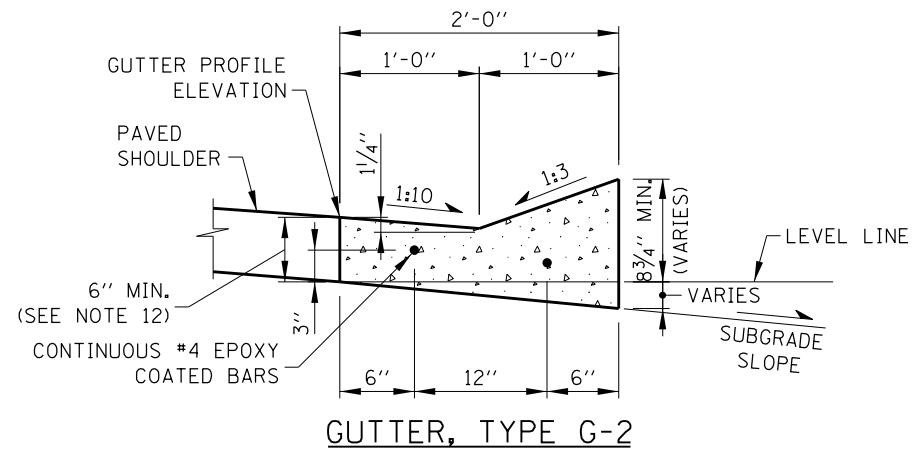


**Illinois Tollway Standard Drawing Revisions**

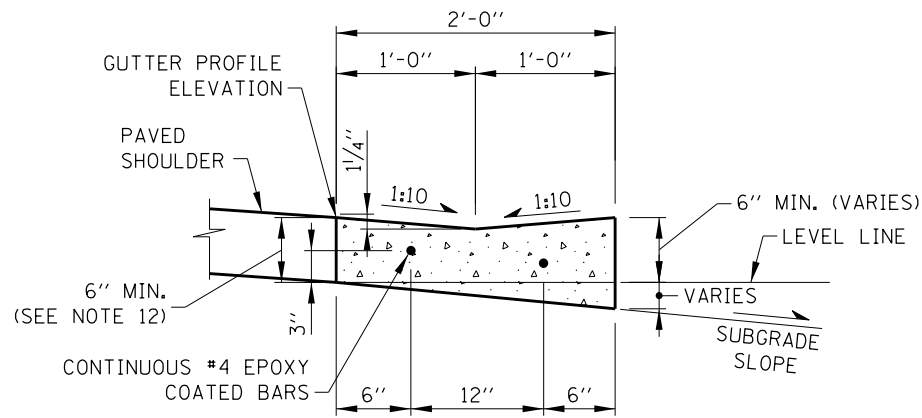
<b>Section B</b>		<b>Drainage Structures, Curbs &amp; Gutter</b>	
<b>Standard</b>	<b>Modification Summary</b>	<b>Effective: 03-01-2021</b>	
<b>B6</b>	<b>Headwall Type III 18"-24"-30"-36"-42"-48"-54"-60" For 1:3, 1:4, 1:6, and 1:10 Slopes</b>		
Sheet 1	Noted in Section A-A that the 'h' bars shall be cut in field to fit.		
Sheet 2	Adjusted the length of 'h' bars for the Headwall Type III 1:3 Slope.		
<b>B10</b>	<b>Sloped Headwalls Type III Details</b>		
Sheet 1	Added an 8" Sloped Headwall Type III for 1:3, 1:4, and 1:6 slopes.		
<b>B24</b>	<b>Pipe Underdrains</b>		
Sheet 1	Added pipe underdrain details for location with barrier.		

 New Sheet

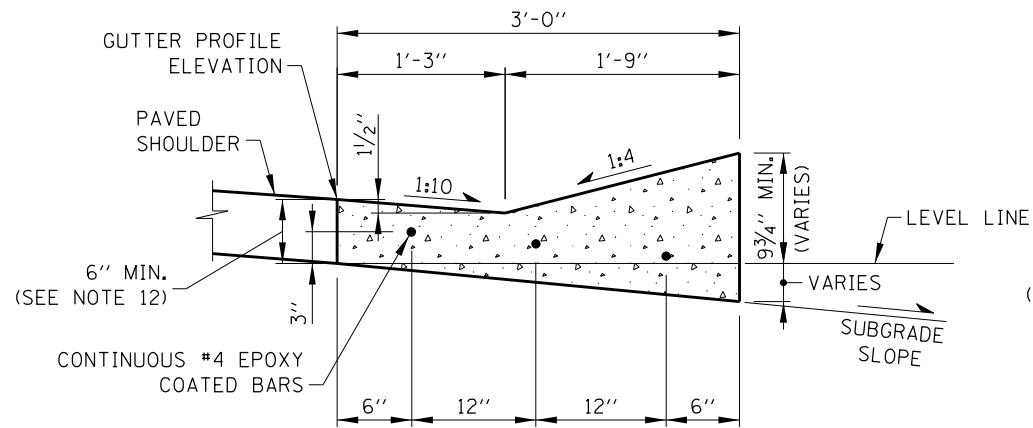
 Retired Standard



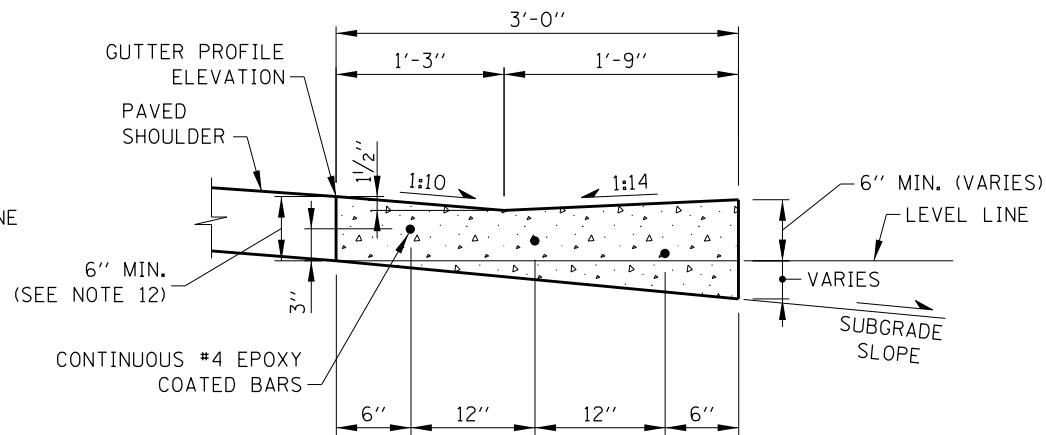
GUTTER, TYPE G-2



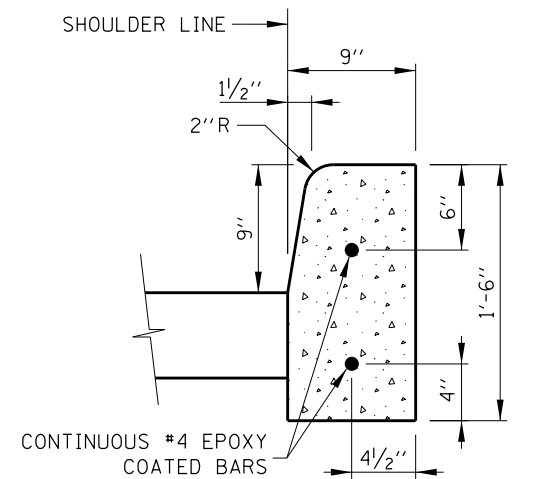
GUTTER, TYPE G-2, MODIFIED



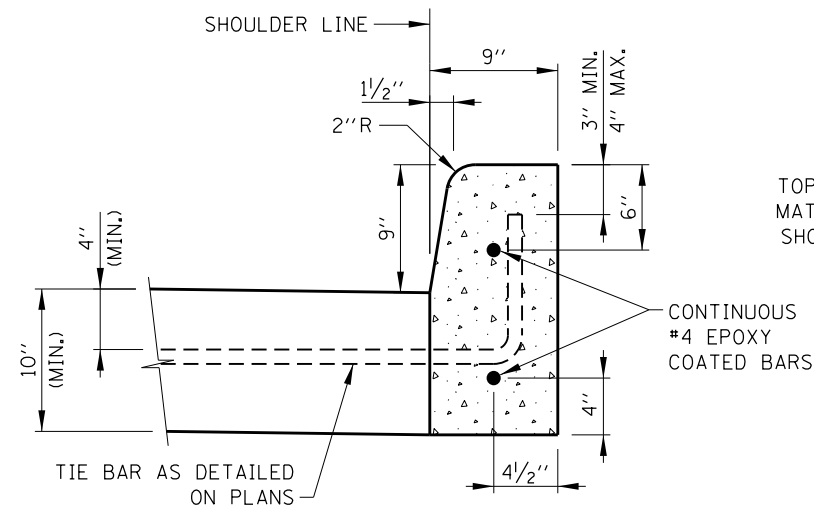
GUTTER, TYPE G-3



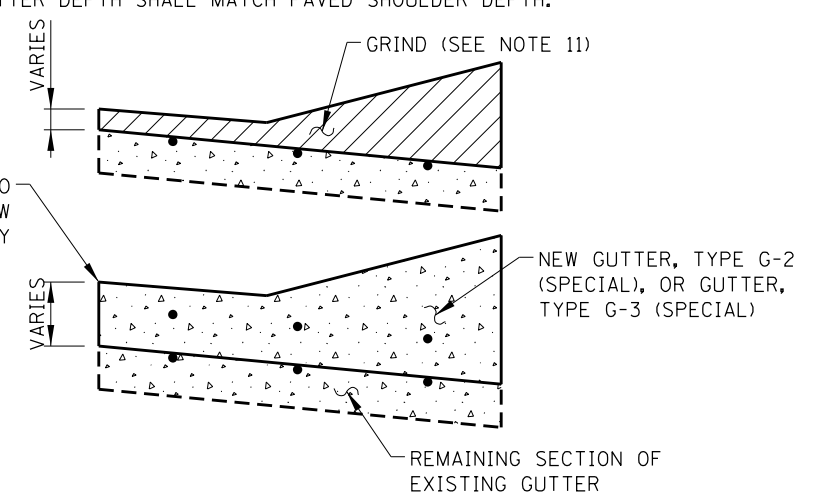
GUTTER, TYPE G-3, MODIFIED



ADJACENT TO FLEXIBLE PAVEMENT



ADJACENT TO PCC PAVEMENT



CONCRETE GUTTER OVERLAY

SHEET 1 OF 2

CONCRETE CURB, TYPE C  
(RAMP TOLL PLAZAS ONLY)

NOTES:

- FOR CONCRETE CURB, TYPE C 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 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 1'-1".
- FOR CONCRETE GUTTER OVERLAYS, CRACK CONTROL JOINTS SHALL BE PLACED AT LOCATIONS OF UNDERLYING JOINTS AND WORKING CRACKS.
- GUTTER CRACK CONTROL JOINTS TO ALIGN IN PROLONGATION WITH PCC SHOULDER JOINTS WHERE EXISTING. CRACK CONTROL JOINTS SHALL BE SEALED FULL DEPTH AND WIDTH IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS.
- EXPANSION JOINTS SHALL BE CONSTRUCTED IN GUTTER AT MAXIMUM JOINT SPACING OF 60'-0", SEE EXPANSION JOINT DETAIL ON SHEET 2 OF THIS STANDARD.
- GUTTER REMOVAL TO BE PAID AS GUTTER REMOVAL (SPECIAL).
- GUTTER DEPTH SHALL MATCH PAVED SHOULDER DEPTH.

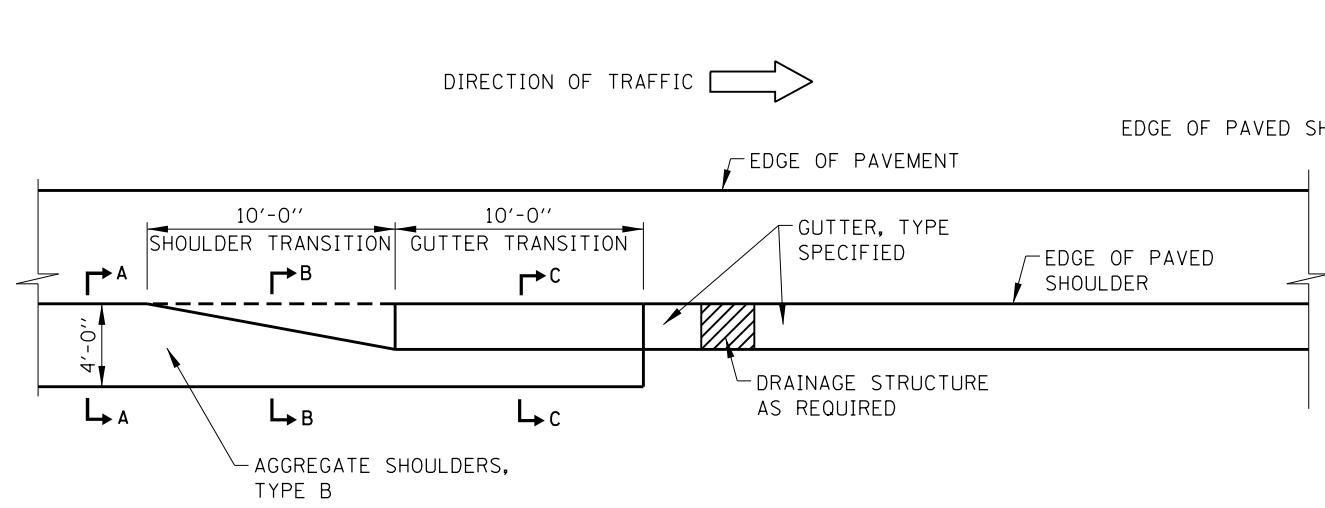
APPROVED: *Paul Kovacs*  
CHIEF ENGINEERING OFFICER  
DATE: 2-7-2012

DATE	REVISIONS
3-11-2015	REVISED DETAIL DESCRIPTIONS
3-31-2016	REVISED NOTE
3-01-2018	REVISED NOTE
3-01-2019	NOTED GUTTER DEPTH SHALL MATCH PAVED SHOULDER DEPTH

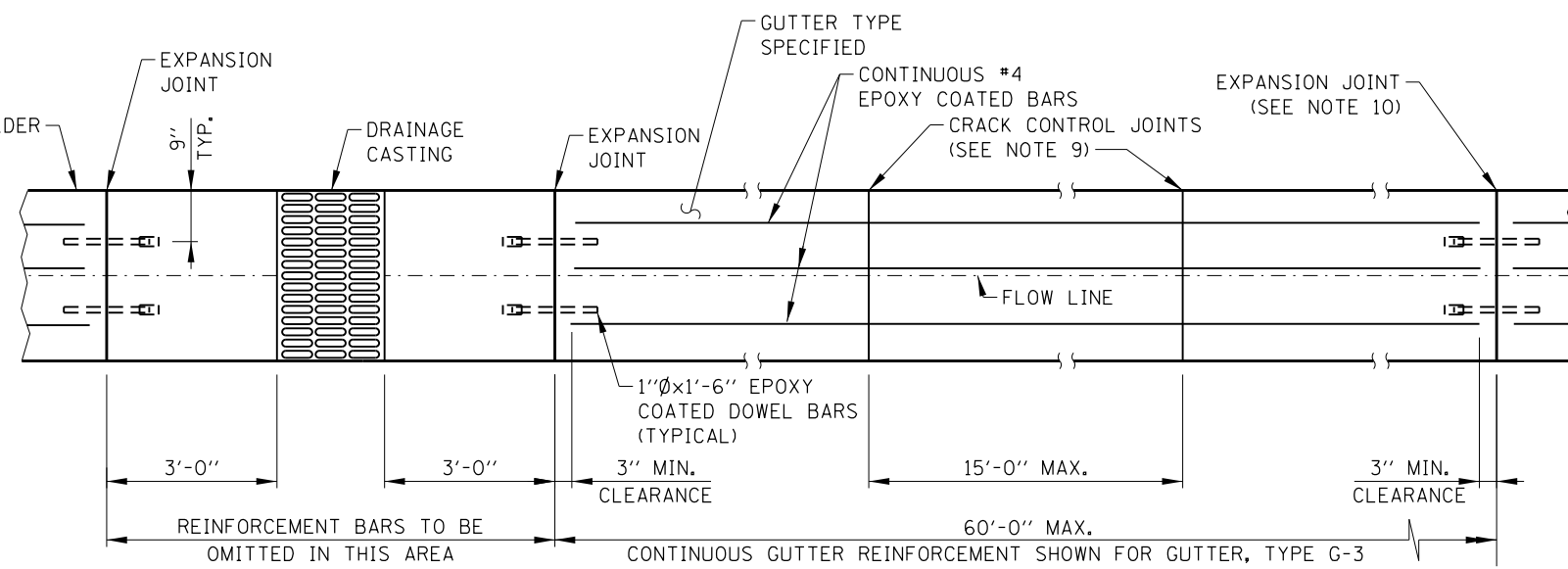


GUTTER AND CURB  
DETAILS

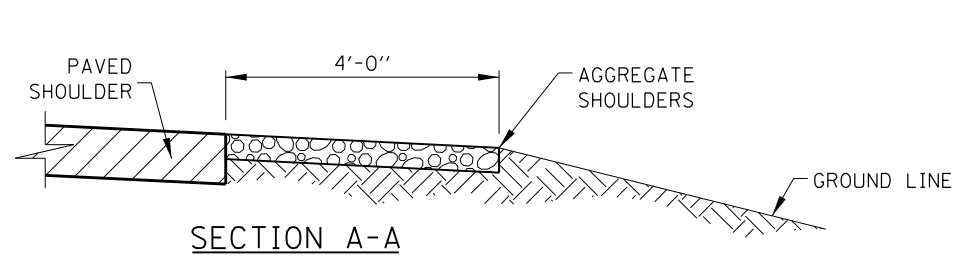
STANDARD B1-09



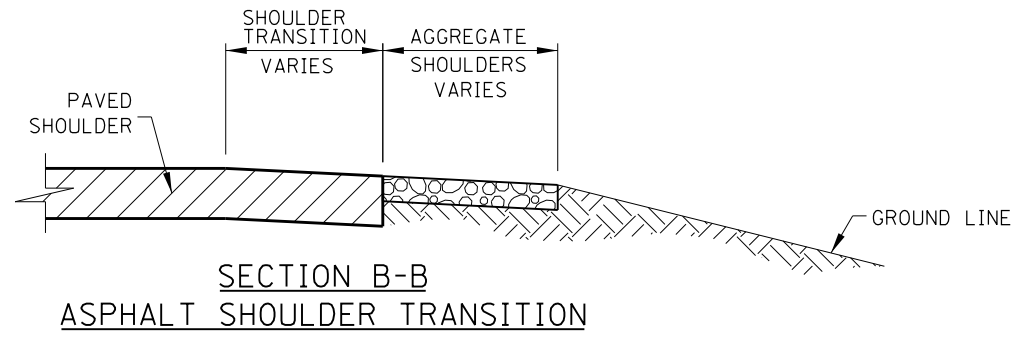
**GUTTER TRANSITION TERMINATION**



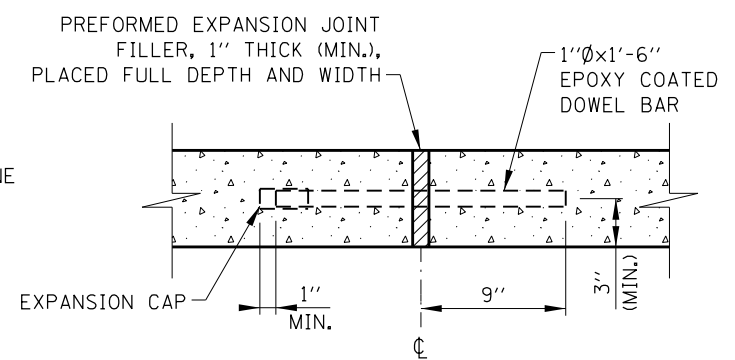
**GUTTER PLAN**



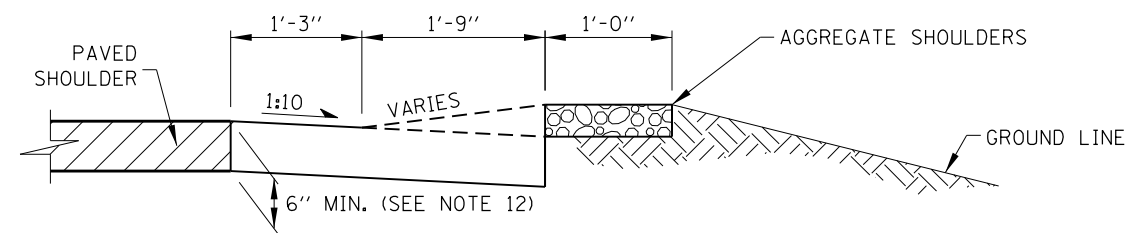
**SECTION A-A**



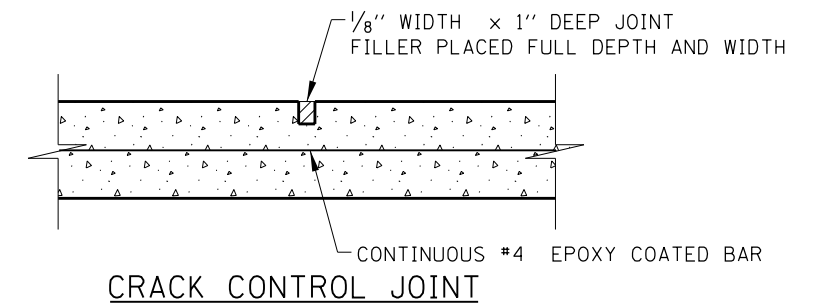
**SECTION B-B  
ASPHALT SHOULDER TRANSITION**



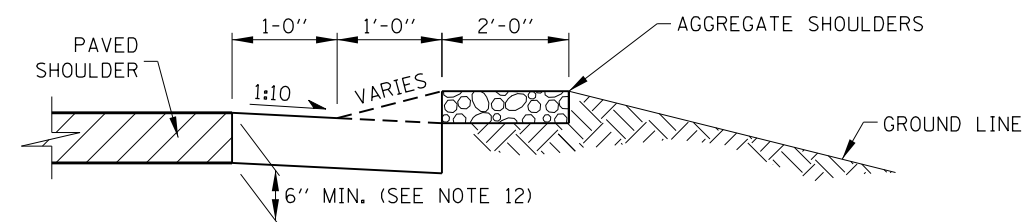
**EXPANSION JOINT**



**GUTTER, TYPE G-3 TRANSITION**



**CRACK CONTROL JOINT**



**GUTTER, TYPE G-2 TRANSITION**

**EXPANSION-CRACK CONTROL JOINTS  
GUTTER, TYPE SPECIFIED**

**SECTION C-C**

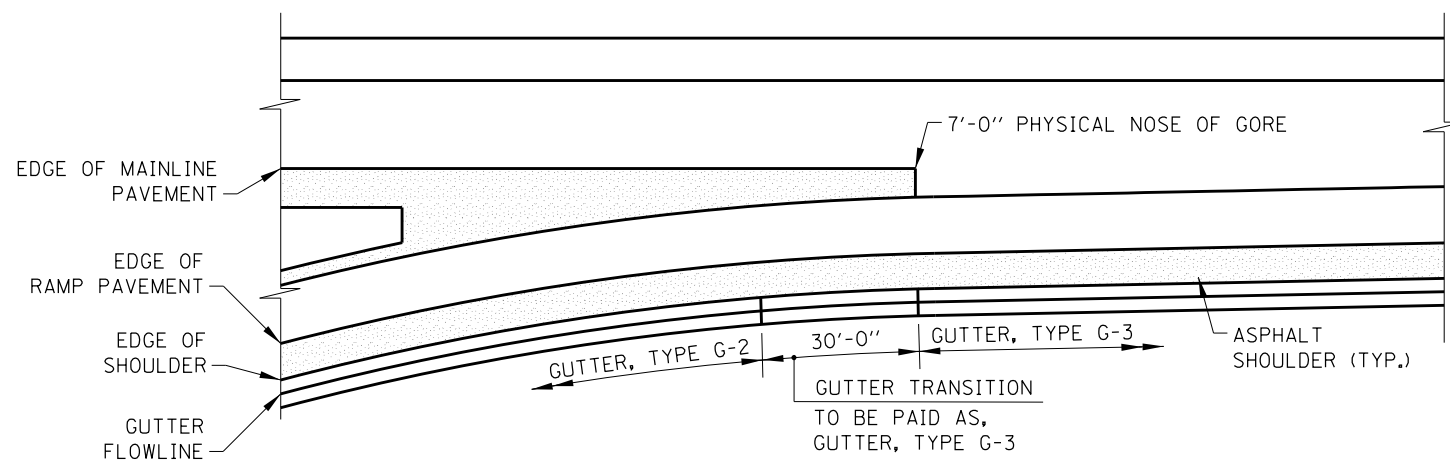
APPROVED *Paul Kovacs* CHIEF ENGINEERING OFFICER DATE 2-7-2012

NOTE:  
SEE SHEET 1 OF THIS SERIES FOR NOTES.

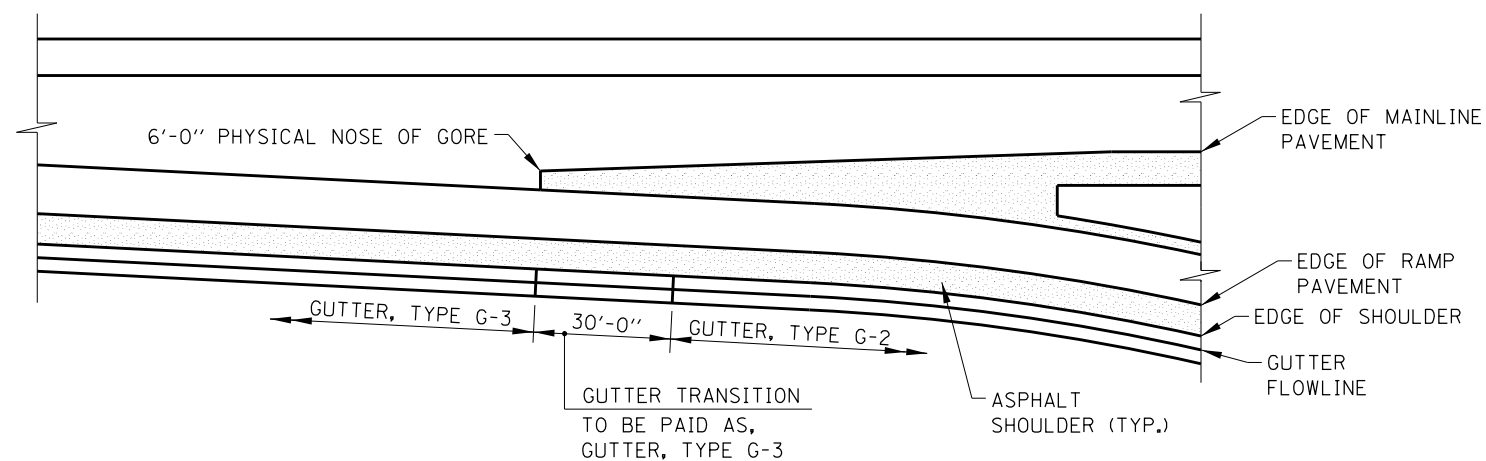
**Illinois Tollway**

GUTTER AND CURB DETAILS

STANDARD B1-09



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, BARRIER, OR PARAPET.
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 BARS SHALL BE ACCURATELY PLACED AND FIRMLY HELD AT THE POSITION USING EPOXY COATED CHAIRS. CHAIR SPACING SHALL NOT EXCEED 4'-0".
5. GUTTER REINFORCEMENT BARS SHALL BE PLACED 3" ABOVE BOTTOM OF GUTTER FOLLOWING SUBGRADE SLOPE.
6. CONTINUOUS #4 BARS SHALL BE LAPPED A MINIMUM OF 1'-1".
7. GUTTER DEPTH SHALL MATCH PAVED SHOULDER DEPTH.

SHEET 1 OF 2

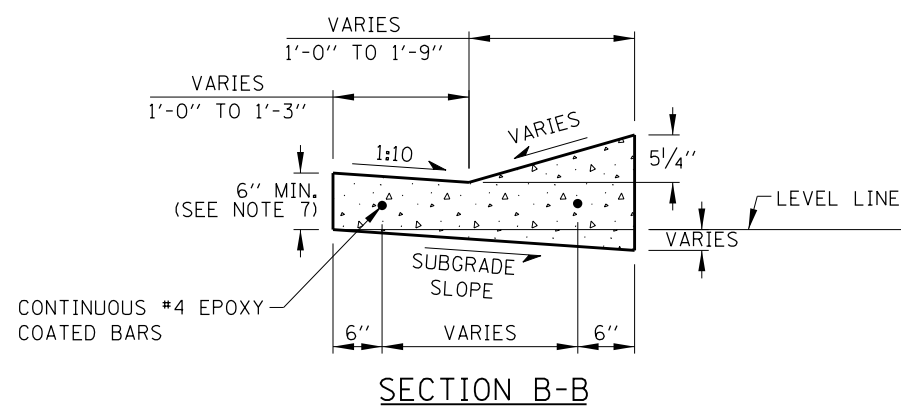
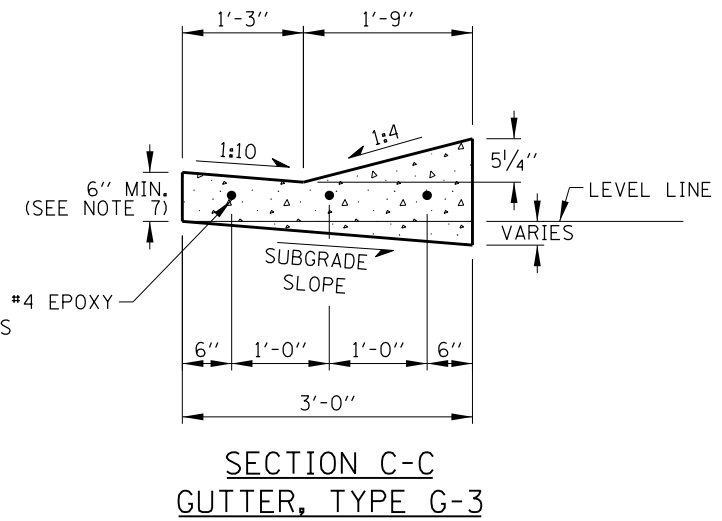
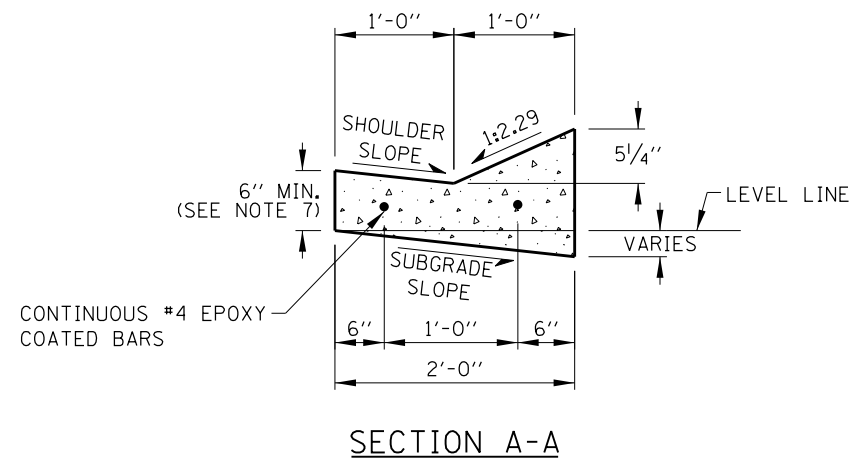
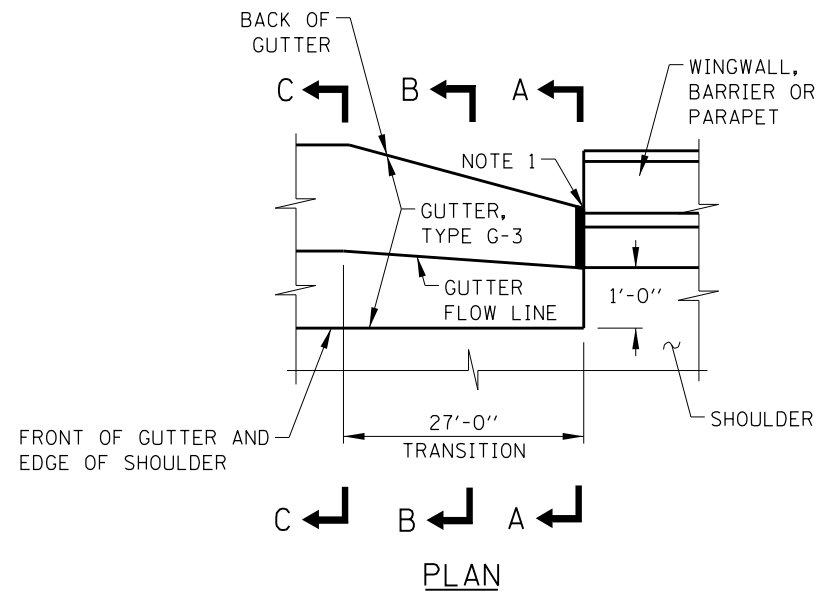
DATE	REVISIONS
3-01-2010	RELOCATED GUTTER TRANSITION DETAIL TO STANDARD B28, REVISED NOTES
	REVISED TYPE G-3, G-2 GUTTER AT BRIDGE APPROACH.
2-07-2012	REVISED NOTES.
3-11-2015	REVISED DETAIL DESCRIPTIONS AND NOTES.
3-31-2016	REVISED G-2 GUTTER SHAPE
3-01-2018	REVISED NOTE
3-01-2019	NOTED GUTTER DEPTH SHALL MATCH PAVED SHOULDER DEPTH



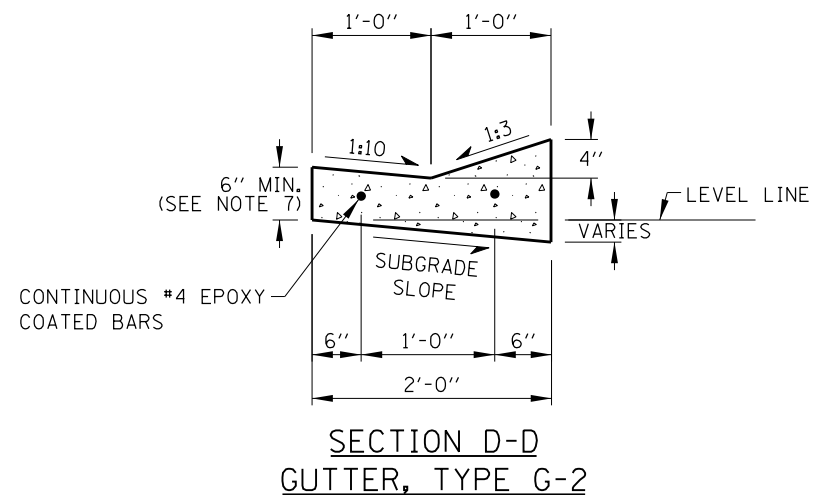
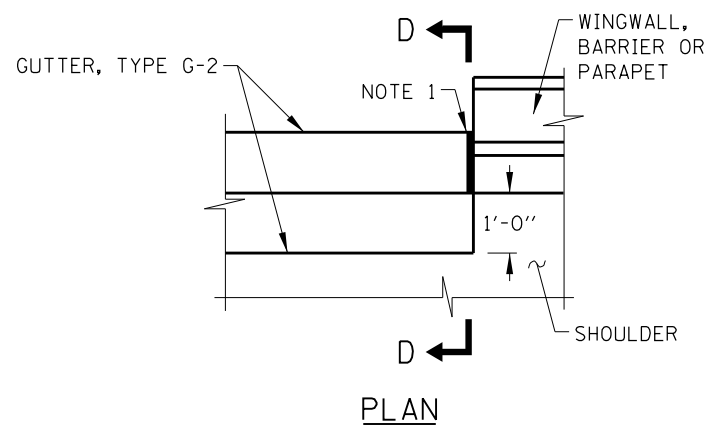
TYPE G-2 AND G-3  
GUTTER TRANSITIONS

STANDARD B2-08

APPROVED *Paul Kovacs* CHIEF ENGINEERING OFFICER DATE 2-7-2012



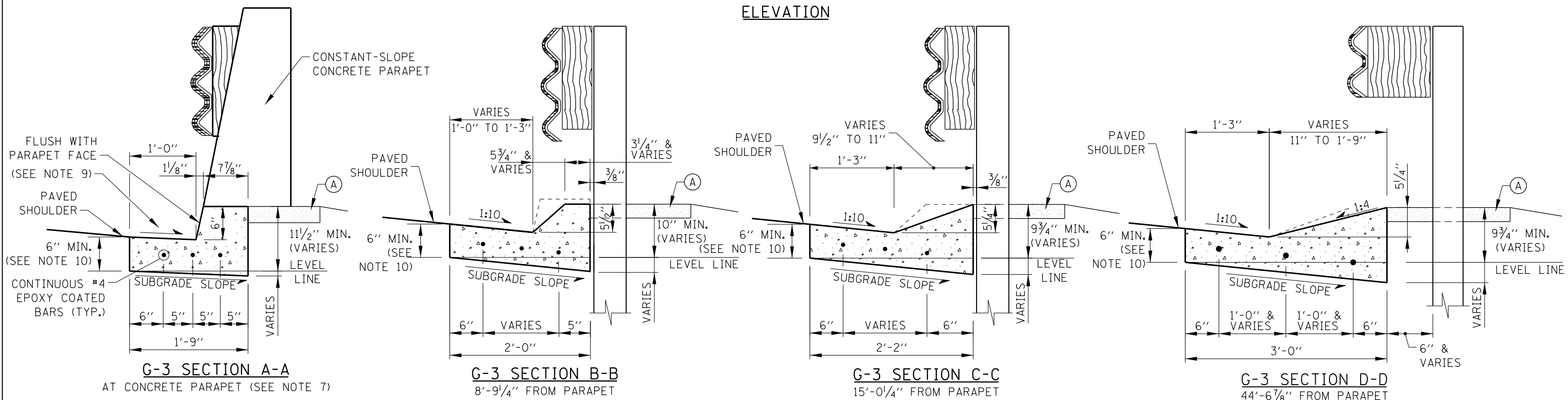
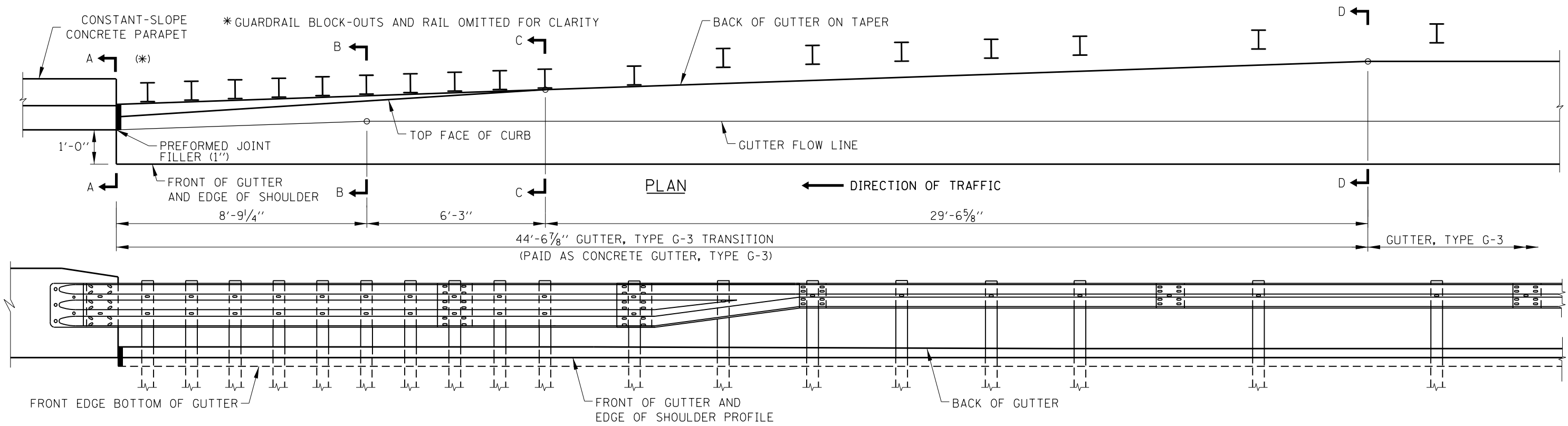
GUTTER, TYPE G-3 TRANSITION AT BRIDGE DEPARTURE



GUTTER, TYPE G-2 AT BRIDGE DEPARTURE

NOTE:  
SEE SHEET 1 OF THIS SERIES FOR NOTES.





**GUTTER, TYPE G-3 TRANSITION AT TRAFFIC BARRIER TERMINAL, TYPE T6 TO CONSTANT-SLOPE CONCRETE PARAPET**

**GUTTER TRANSITION NOTES:**


1. SLOPE TO MATCH ADJACENT SHOULDER SLOPE.
2. PROVIDE 1" EXPANSION JOINT WITH PREFORMED JOINT FILLER BETWEEN TRANSITION SECTION AND WINGWALL OR BARRIER WALL.
3. INSTALLATION ON CURVED WINGWALLS SIMILAR.
4. FOR DETAILS OF TRAFFIC BARRIER TERMINAL, TYPE T6, SEE ILLINOIS TOLLWAY STANDARD C9.
5. GUTTER TRANSITIONS SHALL BE CONSTRUCTED TO FIT THE STANDARD LOCATION OF THE TRAFFIC BARRIER TERMINAL, TYPE T6.
6. ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENT (V:H).
7. GUTTER SECTION SHOWN AT BARRIER WALL SHALL MATCH PROFILE AND VERTICAL FACE OF BARRIER. MODIFY GUTTER FACE TO MATCH OTHER BARRIER/PARAPET PROFILES.
8. CONTINUOUS #4 BARS SHALL BE LAPPED A MINIMUM OF 1'-1".
9. MATCH SHOULDER SLOPE IN FRONT OF PARAPET OR BARRIER.
10. GUTTER DEPTH SHALL MATCH PAVED SHOULDER DEPTH.

**LEGEND**

(A) AGGREGATE SHOULDERS SPECIAL, TYPE C

DATE	REVISIONS
3-11-2015	GUTTER TRANSITION FOR CONCRETE BARRIER, SINGLE-FACE.
3-31-2016	REVISED G-2 GUTTER SHAPE
3-01-2018	REVISED NOTES
3-01-2019	ADDED PG 1, 2 & 3 CONSTANT-SLOPE BARRIER & NOTE 10 (GUTTER DEPTH).
3-01-2020	REVISED GUTTER TRANSITION LENGTH AND TAPER

SHEET 1 OF 6

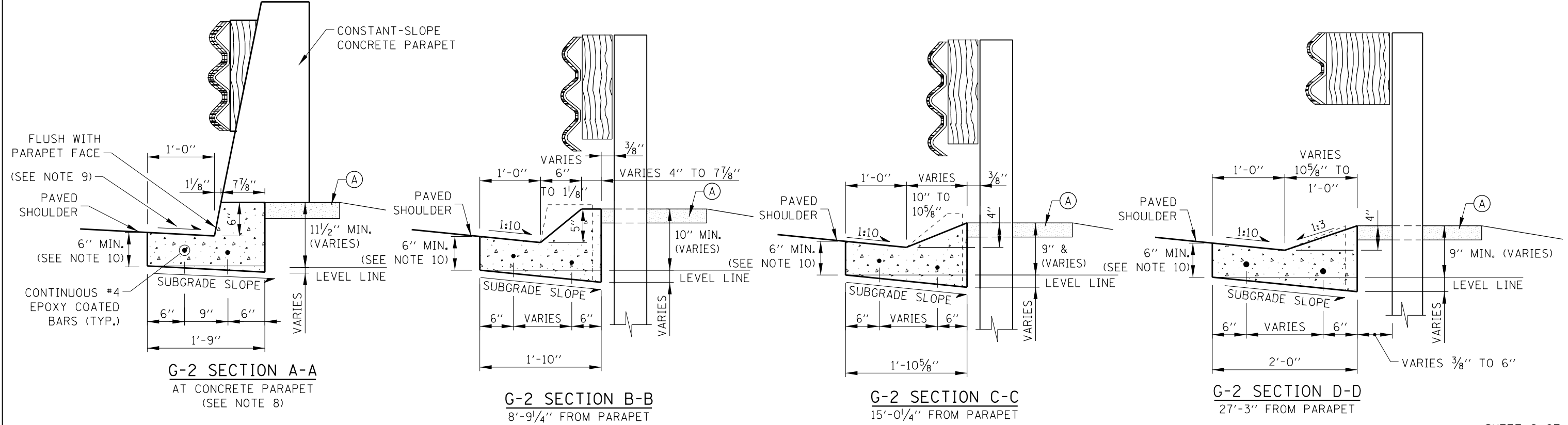
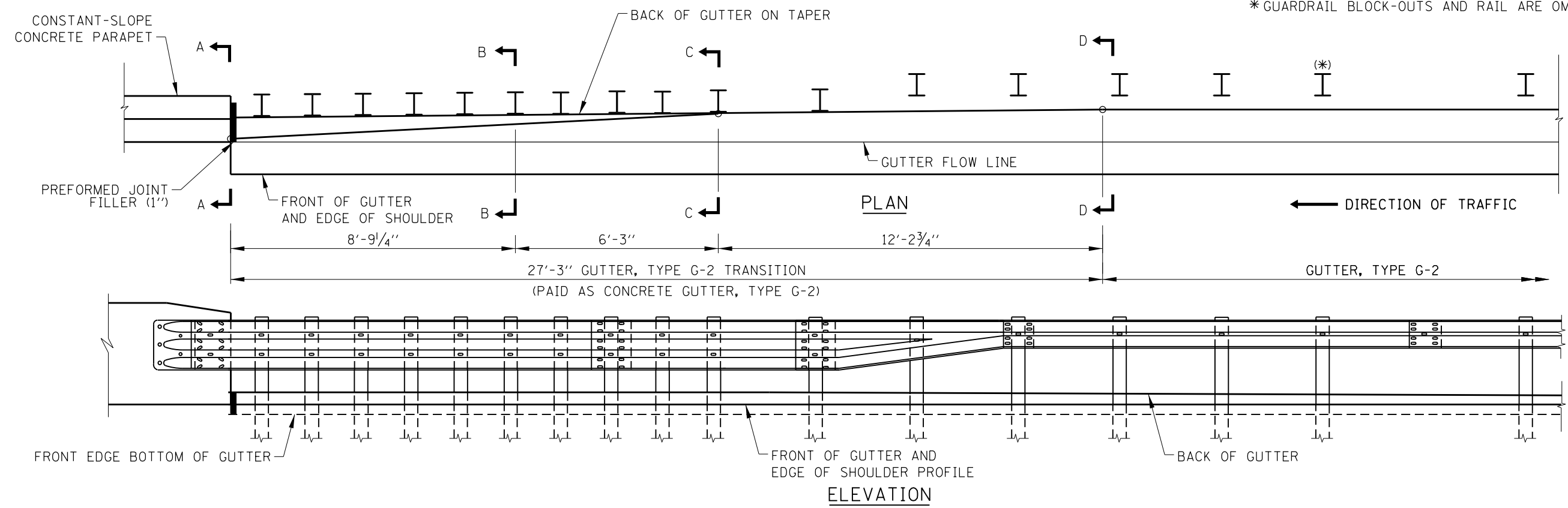


**TYPE G-2/G-3 GUTTER TRANSITION AT TRAFFIC BARRIER TERMINAL, TYPE T6**

STANDARD B3-09

APPROVED: *Paul Kovacs* CHIEF ENGINEERING OFFICER DATE 2-7-2012

\* GUARDRAIL BLOCK-OUTS AND RAIL ARE OMITTED FOR CLARITY



**GUTTER, TYPE G-2 TRANSITION AT TRAFFIC BARRIER TERMINAL, TYPE T6 TO CONSTANT-SLOPE CONCRETE PARAPET**

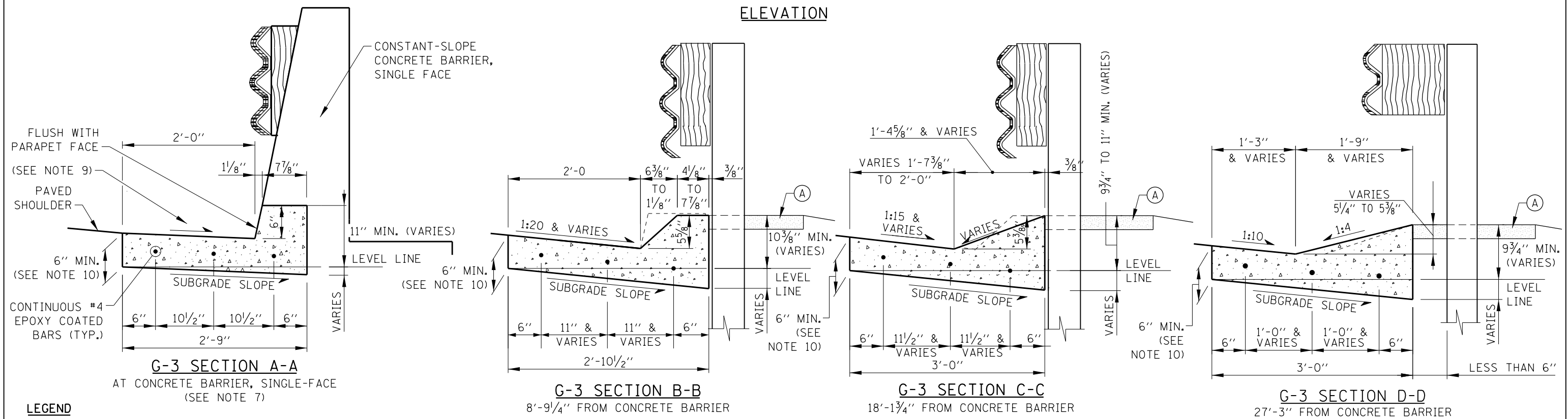
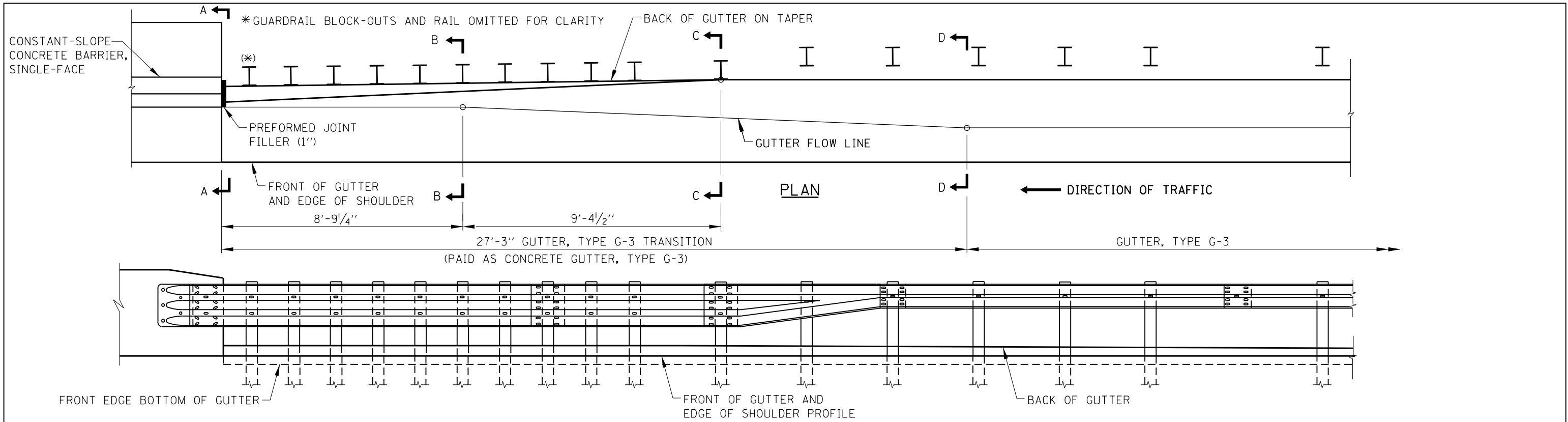
**LEGEND**  
 (A) AGGREGATE SHOULDERS SPECIAL, TYPE C

**NOTE:**  
 SEE SHEET 1 OF THIS SERIES FOR GUTTER TRANSITION NOTES.

APPROVED: *Paul Kovacs* CHIEF ENGINEERING OFFICER DATE: 2-7-2012

SHEET 2 OF 6

TYPE G-2/G-3 GUTTER TRANSITION AT TRAFFIC BARRIER TERMINAL, TYPE T6  
 STANDARD B3-09



**LEGEND**  
 (A) AGGREGATE SHOULDERS SPECIAL, TYPE C

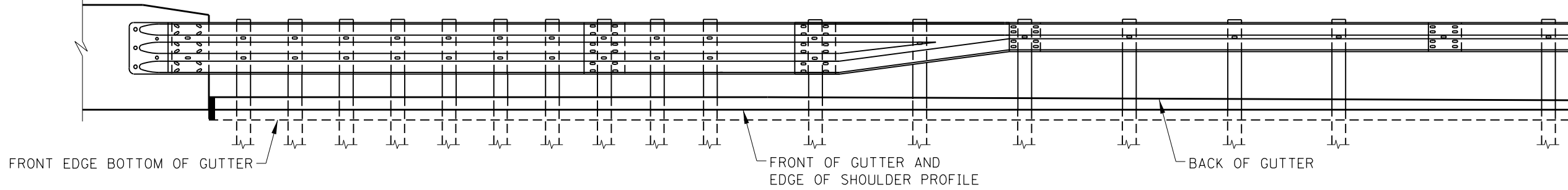
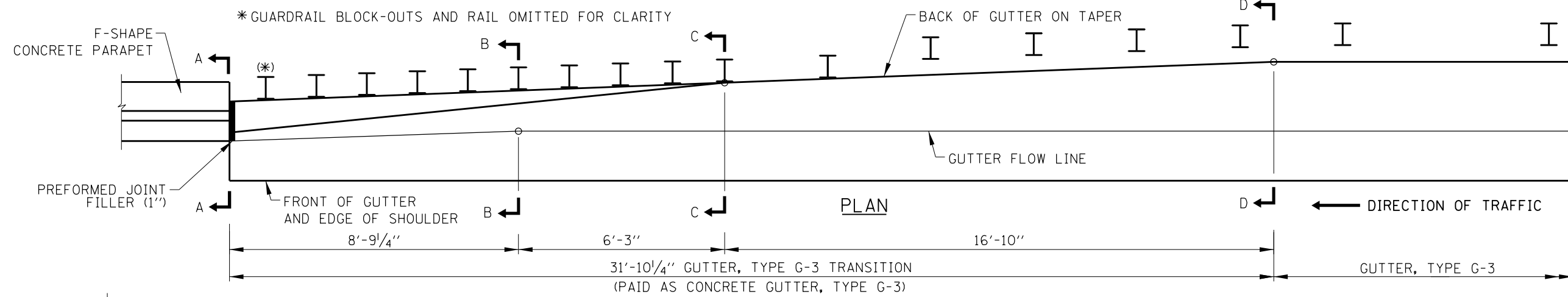
**GUTTER, TYPE G-3 TRANSITION AT TRAFFIC BARRIER TERMINAL, TYPE T6,  
 TO CONSTANT-SLOPE CONCRETE BARRIER, SINGLE FACE**

**NOTE:**  
 SEE SHEET 1 OF THIS SERIES FOR GUTTER  
 TRANSITION NOTES.

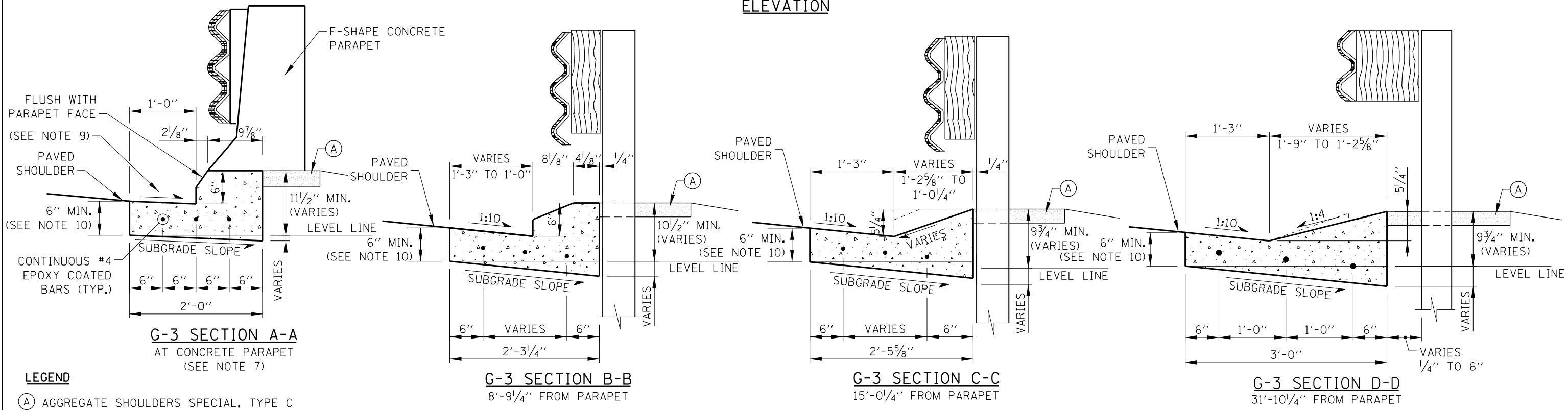
TYPE G-2/G-3 GUTTER  
 TRANSITION AT TRAFFIC  
 BARRIER TERMINAL,  
 TYPE T6  
 STANDARD B3-09

APPROVED: *Paul Kovacs*  
 CHIEF ENGINEERING OFFICER DATE 2-7-2012





ELEVATION



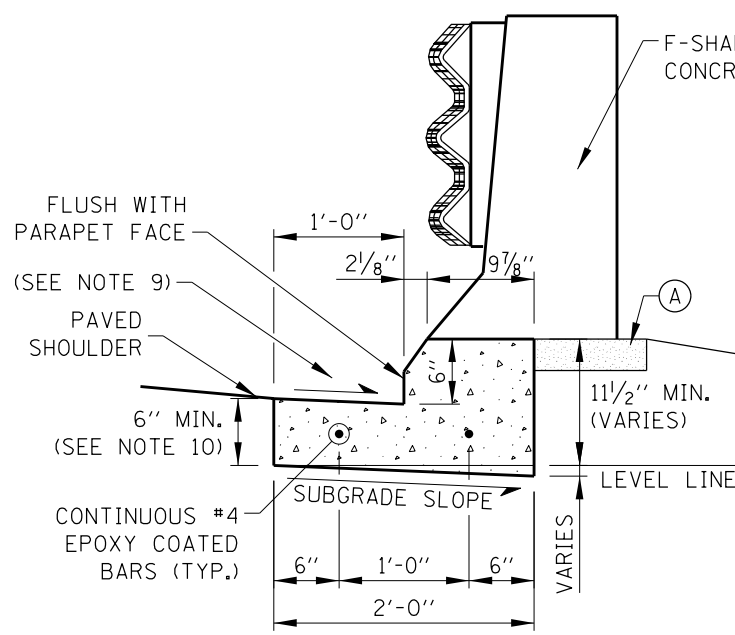
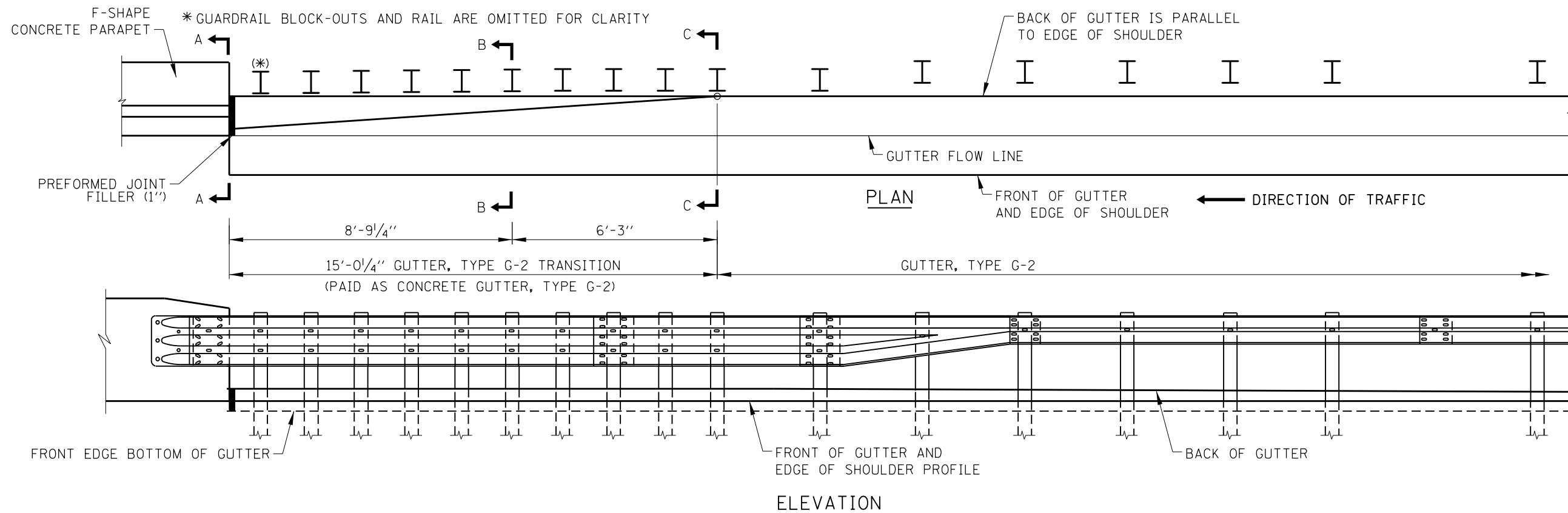
LEGEND  
 (A) AGGREGATE SHOULDERS SPECIAL, TYPE C

GUTTER, TYPE G-3 TRANSITION AT TRAFFIC BARRIER TERMINAL, TYPE T6 TO F-SHAPE CONCRETE PARAPET

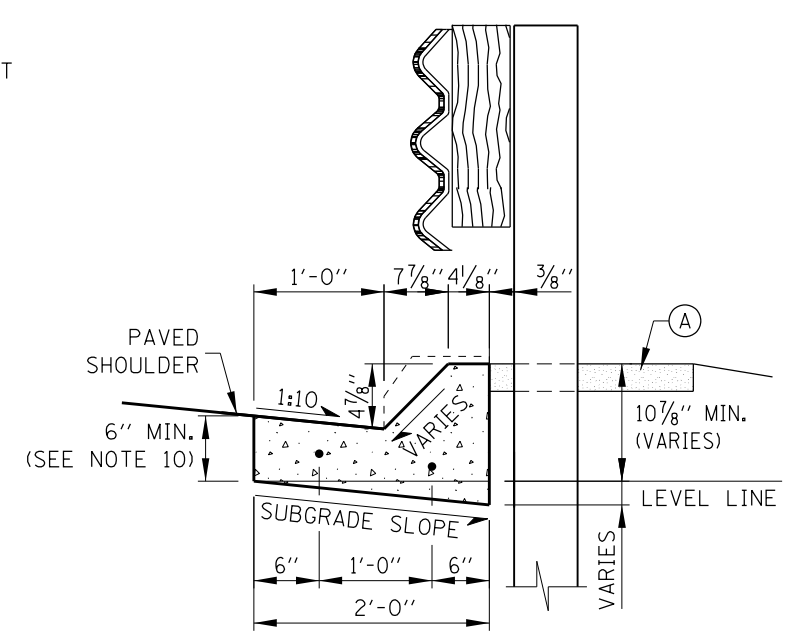
NOTE:  
 SEE SHEET 1 OF THIS SERIES FOR GUTTER TRANSITION NOTES.

