

Illinois Tollway Standard Drawing Revisions

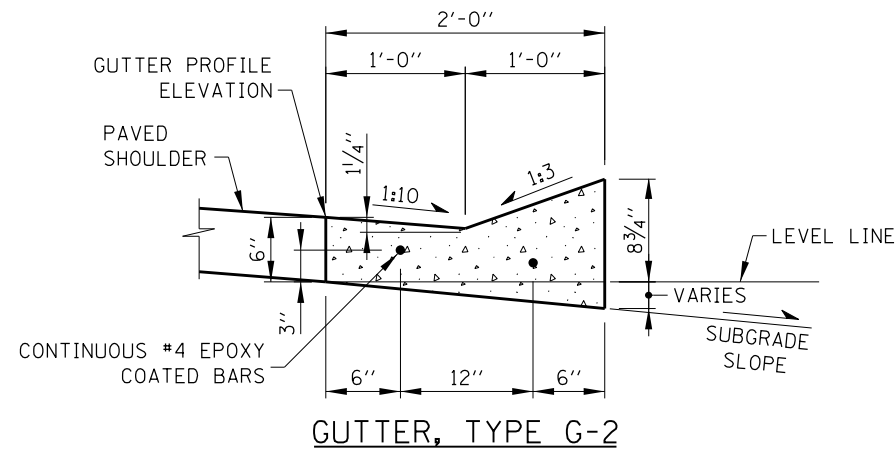
Section B Drainage Structures, Curbs & Gutter		
Standard	Modification Summary	Effective: 03-01-2018
B1	Gutter and Curb Details	
Sheet 1	Revised Note 9 to indicate that crack control joints shall be sealed per specifications.	
Sheet 2	Changed the line style to dashed at the shoulder transition.	
B2	Type G-2 and G-3 Gutter Transitions	
Sheet 1	Revised Note 1 to include barrier or parapet.	
B3	Type G-2 /G-3 Gutter Transition at Traffic Barrier Terminal, Type T6	
Sheet 1	Added Note 9 to indicate that the cross slope at Section A-A should match the shoulder slope in front of parapet or barrier. Corrected the reference to Note 8 at G-3 Section A-A to read (See Note 7).	
Sheet 2	In G-2 Section A-A changed the cross slope from 3% to (See Note 9). Corrected the reference to Note 8 at G-2 Section A-A to read (See Note 7).	
Sheet 3	In G-3 Section A-A changed the cross slope from 3% to (See Note 9). Corrected the reference to Note 8 at G-3 Section A-A to read (See Note 7).	
B5	Concrete Flume Details	
Sheet 1	Revised Sections A-A and B-B to include a 6" bed of coarse aggregate. Made reference to Note 4 in Section A-A. Note 8 was removed.	
B11	Sloped Headwalls Type IV Details	
B12	Trench Drain Detail	
Sheet 1	Updated maximum rollover requirements (physical nose to gore nose) at Section A-A to be consistent with roadway design criteria.	
Sheet 2	Updated maximum rollover requirements (physical nose to gore nose) at Section E-E to be consistent with roadway design criteria.	
B24	Pipe Underdrains	
Sheet 1	Indicated a minimum 3" thickness of capping stone.	
B28	Gutter Transition at Traffic Barrier Terminal Type T1 (Special)	
Sheet 2	Changed the line style to dashed at the asphalt wedge.	



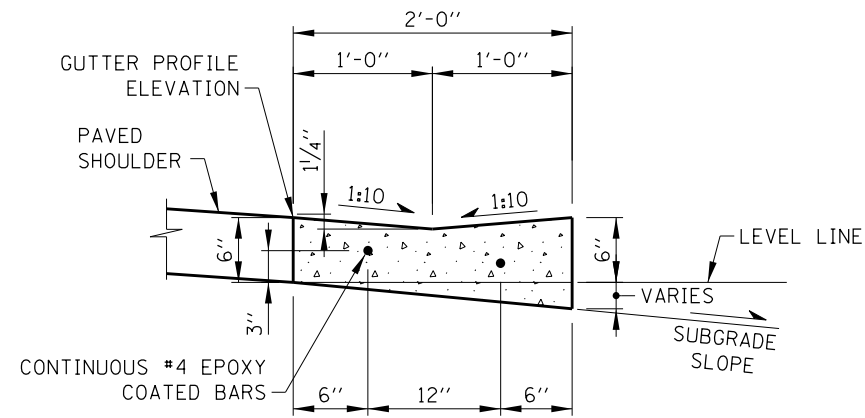
New Sheet



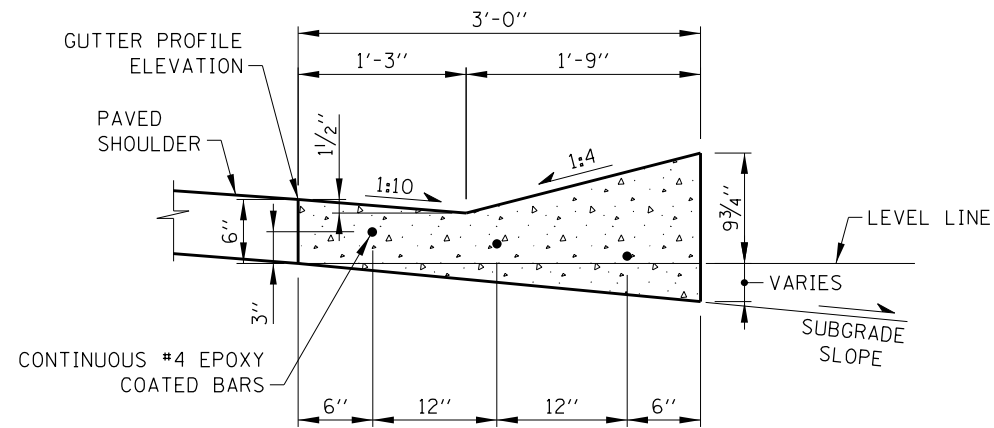
Retired Standard



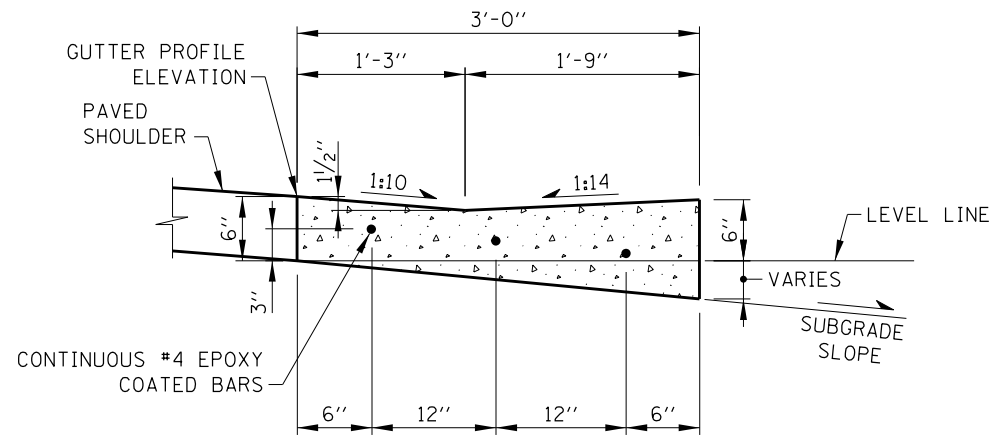
GUTTER, TYPE G-2



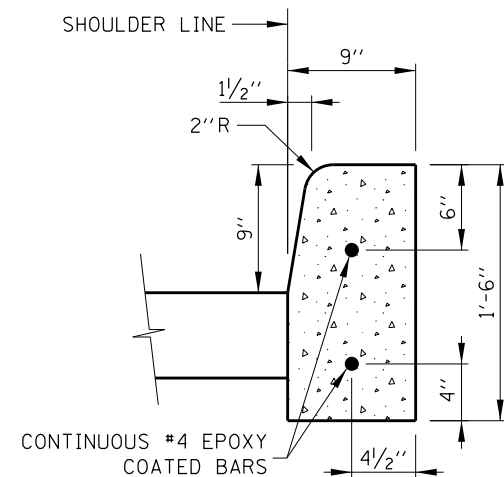
GUTTER, TYPE G-2, MODIFIED



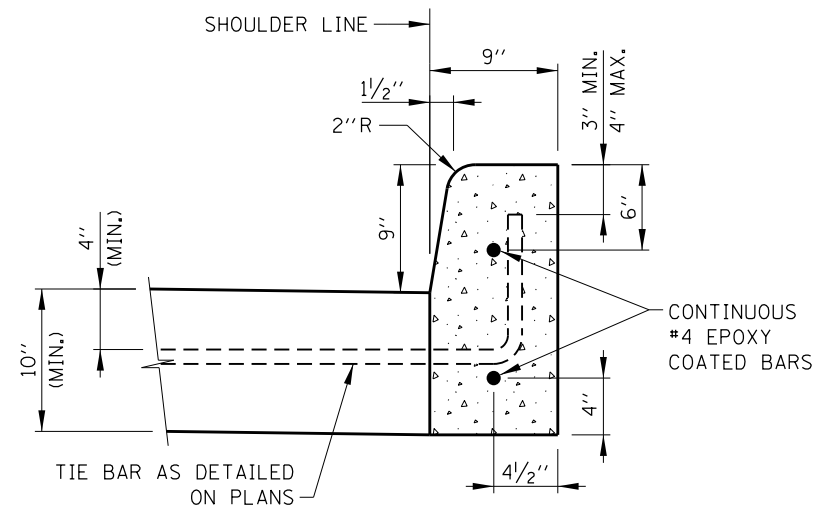
GUTTER, TYPE G-3



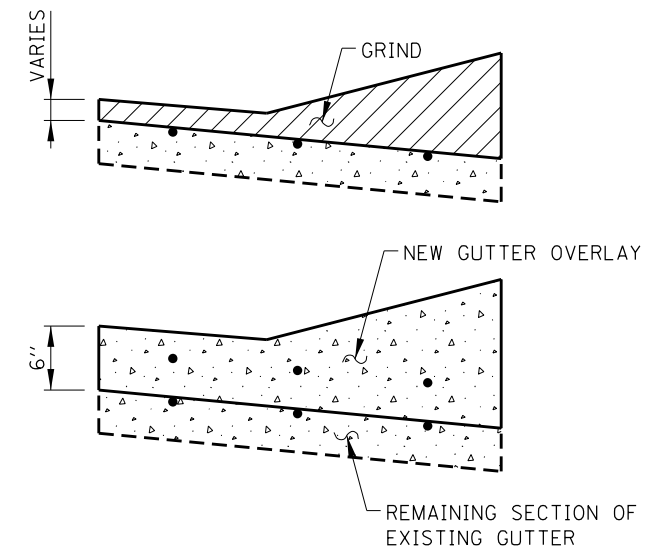
GUTTER, TYPE G-3, MODIFIED



ADJACENT TO FLEXIBLE PAVEMENT



ADJACENT TO PCC PAVEMENT



CONCRETE GUTTER OVERLAY

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.

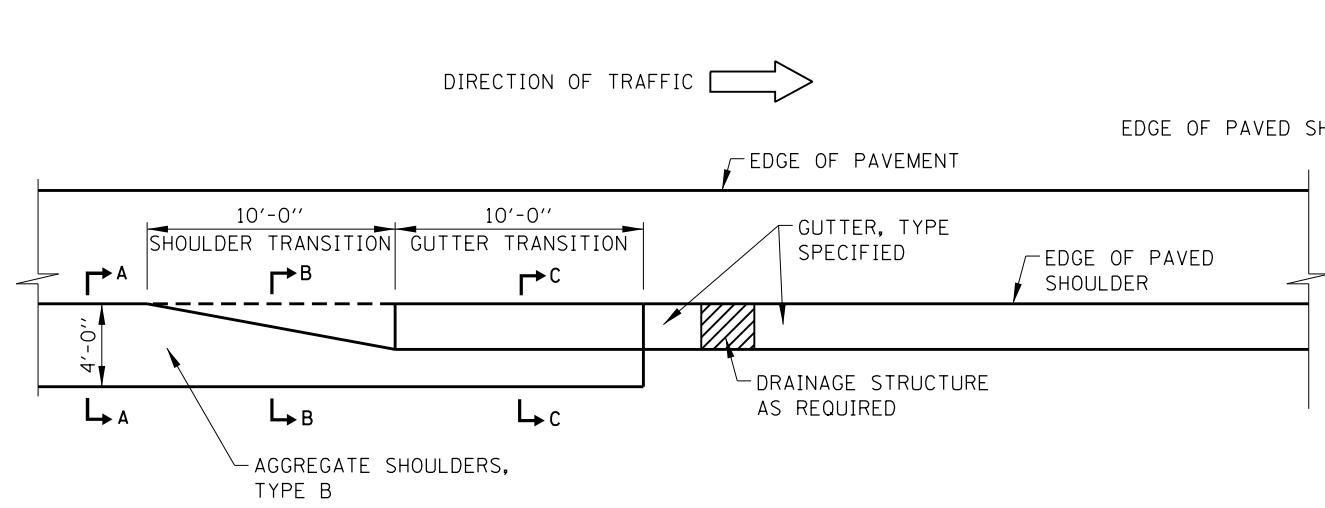
APPROVED: *Paul Kovacs*
CHIEF ENGINEERING OFFICER DATE: 2-7-2012

DATE	REVISIONS
2-07-12	REVISED NOTES
11-01-12	ADDED CONCRETE GUTTER OVERLAY, MODIFIED GUTTER CONTROL JOINT SPACING
3-11-2015	REVISED DETAIL DESCRIPTIONS
3-31-2016	REVISED NOTE
3-01-2018	REVISED NOTE

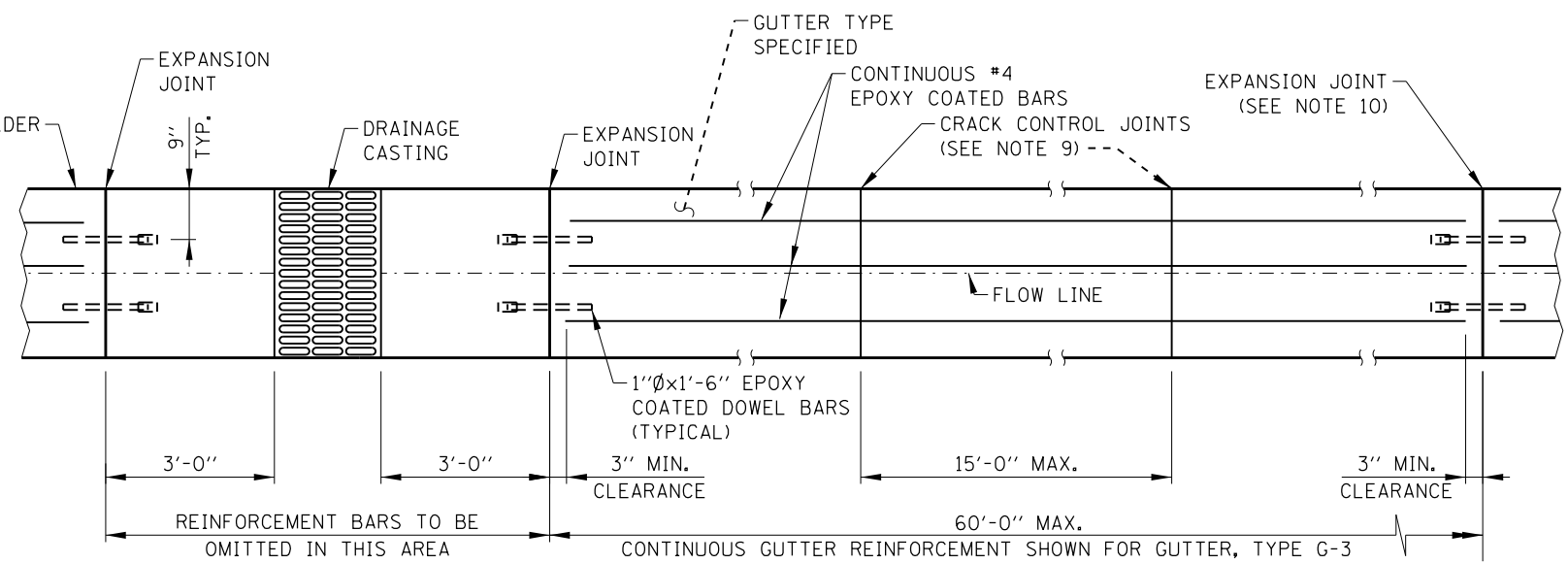


GUTTER AND CURB
DETAILS

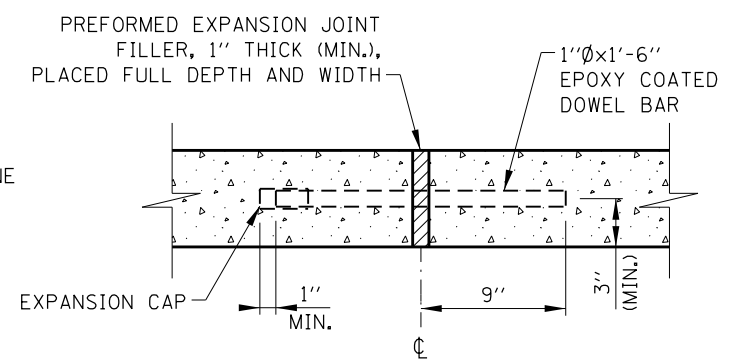
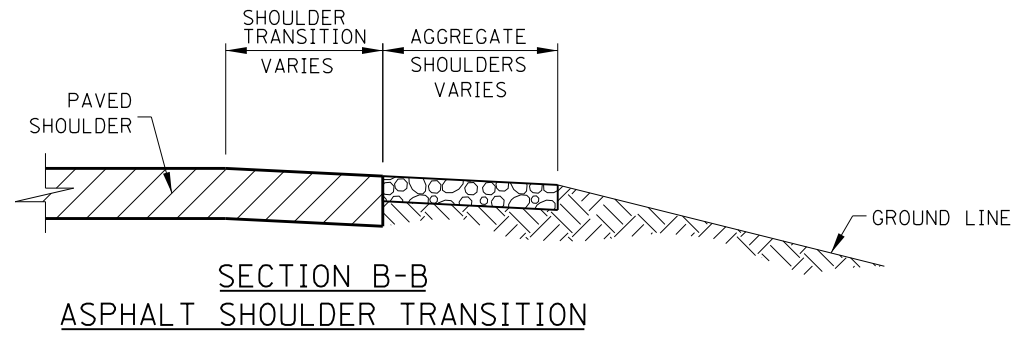
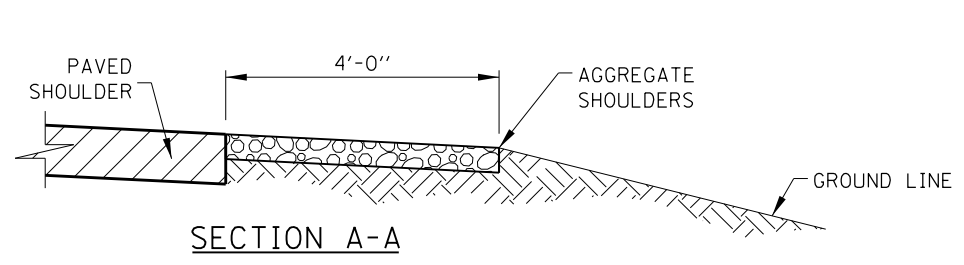
STANDARD B1-08



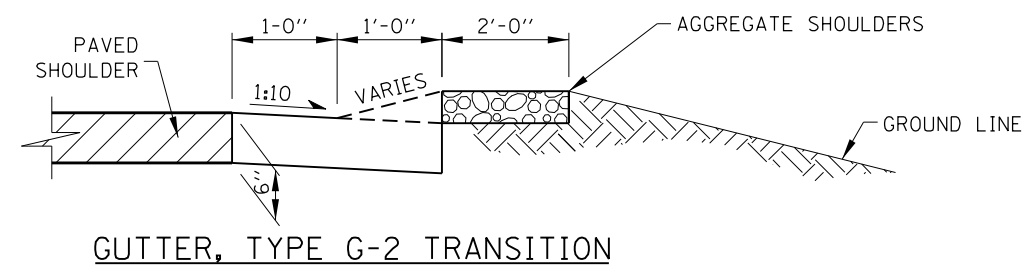
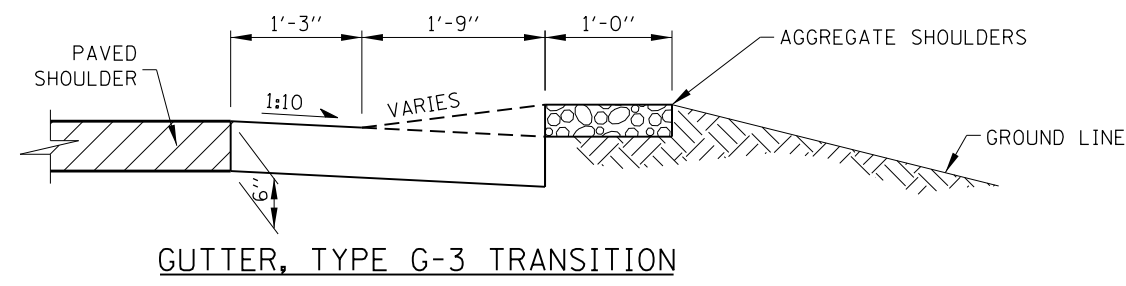
GUTTER TRANSITION TERMINATION



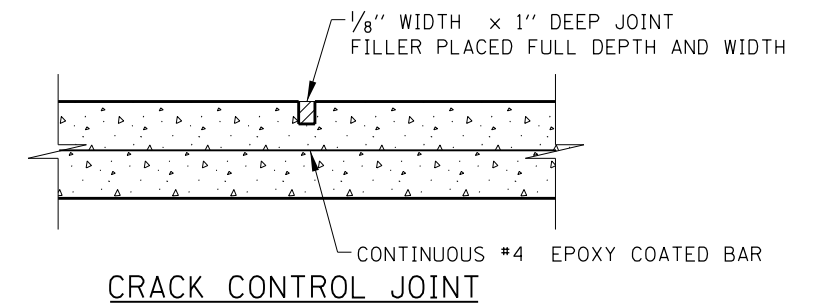
GUTTER PLAN



EXPANSION JOINT



SECTION C-C



EXPANSION-CRACK CONTROL JOINTS
GUTTER, TYPE SPECIFIED

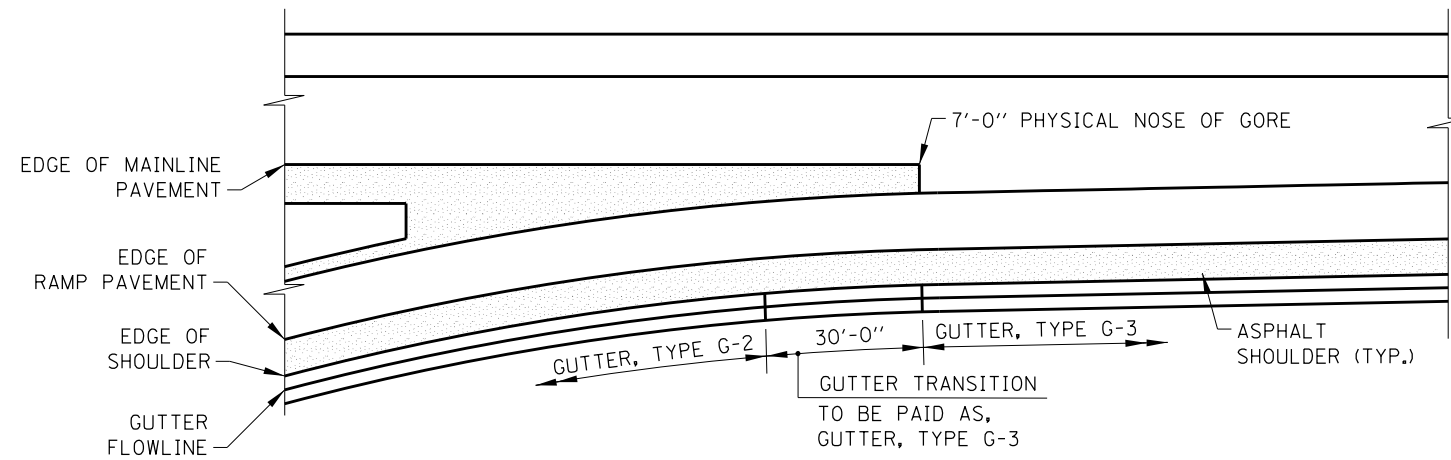
NOTE:
SEE SHEET 1 OF THIS SERIES FOR NOTES.



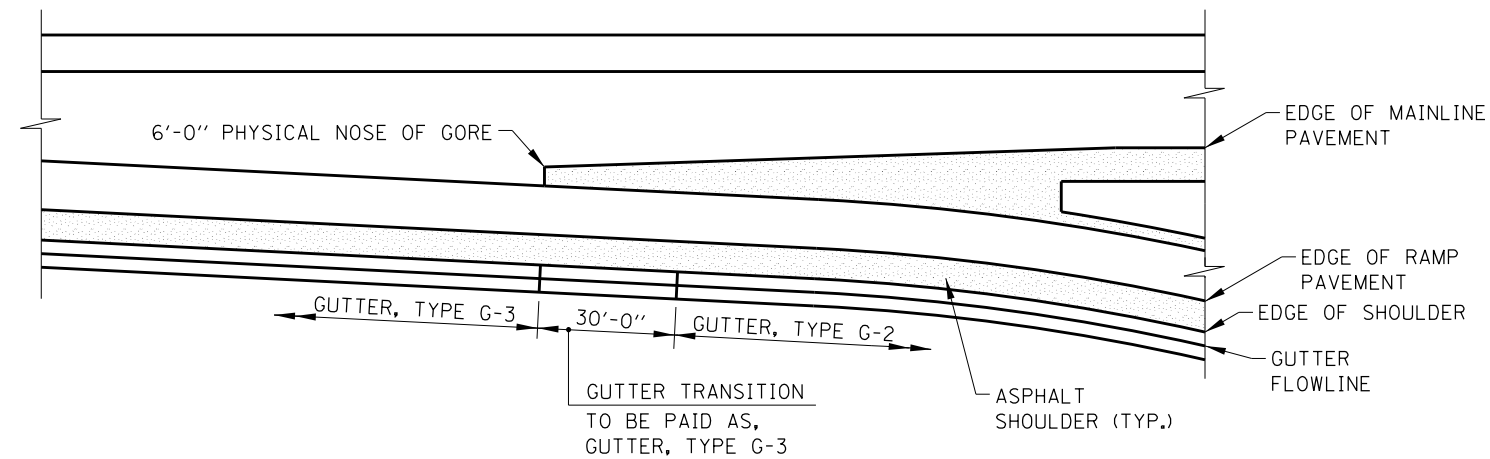
GUTTER AND CURB
DETAILS

STANDARD B1-08

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



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".

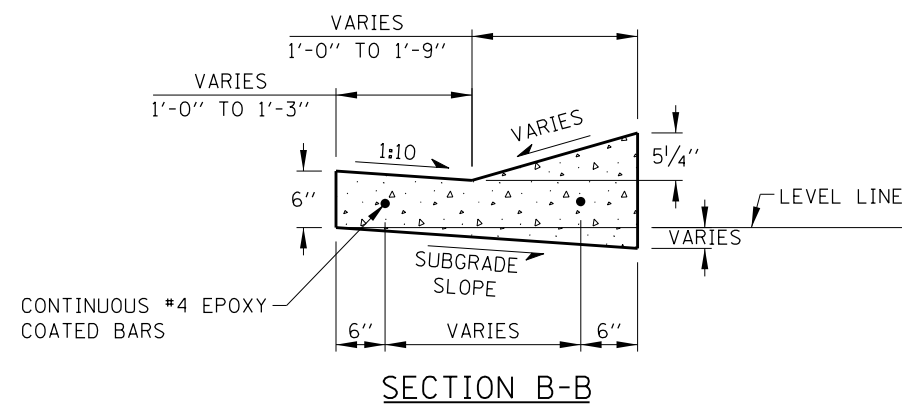
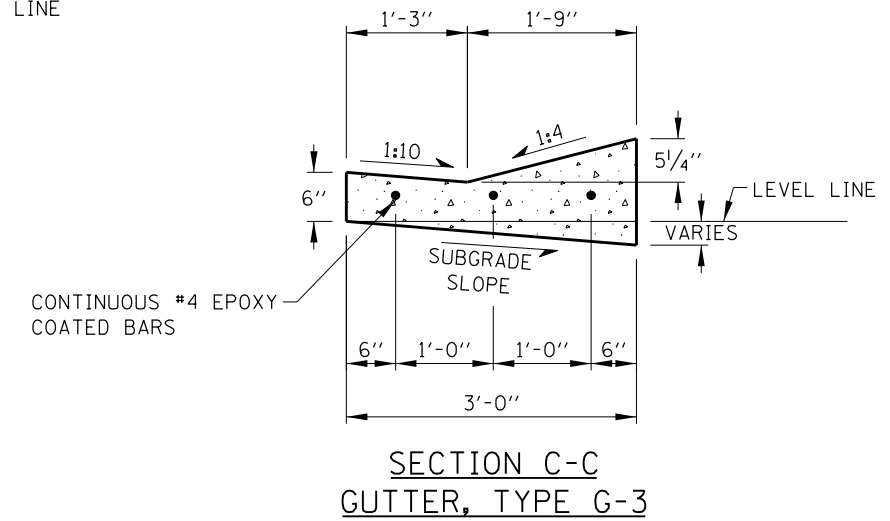
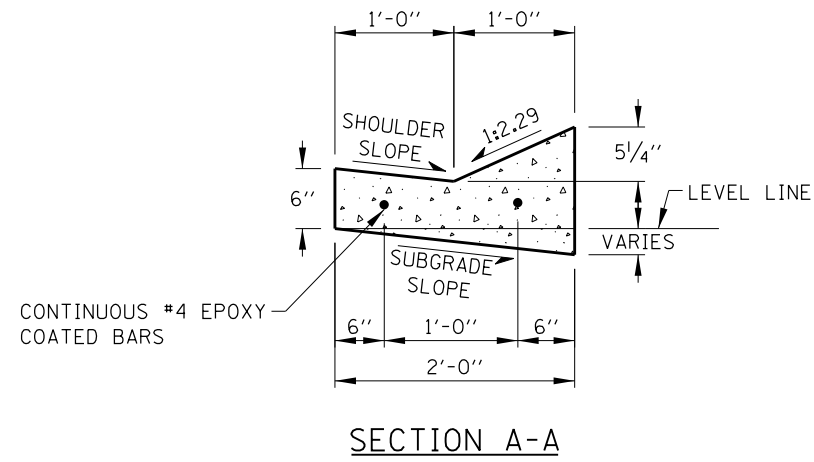
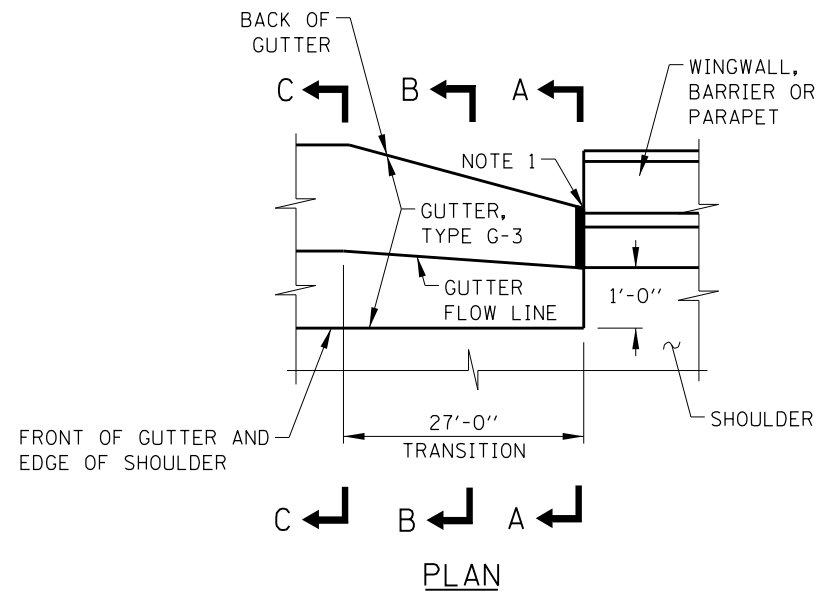
APPROVED *Paul Kovacs* CHIEF ENGINEERING OFFICER DATE 2-7-2012

DATE	REVISIONS
9-01-2009	ADDED GUTTER TRANSITION TERMINAL DETAIL
	REVISED NOTES
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

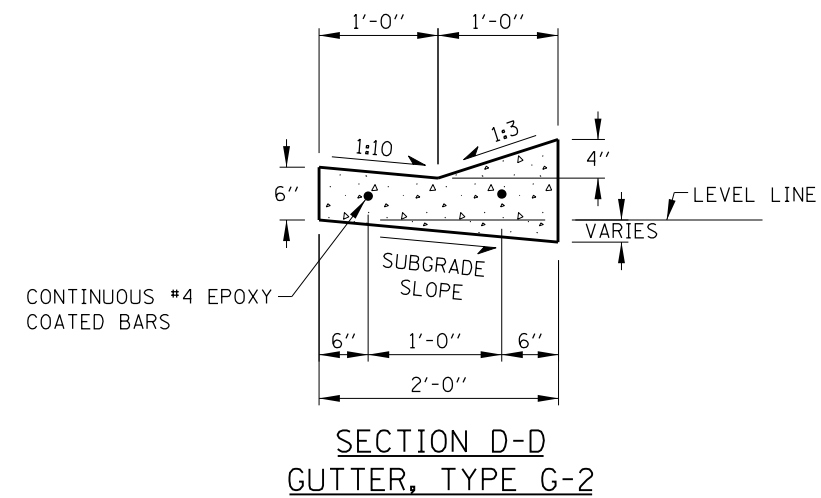
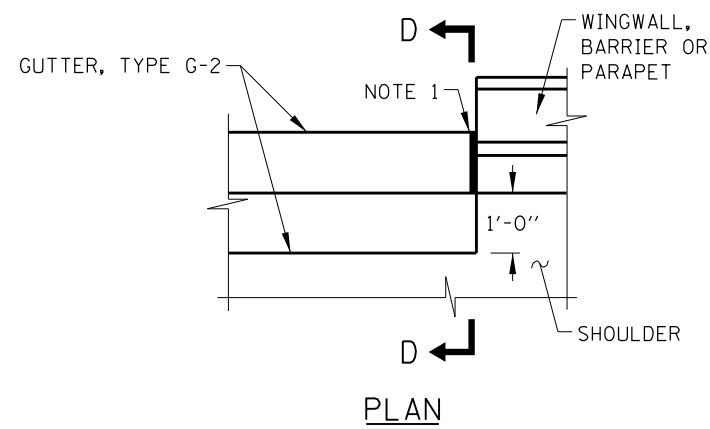


TYPE G-2 AND G-3
GUTTER TRANSITIONS

STANDARD B2-07



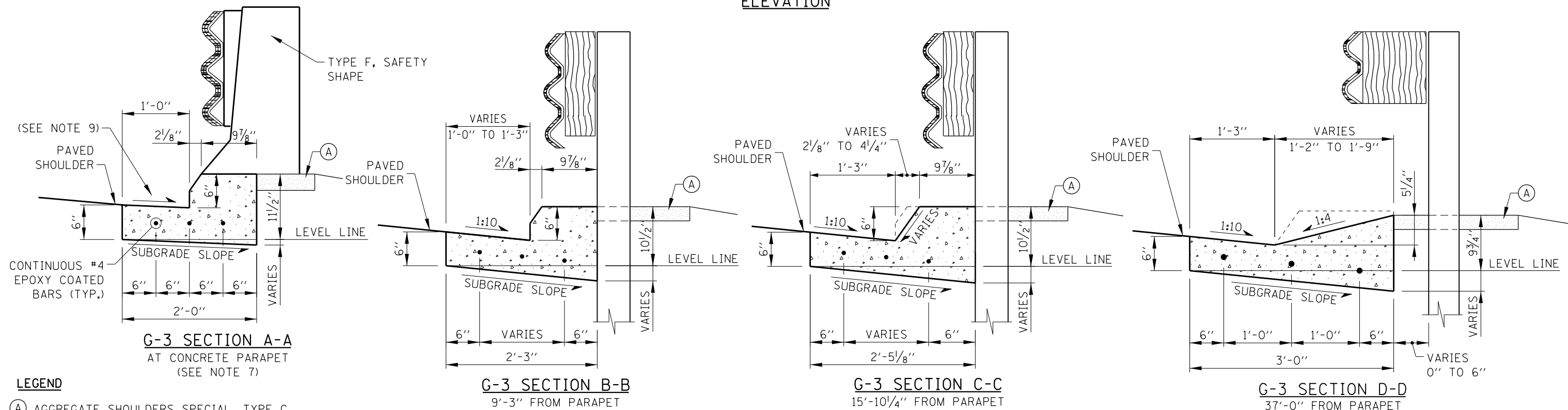
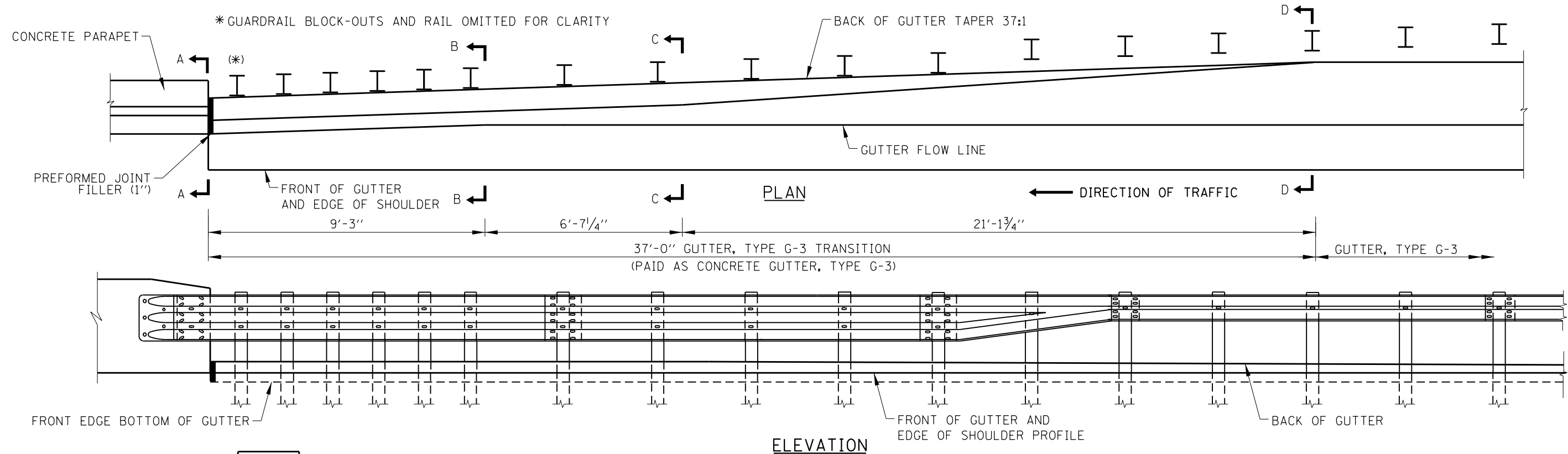
GUTTER, TYPE G-3 TRANSITION AT BRIDGE DEPARTURE



GUTTER, TYPE G-2 AT BRIDGE DEPARTURE

NOTE:
SEE SHEET 1 OF THIS SERIES FOR NOTES.





LEGEND
 (A) AGGREGATE SHOULDERS SPECIAL, TYPE C

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 TO MATCH VERTICAL PROFILE OF TYPE F SAFETY SHAPE. MODIFY GUTTER FACE TO MATCH OTHER PARAPET PROFILES. (SEE ILLINOIS TOLLWAY STANDARD C4)
8. CONTINUOUS #4 BARS SHALL BE LAPPED A MINIMUM OF 1'-1".
9. MATCH SHOULDER SLOPE IN FRONT OF PARAPET OR BARRIER.

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

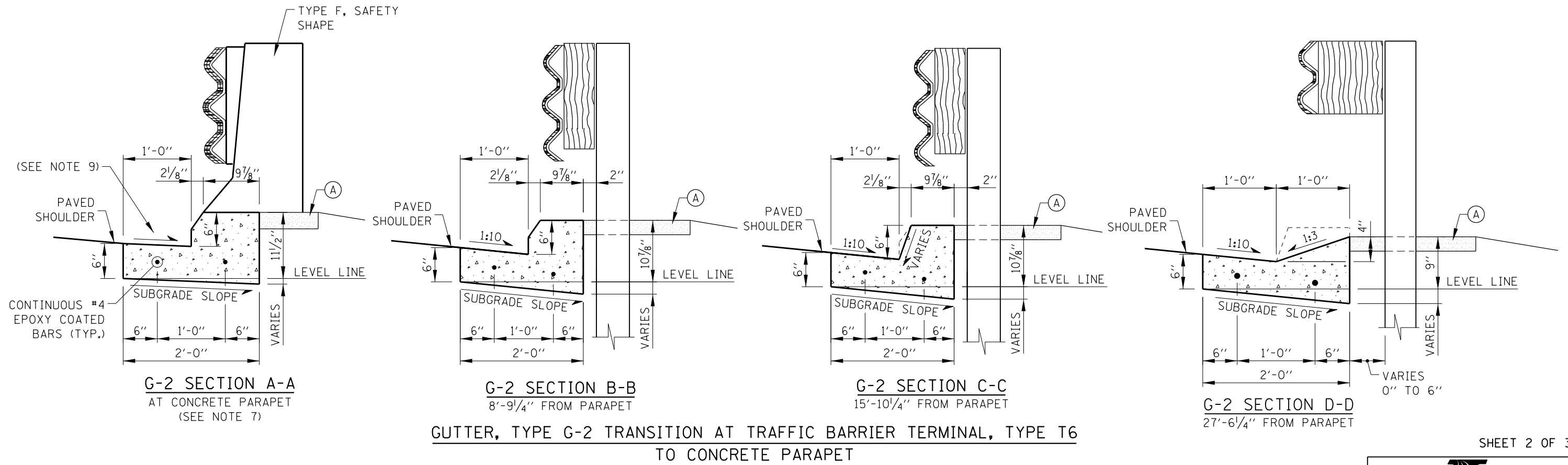
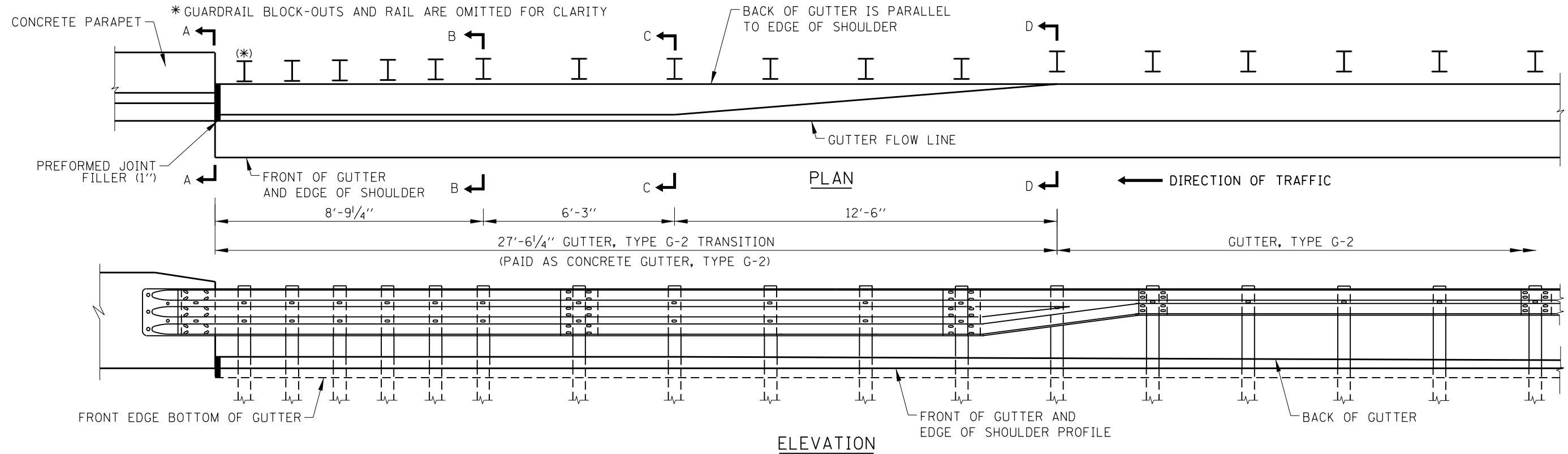
APPROVED: *Paul Kovacs*
 CHIEF ENGINEERING OFFICER DATE 2-7-2012

DATE	REVISIONS
3-01-2010	REVISED G-2/G-3 GUTTER TRANSITION DETAILS, REVISED NOTES.
1-01-2011	REVISED NOTE 8.
2-07-2012	REVISED GUTTER.
3-11-2015	GUTTER TRANSITION FOR CONCRETE BARRIER, SINGLE-FACE.
3-31-2016	REVISED G-2 GUTTER SHAPE
3-01-2018	REVISED NOTES

SHEET 1 OF 3

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

STANDARD B3-07



LEGEND

(A) AGGREGATE SHOULDERS SPECIAL, TYPE C

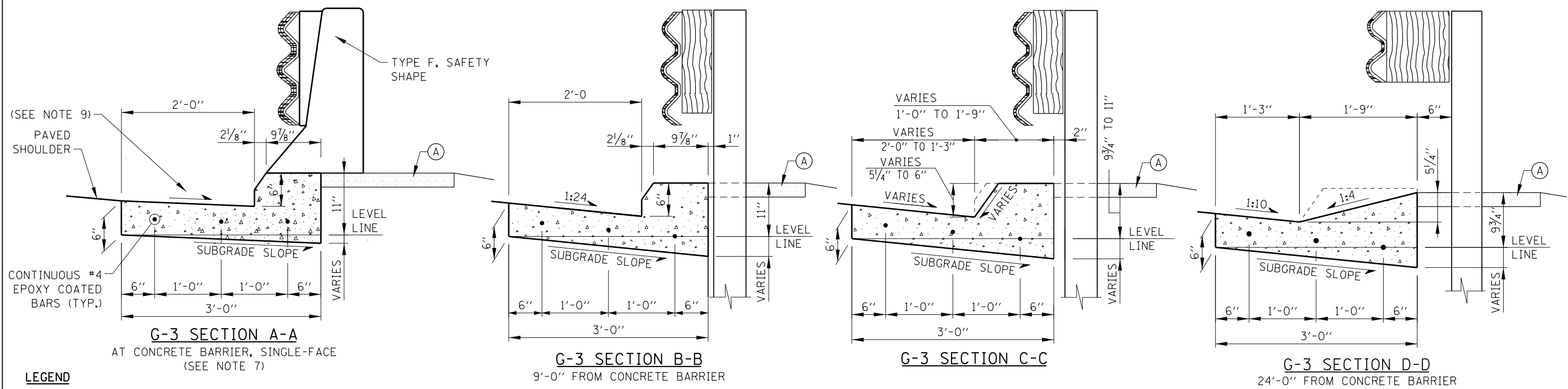
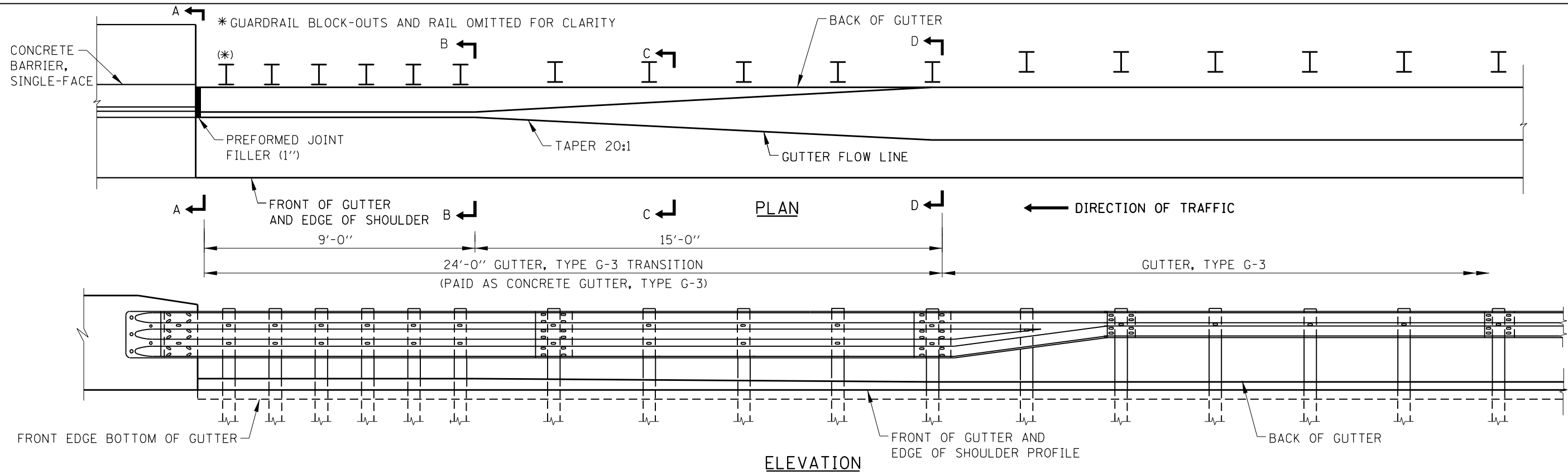
NOTE:
SEE SHEET 1 OF THIS SERIES FOR GUTTER TRANSITION NOTES.



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

STANDARD B3-07

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 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

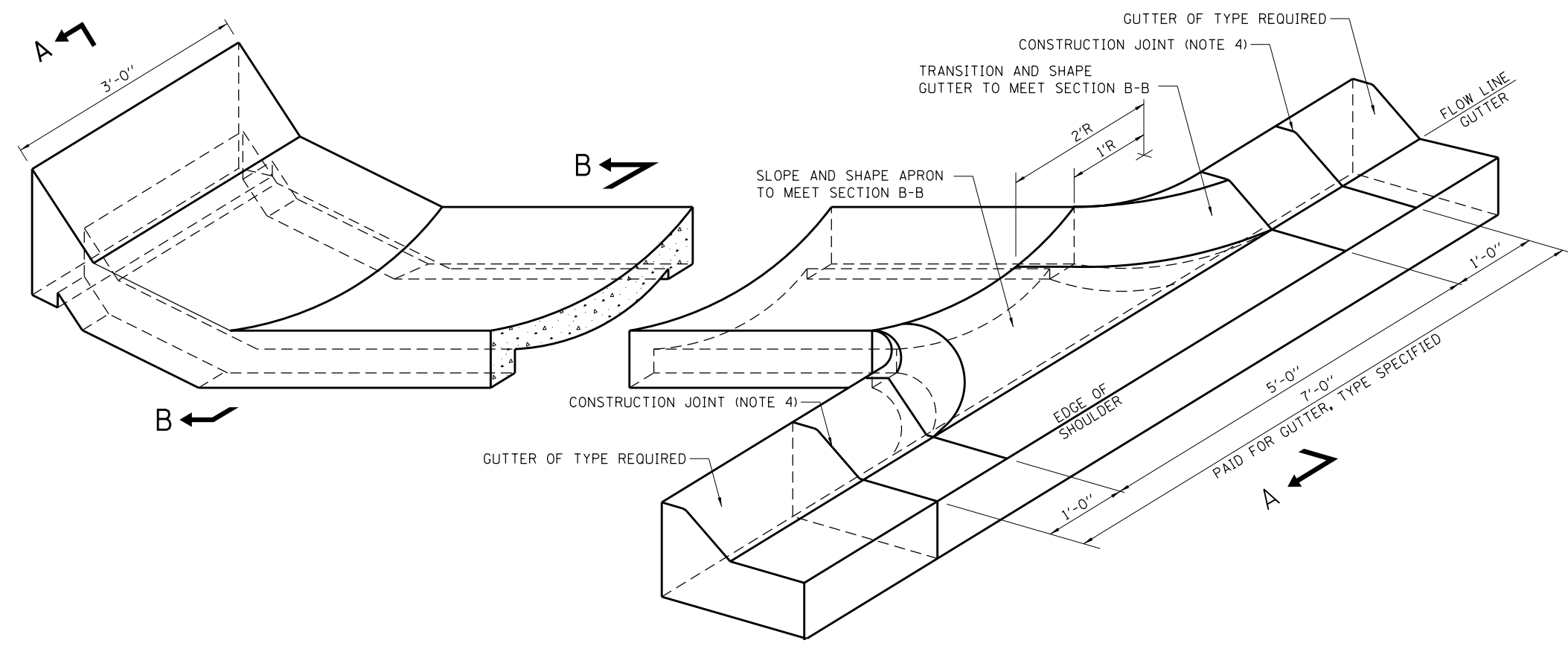
STANDARD B3-07

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

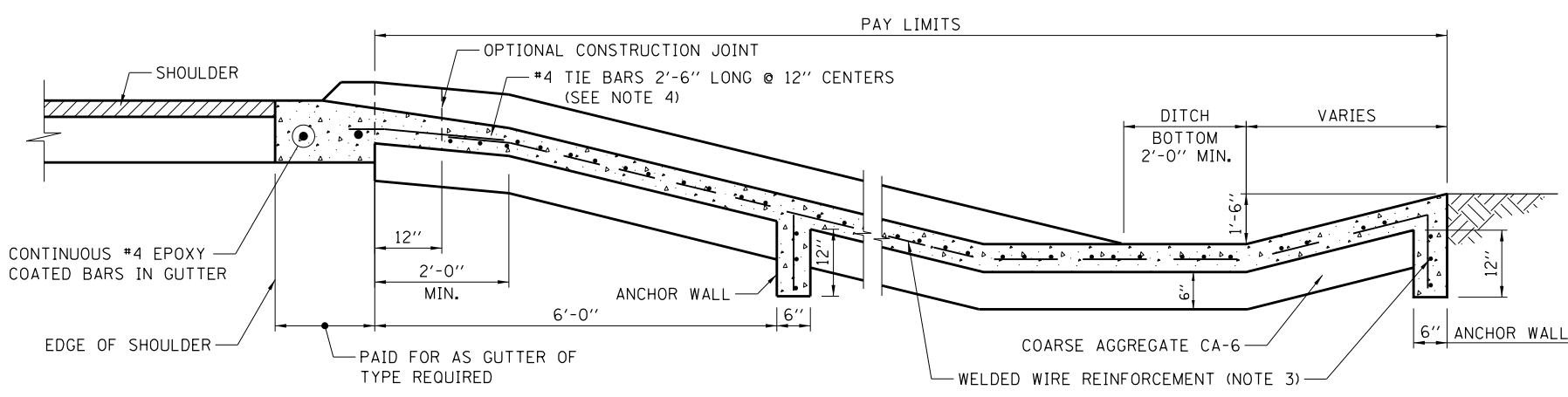
CONCRETE FLUME

NOTES:

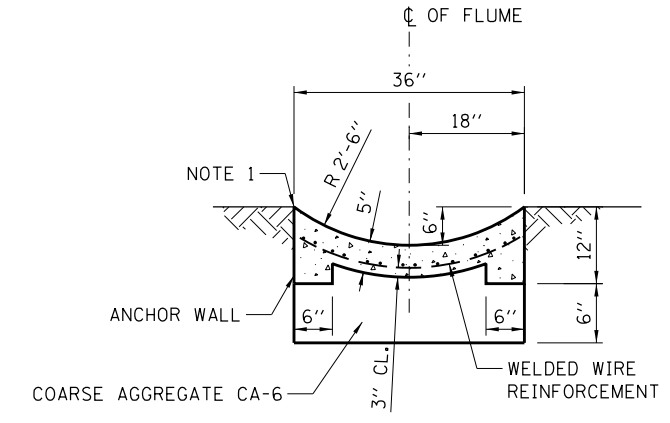
1. CONCRETE FLUMES SHALL BE CONSTRUCTED FLUSH WITH THE ADJACENT EXISTING OR PROPOSED SURFACES.
2. CLASS SI CONCRETE SHALL BE USED THROUGHOUT.
3. WELDED WIRE REINFORCEMENT SHALL BE EPOXY COATED 6x6 W4xW4, 58 LBS. PER 100 SQ. FT.
4. #4 EPOXY COATED TIE BARS 2'-6" LONG AT 12" O/C SHALL BE PROVIDED AT ALL 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:

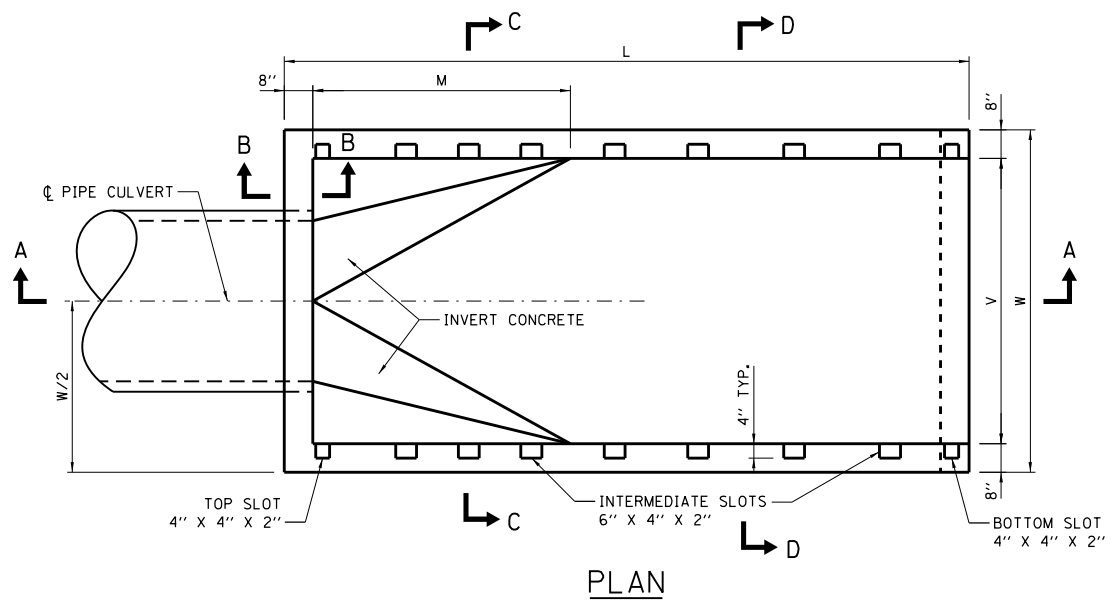
0.62 C.Y. CONCRETE / L.F.

