST. CONCRETE IS EXTENDED INTO THE NEW CONCRETE A MIN. OF 1'-3".

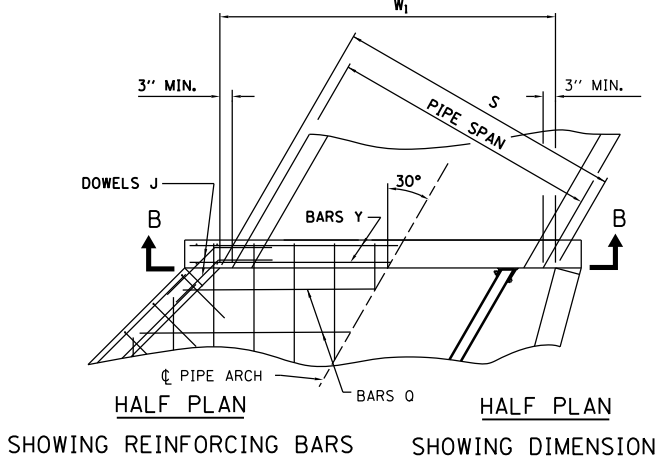


HALF PLAN SHOWING REINFORCING BARS

HALF PLAN SHOWING DIMENSIONS

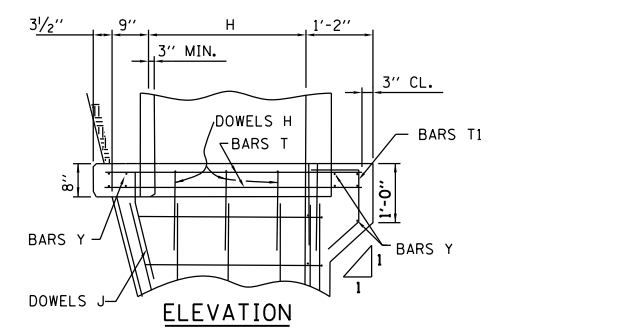


ELEVATION

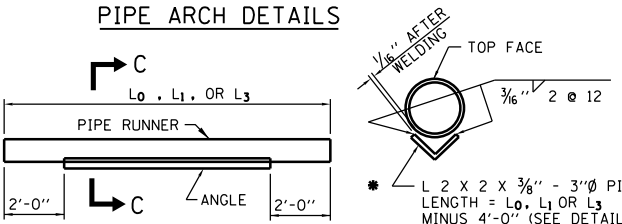


HALF PLAN SHOWING REINFORCING BARS

HALF PLAN SHOWING DIMENSIONS



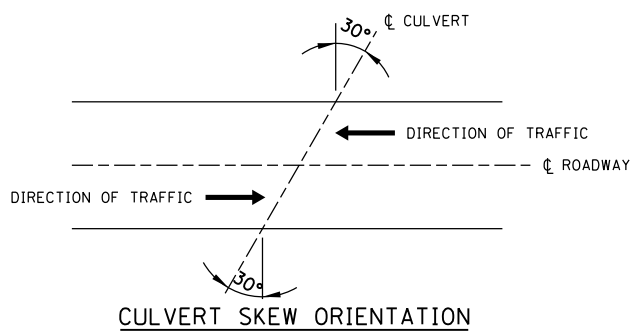
ELEVATION PIPE ARCH DETAILS



DETAIL A

SECTION C-C

PIPE RUNNER DETAILS



CULVERT SKEW ORIENTATION

BOX CULVERT DETAILS

S = DESIGN SPAN
H = DESIGN HEIGHT

GENERAL NOTES:

- ALL CONCRETE SHALL BE CLASS SI.
- ALL EXPOSED CONCRETE EDGES SHALL HAVE A 3/4" x 45° CHAMFER. CHAMFER ON VERTICAL EDGES SHALL BE CONTINUED A MINIMUM OF ONE FOOT BELOW FINISHED GROUND LEVEL. COVER FROM THE FACE OF CONCRETE TO THE FACE OF REINFORCEMENT BARS SHALL BE 2", UNLESS OTHERWISE SHOWN.
- CONCRETE QUANTITIES SHOWN ON SHEET 2 (OF 2) IN THIS SERIES ARE FOR REINFORCED CONCRETE BOX CULVERT SECTIONS AND ADDITIONAL CONCRETE REQUIRED IN HEADWALLS FOR PIPE OR ARCH CULVERT SECTIONS SHALL BE ADDED TO THESE QUANTITIES.
- THIS STANDARD MAY BE USED FOR CULVERTS WITH SKEW OF 30° ± 7.5°, AS SHOWN PER CULVERT SKEW ORIENTATION ON THIS SHEET.
- DESIGN: SAFETY PIPE RUNNERS ARE DESIGNED FOR A TRANSVERSING LOAD OF 1,800 POUNDS AT YIELD AS RECOMMENDED BY RESEARCH REPORT 280-1, SAFETY TREATMENT OF ROADSIDE CROSS DRAINAGE STRUCTURES, TEXAS TRANSPORTATION INSTITUTE, MARCH 1981.
- ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENT (V:H).
- FOR EROSION PROTECTION SEE STANDARD B19.

*** NOTE:**
WHERE L0, L1, OR L3 EXCEEDS THE FOLLOWING LENGTH, THE PIPE RUNNER SHALL BE STRENGTHENED OVER THE MIDSPAN AS SHOWN.

PIPE	LENGTH
3" Ø SCH 40	12'-8"
3" Ø SCH 80	15'-4"

DATE	REVISIONS
6-1-2009	REVISED NOTES
3-1-2010	MODIFIED CULVERT SKEW DETAIL, REVISED EROSION PROTECTION AND NOTES
2-7-2012	REVISED TABLE QUANTITIES

SHEET 1 OF 2



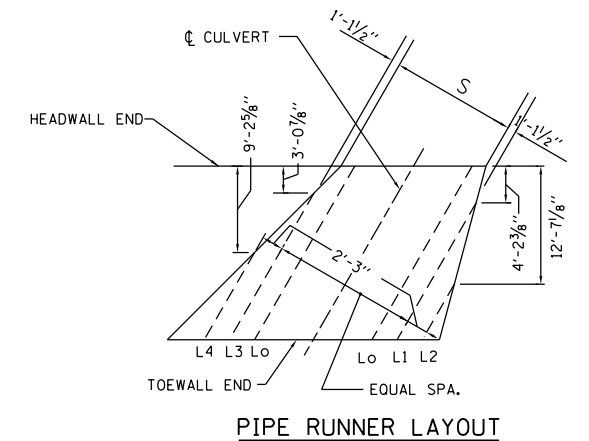
SAFETY END TREATMENT FOR SINGLE CULVERTS 30° SKEW 1:4 SLOPE H ≤ 4'

STANDARD B17-03

APPROVED: *Paul Kovacs* CHIEF ENGINEER DATE 6-1-2009

CULVERT SIZE (FEET)	TABLE OF DIMENSIONS									
	S X H	L	NL	NR	V	W1	W2	WL	WR	TA
3 x 2	10'-10"	10'-10"	11'-2 3/8"	15'-3 3/8"	7"	3'-5 3/8"	11'-4 3/4"	2'-10 7/8"	10'-10"	6"
3 x 3	14'-10"	14'-10"	15'-4 1/4"	20'-11 3/4"	7"	3'-5 3/8"	14'-3 3/8"	3'-11 3/4"	14'-10"	6"
4 x 2	10'-10"	10'-10"	11'-2 3/8"	15'-3 3/8"	7"	4'-7 3/8"	12'-6 1/2"	2'-10 7/8"	10'-10"	6"
4 x 3	14'-10"	14'-10"	15'-4 1/4"	20'-11 3/4"	7"	4'-7 3/8"	15'-5 5/8"	3'-11 3/4"	14'-10"	6"
4 x 4	18'-10"	18'-10"	19'-6"	26'-7 7/8"	7"	4'-7 3/8"	18'-4 1/8"	5'-0 1/2"	18'-10"	6"
5 x 2	10'-10"	10'-10"	11'-2 3/8"	15'-3 3/8"	7"	5'-9 1/4"	13'-8 3/8"	2'-10 7/8"	10'-10"	6"
5 x 3	14'-10"	14'-10"	15'-4 1/4"	20'-11 3/4"	7"	5'-9 1/4"	16'-7 1/2"	3'-11 3/4"	14'-10"	6"
5 x 4	18'-10"	18'-10"	19'-6"	26'-7 7/8"	7"	5'-9 1/4"	19'-6 3/4"	5'-0 1/2"	18'-10"	6"
6 x 3	14'-10"	14'-10"	15'-4 1/4"	20'-11 3/4"	7"	6'-11 1/8"	17'-9 3/8"	3'-11 3/4"	14'-10"	6"
6 x 4	18'-10"	18'-10"	19'-6"	26'-7 7/8"	7"	6'-11 1/8"	20'-8 5/8"	5'-0 1/2"	18'-10"	6"
7 x 3	14'-10"	14'-10"	15'-4 1/4"	20'-11 3/4"	7"	8'-1"	18'-11 1/4"	3'-11 3/4"	14'-10"	6 1/2"
7 x 4	18'-10"	18'-10"	19'-6"	26'-7 7/8"	7"	8'-1"	21'-10 1/2"	5'-0 1/2"	18'-10"	6 1/2"
8 x 4	18'-10"	18'-10"	19'-6"	26'-7 7/8"	7"	9'-2 1/8"	23'-0 3/8"	5'-0 1/2"	18'-10"	7"

SCHEDULE	PIPE RUNNERS FOR ONE END SIZE 3" DIA.					
	NO.	HEADWALL PIPE L ₀	WINGWALL PIPE - ONE PER EACH LENGTH SHOWN			
			15° WALL L ₁	45° WALL L ₂	L ₃	L ₄
40	2	12'-10"	7'-10"	-	9'-2"	-
40	2	17'-8"	12'-6"	-	13'-11"	6'-7"
40	2	12'-10"	7'-10"	-	9'-2"	-
40	2	17'-8"	12'-6"	-	13'-11"	6'-7"
80	2	22'-4"	17'-3"	7'-4"	18'-7"	11'-4"
40	3	12'-10"	7'-10"	-	9'-2"	-
40	3	17'-8"	12'-6"	-	13'-11"	6'-7"
80	3	22'-4"	17'-3"	7'-4"	18'-7"	11'-4"
40	3	17'-8"	12'-6"	-	13'-11"	6'-7"
80	3	22'-4"	17'-3"	7'-4"	18'-7"	11'-4"
40	4	17'-8"	12'-6"	-	13'-11"	6'-7"
80	4	22'-4"	17'-3"	7'-4"	18'-7"	11'-4"
80	4	22'-4"	17'-3"	7'-4"	18'-7"	11'-4"



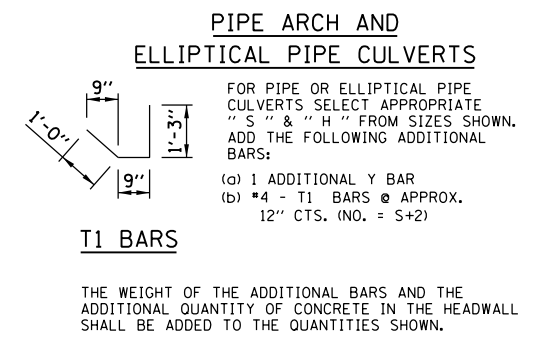
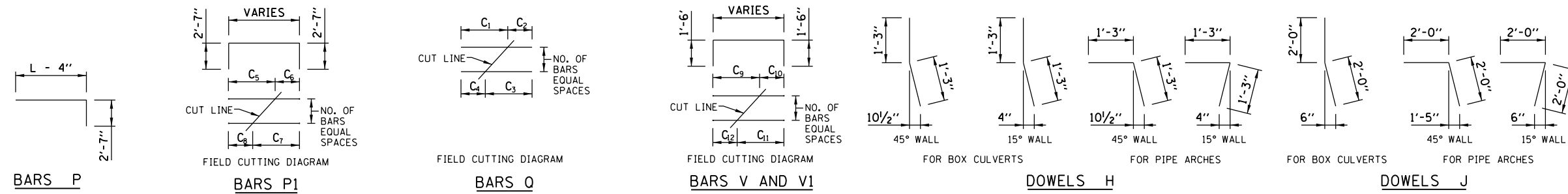
CULVERT SIZE (FEET)	TABLE OF REINFORCING STEEL FOR ONE END																													
	DOWELS H #4 @ 12" 2'-6" LG.		DOWELS J #4 @ 12" 4'-0" LG.		BARS P #4 @ 12"		BARS P1 #4 @ 12"					BARS P2 - ONE PER EACH LENGTH SHOWN #4 @ 12"					BARS O #4 @ 12"				BARS R 3-#4		BARS S 45° WALL 2-#4		BARS S1 15° WALL 2-#4		BARS U - ONE PER EACH LENGTH SHOWN #4 @ 12"			
	S X H	NO. #	NO. **	NO. #	NO. **	NO.	LENGTH	NO.	C ₅	C ₆	C ₇	C ₈	LENGTH	a ₁	a ₂	a ₃	a ₄	a ₅	NO.	C ₁	C ₂	C ₃	C ₄	LENGTH	LENGTH	LENGTH	LENGTH	a ₆	a ₇	a ₈
3 x 2	3	3	2	2	1	13'-1"	5	10'-6"	1'-6"	5'-6"	6'-6"	17'-2"	5'-4"	9'-1"	-	-	-	5	11'-6"	4'-11"	7'-10"	8'-7"	16'-5"	11'-10"	14'-10"	11'-0"	6'-2"	11'-10"	-	-
3 x 3	4	4	2	2	0	-	7	14'-6"	1'-6"	7'-6"	8'-6"	21'-2"	5'-4"	9'-1"	12'-10"	-	-	7	14'-5"	4'-11"	9'-4"	10'-0"	19'-4"	14'-9"	20'-6"	15'-2"	6'-2"	11'-10"	17'-6"	-
4 x 2	3	3	2	2	2	13'-1"	5	10'-6"	1'-6"	5'-6"	6'-6"	17'-2"	2'-3"	6'-0"	9'-9"	-	-	5	12'-8"	6'-1"	9'-0"	9'-9"	18'-9"	13'-0"	14'-10"	11'-0"	6'-2"	11'-10"	-	-
4 x 3	4	4	2	2	1	17'-1"	7	14'-6"	1'-6"	7'-6"	8'-6"	21'-2"	2'-3"	6'-0"	9'-9"	13'-6"	-	7	15'-7"	6'-1"	10'-6"	11'-2"	21'-8"	15'-11"	20'-6"	15'-2"	6'-2"	11'-10"	17'-6"	-
4 x 4	5	5	2	2	0	-	9	18'-6"	1'-6"	9'-6"	10'-6"	25'-2"	2'-3"	6'-0"	9'-9"	13'-6"	17'-3"	9	18'-6"	6'-1"	11'-11"	12'-8"	24'-7"	18'-10"	26'-2"	19'-4"	6'-2"	11'-10"	17'-6"	23'-1"
5 x 2	3	3	2	2	3	13'-1"	5	10'-6"	1'-6"	5'-6"	6'-6"	17'-2"	2'-10"	6'-7"	10'-4"	-	-	5	13'-10"	7'-3"	10'-2"	10'-11"	21'-1"	14'-2"	14'-10"	11'-0"	6'-2"	11'-10"	-	-
5 x 3	4	4	2	2	2	17'-1"	7	14'-6"	1'-6"	7'-6"	8'-6"	21'-2"	2'-10"	6'-7"	10'-4"	14'-0"	-	7	16'-9"	7'-3"	11'-8"	12'-4"	24'-0"	17'-1"	20'-6"	15'-2"	6'-2"	11'-10"	17'-6"	-
5 x 4	5	5	2	2	1	21'-1"	9	18'-6"	1'-6"	9'-6"	10'-6"	25'-2"	2'-10"	6'-7"	10'-4"	14'-0"	17'-9"	9	19'-8"	7'-3"	13'-1"	13'-10"	26'-11"	20'-0"	26'-2"	19'-4"	6'-2"	11'-10"	17'-6"	23'-1"
6 x 3	4	4	2	2	3	17'-1"	7	14'-6"	1'-6"	7'-6"	8'-6"	21'-2"	3'-4"	7'-1"	10'-10"	14'-7"	-	7	17'-11"	8'-4"	12'-9"	13'-6"	26'-3"	18'-3"	20'-6"	15'-2"	6'-2"	11'-10"	17'-6"	-
6 x 4	5	5	2	2	2	21'-1"	9	18'-6"	1'-6"	9'-6"	10'-6"	25'-2"	3'-4"	7'-1"	10'-10"	14'-7"	18'-3"	9	20'-10"	8'-4"	14'-3"	14'-11"	29'-2"	21'-2"	26'-2"	19'-4"	6'-2"	11'-10"	17'-6"	23'-1"
7 x 3	4	4	2	2	4	17'-1"	7	14'-6"	1'-6"	7'-6"	8'-6"	21'-2"	4'-0"	7'-9"	11'-5"	15'-2"	-	7	19'-1"	9'-6"	13'-11"	14'-8"	28'-7"	19'-5"	20'-6"	15'-2"	6'-2"	11'-10"	17'-6"	-
7 x 4	5	5	2	2	3	21'-1"	9	18'-6"	1'-6"	9'-6"	10'-6"	25'-2"	4'-0"	7'-9"	11'-5"	15'-2"	18'-6"	9	22'-0"	9'-6"	15'-5"	16'-1"	31'-6"	22'-4"	26'-2"	19'-4"	6'-2"	11'-10"	17'-6"	23'-1"
8 x 4	5	5	2	2	5	21'-1"	9	18'-6"	1'-6"	9'-6"	10'-6"	25'-2"	4'-6"	8'-3"	12'-0"	15'-9"	-	9	23'-1"	10'-8"	16'-6"	17'-3"	33'-9"	23'-6"	26'-2"	19'-4"	6'-2"	11'-10"	17'-6"	23'-1"

CULVERT SIZE (FEET)	TABLE OF REINFORCING STEEL FOR ONE END																								
	BARS U1 - ONE PER EACH LENGTH SHOWN #4 @ 12"					BARS V #4 @ 12"					BARS V1 #4 @ 12"					2 BARS W 45° WALL		2 BARS W1 15° WALL		BARS Y 8-#5	BARS T 8-#5 BOX CULVERT	BARS T 8-#5 PIPE ARCH			
	S X H	a ₁₀	a ₁₁	a ₁₂	a ₁₃	NO.	C ₉	C ₁₀	C ₁₁	C ₁₂	LENGTH	NO.	C ₉	C ₁₀	C ₁₁	C ₁₂	LENGTH	SIZE	LENGTH	SIZE	LENGTH	LENGTH	LENGTH	LENGTH	LENGTH
3 x 2	4'-6"	8'-7"	-	-	7	2'-9"	6"	1'-6"	1'-9"	6'-3"	5	2'-9"	6"	1'-6"	1'-9"	6'-3"	5	#5	14'-5"	#5	10'-8"	4'-4"	3'-2"	3'-8"	
3 x 3	4'-6"	8'-7"	12'-9"	-	10	3'-9"	6"	2'-0"	2'-3"	7'-3"	7	3'-9"	6"	2'-0"	2'-3"	7'-3"	5	#5	20'-2"	#5	14'-11"	4'-4"	4'-2"	4'-8"	
4 x 2	4'-6"	8'-7"	-	-	7	2'-9"	6"	1'-6"	1'-9"	6'-3"	5	2'-9"	6"	1'-6"	1'-9"	6'-3"	5	#5	14'-5"	#5	10'-8"	5'-6"	3'-2"	3'-8"	
4 x 3	4'-6"	8'-7"	12'-9"	-	10	3'-9"	6"	2'-0"	2'-3"	7'-3"	7	3'-9"	6"	2'-0"	2'-3"	7'-3"	5	#5	20'-2"	#5	14'-11"	5'-6"	4'-2"	4'-8"	
4 x 4	4'-6"	8'-7"	12'-9"	16'-11"	13	4'-9"	6"	2'-6"	2'-9"	8'-3"	9	4'-9"	6"	2'-6"	2'-9"	8'-3"	9	#6	25'-11"	#6	19'-1"	5'-6"	5'-2"	5'-8"	
5 x 2	4'-6"	8'-7"	-	-	7	2'-9"	6"	1'-6"	1'-9"	6'-3"	5	2'-9"	6"	1'-6"	1'-9"	6'-3"	5	#5	14'-5"	#5	10'-8"	6'-8"	3'-2"	3'-8"	
5 x 3	4'-6"	8'-7"	12'-9"	-	10	3'-9"	6"	2'-0"	2'-3"	7'-3"	7	3'-9"	6"	2'-0"	2'-3"	7'-3"	5	#5	20'-2"	#5	14'-11"	6'-8"	4'-2"	4'-8"	
5 x 4	4'-6"	8'-7"	12'-9"	16'-11"	13	4'-9"	6"	2'-6"	2'-9"	8'-3"	9	4'-9"	6"	2'-6"	2'-9"	8'-3"	9	#6	25'-11"	#6	19'-1"	6'-8"	5'-2"	5'-8"	
6 x 3	4'-6"	8'-7"	12'-9"	-	10	3'-9"	6"	2'-0"	2'-3"	7'-3"	7	3'-9"	6"	2'-0"	2'-3"	7'-3"	5	#5	20'-2"	#5	14'-11"	7'-10"	4'-2"	4'-8"	
6 x 4	4'-6"	8'-7"	12'-9"	16'-11"	13	4'-9"	6"	2'-6"	2'-9"	8'-3"	9	4'-9"	6"	2'-6"	2'-9"	8'-3"	9	#6	25'-11"	#6	19'-1"	7'-10"	5'-2"	5'-8"	
7 x 3	4'-6"	8'-7"	12'-9"	-	10	3'-9"	6"	2'-0"	2'-3"	7'-3"	7	3'-9"	6"	2'-0"	2'-3"	7'-3"	5	#5	20'-2"	#5	14'-11"	9'-0"	4'-2"	4'-8"	
7 x 4	4'-6"	8'-7"	12'-9"	16'-11"	13	4'-9"	6"	2'-6"	2'-9"	8'-3"	9	4'-9"	6"	2'-6"	2'-9"	8'-3"	9	#6	25'-11"	#6	19'-1"	9'-0"	5'-2"	5'-8"	
8 x 4	4'-6"	8'-7"	12'-9"	16'-11"	13	4'-9"	6"	2'-6"	2'-9"	8'-3"	9	4'-9"	6"	2'-6"	2'-9"	8'-3"	9	#6	25'-11"	#6	19'-1"	10'-2"	5'-2"	5'-8"	

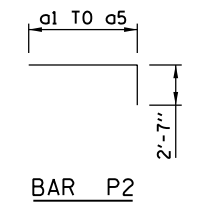
TOTAL QUANTITIES ONE END		
CONC.	RE-BARS	PIPE RUNNERS
CU. YD.	LB.	FT.
3.8	396	41.67
5.8	580	67.17
4.2	430	41.67
6.3	617	67.17
8.8	874	97.83
4.6	460	54.17
6.8	653	84.42
9.4	915	119.83
7.3	688	84.42
9.9	957	119.83
8.0	724	101.67
10.9	999	141.84
12.0	1042	141.84

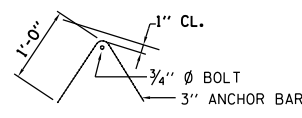
NOTE:
REINFORCEMENT BAR BENDING DIMENSIONS ARE OUT TO OUT.

* 45° WALL
** 15° WALL



APPROVED: *Paul Kovacs* CHIEF ENGINEER DATE 6-1-2009

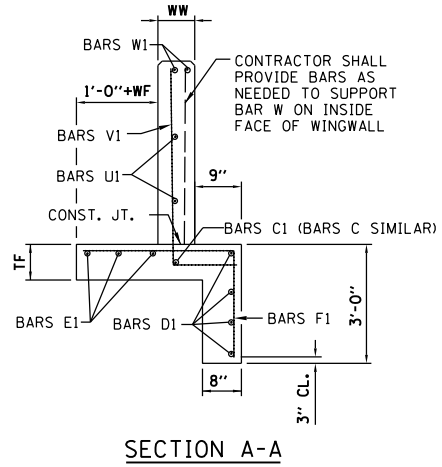




ANCHOR BARS

CONTRACTOR SHALL PROVIDE 2 #3 ANCHOR BARS PER SIDEWALL BOLT

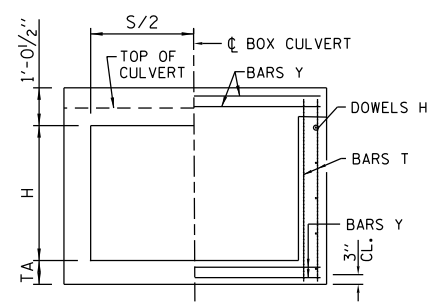
DETAIL B



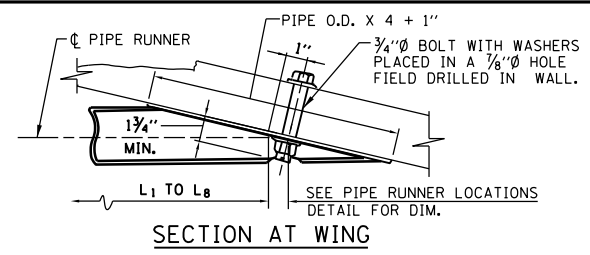
SECTION A-A

NOTE:

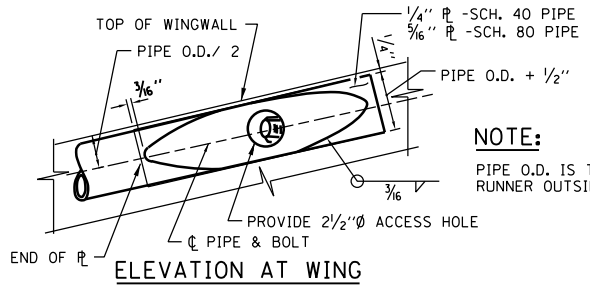
BARS F, F1, V & V1 ARE TO BE FIELD CUT PER CUTTING DIAGRAM. PLACE BARS WITH DIMENSIONS C2 - C4, C15 - C18 BEGINNING AT HEADWALL & BARS WITH DIMENSIONS C1 - C3, C16 - C17 BEGINNING AT THE TOEWALL END.



SECTION F-F



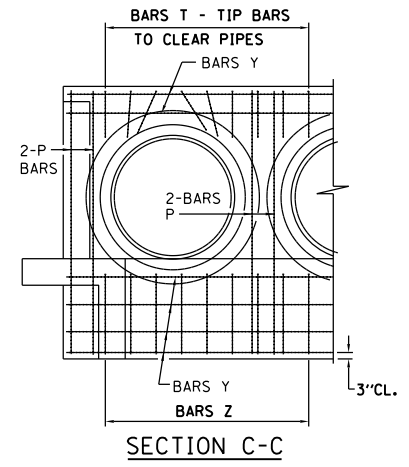
SECTION AT WING



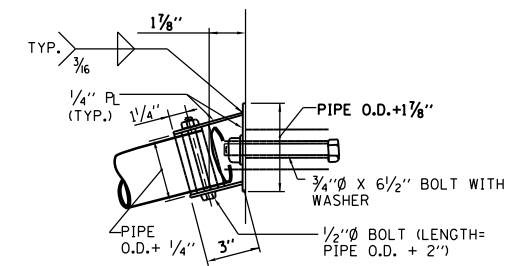
ELEVATION AT WING

NOTE:

PIPE O.D. IS THE PIPE RUNNER OUTSIDE DIAMETER.