TYPE G-2/G-3 GUTTER TRANSITION AT TRAFFIC BARRIER TERMINAL, TYPE T6  
 STANDARD B3-09

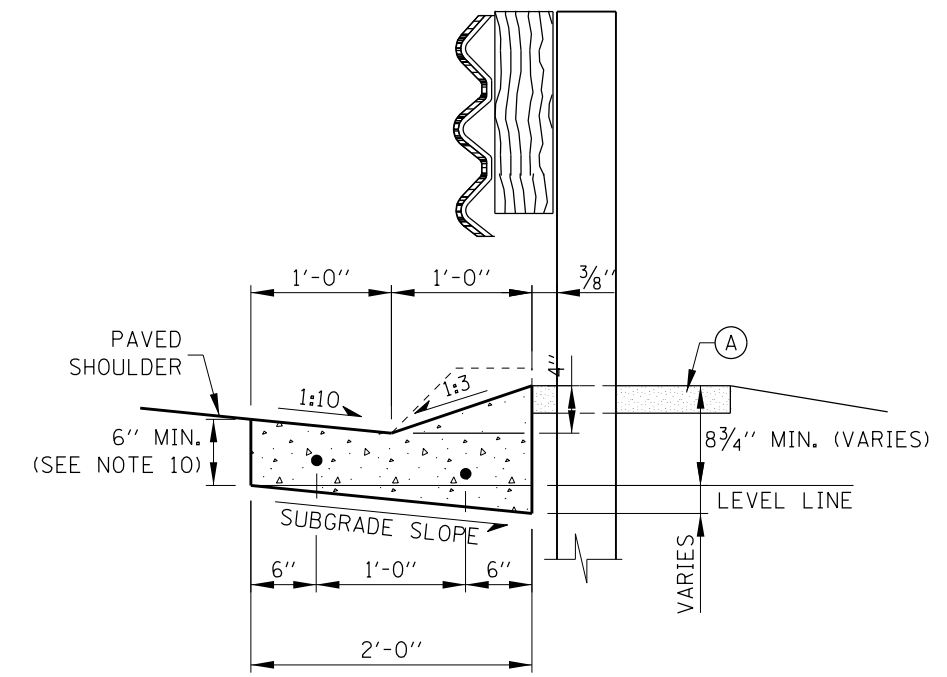
APPROVED: *Paul Kovacs*  
 CHIEF ENGINEERING OFFICER DATE 2-7-2012



**G-2 SECTION A-A**  
AT CONCRETE PARAPET  
(SEE NOTE 7)



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



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

**GUTTER, TYPE G-2 TRANSITION AT TRAFFIC BARRIER TERMINAL, TYPE T6 TO F-SHAPE CONCRETE PARAPET**

**LEGEND**  
(A) AGGREGATE SHOULDERS SPECIAL, TYPE C

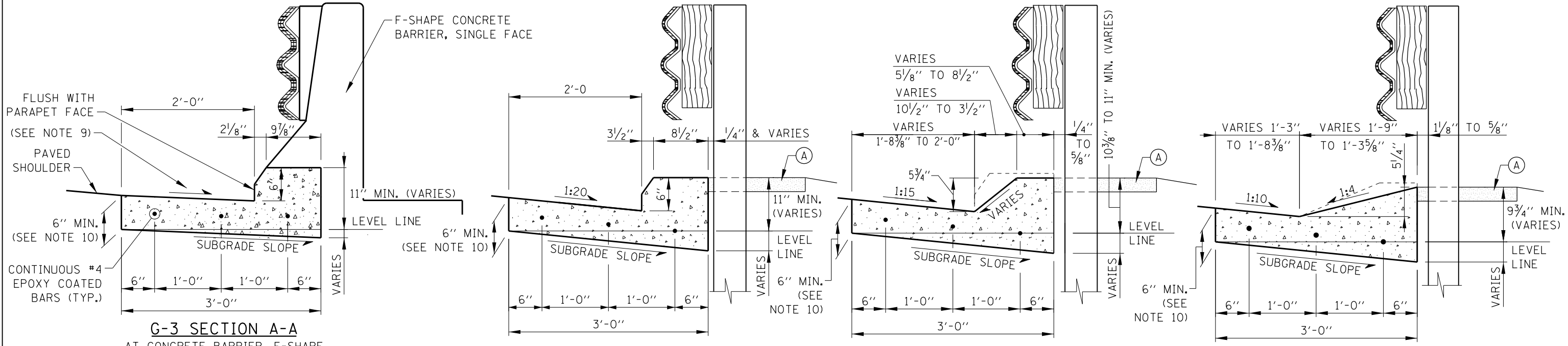
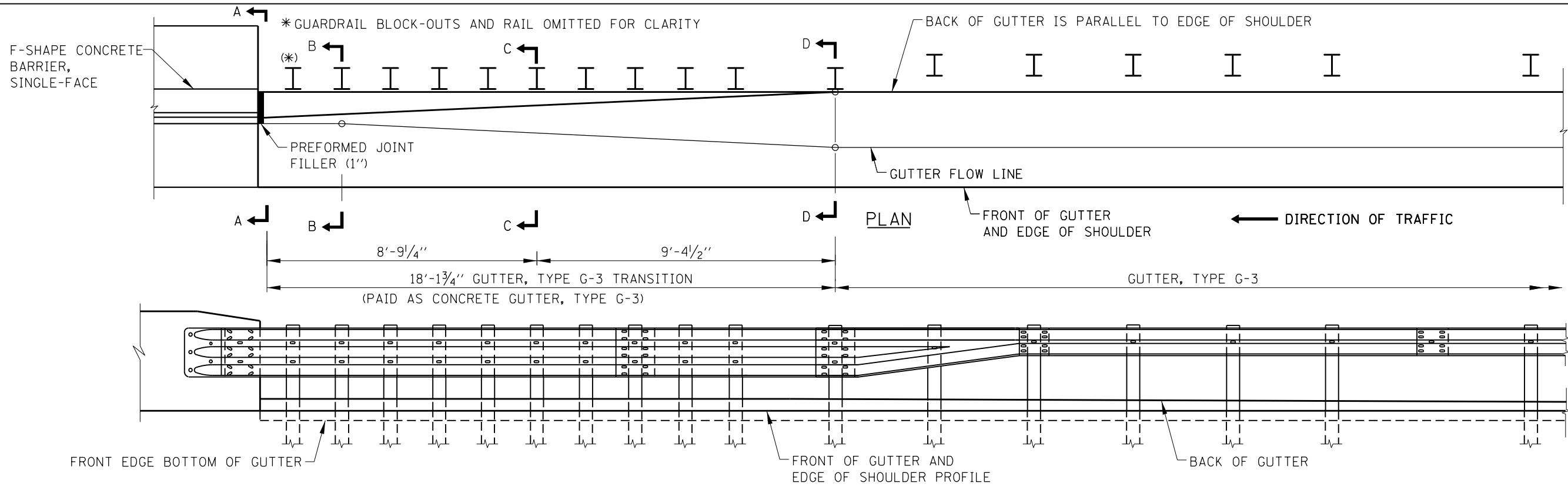
**NOTE:**  
SEE SHEET 1 OF THIS SERIES FOR GUTTER TRANSITION NOTES.



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

STANDARD B3-09

APPROVED *Paul Kovacs* CHIEF ENGINEERING OFFICER DATE 2-7-2012




**LEGEND**  
 (A) AGGREGATE SHOULDERS SPECIAL, TYPE C

**GUTTER, TYPE G-3 TRANSITION AT TRAFFIC BARRIER TERMINAL, TYPE T6, TO F-SHAPE CONCRETE BARRIER, SINGLE-FACE**

**NOTE:**  
 SEE SHEET 1 OF THIS SERIES FOR GUTTER TRANSITION NOTES.

APPROVED: *Paul Kovacs*  
 CHIEF ENGINEERING OFFICER DATE: 2-7-2012

SHEET 6 OF 6

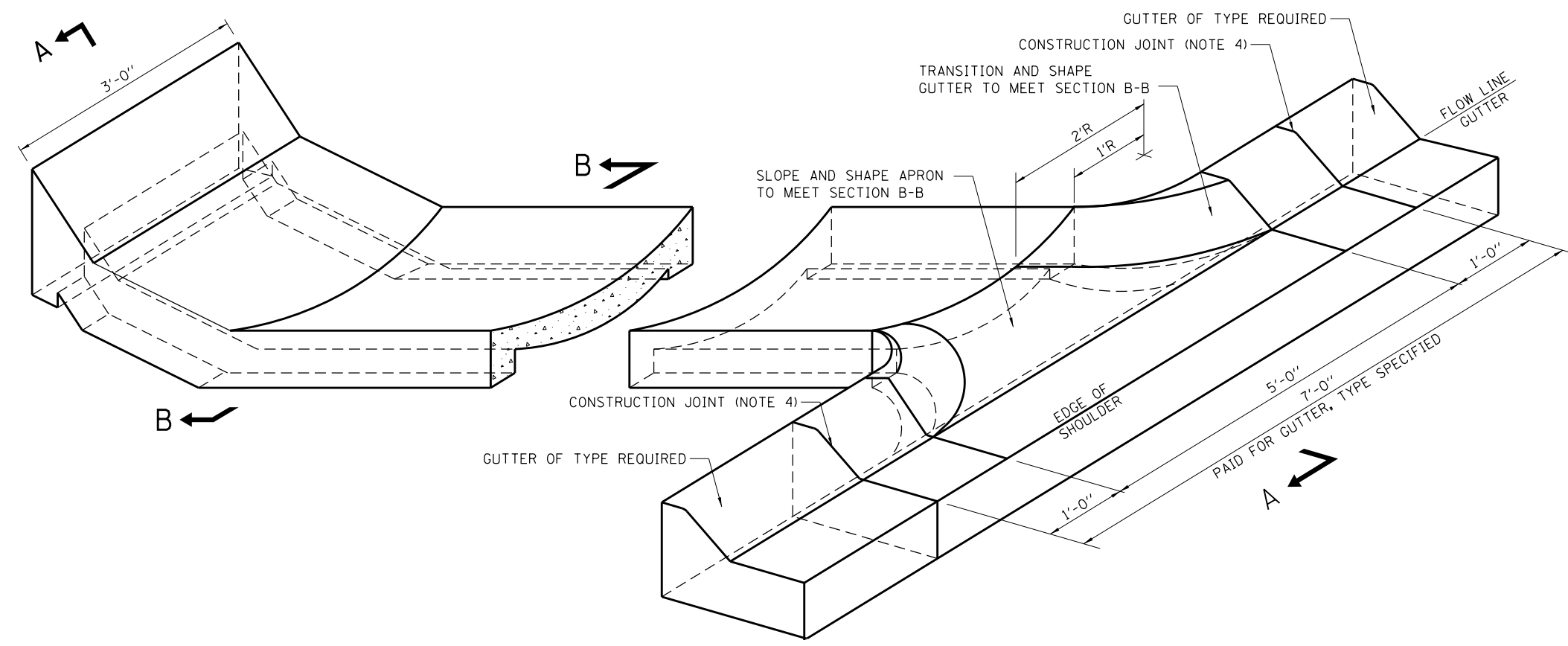


TYPE G-2/G-3 GUTTER  
 TRANSITION AT TRAFFIC  
 BARRIER TERMINAL,  
 TYPE T6  
 STANDARD B3-09

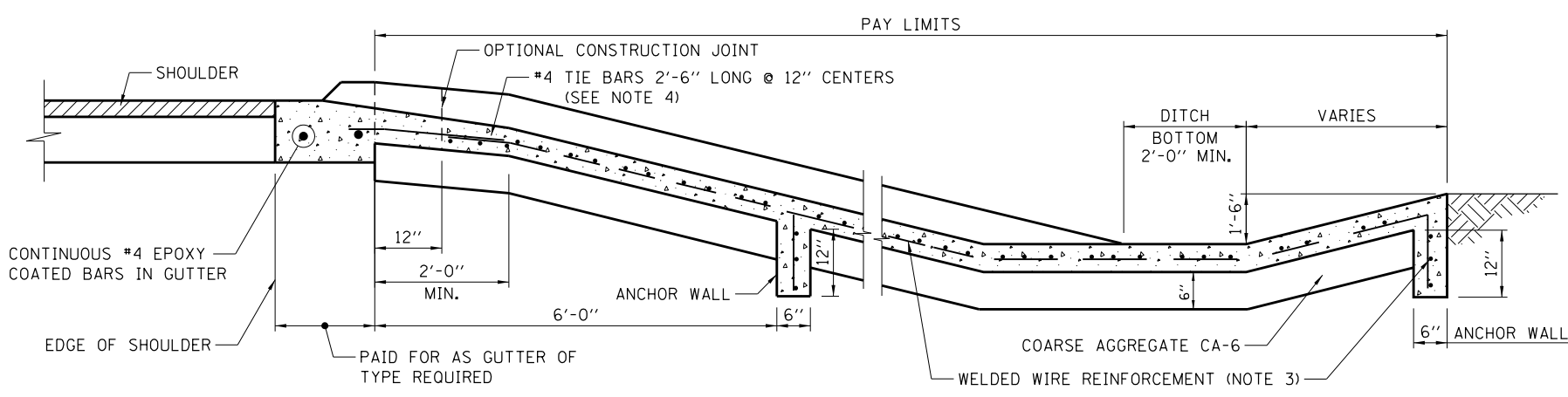
# CONCRETE FLUME

## NOTES:

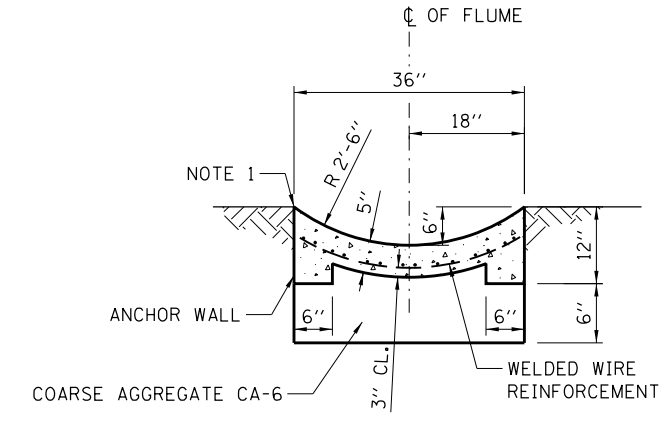
1. CONCRETE FLUMES SHALL BE CONSTRUCTED FLUSH WITH THE ADJACENT EXISTING OR PROPOSED SURFACES.
2. CLASS SI CONCRETE SHALL BE USED THROUGHOUT.
3. WELDED WIRE REINFORCEMENT SHALL BE EPOXY COATED 6x6 W4xW4, 58 LBS. PER 100 SQ. FT.
4. #4 EPOXY COATED TIE BARS 2'-6" LONG AT 12" O/C SHALL BE PROVIDED AT ALL CONSTRUCTION JOINTS.
5. EPOXY COATED EXPANDED METAL FABRIC OF EQUIVALENT STRENGTH MAY BE USED IN LIEU OF WELDED WIRE REINFORCEMENT 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.



PLAN



SECTION A-A  
ADJACENT TO GUTTER




## NOTE:

0.62 C.Y. CONCRETE / L.F.

SECTION B-B

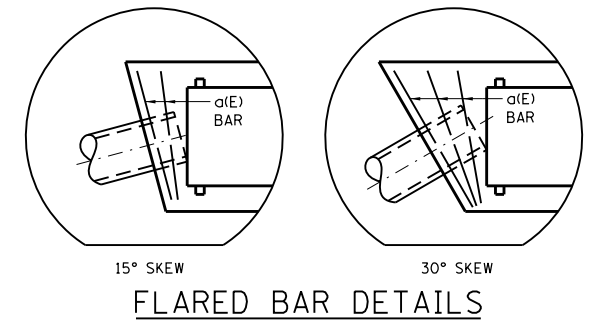
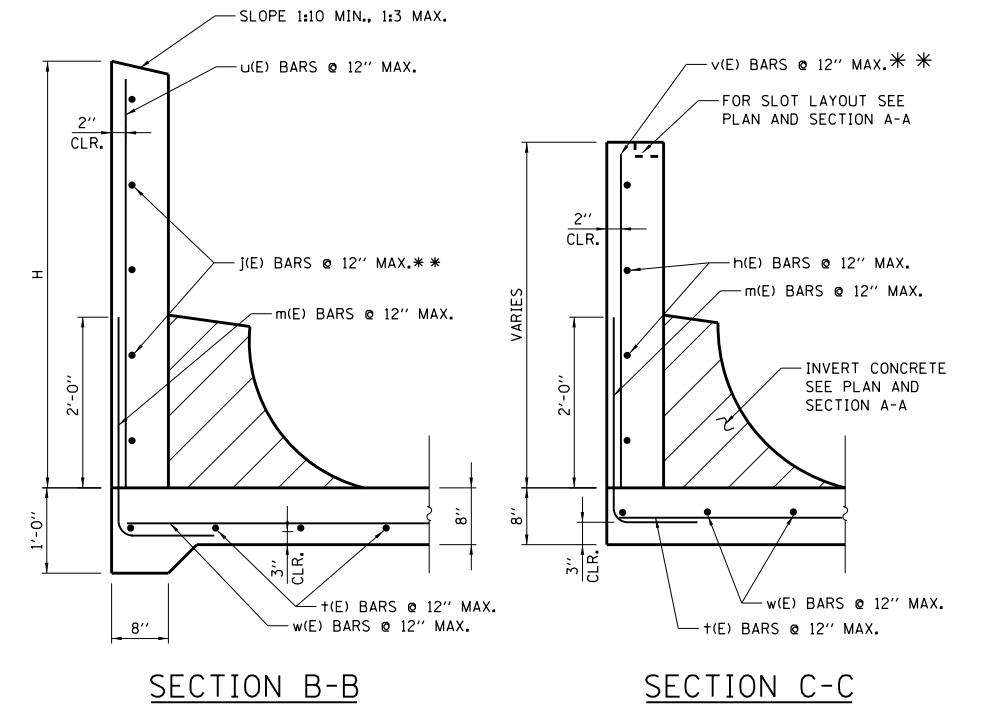
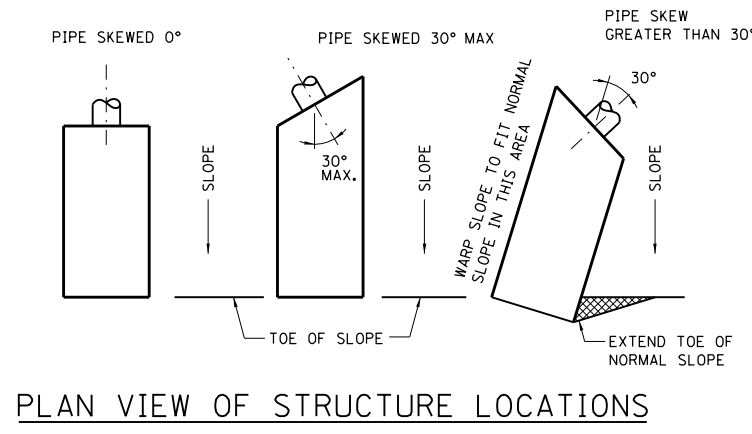
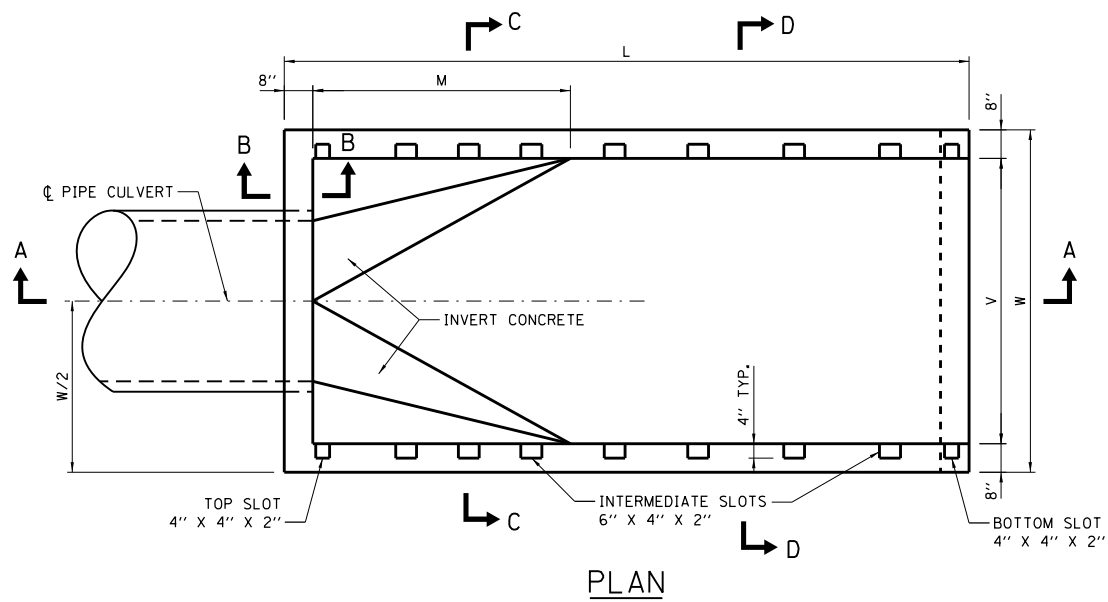
APPROVED: *Paul Kovacs*  
CHIEF ENGINEERING OFFICER DATE 2-7-2012

DATE	REVISIONS
2-07-2012	REVISED NOTES
3-11-2015	DELETED CURB SECTION
3-31-2016	CHANGED TERMINOLOGY TO WELDED WIRE REINFORCEMENT
3-01-2018	REVISED SECTION A-A TO INCLUDE COARSE AGGREGATE NOTE 8 WAS REMOVED

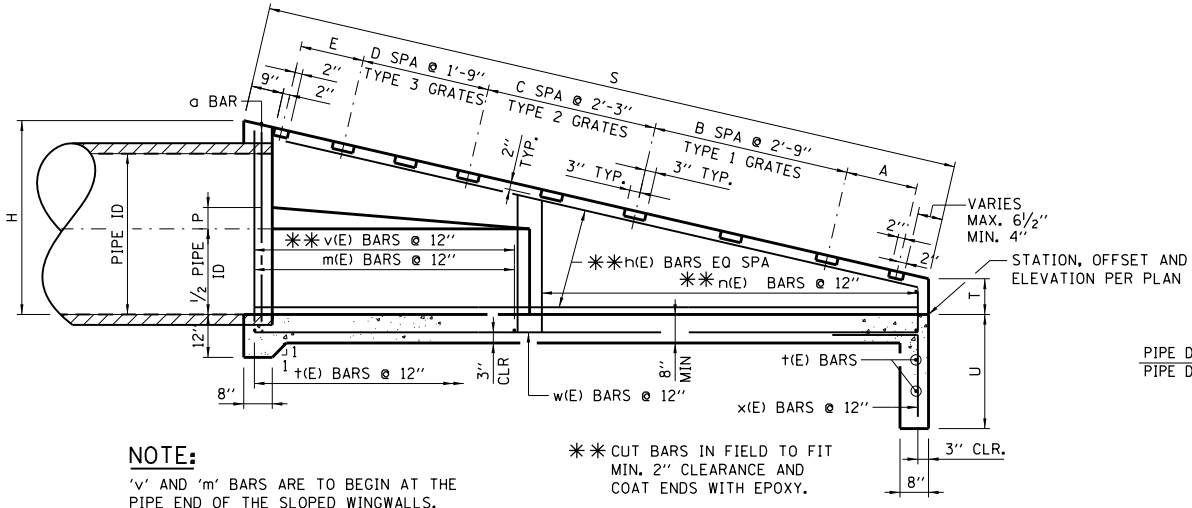


CONCRETE FLUME DETAILS

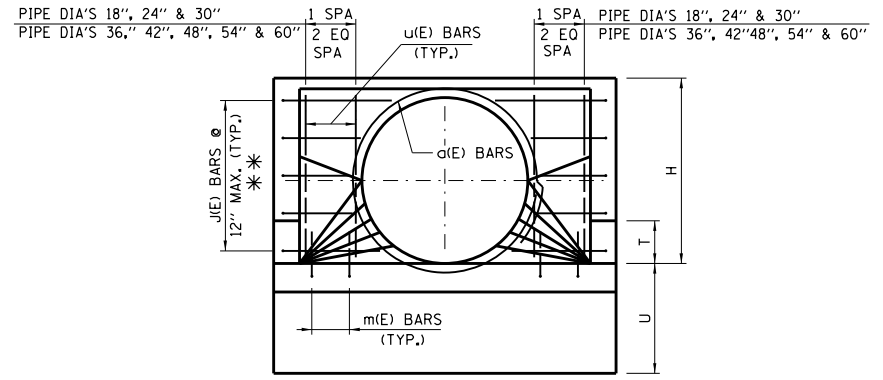
STANDARD B5-04



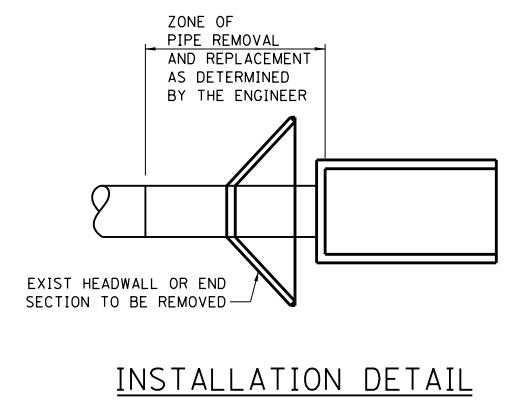
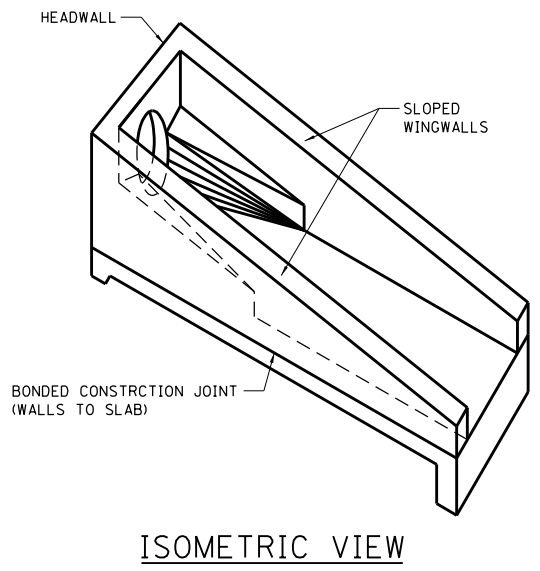
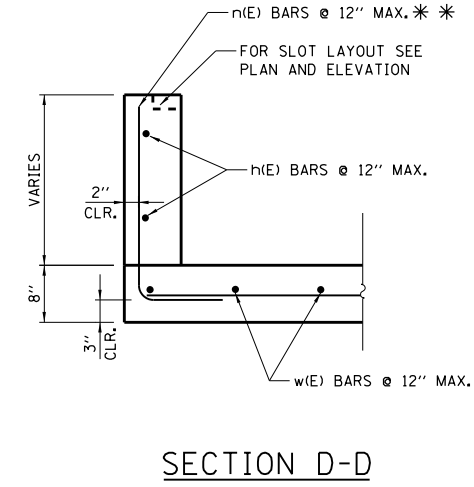
**NOTES:**  
 ADDITIONAL "a" BARS SHALL BE FURNISHED AND PLACED BY THE CONTRACTOR. THE ADDITIONAL BARS ARE NOT INCLUDED IN THE LISTED QUANTITIES, BUT WILL BE PAID FOR AS REINFORCEMENT BARS (EPOXY COATED).  
 1 ADDITIONAL BAR REQUIRED FOR EACH 15° SKEW OR FRACTION THEREOF.



**NOTE:**  
 "v" AND "m" BARS ARE TO BEGIN AT THE PIPE END OF THE SLOPED WINGWALLS.  
 \*\* CUT BARS IN FIELD TO FIT MIN. 2" CLEARANCE AND COAT ENDS WITH EPOXY.



- NOTES:**
1. 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 (E).
  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 IN THIS SERIES.
  9. FOR STEEL GRATING DETAILS, SEE SHEET 3 IN THIS SERIES.
  10. FOR ALTERNATE PRECAST CONCRETE DETAILS AND NOTES, SEE SHEET 4 IN THIS SERIES.
  11. ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENT (V:H).



APPROVED: *Paul Kovacs* DATE 5-1-2009  
 CHIEF ENGINEERING OFFICER

DATE	REVISIONS
3-31-2016	ADDED NOTE TO OMIT RESTRAINT ANGLE AND THE PLATE FOR MULTI-END SECTIONS REVISED GRATE LAYOUT
3-01-2019	MINOR EDIT
3-01-2021	ADJUSTED LENGTH OF "h" BARS FOR THE 1:3 SLOPE HEADWALL

SHEET 1 OF 4

**HEADWALL TYPE III**  
 18"-24"-30"-36"-42"-48"-54"-60"  
 FOR 1:3, 1:4, 1:6, AND 1:10 SLOPES  
 STANDARD B6-08



**GRATE DIMENSIONS AND QUANTITIES IN ONE HEADWALL TYPE III END ENTRANCE 1:3 SLOPE**

INSIDE PIPE DIAMETER	GRATES		BARS FOR ONE GRATE				HEADWALL GRATES (POUND)	
	NUMBER REQUIRED	TYPE REQ'D	BAR NO 1		BAR NO 2		EACH GRATE	TOTAL
			BARS REQ'D	LENGTH	BARS REQ'D	LENGTH		
36"	0	1	2	6'-7"	11	2'-4 1/2"	112	493
	3	2	2	6'-7"	11	1'-10 1/2"	102	
	2	3	2	6'-7"	11	1'-4 1/2"	93	
42"	0	1	2	7'-1"	12	2'-4 1/2"	121	633
	3	2	2	7'-1"	12	1'-10 1/2"	110	
	3	3	2	7'-1"	12	1'-4 1/2"	100	
48"	0	1	2	7'-7"	13	2'-4 1/2"	130	863
	0	2	2	7'-7"	13	1'-10 1/2"	119	
	8	3	2	7'-7"	13	1'-4 1/2"	108	
54"	0	1	2	8'-1"	14	2'-4 1/2"	139	958
	3	2	2	8'-1"	14	1'-10 1/2"	127	
	5	3	2	8'-1"	14	1'-4 1/2"	115	
60"	3	1	2	8'-7"	15	2'-4 1/2"	148	1058
	0	2	2	8'-7"	15	1'-10 1/2"	135	
	5	3	2	8'-7"	15	1'-4 1/2"	123	

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

INSIDE PIPE DIAMETER	GRATES		BARS FOR ONE GRATE				HEADWALL GRATES (POUND)	
	NUMBER REQUIRED	TYPE REQ'D	BAR NO 1		BAR NO 2		EACH GRATE	TOTAL
			BARS REQ'D	LENGTH	BARS REQ'D	LENGTH		
36"	5	1	2	6'-7"	11	2'-4 1/2"	112	558
	0	2	2	6'-7"	11	1'-10 1/2"	102	
	0	3	2	6'-7"	11	1'-4 1/2"	93	
42"	1	1	2	7'-1"	12	2'-4 1/2"	121	784
	6	2	2	7'-1"	12	1'-10 1/2"	110	
	0	3	2	7'-1"	12	1'-4 1/2"	100	
48"	1	1	2	7'-7"	13	2'-4 1/2"	130	962
	7	2	2	7'-7"	13	1'-10 1/2"	119	
	0	3	2	7'-7"	13	1'-4 1/2"	108	
54"	1	1	2	8'-1"	14	2'-4 1/2"	139	1157
	8	2	2	8'-1"	14	1'-10 1/2"	127	
	0	3	2	8'-1"	14	1'-4 1/2"	115	
60"	0	1	2	8'-7"	15	2'-4 1/2"	148	1595
	0	2	2	8'-7"	15	1'-10 1/2"	135	
	13	3	2	8'-7"	15	1'-4 1/2"	123	

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

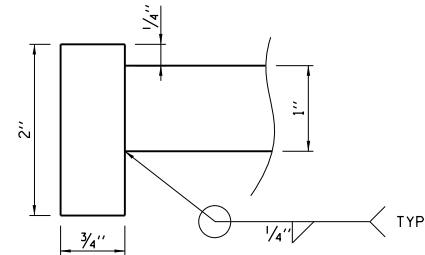
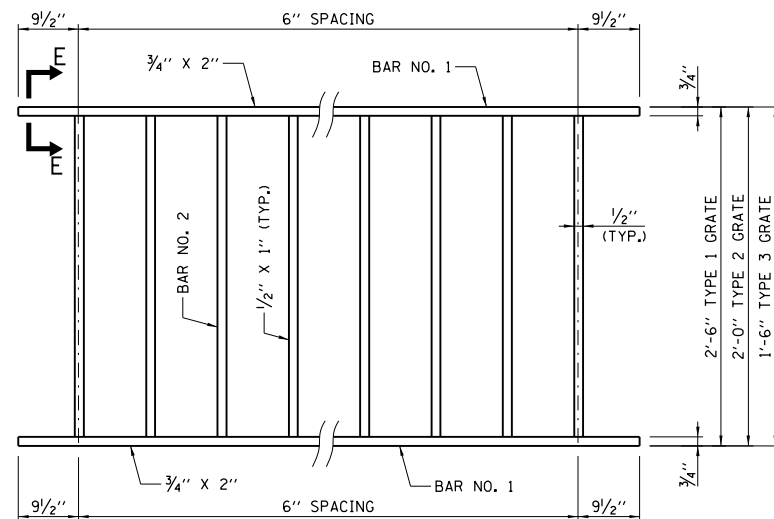
INSIDE PIPE DIAMETER	GRATES		BARS FOR ONE GRATE				HEADWALL GRATES (POUND)	
	NUMBER REQUIRED	TYPE REQ'D	BAR NO 1		BAR NO 2		EACH GRATE	TOTAL
			BARS REQ'D	LENGTH	BARS REQ'D	LENGTH		
18"	3	1	2	3'-7"	5	2'-4 1/2"	57	433
	5	2	2	3'-7"	5	1'-10 1/2"	52	
	0	3	2	3'-7"	5	1'-4 1/2"	48	
24"	0	1	2	4'-7"	7	2'-4 1/2"	75	884
	0	2	2	4'-7"	7	1'-10 1/2"	69	
	14	3	2	4'-7"	7	1'-4 1/2"	63	
30"	7	1	2	5'-7"	9	2'-4 1/2"	93	1082
	5	2	2	5'-7"	9	1'-10 1/2"	86	
	0	3	2	5'-7"	9	1'-4 1/2"	78	
36"	8	1	2	6'-7"	11	2'-4 1/2"	112	1507
	6	2	2	6'-7"	11	1'-10 1/2"	102	
	0	3	2	6'-7"	11	1'-4 1/2"	93	
42"	15	1	2	7'-1"	12	2'-4 1/2"	121	1812
	0	2	2	7'-1"	12	1'-10 1/2"	110	
	0	3	2	7'-1"	12	1'-4 1/2"	100	
48"	0	1	2	7'-7"	13	2'-4 1/2"	130	2497
	21	2	2	7'-7"	13	1'-10 1/2"	119	
	0	3	2	7'-7"	13	1'-10 1/2"	108	
54"	19	1	2	8'-1"	14	2'-4 1/2"	139	2643
	0	2	2	8'-1"	14	1'-10 1/2"	127	
	0	3	2	8'-1"	14	1'-4 1/2"	115	
60"	20	1	2	8'-7"	15	2'-4 1/2"	148	3100
	1	2	2	8'-7"	15	1'-10 1/2"	135	
	0	3	2	8'-7"	15	1'-4 1/2"	123	

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

INSIDE PIPE DIAMETER	GRATES		BARS FOR ONE GRATE				HEADWALL GRATES (POUND)	
	NUMBER REQUIRED	TYPE REQ'D	BAR NO 1		BAR NO 2		EACH GRATE	TOTAL
			BARS REQ'D	LENGTH	BARS REQ'D	LENGTH		
36"	0	1	2	6'-7"	11	2'-4 1/2"	112	1115
	0	2	2	6'-7"	11	1'-10 1/2"	102	
	12	3	2	6'-7"	11	1'-4 1/2"	93	
42"	0	1	2	7'-1"	12	2'-4 1/2"	121	1405
	0	2	2	7'-1"	12	1'-10 1/2"	110	
	14	3	2	7'-1"	12	1'-4 1/2"	100	
48"	0	1	2	7'-7"	13	2'-4 1/2"	130	1725
	0	2	2	7'-7"	13	1'-10 1/2"	119	
	16	3	2	7'-7"	13	1'-4 1/2"	108	
54"	0	1	2	8'-1"	14	2'-4 1/2"	139	1916
	6	2	2	8'-1"	14	1'-10 1/2"	127	
	10	3	2	8'-1"	14	1'-4 1/2"	115	
60"	0	1	2	8'-7"	15	2'-4 1/2"	148	2357
	2	2	2	8'-7"	15	1'-10 1/2"	135	
	17	3	2	8'-7"	15	1'-4 1/2"	123	

**NOTES:**

- ALL STRUCTURAL STEEL SHALL BE AASHTO M270, GRADE 36 OR 50.
- GALVANIZING SHALL BE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS.
- FOR PLACEMENT OF GRATES, SEE SHEET 1 IN THIS SERIES.
- ALL TABLE DIMENSIONS AND QUANTITIES ARE FOR SINGLE HEADWALL, TYPE III.
- ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENT (V:H).

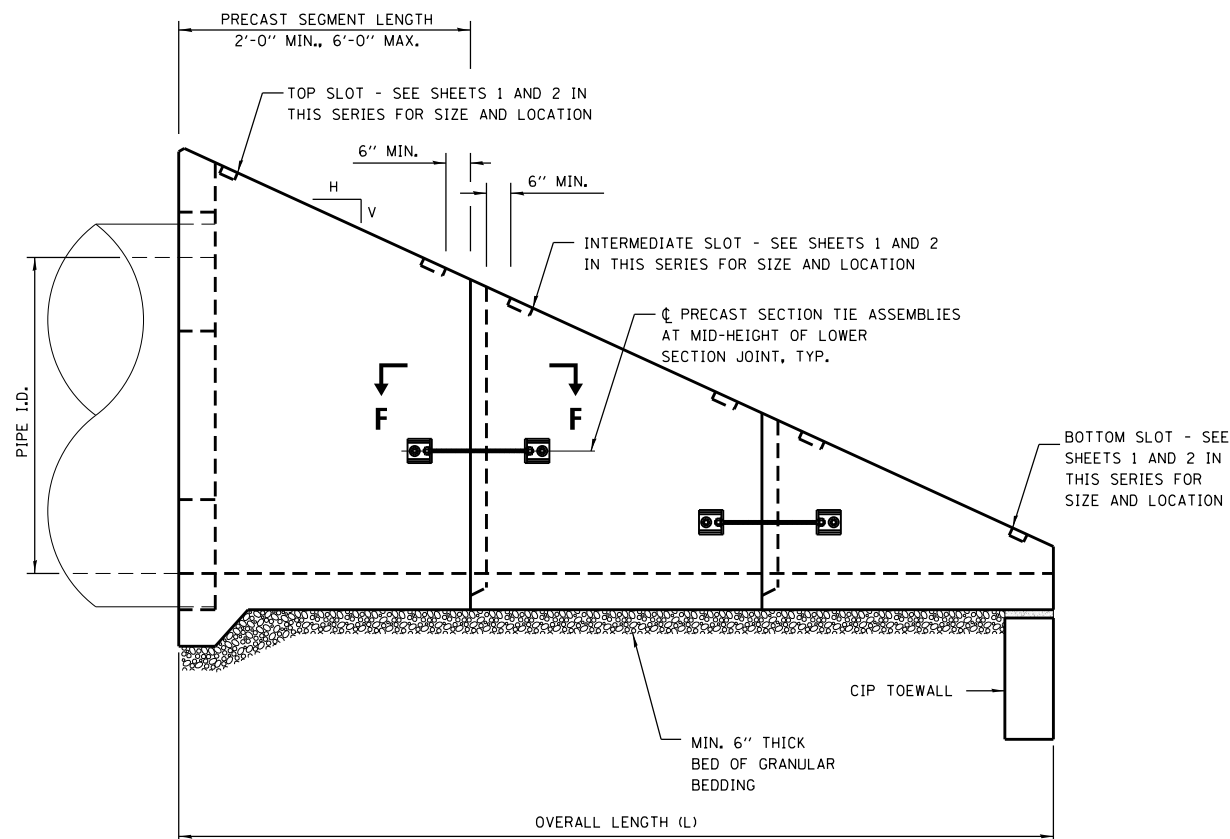


SECTION E-E

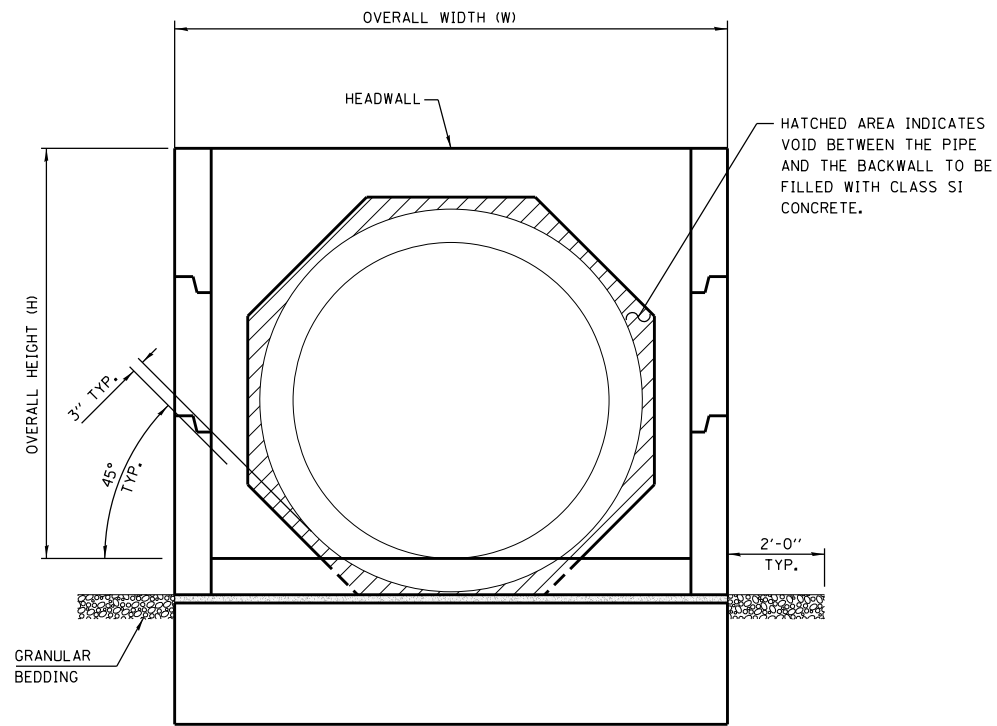
TYPICAL GRATE

APPROVED: *Paul Kovacs* DATE 5-1-2009  
CHIEF ENGINEERING OFFICER

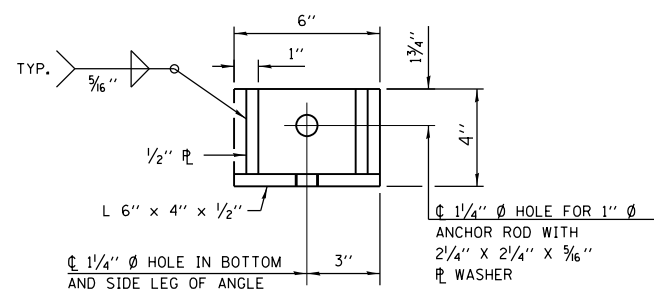
HEADWALL TYPE III 18"-24"-30"-36"-42"-48"-54"-60" FOR 1:3, 1:4, 1:6, AND 1:10 SLOPES
STANDARD B6-08



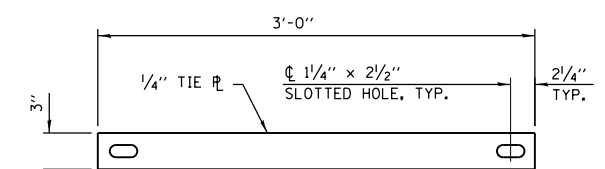
**ELEVATION**



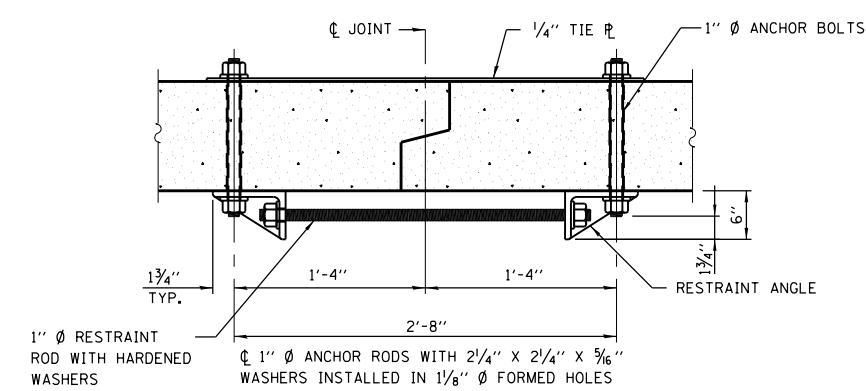
**END VIEW**



**RESTRAINT ANGLE DETAIL**



**TIE PLATE DETAIL**

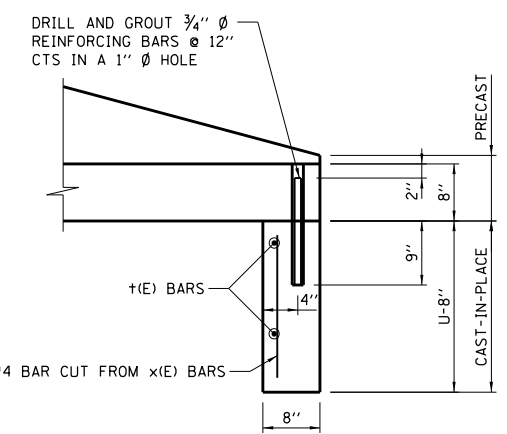


**SECTION F-F**

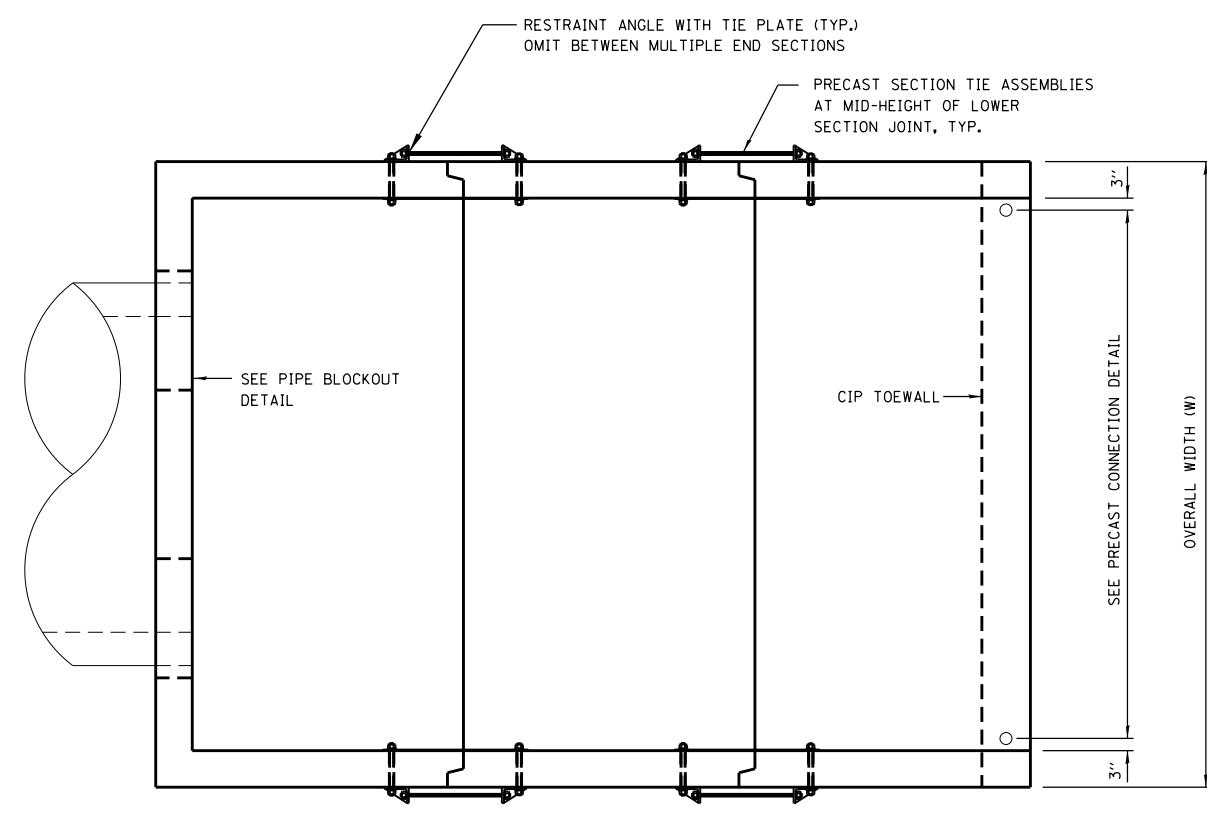
(SHOWING PRECAST SECTION TIE DETAILS)

**GENERAL NOTES:**

1. THE NUMBER OF SEGMENTS SHOWN IN ELEVATION IS FOR EXAMPLE ONLY. THE LENGTH AND NUMBER OF PRECAST SECTIONS REQUIRED TO CONSTRUCT THE END SECTION SHALL BE DETERMINED BY THE CONTRACTOR.
2. CONTRACTOR SHALL RETAIN THE SERVICES OF AN ILLINOIS LICENSED STRUCTURAL ENGINEER TO PROPORTION, DESIGN AND DETAIL PRECAST SECTIONS FOR INSTALLATION AND FOR SERVICE. SEE CAST-IN-PLACE DIMENSIONS AND REINFORCING DETAILS FOR MINIMUM REQUIREMENTS. INCREASE MEMBER SIZES AND REINFORCING AS NECESSARY TO SATISFY HANDLING AND INSTALLATION STRESSES IN PRECAST SECTIONS.
3. CLASS "SI" CONCRETE SHALL BE USED THROUGHOUT.
4. REINFORCEMENT BARS (GRADE 60) SHALL BE EPOXY COATED. SEE CAST-IN-PLACE DETAILS FOR BENDING DIAGRAMS. SEE NOTES ON SHEET 1 IN THIS SERIES FOR REINFORCING COVER REQUIREMENTS.
5. ALL EXPOSED EDGES SHALL BE CHAMFERED. SEE NOTES ON SHEET 1 IN THIS SERIES.
6. SEE ROADWAY PLANS FOR SLOPE (V:H) AND PIPE INSIDE DIAMETER.
7. HOLES IN THE WALLS FOR THE PRECAST TIE ASSEMBLY MAY BE DRILLED USING CORE BITS IN LIEU OF FORMED HOLES. AVOID DAMAGE TO REINFORCING FROM DRILLING HOLES.
8. FOR STEEL GRATING DETAILS, SEE SHEET 3 IN THIS SERIES.
9. ALL SLOPE RATIOS ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENT (V:H).
10. TIE ASSEMBLIES, CONSISTING OF ANCHOR RODS, TIE PLATES, RESTRAINT ANGLES, RESTRAINT RODS AND ALL NUTS AND WASHERS SHALL CONFORM WITH AASHTO M270 GR36, OR GR50 AND SHALL BE HOT DIPPED GALVANIZED IN ACCORDANCE WITH AASHTO M 111 AFTER FABRICATION.



**PRECAST CONNECTION DETAIL**



**PLAN**



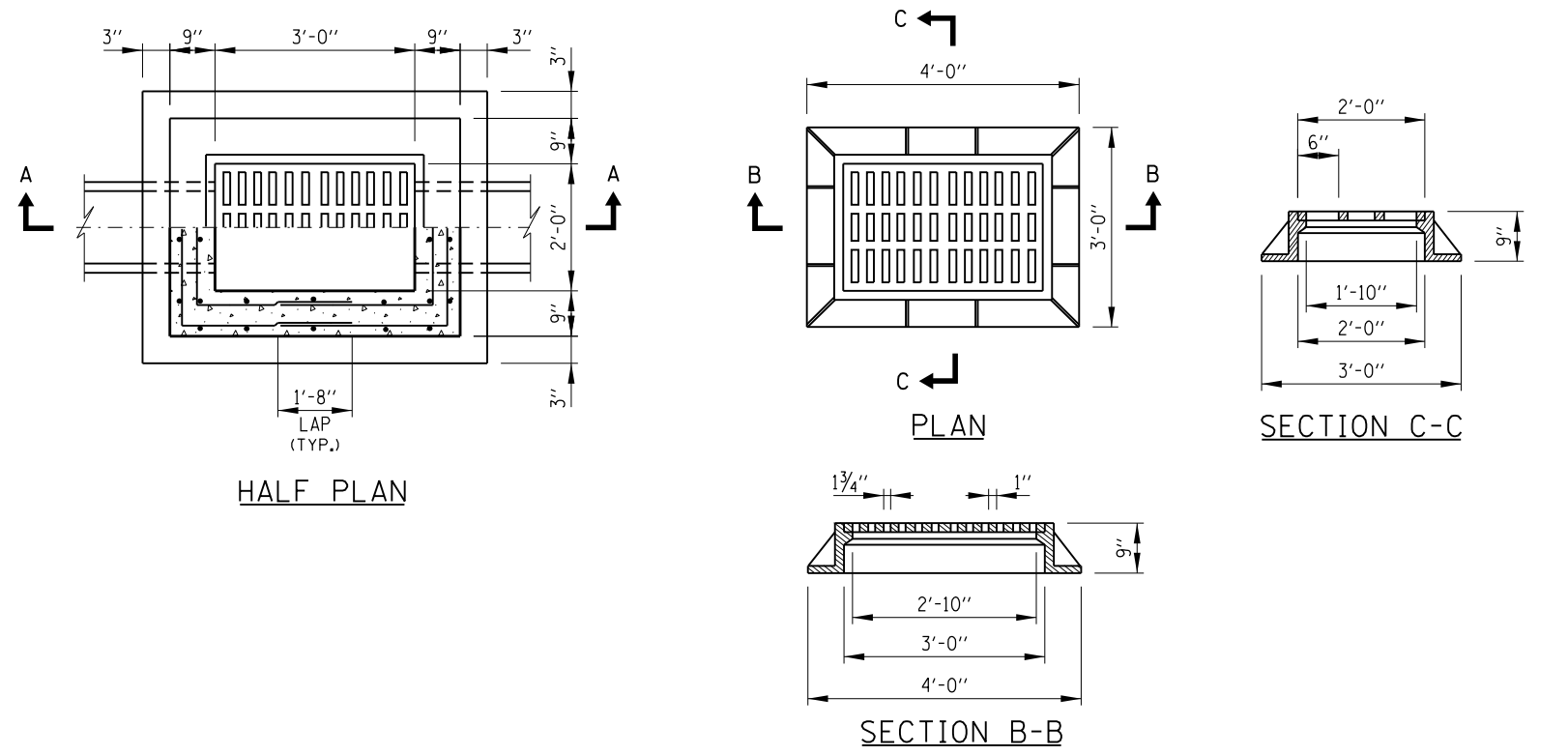
HEADWALL TYPE III  
18"-24"-30"-36"-42"-48"-54"-60"  
FOR 1:3, 1:4, 1:6, AND  
1:10 SLOPES

STANDARD B6-08

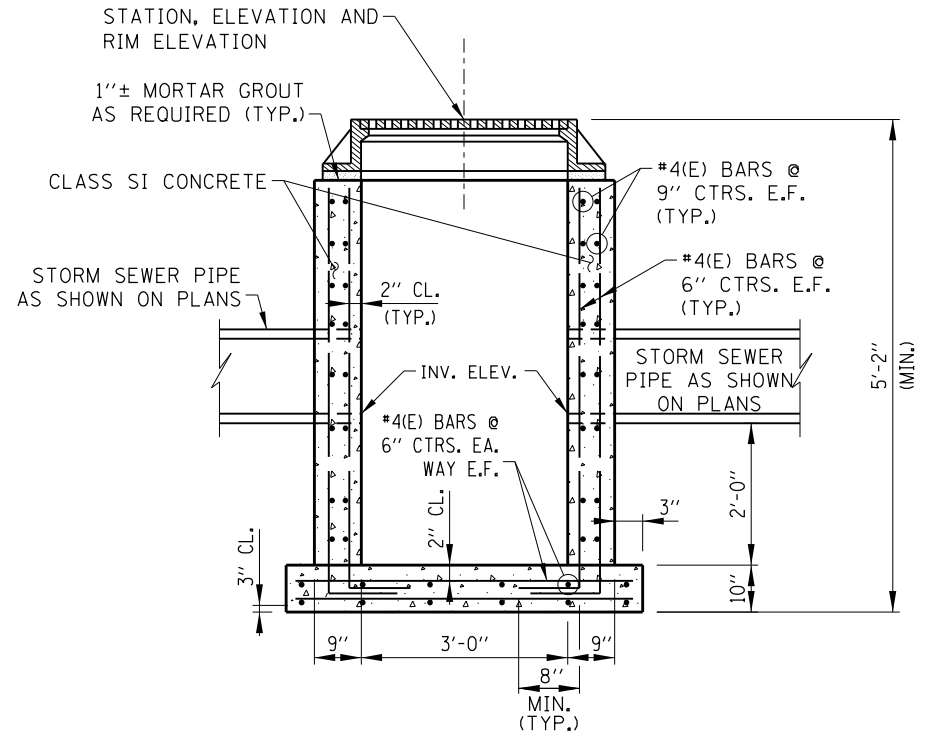
APPROVED: *Paul Kovacs* DATE 5-1-2009  
CHIEF ENGINEERING OFFICER

**HEADWALL TYPE III ALTERNATE PRECAST CONCRETE DETAILS**



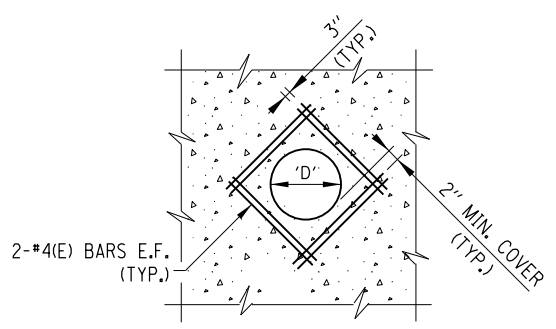


FRAME AND GRATE DETAIL



SECTION A-A

CATCH BASIN TYPE B



TYPICAL REINFORCEMENT AROUND STORM SEWER PIPE

NOTES:

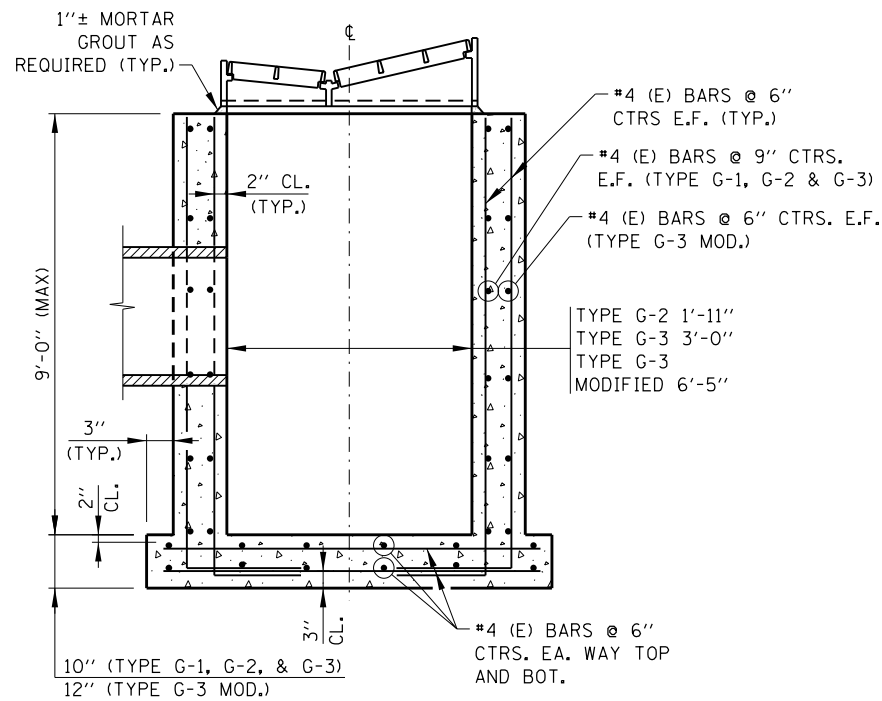
- FOR MATERIALS AND CONSTRUCTION REQUIREMENTS OF THE CATCH BASIN, REFER TO THE STANDARD SPECIFICATIONS.
- FRAME AND GRATE FOR CATCH BASIN TYPE B SHALL BE NEENAH FOUNDRY COMPANY TYPE R-3455C, EAST JORDAN IRON WORKS V5360-1 OR APPROVED EQUAL.
- REINFORCEMENT BARS DESIGNATED (E) SHALL BE EPOXY COATED.