SECTION B-B

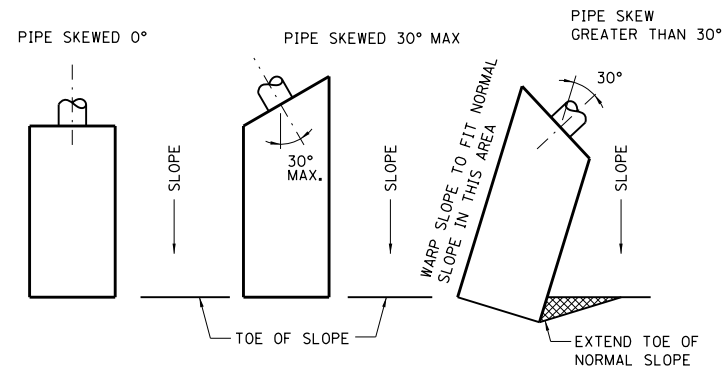

 APPROVED, CHIEF ENGINEERING OFFICER DATE 2-7-2012

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

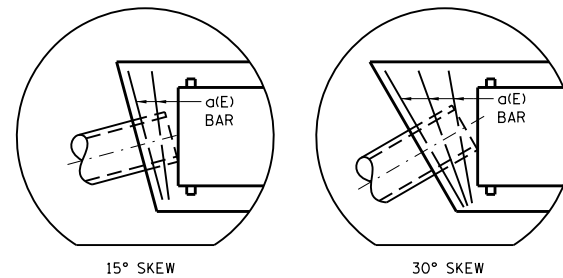

CONCRETE FLUME DETAILS
 STANDARD B5-04



PLAN



PLAN VIEW OF STRUCTURE LOCATIONS

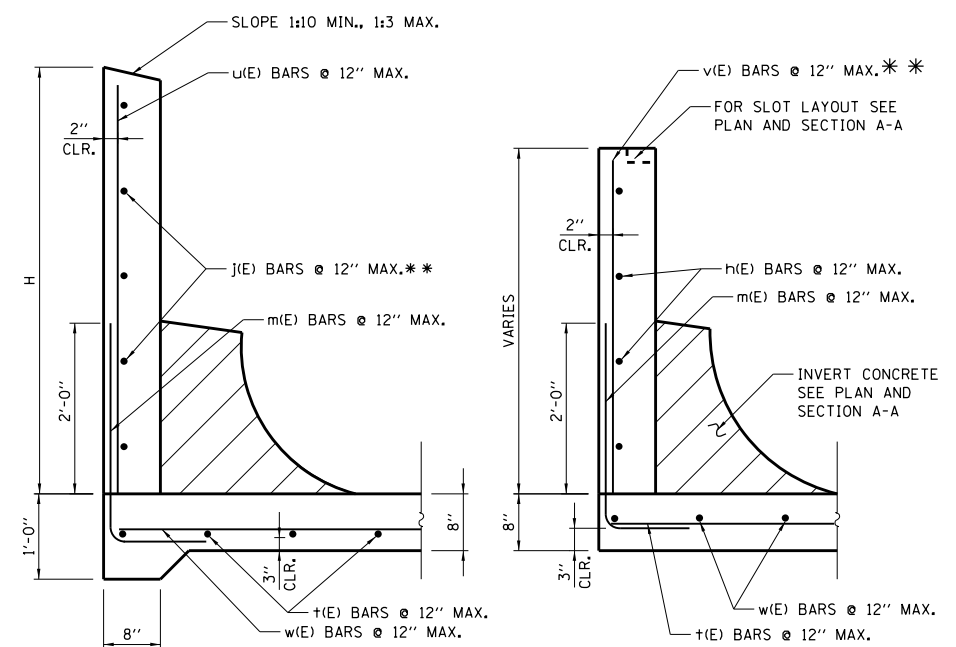


FLARED BAR DETAILS

NOTES:

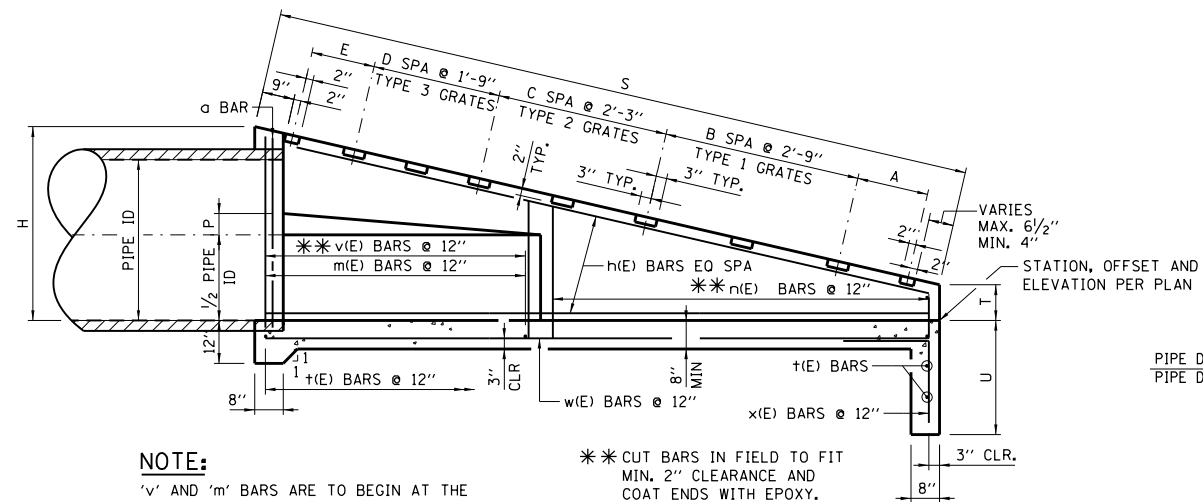
ADDITIONAL "a" BARS SHALL BE FURNISHED AND PLACED BY THE CONTRACTOR. THE ADDITIONAL BARS ARE NOT INCLUDED IN THE LISTED QUANTITIES, BUT WILL BE PAID FOR AS REINFORCEMENT BARS (EPOXY COATED).

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



SECTION B-B

SECTION C-C



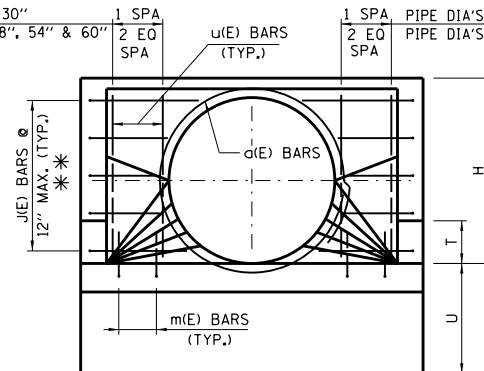
SECTION A-A

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.

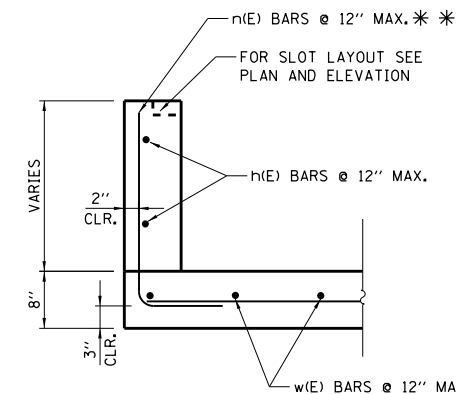
PIPE DIA'S 18", 24" & 30"
PIPE DIA'S 36", 42", 48", 54" & 60"



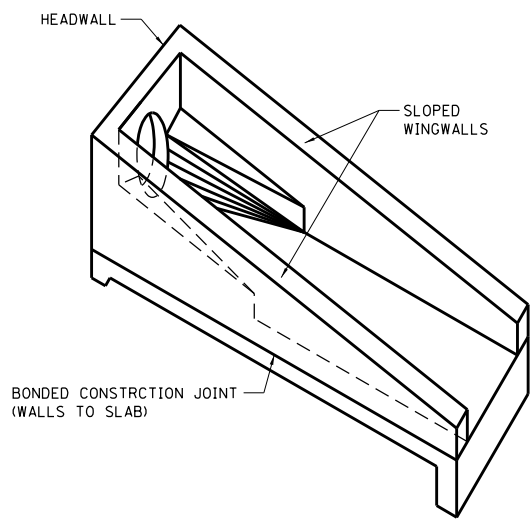
FRONT ELEVATION

NOTES:

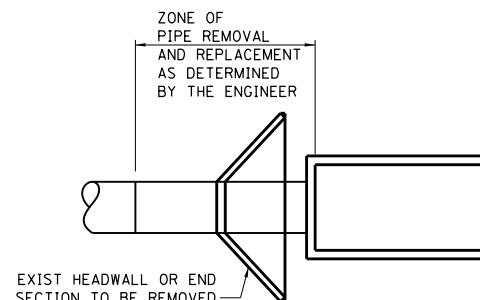
- HEADWALL TYPE III SHALL BE CONSTRUCTED FLUSH WITH EXISTING OR PROPOSED SLOPE.
- CLASS SI CONCRETE SHALL BE USED THROUGHOUT.
- ALL REINFORCEMENT BARS SHOWN SHALL BE EPOXY COATED (E).
- BAR BENDING DETAILS ARE DIMENSIONED OUT TO OUT OF BARS.
- ALL EXPOSED EDGES SHALL HAVE A 3/4" - 45° CHAMFER. CHAMFER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



SECTION D-D



ISOMETRIC VIEW



INSTALLATION DETAIL



HEADWALL TYPE III 18"-24"-30"-36"-42"-48"-54"-60" FOR 1:3, 1:4, 1:6, AND 1:10 SLOPES	
STANDARD B6-06	

DATE	REVISIONS
3-31-2014	REVISED QUANTITIES-CONC REINF STEEL
3-11-2015	REVISED QUANTITIES, CONCRETE REINFORCEMENT STEEL AND PRECAST CONCRETE DETAILS
3-31-2016	ADDED NOTE TO OMIT RESTRAINT ANGLE AND THE PLATE FOR MULTI-END SECTIONS
	REVISED GRATE LAYOUT

APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 5-1-2009

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

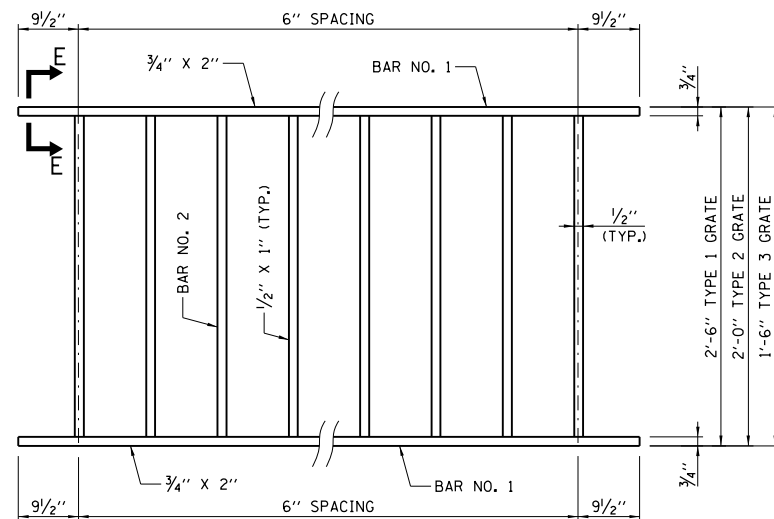
INSIDE PIPE DIAMETER	GRATES		BARS FOR ONE GRATE				HEADWALL GRATES (POUND)	
	NUMBER REQUIRED	TYPE REQ'D	BAR NO 1		BAR NO 2		EACH GRATE	TOTAL
			BARS REQ'D	LENGTH	BARS REQ'D	LENGTH		
18"	3	1	2	3'-7"	5	2'-4 1/2"	57	433
	5	2	2	3'-7"	5	1'-10 1/2"	52	
	0	3	2	3'-7"	5	1'-4 1/2"	48	
24"	0	1	2	4'-7"	7	2'-4 1/2"	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

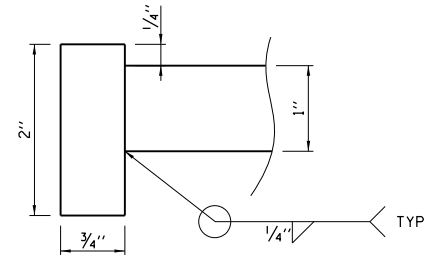
INSIDE PIPE DIAMETER	GRATES		BARS FOR ONE GRATE				HEADWALL GRATES (POUND)	
	NUMBER REQUIRED	TYPE REQ'D	BAR NO 1		BAR NO 2		EACH GRATE	TOTAL
			BARS REQ'D	LENGTH	BARS REQ'D	LENGTH		
36"	0	1	2	6'-7"	11	2'-4 1/2"	112	1115
	0	2	2	6'-7"	11	1'-10 1/2"	102	
	12	3	2	6'-7"	11	1'-4 1/2"	93	
42"	0	1	2	7'-1"	12	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).



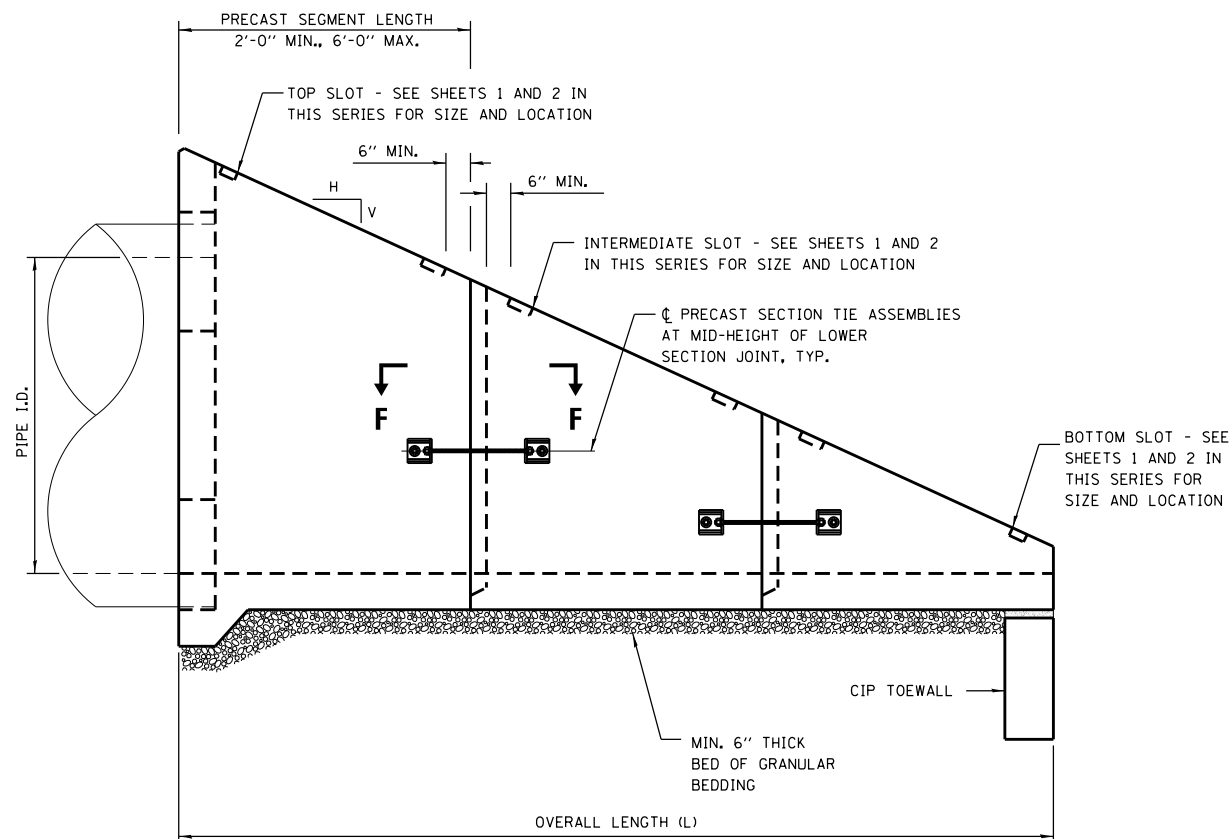
TYPICAL GRATE



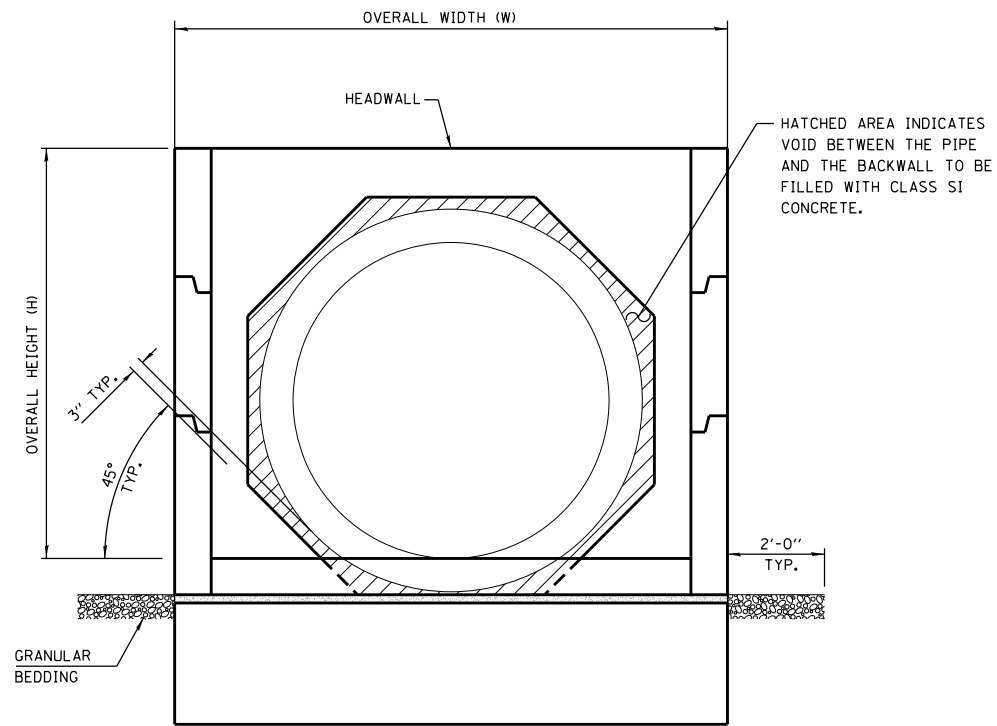
SECTION E-E

Paul Kovacs
 APPROVED CHIEF ENGINEER DATE 5-1-2009

HEADWALL TYPE III 18"-24"-30"-36"-42"-48"-54"-60" FOR 1:3, 1:4, 1:6, AND 1:10 SLOPES
STANDARD B6-06



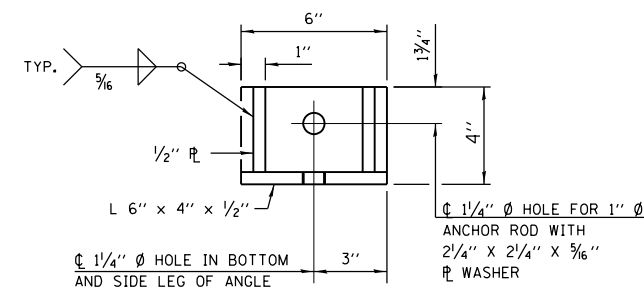
ELEVATION



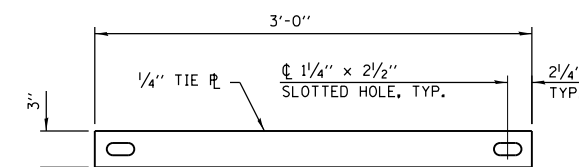
END VIEW

GENERAL NOTES:

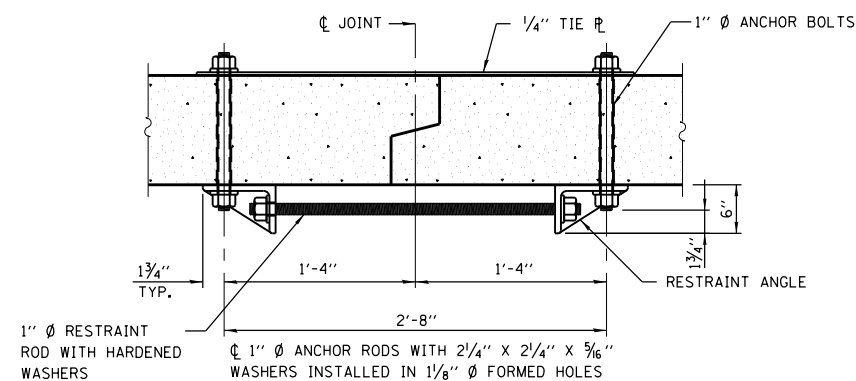
1. THE NUMBER OF SEGMENTS SHOWN IN ELEVATION IS FOR EXAMPLE ONLY. THE LENGTH AND NUMBER OF PRECAST SECTIONS REQUIRED TO CONSTRUCT THE END SECTION SHALL BE DETERMINED BY THE CONTRACTOR.
2. CONTRACTOR SHALL RETAIN THE SERVICES OF AN ILLINOIS LICENSED STRUCTURAL ENGINEER TO PROPORTION, DESIGN AND DETAIL 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.



RESTRAINT ANGLE DETAIL

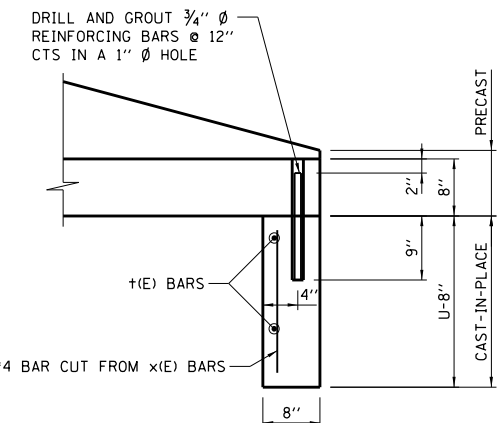


TIE PLATE DETAIL

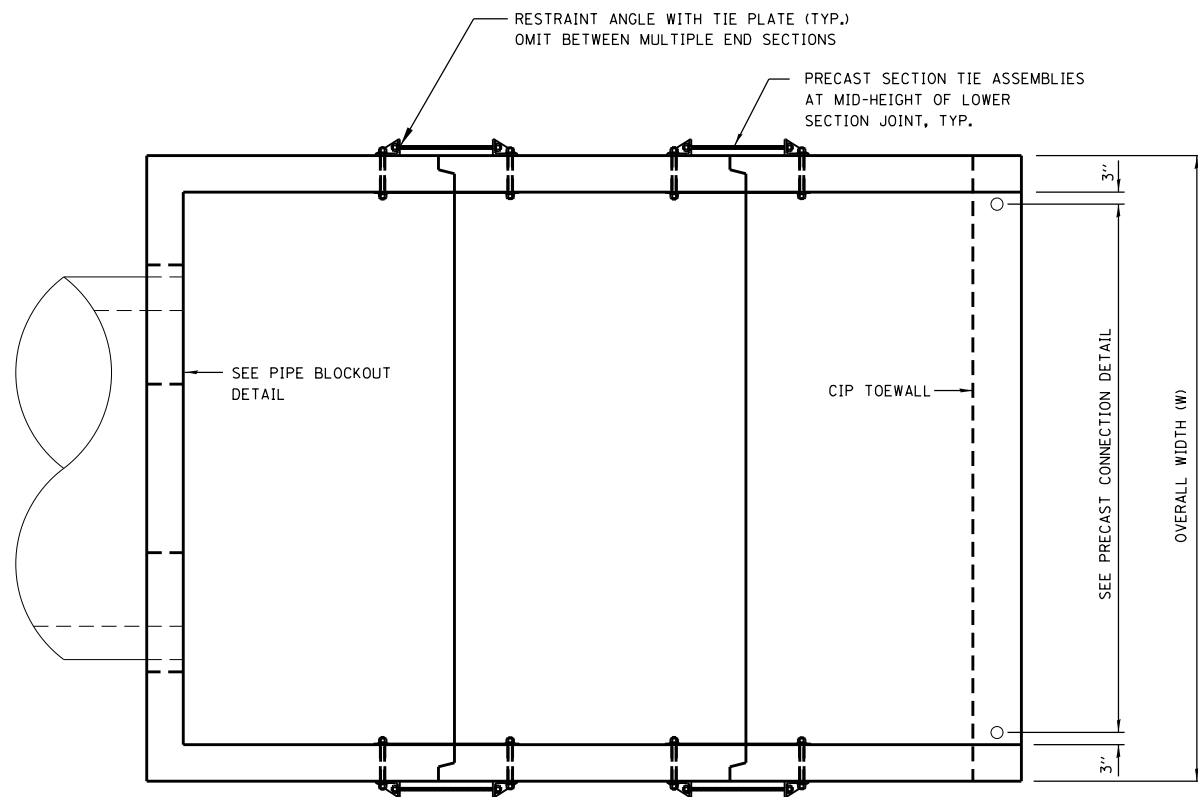


SECTION F-F

(SHOWING PRECAST SECTION TIE DETAILS)



PRECAST CONNECTION DETAIL



PLAN

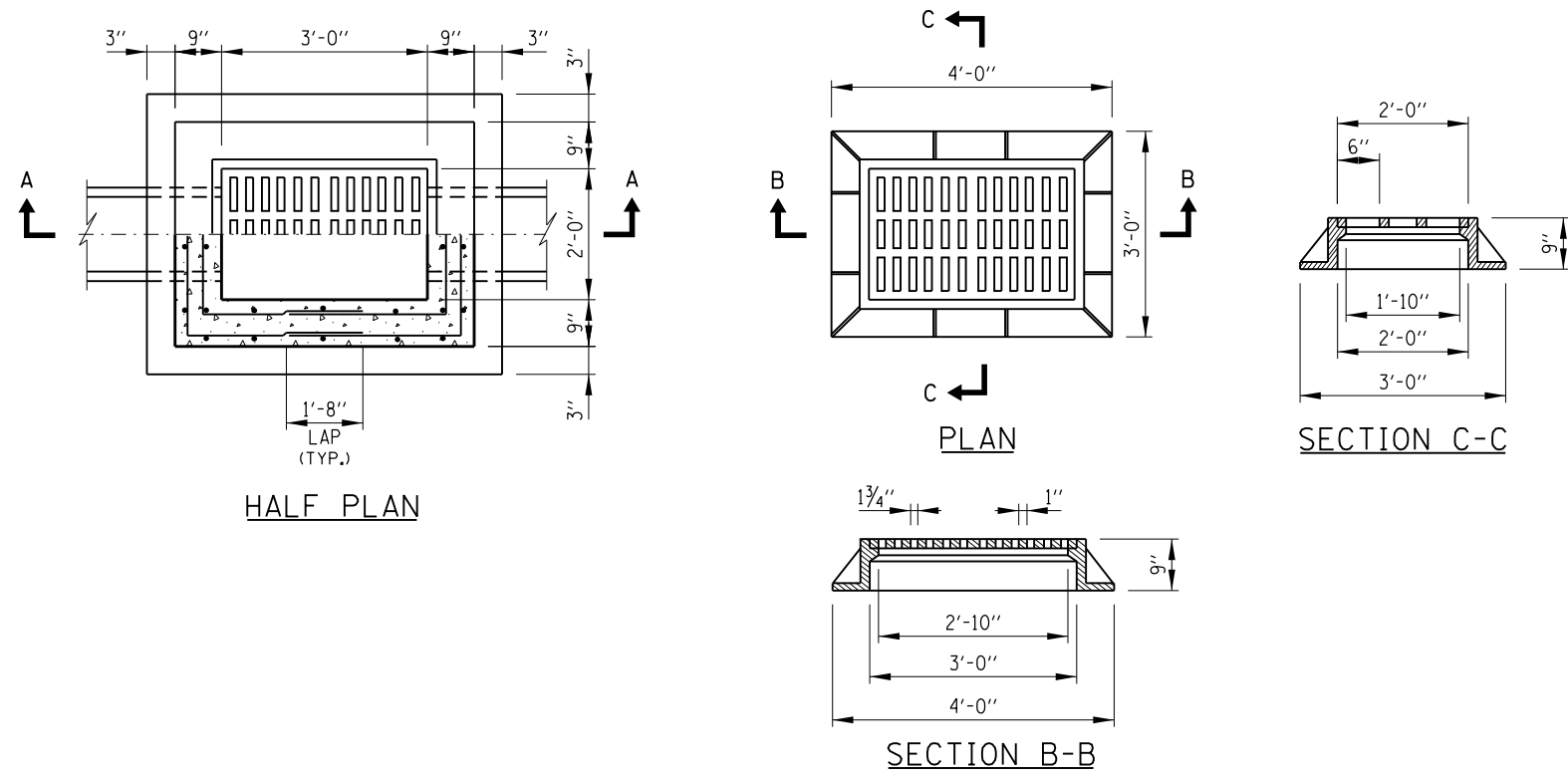


HEADWALL TYPE III
18"-24"-30"-36"-42"-48"-54"-60"
FOR 1:3, 1:4, 1:6, AND
1:10 SLOPES

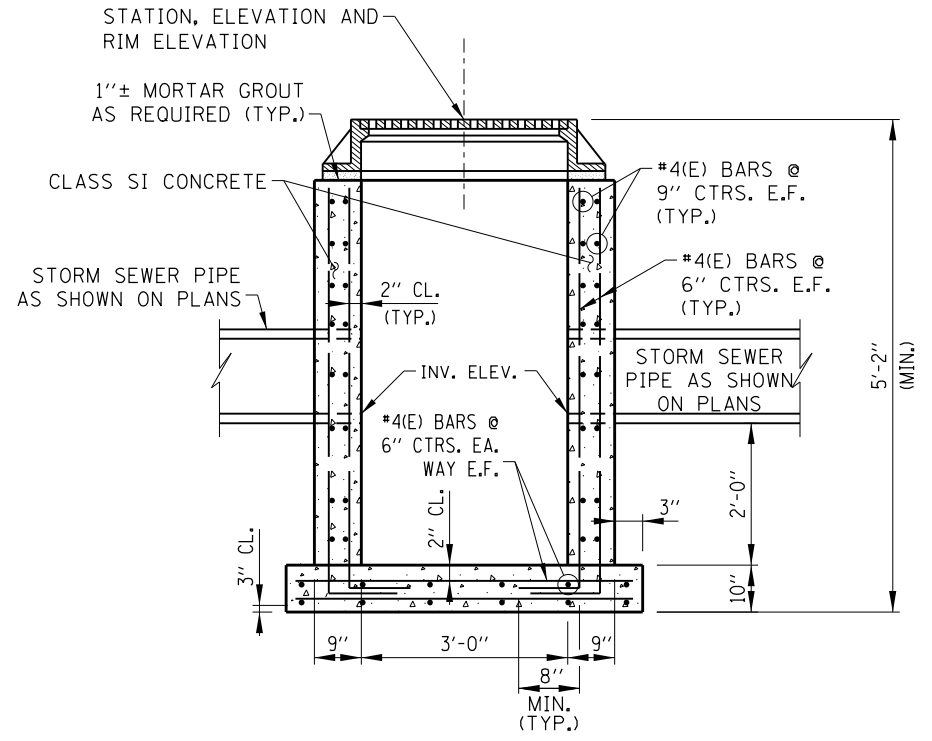
STANDARD B6-06

APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 5-1-2009

HEADWALL TYPE III ALTERNATE PRECAST CONCRETE DETAILS

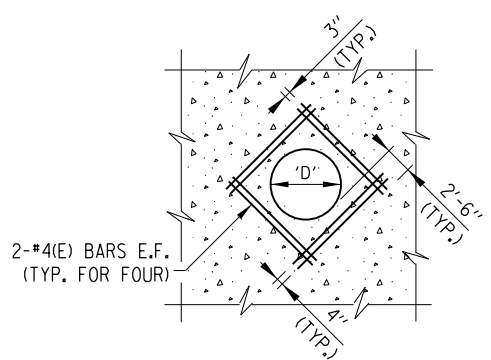


FRAME AND GRATE DETAIL



SECTION A-A

CATCH BASIN TYPE B



TYPICAL REINFORCEMENT AROUND STORM SEWER PIPE

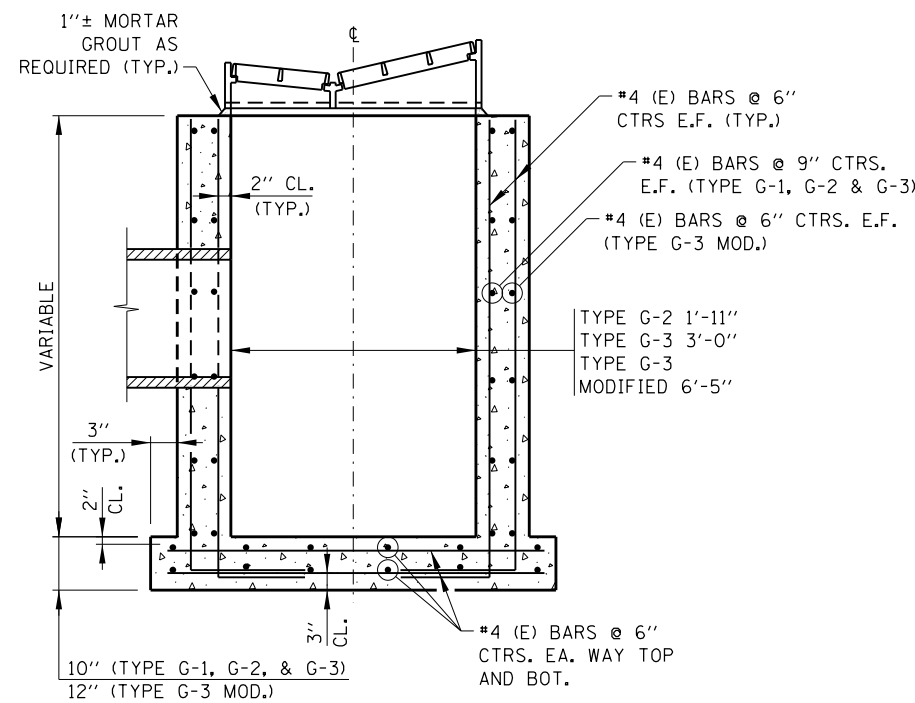
NOTES:

1. FOR MATERIALS AND CONSTRUCTION REQUIREMENTS OF THE CATCH BASIN, REFER TO THE STANDARD SPECIFICATIONS.
2. 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.
3. REINFORCEMENT BARS DESIGNATED (E) SHALL BE EPOXY COATED.

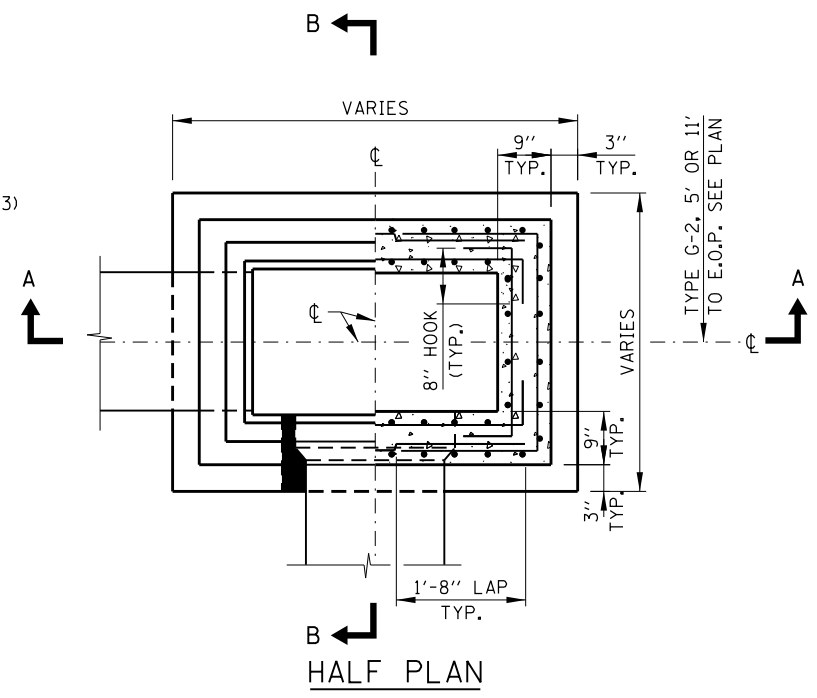
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 2-7-2012

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.

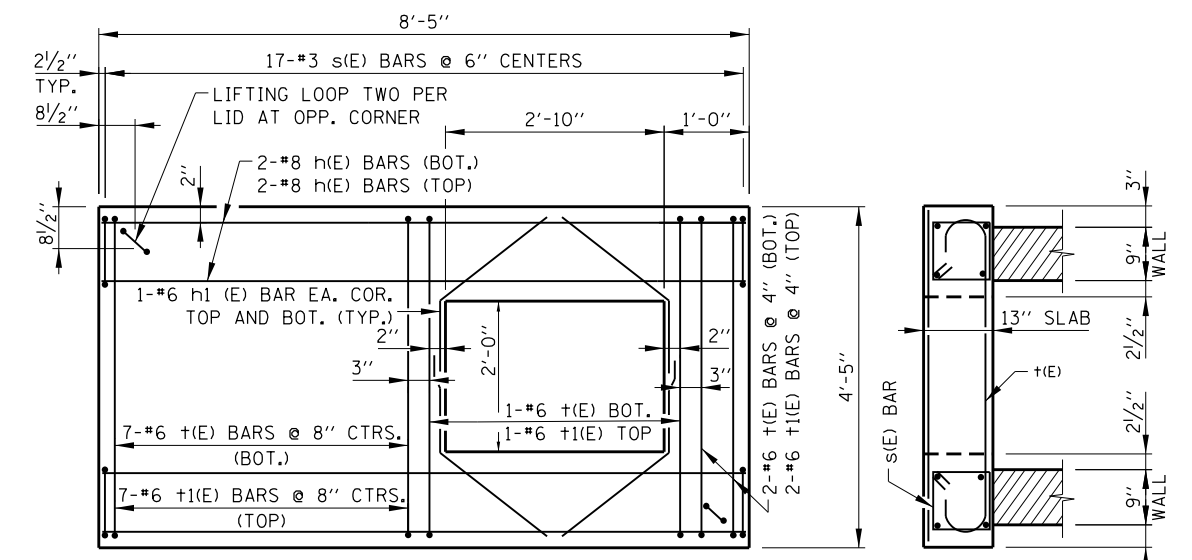
CATCH BASIN, TYPE B
STANDARD B7-03



SECTION A-A



HALF PLAN

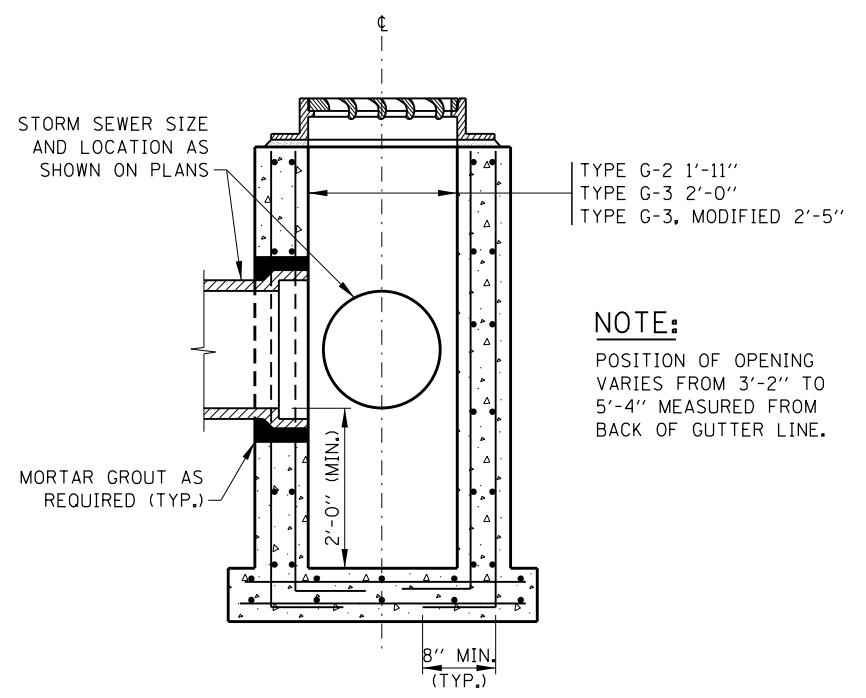


REINFORCED CONCRETE LID

CATCH BASIN, TYPE G-3, MODIFIED

NOTES:

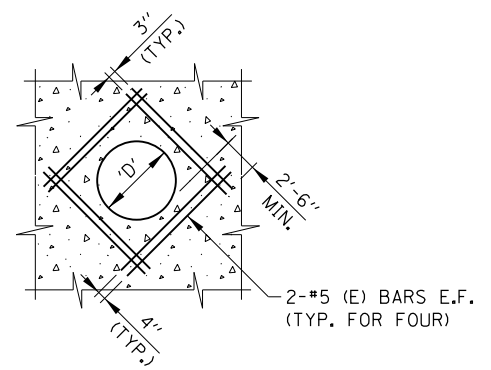
1. PRECAST CONCRETE UNITS WILL BE ACCEPTABLE PROVIDED THEY MEET ALL THE REQUIREMENTS AS SHOWN ON THIS DRAWING. BASE EXTENSION OF 3" NOT REQUIRED FOR PRECAST UNITS. FABRICATION DRAWINGS SHOWING PIPE OPENINGS, REINFORCEMENT AND OTHER PERTINENT DIMENSIONS WILL BE REQUIRED FOR EACH UNIT, FOR APPROVAL BY THE ENGINEER PRIOR TO FABRICATION.
2. CATCH 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.



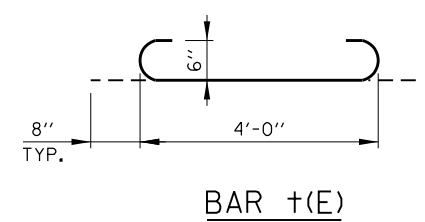
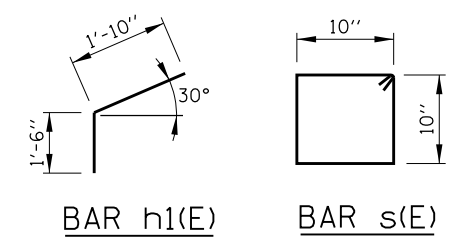
SECTION B-B

CATCH BASIN TYPE "G" SERIES

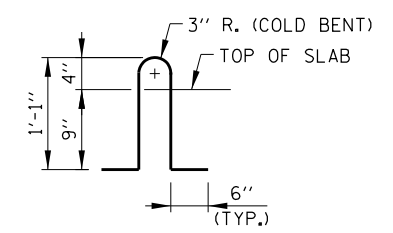
NOTE:
POSITION OF OPENING VARIES FROM 3'-2" TO 5'-4" MEASURED FROM BACK OF GUTTER LINE.



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

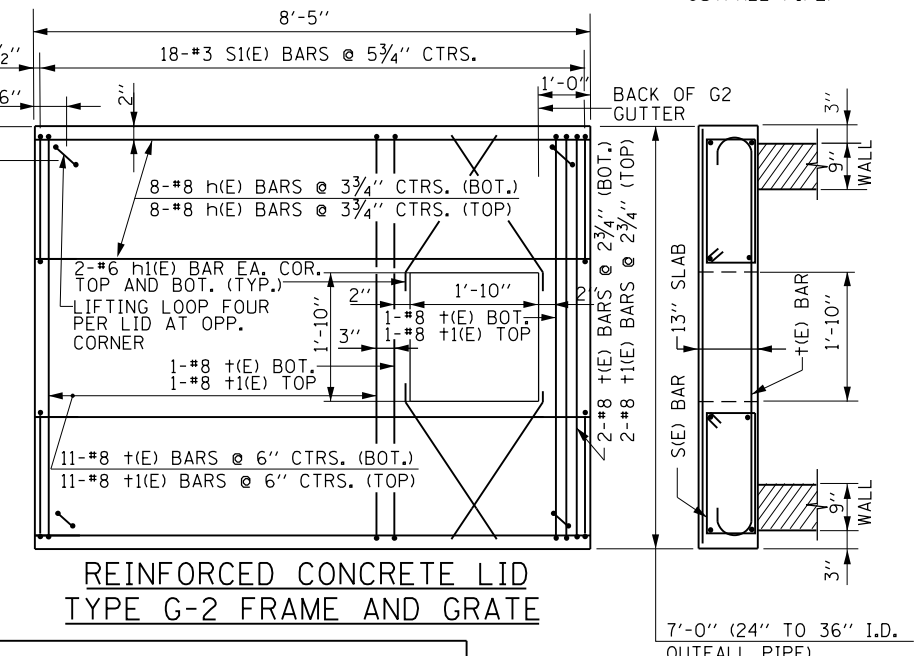
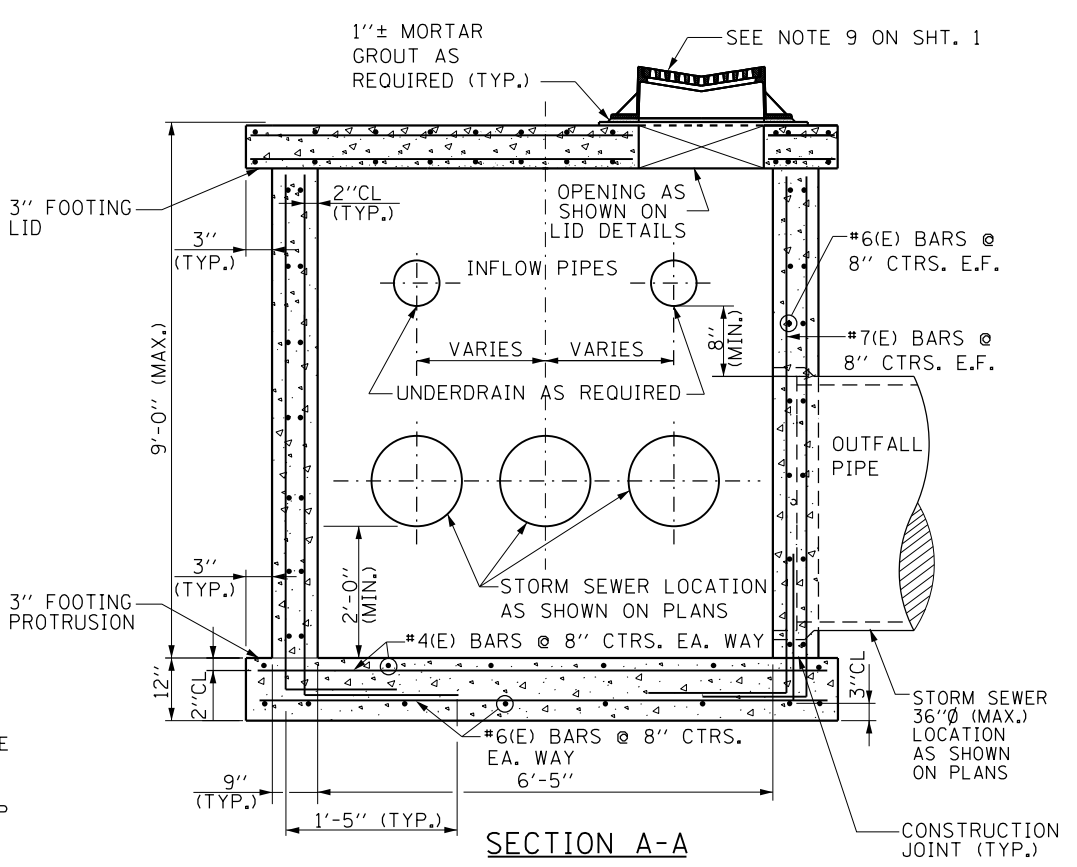
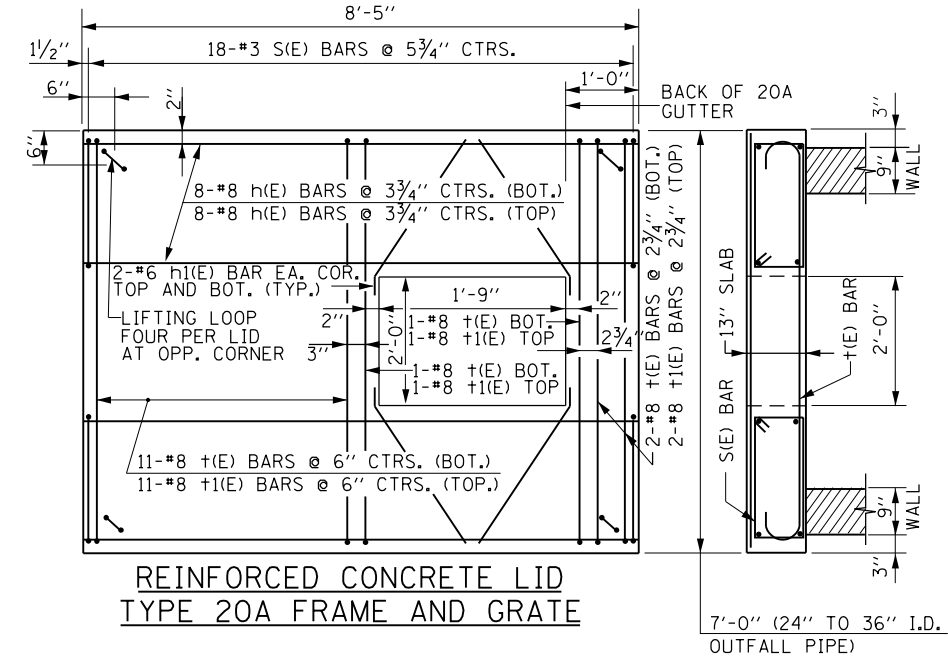
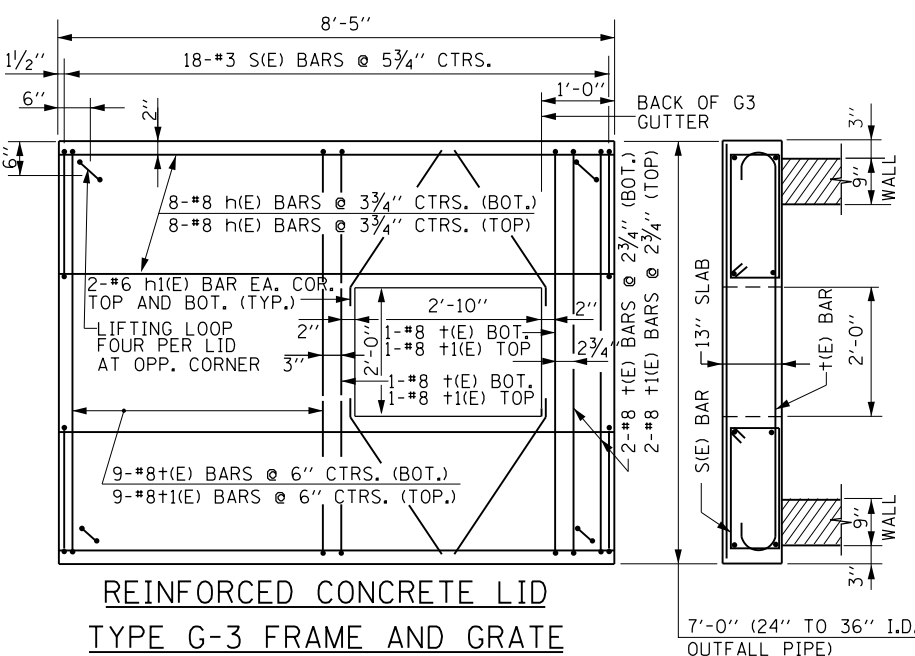
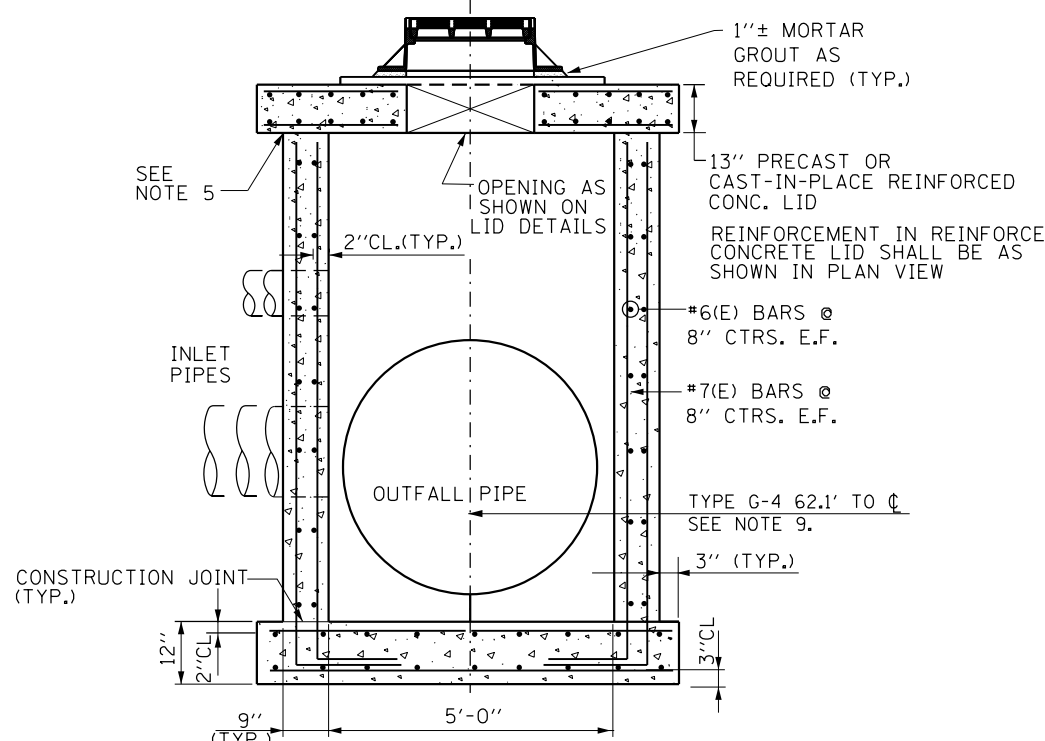
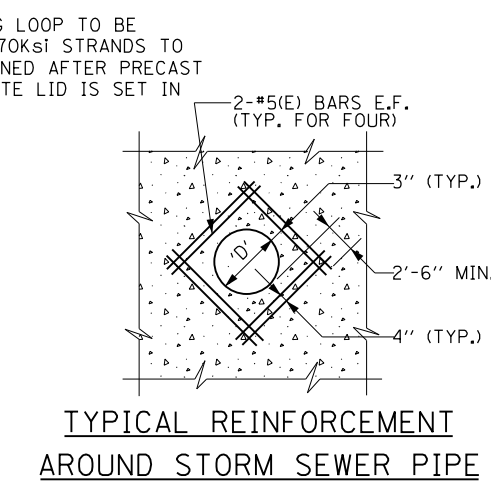
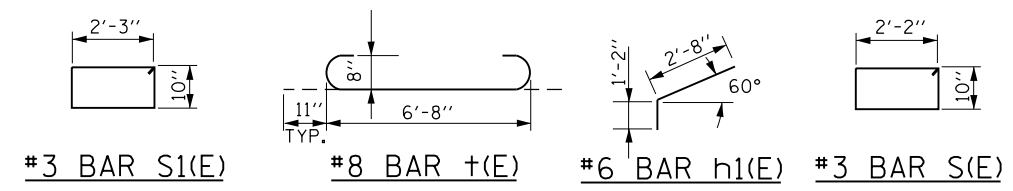
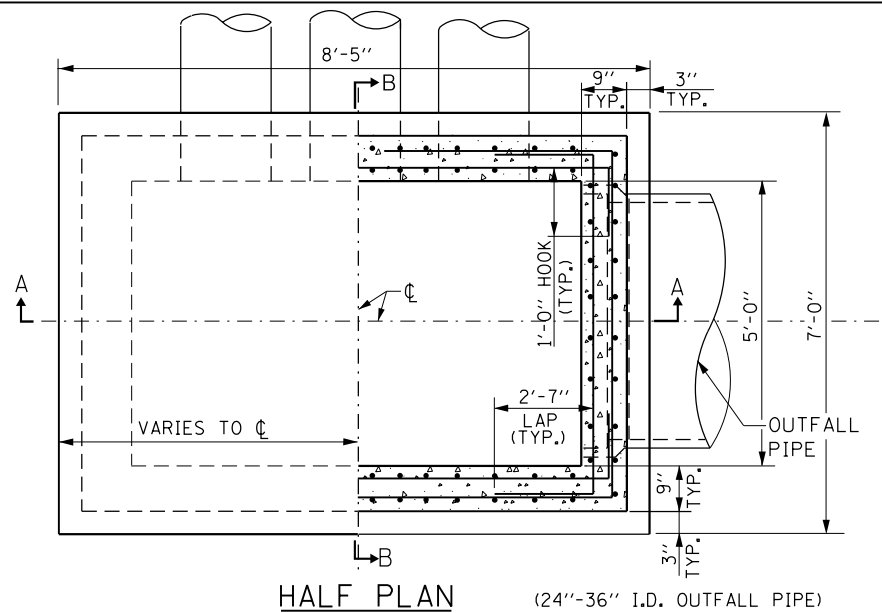
DATE	REVISIONS
6-01-2009	DELETE REINF. CONC. LID TYPE S FRAME & GRATE
2-07-2012	REVISED REINFORCEMENT BARS
11-01-2012	ADDED TYPE G-2, MODIFIED FRAME AND GRATE
	MODIFIED PIPE BELL DETAIL
3-31-2014	ADDED FRAME AND GRATE CASTINGS
3-11-2015	REVISED NOTES AND ADDED CATCH BASIN TYPE G-4 AND TYPE G-5

