DESIGN STANDARDS

FOR DESIGN, CONSTRUCTION, MAINTENANCE AND UTILITY OPERATIONS ON THE STATE HIGHWAY SYSTEM

2010

TOPIC NO. 625-010-003

Approved For Use On Federal Aid Projects

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For Martin Knopp, Division Administrator

State of Florida, Department Of Transportation
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CERTIFICATION STATEMENT

I hereby certify that this Design Standard Book was compiled under my responsible charge from designs prepared, examined, adopted and implemented by the Florida Department of Transportation in accordance with established procedures, and as approved by the Federal Highway Administration.

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As To Planning
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17900

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As To ITS
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Index Number	Sheet Number	Description
001	1 thru 3	Added the following standard abbreviations: ℄ Base Line, Base Line Control ℄ Flow Line GRI Geosynthetic Research Institute HDPE High Density Polyethylene NPS Nominal Pipe Size
		Deleted the following standard abbreviations: Bbl Barrel FRCP Fiber Reinforced Concrete Pipe FRP Fiber Reinforced Pipe FS Far Side
002	2 of 3	Deleted Hand Drafting Symbols
102	2 of 3	NOTES FOR SYNTHETIC BALES OR BALE TYPE BARRIERS, Note 2, deleted the text "trenched 3" to 4" and" from the first sentence.
104	2 of 2	RURAL DIVIDED detail, changed "5' Shoulder Pavement" to "4' Shoulder Pavement".
105	1 of 1	TREATMENT I, Criteria for using Treatment I, replaced text of the last bullet with the following: "resurfacing build-up is less than 3" ".
200	1 of 5	TOP SLAB REINFORCING STEEL DIAGRAM (ALTERNATE B) to the notes "2 Additional Bars A @ 5" O.C." and "2 Additional Bars B @ 5" Max. O.C. Each Side Of Opening", added "(Minimum #4 Bars)".
	2 of 5	Note 9, Delete second sentence and substitute, "Additional bars used to restrain hole formers for precast structures with grouted pipe connections, may be left flush with the hole surface."
	4 of 5	SLAB AND WALL DESIGN TABLE NOTES, added the following to the end of Note 10: "See Index No. 201, Sheet 4 for allowable bar spacing adjustments when larger areas of reinforcing are substituted."
201	4 of 5	"Revised title of notes to ""NOTES FOR PRECAST OPTIONS AND EQUIVALENT REINFORCEMENT SUBSTITUTION"" and added the following to Note 4, ""When an increased area of reinforcing is provided, then the maximum bar spacing may be increased by the squared ratio of increased steel area, but not to exceed 12 inches: Max. Bar Spacing Provided < Max. Bar Spacing Required x (Steel Area Provided/Min. Steel Area Required)² "
205	1 of 6	Changed maximum size of allowed PVC pipe to 36".
	2 of 6	ROUND PIPE DIMENSIONS, deleted the column, "Wall Thickness (In.) Class III" and subcolumn "NRCHP" and heading "SRCP". Also deleted the ** note at the bottom of the table.
	3 of 6	NOTES: deleted note 4; table "PIPE ARCH: SPIRAL RIB: ¾" x¾" x 7½" RIB SPACING..." deleted references to note 4; table "ROUND PIPE - SPIRAL RIB", "Maximum Height of Fill (Ft.)", "Sheet Thickness In Inches (Gage)", "0.138 (10)" added measurements.
210	1 of 1	Delete General Note 4, and substitute the following: "For precast units the rear wall and apron may be precast as a separate piece from the top slab. Provide a minimum of 7 ~ #4 dowels in accordance with Index No. 201 "OPTIONAL CONSTRUCTION JOINTS".
211	1 thru 5	Revised index completely 3 sheets added, Reinforcing configuration and C.I.P. details revised; precast and WWR details added. Changed Note 4 to allow 4'-0" round risers.
213	1 of 1	In PLAN view changed "1/2" Exp. Joint (Typ)" to "1/2" Preformed Joint Filler (Typ)".
218	2 of 2	"STEEL GRATE", "TOP VIEW", for the overall dimension on the left side of the grate, inserted "44¼" ". For the small dimension at the upper left corner of the grate, inserted "3½" ".
219	1 of 2	In PLAN view and Section HH changed "Expansion Joint (Typ)" and "Expansion Material Joint" to "1/2" Preformed Joint Filler (Typ)".
220	1 of 3	"GUTTER INLET TYPE S", "SECTION BB", Changed the vertical dimension between the top of the inlet and the grate elevation from "5½" to "4½" ".
		"SECTION AA", at the top right corner, for precast thickness changed " 6" " to " 3" " (same as left side).
		"SECTION BB", at the top, changed "3'-11" Precast" to " 4'-3" Precast". "PLAN", at the top, changed " 3'-11" Precast to " 4'-3" Precast".
230	1 of 2	In "PLAN" view changed "1/2" Exp. Joint (typ)" to "1/2" Preformed Joint Filler (Typ)". Section E-E, Changed 4Z15.9 shape to built up section (3.5 x 3 x ½L + ½ x 3 Bar) for grating.
231	1 of 3	"DITCH BOTTOM INLET TYPE B", "SECTION BB", upper left side, deleted the dimension "2'-6" (Min.)" and replaced with "1'-10" (Min.)".
232	1 thru 7	Index was expanded due to font size change.
233	1 thru 2	Index was expanded due to font size change.
234	1 thru 2	Index was expanded due to font size change.
	2 of 2	Under Pavement & Sodding detail changed "1/2" Exp. Joint" to "1/2" Preformed Joint Filler".
235	1 of 2	"GENERAL NOTES", Note 3, deleted "Alternate B" replaced with "Index 200", Note 8 changed "Specification Section 962" to "Specification Section 975".
245	1 of 1	"GENERAL NOTES" Note 2, delete and replace with the following: "Concrete shall be Class I (Structural), except ASTM C478 (4000 psi) concrete may be substituted for precast items manufactured in plants meeting the requirements of Section 449 of the Specifications. Box shall be reinforced with No. 3 bars (Grade 60) on 8" centers both ways, sides and bottom.
250	1 of 2	"GENERAL NOTES" Note 5, deleted and replaced with the following: "Concrete shall be Class I (Structural), except ASTM C478 (4000 psi) concrete may be substituted for precast items manufactured in plants meeting the requirements of Section 449 of the Specifications."
251	1 of 2	"GENERAL NOTES" Note 4, deleted and replaced with the following: "Concrete shall be Class II, except ASTM C478 (4000 psi) concrete may be substituted for precast items manufactured in plants meeting the requirements of Section 449 of the Specifications."
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260	1 of 1	"GENERAL NOTES" Note 3 changed "Specification Section 962" to "Specification Section 975".
261	1 of 3	"GENERAL NOTES" Note 4 changed "Specification Section 962" to "Specification Section 975".
264	1 thru 2	Index was expanded due to font size change. General note 3 changed.
270	1 of 1	"GENERAL NOTES" Note 2 changed "Specification Section 941-1.5" to "Specification Section 449". Changed Note 3.
272	6 of 6	Reordered "GENERAL NOTES" and changed "Class I concrete" to "Class NS concrete".
273	1 thru 7	Index was expanded due to font size change.
	7 of 7	"GENERAL NOTES", Note 8, deleted "Class I concrete" and substituted "Class NS concrete".
280	1 thru 3	Index was expanded due to font size change.
	1 of 3	"DISSIMILAR TYPES CONCRETE JACKET FOR CONNECTING DISSIMILAR TYPES OF PIPE AND CONCRETE PIPES WITH DISSIMILAR JOINTS" detail, added the note, "Alternate connection must be approved by the State Drainage Engineer."
282	1 thru 3	Index was expanded due to font size change.
	1 of 3	"FRONT ELEVATION" and "SECTION AA" details changed "1/2" Exp. Matl. " to "1/2" Preformed Joint Filler".
	2 of 3	"PLAN" and "SECTION AA" details changed "1/2" Exp. Matl. " to "1/2" Preformed Joint Filler".
284	1 of 1	Deleted note "1" and substituted the following: "1. Spillway to be paid for as Shoulder Gutter, LF." Deleted note "2", and substituted the following: "2. If spillway empties into an unpaved ditch the detail should be modified as necessary."
287	1 thru 4	Sheet 3 is new. Renumbered other sheets.
	1 of 4	Changed all 3 occurrences of "Class I concrete" to "Class NS concrete".
288	1 of 1	New Index added "DEEP WELL INJECTION BOX".
289	6 of 7	Changed "FLARED ENDWALL" to "FLARED WINGWALL" and "STRAIGHT ENDWALL" to "STRAIGHT WINGWALL".
291	1 of 5	Changed "Class I Concrete" to "Class NS".
	5 of 5	Changed "Bond Beam" to "Link Slab", and "Class I Concrete" to "Class NS".
292	2 of 14	"GENERAL NOTES" note 1, changed AASHTO LRFD Bridge Specifications, to "4th Edition"; added note 10.

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Index Number	Sheet Number	Description
295	1 of 1	"GENERAL NOTES" Note 2 changed "Specification Section 962" to "Specification Section 975".
300	1 thru 2	Index was expanded due to change in font.
304	6 of 6	Added alternate location of detectable warnings on linear ramps. Added note "On curb ramps, landings and flush transitions perpendicular to the curb line: Rows of domes shall be aligned with the centerline of the ramp. (See Pictorial View A)" at top of sheet. Added Rail Road Crossing PLAN view.
305	1 & 4 of 4	Deleted bar spacing table and revised notes (Sheet 1); Changed width of outside lanes (Sheet 4).
307	2 of 3	"UTILITY CONFLICT PIPES THRU STORM SEWER STRUCTURES" changed to "UTILITY CONFLICT PIPES THRU STORM DRAIN STRUCTURES"
310	1 of 2	"SIDEWALK WITH EDGE BEAM FOR SURFACE MOUNTED RAILINGS", "Clear Width", deleted "3' Min." and substituted "4' Min. *".
		"NOTES FOR CONCRETE SIDEWALK ON CURBED ROADWAYS", deleted "Note 1", and substituted the following: "1. Sidewalks shall be constructed in accordance with Section 522 of the FDOT Standard Specifications. Public sidewalk curb ramps shall include detectable warnings and be constructed in accordance with Index No. 304. Detectable warnings are not required where sidewalks intersect urban flared turnouts."
		"Note 3" , deleted.
	2 of 2	"NOTES FOR CONCRETE SIDEWALKS ON UNCURBED ROADWAYS", Changed Note 2 to "Provide detectable warnings that extend the full width of the sidewalk and 24" deep from the edge of pavement where sidewalks adjoin the following vehicular ways: side roads and streets driveways with signalized entrances driveways with entrance volumes greater than 600 vpd driveways with entrance speeds of 25 mph or greater right in – right out composite driveways.
400	1 thru 26	Index expanded by one sheet due to font size change and added new sheet 2, "APPROACH END ANCHORAGE DETAILS", Index renumbered.
	1 of 26	"GENERAL NOTES" Note 17 changed "Specification Section 971" to "Specification Section 975".
	2 of 26	New sheet added showing limits of pay for guardrail, details of shoulder treatment and miscellaneous asphalt for guardrail approach end treatments.
	3 of 26	Corrected spelling of guardrail in last paragraph.
	15 of 26	"LOCATIONS ON FRONT SLOPES", deleted the details for guardrail on slope and rubrail termination and the chart for lateral placement on slopes. (See sheet 26)
	16 of 26	Deleted "REFLECTORS- DETAIL M" (See sheet 17)
	26 of 26	Added "GUARDRAIL ON SLOPES", details for guardrail on slope and rubrail termination and the chart for lateral placement on slopes.
410	1 thru 25	Index completely revised and reorganized.
411	2 of 10	Changed tangent offsets In Detail 'A' to "2.49'-Design Speed ≤45 mph; 1.76' - Design Speed ≥50 mph".
	4 of 10	Changed tangent offsets In Detail 'B' to "2.49'-Design Speed ≤45 mph; 1.76' - Design Speed ≥50 mph".
414	1 of 15	Updated Specification reference Section 971 to 975; Added steel option to ALTERNATE DESIGN note.
	5 of 15	Added PTFE tape option to anchor bolt details.
415	4 of 10	"NOTES FOR WALL END SHIELDING", Note 1, changed the second sentence to: "Except where the plans designate a particular type crash cushion for a specific location, the contractor has the option to construct any of the redirective crash cushions listed on the Qualified Products List, subject to the uses and limitations described on their respective drawings."
		"ANCHOR PLATE BOLTS", upper note, changed "?" to "3/4"".
420	1 of 3	Added the following to the NAME, DATE AND BRIDGE NUMBER note: "The Name shall be as shown in the General Notes in the Structures Plans."; Changed REFLECTIVE RAILING MARKERS note.
		Changed REFLECTIVE RAILING MARKERS note, "Reflective Railing Markers shall meet Specification Section 993. Install markers on top of the Traffic Railing 2" from the face on the traffic side at the spacing shown in the table above. Reflector color (white or yellow) shall match the color of the near edgeline. The cost of the reflective markers shall be included in the Contract Unit Price for the Traffic Railing."
421	1 of 3	Changed REFLECTIVE RAILING MARKERS note, "Reflective Railing Markers shall meet Specification Section 993. Install markers on top of the Traffic Railing along the centerline at the spacing shown in the table above. Reflector color (white or yellow) shall match the color of the near edgeline. The cost of the reflective markers shall be included in the Contract Unit Price for the Traffic Railing."
422	1 of 3	Added the following to the NAME, DATE AND BRIDGE NUMBER note: "The Name shall be as shown in the General Notes in the Structures Plans."; Changed REFLECTIVE RAILING MARKERS note.
		Changed REFLECTIVE RAILING MARKERS note, "Reflective Railing Markers shall meet Specification Section 993. Install markers on top of the Traffic Railing 2" from the face on the traffic side at the spacing shown in the table above. Reflector color (white or yellow) shall match the color of the near edgeline. The cost of the reflective markers shall be included in the Contract Unit Price for the Traffic Railing."
423	1 of 3	Added the following to the NAME, DATE AND BRIDGE NUMBER note: "The Name shall be as shown in the General Notes in the Structures Plans."; Bicycle Railing to "Special Height Bicycle Railing" and Post "B" to Post "B1".
		"TRAFFIC RAILING-(32" VERTICAL SHAPE)", deleted the "REFLECTIVE RAILING MARKERS" note and substituted the following: "Reflective Railing Markers shall meet Specification Section 993. Install markers on top of the Traffic Railing 2" from the face on the traffic side at the spacing shown in the table above. Reflector color (white or yellow) shall match the color of the near edgeline. The cost of the reflective markers shall be included in the Contract Unit Price for the Traffic Railing."
	2 of 3	Changed Bicycle Railing to "Special Height Bicycle Railing" and Post "B" to Post "B1".
	3 of 3	Changed 83 degrees to 93 degrees in CONVENTIONAL REINFORCING STEEL BENDING DIAGRAM Cross-slope table.
424	1 of 7	Added the following to the NAME, DATE AND BRIDGE NUMBER note: "The Name shall be as shown in the General Notes in the Structures Plans."
		"TRAFFIC RAILING - (CORRAL SHAPE)", deleted the "REFLECTIVE RAILING MARKERS" note and substituted the following: "Reflective Railing Markers shall meet Specification Section 993. Install markers on top of the Traffic Railing 2" from the face on the traffic side at the spacing shown in the table above. Reflector color (white or yellow) shall match the color of the near edgeline. The cost of the reflective markers shall be included in the Contract Unit Price for the Traffic Railing."
425	1 of 3	Added the following to the NAME, DATE AND BRIDGE NUMBER note: "The Name shall be as shown in the General Notes in the Structures Plans."
		"TRAFFIC RAILING - (42" F SHAPE)", added the following note: "REFLECTIVE RAILING MARKERS: Reflective Railing Markers shall meet Specification Section 993. Install markers on top of the Traffic Railing 2" from the face on the traffic side at the spacing shown in the table above. Reflector color (white or yellow) shall match the color of the near edgeline. The cost of the reflective markers shall be included in the Contract Unit Price for the Traffic Railing."
470	1 of 3	Added Field testing proof loads to the ADHESIVE BONDED ANCHORS AND DOWELS note; "TRAFFIC RAILING-(THRIE BEAM RETROFIT) GENERAL NOTES & DETAILS", deleted the "BRIDGE NAME PLATE" note and substituted the following: "If a portion of the existing Traffic Railing is to be removed that carries the bridge name, number and or date, or if the installation of the Traffic Railing (Thrie Beam Retrofit) will obscure the bridge name, number and or date, then replace the information that has been removed or obscured, with 3" tall black lettering on white nonreflective sheeting applied to the top of the adjacent guardrail. The information must be clearly visible from the right side of the approaching travel lane. The sheeting and adhesive backing shall comply with Specification Section 994 and may comprise of individual decals of letters and numbers."
		Added the following note: "NEOPRENE PADS: Neoprene pads must be plain pads with a durometer hardness of 60 or 70 and meet the requirements of Specification Section 932, except that testing of the finished pad will not be required."
	3 of 3	Changed offset of 7/8" dia. anchor bolts to 2 3/4" from back edge of base plate in SECTION B-B.
471	2 of 4	"SECTION A-A" and "SECTION B-B", changed "Resilient Pad" to "Neoprene Pad".
472	2 of 4	"SECTION A-A" and "SECTION B-B", changed "Resilient Pad" to "Neoprene Pad".
473	2 of 4	"SECTION A-A" and "SECTION B-B", changed "Resilient Pad" to "Neoprene Pad".
474	2 of 4	"SECTION A-A" and "SECTION B-B", changed "Resilient Pad" to "Neoprene Pad".
	4 of 4	"SECTION C-C", changed "Resilient Pad" to "Neoprene Pad".

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Index Number	Sheet Number	Description
475	2 of 4	"SECTION A-A" and "SECTION B-B", changed "Resilient Pad" to "Neoprene Pad".
476	2 of 4	"SECTION A-A" and "SECTION B-B", changed "Resilient Pad" to "Neoprene Pad".
480	1 of 2	"TRAFFIC RAILING-(VERTICAL FACE RETROFIT) GENERAL NOTES & DETAILS", added the following to the "ADHESIVE-BONDED ANCHORS AND DOWELS" note, "The field testing proof loads required by Specification Section 416 shall be 23,800 lbs. for Dowel Bars 6D on the inside face (traffic side) of the railing (1'-0" embedment) and 18,500 lbs for Dowel Bars 6D along the outside face of the traffic railing (5" min. embedment)." Added NEOPRENE PADS note. Also deleted the "REFLECTIVE RAILING MARKERS" note and substituted the following: "Reflective Railing Markers shall meet Specification Section 993. Install markers on top of the Traffic Railing 2" from the face on the traffic side at the spacing shown in the table below. Reflector color (white or yellow) shall match the color of the near edgeline."
	2 of 2	CONVENTIONAL REINFORCING STEEL BENDING DIAGRAM, added Bars 5E, 5F and 4G for Index No. 484
484	1-10 of 10	New Index added TRAFFIC RAILING (VERTICAL FACE RETROFIT) SPREAD FOOTING APPROACH
500	2 of 2	"HALF SECTION" detail, deleted "Storm Sewer Mains" replaced with "Storm Drain Trunk Lines"
501	3-9 of 9	Changed the REQUIRED TEST METHOD for Burst Strength, Soil-Geosynthetic Friction, Creep Reduction Factor & Joint Overlap to ASTM D 6706.
	4 of 9	Updated values for COMTRAC 70.70; Deleted AMOCO 2006, 2016 & 2044; Added GEOTEX 315ST, 2x2HF, 4x4, 3x3HF, 4x4HF & 4x6 woven geogrids.
	5 of 9	Changed Joint Strength Overlap value to 1.2 for all Marafi products.
	6 of 9	Deleted Application Usage 3 & 4 for SYNTEEN SF 11 & SF 12.
	7 of 9	Added Fornir 20
	8 of 9	Changed Creep Resistance and Creep Reduction Factors for TENSAR BX 1120, BX 1200, BX 1220 & BX 1500
	9 of 9	Updated values for TENAX MS 220 & TENAX MS 330. Added Combigrid 30/30, Secugrid 20/20 & 30/30 extruded geogrids.
505	1-4 of 4	Sheet 3 is new. Renumbered other sheets.
515	5 of 7	In second symbolized note changed "Section 102-6" to "Section 102-8".
	6 of 7	"PAVEMENT STRUCTURE FOR TURNOUTS AND AUXILLIARY LANES TABLE 515-1", "NOTES", Note 5, Deleted "Class I concrete" substituted "Class NS concrete".
518	3 of 3	Revised width of rigid pavement outside travel lane and changed location of rumble strip.
520	1 of 1	"GENERAL NOTES", Note 7, Deleted "Class I Concrete (Retaining Walls)" and substituted "Class NS Concrete"
546	1 of 6	Added detail "PLAN", "PICTORIAL" and ** note. Index sheets reordered.
	5 of 6	Under "NOTES FOR 4-LANE DIVIDED ROADWAY", Note 1, changed reference from "Sheet 6" to "Sheet 2".
600	2 of 13	OVERHEAD WORK, deleted "OPTION 4 - - -" and substituted the following: OPTION 4 (OVERHEAD WORK MAINTAINING TRAFFIC WITH NO ENCROACHMENT BELOW THE OVERHEAD WORK AREA) Traffic shall be detoured, shifted, diverted or paced as to not encroach in the area directly below the overhead work operations in accordance with the appropriate standard index drawing or detailed in the plans. This option applies to, but not limited to, the following construction activities: (a) Beam, girder and segment placement. (b) Deck form placement and removal. (c) Concrete deck placement. (d) Railing construction located at edge of deck. (e) Structure demolition. DEFINITIONS, added the following after definition of TRAVEL WAY: a. Travel Lane: The designated widths of roadway pavement marked to carry through traffic and to separate it from opposing traffic or traffic occupying other lanes. b. Auxiliary Lane: The designated widths of roadway pavement marked to separate speed change, turning, passing and climbing maneuvers from through traffic. CLEAR ZONE WIDTHS FOR WORK ZONES, deleted the text "travel" in the first sentence and substituted "traffic". Replaced chart "CLEAR ZONE WIDTHS FOR WORK ZONES".
600	3 of 13	LANE WIDTHS, in the second sentence, change the word "expected" to "excepted".
	5 of 13	Changed note under "SIGN COVERING AND INTERMITTENT WORK STOPPAGE SIGNING"; added information for the use of the new "PROJECT INFORMATION SIGN".
	6 of 13	GENERAL NOTES, deleted note 1, substituted the following: "1. All signs shall be post mounted when work operations exceed one day except for: a) Road closure signs mounted in accordance with the vendor drawing for the Type III Barricade shown on the QPL. b) Pedestrian advanced warning or regulatory signs mounted on sign supports shown on the QPL." "2 POST SIGN SUPPORT MOUNTING DETAILS", updated text to include a tolerance between sign supports. Insert "+/- 3" " after "1'-6" "and insert "+/- 6" "after "2'-6" ". POST AND FOUNDATION TABLE FOR WORK ZONE SIGNS, expanded Note 2 by adding: "unless otherwise specified in the vendor drawing on the QPL." POST MOUNTED SIGN NOTES, added new notes 1 and 12.
	7 of 13	Added new sheet showing Project Information Sign and renumbered index.
605	1 of 1	"GENERAL NOTES", deleted the text of "Note 8" and substituted the following: "The two channelizing devices directly in front and directly at the end of the work area may be omitted provided vehicles in the work area have high intensity rotating, flashing, oscillating or strobe lights operating." Added new heading "DURATION NOTE" and placed the following note under this heading: 1. ROAD WORK AHEAD sign may be omitted if all of the following conditions are met: a) Work operations are 60 minutes or less. b) Speed is 45 mph or less. c) No sight obstructions to vehicles approaching the work area for a distance of 600 feet. d) Vehicles in the work area have high-intensity, rotating, flashing, oscillating, or strobe lights operating. e) Volume and complexity of the roadway has been considered.
625	1 of 1	New Index added "TEMPORARY ROAD CLOSURE- 5 MINUTES OR LESS".
655	1-3 of 3	New Index added "TRAFFIC PACING-LIMITED ACCESS".
667	1-6 of 6	New Index added "TOLL PLAZAS".
801	1 of 3	"GENERAL NOTES", Note 15 and 21, deleted "Class I" and substituted "Class NS".
802	1-3 of 3	Added tolerance to ground clearance; revised Notes 7a and 7b; rearranged sheets.
	1 of 3	"GENERAL NOTES", Note 6 and 13, deleted "Class I concrete" and substituted "Class NS concrete" for all occurrences.
803	1 of 1	"GENERAL NOTES", Note 4, deleted both occurrences of "Class I" and substituted "Class NS".
810	2 of 4	Deleted "Section 971" and substituted "Section 975" in ANCHOR RODS, NUTS AND WASHERS note.
811	3 of 3	Deleted "Section 971" and substituted "Section 975" in ANCHOR RODS, NUTS AND WASHERS note.
812	2 of 4	Deleted "Section 971" and substituted "Section 975" in ANCHOR RODS, NUTS AND WASHERS note.
820	1 of 1	Changed Top Rail to "Special Height Bicycle Railing" and added new Post "B2" for 3'-6" height Pedestrian/Bicycle Railing.
821	1 of 1	Changed designation of 4'-6" tall railing to "Special Height Bicycle Railing" and added 3'-6" tall Pedestrian/Bicycle Railing.
822	1 of 2	Changed designation of 4'-6" tall railing to "Special Height Bicycle Railing" and "Post B" to "Post B1"; Added "Post B2" details.
850	1 of 5	Changed "Pedestrian Railing" to "Pedestrian/Bicycle Railing" and "Bicycle Railing" to "Special Height Bicycle Railing"; Added anchor bolt requirements to SHOP DRAWINGS note.
	2 of 5	Added "DETAIL FOR NON-CONTINUOUS RAILING AT CORNERS" detail. Changed Pedestrain and Bicyle Railing designation; maximum ramp length for slopes less than 6.25%; and minimum clear picket opening at post to 3/4".
	3 of 5	Changed Pedestrain and Bicyle Railing designation.
	4 of 5	Added requirement for set screw to be set flush against outside face of rail and 18-8 Alloy option in DETAILS "D" & "E", option to notch post in SECTION G-G, and 1/4" joint tolerance in DETAIL "D".
	5 of 5	Added DETAIL "F" and note (*) to ANCHOR BOLT TABLE. Changed Pedestrain and Bicyle Railing designation. Corrected height dimension on steps to top of nosing.

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Index Number	Sheet Number	Description
851	1 of 2	Changed Pedestrain and Bicyle Railing designation.
	2 of 2	Added requirement for set screw to be set flush against outside face of rail and 18-8 Alloy option in DETAIL "B". Changed field splice joint tolerance to ¼" in DETAIL "B".
860	1 of 5	Changed "Pedestrian Railing" to "Pedestrian/Bicycle Railing" and "Bicycle Railing" to "Special Height Bicycle Railing"; Added anchor bolt requirements to SHOP DRAWINGS note. Added filler metal ER4043 to WELDING note.
	2 of 5	Added "DETAIL FOR NON-CONTINUOUS RAILING AT CORNERS" detail. Changed Pedestrain and Bicyle Railing designation; maximum ramp length for slopes less than 6.25%; and minimum clear picket opening at post to ¾".
	3 of 5	Changed Pedestrain and Bicyle Railing designation.
	4 of 5	Added requirement for set screw to be set flush against outside face of rail and 18-8 Alloy option in DETAILS "D" & "E"; option to notch post in SECTION G-G; ¼" joint tolerance in DETAIL "D"; Type B (Nonwelded) connection detail in SECTION A-A. Changed Expansion Joint sleeve embedded length to 10" in DETAIL "D" and picket fillet weld size to ⅛", handrail and top rail fillet weld size to ¼", and base plate fillet weld size to ⅜".
	5 of 5	Added DETAIL "F" and note (*) to ANCHOR BOLT TABLE. Changed Pedestrain and Bicyle Railing designation. Corrected height dimension on steps to top of nosing.
861	1 of 2	Changed designation of 54" tall railing to "Special Height Bicycle Railing".
	2 of 2	Added requirement for set screw to be set flush against outside face of rail and 18-8 Alloy option in DETAIL "B". Changed field splice joint tolerance to ¼" and "Steel Sleeve" to "Aluminum Sleeve" in DETAIL "B".
870	1 of 5	Deleted Pedestrian and Bicycle designations from DESIGN LIVE LOADS and ALTERNATE DESIGN notes.
	2 of 5	Deleted 4'-6" Bicycle Railing option and "**" note. Changed maximum ramp length for slopes less than 6.25%.
	3 of 5	Deleted 4'-6" Bicycle Railing option.
	4 of 5	Added requirement for set screw to be set flush against outside face of rail and 18-8 Alloy option in DETAILS "D" & "E"; and ¼" joint tolerance in DETAIL "D". Deleted Intermediate Rails from DETAILS "B" and "C".
	5 of 5	Added DETAIL "F". Deleted 4'-6" Bicycle Railing option. Corrected height dimension on steps to top of nosing.
880	1 of 5	Deleted Pedestrian and Bicycle designations from DESIGN LIVE LOADS and ALTERNATE DESIGN notes.
	2 of 5	Deleted 4'-6" Bicycle Railing option and "**" note. Changed maximum ramp length for slopes less than 6.25%.
	3 of 5	Deleted 4'-6" Bicycle Railing option.
	4 of 5	Added requirement for set screw to be set flush against outside face of rail and 18-8 Alloy option in DETAILS "D" & "E"; and ¼ joint tolerance in DETAIL "D". Deleted Intermediate Rails from DETAILS "B" and "C".
	5 of 5	Added DETAIL "F". Deleted 4'-6" Bicycle Railing option. Corrected height dimension on steps to top of nosing.
5100	2 of 2	Changed to plastic sleeve expansion joint and "Premoulded Expansion Material" to "Preformed Joint Filler". Changed wall and expansion joint key.
5200	1 of 1	Post caps added to note C.1.b; Changed note K.2 to allow 8 ft height panels. Added note K.11; Changed notes H.1, H.2 and O.2; Deleted note H.3.
5201	1 of 1	Texture Type "I" (Cut Coral Block) added.
5202	1 of 4	Added precast post cap; Changed clearance tolerance on stepped panel and Neoprene Pad options.
	3 of 4	Changed #4 Bar Mark to Bars P5 and P6 for Pile/Post Options A, B, & E; changed Texture Thickness to 1¼" Max.
5203	1 of 5	Added precast post cap; Changed clearance tolerance on stepped panel and Neoprene Pad options.
	3 of 5	Changed #4 Bar Mark to Bars P5 & P6 for Pile/Post Options A, B & E, and changed texture thickness dimension to ¼" Max.
	4 of 5	New sheet added for 45 degree corner post.
	5 of 5	Renumbered from Sheet 4 of 4.
5204	1 of 1	Changed "Ribbed" to "Slotted" in PLUG DETAIL.
5205	1, 3, 4 & 6 of 7	Added note in Elevation Views to 'Extend post 2" above high side wall panel when post caps are shown in the plans'.
	2 of 7	Added tolerance between Top of Precast Collar and Auger Cast Pile; Changed "Composite Bearing Pads" to "Fiber Reinforced Bearing Pads".
	5 of 7	Changed "Composite Bearing Pads" to "Fiber Reinforced Bearing Pads".
	7 of 7	Added "Octangonal Precast Collar" details and tolerance between Top of Precast Collar and Auger Cast Pile; Changed "Composite Bearing Pads" to "Fiber Reinforced Bearing Pads".
5206	1 of 1	Added "POST LENGTH WITH CAP" column, BARS D, P5 thru P8 to table and bar bending details for corner posts.
5207	1 of 1	New Index added "PRECAST SOUND BARRIERS-PRECAST POST CAPITAL".
5210	2 of 5	Changed NAME, DATE AND BRIDGE NUMBER note, and "Ribbed" to "Slotted" in NEOPRENE DIAPHRAGM PLUG DETAIL. Added REFLECTIVE RAILING MARKERS note and RELECTIVE RAILING MARKER SPACING table.
5211	3 of 3	Changed "Ribbed" to "Slotted" in NEOPRENE DIAPHRAGM PLUG DETAIL. Corrected Anchor Pin daimeter on FIRE HOSE ACCESS DETAIL.
5212	2 of 2	Added note for "Full Depth Structural Asphalt" above junction slab and changed coping dimension to 6" Min.
5300	3 of 19	Increased max. gap at back of precast coping and added timber blocking.
	6 of 19	Added note for "Full Depth Structural Asphalt" above junction slab and increased max. gap at back of precast coping.
	7 of 19	Added note for "Full Depth Structural Asphalt" above junction slab.
	12 & 15 of 19	Increased max. gap at back of precast coping. Corrected size of Bar 5U1 in BILL OF REINFORCING TABLE
11200	1-2 of 2	Deleted sheet 2
	1 of 2	Revised and rearranged notes, sheet renumbered to 1 of 2.
	2 of 2	Renumbered sheet 3 of 3 to sheet 2 of 2 revised and rearranged notes. Deleted "Class 1 (Special) Concrete" replaced with "Class 1 Concrete".
11300	1 of 1	Hanger table values revised; connection bolt size revised; sign depth for horizontal splice changed to 10'. U-Bolt material spec (A325) added to Typical Detail of Sign & Truss Connection.
11310	1 of 5	Deleted A307 bolts and Palnut (Note 4e). Changed foundation concrete (Note 7). Changed to ½" mesh (Note 9). Deleted grout pad and notes (former Notes 7c & 9). Added CSL tube note (Note 14).
	2 of 5	Changed foundation standoff distance and changed drilled shaft detail. Deleted grout pad and added wire screen. Added CSL tubes. Changed FC & FL reinforcing.
	5 of 5	Changed bolt spacing connection details.
11320	1 of 5	Deleted A307 bolts and Palnut (Note 4e). Changed foundation concrete (Note 7). Changed to ½" mesh (Note 9). Deleted grout pad and notes (former Notes 7c & 9). Added CSL tube note (Note 14).
	2 of 5	Changed foundation standoff distance. Deleted grout pad and added wire screen.
	4 of 5	Changed bolt spacing connection details.
	5 of 5	Changed drilled shaft detail. Added CSL tubes.
11860	1 of 8	Changed SINGLE COLUMN GROUND SIGN NOTES, Note 11, and GUIDE TO USE THIS STANDARD, Note 4 and example. Modified concrete classification. Modified "ALUMINUM COLUMN (POST) SELECTION TABLE".
	2 of 8	Changed maximum limits of sign cluster area and width in NOTE.
	3 of 8	Added Aluminum Soil Plate details and notes. Changed Post and Foundation Table depth values. Modified "ALUMINUM COLUMN (POST) SELECTION TABLE".
	4 of 8	Deleted "Signs at 90°" note. Added "*For" note. Changed number of Z-brackets for STOP and RECTANGULAR sign. Changed '1" Min.' to '0" Min.' and sign panel edge distance in VIEW A-A. Modified U-bolt size. Changed panel overhang length.
	5 of 8	Modified "DRIVEN POST DETAIL IN CONCRETE".
17302	1 of 1	CASE II, and CASE VIII dimensions and notes revised.
17328	1 of 1	Weigh Station and combination Weigh Station and Inspection Station signing details separated.

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Index Number	Sheet Number	Description
17344	2, 3, 4 & 6 of 6	SCHOOL SIGNS AND MARKINGS, on each sheet, in the Distance table at the bottom of the sheet, deleted the "A" column. Also deleted the "A" dimension from the detail drawings.
17345	2 of 4	NORMAL TAPERED ENTRANCE WITH ADDED LANE, note in lower left corner, arrow now points to the reflective markers on the LEFT side of the ramp.
	4 of 4	Deleted note 2
17346	1-14 of 14	Completely revised and renumbered.
17347	1-4 of 4	New Index BICYCLE MARKINGS added.
17349	1 of 1	Case I and Case II revised; 18" x 18" marker detail revised; notes at bottom right revised.
17355	1 of 11	Revised signs FTP-9A-06 & FTP-9B-06 and notes.
	7 of 11	For all signs with 1-800 phone number, deleted "1-800-998-RIDE" and substituted "1-8XX-XXX-XXXX" and below each sign added note: "Design Project Manager or Transit Administrator will supply correct 1-8XX number".
	8 of 11	Revised sign FTP-68A-06, bolt holes located outside of sign message, notes revised. Sign FTP-69-06 and FTP-68B-06 message and spacing revised.
	9 of 11	Revised sign FTP-82-08 and arrow detail. Added Sign FTP-83-08.
17356	1 of 1	Removed signal head from detail. Single point attachment details deleted from Index. (Deleted sheet 1.)
17359	1 of 2	Changed delineators to object markers; revised reference notes; sign W13-1 made optional. RURAL NARROW BRIDGE TREATMENT, changed the OM3L on the right side of the roadways to an OM3R.
	2 of 2	Notes revised; inserts reorganized
17500	1 of 3	Deleted concrete pole detail, added METAL POLE DETAIL AND WIRING DIAGRAM.
	2 of 3	Note 7, deleted "class I Concrete (Miscellaneous)" replaced with "Concrete and reinforcing for slabs around poles and pull boxes shall be included in the price for pull box or pole."
	3 of 3	Note 7, deleted "class I Concrete (Miscellaneous)" replaced with "Concrete and reinforcing for slabs around poles and pull boxes shall be included in the price for pull box or pole."
17501	1 of 1	Deleted note 28.
17502	3 of 7	Changed Note 9. Added Notes 10 & 11. Changed Notes 11 & 12. Deleted grout pad notes (former Notes 4 & 9). Added CSL tube note (Note 11).
	4 of 7	Added ID plate and changed base plate thickness. Deleted grout pad. Changed drilled shaft reinforcing.
	5 of 7	Changed Weld symbol in SECTION A-A. Added padlock tab to HANDHOLE RING. Added Section E-E detail and bottom baseplate washer to SECTION C-C. Deleted grout pad and added wire screen. Added CSL tubes.
	6 of 7	Grout notes and details removed, new wire screen.
	7 of 7	Note 3, changed "Concrete class" to "concrete NS"
17503	1 of 1	Index deleted.
17504	1 of 1	Dimensions 5'-6" added for height of meter base. Pole type changed from type "N" to type "P".
17505	1 of 2	Mercury Vapor Luminaires changed to Induction Luminaires. Luminaire chart deleted, dimensions revised on spacing detail note and added to structure detail.
17515	1 of 8	Added median barrier mounted light poles. Moved notes to sheet 2.
	2 of 8	New Sheet for Notes. Change Note 7 for QPL Criteria. Modified concrete classification. Added notes for median barrier mounted light pole and foundation.
	3 of 8	Sheet renumberd from 2 to 3. Added double arm configuration to ARM ELEVATION.
	4 of 8	Allowed fusion weld reinforcing cage (*) and changed foundation concrete note. Added 1" dimension to Double Nuts in FOUNDATION. Modified concrete classification. Renumbered sheet from 3 of 3 to 4 of 8.
	5-8 of 8	New Sheets for median barrier mounted light pole.
17600	2 of 3	Added detail for pole foundation to be used only behind guardrail.
	3 of 3	GENERAL NOTES, note 2, changed "Class II Concrete" to "Class I Concrete"; changed note 4.
17723	1 of 3	Changed Note 5i, 6 and 7. Added Note 8. Deleted grout pad and notes (former Notes 4d & 7). Added CSL tube note (Note 9).
	2 of 3	Changed number of bolts in VIEW B-B, number and size of foundation reinforcing bars, and TABLE OF STRAIN POLE VARIABLES. Added foundation standoff distance and washer for base plate. Deleted grout pad and added wire screen. Added CSL tubes. Changed drilled shaft reinforcing.
	3 of 3	Changed note in VIEW E-E; Added 1/4" and 3/8" cable clamps and changed weld criteria. Changed clevis size.
17725	1 of 2	Round pole note revised; pole height dimensions added to Type P-III through P-VIII; Copper Ground note changed.
	2 of 2	Notes revised and rearranged, D(feet) changed to H(feet) in both tables.
17727	1-2 of 2	Schedule 40 aluminum pipe (T6061) added as an alternate to stainless steel pipe in assembly details and signal head notes. Added backplates to signal head details.
17736	1 of 1	Added notes 5 & 6.
17743	1 of 3	Updated assembly dimensions. Changed drilled shaft reinforcing.
	2 of 3	Updated assembly dimensions. Changed drilled shaft reinforcing. Changed T3-BF.
	3 of 3	Updated assembly dimensions. Changed drilled shaft reinforcing.
17745	1 of 5	QPL requirements added in new note 17; added backplates to pole detail; Notes 6 & 14 revised, deleted note 19.
	2 of 5	Revised foundation reinforcing details, Section AA, Section DD and Foundation Plan details.
17748	1 of 1	Option 1 deleted and Options 2 and 3 renumbered; Note 1 revised. Added backplates to signal head displays.
17784	1 of 2	Dimensions revised on Figures A & B. Note 5 and Note to Designers revised.
	2 of 2	Revised details and spacing for signs FTP-68A-06 and FTP-68B-06, also located bolt holes outside of sign message.
17890	2-3 of 3	Added backplates to signal head displays.
17900	7 of 7	Changed pole type call outs, deleted "N-III" and substituted "P-III".
18111	1-2 of 2	Index totally revised.
18113	1-2 of 2	Index totally revised.
20110	1 of 1	Changed Insert Detail for Diaphragm Reinforcing.
20199	1 of 1	Changed BEAM CAMBER AND BUILD-UP NOTES.
20210	2 of 2	Added "Type Q" Epoxy to Note 9.
20299	1 of 1	Changed BEAM CAMBER AND BUILD-UP NOTES.
20500	1 of 1	Added Type C Pads for larger skew ranges. Changed specification of elastomer from "durometer" to "shear modulus".
20501	1 of 1	Changed Note 4.
20502	1 of 1	Changed Note 4.
20602	1 of 1	Changed EDC location to 1D from tip of pile.
20900	2 of 2	Changed coping width and End Bent lug from 6" to 5½" thickness.
20910	2 of 2	Changed coping width and End Bent lug from 6" to 5½" thickness.
21100	1 of 3	Deleted redundant notes from Specification Section 458.
	3 of 3	Changed Sidewalk Cover Plate edge treatment.
21110	1 of 2	Deleted redundant notes from Specification Section 458. Changed last line of title of bottom left detail to "DECK WITH SLOPES 2% OR GREATER".
	2 of 2	Changed Sidewalk Cover Plate edge treatment.
21200	1 of 2	Added "Anchor Plate (dashed lines) (provide Design) to ELEVATION VIEW and TYPICAL SECTION. Added design of anchor bolts and accessories.
	2 of 2	Added design of anchor bolts and accessories.
21600	1 of 7	Clarified INSTRUCTIONS TO DESIGNER for variable end span lengths.
	3 of 7	Added vertical dimensions between deck surface and underside of bearings, including depth of Truss Panel.
21802	1 of 1	Changed "Methyl Methacrylate" to "High Molecular Weight Methacrylate".
21803	1-2 of 3	Revised call-outs for Grout Outlets; Changed "Methyl Methacrylate" to "High Molecular Weight Methacrylate".
	3 of 3	Shrink wrap deleted from Duct Coupler Detail. Revised call-outs for Duct Couplers; Changed "Methyl Methacrylate" to "High Molecular Weight Methacrylate".

A	Area or Amperes
AAA	American Automobile Association
AADT	Annual Average Daily Traffic
AASHO	American Association Of State Highway Officials
AASHTO	American Association Of State Highway And Transportation Officials
ABC	Asphalt Base Course
Abd.	Abandoned
ABS	Acrylonitrite-Butadiene-Styrene Pipe
AC, Ac.	Acre
AC or Asph. Conc.	Asphaltic Concrete
Accel.	Acceleration
ACI	American Concrete Institute
Act.	Actuated
ADA	The Americans With Disabilities Act
Adh.	Adhesive
Adj.	Adjust
ADT	Average Daily Traffic
AFAD	Automatted Flagger Assistance Device
Agg.	Aggregate
Ah.	Ahead
AISC	American Institute Of Steel Construction
Alt.	Alternate
Al.	Aluminum
AM	12:00 Midnight Until 11:59 Noon
ANSI	American National Standards Institute
AOS	Apparent Opening Size
Appl..	Applied, Application
Apprh.	Approach
Approx.	Approximate
ARTBA	American Road & Transportation Builders Association
Artf.	Artificial
Asph.	Asphalt
Assem.	Assembly
Assn.	Association
Assoc.	Associate, Association
ASTM	American Society For Testing And Materials
ATPB	Asphalt Treated Permeable Base
Attn.	Attention
Attnuatr.	Attenuator
Aux. or Auxil.	Auxiliary
Ave.	Avenue
AWG	American Wire Gauge
AWS	American Welding Society
Az	Azimuth
B to B	Back to Back
Basc.	Bascule
Bd. or Bnd.	Bond or Bonded
BC	Bottle Cap or Bolt Circle
B/C, B.C.	Back Of Curb
BCCMP	Bituminous Coated Corrugated Metal Pipe Culvert
BCPA	Bituminous Coated Pipe Arch Culvert
BCPCMP	Bituminous Coated And Paved Corrugated Metal Pipe Culvert
BCPPA	Bituminous Coated And Paved Pipe Arch Culvert
BCT	Breakaway Cable Terminal
BCWE	Base Clearance Water Elevation
BE	Buried Electric
Beg.	Begin
Bit.	Bituminous
Bk.	Back
BL, BLC, or ℄	Base Line, Base Line Control
Bldg.	Building
Blkhd.	Bulkhead
BLON	Begin Length Of Need
Blvd.	Boulevard
BM	Bench Mark
Bndry.	Boundary
Bdr.	Border
Bot.	Bottom
BO	Basin Outlet
BOS	Beginning Of Survey
BP	Borrow Pit
Bq.	Becquerel

Br.	Bridge
Brg.	Bearing
Brkwy.	Breakaway
BT	Buried Telephone Cable or Duct
Btfly.	Butterfly
BW	Barbed Wire, Bottom Width or Both Ways
C	Cantilever Length, Cut, Colorless, Coulomb or Cycle Length
°C	Degree Celsius
C & G	Curb And Gutter
CA	Coarse Aggregate
Cap.	Capacity
CAP	Corrugated Aluminum Pipe
Caps.	Capital Letters
CASP	Corrugated Aluminized Steel Pipe
CATV	Cable Television
CB	Catch Basin
CBC	Concrete Box Culvert
CBS	Concrete Box Structure
CC, C/C, C to C, or C.C.	Center to Center, Crash Cushion
CCEW	Center to Center Each Way
CCTV	Closed-Circuit Television
CD	Cross Drain, Cross Direction (Geotextiles)
cd	Candela
Cem.	Cement or Cemetery
Cem'd.	Cemented
CFS	Cubic Feet Per Second
Ch.	Channel
Chchg.	Channel Change
Chg.	Changeable
CI	Cast Iron
CIP	Cast Iron Pipe
CIPL, C.I.P., C-I-P	Cast In Place
circ.	Circumference
Ckt.	Circuit
Cl. or Clear	Clearance
CL, C/L or ℄	Center Line
CM	Concrete Monument
CMB	Concrete Median Barrier
CMP	Corrugated Metal Pipe
CMPA	Corrugated Metal Pipe Arch
Co.	County or Company
Col.	Column
Com.	Commercial or Common
COMM	Committee or By Committee
Comp.	Composite
Con.	Connect or Connection
Conc.	Concrete
Const.	Construct or Construction
Contrl.	Controller
Cont.	Continuation
Contr.	Contractor
Coord.	Coordinate
Cor.	Corner
Corr.	Corrugated
CP	Concrete Pipe
CPE	Corrugated Polyethylene Pipe
CPT	Cone Penetration Test
CR	Control Radius or County Road
CRA	Clear Recovery Area
Crs. or Cse.	Course
CS	Curve To Spiral
CSP	Corrugated Steel Pipe
CT	Clear Trunk
CTPB	Cement Treated Permeable Base
Ctlvr.	Cantilever
Ctr., Ctrs.	Center
CU or Cu	Copper
Culv.	Culvert
Cwt.	Hundredweight
CY,Cu. Yd., CY, or C.Y.	Cubic Yard
Cyl.	Cylindrical

D	Degree Of Curvature, Depth, Density, Distance, Diameter or Directional Distribution
DA	Drainage Area or Deflection Angle
DBH	Diameter At Breast Height
DBI	Ditch Bottom Inlet
Dbl.	Double
DCS	Degree Of Curvature (Spiral)
DD	Dry Density
DDHV	Directional Design Hour Traffic
Decel.	Deceleration
Deg.	Degree
Delin.	Delineators
Demobl.	Demobilization
Dept.	Department
Det.	Detour, Detection, Detectable
DFE	Design Flood Elevation
DGN or Dgn.	Design
DHV	Design Hourly Volume
DHW	Design High Water
DT	Ditch
DI	Drop Inlet
Dia. or D	Diameter
Dim.	Dimension
Disp.	Disposal
Dist.	Distance
DLS	District Location Surveyor
DMM	Domestic Mail Manual
DOT	Department Of Transportation
DPI or D.P.I.	Ditch Point Intersection
Dr. or DR.	Drain, Drive or Design Review
DR	Design Review
Driv.	Driven
Drwy.	Driveway
DS	Design Speed
DSL	Design Service Life
Dwg.	Drawing
E	East or External Distance
e	Rate Of Superelevation
E to E	End to End
EA or Ea.	Each
EB	Eastbound
EIA	Electronic Industries Alliance
El. or Elev.	Elevation
Elast.	Elastomeric
Elec.	Electric
Ellip.	Elliptical
Embk.	Embankment
Emul.	Emulsified
Encl.	Enclosure
Engr.	Engineer
EOS	End Of Survey or Equivalent Opening Size
E.P. or EOP	Edge Of Pavement
EPDM	Ethylene Propylene Diene Monomer
Eq.	Equation or Equal
Equip.	Equipment
Esmt.	Easement
Est. or Estm.	Estimate
Est.	Establish or Established
Etc. or etc.	Et Cetera (And So Forth)
ETP	Electronic Tough Pitch
EW	Endwall
Ex.	Except, Example
Exc. or Excav.	Excavation
Exist.	Existing
Exp.	Expansion
Ext.	Extension
Exwy.	Expressway

The abbreviations listed are the standard for contract plans production. This list is not all inclusive. Other Department accepted abbreviations may be used when deemed more appropriate. Where special abbreviations are used a descriptive tabulation may be necessary in the plans.

F	Fill, Farad
F or Final	Final Quantity
F & I	Furnish & Install
F to F	Face to Face
FA	Federal Aid or Fine Aggregate
FAC	Florida Administrative Code
FAP	Federal Aid Project
FC	Friction Course
FD	French Drain
Fdn.	Foundation
FDOT	Florida Department Of Transportation
FE	Floor Elevation
Fed.	Federal
Fert.	Fertilizer
FES	Flared End Section
FETS	Flared End Terminal Section
FH	Fire Hydrant
FHWA	Federal Highway Administration
Fig.	Figure
Fin.	Finish
F.L., FL or ℄	Flow Line
FL, Fl. or Fla.	Florida
Flex.	Flexible
FNQ	Fuse (Type Slow Burn)
FOC	Fiber Optics Cable
FPM or fpm	Feet Per Minute
FPS or fps	Feet Per Second
FR or Fr.	Frame
Frang.	Frangible
Freq.	Frequency
F.S.	Florida Statutes
Ft.	Foot or Feet
FTB	Floating Turbidity Barrier
FTBA	Florida Transportation Builder Association
FTP	Florida Traffic Plans
Furn.	Furnish
G	Giga or Gauss
g	Gram or Gravity
Galv.	Galvanized
Ga.	Gauge or Gage
Ga. or Gal.	Gallon
Gar.	Garage
GD	Gutter Drain
GFI	Ground Fault Interrupter
GIP	Galvanized Iron Pipe
GM	Gas Main
GP	Grade Point
Gr.	Grade, Guardrail or Grate
Gr. or Gro.	Gross
GRC	Galvanized Rigid Steel Conduit
Grd.	Ground
GRI	Geosynthetic Research Institute
gross km	Gross Kilometer
Gr. Wt. or gr. wt.	Gross Weight
Gttr.	Gutter
H	Henry
h	Hour or Hecto
ha	Hectare
HAR	Highway Advisory Radio
HB	Hay Bales
HC	Horizontal Clearance
HD	High Density or Heavy Duty
HD or Hd.	Head
HDPE	High Density Polyethylene
Hdwl.	Headwall
HH	Heavy Hex
Hndrl	Handrail
HOA	Hand/Off/Automatic
Horiz. or Hor.	Horizontal
HP	High Pressure or Horsepower
Hr.	Hour
HS	High Strength
HSHV	High Strength Horizontal Vertical
Hse.	House
Ht.	Height
HW or H.W.	High Water or Hot Water
Hwy.	Highway
Hyd.	Hydraulic
Hz	Hertz
I	External Angle (Delta), Interstate
Intchg. or Ichg.	Interchange
IES	Illuminating Engineering Society
ID, I.D.	Inside Diameter or Identification
IMC	Intermediate Metal Conduit
In.	Inch or Inches
Inc.	Incorporated or Including
Incl. or Inc.	Included
Ind.	Industry or Industrial
INV. or Inv.	Invert
IP	Iron Pipe
Install.	Installed
Isect.	Intersection
Isl.	Island
IR	Iron Rod
ITE	Institute Of Transportation Engineers
ITS	Intelligent Transportation Systems
J	Joule
JB	Junction Box
Jct.	Junction
Jt.	Joint
K	Design Hour Factor or Kelvin
k	Kilo (prefix)
kg	Kilogram
kg/m	Kilogram Per Meter
kg/m²	Kilogram Per Square Meter
kg/m³	Kilogram Per Cubic Meter
Kilo	One Thousand
Kip	1000 Pounds
km	Kilometer
km/h	Kilometer Per Hour
kn	Knot
kN	Kilonewton
kPa	Kilopascal
ksi	Kips Per Square Inch
kV	Kilovolt
kVA	Kilovolt Ampere
kWh	Kilowatthour
L	Length, Length Of Curve, Liter, Left
2-L	Two-Lane
2L1W	Two-Lane One-Way
2L2W	Two-Lane Two-Way
LA or L/A	Limited Access
Lat.	Lateral or Latitude
Lb.	Pound
LBS.	Pounds
lb/sy	Pounds Per Square Yard
LBR	Limerock Bearing Ratio
LC	Long Chord
LEO	Law Enforcement With Flashing Lights And Radar
LFD	Load Factor Design
Lgth.	Length
Lin.	Linear
lm	Lumen
Lmrk.	Limerock
LOS	Limit Of Clear Sight
Loc., LO	Location
Long.	Longitude
LRFD	Load Resistance Factor Design
LS	Length Of Spiral
LT	Left Turn
Lt.	Left
Ltd.	Lighted or Limited
Lum.	Luminaire
L/W	Lightweight
lx	Lux
M	Mass, Middle Ordinate Length or Mega
m	Meter or Milli
m²	Square Meter or Meter Square
m³	Cubic Meter or Meter Cubed
m³ /m	Cubic Meter Per Meter
m/s	Meters Per Second
Mach.	Machine
Maint.	Maintenance
Matl.	Material
Max.	Maximum
MB	Median Barrier
MBM	Thousand (Feet) Board Measure
MD	Machine Direction (Geotextiles)
Med.	Median
Mega	One Million
Memb.	Member
MES	Mitered End Section
Mess.	Message
Mfg.	Manufactured or Manufacturer
MG	1000 Gallons
MH, M.H.	Manhole, Mounting Height
MHW	Mean High Water
µ	Micro
Mi.	Mile
Micro	One-Millionth
Mid.	Middle
Mil	One-Thousandth Of An Inch
Mil.	Military
Milli	One-Thousandth
Min.	Minimum or Minute
Misc.	Miscellaneous
mL	Milliliter
MLW	Mean Low Water
mm	Millimeter
Mobl.	Mobilization
Mod.	Modify or Modified
Mol	Mole
Mon.	Monument
MOT	Maintenance Of Traffic
MP	Mile Post
MPa	Megapascal
MPH or mph	Miles Per Hour
MSL	Mean Sea Level
MSTCSD	Minimum Specifications For Traffic Control Signal Devices
Mtd.	Mounted
MUTCD	Manual On Uniform Traffic Control Device
MUTS	Manual On Uniform Traffic Studies
N	North or Newton
N/m	Newtons Per Meter
N/m²	Newtons Per Square Meter
N/m³	Newtons Per Cubic Meter
N/mm²	Newtons Per Square Millimeter
NA or N/A	Not Available or Not Applicable
N & C	Nail & Cap
N & D	Nail & Disk
NAVD	National American Vertical Datum
NB	Northbound
NC	National Coarse or Normal Crown
NCHRP	National Cooperative Research Program
NDCBU	Neighborhood Delivery And Collection Box Unit
NE	Northeast
net km	Net Kilometer
NEMA	National Electrical Manufacturers Association
NGVD	National Geodetic Vertical Datum of 1929
NGS	National Geodetic Survey
NHS	National Highway System
NHW	Normal High Water
NIC	Not In Contract
NJ	New Jersey
N m	Newton Meter
No.	Number
Nom.	Nominal
Norm.	Normal
N.P.	Non Plastic
NPS	Nominal Pipe Size
NPT	National Pipe Thread
NRCP	Non-Reinforced Concrete Pipe
NS	Non Stress, Not Suitable or Near Side
NT, N&T	Non Traffic, Nail & Tin
NTS	Not To Scale
NW	Northwest
Opass	Overpass
O to O, o to o or O.O.	Out to Out
OA	Overall
O.B.G.	Optional Base Group
OC or O.C.	On Center
OD or O.D.	Outside Diameter
OE	Overhead Electric
OH, OHD or Ohd.	Overhead
Opt.	Option, Optional or Optically
OT	Overhead Telephone
Oz.	Ounce
Ω	Ohm
P	Passenger Car & Light Delivery Truck
P or Plan	Plan Quantity
Pa	Pascal
Par.	Parallel
Pa•s	Pascal Second
Part.	Participation or Partition
Pavt.	Pavement
PC	Point Of Curvature
PCBC	Precast Concrete Box Culvert
PCC	Point Of Compound Curvature or Plain Cement Concrete
PCE	Permanent Construction Easement
PE	Professional Engineer
Ped	Pedestrian or Pedestal
Pen.	Penetration
PG	Profile Grade
PGL	Profile Grade Line
Ph.	Phase
pH	Measure Of Acidity or Alkalinity
PI	Point Of Intersection
Pkg.	Parking
Pkwy.	Parkway
PL or ℄	Property Line or Plate
PM	12:00 Noon Until 11:59 Midnight
POC	Point On Curve
POST	Point On Semi-Tangent
POT	Point On Tangent
PP	Power Pole
PPB	Pier Protection Barrier
Pr.	Pair
PRC	Point Of Reverse Curvature
Prcst.	Precast
Prest.	Prestressed
Prob.	Probability
Prod.	Product, Production, Producer or Produced
Prog.	Program or Progression
Proj.	Project or Projection
PRM	Permanent Reference Monument
Prop.	Proposed
Prov.	Provisions
PRS	Portable Regulatory Sign
PS & E	Plans, Specifications And Estimates
PSF or psf	Pounds Per Square Foot
PSI or psi	Pounds Per Square Inch
PT	Point Of Tangency or Pressure Treated
PVC	Polyvinyl Chloride
PW	Pressure Water

The abbreviations listed are the standard for contract plans production. This list is not all inclusive. Other Department accepted abbreviations may be used when deemed more appropriate. Where special abbreviations are used a descriptive tabulation may be necessary in the plans.

Q	Peak Discharge or Flow Volume
QPL	Qualified Products List
R	Right
R or Rad.	Radius
R or Rng.	Range
rad	Radian
rad/s	Radian Per Second
RBAC	Rock Base Asphaltic Concrete
RBST	Rock Base Surface Treatment
RC	Reverse Crown
RCP	Reinforced Concrete Pipe
RCPA	Reinforced Concrete Pipe Arch
Rd.	Road or Round
Rdsd.	Roadside
Rdwy.	Roadway
Rec.	Recovery
Rect.	Reticuline or Rectangular
Ref.	Reference
Refl.	Reflective
Reg.	Region, Regular, Registered or Regulation
Reinf.	Reinforced or Reinforcing
Rejuv.	Rejuvenation
Reloc.	Relocated
Rem.	Removal
Repl.	Replace
Req. or Reqd.	Required
Res.	Residence or Residential
RGS	Rigid Galvanized Steel
RHW	Insulation (Moisture & Heat Resistant Rubber)
RM	Reference Monument
r/min	Revolution Per Minute
RP	Reference Point
rpm	Revolution Per Minute
RPM	Raised Reflective Pavement Markers
r/s	Revolution Per Second
RR	Railroad
RSDU	Radar Speed Display Unit
Rsf.	Resurface
Rt.	Right
RU	Rack Unit
R/W, ROW	Right Of Way
RX	Receive
S or s	Speed, South, Siemens, Or Second
SAHM	Sand-Asphalt Hot Mix
SAN or San.	Sanitary
SB	Southbound
SBAC	Shell Base Asphaltic Concrete
SBRM	Sand Bituminous Road Mix
SBST	Shell Base Surface Treatment
SC	Seal Coat or Spiral To Curve
Sch.	Schedule
SCST	Sand-Clay Surface Treatment
SD	Side Drain, Storm Drain
SE	Southeast
Sec.	Second
Sect.	Section
Sed.	Sediment
Sep.	Separator
Seq.	Sequential
Serv.	Service
SF	Adjustment Factor In Percent, Silt Fence
SG	Subgrade
SG	Specific Gravity
Sh. or Sht.	Sheet
Shldr.	Shoulder
SHW	Seasonal High Water
SIP	Stay In Place
SP	Superpave
Spa.	Space
Spcg. or Sp.	Spacing
Spec.	Specification
SPT	Standard Penetration Test
Sq. Ft., SF, or S.F.	Square Foot
Sq. In.	Square Inch
Sq. Yd., SY or S.Y.	Square Yard
SR or S.R.	State Road
SRAP	Spiral Rib Aluminum Pipe
SRASP	Spiral Rib Aluminized Steel Pipe
SRCP	Steel Reinforced Concrete Pipe
SRD	State Road Department
SRSP	Spiral Rib Steel Pipe
SS	Sanitary Sewer
SSMD	Solid State Modular Design
ST	Surface Treatment or Spiral To Tangent
St. or ST.	Street
Sta.	Station
Stab.	Stability or Stabilization
STB	Staked Turbidity Barrier
Std.	Standard
Stg.	Strong
Stge.	Storage
Stl.	Steel
Str.	Structure
Sty.	Story
SU	Single Unit Trucks
Sub. or Subs.	Subsoil
Sub. or Subst.	Substitute
Subgr.	Subgrade
Suppts.	Supports
SUR or Sur.	Survey
Surf.	Surface
SW	Southwest
SW or Swk.	Sidewalk
Sys. or Syst.	System
Sv	Sievert
Sym.	Symmetrical
T	Tangent, Length Of Curve, Percent Trucks, Tesla,
T, TWP or Twp.	Township
t	Metric Ton
tan.	Tangent
TBM	Temporary Bench Mark
TC	Tangent To Curve
TCB	Temporary Concrete Barrier
TCE	Temporary Construction Easement
TCP	Terra Cotta Pipe
TCZ	Traffic Control Zone
TDLC	Transportation Design For Livable Communities
Tel.	Telephone
Temp.	Temperature or Temporary
Theo.	Theoretical
THRMPLSTC	Thermoplastic
THW or THWN	Insulation (Flame Retardant, Moisture And Heat Resistant Thermoplastic)
Thick.	Thickness
Tk	Thick, Thickness or Truck
Tn.	Ton
Traf.	Traffic
Trans.	Transition, Transverse, Translate or Transportation
Treat.	Treatment
TS	Tangent To Spiral
TSC	Length Of Tangent (Spiral Curve)
TTC	Temporary Traffic Control
TVSS	Transient Voltage Surge Suppression
TX	Transmit
Typ.	Typical
Upass.	Underpass
UG	Underground
UL	Underwriters Laboratories
Ult.	Ultimate
Ultd.	Unlimited
Unddr.	Underdrains
Undrdwy.	Underroadway
UNL or Undl.	Unloaded
Untr.	Untreated
UPS	Uninterruptible Power Supply
USC & GS	US Coast and Geodetic Survey (now National Geodetic Survey)
USGS	US Geological Survey
USPS	United States Postal Service
Util.	Utilities
UV	Ultraviolet
V	Volt, Velocity, Volume or Hourly Volume
Var.	Varies, Variable or Variance
VC	Vertical Curve
VCP	Vitrified Clay Pipe
VECP	Value Engineering Change Proposal
Veh.	Vehicle
Vert.	Vertical
VF	Vertical Foot
Vh	Verified Horizontal Location
VMS	Variable Message Sign
Vol.	Volume
VP	Vertical Panel
VPD or Vpd.	Vehicles Per Day
VPH or Vph.	Vehicles Per Hour
VPHPL or Vphpl.	Vehicles Per Hour Per Lane
VRMS	Volts Root Mean Square
Vv	Verified Vertical Elevation
Vvh	Verified Vertical Elevation And Horizontal Location
VW	Variable Width
W	Width, Wide, West or Watt
W/C	Water-Cement Ratio
WB	Westbound
Wb.	Weber
WB40	Intermediate Semi Trailer
WB50	Large Semi Trailer
WB62	Interstate Semi Trailer
WB67D	Tandem Semi Trailer
WM	Water Main
W.P.I.	Work Program Item
WT	Water Table Or Weight
WWF	Welded Wire Fabric
WWR	Welded Wire Reinforcing
X	Coordinate Value (East-West Direction) or Extra
X Rd.	Cross Road
Xing.	Crossing
Xsec.	Cross Section
Y	Coordinate Value (North-South Direction)
Yd.	Yard
Yr.	Year

The abbreviations listed are the standard for contract plans production. This list is not all inclusive. Other Department accepted abbreviations may be used when deemed more appropriate. Where special abbreviations are used a descriptive tabulation may be necessary in the plans.

UNITS OF MEASURE

US MEASUREMENT

AC	Acre
AS	Assembly
BU	Bushel
CF	Cubic Foot
CO	Cleanout
CY	Cubic Yard
EA	Each
ED	Each Day
GA	Gallon
GM	Gross Mile
LB	Pound
LF	Linear Foot
LM	Lane Mile
LO	Per Location
LS	Lump Sum
LU	Luminaire
MB	Thousand Board Measure
MG	Thousand Gallons
MH	Man Hour
NM	Net Mile
PA	Per Analysis
PB	Per Building
PE	Pile
PI	Per Intersection
PL	Plant
PM	Per Mile
PS	Per Set
PW	Per Well
SI	Square Inch
SF	Square Foot
SY	Square Yard
TN	Ton

METRIC MEASUREMENT

AS	Assembly
CO	Cleanout
DA	Day
EA	Each
ED	Each Day
GK	Gross Kilometer
HA	Hectare
HR	Hour
KG	Kilogram
KL	Kiloliter
KM	Kilometer
LI	Liter
LK	Lane Kilometer
LO	Per Location
LS	Lump Sum
LS/AS	Lump Sum Per Assembly
LS/DA	Lump Sum Per Day
LS/EA	Lump Sum Per Each
LS/HA	Lump Sum Per Hectare
LS/KG	Lump Sum Per Kilogram
LS/LS	Lump Sum Per Lump Sum
LS/MT	Lump Sum Per Metric Ton
LS/MI	Lump Sum Per Linear Meter
LS/M2	Lump Sum Per Square Meter
LU	Luminaire
MH	Man Hour
MO	Month
MT	Metric Ton
MI	Meter
M2	Square Meter
M3	Cubic Meter
NK	Net Kilometer
PA	Per Analysis
PB	Per Building
PI	Per Intersection
PL	Plant
PW	Per Well

STANDARD SYMBOLS FOR KEY MAP

- Highway With Full Control of Access
- Highway With Frontage Roads
- Highway Interchange
- Proposed Controlled Access Highway
- Divided Highway
- Hard Surfaced Road
- Soil, Gravel Or Shell Surfaced Road
- Graded And Drained Road
- Unimproved Road
- Primitive Road
- P — Private Road
- Streets In Inset Or Delimited Areas
- Extension Of Local Roads Within Cities
- FAI — Federal Aid Interstate Highway
- FAU — Federal Aid Urban Highway
- FAP — Federal Aid Primary Highway
- FAS — Federal Aid Secondary Highway
- NFR — National Forest Road
- SFR — State Forest Road
- SPR — State Park Road
- Interstate Highway
- US Numbered Highway
- State Highway
- County Road

- Railroad
- Double Track Railroad
- Abandoned Railroad
- Railroad Station
- Grade Crossing
- Railroad Above
- Railroad Below
- Military Field
- Commercial Or Municipal Airport
- Landing Area Or Strip
- Runways

- FF — Free Ferry
- TF — Toll Ferry
- Canal Or Drainage Ditch
- Intracoastal Waterway
- Narrow Stream
- Wide Stream
- Dam
- Dam Or Spillway With Lock
- Dam With Road
- Flood Control Structure
- Lake, Reservoir Or Pond
- Intermittent Pond
- M — Meandered Lake
- Marsh Or Swamp
- Mangroves
- Levee Or Dike
- Levee Or Dike With Road
- Highway Bridge
- 3 — Small Bridges Closely Spaced
- Drawbridge
- Highway Grade Separation
- Tunnel
- State Boundary Line
- County Boundary Line
- Civil Township Boundary
- Extended Township Line
- Land Grant Line
- Land Section Line
- State Survey Section Line
- Survey By Others
- Location Of Inset Boundary Within Map
- Military Reservation Boundary
- College Or University Boundary
- Corporate Limits
- Delimited Area, Population Est.
- Reservation, Forest Or Park Boundary
  Wildlife Refuge Boundary

- Residential Area Under Development
- Lighthouse
- State Capital
- County Seat
- Other City Or Village
- Seminole Indian Village
- Welcome Station
- WP — Wayside Park Or Small Park
- WP — Park With Boat Ramp
- B — Boat Ramp
- Museum
- Recreational Area Or Historic Site
- Scenic Site
- Post Office
- School
- Church
- Cemetery
- Church And Cemetery
- Hospital, Health Center Or Rest Home
- Toll House, Port Of Entry Or Weight Station
- Fair Grounds, Race Course Or Rodeo Arena
- Mine Or Strip Mine
- Governmental Research Station

- Agricultural Inspection Station
- FM — Farmers Market
- Game Preserve
- Game Checking Station
- Bird Sanctuary
- Fire Control Headquarters
- Lookout Tower
- FS — Fire Station
- Patrol Or Police Station
- Correctional Institution Or Road Camp
- DOT — Department of Transportation Facility
- Coast Guard Station
- A — Armory
- J — Junkyard
- F — Sanitary Fill
- S — Sewage Disposal Plant
- I — Incinerator
- Power Plant
- Power Substation
- Communications Facility
- Locked Gate Or Fence
- WOOD — Triangulation Station

GENERAL NOTE

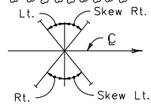
1. Symbols on this Index are intended for use on all Roadway, Signing And Marking, Signalization, and Lighting projects. For work zone traffic control symbols refer to Index 600. When additional or similar symbols are used, legends or notations may be required for clarity.

STANDARD SYMBOLS FOR PLAN SHEETS

GENERAL SYMBOLS

- State Line
- County Line
- Township Line
- Section Line
- City Line
- Base Or Survey Line
- Right-Of-Way
- Easement Line
- Limited Access Line
- Fence Line
- National Or State Park Or Forest
- Grant Line
- Railroad (Drainage Maps)
- Railroad (Detail Plans)
- Fence (Limited Access)
- Box Culvert
- Bridge
- Pipe Culvert-Mitered End Section
- Pipe Culvert-Straight Endwall
- Pipe Culvert-U-Type Endwall
- Pipe Culvert-Median Drain
- Pipe Culvert-Other End Treatments
- 18" SD — Storm Drain (Proposed)
- 18" SD - - - - Storm Drain (Existing)
- Inlet
- Manhole
- Tied Longitudinal Joint
- Keyed Longitudinal Joint
- Doweled Transverse Expansion Joint
- Doweled Transverse Contraction Joint
- Transverse Contraction Joint Without Dowels
- Survey Reference Point
- AL ACHUA — Triangulation Station
- B.M. NO. 112 — Bench Mark
- Point Of Intersection
- North Arrow
- TYP. TYPE PAV'T WALK — Edges Of Existing Pavement And Sidewalk
- Guardrail
- C. C. — Crash Cushion (Attenuator)
- Piling Pier Column
- Concrete Monument
- Base Line
- Centerline
- Flow Line
- Property Line
- Delta Angle
- Approximate
- Round Or Diameter

- Curb
- Curb And Gutter
- Water Well, Spring
- Levee
- MP 327 — Railroad Mile Post
- Railroad Signal With Gate
- Railroad Switch
- 12' — Gate
- Pump Island
- Storage Tank (Surface)
- Storage Tank (Underground)
- Mine Or Quarry
- B P — Borrow Pit
- Church
- S — Store
- RES — Residence
- B — Barn
- School
- Synthetic Bales
- Silt Fence
- Floating Turbidity Barrier
- Staked Turbidity Barrier
- Stream
- Shore Line
- Marsh
- Wetland Boundary (Proposed)
- Wetland Boundary (Existing)
- Hedge
- Trees
- Edge Of Wooded Area
- Shrubbery
- Grove Or Orchard



Definition Of Skew For Cross Drains And Barrels Of Conrete Box Culverts

- Concrete
- Wood
- e — Rate Of Superelevation

UTILITY ADJUSTMENT SYMBOLS

EXISTING	PROPOSED	
		Manhole
		Fire Hydrant
		Meter (Type)
		Valve (Type)
		Valve Box (Type)
		Valve Cover (Type)
		Vent (Type)
		Pump Station
		Sewage Pump Station
		Cleanout
		Cable TV Service Box
		Power Pole
		Telephone Pole
		Combination Pole
		Guy Wire And Anchor Pin
		Guy Pole Deadman
		Tower
		Light Pole
		Transformer

EXISTING	PROPOSED	
W - - - - 6" - - - - W	W W W W W W 6" M M M M M M	Water Main
NPW - - - 6" - - - NPW	NPW NPW 6" NPW NPW	Non Potable Water
S - - - - 8" - - - - S	S S S S S S 8" S S S S S	Sanitary Sewer
G - - - - 6" - - - - G	G G G G G G 6" G G G G G G	Gas
RD - - - - 4" - - - - RD	RD RD RD 4" RD RD	Roof Drain
PET - - - 8" - - - PET	PET PET 8" PET PET	Petroleum
STM - - - 12" - - - STM	STM STM 12" STM STM	Steam
CAS - - - 12" - - - CAS	CAS CAS 12" CAS CAS	Casing
DT - - - 4"x4" - - - DT	DT DT 4"x4" DT DT	Duct
BE - - (7.5 kV) - - BE	BE BE (7.5 kV) BE BE	Buried Electric
OE - - (7.5 kV) - - OE	OE OE (7.5 kV) OE OE	Overhead Electric
BTV - - - 3" - - - BTV	BTV BTV 3" BTV BTV	Buried Cable Television
OTV - - - -2" - - - OTV	OTV OTV 2" OTV OTV	Overhead Cable Television
BT - - - - 2" - - - - BT	BT BT BT 2" BT BT BT	Buried Telephone
OT - - - - 2" - - - - OT	OT OT OT 2" OT OT OT	Overhead Telephone
BFO - - - 2" - - - BFO	BFO BFO 2" BFO BFO	Buried Fiber Optic
OFO - - - -1" - - - - OFO	OFO OFO 1" OFO OFO	Overhead Fiber Optic

See General Note, Sheet 1 of 3

STANDARD SYMBOLS FOR PLAN SHEETS

TRAFFIC SIGNALS SYMBOLS

EXISTING	PROPOSED	
		Traffic Signal Head (Span Wire Mounted)
		Traffic Signal Head (Pedestal Mounted)
		Traffic Signal Head (Mast Arm Mounted)
		Traffic Signal Pole (Concrete, Wood, Metal)
		Vehicle Detector (Loop)
		Signal Cable (On Messenger Wire)
		Conduit
		Vehicle Detector (Points)
		Pedestrian Detector
		Pedestrian Signal Head (Pole Or Pedestal Mounted)
		Controller Cabinet (Base Mounted)
		Controller Cabinet (Pole Mounted)
W - D W		Walk - Dont Walk
FDW		Flashing Dont Walk
5		Signal Face Number
		Signal Lens
P		Programmed Signal Head
		Messenger Wire
3		Pole Tabulation Cross Reference
*3		Pole Tabulation Cross Reference (Joint Use Pole)
		Signal Phase

LIGHTING SYMBOLS

EXISTING	PROPOSED	
		Pole & Luminaire
		Existing Pole & Luminaire To Be Removed
		Final Position Of Relocated Or Adjusted Pole & Luminaire
		High Mast Lighting Tower
		City Or Utility Owned Luminaire & Pole
		PVC (Polyvinyl Chloride) Lighting Conduit And Conductors
		Rigid Galvanized Lighting Conduit And Conductors
		Lighting Pull-Box
		Light Distribution Point
		Joint Use Pole
		Pier Cap Underdeck Luminaire
		Pendant Hung Underdeck Luminaire

SIGNING AND PAVEMENT MARKING SYMBOLS

	Pavement Arrow
	Single Solid Line
	Double Solid Line
	Skip Line
	Stop Bar
	Traffic Sign (Post Mounted)
	Traffic Sign (Overhead)
13	Sign Number
700-83	Sign Item Number
	Traffic Flow Arrow

See General Note, Sheet 1 of 3

STANDARD CRITERIA

CLASS	TYPE (1)	APPLICATION DESCRIPTION	INDEX NO.	PERMITTIVITY SEC^{-1}	AOS SIEVE#	MIN. GRAB TENSILE STRENGTH kN	MIN. SEWN STRENGTH kN/m	MIN. PUNCTURE kN	MIN. TRAPEZOIDAL TEAR kN	MIN. WIDE WIDTH TENSILE STRENGTH kN/m	UV RESISTANCE (Min. Allowed) %	UV RESISTANCE (Min. Allowed) Time (Hrs.)	COMMENTS
DRAINAGE (D)	D-1	Revetment (Special)		(See D-2)	(See D-2)	1.40	1.26	0.50	0.50		50	500	Woven Monofilament Geotextiles only (Elongation <50%) Provide 12" thick bedding stone layer.
	D-2	Revetment (Standard) Articulating Block**** Gabions Rock, Rubble, Broken Concrete	281	% SOIL PASSING No. 200 SIEVE <15% 0.7 15% to 50% 0.2 >50% 0.1	% SOIL PASSING No. 200 SIEVE <15% 40 15% to 50% 60 >50% 70*	Woven Monofilament 1.10 Other Geotextiles: Elongation <50% 1.40 ≥50% 0.90	Woven Monofilament 0.99 Other Geotextiles: Elongation <50% 1.20 ≥50% 0.81	Woven Monofilament 0.40 Other Geotextiles: Elongation <50% 0.50 ≥50% 0.35	Woven Monofilament 0.25 Other Geotextiles: Elongation <50% 0.50 ≥50% 0.35		50	500	Woven Geotextiles only. No Slit Film Geotextiles allowed. Provide 12" thick bedding stone layer for revetment (standard). The bedding layer may be omitted if a D-1 fabric is used with revetment (standard). ****Bedding Stone not required for Articulating Block. *For cohesive soils with a plasticity index >7, maximum average role value for AOS is number 50 sieve.
	D-3	Underdrain *** French Drain Sheet Piling Filter Filter Fabric Jacket (Culvert) Concrete Pavement Subdrainage	286 285 280 287	% SOIL PASSING No. 200 SIEVE <15% 0.5 15% to 50% 0.2 >50% 0.1	% SOIL PASSING No. 200 SIEVE <15% 40 15% to 50% 60 >50% 70*	Elongation <50% 1.10 ≥50% 0.70	Elongation <50% 0.99 ≥50% 0.63	Elongation <50% 0.40 ≥50% 0.25	Elongation <50% 0.40** ≥50% 0.25		50	500	No woven slit film fabrics allowed. *For cohesive soils with a plasticity index >7, maximum average role value for AOS is number 50 sieve. **Required Trapezoidal tear for woven monofilament is 250. ***See Index No. 286 for the permittivity and AOS values of the internal filter fabric of Type V Underdrain.
	D-4	Slope Pavement (Sand-Cement) Ditch Pavement (Sand-Cement)	 281	0.5	40	0.80	0.72	0.22	0.155		50	500	Non-woven, needle-punch only. Elongation ≥50%
	D-5	Mechanical Stabilized Retaining Wall Cast-In-Place Retaining Wall		0.5	40	0.40	0.36	0.22	0.175		50	500	
	D-6	Slope Pavement (Concrete) Ditch Pavement (Concrete)	 281	0.5	40	0.80	0.72	0.22	0.155		50	500	Non-woven, needle-punch only. Elongation ≥50%
EROSION (E)	E-1	Staked Silt Fence	102	0.05	NA	0.40	0.36	NA	0.155		80	500	Min. Filtration Efficiency of 75% & min. flow rate of 0.3 gal.
	E-2	Wind Screen		0.05	NA	0.40	0.36	NA	NA		80	150	
	E-3	Plastic Erosion Mat (Turf Reinforcement Mat) (Type 1)	NA	NA	NA	NA	NA	NA	NA	2 x 1	80	500	Use where design shear stress is ≤100 Pa
	E-4	Plastic Erosion Mat (Turf Reinforcement Mat) (Type 2)	NA	NA	NA	NA	NA	NA	NA	4 x 2	80	500	Use where design shear stress is ≤170 Pa
	E-5	Plastic Erosion Mat (Turf Reinforcement Mat) (Type 3)	NA	NA	NA	NA	NA	NA	NA	8 x 4	80	500	Use where design shear stress is ≤240 Pa

(1) Type refers to FDOT class and application.

TABLE I

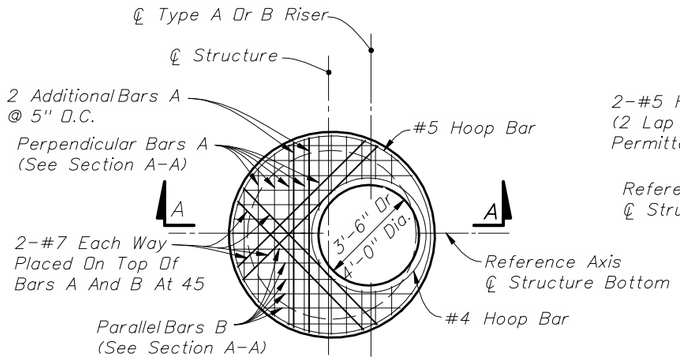
Test	Unit	Test Method
Permittivity	sec^{-1}	ASTM-D-4491
AOS	mm	ASTM-D-4751
Elongation	%	ASTM-D-4632
Grab Tensile Strength	kN	ASTM-D-4632
Wide With Tensile Strength	kN/m	ASTM-D-4595
Maximum Design Velocity	M/sec	See Design Note 3
Sewn Strength	kN/m	ASTM-D-4884
Puncture	kN	ASTM-D-4833
Trapezoidal Tear	kN	ASTM-D-4533
Ultraviolet Resistance	% Retained In Strength	ASTM-D-4355
Filtration Efficiency	%	ASTM-D-5141
Flow Rate	L^3/min.	ASTM-D-5141

GENERAL NOTES

1. Specifications for geotextiles are in Section 985. Physical criteria for each application is provided by this standard, in conjunction with those sections.
2. All values except AOS are MINIMUM AVERAGE ROLL values in the weakest principal direction. Values for AOS are MAXIMUM AVERAGE ROLL values.
3. Test soil or fill material adjacent to the geotextile for gradation to select values for permittivity and AOS.
4. Unless specifically restricted in COMMENTS column, any type of material meeting specification 985 may be used.
5. Wide width tensile strength is expressed in units of measure of kN/m, in machine direction and cross direction, as MD x CD.

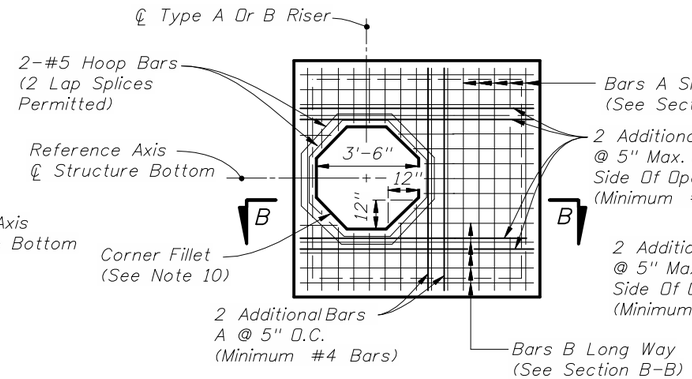
DESIGN NOTES

1. The Designer shall review this criteria and adjust the values as necessary to satisfy project requirements. These adjustments shall be called for in the plans or contained in the project special provisions.
2. UV Resistance: The value represents the percent minimum textile strength retained (ASTM-D-4632) after weathering per ASTM-D-4355 for the test period (hours).
3. Shear stress limits for plastic erosion mats determined by 30 minutes sustained flow in unvegetated state as determined by tests performed by Utah State University, Texas Transportation Institute or an independent testing laboratory approved by the State Drainage Engineer.

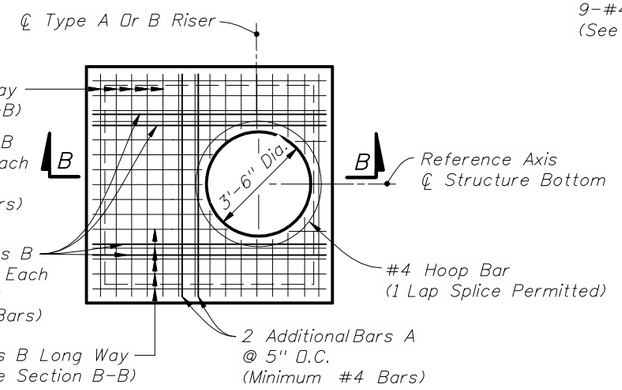


NOTE:
Not Applicable For Type A, B, C, D & E Ditch Bottom Inlets Or Type S & V Gutter Inlets. See Index Nos. 220, 221, 230, 231 & 232.

TOP SLAB REINFORCING STEEL DIAGRAM (ALTERNATE A)

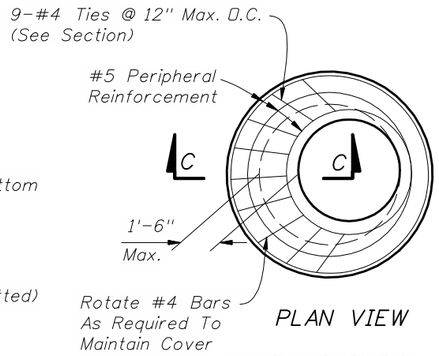


SQUARE OPENING WITH CORNER FILLETS



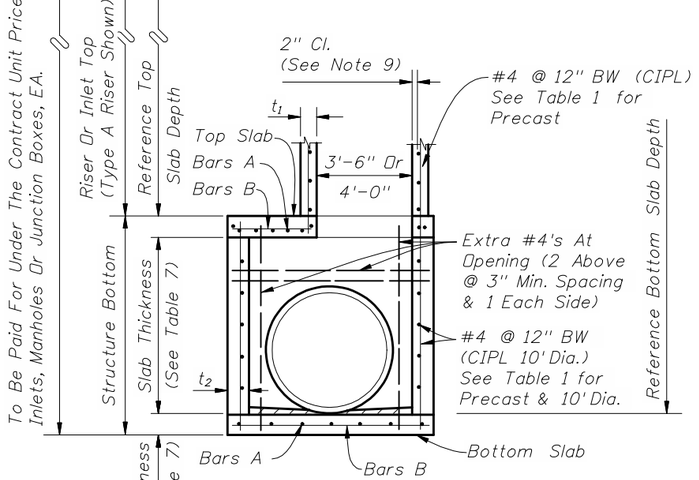
ROUND RISER OPENING

TOP SLAB REINFORCING STEEL DIAGRAM (ALTERNATE B)



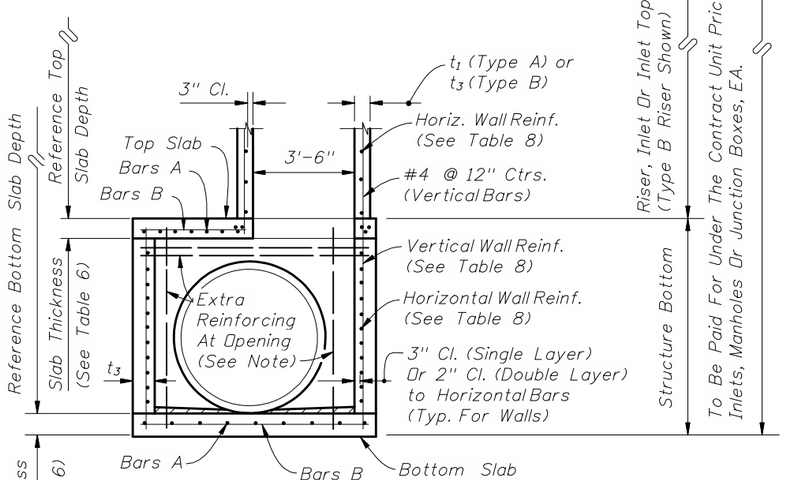
SECTION C-C

SPECIAL TOP SLAB*



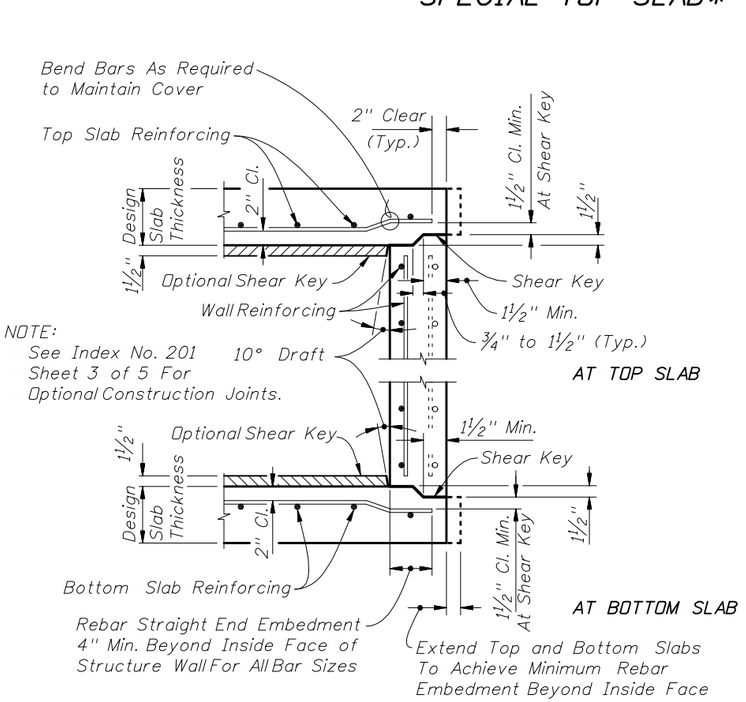
*NOTE:
When the inside diameter of a round structure is not more than 1'-6" larger than the opening in the riser or top slab, the top of the structure or riser shall be constructed according to the "Special Top Slab" details on this sheet.

SECTION A-A
(ALTERNATE A)



NOTE:
Provide one extra #4 bar reinforcement each side of each opening and two extra #4 bars at 3" min. spacing above each opening.

SECTION B-B
(ALTERNATE B)



TYPICAL SLAB TO WALL DETAILS FOR PRECAST STRUCTURES

2010 FDOT Design Standards

STRUCTURES BOTTOMS TYPE J AND P

Last Revision	Sheet No.
07/01/09	1 of 5

Index No. 200

ROUND STRUCTURE BOTTOMS (ALTERNATE A) & ROUND RISERS-TABLE 1

Wall Thickness (t_1 & t_2) and Vertical & Horizontal Areas of Reinforcement (A_s)

Type	Structure / Riser Diameter (feet)	Cast-In-Place Items Class II Concrete			Precast Items				
					Class II Concrete			ASTM C478	
		t_1 Riser (inches)	t_2 Bottom (inches)	A_s (in.²/ft.)	t_1 Riser (inches)	t_2 Bottom (inches)	A_s (in.²/ft.)	t_1 or t_2 (inches)	A_2 *** (in.²/ft.)
P	3'-6"	6	8	0.20	6	8	0.20	4**	0.105
P	4'-0"	6	8	0.20	6	8	0.20	5**	0.120
J	5'-0"	–	8	0.20	–	8	0.20	6**	0.150
J	6'-0"	–	8	0.20	–	8	0.20	6	0.180
J	7'-0"	–	8	0.20	–	8	0.20	7	0.210
J	8'-0"	–	8	0.20	–	8	0.24	8	0.240
J	10'-0"	–	10	0.40##	–	10	0.40##	10	0.300
J	12'-0"	–	10	0.40##	–	12	0.40##	12	0.360

TABLE 1 NOTES:
##Provide 0.20 eq. in.²/ft. at each face, 12" max. bar spacing.
**Modified minimum wall thickness.
***Min. total circumferential reinforcement for continuous steel hoops:
A_2 =0.50 sq. in. for riser section height equal or less than 2'-0" (2 hoop min.)
A_2 =0.75 sq. in. for riser section height more than 2'-0" up to 4'-0" (3 hoop min.)
Areas of reinforcing for precast items are based on Grade 60 reinforcing;
No reduction in the area of reinforcement is allowed for welded wire fabric in Table 1;
Area of vertical reinforcing may be reduced in accordance with ASTM C478.

SQUARE & RECTANGULAR STRUCTURES (ALTERNATE B) - TABLE 2

Type	Wall Length (feet)	Max. Depth (feet)	Wall Thickness (t_3)	
			CIPL (in.)	Precast (in.)
P	≤3'-6"	40	6 Riser 8 Bottom	6
J	4'-0"	40	8	6
J	5'-0"	22	—	6
J	6'-0"	15	—	6
J	5'-0" to 9'-0"	40	8	8
J	10'-0"	26	8	8
J	≥10'-0"	40	10	10

TABLE 2 NOTES:
See Table 8 for Reinforcing Schedule.

GENERAL NOTES

1. Standard structure bottoms 4'-0" diameter and smaller (Alt. A) and 3'-6" square (Alt. B) are designated Type P. Larger standard structure bottoms are designated Type J. Risers are permitted for all structures. Round risers are designated Type A, square risers are designated Type B.
2. Walls of circular structures (Alt. A) constructed in place may be of brick or reinforced concrete. Precast and rectangular structures (Alt. B) shall be constructed of reinforced concrete only.
3. Wall thickness and reinforcement are for either reinforced cast-in-place or precast concrete units except that precast circular units may be furnished with walls in accordance with ASTM C478 (see modified wall thicknesses in Table 1).
4. Top and bottom slab thickness and reinforcement are for precast and cast-in-place construction. All concrete shall be of Class II concrete, except use Class IV concrete when shown in the Plans, for special applications of structures located in extremely aggressive environments. Concrete as specified in ASTM C478 (4000 psi) may be used in lieu of Class II concrete for precast items manufactured in accordance with Specifications Section 449.
5. All reinforcement shown is ASTM A615/A615M Grade 60 steel, deformed bar. Equivalent area Grade 40 steel or equivalent area ASTM A185 (smooth) or ASTM A497 (deformed) welded wire fabric may be substituted according to Index No. 201, unless otherwise noted.
6. Alt. A or Alt. B structure bottoms may be used in conjunction with curb inlet tops Types 1, 2, 3, 4, 5, 6, 9, and 10, and any manhole or junction box unless otherwise shown in the plans or other standard drawings. Alt. B structure bottoms may be used in conjunction with curb inlet Types 7 & 8, or any ditch bottom inlet unless otherwise shown in the plans or other standard drawings.
7. Rectangular structures may be rotated as directed by the Engineer in order to facilitate connections between the structure walls and storm sewer pipes.
8. Except when ACI hooks are specifically required, reinforcement in top and bottom slab shall be straight embedment.
9. All reinforcement must have 2" minimum cover except for 3'-6" diameter precast circular units manufactured under ASTM C478, keyed construction joints, and pipe openings must all have 1½" minimum cover, unless otherwise shown. Additional bars used to restrain hole formers for precast structures with grouted pipe connections, may be left flush with the hole surface. Cut or bend reinforcement at pipe openings to maintain cover. Exposed ends of reinforcing at precast pipe openings and grouted joints must be removed to 1" below the concrete surface and sealed with a Type F epoxy in accordance with Specification Section 926. Horizontal steel in rectangular structures shall be lapped a minimum of 30 bar diameters or by standard hooks at corners.
10. The corner fillets shown are necessary for rectangular structures used with circular risers and inlet throats and when used on skew with rectangular risers, inlets and inlet throats. Fillets will be required in the top slab of the Alt. A structure bottoms when used with the Alt. B risers. Each fillet shall be reinforced with two #5 bars.
11. Inlet walls, throats, risers or manhole tops shall be secured to structures as shown on Index No. 201 (Sheet 3 of 5) Optional Construction Joints.
12. Structures with depths over 14' below the mean high water table are to be checked for flotation by the designer of the drainage project.
13. Units larger than specified standards may be substituted at the contractor's option when these units will not cause or increase the severity of utility conflicts. Such larger units shall be furnished at no additional cost to the Department. Larger Alt. A units cannot replace Alt. B units without approval of the Engineer. This note applies to this Index only.
14. For manhole and junction box tops, for frames and covers, and, for supplementary details see Index No. 201.
15. Type J structure bottoms must have a minimum 6'-0" wall height when possible, for maintenance access.

TABLE 3–MINIMUM STRUCTURE SIZES FOR SINGLE PIPE CONNECTION PER SIDE

PIPE SIZE	RECTANGULAR Side Dimension (L)		ROUND Diameter (D)	
	Single Pipe Per Side	Note Number	Single Pipe or θ=180°	2 to 4 Pipes θ=90°
18"	3'-6"		3'-6"	4'-0"
24"	3'-6"		3'-6"	5'-0"
30"	3'-6"/4'-0"	2	4'-0"	6'-0"
36"	4'-0"/5'-0"	3	5'-0"	7'-0"
42"	5'-0"		6'-0"	7'-0"
48"	6'-0"		6'-0"	8'-0"
54"	6'-0"		7'-0"	10'-0"
60"	7'-0"		7'-0"	10'-0"
66"	7'-0"/8'-0"	4	8'-0"	12'-0"
72"	8'-0"		8'-0"	12'-0"
78"	9'-0"		10'-0"	12'-0"
84"	9'-0"		12'-0"	N/A

TABLE 3 NOTES:

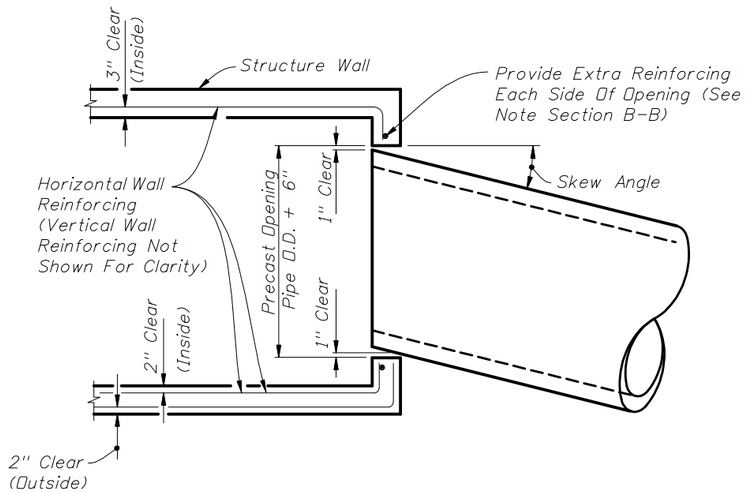
1. For Round Structures sizes with variable angles between pipes and variable pipe sizes, refer to the FDOT Storm Drain Handbook.
2. For 3'-6" Precast Square Structure Bottoms, 30" Pipes with similar invert elevations are not permitted in adjacent walls. Use 4'-0" Side Dimensions when 30" pipe openings are required on adjacent walls and the difference in flow lines is less than 3'-0".
3. For 4'-0" Precast Square Structure Bottoms, 36" Pipes with similar invert elevations are not permitted in adjacent walls. Use 5'-0" Side Dimensions when 36" pipe openings are required on adjacent walls and the difference in flow lines is less than 3'-0".
4. For 7'-0" Precast Square Structure Bottoms, 66" Pipes with similar invert elevations are not permitted in adjacent walls. Use 8'-0" Side Dimensions when 66" pipe openings are required on adjacent walls and the difference in flow lines is less than 4'-0".

TABLE 4–MINIMUM SIZES FOR MULTIPLE PARALLEL PIPE CONNECTIONS FOR RECTANGULAR STRUCTURE BOTTOMS

PIPE SIZE	PIPE SPACING (S)	MINIMUM WALL LENGTH (L) FOR NUMBER OF PARALLEL PIPES		
		2	3	4
18"	2'-10"	6'-0"	8'-6"	11'-0"
24"	3'-5"	6'-6"	10'-0"	13'-6"
30"	4'-3"	8'-0"	12'-6"	16'-6"
36"	5'-1'	9'-6"	14'-6"	19'-6"
42"	6'-0"	11'-0"	17'-0"	–
48"	6'-9"	12'-6"	19'-0"	–
54"	7'-8"	14'-0"	–	–
60"	8'-6"	15'-0"	–	–
66"	9'-0"	16'-6"	–	–
72"	10'-0"	18'-0"	–	–
78"	10'-9"	19'-0"	–	–
84"	11'-8"	20'-6"	–	–

TABLE 4 NOTES:

1. Minimum wall lengths based on precast structures, using concrete pipe with maximum skew angles per Table 5.
2. Wall lengths exceeding 20'-0" require special designs.

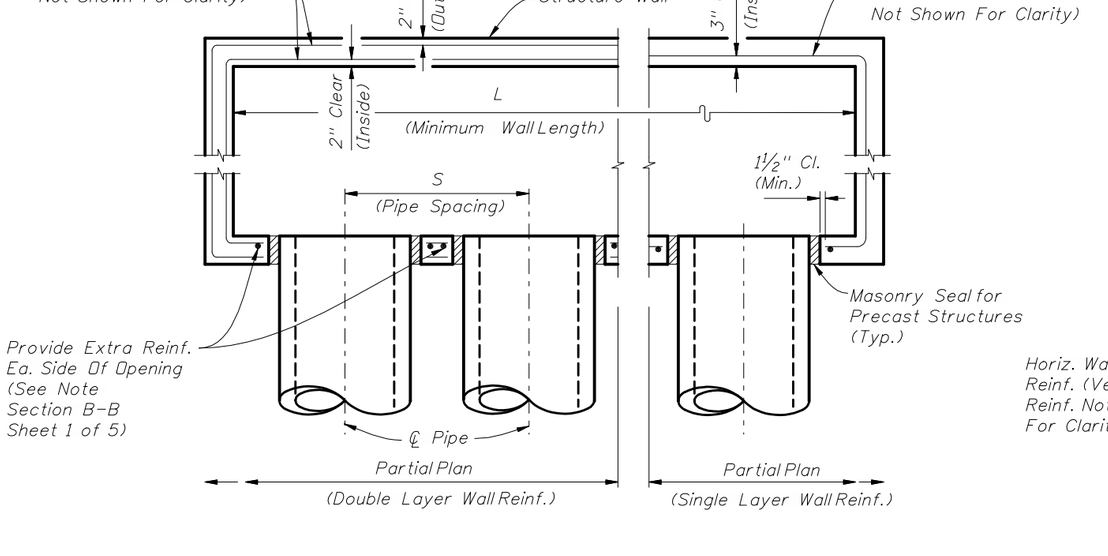


MAXIMUM PIPE SKEW FOR PRECAST ROUND OPENINGS
PLAN VIEW

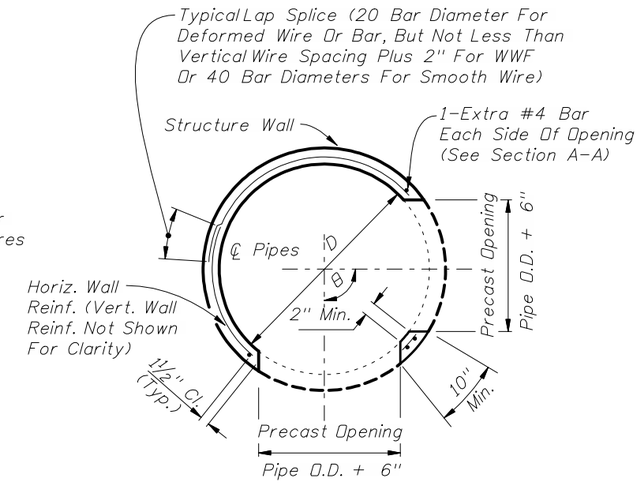
TABLE 5 – MAXIMUM PIPE SKEW FOR PRECAST ROUND OPENINGS

	WALL THICKNESS	PIPE SIZE											
		18"	24"	30"	36"	42"	48"	54"	60"	66"	72"	78"	84"
MAXIMUM SKEW ANGLE	8"	19°	17°	16°	16°	15°	14°	14°	13°	13°	13°	12°	12°
	6"	21°	20°	18°	17°	17°	16°	15°	15°	14°	14°	13°	13°

TABLE 5 NOTES:
These values are based on 2" clearance for precast structures. Larger skews are possible for Cast-In-Place Structures or elliptical pipe openings when approved by the Engineer.



MULTIPLE PARALLEL PIPE CONNECTIONS DETAIL
PLAN VIEW



PRECAST ROUND STRUCTURES WITH MULTIPLE PIPE CONNECTIONS

STRUCTURE SIZES FOR PIPE CONNECTIONS

2010 FDOT Design Standards

STRUCTURE BOTTOMS TYPE J AND P

Last Revision 07/01/07 | Sheet No. 3 of 5 | Index No. 200

SLAB DESIGNS - SQUARE AND RECTANGULAR STRUCTURES (TABLE 6)
(ALL SLABS 8" THICK EXCEPT AS NOTED - REINFORCING PARALLEL TO SHORT WAY AND LONG WAY)

SHORT-WAY		LONG-WAY	
SLAB DEPTH	SCHEDULE (Bars A)	SLAB DEPTH	SCHEDULE (Bars B)
SIZE: 3'-6" x UNLIMITED			
≥0.5' < 8'	B10	≥0.5' < 24'	B10
8' < 13'	B5.5	24'-40'	B5.5
13' < 31'	C6.5		
31'-40'	D7		
SIZE: 4' x UNLIMITED			
≥0.5' < 7'	B5.5	≥0.5' < 15'	B10
7' < 19'	C6.5	15' < 29'	B5.5
19' < 31'	D7	29'-40'	C6.5
31'-40'	E5		
SIZE: 5' x 5'			
≥0.5' < 3'	C6.5	≥0.5' < 3'	C6.5
3' < 7'	B5.5	3' < 13'	C6.5
7' < 22'	C6.5	13' < 22'	D7
22' < 29'	D7	22' < 29'	D4.5
29'-40'	E5	29'-40'	E5
SIZE: 5' x 6'			
≥0.5' < 12'	C6.5	≥0.5' < 3'	C6.5
12' < 26'	D7	3' < 9'	B5.5
26'-40'	E5	9' < 23'	C3.5
		23' < 35'	D4.5
		35'-40'	E5
SIZE: 5' x 7'			
≥0.5' < 10'	C6.5	≥0.5' < 10'	B5.5
10' < 20'	D7	10' < 31'	C3.5
20' < 34'	E5	31'-40'	D4.5
34'-40'	F5		
SIZE: 5' x 8'			
≥0.5' < 7'	C6.5	≥0.5' < 8'	B10
7' < 13'	D7	8' < 17'	B5.5
13' < 24'	E5	17' < 25'	C6.5
24'-40'	F5	25'-40'	C3.5
SIZE: 5' x 9'			
≥0.5' < 8'	C6.5	≥0.5' < 14'	B10
8' < 14'	D7	14' < 24'	B5.5
14' < 25'	E5	24' < 34'	C6.5
25'-40'	F5	34'-40'	C3.5
SIZE: 5' x UNLIMITED			
≥0.5' < 8'	C6.5	≥0.5' < 14'	B10
8' < 14'	D7	14' < 24'	B5.5
14' < 25'	E5	24' < 34'	C6.5
25'-40'	F5	34'-40'	C3.5

SHORT-WAY		LONG-WAY	
SLAB DEPTH	SCHEDULE (Bars A)	SLAB DEPTH	SCHEDULE (Bars B)
SIZE: 6' x 6'			
≥0.5' < 13'	C6.5	≥0.5' < 10'	C3.5
13' < 23'	D7	10' < 18'	D4.5
23'-40'	E5	18' < 27'	E5
		27' < 33'	E3
		33'-40'	F5
SIZE: 6' x 7'			
≥0.5' < 8'	C6.5	≥0.5' < 8'	C6.5
8' < 16'	D7	8' < 12'	C3.5
16' < 28'	E5	12' < 21'	D4.5
28'-40'	F5	21' < 28'	E5
		28' < 35'	E3
		35'-40'	F5
SIZE: 6' x 8'			
≥0.5' < 6'	C6.5	≥0.5' < 6'	B5.5
6' < 13'	D7	6' < 11'	C6.5
13' < 22'	E5	11' < 17'	C3.5
22' < 35'	F5	17' < 22'	D4.5
35'-40'	G5	22' < 32'	E5
		32'-40'	E3
SIZE: 6' x 9'			
≥0.5' < 8'	D7	≥0.5' < 8'	B5.5
8' < 14'	E5	8' < 14'	C6.5
14' < 24'	F5	14' < 21'	C3.5
24'-34'	G5	21' < 25'	D4.5
		25'-34'	E5
SIZE: 6' x UNLIMITED			
≥0.5' < 8'	D7	≥0.5' < 8'	B5.5
8' < 14'	E5	8' < 14'	C6.5
14' < 24'	F5	14' < 21'	C3.5
24'-34'	G5	21' < 25'	D4.5
		25'-34'	E5
SIZE: 7' x 7'			
≥0.5' < 8'	C6.5	≥0.5' < 4'	C6.5
8' < 15'	D7	4' < 7'	C3.5
15' < 26'	E5	7' < 11'	D4.5
26'-40'	F5	11' < 22'	E3
		22' < 32'	F3.5
		32'-40'	G3.5
SIZE: 7' x 8'			
≥0.5' < 5'	C6.5	≥0.5' < 5'	C6.5
5' < 11'	D7	5' < 8'	C3.5
11' < 19'	E5	8' < 13'	D4.5
19' < 30'	F5	13' < 22'	E3
30'-40'	G5	22' < 30'	F3.5
		30'-40'	G3.5
SIZE: 7' x 9'			
≥0.5' < 9'	D7	≥0.5' < 7'	C6.5
9' < 15'	E5	7' < 10'	C3.5
15' < 25'	F5	10' < 14'	D4.5
25' - 34'	G5	14' < 21'	E5
		21' < 29'	F5
		29'-34'	F3.5

SHORT-WAY		LONG-WAY	
SLAB DEPTH	SCHEDULE (Bars A)	SLAB DEPTH	SCHEDULE (Bars B)
SIZE: 8' x 8'			
≥0.5' < 10'	D7	≥0.5' < 9'	D4.5
10' < 19'	E5	9' < 13'	E5
19'-30'	F5	13' < 18'	F5
		18' < 23'	F3.5
		23'-30'	G3.5
SIZE: 8' x 9'			
≥0.5' < 8'	D7	≥0.5' < 7'	D7
8' < 14'	E5	7' < 9'	D4.5
14' < 23'	F5	9' < 15'	E3
23'-31'	G3.5	15' < 20'	F5
		20' < 23'	F3.5
		23'-31'	G3.5
SIZE: 9' x 9'			
≥0.5' < 8'	D7	≥0.5' < 7'	D4
8' < 14'	E5	7' < 10'	E5
14' < 22'	F5	10' < 17'	F3.5
		17' < 22'	G3.5
SIZE: 9'x9'x10" SLAB THICKNESS			
22' < 36'	F5	22' < 31'	F3.5
36'-40'	G5	31'-40'	G3.5
SIZE: 10'x10'x10" SLAB THICKNESS			
≥0.5' < 7'	C6.5	0.5' < 6'	C6.5
7' < 10'	D7	6' < 9'	D4.5
10' < 18'	E5	9' < 15'	E5
18' < 27'	F5	15' < 22'	F5
27'-32'	G5	22'-32'	G3.5
SIZE: 12'x12'x12" SLAB THICKNESS			
≥0.5' < 10'	D7	≥0.5' < 8'	D7
10' < 16'	E5	8' < 14'	E5
16' < 25'	F5	14' < 22'	F5
25'-35'	G5	22' < 30'	G5
		30'-35'	H4

SLAB DESIGNS - ROUND STRUCTURES (TABLE 7)

SLAB DEPTH	SLAB THICKNESS	REINF. (2-WAY) SCHEDULE
SIZE: 3'-6" DIAMETER		
2'-15'	6" Precast	C6.5
0.5' < 30'	8"	A6
30'-40'	8"	B5.5
SIZE: 4'-0" DIAMETER		
≥0.5' < 19'	8"	A6
19' < 30'	8"	B5.5
30'-40'	8"	C6.5
SIZE: 5'-0" DIAMETER		
≥0.5' < 15'	8"	B5.5
15' < 26'	8"	C6.5
26' < 35'	8"	D7
35'-40'	8"	D4.5
SIZE: 6'-0" DIAMETER		
≥0.5' < 9'	8"	B5.5
9' < 15'	8"	C6.5
15' < 22'	8"	C3.5
22' < 30'	8"	D4.5
30'-40'	8"	E5
SIZE: 7'-0" DIAMETER		
≥0.5' < 8'	8"	C3.5
8' < 16'	8"	D4.5
16' < 23'	8"	E5
23' < 27'	8"	E3
27'-40'	8"	F3.5
SIZE: 8'-0" DIAMETER		
≥0.5' < 10'	8"	D4.5
10' < 16'	8"	E5
16' < 19'	8"	E3
19' < 29'	8"	F3.5
29'-40'	10"	F5
SIZE: 10'-0" DIAMETER		
≥0.5' < 12'	10"	D4.5
12' < 20'	10"	E5
20' < 28'	10"	F5
28'-40'	10"	G3.5
SIZE: 12'-0" DIAMETER		
≥0.5' < 8'	10"	D4.5
8' < 13'	10"	E5
13' < 18'	10"	F5
18' < 26'	10"	G3.5
26'-40'	12"	G3.5

SLAB AND WALL DESIGN TABLE NOTES

1. Size is the inside dimension(s) of a structure.
2. Slab reinforcement is appropriate for top, intermediate, and bottom slabs.
3. Bottom Slabs for precast 3'-6" x 3'-6" rectangular structures at 15' depth or less, may be 6" thick.
4. Slab depth is measured from finished grade to top of slab.
5. Wall depth is measured to the top of the bottom slab for boxes and to the top of the intermediate slab for risers.
6. Wall height is the distance between top of lower slab to bottom of upper slab. Maximum wall height is 12' for wall lengths exceeding 5', or 10' for wall lengths exceeding 12'.
7. Wall lengths exceeding 6'-0" require two layers of reinforcing (See Table 8) with 2" of cover from the horizontal bars to the inside and outside faces for each layer.
8. Wall lengths exceeding the dimensions or depths shown in Table 8, or 12'-0" diameter require a special design.
9. Wall thickness and reinforcing for rectangular structures is the same for both long and short sides.
10. Reinforcing schedules with larger areas of steel may be substituted for schedules with smaller bar or wire spacing, except that Schedule B10 may not be substituted for Schedule A6. See Index 201, Sheet 4 for allowable bar spacing adjustments when larger areas of reinforcing are substituted.

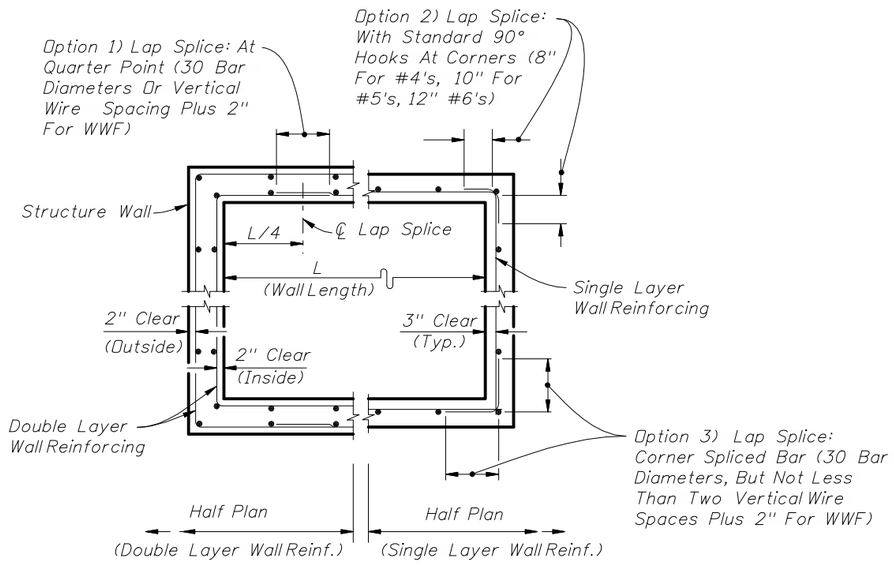
WALL DESIGNS - RECTANGULAR STRUCTURES (TABLE 8)

VERTICAL REINFORCING		HORIZONTAL REINFORCING		WALL THICKNESS
WALL DEPTH	SCHEDULE	WALL DEPTH	SCHEDULE	
SIZE: 3'-6" & RISERS				
≥1.17'-40'	A12	≥1.17' < 10'	B10	6"/8"
		10' < 18'	B5.5	6"/8"
		18' < 29'	C6.5	6"/8"
		29'-40'	C3.5	6"/8"
SIZE: 4'-0"				
≥1.17'-40'	A12	≥1.17' < 6'	B10	6"/8"
		6' < 10'	B5.5	6"/8"
		10' < 20'	C6.5	6"/8"
		20' < 28'	C3.5	6"/8"
		28'-40'	D4.5	6"/8"
SIZE: 5'-0"				
≥1.17'-40'	A12	≥1.17' < 5'	B5.5	6"/8"
		5' < 9'	C6.5	6"/8"
		9' < 15'	C3.5	6"/8"
		15' < 22'	D4.5	6"/8"
		22'-40'	E3	8"
SIZE: 6'-0"				
≥1.17' < 26'	A12	≥1.17' < 9'	C3.5	6"/8"
		9' < 15'	D4.5	6"/8"
		15' < 26'	E3	8"
	Inside / Outside		Inside / Outside	
26' - 40'	A12 / A12	26'-40'	D7 / D7	8"
SIZE: 7'-0"				
	Inside / Outside		Inside / Outside	
≥1.17' < 25'	A12 / A12	≥1.17' < 7'	B10 / B10	8"
25'-40'	B10 / B10	7' < 10'	B5.5 / B5.5	8"
		10' < 20'	C6.5 / C6.5	8"
		20' < 30'	D7 / D7	8"
		30'-40'	E5 / E5	8"
SIZE: 8'-0"				
	Inside / Outside		Inside / Outside	
≥1.17' < 20'	A12 / A12	≥1.17' < 6'	B5.5 / B5.5	8"
20'-40'	C6.5 / C6.5	6' < 13'	C6.5 / C6.5	8"
		13' < 22'	D7 / D7	8"
		22' < 31'	E5 / E5	8"
		31'-40'	F5 / F5	8"

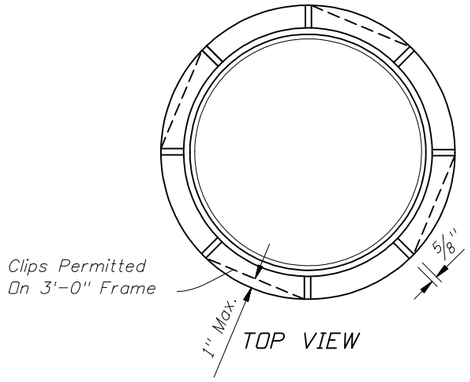
VERTICAL REINFORCING		HORIZONTAL REINFORCING		WALL THICKNESS
WALL DEPTH	SCHEDULE	WALL DEPTH	SCHEDULE	
SIZE: 9'-0"				
	Inside / Outside		Inside / Outside	
≥1.17' < 12'	A12 / A12	≥1.17' < 8'	C6.5 / C6.5	8"
12' < 28'	C6.5 / C6.5	8' < 15'	D7 / D7	8"
28'-40'	D7 / D7	15' < 23'	E5 / E5	8"
		23'-40'	F5 / F5	8"
SIZE: 10'-0"				
	Inside / Outside		Inside / Outside	
≥1.17' < 10'	B10 / B10	≥1.17' < 10'	D7 / D7	8"
10' < 21'	C6.5 / C6.5	10' < 17'	E5 / E5	8"
21' < 26'	D7 / D7	17' < 26'	F5 / F5	8"
26'-40'	C6.5 / C6.5	26'-40'	F5 / F5	10"
SIZE: 12'-0"				
	Inside / Outside		Inside / Outside	
≥1.17' < 10'	B10 / B10	≥1.17' < 10'	D7 / D7	10"
10' < 21'	C6.5 / C6.5	10' < 17'	E5 / E5	10"
21' -40'	D7 / D7	17' < 26'	F5 / F5	10"
		26'-40'	G5 / G5	10"
SIZE: 20'-0"				
	Inside / Outside		Inside / Outside	
≥1.17' < 10'	C6.5 / C6.5	≥1.17' > 10'	E5 / E5	10"
10' < 17'	D7 / D7	10' < 17'	F5 / F5	10"
17' -30'	E5 / E5	17'-30'	G5 / G5	10"

REINFORCING SCHEDULE				
SCHEDULE	GRADE 60 BARS OR 65 KSI & 70 KSI WELDED WIRE FABRIC			
	GRADE 60 AREA (in.²/ft.)	MAXIMUM SPACING		
		GR 60 BARS	WWF EQUIV. AREA*	
			65 KSI	70 KSI
A12	0.20	12"	8"	8"
A6	0.20	6"	5"	4½"
B10	0.24	10"	8"	7½"
B5.5	0.24	5½"	5"	4"
C6.5	0.37	6½"	6"	5"
C3.5	0.37	3½"	3"	2½"
D7	0.53	7"	6"	5"
D4.5	0.53	4½"	4"	3½"
E5	0.73	5"	4"	4"
E3	0.73	3"	3"	3"
F5	1.06	5"	4"	4"
F3.5	1.06	3½"	3"	3"
G5	1.45	5"	4"	4"
G3.5	1.45	3½"	3"	3"
H4	1.75	4"	3"	3"

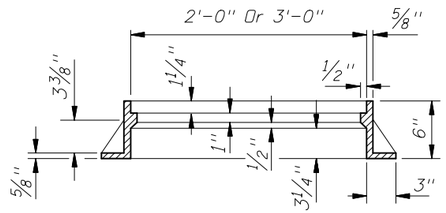
*Equivalent Area Welded Wire Fabric may be substituted in accordance with Index No. 201, Sheet 4.



WALL REINFORCING SPLICE DETAILS (ALTERNATE B)



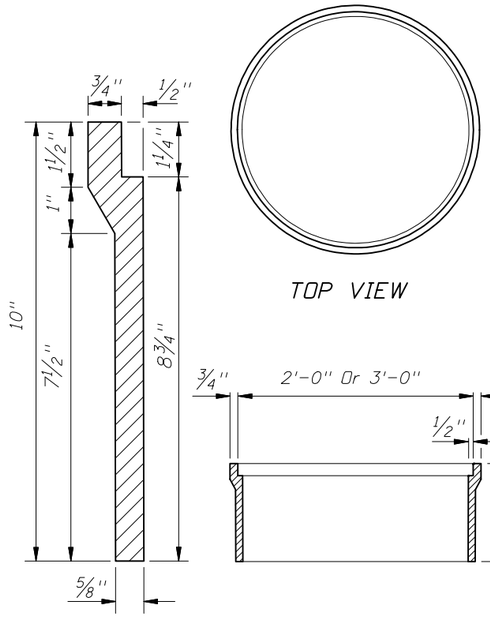
TOP VIEW



SECTION

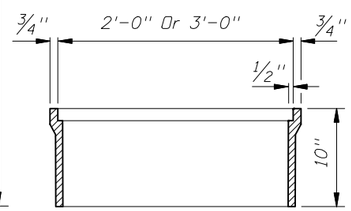
For Manholes

TYPE I



WALL SECTION

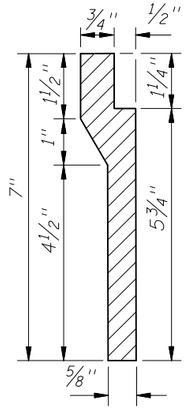
TOP VIEW



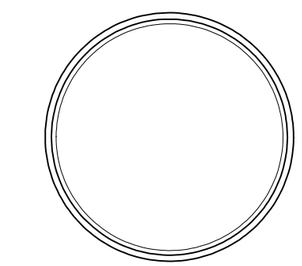
SECTION

For Curb Inlets Types 1, 2, 3, & 4

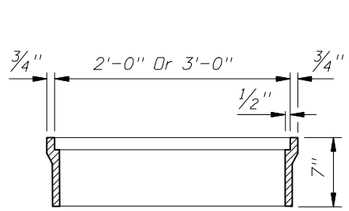
TYPE II



WALL SECTION



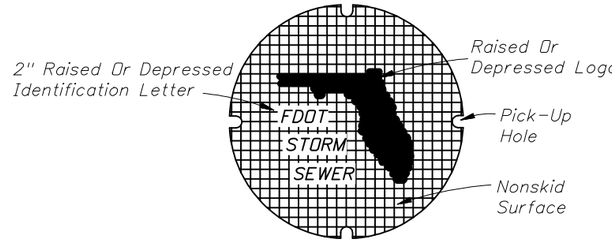
TOP VIEW



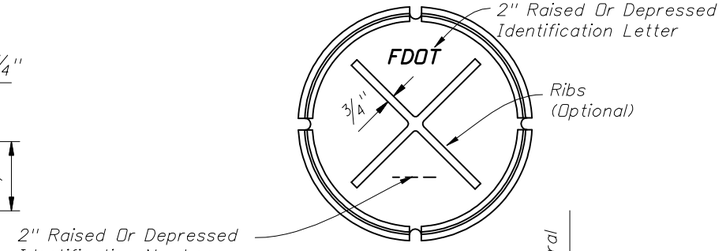
SECTION

For Curb Inlets Types 7 & 8

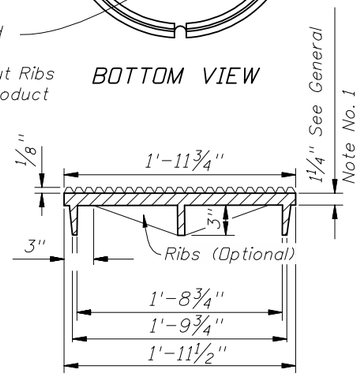
TYPE III



TOP VIEW

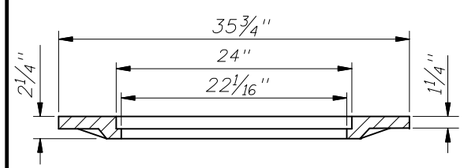


BOTTOM VIEW

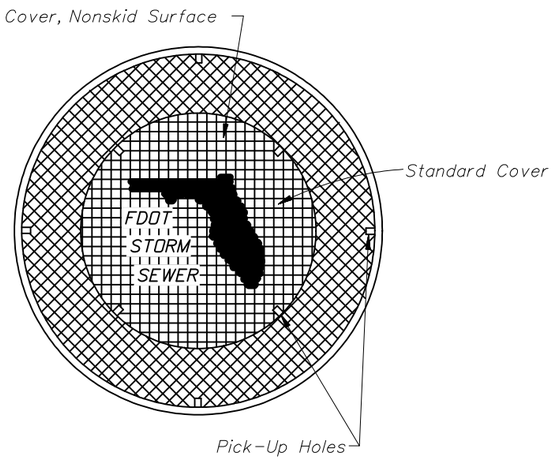


SECTION

COVER FOR ALL FRAMES



2-PIECE COVER



For Use With Types I, II And III Frames With 3'-0" Opening

2-PIECE COVER

CAST IRON FRAMES

NOTES (FRAMES, AND COVER)

1. The standard cover is to be used for all frames Types I, II, III and the 2-piece cover, and is the replacement cover for all previous frames with 1½" deep seats (traffic type). The 185 lb. cover (nontraffic type), 1984 Roadway and Traffic Design Standards Index No. 201, is the replacement cover for existing frames with ½" deep seats. Installation of frame with ½" deep seats is not permitted.
2. Use the 2'-0" cover, unless the 2-piece cover is called for in the plans, except at inlets and manholes with sump bottoms use the 2-piece cover when the sump depth exceeds 2', unless otherwise noted.

DESIGNER NOTE:
Consider using the 2-piece cover where depths exceed 5' and manual entry may be required for cleaning. Clearly note the requirement for a 2-piece cover, on the Drainage Structure sheets in the plans.

WEIGHT OF CASTINGS

Frame Type	2' OPENING		3' OPENING			
	Frame	Cover (Std.)	Frame	2-Piece Cover		
				Inside	Outside	Total
I	155 Lbs.	190 Lbs.	220 Lbs.	190 Lbs.	220 Lbs.	410 Lbs.
II	145 Lbs.	190 Lbs.	255 Lbs.	190 Lbs.	220 Lbs.	410 Lbs.
III	90 Lbs.	190 Lbs.	180 Lbs.	190 Lbs.	220 Lbs.	410 Lbs.

2010 FDOT Design Standards

SUPPLEMENTARY DETAILS FOR MANHOLES AND INLETS

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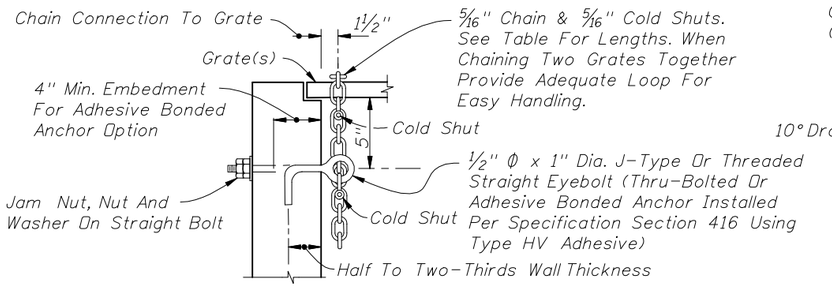
Sheet No. 1 of 5

Index No. 201

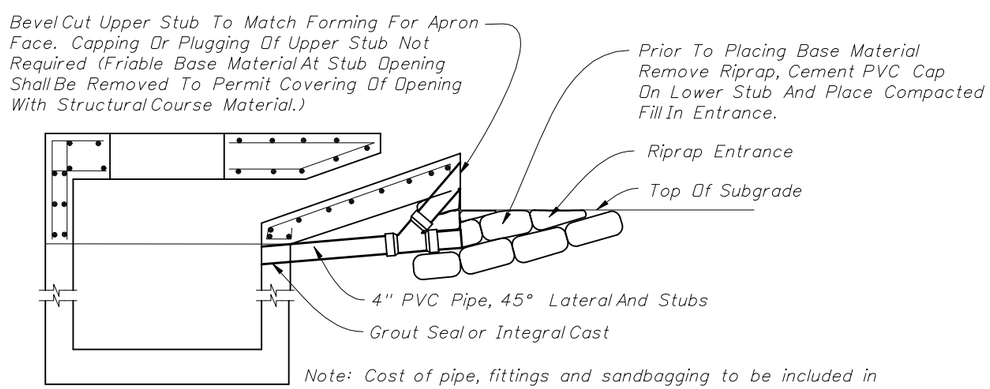


NOTE: When Alternate "G" grate is specified, the chain, bolt, nuts, washer and cold shuts shall be galvanized in accordance with Section 425 of the Standard Specifications.

Cost of eyebolt and chain to be included in the contract unit price for inlets.

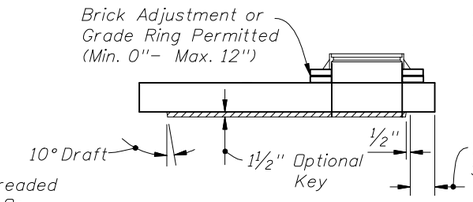
EYEBOLT AND CHAIN REQUIREMENTS				
Index Number	Inlet Type	Eye-Bolts	Length Of Chain	Handling & Remarks
217	(MB) 1	1	4'-0"	Slide & Spin
	(MB) 2	1	4'-0"	Slide & Spin
	(MB) 3	2	2 @ 4'-0"	Slide & Spin
	(MB) 4	2	2 @ 4'-0"	Slide & Spin
	(MB) 5	2	2 @ 4'-0"	Slide & Spin
218	(BW)	1	3'-8"	Slide Or Slide & Spin
219	(BW, RGD)	1	4'-0"	Slide & Spin
220	S	1	4'-0"	Slide & Spin
221	V	1	4'-0"	Slide & Spin
230	A	1	3'-0"	Slide
231	B	1	5'-0"	Slide & Spin
232	C	1	2'-6"	Slide & Spin
	D	1	2'-6"	Slide & Spin
	E	2	2 @ 2'-6"	Slide & Spin
	H	2	2 @ 2'-6"	Flip Ctr. Grate and Slide & Spin Single Free Grate
			1 or 2 @ 1'-6"	Ctr. Grate(s) Chained To One End Grate
233	F	1	3'-6"	Flip Or Slide & Spin
	G	1	6'-0"	Slide
			2'-0"	Lifting Loop
234	J	1	4'-0"	Slide & Spin

EYEBOLT AND CHAIN FOR LOCKING GRATES TO INLETS



Note: Cost of pipe, fittings and sandbagging to be included in the contract unit price for inlets. See Index No. 102 for sediment control at inlet.

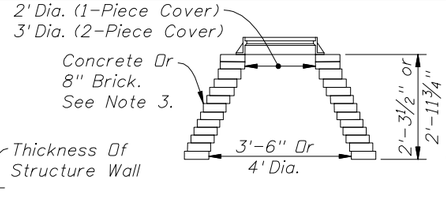
TEMPORARY DRAINS FOR SUBGRADE AND BASE



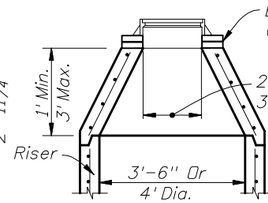
SECTION

Note: See Slab Designs Index No. 200.

TYPE 7

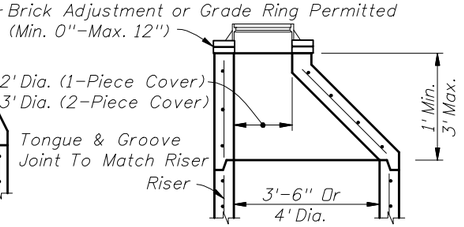


BRICK OR CONCRETE



PRECAST CONCENTRIC CONE

TYPE 8



PRECAST ECCENTRIC CONE

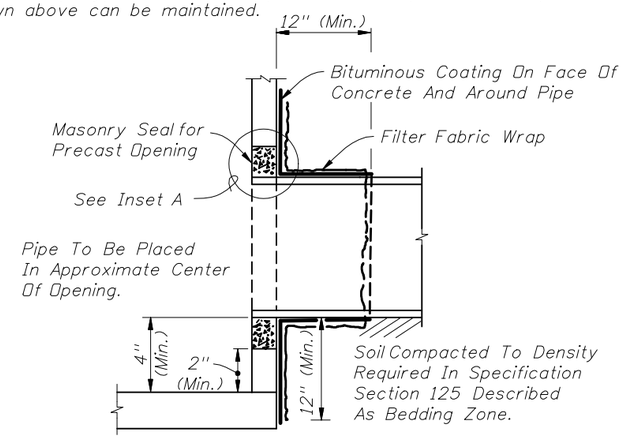
MANHOLE TOPS

NOTES (TOPS)

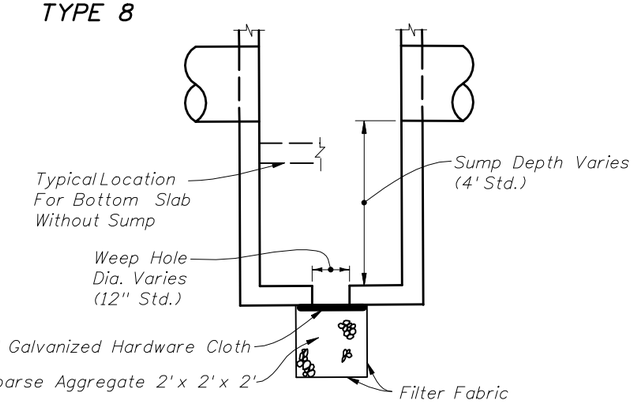
1. Manhole top Type 7 slabs shall be of Class II concrete. Concrete as specified in ASTM C478 may be used for precast units; see General Note No. 3.
2. Manhole top Type 7 slabs may be of cast-in-place or precast construction. The optional key is for precast tops and in lieu of dowels. Frame and slab openings are to be omitted when top is used over a junction box.
3. Manhole top Type 8 may be of cast-in-place or precast concrete construction or brick construction. For concrete construction, the concrete and steel reinforcement shall be the same as the supporting wall unit. An eccentric cone may be used.
4. Manhole tops shall be secured to structures by optional construction joints as shown on Sheet 3 of 4.
5. Frames can be adjusted a maximum 12" height with brick or precast ASTM C478 grade rings.
6. Substitution of manhole top Type 8 for manhole top Type 7 is allowed provided that minimum dimensions shown above are not reduced.
7. Substitution of Manhole top Type 7 for Type 8 is allowed if the minimum thickness (h) above pipe opening cannot be maintained with manhole top Type 8.

DESIGN NOTES

1. Manhole top Type 8 should be specified in the plans when depths shown above can be maintained.

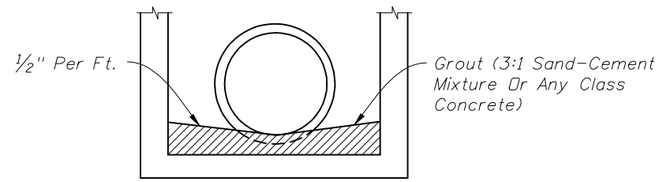


FILTER FABRIC WRAP ON GROUTED PIPE TO STRUCTURE JOINT



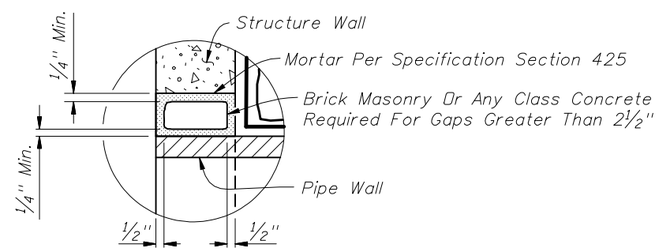
NOTE: Sump bottom appropriate for all manhole and inlet types. Sumps are to be constructed in inlet and manholes connected to French Drains unless excluded in the plans. At other locations, sump is to be constructed only where called for in the plans. Weep holes to be constructed in sump bottom only where called for in the plans. Cost of sump bottom and weep hole to be included in the contract unit price for inlet or manhole.

SUMP BOTTOM



FOR ALL STRUCTURES UNLESS EXCLUDED BY SPECIAL DETAIL

ALL PIPE TYPES DRAINAGE STRUCTURE INVERT



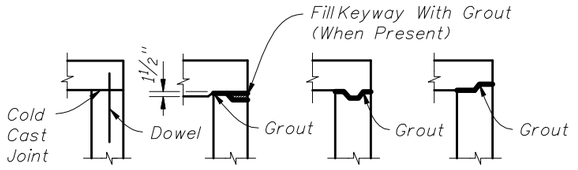
INSET A

2010 FDOT Design Standards

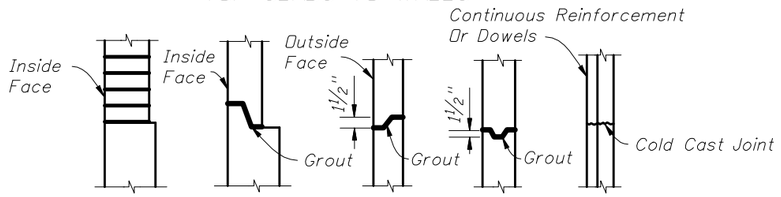
SUPPLEMENTARY DETAILS FOR MANHOLES AND INLETS

Last Revision	Sheet No.
07/01/05	2 of 5

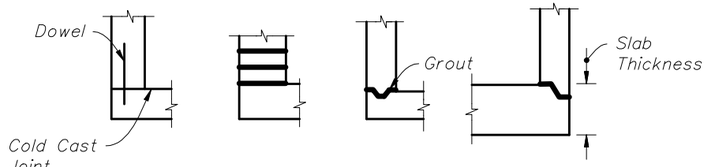
Index No. 201



TOP SLABS TO WALLS



WALL JOINTS



BOTTOM SLABS TO WALLS

1. One or more types of joints may be used in a single structure, except brick wall structure. Brick wall construction is permitted on circular units only.

2. All grouted joints are to have a maximum thickness of 1".

3. Keyways are to be a minimum of 1½" deep.

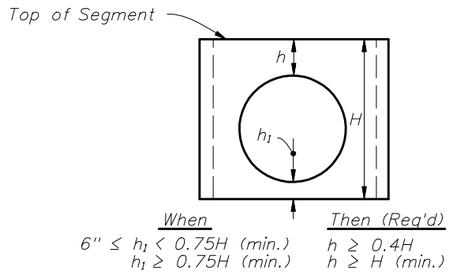
4. Joint dowels are to be #4 bars, 12" long with a minimum of 6 bars per joint approximately evenly spaced for circular structures or at maximum 12" spacing for rectangular structures. Bars may be either Adhesive Bonded Dowels in accordance with Specification Section 416, or placed approximately 6" into fresh concrete leaving the remainder to extend into the secondary cast. Welded wire fabric may be substituted for the dowel bar in accordance with the equivalent steel area table on Sheet 4.

5. Minimum cover on dowel reinforcing bars is 2" to outside face of structure.

6. Joints between wall segments and between wall segments and top or bottom slabs may be sealed either by preformed plastic gasket material using the procedures given in Section 430-7.3.1 of the Specifications or by non-shrink grout, in accordance with Section 934 of the Specifications.

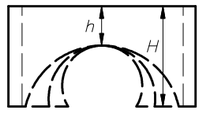
7. Approved product inserts may be used in lieu of dowel embedment.

OPTIONAL CONSTRUCTION JOINTS



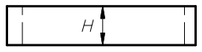
When: $6'' \le h_1 < 0.75H$ (min.), $h_1 \ge 0.75H$ (min.)

Then (Req'd): $h \ge 0.4H$, $h \ge H$ (min.)



H (min.) $\le h \ge 0.4H$

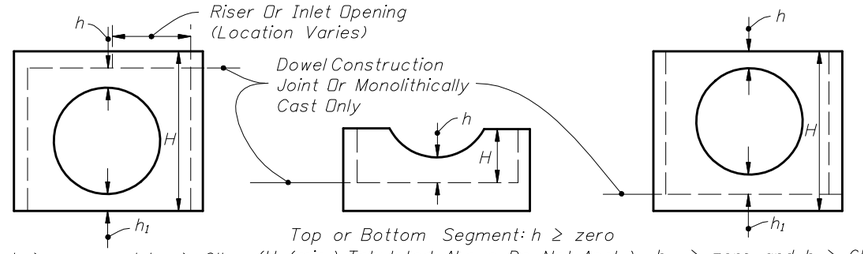
Segments may be inverted. Opening for pipe shall be the pipe OD plus 6" (± 2" tolerance). If h can not be attained, then a top or bottom slab must be attached to the segment as shown below.



$H \ge H$ (min.)

Minimum Value For H	
H (min.)	Box Or Riser Diameter
1'-0" 1'-6" 2'-0"	3'-6" & 4'-0" 5'-0" & 6'-0" >6'-0"

SEPARATE RISER SEGMENTS WITH CONSTRUCTION JOINTS OTHER THAN DOWEL OPTION



$h \ge$ zero and $h_1 \ge 6''$

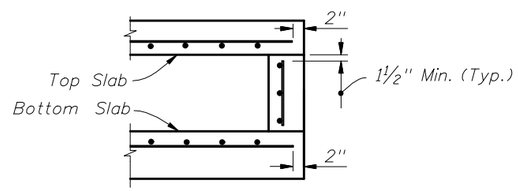
Top or Bottom Segment: $h \ge$ zero
(H (min.) Tabulated Above Do Not Apply) $h_1 \ge$ zero and $h \ge 6''$

SEGMENTS FOR SLAB TO WALL DOWEL CONSTRUCTION JOINTS OR MONOLITHICALLY CAST SEGMENTS

NOTE: h may be less than 6" when approved by the Engineer, but not for inlet segments at finish grade elevation.

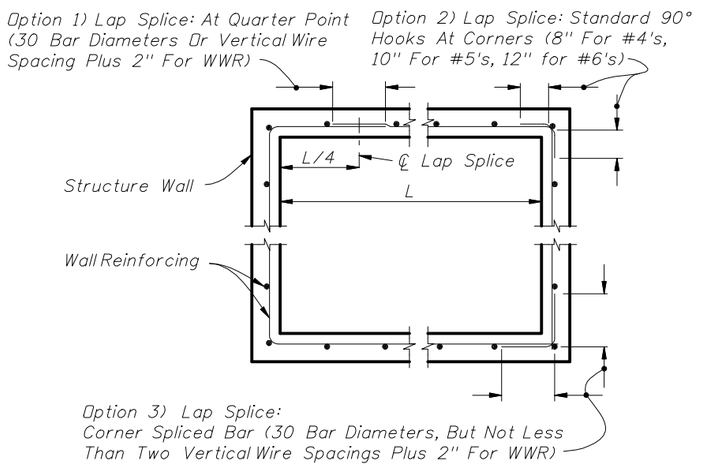
COMPARATIVE SIDE VIEWS

MINIMUM DIMENSIONS FOR BOX AND RISER SEGMENTS



(NOTE: NOT APPLICABLE AROUND MANHOLE AND RISER OPENINGS)

REBAR STRAIGHT END EMBEDMENT FOR TOP AND BOTTOM SLABS



WALL REINFORCING SPLICE DETAILS

EQUIVALENT STEEL AREA TABLE

SCHEDULE	GRADE 60 REINFORCING BAR		EQUIVALENT GRADE 40 REINFORCING BAR		EQUIVALENT 65 KSI SMOOTH WELDED WIRE REINFORCEMENT		EQUIVALENT 70 KSI DEFORMED WELDED WIRE REINFORCEMENT	
	Bar Size & Spacing	Steel Area (in^2/ft)	Bar Size & Spacing	Min. Steel Area (in^2/ft)	Style Designation	Min. Steel Area (in^2/ft)	Style Designation	Min. Steel Area (in^2/ft)
A	#3 @ 6½" Ctrs. #4 @ 12" Ctrs.	0.20	#3 @ 4½" Ctrs. #4 @ 8" Ctrs. #5 @ 12" Ctrs.	0.30	3"x3"–W4.6xW4.6 4"x4"–W6.2xW6.2 6"x6"–W9.2xW9.2	0.1846	3"x3"–D4.3xD4.3 4"x4"–D5.7xD5.7 6"x6"–D8.6xD8.6	0.1714
B	#3 @ 5½" Ctrs. #4 @ 10" Ctrs.	0.24	#3 @ 3½" Ctrs. #4 @ 6½" Ctrs. #5 @ 10" Ctrs.	0.36	3"x3"–W5.5xW5.5 4"x4"–W7.4xW7.4 6"x6"–W11.1xW11.1	0.2215	3"x3"–D5.1xD5.1 4"x4"–D6.9xD6.9 6"x6"–D10.3xD10.3	0.2057
Special 1	#3 @ 5" Ctrs. #4 @ 9" Ctrs.	0.267	#3 @ 3" Ctrs. #4 @ 6" Ctrs. #5 @ 9" Ctrs.	0.40	3"x3"–W6.2xW6.2 4"x4"–W8.2xW8.2 6"x6"–W12.3xW12.3	0.2465	3"x3"–D5.7xD5.7 4"x4"–D7.6xD7.6 6"x6"–D11.4xD11.4	0.2289
C	#3 @ 3½" Ctrs. #4 @ 6½" Ctrs. #5 @ 10" Ctrs.	0.37	#4 @ 4" Ctrs. #5 @ 6½" Ctrs. #6 @ 9½" Ctrs.	0.555	3"x3"–W8.5xW8.5 4"x4"–W11.4xW11.4 6"x6"–W17.1xW17.1	0.3415	3"x3"–D7.9xD7.9 4"x4"–D10.6xD10.6 6"x6"–D15.9xD15.9	0.3171
D	#4 @ 4½" Ctrs. #5 @ 7" Ctrs. #6 @ 10" Ctrs.	0.53	#4 @ 3" Ctrs. #5 @ 4½" Ctrs. #6 @ 6½" Ctrs.	0.795	3"x3"–W12.2xW12.2 4"x4"–W16.3xW16.3 6"x6"–W24.5xW24.5	0.4892	3"x3"–D11.4xD11.4 4"x4"–D15.1xD15.1 6"x6"–D22.7xD22.7	0.4543
E	#4 @ 3" Ctrs. #5 @ 5" Ctrs. #6 @ 7" Ctrs.	0.73	#5 @ 3½" Ctrs. #6 @ 4½" Ctrs. #7 @ 6½" Ctrs.	1.095	3"x3"–W16.8xW16.8 4"x4"–W22.5xW22.5 6"x6"–W33.7xW33.7	0.6738	3"x3"–D15.6xD15.6 4"x4"–D20.9xD20.9 6"x6"–D31.3xD31.3	0.6257
F	#5 @ 3½" Ctrs. #6 @ 5" Ctrs. #7 @ 7" Ctrs.	1.06	#6 @ 3" Ctrs. #7 @ 4½" Ctrs. #8 @ 6" Ctrs.	1.59	3"x3"–W24.5xW24.5 4"x4"–W32.6xW32.6 6"x6"–W48.9xW48.9	0.9785	3"x3"–D22.7xD22.7 4"x4"–D30.3xD30.3 6"x6"–D45.4xD45.4	0.9086
Special 2	#5 @ 3" Ctrs. #6 @ 4" Ctrs. #7 @ 5½" Ctrs.	1.24	#7 @ 4" Ctrs. #8 @ 5" Ctrs.	1.86	3"x3"–W28.6xW28.6 4"x4"–W38.2xW38.2 6"x6"–W57.2xW57.2	1.1446	3"x3"–D26.6xD26.6 4"x4"–D35.4xD35.4 6"x6"–D53.1xD53.1	1.0629
G	#6 @ 3½" Ctrs. #7 @ 5" Ctrs.	1.46	#7 @ 3" Ctrs. #8 @ 4" Ctrs.	2.19	3"x3"–W33.7xW33.7 4"x4"–W44.9xW44.9	1.3477	3"x3"–D31.3xD31.3 4"x4"–D41.7xD41.7	1.2514

GENERAL NOTES

1. For square or rectangular precast drainage structures, either deformed or smooth welded wire reinforcement may be used provided:

   a) The smooth welded wire reinforcement shall comply with ASTM A185 and deformed welded wire reinforcement shall comply with ASTM A497.

   b) Width and length of the unit is four times the spacing of the cross wires.

   c) Wire reinforcement shall be continuous around the box, and lapped in accordance with Option 1 or 3 as shown in the Wall Reinforcing Splice Details.