APPROVED: *Paul Kovacs* CHIEF ENGINEERING OFFICER DATE: 2-7-2012

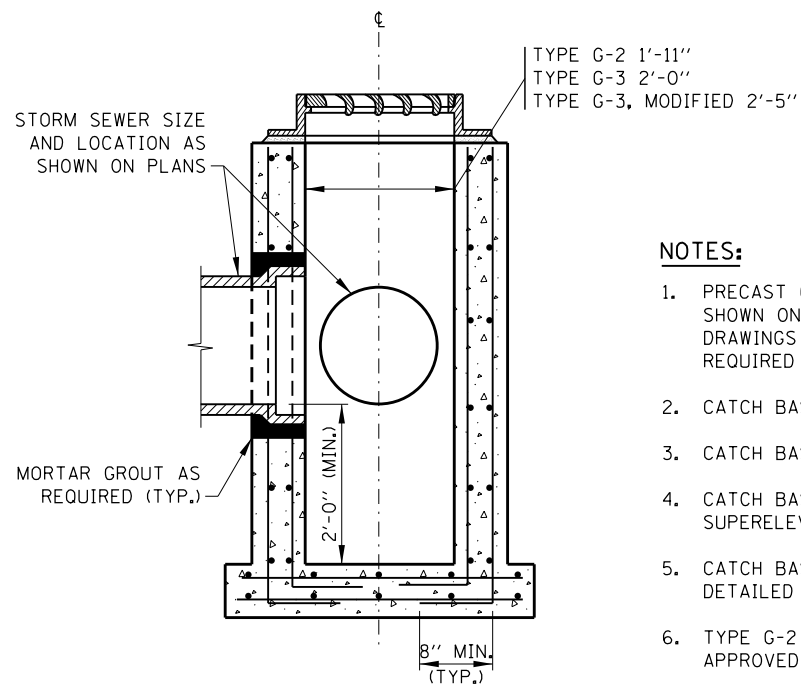
DATE	REVISIONS
02-07-12	REVISED REINFORCEMENT BARS
03-31-14	REVISED SLOPE DRAIN ALSO FRAME AND GRATE CASTINGS
3-11-2015	SLOPE DRAIN CHANGE TO BASE SHEET
3-01-2020	REVISED TYPICAL REINFORCEMENT AROUND PIPE

CATCH BASIN, TYPE B

STANDARD B7-04



SECTION A-A

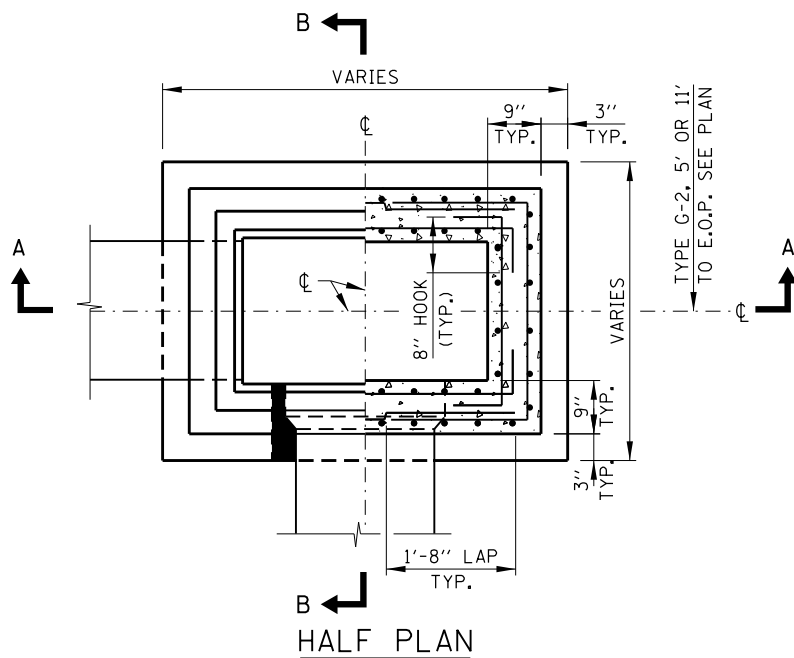


SECTION B-B

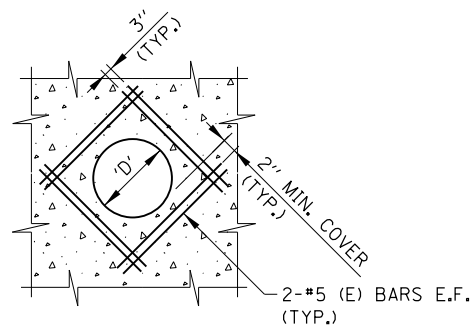
CATCH BASIN TYPE "G" SERIES

**NOTE:**

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

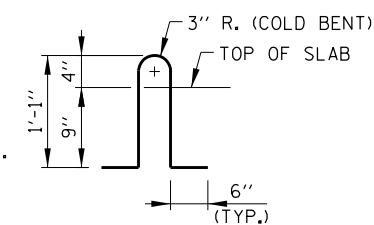


HALF PLAN



TYPICAL REINFORCEMENT AROUND STORM SEWER PIPE

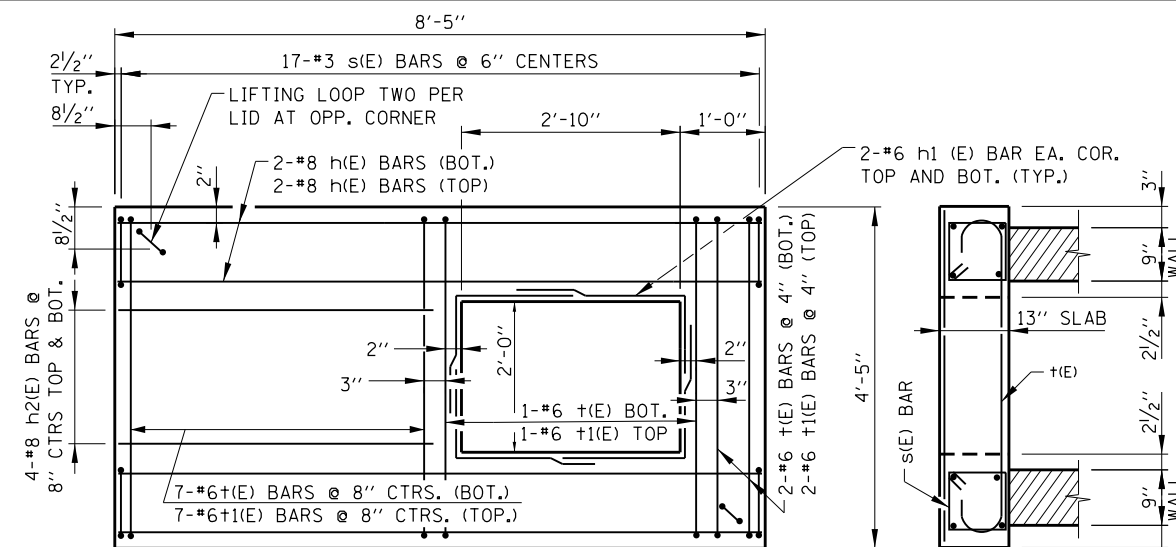
LIFTING LOOP TO BE 1/2"Ø x 270 KSI STRANDS TO BE BURNED AFTER PRECAST CONCRETE LID IS SET IN PLACE.



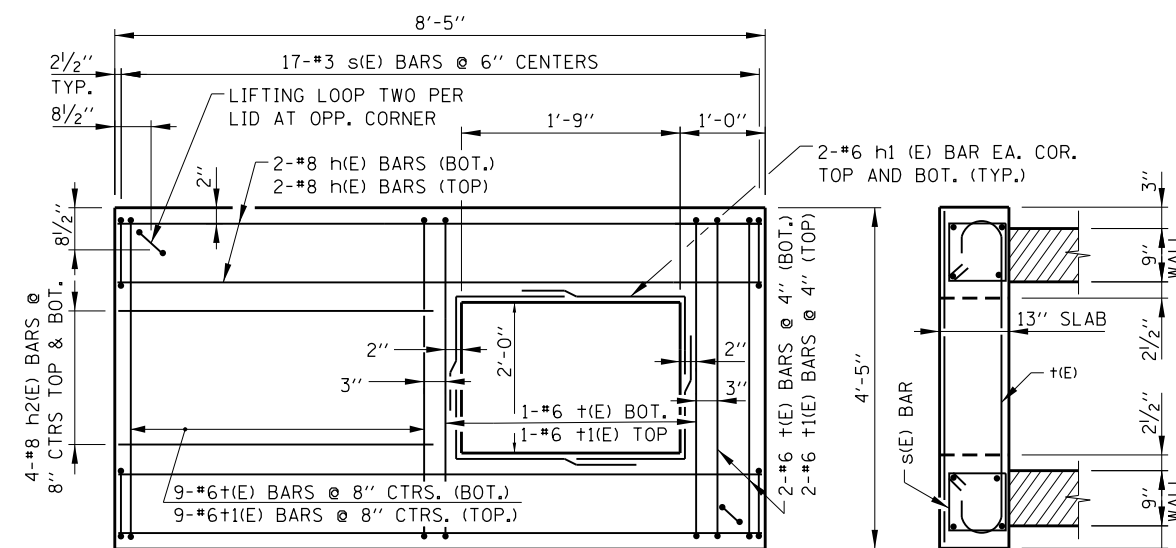
LIFTING LOOP DETAIL

**NOTES:**

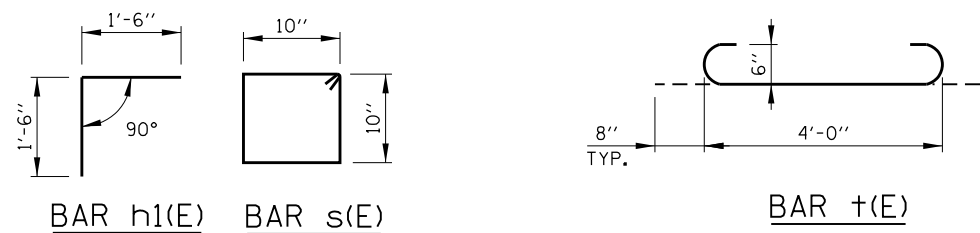
1. PRECAST CONCRETE UNITS WILL BE ACCEPTABLE PROVIDED THEY MEET ALL THE REQUIREMENTS AS SHOWN ON THIS DRAWING. BASE EXTENSION OF 3" NOT REQUIRED FOR PRECAST UNITS. FABRICATION DRAWINGS SHOWING PIPE OPENINGS, REINFORCEMENT AND OTHER PERTINENT DIMENSIONS WILL BE REQUIRED FOR EACH UNIT, FOR APPROVAL BY THE ENGINEER PRIOR TO FABRICATION.
2. CATCH BASIN, TYPE G-2 SHALL BE USED ALONG RAMPS WHERE GUTTER TYPE G-2 IS PROVIDED.
3. CATCH BASIN, TYPE G-3 SHALL BE USED WHERE GUTTER TYPE G-3 IS PROVIDED.
4. CATCH BASIN, TYPE G-3 MODIFIED SHALL BE USED IN PAVEMENT SECTIONS AND ON THE LOW SIDE OF SUPERELEVATED PAVEMENT.
5. CATCH BASIN, TYPE G-3 MODIFIED SHALL BE PROVIDED WITH A REINFORCED CONCRETE SLAB TOP AS DETAILED ON THIS DRAWING.
6. TYPE G-2 FRAME AND GRATE SHALL BE NEENAH R-3508-A2, EAST JORDAN IRON WORKS 7300 OR APPROVED EQUAL.
7. TYPE G-3 FRAME AND GRATE SHALL BE NEENAH INLET FOR ROLL TYPE CURB R-3501-U OR EAST JORDAN IRON WORKS 7545 OR APPROVED EQUAL.
8. TYPE G-3, MODIFIED FRAME AND GRATE SHALL BE NEENAH INLET FOR ROLL TYPE CURB SPECIAL R-3501-U1, EAST JORDAN IRON WORKS 7546 OR APPROVED EQUAL.
9. TYPE G-2, MODIFIED FRAME AND GRATE FOR ROLL TYPE CURB R-3508-B2 OR APPROVED EQUAL.
10. MORTAR OR SEALER SHALL BE USED WHEN A PRECAST REINFORCED CONCRETE LID IS USED.
11. REINFORCEMENT BARS DESIGNATED (E) SHALL BE EPOXY COATED.
12. E.O.P. = EDGE OF PAVEMENT.
13. ALL CONCRETE SHALL BE CLASS SI CONCRETE.
14. FRAME AND GRATE RIM ELEVATION AND OFFSET MEASURED AT THE EDGE OF SHOULDER.



REINFORCED CONCRETE LID  
TYPE G-3 FRAME AND GRATE  
CATCH BASIN, TYPE G-3, MODIFIED



REINFORCED CONCRETE LID  
TYPE 20A FRAME AND GRATE  
CATCH BASIN, TYPE G-3, MODIFIED



BAR h1(E) BAR s(E) BAR t(E)

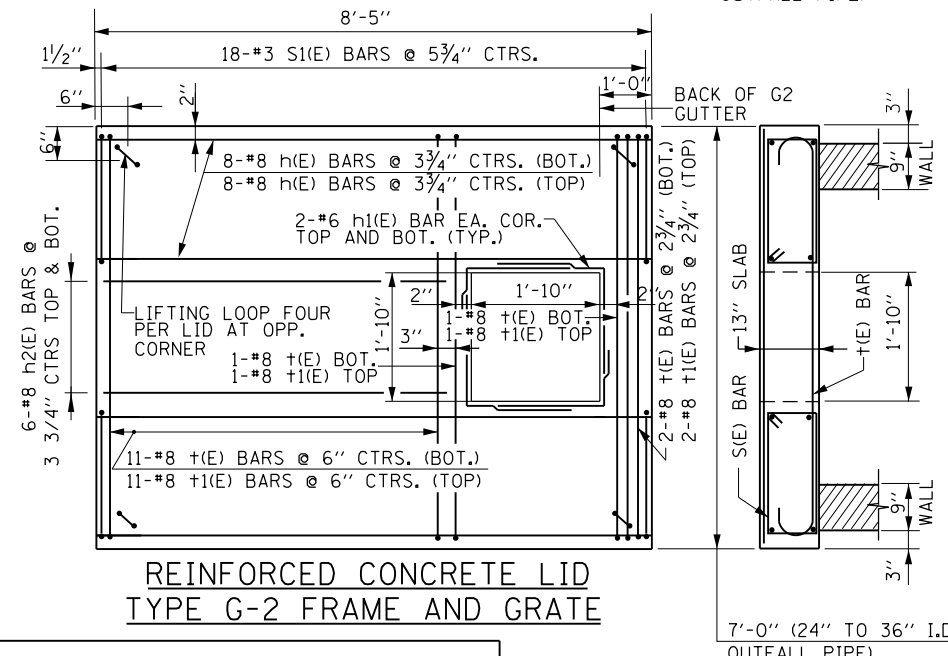
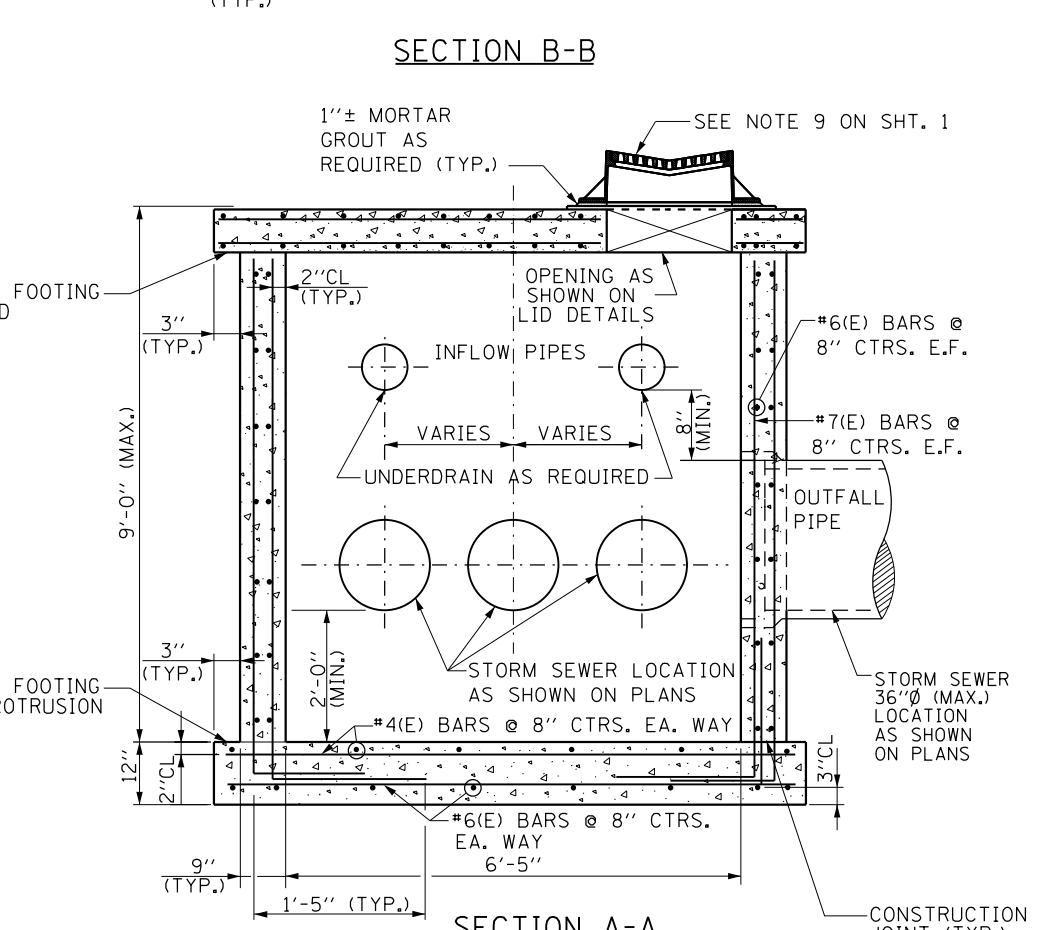
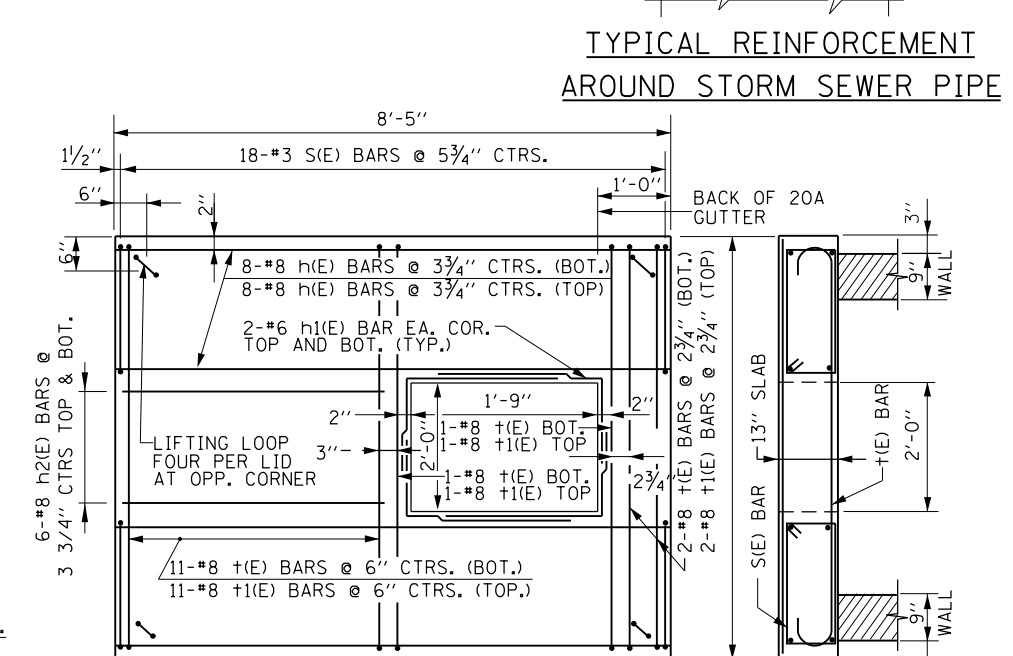
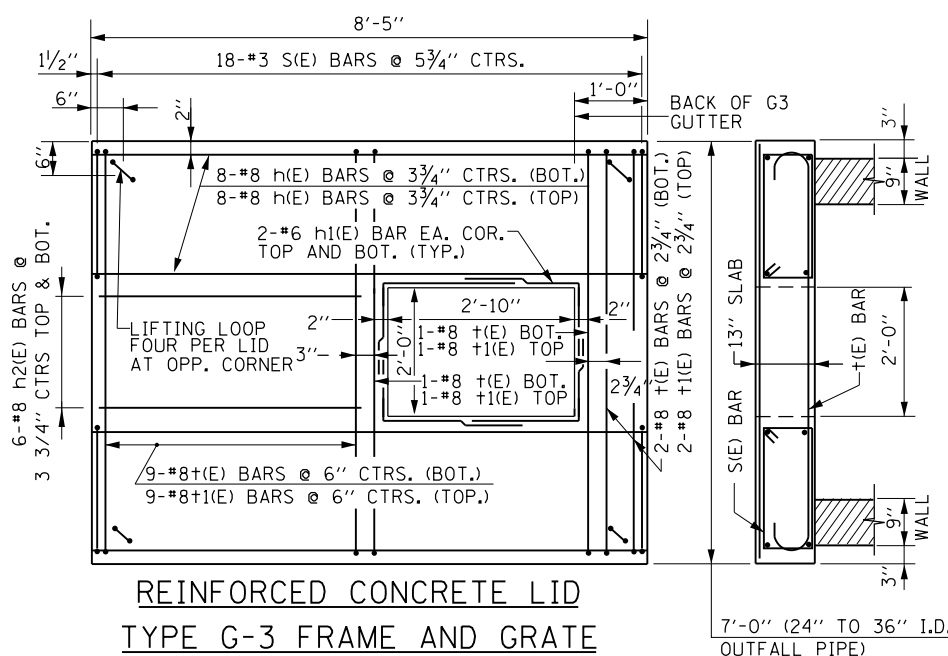
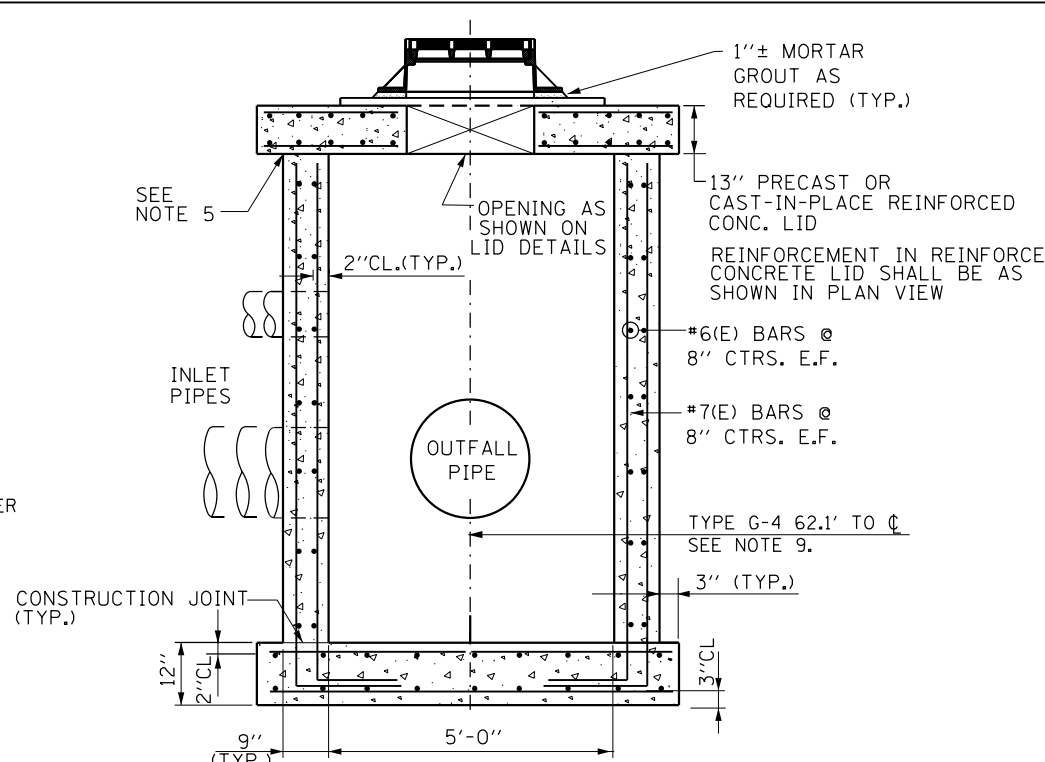
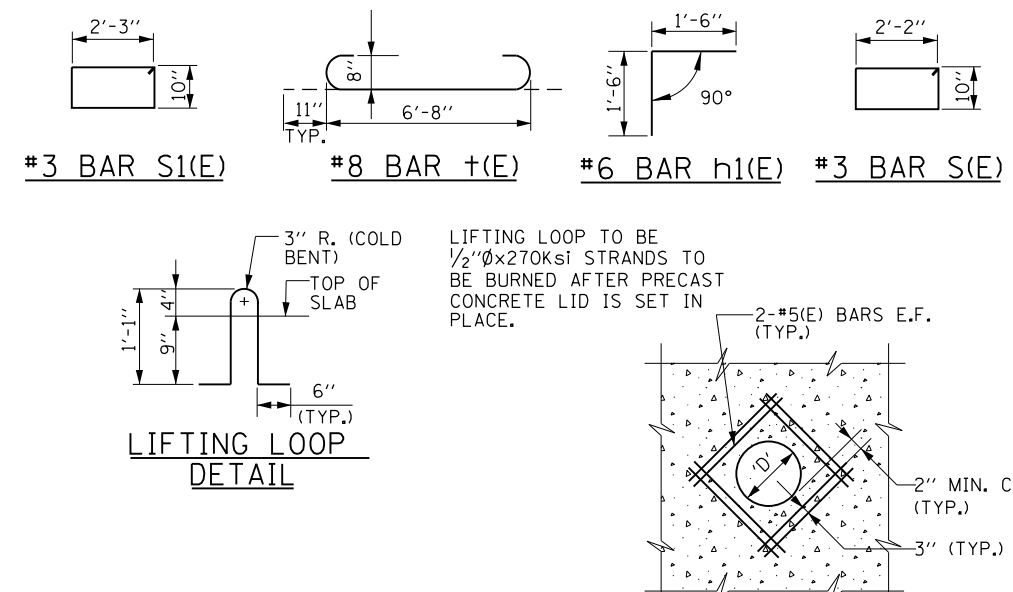
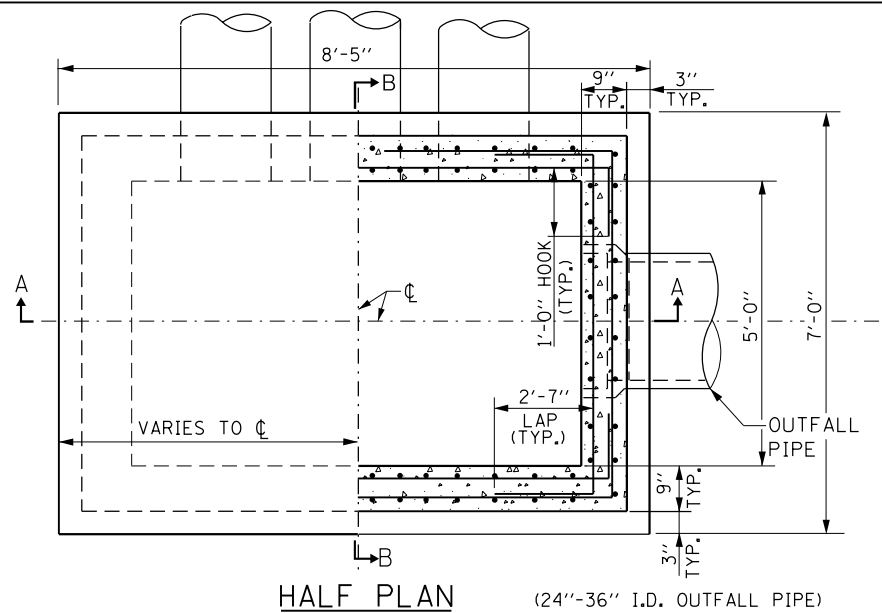
APPROVED: *Paul Kovacs* DATE: 6-1-2009  
CHIEF ENGINEERING OFFICER

DATE	REVISIONS
3-31-2014	ADDED FRAME AND GRATE CASTINGS
3-11-2015	REVISED NOTES AND ADDED CATCH BASIN TYPE G-4 AND TYPE G-5
3-01-2019	NOTED MAXIMUM HEIGHT, AND PROVIDED RIM ELEVATION AND OFFSET LOCATION FOR CATCH BASINS TYPE G-2, G-3, AND G-3 MODIFIED
3-01-2020	ADDED TYPE 20A FRAME AND GRATE OPTION FOR CATCH BASIN, TYPE G-3, MODIFIED

**Illinois Tollway**

CATCH BASINS TYPE G AND TYPE G-3 MODIFIED, FRAMES AND GRATES

STANDARD B8-07



**CATCH BASIN TYPE G-4**

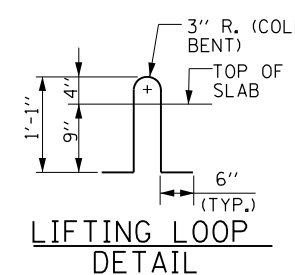
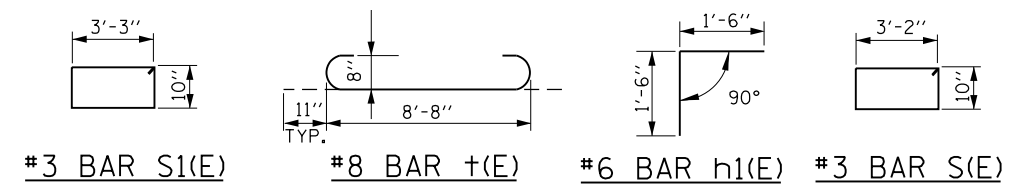
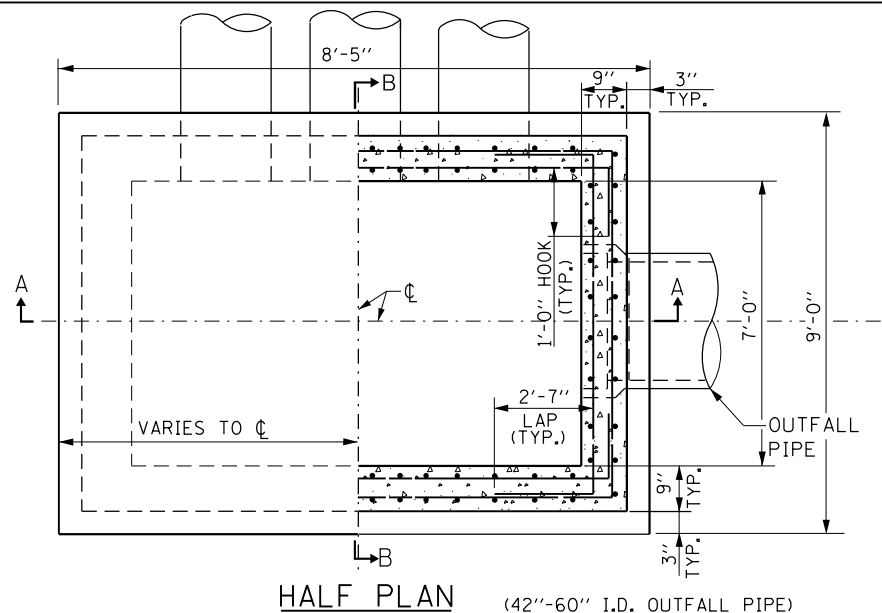
- NOTES:**
- SEE SHEET 1 OF THIS SERIES FOR ADDITIONAL NOTES.
  - CATCH BASINS TYPE G-4 SHALL BE USED IN TANGENT SECTIONS AND ON THE LOW SIDE OF SUPERELEVATED PAVEMENT.
  - CATCH BASINS TYPE G-4 SHALL BE PROVIDED WITH A REINFORCED CONCRETE SLAB TOP AS DETAILED ON THIS DRAWING.
  - CATCH BASINS TYPE G-4 SHALL BE USED WHEN GUTTER, TYPE G-3 IS PROVIDED.
  - MORTAR OR SEALER SHALL BE USED WHEN A PRECAST REINFORCED CONCRETE LID IS USED.
  - FRAME AND GRATE RIM ELEVATION AND OFFSET MEASURED AT THE EDGE OF SHOULDER.
  - 36" Ø MAX. OUTFALL PIPE FOR TYPE G-4 CATCH BASIN.
  - ALL CONCRETE SHALL BE CLASS SI CONCRETE.
  - DISTANCE FROM  $\phi$  OUTFALL PIPE TO  $\phi$  ROADWAY TO BE VERIFIED BY ENGINEER.



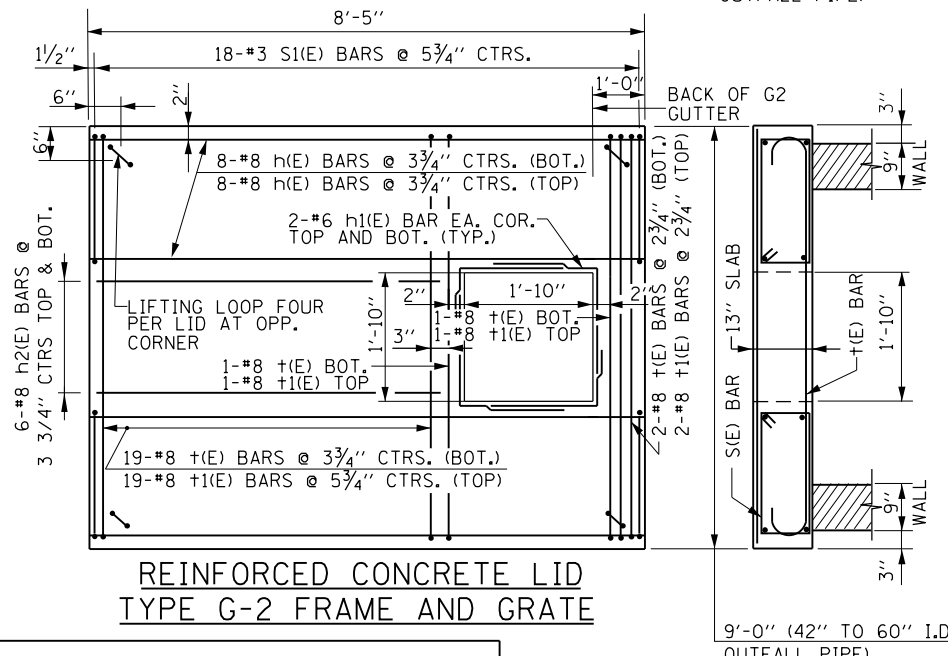
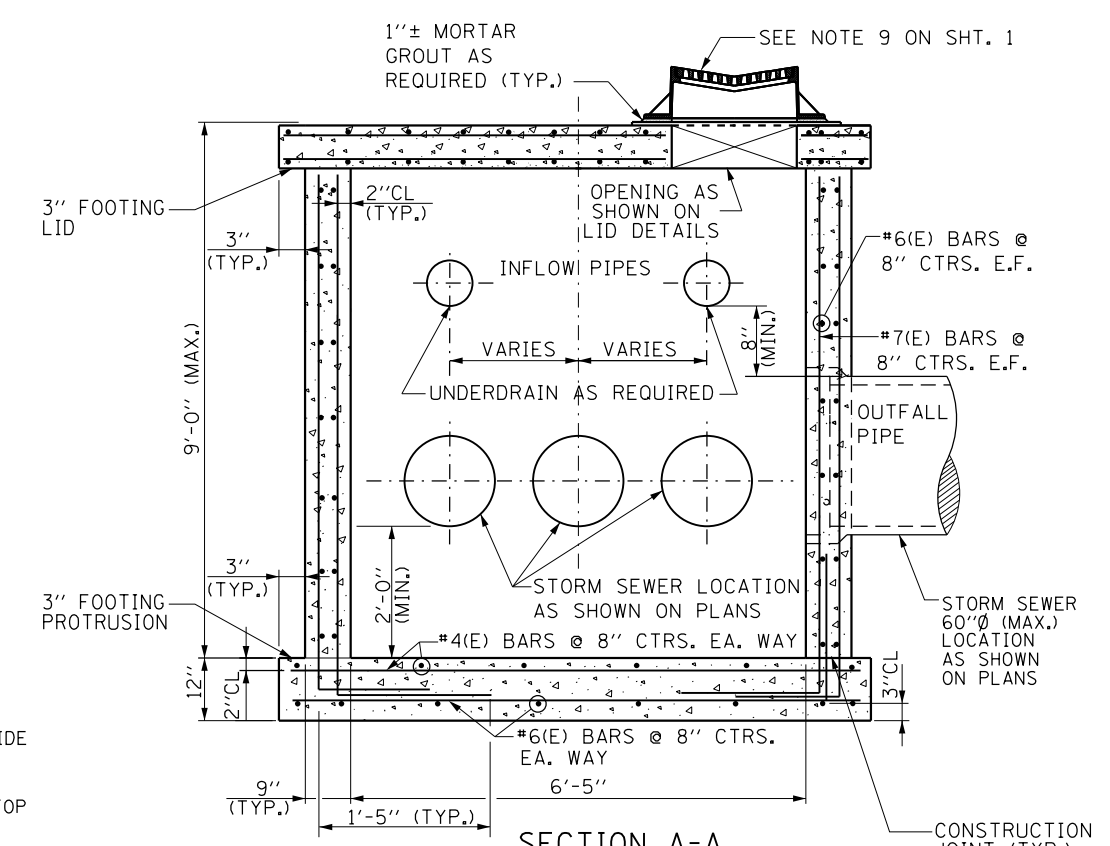
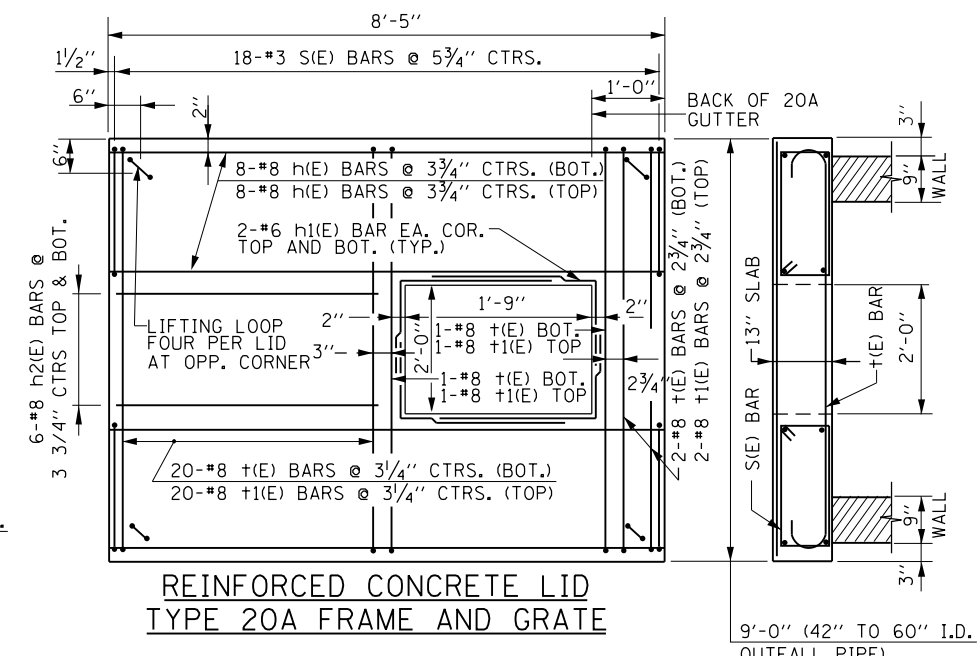
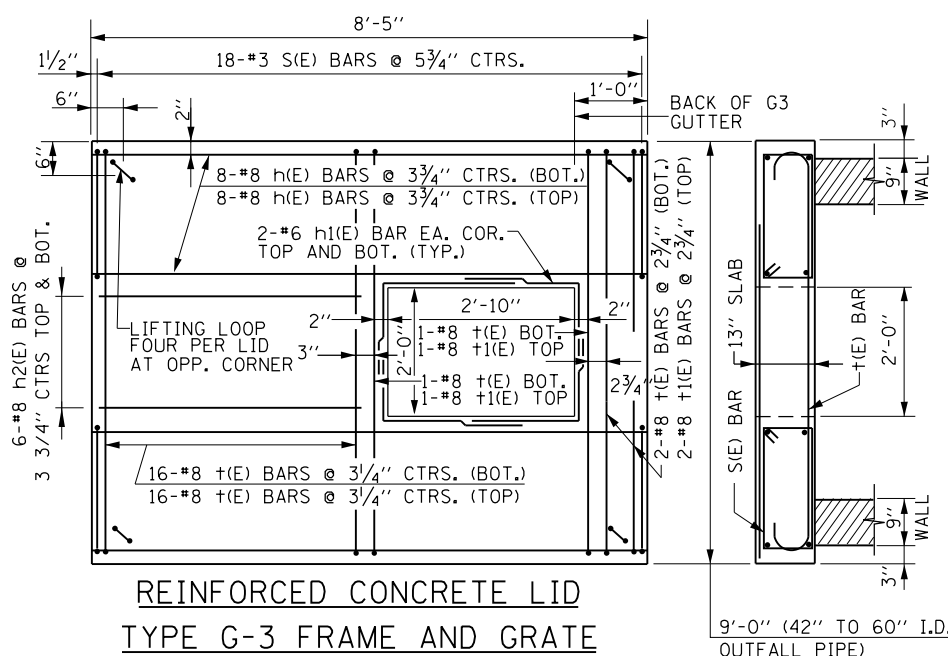
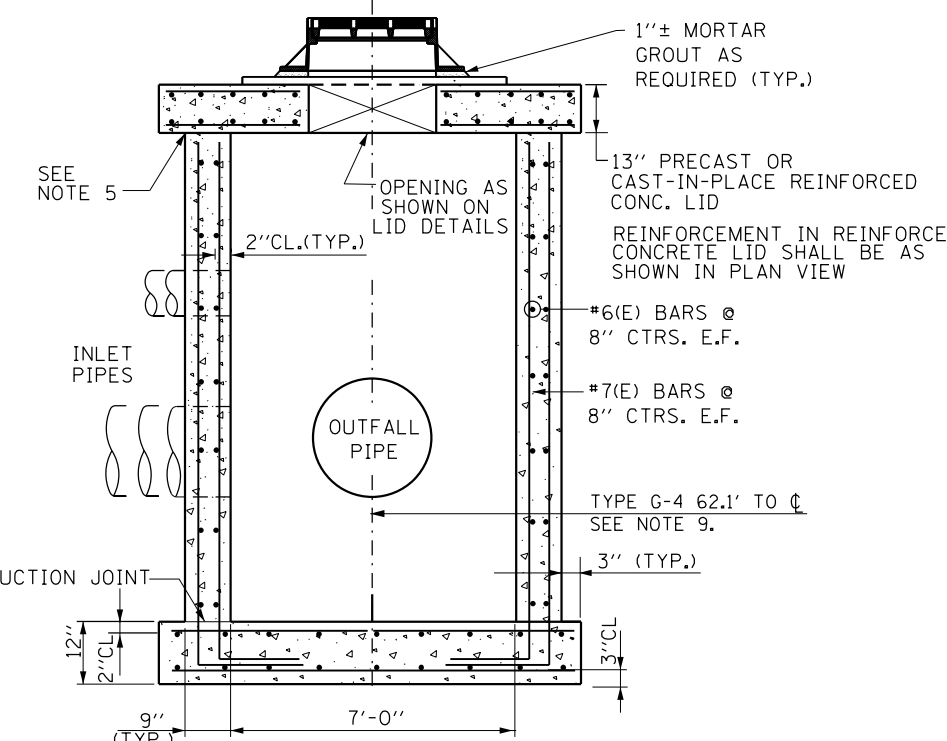
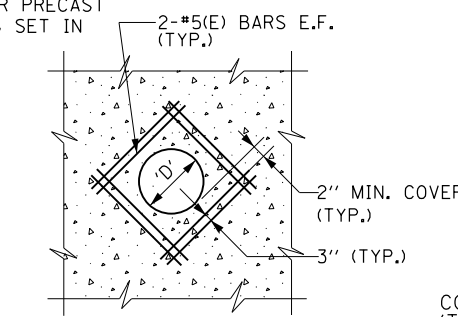
CATCH BASINS TYPE G AND TYPE G-3 MODIFIED, FRAMES AND GRATES

STANDARD B8-07

APPROVED: *Paul Kovacs* DATE: 6-1-2009  
CHIEF ENGINEERING OFFICER



LIFTING LOOP TO BE 1/2"Øx270ksi STRANDS TO BE BURNED AFTER PRECAST CONCRETE LID IS SET IN PLACE.



**CATCH BASIN TYPE G-5**

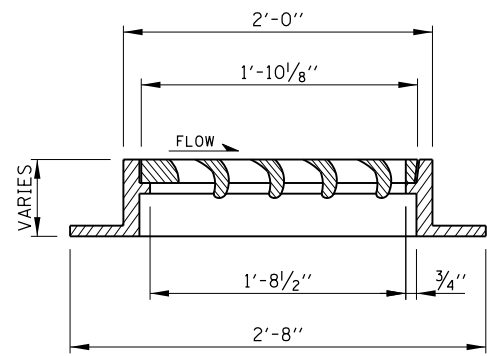
- NOTES:**
- SEE SHEET 1 OF THIS SERIES FOR ADDITIONAL NOTES.
  - CATCH BASINS TYPE G-5 SHALL BE USED IN TANGENT SECTIONS AND ON THE LOW SIDE OF SUPERELEVATED PAVEMENT.
  - CATCH BASINS TYPE G-5 SHALL BE PROVIDED WITH A REINFORCED CONCRETE SLAB TOP AS DETAILED ON THIS DRAWING.
  - CATCH BASINS TYPE G-5 SHALL BE USED WHEN GUTTER, TYPE G-3 IS PROVIDED.
  - MORTAR OR SEALER SHALL BE USED WHEN A PRECAST REINFORCED CONCRETE LID IS USED.
  - FRAME AND GRATE RIM ELEVATION AND OFFSET MEASURED AT THE EDGE OF SHOULDER.
  - 60"Ø MAX. OUTFALL PIPE FOR TYPE G-5 CATCH BASIN.
  - ALL CONCRETE SHALL BE CLASS S1 CONCRETE.
  - DISTANCE FROM Ø OUTFALL PIPE TO Ø ROADWAY TO BE VERIFIED BY ENGINEER.



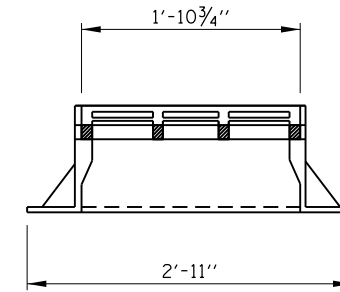
CATCH BASINS TYPE G AND TYPE G-3 MODIFIED, FRAMES AND GRATES

STANDARD B8-07

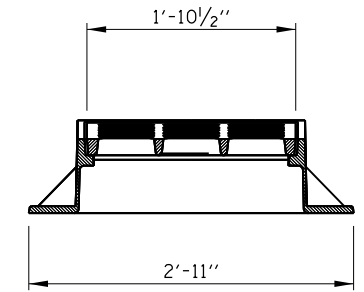
APPROVED: *Paul Kovacs* DATE: 6-1-2009  
CHIEF ENGINEERING OFFICER



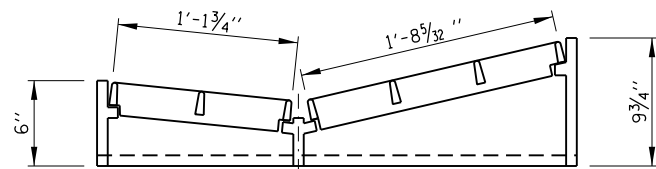
SECTION T-T



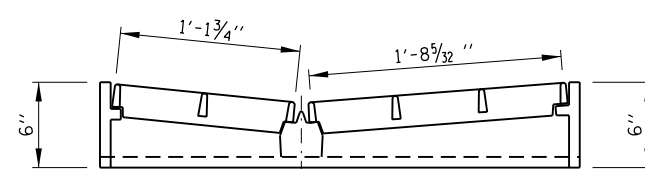
SECTION Y-Y



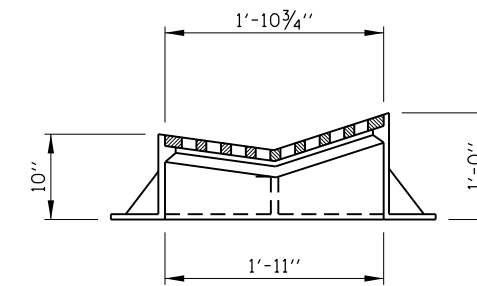
SECTION S-S



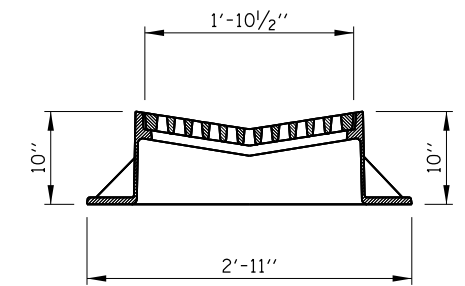
SECTION U-U



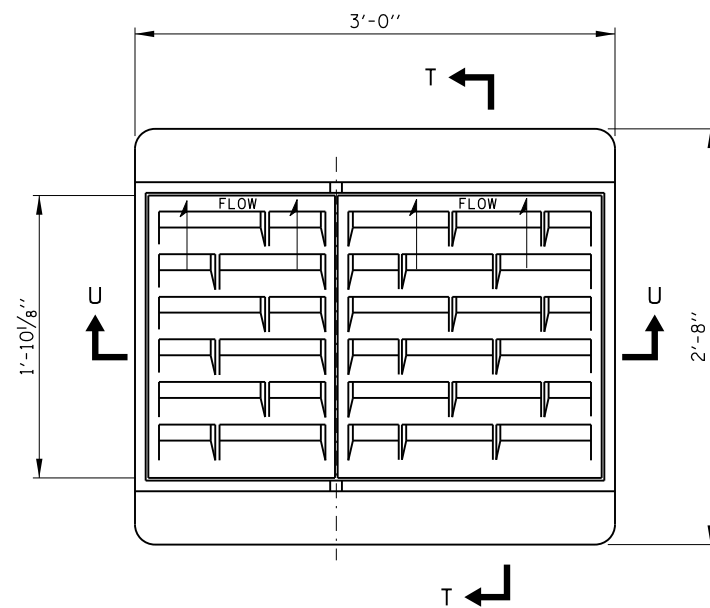
SECTION W-W



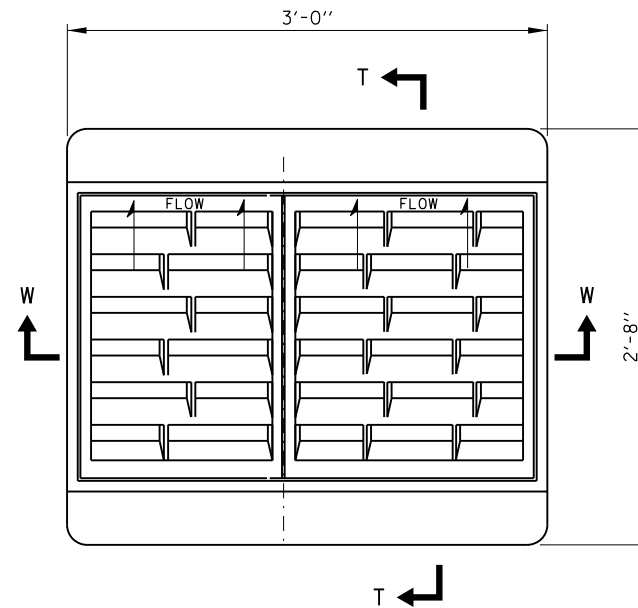
SECTION Z-Z



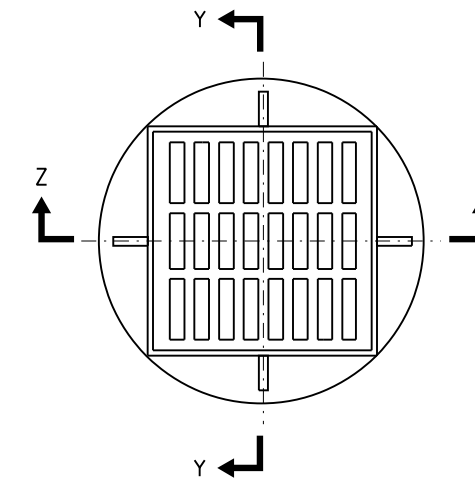
SECTION V-V



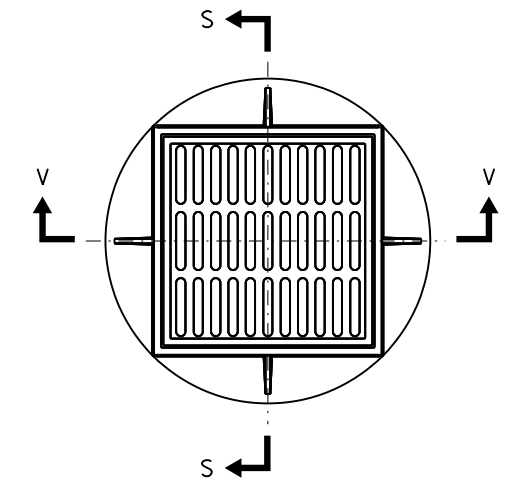
TYPE G-3 FRAME & GRATE



TYPE G-3, MODIFIED  
FRAME & GRATE



TYPE G-2 FRAME & GRATE



TYPE G-2 MODIFIED  
FRAME & GRATE

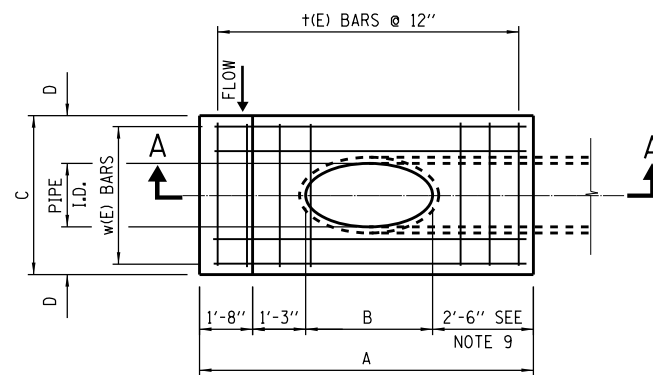
Paul Kovacs  
APPROVED... DATE 6-1-2009...  
CHIEF ENGINEERING OFFICER

NOTE:  
SEE SHEET 1 OF THIS SERIES FOR NOTES.

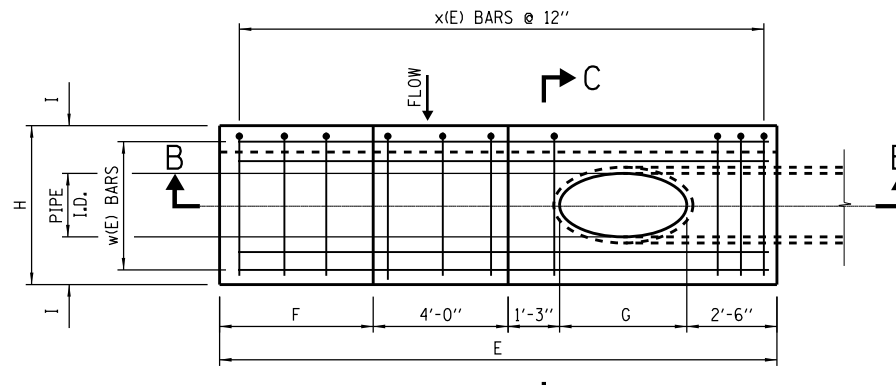


CATCH BASINS TYPE G AND  
TYPE G-3 MODIFIED, FRAMES  
AND GRATES

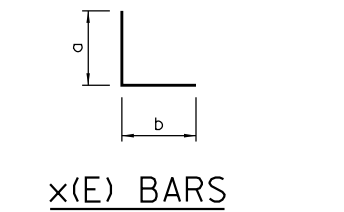
STANDARD B8-07



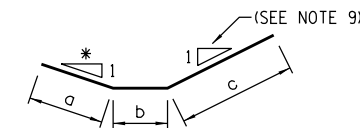
PLAN I



PLAN II

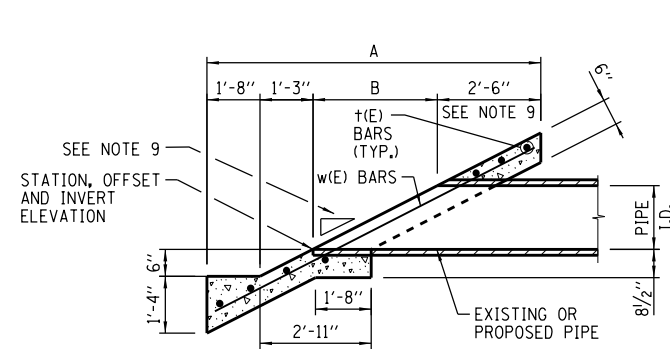


x(E) BARS

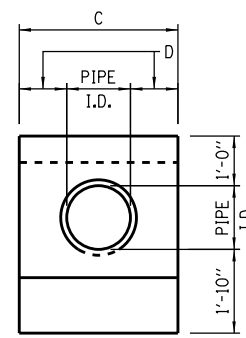


w(E) BARS

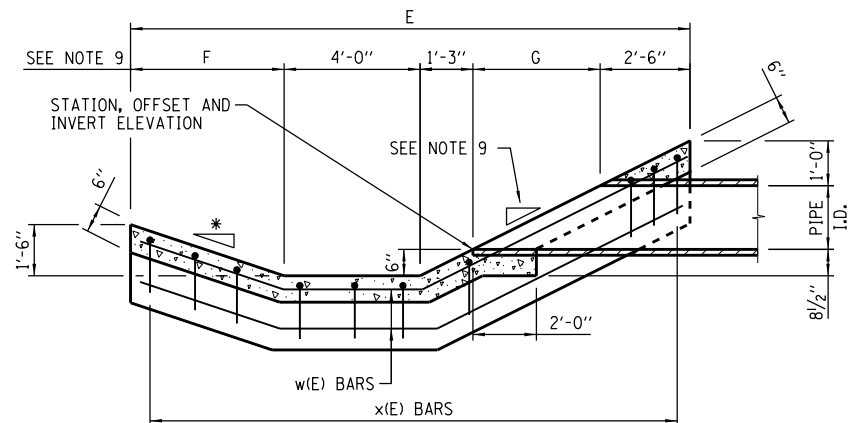
- NOTES:
1. SLOPED HEADWALL TYPES I AND II SHALL BE CONSTRUCTED FLUSH WITH EXISTING OR PROPOSED SLOPE.
  2. CLASS SI CONCRETE SHALL BE USED THROUGHOUT.
  3. ALL REINFORCEMENT BARS SHOWN SHALL BE EPOXY COATED (E).
  4. BAR BENDING DETAILS ARE DIMENSIONED OUT TO OUT OF BARS.
  5. ALL EXPOSED EDGES SHALL HAVE A 3/4" 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 BARS 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 (V:H).
  9. SLOPED HEADWALLS, TYPES I AND II TO BE USED ONLY FOR SLOPES STEEPER THAN 1:3. DIMENSIONS AND QUANTITIES SHOWN ARE BASED ON A 1:2.5 SLOPE (EXISTING AND PROPOSED).
  10. I.D. DENOTES INSIDE DIAMETER OF PIPE. O.D. DENOTES OUTSIDE DIAMETER OF PIPE.