SHEET 1 OF 4

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

STANDARD B8-05

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



CATCH BASIN TYPE G-4

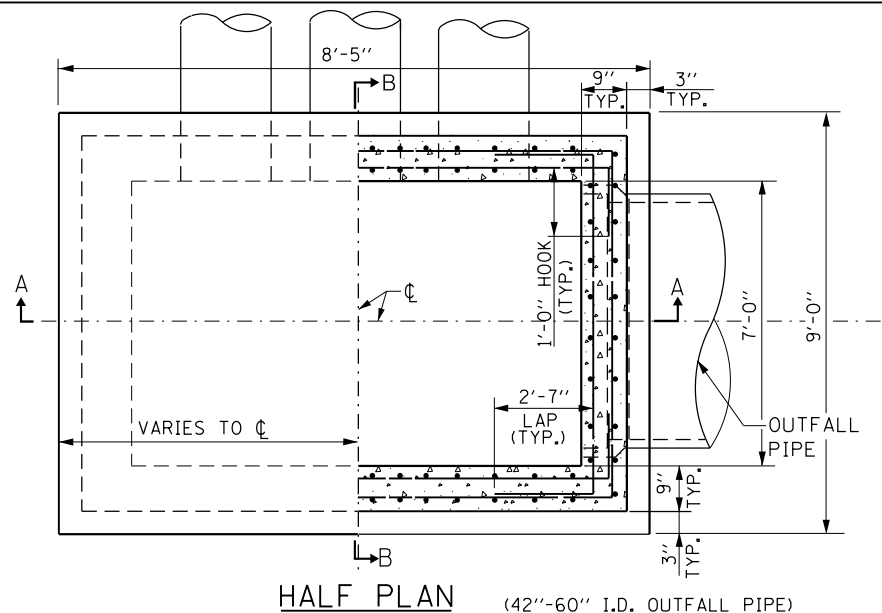
- NOTES:**
- SEE SHEET 1 OF THIS SERIES FOR ADDITIONAL NOTES.
 - CATCH BASINS TYPE G-4 SHALL BE USED IN TANGENT SECTIONS AND ON THE LOW SIDE OF SUPERELEVATED PAVEMENT.
 - CATCH BASINS TYPE G-4 SHALL BE PROVIDED WITH A REINFORCED CONCRETE SLAB TOP AS DETAILED ON THIS DRAWING.
 - CATCH BASINS TYPE G-4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



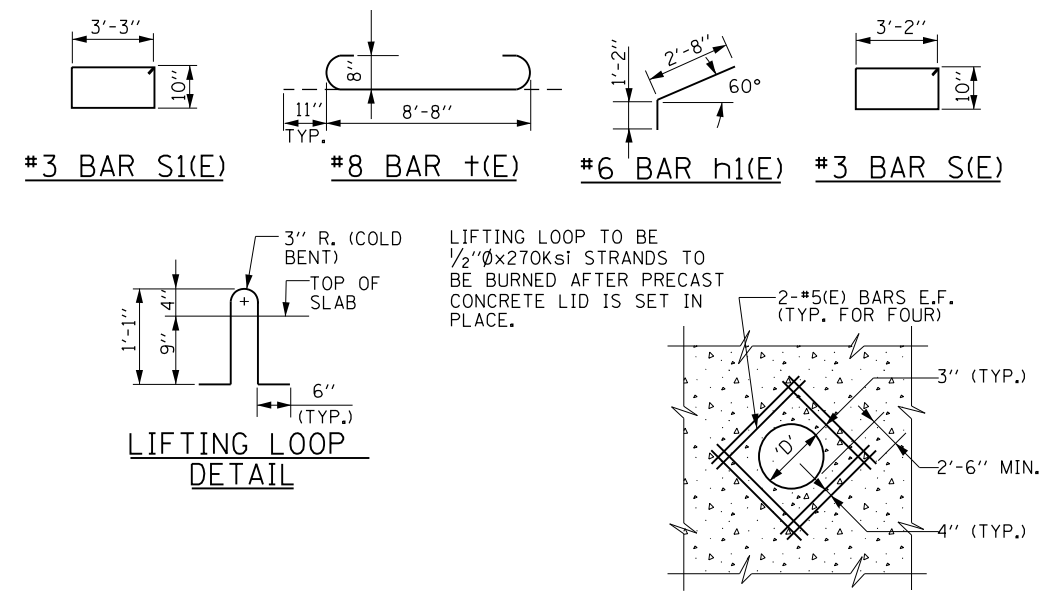
CATCH BASINS TYPE G AND TYPE G MODIFIED, FRAMES AND GRATES

STANDARD B8-05

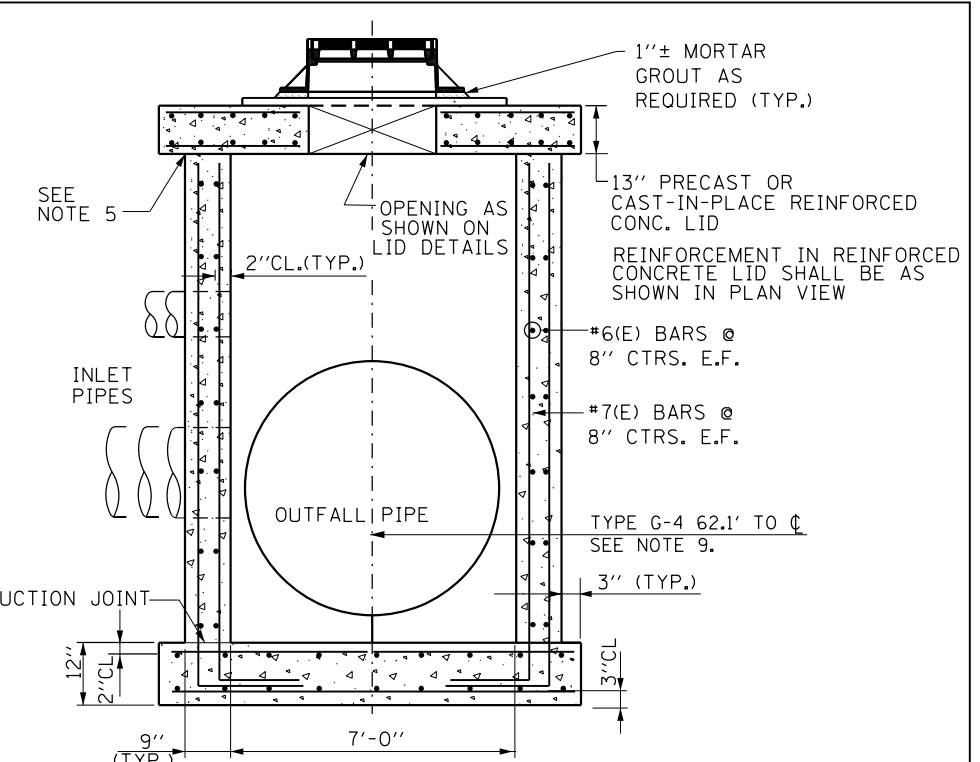
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 6-1-2009



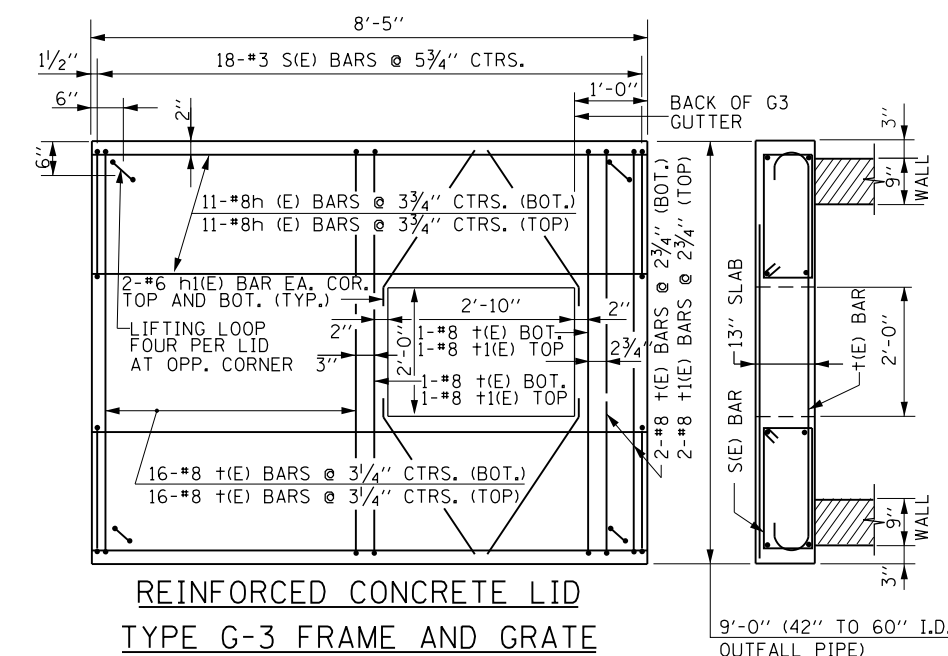
HALF PLAN (42"-60" I.D. OUTFALL PIPE)



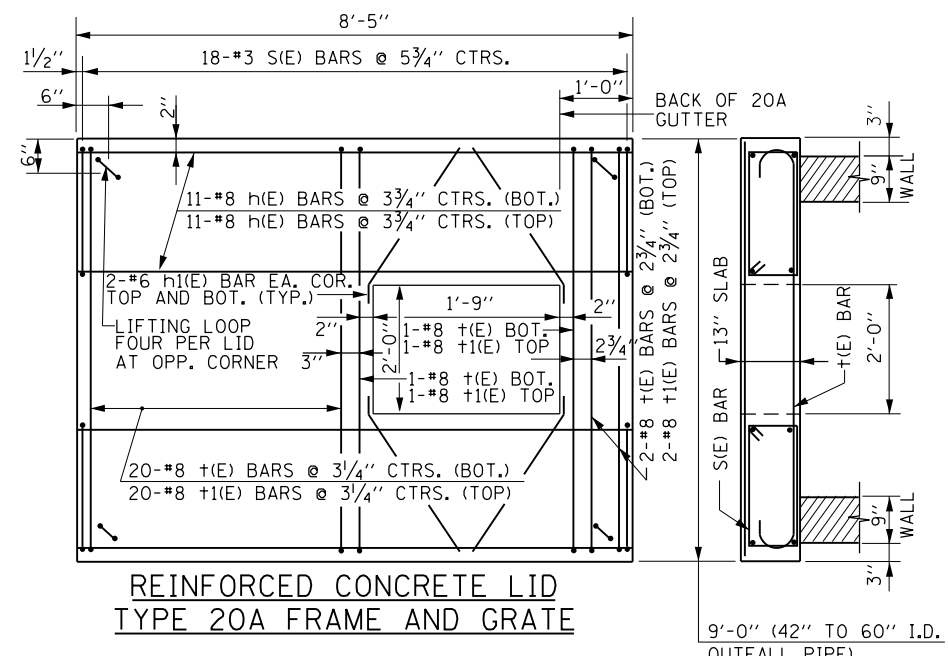
TYPICAL REINFORCEMENT AROUND STORM SEWER PIPE



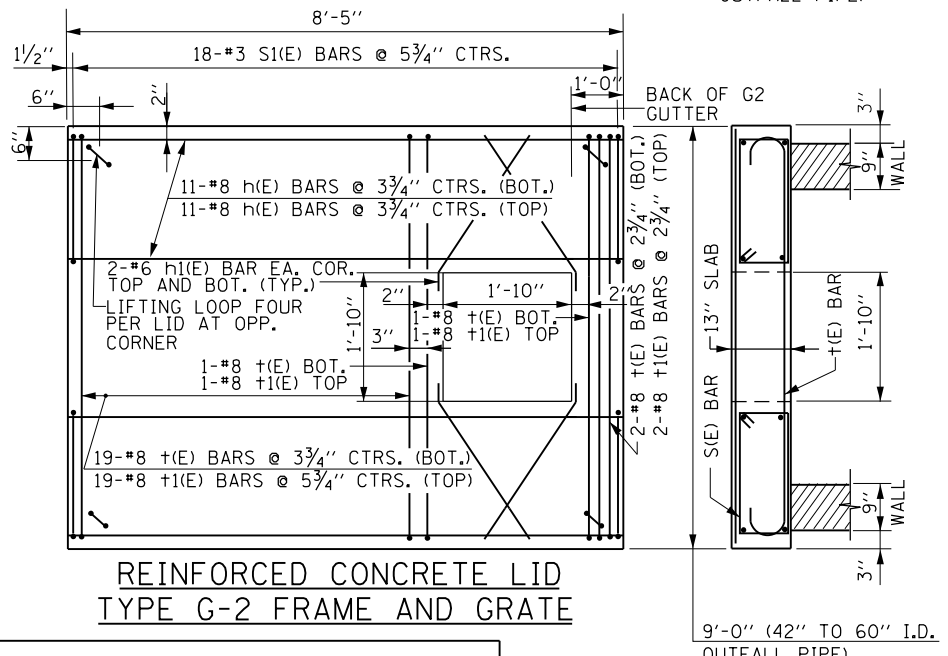
SECTION B-B



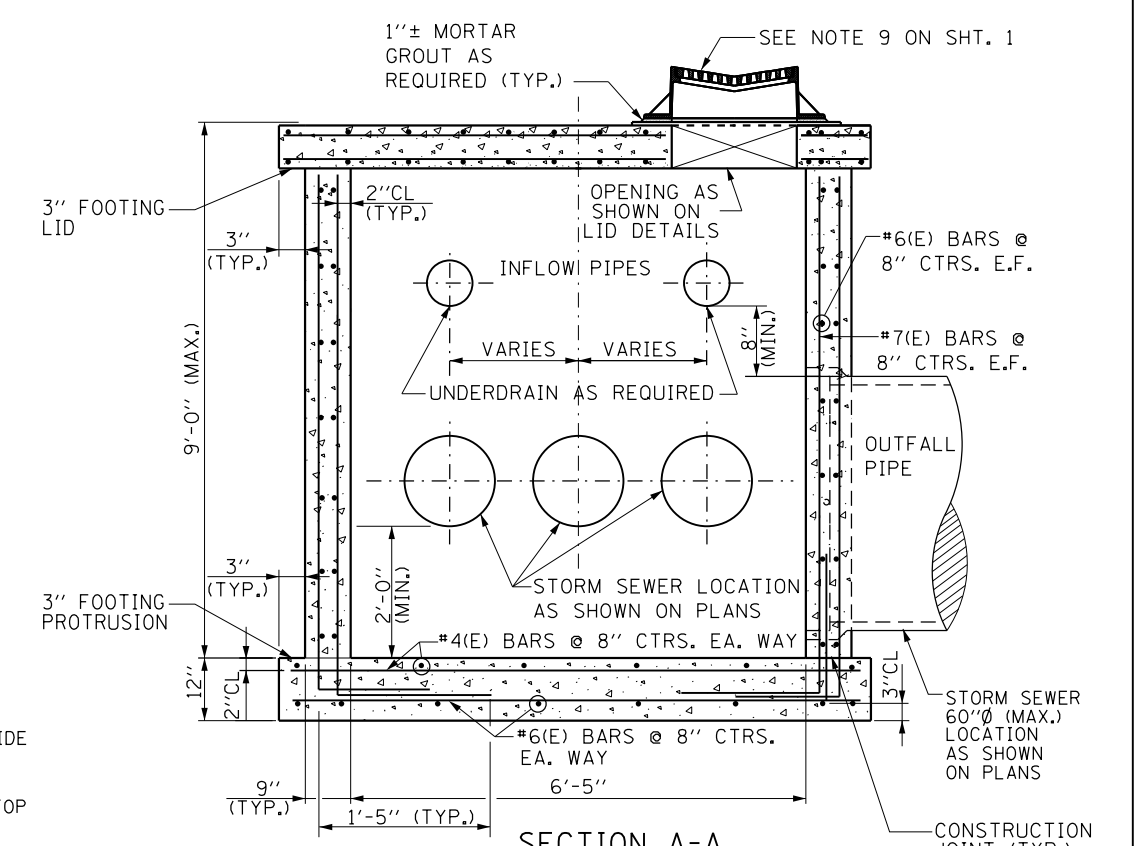
REINFORCED CONCRETE LID TYPE G-3 FRAME AND GRATE



REINFORCED CONCRETE LID TYPE 20A FRAME AND GRATE



REINFORCED CONCRETE LID TYPE G-2 FRAME AND GRATE



SECTION A-A

CATCH BASIN TYPE G-5

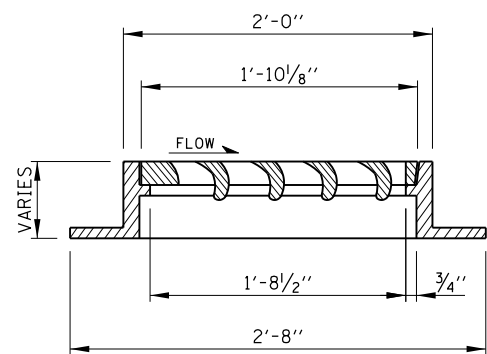
- NOTES:
- SEE SHEET 1 OF THIS SERIES FOR ADDITIONAL NOTES.
 - CATCH BASINS TYPE G-5 SHALL BE USED IN TANGENT SECTIONS AND ON THE LOW SIDE OF SUPERELEVATED PAVEMENT.
 - CATCH BASINS TYPE G-5 SHALL BE PROVIDED WITH A REINFORCED CONCRETE SLAB TOP AS DETAILED ON THIS DRAWING.
 - CATCH BASINS TYPE G-5 SHALL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



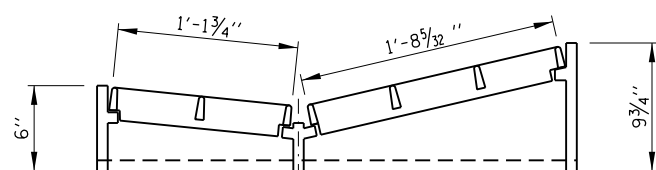
CATCH BASINS TYPE G AND TYPE G MODIFIED, FRAMES AND GRATES

STANDARD B8-05

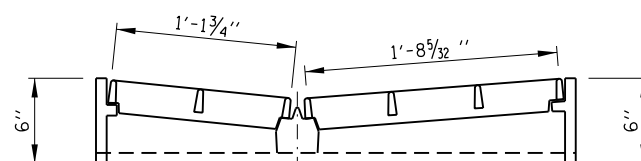
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 6-1-2009



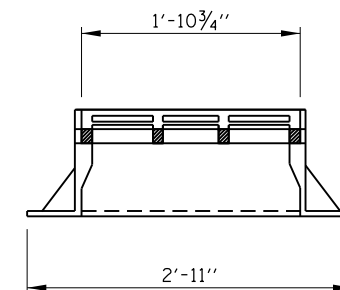
SECTION T-T



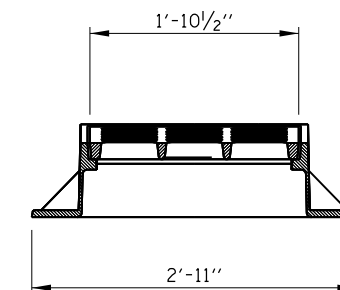
SECTION U-U



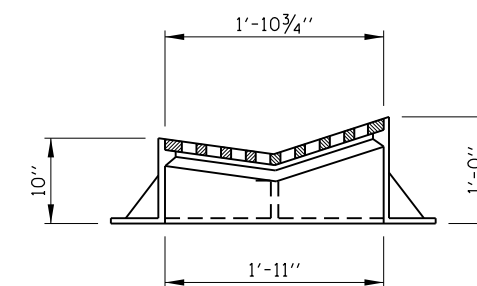
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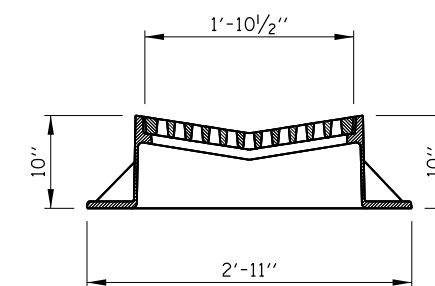
SECTION Y-Y



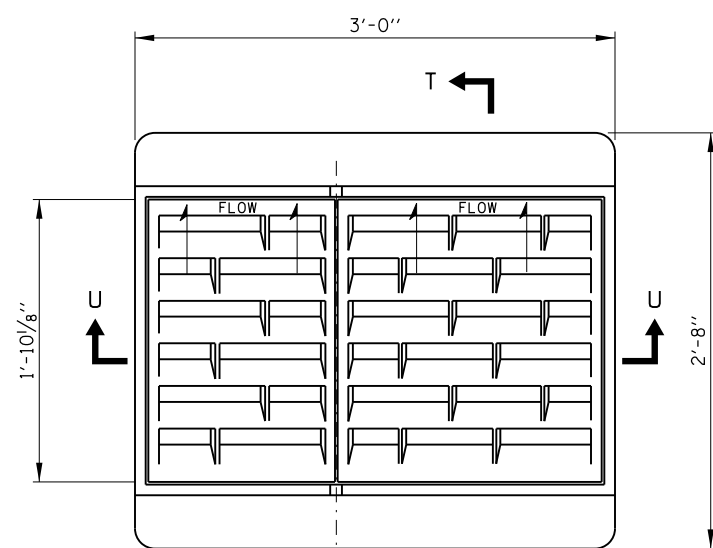
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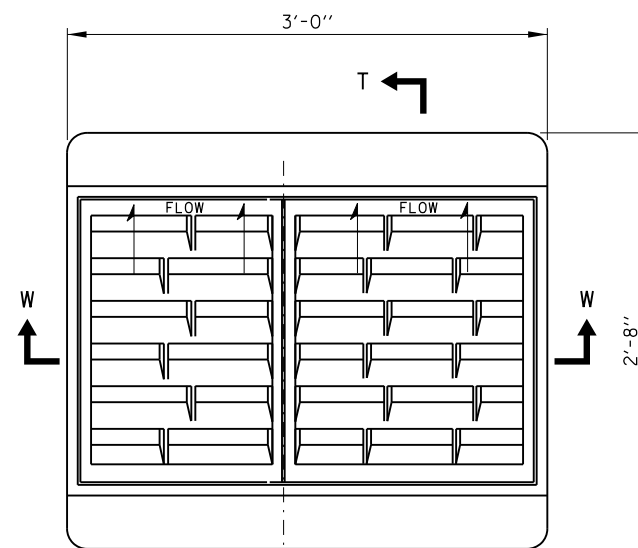
SECTION Z-Z



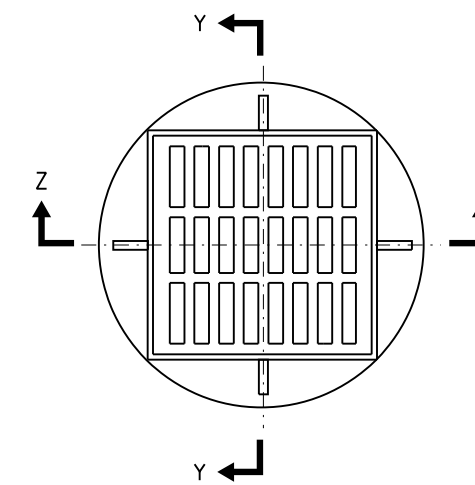
SECTION V-V



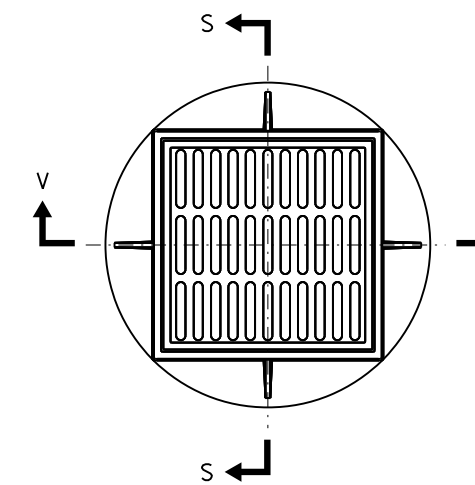
TYPE G-3 FRAME & GRATE



TYPE G-3, MODIFIED
FRAME & GRATE



TYPE G-2 FRAME & GRATE



TYPE G-2 MODIFIED
FRAME & GRATE

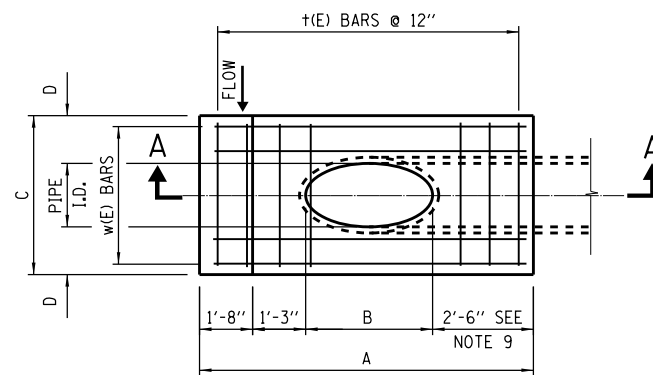
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 6-1-2009

NOTE:
SEE SHEET 1 OF THIS SERIES FOR NOTES.

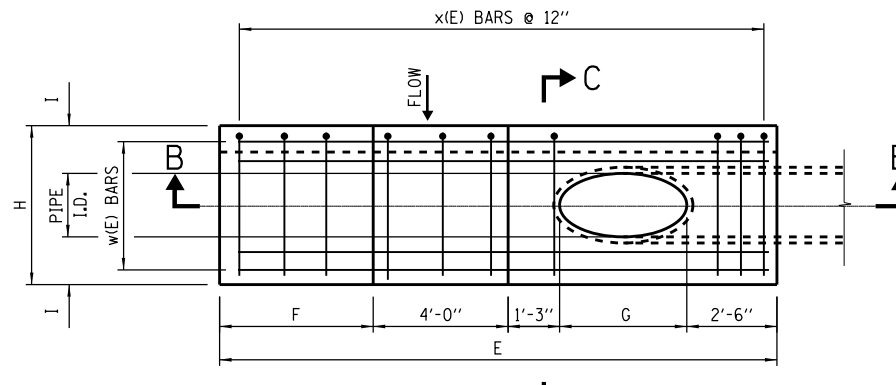


CATCH BASINS TYPE G AND
TYPE G MODIFIED, FRAMES
AND GRATES

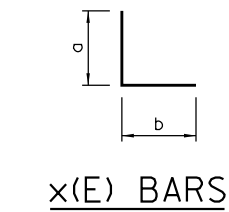
STANDARD B8-05



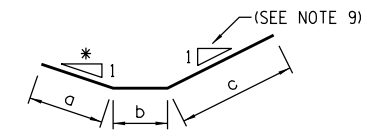
PLAN I



PLAN II

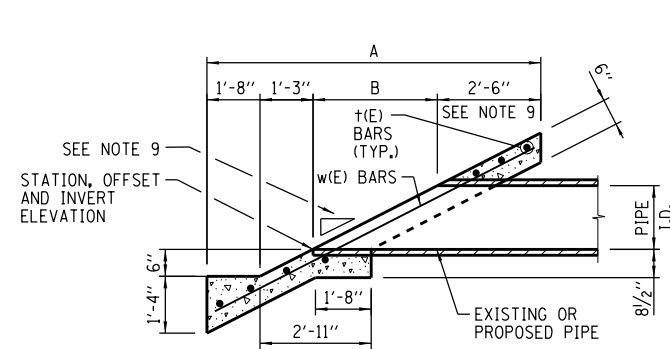


x(E) BARS

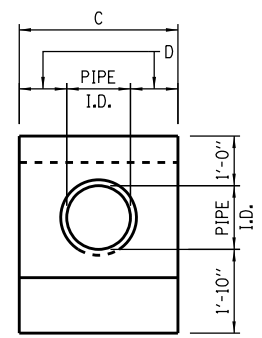


w(E) BARS

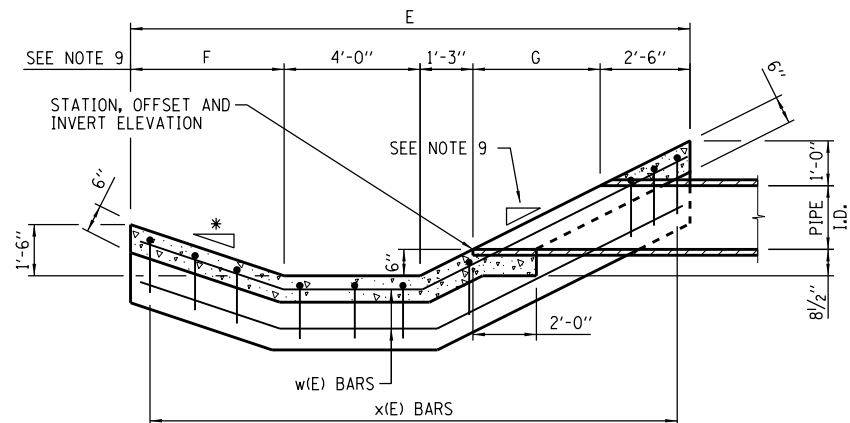
- NOTES:
1. SLOPED HEADWALL TYPES I AND II SHALL BE CONSTRUCTED FLUSH WITH EXISTING OR PROPOSED SLOPE.
 2. CLASS SI CONCRETE SHALL BE USED THROUGHOUT.
 3. ALL REINFORCEMENT BARS SHOWN SHALL BE EPOXY COATED (E).
 4. BAR BENDING DETAILS ARE DIMENSIONED OUT TO OUT OF BARS.
 5. ALL EXPOSED EDGES SHALL HAVE 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.



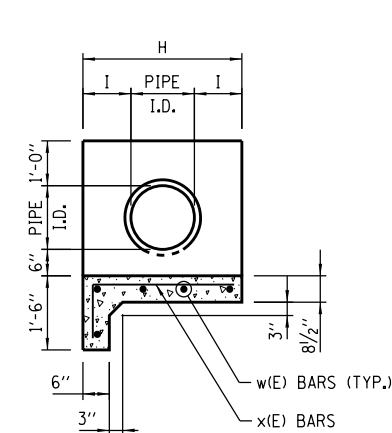
SECTION A-A



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

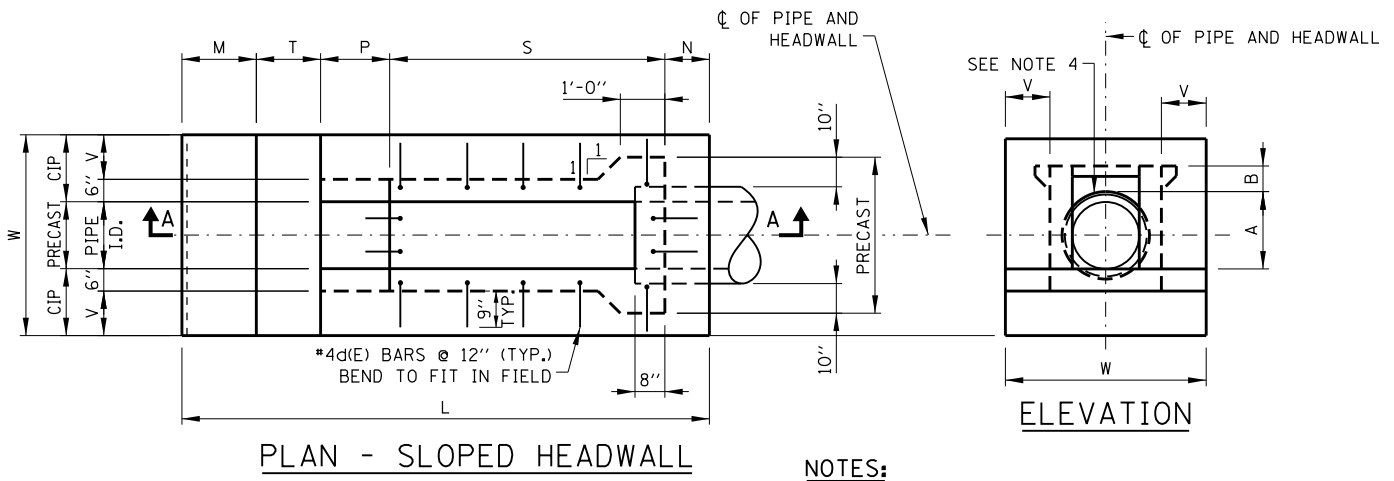
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 2-7-2012

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

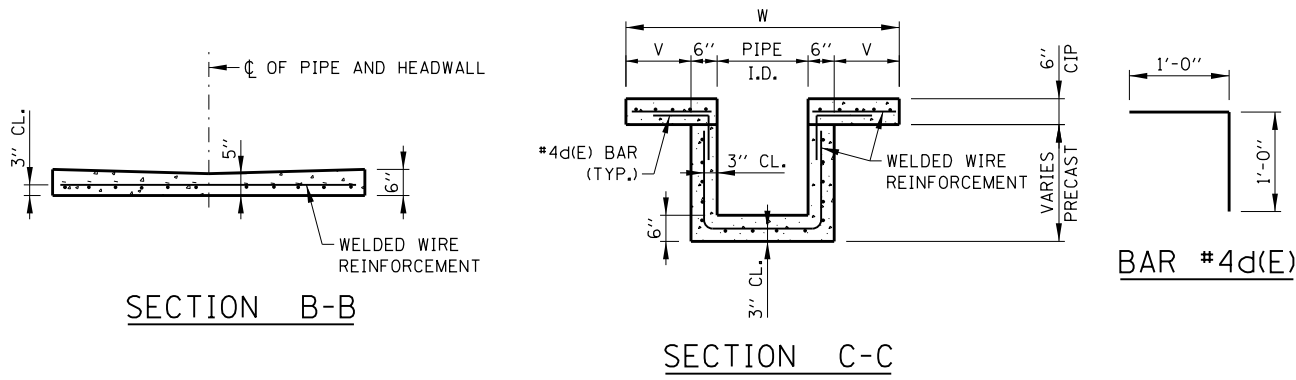
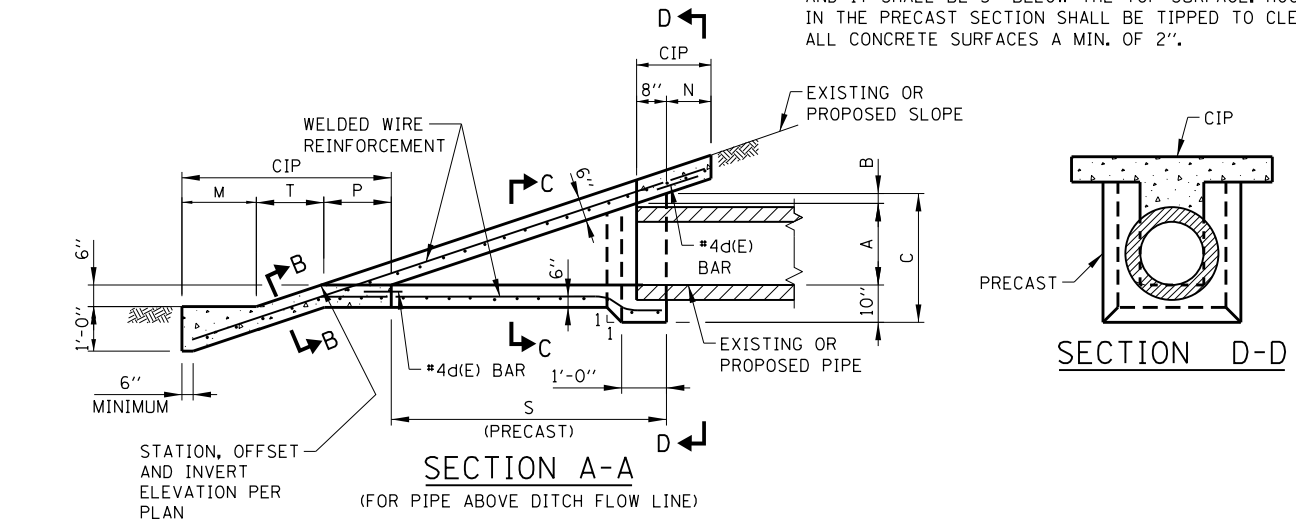
SLOPED HEADWALLS TYPE I AND TYPE II

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".



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
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
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
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

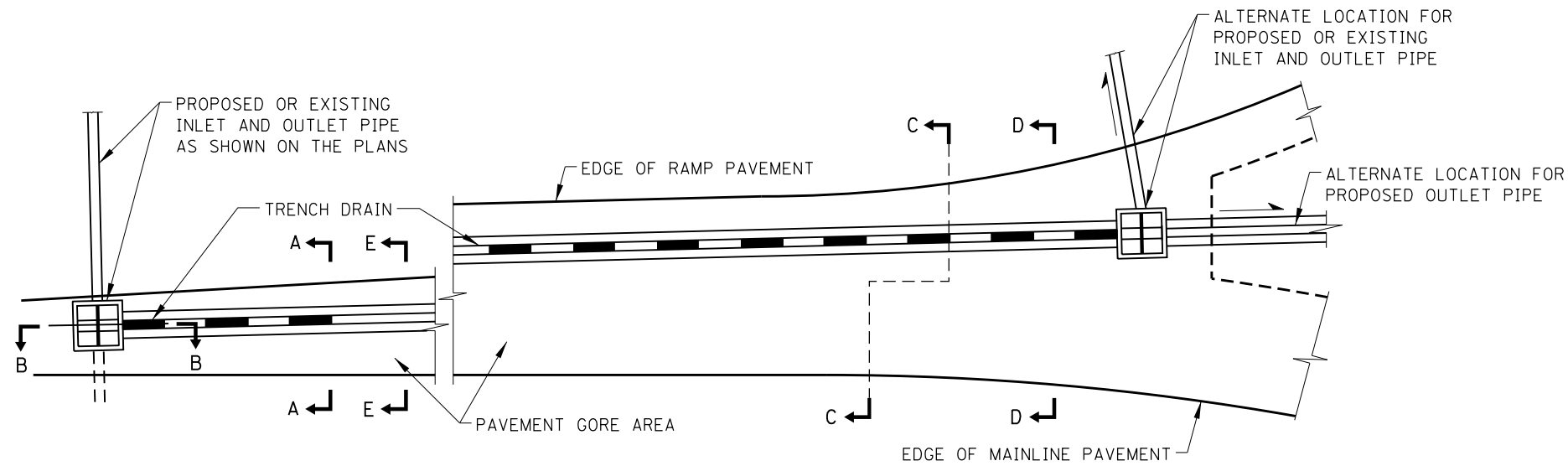
- NOTES:**
- THE CAST IN PLACE (CIP) SLOPED HEADWALL SHALL BE CONSTRUCTED FLUSH WITH EXISTING OR PROPOSED SLOPE.
 - CLASS SI CONCRETE SHALL BE USED THROUGHOUT.
 - WELDED WIRE REINFORCEMENT SHALL BE EPOXY COATED 6x6-W4xW4, 58 LBS. PER 100 SQ.FT.
 - ALL REINFORCEMENT BARS SHOWN SHALL BE EPOXY COATED (E).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

Paul Kovacs
APPROVED CHIEF ENGINEER DATE 2-7-2012

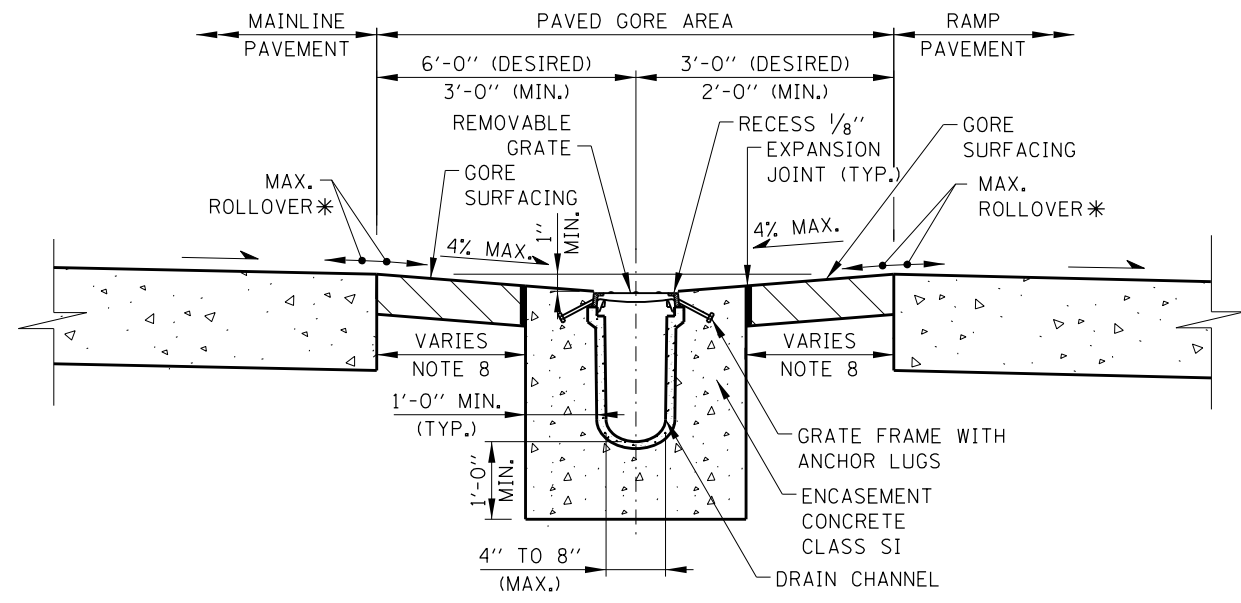
DATE	REVISIONS
3-31-2014	REVISED QUANTITIES
3-11-2015	REVISED TABLES AND SECTIONS
3-31-2016	CHANGED TERMINOLOGY TO WELDED WIRE REINFORCEMENT
3-31-2017	REVISED TABLE (L)

**SLOPED HEADWALLS
TYPE III DETAILS**

STANDARD B10-09



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

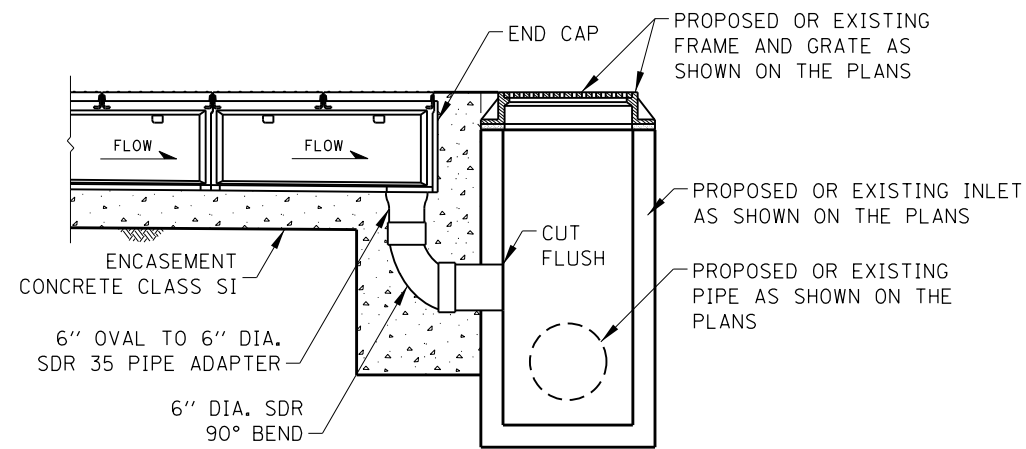


TRENCH DRAIN DETAIL

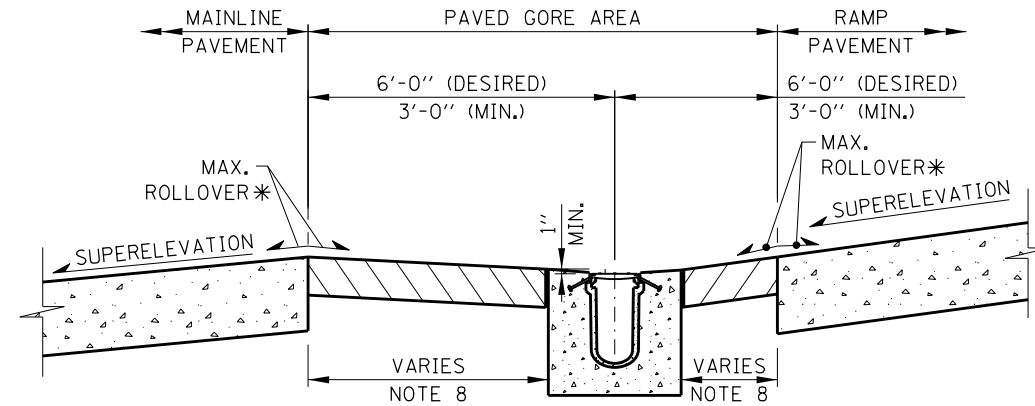
STANDARD B12-07

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.

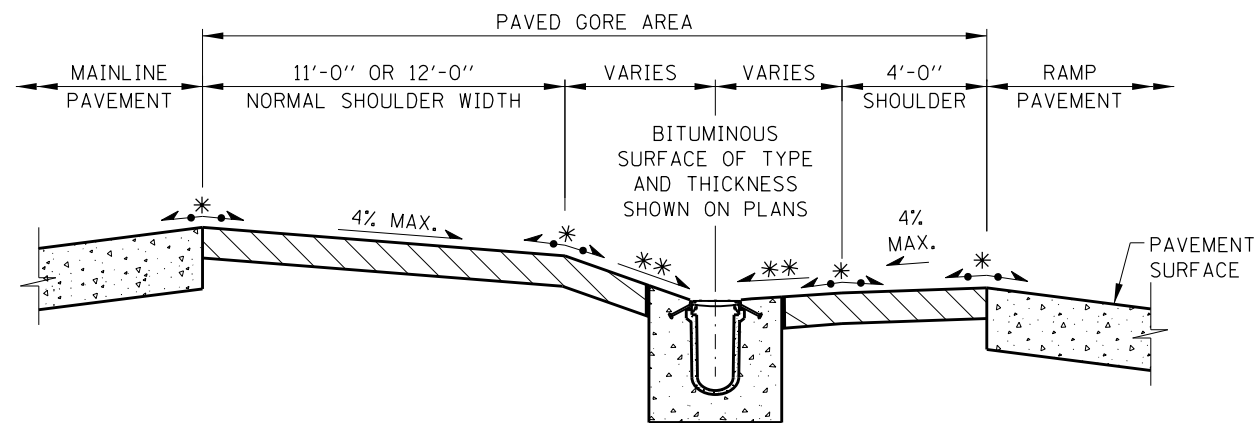
APPROVED: *Paul Kovacs*
CHIEF ENGINEERING OFFICER DATE: 1-1-2011



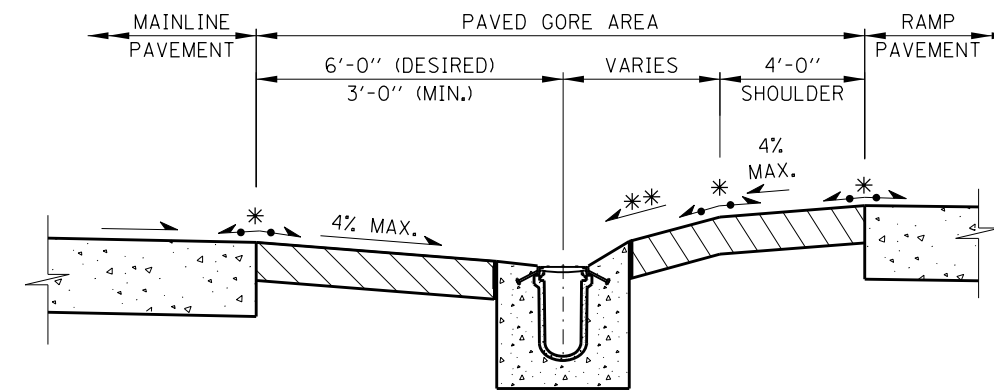
SECTION B-B
PIPE OUTLET TO DRAINAGE STRUCTURE



SECTION E-E
RAMP ON OUTSIDE OF
SUPERELEVATED MAINLINE SECTION



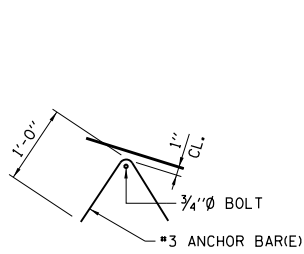
SECTION D-D



SECTION C-C

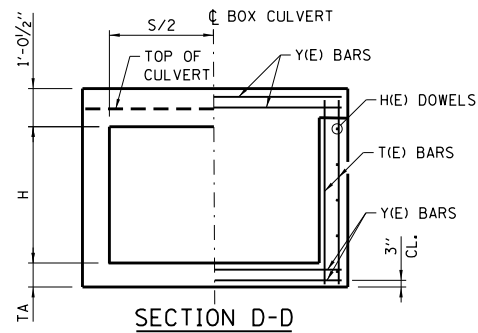
NOTE:
SEE SHEET 1 OF THIS SERIES FOR NOTES.

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

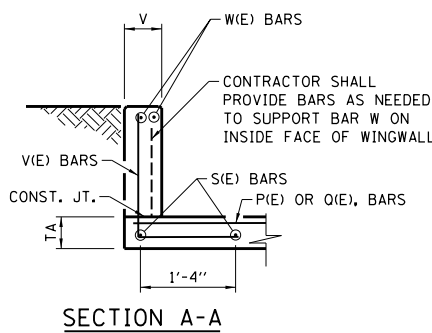


ANCHOR BARS
CONTRACTOR SHALL PROVIDE 2-#3 ANCHOR BARS(E) PER SIDEWALL BOLT.

DETAIL B

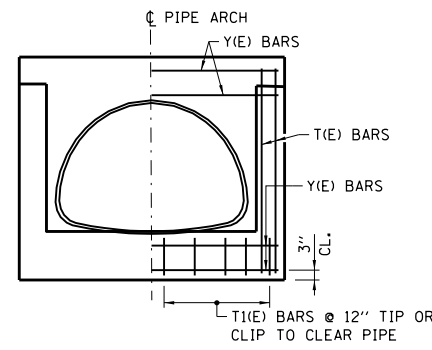


SECTION D-D

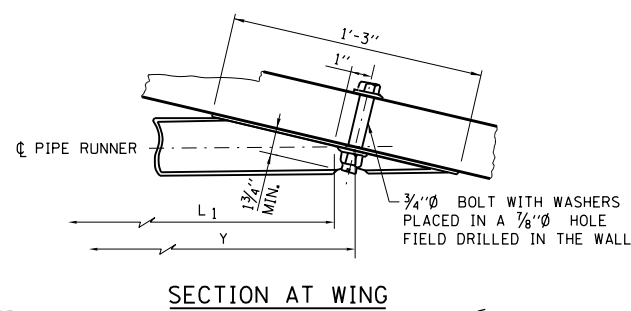


SECTION A-A

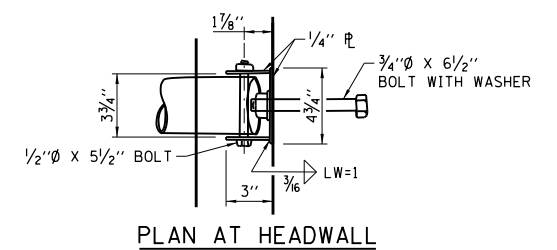
NOTE:
J & H, DOWEL BARS NOT REQUIRED WITH EXISTING BOX CULVERTS PROVIDING THE REINFORCING FROM THE EXISTING BOX IS EXTENDED INTO THE NEW CONCRETE A MINIMUM OF 1'-3".



SECTION B-B



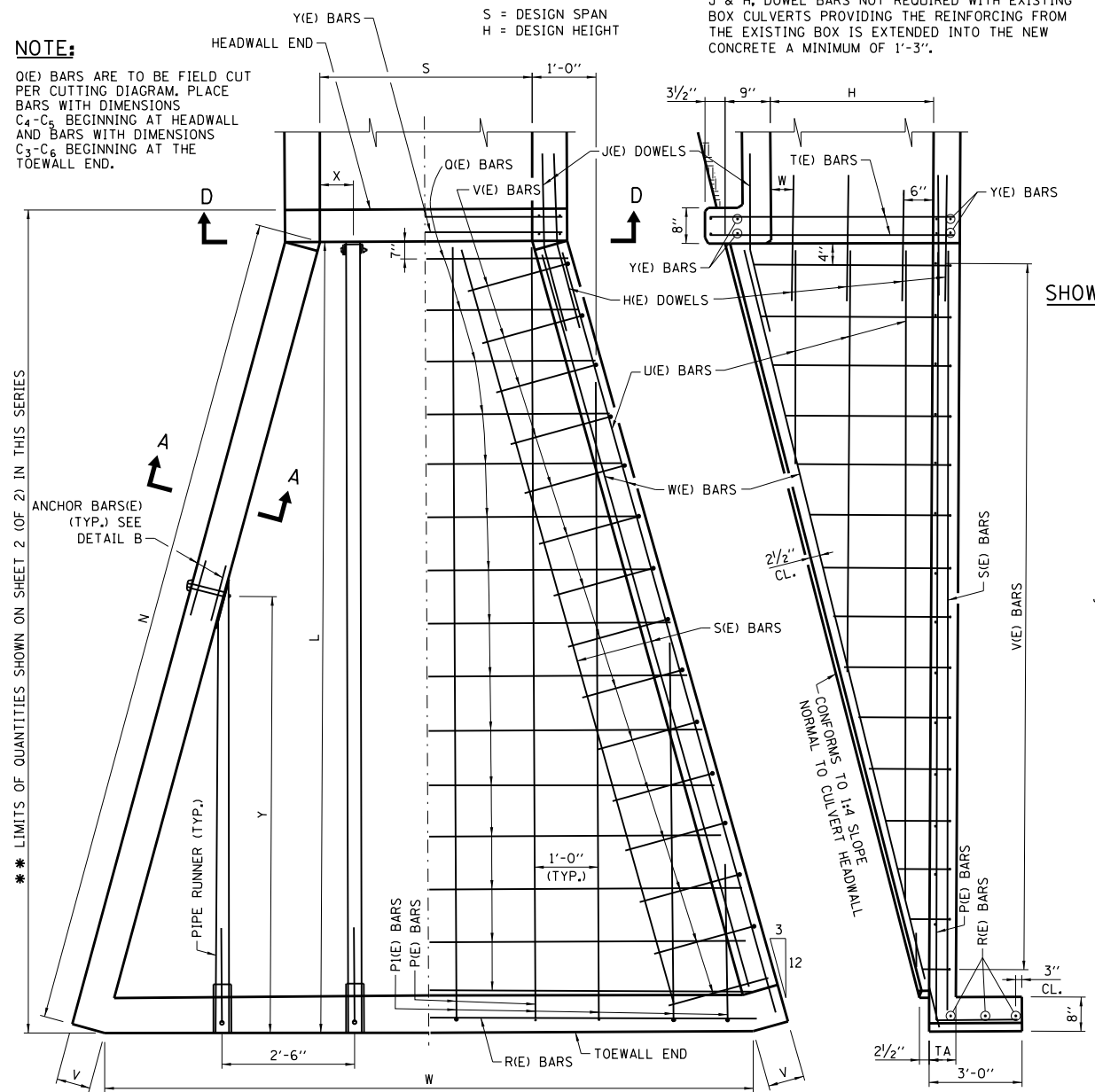
SECTION AT WING



PLAN AT HEADWALL

NOTE:
A 3/4" x 9 1/2" BOLT WITH ADDITIONAL W WASHER PLACED IN A 7/8" 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 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.

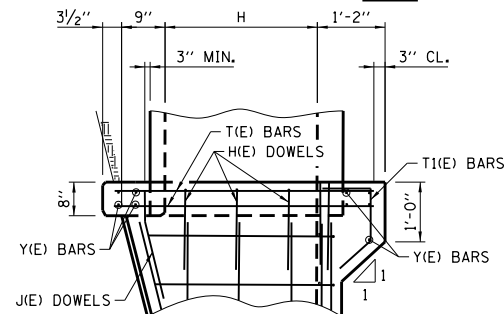


HALF PLAN SHOWING DIMENSIONS

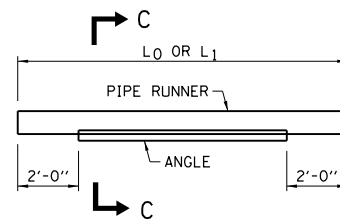
HALF PLAN SHOWING REINFORCEMENT BARS
BOX CULVERT DETAILS

ELEVATION PARALLEL TO BARREL

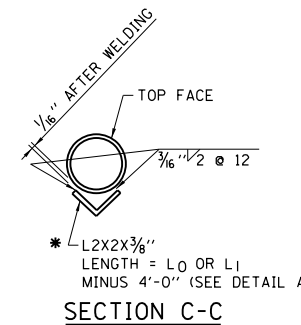
HALF PLAN SHOWING DIMENSIONS
HALF PLAN SHOWING REINFORCEMENT BARS



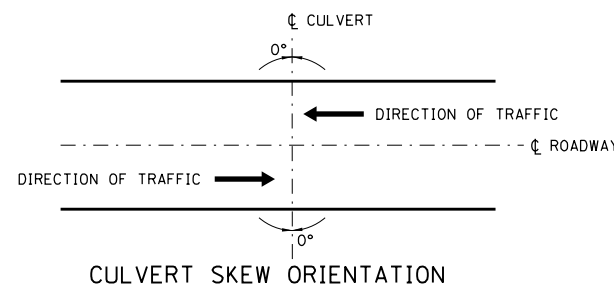
ELEVATION PIPE ARCH DETAILS



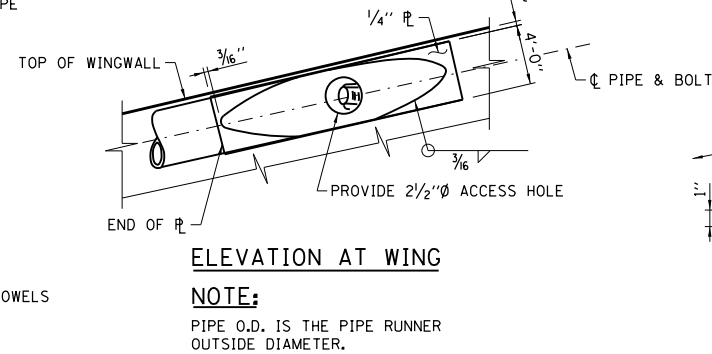
DETAIL A
PIPE RUNNER DETAILS



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

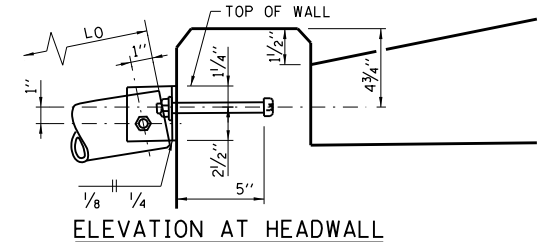


CULVERT SKEW ORIENTATION

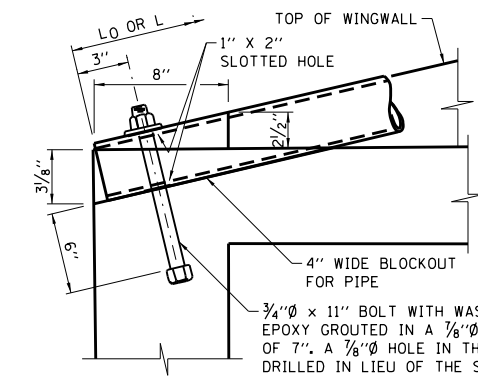


ELEVATION AT WING

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).