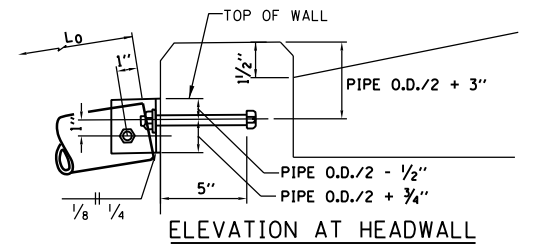
SECTION C-C



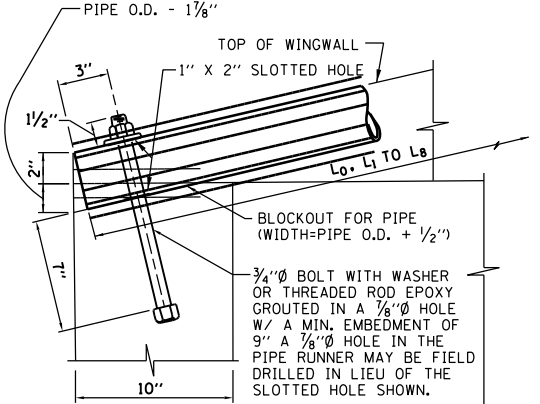
PLAN AT HEADWALL

NOTE:

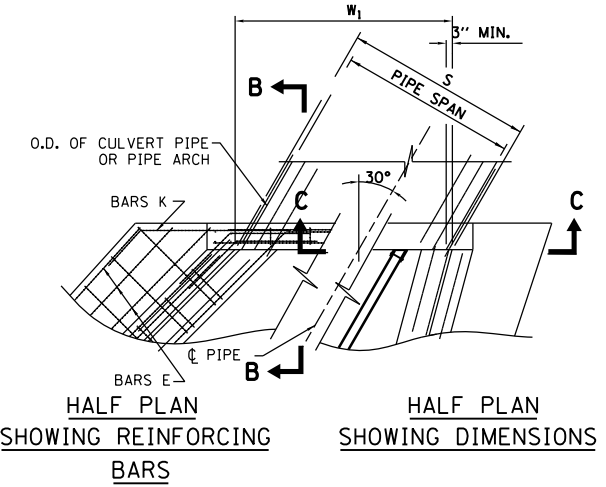
A 3/4 inch x 9/2 inch BOLT WITH ADDITIONAL P WASHER PLACED IN A 1/8 inch HOLE DRILLED THROUGH THE HEADWALL OR A 3/4 inch x 8 inch THREADED ROD EPOXY GROUTED IN A 1/8 inch HOLE WITH A MINIMUM EMBEDMENT OF 6 5/8 inch MAY BE USED IN LIEU OF CAST-IN-PLACE BOLT SHOWN.



ELEVATION AT HEADWALL

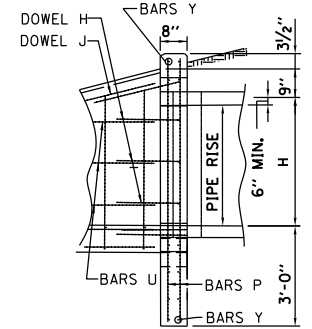


SECTION THRU TOEWALL

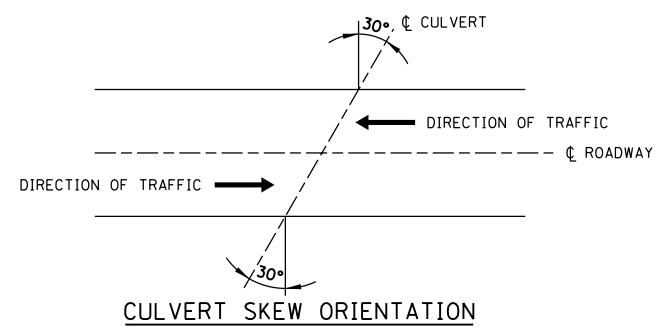


HALF PLAN SHOWING REINFORCING BARS

HALF PLAN SHOWING DIMENSIONS



SECTION B-B FOR PIPE AND PIPE-ARCH CULVERTS

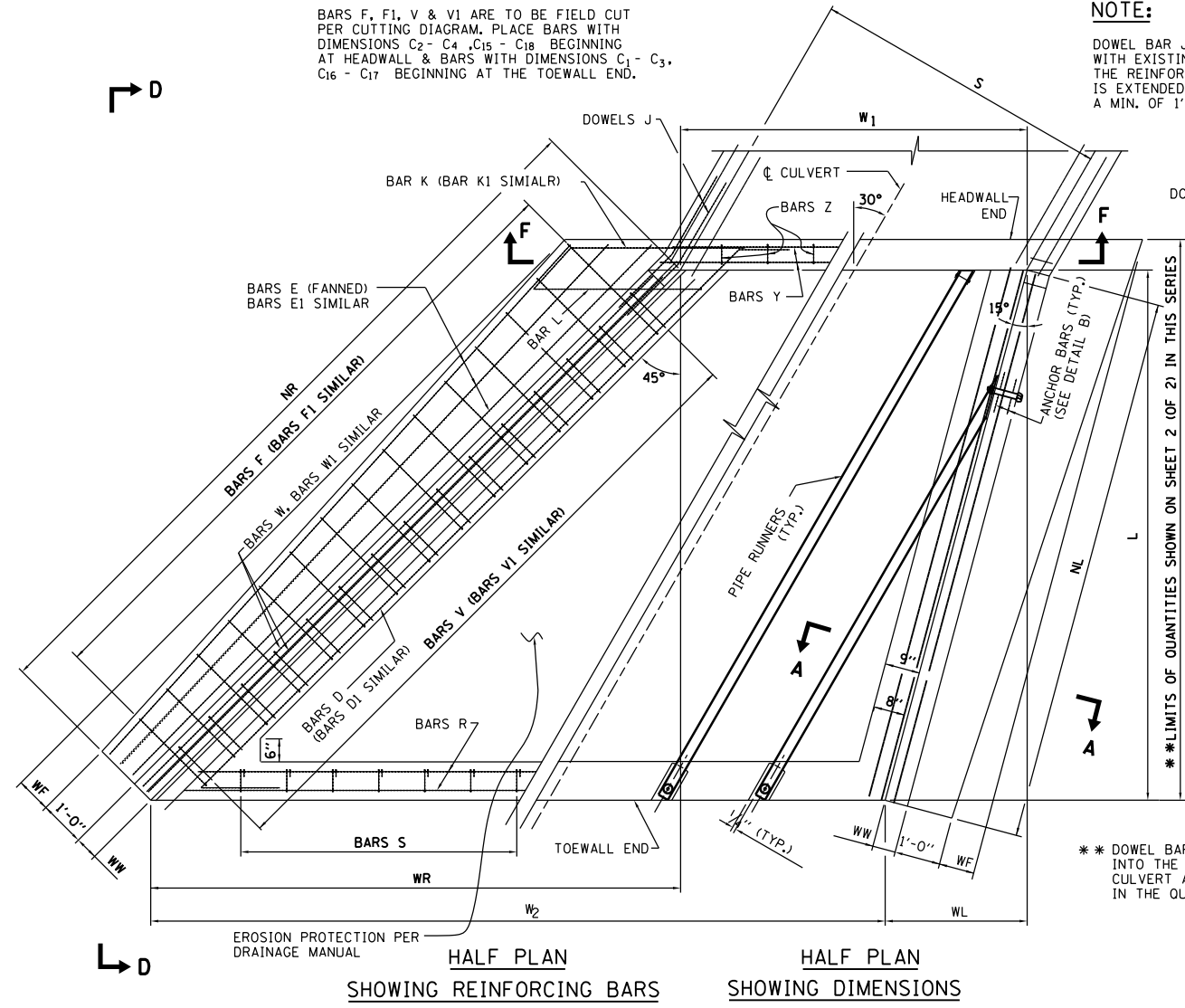


CULVERT SKEW ORIENTATION

NOTE:

WHERE L0, L1, L4 OR L5 EXCEEDS THE FOLLOWING LENGTH THE PIPE RUNNER SHALL BE STRENGTHENED OVER MIDSPAN AS SHOWN.

PIPE	LENGTH
3"Ø, SCH. 40	12'-8"
3"Ø, SCH. 80	15'-4"
3 1/2"Ø, SCH. 80	22'-1"
4"Ø, SCH. 80	29'-4"



HALF PLAN SHOWING REINFORCING BARS
HALF PLAN SHOWING DIMENSIONS

FOR BOX CULVERTS

NOTE:

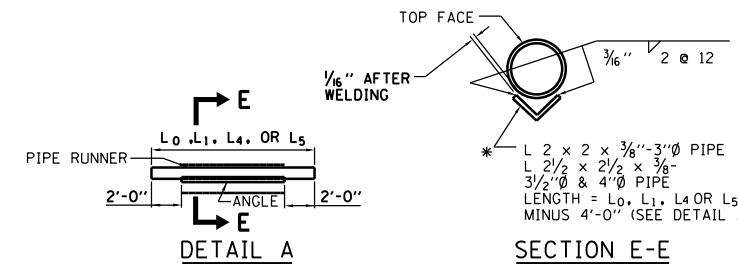
DOWEL BAR J & H NOT REQUIRED WITH EXISTING BOX CULVERTS PROVIDING THE REINFORCING FROM THE EXIST. BOX IS EXTENDED INTO THE NEW CONCRETE A MIN. OF 1'-3".

** DOWEL BARS EXTENDING INTO THE CONCRETE BOX CULVERT ARE INCLUDED IN THE QUANTITIES.

S = DESIGN SPAN
H = DESIGN HEIGHT

- ALL CONCRETE SHALL BE CLASS S1.
- ALL EXPOSED CONCRETE EDGES SHALL HAVE A 3/4 inch x 45 degree CHAMFER. CHAMFER ON VERTICAL EDGES SHALL BE CONTINUED A MINIMUM OF ONE FOOT BELOW FINISHED GROUND LEVEL. COVER FROM THE FACE OF CONCRETE TO THE FACE OF REINFORCEMENT BARS SHALL BE 2 inch, UNLESS OTHERWISE SHOWN.
- CONCRETE QUANTITIES SHOWN ON SHEET 2 (OF 2) IN THIS SERIES ARE FOR REINFORCED CONCRETE BOX CULVERT SECTIONS AND ADDITIONAL CONCRETE REQUIRED IN HEADWALLS FOR PIPE OR ARCH CULVERT SECTIONS SHALL BE ADDED TO THESE QUANTITIES.
- THIS STANDARD MAY BE USED FOR CULVERTS WITH SKEW OF 30 degrees ± 7.5%, AS SHOWN PER CULVERT SKEW ORIENTATION ON THIS SHEET.
- DESIGN: SAFETY PIPE RUNNERS ARE DESIGNED FOR A TRANSVERSING LOAD OF 1,800 POUNDS AT YIELD AS RECOMMENDED BY RESEARCH REPORT 280-1, SAFETY TREATMENT OF ROADSIDE CROSS DRAINAGE STRUCTURES, TEXAS TRANSPORTATION INSTITUTE, MARCH 1981.
- ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENT (V/H).
- FOR EROSION PROTECTION SEE STANDARD B19.

GENERAL NOTES:



DETAIL A

SECTION E-E

PIPE RUNNER DETAILS

DATE	REVISIONS
6-1-2009	REVISED NOTES
3-1-2010	MODIFIED CULVERT SKEW DETAIL, REVISED EROSION PROTECTION AND NOTES
2-7-2012	REVISED TABLE QUANTITIES



SAFETY END TREATMENT FOR SINGLE AND MULTIPLE CULVERTS 30° SKEW, 1:4 H ≤ 8' & S=VARIES

STANDARD B18-03

APPROVED: *Paul Kovacs* CHIEF ENGINEER DATE 6-1-2009

H	S	L	NL	NR	WW	W1 (4)	W2 (4)	WL	WR	WF	TF
3'	9'	14'-4"	14'-10 1/8"	20'-3 1/4"	7"	10'-4 1/4"	20'-10 5/8"	3'-10 1/8"	14'-4"	3"	7"
4'	9'	18'-4"	18'-11 1/4"	25'-11 1/8"	7"	10'-4 1/4"	23'-9 3/4"	4'-11"	18'-4"	9"	8"
5'	5'	22'-4"	23'-1 1/2"	31'-7"	7"	5'-9 1/4"	22'-1 1/2"	5'-11 3/4"	22'-4"	1'-3"	8"
6'	6'	26'-4"	27'-3 3/8"	37'-2 3/8"	7"	6'-11 1/8"	26'-2 1/2"	7'-5 1/8"	26'-4"	1'-9"	8 1/2"
7'	7'	30'-4"	31'-4 3/8"	42'-10 3/4"	7"	8'-1"	30'-3 3/4"	8'-1 1/2"	30'-4"	2'-3"	9"
8'	8'	34'-4"	35'-6 1/2"	48'-6 5/8"	8"	9'-2 3/8"	34'-4 1/2"	9'-2 3/8"	34'-4"	2'-9"	9 1/2"

TOTAL QUANTITIES ONE END MINIMUM "S"		INCREASE IN QUANTITIES FOR 1' INCREASE IN "S"	
CONC. CU. YD.	RE-BARS LBS.	CONC. CU. YD.	RE-BARS LBS.
8.4	1050	0.22	33
11.5	1301	0.22	33
14.0	1406	0.22	33
18.4	1878	0.22	33
23.4	2343	0.22	33
30.6	2959	0.22	33

NOTE:
REINFORCEMENT BARS BENDING DIMENSIONS ARE OUT TO OUT.

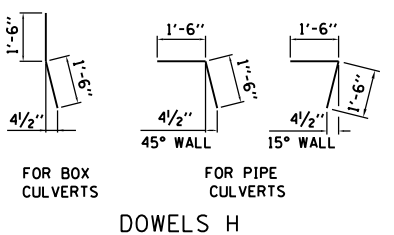
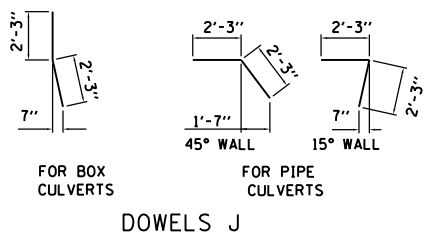
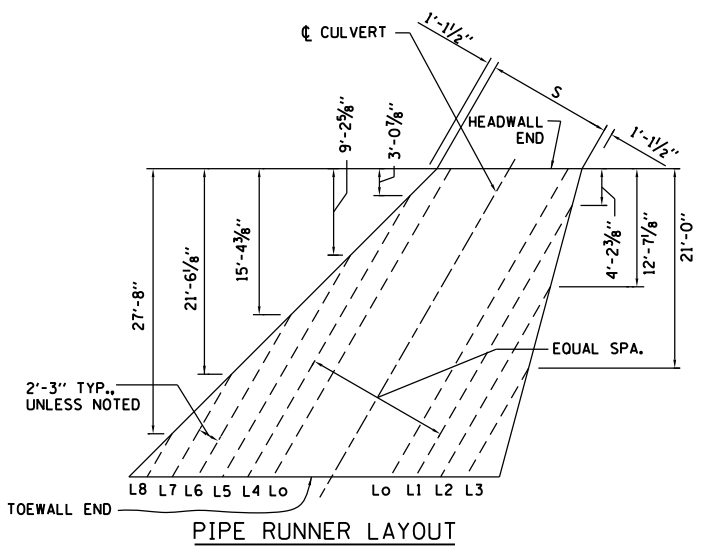
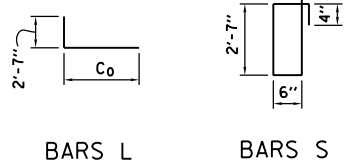
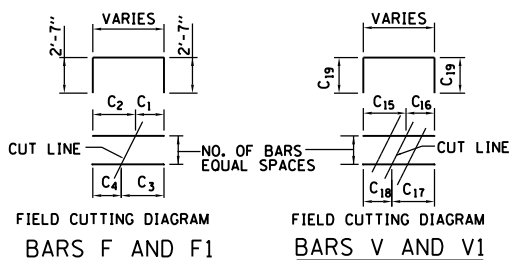
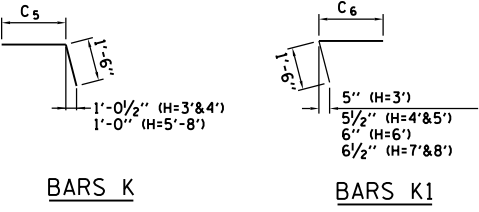
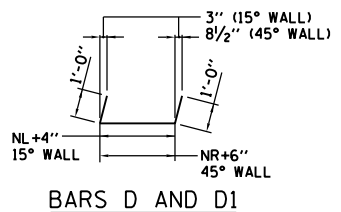
H	SIZE (DIA.)	SCHEDULE	WINGWALL PIPES - ONE PER EACH LENGTH SHOWN								HEADWALL PIPES				TOTAL LENGTH	1-BAR C 45° WALL		1-BAR C1 15° WALL		BAR D 4-#4 45° WALL	BAR D1 4-#4 15° WALL	#4-BARS E 45° WALL (6)		#4-BARS E1 15° WALL (6)	
			15° WALL				45° WALL				S	No.	L0	SIZE		LENGTH	SIZE	LENGTH	LENGTH	LENGTH	NO.	LENGTH	NO.	LENGTH	
			L1	L2	L3	L4	L5	L6	L7	L8															
3'	3"	40	11'-11"	-	-	13'-3"	6'-0"	-	-	9'	4	16'-10"	98.50	#4	20'-8"	#4	15'-3"	22'-9"	17'-2"	2	21'-4"	2	17'-0"		
4'	3"	80	16'-8"	-	-	18'-0"	10'-9"	-	-	9'	4	21'-7"	131.75	#4	26'-4"	#4	19'-5"	28'-5"	21'-4"	2	27'-0"	2	21'-1"		
5'	3 1/2"	80	21'-4"	11'-6"	-	22'-8"	15'-5"	8'-2"	-	5'	3	26'-4"	158.08	#4	32'-0"	#4	23'-7"	34'-1"	25'-6"	2	32'-8"	2	25'-3"		
6'	3 1/2"	80	26'-1"	16'-2"	-	27'-9"	20'-2"	12'-11"	5'-8"	6'	3	31'-0"	201.75	#4	37'-8"	#4	27'-8"	39'-9"	29'-7"	3	38'-4"	3	29'-4"		
7'	4"	80	30'-10"	20'-11"	11'-0"	32'-2"	24'-9"	17'-8"	10'-9"	7'	4	35'-9"	291.08	#5	44'-10"	#5	31'-10"	46'-11"	33'-9"	3	44'-0"	3	33'-6"		
8'	4"	80	35'-9"	25'-8"	15'-9"	36'-10"	29'-7"	22'-4"	15'-1"	8'	4	40'-6"	350.83	#5	50'-6"	#5	36'-0"	52'-6"	37'-10"	3	49'-8"	3	37'-7"		

H	SIZE	NO.	BARS F EQUALLY SPACED 45° WALL				BARS L 45° WALL				BARS F1 EQUALLY SPACED 15° WALL				DOWELS H #5 @ 12" 45° WALL	DOWELS H #5 @ 12" 15° WALL	DOWELS J 4-#6 (5)	1-BAR K 45° WALL		1-BAR K1 15° WALL		2-BARS W 45° WALL		2-BARS W1 15° WALL									
			C1	C2	C3	C4	LENGTH	SIZE	NO.	C0	LENGTH	SIZE	NO.	C1				C2	C3	C4	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH				
3'	#4	10	1'-11"	2'-2"	2'-0"	2'-1"	9'-3"	#4	-	-	-	#4	8	1'-11"	2'-2"	2'-0"	2'-1"	9'-3"	3	3'-0"	3	3'-0"	4'-6"	#5	4'-3"	5'-9"	#5	3'-10"	5'-4"	#5	20'-6"	#5	14'-11"
4'	#4	12	1'-11"	2'-8"	2'-3"	2'-4"	9'-9"	#4	1	3'-10"	6'-5"	#4	10	1'-11"	2'-8"	2'-3"	2'-4"	9'-9"	4	3'-0"	4	3'-0"	4'-6"	#5	5'-0"	6'-6"	#5	4'-4"	5'-10"	#6	26'-4"	#6	19'-2"
5'	#4	15	1'-11"	3'-2"	2'-6"	2'-7"	10'-3"	#4	2	4'-6"	7'-1"	#4	12	1'-11"	3'-2"	2'-6"	2'-7"	10'-3"	5	3'-0"	5	3'-0"	4'-6"	#5	5'-8"	7'-2"	#5	4'-10"	6'-4"	#6	32'-2"	#6	23'-5"
6'	#5	18	1'-11"	3'-8"	2'-9"	2'-10"	10'-9"	#5	2	5'-3"	7'-10"	#5	14	1'-11"	3'-8"	2'-9"	2'-10"	10'-9"	6	3'-0"	6	3'-0"	4'-6"	#5	6'-5"	7'-11"	#5	5'-4"	6'-10"	#6	38'-0"	#6	27'-8"
7'	#5	20	2'-0"	4'-3"	3'-1"	3'-2"	11'-5"	#5	3	6'-0"	8'-7"	#5	16	2'-0"	4'-2"	3'-1"	3'-1"	11'-4"	7	3'-0"	7	3'-0"	4'-6"	#5	7'-1"	8'-7"	#5	5'-10"	7'-4"	#7	45'-4"	#7	31'-11"
8'	#6	23	2'-1"	4'-10"	3'-5"	3'-6"	12'-1"	#6	3	6'-9"	9'-4"	#6	18	2'-1"	4'-8"	3'-4"	3'-5"	11'-11"	8	3'-0"	8	3'-0"	4'-6"	#5	7'-10"	9'-4"	#5	6'-5"	7'-11"	#7	51'-2"	#7	36'-2"

S	NO.	S	NO.
10'	5	23'	11
11'	5	24'	11
12'	6	25'	12
13'	6	26'	12
14'	7	27'	12
15'	7	28'	13
16'	8	29'	13
17'	8	30'	14
18'	8	31'	14
19'	9	32'	15
20'	9	33'	15
21'	10	34'	16
22'	10	35'	16

H	BARS U- ONE PER EACH LENGTH SHOWN #4 @ 12" 45° WALL								BARS UI - ONE PER EACH LENGTH SHOWN #4 @ 12" 15° WALL								BARS V #4-EQUALLY SPACED 45° WALL				BARS VI #4-EQUALLY SPACED 15° WALL								
	C7	C8	C9	C10	C11	C12	C13	C14 (6)	C7	C8	C9	C10	C11	C12	C13	C14	NO.	C15	C16	C17	C18	C19	LENGTH	NO.	C15	C16	C17	C18	C19
3'	6'-2"	11'-9"	17'-5"	--	--	--	--	--	4'-6"	8'-7"	12'-9"	--	--	--	--	10	3'-10"	9"	2'-2"	2'-5"	1'-0"	6'-7"	7	3'-10"	9"	2'-2"	2'-5"	1'-0"	6'-7"
4'	6'-2"	11'-9"	17'-5"	23'-1"	--	--	--	--	4'-6"	8'-7"	12'-9"	16'-11"	--	--	--	13	4'-11"	10"	2'-9"	3'-0"	1'-0"	7'-9"	9	4'-11"	10"	2'-9"	3'-0"	1'-0"	7'-9"
5'	6'-2"	11'-9"	17'-5"	23'-1"	28'-9"	--	--	--	4'-6"	8'-7"	12'-9"	16'-11"	21'-0"	--	--	15	5'-11"	10"	3'-3"	3'-6"	1'-0"	8'-9"	11	5'-11"	10"	3'-3"	3'-6"	1'-0"	8'-9"
6'	6'-2"	11'-9"	17'-5"	23'-1"	28'-9"	34'-5"	--	--	4'-6"	8'-7"	12'-9"	16'-11"	21'-0"	25'-2"	--	18	6'-11"	10"	3'-9"	4'-0"	1'-0"	9'-9"	14	6'-11"	10"	3'-9"	4'-0"	1'-0"	9'-9"
7'	6'-2"	11'-9"	17'-5"	23'-1"	28'-9"	34'-5"	40'-0"	--	4'-6"	8'-7"	12'-9"	16'-11"	21'-0"	25'-2"	29'-4"	21	8'-0"	11"	4'-4"	4'-7"	1'-0"	10'-11"	16	8'-0"	11"	4'-4"	4'-7"	1'-0"	10'-11"
8'	6'-2"	11'-9"	17'-5"	23'-1"	28'-9"	34'-5"	40'-0"	47'-3"	4'-6"	8'-7"	12'-9"	16'-11"	21'-0"	25'-2"	29'-4"	24	9'-0"	11"	4'-10"	5'-1"	1'-1"	12'-1"	18	9'-0"	11"	4'-10"	5'-1"	1'-1"	12'-1"

H	S	BARS Y #2-#5 (2)		BARS R #6-#5 (2)		BARS Z #4 @ 12" (1)		BARS S #4 @ 12" (1)		BARS T #4 @ 12" (1)		BARS P #8-#5 (3)	
		LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.
3'	≥9'	11'-4"	19'-10"	10	5'-4"	20	6'-10"	10	3'-0"	6'-8"			
4'	≥9'	11'-4"	22'-10"	10	5'-4"	23	6'-10"	10	3'-0"	7'-8"			
5'	≥5'	6'-9"	21'-1"	6	5'-4"	21	6'-10"	6	3'-0"	8'-8"			
6'	≥6'	7'-10"	25'-2"	7	5'-4"	25	6'-10"	7	3'-0"	9'-8"			
7'	≥7'	9'-1"	29'-3"	8	5'-4"	30	6'-10"	8	3'-0"	10'-8"			
8'	≥8'	10'-4"	33'-4"	9	5'-4"	34	6'-10"	9	3'-0"	11'-8"			



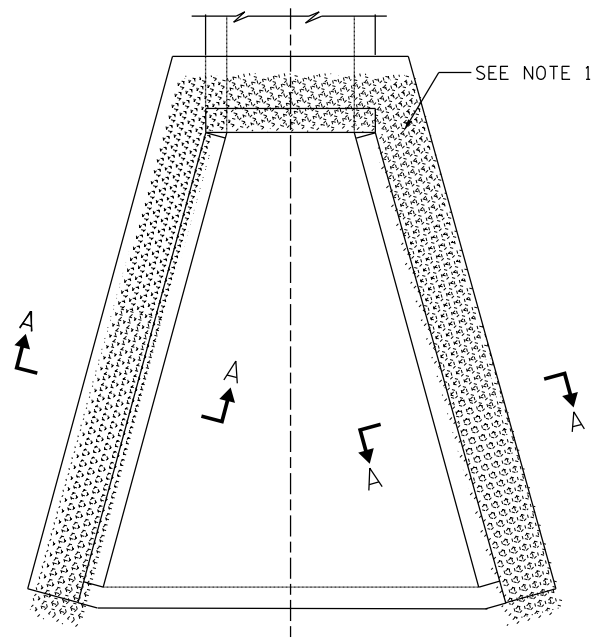
- NOTES FOR TABLES:**
1. THE NUMBER OF BARS S, T AND Z SHALL BE INCREASED BY 1 FOR EACH 1 FOOT OF INCREASE IN DIMENSION "W1".
 2. THE LENGTH OF BARS R AND Y SHALL BE INCREASED BY 1'-1/8" FOR EACH 1 IF INCREASE IN DIMENSION "S".
 3. THE NUMBER OF BARS P SHOWN ARE FOR SINGLE SPAN PIPES OR BOX CULVERTS. THIS NUMBER SHALL BE INCREASED BY 4 FOR EACH MULTIPLE OF PIPE OR BOX ADDED.
 4. THIS DIMENSION SHALL BE INCREASED BY 1'-1/8" INCHES FOR EACH 1 FOOT INCREASE IN DIMENSION "S".
 5. 2 BARS FOR 15° WALL, 2 BARS FOR 45° WALL.
 6. THE LENGTH OF THIS BAR INCLUDES ONE 1'-6" MINIMUM LAP.