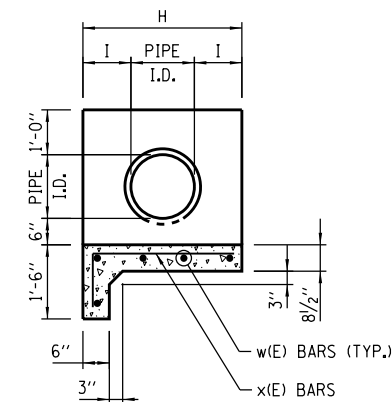
SECTION A-A



ELEVATION



SECTION B-B



SECTION C-C

\* MATCH EXISTING OR PROPOSED SLOPE, SEE NOTE 9

TABLES FOR DIMENSIONS, REINFORCEMENT AND QUANTITIES FOR ONE SLOPED HEADWALL TYPE I

PIPE I.D.	A	B	C	D
6"	6'-8"	1'-3"	2'-6"	1'-0"
12"	7'-11"	2'-6"	3'-0"	1'-0"
15"	8'-7"	3'-2"	3'-9"	1'-3"
18"	9'-2"	3'-9"	4'-6"	1'-6"

PIPE I.D.	REINFORCEMENT BARS		
	MARK(E)	NO. & SIZE	LENGTH
6"	+6	7-#4	2'-2"
	w6	4-#4	6'-8"
12"	+12	7-#4	2'-8"
	w12	4-#4	8'-2"
15"	+15	7-#4	3'-5"
	w15	4-#4	8'-11"
18"	+18	7-#4	4'-2"
	w18	4-#4	9'-6"

DESIGN NO.	INSIDE DIA. OF PIPE	CONC. 1 HDWL. (CU. YD.)	REINF. BARS. 1 HDWL. (POUND)
F-6-2	6"	0.5	29
F-12-2	12"	0.6	35
F-15-2	15"	0.8	40
F-18-2	18"	1.0	45

SLOPED HEADWALL TYPE I

TABLES FOR DIMENSIONS, REINFORCEMENT AND QUANTITIES FOR ONE SLOPED HEADWALL TYPE II

PIPE I.D.	E	F	G	H	I
12"	14'-0"	3'-9"	2'-6"	3'-0"	1'-0"
15"	14'-8"	3'-9"	3'-2"	3'-9"	1'-3"
18"	15'-3"	3'-9"	3'-9"	4'-6"	1'-6"

PIPE I.D.	REINFORCEMENT BARS					
	MARK(E)	NO. & SIZE	LENGTH	a	b	c
12"	x12	10-#4	3'-6"	2'-6"	1'-0"	---
	w12	5-#4	14'-4"	3'-10"	4'-0"	6'-6"
15"	x15	10-#4	4'-3"	3'-3"	1'-0"	---
	w15	5-#4	15'-1"	3'-10"	4'-0"	7'-3"
18"	x18	10-#4	5'-0"	4'-0"	1'-0"	---
	w18	5-#4	15'-8"	3'-10"	4'-0"	7'-10"

DESIGN NO.	INSIDE DIA. OF PIPE	CONC. 1 HDWL. (CU. YD.)	REINF. BARS. 1 HDWL. (POUND)
E-12-2	12"	1.2	75
E-15-2	15"	1.6	82
E-18-2	18"	1.7	89

SLOPED HEADWALL TYPE II

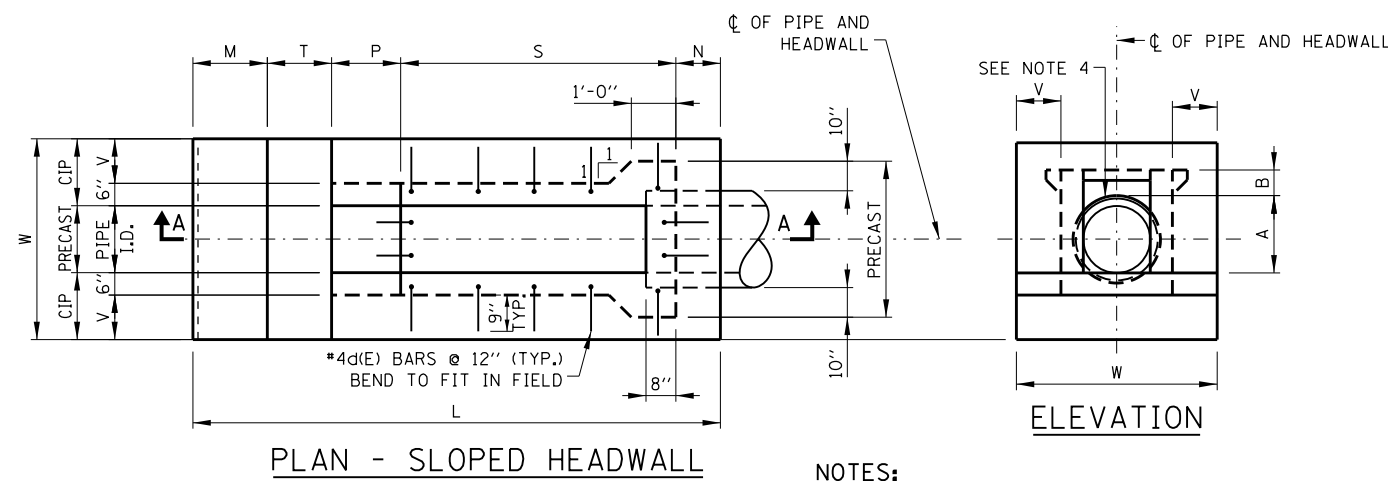
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 2-7-2012

DATE	REVISIONS
2-7-2012	REVISED REINFORCEMENT BARS, TABLES
3-31-2014	REVISED CONCRETE QUANTITIES- REINFORCEMENT STEEL
3-11-2015	REVISED REINFORCEMENT BARS, TABLES
3-31-2017	REVISED REINFORCEMENT BARS, TABLES

SLOPED HEADWALLS TYPE I AND TYPE II

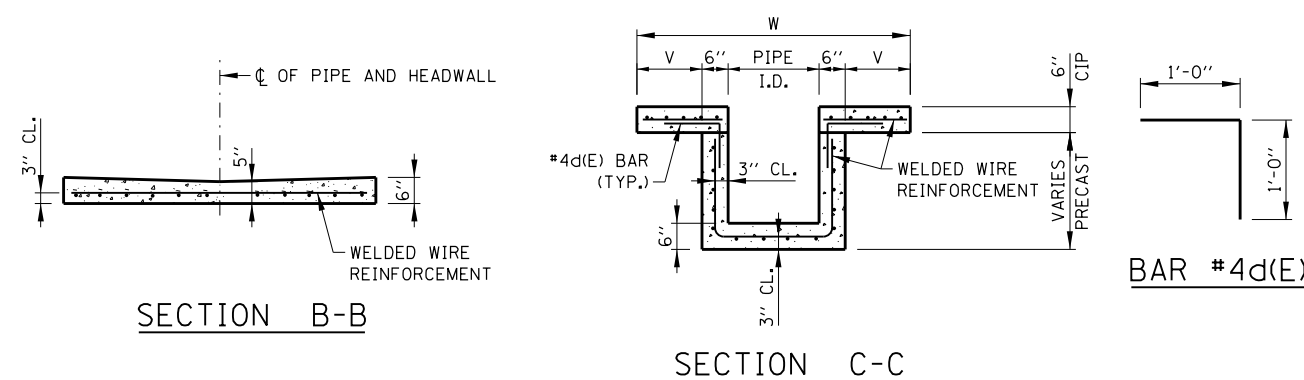
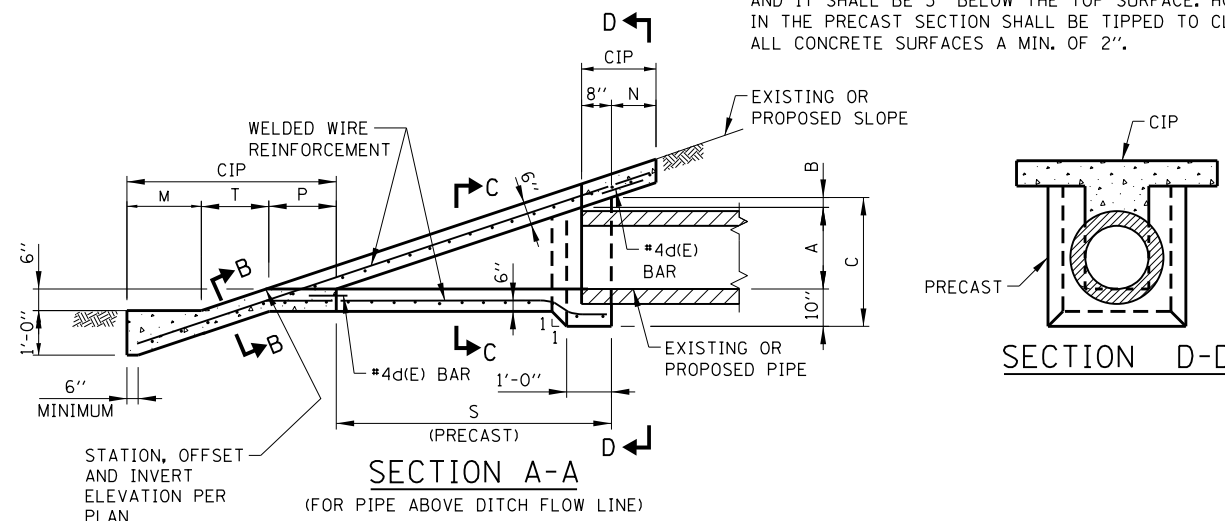
STANDARD B9-04

DIMENSIONS AND QUANTITIES FOR ONE SLOPED HEADWALL TYPE III



NOTES:

EACH #4d(E) 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".



NOTES:

1. THE CAST IN PLACE (CIP) SLOPED HEADWALL SHALL BE CONSTRUCTED FLUSH WITH EXISTING OR PROPOSED SLOPE.
2. CLASS SI CONCRETE SHALL BE USED THROUGHOUT.
3. WELDED WIRE REINFORCEMENT SHALL BE EPOXY COATED 6x6-W4xW4, 58 LBS. PER 100 SQ.FT.
4. ALL REINFORCEMENT BARS SHOWN SHALL BE EPOXY COATED (E).
5. BAR BENDING DETAILS ARE DIMENSIONED OUT TO OUT OF BARS.
6. 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.
7. PRECAST UNIT USE IS OPTIONAL. THE ENTIRE STRUCTURE MAY BE CAST IN PLACE.

PIPE I.D.	DIMENSIONS											PRE CAST CONC. CU. YD.	CAST-IN-PLACE CU. YD.	WELDED WIRE REINFORCEMENT SQ. YD.	REINFORCEMENT BARS				
	A	B	C	N	M	T	P	S	L	V	W				MARK(E)	SIZE	NO.	LENGTH	LB.
6"	9"	2 3/4"	1'-9 3/4"	1'-0"	1'-8"	1'-6"	1'-6 3/4"	2'-11 1/4"	8'-8"	1'-0"	3'-6"	0.15	0.72	3.28	d6	#4	12	2'-0"	16
8"	11"	2 3/4"	1'-11 3/4"	1'-0"	1'-8"	1'-6"	1'-6 3/4"	3'-5 1/4"	9'-2"	1'-0"	3'-8"	0.22	0.75	3.89	d8	#4	12	2'-0"	16
12"	1'-3 1/2"	2 3/4"	2'-4 1/4"	1'-0"	1'-8"	1'-6"	1'-6 3/4"	4'-6 3/4"	10'-3 1/2"	1'-0"	4'-0"	0.34	0.92	4.50	d12	#4	14	2'-0"	19
15"	1'-6 1/2"	2 3/4"	2'-7 1/4"	1'-0"	1'-8"	1'-6"	1'-6 3/4"	5'-3 3/4"	11'-1 1/2"	1'-0"	4'-3"	0.45	1.01	5.88	d15	#4	16	2'-0"	21
18"	1'-10"	2 3/4"	2'-10 3/4"	1'-0"	1'-8"	1'-6"	1'-6 3/4"	6'-2 1/4"	11'-11"	1'-0"	4'-6"	0.61	1.13	6.44	d18	#4	18	2'-0"	24
21"	2'-1"	2 3/4"	3'-1 3/4"	1'-0"	1'-9"	1'-6"	1'-6 3/4"	6'-11 1/4"	12'-9"	1'-3"	5'-3"	0.76	1.39	8.34	d21	#4	22	2'-0"	29
24"	2'-4 1/2"	2 3/4"	3'-5 1/4"	1'-0"	2'-0"	1'-6"	1'-6 3/4"	7'-9 3/4"	13'-10 1/2"	1'-6"	6'-0"	0.95	1.72	9.85	d24	#4	24	2'-0"	32
27"	2'-7 1/2"	2 3/4"	3'-8 1/4"	1'-1 1/2"	2'-3"	1'-6"	1'-6 3/4"	8'-6 3/4"	15'-0"	1'-9"	6'-9"	1.14	2.07	13.54	d27	#4	24	2'-0"	32
30"	2'-11"	2 3/4"	3'-11 3/4"	1'-3"	2'-6"	1'-6"	1'-6 3/4"	9'-5 1/4"	16'-3"	2'-0"	7'-6"	1.38	2.46	16.40	d30	#4	26	2'-0"	35

PIPE I.D.	DIMENSIONS											PRE CAST CONC. CU. YD.	CAST-IN-PLACE CU. YD.	WELDED WIRE REINFORCEMENT SQ. YD.	REINFORCEMENT BARS				
	A	B	C	N	M	T	P	S	L	V	W				MARK(E)	SIZE	NO.	LENGTH	LB.
6"	9"	2"	1'-9"	1'-0"	1'-8"	2'-0"	2'-1"	3'-8"	10'-5"	1'-0"	3'-6"	0.17	0.83	4.07	d6	#4	12	2'-0"	16
8"	11"	2"	1'-11"	1'-0"	1'-8"	2'-0"	2'-1"	4'-4"	11'-1"	1'-0"	3'-8"	0.28	0.87	4.97	d8	#4	14	2'-0"	19
12"	1'-3 1/2"	2"	2'-3 1/2"	1'-0"	1'-8"	2'-0"	2'-1"	5'-10"	12'-7"	1'-0"	4'-0"	0.41	1.07	5.50	d12	#4	16	2'-0"	21
15"	1'-6 1/2"	2"	2'-6 1/2"	1'-0"	1'-8"	2'-0"	2'-1"	6'-10"	13'-7"	1'-0"	4'-3"	0.55	1.18	6.63	d15	#4	18	2'-0"	24
18"	1'-10"	2"	2'-10"	1'-0"	1'-8"	2'-0"	2'-1"	8'-0"	14'-9"	1'-0"	4'-6"	0.74	1.32	8.60	d18	#4	22	2'-0"	29
21"	2'-1"	2"	3'-1"	1'-0"	1'-9"	2'-0"	2'-1"	9'-0"	15'-10"	1'-3"	5'-3"	0.93	1.63	11.03	d21	#4	24	2'-0"	32
24"	2'-4 1/2"	2"	3'-4 1/2"	1'-0"	2'-0"	2'-0"	2'-1"	10'-2"	17'-3"	1'-6"	6'-0"	1.18	2.00	13.88	d24	#4	28	2'-0"	37
27"	2'-7 1/2"	2"	3'-7 1/2"	1'-1 1/2"	2'-3"	2'-0"	2'-1"	11'-2"	18'-7 1/2"	1'-9"	6'-9"	1.42	2.41	14.83	d27	#4	30	2'-0"	40
30"	2'-11"	2"	3'-11"	1'-3"	2'-6"	2'-0"	2'-1"	12'-4"	20'-2"	2'-0"	7'-6"	1.71	2.87	20.49	d30	#4	32	2'-0"	43

PIPE I.D.	DIMENSIONS											PRE CAST CONC. CU. YD.	CAST-IN-PLACE CU. YD.	WELDED WIRE REINFORCEMENT SQ. YD.	REINFORCEMENT BARS				
	A	B	C	N	M	T	P	S	L	V	W				MARK(E)	SIZE	NO.	LENGTH	LB.
6"	9"	1 1/2"	1'-8 1/2"	1'-0"	1'-8"	3'-0"	3'-0"	5'-3"	13'-11"	1'-0"	3'-6"	0.23	1.07	5.29	d6	#4	16	2'-0"	21
8"	11"	1 1/2"	1'-10 1/2"	1'-0"	1'-8"	3'-0"	3'-0"	6'-3"	14'-11"	1'-0"	3'-8"	0.43	1.13	7.13	d8	#4	18	2'-0"	24
12"	1'-3 1/2"	1 1/2"	2'-3"	1'-0"	1'-8"	3'-0"	3'-0"	8'-6"	17'-2"	1'-0"	4'-0"	0.57	1.38	8.62	d12	#4	22	2'-0"	29
15"	1'-6 1/2"	1 1/2"	2'-6"	1'-0"	1'-8"	3'-0"	3'-0"	10'-0"	18'-8"	1'-0"	4'-3"	0.77	1.53	10.35	d15	#4	26	2'-0"	35
18"	1'-10"	1 1/2"	2'-9 1/2"	1'-0"	1'-8"	3'-0"	3'-0"	11'-9"	20'-5"	1'-0"	4'-6"	1.04	1.70	12.47	d18	#4	28	2'-0"	37
21"	2'-1"	1 1/2"	3'-0 1/2"	1'-0"	1'-9"	3'-0"	3'-0"	13'-3"	22'-0"	1'-3"	5'-3"	1.31	2.11	15.77	d21	#4	34	2'-0"	45
24"	2'-4 1/2"	1 1/2"	3'-4"	1'-0"	2'-0"	3'-0"	3'-0"	15'-0"	24'-0"	1'-6"	6'-0"	1.66	2.59	17.62	d24	#4	38	2'-0"	51
27"	2'-7 1/2"	1 1/2"	3'-7"	1'-1 1/2"	2'-3"	3'-0"	3'-0"	16'-6"	25'-10 1/2"	1'-9"	6'-9"	1.99	3.11	24.10	d27	#4	40	2'-0"	53
30"	2'-11"	1 1/2"	3'-10 1/2"	1'-3"	2'-6"	3'-0"	3'-0"	18'-3"	28'-0"	2'-0"	7'-6"	2.41	3.70	29.13	d30	#4	44	2'-0"	59

8. 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 COMPRESSIVE STRENGTH IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS.
9. THE SLOPED HEADWALL DETAILS SHOWN ON THIS DRAWING ARE FOR USE ONLY WITH PIPES HAVING DIAMETER OR SPAN OF 30" OR LESS.
10. ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENT (V:H).
11. I.D. DENOTES INSIDE DIAMETER OF PIPE. O.D. DENOTES OUTSIDE DIAMETER OF PIPE.
12. REBAR REINFORCEMENT MAY BE USED AS AN OPTION TO WELDED WIRE REINFORCEMENT, DRAWINGS SHALL BE SUBMITTED FOR APPROVAL BY THE ENGINEER.

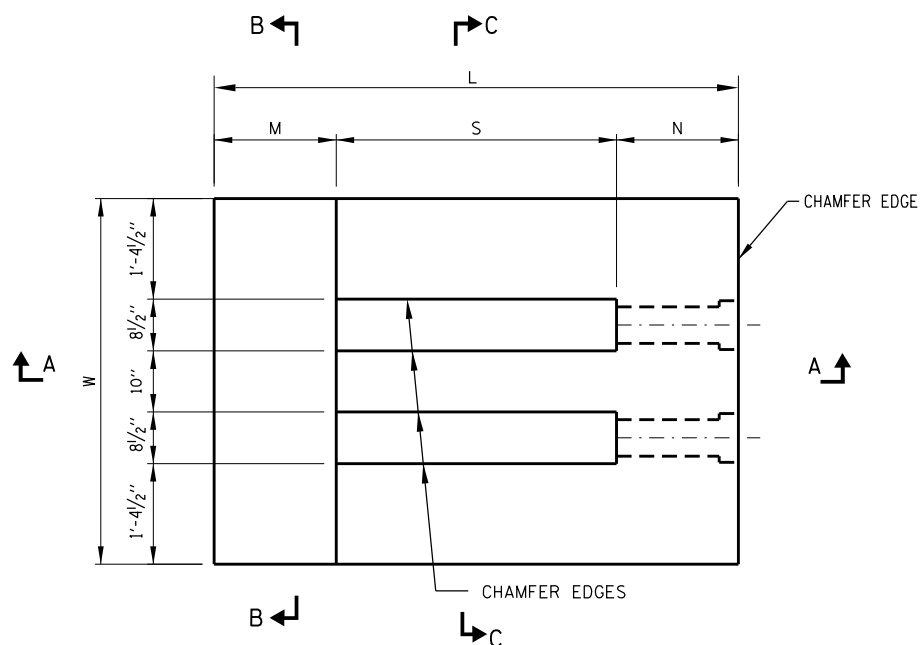


SLOPED HEADWALLS  
TYPE III DETAILS

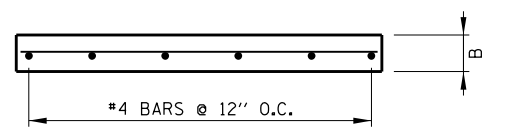
STANDARD B10-12

DATE	REVISIONS
3-31-2016	CHANGED TERMINOLOGY TO WELDED WIRE REINFORCEMENT
3-31-2017	REVISED TABLE (L)
3-01-2019	ADDED DOUBLE SLOPED HEADWALL TYPE III
3-01-2020	REVISED NOTES
3-01-2021	ADDED 8" SLOPED HEADWALL TYPE III

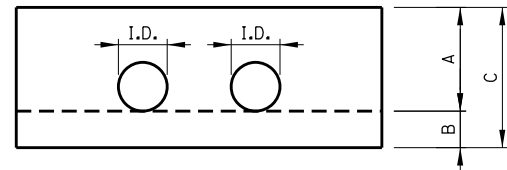
APPROVED: *Paul Kovacs* DATE 2-7-2012  
CHIEF ENGINEERING OFFICER



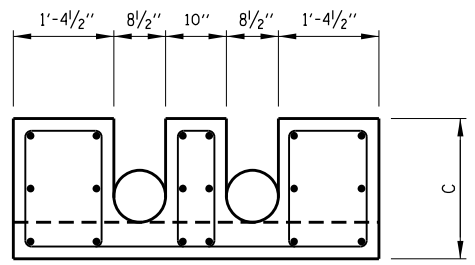
PLAN - DOUBLE SLOPED HEADWALL



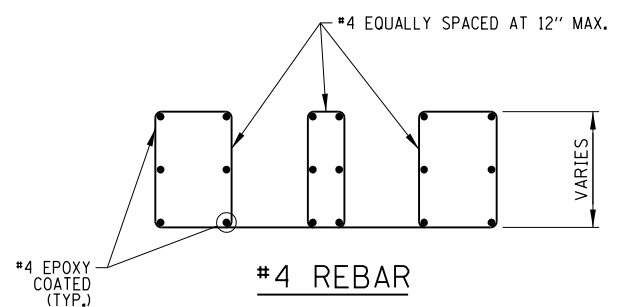
SECTION B-B



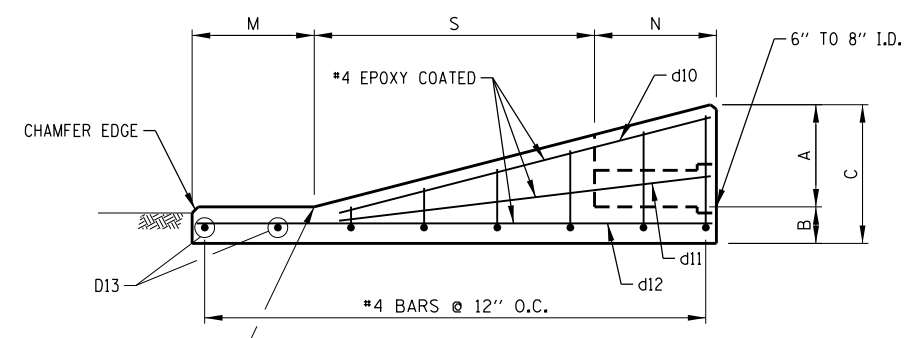
ELEVATION



SECTION C-C

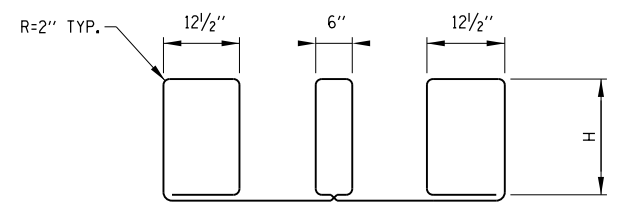


#4 REBAR



SECTION A-A

STATION, OFFSET AND INVERT ELEVATION PER PLAN



d1 THROUGH d9 BAR BENT

STIRRUP HEIGHT TABLE FOR DOUBLE SLOPED HEADWALL TYPE III

1 TO 3 SLOPE AND C=1'-11"		1 TO 4 SLOPE AND C=1'-11"		1 TO 6 SLOPE AND C=1'-11"	
	STIRRUP HEIGHT, H		STIRRUP HEIGHT, H		STIRRUP HEIGHT, H
d1 E	17'-6"	d1 E	17'-7"	d1 E	17'-8 1/4"
d2 E	14'-4 3/4"	d2 E	15'-3/4"	d2 E	15'-10 1/2"
d3 E	11'-3 3/4"	d3 E	12'-6 3/4"	d3 E	14'-1/4"
d4 E	8'-2 3/4"	d4 E	10'-1/2"	d4 E	12'-2 1/4"
d5 E	5'-1 1/2"	d5 E	7'-6"	d5 E	10'-4 1/4"
		d6 E	5'-0"	d6 E	8'-6"
				d7 E	6'-8 1/4"
				d8 E	4'-10"

1 TO 3 SLOPE AND C=2'-1"		1 TO 4 SLOPE AND C=2'-1"		1 TO 6 SLOPE AND C=2'-1"	
	STIRRUP HEIGHT, H		STIRRUP HEIGHT, H		STIRRUP HEIGHT, H
d1 E	19'-6"	d1 E	19'-7"	d1 E	19'-8 1/4"
d2 E	16'-4 3/4"	d2 E	17'-3/4"	d2 E	17'-10 1/2"
d3 E	13'-3 3/4"	d3 E	14'-6 3/4"	d3 E	16'-1/4"
d4 E	10'-2 3/4"	d4 E	12'-1/2"	d4 E	14'-2 1/4"
d5 E	7'-1 1/2"	d5 E	9'-6"	d5 E	12'-4 1/4"
d6 E	4'-1/2"	d6 E	7'-0"	d6 E	10'-6"
		d7 E	4'-5 3/4"	d7 E	8'-8 1/4"
				d8 E	6'-10"
				d9 E	5'-0"

NOTES:

1. THE DOUBLE SLOPED HEADWALL 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 (E).
4. BAR BENDING DETAILS ARE DIMENSIONED OUT TO OUT OF BARS.
5. 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.
6. PRECAST UNIT USE IS OPTIONAL. THE ENTIRE STRUCTURE MAY BE CAST IN PLACE.
7. 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 COMPRESSIVE STRENGTH IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS.
8. THE DOUBLE SLOPED HEADWALL DETAILS SHOWN ON THIS DRAWING ARE FOR USE ONLY WITH PIPES HAVING DIAMETER OR SPAN OF 8" OR LESS.
9. ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL DISPLACEMENT (V:H).
10. I.D. DENOTES INSIDE DIAMETER OF PIPE.
11. WELDED WIRE REINFORCEMENT MAY BE USED AS AN OPTION TO REBAR REINFORCEMENT, DRAWINGS SHALL BE SUBMITTED FOR APPROVAL BY THE ENGINEER.



SLOPED HEADWALLS TYPE III DETAILS

STANDARD B10-12

APPROVED: *Paul Kovacs* DATE: 2-7-2012  
CHIEF ENGINEERING OFFICER



	PIPE I.D.	DIMENSIONS								PRECAST CONCRETE CU YD	MARK	SIZE	NO	LENGTH	LB
		A	B	C	N	S	M	L	W						
1 TO 3 SLOPE	(2) - 6" PIPE	1'-5"	6"	1'-11"	1'-8"	3'-10"	1'-8"	7'-2"	5'-0"	1.29	d1 E	#4	1	17'-4 3/4"	12
											d2 E	#4	1	15'-10 1/4"	11
											d3 E	#4	1	14'-3 1/2"	10
											d4 E	#4	1	12'-9 1/4"	9
											d5 E	#4	1	11'-2 1/2"	7
											d10 E	#4	6	4'-8"	19
											d11 E	#4	6	3'-10 3/4"	16
											d12 E	#4	6	6'-10"	27
	d13 E	#4	2	4'-8"	6										
	(2) - 8" PIPE OR (1) - 6" PIPE & (1) - 8" PIPE	1'-5"	8"	2'-1"	1'-8"	3'-10"	1'-8"	7'-2"	5'-0"	1.51	d1 E	#4	1	18'-4 3/4"	12
											d2 E	#4	1	16'-10 1/4"	11
											d3 E	#4	1	15'-3 1/2"	10
											d4 E	#4	1	13'-9 1/4"	9
d5 E											#4	1	12'-2 1/2"	8	
d6 E	#4	1	10'-8"	7											
d10 E	#4	6	5'-4"	21											
d11 E	#4	6	4'-6 1/2"	18											
d12 E	#4	6	6'-10"	27											
d13 E	#4	2	4'-8"	6											

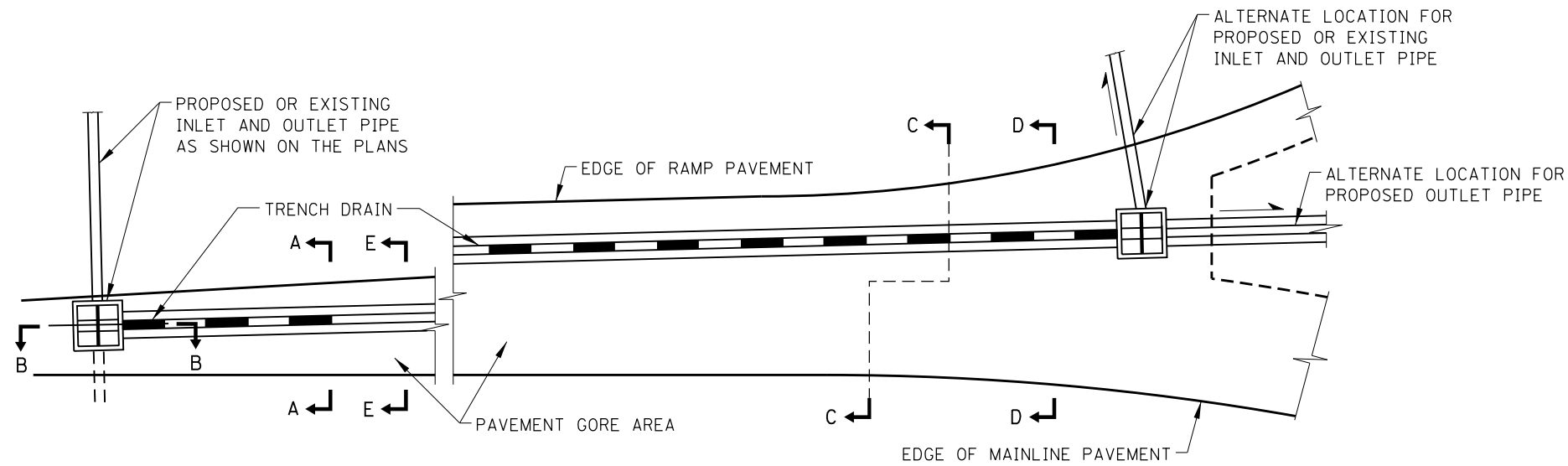
	PIPE I.D.	DIMENSIONS								PRECAST CONCRETE CU YD	MARK	SIZE	NO	LENGTH	LB
		A	B	C	N	S	M	L	W						
1 TO 6 SLOPE	(2) - 6" PIPE	1'-5"	6"	1'-11"	1'-8"	7'-7"	1'-8"	10'-11"	5'-0"	2.00	d1 E	#4	1	17'-6"	12
											d2 E	#4	1	16'-7"	11
											d3 E	#4	1	15'-8"	10
											d4 E	#4	1	14'-9"	10
											d5 E	#4	1	13'-10"	9
											d6 E	#4	1	12'-10 3/4"	9
											d7 E	#4	1	12'-0"	8
											d8 E	#4	1	11'-3/4"	7
											d10 E	#4	6	7'-9 3/4"	31
											d11 E	#4	6	6'-7 3/4"	27
											d12 E	#4	6	10'-7 1/4"	42
											d13 E	#4	2	4'-8"	6
											(2) - 8" PIPE OR (1) - 6" PIPE & (1) - 8" PIPE	1'-5"	8"	2'-1"	1'-8"
	d2 E	#4	1	17'-7"	12										
	d3 E	#4	1	16'-8"	11										
	d4 E	#4	1	15'-9"	11										
	d5 E	#4	1	14'-10"	10										
	d6 E	#4	1	13'-10 3/4"	9										
	d7 E	#4	1	13'-0"	9										
	d8 E	#4	1	12'-3/4"	8										
	d9 E	#4	1	11'-1 3/4"	7										
	d10 E	#4	6	8'-11"	36										
	d11 E	#4	6	7'-9"	31										
	d12 E	#4	6	10'-7 1/4"	42										
	d13 E	#4	2	4'-8"	6										

	PIPE I.D.	DIMENSIONS								PRECAST CONCRETE CU YD	MARK	SIZE	NO	LENGTH	LB
		A	B	C	N	S	M	L	W						
1 TO 4 SLOPE	(2) - 6" PIPE	1'-5"	6"	1'-11"	1'-8"	5'-1"	1'-8"	8'-5"	5'-0"	1.53	d1 E	#4	1	17'-5 1/4"	12
											d2 E	#4	1	16'-2 1/4"	11
											d3 E	#4	1	14'-11"	10
											d4 E	#4	1	13'-8"	9
											d5 E	#4	1	12'-4 3/4"	8
											d6 E	#4	1	11'-1 3/4"	7
											d10 E	#4	6	5'-8 1/2"	23
											d11 E	#4	6	4'-9 3/4"	19
	d12 E	#4	6	8'-1 1/4"	32										
	d13 E	#4	2	4'-8"	6										
	(2) - 8" PIPE OR (1) - 6" PIPE & (1) - 8" PIPE	1'-5"	8"	2'-1"	1'-8"	5'-1"	1'-8"	8'-5"	5'-0"	1.79	d1 E	#4	1	18'-5 1/4"	12
											d2 E	#4	1	17'-2 1/4"	11
											d3 E	#4	1	15'-11"	11
d4 E											#4	1	14'-8"	10	
d5 E											#4	1	13'-4 3/4"	9	
d6 E	#4	1	12'-1 3/4"	8											
d7 E	#4	1	10'-10 3/4"	7											
d10 E	#4	6	6'-6 1/4"	26											
d11 E	#4	6	5'-7 1/4"	22											
d12 E	#4	6	8'-1 1/4"	32											
d13 E	#4	2	4'-8"	6											

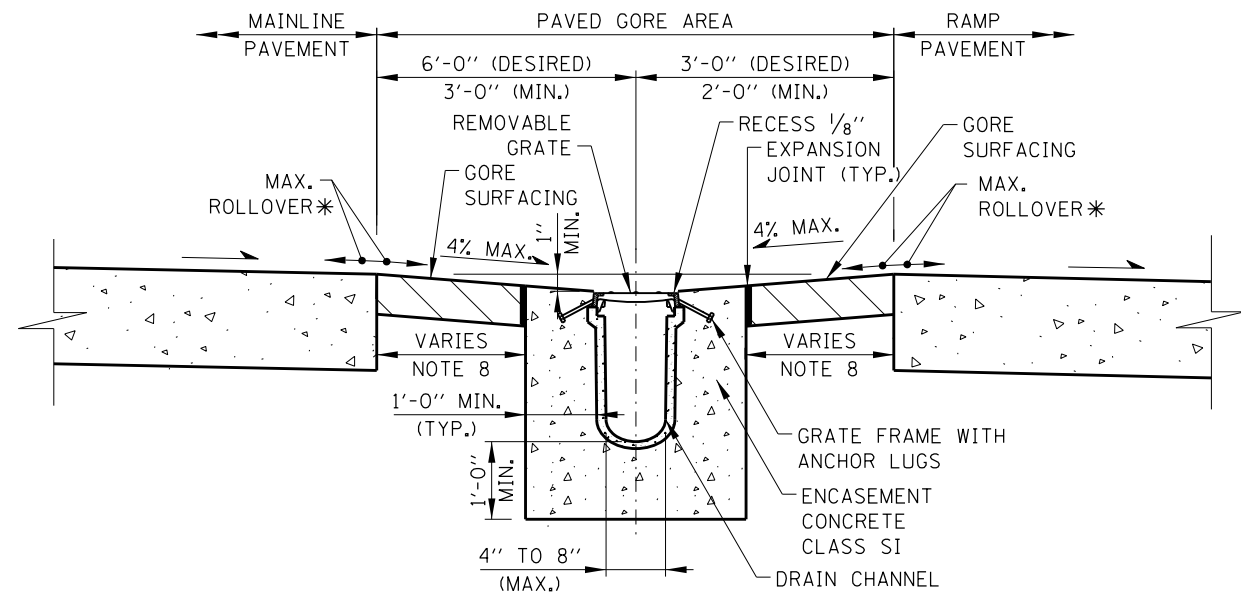
DIMENSIONS AND QUANTITIES  
FOR DOUBLE SLOPED HEADWALL TYPE III

*Paul Kovacs*  
APPROVED..... DATE 2-7-2012  
CHIEF ENGINEERING OFFICER





PLAN



SECTION A-A  
TRENCH DRAIN 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. TRENCH EXCAVATION MUST ALLOW FOR A MINIMUM OF 12 INCHES OF CONCRETE TO BE PLACED UNDER AND ALONGSIDE THE TRENCH DRAIN CHANNEL SYSTEM.
4. THE FINISHED LEVEL OF CONCRETE MUST BE APPROXIMATELY 1/8" ABOVE THE TOP OF THE DRAIN CHANNEL.
5. TRENCH DRAINS SHALL BE IN ACCORDANCE WITH THE MANUFACTURERS DETAILS AND SPECIFICATIONS.
6. PROVIDE 1" EXPANSION JOINT WITH PREFORMED JOINT FILLER BETWEEN PAVED SHOULDER AND TRENCH DRAIN ENCASEMENT.
7. ALL SLOPES ARE EXPRESSED AS UNITS OF VERTICAL DISPLACEMENT TO UNITS OF HORIZONTAL PLACEMENT (V:H).
8. 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 SHOULDERS (JOINTED) 9".

\* MAXIMUM ROLLOVER AND \*\* MAXIMUM SLOPE FROM EDGE OF SHOULDER VARIES FROM THE PHYSICAL NOSE TO THE GORE NOSE ACCORDING TO THE FOLLOWING:

- FOR EXIT RAMPS:      \* 5% MAX. ROLLOVER AND  
                                  \*\* 9% MAX. SLOPE FROM EDGE OF SHOULDER
- FOR ENTRANCE RAMPS:      \* 7% MAX. ROLLOVER AND  
                                  \*\* 10% MAX. SLOPE FROM EDGE OF SHOULDER

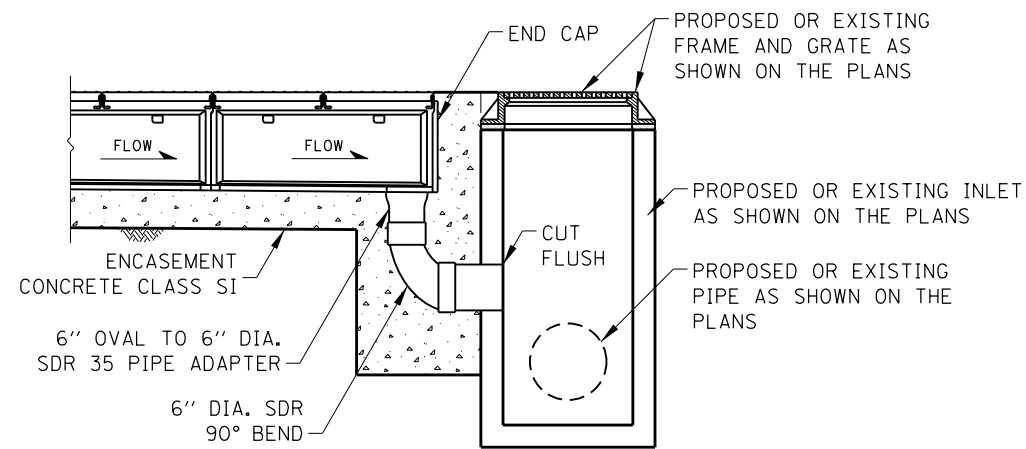


TRENCH DRAIN DETAIL

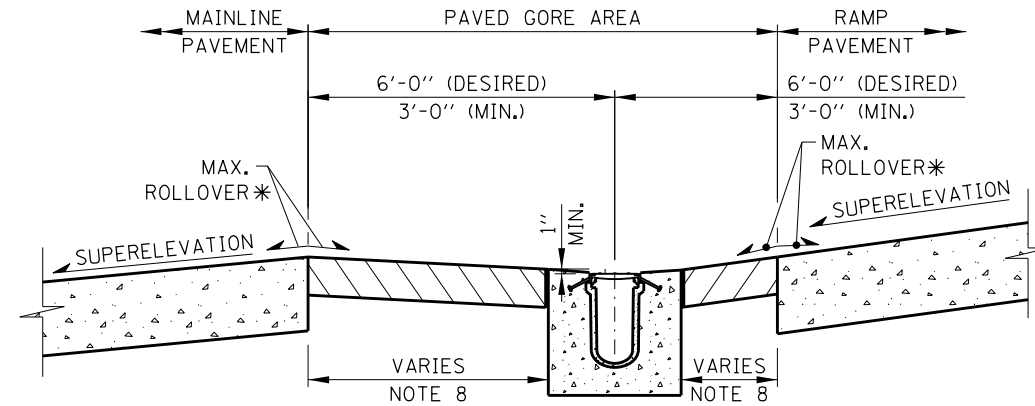
STANDARD B12-07

DATE	REVISIONS
2-01-2013	REVISED MAINLINE SHOULDER GRADE
3-31-2014	REVISED NOTES
3-11-2015	REVISED ROLLOVER, ADDED CATCH BASIN, TYPE B
3-31-2016	REVISED PIPING BEND
3-01-2018	UPDATED MAX. ROLLOVER REQUIREMENTS. REVISED SECTION E-E HATCHING.

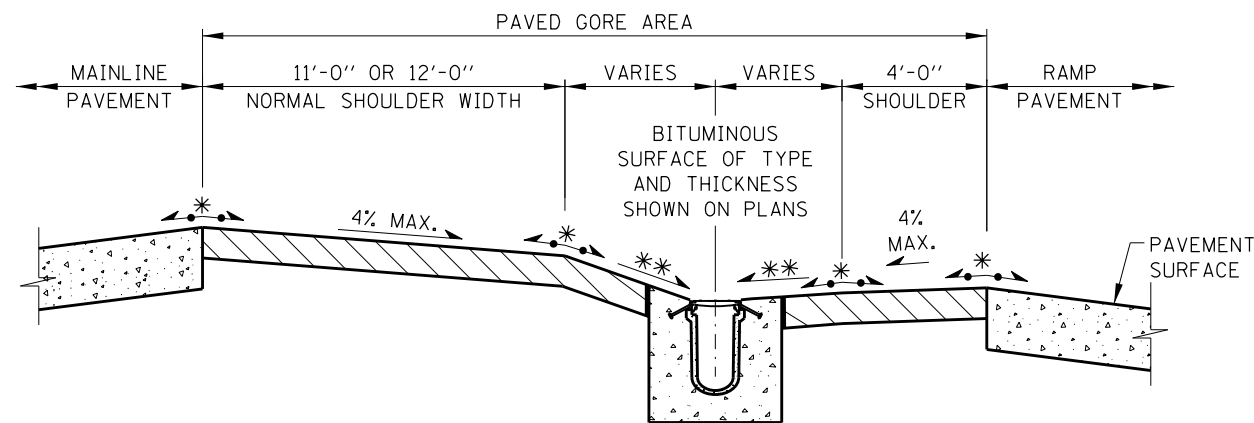
APPROVED: *Paul Kovacs*  
 CHIEF ENGINEERING OFFICER      DATE: 1-1-2011



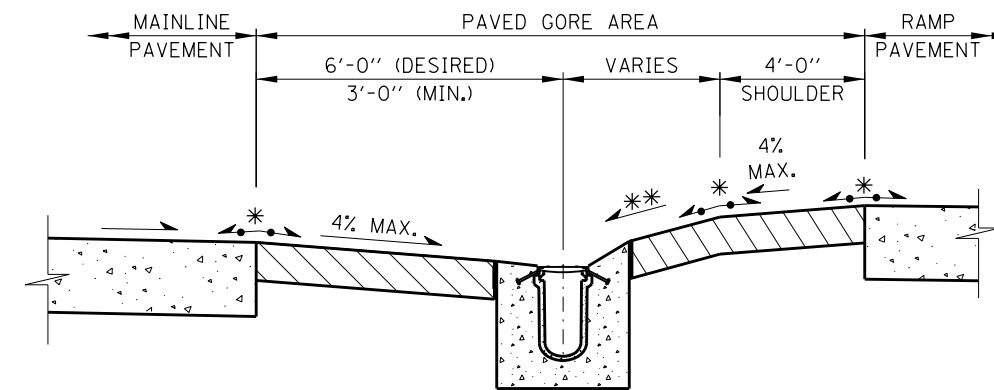
SECTION B-B  
PIPE OUTLET TO DRAINAGE STRUCTURE



SECTION E-E  
RAMP ON OUTSIDE OF  
SUPERELEVATED MAINLINE SECTION

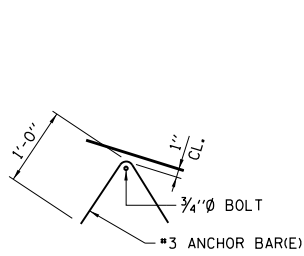


SECTION D-D



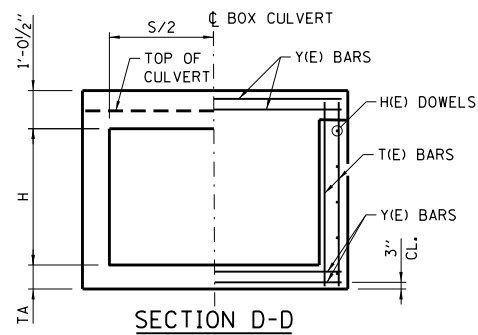
SECTION C-C

NOTE:  
SEE SHEET 1 OF THIS SERIES FOR NOTES.

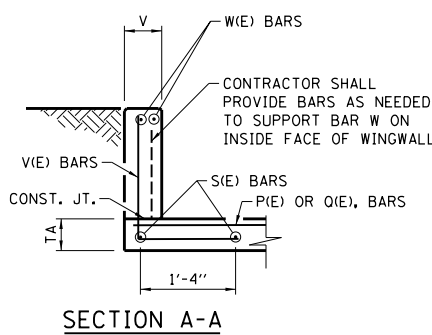


**ANCHOR BARS**  
CONTRACTOR SHALL PROVIDE 2-#3 ANCHOR BARS(E) PER SIDEWALL BOLT.

**DETAIL B**

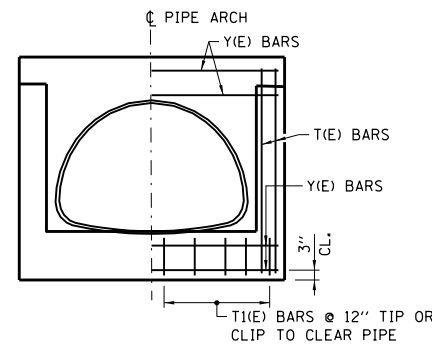


**SECTION D-D**

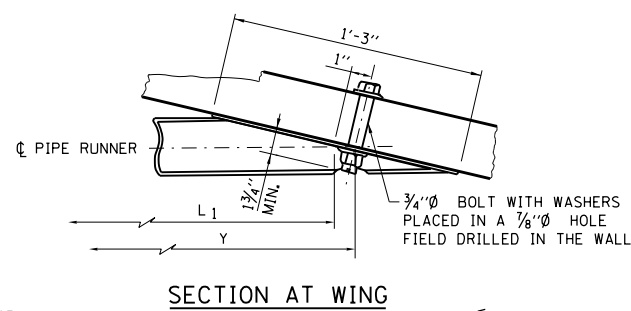


**SECTION A-A**

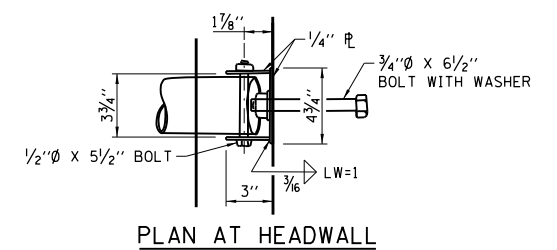
**NOTE:**  
J & H, DOWEL BARS NOT REQUIRED WITH EXISTING BOX CULVERTS PROVIDING THE REINFORCING FROM THE EXISTING BOX IS EXTENDED INTO THE NEW CONCRETE A MINIMUM OF 1'-3".



**SECTION B-B**



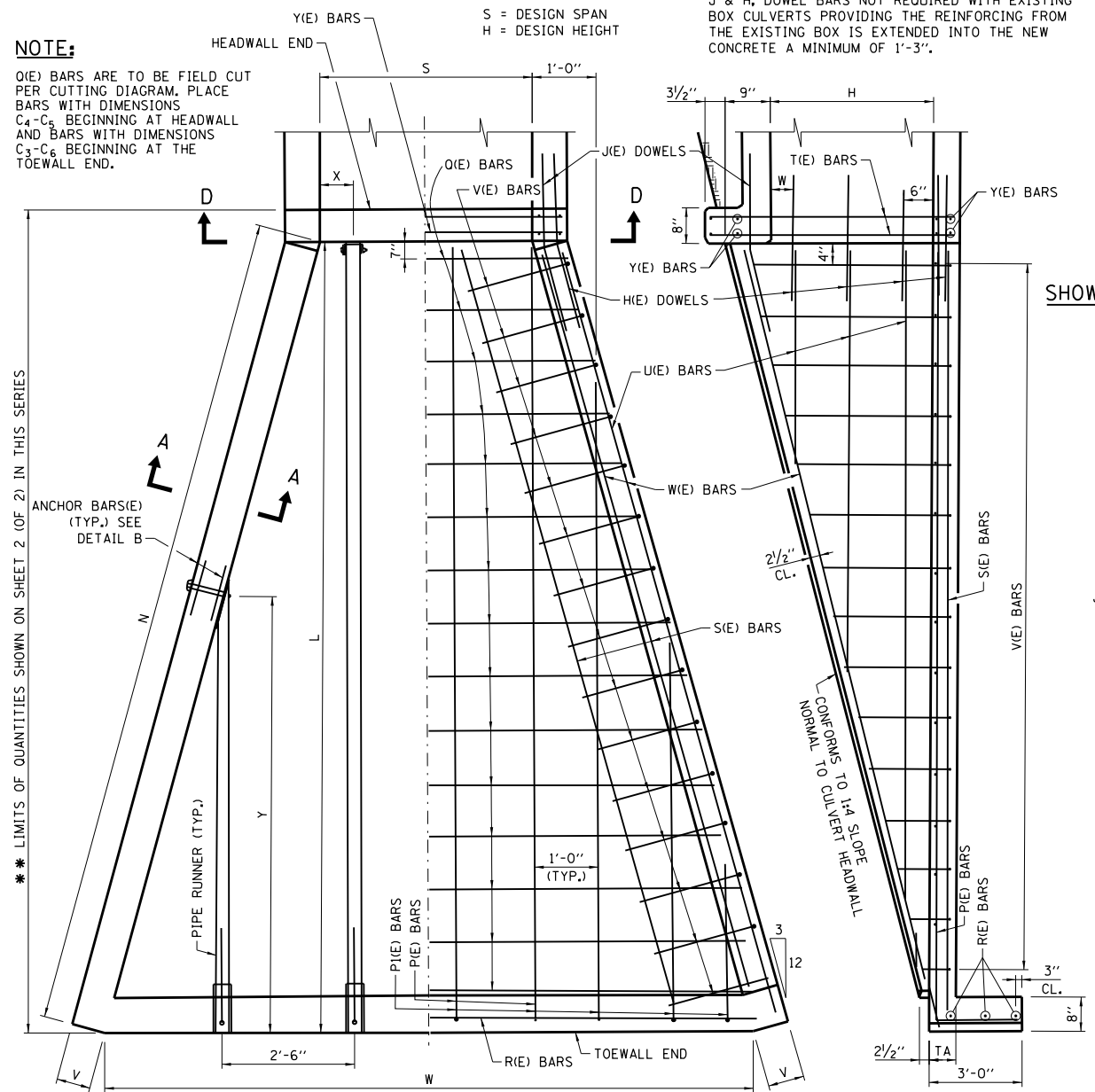
**SECTION AT WING**



**PLAN AT HEADWALL**

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

**NOTE:**  
Q(E) BARS ARE TO BE FIELD CUT PER CUTTING DIAGRAM. PLACE BARS WITH DIMENSIONS C4-C6 BEGINNING AT HEADWALL AND BARS WITH DIMENSIONS C3-C6 BEGINNING AT THE TOEWALL END.



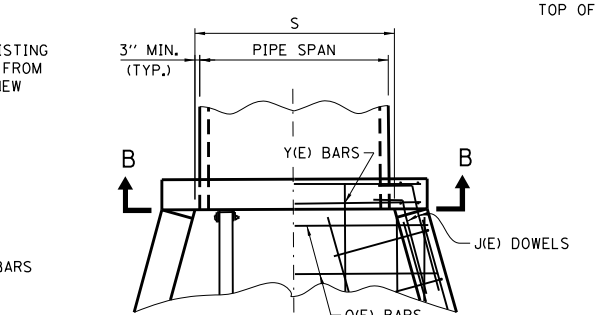
**HALF PLAN SHOWING DIMENSIONS**

**HALF PLAN SHOWING REINFORCEMENT BARS**

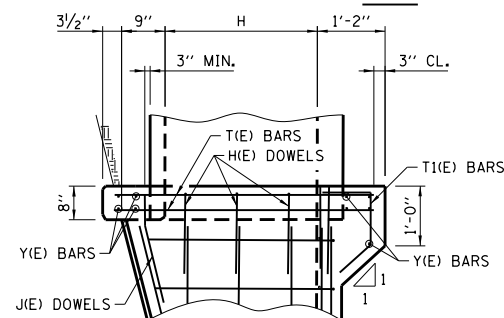
**ELEVATION PARALLEL TO BARREL**

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

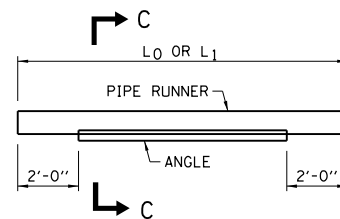
**BOX CULVERT DETAILS**



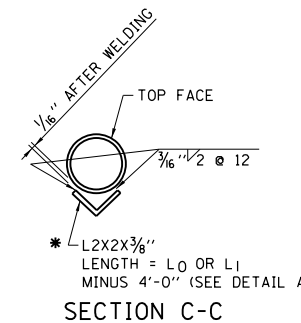
**HALF PLAN SHOWING DIMENSIONS**      **HALF PLAN SHOWING REINFORCEMENT BARS**



**ELEVATION PIPE ARCH DETAILS**



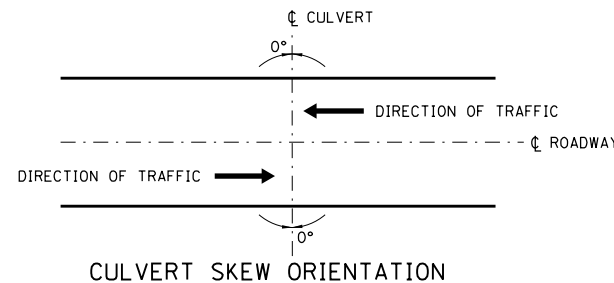
**DETAIL A PIPE RUNNER DETAILS**



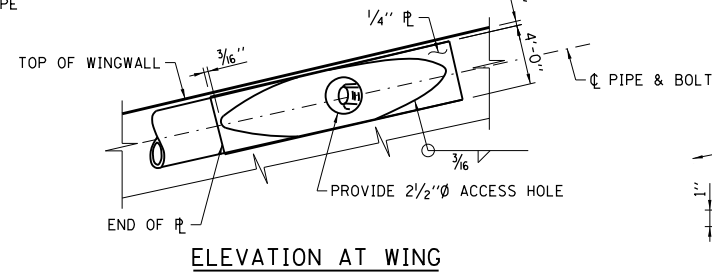
**SECTION C-C**

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

PIPE	LENGTH
3"Ø, SCH. 40	12'-8"

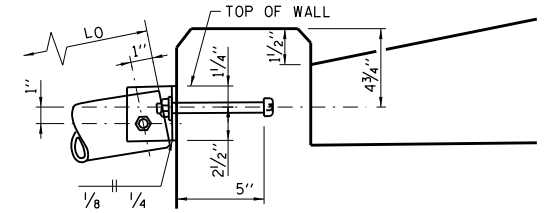


**CULVERT SKEW ORIENTATION**

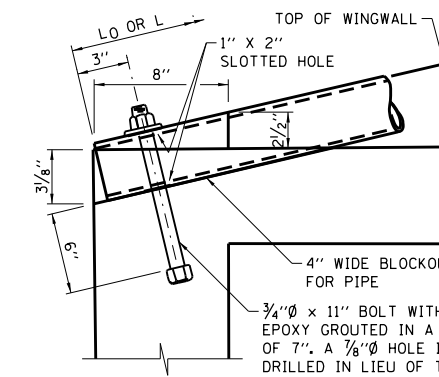


**ELEVATION AT WING**

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



**ELEVATION AT HEADWALL**



**SECTION THRU TOEWALL**

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

**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 STANDARD B19.
- ALL REINFORCEMENT BARS SHOWN SHALL BE EPOXY COATED (E).



DATE	REVISIONS
06-01-09	REVISED NOTES
03-01-10	REVISED EROSION PROTECTION AND NOTES
02-07-12	TABLE QUANTITIES REVISED
03-31-14	TABLE QUANTITIES REVISED
3-11-2015	REVISED NOTES

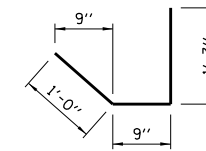
SAFETY END TREATMENT FOR SINGLE CULVERTS  
0° SKEW 1:4  
SLOPE H ≤ 4'  
STANDARD B13-05

CULVERT SIZE	TABLE OF DIMENSIONS							TOTAL QUANTITIES ONE END			PIPE RUNNERS FOR ONE END - SIZE 3" O.D.			
								CONC.	REINF. BARS	PIPE RUNNER	HEADWALL PIPE		WINGWALL PIPE	
	L	N	V	W	TA	X	Y	CU. YD.	POUND	FT.	NO.	L <sub>0</sub>	NO.	L <sub>1</sub>
3 x 2	10'-10"	11'-2"	7"	8'-5"	6"	0'-3"	--	3.2	346	22.16	2	11'-1"	0	--
3 x 3	14'-10"	15'-3 1/2"	7"	10'-5"	6"	1'-6"	10'-10"	5.2	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"	6.5	521	41.50	1	15'-2"	2	13'-2"
4 x 4	18'-10"	19'-5"	7"	13'-5"	6"	0'-9"	11'-10"	8.1	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"	5.9	554	50.50	2	15'-2"	2	10'-1"
5 x 4	18'-10"	19'-5"	7"	14'-5"	6"	1'-3"	13'-10"	8.5	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"	6.2	583	54.67	2	15'-2"	2	12'-2"
6 x 4	18'-10"	19'-5"	7"	15'-5"	6"	0'-6"	10'-10"	8.9	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"	9.3	835	84.33	3	19'-4"	2	13'-2"
8 x 4	18'-10"	19'-5"	7"	17'-5"	7"	0'-3"	9'-10"	9.7	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(E) BARS @ APPROX. 12" CTS. (NO. = S + 2)



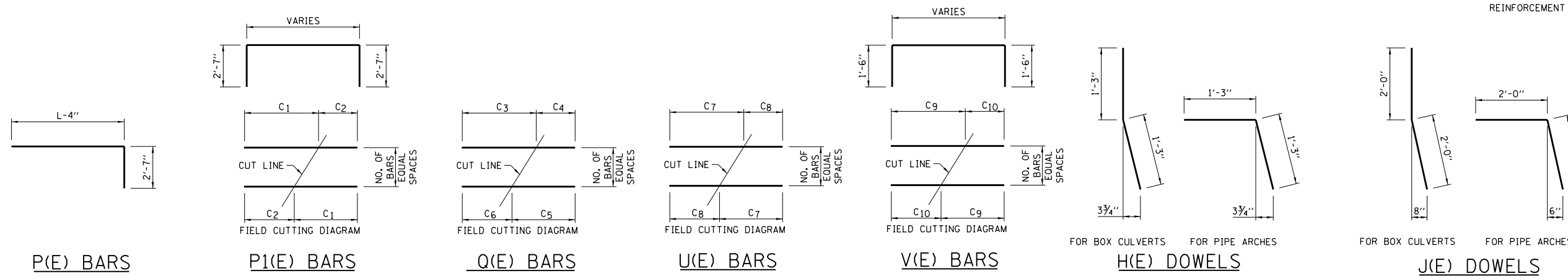
### T1(E) BARS

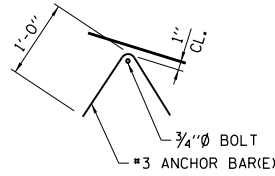
THE WEIGHT OF THE ADDITIONAL BARS AND THE ADDITIONAL QUANTITY OF CONCRETE IN THE HEADWALL SHALL BE ADDED TO THE QUANTITIES SHOWN.

