

DELAWARE
DEPARTMENT OF TRANSPORTATION

HARDWARE

STANDARD NO. B-13 (2004)

SHT. 6 OF 13

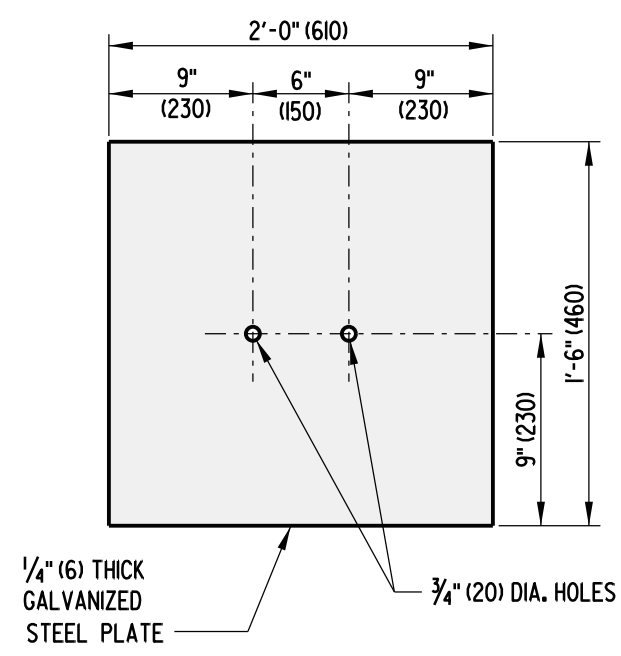
APPROVED

Carolann Wicks
CHIEF ENGINEER
DATE 1/10/05

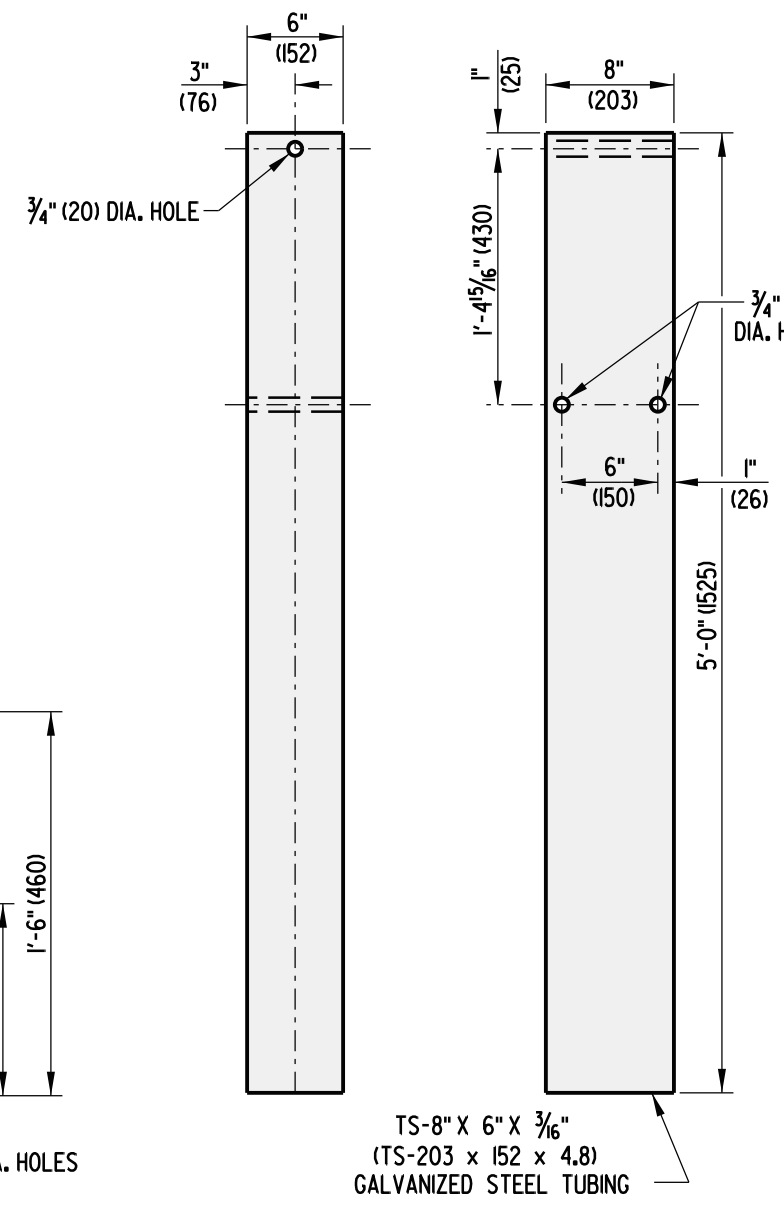
RECOMMENDED

Dennis M. O'Flaherty
DESIGN ENGINEER
DATE 1/3/05

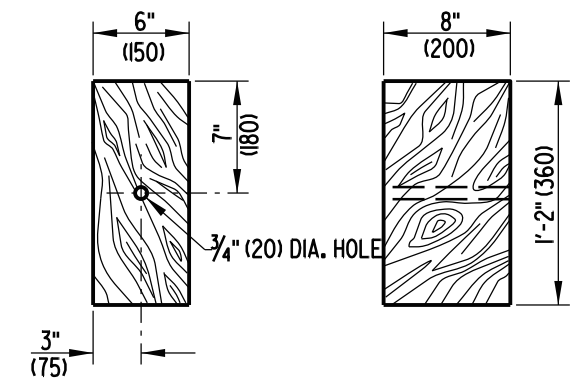
NOTES : 1). ALL HOLES SHALL BE DRILLED PRIOR TO GALVANIZING.
2). ALL WOOD SIZES ARE NOMINAL DIMENSIONS.
3). POSTS SHOULD BE PLACED SO THAT BREAKAWAY HOLES ARE NO LOWER THAN GROUND LEVEL AND NO HIGHER THAN 4" (100) ABOVE GROUND LEVEL.



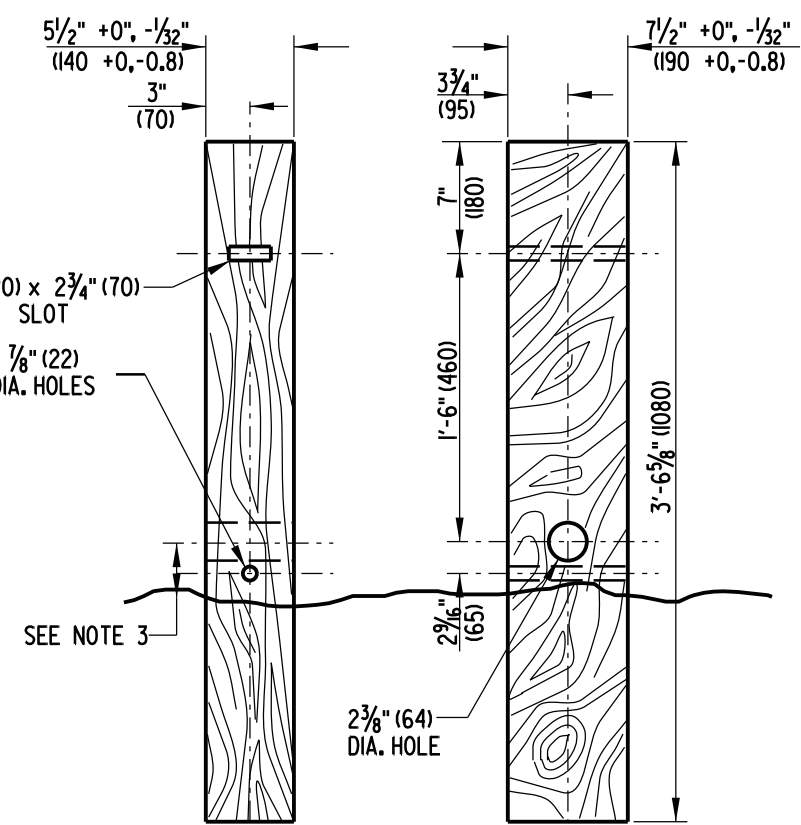
SOIL PLATE



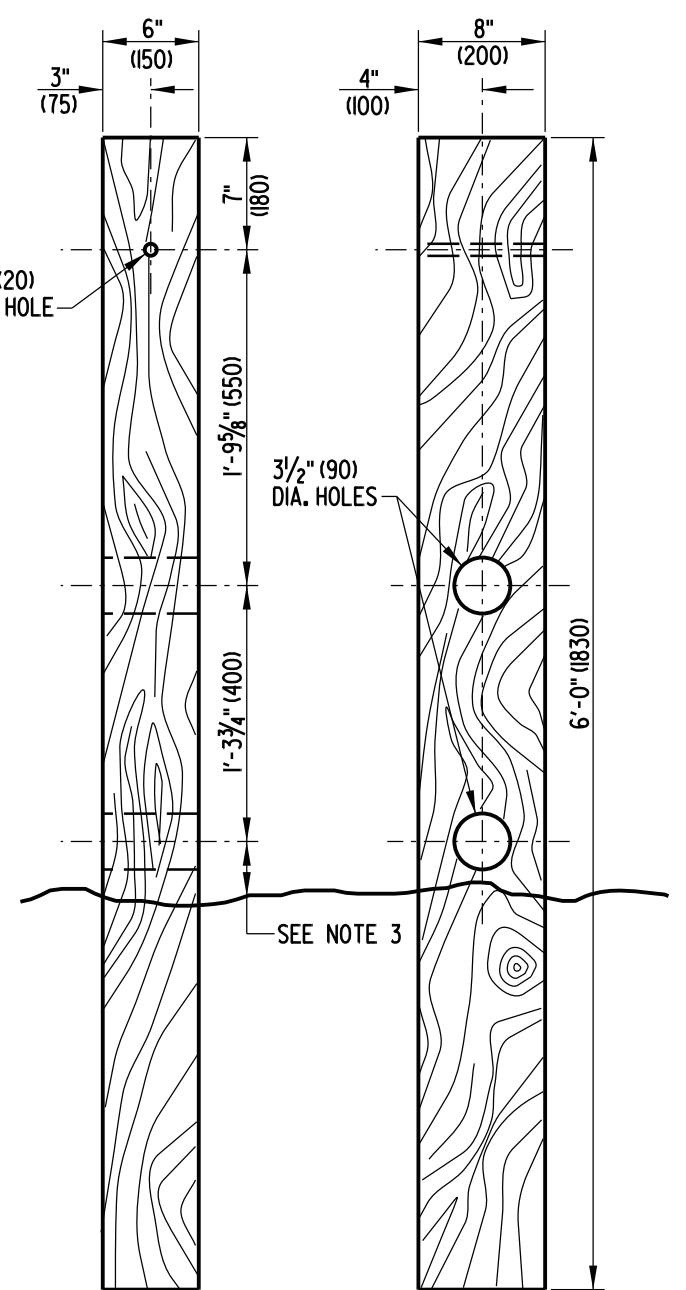
STEEL TUBE



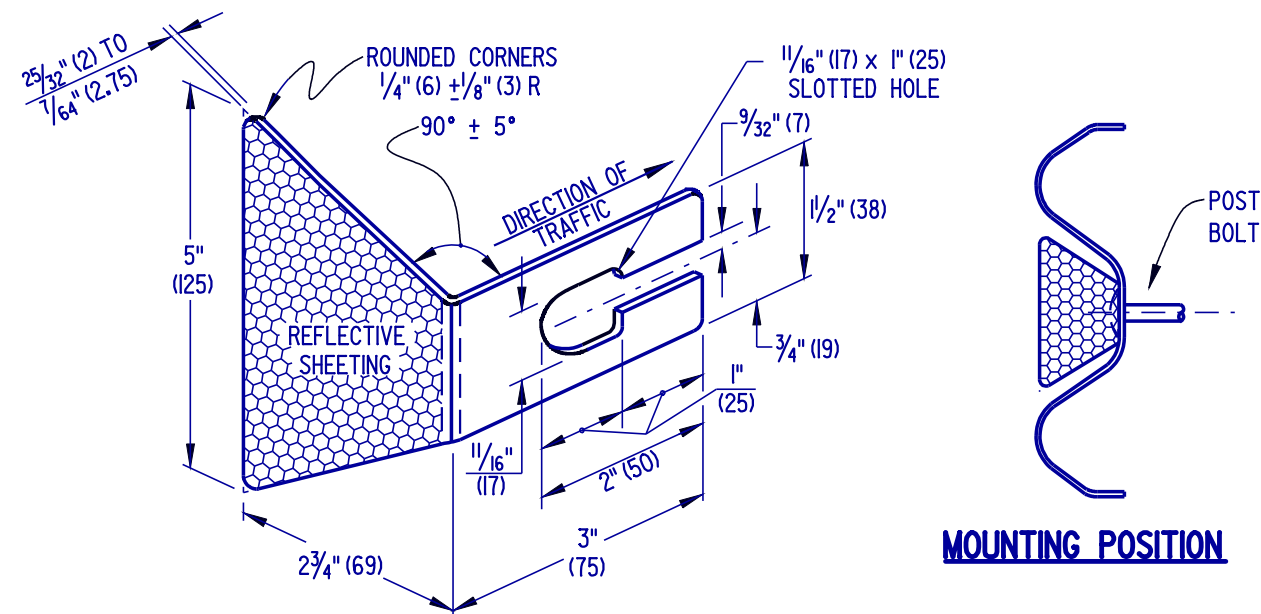
WOOD BLOCK



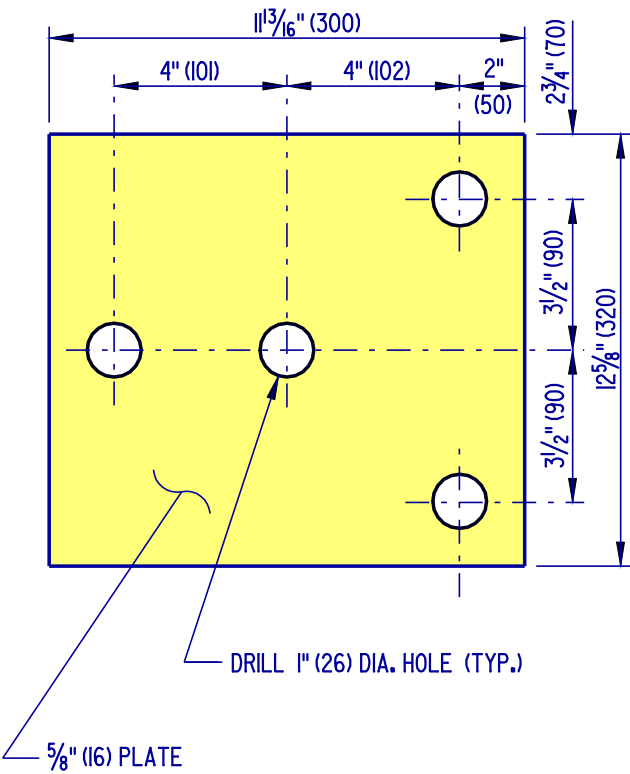
SHORT WOOD BREAKAWAY POST



LONG WOOD BREAKAWAY POST



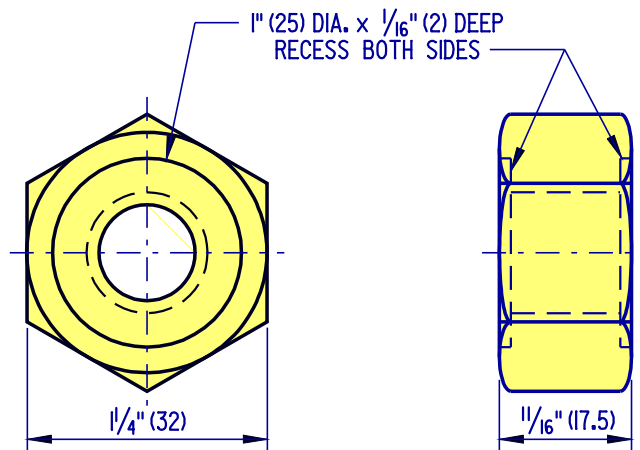
GUARDRAIL REFLECTOR



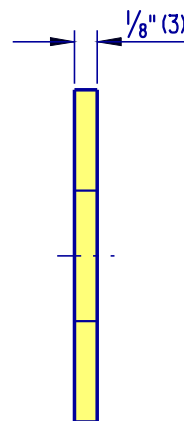
BEARING PLATE DETAIL

11

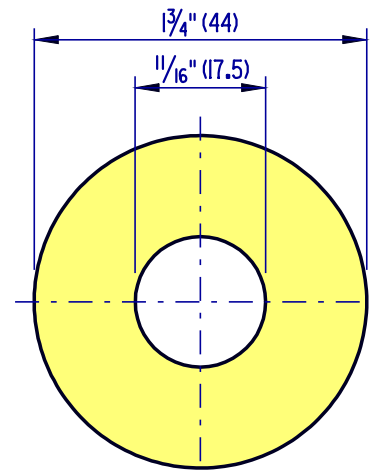




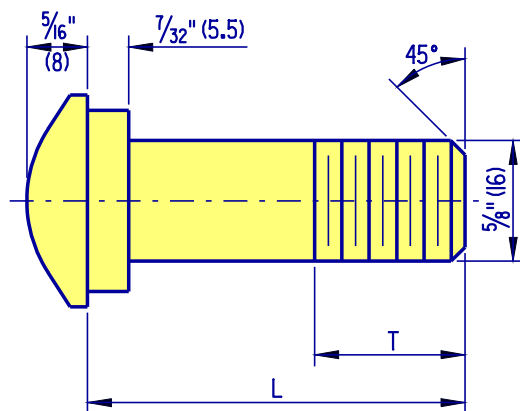
RECESSED NUT
(FOR 5/8\" (16) GUARDRAIL BOLT)



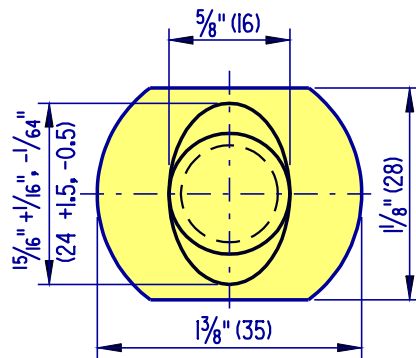
STEEL WASHER (FOR 5/8\" (16) GUARDRAIL BOLT)



NOTE: DIMENSION FOR WASHER THICKNESS IS APPROXIMATE BASED ON METAL THICKNESS.



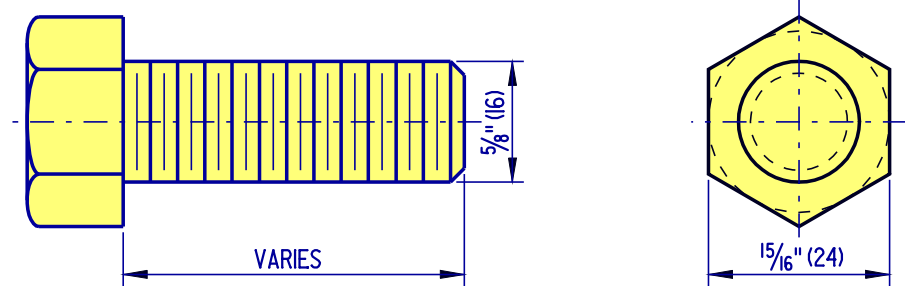
GUARDRAIL BOLT



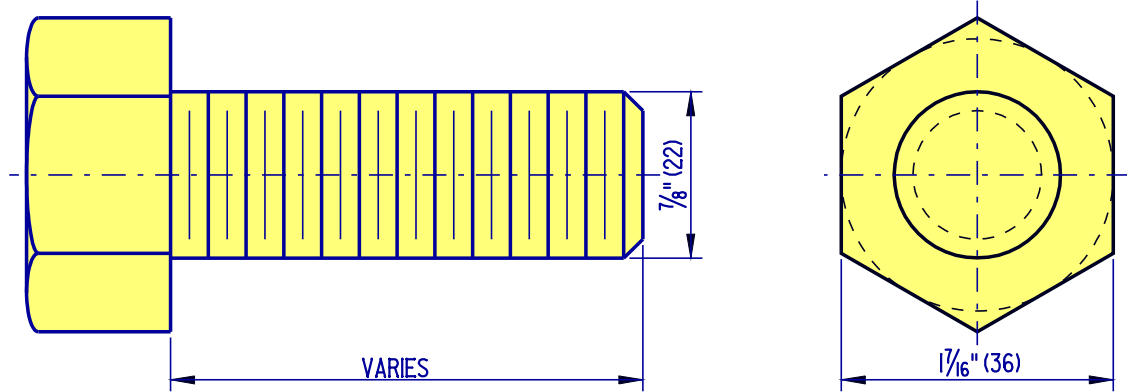
L	T (MIN.)
1 1/4\" (35)	FULL THREAD LENGTH
2\" (50)	FULL THREAD LENGTH
4\" (100)	FULL THREAD LENGTH
10\" (255)	4\" (100) THREAD LENGTH
18\" (460)	4\" (100) THREAD LENGTH

NOTES : 1. ALL FILLETS SHALL HAVE A MINIMUM RADIUS OF 1/16\" (2).
2. IF THE BOLT EXTENDS MORE THAN 1/2\" (12) BEYOND THE NUT, THE BOLT SHALL BE TRIMMED BACK AS PER THE DEPARTMENT'S SPECIFICATIONS.