Paul Kovacs
APPROVED... CHIEF ENGINEER... DATE 6-1-2009...

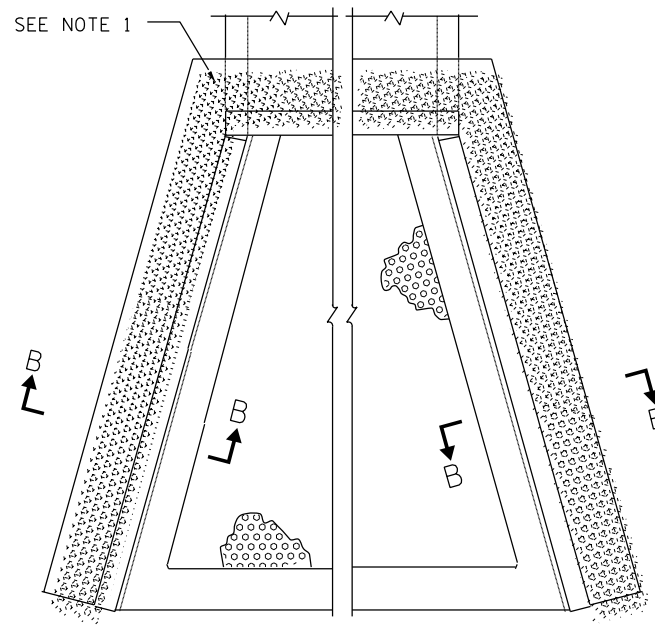
SHEET 2 OF 2

SAFETY END TREATMENT FOR SINGLE AND MULTIPLE CULVERTS 30° SKEW 1:4 H ≤ 8' & S=VARIES

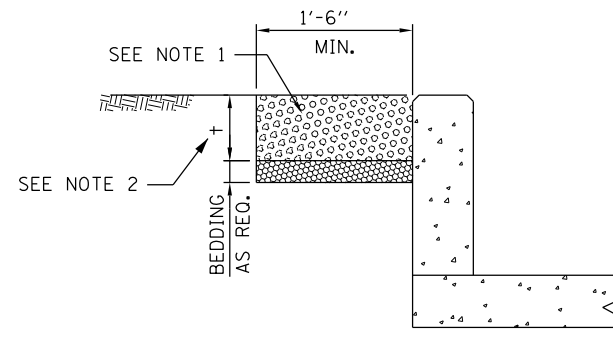
STANDARD B18-03



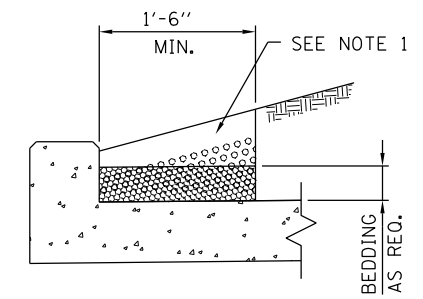
PLAN-0° SKEW, H ≤ 4'



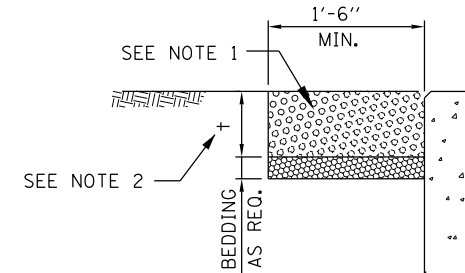
PLAN-0° SKEW, H ≤ 8'



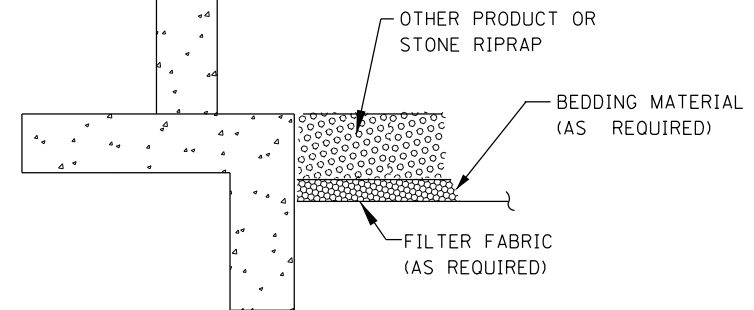
SECTION A-A



SECTION AT HEADWALL

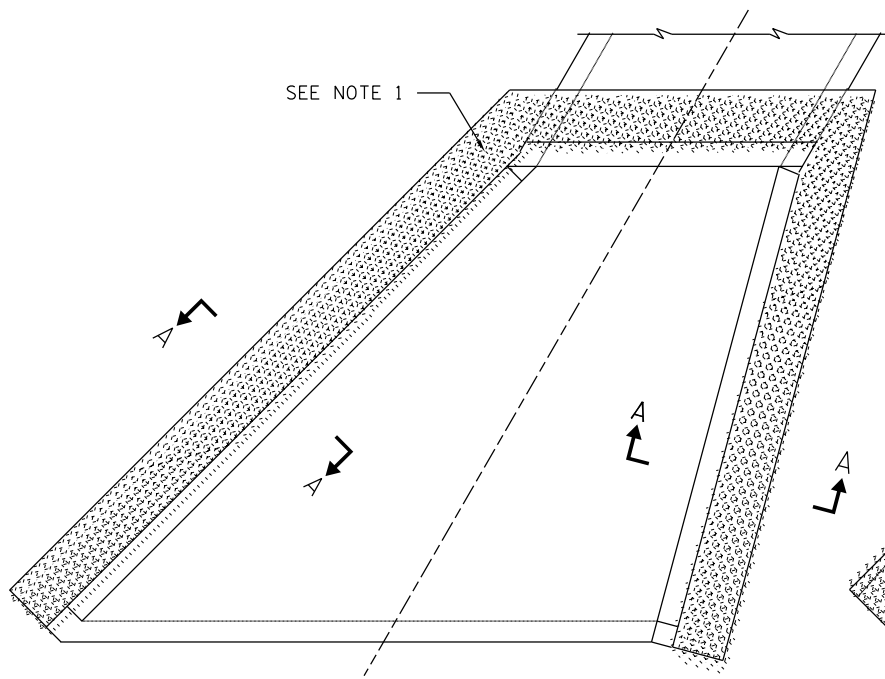


SECTION B-B

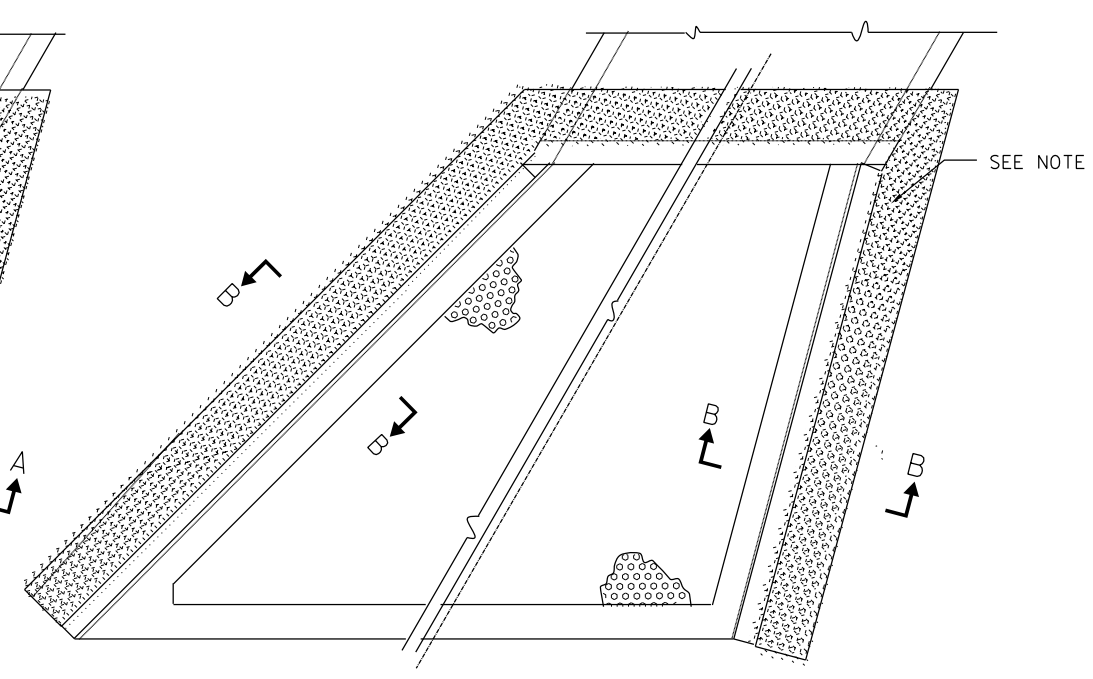


NOTES:


1. THE PREFERRED METHOD FOR ACHIEVING EROSION PROTECTION AT END SECTIONS SHOULD BE THROUGH THE USE OF PRODUCTS THAT PROMOTE REVEGETATION WITHIN THE AREA OF CONCERN.
2. THICKNESS "t" WILL BE DETERMINED BY THE MANUFACTURE'S RECOMMENDATION FOR THE PRODUCT USED. STONE RIPRAP SHALL BE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS.
3. EROSION PROTECTION PLACEMENT SHALL BE INSTALLED FLUSH WITH ADJACENT GRADE.
4. FOR USE WITH STANDARDS B10 TO B18.



PLAN-SKEW, H ≤ 4'

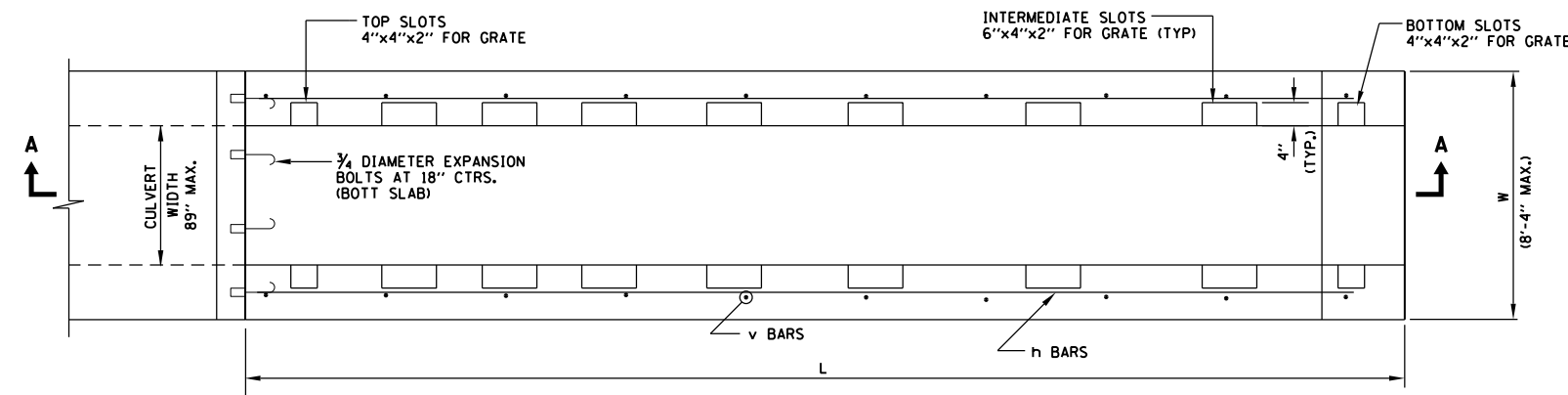


PLAN-SKEW, H ≤ 8'


 APPROVED..... CHIEF ENGINEER DATE 3-1-2010.....

DATE	REVISIONS
3-1-2010	REVISED EROSION PROTECTION AND NOTES


 EROSION PROTECTION
 STANDARD B19-01



DIMENSIONS AND QUANTITIES IN TWO WINGWALLS 1:4 SLOPE

CULVERT HEIGHT	DIMENSIONS								NO. OF SPACES			CONC. HWLS CLASS S1 CY*	REINF. STEEL LBS.*
	H	L	S	T	U	A	E	B	C	D			
36"	3'-8"	14'-0"	14'-5 1/8"	2"	2'-8"	2'-2"	2'-2"	-	4	-	1.33	188	
42"	4'-3"	16'-4"	16'-10"	2"	3'-2"	2'-8"	2'-2"	4	-	-	1.78	259	
48"	4'-9"	18'-4"	18'-10 3/4"	2"	3'-2"	2'-2"	2'-2"	-	6	-	2.23	304	
54"	5'-3"	20'-4"	20'-11 1/2"	2"	3'-6"	2'-2"	2'-2"	4	2	-	2.72	379	
60"	5'-10"	22'-8"	23'-4 3/8"	2"	3'-6"	2'-2"	2'-2"	-	8	-	3.36	468	

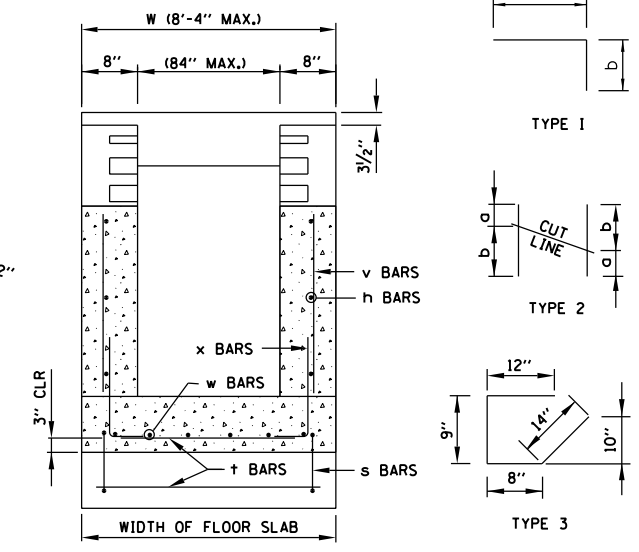
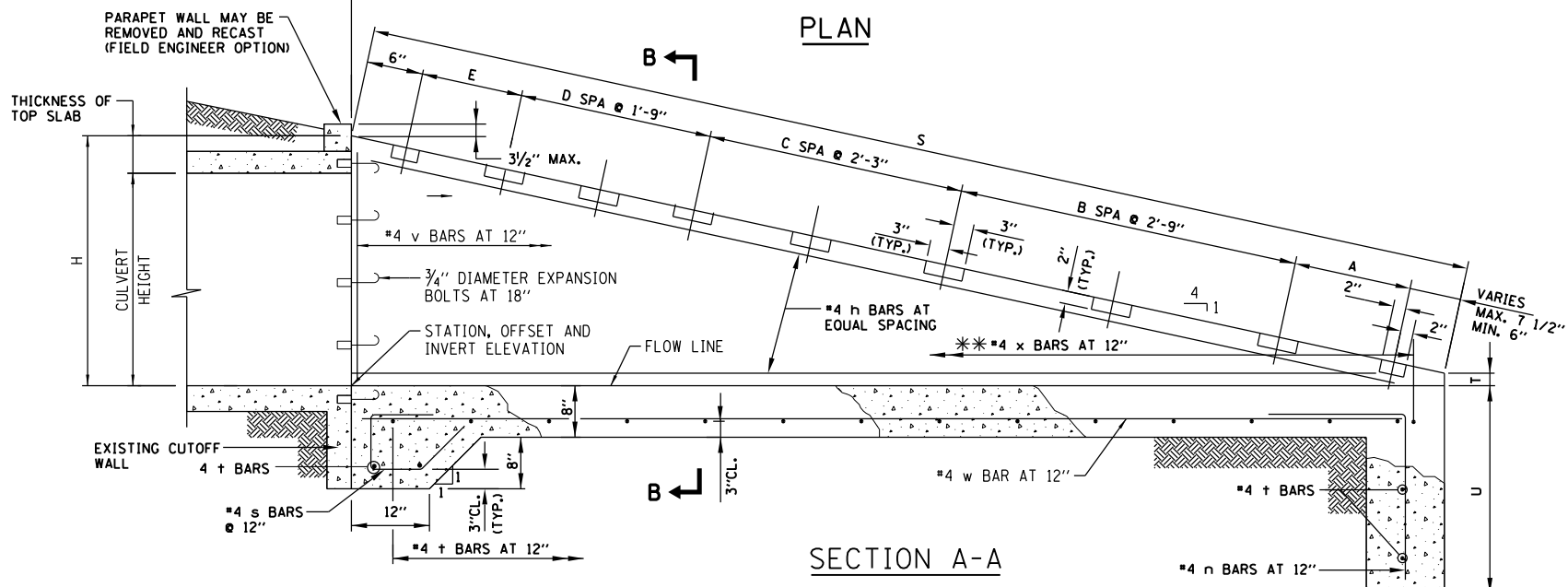


TABLE OF BARS IN ONE WINGWALL 1:4 SLOPE

CULVERT HEIGHT	NO. 4 REINFORCING BARS					
	MARK	TYPE	NO. REQ'D	LENGTH	a	b
36"	h 36	STR.	4	13'-8"	-	-
	3/4" EXP BLT	---	3	---	-	-
	v 36	2	7	5'-6"	2'-0"	3'-6"
	x 36	1	15	3'-2"	2'-2"	1'-0"
42"	h 42	STR.	5	16'-0"	-	-
	3/4" EXP BLT	---	4	---	-	-
	v 42	2	10	6'-0"	1'-11"	4'-1"
	x 42	1	17	3'-2"	2'-2"	1'-0"
48"	h 48	STR.	5	18'-0"	-	-
	3/4" EXP BLT	---	4	---	-	-
	v 48	2	12	6'-5"	1'-10"	4'-7"
	x 48	1	19	3'-2"	2'-2"	1'-0"
54"	h 54	STR.	6	20'-0"	-	-
	3/4" EXP BLT	---	4	---	-	-
	v 54	2	14	6'-11"	1'-10"	5'-1"
	x 54	1	21	3'-2"	2'-2"	1'-0"
60"	h 60	STR.	7	22'-4"	-	-
	3/4" EXP BLT	---	5	---	-	-
	v 60	2	16	7'-7"	1'-11"	5'-8"
	x 60	1	23	3'-2"	2'-2"	1'-0"

NOTES:

v BARS ARE TO BEGIN AT THE CULVERT END OF THE SLOPE HEADWALL
 3/4" DIAMETER EXPANSION BOLTS SHALL CONSIST OF SELF DRILLING EXPANSION SHIELDS AND 3/4" DIAMETER HOOKED BOLTS. HOOKED BOLTS SHALL EXTEND A MINIMUM OF 9" INTO NEW CONCRETE WITH ANCHORAGE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS. MINIMUM CERTIFIED PROOF LOAD = 4,080 LBS.

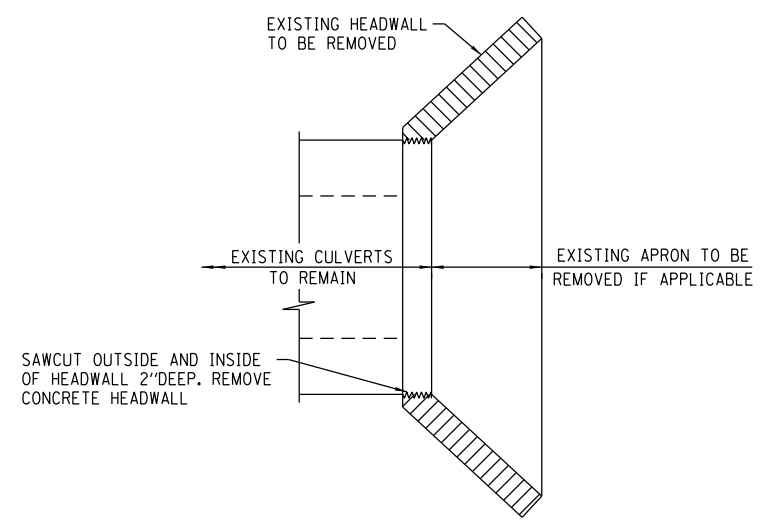
** CUT BARS IN FIELD TO FIT MINIMUM 2" VERTICAL CLEARANCE

TABLE OF BARS IN SLAB 1:4 SLOPE (PER FT. OF FLOOR SLAB WIDTH)

CULVERT HEIGHT	NO. 4 REINFORCING BARS							
	MARK	TYPE	NO. REQ'D	LENGTH	a	b	REINF. LBS. *	CY. CONC. *
36"	n 36	1	1	4'-1"	2'-1"	2'-0"	27	.45
	w 36	STR.	1	13'-5"	-	-		
	t 36	STR.	18	W-(0'-4")	-	-		
	3/4" EXP BLT	---	0.67	---	-	-		
	s 36	3	1	3'-7"	-	-		
42"	n 42	1	1	4'-7"	2'-7"	2'-0"	32	.53
	w 42	STR.	1	15'-9"	-	-		
	t 42	STR.	20	W-(0'-4")	-	-		
	3/4" EXP BLT	---	0.67	---	-	-		
	s 42	3	1	3'-7"	-	-		
48"	n 48	1	1	4'-7"	2'-7"	2'-0"	33	.58
	w 48	STR.	1	17'-9"	-	-		
	t 48	STR.	22	W-(0'-4")	-	-		
	3/4" EXP BLT	---	0.67	---	-	-		
	s 48	3	1	3'-7"	-	-		
54"	n 54	1	1	4'-11"	2'-11"	2'-0"	37	.64
	w 54	STR.	1	19'-9"	-	-		
	t 54	STR.	24	W-(0'-4")	-	-		
	3/4" EXP BLT	---	0.67	---	-	-		
	s 54	3	1	3'-7"	-	-		
60"	n 60	1	1	4'-11"	2'-11"	2'-0"	39	.70
	w 60	STR.	1	22'-1"	-	-		
	t 60	STR.	26	W-(0'-4")	-	-		
	3/4" EXP BLT	---	0.67	---	-	-		
	s 60	3	1	3'-7"	-	-		

GENERAL NOTES:

- ALL EXPOSED CONCRETE EDGES SHALL HAVE A 3/4" x 45° CHAMFER. CHAMFER ON VERTICAL EDGES SHALL BE CONTINUED A MINIMUM OF ONE FOOT BELOW FINISHED GROUND LEVEL.
- COVER FROM THE FACE OF CONCRETE TO FACE OF REINFORCEMENT BARS SHALL BE 2" UNLESS OTHERWISE SHOWN.
- CONCRETE QUANTITIES SHOWN ARE FOR REINFORCED CONCRETE BOX CULVERT HEADWALLS.
- PAY ITEMS ARE IDENTIFIED BY AN ASTERISK (*).
- ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENT (v:h).



REMOVAL DETAIL

NOTES:

- TYPE 2 "v" BARS SHALL BE ORDERED FULL LENGTH AND CUT IN THE FIELD. THE REMAINING PORTION OF THE "v" BARS SHALL BE USED IN THE OTHER WALL.
- THE LONG LEG OF THE "n" BAR SHALL BE VERTICAL.
- SEE STANDARD B23 FOR GRATING DETAILS.