CULVERT SIZE	TABLE OF REINFORCING STEEL FOR ONE END																														
	H(E) DOWEL #4 @ 12"		J(E) DOWEL #6		P(E) BARS #4 @ 12"		P1(E) BARS #4 @ 12"			Q(E) BARS #4 @ 12"						R(E) BARS 3-#4	S(E) BARS 4-#4	U(E) BARS #4 @ 12"			V(E) BARS #4 @ 12"			4 W(E) BARS		Y(E) BARS 8-#5	T(E) BARS 8-#5 BOX CULVERT	T(E) BARS 8-#5 PIPE ARCH			
	NO.	LENGTH.	NO.	LENGTH.	NO.	LENGTH.	NO.	C <sub>1</sub>	C <sub>2</sub>	LENGTH.	NO.	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>	C <sub>6</sub>	LENGTH.	LENGTH.	LENGTH.	NO.	C <sub>7</sub>	C <sub>8</sub>	LENGTH.	NO.	C <sub>9</sub>	C <sub>10</sub>	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"	5'-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.





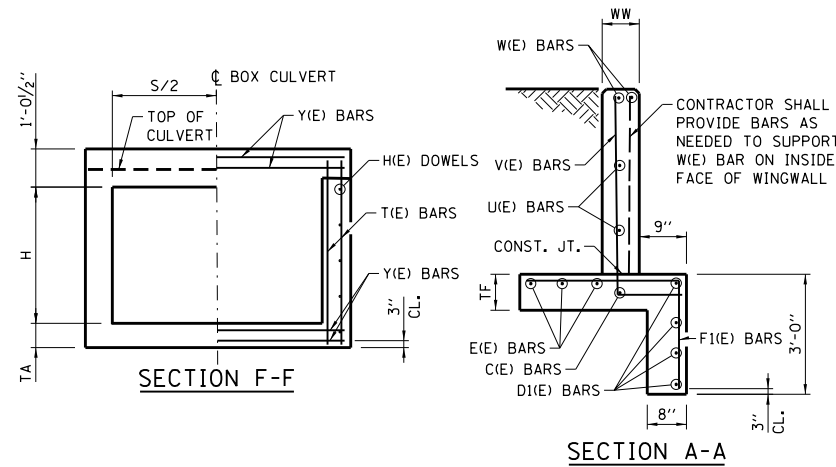
**ANCHOR BARS**

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

**DETAIL B**

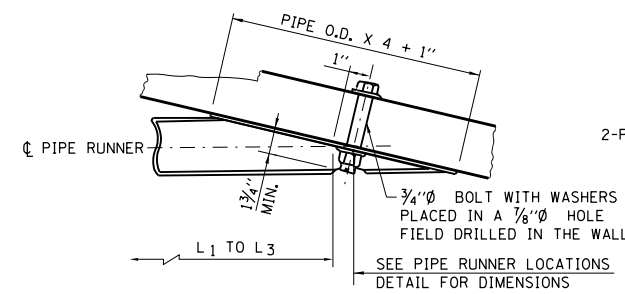
**NOTE:**

F & V BAR 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.

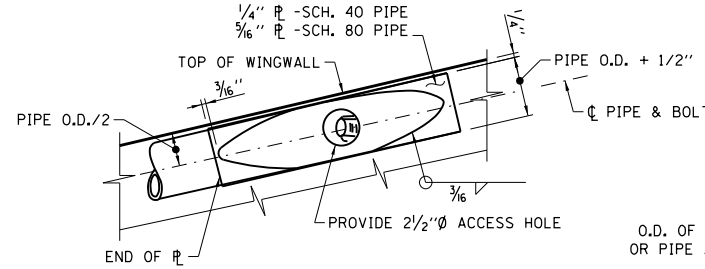


**NOTE:**

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

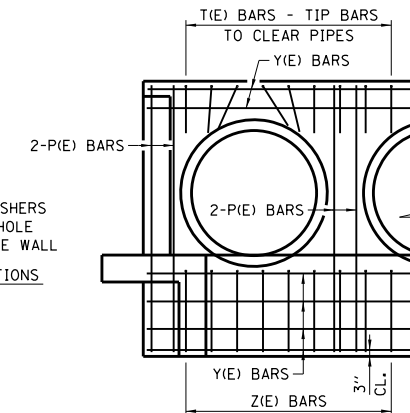


**SECTION AT WING**

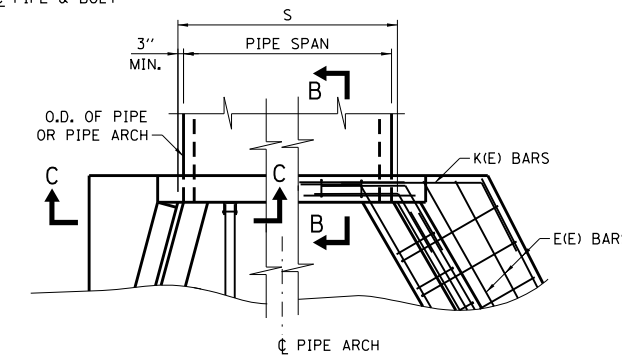


**ELEVATION AT WING**

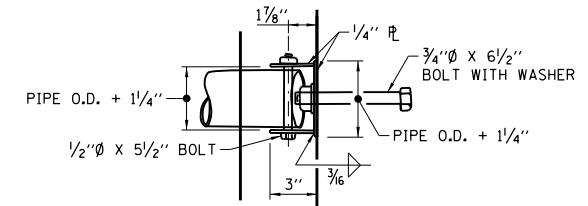
**NOTE:** PIPE O.D. IS THE PIPE RUNNER OUTSIDE DIAMETER.



**SECTION C-C**



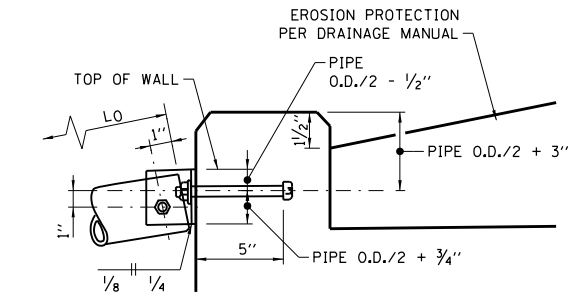
**HALF PLAN SHOWING DIMENSIONS** **HALF PLAN SHOWING REINFORCEMENT BARS**



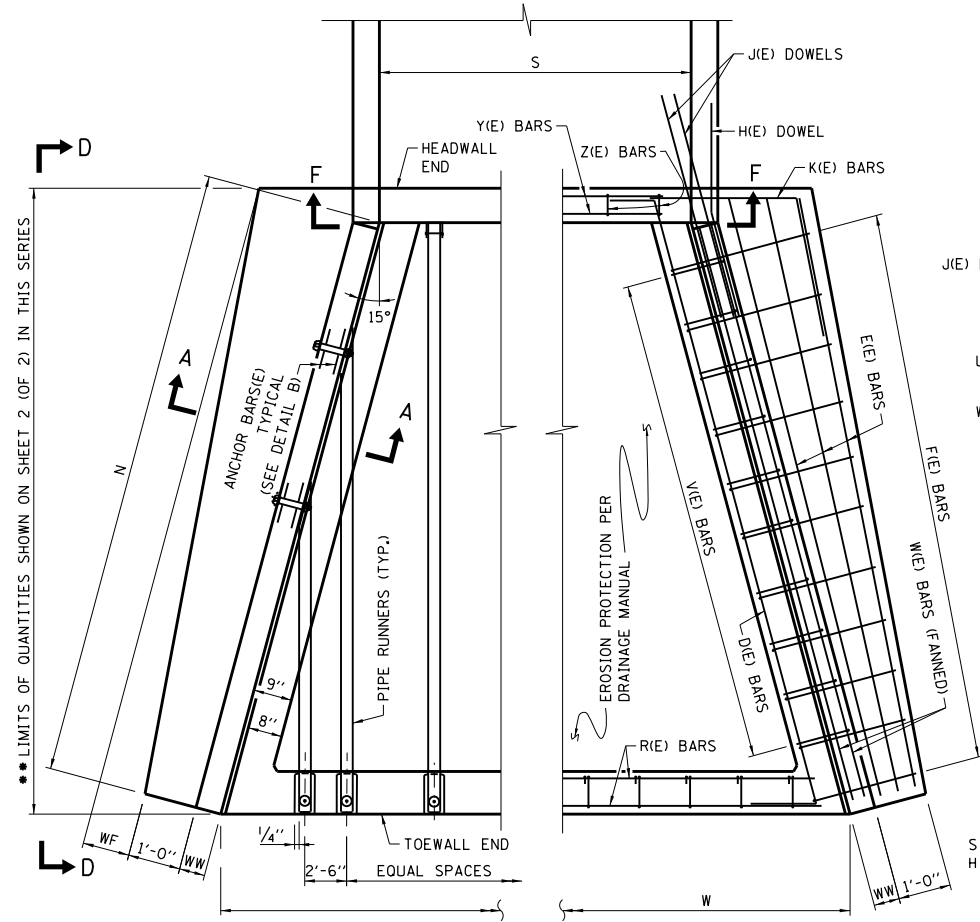
**PLAN AT HEADWALL**

**NOTE:**

A 3/4" x 9 1/2" BOLT WITH ADDITIONAL W WASHER PLACED IN A 1/8" HOLE DRILLED THROUGH THE HEADWALL OR A 3/4" x 8" THREADED ROD EPOXY GROUTED IN A 7/8" HOLE WITH A MINIMUM EMBEDMENT OF 6 5/8" MAY BE USED IN LIEU OF CAST-IN-PLACE BOLT SHOWN.

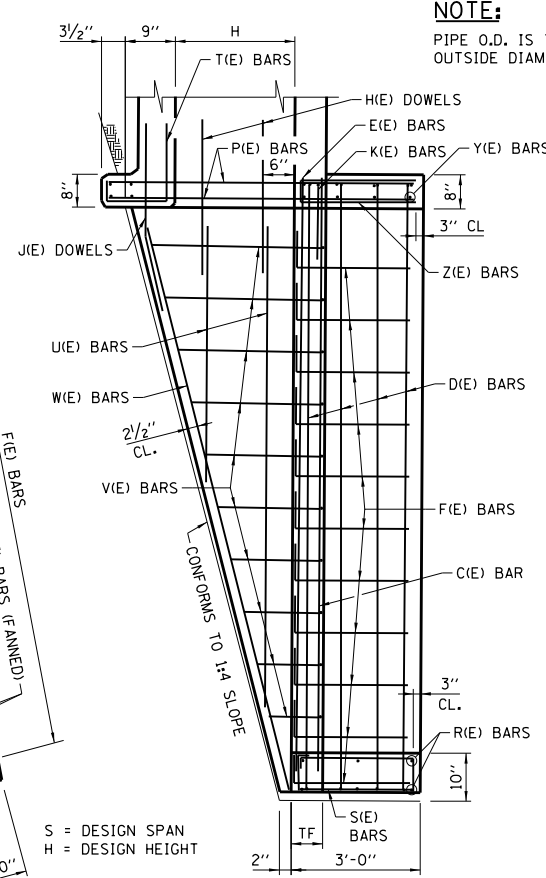


**ELEVATION AT HEADWALL**

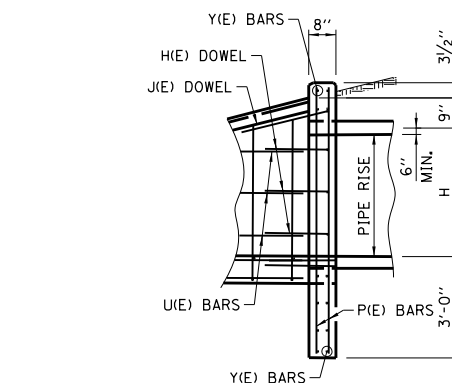


**HALF PLAN SHOWING DIMENSIONS**

**HALF PLAN SHOWING REINFORCEMENT BARS**

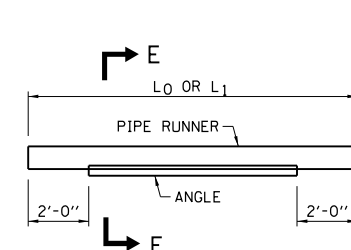


**ELEVATION D-D**

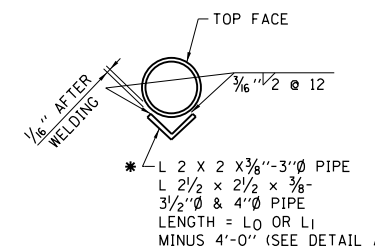


**SECTION B-B**

**FOR PIPE AND PIPE-ARCH CULVERTS**



**DETAIL A**



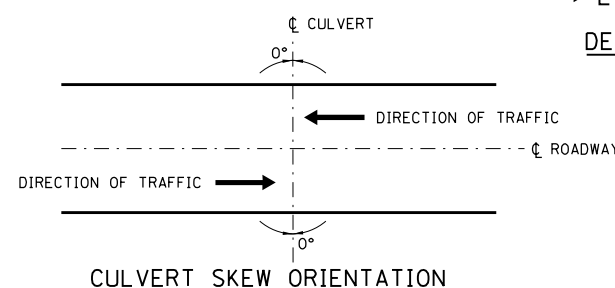
**SECTION E-E**

**NOTE:**

WHERE L<sub>0</sub> OR L<sub>1</sub> EXCEEDS THE FOLLOWING LENGTH, THE PIPE RUNNER SHALL BE STRENGTHENED OVER THE 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**



**CULVERT SKEW ORIENTATION**

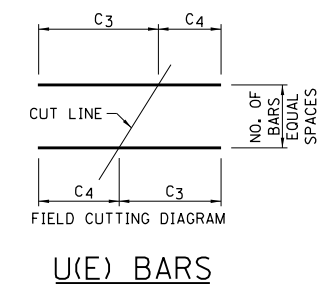
**GENERAL NOTES:**

- 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.
- ALL REINFORCED BARS SHALL BE EPOXY COATED (E).

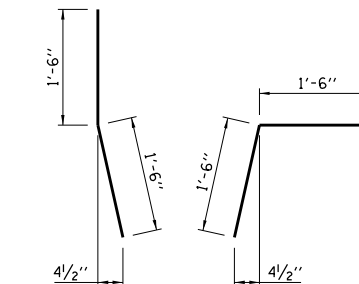
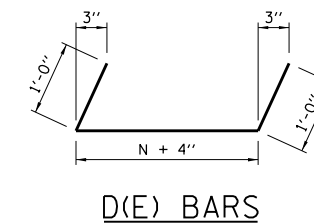


DATE	REVISIONS	SAFETY END TREATMENT FOR SINGLE AND MULTIPLE CULVERTS 0° SKEW 1:4 SLOPE H ≤ 8'
3-01-2010	REVISED EROSION PROTECTION AND NOTES.	STANDARD B14-05
2-07-2012	TABLE QUANTITIES REVISED.	
3-31-2014	TABLE QUANTITIES REVISED.	
3-11-2015	REVISED NOTES.	

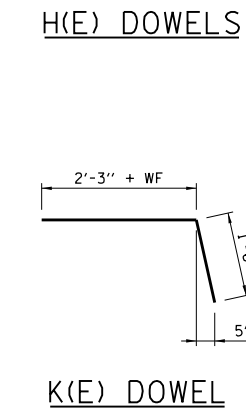
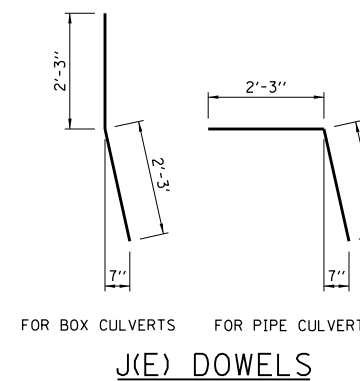
TABLE OF DIMENSIONS								TABLE OF REINFORCEMENT BARS FOR ONE END																							
S	H	L	WF	WW	TF	N	C(E) BARS 2 REOD.		D(E) BARS 8-#4		E(E) BARS #4 (5)		F(E) BARS			H(E) DOWEL #5 @ 12"		J(E) DOWEL 4-#6		K(E) DOWEL 2-#5		U(E) BARS #4 @ 12"			V(E) BARS #4 @ 12" CTS.				W(E) BARS 4 REOD.		
							SIZE	LENGTH	LENGTH	NO.	LENGTH	SIZE	NO.	C <sub>1</sub>	C <sub>2</sub>	LENGTH	NO.	LENGTH	LENGTH	LENGTH	NO.	C <sub>3</sub>	C <sub>4</sub>	LENGTH	NO.	C <sub>5</sub>	C <sub>6</sub>	C <sub>7</sub>	LENGTH	SIZE	LENGTH
9'	3'	14'-4"	3"	7"	7"	14'-10 <sup>1</sup> / <sub>8</sub> "	#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"
9'	4'	18'-4"	9"	7"	8"	18'-11 <sup>3</sup> / <sub>4</sub> "	#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 <sup>1</sup> / <sub>2</sub> "	#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 <sup>1</sup> / <sub>2</sub> "	27'-3 <sup>1</sup> / <sub>8</sub> "	#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 <sup>1</sup> / <sub>8</sub> "	#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 <sup>1</sup> / <sub>2</sub> "	35'-6 <sup>1</sup> / <sub>2</sub> "	#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								
S	H	SIZE (DIA.)	SCHEDULE	NO. WINGWALL PIPES	L1	L2	L3	LENGTH (FT.)
9'	3'	3"	40	2	9'-11"	--	--	19.84
9'	4'	3"	40	2	14'-0"	--	--	28.00
5'	5'	3 <sup>1</sup> / <sub>2</sub> "	40	4	18'-1"	8'-6"	--	53.16
6'	6'	3 <sup>1</sup> / <sub>2</sub> "	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



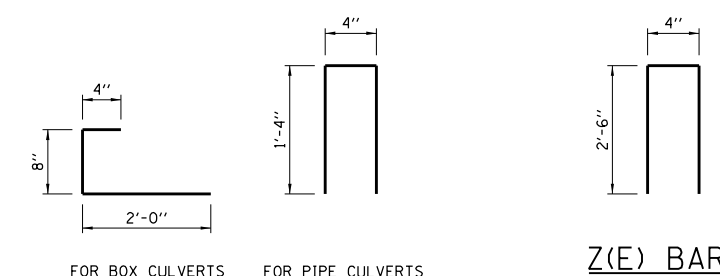
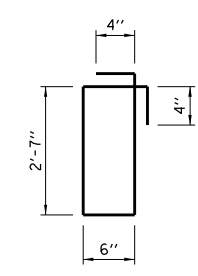
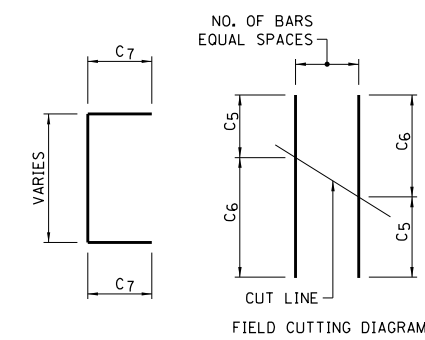
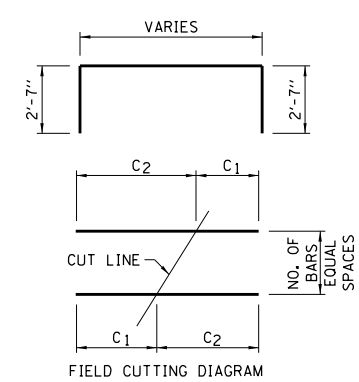
S	H	W (4)	TABLE OF REINFORCEMENT BARS FOR MINIMUM "S"						HEADWALL PIPE RUNNERS FOR MINIMUM "S"				QUANTITIES FOR MIN. "S" (SINGLE PIPE OR CONC. BOX CULVERT)		INCREASE IN QUANTITIES FOR 1' INCREASE IN "S"					
			② Y(E) BARS 12-#5	① Z(E) BARS #4 @ 12"	② R(E) BARS 6-#5	① S(E) BARS #4 @ 12"	① T(E) BARS #4 @ 12"	③ P(E) BARS 8-#5	SIZE (DIA.)	SCHEDULE	NO.	L <sub>0</sub>	LENGTH (FT.)	CONCRETE CU. YD.	REIN. BARS POUND	CONCRETE CU. YD.	REIN. BARS POUND			
IV 9'	3'	16'-8"	9'-10"	9	5'-4"	15'-10"	16	6'-10"	9	3'-0"	6'-8"	3"	40	4	14'-9"	59.00	7.24	863	0.35	13
IV 9'	4'	18'-9"	9'-10"	9	5'-4"	17'-11"	18	6'-10"	9	3'-0"	7'-8"	3"	40	4	18'-10"	75.33	10.44	1078	0.35	13
IV 5'	5'	16'-11"	5'-10"	5	5'-4"	16'-1"	16	6'-10"	5	3'-0"	8'-8"	3 <sup>1</sup> / <sub>2</sub> "	40	2	23'-0"	46.00	10.87	1162	0.35	13
IV 6'	6'	20'-1"	6'-10"	6	5'-4"	19'-3"	19	6'-10"	6	3'-0"	9'-8"	3 <sup>1</sup> / <sub>2</sub> "	80	3	27'-2"	81.51	14.77	1553	0.35	13
IV 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	19.47	1869	0.35	13
IV 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	25.01	2379	0.35	13



NUMBER OF HOWL 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.

- NOTES FOR TABLE OF DIMENSIONS:**
- THE NUMBER OF S, T AND Z BARS SHALL BE INCREASED BY 1 FOR EACH 1 FOOT OF INCREASE IN DIMENSION "S".
  - THE LENGTH OF R AND Y BARS SHALL BE INCREASED BY 1 FOOT FOR EACH 1 FOOT OF INCREASE IN DIMENSION "S".
  - THE NUMBER OF P BARS 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.



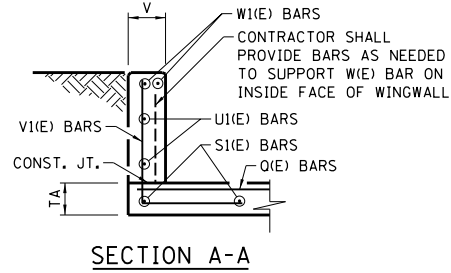
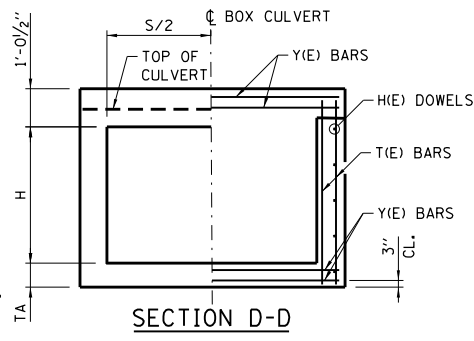
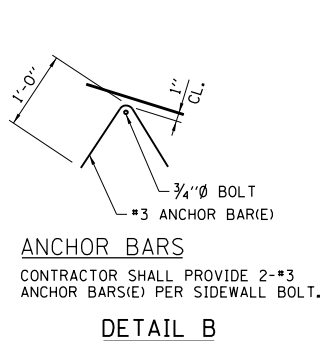
**Z(E) BARS**

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

**Illinois Tollway**

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

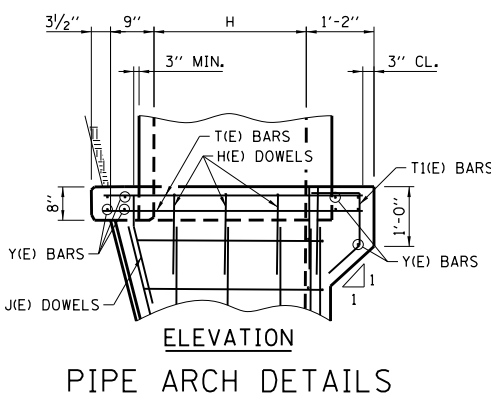
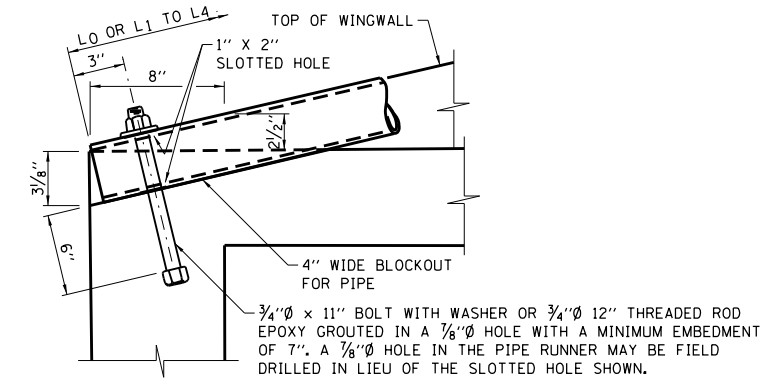
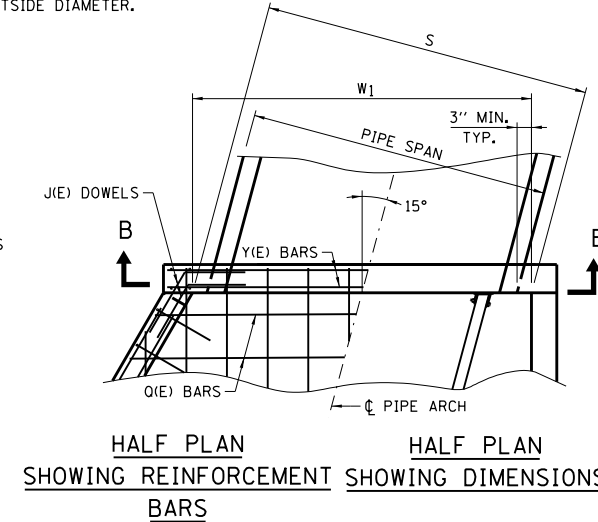
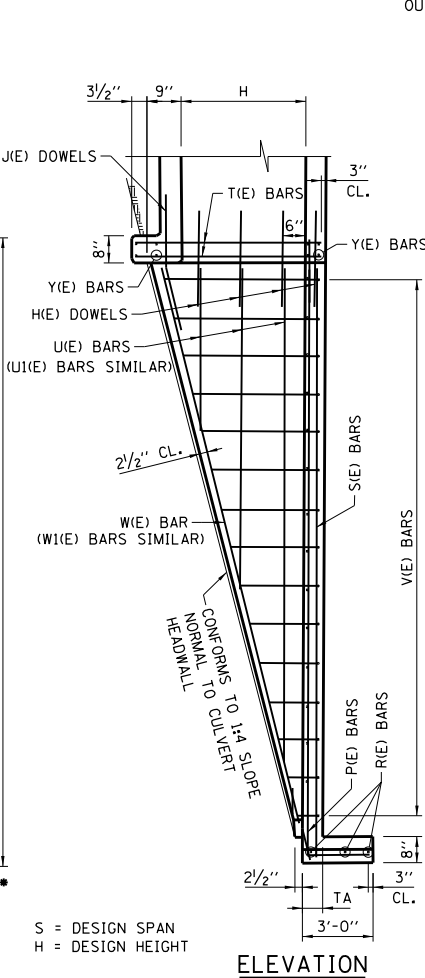
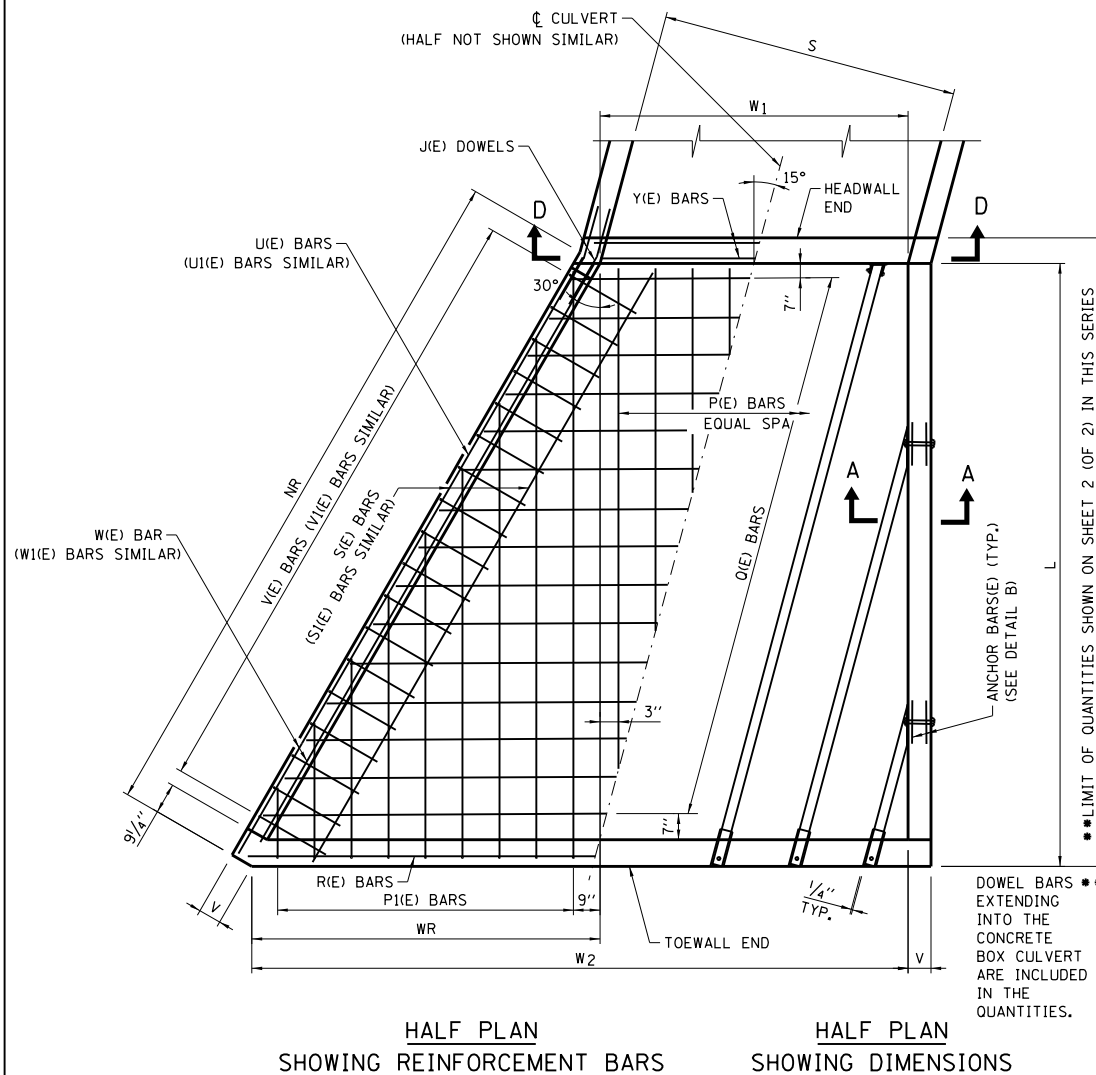
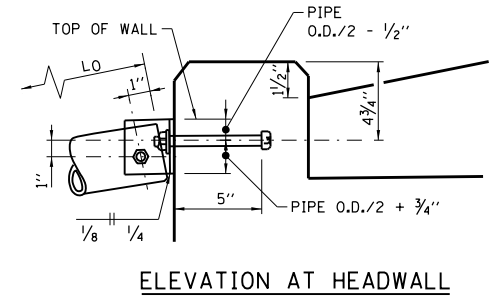
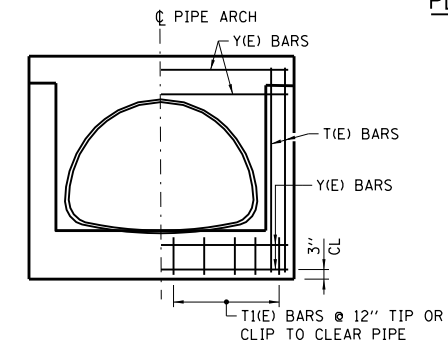
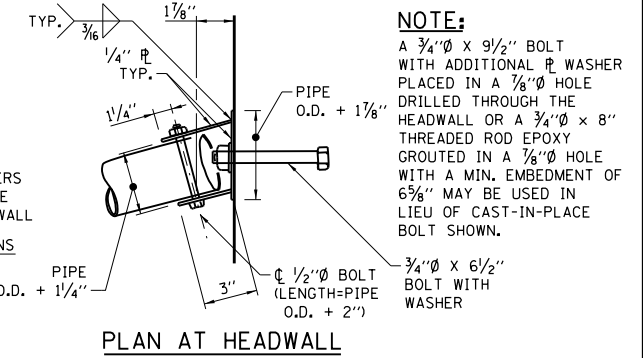
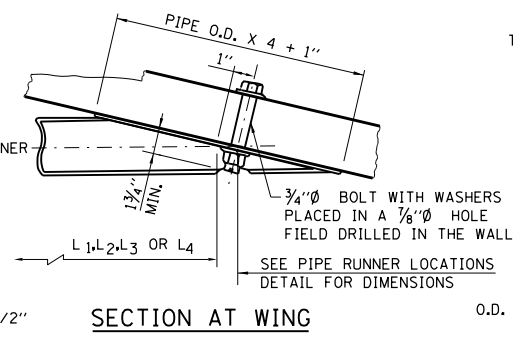
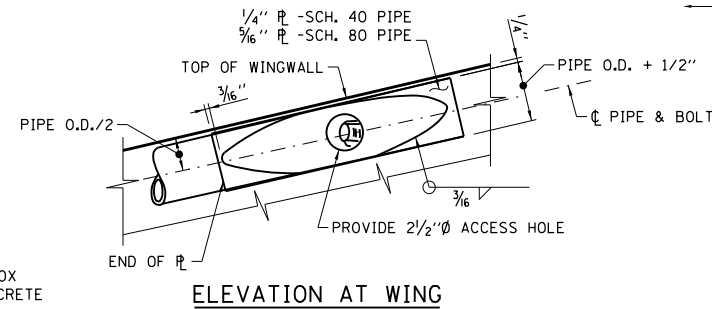
STANDARD B14-05



**NOTE:**  
Q, V, AND V<sub>1</sub> BARS ARE TO BE FIELD CUT PER CUTTING DIAGRAM. PLACE BARS WITH DIMENSIONS C<sub>2</sub>-C<sub>3</sub>, C<sub>9</sub>-C<sub>12</sub> BEGINNING AT HEADWALL AND BARS WITH DIMENSIONS C<sub>1</sub>-C<sub>4</sub>, C<sub>10</sub>-C<sub>11</sub> BEGINNING AT THE TOEWALL END.

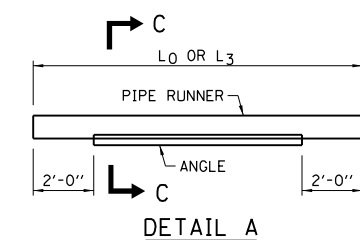
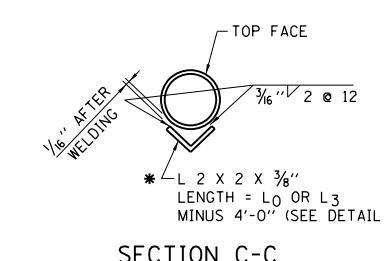
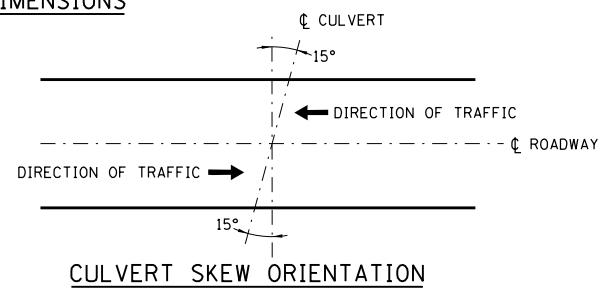
**NOTE:**  
P1 BARS ARE TO BE FIELD CUT PER CUTTING DIAGRAM. PLACE BARS WITH DIMENSIONS C<sub>6</sub>-C<sub>7</sub> BEGINNING AT TOEWALL END OF 30° WING AND BARS WITH DIMENSIONS C<sub>5</sub>-C<sub>8</sub> BEGINNING PARALLEL THE P(E) BARS.

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



- 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 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.
  - ALL REINFORCEMENT BARS SHALL BE EPOXY COATED (E).

**BOX CULVERT DETAILS**



**NOTE:**  
WHERE L<sub>0</sub> OR L<sub>3</sub> 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"

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

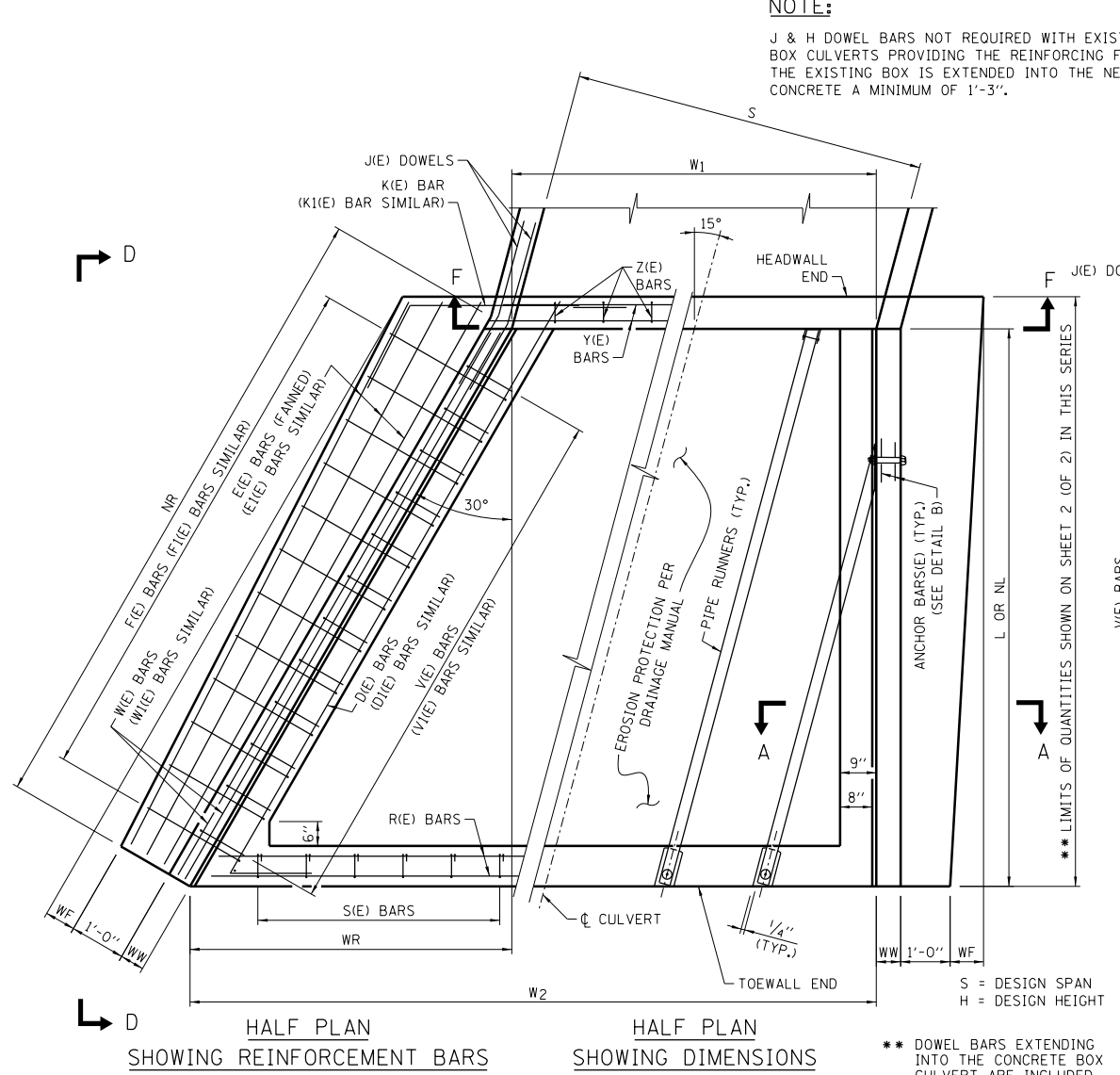
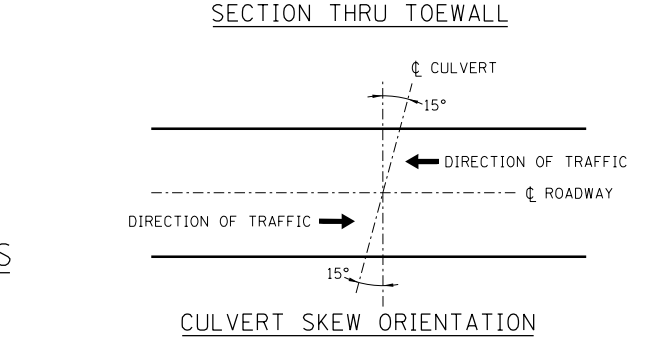
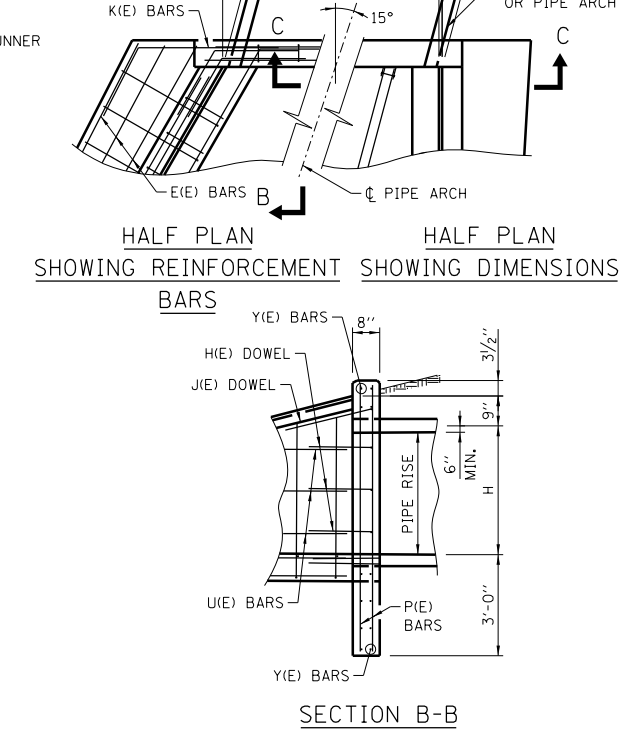
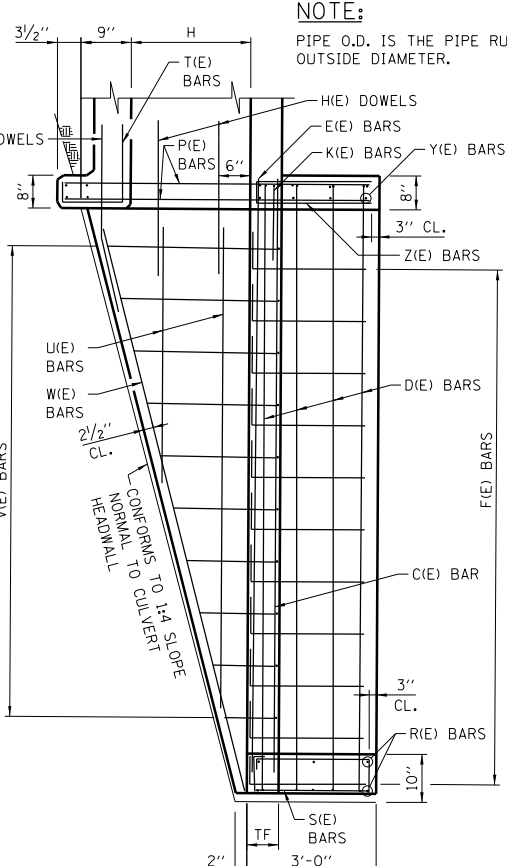
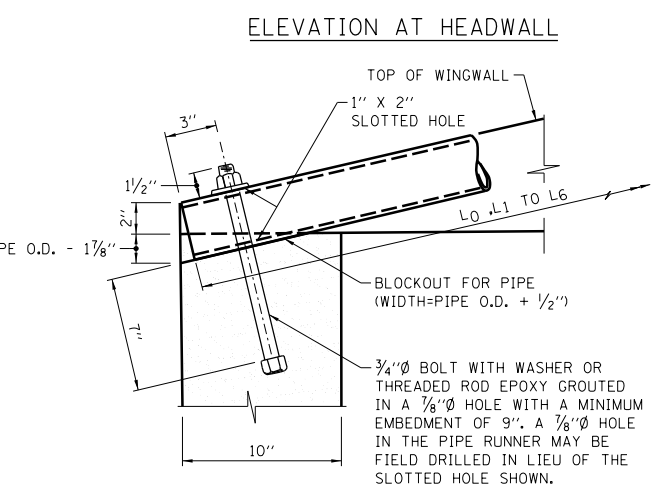
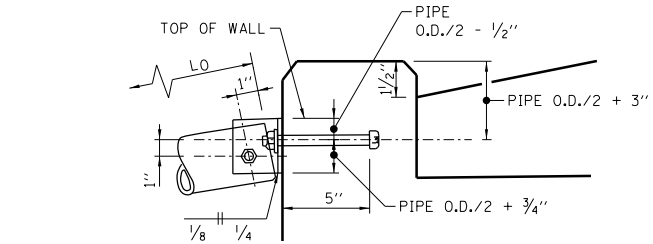
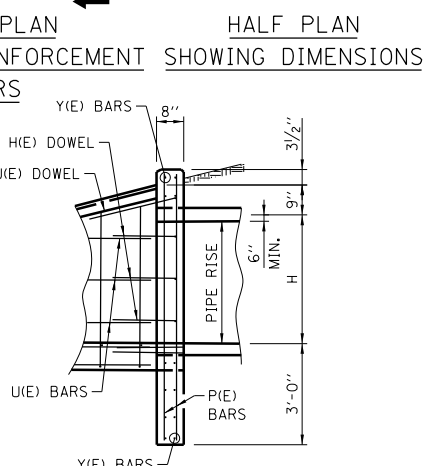
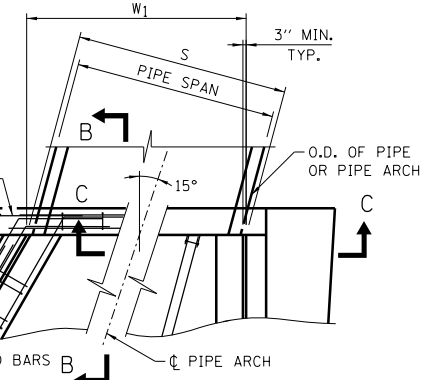
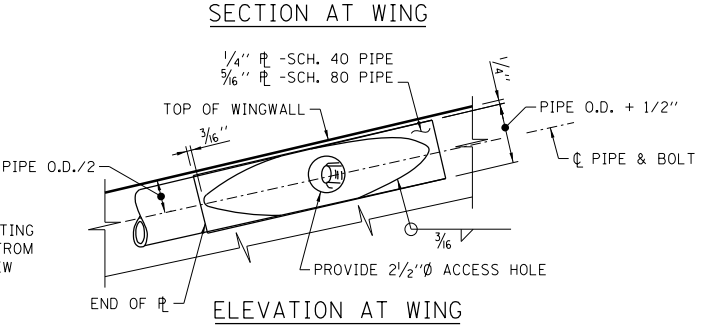
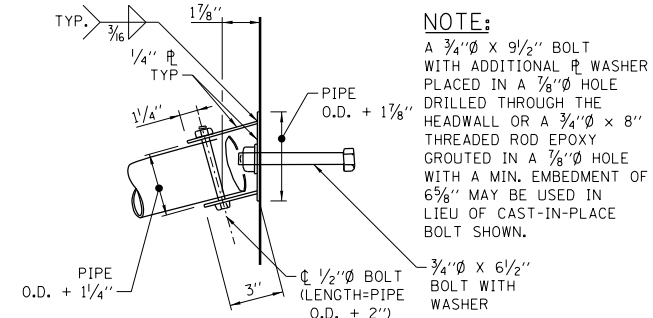
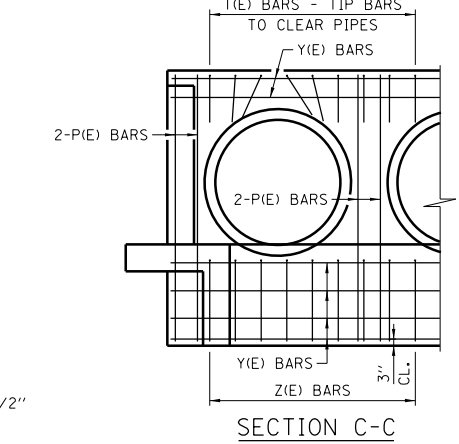
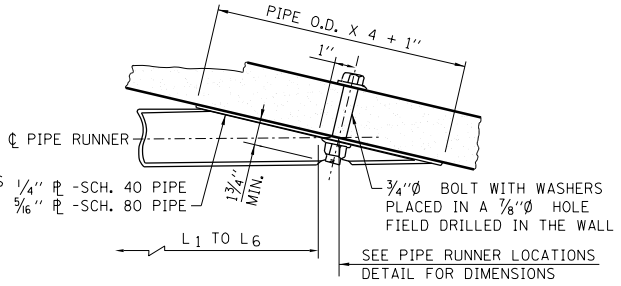
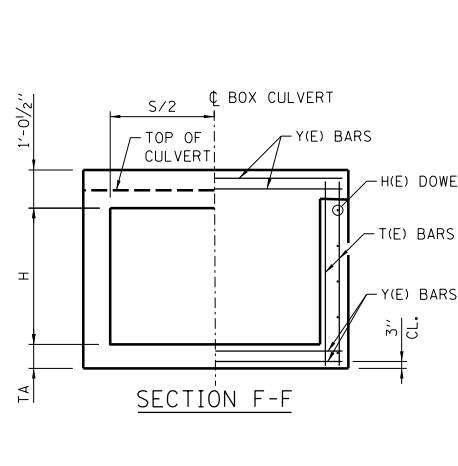
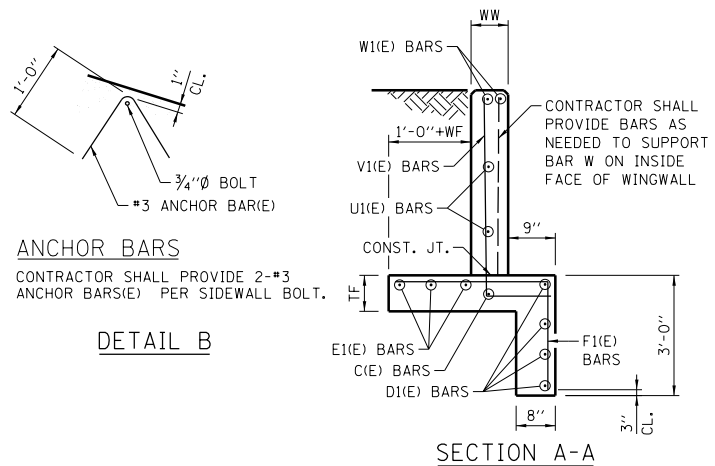


DATE	REVISIONS
06-01-09	REVISED NOTES
03-01-10	MODIFIED CULVERT SKEW
03-01-10	DETAIL, REVISED EROSION PROTECTION AND NOTES
02-07-12	TABLE QUANTITIES REVISED
3-11-2015	REVISED NOTES

SAFETY END TREATMENT FOR SINGLE CULVERTS  
15° SKEW 1:4  
SLOPE H ≤ 4'  
STANDARD B15-04



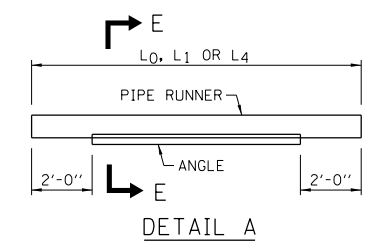




**FOR BOX CULVERTS**

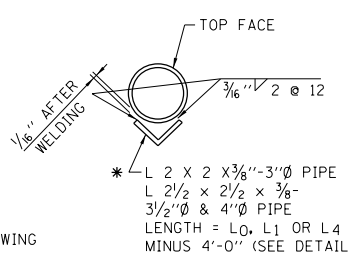
- GENERAL NOTES:**
- ALL CONCRETE SHALL BE CLASS S1.
  - ALL EXPOSED CONCRETE EDGES SHALL HAVE A 3/4" X 45° CHAMFER. CHAMFER ON VERTICAL EDGES SHALL BE CONTINUED A MINIMUM OF ONE FOOT BELOW FINISHED GROUND LEVEL. COVER FROM THE FACE OF CONCRETE TO THE FACE OF REINFORCEMENT BARS SHALL BE 2", UNLESS OTHERWISE 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 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.
- ALL REINFORCEMENT BARS SHALL BE EPOXY COATED (E).



**\* NOTE:** WHERE L0, L1 OR L4 EXCEEDS THE FOLLOWING LENGTH, THE PIPE RUNNER SHALL BE STRENGTHENED OVER THE 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**

DATE	REVISIONS
06-01-09	REVISED NOTES
03-01-10	MODIFIED CULVERT SKEW DETAIL, REVISED EROSION PROTECTION AND NOTES
02-07-12	TABLE QUANTITIES REVISED
03-31-14	TABLE QUANTITIES REVISED

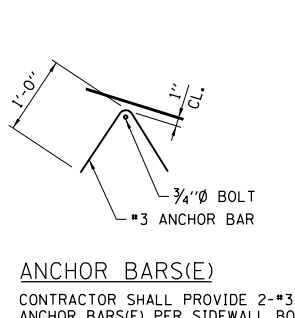
SHEET 1 OF 2

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

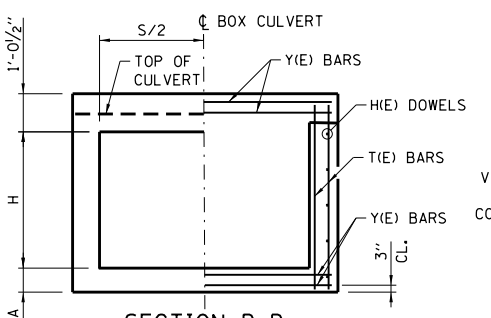
STANDARD B16-05

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

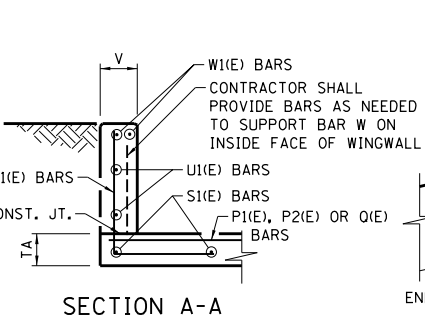




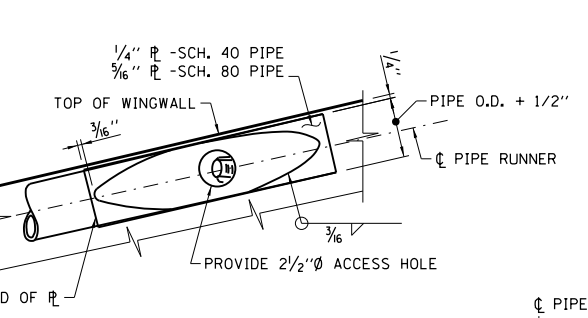
**DETAIL B**  
ANCHOR BARS(E)  
CONTRACTOR SHALL PROVIDE 2-#3 ANCHOR BARS(E) PER SIDEWALL BOLT.



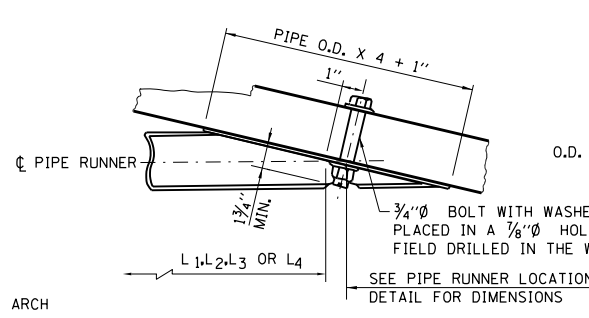
**SECTION D-D**



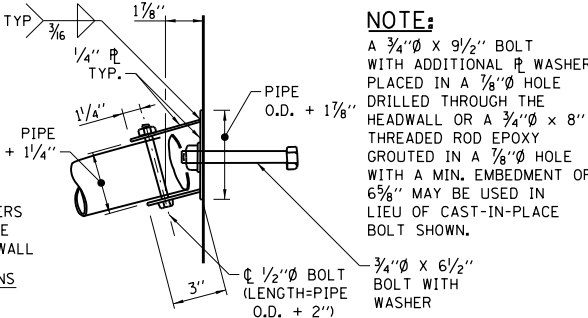
**SECTION A-A**



**ELEVATION AT WING**



**SECTION AT WING**

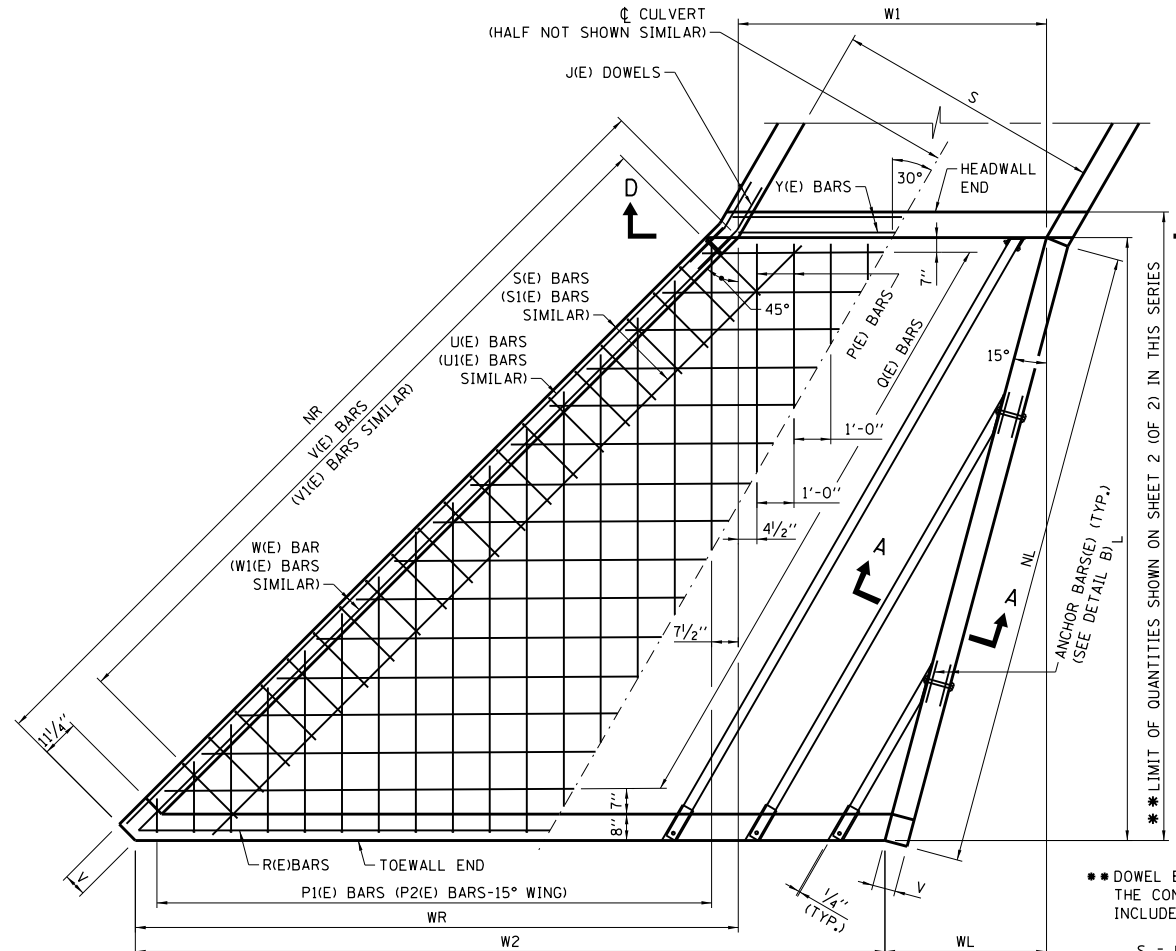


**PLAN AT HEADWALL**

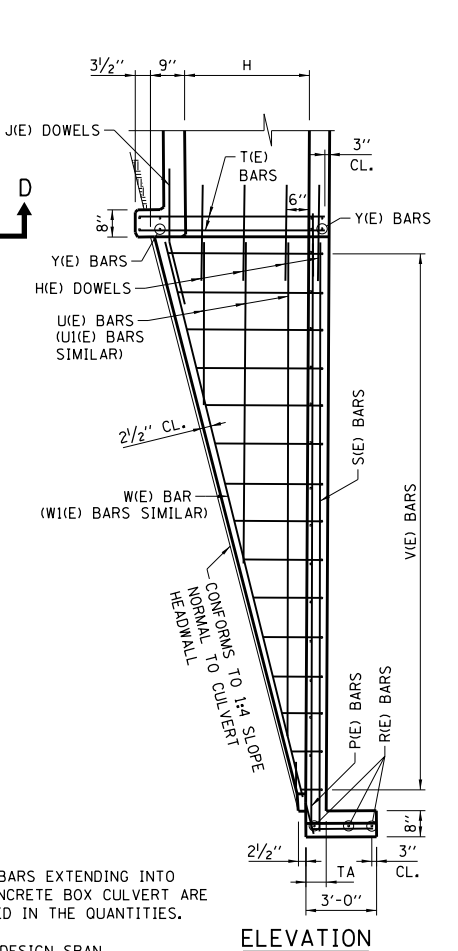
**NOTE:**  
Q(E), V(E), and V<sub>1</sub>(E) BARS ARE TO BE FIELD CUT PER CUTTING DIAGRAM. PLACE BARS WITH DIMENSIONS C<sub>2</sub>-C<sub>3</sub>, C<sub>9</sub>-C<sub>12</sub> BEGINNING AT HEADWALL AND BARS WITH DIMENSIONS C<sub>1</sub>-C<sub>4</sub>, C<sub>10</sub>-C<sub>11</sub> BEGINNING AT THE TOEWALL END.