2. Horizontal steel in the walls of rectangular structures shall be lap spliced in accordance with Option 1, 2 or 3 as shown in the Wall Reinforcing Splice Details.

3. Welding of splices and laps is permitted. The requirements and restrictions placed on welding in AASHTO M259 shall apply.

4. Rebar straight end embedment of peripheral reinforcement may be used in lieu of ACI standard hooks for top and bottom slabs except when hooks are specifically called for in the plans or standard drawings.

5. Concrete as specified in ASTM C478, (4000 psi) may be used in lieu of Class II concrete in precast items manufactured in plants which meet the requirements of Section 449 of the Specifications.

6. Precast opening for pipe shall be the pipe OD plus 6" (± 2" tolerance). Mortar used to seal the pipe into the opening will be of such a mix that shrinkage will not cause leakage into or out of the structure. Dry-pack mortar may be used in lieu of brick and mortar construction to seal openings less than 2½" wide.

7. For pay item purposes, the height used to determine if a drainage structure is less than or greater than 10 feet shall be computed using
   (a) the elevation of the top of the manhole lid,
   (b) the grate elevation or the theoretical gutter grade elevation of an inlet, or
   (c) the outside top elevation of a junction box less the flow line elevation of the lowest pipe or to top of sump floor.

NOTES FOR PRECAST OPTIONS & EQUIVALENT REINFORCEMENT SUBSTITUTION

1. Details for optional precast inlet construction up to depths of 15' are shown on the inlet indexes.

2. When precast units are used in conjunction with Alt. "B" Structure Bottoms, Index No. 200, the interior dimensions of an Alt. "B" Bottom can be adjusted to reflect these inlet interior dimensions.

3. Concrete which meets the requirements of ASTM C478 or Class IV must be used for precast structures constructed with 6" wall or slab thickness.

4. Reinforcement can be either deformed bar reinforcement or welded wire reinforcement. Bar reinforcement other than 60 ksi may be used, however only two grades are recognized; Grade 40 and Grade 60. Smooth welded wire reinforcement, will be recognized as having a design strength of 65 ksi and deformed welded wire reinforcement will be recognized as having a design strength of 70 ksi. The area of reinforcement required may be adjusted in accordance with the Equivalent Steel Area Table provided. For bars and spacings not given, the steel area required can be determined by the following equations:

$$\text{Grade 40 Steel Area} = A_s40 = \frac{60}{40} \times A_s60$$

$$\text{Smooth Welded Wire Reinforcement Steel Area} = A_s65 = \frac{60}{65} \times A_s60$$

$$\text{Deformed Welded Wire Reinforcement Steel Area} = A_s70 = \frac{60}{70} \times A_s60$$

continued...

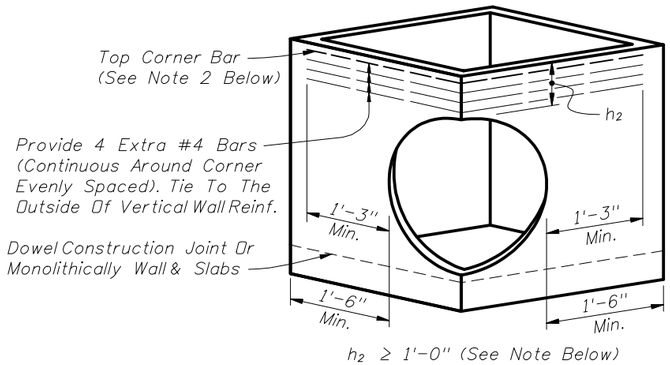
When a reduced area of reinforcement is provided, any maximum bar spacing shown must also be reduced as determined by the following equations, unless otherwise shown:

Max. Grade 40 Bar Spacing = Grade 60 Bar Spacing
Max. Smooth Welded Wire Spacing = Grade 60 Bar Spacing x 0.86
Max. Deformed Welded Wire Spacing = Grade 60 Bar Spacing x 0.74

When an increased area of reinforcing is provided, then the maximum bar spacing may be increased by the squared ratio of increased steel area, but not to exceed 12":

$$\text{Max. Bar Spacing Provided} \le \text{Max. Bar Spacing Required} \times \left(\frac{\text{Steel Area Provided}}{\text{Min. Steel Area Required}}\right)^2$$

In no case will reinforcement with wires smaller than W3.1 or D3.1, or spacings greater than 8" be permitted. Bar reinforcement shall show the minimum yield designation grade mark or either the number 60 or one (1) grade mark line to be acceptable at the higher value. Maximum bar spacing shall not be greater than two (2) times the slab thickness with a maximum spacing of 12" or three (3) times the wall thickness, with a maximum spacing of 18" for vertical bars and 12" for horizontal bars.



$h_2 \geq 1'-0''$ (See Note Below)

DESIGNER NOTE: Rectangular structures with corner openings are not recommended. Use round structure bottoms when possible.

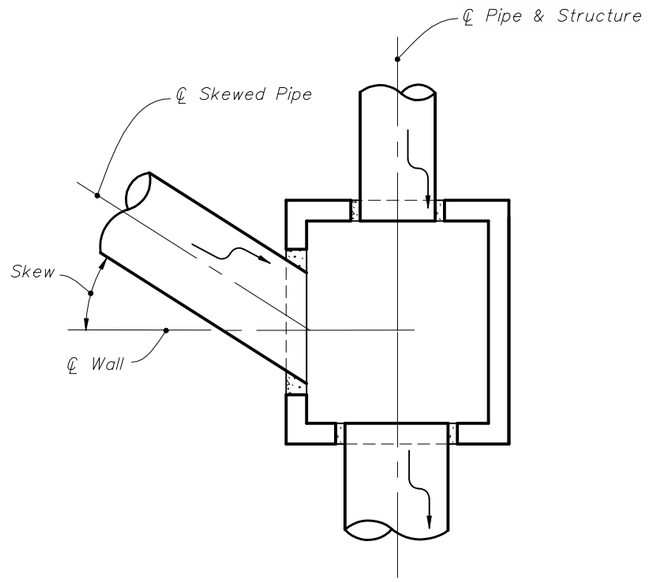
PICTORIAL VIEW

NOTE: 1. h_2 may be less than 1'-0" when approved by the Engineer or when a minimum 1'-0" deep segment, 8" slab or curb inlet is provided above the corner opening.

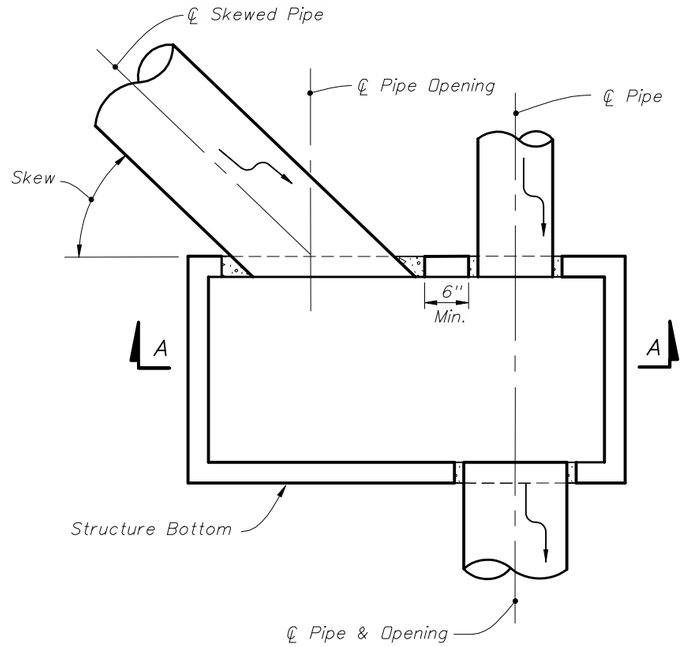
2. For inlet segments at finish grade elevation substitute a #8 Bar for the top corner bar when h_2 is less than 2'-0".

3. Rectangular structures with corner openings must be approved by the Engineer.

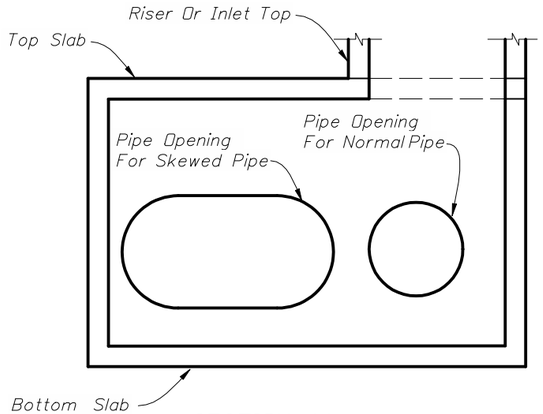
RECTANGULAR SEGMENT WITH PIPE OPENING AT CORNER



PLAN VIEW FOR SKEWS ≤ 45°
(Not Centered)



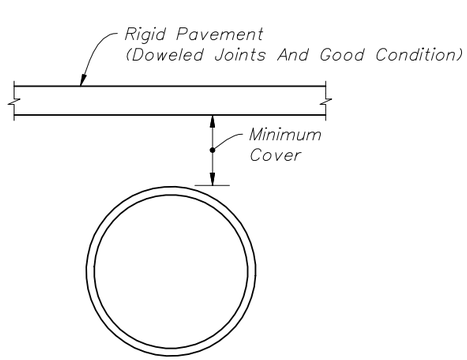
PLAN VIEW FOR SKEWS > 45°
(Not Centered)

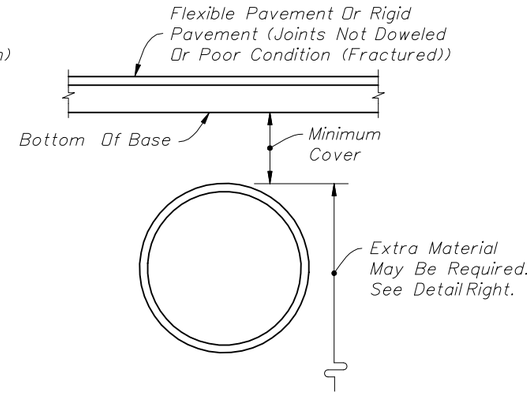


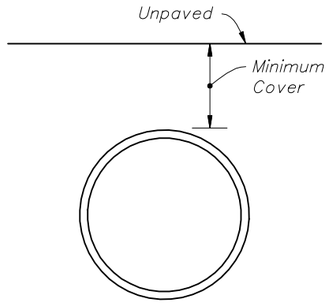
SECTION AA
(Pipes Not Shown For Clarity)

DETAILS FOR SKEWED PIPES IN RECTANGULAR STRUCTURES

	2010 FDOT Design Standards	Last Revision 07/01/07	Sheet No. 5 of 5
STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION	SUPPLEMENTARY DETAILS FOR MANHOLES AND INLETS		Index No. 201







RIGID PAVEMENT

PIPE TYPE/SIZE & SHAPE	MINIMUM COVER
CONCRETE (See Note 6)	
Round & Elliptical	9"
CORRUGATED STEEL	
15"-72" Round & Arch Equiv.	9"
78" & Larger Round & Arch Eq.	15"
CORRUGATED ALUMINUM	
15"-72" Round & Arch Equiv.	9"
78"-102" Round & Arch Equiv.	15"
108" & Larger Round	18"
CORRUGATED POLYETHYLENE	
15"-60" Round	9"
POLYVINYL CHLORIDE	
15"-36" Round	9"

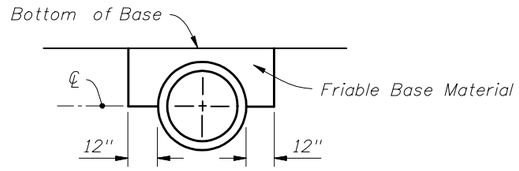
FLEXIBLE PAVEMENT

PIPE TYPE/SIZE & SHAPE	MINIMUM COVER
CONCRETE (See Note 6)	
Round & Elliptical	7"
CORRUGATED STEEL	
12"-30" Round	12" [12"]
36"-48" Round	18" (12") [15"]
54"-72" Round	21" (15") [18"]
78"-96" Round	(18") [27"]
102" & Larger Round	(24") [33"]
15"-30" Arch Equiv.	18" [18"]
36"-48" Arch Equiv.	24" (12") [18"]
54"-72" Arch Equiv.	27" (15") [24"]
78"-96" Arch Equiv.	(18") [30"]
102" & Larger Arch Equiv.	(24")
CORRUGATED ALUMINUM	
12"-24" Round	15" [12"]
30"-48" Round	18" (12") [18"]
54"-72" Round	24" (18") [24"]
78"-102" Round	(24") [30"]
108" & Larger	(30")
15"-24" Arch Equiv.	24" [21"]
30"-48" Arch Equiv.	27" (15") [24"]
54"-72" Arch Equiv.	30" (18") [27"]
78"-90" Arch Equiv.	(24") [30"]
96"-102" Arch Equiv.	(30")
CORRUGATED POLYETHYLENE	
15"-60" Round	15"
POLYVINYL CHLORIDE	
15"-36" Round	15"

UNPAVED

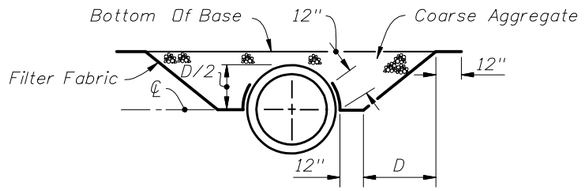
PIPE TYPE/SIZE & SHAPE	MINIMUM COVER	
	COMMERCIAL	NON-COMMERCIAL
CONCRETE (See Note 6)		
Round & Elliptical	12"	3"
CORRUGATED STEEL		
12"-30" Round	18" [15"]	12" [12"]
36"-48" Round	18" (12") [15"]	12" (12") [12"]
54"-72" Round	18" (12") [15"]	15" (12") [12"]
78"-96" Round	(18") [27"]	(12") [12"]
102" & Larger Round	24" [33"]	18" [21"]
15"-30" Arch Equiv.	18" [18"]	12" [12"]
36"-48" Arch Equiv.	24" (12") [21"]	18" (12") [15"]
54"-72" Arch Equiv.	30" (18") [24"]	24" (12") [18"]
78"-96" Arch Equiv.	(24") [27"]	(18") [21"]
102" & Larger Arch Equiv.	(30")	(24")
CORRUGATED ALUMINUM		
12"-24" Round	21" [21"]	15" [15"]
30"-48" Round	24" (18") [21"]	18" (12") [15"]
54"-72" Round	30" (24") [27"]	24" (18") [21"]
78"-102" Round	(30") [33"]	(24") [27"]
108" & Larger	36"	30"
15"-24" Arch Equiv.	27" [24"]	24" [21"]
30"-48" Arch Equiv.	33" (21") [27"]	27" (15") [21"]
54"-72" Arch Equiv.	36" (24") [30"]	30" (18") [24"]
78"-90" Arch Equiv.	(30") [36"]	(24") [30"]
96"-102" Arch Equiv.	(36")	(30")
CORRUGATED POLYETHYLENE		
15"-60" Round	21"	15"
POLYVINYL CHLORIDE		
15"-36" Round	21"	15"

MINIMUM COVER FOR CONCRETE, STEEL, ALUMINUM, POLYETHYLENE AND POLYVINYL CHLORIDE PIPE



The cost of furnishing and installing the extra base material shall be included in the cost of the culvert.

FRIABLE BASE



The coarse aggregate shall be placed in 6 inch lifts and compacted sufficiently as to be firm and unyielding. The coarse aggregate shall be gravel or stone meeting the requirements of Standard Specification Sections 901-2 or 901-3 respectively. The gradation shall meet Section 901-1.4, Grades 4, 467, 5, 56, or 57 unless restricted in the plans. The filter fabric shall be Type D-3 (See Index No. 199). The cost of furnishing and installing the coarse aggregate and filter fabric shall be included in the cost of the culvert.

ASPHALTIC CONCRETE BASE

Note: Extra material is required when cross culverts are located on facilities subject to high speed traffic (≥55 mph) or high traffic volumes (> 1600 ADT) and the cover is less than 12 inches for concrete pipe, 15 inches for corrugated steel pipe, and 18 inches for corrugated aluminum pipe, corrugated polyethylene and corrugated polyvinyl chloride pipe.

EXTRA MATERIAL FOR CROSS CULVERTS UNDER FLEXIBLE PAVEMENTS

GENERAL NOTES

1. The tabulated values are recommended minimum dimensions to withstand anticipated highway traffic loads. Additional cover may be required to support construction equipment loads or highway traffic loads before pavement is completed. Some size thickness combinations may require minimum cover greater than those listed above. See Sheets 2, 3, & 4.
2. Less than the tabulated minimum cover may be used provided suitable method(s) are detailed in the plans.
3. Values shown in parenthesis () are for 3" x 1" corrugations which must be specified to utilize the lesser cover.
4. The tabulated values in the brackets [] apply to Type 1-R (Spiral Rib) pipe which must be specified to utilize the lesser cover.
5. Commercial and noncommercial refers to typical vehicular utilization of unpaved roads and drives where rutting and cover displacement may occur.
6. For Pipe Class S with diameters of 12" to 30", the minimum height of fill measured from top of finished grade to outside top of pipe is 3 feet.

ROUND PIPE DIMENSIONS

Equiv. Dia. (In.)	Area (Sq. Ft.)	Wall Thickness (In.)* CLASSES II, III, IV, V B WALL
12	0.8	2
15	1.2	2¼
18	1.8	2½
24	3.1	3
30	4.9	3½
36	7.1	4
42	9.6	4½
48	12.6	5
54	15.9	5½
60	19.6	6
66	23.8	6½
72	28.3	7
78	33.2	7½
84	38.5	8
90	44.4	8½
96	50.3	9
102	56.7	9½
108	63.7	10
114	70.9	—
120	78.5	—

* For Informational Purposes Only.
Do Not Specify Wall Thickness.
Option B Wall Is Industry Standard.

ELLIPTICAL PIPE DIMENSIONS

Nominal Dimensions				Equiv. Dia. (In.)	Area (Sq.Ft.)	Wall Thickness (In.)
Horiz.		Vert.				
Rise (In.)	Span (In.)	Rise (In.)	Span (In.)			Classes HE II, III, IV VE II, III, IV
NA	NA	NA	NA	12	NA	NA
12	18	18	12	15	1.3	2½
14	23	23	14	18	1.8	2¾
19	30	30	19	24	3.3	3¼
24	38	38	24	30	5.1	3¾
29	45	45	29	36	7.4	4½
34	53	53	34	42	10.2	5
38	60	60	38	48	12.9	5½
43	68	68	43	54	16.6	6
48	76	76	48	60	20.5	6½
53	83	83	53	66	24.8	7
58	91	91	58	72	29.5	7½
63	98	98	63	78	34.6	8
68	106	106	68	84	40.1	8½
72	113	113	72	90	46.1	9
77	121	121	77	96	52.4	9½
82	128	128	82	102	59.2	10
87	136	136	87	108	66.4	10½
92	143	143	92	114	74.0	11
97	151	151	97	120	82.0	11½

For Informational Purposes Only

ROUND PIPE INSTALLATIONS

PIPE DIAMETER	Maximum Height of Fill (ft.)					
	Class S	Class I	Class II	Class III	Class IV	Class V
12"-30"	9	13	17	24	36	55
36"-54"	8	12	16	22	34	52
60"-78"	7	11	15	21	33	51
84"-96"	6	10	14	20	32	49

Pipe Class S	D-Load=600 Lbs./Ft./Ft. (0.01" Crack) D-Load=900 Lbs./Ft./Ft. (Ultimate)
Pipe Class I	D-Load=800 Lbs./Ft./Ft. (0.01" Crack) D-Load=1200 Lbs./Ft./Ft. (Ultimate)
Pipe Class II	D-Load=1000 Lbs./Ft./Ft. (0.01" Crack) D-Load=1500 Lbs./Ft./Ft. (Ultimate)
Pipe Class III	D-Load=1350 Lbs./Ft./Ft. (0.01" Crack) D-Load=2000 Lbs./Ft./Ft. (Ultimate)
Pipe Class IV	D-Load=2000 Lbs./Ft./Ft. (0.01" Crack) D-Load=3000 Lbs./Ft./Ft. (Ultimate)
Pipe Class V	D-Load=3000 Lbs./Ft./Ft. (0.01" Crack) D-Load=3750 Lbs./Ft./Ft. (Ultimate)

Note: At the option of the pipe supplier or the contractor, a Pipe Class with greater strength may be substituted for the Pipe Class designated in the plans.

ELLIPTICAL PIPE INSTALLATIONS (All Sizes)

Installation	Maximum Height Of Fill (Ft.)	Pipe Class	Bedding Class
Horizontal	1-6* 7-10 11-16 17+	HE II* HE III HE IV Special Design	C C C Modified
Vertical	1-6* 7-10 11-16 17+	VE II* VE III VE IV Special Design	C C C Modified

Pipe Class HE II And VE II	D-Load=1000 Lbs./Ft./Ft. (0.01" Crack) D-Load=1500 Lbs./Ft./Ft. (Ultimate)
Pipe Class HE III And VE III	D-Load=1350 Lbs./Ft./Ft. (0.01" Crack) D-Load=2000 Lbs./Ft./Ft. (Ultimate)
Pipe Class HE IV And VE IV	D-Load=2000 Lbs./Ft./Ft. (0.01" Crack) D-Load=3000 Lbs./Ft./Ft. (Ultimate)

*Note: HE III and VE III pipe required for depths of cover less than 2' for 15", 18" and 24" equivalent.

PIPE DIMENSIONS CONCRETE PIPE

MAXIMUM COVER HEIGHTS CONCRETE PIPE

Note: Height of fill (maximum cover) is measured from top of finished grade to outside top of pipe.

POLYETHYLENE PIPE

DIAMETER	HEIGHT OF MAXIMUM FILL (Ft.)
12"-60"	17'

POLYVINYL CHLORIDE PIPE

DIAMETER	HEIGHT OF MAXIMUM FILL (Ft.)
12"-36"	17'

MAXIMUM COVER FOR PLASTIC PIPE

ROUND PIPE – 2⅔" x ½" CORRUGATION

D (In.)	Area (Sq. Ft.)	Maximum Height Of Fill (Ft.) Sheet Thickness In Inches (Gage) 0.064 (16)	0.079 (14)	0.109 (12)	0.138 (10)	0.168 (8)	Min. Cover (Ft.)
12	0.79	100+	100+	NA	NA	NA	See Sheet 1 of 6
15	1.23	100+	100+	NA	NA	NA	
18	1.77	100+	100+	100+	NA	NA	
21	2.40	100+	100+	100+	NA	NA	
24	3.14	100+	100+	100+	NA	NA	
30	4.91	85	100+	100+	NA	NA	
36	7.1	71+	88	100+	100+	NA	
42	9.6	60+	76	100+	100+	NA	
48	12.6	53	66	93	100+	100+*	
54	16.0	NS	59	82	100+	100+*	
60	19.6	NS	NS	74	95	100+*	
66	23.8	NS	NS	NS	87	100+*	
72	28.3	NS	NS	NS	NS	97*	
78	33.2	NS	NS	NS	NS	90*	
84	38.5	NS	NS	NS	NS	83*	

ROUND PIPE – 3" x 1" CORRUGATION

D (In.)	Area (Sq. Ft.)	Maximum Height Of Fill (Ft.) Sheet Thickness In Inches (Gage) 0.064 (16)	0.079 (14)	0.109 (12)	0.138 (10)	0.168 (8)	Min. Cover (Ft.)
36	7.1	81	100+	100+	NA	NA	See Sheet 1 of 6
42	9.6	70	87	100+	NA	NA	
48	12.6	61	76	100+	100+	NA	
54	16.0	54	68	95	100+	NA	
60	19.6	48	61	85	100+	NA	
66	23.8	44	55	78	100	100+*	
72	28.3	40	51	71	91	100+*	
78	33.2	37	47	66	84	100+*	
84	38.5	35	43	61	78	100+*	
90	44.2	32	40	57	73	90*	
96	50.3	NS	38	53	68	84*	
102	56.7	NS	36	50	64	79*	
108	63.6	NS	NS	47	61	75*	
114	70.9	NS	NS	45	58	71*	
120	78.5	NS	NS	42	55	67*	
132	95.0	NS	NS	NS	50	61*	

ROUND PIPE – 5" x 1" CORRUGATION ③

D (In.)	Area (Sq. Ft.)	Maximum Height Of Fill (Ft.) Sheet Thickness In Inches (Gage) 0.064 (16)	0.079 (14)	0.109 (12)	0.138 (10)	0.168 (8)	Min. Cover (Ft.)
36	7.1	72	90	100+	NA	NA	See Sheet 1 of 6
42	9.6	62	77	100+	NA	NA	
48	12.6	54	68	95	100+	NA	
54	16.0	48	60	84	100+	NA	
60	19.6	43	54	76	98	NA	
66	23.8	39	49	69	89	100+*	
72	28.3	36	45	63	81	100*	
78	33.2	33	41	58	75	92*	
84	38.5	31	38	54	70	85*	
90	44.2	29	36	50	65	80*	
96	50.3	NS	34	47	61	75*	
102	56.7	NS	32	44	57	70*	
108	63.6	NS	NS	42	54	66*	
114	70.9	NS	NS	40	51	63*	
120	78.5	NS	NS	38	49	60*	
132	95.0	NS	NS	NS	44	54*	

Notes:

Increase the minimum cover values shown on Sheet 1 of 6 by 6" for gage and size combinations below the heavy lines.

Height of fill (maximum cover) is measured from top of finished grade to outside of pipe.

*Recorrugated end not available. May be considered for cross drain and side drain applications only.
NA–Not Available
NS–Not Suitable (For Highway H–20 or HS–20 Loadings)

① Limited availability of this product. Check availability before specifying (generally limited to 3" x 1" corrugation pipe arch fabricated from 60" and smaller diameter round pipe in 12 ga. and thicker material).

② 360° perforated pipe arch (french drain pipe) is not recommended. Do not specify without checking suitability and availability.

③ 5" x 1" corrugated pipe is currently not manufactured for the Florida market. Check availability before specifying.

PIPE ARCH: SPIRAL RIB: ¾" x ¾" x 7½" RIB SPACING
PIPE ARCH: SPIRAL RIB: ¾" X 1" X 11½" RIB SPACING
PIPE ARCH – 2⅔" x ½" CORRUGATION

Span (In.)	Rise (In.)	Equiv. Round Pipe (In.)	Area (Ft.²)	Minimum Sheet Thickness Required (In.) (Ga.)	Maximum Height Of Fill (Ft.) Maximum Corner Pressure Lbs./Ft.² 4000	6000	Min. Cover (Ft.)
17	13	15	1.1	0.064 (16)	12	14	See Sheet 1 of 6
21	15	18	1.6	0.064 (16)	10	14	
24	18	21	2.2	0.064 (16)	7	13	
28	20	24	2.9	0.064 (16)	5	11	
35	24	30	4.5	0.064 (16)	NS	7	
42	29	36	6.5	0.064 (16)	NS	7	
49	33	42	8.9	0.079 (14)	NS	6	
57	38	48	11.6	0.109 (12)	NS	8	
64	43	54	14.7	0.109 (12)	NS	9	
71	47	60	18.1	0.138 (10)	NS	10	
77	52	66	21.9	0.168 (8)*	5	10	
83	57	72	26.0	0.168 (8)*	5	10	

PIPE ARCH–3" x 1" ①②③ and 5" x 1" ②③ CORR.

Span (In.)	Rise (In.)	Equiv. Round Pipe (In.)	Area (Ft.²)	Minimum Sheet Thickness Required (In.) (Ga.)	Maximum Height Of Fill (Ft.) Maximum Corner Pressure Lbs./Ft.² 4000	6000	Min. Cover (Ft.)
40	31	36	7.0	0.079 (14)	8	12	See Sheet 1 of 6
46	36	42	9.4	0.079 (14)	8	13	
53	41	48	12.3	0.079 (14)	8	13	
60	46	54	15.6	0.079 (14)	8	13	
66	51	60	19.3	0.079 (14)	9	13	
73	55	66	23.2	0.079 (14)	11	16	
81	59	72	27.4	0.079 (14)	11	17	
87	63	78	32.1	0.079 (14)	10	16	
95	67	84	37.0	0.079 (14)	11	17	
103	71	90	42.4	0.109 (12)	10	15	
112	75	96	48.0	0.109 (12)	10	16	
117	79	102	54.2	0.109 (12)	10	15	
128	83	108	60.5	0.138 (10)	9	14	
137	87	114	67.4	0.138 (10)	8	13	
142	91	120	74.5	0.168 (8)	7	12	

ROUND PIPE – SPIRAL RIB
RIB SPACING (¾" x ¾" x 7½") or (¾" x 1" x 11½")

D (In.)	Area (Sq. Ft.)	Maximum Height Of Fill (Ft.) Sheet Thickness In Inches (Gage) 0.064 (16)	0.079 (14)	0.109 (12)	0.138 (10)	0.168 (8)	Min. Cover (Ft.)
12	0.79	NA	NA	NA	NA	NA	See Sheet 1 of 6
15	1.23	NA	NA	NA	NA	NA	
18	1.77	68	72	NA	NA	NA	
21	2.40	58	62	100+	NA	NA	
24	3.14	51	72	100+	100+	NA	
30	4.91	41	58	97	100+	NA	
36	7.1	34	48	81	100+	NA	
42	9.6	29	41	69	100+	NA	
48	12.6	26	36	61	100+	NA	
54	16.0	23	32	54	91	NA	
60	19.6	NS	29	49	83	NA	
66	23.8	NS	26	44	74	NA	
72	28.3	NS	24	40	67	NA	
78	33.2	NS	NS	37	59	NA	
84	38.5	NS	NS	35	54	NA	
90	44.2	NS	NS	32	48	NA	
96	50.3	NS	NS	30	45	NA	
102	56.7	NS	NS	29	40	NA	
108	63.6	NS	NS	27Ⓐ	36	NA	

Ⓐ = ¾" x 1" x 11½" Only

MAXIMUM COVER FOR CORRUGATED STEEL PIPE ROUND AND PIPE ARCH

ROUND PIPE – 2⅔" x ½" CORRUGATION

D (In.)	Area (Sq. Ft.)	Maximum Height Of Fill (Ft.) — Sheet Thickness In Inches (Gage) 0.060 (16)	0.075 (14)	0.105 (12)	0.135 (10)	0.164 (8)	Min. Cover (Ft.)
12	0.8	90	100+	NA	NA	NA	See Sheet 1 of 6
15	1.2	72	90	NA	NA	NA	
18	1.8	59	75	100+	NA	NA	
21	2.4	52	65	92	NA	NA	
24	3.1	44	56	79	NA	NA	
30	4.9	35 DR	44	63	NA	NA	
36	7.1	NS	36 DR	52	68	NA	
42	9.6	NS	NS	44 DR	58	NA	
48	12.6	NS	NS	38 DR	50 DR	61	
54	15.9	NS	NS	34 DR	45 DR	54 DR	
60	19.6	NS	NS	NS	39 DR	49 DR	
66	23.8	NS	NS	NS	NS	44 DR	
72	28.3	NS	NS	NS	NS	40 DR	

ROUND PIPE – 3" x 1" CORRUGATION

D (In.)	Area (Sq. Ft.)	Maximum Height Of Fill (Ft.) — Sheet Thickness In Inches (Gage) 0.060 (16)	0.075 (14)	0.105 (12)	0.135 (10)	0.164 (8)	Min. Cover (Ft.)
36	7.1	33	42	60	NA	NA	See Sheet 1 of 6
42	9.6	28	36	51	NA	NA	
48	12.6	24	31	45	58	NA	
54	15.9	21	28	39	51	NA	
60	19.6	19	24	35	46	NA	
66	23.8	15DR	22	32	42	51	
72	28.3	NS	20DR	29	38	47	
78	33.2	NS	15DR	27	35	43	
84	38.5	NS	NS	24DR	32	40	
90	44.2	NS	NS	23DR	30	37	
96	50.3	NS	NS	21 DR	28DR	34	
102	56.7	NS	NS	NS	26DR	32	
108	63.6	NS	NS	NS	24DR	30DR	
114	70.9	NS	NS	NS	NS	28DR	
120	78.5	NS	NS	NS	NS	27DR	

ROUND PIPE – SPIRAL RIB
RIB SPACING (¾" x ¾" x 7½")

D (In.)	Area (Sq. Ft.)	Maximum Height Of Fill (Ft.) — Sheet Thickness In Inches (Gage) 0.060 (16)	0.075 (14)	0.105 (12)	0.135 (10)	0.164 (8)	Min. Cover (Ft.)
12	0.79	NA	NA	NA	NA	NA	See Sheet 1 of 6
15	1.23	63 ①	87 ①	NA	NA	NA	
18	1.77	55	76	NA	NA	NA	
21	2.40	47	65	NA	NA	NA	
24	3.14	41	57	NA	NA	NA	
30	4.91	33 DR	45	73	NA	NA	
36	7.1	■	38 DR	61	NA	NA	
42	9.6	NS	■	52	NA	NA	
48	12.6	NS	NS	46	65	NA	
54	16.0	NS	NS	40 DR	57	NA	
60	19.6	NS	NS	■	52	NA	
66	23.8	NS	NS	NS	47 DR	NA	
72	28.3	NS	NS	NS	■	NA	
78	33.2	NS	NS	NS	■	NA	
84	38.5	NS	NS	NS	■	NA	
90	44.2	NS	NS	NS	■	NA	
96	50.3	NS	NS	NS	■	NA	

■ – Note:

Special installation required. Refer to AASHTO Standard Specifications for Highway Bridges or ASTM B788-88 and manufacturer's recommendations.

PIPE ARCH – 2⅔" x ½" CORRUGATION ②

Span (In.)	Rise (In.)	Equiv. Round Pipe (In.)	Area (Sq. Ft.)	Minimum Sheet Thickness Required (In.) (Ga.)	Maximum Height Of Fill (Ft.) — Maximum Corner Pressure-Lbs./Sq.Ft. 4000	6000	Min. Cover (Ft.)
17	13	15	1.1	0.060 (16)	12	15	See Sheet 1 of 6
21	15	18	1.6	0.060 (16)	10	14	
24	18	21	2.2	0.060 (16)	7	13	
28	20	24	2.9	0.075 (14)	5	11	
35	24	30	4.5	0.075 (14)	NS	7	
42	29	36	6.5	0.105 (12)	NS	7	
49	33	42	8.9	0.105 (12)	NS	6	
57	38	48	11.6	0.135 (10)	NS	8	
64	43	54	14.7	0.135 (10)	NS	9	
71	47	60	18.1	0.164 (8)	NS	10	
77	52	66	21.9	0.164 (8)	NS	10	
83	57	72	26.0	0.164 (8)	NS	10	

PIPE ARCH – 3" x 1" CORRUGATION ①②

Span (In.)	Rise (In.)	Equiv. Round Pipe (In.)	Area (Sq. Ft.)	Minimum Sheet Thickness Required (In.) (Ga.)	Maximum Height Of Fill (Ft.) — Maximum Corner Pressure-Lbs./Sq.Ft. 4000	6000	Min. Cover (Ft.)
40	31	36	7.0	0.060 (16)	8	12	See Sheet 1 of 6
46	36	42	9.4	0.060 (16)	8	13	
53	41	48	12.3	0.060 (16)	8	13	
60	46	54	15.6	0.075 (14)	8	13	
66	51	60	19.3	0.075 (14)	8	13	
73	55	66	23.2	0.105 (12)	11	16	
81	59	72	27.4	0.105 (12)	11	17	
87	63	78	32.1	0.105 (12)	10	16	
95	67	84	37.0	0.105 (12)	11	17	
103	71	90	42.4	0.135 (10)	10	15	
112	75	96	48.0	0.135 (10)	10	16	
117	79	102	54.2	0.164 (8)	10	15	

PIPE ARCH – SPIRAL RIB
RIB SPACING (¾" x ¾" x 7½")

Span (In.)	Rise (In.)	Equiv. Round Pipe (In.)	Area (Sq. Ft.)	Minimum Sheet Thickness Required (In.) (Ga.)	Maximum Height Of Fill (Ft.) — Maximum Corner Pressure-Lbs./Sq.Ft. 4000	6000	Min. Cover (Ft.)
16	14	15	1.2	0.060 (16)	12	13	See Sheet 1 of 6
20	16	18	1.7	0.060 (16)	10	12	
23	19	21	2.3	0.060 (16)	7	11	
27	21	24	3.0	0.060 (16)	5	10	
33	26	30	4.7	0.075 (14)	NS	9	
40	31	36	7.0	0.075 (14)	NS	8	
46	36	42	9.4	0.105 (12)	NS	8	
53	41	48	12.3	0.105 (12)	NS	8	
60	46	54	15.6	0.105 (10)	NS	8	
66	51	60	19.3	0.135 (10)	NS	8	
73	55	66	23.2	■	NS	8	
81	59	72	27.4	■	NS	8	

MAXIMUM COVER FOR CORRUGATED ALUMINUM ALLOY ROUND PIPE AND PIPE ARCH

Notes:

Increase the minimum cover values shown on Sheet 1 of 6 by 6" for gage and size combinations below the heavy lines.

Height of fill (maximum cover) is measured from top of finished grade to outside top of pipe.

NA–Not Available

NS–Not Suitable (For Highway H-20 or HS-20 Loadings)

DR–Design Review is recommended for each specific application. The review should identify any special handling, installation, backfill procedures, and construction load restrictions which may be required. (The review performed by the designer does not relieve the contractor from analyzing and taking any necessary precautions required to protect partially or completely constructed pipe from the equipment used during construction.) (NOTE: The DESIGNER may use a thicker gage in lieu of the Design Review.)

① *Limited availability of this product. Check availability before specifying.*

② *360° perforated pipe (french drain pipe) is not recommended in the pipe arch shape. Do not specify without checking both for suitability and availability.*

③ *This size and gage combination must be strutted during installation per manufacturer's recommendations. Extra care will be required during handling and installation.*

④ *Use of this size and gage combination must be approved by the State Drainage Engineer.*

Aluminum Structural Plate
Height of Cover Limits*
Combination Metal Thickness, Reinforcing Rib Type, and Rib Spacing
Arch Shape- HS 20 Live Load

Span (Ft.-In.)	Rise (Ft.-In.)	Area (Sq.Ft.)	Minimum Height of Cover (Ft.) 1.00	1.50	2.00	2.50	3.00	3.50
5-0	1-9 2-3 2-7	7 9 10	0.125 (45)	0.100 (31)	0.100 (31)	0.100 (31)	0.100 (31)	0.100 (31)
6-0	1-10 2-4 2-9 3-2	8 10 13 15	0.125-II-18 (37)	0.100 (25)	0.100 (25)	0.100 (25)	0.100 (25)	0.100 (25)
7-0	2-4 2-10 3-3 3-8	12 15 18 20	0.125-II-18 (32)	0.100 (22)	0.100 (22)	0.100 (22)	0.100 (22)	0.100 (22)
8-0	2-11 3-4 4-2	17 20 26	0.125-II-9 (28)	0.150 (37)	0.100 (19)	0.100 (19)	0.100 (19)	0.100 (19)
9-0	2-11 3-10 4-8	19 26 33	0.125-IV-9 (25)	0.125-II-18 (25)	0.100 (17)	0.100 (17)	0.100 (17)	0.100 (17)
10-0	3-6 4-5 5-2	25 33 41	0.125-IV-9 (22)	0.125-II-18 (22)	0.125 (22)	0.100 (15)	0.100 (15)	0.100 (15)
11-0	3-6 4-6 5-8	28 37 50	0.175-IV-9 (32)	0.125-II-18 (20)	0.125-II-27 (20)	0.100 (14)	0.100 (14)	0.100 (14)
12-0	4-1 5-0 6-3	35 45 59		0.125-IV-18 (18)	0.125-II-27 (18)	0.125 (18)	0.100 (12)	0.100 (12)
13-0	4-1 5-1 5-11 6-9	38 49 59 70		0.150-IV-18 (23)	0.125-II-27 (17)	0.150 (23)	0.100 (11)	0.100 (11)
14-0	4-8 5-7 6-5 7-3	47 58 70 81		0.125-IV-9 (16)	0.125-IV-27 (16)	0.125-II-27 (16)	0.100 (11)	0.100 (11)
15-0	4-8 5-8 6-7 7-5 7-9	50 63 75 87 93		0.125-IV-9 (15)	0.125-IV-27 (15)	0.125-II-27 (15)	0.125 (15)	0.125 (15)
16-0	5-3 6-2 7-1 7-11 8-3	60 73 86 99 105		0.150-IV-9 (18)	0.125-IV-18 (14)	0.125-II-27 (14)	0.150 (18)	0.125 (14)
17-0	5-3 6-3 7-2 8-0 8-10	64 78 92 105 119		0.225-IV-9 (27)	0.150-IV-18 (17)	0.125-II-27 (13)	0.175 (20)	0.150 (17)
18-0	5-9 6-9 7-8 8-6 8-11	75 90 105 119 126			0.175-IV-18 (19)	0.125-IV-27 (12)	0.200 (22)	0.175 (19)
19-0	6-4 7-4 8-2 9-0 9-5	87 103 118 133 141			0.125-IV-9 (11)	0.125-IV-27 (11)	0.125-IV-54 (11)	0.125-IV-54 (11)

Aluminum Structural Plate
Height of Cover Limits*
Combination Metal Thickness, Reinforcing Rib Type, and Rib Spacing
Round Shape- HS 20 Live Load

Diameter (Ft.-In.)	Area (Sq. Ft.)	Minimum Height of Cover (Ft.) 1.00	1.50	2.00	2.50	3.00	3.50
5-0	19	0.125 (45)	0.100 (31)	0.100 (31)	0.100 (31)	0.100 (31)	0.100 (31)
5-6 6-0	23 28	0.125-II-18 (37)	0.100 (25)	0.100 (25)	0.100 (25)	0.100 (25)	0.100 (25)
6-6 7-0	32 38	0.125-II-18 (32)	0.100 (22)	0.100 (22)	0.100 (22)	0.100 (22)	0.100 (22)
7-6 8-0	44 50	0.125-II-9 (28)	0.150 (37)	0.100 (19)	0.100 (19)	0.100 (19)	0.100 (19)
8-6 9-0	56 63	0.125-IV-9 (25)	0.125-II-18 (25)	0.100 (17)	0.100 (17)	0.100 (17)	0.100 (17)
9-6 10-0	71 79	0.125-IV-9 (22)	0.125-II-18 (22)	0.125 (22)	0.100 (15)	0.100 (15)	0.100 (15)
10-6 11-0	87 95	0.175-IV-9 (32)	0.125-II-18 (20)	0.125-II-27 (20)	0.100 (14)	0.100 (14)	0.100 (14)
11-6 12-0	104 114		0.125-IV-18 (18)	0.125-II-27 (18)	0.125 (18)	0.100 (12)	0.100 (12)
12-6 13-0	124 134		0.150-IV-18 (23)	0.125-II-27 (17)	0.150 (23)	0.125 (17)	0.125 (17)
13-6 14-0	145 156		0.125-IV-9 (16)	0.125-IV-27 (16)	0.125-II-27 (16)	0.150 (21)	0.150 (21)
14-6 15-0	167 179		0.125-II-54 (15)	0.125-IV-9 (15)	0.125-IV-27 (15)	0.125-II-27 (15)	0.125-II-54 (15)
15-6 16-0	191 204		0.150-IV-9 (18)	0.125-IV-18 (14)	0.125-II-27 (14)	0.150-II-54 (18)	0.150-II-54 (18)
16-6 17-0	217 231		0.225-IV-9 (27)	0.150-IV-18 (17)	0.150-II-27 (17)	0.150-II-27 (17)	0.150-II-27 (17)
17-6 18-0	245 259			0.175-IV-18 (19)	0.175-II-27 (19)	0.175-II-27 (19)	0.175-II-27 (19)
18-6 19-0	274 289			0.175-IV-9 (18)	0.175-IV-27 (18)	0.175-II-27 (18)	0.175-II-27 (18)
19-6	305			0.200-IV-9 (20)	0.200-IV-27 (20)	0.200-II-27 (20)	0.200-II-27 (20)

* Number in ( ) below combination indicates maximum cover for the given combination plate thickness, rib type and rib spacing. All maxium cover depths are given in feet. (See Note Number 2 Under Structural Plate Notes Sheet 6 of 6).

MINIMUM AND MAXIMUM COVER FOR ALUMINUM STRUCTURAL PLATE

Aluminum Structural Plate
Height of Cover Limits*
Combination Metal Thickness, Reinforcing Rib Type, and Rib Spacing
Underpass Shape- HS 20 Live Load

Span (Ft.-In.)	Rise (Ft.-In.)	Area (Sq.Ft.)	Minimum Height of Cover (Ft.) 1.00	1.50	2.00	2.50	3.00	3.50
6-1	5-9	28	0.125-II-18 (29)	0.100 (25)	0.100 (25)	0.100 (25)	0.100 (25)	0.100 (25)
6-3 6-3 6-2 6-4 6-3 6-5	6-1 6-5 6-11 7-3 7-9 8-1	30 32 34 37 39 42	0.125-II-18 (25)	0.100 (22)	0.100 (22)	0.100 (22)	0.100 (22)	0.100 (22)
12-1	11-0	106		0.125-IV-18 (14)	0.125-II-27 (14)	0.125 (14)	0.100 (12)	0.100 (12)
12-10 13-0	11-2 12-0	114 124		0.150-IV-18 (13)	0.125-II-27 (13)	0.150 (13)	0.125 (13)	0.125 (13)
13-8 14-0	12-4 12-11	133 143		0.125-IV-9 (12)	0.125-IV-27 (12)	0.125-II-27 (12)	0.125-II-54 (12)	0.125-II-54 (12)
14-6 14-8	13-5 14-1	155 165		0.125-IV-9 (11)	0.125-IV-27 (11)	0.125-II-27 (11)	0.125-II-54 (11)	0.125-II-54 (11)
15-5 15-6	14-5 15-2	177 190		0.150-IV-9 (11)	0.125-IV-18 (11)	0.125-II-27 (11)	0.125-II-27 (11)	0.125-II-2 (11)
16-2 16-6 16-8	15-6 16-0 16-4	200 208 215		0.225-IV-9 (10)	0.150-IV-18 (10)	0.150-II-27 (10)	0.150-II-27 (10)	0.150-II-27 (10)

Aluminum Structural Plate
Height of Cover Limits*
Combination Metal Thickness, Reinforcing Rib Type, and Rib Spacing
Pipe-Arch Shape- HS 20 Live Load

Span (Ft.-In.)	Rise (Ft-In)	Area (Sq-Ft)	Minimum Height of Cover (Ft.) 1.00	1.50	2.00	2.50	3.00	3.50
6-7 6-11	5-8 5-9	30 32	0.125-II-18 (25)	0.100 (22)	0.100 (22)	0.100 (22)	0.100 (22)	0.100 (22)
7-3 7-9 8-1	5-11 6-0 6-1	34 37 39	0.125-IV-18 (22)	0.150 (22)	0.100 (19)	0.100 (19)	0.100 (19)	0.100 (19)
8-5 8-10	6-3 6-4	42 45	0.125-IV-9 (19)	0.125-II-18 (19)	0.100 (17)	0.100 (17)	0.100 (17)	0.100 (17)
9-3 9-7 9-11	6-5 6-6 6-8	47 50 53	0.125-IV-9 (17)	0.125-II-18 (17)	0.125 (17)	0.100 (15)	0.100 (15)	0.100 (15)
10-3 10-9 11-1	6-9 6-10 7-0	56 58 61	0.175-IV-9 (16)	0.125-II-18 (16)	0.125-II-27 (16)	0.100 (14)	0.100 (14)	0.100 (14)
11-5 11-9	7-1 7-2	64 68		0.125-II-18 (14)	0.125-II-27 (14)	0.125 (14)	0.100 (12)	0.100 (12)
12-3 12-7 12-11 13-1 13-1	7-3 7-5 7-6 8-2 8-4	71 74 77 83 87		0.150-IV-18 (13)	0.125-II-27 (13)	0.150 (13)	0.100 (11)	0.100 (11)
13-11 14-0 13-11	8-5 8-7 9-5	90 94 102		0.125-IV-9 (12)	0.125-IV-27 (12)	0.125-II-27 (12)	0.100 (11)	0.100 (11)
14-3 14-8 14-11	9-7 9-8 9-10	106 110 114		0.125-IV-9 (11)	0.125-IV-27 (11)	0.125-II-27 (11)	0.125 (11)	0.125 (11)
15-4 15-7 16-1	10-0 10-2 10-4	119 123 128		0.150-IV-9 (11)	0.125-IV-18 (11)	0.125-II-27 (11)	0.125-II-54 (11)	0.125 (11)
16-4	10-6	132		0.225-IV-9 (10)	0.150-IV-18 (10)	0.125-II-27 (10)	0.125-II-54 (10)	0.125-II-54 (10)

* Number in ( ) below combination indicates maximum cover for the given combination plate thickness, rib type and rib spacing. All maximum cover depths are given in feet. (See Note Number 2 Under Structural Plate Notes)

ALUMINUM STRUCTURAL PLATE NOTES

1. Allowable cover (minimum & maximum) is measured from the outside valley of crown plate to the bottom of flexible pavement or from the outside valley of the crown plate to the top of rigid pavement. Minimum cover must be maintained in unpaved areas. Maximum cover is measured at the highest fill and/or the highest pavement elevation.

2. To find the minimum material requirements for the aluminum structural plate structure:
   a. Select the span in the left hand column that is equal to or larger than structure size required.
   b. Select the cover in the top row that is equal to or smaller than that required for the site.
   c. Intersect appropriate span and cover to find the appropriate plate. Example: Round Pipe, Span= 17'-0", Height of Cover= 2'-7" (use 2.5 ft. in table). Ans: 0.150-II-27 (17) The table selections show metal thickness, rib type, rib spacing and maximum cover. Example: 0.150-II-27=0.150" thick plate structure with Type II rib at 27" on centers on the crown. Number (17) in parenthesis below combination indicates maximum cover in feet for the given combination of plate thickness, rib type, and rib spacing.

3. Arch shapes shown are single radius and have a rise-to-span ratio of 0.30 to 0.53 Structures with rise-to-span ratios of less than 0.30 are typically not used because of structural considerations.

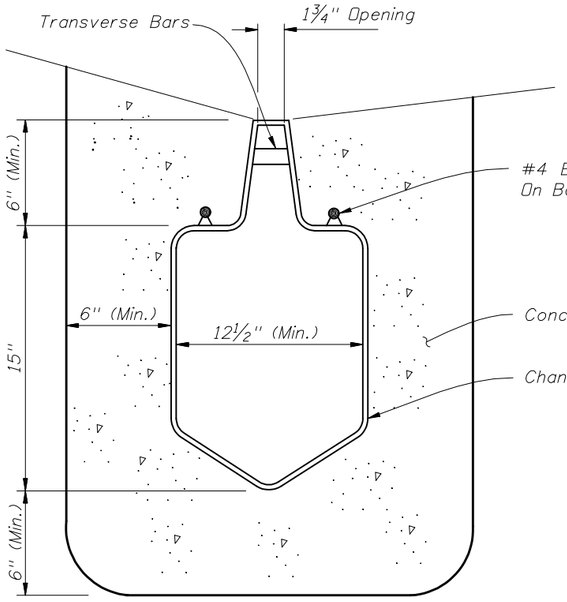
4. Tables based on HS 20 wheel loads.

DESIGN NOTES

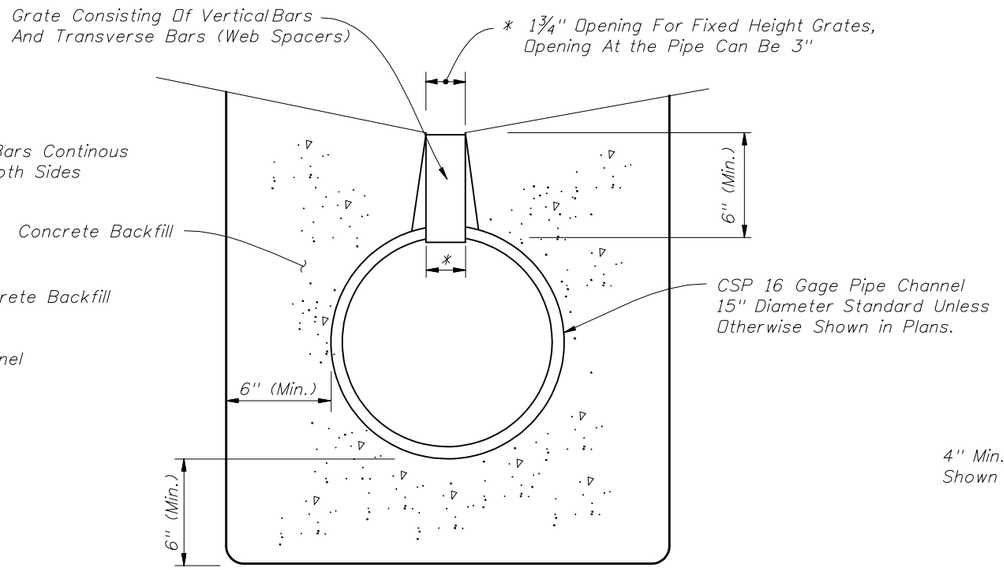
1. The plans must call out size, metal thickness, reinforcing rib type and rib spacing.

2. Pipe-arch and underpass shapes will generate high corner bearing pressures against the sidefill and foundation. The height of cover is directly affected by these bearing pressures. The surrounding soil and foundation must be checked to ensure that they to react against these pressures to avoid inducing excessive strain in plate.

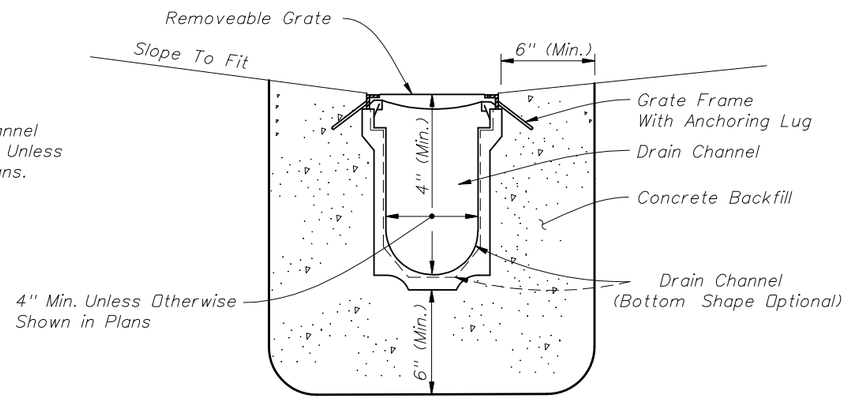
MINIMUM AND MAXIMUM COVER FOR ALUMINUM STRUCTURAL PLATE



PREFORMED POLYETHYLENE ALTERNATE



ROUND CSP ALTERNATE



PREFORMED CHANNEL WITH REMOVABLE GRATE

SEE SHEET 2 FOR TYPICAL LOCATIONS

TYPE I (NON-REMOVABLE GRATE)

GENERAL NOTES

1. Trench drain is intended for use in gutters and driveways as shown on the typical locations on Sheet 2. Type I is intended for use in Type E, F and drop curbing, and adjacent to traffic separators and standard barrier walls. The width of the channel grate for Type I Trench Drain shall be 1¾" throughout the length of its application. The linear slope or gradient for Type I may be manufactured by varying the depth of the channel neck. Type II may also be used in those locations if an independent laboratory certifies that the grating used has an open area equal to at least 0.27 square feet per linear foot. Type II is primarily intended for use in valley gutter across driveway openings and drop curbing; Type I may also be used in those locations. The width of the channel grate for Type II Trench Drain shall be the same as the width of the channel. The linear slope or gradient for Type II may be manufactured by varying the depth of the channel. Trench Drain shall not be placed in designated pedestrian paths unless ADA compliant grates are used.

2. Unless shown in the plans, outlet pipes and preformed channel inverts shall be sloped 0.6% or steeper toward the outlet regardless of the surface slope.

3. Trench drain may be stubbed directly into drainage structures, or outlet pipes may be used to connect trench drain to drainage structures.

4. A cleanout port compatible with the manufactured system shall be provided for Type I drains at the upstream end and at intervals not to exceed 50 feet. The cleanout port shall provide an opening 6" to 10" wide (transverse to the trench drain length) and 18" to 24" long. Where cleanouts are placed adjacent to raised curb or separator, the curb or separator shall be formed around the cleanout. The cleanout shall have a removable load resistant cover or grate.

5. Trench excavation must allow for a minimum of 6" of concrete to be placed under and alongside the trench drain channel system. Concrete backfill shall meet the requirements of Section 347 of the Standard Specifications. At the end of all units (Type I or II), the concrete backfill shall extend 6" minimum past the end of the drain opening.

6. Transverse bars for Type I Trench Drain shall be spaced 4" to 6" on center.

7. Whenever the work disturbs existing conditions or work already completed, restore the same to its original condition in every detail. All such repair and replacement shall meet the approval of the Engineer.

8. Payment to be made under the contract unit price for Trench Drain, LF.

SEE SHEET 2 FOR TYPICAL LOCATIONS

TYPE II

DESIGN NOTES

1. Where placed adjacent to reinforced concrete barrier wall or median barrier wall, the designer shall detail in the plans the position of the drain relative to the barrier wall to avoid conflicts with the barrier wall footing. See Index No. 410.

2. The designer shall identify the following in the plans:
   (a) The type of drain at each location.
   (b) The begin and end locations of the Trench Drain.
   (c) The location of the outlet pipe if the Trench Drain is not stubbed directly into a drainage structure.
   (d) The design flow (Q) for the Trench Drain must be shown on the plans.

3. Capture efficiency for Type I Trench Drain may be computed using the equations for slotted drain in FHWA's HEC 12 & 22. Grate Type I and Type II must have at least 30% open area.

4. Round pipe alternate is available in 12, 18, 24 and 36 inch CSP.

5. Type II Preformed Channel with integral anchoring lugs are applicable.

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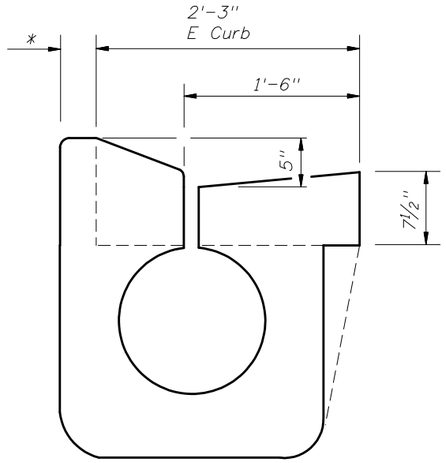
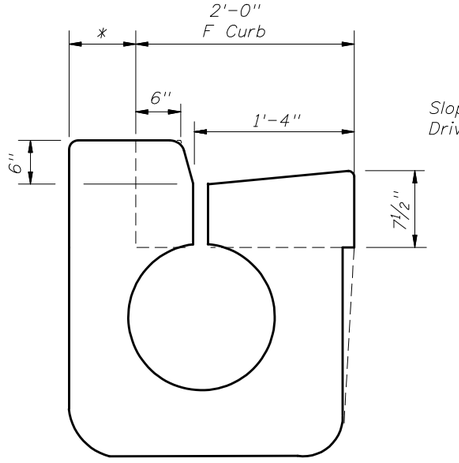
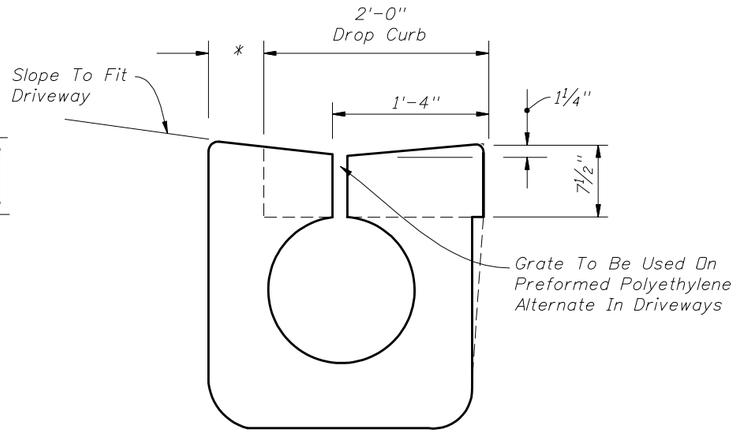
	TRENCH DRAIN		Index No. 206



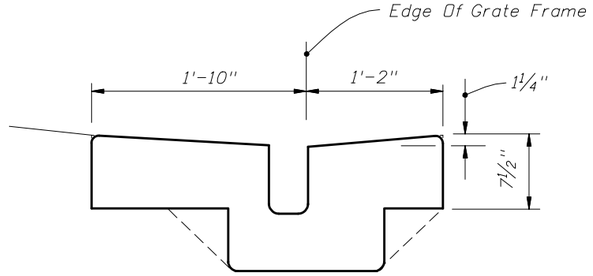
WITHIN TYPE E CURB



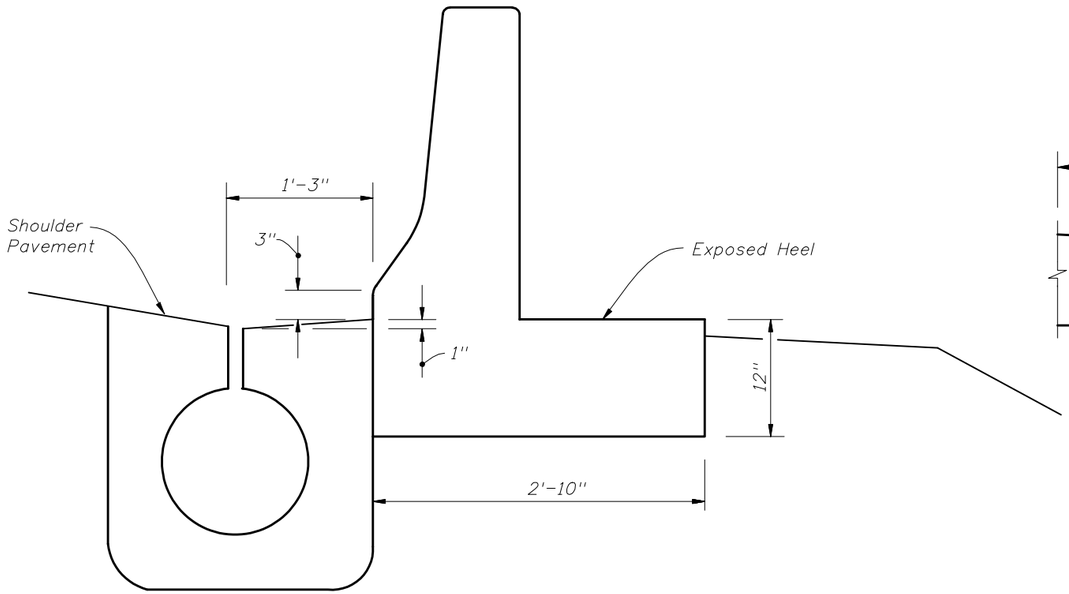
WITHIN TYPE F CURB



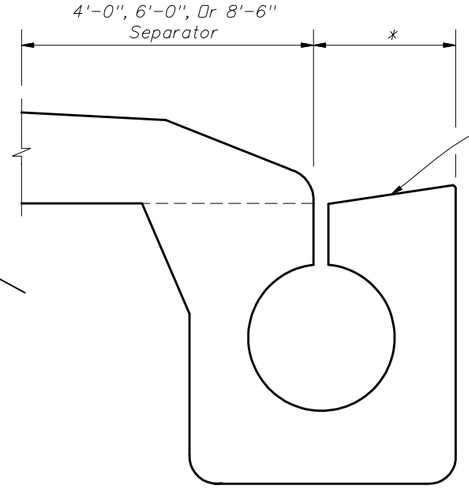
WITHIN DROP CURB



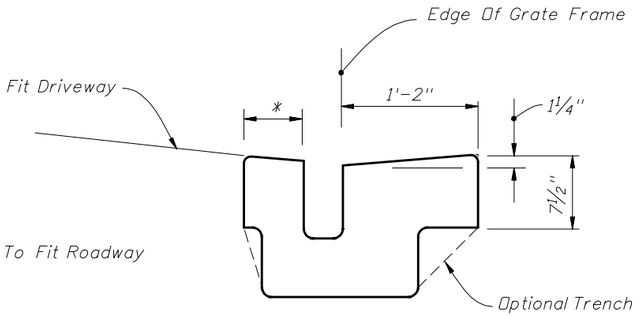
WITHIN VALLEY GUTTER



ADJACENT TO SHOULDER BARRIER WALL



ADJACENT TO TRAFFIC SEPARATOR



WITHIN DROP CURB

TYPICAL LOCATIONS FOR TYPE II

* As Necessary To Provide 6" Of Concrete On This Side Of Drain

ROUND PIPE ALTERNATE SHOWN, BUT PREFORMED POLYETHYLENE ALTERNATE ACCEPTABLE

TYPICAL LOCATIONS FOR TYPE I

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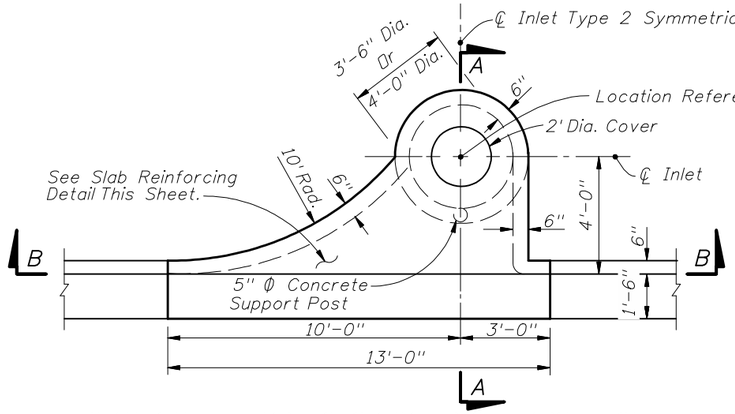
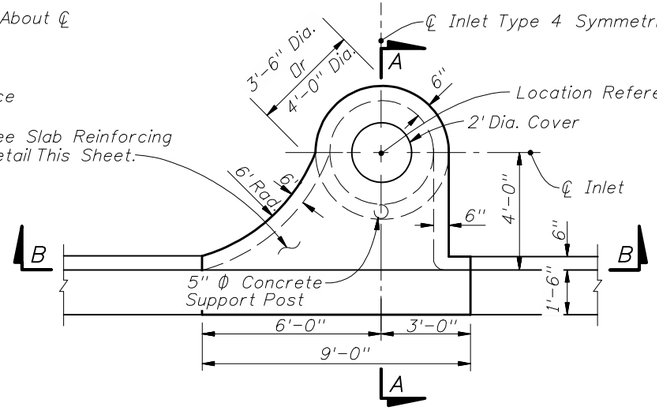
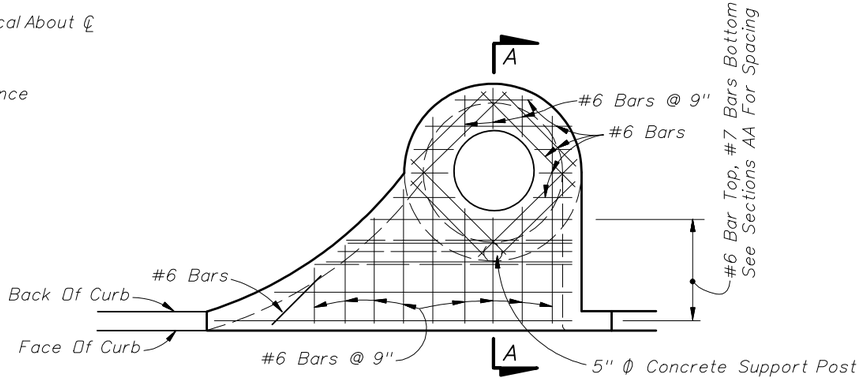
	TRENCH DRAIN	Index No. 206	



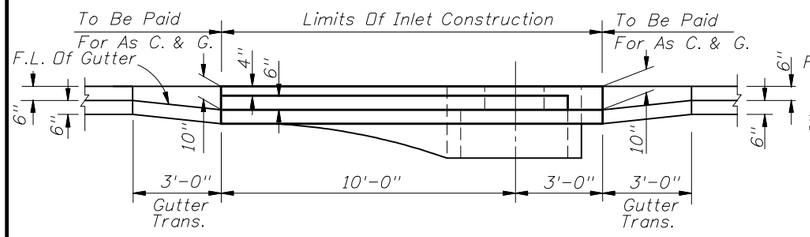
PLAN (INLET TYPE 2 SYMMETRICAL ABOUT ℄)



PLAN (INLET TYPE 4 SYMMETRICAL ABOUT ℄)

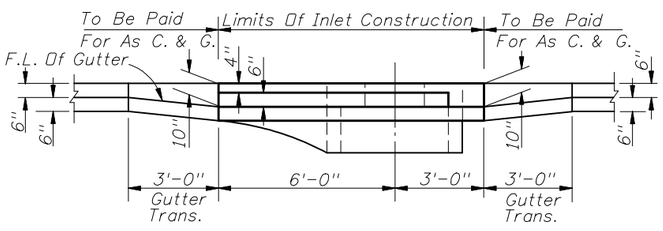


INLETS TYPES 1 AND 3



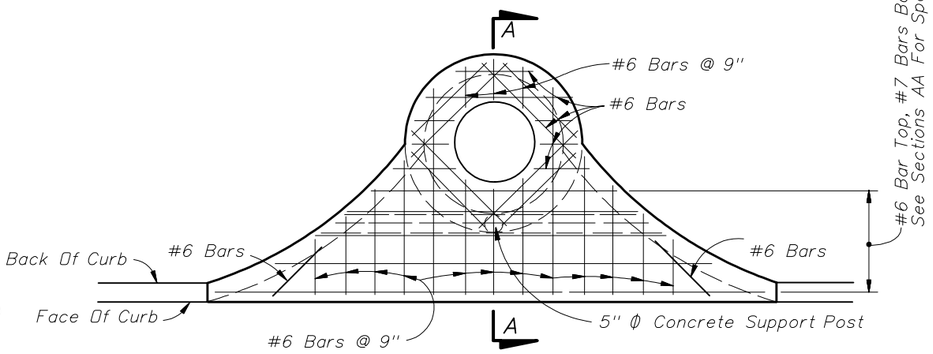
SECTION BB (INLET TYPE 2 SYMMETRICAL ABOUT ℄)

INLETS TYPES 1 AND 2



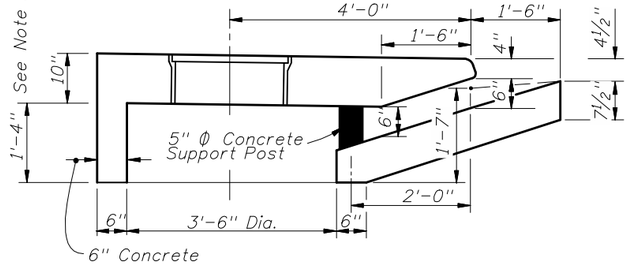
SECTION BB (INLET TYPE 4 SYMMETRICAL ABOUT ℄)

INLETS TYPES 3 AND 4

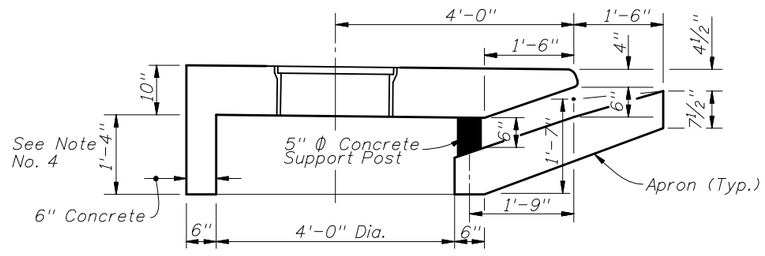


INLETS TYPES 2 AND 4

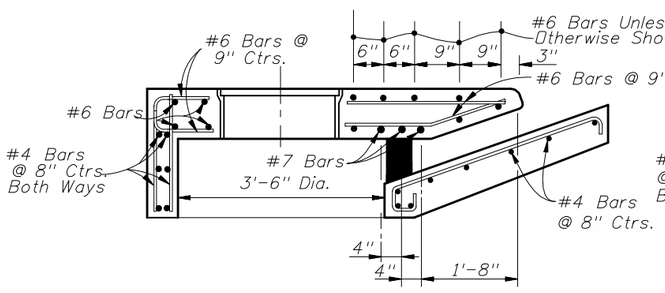
SLAB REINFORCING



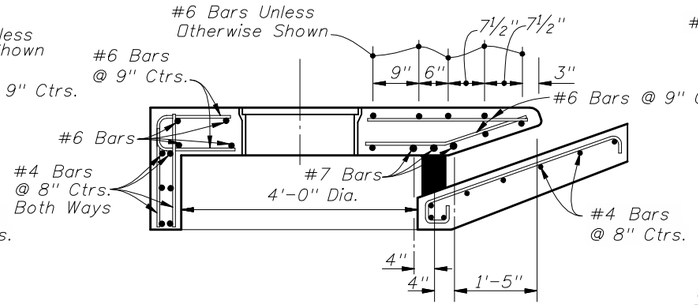
DIMENSIONAL SECTION



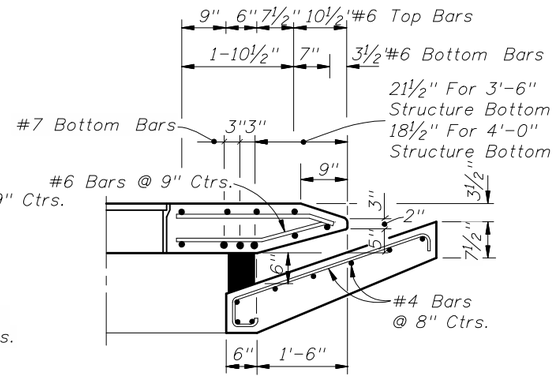
DIMENSIONAL SECTION



REINFORCING SECTION
3'-6" DIA. STRUCTURE BOTTOM (SECTION AA)



REINFORCING SECTION
4'-0" DIA. STRUCTURE BOTTOM (SECTION AA)



DIMENSION & REINFORCING HALF SECTION
TYPES A & E CURB (HALF SECTION AA)
(TYPE E GUTTER SHOWN)

GENERAL NOTES

1. The finished grade and slope of the inlet tops are to conform with the finished cross slope and grade of the proposed sidewalk and/or border.
2. When inlets are to be constructed on a curve, refer to the plans to determine the radius and, where necessary, modify the inlet details accordingly. Bend steel when necessary.
3. All steel in inlet top shall have 1¼" minimum cover unless otherwise shown. Inlet tops shall be either cast-in-place or precast concrete.
4. For precast units the rear wall and apron may be precast as a separate piece from the top slab. Provide a minimum of 7 ~ #4 dowels in accordance with Index No. 201 "OPTIONAL CONSTRUCTION JOINTS".
5. For supplemental details see Index No. 201.
6. Only round concrete support post will be acceptable.
7. These inlets are designed for use with standard curb and gutter Types E and Type F. Locate inlet outside of pedestrian crosswalks.
8. For structure bottoms see Index No. 200.
9. Inlet to be paid for under the contract unit price for inlets (Curb) (Type_), Each.

TRANSVERSE SECTIONS FOR INLETS TYPES 1, 2, 3 & 4

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2010 FDOT Design Standards

CURB INLET TOPS TYPES 1, 2, 3 & 4

Last Revision	Sheet No.
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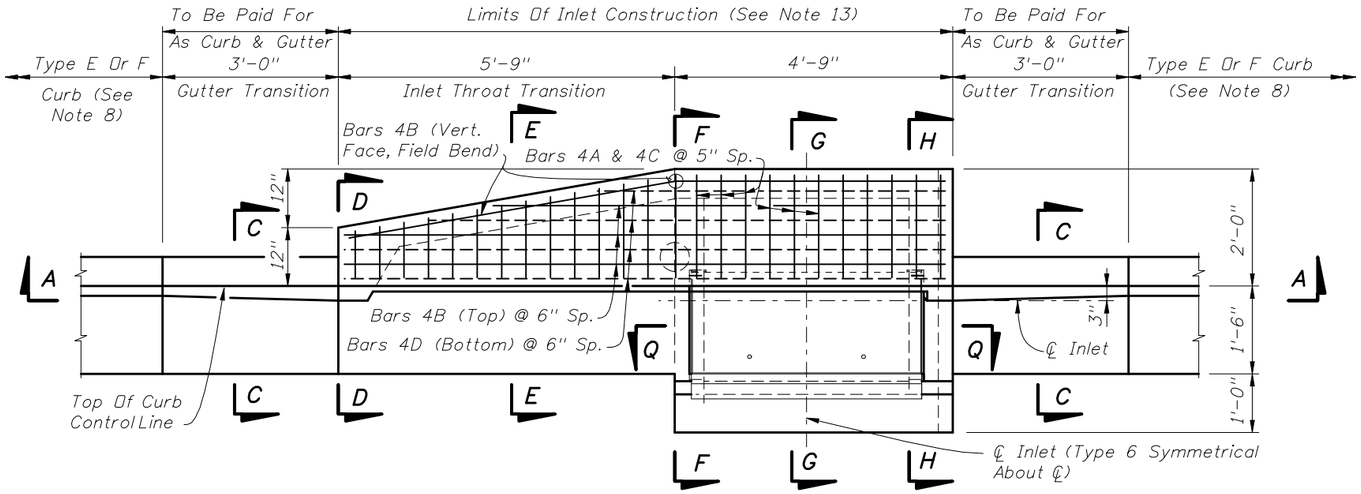
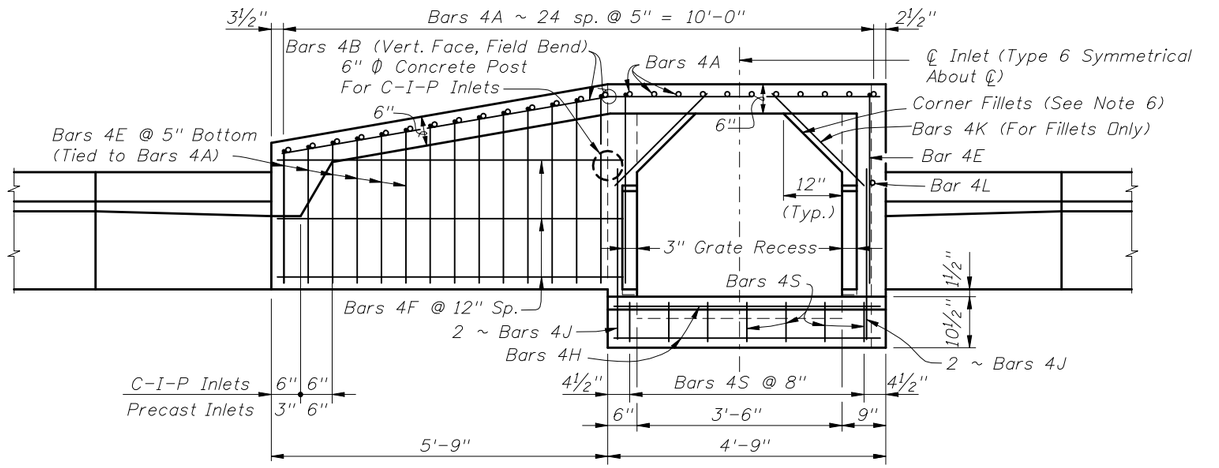
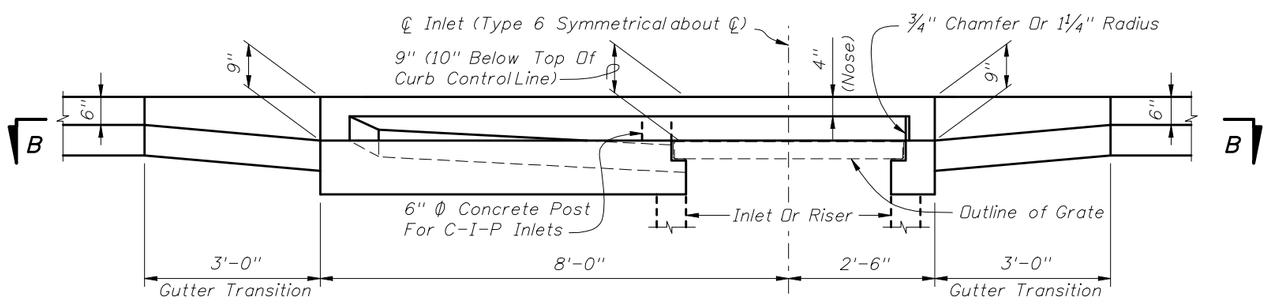
Index No. 210



TOP VIEW



SECTION BB

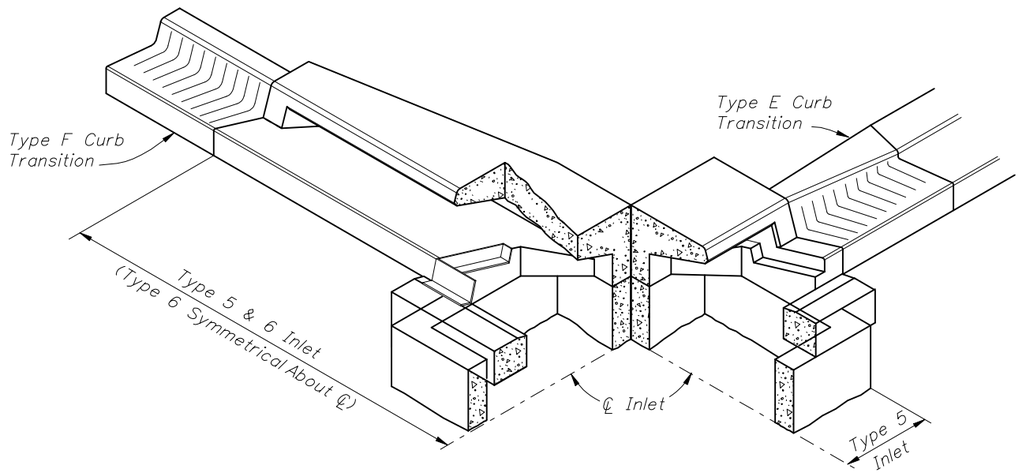


SECTION AA
(At ℄ Inlet)

INLET TYPE 5
(Curb Inlet Type 6 Symmetrical With Left Half)

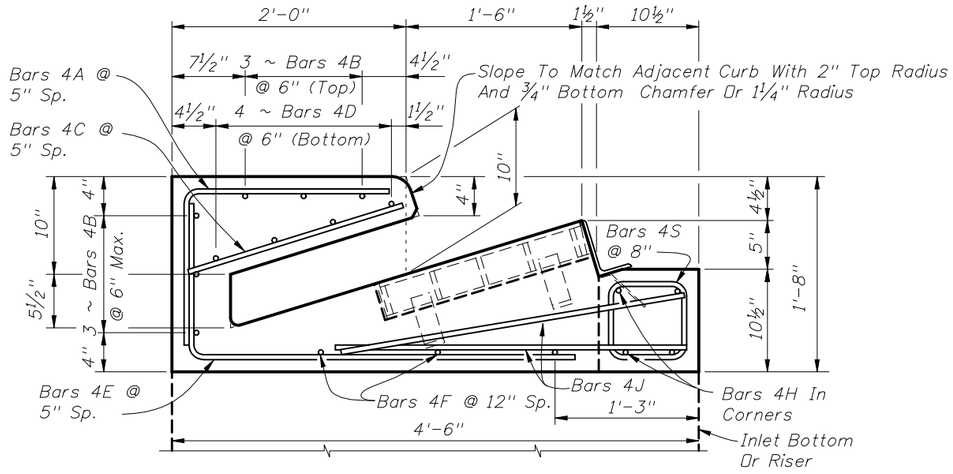
GENERAL NOTES

1. The finished grade and slope of the inlet tops are to conform with the finished cross slope and grade of the proposed sidewalk and/or border.
2. For inlets constructed on a curve, refer to the plans to determine the radius, and modify the inlet details accordingly. Bend steel when necessary.
3. All reinforcing steel to be Grade 60 bars with 1¼" minimum cover unless otherwise shown, see Sheet 4 for equivalent area Welded Wire Reinforcement details.
4. Inlet tops shall be either cast-in-place or precast concrete. Precast units shall conform to the dimensions shown or in accordance with approved shop drawing's. Request for shop drawing approval shall be directed to the State Drainage Engineer.
5. Concrete meeting the requirements of ASTM C478 (4,000 psi) may be used in lieu of Class II concrete for precast units, manufactured in plants which meet the requirements of Section 449 of the Specifications.
6. Corner fillets are required at inlet opening for precast units or C-I-P units used in conjunction with circular inlet bottoms or skewed rectangular inlet boxes. Finish top of fillets flush with drain throat bottom and match slope.
7. For inlet bottoms see Index No. 200. Inlet tops are to be used with Type P bottoms, or Type J bottoms with 3'-6" square (Type B), 3'-6" or 4' round (Type A) risers or top slab openings.
8. These inlet tops are designed for use with standard curb and gutter Type E and Type F. Locate inlet outside of pedestrian crosswalks. For Type E curb, transition the shape of the curb over the gutter transition length to match the face of the inlet (Type F).
9. See Index No. 201 for supplemental details.
10. All steel used for frame and grate shall meet the requirements of ASTM A36/A36M.
11. Either cast iron grates or steel grates may be used.
12. When Alternate "G" grate is specified in the plans either the cast iron grate and galvanized steel frame or the the galvanized steel grate and frame must be used. Grates are to be grouted in accordance with the grouting detail shown on Sheet 5, in lieu of tack welding.
13. Inlet to be paid for under the contract unit price for Inlets (Curb) (Type _), Each.

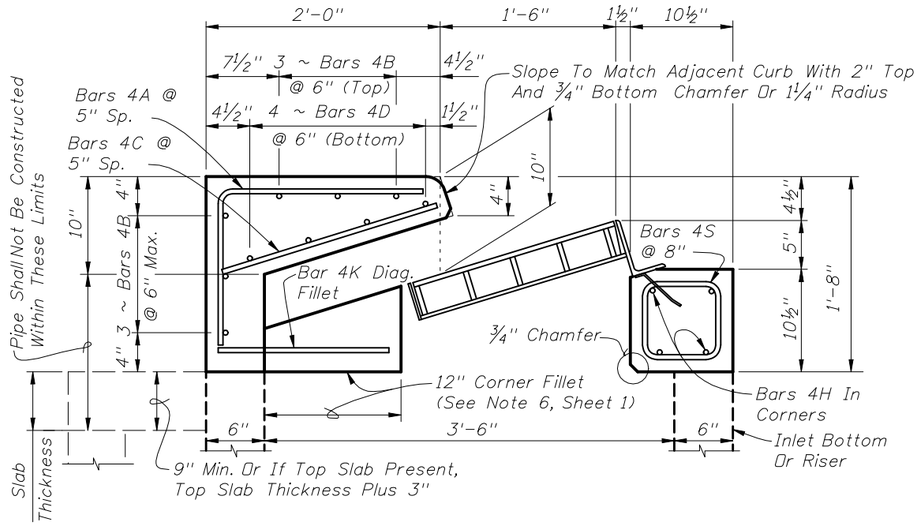


SKETCH SHOWING FRAME SEAT AND THROAT RECESS

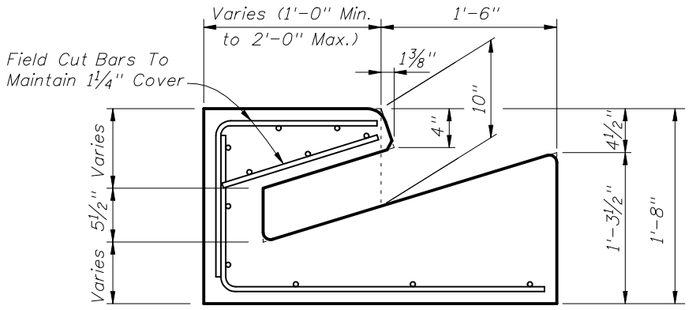
STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION	2010 FDOT Design Standards	Last Revision 07/01/09	Sheet No. 1 of 5
	CURB INLET TOPS TYPES 5 & 6		Index No. 211



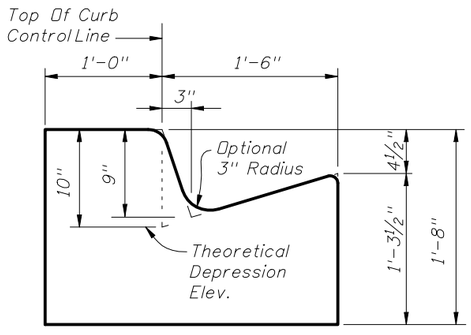
SECTION FF



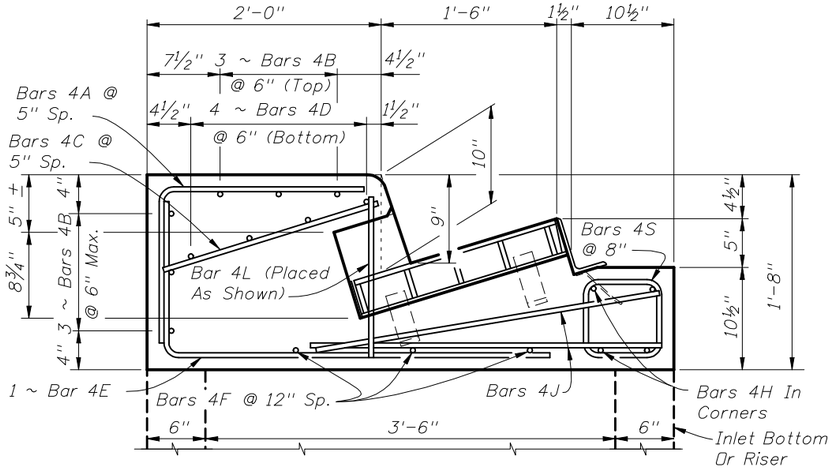
SECTION GG



SECTION EE



SECTION DD
(End View Of Inlet)



SECTION HH
(Type 5 Inlet Only)

CROSS REFRENCES:
For General Notes See Sheet 1.
For Location Of Sections DD Thru HH See Sheet 1.

PRECAST DETAILS

2010 FDOT Design Standards

CURB INLETS TOPS TYPES 5 & 6

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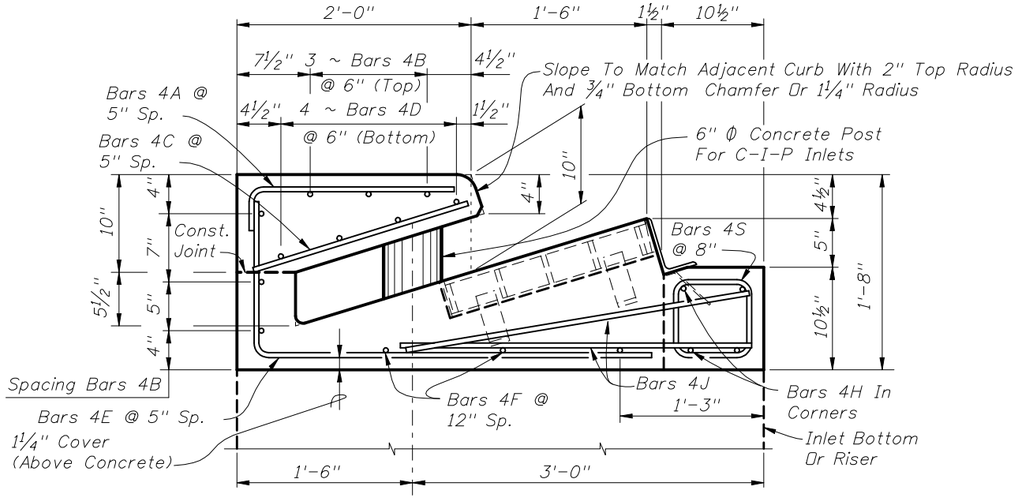
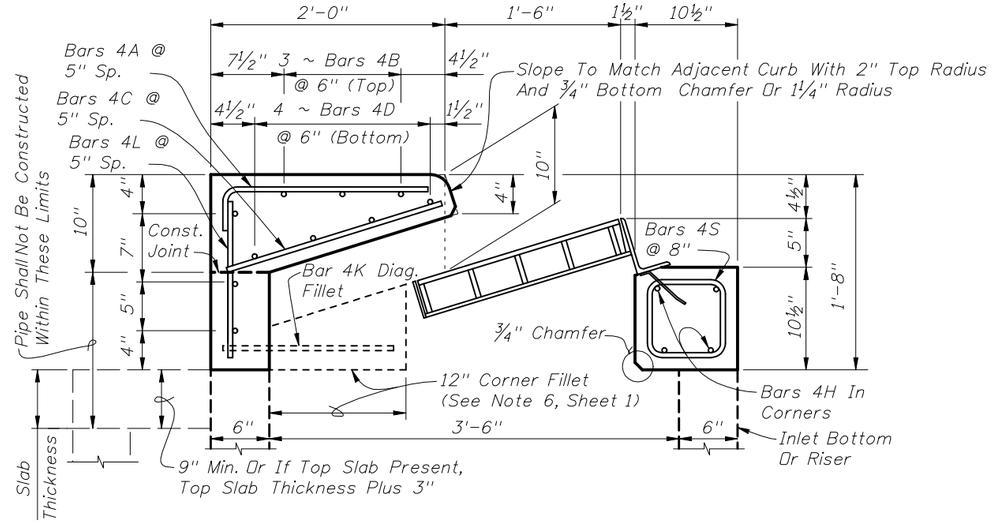
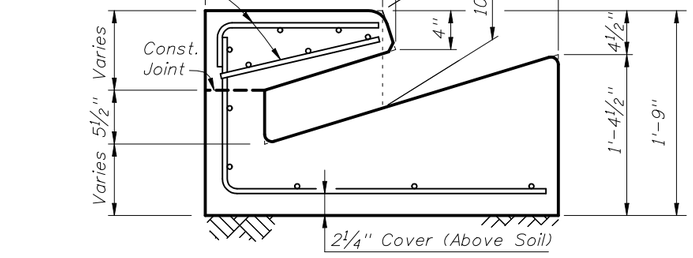


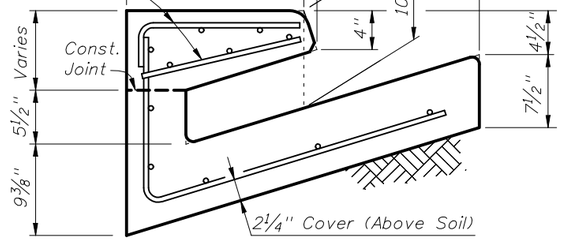
SECTION FF



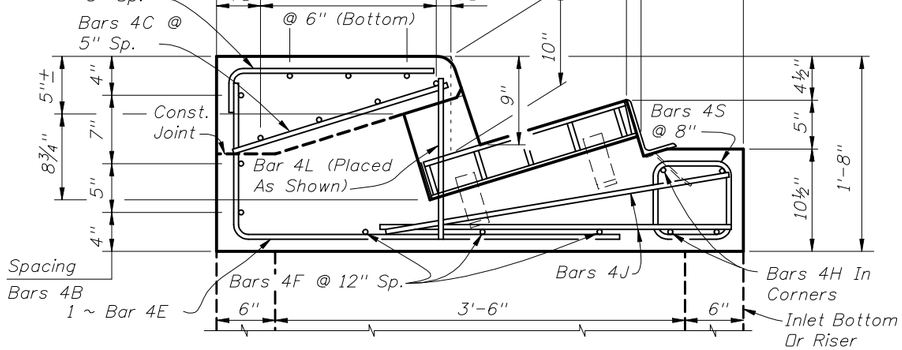
SECTION GG



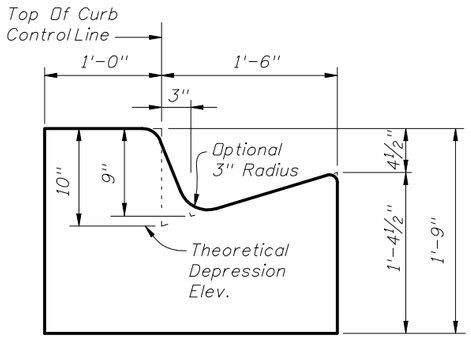
SECTION EE (OPTION A)



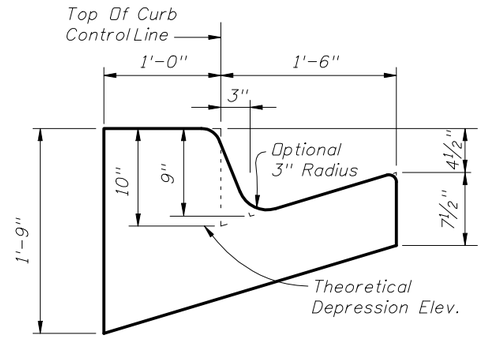
SECTION EE (OPTION B)



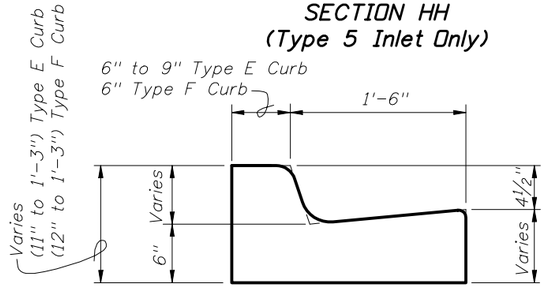
SECTION HH
(Type 5 Inlet Only)



SECTION DD (OPTION A)
(End View Of Inlet)



SECTION DD (OPTION B)
(End View Of Inlet)



SECTION CC
(Gutter Transition
Type F Shown, Type E Similar)

CROSS REFRENCES:
For General Notes See Sheet 1.
For Location Of Sections CC
Thru HH See Sheet 1.

CAST-IN-PLACE DETAILS

2010 FDOT Design Standards

CURB INLETS TOPS
TYPES 5 & 6

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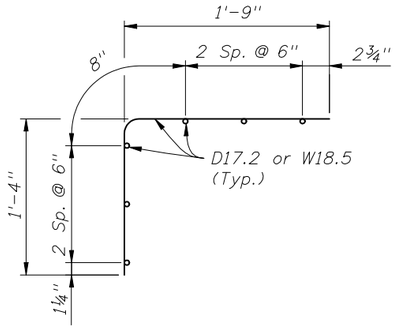
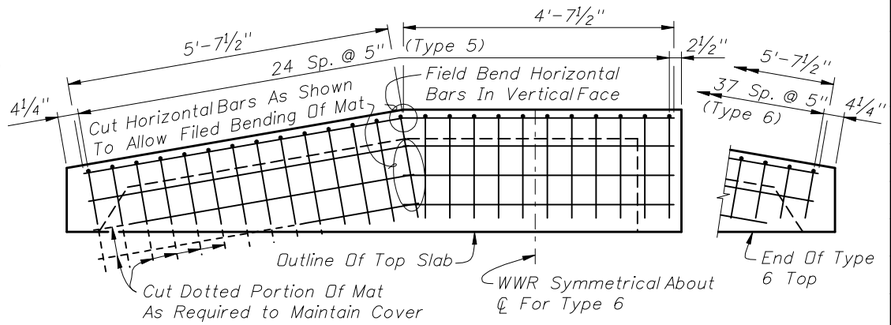
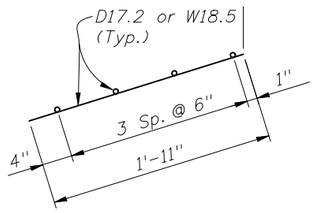
ALTERNATE REINFORCING STEEL DETAILS FOR WELDED WIRE REINFORCEMENT (WWR)



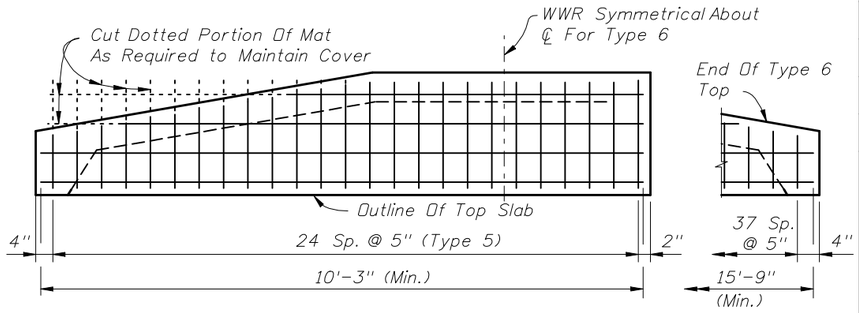
WELDED WIRE REINFORCEMENT
PIECE NO. 1



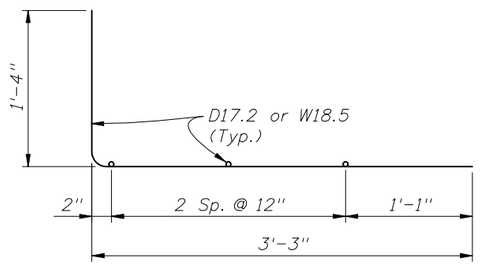
PLACEMENT SCHEMATIC FOR WELDED WIRE
REINFORCEMENT PIECE NO. 1



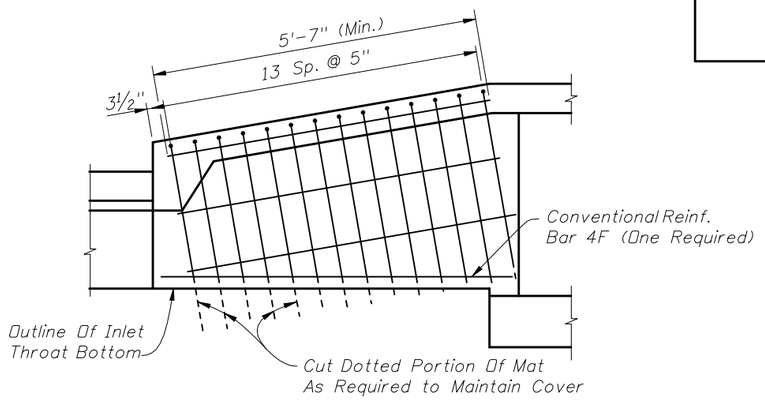
WELDED WIRE REINFORCEMENT
PIECE NO. 2



PLACEMENT SCHEMATIC FOR WELDED WIRE
REINFORCEMENT PIECE NO. 2



WELDED WIRE REINFORCEMENT
PIECE NO. 3



PLACEMENT SCHEMATIC FOR WELDED WIRE
REINFORCEMENT PIECE NO. 3

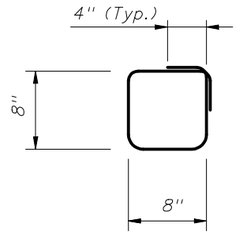
CONVENTIONAL REINFORCING STEEL BENDING DIAGRAMS

BILL OF REINFORCING STEEL

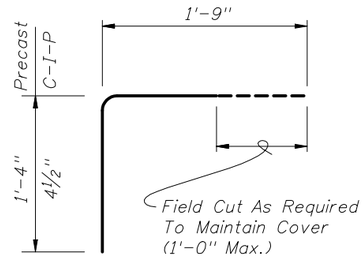
MARK	SIZE	TYPE 5 INLET		TYPE 6 INLET	
		NO.	LENGTH	NO.	LENGTH
A (Precast)	4	25	3'-1"	38	3'-1"
A (C-I-P)	4	25	2'-1½"	38	2'-1½"
B	4	6	10'-3"	6	15'-9"
C	4	25	11" to 1'-11"	38	11" to 1'-11"
D	4	4	10'-3"	4	15'-9"
E	4	16	4'-7"	30	4'-7"
F	4	3	6'-0"	6	6'-0"
H	4	4	4'-6"	4	4'-6"
J	4	4	3'-0"	4	3'-0"
K (Fillet)	4	2	2'-3"	2	2'-3"
L(Precast)	4	1	1'-4"	0	---
L (C-I-P)	4	10	1'-4"	9	1'-4"
S	4	7	3'-2"	7	3'-2"

REINFORCING STEEL NOTES:

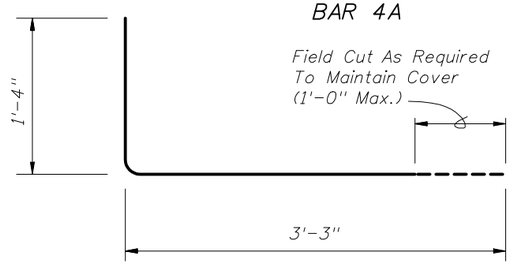
1. All bar dimensions in the bending diagrams are out to out.
2. Bars 4A and 4E may be combined into a single bar.
3. Welded Wire Reinforcement shall comply with ASTM A185 or ASTM A497.



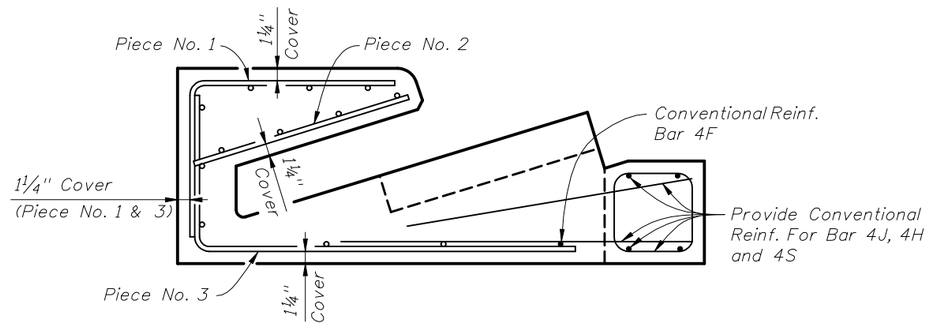
BAR 4S



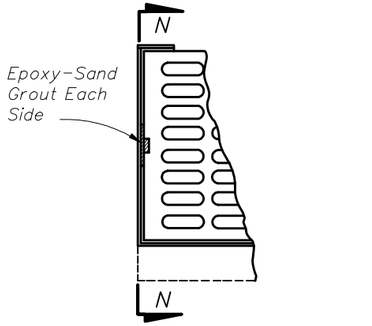
BAR 4A



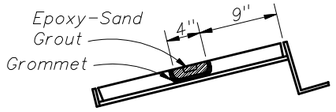
BAR 4E



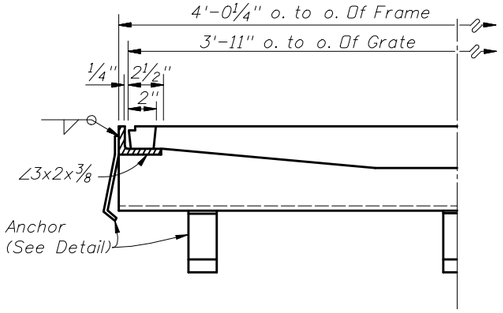
TYPICAL SECTION SHOWING
WELDED WIRE REINFORCEMENT



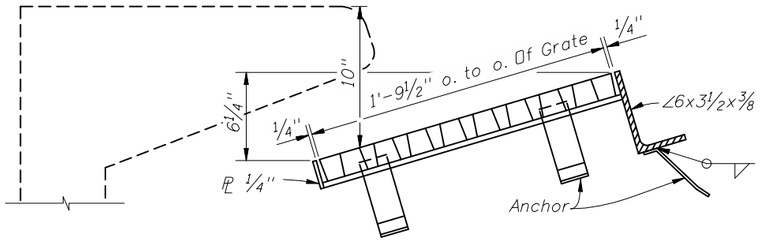
TOP VIEW
CAST IRON GRATE



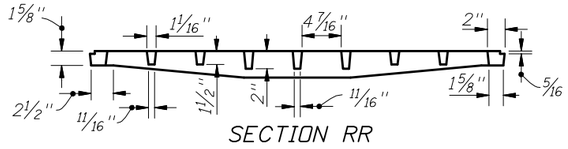
SECTION NN



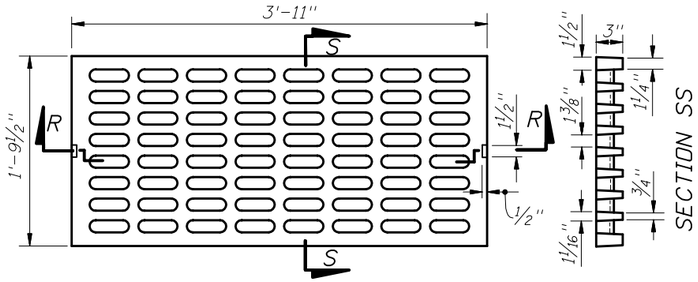
HALF SECTION QQ



SECTION GG

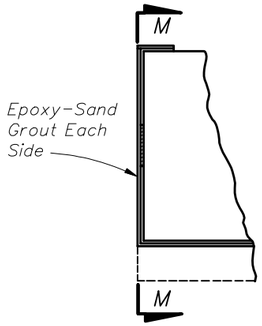


SECTION RR

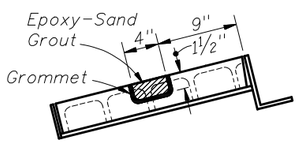


TOP VIEW

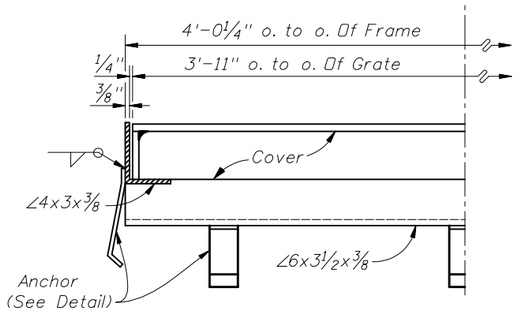
CAST IRON GRATE



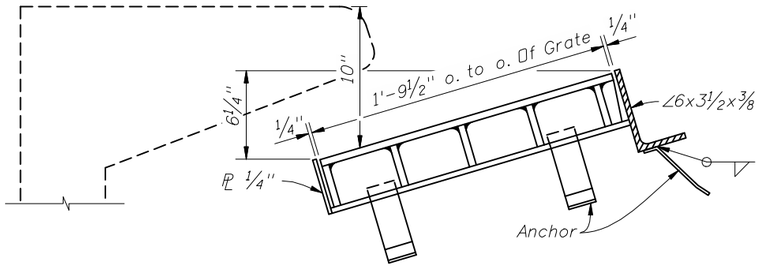
TOP VIEW
STEEL GRATE



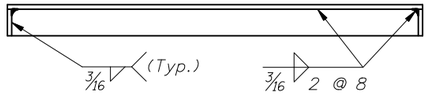
SECTION MM



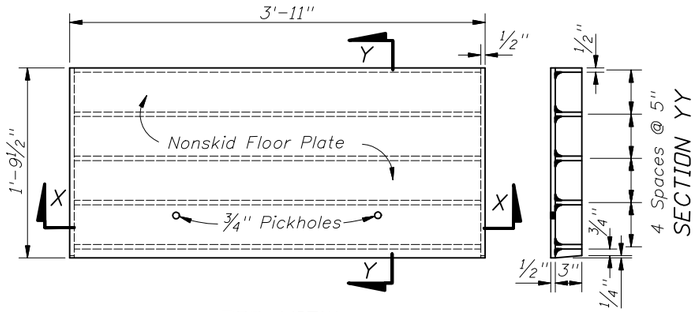
HALF SECTION QQ



SECTION GG



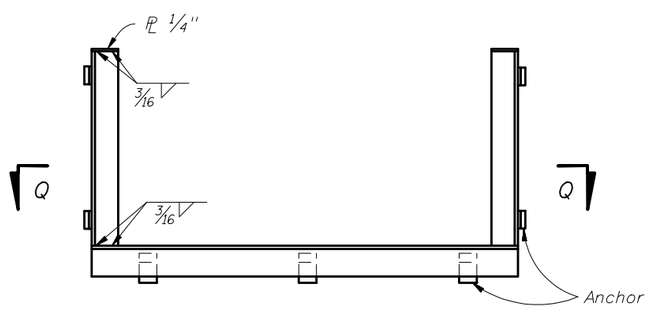
SECTION XX



TOP VIEW

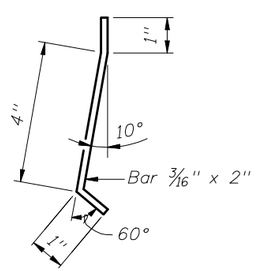
STEEL GRATE

GROUTING DETAILS



TOP VIEW

FRAME DETAIL



ANCHOR DETAIL

CROSS REFERENCES:
For Location Of Section GG and QQ
See Sheet 1.

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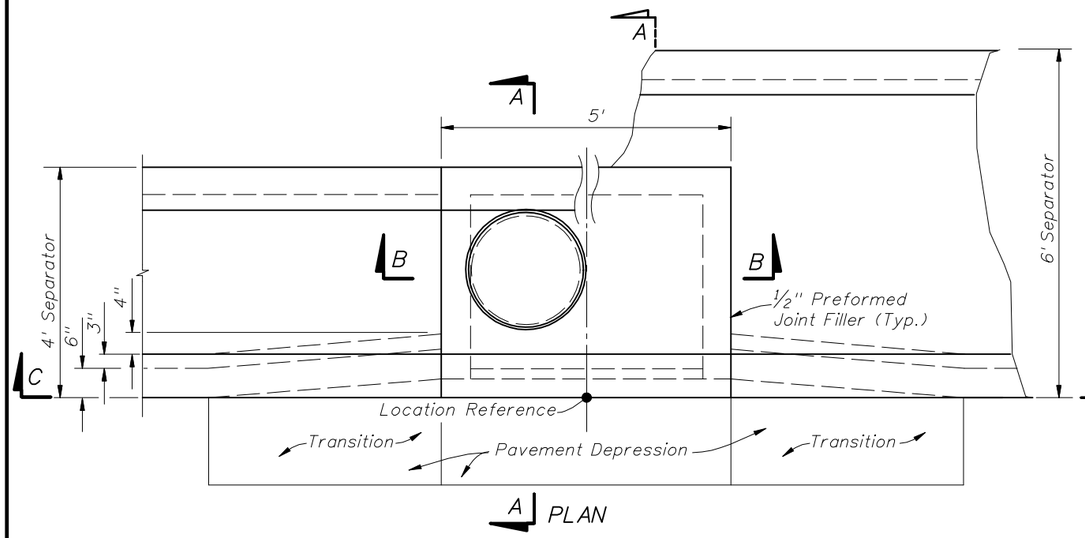
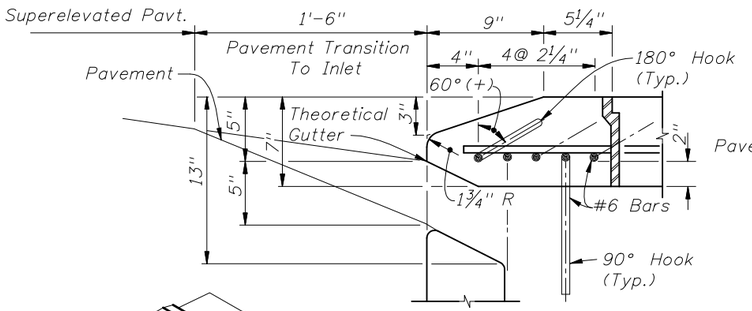
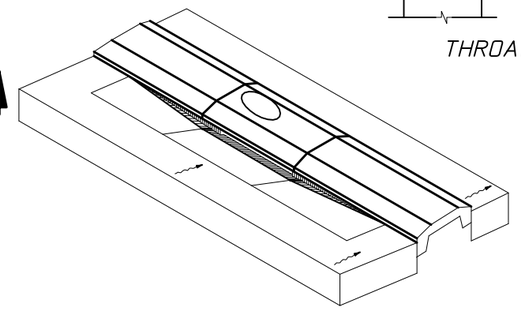
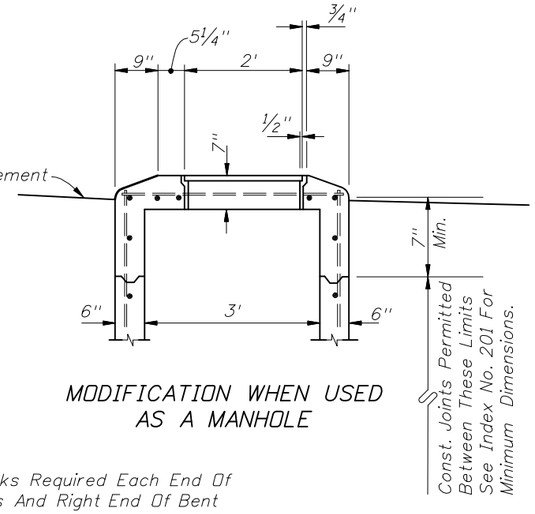
	CURB INLET TOPS TYPES 5 & 6	Index No. 211	





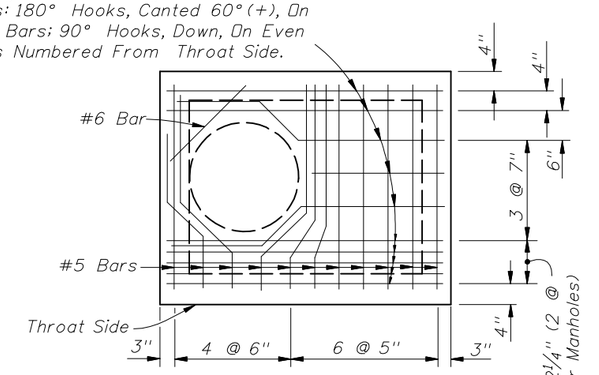
THROAT DETAIL



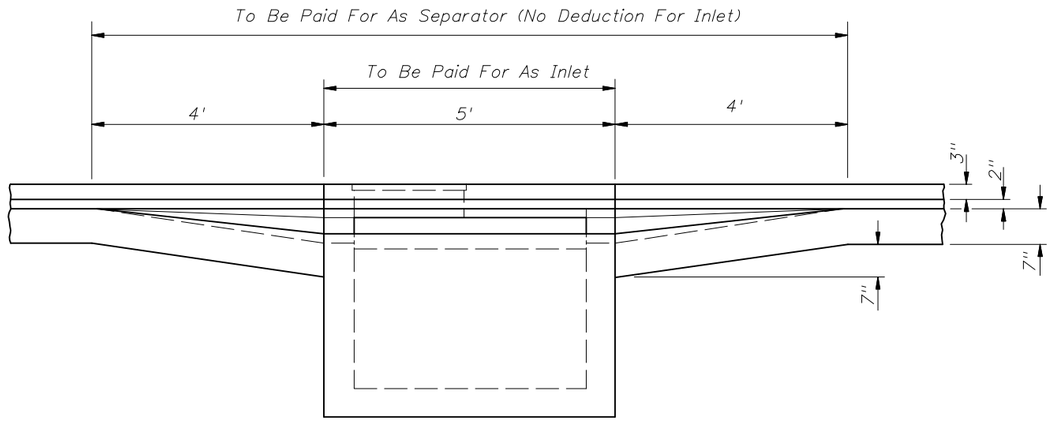


MODIFICATION WHEN USED AS A MANHOLE

#6 Bars
ACI Std. Hooks Required Each End Of Straight Bars And Right End Of Bent Bars: 180° Hooks, Canted 60°(+), On Odd Bars; 90° Hooks, Down, On Even Bars Numbered From Throat Side.

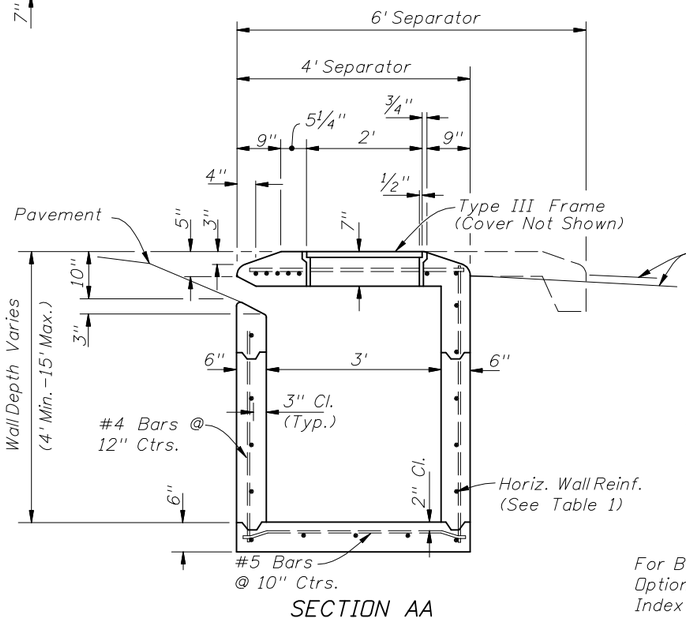


REINFORCING STEEL DIAGRAM TOP SLAB OF INLETS

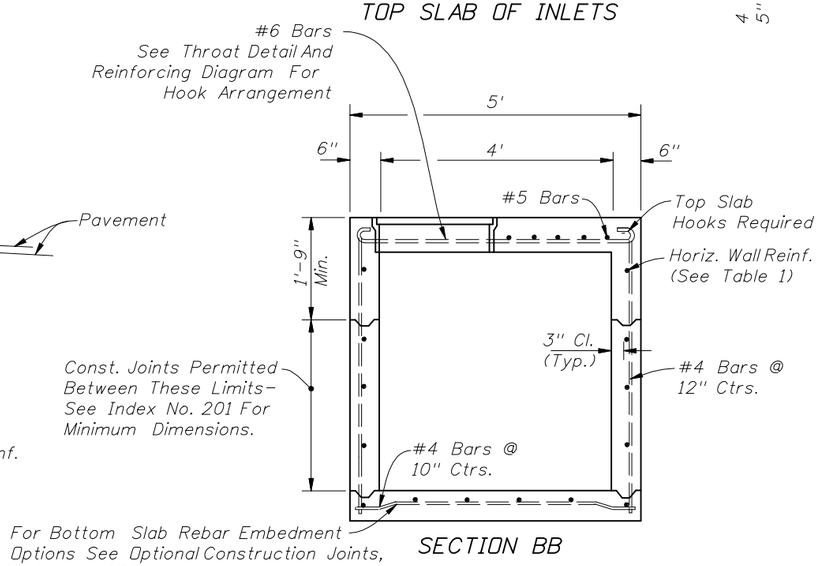


HORIZONTAL WALL REINFORCING SCHEDULE (TABLE 1)

WALL DEPTH	SCHEDULE	AREA (in.²/ft.)	MAX. SPACING	
			BARS	WWF
0' – 6'	A12	0.20	12"	8"
6' – 10'	A6	0.20	6"	5"
10' – 13'	A4	0.20	4"	3"
10' – 15'	B5.5	0.24	5½"	5"



SECTION AA



SECTION BB

GENERAL NOTES

1. This inlet is used in Traffic Separators Types I and II; or, in separators constructed with Curbs Types A, B and E and sidewalk paving, which cannot accommodate Inlets Types 1, 2, 3, 4, 5, or 6. Use of this Inlet on through traffic side of the separator is not permitted in medians with Curb Types A and B. Locate inlet outside of designated pedestrian travel way.

2. All reinforcing to be Grade 60 bars with 2" min. cover unless otherwise shown. See Index No. 201 for equivalent area of welded wire fabric. Cut or bend bars out of way of pipe when necessary. Bars to clear pipe by 1½"

3. Recommended maximum pipe sizes are 24" longitudinal and 30" transverse. For larger pipe, inlets with Alt. B bottoms, Index No. 200 are recommended.

4. For supplementary details see Index No. 201.

5. All dimensions are for both precast and cast-in-place inlets unless otherwise shown.

6. Inlet to be paid for under the contract unit price for Inlets (Curb) (Type 7), Each.

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CURB INLET TYPE 7

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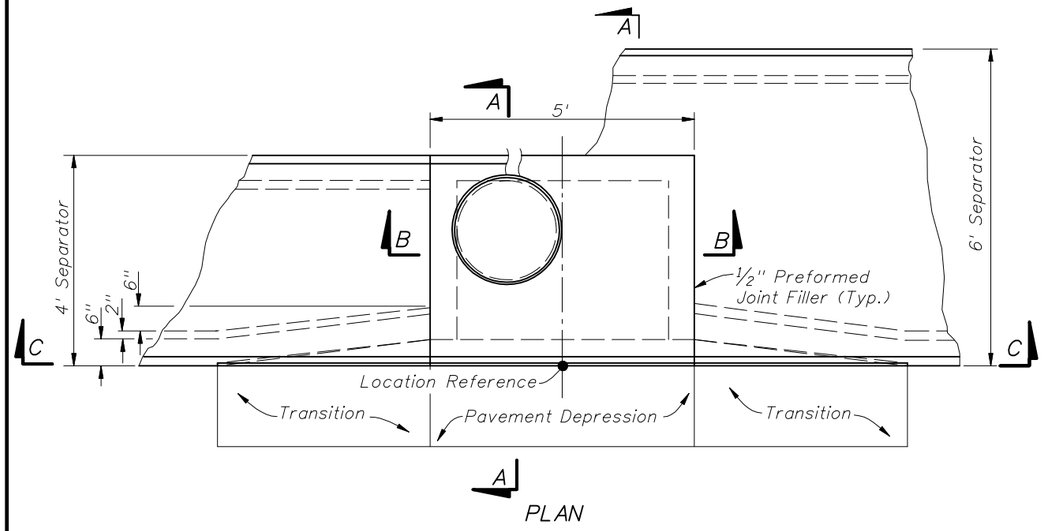
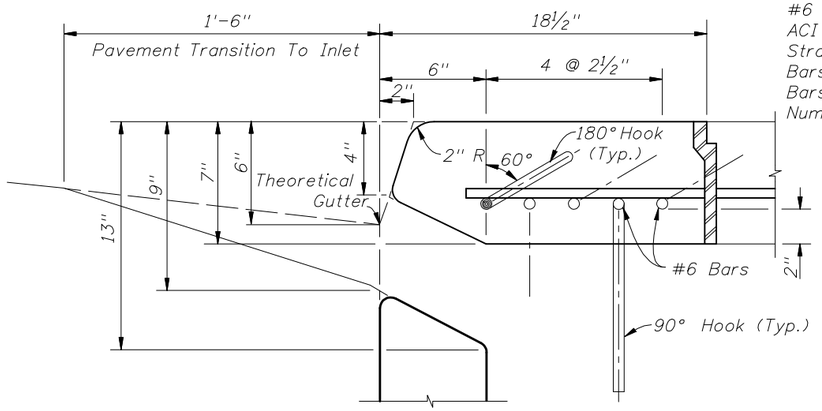
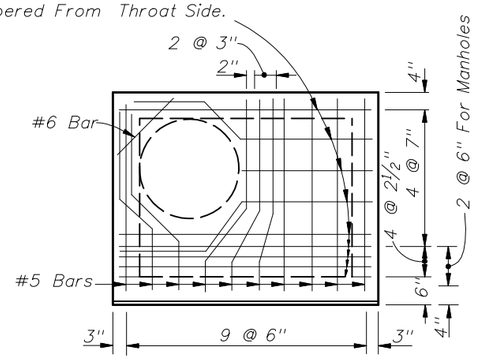


PLAN

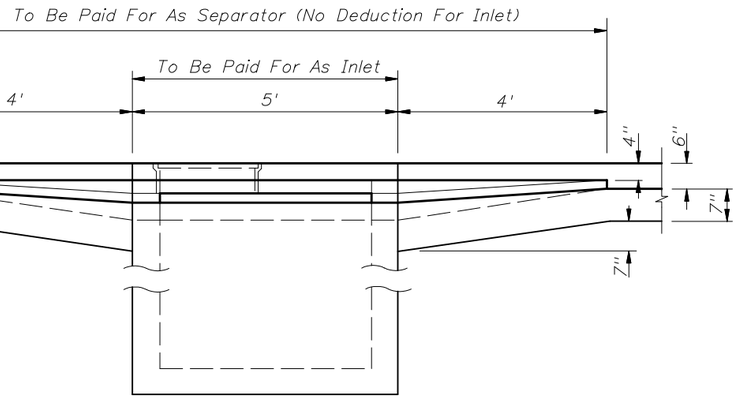


THROAT DETAIL (SECTION AA)

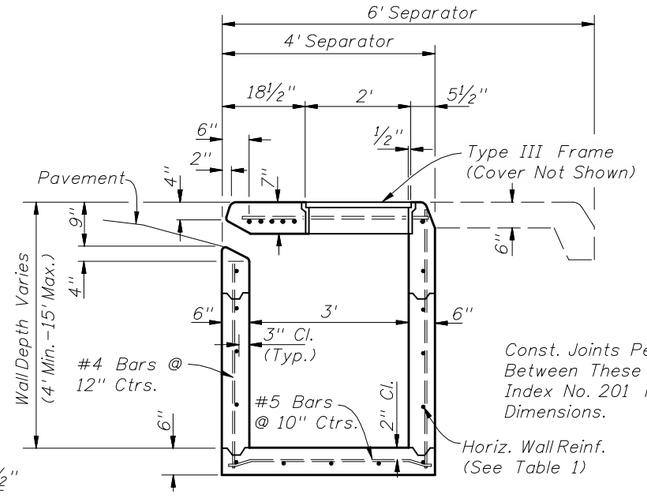
#6 Bars
ACI Std. Hooks Required Each End Of Straight Bars And Right End Of Bent Bars. 180° Hooks, Canted 60°(+), On Odd Bars; 90° Hooks, Down, On Even Bars Numbered From Throat Side.



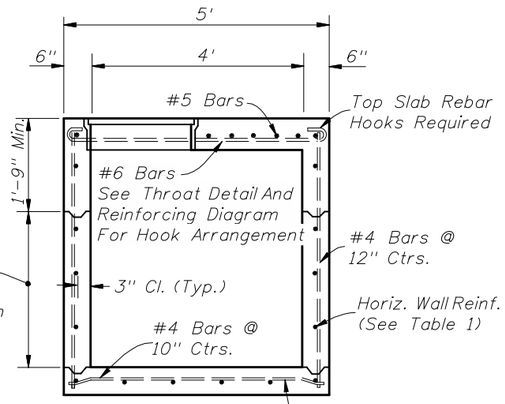
REINFORCING STEEL DIAGRAM
TOP SLAB OF INLET



SECTION CC

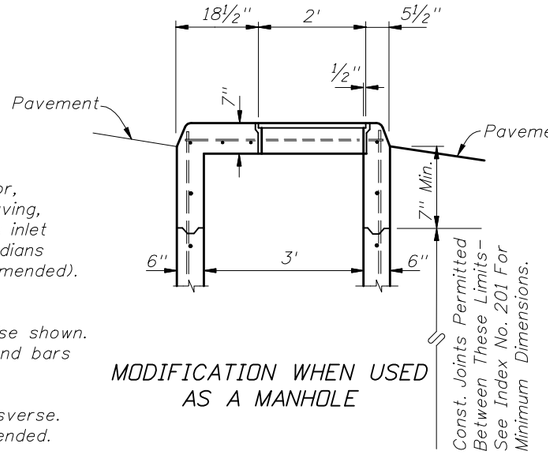


SECTION AA

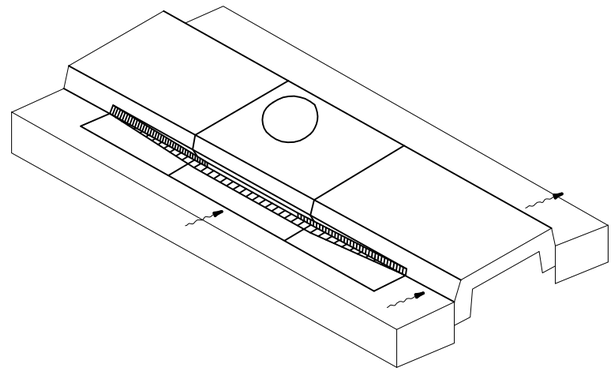


SECTION BB

For Bottom Slab Rebar Embedment Options See Optional Construction Joints, Index No. 201.



MODIFICATION WHEN USED AS A MANHOLE



GENERAL NOTES

1. This inlet is to be used only in Traffic Separators Types IV and V; or, in separators constructed with Curbs Types D and F and sidewalk paving, which cannot accommodate Inlets Types 1, 2, 3, 4, 5 or 6. Use of this inlet on the through traffic side of the separator should be avoided in medians constructed with Curb Type D (Curb inlets Types 9 or 10 are recommended). Locate inlet outside of designated pedestrian travel way.
2. All reinforcing to be Grade 60 bars with 2" min. cover unless otherwise shown. See Index No. 201 for equivalent area of welded wire fabric. Cut or bend bars out of way of pipe when necessary. Bars to clear pipe by 1½".
3. Recommended maximum pipe sizes are 24" longitudinal and 30" transverse. For larger pipe, inlets with Alt. B bottoms, Index No. 200 are recommended.
4. For supplemental details see Index No. 201.
5. All dimensions are for both precast and cast-in-place inlets unless otherwise shown.
6. Inlet to be paid for under the contract unit price for Inlets (Curb) (Type 8), Each.

HORIZONTAL WALL REINFORCING SCHEDULE (TABLE 1)

WALL DEPTH	SCHEDULE	AREA (in.²/ft.)	MAX. SPACING	
			BARS	WWF
0'-6'	A12	0.20	12"	8"
6'-10'	A6	0.20	6"	5"
10'-13'	A4	0.20	4"	3"
10'-15'	B5.5	0.24	5½"	5"

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CURB INLET TYPE 8

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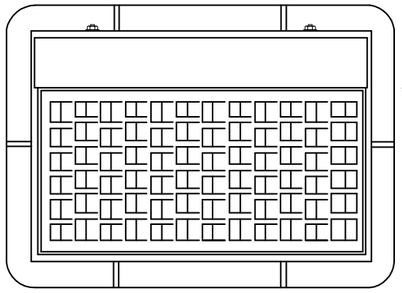
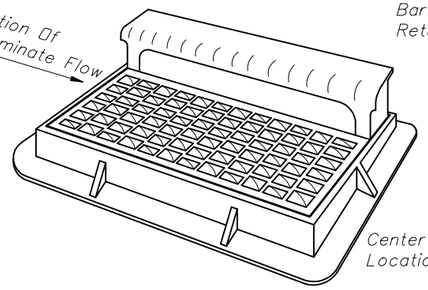
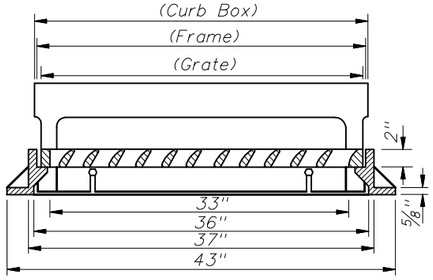
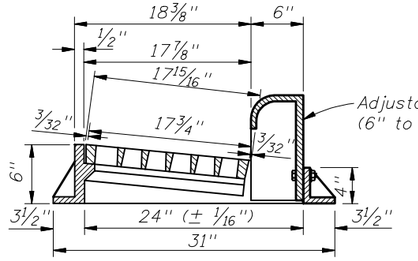


TOP VIEW



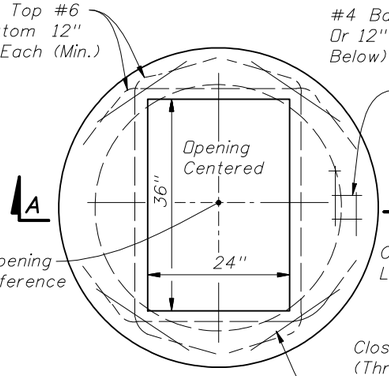


LONGITUDINAL SECTION



TRANSVERSE SECTION

FRAME AND GRATE



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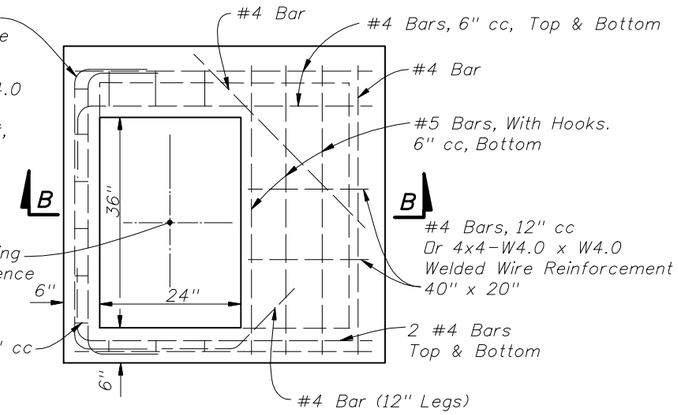

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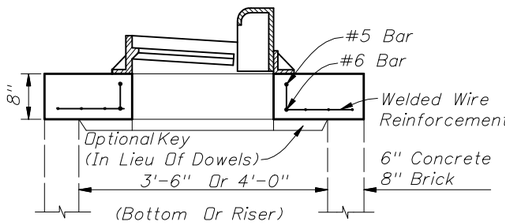
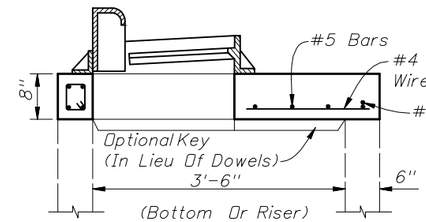
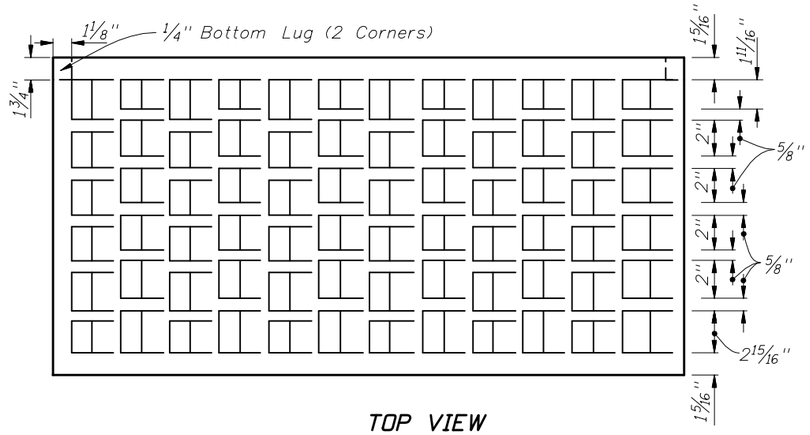


SECTION AA
(SEE NOTE 6 BELOW)



SECTION BB
(SEE NOTE 6 BELOW)



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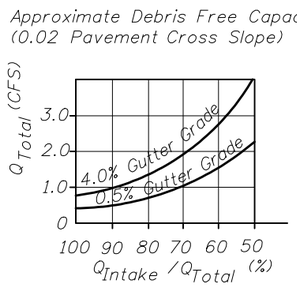
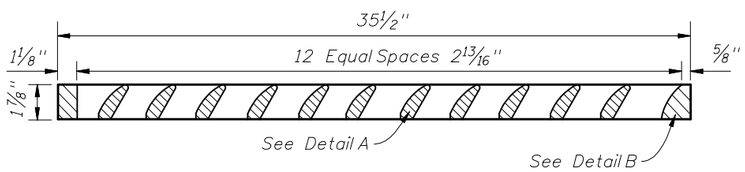
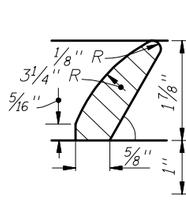


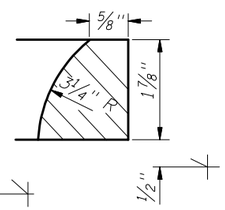
EFFICIENCY CURVE



SECTION



DETAIL A



DETAIL B

GRATE DETAIL

TOP SLABS

GENERAL NOTES

1. This inlet is primarily intended for locations with light to moderate flows where right of way does not permit the use of throated Curb Inlets Types 1 through 6. The typical application is on curb returns to city streets. The inlet grate is suitable for pedestrian and bicycle traffic.
2. This inlet to be located outside of curb ramp area in vertical faced curbs such as Curb and Gutter Type F. Grate shall be oriented with vanes directed toward predominate flow.
3. For structure bottoms see Index No. 200. For supplemental details see Index No. 201.
4. All steel in slab tops shall have 1 1/4" minimum cover unless otherwise shown. Tops shall be either cast-in-place or precast concrete.
5. For Alternate B applications, top slab openings shall be placed such that 2 edges of inlet frame will be located directly above bottom wall or riser wall.
6. When used on a structure with dimensions larger than those detailed above and risers are not applied, the top slab shall be constructed using Index No. 200 with the slab opening adjusted to 24"x36". The "Special Top Slab" on Index No. 200 is not permitted.
7. Frame may be adjusted with one to six courses of brick.
8. Cast iron frame grate and hood to be U.S. Foundry 5130-6016, Neenah Foundry R-3067-L, or approved equal. Inlet and grate detail shown is Neenah R-3067-L. Vaned grates with approximately equal openings will be permitted that satisfy AASHTO HS-20 loading. Grates shall be reversible, right or left.

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CURB INLET TOP TYPE 9

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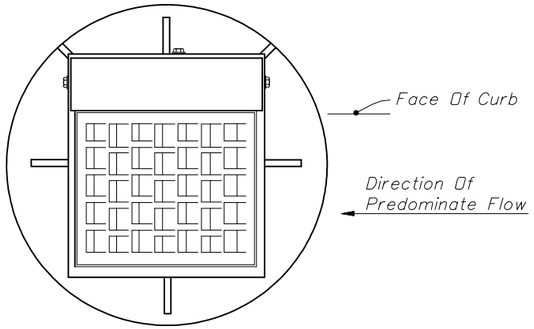
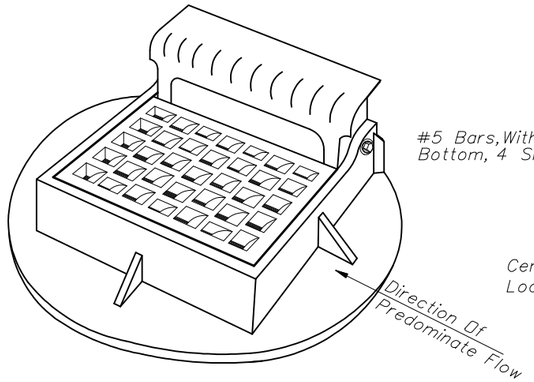
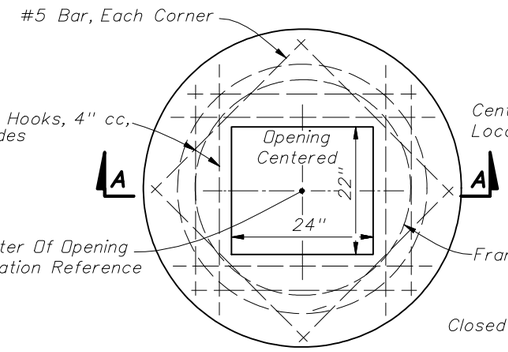
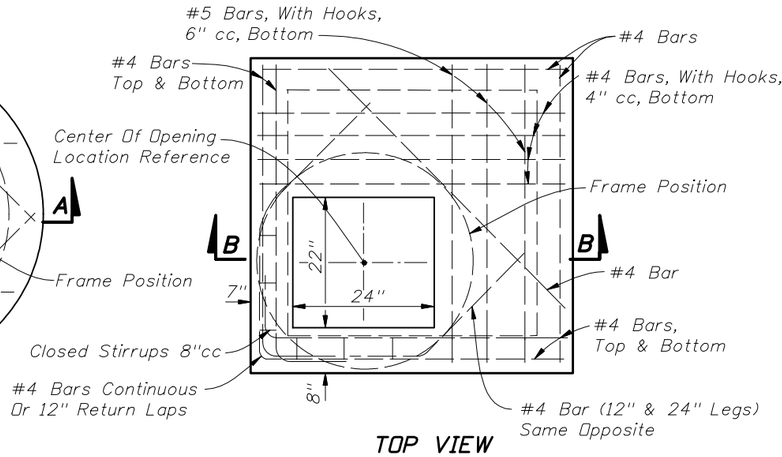


TOP VIEW

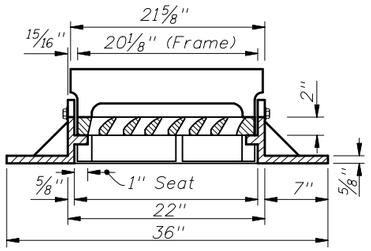




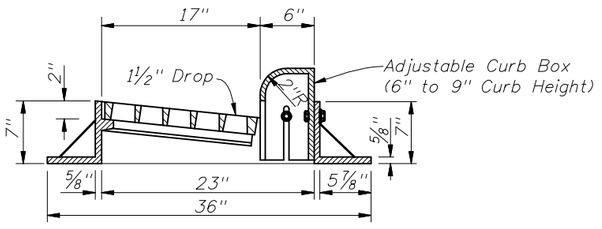
TOP VIEW



TOP VIEW

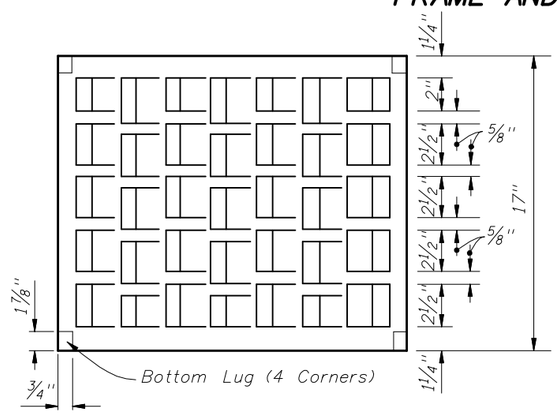


LONGITUDINAL SECTION

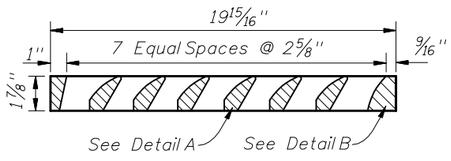


TRANSVERSE SECTION

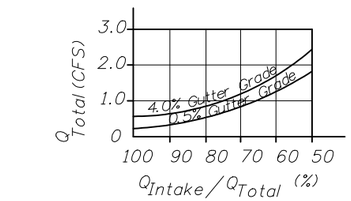
FRAME AND GRATE



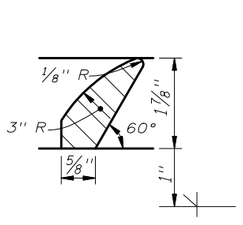
PLAN



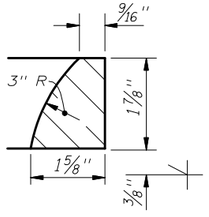
SECTION



EFFICIENCY CURVE

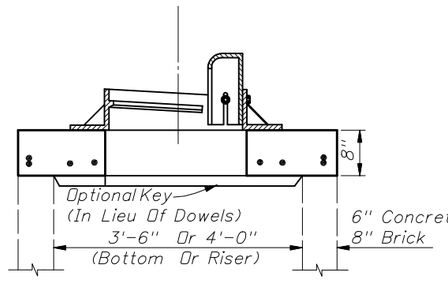


DETAIL A



DETAIL B

GRATE DETAIL



SECTION AA
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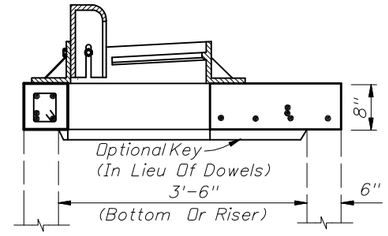

SECTION BB
(SEE NOTE 6 BELOW)

TOP SLABS

GENERAL NOTES

1. This inlet is primarily intended for locations with light flows where right of way does not permit the use of throated Curb Inlets Types 1 through 6. The typical application is on curb returns to city streets. The inlet grate is suitable for pedestrian and bicycle traffic.

2. This inlet to be located outside of curb ramp area in vertical faced curbs such as Curb and Gutter Type F. Grate shall be oriented with vanes directed toward predominate flow.

3. For structure bottoms see Index No. 200. For supplemental details see Index No. 201.

4. All steel in slab tops shall have 1¼" minimum cover unless otherwise shown. Tops shall be either cast-in-place or precast concrete.

5. For Alternate B applications, top slab openings shall be placed such that 2 edges of inlet frame will be located directly above bottom or riser walls.

6. When used on a structure with dimensions larger than those detail above and risers are not applied, the top slab shall be constructed using Index No. 200 with the slab opening adjusted to 24"x36". The "Special Top Slab" on Index No. 200 is not permitted.

7. Frame may be adjusted with one to six courses of brick.

8. Cast iron frame grate and hood to be U.S. Foundry 5161-6019, Neenah Foundry R-3065-L, or approved equal. Inlet and grate detail shown is Neenah R-3065-L. Vaned grates with approximately equal openings will be permitted that satisfy AASHTO HS-20 loading. Grates shall be reversible.