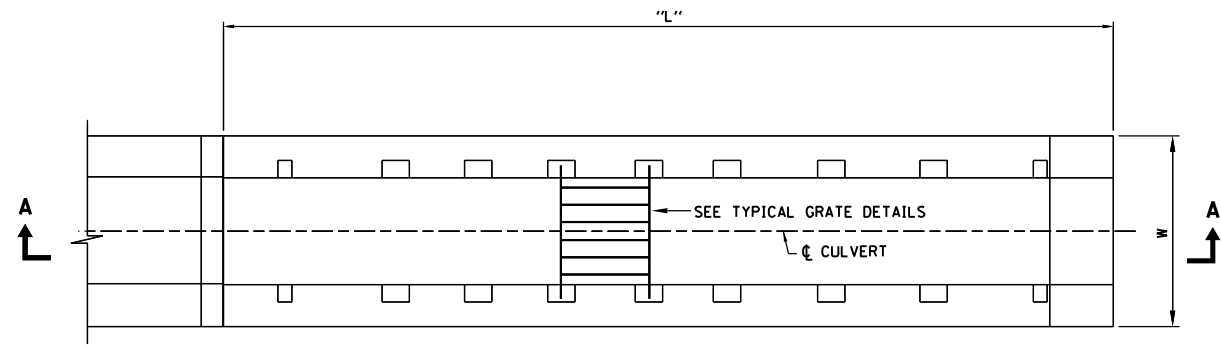
DATE	REVISIONS
6-1-2009	REVISED NOTES
1-1-2011	REVISED NOTES
2-7-2012	REVISED TABLE QUANTITIES AND NOTES



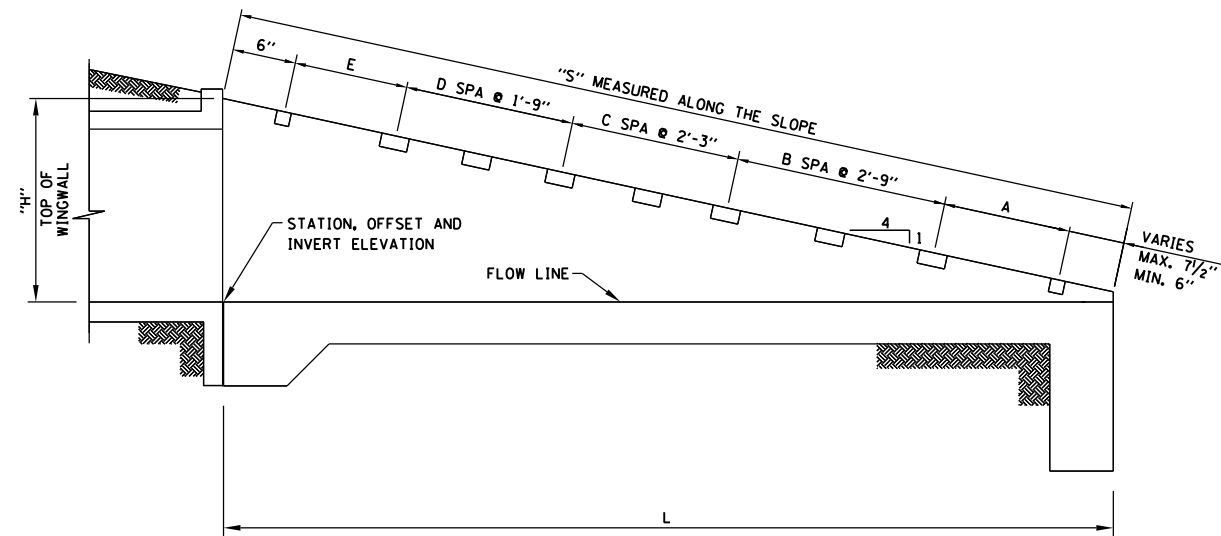
HEADWALL TYPE IV
 CONCRETE BOX CULVERT
 ≤ 84" WIDTH

STANDARD B20-03

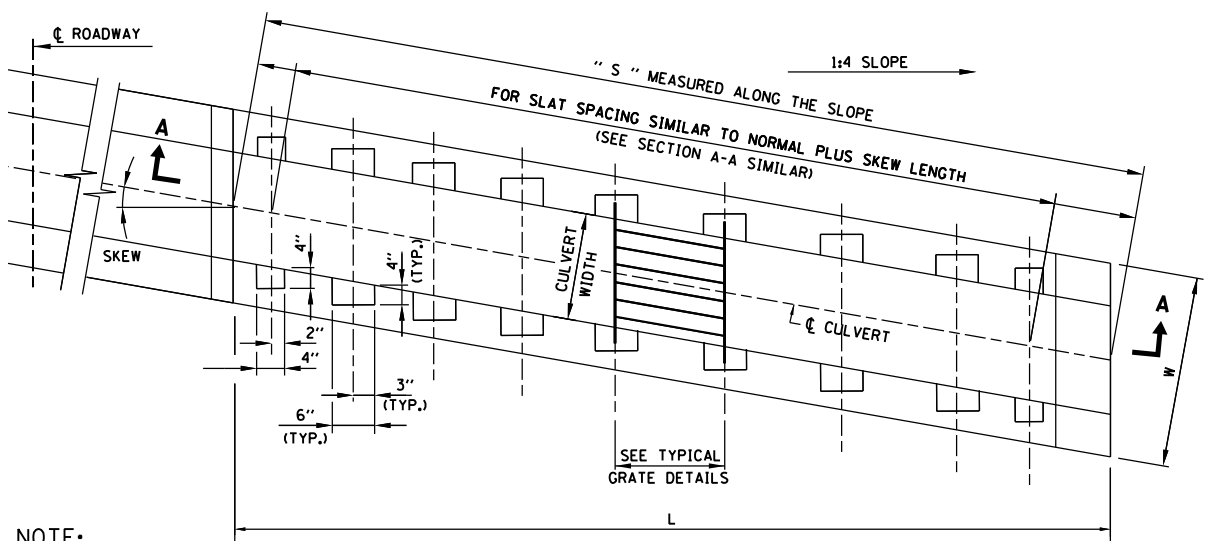
APPROVED: *Paul Kovacs* CHIEF ENGINEER DATE 2-7-2012



PLAN VIEW (NO SKEW)
SINGLE BOX CULVERT ≤ 84" WIDE

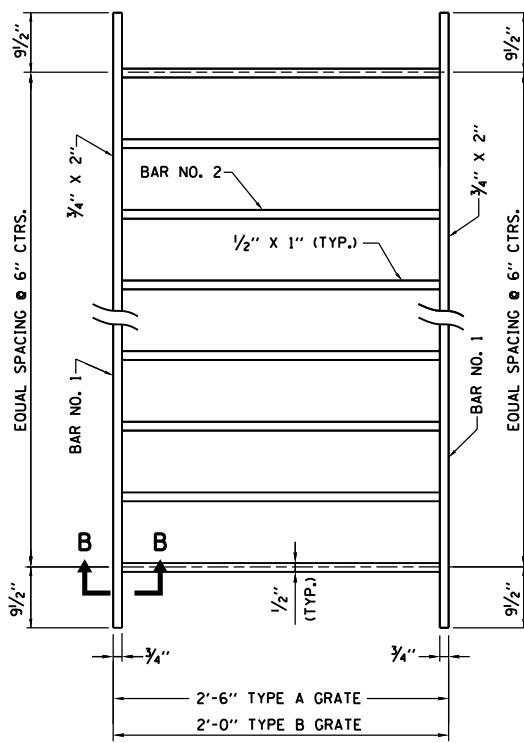


SECTION A-A
END TREATMENT - MULTIPLE OR SINGLE CELL
BOX CULVERT

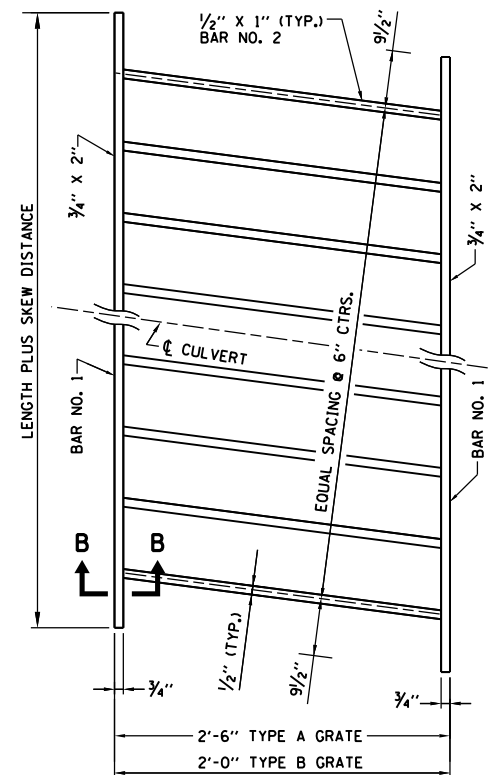


NOTE:
REINFORCEMENT BARS AND GRATE SPACING ARE
SIMILAR TO BOX CULVERT AT NORMAL (NO SKEW).

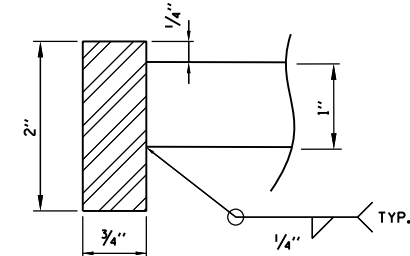
PLAN VIEW (WITH SKEW)
SINGLE BOX CULVERT ≤ 84" WIDE



TYPICAL GRATE
(NO SKEW)



GRATE
(WITH SKEW)



SECTION B-B

GRATE DIMENSIONS AND QUANTITIES
IN ONE HEADWALL TYPE IV
BASED ON A 1 FOOT WIDTH, 1:4 SLOPE, AND NO SKEW

CULVERT HEIGHT	GRATES		BARS FOR ONE GRATE				HEADWALL GRATES (LBS.) *
	NUMBER REQUIRED	TYPE REQ'D.	BAR NO. 1		BAR NO. 2		
			BARS REQ'D.	LENGTH	BARS REQ'D.	LENGTH	
36"	6	B	2	W-0.75	W-1.33 0.5 -1	1'-10 1/2"	16.6W - 19.3
42"	5	A	2	W-0.75	W-1.33 0.5 -1	2'-4 1/2"	18.3W - 22.4
	1	B	2	W-0.75	W-1.33 0.5 -1	1'-10 1/2"	16.6W - 19.3
48"	8	B	2	W-0.75	W-1.33 0.5 -1	1'-10 1/2"	16.6W - 19.3
54"	4	A	2	W-0.75	W-1.33 0.5 -1	2'-4 1/2"	18.3W - 22.4
	4	B	2	W-0.75	W-1.33 0.5 -1	1'-10 1/2"	16.6W - 19.3
60"	10	B	2	W-0.75	W-1.33 0.5 -1	1'-10 1/2"	16.6W - 19.3

DIMENSIONS "S" FOR SLOPE 1:4
FOR VARIOUS CULVERT SIZES AND SKEWS

CULVERT HEIGHT	NO SKEW	≤ 10°	10° ≤ 20°	20° ≤ 30°
36"	14'-5 1/8"	14'-7 3/4"	15'-4 1/4"	16'-8"
42"	16'-10"	17'-1"	17'-11"	19'-5 1/4"
48"	18'-10 3/4"	19'-2 1/4"	20'-1 1/4"	21'-10"
54"	20'-11 1/2"	21'-3 3/8"	22'-3 3/8"	24'-2 3/8"
60"	23'-4 3/8"	23'-8 3/4"	24'-10 3/8"	26'-11 3/4"

GENERAL NOTES:

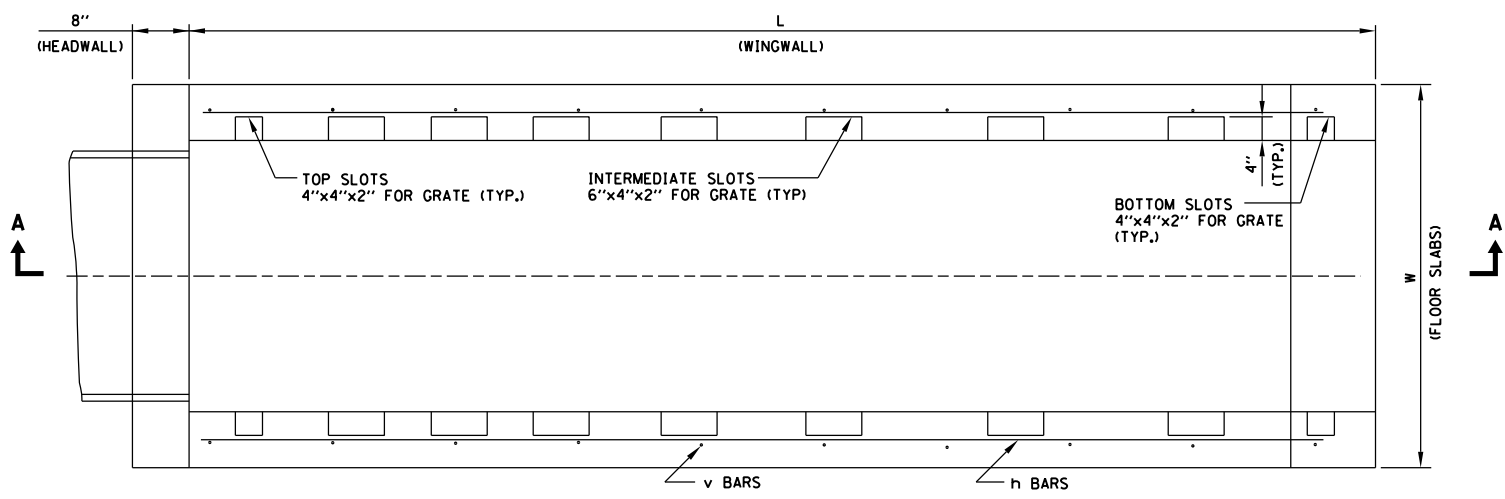
- ALL TABLE DIMENSIONS AND QUANTITIES ARE FOR SINGLE BOX CULVERT HEADWALLS. TO ADAPT ANY OF THESE TABLES FOR DOUBLE BOX CULVERTS, DOUBLE THE NUMBER OF GRATES REQUIRED AND ADD AN ADDITIONAL WALL. (WALL THICKNESS SHALL BE SAME AS THE CENTER WALL THICKNESS OF THE BOX CULVERT)
- FOR QUANTITY CALCULATIONS DIMENSION "W" SHALL BE MEASURED IN FEET.
- QUANTITIES FOR SKEWED HEADWALLS NOT SHOWN.
- PAY ITEMS ARE IDENTIFIED BY AN ASTERISK (*).
- ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENT (V:H).

APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 2-7-2012

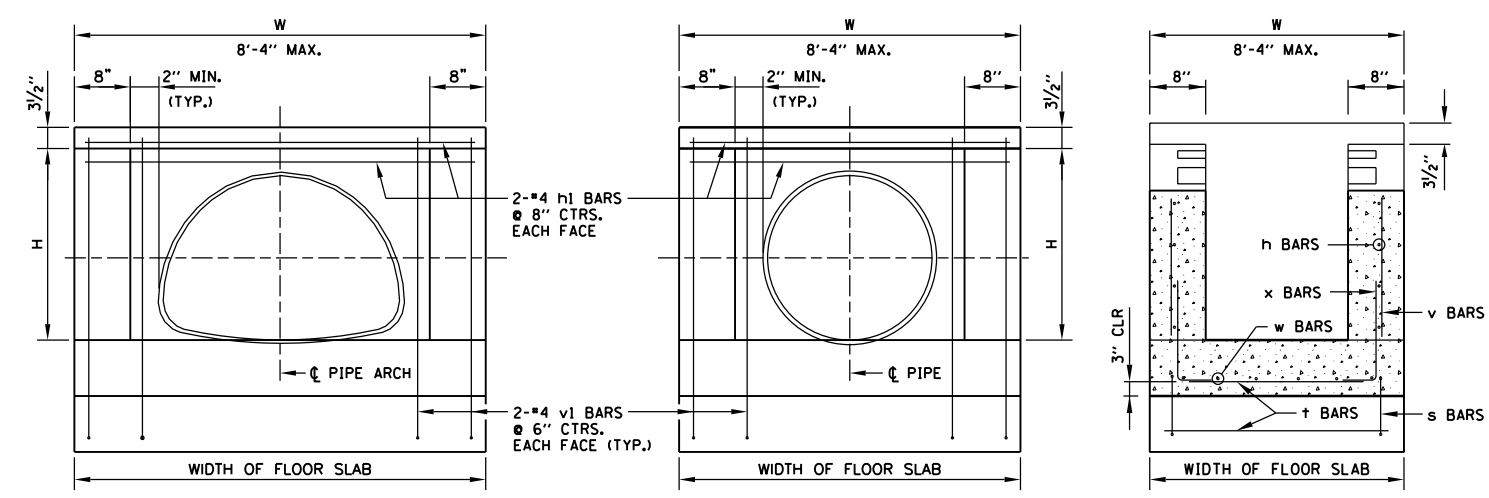
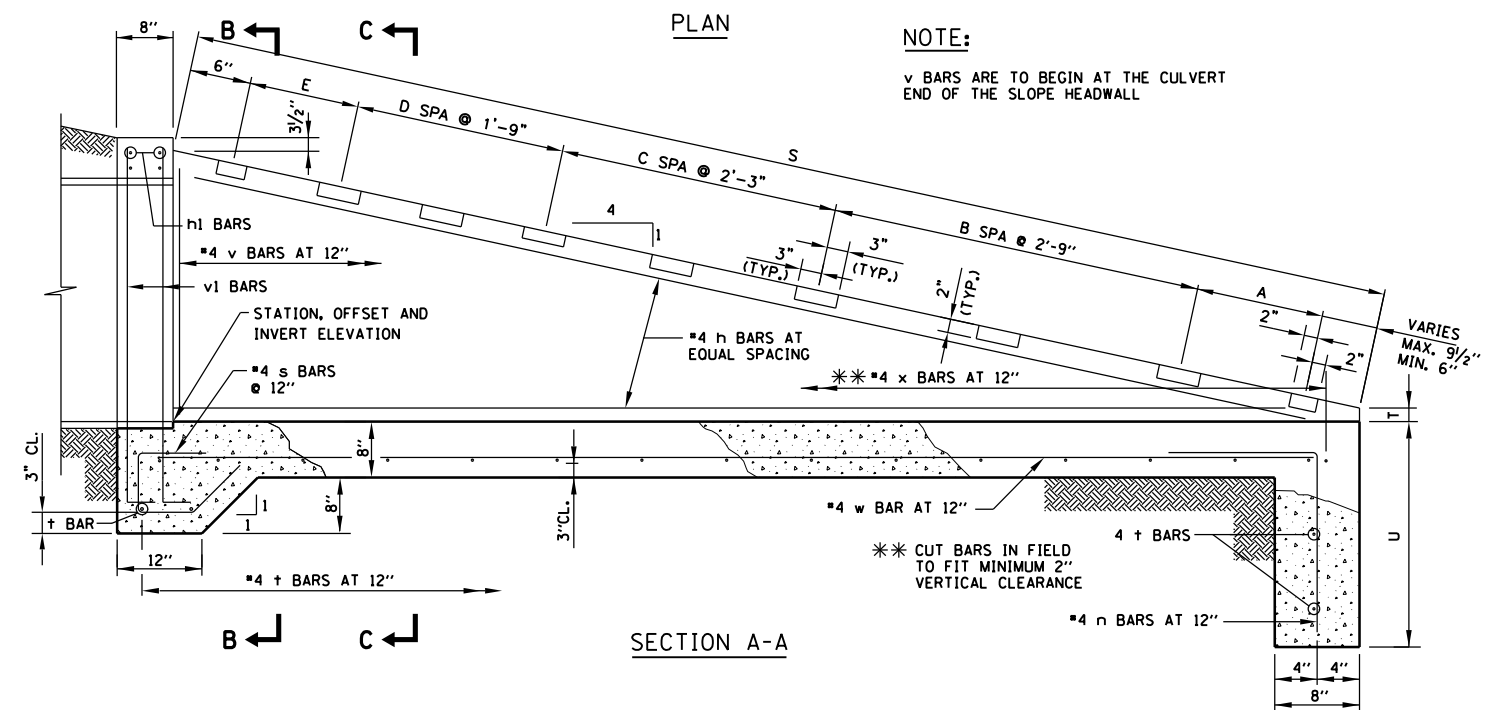
DATE	REVISIONS
6-1-2009	CHANGED SECTION B-B DIMENSION
	REVISED NOTES
2-7-2012	DELETED SECTION FROM PLAN VIEW

STEEL GRATE FOR
HEADWALL TYPE IV
BOX CULVERT ≤ 84" WIDTH

STANDARD B21-02

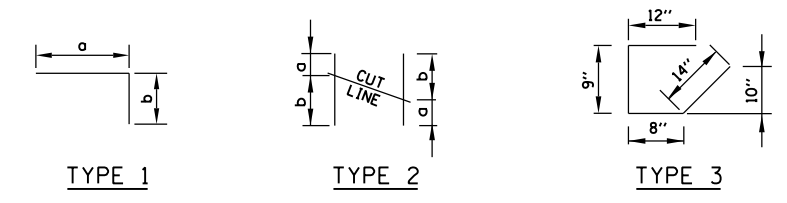


NOTE:
v BARS ARE TO BEGIN AT THE CULVERT
END OF THE SLOPE HEADWALL



DIMENSIONS AND QUANTITIES IN TWO WINGWALLS 1:4 SLOPE

PIPE-ARCH ELLIPTICAL PIPE (SPAN ≤ 77")	CIRCULAR PIPE (DIAMETER)	DIMENSIONS								NO. OF SPACES			CONC. HDWLS. CLASS SI CY. *	REINF. STEEL LBS. *
		H	L	S	T	U	A	E	B	C	D			
RISE ≤ 30"		3'-2"	12'-0"	12'-4 1/2"	2"	2'-8"	2'-2"	2'-2"	-	3	-	.98	151	
RISE ≤ 36"		3'-8"	14'-0"	14'-5 5/8"	2"	2'-8"	2'-2"	2'-2"	-	4	-	1.33	188	
RISE ≤ 42"		4'-3"	16'-4"	16'-10"	2"	3'-2"	2'-8"	2'-2"	4	-	-	1.78	251	
RISE ≤ 48"		4'-9"	18'-4"	18'-10 3/4"	2"	3'-2"	2'-2"	2'-2"	-	6	-	2.23	295	
RISE ≤ 54"	54"	5'-3"	20'-4"	20'-11 1/2"	2"	3'-6"	2'-2"	2'-2"	4	2	-	2.72	370	
RISE ≤ 60"	60"	5'-10"	22'-8"	23'-4 3/4"	2"	3'-6"	2'-2"	2'-2"	-	8	-	3.36	428	
	66"	6'-4"	24'-8"	25'-5 5/8"	2"	3'-6"	2'-2"	2'-2"	4	4	-	3.96	517	



**TABLE OF BARS
IN ONE WINGWALL 1:4 SLOPE**

NO. 4 REINFORCING BARS						
H	MARK	TYPE	NO. REO'D	LENGTH	a	b
3'-2"	H 30	STR.	4	11'-8"		
	V 30	2	5	5'-0"	2'-0"	3'-0"
	X 30	1	13	3'-2"	2'-2"	1'-0"
3'-8"	H 36	STR.	4	13'-8"		
	V 36	2	7	5'-6"	2'-0"	3'-6"
	X 36	1	15	3'-2"	2'-2"	1'-0"
4'-3"	H 42	STR.	5	16'-0"		
	V 42	2	9	6'-0"	1'-11"	4'-1"
	X 42	1	17	3'-2"	2'-2"	1'-0"
4'-9"	H 48	STR.	5	18'-0"		
	V 48	2	11	6'-5"	1'-10"	4'-7"
	X 48	1	19	3'-2"	2'-2"	1'-0"
5'-3"	H 54	STR.	6	20'-0"		
	V 54	2	13	6'-11"	1'-10"	5'-1"
	X 54	1	21	3'-2"	2'-2"	1'-0"
5'-10"	H 60	STR.	6	22'-4"		
	V 60	2	15	7'-7"	1'-11"	5'-8"
	X 60	1	23	3'-2"	2'-2"	1'-0"
6'-4"	H 66	STR.	7	24'-4"		
	V 66	2	17	8'-1"	1'-11"	6'-2"
	X 66	1	25	3'-2"	2'-2"	1'-0"

**TABLE OF BARS IN SLAB 1:4 SLOPE
(PER FT. OF FLOOR SLAB WIDTH)**

NO. 4 REINFORCING BARS							
H	MARK	TYPE	NO. REO'D	LENGTH	a	b	REINF. LBS. * CY. CONC. *
3'-2"	h 131	STR.	4	W-(0'-4")			52
	v 131	1	8	5'-0"	4'-4"	8"	
	n 30	1	1	4'-1"	2'-1"	2'-0"	
	w 30	STR.	1	12'-1"			
	t 30	STR.	15	W-(0'-4")			
3'-8"	h 136	STR.	4	W-(0'-4")			58
	v 136	1	8	5'-6"	4'-10"	8"	
	n 36	1	1	4'-1"	2'-1"	2'-0"	
	w 36	STR.	1	14'-1"			
	t 36	STR.	19	W-(0'-4")			
4'-3"	h 142	STR.	4	W-(0'-4")			65
	v 142	1	8	6'-1"	5'-5"	8"	
	n 42	1	1	4'-7"	2'-7"	2'-0"	
	w 42	STR.	1	16'-5"			
	t 42	STR.	21	W-(0'-4")			
4'-9"	h 148	STR.	4	W-(0'-4")			70
	v 148	1	8	6'-7"	5'-11"	8"	
	n 48	1	1	4'-7"	2'-7"	2'-0"	
	w 48	STR.	1	18'-5"			
	t 48	STR.	23	W-(0'-4")			
5'-3"	h 154	STR.	4	W-(0'-4")			76
	v 154	1	8	7'-1"	6'-5"	8"	
	n 54	1	1	4'-11"	2'-11"	2'-0"	
	w 54	STR.	1	20'-5"			
	t 54	STR.	25	W-(0'-4")			
5'-10"	h 160	STR.	4	W-(0'-4")			82
	v 160	1	8	7'-8"	7'-0"	8"	
	n 60	1	1	4'-11"	2'-11"	2'-0"	
	w 60	STR.	1	22'-9"			
	t 60	STR.	27	W-(0'-4")			
6'-4"	h 166	STR.	4	W-(0'-4")			87
	v 166	1	8	8'-2"	7'-6"	8"	
	n 66	1	1	4'-11"	2'-11"	2'-0"	
	w 66	STR.	1	24'-9"			
	t 66	STR.	29	W-(0'-4")			

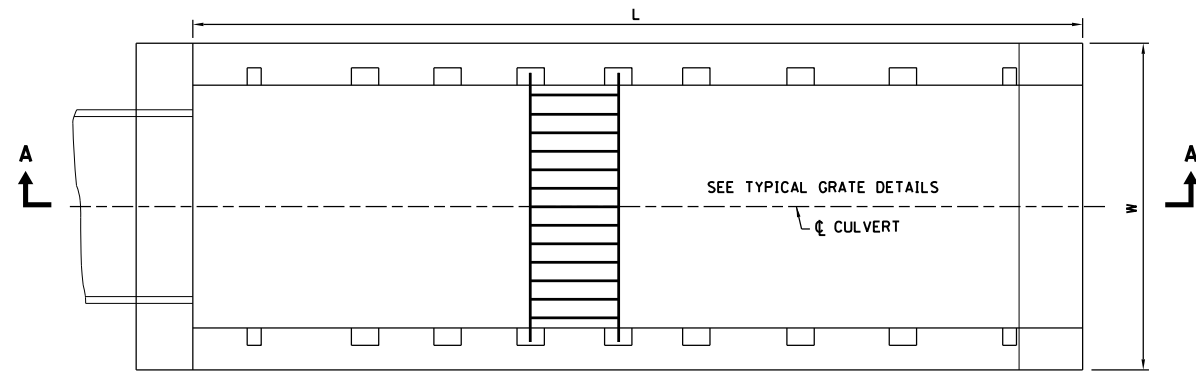
- GENERAL NOTES:**
- TYPE 2 "v" BARS SHALL BE ORDERED FULL LENGTH, AND CUT IN THE FIELD. THE REMAINING PORTION OF THE "v" BARS SHALL BE USED IN THE OTHER WALL.
 - THE LONG LEG OF THE "n" BARS SHALL BE VERTICAL.
 - PAY ITEMS ARE IDENTIFIED BY AN ASTERISK (*).
 - SEE STANDARD B23 FOR GRATING DETAILS.
 - ALL CONCRETE SHALL BE CLASS SI.
 - ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENT (V:H).