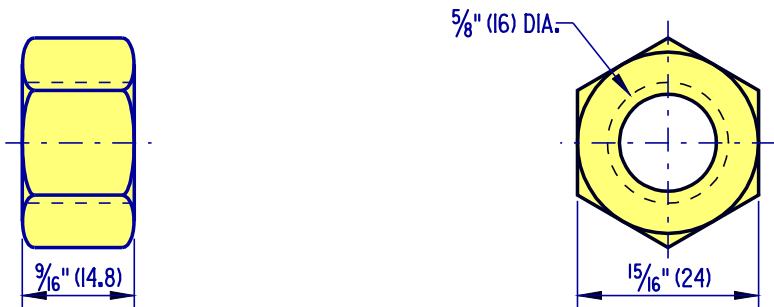




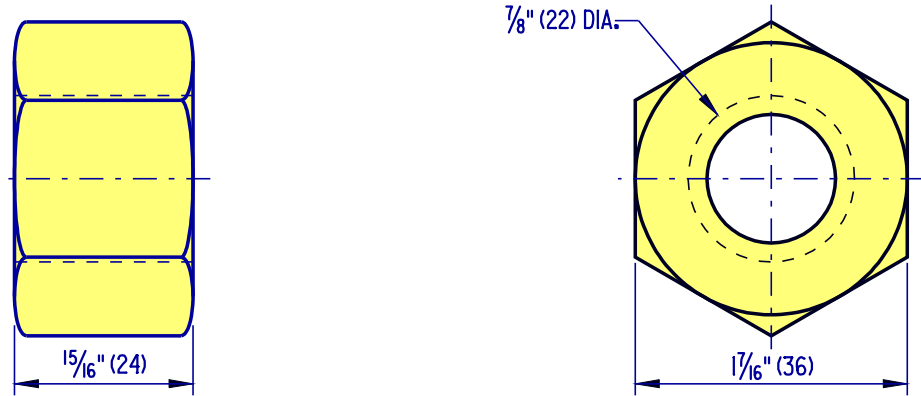
5/8" (16) HEX BOLT



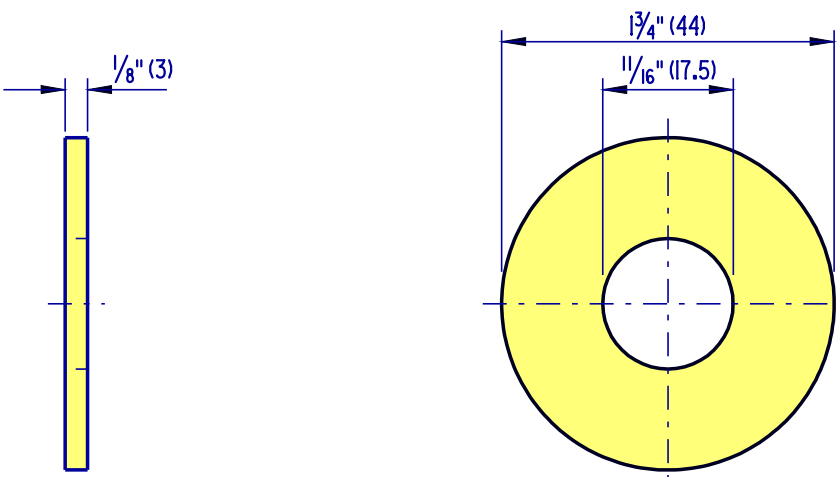
HIGH-STRENGTH STRUCTURAL HEX BOLT



5/8" (16) HEX NUT

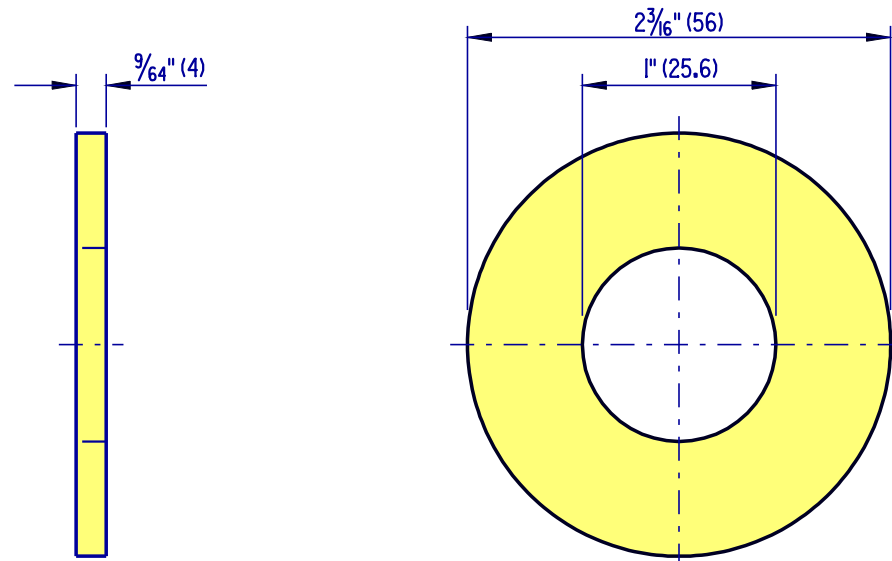


HIGH-STRENGTH STRUCTURAL HEX NUT



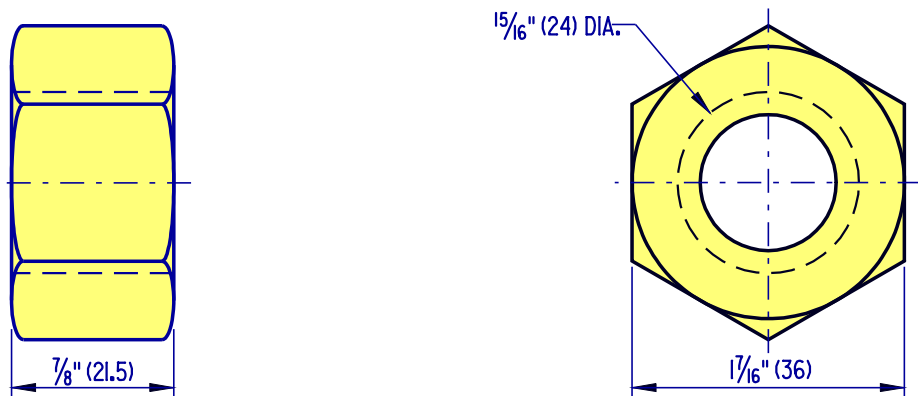
5/8" (16) STEEL WASHER

NOTE : DIMENSION FOR WASHER THICKNESS IS APPROXIMATE BASE METAL THICKNESS.



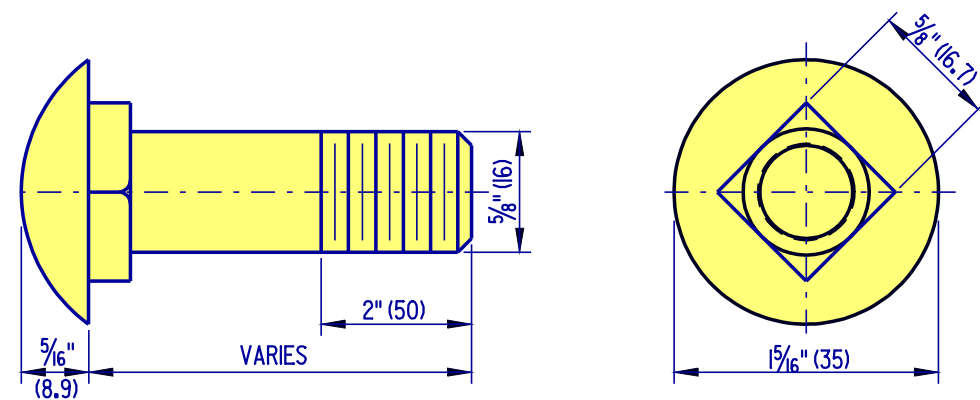
STEEL WASHER

NOTES : 1. FOR USE WITH SWAGED CABLE ASSEMBLAGE.
2. DIMENSION FOR WASHER THICKNESS IS APPROXIMATE BASE METAL THICKNESS.



$1\frac{5}{16}$ " (24) HEX NUT

NOTE : FOR USE WITH SWAGED CABLE ASSEMBLAGE.



$\frac{5}{8}$ " (16) CARRIAGE BOLT



DELAWARE
DEPARTMENT OF TRANSPORTATION

HARDWARE

STANDARD NO.

B-13 (2004)

SHT.

12

OF

13

APPROVED

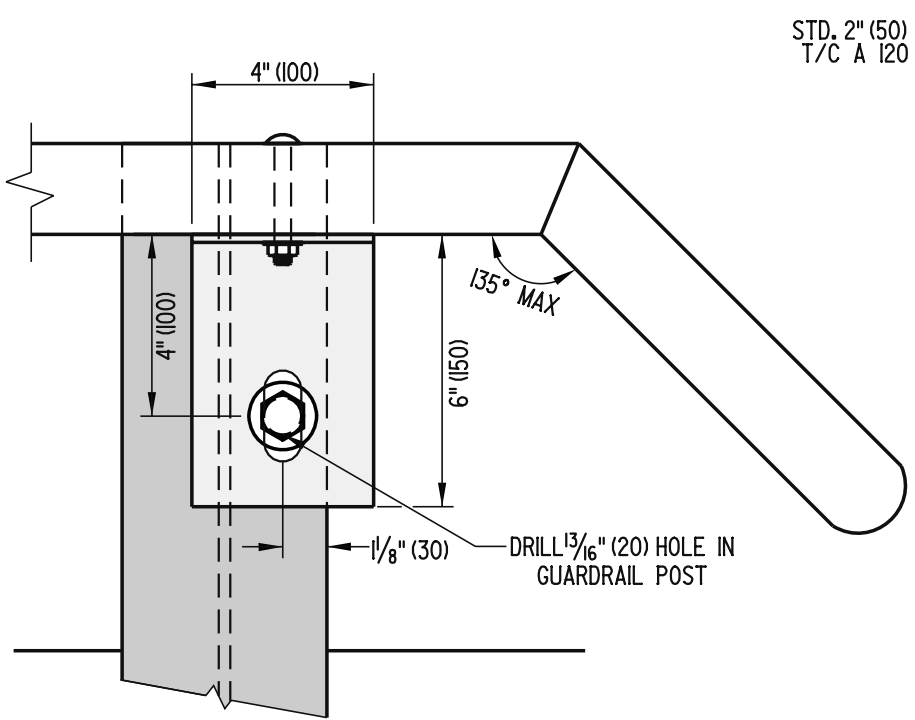
Carolann Wicks
CHIEF ENGINEER

1/10/05
DATE

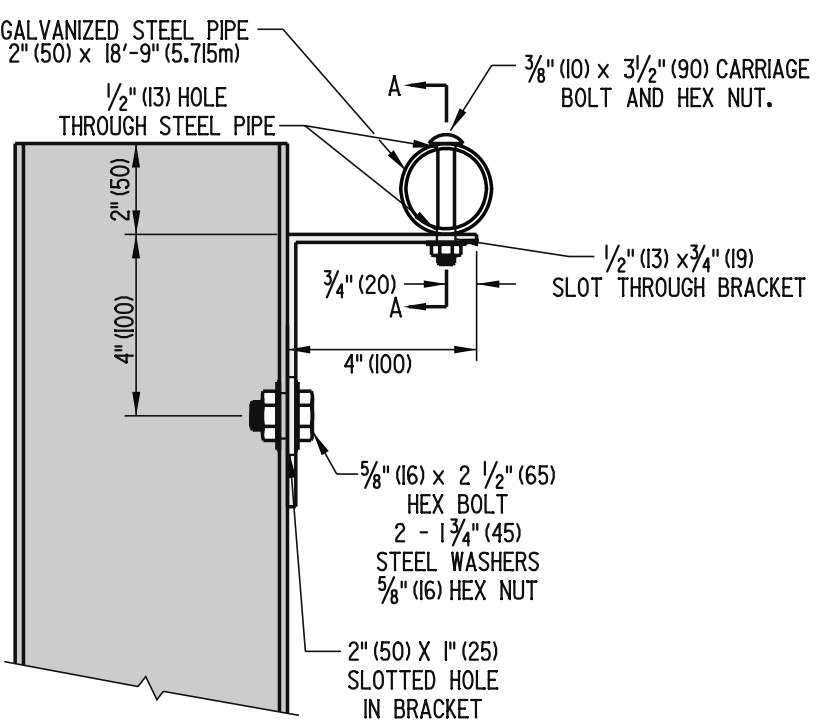
RECOMMENDED

Dennis M. O'Flaherty
DESIGN ENGINEER

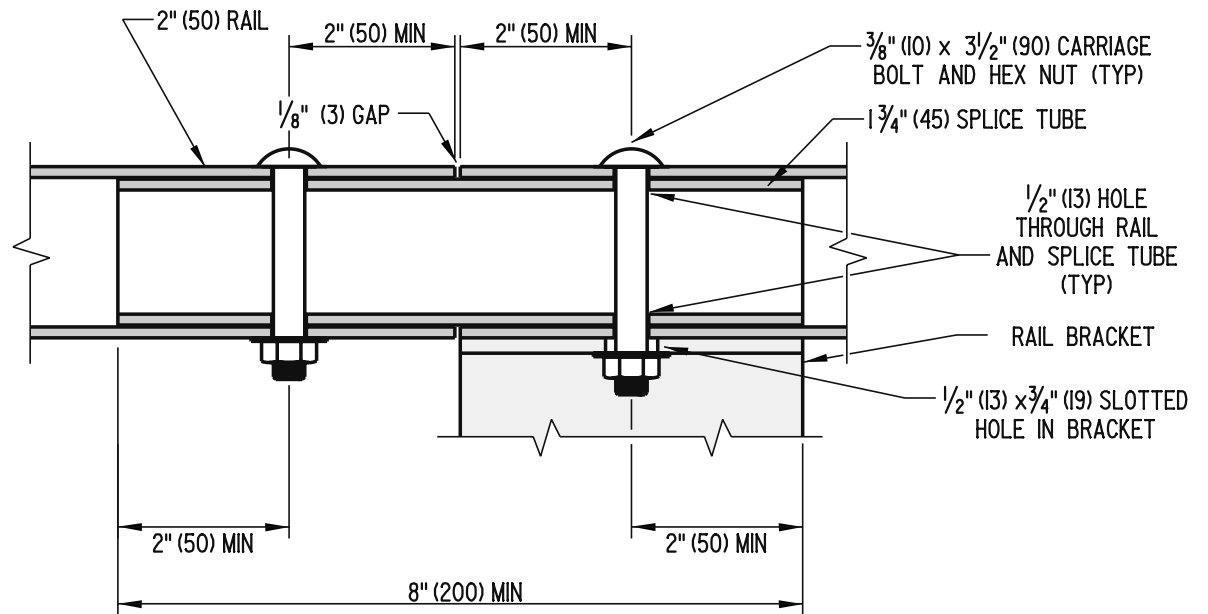
1/3/05
DATE



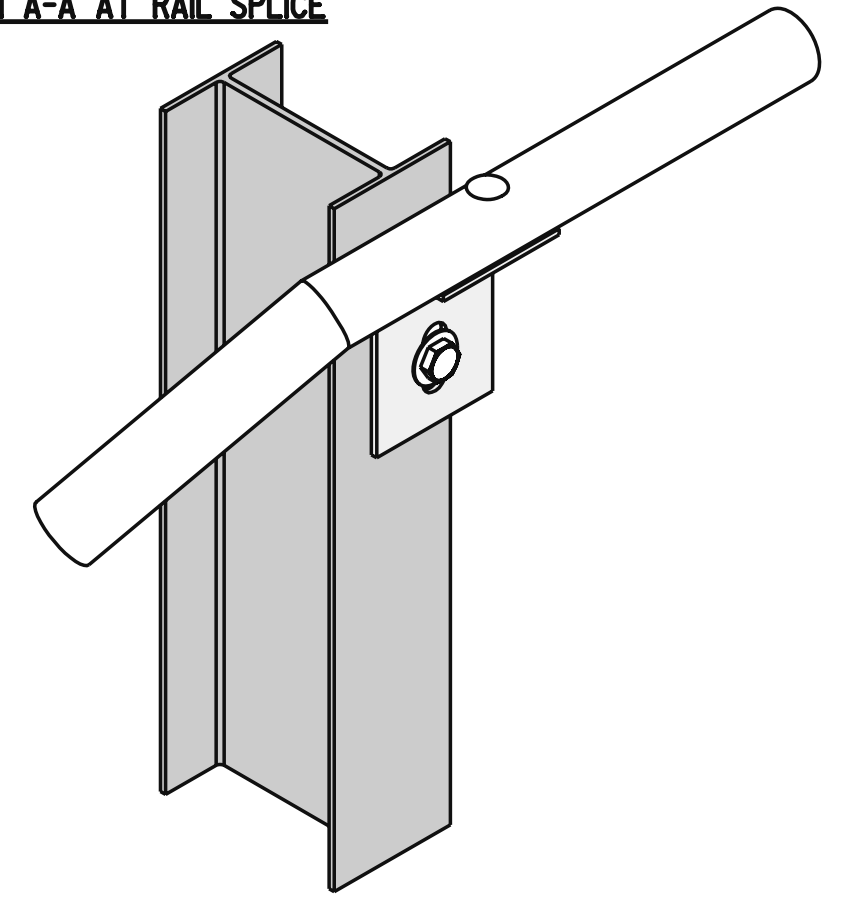
REAR VIEW WITH START & END SECTION



SIDE VIEW

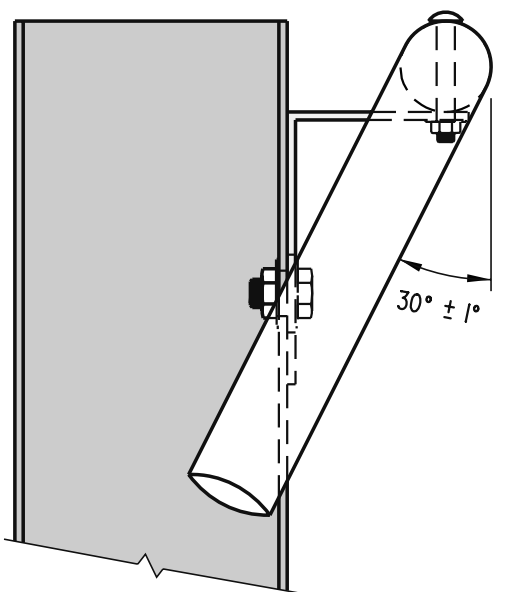


SECTION A-A AT RAIL SPLICE




ISOMETRIC VIEW WITH START & END SECTION

- NOTES:
1. RAIL SHALL BE MOUNTED ON GUARDRAIL ADJACENT TO A BIKEWAY OR SIDEWALK.
 2. ALL COMPONENTS OF THE RAIL SHALL BE SHOP FABRICATED. ALL CUTTING AND DRILLING SHALL BE DONE IN THE SHOP.
 3. ALL EXPOSED THREADED HARDWARE SHALL BE BURRED.
 4. GUARDRAIL POSTS UPON WHICH RAIL IS TO BE INSTALLED SHALL BE SHOP DRILLED FOR THE RAIL BRACKETS DURING FABRICATION.
 5. ALL RAIL SPLICES WILL BE AT RAIL SUPPORT BRACKETS, THE SAME BOLT USED TO ATTACH THE RAIL TO THE BRACKET WILL BE USED TO SECURE THE SPLICE TUBE.
 6. RAILS SHALL BE INSTALLED ONLY ON STANDARD W-BEAM SECTIONS AND AT LEAST ONE POST AWAY FROM THE PAYMENT LIMITS OF THE END TREATMENT.