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CURB INLET TOP TYPE 10

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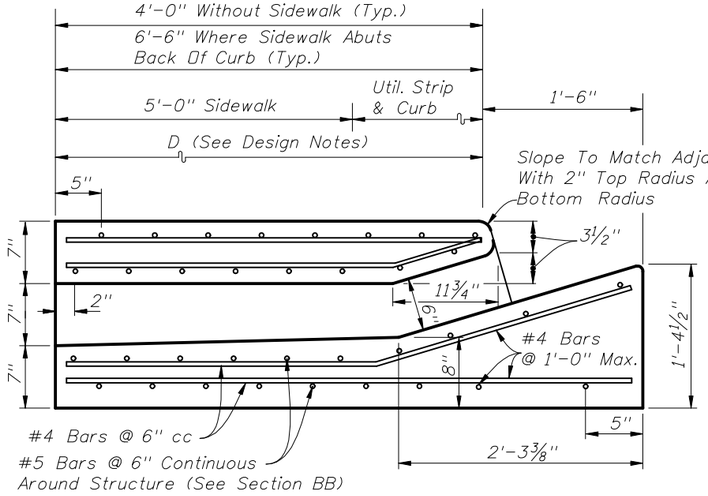
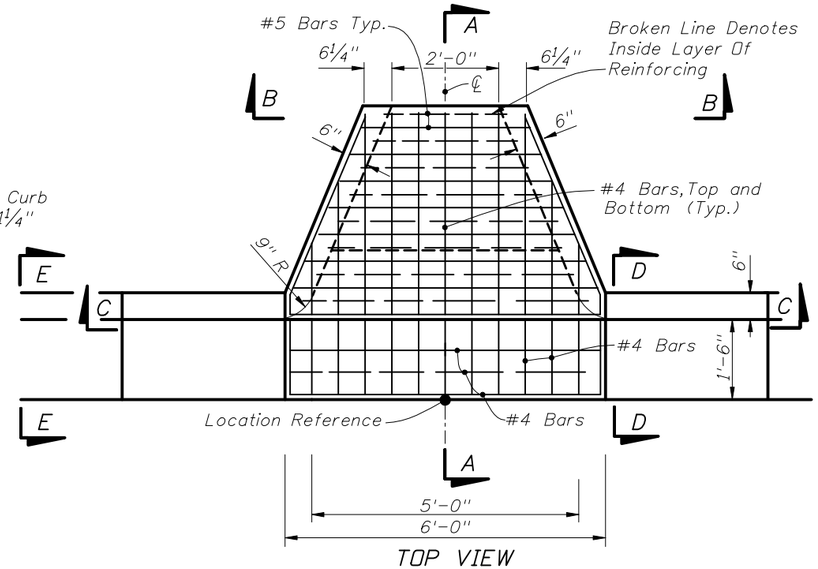
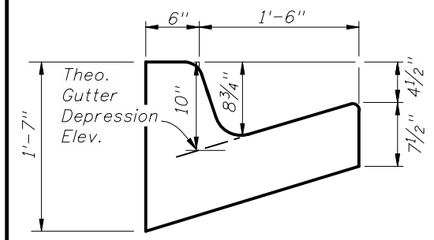


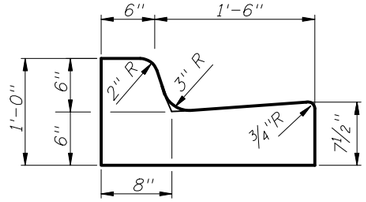
SECTION AA



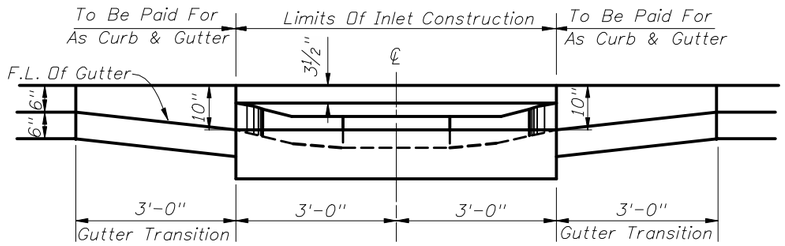
TOP VIEW



SECTION DD



Curb And Gutter Type F
SECTION EE



SECTION CC

SINGLE BARREL FLUME

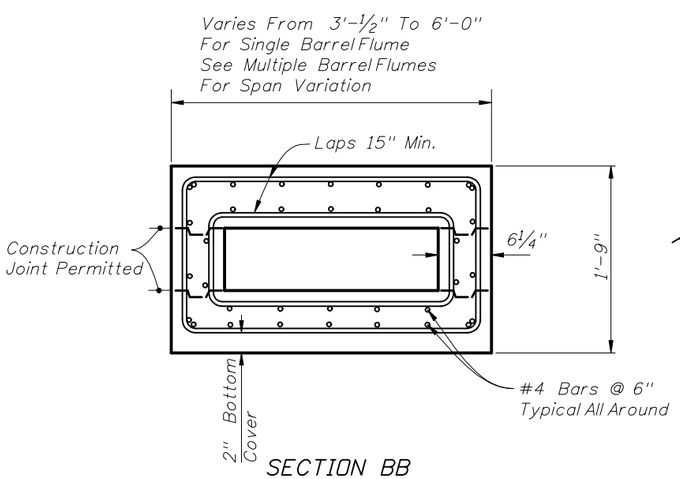
GENERAL NOTES

1. The finished grade and slope of the inlet top are to conform with the finished cross slope and grade of the proposed sidewalk and/or border.
2. When inlets are to be constructed on a curve, refer to the plans to determine the radius and, where necessary, modify the inlet details accordingly. Bend steel when necessary.
3. All steel shall have 1¼" minimum cover unless otherwise shown. Inlets can be either cast-in-place or precast concrete. Chamfer all exposed edges ¾".
4. All reinforcement is ASTM A615/A615M Grade 60 steel, either smooth or deformed. Equivalent area grade 40 steel or 65 ksi welded wire fabric may be substituted.
5. Inlets to be paid for under the contract unit price for Inlets (Closed Flume) EA.

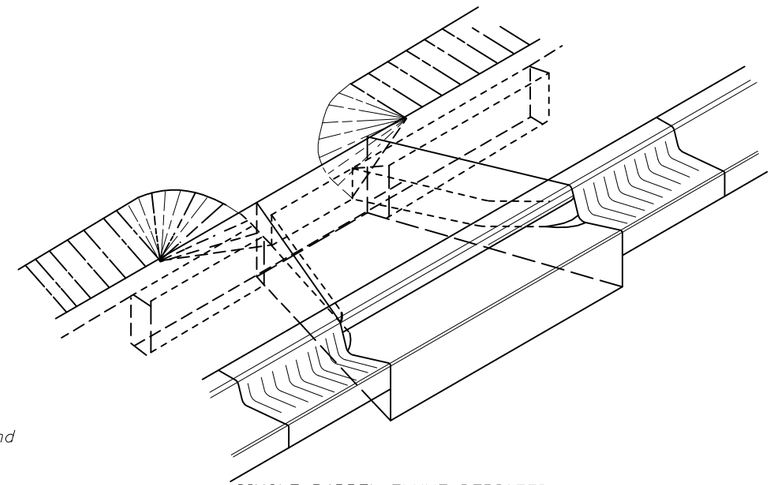
DESIGN NOTES

1. These inlets are designed for use with Type F curb and gutter only. Locate inlet outside of curb ramp area.

   The Single Barrel Flume is intended for locations with light to moderate flows. Multiple Barrel Flumes must be selected to meet design heavy flows.
2. Designer must specify Flume Type, "D" dimension, number of barrels and guiderail requirements in plans.
3. Designer must specify where energy dissipating bricks are required.

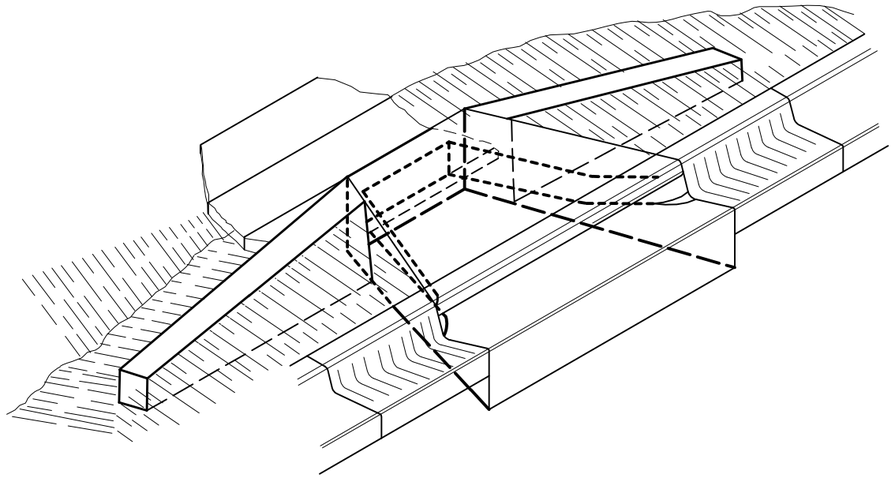


SECTION BB



SINGLE BARREL FLUME DEPICTED

FLUME W/SIDEWALK INLET (CLOSED FLUME) TYPE I



SINGLE BARREL FLUME DEPICTED

FLUME W/O SIDEWALK INLET (CLOSED FLUME) TYPE II

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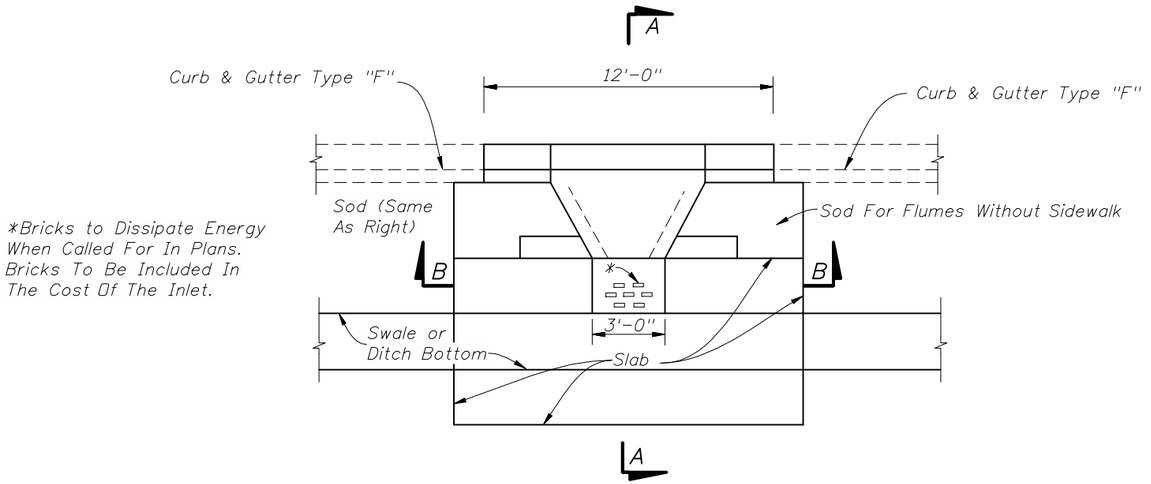
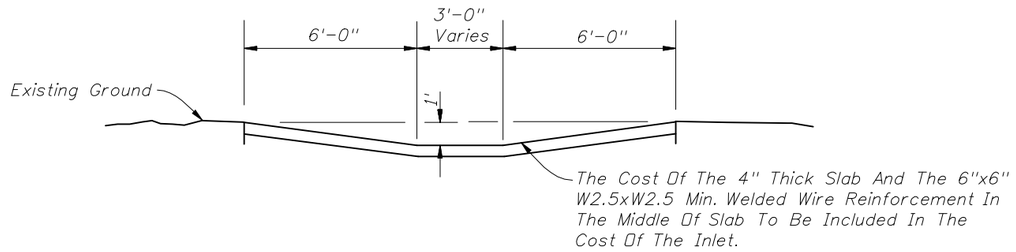


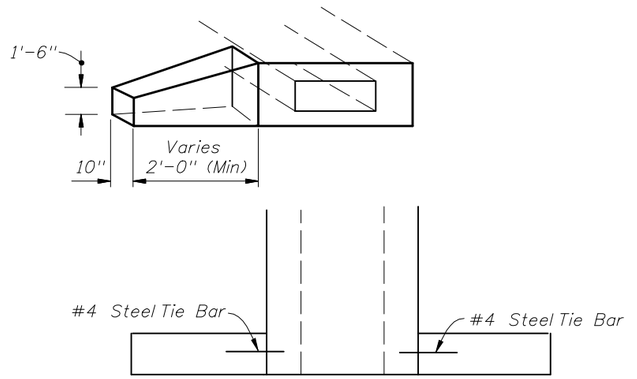
SINGLE BARREL FLUME DEPICTED

PLAN



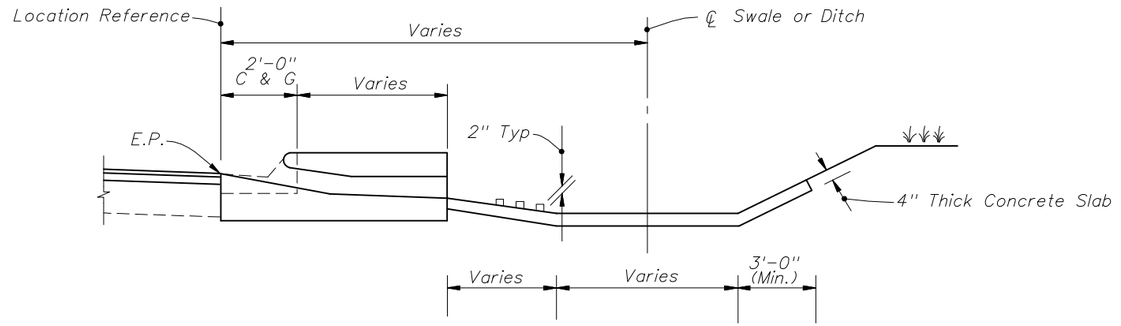
SINGLE BARREL FLUME DEPICTED

SECTION BB



SINGLE BARREL FLUME DEPICTED

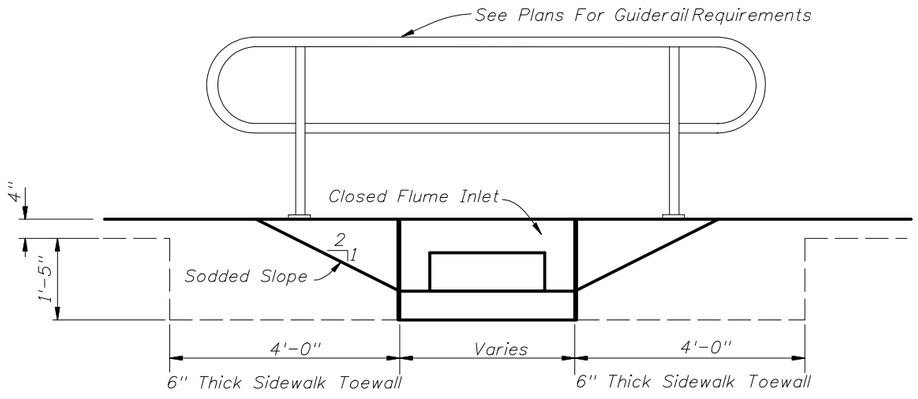
ENDWALL



Ditch Pavement To Be Adjusted When Inlet Present

SECTION AA

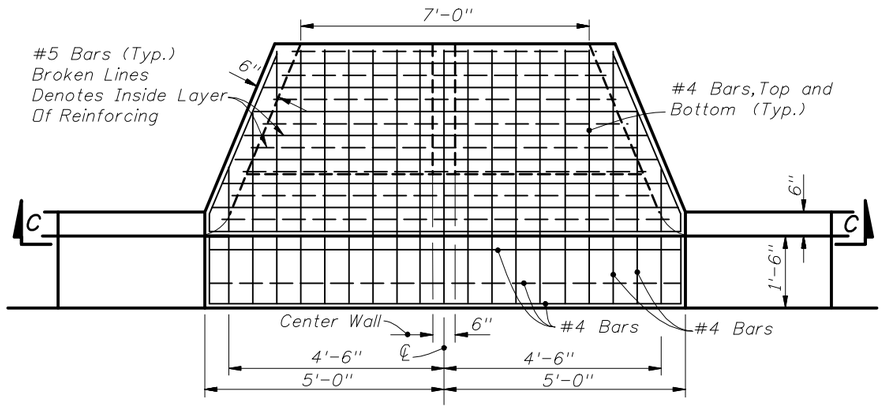
SLOPES, DITCH APRON AND ENDWALLS



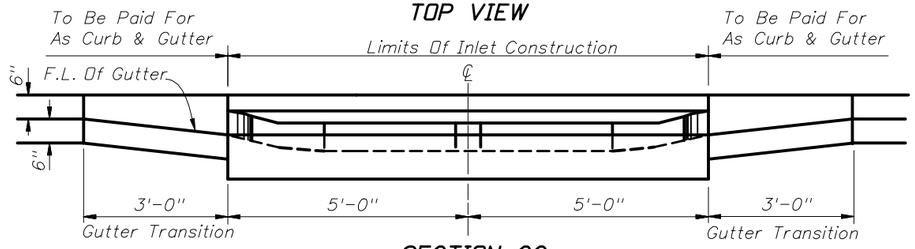
SINGLE BARREL FLUME DEPICTED

ELEVATION

GUIDERAIL FOR FLUME IN SIDEWALK

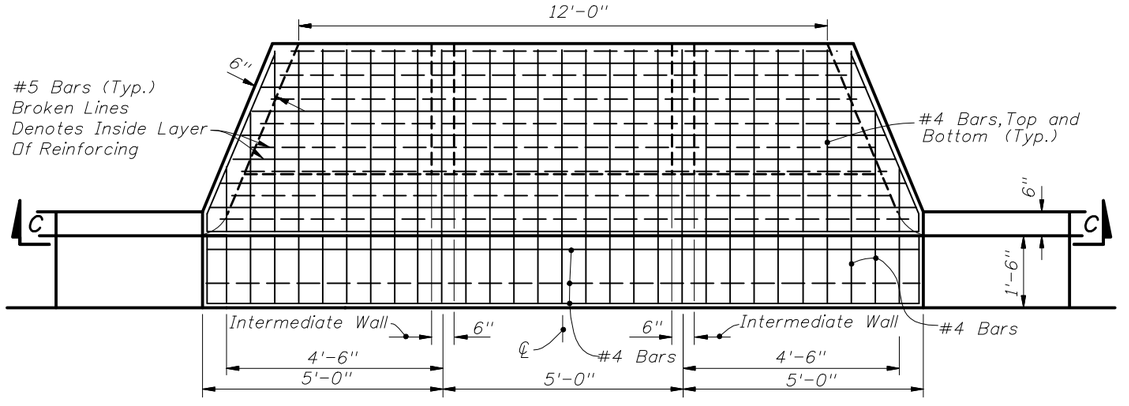


TOP VIEW

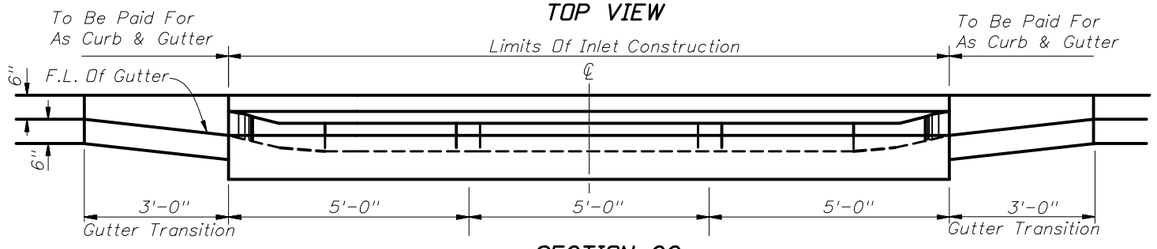


SECTION CC

DOUBLE BARREL FLUME

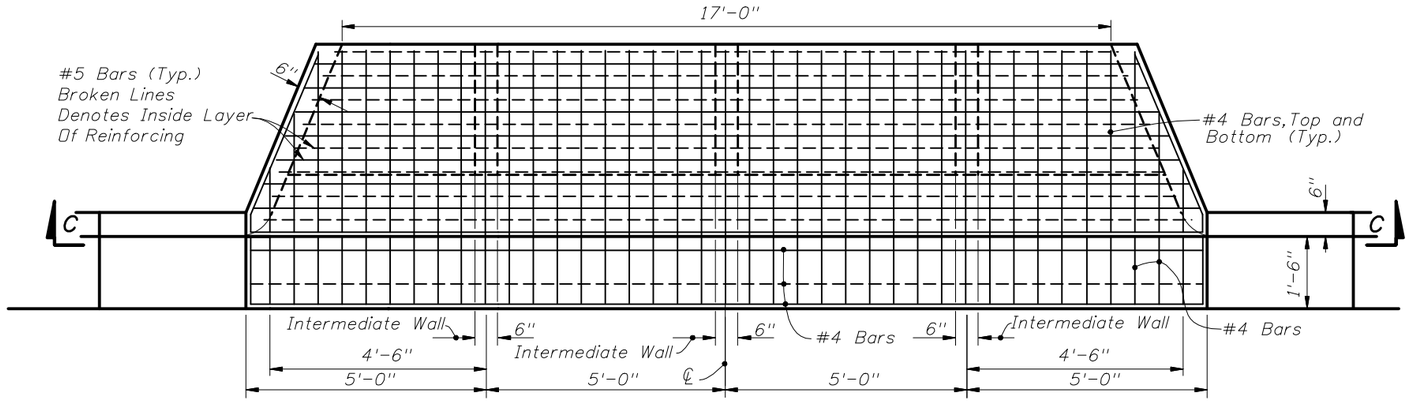


TOP VIEW

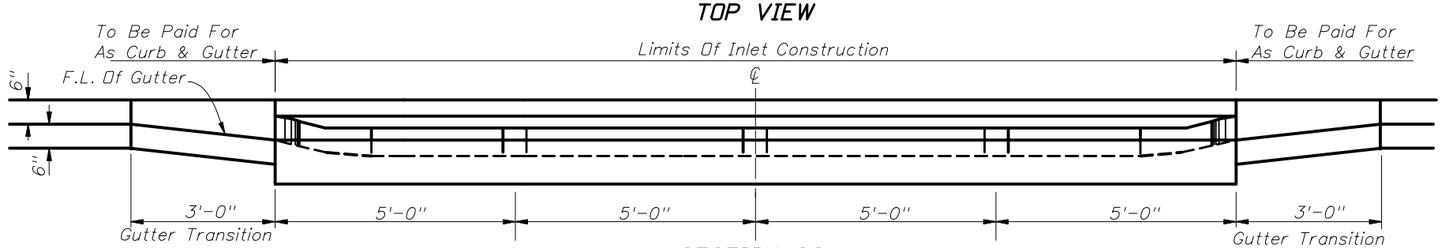


SECTION CC

TRIPLE BARREL FLUME

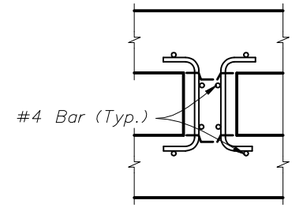


TOP VIEW



SECTION CC

QUADRUPLE BARREL FLUME



INTER-WALL REINFORCING

NOTE: See Single Barrel Flume For Base Dimensions.

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CLOSED FLUME INLET

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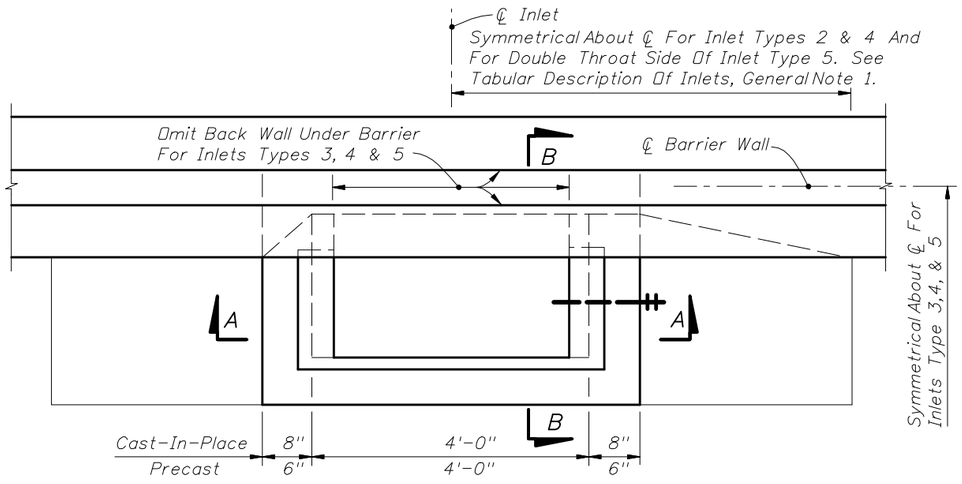
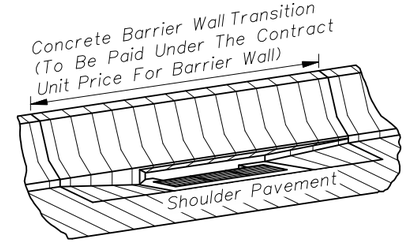


PLAN (INLETS TYPES 1 THRU 5)

GRATE SLOPE & DROP HEIGHT				
Shoulder Slope	Grate Slope Rate	Drop Height CIPL	Drop Height Precast	Remarks
0.03	1:6	1 3/16"	1 5/16"	Std. Median Concrete Shoulder
0.05	1:6	1 1/16"	7/8"	Std. Median Flexible Shoulder
0.06	1:6	13/16"	5/8"	
0.07	1:5	1 5/8"	1 3/8"	
0.08	1:5	1 3/8"	1 3/16"	
0.09	1:5	1 1/8"	15/16"	
0.10	1:5	7/8"	11/16"	e (max)

HORIZONTAL WALL REINFORCING SCHEDULE (TABLE 1)

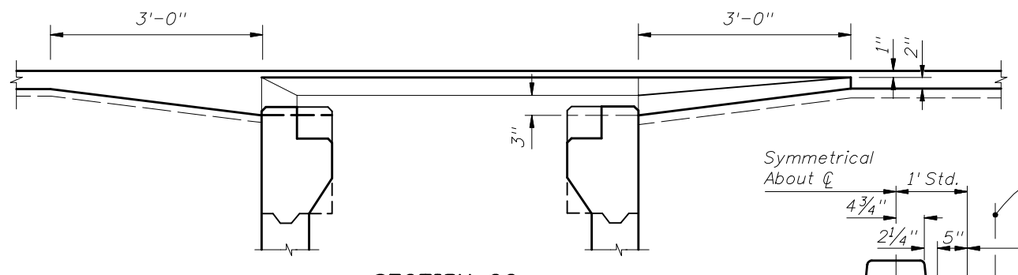
WALL DEPTH	SCHEDULE	AREA (in.²/ft.)	MAX. SPACING BARS	MAX. SPACING WWF
0'-3'	A12	0.20	12"	8"
3'-6'	A6	0.20	6"	5"
6'-9'	B5.5	0.24	5 1/2"	5"
9'-15'	C6.5	0.37	6 1/2"	6"



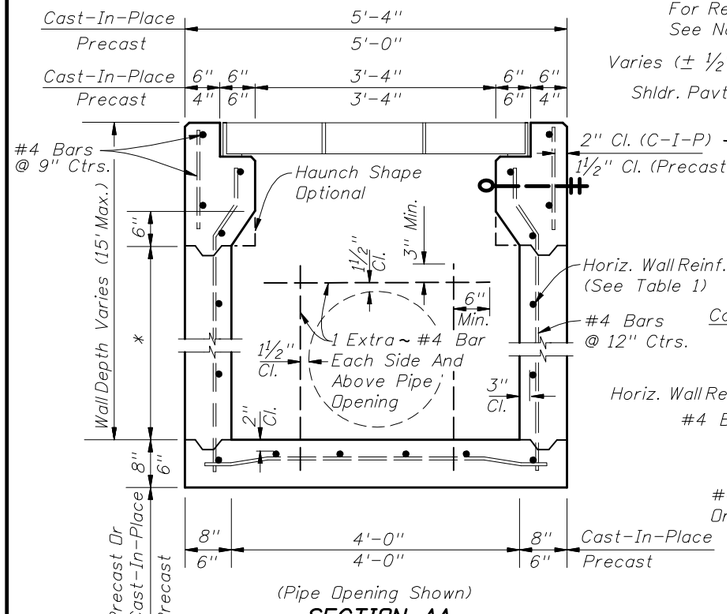
PICTORIAL VIEW (TYPE I SHOWN)

GENERAL NOTES

1. Inlet Descriptions:
   - Type 1 Single throat, one side of barrier wall.
   - Type 2 Double throats, one side of barrier wall.
   - Type 3 Two single throats, opposite side of barrier wall.
   - Type 4 Two double throats, opposite sides of barrier wall.
   - Type 5 Double throats, one side of barrier wall, and single throat other side of barrier wall.
2. For grate details see Index No. 220. The parallel bar grate shall be used unless the reticuline grate is called for in the plans. The reticulinegrate shall be specified where bicycle traffic is anticipated. Not suitable for pedestrian traffic.
3. All exposed edges and corners shall be 3/4" chamfer or tooled to 1/4" radius.
4. For standard concrete barrier wall dimensions, and for dimensions of concrete barrier wall incorporating light standards within the wall, see Index No. 410.
5. Reinforcing steel shall have 2" minimum cover.Horizontal wall reinforcing must be positioned 3" from the inside face unless otherwise shown.
6. All reinforcing is Grade 60 #4 bars. See Index No. 201 for equivalent area of welded wire fabric for inlet. Longitudinal steel bars extend over full length of concrete barrier wall transition. Tie bars @ 12" ctrs. Reinforcing to be paid for under the contract unit price for Concrete Barrier Wall. LF.
7. For supplemental details see Index No. 201.
8. All dimensions are for both precast and cast-in-place inlets unless otherwise noted.
9. Inlets to be paid for under the contract unit price for Inlets (Median Barrier Type_), EA. Barrier wall to be paid for under the contract unit price for Concrete Barrier Wall, LF.



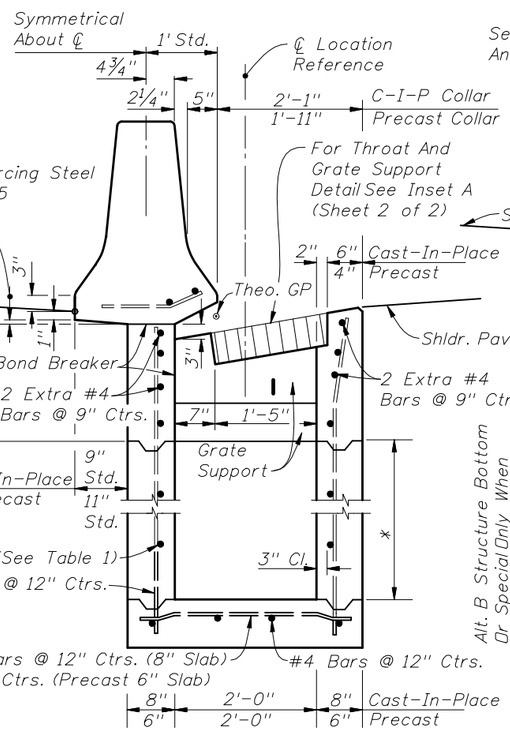
SECTION CC



(Pipe Opening Shown)

SECTION AA

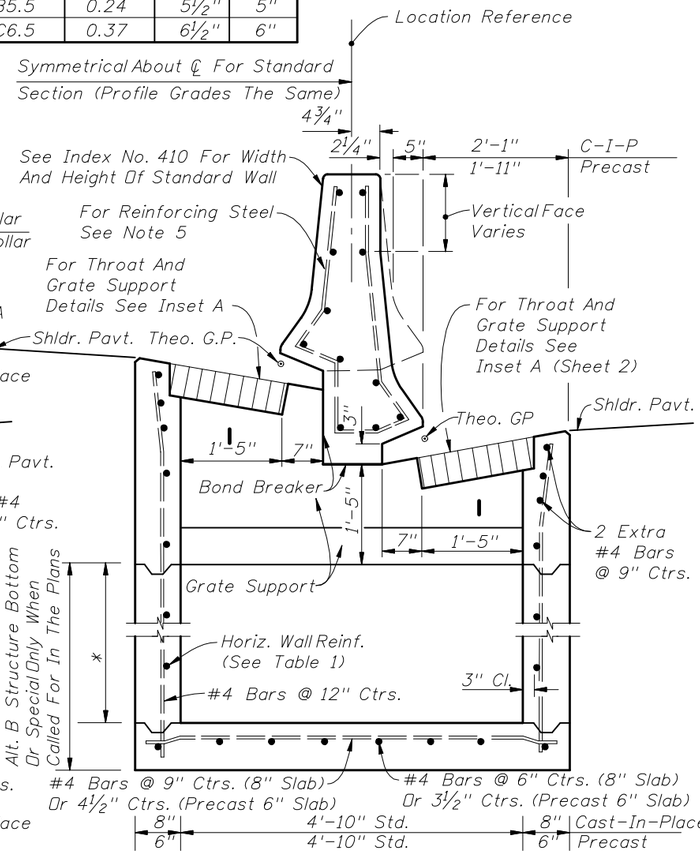
*Const. Joint Permitted Between These Limits
See Index No. 201 For Min. Dimensions



SECTION FOR INLETS TYPES 1 & 2

(Pipe Opening Not Shown)

SECTION BB



SECTION FOR INLETS TYPES 3, 4 & 5
(NON-SYMMETRICAL SECTION SHOWN)

2010 FDOT Design Standards

MEDIAN BARRIER INLETS TYPES 1, 2, 3, 4 & 5

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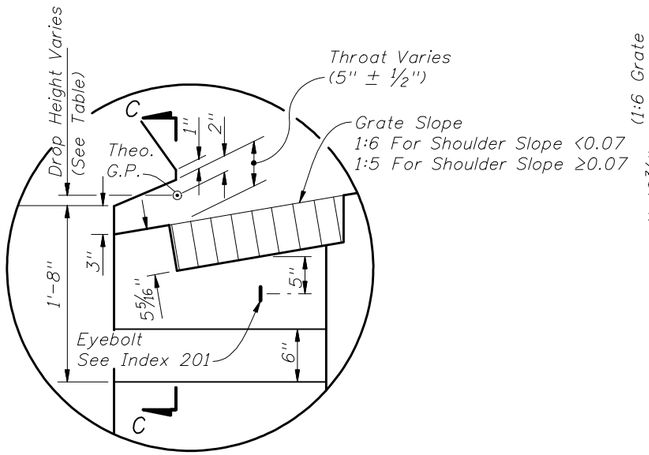
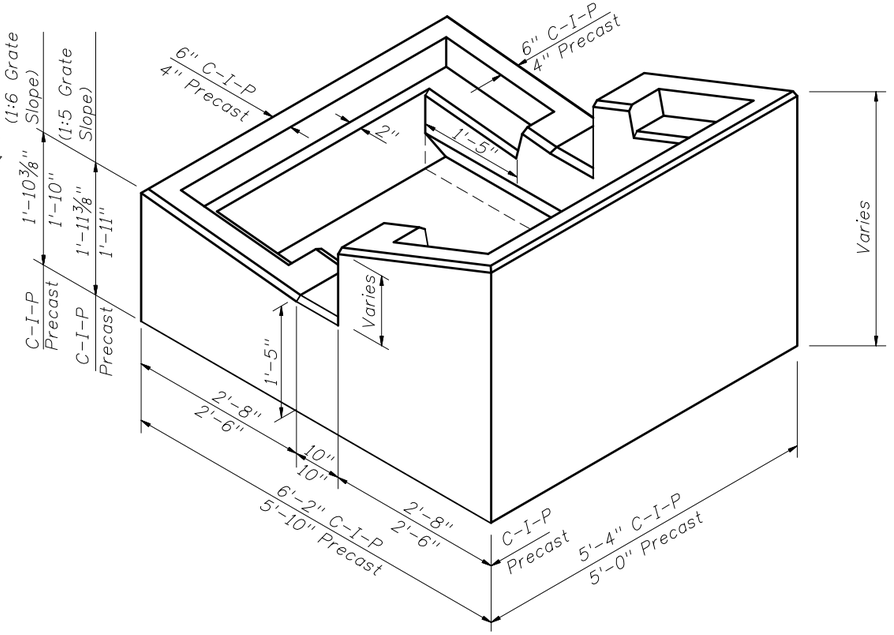
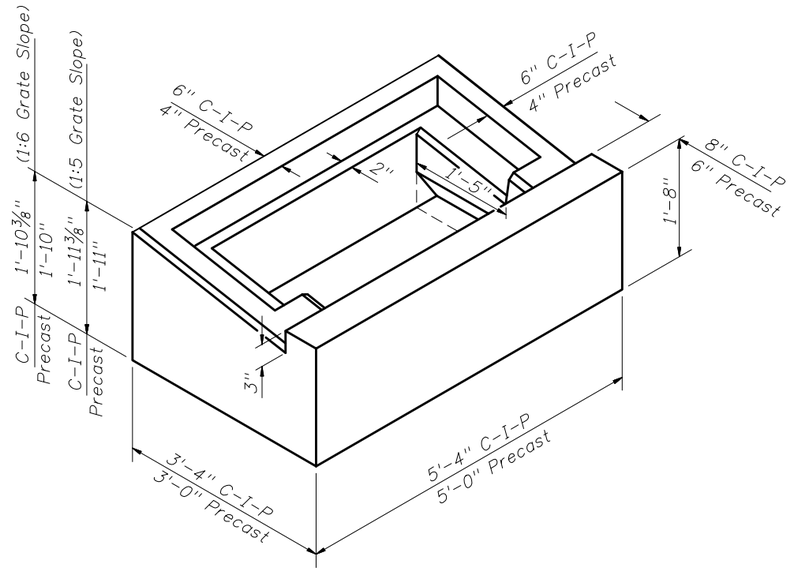


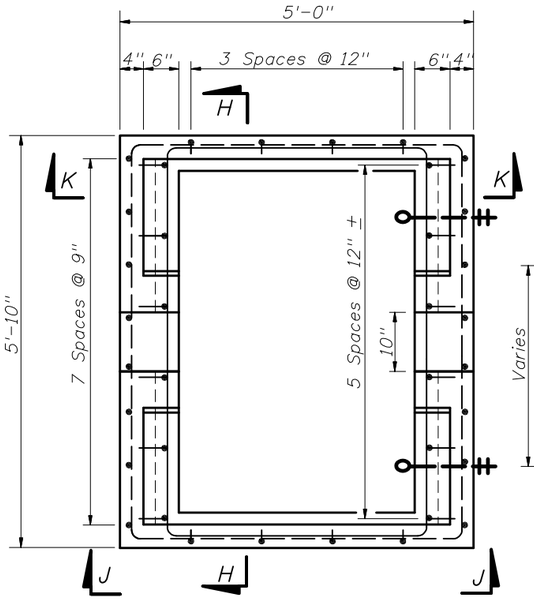
INSET A



PICTORIAL VIEW OF INLET COLLAR (TYPES 3, 4, & 5)

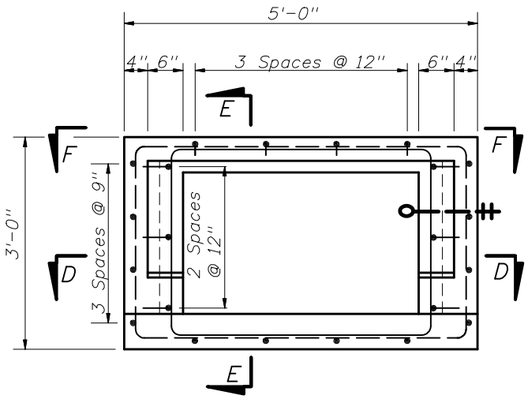


PICTORIAL VIEW OF INLET COLLAR (TYPES 1 & 2)

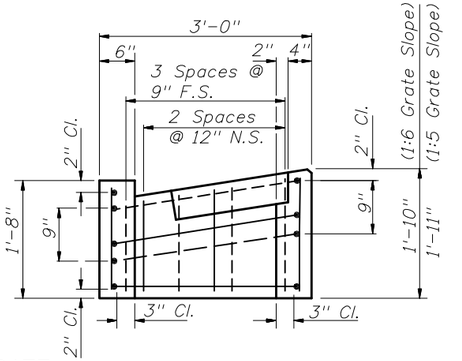


TOP VIEW OF INLET COLLAR WITHOUT GRATE

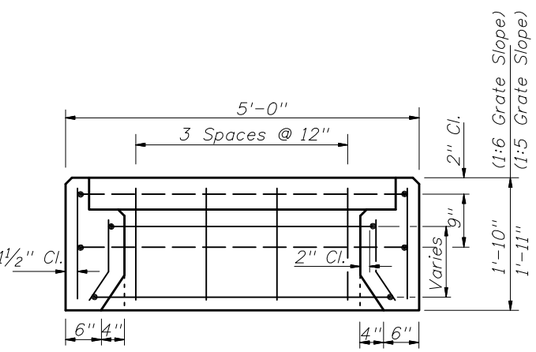
SECTION HH



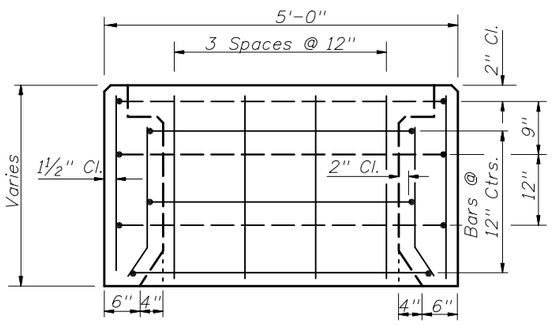
TOP VIEW OF INLET COLLAR WITHOUT GRATE



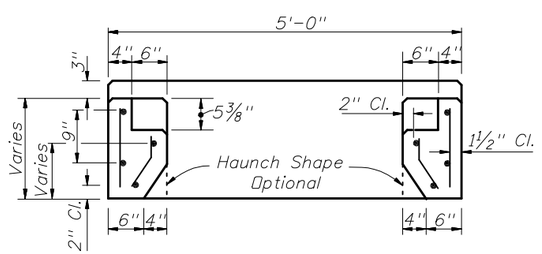
SECTION EE



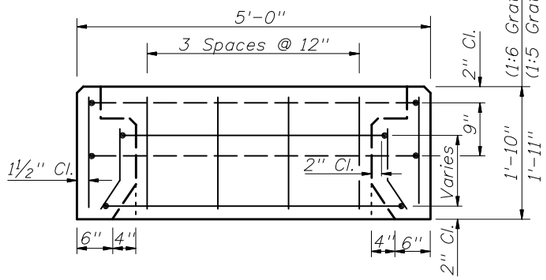
VIEW KK



VIEW JJ



SECTION DD



VIEW FF

PRECAST COLLAR REINFORCING DETAILS (TYPES 1 & 2)
(C-I-P COLLAR REINFORCING DETAILS SIMILAR)

PRECAST COLLAR REINFORCING DETAILS (TYPES 3, 4 & 5)
(C-I-P COLLAR REINFORCING DETAILS SIMILAR)

2010 FDOT Design Standards

MEDIAN BARRIER INLETS
TYPES 1, 2, 3, 4 & 5

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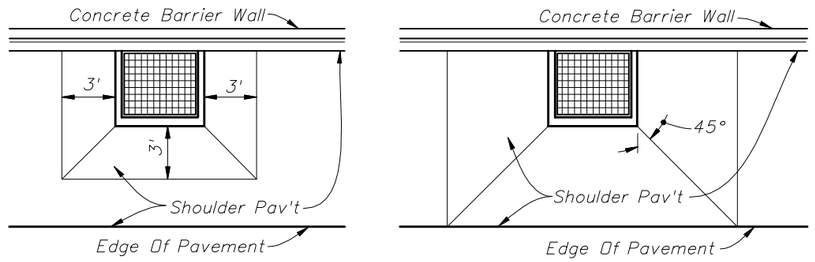
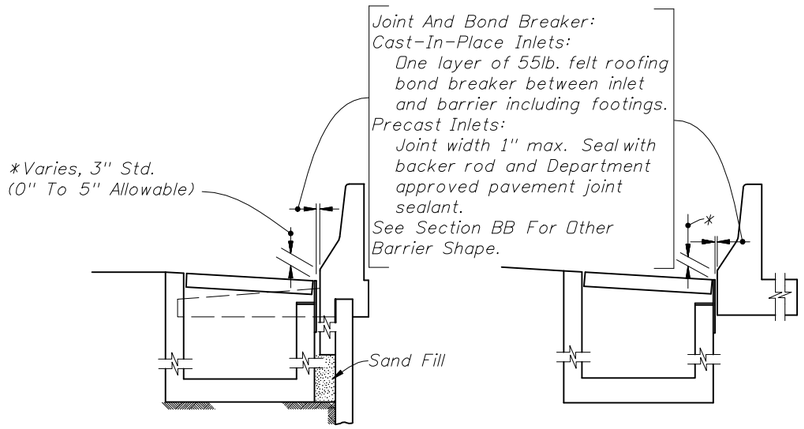


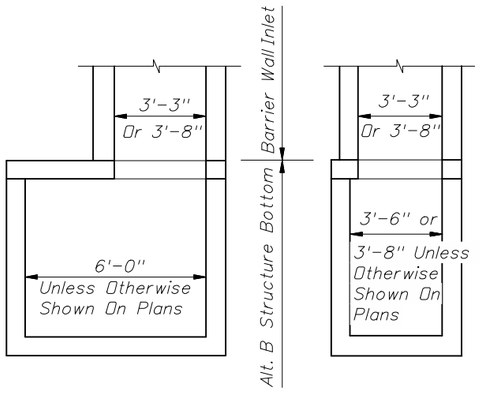
LOW SIDE SUPERELEVATION HIGH SIDE TRANSITION

PAVEMENT WARP FOR SHOULDERS IN SUPERELEVATION



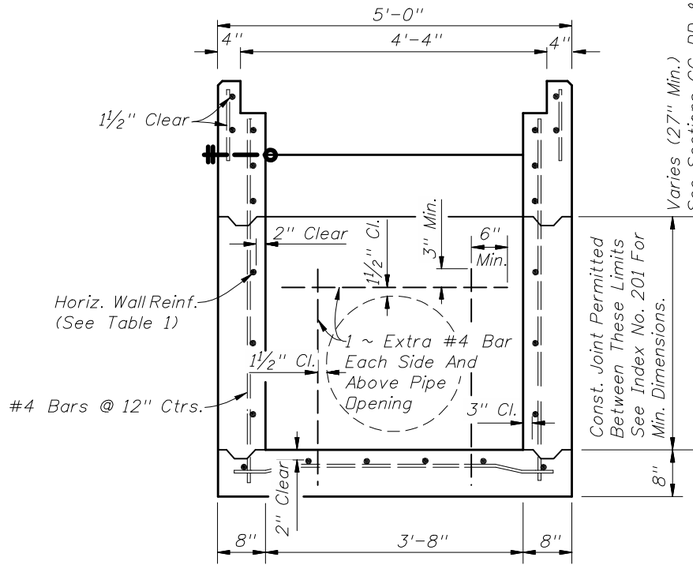
BARRIER WALL / RETAINING WALL SINGLE FACE ROADWAY BARRIER

INLET SECTION AT WALLS



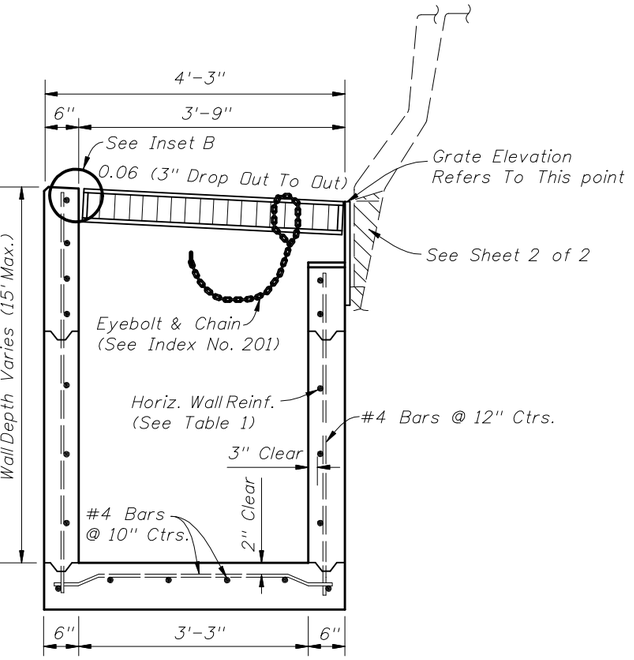
Note: Alt. B Structure Bottom Only. See Index No. 200.

INLET WITH STRUCTURE BOTTOM



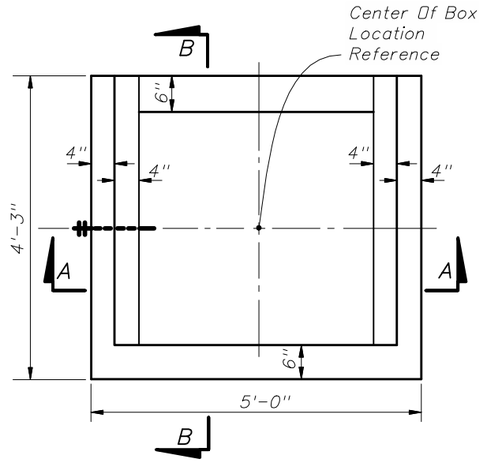
(Pipe Opening Shown)

SECTION AA (WITHOUT GRATE)



(Pipe Opening Not Shown)

SECTION BB



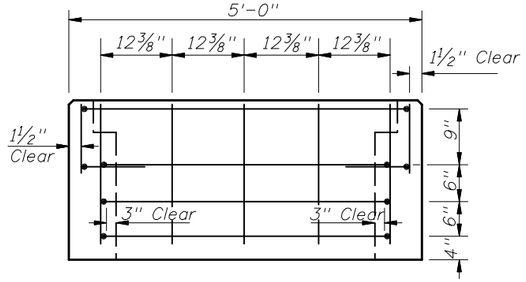
TOP VIEW (WITHOUT GRATE)

GENERAL NOTES

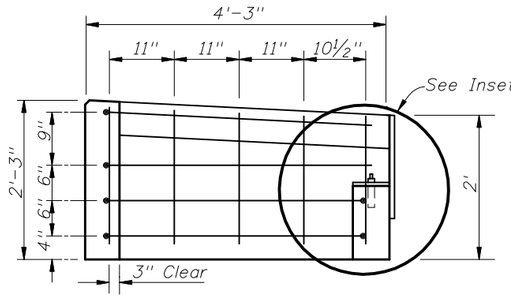
1. This inlet is primarily intended for use adjacent to concrete barrier walls on paved shoulders. Use of the inlet adjacent to other wall types shall be approved by the Drainage Engineer. The inlet is suitable for bicycle and occasional pedestrian traffic, but should not be placed in a designated pedestrian travel way. It is not intended for use in curb and gutter or other areas where throated inlets are required, nor areas subject to high debris.
2. Inlets located in embankments constructed with earth anchored retaining wall shall be designed with minimum depths to reduce adverse impact on the anchorage system. Runs of pipe parallel to and near anchored wall shall be avoided wherever practical. Special coordination must be exercised during the design and construction of storm water systems within anchored wall systems.
3. Inlet bottoms and/or tops may be either precast or cast-in-place. Whether cast as a single unit or as multiple segments, and whether precast or cast-in-place, the upper 2'-3" of the inlet shall be reinforced in accordance with sections CC, DD and EE.
4. All exposed edges and corners shall be ¾" chamfer or tooled to ¼" radius.
5. When Alternate G grate is specified in the plans, the grate is to be hot-dip galvanized after fabrication. Field installation of the filler bar called for in Inset B will not be permitted, thereby requiring tolerance adjustment during fabrication and/or casting, or, matching grate to structure prior to galvanizing.
6. All reinforcing is Grade 60 bars. See Index No. 201 for equivalent area of welded wire fabric.
7. All dimensions are for both precast and cast-in-place inlets unless otherwise noted.
8. For supplemental details see Index Nos. 200 and 201.
9. Inlets to be paid for under the contract unit for Inlets (Barrier Wall), Each.

HORIZONTAL WALL REINFORCING SCHEDULE (TABLE 1)

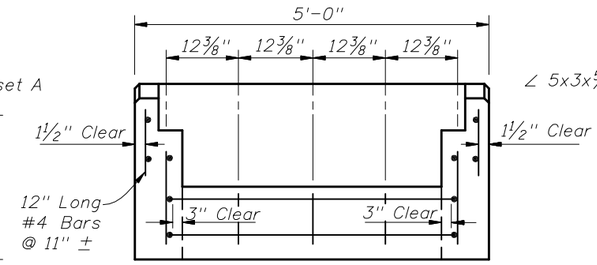
WALL DEPTH	SCHEDULE	AREA (in.²/ft.)	MAX. SPACING	
			BARS	WWF
0'-5'	A12	0.20	12"	8"
5'-10'	A6	0.20	6"	5"
10'-15'	A4	0.20	4"	3"
10'-15'	B5.5	0.24	5½"	5"



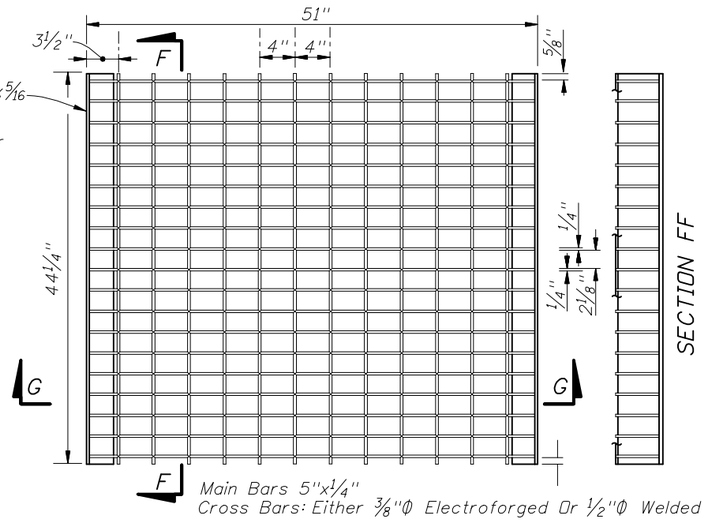
SECTION CC



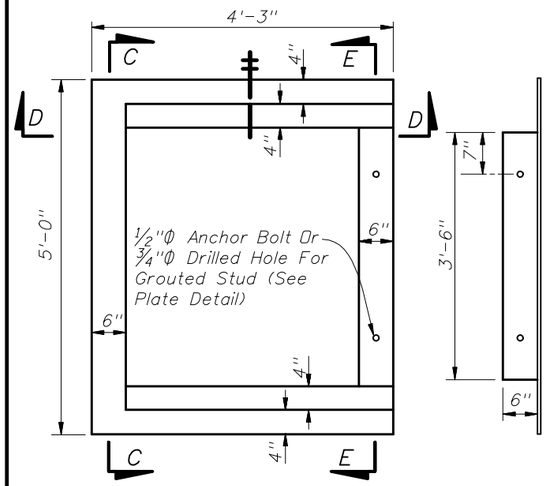
SECTION DD



SECTION EE

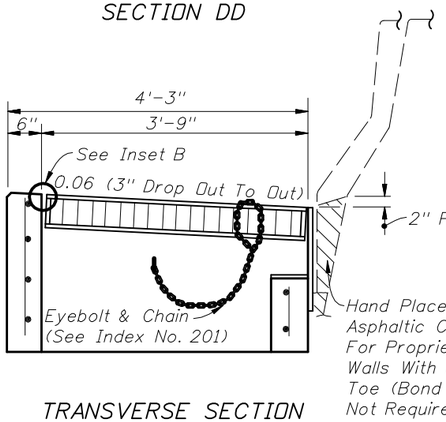


TOP VIEW

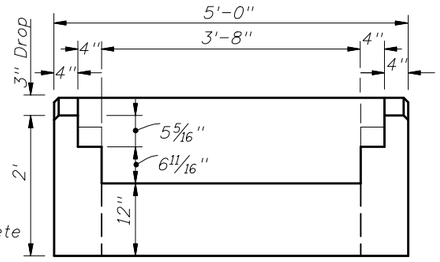


TOP VIEW OF INLET WITHOUT GRATE

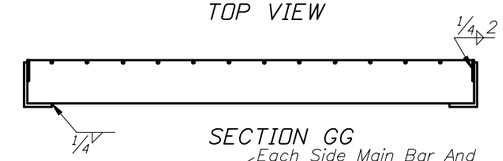
TOP VIEW OF METAL PLATE



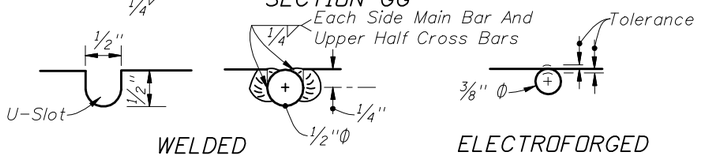
TRANSVERSE SECTION WITH GRATE & PLATE



BACK VIEW WITHOUT BACK PLATE



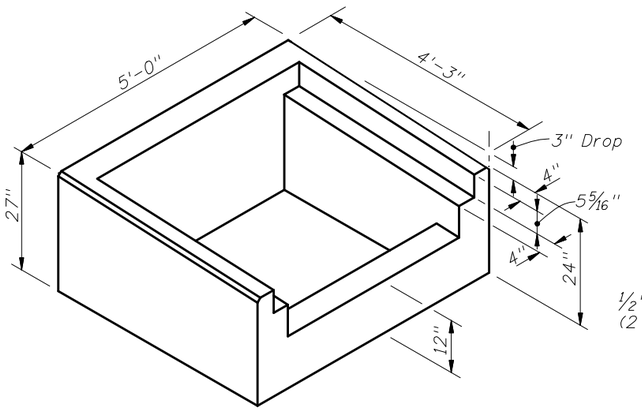
SECTION GG



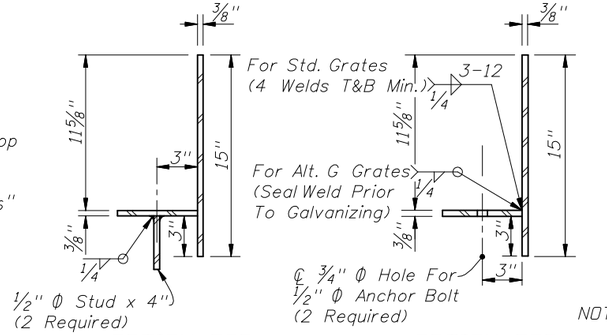
WELDED ELECTROFORGED

CROSS BAR OPTIONS

STEEL GRATE



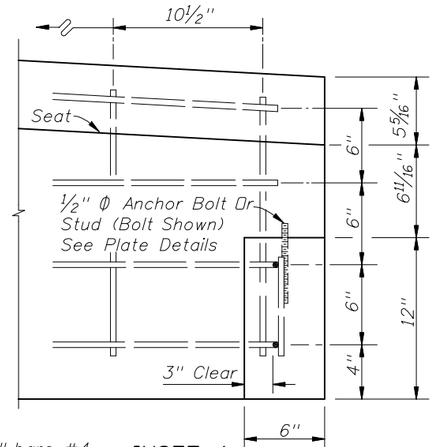
PICTORIAL VIEW OF INLET COLLAR



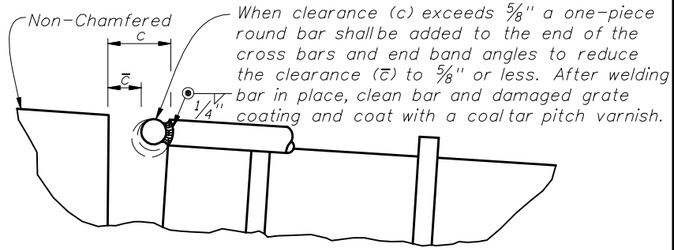
OPTION FOR GROUT STUD

OPTION FOR ANCHOR BOLT

TRANSVERSE SECTIONS THRU BACKWALL PLATE



INSET A



INSET B

NOTES:

1. All bars #4.
2. Anchor bolts shall be either ASTM A307 hex head bolts cast-in-place, or ASTM A36 or F1554 (Grade 36) galvanized fully threaded rod, adhesive bonded anchors installed in accordance with Specification Section 416. Bolts or rods shall be 6" long (4" min. embedment) with one heavy hex head nut (ASTM 194 or A563) and one flat washer (ASTM F436) each. All anchor bolts, nuts and washers shall be hot-dip galvanized.

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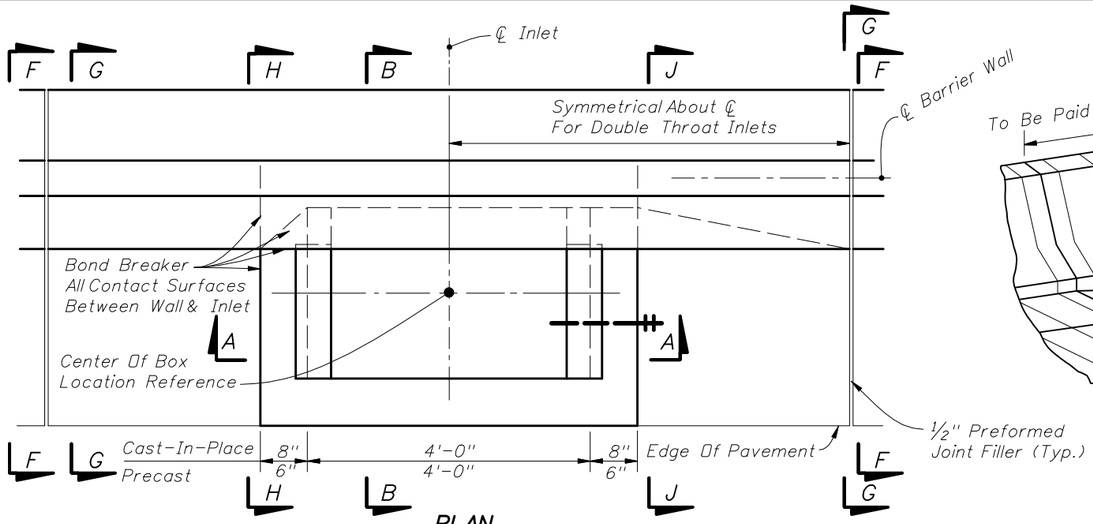
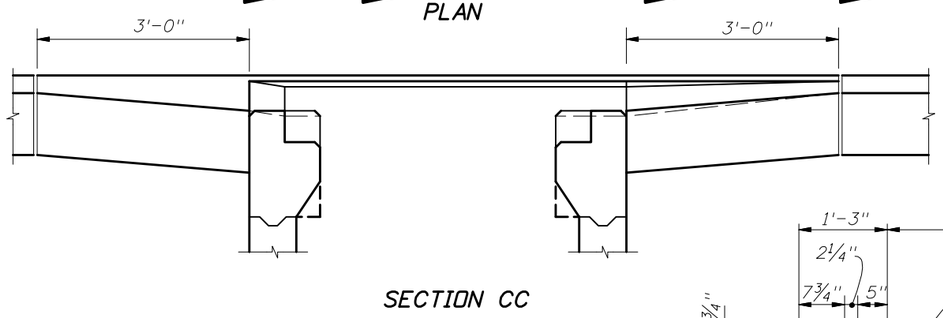
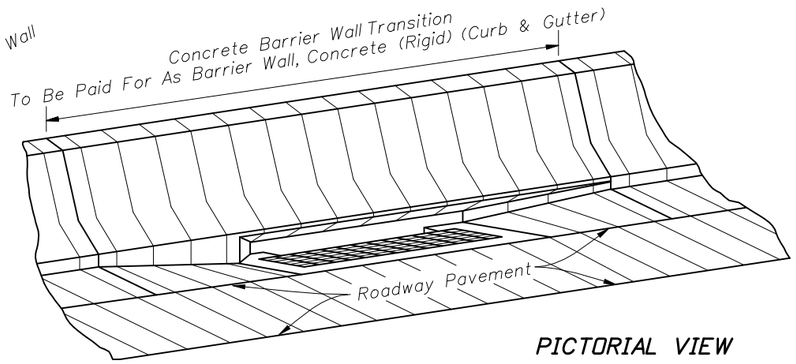
	BARRIER WALL INLET		Index No. 218



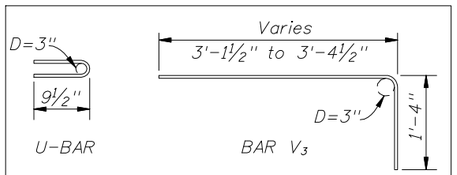
PLAN



SECTION CC



PICTORIAL VIEW



BENDING DIAGRAM

Bars L_1 : Length 11'-1", Straight

Bars L_2 :
Length 8'-4" (Single Throat)
11'-0" (Double Throat)

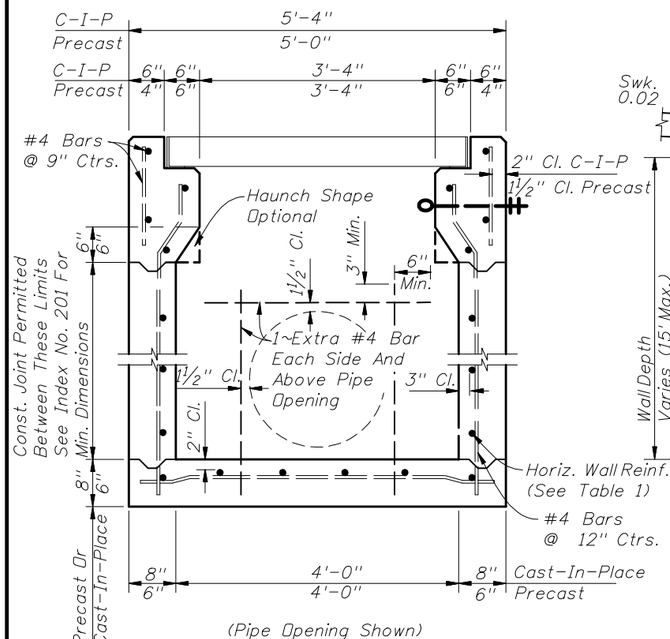
Bars L_3 & L_4 : Length 11'-1"
Field Bend For 4" Drop (Top Bars)
3" Drop (Bottom Bars)

Bars L_5 : Length 2'-8"
Field Bend For Drop Same As L_3 & L_4

Bars V_1 : 18" Ctrs., Length Varies
Bars V_2 : 12" Ctrs., Field Bend
Bars V_3 : See Bending Diagram

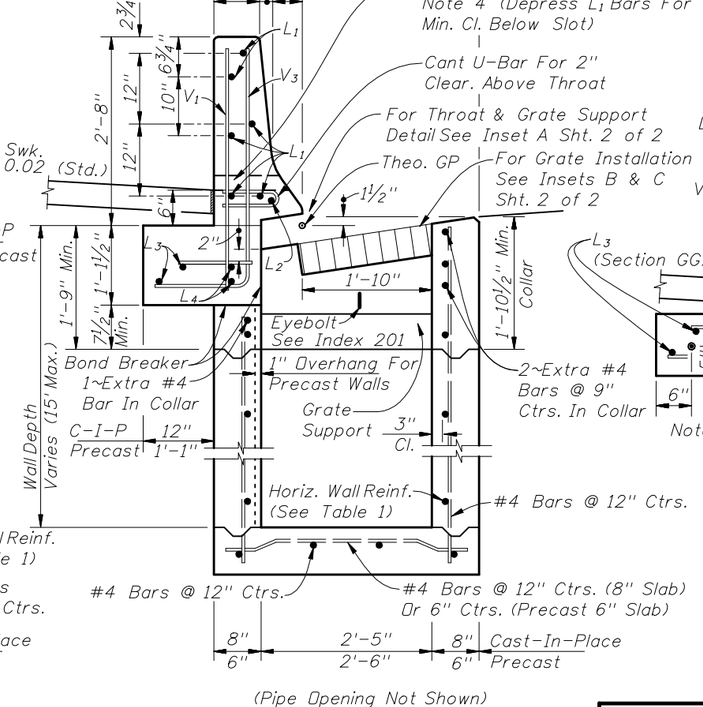
GENERAL NOTES

1. This inlet to be used in conjunction with Barrier Wall, Concrete (Rigid) (Curb & Gutter), Index No. 410.
2. All reinforcing is Grade 60 bars. See Index No. 201 for equivalent area of welded wire fabric for inlet. Reinforcing shall have 2" min. cover unless otherwise shown. Bars to be cut or bent to provide 1½" clearance around pipe opening. Cost of additional reinforcing in barrier wall to be included in cost for concrete barrier wall.
3. Barrier wall shall be Class II concrete, finished in accordance with Index No. 410.
4. All exposed edges and corners shall be ¾" chamfer or tooled to ¼" radius.
5. A flat 18"x2½" drainage slot shall be constructed at the inlet centerline when the inlet is located in a curb sag. No more than one V_1 bar, one V_3 bar and one U-bar are to be deleted for construction of the drainage slot.
6. For supplemental details see Index Nos. 201 and 410.
7. Recommended maximum pipe sizes are 18" longitudinal and 30" transverse. For larger pipe, use Alt. B bottoms, Index No. 200.
8. Grates can be fabricated with reticuline bars or with either ⅜"Ø electroforged or ½"Ø welded cross bars and full depth bars as detailed.
9. When Alternate G grate is specified in plans, the grate is to be hot-dip galvanized after fabrication.
10. For pay item purposes the height of the structure shall be computed using the theoretical gutter elevation, less the flow line elevation of the lowest pipe or to top of sump floor.
11. All dimensions are for both precast and cast-in-place inlets unless otherwise noted.
12. Inlets to be paid for under the contract unit price for Inlets (Barrier Wall) (Rigid) (Curb & Gutter), Each.
13. Barrier wall to be paid for under the contract unit price for Barrier Wall, Concrete (Rigid-Curb & Gutter) LF.



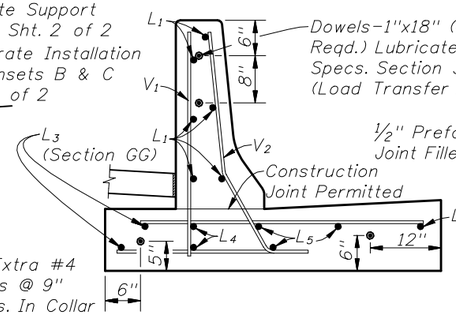
(Pipe Opening Shown)

SECTION AA



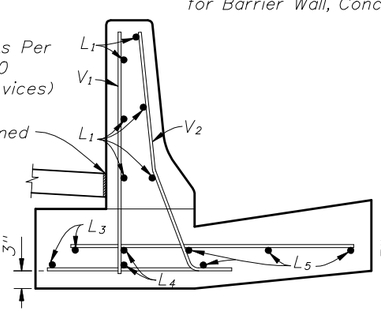
(Pipe Opening Not Shown)

SECTION BB

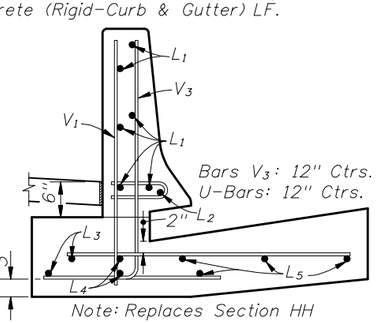


Note: For SECTION FF and additional details see Index No. 410, 'CONCRETE BARRIER WALL (RIGID) (CURB & GUTTER)'

SECTION FF & GG



SECTION HH



Note: Replaces Section HH for double throat inlet.

SECTION JJ

HORIZONTAL WALL REINFORCING SCHEDULE (TABLE 1)

WALL DEPTH CIPL	WALL DEPTH PRECAST	SCHEDULE	AREA (in.²/ft.)	MAX. SPACING BARS	MAX. SPACING WWF
0'-4'	0'-3'	A12	0.20	12"	8"
4'-9'	3'-6'	A6	0.20	6"	5"
9'-15'	6'-10'	B5.5	0.24	5½"	5"
	10'-15'	C6.5	0.37	6½"	6"

2010 FDOT Design Standards

BARRIER WALL INLET
BARRIER WALL, CONCRETE (RIGID) (C & G)

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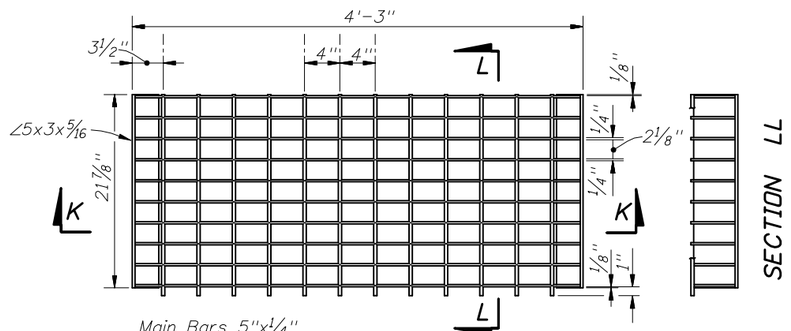
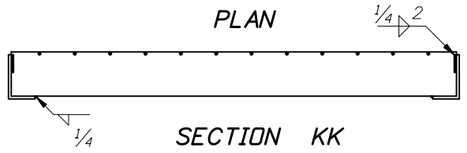
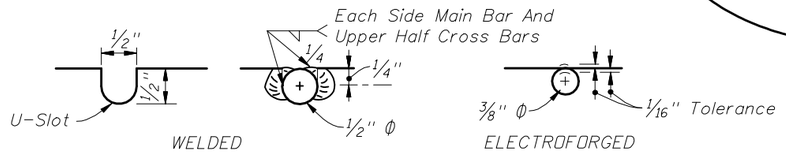


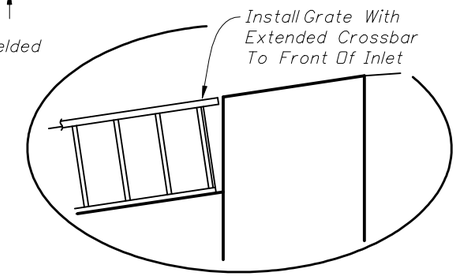
PLAN



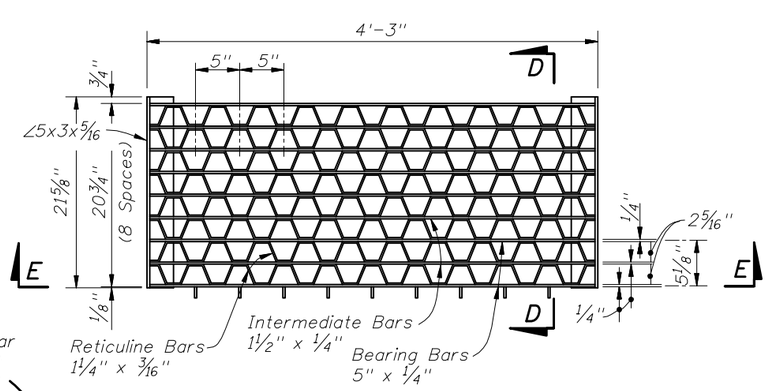
SECTION KK



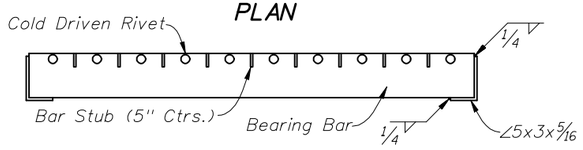
CROSS BAR OPTIONS



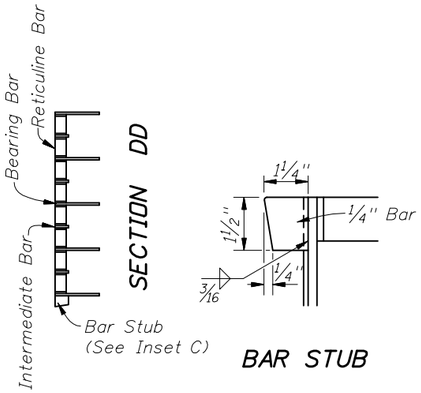
INSET B



PLAN

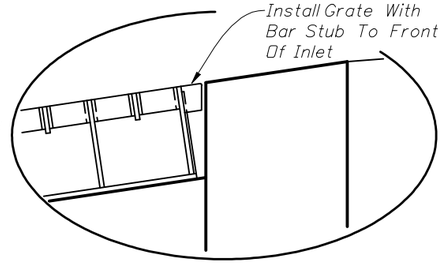


SECTION EE



SECTION DD

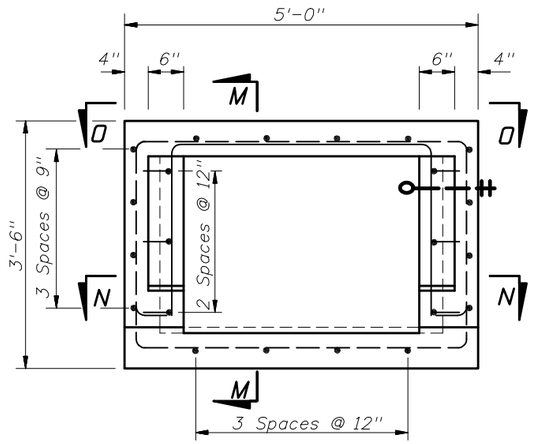
BAR STUB



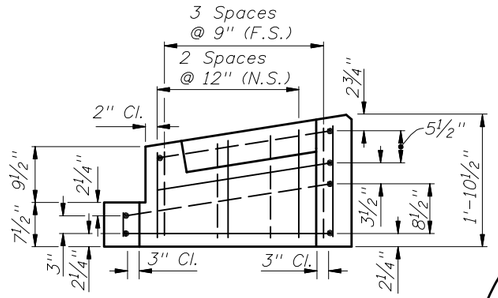
INSET C

OPTIONAL STEEL GRATES

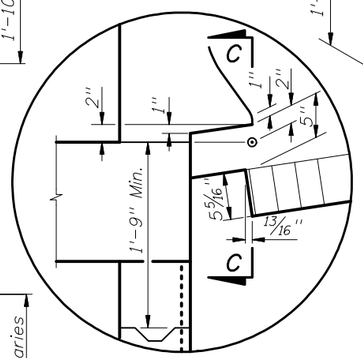
CROSS BAR



TOP VIEW OF INLET COLLAR WITHOUT GRATE

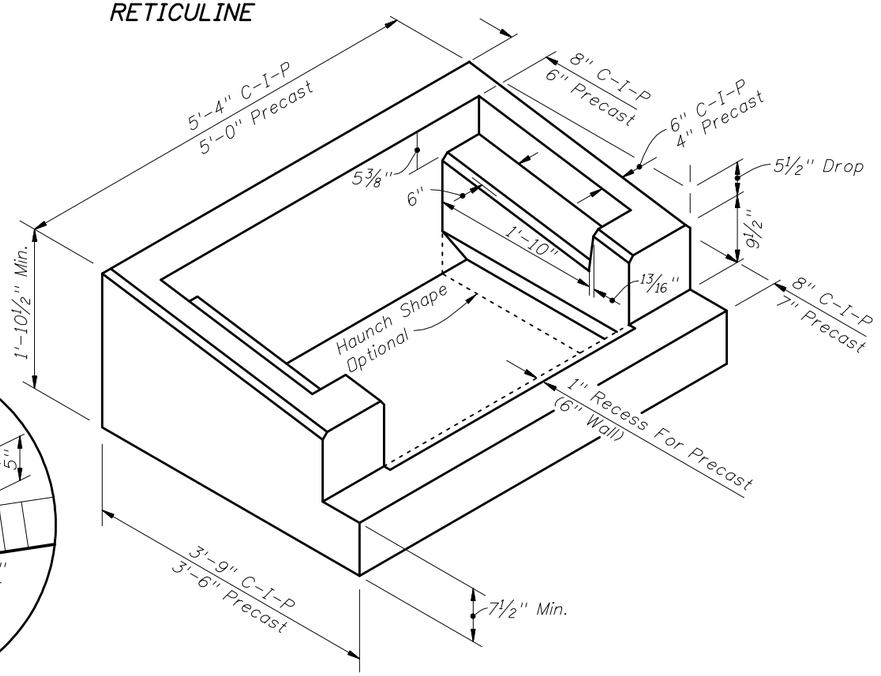


SECTION MM

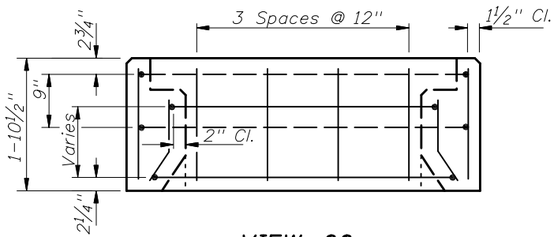


INSET A

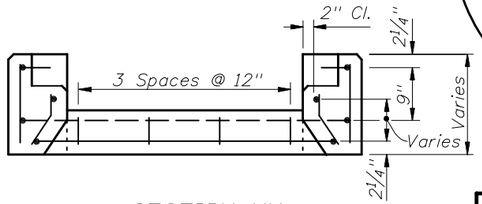
RETICULINE



PICTORIAL VIEW OF INLET COLLAR



VIEW OO



SECTION NN

PRECAST COLLAR REINFORCING DETAILS
(CAST-IN-PLACE COLLAR REINFORCING SIMILAR)

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2010 FDOT Design Standards

BARRIER WALL INLET
BARRIER WALL, CONCRETE (RIGID) (C & G)

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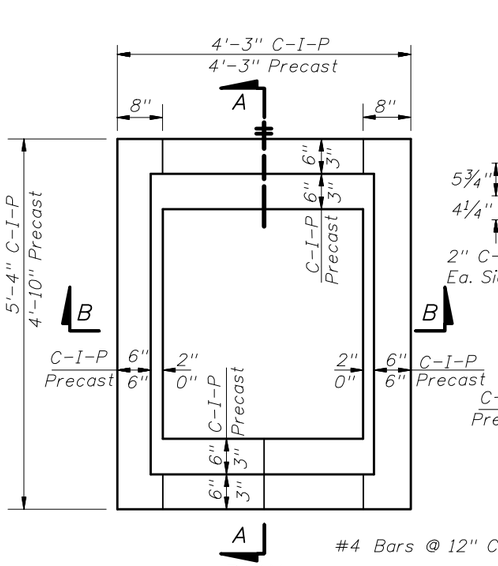
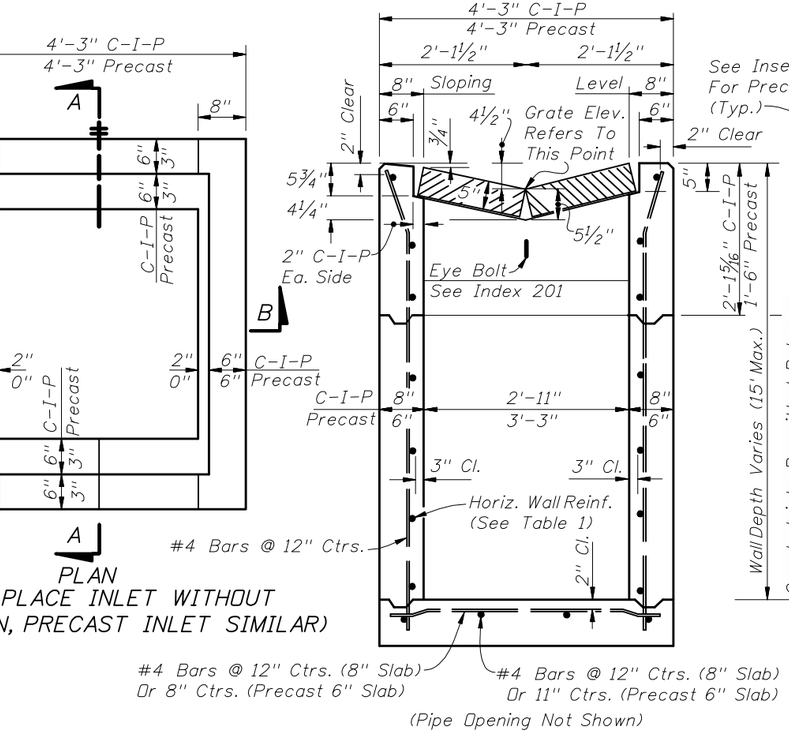
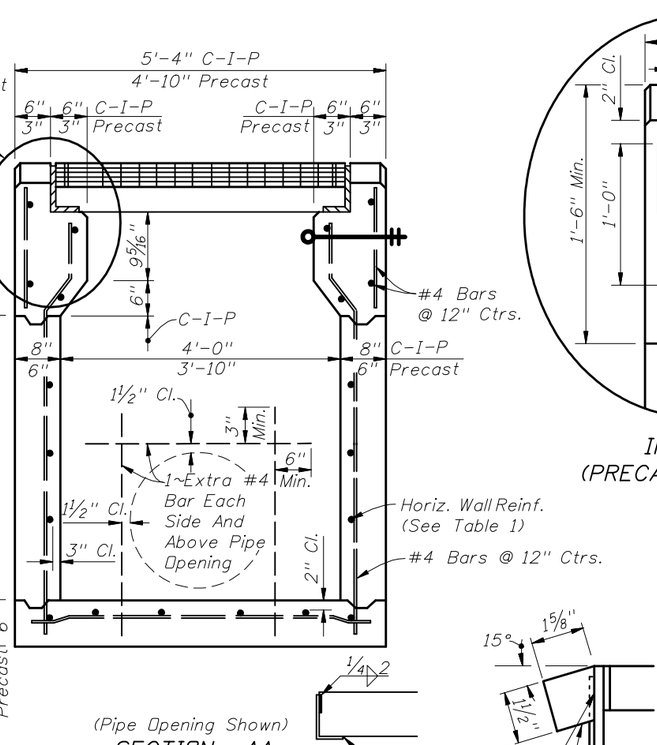


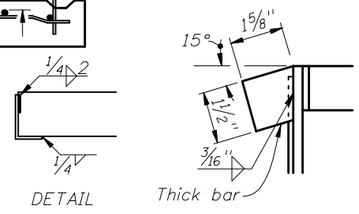
PLAN
(CAST-IN-PLACE INLET WITHOUT GRATE SHOWN, PRECAST INLET SIMILAR)



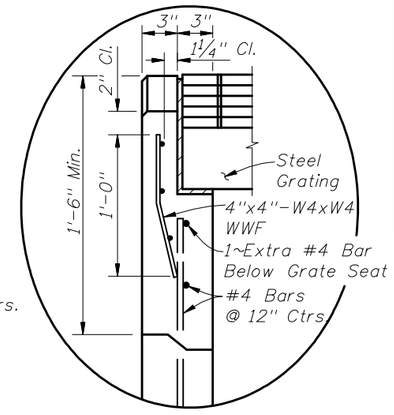
SECTION BB
(CAST-IN-PLACE INLET SHOWN, PRECAST INLET SIMILAR)



(Pipe Opening Shown)
SECTION AA



DETAIL OF BAR STUB



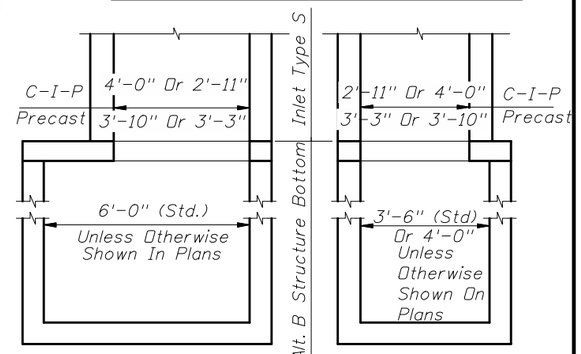
INSET A
(PRECAST OPTION)

RECOMMENDED MAXIMUM PIPE SIZES	
INLET INSIDE WIDTH	PIPE SIZE
2'-11" or 3'-3"	24"
4'-0" or 3'-10"	30"

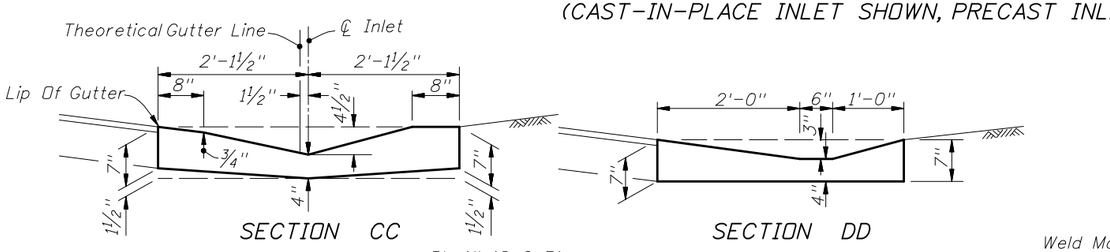
Note: Recommended sizes are for concrete pipe. Sizes for other types of pipe must be verified for fit in accordance with Index No. 201. For larger pipe see bottom detail below and Index No. 200.

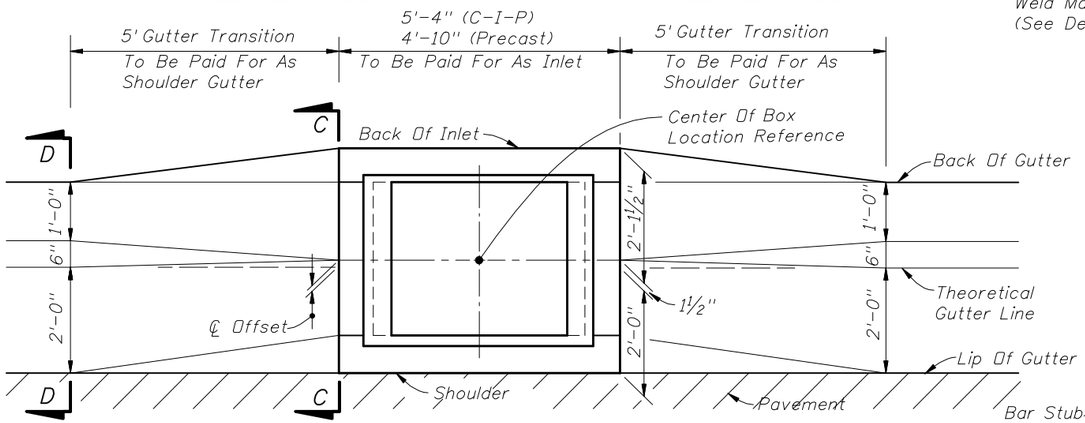
HORIZONTAL WALL REINFORCING SCHEDULE (TABLE 1)

WALL DEPTH	SCHEDULE	AREA (in²/ft)	MAX. SPACING BARS	MAX. SPACING WWF
0'-5'	A12	0.20	12"	8"
5'-9'	A6	0.20	6"	5"
9'-12'	A4	0.20	4"	3"
9'-15'	B5.5	0.24	5½"	5"

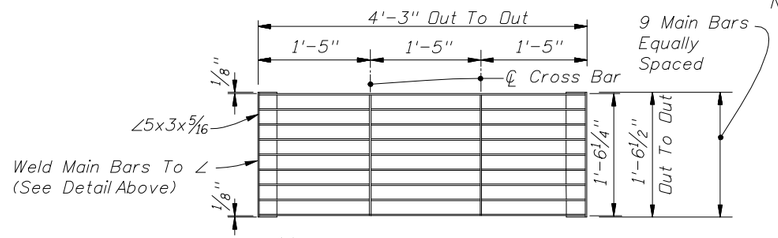


NOTE: Alt. B Structure Bottom Only. See Index No. 200 for structure bottom details and hole reinforcement.





SHOULDER GUTTER TRANSITION



STEEL GRATE

GENERAL NOTES

1. This inlet is intended for use in shoulder gutter on facilities subject to heavy wheel loads. The parallel bar grate shall be used on limited access facilities. On other facilities the reticuline grate shall be used. Locate inlet outside of designated pedestrian travel way.
2. All reinforcing is Grade 60 bars with 2" min. cover unless otherwise noted. See Index No. 201 for equivalent area of welded wire fabric. Bars to be cut or bent for 1½" minimum clearance around pipe.
3. All exposed edges and corners shall be ¾" chamfer or tooled to ¼" radius.
4. When Alternate G grate is specified in plans, the grate is to be hot-dip galvanized after fabrication.
5. For supplementary details see Index Nos. 200 and 201.
6. All dimensions are for both precast and cast-in-place inlets unless otherwise noted.
7. Inlets to be paid for under the contract unit price for inlets (Gutter Type S), EA. Cost of concrete apron at terminal inlets to be included in the cost of the inlet.

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GUTTER INLET TYPE S

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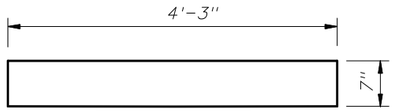
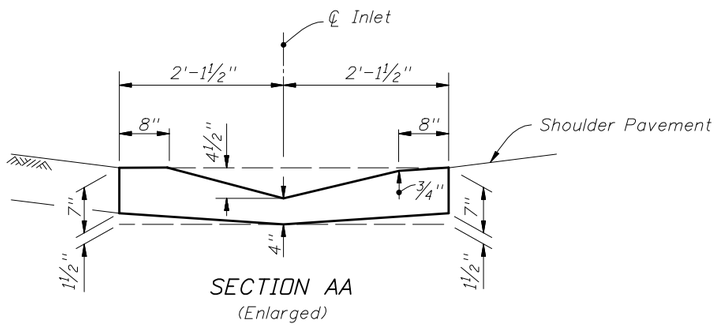
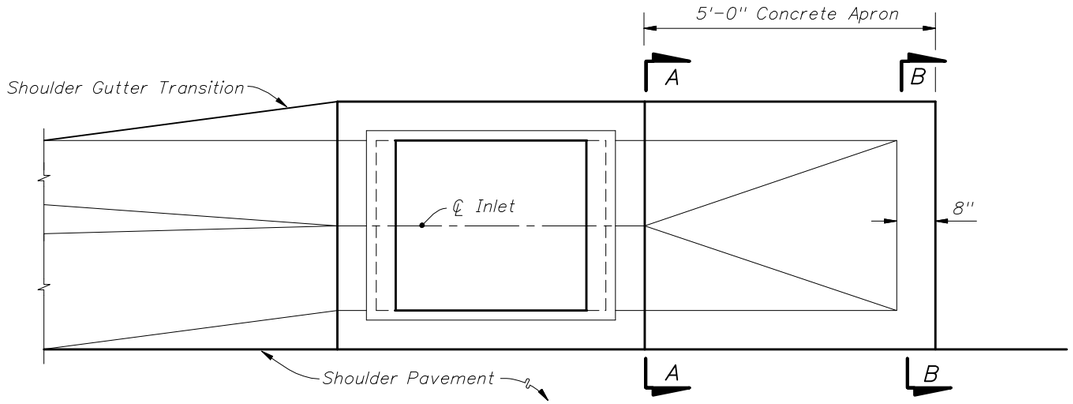


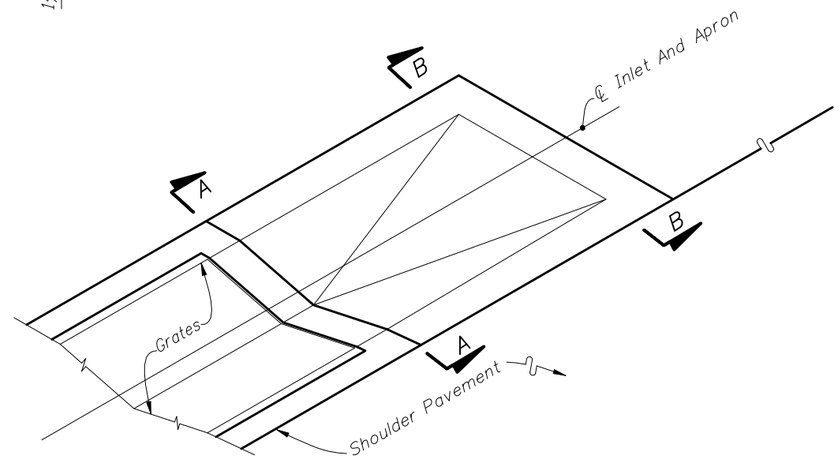
SECTION BB
(Enlarged)



SECTION AA
(Enlarged)



Top View



PICTORIAL VIEW

Apron To be Constructed At The Most Downstream Inlet In A Run Of Shoulder Gutter

CONCRETE APRON AT TERMINAL INLETS

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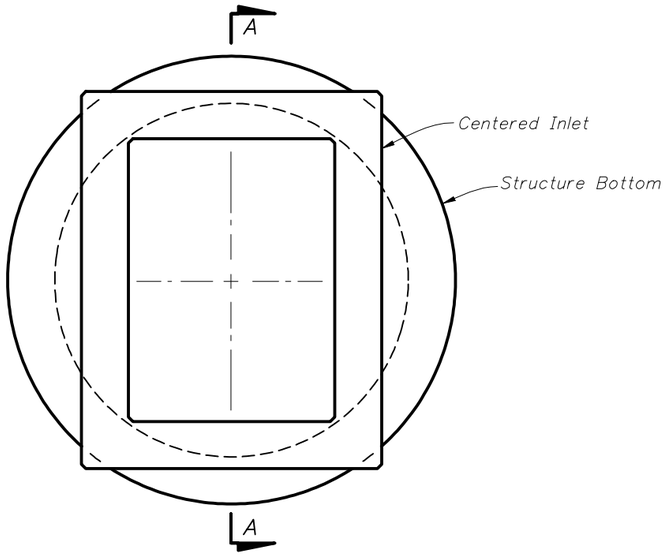
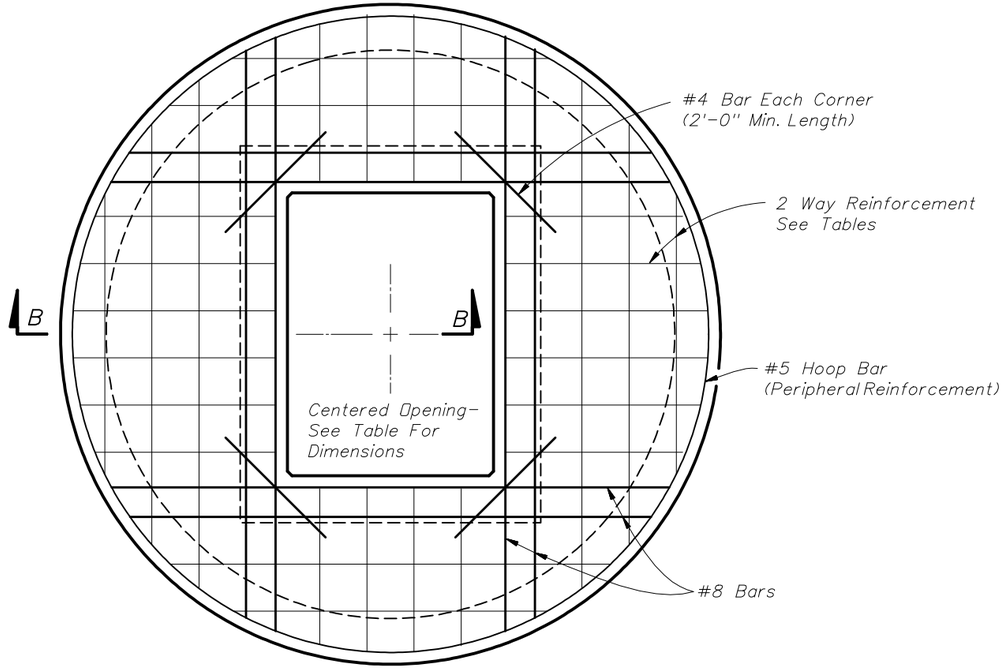


TOP VIEW

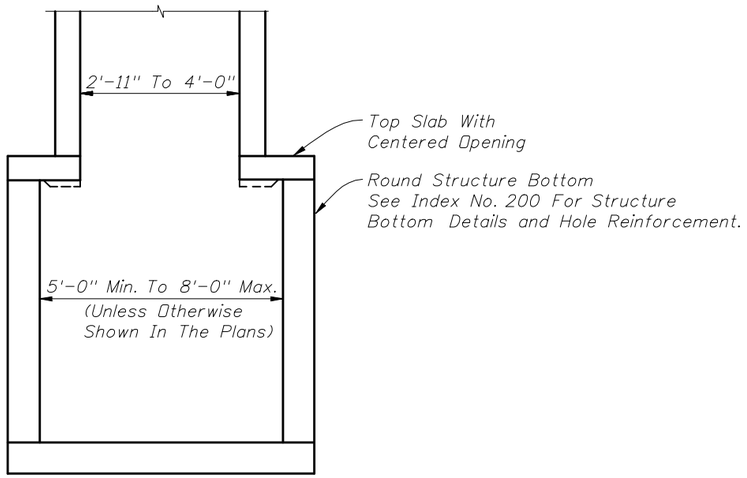
TOP SLAB OPENINGS		
DIAMETER	OPENING SIZE	
	MIN.	MAX.
5'-0" To 8'-0"	2'-11" x 4'-0"	3'-3" x 3'-10"



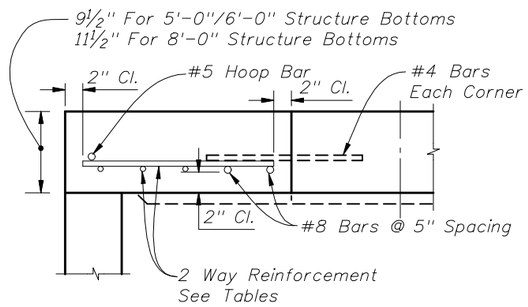
TOP SLAB REINFORCING DIAGRAM

TOP SLAB REINFORCING SCHEDULE	
SCHEDULE	GRADE 60 (BAR) OR 65 KSI & 70 KSI (WIRE FABRIC) In^2 /ft.
A	0.20
B	0.24
C	0.37
D	0.53
E	0.73
F	1.06
G	1.45

TOP SLAB WITH CENTERED OPENING		
SLAB DEPTH	SLAB THICKNESS	REINFORCING (2 WAYS) SCHEDULE
SIZE: 5'-0"		
≥0.5'<30'	9½"	C
30'-40'	9½"	D
SIZE: 6'-0"		
≥0.5'<8'	9½"	B
8'<18'	9½"	C
18'<30'	9½"	D
30'<37'	9½"	E
37'-40'	9½"	G
SIZE: 8'-0"		
≥0.5'<9'	11½"	C
9'<15'	11½"	D
15'<23'	11½"	E
23'<33'	11½"	E
33'-40'	11½"	G



SECTION AA



SECTION BB

ALT. A STRUCTURE BOTTOM FOR INLET TYPE S

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GUTTER INLET TYPE S

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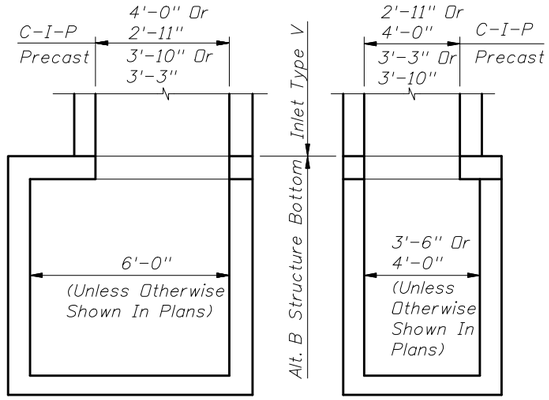
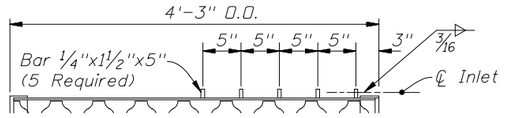


NOTE: Alt. B Structure Bottom Only. See Index No. 200 for structure bottom details and hole reinforcement. (For Pipes 30" Dia. And Larger)

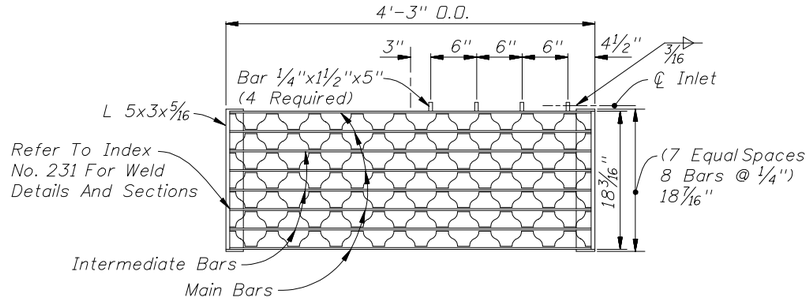
INLET WITH STRUCTURE BOTTOM

RECOMMENDED MAXIMUM PIPE SIZES	
Inlet Inside Width	Pipe Size
2'-11" Or 3'-3"	24"
4'-0" Or 3'-10"	30"

Note: Recommended sizes are for concrete pipe. Sizes for other types of pipe must be verified for fit in accordance with Index No. 201. For larger pipe see bottom detail above and Index No. 200.



OPTIMAL BAR SPACING



TWO REQUIRED PER INLET

5" Steel Grate:
Main Bars 5"x1/4"
Intermediate Bars 1 1/2"x1/4"
Reticuline Bars 1 1/4"x3/16"

Steel Grate : Manufactured By Borden, Florida Steel, U.S. Foundry Irving, Reliance, Greulich (Or Equal).

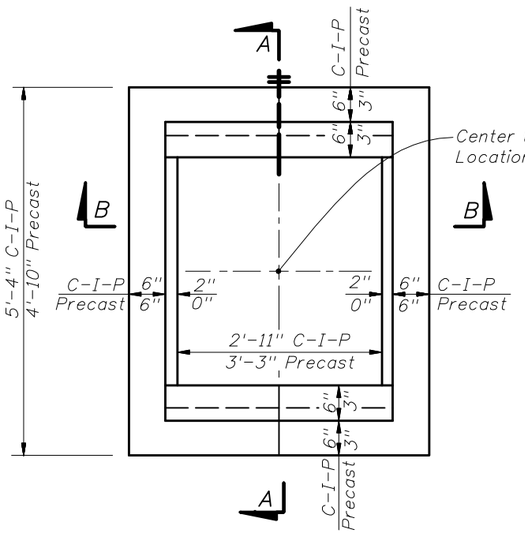
STEEL GRATE

GENERAL NOTES

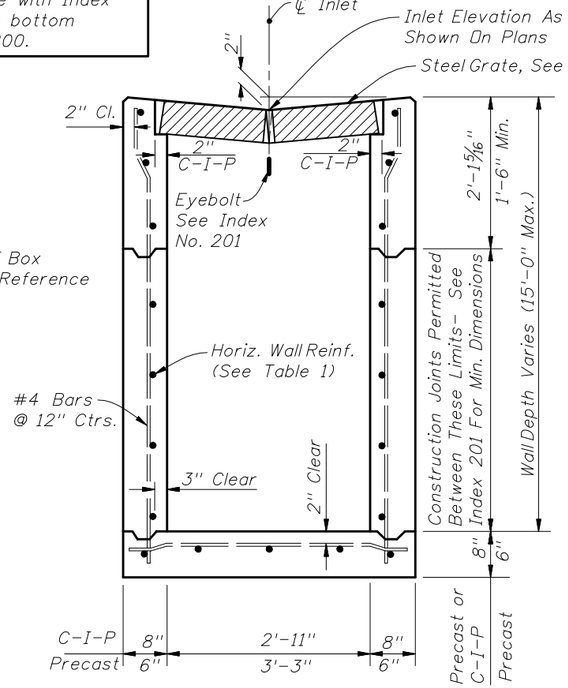
1. This inlet is suitable for village swales, ditches, or other areas subject to heavy wheel loads, minimum debris, and bicycle traffic. This inlet may be placed in areas subject to occasional pedestrian traffic such as landscaped areas and pavement areas where pedestrians can walk around the inlet.
2. When alternate "G" grate is specified in plans, the grate is to be hot dip galvanized after fabrication.
3. All reinforcing is Grade 60 bars with 2" min. cover unless otherwise noted. See Index No. 201 for equivalent area of welded wire fabric. Cut or bend bars out of way of pipe to clear pipe 1 1/2".
4. All exposed edges and corners shall be 3/4" chamfer or tooled to 1/4" radius.
5. All dimensions are for both precast and cast-in-place inlets unless otherwise noted.
6. For supplementary details see Index No. 201.
7. Inlet to be paid for under the contract unit price for Inlets (Gutter Type V), EA.

WALL DEPTH	SCHEDULE	AREA (in.²/ft.)	MAX. SPACING	
			BARS	WWF
0' - 5'	A12	0.20	12"	8"
5' - 9'	A6	0.20	6"	5"
9' - 12'	A4	0.20	4"	3"
9' - 15'	B5.5	0.24	5 1/2"	5"

HORIZONTAL WALL REINFORCING SCHEDULE (TABLE 1)

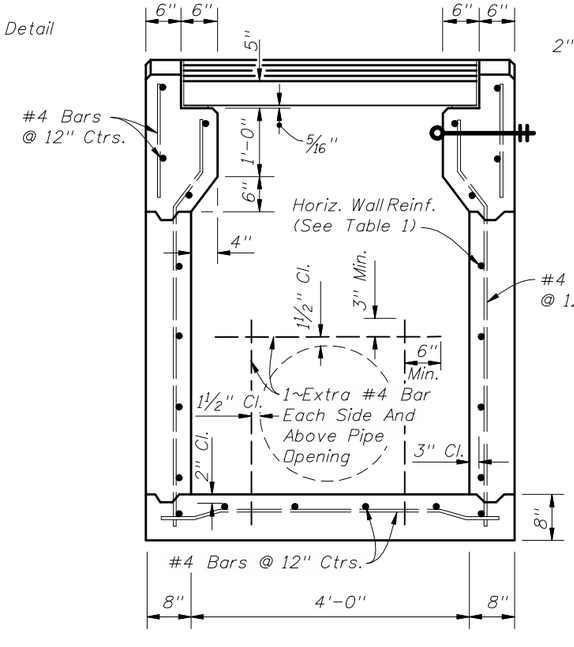


PLAN
(CAST-IN-PLACE INLET SHOWN WITHOUT GRATE; PRECAST INLET SIMILAR)



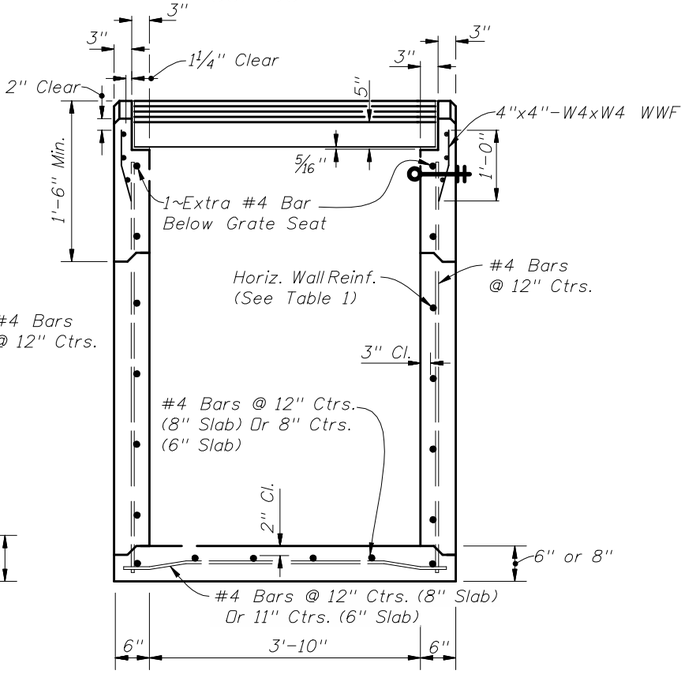
(Pipe Opening Not Shown)

SECTION BB
(CAST-IN-PLACE INLET SHOWN PRECAST INLET SIMILAR)



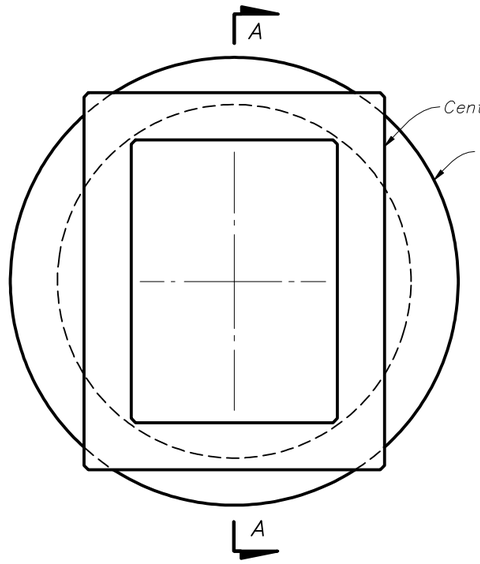
(Pipe Opening Shown)

SECTION AA
(CAST-IN-PLACE INLET)

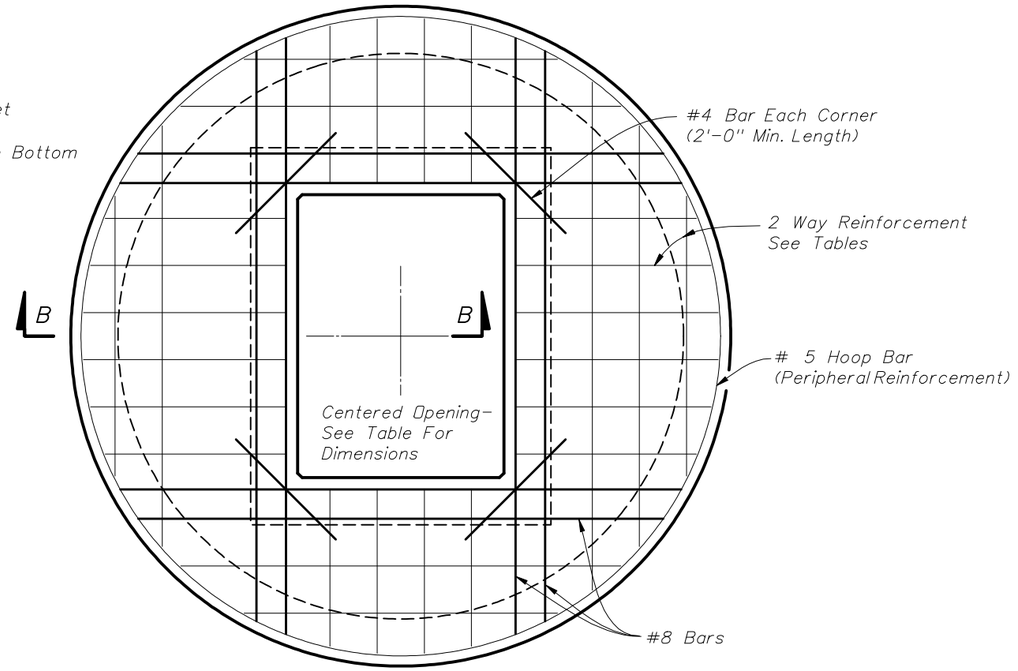


(Pipe Opening Not Shown)

SECTION AA
(PRECAST INLET)



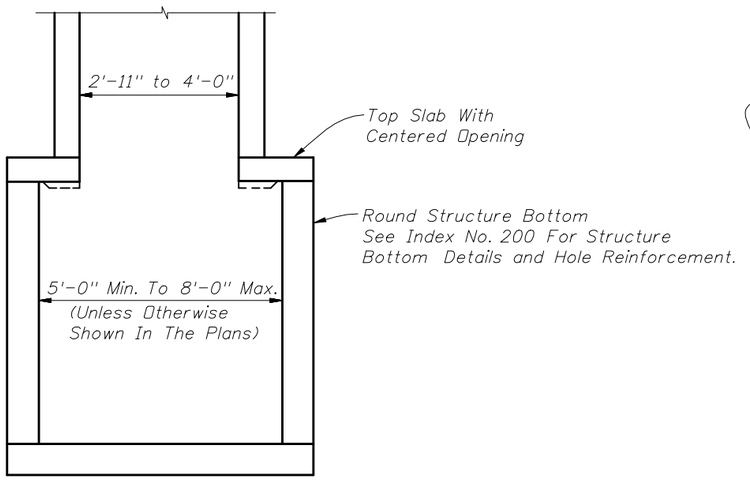
TOP SLAB OPENINGS		
DIAMETER	OPENING SIZE	
	MIN.	MAX.
5'-0" To 8'-0"	2'-11" x 4'-0"	3'-3" x 3'-10"



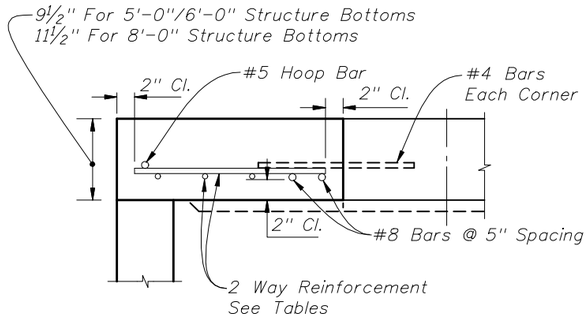
TOP SLAB REINFORCING DIAGRAM

TOP SLAB REINFORCING SCHEDULE	
SCHEDULE	GRADE 60 (BAR) OR 65 KSI & 70 KSI (WIRE FABRIC) $In.^2/ft.$
A	0.20
B	0.24
C	0.37
D	0.53
E	0.73
F	1.06
G	1.45

TOP SLAB WITH CENTERED OPENING		
SLAB DEPTH	SLAB THICKNESS	REINFORCING (2 WAYS) SCHEDULE
SIZE: 5'-0"		
≥0.5' <30'	9½"	C
30'-40'	9½"	D
SIZE: 6'-0"		
0.5' < 8'	9½"	B
8' < 18'	9½"	C
18' < 30'	9½"	D
30' < 37'	9½"	E
37'-40'	9½"	G
SIZE: 8'-0"		
≥0.5' < 9'	11½"	C
9' < 15'	11½"	D
15' < 23'	11½"	E
23' < 33'	11½"	E
33'-40'	11½"	G

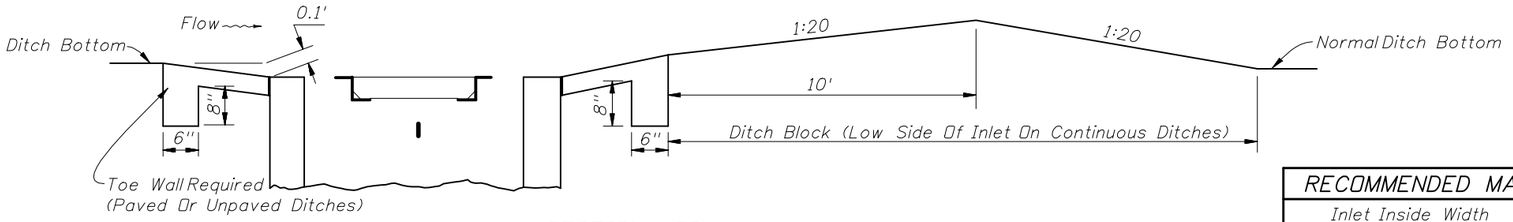


SECTION AA



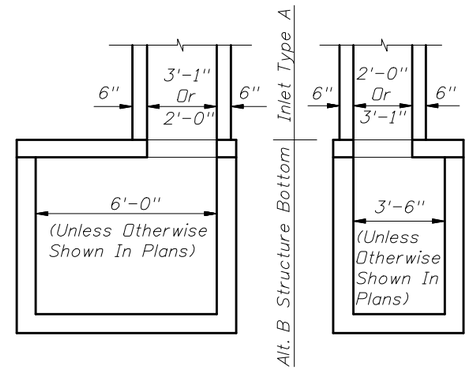
SECTION BB

ALT. A STRUCTURE BOTTOM FOR INLET TYPE V



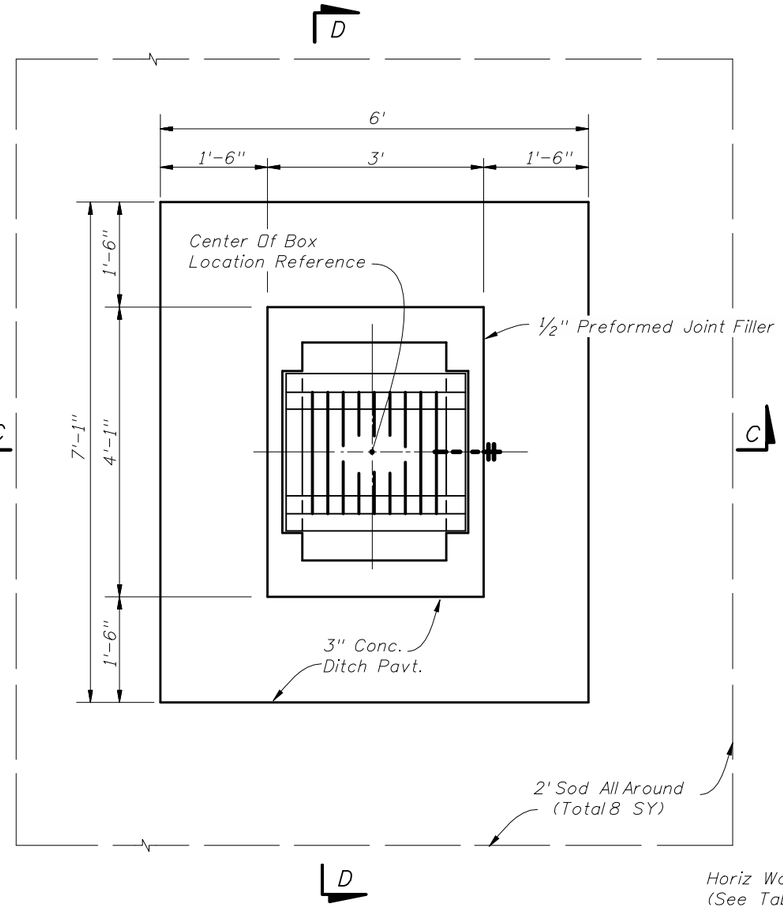
SECTION DD

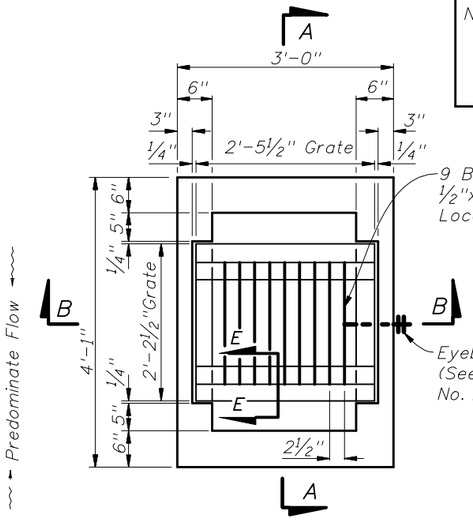
RECOMMENDED MAXIMUM PIPE SIZES	
Inlet Inside Width	Pipe Size
2'-0"	18"
3'-1"	24" 18" Where An 18" pipe Enters A 2'-0" Wall
Note: Recommended sizes are for concrete pipe. Sizes for other types of pipe must be verified for fit in accordance with Index No. 201. For larger pipe see bottom detail right and Index No. 200.	



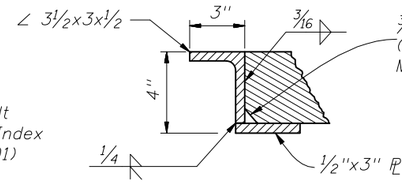
NOTE: Alt. B Structure Bottom Only. See Index No. 200 for Structure Bottom Details And Hole Reinforcement.

INLET WITH STRUCTURE BOTTOM

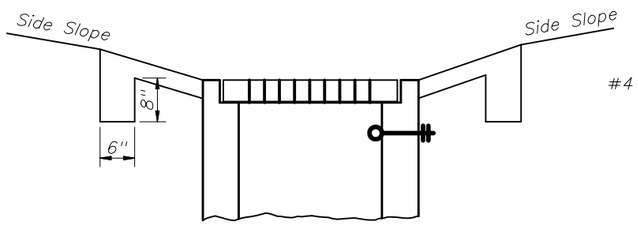




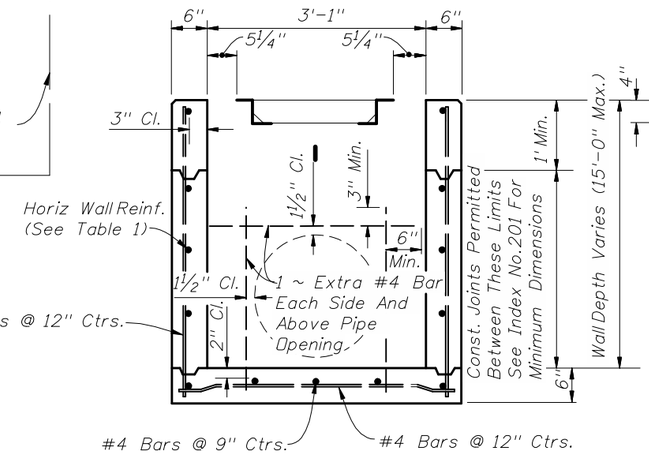
PLAN



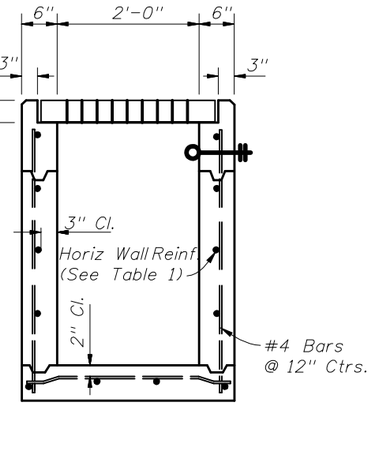
SECTION EE



SECTION CC



SECTION AA



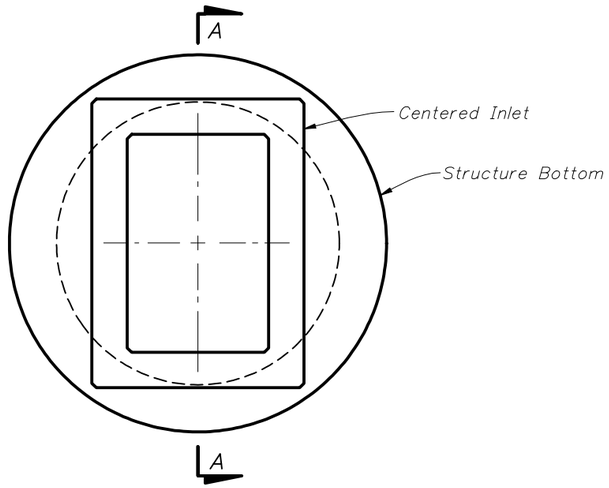
SECTION BB

GENERAL NOTES

1. This inlet is designed for ditches, medians, or other area subject to heavy wheel loads on limited access facilities where debris may be a problem. This inlet is not for use in areas subject to pedestrian and/or bicycle traffic.
2. All reinforcing is Grade 60 bars with 2" min. cover unless otherwise noted. Cut or bend bars out of way of pipe to clear pipe by 1 1/2". See Index 201 for equivalent area of welded wire fabric.
3. All exposed edges and corners shall be 3/4" chamfer or tooled to 1/4" radius.
4. When alternate "G" grate is specified in plans, the grate is to be hot-dip galvanized after fabrication.
5. Cost of ditch paving to be included in the cost of Inlet. Sodding to be paid for under contract unit price for Performance Turf, SY.
6. For supplemental details see Index No. 201.
7. All dimensions are for both precast and cast-in-place inlets unless otherwise noted.
8. Inlet to be paid for under the contract unit price for inlets (Dt Bot Type A), EA.

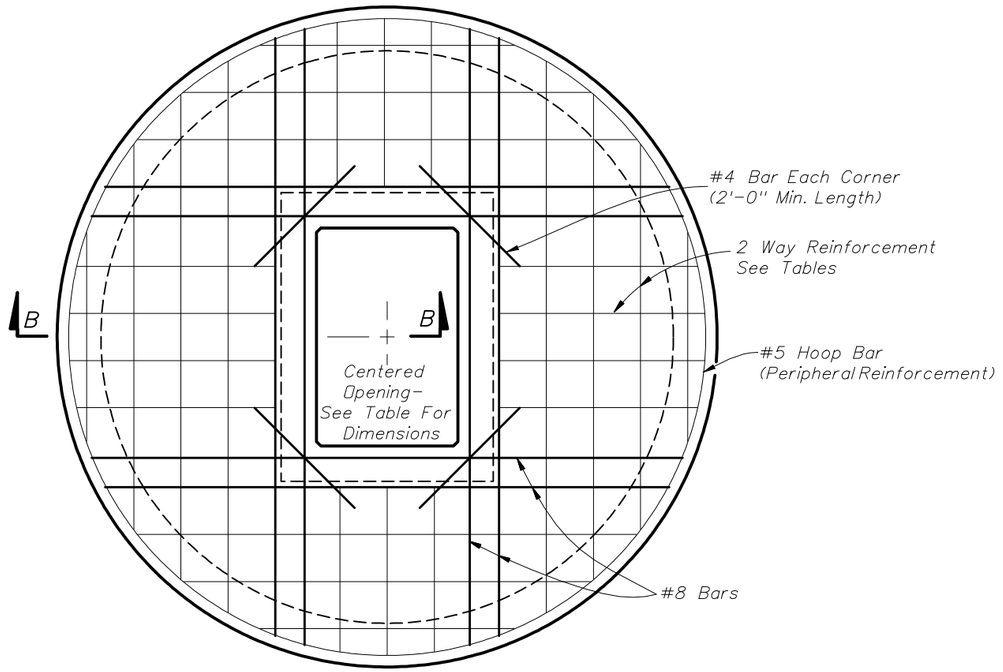
HORIZONTAL WALL REINFORCING SCHEDULE (TABLE 1)

WALL DEPTH	SCHEDULE	AREA (in.²/ft.)	MAX. SPACING	
			BARS	WWF
0' – 10'	A12	0.20	12"	8"
10' – 15'	A6	0.20	6"	5"



TOP VIEW

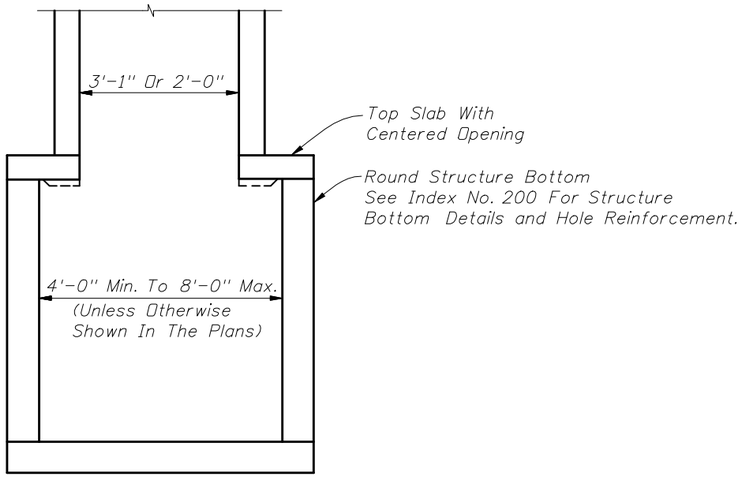
TOP SLAB OPENINGS	
DIAMETER	OPENING SIZE
	MIN.
4'-0" To 8'-0"	2'-0" x 3'-1"



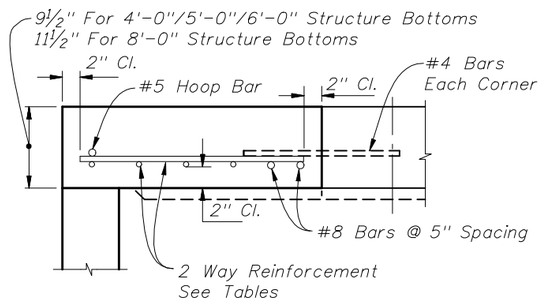
TOP SLAB REINFORCING DIAGRAM

TOP SLAB REINFORCING SCHEDULE	
SCHEDULE	GRADE 60 (BAR) OR 65 KSI & 70 KSI (WIRE FABRIC) $In.^2/ft.$
A	0.20
B	0.24
C	0.37
D	0.53
E	0.73
F	1.06
G	1.45

TOP SLAB WITH CENTERED OPENING		
SLAB DEPTH	SLAB THICKNESS	REINFORCING (2 WAYS) SCHEDULE
SIZE: 4'-0"		
≥0.5'–40'	9½"	C
SIZE: 5'-0"		
≥0.5'<30'	9½"	C
30'–40'	9½"	D
SIZE: 6'-0"		
0.5'<8'	9½"	B
8'<18'	9½"	C
18'<30'	9½"	D
30'<37'	9½"	E
37'–40'	9½"	G
SIZE: 8'-0"		
≥0.5'<9'	11½"	C
9'<15'	11½"	D
15'<23'	11½"	E
23'<33'	11½"	E
33'–40'	11½"	G

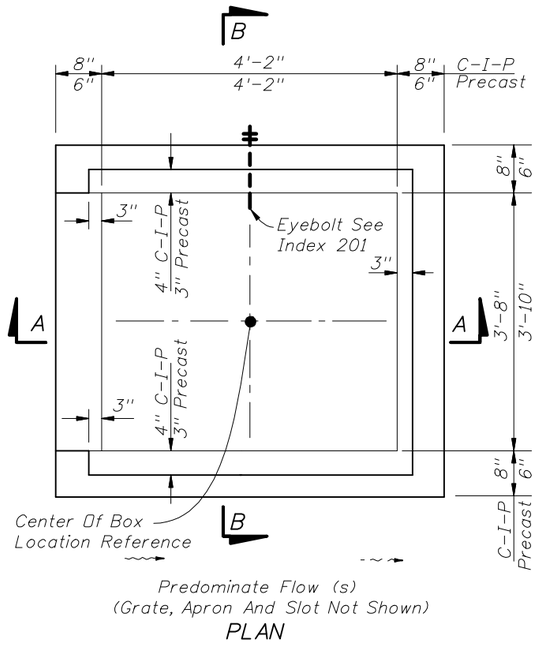


SECTION AA



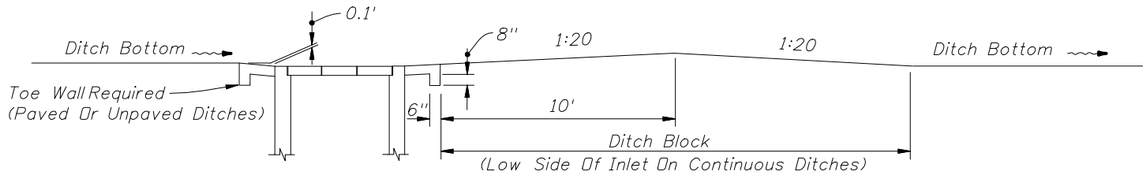
SECTION BB

ALT. A STRUCTURE BOTTOM FOR INLET TYPE A



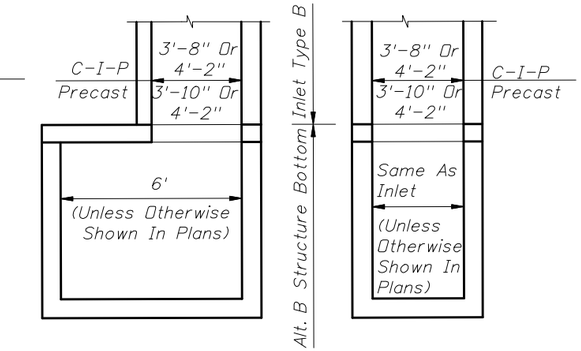
Predominate Flow (s)
(Grate, Apron And Slot Not Shown)

PLAN



SECTION EE

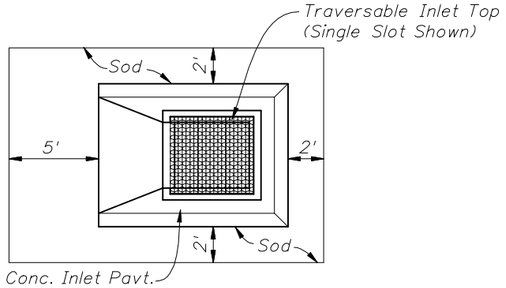
DITCH BLOCK



NOTE: Alt. B Structure Bottom Only. See Index No. 200 for structure bottom details and pipe opening reinforcement.

INLET WITH STRUCTURE BOTTOM

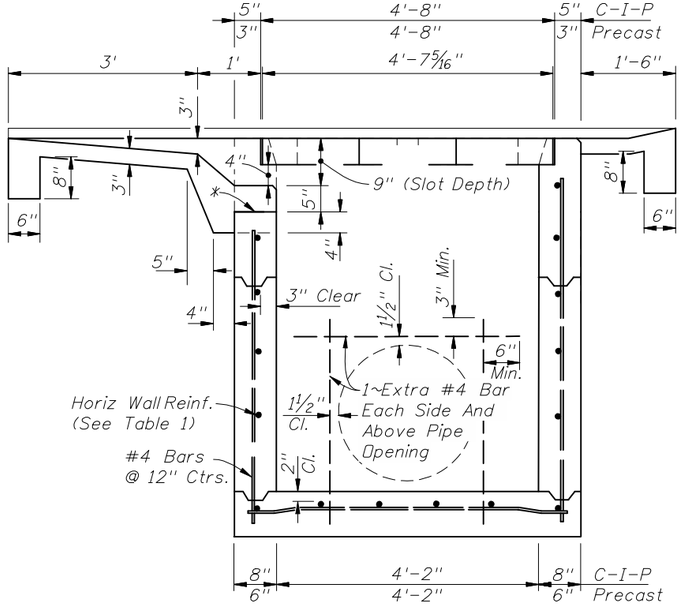
ESTIMATED QUANTITIES For Informational Purposes Only			
SLOT TYPE	PAVEMENT		SOD
	SY	CY	SY
Single Slot	6.2	0.9	14
Double Slot	8.1	1.1	19



CONCRETE INLET PAVEMENT AND SODDING

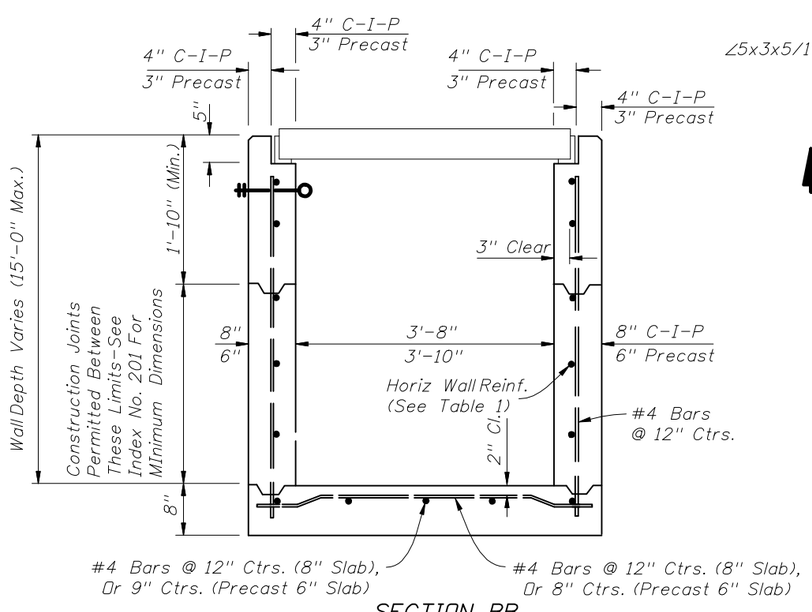
RECOMMENDED MAXIMUM PIPE SIZES	
INLET INSIDE WIDTH	PIPE SIZE
3'-8"	30"
4'-2"	36"

Note: Recommended sizes are for concrete pipe. Sizes for other types of pipe must be verified for fit in accordance with Index No. 201. For larger pipe see bottom detail above and Index No. 200.



SECTION AA

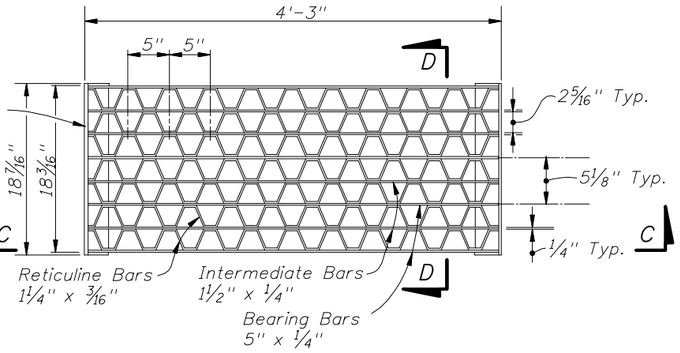
*See Sheet 2 of 3



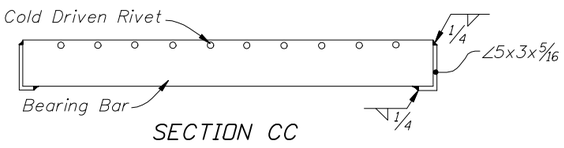
SECTION BB

HORIZONTAL WALL REINFORCING SCHEDULE (TABLE 1)

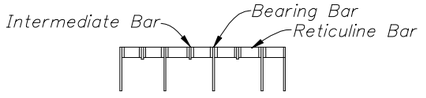
WALL DEPTH	SCHEDULE	AREA (in.²/ft.)	MAX. SPACING	
			BARS	WWF
0' - 5'	A12	0.20	12"	8"
5' - 9'	A6	0.20	6"	5"
9' - 13'	B5.5	0.24	5½"	5"
13' - 15'	Special	0.267	5"	4"



PLAN



SECTION CC



SECTION DD

STEEL GRATE

2010 FDOT Design Standards

DITCH BOTTOM INLET TYPE B

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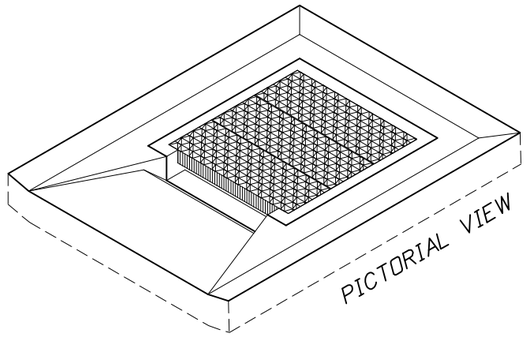
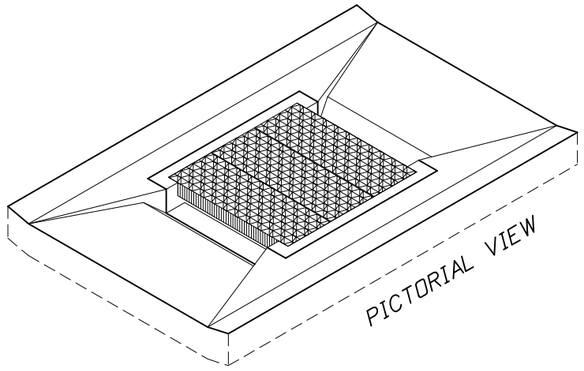
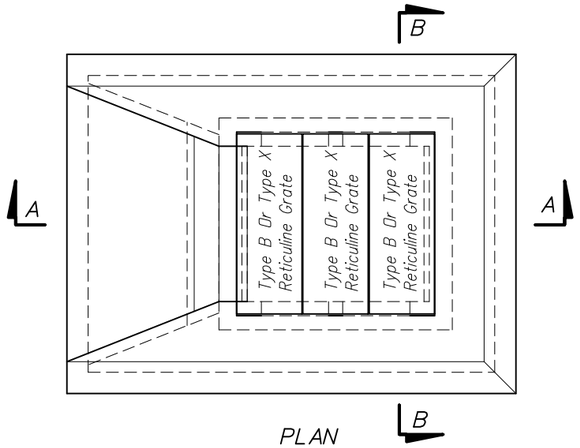
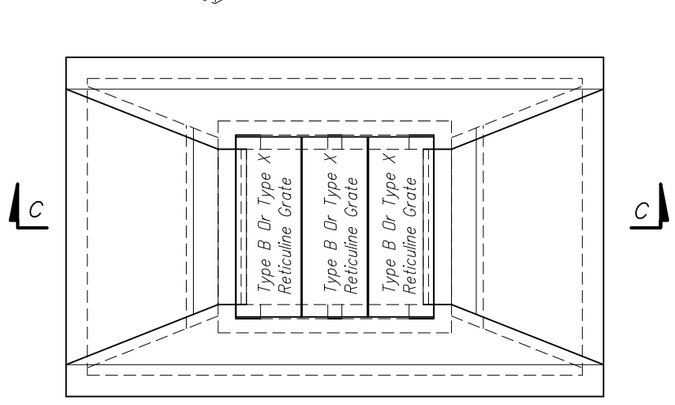


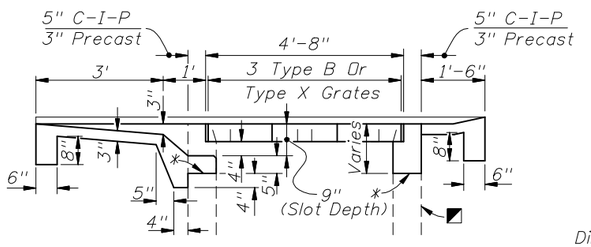




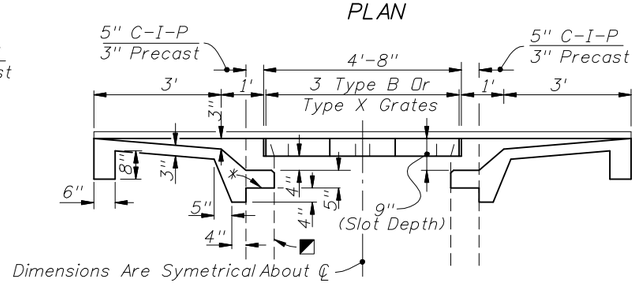
PLAN



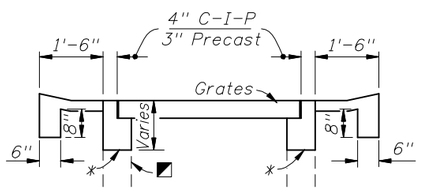
PLAN



SECTION AA
SINGLE SLOT



SECTION CC
DOUBLE SLOT



SECTION BB

◩ *Inlet Box (Line Type Indicates Existing Box To Facilitate Depiction Of Partial Construction On Existing Inlets)*

* *On new boxes the traversable top may be cast as a monolithic unit or cast in segments, and the location of this line may be lower to facilitate handling and placement; however, the slot depth is to remain at 9 inches. See Index No. 201 for top to wall connection. For converting to traversable tops on existing inlets remove concrete to this line and expose the existing reinforcement. Reshape or splice in reinforcement to penetrate the rim and returns of the grate seat, and bend the reinforcement into the slot shelf to extend into the abutting throat pavement.*

GENERAL NOTES

1. *The general purpose of the inlet top designs are:*
   a. *For ditches, medians or other areas subject to heavy wheel loads. This inlet may be placed in areas subject to occasional pedestrian traffic such as landscaped areas and pavement areas where pedestrians can walk around the inlet.*
   b. *Provide full grate and horizontal slot designs for new construction.*
   c. *Provide full grate and horizontal slot designs for replacing the vertical slot tops on existing Inlets Type B and Type X that are in locations subject to occasional pedestrian traffic.*
2. *All reinforcing is Grade 60 bars with 2" min. cover unless otherwise noted. See Index No. 201 for equivalent area of welded wire fabric. Bars to be cut or bent for min. 1½" clearanc around pipe.*
3. *All exposed edges and corners shall be ¾" chamfer or tooled to ¼" radius.*
4. *When Alternate G grates are specified in the plans, the grates are to be hot-dip galvanized after fabrication.*
5. *Cost for constructing traversable tops on new inlet boxes shall be included in the contract unit price for Inlets (DT BOT) (Type B), EA., and shall include the cost for surrounding concrete inlet pavement.*
   Existing Inlets Type B and Inlets Type X that are converted to traversable inlet tops shall be paid for under the contract unit price for Inlets (DT BOT) (Type B) (Partial), EA. Unit price and payment shall be full compensation for inlet conversion and shall include the removal and disposal of any existing concrete inlet pavement; the removal and stockpiling or disposal of sufficient material from the existing inlet box to facilitate construction of the required inlet top; construction of the required inlet conversion; backfill construction; construction of concrete inlet pavement; reusing, supplementing, transferring or replacing grates as required by plans or as directed by the Engineer; any required earthwork for ditch restoration within 30' of the inlet; and, restoration of disturbed turf.
6. *Ditch pavement shall be paid for, separate from the inlet and concrete inlet pavement, by pavement types and units as called for in the plans.*
7. *Sod will be paid for under the contract unit price for Performance Turf, SY.*
8. *For supplementary details see Index No. 201.*
9. *All dimensions are for both precast and cast-in-place inlets unless otherwise noted.*

DESIGN NOTES

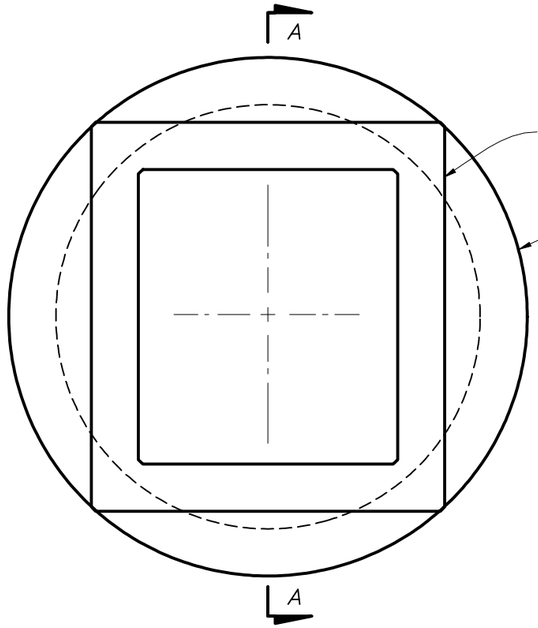
1. *The type of top (single or double slots) depends on the approach ditch configuration and the hydraulic requirements of the site. The designer will stipulate in the plans the type of top to be constructed at each individual inlet location.*

   On existing inlets, conversion grates shall be constructed at the original grate elevations unless other elevations are called for in the plans. When plans call for the inlet top to be constructed to support storm water detention, details for ditch modifications and underdrains shall be shown in the plans.