DATE	REVISIONS
6-1-2009	CHANGED SECTION B-B DIMENSION
	REVISED NOTES
2-7-2012	REVISED TABLE QUANTITIES

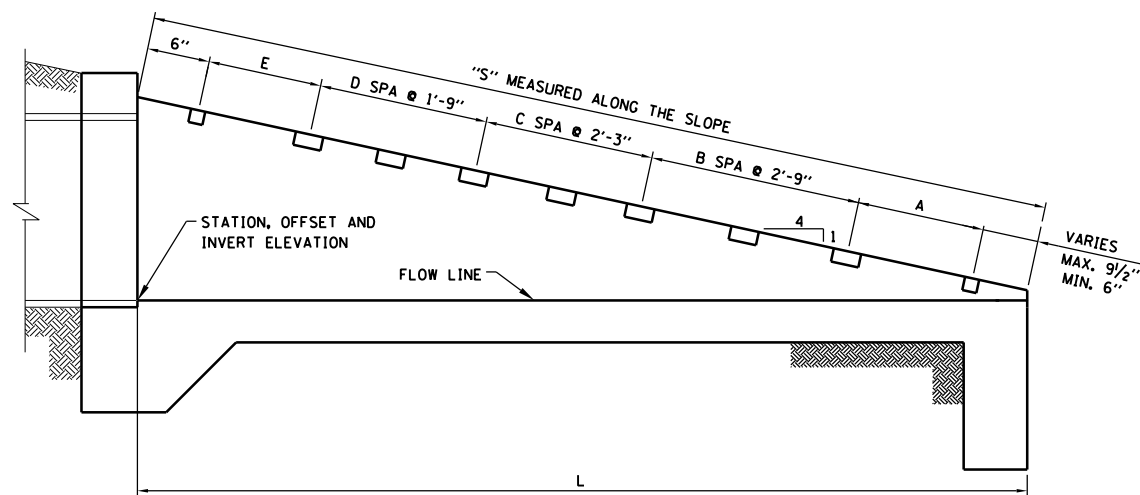
HEADWALL TYPE IV
METAL PIPE & PIPE-ARCH
CULVERTS

STANDARD B22-02

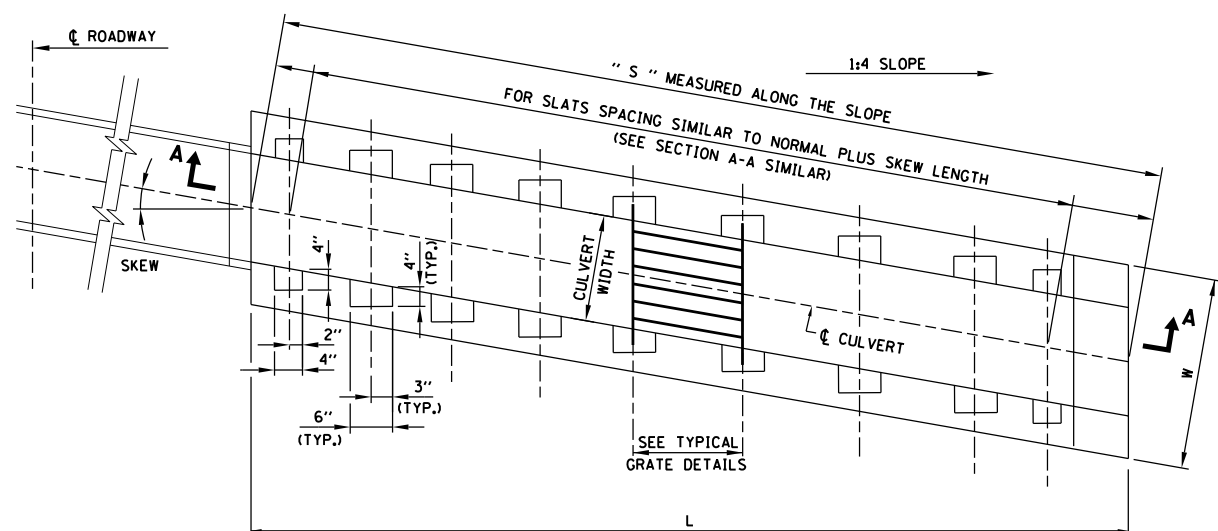
APPROVED: *Paul Kovacs*
CHIEF ENGINEER DATE 2-7-2012



PLAN VIEW (NO SKEW)
SINGLE BOX CULVERT \leq 84" WIDE

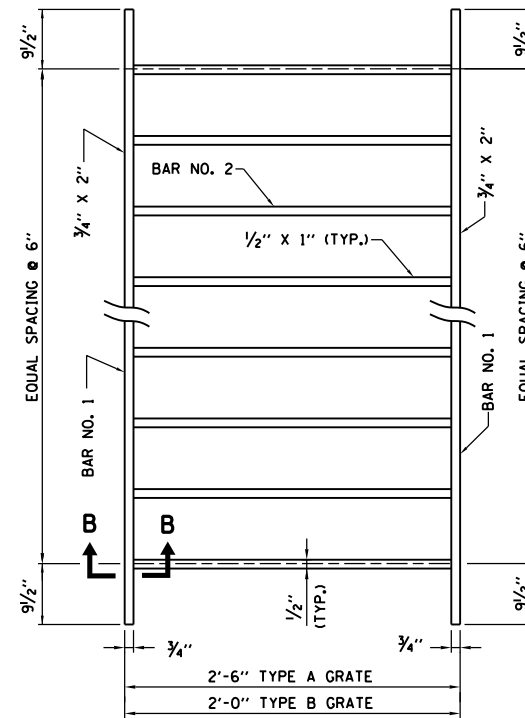


SECTION A-A
END TREATMENT - MULTIPLE OR SINGLE CELL
BOX CULVERT

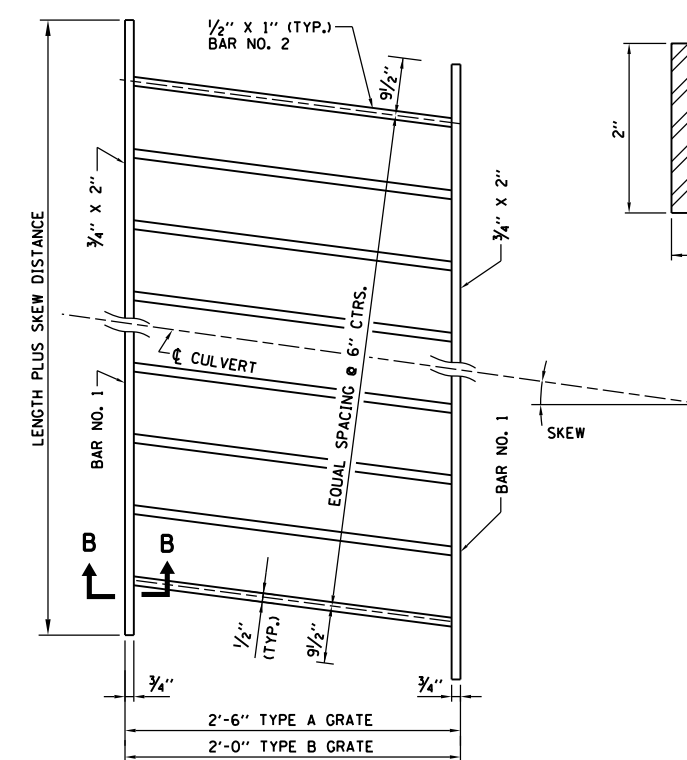


NOTE:
REINFORCEMENT BARS AND GRATE SPACING ARE
SIMILAR TO BOX CULVERT AT NORMAL (NO SKEW).

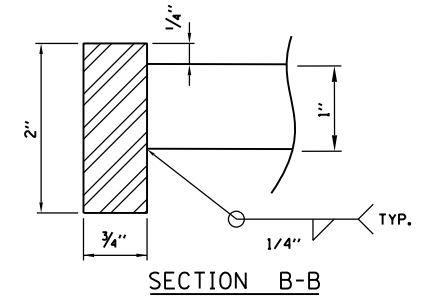
PLAN VIEW (WITH SKEW)



GRATE DETAILS
(WITH SKEW)



GRATE DETAILS
(WITH SKEW)



SECTION B-B

GRATE DIMENSIONS AND QUANTITIES IN ONE HEADWALL TYPE IV
BASED ON A 1 FOOT WIDTH, 1:4 SLOPE AND SKEW

H	GRATES		BARS FOR ONE GRATE				HEADWALL GRATES (LBS.) *	
	NUMBER REQUIRED	TYPE REQ'D.	BAR NO. 1 BARS REQ'D.	BAR NO. 2 BARS REQ'D.	LENGTH	LENGTH		
3'-2"	5	B	2	W-.75	W-1.33 0.5	-1	1'-10 1/2"	16.6W - 19.3
3'-8"	6	B	2	W-.75	W-1.33 0.5	-1	1'-10 1/2"	16.6W - 19.3
4'-3"	5	A	2	W-.75	W-1.33 0.5	-1	2'-4 1/2"	18.3W - 22.4
	1	B	2	W-.75	W-1.33 0.5	-1	1'-10 1/2"	16.6W - 19.3
4'-9"	8	B	2	W-.75	W-1.33 0.5	-1	1'-10 1/2"	16.6W - 19.3
5'-3"	4	A	2	W-.75	W-1.33 0.5	-1	2'-4 1/2"	18.3W - 22.4
	4	B	2	W-.75	W-1.33 0.5	-1	1'-10 1/2"	16.6W - 19.3
5'-10"	10	B	2	W-.75	W-1.33 0.5	-1	1'-10 1/2"	16.6W - 19.3
6'-4"	4	A	2	W-.75	W-1.33 0.5	-1	2'-4 1/2"	18.3W - 22.4
	6	B	2	W-.75	W-1.33 0.5	-1	1'-10 1/2"	16.6W - 19.3

DIMENSIONS "S" FOR SLOPE 1:4
FOR VARIOUS CULVERT SIZES AND SKEWS

H	NO SKEW	$\leq 10^\circ$	$10^\circ \leq 20^\circ$	$20^\circ \leq 30^\circ$
3'-2"	12'-4 1/2"	12'-6 3/4"	13'-2"	14'-3 3/8"
3'-8"	14'-5 1/4"	14'-7 3/4"	15'-4 1/4"	16'-8"
4'-3"	16'-10"	17'-1"	17'-11"	19'-5 1/4"
4'-9"	18'-10 3/4"	19'-2 1/4"	20'-1 1/4"	21'-10"
5'-3"	20'-11 1/2"	21'-3 3/8"	22'-3 5/8"	24'-2 3/4"
5'-10"	23'-4 3/8"	23'-8 3/4"	24'-10 3/8"	26'-11 3/4"
6'-4"	25'-5 1/8"	25'-9 3/4"	27'-0 5/8"	29'-4 1/4"

GENERAL NOTES:

- ALL TABLE DIMENSIONS AND QUANTITIES ARE FOR SINGLE CULVERT HEADWALLS. TO ADAPT ANY OF THESE TABLES FOR DOUBLE CULVERTS, DOUBLE THE NUMBER OF GRATES REQUIRED AND ADD AN ADDITIONAL WALL. (WALL THICKNESS SHALL BE SAME AS THE CENTER WALL THICKNESS OF THE CULVERT.)
- FOR QUANTITY CALCULATIONS DIMENSION "W" SHALL BE MEASURED IN FEET.
- QUANTITIES FOR SKEWED HEADWALLS NOT SHOWN.
- PAY ITEMS ARE IDENTIFIED BY AN ASTERISK (*).
- ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENT (V:H).

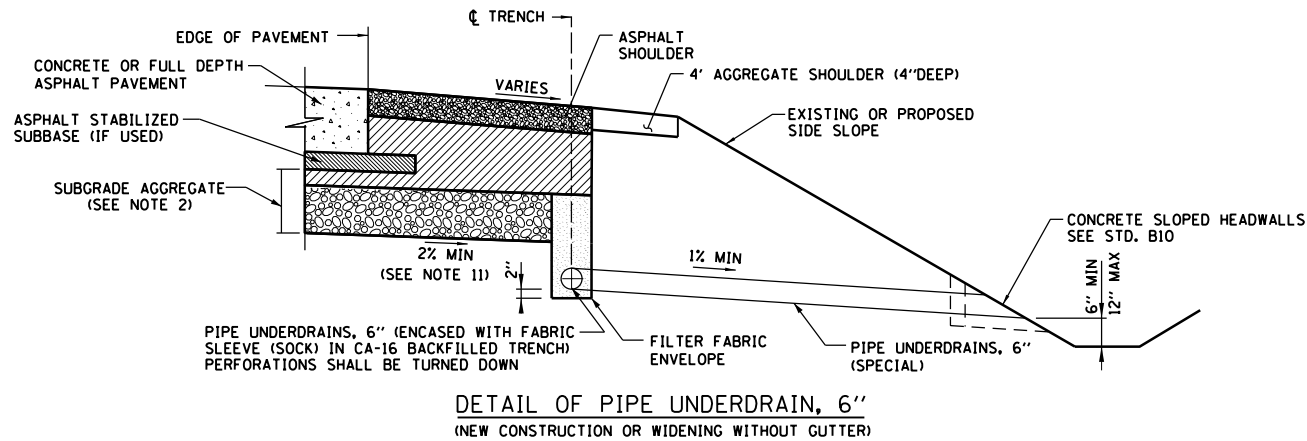
DATE	REVISIONS
6-1-2009	CHANGED SECTION B-B DIMENSION
	REVISED NOTES
2-7-2012	DELETED SECTION VIEW FROM SKEW PLAN

Illinois Tollway

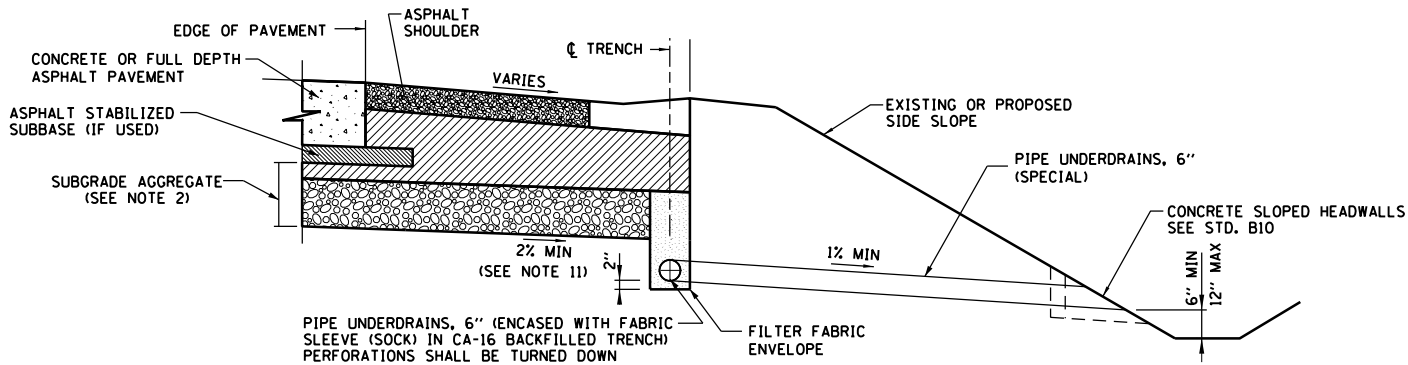
STEEL GRATE FOR
HEADWALL TYPE IV
PIPE & PIPE-ARCH CULVERTS

STANDARD B23-02

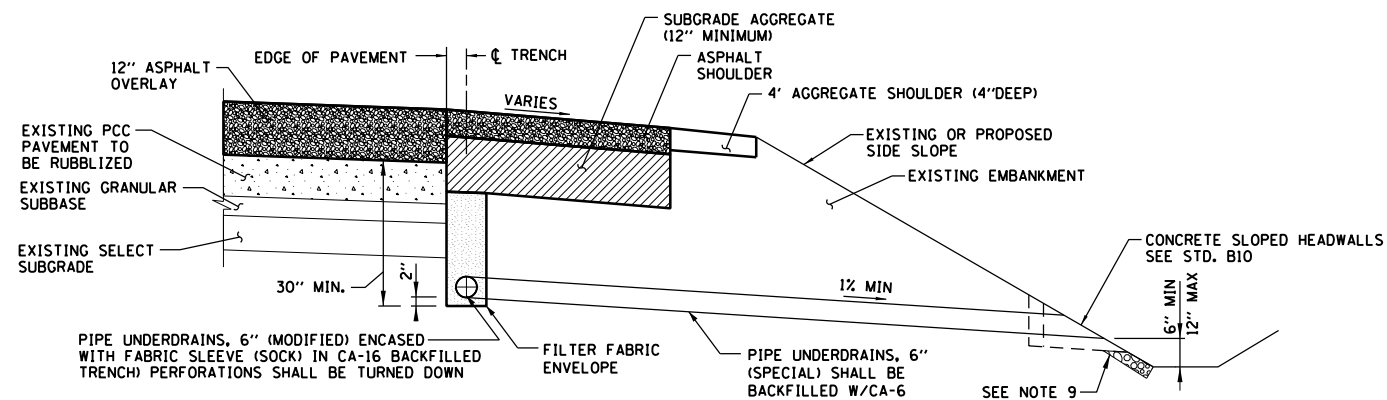
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 2-7-2012



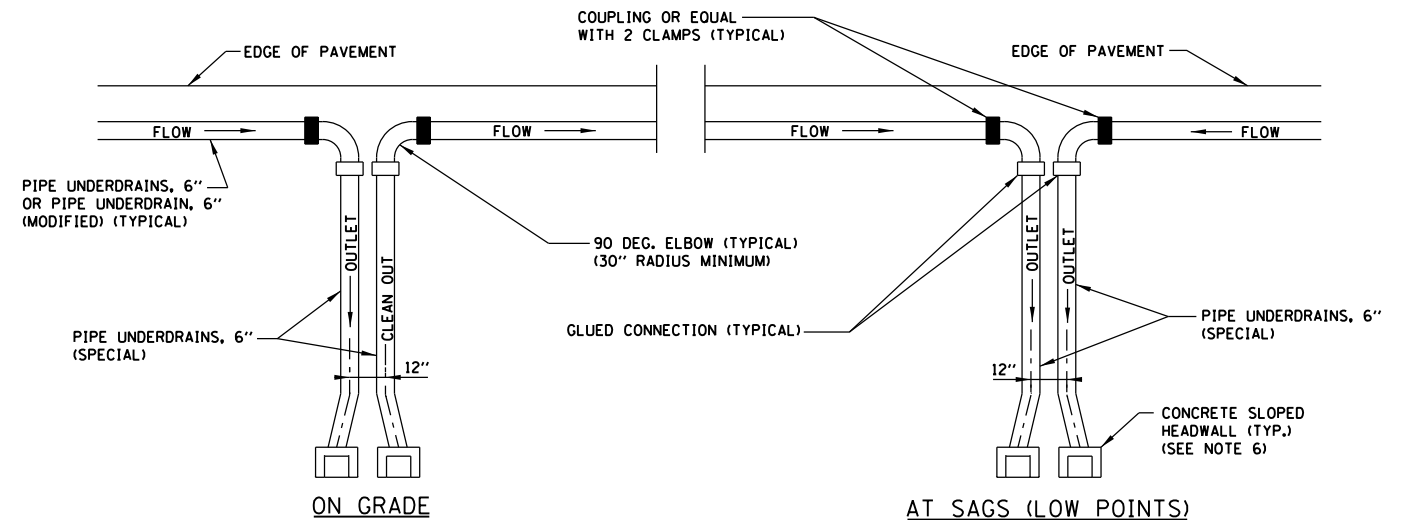
DETAIL OF PIPE UNDERDRAIN, 6''
(NEW CONSTRUCTION OR WIDENING WITHOUT GUTTER)



DETAIL OF PIPE UNDERDRAIN, 6''
(NEW CONSTRUCTION OR WIDENING WITH GUTTER)



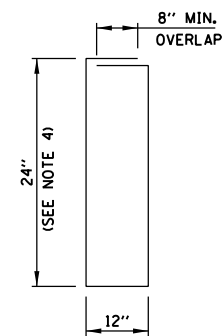
DETAIL OF PIPE UNDERDRAIN, 6'' (MODIFIED)
(RUBBLIZED CONCRETE PAVEMENT)



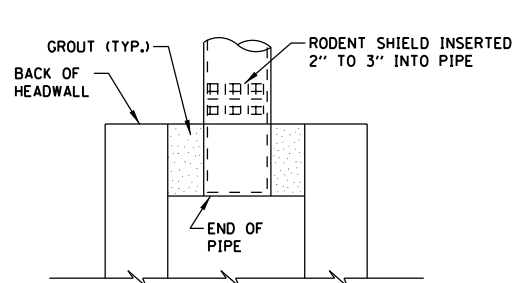
DETAIL OF PIPE UNDERDRAIN OUTLETS
(SEE NOTE 7)

NOTES FOR PIPE UNDERDRAIN

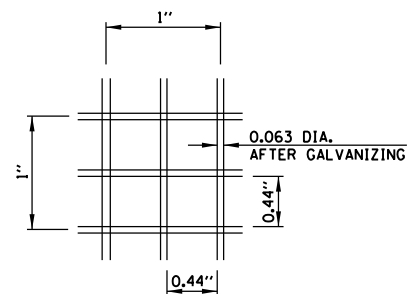
- FOR NEW CONSTRUCTION OR WIDENING PROJECTS, THE PIPE UNDERDRAIN INSTALLATION SHALL OCCUR AFTER SUBGRADE HAS BEEN PREPARED AND AFTER LIFT OF PGE BASE IS PLACED AND BEFORE 3" AND VARIES CA-6 CAPPING STONE IS PLACED. FOR PAVEMENT RUBBLIZATION PROJECTS, THE PIPE UNDERDRAIN SHALL BE INSTALLED PRIOR TO RUBBLIZATION.
- SUBGRADE AGGREGATE SHALL CONSIST OF A 3" AND VARIES CA-6 CAP ABOVE A PGE BASE. THICKNESS AS NOTED IN THE PLANS.
- ON SUPERELEVATED CURVES PLACE LONGITUDINAL UNDERDRAIN ON LOW SIDE ONLY.
- IN AREAS WHERE ROADWAY LONGITUDINAL GRADE IS LESS THAN 0.5%, DIMENSION WILL INCREASE AS NECESSARY TO MAINTAIN MINIMUM 0.5% SLOPE IN PIPE UNDERDRAIN.
- IF 500' MAXIMUM DISTANCE IS EXCEEDED, PIPE UNDERDRAIN SHALL BE INCREASED TO 8" DIAMETER AND TRENCH WIDTH INCREASED TO 16".
- AT OUTLET LOCATIONS, PIPE UNDERDRAINS SHALL SEPARATE SUFFICIENTLY TO PROVIDE SPACE FOR TWO CONCRETE SLOPED HEADWALLS, OR TWO PIPES CAN RUN PARALLEL INTO A LARGER HEADWALL.
- IN AREAS WHERE A CLOSED DRAINAGE SYSTEM EXISTS, THE PIPE UNDERDRAIN, 6" (SPECIAL) SHALL DRAIN TO THE NEAREST CATCH BASIN. THE UPPER END OF A RUN ON GRADE SHALL ALSO BE CONNECTED TO A CATCH BASIN TO BE USED AS A CLEANOUT.
- THE OUTLET END OF THE SUBDRAIN SHALL BE PROTECTED BY A PERMANENT RODENT SHIELD. THE RODENT SHIELD SHALL HAVE THE CONFIGURATION SHOWN AND BE CONSTRUCTED FROM HOT DIP GALVANIZED STEEL INDUSTRIAL WIRE CLOTH 3x3 MESH, 0.063"x0.063" WIRE SIZE IN ACCORDANCE WITH AASHTO M232 (ASTM A153). THE COST OF THE RODENT SHIELD IS INCLUDED IN CONCRETE SLOPED HEADWALL.
- FOR RUBBLIZATION PROJECTS, ADDITIONAL EROSION CONTROL MEASURES MAY BE NECESSARY AT THE BASE OF THE HEADWALL.
- FOR RUBBLIZATION PROJECTS, MAXIMUM DISTANCE SHALL BE 250 FT. REGARDLESS OF ROADWAY PROFILE.
- BOTTOM OF SUBGRADE SLOPE SHALL MATCH PAVEMENT SLOPE OF OUTSIDE LANE, BUT SHALL NOT BE LESS THAN 2%.



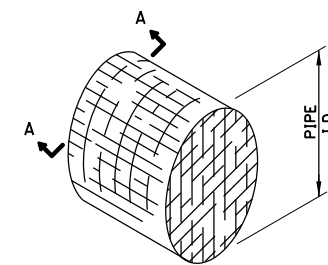
FILTER FABRIC ENVELOPE



RODENT SHIELD PLACEMENT



SECTION A-A



DETAIL OF RODENT SHIELD

MAXIMUM ALLOWABLE DRAINAGE DISTANCE TO OUTLET OR SEPARATION DISTANCE BETWEEN OUTLETS (SEE NOTE 10)	
ROADWAY PROFILE GRADE (%)	DISTANCE
≤ 1	250 FT.
BETWEEN 1 AND 2	375 FT.
≥ 2	500 FT. (NOTE 5)

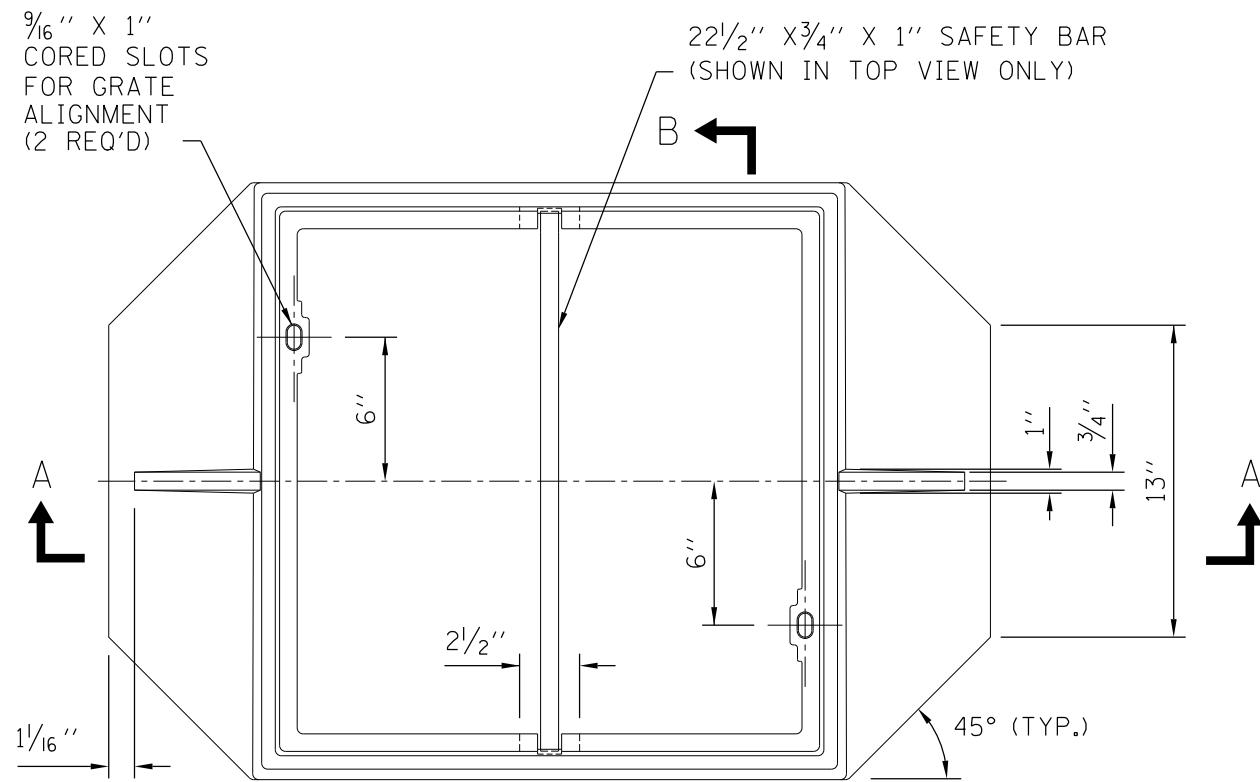
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 6-1-2009

DATE	REVISIONS
6-1-09	CHANGES TO PIPE UNDERDRAIN, 6" (MODIFIED) DETAIL
11-1-12	REVISED NOTES, MODIFIED PIPE UNDERDRAIN WITHOUT GUTTER