SIDE VIEW WITH START & END SECTION

 DELAWARE DEPARTMENT OF TRANSPORTATION	GUARDRAIL MOUNTED RAIL			APPROVED <i>Carolann Wick</i> 12/5/05 CHIEF ENGINEER DATE
	STANDARD NO. B-13 (2005)	SHT. 13	OF 13	RECOMMENDED <i>James M. O'Brien</i> 11/29/05 DESIGN ENGINEER DATE



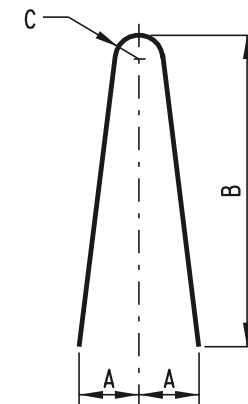
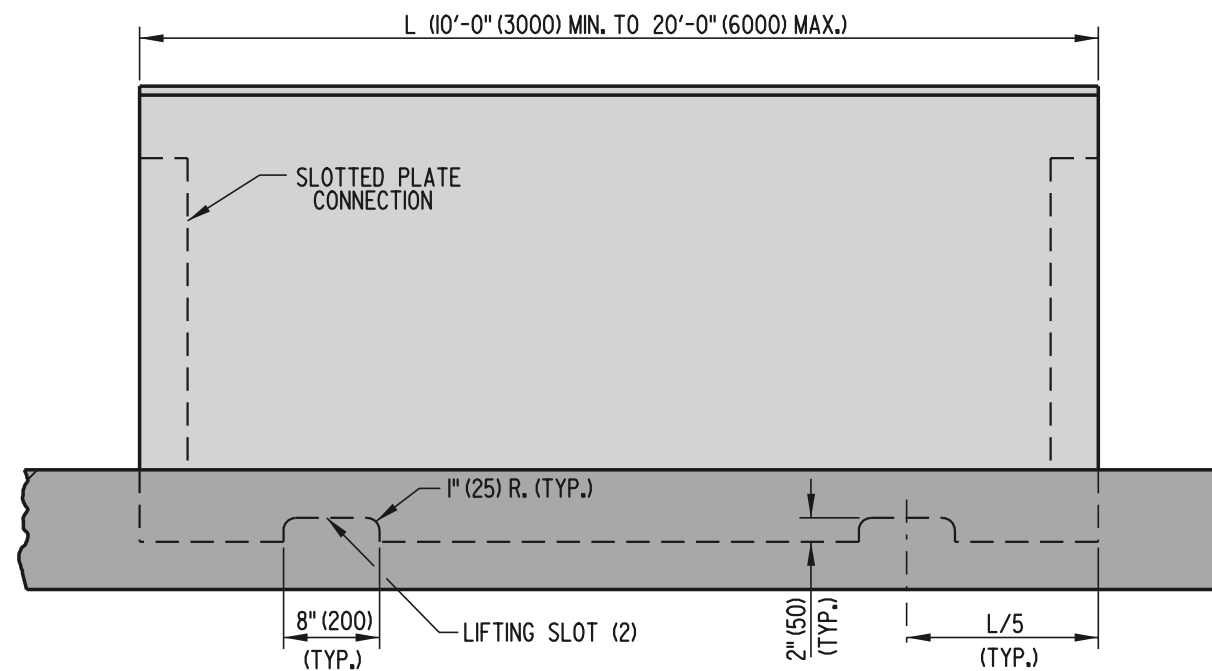
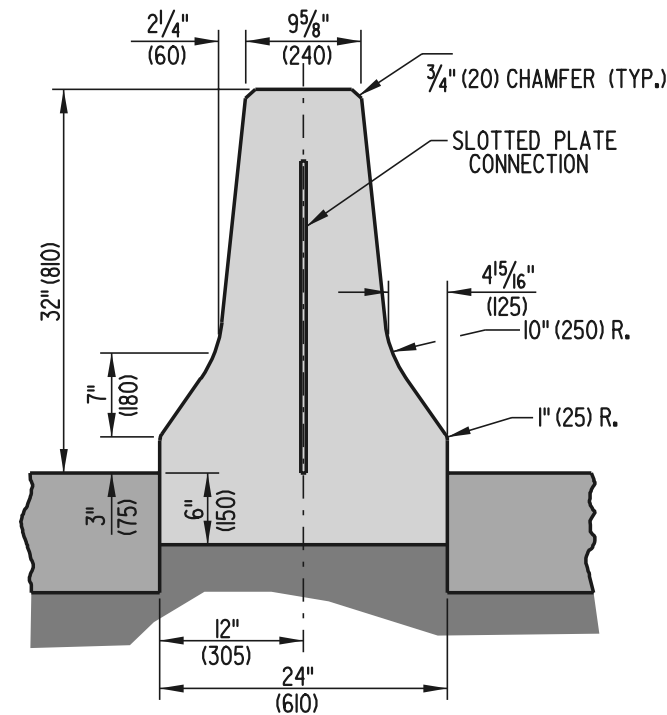
CONCRETE SAFETY BARRIER (F SHAPE)

SHT. 1 OF 3

① Raymond M. Harbony 6/18/01
CHIEF ENGINEER DATE

① Michael P. Gotsch 6/15/01
DESIGN ENGINEER DATE

RECOMMENDED



TYPE 'I' BAR

BAR OFFSETS

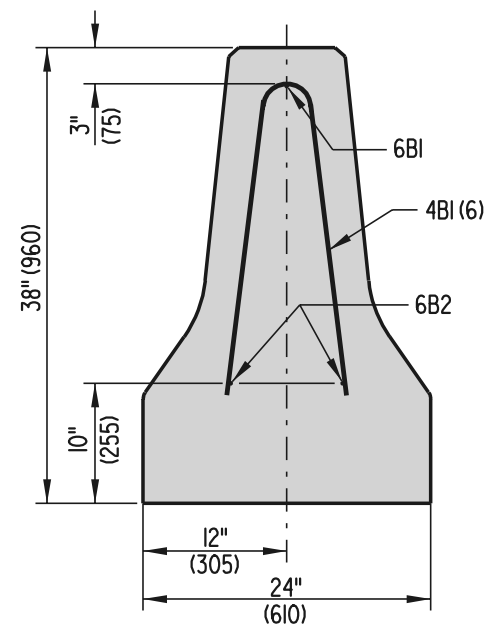
NOMINAL LENGTH OF BARRIER UNIT	"X"	NO. REQ'D FOR EACH BARRIER UNIT
20' (6000)	6' - 11" (2100)	2
18' (5500)	6' - 5" (1950)	2
16' (5000)	5' - 11" (1800)	2
14' (4500)	7' - 0" (2250)	1
12' (4000)	6' - 0" (2000)	1
10' (3000)	5' - 0" (1500)	1

BAR LIST

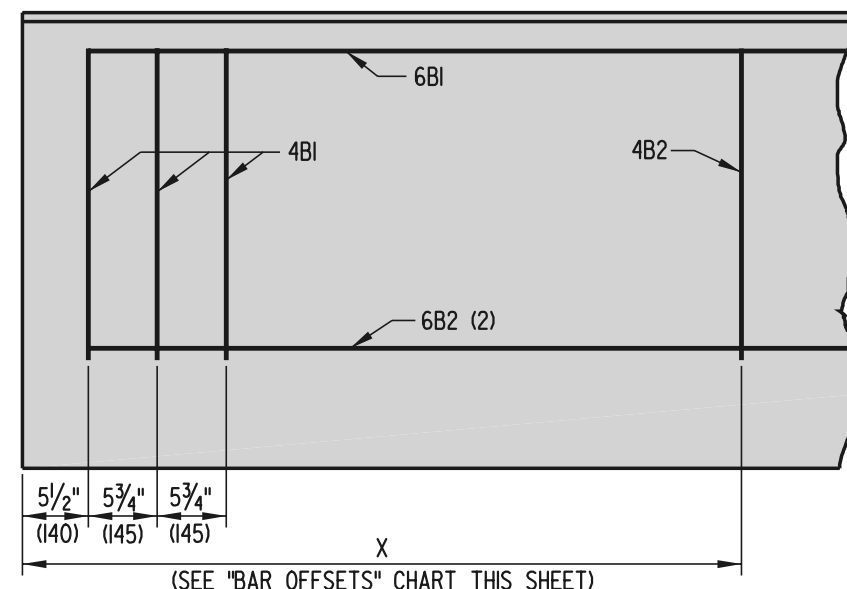
MARK	SIZE	NUMBER IN EACH SECTION	LENGTH	TYPE	A	B	C
4B1	4 (13)	6	4'-7" (1400)	I	5" (125)	26" (660)	2" (50)
4B2	4 (13)	**	4'-7" (1400)	I	5" (125)	26" (660)	2" (50)
6B1	6 (19)	1	*	STR.			
6B2	6 (19)	2	*	STR.			

* THE LENGTH OF BARS 6B1 AND 6B2 SHALL BE 11" (280) SHORTER IN LENGTH THAN THE NOMINAL SIZE OF THE BARRIER IN WHICH IT IS USED.
** SEE "BAR OFFSETS" CHART ON THIS SHEET FOR MORE INFORMATION.

TYPICAL PRE-CAST CONSTRUCTION



F' SHAPE BARRIER SECTION



ELEVATION

TYPICAL PRE-CAST REINFORCEMENT DETAILS

NOTES: 1). CONCRETE CLEAR COVER FOR REINFORCING BARS SHALL BE 1 1/2" (40) MIN..



DELAWARE
DEPARTMENT OF TRANSPORTATION

CONCRETE SAFETY BARRIER (F SHAPE)

STANDARD NO. B-14 (2001)

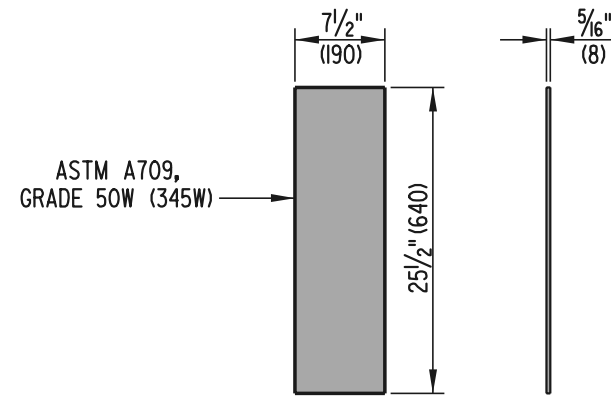
SHT. 2 OF 3

APPROVED

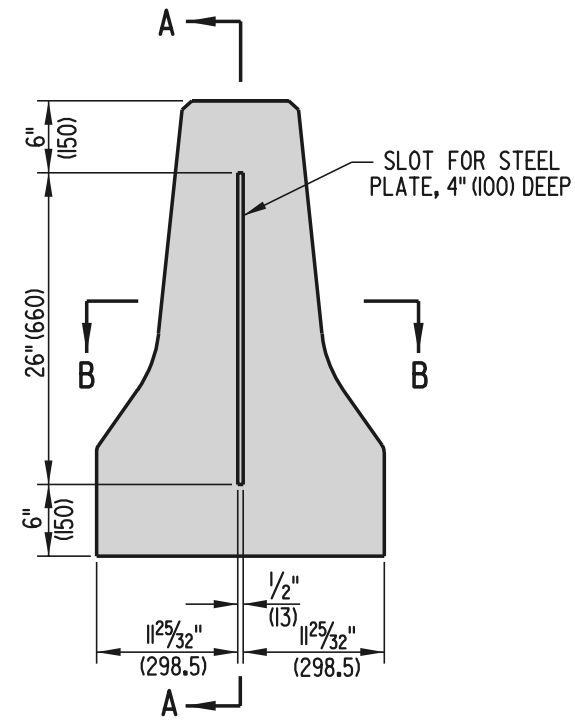
Ryan M. Hershman
CHIEF ENGINEER
DATE 6/18/01

RECOMMENDED

Michael P. Gotsch
DESIGN ENGINEER
DATE 6/18/01

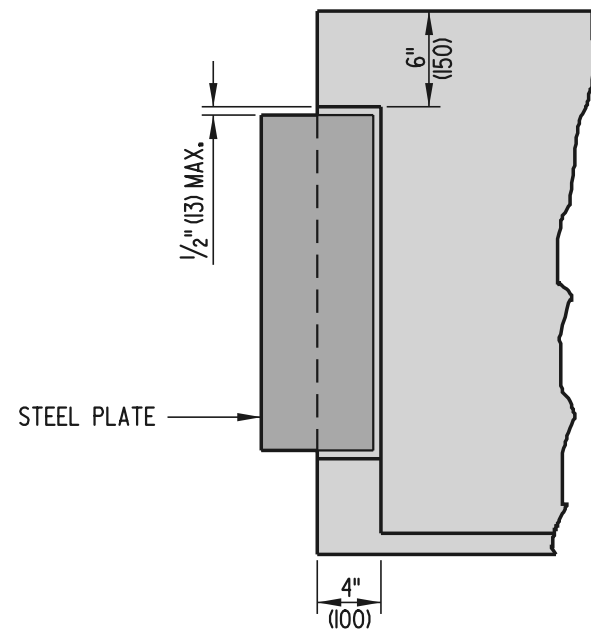


STEEL CONNECTOR PLATE

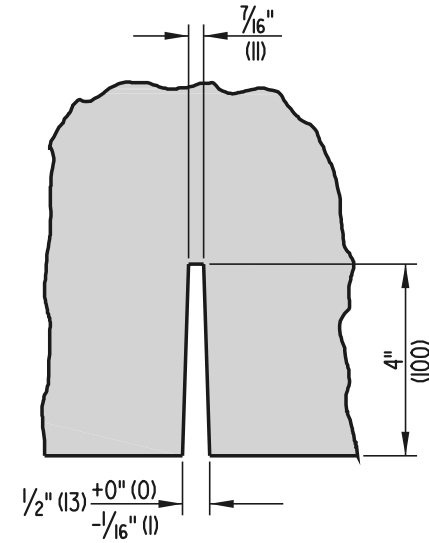


SLOT DIMENSIONS

CONCRETE SAFETY BARRIER, PRECAST CONSTRUCTION
F' SHAPE BARRIER SECTION



SECTION A-A



SECTION B-B



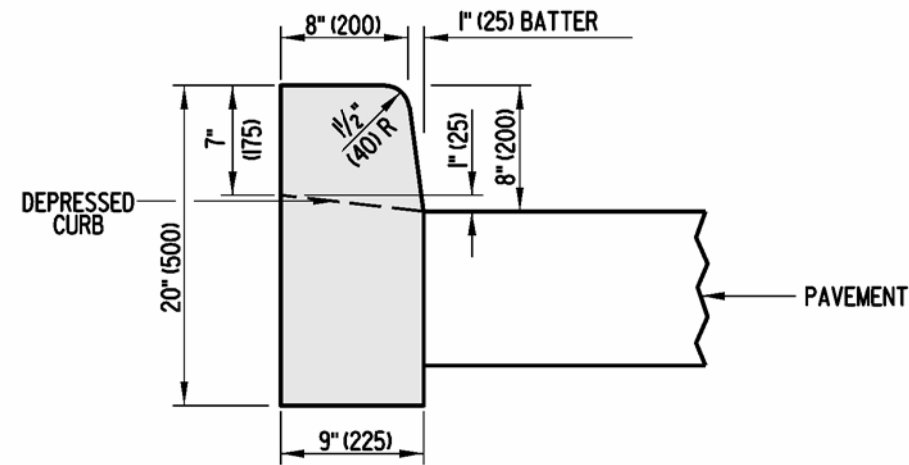
DELAWARE
DEPARTMENT OF TRANSPORTATION

SLOTTED PLATE CONNECTION DETAILS

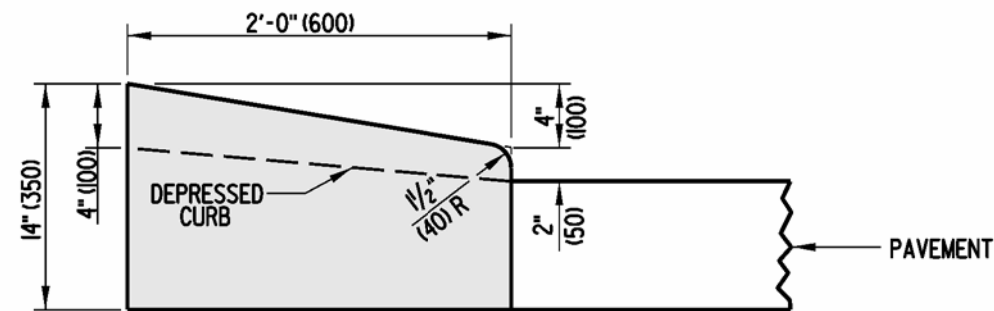
STANDARD NO. B-14 (2001)

SHT. 3 OF 3

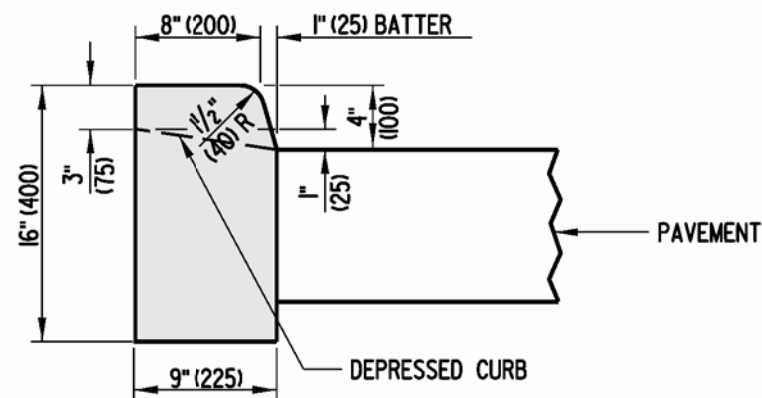
APPROVED *Ryan M. Harkins* 6/18/01
CHIEF ENGINEER DATE
RECOMMENDED *Michael P. Gotsch* 6/18/01
DESIGN ENGINEER DATE



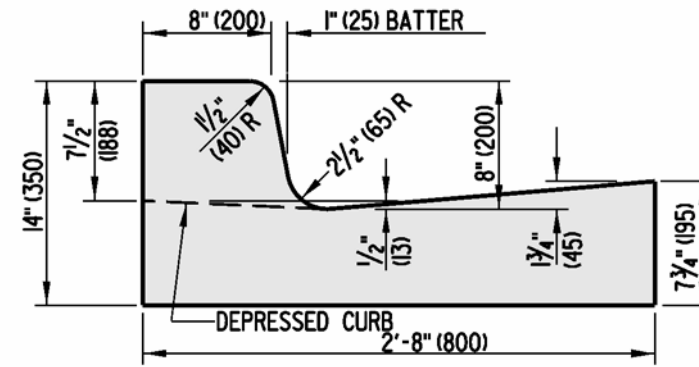
P.C.C. CURB
TYPE 1



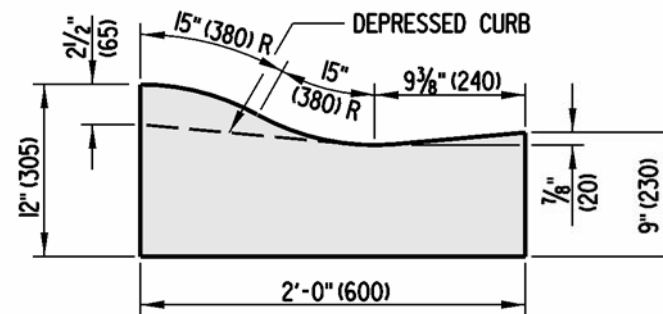
P.C.C. CURB
TYPE 2



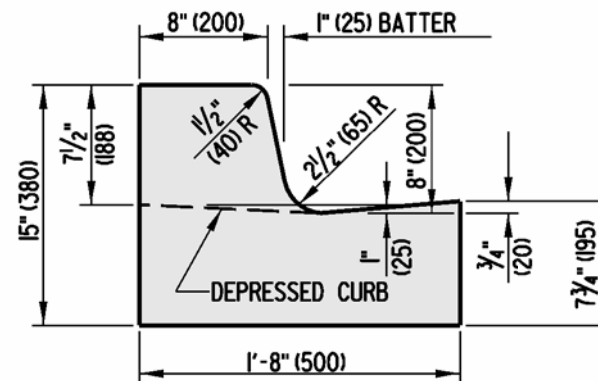
P.C.C. CURB
TYPE 3



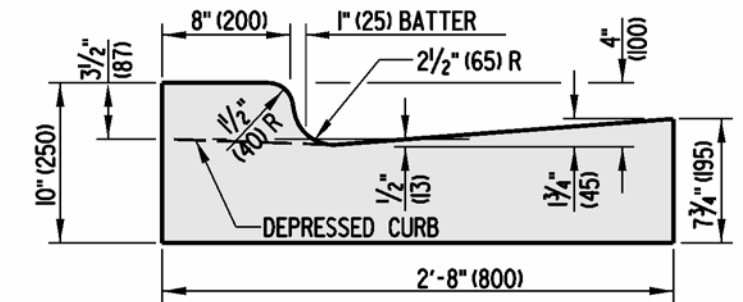
INTEGRAL P.C.C. CURB AND GUTTER
TYPE 1



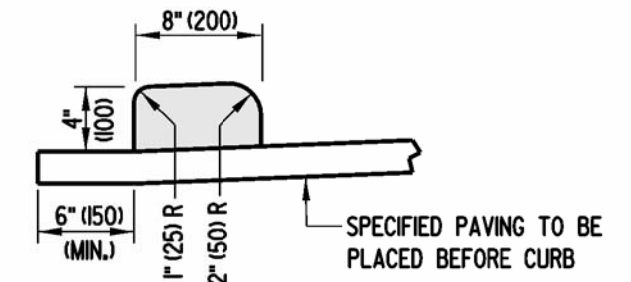
INTEGRAL P.C.C. CURB AND GUTTER
TYPE 2



INTEGRAL P.C.C. CURB AND GUTTER
TYPE 3



INTEGRAL P.C.C. CURB AND GUTTER
TYPE 4



**HOT-MIX, HOT LAID BITUMINOUS
CONCRETE CURB**

NOTES:

1. WHEN P.C.C. CURB OR INTEGRAL P.C.C. CURB AND GUTTER IS PLACED ADJACENT TO PORTLAND CEMENT CONCRETE PAVEMENT, CONSTRUCT THE JOINT AS PER THE LONGITUDINAL JOINT SEALANT DETAIL ON DETAIL P-2, SHEET 3 OF 5. USE APPROVED JOINT FILLER TO SEAL. WORK TO BE PAID UNDER RESPECTIVE CURB AND GUTTER ITEM.
2. DEPRESS CURB AT ENTRANCES AND CURB RAMPS AS DETAILED ON THIS SHEET.
3. DEPRESS CURB FLUSH WITH PAVEMENT AT CURB RAMPS. MAXIMUM SLOPE OF CURB AT CURB RAMPS IS 20:1 IN THE DIRECTION OF PEDESTRIAN TRAVEL. SEE DETAIL C-2, SHEET 1 OF 4.
4. DEPRESS CURB FLUSH WITH PAVEMENT OR ADJACENT AREA AT NOSE OF ISLANDS, TAPERING BACK TO FULL HEIGHT AT A SLOPE OF 12:1.