MAINTENANCE NOTES

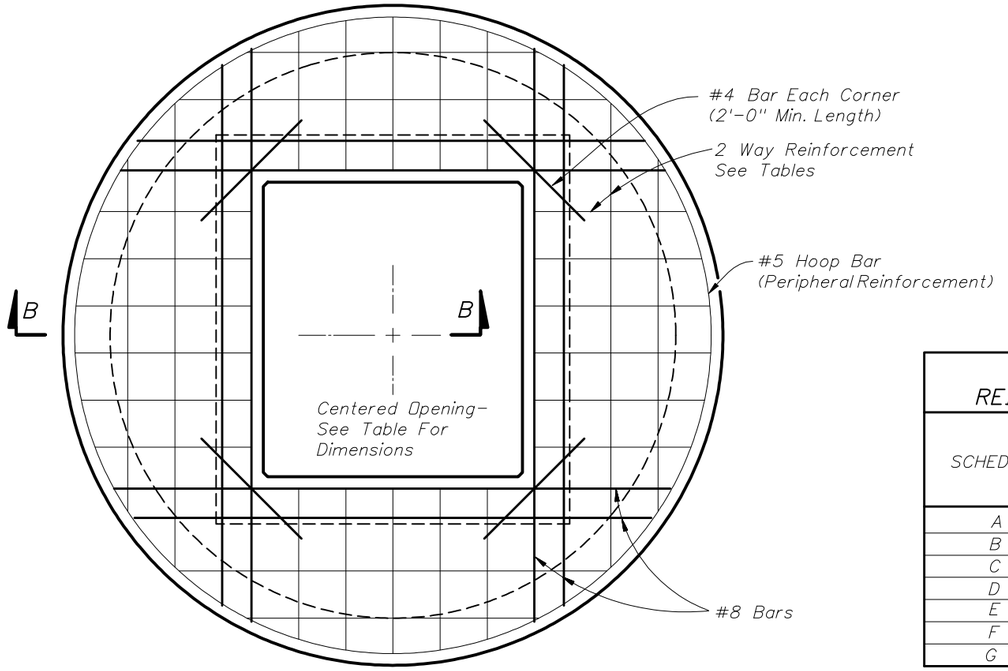
1. *Traversable inlet tops that are constructed by maintenance contract or by maintenance forces may reuse the existing grates that are determined by the Maintenance Engineer to be functionally sound, and their reuse is so directed by the Maintenance Engineer. Existing grates approved for reuse and new grates may be mixed, matched or replaced as directed by the Maintenance Engineer.*

TRAVERSABLE TOPS FOR INLETS TYPE B AND FOR CONVERSIONS OF EXISTING INLETS TYPE B AND TYPE X



TOP VIEW

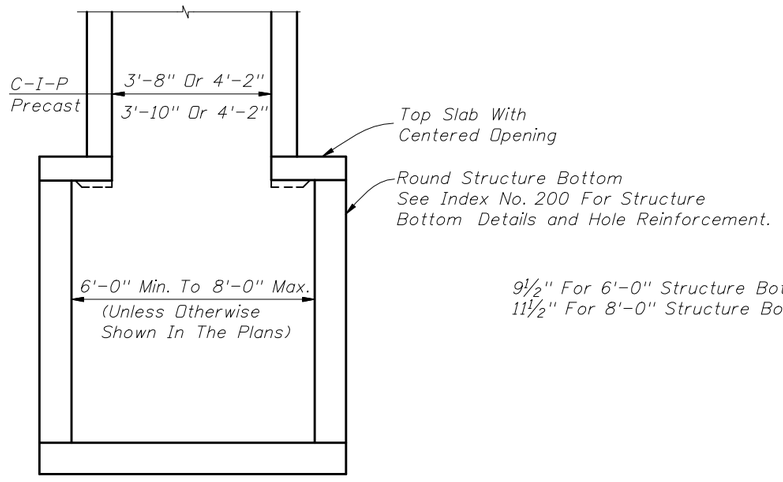
TOP SLAB OPENINGS		
DIAMETER	OPENING SIZE	
	MIN.	MAX.
6'-0" to 8'-0"	3'-8" x 4'-2"	3'-10" x 4'-2"



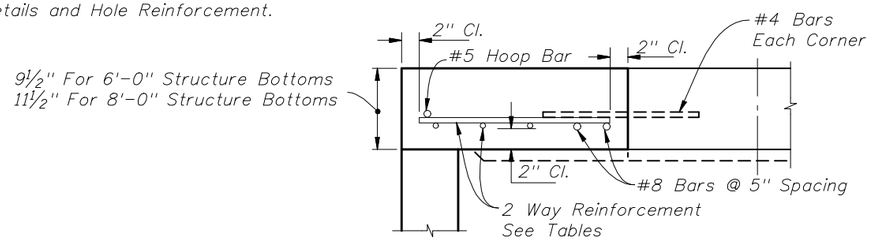
TOP SLAB REINFORCING DIAGRAM

TOP SLAB REINFORCING SCHEDULE	
SCHEDULE	GRADE 60 (BAR) OR 65 KSI & 70 KSI (WIRE FABRIC) $In^2/ft.$
A	0.20
B	0.24
C	0.37
D	0.53
E	0.73
F	1.06
G	1.45

TOP SLAB WITH CENTERED OPENING		
SLAB DEPTH	SLAB THICKNESS	REINFORCING (2 WAYS) SCHEDULE
SIZE: 6'-0"		
0.5' < 8'	9½"	B
8' < 18"	9½"	C
18' < 30'	9½"	D
30' < 37'	9½"	E
37'-40'	9½"	G
SIZE: 8'-0"		
≥0.5' < 9'	11½"	C
9' < 15'	11½"	D
15' < 23'	11½"	E
23' < 33'	11½"	E
33'-40'	11½"	G



SECTION AA



SECTION BB

ALT. A STRUCTURE BOTTOM FOR INLET TYPE B

2010 FDOT Design Standards

DITCH BOTTOM INLET TYPE B

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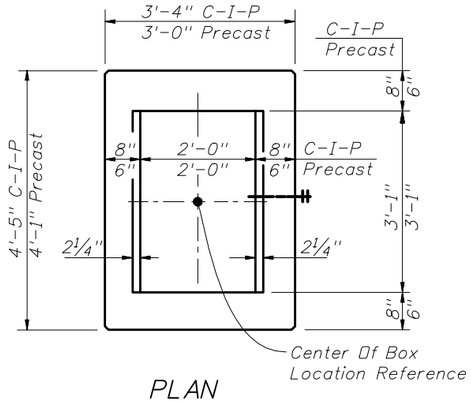
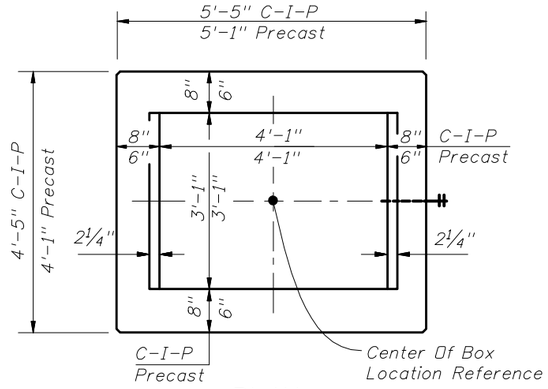


PLAN



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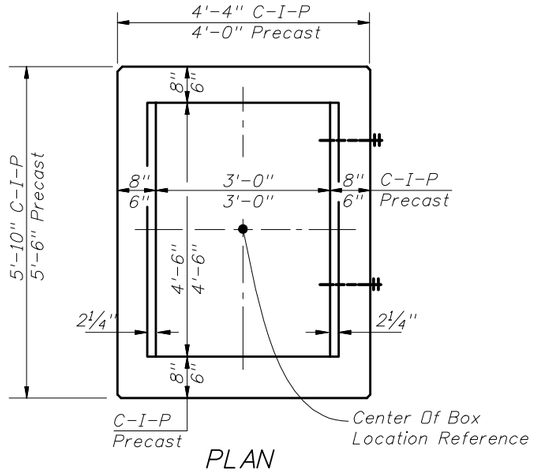
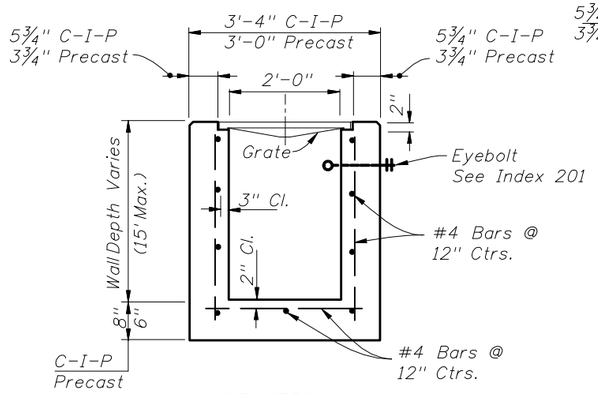


PLAN



SECTION

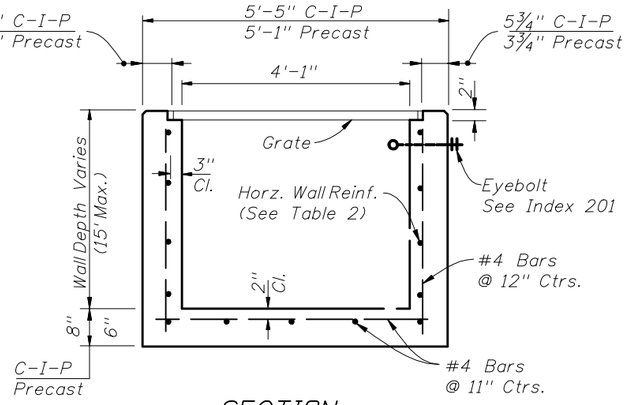
HORIZONTAL WALL REINFORCING SCHEDULES (TABLE 1)

WALL DEPTH	SCHEDULE	AREA (in.²/ft.)	MAX. SPACING	
			BARS	WWF
0'-15'	A12	0.20	12"	8"

TYPE C

Recommended Maximum Pipe Size:

2'-0" Wall – 18" Pipe
3'-1" Wall – 24" Pipe (18" where an 18" pipe enters a 2'-0" wall)



SECTION

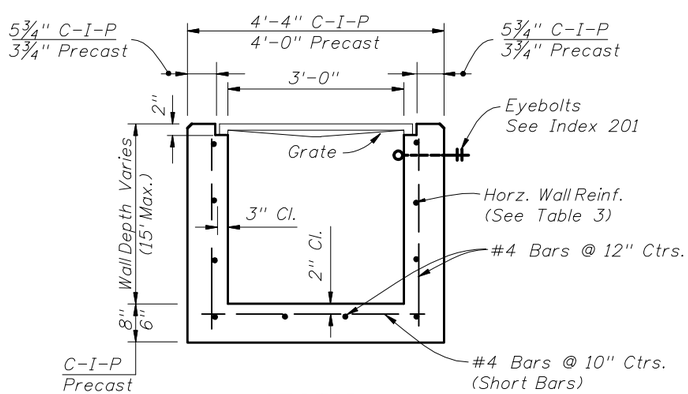
HORIZONTAL WALL REINFORCING SCHEDULES (TABLE 2)

WALL DEPTH	SCHEDULE	AREA (in.²/ft.)	MAX. SPACING	
			BARS	WWF
0'-6'	A12	0.20	12"	8"
6'-10'	A6	0.20	6"	5"
10'-13'	A4	0.20	4"	3"
10'-15'	B5.5	0.24	5½"	5"

TYPE D

Recommended Maximum Pipe Size:

3'-1" Wall – 24" Pipe
4'-1" Wall – 36" Pipe



SECTION

HORIZONTAL WALL REINFORCING SCHEDULES (TABLE 3)

WALL DEPTH	SCHEDULE	AREA (in.²/ft.)	MAX. SPACING	
			BARS	WWF
0'-5'	A12	0.20	12"	8"
0'-7.5'	A6	0.20	6"	5"
7.5'-10'	B5.5	0.24	5½"	5"
10'-15'	C6.5	0.37	6½"	6"

TYPE E

Recommended Maximum Pipe Size:

3'-0" Wall – 24" Pipe
4'-6" Wall – 36" Pipe

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

2010 FDOT Design Standards

DITCH BOTTOM INLET TYPES C, D, E & H

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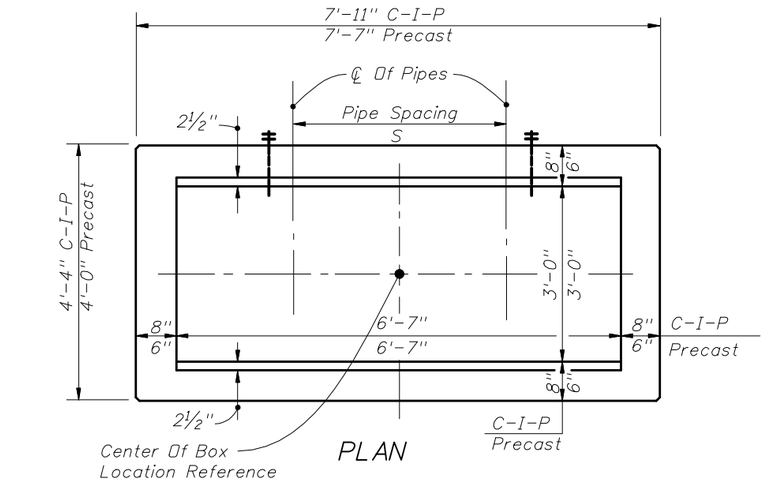
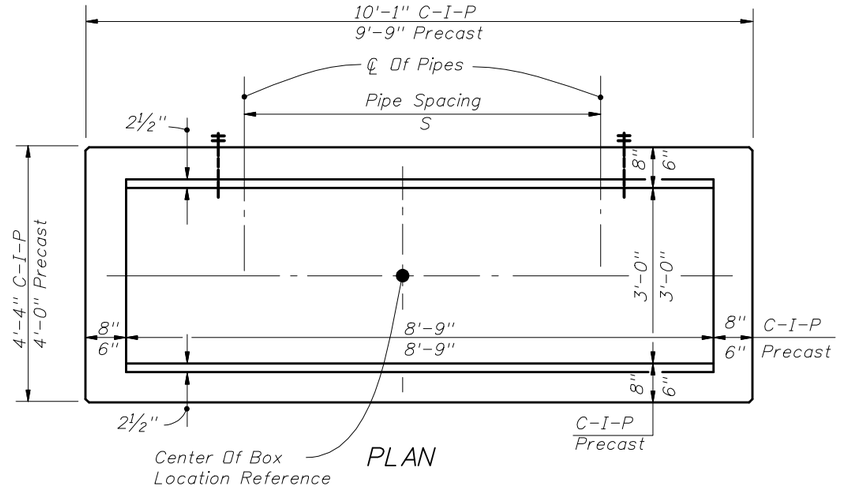
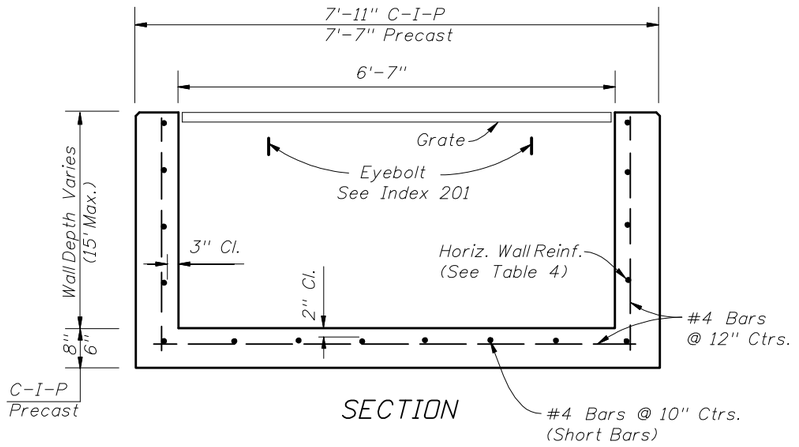
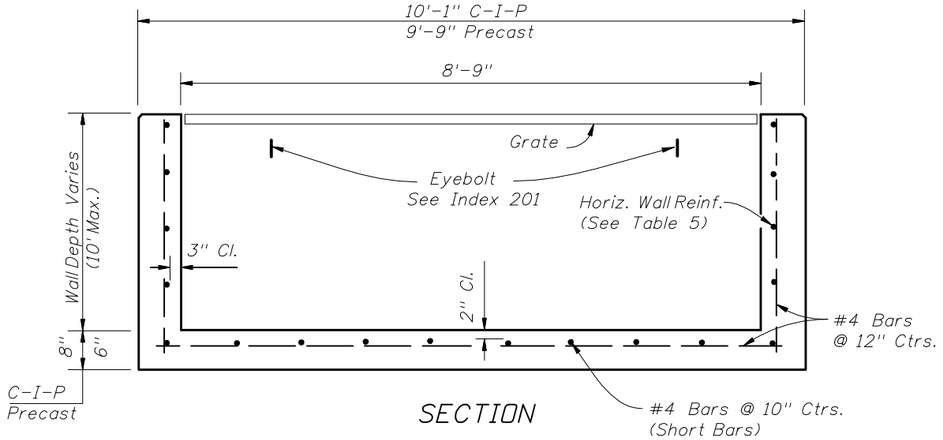








HORIZONTAL WALL REINFORCING SCHEDULES (TABLE 4)

WALL DEPTH	SCHEDULE	AREA (in.²/ft.)	MAX. SPACING	
			BARS	WWF
0'-5'	B5.5	0.24	5½"	5"
5'-7'	C6.5	0.37	6½"	6"
7'-15'	D4.5	0.53	4½"	4"

TYPE H (2 & 3-GRATE INLET)

Recommended Maximum Pipe Size:
3'-0" Wall - 24" Pipe
6'-7" Wall - 1-60" Pipe
Or 2-24" Pipe (S=3'-5")

HORIZONTAL WALL REINFORCING SCHEDULES (TABLE 5)

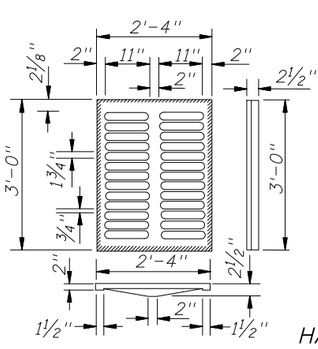
WALL DEPTH	SCHEDULE	AREA (in.²/ft.)	MAX. SPACING	
			BARS	WWF
0'-5'	C3.5	0.37	3½"	3"
5'-10'	D4.5	0.53	4½"	4"

TYPE H (4-GRATE INLET)

Recommended Maximum Pipe Size:
3'-0" Wall - 24" Pipe
8'-9" Wall - 1-78" Pipe
Or 2-30" Pipe (S=4'-3")

GENERAL NOTES

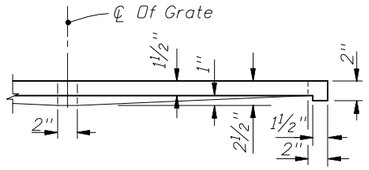
See Sheet 3 of 7.



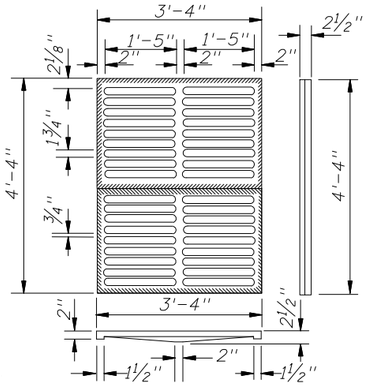
TYPE C

Approx. Weight 235 Lbs.

CAST IRON GRATE NOT PERMITTED ON INLET TYPE D

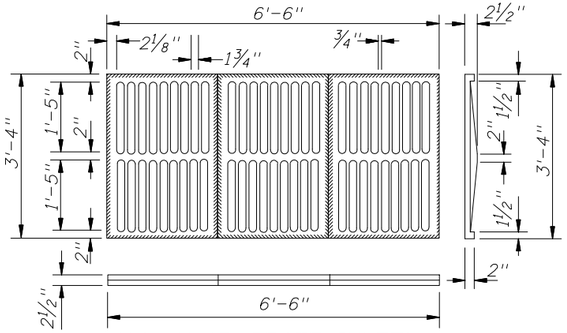


HALF SECTION CAST IRON GRATES



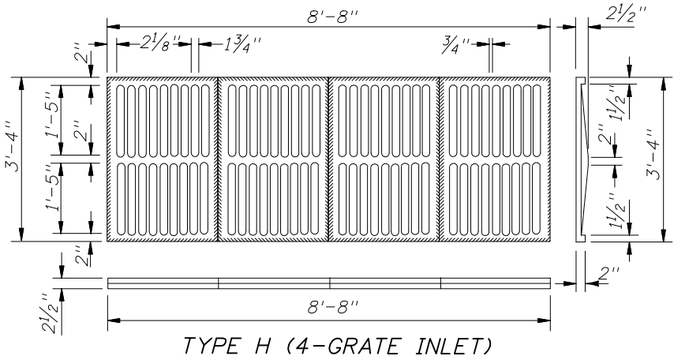
TYPE E

Approx. Weight 465 Lbs.



TYPE H (3-GRATE INLET)

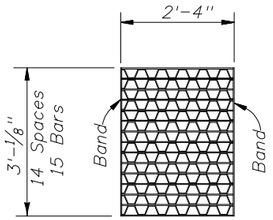
Approx. Weight 725 Lbs.



TYPE H (4-GRATE INLET)

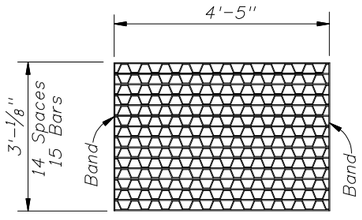
Approx. Weight 967 Lbs.

CAST IRON GRATES



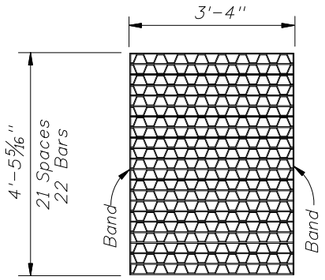
TYPE C

Straight Bars 2"x ¼"
Reticuline Bars 1¼" x 3/16"
Bands 2" x ¼"
Approx. Weight 104 Lbs.



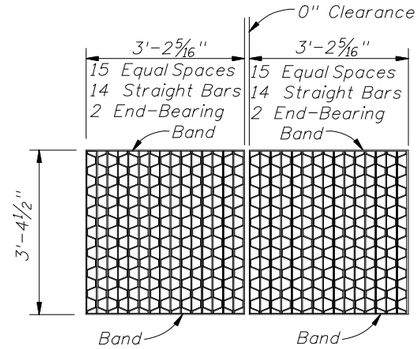
TYPE D

Straight Bars 2" x ¼"
Reticuline Bars 1¼" x 3/16"
Bands 2" x ¼"
Approx. Weight 190 Lbs.



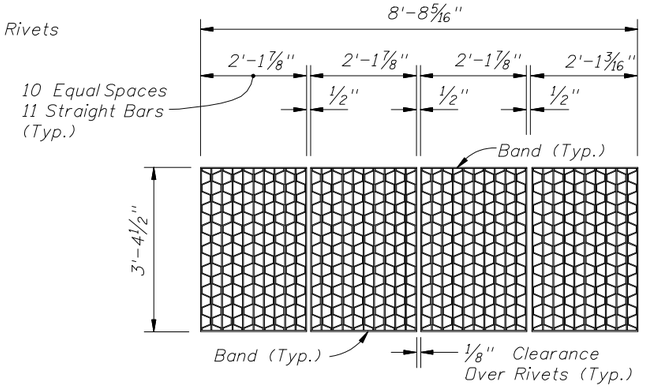
TYPE E

Straight Bars 2" x ¼"
Reticuline Bars 1¼" x 3/16"
Bands 2" x ¼"
Approx. Weight 215 Lbs.



TYPE H (2-GRATE INLET)

Straight End-Bearing Bars 2" x 3/8"
Straight Bearing Bars 2" x ¼"
Reticuline Bars 1¼" x 3/16"
Banding Bars 2" x ¼"
Approx. Total Weight 310 Lbs.



TYPE H (4-GRATE INLET)

Straight End-Bearing Bars 2" x ¼"
Reticuline Bars 1¼" x 3/16"
Banding Bars 2" x 3/16"
Approx. Total Weight 388 Lbs.

STEEL GRATES

NOTE: Steel Grates Are Required On Inlets With Traversable Slots And On Inlets where Bicycle Traffic Is Anticipated.

GENERAL NOTES

1. These inlets are suitable for bicycle traffic and are to be used in ditches, medians and other areas subject to infrequent traffic loadings but are not to be placed in areas subject to any heavy wheel loads. These inlets may be placed in areas subject to occasional pedestrian traffic such as landscaped areas and pavement areas where pedestrians can walk around the inlet.

2. Inlets subject to minimal debris should be constructed without slots. Where debris is a problem inlets should be constructed with slots. Slotted inlets located within roadway clear zones and areas subject to bicycles and/or pedestrians shall have traversable slots. The traversable slot modification is not adaptable to inlet Type H. Slots may be constructed at either or both ends as shown on plans.

3. Steel grates are to be used on all inlets where bicycle traffic is anticipated. Steel grates are to be used on all inlets with traversable slots. Either cast iron or steel grates may be used on inlets without slots where bicycle traffic is not anticipated. Either cast iron or steel grates may be used on all inlets with non-traversable slots. Subject to the selection described above, when Alternate G grate is specified in the plans, either the steel grate, hot dip galvanized after fabrication, or the cast iron grate may be used, unless the plans stipulate the particular type.

4. Recommended maximum pipe sizes shown are for concrete pipe. Size for other types of pipe must be checked for fit.

5. All exposed edges and corners shall be ¾" chamfer or tooled to ¼" radius.

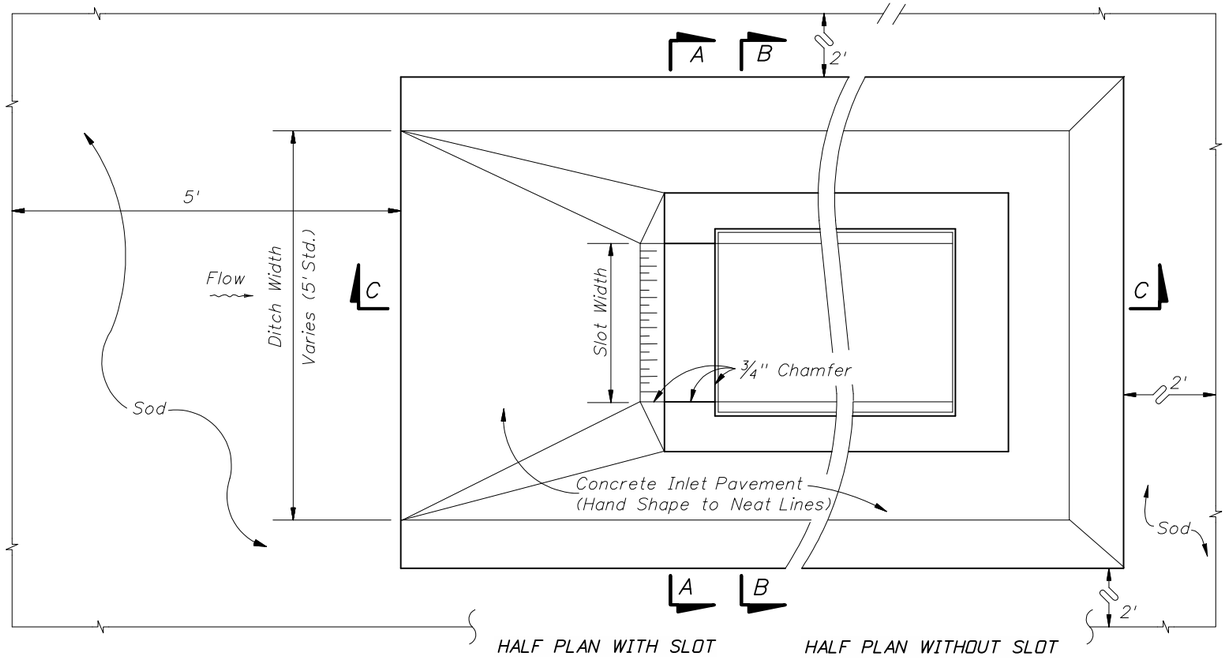
6. Concrete inlet pavement to be used on inlets without slots and inlets with nontraversable slots only when called for in the plans; but required on all traversable slot inlets. Cost to be included in contract unit price for inlets. Quantities shown are for information only.

7. Traversable slots constructed in existing inlets shall be paid for as inlets partial. For conversion work and method of payment see 'TRAVERSABLE SLOT INLETS (PARTIAL) FOR EXISTING INLETS'.

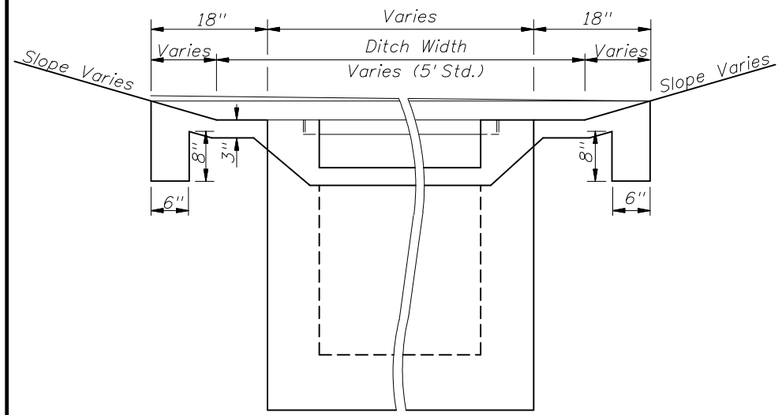
8. Sodding to be used on all inlets not located in paved areas and paid for under contract unit price for Performance Turf, SY.

9. For supplementary details see Index No. 201.

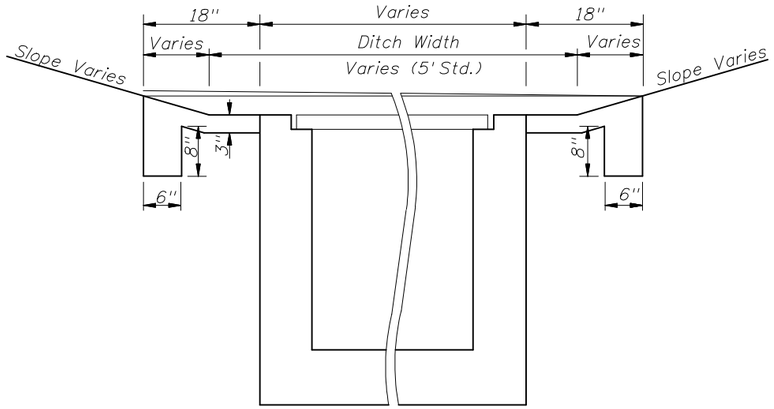
10. All reinforcing is Grade 60 bars with 2" min. cover unless otherwise noted. Bars to be cut or bent for 1½" clearance around pipe opening. Provide one additional #4 bar above and at each side of pipe opening.



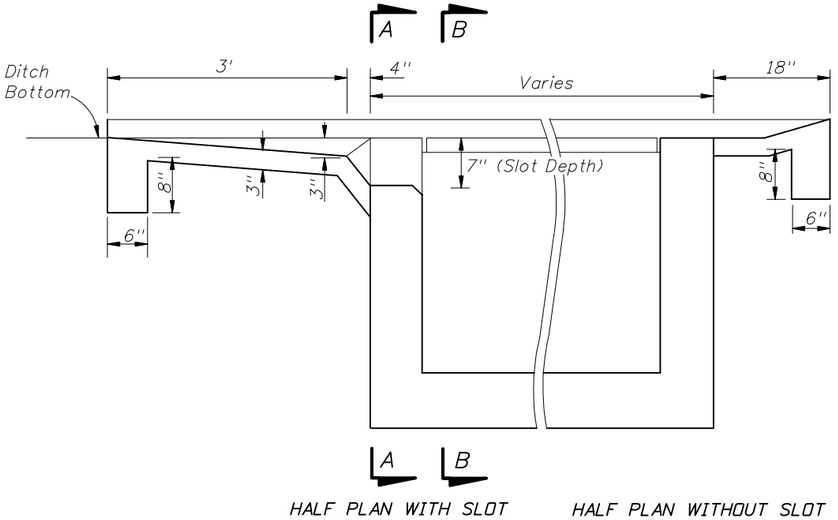
PLAN VIEW



SECTION AA



SECTION BB



SECTION CC

PAVEMENT AND SODDING QUANTITIES FOR TRAVERSABLE SLOTS						
Inlet	Pavement				Sod	
	Single Slot		Double Slot		Single Slot	Double Slot
	SY	CY	SY	CY	SY	SY
C	4.87	0.77	6.16	0.93	12	16
D	5.99	0.91	7.70	1.10	14	19
E	5.88	0.91	7.37	1.08	14	18

TRAVERSABLE SLOTS

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DITCH BOTTOM INLET TYPES C, D, E & H

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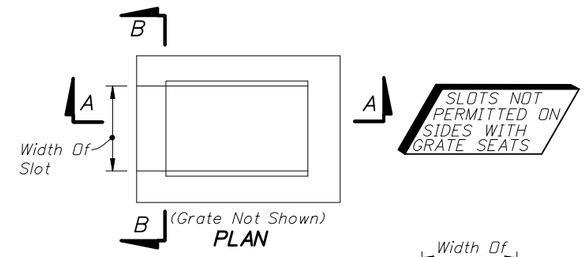
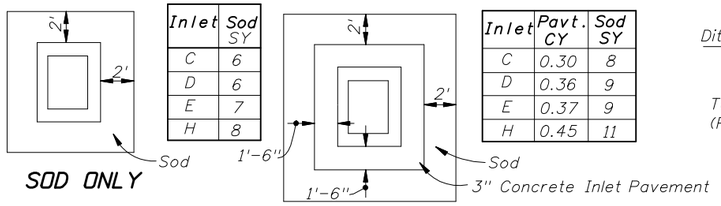


SECTION AA NONTRAVERSABLE SLOTS

SECTION BB



Inlet	Sod SY
C	6
D	6
E	7
H	8

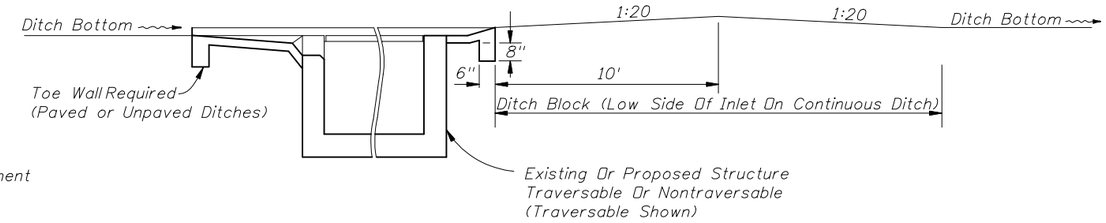
Inlet	Pavt. CY	Sod SY
C	0.30	8
D	0.36	9
E	0.37	9
H	0.45	11

SOD ONLY

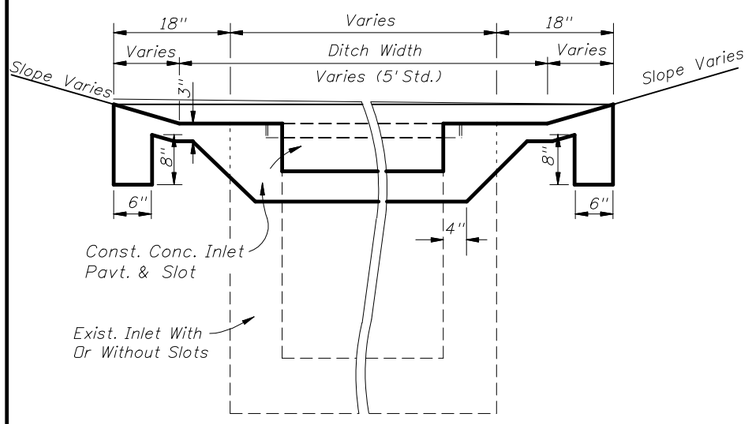
PAVT. AND SOD

NOTE: See General Notes Nos. 6 and 7, Sheet 3 of 7.

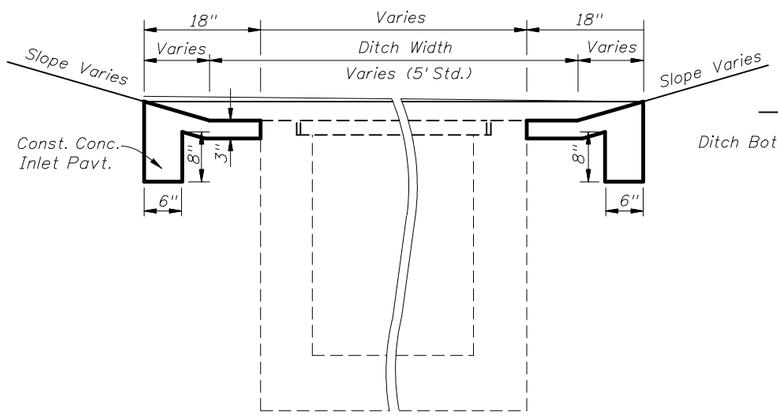
SODDING AND PAVEMENT FOR INLETS WITHOUT SLOTS AND INLETS WITH NONTRAVERSABLE SLOTS



DITCH BLOCK FOR INLETS WITH OR WITHOUT SLOTS

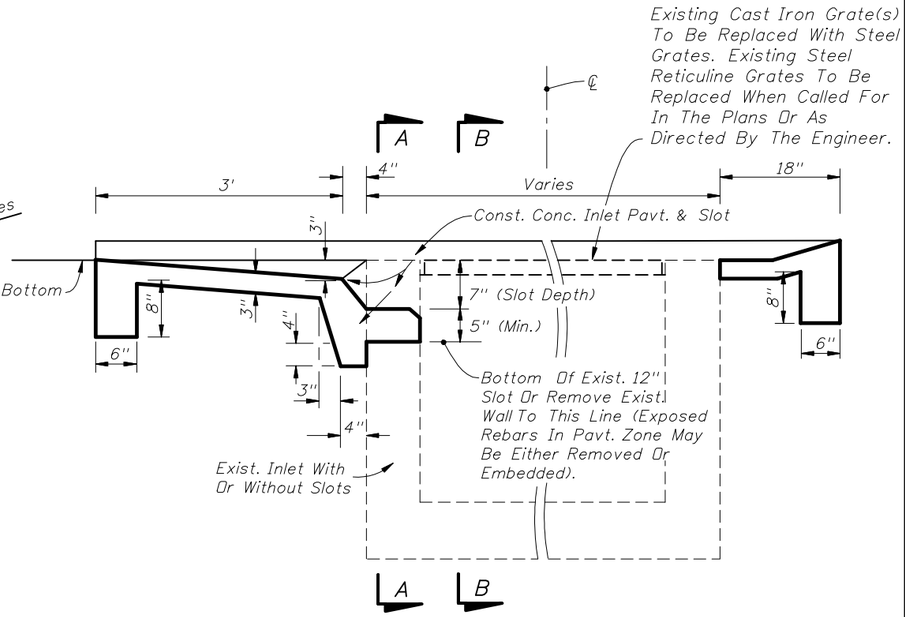


SECTION AA



SECTION BB

PAVEMENT AND SODDING QUANTITIES FOR TRAVERSABLE SLOTS						
Inlet	Pavement				Sod	
	Single Slot		Double Slot		Single Slot	Double Slot
	SY	CY	SY	CY	SY	SY
C	4.87	0.83	6.16	1.05	12	16
D	5.99	1.01	7.70	1.30	14	19
E	5.88	0.99	7.37	1.24	14	18

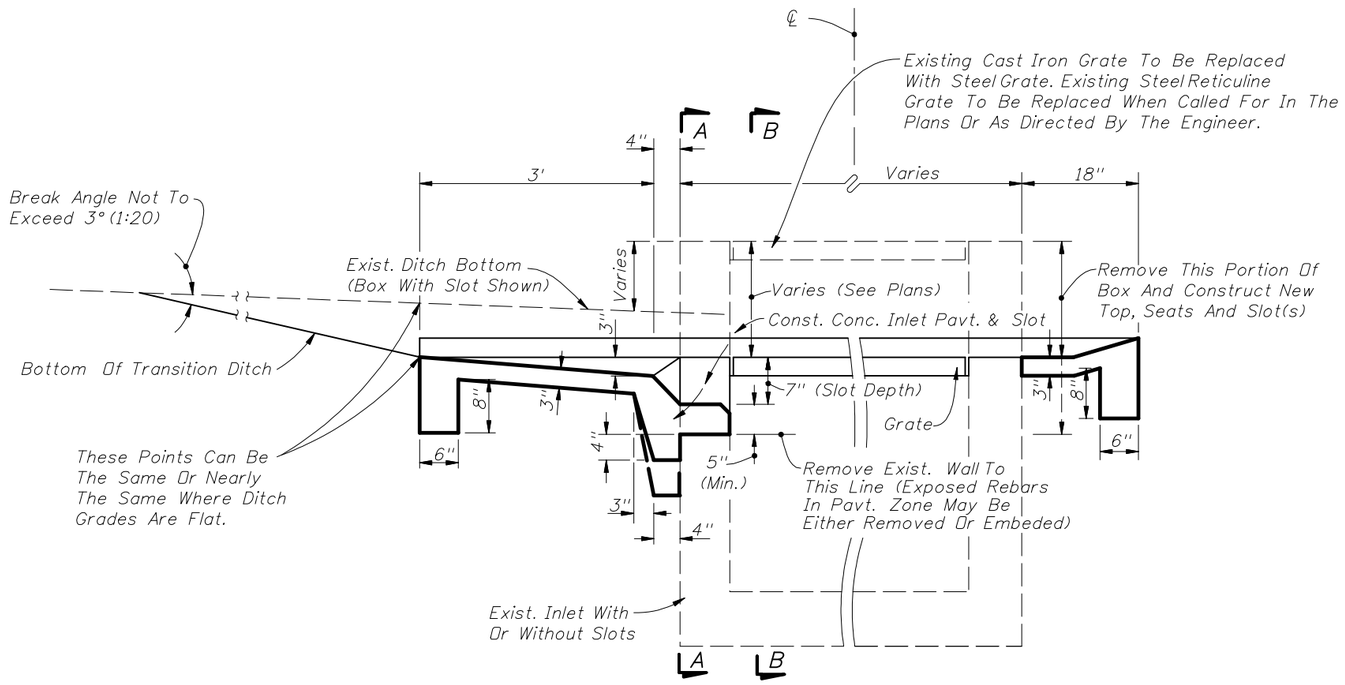


SINGLE SLOT SHOWN (DOUBLE SLOTS SYMMETRICAL ABOUT CENTERLINE)

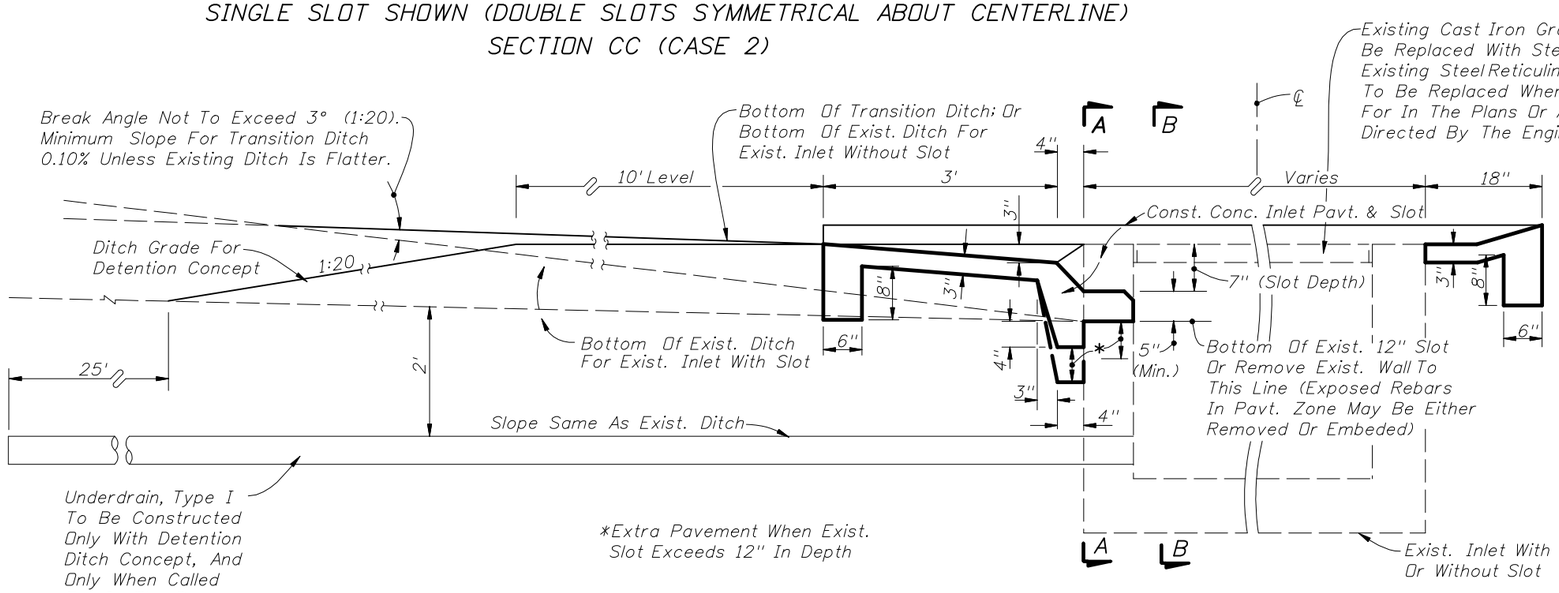
SECTION CC (CASE I)

NOTE: For plan view and additional details see Sheet 4 of 7.
For payment see General Notes Nos. 6 and 7, Sheet 3 of 7.

TRAVERSABLE SLOTS FOR EXISTING INLETS



SINGLE SLOT SHOWN (DOUBLE SLOTS SYMMETRICAL ABOUT CENTERLINE)
SECTION CC (CASE 2)



SINGLE SLOT SHOWN (DOUBLE SLOTS SYMMETRICAL ABOUT CENTERLINE)
SECTION CC (CASE 3)

TRAVERSABLE SLOT INLETS (PARTIAL) FOR EXISTING INLETS

DESIGN NOTES FOR TRAVERSABLE SLOT INLETS (PARTIAL) FOR EXISTING INLETS

1. The general purpose of these conversions is to remove the hazard of the protruding inlet top, while not creating a hazard by depressing the top too deeply.

2. The corrective procedure depends on the approach ditch grade and hydraulic requirements of the site. The selection of the appropriate case depends on the relationship between inlet top and ditch elevation, and, on the vertical clearance between the top of the uppermost pipe(s) and the grate. The purpose for the Case 1 conversion is to add the traversable slot to an existing inlet where top removal, change in grate elevation and ditch transitions are not required. Case 2 will normally be applicable to ditches with flatter grades adjoining the inlet. Case 3 will normally be applicable to ditches with steeper grades adjoining the inlet where build up of the existing ditch is acceptable.

3. The designer shall stipulate in the plans which case is to be constructed at each individual inlet location.

   Where the existing inlet top is above the existing ditch (Case 2) but borrow material will be required to adjust the ditch (Case 3), and vertical clearance or other conditions do not prevent removal of the inlet top, the designer should call for Case 2. The designer shall determine if ditch reconstruction is required more than 35 feet beyond any traversable slot side and shall include separate pay items in the plans to cover the cost for that portion of required ditch reconstruction exceeding the 35 foot limit. The designer shall also determine whether ditch pavement is required for ditch restoration within the 35 foot limit and include that pavement under a pay item separate from the inlets partial.

   When the detention ditch concept is to be used with Case 3, the designer shall stipulate 'Case 3 (Detention)' in the plans.

   The designer shall determine whether tight soil or other conditions at each individual inlet indicates the need for underdrain in Case 3 conversions and shall call for Underdrain, Type I in the plans.

METHOD OF PAYMENT FOR TRAVERSABLE SLOT INLETS (PARTIAL) FOR EXISTING INLETS

1. Existing inlets converted to traversable slot tops under Cases 1, 2 and 3 shall be paid for as inlets partial, each. Case shall not be included in the pay item description.

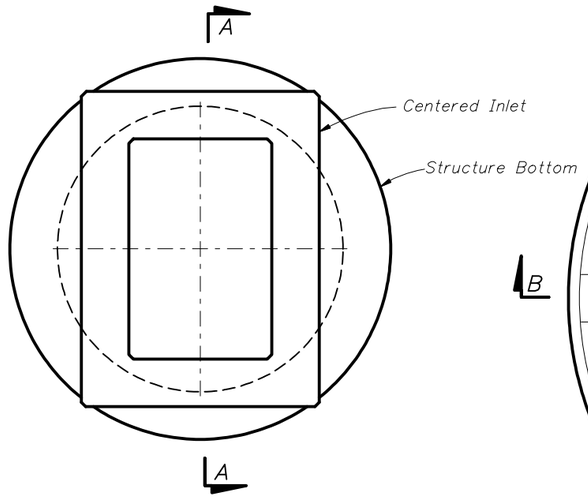
2. All ditch reconstruction work within 35 feet of each traversable slot conversion, whether required by these details or as a direct result of the conversion, shall be included as a part of the partial cost. Reconstruction work shall include excavation and removal of surplus materials or borrow materials in place, grading, compaction, shaping and restoration of disturbed turf. Sodding, ditch pavement and underdrain are not included as part of the inlet partial cost and are to be paid for separately.

3. Concrete inlet pavement and sodding shall be in accordance with the sections on this detail and with the Plan on Sheet 4 and Sections AA, BB and CC (as Case 1) and tabular quantities on Sheet 5.

4. Unit price and payment shall constitute full compensation for inlet conversion (including concrete inlet paving and replacement grate(s)), ditch reconstruction, restoration of disturbed turf, and shall be paid for under the contract price for Inlets (DT Bot) (Type __) (Partial), each.

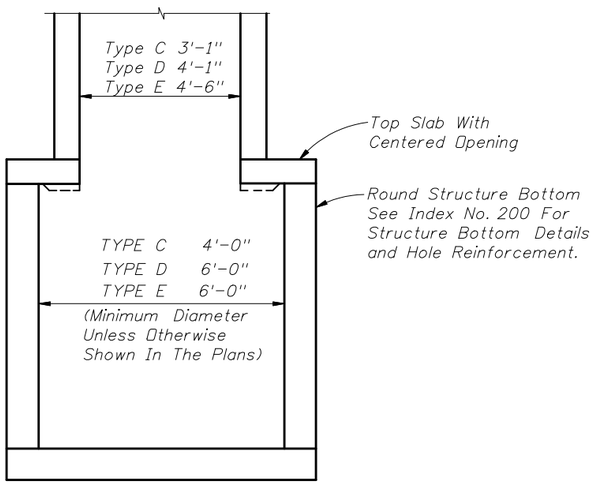
   Sodding shall be paid for under the contract unit price for Performance Turf, SY.

   Ditch pavement shall be paid for separate from the inlet by pavement type(s) and unit(s) as called for in the plans.

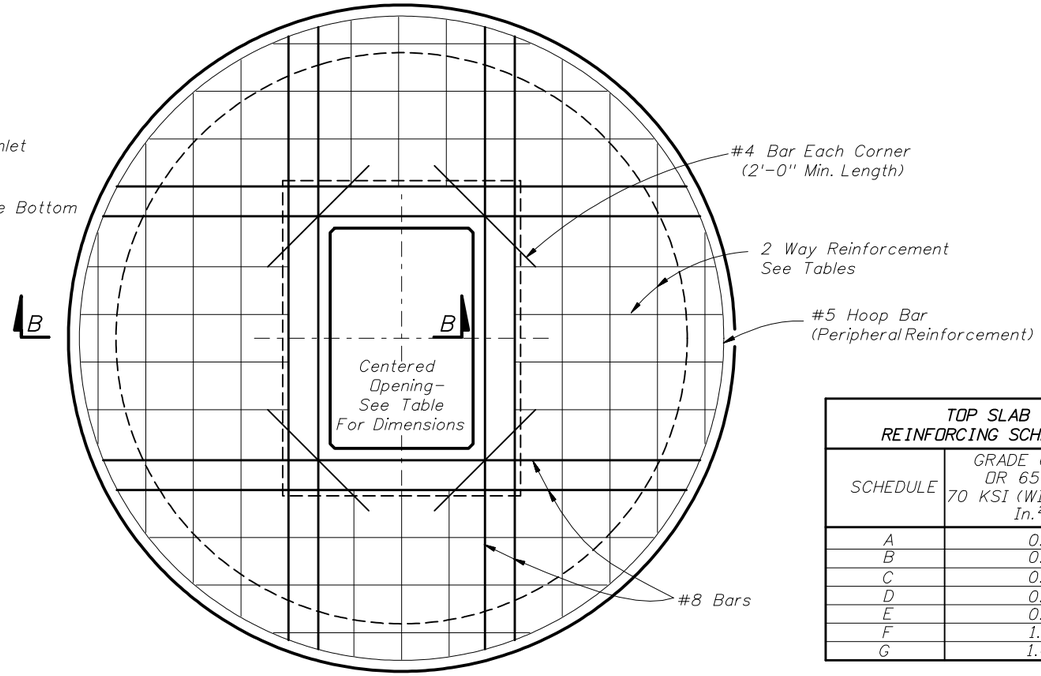


TOP VIEW

TOP SLAB OPENINGS		
DIAMETER	OPENING SIZE	
	MIN.	MAX.
4'-0"	2'-0" x 3'-1"	2'-0" x 3'-1"
5'-0"	2'-0" x 3'-1"	3'-1" x 4'-1"
6'-0"	2'-0" x 3'-1"	3'-0" x 4'-6"
8'-0"	2'-0" x 3'-1"	3'-0" x 4'-6"

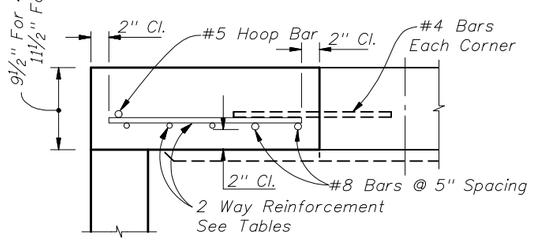


SECTION AA



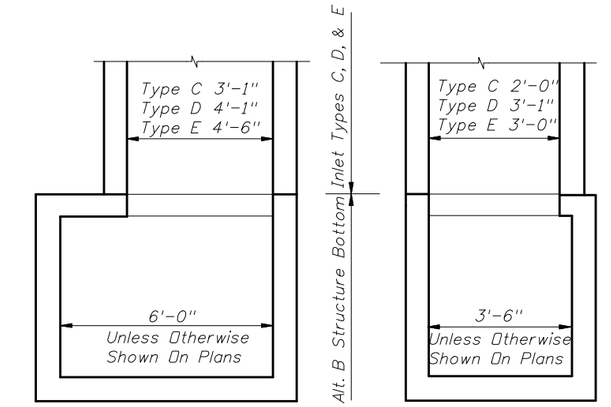
TOP SLAB REINFORCING DIAGRAM

TOP SLAB REINFORCING SCHEDULE	
SCHEDULE	GRADE 60 (BAR) OR 65 KSI & 70 KSI (WIRE FABRIC) $In.^2/ft.$
A	0.20
B	0.24
C	0.37
D	0.53
E	0.73
F	1.06
G	1.45



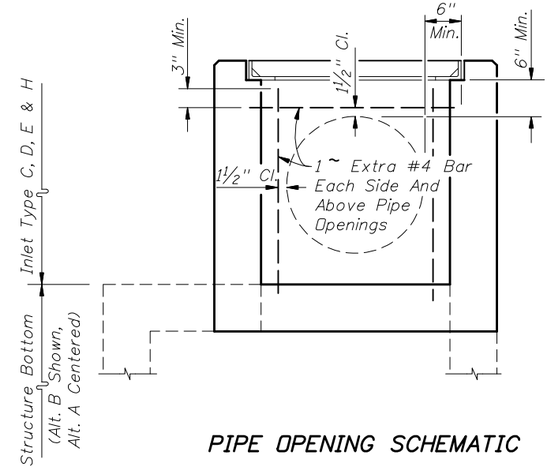
SECTION BB

TOP SLAB WITH CENTERED OPENING		
SLAB DEPTH	SLAB THICKNESS	REINFORCING (2 WAYS) SCHEDULE
SIZE:4'-0"		
≥0.5'-40'	9½"	C
SIZE:5'-0"		
≥0.5' < 30'	9½"	C
30'-40'	9½"	D
SIZE:6'-0"		
0.5' < 8'	9½"	B
8' < 18'	9½"	C
18' < 30'	9½"	D
30' < 37'	9½"	E
37'-40'	9½"	G
SIZE:8'-0"		
≥0.5' < 9'	11½"	C
9' < 15'	11½"	D
15' < 23'	11½"	E
23' < 33'	11½"	E
33'-40'	11½"	G



See Index No. 200 for structure bottom details and hole reinforcement.

ALT. B STRUCTURE BOTTOM FOR INLETS TYPE C, D & E



PIPE OPENING SCHEMATIC

ALT. A STRUCTURE BOTTOM FOR INLETS TYPE C, D AND E

2010 FDOT Design Standards

DITCH BOTTOM INLET TYPES C, D, E & H

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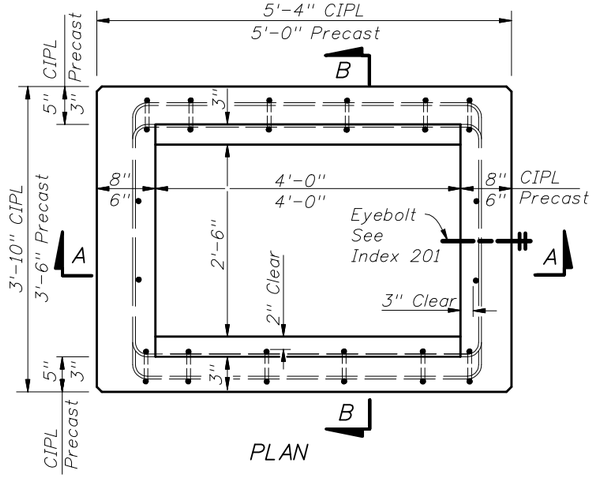
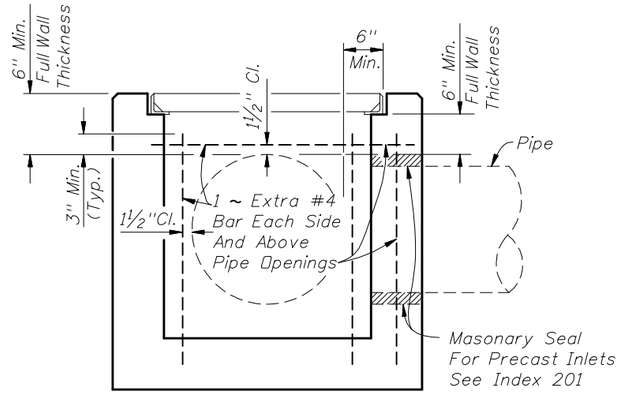
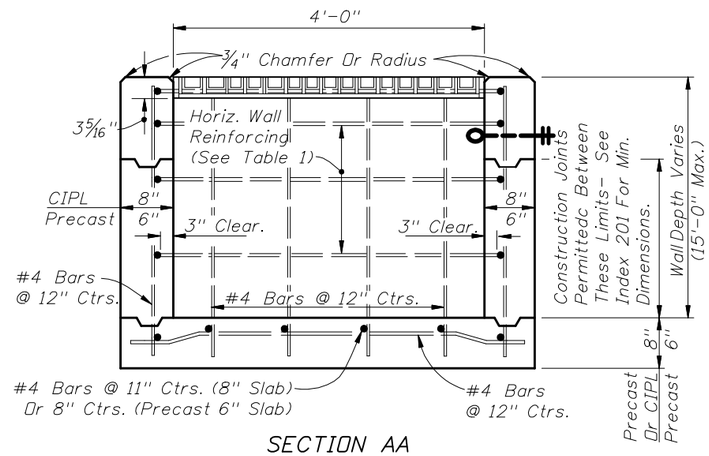


PLAN

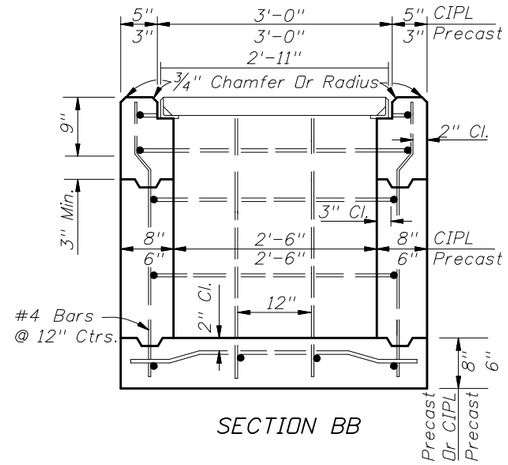


(TYPE F SHOWN, TYPE G SIMILAR)

PIPE OPENING SCHEMATIC

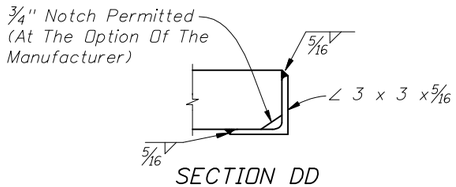


SECTION AA



SECTION BB

SECTION CC



SECTION DD

HORIZONTAL WALL REINF. SCHEDULES
TYPE F INLET (TABLE 1)

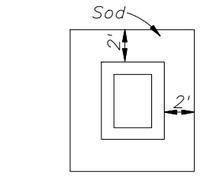
WALL DEPTH	SCHEDULE	AREA (in.²/ft.)	MAX. SPACING	
			BARS	WWF
0' - 4'	A12	0.20	12"	8"
4' - 7'	A6	0.20	6"	5"
7' - 12'	B5.5	0.24	5½"	5"
12' - 15'	Special 1	0.267	5"	4"

GENERAL NOTES

1. These inlets are designed for use in ditches, medians, pavement areas, or other areas subject to heavy wheel loads, minimal debris, and bicycle traffic. This inlet may be placed in areas subject to occasional pedestrian traffic such as landscaped areas and pavement areas where pedestrians can walk around the inlet. When inlet is placed in areas subject to bicycle traffic, install filler bar when clearance or gap is greater than 1" as shown in Index 218 Inset B.
2. When Alternate G grate is specified in plans, the grate is to be hot dip galvanized after fabrication.
3. These inlets may be used with Alternate B structure bottoms, Index 200. The inlet and bottom combinations are to be paid for under the contract unit price for inlets (DT Bot) (Type F (or G)) (J Bot, Depth), Ea.
4. All exposed edges and corners shall be ¾" chamfer or tooled to ¼" radius.
5. For supplemental details, see Index 201.
6. All reinforcing is Grade 60 bars with 2" min. cover unless otherwise noted. Bars to be cut or bent for 1½" clearance around pipe opening. Provide one additional #4 bar above and at each side of pipe opening, as shown.
7. All dimensions are for both precast and cast-in-place inlets unless otherwise noted.

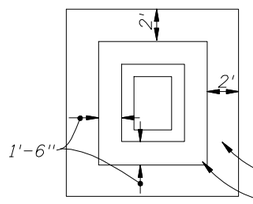
RECOMMENDED MAXIMUM PIPE SIZES	
INLET INSIDE WIDTH	PIPE SIZE
2'-6" (Type F)	18"
4'-0" (Type F)	30"
4'-10" / 5'-0" (Type G)	42"

Note: Recommended sizes are for concrete pipe. Sizes for other types of pipe must be verified for fit in accordance with Index No. 201. For larger pipe sizes see Note 3.



Inlet	Sod SY
G	7
F	6

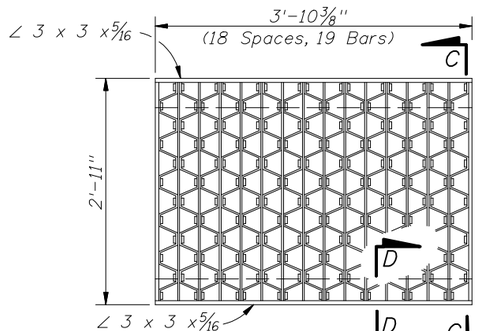
SOD ONLY



Inlet	Pavt. CY*	Sod SY
G	0.43	10
F	0.34	9

*For Estimating Purposes Only

PAVT. AND SOD



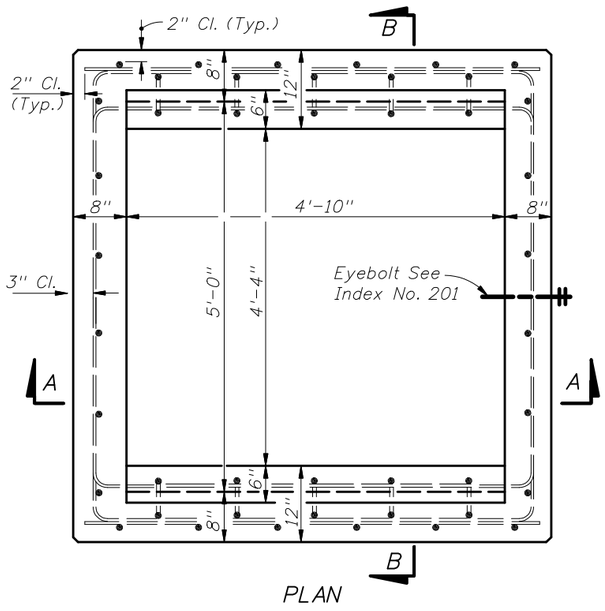
STEEL GRATE

Steel Grating, Straight Bars 3"x ¼"
Reticuline Bars 2"x 3/16"

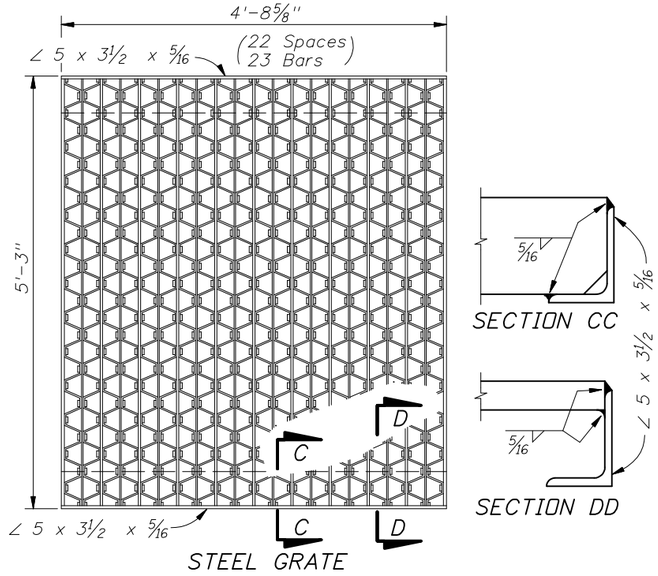
Notes:
1. Pavement and/or sod to be used only where called for in the plans.
2. Cost of paving to be included in cost of inlet.

TYPE F

PAVEMENT AND SODDING



PLAN

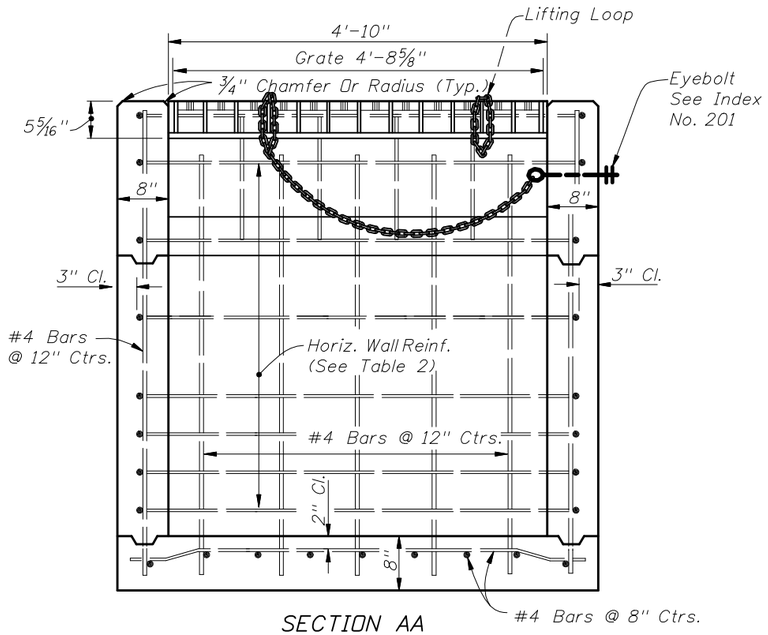


STEEL GRATE

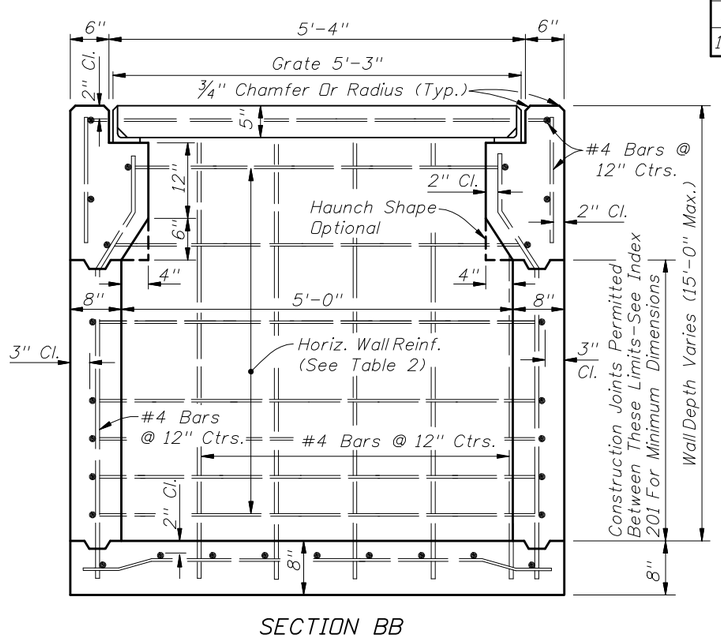
5" Steel Decking, Weight 630 Lbs. Main Bars 5" x ¼"
Intermediate Bars 1½" x¼", Reticuline Bars 1¼" x 3/16"

TYPE G INLET (TABLE 2)

WALL DEPTH	SCHEDULE	AREA (in.²/ft.)	MAX. SPACING	
			BARS	WWF
0' – 3'	A12	0.20	12"	8"
3' – 7'	A6	0.20	6"	5"
7' – 10'	B5.5	0.24	5½"	5"
10' – 15'	C6.5	0.37	6½"	6"



SECTION AA



SECTION BB

TYPE G

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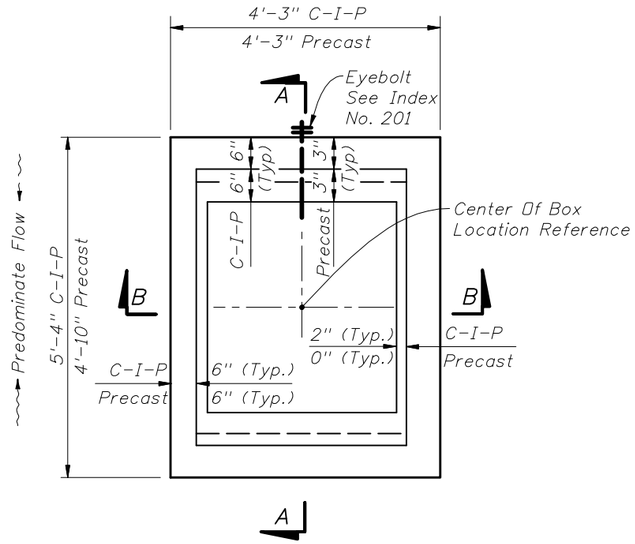
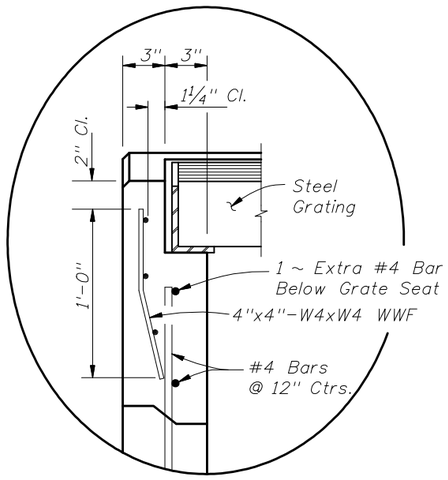
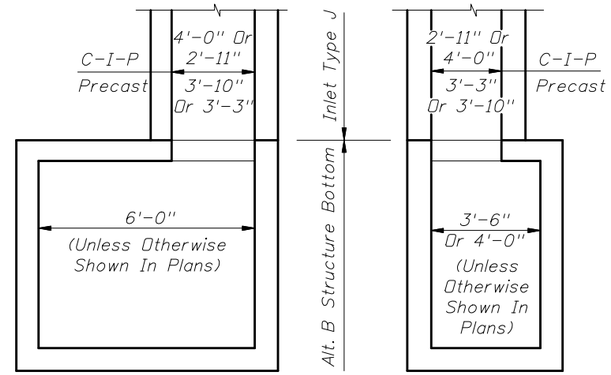
	DITCH BOTTOM INLET TYPES F & G	Index No. 233



PLAN
(CAST-IN-PLACE INLET SHOWN, WITHOUT GRATE, PRECAST INLET SIMILAR)



INSET A
(PRECAST OPTION)



NOTE: Alt. B Structure Bottom Only. See Index No. 200 for structure bottom details and hole reinforcement.

INLET WITH STRUCTURE BOTTOM

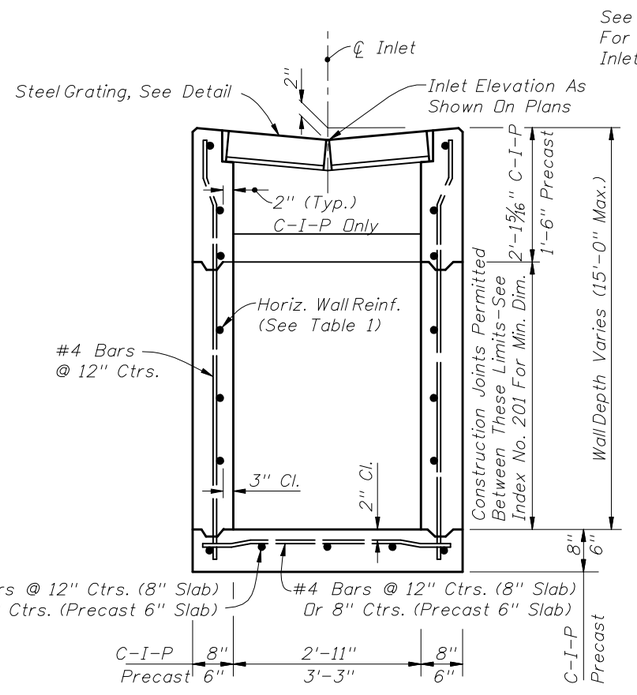
HORIZONTAL WALL REINFORCING SCHEDULE (TABLE 1)

WALL DEPTH	SCHEDULE	AREA (In^2/ft)	MAX. SPACING	
			BARS	WWF
0' - 4'	A12	0.20	12"	8"
4' - 9'	A6	0.20	6"	5"
9' - 12'	A4	0.20	4"	3"
9' - 15'	B5.5	0.24	5½"	5"

RECOMMENDED MAXIMUM PIPE SIZES

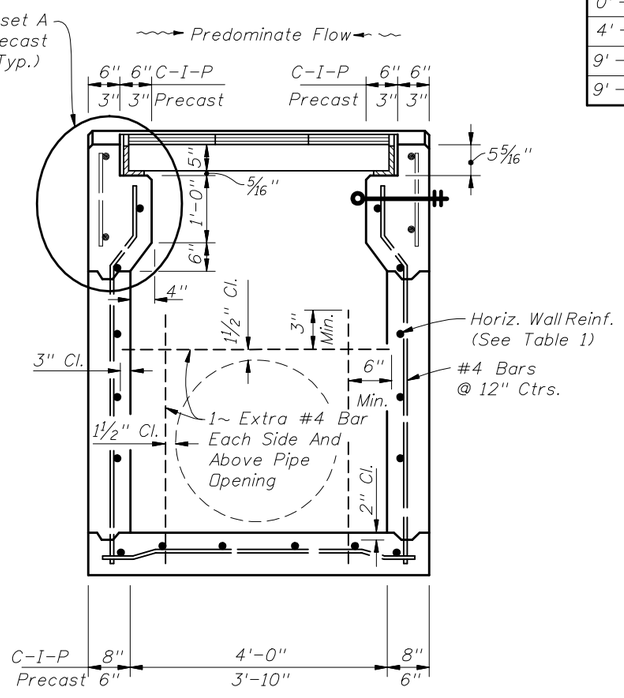
INLET INSIDE WIDTH	PIPE SIZE
2'-11" or 3'-3"	24"
3'-10" or 4'-0"	30"

Note: Recommended sizes are for concrete pipe. Sizes for other types of pipe must be verified for fit in accordance with Index No. 201. For larger pipe, see Structure Bottom detail above and Index No. 200.



(Pipe Opening Not Shown)

SECTION BB



(Pipe Opening Shown)

SECTION AA

GENERAL NOTES

1. This inlet is designed for use in ditches, medians, pavement areas or other areas subject to heavy wheel loads with minimal debris. This inlet is not for use in areas subject to bicycle traffic. This inlet may be placed in areas subject to occasional pedestrian traffic such as landscaped areas and pavement areas where pedestrians can walk around the inlet.
2. All reinforcing Grade 60 bars with 2" min. cover unless otherwise noted. See Index No. 201 for equivalent area of welded wire fabric. Cut or bend bars out of way of pipe when necessary; bars to clear pipe by 1½".
3. All exposed edges and corners shall be ¾" chamfer or tooled to ¼" radius.
4. When alternate G grate is specified in plans the grate is to be hot dip galvanized after fabrication.
5. For supplemental details, see Index No. 201.
6. All dimensions are for both precast and cast-in-place inlets unless otherwise noted.
7. Cost of ditch paving to be included in cost of inlet. Sodding to be paid for under contract unit price for Performance Turf, SY.

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DITCH BOTTOM INLET TYPE J

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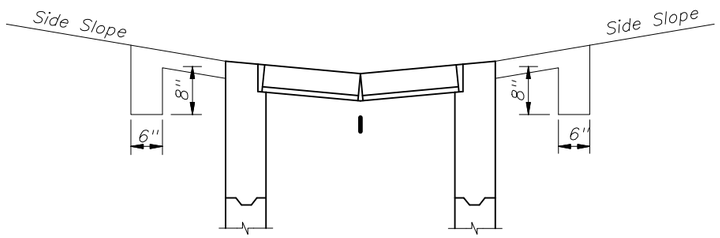
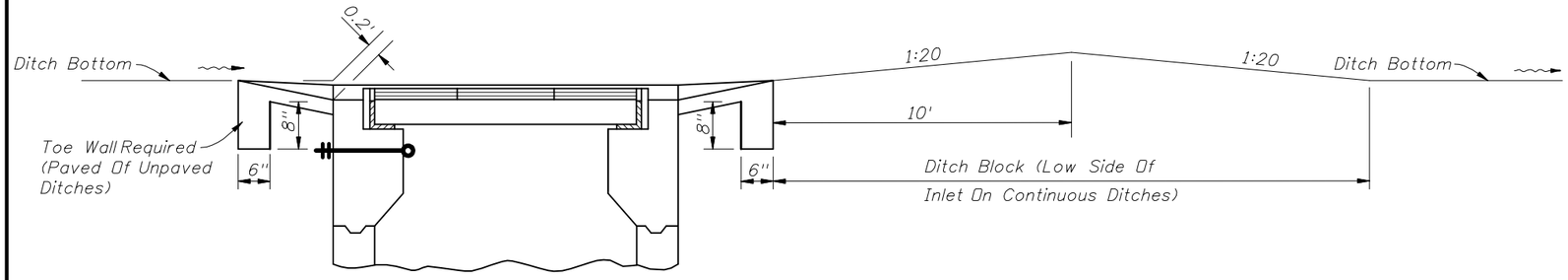
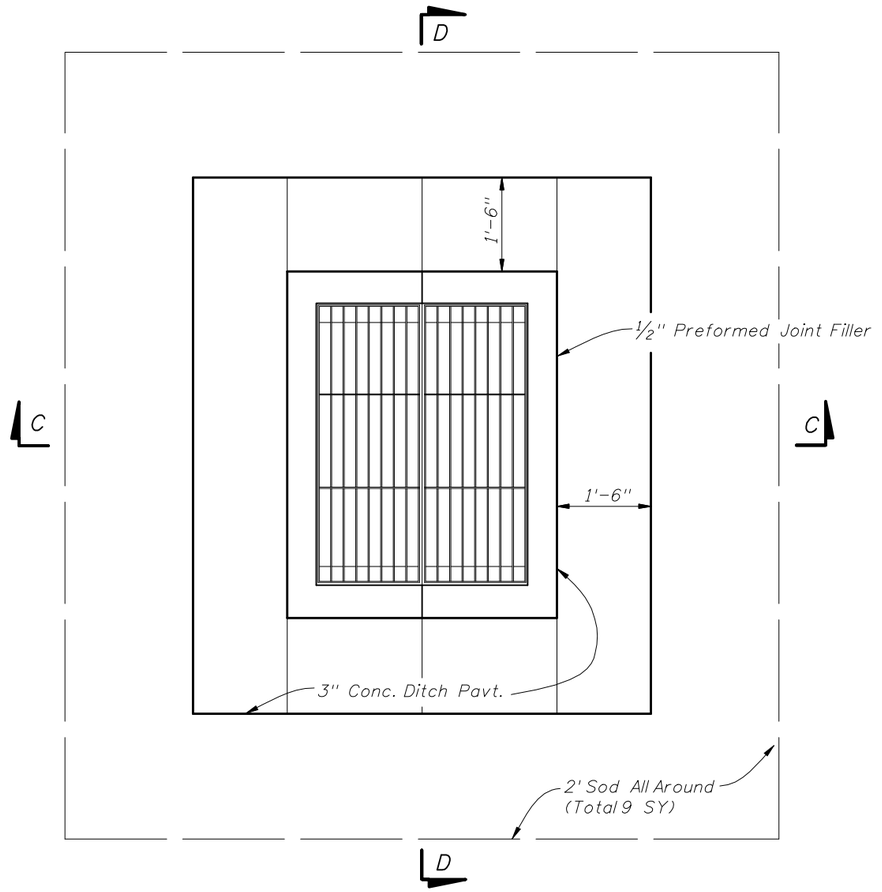


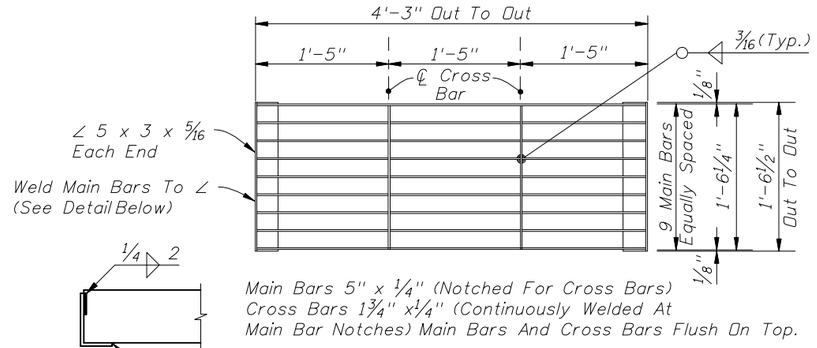
SECTION CC



SECTION DD



PAVEMENT & SODDING



DETAIL

Main Bars 5" x ¼" (Notched For Cross Bars)
Cross Bars 1¾" x¼" (Continuously Welded At
Main Bar Notches) Main Bars And Cross Bars Flush On Top.

Note: Two Required Per Inlet

STEEL GRATING

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DITCH BOTTOM INLET
TYPE J

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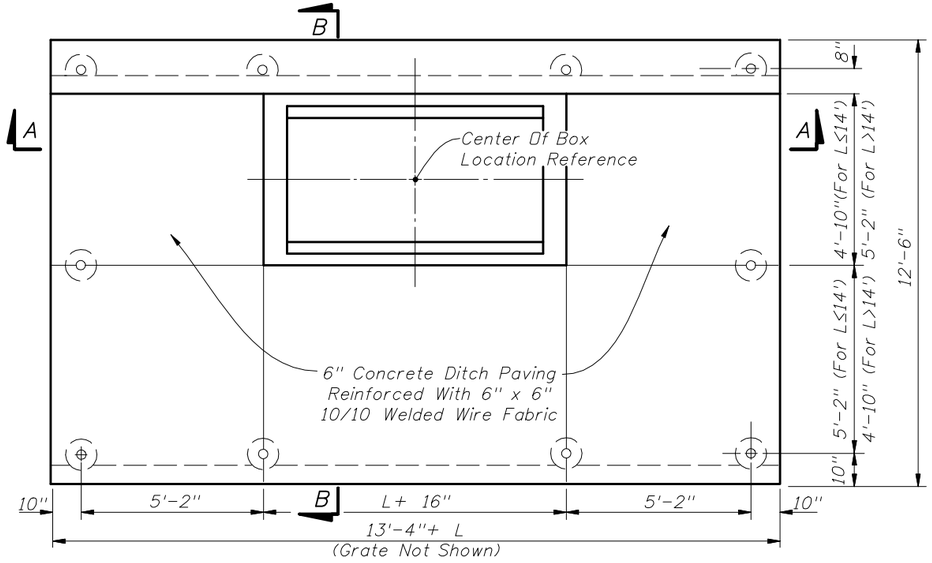
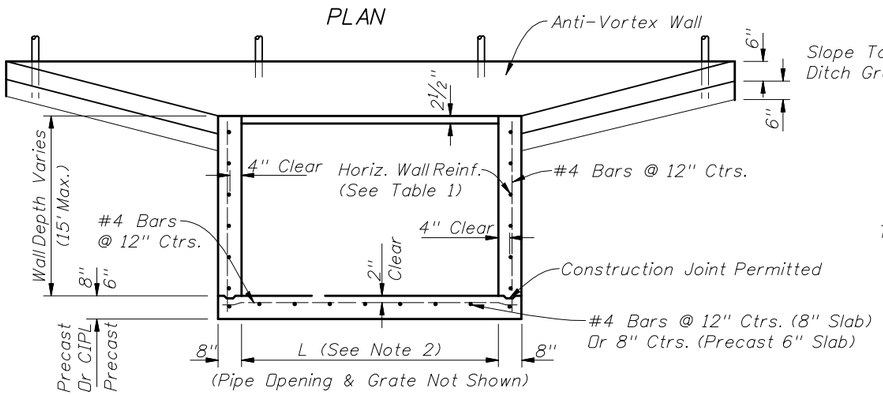
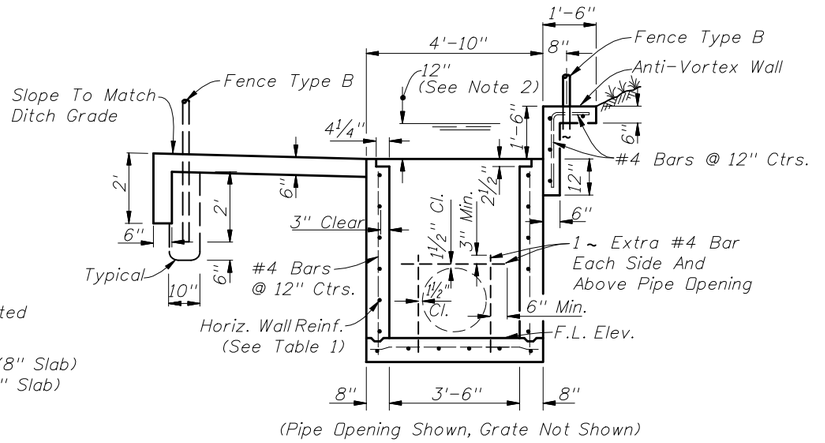


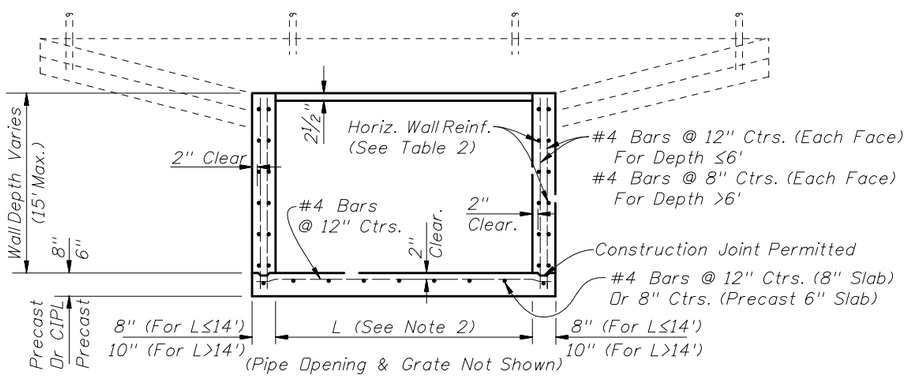


SECTION AA

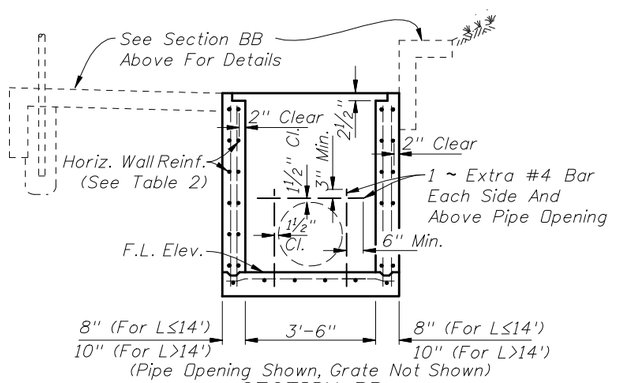


SECTION BB

INLET LENGTHS (L) LESS THAN OR EQUAL TO 9' (SINGLE LAYER WALL REINFORCING)



SECTION AA



SECTION BB

INLET LENGTHS (L) GREATER THAN OR EQUAL TO 9' (DOUBLE LAYER WALL REINFORCING)

GENERAL NOTES

1. This inlet is to be used at locations having high flow rates, usually where an endwall could not be utilized without hazardous intake.
2. Inlet length (L) shall be set by the designer for the greater of either culvert requirement or inlet pool not to exceed 12" depth. Structures over 6 feet in depth are to be checked for flotation by the designer of project drainage.
3. This inlet is not intended for use with Index 200 structure bottoms.
4. All exposed edges and corners shall be ¾" chamfer or tooled to ¼" radius.
5. Inlet and anti-vortex wall to be Class II Concrete.
6. All reinforcing is Grade 60 with 2" min. cover unless otherwise noted. See Index No. 201 for equivalent area of welded wire fabric (WWF). Bars to be cut or bent for 1½" clearance around pipe opening. Bend top and corner bars to clear anchor holes.
7. Channel section C 3x6 at 14" max. bar spacing may be used as an alternate for the C 4x5.4 channel at 15" bar spacing.
8. Channels and bars for grate shall be ASTM A242/A242M, A572/A572M or A588/A588M, Grade 50 steel, and galvanized in accordance with Specification Section 975.
9. Fence enclosure shall be Fence Type B (Index No. 802). All posts to be set in concrete. A minimum of 10 posts required. Corner and approach side posts to be 3" nominal diameter.
10. Cost of ditch paving, anti-vortex wall, grate, concrete, reinforcing steel and fence enclosure to be included in the cost of inlet. Inlet to be paid for under the contract unit price for Inlets (DT Bot) (Type K), Each.
11. Anchor Bolts shall be ASTM F1554 Grade 36 fully threaded headless bolts, installed in accordance with Specification Sections 416 and 937. Nuts shall be ASTM A563 or A194 and washers shall be ASTM F436 or Type A plain washers. All nuts, bolts and washers shall be galvanized.

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DITCH BOTTOM INLET TYPE K

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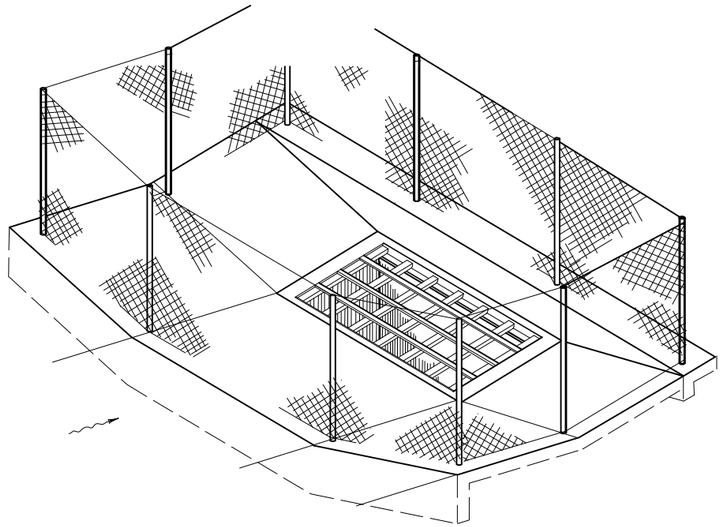
HORIZONTAL WALL REINFORCING SCHEDULES



ISOMETRIC OF INLET FENCE ENCLOSURE

WALL DEPTH	SCH.	AREA (in.²/ft.)	MAX. SPACING BARS	MAX. SPACING WWF
SIZE: L=5'-0"				
0'-5'	A12	0.20	12"	8"
5'-8'	A6	0.20	6"	5"
8'-15'	B5.5	0.24	5½"	5"
SIZE: L=6'-0"				
0'-4'	A12	0.20	12"	8"
4'-6'	B5.5	0.24	5½"	5"
6'-9'	C6.5	0.37	6½"	6"
9'-15'	C3.5	0.37	3½"	3"
SIZE: L=7'-0"				
0'-4'	B5.5	0.24	5½"	5"
4'-7'	C6.5	0.37	6½"	6"
7'-15'	D4.5	0.53	4½"	4"
SIZE: L=8'-0"				
0'-3'	B5.5	0.24	5½"	5"
3'-5'	C6.5	0.37	6½"	6"
5'-9'	D4.5	0.53	4½"	4"
9'-15'	E5	0.73	5"	4"
SIZE: L=9'-0"				
0'-4'	C6.5	0.37	6½"	6"
4'-7'	D4.5	0.53	4½"	4"
7'-15'	E3	0.73	3"	3"

SINGLE LAYER REINFORCING (TABLE 1)

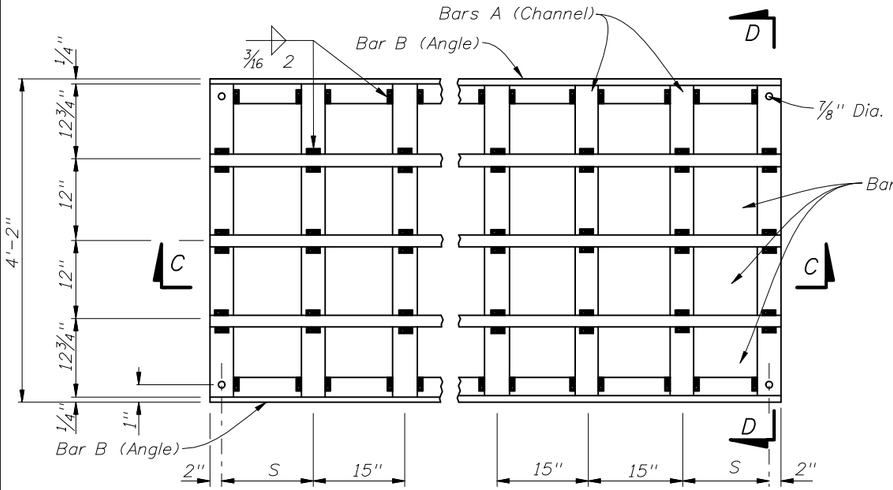
WALL DEPTH	SCH.	AREA (in.²/ft.)	MAX. SPACING BARS	MAX. SPACING WWF
SIZE: L=9'-0"				
0'-4'	A12	0.20	12"	8"
4'-6'	A6	0.20	6"	5"
6'-8'	B5.5	0.24	5½"	5"
8'-15'	C6.5	0.37	6½"	6"
SIZE: L=10'-0"				
0'-3'	A12	0.20	12"	8"
3'-5'	A6	0.20	6"	5"
5'-8'	C6.5	0.37	6½"	6"
8'-15'	C3.5	0.37	3½"	3"
SIZE: L=12'-0"				
0'-4'	B5.5	0.24	5½"	5"
4'-6'	C6.5	0.37	6½"	6"
6'-15'	D4.5	0.53	4½"	4"
SIZE: L=14'-0"				
0'-4'	C6.5	0.37	6½"	6"
4'-7'	D4.5	0.53	4½"	4"
7'-15'	E5	0.73	5"	4"
SIZE: L=16'-0" x 10" WALL THICK				
0'-4'	C6.5	0.37	6½"	6"
4'-8'	D4.5	0.53	4½	4"
8'-15'	E5	0.73	5"	4"
SIZE: L=18'-0" x 10" WALL THICK				
0'-3'	C6.5	0.37	6½"	6"
3'-5'	D4.5	0.53	4½"	4"
5'-8'	E5	0.73	5"	4"
8'-15'	F5	1.06	5"	4"

DOUBLE LAYER REINFORCING (TABLE 2)

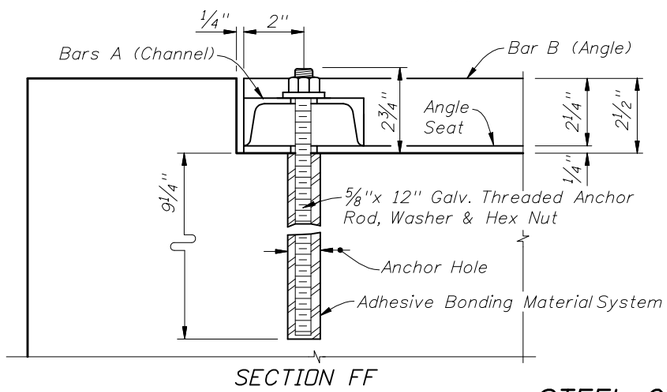
GRATE QUANTITIES

PIPE SIZE	L	S	BILL OF STEEL BAR	BILL OF STEEL No. REQD.	BILL OF STEEL LENGTH	STEEL WEIGHT CHANNEL 4"x 5.4#	STEEL WEIGHT ANGLE 3"x 2½"x ¼" (4.5#/FT.)	STEEL WEIGHT FLAT 2" x ½" (3.4#/FT.)
30"&36"	5'-0"	12¾"	A	5	4'-1½"	111		
			B	2	4'-11½"		45	
			C	3	4'-11½"			51
42"&48"	6'-0"	11¼"	A	6	4'-1½"	134		
			B	2	5'-11½"		54	
			C	3	5'-11½"			61
54"&60"	7'-0"	9¾"	A	7	4'-1½"	156		
			B	2	6'-11½"		63	
			C	3	6'-11½"			71
66"&72"	8'-0"	8¼"	A	8	4'-1½"	178		
			B	2	7'-11½"		72	
			C	3	7'-11½"			81
84"	9'-0"	14¼"	A	8	4'-1½"	178		
			B	2	8'-11½"		81	
			C	3	8'-11½"			91
SPECIAL	10'-0"	12¾"	A	9	4'-1½"	201		
			B	2	9'-11½"		90	
			C	3	9'-11½"			102
SPECIAL	12'-0"	9¾"	A	11	4'-1½"	245		
			B	2	11'-11½"		108	
			C	3	11'-11½"			122
SPECIAL	14'-0"	14¼"	A	12	4'-1½"	267		
			B	2	13'-11½"		126	
			C	3	13'-11½"			142
SPECIAL	16'-0"	11¼"	A	14	4'-1½"	312		
			B	2	15'-11½"		144	
			C	3	15'-11½"			163
SPECIAL	18'-0"	8¼"	A	16	4'-1½"	356		
			B	2	17'-11½"		162	
			C	3	17'-11½"			183

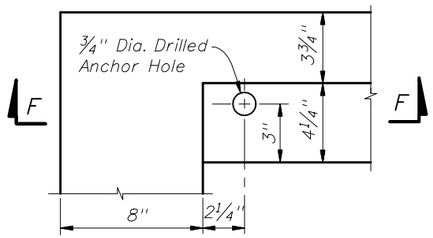
Table Notes:
See Sheet No. 1 of 2 for dimension "L" location.
See steel grate Plan View for dimension "S" location.



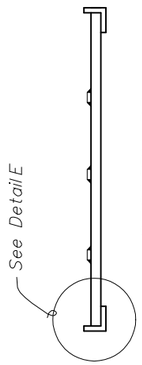
PLAN



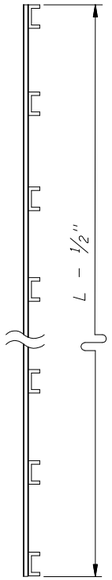
SECTION FF



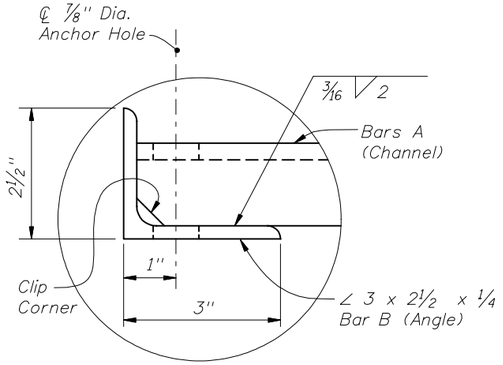
GRATE SEAT AND ANCHOR HOLE PLAN



SECTION DD



SECTION CC



DETAIL E

STEEL GRATE

2010 FDOT Design Standards

DITCH BOTTOM INLET TYPE K

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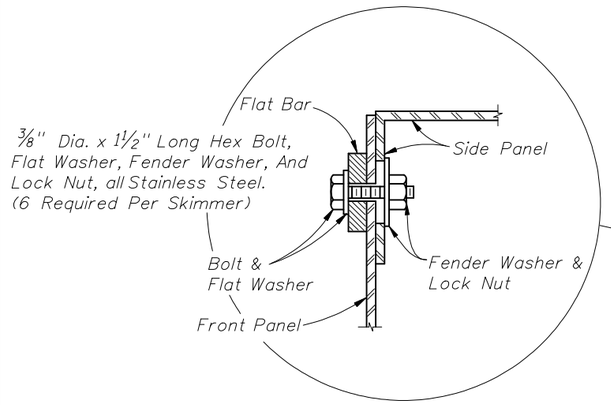
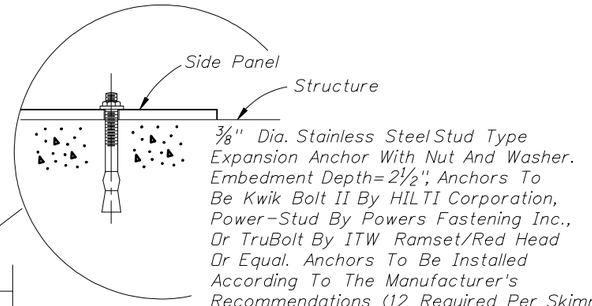
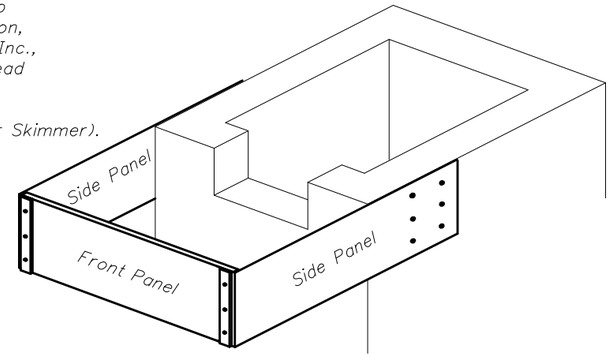
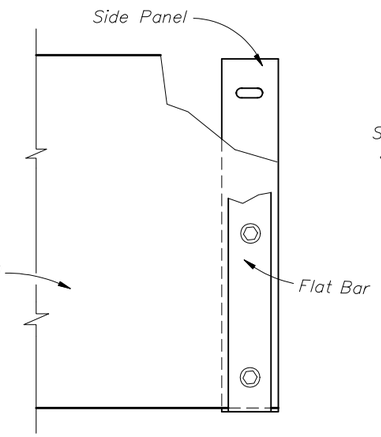


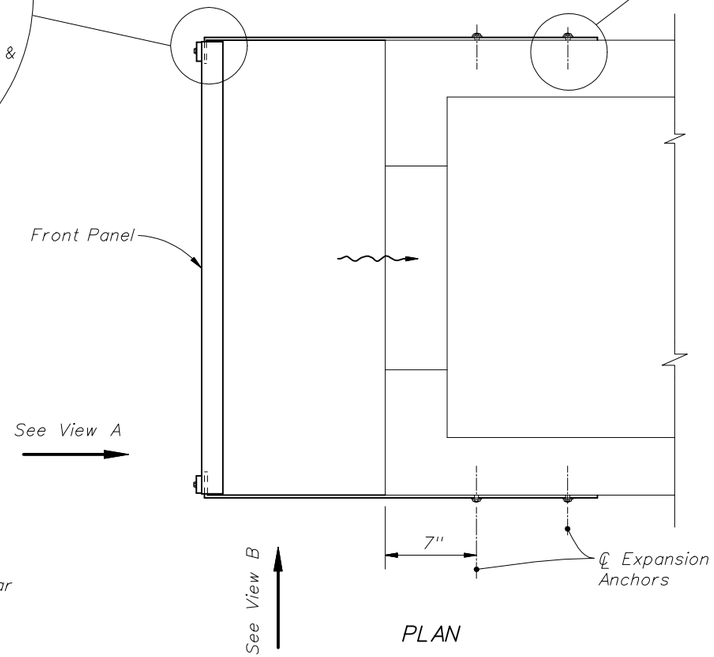




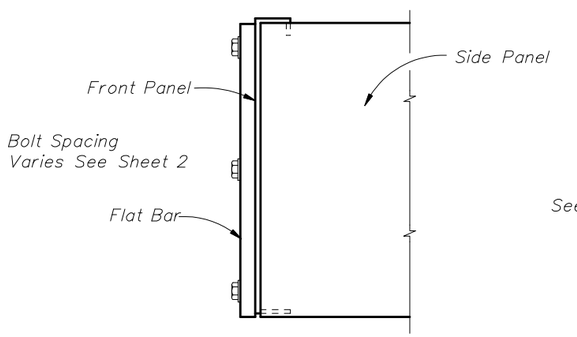
PICTORIAL VIEW



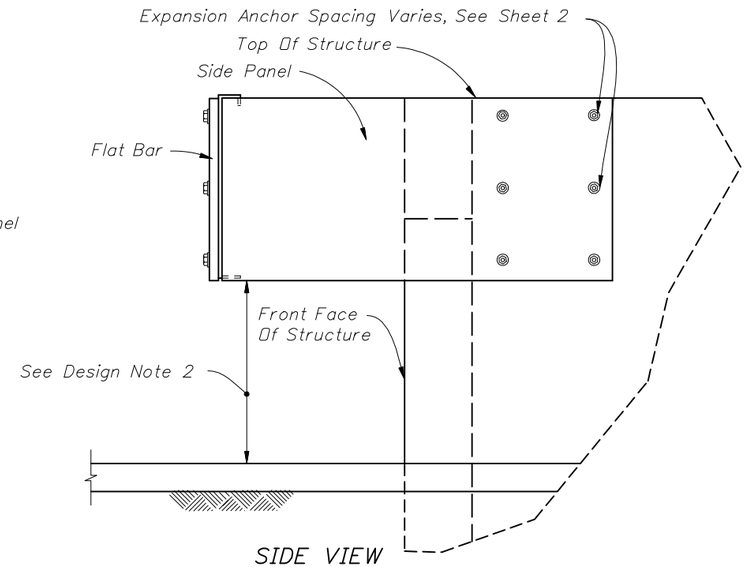
VIEW A



PLAN



VIEW B



SIDE VIEW

GENERAL NOTES

1. This skimmer is intended for use on Type C, D, or E Ditch Bottom Inlets that are used as outlet control structures of stormwater management facilities.
2. The side panels are dimensionally symmetric, therefore they may be used on either side of the structure.
3. Two (2) skimmers may be constructed on one structure provided they are on opposite ends.
4. The width of the front panel (dimension W) shall be the same as the outside dimension across the front of the structure.
5. The front panel, side panels, and flat bars are to be hot dip galvanized after fabrication.
6. The location of the reinforcing steel in these structures must conform to the applicable standards to avoid conflict with the expansion anchors used to attach the skimmer.
7. Grates to be used on the inlets unless otherwise specified in the plans.
8. A skimmer consists of two (2) side panels, one front panel, two (2) flat bars, and accessory hardware. The cost of skimmers is to be included in the cost of the inlet.

DESIGN NOTES

1. The designer must specify, in the plans, the skimmer height (dimension H) and the sides where the weir slots and skimmers are located. The skimmer height must be one of the dimensions shown in the table on Sheet 2. The skimmer should not be used on structure sides with outside dimensions greater than 6'-4".
2. To minimize hydraulic losses across the skimmer, the flow area under the skimmer should be three times larger than the flow area of the weir slot. The distance between the pond bottom at the structure and the skimmer shall be not less than 1 foot.
3. The configuration of skimmers may be subject to regulatory requirements. The designer should coordinate the outlet control structure details with the permitting agencies.
4. Where this skimmer is used, the designer should reference this index with the outlet control structure details. Where a different skimmer design is needed, the designer should provide skimmer details in the plans.
5. The designer shall evaluate if a grate is needed for safety reasons. Where a grate is not needed for safety reasons and is not desirable for hydraulic or other reasons, the designer may omit the grate by stating so in the outlet control structure details.
6. The designer must show the configuration of the weir slots in the outlet control structure detail.

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SKIMMER FOR OUTLET CONTROL STRUCTURES

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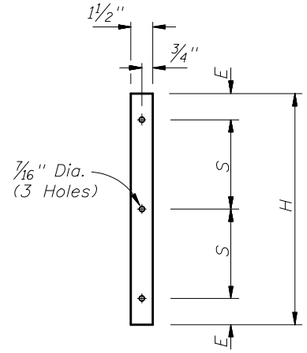
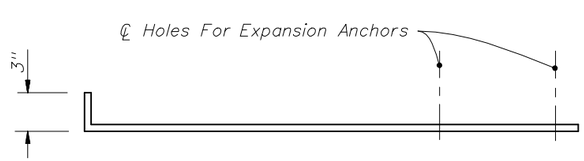
DIMENSIONS				
Skimmer Height As Specified In The Plans H	D	E	L	Bolt Spacing S
Inches				
12	3	3 3/16	28	3
14	3	3 3/16	28	4
16	3	3 3/16	28	5
18	3	3 3/16	28	6
20	4	4 3/16	31	6
22	4	4 3/16	31	7
24	4	4 3/16	31	8
26	4	4 3/16	31	9
28	4	4 3/16	31	10
30	5	5 3/16	31	10
32	5	5 3/16	31	11
34	5	5 3/16	31	12
36	6	6 3/16	31	12
38	6	6 3/16	31	13
40	6	6 3/16	31	14

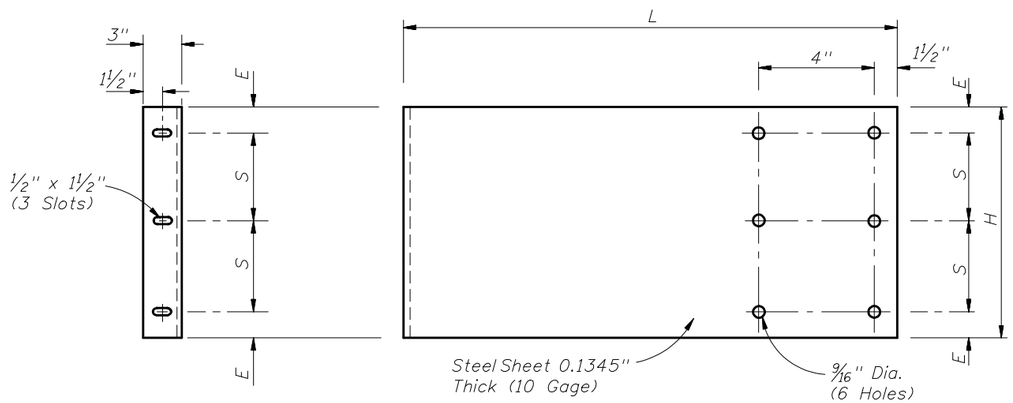


¼" Thick x 1½" Wide

FLAT BAR

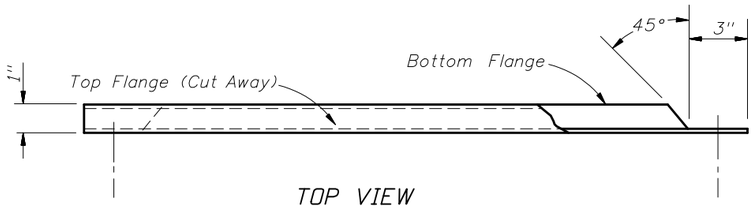


TOP VIEW

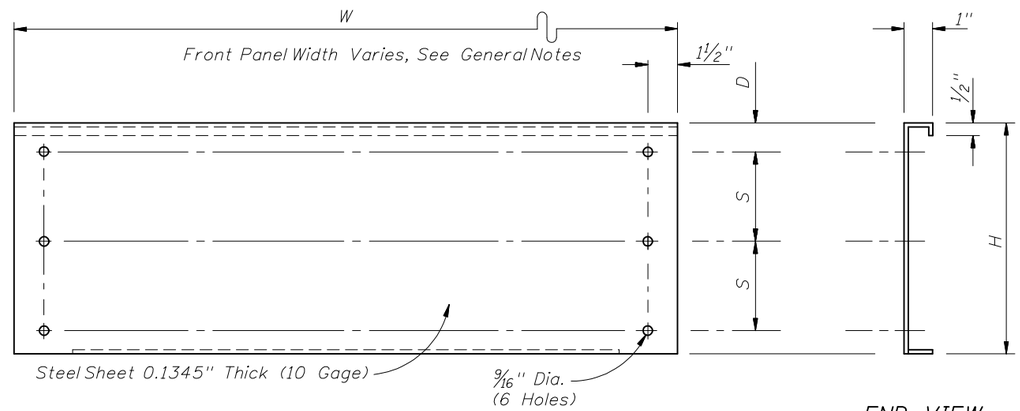


END VIEW (FRONT) SIDE VIEW

SIDE PANEL



TOP VIEW



FRONT VIEW END VIEW

FRONT PANEL

2010 FDOT Design Standards

SKIMMER FOR OUTLET CONTROL STRUCTURES

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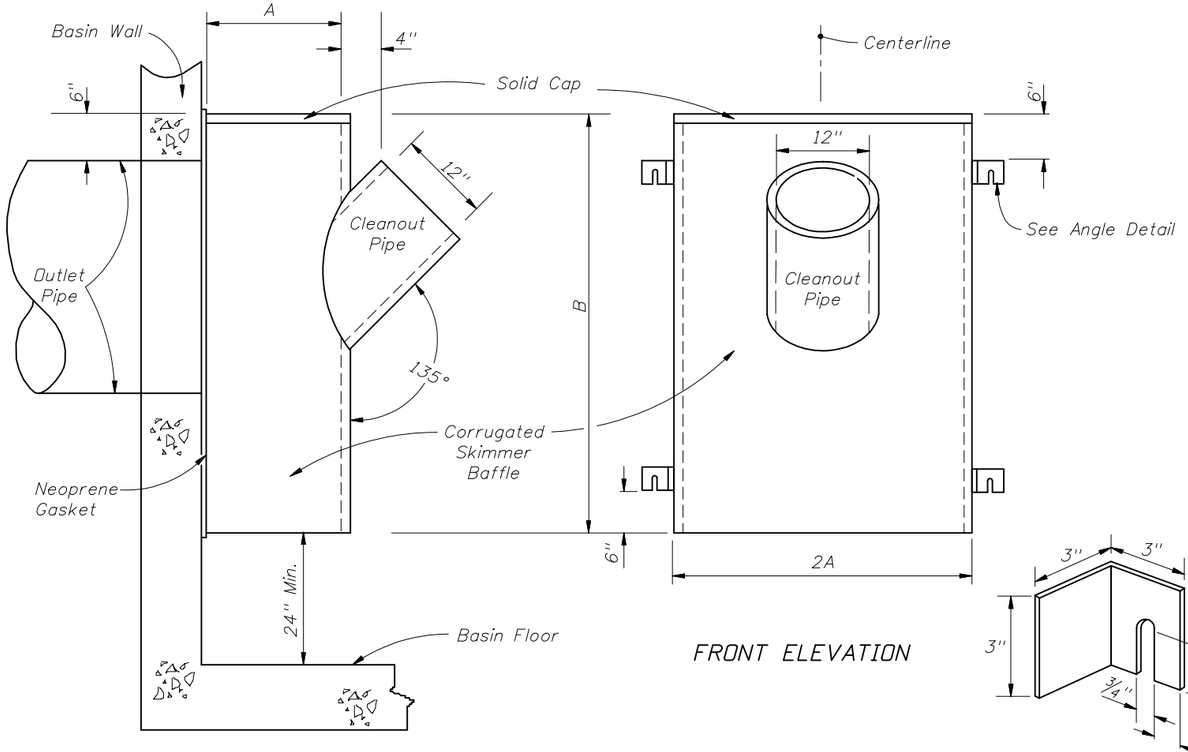
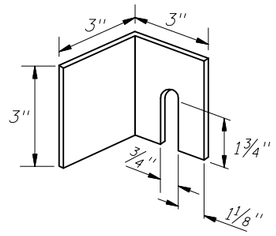


SIDE ELEVATION

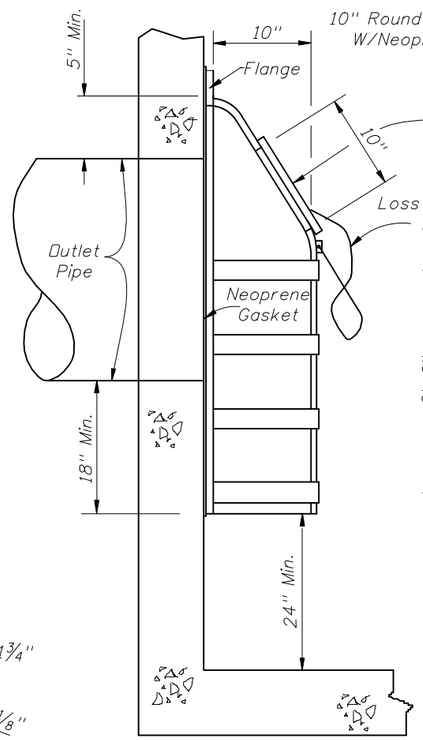
FRONT ELEVATION



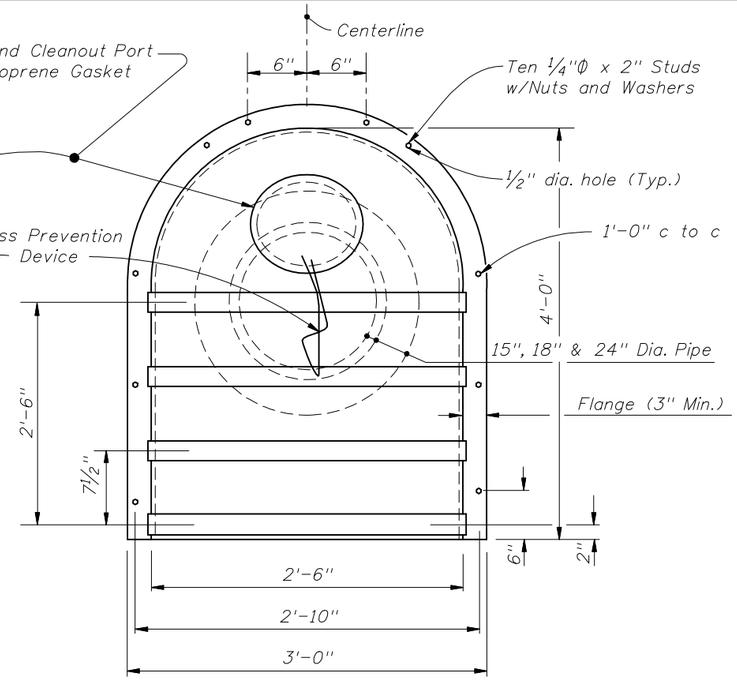
ANGLE DETAIL

Angles on other side of skimmer are mirror image.

TYPE I SKIMMER



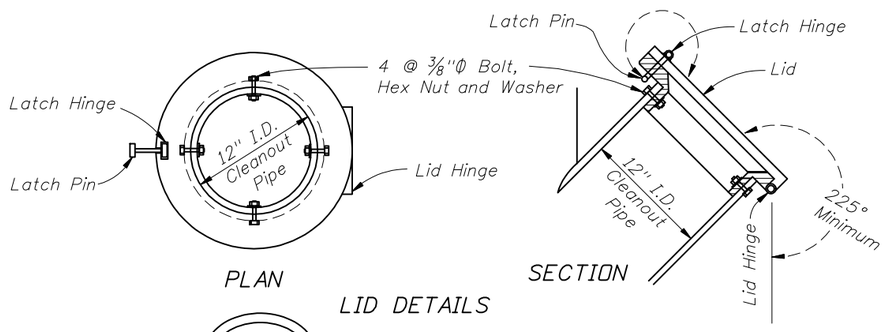
SIDE ELEVATION



FRONT ELEVATION

Note: The cleanout port for the Type II skimmer shall be gasketed, with either a threaded screw-in lid or a lid secured by four stainless steel quick-release latches.

TYPE II SKIMMER

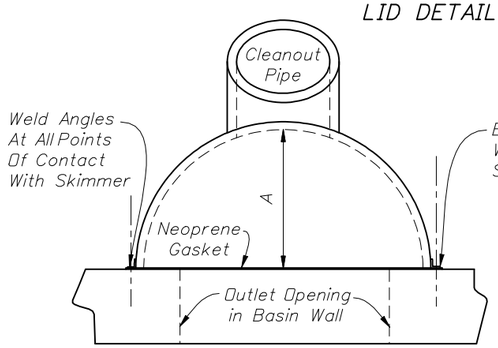


PLAN

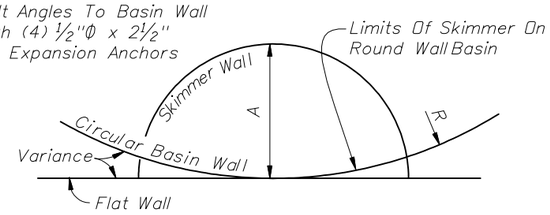
SECTION

LID DETAILS

TYPE I SKIMMER DIMENSION TABLE		
OUTLET PIPE	A	B
18"	12"	42"
24"	15"	48"
30"	18"	54"
36"	21"	60"



TOP VIEW



TOP VIEW SCHEMATIC

The backs of skimmers must conform to the shape of the basin walls on which they are mounted. Show, in the plans, the radii required for curved-back skimmers. Applies to both skimmer types.

GENERAL NOTES

1. The Frenchdrain Skimmer is a hooded cover, mounted over an outlet in a catchbasin, that prevents oil and floating debris from exiting the basin. Use this skimmer in Frenchdrain Catchbasins and in other locations where there is a need to prevent oil, debris or other floating contaminants from exiting Catchbasins through outlet pipes.
2. Place neoprene gasket material between the skimmer and the catchbasin at all points of contact. Trim the gasket neatly to extend ½ inch beyond the joint on all sides.
3. Skimmer baffle, cleanout pipe and angles shall be primarily constructed of either galvanized steel, aluminum, polyvinyl chloride, polyethylene, fiberglass or acrylonitrite butadiene styrene. All steel components, other than stainless, shall be hot-dip galvanized.
4. Mounting hardware, hinges and latches shall all be stainless steel. Loss prevention device shall be either stainless steel chain or riveted nylon strap.
5. Material used in construction of skimmer bodies (baffles) and cleanout pipe shall comply with Standard Specification 943 for steel, 945 for aluminum or 948 for plastics.
6. All costs for furnishing and installing a frenchdrain skimmer shall be included in the cost of the basin in which it is installed. Retrofit skimmers shall be paid for as 'modify existing structure'.
7. Plastic Skimmers shall contain a minimum of 1.5% by weight of carbon black for UV protection.

DESIGN NOTES

1. The contractor may submit an alternative design prefabricated Frenchdrain Skimmer for approval by the Engineer.
2. Show, in the plans, the location of the basin and indicate the interior side(s) of the basin on which a skimmer will be installed.
3. Type I Skimmer dimensions shall be based on the outlet pipe diameter as shown in the dimension table.
4. Type II Skimmers are to be used only with outlet pipe diameters of 15", 18", and 24".

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SKIMMER FOR FRENCHDRAIN OUTLETS

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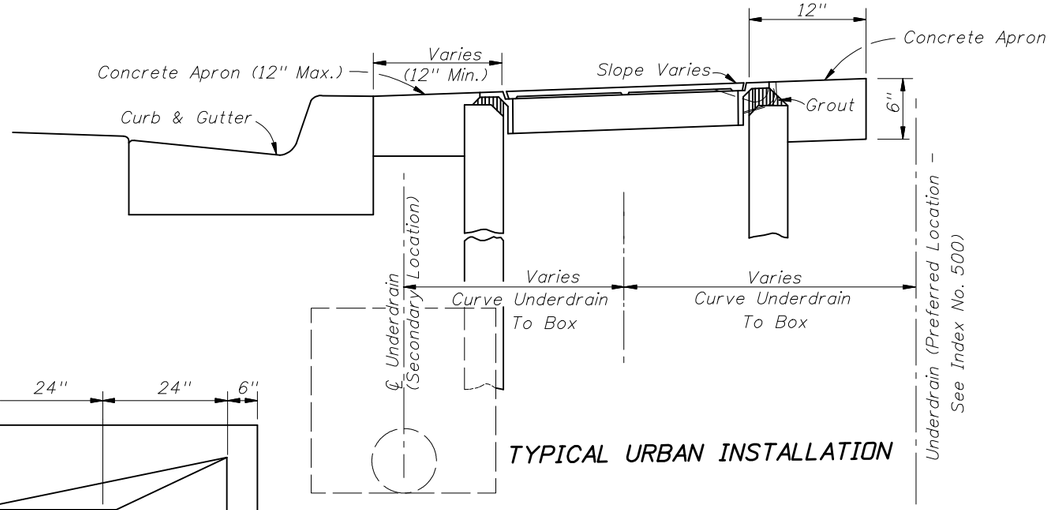
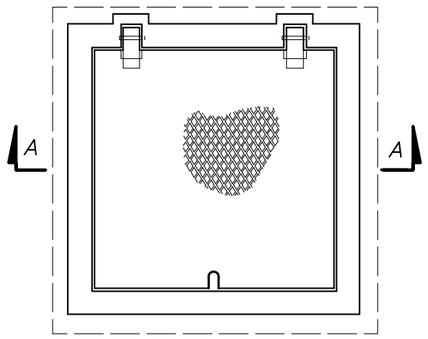
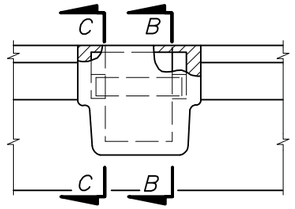


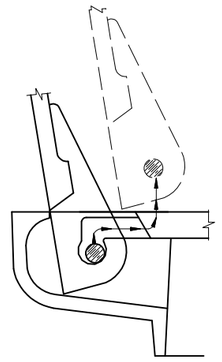
TYPICAL URBAN INSTALLATION



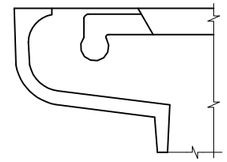
TOP VIEW



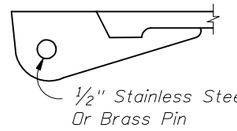
BACK VIEW



COVER REMOVAL

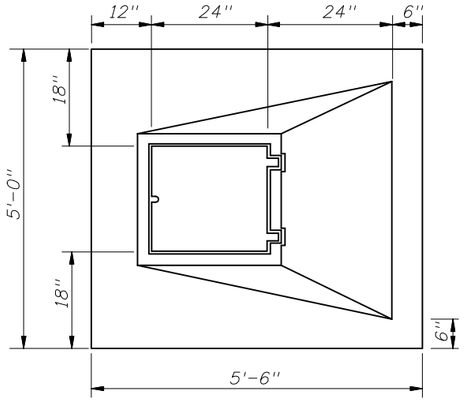


SECTION CC

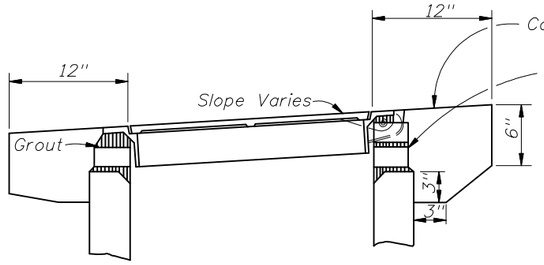


SECTION BB

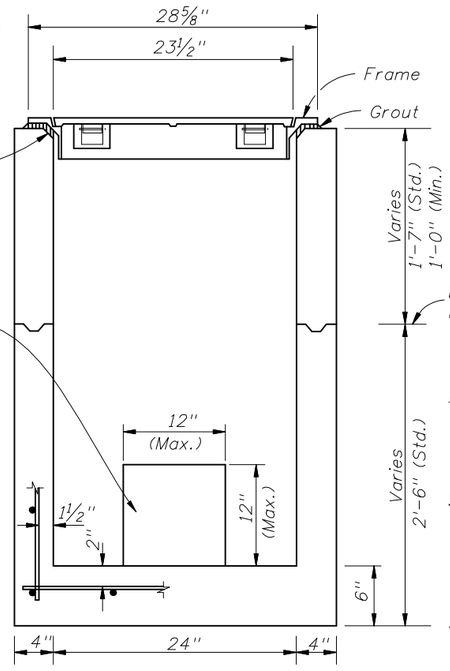
HINGE DETAIL



TOP VIEW

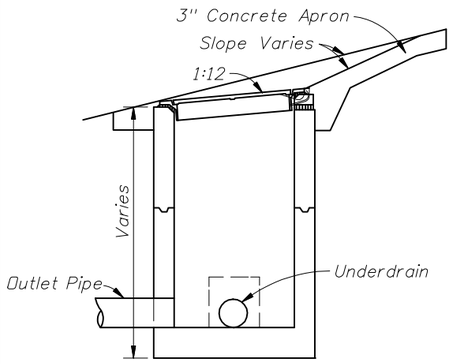


PERMISSIBLE TOP ADJUSTMENT



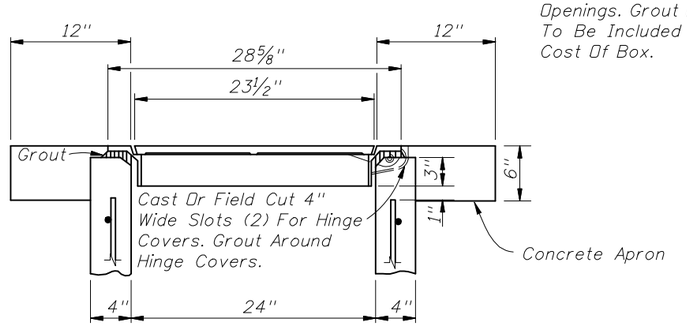
SECTION AA

BOX AND TOP



SECTION

TYPICAL INSTALLATION ON SLOPES



TYPICAL TOP AND APRON

GENERAL NOTES

1. Cast iron cover and frame to be Neenah Foundary Company R-6660-JH, U.S. Foundary & Manufacturing Corporation No. 7640-JK or equal. Neenah R-6660-JH detailed this index.
2. Concrete shall be Class I, except ASTM C478 (4000 psi) concrete may be substituted for precast items manufactured in plants meeting the requirements of Section 449 of the Specifications. Box shall be reinforced with No. 3 bars (Grade 60) on 8" centers both ways, sides and bottom.
3. Concrete apron to be included in the contract unit price for Underdrain Inspection Box.
4. All covers shall be furnished with pick holes. Fitted lifts or handles are not permitted.
5. Manhole Type P Alternate A, Index No. 200, with Type I Frame and Cover, Index No. 201, may be used in lieu of the box detailed on this sheet, and is recommended when high ADT increases chance of the repeated vehicle loadings.

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UNDERDRAIN INSPECTION BOX

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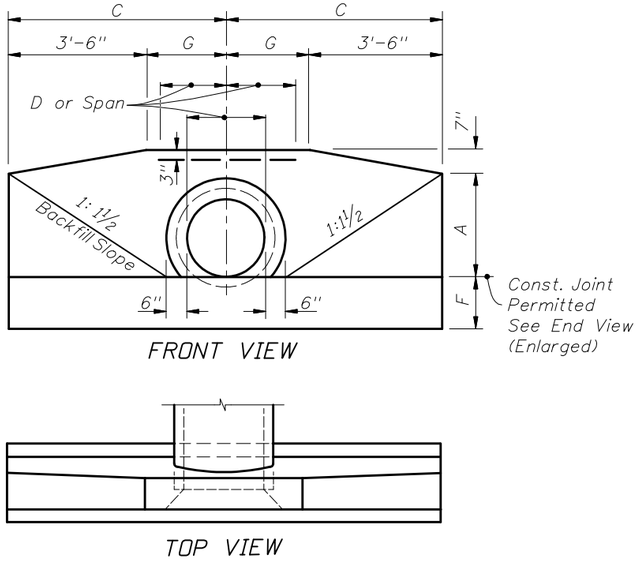
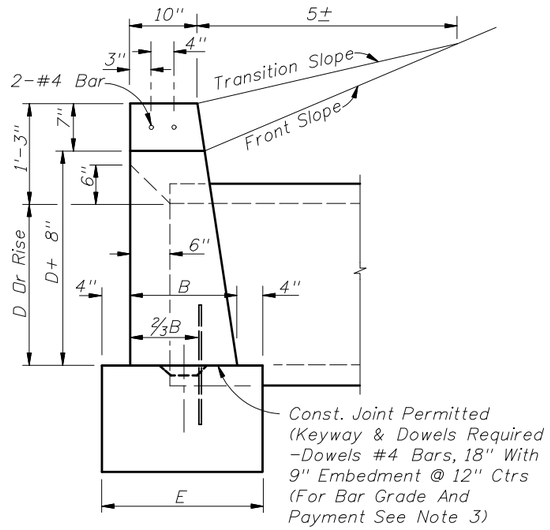
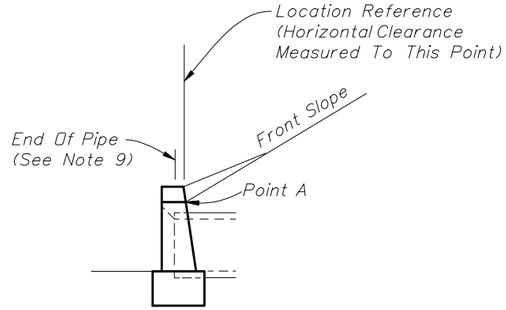


FRONT VIEW

TOP VIEW



END VIEW (ENLARGED)



END VIEW

1. Position is set by the intersection of the front slope and Point A where this intersection falls outside the clear zone.

2. Where the front slope and Point A intersects inside the clear zone, the endwall is positioned so the location reference point is at the clear zone limit. The front slope is transitioned to the endwall as shown in Index No. 280.

STANDARD LOCATION CONTROL

GENERAL NOTES

1. Endwall dimensions, locations and positions are for round and elliptical concrete pipe and for round and pipe-arch corrugated metal pipe. Round concrete pipe shown.

2. Front slope and ditch transitions shall be in accordance with Index No. 280.

3. Endwalls may be cast in place or precast concrete. Reinforcing steel shall be Grades 40 or 60. Additional reinforcement necessary for handling precast units shall be determined by the Contractor or the supplier. Cost of reinforcement shall be included in the contract unit price for Concrete, (Endwalls).

4. All exposed corners and edges of concrete are to be chamfered ¾".

5. Concrete shall be Class I, except ASTM C478 (4000 psi) concrete may be substituted for precast items manufactured in plants meeting the requirements of Section 449 of the Specifications.

6. On outfall ditches with side slopes flatter than 1:1½ provide 20' transitions from the endwall to the flatter side slopes, right of way permitting.

7. For sodding around endwalls see Index No. 281.

8. Payment for concrete quantities for endwalls skewed to the pipe shall be made on the following basis:

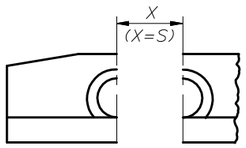
Endwall Skew to Pipe	Use Tabulated Value
0° to 5°	0°
6°	15°
16°	30°
31° or over	45°

9. Pipe length plan quantities shall be based on the pipe end locations shown in the standard location control end view, or lengths based on special endwall locations called for in the plans.

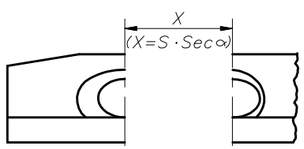
10. Payment for pipe in pipe culverts shall be based on plan quantities, adjusted for endwall locations subsequently established by the Engineer.

11. Endwalls to be paid for under the contract unit price for Class I Concrete (Endwalls), CY.

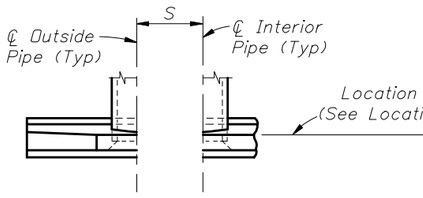
ENDWALL DIMENSIONS (EXCLUSIVE OF MULTIPLE PIPE SPACING)



FRONT VIEW



FRONT VIEW

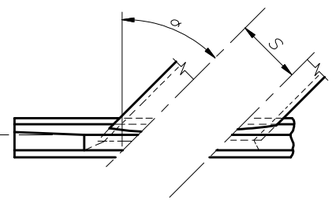


TOP VIEW

NORMAL PIPE

Location Reference Line
(See Location Control Above)

LEGEND



TOP VIEW

SKEWED PIPE

∝ Pipe Skew
S Center To Center Pipe Spacing
X Centerline To Centerline Dimension At Face Of Headwall

ENDWALL POSITIONS FOR SINGLE AND MULTIPLE PIPE AND SPACING FOR MULTIPLE PIPE

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STRAIGHT CONCRETE ENDWALLS SINGLE AND MULTIPLE PIPE

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DATA AND ESTIMATED QUANTITIES FOR ONE ENDWALL

ROUND CONCRETE AND CORRUGATED METAL PIPE

D	Opening Area (SF) Number Of Pipes				Dimensions												Class I Concrete (CY) Number And Type Of Pipe And Skew Angle Of Pipe																				D
												X				Single		Double																		
																Conc	Metal	Concrete				Metal				Concrete				Metal				Concrete			
	1	2	3	4	A	B	C	E	F	G	S	0°	15°	30°	45°	0°	0°	0°	15°	30°	45°	0°	15°	30°	45°	0°	15°	30°	45°	0°	15°	30°	45°	0°	15°	30°	45°
15"	1.23	2.46	3.69	4.92	1'-11"	1'-2"	4'-0"	1'-10"	1'-2"	0'-6"	2'-7"	2'-7"	2'-8"	3'-0"	3'-8"	1.23	1.24	1.59	1.60	1.65	1.74	1.62	1.63	1.68	1.78	1.94	1.96	2.05	2.23	1.99	2.02	2.11	2.30	2.30	2.34	2.47	2.74	15"
18"	1.77	3.54	5.31	7.08	2'-2"	1'-3"	4'-6"	1'-11"	1'-3"	1'-0"	2'-10"	2'-10"	2'-11"	3'-3"	4'-0"	1.56	1.59	1.99	2.01	2.06	2.17	2.04	2.06	2.11	2.23	2.43	2.46	2.56	2.79	2.51	2.54	2.65	2.89	2.86	2.91	3.06	3.40	18"
21"	2.41	4.82	7.23	9.64	2'-5"	1'-4"	5'-0"	2'-0"	1'-4"	1'-6"	3'-2"	3'-2"	3'-3"	3'-8"	4'-6"	1.97																						21"
24"	3.14	6.28	9.42	12.56	2'-8"	1'-4"	5'-6"	2'-0"	1'-4"	2'-0"	3'-5"	3'-5"	3'-6"	3'-11"	4'-10"	2.24	2.29	2.82	2.84	2.91	3.06	2.91	2.93	3.01	3.17	3.39	3.43	3.57	3.87	3.52	3.56	3.71	4.03	3.97	4.03	4.24	4.69	24"
27"	3.98	7.96	11.94	15.92	2'-11"	1'-5"	6'-0"	2'-1"	1'-5"	2'-6"	3'-10"	3'-10"	4'-0"	4'-5"	5'-5"	2.73																						27"
30"	4.91	9.82	14.73	19.64	3'-2"	1'-6"	6'-6"	2'-2"	1'-6"	3'-0"	4'-3"	4'-3"	4'-5"	4'-11"	6'-0"	3.26	3.34	4.13	4.16	4.26	4.49	4.28	4.31	4.43	4.67	4.98	5.04	5.25	5.69	5.20	5.27	5.49	5.97	5.84	5.93	6.24	6.91	30"
36"	7.07	14.14	21.21	28.28	3'-8"	1'-8"	7'-6"	2'-4"	1'-8"	4'-0"	5'-1"	5'-1"	5'-3"	5'-10"	7'-2"	4.53	4.64	5.73	5.77	5.92	6.23	5.95	6.00	6.15	6.49	6.92	7.00	7.29	7.91	7.25	7.34	7.65	8.33	8.13	8.26	8.69	9.62	36"
42"	9.62	19.24	28.86	38.48	4'-2"	1'-10"	8'-6"	2'-6"	2'-0"	5'-0"	6'-0"	6'-0"	6'-3"	6'-11"	8'-6"	6.33	6.49	8.11	8.17	8.39	8.85	8.43	8.50	8.73	9.23	9.90	10.02	10.45	11.38	10.38	10.52	10.98	11.99	11.68	11.87	12.51	13.89	42"
48"	12.57	25.14	37.71	50.28	4'-8"	2'-1"	9'-6"	2'-9"	2'-0"	6'-0"	6'-9"	6'-9"	7'-0"	7'-10"	9'-7"	8.15	8.38	10.40	10.48	10.75	11.33	10.85	10.94	11.23	11.87	12.64	12.80	13.34	14.50	13.34	13.51	14.11	15.39	14.89	15.13	15.93	17.68	48"
54"	15.90	31.80	47.70	63.60	5'-2"	2'-6"	10'-6"	3'-2"	2'-3"	7'-0"	7'-8"	7'-8"	7'-11"	8'-10"	10'-10"	11.71	11.77	15.23	15.35	15.78	16.69	15.35	15.48	15.90	16.83	18.77	19.02	19.86	21.69	18.93	19.18	20.04	21.89	22.29	22.66	23.93	26.67	54"

D	Quadruple								D
	Metal								
	0°	15°	30°	45°					
15"	2.37	2.41	2.75	2.84	15"				
18"	2.96	3.01	3.17	3.53	18"				
21"					21"				
24"	4.14	4.20	4.43	4.91	24"				
27"					27"				
30"	6.13	6.23	6.56	7.29	30"				
36"	8.57	8.71	9.18	10.20	36"				
42"	12.32	12.52	13.22	14.73	42"				
48"	15.82	16.08	16.97	18.90	48"				
54"	22.51	22.89	24.17	26.96	54"				

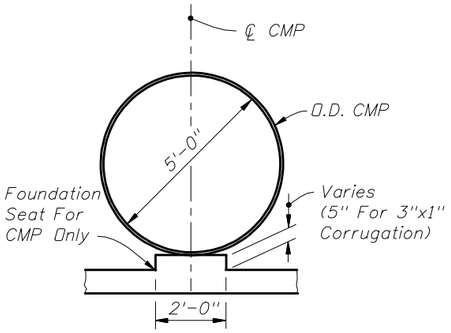
CORRUGATED METAL PIPE ARCH

Span	Rise	Opening Area (SF) Number Of Pipes				Dimensions											Class I Concrete (CY) Number Of Pipe And Skew Angle Of Pipe																Span	Rise	Approx. Equiv. Round Pipe
													X				Single	Double				Triple				Quadruple										
		1	2	3	4	A	B	C	E	F	G	S	0°	15°	30°	45°	0°	0°	15°	30°	45°	0°	15°	30°	45°	0°	15°	30°	45°			
17"	13"	1.1	2.2	3.3	4.4	1'-9"	1'-2"	3'-10"	1'-10"	1'-2"	0'-4"	2'-6"	2'-6"	2'-7"	2'-11"	3'-6"	1.16	1.47	1.48	1.52	1.60	1.78	1.80	1.88	2.04	2.09	2.12	2.23	2.48	17"	13"	15"
21"	15"	1.6	3.2	4.8	6.4	1'-11"	1'-2"	4'-3"	1'-10"	1'-2"	0'-9"	2'-10"	2'-10"	2'-11"	3'-3"	4'-0"	1.33	1.69	1.70	1.75	1.84	2.04	2.06	2.15	2.33	2.40	2.44	2.57	2.84	21"	15"	18"
28"	20"	2.8	5.6	8.4	11.2	2'-4"	1'-3"	5'-2"	1'-11"	1'-3"	1'-8"	3'-5"	3'-5"	3'-6"	3'-11"	4'-10"	1.78	2.31	2.33	2.39	2.53	2.83	2.87	2.99	3.26	3.36	3.42	3.60	4.01	28"	20"	24"
35"	24"	4.3	8.6	12.9	17.2	2'-8"	1'-4"	5'-11½"	2'-0"	1'-4"	2'-5½"	4'-0"	4'-0"	4'-2"	4'-7"	5'-8"	2.34	3.03	3.05	3.14	3.32	3.72	3.77	3.93	4.29	4.40	4.47	4.72	5.25	35"	24"	30"
42"	29"	5.9	11.8	17.7	23.6	3'-1"	1'-5"	6'-10½"	2'-1"	1'-5"	3'-4½"	4'-9"	4'-9"	4'-11"	5'-6"	6'-9"	3.13	4.06	4.09	4.20	4.45	4.99	5.06	5.28	5.76	5.93	6.03	6.36	7.09	42"	29"	36"
49"	33"	8.4	16.8	25.2	33.6	3'-5"	1'-6"	7'-8"	2'-2"	1'-6"	4'-2"	5'-6"	5'-6"	5'-8"	6'-4"	7'-9"	3.83	5.00	5.04	5.18	5.48	6.16	6.24	6.52	7.12	7.32	7.44	7.86	8.76	49"	33"	42"
57"	38"	10.6	21.2	31.8	42.4	3'-10"	1'-7"	8'-7½"	2'-3"	1'-7"	5'-1½"	6'-4"	6'-4"	6'-7"	7'-4"	8'-11"	4.87	6.31	6.36	6.53	6.91	7.74	7.84	8.18	8.93	9.18	9.33	9.85	10.96	57"	38"	48"
64"	43"	13.2	26.4	39.6	52.8	4'-3"	1'-8"	9'-6½"	2'-4"	1'-8"	6'-0½"	7'-1"	7'-1"	7'-4"	8'-2"	10'-0"	5.88	7.64	7.70	7.91	8.37	9.40	9.52	9.94	10.86	11.15	11.33	11.97	13.33	64"	43"	54"
71"	47"	16.9	33.8	50.7	67.6	4'-7"	1'-10"	10'-4"	2'-6"	2'-0"	6'-10"	7'-10"	7'-10"	8'-1"	9'-1"	11'-1"	7.80	10.15	10.23	10.51	11.12	12.49	12.65	13.22	14.43	14.85	15.10	15.94	17.77	71"	47"	

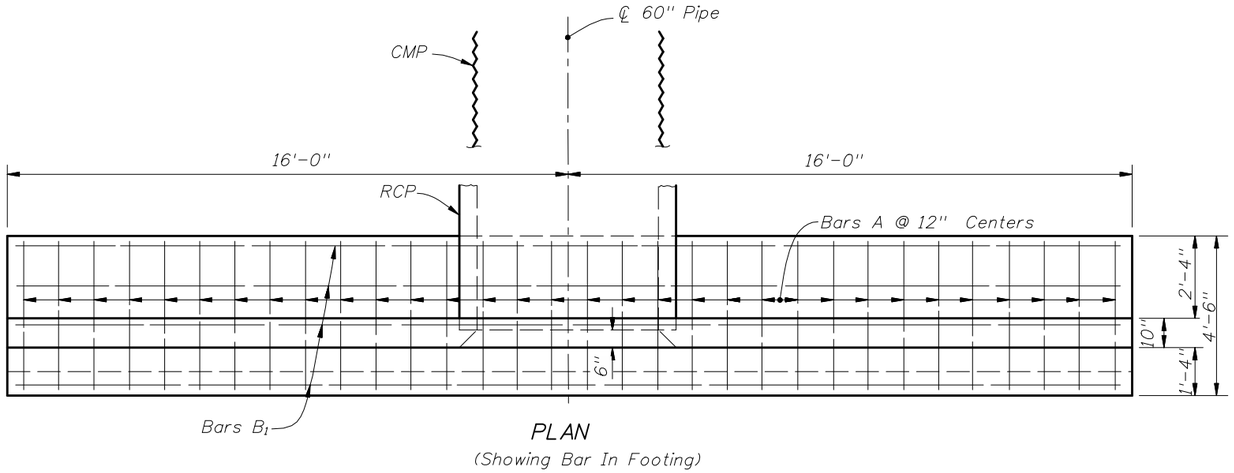
CONCRETE ELLIPTICAL PIPE

Rise	Span	Opening Area (SF) Number Of Pipes				Dimensions											Class I Concrete (CY) Number Of Pipe And Skew Angle Of Pipe																Rise	Span	Approx. Equiv. Round Pipe
													X				Single	Double				Triple				Quadruple										
		1	2	3	4	A	B	C	E	F	G	S	0°	15°	30°	45°	0°	0°	15°	30°	45°	0°	15°	30°	45°	0°	15°	30°	45°			
12"	18"	1.3	2.6	3.9	5.2	1'-8"	1'-2"	3'-9"	1'-10"	1'-2"	0'-3"	2'-10"	2'-10"	2'-11"	3'-3"	4'-0"	1.09	1.45	1.46	1.51	1.60	1.80	1.82	1.91	2.09	2.16	2.20	2.33	2.60	12"	18"	15"
14"	23"	1.8	3.6	5.4	7.2	1'-10"	1'-3"	4'-2½"	1'-11"	1'-3"	8½"	3'-5"	3'-5"	3'-6"	3'-11"	4'-10"	1.36	1.82	1.84	1.89	2.01	2.29	2.32	2.43	2.68	2.75	2.80	2.97	3.33	14"	23"	18"
19"	30"	3.3	6.6	9.9	13.2	2'-3"	1'-4"	5'-1½"	2'-0"	1'-4"	1'-7½"	4'-2"	4'-2"	4'-4"	4'-10"	5'-11"	1.89	2.55	2.57	2.65	2.82	3.22	3.27	3.43	3.77	3.88	3.95	4.19	4.70	19"	30"	24"
24"	38"	5.1	10.2	15.3	20.4	2'-8"	1'-5"	6'-3"	2'-1"	1'-5"	2'-9"	5'-2"	5'-2"	5'-4"	6'-0"	7'-4"	2.64	3.55	3.58	3.69	3.93	4.48	4.54	4.77	5.24	5.39	5.49	5.82	6.53	24"	38"	30"
29"	45"	7.4	14.8	22.2	29.6	3'-1"	1'-6"	7'-0"	2'-2"	1'-6"	3'-6"	6'-0"	6'-0"	6'-3"	6'-11"	8'-6"	3.32	4.48	4.52	4.66	4.96	5.64	5.72	6.00	6.60	6.80	6.92	7.34	8.24	29"	45"	36"
34"	53"	10.2	20.4	30.6	40.8	3'-6"	1'-7"	7'-11½"	2'-3"	1'-7"	4'-5½"	7'-1"	7'-1"	7'-4"	8'-2"	10'-0"	4.24	5.76	5.81	6.00	6.39	7.29	7.40	7.76	8.55	8.81	8.97	9.52	10.70	34"	53"	42"
38"	60"	12.9	25.8	38.7	51.6	3'-10"	1'-8"	8'-9"	2'-4"	1'-8"	5'-3"	7'-11"	7'-11"	8'-2"	9'-2"	11'-2"	5.22	7.16	7.23	7.46	7.96	9.10	9.24	9.70	10.71	11.05	11.25	11.95	13.46	38"	60"	48"
43"	68"	16.6	33.2	49.8	66.4	4'-3"	1'-10"	9'-8½"	2'-6"	1'-10"	6'-2½"	8'-10"	8'-10"	9'-2"	10'-2"	12'-6"	6.63	9.01	9.09	9.38	10.00	11.39	11.56	12.13	13.36	13.77	14.02	14.88	16.73	43"	68"	54"
48"	76"	20.5	41.0	61.5	82.0	4'-8"	2'-1"	10'-8"	2'-9"	2'-0"	7'-2"	9'-9"	9'-9"	10'-1"	11'-3"	13'-9"	8.66	11.74	11.85	12.22	13.02	14.82	15.04	15.77	17.37	17.91	18.23	19.34	21.74	48"	76"	60"
53"	83"	24.8	49.6	74.4	99.2	5'-1"	2'-6"	11'-7"	3'-2"	2'-6"	8'-1"	10'-7"	10'-7"	10'-11"	12'-3"	15'-0"	12.50	16.98	16.98	17.67	18.83	21.47	21.78	22.86	25.18	25.97	26.44	28.06	31.55	53"	83"	66"
58"	91"	29.5	59.0	88.5	118.0	5'-6"	2'-10"	12'-6½"	3'-6"	2'-10"	9'-0½"	11'-4"	11'-4"	11'-9"	13'-1"	16'-0"	16.46	22.26	22.46	23.16	24.66	28.05	28.46	29.85	32.85	33.85	34.46	36.55	41.05	58"	91"	72"

Note: Use the guidelines of General Note No. 8 for selecting tabular quantities.