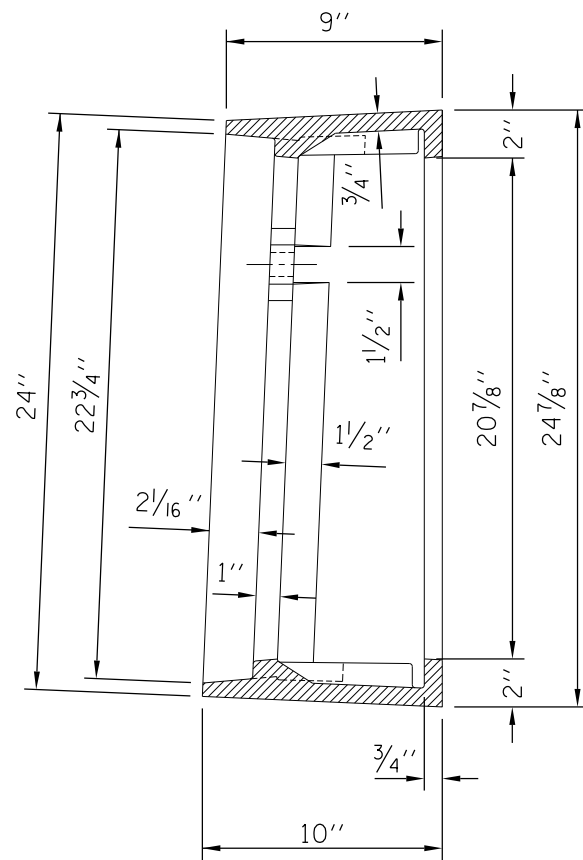
Illinois Tollway

PIPE UNDERDRAINS

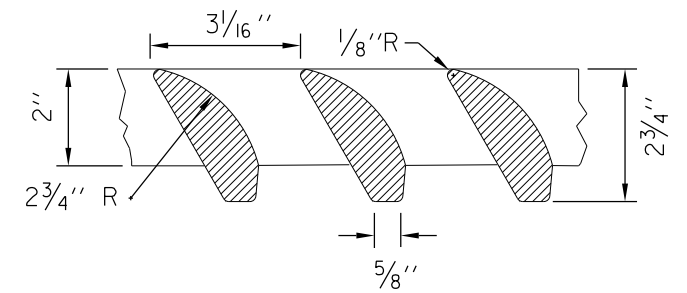
STANDARD B24-02



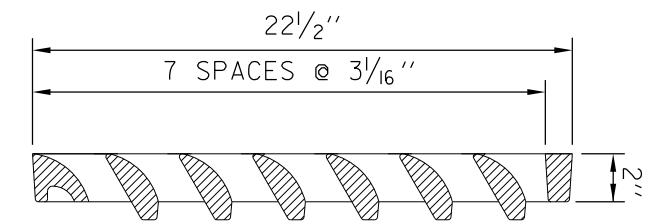
TOP VIEW



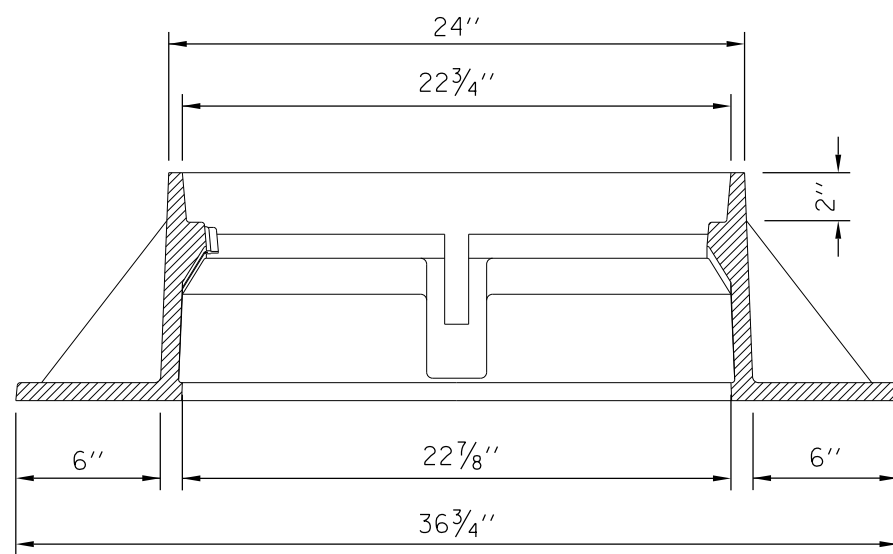
SECTION B-B



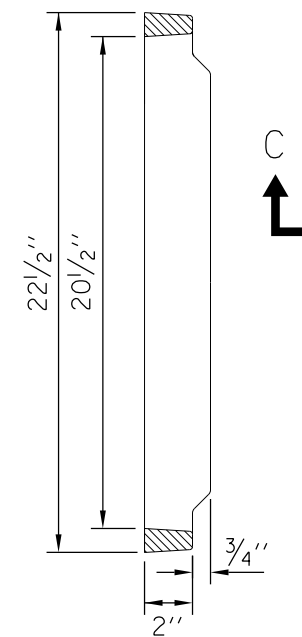
DETAIL OF VANES



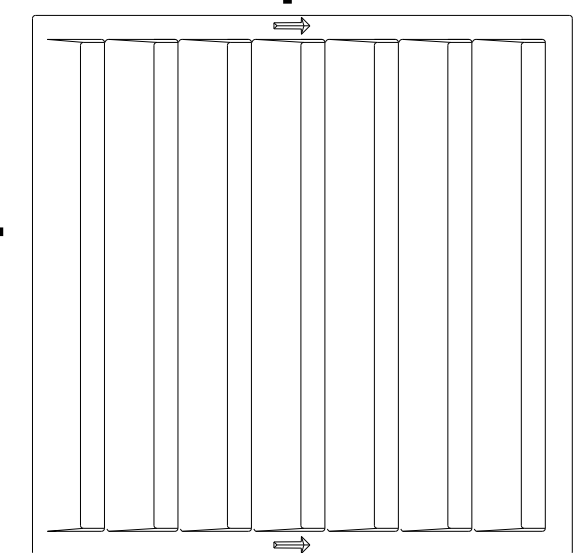
SECTION C-C



SECTION A-A
CAST FRAME



SECTION D-D



TOP VIEW

CAST GRATE

NOTES:

1. ALL FRAMES AND GRATES SHALL CONFORM TO THE REQUIREMENTS OF ART. 1006.14 FOR GRAY IRON CASTINGS AND TO ART. 1006.15 FOR DUCTILE IRON CASTINGS.
2. FRAME AND GRATE TO BE NEENAH FOUNDRY COMPANY, NEENAH NO. R-3528-V OR APPROVED EQUAL.
3. GRATE SHALL NOT BE BOLTED TO FRAME.

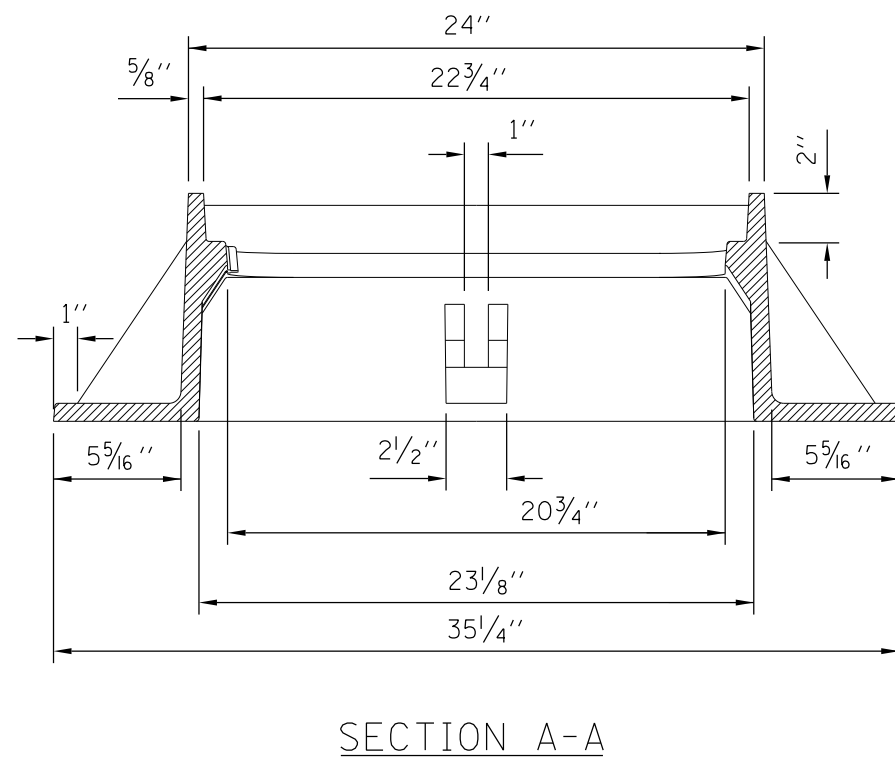
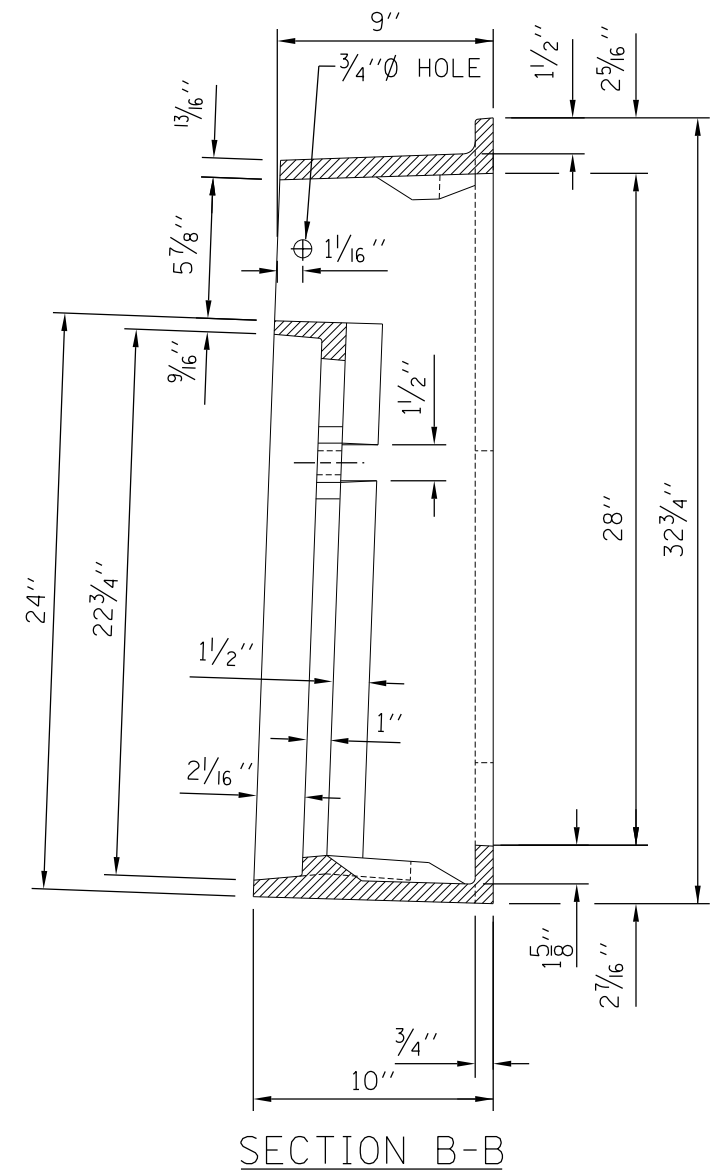
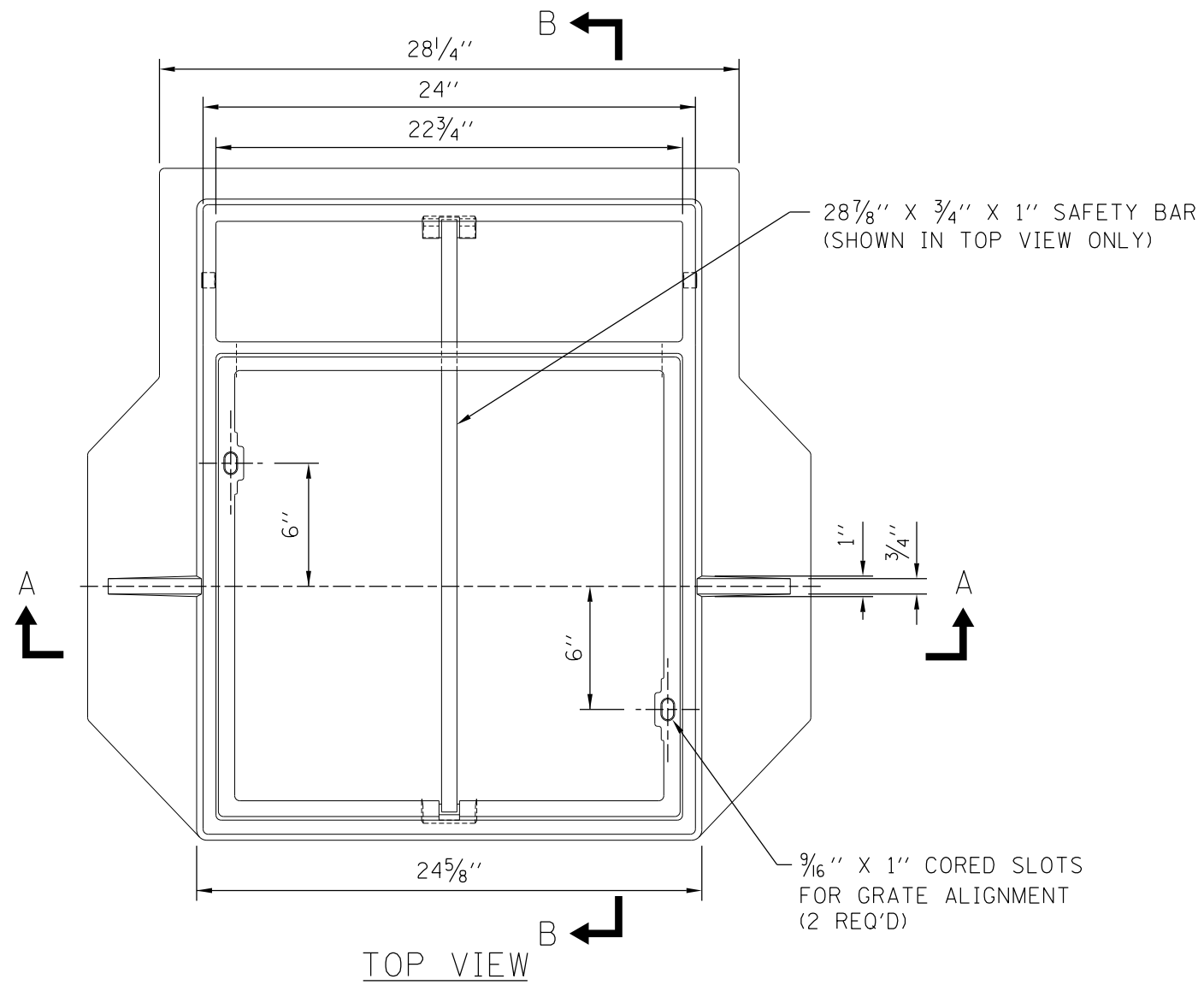
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 6-30-2008

DATE	REVISIONS



FRAME AND GRATE
TYPE 20A

STANDARD B25-00



SHEET 1 OF 2

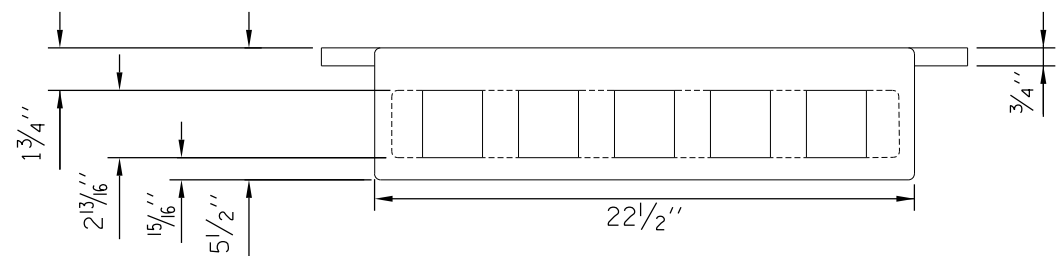


FRAME AND GRATE
TYPE 21A

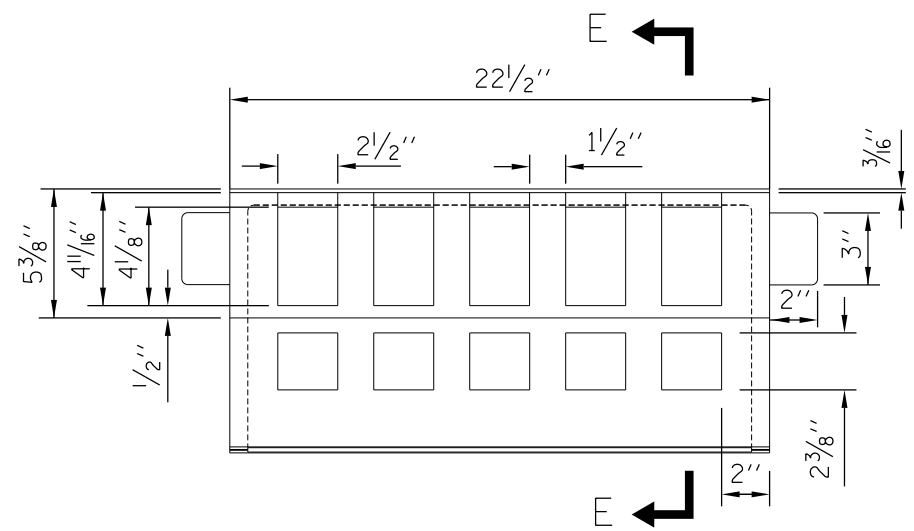
STANDARD B26-00

DATE	REVISIONS

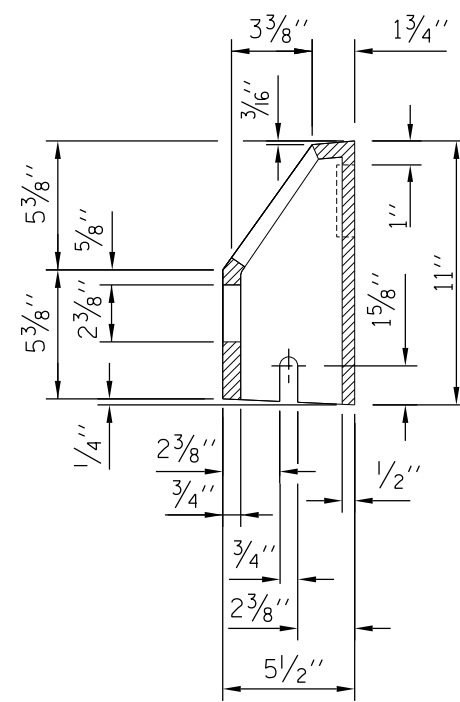
APPROVED *Paul Kovacs* DATE 6-30-2008
CHIEF ENGINEER



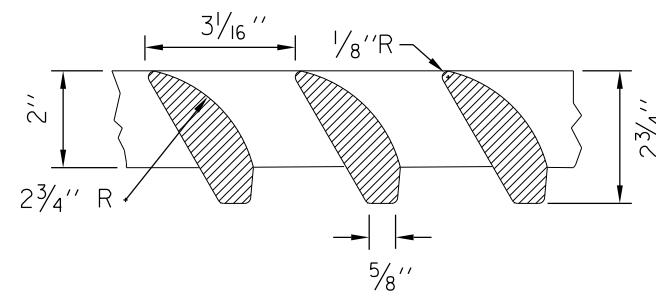
TOP VIEW



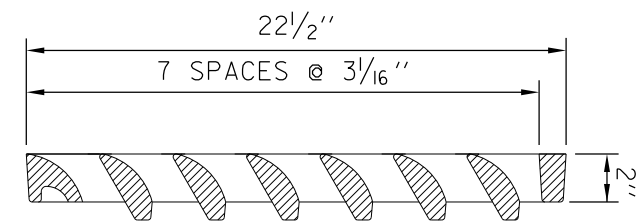
FRONT VIEW



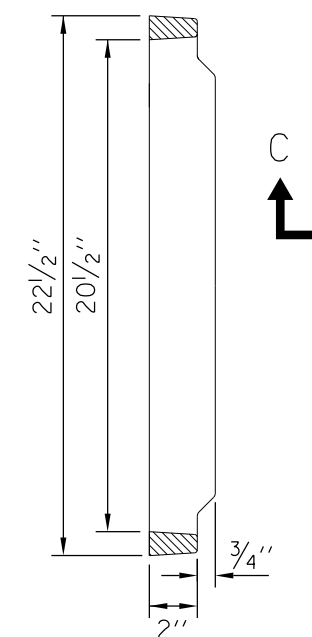
SECTION E-E



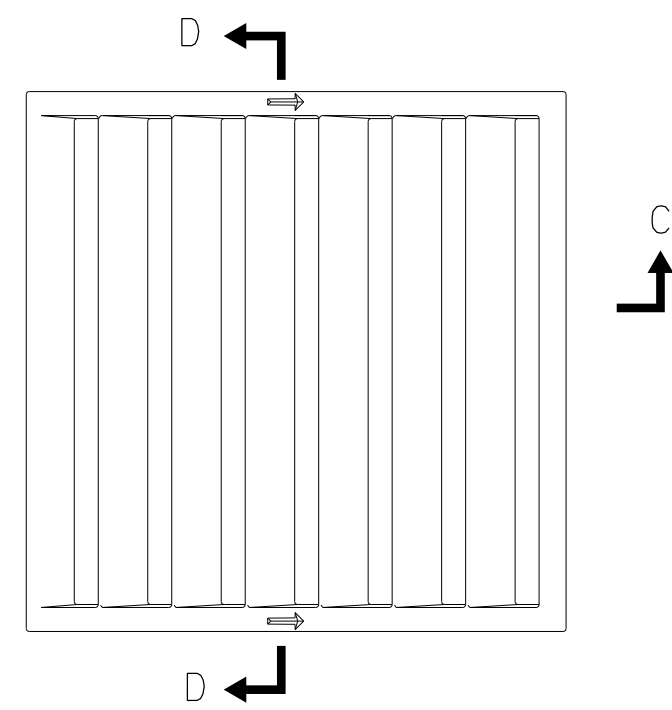
DETAIL OF VANES



SECTION C-C



SECTION D-D



TOP VIEW

CAST GRATE

CURB BOX

NOTES:

1. ALL FRAMES AND GRATES SHALL CONFORM TO THE REQUIREMENTS OF ART. 1006.14 FOR GRAY IRON CASTINGS AND TO ART. 1006.15 FOR DUCTILE IRON CASTINGS.
2. FRAME AND GRATE TO BE NEENAH FOUNDRY COMPANY, NEENAH NO. R-3527-VF OR APPROVED EQUAL.
3. GRATE SHALL NOT BE BOLTED TO FRAME.
4. CURB BOX SHALL BE BOLTED TO FRAME WITH 5/8" GALVANIZED HEX. HD. BOLT AND NUT WITH GALV. WASHERS.
5. CURB BOXES SHALL ONLY BE USED AT SAG LOCATIONS.

APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 6-30-2008

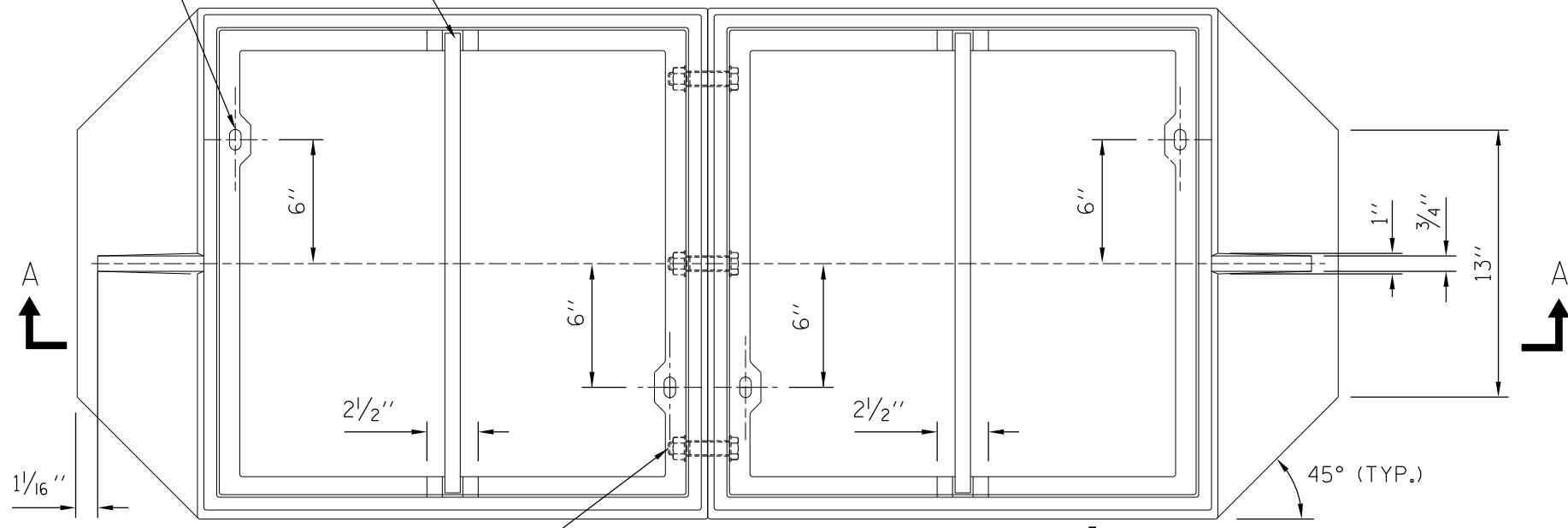


FRAME AND GRATE TYPE 21A

STANDARD B26-00

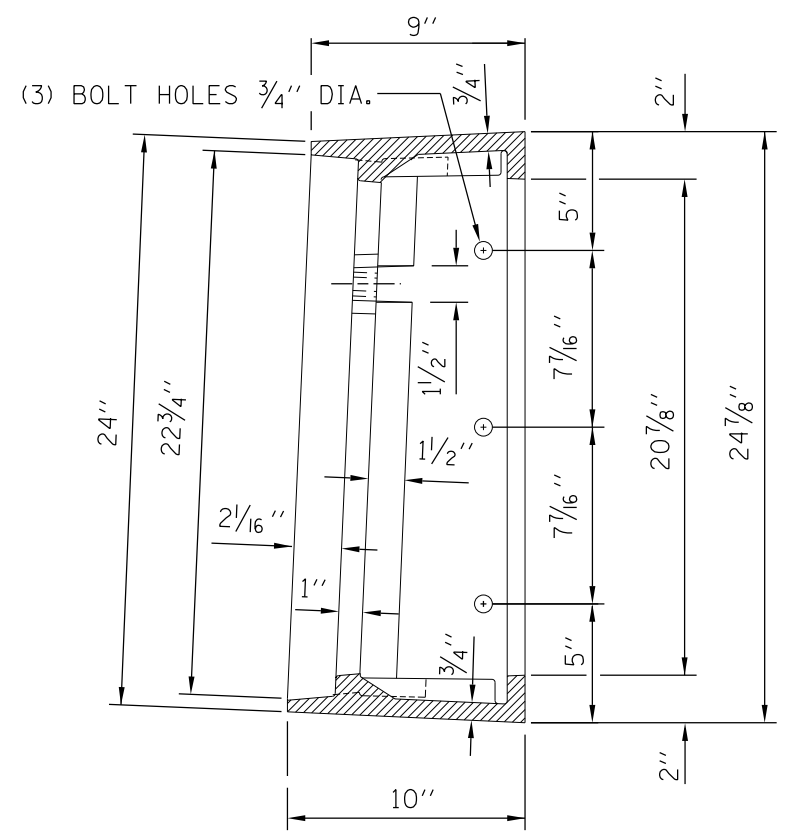
9/16" X 1"
CORED SLOTS
FOR GRATE
ALIGNMENT
(2 REQ'D
PER FRAME)

22 1/2" X 3/4" X 1" SAFETY BAR
(2 REQ'D) (SHOWN IN TOP
VIEW ONLY)