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

Paul Kovacs
APPROVED CHIEF ENGINEER DATE 6-1-2009



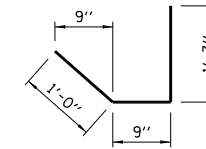
DATE	REVISIONS	SAFETY END TREATMENT FOR SINGLE CULVERTS 0° SKEW 1:4 SLOPE H ≤ 4' STANDARD B13-05
06-01-09	REVISED NOTES	
03-01-10	REVISED EROSION PROTECTION AND NOTES	
02-07-12	TABLE QUANTITIES REVISED	
03-31-14	TABLE QUANTITIES REVISED	
3-11-2015	REVISED NOTES	

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 ₀	NO.	L ₁
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)



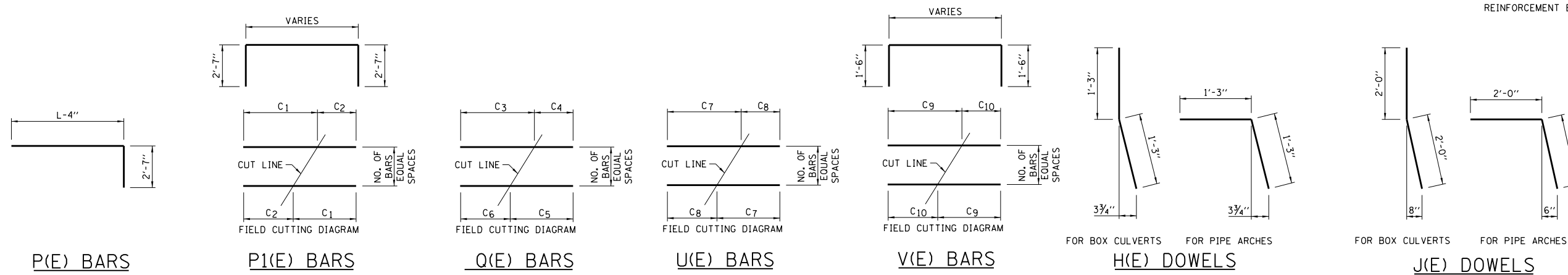
T1(E) BARS

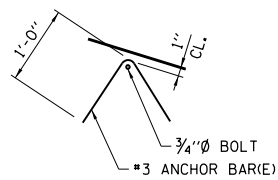
THE WEIGHT OF THE ADDITIONAL BARS AND THE ADDITIONAL QUANTITY OF CONCRETE IN THE HEADWALL SHALL BE ADDED TO THE QUANTITIES SHOWN.

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 ₁	C ₂	LENGTH.	NO.	C ₃	C ₄	C ₅	C ₆	LENGTH.	LENGTH.	LENGTH.	NO.	C ₇	C ₈	LENGTH.	NO.	C ₉	C ₁₀	LENGTH.	SIZE	LENGTH.	LENGTH.	LENGTH.	LENGTH.
3 x 2	6	2'-6"	4	4'-0"	4	13'-1"	2	8'-4"	4'-4"	17'-10"	5	8'-8"	4'-2"	6'-2"	6'-8"	12'-10"	8'-9"	10'-10"	2	8'-7"	4'-5"	13'-0"	10	2'-9"	6"	6'-3"	#5	10'-4"	3'-8"	3'-2"	3'-8"
3 x 3	8	2'-6"	4	4'-0"	4	17'-1"	3	12'-4"	4'-4"	21'-10"	7	10'-8"	4'-2"	7'-2"	7'-8"	14'-10"	10'-9"	15'-0"	3	12'-8"	4'-5"	17'-1"	14	3'-9"	6"	7'-3"	#5	14'-6"	3'-8"	4'-2"	4'-8"
4 x 2	6	2'-6"	4	4'-0"	5	13'-1"	2	8'-4"	4'-4"	17'-10"	5	9'-8"	5'-2"	7'-2"	7'-8"	14'-10"	9'-9"	10'-10"	2	8'-7"	4'-5"	13'-0"	10	2'-9"	6"	6'-3"	#5	10'-4"	4'-8"	3'-2"	3'-8"
4 x 3	8	2'-6"	4	4'-0"	5	17'-1"	3	12'-4"	4'-4"	21'-10"	7	11'-8"	5'-2"	8'-2"	8'-8"	16'-10"	11'-9"	15'-0"	3	12'-8"	4'-5"	17'-1"	14	3'-9"	6"	7'-3"	#5	14'-6"	4'-8"	4'-2"	4'-8"
4 x 4	10	2'-6"	4	4'-0"	5	21'-1"	4	16'-4"	4'-4"	25'-10"	9	13'-8"	5'-2"	9'-2"	9'-8"	18'-10"	13'-9"	19'-1"	4	16'-9"	4'-5"	21'-2"	18	4'-9"	6"	8'-3"	#6	18'-7"	4'-8"	5'-2"	5'-8"
5 x 2	6	2'-6"	4	4'-0"	6	13'-1"	2	8'-4"	4'-4"	17'-10"	5	10'-8"	6'-2"	8'-2"	8'-8"	16'-10"	10'-9"	10'-10"	2	8'-7"	4'-5"	13'-0"	10	2'-9"	6"	6'-3"	#5	10'-4"	5'-8"	3'-2"	3'-8"
5 x 3	8	2'-6"	4	4'-0"	6	17'-1"	3	12'-4"	4'-4"	21'-10"	7	12'-8"	6'-2"	9'-2"	9'-8"	18'-10"	12'-9"	15'-0"	3	12'-8"	4'-5"	17'-1"	14	3'-9"	6"	7'-3"	#5	14'-6"	5'-8"	4'-2"	4'-8"
5 x 4	10	2'-6"	4	4'-0"	6	21'-1"	4	16'-4"	4'-4"	25'-10"	9	14'-8"	6'-2"	10'-2"	10'-8"	20'-10"	14'-9"	19'-1"	4	16'-9"	4'-5"	21'-2"	18	4'-9"	6"	8'-3"	#6	18'-7"	5'-8"	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.





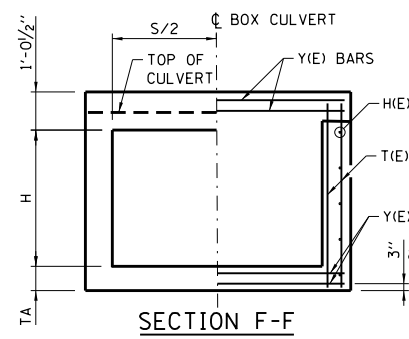
ANCHOR BARS

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

DETAIL B

NOTE:

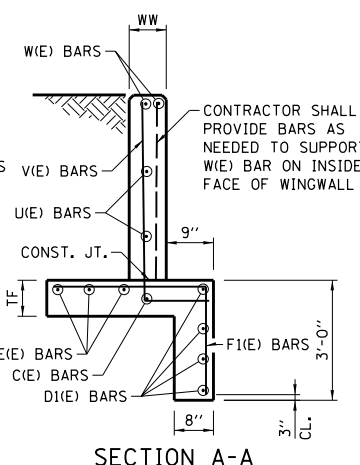
F & V BAR TO BE FIELD CUT PER CUTTING DIAGRAM. PLACE BARS WITH DIMENSIONS C2, C6 BEGINNING AT HEADWALL & BARS WITH DIMENSIONS C1, C5 BEGINNING AT THE TOEWALL END.



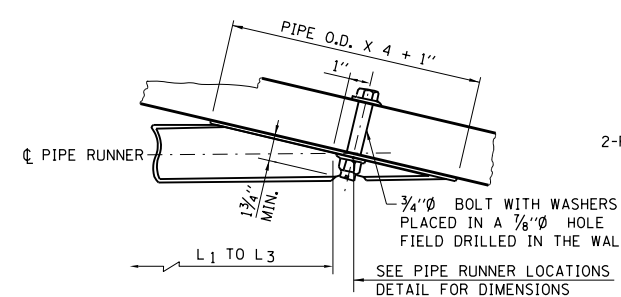
SECTION F-F

NOTE:

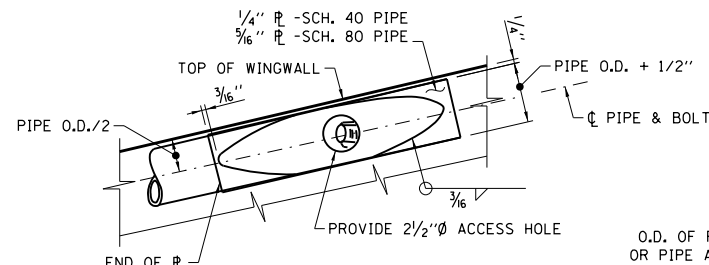
J & H, DOWEL BARS NOT REQUIRED WITH EXISTING BOX CULVERTS PROVIDING THE REINFORCING FROM THE EXISTING BOX IS EXTENDED INTO THE NEW CONCRETE A MINIMUM OF 1'-3".



SECTION A-A

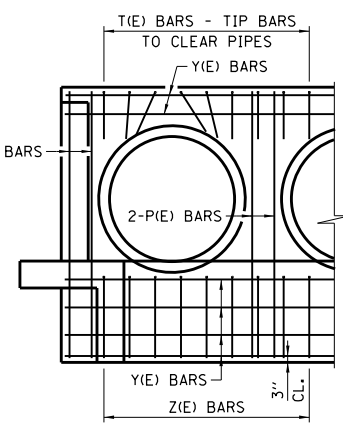


SECTION AT WING

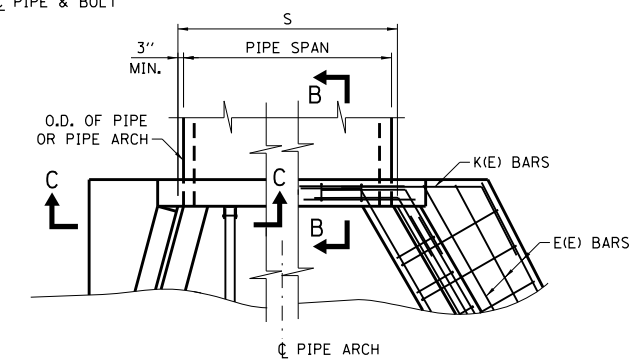


ELEVATION AT WING

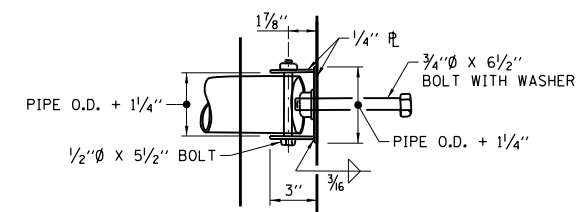
NOTE: PIPE O.D. IS THE PIPE RUNNER OUTSIDE DIAMETER.



SECTION C-C



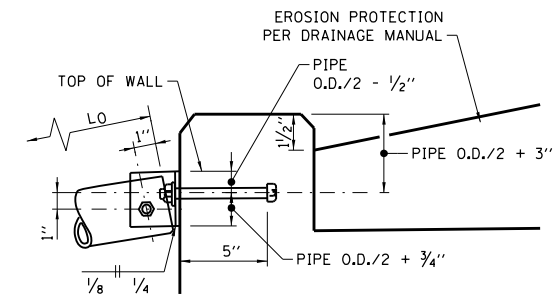
HALF PLAN SHOWING DIMENSIONS HALF PLAN SHOWING REINFORCEMENT BARS



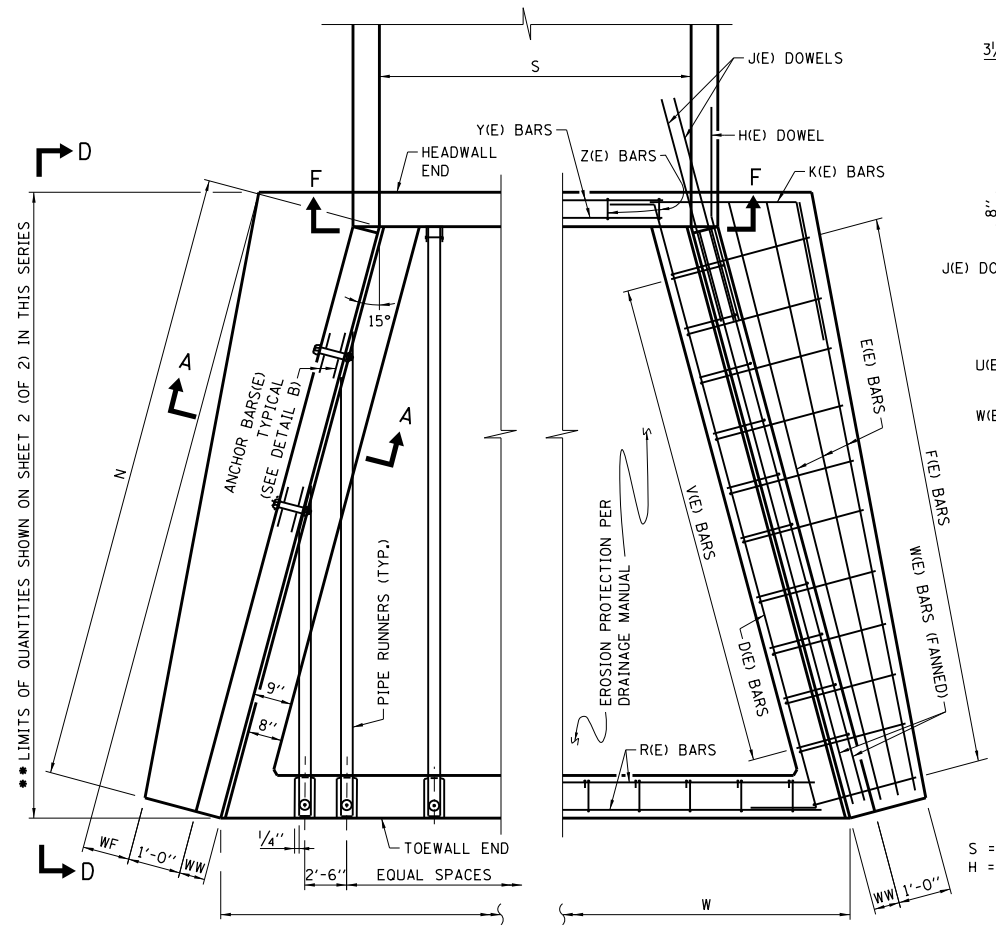
PLAN AT HEADWALL

NOTE:

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



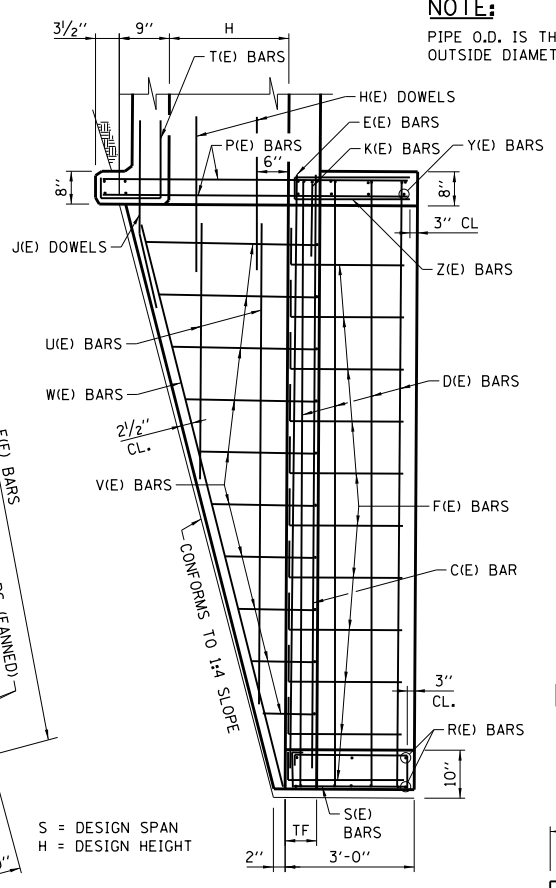
ELEVATION AT HEADWALL



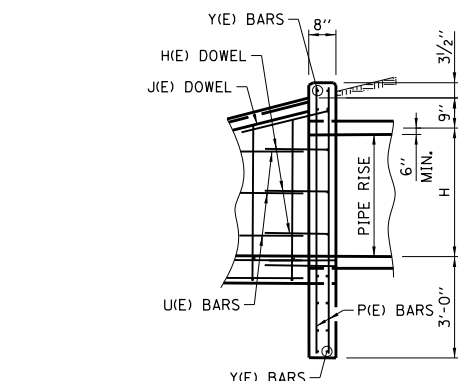
HALF PLAN SHOWING DIMENSIONS

HALF PLAN SHOWING REINFORCEMENT BARS

FOR BOX CULVERTS

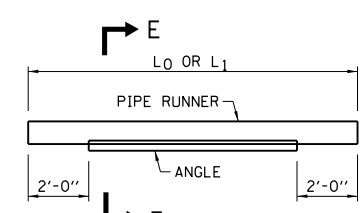


ELEVATION D-D

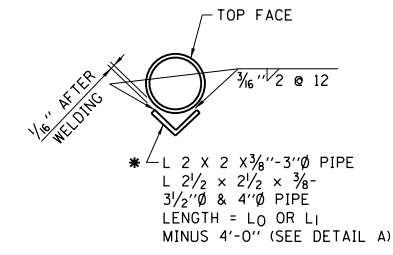


SECTION B-B

FOR PIPE AND PIPE-ARCH CULVERTS



DETAIL A



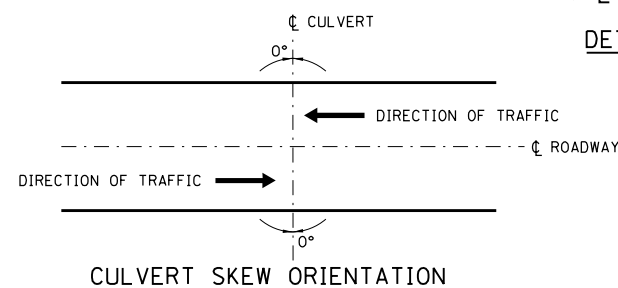
SECTION E-E

***NOTE:**

WHERE L0 OR L1 EXCEEDS THE FOLLOWING LENGTH, THE PIPE RUNNER SHALL BE STRENGTHENED OVER 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).

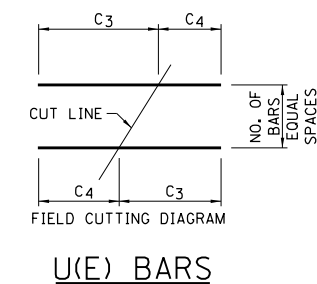


DATE	REVISIONS
3-01-2010	REVISED EROSION PROTECTION AND NOTES.
2-07-2012	TABLE QUANTITIES REVISED.
3-31-2014	TABLE QUANTITIES REVISED.
3-11-2015	REVISED NOTES.

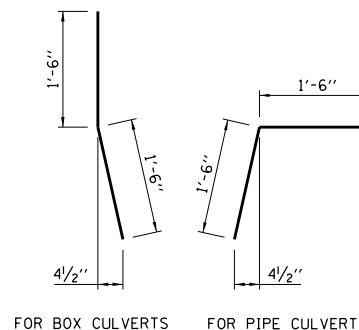
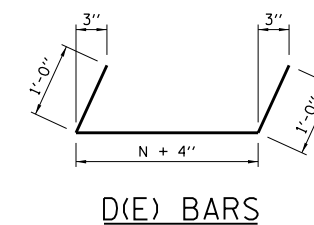
SAFETY END TREATMENT FOR SINGLE AND MULTIPLE CULVERTS
0° SKEW 1:4
SLOPE H ≤ 8'
STANDARD B14-05

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

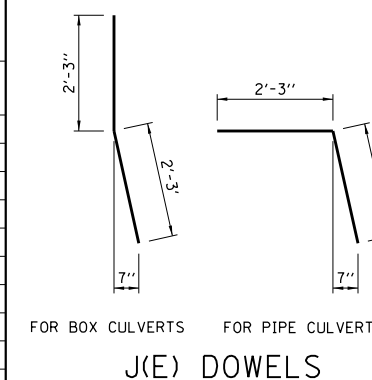
TABLE OF DIMENSIONS								TABLE OF REINFORCEMENT BARS FOR ONE END																							
S	H	L	WF	WW	TF	N	C(E) BARS 2 REOD.		D(E) BARS 8-#4		E(E) BARS #4 (5)		F(E) BARS			H(E) DOWEL #5 @ 12"		J(E) DOWEL 4-#6		K(E) DOWEL 2-#5		U(E) BARS #4 @ 12"			V(E) BARS #4 @ 12" CTS.				W(E) BARS 4 REOD.		
					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



PIPE RUNNERS FOR ONE END								
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 ¹ / ₂ "	40	4	18'-1"	8'-6"	--	53.16
6'	6'	3 ¹ / ₂ "	80	4	22'-3"	12'-7"	--	69.66
7'	7'	4"	40	6	26'-4"	16'-9"	7'-2"	100.50
8'	8'	4"	80	6	30'-6"	20'-10"	11'-7"	125.83



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 ₀	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 ¹ / ₂ "	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 ¹ / ₂ "	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

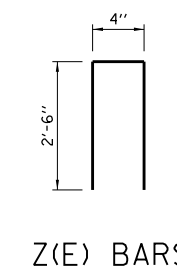
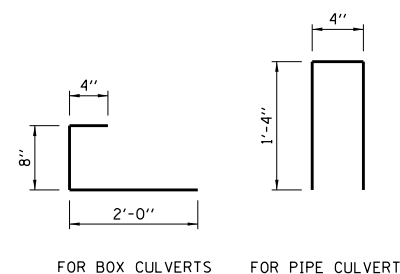
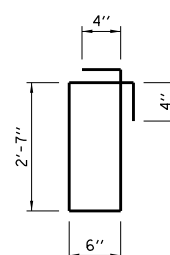
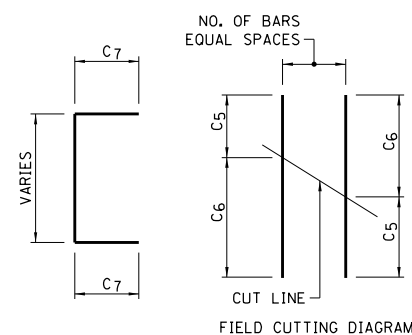
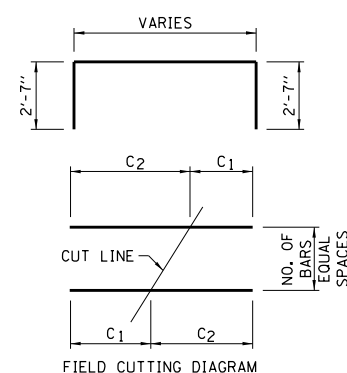


NUMBER OF HOWL PIPE RUNNERS FOR ONE END			
S	No	S	No
10'	4	23'	10
11'	5	24'	10
12'	5	25'	10
13'	6	26'	11
14'	6	27'	11
15'	6	28'	12
16'	7	29'	12
17'	7	30'	12
18'	8	31'	13
19'	8	32'	13
20'	8	33'	14
21'	9	34'	14
22'	9	35'	14

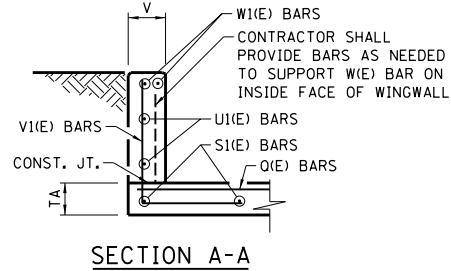
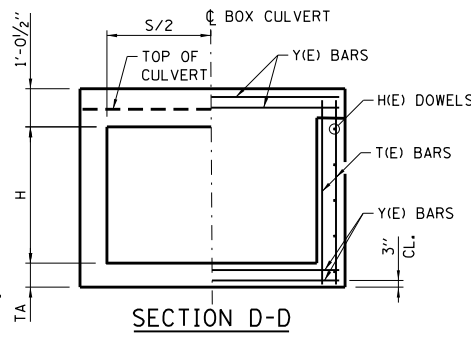
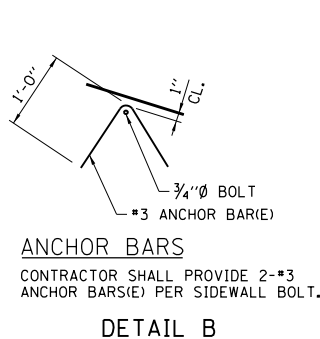
NOTE:
REINFORCEMENT BARS BENDING DIMENSIONS ARE OUT TO OUT.

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.



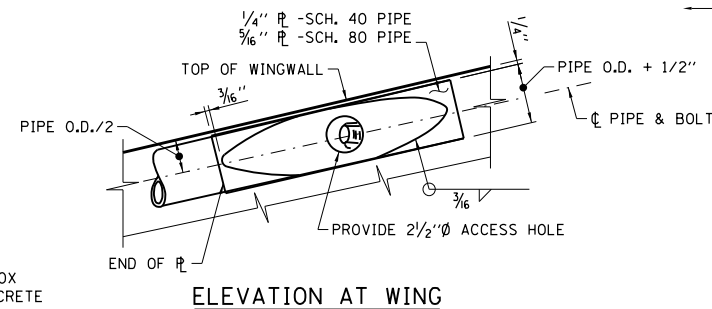
SAFETY END TREATMENT FOR SINGLE AND MULTIPLE CULVERTS
0° SKEW 1:4
SLOPE H ≤ 8'
STANDARD B14-05



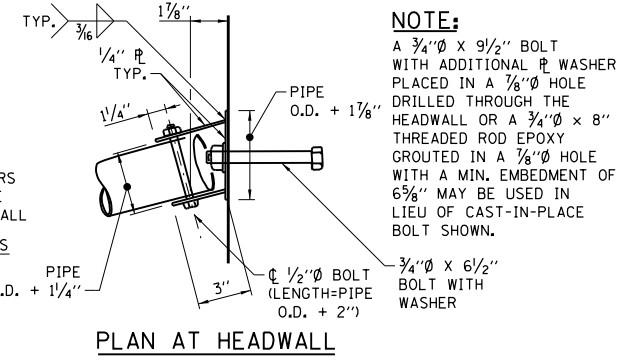
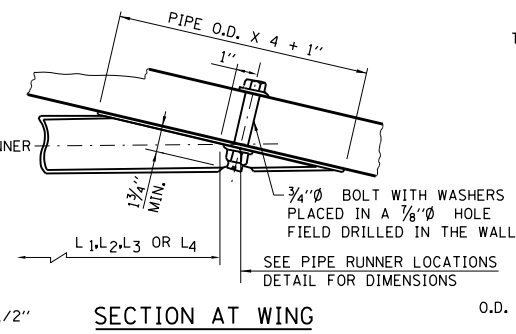
NOTE:
Q, V, AND V₁ BARS ARE TO BE FIELD CUT PER CUTTING DIAGRAM. PLACE BARS WITH DIMENSIONS C₂-C₃, C₉-C₁₂ BEGINNING AT HEADWALL AND BARS WITH DIMENSIONS C₁-C₄, C₁₀-C₁₁ BEGINNING AT THE TOEWALL END.

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

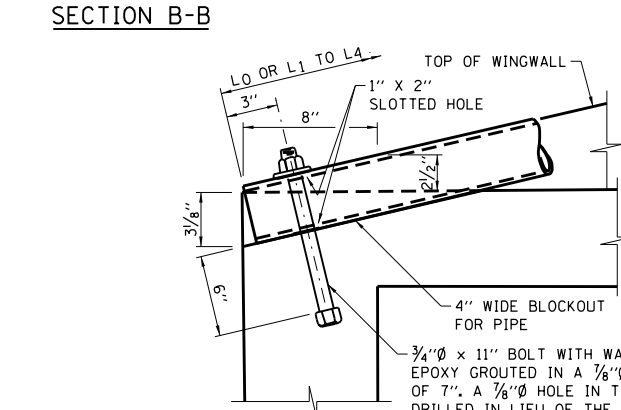
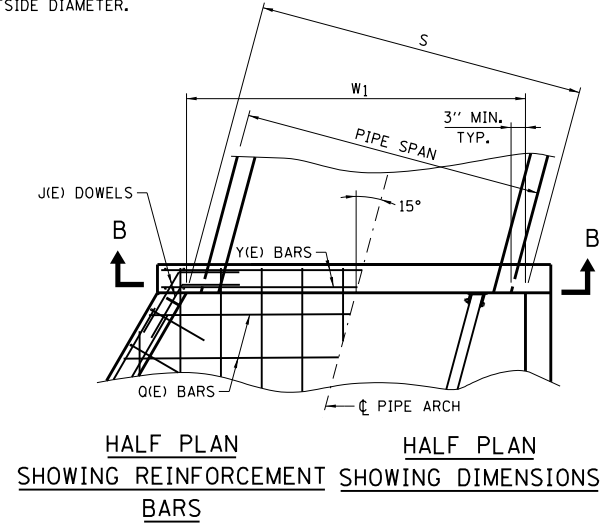
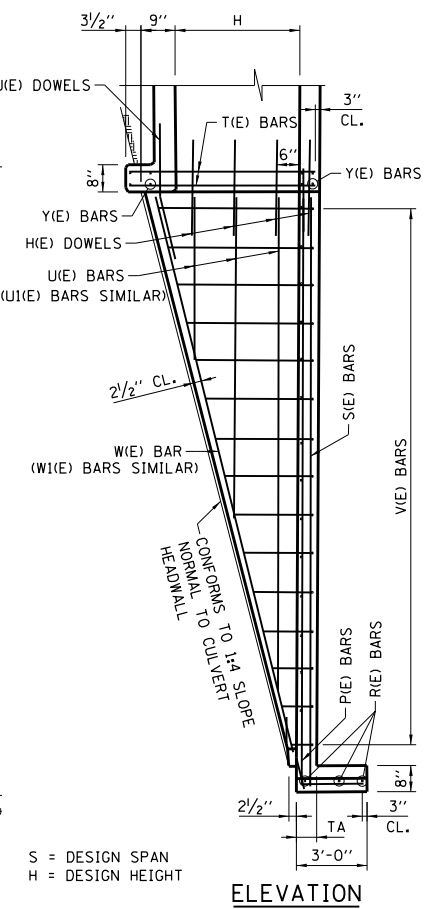
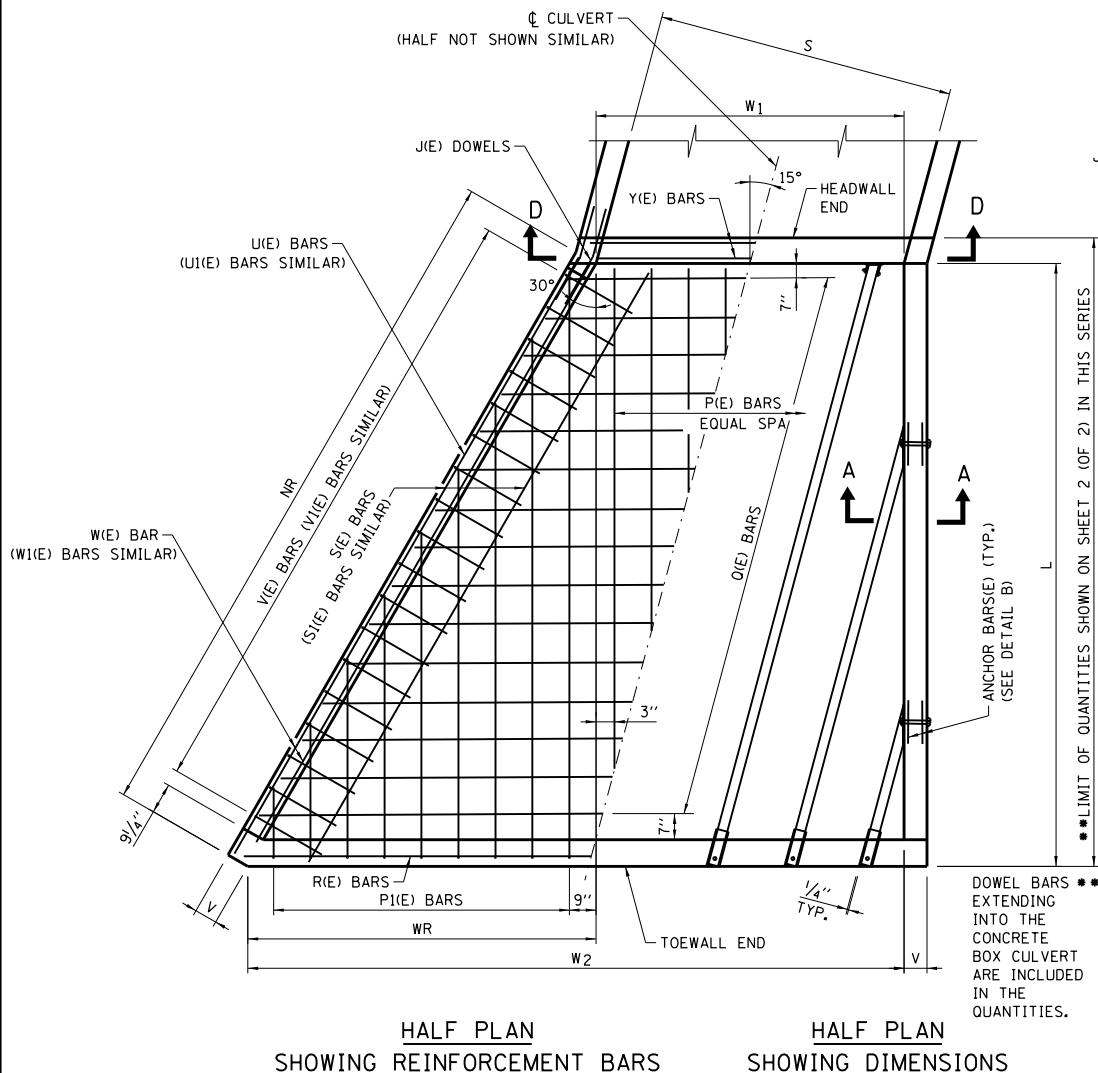
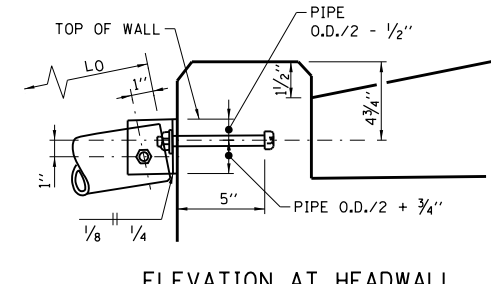
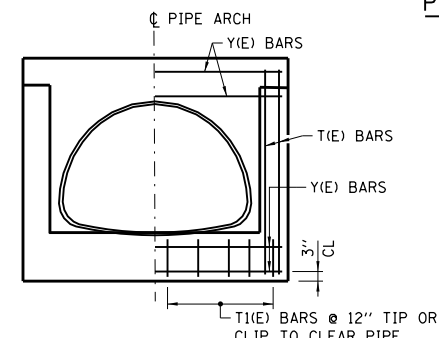
NOTE:
J & H DOWEL BAR NOT REQUIRED WITH EXISTING BOX CULVERTS PROVIDING THE REINFORCING FROM THE EXIST. BOX IS EXTENDED INTO THE NEW CONCRETE A MIN. OF 1'-3".



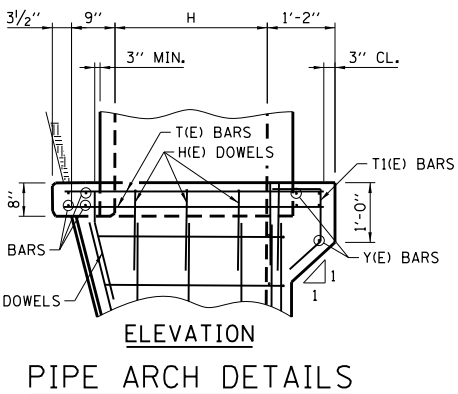
NOTE:
PIPE O.D. IS THE PIPE RUNNER OUTSIDE DIAMETER.



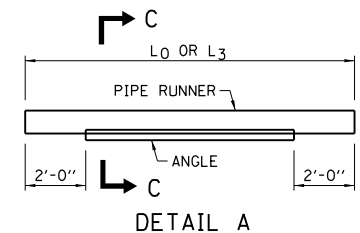
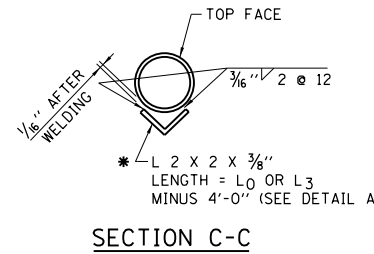
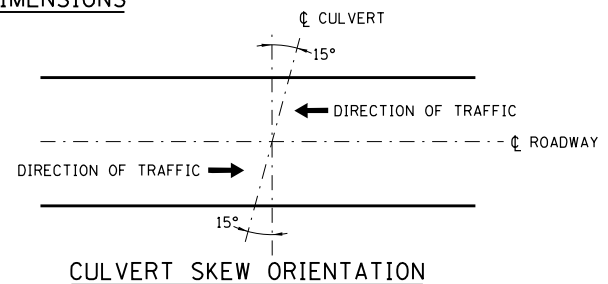
NOTE:
A 3/4" x 9/2" BOLT WITH ADDITIONAL P WASHER PLACED IN A 7/8" HOLE DRILLED THROUGH THE HEADWALL OR A 3/4" x 8" THREADED ROD EPOXY GROUTED IN A 7/8" HOLE WITH A MIN. EMBEDMENT OF 6 5/8" MAY BE USED IN LIEU OF CAST-IN-PLACE BOLT SHOWN.



PIPE RUNNER DETAILS



- 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 OR L₃ EXCEEDS THE FOLLOWING LENGTH, THE PIPE RUNNER SHALL BE STRENGTHENED OVER THE MIDSPAN AS SHOWN.

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

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



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

STANDARD B15-04

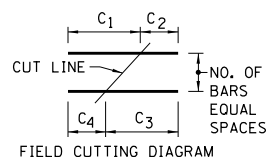
DATE	REVISIONS
06-01-09	REVISED NOTES
03-01-10	MODIFIED CULVERT SKEW
03-01-10	DETAIL, REVISED EROSION PROTECTION AND NOTES
02-07-12	TABLE QUANTITIES REVISED
3-11-2015	REVISED NOTES

CULVERT SIZE (FEET)	TABLE OF DIMENSIONS								PIPE RUNNERS FOR ONE END SIZE 3" DIA.								TABLE OF REINFORCEMENT BARS FOR ONE END											
	S X H	L	NR	V	W1	W2	WR	TA	HEADWALL PIPE		WINGWALL PIPE - ONE PER EACH LENGTH SHOWN				H(E) DOWELS #4 @ 12"		J(E) DOWELS 2-#6 EACH WALL		P(I) BARS #4 - EQUALLY SPACED		P(I) BARS #4 @ 12"							
									SCH.	NO.	L ₀	L ₁	L ₂	L ₃	L ₄	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	C ₅	C ₆	C ₇	C ₈	LENGTH	
3 x 2	10'-10"	12'-6/8"	7"	3'-1/4"	9'-4/4"	6'-3"	6"	40	2	11'-5"	6'-3"	-	7'-0"	-	3	2'-6"	3	2'-6"	4'-0"	4'-0"	4	13'-1"	3	10'-2"	1'-6"	5'-0"	6'-8"	16'-10"
3 x 3	14'-10"	17'-1/2"	7"	3'-1/4"	11'-8"	8'-6 3/4"	6"	40	2	15'-8"	10'-6"	-	11'-3"	-	4	2'-6"	4	2'-6"	4'-0"	4'-0"	4	17'-1"	4	14'-2"	2'-0"	7'-3"	8'-11"	21'-4"
4 x 2	10'-10"	12'-6/8"	7"	4'-1 3/4"	10'-4 3/4"	6'-3"	6"	40	2	11'-5"	6'-3"	-	7'-0"	-	3	2'-6"	3	2'-6"	4'-0"	4'-0"	5	13'-1"	3	10'-2"	1'-6"	5'-0"	6'-8"	16'-10"
4 x 3	14'-10"	17'-1/2"	7"	4'-1 3/4"	12'-8 1/2"	8'-6 3/4"	6"	40	2	15'-8"	10'-6"	-	11'-3"	-	4	2'-6"	4	2'-6"	4'-0"	4'-0"	5	17'-1"	4	14'-2"	2'-0"	7'-3"	8'-11"	21'-4"
4 x 4	18'-10"	21'-9"	7"	4'-1 3/4"	15'-0 1/4"	10'-10 1/2"	6"	80	2	19'-11"	14'-9"	4'-6"	15'-6"	6'-7"	5	2'-6"	5	2'-6"	4'-0"	4'-0"	5	18'-2"	5	18'-2"	2'-5"	9'-5"	11'-2"	25'-9"
5 x 2	10'-10"	12'-6/8"	7"	5'-2 1/8"	11'-5 1/8"	6'-3"	6"	40	2	11'-5"	6'-3"	-	7'-0"	-	3	2'-6"	3	2'-6"	4'-0"	4'-0"	6	13'-1"	3	10'-2"	1'-6"	5'-0"	6'-8"	16'-10"
5 x 3	14'-10"	17'-1/2"	7"	5'-2 1/8"	13'-8 3/8"	8'-6 3/4"	6"	40	2	15'-8"	10'-6"	-	11'-3"	-	4	2'-6"	4	2'-6"	4'-0"	4'-0"	6	17'-1"	4	14'-2"	2'-0"	7'-3"	8'-11"	21'-4"
5 x 4	18'-10"	21'-9"	7"	5'-2 1/8"	16'-0 3/8"	10'-10 1/2"	6"	80	2	19'-11"	14'-9"	4'-6"	15'-6"	6'-7"	5	2'-6"	5	2'-6"	4'-0"	4'-0"	6	21'-1"	5	18'-2"	2'-5"	9'-5"	11'-2"	25'-9"
6 x 3	14'-10"	17'-1/2"	7"	6'-2 1/2"	14'-9 1/4"	8'-6 3/4"	6"	40	3	15'-8"	10'-6"	-	11'-3"	-	4	2'-6"	4	2'-6"	4'-0"	4'-0"	7	17'-1"	4	14'-2"	2'-0"	7'-3"	8'-11"	21'-4"
6 x 4	18'-10"	21'-9"	7"	6'-2 1/2"	17'-1"	10'-10 1/2"	6"	80	3	19'-11"	14'-9"	4'-6"	15'-6"	6'-7"	5	2'-6"	5	2'-6"	4'-0"	4'-0"	7	21'-1"	5	18'-2"	2'-5"	9'-5"	11'-2"	25'-9"
7 x 3	14'-10"	17'-1/2"	7"	7'-3"	15'-9 3/4"	8'-6 3/4"	6 1/2"	40	3	15'-8"	10'-6"	-	11'-3"	-	4	2'-6"	4	2'-6"	4'-0"	4'-0"	8	17'-1"	4	14'-2"	2'-0"	7'-3"	8'-11"	21'-4"
7 x 4	18'-10"	21'-9"	7"	7'-3"	18'-1 1/2"	10'-10 1/2"	6 1/2"	80	3	19'-11"	14'-9"	4'-6"	15'-6"	6'-7"	5	2'-6"	5	2'-6"	4'-0"	4'-0"	8	21'-1"	5	18'-2"	2'-5"	9'-5"	11'-2"	25'-9"
8 x 4	18'-10"	21'-9"	7"	8'-3 3/8"	19'-1 7/8"	10'-10 1/2"	7"	80	4	19'-11"	14'-9"	4'-6"	15'-6"	6'-7"	5	2'-6"	5	2'-6"	4'-0"	4'-0"	9	21'-1"	5	18'-2"	2'-5"	9'-5"	11'-2"	25'-9"

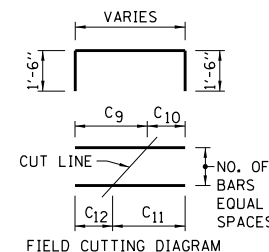
CULVERT SIZE (FEET)	TABLE OF REINFORCEMENT BARS FOR ONE END																														
	S X H	NO.	Q(E) BARS #4 @ 12"					R(E) BARS 3-#4	S(E) BARS 30° WALL 2-#4		T(E) BARS 8-#5 BOX CULVERT	T(E) BARS 8-#5 PIPE ARCH	U(E) BARS-ONE PER EACH LENGTH SHOWN #4 @ 12"				V(I) BARS ONE PER EACH LENGTH SHOWN #4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

CULVERT SIZE (FEET)	TABLE OF REINFORCING STEEL FOR ONE END					
	S X H	2 W(E) BARS		2 W1(E) BARS		Y(E) BARS 8-#5
		SIZE	LENGTH	SIZE	LENGTH	
3 x 2	#5	11'-6"	#5	10'-4"	3'-11"	
3 x 3	#5	16'-2"	#5	14'-5"	3'-11"	
4 x 2	#5	11'-6"	#5	10'-4"	4'-11"	
4 x 3	#5	16'-2"	#5	14'-5"	4'-11"	
4 x 4	#6	20'-11"	#6	18'-7"	4'-11"	
5 x 2	#5	11'-6"	#5	10'-4"	6'-0"	
5 x 3	#5	16'-2"	#5	14'-5"	6'-0"	
5 x 4	#6	20'-11"	#6	18'-7"	6'-0"	
6 x 3	#5	16'-2"	#5	14'-5"	7'-0"	
6 x 4	#6	20'-11"	#6	18'-7"	7'-0"	
7 x 3	#5	16'-2"	#5	14'-5"	8'-1"	
7 x 4	#6	20'-11"	#6	18'-7"	8'-1"	
8 x 4	#6	20'-11"	#6	18'-7"	9'-1"	

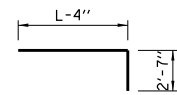
TOTAL QUANTITIES ONE END		
CONC.	REINF. BARS	PIPE RUNNERS
CU. YD.	LB.	FT.
3.2	395	36.09
4.9	537	53.08
3.6	426	36.09
5.3	573	53.08
7.4	781	81.17
3.9	446	36.09
5.7	610	53.08
7.9	823	81.17
6.2	635	68.75
8.4	854	101.08
6.8	676	68.75
9.3	903	101.08
10.2	950	121.00



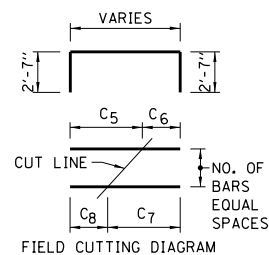
Q(E) BARS



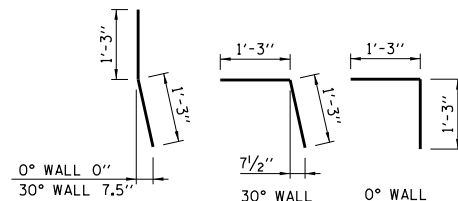
V(E) AND V(I) BARS



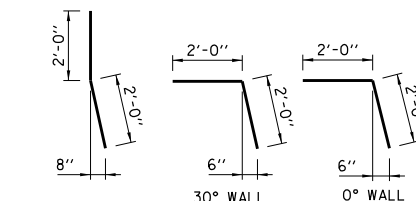
P(E) BARS



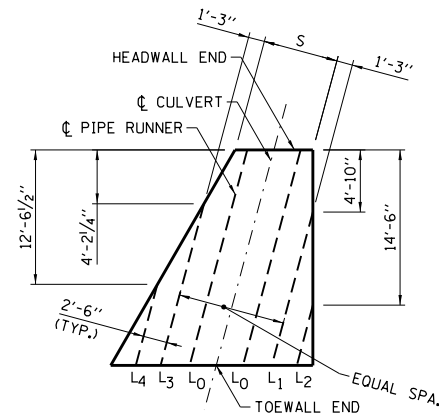
P1(E) BARS



H(E) DOWELS



J(E) DOWELS

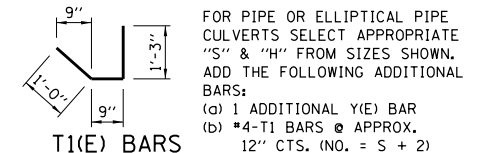


PIPE RUNNER LAYOUT

NOTE:

REINFORCEMENT BARS BENDING DIMENSIONS ARE OUT TO OUT.

PIPE ARCH AND ELLIPTICAL PIPE CULVERTS



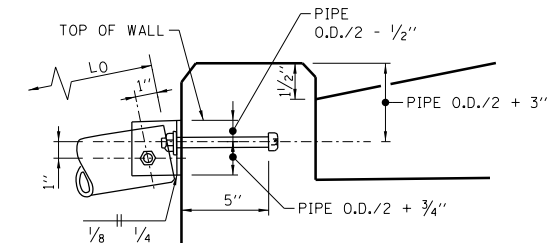
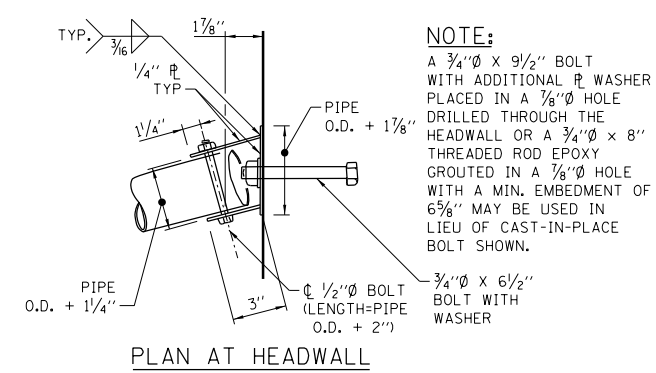
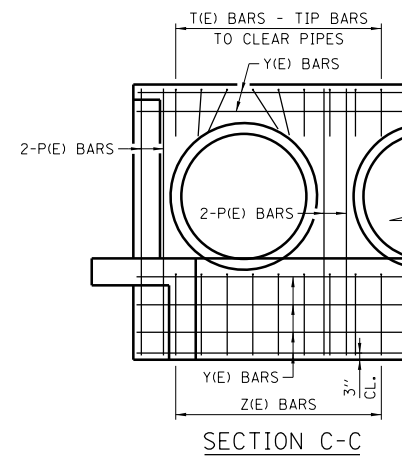
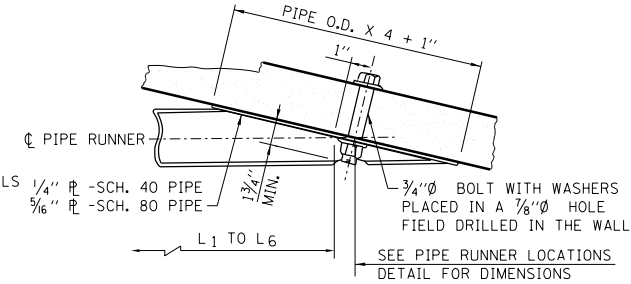
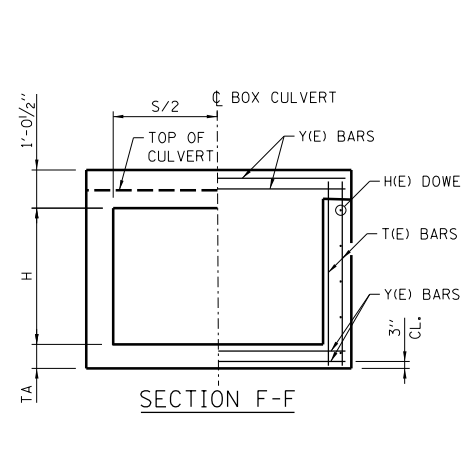
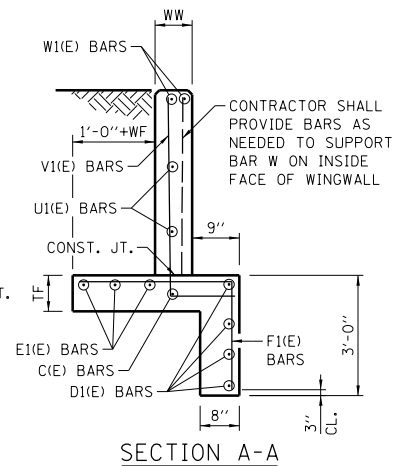
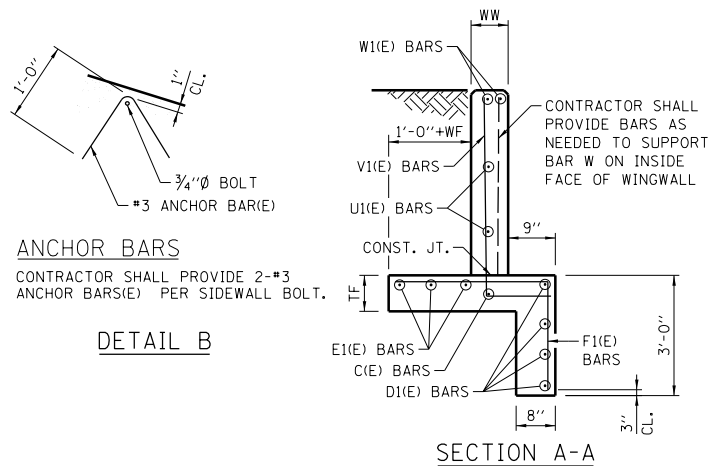
T1(E) BARS

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

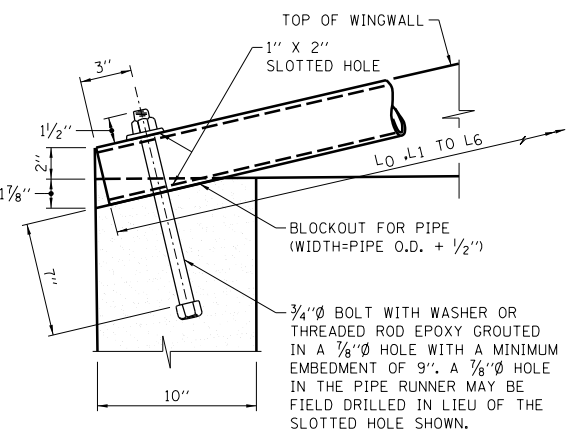
THE WEIGHT OF THE ADDITIONAL BARS AND THE ADDITIONAL QUANTITY OF CONCRETE IN THE HEADWALL SHALL BE ADDED TO THE QUANTITIES SHOWN.

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

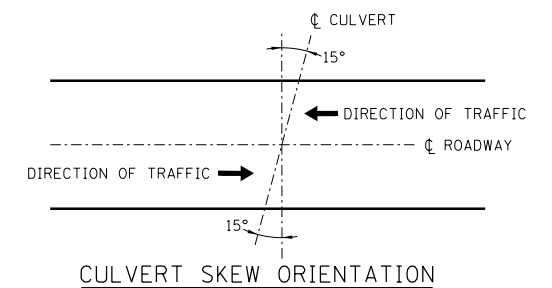
APPROVED ... CHIEF ENGINEER ... DATE 6-1-2009



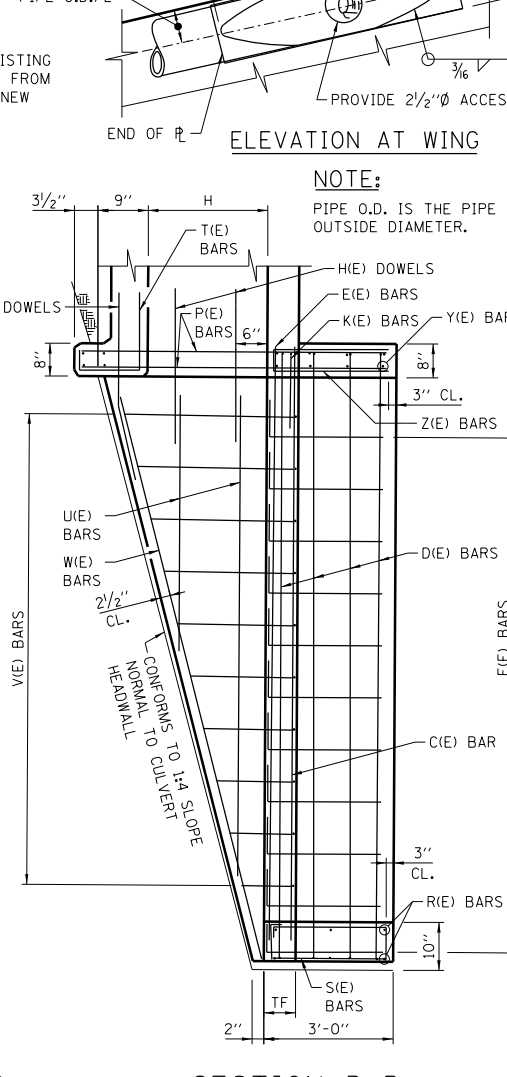
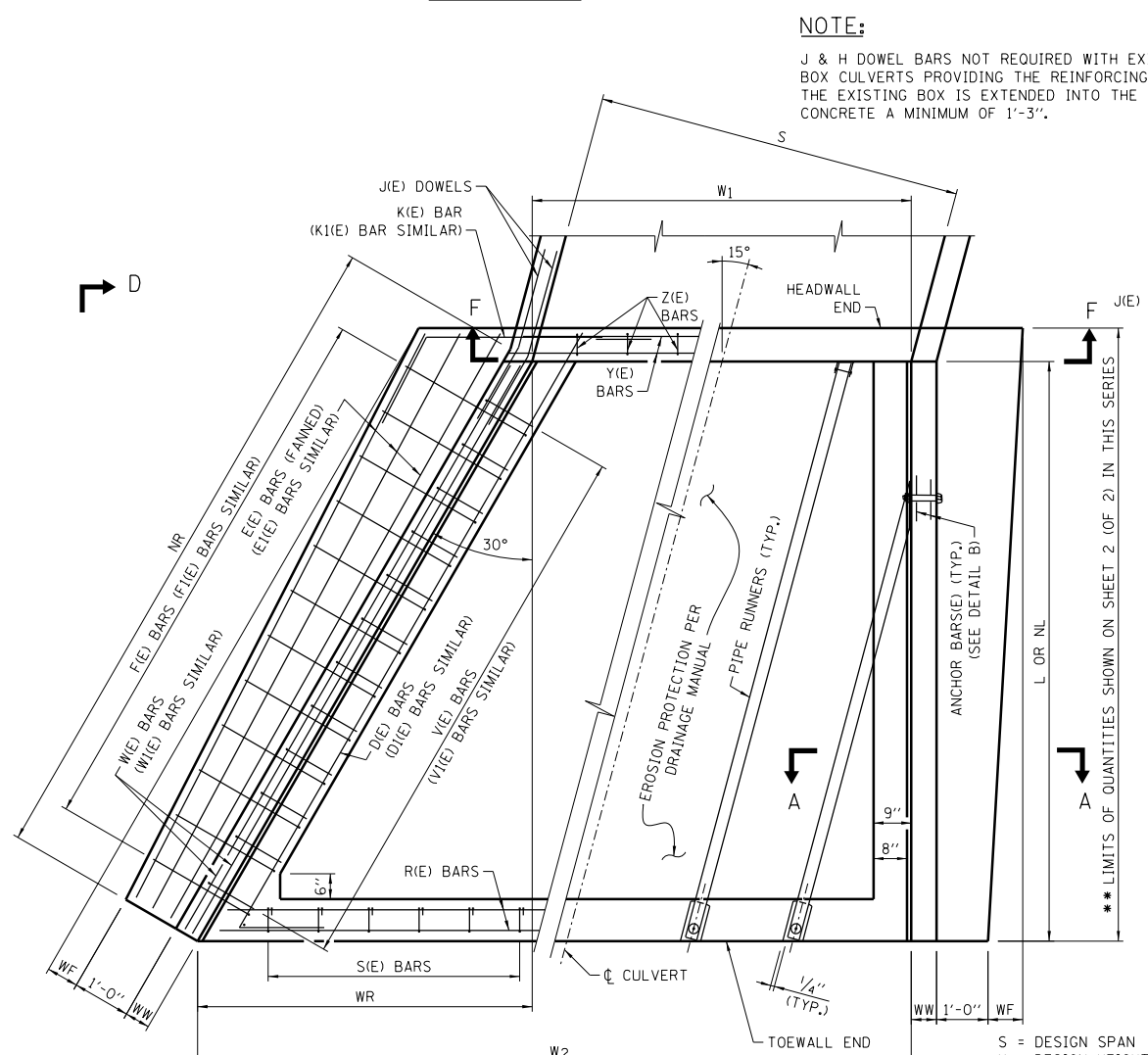
ELEVATION AT HEADWALL



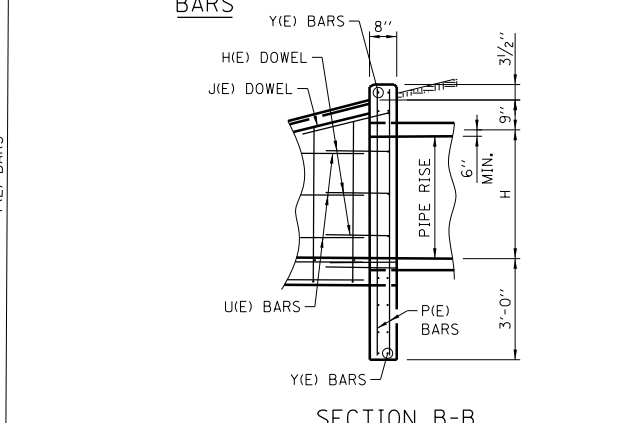
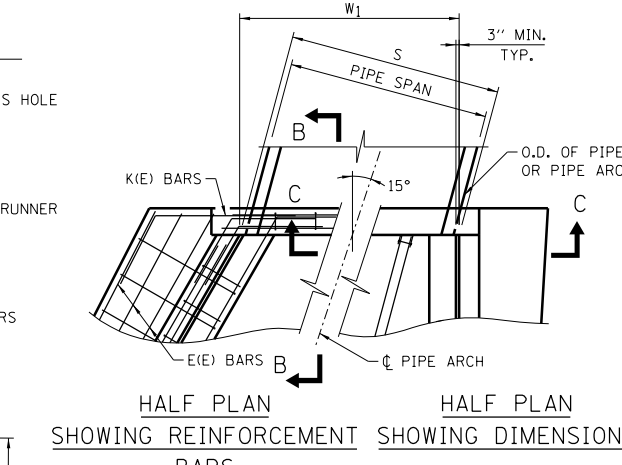
SECTION THRU TOEWALL



CULVERT SKEW ORIENTATION

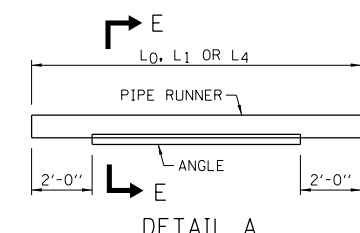


SECTION D-D



SECTION B-B

FOR PIPE AND PIPE-ARCH CULVERTS

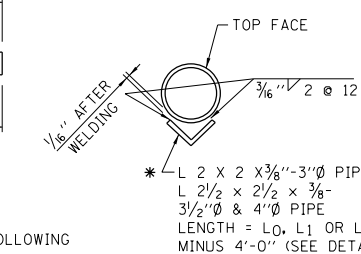


DETAIL A

*** 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



SECTION E-E

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).