SECTION BB

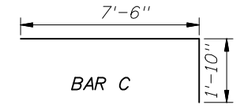


PLAN
(Showing Bar In Footing)

BILL OF REINFORCING STEEL

MARK	SIZE	NO. REQD.	LENGTH	LOCATION	BENDING
A	#4	32	4'-2"	Footing	Straight
B_1	#4	13	31'-8"	Footing & Wall	Straight
B_2	#4	4	12'-4"	Wall	Straight
B_3	#4	4	13'-9"	Wall	Straight
C	#4	26	9'-4"	Wall	Bend
D	#4	18	7'-6"	Wall	Straight
E	#4	8	1'-8"	Footing & Wall	Straight

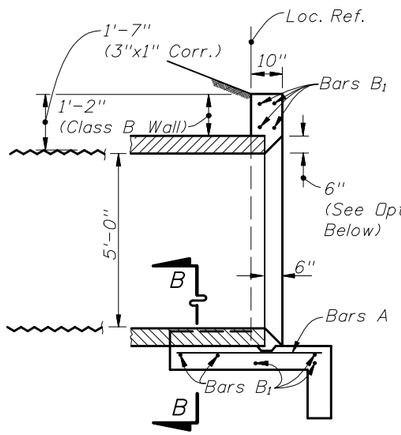
BENDING DIAGRAM



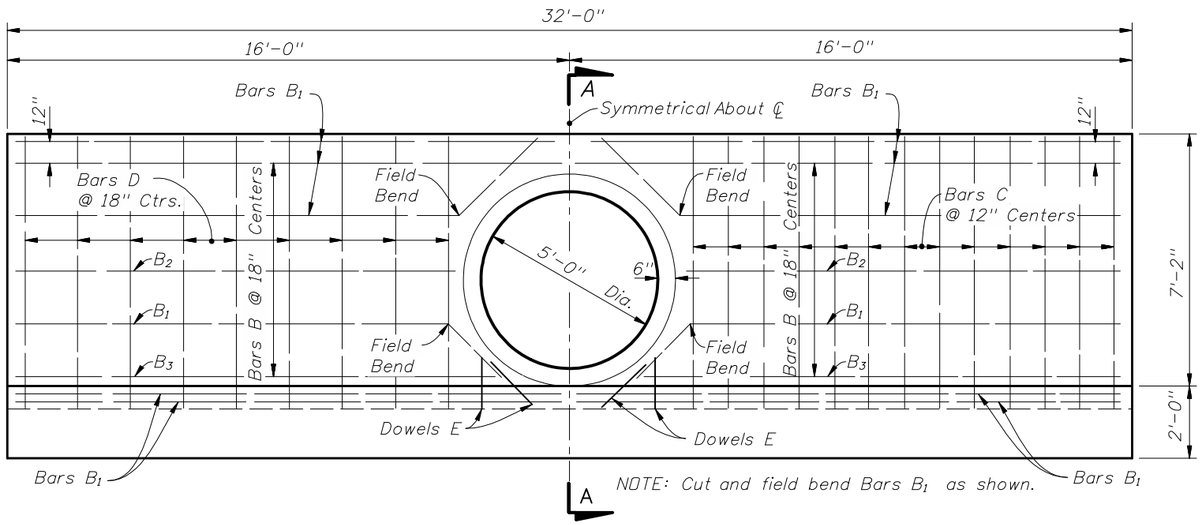
NOTE: All bar dimensions are out to out

ESTIMATED QUANTITIES

ITEM	UNIT	RCP	CMP
Class II Concrete	Cu. Yd.	11.3	11.4
Reinforcing Steel	Lb.	695	695

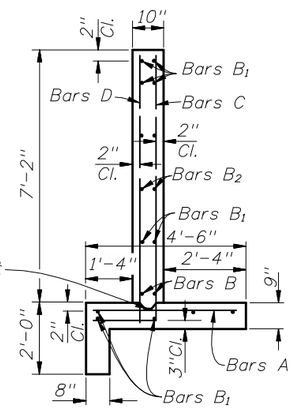


SECTION AA

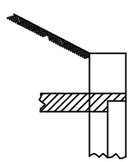


HALF ELEVATION
(Showing Bars In Front Face Of Wall)

HALF ELEVATION
(Showing Bars In Back Face Of Wall)



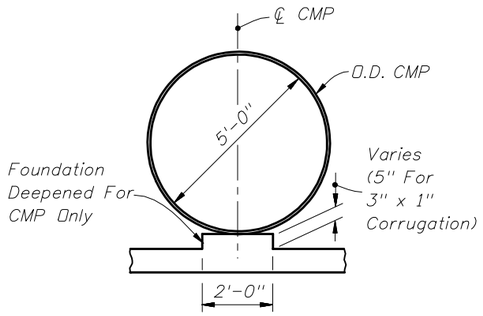
TYPICAL SECTION
THRU ENDWALL



OPTIONAL ENTRANCE
FOR CONCRETE PIPE

GENERAL NOTES

1. Straight concrete endwalls are intended for use outside the clear zone.
2. Endwalls may be cast-in-place or precast construction. Cast-in-place endwalls shall conform to the details on this index, design specifications AASHTO 1989. Precast construction which adheres to this Index, including any additional reinforcement required for handling which shall be determined by the Contractor or supplier, does not require additional approvals. Deviations from this Index, for precast units, shall require the approval of the State Drainage Engineer prior to construction. For precast construction, see Index No. 201 for opening and grouting details.
3. Reinforcing steel shall be either Grade 40 or 60.
4. Concrete shall be Class II, except ASTM C478 (4000 psi) concrete may be substituted for precast items manufactured in plants meeting the requirements of Section 449 of the Specifications.
5. Chamfer: All exposed edges and corners to be chamfered ¾" unless otherwise shown.
6. That portion of corrugated metal pipe in direct contact with the concrete slab and extending 12" beyond shall have a continuous bituminous coating of .004" minimum thickness applied prior to placing of the concrete.
7. Sodding shall be in accordance with Index No. 281 and paid for under the contract unit price for Performance Turf, SY.
8. Basis of payment for either cast-in-place or precast construction shall be the estimated quantities tabulated on the Index. Concrete and reinforcing steel shall be paid for under the contract unit prices for Class II Concrete (Endwalls), CY and Reinforcing Steel (Roadway), LB.



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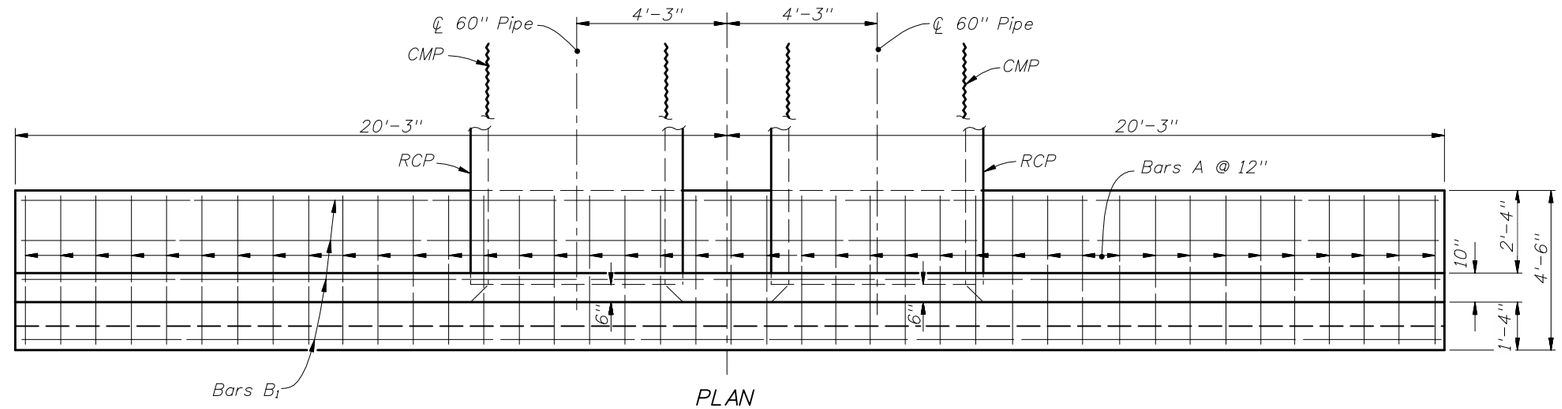
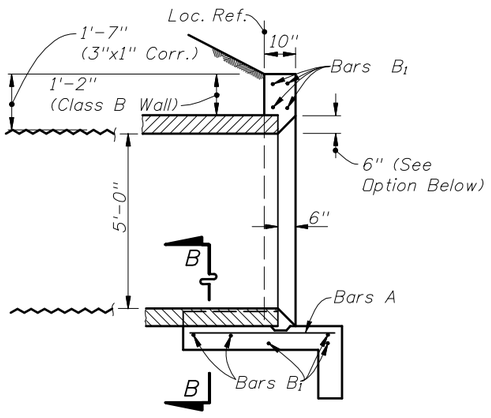


PLAN
(Showing Bar In Footing)



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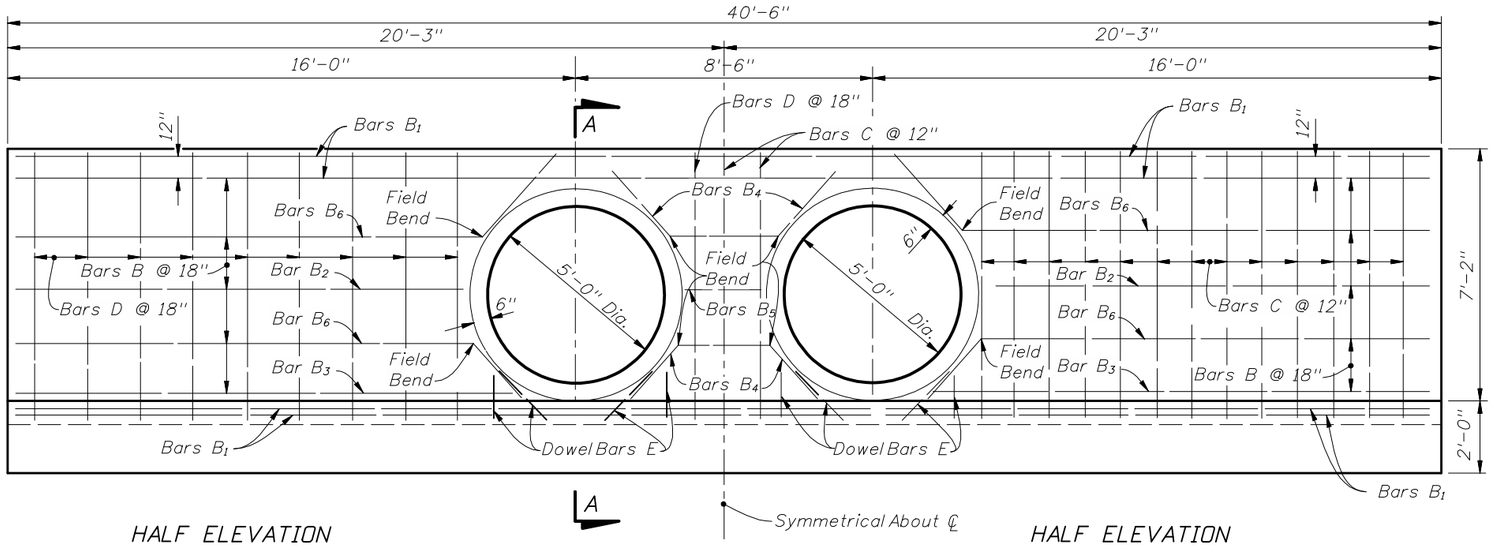
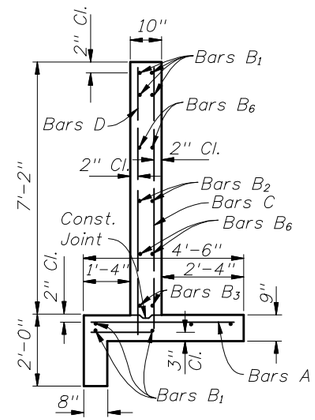
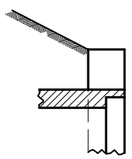


HALF ELEVATION
(Showing Bars In Front Face Of Wall)

HALF ELEVATION
(Showing Bars In Back Face Of Wall)



TYPICAL SECTION
THRU ENDWALL

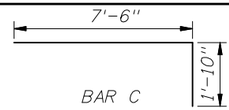


OPTIONAL ENTRANCE
FOR CONCRETE PIPE

BILL OF REINFORCING STEEL

MARK	SIZE	NO. REQD.	LENGTH	LOCATION	BENDING
A	#4	41	4'-2"	Footing	Straight
B_1	#4	9	40'-2"	Footing & Wall	Straight
B_2	#4	4	12'-6"	Wall	Straight
B_3	#4	4	13'-9"	Wall	Straight
B_4	#4	4	6'-0"	Wall	Field Bend
B_5	#4	2	2'-2"	Wall	Straight
B_6	#4	8	15'-0"	Wall	Field Bend
C	#4	29	9'-4"	Footing & Wall	Bend
D	#4	20	7'-6"	Footing & Wall	Straight
E	#4	16	1'-8"	Footing & Wall	Straight

BENDING DIAGRAM



NOTE: All bar dimensions are out to out

ESTIMATED QUANTITIES

ITEM	UNIT	RCP	CMP
Class II Concrete	Cu. Yd.	13.7	13.8
Reinforcing Steel	Lb.	824	824

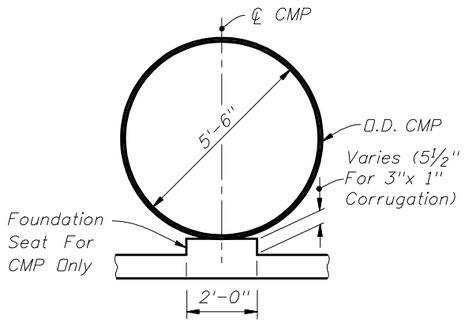
NOTE: See Sheet 1 of 2 For General Notes.

2010 FDOT Design Standards

STRAIGHT CONCRETE ENDWALLS SINGLE AND DOUBLE 60" PIPE

Last Revision	Sheet No.
00	2 of 2

Index No. 251



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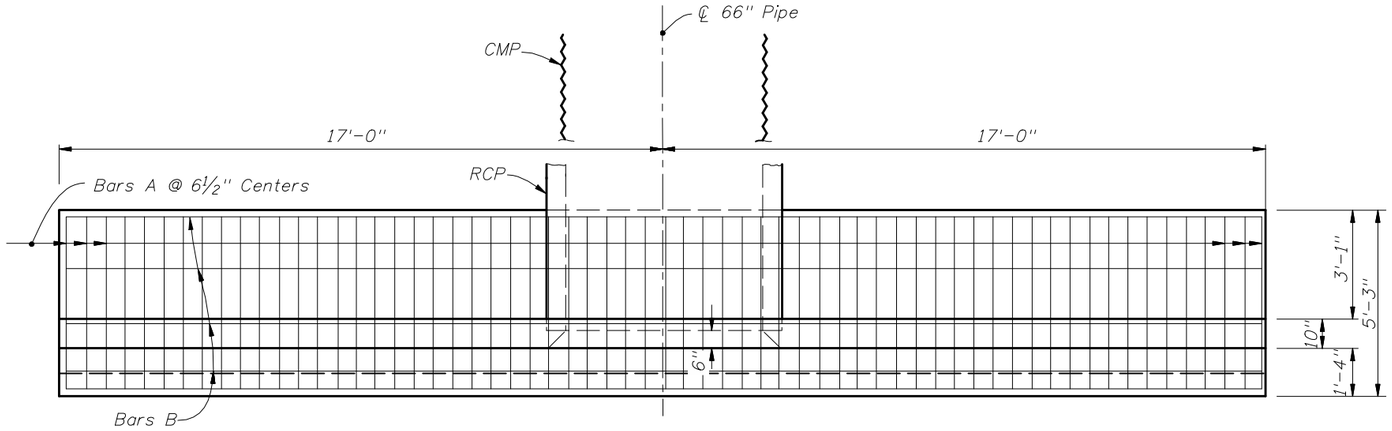


PLAN
(Showing Bars In Footing)

BILL OF REINFORCING STEEL

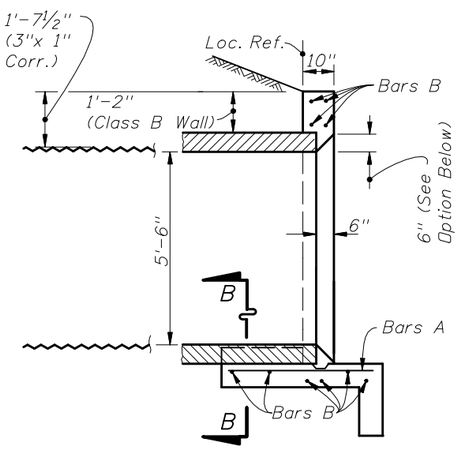
MARK	SIZE	NO. REQD.	LENGTH	LOCATION	BENDING
A	5	63	4'-11"	Footing	Straight
B	4	17	33'-8"	Footing & Wall	Straight
C	5	34	9'-11"	Wall	Bend
D	4	20	8'-1"	Wall	Straight
E	4	4	1'-8"	Wall	Straight

BENDING DIAGRAM

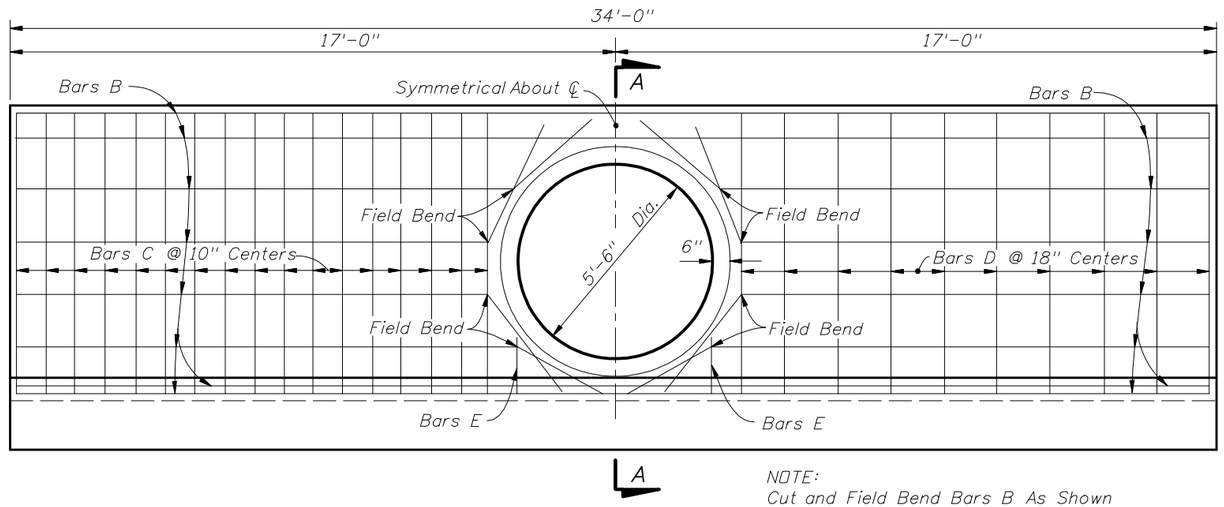
NOTE: All bar dimensions are out to out

ESTIMATED QUANTITIES

ITEM	UNIT	RCP	CMP
Class II Concrete	Cu. Yd.	13.2	13.3
Reinforcing Steel	Lb.	1170	1170



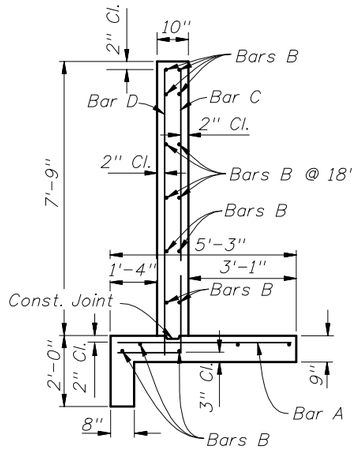
SECTION AA



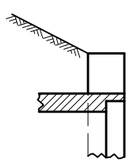
HALF ELEVATION
(Showing Bars In Back Face Of Wall)

NOTE:
Cut and Field Bend Bars B As Shown

HALF ELEVATION
(Showing Bars In Front Face Of Wall)



TYPICAL SECTION
THRU ENDWALL



OPTIONAL ENTRANCE
FOR CONCRETE PIPE

GENERAL NOTES

1. Straight concrete endwalls are intended for use outside the clear zone.
2. Endwalls may be cast-in-place or precast construction. Cast-in-place endwalls shall conform to the details on this index, design specifications AASHTO 1989. Precast construction which adheres to this Index, including any additional reinforcement required for handling which shall be determined by the Contractor or supplier, does not require additional approvals. Deviations from this Index, for precast units, shall require the approval of the State Drainage Engineer prior to construction. For precast construction, see Index No. 201 for opening and grouting details.
3. Reinforcing steel shall be either Grade 40 or 60.
4. Concrete shall be Class II except ASTM C478 (4000 psi) concrete may be substituted for precast items manufactured in plants meeting the requirements of Section 449 of the Specifications.
5. Chamfer: All exposed edges and corners to be chamfered ¾" unless otherwise shown.
6. That portion of corrugated Metal pipe in direct contact with the concrete slab and extending 12" beyond shall have a continuous bituminous coating of 0.004" minimum thickness applied prior to placing of the concrete.
7. Sodding shall be in accordance with Index No. 281 and paid for under the contract unit price for Performance Turf, SY.
8. Basis of payment for either cast-in-place or precast construction shall be the estimated quantities tabulated on the Index. Concrete and reinforcing steel shall be paid for under the contract unit prices for Class II Concrete (Endwalls), CY and Reinforcing Steel (Roadway), LB.

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

2010 FDOT Design Standards

STRAIGHT CONCRETE ENDWALLS SINGLE AND DOUBLE 66" PIPE

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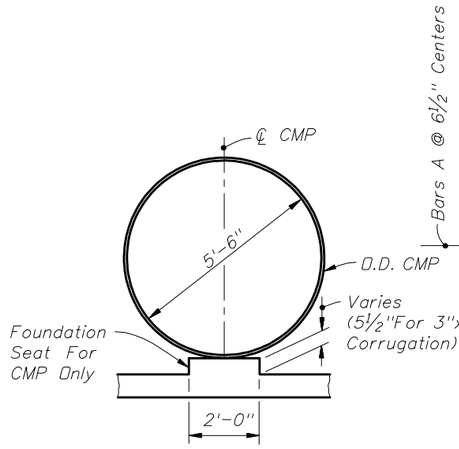
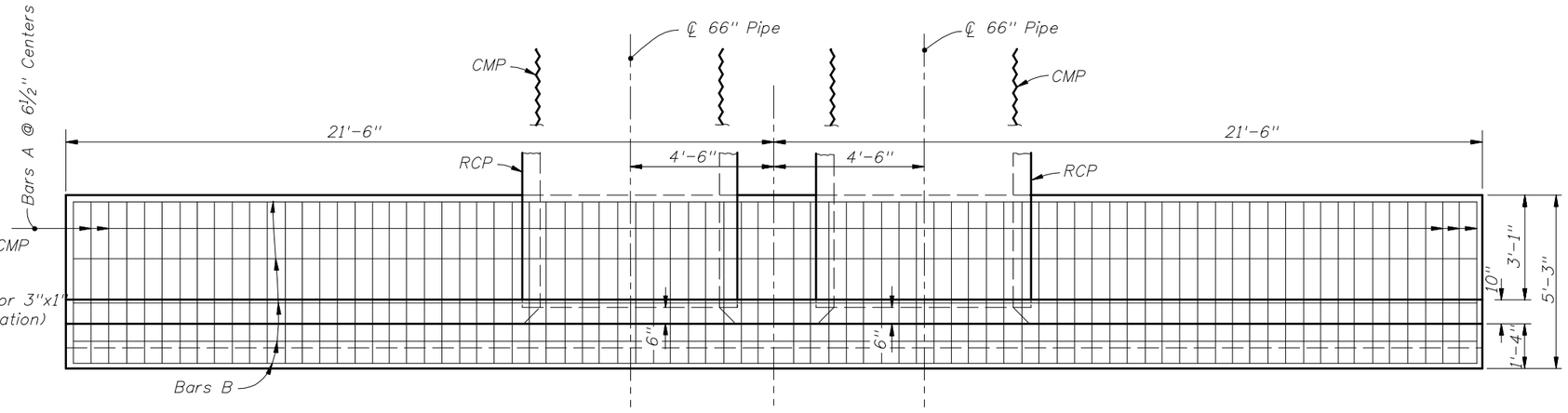
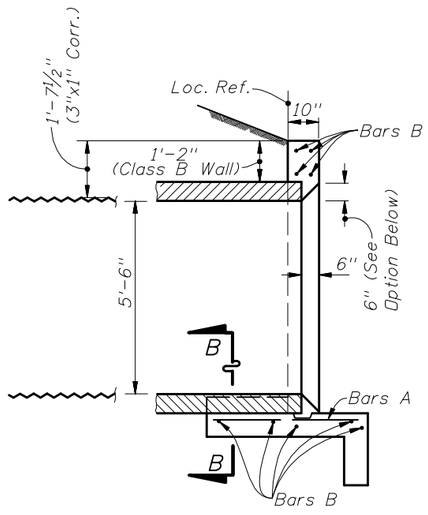
Index No. 252



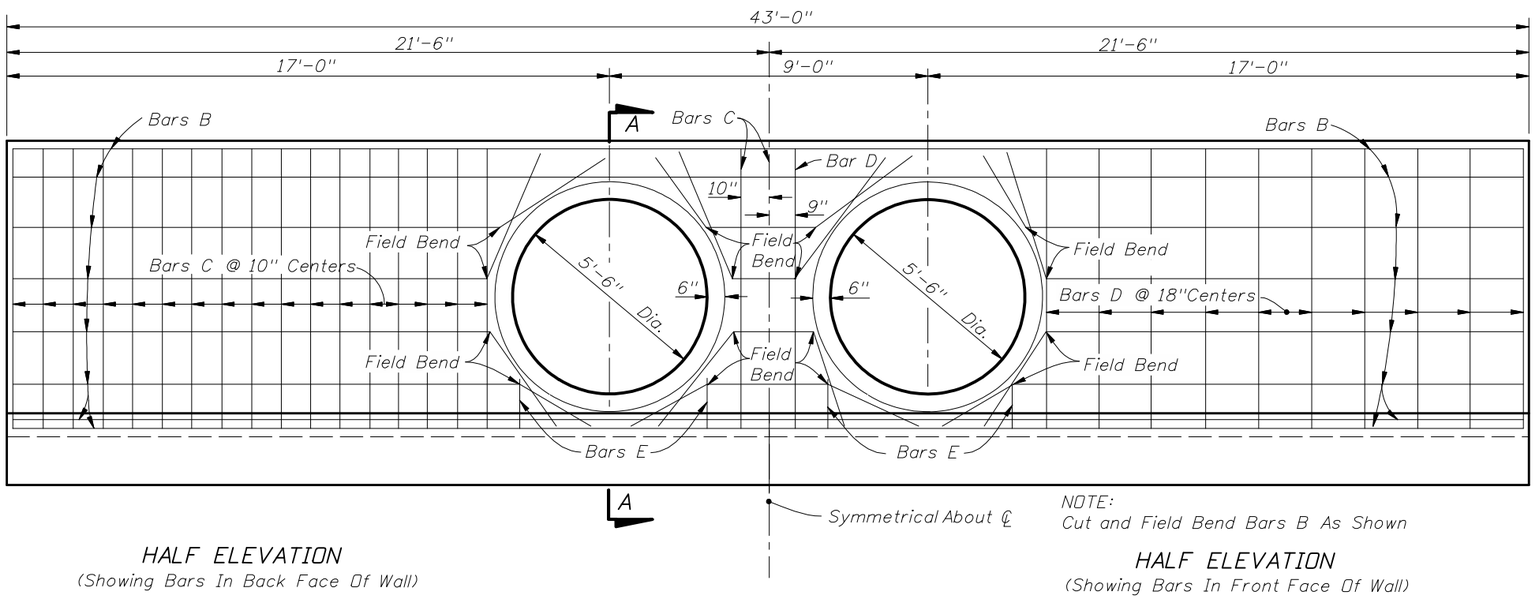
SECTION BB



PLAN
(Showing Bars In Footing)



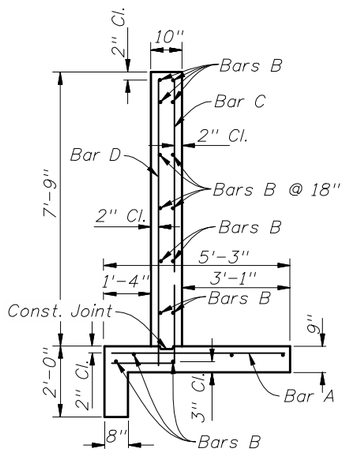
SECTION AA



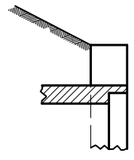
HALF ELEVATION
(Showing Bars In Back Face Of Wall)

NOTE:
Cut and Field Bend Bars B As Shown

HALF ELEVATION
(Showing Bars In Front Face Of Wall)



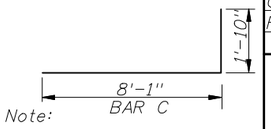
TYPICAL SECTION
THRU ENDWALL



OPTIONAL ENTRANCE
FOR CONCRETE PIPE

BILL OF REINFORCING STEEL					
MARK	SIZE	NO. REQD.	LENGTH	LOCATION	BENDING
A	5	80	4'-11"	Footing	Straight
B	4	17	42'-8"	Footing &Wall	Straight
C	5	37	9'-11"	Wall	Bend
D	4	22	8'-1"	Wall	Straight
E	4	8	1'-8"	Wall	Straight

BENDING DIAGRAMS



Note:
All bar dimensions are
out to out

ESTIMATED QUANTITIES			
ITEM	UNIT	RCP	CMP
Class II Concrete	Cu. Yd.	16.0	16.2
Reinforcing Steel	Lb.	1,406	1,406

NOTE: See Sheet 1 of 2 for General Notes.

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STRAIGHT CONCRETE ENDWALLS SINGLE AND DOUBLE 66" PIPE

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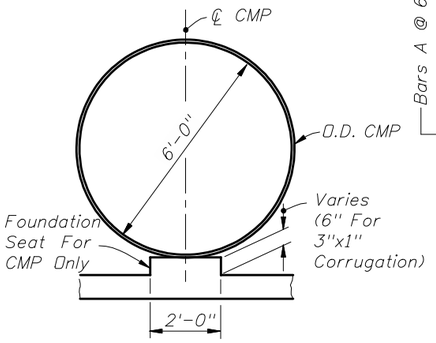
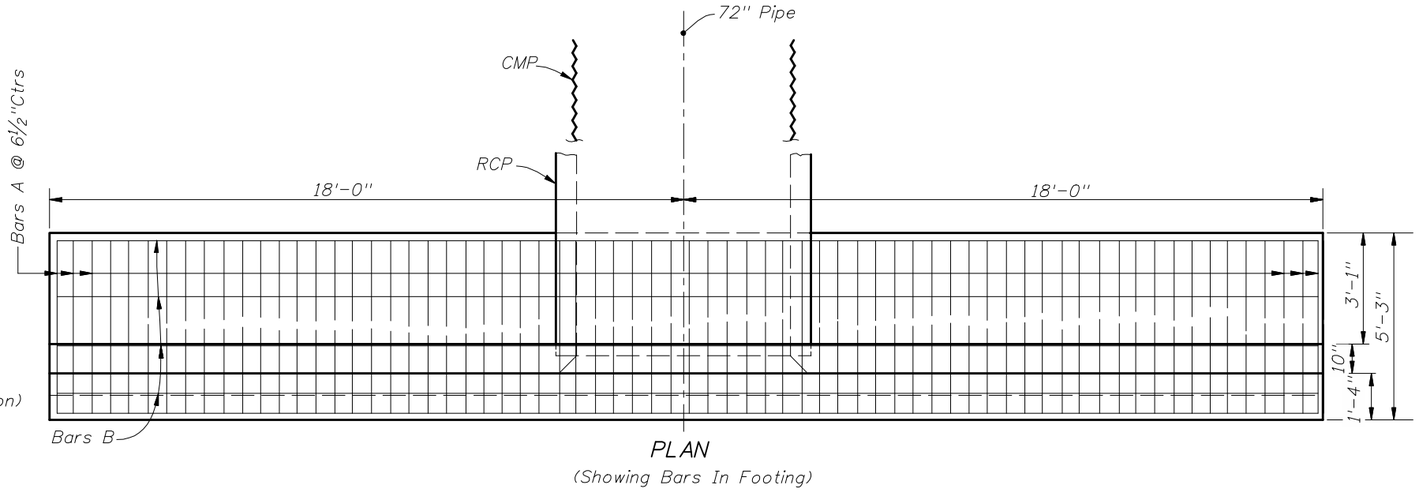
Index No. 252



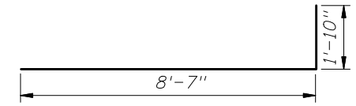


PLAN
(Showing Bars In Footing)

BILL OF REINFORCING STEEL

MARK	SIZE	NO. REQD.	LENGTH	LOCATION	BENDING
A	5	68	4'-11"	Footing	Straight
B	4	17	35'-8"	Footing & Wall	Straight
C	5	34	10'-5"	Wall	Bend
D	4	20	8'-7"	Wall	Straight
E	4	4	2'-6"	Wall	Straight
F	4	4	1'-6"	Wall	Straight

BENDING DIAGRAM



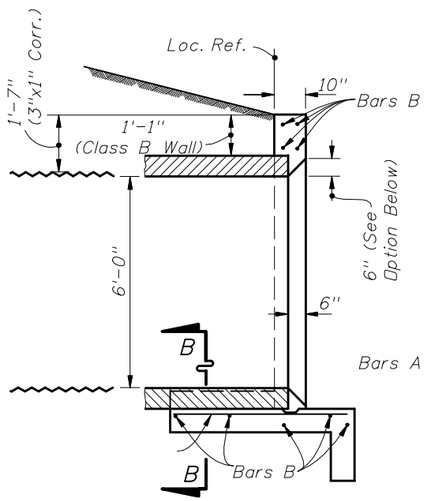
BAR C

NOTE: All bar dimensions are out to out

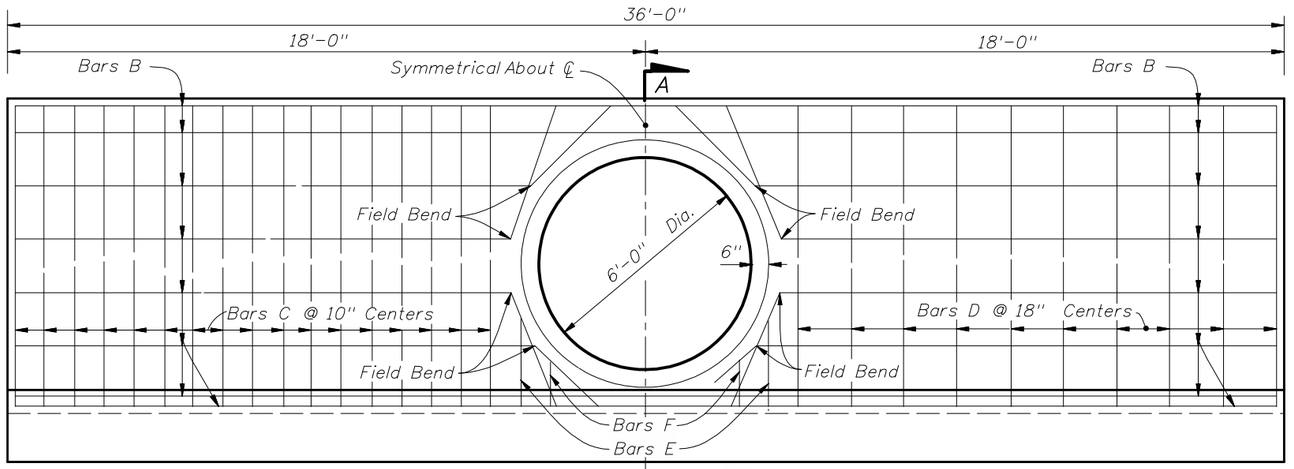
ESTIMATED QUANTITIES

ITEM	UNIT	RCP	CMP
Class II Concrete	Cu. Yd.	14.4	14.5
Reinforcing Steel	Lb.	1249	1249

SECTION BB



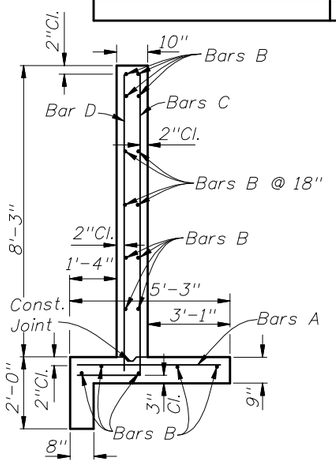
SECTION AA



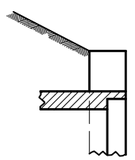
HALF ELEVATION
(Showing Bars In Back Face Of Wall)

NOTE:
Cut and Field Bend Bars B As Shown

HALF ELEVATION
(Showing Bars In Front Face Of Wall)



TYPICAL SECTION
THRU ENDWALL



OPTIONAL ENTRANCE
FOR CONCRETE PIPE

GENERAL NOTES

1. Straight concrete endwalls are intended for use outside the clear zone.
2. Endwalls may be cast-in-place or precast construction. Cast-in-place endwalls shall conform to the details on this index, design specifications AASHTO 1989. Precast construction which adheres to this Index, including any additional reinforcement required for handling which shall be determined by the Contractor or supplier, does not require additional approvals. Deviations from this Index, for precast units, shall require the approval of the State Drainage Engineer prior to construction. For precast construction, see Index No. 201 for opening and grouting details.
3. Reinforcing steel shall be either Grade 40 or 60.
4. Concrete shall be Class II, except ASTM C478 (4000 psi) concrete may be substituted for precast items manufactured in plants meeting the requirements of Section 449 of the Specifications.
5. Chamfer: All exposed edges and corners to be chamfered ¾" unless otherwise shown.
6. That portion of corrugated Metal pipe in direct contact with the concrete slab and extending 12" beyond shall have a continuous bituminous coating of 0.004" minimum thickness coated applied prior to placing of the concrete.
7. Sodding shall be in accordance with Index No. 281 and paid for under the contract unit price for Performanace Turf, SY.
8. Basis of payment for either cast-in-place or precast construction shall be the estimated quantities tabulated on the Index. Concrete and reinforcing steel shall be paid for under the contract unit prices for Class II Concrete (Endwalls), CY and Reinforcing Steel (Roadway), LB.

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STRAIGHT CONCRETE ENDWALLS SINGLE AND DOUBLE 72" PIPE

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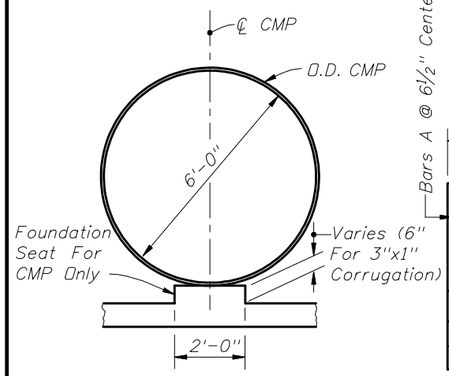
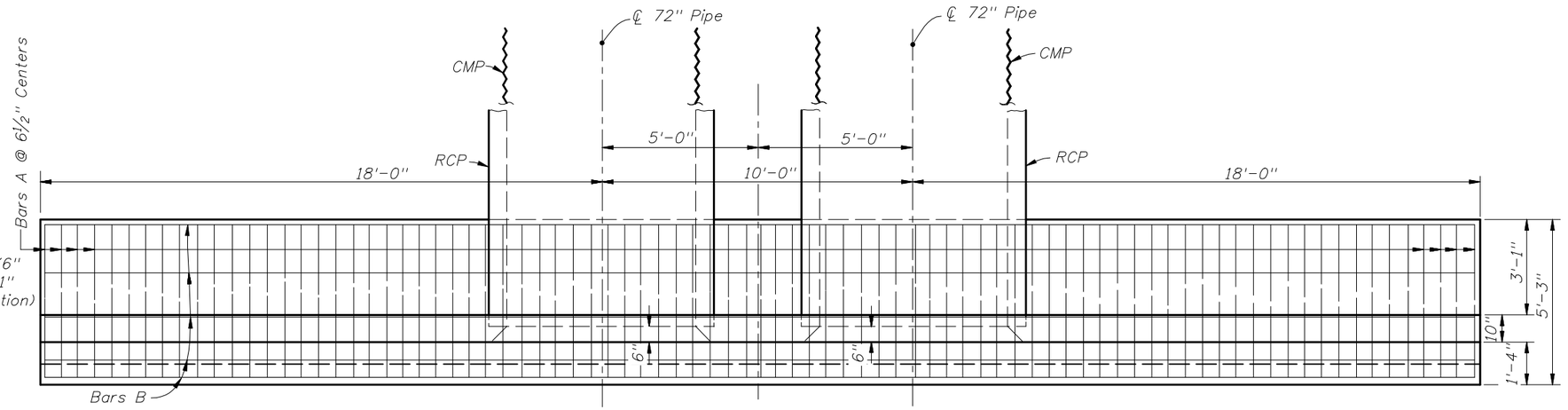
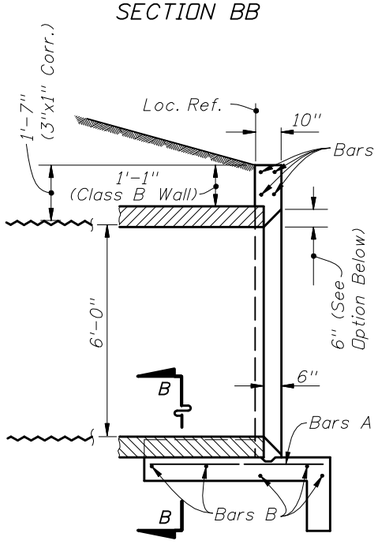


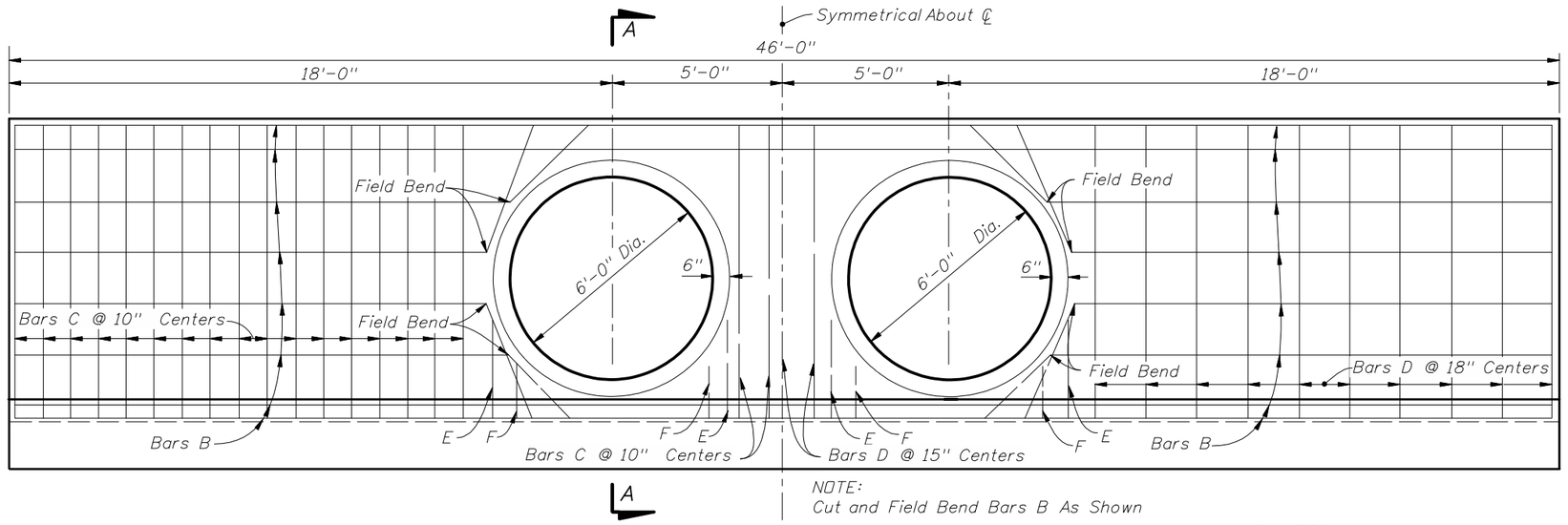


PLAN
(Showing Bars In Footing)

SECTION BB



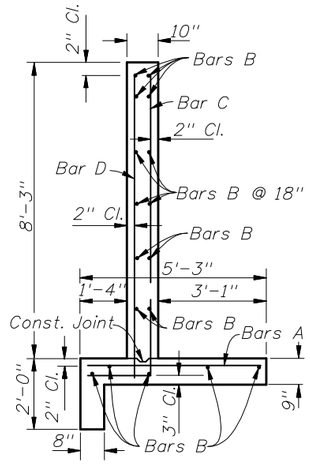
SECTION AA



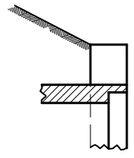
NOTE:
Cut and Field Bend Bars B As Shown

HALF ELEVATION
(Showing Bars In Back Face Of Wall)

HALF ELEVATION
(Showing Bars In Front Face Of Wall)



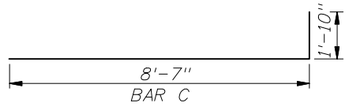
TYPICAL SECTION
THRU ENDWALL



OPTIONAL ENTRANCE
FOR CONCRETE PIPE

BILL OF REINFORCING STEEL					
MARK	SIZE	NO. REQD.	LENGTH	LOCATION	BENDING
A	5	85	4'-11"	Footing	Straight
B	4	17	45'-8"	Footing & Wall	Straight
C	5	38	10'-5"	Wall	Bend
D	4	23	8'-7"	Wall	Straight
E	4	8	2'-6"	Wall	Straight
F	4	8	1'-6"	Wall	Straight

BENDING DIAGRAM



NOTE: All bar dimensions are out to out

ESTIMATED QUANTITIES			
ITEM	UNIT	RCP	CMP
Concrete Class II	Cu. Yd.	17.5	17.8
Reinforcing Steel	Lb.	1519	1519

NOTE: See Sheet 1 of 2 for General Notes.

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STRAIGHT CONCRETE ENDWALLS SINGLE AND DOUBLE 72" PIPE

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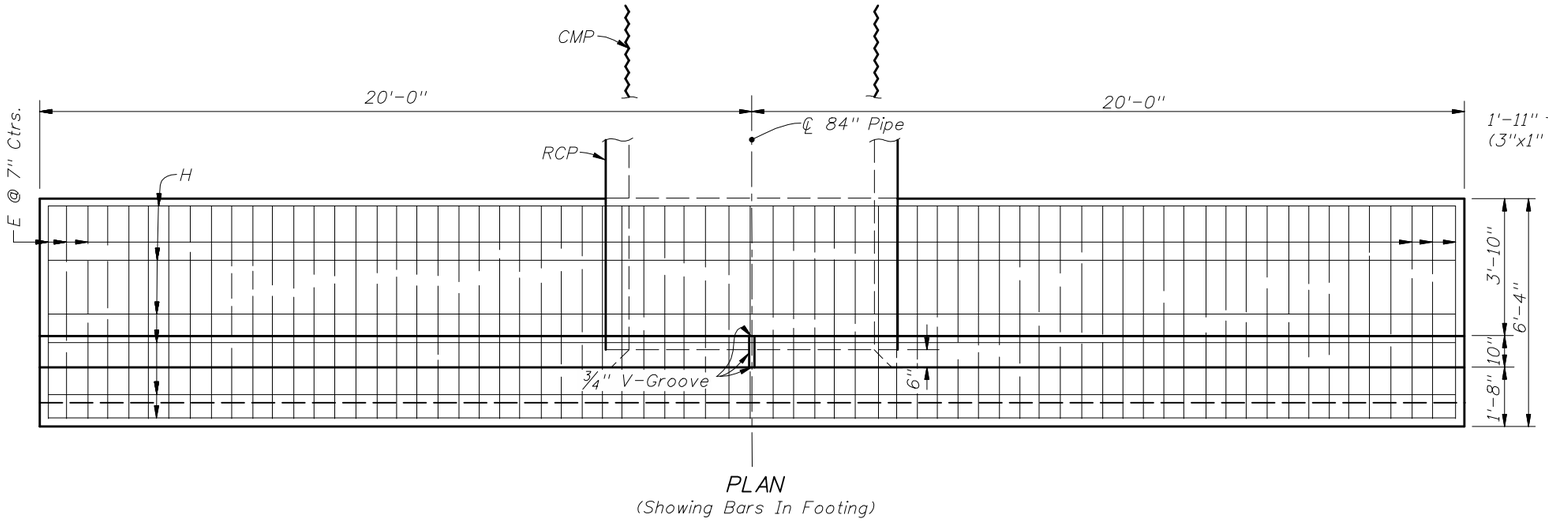
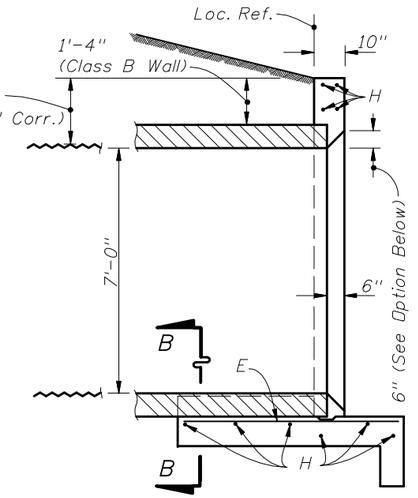


PLAN
(Showing Bars In Footing)

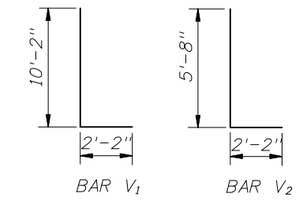


SECTION AA

BILL OF REINFORCING STEEL

MARK	SIZE	NO. REQD.	LENGTH
E	6	69	6'-0"
H	4	20	39'-8"
V_1	6	26	12'-4"
V_2	6	26	7'-10"
V_3	4	22	10'-2"
V_4	4	4	2'-0"

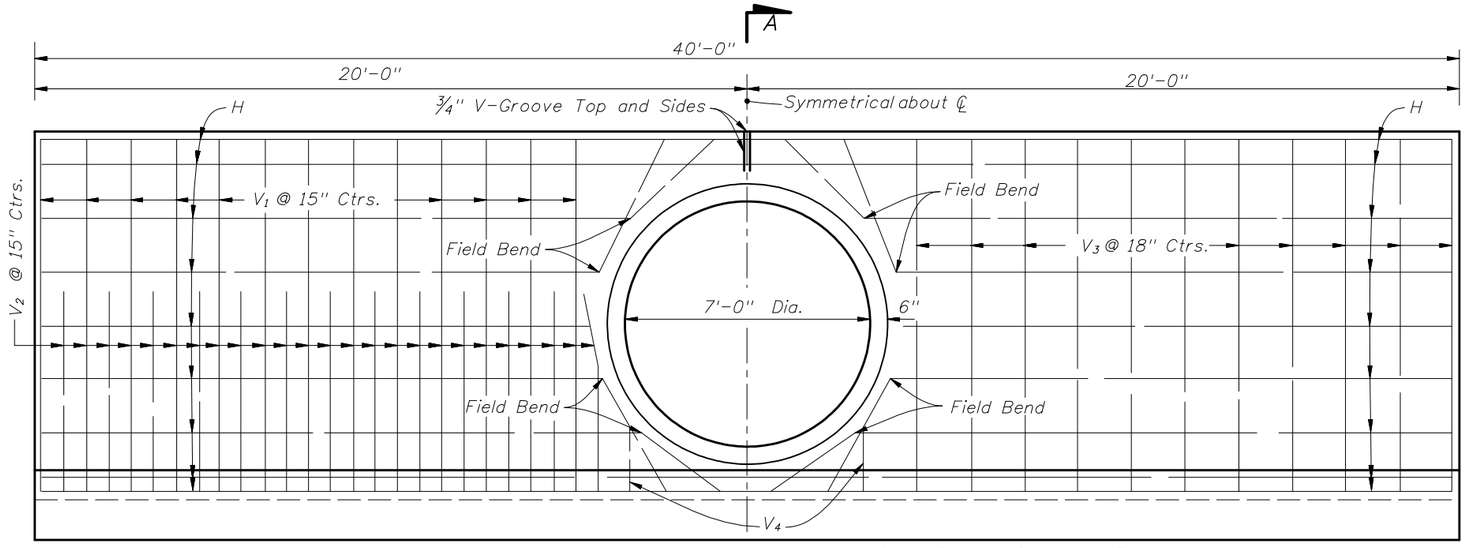
BENDING DIAGRAM



NOTE:
All bar dimensions are out to out

ESTIMATED QUANTITIES

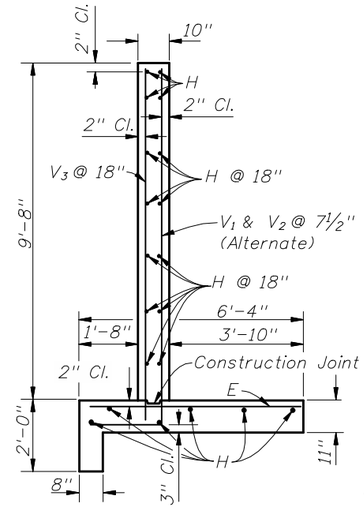
ITEM	UNIT	RCP	CMP
Class II Concrete	Cu. Yd.	20.0	20.2
Reinforcing Steel	Lb.	2,095	2,095



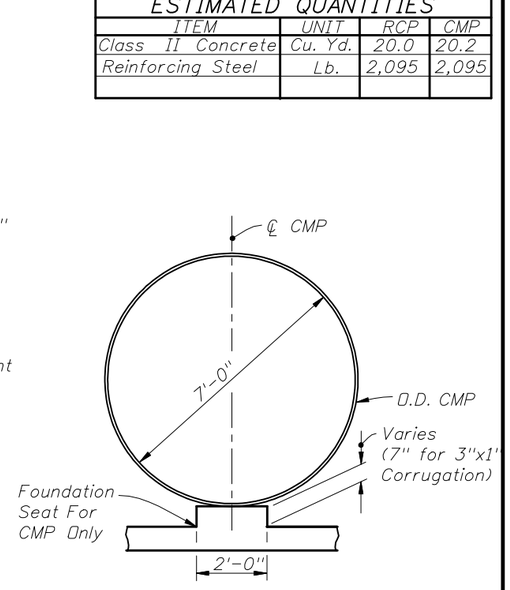
HALF ELEVATION
(Showing Bars In Back Face Of Wall)

Note: Cut and field bend Bars H as shown

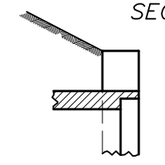
HALF ELEVATION
(Showing Bars In Front Face Of Wall)



TYPICAL SECTION
THRU ENDWALL



SECTION BB



OPTIONAL ENTRANCE
FOR CONCRETE PIPE

GENERAL NOTES

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2. Endwalls may be cast-in-place or precast construction. Cast-in-place endwalls shall conform to the details on this index, design specifications AASHTO 1989. Precast construction which adheres to this Index, including any additional reinforcement required for handling which shall be determined by the Contractor or supplier, does not require additional approvals. Deviations from this Index, for precast units, shall require the approval of the State Drainage Engineer prior to construction. For precast construction, see Index No. 201 for opening and grouting details.
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4. Concrete shall be Class II, except ASTM C478 (4000 psi) concrete may be substituted for precast items manufactured in plants meeting the requirements of Section 449 of the Specifications.
5. Chamfer: All exposed edges and corners to be chamfered ¾" unless otherwise shown.
6. That portion of corrugated metal pipe in direct contact with the concrete slab and extending 12" beyond shall have a continuous bituminous coating of 0.004" minimum thickness applied prior to placing of the concrete.
7. Sodding shall be in accordance with Index No. 281 and paid for under the contract unit price for Performance Turf, SY.
8. Basis of payment for either cast-in-place or precast construction shall be the estimated quantities tabulated on the Index. Concrete and reinforcing steel shall be paid for under the contract unit prices for Class II Concrete (Endwalls), CY and Reinforcing Steel (Roadway), LB.

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

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STRAIGHT CONCRETE ENDWALL SINGLE 84" PIPE

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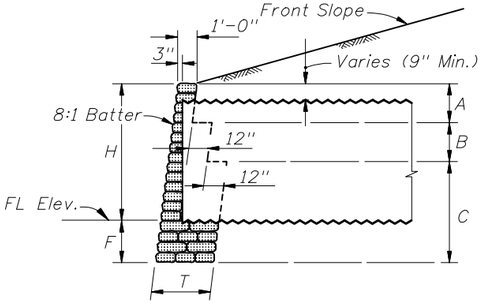
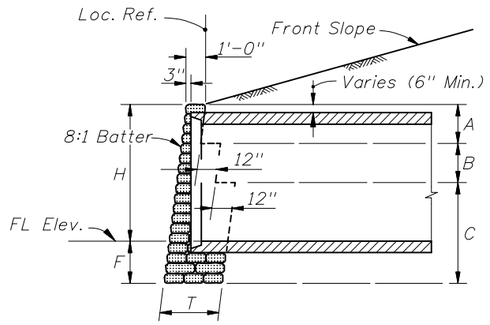
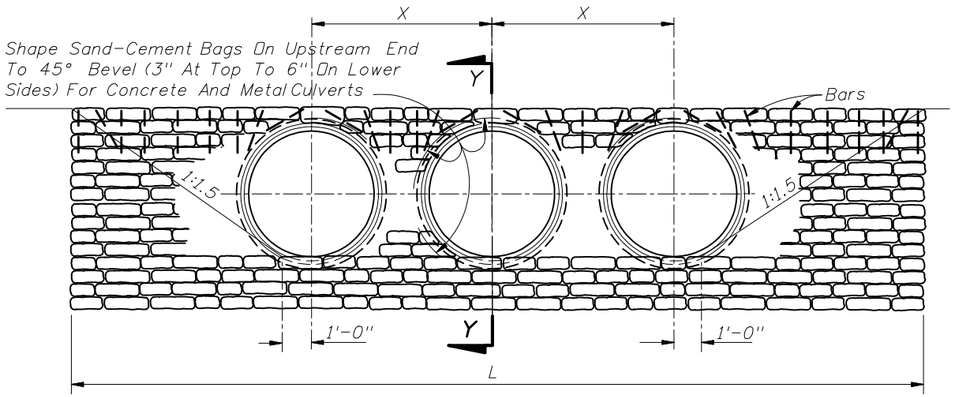


CORRUGATED METAL PIPE



CONCRETE PIPE

SECTION YY



Note:
(1) For concrete and corrugated metal pipes. Concrete pipe shown.
(2) The top row of riprap bags shall be secured by pinning, using #4 reinforcing bars 18 inches in length, as follows:
(a) The end bags shall be secured using two bars per bag, one vertical and one diagonal as shown.
(b) The next to last bag on each end shall be secured with two bars vertically.
(c) Bags located over the pipe shall be secured by a bar which is driven diagonally except that for concrete pipe two bars shall be used for single bags above the pipe.
(d) Intermediate bags shall be secured with a single bar.

Bars shall be driven to one inch below the surface of the bag. The cost of furnishing and installing the bars shall be included in the cost of the riprap.

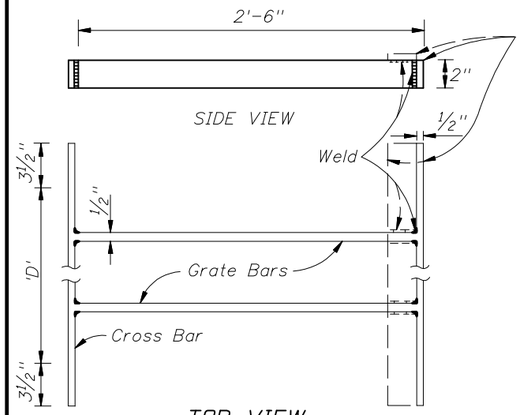
FRONT ELEVATION

TABLE OF DIMENSIONS AND QUANTITIES FOR ONE ENDWALL

SIZE OF PIPE	H	T	A	B	C	F	X	ONE PIPE CULVERTS			TWO PIPE CULVERTS			THREE PIPE CULVERTS			FOUR PIPE CULVERTS		
								L	RIPRAP CY		L	RIPRAP CY		L	RIPRAP CY		L	RIPRAP CY	
									CP	CMP		CP	CMP		CP	CMP		CP	CMP
18"	2'-3"	1'-0"	4'-0"	0'-0"	0'-0"	1'-9"	2'-10"	8'-9"	1.2	1.2	11'-7"	1.5	1.6	14'-5"	1.8	1.9	17'-3"	2.1	2.3
24"	2'-9"	2'-0"	2'-0"	2'-6"	0'-0"	1'-9"	3'-5"	10'-3"	2.4	2.5	13'-8"	3.0	3.2	17'-1"	3.7	4.0	20'-6"	4.3	4.7
30"	3'-4"	2'-0"	2'-0"	3'-2"	0'-0"	1'-10"	4'-3"	12'-0"	3.3	3.4	16'-3"	4.2	4.5	20'-6"	5.1	5.5	24'-9"	6.0	6.5
36"	3'-10"	2'-0"	2'-0"	3'-8"	0'-0"	1'-10"	5'-1"	13'-6"	4.0	4.2	18'-7"	5.2	5.7	23'-8"	6.3	6.9	28'-9"	7.4	8.2
42"	4'-5"	3'-0"	2'-0"	2'-0"	2'-4"	1'-11"	6'-0"	15'-3"	6.4	6.7	21'-3"	8.3	8.9	27'-3"	10.2	11.2	33'-3"	12.3	13.4
48"	4'-11"	3'-0"	2'-0"	2'-0"	2'-10"	1'-11"	6'-9"	16'-9"	7.7	8.1	23'-6"	10.0	10.8	30'-3"	12.3	13.5	37'-0"	14.5	16.2
54"	5'-6"	3'-0"	2'-0"	2'-0"	3'-6"	2'-0"	7'-8"	18'-6"	9.5	10.1	26'-2"	12.4	13.5	33'-10"	15.3	17.0	41'-6"	18.2	20.4
60"	6'-0"	3'-0"	2'-0"	2'-0"	4'-0"	2'-0"	8'-6"	20'-0"	11.0	11.7	28'-6"	14.4	15.8	37'-0"	17.8	19.8	45'-6"	21.1	23.8
66"	6'-7"	3'-0"	2'-0"	2'-0"	4'-8"	2'-1"	9'-3"	21'-9"	13.2	14.1	31'-0"	17.2	18.9	40'-3"	21.2	23.7	49'-6"	25.1	28.5
72"	7'-1"	3'-0"	2'-0"	2'-0"	5'-2"	2'-1"	10'-0"	23'-3"	15.0	16.0	33'-3"	19.4	21.4	43'-3"	23.9	26.8	53'-3"	28.3	32.3
78"	7'-8"	3'-0"	2'-0"	2'-0"	5'-10"	2'-2"	10'-9"	25'-0"	17.5	18.7	35'-9"	22.6	25.0	46'-6"	27.8	31.3	57'-3"	32.9	37.6
84"	8'-2"	3'-0"	2'-0"	2'-0"	6'-4"	2'-2"	11'-8"	26'-6"	19.5	20.9	38'-2"	25.3	28.1	49'-10"	31.1	35.2	61'-6"	36.9	42.4

GENERAL NOTES

1. Straight sand-cement endwalls are intended for use outside the clear zone.

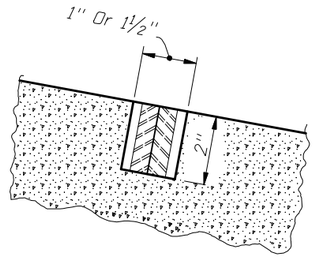


TOP VIEW

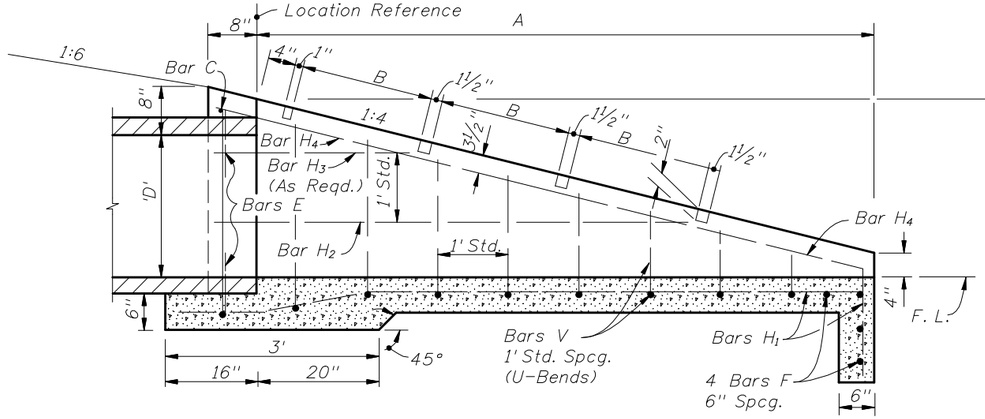
GRATE TYPE NO. 1

Pipe Size	Grate Bars Reqd.	Grate LB.
15"	2	28.93

Bars to be evenly spaced across dimension 'D'
All bars 1/2" x 2"



SECTION AA



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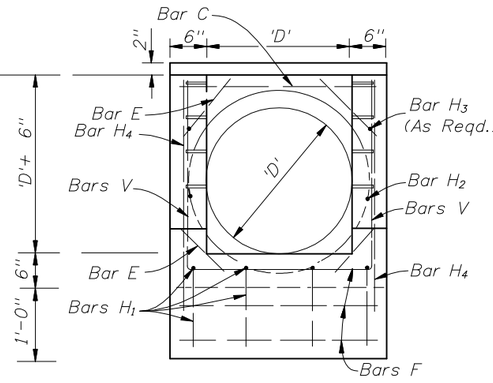

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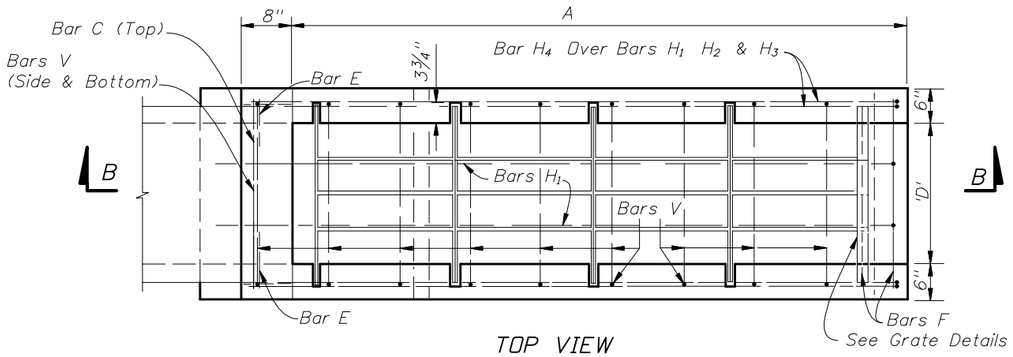
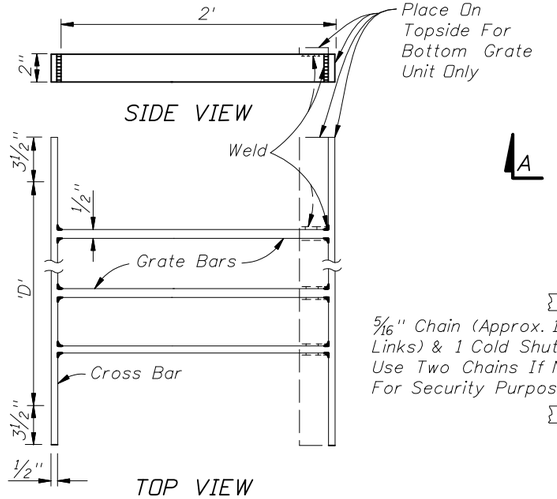


TOP VIEW

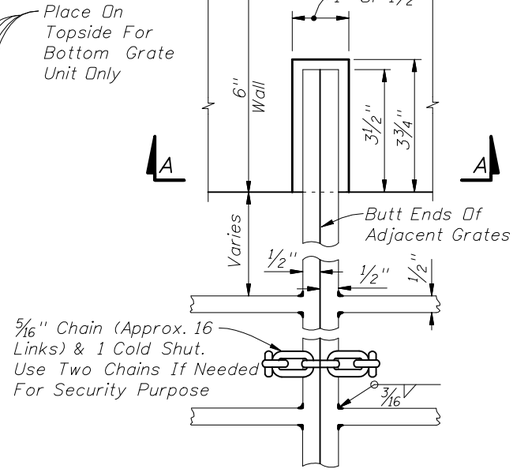


TOP VIEW

GRATE TYPE NO. 2

Pipe Size	Grate Bars Reqd.	Grate LB.
18"	3	33.69
24"	4	43.63
30"	5	53.55

Bars to be evenly spaced across dimension 'D'.
All bars 1/2" x 2".



TOP VIEW

GRATE, SEAT, WELD & CHAIN DETAIL

TABLE OF DIMENSIONS AND QUANTITIES

Slope	Pipe Size D	A	B	Class I Conc. (CY)	Reinf. Steel (Lbs.)	Number Of Grates Reqd. Type No. 1	Number Of Grates Reqd. Type No. 2	Total Grate Wt. (Lbs.)	Sodding (SY)	Slope Transition Offset	Slope Transition L
1:4	15"	5.67'	2.38'	0.85	56	2	0	57.86	15	4.2'	42'
	18"	6.67'	1.875'	1.01	73	0	3	101.08	16	4.8'	48'
	24"	8.67'	1.875'	1.65	97	0	4	174.52	19	5.8'	58'
	30"	10.67'	1.875'	2.33	129	0	5	267.75	21	6.9'	69'

GENERAL NOTES

1. This endwall is to be used only in the clear zone for the drainage of medians and other areas having low design velocities and negligible debris.

2. Reinforcing steel: All bars are size #4. Spacings shown are center to center. Laps to be 12" minimum. Clearance is 2" except as noted.
   Square welded wire fabric (two cages max.) having an equivalent cross sectional area (0.20 sq. in.) may be substituted for bar reinforcement.

3. Grates shall be ASTM A242/A242M, A572/A572M or ASTM A5888/A588M, Grade 50 steel. When "Alt. G" grates are specified in the plans, grates shall be galvanized in accordance with Section 975 and 425.3.2 of the Standard Specifications.

4. Endwall to be paid for under the contract unit price for U-Endwall, Each. Payment shall include cost of concrete, reinforcing steel, grate, and accessories. Quantities shown are for estimating purposes only.

5. Sod slopes 5' each side and above endwall. Sodding to be paid for under contract unit price for Performance Turf, SY.

6. Precasting of this endwall will be permitted. Precast units shall conform to the dimensions shown or in accordance with approved shop drawings. Request for shop drawing approval shall be directed to the State Drainage Engineer. Use Index No. 201 for opening and grouting details.

7. Concrete shall be Class I except ASTM C478 (4000 psi) concrete may be substituted for precast items manufactured in plants meeting the requirements of Section 449 of the Specifications.

FRONT SLOPE TRANSITION AT ENDWALL

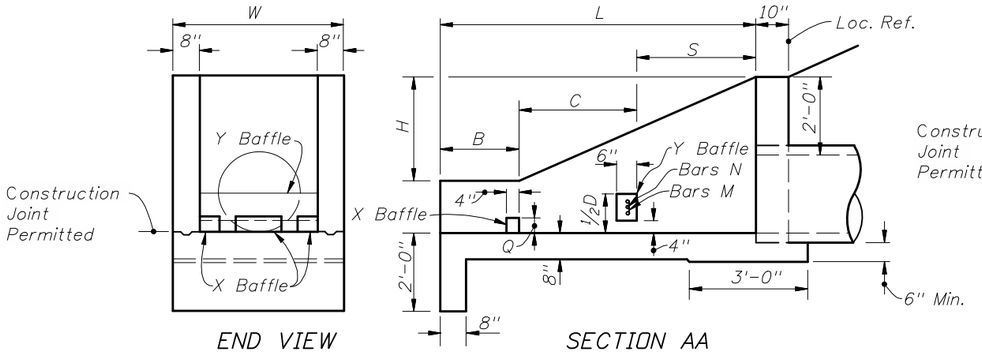
2010 FDOT Design Standards

U-TYPE CONCRETE ENDWALLS WITH GRATES 15" TO 30" PIPE

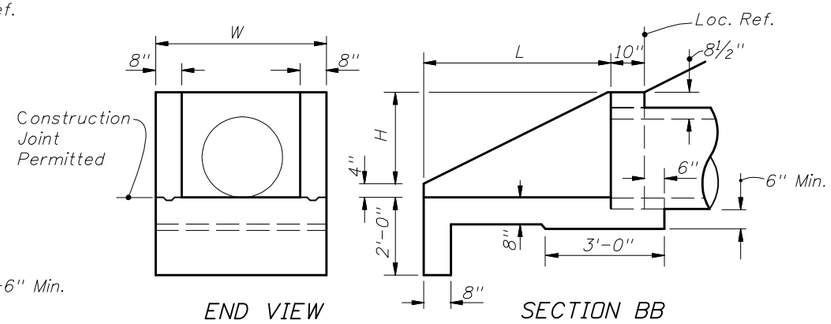
Last Revision 07/01/09

Sheet No. 1 of 1

Index No. 260



END VIEW SECTION AA



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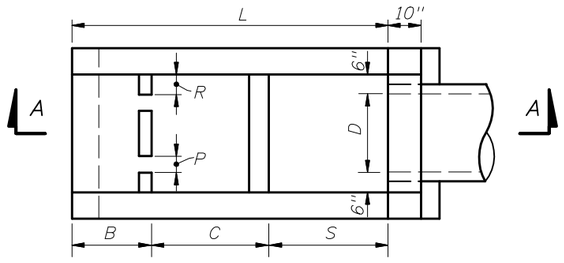
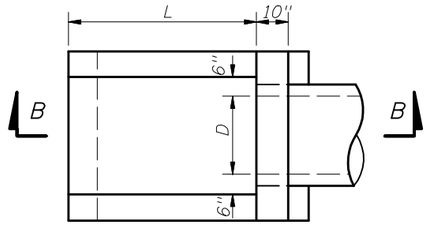


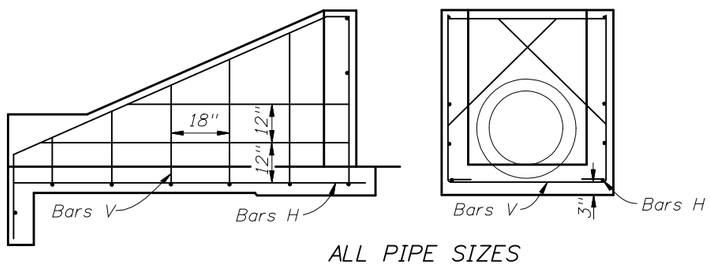
PLAN

DIMENSIONAL DETAILS



PLAN

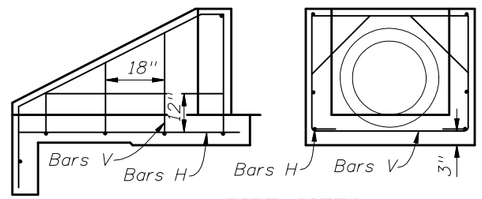
DIMENSIONAL DETAILS



ALL PIPE SIZES
SIDE VIEW AND BACKWALL SECTION
REINFORCING DETAIL

DIMENSIONS AND QUANTITIES FOR ONE U-ENDWALL														
Pipe Size		L	H	W	S	B	C	X Baffle			Y Baffle Reinf. Steel		Class I Conc. Cu. Yd.	Reinf. Steel Lbs.
D	Area Sq. Ft.							P	Q	R	Bar M	Bar N		
15"	1.23	5'-9"	2'-3½"	3'-7"	2'-3"	1'-3"	2'-3"	4"	4"	4"	2 #4	1 #4	1.61	72
18"	1.77	6'-6"	2'-5"	3'-10"	2'-6"	1'-6"	2'-6"	4"	4"	5"	3 #4	2 #4	1.89	86
24"	3.14	8'-0"	2'-8"	4'-4"	3'-0"	2'-0"	3'-0"	5"	5"	6"	4 #4	3 #4	2.52	108
30"	4.91	9'-6"	2'-11"	4'-10"	3'-6"	2'-6"	3'-6"	5"	5"	7"	4 #4	4 #4	3.34	131

WITH BAFFLES



ALL PIPE SIZES
SIDE VIEW AND BACKWALL SECTION
REINFORCING DETAIL

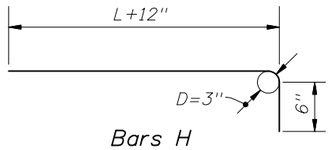
DIMENSIONS AND QUANTITIES FOR ONE U-ENDWALL						
Pipe Size		L	H	W	Class I Conc. Cu. Yd.	Reinf. Steel Lbs.
D	Area Sq. Ft.					
15"	1.23	3'-3"	1'-7½"	3'-7"	0.89	39
18"	1.77	3'-9"	1'-10½"	3'-10"	1.05	43
24"	3.14	4'-9"	2'-4½"	4'-4"	1.40	55
30"	4.91	5'-9"	2'-10½"	4'-10"	1.88	64

WITHOUT BAFFLES

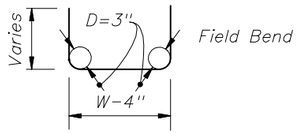
GENERAL NOTES

1. Baffles to be constructed only when called for in plans.
2. When steel grating is required on endwall see Sheet 3 of 3 for details.
3. All reinforcing No. 4 bars with 2" clearance except as noted.
4. All angles, channels and bars shall be ASTM A242/A242M, A572/A572M or A588/A588M Grade 50 steel. When designated Alternate G in the plans galvanize in accordance with Section 975 and 425-3.2 of the Standard Specifications.
5. Channel section C 3x6 may be substituted for C 4x5.4 channel.
6. Precasting of this endwall will be permitted. Precast units shall conform to the dimensions shown or in accordance with approved shop drawings. Request for shop drawing approval shall be directed to the State Drainage Engineer. Use Index No. 201 for opening and grouting details.
7. Concrete shall be Class I, except ASTM C478 (4000 psi) concrete may be substituted for precast items manufactured in plants meeting the requirements of Section 449 of the Specifications.
8. Sodding shall be in accordance with Index No. 281, and paid for under the contract unit price for Performance Turf, SY.
9. Endwall to be paid for under the contract unit price for U-Endwall, Each. Payment shall include cost of concrete, reinforcing steel, and when called for in the plans, steel grating, baffles and accessories. Quantities shown are for estimating purposes only.

ENDWALLS FOR 1:2 SLOPES

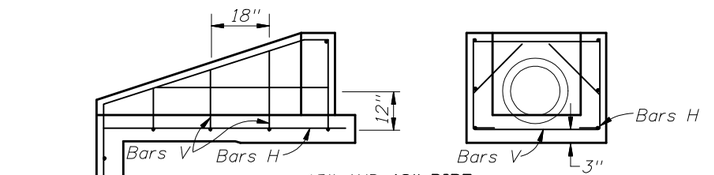


Bars H

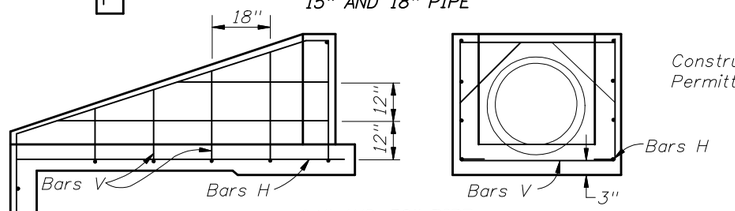


Bars V

BENDING DIAGRAM

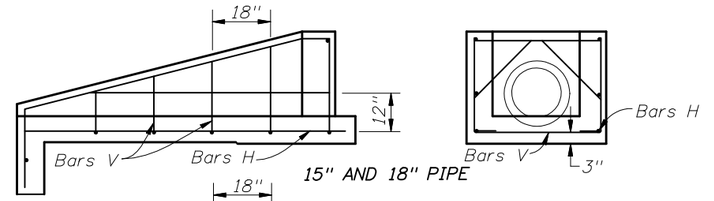


15" AND 18" PIPE

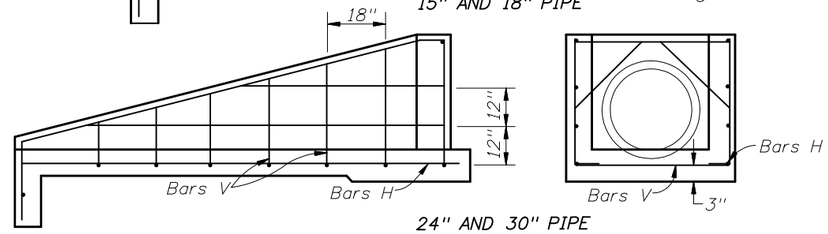


24" AND 30" PIPE

1:3 SLOPES

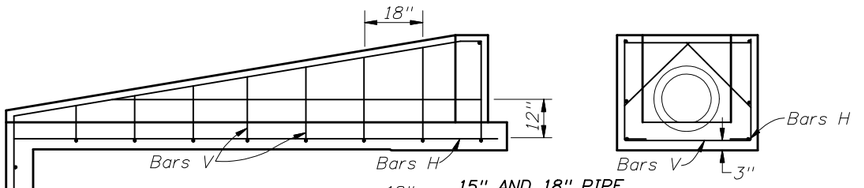


15" AND 18" PIPE

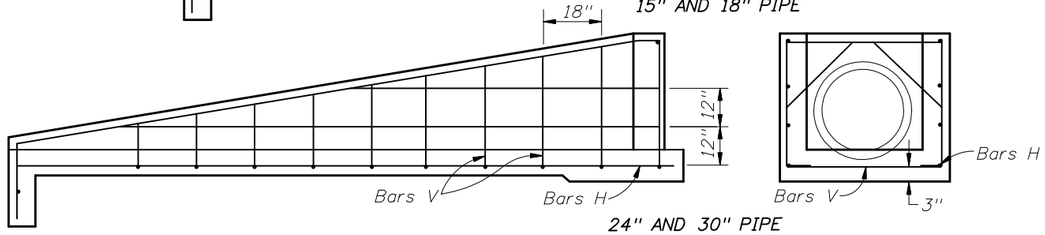


24" AND 30" PIPE

1:4 SLOPES



15" AND 18" PIPE

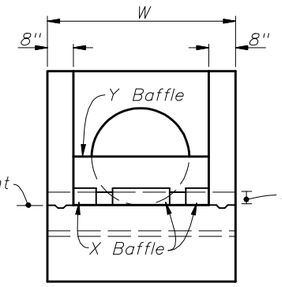


24" AND 30" PIPE

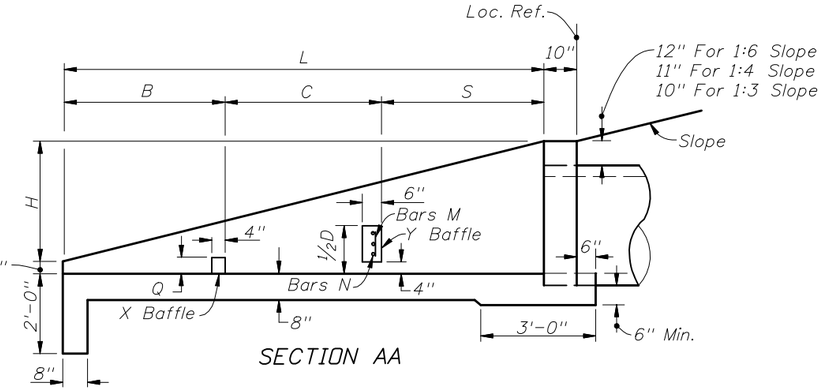
1:6 SLOPES

SIDE VIEWS AND BACKWALL SECTIONS

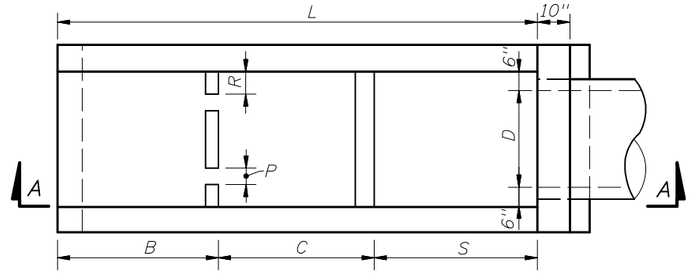
REINFORCING DETAILS



END VIEW



SECTION AA



PLAN

DIMENSIONAL DETAILS

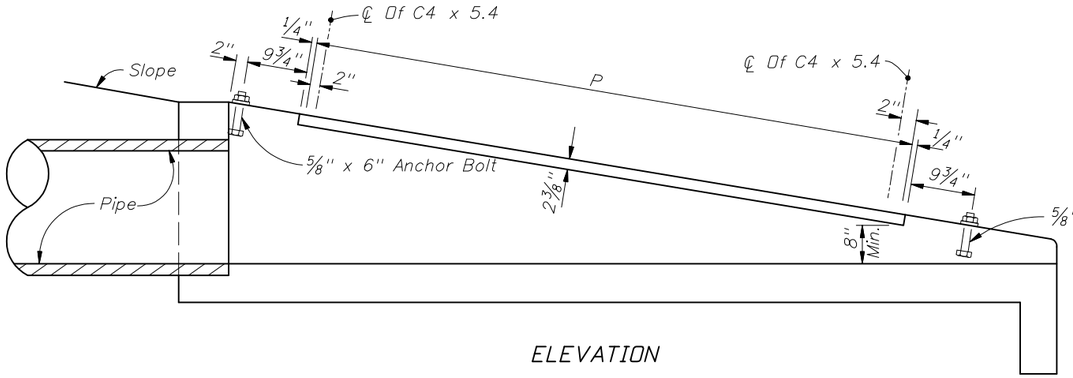
DIMENSIONS AND QUANTITIES FOR BAFFLES

Pipe Size D	X Baffle P Width	X Baffle Q Height	X Baffle R Length	Y Baffle Reinf. Steel Bar M	Y Baffle Reinf. Steel Bar N	Class I Concrete Cu. Yd.	Reinf. Steel Lbs.
15"	4"	4"	4"	2-#4	1-#4	0.10	4
18"	4"	4"	5"	3-#4	2-#4		8
24"	5"	5"	6"	4-#4	3-#4		12
30"	5"	5"	7"	4-#4	4-#4		16

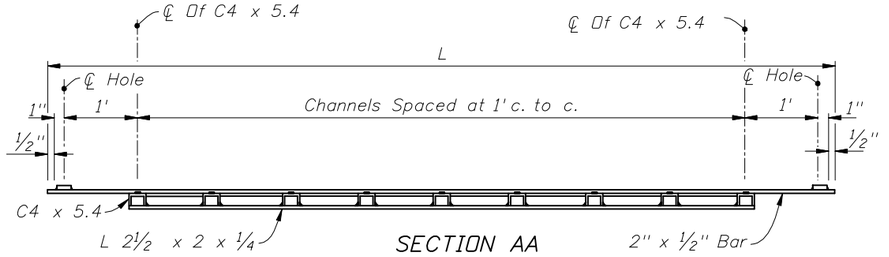
DIMENSIONS AND QUANTITIES FOR ONE U-ENDWALL

Rate Of Slope	Pipe Size D	Pipe Size Area Sq. Ft.	L	H	W	Baffle Locations (When Required) S	B	C	Conc. Class I Cu. Yd.	Reinf. Steel Lbs.
1 : 3	15"	1.23	5'-3"	1'-9"	3'-7"	1'-9"	1'-9"	1'-9"	1.19	51
	18"	1.77	6'-0"	2'-0"	3'-10"	2'-0"	2'-0"	2'-0"	1.42	56
	24"	3.14	7'-6"	2'-6"	4'-4"	2'-6"	2'-6"	2'-6"	1.94	77
	30"	4.91	9'-0"	3'-0"	4'-10"	3'-0"	3'-0"	3'-0"	2.54	96
1 : 4	15"	1.23	7'-4"	1'-10"	3'-7"	2'-6"	2'-6"	2'-4"	1.54	64
	18"	1.77	8'-4"	2'-1"	3'-10"	2'-10"	2'-10"	2'-8"	1.84	71
	24"	3.14	10'-4"	2'-7"	4'-4"	3'-6"	3'-6"	3'-4"	2.53	92
	30"	4.91	12'-4"	3'-1"	4'-10"	4'-2"	4'-2"	4'-0"	3.34	124
1 : 6	15"	1.23	11'-6"	1'-11"	3'-7"	3'-10"	3'-10"	3'-10"	2.19	89
	18"	1.77	13'-0"	2'-2"	3'-10"	4'-4"	4'-4"	4'-4"	2.63	103
	24"	3.14	16'-0"	2'-8"	4'-4"	5'-4"	5'-4"	5'-4"	3.59	143
	30"	4.91	19'-0"	3'-2"	4'-10"	6'-4"	6'-4"	6'-4"	4.81	180

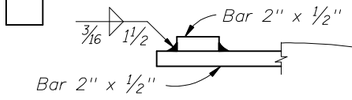
ENDWALLS WITH AND WITHOUT BAFFLES FOR 1:3, 1:4 AND 1:6 SLOPES



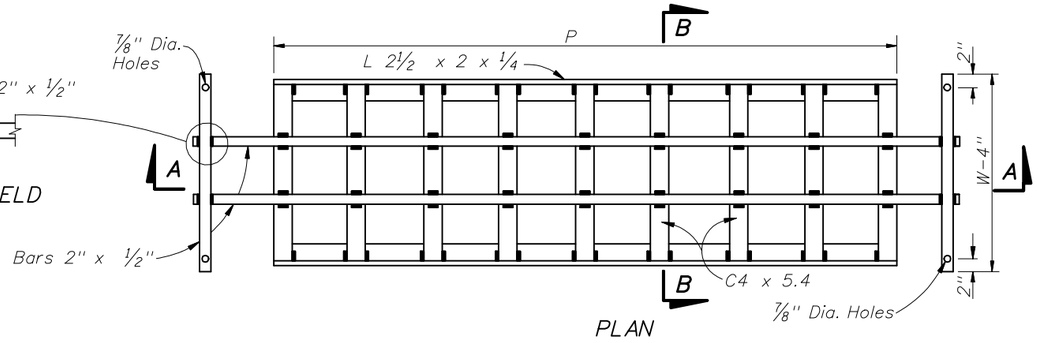
ELEVATION



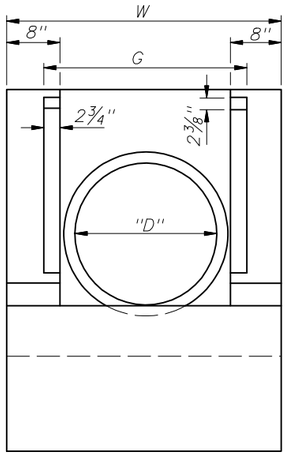
SECTION AA



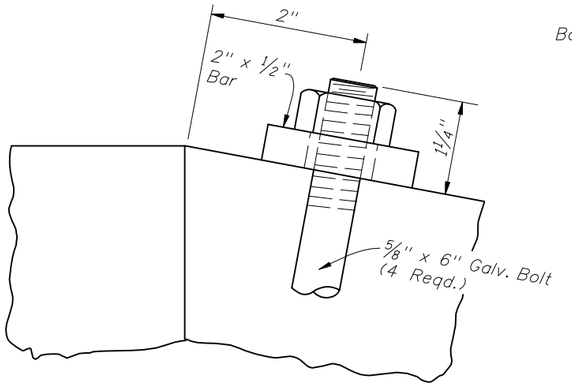
BAR TO BAR WELD



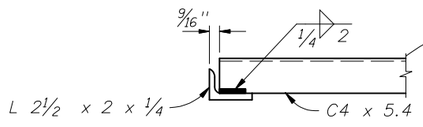
PLAN



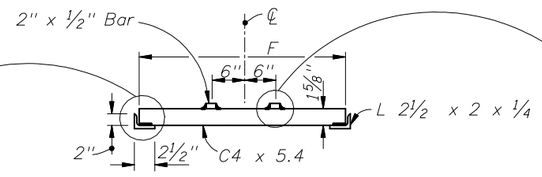
END VIEW



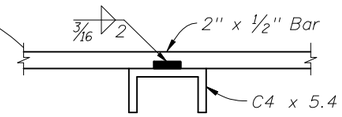
ANCHOR BOLT DETAIL



CHANNEL TO ANGLE WELD



SECTION BB



BAR TO CHANNEL WELD

STEEL GRATE

MOUNTING FOR STEEL GRATE

STEEL GRATING USE CRITERIA

1. Grates to be used on pipe culvert endwalls located within the designated clear zone. Positive debris control shall be provided at all upgradient openings. Grates shall not be used unless one or more of the following conditions exist:

   A. Drainage area to culvert consists of median or infield areas or areas where debris and/or drift is negligible.
   B. Runoff to culvert is by sheet flow or in shuch ill defined channels that debris transport is not considered a major problem.
   C. Runoff to culvert is minor except on an infrequent basis (10 to 15 year frequency); for example a drainage basin in flat sandy terrain with normally low ground water table.
   D. Areas where culvert blockage with resultant backwater would not seriously affect roadway embankment, traffic operation or upland property.

2. Steel grating to be used only where called for in plans.

TABLE OF DIMENSIONS AND QUANTITIES FOR ONE GRATE

Rate Of Slope	Size Pipe D	G	2 Each Bars @ 3.4 Lbs./L.F.			(X) Channels @ 5.4 Lbs./L.F.			2 Angles @ 3.62 Lbs./L.F.		Total Weight Lbs.
			L	W-4"	Lbs.	(X)	F	Lbs.	P	Lbs.	
1:6											
	15"	2'-8 1/2"	9'-3"	3'-3"	85	8	2'-6 7/8"	111	7'-4"	53	249
	18"	2'-11 1/2"	10'-3"	3'-6"	94	9	3'-9 7/8"	137	8'-4"	62	292
	24"	3'-5 1/2"	13'-3"	4'-0"	117	12	3'-3 7/8"	215	11'-4"	82	414
	30"	3'-11 1/2"	16'-3"	4'-6"	141	15	3'-9 7/8"	310	14'-4"	104	555
1:4											
	15"	2'-8 1/2"	6'-3"	3'-3"	65	5	2'-6 7/8"	70	4'-4"	32	167
	18"	2'-11 1/2"	7'-3"	3'-6"	73	6	2'-9 7/8"	92	5'-4"	39	204
	24"	3'-5 1/2"	9'-3"	4'-0"	90	8	3'-3 7/8"	144	7'-4"	53	287
	30"	3'-11 1/2"	11'-3"	4'-6"	107	10	3'-9 7/8"	206	9'-4"	68	381
1:3											
	15"	2'-8 1/2"	4'-3"	3'-3"	51	3	2'-6 7/8"	42	2'-4"	17	110
	18"	2'-11 1/2"	5'-3"	3'-6"	60	4	2'-9 7/8"	61	3'-4"	24	145
	24"	3'-5 1/2"	6'-3"	4'-0"	70	5	3'-3 7/8"	90	4'-4"	31	191
	30"	3'-11 1/2"	8'-3"	4'-6"	87	7	3'-9 7/8"	145	6'-4"	46	278

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2010 FDOT Design Standards

U-TYPE CONCRETE ENDWALLS BAFFLES AND GRATE OPTIONAL - 15" TO 30" PIPE

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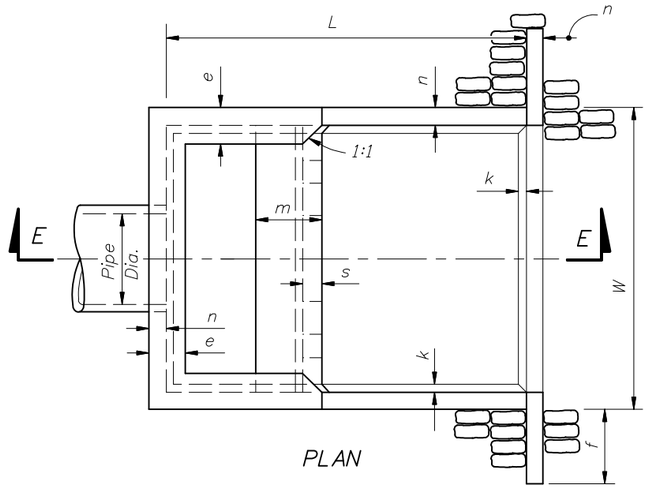
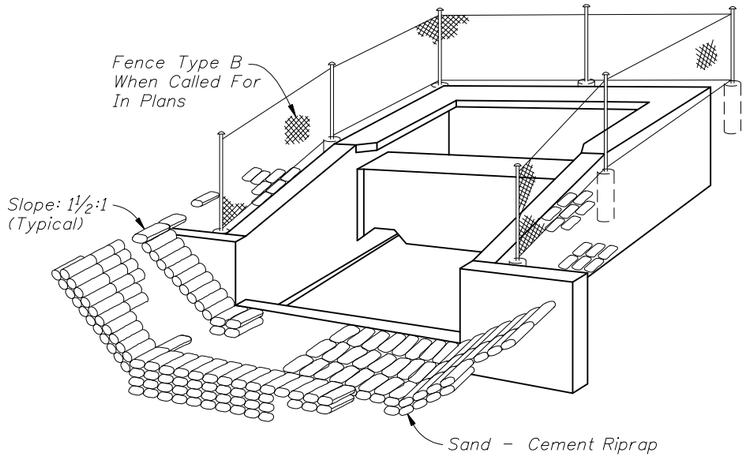
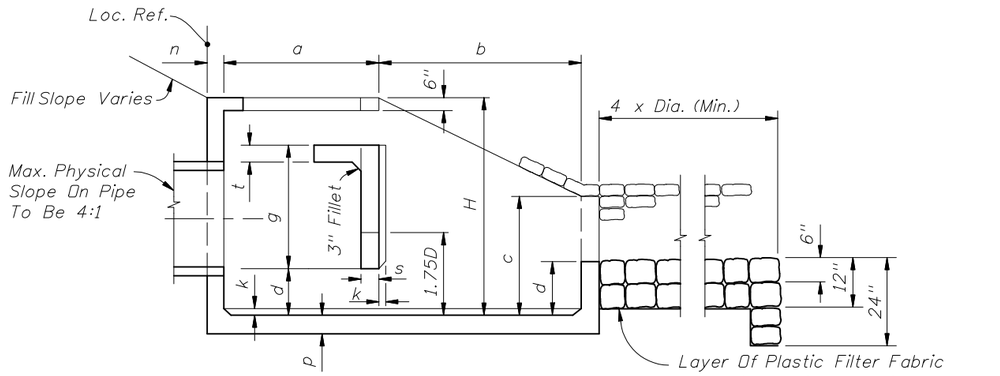


PLAN



PERSPECTIVE



SECTION EE

GENERAL NOTES

1. U-type concrete endwall energy dissipators are intended for use outside the clear zone.
2. Chamfer all exposed edges ¾".
3. Concrete shall be Class I, except ASTM C478 (4000 psi) concrete may be substituted for precast items manufactured in plants meeting the requirements of Section 449 of the Specifications.
4. Reinforcing steel shall have 2" min. cover.
5. Endwall to be paid for under the contract unit price for Class I Concrete (Endwalls), CY and Reinforcing Steel (Roadway), LB. Riprap to be paid for under the contract unit price for Riprap (Sand-Cement) (Roadway), CY. Cost of plastic filter fabric to be included in the contract unit price for riprap.
6. Fencing, when called for in the plans, to be paid for under the contract unit price for Fencing, Type B, LF. See Index No. 802 for details of Type B fencing.

Pipe Size		Q (Max) (cfs)	Dimensions																Concrete Class I (C.Y.)	Reinf. Steel (Lbs.)	Sand Cement Riprap C.Y. (Nom.)
			Ft. - In.											Inches							
Dia. (In.)	Area (S.F.)		W	H	L	a	b	c	d	e	f	g	m	n	p	s	t	k			
30	4.91	59	9-0	6-3	10-8	4-7	6-1	3-4	1-4	1-2	2-6	3-0	1-11	6	6½	7	7	3	6.72	736	10.6
36	7.07	85	10-5	7-3	12-4	5-3	7-1	3-10	1-7	1-3	3-0	3-6	2-3	7	7½	8	8	3	10.34	1,072	13.6
42	9.62	115	11-10	8-0	14-0	6-0	8-0	4-5	1-9	1-6	3-0	3-11	2-6	8	8½	9	8	4	14.82	1,429	17.5
48	12.57	151	13-3	9-0	15-8	6-9	8-11	4-11	2-0	1-7	3-0	4-5	2-10	9	9½	10	8	4	20.36	2,000	22.1
54	15.90	191	14-8	9-9	17-4	7-4	10-0	5-5	2-2	1-10	3-0	4-11	3-0	10	10½	10	8	4	27.19	2,659	27.2
60	13.63	236	16-1	10-9	19-0	8-0	11-0	5-11	2-5	1-11	3-0	5-4	3-4	11	11½	11	8	6	34.49	3,552	32.5
66	23.76	285	17-3	11-6	20-6	8-8	11-10	6-5	2-7	2-1	3-0	5-9	3-7	12	12½	12	8	6	42.82	4,472	38.3
72	28.27	339	18-6	12-3	22-0	9-3	12-9	6-11	2-9	2-3	3-0	6-2	3-9	12	12½	12	8	6	50.68	5,426	44.5

2010 FDOT Design Standards

U-TYPE CONCRETE ENDWALLS ENERGY DISSIPATOR - 30" TO 72" PIPE

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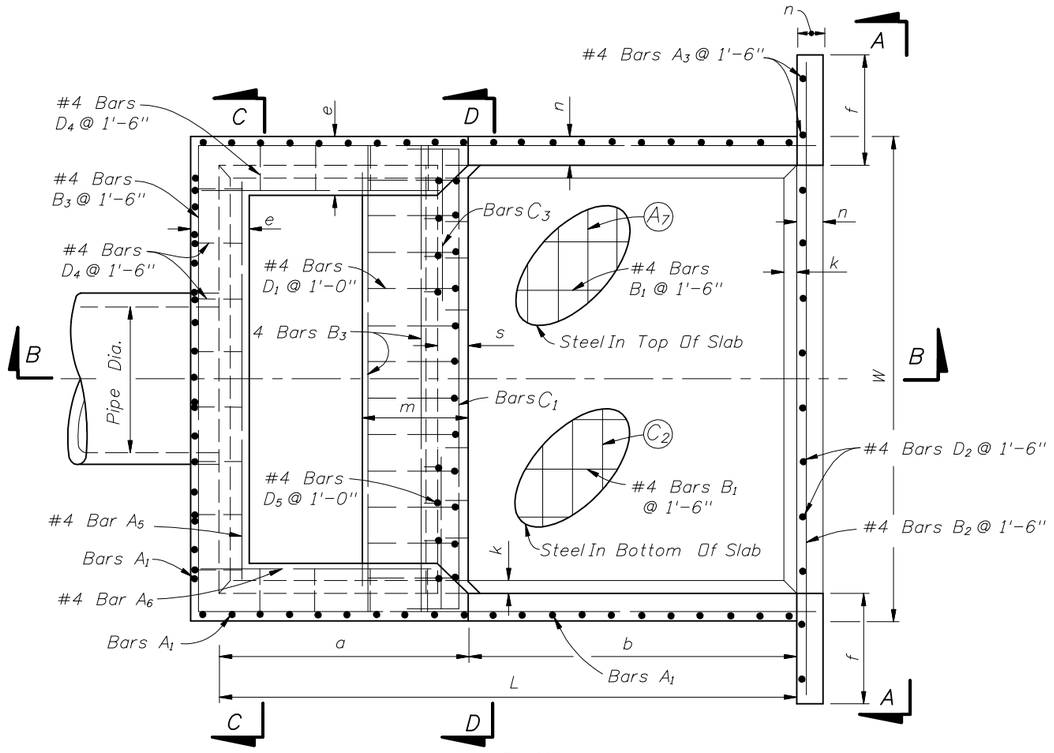
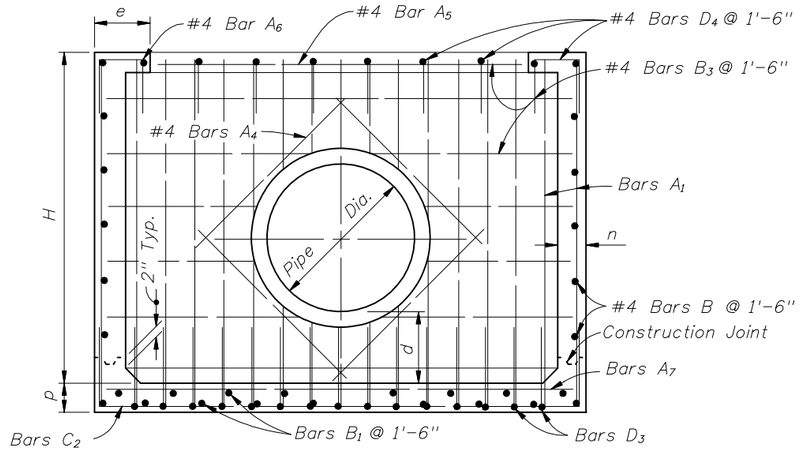
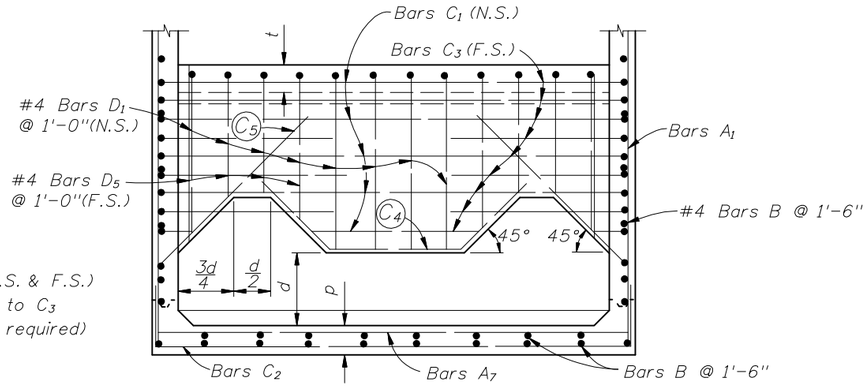


PLAN

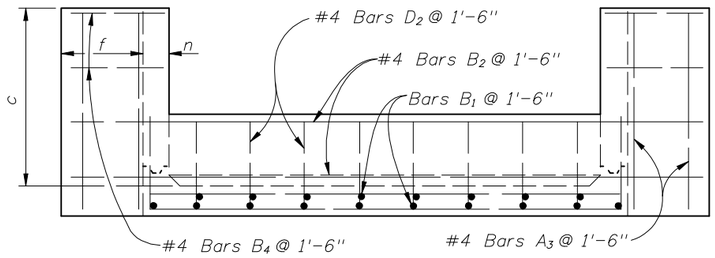


SECTION CC

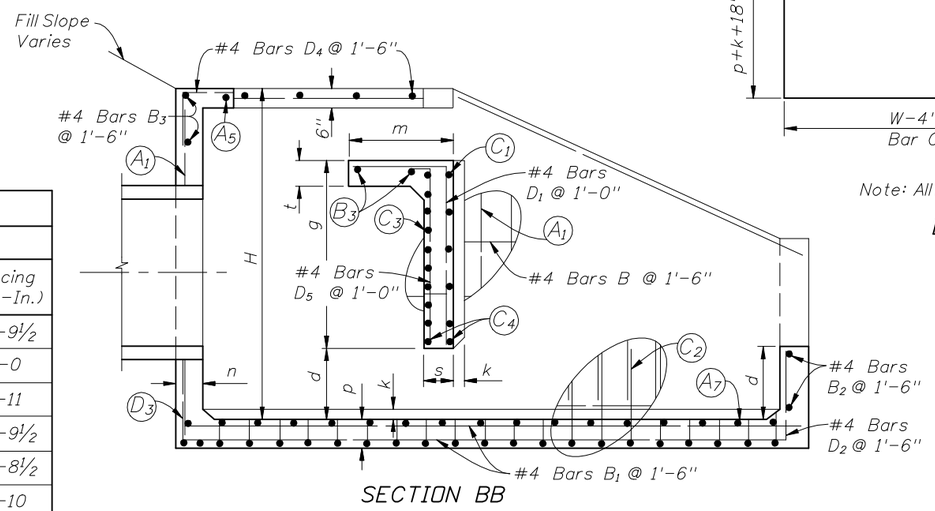


SECTION DD

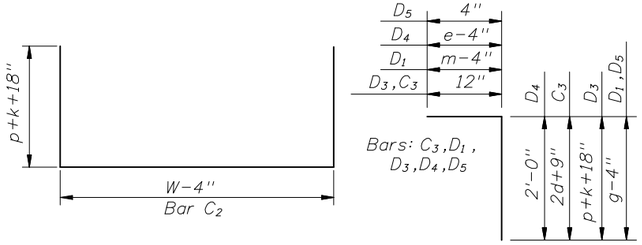
Note: Bars C_4 & C_5 (N.S. & F.S.) equivalent in size to C_3 (cut and bend as required)



VIEW AA



SECTION BB



Note: All bar dimensions are out to out.

BENDING DIAGRAM

BARS

Pipe Size	A_1		A_7		C_1		C_2		C_3		D_3	
	Size (No.)	Spacing (Ft.-In.)	Size (No.)	Spacing (Ft.-In.)	Size (No.)	Spacing (Ft.-In.)	Size (No.)	Spacing (Ft.-In.)	Size (No.)	Spacing (Ft.-In.)	Size (No.)	Spacing (Ft.-In.)
30"	4	0-9½	4	1-6	5	0-11	4	0-9½	5	0-5½	4	0-9½
36"	5	1-0	4	1-6	5	0-10	5	1-0	5	0-5	5	1-0
42"	5	0-11	4	1-6	6	1-1	5	0-11	6	0-6½	5	0-11
48"	5	0-9½	4	1-0	6	1-0	5	0-9½	6	0-6	5	0-9½
54"	5	0-8½	4	0-10	7	1-1	5	0-8½	7	0-6½	5	0-8½
60"	6	0-10	5	1-1	7	1-0	6	0-10	7	0-6	6	0-10
66"	6	0-8½	5	0-11½	7	0-11	6	0-8½	7	0-5½	6	0-8½
72"	6	0-7½	5	0-10	7	0-10	6	0-7½	7	0-5	6	0-7½

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U-TYPE CONCRETE ENDWALLS ENERGY DISSIPATOR - 30" TO 72" PIPE

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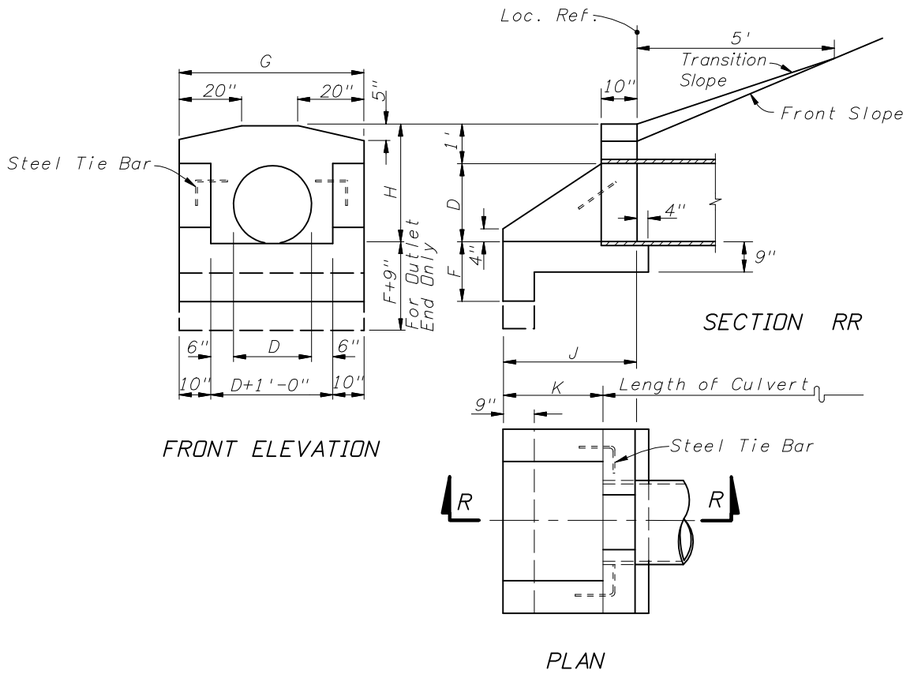
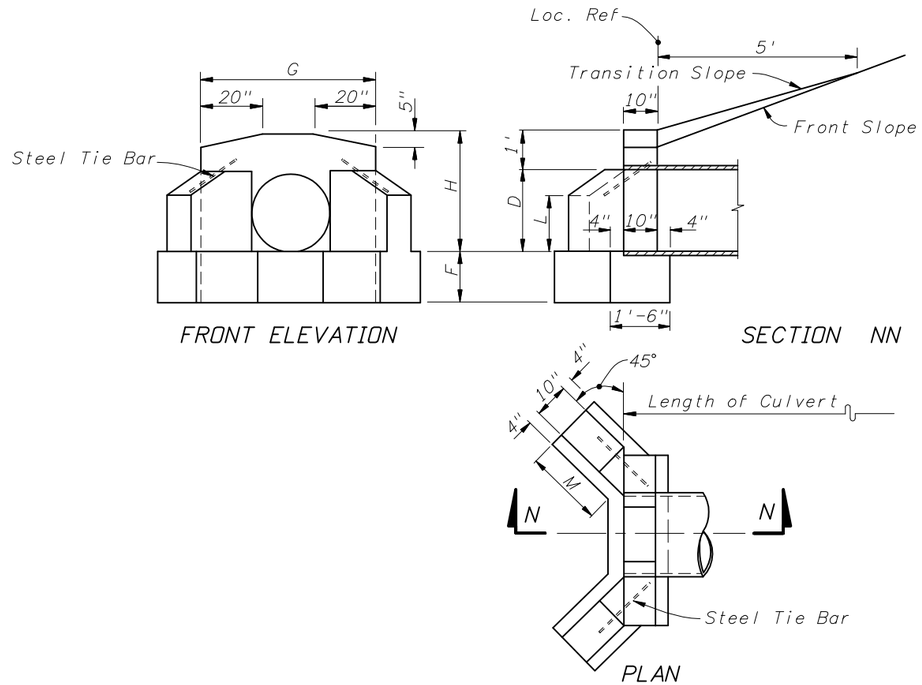


FRONT ELEVATION

SECTION RR

PLAN

CONCRETE ENDWALL WITH U-TYPE WINGS FOR PIPE CULVERTS



FRONT ELEVATION

SECTION NN

PLAN

CONCRETE ENDWALL WITH 45° WINGS FOR PIPE CULVERTS

TABLE OF DIMENSIONS AND ESTIMATED QUANTITIES
PIPE CULVERT ENDWALLS WITH U-TYPE WINGS

DIMENSIONS							QUANTITIES IN ONE ENDWALL						
Opening		Wall			Footing		Total Cu. Yds. Concrete, Class I						Steel Tie Bars
							Conc. Pipe		C.M. Pipe		C.I. Pipe		
D	Area Ft²	G	H	K	F	J	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	
12"	0.8	3'-8"	2'-0"	1'-0"	1'-3"	2'-2"	0.48	0.55	0.49	0.57	0.49	0.57	none
15"	1.2	3'-11"	2'-3"	1'-5"	1'-3"	2'-7"	0.59	0.67	0.62	0.70	0.61	0.70	none
18"	1.8	4'-2"	2'-6"	1'-9"	1'-3"	2'-11"	0.70	0.79	0.74	0.82	0.74	0.82	none
24"	3.1	4'-8"	3'-0"	2'-6"	1'-6"	3'-8"	1.01	1.11	1.06	1.16	1.06	1.16	2-#6 Bars x 2'-0"
30"	4.9	5'-2"	3'-6"	3'-3"	1'-6"	4'-5"	1.33	1.44	1.41	1.51	1.40	1.51	2-#6 Bars x 2'-0"
36"	7.1	5'-8"	4'-0"	4'-0"	1'-9"	5'-2"	1.73	1.85	1.84	1.96	1.82	1.94	2-#6 Bars x 2'-6"
42"	9.6	6'-2"	4'-6"	4'-9"	2'-0"	5'-11"	2.19	2.32	2.32	2.45			2-#6 Bars x 2'-6"
48"	12.6	6'-8"	5'-0"	5'-6"	2'-0"	6'-8"	2.64	2.78	2.81	2.95			2-#6 Bars x 3'-0"

TABLE OF DIMENSIONS AND ESTIMATED QUANTITIES
PIPE CULVERT ENDWALLS WITH 45° WINGS

DIMENSIONS							QUANTITIES IN ONE ENDWALL			
Opening		Wall				Footing	Concrete, Class I			Steel Tie Bars
							Total Cu. Yds.			
D	Area Ft²	H	G	L	M	F	Conc. Pipe	C.M.P	C.I.P.	
15"	1.2	2'-3"	3'-7"	1'-0"	1'-3"	1'-3"	0.56	0.59	0.59	none
18"	1.8	2'-6"	3'-10"	1'-2"	1'-7"	1'-3"	0.74	0.77	0.77	none
24"	3.1	3'-0"	4'-4"	1'-5"	2'-1"	1'-4"	1.01	1.06	1.06	2 -#6 Bars x 2'-0"
30"	4.9	3'-6"	4'-10"	1'-9"	2'-5"	1'-6"	1.32	1.40	1.39	2 -#6 Bars x 2'-0"
36"	7.1	4'-0"	5'-4"	2'-0"	2'-11"	1'-8"	1.72	1.83	1.82	2 -#6 Bars x 2'-6"
42"	9.6	4'-6"	5'-10"	2'-3"	3'-6"	2'-0"	2.34	2.47		2 -#6 Bars x 2'-6"
48"	12.6	5'-0"	6'-4"	2'-6"	4'-0"	2'-0"	2.74	2.90		2 -#6 Bars x 2'-6"

GENERAL NOTES

1. Winged concrete endwalls are intended for use outside the clear zone.
2. Chamfer all exposed edges ¾".
3. Concrete shall be Class I, except ASTM C478 (4000 psi) Concrete may be substituted for precast items manufactured in plants meeting the requirements of Section 449 of the Specifications.
4. Endwall to be paid for under the contract unit price for Class I Concrete.
5. Sodding to be in accordance with Index No. 281, and paid for under the contract unit price for Performance Turf, SY.

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2010 FDOT Design Standards

WINGED CONCRETE ENDWALLS SINGLE ROUND PIPE

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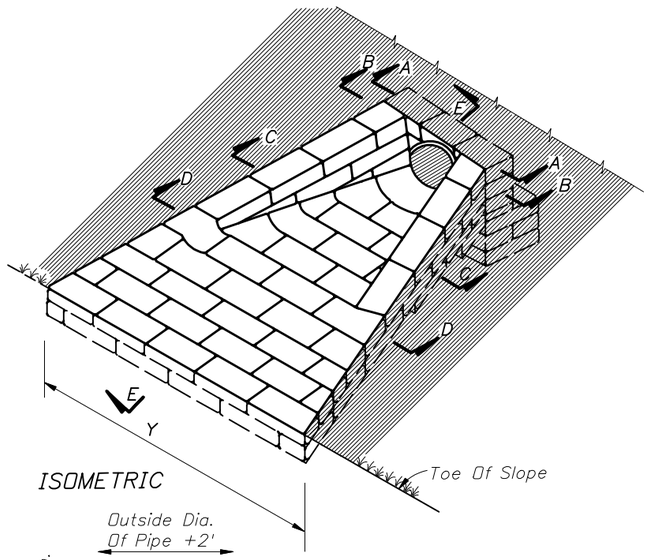

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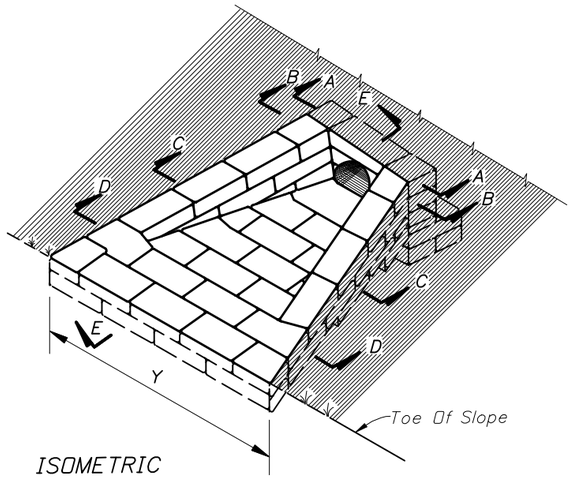
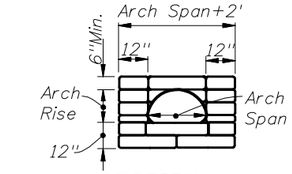


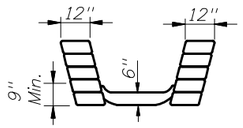
ISOMETRIC

GENERAL NOTES

1. U-Type Sand-Cement Endwalls Are Intended For Use Outside The Clear Zone.



SECTION AA



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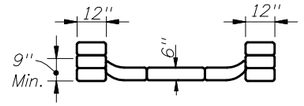

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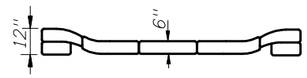
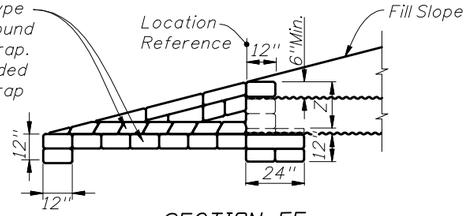


SECTION DD

Place Plastic Filter Fabric Type D-4 (See Index No. 199) Around And Below Sand-Cement Riprap. Cost Of Fabric To Be Included In Cost Of Sand-Cement Riprap

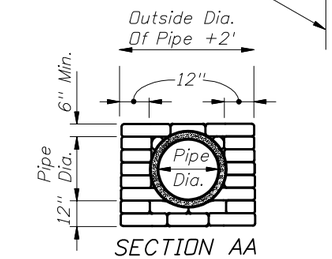


SECTION EE

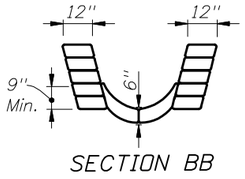
DETAILS FOR SINGLE METAL PIPE ARCH CULVERTS

NOTE: For multiple metalpipe arch culvert spacing between arch centers=X

DIMENSIONS AND QUANTITIES FOR METAL PIPE ARCH CULVERTS															
Span	Rise	Dimensions						Quantity Of Sand-Cement Riprap In Cu. Yds. For One Endwall							
		X	Y				Z	For 1:2 Slopes				For 1:4 Slopes			
			1-Arch	2-Arch	3-Arch	4-Arch		1-Arch	2-Arch	3-Arch	4-Arch	1-Arch	2-Arch	3-Arch	4-Arch
17"	13"	2'-6"	6'-6"	9'-0"	11'-6"	14'-0"	1'-7"	1.0	1.5	2.0	2.5	1.5	2.2	2.9	3.6
21"	15"	2'-10"	7'-6"	10'-4"	13'-2"	16'-0"	1'-9"	1.2	1.8	2.4	3.0	1.9	2.7	3.5	4.3
28"	20"	3'-5"	9'-3"	12'-8"	16'-1"	19'-6"	2'-0"	1.7	2.5	3.3	4.1	2.6	3.7	4.8	5.9
35"	24"	4'-0"	11'-0"	15'-0"	19'-0"	23'-0"	2'-0"	2.2	3.1	4.0	4.9	3.4	4.7	6.0	7.3
42"	29"	4'-9"	12'-9"	17'-6"	22'-3"	27'-0"	2'-0"	2.9	4.1	5.3	6.5	4.5	6.1	7.7	9.3
49"	33"	5'-6"	14'-6"	20'-0"	25'-6"	31'-0"	2'-0"	3.5	4.9	6.3	7.7	5.5	7.4	9.3	11.2
57"	38"	6'-4"	16'-6"	22'-10"	29'-2"	35'-6"	2'-0"	4.4	6.1	7.8	9.5	6.9	9.2	11.5	13.8
64"	43"	7'-1"	18'-3"	25'-4"	32'-5"	39'-6"	2'-0"	5.1	7.0	8.9	10.8	8.1	10.7	13.3	15.9
71"	47"	7'-10"	20'-0"	27'-10"	35'-8"	43'-6"	2'-0"	5.9	8.1	10.3	12.5	9.5	12.4	15.3	18.2



SECTION AA



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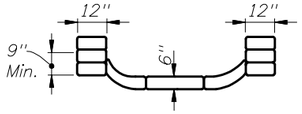

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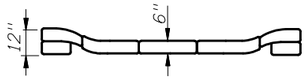
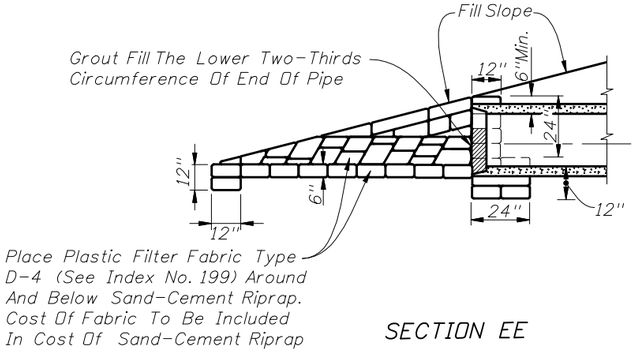


SECTION DD



SECTION EE

DETAIL FOR SINGLE PIPE CULVERT

Note: For multiple pipe culvert spacing between pipe centers=X

DIMENSIONS AND QUANTITIES FOR ROUND PIPE CULVERTS															
Pipe Dia.	Dimensions						Quantity Of Sand-Cement Riprap In Cu. Yds. For One Endwall							
	X	Y					For 1:2 Slopes				For 1:4 Slopes			
		1-Pipe	2-Pipes	3-Pipes	4-Pipes		1-Pipe	2-Pipes	3-Pipes	4-Pipes	1-Pipe	2-Pipes	3-Pipes	4-Pipes
15"	2'-7"	7'-0"	9'-7"	12'-2"	14'-9"		1.2	1.6	2.1	2.6	1.7	2.4	3.0	3.6
18"	2'-10"	8'-0"	10'-10"	13'-8"	16'-6"		1.4	2.0	2.6	3.1	2.1	2.9	3.7	4.4
24"	3'-5"	10'-0'	13'-5"	16'-10"	20'-3"		1.9	2.7	3.5	4.3	2.9	4.0	5.1	6.3
30"	4'-3"	12'-0"	16'-3"	20'-6"	24'-9"		2.5	3.6	4.8	5.9	3.8	5.4	7.0	8.6
36"	5'-1"	14'-0"	19'-1"	24'-2"	29'-3"		3.1	4.6	6.2	7.7	4.8	7.0	9.2	11.4
42"	6'-0"	16'-0"	22'-0"	28'-0"	34'-0"		3.8	5.8	7.7	9.7	6.0	8.8	11.7	14.5
48"	6'-9"	18'-0"	24'-9"	31'-6"	38'-3"		4.5	7.0	9.4	11.8	7.2	10.8	14.3	17.9
54"	7'-8"	20'-0"	27'-8"	35'-4"	43'-0"		5.3	8.3	11.3	14.2	8.5	12.9	17.3	21.7
60"	8'-6"	22'-0"	30'-6"	39'-0"	47'-6"		6.2	9.7	13.3	16.9	10.0	15.3	20.6	25.9

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U-TYPE SAND-CEMENT ENDWALLS

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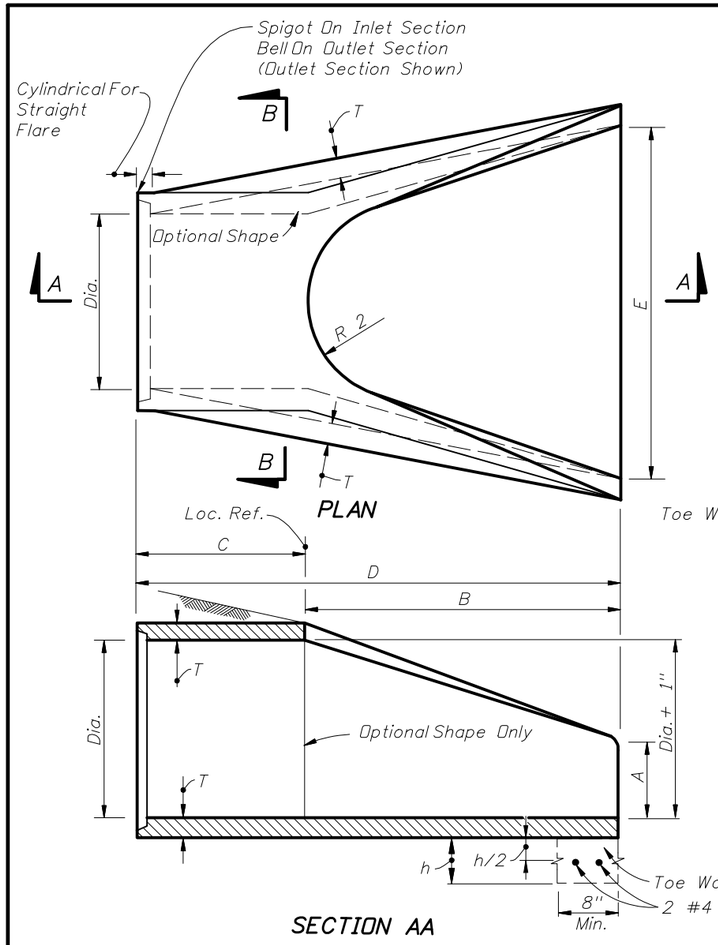
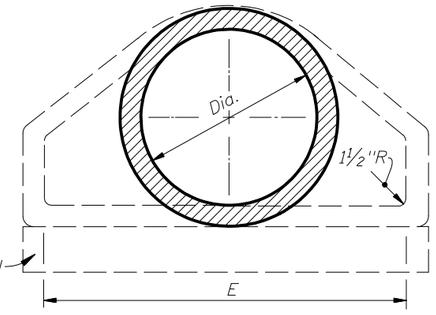
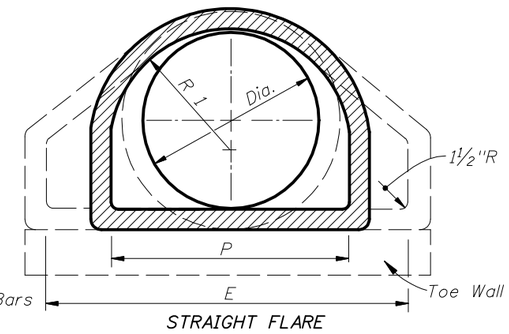
Index No. 268







FLARED END SECTION

DIA.	T	REINF. SQIN/LF	BELL Or Spigot	A	B	C	D	E	P	R 1	R 2	FLAT	WEIGHT (LBS.)	h	TOE WALL CLASS I CONC (Misc.) Cy
12"	2"	0.07	1½"	4"	2'-0"	4'-0⅞"	6'-0⅞"	2'-0"	19¹⁵⁄₁₆"	10⅛"	9"	3½"	530	12"	.06
15"	2¼"	0.07	2"	6"	2'-3"	3'-10"	6'-1"	2'-6"	24⁵⁄₁₆"	12½"	11"	3½"	740	12"	.07
18"	2½"	0.07	2½"	9"	2'-3"	3'-10"	6'-1"	3'-0"	29"	15½"	12"	4"	990	15"	.11
21"	2¾"	0.07	2¼"	9"	2'-11"	3'-2"	6'-1"	3'-6"	31⅝"	16⅛"	13"	4"	1280	15"	.12
24"	3"	0.07	2½"	9½"	3'-7½"	2'-6"	6'-1½"	4'-0"	33³⁄₁₆"	16¹³⁄₁₆"	14"	4½"	1520	18"	.17
27"	3¼"	0.148	2½"	10½"	4'-0"	2'-1½"	6'-1½"	4'-6"	36"	18⁹⁄₁₆"	14½"	4½"	1930	18"	.19
30"	3½"	0.148	3"	1'-0"	4'-6"	1'-7¾"	6'-1¾"	5'-0"	37"	18½"	15"	5"	2190	21"	.24
36"	4"	0.148	3½"	1'-3"	5'-3"	2'-10¾"	8'-1¾"	6'-0"	47¹³⁄₁₆"	24⅝"	20"	5½"	4100	21"	.29
42"	4½"	0.148	3¾"	1'-9"	5'-3"	2'-11"	8'-2"	6'-6"	53⅞"	27½"	22"	5½"	5380	24"	.36
48"	5"	0.148	4¼"	2'-0"	6'-0"	2'-2"	8'-2"	7'-0"	56½"	28½"	22"	5¾"	6550	24"	.39
54"	5½"	0.174	4¾"	2'-3"	5'-5"	2'-11"	8'-4"	7'-6"	65½"	33⅛"	24"	6¼"	8040	24"	.42
60"	6"	0.174	5"	2'-6"	5'-0"	3'-3"	8'-3"	8'-0"	72½"	36¹¹⁄₁₆"	24"	6¾"	8750	24"	.44
66"	6½"	0.174	5½"	2'-0"	6'-6"	1'-9"	8'-3"	8'-6"	72"	36⅛"	24"	7¼"	10630	24"	.47
72"	7"	0.174	6"	2'-0"	6'-6"	1'-9"	8'-3"	9'-0"	77¹³⁄₁₆"	38¹⁵⁄₁₆"	24"	7¾"	12520	24"	.50

GENERAL NOTES

1. Flared end sections shall conform to the requirements of ASTM C76 with the exception that dimensions and reinforcement shall be as prescribed in the table above. Circumferential reinforcement may consist of either one cage or two cages of steel. Compressive strength of concrete shall be 4000 psi. Shop drawings for flared end sections having dimensions other than above must be submitted for approval to the State Drainage Engineer.

2. Connections between the flared end section and the pipe culvert may be any of the following types unless otherwise shown on the plans.

   a. Joints meeting the requirements of Section 449 of the Standard Specifications (O-Ring Gasket). Flared end section joint dimensions and tolerances shall be identical or compatible to those used in the pipe culvert joint. When pipe culvert and flared end section manufacturers are different, the compatibility of joint designs shall be certified to by the manufacturer of the flared end sections.

   b. Joints sealed with preformed plastic gaskets. The gaskets shall meet the requirements of Section 942-2 of the Standard Specifications and the minimum sizes for gaskets shall be as that specified for equivalent sizes of elliptical pipe.

   c. Reinforced concrete jackets, as detailed on this drawing. Cost of the reinforced concrete jacket to be included in the contract unit price for the flared end section. When non-coated corrugated metal pipe is called for in the plans, the pipe shall be bituminous coated in the jacketed area as specified on Index No. 280. Bituminous coating to be included in the contract unit price for the pipe culvert. Concrete jacket shall be as specified on Index No. 280. Cost of concrete and reinforcement shall be included in the contract unit price for the pipe culvert.

3. Toe walls shall be constructed when shown on the plans or at locations designated by the Engineer. Toe walls are to be cast-in-place with Class I Concrete and paid for under the contract unit price for Flared End Section (Concrete), EA. Reinforcing steel shall also be included in the cost of the Flared End Section (Concrete), EA.

4. On skewed pipe culverts the flared end sections shall be placed in line with the pipe culvert. Side slopes shall be warped as required to fit the flared end sections.

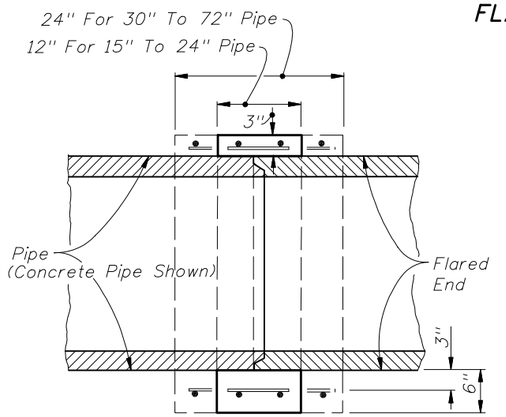
5. Flared End Section to be paid for under the contract unit price for Flared End Section (Concrete), EA. Sodding shall be in accordance with Index No. 281, and paid for under the contract unit price for Performance Turf, SY.

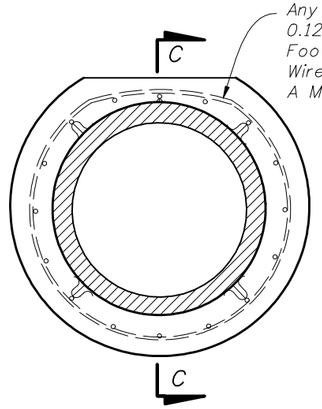
DESIGN NOTES

1. Flared end sections are intended for use outside the clear zone on median drain and cross drain installation, except that flared end sections for pipe sizes 12" and 15" are permitted within the clear zone. When the slope intersection permits, 12" and 15" flared end sections may be located with the culvert opening as close as 8' beyond the outside edge of the shoulder. Flared end sections are not intended for side drain installations.

2. Reinforced concrete jackets shall be used at all locations where high velocities and/or highly erosive soils may cause disjointing. These locations are to be shown on the plans.

3. Toe walls shall be used whenever the anticipated velocity of discharge and soil type are such that erosive action would occur. Toe walls are not required where ditch pavement is provided, except when disjointing would occur if the ditch pavement should fail.





REINFORCED CONCRETE JACKET DETAIL

2010 FDOT Design Standards

FLARED END SECTION

Last Revision 07/01/09 | Sheet No. 1 of 1 | Index No. 270

DIMENSIONS AND QUANTITIES

	D	X	A	B	C	E	F	G	H ■	M Single Pipe	M Double Pipe	M Triple Pipe	M Quad. Pipe	N	5½" CONCRETE SLAB (CY) ◪ Single Pipe	5½" CONCRETE SLAB (CY) ◪ Double Pipe	5½" CONCRETE SLAB (CY) ◪ Triple Pipe	5½" CONCRETE SLAB (CY) ◪ Quad. Pipe	SODDING (SQ. YDS.) Single Pipe	SODDING (SQ. YDS.) Double Pipe	SODDING (SQ. YDS.) Triple Pipe	SODDING (SQ. YDS.) Quad. Pipe
1:2 Slope	15"	2'-7"	1.92'	2.18'	4.10'	2.06'	5'	1.22'	2.9'	4.63'	7.21'	9.79'	12.37'	1.19'	0.38	0.58	0.77	0.96	21	24	27	30
	18"	2'-10"	1.97'	2.74'	4.71'	2.56'	6'	1.41'	3.4'	4.92'	7.75'	10.58'	13.42'	1.21'	0.44	0.65	0.87	1.09	22	25	28	31
	24"	3'-5"	2.06'	3.85'	5.91'	3.56'	7'	1.73'	3.4'	5.50'	8.92'	12.33'	15.75'	1.25'	0.54	0.83	1.12	1.42	24	28	32	35
	30"	4'-3"	2.15'	4.95'	7.10'	4.56'	8'	2.00'	3.4'	6.08'	10.33'	14.58'	18.83'	1.29'	0.66	1.09	1.50	1.91	26	31	35	40
	36"	5'-1"	2.25'	6.08'	8.33'	5.56'	9'	2.24'	3.4'	6.67'	11.75'	16.83'	21.92'	1.33'	0.81	1.38	1.95	2.51	28	34	39	45
	42"	6'-0"	2.34'	7.21'	9.55'	6.56'	10'	2.45'	3.4'	7.25'	13.25'	19.25'	25.25'	1.38'	0.97	1.70	2.45	3.19	30	37	43	50
	48"	6'-9"	2.43'	8.33'	10.76'	7.56'	11'	2.65'	3.4'	7.83'	14.58'	21.33'	28.08'	1.42'	1.13	2.04	2.93	3.84	32	39	47	54
	54"	7'-8"	2.52'	9.44'	11.96'	8.56'	12'	2.83'	3.4'	8.42'	16.08'	23.75'	31.42'	1.46'	1.31	2.44	3.58	4.72	34	42	51	59
	60"	8'-6"	2.62'	10.56'	13.18'	9.56'	14'	3.00'	4.4'	9.00'	17.50'	26.00'	34.50'	1.50'	1.51	2.89	4.28	5.68	36	45	55	64
	66"	9'-2"	2.71'	11.68'	14.39'	10.56'	15'	3.18'	4.4'	9.58'	18.75'	27.92'	37.08'	1.54'	1.68	3.25	4.84	6.43	38	48	58	68
	72"	10'-0"	2.80'	12.80'	15.60'	11.56'	16'	3.30'	4.4'	10.16'	20.16'	30.16'	40.16'	1.58'	1.89	3.74	5.59	7.45	40	51	62	73
1:4 Slope	15"	2'-7"	2.27'	4.09'	6.36'	4.03'	8'	1.22'	4.0'	4.63'	7.21'	9.79'	12.37'	1.19'	0.57	0.87	1.15	1.44	23	26	29	32
	18"	2'-10"	2.36'	5.12'	7.48'	5.03'	9'	1.41'	4.0'	4.92'	7.75'	10.58'	13.42'	1.21'	0.66	0.99	1.31	1.65	25	28	31	35
	24"	3'-5"	2.53'	7.18' △	9.71'	7.03' △	11'	1.73'	4.0'	5.50'	8.92'	12.33'	15.75'	1.25'	0.85	1.30	1.75	2.20	28	32	36	40
	30"	4'-3"	2.70'	9.25'	11.95'	9.03'	13'	2.00'	4.0'	6.08'	10.33'	14.58'	18.83'	1.29'	1.10	1.74	2.39	3.05	31	36	41	46
	36"	5'-1"	2.87'	11.31' ◇	14.18'	11.03' ◇	15'	2.24'	4.0'	6.67'	11.75'	16.83'	21.92'	1.33'	1.32	2.21	3.08	3.96	34	40	46	52
	42"	6'-0"	3.05'	13.37'	16.42'	13.03'	17'	2.45'	4.0'	7.25'	13.25'	19.25'	25.25'	1.38'	1.58	2.76	3.91	5.09	38	44	51	58
	48"	6'-9"	3.22'	15.43'	18.65'	15.03'	19'	2.65'	4.0'	7.83'	14.58'	21.33'	28.08'	1.42'	1.85	3.30	4.73	6.17	41	48	56	63
	54"	7'-8"	3.39'	17.49'	20.88'	17.03'	21'	2.83'	4.0'	8.42'	16.08'	23.75'	31.42'	1.46'	2.14	3.95	5.77	7.58	44	52	61	69
	60"	8'-6"	3.56'	19.55'	23.11'	19.03'	23'	3.00'	4.0'	9.00'	17.50'	26.00'	34.50'	1.50'	2.45	4.66	6.87	9.07	47	56	66	75
	66"	9'-2"	3.73'	21.62'	25.35'	21.03'	25'	3.18'	4.0'	9.58'	18.75'	27.92'	37.08'	1.54'	2.88	5.54	8.18	10.84	49	59	69	80
	72"	10'-0"	3.91'	23.68'	27.59'	23.03'	27'	3.30'	4.0'	10.16'	20.16'	30.16'	40.16'	1.58'	3.54	6.61	9.87	13.13	52	63	74	85

◪ See General Note No. 3.
See Sheet 5 Of 6 For 3" Slab Quantities

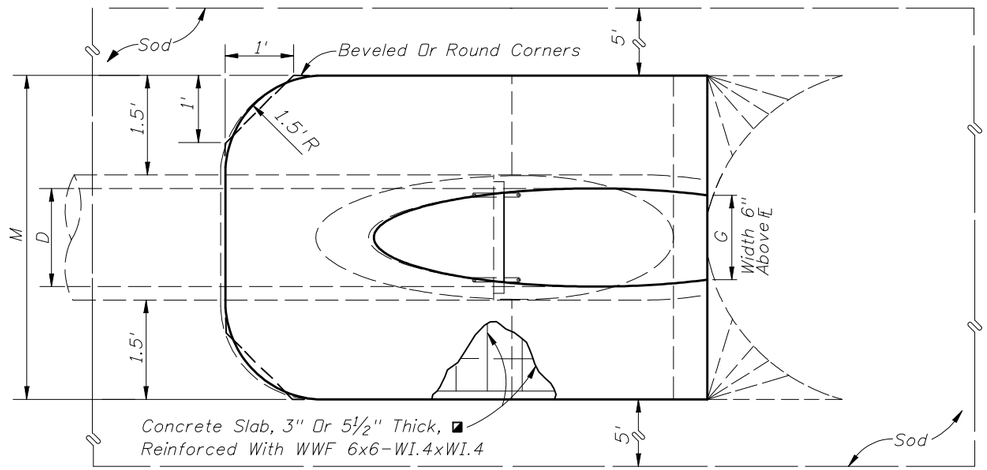
■ Values shown for estimating pipe quantities and are for information only.

	B	E
△	6.42'	6.25'
◇	10.40'	10.10'

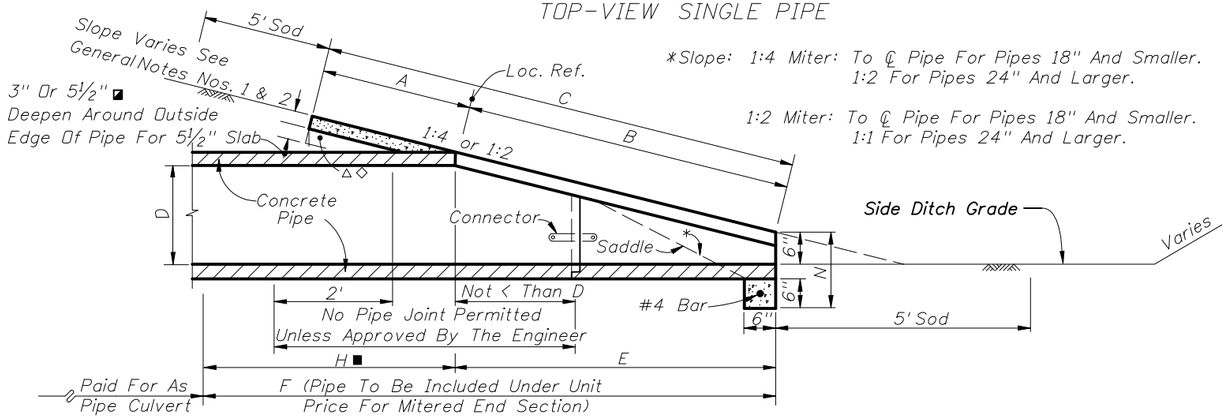
△ Dimensions permitted to allow use of 8' standard pipe lengths.

◇ Dimensions permitted to allow use of 12' standard pipe lengths.

△◇ Concrete slab shall be deepened to form bridge across crown of pipe. See section below.



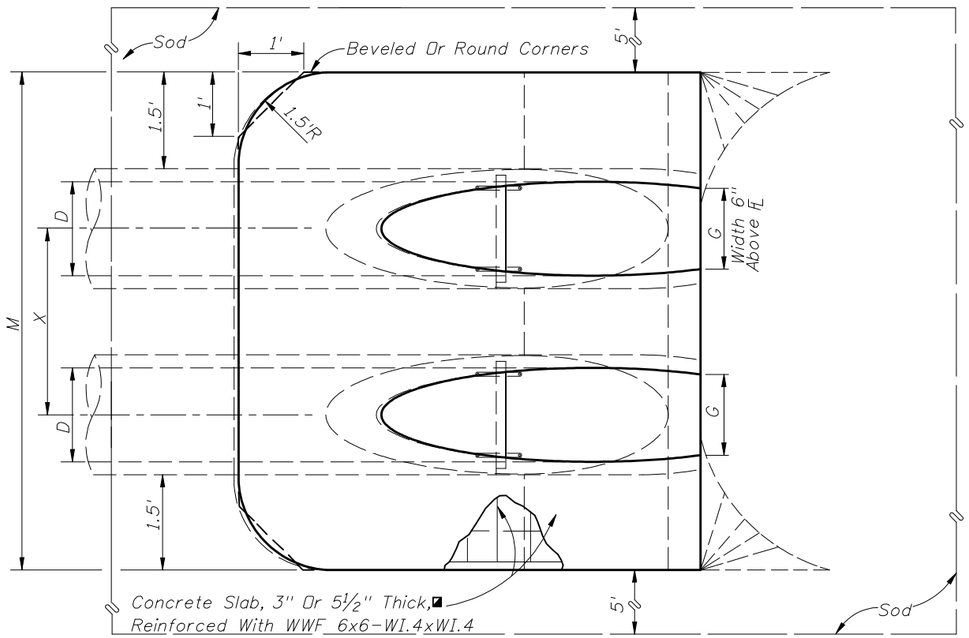
TOP-VIEW SINGLE PIPE



SECTION

*Slope: 1:4 Miter: To ℄ Pipe For Pipes 18" And Smaller.
1:2 For Pipes 24" And Larger.

1:2 Miter: To ℄ Pipe For Pipes 18" And Smaller.
1:1 For Pipes 24" And Larger.



TOP-VIEW MULTIPLE PIPE

NOTE: See sheet 6 for details and notes.