**NOTE:**  
P(I)E BARS ARE TO BE FIELD CUT PER CUTTING DIAGRAM. PLACE BARS WITH DIMENSIONS C<sub>6</sub>-C<sub>7</sub> BEGINNING AT THE TOEWALL END OF 45° WINGWALL AND BARS WITH DIMENSIONS C<sub>5</sub>-C<sub>8</sub> BEGINNING PARALLEL TO THE P(I)E BARS. PLACE P2(I)E BARS PARALLEL TO THE P(I)E BARS BEGINNING WITH THE SHORTEST BARS AT THE HEADWALL END OF THE 15° WINGWALL.

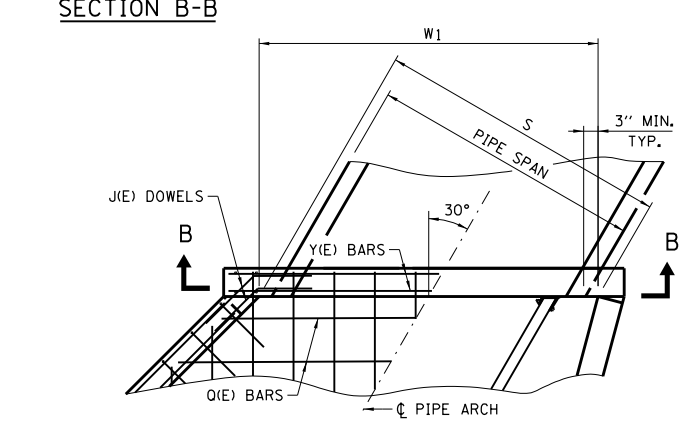
**NOTE:**  
J(I)E & H(E) DOWEL BARS NOT REQUIRED WITH EXISTING BOX CULVERTS PROVIDING THE REINFORCING FROM THE EXIST. BOX IS EXTENDED INTO THE NEW CONCRETE A MIN. OF 1'-3".



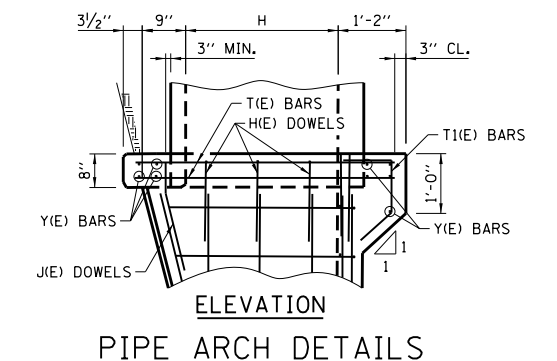
**HALF PLAN SHOWING REINFORCEMENT BARS**      **HALF PLAN SHOWING DIMENSIONS**



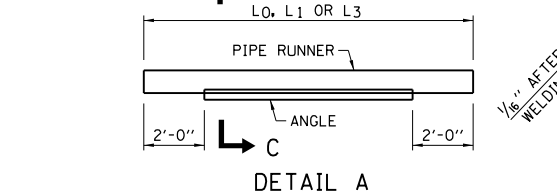
**ELEVATION**



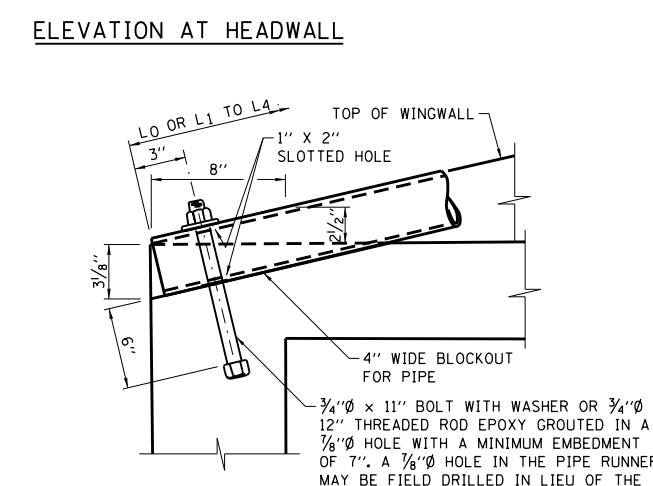
**HALF PLAN SHOWING DIMENSIONS**



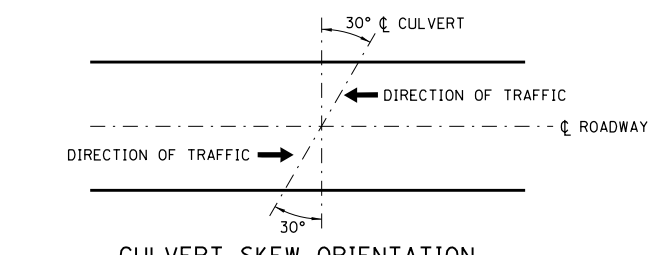
**ELEVATION PIPE ARCH DETAILS**



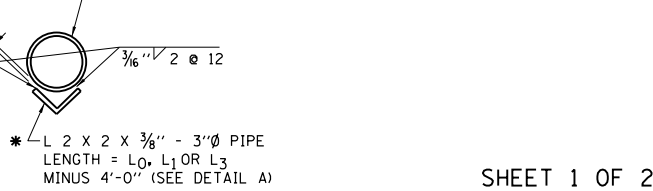
**DETAIL A**



**SECTION THRU TOEWALL**



**CULVERT SKEW ORIENTATION**



**SECTION C-C**

- GENERAL NOTES:**
1. ALL CONCRETE SHALL BE CLASS SI.
  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 30° ± 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

5. 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.
8. ALL REINFORCEMENT BARS SHALL BE EPOXY COATED (E).

**\*NOTE:**  
WHERE L<sub>0</sub>, L<sub>1</sub> OR L<sub>3</sub> 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"

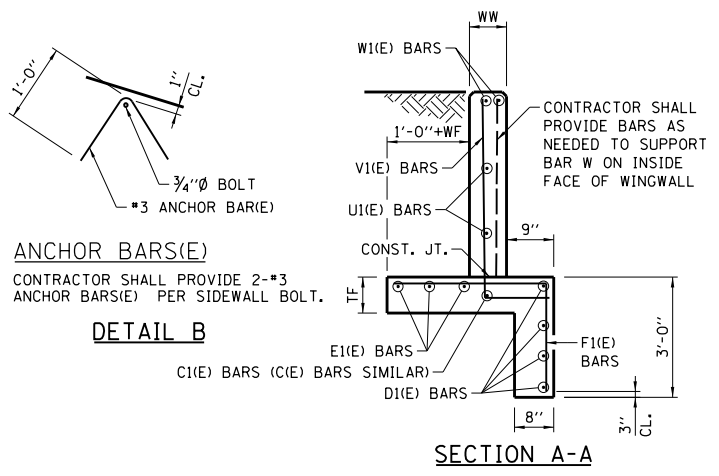
**PIPE RUNNER DETAILS**

DATE	REVISIONS
6-01-2009	REVISED NOTES
3-01-2010	MODIFIED CULVERT SKEW DETAIL, REVISED EROSION PROTECTION AND NOTES
2-07-2012	TABLE QUANTITIES REVISED
3-11-2015	REVISED NOTES

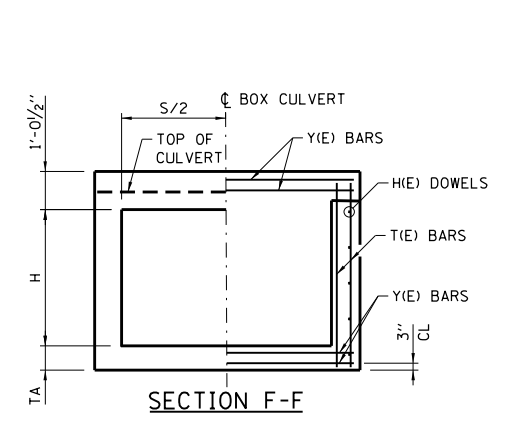
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 6-1-2009

**Illinois Tollway**  
SAFETY END TREATMENT FOR SINGLE CULVERTS  
30° SKEW 1:4  
SLOPE H ≤ 4'  
STANDARD B17-04

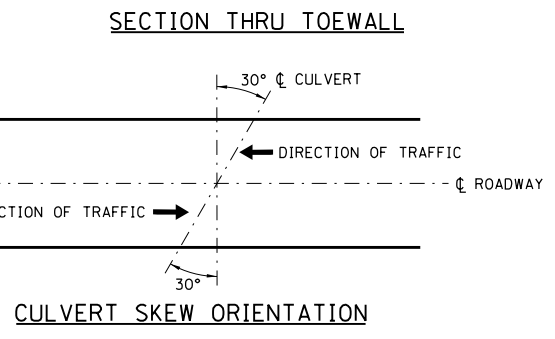
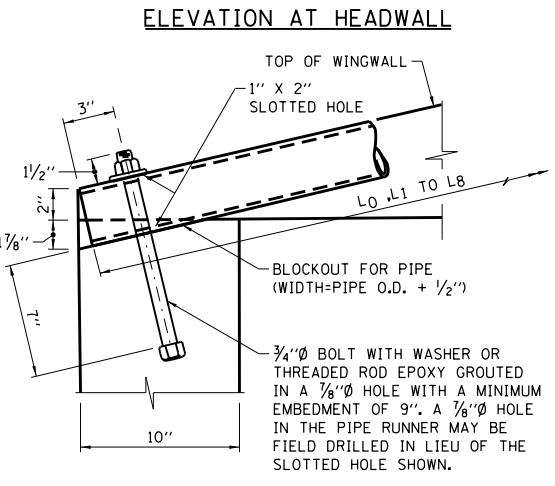
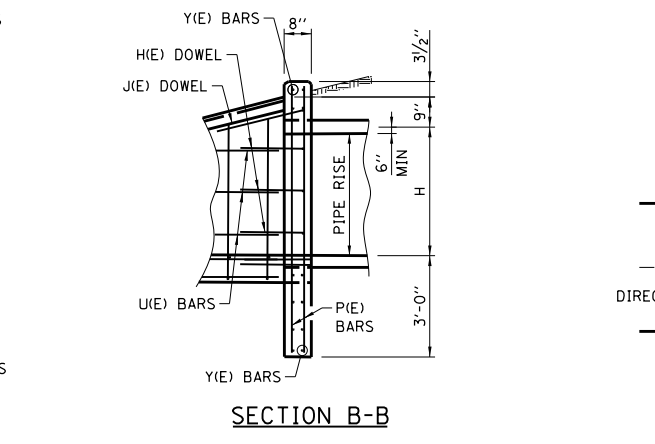
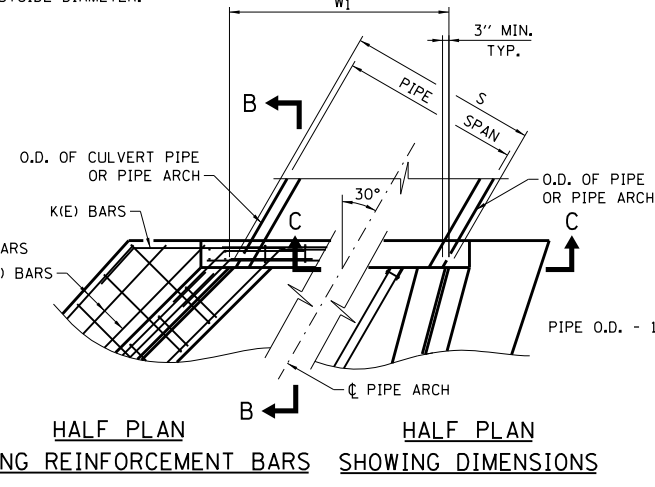
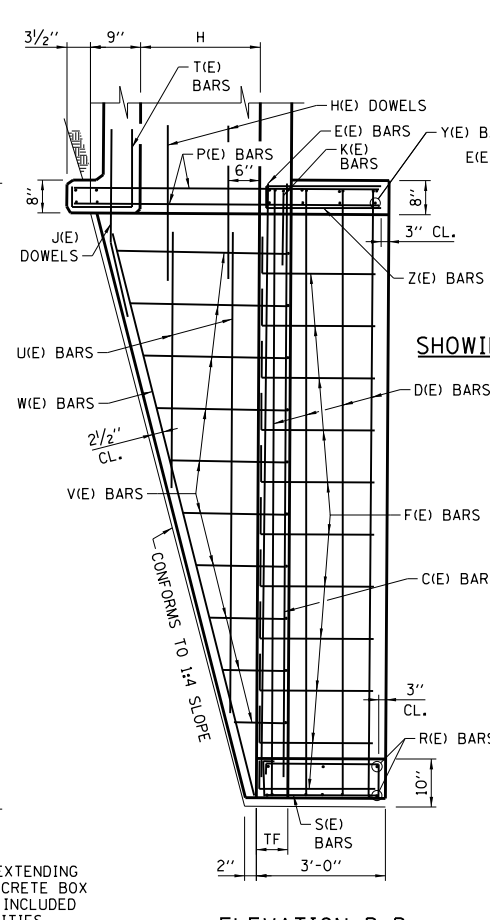
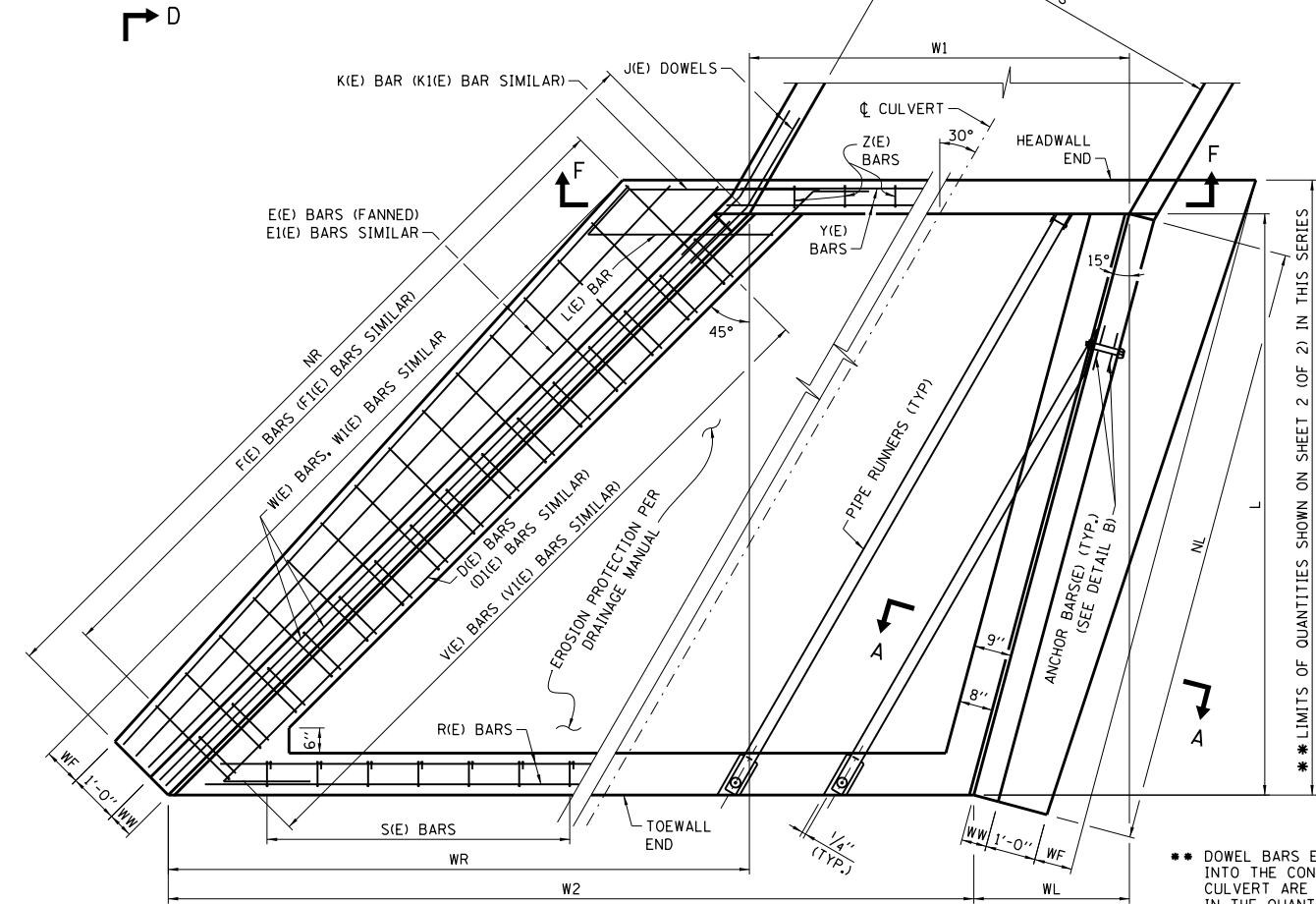
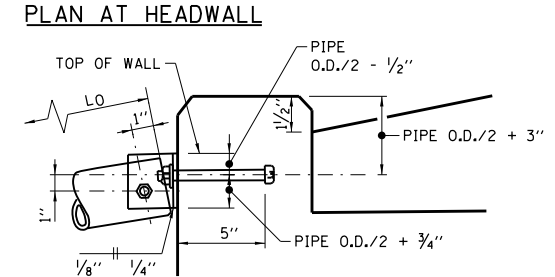
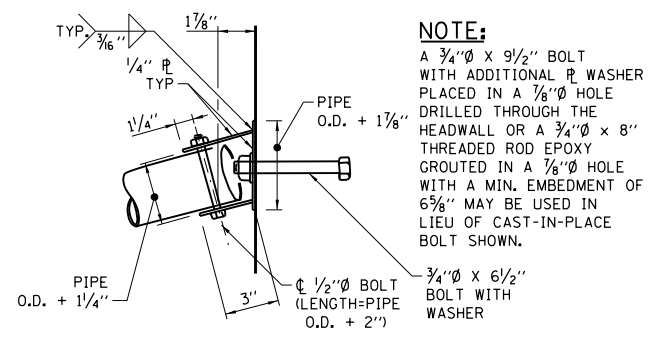
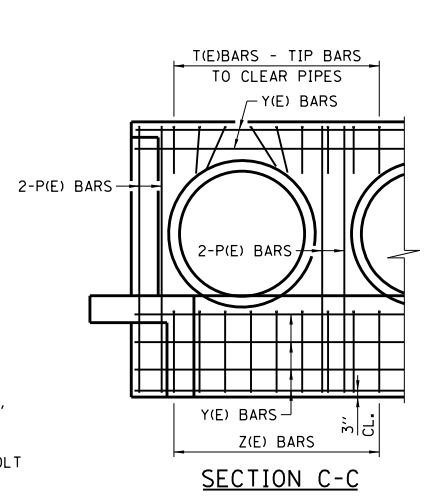
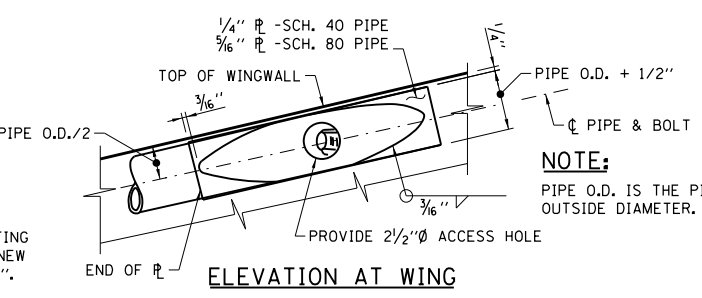
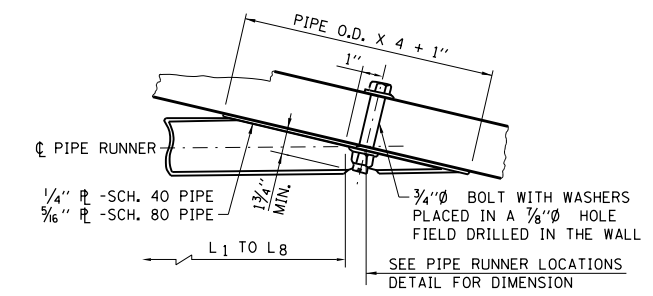




**NOTE:**  
F(E), F1(E), V(E) & V1(E) BARS ARE TO BE FIELD CUT PER CUTTING DIAGRAM. PLACE BARS WITH DIMENSIONS C<sub>2</sub>-C<sub>4</sub>, C<sub>15</sub>-C<sub>18</sub> BEGINNING AT HEADWALL AND BARS WITH DIMENSIONS C<sub>1</sub>-C<sub>3</sub>, C<sub>16</sub>-C<sub>17</sub> BEGINNING AT THE TOEWALL END.



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



**GENERAL NOTES:**

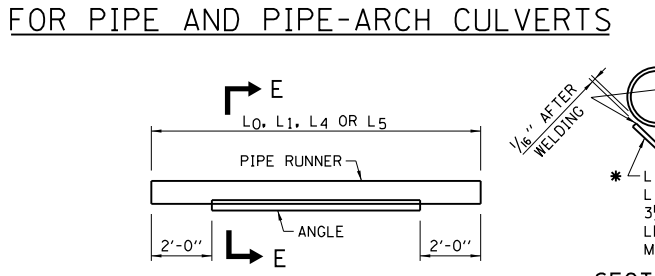
- ALL CONCRETE SHALL BE CLASS S1.
- ALL EXPOSED CONCRETE EDGES SHALL HAVE A 3/4" x 45° CHAMFER. CHAMFER ON VERTICAL EDGES SHALL BE CONTINUED A MINIMUM OF ONE FOOT BELOW FINISHED GROUND LEVEL. COVER FROM THE FACE OF CONCRETE TO THE FACE OF REINFORCEMENT BARS SHALL BE 2", UNLESS OTHERWISE SHOWN.
- CONCRETE 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 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.
- ALL REINFORCEMENT BARS SHALL BE EPOXY COATED (E).

**FOR BOX CULVERTS**

S = DESIGN SPAN  
H = DESIGN HEIGHT

**NOTE:**  
\*\* LIMITS OF QUANTITIES SHOWN ON SHEET 2 (OF 2) IN THIS SERIES

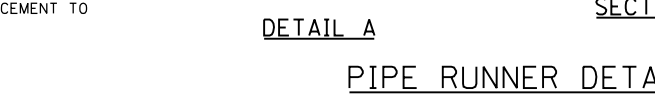
**NOTE:**  
\*\* DOWEL BARS EXTENDING INTO THE CONCRETE BOX CULVERT ARE INCLUDED IN THE QUANTITIES.



**NOTE:**  
WHERE L<sub>0</sub>, L<sub>1</sub>, L<sub>4</sub> OR L<sub>5</sub> 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"
3 1/2"Ø, SCH. 80	22'-1"
4"Ø, SCH. 80	29'-4"

\* L 2 x 2 x 3/8"-3"Ø PIPE  
L 2 1/2 x 2 1/2 x 3/8"  
3 1/2"Ø & 4"Ø PIPE  
LENGTH = L<sub>0</sub>, L<sub>1</sub>, L<sub>4</sub> OR L<sub>5</sub> MINUS 4'-0" (SEE DETAIL A)



**PIPE RUNNER DETAILS**

DATE	REVISIONS
3-01-2010	MODIFIED CULVERT SKEW DETAIL, REVISED EROSION PROTECTION AND NOTES
2-07-2012	TABLE QUANTITIES REVISED
3-31-2014	TABLE QUANTITIES REVISED
3-11-2015	REVISED NOTES

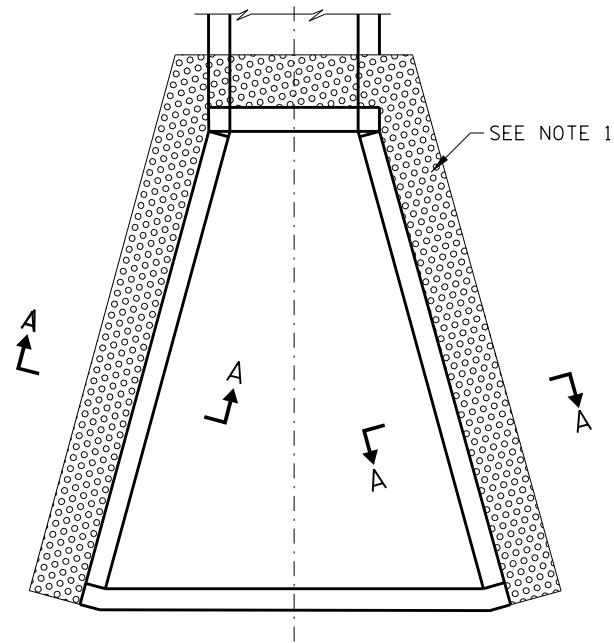
SAFETY END TREATMENT FOR SINGLE AND MULTIPLE CULVERTS 30° SKEW, 1:4 H:8' AND S-VARIES

STANDARD B18-05

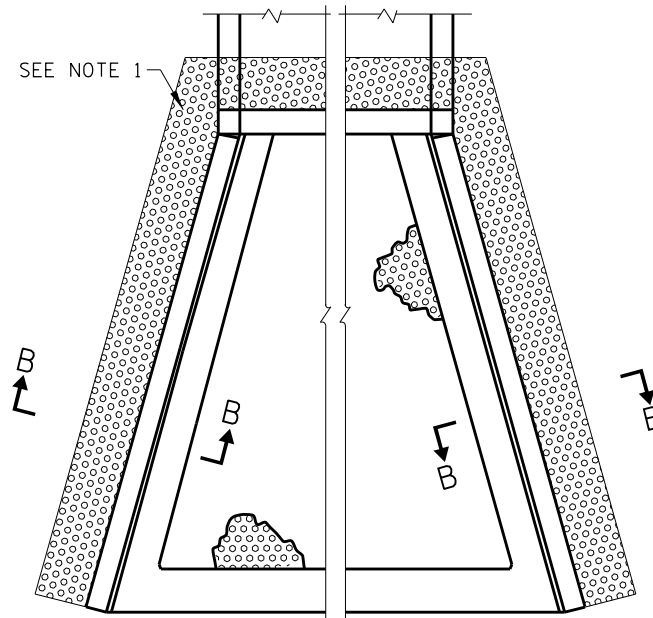
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 6-1-2009



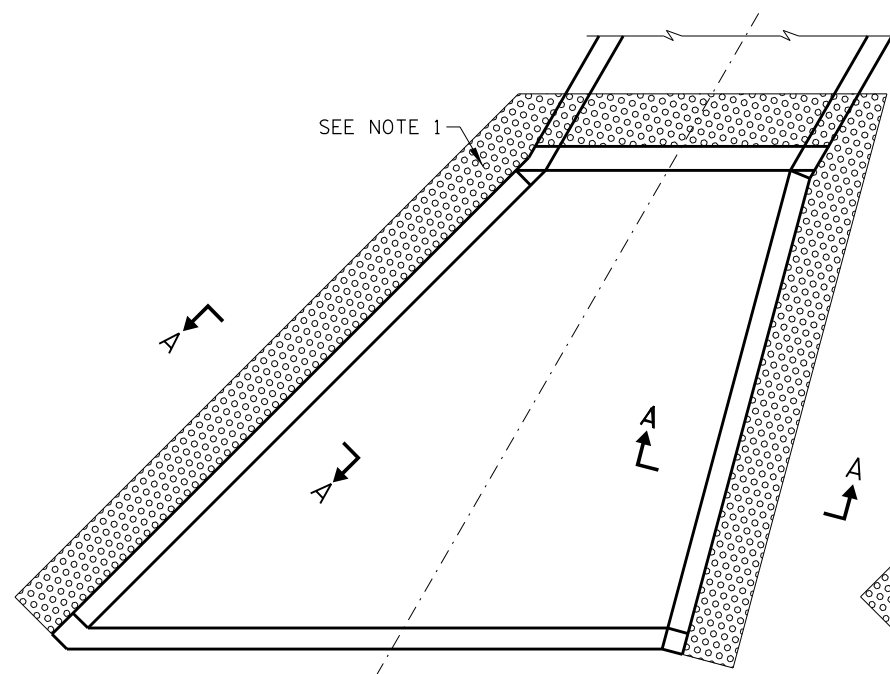




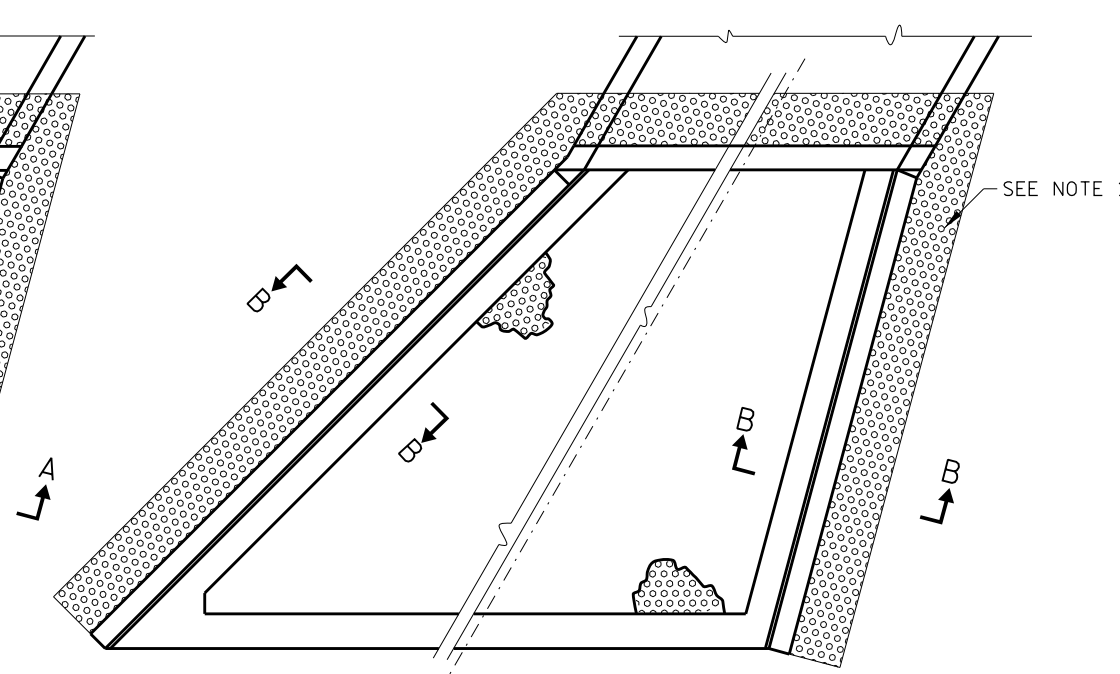
PLAN-0° SKEW, H ≤ 4'



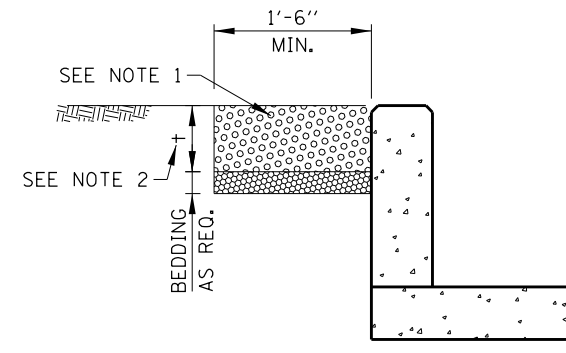
PLAN-0° SKEW, H ≤ 8'



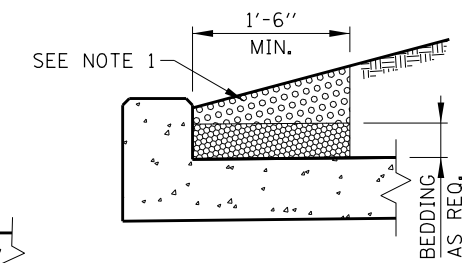
PLAN-SKEW, H ≤ 4'



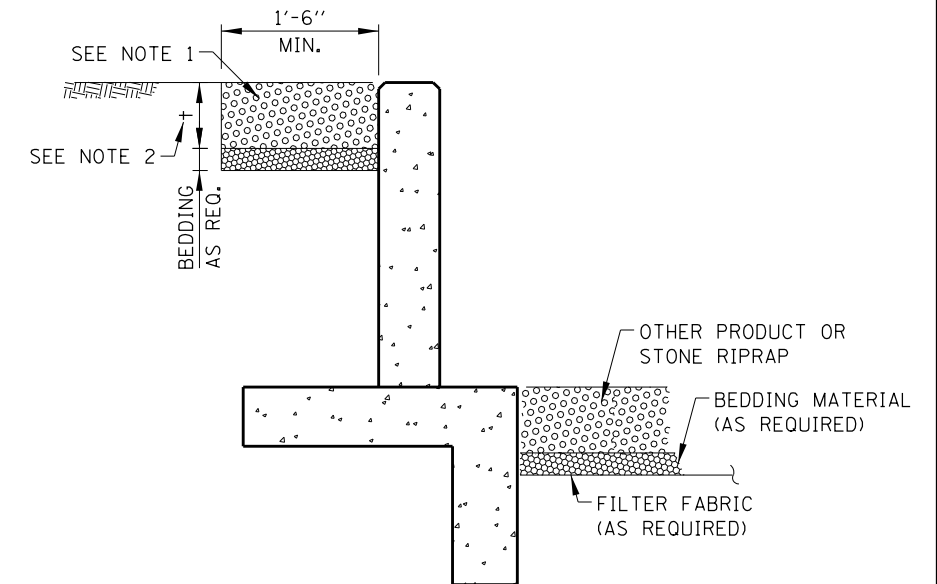
PLAN-SKEW, H ≤ 8'



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 "+" WILL BE DETERMINED BY THE MANUFACTURER'S RECOMMENDATION FOR THE PRODUCT USED.
3. EROSION PROTECTION PLACEMENT SHALL BE INSTALLED FLUSH WITH ADJACENT GRADE.
4. FOR USE WITH STANDARDS B10 TO B18.
5. STONE RIPRAP SHALL BE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS AND DRAINAGE DESIGN MANUAL.

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

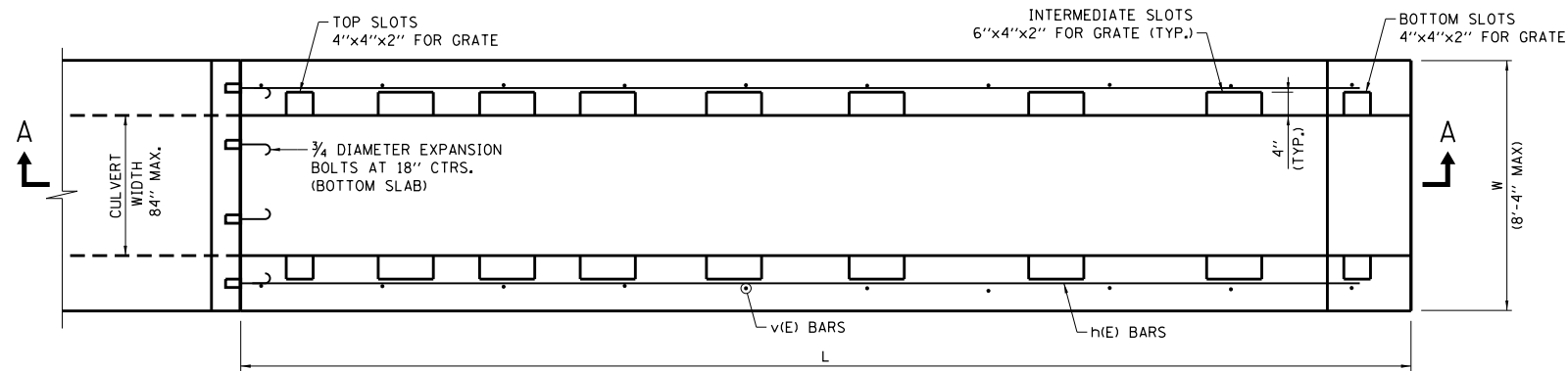
DATE	REVISIONS
3-01-2010	REVISED EROSION PROTECTION AND NOTES
3-11-2015	REVISED NOTES



EROSION PROTECTION

STANDARD B19-02





DIMENSIONS AND QUANTITIES IN TWO WINGWALLS 1:4 SLOPE

CULVERT HEIGHT	DIMENSIONS								NO. OF SPACES			CONCRETE CLASS SI C.Y. *	REINF. BARS (POUND) *
	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

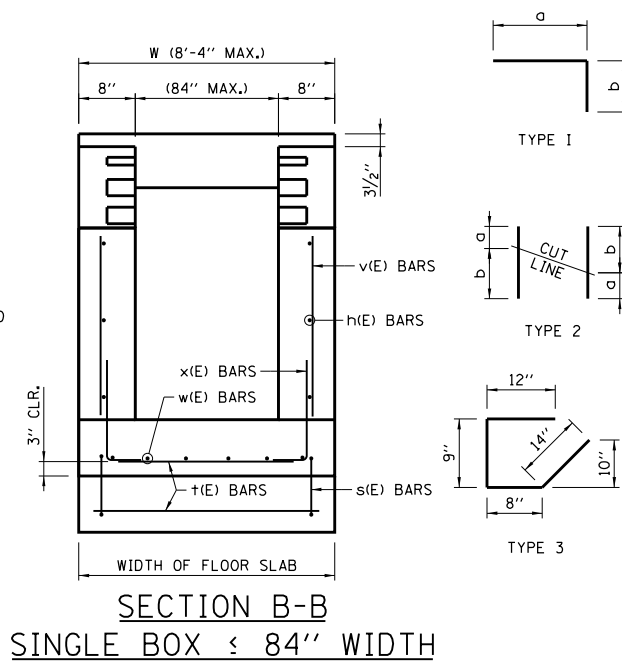
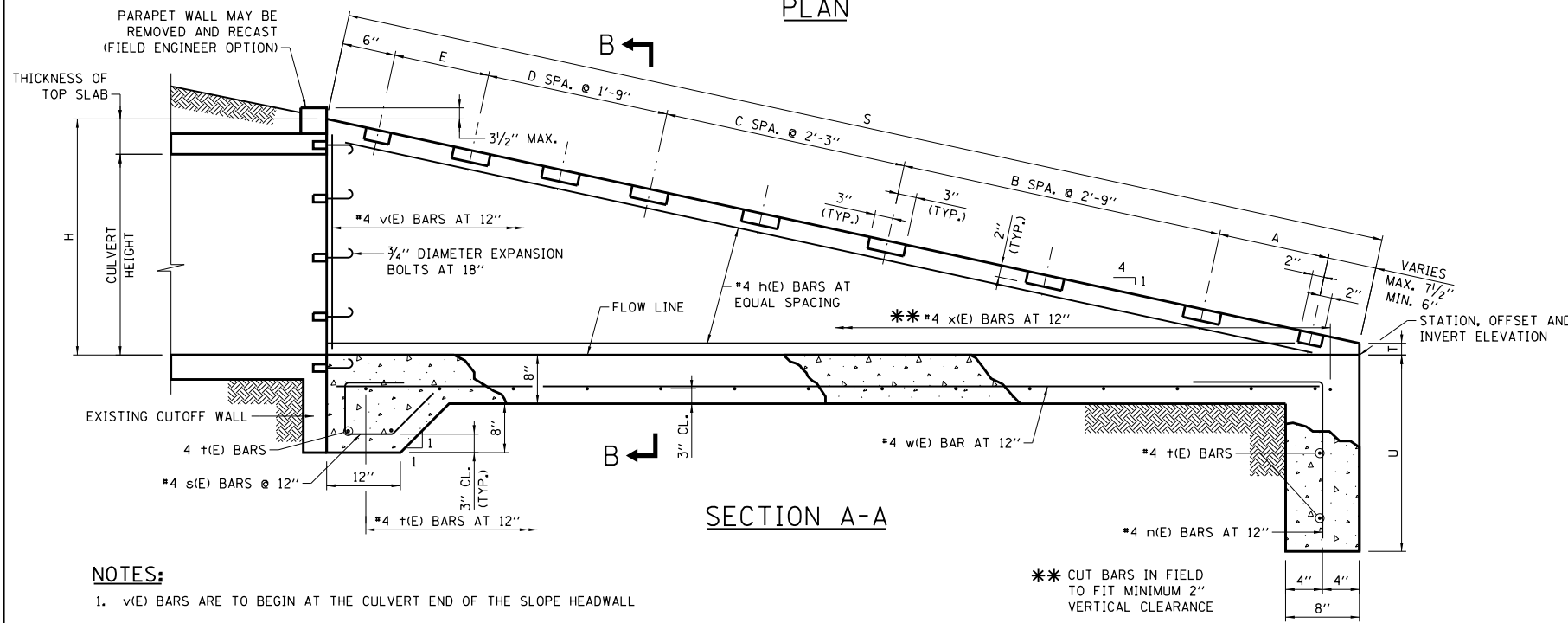


TABLE OF BARS IN ONE WINGWALL 1:4 SLOPE

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

NOTES:

- v(E) 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.

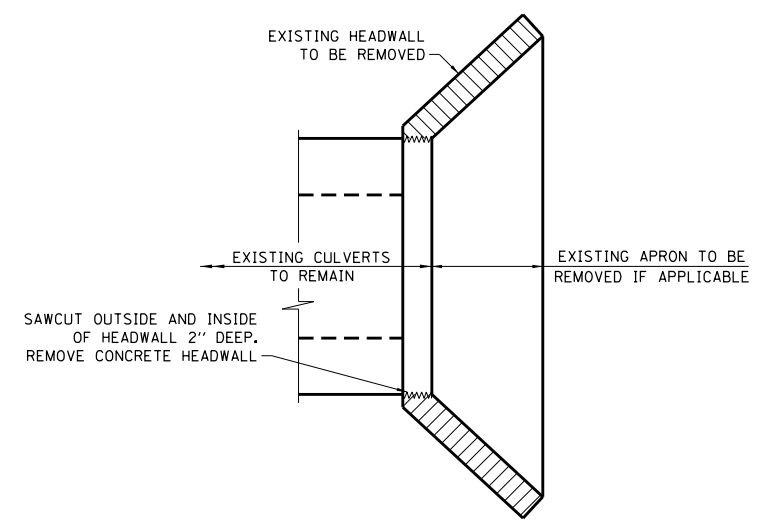
\*\* CUT BARS IN FIELD TO FIT MINIMUM 2" VERTICAL CLEARANCE

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

CULVERT HEIGHT	NO. 4 REINFORCEMENT BARS						REINF. BAR LB. *	CONCRETE CLASS SI (C.Y.) *
	MARK(E)	TYPE	NO. REQ'D	LENGTH	a	b		
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	---	3	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	---	3	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	---	3	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	---	3	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	---	3	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).
- ALL REINFORCEMENT BARS SHALL BE EPOXY COATED (E).



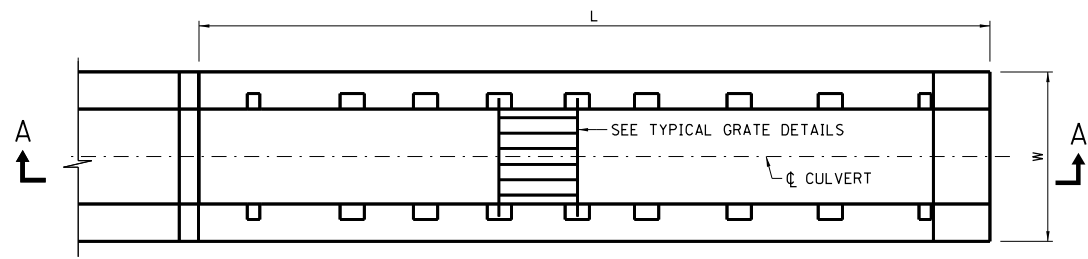
NOTES:

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

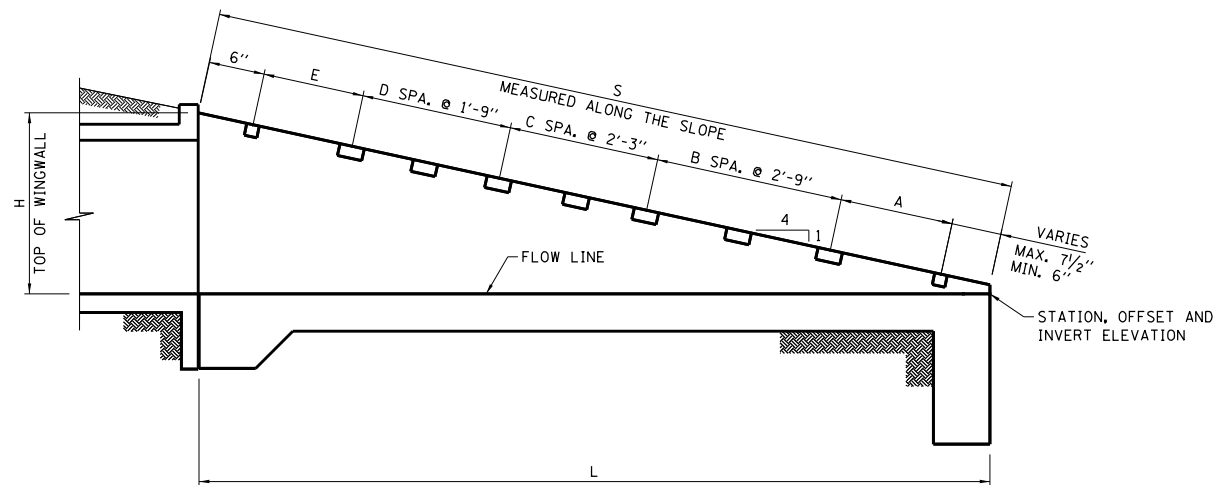
DATE	REVISIONS
2-07-2012	REVISED TABLE QUANTITIES AND NOTES
3-11-2015	REVISED TABLE TITLES AND NOTES
3-31-2016	STATION, OFFSET & INVERT ELEVATION MOVED.

HEADWALL TYPE IV  
CONCRETE BOX CULVERT  
≤ 84" WIDTH  
STANDARD B20-05

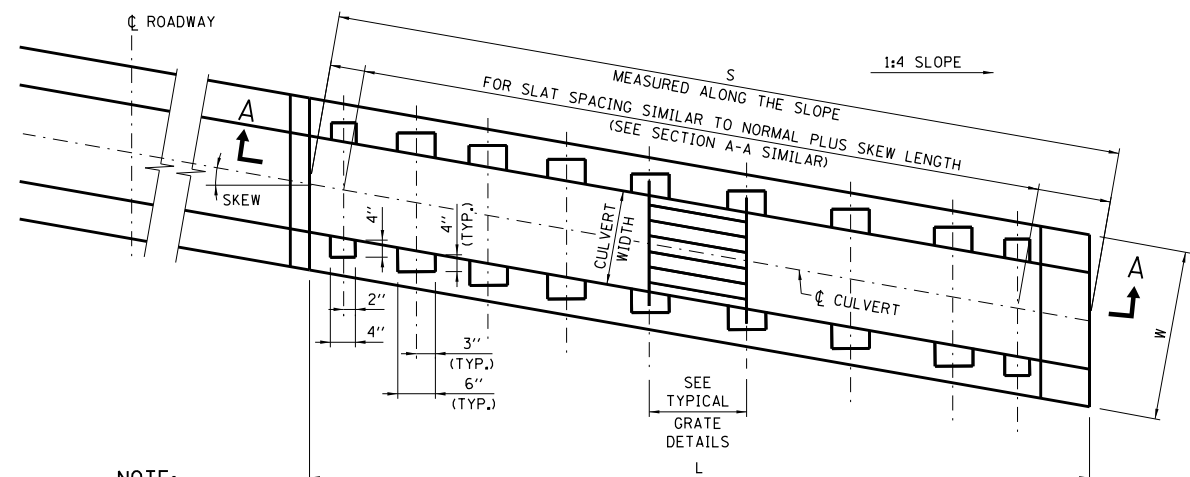
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 2-7-2012



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



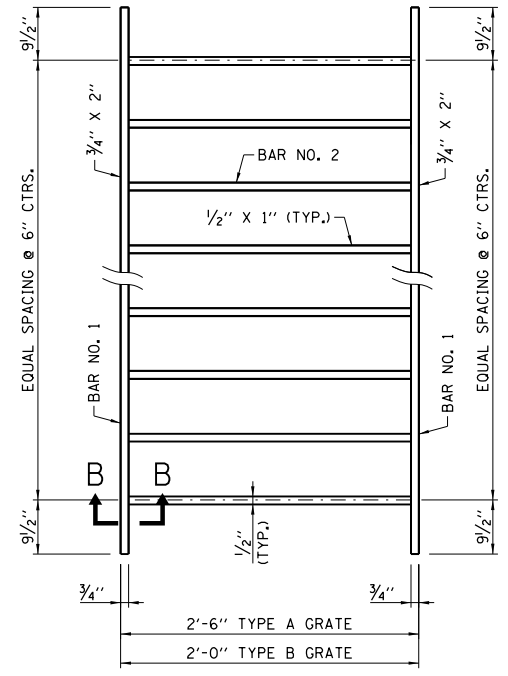
SECTION A-A  
END TREATMENT - MULTIPLE OR SINGLE CELL  
BOX CULVERT



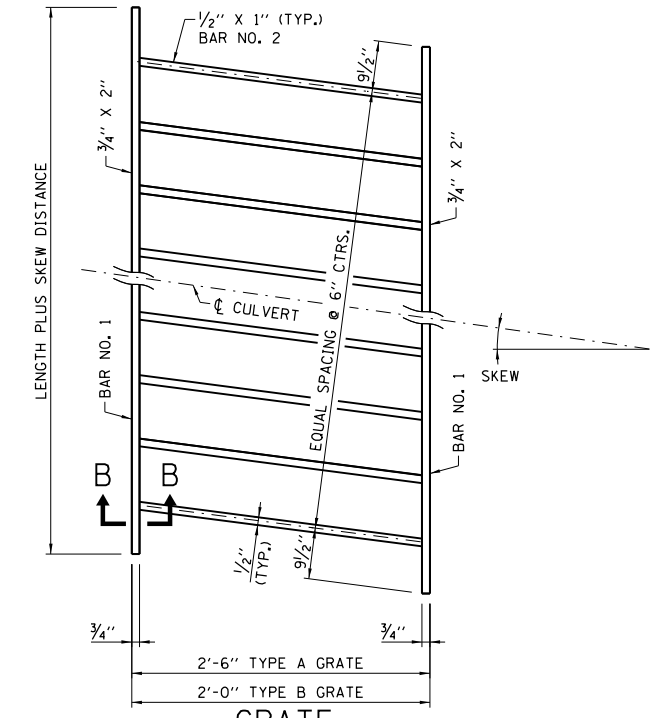
NOTE:

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

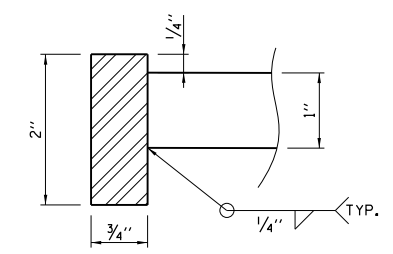
PLAN VIEW (WITH SKEW)  
SINGLE BOX CULVERT ≤ 84" WIDE



TYPICAL GRATE  
(NO SKEW)



GRATE  
(WITH SKEW)



SECTION B-B

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

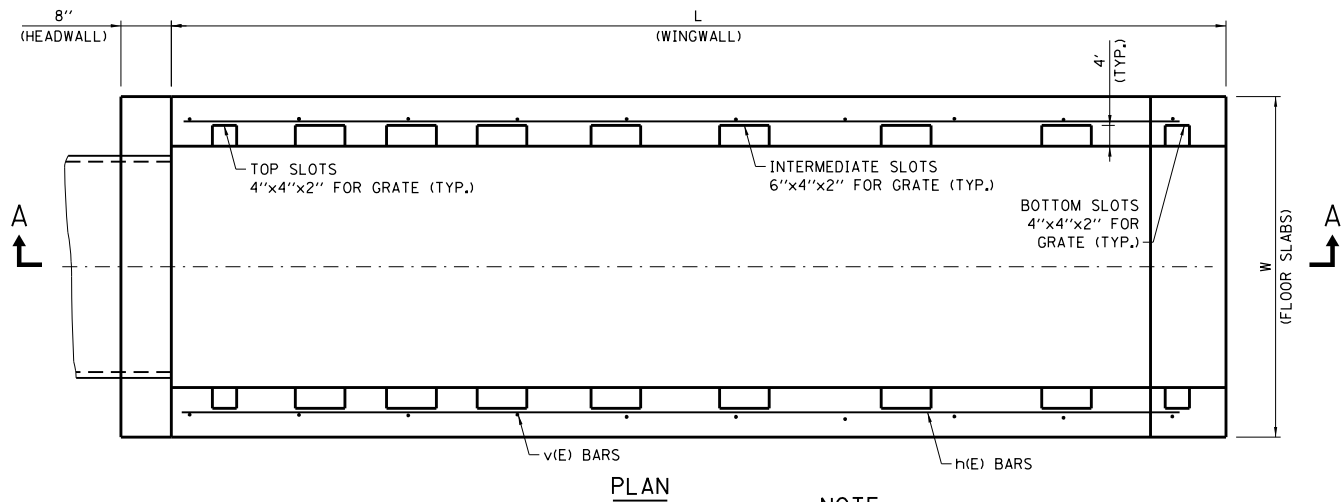
- ALL TABLE DIMENSIONS AND QUANTITIES ARE FOR SINGLE BOX CULVERT HEADWALLS. TO ADAPT ANY OF THESE TABLES FOR DOUBLE BOX CULVERTS, DOUBLE THE NUMBER OF GRATES REQUIRED AND ADD AN ADDITIONAL WALL. (WALL THICKNESS SHALL BE SAME AS THE CENTER WALL THICKNESS OF THE BOX CULVERT).
- FOR QUANTITY CALCULATIONS 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
06-01-09	CHANGED SECTION B-B
	DIMENSION REVISED NOTES.
02-07-12	DELETED SECTION FROM PLAN VIEW.
3-31-2016	STATION, OFFSET AND INVERT ELEVATION MOVED.

GRATING FOR HEADWALL TYPE IV BOX CULVERT ≤ 84" WIDTH

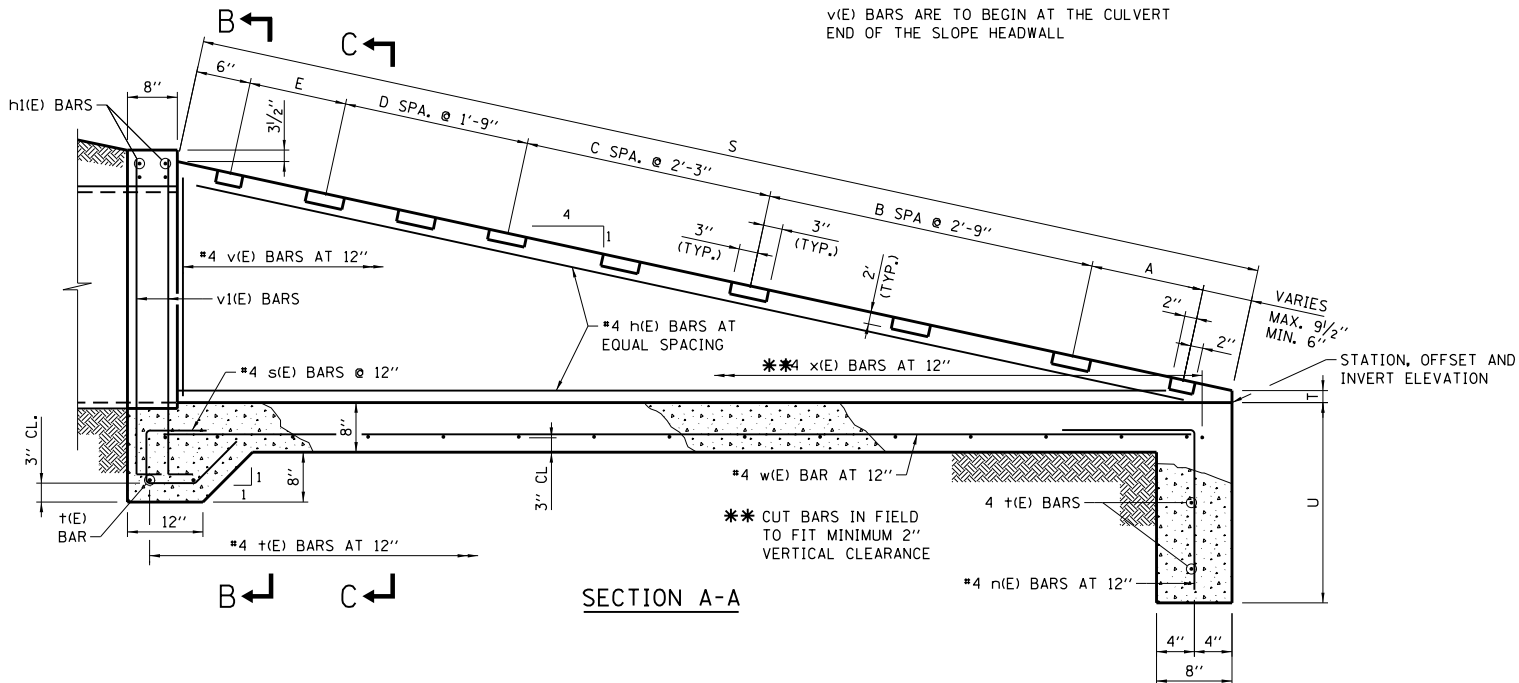
STANDARD B21-03



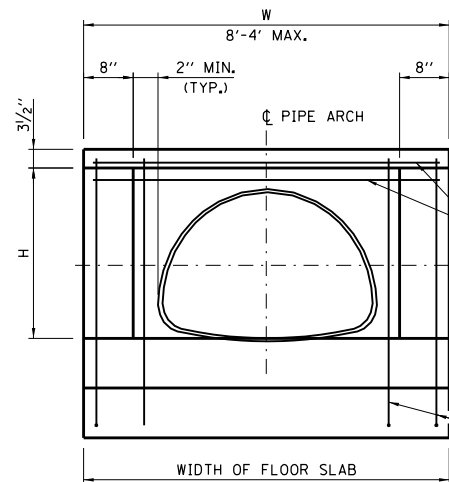
PLAN

**NOTE:**

v(E) BARS ARE TO BEGIN AT THE CULVERT END OF THE SLOPE HEADWALL

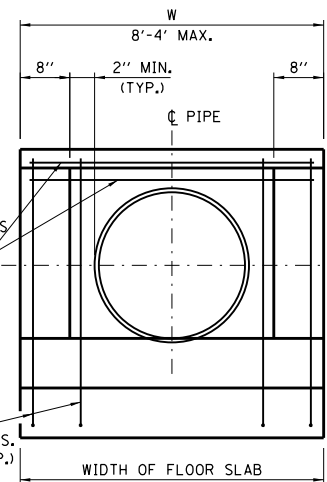


SECTION A-A



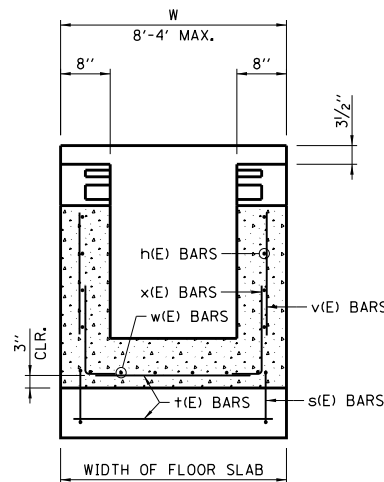
SECTION B-B

ELLIPTICAL PIPE OR PIPE-ARCH



SECTION B-B

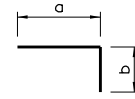
CIRCULAR PIPE



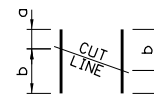
SECTION C-C

**DIMENSIONS AND QUANTITIES IN TWO WINGWALLS 1:4 SLOPE**

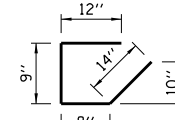
PIPE-ARCH ELLIPTICAL PIPE (SPAN ≤ 77")	CIRCULAR PIPE (DIAMETER)	DIMENSIONS						NO. OF SPACES			CONCRETE CLASS SI * (C.Y.)	REINF. BAR * (POUND)	
		H	L	S	T	U	A	E	B	C			D
RISE ≤ 30"		3'-2"	12'-0"	12'-4 1/2"	2"	2'-8"	2'-2"	2'-2"	-	3	-	.98	151
RISE ≤ 36"		3'-8"	14'-0"	14'-5 5/8"	2"	2'-8"	2'-2"	2'-2"	-	4	-	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



TYPE 1



TYPE 2



TYPE 3

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

NO. 4 REINFORCEMENT BARS						
H	MARK(E)	TYPE	NO. REQ'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 REINFORCEMENT BARS							
H	MARK(E)	TYPE	NO. REQ'D	LENGTH	a	b	REINF. BARS (POUND)* CONCRETE CLASS SI (C.Y.)*
3'-2"	h 131	STR.	4	W-(0'-4")			52 .38
	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 .43
	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 .50
	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 .55
	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 .60
	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 .66
	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 .71
	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(E)" BARS SHALL BE ORDERED FULL LENGTH AND CUT IN THE FIELD. THE REMAINING PORTION OF THE "v(E)" BARS SHALL BE USED IN THE OTHER WALL.
- THE LONG LEG OF THE "h(E)" 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).
- ALL REINFORCEMENT BARS SHALL BE EPOXT COATED (E).