**DELAWARE
DEPARTMENT OF TRANSPORTATION**

P.C.C. CURB, P.C.C. CURB & GUTTER, AND HOT-MIX CURB

STANDARD NO. C-1 (2008)

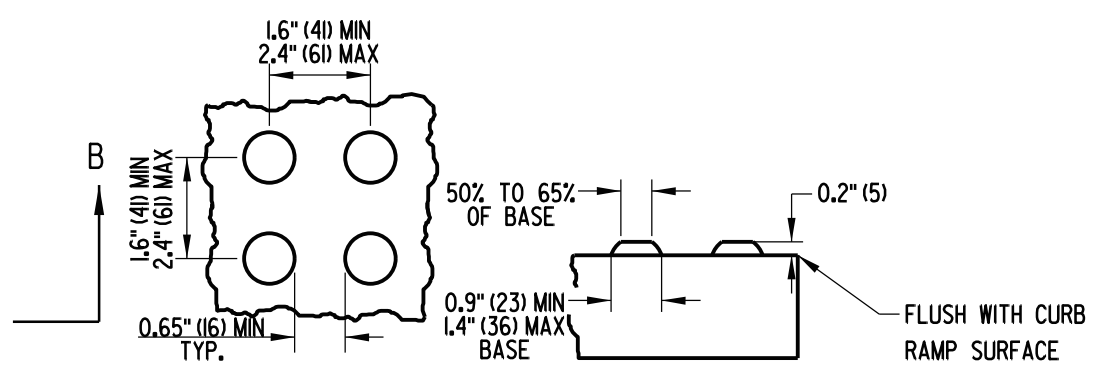
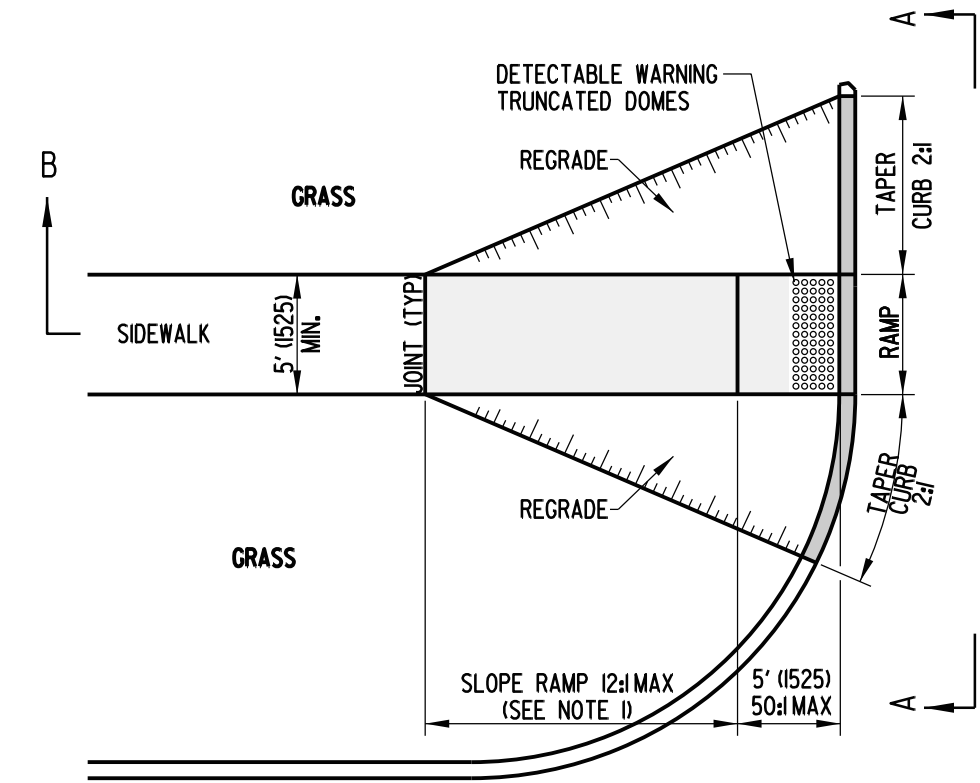
SHT. 1 OF 1

APPROVED

[Signature] **11/18/08**
CHIEF ENGINEER DATE

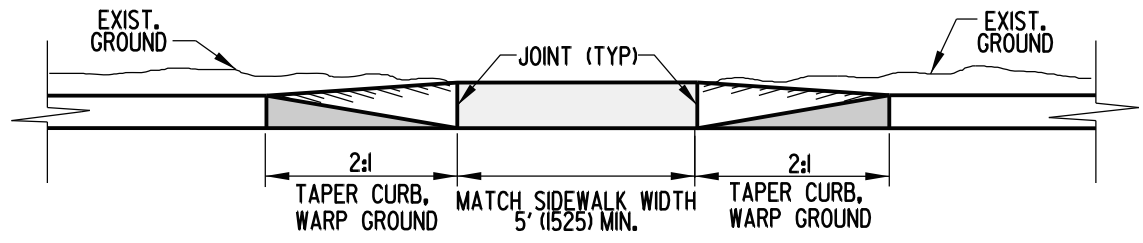
RECOMMENDED

[Signature] **11/17/08**
DESIGN ENGINEER DATE

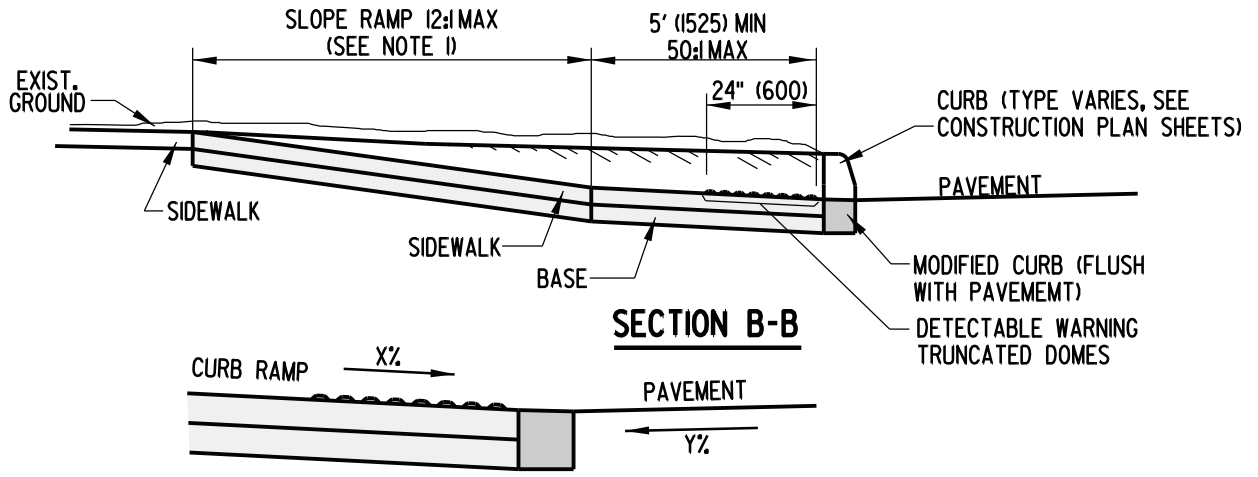


DETECTABLE WARNING TRUNCATED DOME DETAILS

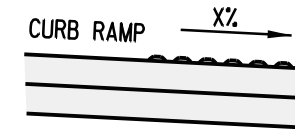
- NOTES:
- A). THE AREA OF DETECTABLE WARNING TRUNCATED DOMES SHALL BE 24" (600) LONG AND THE FULL WIDTH OF THE RAMP OR DEPRESSED CURB.
 - B). SEE SPECIFICATION FOR ADDITIONAL INFORMATION.



ELEVATION A-A



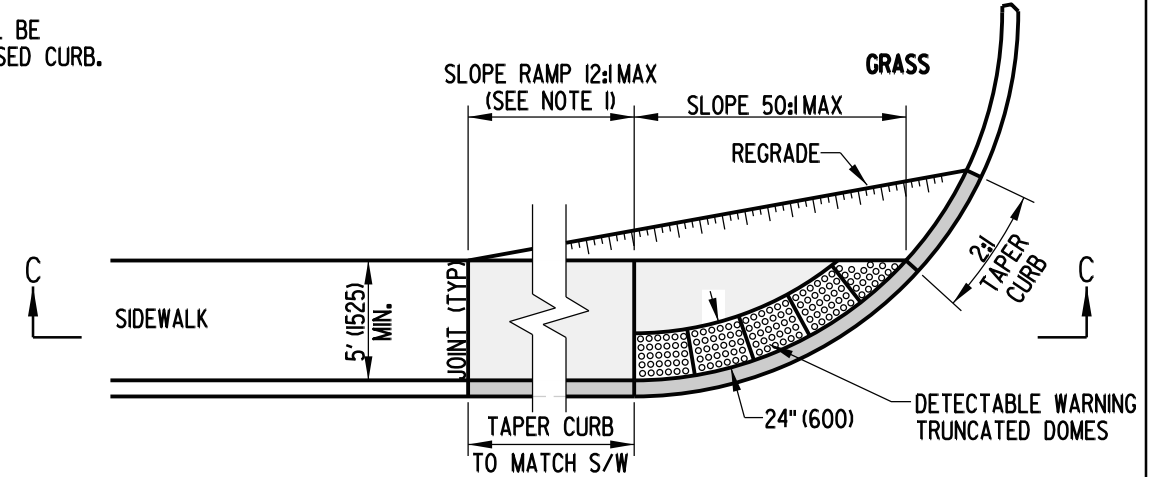
SECTION B-B



MAXIMUM DIFFERENCE IN GRADE




FOR EXAMPLE, IF THE CURB RAMP AND DEPRESSED CURB SLOPE (X) IS 8.1% AND THE PAVEMENT SLOPE (Y) IS 4.0%, THEN TO DETERMINE THE DIFFERENCE IN GRADE, ADD X + Y TO GET 12.1%. WHICH IS GREATER THAN THE 11% PREFERRED BUT LESS THAN THE 13% MAXIMUM.

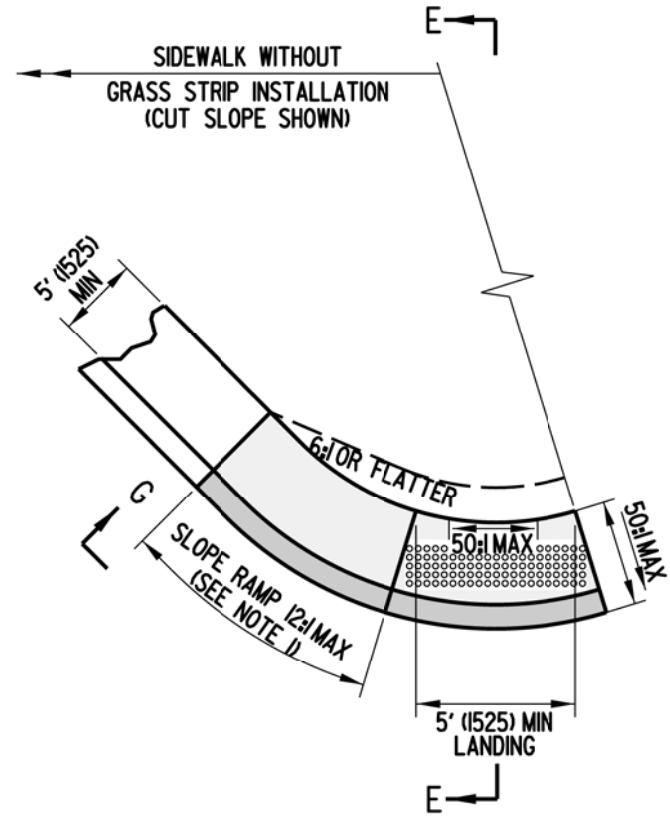
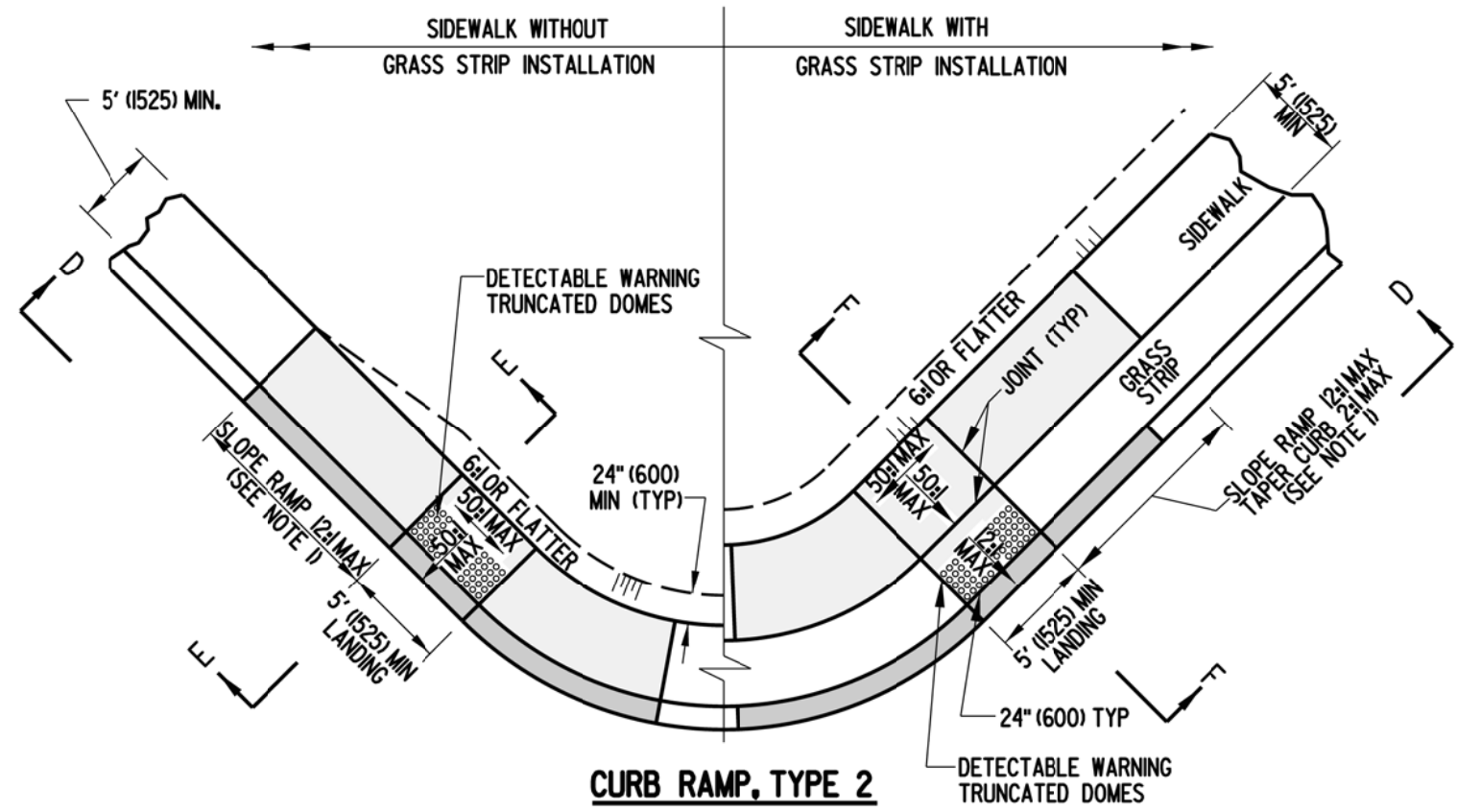
CURB RAMP, TYPE 1
PERPENDICULAR CURB RAMP



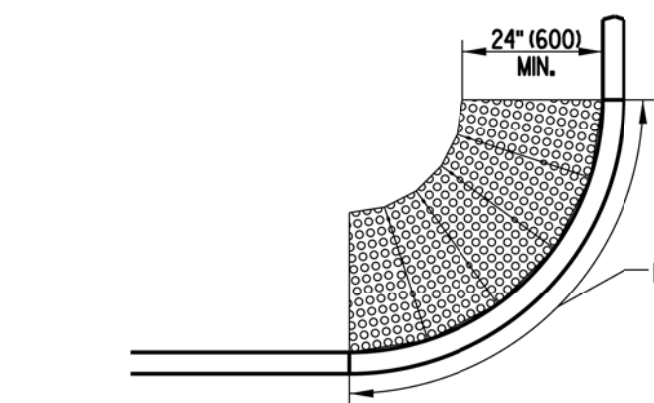
SECTION C-C

- NOTES:
- 1). WHERE A 12:1 MAXIMUM SLOPE RAMP WILL NOT MEET THE SIDEWALK GRADE WITHIN A LENGTH OF 15' (4570) DUE TO STEEP ADJACENT ROADWAY, THE RAMP LENGTH MAY BE LIMITED TO 15' (4570), AND ALLOWED TO EXCEED 12:1.
 - 2). RAMP AND SIDEWALK CROSS SLOPE SHALL BE 50:1 (2%) MAXIMUM.
 - 3). IF GRADING WILL BE STEEPER THAN 6:1, THEN A TYPE 1 CURB OR RETAINING WALL SHOULD BE USED TO ELIMINATE THE NEED FOR THE STEEP SLOPE.
 - 4). THE MAXIMUM DIFFERENCE IN GRADE BETWEEN THE CURB RAMP OR MODIFIED CURB AND THE PAVEMENT SHALL BE 13%, HOWEVER 11% IS PREFERRED.

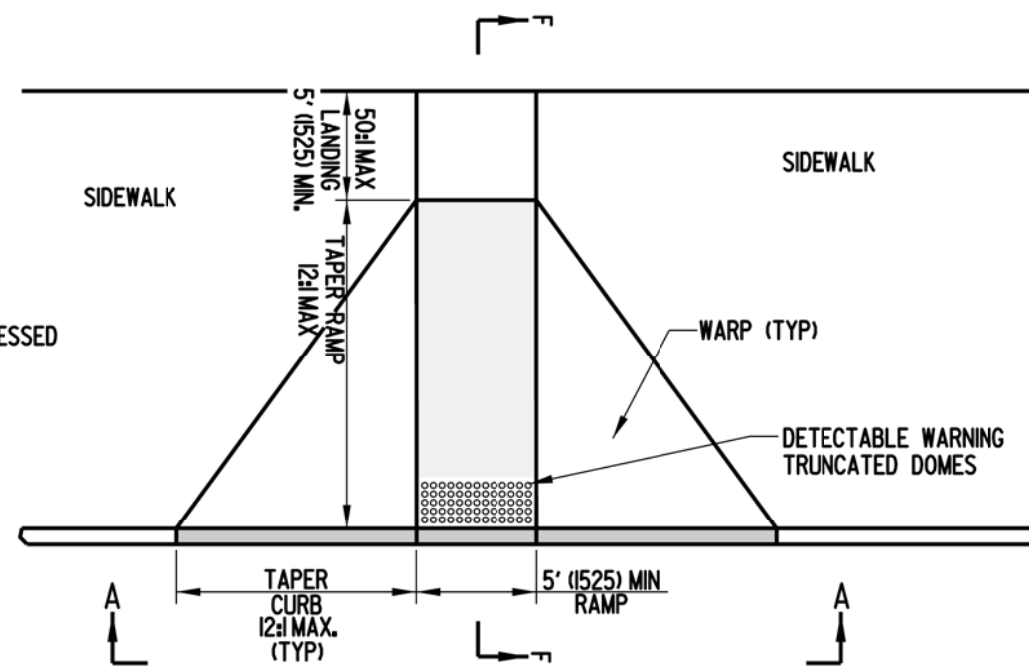
 DELAWARE DEPARTMENT OF TRANSPORTATION	CURB RAMP, TYPE 1 AND SECTIONS			APPROVED  11/18/08 CHIEF ENGINEER DATE
	STANDARD NO. C-2 (2008)	SHT. 1	OF 4	RECOMMENDED  11/17/08 DESIGN ENGINEER DATE



CURB RAMP, TYPE 3
DIAGONAL CURB RAMP






SAMPLE LAYOUT OF DETECTABLE WARNING TRUNCATED DOMES ALONG A CURB RADIUS
DETECTABLE WARNINGS SHALL BE PLACED THE FULL WIDTH OF THE DEPRESSED CURB.

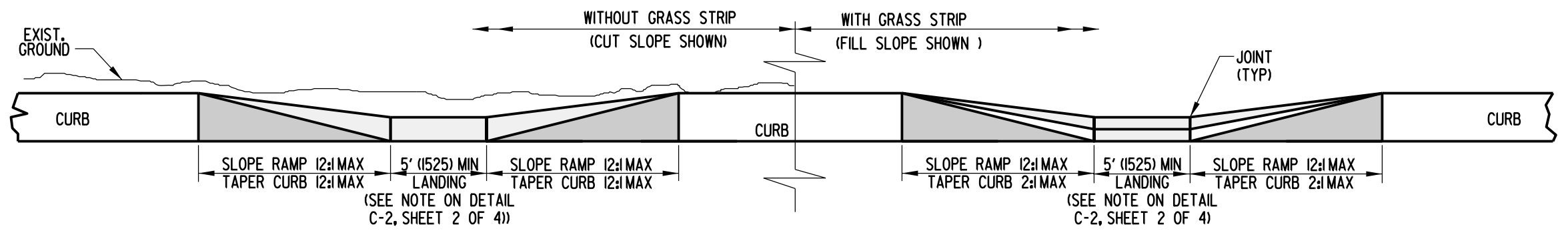


CURB RAMP, TYPE 4
PERPENDICULAR CURB RAMP

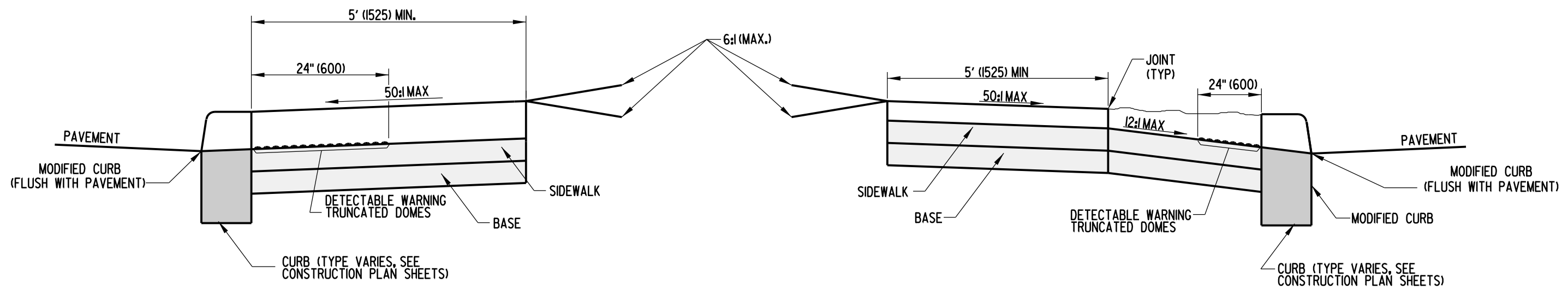
NOTES:

- 1). WHERE A 12:1 MAXIMUM SLOPE RAMP WILL NOT MEET THE SIDEWALK GRADE WITHIN A LENGTH OF 15' (4570) DUE TO STEEP ADJACENT ROADWAY, THE RAMP LENGTH MAY BE LIMITED TO 15' (4570), AND THE RAMP SLOPE ALLOWED TO EXCEED 12:1.
- 2). TRANSITION TO EXISTING SIDEWALK WIDTH OVER THE LENGTH OF THE RAMP.
- 3). RAMP AND SIDEWALK CROSS SLOPE SHALL BE 50:1 (2%) MAXIMUM.
- 4). IF GRADING WILL BE STEEPER THAN 6:1 ADJACENT TO THE CURB RAMP OR SIDEWALK, THEN A TYPE 1 CURB OR RETAINING WALL SHOULD BE USED TO ELIMINATE THE NEED FOR THE STEEP SLOPE.
- 5). FOR THE CURB RAMP, TYPE 3, IF THE WIDTH OF THE FULLY DEPRESSED CURB AT THE STREET IS MORE THAN 5' (1525), THE DETECTABLE WARNING TRUNCATED DOMES SHALL FOLLOW THE RADIUS OF THE CURB CONTINUOUSLY WITHOUT GAPS FOR THE ENTIRE LENGTH OF DEPRESSED CURB.
- 6). THE MAXIMUM DIFFERENCE IN GRADE BETWEEN THE SIDEWALK OR CURB AND THE PAVEMENT SHALL BE 13%, HOWEVER 11% IS PREFERRED. SEE STANDARD NO. C-2, SHEET 1 OF 4.
- 7). IF THE WIDTH OF THE FULLY DEPRESSED CURVED CURB AT THE STREET IS 5' (1525) OR LESS, THEN A RECTANGULAR PIECE OF DETECTABLE WARNING TRUNCATED DOMES MAY BE USED.