SINGLE AND MULTIPLE ROUND CONCRETE PIPE

2010 FDOT Design Standards

CROSS DRAIN MITERED END SECITON

Last Revision	Sheet No.
02	1 of 6

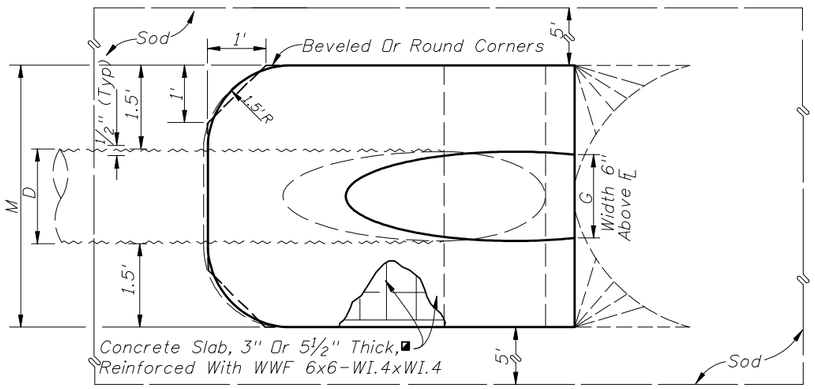
Index No. 272

DIMENSIONS AND QUANTITIES

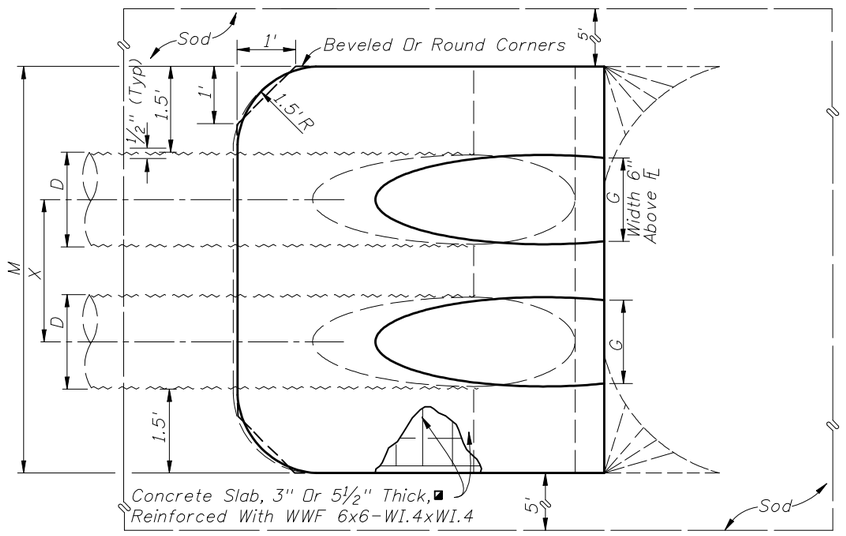
	D	X	A	B	C	E	F	G	H ■	M				N	5½" CONCRETE SLAB (CY) ◪				SODDING (SQ. YDS.)			
										Single Pipe	Double Pipe	Triple Pipe	Quad. Pipe		Single Pipe	Double Pipe	Triple Pipe	Quad. Pipe	Single Pipe	Double Pipe	Triple Pipe	Quad. Pipe
1:2 Slope	15"	2'-7"	2.5'	1.68'	4.18'	1.5'	5.0'	1.23'	3.5'	4.33'	6.92'	9.50'	12.08'	1.04'	0.35	0.54	0.74	0.94	21	24	27	29
	18"	2'-10"	2.5'	2.24'	4.74'	2.0'	6.0'	1.41'	4'	4.58'	7.42'	10.25'	13.08'	1.04'	0.38	0.62	0.87	1.12	22	25	28	31
	24"	3'-5"	2.5'	3.35'	5.85'	3.0'	7.0'	1.73'	4'	5.08'	8.50'	11.92'	15.33'	1.04'	0.47	0.76	1.05	1.34	23	27	31	35
	30"	4'-3"	2.5'	4.47'	6.97'	4.0'	8.0'	2.00'	4'	5.58'	9.83'	14.08'	18.33'	1.04'	0.57	0.96	1.37	1.77	25	30	35	39
	36"	5'-1"	2.5'	5.59'	8.09'	5.0'	9.0'	2.24'	4'	6.08'	11.17'	16.25'	21.33'	1.04'	0.67	1.19	1.72	2.26	27	33	38	44
	42"	6'-0"	2.5'	6.71'	9.21'	6.0'	10.0'	2.45'	4'	6.58'	12.58'	18.58'	24.58'	1.04'	0.78	1.48	2.17	2.87	29	36	42	49
	48"	6'-9"	2.5'	7.83'	10.33'	7.0'	11.0'	2.65'	4'	7.08'	13.83'	20.58'	27.33'	1.04'	0.89	1.71	2.54	3.36	31	38	46	53
	54"	7'-8"	2.5'	8.94'	11.44'	8.0'	12.0'	2.83'	4'	7.58'	15.25'	22.92'	30.58'	1.04'	1.02	2.06	3.10	4.14	33	41	50	58
	60"	8'-6"	2.5'	10.06'	12.56'	9.0'	13.0'	3.00'	4'	8.08'	16.58'	25.08'	33.58'	1.04'	1.14	2.38	3.63	4.89	34	44	53	63
1:4 Slope	15"	2'-7"	2.5'	3.09'	5.59'	3.0'	7.0'	1.23'	4'	4.33'	6.92'	9.50'	12.08'	1.04'	0.44	0.68	0.91	1.15	22	25	28	31
	18"	2'-10"	2.5'	4.12'	6.62'	4.0'	8.0'	1.41'	4'	4.58'	7.42'	10.25'	13.08'	1.04'	0.49	0.77	1.03	1.31	24	27	30	33
	24"	3'-5"	2.5'	6.18'	8.68'	6.0'	10.0'	1.73'	4'	5.08'	8.50'	11.92'	15.33'	1.04'	0.65	1.09	1.38	1.77	27	30	34	38
	30"	4'-3"	2.5'	8.25'	10.75'	8.0'	12.0'	2.00'	4'	5.58'	9.83'	14.08'	18.33'	1.04'	0.81	1.34	1.90	2.44	29	34	39	44
	36"	5'-1"	2.5'	10.31'	12.81'	10.0'	14.0'	2.24'	4'	6.08'	11.17'	16.25'	21.33'	1.04'	0.97	1.68	2.41	3.14	32	38	44	49
	42"	6'-0"	2.5'	12.37'	14.87'	12.0'	16.0'	2.45'	4'	6.58'	12.58'	18.58'	24.58'	1.04'	1.13	2.08	3.06	4.02	35	42	48	55
	48"	6'-9"	2.5'	14.43'	16.93'	14.0'	18.0'	2.65'	4'	7.08'	13.83'	20.58'	27.33'	1.04'	1.29	2.49	3.69	4.88	38	46	53	60
	54"	7'-8"	2.5'	16.49'	18.99'	16.0'	20.0'	2.83'	4'	7.58'	15.25'	22.92'	30.58'	1.04'	1.48	2.98	4.47	5.98	41	49	58	66
	60"	8'-6"	2.5'	18.55'	21.05'	18.0'	22.0'	3.00'	4'	8.08'	16.58'	25.08'	33.58'	1.04'	1.66	3.49	5.31	7.13	44	53	63	72

◪ See General Note No. 3. See Sheet 5 Of 6 For 3" Slab Quantities

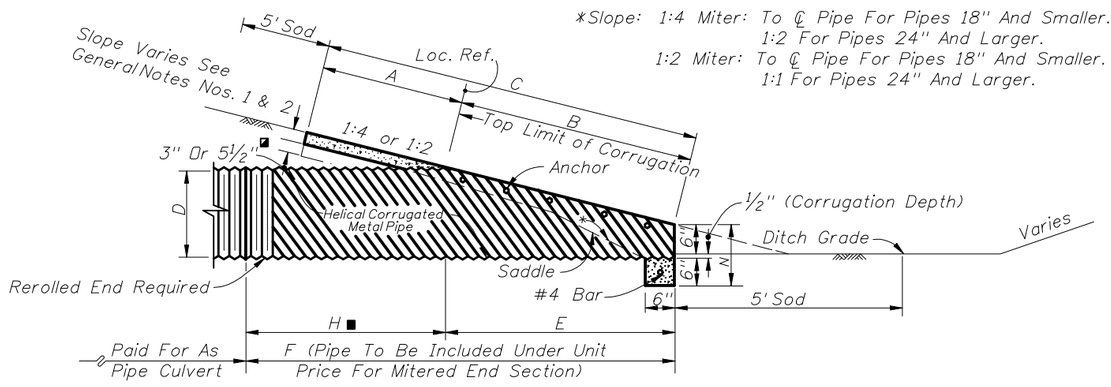
■ Values shown for estimating pipe quantities and are for information only



TOP VIEW-SINGLE PIPE



TOP VIEW-MULTIPLE PIPE



SECTION

*Slope: 1:4 Miter: To ℄ Pipe For Pipes 18" And Smaller.
1:2 For Pipes 24" And Larger.
1:2 Miter: To ℄ Pipe For Pipes 18" And Smaller.
1:1 For Pipes 24" And Larger.

NOTE: See Sheet 6 For Details And Notes.

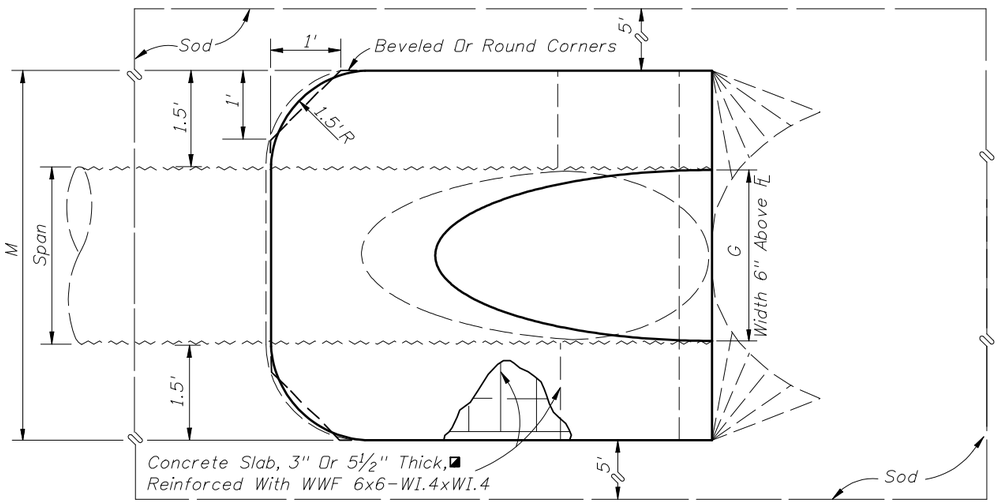
SINGLE AND MULTIPLE ROUND CORRUGATED METAL PIPE

	2010 FDOT Design Standards	Last Revision 02	Sheet No. 2 of 6
STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION	CROSS DRAIN MITERED END SECTION		Index No. 272

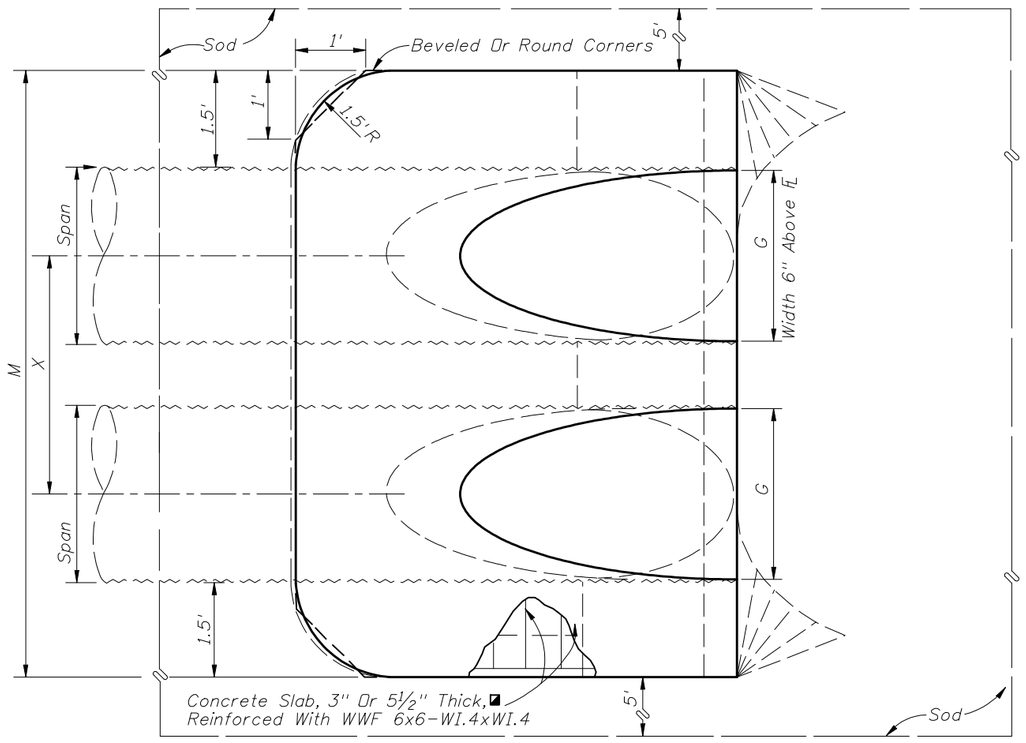
1974 AASHTO		DIMENSIONS AND QUANTITIES													5½" CONCRETE SLAB (CY) ◪				SODDING (SQ. YDS.)			
	SPAN	RISE	X	A	B	C	E	F	G	H ■	M Single Pipe	M Double Pipe	M Triple Pipe	M Quad. Pipe	N	Single Pipe	Double Pipe	Triple Pipe	Quad. Pipe	Single Pipe	Double Pipe	Triple Pipe	Quad. Pipe
1:2 Slope	17"	13"	2'-6"	2.5'	1.30'	3.80'	1.17'	4'	1.39'	2.8'	4.50'	7.00'	9.50'	12.00'	1.04'	0.41	0.61	0.81	1.02	21	23	26	29
	21"	15"	2'-10"	2.5'	1.68'	4.17'	1.50'	5'	1.76'	3.5'	4.83'	7.67'	10.50'	13.33'	1.04'	0.43	0.66	0.88	1.10	22	25	28	31
	28"	20"	3'-5"	2.5'	2.61'	5.11'	2.33'	6'	2.22'	3.7'	5.42'	8.83'	12.25'	15.67'	1.04'	0.51	0.78	1.06	1.33	23	27	30	34
	35"	24"	4'-0"	2.5'	3.35'	5.85'	3.00'	7'	2.55'	4.0'	6.00'	10.00'	14.00'	18.00'	1.04'	0.57	0.90	1.22	1.55	24	29	33	38
	42"	29"	4'-9"	2.5'	4.29'	6.79'	3.83'	8'	2.97'	4.2'	6.58'	11.33'	16.08'	20.83'	1.04'	0.64	1.04	1.46	1.87	26	31	37	42
	49"	33"	5'-6"	2.5'	5.03'	7.53'	4.50'	9'	3.34'	4.5'	7.17'	12.67'	18.17'	23.67'	1.04'	0.73	1.23	1.72	2.22	28	34	40	46
	57"	38"	6'-4"	2.5'	5.96'	8.46'	5.33'	10'	3.65'	4.7'	7.83'	14.17'	20.50'	26.83'	1.04'	0.83	1.44	2.04	2.64	29	36	44	51
	64"	43"	7'-1"	2.5'	6.89'	9.39'	6.17'	11'	3.89'	4.8'	8.42'	15.50'	22.58'	29.67'	1.04'	0.95	1.67	2.39	3.11	31	39	47	55
	71"	47"	7'-10"	2.5'	7.64'	10.14'	6.83'	12'	4.14'	5.2'	9.00'	16.83'	24.67'	32.50'	1.04'	1.05	1.89	2.74	3.57	33	41	50	59
1:4 Slope	17"	13"	2'-6"	2.5'	2.41'	4.91'	2.33'	7'	1.39'	4.7'	4.50'	7.00'	9.50'	12.00'	1.04'	0.48	0.71	0.95	1.18	22	25	27	30
	21"	15"	2'-10"	2.5'	3.09'	5.59'	3.00'	8'	1.76	5.0'	4.83'	7.67'	10.50'	13.33'	1.04'	0.52	0.80	1.09	1.31	23	26	29	32
	28"	20"	3'-5"	2.5'	4.81'	7.31'	4.67'	9'	2.22'	4.3'	5.42'	8.83'	12.25'	15.67'	1.04'	0.61	0.92	1.27	1.59	25	29	33	37
	35"	24"	4'-0"	2.5'	6.18'	8.68'	6.00'	11'	2.55'	5.0'	6.00'	10.00'	14.00'	18.00'	1.04'	0.73	1.14	1.55	1.97	28	32	37	41
	42"	29"	4'-9"	2.5'	7.90'	10.40'	7.67'	12'	2.97'	4.3'	6.58'	11.33'	16.08'	20.83'	1.04'	0.87	1.39	1.92	2.45	30	35	41	46
	49"	33"	5'-6"	2.5'	9.28'	11.78'	9.00'	14'	3.34'	5.0'	7.17'	12.67'	18.17'	23.67'	1.04'	1.00	1.66	2.30	2.96	32	38	45	51
	57"	38"	6'-4"	2.5'	11.00'	13.50'	10.67'	16'	3.65'	5.3'	7.83'	14.17'	20.50'	26.83'	1.04'	1.18	2.00	2.82	3.64	35	42	49	56
	64"	43"	7'-1"	2.5'	12.71'	15.21'	12.33'	17'	3.89'	4.7'	8.42'	15.50'	22.58'	29.67'	1.04'	1.36	2.39	3.38	4.38	38	45	53	61
	71"	47"	7'-10"	2.5'	14.09'	16.59'	13.67'	19'	4.14'	5.3'	9.00'	16.83'	24.67'	32.50'	1.04'	1.50	2.65	3.81	4.97	40	48	57	66

◪ See General Note No. 3.
See Sheet 5 Of 6 For 3" Slab Quantities

■ Values shown for estimating pipe quanties and are for information.

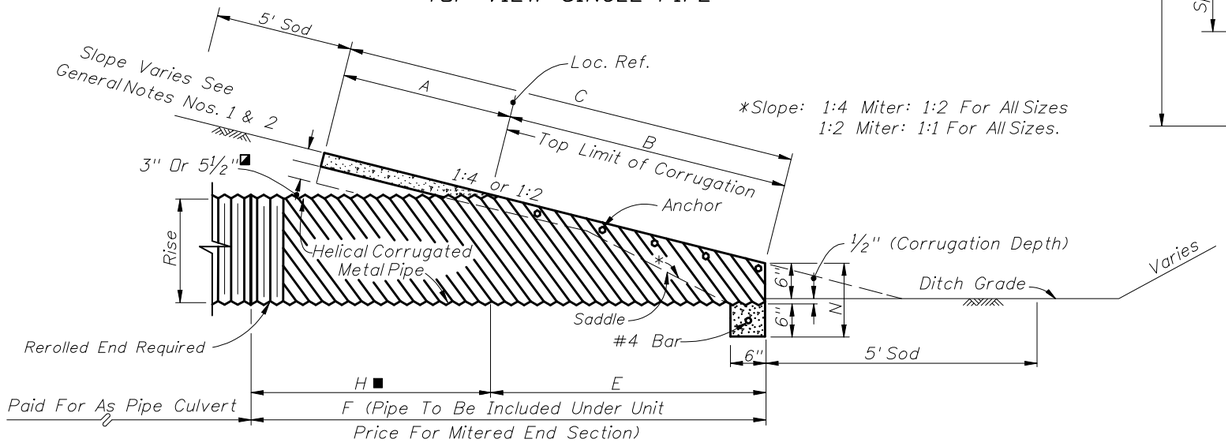


TOP VIEW-SINGLE PIPE



TOP VIEW-MULTIPLE PIPE

NOTE: See Sheet 6 For Details And Notes.



SECTION

SINGLE AND MULTIPLE CORRUGATED METAL PIPE-ARCH

2010 FDOT Design Standards	Last Revision 02	Sheet No. 3 of 6
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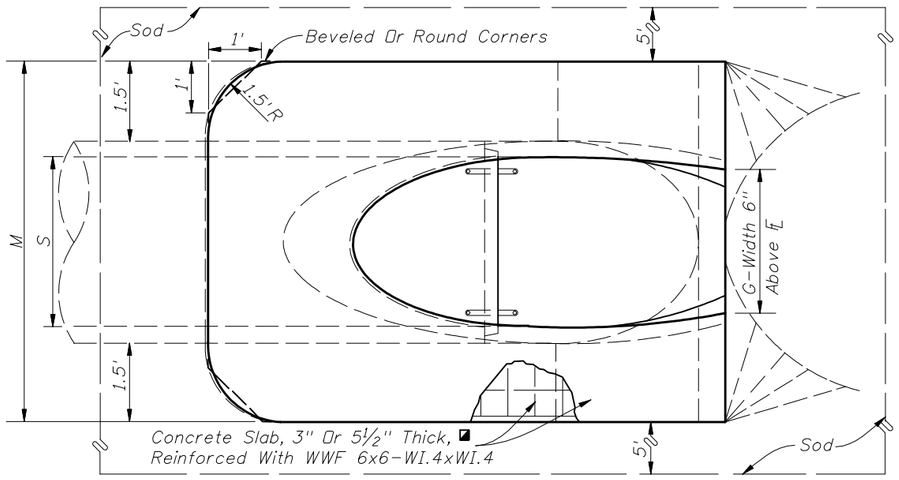
DIMENSIONS & QUANTITIES

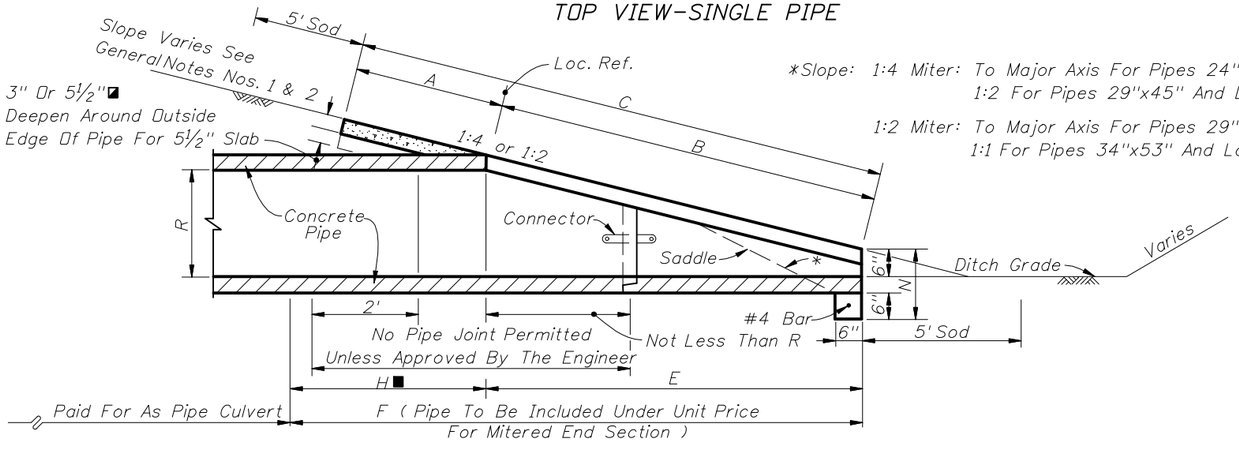
	Rise R	Span S	X	A	B	C	E	F	G	H ■	M				N	5½" CONC. SLAB (CY)◪				SODDING (SQ. YDS.)			
											Single Pipe	Double Pipe	Triple Pipe	Quad. Pipe		Single Pipe	Double Pipe	Triple Pipe	Quad. Pipe	Single Pipe	Double Pipe	Triple Pipe	Quad. Pipe
1:2 Slope	12"	18"	2'-10"	1.97'	1.62'	3.59'	1.56'	4'	1.50'	2.4'	4.92'	7.75'	10.58'	13.42'	1.21'	0.30	0.49	0.67	0.85	21	24	27	30
	14"	23"	3'-4"	2.01'	1.99'	4.00'	1.89'	5'	1.90'	3.1'	5.38'	8.71'	12.04'	15.38'	1.23'	0.37	0.59	0.81	1.02	22	26	29	33
	19"	30"	4'-0"	2.11'	2.92'	5.03'	2.73'	6'	2.37'	3.3'	6.04'	10.04'	14.04'	18.04'	1.27'	0.50	0.80	1.09	1.39	24	28	33	37
	24"	38"	5'-0"	2.20'	3.85'	6.05'	3.56'	7'	2.85'	3.4'	6.79'	11.79'	16.79'	21.79'	1.31'	0.62	1.03	1.45	1.86	26	31	37	42
	29"	45"	5'-11"	2.34'	4.79'	7.13'	4.39'	8'	3.19'	3.6'	7.50'	13.42'	19.33'	25.25'	1.38'	0.75	1.30	1.84	2.39	28	34	41	47
	34"	53"	7'-0"	2.43'	5.72'	8.15'	5.23'	9'	3.57'	3.8'	8.25'	15.25'	22.25'	29.25'	1.42'	0.90	1.61	2.32	3.03	30	37	45	53
	38"	60"	7'-10"	2.52'	6.46'	8.98'	5.89'	9'	3.95'	3.1'	8.92'	16.75'	24.58'	32.42'	1.46'	1.03	1.89	2.74	3.60	31	40	49	57
	43"	68"	8'-11"	2.62'	7.39'	10.01'	6.73'	10'	4.28'	3.3'	9.67'	18.58'	27.50'	36.42'	1.50'	1.19	2.26	3.33	4.40	33	43	53	63
	48"	76"	9'-11"	2.71'	8.33'	11.04'	7.56'	11'	4.59'	3.4'	10.42'	20.33'	30.25'	40.17'	1.54'	1.38	2.65	3.93	5.21	35	46	57	68
	53"	83"	10'-8"	2.80'	9.26'	12.06'	8.39'	12'	4.77'	3.6'	11.08'	21.75'	32.42'	43.08'	1.58'	1.55	3.03	4.50	5.96	37	49	61	73
	58"	91"	11'-8"	2.90'	10.19'	13.09'	9.23'	13'	5.01'	3.8'	11.83'	23.50'	35.17'	46.83'	1.63'	1.75	3.47	5.20	6.93	39	52	65	78
1:4 Slope	12"	18"	2'-10"	2.36'	3.06'	5.42'	3.03'	5'	1.50'	2.0'	4.92'	7.75'	10.58'	13.42'	1.21'	0.45	0.68	0.92	1.14	23	26	29	32
	14"	23"	3'-4"	2.44'	3.75'	6.19'	3.70'	6'	1.90'	2.3'	5.38'	8.71'	12.04'	15.38'	1.23'	0.53	0.83	1.13	1.42	24	28	32	35
	19"	30"	4'-0"	2.62'	5.47'	8.09'	5.36'	8'	2.37'	2.6'	6.04'	10.04'	14.04'	18.04'	1.27'	0.74	1.15	1.57	1.98	27	32	36	40
	24"	38"	5'-0"	2.79'	7.18'	9.97'	7.03'	10'	2.85'	3.0'	6.79'	11.79'	16.79'	21.79'	1.31'	0.97	1.57	2.19	2.81	30	36	41	47
	29"	45"	5'-11"	3.05'	8.90'	11.95'	8.70'	12'	3.19'	3.3'	7.50'	13.42'	19.33'	25.25'	1.38'	1.22	2.07	2.92	3.77	33	40	46	53
	34"	53"	7'-0"	3.22'	10.62'	13.84'	10.36'	13'	3.57'	2.6'	8.25'	15.25'	22.25'	29.25'	1.42'	1.48	2.62	3.77	4.92	36	44	52	59
	38"	60"	7'-10"	3.39'	11.99'	15.38'	11.70'	15'	3.95'	3.3'	8.92'	16.75'	24.58'	32.42'	1.46'	1.72	3.12	4.53	5.92	38	47	56	65
	43"	68"	8'-11"	3.56'	13.71'	17.27'	13.36'	17'	4.28'	3.6'	9.67'	18.58'	27.50'	36.42'	1.50'	2.02	3.78	5.56	7.32	41	51	61	71
	48"	76"	9'-11"	3.73'	15.43'	19.16'	15.03'	19'	4.59'	4.0'	10.42'	20.33'	30.25'	40.17'	1.54'	2.34	4.49	6.64	8.79	44	55	66	77
	53"	83"	10'-8"	3.91'	17.15'	21.06'	16.70'	20'	4.77'	3.3'	11.08'	21.75'	32.42'	43.08'	1.58'	2.66	5.17	7.66	10.16	47	59	71	83
	58"	91"	11'-8"	4.08'	18.87'	22.95'	18.36'	22'	5.01'	3.6'	11.83'	23.50'	35.17'	46.83'	1.63'	3.02	5.98	8.95	11.90	50	63	76	89

◪ See General Note No. 3.
See Sheet 5 Of 6 For 3" Slab Quantities

■ Values shown for estimating pipe quantities and are for information only.



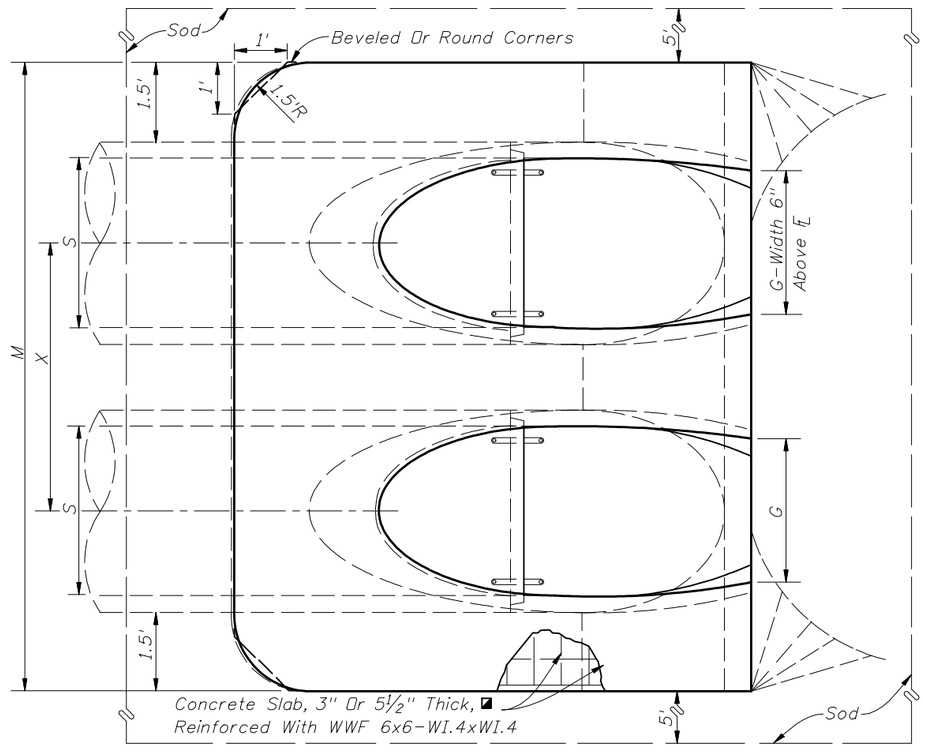
TOP VIEW-SINGLE PIPE



SECTION

*Slope: 1:4 Miter: To Major Axis For Pipes 24"x38" And Smaller.
1:2 For Pipes 29"x45" And Larger.

1:2 Miter: To Major Axis For Pipes 29"x45" And Smaller.
1:1 For Pipes 34"x53" And Larger.



NOTE: See Sheet 6 For Details And Notes.

TOP VIEW - MULTIPLE PIPE

SINGLE AND MULTIPLE ELLIPTICAL CONCRETE PIPE

2010 FDOT Design Standards

CROSS DRAIN MITERED END SECTION

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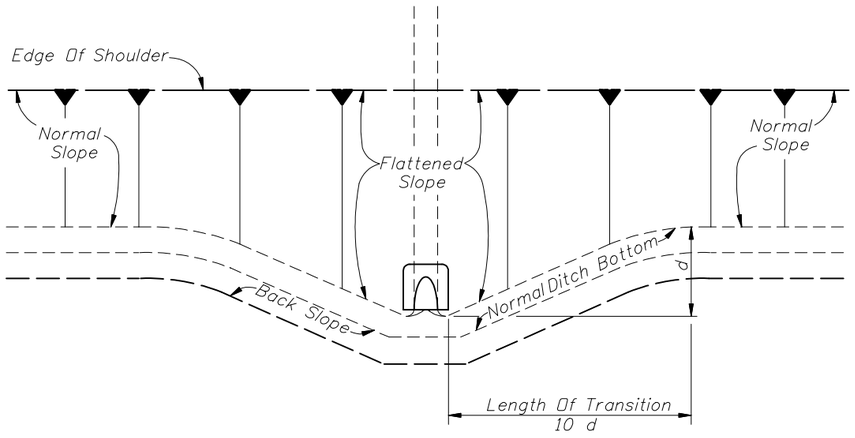
QUANTITIES FOR 3" THICK CONCRETE SLABS (CY)

	D	ROUND-CONCRETE			
		Single Pipe	Double Pipe	Triple Pipe	Quad. Pipe
1:2 Slope	15"	0.27	0.41	0.54	0.67
	18"	0.31	0.45	0.60	0.75
	24"	0.39	0.59	0.79	1.00
	30"	0.46	0.76	1.04	1.32
	36"	0.55	0.94	1.33	1.71
	42"	0.66	1.15	1.66	2.15
	48"	0.76	1.37	1.96	2.57
	54"	0.87	1.62	2.38	3.14
	60"	0.99	1.90	2.81	3.73
	66"	1.11	2.15	3.21	4.27
	72"	1.24	2.46	3.68	4.90
1:4 Slope	15"	0.40	0.61	0.80	1.00
	18"	0.47	0.69	0.91	1.14
	24"	0.60	0.90	1.21	1.52
	30"	0.76	1.19	1.63	2.07
	36"	0.89	1.48	2.05	2.63
	42"	1.05	1.82	2.57	3.34
	48"	1.21	2.15	3.07	4.00
	54"	1.39	2.55	3.72	4.88
	60"	1.59	3.02	4.44	5.86
	66"	1.91	3.66	5.40	7.15
	72"	2.12	4.18	6.24	8.30

	D	ROUND-CMP			
		Single Pipe	Double Pipe	Triple Pipe	Quad. Pipe
1:2 Slope	15"	0.24	0.37	0.51	0.64
	18"	0.26	0.43	0.61	0.78
	24"	0.32	0.52	0.72	0.91
	30"	0.38	0.64	0.91	1.18
	36"	0.44	0.78	1.13	1.48
	42"	0.51	0.96	1.41	1.87
	48"	0.57	1.09	1.63	2.15
	54"	0.65	1.32	1.99	2.66
	60"	0.71	1.49	2.28	3.07
1:4 Slope	15"	0.31	0.47	0.63	0.79
	18"	0.34	0.53	0.71	0.90
	24"	0.44	0.69	0.92	1.18
	30"	0.53	0.88	1.25	1.60
	36"	0.62	1.07	1.53	2.00
	42"	0.71	1.30	1.92	2.52
	48"	0.80	1.54	2.29	3.02
	54"	0.91	1.83	2.74	3.67
	60"	1.02	2.15	3.27	4.39

	Span	Rise	CMP-ARCH			
			Single Pipe	Double Pipe	Triple Pipe	Quad. Pipe
1:2 Slope	17"	13"	0.33	0.49	0.65	0.81
	21"	15"	0.33	0.50	0.67	0.83
	28"	20"	0.37	0.56	0.76	0.95
	35"	24"	0.40	0.62	0.84	1.07
	42"	29"	0.43	0.70	0.98	1.25
	49"	33"	0.49	0.82	1.15	1.48
	57"	38"	0.55	0.95	1.35	1.75
	64"	43"	0.62	1.10	1.57	2.05
	71"	47"	0.69	1.24	1.80	2.35
1:4 Slope	17"	13"	0.38	0.56	0.74	0.92
	21"	15"	0.39	0.59	0.80	0.95
	28"	20"	0.43	0.64	0.88	1.10
	35"	24"	0.49	0.77	1.05	1.33
	42"	29"	0.57	0.92	1.27	1.62
	49"	33"	0.65	1.08	1.50	1.93
	57"	38"	0.76	1.30	1.83	2.37
	64"	43"	0.87	1.55	2.18	2.83
	71"	47"	0.95	1.68	2.43	3.17

	Rise	Span	ELLIPTICAL-CONCRETE			
			Single Pipe	Double Pipe	Triple Pipe	Quad. Pipe
1:2 Slope	12"	18"	0.19	0.33	0.45	0.57
	14"	23"	0.25	0.40	0.55	0.69
	19"	30"	0.34	0.55	0.75	0.95
	24"	38"	0.43	0.71	1.00	1.28
	29"	45"	0.52	0.90	1.27	1.65
	34"	53"	0.62	1.11	1.60	2.09
	38"	60"	0.70	1.29	1.87	2.46
	43"	68"	0.81	1.54	2.26	2.99
	48"	76"	0.93	1.79	2.66	3.53
	53"	83"	1.04	2.04	3.03	4.02
	58"	91"	1.17	2.33	3.49	4.66
1:4 Slope	12"	18"	0.30	0.45	0.61	0.76
	14"	23"	0.36	0.56	0.76	0.95
	19"	30"	0.51	0.79	1.08	1.36
	24"	38"	0.68	1.10	1.53	1.96
	29"	45"	0.86	1.45	2.04	2.63
	34"	53"	1.02	1.81	2.60	3.39
	38"	60"	1.18	2.14	3.10	4.05
	43"	68"	1.38	2.58	3.79	4.99
	48"	76"	1.59	3.05	4.51	5.97
	53"	83"	1.80	3.50	5.19	6.88
	58"	91"	2.04	4.04	6.05	8.05



PLAN

NOTE: See General Note 2

SLOPE AND DITCH TRANSITIONS

GENERAL NOTES

1. Unless otherwise designated in the plans, concrete pipe mitered end sections may be used with any type of cross drain pipe; corrugated steel pipe mitered end sections may be used with any type of cross drain pipe except aluminum pipe; and, corrugated aluminum mitered end sections may be used with any type of cross drain pipe except steel pipe. When bituminous coated metal pipe is specified for cross drain pipe, mitered end sections shall be constructed with like pipe or concrete pipe.

2. When the mitered end section pipe is dissimilar to the cross drain pipe, a concrete jacket shall be constructed in accordance with Standard Index 280.

3. Mitered end sections for pipe sizes 15", 18" and 24" round or equivalent pipe arch or elliptical pipe are permitted within the clear zone. When the slope intersection permits, the mitered end section may be located with the culvert opening as close as 8' beyond the outside edge of the shoulder.

4. Slope and ditch transitions shall be used when the normal roadway slope must be flattened to place end section outside clear zone. See detail left.

5. The reinforced concrete slab shall be constructed for all sizes of cross drain pipe and cast in place with Class NS concrete. Slabs shall be 5½" thick unless 3" thickness called for in plans.

6. Concrete pipe used in the assembly of mitered end sections shall be selective lengths to avoid excessive connections.

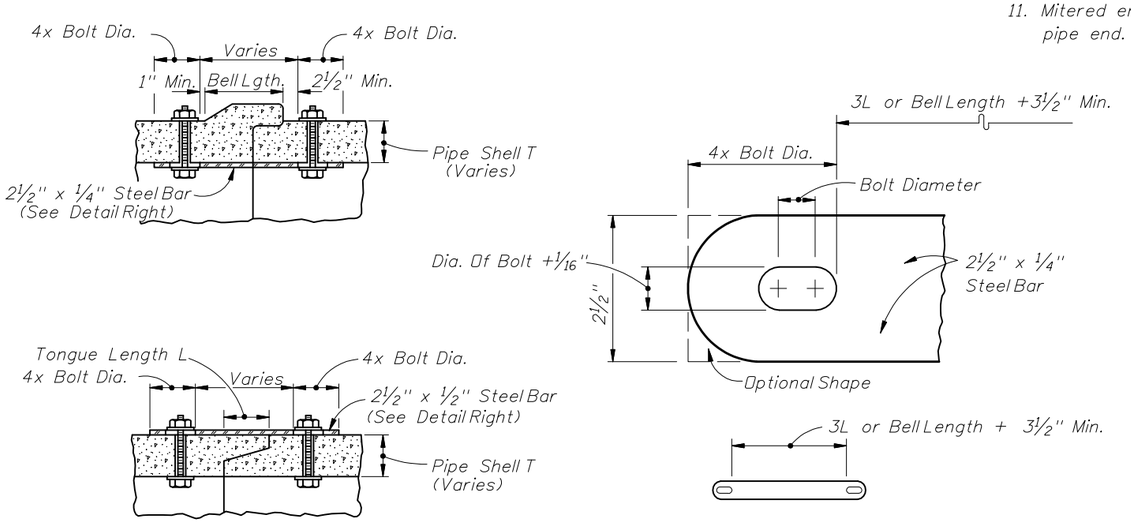
7. Corrugated metal pipe galvanizing that is damaged during beveling and perforating for mitered end section shall be repaired.

8. That portion of corrugated metal pipe in direct contact with the concrete slab and extending 12" beyond shall be bituminous coated prior to placing of the concrete.

9. When existing multiple cross drain pipes are spaced other than the dimensions shown in this detail, or have non-parallel axes, or have non-uniform sections, the mitered end sections will be constructed either separately as single pipe mitered end sections or collectively as multiple pipe end sections as directed by the Engineer; however, mitered end sections will be paid for each based on each independent pipe end.

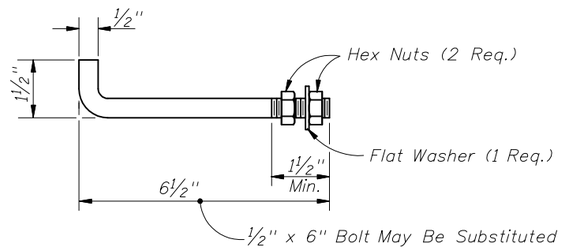
10. The cost of all pipe(s), fasteners, reinforcing, connectors, anchors, concrete, sealants, jackets, and coupling bands shall be included in the cost for the mitered end section. Sodding shall be paid for separately under the contract unit price of Performance Turf, SY.

11. Mitered end sections shall be paid for under the contract unit price for Mitered End Section (CD), Each, based on each independent pipe end.



All bars, bolts, nuts and washers are to be galvanized steel.
Bolt diameters shall be ⅜" for 15" to 36" pipe and ⅝" for 42" to 72" pipe.
Two connectors required per joint, located 60° right and left of bottom center of pipe.
Bolt holes in pipe shell are to be drilled.

CONCRETE PIPE CONNECTOR



Anchors required for CMP only.

Anchor, washer and nuts to be galvanized steel.

Bend anchor where required to center in concrete slab. Damaged surfaces to be repaired after bending. Anchors are to be spaced a distance equal to four (4) corrugations. Place the anchors in the outside crest of corrugation.

Flat washers to be placed on inside wall of pipe.

Holes in the mitered end pipe are to be drilled or punched; burning not permitted.

ANCHOR DETAIL

SPECIAL DETAILS AND NOTES

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

2010 FDOT Design Standards

CROSS DRAIN MITERED END SECTION

Last Revision	Sheet No.
07/01/09	6 of 6

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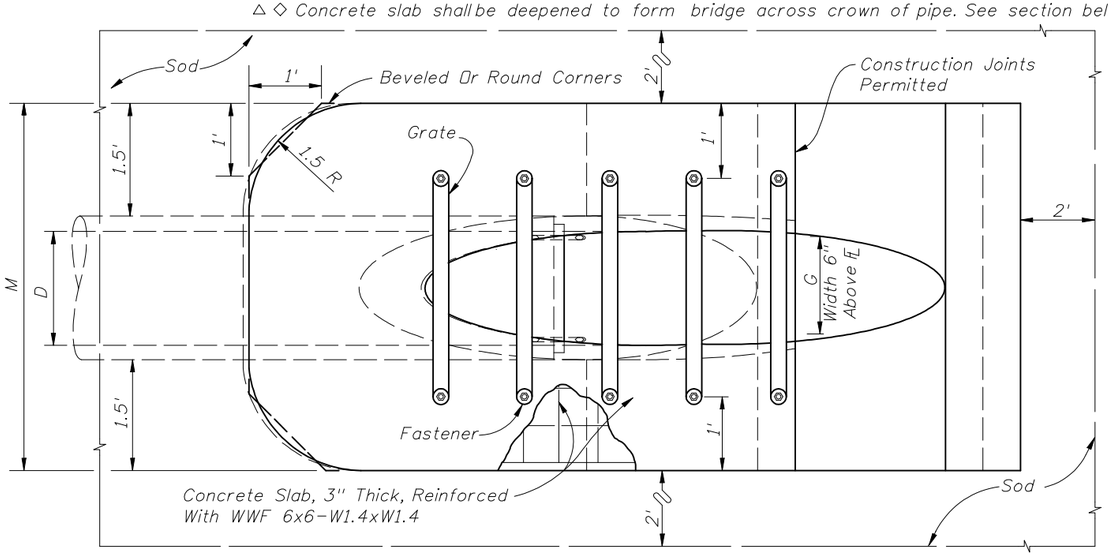
DIMENSIONS & QUANTITIES

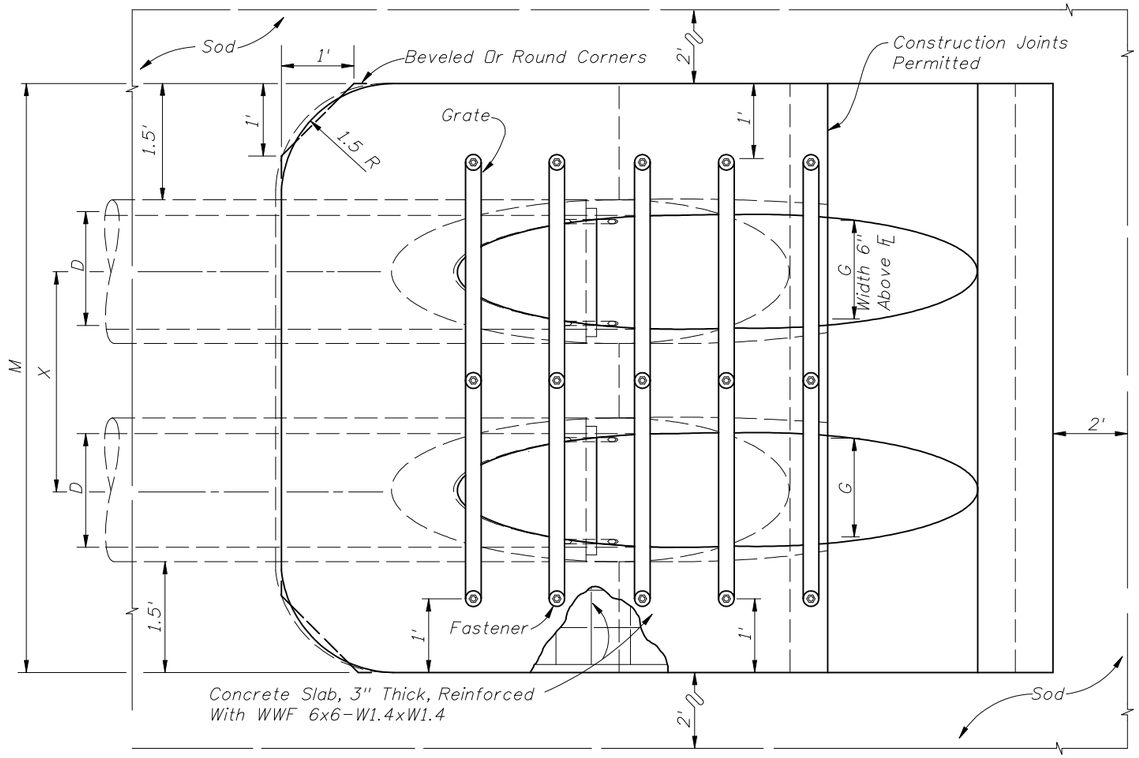
D	X	A	B	C	E	F	G	H ■	M				N	GRATE SIZES		CONCRETE (Cu. Yds.)				SODDING (Sq. Yds.)			
									Single Pipe	Double Pipe	Triple Pipe	Quad Pipe		Standard Weight Pipe	Extra Strong Pipe	Single Pipe	Double Pipe	Triple Pipe	Quad Pipe	Single Pipe	Double Pipe	Triple Pipe	Quad Pipe
15"	2'-7"	2.27'	4.09'	6.36'	4.03'	8'	1.22'	4.0'	4.63'	7.21'	9.79'	12.37'	1.19'			0.76	1.16	1.54	1.94	8	10	11	12
18"	2'-10"	2.36'	5.12'	7.48'	5.03'	9'	1.41'	4.0'	4.92'	7.75'	10.58'	13.42'	1.21'			0.85	1.28	1.71	2.17	9	10	12	13
24"	3'-5"	2.53'	7.18'△	9.71'	7.03'△	11'	1.73'	4.0'	5.50'	8.92'	12.33'	15.75'	1.25'			1.02	1.58	2.15	2.75	10	12	13	15
30"	4'-3"	2.70'	9.25'	11.95'	9.03'	13'	2.00'	4.0'	6.08'	10.33'	14.58'	18.83'	1.29'	2½"	3"	1.23	1.98	2.74	3.50	12	14	15	17
36"	5'-1"	2.87'	11.31'◇	14.18'	11.03'◇	15'	2.24'	4.0'	6.67'	11.75'	16.83'	21.92'	1.33'	2½"	3"	1.40	2.38	3.33	4.24	13	15	17	20
42"	6'-0"	3.05'	13.37'	16.42'	13.03'	17'	2.45'	4.0'	7.25'	13.25'	19.25'	25.25'	1.38'	2½"	3½"	1.60	2.83	4.04	5.26	14	17	19	22
48"	6'-9"	3.22'	15.43'	18.65'	15.03'	19'	2.65'	4.0'	7.83'	14.58'	21.33'	28.08'	1.42'	2½"	3½"	1.81	3.26	4.70	6.14	15	18	21	24
54"	7'-8"	3.39'	17.49'	20.88'	17.03'	21'	2.83'	4.0'	8.42'	16.08'	23.75'	31.42'	1.46'	3"	4"	2.03	3.78	5.54	7.28	17	20	23	27
60"	8'-6"	3.56'	19.55'	23.11'	19.03'	23'	3.00'	4.0'	9.00'	17.50'	26.00'	34.50'	1.50'	3"	4"	2.28	4.36	6.43	8.50	18	22	25	29

△ 6.42' △ 6.25' Dimensions permitted to allow use of 8' standard pipe lengths.
◇ 10.40' ◇ 10.10' Dimensions permitted to allow use of 12' standard pipe lengths.
△ ◇ Concrete slab shall be deepened to form bridge across crown of pipe. See section below.

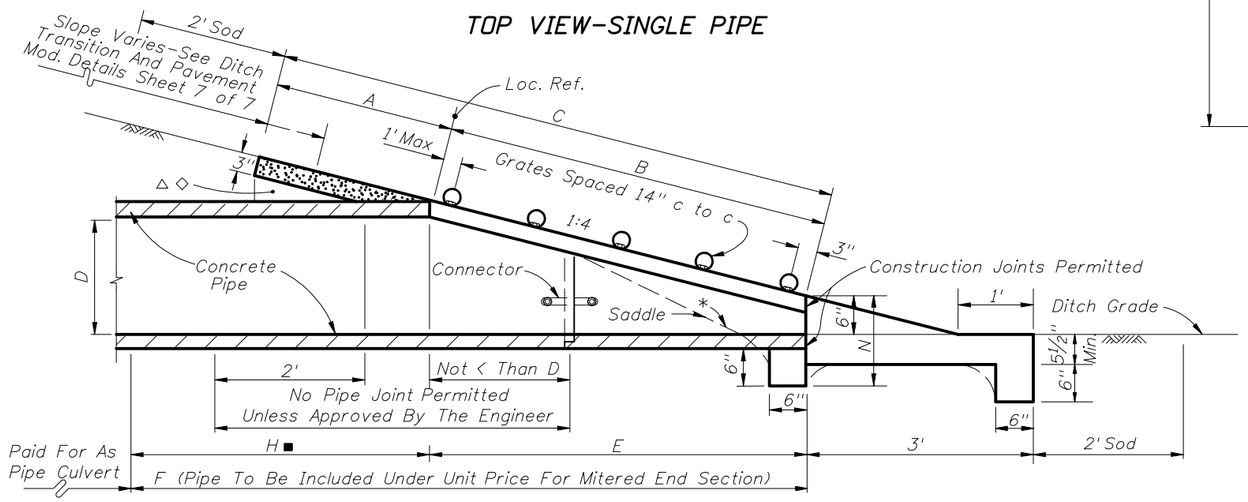
■ Values shown for estimating pipe quantities and are for information only.



TOP VIEW-SINGLE PIPE



TOP VIEW-MULTIPLE PIPE



SECTION

Note: See Sheets 6 and 7 for details and general notes.

*Slope:
To ℄ Pipe For Pipes 18" And Smaller
1:2 For Pipes 24" And Larger.

SINGLE AND MULTIPLE ROUND CONCRETE PIPE

2010 FDOT Design Standards

SIDE DRAIN MITERED END SECTION

Last Revision 02 | Sheet No. 1 of 7 | Index No. 273

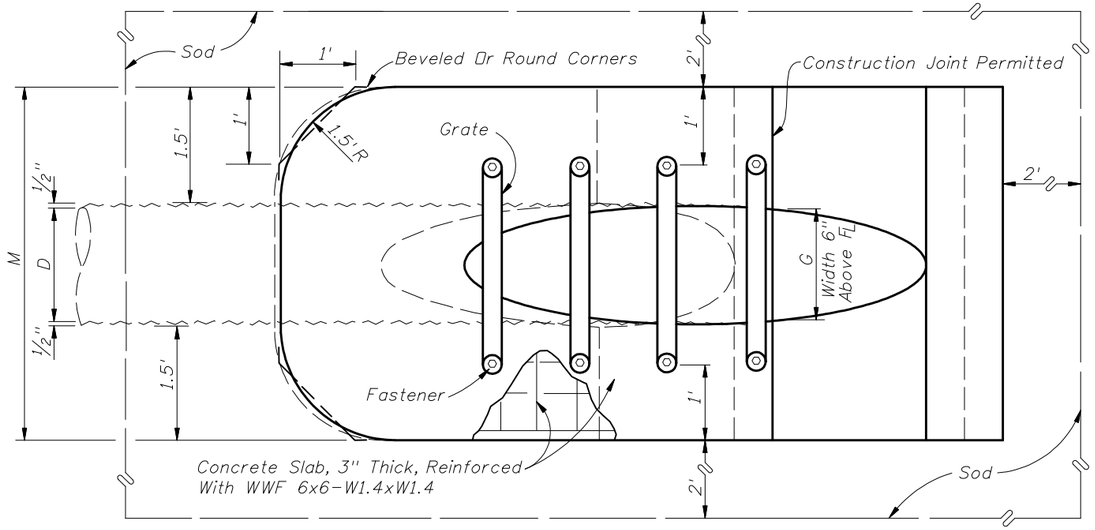
DIMENSIONS & QUANTITIES

D	X	A	B	C	E	F	G	H ■	M Single Pipe	M Double Pipe	M Triple Pipe	M Quad. Pipe	N	GRATE SIZES Standard Weight Pipe	GRATE SIZES Extra Strong Pipe	CONCRETE (Cu. Yds.) Single Pipe	CONCRETE (Cu. Yds.) Double Pipe	CONCRETE (Cu. Yds.) Triple Pipe	CONCRETE (Cu. Yds.) Quad. Pipe	SODDING (Sq. Yds.) Single Pipe	SODDING (Sq. Yds.) Double Pipe	SODDING (Sq. Yds.) Triple Pipe	SODDING (Sq. Yds.) Quad. Pipe
8"	2'-0"	2.5'	0.72'	3.22'	0.7'	4.0'	0.58'	3.3'	3.75'	5.75'	7.75'	9.75'	1.04'			0.52	0.90	1.22	1.54	7	8	8	9
10"	2'-2"	2.5'	1.34'	3.84'	1.3'	5.0'	0.81'	3.7'	3.92'	6.08'	8.25'	10.41'	1.04'			0.64	0.99	1.34	1.70	7	8	9	10
12"	2'-4"	2.5'	2.06'	4.56'	2.0'	6.0'	1.00'	4.0'	4.08'	6.42'	8.75'	11.08'	1.04'			0.68	1.09	1.48	1.88	7	8	10	11
15"	2'-7"	2.5'	3.09'	5.59'	3.0'	7.0'	1.23'	4.0'	4.33'	6.92'	9.50'	12.08'	1.04'			0.64	1.00	1.35	1.71	8	9	10	11
18"	2'-10"	2.5'	4.12'	6.62'	4.0'	8.0'	1.41'	4.0'	4.58'	7.42'	10.25'	13.08'	1.04'			0.69	1.09	1.49	1.89	9	10	11	12
24"	3'-5"	2.5'	6.18'	8.68'	6.0'	10.0'	1.73'	4.0'	5.08'	8.50'	11.92'	15.33'	1.04'			0.83	1.34	1.82	2.34	10	11	13	14
30"	4'-3"	2.5'	8.25'	10.75'	8.0'	12.0'	2.00'	4.0'	5.58'	9.83'	14.08'	18.33'	1.04'	2½"	3"	0.96	1.63	2.32	2.99	11	13	15	17
36"	5'-1"	2.5'	10.31'	12.81'	10.0'	14.0'	2.24'	4.0'	6.08'	11.17'	16.25'	21.33'	1.04'	2½"	3"	1.08	1.92	2.77	3.62	12	14	17	19
42"	6'-0"	2.5'	12.37'	14.87'	12.0'	16.0'	2.45'	4.0'	6.58'	12.58'	18.58'	24.58'	1.04'	2½"	3½"	1.20	2.26	3.34	4.61	13	16	18	21
48"	6'-9"	2.5'	14.43'	16.93'	14.0'	18.0'	2.65'	4.0'	7.08'	13.83'	20.58'	27.33'	1.04'	2½"	3½"	1.60	3.11	4.62	6.12	14	17	20	23
54"	7'-8"	2.5'	16.49'	18.99'	16.0'	20.0'	2.83'	4.0'	7.58'	15.25'	22.92'	30.58'	1.04'	3"	4"	1.76	3.56	5.34	7.14	15	19	22	26
60"	8'-6"	2.5'	18.55'	21.05'	18.0'	22.0'	3.00'	4.0'	8.08'	16.58'	25.08'	33.58'	1.04'	3"	4"	1.94	4.03	6.12	8.20	17	20	24	28

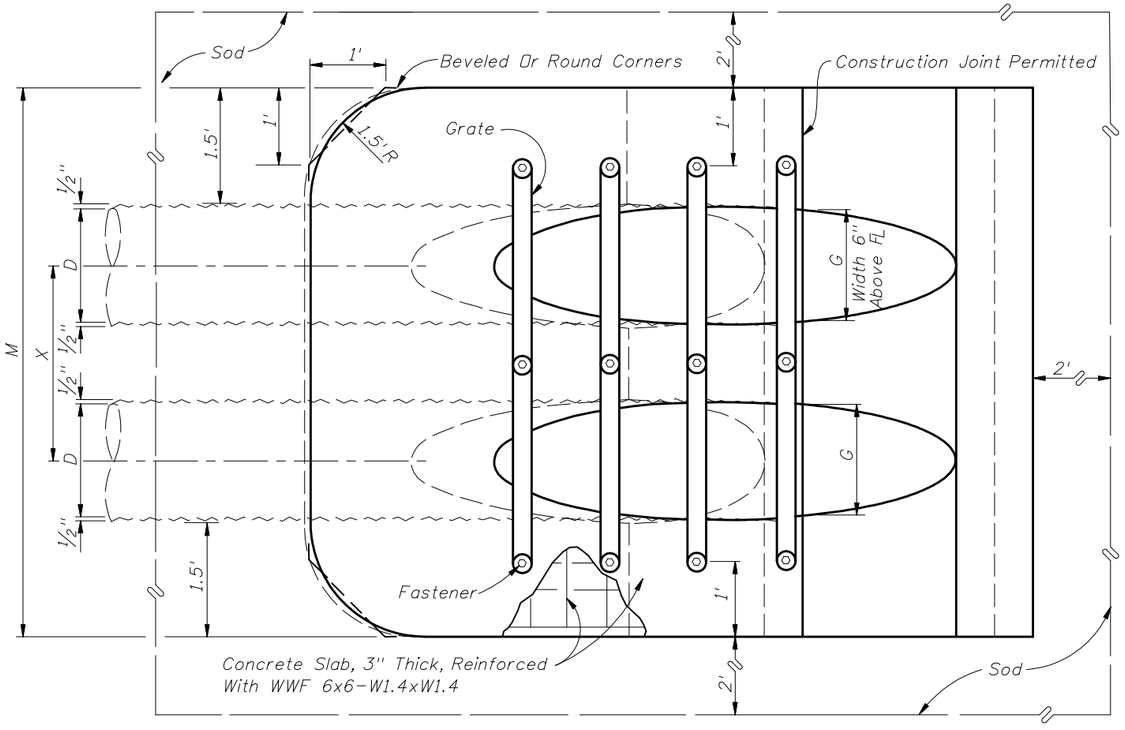
REMARKS

These sizes are restricted to inlet and outlet treatment for water management systems or similar applications.

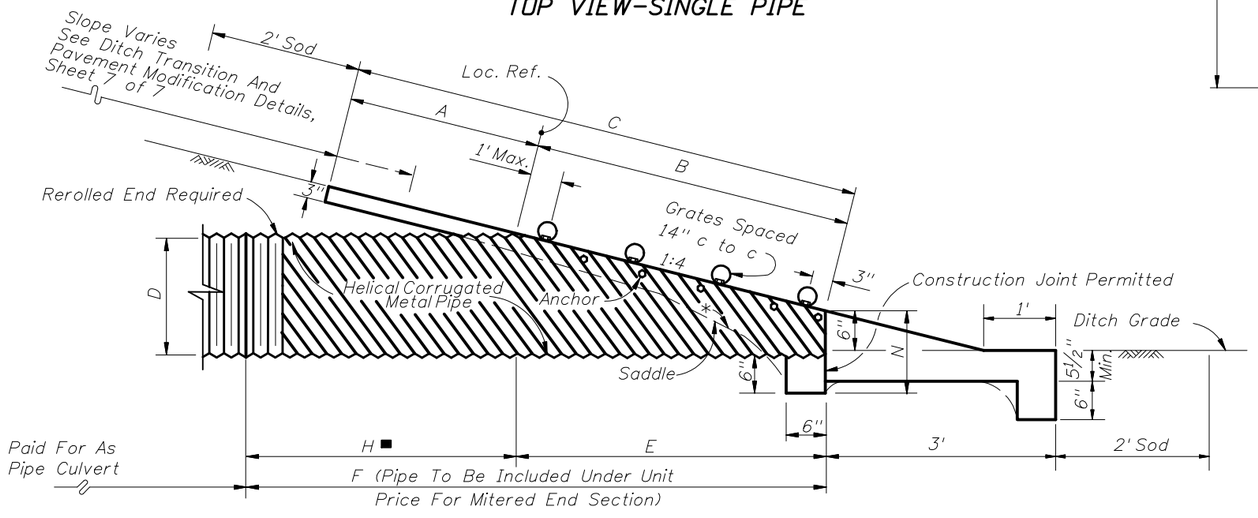
■ Values shown for estimating pipe quantities and are for information only.



TOP VIEW-SINGLE PIPE



TOP VIEW-MULTIPLE PIPE



SECTION

NOTE: See Sheets 6 and 7 for details and general notes.

*Slope:
To ℄ Pipe For Pipe 18" And Smaller
1:2 For Pipe 24" And Larger

SINGLE AND MULTIPLE ROUND CORRUGATED METAL PIPE

2010 FDOT Design Standards

SIDE DRAIN MITERED END SECTION

Last Revision	Sheet No.
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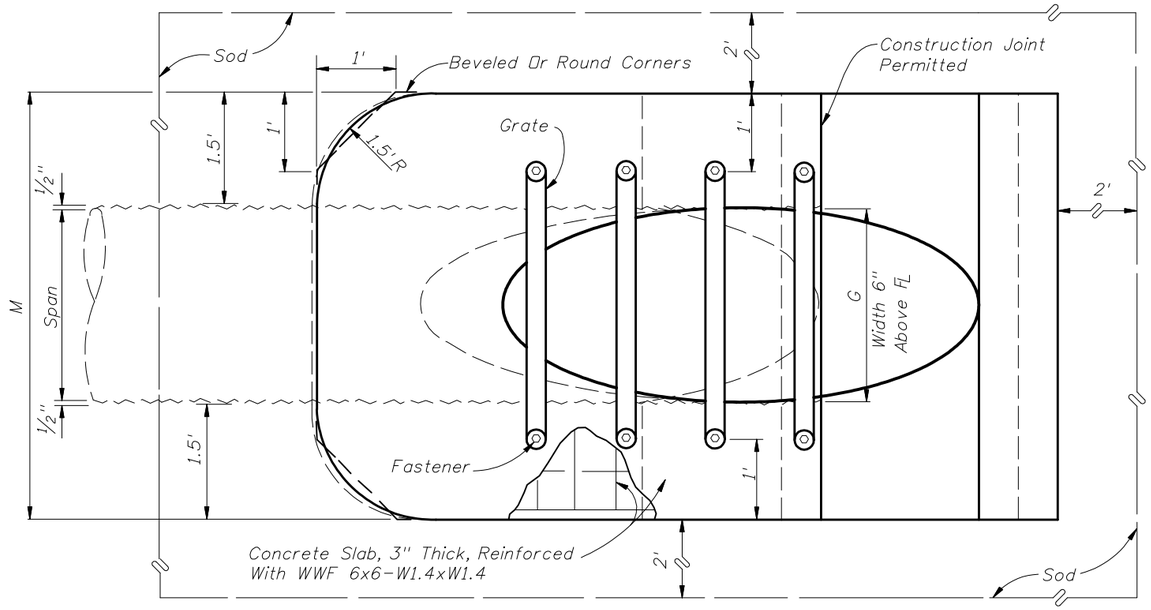
Index No. 273

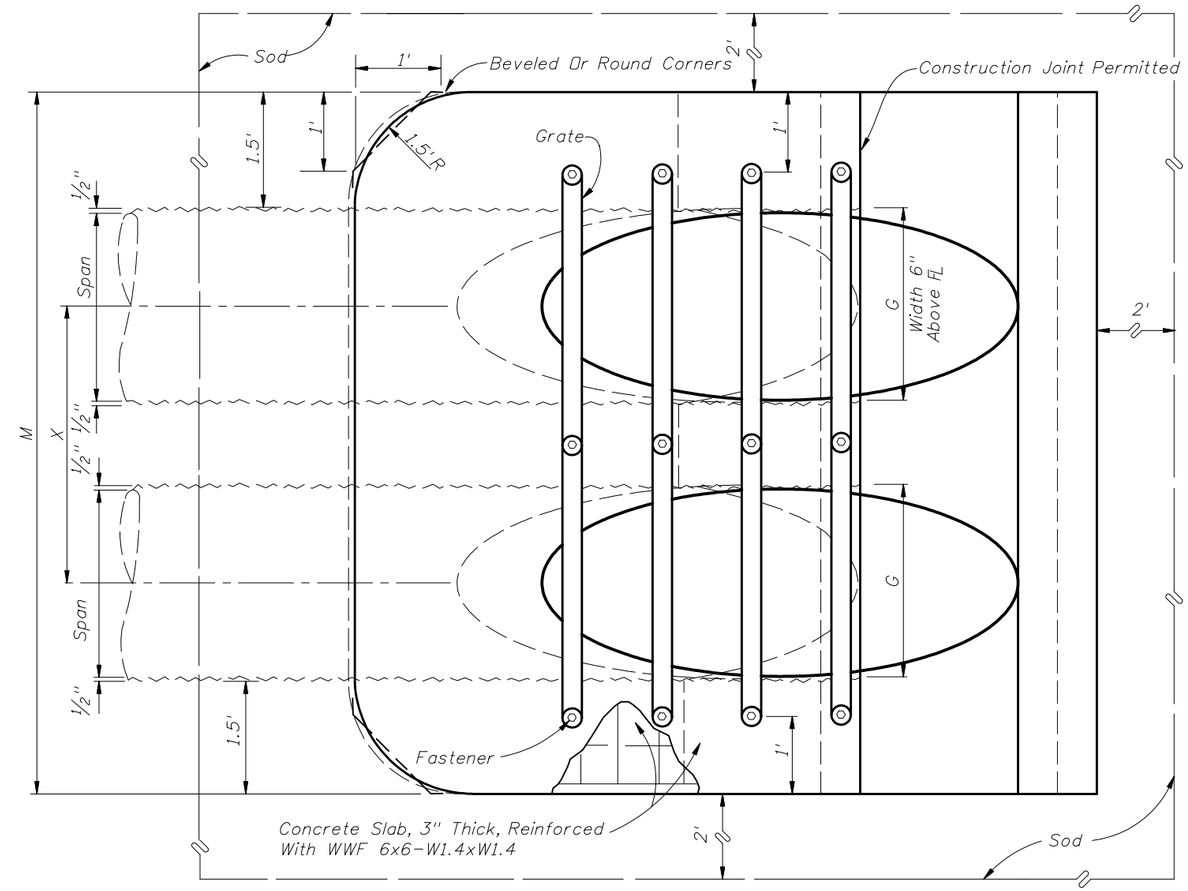
DIMENSIONS & QUANTITIES

1974 AASHTO										M					GRATE SIZES		CONCRETE (Cu. Yds.)				SODDING (Sq. Yds.)			
Span	Rise	X	A	B	C	E	F	G	H ■	Single Pipe	Double Pipe	Triple Pipe	Quad. Pipe	N	Standard Weight	Extra Strong	Single Pipe	Double Pipe	Triple Pipe	Quad. Pipe	Single Pipe	Double Pipe	Triple Pipe	Quad. Pipe
17"	13"	2'-6"	2.5'	2.41'	4.91'	2.33'	7'	1.39'	4.7'	4.50'	7.00'	9.50'	12.00'	1.04'			0.62	0.95	1.27	1.60	8	9	10	11
21"	15"	2'-10"	2.5'	3.09'	5.59'	3.00'	8'	1.76'	5.0'	4.83'	7.67'	10.50'	13.33'	1.04'			0.69	1.06	1.44	1.77	8	9	11	12
28"	20"	3'-5"	2.5'	4.81'	7.31'	4.67'	9'	2.22'	4.3'	5.42'	8.83'	12.25'	15.67'	1.04'			0.81	1.26	1.73	2.19	9	11	12	14
35"	24"	4'-0"	2.5'	6.18'	8.68'	6.00'	11'	2.55'	5.0'	6.00'	10.00'	14.00'	18.00'	1.04'	2½"	3"	0.94	1.51	2.09	2.66	10	12	14	15
42"	29"	4'-9"	2.5'	7.90'	10.40'	7.67'	12'	2.97'	4.3'	6.58'	11.33'	16.08'	20.83'	1.04'	2½"	3½"	1.06	1.76	2.46	3.16	11	13	15	17
49"	33"	5'-6"	2.5'	9.28'	11.78'	9.00'	14'	3.34'	5.0'	7.17'	12.67'	18.17'	23.67'	1.04'	2½"	3½"	1.19	2.02	2.84	3.68	12	14	17	19
57"	38"	6'-4"	2.5'	11.00'	13.50'	10.67'	16'	3.65'	5.3'	7.83'	14.17'	20.50'	26.83'	1.04'	3"	4"	1.35	2.35	3.35	4.36	13	16	19	22
64"	43"	7'-1"	2.5'	12.71'	15.21'	12.33'	17'	3.89'	4.7'	8.42'	15.50'	22.58'	29.67'	1.04'	3"	4"	1.50	2.70	3.86	5.03	14	17	20	24
71"	47"	7'-10"	2.5'	14.09'	16.59'	13.67'	19'	4.14'	5.3'	9.00'	16.83'	24.67'	32.50'	1.04'	3"	4"	1.62	2.94	4.27	5.59	15	18	22	25

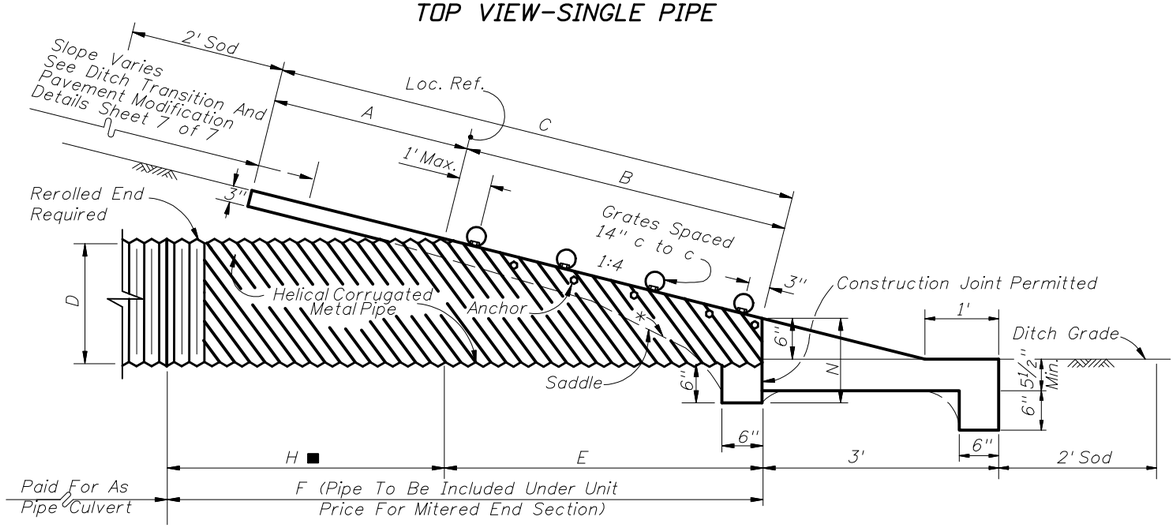
■ Values shown for estimating pipe quantities and are for information only.



TOP VIEW-SINGLE PIPE



TOP VIEW-MULTIPLE PIPE



SECTION

NOTE: See Sheets 6 and 7 for details and general notes.

*Slope:

To Span Line For Pipe Arch 28"x20" And Smaller
1:2 For Pipe Arch 35"x24" And Larger

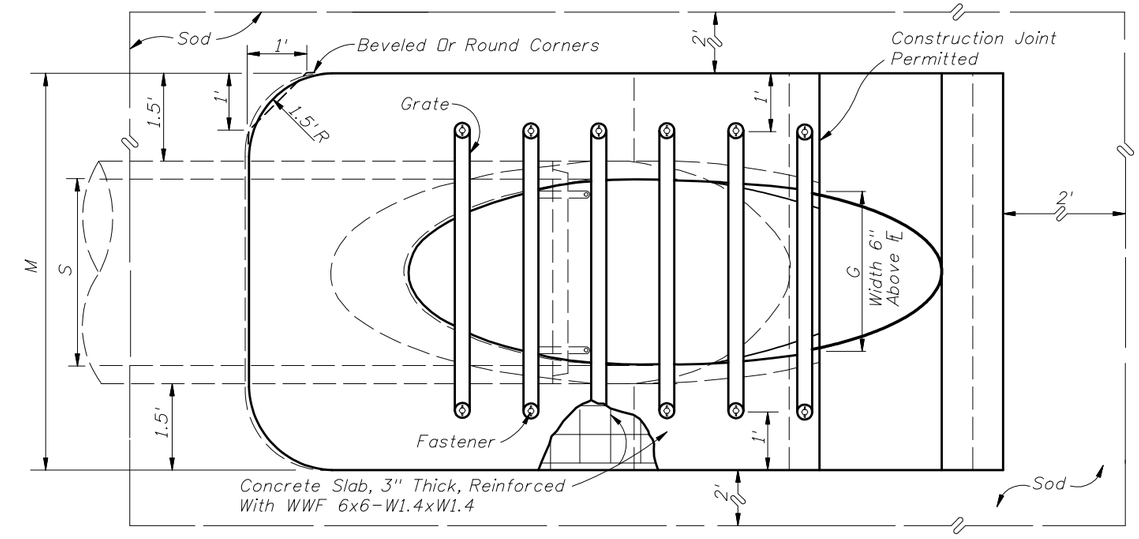
SINGLE AND MULTIPLE CORRUGATED METAL PIPE-ARCH

	2010 FDOT Design Standards	Last Revision 02	Sheet No. 3 of 7
STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION	SIDE DRAIN MITERED END SECTION		Index No. 273

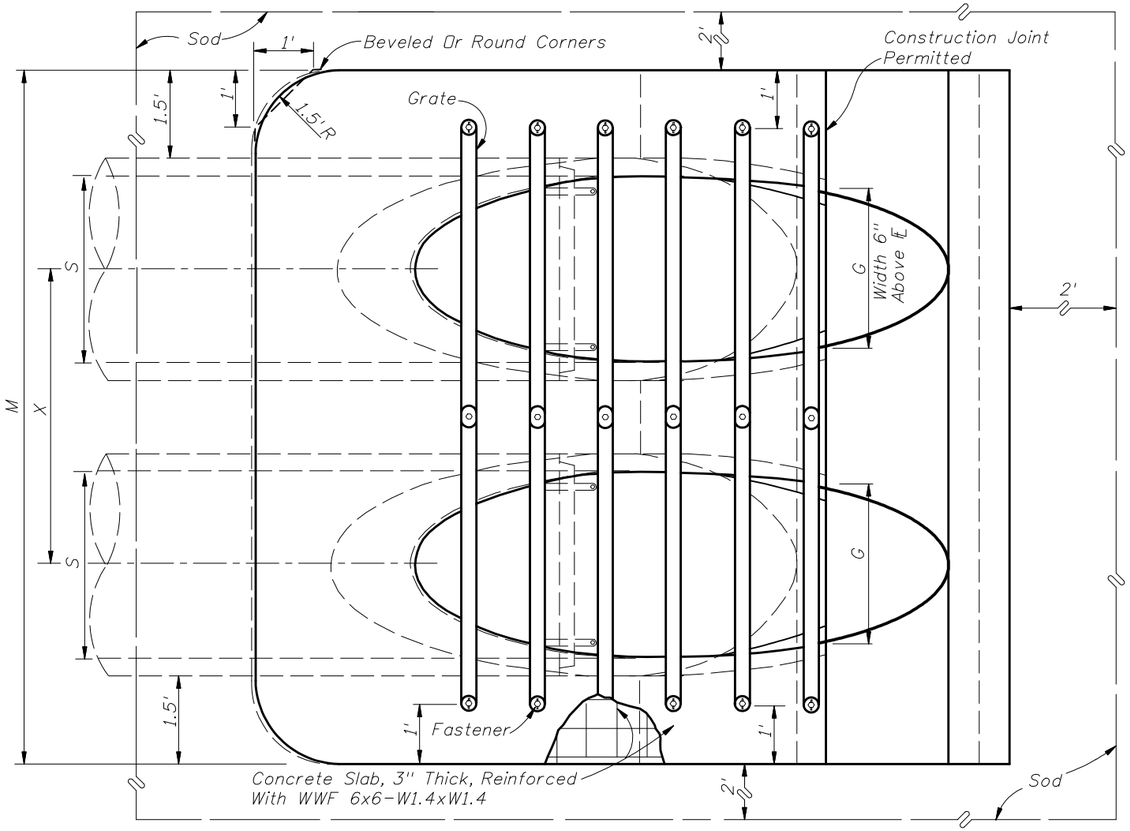
DIMENSIONS & QUANTITIES

Rise R	Span S	X	A	B	C	E	F	G	H■	M				N	GRATE SIZES		CONCRETE (Cu. Yds.)				SODDING (Sq. Yds.)			
										Single Pipe	Double Pipe	Triple Pipe	Quad. Pipe		Standard Weight Pipe	Extra Strong Pipe	Single Pipe	Double Pipe	Triple Pipe	Quad. Pipe	Single Pipe	Double Pipe	Triple Pipe	Quad. Pipe
12"	18"	2'-10"	2.36'	3.06'	5.42'	3.03'	5'	1.50'	2.0'	4.92'	7.75'	10.58'	13.42'	1.21'			0.68	1.04	1.41	1.77	8	9	11	12
14"	23"	3'-4"	2.44'	3.75'	6.19'	3.70'	6'	1.90'	2.3'	5.38'	8.71'	12.04'	15.38'	1.23'			0.76	1.19	1.63	2.05	9	10	12	13
19"	30"	4'-0"	2.62'	5.47'	8.09'	5.36'	8'	2.37'	2.6'	6.04'	10.04'	14.04'	18.04'	1.27'	2½"	3"	0.95	1.52	2.09	2.65	10	12	13	15
24"	38"	5'-0"	2.79'	7.18'	9.97'	7.03'	10'	2.85'	3.0'	6.79'	11.79'	16.79'	21.79'	1.31'	2½"	3"	1.18	1.95	2.74	3.53	11	13	15	18
29"	45"	5'-11"	3.05'	8.90'	11.95'	8.70'	12'	3.19'	3.3'	7.50'	13.42'	19.33'	25.25'	1.38'	2½"	3½"	1.41	2.42	3.44	4.45	12	15	18	20
34"	53"	7'-0"	3.22'	10.62'	13.84'	10.36'	13'	3.57'	2.6'	8.25'	15.25'	22.25'	29.25'	1.42'	3"	3½"	1.63	2.92	4.22	5.52	13	17	20	23
38"	60"	7'-10"	3.39'	11.99'	15.38'	11.70'	15'	3.95'	3.3'	8.92'	16.75'	24.58'	32.42'	1.46'	3"	4"	1.83	3.36	4.89	6.41	14	18	21	25
43"	68"	8'-11"	3.56'	13.71'	17.27'	13.36'	17'	4.28'	3.6'	9.67'	18.58'	27.50'	36.42'	1.50'	3"	4"	2.09	3.95	5.80	7.65	16	20	23	27
48"	76"	9'-11"	3.73'	15.43'	19.16'	15.03'	19'	4.59'	4.0'	10.42'	20.33'	30.25'	40.17'	1.54'	Special	Special	2.37	4.54	6.73	8.92	17	21	26	30
53"	83"	10'-8"	3.91'	17.15'	21.06'	16.70'	20'	4.77'	3.3'	11.08'	21.75'	32.42'	43.08'	1.58'	Special	Special	2.61	5.09	7.56	10.03	18	23	27	32
58"	91"	11'-8"	4.08'	18.87'	22.95'	18.36'	22'	5.01'	3.6'	11.83'	23.50'	35.17'	46.83'	1.63'	Special	Special	2.91	5.77	8.64	11.50	19	24	29	35

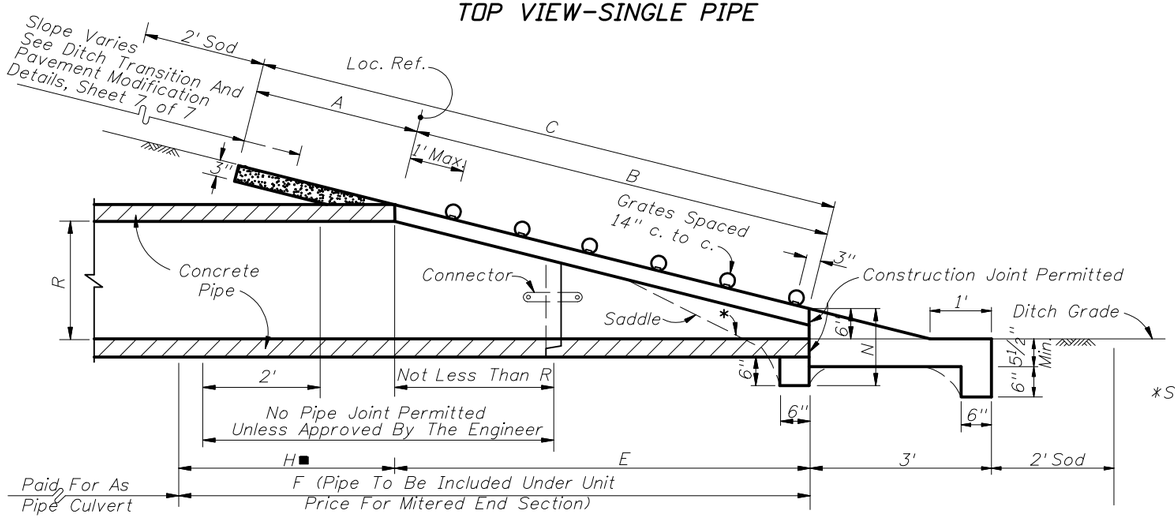
■ Values shown for estimating pipe quantities and are for information only.



TOP VIEW-SINGLE PIPE



TOP VIEW-MULTIPLE PIPE



SECTION

*Slope:
To Major Axis For Pipes 24"x38" And Smaller.
1:2 For Pipes 29"X45" And Larger.

NOTE: See Sheets 6 and 7 for details and general notes.

SINGLE AND MULTIPLE ELLIPTICAL CONCRETE PIPE

2010 FDOT Design Standards

SIDE DRAIN MITERED END SECTION

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Drain Size	s	n	L	La
CONCRETE PIPE (ROUND)				
15"	3	4	4'-0"	4'-11"
18"	4	5	5'-2"	6'-1"
24"	6	7	7'-6"	8'-5"
30"	7	8	8'-8"	9'-7"
36"	9	10	11'-0"	11'-11"
42"	11	12	13'-4"	14'-3"
48"	13	14	15'-8"	16'-7"
54"	14	15	16'-10"	17'-9"
60"	16	17	19'-2"	20'-1"
CORRUGATED METAL PIPE (ROUND)				
15"	2	3	2'-10"	3'-9"
18"	3	4	4'-0"	4'-11"
24"	5	6	6'-4"	7'-3"
30"	7	8	8'-8"	9'-7"
36"	8	9	9'-10"	10'-9"
42"	10	11	12'-2"	13'-1"
48"	12	13	14'-6"	15'-5"
54"	14	15	16'-10"	17'-9"
60"	15	16	18'-0"	18'-11"

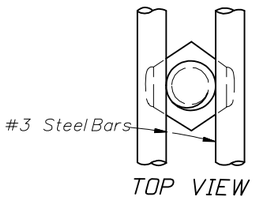
Drain Size	s	n	L	La
ELLIPTICAL CONCRETE PIPE				
12"x18"	2	3	2'-10"	3'-9"
14"x23"	3	4	4'-0'	4'-11"
19"x30"	4	5	5'-2"	6'-1"
24"x38"	5	6	6'-4"	7'-3"
29"x45"	7	8	8'-8"	9'-7"
34"x53"	8	9	9'-10"	10'-9"
38"x60"	10	11	12'-2"	13'-1"
43"x68"	11	12	13'-4"	14'-3"
48"x76"	13	14	15'-8"	16'-7"
53"x83"	14	15	16'-10"	17'-9"
58"x91"	15	16	18'-0"	18'-11"
CORRUGATED METAL PIPE (ARCH) ***				
17"x13"	1	2	1'-8"	2'-7"
21"x15"	2	3	2'-10"	3'-9"
28"x20"	4	5	5'-2"	6'-1"
35"x24"	5	6	6'-4"	7'-3"
42"x29"	6	7	7'-6"	8'-5"
49"x33"	7	8	8'-8"	9'-7"
57"x38"	9	10	11'-0"	11'-11"
64"x43"	10	11	12'-2"	13'-1"
71"x47"	12	13	14'-6"	15'-5"

Note: 5/8" x 3" bolts are standard for all grate fasteners, except when the contractor elects to use the slotted upper holes for the intermediate fasteners on multiple drain pipes, which will require the following bolt lengths:

Grate Size (Std. & X-Stg.)	Bolt Length
2½"	5½"
3"	6"
3½"	6½"
4"	7"

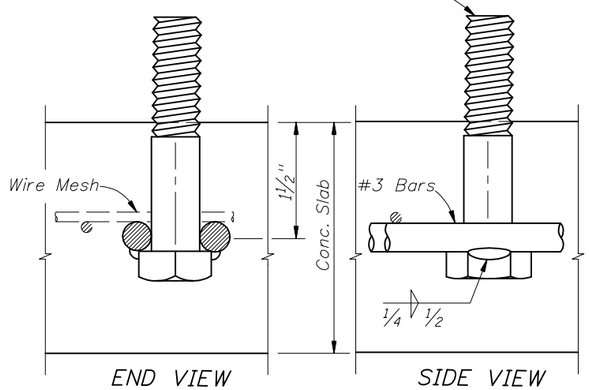
** To be used only when grates are called for in the plans.

*** 1974 AASHTO Pipe Arch Sizes.

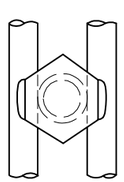


TOP VIEW

5/8" Galvanized Bolt Hex Head Bolt Shown; Either Hex Head Or Square Head Bolt May Be Used. Only Hex Nut To Be Used.

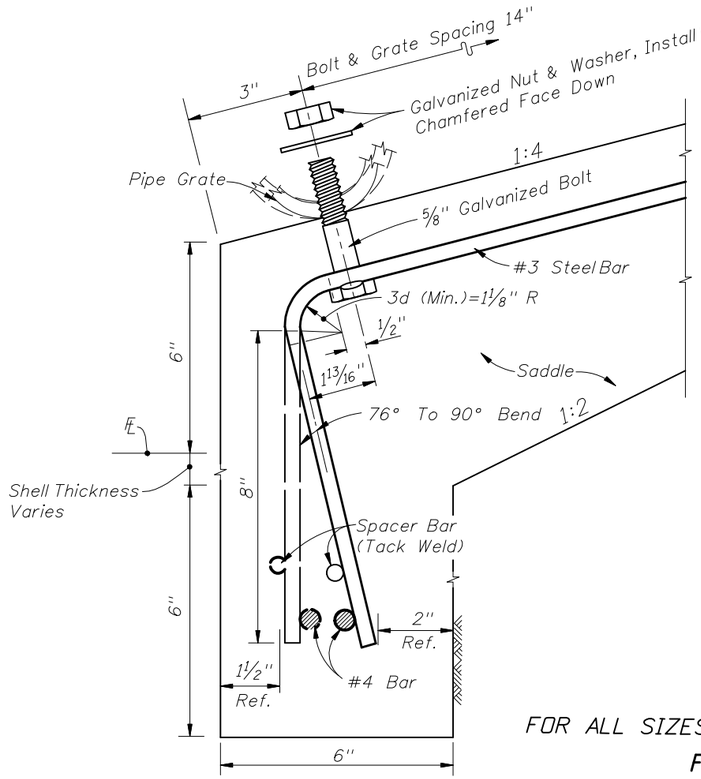


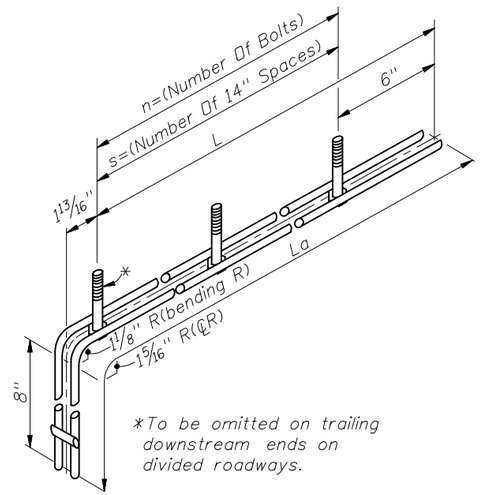
END VIEW SIDE VIEW



BOTTOM VIEW

The specified weld shall be made when the fabricated unit is subject to hazardous hauls and repeated handling. Tack welds are permitted for local or job site fabrication. Galvanizing over welded surface not required.

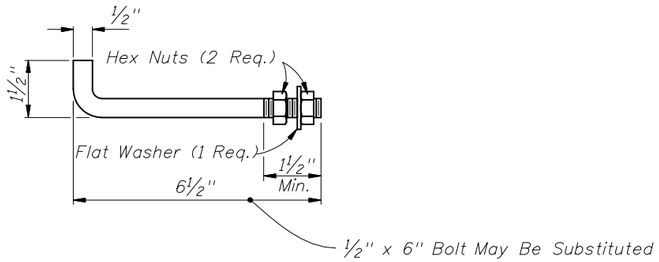




*To be omitted on trailing downstream ends on divided roadways.

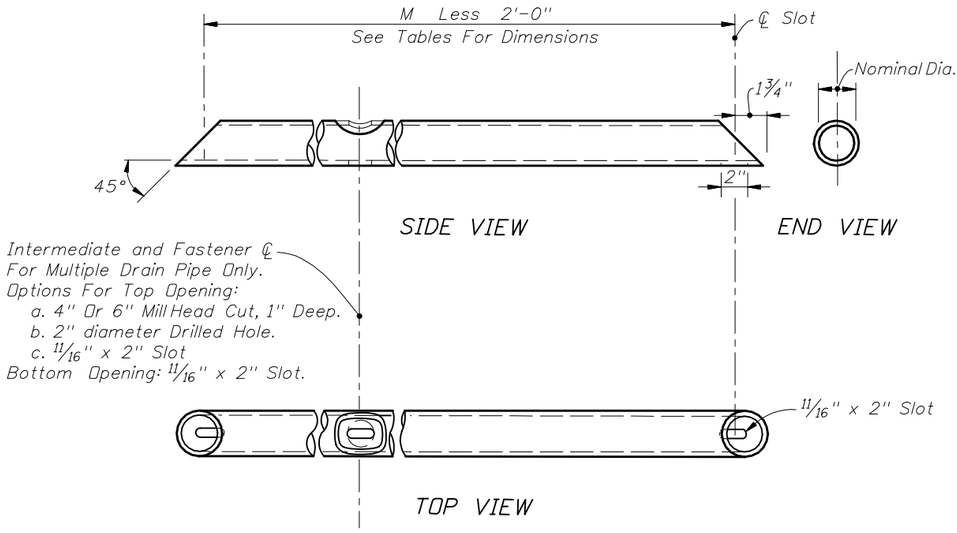
FOR ALL SIZES OF SINGLE AND MULTIPLE DRAIN PIPE
FASTENER UNIT

DETAILS FOR CONCRETE & CORRUGATED METAL PIPE



Notes:
Anchors required for CMP only.
Anchor, washer and nuts to be galvanized steel.
Bend anchor where required to center in concrete slab.
Damaged surfaces to be repaired after bending.
Anchors are to be spaced a distance equal to four (4) corrugations.
Place the anchors in the outside crest of corrugation.
Flat washer to be placed on inside wall of pipe.
Holes in the mitered end pipe are to be drilled or punched; burning not permitted.

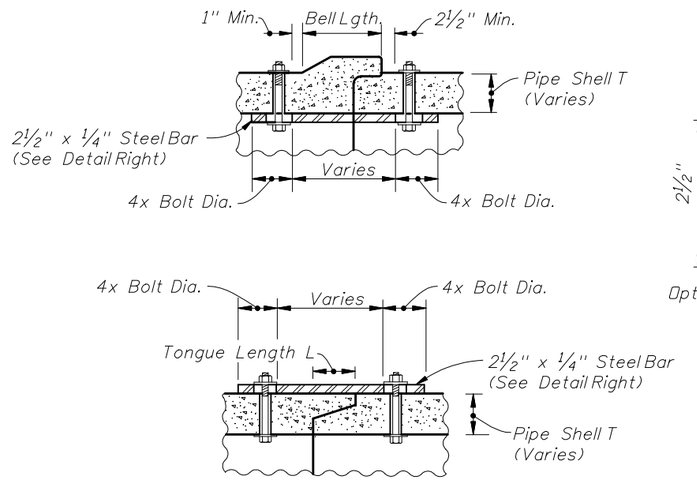
ANCHOR DETAIL

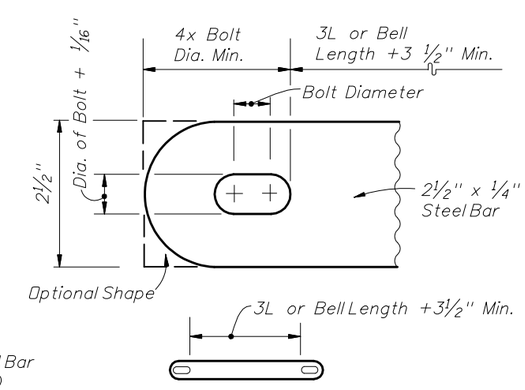


FOR SINGLE & MULTIPLE DRAIN PIPE

GRATE DETAIL

See General Notes, Sheet 7.



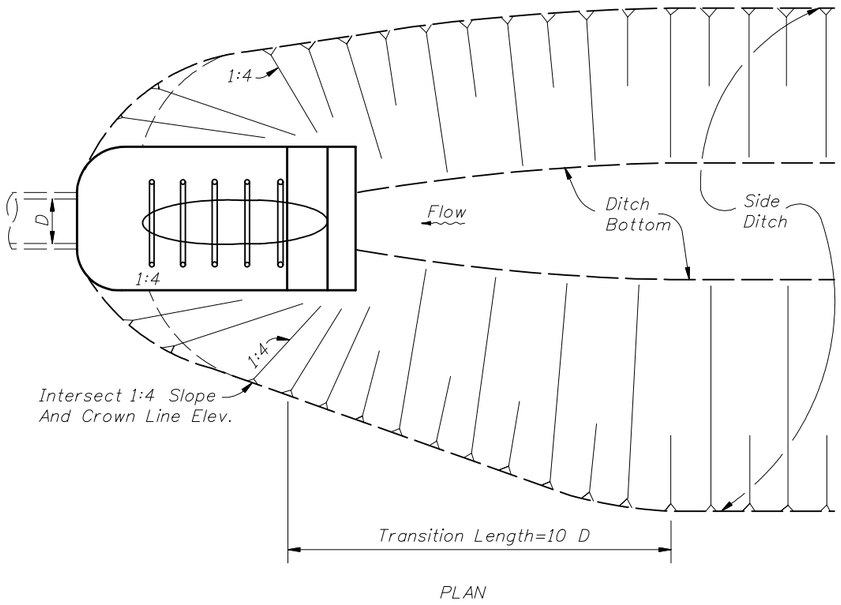


All bars, bolts, nuts and washers are to be galvanized steel.
Bolt diameters shall be ⅜" for 15" to 36" pipe and ⅝" for 42" to 60" pipe.
Two connectors required per joint, located 60° right and left of bottom center of pipe.
Bolt holes in pipe shell are to be drilled.

CONCRETE PIPE CONNECTOR DETAIL

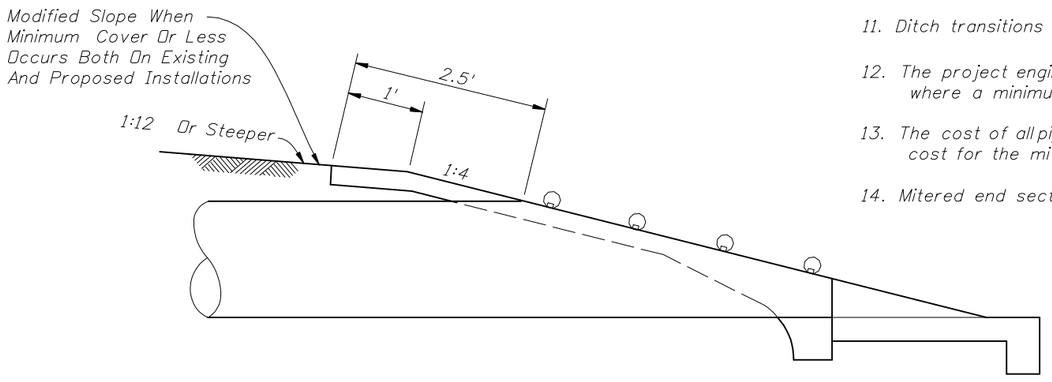
DETAILS FOR CONCRETE & CORRUGATED METAL PIPE

	2010 FDOT Design Standards	Last Revision	Sheet No.
STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION	**SIDE DRAIN MITERED END SECTION**	00	6 of 7
		Index No.	273



PLAN

DITCH TRANSITION



PERMISSIBLE PAVEMENT MODIFICATION

GENERAL NOTES

1. Unless otherwise designated in the plans, concrete pipe mitered end sections may be used with any type of side drain pipe; corrugated steel pipe mitered end sections may be used with any type of side drain pipe except aluminum pipe; and, corrugated aluminum mitered end sections may be used with any type of side drain pipe except steel pipe. When bituminous coated metal pipe is specified for side drain pipe, mitered end sections shall be constructed with like pipe or concrete pipe. When the mitered end section pipe is dissimilar to the side drain pipe, a concrete jacket shall be constructed in accordance with Index No. 280.

2. Corrugated polyethylene pipe (HDPE) and polyvinyl-chloride pipe (PVC) for side drain applications shall utilize either corrugated metal or concrete mitered end sections (MES). When used in conjunction with corrugated (MES), connection shall be by either a formed metal band specifically designated to join HDPE or PVC pipe, with metal pipe or other coupler approved by the State Drainage Engineer. When used in conjunction with a concrete (MES), connection shall be by concrete jacket constructed in accordance with Index No. 280.

3. Concrete pipe used in the assembly of mitered end sections shall be of selective lengths to avoid excessive connections.

4. Corrugated metal pipe galvanizing that is damaged during beveling and perforating for mitered end section shall be repaired.

5. That portion of corrugated metal pipe in direct contact with the concrete slab and extending 12" beyond shall be bituminous coated prior to placing of the concrete.

6. When existing multiple side drain pipes are spaced other than the dimensions shown in this detail, or have nonparallel axes, or have non-uniform sections, The mitered end sections will be constructed either separately as single pipe mitered end sections or collectively as multiple pipe end sections as directed by the Engineer; however, mitered end sections will be paid for each, based on each independent pipe end.

7. In addition to the requirements of Section 430-4, side drain culverts shall comply with the cover requirements shown on Index No. 205.

8. The reinforced concrete slab shall be constructed for all sizes of side drain pipe and cast in place with Class NS concrete.

9. Round pipe size 30" or greater, pipe-arch size 35"x24" or greater and elliptical pipe 19"x30" or greater shall be grated unless excepted in the plans. Smaller sizes of pipe shall be grated only when called for in plans. The lower grate on trailing downstream ends on divided highways shall be omitted.

10. Grates are to be fabricated from steel ASTM A53, Grade B, pipe. The lower grate on all traffic approach ends shall be Schedule 80 and all remaining grates shall be Schedule 40. Grates subject to salt free and corrosive free environment may be fabricated from galvanized pipe, with base metal exposed during fabrication repaired as specified in Section 562, Standard Specifications; or, fabricated from black pipe and hot dip galvanized after fabrication in accordance with ASTM A123. Grates subject to salt water or highly corrosive environment shall be hot dip galvanized after fabrication in accordance with ASTM A123.

11. Ditch transitions shall be used on all grades in excess of 3% as directed by the Engineer.

12. The project engineer shall contact the District Drainage Engineer for possible alternate treatment prior to constructing side drain mitered end sections where a minimum spacing of 30' will not result between the toe points of the mitered end sections.

13. The cost of all pipe(s), grates, fasteners, reinforcing, connectors, anchors, concrete, sealants, jackets and coupling bands shall be included in the cost for the mitered end section. Sodding shall be paid for separately under the contract unit price for Performance Turf, SY.

14. Mitered end sections shall be paid for under the contract unit price for Mitered End Section (SD), Ea., based on each independent pipe end.

DESIGN NOTES

1. In critical hydraulic locations, grates shall not be used until potential debris transport has been evaluated by the drainage engineer and appropiate adjustments made. Ditch grades in excess of 3% or pipe with less than 1.5' of cover and grades in excess of 1% will require such an evaluation (General Note 9).

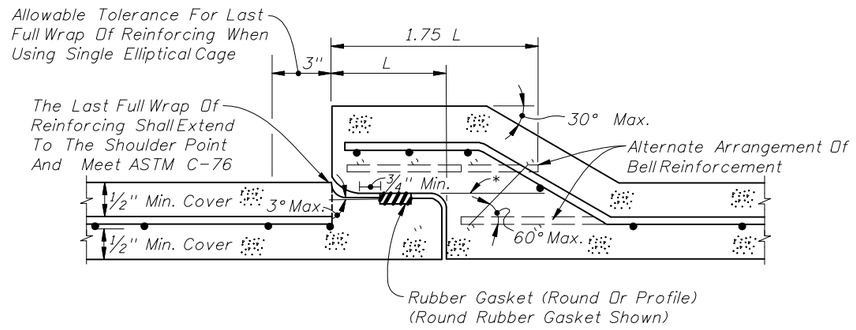
2. The design engineer shall determine highly corrosive locations and specify in the plans when the grates shall be hot-dip galvanized after fabrication (General Note 10).

3. The design engineer shall determine and designate in the plans which alternate types of mitered end section will not be permitted. The restriction shall be based on corrosive or structural requirements.

NOTES & INFORMATION

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION	2010 FDOT Design Standards	Last Revision 07/01/09	Sheet No. 7 of 7
	SIDE DRAIN MITERED END SECTION		Index No. 273

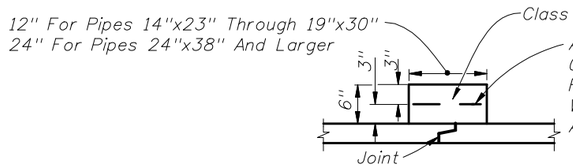
SCHEDULE OF BELL REINFORCEMENT Classes II, III, IV, V: Wall A, B, C		
Nominal Pipe Diameter	Design Bell Reinforcement	Maximum Reinforcement Under Tolerance
	in^2 per foot	in^2 per foot
15"	0.07	0.010
18"	0.07	0.010
24"	0.09	0.010
30"	0.12	0.010
36"	0.14	0.010
42"	0.16	0.010
48"	0.19	0.011
54"	0.21	0.012
60"	0.23	0.0135
66"	0.26	0.015
72"	0.28	0.0165
78"	0.30	0.018
84"	0.33	0.0195
90"	0.35	0.021
96"	0.37	0.0225
102"	0.40	0.024
108"	0.42	0.0255



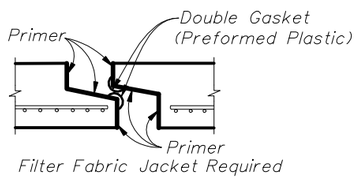
*All circumferential steel located above this line within 1.75 L is defined as bell reinforcement.

ROUND RUBBER GASKET SHOWN

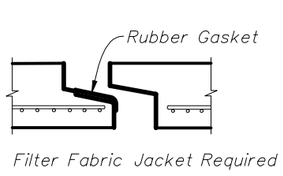
DETAIL OF BELL & SPIGOT CONCRETE PIPE JOINT USING ROUND OR PROFILE RUBBER GASKET



CONCRETE JACKET



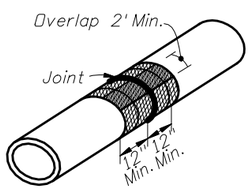
PREFORMED PLASTIC JOINT (BEFORE PULL-UP)



PROFILE RUBBER GASKET (BEFORE PULL-UP)

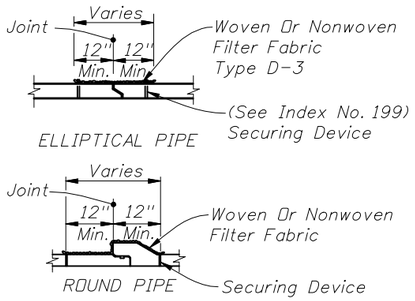
Cost of concrete jacket or filter fabric jacket to be included in cost of elliptical concrete pipe culverts.

ELLIPTICAL CONCRETE PIPE JOINTS



ELLIPTICAL PIPE SHOWN

ISOMETRIC VIEW

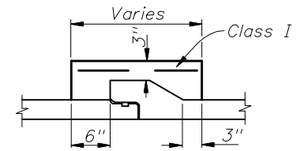


PIPE SECTIONS

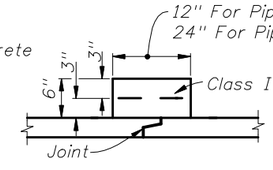
Cost of filter fabric jacket to be included in cost of pipe culverts.

FOR ALL PIPE TYPES - CONCRETE PIPE SHOWN

FILTER FABRIC JACKET



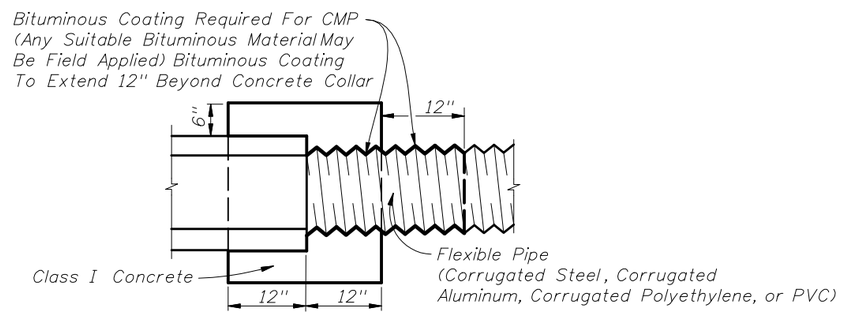
BELL AND SPIGOT



TONGUE & GROOVE

Note: For reinforcement see elliptical pipe concrete jacket. (All Pipe Sizes)

DISSIMILAR JOINTS



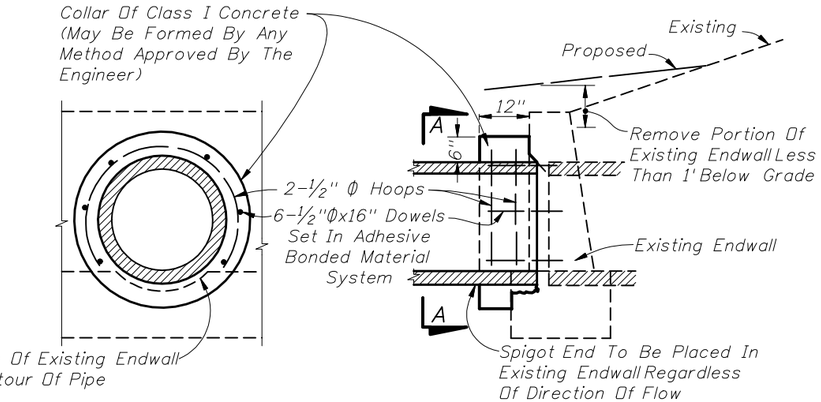
Note: Cost of concrete and bituminous coating to be included in contract unit price for either new pipe or Mitered End Section.

Alternate connection must be approved by the State Drainage Engineer.

A concrete jacket shall not be used to join:
(a) metal pipe of dissimilar materials
(b) flexible pipe when the minimum cover required in accordance with Index No. 205 cannot be obtained

DISSIMILAR TYPES

CONCRETE JACKET FOR CONNECTING DISSIMILAR TYPES OF PIPE AND CONCRETE PIPES WITH DISSIMILAR JOINTS

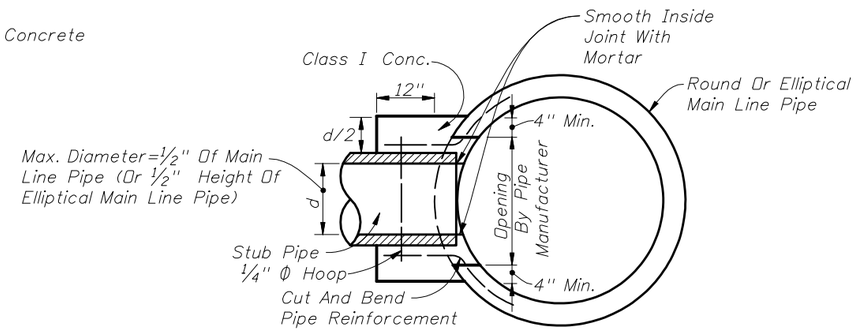


SECTION AA

LONGITUDINAL SECTION

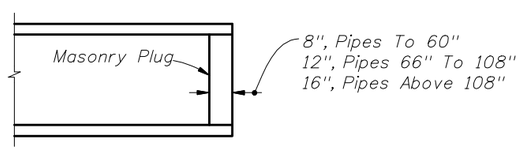
Note: Cost for removal and disposal of portions of top and toe of existing endwall and cost of concrete, reinforcing steel and construction of collar to be included in the contract unit price for pipe culvert.

CONCRETE COLLAR FOR EXTENSION OF EXISTING PIPE CULVERTS



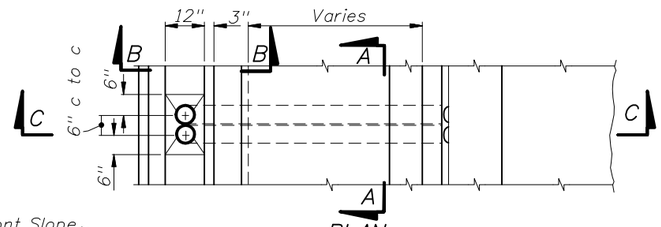
Cost of concrete and steel to be included in contract unit price for pipe culvert.

CONCRETE COLLAR FOR JOINING MAINLINE PIPE AND STUB PIPE

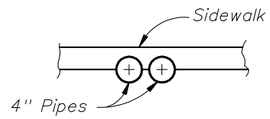


Note: Unless otherwise called for in the plans, the cost of plugging pipes to be included in contract unit price for new pipe.

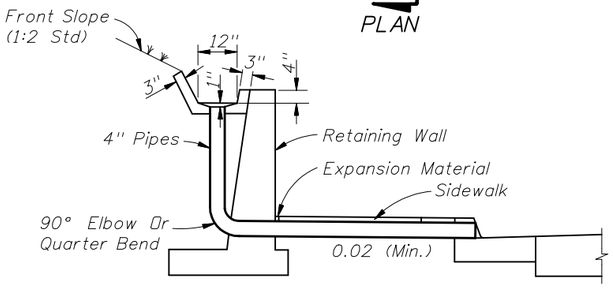
PIPE PLUG



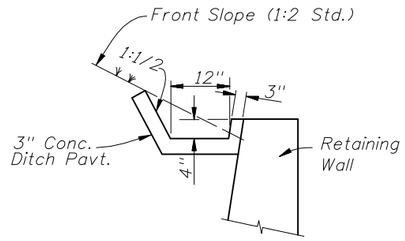
PLAN



SECTION AA



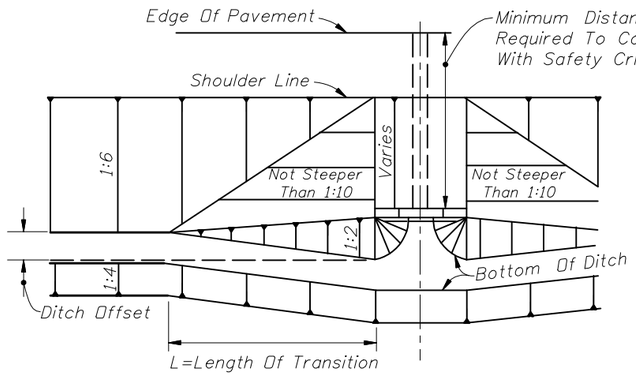
SECTION CC

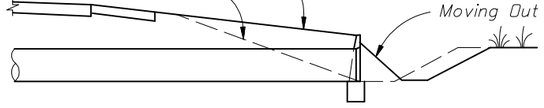


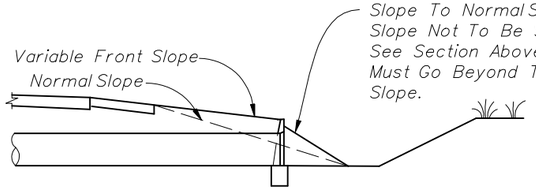
SECTION BB

Note: PVC pipe, Schedule 40, to be paid for under the contract unit price for Polyvinyl Chloride Pipe Culvert (4"), LF.

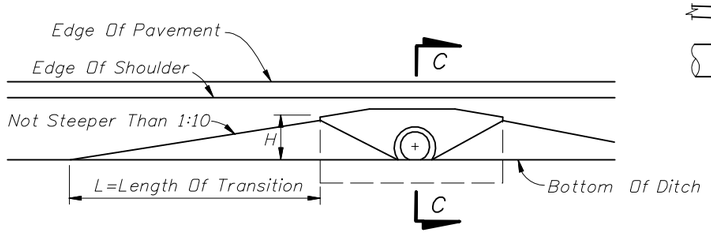
CONCRETE GUTTER AND DRAINS AT RETAINING WALLS







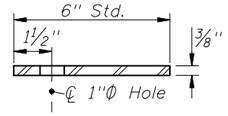
NOTE: Filling or excavation of variable slopes to be done during normal grading operations.



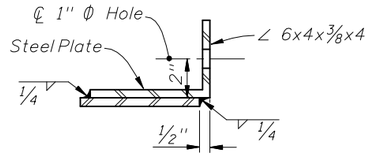
SECTION CC

Use Larger Value Of Either:
1. L=10xH (No Maximum)
2. L=10xDitch Offset (Maximum L=100')

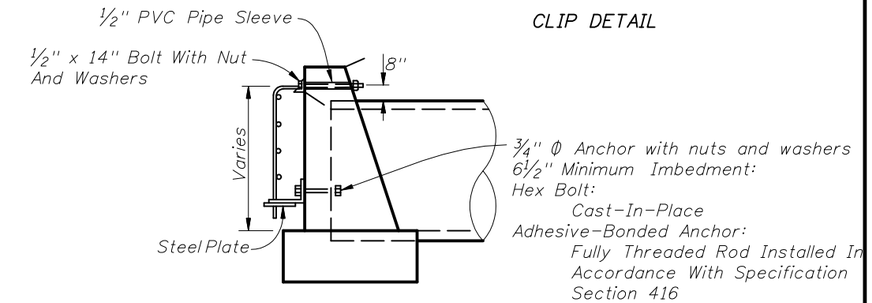
METHOD FOR SETTING LIMITS OF VARIABLE FRONT SLOPES AT DRAINAGE STRUCTURES



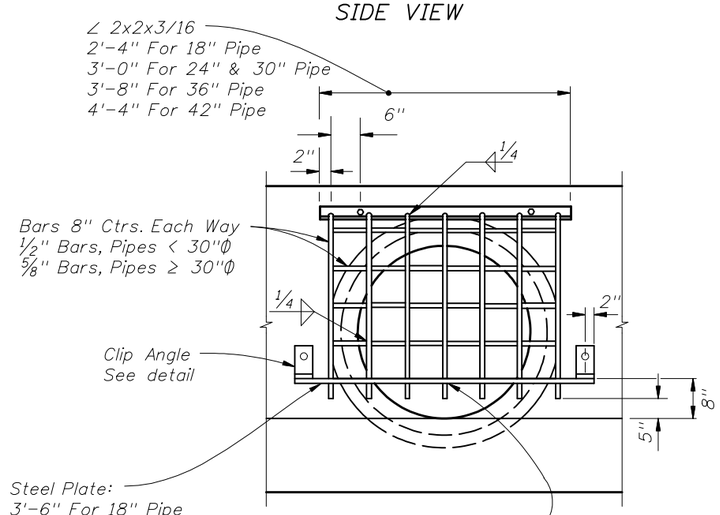
SECTION - STEEL PLATE



CLIP DETAIL



SIDE VIEW



Pipe Dia.	18"	24"	30"	36"	42"
Grate (Lbs.)	48	58	74	90	111

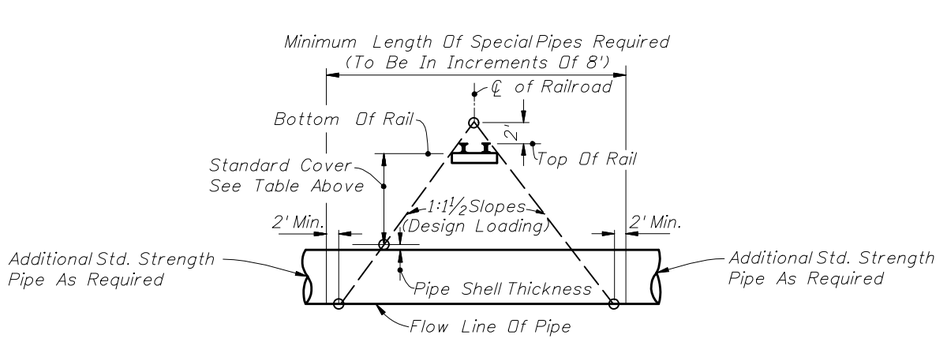
FRONT VIEW

Note: Guards to be constructed only at locations specifically called for in plans. Guard, plate & clips, bolts, nuts and sleeves to be included in the contract unit price for Reinforcing Steel (Miscellaneous).

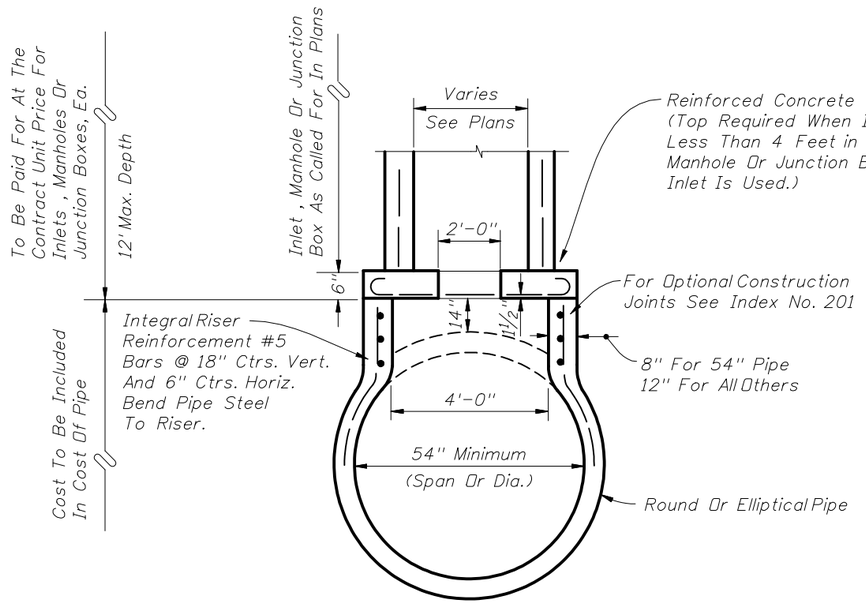
GUARD AT PIPE ENDS

RAILROAD COMPANY	CLEARANCE BELOW BOTTOM OF RAIL (FEET)	STRENGTH ASTM (C76) CLASS
Apalachicola Northern	4.0	IV
Atlanta And St. Andrews Bay	4.0	IV
Florida East Coast	5.5*	IV
Burlington Northern Railroad	S-TRK M/L	IV
	4.5 5.5	
CSX Transportation, Inc.	5.5	IV
Southern Railway System		
Georgia Southern And Florida	5.5	V
Live Oak Perry And South Georgia	5.5	V
St. Johns River Terminal	5.5	V

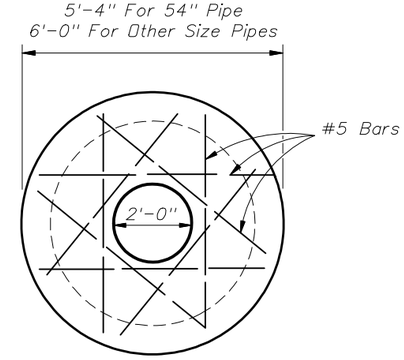
*Clearance is for casing pipe. All subgrade carrier pipelines and wirelines will be installed within a casing pipe which will extend from Right-of-Way line to Right-of-Way line.



METHOD FOR DETERMINING THE LENGTH OF SPECIAL PIPE REQUIRED UNDER RAILROADS

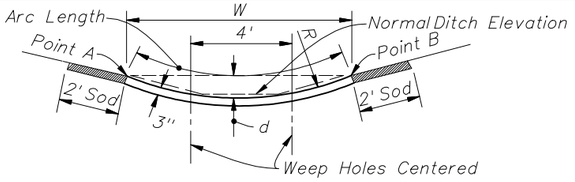


SECTION



PLAN OF TOP

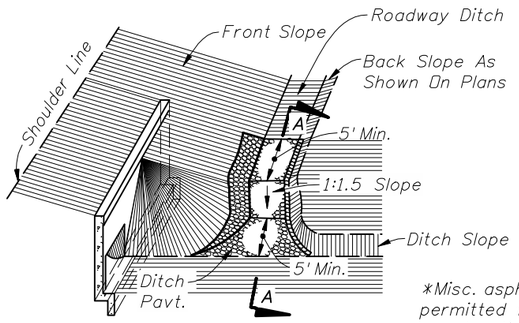
INLETS, MANHOLES OR JUNCTION BOXES
ON INTEGRAL PRECAST CONCRETE RISER FOR CONCRETE PIPE



TO REPLACE:	W	d	R	Rows Of Weep Holes	Arc Length
6' Median Swale	6'	0.24'	19'	0	6.0'
1:6 Front Slopes; 1:4 Back Slope					
5' BW Ditch	10'	0.67'	19'	2	10.1'
4' BW Ditch	9'	0.54'	19'	2	9.1'
1:4 Front Slopes & Back Slope					
5' BW Ditch	9'	0.74'	14'	2	9.2'
4' BW Ditch	8'	0.58'	14'	1 (in center)	8.1'

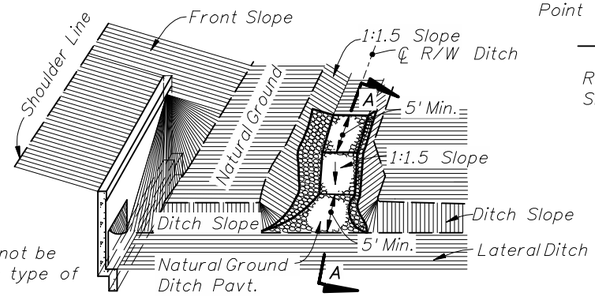
For use only where side slopes are 1:4 or flatter. Point "A" and "B" are to be the same elevation and should be used to locate the paved section.

ALTERNATE DITCH PAVEMENT

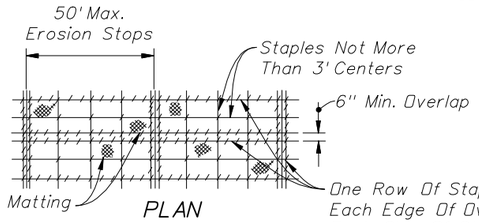


*Misc. asphalt will not be permitted for this type of construction.

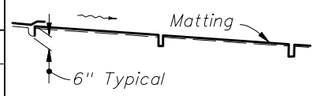
JUNCTION OF ROADWAY DITCH* AND LATERAL DITCH



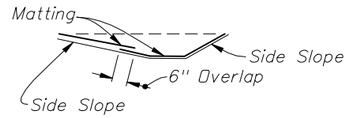
JUNCTION OF R/W DITCH* AND LATERAL DITCH



PLAN

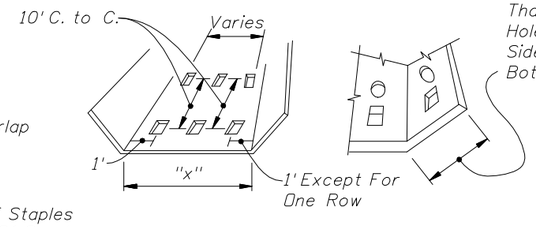


LONGITUDINAL SECTION



SECTION

MATTING FOR DITCH

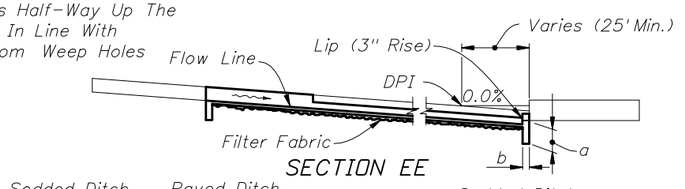


When Width Is Greater Than 4', Const. Weep Holes Half-Way Up The Side In Line With Bottom Weep Holes

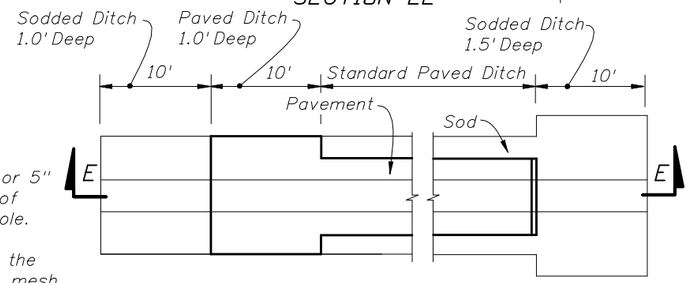
When "x"= 1' To 4' Const. 1 Row (Centered)
"x"= 5' To 7' Const. 2 Rows
"x"= 8' To 12' Const. 3 Rows
"x"= 13' To 17' Const. 4 Rows
"x"= 18' To 22' Const. 5 Rows

Note:
All weep holes to be 3"x4" rectangle or 4" or 5" dia. circle hole. ½ cu. ft. (12" x 12" x 6") of No. 6 aggregate to be placed under each hole. 1 sq. ft. of galv. wire mesh (¼" openings) shall be placed between the aggregate and the concrete. Cost of holes, aggregate and wire mesh to be included in the cost of ditch pavement.

WEEP HOLE ARRANGEMENT

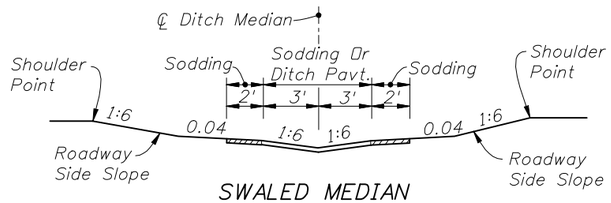


SECTION EE

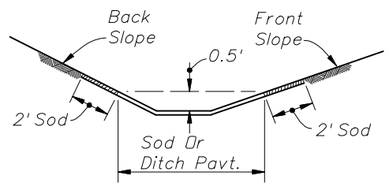


PLAN

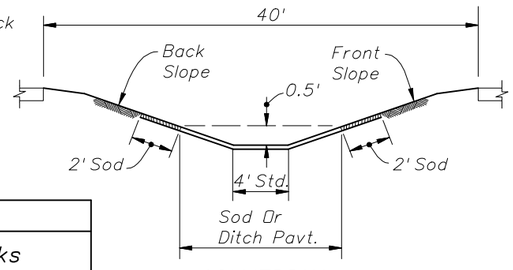
PAVED DITCH END TREATMENT



SWALED MEDIAN (No Weep Holes)



ROADWAY SIDE DITCH

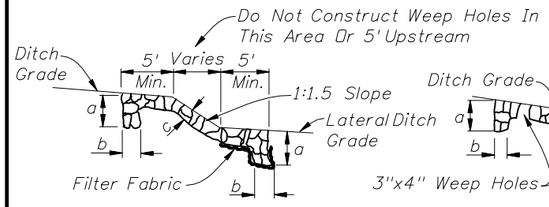


40' MEDIAN

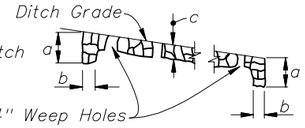
GENERAL NOTES

1. Type of ditch pavement shall be as shown on plans.
2. In concrete ditch pavement, contraction joints are to be spaced at 25' maximum intervals, or as directed by the Engineer. Contraction joints may be either formed (construction joint) or tooled. No open joints will be permitted in concrete ditch pavement.

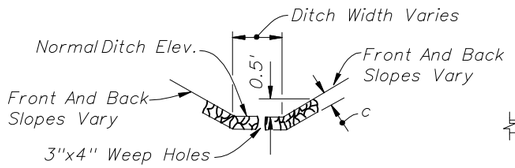
   Expansion joints with ½" preformed joint filler shall be constructed at all inlets, endwalls, and at intervals of not more than 200'.
3. Lip at end of ditch pavement shall normally be located downstream of DPI or on flatter grades where there is a decrease in ditch velocity.
4. Toewalls are to be used with all ditch paving. A toewall is not required adjacent to drainage structures.
5. When directed by the Engineer, weep hole spacing may be reduced to 5' minimum.
6. For junction of R/W ditch spillway and lateral ditch, sides of paving to be 1' high minimum.
7. For ditch pavements requiring filter fabric, the fabric shall be placed directly beneath the pavement for the entire length and width of the pavement. When weep holes with aggregate are used, the filter fabric shall be placed below the aggregate to form a mat continuous with or underlapping the pavement fabric. (See Index No. 199 for fabric type and application).
8. Ditch pavement requiring reinforcement shall be detailed in the plan.
9. Cost of plastic filter fabric to be included in the contract unit price for ditch pavement.
10. Sodding to be paid for under contract unit price for Performance Turf, SY



SECTION AA

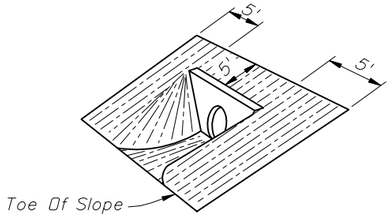


PROFILE OF DITCH PAV'T AT LOCATIONS OTHER THAN JUNCTION WITH LATERAL DITCH



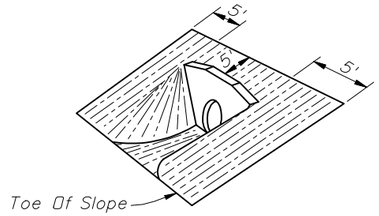
TYPICAL SECTION

DITCH PAVEMENT								
Pavement Type	Dimensions a	b	c	Payment Unit	Basis Of Estimate	Filter Fabric Type	Velocity Range	References & Remarks
Concrete	24"	6"	3"	SY	SY	D-6	Low-High	Section 524 of the Standard Specifications.
Miscellaneous Asphalt	24"	12"	4"	TN	0.2 TN/SY	None	Low-Moderate	Section 339.
Riprap (Sand-Cement)	24"	12"	4"	CY	0.11 CY/SY	D-4	Low-Moderate	Section 530. Grouting of joints required.
Riprap (Ditch Lining)				TN	TN	D-2	Moderate-High	Section 530.

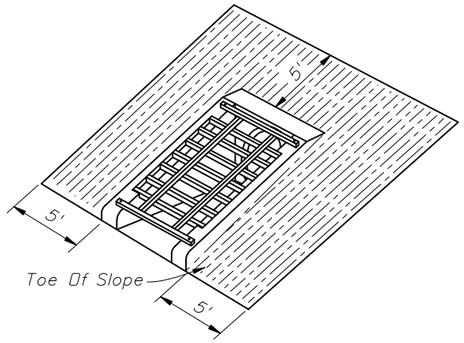


Note: Sodding quantities for each endwall to be determined by the designer from this detail.

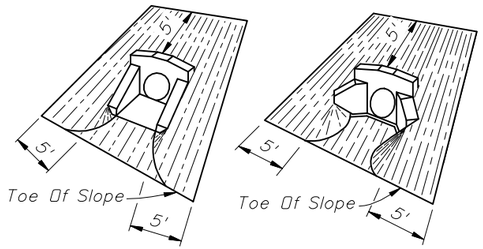
(EXCEPT INDEX NO. 250)
STRAIGHT ENDWALL



STRAIGHT ENDWALL
INDEX NO. 250

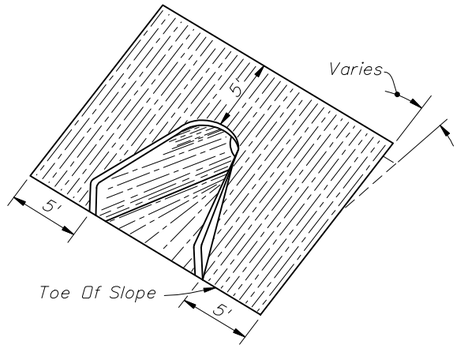


U-TYPE ENDWALL
INDEX NO. 261

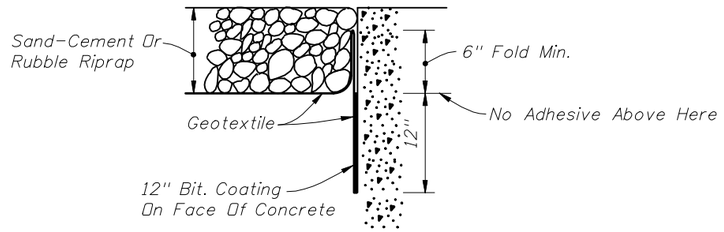


U-TYPE WINGS 45° WINGS

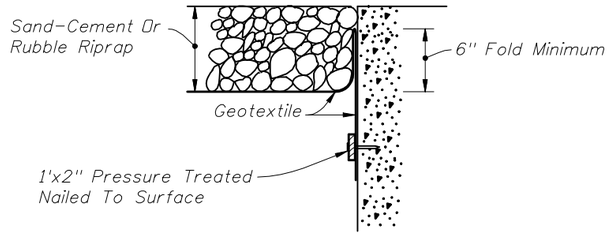
WINGED ENDWALLS
INDEX NO. 266



FLARED END SECTION
INDEX NO. 270



BONDED OPTION



NAILED OPTION

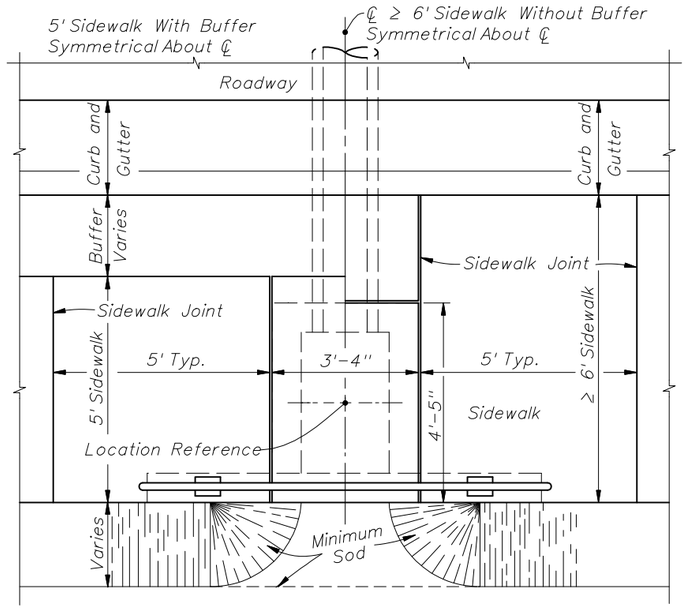
Note: Either option may be used unless otherwise called for in the plans.

GEOTEXTILE PLACEMENT AT CONCRETE STRUCTURE

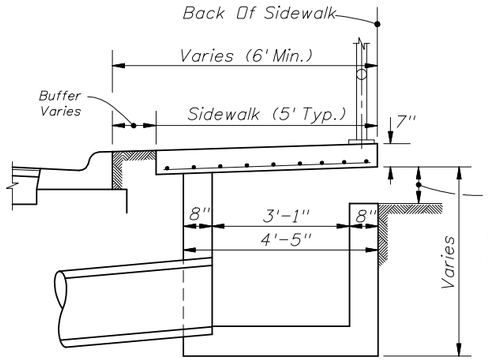
SOD QUANTITIES (SY)

PIPE SIZE	INDEX NO. 250												INDEX NO. 261				INDEX NO. 266				INDEX NO. 270
	SLOPE												SLOPE				SLOPE				ALL SLOPES
	1:2			1:3			1:4			1:6			1:2	1:3	1:4	1:6	1:2	1:3	1:4	1:6	
	PIPES												PIPES				PIPES				PIPES
	1	2	3	1	2	3	1	2	3	1	2	3	1	1	1	1	1	1	1	1	1
12"																	14	15	18	22	10
15"	19	21	24	22	26	29	26	30	33	34	38	43	13 (15)	16	17	23	15	17	20	25	11
18"	21	24	27	25	29	33	30	34	38	39	44	50	14 (16)	17	19	25	16	18	22	28	11
21"																					12
24"	26	30	34	32	37	42	38	44	50	50	58	66	15 (17)	19	21	28	19	22	26	34	14
27"																					15
30"	31	37	42	39	46	53	46	55	63	62	74	85	17 (18)	21	24	32	21	25	30	40	16
36"	37	44	52	46	56	65	56	67	79	76	91	107					24	29	35	47	18
42"	43	53	62	55	67	79	67	82	96	91	111	132					27	32	39	54	19
48"	50	62	73	64	79	93	78	97	115	108	133	158					30	36	44	61	21
54"	57	71	85	74	92	110	91	113	136	126	157	188									21
60"																					22
66"																					25
72"																					26
													() Endwall With Baffles								

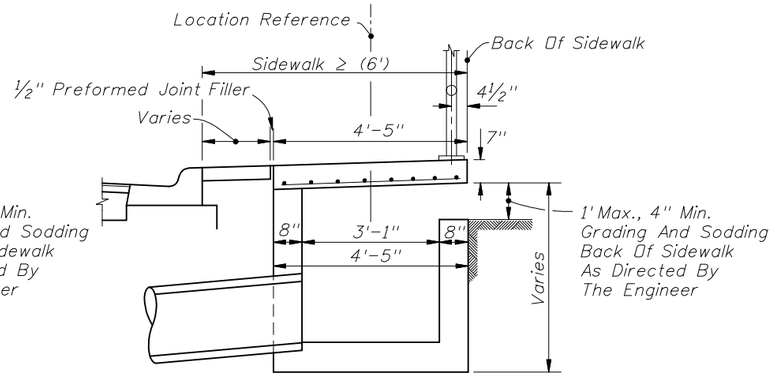
SOD



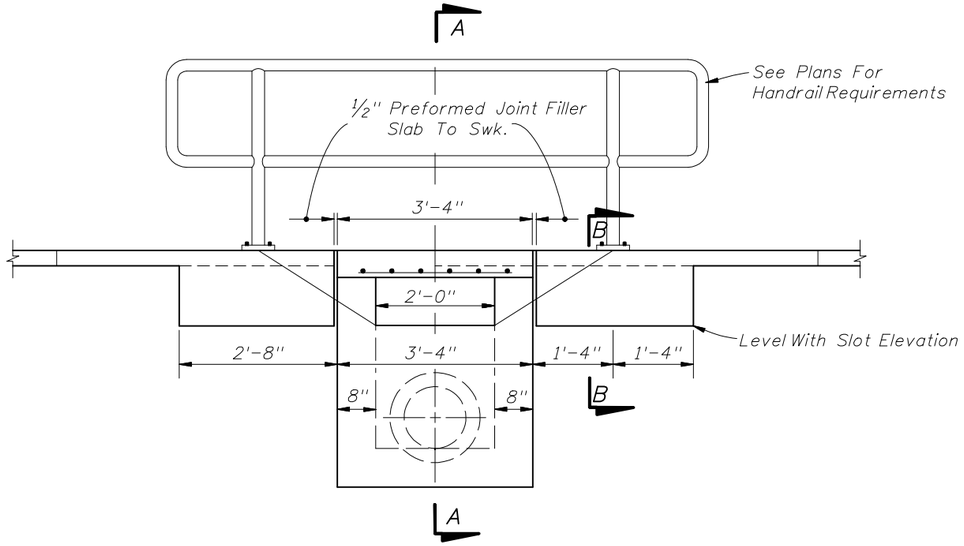
PLAN



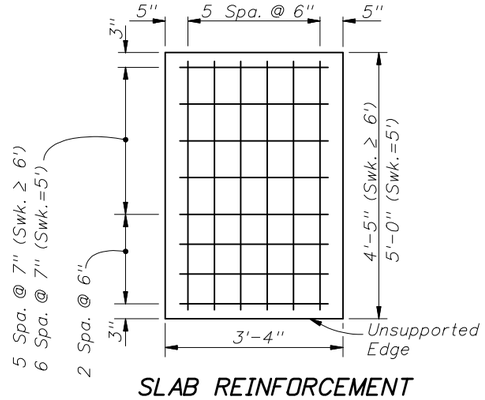
5' SIDEWALK
SECTION AA



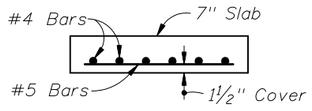
≥ 6' SIDEWALK
SECTION AA



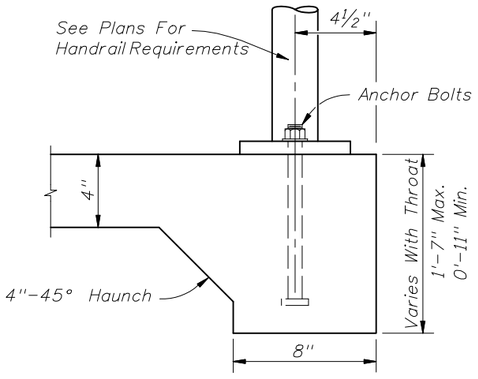
FRONT ELEVATION



SLAB REINFORCEMENT



SLAB SECTION



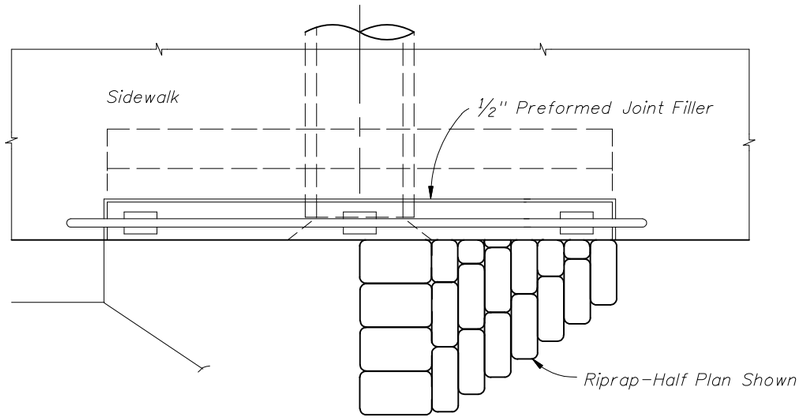
SECTION BB

Notes:

1. For additional details see Index No. 232.
2. Inlet to be paid for under the contract unit price for Inlets (Ditch Bottom Type C Modified), EA. Handrail to be paid for under the contract unit price for Pipe Handrail, (Material), LF.

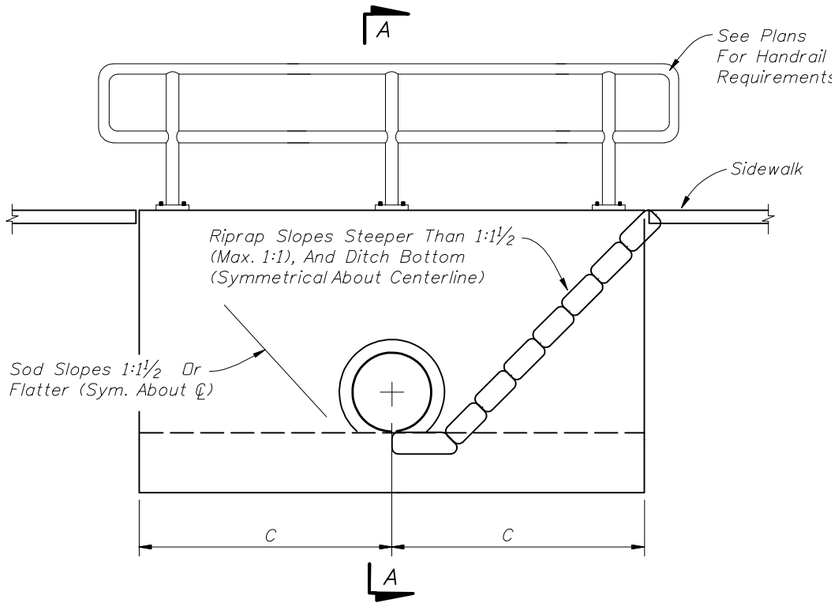
INLET TYPE C (MODIFIED)

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION	2010 FDOT Design Standards	Last Revision 07/01/09	Sheet No. 1 of 3
	BACK OF SIDEWALK DRAINAGE		Index No. 282

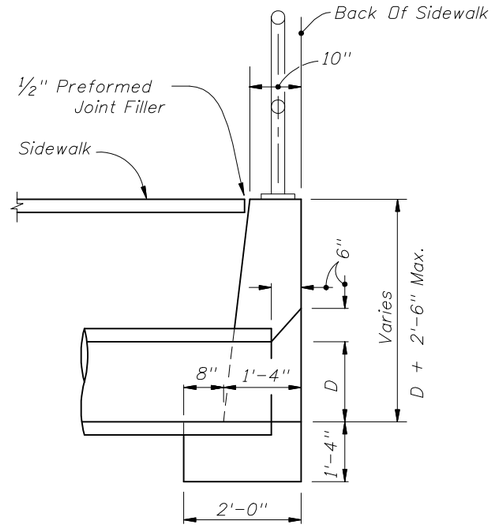


PLAN

Pipe Size	C	Conc.-CY	Riprap-CY (Sand-Cement)
15"	4'-9"	2.27	1.1
18"	5'-3"	2.59	1.3
24"	6'-3"	3.26	1.8



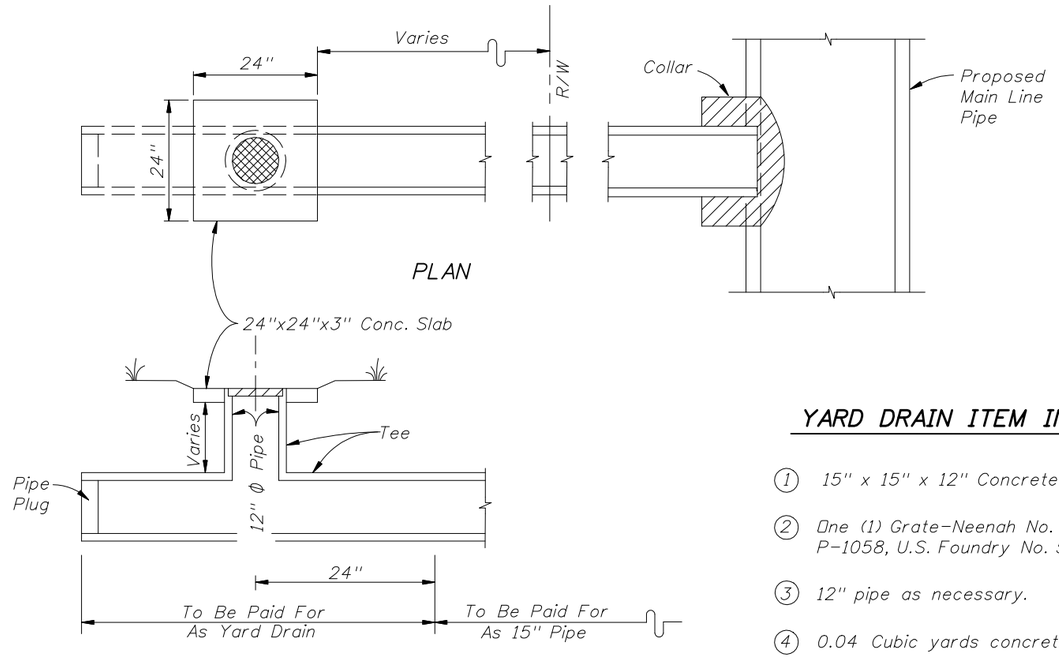
FRONT ELEVATION



SECTION AA

Notes:
1. Maximum pipe size shall be 24" diameter.
2. Grading back of sidewalk varies and shall be done as directed by the Engineer.
3. Concrete quantities shown are for maximum wall heights, and shall be basis for estimate and payment.
4. Riprap quantities shown are for estimate purposes only. Cost of riprap to be included in cost of the endwall.
5. Endwalls to be paid for under the contract unit price for Conc. Class I (Endwalls), CY. Handrail to be paid for under the contract unit price for Pipe Handrail, (Material), LF.

SPECIAL CONCRETE ENDWALL

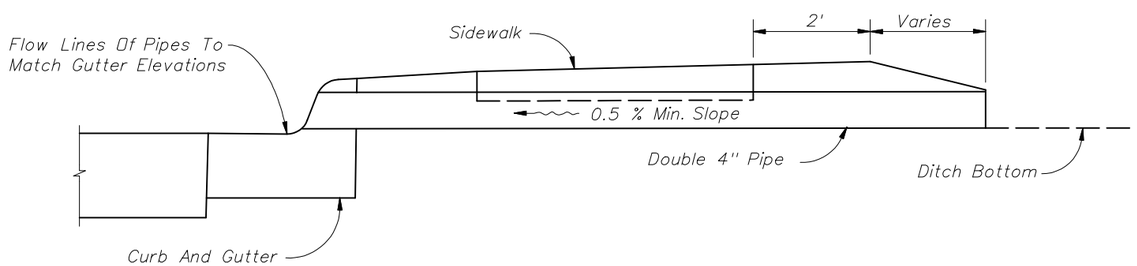


YARD DRAIN ITEM INCLUDES:

1. 15" x 15" x 12" Concrete or PVC Tee 4'long.
2. One (1) Grate-Neenah No. R-4030, Phoenix No. P-1058, U.S. Foundry No. 5605 or equivalent.
3. 12" pipe as necessary.
4. 0.04 Cubic yards concrete for slab.

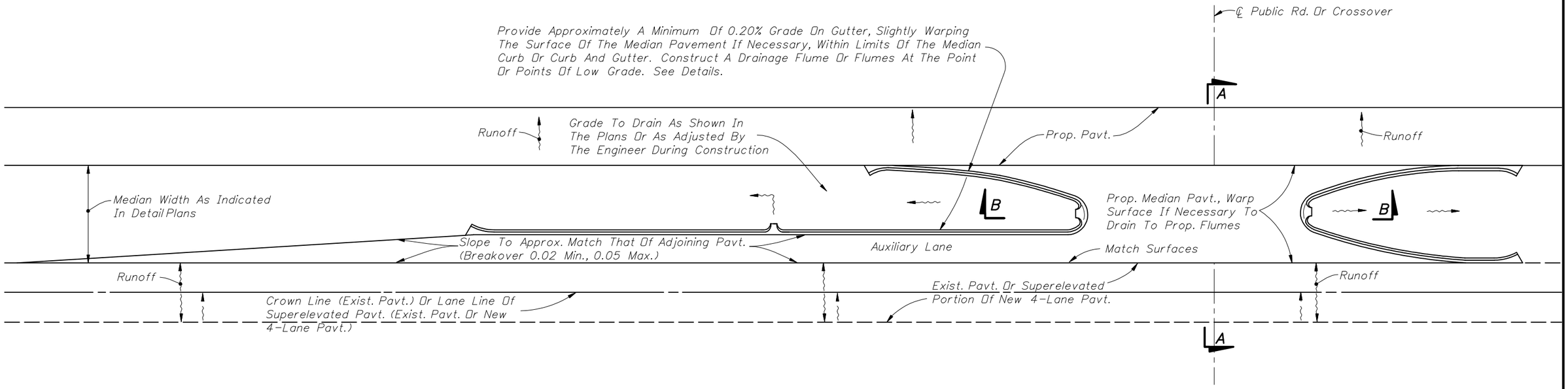
Notes:
1. Yard drains to be located outside the R/W. Drainage area should not exceed 750 SF (grate flow 0.1 Cfs).
2. Yard drains may be constructed at the option of the property owner as shown on the plans.
3. Cost of plugs and collars to be included in the cost for 15" pipe. For collar and plug details see Index No. 280.
4. Yard drains to be paid for under the contract unit price for Yard Drains, EA.