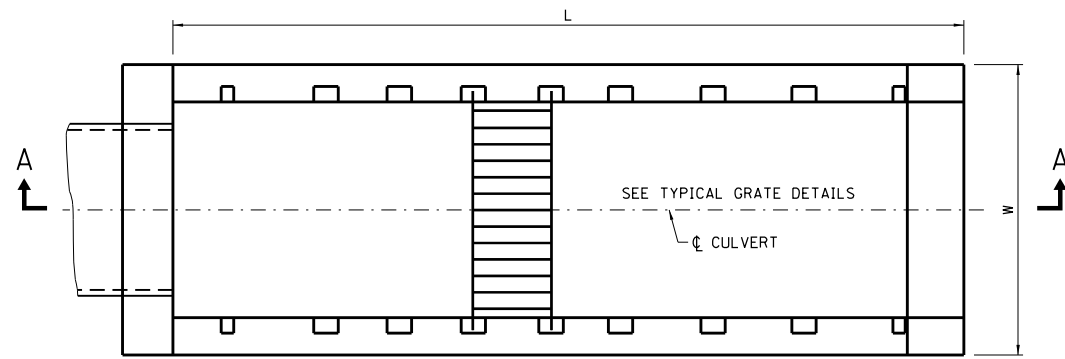
DATE	REVISIONS
2-07-2012	REVISED TABLE QUANTITIES
3-11-2015	REVISED NOTES
3-31-2016	STATION, OFFSET AND INERT ELEVATION, MOVE,



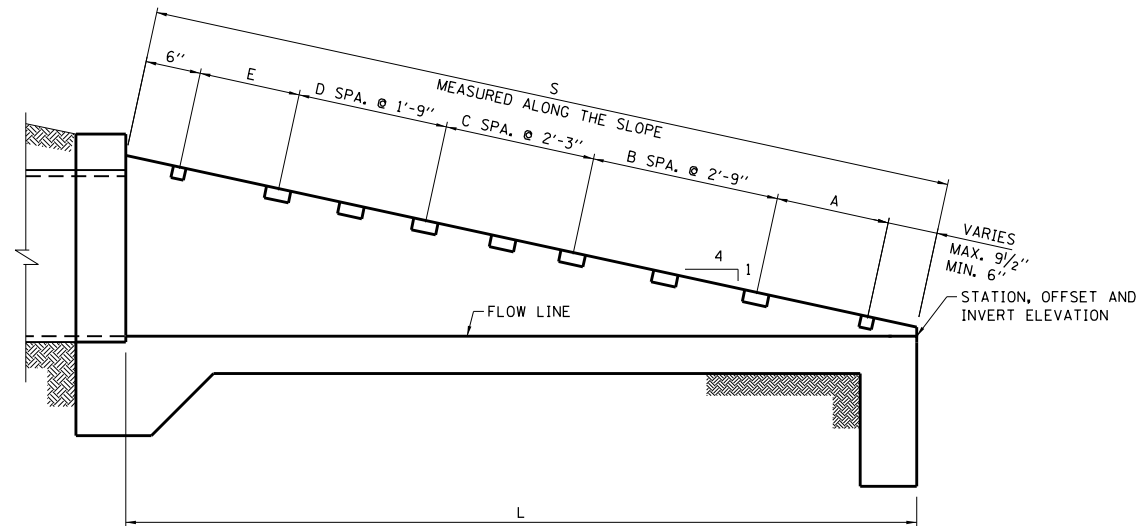
HEADWALL TYPE IV  
METAL PIPE & PIPE-ARCH  
CULVERTS

STANDARD B22-04

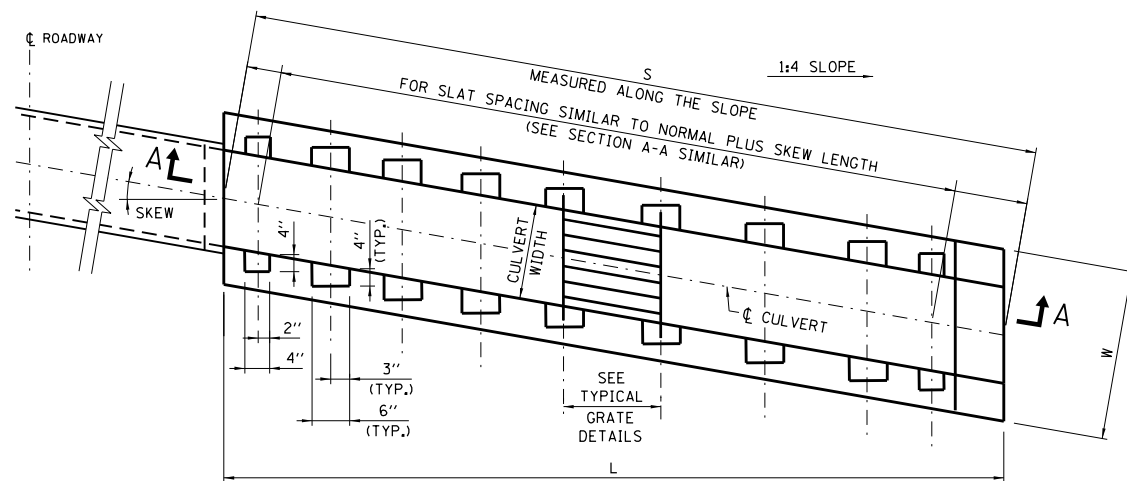
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 2-7-2012



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

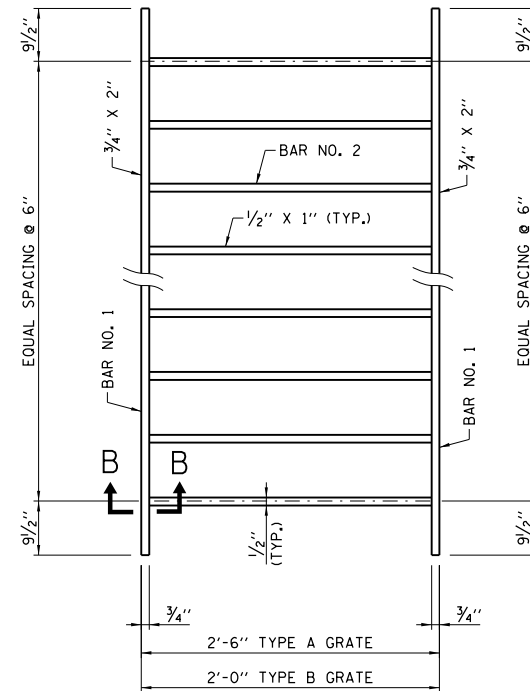


SECTION A-A  
END TREATMENT - MULTIPLE OR SINGLE CELL  
BOX CULVERT

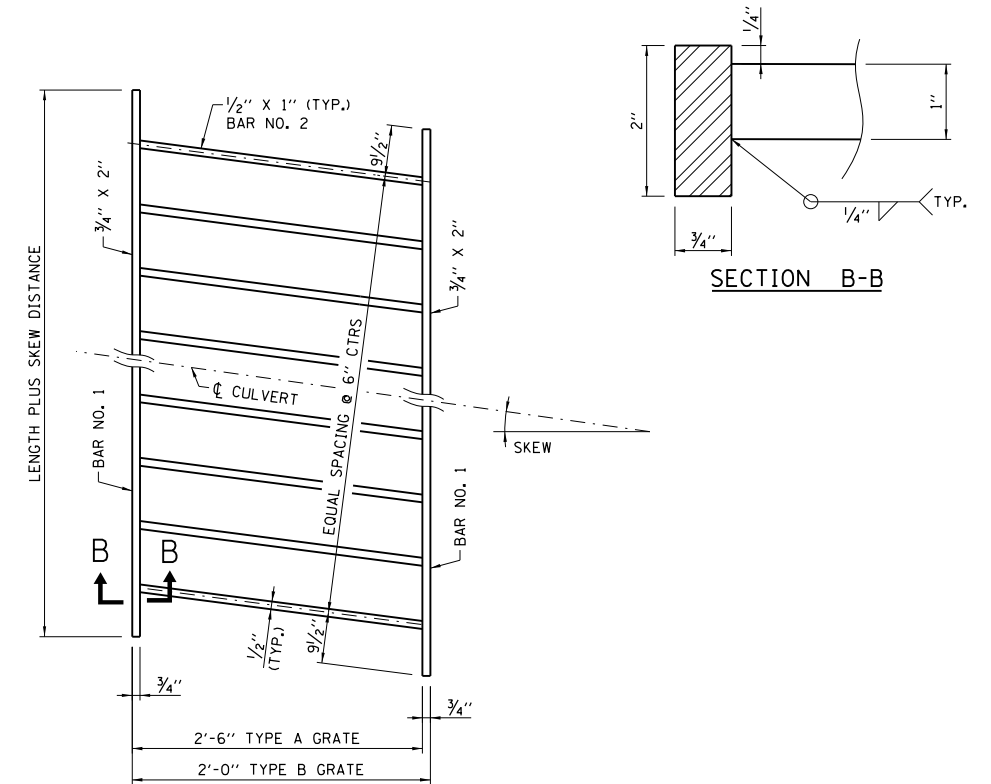


PLAN VIEW (WITH SKEW)

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



GRATE DETAILS  
(WITH NO SKEW)



GRATE DETAILS  
(WITH SKEW)

GRATING 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				GRATING (POUND)* EACH GRATE
	NUMBER REQUIRED	TYPE REQ'D.	BAR NO. 1 BARS REQ'D.	LENGTH	BAR NO. 2 BARS REQ'D.	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"
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	≤ 10°	10° ≤ 20°	20° ≤ 30°
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 3/8"	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).

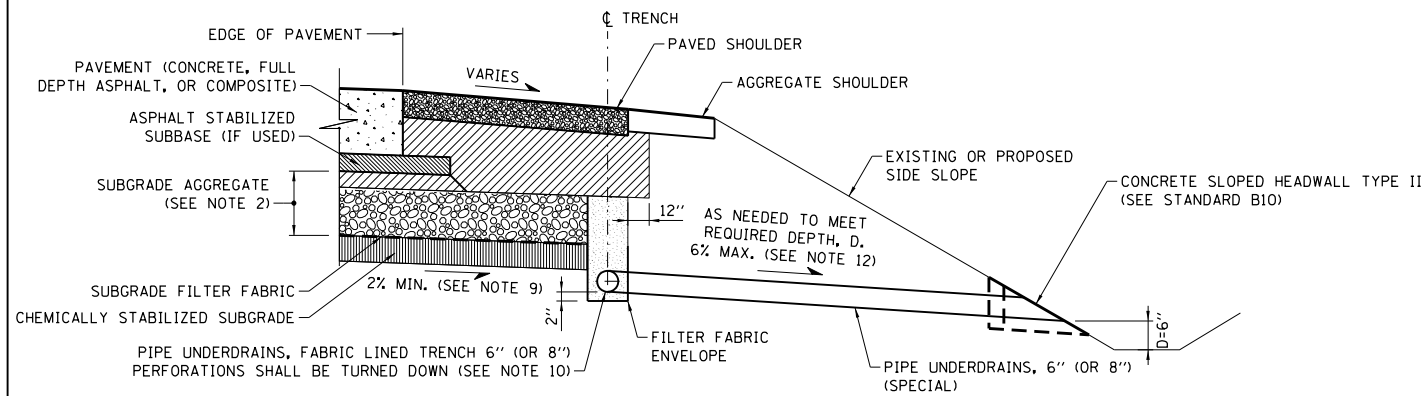
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 2-7-2012

DATE	REVISIONS
06-01-09	CHANGED SECTION B-B
02-07-12	DIMENSION REVISED NOTES, DELETED SECTION VIEW FROM SKEW PLAN.
3-31-2016	STATION, OFFSET AND INVERT ELEVATION MOVED.

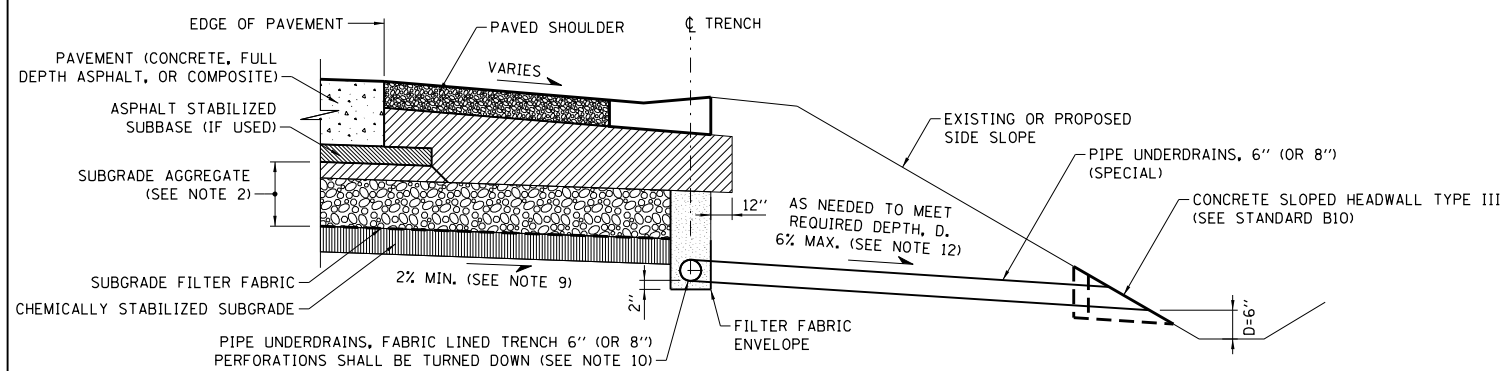


GRATING FOR  
HEADWALL TYPE IV PIPE  
AND PIPE-ARCH CULVERTS

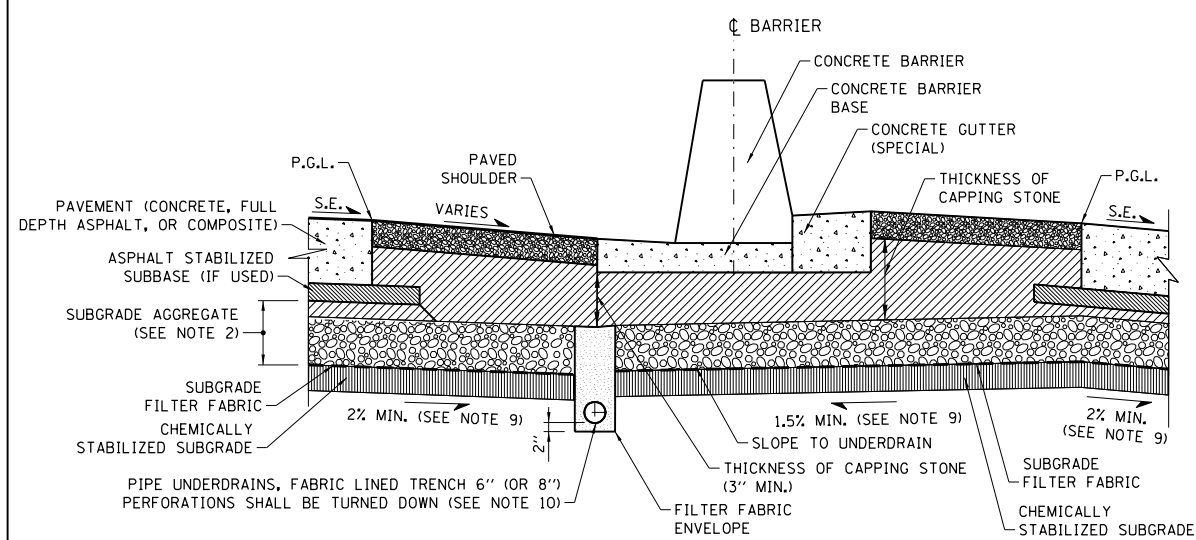
STANDARD B23-03



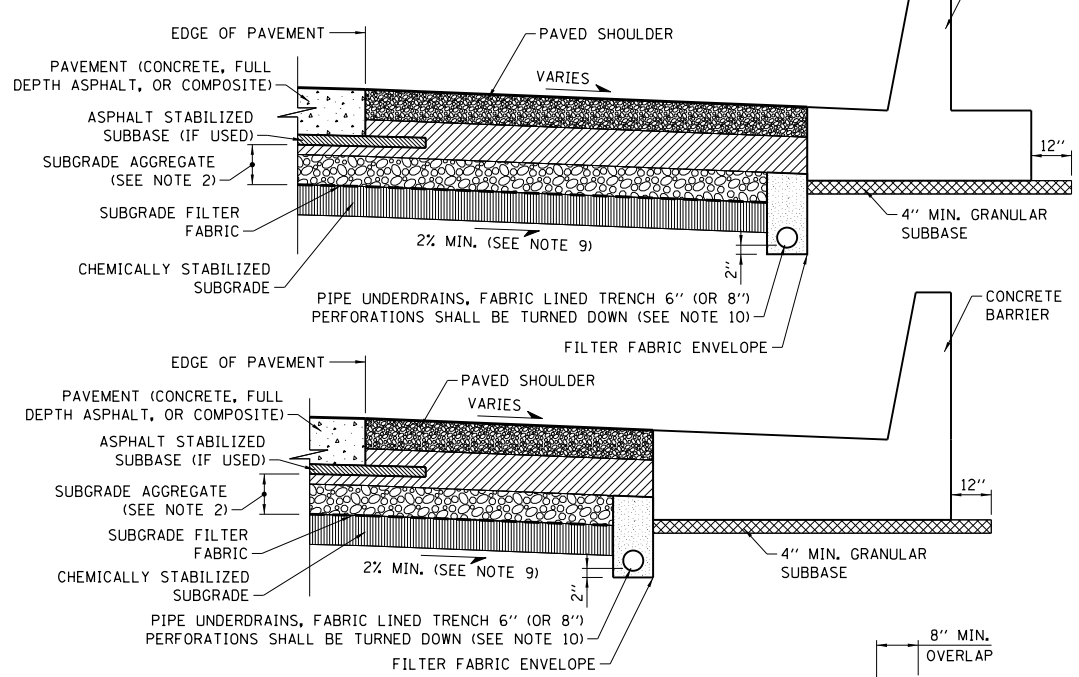
LOCATIONS WITHOUT GUTTER



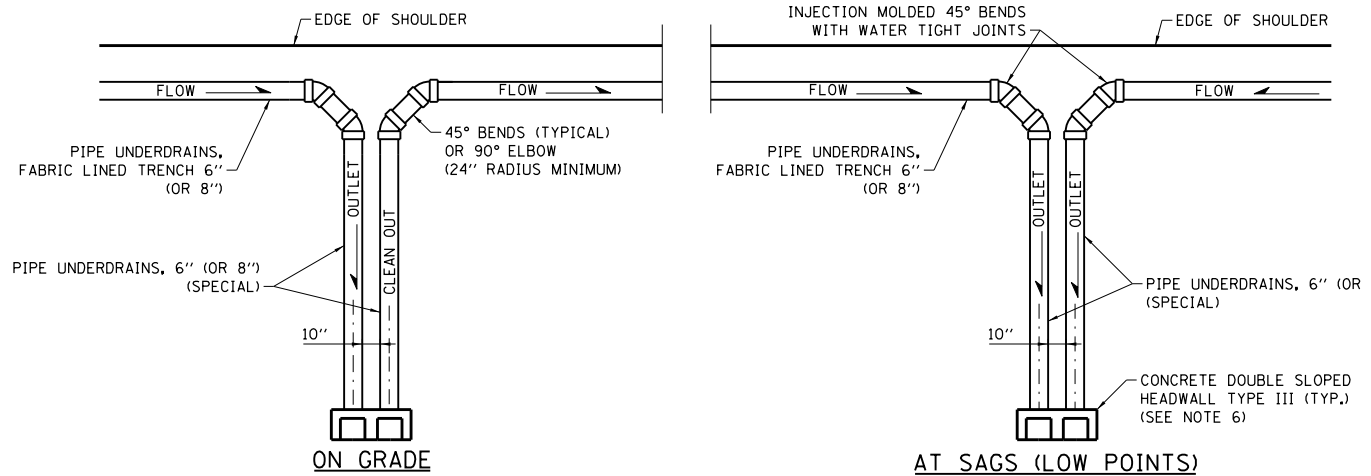
LOCATIONS WITH GUTTER



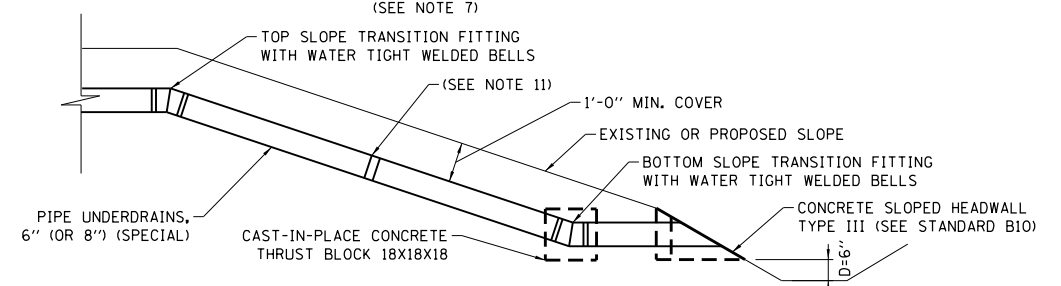
LOCATIONS WITH VARIABLE HEIGHT DOUBLE FACE BARRIER



LOCATIONS WITH BARRIER



DETAIL OF PIPE UNDERDRAIN OUTLETS

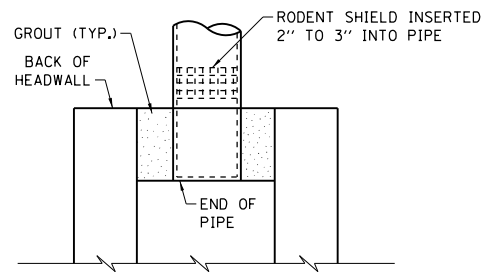


DETAIL OF PIPE UNDERDRAIN OUTLET ON HIGH FILL SLOPE

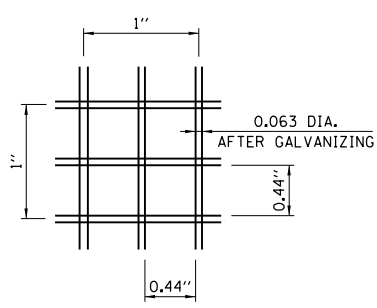
NOTES FOR PIPE UNDERDRAIN

- 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\"/>
- SUBGRADE AGGREGATE SHALL CONSIST OF A 3\"/>
- 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\"/>
- AT OUTLET LOCATIONS, PIPE UNDERDRAINS SHALL SEPARATE SUFFICIENTLY TO PROVIDE SPACE FOR TWO CONCRETE SLOPED HEADWALLS, OR TWO PIPES CAN RUN PARALLEL INTO A DOUBLE SLOPED HEADWALL.
- IN AREAS WHERE A CLOSED DRAINAGE SYSTEM EXISTS, THE PIPE UNDERDRAIN, 6\"/>
- 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\"/>
- BOTTOM OF SUBGRADE AGGREGATE SLOPE FROM ROADWAY PROFILE GRADE SHALL NOT BE LESS THAN 1.5% TOWARD THE PIPE UNDERDRAIN IN SUPERELEVATED SECTIONS.
- A CA 16 BACKFILLED TRENCH SHALL BE USED WITH THE INSTALLATION OF A PIPE UNDERDRAIN SYSTEM, EXCEPT THE PERCENT PASSING THE NO. 16 (1.18 mm) SIEVE SHALL BE 4 ± 4 PERCENT.
- ALL JOINTS IN SLOPE DRAIN SYSTEM SHALL BE WATERTIGHT WITH A WELDED INTERNAL CYLINDER ON THE SPIGOT END OF THE PIPE. FIELD JOINTS SHALL BE WRAPPED WITH A DOUBLE WIDE MARMAC COUPLER, OR EQUIVALENT.
- IF REQUIRED PIPE UNDERDRAIN SLOPE EXCEEDS 6%, PIPE UNDERDRAIN OUTLET ON HIGH FILL SLOPE DETAIL SHALL APPLY.

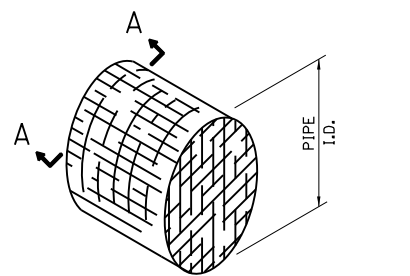
MAXIMUM ALLOWABLE DRAINAGE DISTANCE TO OUTLET OR SEPARATION DISTANCE BETWEEN OUTLETS	
ROADWAY PROFILE GRADE (%)	DISTANCE
≤ 1	250 FT.
BETWEEN 1 AND 2	375 FT.
≥ 2	500 FT. (NOTE 5)



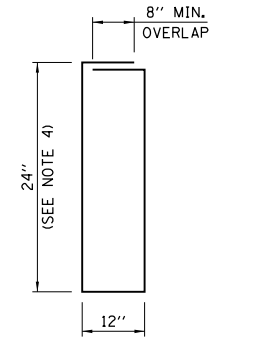
RODENT SHIELD PLACEMENT



SECTION A-A



DETAIL OF RODENT SHIELD

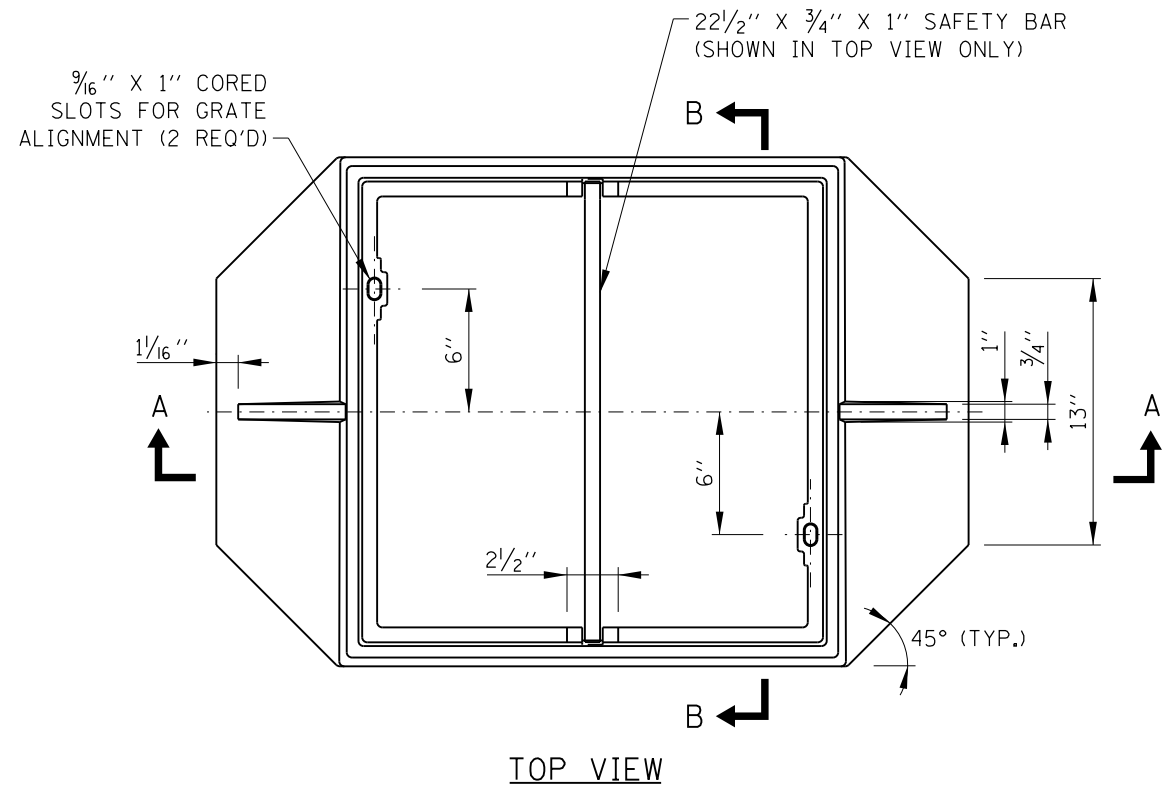


FILTER FABRIC ENVELOPE

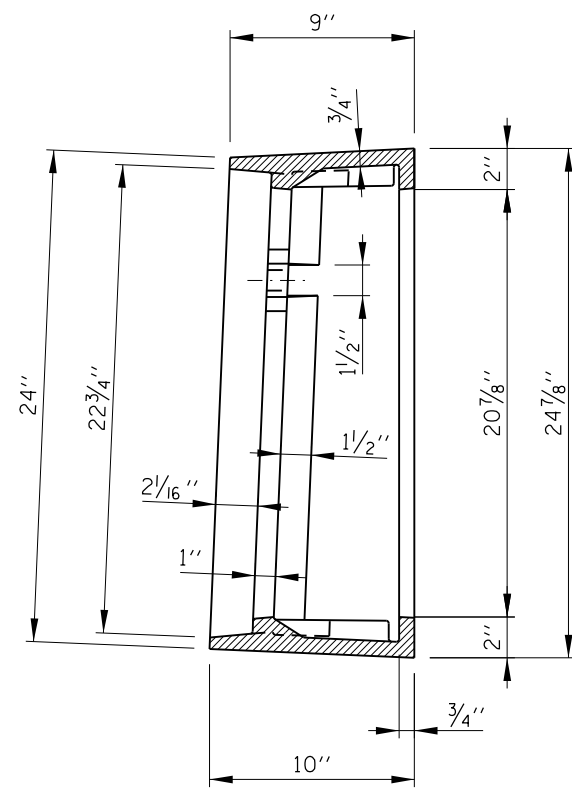
APPROVED: *Paul Kovacs*  
CHIEF ENGINEERING OFFICER DATE 6-1-2009

DATE	REVISIONS
3-01-2018	ADDED MINIMUM THICKNESS OF CAPPING STONE
3-01-2019	REVISED PIPE UNDERDRAIN OUTLETS TO SHOW 45 DEGREE BENDS OR 90 DEGREE ELBOW. ADDED DETAIL FOR OUTLET AT HIGH FILL SLOPE.
3-01-2020	ADDED COMPOSITE PAVEMENT AS OPTION
3-01-2021	ADDED DETAIL FOR BARRIER

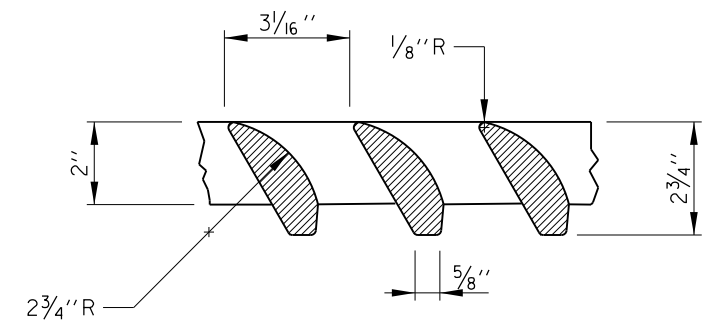
PIPE UNDERDRAINS  
STANDARD B24-09



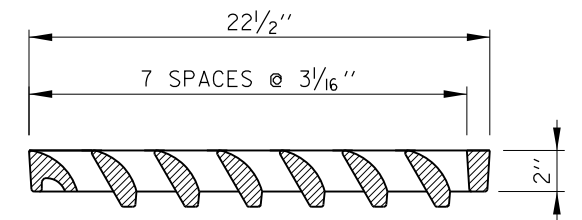
TOP VIEW



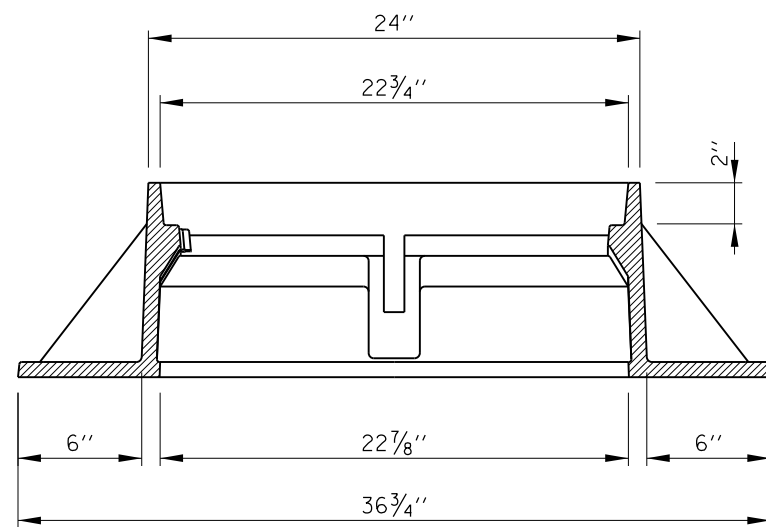
SECTION B-B



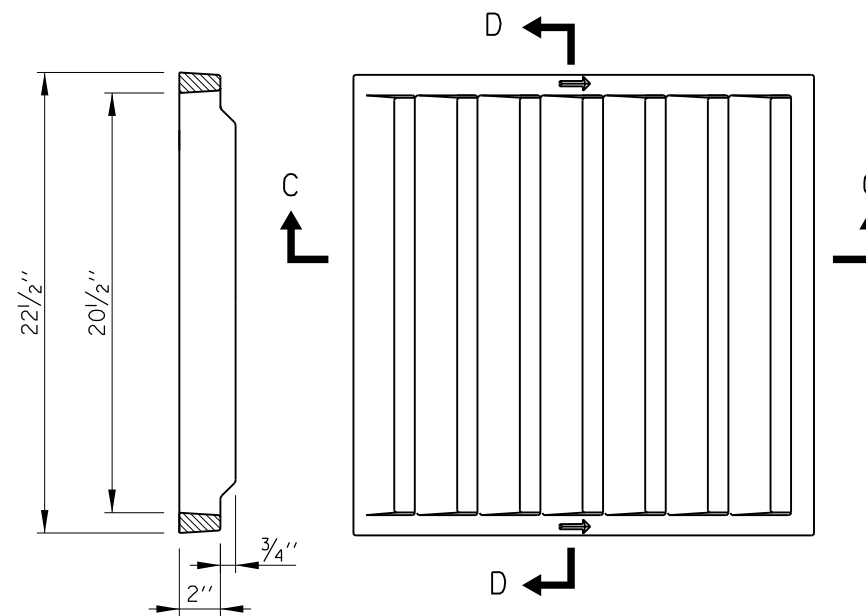
DETAIL OF VANES



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, EAST JORDAN IRON WORKS 7535 OR APPROVED EQUAL.
3. GRATE SHALL NOT BE BOLTED TO FRAME.

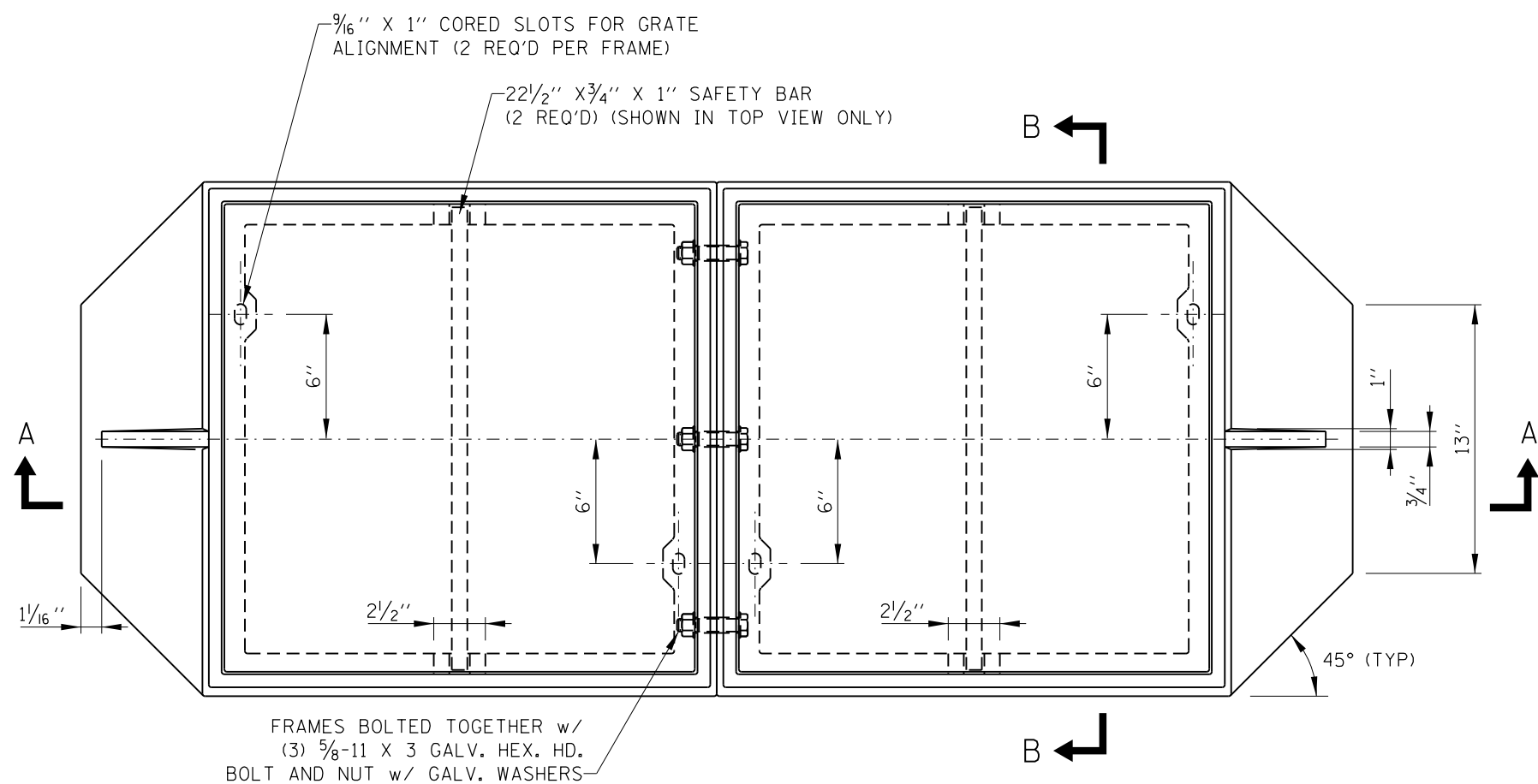
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 6-30-2008

DATE	REVISIONS
03-31-14	ADDED FRAME AND GRATE CASTINGS



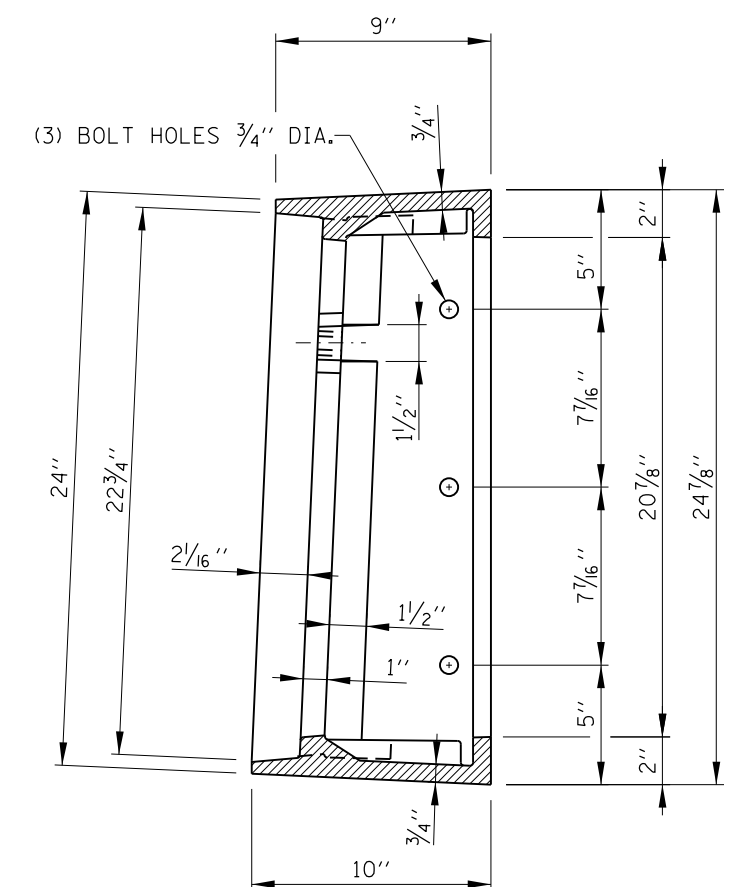
FRAME AND GRATE  
TYPE 20A

STANDARD B25-01

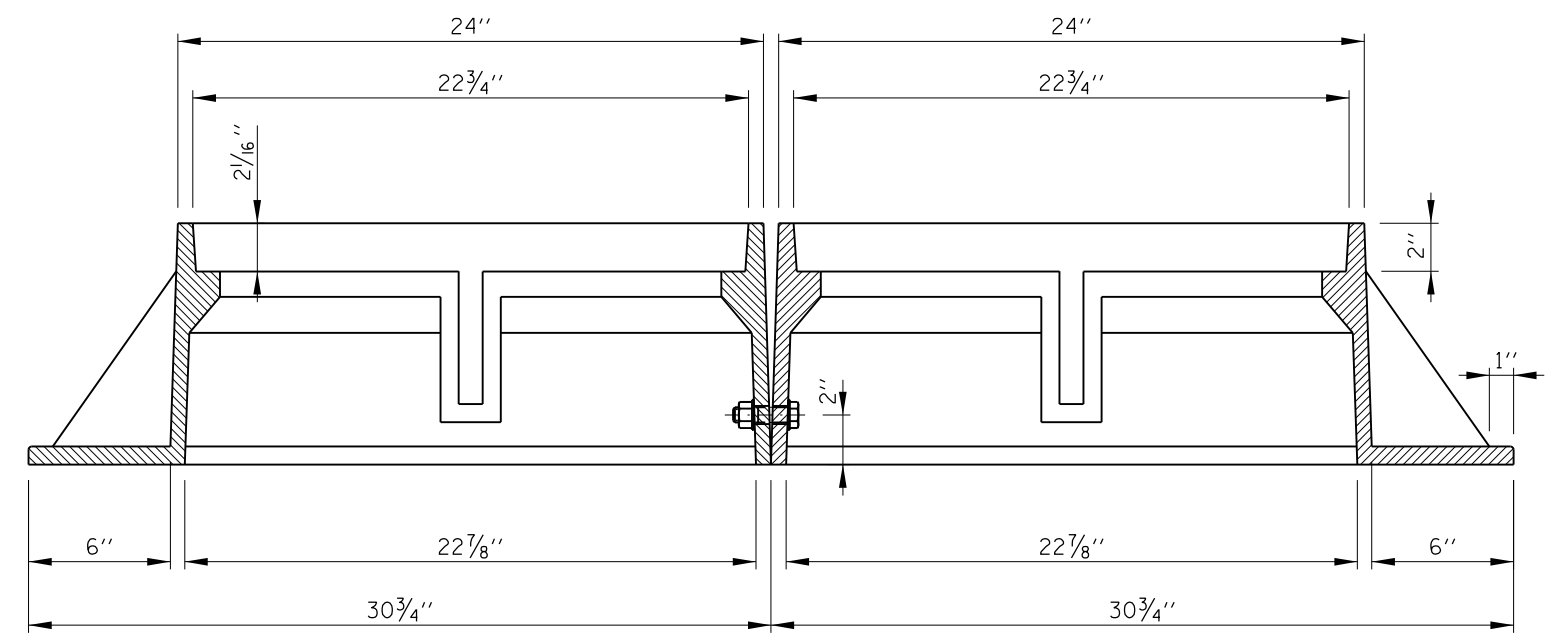


FRAMES BOLTED TOGETHER w/  
 (3) 5/8-11 X 3 GALV. HEX. HD.  
 BOLT AND NUT w/ GALV. WASHERS

TOP VIEW



SECTION B-B



SECTION A-A  
 CAST FRAME

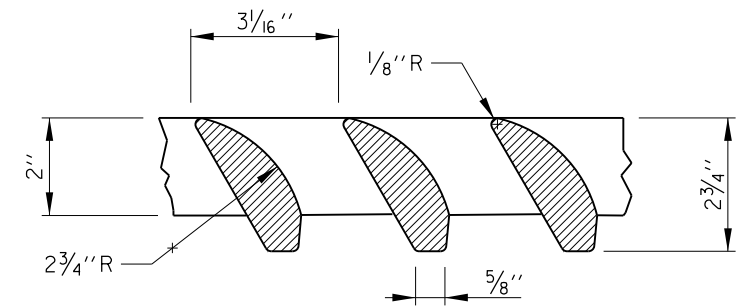


DATE	REVISIONS
03-31-14	ADDED FRAME AND GRATE CASTINGS

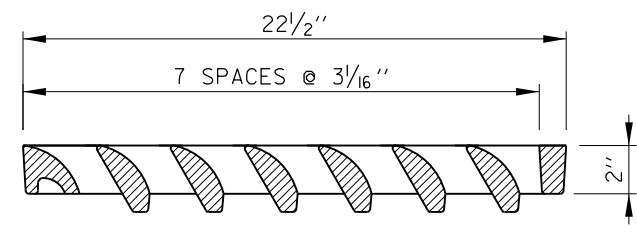
FRAME AND GRATE  
 TYPE 22A

STANDARD B27-01

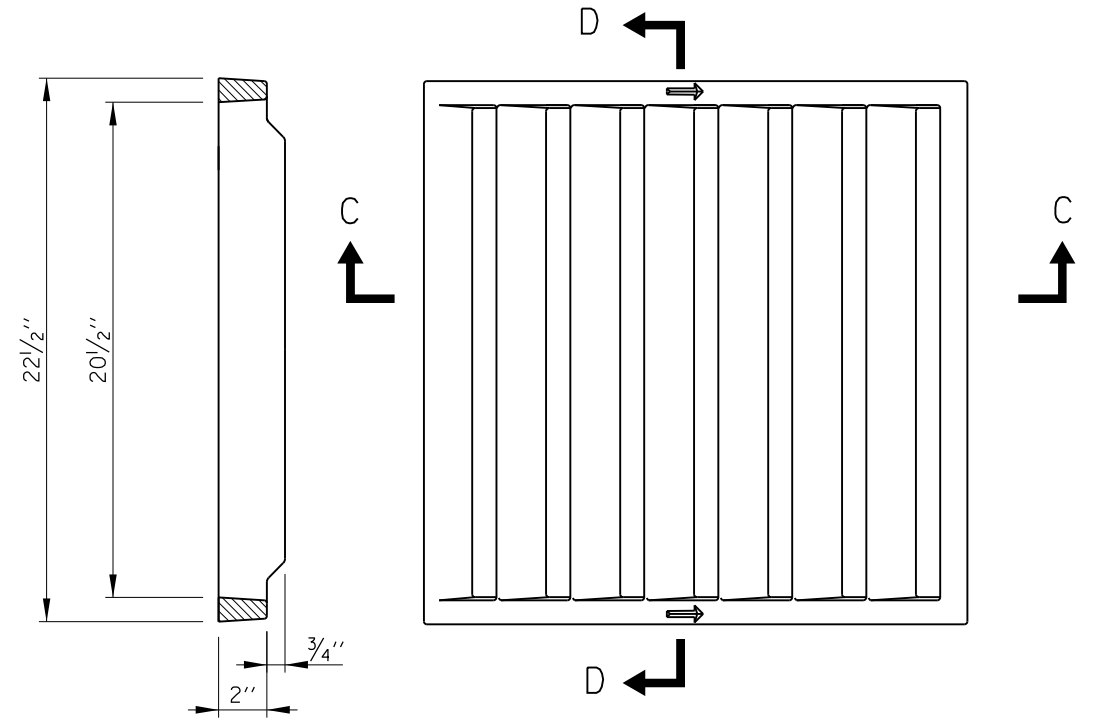
*Paul Kovacs*  
 APPROVED CHIEF ENGINEER DATE 6-30-2008



DETAIL OF VANES



SECTION C-C



SECTION D-D

TOP VIEW

CAST GRATE  
(2 REQ'D)

**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, EAST JORDAN IRON WORKS 7536 OR APPROVED EQUAL.
3. GRATE SHALL NOT BE BOLTED TO FRAME.

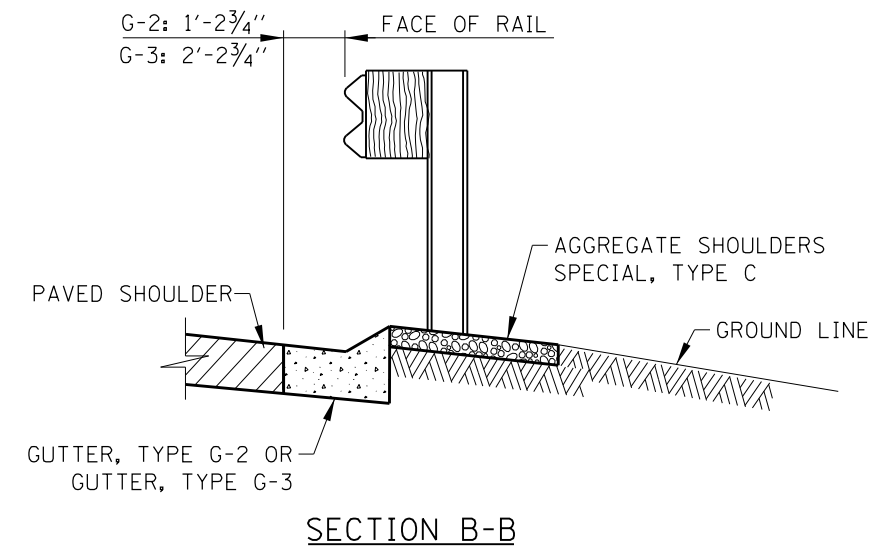
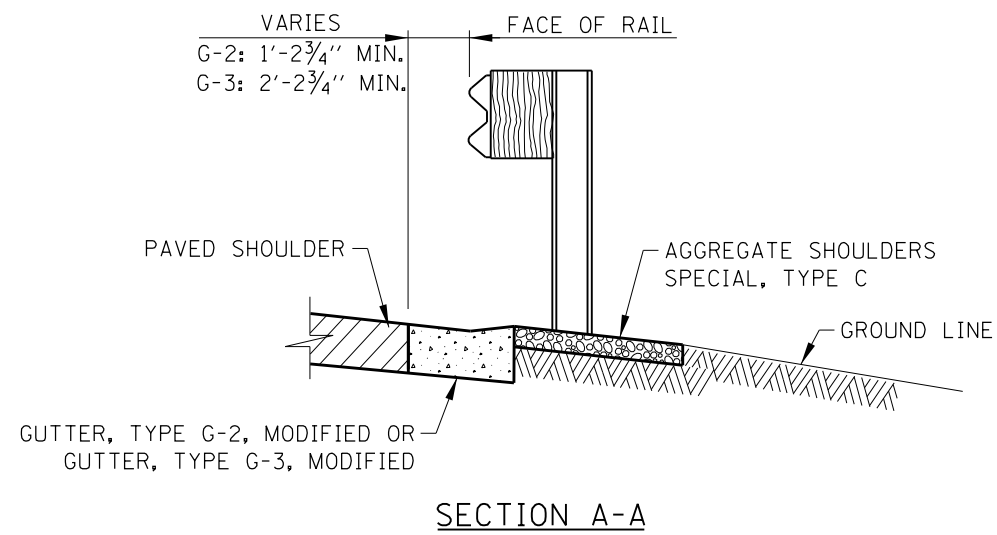
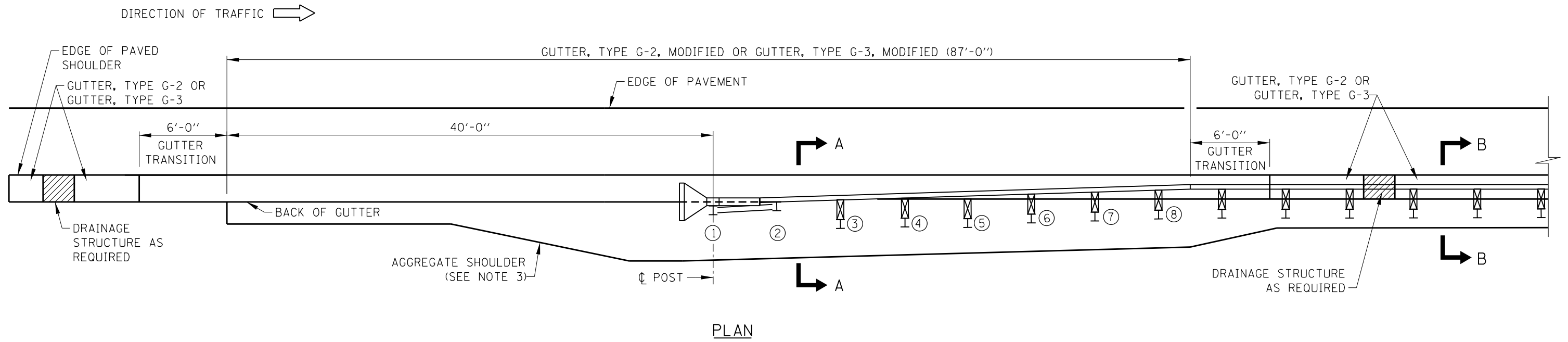


FRAME AND GRATE  
TYPE 22A

STANDARD B27-01

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





**GUTTER, TYPE G-2 TRANSITION AND GUTTER, TYPE G-3 TRANSITION  
AT TRAFFIC BARRIER TERMINAL, TYPE T1 (SPECIAL)**

**GENERAL NOTES:**

1. GUTTER TRANSITIONS SHALL BE PAID FOR PER FOOT AS GUTTER, TYPE G-2 OR GUTTER, TYPE G-3, AS SPECIFIED IN THE PLANS.
2. REFERENCE ILLINOIS TOLLWAY STANDARD DRAWING C1 FOR ADDITIONAL GUARDRAIL INFORMATION.
3. REFERENCE ILLINOIS TOLLWAY STANDARD DRAWING C6 FOR SHOULDER WIDENING INFORMATION.

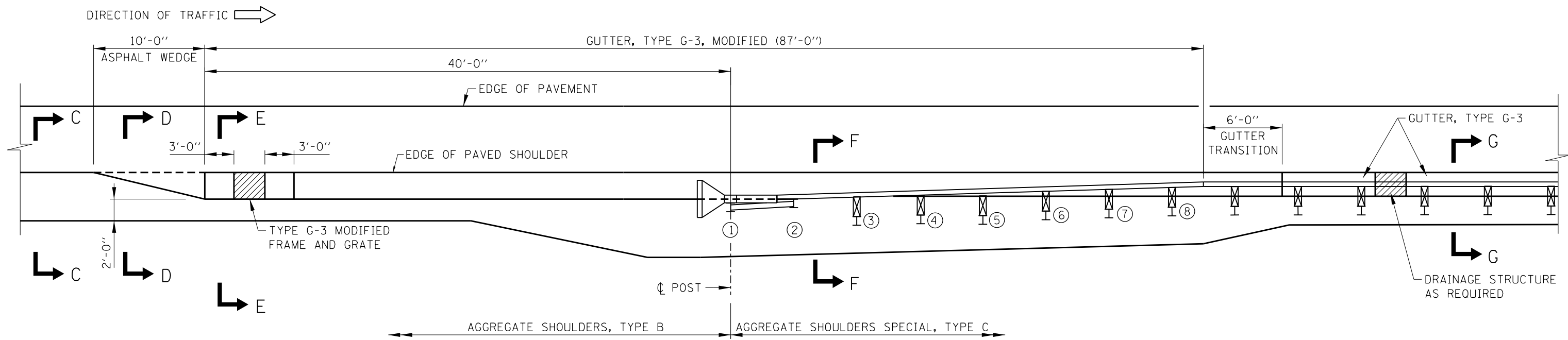
*Paul Kovacs*  
APPROVED, CHIEF ENGINEERING OFFICER DATE 3-1-2010

DATE	REVISIONS
1-01-2011	REVISED GUTTER TRANSITION TERMINATION
3-01-2013	REVISED GUTTER
3-11-2015	REVISED NOTES
3-31-2017	DELETED SHEET 2
3-01-2018	CHANGED LINSTYLE AT WEDGE TO DASHED.

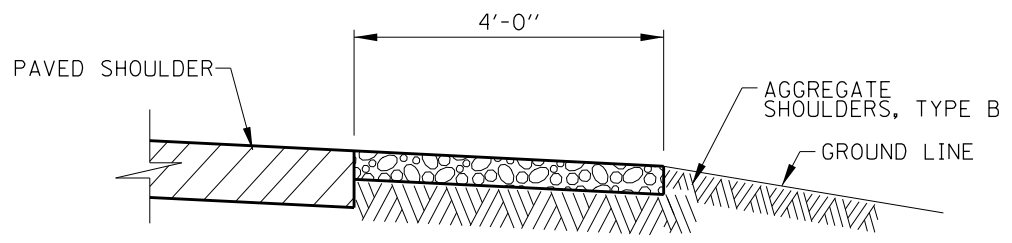
**Illinois Tollway**

GUTTER TRANSITION AT TRAFFIC BARRIER TERMINAL TYPE T1 (SPECIAL)

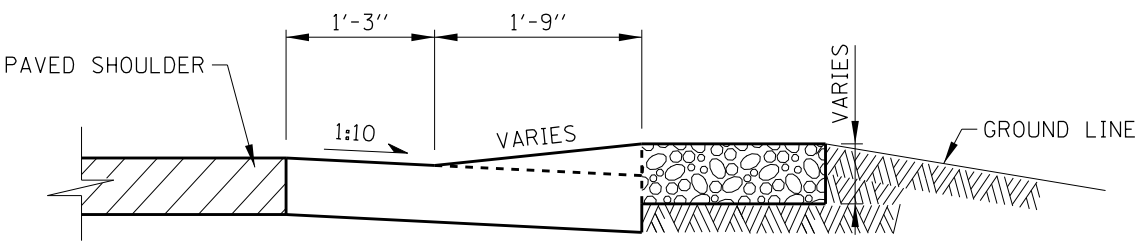
STANDARD B28-05



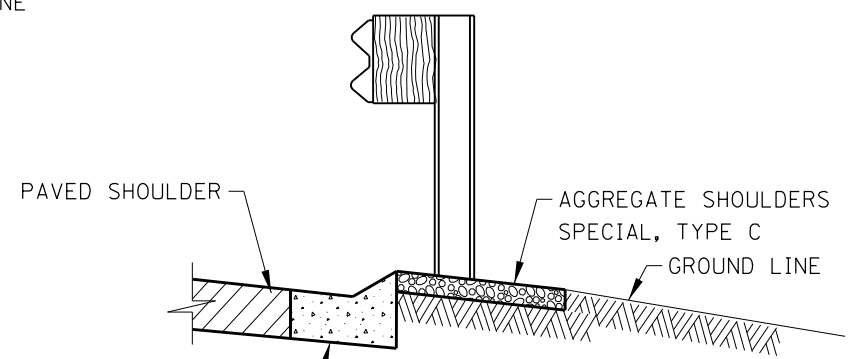
PLAN



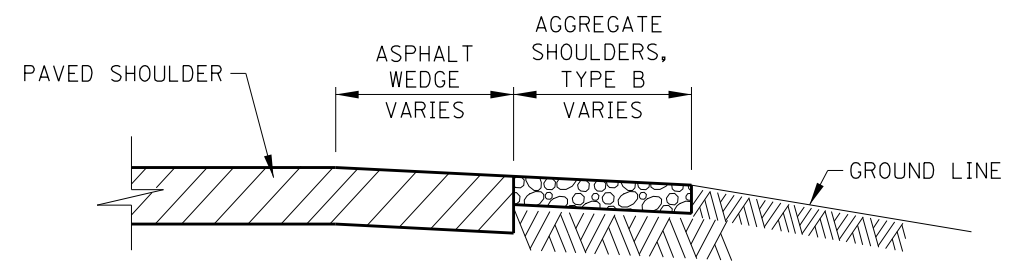
SECTION C-C



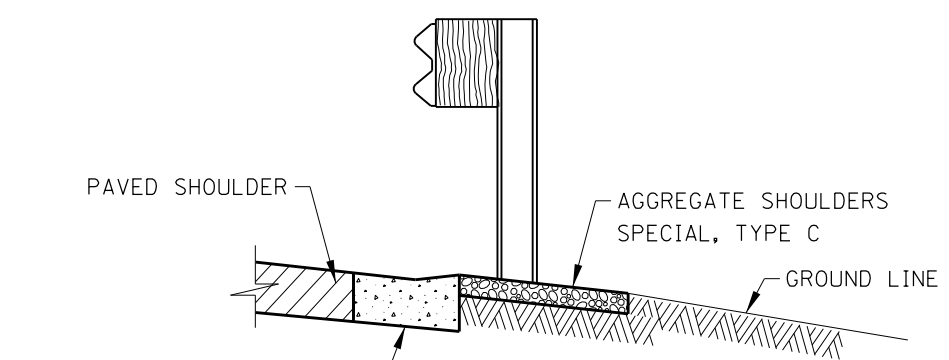
SECTION E-E  
GUTTER, TYPE G-3, MODIFIED TRANSITION



SECTION G-G



SECTION D-D  
ASPHALT SHOULDER TRANSITION



SECTION F-F

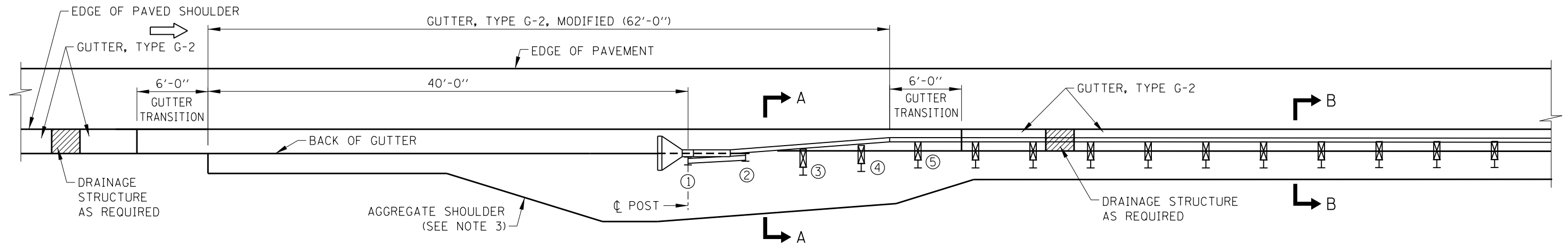
NOTE:  
SEE SHEET 1 OF THIS SERIES FOR NOTES

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

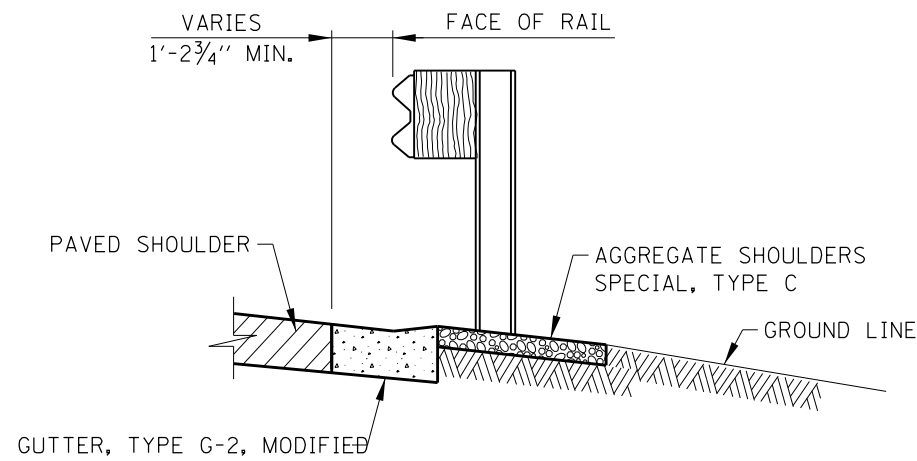
APPROVED *Paul Kovacs* CHIEF ENGINEERING OFFICER DATE 3-1-2010

GUTTER TRANSITION AT TRAFFIC BARRIER TERMINAL TYPE T1 (SPECIAL)  
STANDARD B28-05

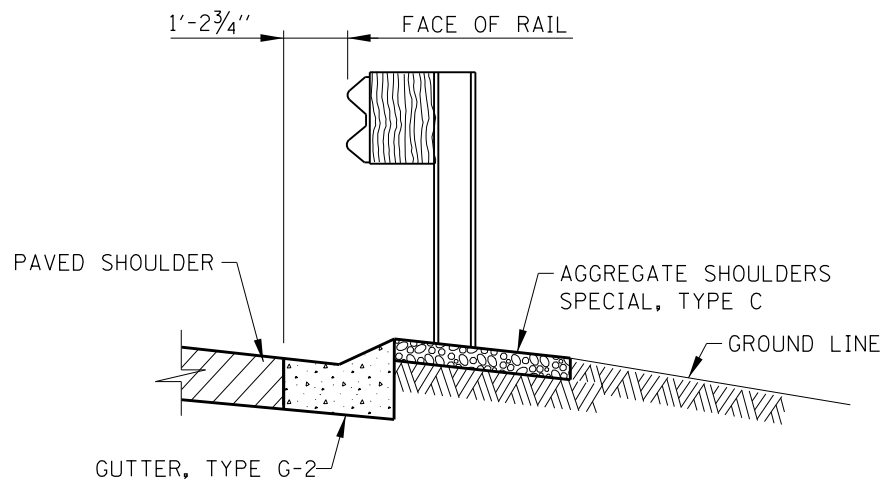
DIRECTION OF TRAFFIC →



PLAN



SECTION A-A



SECTION B-B

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

GENERAL NOTES:

1. GUTTER TRANSITIONS SHALL BE PAID FOR PER FOOT AS GUTTER, TYPE G-2 OR AS SPECIFIED IN THE PLANS.
2. REFERENCE ILLINOIS TOLLWAY STANDARD DRAWING C1 FOR ADDITIONAL GUARDRAIL INFORMATION.
3. REFERENCE ILLINOIS TOLLWAY STANDARD DRAWING C12 FOR SHOULDER WIDENING INFORMATION.