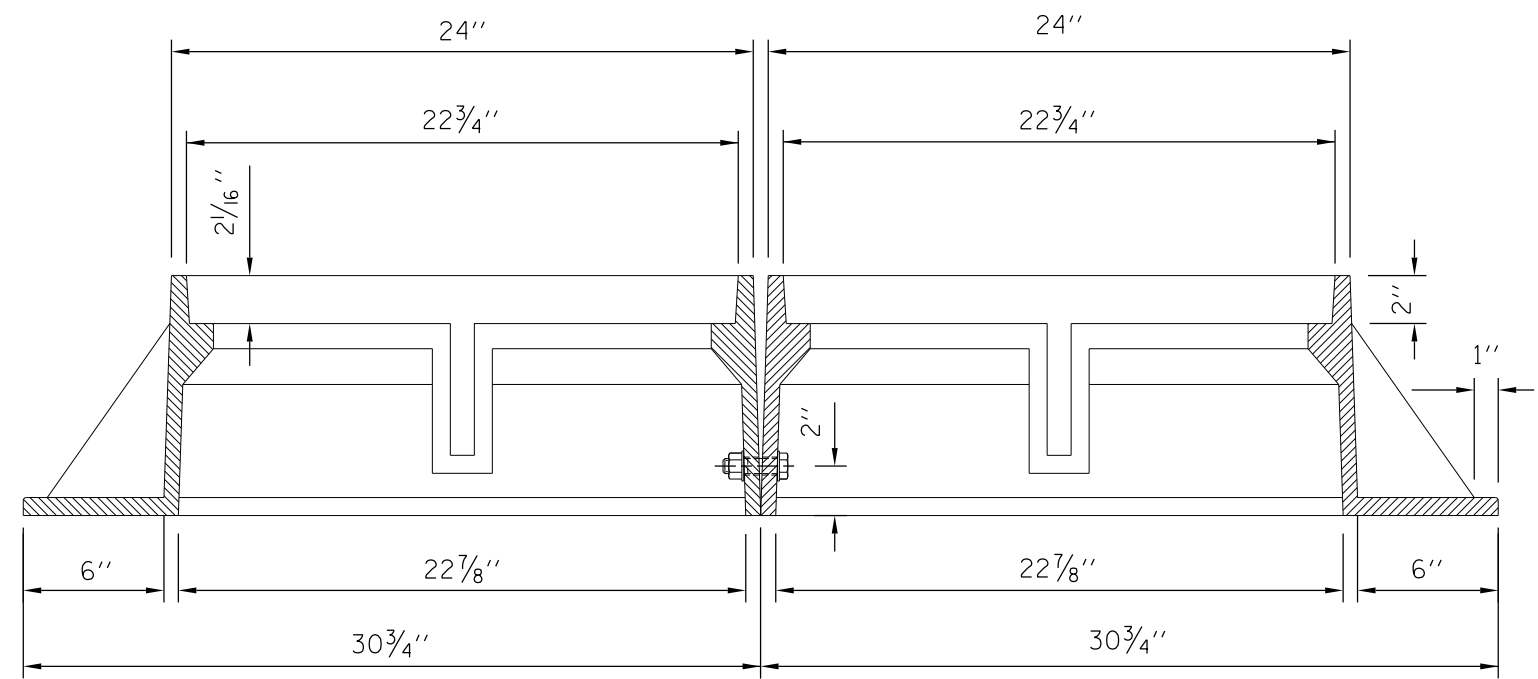


FRAMES BOLTED TOGETHER w/
(3) 5/8-11 X 3 GALV. HEX. HD.
BOLT AND NUT w/ GALV. WASHERS

TOP VIEW



SECTION B-B



SECTION A-A

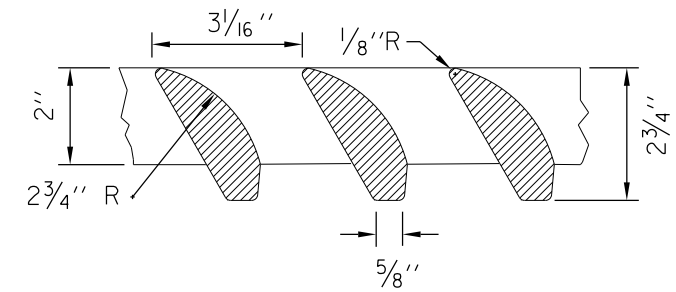


FRAME AND GRATE
TYPE 22A

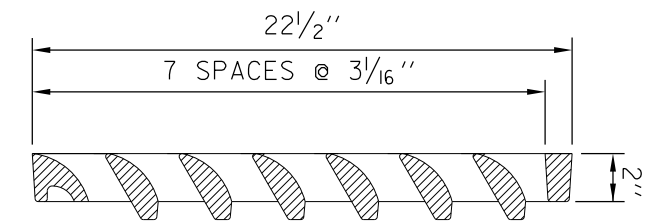
STANDARD B27-00

DATE	REVISIONS

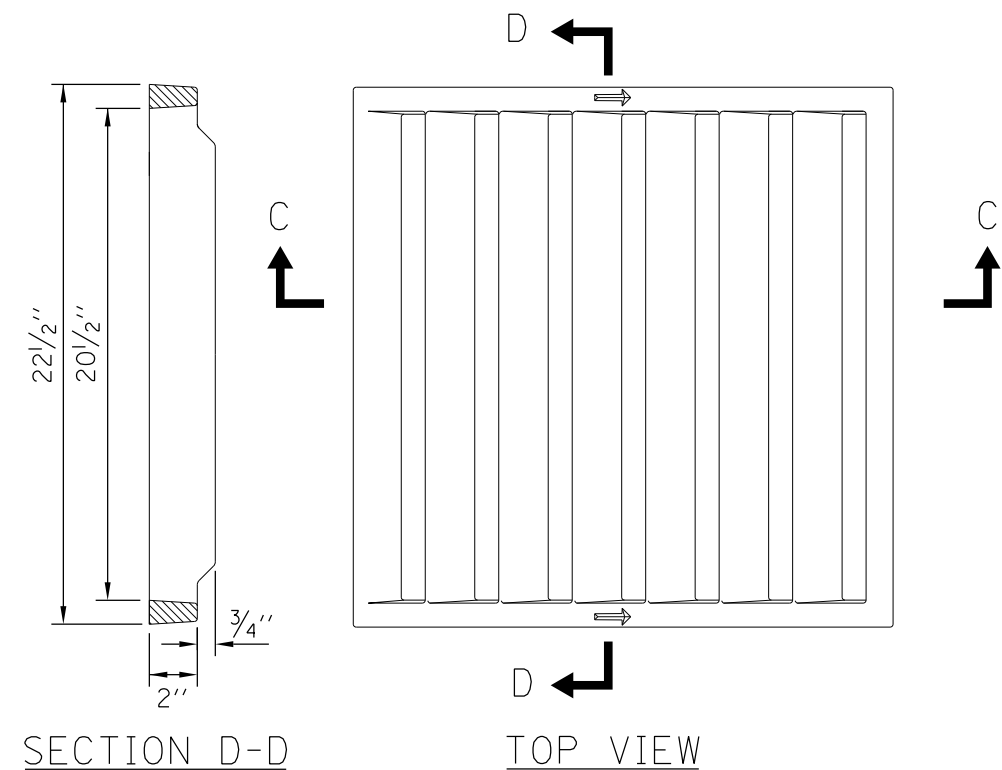
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 6-30-2008



DETAIL OF VANES



SECTION C-C



SECTION D-D

TOP VIEW

NOTES:

1. ALL FRAMES AND GRATES SHALL CONFORM TO THE REQUIREMENTS OF ART. 1006.14 FOR GRAY IRON CASTINGS AND TO ART. 1006.15 FOR DUCTILE IRON CASTINGS.
2. FRAME AND GRATE TO BE NEENAH FOUNDRY COMPANY, NEENAH NO. R-3529-V OR APPROVED EQUAL.
3. GRATE SHALL NOT BE BOLTED TO FRAME.

APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 6-30-2008

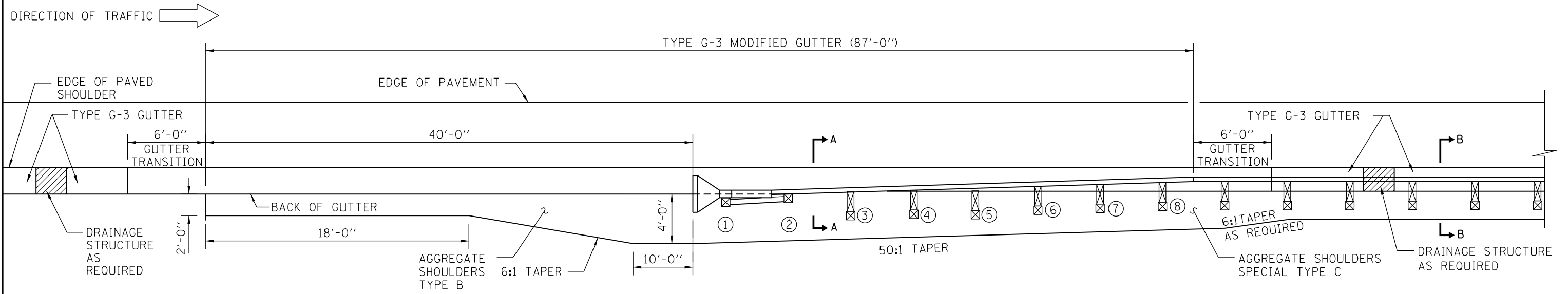
CAST GRATE
(2 REQ'D)

SHEET 2 OF 2

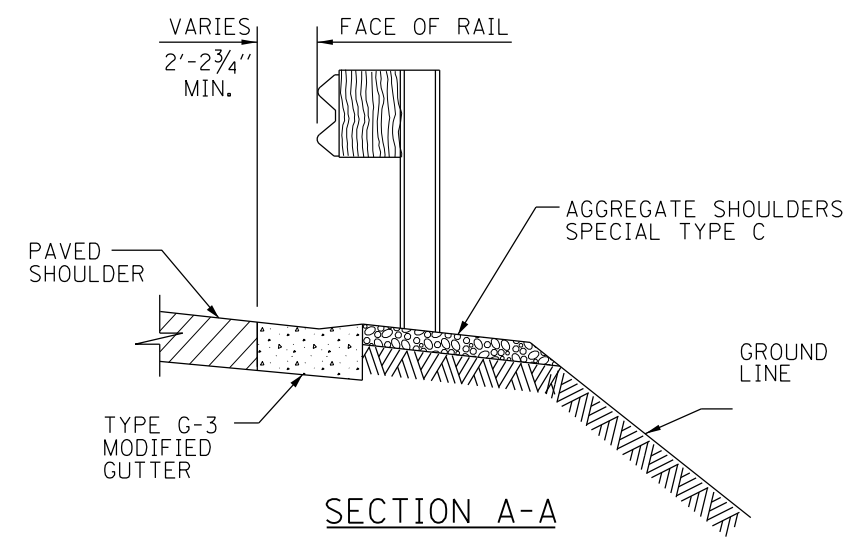


FRAME AND GRATE
TYPE 22A

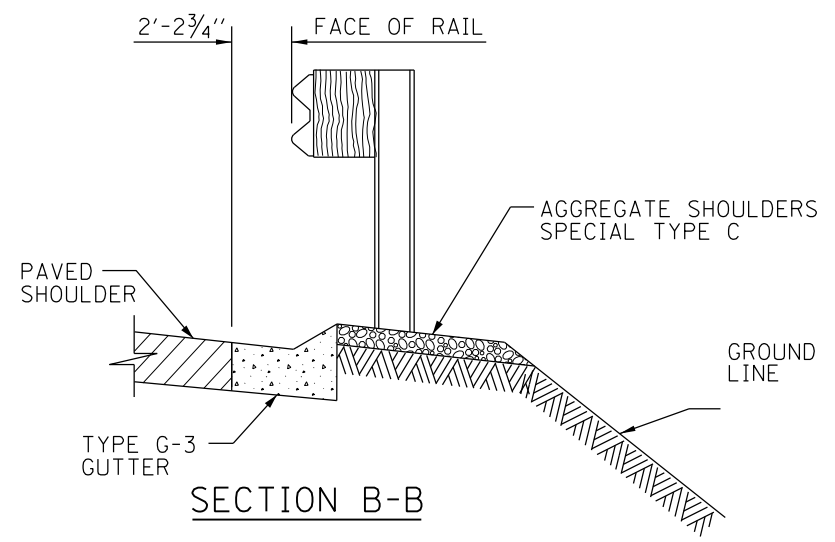
STANDARD B27-00



PLAN



SECTION A-A



SECTION B-B


TYPE G-3 GUTTER TRANSITION AT TRAFFIC BARRIER TERMINAL, TYPE T1 (SPECIAL)

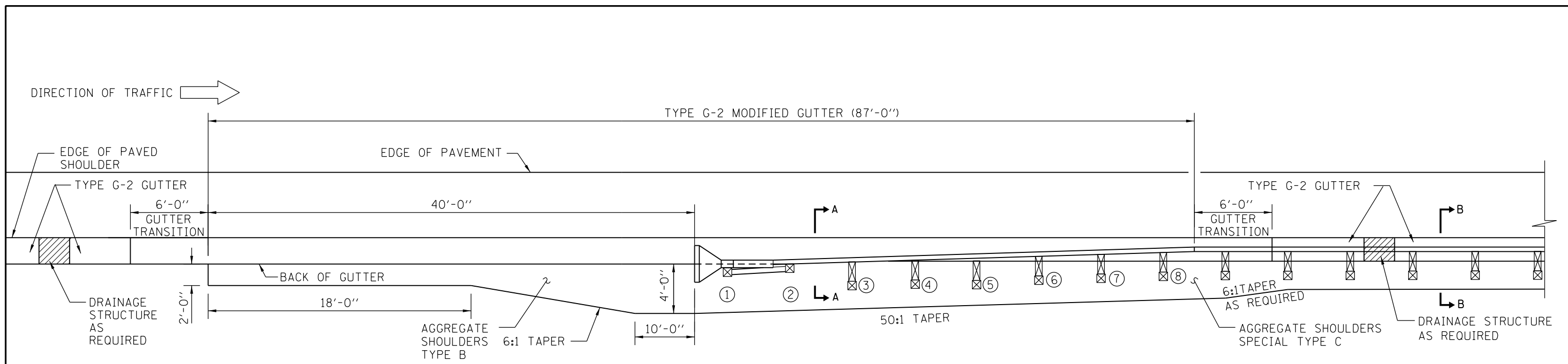
NOTE:
GUTTER TRANSITIONS WILL BE PAID FOR PER FOOT AS TYPE G-3 GUTTER.



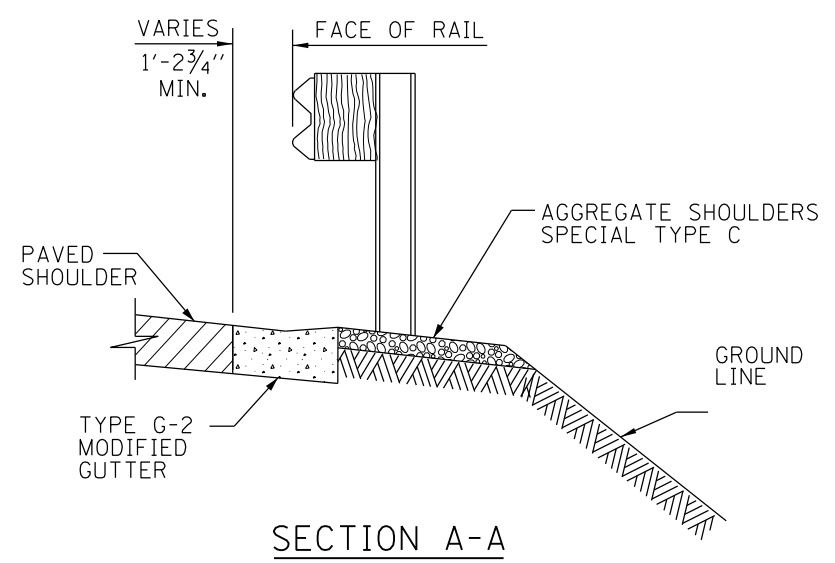
REVISIONS	
1-1-2011	REVISED GUTTER TRANSITION TERMINATION
3-1-2013	REVISED GUTTER

GUTTER TRANSITION AT TRAFFIC BARRIER TERMINAL, TYPE T1 (SPECIAL)
STANDARD B28-02

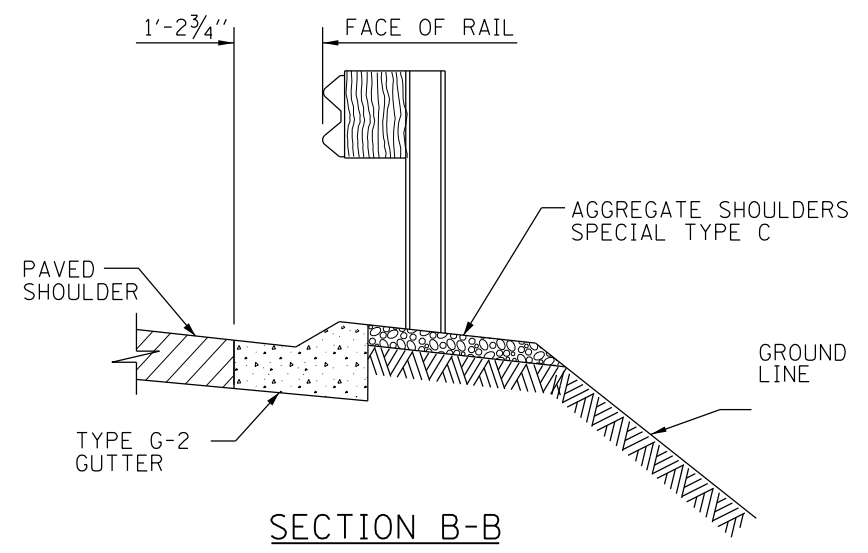
APPROVED.....

 CHIEF ENGINEER DATE 3-1-2010..



PLAN



SECTION A-A



SECTION B-B

NOTE:
GUTTER TRANSITIONS WILL BE PAID FOR PER FOOT AS TYPE G-2 GUTTER.

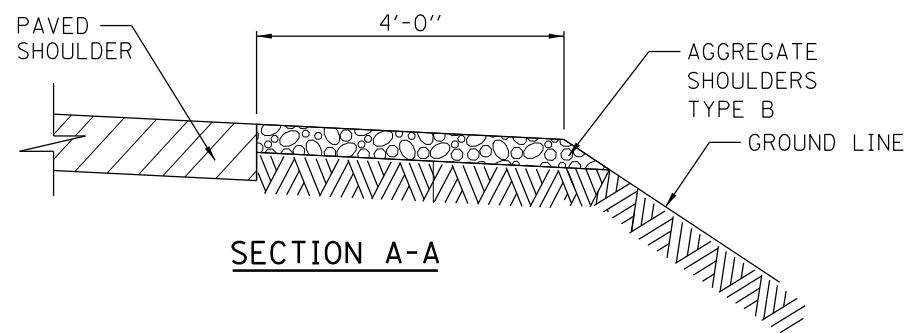
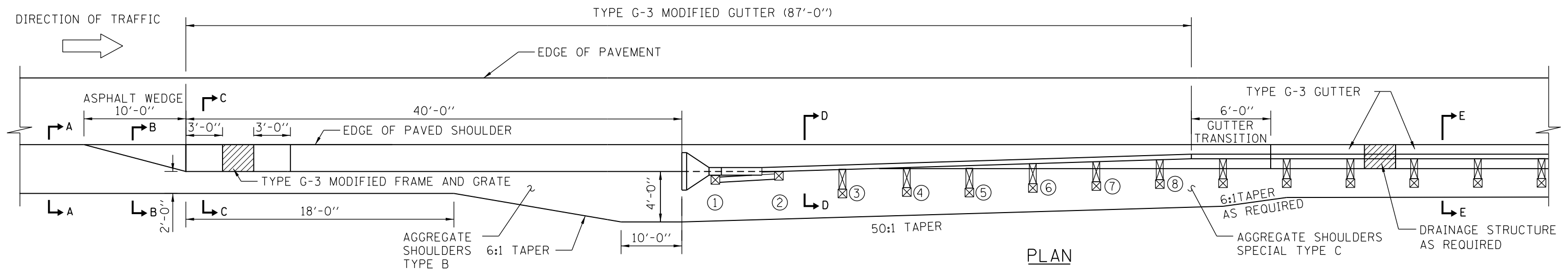


GUTTER TRANSITION AT
TRAFFIC BARRIER TERMINAL,
TYPE T1 (SPECIAL)

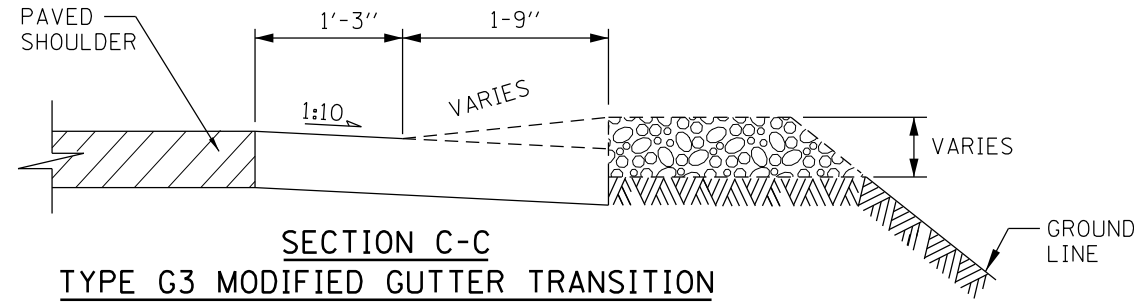
STANDARD B28-02

TYPE G-2 GUTTER TRANSITION AT TRAFFIC BARRIER TERMINAL, TYPE T1 (SPECIAL)

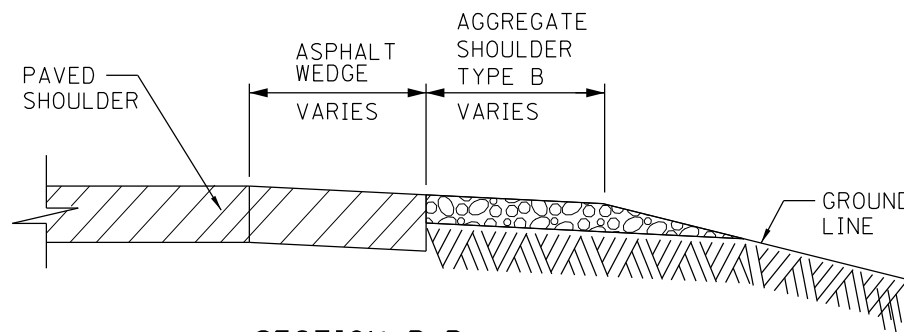
Paul Kovacs
APPROVED.....
CHIEF ENGINEER DATE 3-1-2010..



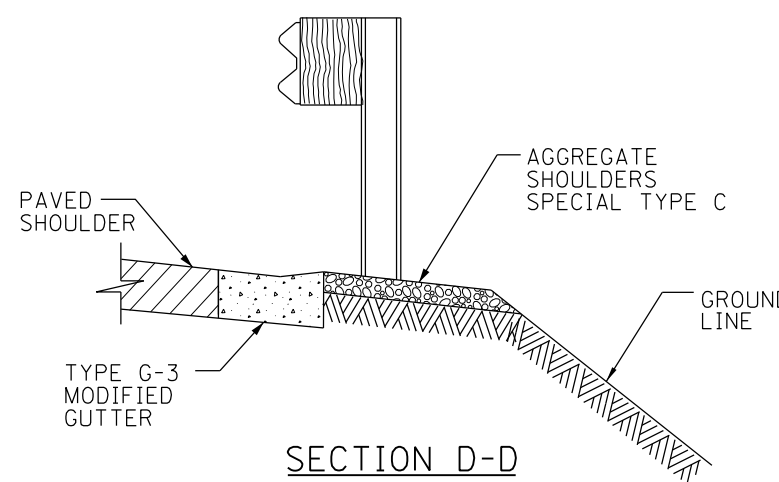
SECTION A-A



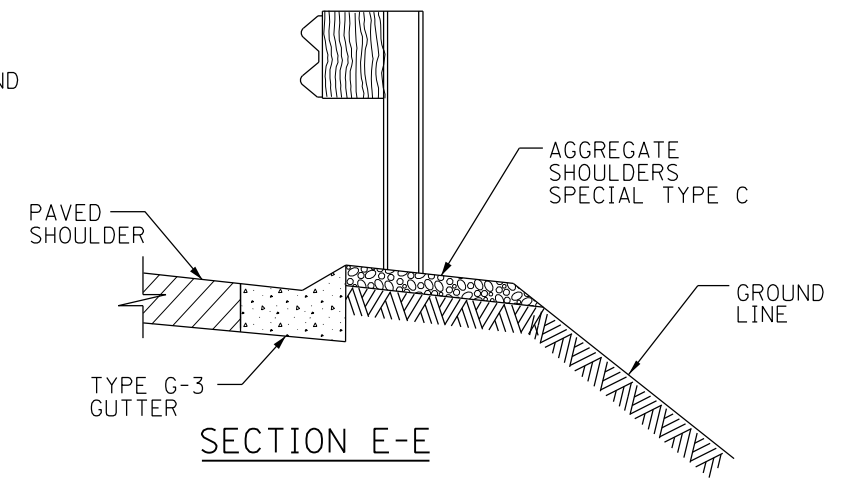
SECTION C-C
TYPE G3 MODIFIED GUTTER TRANSITION



SECTION B-B
ASPHALT SHOULDER TRANSITION



SECTION D-D



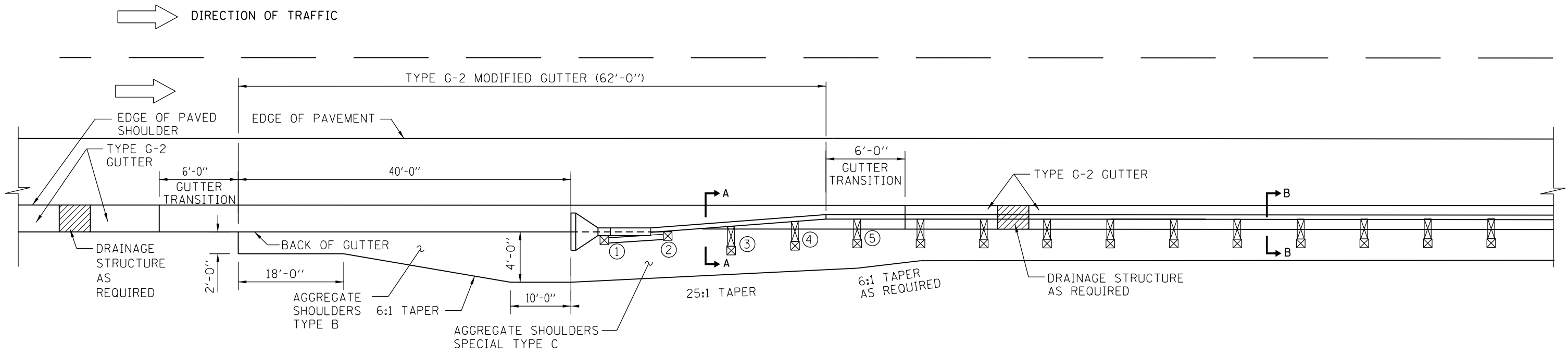
SECTION E-E

NOTE:
GUTTER TRANSITIONS WILL BE PAID FOR PER FOOT AS TYPE G-3 GUTTER.