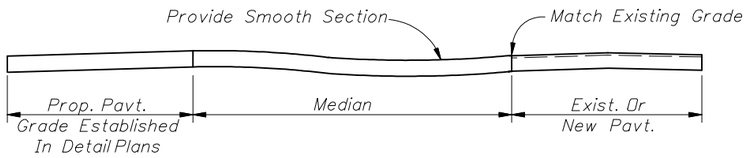
YARD DRAINS



Notes:
1. To be constructed at locations as directed by the Engineer.
2. Either cast iron pipe or PVC rigid conduit, U.L. listed for direct sunlight exposure, Schedule 40, may be used.
3. Pipe to be paid for under the contract unit price for either Cast Iron Soil Pipe (Standard) (4"), LF or Polyvinyl Chloride Pipe Culvert (4"), LF.

SHALLOW DITCHES

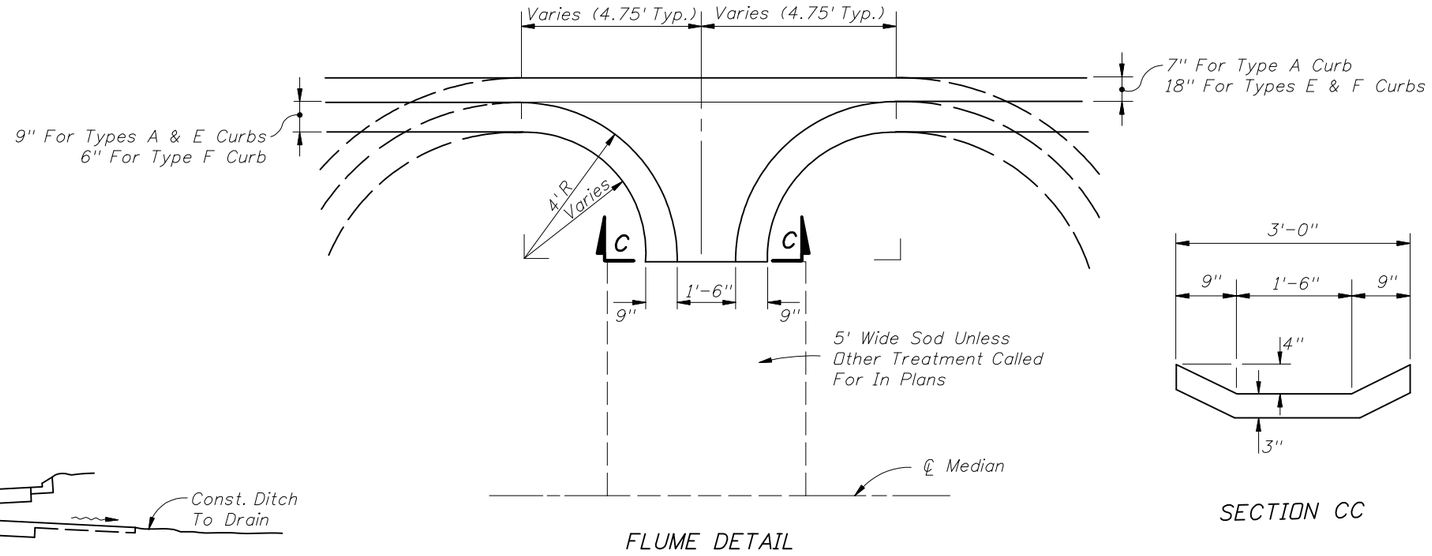




SECTION AA

SECTION BB

(May Drain From Any Point Designated In the Plans Or As Adjusted By The Engineer During Construction)



FLUME DETAIL

SECTION CC

GENERAL NOTES

1. These details are to apply to projects which provide for the conversion of 2-lane sections to 4-lane divided highway sections and for superelevated sections of new 4-lane divided highways. Layout above is illustration only. Cost of flumes to be included in the contract price for Curb or Curb and Gutter. Sod to be paid for under the contract unit price for Performance Turf, SY.
2. Flumes to be located in low point of noses and at other points as designated in the plans. The locations may be adjusted by the Engineer during construction.

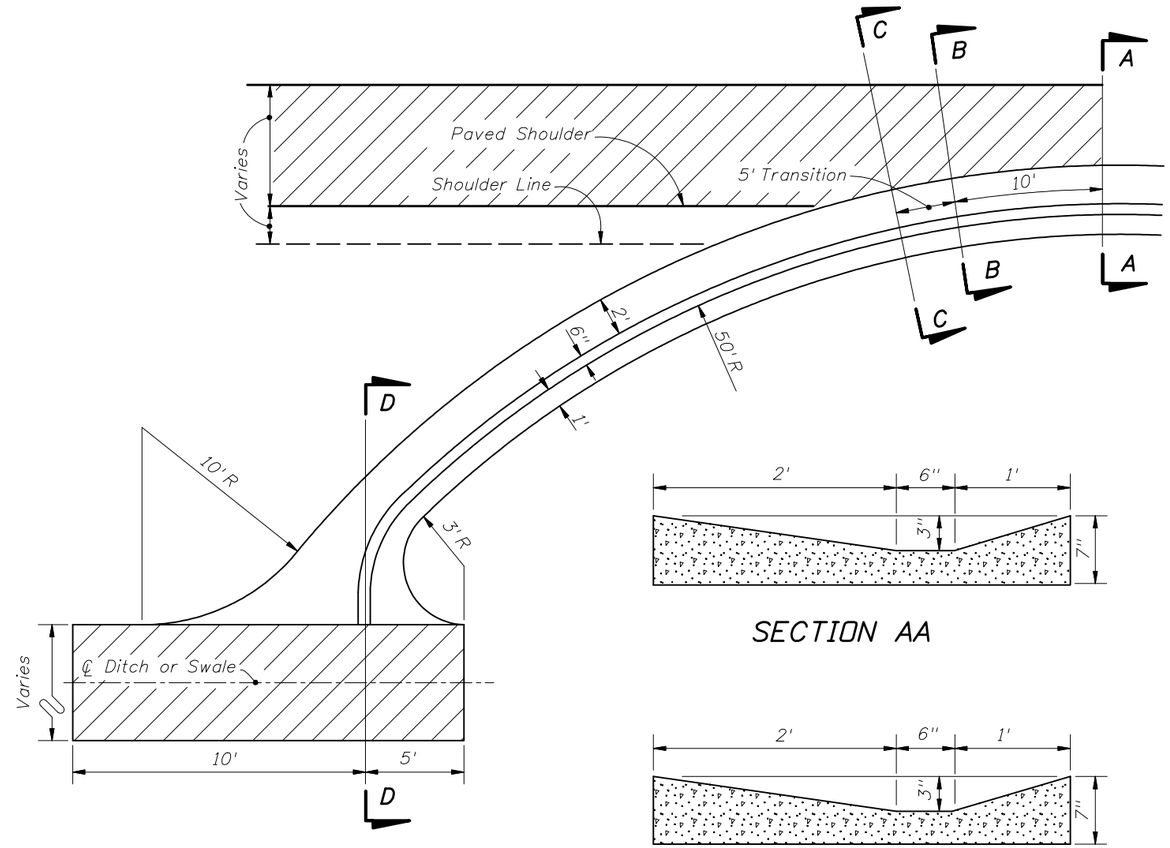
STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

2010 FDOT Design Standards

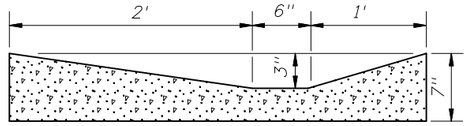
MEDIAN OPENING FLUME

Last Revision	Sheet No.
07/01/07	1 of 1

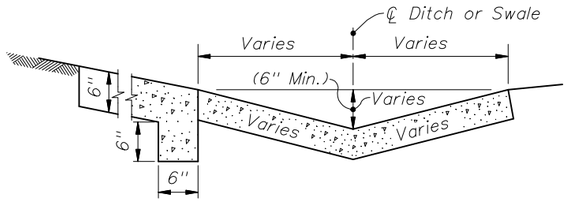
Index No. 283



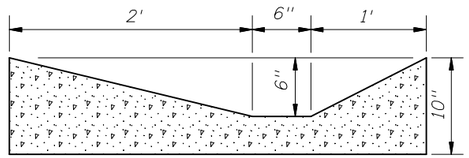
SECTION AA



SECTION BB



SECTION DD



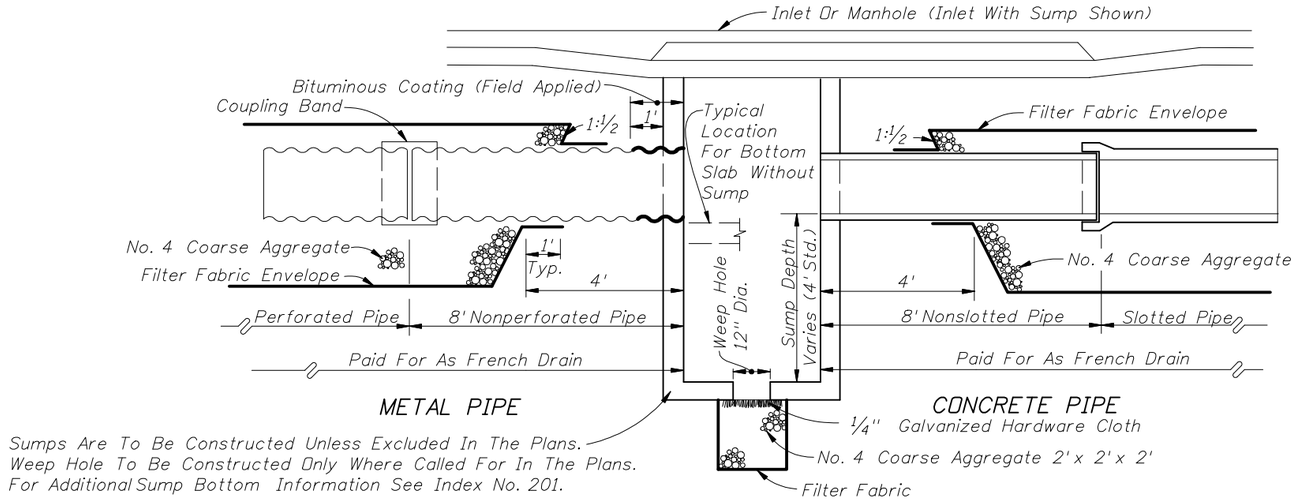
SECTION CC

1. Spillway to be paid for as Shoulder Gutter, L.F.
2. If spillway empties into an unpaved ditch, the detail should be modified as necessary.

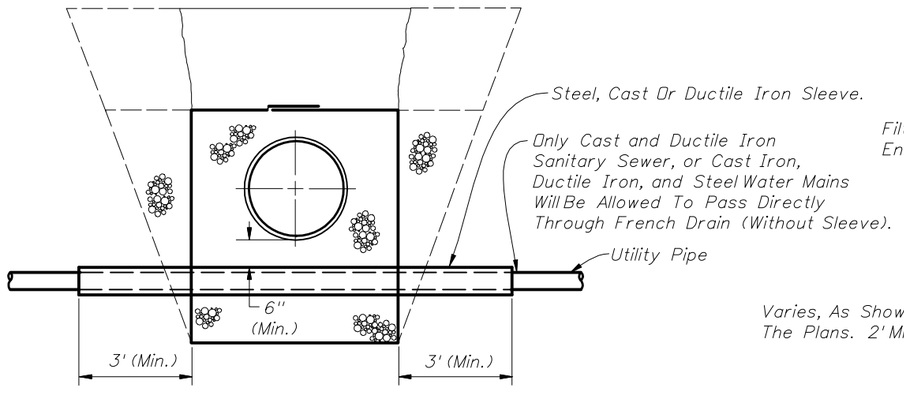
DETAIL OF CONCRETE SPILLWAY AT END OF SHOULDER GUTTER

(TO BE USED WHERE INLETS, PIPES & ENDWALLS ARE IMPRACTICAL)

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION	2010 FDOT Design Standards	Last Revision 07/01/09	Sheet No. 1 of 1
	CONCRETE SHOULDER GUTTER SPILLWAY	Index No. 284	

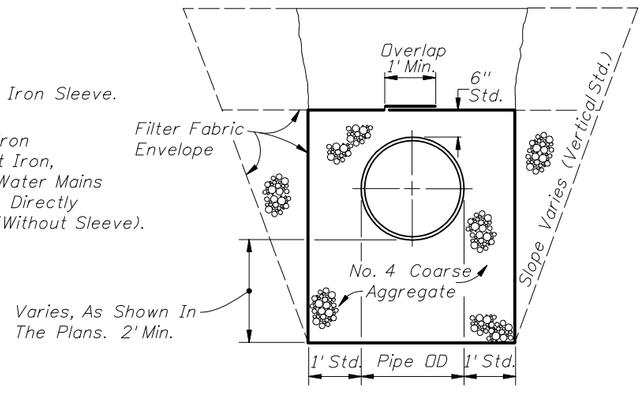


LONGITUDINAL SECTION



ROUND PIPE SHOWN

UTILIITY PIPES THRU FRENCH DRAIN



ROUND PIPE SHOWN

STANDARD CROSS SECTION (ENLARGED)

FRENCH DRAIN SYSTEM

GENERAL NOTES

1. Pipe shall be any of the optional types permitted in Section 443 of the Specifications unless otherwise restricted in the plans. Dissimilar types of pipe will not be permitted in a continuous run of pipe.

2. Concrete pipe shall be placed with the slots positioned on sides.

3. Alignment joints are standard (gaskets not required). Recorrugation of metal pipe ends not required.

4. The contractor may submit other methods of providing slots having equal or greater area of opening, for approval by the Engineer.

5. Filter fabric shall be Type D-3 meeting the requirements of Section 985. All filter fabric joints shall lap a minimum of one (1) foot.

6. The standard cross section shall be constructed unless other section(s) described or detailed in the plans.

7. For supplemental details see Index No. 280.

8. The contractor shall take the necessary precautions to prevent contamination of the trench with sand, silt and foreign materials.

9. French drains following the typical cross section shall be paid for under the contract unit price for French Drains, LF. The unit price shall include the cost of pipe, pipe plugs, pipe fittings, coarse aggregate and filter fabric in place, and the cost for trench excavation, backfill and compaction. The unit price shall also include the cost for disposal of surplus excavated materials and cost for restoration of pavement removed or damaged by french drain construction, but shall not include payments for items paid for elsewhere.

   French drains with a significantly different cross section shall be paid for under the contract unit prices for separate items as follows:

   (a) Slotted or Perforated Pipe Culvert, LF. Unit price shall include cost for pipe, pipe plugs and fittings in place.

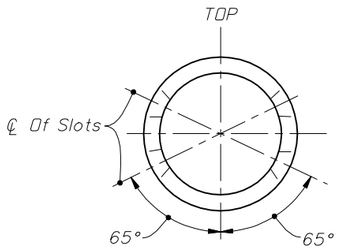
   (b) Ballast Rock (French Drain Aggregate), CY. Unit price shall include cost for coarse aggregate in place, and cost for trench excavation, backfill and compaction. The unit price shall also include the cost for disposal of surplus excavated materials and cost for restoration of pavement removed or damaged by french drain construction, but shall not include payment for items paid for elsewhere.

   (c) Plastic Filter Fabric (Subsurface), SY. Unit price shall be for cost of fabric in place. Quantity shall be determined by plan neat dimensions of the fabric envelope.

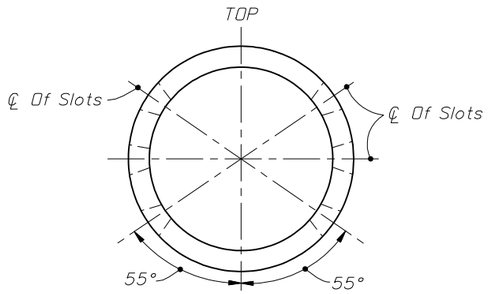
DESIGN NOTES

1. Pipe invert should be at or above the water table whenever possible.

2. French drains with minor dimensional changes or otherwise different from the standard cross-section shall be either described or detailed in the plans. French drains with significantly different cross-sections shall be detailed in the plans.



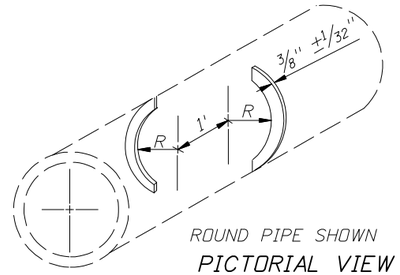
15"–30"



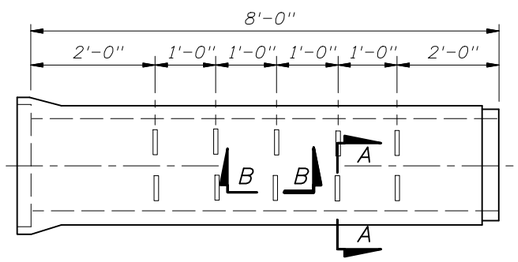
36"–72"

ELLIPTICAL PIPE		
Pipe Size	Slot Cut Opening c	
	Min.	Max.
14"x23"	10"	12"
19"x30"	14"	16"
24"x38"	14"	16"
29"x45"	20"	22"
34"x53"	20"	22"
38"x60"	20"	22"

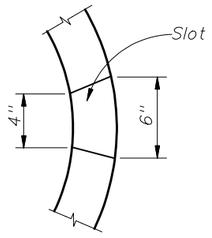
ROUND PIPE		
Pipe Size	Slot Cut Opening c	
	Min.	Max.
15"	12"	14"
18"	12"	14"
24"	16"	18"
30"	16"	18"
36"	22"	24"
42"	22"	24"
48"	22"	24"
54"	24"	26"
60"	24"	26"
66"	24"	26"
72"	24"	26"



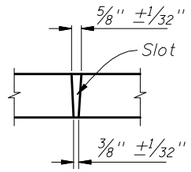
ROUND PIPE SHOWN
PICTORIAL VIEW



SIDE VIEW

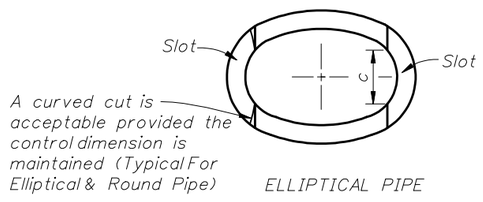


SECTION AA

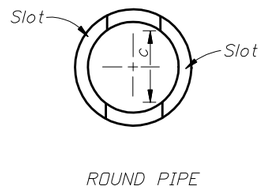


SECTION BB

OPTION A – ROUND PIPE

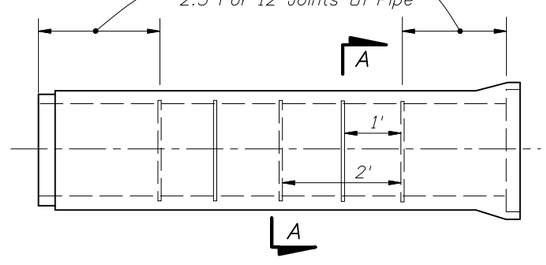


ELLIPTICAL PIPE



ROUND PIPE

SECTION AA



SIDE VIEW

OPTION B – ROUND OR ELLIPTICAL PIPE

SLOTTED PIPE OPTIONS

	2010 FDOT Design Standards	Last Revision 07/01/07	Sheet No. 2 of 2
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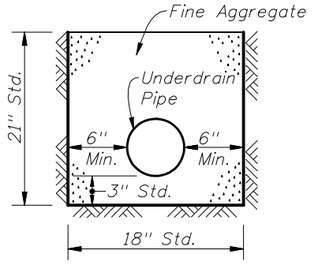
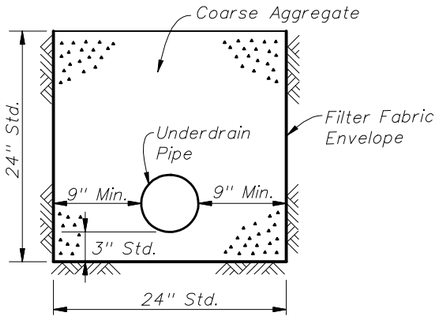
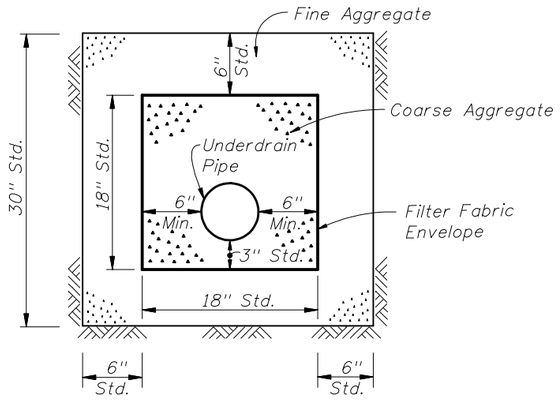


TYPE I



TYPE II



TYPE III

DESIGN NOTES

1. The type of underdrain should be selected to meet design water removal rate and soil conditions. Caution is prescribed in the use of these typical sections since special designs may be required to satisfy project conditions.

2. Type I underdrain is intended for minimum water removal conditions.

3. Type II underdrain is intended for moderate water removal conditions. Where reactive conditions may create chemical clogging, the use of an inert material and/or elimination of the filter fabric may be necessary.

4. Type III underdrain is intended for maximum water removal conditions. Filter fabric is required between the coarse aggregate or fine aggregate including those described in general notes 2 and 3. Design note 3 applies for reactive conditions.

5. Type V underdrain is intended for use in detention basins and other locations which require a filtration system. The standard fine aggregate specified for Type V underdrain conforms to filtration gradation requirements of Chapter 62-25 FAC.

6. The designer should detail in the plans, the location of:
(a) Type V underdrain, (b) nonstandard locations of Type I, II, and III underdrain, (c) underdrain inspection boxes, (d) cleanouts for Type V underdrain, and (e) underdrain outlet pipes.

7. The designer should specify the flow line elevations at the beginning, bends, junctions and ends of underdrain pipes and outlet pipes.

8. The designer should evaluate whether an external filter fabric envelope is required around underdrain Types I and III. When required, fabric shall be specified in the plans.

GENERAL NOTES

1. The underdrain pipe shall be either 4" smooth or 5" corrugated tubing unless otherwise shown in the plans. The size to be furnished will be based on the nominal internal diameter of a pipe with a smooth interior wall. Except when prohibited by the plans, the special provisions or this standard, pipe with a corrugated interior wall may be provided based on the following size equivalency.

   4" smooth interior equivalent to 5" corrugated interior
   5" smooth interior equivalent to 6" corrugated interior
   6" smooth interior equivalent to 8" corrugated interior
   8" smooth interior equivalent to 10" corrugated interior

2. Fine aggregate shall be quartz sand meeting the requirements of Sections 902-4 of the Standard Specifications.

3. Coarse aggregate shall be gravel or stone meeting the requirements of Sections 901-2 or 901-3. The gradation shall meet Section 901, Grades 4, 467, 5, 56 or 57 stone unless otherwise shown restricted in the plans.

4. Underdrain Type I, II, III and V shall be in accordance with Section 440.

5. Filter fabric shall be Type D-3 (See Index No. 199). The internal filter fabric of Type V underdrain shall have a permittivity of 0.7 /sec. and an AOS of #40 sieve.

6. When Type I is used, a filter fabric sock meeting Section 948 is required.

7. See Index No. 500 for the standard location of Type I, II, and III underdrain. The location of Type V underdrain and nonstandard locations of Type I, II, and III underdrain will be as detailed in the plans.

8. All filter fabric joints shall overlap a minimum of 1'. The internal filter fabric of Type V underdrain shall overlap into the coarse aggregate or the fine aggregate a minimum of 1'.

9. Underdrain outlet pipes shall be nonperforated and all bends shall be made using 1/8 (45 deg.) elbows. 90 deg. bends shall be constructed with two 1/8 elbows separated by at least 1' of straight pipe. Outlet pipes stubbed into inlets or other drainage structures shall be not less than 6" above the structure flow line. Outlet pipes discharging to grassed areas shall have concrete aprons, hardware cloth, and bordering sod as shown in Index No. 287 for Edgedrain outlets.

10. Pay Item shall be based on the size of the smooth interior products. The contract unit price for Underdrain, LF, shall include the cost of pipe, fittings, aggregate, sock, filter fabric, underdrain cleanouts, and concrete aprons.

    The contract unit price for Underdrain Outlet Pipe, LF, shall be full compensation for trench excavation, pipe and fittings, concrete aprons, hardware cloth for concrete aprons, stubbing into drainage structures, backfill in place, and disposal of excess materials.

    The contract unit price for Underdrain Inspection Box, EA. shall be for the number completed and accepted.

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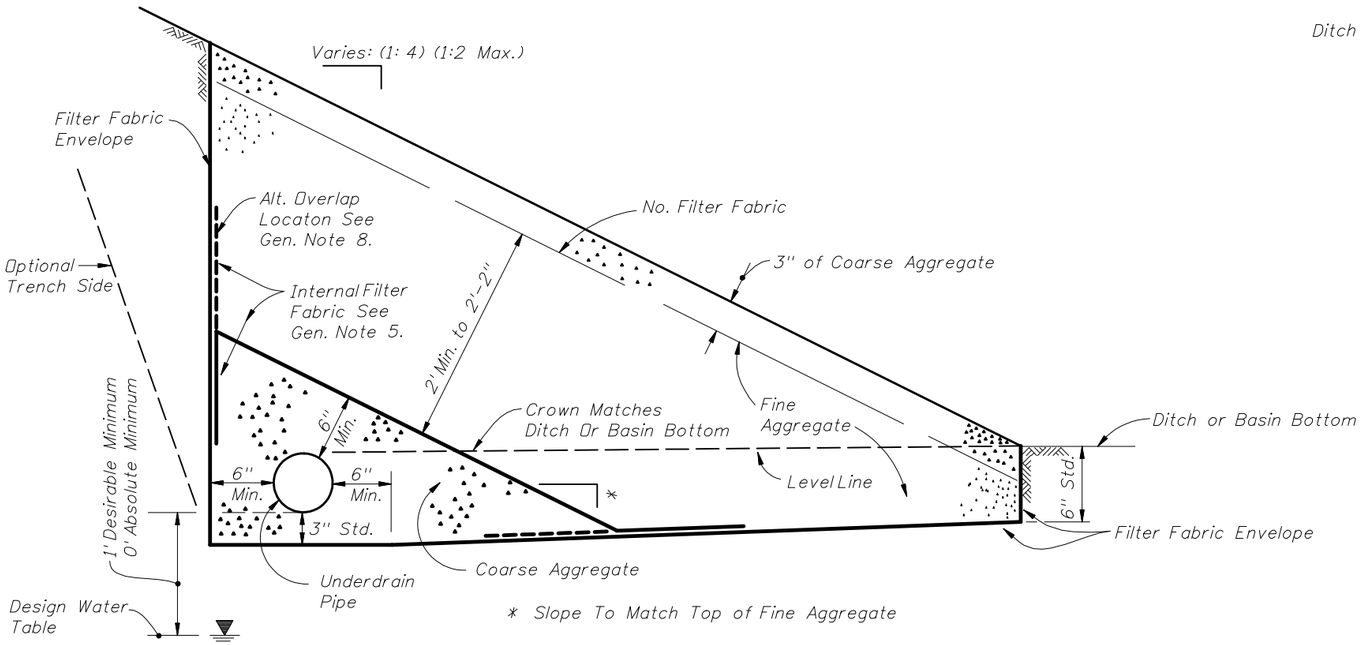
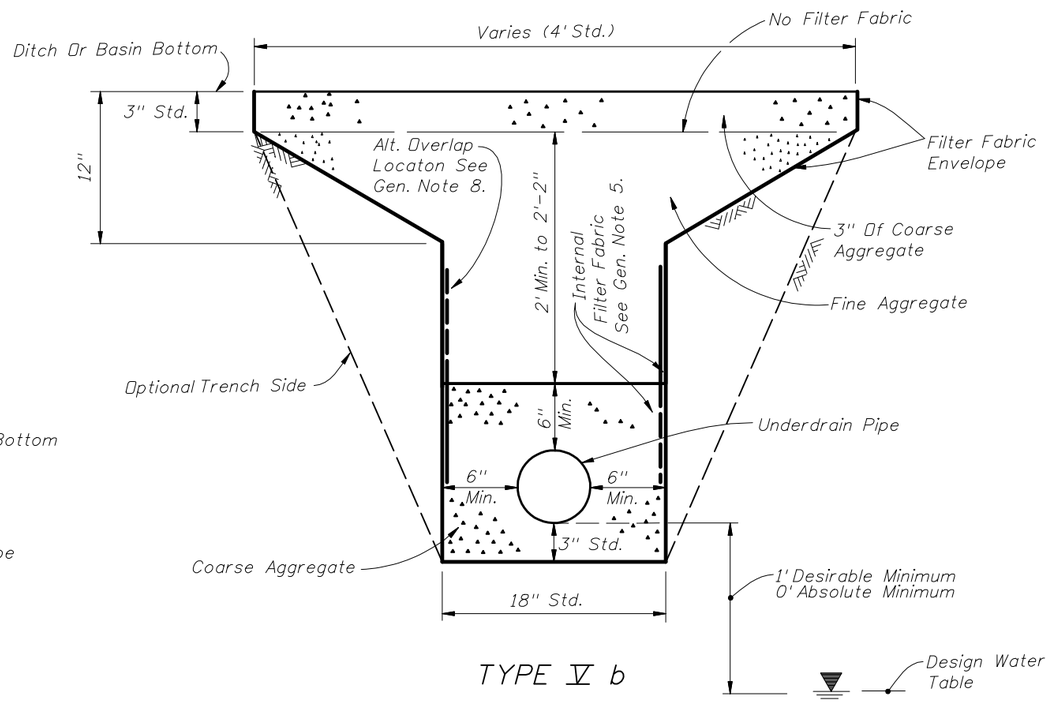
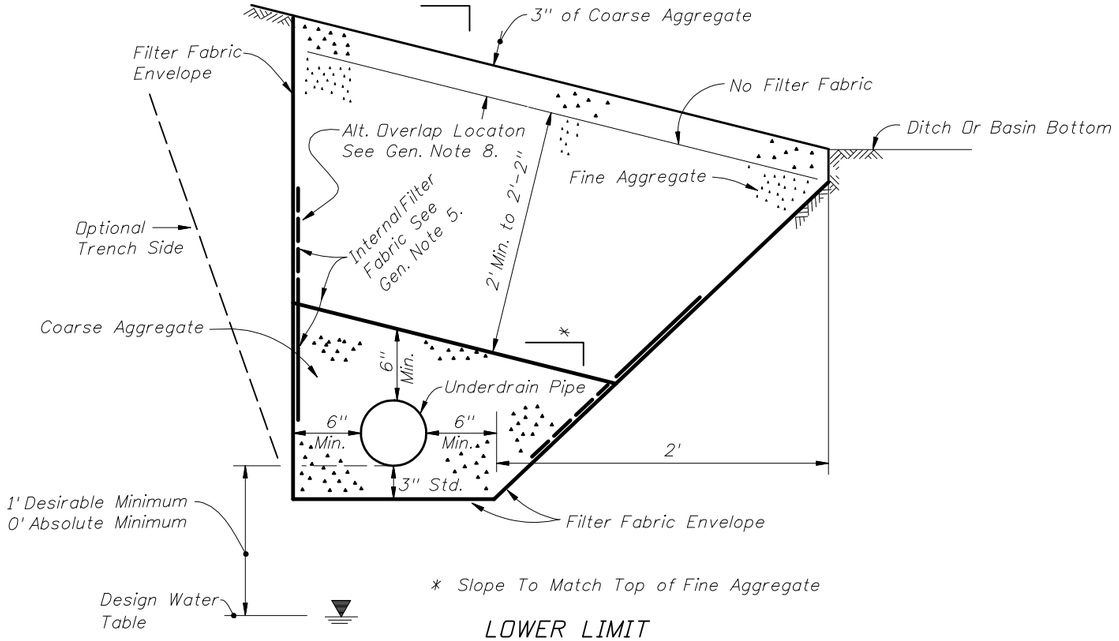


UPPER LIMIT

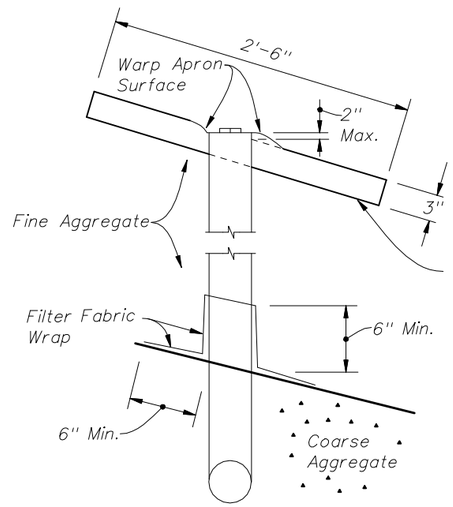


TYPE V b

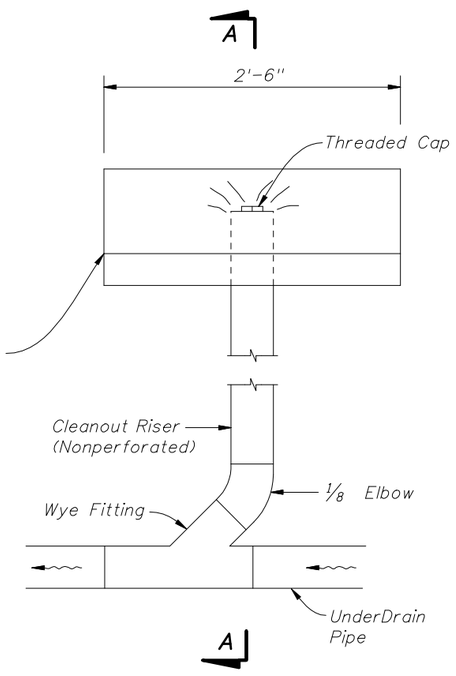


LOWER LIMIT

TYPE V a

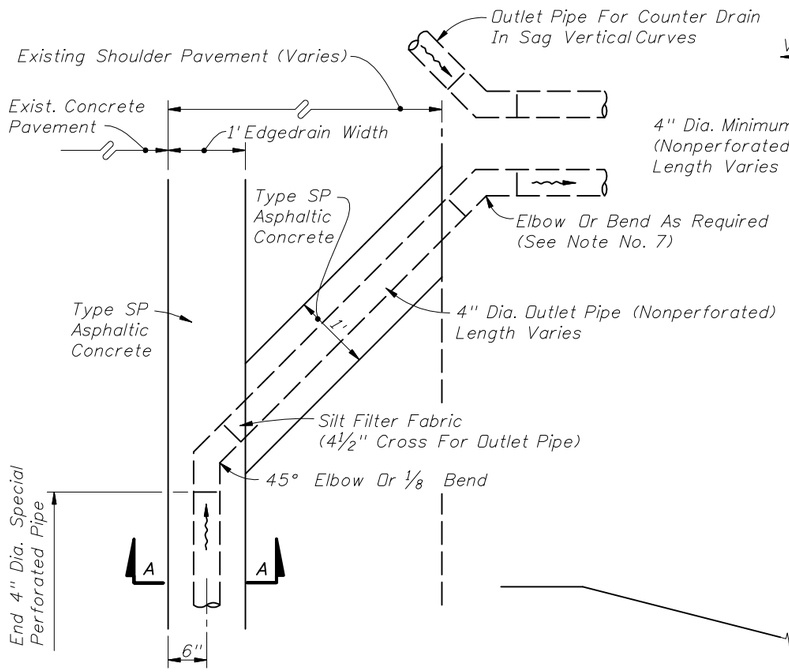


SECTION AA



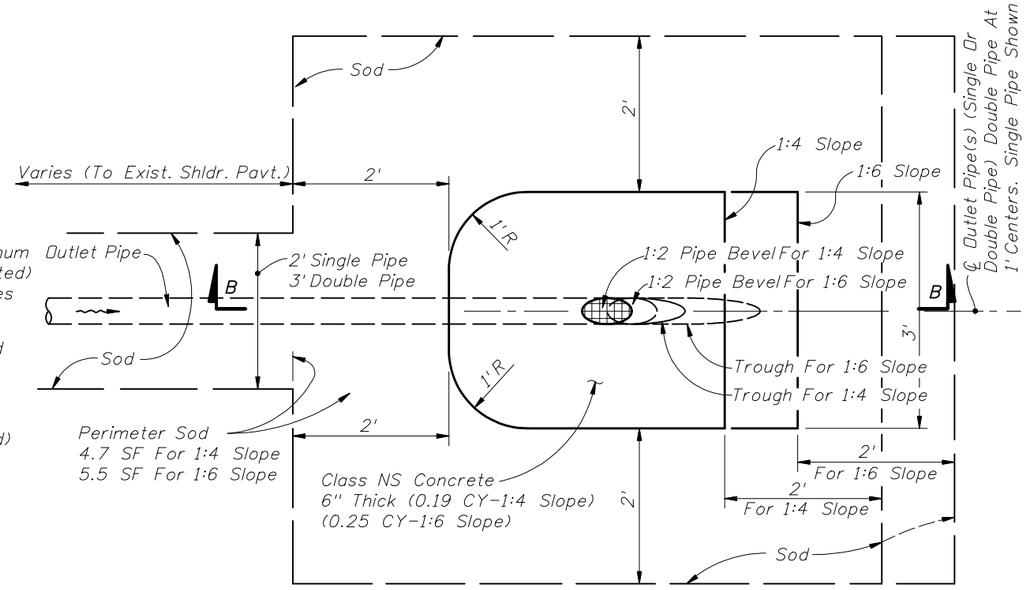
CLEANOUT FOR TYPE V UNDERDRAIN

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION	2010 FDOT Design Standards	Last Revision 02	Sheet No. 2 of 2
	UNDERDRAIN	Index No. 286	

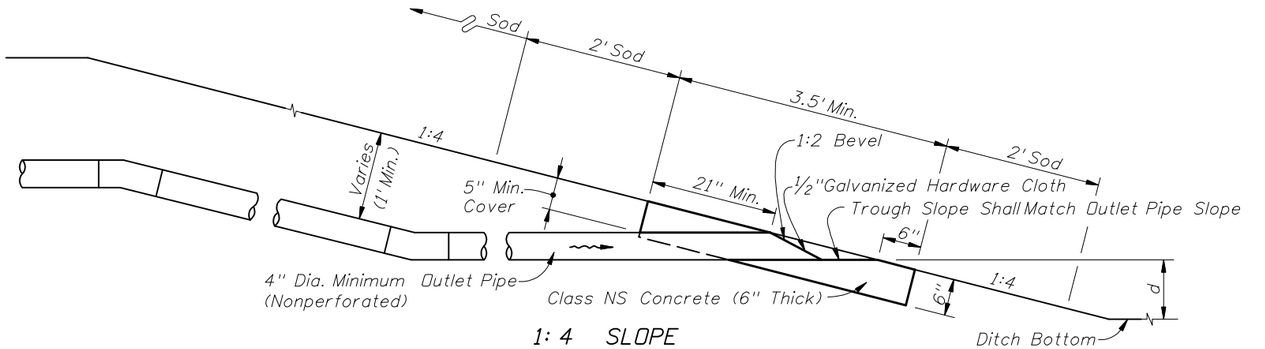


ALIGNMENT OF OUTLET PIPE

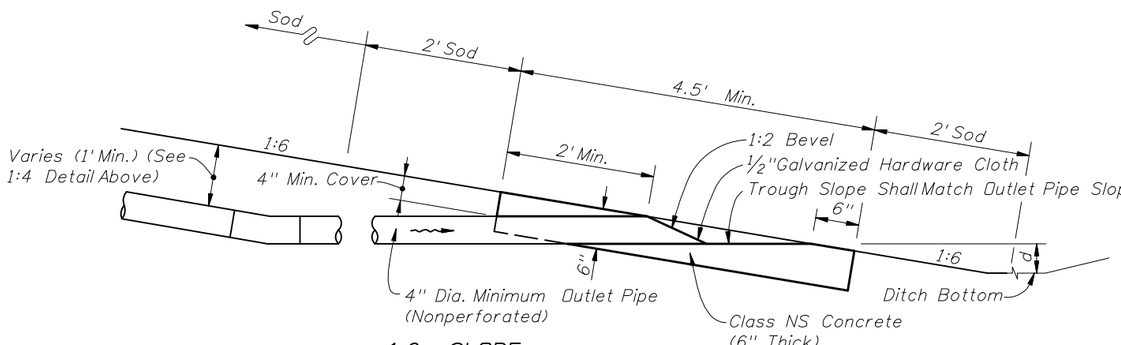
NOTE:
For Section AA see following Sheets.



PLAN - OUTLET PIPE APRON



1:4 SLOPE

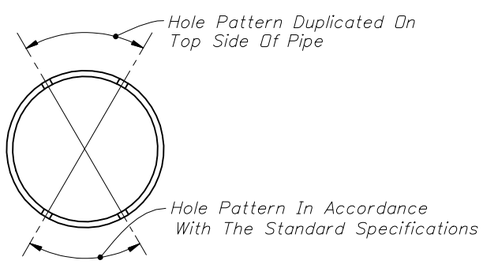


1:6 SLOPE

SECTIONS BB

4" EDGEDRAIN

EDGEDRAIN OUTLET



SUBDRAINAGE PIPE

d= 1.75' std. for grassed ditches [less is acceptable to provide
0.5' std. for paved ditches minimum 0.1% outlet pipe slope]

GENERAL NOTES FOR CONCRETE PAVEMENT SUBDRAINAGE

1. No trench greater than 2' in depth will be allowed overnight. Trenches shall be barricaded at all times.

2. Concrete pavement subdrainage shall be constructed adjacent to the low edge of the roadway pavement and under travel lanes, auxiliary pavement and shoulders, as called for in the plans. When the low edge shifts between outside and inside edges of pavement the concrete pavement subdrainage shall extend 50' beyond and begin 50' before the flat point (100' overlap).

   Concrete pavement subdrainage shall be placed on the low side of ramps of crossroad terminals.

3. Concrete pavement subdrainage shall be constructed on a grade parallel with the edge of pavement profile, except on profiles flatter than one-tenth percent (0.10%) the concrete pavement subdrainage shall be constructed on a grade of one-tenth percent (0.10%).

4. Immediately prior to placing the filter fabric the entire vertical face of the concrete pavement shall be cleaned to remove adhering base material and soil.

5. The Contractor shall devise a procedure for holding the filter fabric in position on the vertical face of the trench. The procedure must be approved by the Engineer prior to placement of the draincrete.

6. The upper end of each separate run of the concrete pavement subdrainage pipe shall be capped.

7. Outlet pipes shall be constructed at a maximum of 500' intervals. Elbows or ⅛ bends shall be used to connect the outlet pipe to the concrete pavement subdrain pipe. The elbows or bends shall be of the same material as the outlet pipe but compatible with the pipe.

   When directed by the Engineer, outlet pipes shall be stubbed into existing inlets or into existing ditch pavements at an elevation 6" above the inlet flowline or ditch bottom. Concrete apron and bordering sod are not required for stubbed outlets, but replacement sodding will be required at trenches for pipes stubbed into paved ditches.

   In sag vertical curves separate outlet pipes for concrete pavement subdrains from opposite directions shall use a single apron unless otherwise shown in the plans or otherwise directed by the Engineer.

   Backfill around outlet pipes shall be of cohesive soils, draincrete will not be permitted.

8. Existing paved shoulder that is removed for the construction of outlet pipes shall be replaced with Type SP asphaltic concrete at the rate of 500 LB per SY.

9. The conract unit price for Edgedrain Outlet Pipe (4") LF, shall be full compensation for removal of existing shoulder pavement, trench excavation, pipe and fitting, concrete apron, hardware cloth, sod, stubbing into existing inlets and paved ditches, restoration of ditch pavement, backfill in place, and disposal of excess materials.

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CONCRETE PAVEMENT SUBDRAINAGE

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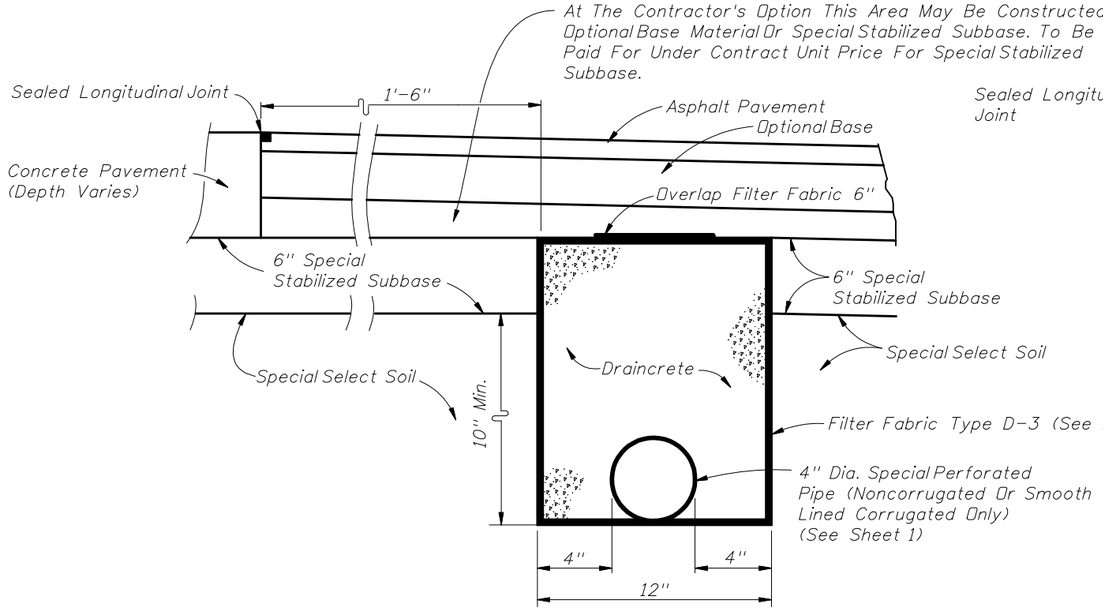
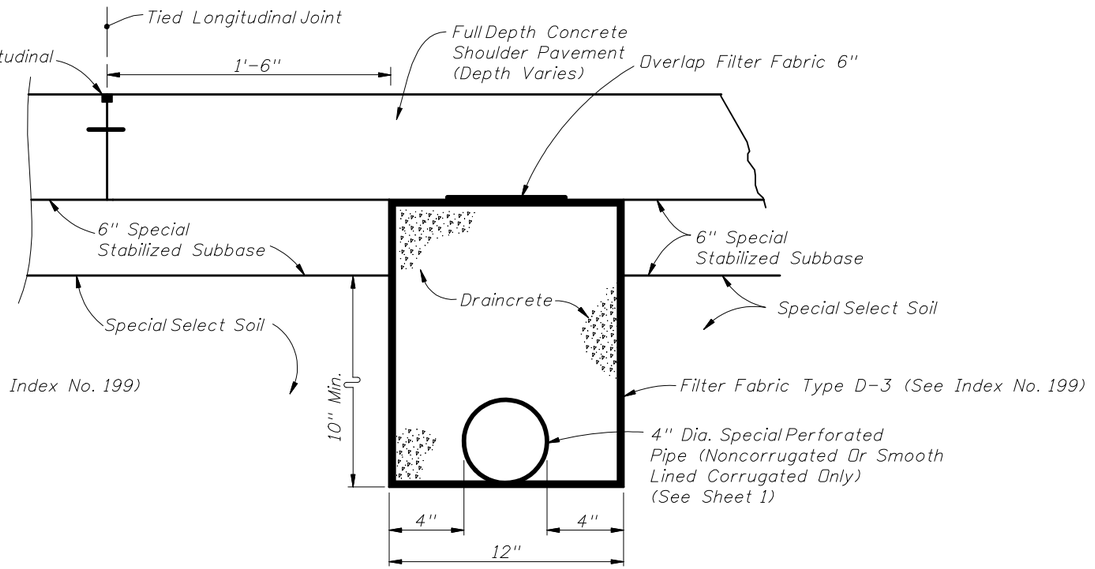
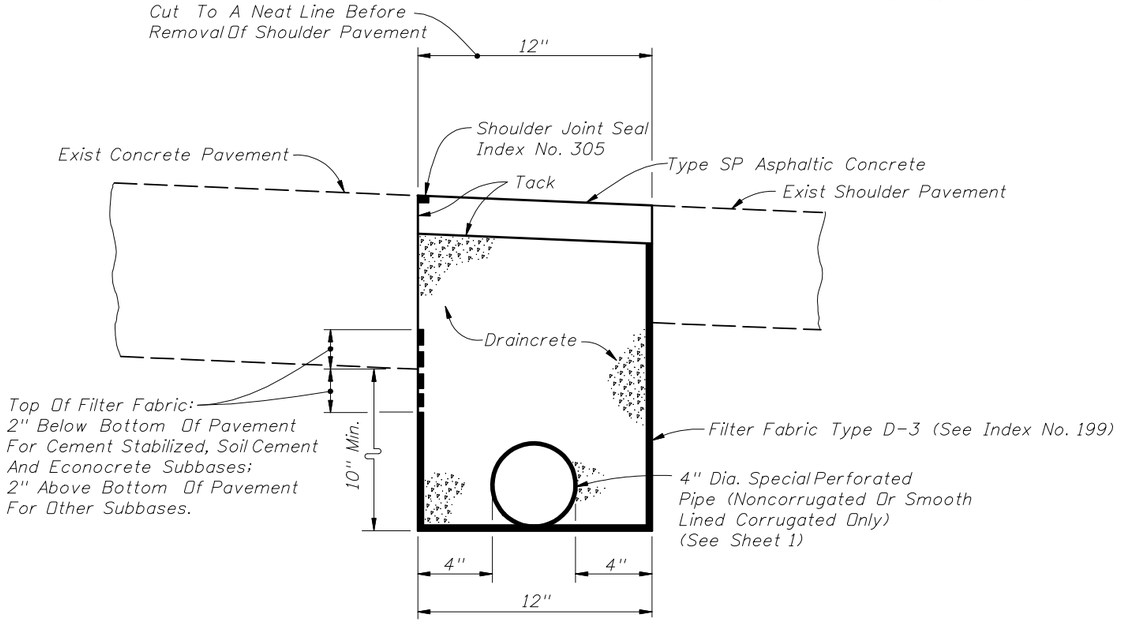


ASPHALT SHOULDERS



CONCRETE TRAVEL LANES, SHOULDERS, AND AUXILIARY PAVEMENT

NEW CONSTRUCTION



REHABILITATION

DRAINCRETE SUBDRAINAGE

NOTES FOR DRAINCRETE PAVEMENT SUBDRAINAGE

1. The edgedrain sections for DRAINCRETE SUBDRAINAGE are applicable to pavement construction identified as RIGID PAVEMENT on Index No. 505, Sheet 2 and 4.

2. The contractor shall confine the construction of draincrete edgedrain to an area in which the entire operation can be carried out in five (5) work days, unless another construction period is called for in the plans, with sufficient time allowed for the draincrete to set before placement of pavement.

METHOD OF PAYMENT

NEW CONSTRUCTION:

1. The contract unit price for Edgedrain (Draincrete) LF shall be full compensation for trench excavation, disposal of excess material, filter fabric, draincrete edgedrain pipe and fittings and draincrete.

   Payment for outlet pipe shall be in accordance with General Note 9, Sheet 1 of 4.

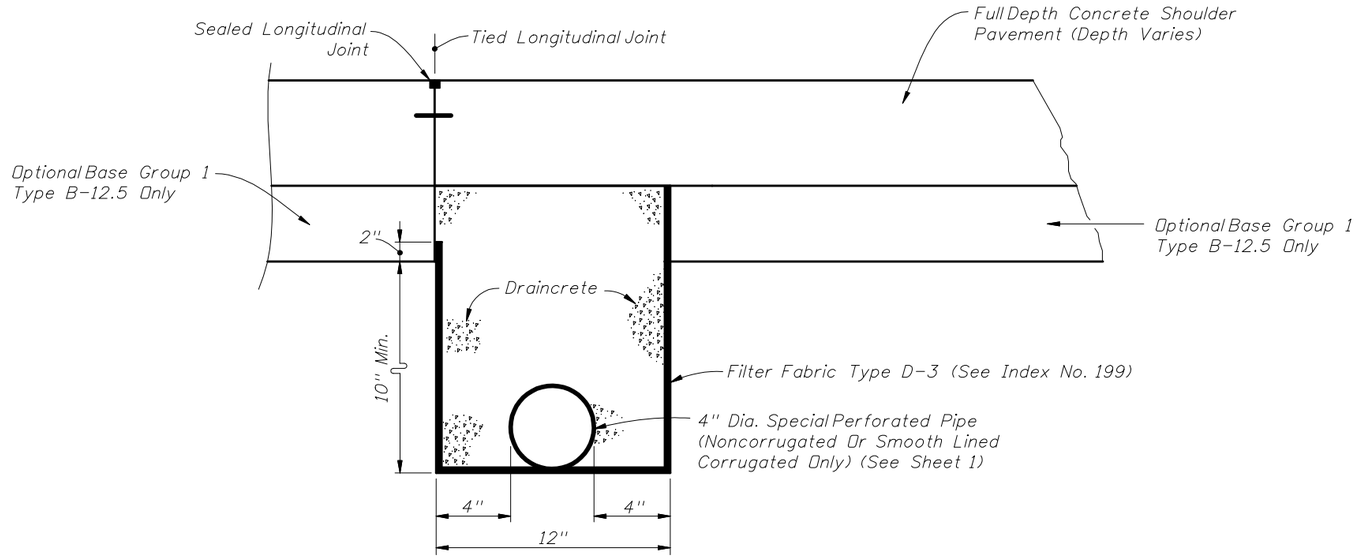
FOR REHABILITATION:

1. The contract unit price for Edgedrain (Draincrete) LF, shall be full compensation for removal of existing shoulder pavement, trench excavation, disposal of excess materials, filter fabric, draincrete edgedrain pipe and fittings, and draincrete, necessary for edgedrain construction.

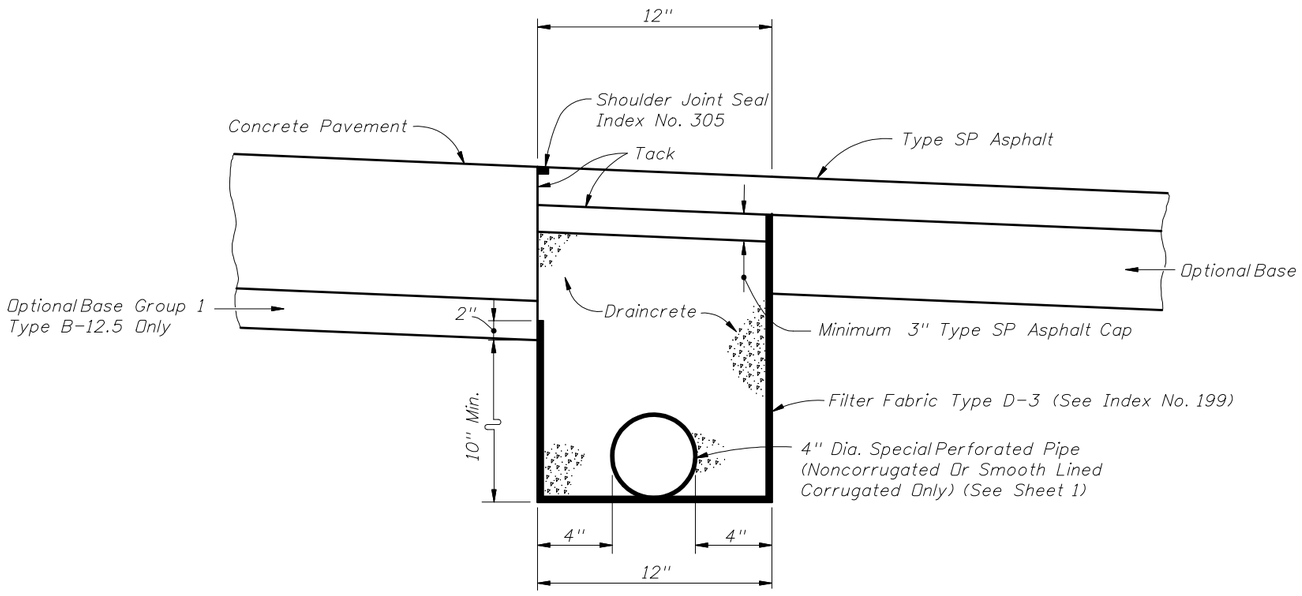
   Payment for outlet pipe shall be in accordance with General Note 9, Sheet 1 of 4.

   Shoulder pavement shall be paid for under the contract unit price for Type SP, Asphaltic Concrete.

   Shoulder joint seal shall be paid for under the contract unit price for Pavement Joint , LF.



CONCRETE TRAVEL LANES, SHOULDERS, AND AUXILIARY PAVEMENT



ASPHALT SHOULDERS

ASPHALT BASE SUBDRAINAGE

NOTES FOR DRAINCRETE PAVEMENT SUBDRAINAGE

1. The edgedrain sections for DRAINCRETE SUBDRAINAGE are applicable to pavement construction identified as RIGID PAVEMENT on Index No. 505, Sheet 2 and 3.

2. The contractor shall confine the construction of draincrete edgedrain to an area in which the entire operation can be carried out in five (5) work days, unless another construction period is called for in the plans, with sufficient time allowed for the draincrete to set before placement of pavement.

METHOD OF PAYMENT

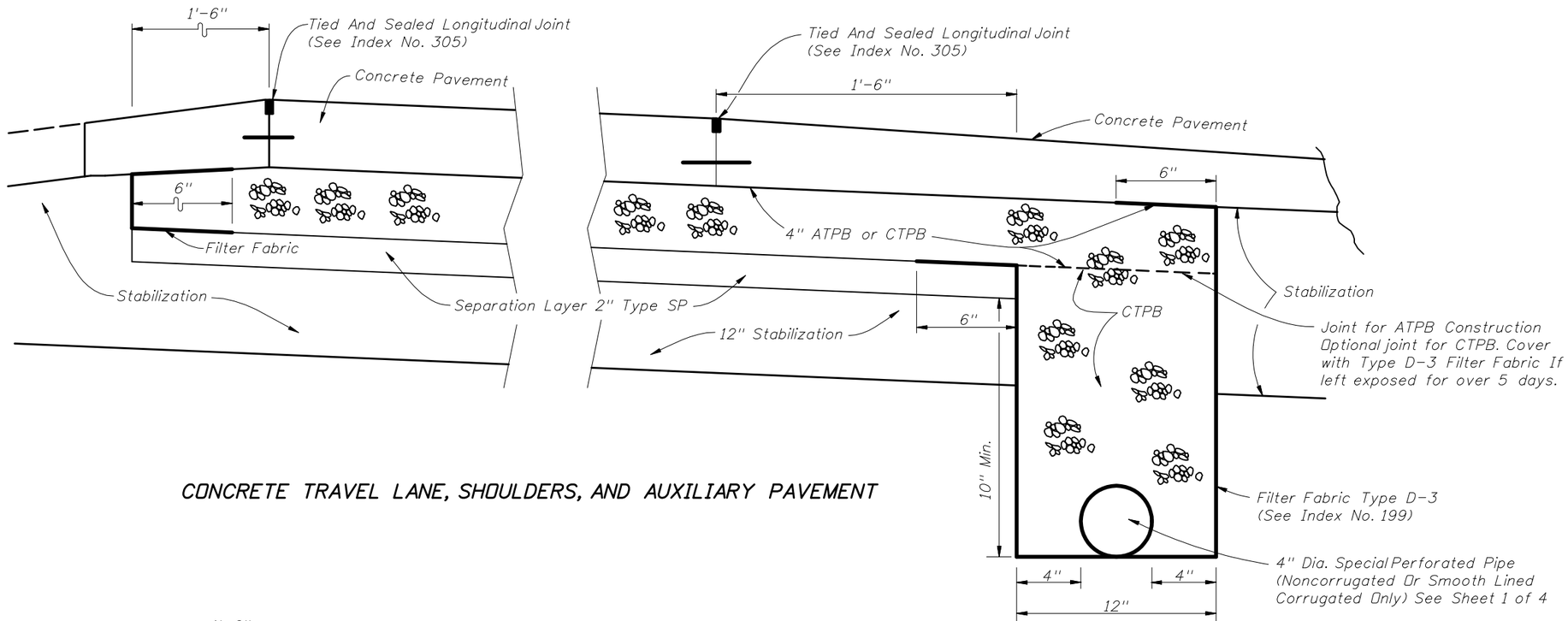
NEW CONSTRUCTION:

1. The contract unit price for Edgedrain (Draincrete) LF shall be full compensation for trench excavation, disposal of excess material, filter fabric, draincrete edgedrain pipe and fittings and draincrete.

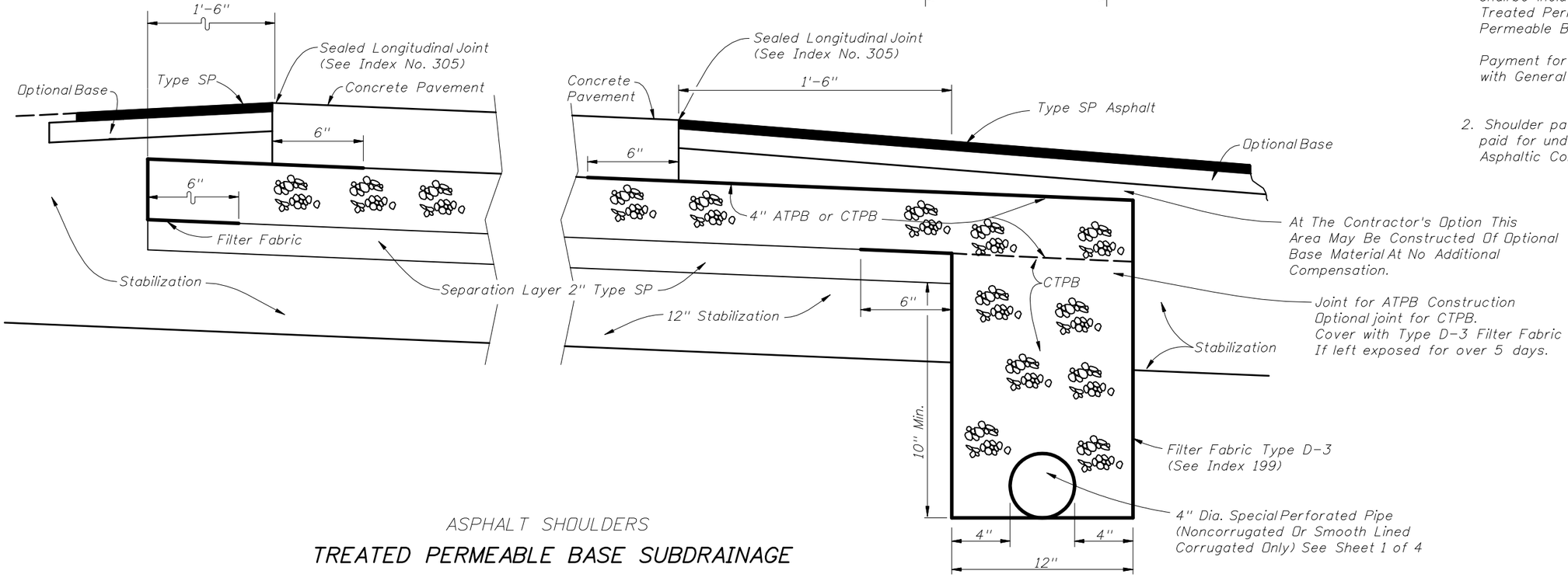
   Payment for outlet pipe shall be in accordance with General Note 9, Sheet 1 of 4.

2. Type B-12.5 shall be paid for under the contract unit price for Optional Base.

3. Shoulder pavement shall be paid for under the contract unit price for Type SP, Asphaltic Concrete.



CONCRETE TRAVEL LANE, SHOULDERS, AND AUXILIARY PAVEMENT



ASPHALT SHOULDERS

TREATED PERMEABLE BASE SUBDRAINAGE

GENERAL NOTES FOR TREATED PERMEABLE BASE EDGEDRAIN

NEW CONSTRUCTION

1. The contractor shall confine the construction of edgedrain to an area in which the entire operation can be carried out in (5) work days, unless another construction period is called for the plans.

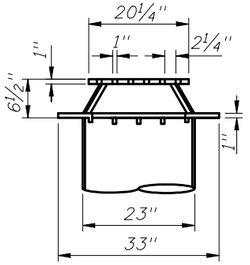
METHOD OF PAYMENT

NEW CONSTRUCTION

1. Payment shall be full compensation for trench excavation, disposal of excess materials, filter fabric, pipe and fittings, necessary for concrete pavement subdrainage construction. Payment shall be included in the cost for Asphalt Treated Permeable Base, CY or Cement Treated Permeable Base, CY.

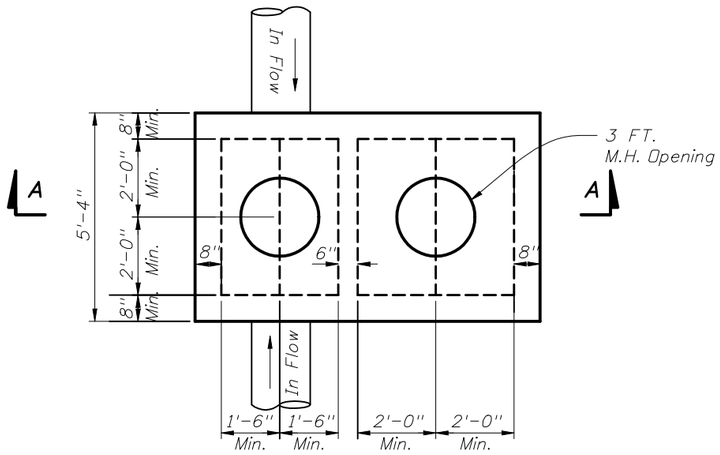
   Payment for outlet pipe shall be in accordance with General Note 9, Sheet 1 of 4.

2. Shoulder pavement and seperation layer shall be paid for under the contract unit price for Type SP, Asphaltic Concrete.

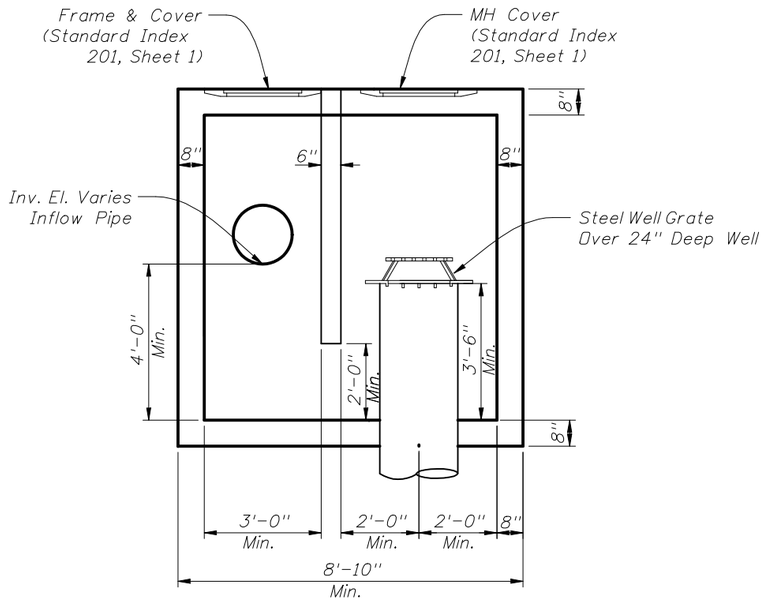


STEEL WELL GRATE DETAIL
NEENAH GRATE CATALOG NO. R-4341-A
OR EQUIVALENT

Note: Steel well grate to be installed over 24" deep well. Steel grate to be hot dipped galvanized after fabrication. Cost to be included in the price of casing.

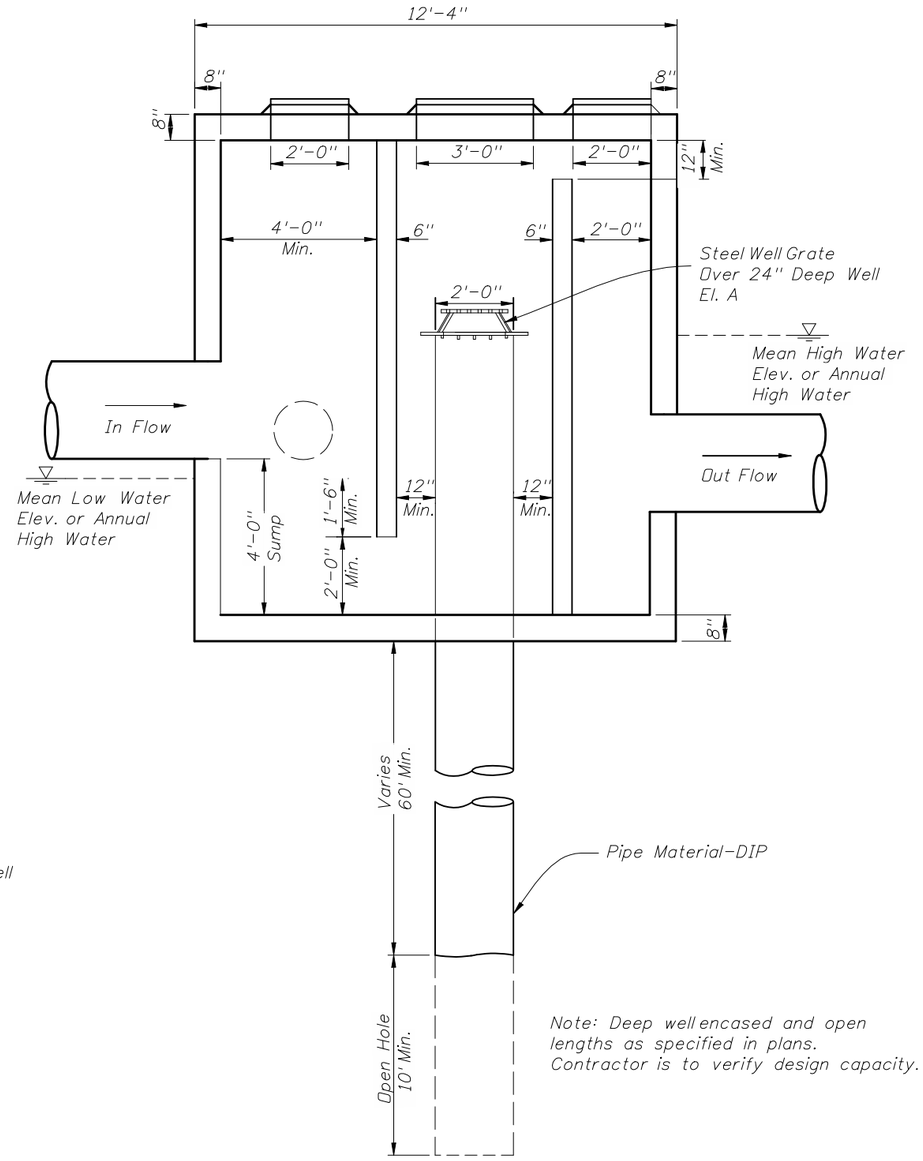


TOP SLAB PLAN



SECTION A-A

STRUCTURE WITH NO OUTFLOW



Note: Deep well encased and open lengths as specified in plans. Contractor is to verify design capacity.

SPECIAL MANHOLE STRUCTURE
DETAIL WITH OUTFALL

Design Notes

1. Depth of Casing Varies, 60' min.

2. Depth of Open Hole, 10'-20'.

3. Actual Size Of The Inflow And Outflow Chambers Will Be Determined By The Size Of The Pipes (Refer To Table 3 Of Index 200.) The Width Of The Box Shall Be Constant Based On The Largest Pipe. The Length Is To Be Adjusted Based On Size and Orientation Of The Pipes.

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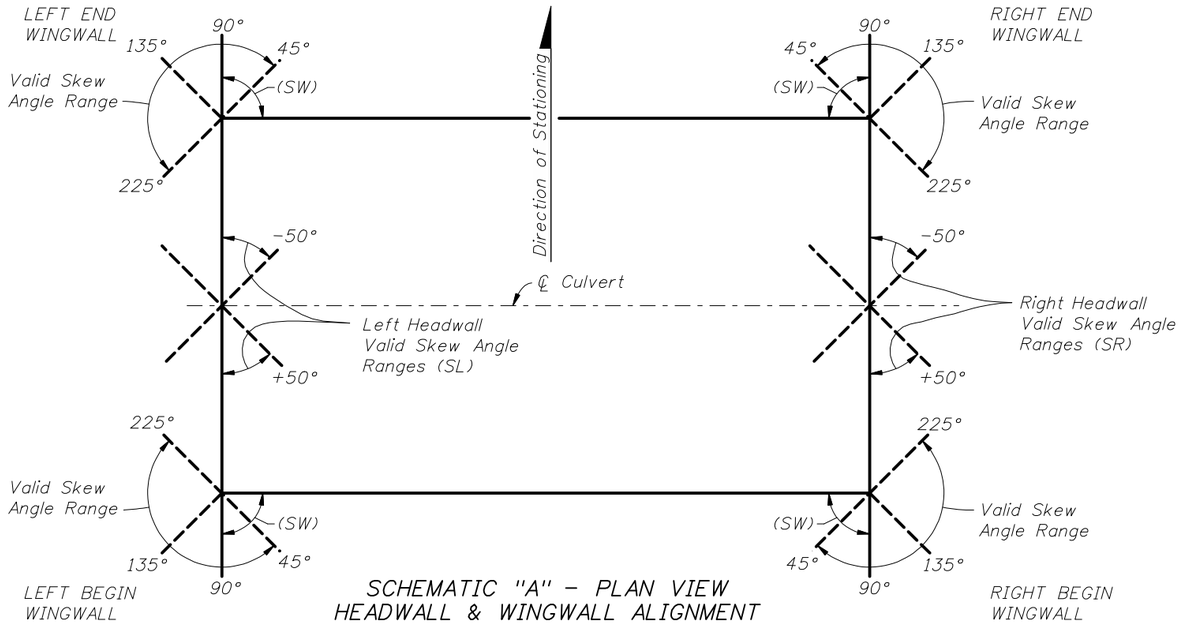
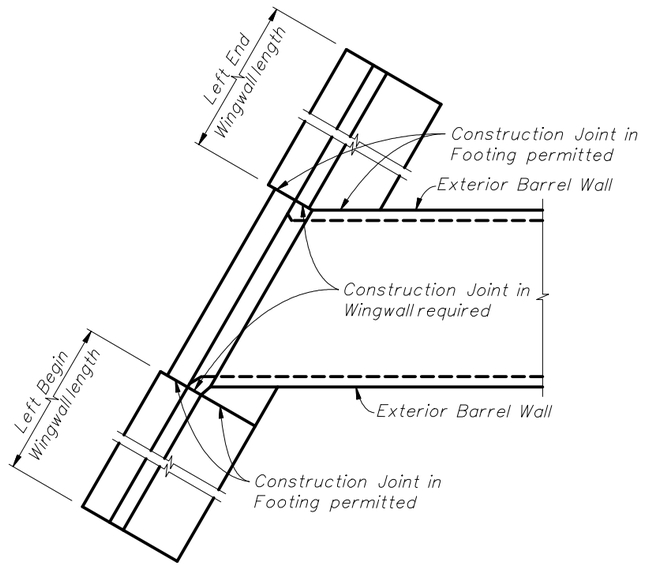


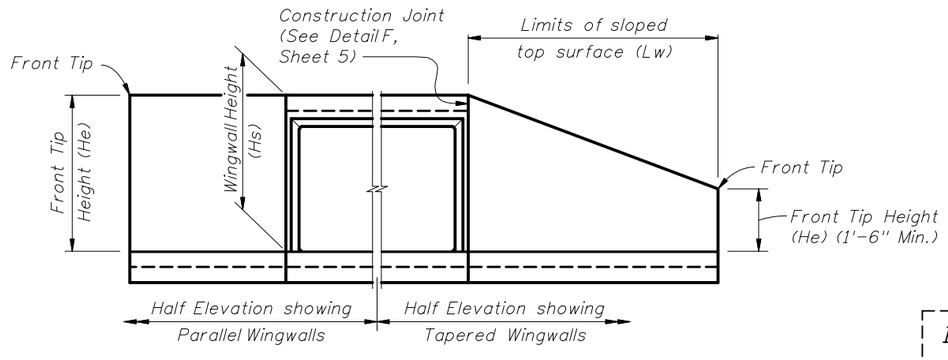
SCHEMATIC "A" - PLAN VIEW
HEADWALL & WINGWALL ALIGNMENT

NOTE: All headwall and culvert skew angles are measured in degrees from a line perpendicular to the centerline of culvert (counter-clockwise positive), see Schematic "B".



PART PLAN SHOWING PARALLEL WINGWALLS
AND LOCATION OF CONSTRUCTION JOINTS

NOTE:
Construction Joints in wingwalls and footings are located as follows: For non-skewed wingwalls they are located adjacent to the exterior face of the exterior barrel wall; when the ℄ of wingwall and ℄ of exterior barrel wall results in an acute angle see Left End Wingwall above, and when the angle is obtuse see Left Begin Wingwall above and Detail C (Sheet 5).



END ELEVATION
OF CULVERT

GENERAL NOTES:

DESIGN SPECIFICATIONS: AASHTO LRFD Bridge Design Specifications, 3rd Edition.

LIVE LOAD: HL-93.

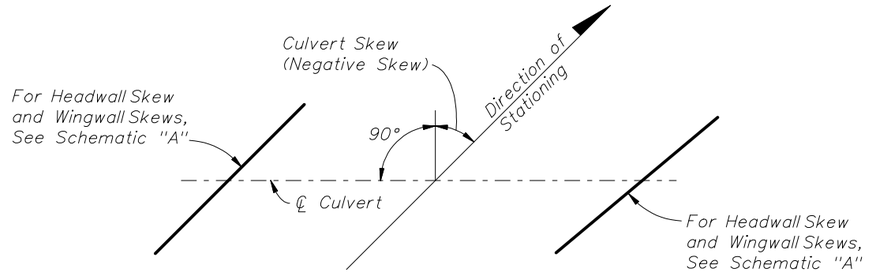
CONSTRUCTION LOADING: It is the construction Contractor's responsibility to provide for supporting construction loads that exceed AASHTO HL-93, and any construction load applied prior to 2 feet of compacted fill placed above the top slab.

SURFACE FINISH: All concrete surfaces shall receive a general surface finish.

SKEWED CONSTRUCTION JOINTS: Construction joints in barrels of culverts with skewed wingwalls may be placed parallel to the headwalls and the reinforcing steel, and the slabs may be cut provided that the cut reinforcing steel extends beyond the construction joint enough for splices to be made in accordance with Table 1 on this sheet. The cost of construction joints and additional reinforcing shall be at the expense of the Contractor.

CULVERT EXTENSIONS: For cut backs and ties into existing concrete box culverts see Sheet 6 of 7.

REINFORCING STEEL: ASTM A615, see the "Box Culvert Data Tables" in the Contract Plans for grade and bar spacing. See the Reinforcing Bar List in the Contract Plans for bar sizes and bar bending details.



SCHEMATIC "B" - PLAN VIEW
CULVERT ALIGNMENT

NOTE: For Culvert Skew see Contract Plans.

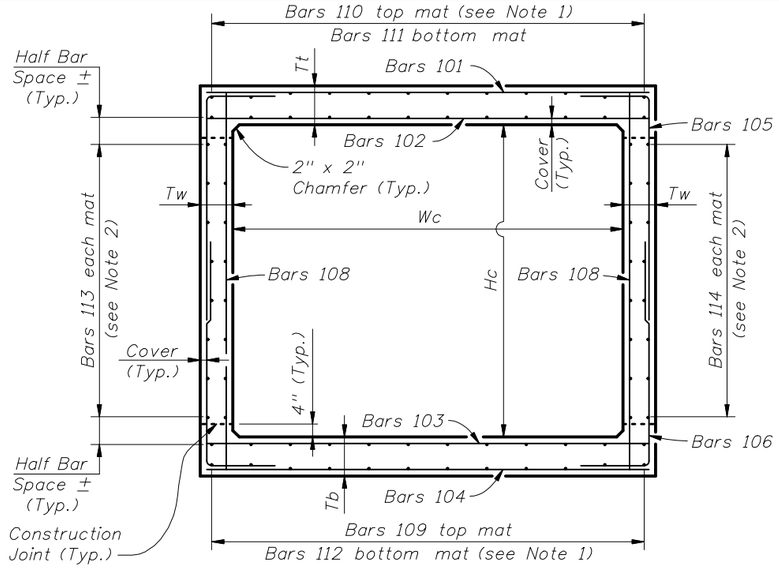
TABLE 1 - MINIMUM BAR SPLICE LENGTHS FOR LONGITUDINAL REINFORCING

BAR SIZE	SPLICE (CLASS B) CLASS II (3400 psi)	SPLICE (CLASS B) CLASS IV (5500 psi)	BAR SIZE	SPLICE (CLASS B) CLASS II (3400 psi)	SPLICE (CLASS B) CLASS IV (5500 psi)
#3	1'-0"	1'-0"	#8	3'-6"	2'-9"
#4	1'-4"	1'-4"	#9	4'-5"	3'-6"
#5	1'-8"	1'-8"	#10	6'-7"	4'-5"
#6	1'-11"	1'-11"	#11	7'-10"	6'-5"
#7	2'-8"	2'-3"			

TABLE 1 NOTE: Splice lengths are based on an AASHTO Class B tension lap splice for the Specification Section 346 concrete class shown.

INSTRUCTIONS TO DESIGNER

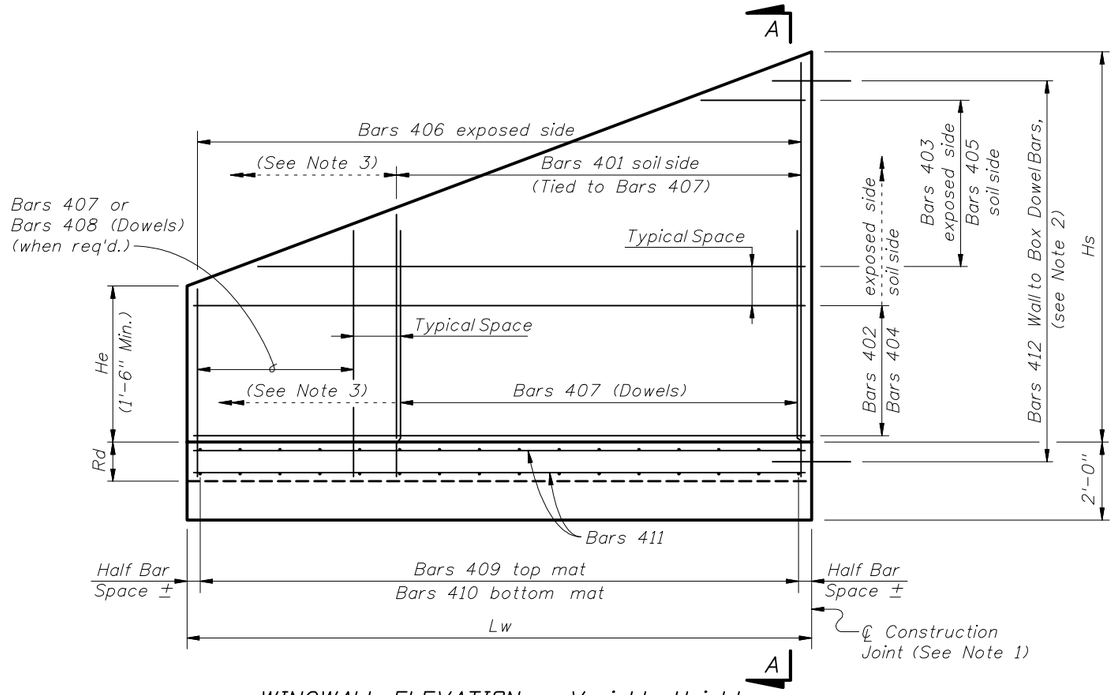
1. Designs for box culverts shown in this Index are to be produced only by computer analysis, utilizing the Department's LRFD Box Culvert Program. Designs are to be limited to the live loads and dimensional restraints shown in the General Notes of this Index and to the fill on the barrel(s), as shown in the Contract Plans.
2. Headwalls with skew angles less than -50° or greater than +50° require special design authorization. Other design options should be considered. Contact the District Drainage Engineer to obtain authorization.



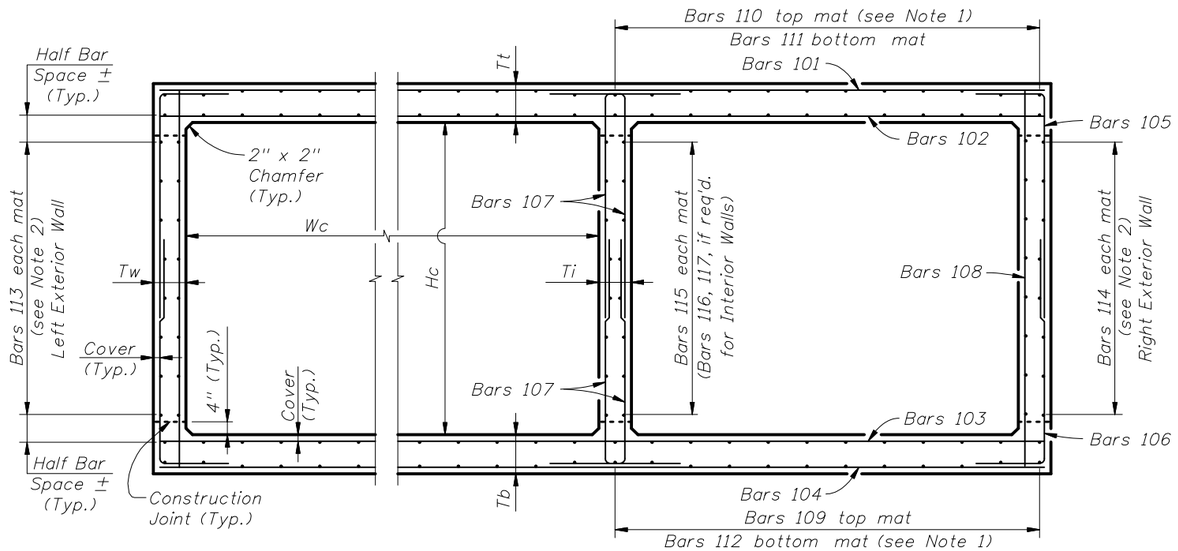
TYPICAL SECTION THRU SINGLE BARREL CULVERT

CULVERT BARREL NOTES:

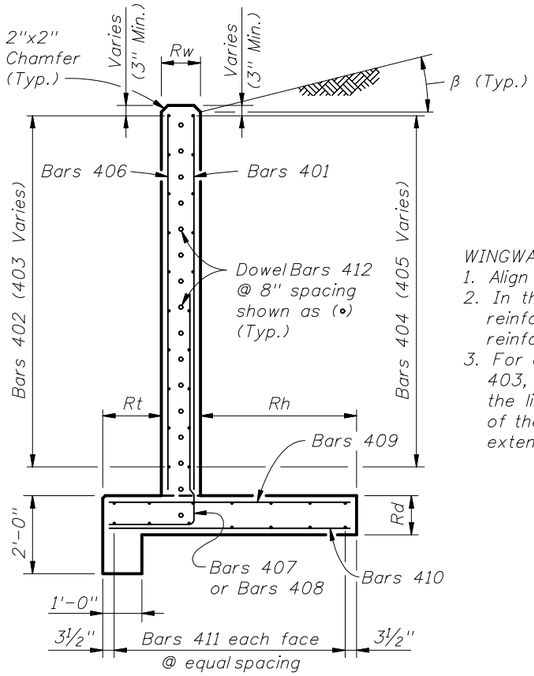
1. *Space Bars 110 and 112 with a bar in each corner, and at the ℄ of interior walls (for multiple barrel culverts only), and the remaining bars placed at equal spacing shown in the Contract Plans. Adjust last bar spacing when required.*
2. *Place Bars 113 and 114 at spacing shown in the Contract Plans evenly between Bars 109 and 111.*
3. *Locate the first transverse bar from the ends of the culvert at one half the bar spacing, but provide the minimum reinforcement cover and not greater than 4" clear.*



WINGWALL ELEVATION - Variable Height
(Left End shown - other corners similar)



TYPICAL SECTION THRU MULTIPLE BARREL CULVERT



WINGWALL SECTION A-A

WINGWALL NOTES:

1. *Align construction joint perpendicular to wingwall.*
2. *In the vicinity of the construction joint, field bend reinforcement as necessary to maintain minimum reinforcement cover.*
3. *For constant height wingwalls, variable length Bars 403, 405 & 408 are not required, and as such the limits of Bars 401 & 407 extend the full length of the wingwall, and the limits of Bars 402 & 404 extend to the full height of the wingwall.*

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Left End Wingwall, (Reinforcing Bars 401-412)

Lc (Length at ℄ of Culvert)

Normal Space

Bars 101 (Top mat of Top Slab), Bars 102 (Bottom mat of Top Slab)

Normal Space

Right End Wingwall, (Reinforcing Bars 601-612)

Rh (Typ.)

Rw (Typ.)

Rt (Typ.)

See Detail D, (Sheet 5)

SW (Typ.) Wingwall Skew

Culvert Skew Angle (See Note 1)

SR, Right Headwall Skew (- shown)

SL, Left Headwall Skew (- shown)

End Culvert (See Note 1)

Bars 106 (Bottom corner of Barrel)

Bars 108 (Inside Face)

Lw (Typ.)

WP (See Note 2)

Bars 303 (Top mat, Right Skew)

Bars 203 (Top mat, Left Skew)

Bars 304 (Bottom mat, Right Skew)

Bars 204 (Bottom mat, Left Skew)

Bars 201 & 202 (Left Skew)
Bars 301 & 302 (Right Skew) (Typ.)

Bars 101 (Top mat)
Bars 102 (Bot. mat)

Bars 110 (Top mat)

Bars 111 (Bottom mat)

Direction of Stationing

Bars 109 (Top mat)

Bars 112 (Bottom mat)

Bars 103 (Top mat)
Bars 104 (Bot. mat)

Brcw

℄ Culvert

Bars 801 (Left Headwall)
Bars 804 (Right Headwall)

Blnw

Bars 303 & 304 (Right Skew)
Bars 203 & 204 (Left Skew) (Typ.)

Bars 201 (Top mat, Left Skew)
Bars 301 (Top mat, Right Skew)
Bars 202 (Bottom mat, Left Skew)
Bars 302 (Bottom mat, Right Skew)

See Detail E, (Sheet 5)

WP (See Note 2)

Bars 811 (Right Cutoff Wall)
Bars 808 (Left Cutoff Wall)

Begin Culvert (See Note 1)

Bars 108 (Inside Face)
Bars 105 (Top corner of Barrel)

SW (Typ.) Wingwall Skew

Left Begin Wingwall, (Reinforcing Bars 501-512)

Right Begin Wingwall, (Reinforcing Bars 701-712)

Bars 103 (Top mat of Bottom Slab)
Bars 104 (Bottom mat of Bottom Slab)

Slab Reinforcing Steel within these limits apply for the skewed portion of culvert slabs when the left Headwall is skewed.

Slab Reinforcing Steel within these limits apply for the nonskewed portion of slabs

Slab Reinforcing Steel within these limits apply for the skewed portion of culvert slab when the right Headwall is skewed.

PARTIAL PLAN TOP SLAB
(Left Side, Left Skew)

PARTIAL PLAN BOTTOM SLAB
(Right Side, Right Skew)

NOTES:
1. See Contract Plans for Culvert location, Culvert Skew Angle and Roadway Cross Section.
2. WP = Working Point, used for wingwall layout and location of construction joint. See Detail C (Sheet 5).

SINGLE BARREL BOX CULVERT
(Skewed Culvert With Parallel Wingwalls Shown)

Center of Traffic Lanes

X

1

Side Slope 1:X

See Detail J, (Sheet 5)

Depth of fill (do not use upper or lower points in normal or superelevated roadway sections unless so directed by the Structures Design Office.)

Bars 803

Half Bar Space ±

Bars 806

Bars 802 (Typ.)

Bars 110

Bars 111

Bars 805 (Typ.)

Construction Joint

Bars 108 ~ Interior Face (Exterior Wall)

Bars 113 & 114 Exterior Walls (Each Face)
Bars 115, 116... Interior Walls (Each Face, Multiple Barrels only)

Bars 107 ~ Each Face
(Interior Wall - Multiple Barrels only)

Bars 105/Bars 106 ~ Exterior Face (Exterior Wall)

Bars 109

Bars 112

Construction Joint

4" (Typ.)

Bars 809

Bars 812

Half Bar Space ±

Bars 808 (Typ.)

See Detail K (Sheet 5)

Bars 811 (Typ.)

Partial Section showing Exterior Walls

Partial Section showing Interior Walls (Multiple Barrels only)

LONGITUDINAL SECTION THRU CULVERT
(Transverse Top & Bottom Slab Reinforcing Not Shown For Clarity)

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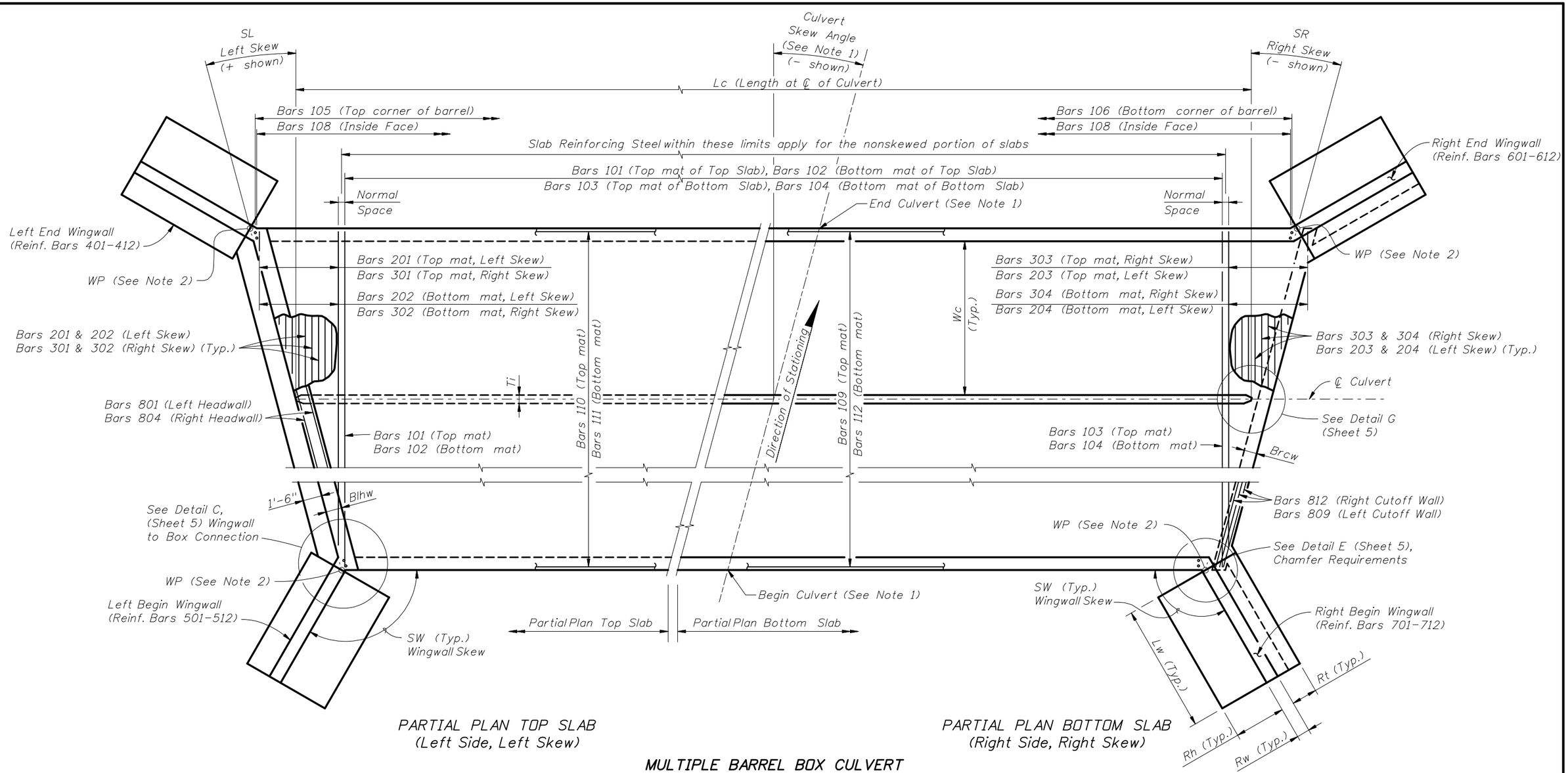
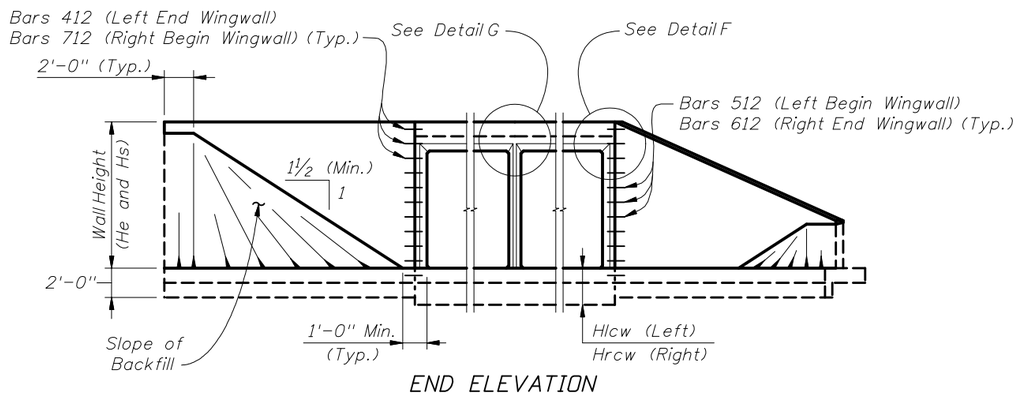


PARTIAL PLAN TOP SLAB
(Left Side, Left Skew)

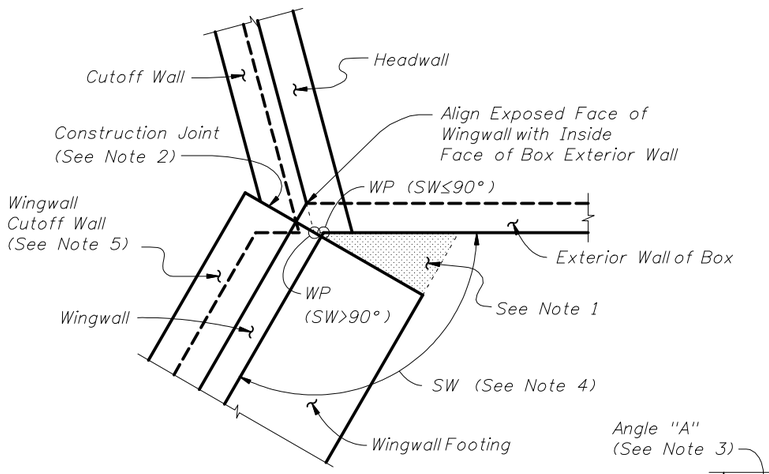
PARTIAL PLAN BOTTOM SLAB
(Right Side, Right Skew)

MULTIPLE BARREL BOX CULVERT
(Skewed Culvert With Skewed Wingwalls Shown)

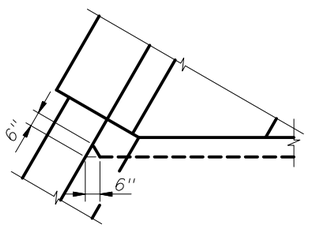
NOTES:
1. See Contract Plans for Culvert Location, Culvert Skew Angle and Roadway Cross Section.
2. WP = Working Point, used for wingwall layout and location of construction joint. See Detail C (Sheet 5).



END ELEVATION
(Showing Constant Height And Variable Height Wingwalls)

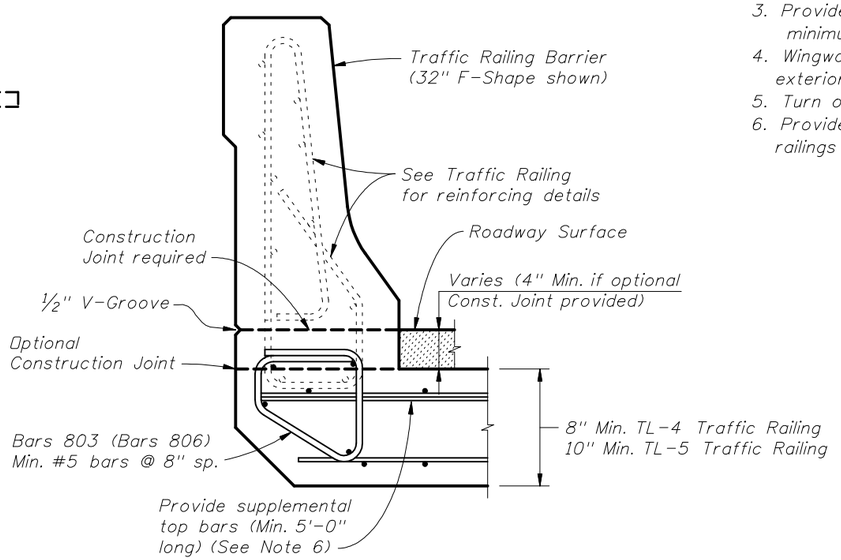


DETAIL C - PLAN VIEW
WINGWALL TO BOX CONNECTION
(Left Begin Corner Shown, Other Corners Similar)

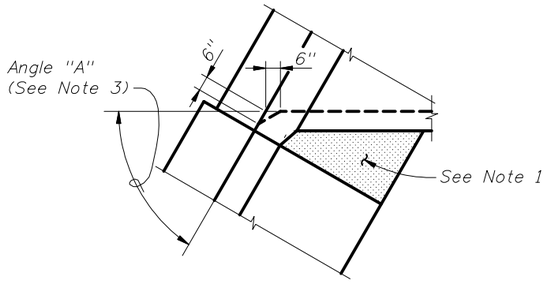


DETAIL D

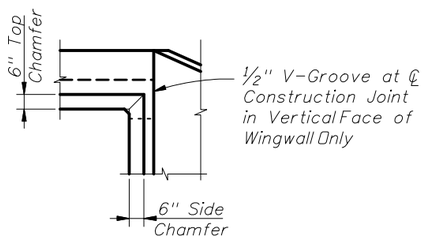
CROSS REFERENCE:
See Sheet 3 for locations of Details D, E, J & K.
See Sheet 4 for locations of Detail C.



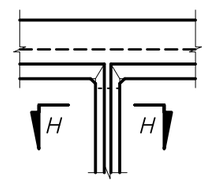
DETAIL I
TRAFFIC RAILING
ATTACHMENT TO HEADWALL



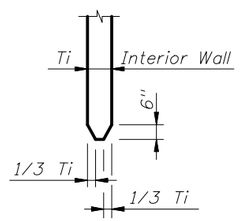
DETAIL E



DETAIL F

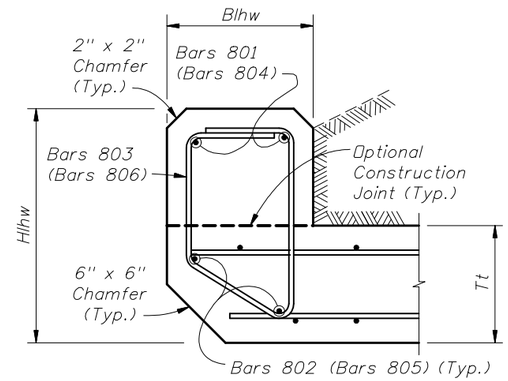


DETAIL G

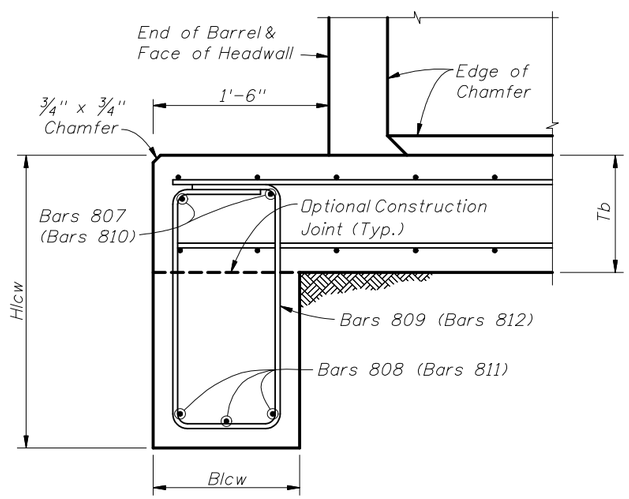


SECTION H-H

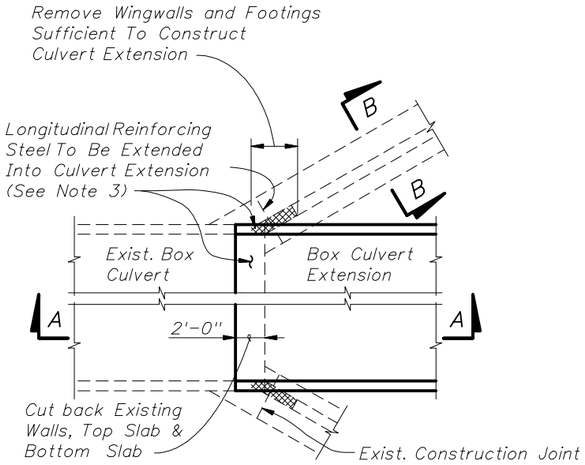
NOTES:
1. For small angles, the Contractor may elect to fill the area between the box and the wingwall footing with unreinforced concrete. For wingwall skew angles less then 90 degrees, field bend wingwall reinforcement as necessary while maintaining cover. No additional payment will be made for this work.
2. Location of Construction Joint determined by WP at theoretical intersection of:
   - Soil side face of Headwall and outside face of Box Exterior Wall, for SW≤90°;
   - Outside face of Wingwall and outside face of Box Exterior Wall, for SW>90°.
3. Provide 6" chamfer when angle "A" is greater than 45°. Maintain minimum wall thickness. Field adjust reinforcing to maintain cover.
4. Wingwall Skew Angles (SW) are measured from the adjacent box exterior wall to the wingwall.
5. Turn or extend Wingwall Cutoff Wall as necessary to meet Box Cutoff Wall.
6. Provide additional reinforcement in the top of the top slab below traffic railings to ensure a minimum area of 0.80 sq. in./ft. transverse reinforcing.



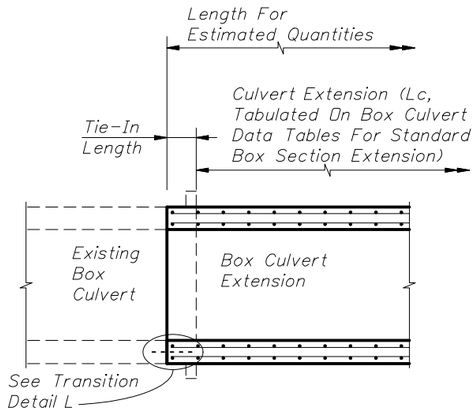
DETAIL J
LEFT HEADWALL SECTION
(Right Headwall similar)



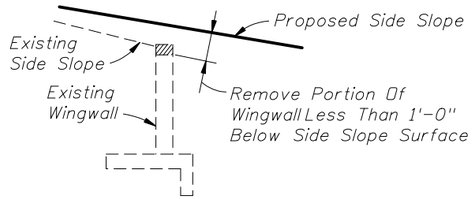
DETAIL K
LEFT CUTOFF WALL SECTION
(Right Cutoff Wall similar)



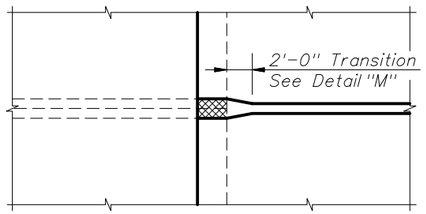
OUTSIDE WALLS OF BOXES



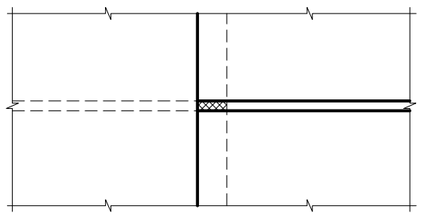
SECTION A-A



SECTION B-B



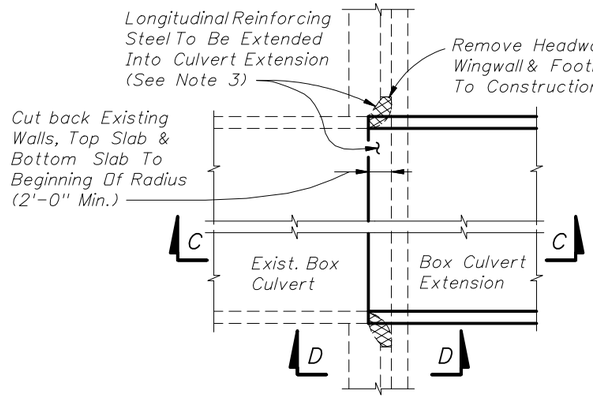
INTERIOR DOUBLE WALLS OF BOXES



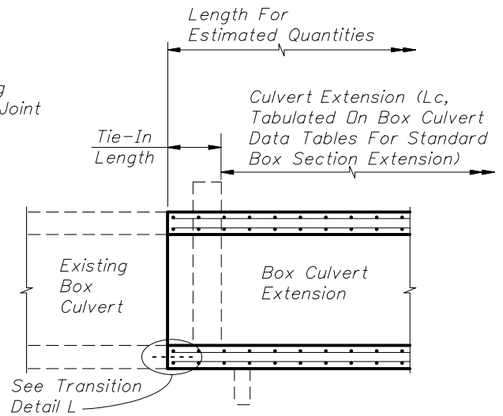
INTERIOR SINGLE WALLS OF BOXES

NOTES:

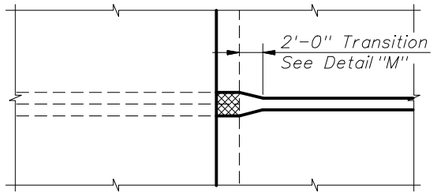
1. The Box Culvert Data Tables and Reinforcing Bar List do not include the additional quantities needed for dowel connections or transitions from double walls of existing concrete box culverts; the cost for additional reinforcement and the thickened concrete wall in the transitional area shall be included in the costs for concrete and steel in the culvert extension.
2. Cost for removal and disposal of material from existing headwalls, wingwalls and box, and cost of cleaning, straightening and extending or doweling longitudinal reinforcing steel shall be included in the cost for concrete and steel of the culvert extension.
3. Remove existing concrete while avoiding damage to existing reinforcement. Clean and straighten existing reinforcement, lap and tie onto extension reinforcement.
4. Dowel in #4 Bars @ 1'-0" max. spacing into center of wall/slab when there is a single mat of existing reinforcing steel, otherwise splice 1'-6" as shown for inside reinforcement. Use an Adhesive Bonding Material System in accordance with Specifications Section 416 & 937.



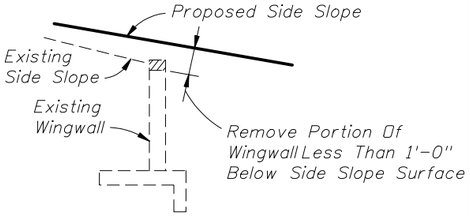
OUTSIDE WALLS OF BOXES



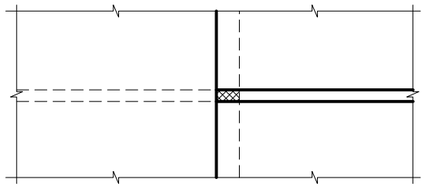
SECTION C-C



INTERIOR DOUBLE WALLS OF BOXES



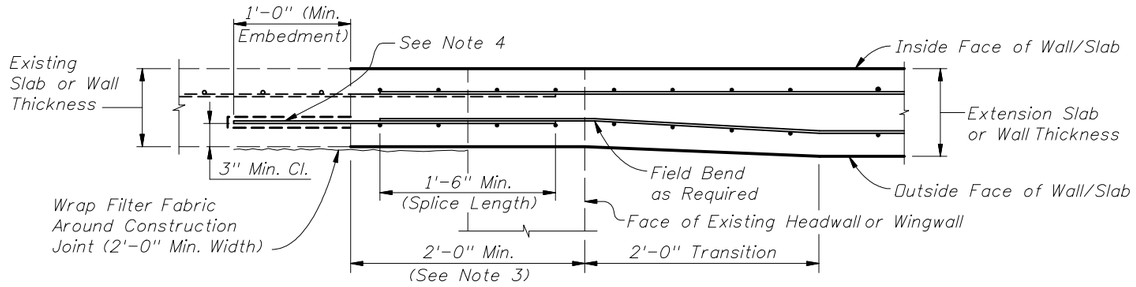
SECTION D-D



INTERIOR SINGLE WALLS OF BOXES

PLAN VIEWS

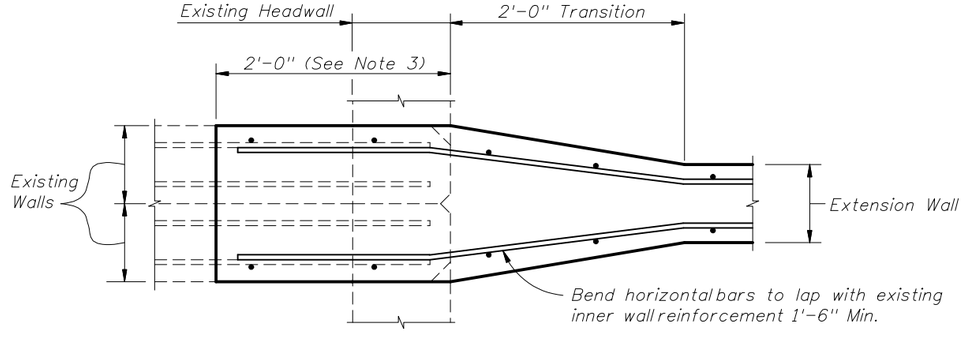
FLARED WINGWALL



DETAIL "L" - TRANSITION FOR EXTERIOR WALL/SLAB EXTENSION

PLAN VIEWS

STRAIGHT WINGWALL



DETAIL "M" - TRANSITION FOR INTERIOR DOUBLE WALLS OF BOX CULVERTS

CONNECTION DETAILS FOR CONCRETE BOX CULVERT EXTENSIONS

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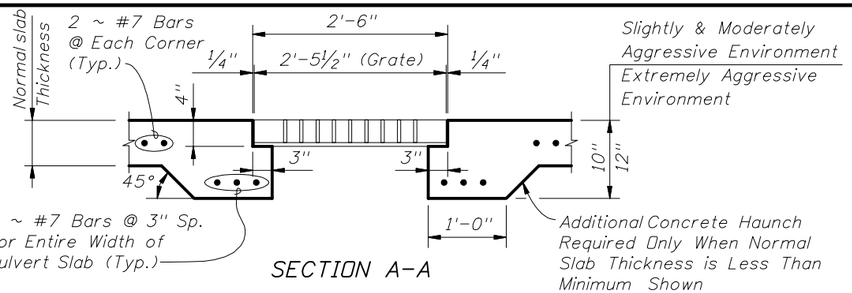
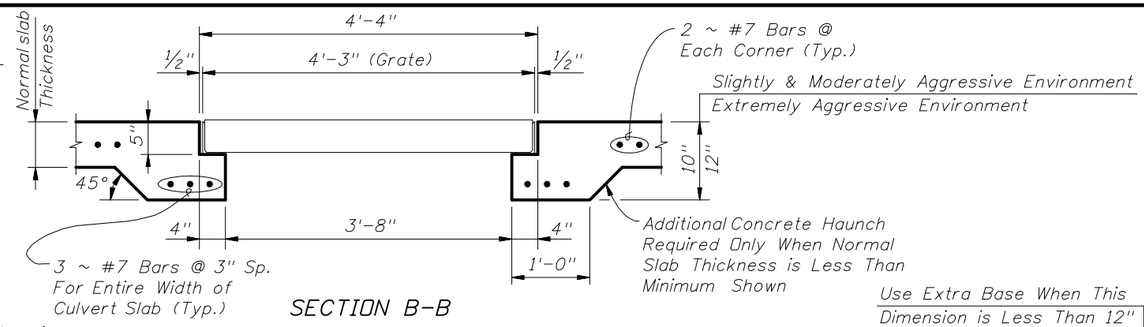
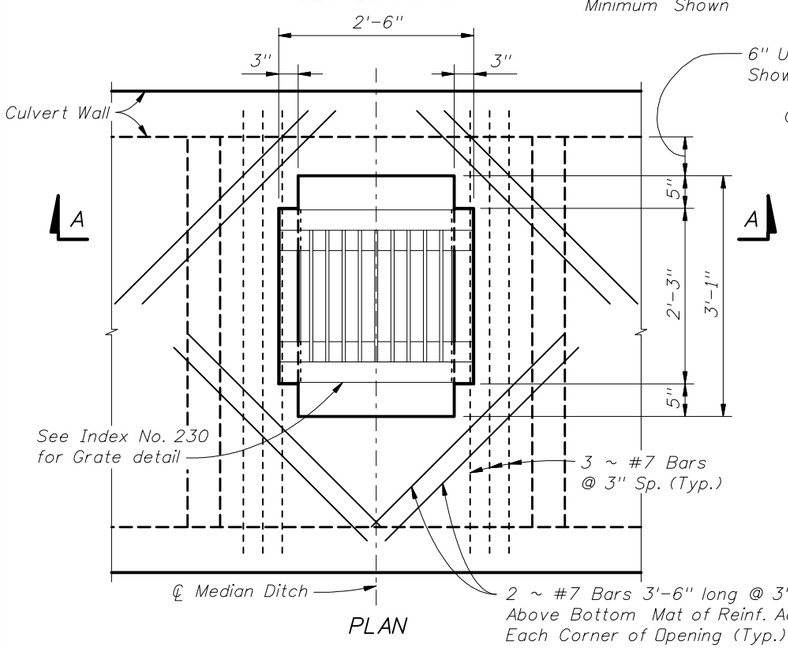


SECTION A-A

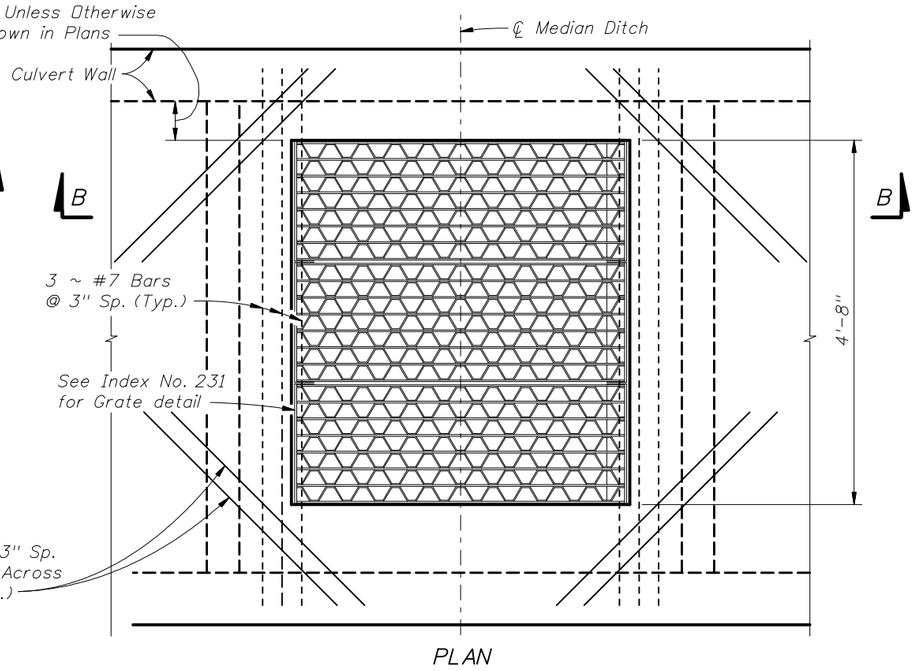


SECTION B-B



PLAN

INLET TYPE A GRATE



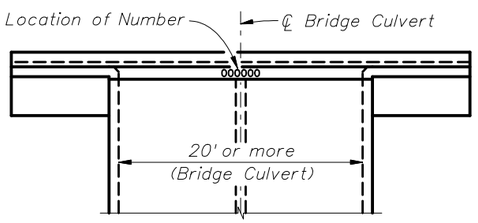
PLAN

INLET TYPE B GRATE

NOTES:

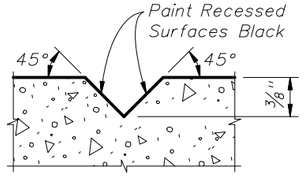
1. Cost of Steel Grating to be included in cost of Box Culvert.
2. All reinforcing shall be 2" clear for Slightly and Moderately Aggressive Environments, and 3" clear for Extremely Aggressive Environments.

INLET IN TOP OF BOX CULVERT



The number is to be placed in the center of the top surface of all bridge culvert headwalls. For Bridge Number see Plan-Profile sheet(s).

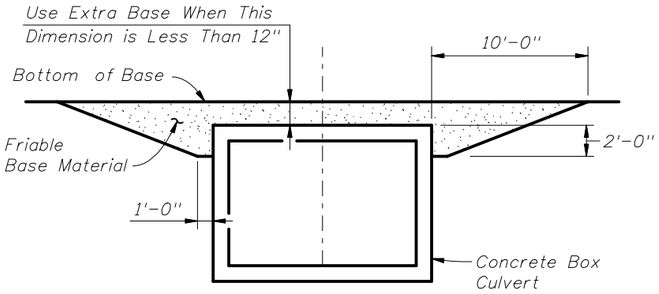
TOP VIEW OF HEADWALL



SECTION THRU RECESSED V-GROOVE TO FORM INSCRIBED FIGURES

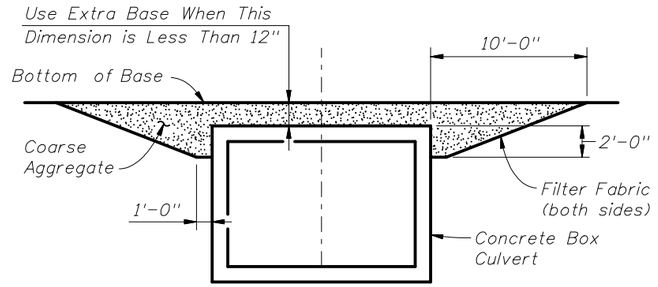
Black Plastic Figures 3" in height as approved by the Engineer may be used in lieu of numbers formed by 3/8" V-Grooves. V-Grooves shall be formed by preformed figures.

BRIDGE CULVERT NUMBER LOCATION



The cost of furnishing and installing extra friable base material shall be included in the cost of the Box Culvert.

FRIABLE BASE



Place coarse aggregate in 6 inch lifts and compact sufficiently as to be firm and unyielding. Provide coarse aggregate gravel or stone meeting the requirements of Section 901-2 or 901-3 respectively. Meet the gradation requirements of Section 901-6, Grades 4, 467, 5, 56 or 57 unless restricted in the plans. Provide Type D-3 filter fabric (see Index No. 199). The cost of furnishing and installing the coarse aggregate and filter fabric shall be included in the cost of the Box Culvert.

ASPHALTIC CONCRETE BASE

NOTE: Extra base is required when cross box culverts are located on facilities subject to high speed traffic (>45 mph) or high traffic volumes (>1600 ADT) and the cover is within the range specified in the notation above.

EXTRA BASE FOR BOX CULVERTS CROSSING UNDER FLEXIBLE PAVEMENT

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

2010 FDOT Design Standards

CONCRETE BOX CULVERT DETAILS (LRFD)

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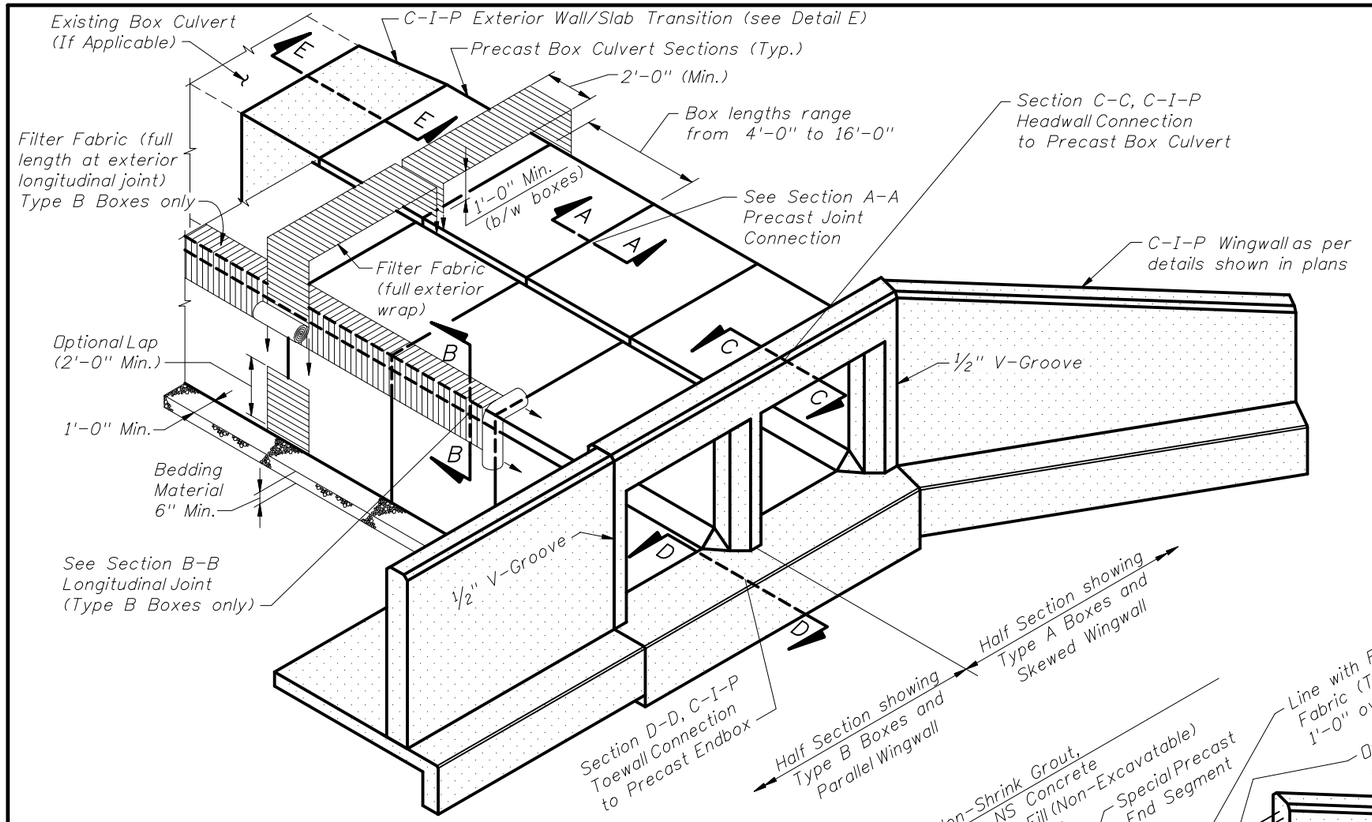
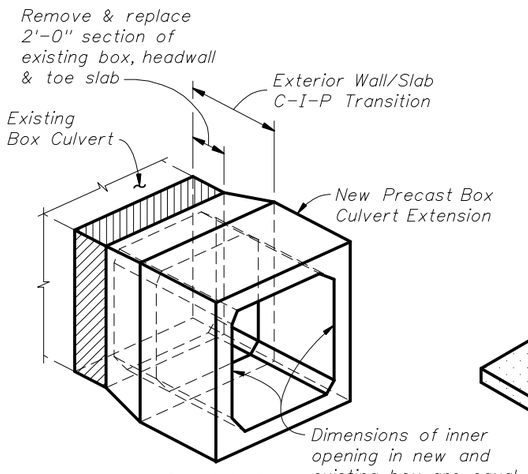
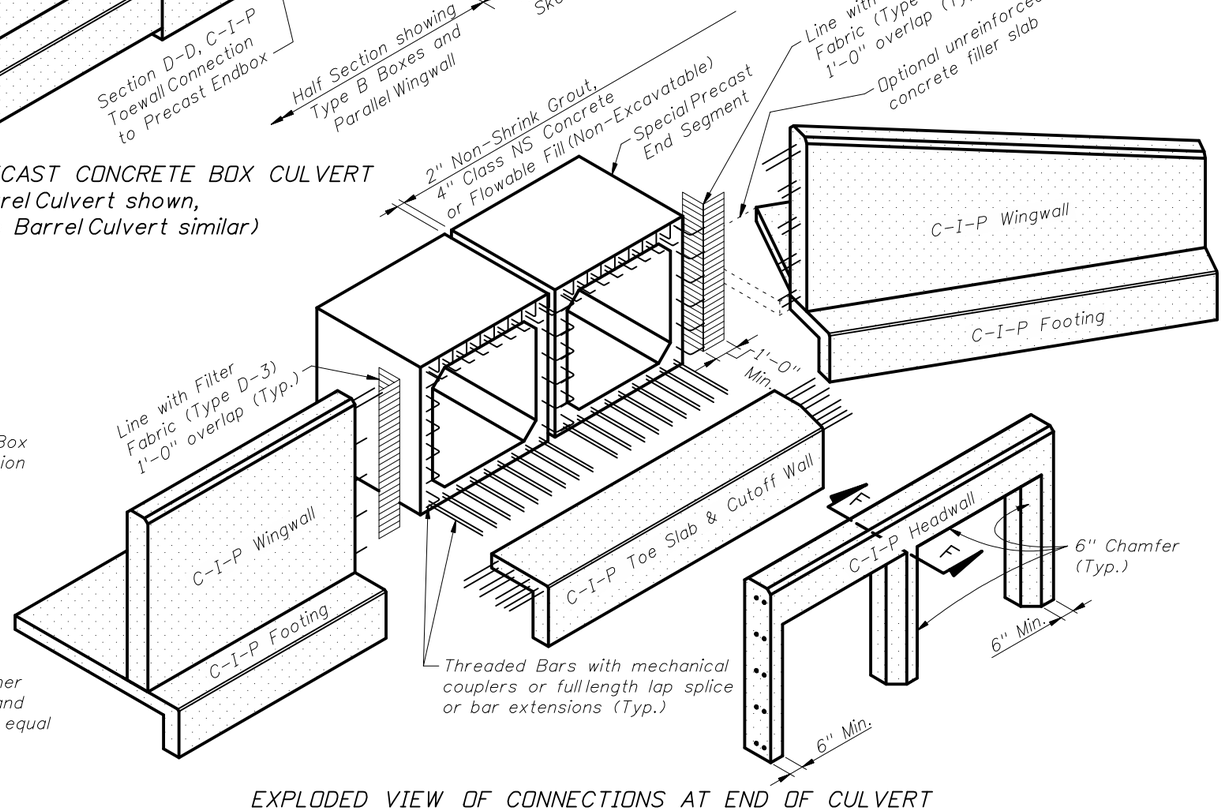


ISOMETRIC VIEW OF PRECAST CONCRETE BOX CULVERT
(Double Barrel Culvert shown,
Single or Multiple Barrel Culvert similar)

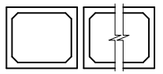
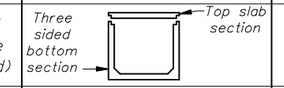
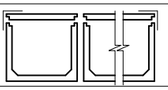
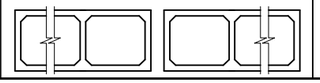


DETAIL E
PICTORIAL VIEW OF EXTERIOR
WALL/SLAB TRANSITION



EXPLODED VIEW OF CONNECTIONS AT END OF CULVERT
(Double Barrel Culvert shown, Single or Multiple Barrel Culvert similar)

PERMITTED PRECAST ALTERNATE BOX SECTIONS

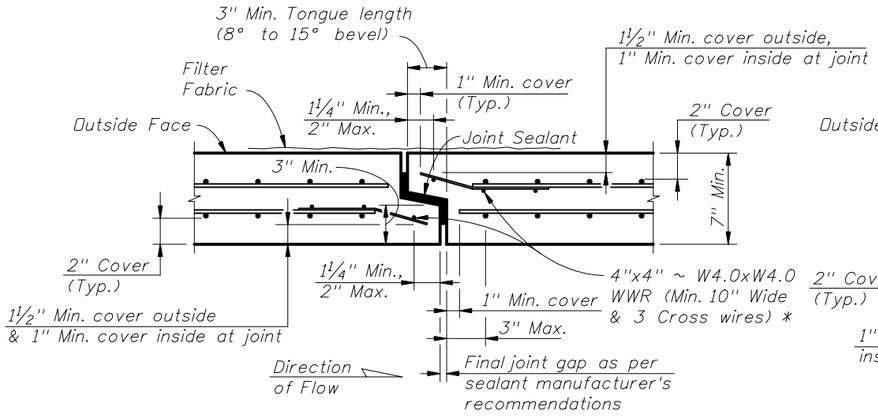
TYPE	DESCRIPTION	SINGLE BARREL	MULTIPLE BARRELS	DESIGN NOTES
A	Single Cell Monolithic (Four Sided)			Index No. 292 or Contractor Design
B	Single Cell Two-Piece (Four Sided)			Contractor Design
C	Multicell Monolithic	Not Applicable		Contractor Design

GENERAL NOTES:

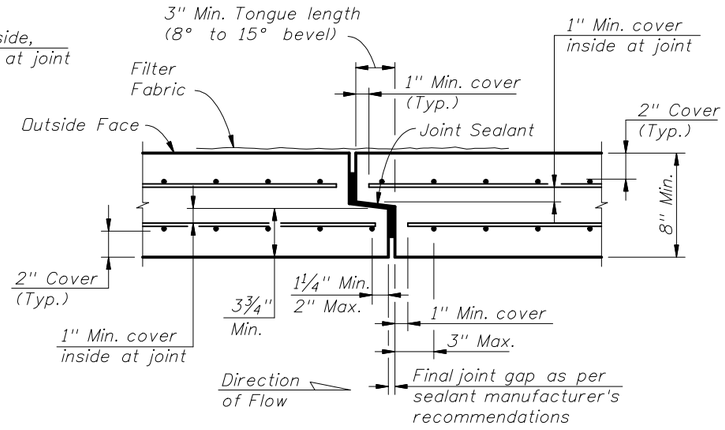
1. Specifications:
   - General:
     FDOT Standard Specifications for Road and Bridge Construction, Section 410 (current edition, and supplements thereto).
   - Concrete (Precast):
     Class III or Class II Modified (5,000 psi) for slightly aggressive environments.
     Class IV (5,500 psi) for moderately to extremely aggressive environments.
   - Concrete (Cast-In-Place):
     Class II (3,400 psi) for slightly aggressive environments.
     Class IV (5,500 psi) for moderately to extremely aggressive environments.
   - Reinforcing Steel:
     ASTM A615 Grade 60 deformed bar unless otherwise noted, with a minimum clearance of 2" for slightly and moderately aggressive environments or 3" for extremely aggressive environments, unless otherwise shown. Equal area substitution of welded wire (WWR) reinforcement is permitted.
2. Work this Index with the Cast-In-Place Concrete Box Culvert Details and Data Tables shown in the plans, Index No. 289 and the Precast Concrete Box Culverts shown in the shop drawings.
3. All joints between precast sections must be tongue & groove with joint sealant. Joints between cast-in-place & precast sections shall have longitudinal reinforcing extending from top, bottom & both side slabs of the precast box tied to the cast-in-place reinforcement. Single barrel culverts may have precast headwalls cast integrally with the end segment when approved by the Engineer.
4. Extension of existing multiple barrel box culverts with multiple single cell precast box culverts is not permitted unless approved by the District Structures Engineer. Full transition details must be shown in the shop drawings when approved.
5. Culverts larger than the specified size may be substituted with no additional payment to the Contractor. Substitution must be approved by the Engineer, minimum earth cover and invert elevations shown in the Contract Documents must be maintained.

INSTRUCTIONS TO DESIGNER:

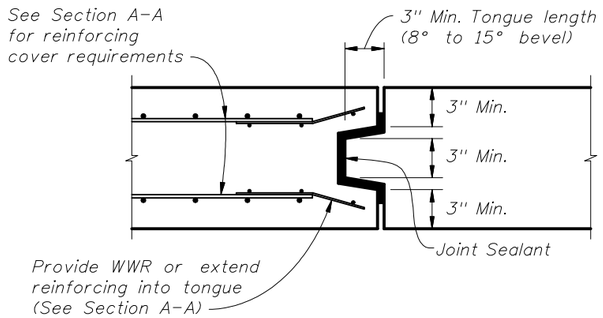
1. Show Differential Settlement (ΔY) and Effective Length (L) for single curvature deflection in the Contract Plans where significant long-term settlement is anticipated. See Sheet 5 of 5 for details.



SECTION A-A
(2" Cover - Thin Wall Detail)

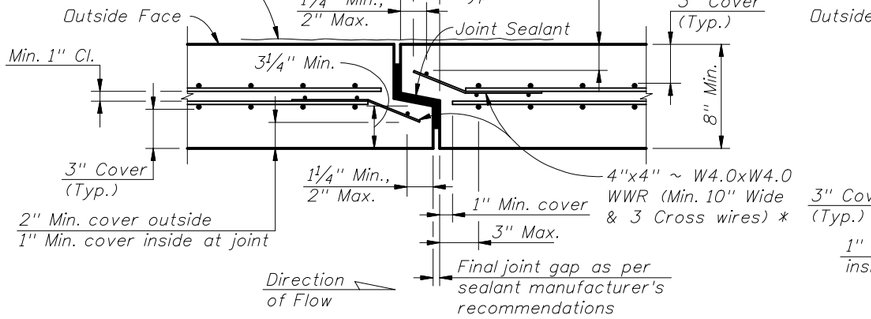


SECTION A-A
(2" Cover - Thick Wall Detail)



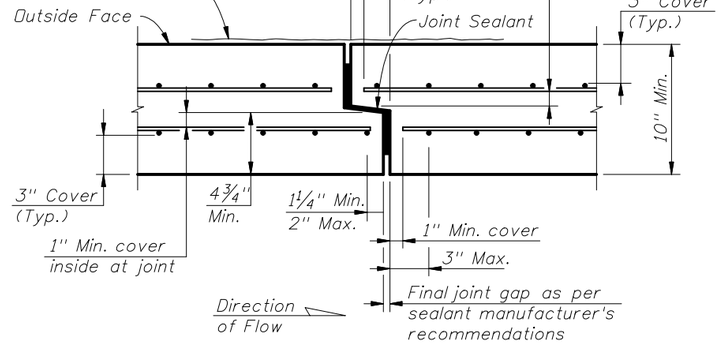
ALTERNATE BOTTOM SLAB TRANSVERSE JOINT
TYPICAL SECTION
(DOUBLE-SIDED TONGUE & GROOVE JOINT)
(All reinforcing not shown for clarity)

NOTE:
Bottom Slab Joints in Type B Boxes may be single tongue & groove joints as shown in Section A-A when the Top Slab Joints are oriented as shown in Schematic A.

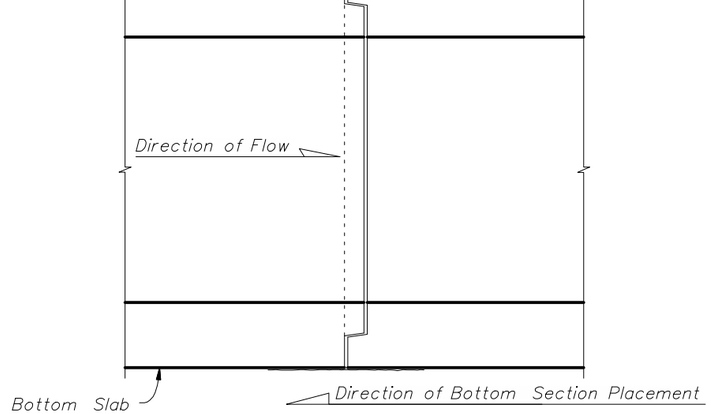


SECTION A-A
(3" Cover - Thin Wall Detail)

* At the Contractor's option when the box culvert reinforcing utilizes WWR, extend wall and slab reinforcing into the joint and bend to maintain cover in lieu of 4"x4" ~ W4.0xW4.0 WWR at joint. Transverse wire in tongue may be cut at corners of box to allow bending of the WWR.



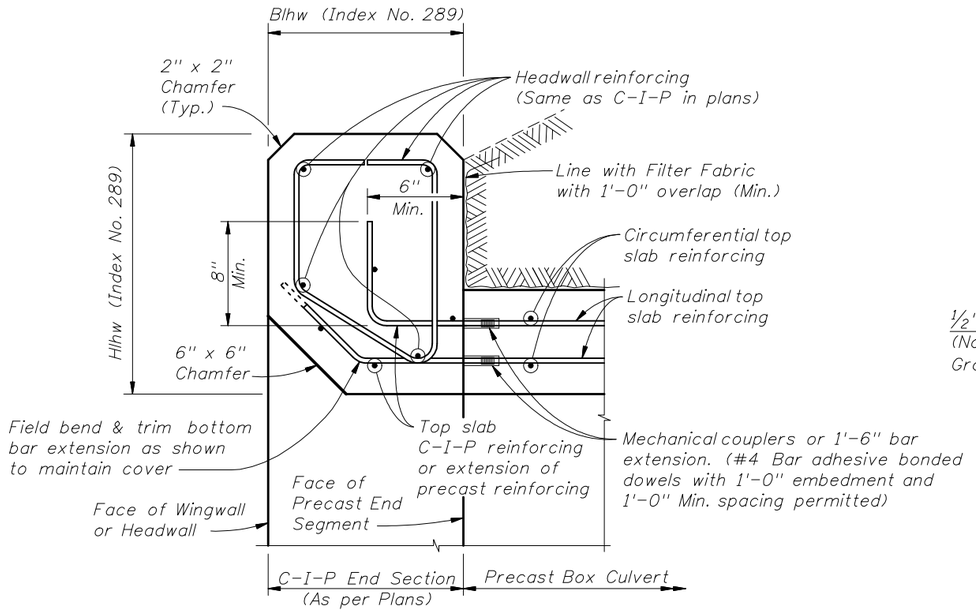
SECTION A-A
(3" Cover - Thick Wall Detail)



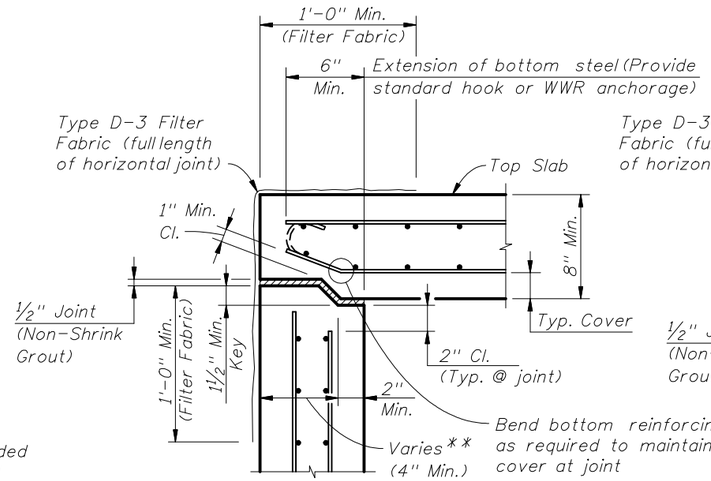
SCHEMATIC A
TYPE B BOX SECTION PLACEMENT
FOR SINGLE TONGUE & GROOVE JOINTS

PRECAST SEGMENT TO SEGMENT TONGUE & GROOVE TRANSVERSE JOINTS

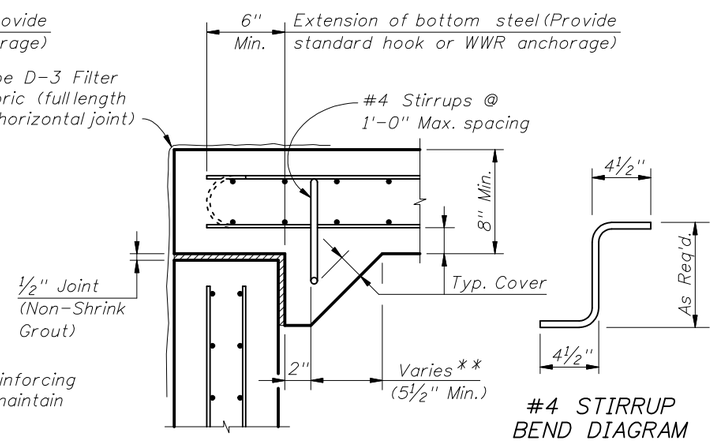
TWO-PIECE PRECAST SEGMENT ADDITIONAL JOINT DETAILS (TYPE B BOX)



SECTION C-C
C-I-P HEADWALL DETAILS AND CONNECTION TO PRECAST BOX



SECTION B-B
TOP SLAB TO WALL JOINT
(KEYED JOINT)

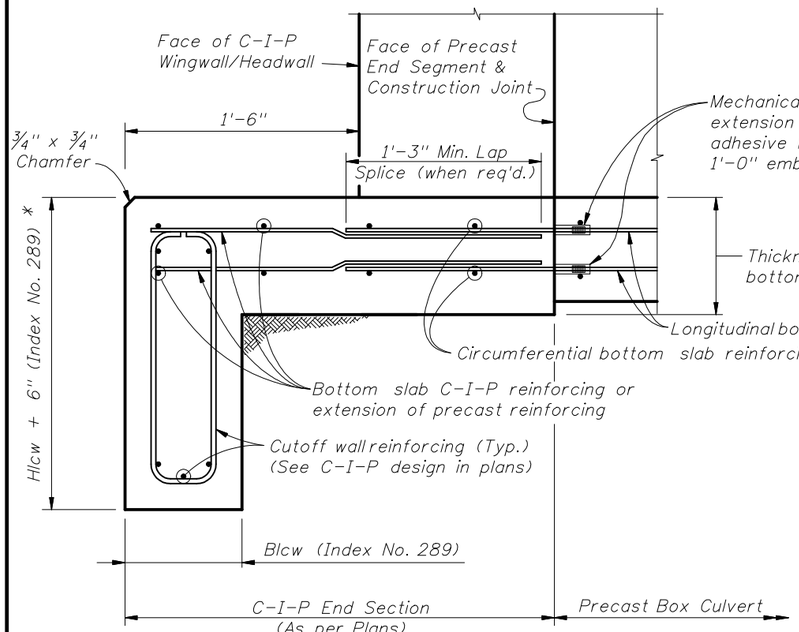


SECTION B-B
TOP SLAB TO WALL JOINT
(HAUNCHED JOINT)

#4 STIRRUP
BEND DIAGRAM

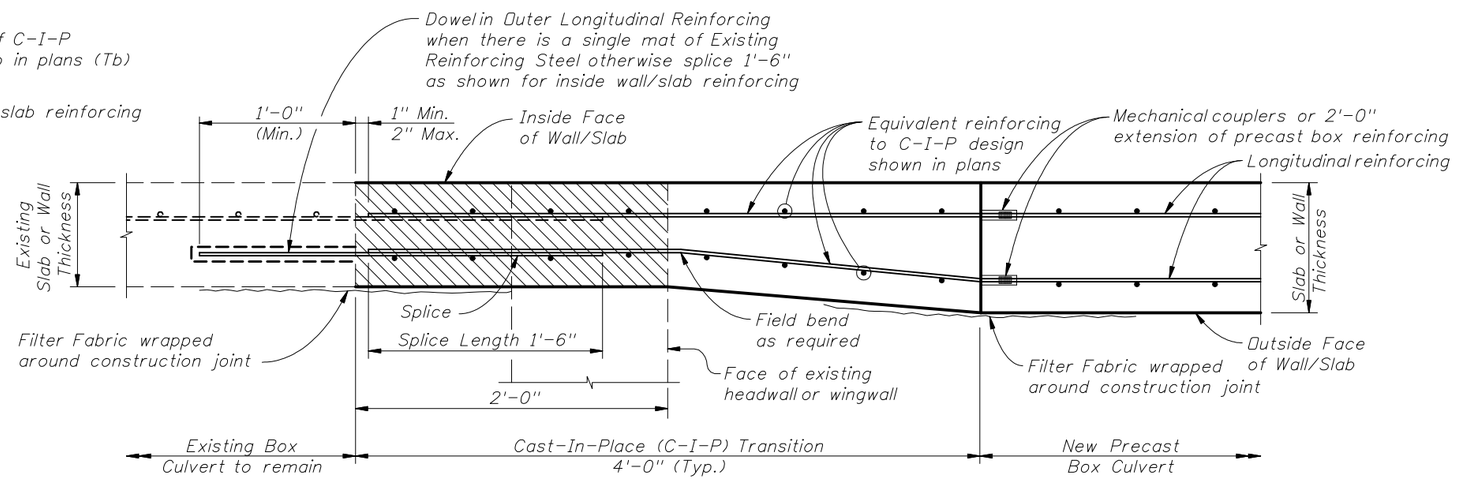
** Provide adequate width to satisfy shear strength requirements at joint

TYPE B BOX LONGITUDINAL JOINTS



SECTION D-D
C-I-P TOE SLAB & CUTOFF WALL DETAILS
AND CONNECTION TO PRECAST BOX

* Provide additional 6" depth of cutoff wall at no additional cost.



SECTION E-E
EXTERIOR WALL/SLAB TRANSITION DETAIL FOR PRECAST EXTENSION

Section of Existing Box Culvert to be removed and replaced.