 DELAWARE DEPARTMENT OF TRANSPORTATION	CURB RAMPS, TYPES 2, 3, & 4			APPROVED  11/18/08 CHIEF ENGINEER DATE
	STANDARD NO. C-2 (2008)	SHT. 2	OF 4	RECOMMENDED  11/17/08 DESIGN ENGINEER DATE

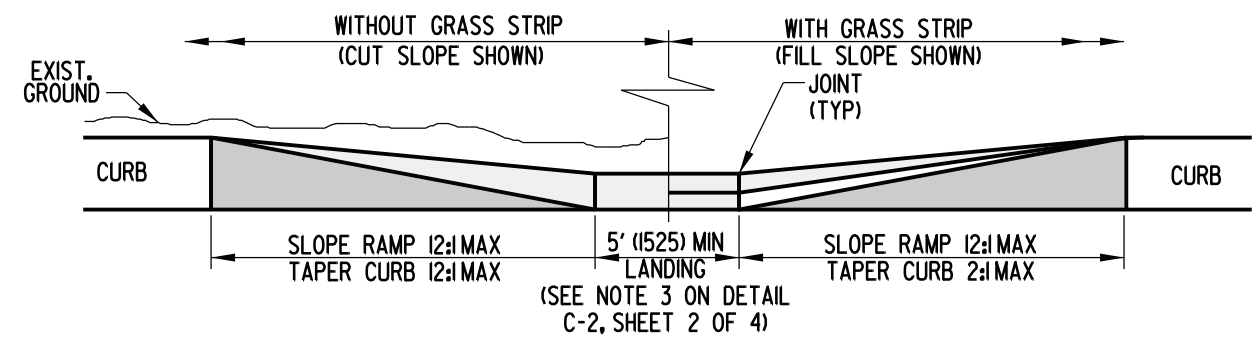


ELEVATION D-D






SECTION E-E

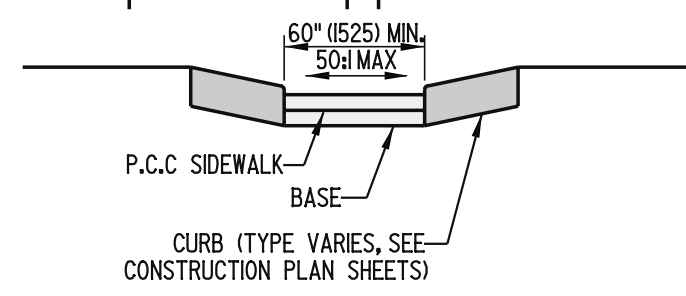
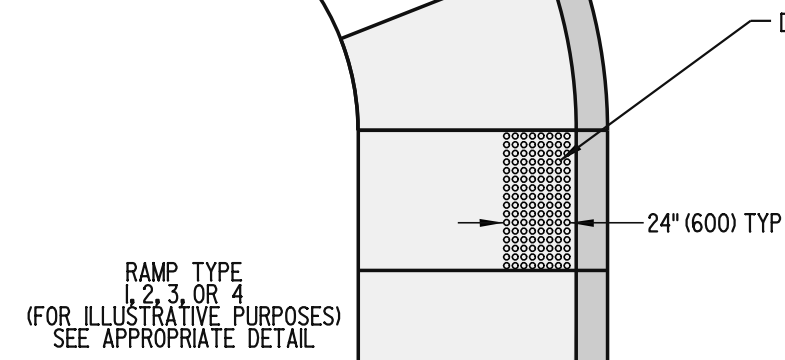
SECTION F-F



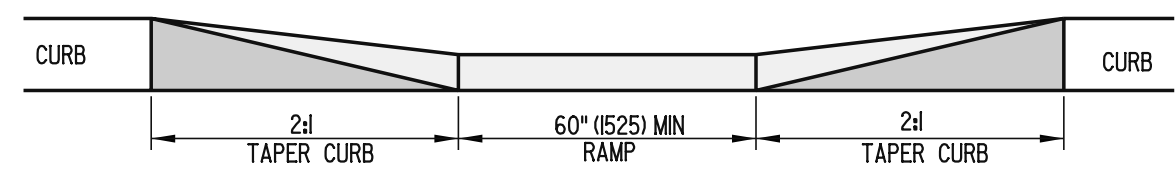
ELEVATION G-G

 DELAWARE DEPARTMENT OF TRANSPORTATION	CURB RAMP SECTIONS FOR TYPES 2 & 3			APPROVED  11/18/08 CHIEF ENGINEER DATE
	STANDARD NO. C-2 (2008)	SHT. 3	OF 4	RECOMMENDED  11/17/08 DESIGN ENGINEER DATE

SCALE : N.T.S.



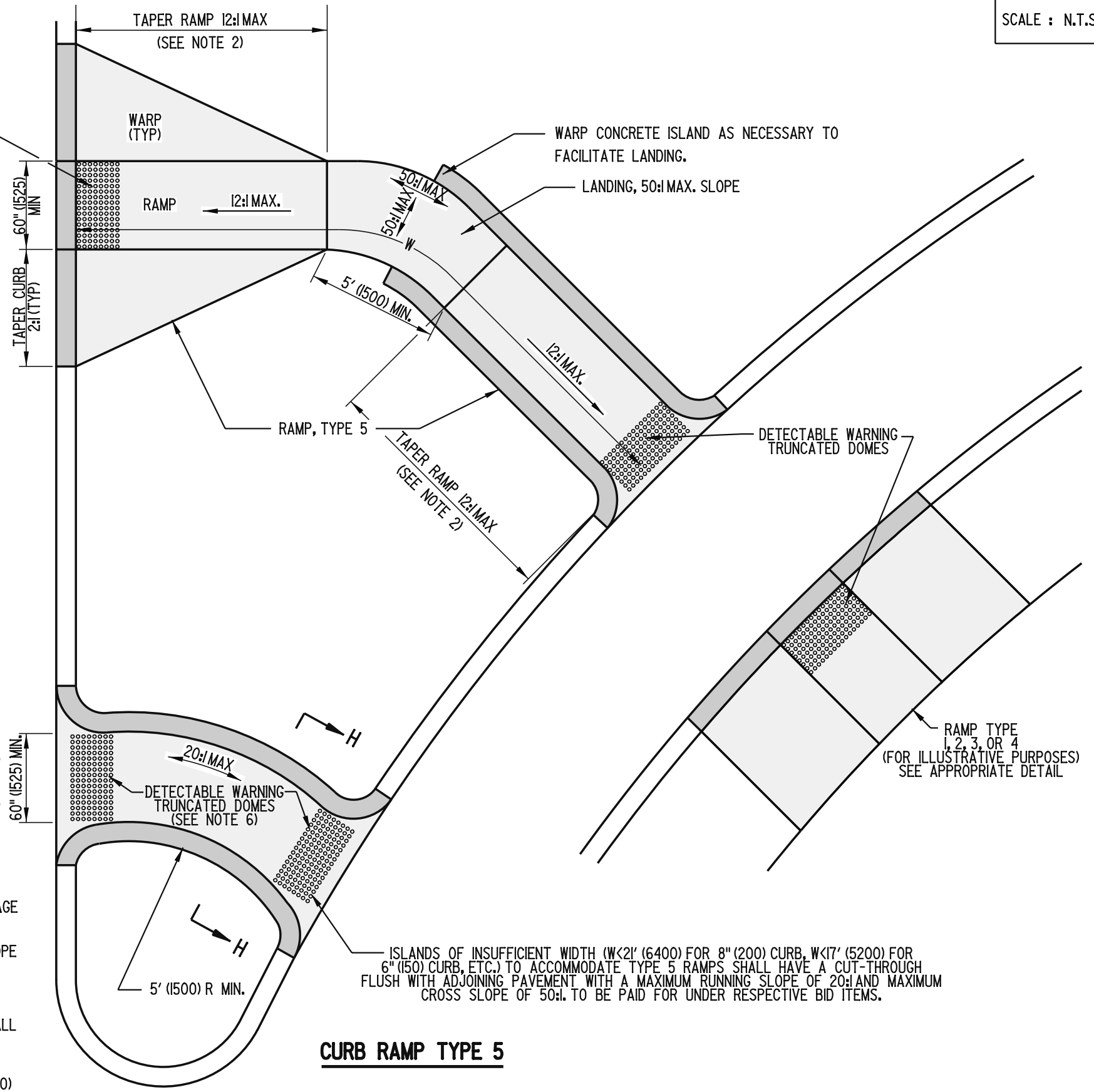
SECTION H-H



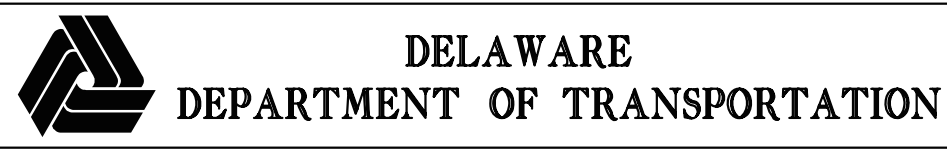
ELEVATION I-I

NOTES:

- 1). A CUT-THROUGH LEVEL WITH THE STREET IS THE PREFERRED TREATMENT FOR ISLANDS, ALTHOUGH, RAMPS CAN BE USED WHERE THE ISLAND WIDTH IS SUFFICIENT TO ACCOMMODATE THEM. POSITIVE SURFACE DRAINAGE MUST BE PROVIDED FOR EITHER TREATMENT. EITHER TREATMENT IS ACCEPTABLE.
- 2). WHERE A 12:1 MAXIMUM SLOPE RAMP WILL NOT MEET THE SIDEWALK GRADE WITHIN A LENGTH OF 15' (4570) DUE TO STEEP ADJACENT ROADWAY, THE RAMP LENGTH MAY BE LIMITED TO 15' (4570), AND THE RAMP SLOPE ALLOWED TO EXCEED 12:1.
- 3). A CONTINUOUS PATH MUST BE PROVIDED BETWEEN ADJACENT CURB RAMPS IN ISLANDS AND MEDIANS, WITH A MAXIMUM RUNNING SLOPE OF 20:1.
- 4). RAMP AND SIDEWALK CROSS SLOPE SHALL BE 50:1 (2%) MAXIMUM.
- 5). WHERE THERE IS NO DEPRESSED CURB AT A CUT-THROUGH OR CURB RAMP, THE DETECTABLE WARNING SHALL BE INSTALLED 3" (75) FROM THE ROADWAY PAVEMENT.
- 6). IF THE MINIMUM CLEAR SPACE BETWEEN DETECTABLE WARNINGS IS LESS THAN 2' (600), THEN THE ENTIRE MEDIAN CURB RAMP AREA SHALL BE COVERED WITH DETECTABLE WARNINGS.
- 7). PEDESTRIAN SIGNALS SHALL BE ACCESSIBLE WITH A LEVEL LANDING, WHOSE EDGE IS NO MORE THAN 10" (250) FROM ALL PEDESTRIAN PUSH BUTTONS.

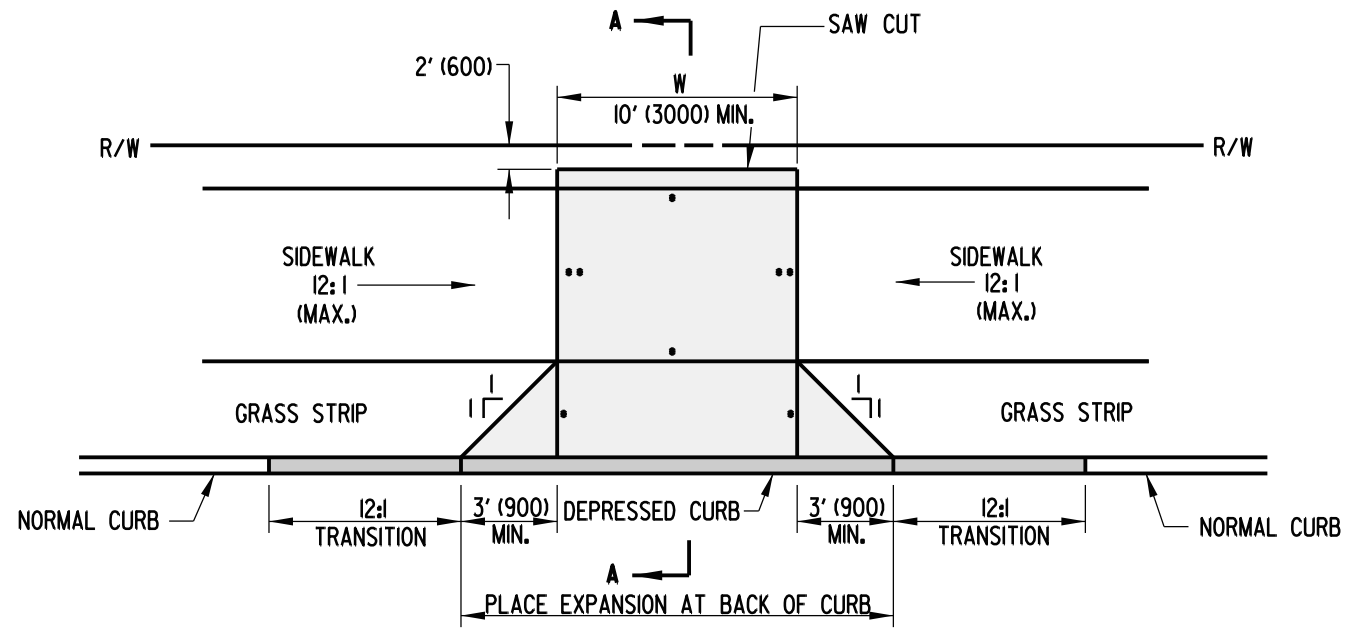


CURB RAMP TYPE 5



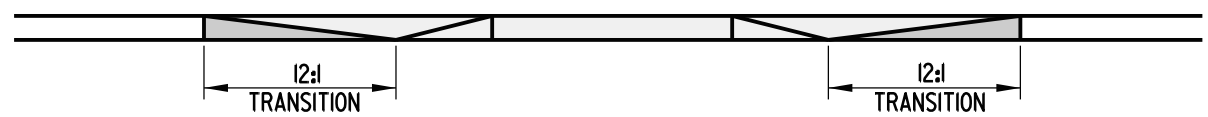
CURB RAMP TYPE 5 & SECTIONS			
STANDARD NO.	C-2 (2006)	SHT.	4 OF 4

APPROVED	<i>[Signature]</i>	10/10/06
CHIEF ENGINEER		DATE
RECOMMENDED	<i>[Signature]</i>	10/13/06
DESIGN ENGINEER		DATE

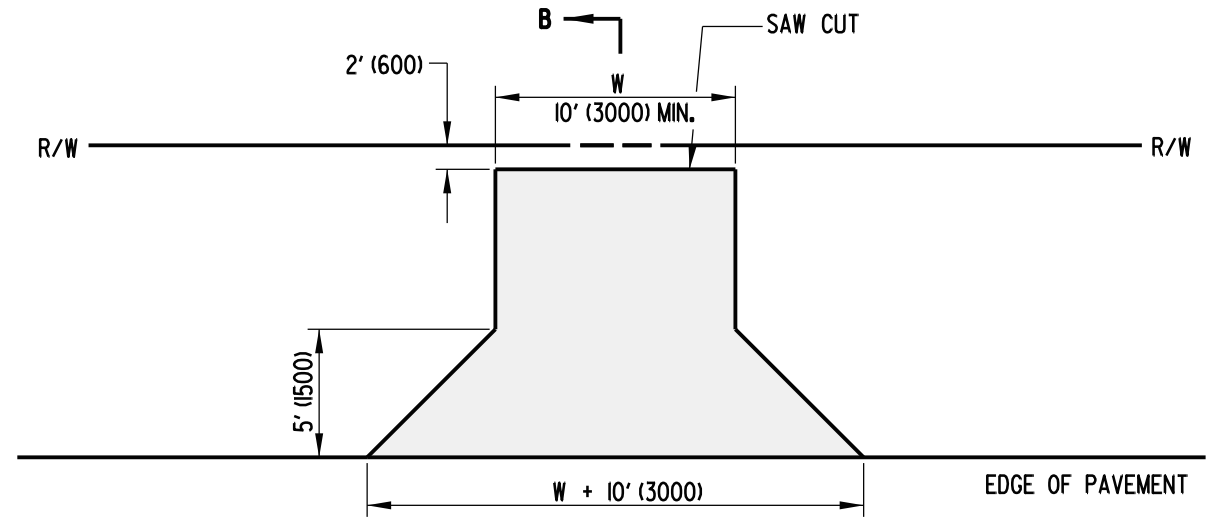


PLAN

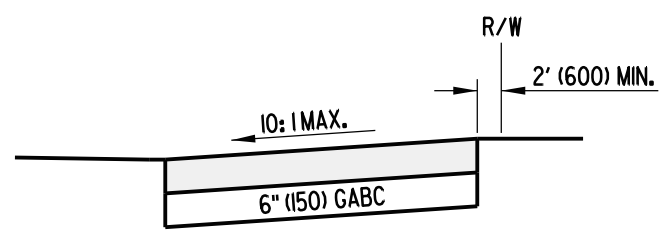
• - JOINT
•• - EXPANSION MATERIAL



ELEVATION

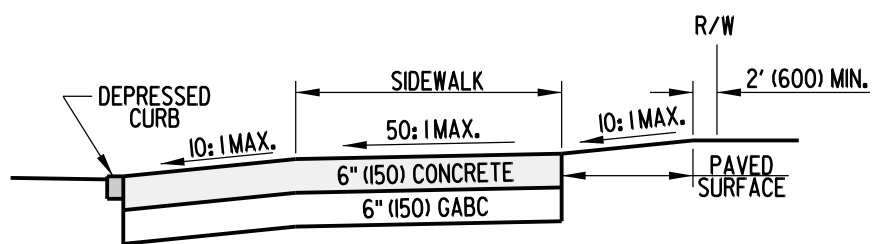


PLAN



SECTION B-B

ENTRANCE WITHOUT SIDEWALK



SECTION A-A

ENTRANCE WITH SIDEWALK

NOTE: IF WIDTH OF DRIVEWAY IS 16' (4870) OR GREATER, THE 1:1 FLARE CAN BE OMITTED.



DELAWARE
DEPARTMENT OF TRANSPORTATION

ENTRANCES

STANDARD NO. C-3 (2008)

SHT. 1 OF 1

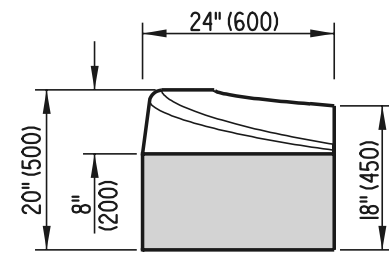
APPROVED

[Signature] 11/18/08
CHIEF ENGINEER DATE

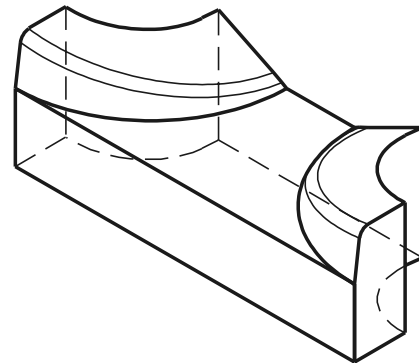
RECOMMENDED

[Signature] 11/17/08
DESIGN ENGINEER DATE

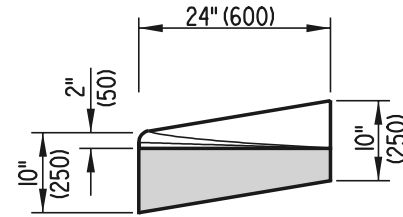
SCALE : N.T.S.