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

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

TABLE OF DIMENSIONS

S	H	L	NL	NR	WW	W ₁ (4)	W ₂ (4)	WR	WF	TF
9'	3'	14'-4"	14'-4"	16'-6 ¹ / ₂ "	7"	9'-3 ³ / ₄ "	17'-7"	8'-3 ¹ / ₄ "	3"	7"
9'	4'	18'-4"	18'-4"	21'-2"	7"	9'-3 ³ / ₄ "	19'-10 ³ / ₄ "	10'-7"	9"	8"
5'	5'	22'-4"	22'-4"	25'-9 ¹ / ₂ "	7"	5'-2"	18'-0 ³ / ₄ "	12'-10 ³ / ₄ "	1'-3"	8"
6'	6'	26'-4"	26'-4"	30'-4 ¹ / ₈ "	7"	6'-2 ¹ / ₂ "	21'-5"	15'-2 ¹ / ₂ "	1'-9"	8 ¹ / ₂ "
7'	7'	30'-4"	30'-4"	35'-0 ¹ / ₄ "	7"	7'-3"	24'-9"	17'-6"	2'-3"	9"
8'	8'	34'-4"	34'-4"	39'-7 ³ / ₄ "	8"	8'-3 ¹ / ₂ "	28'-1 ¹ / ₄ "	19'-9 ³ / ₄ "	2'-9"	9 ¹ / ₂ "

H	TABLE OF REINFORCEMENT BARS FOR ONE END									
	SIZE	LENGTH	SIZE	LENGTH	LENGTH	LENGTH	NO.	LENGTH	NO.	LENGTH
3'	#4	16'-11"	#4	14'-8"	18'-10"	16'-7"	2	18'-4"	2	16'-2"
4'	#4	21'-7"	#4	18'-8"	23'-6"	20'-7"	2	23'-0"	2	20'-2"
5'	#4	22'-2"	#4	22'-8"	24'-1"	24'-7"	2	27'-7"	2	24'-2"
6'	#4	30'-9"	#4	26'-8"	32'-8"	28'-7"	3	32'-3"	3	28'-2"
7'	#5	35'-5"	#5	30'-8"	37'-4"	32'-7"	3	36'-10"	3	32'-2"
8'	#5	40'-0"	#5	34'-8"	41'-11"	36'-7"	3	41'-6"	3	36'-2"

S	H	TOTAL QUANTITIES ONE END MINIMUM "S"		INCREASE IN QUANTITIES FOR 1' INCREASE IN "S"	
		CONC. CU. YD.	REINF. BARS POUND	CONC. CU. YD.	REINF. BARS POUND
9'	3'	8.4	890	0.20	30
9'	4'	12.7	1120	0.20	30
5'	5'	14.4	1200	0.20	30
6'	6'	20.1	1610	0.20	30
7'	7'	27.0	1930	0.20	30
8'	8'	36.0	2460	0.20	30

TABLE OF REINFORCEMENT BARS FOR ONE END

H	F(E) BARS EQUALLY SPACED 30° WALL						F1(E) BARS EQUALLY SPACED 0° WALL						H(E) DOWELS #5 @ 12" 30° WALL		H1(E) DOWELS #5 @ 12" 0° WALL		J(E) DOWELS 4-#6 (5)		1-K(E) BAR 30° WALL		1-K1(E) BAR 0° WALL		2-W(E) BARS 30° WALL		2-W1(E) BARS 0° WALL				
	SIZE	NO.	C ₁	C ₂	C ₃	C ₄	LENGTH	SIZE	NO.	C ₁	C ₂	C ₃	C ₄	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	NO.	C ₅	LENGTH	NO.	C ₆	LENGTH	NO.	C ₅	LENGTH
3'	#4	7	1'-11"	2'-1"	2'-0"	2'-0"	9'-2"	#4	7	1'-11"	2'-1"	2'-0"	2'-0"	9'-2"	3	3'-0"	3	3'-0"	4'-6"	#5	3'-11"	5'-5"	#5	3'-9"	5'-3"	#5	16'-9"	#5	14'-6"
4'	#4	9	1'-11"	2'-7"	2'-3"	2'-3"	9'-8"	4	9	1'-11"	2'-7"	2'-3"	2'-3"	9'-8"	4	3'-0"	4	3'-0"	4'-6"	#5	4'-6"	6'-0"	#5	4'-3"	5'-9"	#6	21'-6"	#6	18'-7"
5'	#4	11	1'-11"	3'-1"	2'-6"	2'-6"	10'-2"	#4	11	1'-11"	3'-1"	2'-6"	2'-6"	10'-2"	5	3'-0"	5	3'-0"	4'-6"	#5	5'-1"	6'-7"	#5	4'-9"	6'-3"	#6	26'-3"	#6	22'-9"
6'	#5	13	1'-11"	3'-8"	2'-9"	2'-10"	10'-9"	#5	13	1'-11"	3'-8"	2'-9"	2'-9"	10'-9"	6	3'-0"	6	3'-0"	4'-6"	#5	5'-8"	7'-2"	#5	5'-3"	6'-9"	#6	31'-10"	#6	26'-11"
7'	#5	15	2'-0"	4'-3"	3'-1"	3'-2"	11'-5"	#5	15	2'-0"	4'-1"	3'-0"	3'-1"	11'-3"	7	3'-0"	7	3'-0"	4'-6"	#5	6'-3"	7'-9"	#5	5'-9"	7'-3"	#6	35'-9"	#6	31'-0"
8'	#6	18	2'-1"	4'-10"	3'-5"	3'-6"	12'-1"	#6	17	2'-1"	4'-8"	3'-4"	3'-5"	11'-11"	8	3'-0"	8	3'-0"	4'-6"	#5	6'-10"	8'-4"	#5	6'-3"	7'-9"	#6	40'-6"	#6	35'-2"

NOTE:

REINFORCEMENT BARS BENDING DIMENSIONS ARE OUT TO OUT.

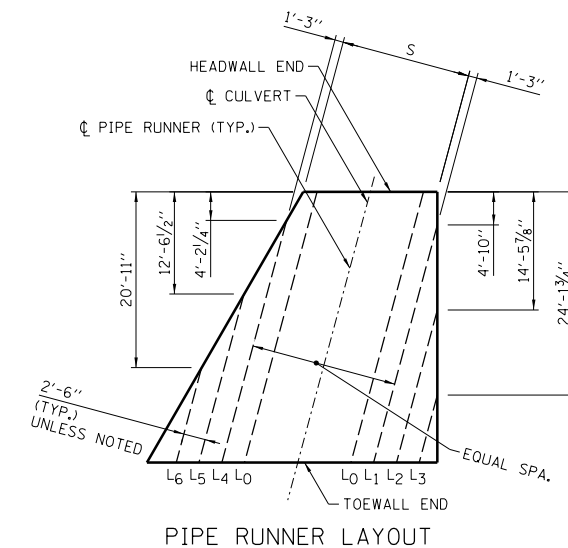
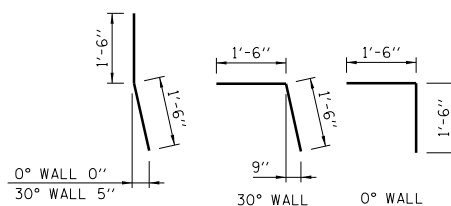


TABLE OF REINFORCEMENT BARS FOR ONE END

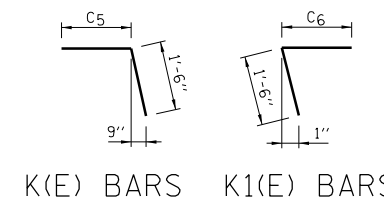
H	U(E) BARS - ONE PER EACH LENGTH SHOWN #4 @ 12" 30° WALL							U1(E) BARS - ONE PER EACH LENGTH SHOWN #4 @ 12" 0° WALL							V(E) BARS #4-EQUALLY SPACED 30° WALL					V1(E) BARS #4-EQUALLY SPACED 0° WALL									
	C ₇	C ₈	C ₉	C ₁₀	C ₁₁	C ₁₂	C ₁₃	C ₁₄	C ₇	C ₈	C ₉	C ₁₀	C ₁₁	C ₁₂	C ₁₃	C ₁₄	NO.	C ₁₅	C ₁₆	C ₁₇	C ₁₈	C ₁₉	LENGTH	NO.	C ₁₅	C ₁₆	C ₁₇	C ₁₈	C ₁₉
3'	5'-1"	9'-8"	14'-3"	-	-	-	-	4'-4"	8'-4"	12'-4"	-	-	-	-	-	8	3'-10"	9"	2'-2"	2'-5"	1'-0"	6'-7"	7	3'-10"	9"	2'-2"	2'-5"	1'-0"	6'-7"
4'	5'-1"	9'-8"	14'-3"	18'-11"	-	-	-	4'-4"	8'-4"	12'-4"	16'-4"	-	-	-	-	11	4'-11"	10"	2'-9"	3'-0"	1'-0"	7'-9"	9	4'-11"	10"	2'-9"	3'-0"	1'-0"	7'-9"
5'	5'-1"	9'-8"	14'-3"	18'-11"	23'-6"	-	-	4'-4"	8'-4"	12'-4"	16'-4"	20'-4"	-	-	-	13	5'-11"	10"	3'-3"	3'-6"	1'-0"	8'-9"	11	5'-11"	10"	3'-3"	3'-6"	1'-0"	8'-9"
6'	5'-1"	9'-8"	14'-3"	18'-11"	23'-6"	28'-1"	-	4'-4"	8'-4"	12'-4"	16'-4"	20'-4"	24'-4"	-	-	15	6'-11"	10"	3'-9"	4'-0"	1'-0"	9'-9"	13	6'-11"	10"	3'-9"	4'-0"	1'-0"	9'-9"
7'	5'-1"	9'-8"	14'-3"	18'-11"	23'-6"	28'-1"	32'-9"	4'-4"	8'-4"	12'-4"	16'-4"	20'-4"	24'-4"	28'-4"	-	17	8'-0"	11"	4'-4"	4'-7"	1'-0"	10'-11"	15	8'-0"	11"	4'-4"	4'-7"	1'-0"	10'-11"
8'	5'-1"	9'-8"	14'-3"	18'-11"	23'-6"	28'-1"	32'-9"	4'-4"	8'-4"	12'-4"	16'-4"	20'-4"	24'-4"	28'-4"	32'-4"	20	9'-0"	11"	4'-10"	5'-1"	1'-1"	12'-1"	17	9'-0"	11"	4'-10"	5'-1"	1'-1"	12'-1"

TABLE OF REINFORCEMENT BARS FOR MINIMUM "S" - ONE END

S	H	Y(E) BARS 12-#5 (2)	R(E) BARS 6-#5 (2)	Z(E) BARS #4 @ 12" (1)	S(E) BARS #4 @ 12" (1)	T(E) BARS #4 @ 12" (1)	P(E) BARS 8-#5 (3)
		LENGTH	LENGTH	NO.	LENGTH	NO.	LENGTH
9'	3'	10'-3"	17'-1"	10	5'-4"	16	6'-10"
9'	4'	10'-3"	19'-5"	10	5'-4"	18	6'-10"
5'	5'	6'-1"	17'-7"	6	5'-4"	16	6'-10"
6'	6'	7'-2"	20'-11"	7	5'-4"	20	6'-10"
7'	7'	8'-2"	24'-3"	8	5'-4"	23	6'-10"
8'	8'	9'-4"	27'-8"	9	5'-4"	26	6'-10"



H(E) AND H1(E) DOWELS

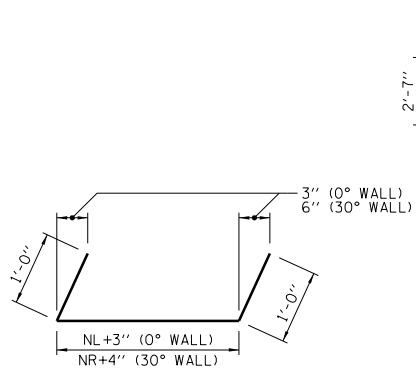


K(E) BARS K1(E) BARS

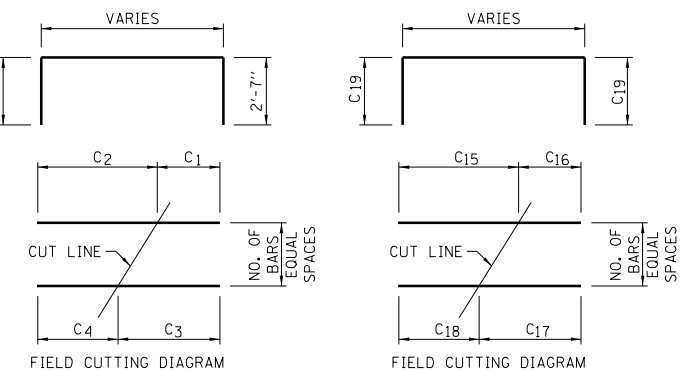
NUMBER OF HEADWALL PIPE RUNNERS FOR 1 END			
S	NO.	S	NO.
10'	4	23'	10
11'	5	24'	10
12'	5	25'	10
13'	6	26'	11
14'	6	27'	11
15'	6	28'	12
16'	7	29'	12
17'	7	30'	12
18'	8	31'	13
19'	8	32'	13
20'	8	33'	14
21'	9	34'	14
22'	9	35'	14

NOTES FOR TABLES:

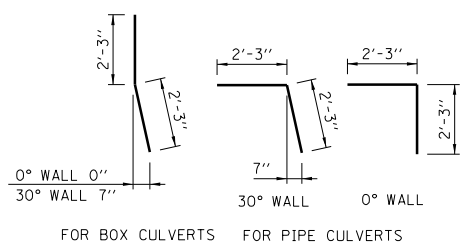
- THE NUMBER OF S, T AND Z BARS SHALL BE INCREASED BY 1 FOR EACH 1 FOOT OF INCREASE IN DIMENSION "W₁".
- THE LENGTH OF R AND Y BARS SHALL BE INCREASED BY 1'-1/2" FOR EACH 1 FOOT OF INCREASE IN DIMENSION "S".
- THE NUMBER OF P BARS SHOWN ARE FOR SINGLE SPAN PIPES OR BOX CULVERTS. THIS NUMBER SHALL BE INCREASED BY 4 FOR EACH MULTIPLE OF PIPE OR BOX ADDED.
- THIS DIMENSION SHALL BE INCREASED BY 1'-1/2" INCHES FOR EACH 1 FOOT INCREASE IN DIMENSION "S".
- 2 BARS FOR 30° WALL, 2 BARS FOR 0° WALL.
- THE LENGTH OF THIS BAR INCLUDES ONE 1'-6" MINIMUM LAP.



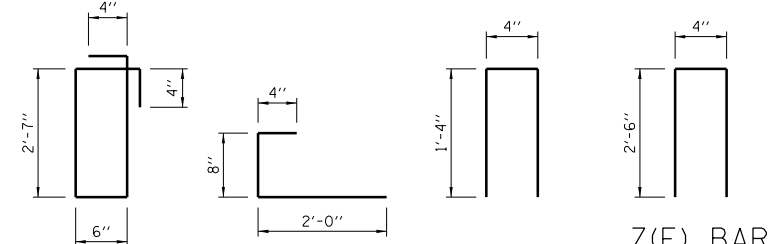
D(E) BARS



F(E) AND F1(E) BARS V(E) AND V1(E) BARS



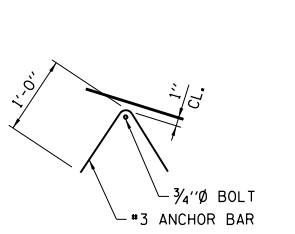
J(E) DOWELS



S(E) BARS T(E) BARS

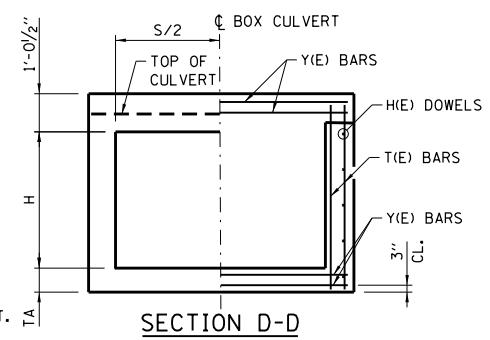
Z(E) BARS

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

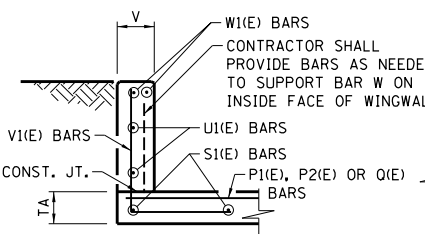


ANCHOR BARS(E)
CONTRACTOR SHALL PROVIDE 2-#3 ANCHOR BARS(E) PER SIDEWALL BOLT.

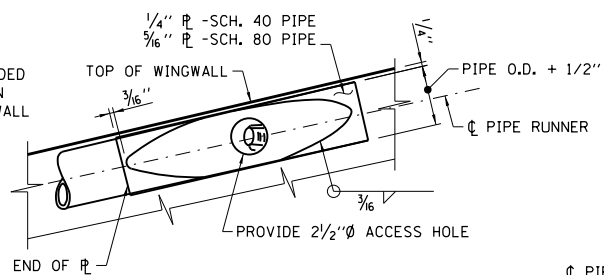
DETAIL B



SECTION D-D

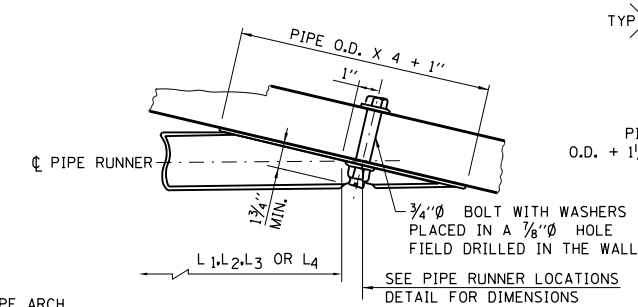


SECTION A-A

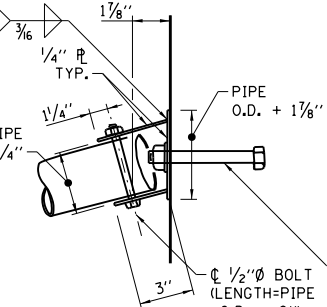


ELEVATION AT WING

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



SECTION AT WING



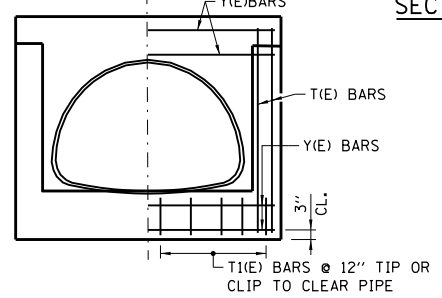
PLAN AT HEADWALL

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

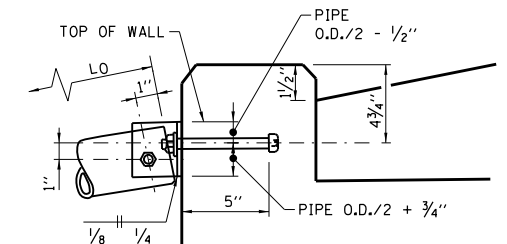
NOTE:
Q(E), V(E), AND V1(E) BARS ARE TO BE FIELD CUT PER CUTTING DIAGRAM. PLACE BARS WITH DIMENSIONS C2-C3, C9-C12 BEGINNING AT HEADWALL AND BARS WITH DIMENSIONS C1-C4, C10-C11 BEGINNING AT THE TOEWALL END.

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

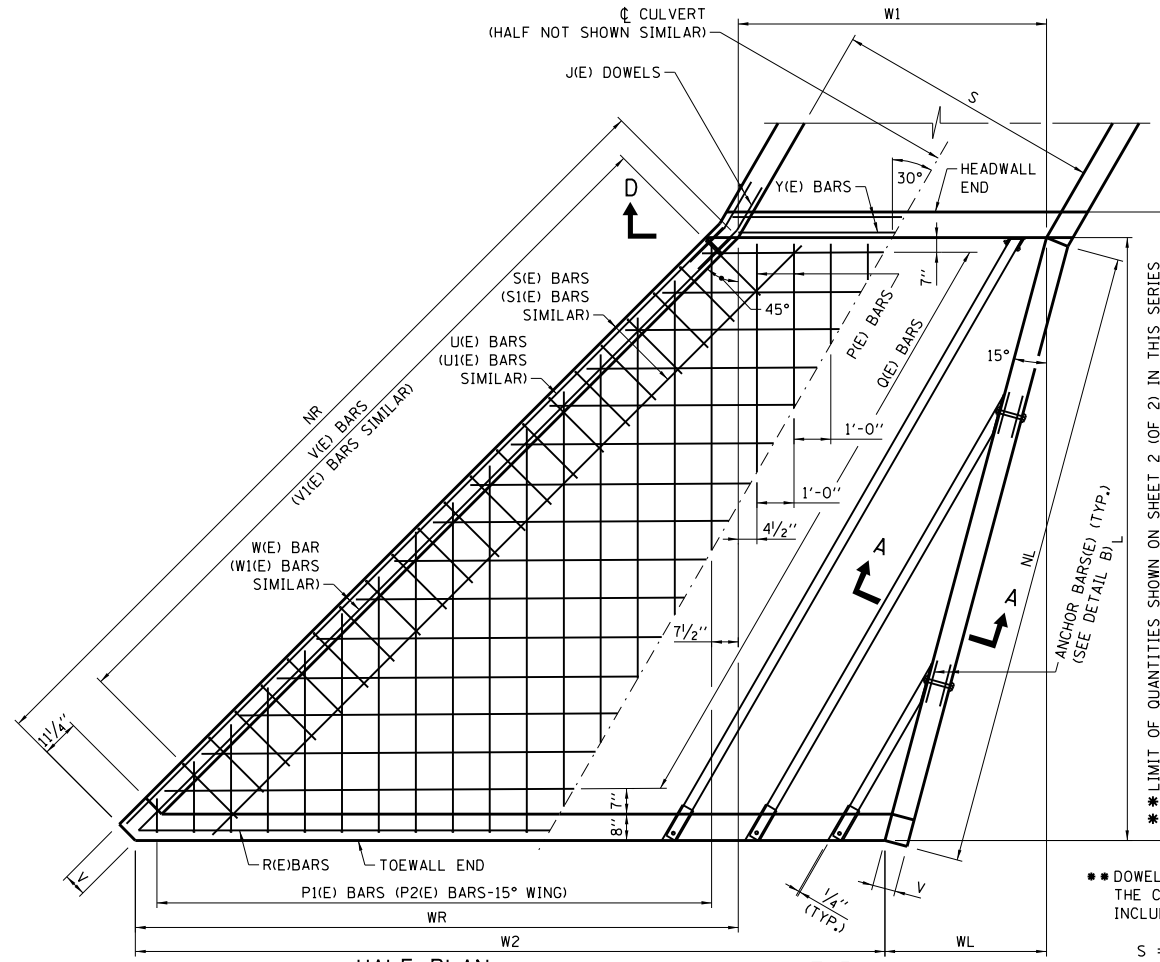
NOTE:
J(E) & H(E) DOWEL BARS NOT REQUIRED WITH EXISTING BOX CULVERTS PROVIDING THE REINFORCING FROM THE EXIST. BOX IS EXTENDED INTO THE NEW CONCRETE A MIN. OF 1'-3".



SECTION B-B

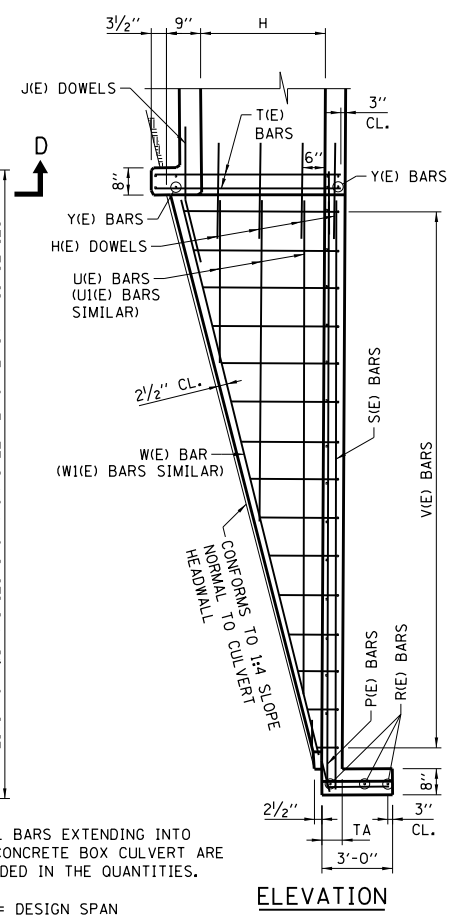


ELEVATION AT HEADWALL



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

BOX CULVERT DETAILS

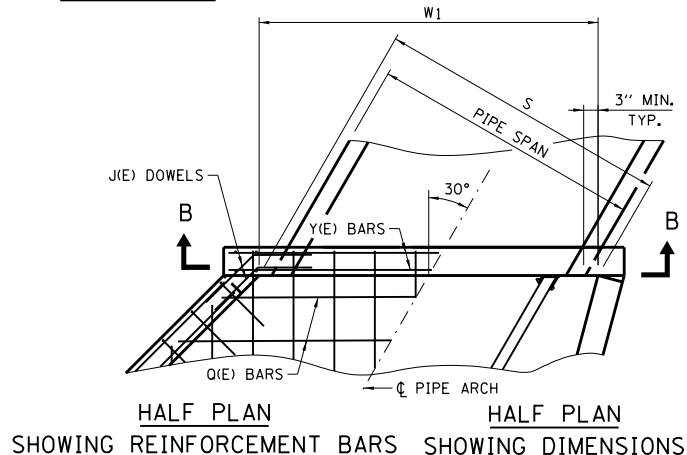


ELEVATION

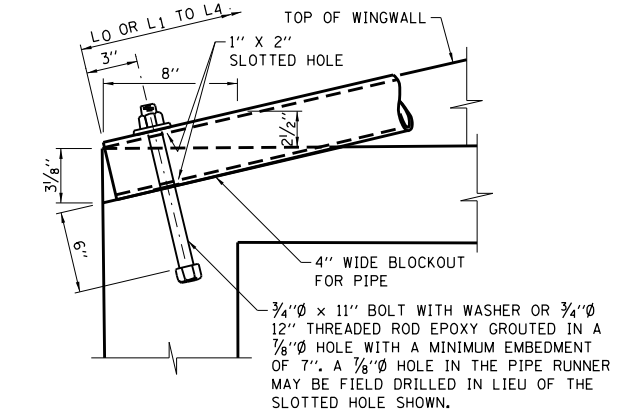
• DOWEL BARS EXTENDING INTO THE CONCRETE BOX CULVERT ARE INCLUDED IN THE QUANTITIES.

S = DESIGN SPAN
H = DESIGN HEIGHT

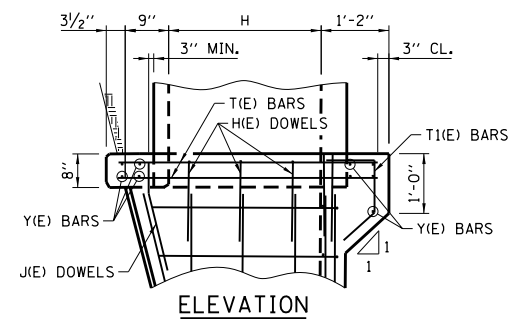
• LIMIT OF QUANTITIES SHOWN ON SHEET 2 (OF 2) IN THIS SERIES



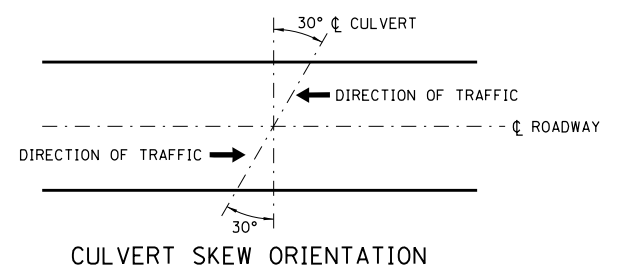
HALF PLAN SHOWING REINFORCEMENT BARS **HALF PLAN SHOWING DIMENSIONS**



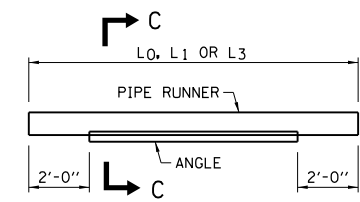
SECTION THRU TOEWALL



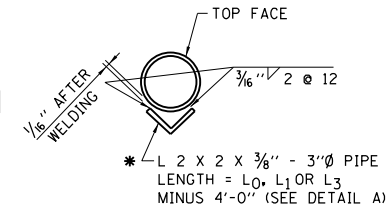
ELEVATION PIPE ARCH DETAILS



CULVERT SKEW ORIENTATION



DETAIL A



SECTION C-C

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

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

PIPE RUNNER DETAILS

GENERAL NOTES:

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

Paul Kovacs
APPROVED CHIEF ENGINEER DATE 6-1-2009

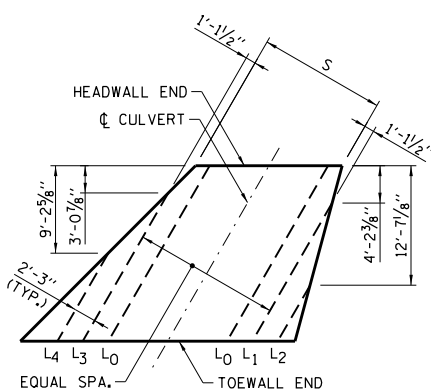
DATE	REVISIONS
6-01-2009	REVISED NOTES
3-01-2010	MODIFIED CULVERT SKEW DETAIL, REVISED EROSION PROTECTION AND NOTES
2-07-2012	TABLE QUANTITIES REVISED
3-11-2015	REVISED NOTES



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

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

SCHEDULE	HEADWALL PIPE		WINGWALL PIPE-ONE PER EACH LENGTH SHOWN			
	NO.	L0	15° WALL		45° WALL	
			L1	L2	L3	L4
40	2	12'-10"	7'-10"	-	9'-2"	-
40	2	17'-8"	12'-6"	-	13'-11"	6'-7"
40	2	12'-10"	7'-10"	-	9'-2"	-
40	2	17'-8"	12'-6"	-	13'-11"	6'-7"
80	2	22'-4"	17'-3"	7'-4"	18'-7"	11'-4"
40	3	12'-10"	7'-10"	-	9'-2"	-
40	3	17'-8"	12'-6"	-	13'-11"	6'-7"
80	3	22'-4"	17'-3"	7'-4"	18'-7"	11'-4"
40	3	17'-8"	12'-6"	-	13'-11"	6'-7"
80	3	22'-4"	17'-3"	7'-4"	18'-7"	11'-4"
40	4	17'-8"	12'-6"	-	13'-11"	6'-7"
80	4	22'-4"	17'-3"	7'-4"	18'-7"	11'-4"
80	4	22'-4"	17'-3"	7'-4"	18'-7"	11'-4"



PIPE RUNNER LAYOUT

CULVERT SIZE (FEET)	H(E) DOWELS #4 @ 12" 2'-6" LG.		J(E) DOWELS #4 @ 12" 4'-0" LG.		P(E) BARS #4 @ 12"		P1(E) BARS #4 @ 12"					P2(E) BARS - ONE PER EACH LENGTH SHOWN #4 @ 12"					Q(E) BARS #4 @ 12"				R(E) BARS 3-#4	S(E) BARS 45° WALL 2-#4	S1(E) BARS 15° WALL 2-#4	U(E) BARS- ONE PER EACH LENGTH SHOWN #4 @ 12"						
	S X H	NO.*	NO.**	NO.*	NO.**	NO.	LENGTH	C5	C6	C7	C8	LENGTH	a1	a2	a3	a4	a5	NO.	C1	C2	C3	C4	LENGTH	LENGTH	LENGTH	LENGTH	a6	a7	a8	a9
3 x 2	3	3	2	2	1	13'-1"	5	10'-6"	1'-6"	5'-6"	6'-6"	17'-2"	5'-4"	9'-1"	-	-	5	11'-6"	4'-11"	7'-10"	8'-7"	16'-5"	11'-10"	14'-10"	11'-0"	6'-2"	11'-10"	-	-	
3 x 3	4	4	2	2	0	-	7	14'-6"	1'-6"	7'-6"	8'-6"	21'-2"	5'-4"	9'-1"	12'-10"	-	7	14'-5"	4'-11"	9'-4"	10'-0"	19'-4"	20'-6"	15'-2"	6'-2"	11'-10"	17'-6"	-		
4 x 2	3	3	2	2	2	13'-1"	5	10'-6"	1'-6"	5'-6"	6'-6"	17'-2"	2'-3"	6'-0"	9'-9"	-	5	12'-8"	6'-11"	9'-0"	9'-9"	18'-9"	13'-0"	14'-10"	11'-0"	6'-2"	11'-10"	-	-	
4 x 3	4	4	2	2	1	17'-1"	7	14'-6"	1'-6"	7'-6"	8'-6"	21'-2"	2'-3"	6'-0"	9'-9"	13'-6"	7	15'-7"	6'-11"	10'-6"	11'-2"	21'-8"	15'-11"	20'-6"	15'-2"	6'-2"	11'-10"	17'-6"	-	
4 x 4	5	5	2	2	0	-	9	18'-6"	1'-6"	9'-6"	10'-6"	25'-2"	2'-3"	6'-0"	9'-9"	13'-6"	9	18'-6"	6'-11"	11'-11"	12'-8"	24'-7"	26'-2"	18'-10"	6'-2"	11'-10"	17'-6"	23'-1"		
5 x 2	3	3	2	2	3	13'-1"	5	10'-6"	1'-6"	5'-6"	6'-6"	17'-2"	2'-10"	6'-7"	10'-4"	-	5	13'-10"	7'-3"	10'-2"	10'-11"	21'-1"	14'-2"	14'-10"	11'-0"	6'-2"	11'-10"	-	-	
5 x 3	4	4	2	2	2	17'-1"	7	14'-6"	1'-6"	7'-6"	8'-6"	21'-2"	2'-10"	6'-7"	10'-4"	14'-0"	7	16'-9"	7'-3"	11'-8"	12'-4"	24'-0"	17'-1"	20'-6"	15'-2"	6'-2"	11'-10"	17'-6"	-	
5 x 4	5	5	2	2	1	21'-1"	9	18'-6"	1'-6"	9'-6"	10'-6"	25'-2"	2'-10"	6'-7"	10'-4"	14'-0"	9	19'-8"	7'-3"	13'-1"	13'-10"	26'-2"	20'-0"	26'-2"	19'-4"	6'-2"	11'-10"	17'-6"	23'-1"	
6 x 3	4	4	2	2	3	17'-1"	7	14'-6"	1'-6"	7'-6"	8'-6"	21'-2"	3'-4"	7'-1"	10'-10"	14'-7"	7	17'-11"	8'-4"	12'-9"	13'-6"	26'-3"	18'-3"	20'-6"	15'-2"	6'-2"	11'-10"	17'-6"	-	
6 x 4	5	5	2	2	2	21'-1"	9	18'-6"	1'-6"	9'-6"	10'-6"	25'-2"	3'-4"	7'-1"	10'-10"	14'-7"	9	20'-10"	8'-4"	14'-3"	14'-11"	29'-2"	21'-2"	26'-2"	19'-4"	6'-2"	11'-10"	17'-6"	23'-1"	
7 x 3	4	4	2	2	4	17'-1"	7	14'-6"	1'-6"	7'-6"	8'-6"	21'-2"	4'-0"	7'-9"	11'-5"	15'-2"	7	19'-1"	8'-6"	13'-11"	14'-8"	28'-7"	19'-5"	20'-6"	15'-2"	6'-2"	11'-10"	17'-6"	-	
7 x 4	5	5	2	2	3	21'-1"	9	18'-6"	1'-6"	9'-6"	10'-6"	25'-2"	4'-0"	7'-9"	11'-5"	15'-2"	9	22'-0"	9'-6"	15'-5"	16'-1"	31'-6"	22'-4"	26'-2"	19'-4"	6'-2"	11'-10"	17'-6"	23'-1"	
8 x 4	5	5	2	2	5	21'-1"	9	18'-6"	1'-6"	9'-6"	10'-6"	25'-2"	4'-6"	8'-3"	12'-0"	15'-9"	9	23'-1"	10'-8"	16'-6"	17'-3"	33'-9"	23'-6"	26'-2"	19'-4"	6'-2"	11'-10"	17'-6"	23'-1"	

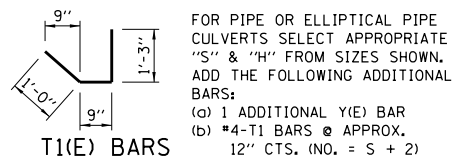
CULVERT SIZE (FEET)	U(E) BARS - ONE PER EACH LENGTH SHOWN #4 @ 12"		V(E) BARS #4 @ 12"				V1(E) BARS #4 @ 12"				2 W(E) BARS 45° WALL		2 W1(E) BARS 15° WALL		Y(E) BARS 8-#5	T(E) BARS 8-#5 BOX CULVERT	T(E) BARS 8-#5 PIPE ARCH						
	15° WALL		45° WALL				15° WALL				SIZE	LENGTH	SIZE	LENGTH									
	S X H	a10	a11	a12	a13	No.	C9	C10	C11	C12	LENGTH	No.	C9	C10	C11	C12	LENGTH	LENGTH	LENGTH				
3 x 2	4'-6"	8'-7"	-	-	7	2'-9"	6"	1'-6"	1'-9"	6'-3"	5	2'-9"	6"	1'-6"	1'-9"	6'-3"	#5	14'-5"	#5	10'-8"	4'-4"	3'-2"	3'-8"
3 x 3	4'-6"	8'-7"	12'-9"	-	10	3'-9"	6"	2'-0"	2'-3"	7'-3"	7	3'-9"	6"	2'-0"	2'-3"	7'-3"	#5	20'-2"	#5	14'-11"	4'-4"	4'-2"	4'-8"
4 x 2	4'-6"	8'-7"	-	-	7	2'-9"	6"	1'-6"	1'-9"	6'-3"	5	2'-9"	6"	1'-6"	1'-9"	6'-3"	#5	14'-5"	#5	10'-8"	4'-4"	3'-2"	3'-8"
4 x 3	4'-6"	8'-7"	12'-9"	-	10	3'-9"	6"	2'-0"	2'-3"	7'-3"	7	3'-9"	6"	2'-0"	2'-3"	7'-3"	#5	20'-2"	#5	14'-11"	5'-6"	4'-2"	4'-8"
4 x 4	4'-6"	8'-7"	12'-9"	16'-11"	13	4'-9"	6"	2'-6"	2'-9"	8'-3"	9	4'-9"	6"	2'-6"	2'-9"	8'-3"	#6	25'-11"	#6	19'-1"	5'-6"	5'-2"	5'-8"
5 x 2	4'-6"	8'-7"	-	-	7	2'-9"	6"	1'-6"	1'-9"	6'-3"	5	2'-9"	6"	1'-6"	1'-9"	6'-3"	#5	14'-5"	#5	10'-8"	4'-4"	3'-2"	3'-8"
5 x 3	4'-6"	8'-7"	12'-9"	-	10	3'-9"	6"	2'-0"	2'-3"	7'-3"	7	3'-9"	6"	2'-0"	2'-3"	7'-3"	#5	20'-2"	#5	14'-11"	6'-8"	4'-2"	4'-8"
5 x 4	4'-6"	8'-7"	12'-9"	16'-11"	13	4'-9"	6"	2'-6"	2'-9"	8'-3"	9	4'-9"	6"	2'-6"	2'-9"	8'-3"	#6	25'-11"	#6	19'-1"	6'-8"	5'-2"	5'-8"
6 x 3	4'-6"	8'-7"	12'-9"	-	10	3'-9"	6"	2'-0"	2'-3"	7'-3"	7	3'-9"	6"	2'-0"	2'-3"	7'-3"	#5	20'-2"	#5	14'-11"	7'-10"	4'-2"	4'-8"
6 x 4	4'-6"	8'-7"	12'-9"	16'-11"	13	4'-9"	6"	2'-6"	2'-9"	8'-3"	9	4'-9"	6"	2'-6"	2'-9"	8'-3"	#6	25'-11"	#6	19'-1"	7'-10"	5'-2"	5'-8"
7 x 3	4'-6"	8'-7"	12'-9"	-	10	3'-9"	6"	2'-0"	2'-3"	7'-3"	7	3'-9"	6"	2'-0"	2'-3"	7'-3"	#5	20'-2"	#5	14'-11"	9'-0"	4'-2"	4'-8"
7 x 4	4'-6"	8'-7"	12'-9"	16'-11"	13	4'-9"	6"	2'-6"	2'-9"	8'-3"	9	4'-9"	6"	2'-6"	2'-9"	8'-3"	#6	25'-11"	#6	19'-1"	9'-0"	5'-2"	5'-8"
8 x 4	4'-6"	8'-7"	12'-9"	16'-11"	13	4'-9"	6"	2'-6"	2'-9"	8'-3"	9	4'-9"	6"	2'-6"	2'-9"	8'-3"	#6	25'-11"	#6	19'-1"	10'-2"	5'-2"	5'-8"

NOTE: REINFORCEMENT BARS BENDING DIMENSIONS ARE OUT TO OUT.

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

* 45° WALL
** 15° WALL

PIPE ARCH AND ELLIPTICAL PIPE CULVERTS



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

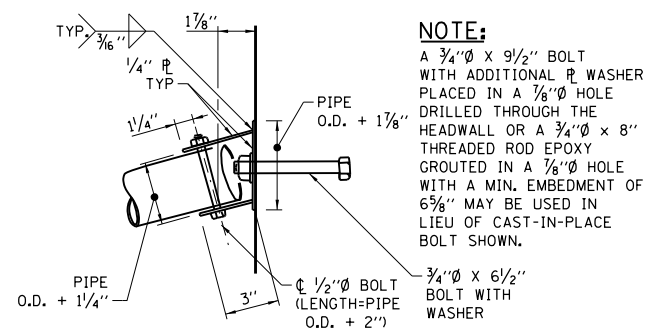
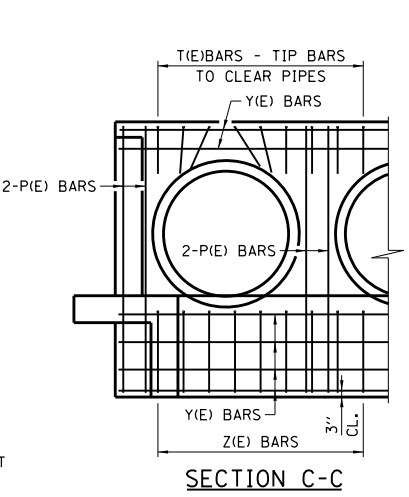
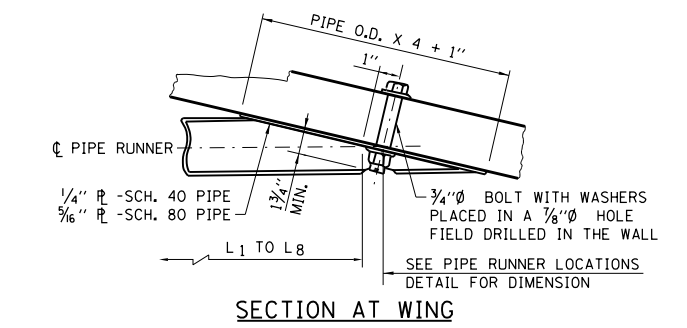
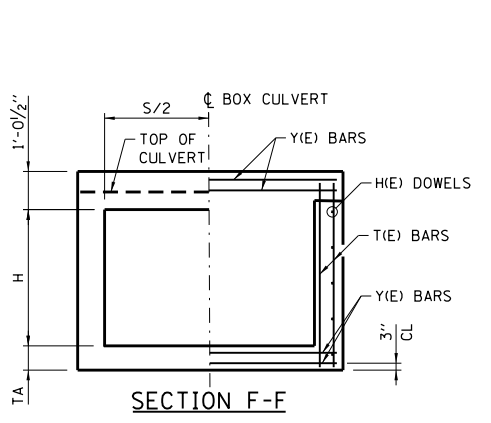
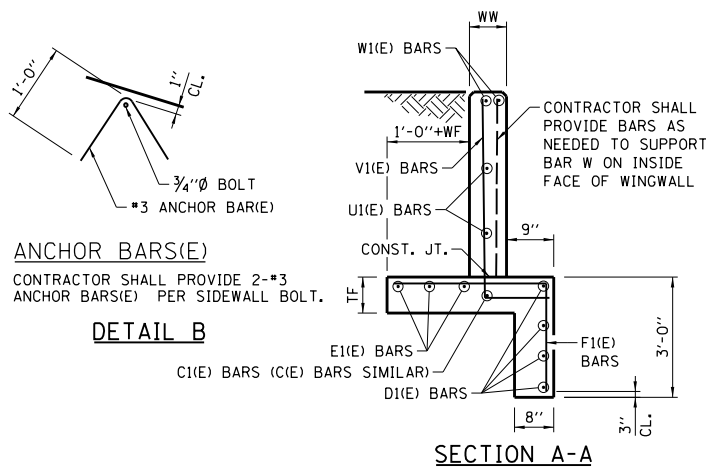
THE WEIGHT OF THE ADDITIONAL BARS AND THE ADDITIONAL QUANTITY OF CONCRETE IN THE HEADWALL SHALL BE ADDED TO THE QUANTITIES SHOWN.

Paul Kovacs
APPROVED CHIEF ENGINEER DATE 6-1-2009

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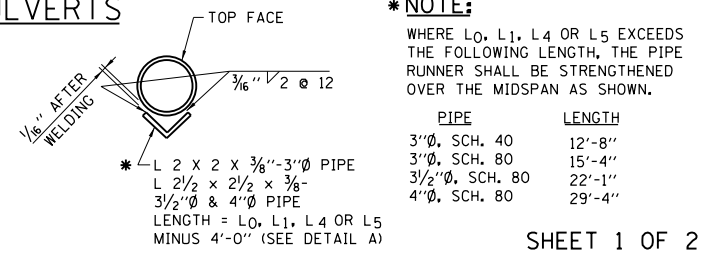
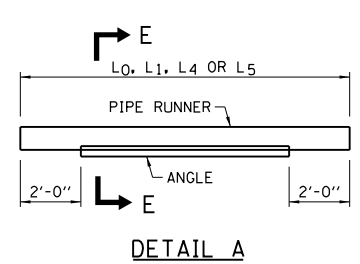
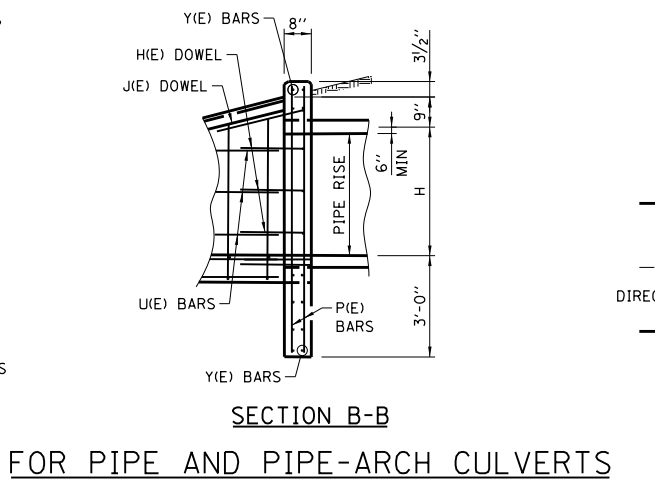
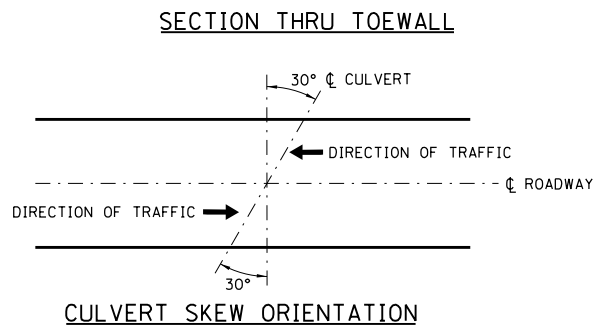
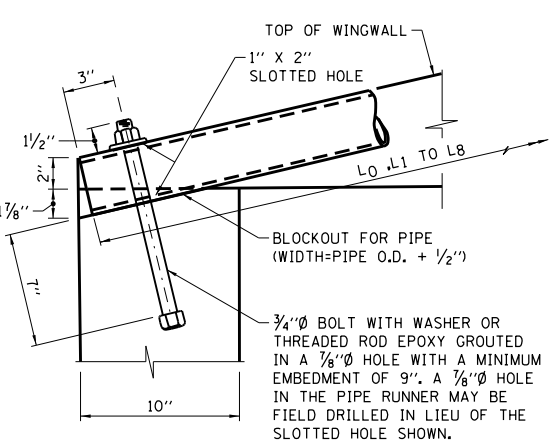
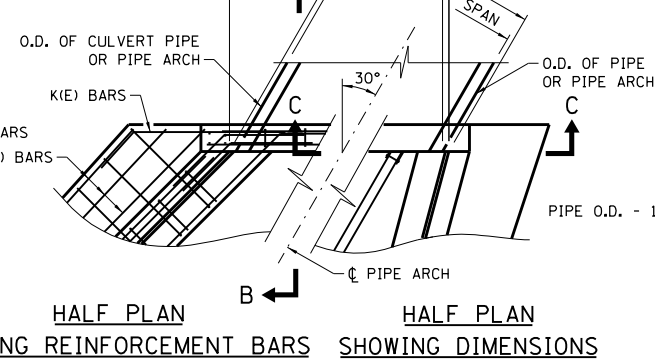
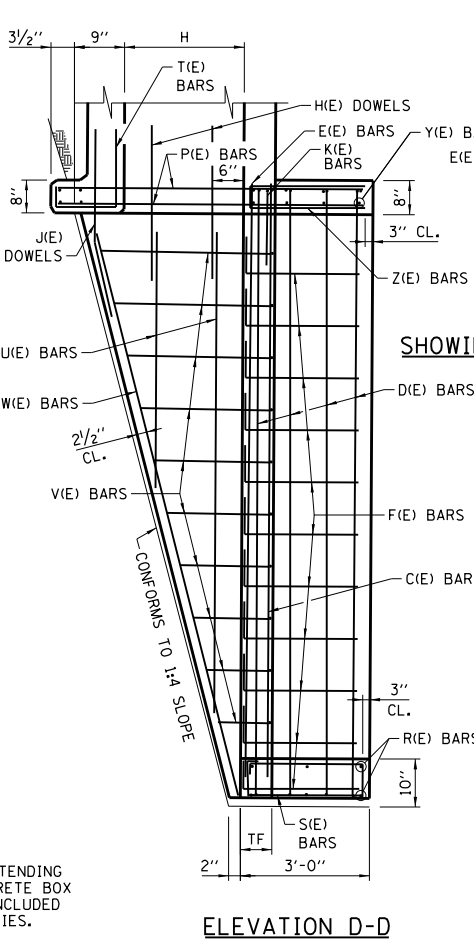
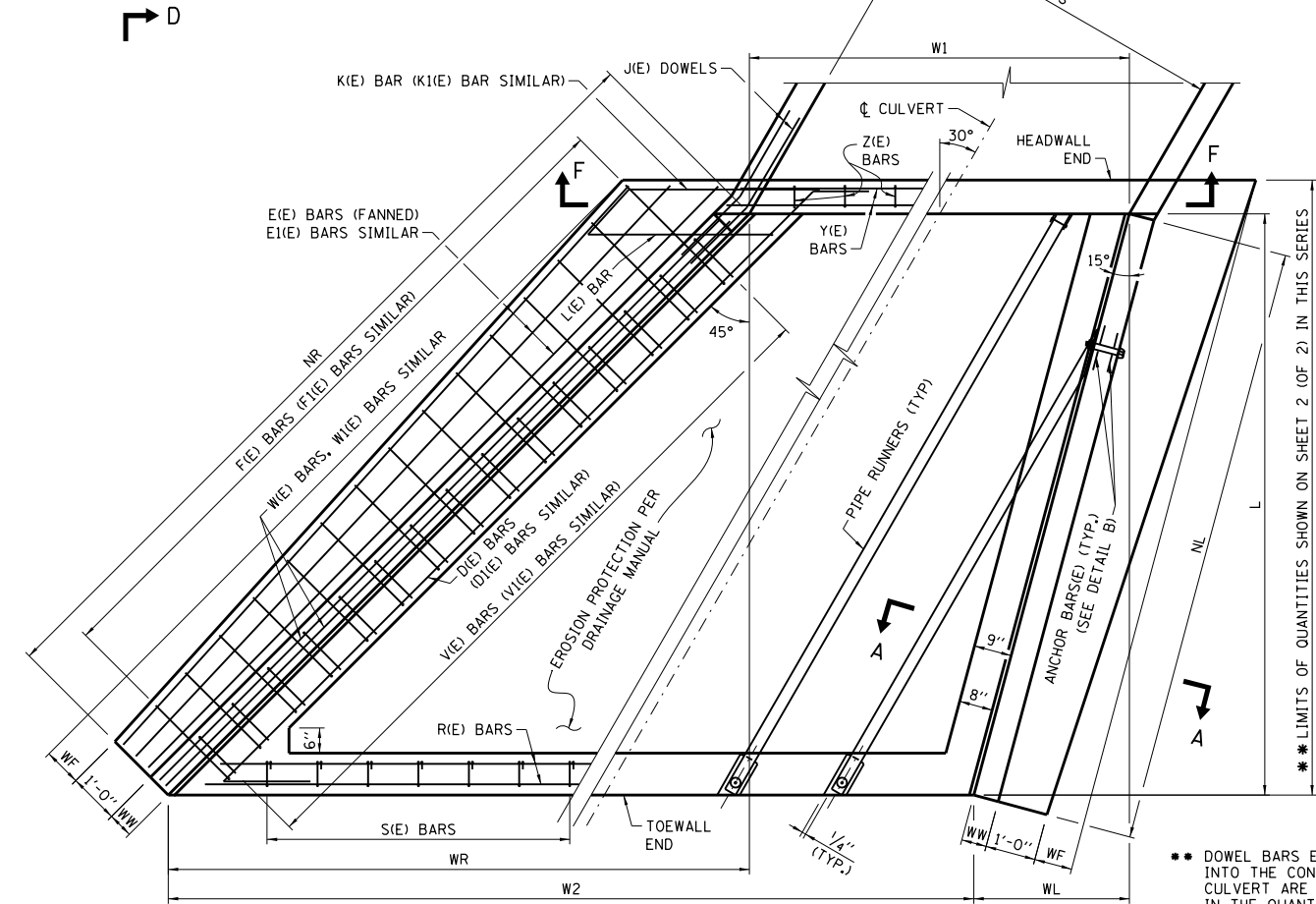
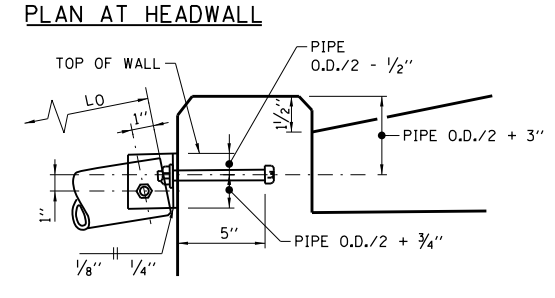
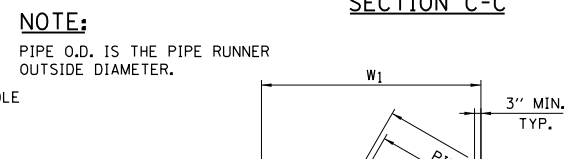
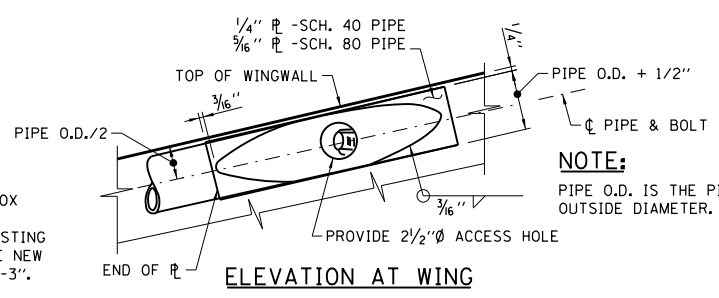
SAFETY END TREATMENT FOR SINGLE CULVERTS
30° SKEW 1:4
SLOPE H ≤ 4'

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 C₂-C₄, C₁₅-C₁₈ BEGINNING AT HEADWALL AND BARS WITH DIMENSIONS C₁-C₃, C₁₆-C₁₇ 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".