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SUPPLEMENTAL DETAILS FOR PRECAST CONCRETE BOX CULVERTS

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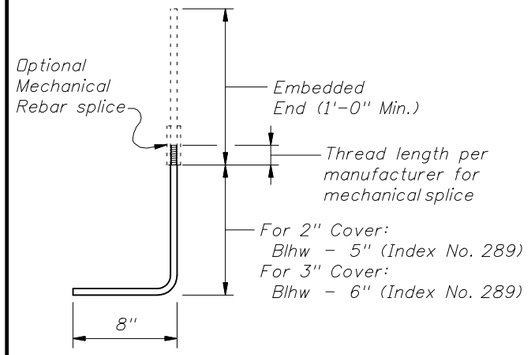
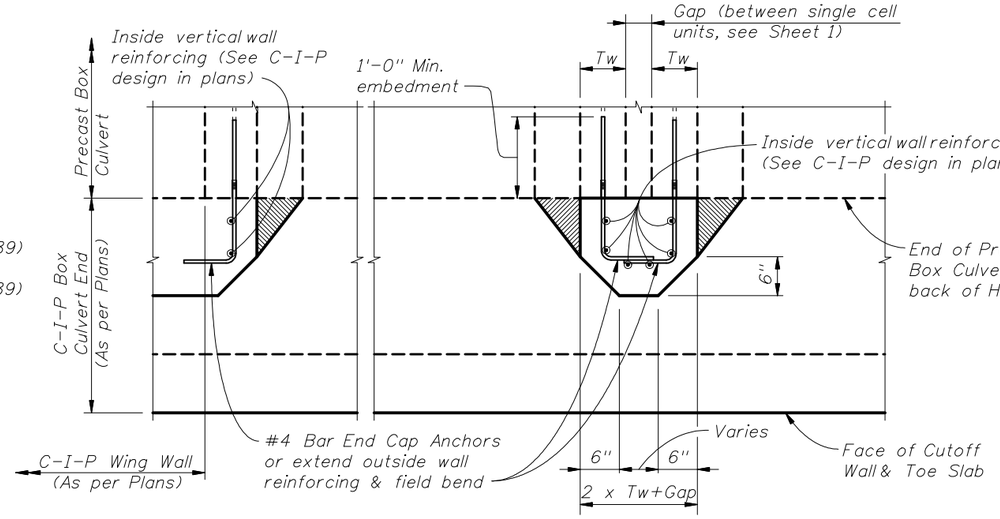
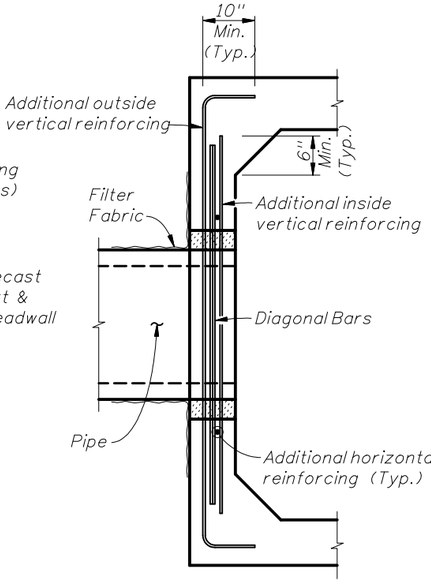


#4 BAR END CAP ANCHOR
BAR BEND DIAGRAM



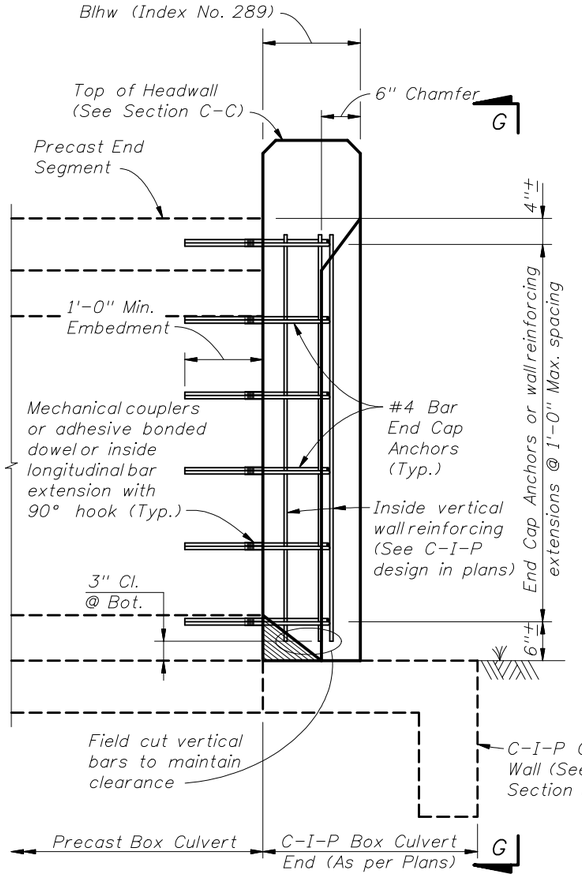
SECTION H-H



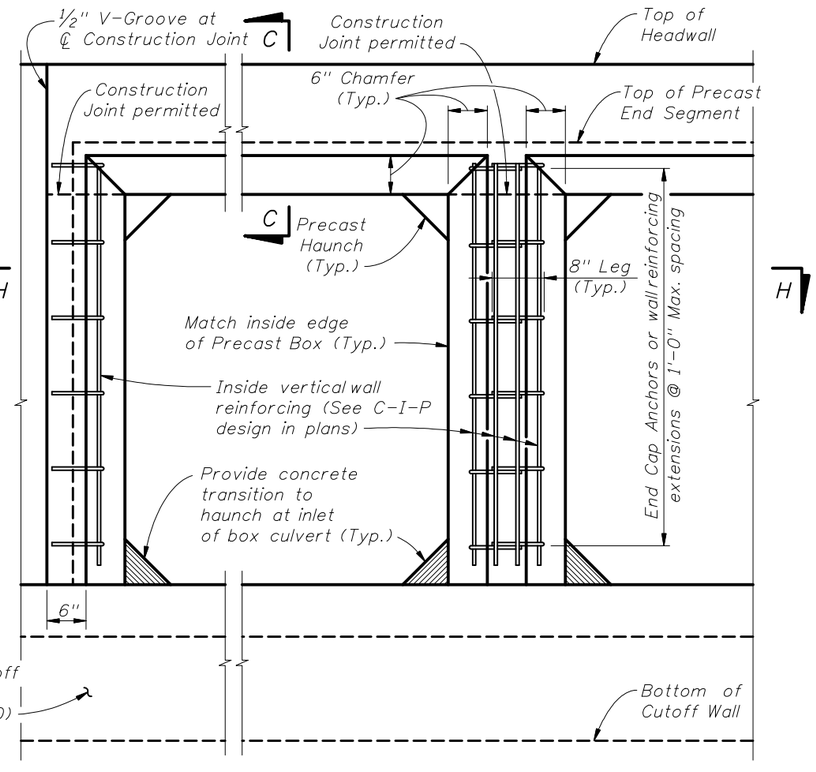
SECTION I-I
(Showing additional blockout reinforcing only)

PIPE BLOCKOUT NOTES:

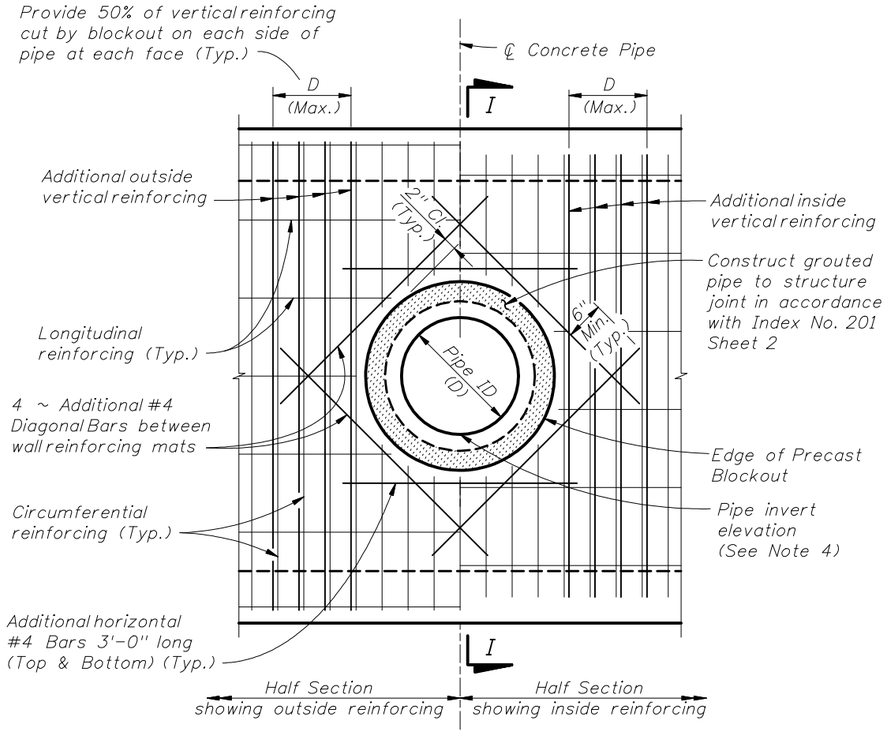
1. Cut box culvert reinforcement as required to maintain 2" cover.
2. For Precast Sections construct opening a minimum of 1'-6" away from any box to box joint, except opening may be a minimum of 1'-0" away from joint when at least 2'-0" of clearance to the box to box joint is provided on the opposite side of the pipe opening.
3. Pipe blockout diameter to be 6" greater than pipe outside diameter.
4. See Drainage Plans for size, placement, and invert elevation.



SECTION F-F



VIEW G-G
(Headwall, Toe Slab and Cutoff Wall Reinforcing not shown for clarity)



ELEVATION VIEW

C-I-P END CAP DETAILS AND CONNECTION TO PRECAST BOX

PIPE BLOCKOUT DETAILS

2010 FDOT Design Standards

SUPPLEMENTAL DETAILS FOR PRECAST CONCRETE BOX CULVERTS

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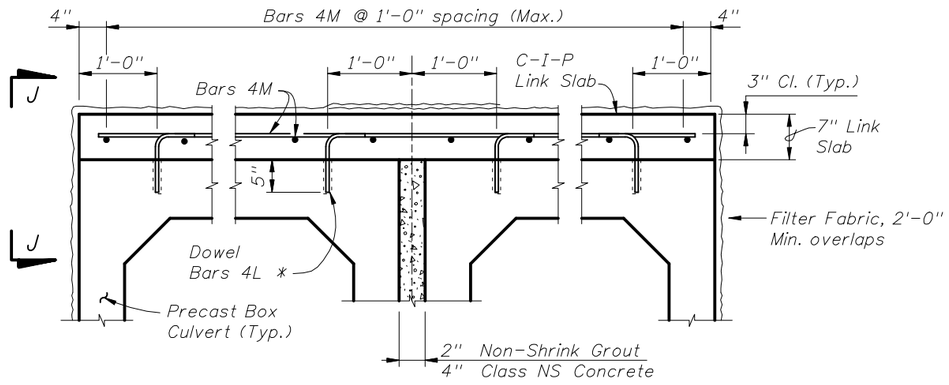


LINK SLAB TYPICAL SECTION
(Multiple Barrel Culvert shown, Single Barrel Culvert similar)

* Install dowels with an Adhesive Bonding Material System in accordance with Specification Section 416. The Contractor may substitute mechanical couplers in lieu of adhesive bonded dowels. Shift dowels to clear box culvert reinforcing.

LINK SLAB NOTES:

1. Provide a Cast-In-Place Link Slab to ensure uniform joint opening of precast box culverts when the differential settlement shown in the plans exceeds the following limits, except that a Link Slab is not required for differential settlements less than ½".

$$\Delta Y \leq \frac{(L)^2}{760 \times R \times W}$$

Where:
ΔY = Maximum Long-Term Differential Settlement (ft.)
R = Exterior height of Box Culvert (ft.)
W = Length of Box Culvert Segments (ft.)
L = Effective length for single curvature deflection (ft.)

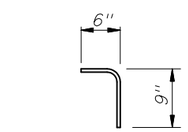
2. Extend Link Slab to back face of headwalls and to limits of existing box culverts for extensions.

ESTIMATED LINK SLAB QUANTITIES		
ITEM	UNIT	QUANTITY
Class II or IV Concrete (Culvert)	CY/SF	0.0216
Reinforcing Steel (Roadway)	Lb./SF	1.52

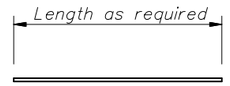
NOTE: Estimated quantities are based the plan area of precast box slabs, and are provided for information only. No additional payment will be made for Link Slabs where these are required for the precast box culverts.

BILL OF REINFORCING STEEL			
MARK	SIZE	NO. REQ'D	LENGTH
L	4	2 per Barrel/Ft.	1'-3"
M	4	As reqd.	As reqd.

REINFORCING STEEL BENDING DIAGRAMS



DOWEL BARS 4L

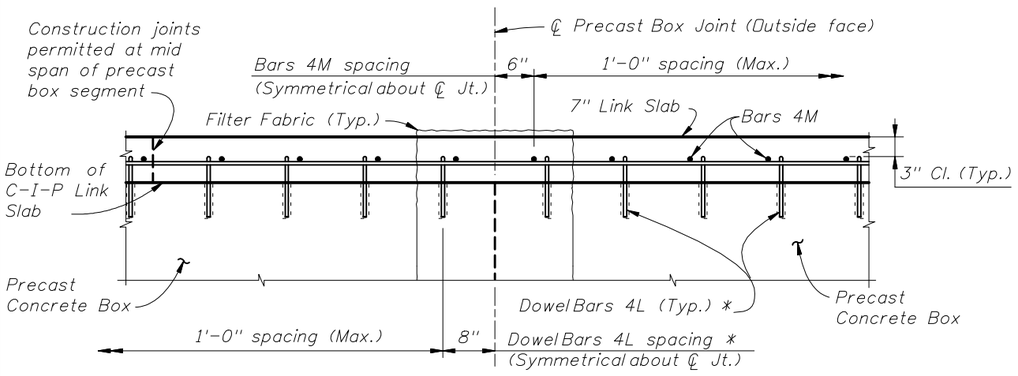


BAR 4M

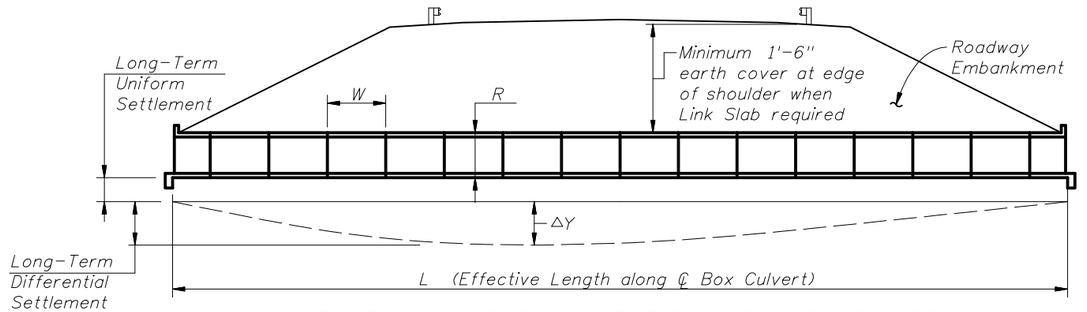
NOTES:
1. All bar dimensions are out to out.
2. Lap splice length for Bars 4M is 1'-4" minimum.

DESIGN NOTE:

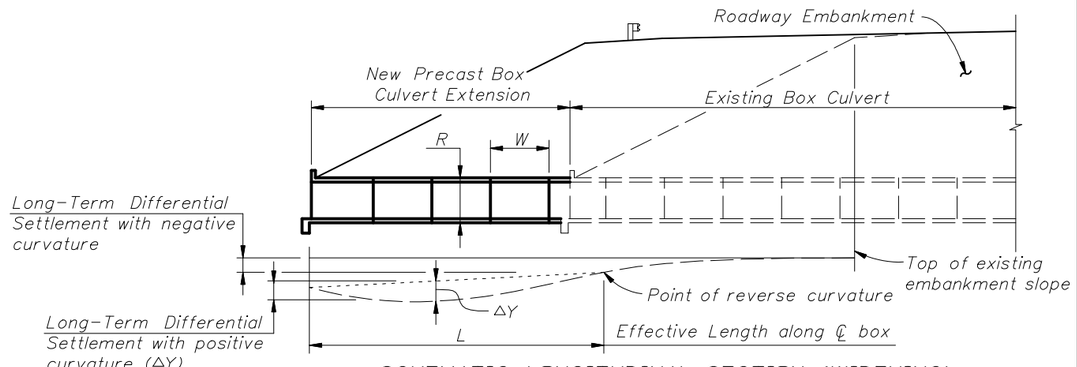
1. Link Slab required when joint openings from differential settlement exceed ⅛" as determined in Link Slab Note 1.



VIEW J-J



SCHEMATIC LONGITUDINAL SECTION (NEW CONSTRUCTION)



SCHEMATIC LONGITUDINAL SECTION (WIDENING)

DIFFERENTIAL SETTLEMENT COUNTERMEASURES FOR PRECAST BOX CULVERTS

2010 FDOT Design Standards

SUPPLEMENTAL DETAILS FOR PRECAST CONCRETE BOX CULVERTS

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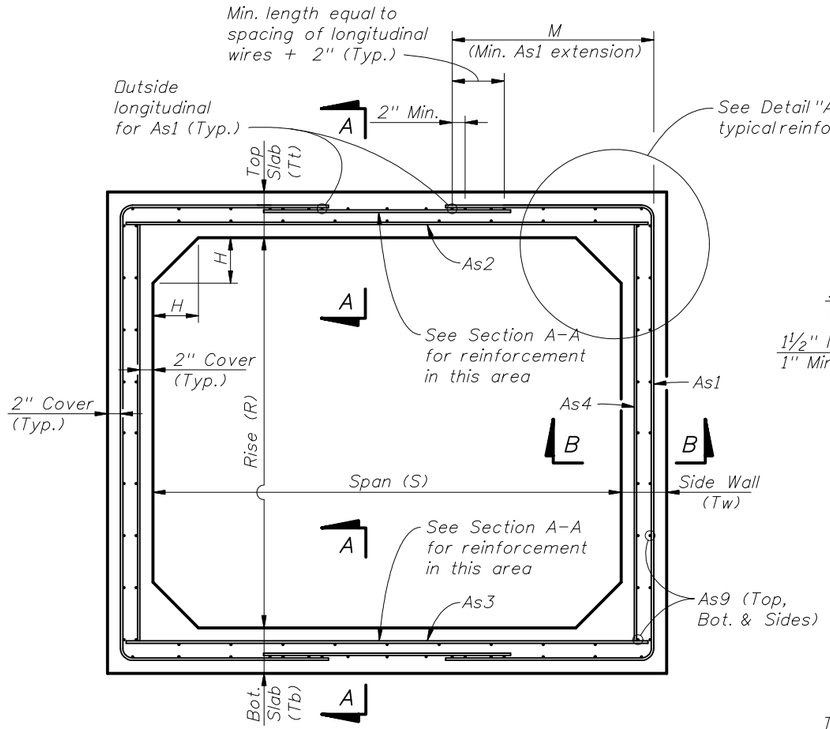
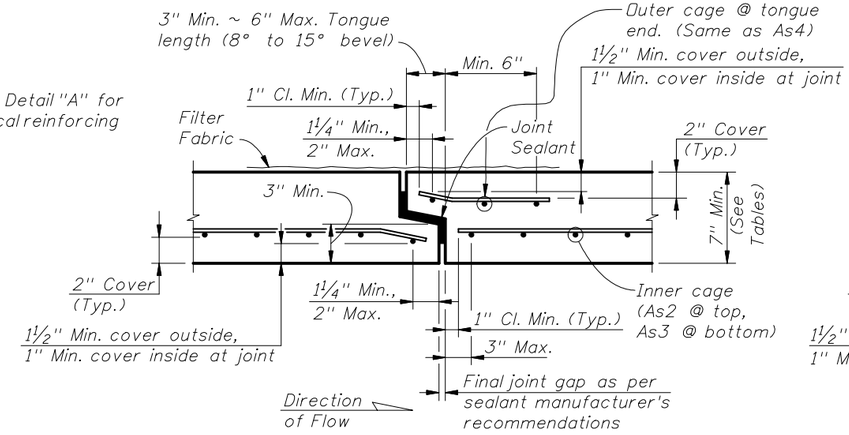
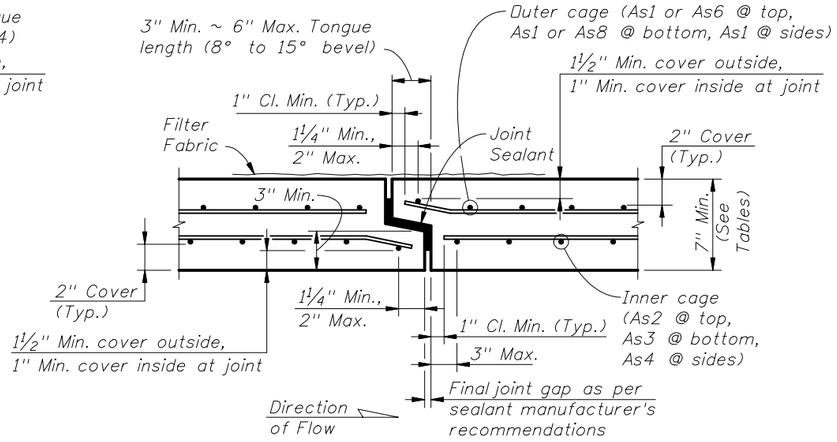


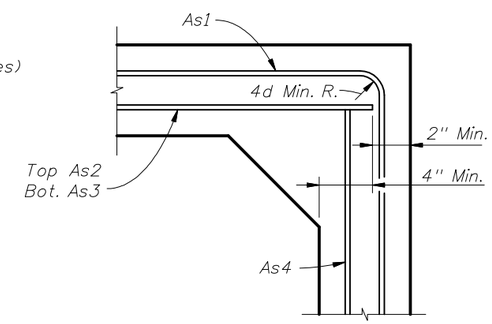
TYPICAL BOX SECTION (TYPE 2)
DESIGN EARTH COVER 2' OR GREATER



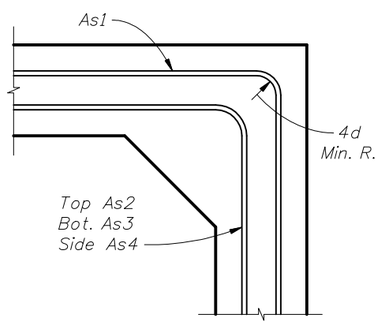
SECTION A-A



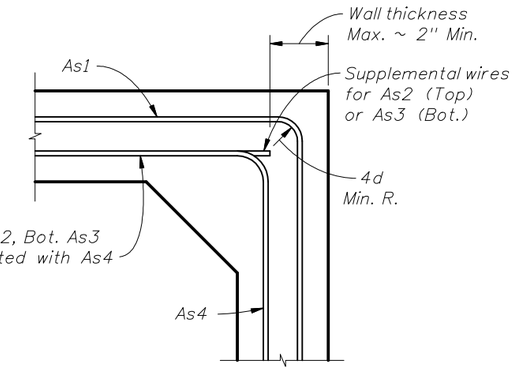
SECTION B-B
TYPICAL SECTION THRU JOINT



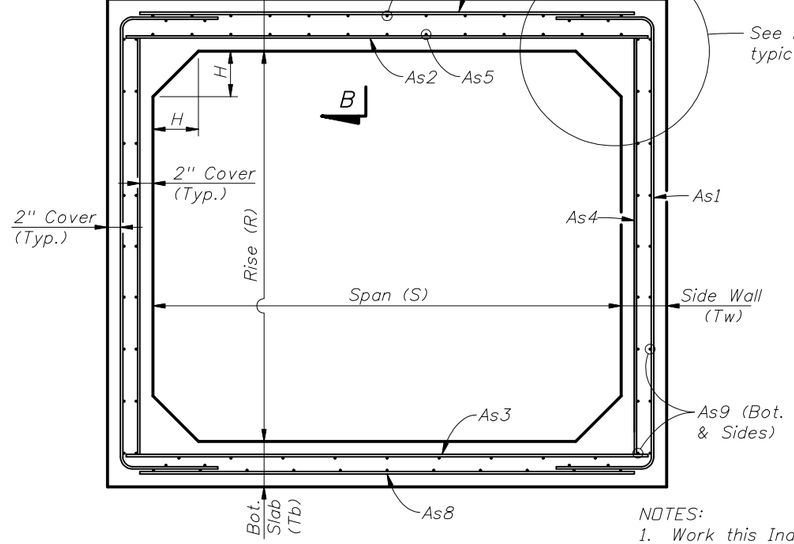
DETAIL "A"
(OPTION 1)



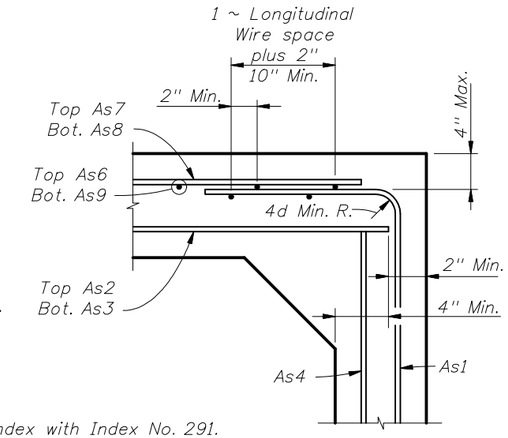
DETAIL "A"
(OPTION 2)



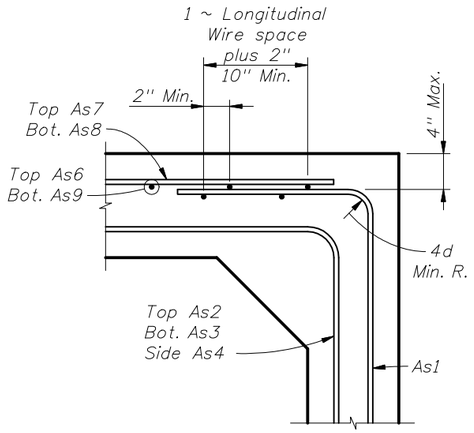
DETAIL "A"
(OPTION 3)



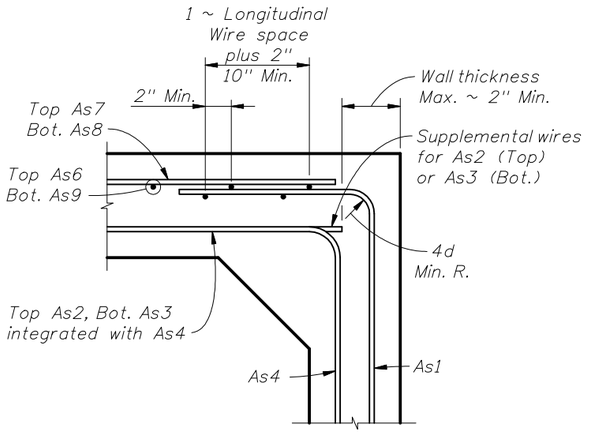
TYPICAL BOX SECTION (TYPE 1)
DESIGN EARTH COVER LESS THAN 2'



DETAIL "B"
(OPTION 1)



DETAIL "B"
(OPTION 2)



DETAIL "B"
(OPTION 3)

NOTES:
1. Work this Index with Index No. 291.
2. See sheets 2 thru 5 for dimensions and areas of reinforcement.

STANDARD PRECAST BOX CULVERT WITH 2" CONCRETE COVER

GENERAL NOTES:

1. These precast designs may be substituted for cast-in-place box culverts designed to AASHTO LRFD Bridge Design Specifications, 4th Edition. Designs are based on the design criteria shown in FDOT Structures Design Guidelines.
2. Loading: HL-93 & any fill heights between the minimum & maximum shown.
3. Only one design of precast box culvert is to be used for any installation.
4. Reinforcing steel must consist of smooth or deformed welded wire reinforcement (WWR) conforming to ASTM A185 or A497. Longitudinal reinforcement may consist of ASTM A615 Grade 60 bars. Minimum cover must be 2" unless otherwise shown. The spacing of circumferential wires must not be less than 2" nor more than 4". The spacing of longitudinal wires or bars must not be more than 8".
5. As9 longitudinal wires must have a minimum cross-sectional area of 40% of the circumferential wires, but not less than a W2.5 or D2.5 for WWR, or #3 bars for ASTM A615 deformed bars.
6. Welding of reinforcement must be limited to the locations shown in ASTM C1577 and in accordance with ANSI/AWS D1.4 "Structural Welding Code - Reinforcing Steel".
7. Haunch dimensions may vary between the minimum and maximum dimensions shown in the Design Tables but only one haunch dimension must be used within the full length of the box culvert installation.
8. Submittal of redesign calculations are not required for any increase to the slab and/or wall thickness when the minimum reinforcement areas shown in the Design Tables are provided.
9. For Design Earth Cover greater than 10 feet, the Contractor may interpolate the required areas of reinforcement and slab or wall thickness. Interpolated areas of reinforcement, slab or wall thickness must be approved by the Engineer.
10. See Index No. 291 for connections to wingwalls, headwalls and other general details.

TABLE 1A - STANDARD PRECAST BOX CULVERT DESIGNS (2" COVER) - 3' & 4' SPANS

SPAN x RISE (S) (R) (ft.)	SLAB / WALL THICKNESS TOP (Tt) (in.)	BOT. (Tb) (in.)	SIDE (Tw) (in.)	HAUNCH (H) (in.)	DESIGN EARTH COVER ABOVE TOP SLAB	REINFORCEMENT AREAS (sq. in./ft.) As1	As2	As3	As4	As5	As6	As7	As8	As9	As1 EXT. LENGTH (M) (in.)
3'x 3'	7	7	7	4	0.33' - <2'	0.17	0.29	0.21	0.17	0.17	0.17	0.17	0.17	See General Note 5	-
					2' - <3'	0.13	0.28	0.21	0.09	-	-	-	-		31
					3' - <5'	0.09	0.17	0.17	0.09	-	-	-	-		31
				to	5' - 10'	0.09	0.17	0.17	0.09	-	-	-	-		31
					15'	0.09	0.17	0.17	0.09	-	-	-	-		31
					20'	0.12	0.17	0.17	0.09	-	-	-	-		31
				8	25'	0.14	0.18	0.18	0.09	-	-	-	-		31
					30'	0.17	0.21	0.22	0.09	-	-	-	-		31
					35'	0.19	0.25	0.25	0.09	-	-	-	-		31
4'x 3'	7	7	7	4	0.33' - <2'	0.19	0.38	0.26	0.17	0.19	0.17	0.17	0.19		-
					2' - <3'	0.19	0.38	0.26	0.09	-	-	-	-		38
					3' - <5'	0.14	0.20	0.22	0.09	-	-	-	-		38
				to	5' - 10'	0.11	0.17	0.17	0.09	-	-	-	-		38
					15'	0.15	0.17	0.18	0.09	-	-	-	-		38
				8	20'	0.20	0.23	0.23	0.09	-	-	-	-		38
					25'	0.24	0.28	0.29	0.09	-	-	-	-		38
					30'	0.29	0.34	0.35	0.09	-	-	-	-		38
4'x 4'	7	7	7	4	0.33' - <2'	0.19	0.41	0.28	0.17	0.21	0.17	0.17	0.19		-
					2' - <3'	0.19	0.41	0.28	0.09	-	-	-	-		38
					3' - <5'	0.14	0.21	0.24	0.09	-	-	-	-		38
				to	5' - 10'	0.12	0.17	0.17	0.09	-	-	-	-		38
					15'	0.16	0.19	0.20	0.09	-	-	-	-		38
				8	20'	0.21	0.25	0.25	0.09	-	-	-	-		38
					25'	0.26	0.31	0.32	0.09	-	-	-	-		38
					30'	0.31	0.37	0.38	0.09	-	-	-	-		38

TABLE 1B - STANDARD PRECAST BOX CULVERT DESIGNS (2" COVER) - 3' & 4' SPANS

SPAN x RISE (S) (R) (ft.)	SLAB / WALL THICKNESS TOP (Tt) (in.)	BOT. (Tb) (in.)	SIDE (Tw) (in.)	HAUNCH (H) (in.)	DESIGN EARTH COVER ABOVE TOP SLAB	REINFORCEMENT AREAS (sq. in./ft.) As1	As2	As3	As4	As5	As6	As7	As8	As9	As1 EXT. LENGTH (M) (in.)
3'x 3'	8	8	8	4	0.33' - <2'	0.20	0.26	0.32	0.20	0.20	0.20	0.20	0.20	See General Note 5	-
					2' - <3'	0.16	0.25	0.31	0.10	-	-	-	-		31
					3' - <5'	0.10	0.20	0.20	0.10	-	-	-	-		31
				to	5' - 10'	0.10	0.20	0.20	0.10	-	-	-	-		31
					15'	0.10	0.20	0.20	0.10	-	-	-	-		31
					20'	0.10	0.20	0.20	0.10	-	-	-	-		31
				8	25'	0.11	0.20	0.20	0.10	-	-	-	-		31
					30'	0.13	0.20	0.20	0.10	-	-	-	-		31
					35'	0.15	0.21	0.21	0.10	-	-	-	-		31
4'x 3'	8	8	8	4	0.33' - <2'	0.20	0.31	0.22	0.20	0.20	0.20	0.20	0.20		-
					2' - <3'	0.12	0.31	0.22	0.10	-	-	-	-		38
					3' - <5'	0.12	0.20	0.20	0.10	-	-	-	-		38
				to	5' - 10'	0.10	0.20	0.20	0.10	-	-	-	-		38
					15'	0.12	0.20	0.20	0.10	-	-	-	-		38
				8	20'	0.16	0.20	0.20	0.10	-	-	-	-		38
					25'	0.19	0.24	0.24	0.10	-	-	-	-		38
					30'	0.22	0.28	0.29	0.10	-	-	-	-		38
4'x 4'	8	8	8	4	0.33' - <2'	0.20	0.33	0.24	0.20	0.20	0.20	0.20	0.20		-
					2' - <3'	0.17	0.33	0.24	0.10	-	-	-	-		38
					3' - <5'	0.12	0.20	0.20	0.10	-	-	-	-		38
				to	5' - 10'	0.10	0.20	0.20	0.10	-	-	-	-		38
					15'	0.13	0.20	0.20	0.10	-	-	-	-		38
				8	20'	0.16	0.21	0.22	0.10	-	-	-	-		38
					25'	0.20	0.26	0.27	0.10	-	-	-	-		38
					30'	0.23	0.31	0.32	0.10	-	-	-	-		38

NOTES: 1. See Sheet 1 for Reinforcing Details and dimension locations.
2. See Sheet 14 for WWR Bending Diagram.

TABLE 2A - STANDARD PRECAST BOX CULVERT DESIGNS (2" COVER) - 5' & 6' SPANS

SPAN x RISE (S) (R) (ft.)	SLAB / WALL THICKNESS TOP (Tt) (in.)	BOT. (Tb) (in.)	SIDE (Tw) (in.)	HAUNCH (H) (in.)	DESIGN EARTH COVER ABOVE TOP SLAB	REINFORCEMENT AREAS (sq. in./ft.) As1	As2	As3	As4	As5	As6	As7	As8	As9	As1 EXT. LENGTH (M) (in.)
5'x 3'	7	7	7	4 to 8	0.33' - <2'	0.31	0.48	0.42	0.17	0.21	0.17	0.23	0.31	See General Note 5	-
					2' - <3'	0.31	0.48	0.42	0.09	-	-	-	-		45
					3' - <5'	0.20	0.27	0.27	0.09	-	-	-	-		36
					5' - 10'	0.17	0.19	0.21	0.09	-	-	-	-		36
					15'	0.24	0.25	0.25	0.09	-	-	-	-		35
					20'	0.32	0.33	0.33	0.09	-	-	-	-		35
					25'	0.39	0.41	0.42	0.09	-	-	-	-		35
					30'	0.47	0.50	0.50	0.09	-	-	-	-		35
5'x 4'	7	7	7	4 to 8	0.33' - <2'	0.30	0.51	0.45	0.17	0.23	0.17	0.21	0.30		-
					2' - <3'	0.30	0.51	0.45	0.09	-	-	-	-		45
					3' - <5'	0.18	0.30	0.29	0.09	-	-	-	-		45
					5' - 10'	0.17	0.21	0.23	0.09	-	-	-	-		36
					15'	0.24	0.27	0.28	0.09	-	-	-	-		35
					20'	0.31	0.36	0.37	0.09	-	-	-	-		35
					25'	0.39	0.45	0.46	0.09	-	-	-	-		35
					30'	0.46	0.55	0.56	0.09	-	-	-	-		35
5'x 5'	7	7	7	4 to 8	0.33' - <2'	0.30	0.53	0.48	0.17	0.24	0.17	0.21	0.30		-
					2' - <3'	0.29	0.53	0.48	0.09	-	-	-	-		45
					3' - <5'	0.19	0.31	0.31	0.09	-	-	-	-		45
					5' - 10'	0.19	0.22	0.25	0.09	-	-	-	-		45
					15'	0.26	0.29	0.31	0.09	-	-	-	-		36
					20'	0.34	0.39	0.40	0.09	-	-	-	-		35
					25'	0.41	0.49	0.50	0.09	-	-	-	-		35
					30'	0.49	0.59	0.61	0.09	-	-	-	-		35
6'x 3'	7.5	7	7	4 to 12	0.33' - <2'	0.39	0.54	0.48	0.17	0.22	0.18	0.25	0.39		-
	7	7	7		2' - <3'	0.39	0.58	0.49	0.09	-	-	-	-		43
					3' - <5'	0.28	0.36	0.36	0.09	-	-	-	-		39
					5' - 10'	0.25	0.26	0.28	0.09	-	-	-	-		39
					15'	0.36	0.34	0.34	0.09	-	-	-	-		38
					20'	0.47	0.46	0.46	0.09	-	-	-	-		38
	7	7.5	7		25'	0.59	0.57	0.55	0.09	-	-	-	-		38
	8	8	7		30'	0.60	0.64	0.64	0.09	-	-	-	-		38
6'x 4'	7.5	7	7	4 to 12	0.33' - <2'	0.37	0.58	0.52	0.17	0.24	0.18	0.23	0.37		-
	7	7	7		2' - <3'	0.37	0.61	0.53	0.09	-	-	-	-		43
					3' - <5'	0.26	0.39	0.39	0.09	-	-	-	-		39
					5' - 10'	0.24	0.28	0.31	0.09	-	-	-	-		39
					15'	0.35	0.37	0.38	0.09	-	-	-	-		38
					20'	0.46	0.50	0.50	0.09	-	-	-	-		38
	7	7.5	7		25'	0.56	0.63	0.60	0.09	-	-	-	-		38
	8	8	7		30'	0.58	0.69	0.69	0.09	-	-	-	-		38
6'x 5'	7.5	7	7	4 to 12	0.33' - <2'	0.36	0.60	0.56	0.17	0.25	0.18	0.22	0.36		-
	7	7	7		2' - <3'	0.36	0.64	0.56	0.09	-	-	-	-		43
					3' - <5'	0.26	0.410	0.42	0.09	-	-	-	-		43
					5' - 10'	0.25	0.30	0.33	0.09	-	-	-	-		39
					15'	0.34	0.40	0.41	0.09	-	-	-	-		38
					20'	0.46	0.54	0.54	0.09	-	-	-	-		38
	7	7.5	7		25'	0.56	0.67	0.65	0.09	-	-	-	-		38
	8	8	8		30'	0.60	0.74	0.74	0.09	-	-	-	-		38
6'x 6'	7.5	7	7	4 to 12	0.33' - <2'	0.36	0.63	0.59	0.17	0.26	0.18	0.22	.036		-
	7	7	7		2' - <3'	0.35	0.67	0.59	0.09	-	-	-	-		52
					3' - <5'	0.27	0.43	0.44	0.09	-	-	-	-		52
					5' - 10'	0.27	0.32	0.35	0.09	-	-	-	-		43
					15'	0.38	0.43	0.44	0.09	-	-	-	-		39
					20'	0.50	0.57	0.59	0.09	-	-	-	-		39
	7	7.5	7		25'	0.60	0.72	0.70	0.09	-	-	-	-		38
	8	8	7		30'	0.67	0.78	0.79	0.09	-	-	-	-		38

TABLE 2B - STANDARD PRECAST BOX CULVERT DESIGNS (2" COVER) - 5' & 6' SPANS

SPAN x RISE (S) (R) (ft.)	SLAB / WALL THICKNESS TOP (Tt) (in.)	BOT. (Tb) (in.)	SIDE (Tw) (in.)	HAUNCH (H) (in.)	DESIGN EARTH COVER ABOVE TOP SLAB	REINFORCEMENT AREAS (sq. in./ft.) As1	As2	As3	As4	As5	As6	As7	As8	As9	As1 EXT. LENGTH (M) (in.)
5'x 3'	8	8	8	4 to 8	0.33' - <2'	0.26	0.39	0.36	0.20	0.20	0.20	0.20	0.26	See General Note 5	-
					2' - <3'	0.26	0.39	0.36	0.10	-	-	-	-		45
					3' - <5'	0.16	0.23	0.24	0.10	-	-	-	-		36
					5' - 10'	0.13	0.20	0.20	0.10	-	-	-	-		36
					15'	0.19	0.21	0.22	0.10	-	-	-	-		35
					20'	0.24	0.28	0.28	0.10	-	-	-	-		35
					25'	0.30	0.34	0.35	0.10	-	-	-	-		35
					30'	0.36	0.41	0.41	0.10	-	-	-	-		35
5'x 4'	8	8	8	4 to 8	0.33' - <2'	0.25	0.42	0.38	0.20	0.20	0.20	0.20	0.25		-
					2' - <3'	0.25	0.42	0.38	0.10	-	-	-	-		45
					3' - <5'	0.16	0.25	0.25	0.10	-	-	-	-		45
					5' - 10'	0.13	0.20	0.20	0.10	-	-	-	-		36
					15'	0.19	0.23	0.24	0.10	-	-	-	-		35
					20'	0.24	0.30	0.31	0.10	-	-	-	-		35
					25'	0.30	0.37	0.38	0.10	-	-	-	-		35
					30'	0.35	0.45	0.46	0.10	-	-	-	-		35
5'x 5'	8	8	8	4 to 8	0.33' - <2'	0.25	0.44	0.41	0.20	0.20	0.20	0.20	0.25		-
					2' - <3'	0.25	0.44	0.41	0.10	-	-	-	-		45
					3' - <5'	0.16	0.26	0.27	0.10	-	-	-	-		45
					5' - 10'	0.15	0.20	0.22	0.10	-	-	-	-		45
					15'	0.20	0.25	0.26	0.10	-	-	-	-		36
					20'	0.26	0.32	0.33	0.10	-	-	-	-		35
					25'	0.32	0.40	0.41	0.10	-	-	-	-		35
					30'	0.37	0.48	0.49	0.10	-	-	-	-		35
6'x 3'	8	8	8	4 to 12	0.33' - <2'	0.32	0.47	0.41	0.20	0.20	0.20	0.25	0.32		-
					2' - <3'	0.32	0.47	0.41	0.10	-	-	-	-		43
					3' - <5'	0.23	0.30	0.31	0.10	-	-	-	-		39
					5' - 10'	0.19	0.22	0.24	0.10	-	-	-	-		39
					15'	0.28	0.29	0.29	0.10	-	-	-	-		38
					20'	0.36	0.38	0.38	0.10	-	-	-	-		38
					25'	0.45	0.47	0.47	0.10	-	-	-	-		38
					30'	0.54	0.57	0.57	0.10	-	-	-	-		38
6'x 4'	8	8	8	4 to 12	0.33' - <2'	0.31	0.50	0.44	0.20	0.21	0.20	0.23	0.31		-
					2' - <3'	0.31	0.50	0.44	0.10	-	-	-	-		43
					3' - <5'	0.23	0.32	0.34	0.10	-	-	-	-		39
					5' - 10'	0.19	0.24	0.26	0.10	-	-	-	-		39
					15'	0.27	0.31	0.32	0.10	-	-	-	-		38
					20'	0.35	0.41	0.41	0.10	-	-	-	-		38
					25'	0.43	0.51	0.51	0.10	-	-	-	-		38
					30'	0.52	0.62	0.62	0.10	-	-	-	-		38
6'x 5'	8	8	8	4 to 12	0.33' - <2'	0.30	0.52	0.47	0.20	0.22	0.20	0.22	0.30		-
					2' - <3'	0.30	0.52	0.47	0.10	-	-	-	-		43
					3' - <5'	0.22	0.34	0.36	0.10	-	-	-	-		43
					5' - 10'	0.20	0.26	0.28	0.10	-	-	-	-		39
					15'	0.27	0.33	0.34	0.10	-	-	-	-		38
					20'	0.36	0.44	0.45	0.10	-	-	-	-		38
					25'	0.44	0.55	0.55	0.10	-	-	-	-		38
					30'	0.52	0.66	0.67	0.10	-	-	-	-		38
6'x 6'	8	8	8	4 to 12	0.33' - <2'	0.30	0.54	0.50	0.20	0.22	0.20	0.22	0.30		-
					2' - <3'	0.30	0.54	0.50	0.10	-	-	-	-		52
					3' - <5'	0.23	0.36	0.38	0.10	-	-	-	-		52
					5' - 10'	0.21	0.27	0.30	0.10	-	-	-	-		43
					15'	0.29	0.35	0.37	0.10	-	-	-	-		39
					20'	0.38	0.47	0.48	0.10	-	-	-	-		39
					25'	0.47	0.59	0.60	0.10	-	-	-	-		38
					30'	0.55	0.70	0.71	0.10	-	-	-	-		38

TABLE 3 - STANDARD PRECAST BOX CULVERT DESIGNS (2" COVER) - 7' SPANS

SPAN x RISE (S) (R) (ft.)	SLAB / WALL THICKNESS TOP (Tt) (in.)	BOT. (Tb) (in.)	SIDE (Tw) (in.)	HAUNCH (H) (in.)	DESIGN EARTH COVER ABOVE TOP SLAB	REINFORCEMENT AREAS (sq. in./ft.) As1	As2	As3	As4	As5	As6	As7	As8	As9	As1 EXT. LENGTH (M) (in.)
7'x 4'	8	8	8	4 to 12	0.33' - <2'	0.37	0.58	0.49	0.20	0.22	0.20	0.29	0.37	See General Note 5	-
					2' - <3'	0.37	0.58	0.49	0.10	-	-	-	-		43
					3' - <5'	0.30	0.40	0.42	0.10	-	-	-	-		43
					5' - 10'	0.26	0.30	0.33	0.10	-	-	-	-		43
					15'	0.37	0.40	0.40	0.10	-	-	-	-		41
					20'	0.49	0.53	0.53	0.10	-	-	-	-		41
	8	8	8	7 to 12	25'	0.60	0.67	0.66	0.10	-	-	-	-		41
	8.5	8.5	8		30'	0.68	0.79	0.78	0.10	-	-	-	-		41
7'x 5'	8	8	8	4 to 12	0.33' - <2'	0.36	0.60	0.53	0.20	0.23	0.20	0.28	0.36		-
					2' - <3'	0.36	0.60	0.53	0.10	-	-	-	-		47
					3' - <5'	0.30	0.42	0.45	0.10	-	-	-	-		43
					5' - 10'	0.26	0.32	0.35	0.10	-	-	-	-		43
					15'	0.37	0.43	0.44	0.10	-	-	-	-		41
					20'	0.48	0.57	0.57	0.10	-	-	-	-		41
	8	8	8	7 to 12	25'	0.60	0.72	0.72	0.10	-	-	-	-		41
	8.5	8.5	8		30'	0.67	0.84	0.84	0.10	-	-	-	-		41
7'x 6'	8	8	8	4 to 12	0.33' - <2'	0.36	0.63	0.56	0.20	0.24	0.20	0.27	0.36		-
					2' - <3'	0.36	0.63	0.56	0.10	-	-	-	-		59
					3' - <5'	0.29	0.44	0.47	0.10	-	-	-	-		47
					5' - 10'	0.27	0.34	0.37	0.10	-	-	-	-		43
					15'	0.38	0.46	0.46	0.10	-	-	-	-		41
					20'	0.49	0.60	0.61	0.10	-	-	-	-		41
	8	8	8	7 to 12	25'	0.61	0.76	0.76	0.10	-	-	-	-		41
	8.5	8.5	8		30'	0.69	0.89	0.89	0.10	-	-	-	-		41
7'x 7'	8	8	8	4 to 12	0.33' - <2'	0.36	0.65	0.58	0.20	0.25	0.20	0.27	0.36		-
					2' - <3'	0.36	0.65	0.58	0.10	-	-	-	-		59
					3' - <5'	0.30	0.46	0.50	0.10	-	-	-	-		59
					5' - 10'	0.30	0.35	0.50	0.10	-	-	-	-		47
					15'	0.41	0.48	0.50	0.10	-	-	-	-		43
					20'	0.53	0.64	0.65	0.10	-	-	-	-		43
	8	8	8	7 to 12	25'	0.65	0.80	0.81	0.10	-	-	-	-		43
	8.5	9	8		30'	0.72	0.92	0.91	0.10	-	-	-	-		41

TABLE 4 - STANDARD PRECAST BOX CULVERT DESIGNS (2" COVER) - 8' SPANS

SPAN x RISE (S) (R) (ft.)	SLAB / WALL THICKNESS TOP (Tt) (in.)	BOT. (Tb) (in.)	SIDE (Tw) (in.)	HAUNCH (H) (in.)	DESIGN EARTH COVER ABOVE TOP SLAB	REINFORCEMENT AREAS (sq. in./ft.) As1	As2	As3	As4	As5	As6	As7	As8	As9	As1 EXT. LENGTH (M) (in.)
8'x 4'	9	8.5	8	4 to 12	0.33' - <2'	0.40	0.60	0.52	0.20	0.22	0.22	0.28	0.39	See General Note 5	-
	8	8	8		2' - <3'	0.45	0.66	0.54	0.10	-	-	-	-		50
					3' - <5'	0.39	0.48	0.50	0.10	-	-	-	-		50
					5' - 10'	0.34	0.38	0.40	0.10	-	-	-	-		45
					15'	0.49	0.51	0.50	0.10	-	-	-	-		41
					20'	0.65	0.68	0.66	0.10	-	-	-	-		41
	8.5	8.5	8	8 to 12	25'	0.76	0.83	0.80	0.10	-	-	-	-		41
	9.5	9.5	8		30'	0.79	0.94	0.92	0.10	-	-	-	-		41
8'x 5'	9	8.5	8	4 to 12	0.33' - <2'	0.38	0.65	0.59	0.20	0.22	0.22	0.30	0.37		-
	8	8	8		2' - <3'	0.43	0.69	0.58	0.10	-	-	-	-		50
					3' - <5'	0.37	0.51	0.53	0.10	-	-	-	-		45
					5' - 10'	0.33	0.41	0.42	0.10	-	-	-	-		45
					15'	0.48	0.54	0.53	0.10	-	-	-	-		41
					20'	0.63	0.73	0.70	0.10	-	-	-	-		41
	8.5	8.5	8	8 to 12	25'	0.74	0.88	0.86	0.10	-	-	-	-		41
	9.5	9.5	8		30'	0.77	1.00	0.98	0.10	-	-	-	-		41
8'x 6'	9	9	8	4 to 12	0.33' - <2'	0.32	0.65	0.58	0.20	0.23	0.22	0.25	0.31		-
	8	8	8		2' - <3'	0.42	0.71	0.61	0.10	-	-	-	-		50
					3' - <5'	0.37	0.54	0.56	0.10	-	-	-	-		50
					5' - 10'	0.34	0.43	0.45	0.10	-	-	-	-		45
					15'	0.49	0.57	0.57	0.10	-	-	-	-		41
					20'	0.64	0.77	0.76	0.10	-	-	-	-		41
	8.5	8.5	8	8 to 12	25'	0.74	0.94	0.92	0.10	-	-	-	-		41
	9.5	9.5	8		30'	0.78	1.05	1.04	0.10	-	-	-	-		41
8'x 7'	9	9	8	4 to 12	0.33' - <2'	0.31	0.67	0.60	0.20	0.24	0.22	0.24	0.31		-
	8	8	8		2' - <3'	0.42	0.74	0.64	0.10	-	-	-	-		55
					3' - <5'	0.37	0.56	0.59	0.10	-	-	-	-		55
					5' - 10'	0.36	0.45	0.47	0.10	-	-	-	-		50
					15'	0.51	0.61	0.61	0.10	-	-	-	-		45
					20'	0.66	0.81	0.80	0.10	-	-	-	-		41
	8.5	8.5	8	8 to 12	25'	0.78	0.98	0.97	0.10	-	-	-	-		41
	9.5	9.5	8		30'	0.84	1.10	1.09	0.10	-	-	-	-		41
8'x 8'	9	9	8	4 to 12	0.33' - <2'	0.32	0.68	0.62	0.20	0.24	0.22	0.25	0.32		-
	8	8	8		2' - <3'	0.43	0.76	0.67	0.14	-	-	-	-		65
					3' - <5'	0.38	0.58	0.61	0.14	-	-	-	-		65
					5' - 10'	0.39	0.46	0.50	0.13	-	-	-	-		55
					15'	0.55	0.64	0.65	0.10	-	-	-	-		45
					20'	0.71	0.86	0.85	0.10	-	-	-	-		45
	8.5	8.5	8	8 to 12	25'	0.84	1.03	1.02	0.10	-	-	-	-		41
	9.5	9.5	8		30'	0.93	1.15	1.15	0.10	-	-	-	-		41

NOTES:
1. See Sheet 1 for Reinforcing Details and dimension locations.
2. See Sheet 2 for General Notes.
3. See Sheet 14 for Welded Wire Reinforcement Bending Diagram.

TABLE 5 - STANDARD PRECAST BOX CULVERT DESIGNS (2" COVER) - 9' SPANS

SPAN x RISE (S) (R) (ft.)	SLAB / WALL THICKNESS TOP (Tt) (in.)	BOT. (Tb) (in.)	SIDE (Tw) (in.)	HAUNCH (H) (in.)	DESIGN EARTH COVER ABOVE TOP SLAB	REINFORCEMENT AREAS (sq. in./ft.) As1	As2	As3	As4	As5	As6	As7	As8	As9	As1 EXT. LENGTH (M) (in.)
9'x 5'	9.5	9.5	9	4	0.33' - <2'	0.41	0.62	0.53	0.22	0.23	0.23	0.34	0.38	See General Note 5	-
	9	9	9	to 12	2' - <3'	0.44	0.65	0.54	0.11	-	-	-	-		54
					3' - <5'	0.39	0.53	0.51	0.11	-	-	-	-		49
					5' - 10'	0.35	0.42	0.44	0.11	-	-	-	-		49
					15'	0.50	0.56	0.55	0.11	-	-	-	-		44
					20'	0.65	0.75	0.73	0.11	-	-	-	-		44
	9.5	9.5	9	8 to 12	25'	0.77	0.92	0.90	0.11	-	-	-	-		44
	10.5	11	9		30'	0.81	1.05	1.02	0.11	-	-	-	-		44
9'x 6'	9.5	9.5	9	4	0.33' - <2'	0.38	0.64	0.56	0.23	0.23	0.23	0.33	0.37		-
	9	9	9	to 12	2' - <3'	0.43	0.67	0.57	0.11	-	-	-	-		54
					3' - <5'	0.37	0.55	0.54	0.11	-	-	-	-		49
					5' - 10'	0.35	0.45	0.47	0.11	-	-	-	-		49
					15'	0.49	0.60	0.59	0.11	-	-	-	-		44
					20'	0.65	0.80	0.78	0.11	-	-	-	-		44
	9.5	9.5	9	8 to 12	25'	0.76	0.98	0.95	0.11	-	-	-	-		44
	10.5	11	9		30'	0.80	1.10	1.08	0.11	-	-	-	-		44
9'x 7'	9.5	9.5	9	4	0.33' - <2'	0.37	0.67	0.59	0.22	0.23	0.23	0.32	0.37		-
	9	9	9	to 12	2' - <3'	0.42	0.69	0.60	0.11	-	-	-	-		59
					3' - <5'	0.37	0.58	0.56	0.11	-	-	-	-		54
					5' - 10'	0.36	0.47	0.49	0.11	-	-	-	-		49
					15'	0.50	0.63	0.63	0.11	-	-	-	-		44
					20'	0.66	0.84	0.80	0.11	-	-	-	-		44
	9.5	9.5	9	8 to 12	25'	0.77	1.02	1.00	0.11	-	-	-	-		44
	10.5	11	9		30'	0.81	1.15	1.13	0.11	-	-	-	-		44
9'x 8'	9.5	9.5	9	4	0.33' - <2'	0.37	0.68	0.61	0.22	0.23	0.23	0.31	0.37		-
	9	9	9	to 12	2' - <3'	0.42	0.71	0.62	0.11	-	-	-	-		59
					3' - <5'	0.37	0.60	0.59	0.11	-	-	-	-		59
					5' - 10'	0.38	0.49	0.51	0.11	-	-	-	-		54
					15'	0.53	0.66	0.66	0.11	-	-	-	-		44
					20'	0.68	0.88	0.87	0.11	-	-	-	-		44
	9.5	9.5	9	8 to 12	25'	0.81	1.07	1.05	0.11	-	-	-	-		44
	10.5	11	9		30'	0.86	1.20	1.18	0.11	-	-	-	-		44
9'x 9'	9.5	9.5	9	4	0.33' - <2'	0.38	0.70	0.63	0.22	0.23	0.23	0.32	0.38		-
	9	9	9	to 12	2' - <3'	0.43	0.73	0.65	0.15	-	-	-	-		72
					3' - <5'	0.38	0.62	0.61	0.15	-	-	-	-		72
					5' - 10'	0.41	0.50	0.53	0.14	-	-	-	-		59
					15'	0.57	0.69	0.70	0.12	-	-	-	-		49
					20'	0.73	0.92	0.91	0.11	-	-	-	-		49
	9.5	10	9	8 to 12	25'	0.83	1.11	1.09	0.11	-	-	-	-		44
	10.5	11	9		30'	0.93	1.25	1.23	0.11	-	-	-	-		44

TABLE 6 - STANDARD PRECAST BOX CULVERT DESIGNS (2" COVER) - 10' SPANS

SPAN x RISE (S) (R) (ft.)	SLAB / WALL THICKNESS TOP (Tt) (in.)	BOT. (Tb) (in.)	SIDE (Tw) (in.)	HAUNCH (H) (in.)	DESIGN EARTH COVER ABOVE TOP SLAB	REINFORCEMENT AREAS (sq. in./ft.) As1	As2	As3	As4	As5	As6	As7	As8	As9	As1 EXT. LENGTH (M) (in.)
10'x 5'	10	10	10	4	0.33' - <2'	0.46	0.62	0.52	0.24	0.24	0.24	0.41	0.45	See General Note 5	-
				to 12	2' - <3'	0.46	0.62	0.52	0.12	-	-	-	-		58
					3' - <5'	0.42	0.54	0.50	0.12	-	-	-	-		53
					5' - 10'	0.38	0.46	0.49	0.12	-	-	-	-		52
					15'	0.52	0.59	0.58	0.12	-	-	-	-		47
					20'	0.69	0.78	0.76	0.12	-	-	-	-		47
	10.5	10.5	10	8 to 12	25'	0.81	0.97	0.93	0.12	-	-	-	-		47
	11.5	12	10		30'	0.87	1.11	1.11	0.12	-	-	-	-		47
10'x 6'	10	10	10	4	0.33' - <2'	0.44	0.64	0.54	0.24	0.24	0.24	0.39	0.44		-
				to 12	2' - <3'	0.44	0.64	0.54	0.12	-	-	-	-		58
					3' - <5'	0.39	0.57	0.52	0.12	-	-	-	-		52
					5' - 10'	0.37	0.48	0.52	0.12	-	-	-	-		52
					15'	0.51	0.62	0.61	0.12	-	-	-	-		47
					20'	0.67	0.83	0.80	0.12	-	-	-	-		47
	10.5	10.5	10	8 to 12	25'	0.79	1.02	0.99	0.12	-	-	-	-		47
	11.5	12	10		30'	0.85	1.17	1.14	0.12	-	-	-	-		47
10'x 7'	10	10	10	4	0.33' - <2'	0.43	0.66	0.57	0.24	0.24	0.24	0.38	0.43		-
				to 12	2' - <3'	0.43	0.66	0.57	0.12	-	-	-	-		58
					3' - <5'	0.38	0.59	0.55	0.12	-	-	-	-		58
					5' - 10'	0.37	0.50	0.54	0.12	-	-	-	-		52
					15'	0.52	0.66	0.65	0.12	-	-	-	-		47
					20'	0.67	0.87	0.85	0.12	-	-	-	-		47
	10.5	10.5	10	8 to 12	25'	0.79	1.07	1.04	0.12	-	-	-	-		47
	11.5	12	10		30'	0.84	1.22	1.19	0.12	-	-	-	-		47
10'x 8'	10	10	10	4	0.33' - <2'	0.43	0.68	0.60	0.24	0.24	0.24	0.38	0.43		-
				to 12	2' - <3'	0.43	0.68	0.60	0.12	-	-	-	-		64
					3' - <5'	0.38	0.62	0.57	0.12	-	-	-	-		58
					5' - 10'	0.38	0.52	0.57	0.12	-	-	-	-		52
					15'	0.53	0.69	0.68	0.12	-	-	-	-		47
					20'	0.68	0.91	0.89	0.12	-	-	-	-		47
	10.5	10.5	10	8 to 12	25'	0.81	1.12	1.09	0.12	-	-	-	-		47
	11.5	12	10		30'	0.86	1.27	1.25	0.12	-	-	-	-		47
10'x 9'	10	10	10	4	0.33' - <2'	0.43	0.70	0.62	0.24	0.24	0.24	0.38	0.43		-
				to 12	2' - <3'	0.43	0.70	0.62	0.12	-	-	-	-		70
					3' - <5'	0.39	0.64	0.60	0.12	-	-	-	-		64
					5' - 10'	0.40	0.54	0.59	0.12	-	-	-	-		58
					15'	0.56	0.72	0.72	0.12	-	-	-	-		52
					20'	0.71	0.95	0.94	0.12	-	-	-	-		47
	10.5	11	10	8 to 12	25'	0.82	1.15	1.13	0.12	-	-	-	-		47
	11.5	12	10		30'	0.90	1.32	1.30	0.12	-	-	-	-		47
10'x 10'	10	10	10	4	0.33' - <2'	0.44	0.71	0.64	0.24	0.24	0.24	0.38	0.44		-
				to 12	2' - <3'	0.44	0.71	0.64	0.17	-	-	-	-		79
					3' - <5'	0.40	0.65	0.62	0.16	-	-	-	-		70
					5' - 10'	0.44	0.56	0.61	0.15	-	-	-	-		64
					15'	0.60	0.75	0.76	0.12	-	-	-	-		52
					20'	0.76	0.99	0.99	0.12	-	-	-	-		52
	10.5	11	10	8 to 12	25'	0.86	1.20	1.18	0.12	-	-	-	-		47
	11.5	12	10		30'	0.97	1.36	1.35	0.13	-	-	-	-		47

NOTES:
1. See Sheet 1 for Reinforcing Details and dimension locations.
2. See Sheet 2 for General Notes.
3. See Sheet 14 for WWR Bending Diagram.

TABLE 7 - STANDARD PRECAST BOX CULVERT DESIGNS (2" COVER) - 11' SPANS

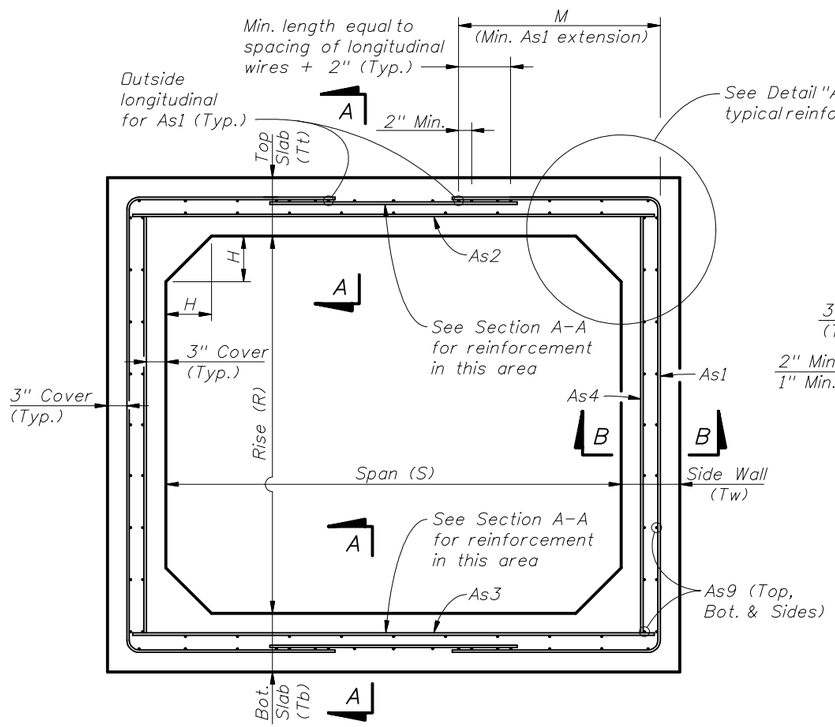
SPAN x RISE (S) (R) (ft.)	SLAB / WALL THICKNESS TOP (Tt) (in.)	BOT. (Tb) (in.)	SIDE (Tw) (in.)	HAUNCH (H) (in.)	DESIGN EARTH COVER ABOVE TOP SLAB	REINFORCEMENT AREAS (sq. in./ft.) As1	As2	As3	As4	As5	As6	As7	As8	As9	As1 EXT. LENGTH (M) (in.)
11' x 4'	11	11	11	4 to 12	0.33' - <2'	0.51	0.57	0.47	0.27	0.27	0.27	0.45	0.48	See General Note 5	-
					2' - <3'	0.51	0.57	0.47	0.14	-	-	-	-		62
					3' - <5'	0.48	0.57	0.46	0.14	-	-	-	-		62
					5' - 10'	0.47	0.50	0.50	0.14	-	-	-	-		55
					15'	0.59	0.58	0.56	0.14	-	-	-	-		55
					20'	0.77	0.77	0.74	0.14	-	-	-	-		55
	11.5	11.5	11	8 to 12	25'	0.92	0.95	0.91	0.14	-	-	-	-		55
	13	13	11		30'	0.94	1.09	1.06	0.14	-	-	-	-		55
11' x 6'	11	11	11	4 to 12	0.33' - <2'	0.45	0.62	0.52	0.27	0.27	0.27	0.41	0.45		-
					2' - <3'	0.45	0.62	0.52	0.14	-	-	-	-		62
					3' - <5'	0.42	0.58	0.51	0.14	-	-	-	-		55
					5' - 10'	0.43	0.56	0.56	0.14	-	-	-	-		55
					15'	0.54	0.65	0.64	0.14	-	-	-	-		50
					20'	0.70	0.86	0.83	0.14	-	-	-	-		50
	11.5	11.5	11	8 to 12	25'	0.83	1.07	1.03	0.14	-	-	-	-		50
	13	13	11		30'	0.85	1.22	1.19	0.14	-	-	-	-		50
11' x 8'	11	11	11	4 to 12	0.33' - <2'	0.42	0.67	0.57	0.27	0.27	0.27	0.39	0.43		-
					2' - <3'	0.43	0.67	0.57	0.14	-	-	-	-		62
					3' - <5'	0.39	0.63	0.56	0.14	-	-	-	-		62
					5' - 10'	0.43	0.60	0.61	0.14	-	-	-	-		55
					15'	0.54	0.72	0.71	0.14	-	-	-	-		50
					20'	0.70	0.94	0.92	0.14	-	-	-	-		50
	11.5	11.5	11	8 to 12	25'	0.82	1.16	1.13	0.14	-	-	-	-		50
	13	13	11		30'	0.86	1.32	1.30	0.14	-	-	-	-		50
11' x 10'	11	11	11	4 to 12	0.33' - <2'	0.44	0.71	0.62	0.27	0.27	0.27	0.38	0.44		-
					2' - <3'	0.44	0.71	0.62	0.14	-	-	-	-		75
					3' - <5'	0.41	0.67	0.61	0.14	-	-	-	-		69
					5' - 10'	0.47	0.64	0.66	0.14	-	-	-	-		62
					15'	0.59	0.78	0.78	0.14	-	-	-	-		55
					20'	0.75	1.03	1.01	0.14	-	-	-	-		50
	11.5	12	11	8 to 12	25'	0.85	1.24	1.22	0.14	-	-	-	-		50
	13	13.5	11		30'	0.91	1.40	1.39	0.14	-	-	-	-		50
11' x 11'	11	11	11	4 to 12	0.33' - <2'	0.45	0.72	0.64	0.27	0.27	0.27	0.39	0.45		-
					2' - <3'	0.45	0.72	0.64	0.18	-	-	-	-		86
					3' - <5'	0.42	0.69	0.63	0.18	-	-	-	-		75
					5' - 10'	0.51	0.66	0.69	0.16	-	-	-	-		69
					15'	0.63	0.81	0.82	0.14	-	-	-	-		55
					20'	0.80	1.07	1.06	0.14	-	-	-	-		55
	11.5	12	11	8 to 12	25'	0.91	1.29	1.27	0.14	-	-	-	-		50
	13	13.5	11		30'	0.99	1.44	1.44	0.14	-	-	-	-		50

TABLE 8 - STANDARD PRECAST BOX CULVERT DESIGNS (2" COVER) - 12' SPANS

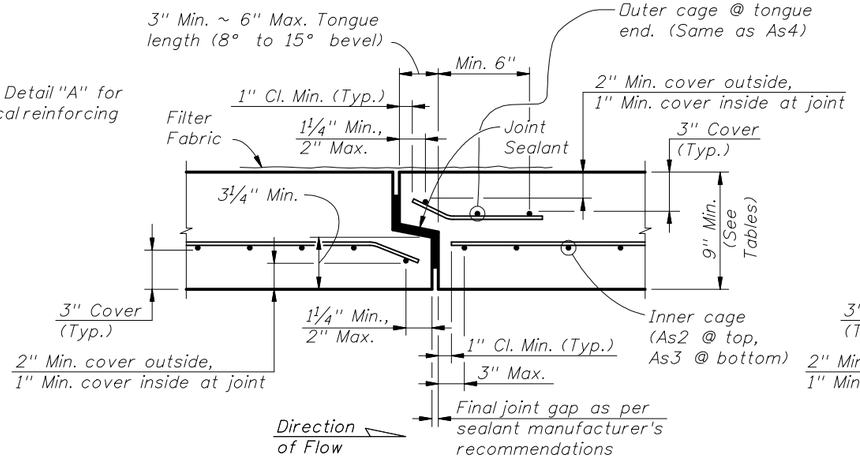
SPAN x RISE (S) (R) (ft.)	SLAB / WALL THICKNESS TOP (Tt) (in.)	BOT. (Tb) (in.)	SIDE (Tw) (in.)	HAUNCH (H) (in.)	DESIGN EARTH COVER ABOVE TOP SLAB	REINFORCEMENT AREAS (sq. in./ft.) As1	As2	As3	As4	As5	As6	As7	As8	As9	As1 EXT. LENGTH (M) (in.)
12' x 4'	12	12	12	4 to 12	0.33' - <2'	0.52	0.57	0.45	0.29	0.29	0.29	0.47	0.49	See General Note 5	-
					2' - <3'	0.52	0.57	0.45	0.15	-	-	-	-		73
					3' - <5'	0.50	0.54	0.45	0.15	-	-	-	-		66
					5' - 10'	0.50	0.52	0.52	0.15	-	-	-	-		66
					15'	0.63	0.61	0.59	0.15	-	-	-	-		59
					20'	0.82	0.81	0.77	0.15	-	-	-	-		59
	12.5	12.5	12	8 to 12	25'	0.99	0.99	0.95	0.15	-	-	-	-		59
	14	14	12		30'	1.03	1.15	1.11	0.15	-	-	-	-		59
12' x 6'	12	12	12	4 to 12	0.33' - <2'	0.47	0.62	0.51	0.29	0.29	0.29	0.42	0.46		-
					2' - <3'	0.47	0.62	0.51	0.15	-	-	-	-		66
					3' - <5'	0.45	0.60	0.51	0.15	-	-	-	-		59
					5' - 10'	0.47	0.59	0.59	0.15	-	-	-	-		59
					15'	0.57	0.68	0.66	0.15	-	-	-	-		53
					20'	0.74	0.90	0.86	0.15	-	-	-	-		53
	12.5	12.5	12	8 to 12	25'	0.88	1.11	1.06	0.15	-	-	-	-		53
	14	14.5	12		30'	0.92	1.27	1.24	0.15	-	-	-	-		53
12' x 8'	12	12	12	4 to 12	0.33' - <2'	0.44	0.67	0.56	0.29	0.29	0.29	0.40	0.44		-
					2' - <3'	0.44	0.67	0.56	0.15	-	-	-	-		66
					3' - <5'	0.41	0.64	0.56	0.15	-	-	-	-		59
					5' - 10'	0.45	0.63	0.64	0.15	-	-	-	-		59
					15'	0.56	0.75	0.73	0.15	-	-	-	-		53
					20'	0.72	0.98	0.95	0.15	-	-	-	-		53
	12.5	13	12	8 to 12	25'	0.85	1.20	1.16	0.15	-	-	-	-		53
	14	14.5	12		30'	0.89	1.38	1.35	0.15	-	-	-	-		53
12' x 10'	12	12	12	4 to 12	0.33' - <2'	0.44	0.71	0.60	0.29	0.29	0.29	0.39	0.44		-
					2' - <3'	0.44	0.71	0.60	0.15	-	-	-	-		73
					3' - <5'	0.42	0.68	0.60	0.15	-	-	-	-		66
					5' - 10'	0.47	0.67	0.69	0.15	-	-	-	-		59
					15'	0.59	0.81	0.81	0.15	-	-	-	-		53
					20'	0.75	1.06	1.04	0.15	-	-	-	-		53
	12.5	13	12	8 to 12	25'	0.87	1.30	1.26	0.15	-	-	-	-		53
	14	14.5	12		30'	0.92	1.47	1.45	0.15	-	-	-	-		53
12' x 12'	12	12	12	4 to 12	0.33' - <2'	0.46	0.74	0.64	0.29	0.29	0.29	0.40	0.46		-
					2' - <3'	0.46	0.74	0.64	0.20	-	-	-	-		93
					3' - <5'	0.42	0.72	0.64	0.20	-	-	-	-		80
					5' - 10'	0.54	0.71	0.74	0.18	-	-	-	-		73
					15'	0.66	0.87	0.89	0.15	-	-	-	-		59
					20'	0.83	1.14	1.13	0.15	-	-	-	-		59
	12.5	13	12	8 to 12	25'	0.96	1.39	1.37	0.15	-	-	-	-		53
	14	14.5	12.5		30'	1.05	1.56	1.56	0.15	-	-	-	-		53

NOTES:

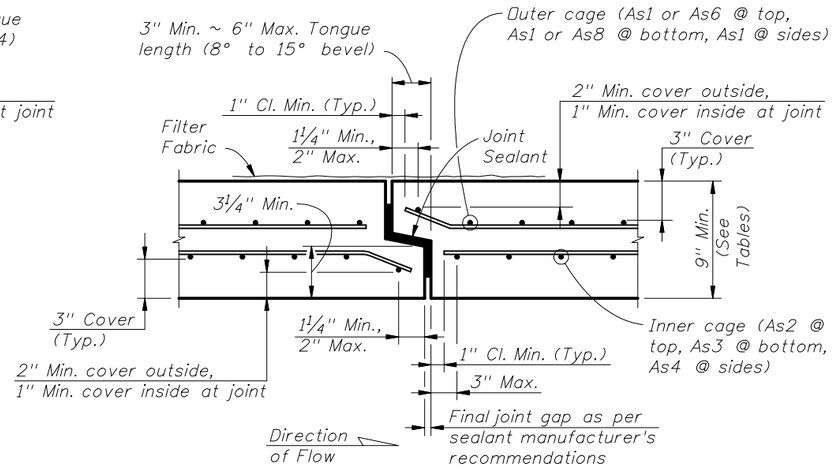
1. See Sheet 1 for Reinforcing Details and dimension locations.
2. See Sheet 2 for General Notes.
3. See Sheet 14 for Welded Wire Reinforcement Bending Diagram.



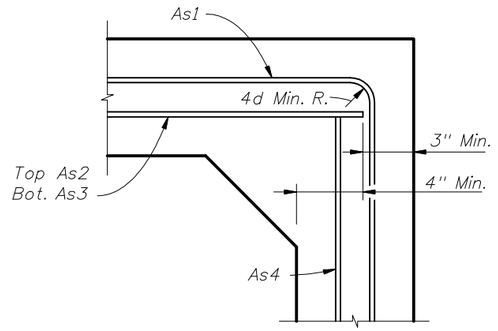
TYPICAL BOX SECTION (TYPE 2)
DESIGN EARTH COVER 2' OR GREATER



SECTION A-A



SECTION B-B
TYPICAL SECTION THRU JOINT



DETAIL "A"
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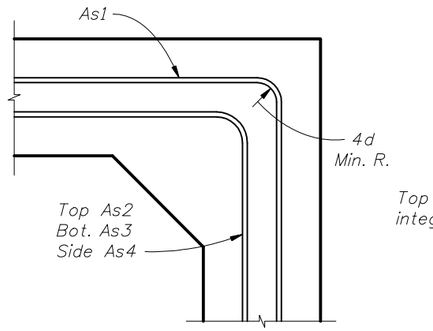

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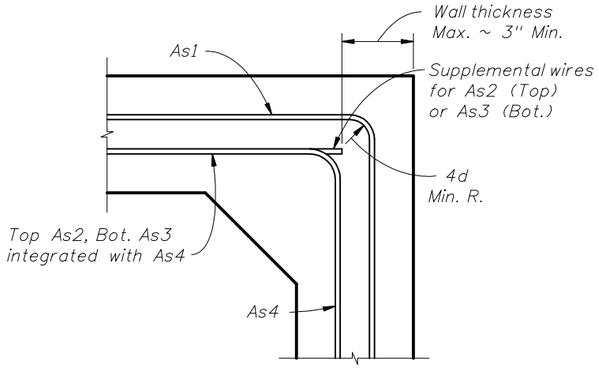

DETAIL "A"
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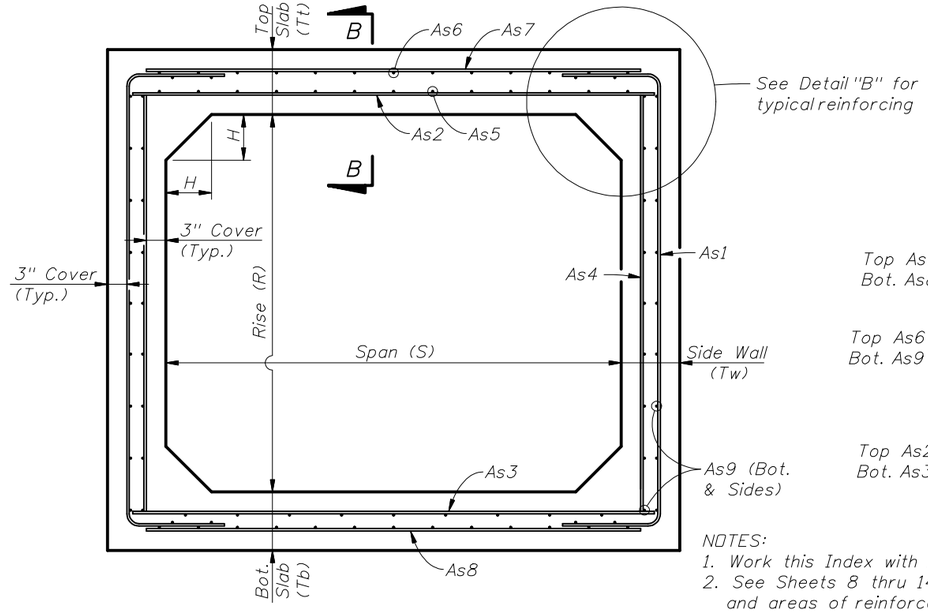
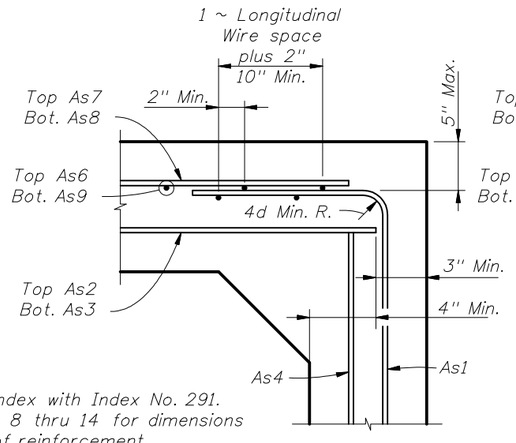
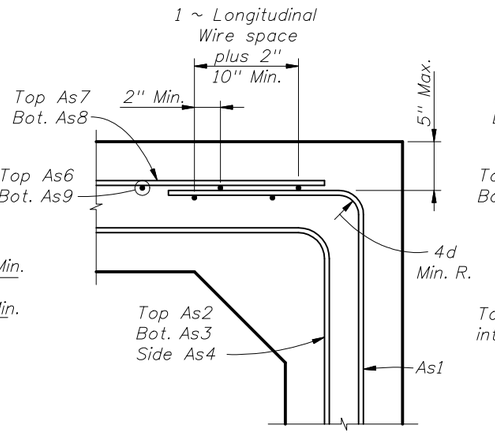


TYPICAL BOX SECTION (TYPE 1)
DESIGN EARTH COVER LESS THAN 2'



DETAIL "B"
(OPTION 1)



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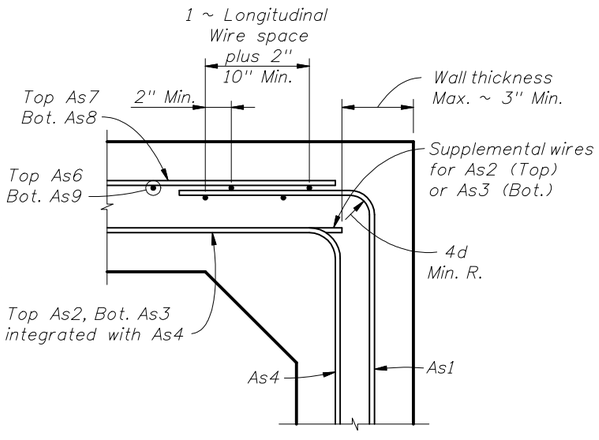


DETAIL "B"
(OPTION 3)

NOTES:
1. Work this Index with Index No. 291.
2. See Sheets 8 thru 14 for dimensions and areas of reinforcement.

STANDARD PRECAST BOX CULVERT WITH 3" CONCRETE COVER

TABLE 9A - STANDARD PRECAST BOX CULVERT DESIGNS (3" COVER) - 3'& 4' SPANS

SPAN x RISE (S) (R) (ft.)	SLAB / WALL THICKNESS TOP (Tt) (in.)	BOT. (Tb) (in.)	SIDE (Tw) (in.)	HAUNCH (H) (in.)	DESIGN EARTH COVER ABOVE TOP SLAB	REINFORCEMENT AREAS (sq. in./ft.) As1	As2	As3	As4	As5	As6	As7	As8	As9	As1 EXT. LENGTH (M) (in.)
3'x 3'	9	9	9	4 to 8	0.33' - <2'	0.22	0.24	0.22	0.22	0.22	0.22	0.22	0.22	See General Note 5	-
					2' - <3'	0.11	0.23	0.22	0.11	-	-	-	-		31
					3' - <5'	0.11	0.22	0.22	0.11	-	-	-	-		31
					5' - 10'	0.11	0.22	0.22	0.11	-	-	-	-		31
					15'	0.11	0.22	0.22	0.11	-	-	-	-		31
					20'	0.13	0.22	0.22	0.11	-	-	-	-		31
					25'	0.16	0.22	0.22	0.11	-	-	-	-		31
					30'	0.19	0.24	0.25	0.11	-	-	-	-		31
					35'	0.22	0.28	0.29	0.11	-	-	-	-		31
4'x 3'	9	9	9	4 to 8	0.33' - <2'	0.22	0.32	0.24	0.22	0.22	0.22	0.22	0.22		-
					2' - <3'	0.17	0.31	0.24	0.11	-	-	-	-		38
					3' - <5'	0.13	0.22	0.22	0.11	-	-	-	-		38
					5' - 10'	0.13	0.22	0.22	0.11	-	-	-	-		38
					15'	0.17	0.22	0.22	0.11	-	-	-	-		38
					20'	0.23	0.26	0.27	0.11	-	-	-	-		38
					25'	0.28	0.32	0.34	0.11	-	-	-	-		38
					30'	0.33	0.39	0.40	0.11	-	-	-	-		38
4'x 4'	9	9	9	4 to 8	0.33' - <2'	0.22	0.34	0.26	022	0.22	0.22	0.22	0.22		-
					2' - <3'	0.17	0.33	0.26	0.11	-	-	-	-		38
					3' - <5'	0.13	0.22	0.22	0.11	-	-	-	-		38
					5' - 10'	0.14	0.22	0.22	0.11	-	-	-	-		38
					15'	0.19	0.22	0.23	0.11	-	-	-	-		38
					20'	0.24	0.28	0.30	0.11	-	-	-	-		38
					25'	0.29	0.36	0.37	0.11	-	-	-	-		38
					30'	0.34	0.43	0.45	0.11	-	-	-	-		38

TABLE 9B - STANDARD PRECAST BOX CULVERT DESIGNS (3" COVER) - 3'& 4' SPANS

SPAN x RISE (S) (R) (ft.)	SLAB / WALL THICKNESS TOP (Tt) (in.)	BOT. (Tb) (in.)	SIDE (Tw) (in.)	HAUNCH (H) (in.)	DESIGN EARTH COVER ABOVE TOP SLAB	REINFORCEMENT AREAS (sq. in./ft.) As1	As2	As3	As4	As5	As6	As7	As8	As9	As1 EXT. LENGTH (M) (in.)
3'x 3'	10	10	10	4 to 8	0.33' - <2'	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	See General Note 5	-
					2' - <3'	0.12	0.24	0.24	0.24	-	-	-	-		31
					3' - <5'	0.12	0.24	0.24	0.24	-	-	-	-		31
					5' - 10'	0.12	0.24	0.24	0.24	-	-	-	-		31
					15'	0.12	0.24	0.24	0.24	-	-	-	-		31
					20'	0.12	0.24	0.24	0.24	-	-	-	-		31
					25'	0.13	0.24	0.24	0.24	-	-	-	-		31
					30'	0.15	0.24	0.24	0.12	-	-	-	-		31
					35'	0.18	0.24	0.24	0.12	-	-	-	-		31
4'x 3'	10	10	10	4 to 8	0.33' - <2'	0.24	0.26	0.24	0.24	0.24	0.24	0.24	0.24		-
					2' - <3'	0.14	0.26	0.24	0.12	-	-	-	-		38
					3' - <5'	0.12	0.24	0.24	0.12	-	-	-	-		38
					5' - 10'	0.12	0.24	0.24	0.12	-	-	-	-		38
					15'	0.14	0.24	0.24	0.12	-	-	-	-		38
					20'	0.18	0.24	0.24	0.12	-	-	-	-		38
					25'	0.22	0.26	0.27	0.12	-	-	-	-		38
					30'	0.26	0.31	0.32	0.12	-	-	-	-		38
4'x 4'	10	10	10	4 to 8	0.33' - <2'	0.24	0.28	0.24	0.24	0.24	0.24	0.24	0.24		-
					2' - <3'	0.14	0.28	0.24	0.12	-	-	-	-		38
					3' - <5'	0.12	0.24	0.24	0.12	-	-	-	-		38
					5' - 10'	0.12	0.24	0.24	0.12	-	-	-	-		38
					15'	0.15	0.24	0.24	0.12	-	-	-	-		38
					20'	0.19	0.24	0.24	0.12	-	-	-	-		38
					25'	0.23	0.28	0.30	0.12	-	-	-	-		38
					30'	0.27	0.34	0.35	0.12	-	-	-	-		38

NOTES:
1. See Sheet 2 for General Notes.
2. See Sheet 7 for Reinforcing Details and dimension locations.
3. See Sheet 14 for WWR Bending Diagrams.

TABLE 10A - STANDARD PRECAST BOX CULVERT DESIGNS (3" COVER) - 5' & 6' SPANS

SPAN x RISE (S) (R) (ft.)	SLAB / WALL THICKNESS TOP (Tt) (in.)	BOT. (Tb) (in.)	SIDE (Tw) (in.)	HAUNCH (H) (in.)	DESIGN EARTH COVER ABOVE TOP SLAB	REINFORCEMENT AREAS (sq. in./ft.) As1	As2	As3	As4	As5	As6	As7	As8	As9	As1 EXT. LENGTH (M) (in.)
5'x 3'	9	9	9	4 to 8	0.33' - <2'	0.27	0.39	0.37	0.22	0.22	0.22	0.22	0.27	See General Note 5	-
					2' - <3'	0.26	0.39	0.37	0.11	-	-	-	-		45
					3' - <5'	0.19	0.24	0.25	0.11	-	-	-	-		36
					5' - 10'	0.20	0.22	0.22	0.11	-	-	-	-		36
					15'	0.28	0.28	0.30	0.11	-	-	-	-		35
					20'	0.37	0.38	0.39	0.11	-	-	-	-		35
					25'	0.45	0.48	0.49	0.11	-	-	-	-		35
					30'	0.54	0.58	0.59	0.11	-	-	-	-		35
5'x 4'	9	9	9	4 to 8	0.33' - <2'	0.26	0.42	0.39	0.22	0.22	0.22	0.22	0.26		-
					2' - <3'	0.26	0.42	0.39	0.11	-	-	-	-		45
					3' - <5'	0.19	0.26	0.27	0.11	-	-	-	-		45
					5' - 10'	0.20	0.22	0.23	0.11	-	-	-	-		36
					15'	0.27	0.31	0.33	0.11	-	-	-	-		35
					20'	0.36	0.42	0.43	0.11	-	-	-	-		35
					25'	0.44	0.52	0.54	0.11	-	-	-	-		35
					30'	0.53	0.63	0.65	0.11	-	-	-	-		35
5'x 5'	9	9	9	4 to 8	0.33' - <2'	0.27	0.44	0.42	0.22	0.22	0.22	0.22	0.27		-
					2' - <3'	0.27	0.44	0.42	0.11	-	-	-	-		45
					3' - <5'	0.20	0.27	0.28	0.11	-	-	-	-		45
					5' - 10'	0.22	0.23	0.26	0.11	-	-	-	-		45
					15'	0.30	0.34	0.36	0.11	-	-	-	-		36
					20'	0.38	0.45	0.47	0.11	-	-	-	-		35
					25'	0.47	0.56	0.59	0.11	-	-	-	-		35
					30'	0.55	0.68	0.71	0.11	-	-	-	-		35
6'x 3'	9	9	9	4 to 12	0.33' - <2'	0.34	0.47	0.42	0.22	0.22	0.22	0.25	0.34		-
					2' - <3'	0.34	0.47	0.42	0.11	-	-	-	-		43
					3' - <5'	0.27	0.31	0.32	0.11	-	-	-	-		39
					5' - 10'	0.29	0.26	0.28	0.11	-	-	-	-		39
					15'	0.42	0.39	0.40	0.11	-	-	-	-		38
					20'	0.55	0.52	0.53	0.11	-	-	-	-		38
					25'	0.68	0.66	0.67	0.11	-	-	-	-		38
					30'	0.82	0.81	0.82	0.11	-	-	-	-		38
6'x 4'	9	9	9	4 to 12	0.33' - <2'	0.33	0.50	0.46	0.22	0.22	0.22	0.23	0.33		-
					2' - <3'	0.33	0.50	0.46	0.11	-	-	-	-		43
					3' - <5'	0.27	0.33	0.35	0.11	-	-	-	-		39
					5' - 10'	0.28	0.29	0.31	0.11	-	-	-	-		39
					15'	0.40	0.43	0.45	0.11	-	-	-	-		38
					20'	0.52	0.57	0.59	0.11	-	-	-	-		38
					25'	0.65	0.73	0.74	0.11	-	-	-	-		38
					30'	0.78	0.88	0.90	0.11	-	-	-	-		38
6'x 5'	9	9	9	4 to 12	0.33' - <2'	0.33	0.52	0.49	0.22	0.22	0.22	0.23	0.33		-
					2' - <3'	0.33	0.52	0.49	0.11	-	-	-	-		43
					3' - <5'	0.27	0.35	0.37	0.11	-	-	-	-		43
					5' - 10'	0.29	0.31	0.34	0.11	-	-	-	-		39
					15'	0.41	0.46	0.49	0.11	-	-	-	-		38
					20'	0.53	0.62	0.64	0.11	-	-	-	-		38
					25'	0.66	0.78	0.80	0.11	-	-	-	-		38
					30'	0.78	0.95	0.97	0.11	-	-	-	-		38
6'x 6'	9	9	9	4 to 12	0.33' - <2'	0.34	0.55	0.51	0.22	0.22	0.22	0.24	0.34		-
					2' - <3'	0.34	0.54	0.51	0.11	-	-	-	-		52
					3' - <5'	0.29	0.37	0.39	0.11	-	-	-	-		52
					5' - 10'	0.32	0.34	0.37	0.11	-	-	-	-		43
					15'	0.44	0.50	0.53	0.11	-	-	-	-		39
					20'	0.57	0.66	0.70	0.11	-	-	-	-		39
					25'	0.70	0.84	0.87	0.11	-	-	-	-		38
					30'	0.83	1.02	1.05	0.11	-	-	-	-		38

TABLE 10B - STANDARD PRECAST BOX CULVERT DESIGNS (3" COVER) - 5' & 6' SPANS

SPAN x RISE (S) (R) (ft.)	SLAB / WALL THICKNESS TOP (Tt) (in.)	BOT. (Tb) (in.)	SIDE (Tw) (in.)	HAUNCH (H) (in.)	DESIGN EARTH COVER ABOVE TOP SLAB	REINFORCEMENT AREAS (sq. in./ft.) As1	As2	As3	As4	As5	As6	As7	As8	As9	As1 EXT. LENGTH (M) (in.)
5'x 3'	10	10	10	4 to 12	0.33' - <2'	0.24	0.33	0.32	0.24	0.24	0.24	0.24	0.24	See General Note 5	-
					2' - <3'	0.22	0.33	0.32	0.12	-	-	-	-		45
					3' - <5'	0.16	0.24	0.24	0.12	-	-	-	-		36
					5' - 10'	0.16	0.24	0.24	0.12	-	-	-	-		36
					15'	0.23	0.24	0.24	0.12	-	-	-	-		35
					20'	0.29	0.30	0.31	0.12	-	-	-	-		35
					25'	0.36	0.38	0.39	0.12	-	-	-	-		35
					30'	0.43	0.46	0.47	0.12	-	-	-	-		35
5'x 4'	10	10	10	4 to 12	0.33' - <2'	0.24	0.35	0.34	0.24	0.24	0.24	0.24	0.24		-
					2' - <3'	0.22	0.35	0.34	0.12	-	-	-	-		45
					3' - <5'	0.15	0.24	0.24	0.12	-	-	-	-		45
					5' - 10'	0.16	0.24	0.24	0.12	-	-	-	-		36
					15'	0.22	0.25	0.27	0.12	-	-	-	-		35
					20'	0.29	0.33	0.34	0.12	-	-	-	-		35
					25'	0.36	0.41	0.43	0.12	-	-	-	-		35
					30'	0.42	0.50	0.51	0.12	-	-	-	-		35
5'x 5'	10	10	10	4 to 12	0.33' - <2'	0.24	0.37	0.36	0.24	0.24	0.24	0.24	0.24		-
					2' - <3'	0.21	0.37	0.36	0.12	-	-	-	-		45
					3' - <5'	0.16	0.24	0.25	0.12	-	-	-	-		45
					5' - 10'	0.17	0.24	0.24	0.12	-	-	-	-		45
					15'	0.24	0.27	0.29	0.12	-	-	-	-		36
					20'	0.30	0.36	0.38	0.12	-	-	-	-		35
					25'	0.37	0.44	0.47	0.12	-	-	-	-		35
					30'	0.44	0.53	0.56	0.12	-	-	-	-		35
6'x 3'	10	10	10	4 to 12	0.33' - <2'	0.28	0.40	0.36	0.24	0.24	0.24	0.24	0.28		-
					2' - <3'	0.28	0.40	0.36	0.12	-	-	-	-		43
					3' - <5'	0.22	0.26	0.28	0.12	-	-	-	-		39
					5' - 10'	0.24	0.24	0.24	0.12	-	-	-	-		39
					15'	0.34	0.31	0.32	0.12	-	-	-	-		38
					20'	0.44	0.41	0.42	0.12	-	-	-	-		38
					25'	0.54	0.52	0.53	0.12	-	-	-	-		38
					30'	0.64	0.63	0.64	0.12	-	-	-	-		38
6'x 4'	10	10	10	4 to 12	0.33' - <2'	0.27	0.42	0.39	0.24	0.24	0.24	0.24	0.27		-
					2' - <3'	0.27	0.42	0.39	0.12	-	-	-	-		43
					3' - <5'	0.21	0.28	0.30	0.12	-	-	-	-		39
					5' - 10'	0.23	0.24	0.25	0.12	-	-	-	-		39
					15'	0.32	0.34	0.35	0.12	-	-	-	-		38
					20'	0.42	0.45	0.47	0.12	-	-	-	-		38
					25'	0.51	0.56	0.58	0.12	-	-	-	-		38
					30'	0.61	0.68	0.70	0.12	-	-	-	-		38
6'x 5'	10	10	10	4 to 12	0.33' - <2'	0.26	0.44	0.42	0.24	0.24	0.24	0.24	0.26		-
					2' - <3'	0.26	0.44	0.42	0.12	-	-	-	-		43
					3' - <5'	0.22	0.30	0.33	0.12	-	-	-	-		43
					5' - 10'	0.24	0.25	0.27	0.12	-	-	-	-		39
					15'	0.33	0.36	0.39	0.12	-	-	-	-		38
					20'	0.42	0.48	0.51	0.12	-	-	-	-		38
					25'	0.52	0.61	0.63	0.12	-	-	-	-		38
					30'	0.61	0.74	0.76	0.12	-	-	-	-		38
6'x 6'	10	10	10	4 to 12	0.33' - <2'	0.27	0.46	0.44	0.24	0.24	0.24	0.24	0.27		-
					2' - <3'	0.27	0.46	0.44	0.12	-	-	-	-		52
					3' - <5'	0.23	0.31	0.34	0.12	-	-	-	-		52
					5' - 10'	0.25	0.27	0.30	0.12	-	-	-	-		43
					15'	0.35	0.39	0.42	0.12	-	-	-	-		39
					20'	0.45	0.52	0.55	0.12	-	-	-	-		39
					25'	0.54	0.65	0.68	0.12	-	-	-	-		38
					30'	0.64	0.78	0.81	0.12	-	-	-	-		38

TABLE 11A - STANDARD PRECAST BOX CULVERT DESIGNS (3" COVER) - 7' SPANS

SPAN x RISE (S) (R) (ft.)	SLAB / WALL THICKNESS TOP (Tt) (in.)	BOT. (Tb) (in.)	SIDE (Tw) (in.)	HAUNCH (H) (in.)	DESIGN EARTH COVER ABOVE TOP SLAB	REINFORCEMENT AREAS (sq. in./ft.) As1	As2	As3	As4	As5	As6	As7	As8	As9	As1 EXT. LENGTH (M) (in.)
7'x 4'	9	9	9	4 to 12	0.33' - <2'	0.42	0.58	0.52	0.22	0.22	0.22	0.31	0.42	See General Note 5	-
					2' - <3'	0.42	0.58	0.51	0.11	-	-	-	-		43
					3' - <5'	0.36	0.41	0.44	0.11	-	-	-	-		43
					5' - 10'	0.39	0.40	0.39	0.11	-	-	-	-		43
					15'	0.56	0.56	0.58	0.11	-	-	-	-		41
					20'	0.74	0.76	0.77	0.11	-	-	-	-		41
					25'	0.92	0.97	0.97	0.11	-	-	-	-		41
	9	9.5	9	7 to 12	30'	1.09	1.18	1.10	0.11	-	-	-	-		41
7'x 5'	9	9	9	4 to 12	0.33' - <2'	0.41	0.61	0.55	0.22	0.23	0.22	0.30	0.41		-
					2' - <3'	0.41	0.61	0.55	0.11	-	-	-	-		47
					3' - <5'	0.37	0.43	0.47	0.11	-	-	-	-		43
					5' - 10'	0.39	0.41	0.43	0.11	-	-	-	-		43
					15'	0.56	0.61	0.63	0.11	-	-	-	-		41
					20'	0.73	0.82	0.83	0.11	-	-	-	-		41
					25'	0.90	1.04	1.06	0.11	-	-	-	-		41
	9	9.5	9	7 to 12	30'	1.06	1.26	1.19	0.11	-	-	-	-		41
7'x 6'	9	9	9	4 to 12	0.33' - <2'	0.42	0.63	0.58	0.22	0.24	0.22	0.30	0.42		-
					2' - <3'	0.42	0.63	0.58	0.11	-	-	-	-		59
					3' - <5'	0.38	0.45	0.50	0.11	-	-	-	-		47
					5' - 10'	0.41	0.44	0.47	0.11	-	-	-	-		43
					15'	0.57	0.65	0.68	0.11	-	-	-	-		41
					20'	0.75	0.87	0.90	0.11	-	-	-	-		41
					25'	0.93	1.11	1.13	0.11	-	-	-	-		41
	9	9.5	9	7 to 12	30'	1.07	1.35	1.27	0.11	-	-	-	-		41
7'x 7'	9	9	9	4 to 12	0.33' - <2'	0.44	0.66	0.61	0.22	0.25	0.22	0.31	0.44		-
					2' - <3'	0.44	0.65	0.61	0.11	-	-	-	-		59
					3' - <5'	0.41	0.47	0.52	0.11	-	-	-	-		59
					5' - 10'	0.44	0.47	0.52	0.11	-	-	-	-		47
					15'	0.62	0.69	0.74	0.11	-	-	-	-		43
					20'	0.80	0.93	0.97	0.11	-	-	-	-		43
					25'	0.99	1.18	1.22	0.11	-	-	-	-		43
	9	9.5	9	7 to 12	30'	1.12	1.43	1.36	0.11	-	-	-	-		41

TABLE 11B - STANDARD PRECAST BOX CULVERT DESIGNS (3" COVER) - 7' SPANS

SPAN x RISE (S) (R) (ft.)	SLAB / WALL THICKNESS TOP (Tt) (in.)	BOT. (Tb) (in.)	SIDE (Tw) (in.)	HAUNCH (H) (in.)	DESIGN EARTH COVER ABOVE TOP SLAB	REINFORCEMENT AREAS (sq. in./ft.) As1	As2	As3	As4	As5	As6	As7	As8	As9	As1 EXT. LENGTH (M) (in.)
7'x 4'	10	10	10	4 to 12	0.33' - <2'	0.33	0.49	0.44	0.24	0.24	0.24	0.24	0.33	See General Note 5	-
					2' - <3'	0.33	0.49	0.44	0.12	-	-	-	-		43
					3' - <5'	0.29	0.35	0.38	0.12	-	-	-	-		43
					5' - 10'	0.31	0.30	0.31	0.12	-	-	-	-		43
					15'	0.44	0.44	0.45	0.12	-	-	-	-		41
					20'	0.58	0.59	0.60	0.12	-	-	-	-		41
					25'	0.71	0.74	0.75	0.12	-	-	-	-		41
					30'	0.85	0.91	0.91	0.12	-	-	-	-		41
7'x 5'	10	10	10	4 to 12	0.33' - <2'	0.32	0.51	0.47	0.24	0.24	0.24	0.24	0.32		-
					2' - <3'	0.32	0.51	0.47	0.12	-	-	-	-		47
					3' - <5'	0.29	0.37	0.41	0.12	-	-	-	-		43
					5' - 10'	0.31	0.32	0.35	0.12	-	-	-	-		43
					15'	0.44	0.47	0.50	0.12	-	-	-	-		41
					20'	0.57	0.63	0.65	0.12	-	-	-	-		41
					25'	0.70	0.80	0.82	0.12	-	-	-	-		41
					30'	0.84	0.97	0.99	0.12	-	-	-	-		41
7'x 6'	10	10	10	4 to 12	0.33' - <2'	0.33	0.53	0.50	0.24	0.24	0.24	0.24	0.33		-
					2' - <3'	0.33	0.53	0.50	0.12	-	-	-	-		59
					3' - <5'	0.30	0.38	0.43	0.12	-	-	-	-		47
					5' - 10'	0.33	0.35	0.38	0.12	-	-	-	-		43
					15'	0.45	0.51	0.54	0.12	-	-	-	-		41
					20'	0.58	0.68	0.70	0.12	-	-	-	-		41
					25'	0.72	0.85	0.88	0.12	-	-	-	-		41
					30'	0.85	1.04	1.06	0.12	-	-	-	-		41
7'x 7'	10	10	10	4 to 12	0.33' - <2'	0.35	0.55	0.52	0.24	0.24	0.24	0.24	0.35		-
					2' - <3'	0.35	0.55	0.52	0.12	-	-	-	-		59
					3' - <5'	0.32	0.40	0.46	0.12	-	-	-	-		59
					5' - 10'	0.35	0.37	0.41	0.12	-	-	-	-		47
					15'	0.48	0.54	0.58	0.12	-	-	-	-		43
					20'	0.62	0.72	0.76	0.12	-	-	-	-		43
					25'	0.76	0.90	0.94	0.12	-	-	-	-		43
					30'	0.90	1.10	1.13	0.12	-	-	-	-		41

NOTES:
1. See Sheet 2 for General Notes.
2. See Sheet 7 for Reinforcing Details and dimension locations.
3. See Sheet 14 for WWR Bending Diagrams.

TABLE 12A - STANDARD PRECAST BOX CULVERT DESIGNS (3" COVER) - 8' SPANS

SPAN x RISE (S) (R) (ft.)	SLAB / WALL THICKNESS TOP (Tt) (in.)	BOT. (Tb) (in.)	SIDE (Tw) (in.)	HAUNCH (H) (in.)	DESIGN EARTH COVER ABOVE TOP SLAB	REINFORCEMENT AREAS (sq. in./ft.) As1	As2	As3	As4	As5	As6	As7	As8	As9	As1 EXT. LENGTH (M) (in.)
8'x 4'	9	9	9	4 to 12	0.33' - <2'	0.52	0.66	0.57	0.22	0.24	0.22	0.42	0.52	See General Note 5	-
					2' - <3'	0.52	0.66	0.57	0.11	-	-	-	-		50
					3' - <5'	0.48	0.49	0.52	0.11	-	-	-	-		50
					5' - 10'	0.52	0.48	0.49	0.11	-	-	-	-		45
					15'	0.75	0.72	0.72	0.11	-	-	-	-		41
					20'	1.00	0.98	0.97	0.11	-	-	-	-		41
	9	9.5	9	8 to 12	25'	1.25	1.24	1.14	0.11	-	-	-	-		41
	10	10.5	9		30'	1.31	1.29	1.21	0.11	-	-	-	-		41
8'x 5'	9	9	9	4 to 12	0.33' - <2'	0.51	0.69	0.60	0.22	0.25	0.22	0.40	0.51		-
					2' - <3'	0.51	0.69	0.60	0.11	-	-	-	-		50
					3' - <5'	0.46	0.52	0.56	0.11	-	-	-	-		45
					5' - 10'	0.51	0.51	0.53	0.11	-	-	-	-		45
					15'	0.74	0.77	0.78	0.11	-	-	-	-		41
					20'	0.97	1.05	1.05	0.11	-	-	-	-		41
	9	9.5	9	8 to 12	25'	1.20	1.33	1.23	0.11	-	-	-	-		41
	10	10.5	9		30'	1.26	1.38	1.30	0.11	-	-	-	-		41
8'x 6'	9	9	9	4 to 12	0.33' - <2'	0.51	0.72	0.64	0.22	0.26	0.22	0.39	0.51		-
					2' - <3'	0.51	0.72	0.64	0.11	-	-	-	-		50
					3' - <5'	0.47	0.55	0.59	0.11	-	-	-	-		50
					5' - 10'	0.52	0.55	0.58	0.11	-	-	-	-		45
					15'	0.74	0.83	0.85	0.11	-	-	-	-		41
					20'	0.97	1.12	1.13	0.11	-	-	-	-		41
	9	9.5	9	8 to 12	25'	1.18	1.42	1.32	0.11	-	-	-	-		41
	10	10.5	9		30'	1.26	1.46	1.39	0.11	-	-	-	-		41
8'x 7'	9	9	9	4 to 12	0.33' - <2'	0.52	0.74	0.67	0.22	0.26	0.22	0.40	0.52		-
					2' - <3'	0.52	0.74	0.67	0.11	-	-	-	-		55
					3' - <5'	0.49	0.57	0.62	0.11	-	-	-	-		55
					5' - 10'	0.55	0.59	0.63	0.11	-	-	-	-		50
					15'	0.77	0.88	0.91	0.11	-	-	-	-		41
					20'	1.01	1.19	1.21	0.11	-	-	-	-		41
	9	9.5	9	8 to 12	25'	1.21	1.51	1.41	0.11	-	-	-	-		41
	10	10.5	9		30'	1.31	1.53	1.47	0.11	-	-	-	-		41
8'x 8'	9	9	9	4 to 12	0.33' - <2'	0.55	0.77	0.70	0.22	0.27	0.22	0.41	0.55		-
					2' - <3'	0.55	0.77	0.70	0.13	-	-	-	-		65
					3' - <5'	0.53	0.59	0.64	0.12	-	-	-	-		65
					5' - 10'	0.60	0.63	0.68	0.11	-	-	-	-		55
					15'	0.83	0.93	0.98	0.11	-	-	-	-		45
					20'	1.08	1.26	1.29	0.11	-	-	-	-		45
	9	9.5	9	8 to 12	25'	1.28	1.59	1.50	0.11	-	-	-	-		41
	10	10.5	9		30'	1.41	1.61	1.55	0.11	-	-	-	-		41

TABLE 12B - STANDARD PRECAST BOX CULVERT DESIGNS (3" COVER) - 8' SPANS

SPAN x RISE (S) (R) (ft.)	SLAB / WALL THICKNESS TOP (Tt) (in.)	BOT. (Tb) (in.)	SIDE (Tw) (in.)	HAUNCH (H) (in.)	DESIGN EARTH COVER ABOVE TOP SLAB	REINFORCEMENT AREAS (sq. in./ft.) As1	As2	As3	As4	As5	As6	As7	As8	As9	As1 EXT. LENGTH (M) (in.)
8'x 4'	10	10	10	4 to 12	0.33' - <2'	0.42	0.56	0.49	0.24	0.24	0.24	0.32	0.41	See General Note 5	-
					2' - <3'	0.42	0.56	0.49	0.12	-	-	-	-		50
					3' - <5'	0.38	0.42	0.46	0.12	-	-	-	-		50
					5' - 10'	0.41	0.38	0.39	0.12	-	-	-	-		45
					15'	0.59	0.56	0.57	0.12	-	-	-	-		41
					20'	0.78	0.75	0.76	0.12	-	-	-	-		41
					25'	0.97	0.96	0.96	0.12	-	-	-	-		41
	10	10.5	10	8 to 12	30'	1.15	1.16	1.10	0.12	-	-	-	-		41
8'x 5'	10	10	10	4 to 12	0.33' - <2'	0.40	0.58	0.52	0.24	.034	0.24	0.31	0.40		-
					2' - <3'	0.40	0.58	0.52	0.12	-	-	-	-		50
					3' - <5'	0.37	0.45	0.48	0.12	-	-	-	-		45
					5' - 10'	0.41	0.41	0.43	0.12	-	-	-	-		45
					15'	0.58	0.60	0.62	0.12	-	-	-	-		41
					20'	0.76	0.81	0.81	0.12	-	-	-	-		41
					25'	0.94	1.03	1.03	0.12	-	-	-	-		41
	10	10.5	10	8 to 12	30'	1.10	1.24	1.24	0.12	-	-	-	-		41
8'x 6'	10	10	10	4 to 12	0.33' - <2'	0.40	0.60	0.55	0.24	0.24	0.24	0.30	0.40		-
					2' - <3'	0.40	0.60	0.55	0.12	-	-	-	-		50
					3' - <5'	0.37	0.47	0.51	0.12	-	-	-	-		50
					5' - 10'	0.42	0.43	0.46	0.12	-	-	-	-		45
					15'	0.58	0.64	0.67	0.12	-	-	-	-		41
					20'	0.76	0.86	0.88	0.12	-	-	-	-		41
					25'	0.94	1.09	1.11	0.12	-	-	-	-		41
	10	10.5	10	8 to 12	30'	1.09	1.32	1.26	0.12	-	-	-	-		41
8'x 7'	10	10	10	4 to 12	0.33' - <2'	0.41	0.63	0.58	0.24	0.24	0.24	0.30	0.41		-
					2' - <3'	0.41	0.63	0.58	0.12	-	-	-	-		55
					3' - <5'	0.39	0.49	0.53	0.12	-	-	-	-		55
					5' - 10'	0.44	0.46	0.50	0.12	-	-	-	-		50
					15'	0.61	0.68	0.72	0.12	-	-	-	-		45
					20'	0.78	0.91	0.94	0.12	-	-	-	-		41
					25'	0.97	1.16	1.18	0.12	-	-	-	-		41
	10	10.5	10	8 to 12	30'	1.11	1.40	1.34	0.12	-	-	-	-		41
8'x 8'	10	10	10	4 to 12	0.33' - <2'	0.44	0.64	0.60	0.24	0.24	0.24	0.31	0.44		-
					2' - <3'	0.44	0.64	0.60	0.12	-	-	-	-		65
					3' - <5'	0.42	0.51	0.56	0.12	-	-	-	-		65
					5' - 10'	0.47	0.50	0.55	0.12	-	-	-	-		55
					15'	0.65	0.72	0.77	0.12	-	-	-	-		45
					20'	0.84	0.96	1.01	0.12	-	-	-	-		45
					25'	1.03	1.22	1.26	0.12	-	-	-	-		41
	10	10.5	10	8 to 12	30'	1.16	1.47	1.42	0.12	-	-	-	-		41

NOTES:
1. See Sheet 2 for General Notes.
2. See Sheet 7 for Reinforcing Details and dimension locations.
3. See Sheet 14 for WWR Bending Diagrams.

TABLE 13A - STANDARD PRECAST BOX CULVERT DESIGNS (3" COVER) - 9' SPANS

SPAN x RISE (S) (R) (ft.)	SLAB / WALL THICKNESS TOP (Tt) (in.)	BOT. (Tb) (in.)	SIDE (Tw) (in.)	HAUNCH (H) (in.)	DESIGN EARTH COVER ABOVE TOP SLAB	REINFORCEMENT AREAS (sq. in./ft.) As1	As2	As3	As4	As5	As6	As7	As8	As9	As1 EXT. LENGTH (M) (in.)
9'x 5'	9	9	9	4 to 12	0.33' - <2'	0.62	0.78	0.65	0.22	0.26	0.22	0.52	0.61	See General Note 5	-
					2' - <3'	0.62	0.78	0.65	0.11	-	-	-	-		54
					3' - <5'	0.58	0.63	0.61	0.11	-	-	-	-		49
					5' - 10'	0.65	0.63	0.64	0.11	-	-	-	-		49
					15'	0.95	0.96	0.95	0.11	-	-	-	-		44
	9	9	9	8	20'	1.26	1.32	1.28	0.11	-	-	-	-		44
	10	10.5	9	to	25'	1.39	1.41	1.32	0.11	-	-	-	-		44
	11	11.5	9	12	30'	1.46	1.50	1.42	0.11	-	-	-	-		44
9'x 6'	9	9	9	4 to 12	0.33' - <2'	0.60	0.81	0.69	0.22	0.27	0.27	0.51	0.60		-
					2' - <3'	0.60	0.81	0.69	0.11	-	-	-	-		54
					3' - <5'	0.56	0.66	0.65	0.11	-	-	-	-		49
					5' - 10'	0.65	0.68	0.69	0.11	-	-	-	-		49
					15'	0.94	1.03	1.02	0.11	-	-	-	-		44
	9	9	9	8	20'	1.25	1.40	1.38	0.11	-	-	-	-		44
	10	10.5	9	to	25'	1.37	1.49	1.40	0.11	-	-	-	-		44
	11	11.5	9	12	30'	1.44	1.58	1.50	0.11	-	-	-	-		44
9'x 7'	9	9	9	4 to 12	0.33' - <2'	0.61	0.84	0.72	0.22	0.28	0.22	0.51	0.61		-
					2' - <3'	0.61	0.83	0.72	0.11	-	-	-	-		59
					3' - <5'	0.58	0.69	0.68	0.11	-	-	-	-		54
					5' - 10'	0.67	0.73	0.75	0.11	-	-	-	-		49
					15'	0.96	1.09	1.10	0.11	-	-	-	-		44
	9	9	9	8	20'	1.27	1.49	1.47	0.11	-	-	-	-		44
	10	10.5	9	to	25'	1.38	1.57	1.48	0.11	-	-	-	-		44
	11	11.5	9	12	30'	1.49	1.70	1.58	0.11	-	-	-	-		44
9'x 8'	9	9.5	9	4 to 12	0.33' - <2'	0.60	0.85	0.73	0.22	0.29	0.22	0.52	0.53		-
					2' - <3'	0.64	0.86	0.76	0.12	-	-	-	-		59
					3' - <5'	0.62	0.72	0.72	0.11	-	-	-	-		59
					5' - 10'	0.71	0.77	0.81	0.11	-	-	-	-		54
					15'	1.01	1.16	1.17	0.11	-	-	-	-		44
	9	9.5	9	8	20'	1.27	1.56	1.45	0.11	-	-	-	-		44
	10	10.5	9	to	25'	1.45	1.65	1.57	0.11	-	-	-	-		44
	11	11.5	9	12	30'	1.59	1.72	1.66	0.11	-	-	-	-		44
9'x 9'	9	9.5	9	4 to 12	0.33' - <2'	0.68	0.88	0.76	0.22	0.29	0.22	0.55	0.57		-
					2' - <3'	0.68	0.88	0.78	0.18	-	-	-	-		72
					3' - <5'	0.68	0.75	0.78	0.18	-	-	-	-		72
					5' - 10'	0.79	0.82	0.88	0.17	-	-	-	-		59
					15'	1.11	1.22	1.26	0.13	-	-	-	-		49
	9	9.5	9	8	20'	1.37	1.64	1.54	0.13	-	-	-	-		49
	10	10.5	9	to	25'	1.56	1.73	1.65	0.13	-	-	-	-		44
	11	11.5	9.5	12	30'	1.56	1.73	1.68	0.12	-	-	-	-		44

TABLE 13B - STANDARD PRECAST BOX CULVERT DESIGNS (3" COVER) - 9' SPANS

SPAN x RISE (S) (R) (ft.)	SLAB / WALL THICKNESS TOP (Tt) (in.)	BOT. (Tb) (in.)	SIDE (Tw) (in.)	HAUNCH (H) (in.)	DESIGN EARTH COVER ABOVE TOP SLAB	REINFORCEMENT AREAS (sq. in./ft.) As1	As2	As3	As4	As5	As6	As7	As8	As9	As1 EXT. LENGTH (M) (in.)
9'x 5'	10	10	10	4 to 12	0.33' - <2'	0.49	0.65	0.57	0.24	0.24	0.24	0.40	0.48	See General Note 5	-
					2' - <3'	0.49	0.65	0.57	0.12	-	-	-	-		54
					3' - <5'	0.46	0.54	0.53	0.12	-	-	-	-		49
					5' - 10'	0.52	0.50	0.51	0.12	-	-	-	-		49
					15'	0.75	0.74	0.75	0.12	-	-	-	-		44
					20'	0.98	1.01	1.00	0.12	-	-	-	-		44
	10	10.5	10	8 to	25'	1.21	1.27	1.19	0.12	-	-	-	-		44
	11	11.5	10	12	30'	1.30	1.36	1.30	0.12	-	-	-	-		44
9'x 6'	10	10	10	4 to 12	0.33' - <2'	0.48	0.68	0.60	0.24	0.24	0.24	0.39	0.48		-
					2' - <3'	0.48	0.68	0.60	0.12	-	-	-	-		54
					3' - <5'	0.45	0.57	0.56	0.12	-	-	-	-		49
					5' - 10'	0.52	0.53	0.56	0.12	-	-	-	-		49
					15'	0.74	0.79	0.81	0.12	-	-	-	-		44
					20'	0.97	1.07	1.07	0.12	-	-	-	-		44
	10	10.5	10	8 to	25'	1.18	1.35	1.28	0.12	-	-	-	-		44
	11	11.5	10	12	30'	1.27	1.44	1.38	0.12	-	-	-	-		44
9'x 7'	10	10	10	4 to 12	0.33' - <2'	0.49	0.70	0.63	0.24	0.24	0.24	0.39	0.49		-
					2' - <3'	0.49	0.70	0.63	0.12	-	-	-	-		59
					3' - <5'	0.46	0.59	0.59	0.12	-	-	-	-		54
					5' - 10'	0.54	0.57	0.60	0.12	-	-	-	-		49
					15'	0.75	0.84	0.86	0.12	-	-	-	-		44
					20'	0.98	1.13	1.14	0.12	-	-	-	-		44
	10	10.5	10	8 to	25'	1.18	1.43	1.36	0.12	-	-	-	-		44
	11	11.5	10	12	30'	1.28	1.52	1.46	0.12	-	-	-	-		44
9'x 8'	10	10	10	4 to 12	0.33' - <2'	0.51	0.72	0.65	0.24	0.24	0.24	0.39	0.51		-
					2' - <3'	0.51	0.72	0.65	0.12	-	-	-	-		59
					3' - <5'	0.49	0.61	0.62	0.12	-	-	-	-		59
					5' - 10'	0.57	0.60	0.65	0.12	-	-	-	-		54
					15'	0.79	0.89	0.92	0.12	-	-	-	-		44
					20'	1.02	1.20	1.22	0.12	-	-	-	-		44
	10	10.5	10	8 to	25'	1.21	1.50	1.44	0.12	-	-	-	-		44
	11	11.5	10	12	30'	1.33	1.59	1.54	0.12	-	-	-	-		44
9'x 9'	10	10	10	4 to 12	0.33' - <2'	0.54	0.74	0.68	0.24	0.24	0.24	0.41	0.54		-
					2' - <3'	0.54	0.74	0.68	0.15	-	-	-	-		72
					3' - <5'	0.53	0.63	0.64	0.13	-	-	-	-		72
					5' - 10'	0.62	0.64	0.70	0.12	-	-	-	-		59
					15'	0.85	0.94	0.99	0.12	-	-	-	-		49
					20'	1.09	1.26	1.29	0.12	-	-	-	-		49
	10	10.5	10	8 to	25'	1.28	1.56	1.52	0.12	-	-	-	-		44
	11	11.5	10	12	30'	1.42	1.66	1.66	0.12	-	-	-	-		44

NOTES:
1. See Sheet 2 for General Notes.
2. See Sheet 7 for Reinforcing Details and dimension locations.
3. See Sheet 14 for WWR Bending Diagrams.

TABLE 14 - STANDARD PRECAST BOX CULVERT DESIGNS (3" COVER) - 10' SPANS

SPAN x RISE (S) (R) (ft.)	SLAB / WALL THICKNESS TOP (Tt) (in.)	BOT. (Tb) (in.)	SIDE (Tw) (in.)	HAUNCH (H) (in.)	DESIGN EARTH COVER ABOVE TOP SLAB	REINFORCEMENT AREAS (sq. in./ft.) As1	As2	As3	As4	As5	As6	As7	As8	As9	As1 EXT. LENGTH (M) (in.)
10' x 5'	10	10	10	4 to 12	0.33' - <2'	0.60	0.73	0.61	0.24	0.24	0.24	0.50	0.57	See General Note 5	-
					2' - <3'	0.60	0.73	0.61	0.12	-	-	-	-		58
					3' - <5'	0.57	0.64	0.58	0.12	-	-	-	-		53
					5' - 10'	0.65	0.60	0.60	0.12	-	-	-	-		52
					15'	0.94	0.90	0.89	0.12	-	-	-	-		47
	10	10	10	8 to 12	20'	1.24	1.23	1.19	0.12	-	-	-	-		47
	11	11.5	10		25'	1.39	1.37	1.28	0.12	-	-	-	-		47
	12.5	12.5	10		30'	1.38	1.43	1.41	0.12	-	-	-	-		47
10' x 6'	10	10	10	4 to 12	0.33' - <2'	0.58	0.75	0.64	0.24	0.24	0.24	0.48	0.56		-
					2' - <3'	0.58	0.75	0.64	0.12	-	-	-	-		58
					3' - <5'	0.56	0.67	0.62	0.12	-	-	-	-		52
					5' - 10'	0.64	0.64	0.65	0.12	-	-	-	-		52
					15'	0.92	0.96	0.95	0.12	-	-	-	-		47
	10	10	10	8 to 12	20'	1.21	1.31	1.27	0.12	-	-	-	-		47
	11	11.5	10		25'	1.35	1.44	1.36	0.12	-	-	-	-		47
	12.5	12.5	10		30'	1.35	1.51	1.49	0.12	-	-	-	-		47
10' x 7'	10	10	10	4 to 12	0.33' - <2'	0.57	0.78	0.67	0.24	0.24	0.25	0.48	0.57		-
					2' - <3'	0.57	0.78	0.67	0.12	-	-	-	-		58
					3' - <5'	0.58	0.70	0.65	0.12	-	-	-	-		58
					5' - 10'	0.65	0.68	0.70	0.12	-	-	-	-		52
					15'	0.92	1.02	1.02	0.12	-	-	-	-		47
	10	10	10	8 to 12	20'	1.21	1.38	1.35	0.12	-	-	-	-		47
	11	11.5	10		25'	1.33	1.52	1.44	0.12	-	-	-	-		47
	12.5	12.5	10		30'	1.38	1.58	1.57	0.12	-	-	-	-		47
10' x 8'	10	10	10	4 to 12	0.33' - <2'	0.58	0.80	0.70	0.24	0.26	0.24	0.48	0.58		-
					2' - <3'	0.58	0.80	0.70	0.12	-	-	-	-		64
					3' - <5'	0.60	0.72	0.68	0.12	-	-	-	-		58
					5' - 10'	0.67	0.72	0.75	0.12	-	-	-	-		52
					15'	0.95	1.08	1.08	0.12	-	-	-	-		47
	10	10	10	8 to 12	20'	1.24	1.45	1.44	0.12	-	-	-	-		47
	11	11.5	10		25'	1.36	1.59	1.52	0.12	-	-	-	-		47
	12.5	12.5	10		30'	1.45	1.64	1.64	0.12	-	-	-	-		47
10' x 9'	10	10	10	4 to 12	0.33' - <2'	0.61	0.82	0.73	0.24	0.26	0.24	0.50	0.61		-
					2' - <3'	0.61	0.82	0.73	0.14	-	-	-	-		70
					3' - <5'	0.64	0.75	0.73	0.13	-	-	-	-		64
					5' - 10'	0.72	0.77	0.80	0.12	-	-	-	-		58
					15'	1.00	1.13	1.15	0.12	-	-	-	-		52
	10	10	10	8 to 12	20'	1.30	1.53	1.52	0.12	-	-	-	-		47
	11	11.5	10		25'	1.42	1.66	1.60	0.12	-	-	-	-		47
	12.5	12.5	10		30'	1.57	1.70	1.72	0.12	-	-	-	-		47
10' x 10'	10	10	10	4 to 12	0.33' - <2'	0.66	0.84	0.75	0.24	0.27	0.24	0.52	0.65		-
					2' - <3'	0.66	0.84	0.75	0.20	-	-	-	-		79
					3' - <5'	0.70	0.77	0.79	0.19	-	-	-	-		70
					5' - 10'	0.79	0.81	0.87	0.18	-	-	-	-		64
					15'	1.09	1.19	1.23	0.15	-	-	-	-		52
	10	10	10	8 to 12	20'	1.40	1.61	1.61	0.14	-	-	-	-		52
	11	11.5	10		25'	1.53	1.74	1.68	0.14	-	-	-	-		47
	12.5	12.5	10.5		30'	1.60	1.71	1.74	0.14	-	-	-	-		47

TABLE 15 - STANDARD PRECAST BOX CULVERT DESIGNS (3" COVER) - 11' SPANS

SPAN x RISE (S) (R) (ft.)	SLAB / WALL THICKNESS TOP (Tt) (in.)	BOT. (Tb) (in.)	SIDE (Tw) (in.)	HAUNCH (H) (in.)	DESIGN EARTH COVER ABOVE TOP SLAB	REINFORCEMENT AREAS (sq. in./ft.) As1	As2	As3	As4	As5	As6	As7	As8	As9	As1 EXT. LENGTH (M) (in.)
11' x 4'	11	11	11	4 to 12	0.33' - <2'	0.60	0.66	0.54	0.27	0.27	0.27	0.52	0.56	See General Note 5	-
					2' - <3'	0.60	0.66	0.54	0.14	-	-	-	-		62
					3' - <5'	0.60	0.61	0.53	0.14	-	-	-	-		62
					5' - 10'	0.79	0.63	0.62	0.14	-	-	-	-		55
					15'	1.01	0.82	0.79	0.14	-	-	-	-		55
	12	12	11	8 to 12	20'	1.34	1.11	1.06	0.14	-	-	-	-		55
	13.5	13.5	11		25'	1.52	1.27	1.23	0.14	-	-	-	-		55
					30'	1.54	1.37	1.34	0.14	-	-	-	-		50
11' x 6'	11	11	11	4 to 12	0.33' - <2'	0.57	0.71	0.60	0.27	0.27	0.27	0.47	0.53		-
					2' - <3'	0.56	0.71	0.60	0.14	-	-	-	-		62
					3' - <5'	0.56	0.67	0.59	0.14	-	-	-	-		55
					5' - 10'	0.73	0.71	0.72	0.14	-	-	-	-		55
					15'	0.92	0.92	0.91	0.14	-	-	-	-		50
	11	11	11	8 to 12	20'	1.21	1.25	1.21	0.14	-	-	-	-		50
	12	12	11		25'	1.37	1.43	1.39	0.14	-	-	-	-		50
	13.5	13.5	11		30'	1.39	1.53	1.50	0.14	-	-	-	-		50
11' x 8'	11	11	11	4 to 12	0.33' - <2'	0.55	0.76	0.66	0.27	0.27	0.27	0.46	0.55		-
					2' - <3'	0.55	0.76	0.66	0.14	-	-	-	-		62
					3' - <5'	0.54	0.72	0.65	0.14	-	-	-	-		62
					5' - 10'	0.73	0.79	0.82	0.14	-	-	-	-		55
					15'	0.93	1.03	1.03	0.14	-	-	-	-		50
	11	11	11	8 to 12	20'	1.21	1.39	1.36	0.14	-	-	-	-		50
	12	12.5	11		25'	1.34	1.56	1.50	0.14	-	-	-	-		50
	13.5	13.5	11		30'	1.41	1.66	1.65	0.14	-	-	-	-		50
11' x 10'	11	11	11	4 to 12	0.33' - <2'	0.60	0.81	0.71	0.27	0.27	0.27	0.48	0.60		-
					2' - <3'	0.60	0.81	0.71	0.15	-	-	-	-		75
					3' - <5'	0.61	0.77	0.70	0.14	-	-	-	-		69
					5' - 10'	0.80	0.88	0.93	0.14	-	-	-	-		62
					15'	1.01	1.13	1.15	0.14	-	-	-	-		55
	11	11	11	8 to 12	20'	1.30	1.52	1.52	0.14	-	-	-	-		50
	12	12.5	11		25'	1.42	1.70	1.65	0.14	-	-	-	-		50
	13.5	14	11		30'	1.53	1.77	1.74	0.14	-	-	-	-		50
11' x 11'	11	11	11	4 to 12	0.33' - <2'	0.64	0.83	0.74	0.27	0.27	0.27	0.51	0.64		-
					2' - <3'	0.64	0.83	0.74	0.21	-	-	-	-		86
					3' - <5'	0.67	0.79	0.75	0.21	-	-	-	-		75
					5' - 10'	0.88	0.93	0.99	0.19	-	-	-	-		69
					15'	1.09	1.19	1.23	0.16	-	-	-	-		55
	11	11	11	8 to 12	20'	1.40	1.59	1.60	0.15	-	-	-	-		55
	12	12.5	11		25'	1.54	1.77	1.73	0.15	-	-	-	-		50
	13.5	14	11.5		30'	1.57	1.77	1.76	0.14	-	-	-	-		50

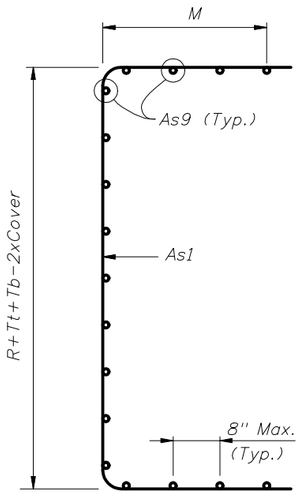
NOTES:
1. See Sheet 2 for General Notes.
2. See Sheet 7 for Reinforcing Details and dimension locations.
3. See Sheet 14 for WWR Bending Diagrams.

TABLE 16 - STANDARD PRECAST BOX CULVERT DESIGNS (3" COVER) - 12' SPANS

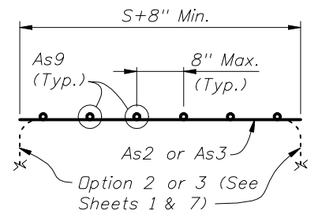
SPAN x RISE (S) (R) (ft.)	SLAB / WALL THICKNESS TOP (Tt) (in.)	BOT. (Tb) (in.)	SIDE (Tw) (in.)	HAUNCH (H) (in.)	DESIGN EARTH COVER ABOVE TOP SLAB	REINFORCEMENT AREAS (sq. in./ft.) As1	As2	As3	As4	As5	As6	As7	As8	As9	As1 EXT. LENGTH (M) (in.)
12' x 4'	12	12	12	4 to 12	0.33' - <2'	0.59	0.64	0.51	0.29	0.29	0.29	0.52	0.55	See General Note 5	-
					2' - <3'	0.60	0.64	0.51	0.15	-	-	-	-		73
					3' - <5'	0.60	0.61	0.51	0.15	-	-	-	-		66
					5' - 10'	0.81	0.61	0.61	0.15	-	-	-	-		66
					15'	1.04	0.80	0.77	0.15	-	-	-	-		59
					20'	1.37	1.08	1.03	0.15	-	-	-	-		59
	13	13	12	8 to 12	25'	1.58	1.26	1.21	0.15	-	-	-	-		59
	14.5	14.5	12		30'	1.63	1.38	1.34	0.15	-	-	-	-		53
12' x 6'	12	12	12	4 to 12	0.33' - <2'	0.56	0.70	0.57	0..29	0.29	0.29	0.47	0.52		-
					2' - <3'	0.56	0.70	0.57	0.15	-	-	-	-		66
					3' - <5'	0.56	0.67	0.57	0.15	-	-	-	-		59
					5' - 10'	0.74	0.69	0.70	0.15	-	-	-	-		59
					15'	0.94	0.90	0.88	0.15	-	-	-	-		53
					20'	1.23	1.22	1.17	0.15	-	-	-	-		53
	13	13	12	8 to 12	25'	1.40	1.42	1.37	0.15	-	-	-	-		53
	14.5	15	12		30'	1.44	1.54	1.48	0.15	-	-	-	-		53
12' x 8'	12	12	12	4 to 12	0.33' - <2'	0.55	0.75	0.63	0.29	0.29	0.29	0.45	0.53		-
					2' - <3'	0.55	0.75	0.63	0.15	-	-	-	-		66
					3' - <5'	0.55	0.73	0.63	0.15	-	-	-	-		59
					5' - 10'	0.73	0.77	0.79	0.15	-	-	-	-		59
					15'	0.93	1.00	0.99	0.15	-	-	-	-		53
	12	12	12	8 to 12	20'	1.21	1.35	1.31	0.15	-	-	-	-		53
	13	13.5	12		25'	1.35	1.55	1.48	0.15	-	-	-	-		53
	14.5	15	12		30'	1.40	1.67	1.62	0.15	-	-	-	-		53
12' x 10'	12	12	12	4 to 12	0.33' - <2'	0.57	0.80	0.68	0.29	0.29	0.29	0.46	0.57		-
					2' - <3'	0.57	0.80	0.68	0.15	-	-	-	-		73
					3' - <5'	0.59	0.77	0.68	0.15	-	-	-	-		66
					5' - 10'	0.78	0.85	0.89	0.15	-	-	-	-		59
					15'	0.98	1.10	1.11	0.15	-	-	-	-		53
	12	12	12	8 to 12	20'	1.26	1.47	1.45	0.15	-	-	-	-		53
	13	13.5	12		25'	1.39	1.68	1.63	0.15	-	-	-	-		53
	14.5	15	12		30'	1.48	1.79	1.76	0.15	-	-	-	-		53
12' x 12'	12	12	12	4 to 12	0.33' - <2'	0.65	0.84	0.73	0.29	0.29	0.29	0.50	0.65		-
					2' - <3'	0.65	0.84	0.73	0.23	-	-	-	-		93
					3' - <5'	0.68	0.81	0.75	0.22	-	-	-	-		80
					5' - 10'	0.90	0.94	1.01	0.21	-	-	-	-		73
					15'	1.12	1.20	1.24	0.18	-	-	-	-		59
	12	12	12	8 to 12	20'	1.42	1.60	1.61	0.16	-	-	-	-		59
	13	13.5	12		25'	1.57	1.81	1.78	0.16	-	-	-	-		53
	14.5	15	12.5		30'	1.63	1.86	1.85	0.15	-	-	-	-		53

NOTES:
1. See Sheet 2 of 14 for General Notes.
2. See Sheet 7 of 14 for Reinforcing Details and dimension locations.

WELDED WIRE REINFORCEMENT BENDING DIAGRAM



WWR PIECE NO. 1
(2 reqd. per segment)



WWR PIECE NO. 2
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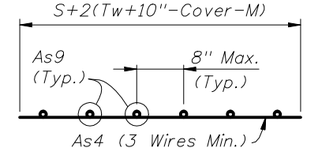
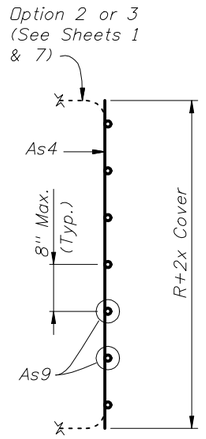
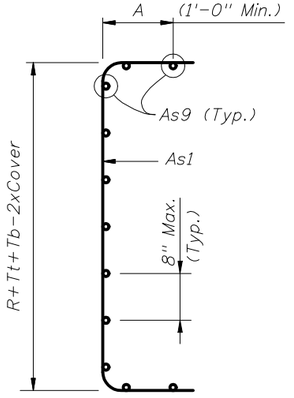


WWR PIECE NO. 4
(Tongue Reinforcement)
(4 reqd. per segment)

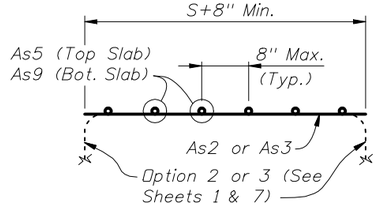


WWR PIECE NO. 3
(2 reqd. per segment)

TYPE 2 BOX SECTION (DESIGN EARTH COVER 2' OR GREATER)



WWR PIECE NO. 1
(2 reqd. per segment)



WWR PIECE NO. 2
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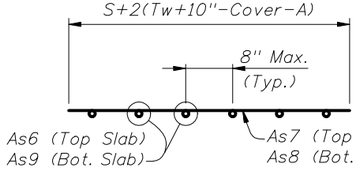
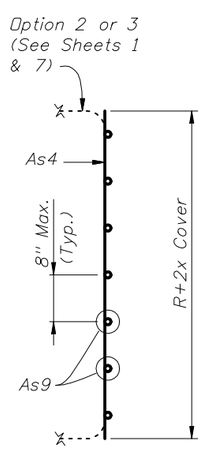


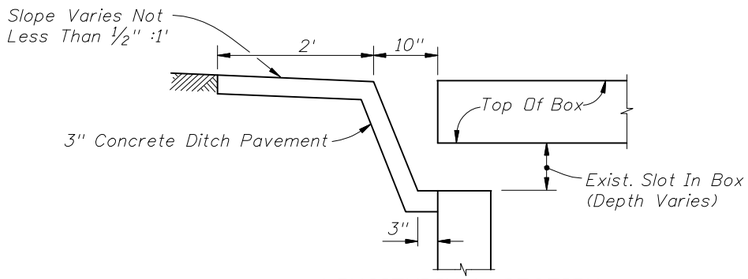
WWR PIECE NO. 4
(2 reqd. per segment)



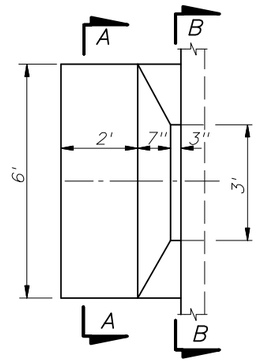
WWR PIECE NO. 3
(2 reqd. per segment)

TYPE 1 BOX SECTION (DESIGN EARTH COVER LESS THAN 2')

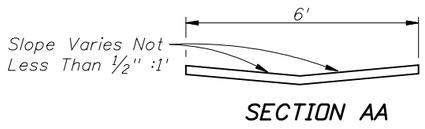
REINFORCEMENT NOTES:
1. Reinforcement bending dimensions are out-to-out.
2. See General Notes 4, 5 and 6 on Sheet 2.
3. See Tables 1 thru 16 for dimensions M, R, S, Tb, Tt and Tw.
4. Dimension "A" is determined by the Manufacturer in accordance with the requirements of Detail "B" on Sheets 1 and 7.



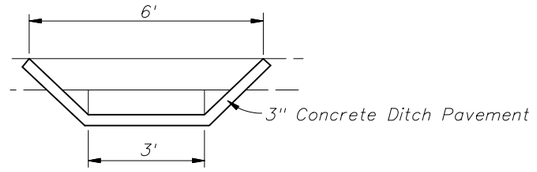
LONGITUDINAL SECTION



PLAN



SECTION AA



SECTION BB

SAFETY MODIFICATION FOR INLETS IN BOX CULVERTS

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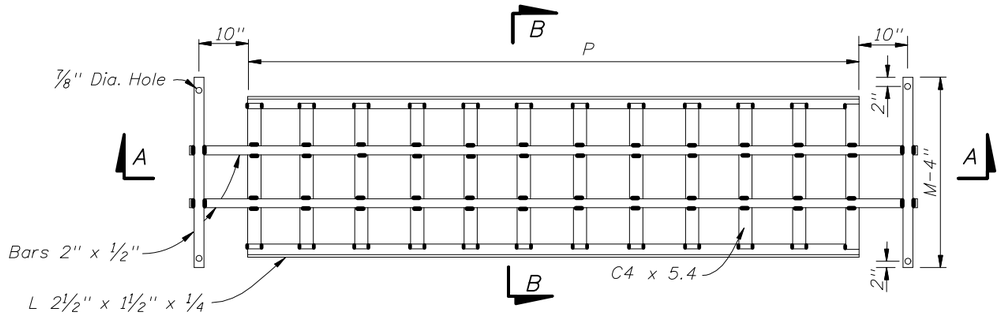
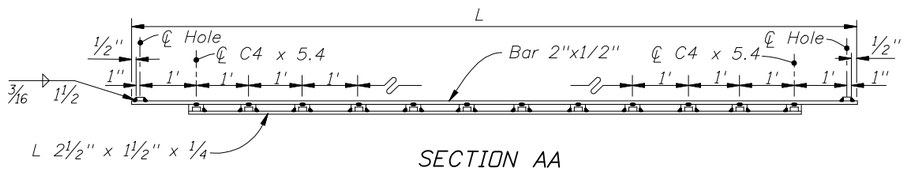
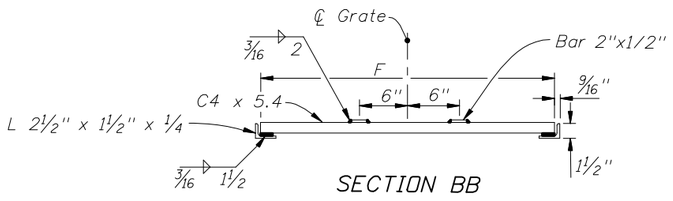
		Index No. 293	



PLAN

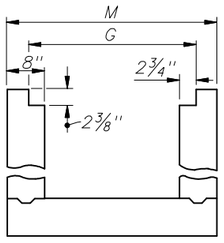


SECTION AA

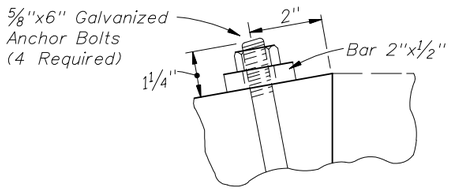


SECTION BB

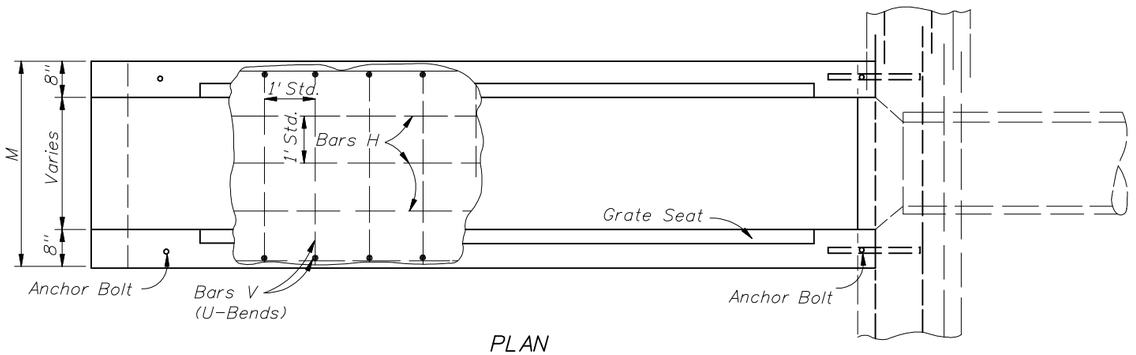
GRATE DETAIL



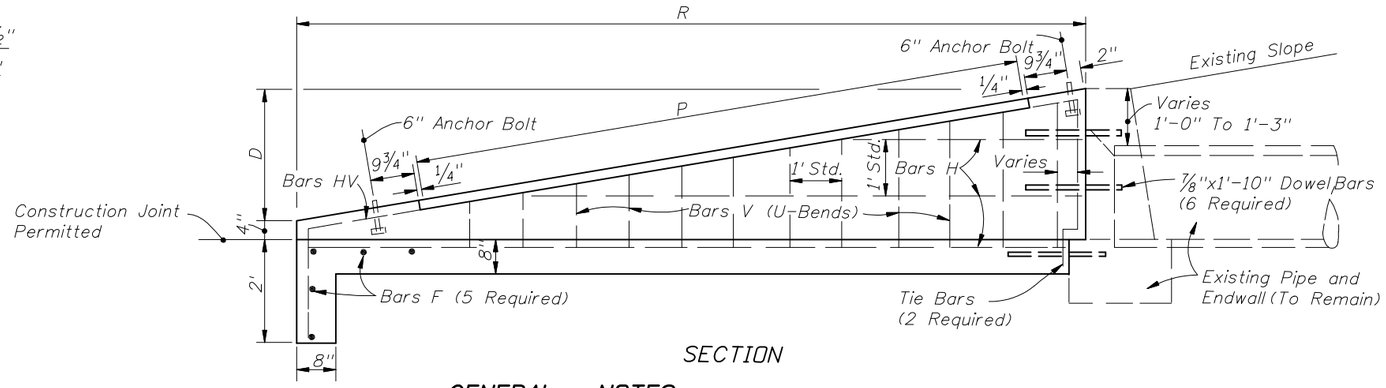
GRATE SEAT DETAIL



ANCHOR BOLT DETAIL



PLAN



SECTION

GENERAL NOTES

1. For use criteria see "Steel Grating Use Criteria" Index No. 261.
2. Grates shall be ASTM A242, A572 or A588, Grade 50 steel, and galvanized in accordance with Section 975 and 425-3.2 of the Standard Specifications.
3. Channel section C3 x 6.0 may be substituted for the C4 x 5.4 channel.
4. All reinforcing No. 4 bars with 2" clearance except as noted. Spacings shown are center to center. Laps to be 12" minimum. Welded wire fabric (two cages max.) having an equivalent cross section area (0.20 sq. in.) may be substituted for bar reinforcement.
5. Drill 1 1/4" holes 8" deep with a rotary drill in existing endwall for dowel bars. Holes shall be thoroughly cleaned prior to installing Adhesive-Bonded Dowels.
6. Endwall to be paid for under the contract unit price for Class I Concrete (Endwalls), CY and Reinforcing Steel (Roadway), LB. Cost of Adhesive-Bonded Dowels to be included in the contract unit price for reinforcing steel. Cost of grates to be paid for under the contract unit price for Endwall Grate, LB., plan quantity. Cost of galvanized bolts and nuts to be included in the contract unit price for the grate.
7. Sod slopes 5' each side and above endwall. Sodding to be paid for under the contract unit price for Performance Turf, SY.

DIMENSIONS AND QUANTITIES PER GRATE

Slope	Pipe Size	Channels @ 5.4 Lbs./LF			Bars @ 3.4 lbs/LF (2 ea.)			Angles @ 3.2 Lbs./LF		(2)Total Weight-Lbs
		Quantity	F	Lbs.	L	M-4"	Lbs.	P	Lbs.	
1:6	15"	10	2'-6 7/8"	139	11'-3"	3'-3"	99	9'-4"	60	298
	18"	12	2'-9 7/8"	183	13'-3"	3'-6"	114	11'-4"	73	370
	24"	15	3'-3 7/8"	269	16'-3"	4'-0"	138	14'-4"	92	499
	30"	18	3'-9 7/8"	372	19'-3"	4'-6"	162	17'-4"	111	645
1:4	15"	6	2'-6 7/8"	83	7'-3"	3'-3"	71	5'-4"	34	188
	18"	7	2'-9 7/8"	107	8'-3"	3'-6"	80	6'-4"	41	228
	24"	9	3'-3 7/8"	161	10'-3"	4'-0"	97	8'-4"	53	311
	30"	11	3'-9 7/8"	227	12'-3"	4'-6"	114	10'-4"	66	407

DIMENSIONS AND QUANTITIES PER U-ENDWALL

Pipe Size	G	M	D	R	P	Class I Concrete-CY	Reinforcing Steel-Lbs.	Sod SY
15"	2'-8 1/2"	3'-7"	2'-2"	13'-0"	9'-4"	2.12	167	23
18"	2'-11 1/2"	3'-10"	2'-5"	14'-6"	11'-4"	2.53	173	25
24"	3'-5 1/2"	4'-4"	2'-11"	17'-6"	14'-4"	3.48	238	29
30"	3'-11 1/2"	4'-10"	3'-5"	20'-6"	17'-4"	4.57	315	32
15"	2'-8 1/2"	3'-7"	2'-2"	8'-8"	5'-4"	1.44	120	19
18"	2'-11 1/2"	3'-10"	2'-5"	9'-8"	6'-4"	1.72	130	20
24"	3'-5 1/2"	4'-4"	2'-11"	11'-8"	8'-4"	2.36	167	22
30"	3'-11 1/2"	4'-10"	3'-5"	13'-8"	10'-4"	3.09	225	25

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