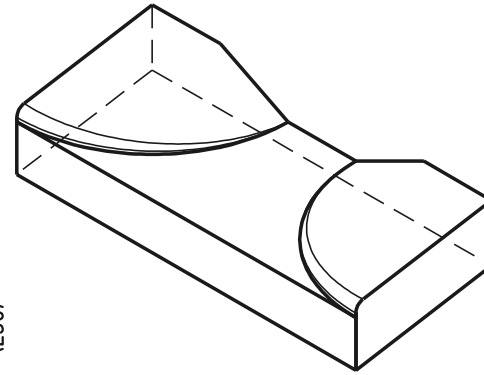
SECTION A-A



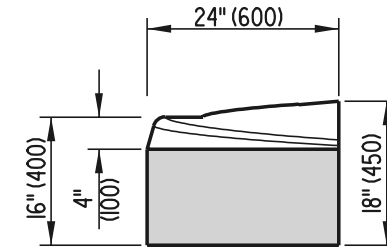
ISOMETRIC VIEW



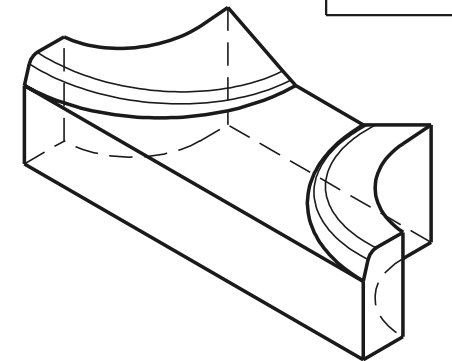
SECTION B-B



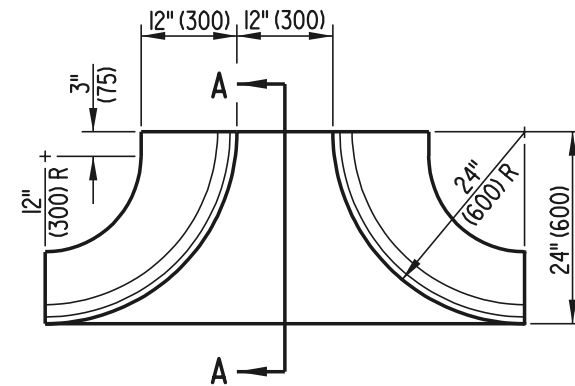
ISOMETRIC VIEW



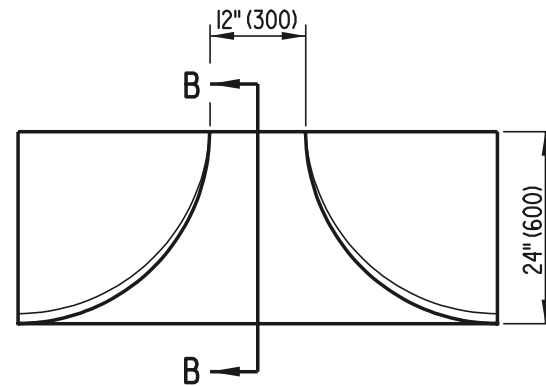
SECTION C-C



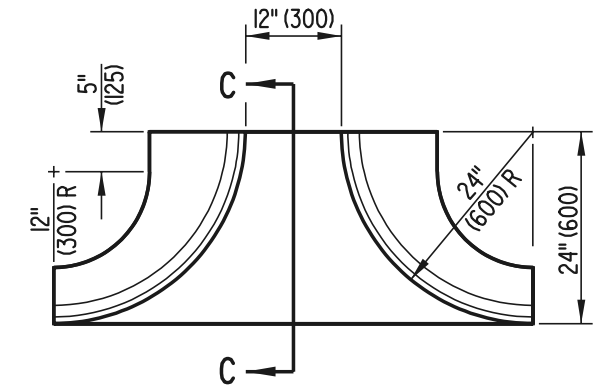
ISOMETRIC VIEW



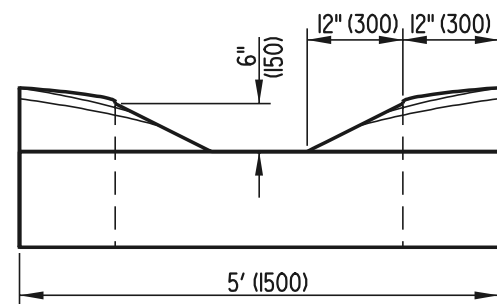
TOP VIEW



TOP VIEW

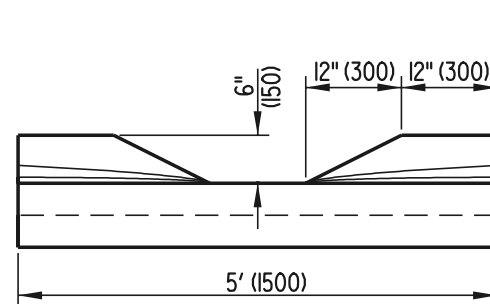


TOP VIEW



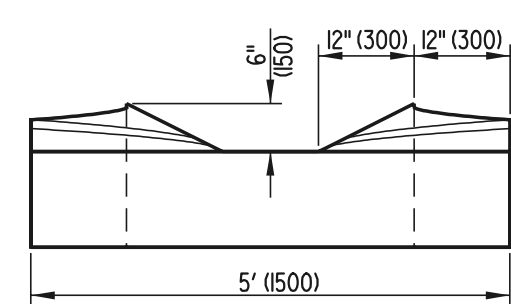
FRONT VIEW

TYPE A
P.C.C. CURB, TYPE 1



FRONT VIEW

TYPE B
P.C.C. CURB, TYPE 2



FRONT VIEW

TYPE C
P.C.C. CURB, TYPE 3



DELAWARE
DEPARTMENT OF TRANSPORTATION

CURB OPENINGS

STANDARD NO.

C-4 (2001)

SHT.

1

OF

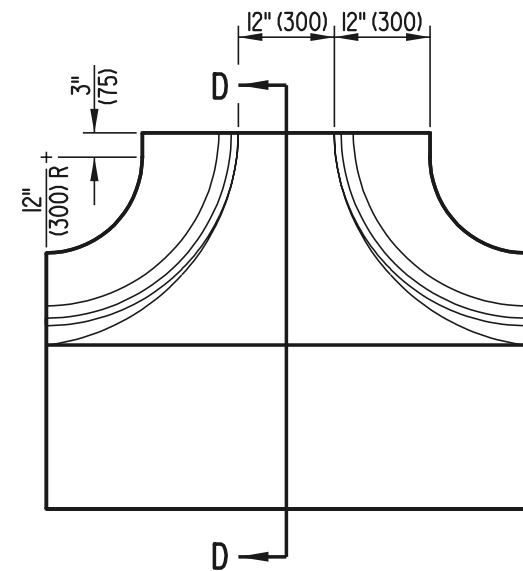
3

APPROVED

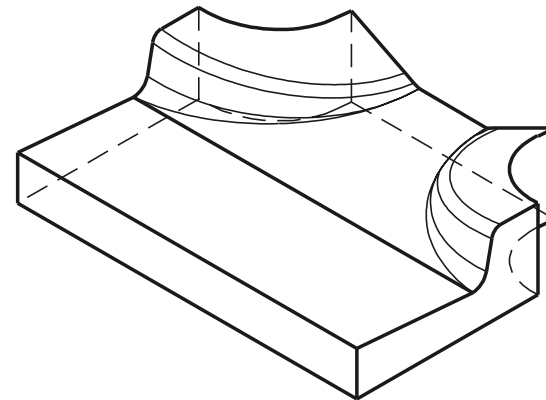
Ryan M. Hershman
CHIEF ENGINEER
DATE 6/18/01

RECOMMENDED

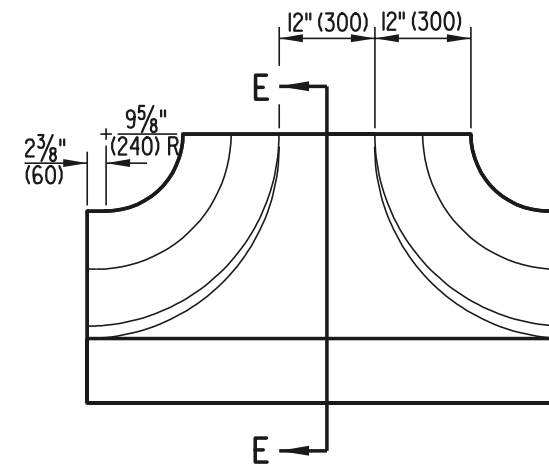
Michael P. Gotsch
DESIGN ENGINEER
DATE 6/18/01



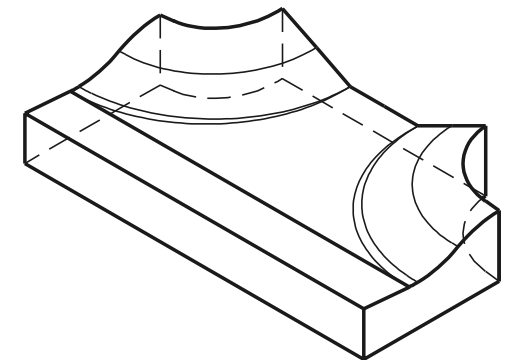
TOP VIEW



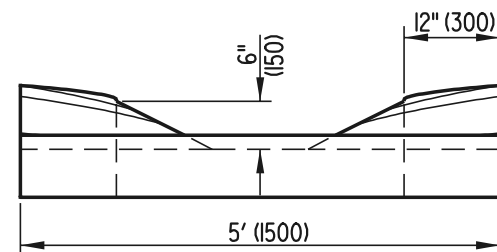
ISOMETRIC VIEW



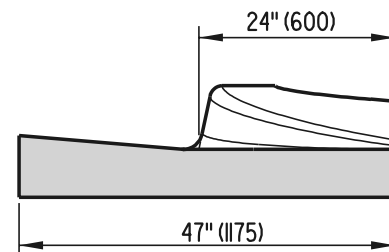
TOP VIEW



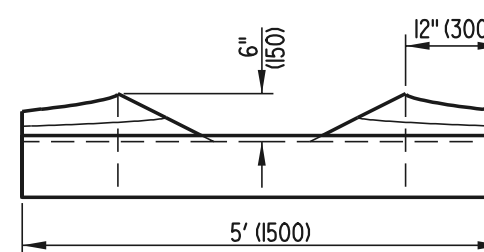
ISOMETRIC VIEW



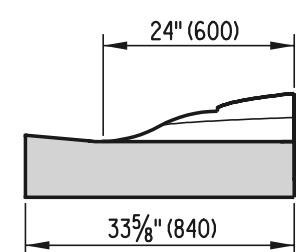
FRONT VIEW



SECTION D-D



FRONT VIEW



SECTION E-E

TYPE D
INTEGRAL P.C.C. CURB AND GUTTER, TYPE 1

TYPE E
INTEGRAL P.C.C. CURB AND GUTTER, TYPE 2



DELAWARE
DEPARTMENT OF TRANSPORTATION

CURB OPENINGS

STANDARD NO.

C-4 (2001)

SHT.

2

OF

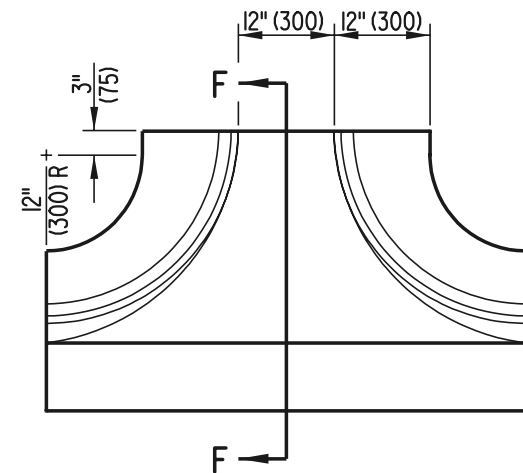
3

APPROVED

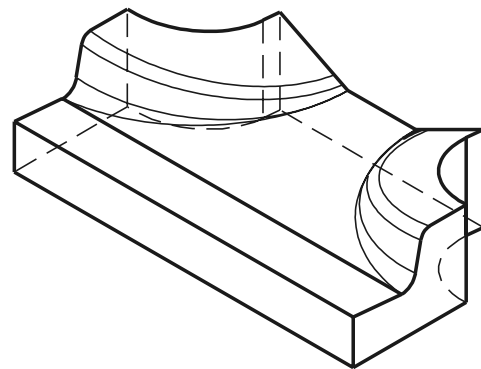
Ryan M. Harkness 6/18/01
CHIEF ENGINEER DATE

RECOMMENDED

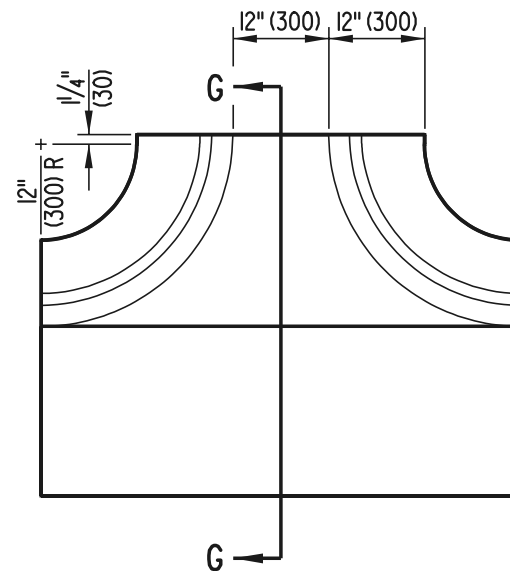
Mehal Akbar 6/18/01
DESIGN ENGINEER DATE



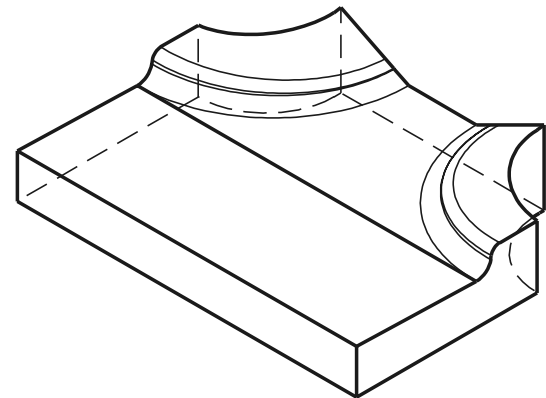
TOP VIEW



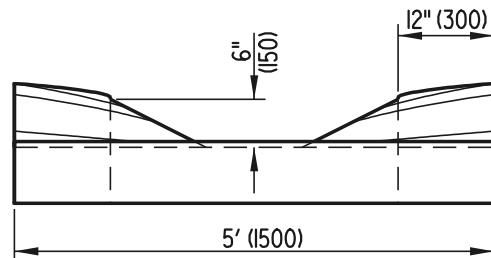
ISOMETRIC VIEW



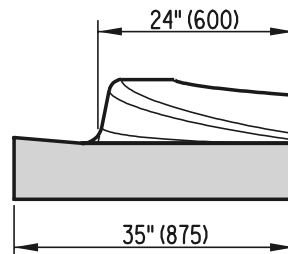
TOP VIEW



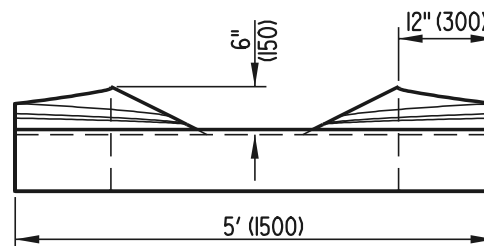
ISOMETRIC VIEW



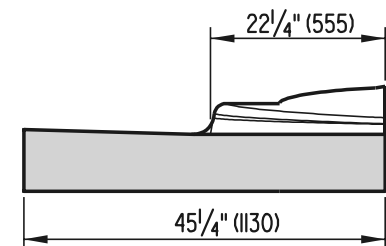
FRONT VIEW



SECTION F-F



FRONT VIEW



SECTION G-G

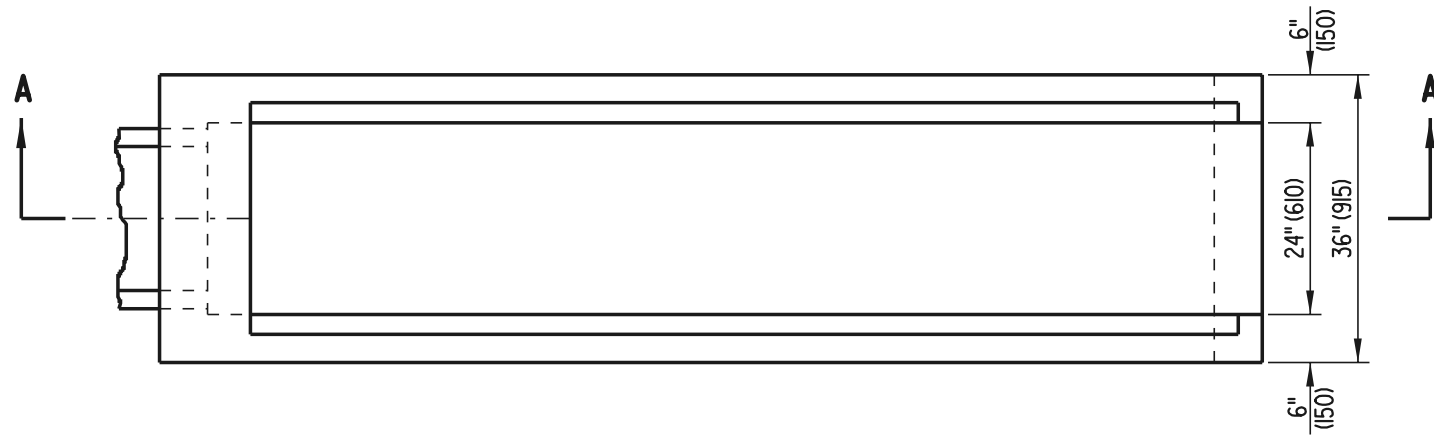
TYPE F
INTEGRAL P.C.C. CURB AND GUTTER, TYPE 3

TYPE G
INTEGRAL P.C.C. CURB AND GUTTER, TYPE 4



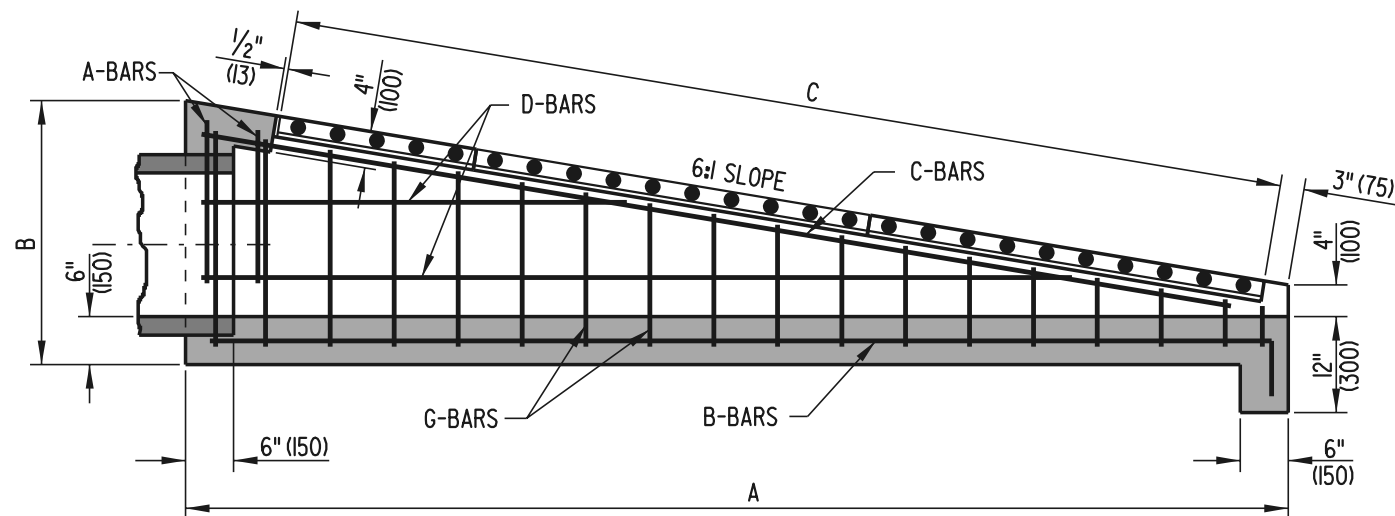
DELAWARE
DEPARTMENT OF TRANSPORTATION

CURB OPENINGS				APPROVED	DATE
STANDARD NO.	C-4 (2001)	SHT.	3 OF 3	<i>Ryan M. Hershman</i> CHIEF ENGINEER	6/18/01
				RECOMMENDED <i>Mehmet Akpinar</i> DESIGN ENGINEER	6/18/01