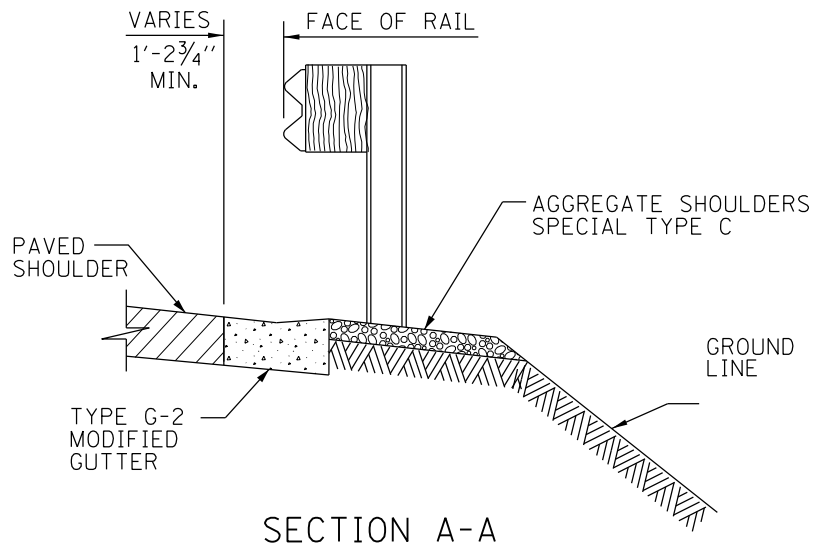
TYPE G-3 GUTTER TRANSITION TERMINATION AT TRAFFIC BARRIER TERMINAL,
TYPE T1 (SPECIAL)

APPROVED.....
DATE 3-1-2010..
CHIEF ENGINEER

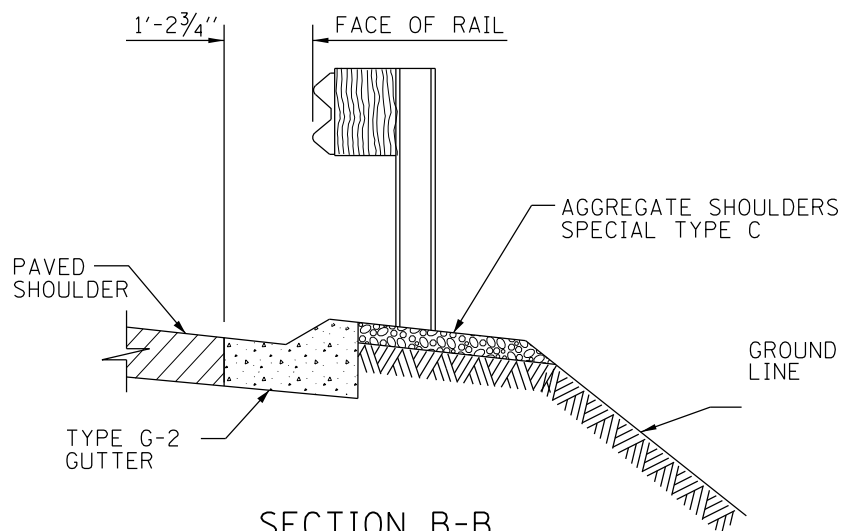




PLAN



SECTION A-A



SECTION B-B

NOTE:
GUTTER TRANSITIONS WILL BE PAID FOR PER FOOT AS TYPE G-2 GUTTER.

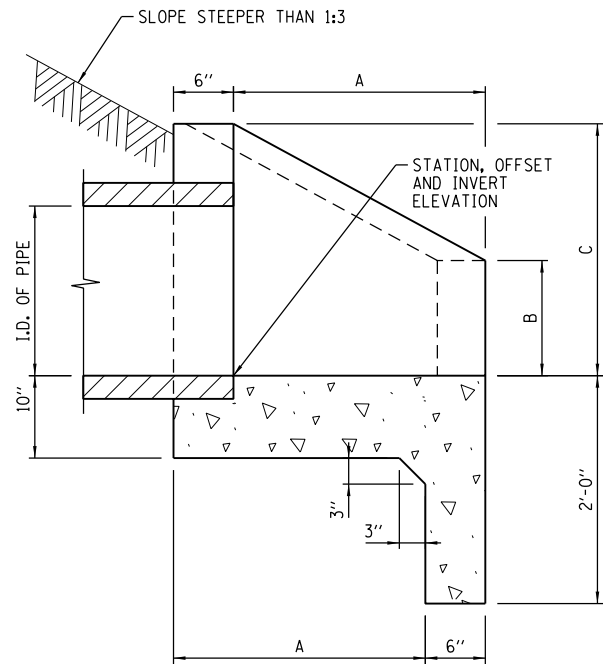
TYPE G-2 GUTTER TRANSITION AT TRAFFIC BARRIER TERMINAL, TYPE T1-A (SPECIAL)

APPROVED..... DATE 1-1-2011..
Paul Kovacs
 CHIEF ENGINEER

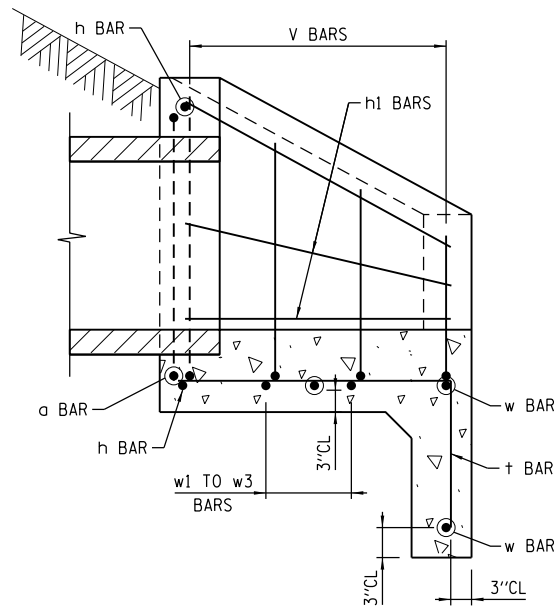
REVISIONS	
3-1-2013	REVISED GUTTER



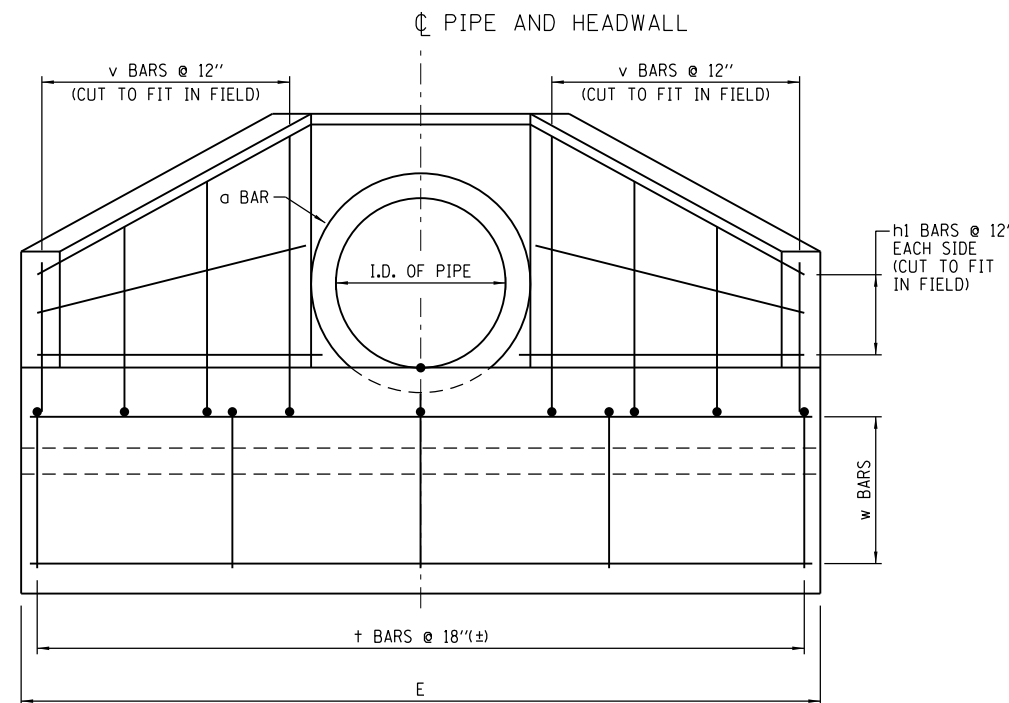
GUTTER TRANSITION AT TRAFFIC BARRIER TERMINAL, TYPE T1-A (SPECIAL)
 STANDARD B29-01



SECTION A-A
(DIMENSIONS)



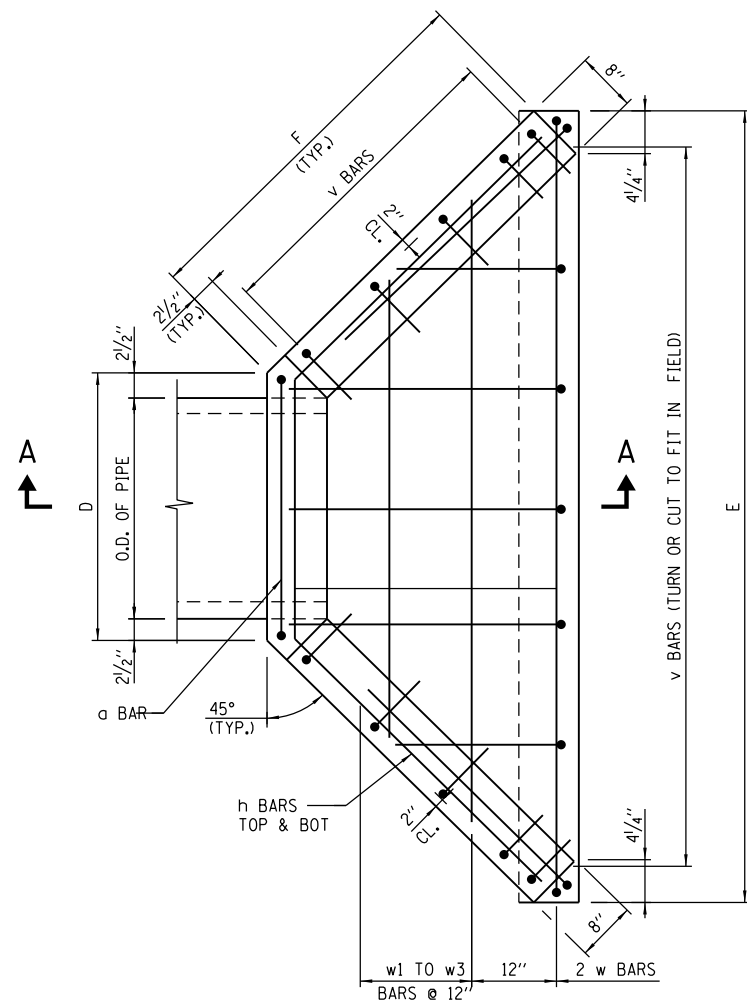
SECTION A-A
(REINFORCEMENT)



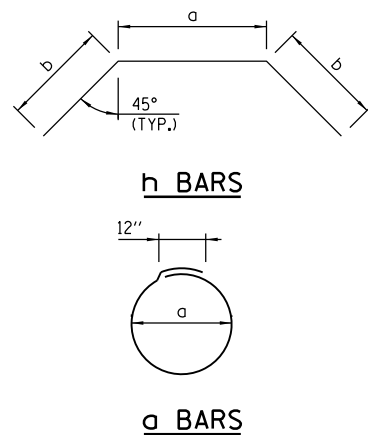
FRONT ELEVATION

NOTES:

1. SLOPED HEADWALL TYPES I AND II SHALL BE CONSTRUCTED FLUSH WITH EXISTING OR PROPOSED SLOPE.
2. CLASS SI CONCRETE SHALL BE USED THROUGHOUT.
3. ALL REINFORCEMENT BARS SHOWN SHALL BE EPOXY COATED.
4. BAR BENDING DETAILS ARE DIMENSIONED OUT TO OUT OF BARS.
5. ALL EXPOSED EDGES SHALL HAVE A 3/4"-45° CHAMFER. CHAMFER ON VERTICAL EDGES SHALL BE CONTINUED A MINIMUM OF ONE FOOT BELOW THE FINISHED GROUND LINE.
6. COVER FROM THE FACE OF CONCRETE TO FACE OF REINFORCEMENT BAR SHALL BE 3" FOR SURFACES FORMED AGAINST EARTH AND 2" FOR ALL OTHER SURFACES UNLESS OTHERWISE SHOWN.
7. CARE SHALL BE EXERCISED IN REMOVING ANY LENGTH OF EXISTING PIPE SO THE REMAINING PIPE IS UNDAMAGED AND FULLY FUNCTIONING.
8. ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENT.
9. TYPES I AND II HEADWALLS TO BE USED ONLY FOR SLOPES STEEPER THAN 1:3. DIMENSIONS AND QUANTITIES ARE BASES ON A SLOPE 1:2.
10. I.D. DENOTES INSIDE DIAMETER OF PIPE.
O.D. DENOTES OUTSIDE DIAMETER OF PIPE.



PLAN



v - BARS
t - BARS

TABLE OF DIMENSIONS AND QUANTITIES FOR ONE HEADWALL

INSIDE DIA. OF PIPE	SLOPE OF FILL	DIMENSIONS						CL. SI CONC.	REINF. BARS.
		A	B	C	D	E	F		
21"	1:3	2'-6"	1'-2"	2'-6"	2'-8"	7'-11 1/2"	3'-6 1/2"	1.6 C.Y.	75 #
24"	1:3	2'-10"	1'-4"	2'-9"	2'-11"	8'-10 1/2"	4'-2 1/2"	2.1 C.Y.	80 #
27"	1:3	3'-2"	1'-8"	3'-0"	3'-3"	9'-7"	4'-5 3/4"	2.0 C.Y.	100 #
30"	1:3	3'-4"	1'-7"	3'-3"	3'-6"	10'-5 1/2"	4'-11"	2.7 C.Y.	120 #
36"	1:3	4'-0"	1'-10"	3'-10"	4'-1"	12'-4 1/2"	5'-10 1/2"	3.6 C.Y.	145 #

TABLE OF REINFORCING STEEL FOR ONE HEADWALL

BAR	MARK	SIZE	21" I.D. PIPE				24" I.D. PIPE				27" I.D. PIPE				30" I.D. PIPE				36" I.D. PIPE			
			NO.	LENGTH	a	b	NO.	LENGTH	a	b	NO.	LENGTH	a	b	NO.	LENGTH	a	b	NO.	LENGTH	a	b
a	#4	1	9'-3"	31 1/2"	-	1	10'-2"	35"	-	1	11'-1"	38 1/2"	-	1	12'-0"	42"	-	1	13'-10"	49"	-	
h	#4	2	8'-7"	2'-3"	3'-2"	2	10'-2"	2'-6"	3'-10"	2	11'-0"	2'-10"	4'-1"	2	9'-5"	3'-1"	3'-2"	2	11'-0"	3'-8"	4'-1"	
h1	#4	4	3'-2"	-	-	4	3'-10"	-	-	4	4'-2"	-	-	5	4'-7"	-	-	6	5'-6"	-	-	
v	#4	8	4'-0"	1'-0"	3'-0"	8	4'-3"	1'-0"	3'-3"	8	4'-6"	1'-0"	3'-6"	10	4'-9"	1'-0"	3'-9"	10	5'-4"	1'-0"	4'-4"	
t	#4	6	4'-0"	1'-6"	2'-6"	6	4'-3"	1'-6"	2'-9"	6	4'-8"	1'-6"	3'-1"	7	4'-10"	1'-6"	3'-4"	8	5'-4"	1'-6"	3'-10"	
w	#4	2	7'-7"	-	-	2	8'-6"	-	-	2	10'-1"	-	-	2	10'-0"	-	-	2	12'-0"	-	-	
w1	#4	1	6'-0"	-	-	1	6'-11"	-	-	1	7'-11"	-	-	1	8'-7"	-	-	1	10'-6"	-	-	
w2	#4	1	4'-0"	-	-	1	4'-11"	-	-	1	5'-11"	-	-	1	6'-7"	-	-	1	8'-6"	-	-	
w3	#4	-	-	-	-	-	-	-	-	-	-	-	-	1	4'-7"	-	-	1	7'-6"	-	-	

APPROVED: *Paul Kovacs*
CHIEF ENGINEER DATE 2-7-2012

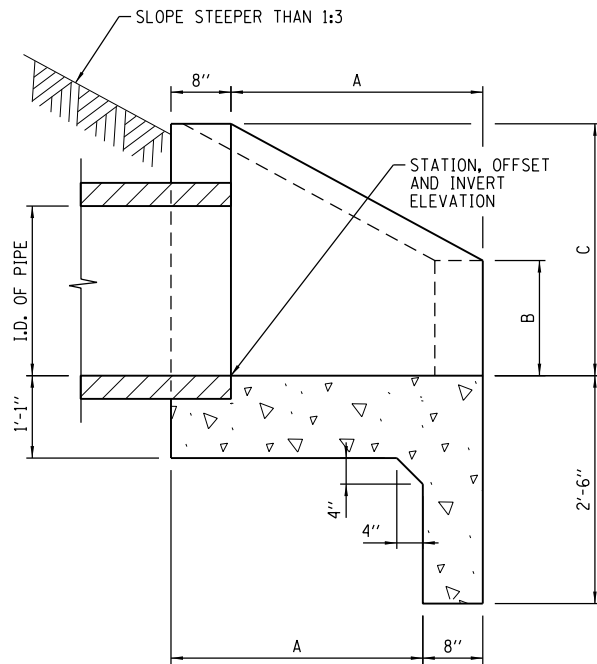
HEADWALL - TYPE I
(PIPE DIAMETER ≤ 36")

DATE	REVISIONS
2-7-2012	ADDED 21" AND 27" DIA. PIPE AND REVISED TABLE QUANTITIES

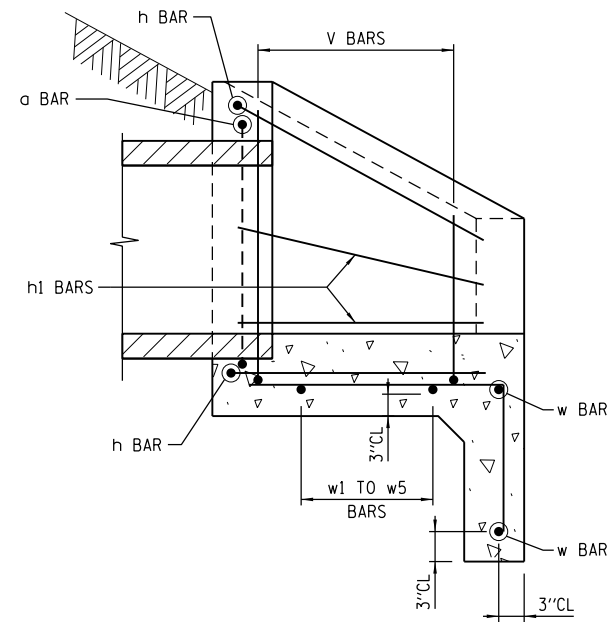


HEADWALLS
TYPE I AND II

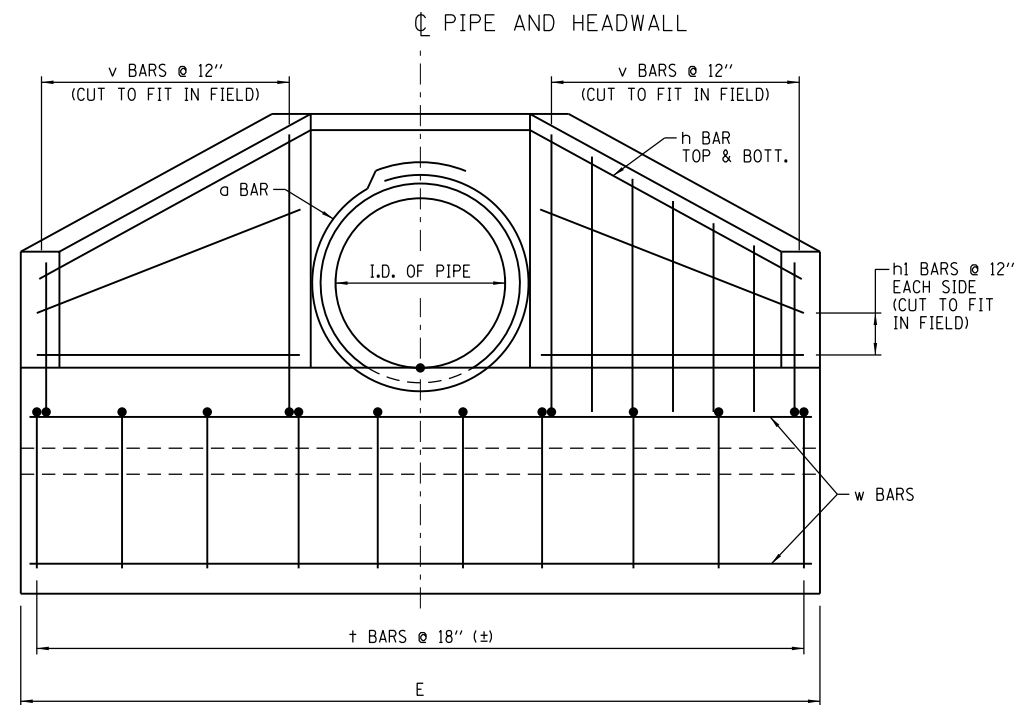
STANDARD B30-01



SECTION A-A
(DIMENSIONS)

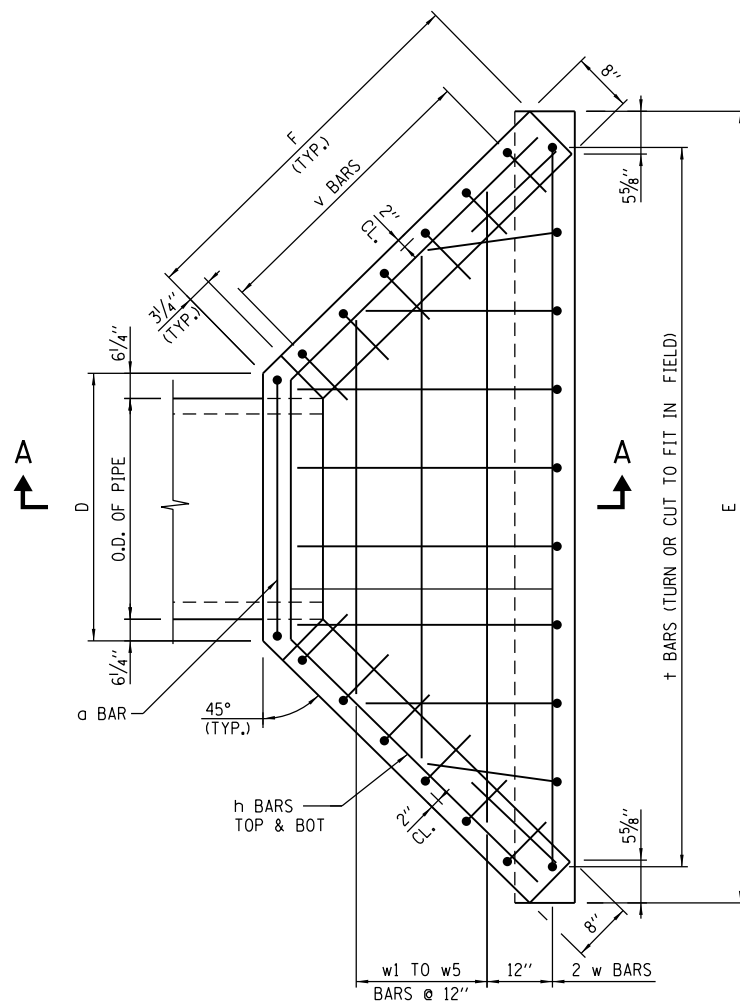


SECTION A-A
(REINFORCEMENT)

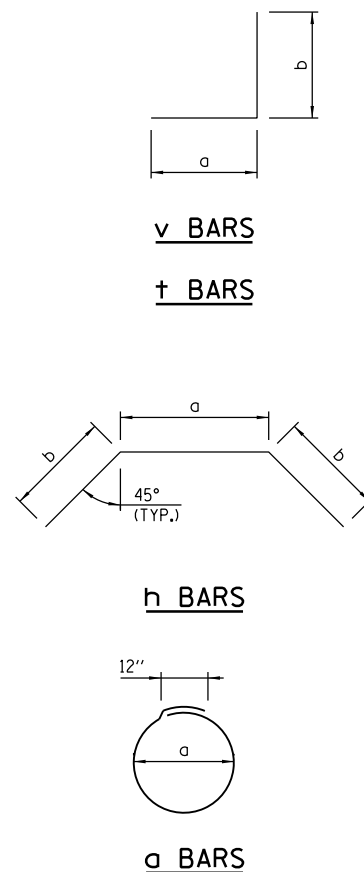


FRONT ELEVATION

NOTE:
1. FOR ADDITIONAL NOTES SEE SHEET 1 OF 2 IN THIS SERIES.



PLAN



v BARS

t BARS

h BARS

a BARS

TABLE OF BARS FOR ONE HEADWALL

BAR	42" PIPE				48" PIPE				54" I.D. PIPE				60" I.D. PIPE					
	MARK	SIZE	NO.	LENGTH	a	b	NO.	LENGTH	a	b	NO.	LENGTH	a	b	NO.	LENGTH	a	b
a	#5	2	15'-11"	4'-9"	-	2	17'-9"	5'-4"	-	2	19'-7"	5'-11"	-	2	21'-5"	6'-6"	-	-
h	#5	2	17'-7"	5'-3"	6'-2"	2	19'-9"	5'-9"	7'-0"	2	22'-0"	6'-4"	7'-10"	2	24'-1"	6'-9"	8'-8"	-
h1	#5	8	6'-6"	-	-	10	7'-4"	-	-	10	8'-2"	-	-	12	9'-0"	-	-	-
t	#5	10	6'-1"	1'-6"	4'-7"	11	6'-8"	1'-6"	5'-2"	13	7'-3"	1'-6"	5'-9"	15	7'-10"	1'-6"	6'-4"	-
v	#5	14	5'-10"	1'-0"	4'-10"	16	6'-6"	1'-0"	5'-6"	16	7'-1"	1'-0"	6'-1"	18	7'-8"	1'-0"	6'-8"	-
w	#5	2	14'-3"	-	-	2	15'-10"	-	-	2	17'-8"	-	-	2	18'-10"	-	-	-
w1	#5	1	12'-0"	-	-	1	13'-8"	-	-	1	15'-2"	-	-	1	16'-10"	-	-	-
w2	#5	1	10'-0"	-	-	1	11'-8"	-	-	1	13'-4"	-	-	1	15'-0"	-	-	-
w3	#5	1	8'-0"	-	-	1	9'-8"	-	-	1	11'-6"	-	-	1	13'-2"	-	-	-
w4	#5	-	-	-	-	1	8'-0"	-	-	1	9'-8"	-	-	1	11'-4"	-	-	-
w5	#5	-	-	-	-	-	-	-	-	-	7'-8"	-	-	1	9'-6"	-	-	-

TABLE OF DIMENSIONS AND QUANTITIES FOR ONE HEADWALL

INSIDE DIA. OF PIPE	SLOPE OF FILL	DIMENSIONS						CL. SP CONC.	REINF. BARS.
		A	B	C	D	E	F		
42"	1:3	4'-5"	2'-2"	4'-4 1/2"	5'-6"	14'-9"	6'-6 1/4"	3.8 C.Y.	400 #
48"	1:3	5'-0"	2'-5"	4'-11"	6'-0"	16'-4 3/4"	7'-4 1/4"	4.1 C.Y.	450 #
54"	1:3	5'-7"	2'-8"	5'-5 1/2"	6'-7"	18'-1 3/4"	8'-2"	5.6 C.Y.	500 #
60"	1:3	6'-2"	2'-11"	6'-0"	7'-0"	19'-2 3/4"	9'-0"	6.5 C.Y.	600 #