NOTE:
WHERE L₀, L₁, L₄ OR L₅ 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 = L₀, L₁, L₄ OR L₅ MINUS 4'-0" (SEE DETAIL A)

GENERAL NOTES:

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

FOR BOX CULVERTS

S = DESIGN SPAN
H = DESIGN HEIGHT

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

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

FOR PIPE AND PIPE-ARCH CULVERTS

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<B' AND S=VARIES

STANDARD B18-05

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



TABLE OF DIMENSIONS

Table with columns S, H, L, NL, NR, WW, W1, W2, WL, WR, WF, TF. Rows 9' through 8'.

Table with columns TOTAL QUANTITIES ONE END MINIMUM "S", INCREASE IN QUANTITIES FOR 1' INCREASE IN "S", CONC. CU. YD., REINF. BARS POUND.

NOTE: REINFORCEMENT BARS BENDING DIMENSIONS ARE OUT TO OUT.

PIPE RUNNERS FOR ONE END

Table for PIPE RUNNERS FOR ONE END with columns H, SIZE (DIA.), SCHEDULE, WINGWALL PIPES (15° WALL, 45° WALL), HEADWALL PIPES, TOTAL LENGTH.

TABLE OF REINFORCEMENT BARS FOR ONE END

Table for TABLE OF REINFORCEMENT BARS FOR ONE END with columns 1-(C) BAR, 1-(C)(E) BAR, D(E) BAR, #4-E(E) BARS, #4-E(E) BARS.

TABLE OF REINFORCEMENT BARS FOR ONE END

Table for TABLE OF REINFORCEMENT BARS FOR ONE END with columns F(E) BARS EQUALLY SPACED, L(E) BARS, F1(E) BARS EQUALLY SPACED, H(E) DOWELS, J(E) DOWELS, 1-(K) BAR, 1-(K)(E) BAR, 2-(W) BARS, 2-(W)(E) BARS.

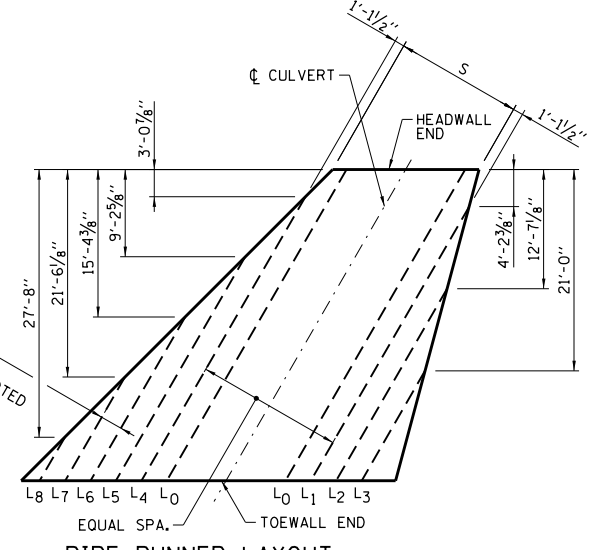
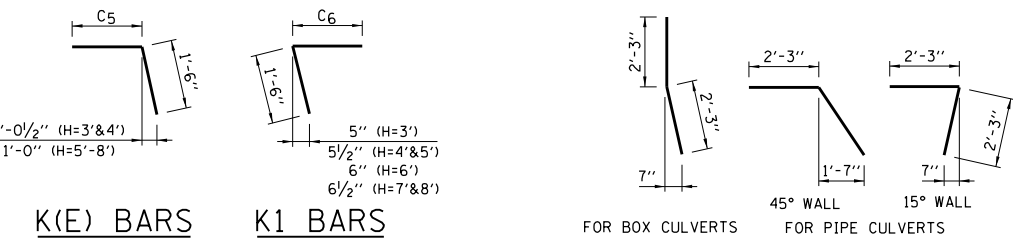
Table for NUMBER OF HEADWALL PIPE RUNNERS FOR 1 END with columns S, NO., S, NO.

TABLE OF REINFORCEMENT BARS FOR ONE END

Table for TABLE OF REINFORCEMENT BARS FOR ONE END with columns U(E) BARS, U1(E) BARS, V(E) BARS, V1(E) BARS.

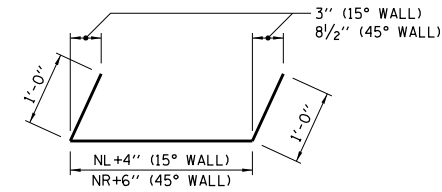
TABLE OF REINFORCEMENT BARS FOR MINIMUM "S" - ONE END

Table for TABLE OF REINFORCEMENT BARS FOR MINIMUM "S" - ONE END with columns Y(E) BARS, R(E) BARS, Z(E) BARS, S(E) BARS, T(E) BARS, P(E) BARS.

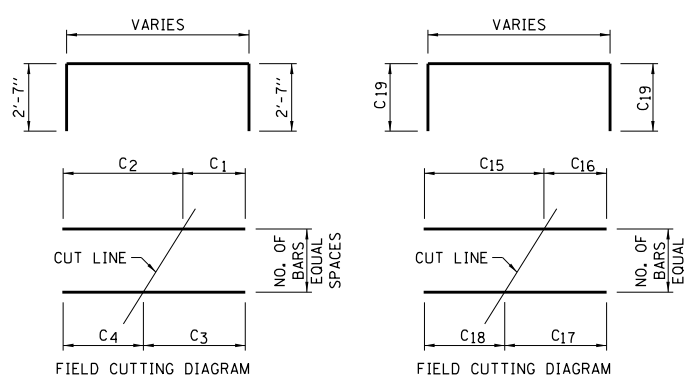


- NOTES FOR TABLES: 1 THE NUMBER OF S(E), T(E) AND Z(E) BARS SHALL BE INCREASED BY 1 FOR EACH 1 FOOT OF INCREASE IN DIMENSION "W1". 2 THE LENGTH OF R(E) AND Y(E) BARS SHALL BE INCREASED BY 1'-1 1/8" FOR EACH 1 FOOT OF INCREASE IN DIMENSION "S". 3 THE NUMBER OF P(E) BARS SHOWN ARE FOR SINGLE SPAN PIPES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

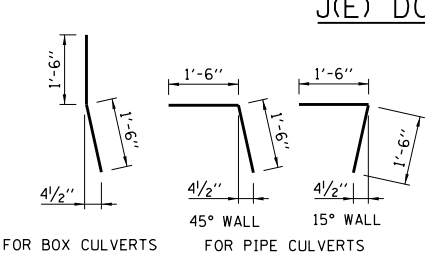
D(E) AND D1(E) BARS



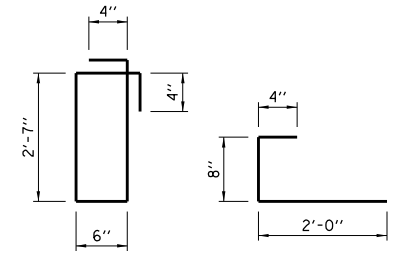
F(E) AND F1(E) BARS V(E) AND V1(E) BARS



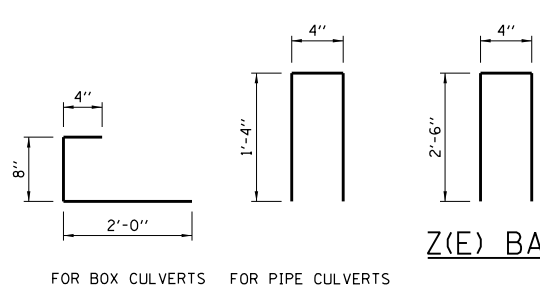
H(E) DOWELS



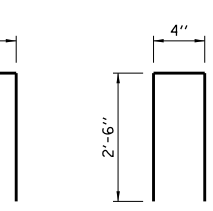
S(E) BARS



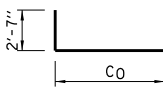
T(E) BARS



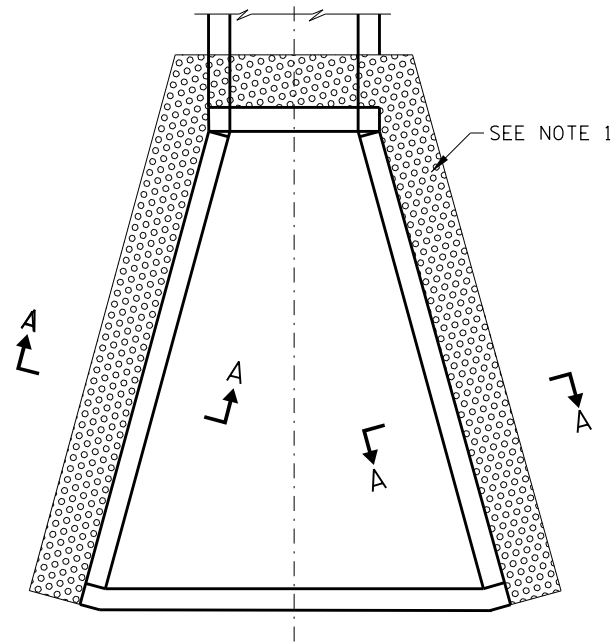
Z(E) BARS



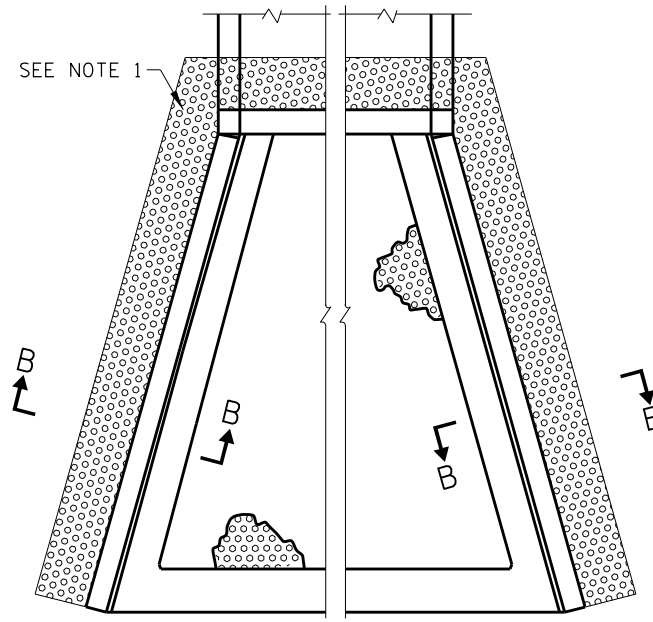
L(E) BARS



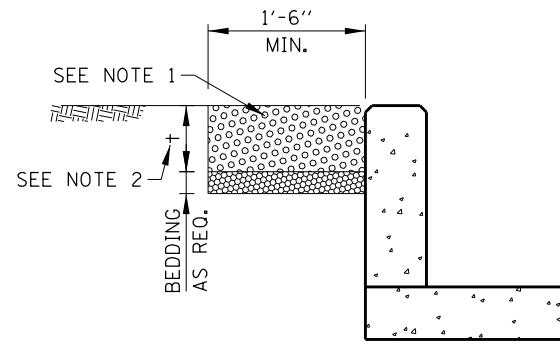
Illinois Tollway logo and text: SAFETY END TREATMENT FOR SINGLE AND MULTIPLE CULVERTS 30° SKEW, 1:4 H:8' AND S=VARIES STANDARD B18-05



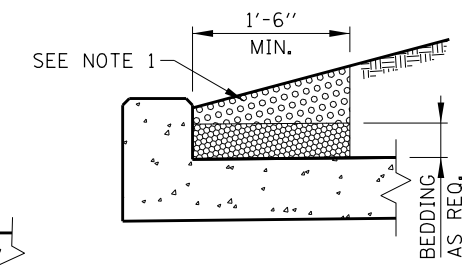
PLAN-0° SKEW, H ≤ 4'



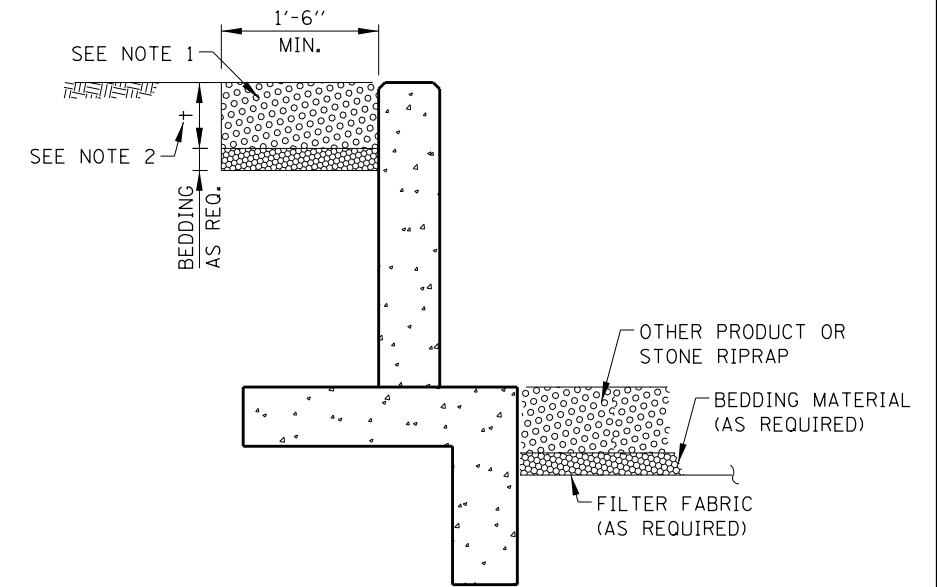
PLAN-0° SKEW, H ≤ 8'



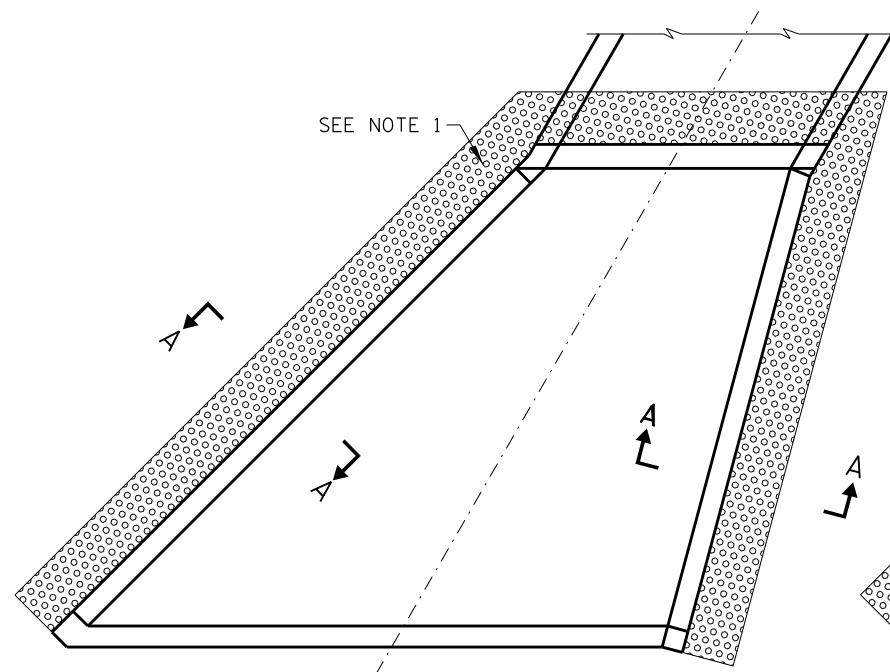
SECTION A-A



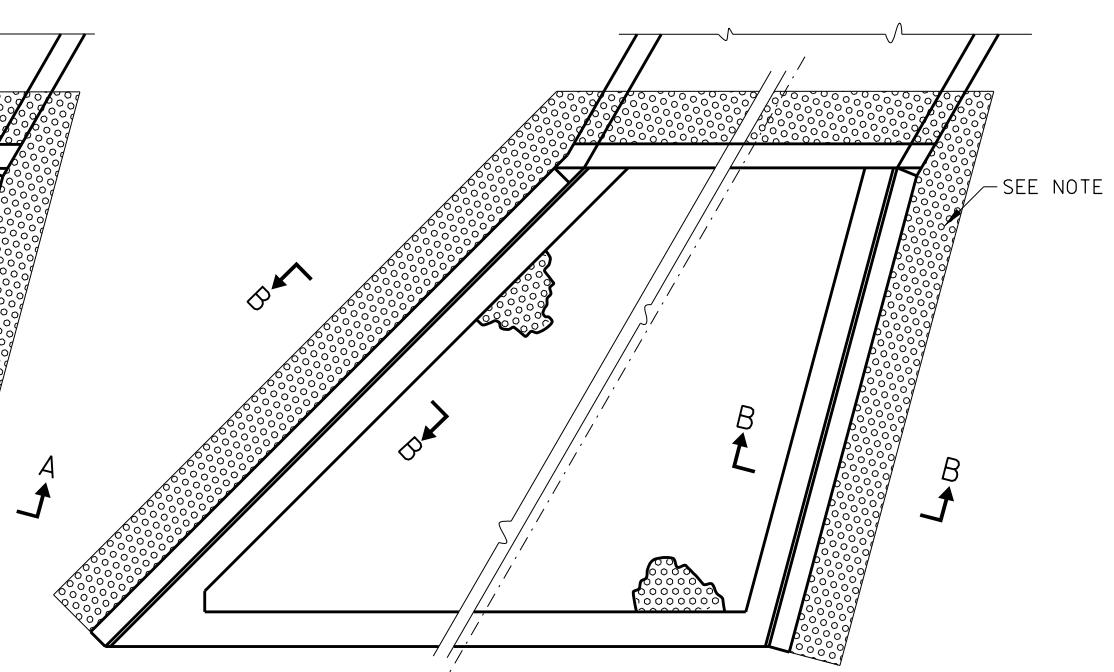
SECTION AT HEADWALL



SECTION B-B



PLAN-SKEW, H ≤ 4'



PLAN-SKEW, H ≤ 8'

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.

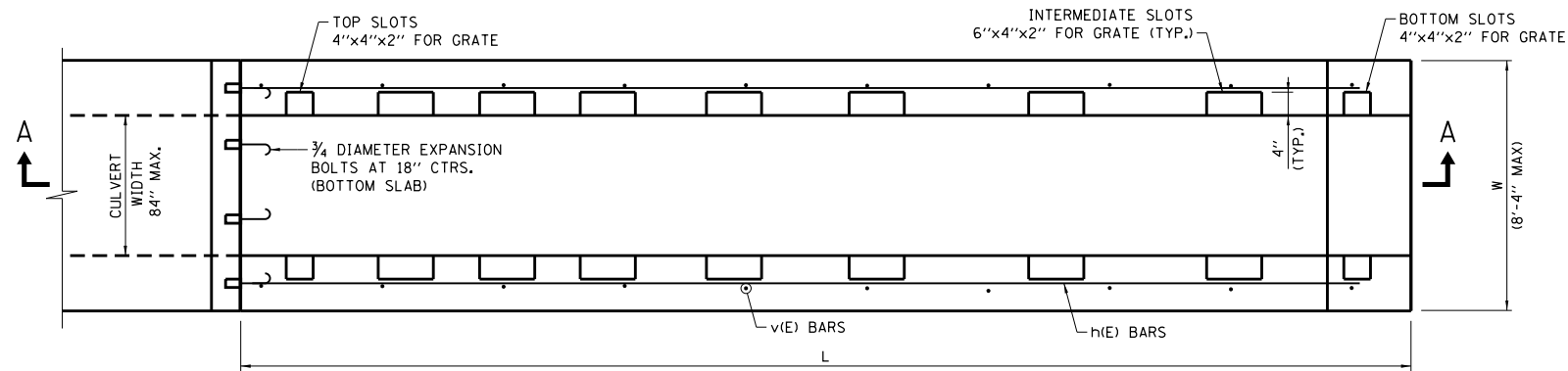
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 3-1-2010

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

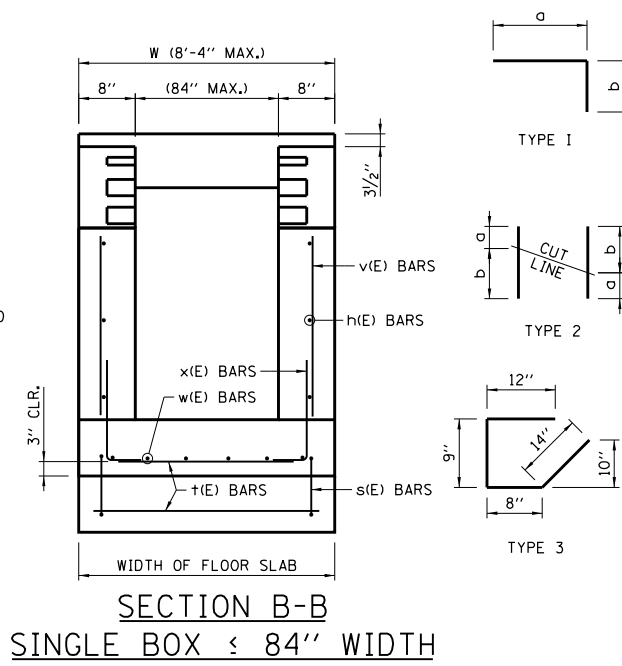
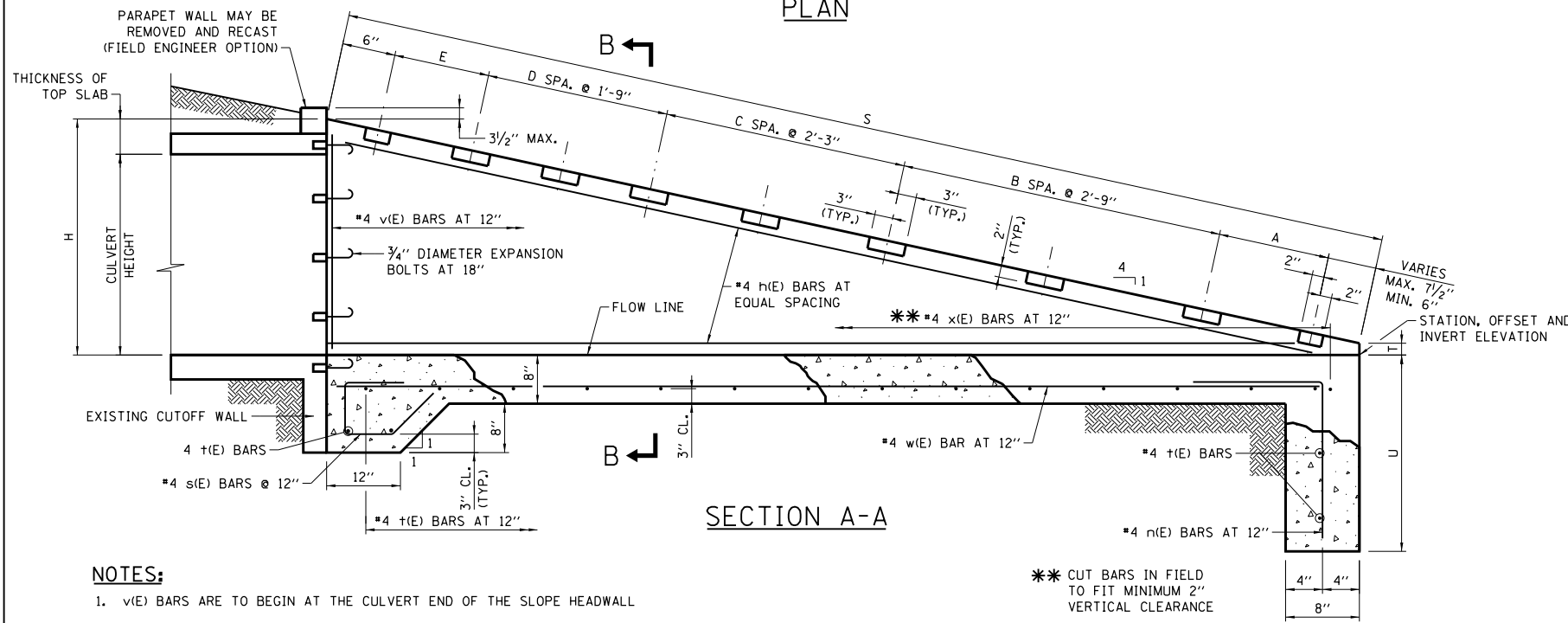


TABLE OF BARS IN ONE WINGWALL 1:4 SLOPE

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.

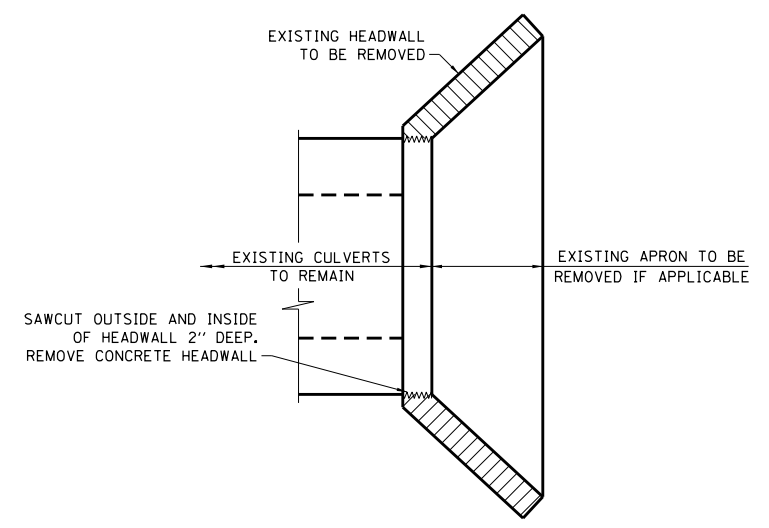
** CUT BARS IN FIELD TO FIT MINIMUM 2" VERTICAL CLEARANCE

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:

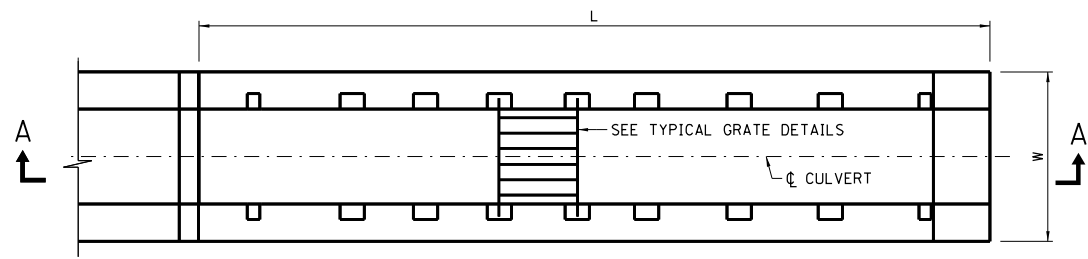
- TYPE 2 "v(E)" BARS SHALL BE ORDERED FULL LENGTH AND CUT IN THE FIELD. THE REMAINING PORTION OF THE "v(E)" BARS SHALL BE USED IN THE OTHER WALL.
- THE LONG LEG OF THE "n(E)" BAR SHALL BE VERTICAL.
- SEE STANDARD B23 FOR GRATING DETAILS.

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.

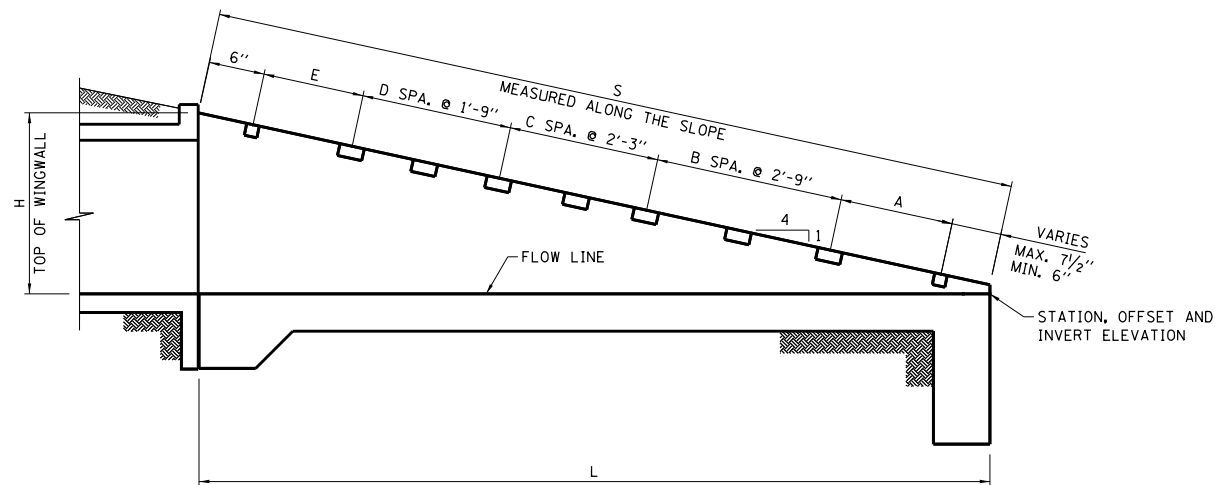
HEADWALL TYPE IV
CONCRETE BOX CULVERT
≤ 84" WIDTH

STANDARD B20-05

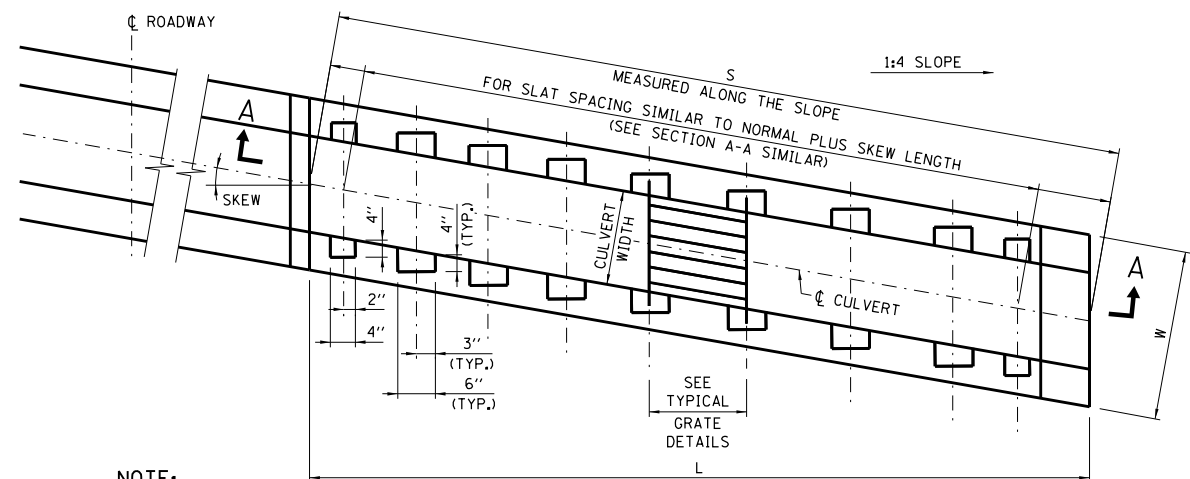
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 2-7-2012



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



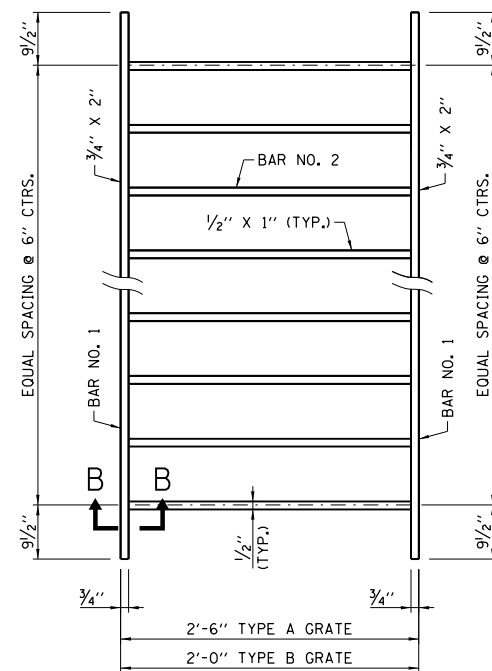
SECTION A-A
END TREATMENT - MULTIPLE OR SINGLE CELL
BOX CULVERT



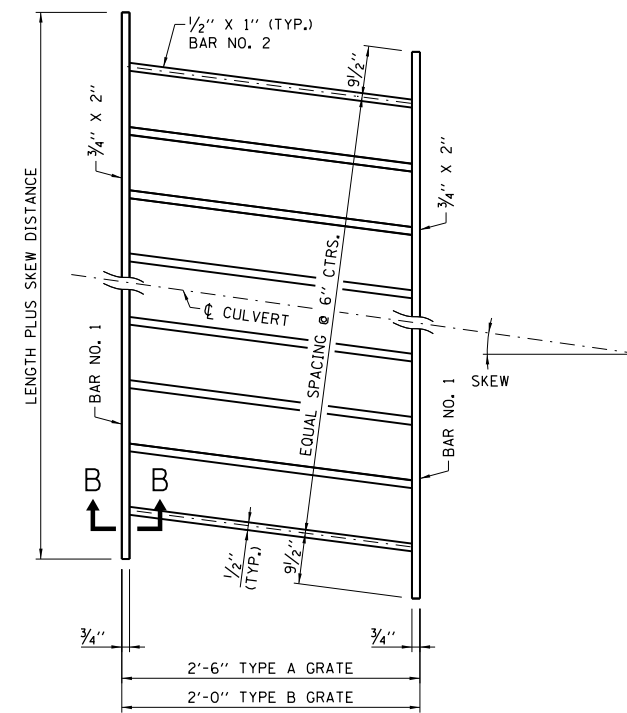
NOTE:

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

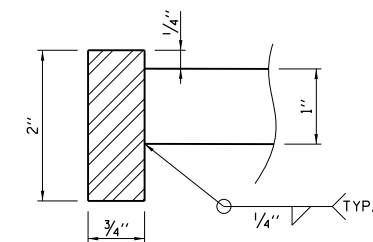
PLAN VIEW (WITH SKEW)
SINGLE BOX CULVERT ≤ 84" WIDE



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.	BAR NO. 1 LENGTH	BAR NO. 2 BARS REQ'D.	BAR NO. 2 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).

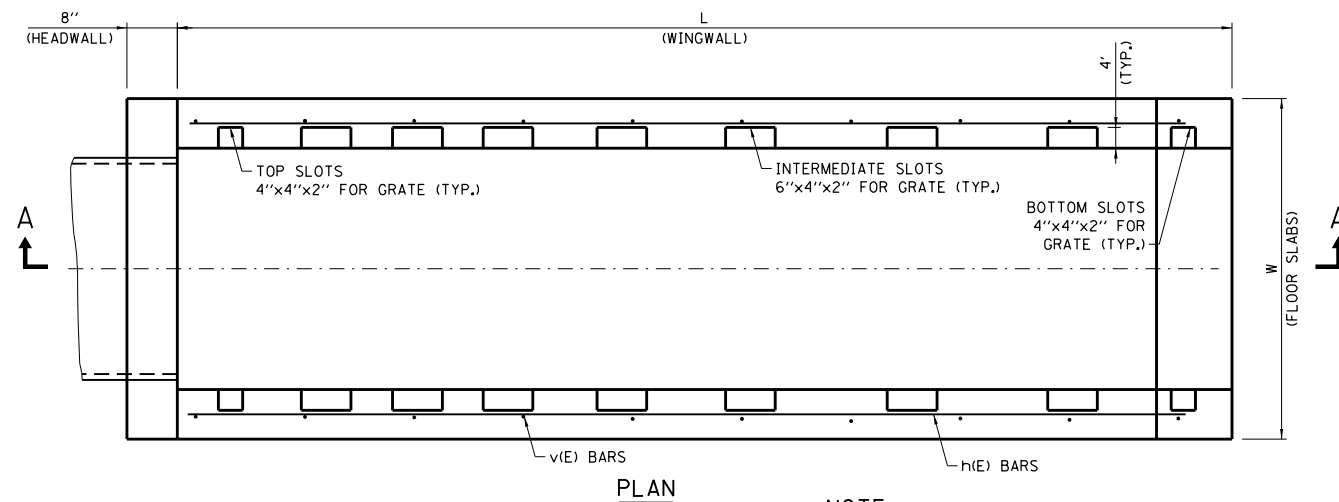
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 2-7-2012

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.



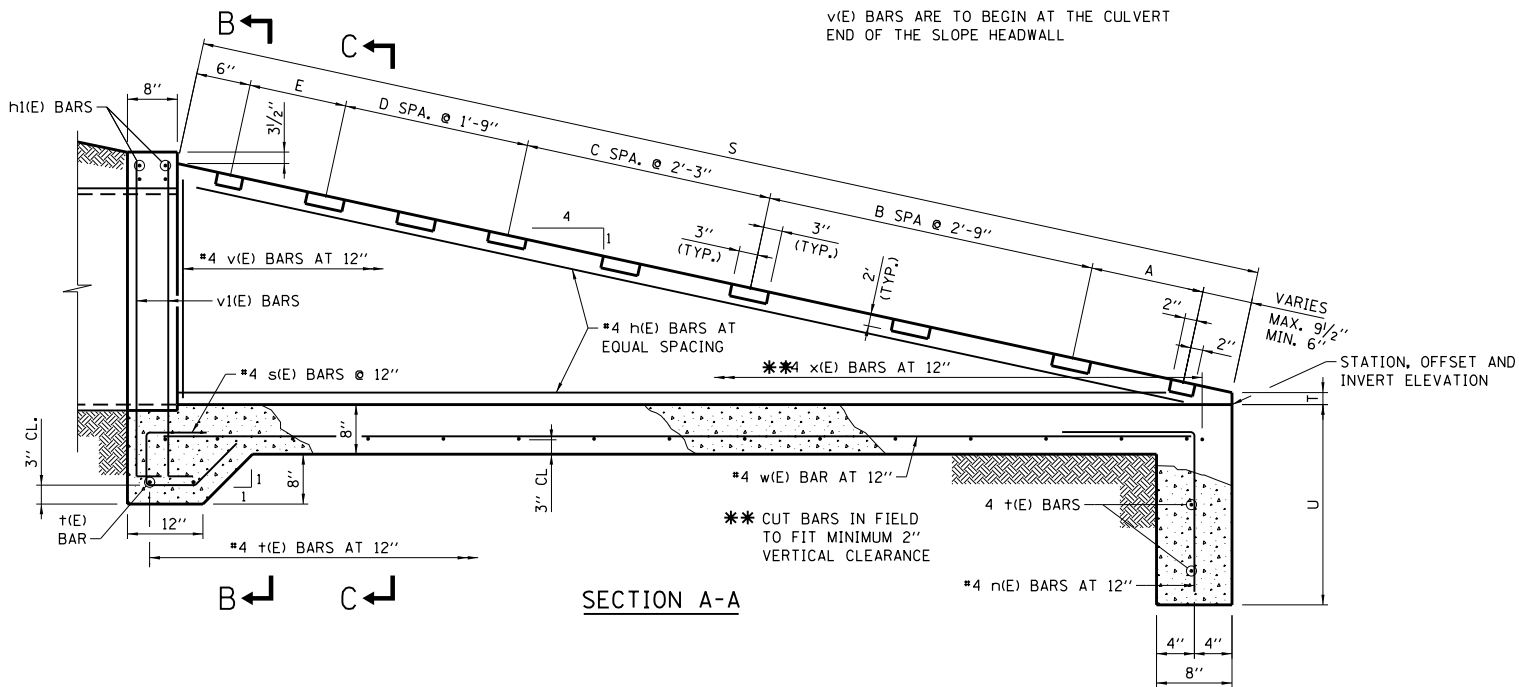
GRATING FOR HEADWALL TYPE IV BOX CULVERT ≤ 84" WIDTH

STANDARD B21-03

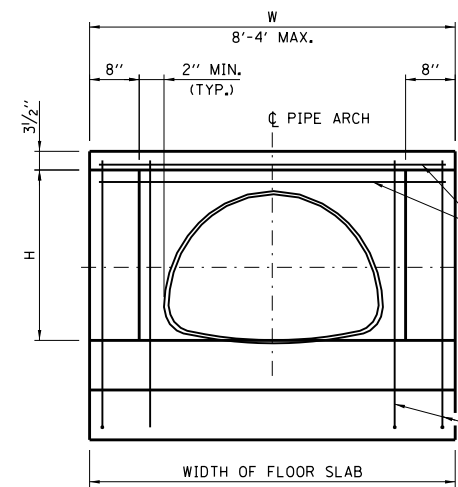


PLAN

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

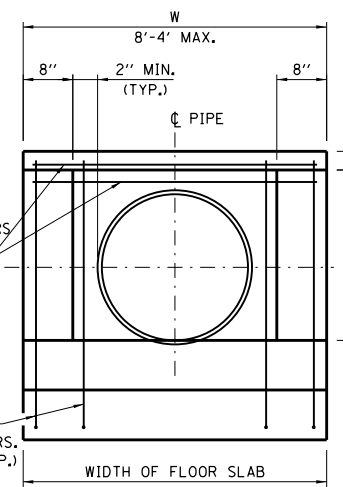


SECTION A-A



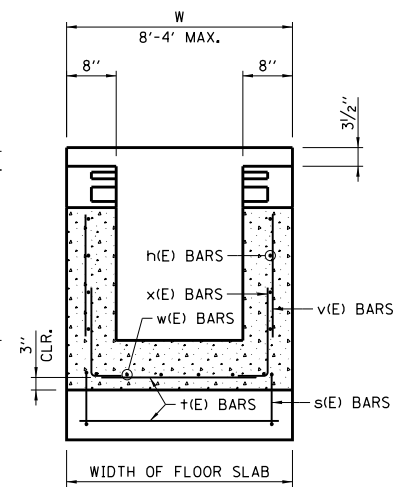
SECTION B-B

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	

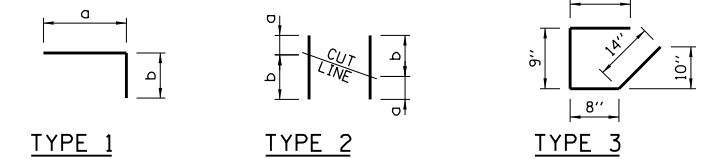


TABLE OF BARS IN ONE WINGWALL 1:4 SLOPE

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:

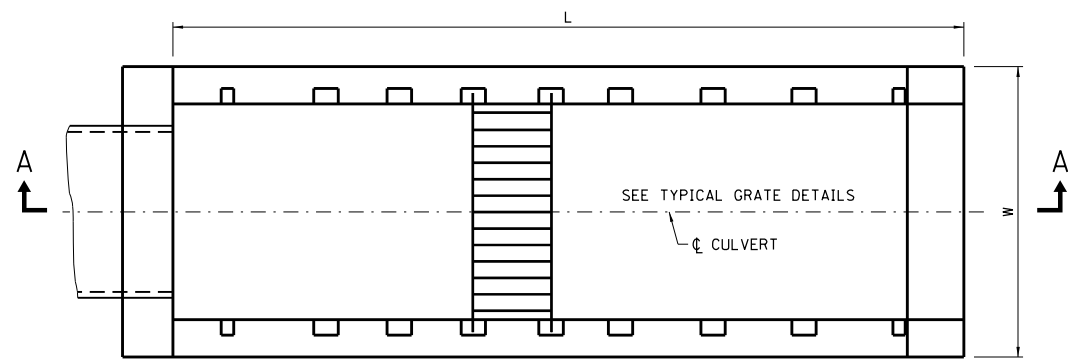
- TYPE 2 "v(E)" BARS SHALL BE ORDERED FULL LENGTH AND CUT IN THE FIELD. THE REMAINING PORTION OF THE "v(E)" BARS SHALL BE USED IN THE OTHER WALL.
- THE LONG LEG OF THE "h(E)" BARS SHALL BE VERTICAL.
- PAY ITEMS ARE IDENTIFIED BY AN ASTERISK (*).
- SEE STANDARD B23 FOR GRATING DETAILS.
- ALL CONCRETE 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 EPOXY COATED (E).

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

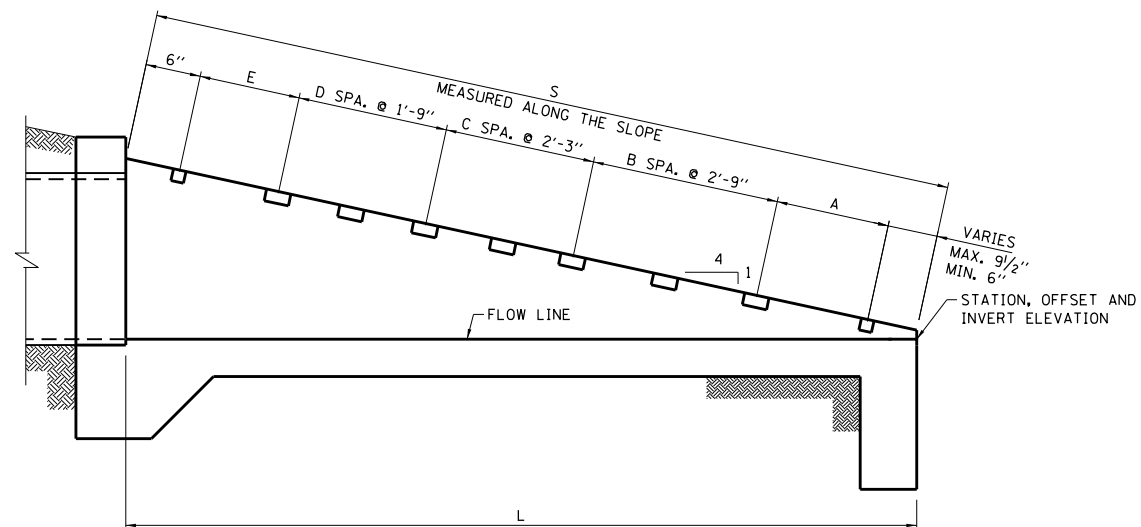
HEADWALL TYPE IV
METAL PIPE & PIPE-ARCH
CULVERTS

STANDARD B22-04

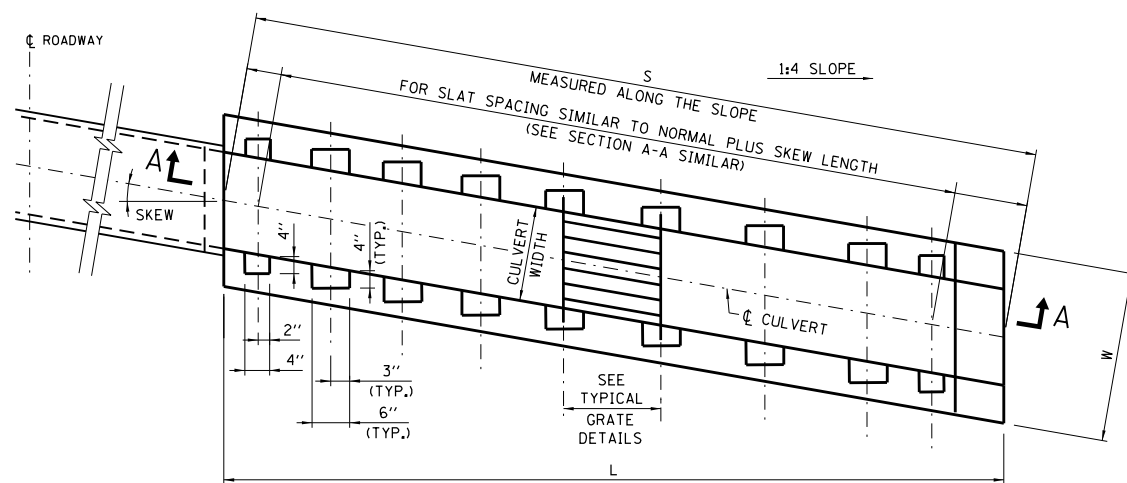
Paul Kovacs
APPROVED CHIEF ENGINEER DATE 2-7-2012



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

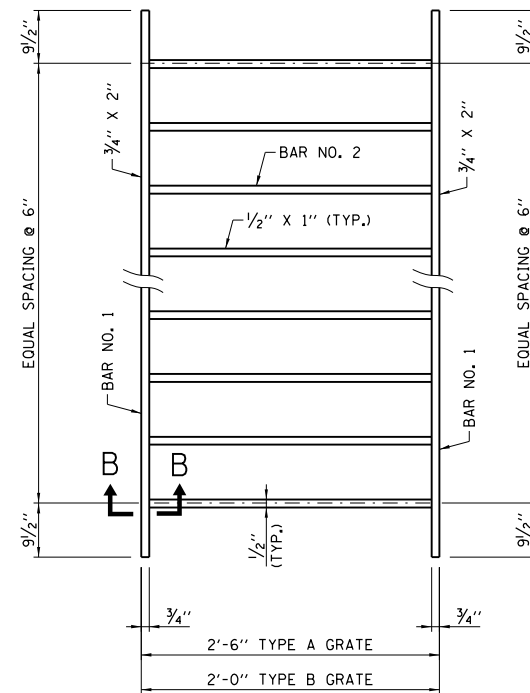


SECTION A-A
END TREATMENT - MULTIPLE OR SINGLE CELL
BOX CULVERT

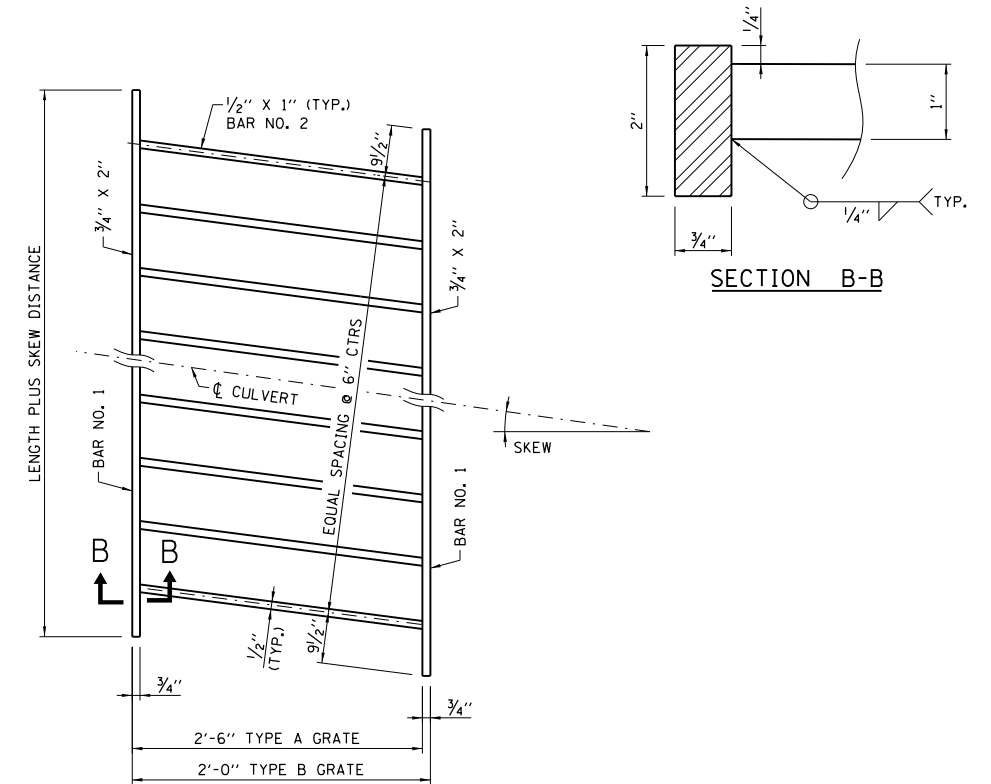


PLAN VIEW (WITH SKEW)

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).

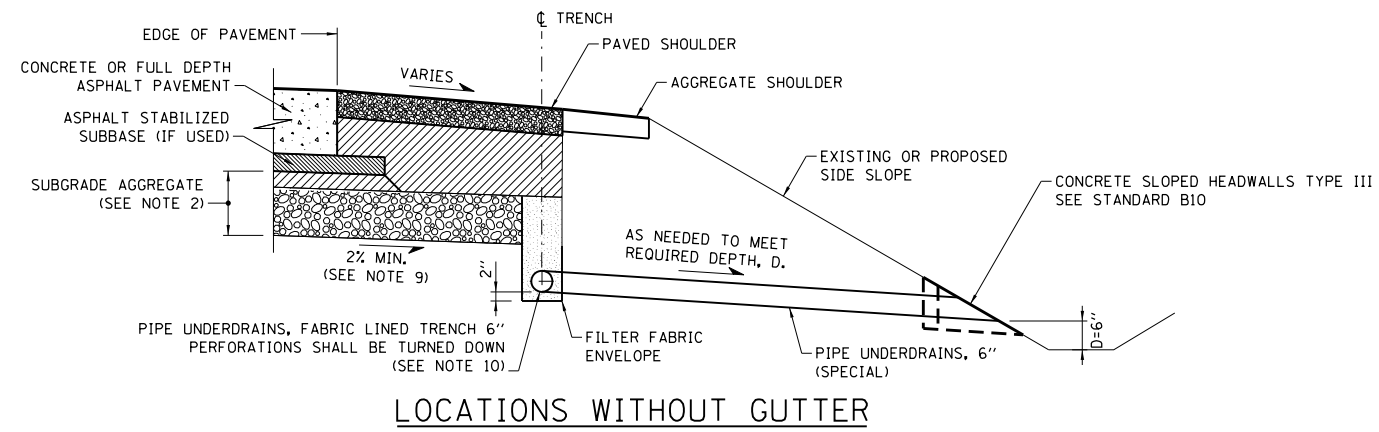
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 2-7-2012

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.