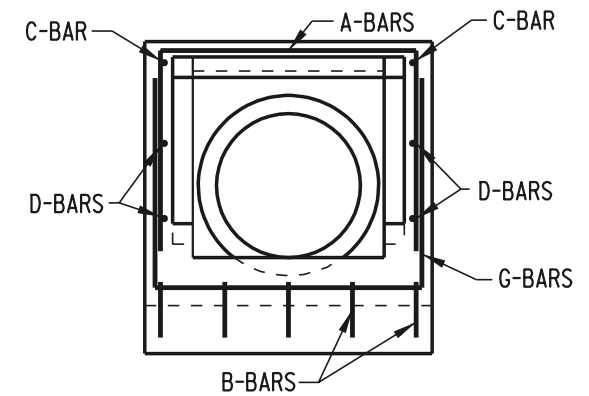


PLAN VIEW
SHOWN WITHOUT GRATE

NOTE: 6:1 SAFETY END STRUCTURE TO BE PRECAST



SECTION A-A



FRONT VIEW



DELAWARE
DEPARTMENT OF TRANSPORTATION

6:1 SAFETY END STRUCTURE

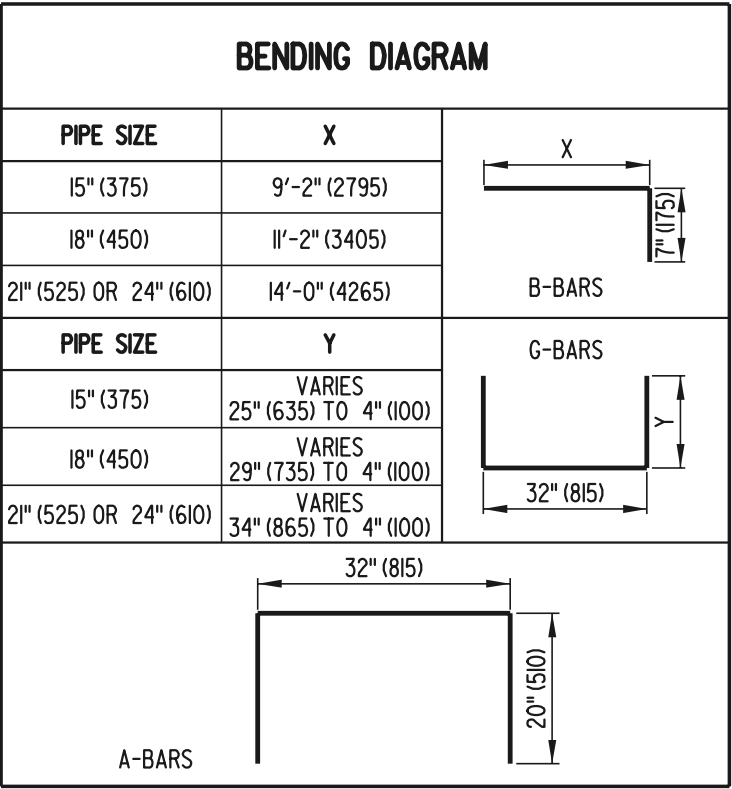
STANDARD NO. D-1 (2001)

SHT. 1 OF 2

APPROVED *Ryan M. Harkins* **6/18/01**
CHIEF ENGINEER DATE
RECOMMENDED *Michael P. Gotsch* **6/18/01**
DESIGN ENGINEER DATE

DIMENSIONS			
PIPE SIZE	A	B	C
15" (375)	9'-6" (2895)	2'-5" (735)	8'-4" (2540)
18" (450)	11'-6" (3505)	2'-9" (840)	10'-5" (3175)
21" (525) OR 24" (600)	14'-4" (4370)	3'-2 ⁵ / ₈ " (980)	12'-6" (3810)

APPROXIMATE QUANTITIES							
PIPE SIZE	CONCRETE FT³ (m³)		REINF. STEEL LBS. (kg)	NO. OF GRATES	LENGTH TO BE CUT FROM 1 GRATE	WEIGHT OF FULL SIZE GRATE LBS. (kg)	WEIGHT OF CUT GRATE LBS. (kg)
	CONC. PIPE	C.M. PIPE					
15" (375)	25 (0.708)	25.43 (0.720)	121.12 (54.94)	2	--	270.92 (122.89)	--
18" (450)	31.5 (0.892)	32.07 (0.908)	156.7 (71.08)	3	2'-1" (635)	270.92 (122.89)	135.47 (61.45)
21" (525) OR 24" (600)	40.75 (1.154)	39.87 (1.129)	194.0 (88.00)	3	--	270.92 (122.89)	--



SCHEDULE OF REINFORCING STEEL																				
PIPE SIZE	A-BARS				B-BARS				C-BARS				D-BARS				G-BARS			
	SIZE	NO.	SPA.	LENGTH	SIZE	NO.	SPA.	LENGTH	SIZE	NO.	SPA.	LENGTH	SIZE	NO.	SPA.	LENGTH	SIZE	NO.	SPA.	LENGTH
15" (375)	#4 (#13)	2	8" (200)	72" (1830)	#4 (#13)	5	8" (200)	9'-9" (2970)	#4 (#13)	2	-	9'-3" (2820)	#4 (#13)	4	8" (200)	VARIES 50" (1270) TO 100" (2540)	#4 (#13)	15	8" (200)	VARIES 40" (1015) TO 82" (2085)
18" (450)	#4 (#13)	2	8" (200)	72" (1830)	#4 (#13)	5	8" (200)	11'-9" (3580)	#4 (#13)	2	-	11'-5" (3480)	#4 (#13)	6	8" (200)	VARIES 43½" (1105) TO 130½" (3315)	#4 (#13)	18	8" (200)	VARIES 40" (1015) TO 90" (2285)
21" (525) OR 24" (600)	#4 (#13)	2	8" (200)	72" (1830)	#4 (#13)	5	8" (200)	14'-7" (4445)	#4 (#13)	2	-	14'-3" (4345)	#4 (#13)	6	8" (200)	VARIES 51" (1295) TO 153" (3885)	#4 (#13)	22	8" (200)	VARIES 40" (1015) TO 100" (2540)

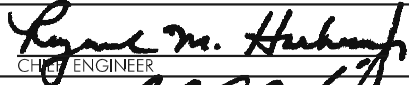



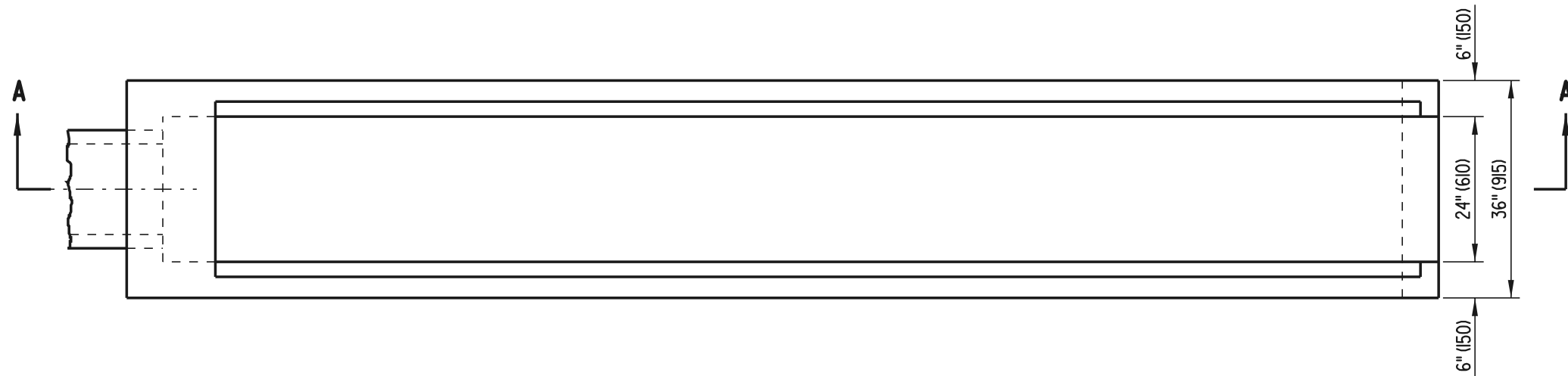
DELAWARE
DEPARTMENT OF TRANSPORTATION

6:1 SAFETY END STRUCTURE

STANDARD NO. D-1 (2001)

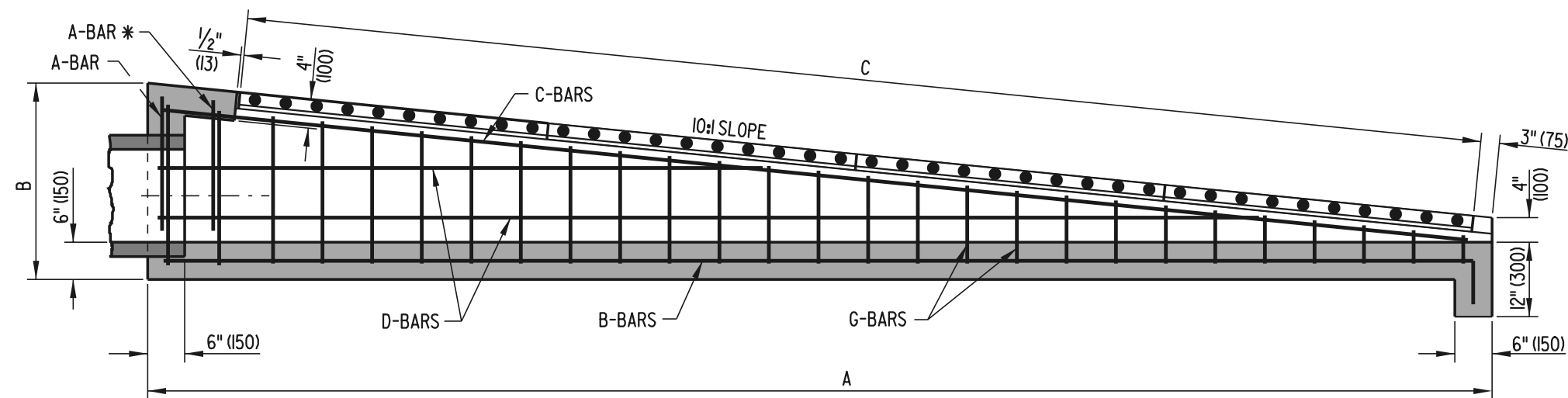
SHT. 2 OF 2

APPROVED  6/18/01
CHIEF ENGINEER DATE
RECOMMENDED  6/18/01
DESIGN ENGINEER DATE



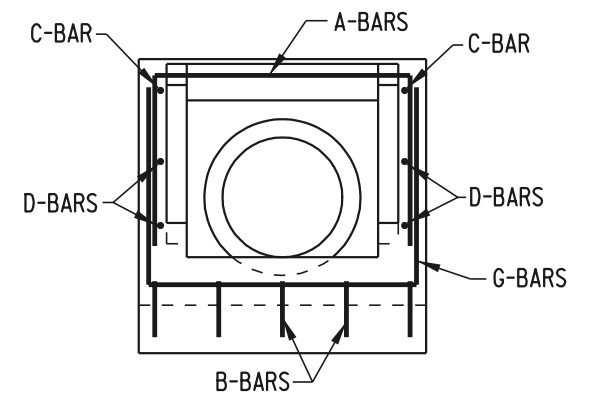
PLAN VIEW
SHOWN WITHOUT GRATE

NOTE: 10:1 SAFETY END STRUCTURE TO BE PRECAST



SECTION A-A

* REQUIRED ONLY FOR PIPE SIZE OF 21" (525) OR 24" (600)



FRONT VIEW



DELAWARE
DEPARTMENT OF TRANSPORTATION

10:1 SAFETY END STRUCTURE

STANDARD NO. **D-2 (2001)**

SHT. **1** OF **2**

APPROVED

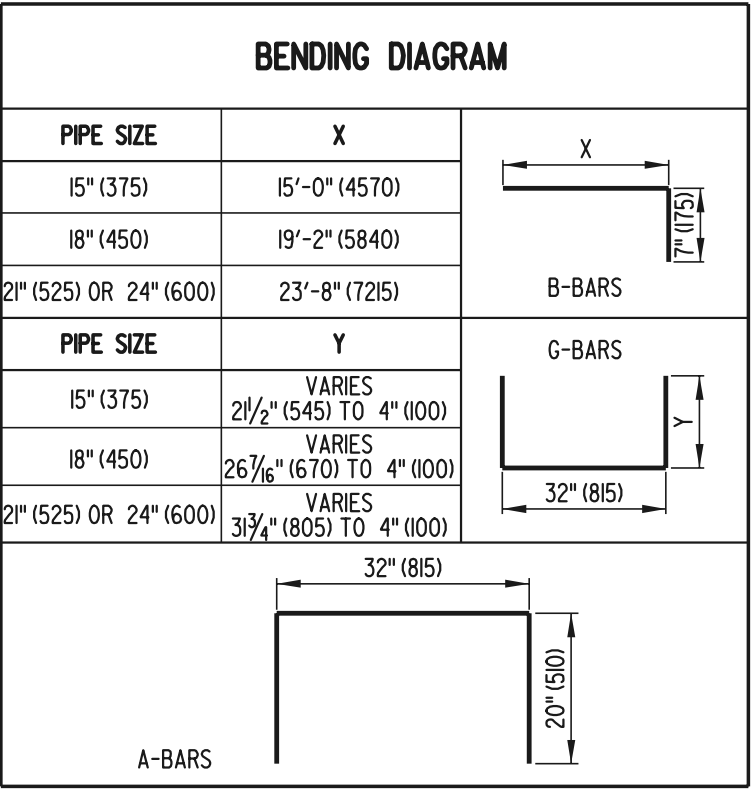
Ryan M. Hershman
CHIEF ENGINEER
DATE **6/18/01**

RECOMMENDED

Michael P. Gotsch
DESIGN ENGINEER
DATE **6/18/01**

DIMENSIONS			
PIPE SIZE	A	B	C
15" (375)	15'-4" (4675)	2'-4 ³ / ₈ " (720)	14'-7" (4445)
18" (450)	19'-6" (5945)	2'-9 ³ / ₈ " (850)	18'-9" (5715)
21" (525) OR 24" (600)	24'-0" (7315)	3'-2 ¹³ / ₁₆ " (985)	22'-11" (6985)

APPROXIMATE QUANTITIES							
PIPE SIZE	CONCRETE FT³ (m³)		REINF. STEEL LBS. (kg)	NO. OF GRATES	LENGTH TO BE CUT FROM 1 GRATE	WEIGHT OF FULL SIZE GRATE LBS. (kg)	WEIGHT OF CUT GRATE LBS. (kg)
	CONC. PIPE	C.M. PIPE					
15" (375)	41.35 (1.171)	41.78 (1.183)	175.0 (79.38)	4	2'-1" (635)	270.92 (122.89)	135.47 (61.45)
18" (450)	50.11 (1.419)	50.68 (1.435)	227.0 (102.98)	5	2'-1" (635)	270.92 (122.89)	135.47 (61.45)
21" (525) OR 24" (600)	69.43 (1.966)	70.31 (1.991)	310.4 (140.79)	6	2'-1" (635)	270.92 (122.89)	135.47 (61.45)



SCHEDULE OF REINFORCING STEEL																				
PIPE SIZE	A-BARS				B-BARS				C-BARS				D-BARS				G-BARS			
	SIZE	NO.	SPA.	LENGTH	SIZE	NO.	SPA.	LENGTH	SIZE	NO.	SPA.	LENGTH	SIZE	NO.	SPA.	LENGTH	SIZE	NO.	SPA.	LENGTH
15" (375)	#4 (#13)	1	-	72" (1830)	#4 (#13)	5	8" (200)	15'-7" (4750)	#4 (#13)	2	-	15'-1 1/16" (4600)	#4 (#13)	4	8" (200)	VARIES 72 13/16" (1850) TO 145 5/8" (3700)	#4 (#13)	24	8" (200)	VARIES 40" (1015) TO 75 1 1/16" (1920)
18" (450)	#4 (#13)	1	-	72" (1830)	#4 (#13)	5	8" (200)	19'-9" (6020)	#4 (#13)	2	-	19'-3 3/8" (5875)	#4 (#13)	4	8" (200)	VARIES 89 5/8" (2275) TO 179 3/16" (4550)	#4 (#13)	30	8" (200)	VARIES 40" (1015) TO 85 3/4" (2180)
21" (525) OR 24" (600)	#4 (#13)	2	-	72" (1830)	#4 (#13)	5	8" (200)	24'-3" (7390)	#4 (#13)	2	-	23'-9 5/8" (7255)	#4 (#13)	6	8" (200)	VARIES 80 3/4" (2050) TO 242 1/8" (6150)	#4 (#13)	37	8" (200)	VARIES 40" (1015) TO 96 3/16" (2455)

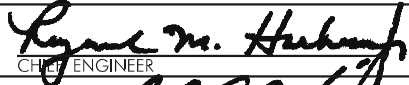



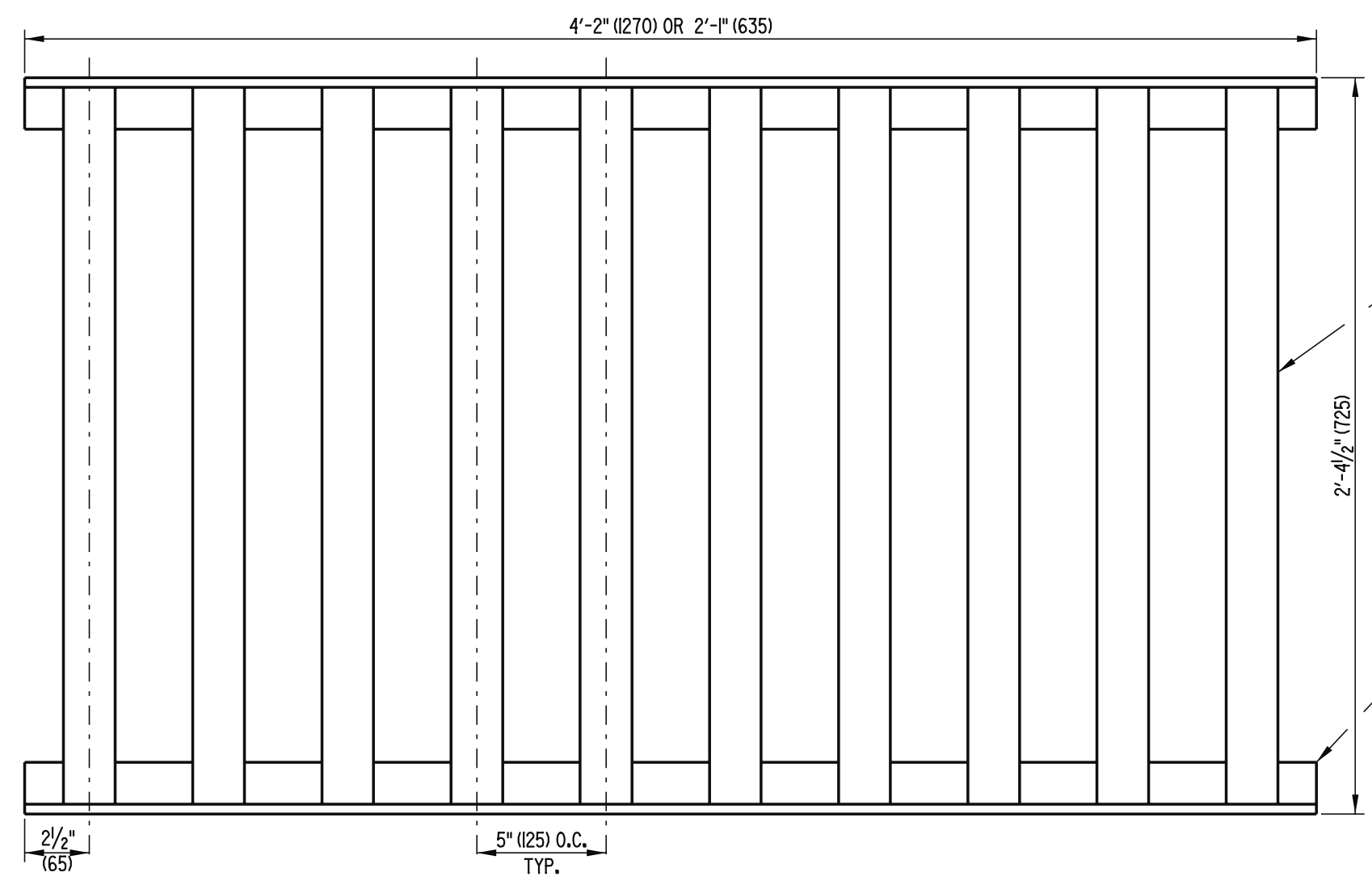
DELAWARE
DEPARTMENT OF TRANSPORTATION

10:1 SAFETY END STRUCTURE

STANDARD NO. D-2 (2001)

SHT. 2 OF 2

APPROVED  6/18/01
CHIEF ENGINEER DATE
RECOMMENDED  6/18/01
DESIGN ENGINEER DATE



GRATE DETAIL

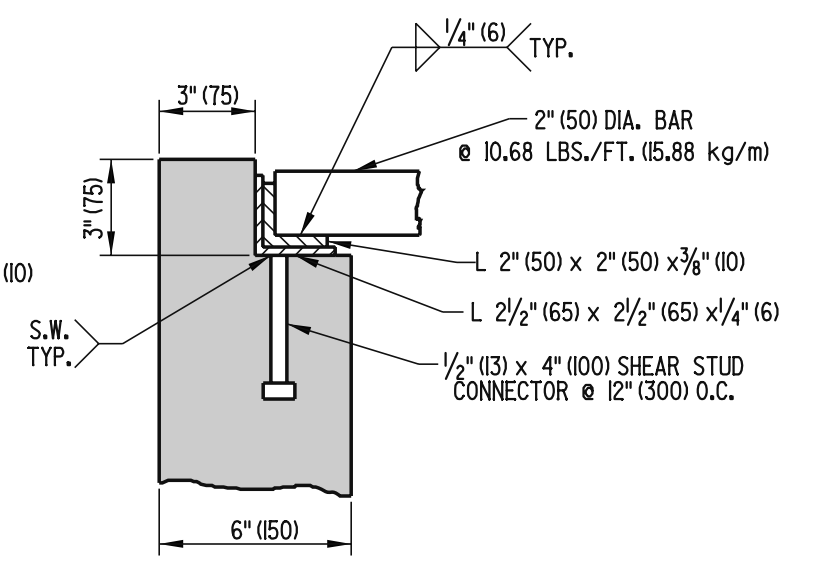
2" (50) DIA. BAR @ 10.68 LBS./FT. (15.88 kg/m)

2'-4 1/2" (725)

L 2" (50) x 2" (50) x 3/8" (10)

2 1/2" (65)

5" (125) O.C. TYP.