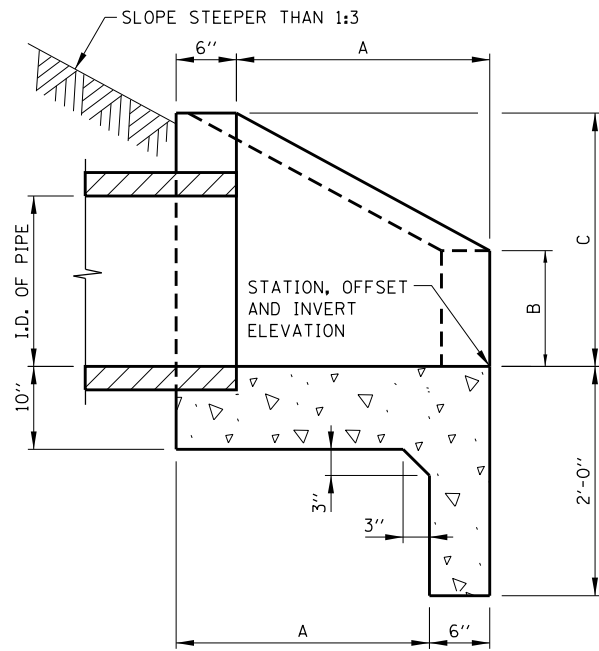
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 1-1-2011

DATE	REVISIONS
3-01-2013	REVISED GUTTER
3-11-2015	REVISED NOTES
3-31-2017	REMOVED SHLDR DIMS

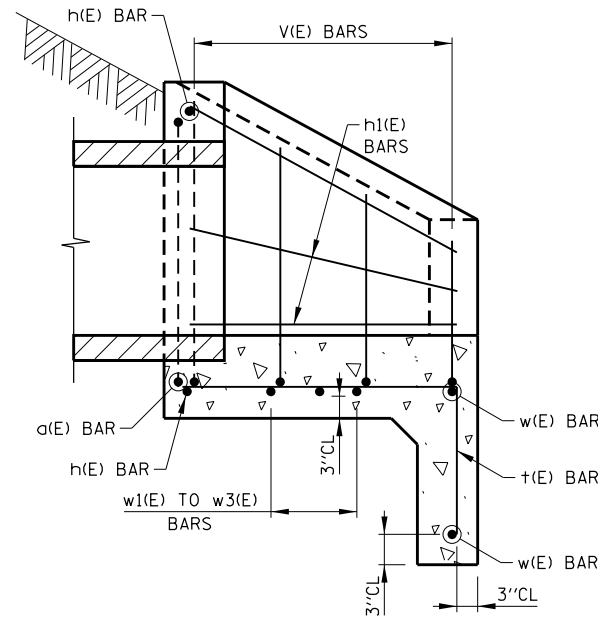


GUTTER TRANSITION AT TRAFFIC BARRIER TERMINAL TYPE T1-A (SPECIAL)

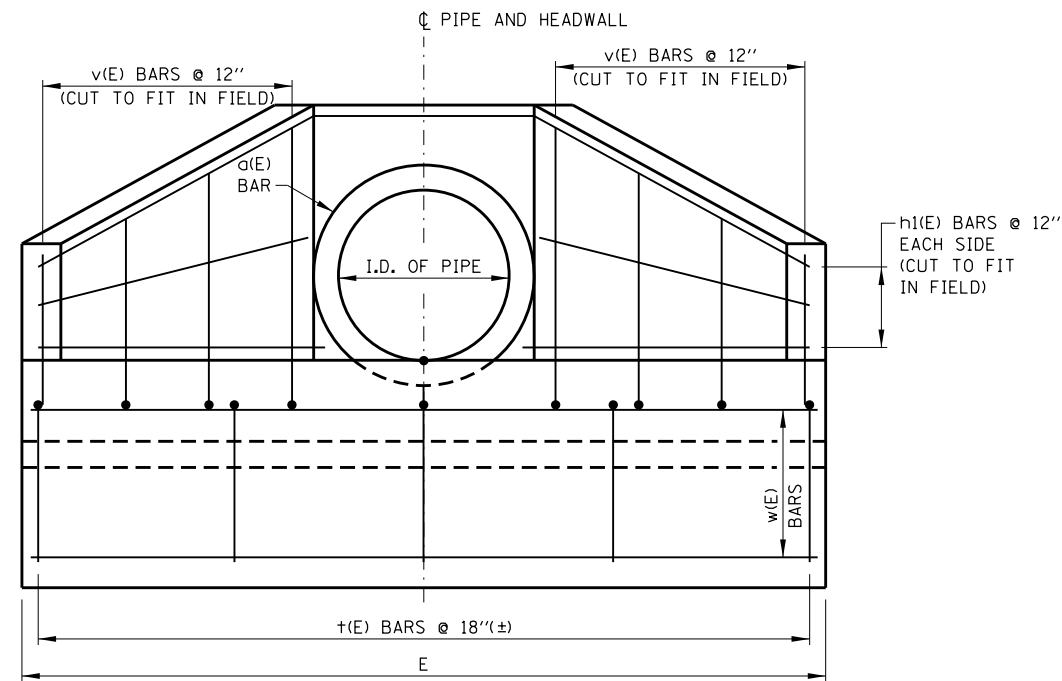
STANDARD B29-03



SECTION A-A  
(DIMENSIONS)



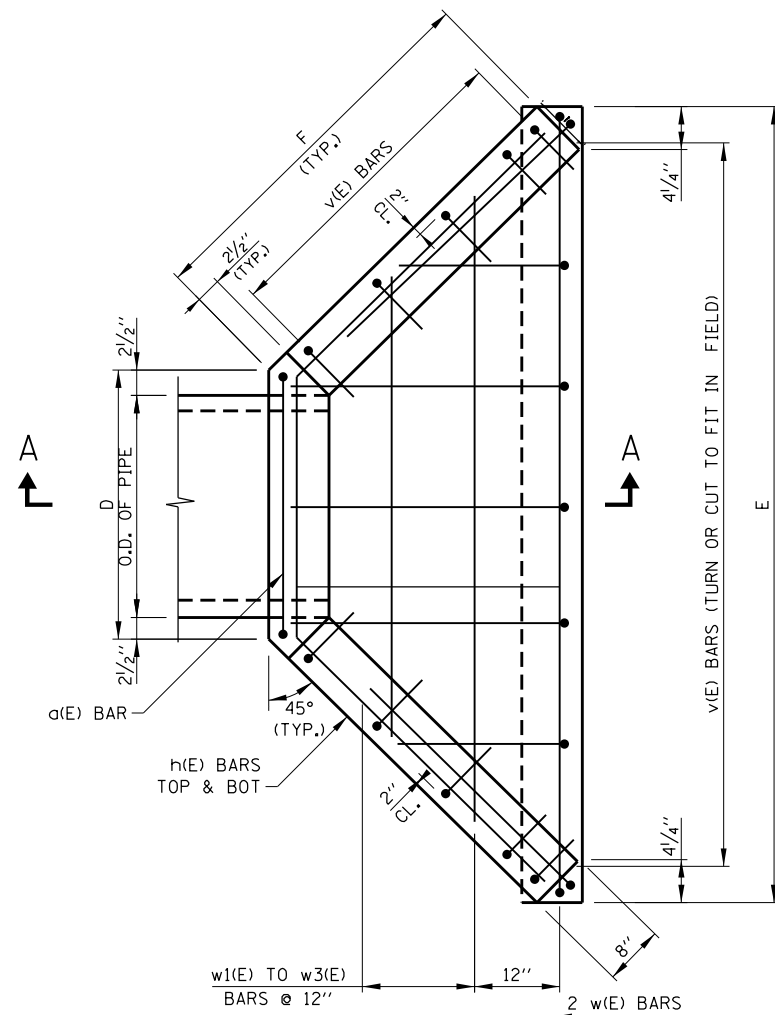
SECTION A-A  
(REINFORCEMENT)



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 (E).
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.
11. FOR EROSION PROTECTION SEE STANDARD B19.



PLAN

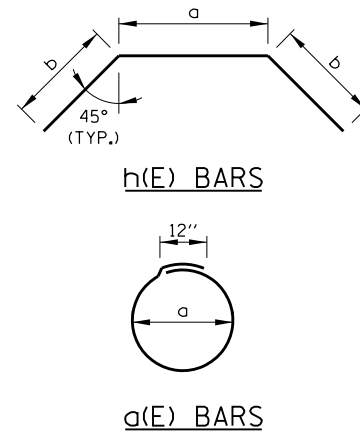


TABLE OF DIMENSIONS AND QUANTITIES FOR ONE HEADWALL

INSIDE DIA. OF PIPE	SLOPE OF FILL	DIMENSIONS						CONCRETE CLASS SI	REINF. BARS (POUND)
		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 (E)	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"	2'-11"	-	1	11'-1"	3'-2 1/2"	-	1	12'-0"	3'-6"	-	1	13'-10"	4'-1"	-
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	6	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	-	-	-	1	4'-11"	-	-	1	5'-11"	-	-	1	6'-7"	-	-	1	8'-6"	-	-
w3	#4	-	-	-	-	-	-	-	-	-	-	-	-	1	4'-7"	-	-	1	7'-6"	-	-

HEADWALL - TYPE I  
(PIPE DIAMETER ≤ 36")



DATE	REVISIONS
2-07-2012	ADDED 21" AND 27" DIA PIPE AND REVISED TABLE QUANTITIES
3-11-2015	REVISED NOTES

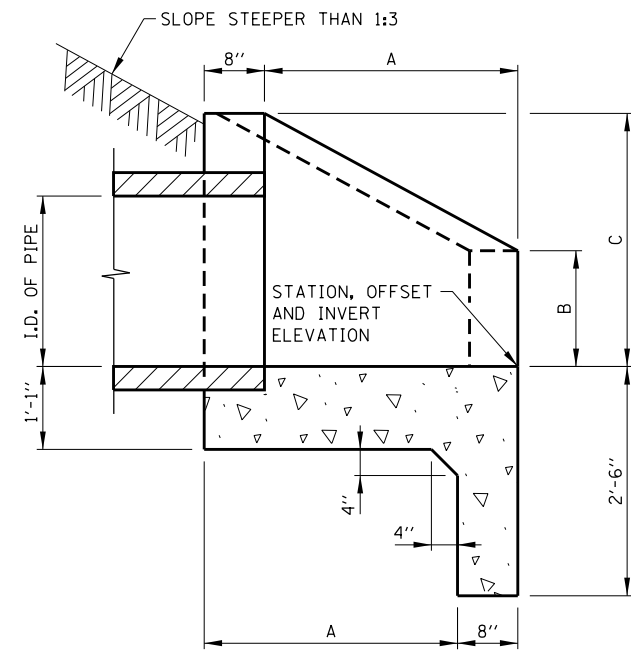
HEADWALLS  
TYPE I AND II

STANDARD B30-02

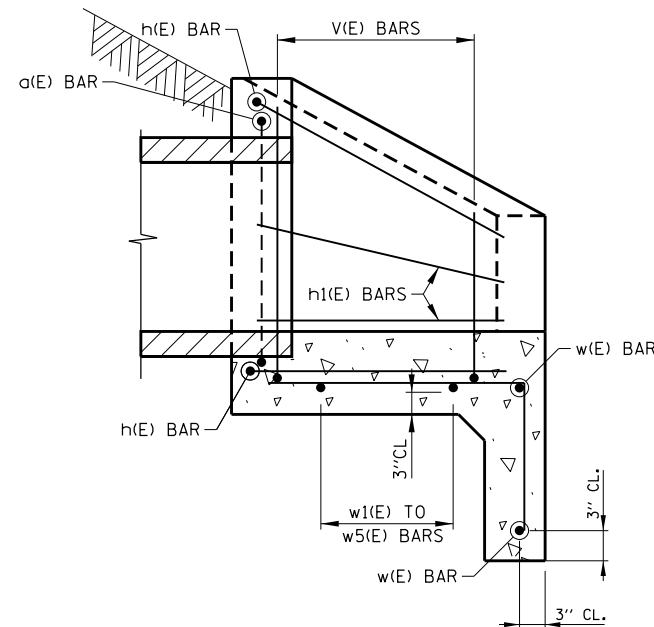
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 2-7-2012

**NOTE:**

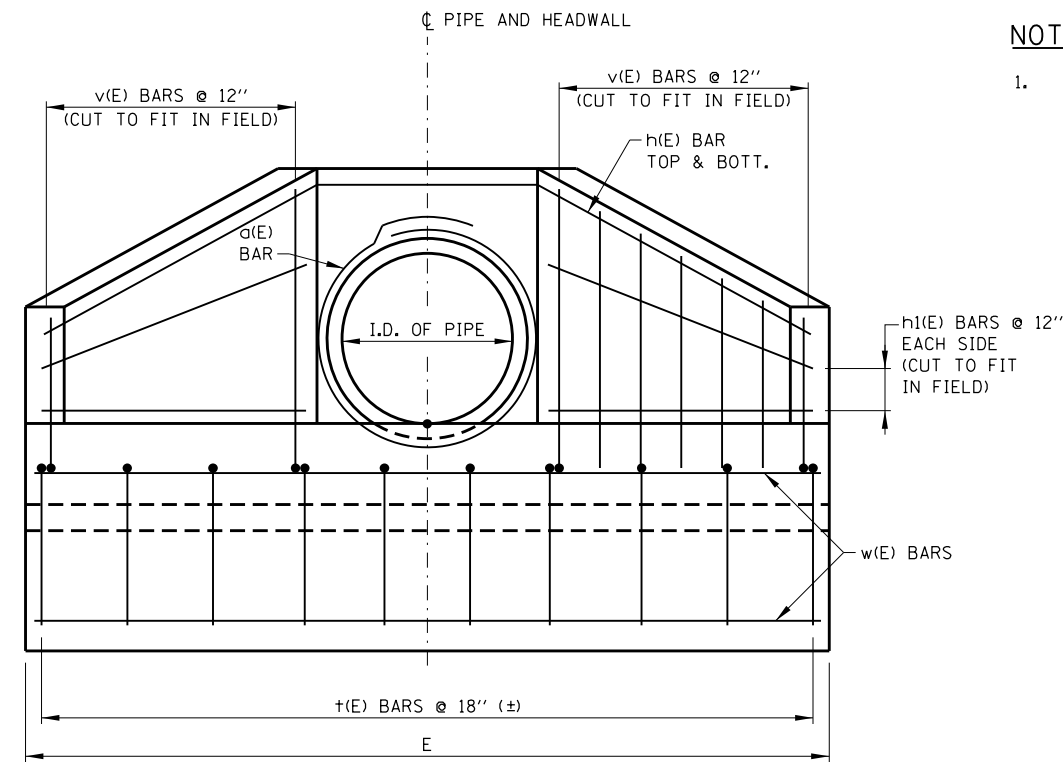
1. FOR ADDITIONAL NOTES SEE SHEET 1 IN THIS SERIES.



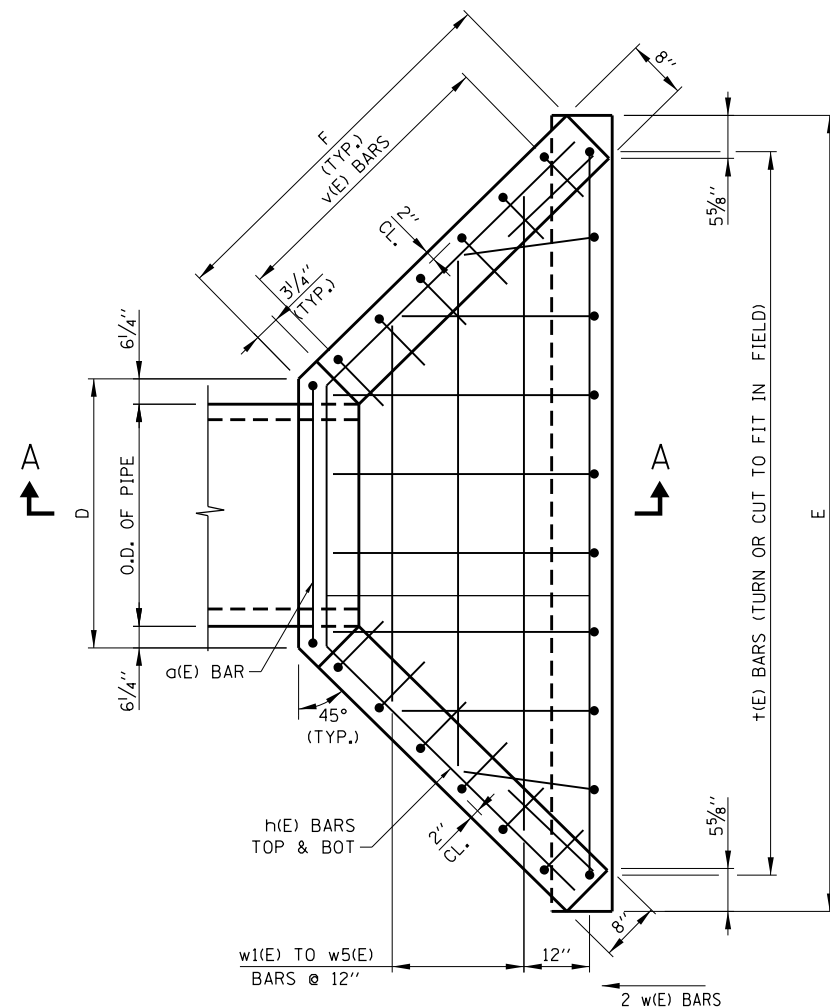
**SECTION A-A**  
(DIMENSIONS)



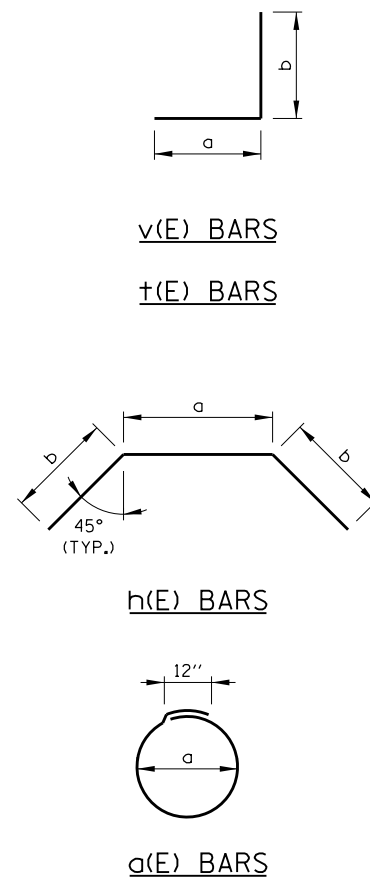
**SECTION A-A**  
(REINFORCEMENT)



**FRONT ELEVATION**



**PLAN**



**HEADWALL - TYPE II**  
(PIPE DIAMETER ≥ 36")

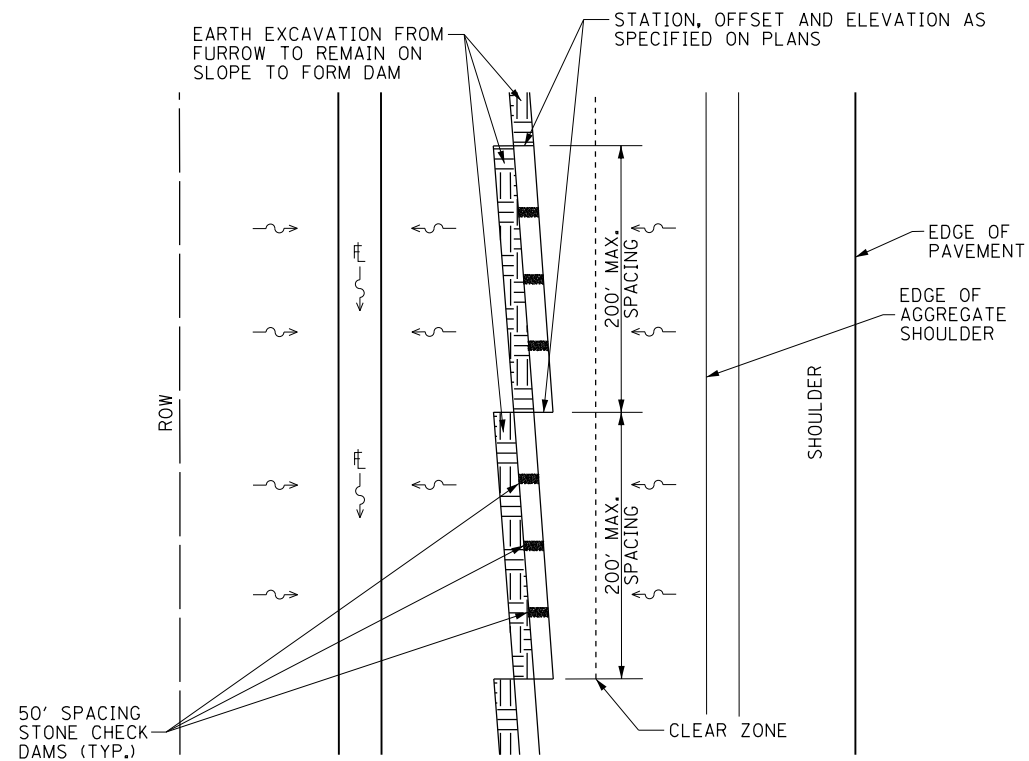
**TABLE OF BARS FOR ONE HEADWALL**

BAR MARK (E)	SIZE	NO.	42" PIPE			48" PIPE			54" I.D. PIPE			60" I.D. PIPE					
			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"	-	-
†	#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**

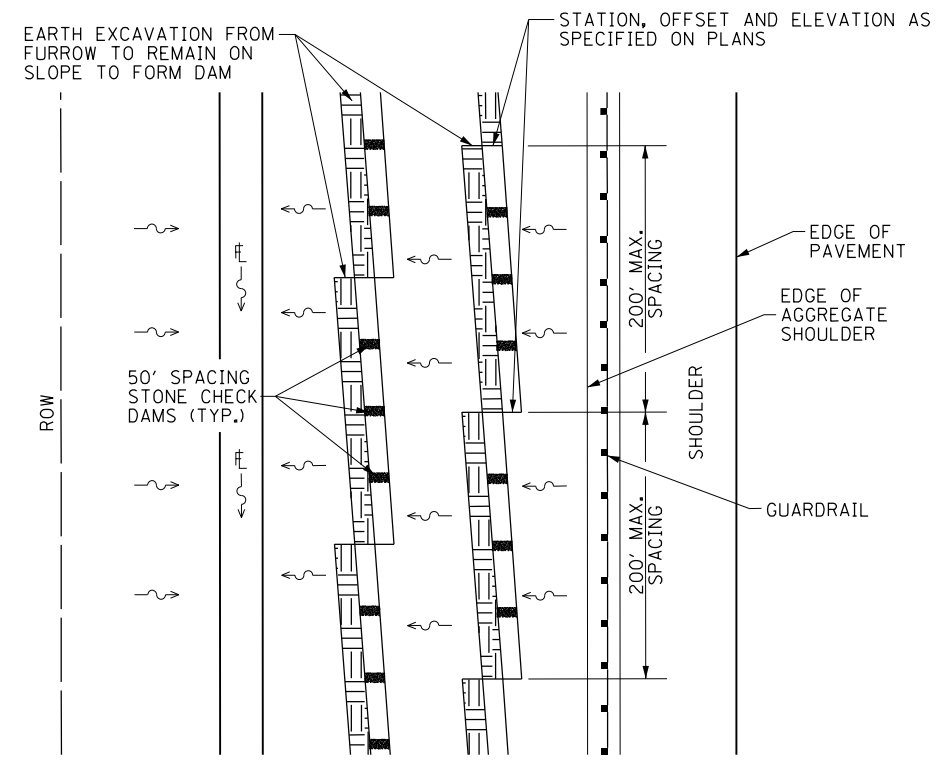
INSIDE DIA. OF PIPE	SLOPE OF FILL	DIMENSIONS						CONCRETE CLASS SI	REINF. BARS (POUND)
		A	B	C	D	E	F		
42"	1:3	4'-5"	2'-2"	4'-4 1/2"	5'-6"	14'-9"	6'-6 1/4"	3.8 C.Y.	400
48"	1:3	5'-0"	2'-5"	4'-11"	6'-0"	16'-4 3/4"	7'-4 1/4"	4.1 C.Y.	450
54"	1:3	5'-7"	2'-8"	5'-5 1/2"	6'-7"	18'-1 3/4"	8'-2"	5.6 C.Y.	500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





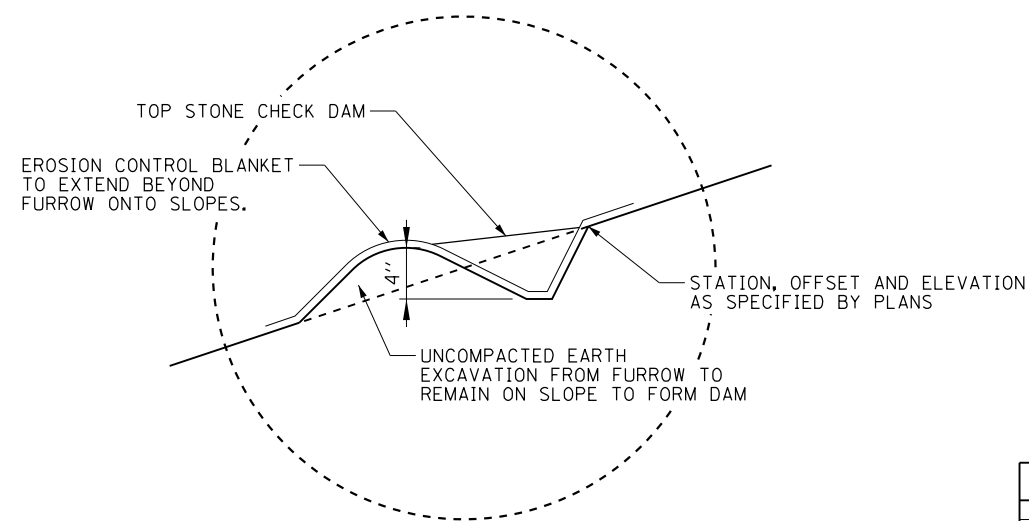
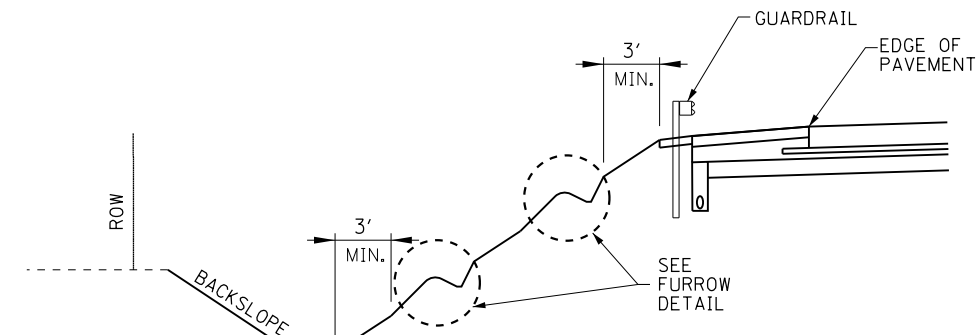
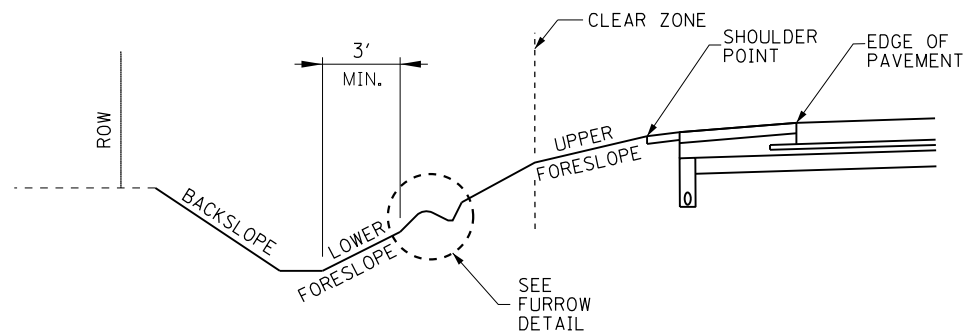
**DEFINED CLEAR ZONE LOCATIONS**

PLAN VIEW: NOT TO SCALE



**SHIELDED LOCATIONS**

PLAN VIEW: NOT TO SCALE



**FURROW DETAIL**  
SECTION VIEW: NOT TO SCALE

**NOTES:**

1. INSTALL STONE CHECK DAMS AT 50' SPACING ALONG FURROW. STONE CHECK DAMS TO CONSIST OF CA-7 STONE, 2' LONG, FILLED TO FULL DEPTH OF FURROW
2. FURROW TO BE SLICED/TILLED ALONG LEVEL CONTOUR BEGINNING.
3. FURROWS SHALL NOT BE INSTALLED IN UNSHIELDED, UNDEFINED CLEAR ZONE LOCATIONS.

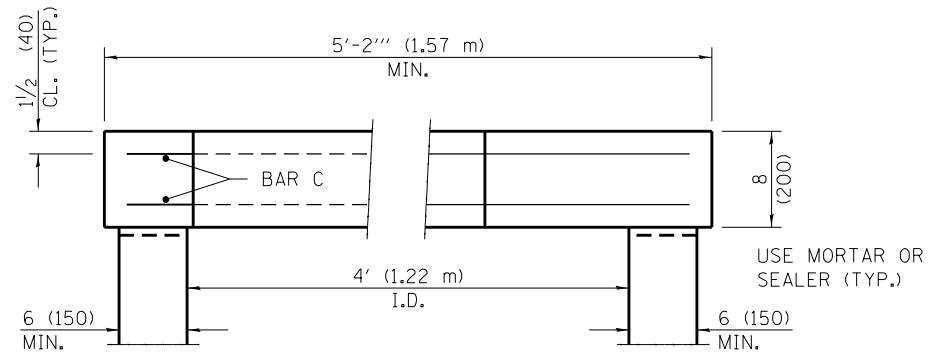
APPROVED: *Paul Kovacs* CHIEF ENGINEER DATE 3-31-2016

DATE	REVISIONS

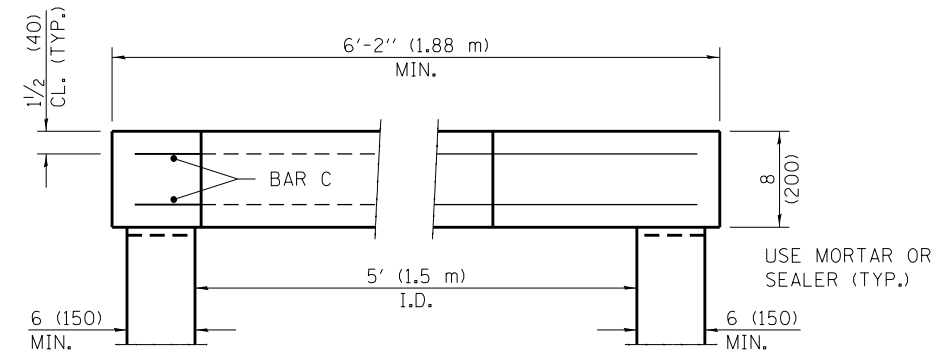
**Illinois Tollway**

FURROW DETAIL

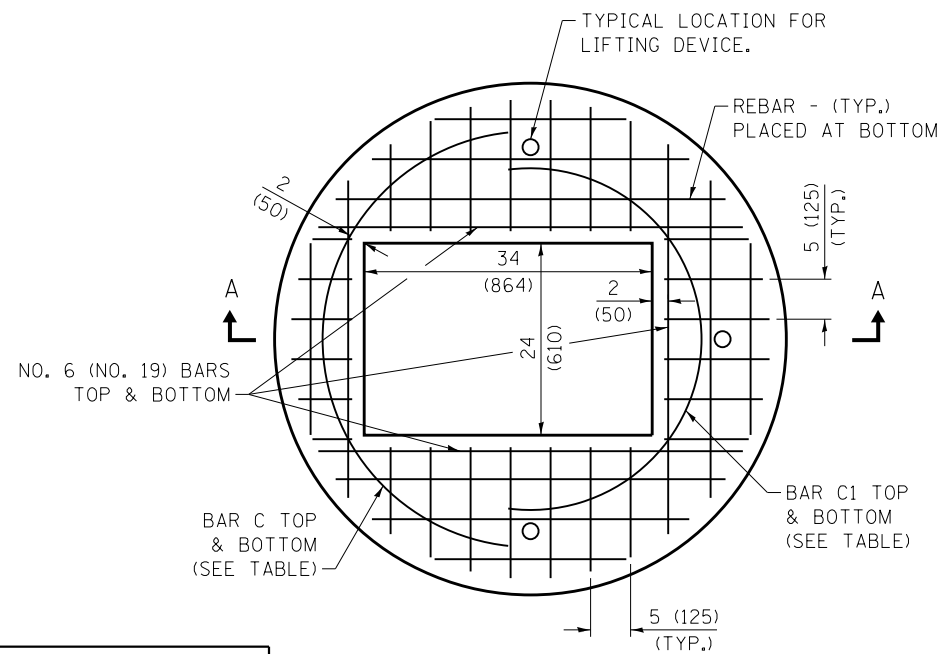
STANDARD B31-00



SECTION A-A

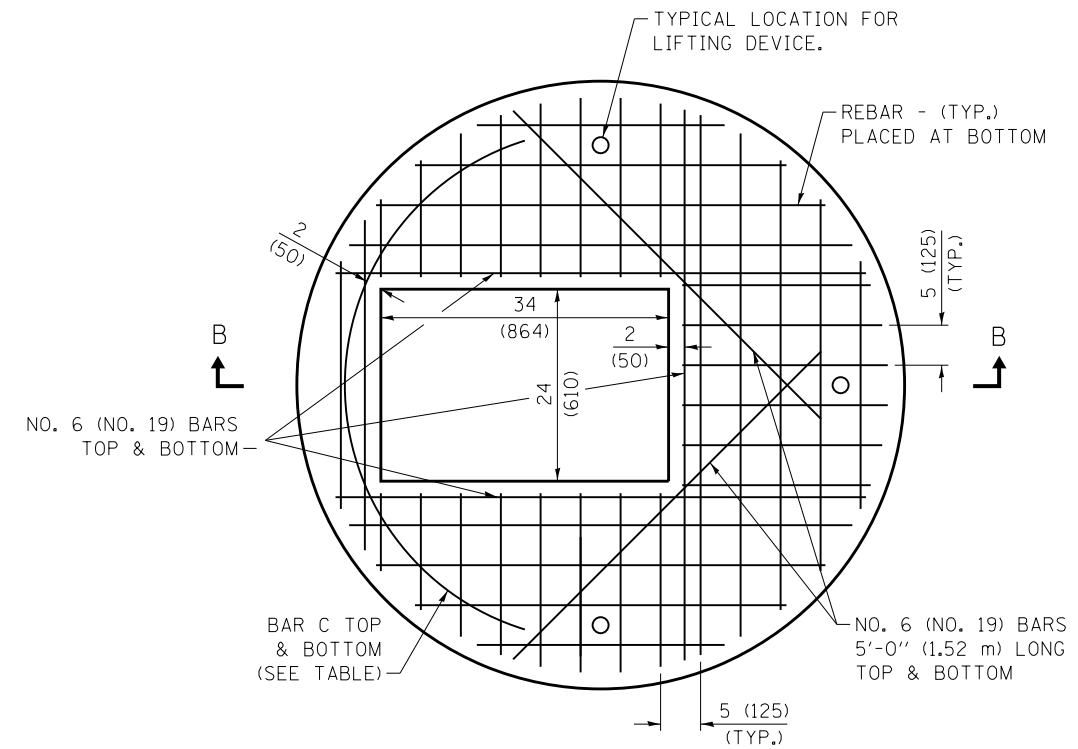


SECTION B-B



4' MANHOLE PLAN  
SHOWING REBAR REINFORCEMENT  
NO. 6 (NO. 19) UNLESS OTHERWISE SHOWN

NO. 4 (NO. 13)		
BAR	LENGTH	RADIUS
C	6'-6" (1.98 m)	26 (660)
C1	6'-6" (1.98 m)	22 (59)



5' MANHOLE PLAN  
SHOWING REBAR REINFORCEMENT  
NO. 6 (NO. 19) UNLESS OTHERWISE SHOWN

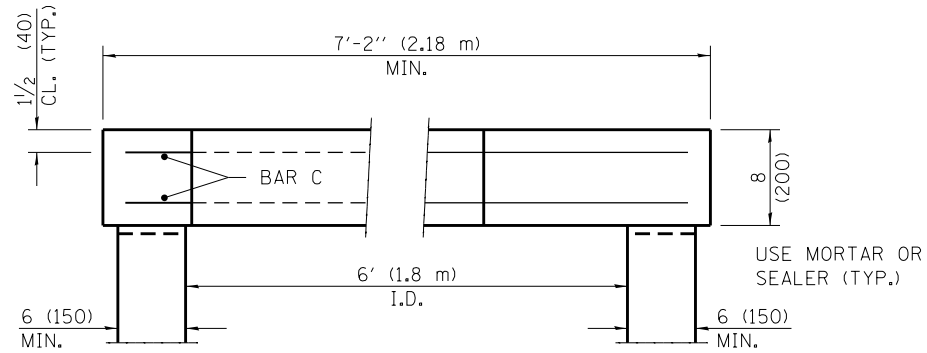
NO. 4 (NO. 13) BAR C	
LENGTH	RADIUS
7'-0" (2.13 m)	32 (813)



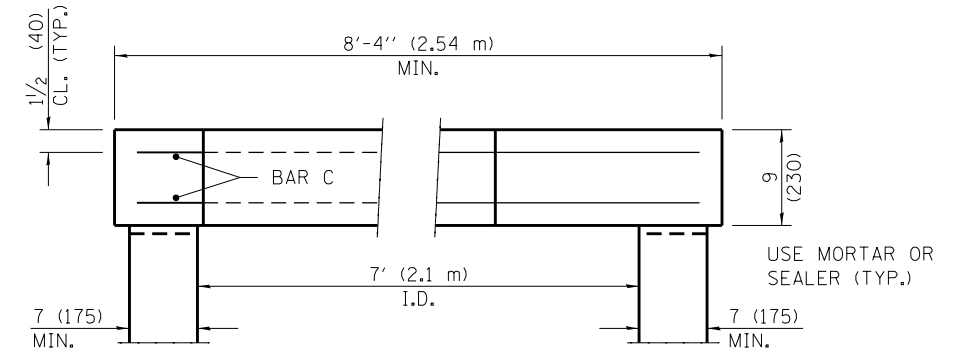
DATE	REVISIONS

FLAT SLAB TOP  
4' (1.2 m) & 5' (1.5 m)  
DIAMETER  
STANDARD B32-00

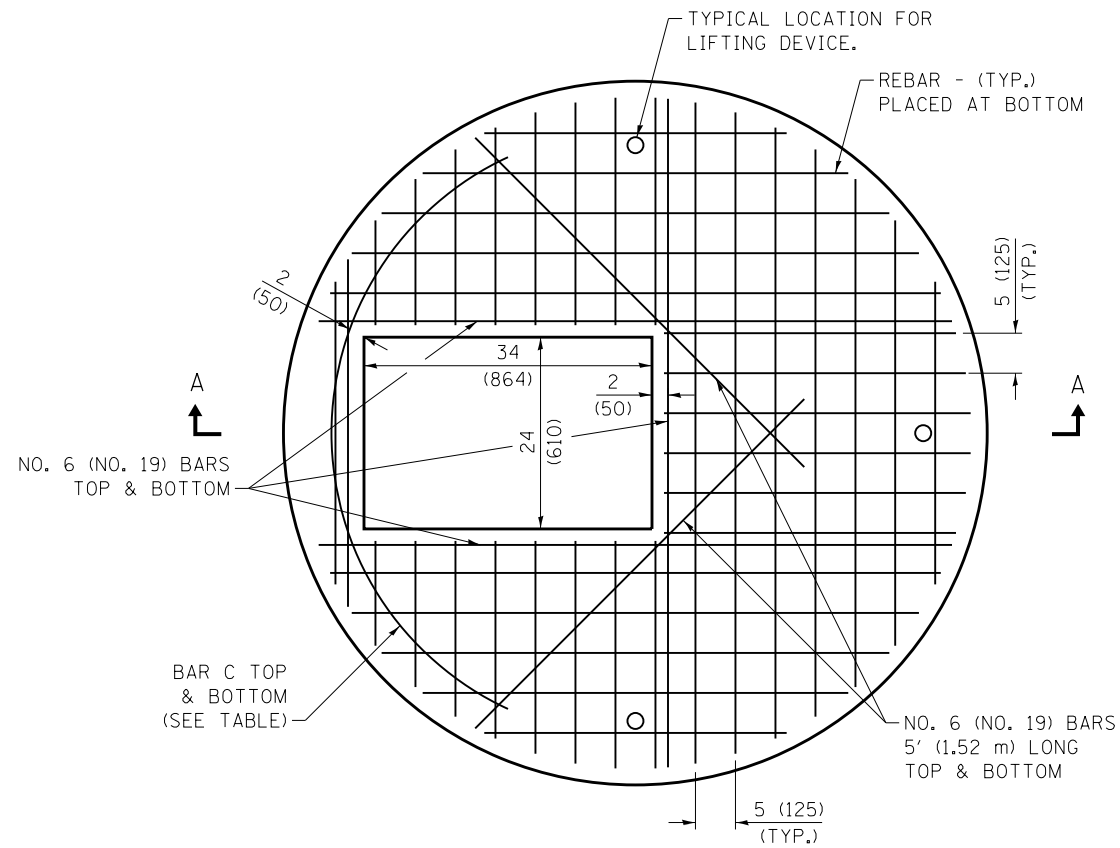
*Paul Kovacs*  
APPROVED CHIEF ENGINEER DATE 3-31-2017



SECTION A-A

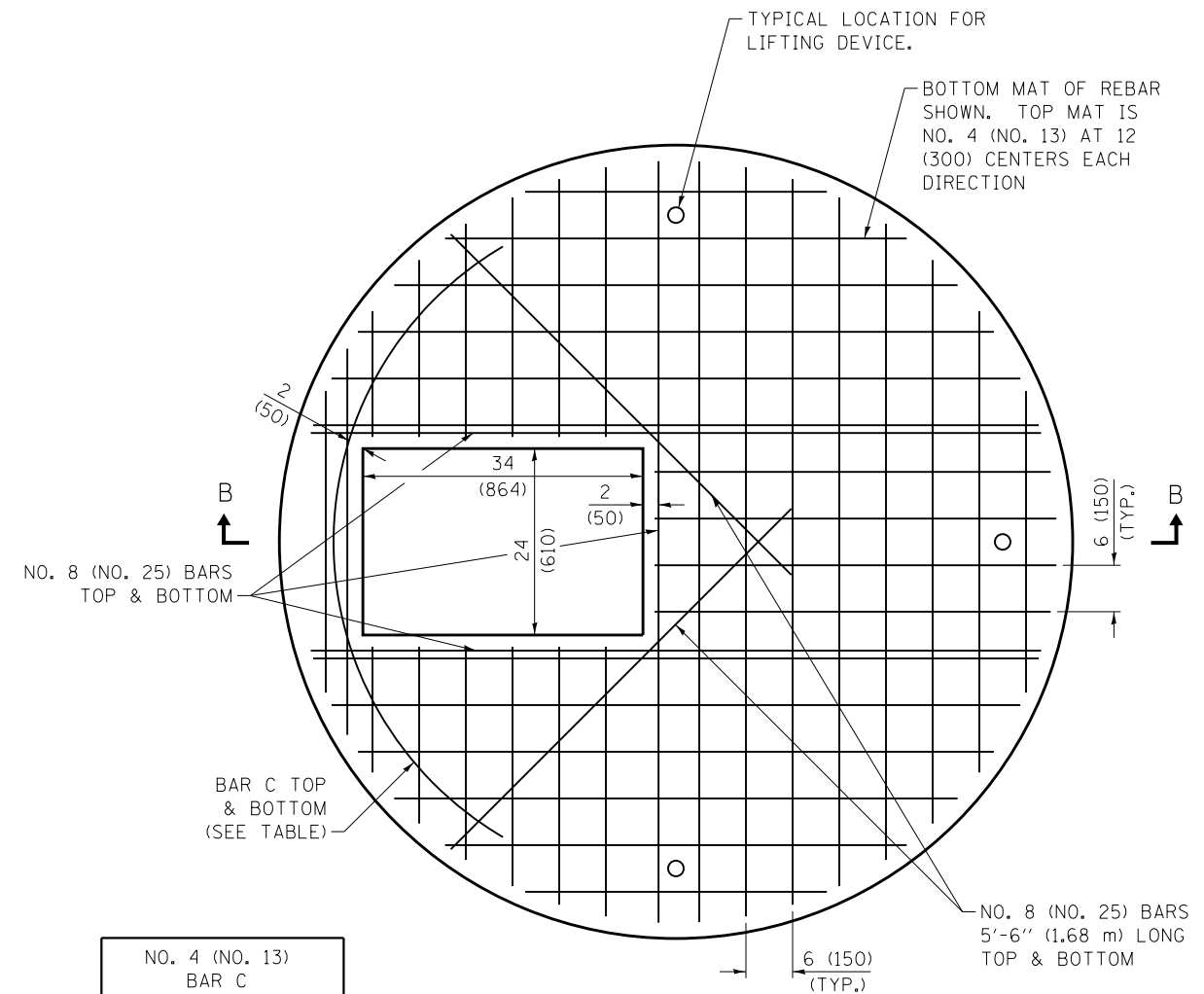


SECTION B-B



6' MANHOLE PLAN  
SHOWING REBAR REINFORCEMENT  
NO. 6 (NO. 19) UNLESS OTHERWISE SHOWN

NO. 4 (NO. 13) BAR C	
LENGTH	RADIUS
7'-6" (2.29 m)	38 (965)



7' MANHOLE PLAN  
SHOWING REBAR REINFORCEMENT  
NO. 8 (NO. 25) UNLESS OTHERWISE SHOWN

NO. 4 (NO. 13) BAR C	
LENGTH	RADIUS
8'-0" (2.44 m)	3'-8" (1.12 m)



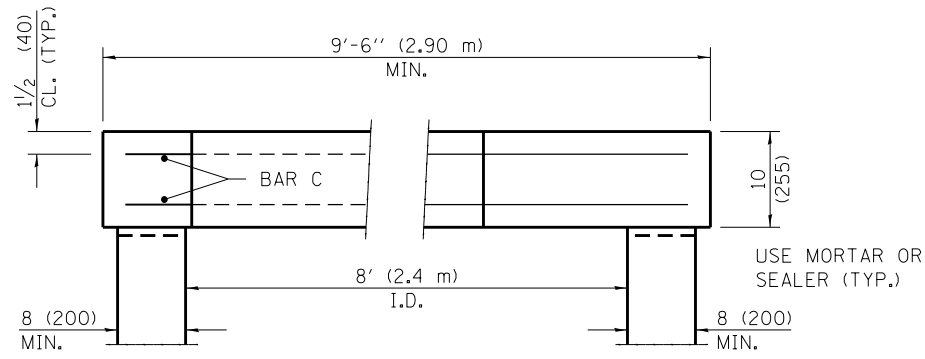
FLAT SLAB TOP  
6' (1.8 m) & 7' (2.1 m)  
DIAMETER

STANDARD B32-00

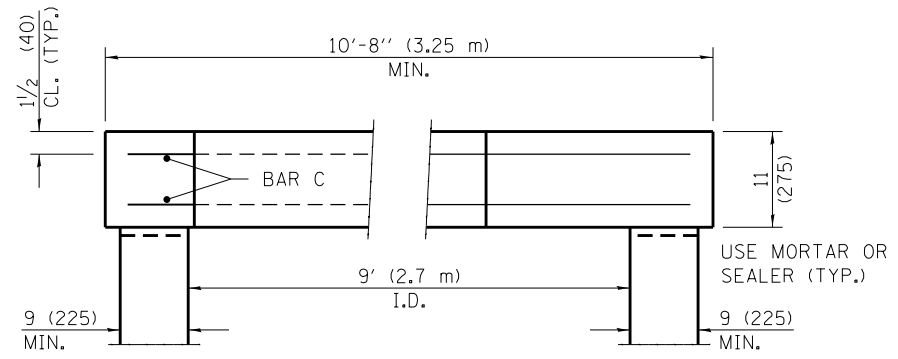
DATE	REVISIONS

*Paul Kovacs*  
APPROVED CHIEF ENGINEER DATE 3-31-2017

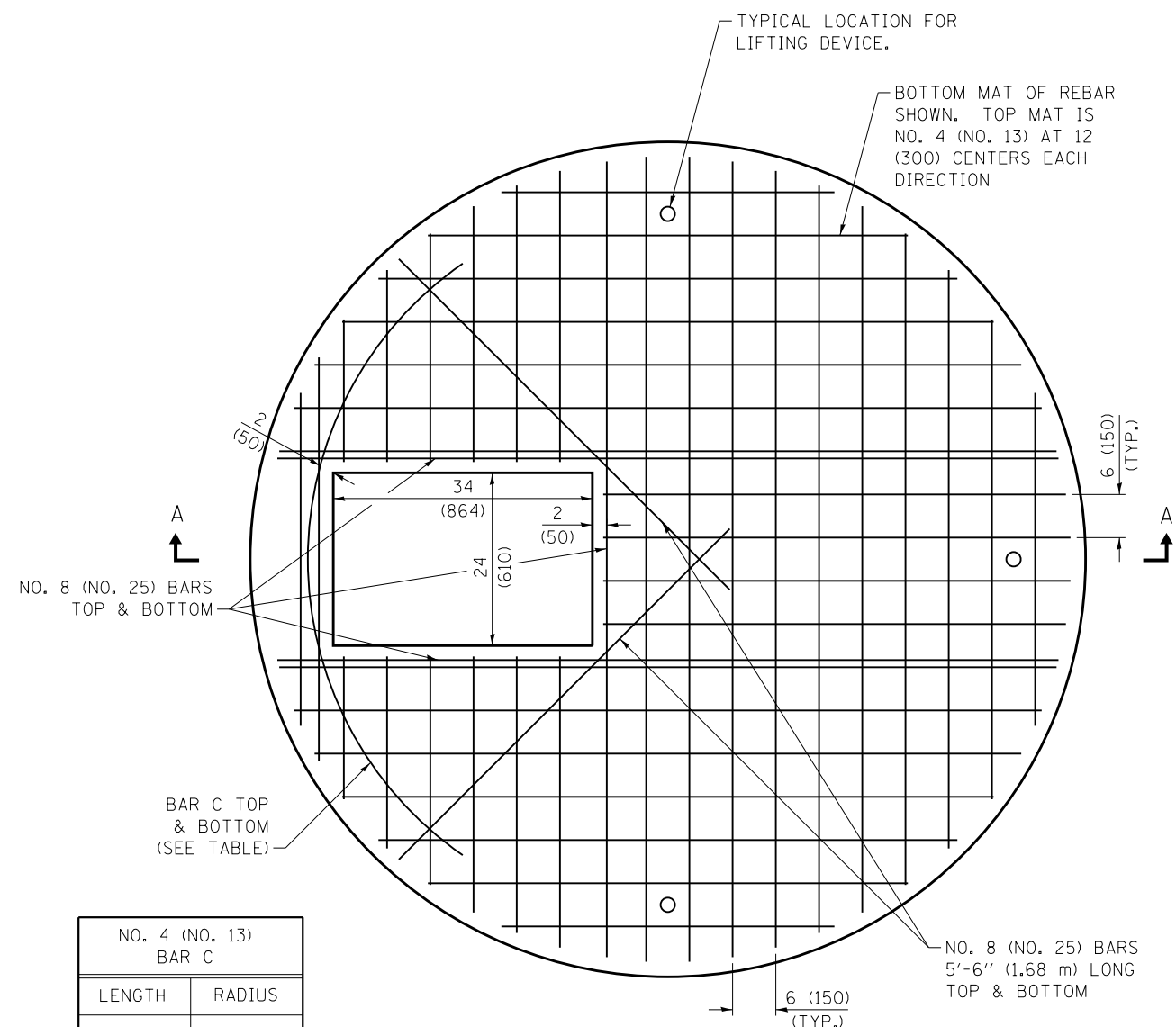




SECTION A-A

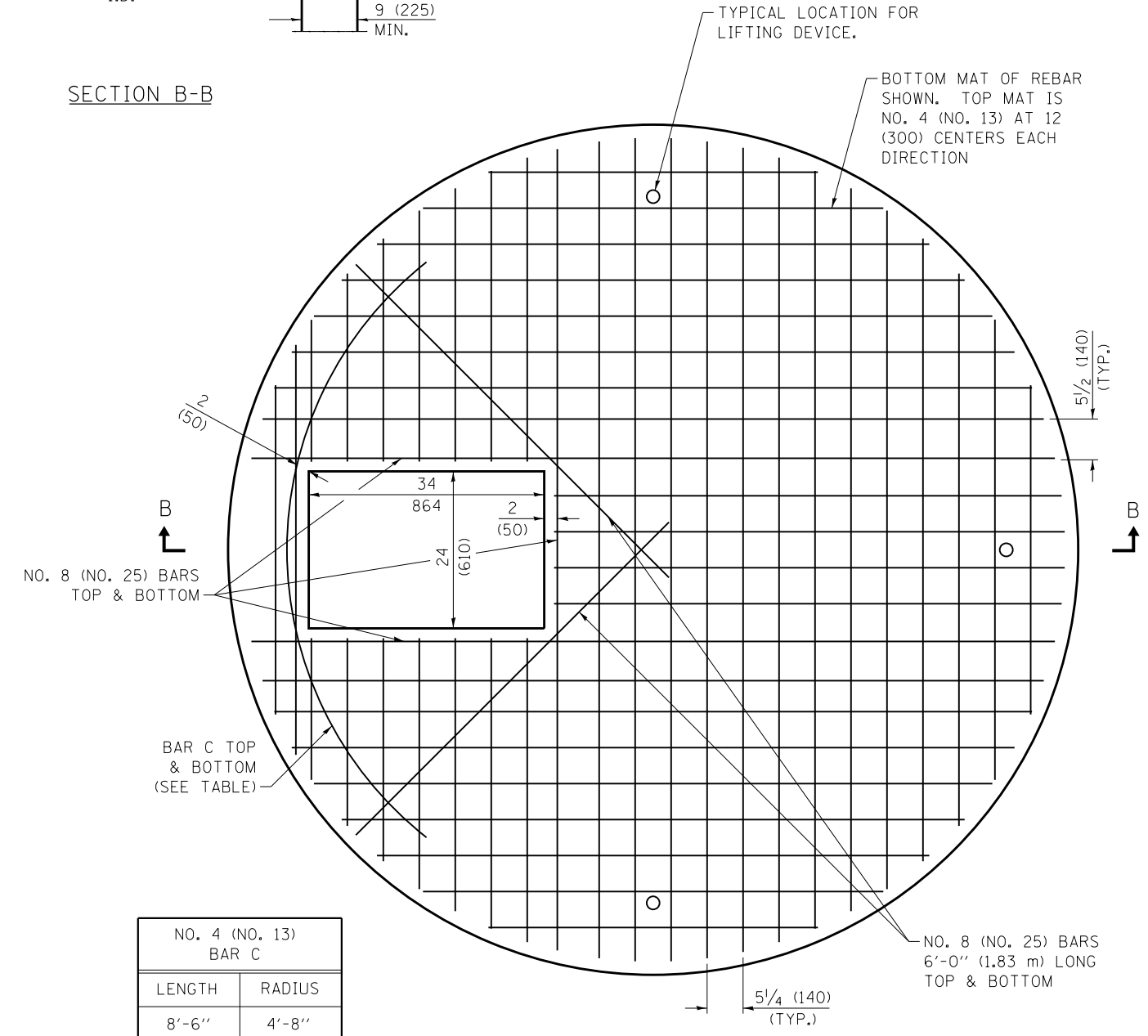


SECTION B-B



8' MANHOLE PLAN  
SHOWING REBAR REINFORCEMENT  
NO. 8 (NO. 25) UNLESS OTHERWISE SHOWN

NO. 4 (NO. 13) BAR C	
LENGTH	RADIUS
8'-6" (2.59 m)	4'-2" (1.27 m)



9' MANHOLE PLAN  
SHOWING REBAR REINFORCEMENT  
NO. 8 (NO. 25) UNLESS OTHERWISE SHOWN

NO. 4 (NO. 13) BAR C	
LENGTH	RADIUS
8'-6" (2.59 m)	4'-8" (1.42 m)



DATE	REVISIONS

FLAT SLAB TOP  
8' (2.4 m) & 9' (2.7 m)  
DIAMETER  
STANDARD B32-00

*Paul Kovacs*  
APPROVED CHIEF ENGINEER DATE 3-31-2017