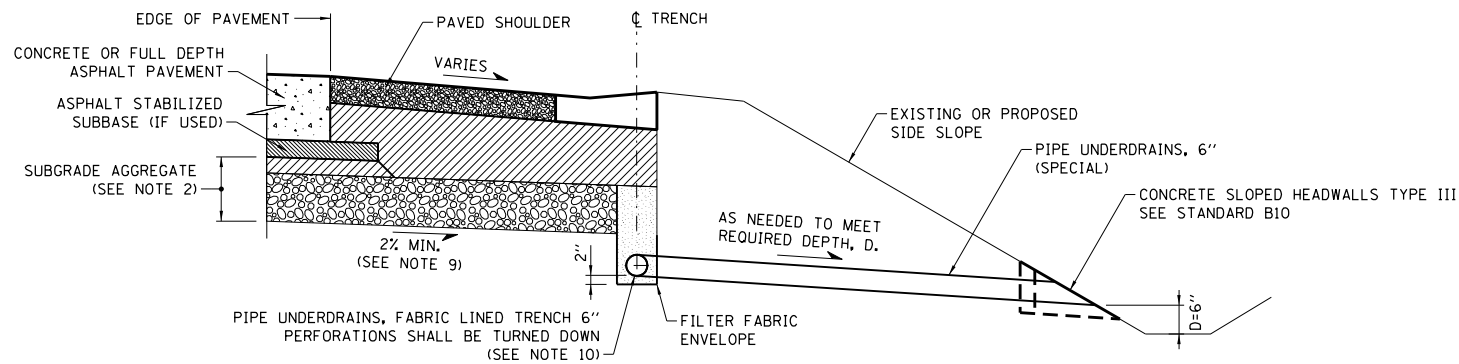


GRATING FOR
HEADWALL TYPE IV PIPE
AND PIPE-ARCH CULVERTS

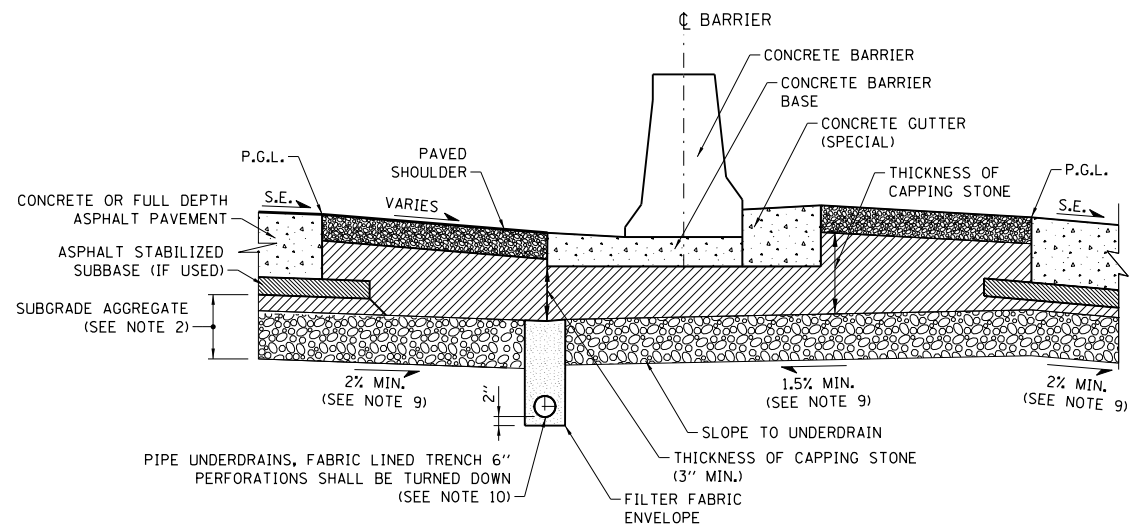
STANDARD B23-03



LOCATIONS WITHOUT GUTTER

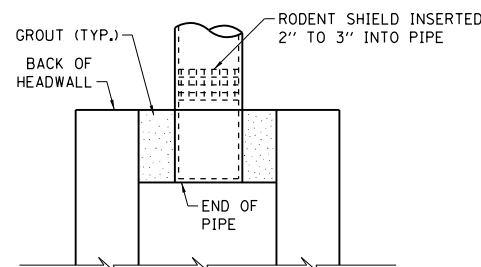


LOCATIONS WITH GUTTER

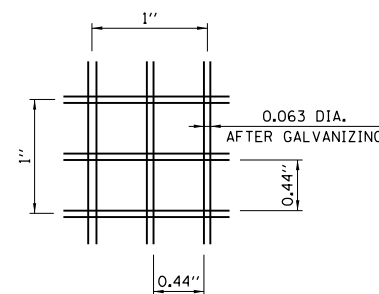


LOCATIONS WITH VARIABLE HEIGHT DOUBLE FACE BARRIER

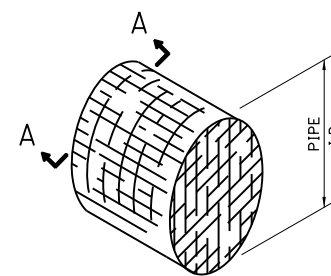
MAXIMUM ALLOWABLE DRAINAGE DISTANCE TO OUTLET OR SEPARATION DISTANCE BETWEEN OUTLETS	
ROADWAY PROFILE GRADE (%)	DISTANCE
≤ 1	250 FT.
BETWEEN 1 AND 2	375 FT.
≥ 2	500 FT. (NOTE 5)



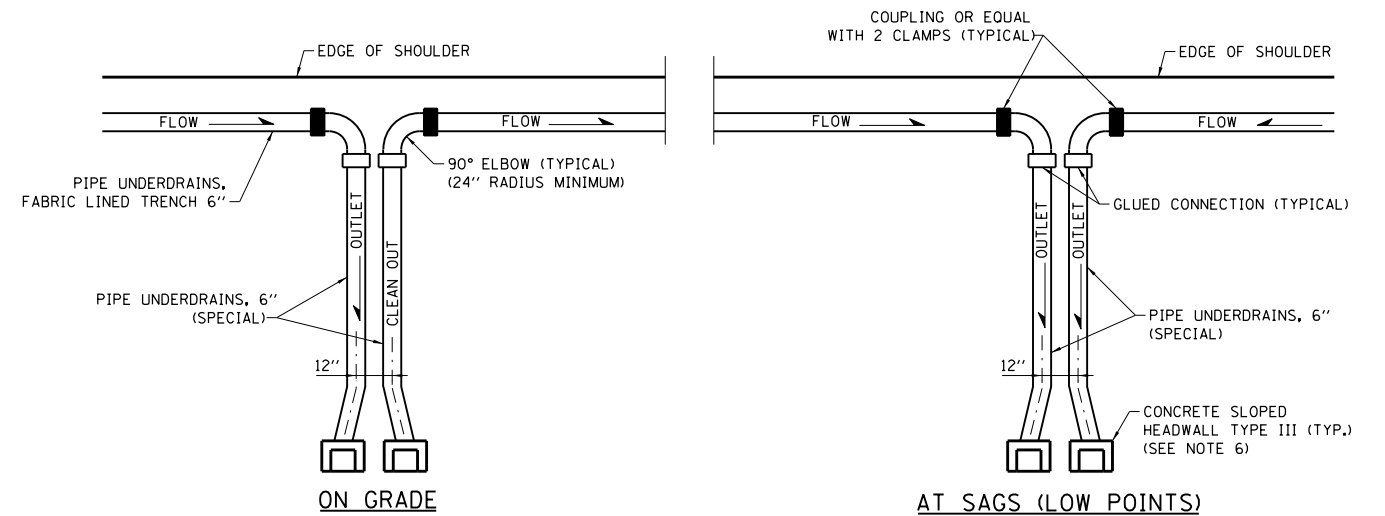
RODENT SHIELD PLACEMENT



SECTION A-A



DETAIL OF RODENT SHIELD



DETAIL OF PIPE UNDERDRAIN OUTLETS

(SEE NOTE 7)

NOTES FOR PIPE UNDERDRAIN

- FOR NEW CONSTRUCTION OR WIDENING PROJECTS, THE PIPE UNDERDRAIN INSTALLATION SHALL OCCUR AFTER SUBGRADE HAS BEEN PREPARED AND AFTER LIFT OF PGE BASE IS PLACED AND BEFORE 3" AND VARIES CA-6 CAPPING STONE IS PLACED. FOR PAVEMENT RUBBLIZATION PROJECTS, THE PIPE UNDERDRAIN SHALL BE INSTALLED PRIOR TO RUBBLIZATION.
- SUBGRADE AGGREGATE SHALL CONSIST OF A 3" AND VARIES CA-6 CAP ABOVE A PGE BASE, THICKNESS AS NOTED IN THE PLANS.
- ON SUPERELEVATED CURVES PLACE LONGITUDINAL UNDERDRAIN ON LOW SIDE ONLY.
- IN AREAS WHERE ROADWAY LONGITUDINAL GRADE IS LESS THAN 0.5%, DIMENSION WILL INCREASE AS NECESSARY TO MAINTAIN MINIMUM 0.5% SLOPE IN PIPE UNDERDRAIN.
- IF 500' MAXIMUM DISTANCE IS EXCEEDED, PIPE UNDERDRAIN SHALL BE INCREASED TO 8" DIAMETER AND TRENCH WIDTH INCREASED TO 16".
- AT OUTLET LOCATIONS, PIPE UNDERDRAINS SHALL SEPARATE SUFFICIENTLY TO PROVIDE SPACE FOR TWO CONCRETE SLOPED HEADWALLS, OR TWO PIPES CAN RUN PARALLEL INTO A LARGER HEADWALL.
- IN AREAS WHERE A CLOSED DRAINAGE SYSTEM EXISTS, THE PIPE UNDERDRAIN, 6" (SPECIAL) SHALL DRAIN TO THE NEAREST CATCH BASIN. THE UPPER END OF A RUN ON GRADE SHALL ALSO BE CONNECTED TO A CATCH BASIN TO BE USED AS A CLEANOUT.
- THE OUTLET END OF THE SUBDRAIN SHALL BE PROTECTED BY A PERMANENT RODENT SHIELD. THE RODENT SHIELD SHALL HAVE THE CONFIGURATION SHOWN AND BE CONSTRUCTED FROM HOT DIP GALVANIZED STEEL INDUSTRIAL WIRE CLOTH 3x3 MESH, 0.063"x0.063" WIRE SIZE IN ACCORDANCE WITH AASHTO M232 (ASTM A153).
- 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.

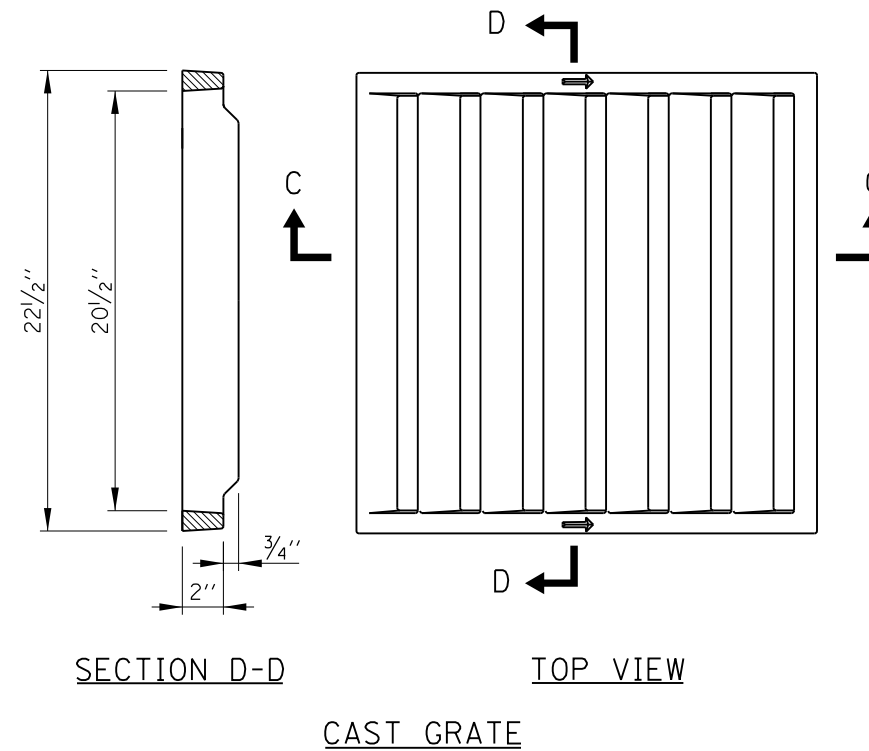
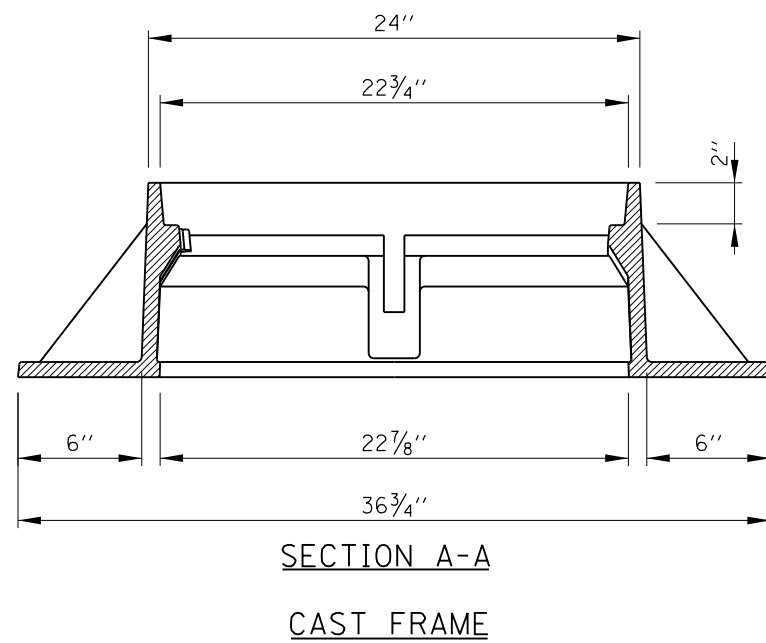
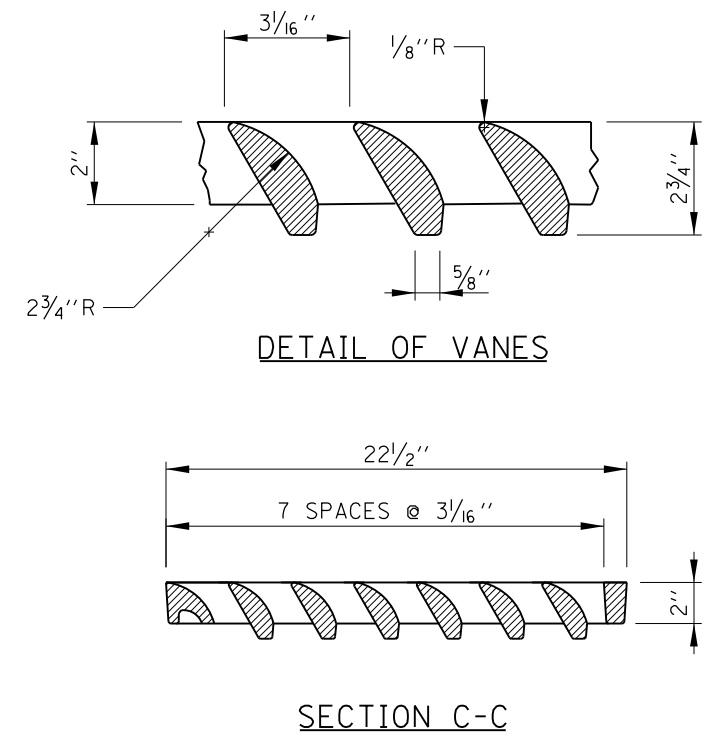
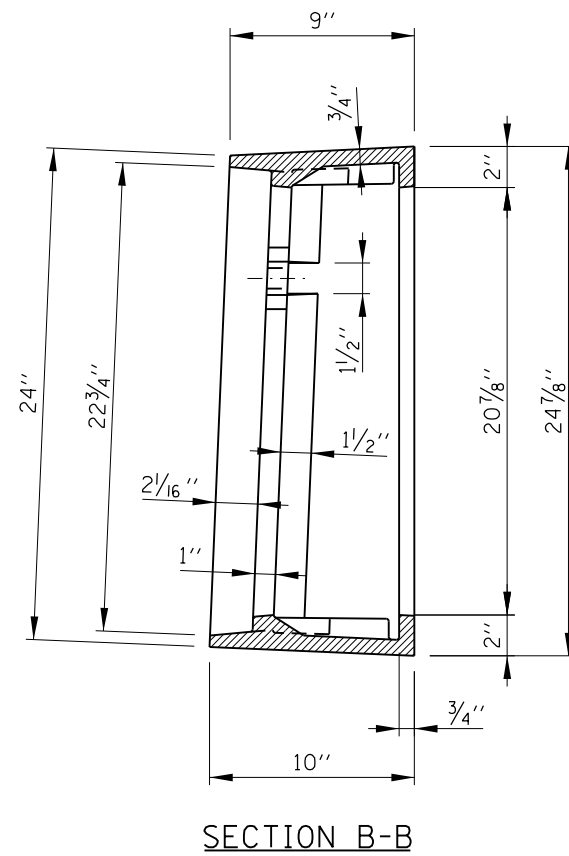
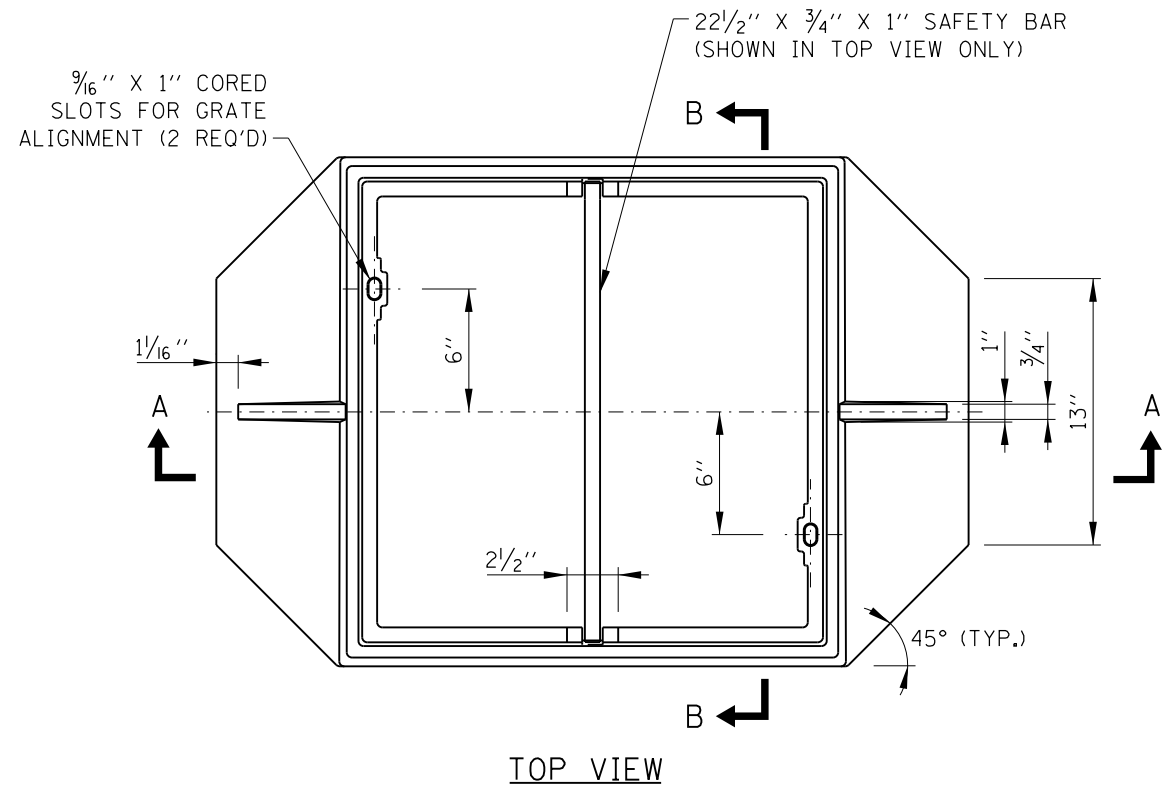
DATE	REVISIONS
11-01-12	REVISED NOTES, MODIFIED PIPE
11-01-12	UNDERDRAIN WITHOUT GUTTER.
3-11-2015	REVISED PIPE UNDERDRAIN DIMENSIONS.
3-31-2016	REMOVE RUBBLIZED DETAIL, ADD VAR. HEIGHT BARRIER DETAIL.
3-31-2017	REVISED SUBGRADE SCOPE IN LOCATIONS WITH VARIABLE HEIGHT DOUBLE FACE BARRIER
3-01-2018	ADDED MINIMUM THICKNESS OF CAPPING STONE



PIPE UNDERDRAINS

STANDARD B24-06

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




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.

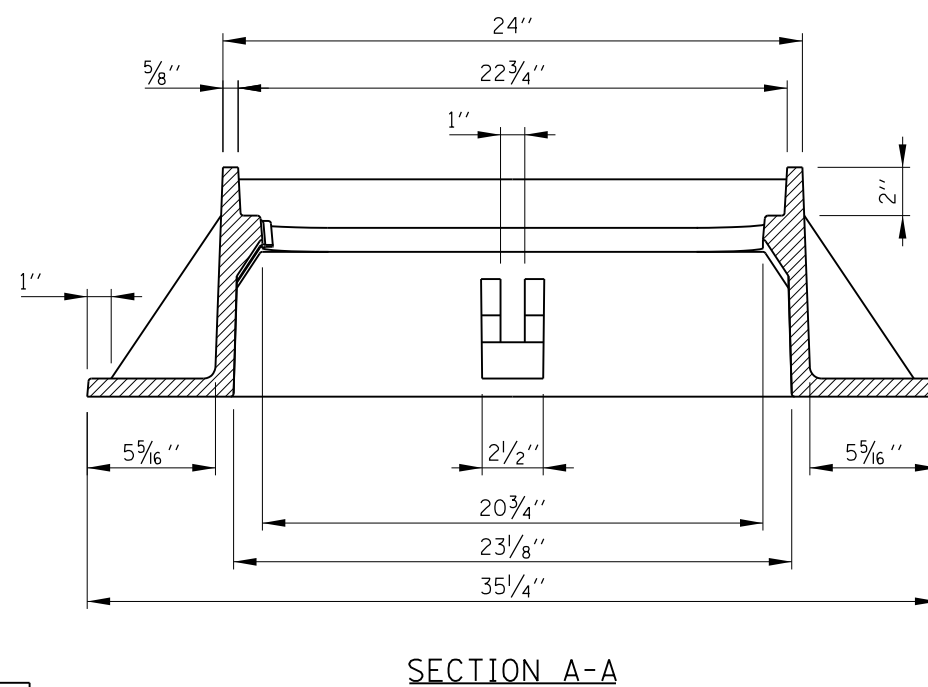
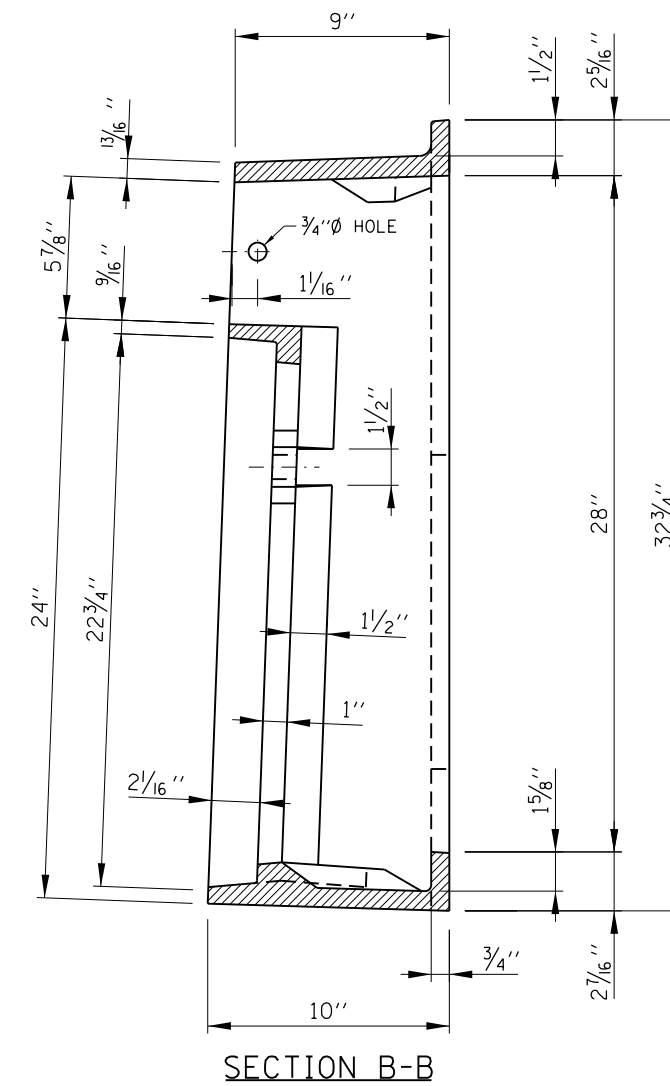
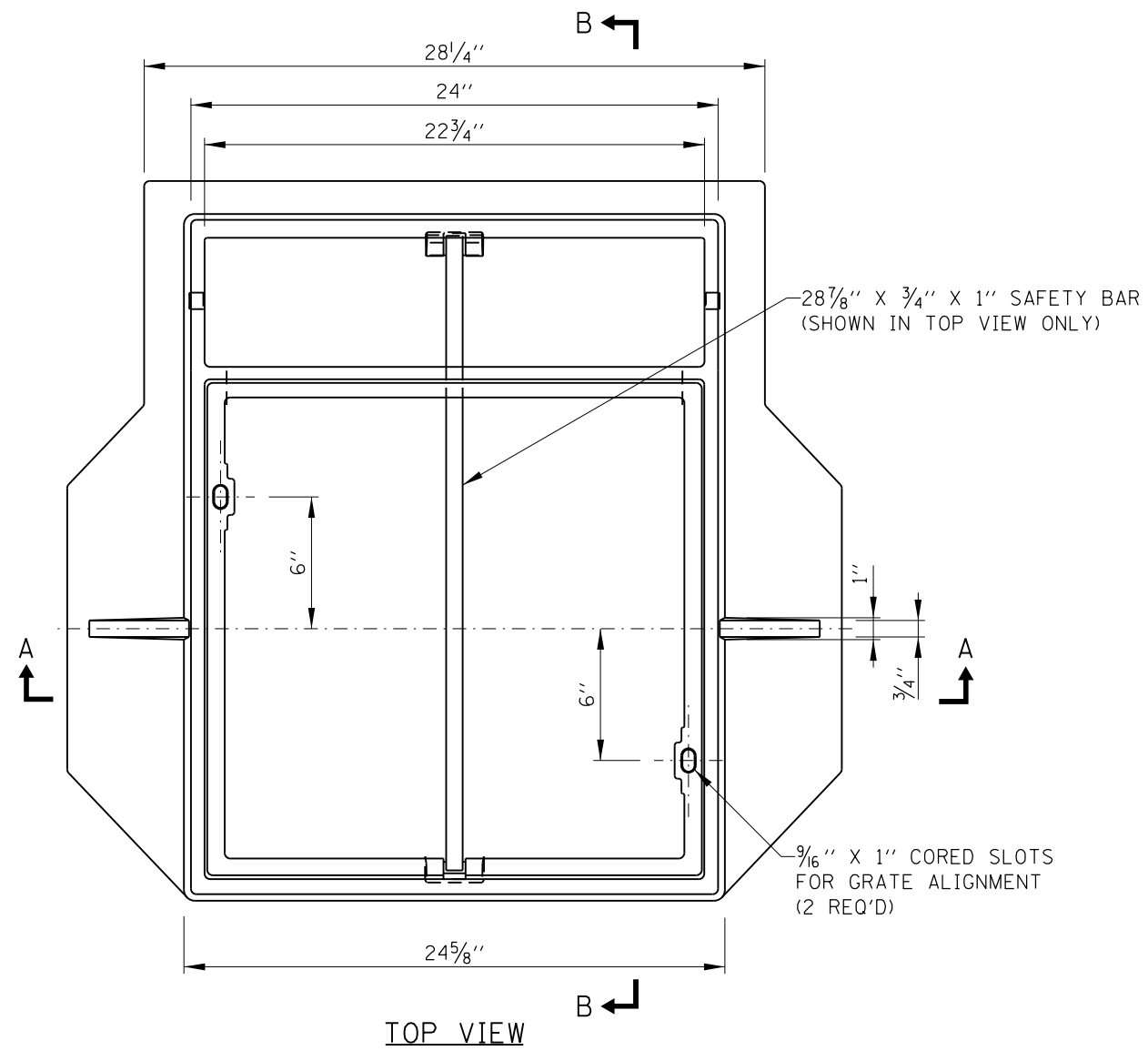
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 6-30-2008

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



FRAME AND GRATE
TYPE 20A


STANDARD B25-01

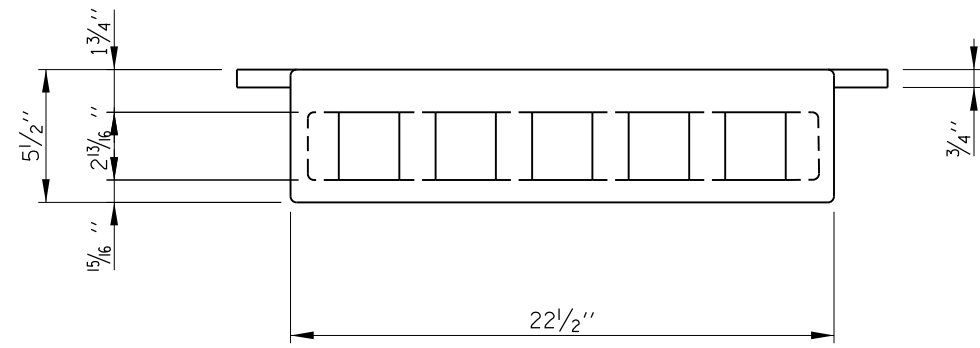


FRAME AND GRATE
TYPE 21A

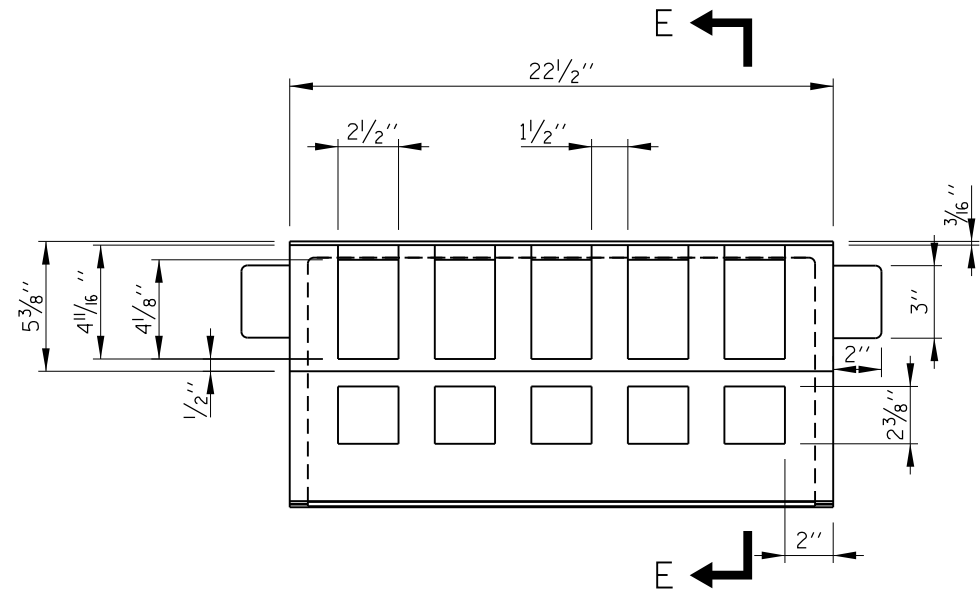
STANDARD B26-01

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

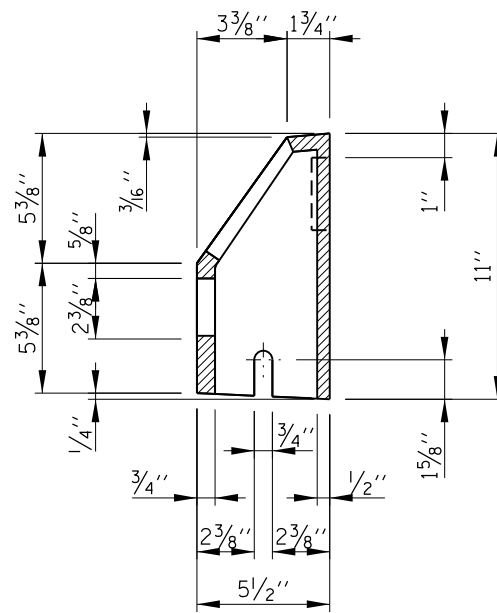

 APPROVED CHIEF ENGINEER DATE 6-30-2008



TOP VIEW

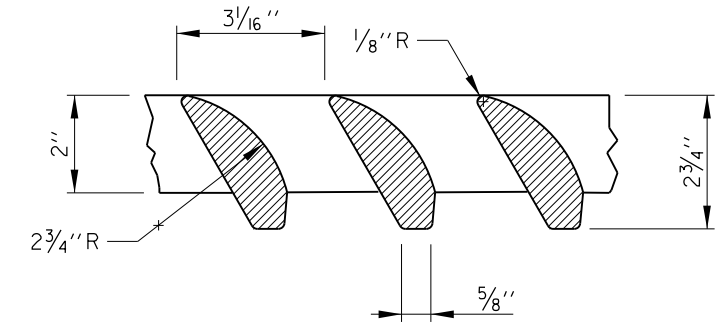


FRONT VIEW

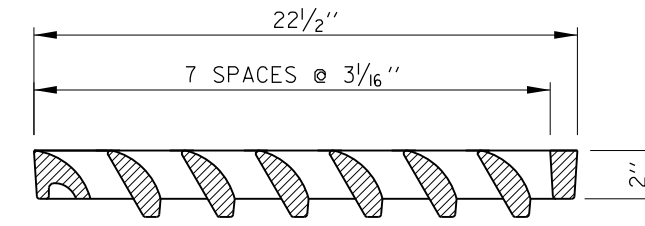


SECTION E-E

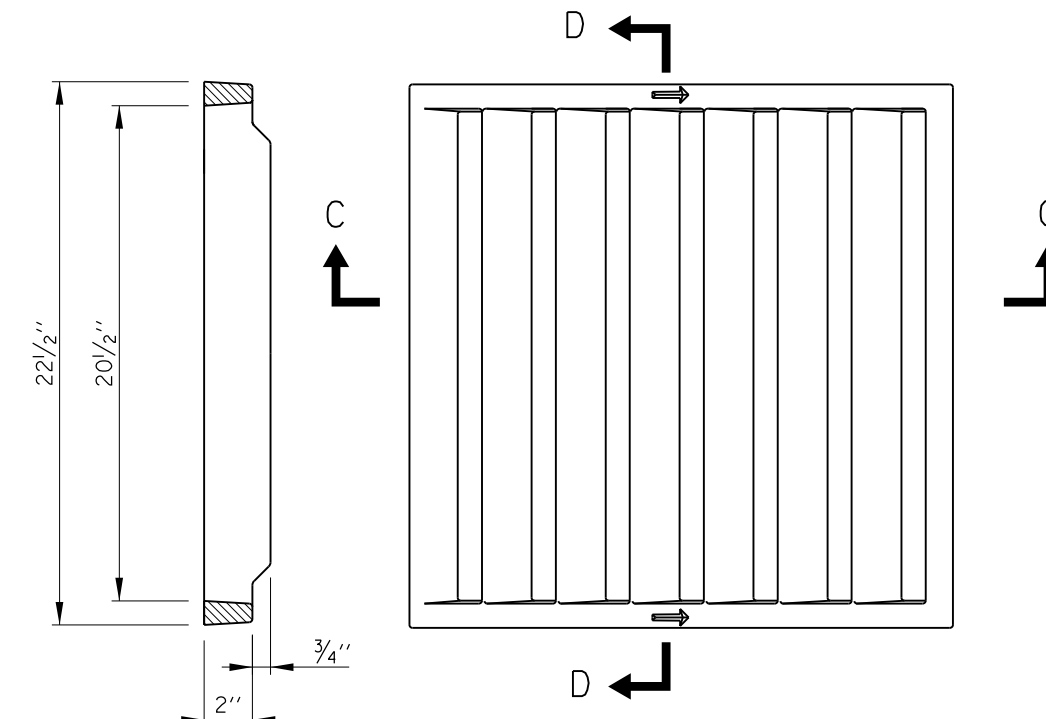
CURB BOX



DETAIL OF VANES



SECTION C-C



SECTION D-D

TOP VIEW

CAST GRATE

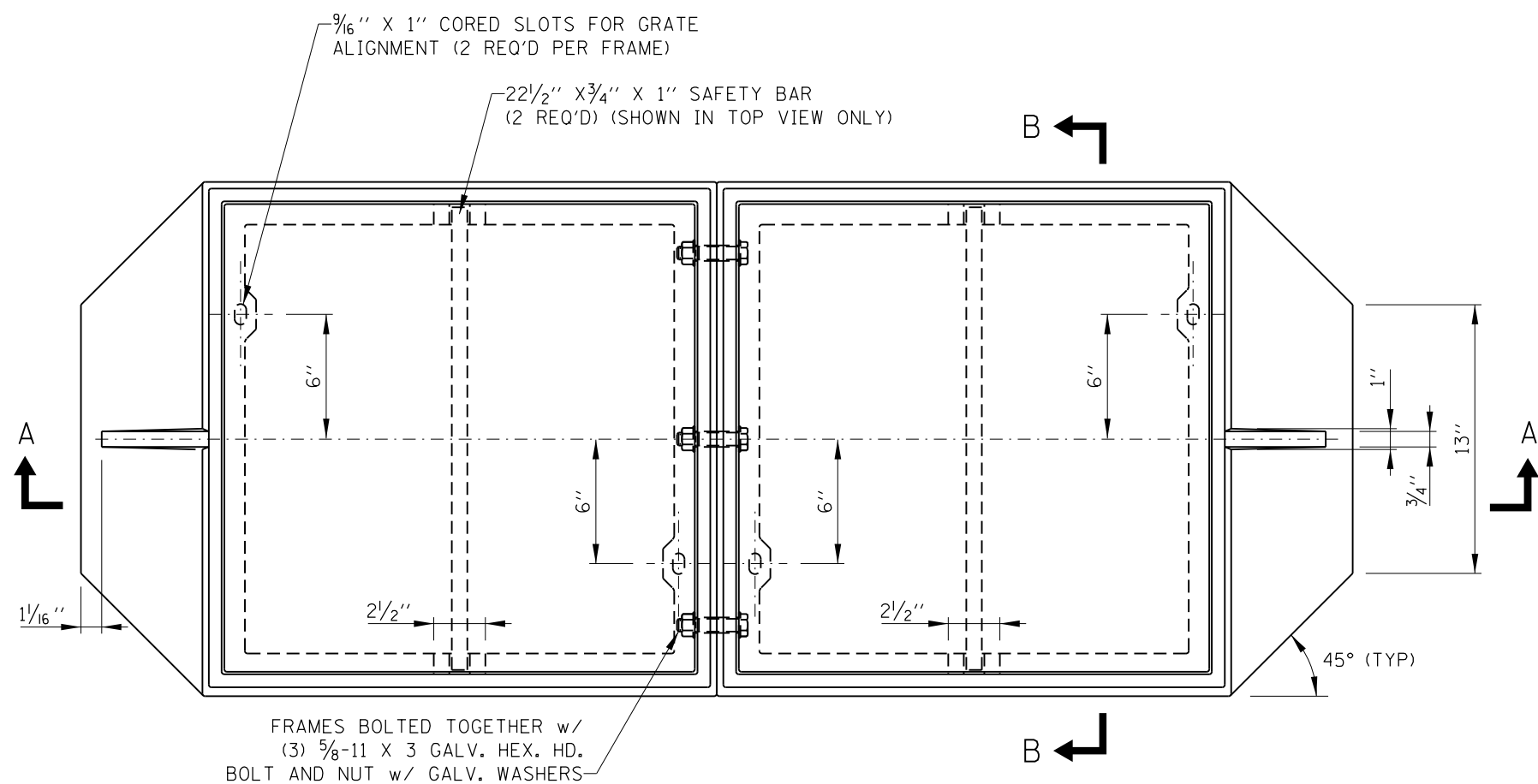
NOTES:

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-3527-VF, EAST JORDAN IRON WORKS 7540 OR APPROVED EQUAL.
3. GRATE SHALL NOT BE BOLTED TO FRAME.
4. CURB BOX SHALL BE BOLTED TO FRAME WITH 5/8" GALVANIZED HEX. HD. BOLT AND NUT WITH GALV WASHERS.
5. CURB BOXES SHALL ONLY BE USED AT SAG LOCATIONS.



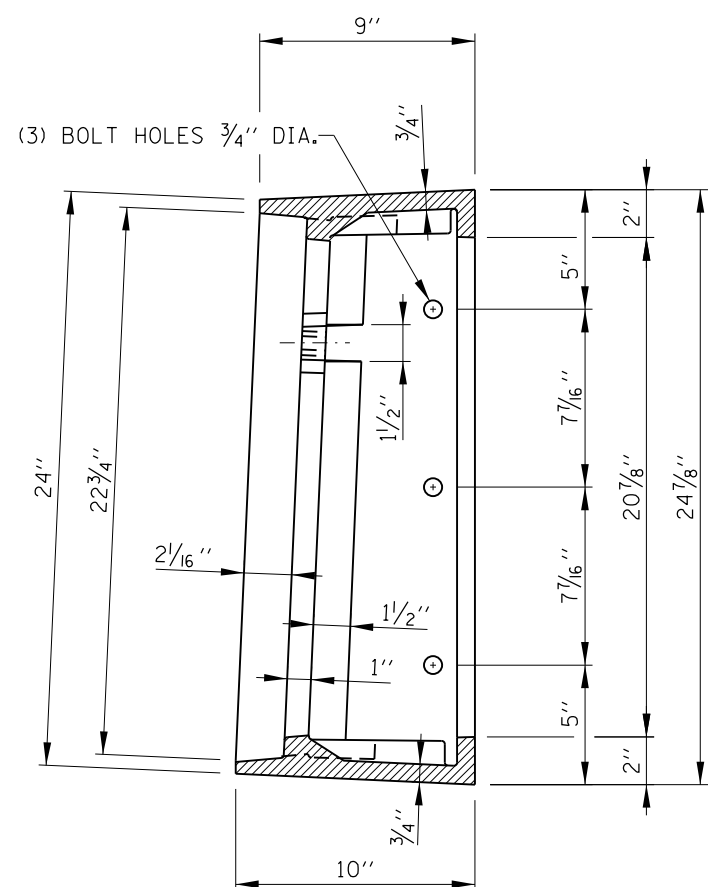
FRAME AND GRATE
TYPE 21A

STANDARD B26-01

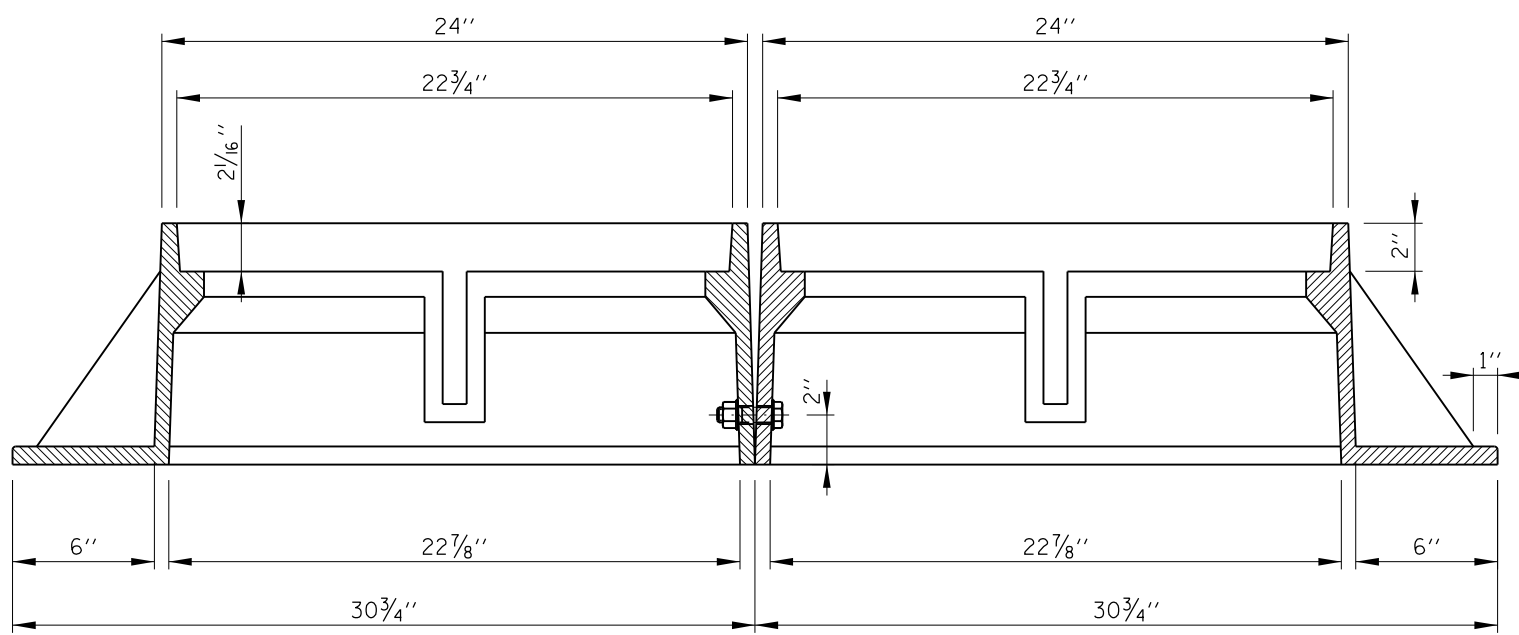


FRAMES BOLTED TOGETHER w/
 (3) 5/8-11 X 3 GALV. HEX. HD.
 BOLT AND NUT w/ GALV. WASHERS

TOP VIEW



SECTION B-B



SECTION A-A
 CAST FRAME

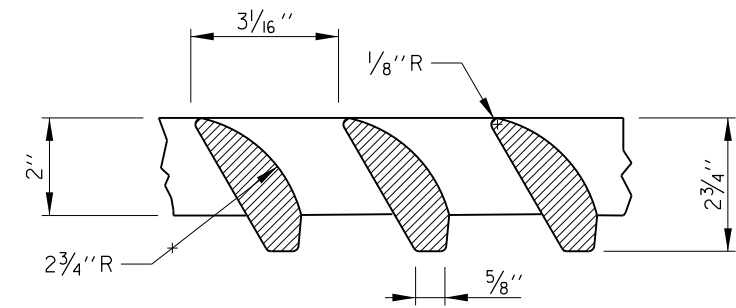


DATE	REVISIONS
03-31-14	ADDED FRAME AND GRATE CASTINGS

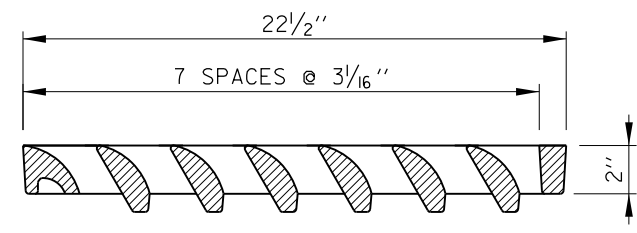
FRAME AND GRATE
 TYPE 22A

STANDARD B27-01

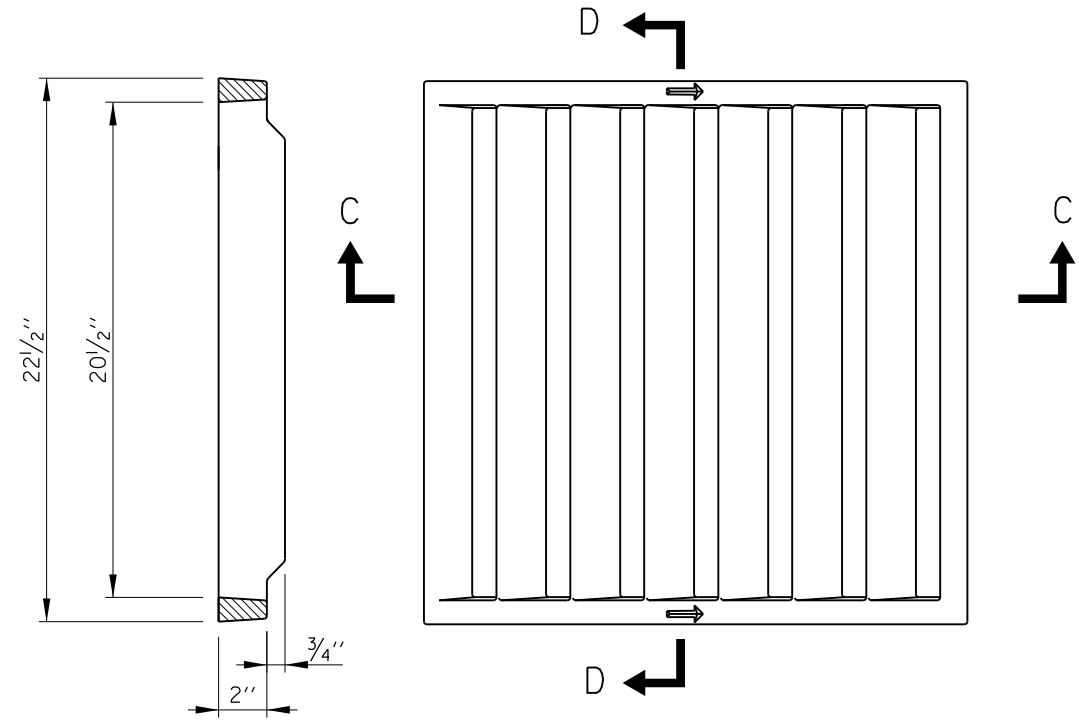
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 6-30-2008



DETAIL OF VANES



SECTION C-C



SECTION D-D

TOP VIEW

CAST GRATE
(2 REQ'D)

NOTES:

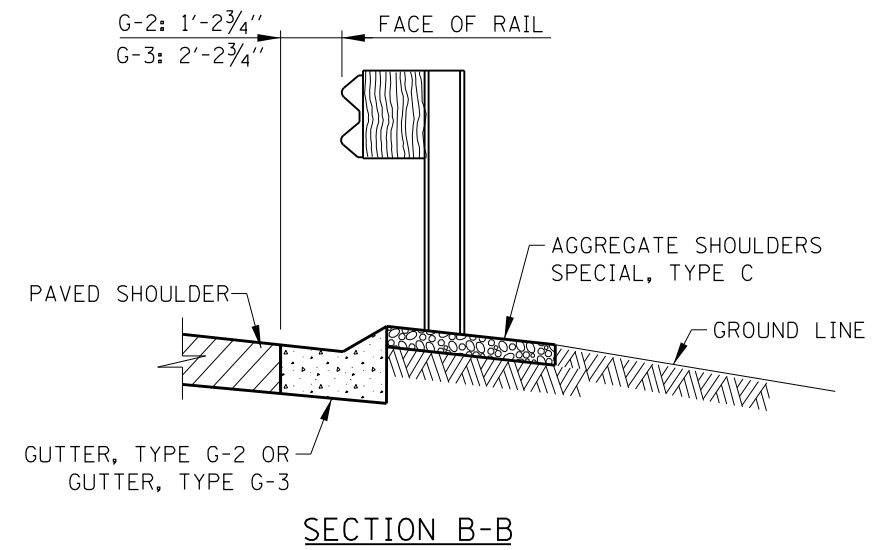
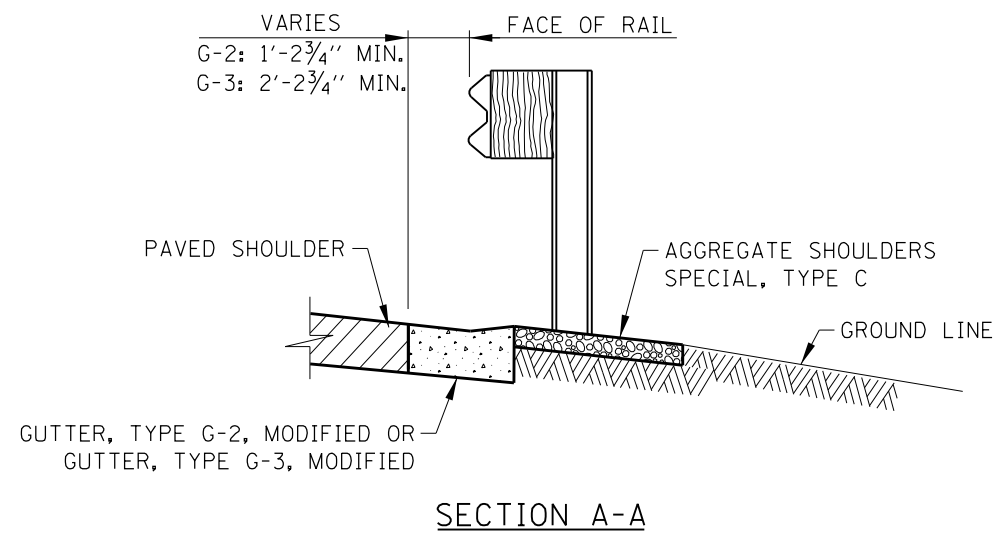
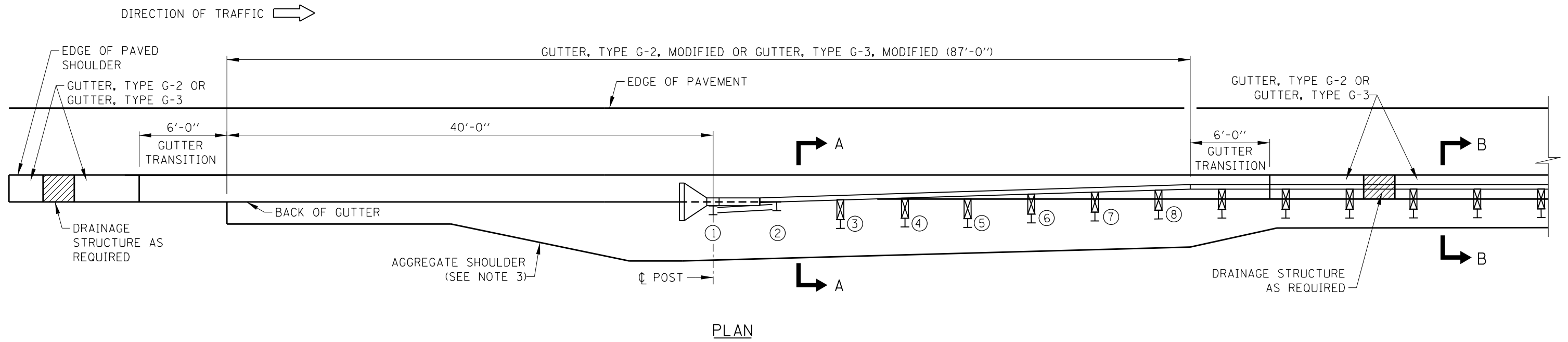
1. ALL FRAMES AND GRATES SHALL CONFORM TO THE REQUIREMENTS OF ART. 1006.14 FOR GRAY IRON CASTINGS AND TO ART. 1006.15 FOR DUCTILE IRON CASTINGS.
2. FRAME AND GRATE TO BE NEENAH FOUNDRY COMPANY, NEENAH NO. R-3529-V, EAST JORDAN IRON WORKS 7536 OR APPROVED EQUAL.
3. GRATE SHALL NOT BE BOLTED TO FRAME.



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.

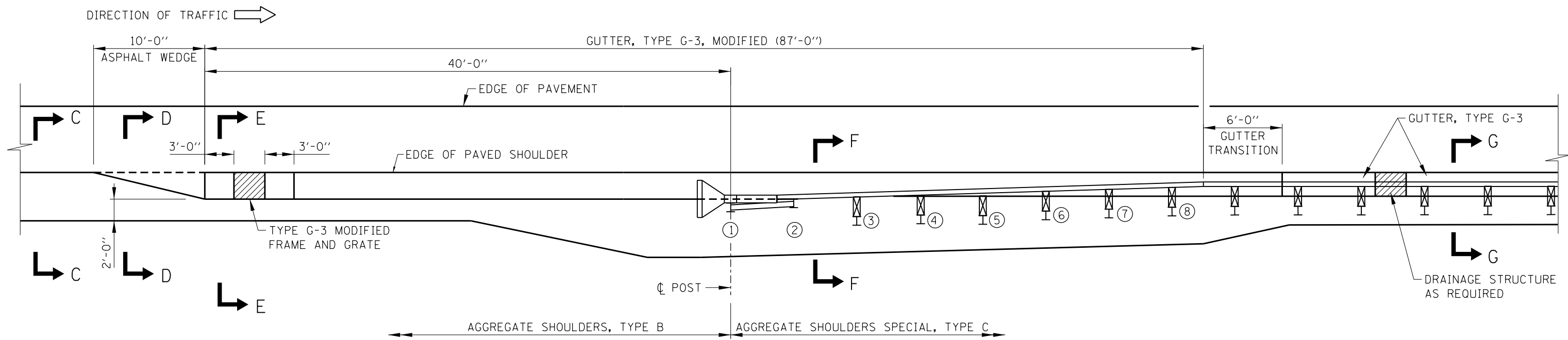
Paul Kovacs
APPROVED, CHIEF ENGINEERING OFFICER DATE 3-1-2010

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 LINESTYLE AT WEDGE TO DASHED.

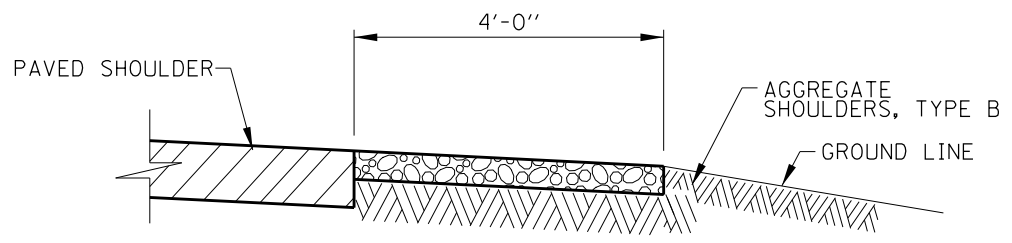
Illinois Tollway

GUTTER TRANSITION AT TRAFFIC BARRIER TERMINAL TYPE T1 (SPECIAL)

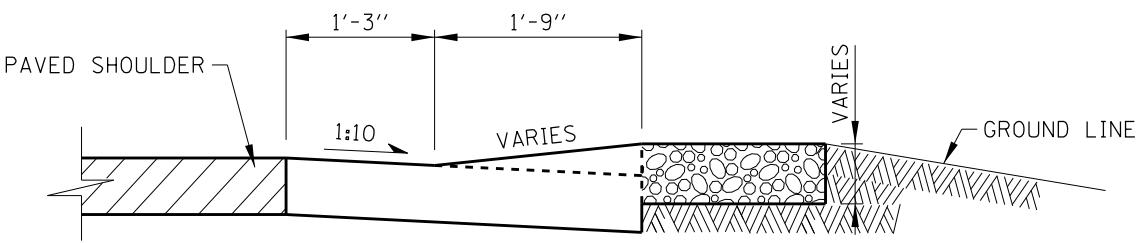
STANDARD B28-05



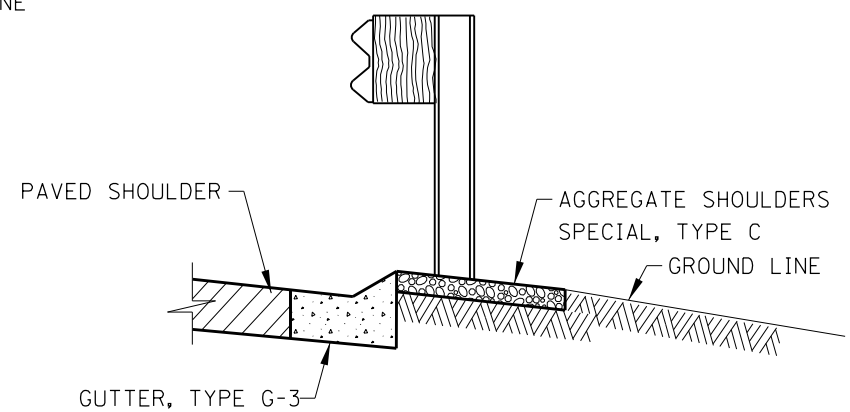
PLAN



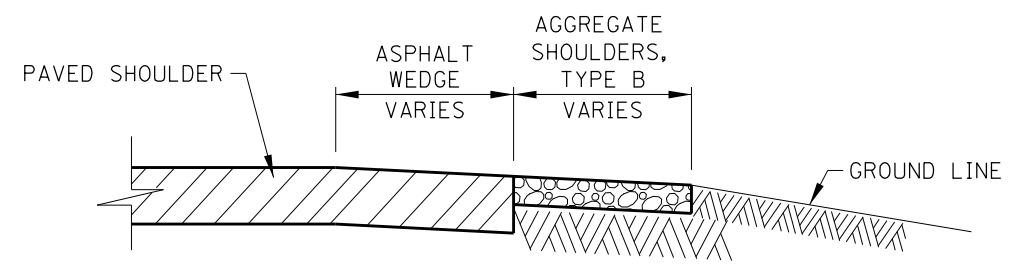
SECTION C-C



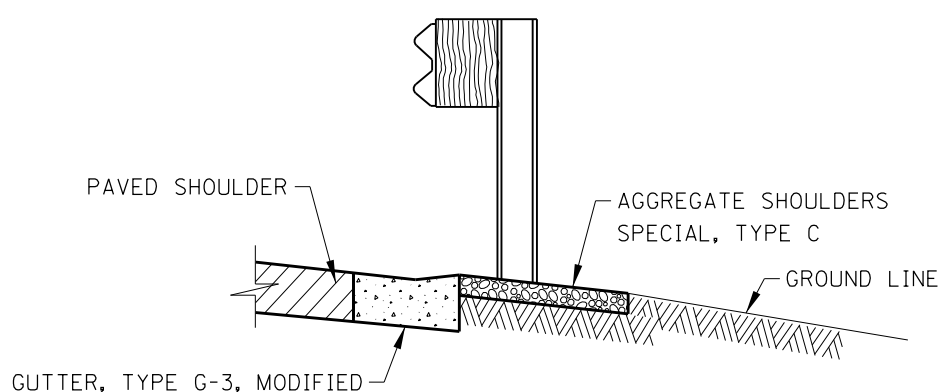
SECTION E-E
GUTTER, TYPE G-3, MODIFIED TRANSITION



SECTION G-G



SECTION D-D
ASPHALT SHOULDER TRANSITION



SECTION F-F

NOTE:
SEE SHEET 1 OF THIS SERIES FOR NOTES

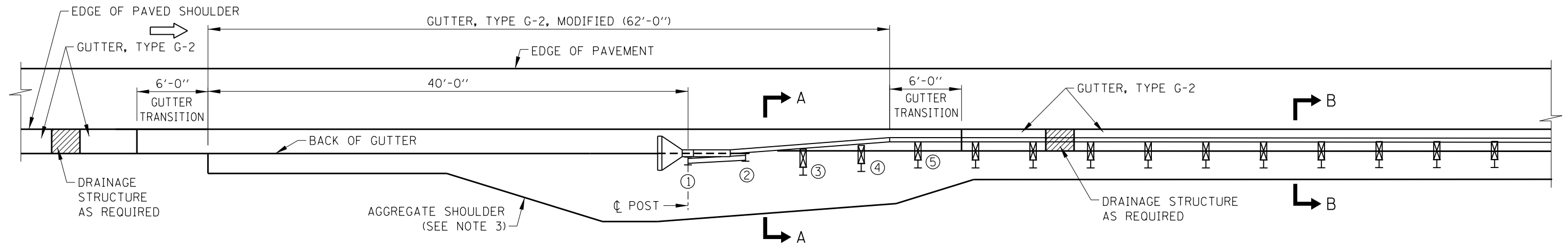
GUTTER, TYPE G-3 TRANSITION TERMINATION AT TRAFFIC BARRIER TERMINAL, TYPE T1 (SPECIAL)

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

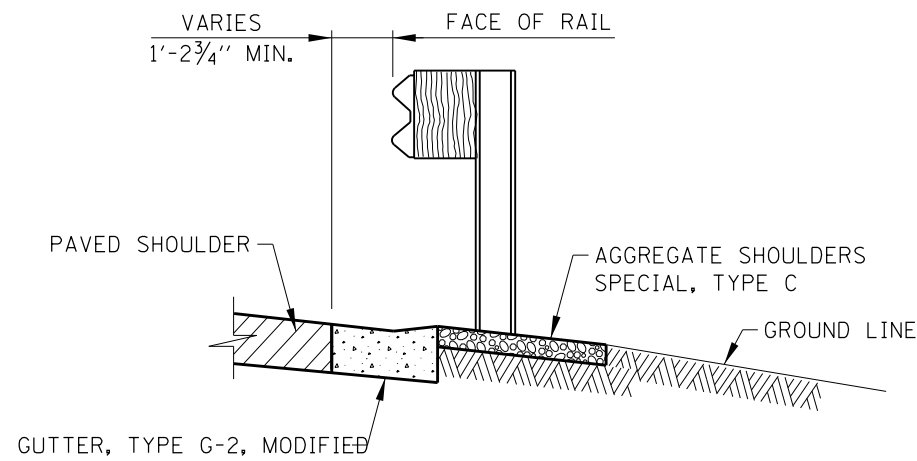
GUTTER TRANSITION AT TRAFFIC BARRIER TERMINAL TYPE T1 (SPECIAL)

STANDARD B28-05

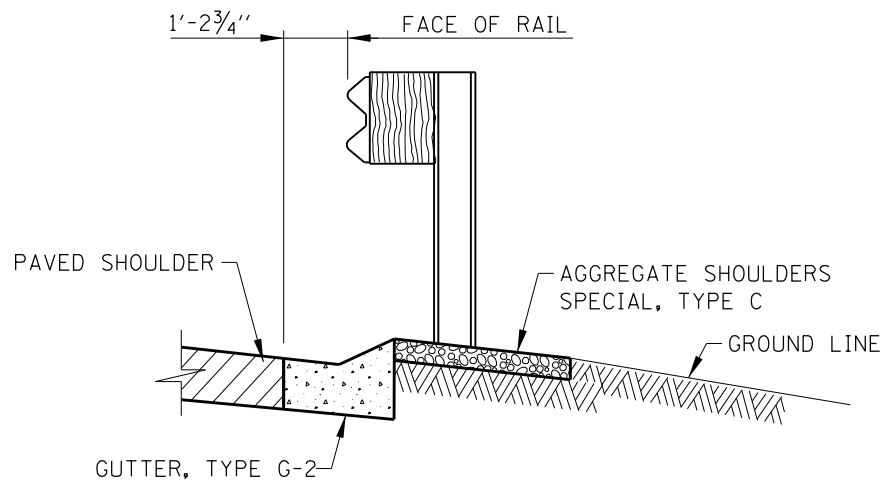
DIRECTION OF TRAFFIC →



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.

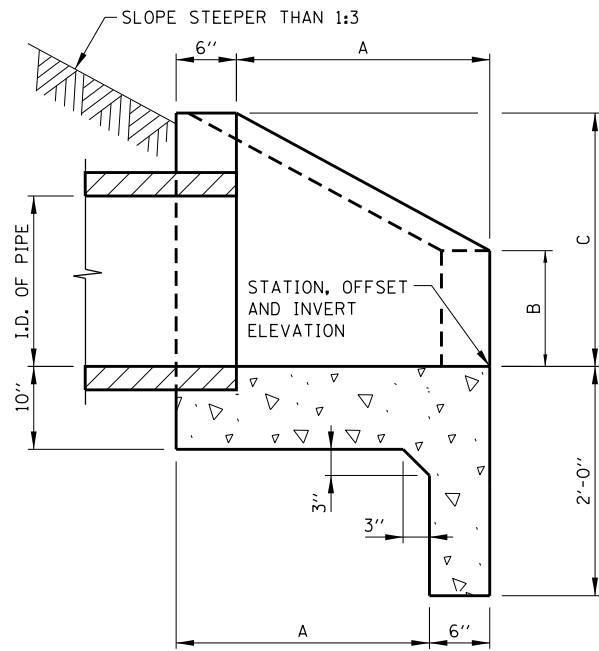
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 1-1-2011

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

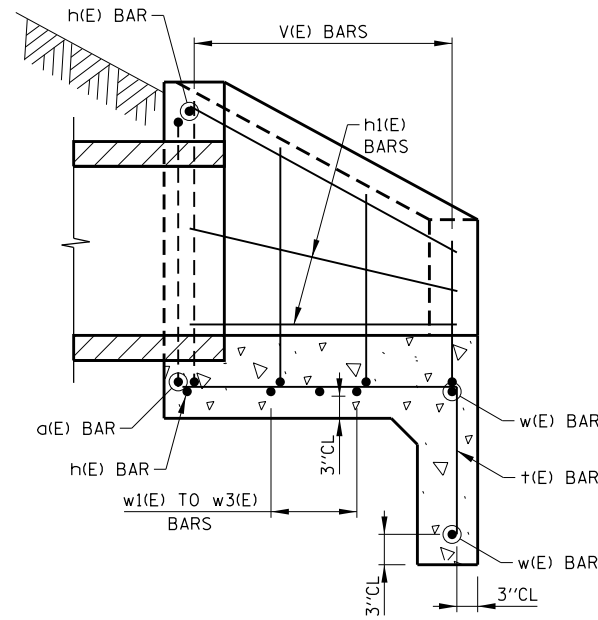


GUTTER TRANSITION AT TRAFFIC BARRIER TERMINAL TYPE T1-A (SPECIAL)

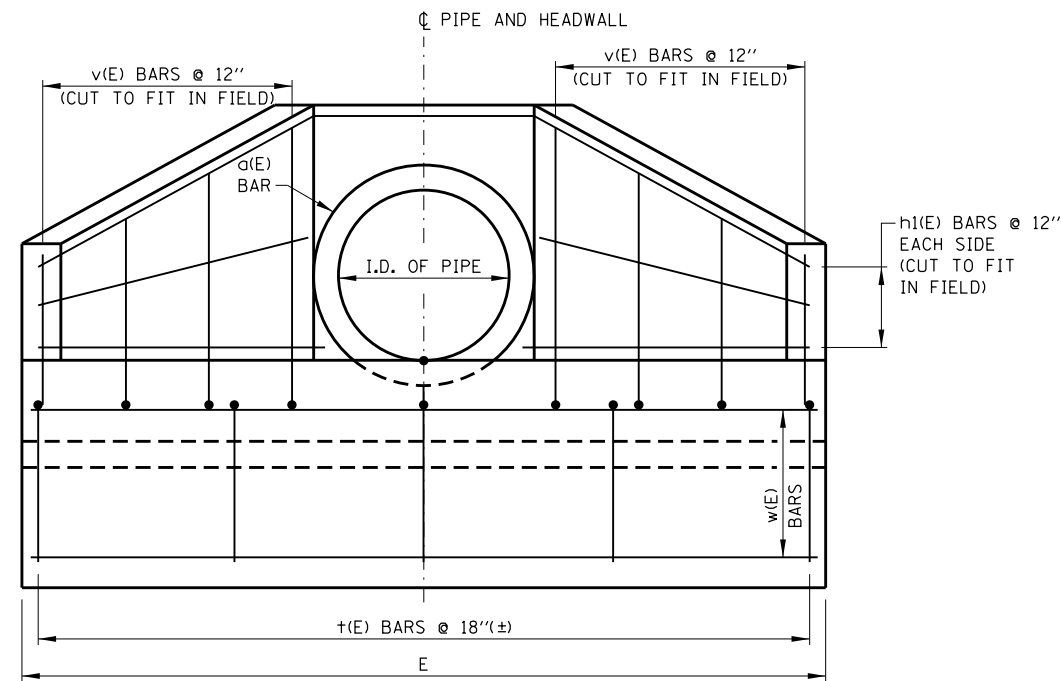
STANDARD B29-03



SECTION A-A
(DIMENSIONS)



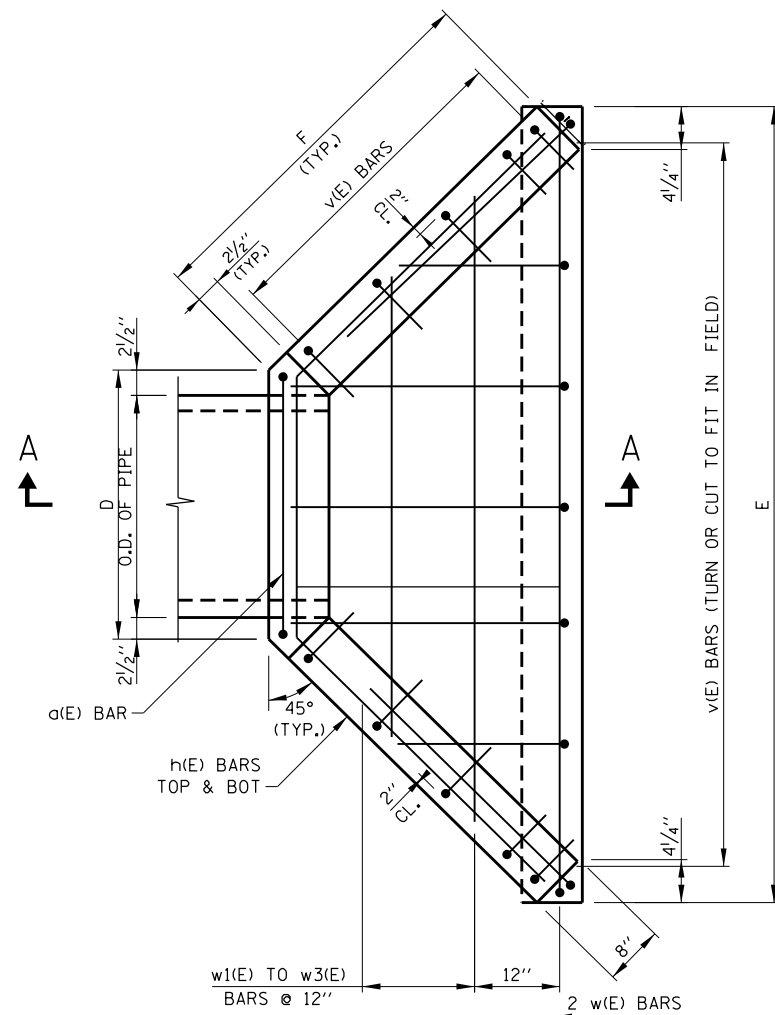
SECTION A-A
(REINFORCEMENT)



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

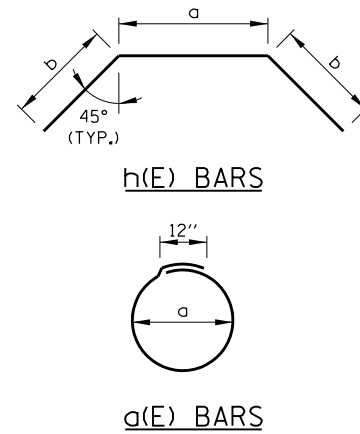


TABLE OF DIMENSIONS AND QUANTITIES FOR ONE HEADWALL

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

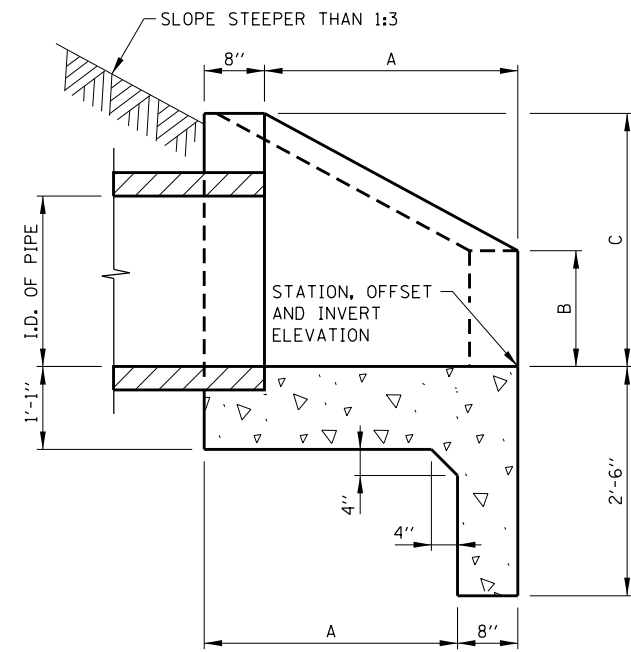
HEADWALLS
TYPE I AND II

STANDARD B30-02

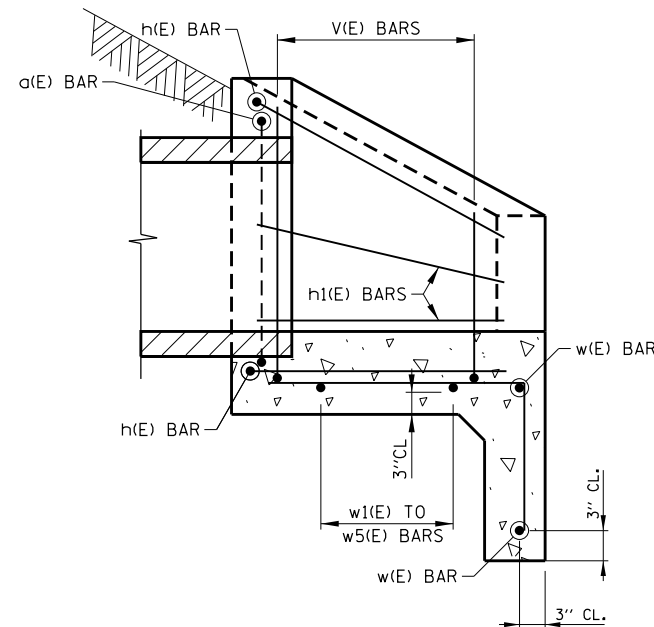
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 2-7-2012

NOTE:

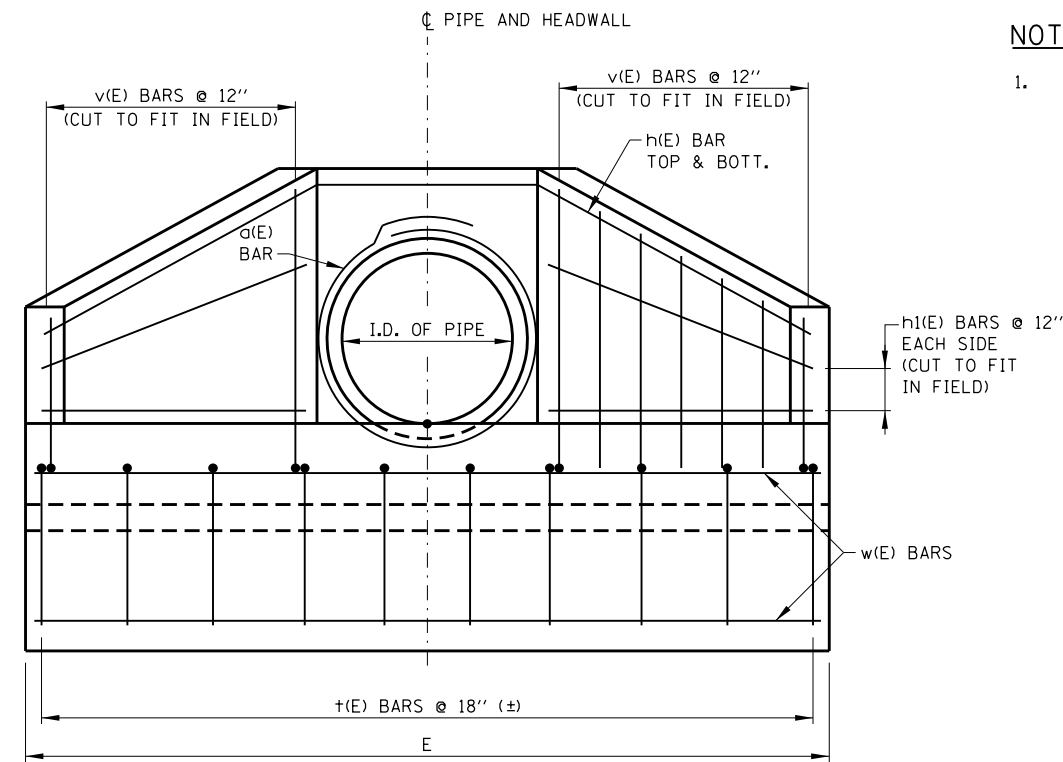
1. FOR ADDITIONAL NOTES SEE SHEET 1 IN THIS SERIES.



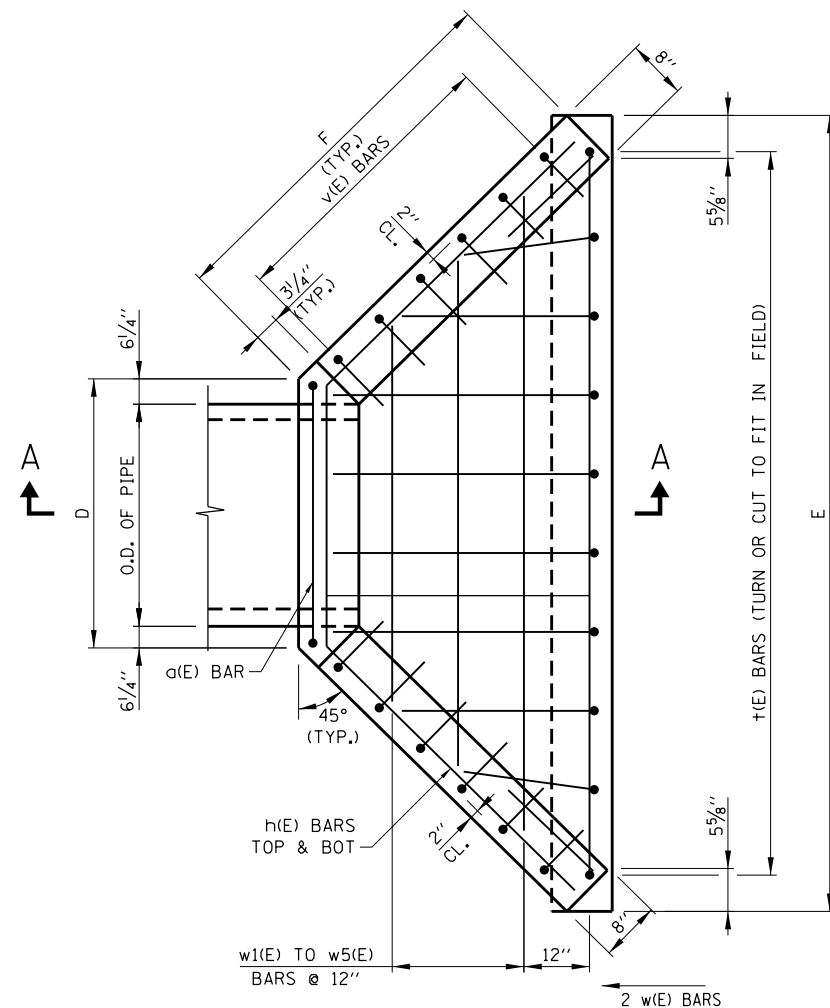
SECTION A-A
(DIMENSIONS)



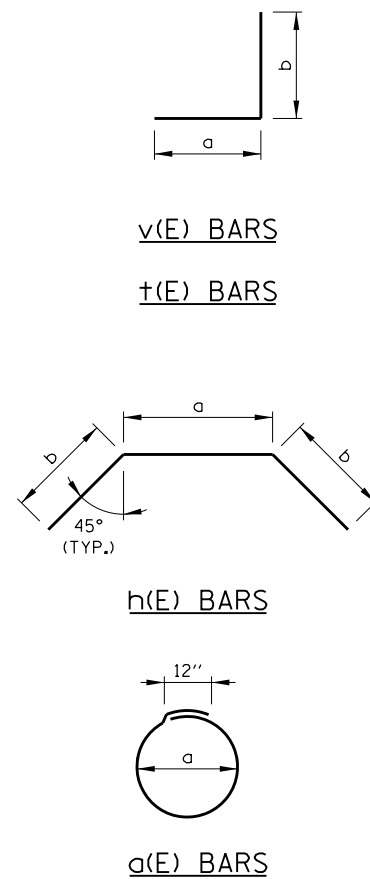
SECTION A-A
(REINFORCEMENT)



FRONT ELEVATION



PLAN



HEADWALL - TYPE II
(PIPE DIAMETER ≥ 36")

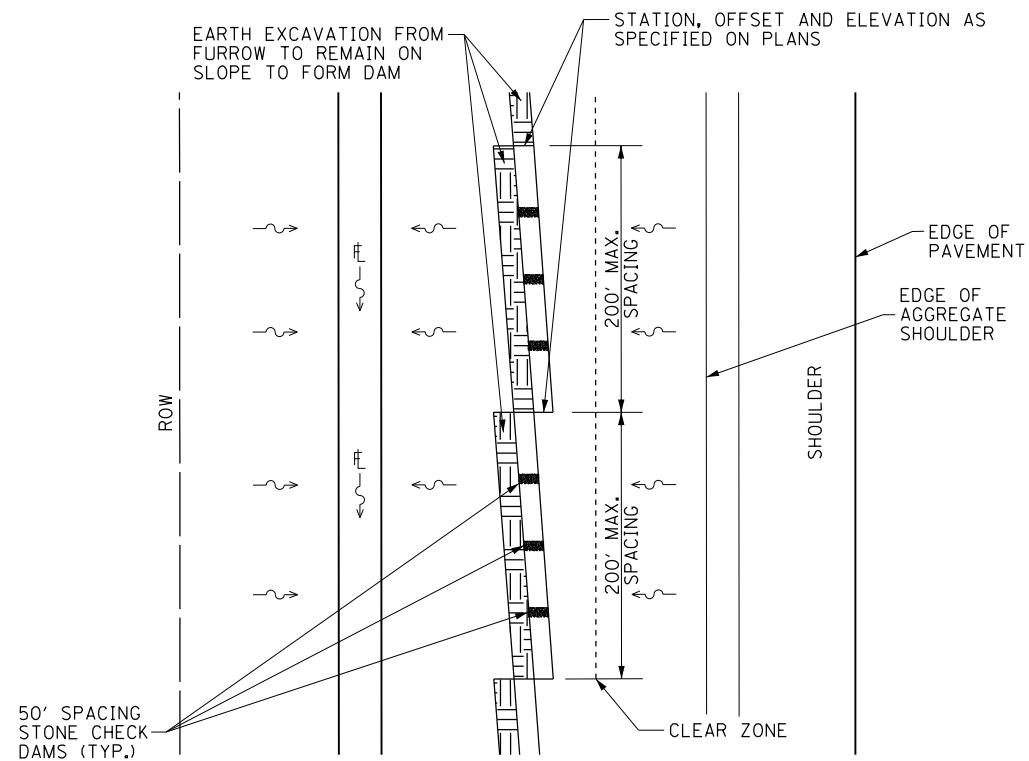
TABLE OF BARS FOR ONE HEADWALL

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

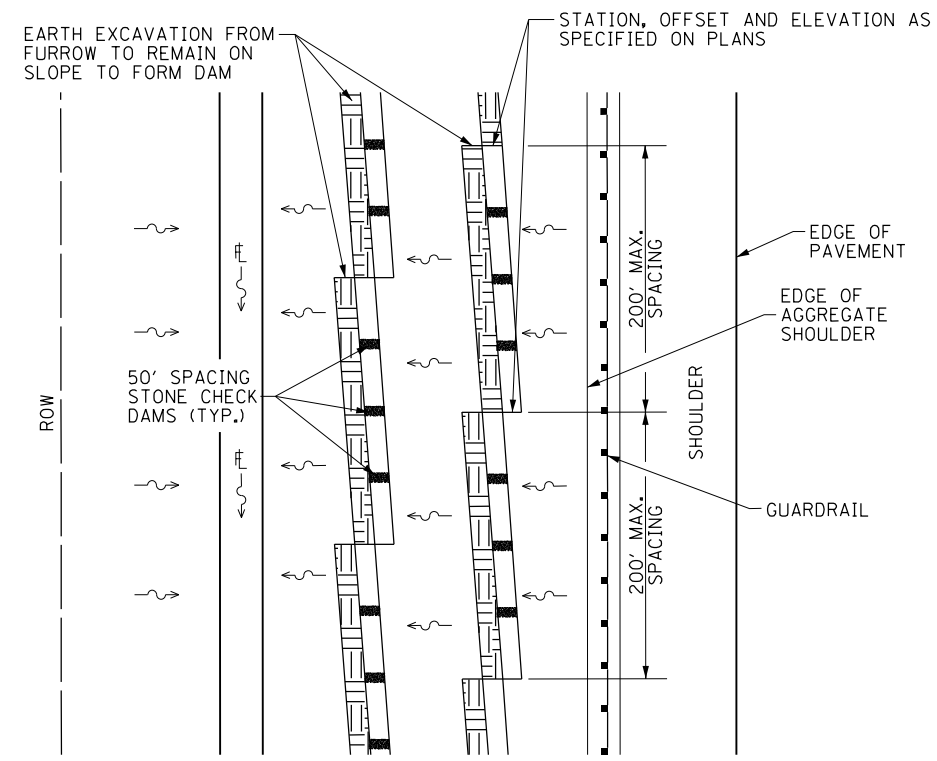
INSIDE DIA. OF PIPE	SLOPE OF FILL	DIMENSIONS						CONCRETE CLASS SI	REINF. BARS (POUND)
		A	B	C	D	E	F		
42"	1:3	4'-5"	2'-2"	4'-4 1/2"	5'-6"	14'-9"	6'-6 1/4"	3.8 C.Y.	400
48"	1:3	5'-0"	2'-5"	4'-11"	6'-0"	16'-4 3/4"	7'-4 1/4"	4.1 C.Y.	450
54"	1:3	5'-7"	2'-8"	5'-5 1/2"	6'-7"	18'-1 3/4"	8'-2"	5.6 C.Y.	500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





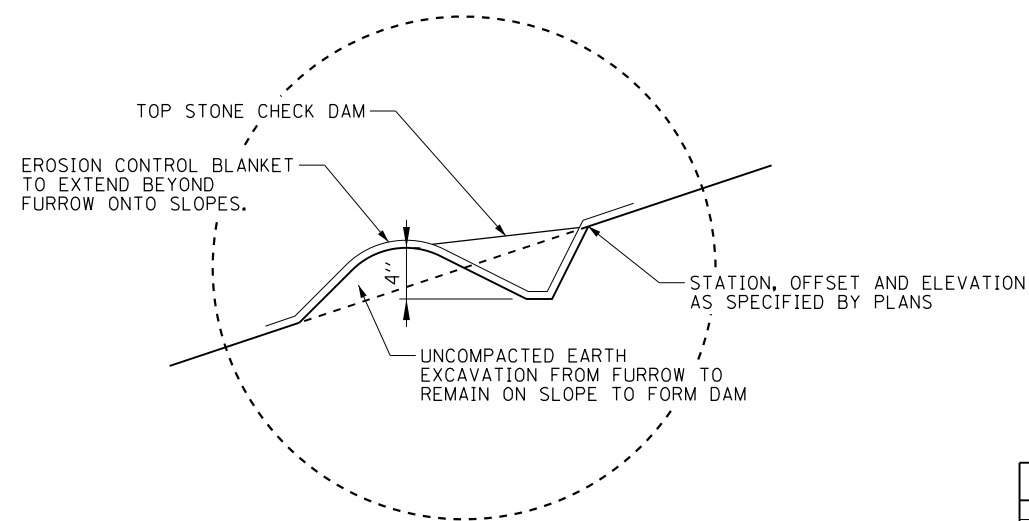
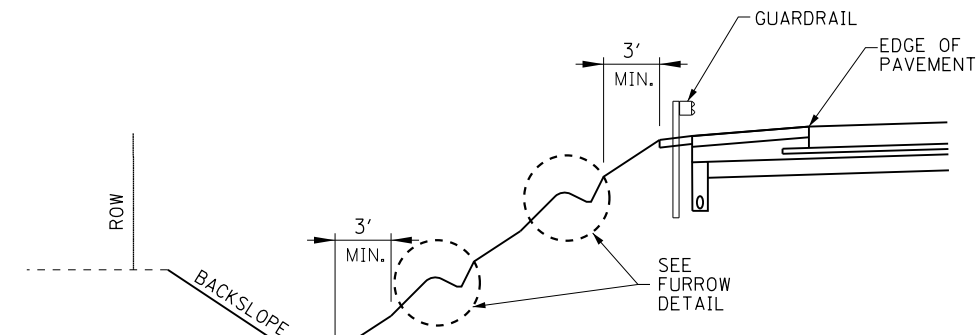
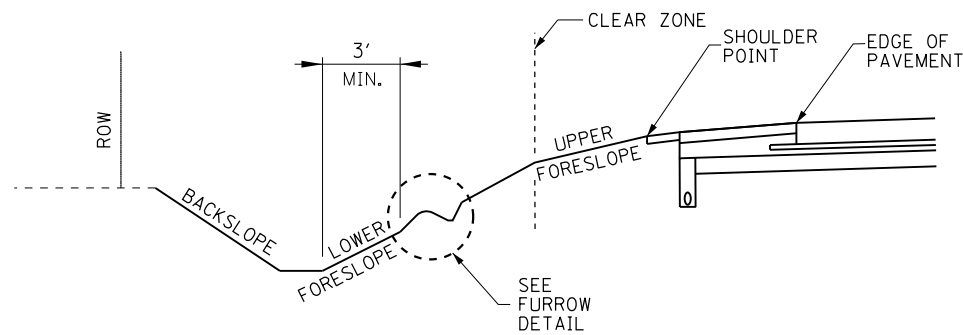
DEFINED CLEAR ZONE LOCATIONS

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.

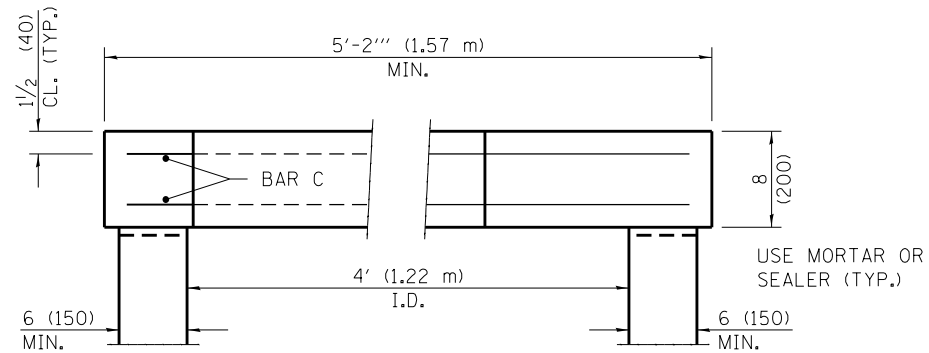
APPROVED: *Paul Kovacs* CHIEF ENGINEER DATE 3-31-2016

DATE	REVISIONS

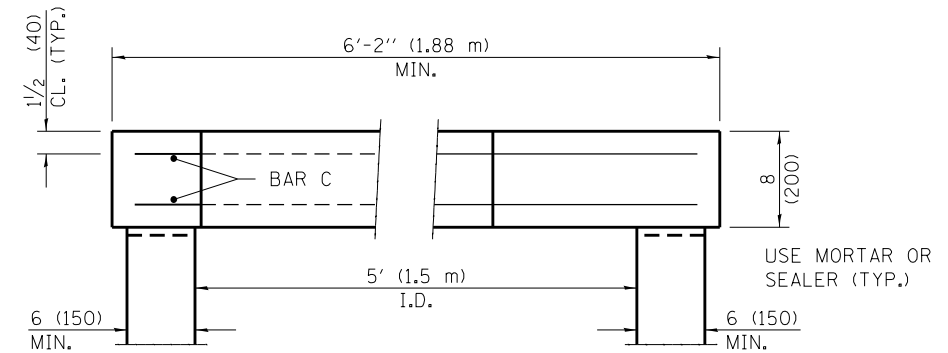
Illinois Tollway

FURROW DETAIL

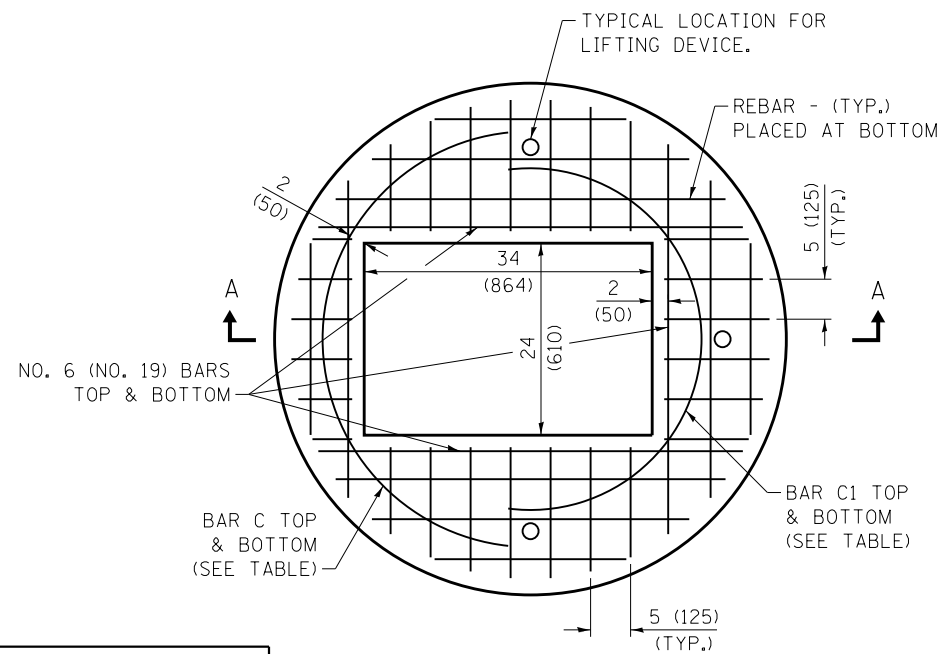
STANDARD B31-00



SECTION A-A

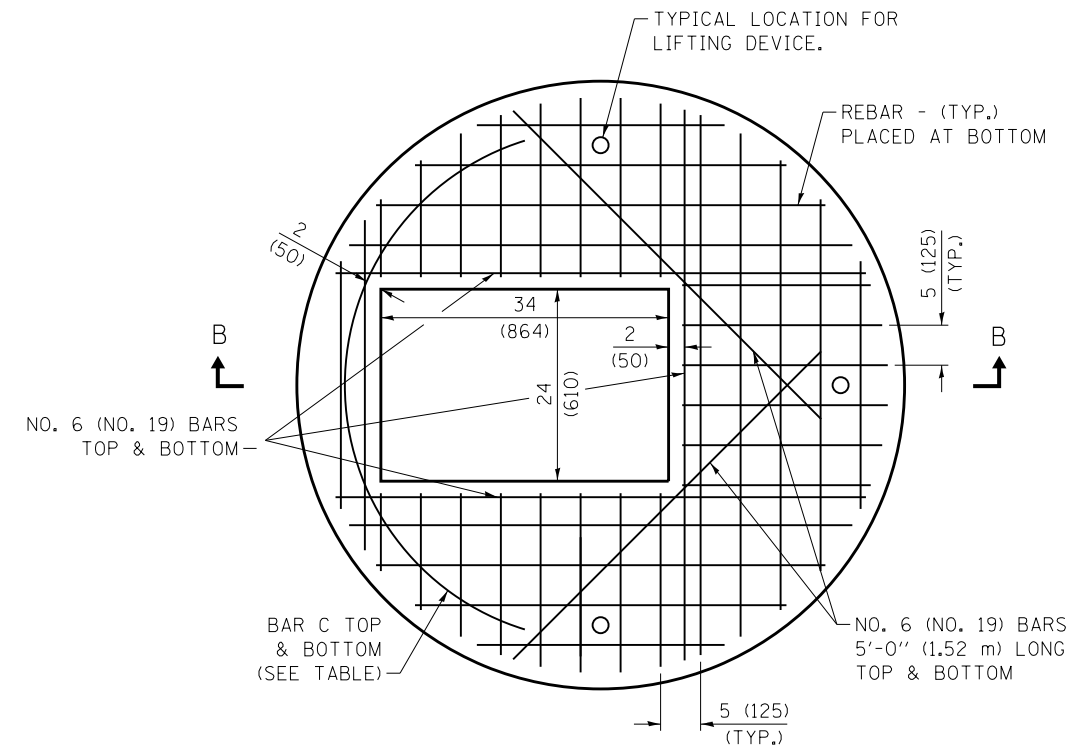


SECTION B-B



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)

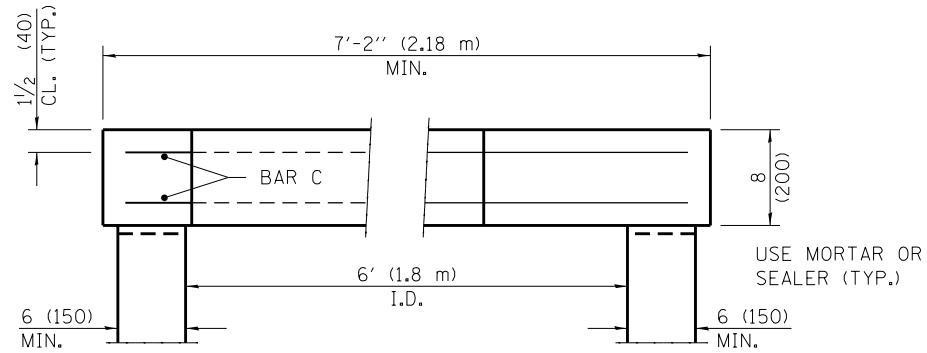


DATE	REVISIONS

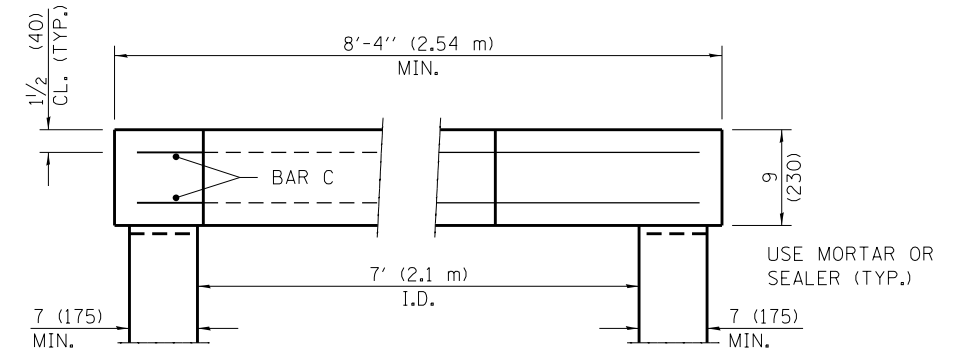
FLAT SLAB TOP
4' (1.2 m) & 5' (1.5 m)
DIAMETER

STANDARD B32-00

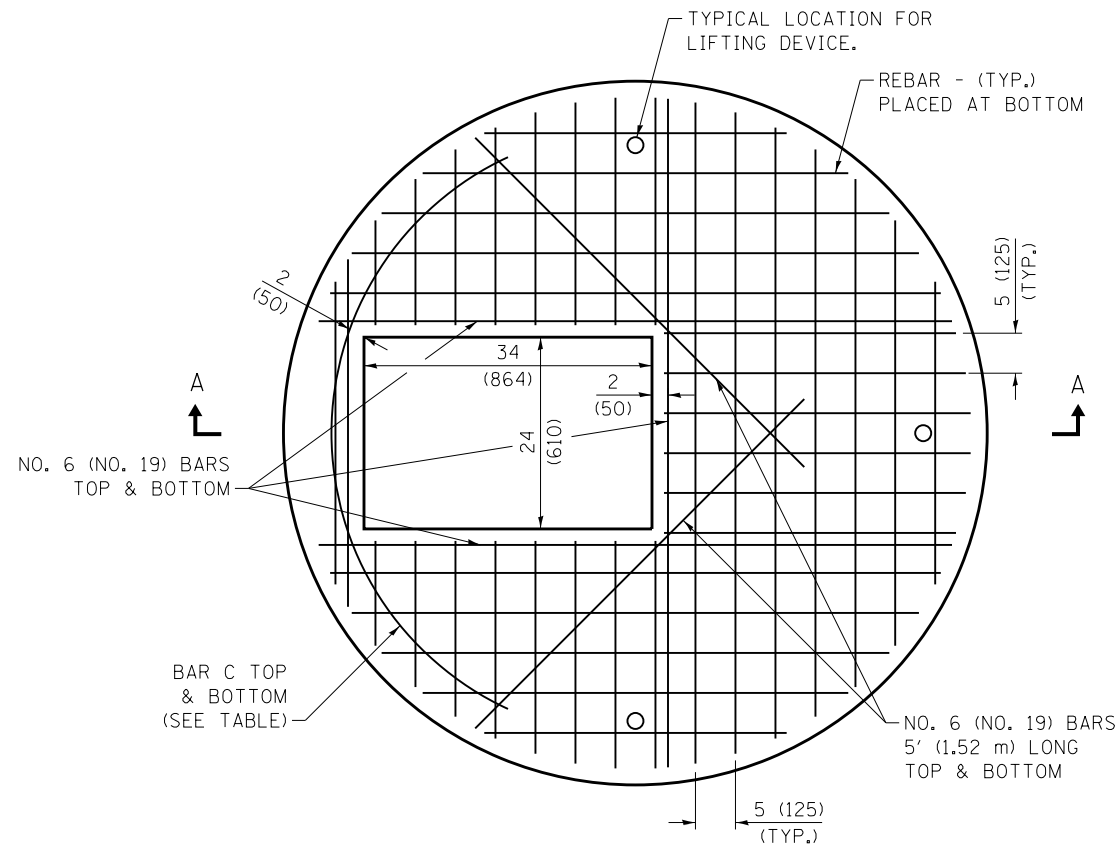
APPROVED *Paul Kovacs* CHIEF ENGINEER DATE 3-31-2017



SECTION A-A

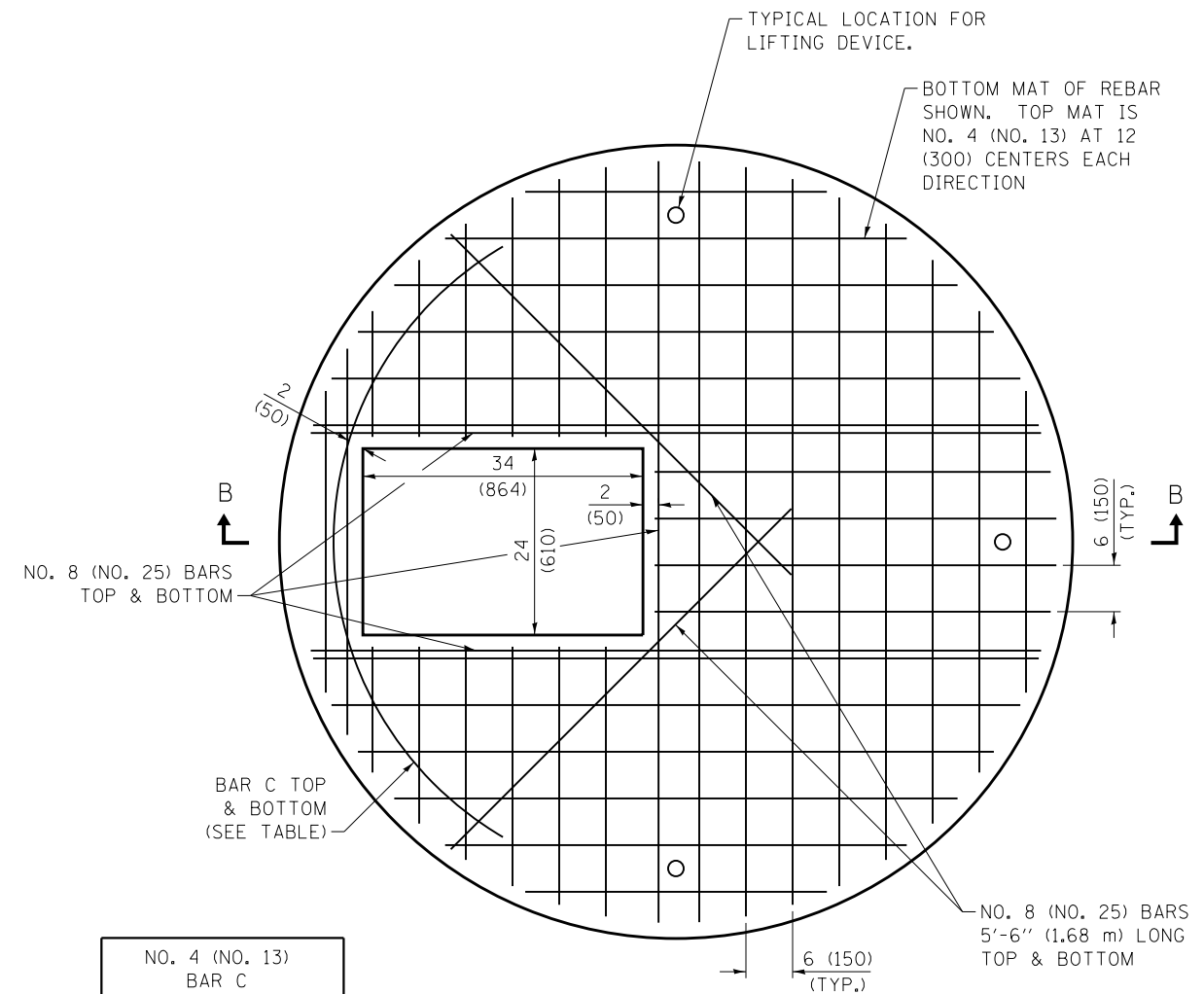


SECTION B-B



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

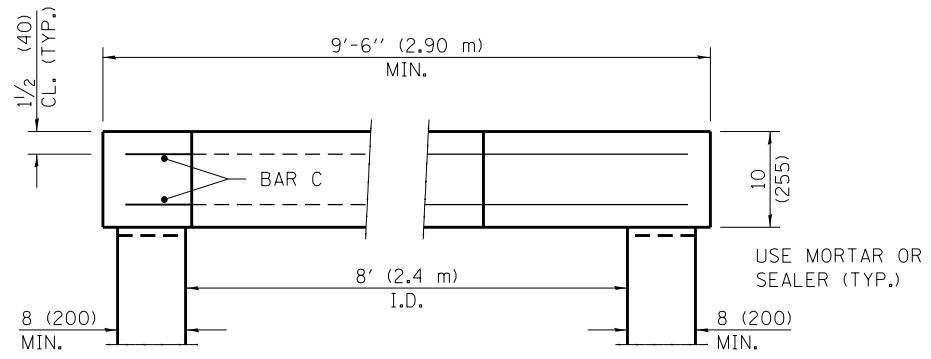
NO. 4 (NO. 13) BAR C	
LENGTH	RADIUS
8'-0" (2.44 m)	3'-8" (1.12 m)



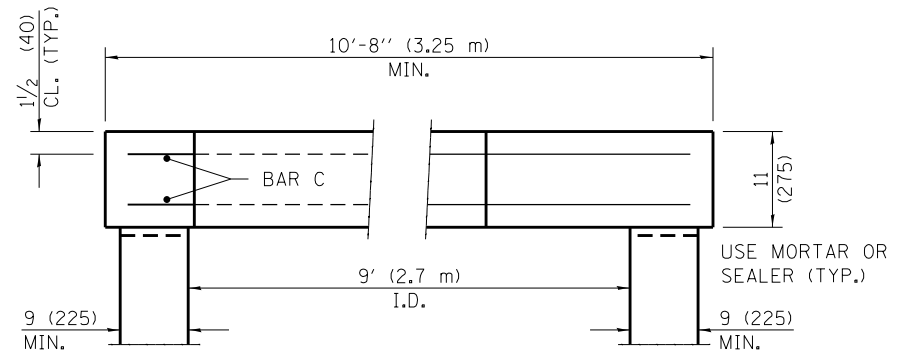
DATE	REVISIONS

FLAT SLAB TOP
6' (1.8 m) & 7' (2.1 m)
DIAMETER
STANDARD B32-00

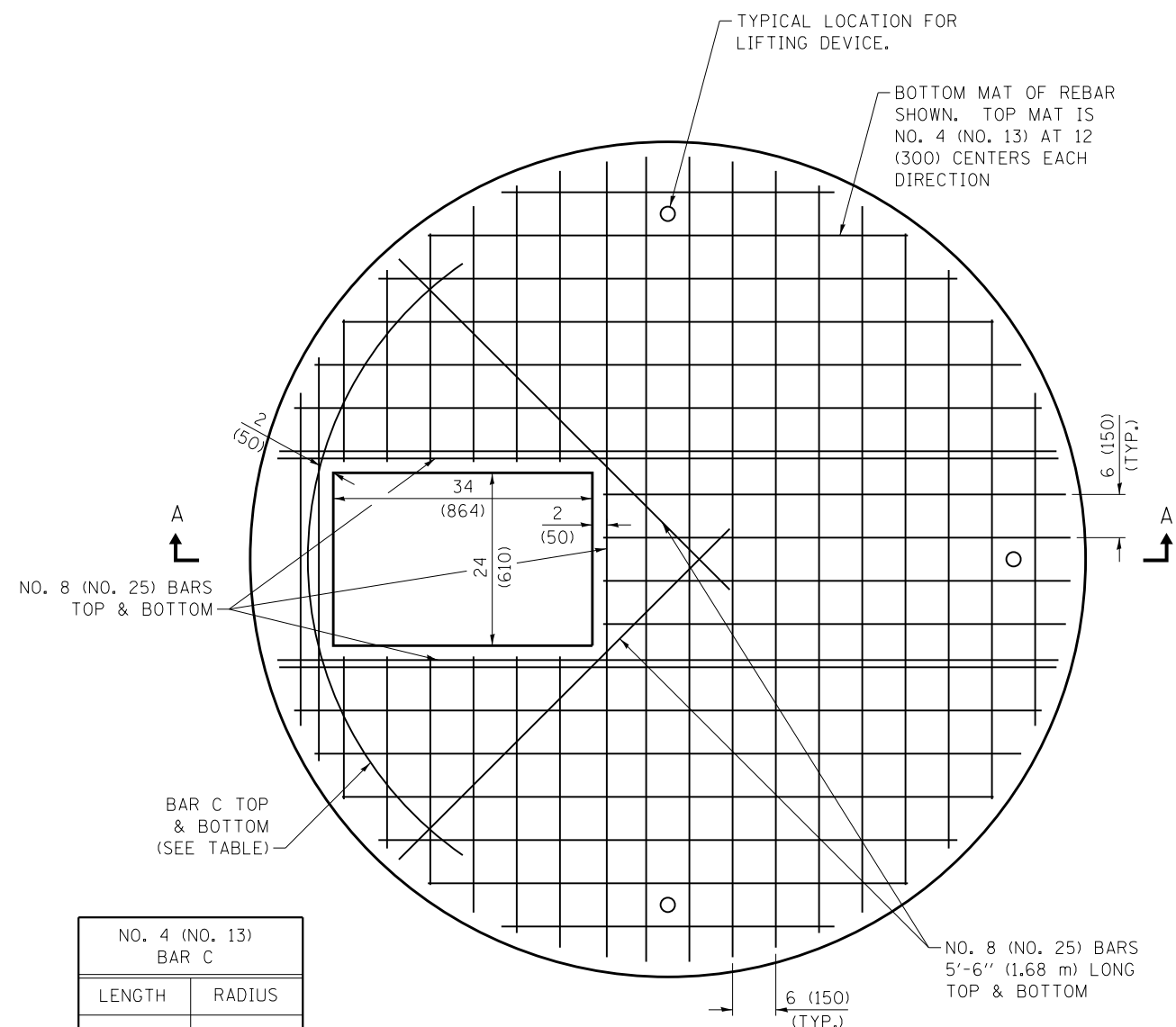
Paul Kovacs
APPROVED CHIEF ENGINEER DATE 3-31-2017



SECTION A-A

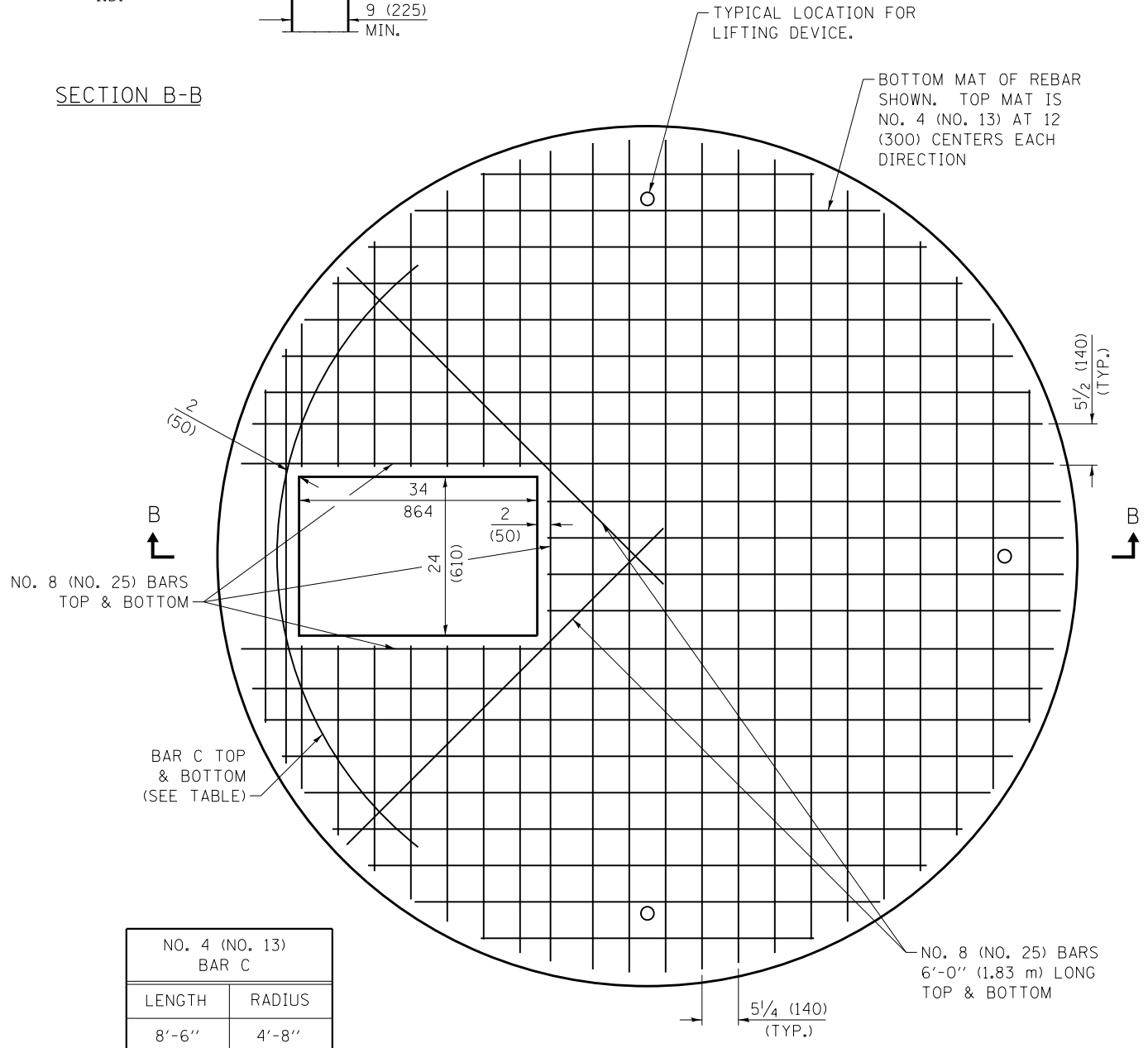


SECTION B-B



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)

Paul Kovacs
APPROVED CHIEF ENGINEER DATE 3-31-2017

DATE	REVISIONS

SHEET 3 OF 3

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