FRAME & GRATE ASSEMBLY DETAIL



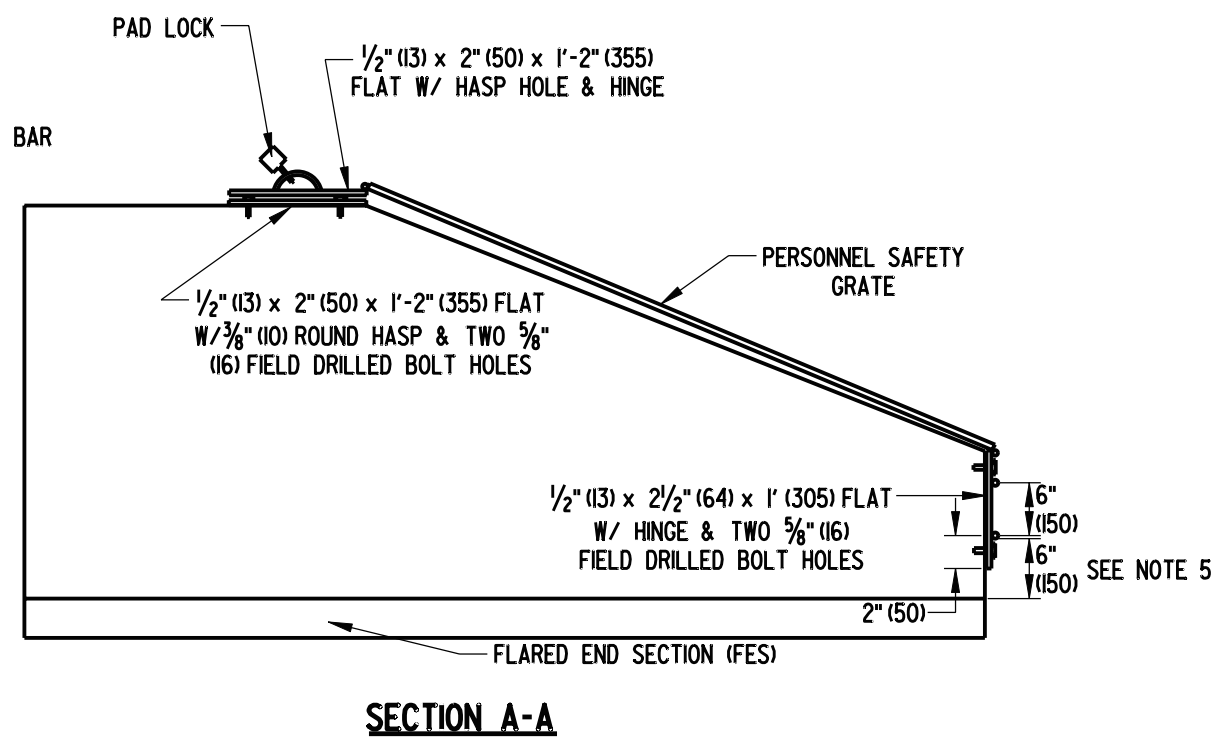
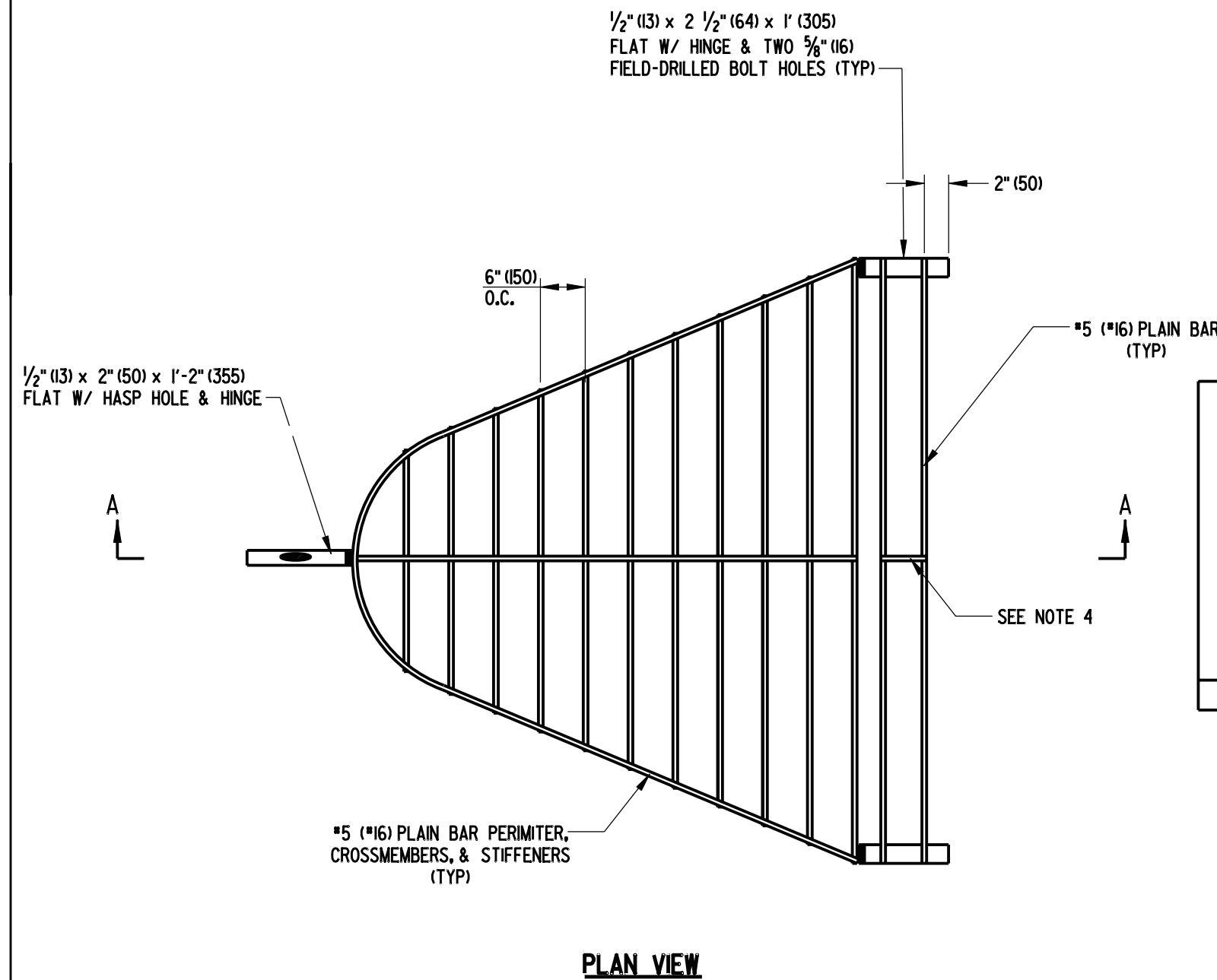
DELAWARE
DEPARTMENT OF TRANSPORTATION

SAFETY GRATES




STANDARD NO. D-3 (2005)

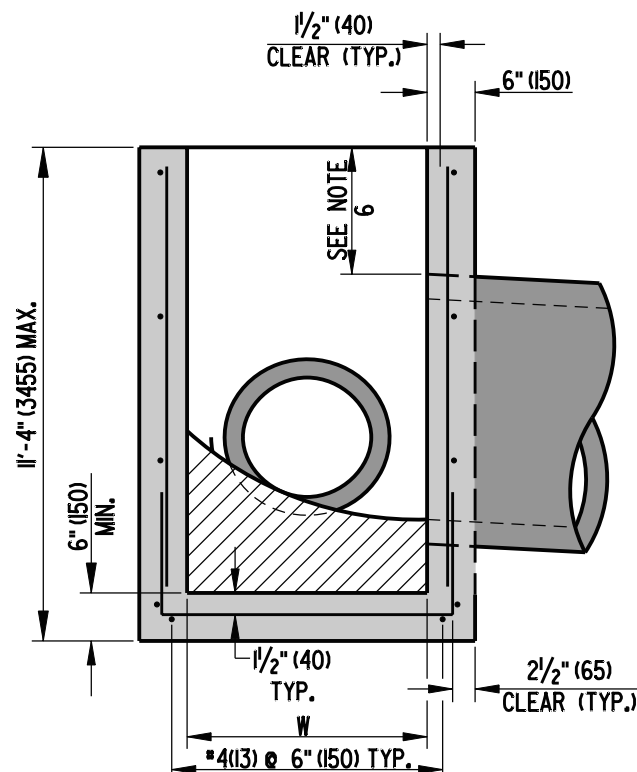
SHT. 1 OF 2

APPROVED *Carolann Wick* 12/5/05
CHIEF ENGINEER DATE
RECOMMENDED *James M. O'Brien* 11/29/05
DESIGN ENGINEER DATE

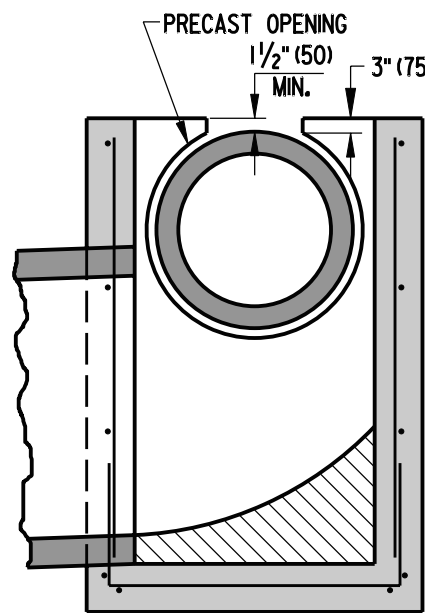


- NOTES:
- 1). PERSONNEL SAFETY GRATES (PSG) SHALL ONLY BE INSTALLED ON THE INLETS OF STORM WATER PIPES 12" (300) OR LARGER IN DIAMETER THAT ARE NOT STRAIGHT FROM THE INLET TO THE OPEN OUTLET, REGARDLESS OF THE LENGTH.
 - 2). THE GRATE SHALL BE MADE TO FIT THE OUTSIDE PERIMETER OF THE FLARED END SECTION (FES) $\pm 1/2"$ (13).
 - 3). ALL BOLT HOLES ARE TO BE DRILLED IN THE FIELD.
 - 4). A STIFFENER IS TO BE INSTALLED WHERE TWO OR MORE BARS ARE USED.
 - 5). BOTTOM BAR SHALL BE 6" (150) ABOVE INVERT OF FES.
 - 6). ALL HARDWARE ATTACHED TO CONCRETE SHALL BE ATTACHED USING APPROVED TAMPER PROOF ANCHORS.

 DELAWARE DEPARTMENT OF TRANSPORTATION	SAFETY GRATES			APPROVED  10/24/07 CHIEF ENGINEER DATE
	STANDARD NO. D-3 (2007)	SHT. 2	OF 2	RECOMMENDED  10/23/07 DESIGN ENGINEER DATE



SECTION A-A

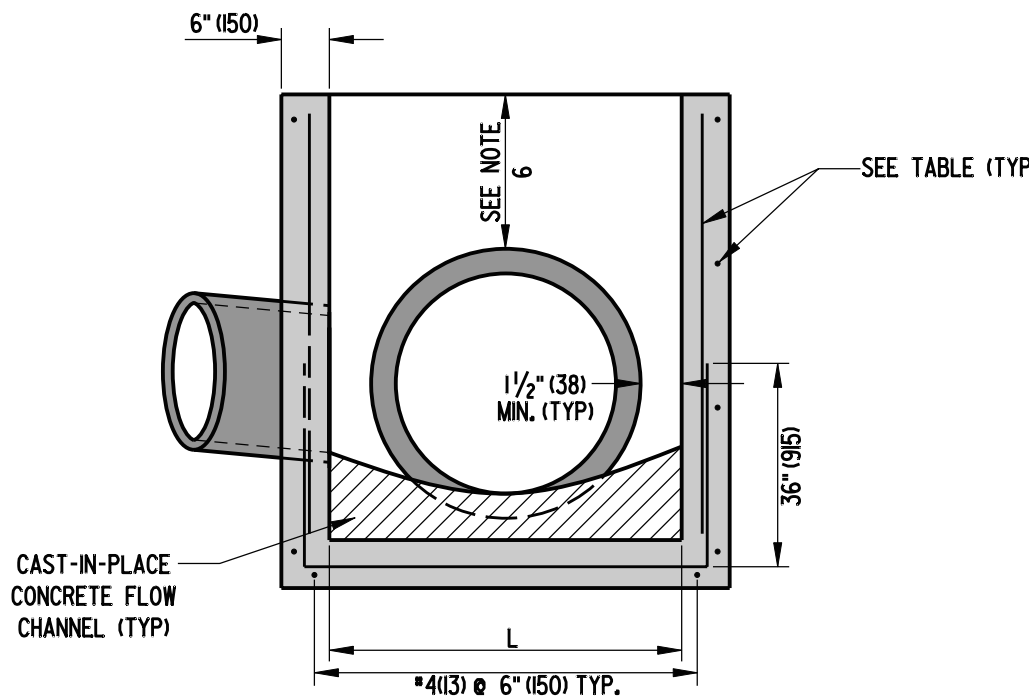


OPTIONAL PIPE OPENING DETAIL

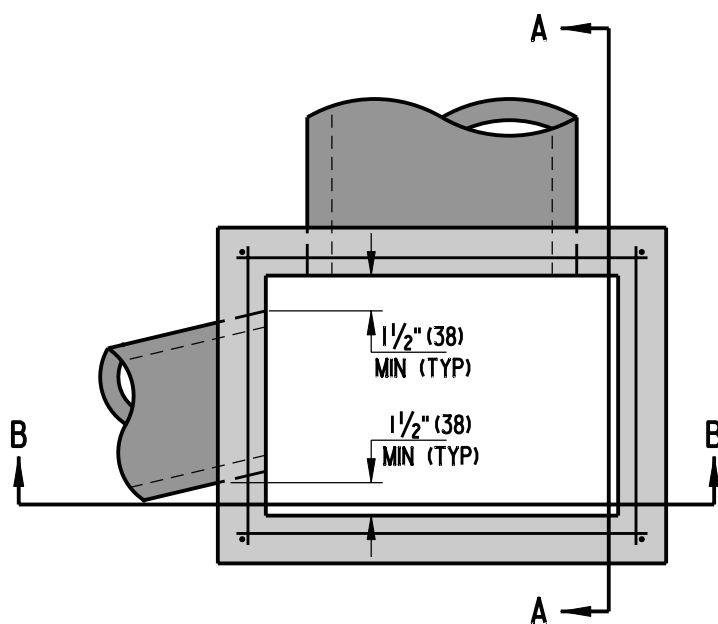
SEE NOTE 6

INLET BOX SCHEDULE		
L	W	FABRICATION TOLERANCE
34" (865)	18" (455)	-1" (25)
34" (865)	24" (610)	-1" (25)
48" (1220)	30" (760)	+6" (150)
48" (1220)	48" (1220)	+6" (150)
66" (1675)	30" (760)	+6" (150)
66" (1675)	48" (1220)	+6" (150)
66" (1675)	66" (1675)	+6" (150)
72" (1830)	24" (610)	-1" (25)
72" (1830)	48" (1220)	-1" (25)
72" (1830)	72" (1830)	-1" (25)

WALL REINFORCEMENT SCHEDULE		
INTERIOR WALL DIMENSION	AREA OF HORIZONTAL REINFORCEMENT PER FOOT (mm ²)	AREA OF VERTICAL REINFORCEMENT PER FOOT (mm ²)
	IN ² (mm ²)	IN ² (mm ²)
LESS THAN 4' (1220)	0.132 (85)	0.132 (85)
4' (1220) TO 4.5' (1370)	0.163 (105)	0.132 (85)
4.5' (1370) TO 5' (1525)	0.198 (128)	0.132 (85)
5' (1525) TO 5.5' (1675)	0.239 (154)	0.132 (85)
5.5' (1675) TO 6' (1830)	0.284 (183)	0.132 (85)

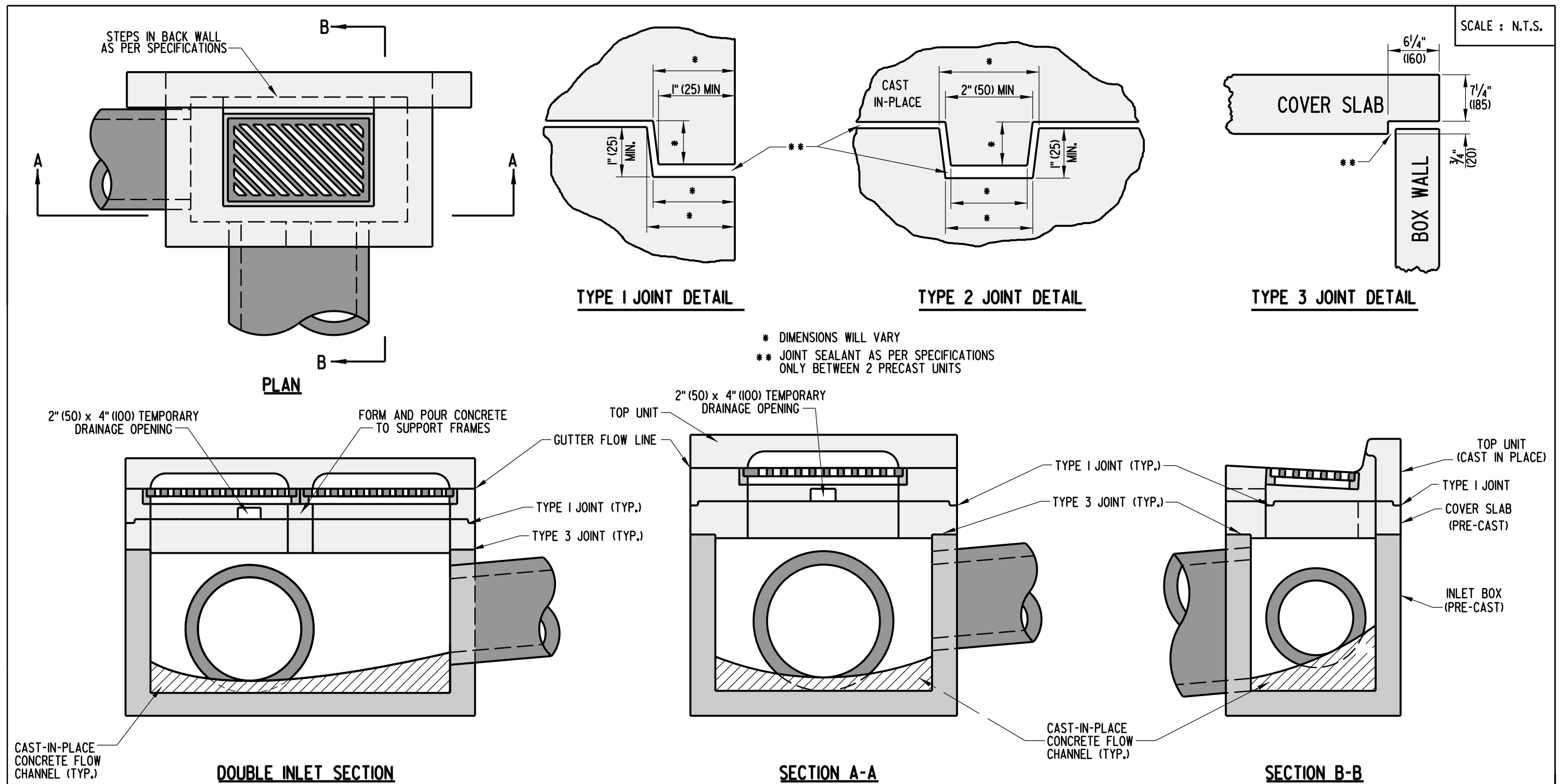


SECTION B-B



TOP VIEW

- NOTES:**
- 1). INLET BOXES SHALL BE PRE-CAST OR CAST-IN-PLACE.
 - 2). PIPES SHALL NOT BE INSTALLED THROUGH ANY CORNER OF THE INLET BOX.
 - 3). RISER SECTIONS MAY BE USED FOR DEEP INLET BOXES.
 - 4). PIPES MAY BE INSTALLED NEAR OR THROUGH JOINTS FOR RISER SECTIONS.
 - 5). WHEN THE COVER ABOVE THE PIPE IS LESS THAN 4" (100) TO THE COVER SLAB OR TOP UNIT OPENING, THE PORTION OF BOX WALL ABOVE THE PIPE MAY BE REMOVED AS SHOWN IN THE OPTIONAL PIPE OPENING DETAIL. THE AREA ABOVE THE PIPE SHALL THEN BE FORMED AND FILLED WITH HIGH-STRENGTH, NON-SHRINK GROUT MIXED WITH COARSE AGGREGATE IN A 1:1 RATIO BY WEIGHT.
 - 6). CONCRETE FLOW CHANNEL SHALL BE WARPED FOR POSITIVE DRAINAGE.
 - 7). WHEN INLET BOX IS PRECAST, PIPE OPENING SHALL BE BETWEEN 3" (75) AND 4" (100) LARGER THAN OUTSIDE DIAMETER OF PIPE AND SHALL NOT ENCROACH ON ADJACENT WALL.



DELAWARE
DEPARTMENT OF TRANSPORTATION

DRAINAGE INLET ASSEMBLY

STANDARD NO. D-5 (2008)

SHT. 1 OF 9

APPROVED

[Signature]
CHIEF ENGINEER

11/18/08
DATE

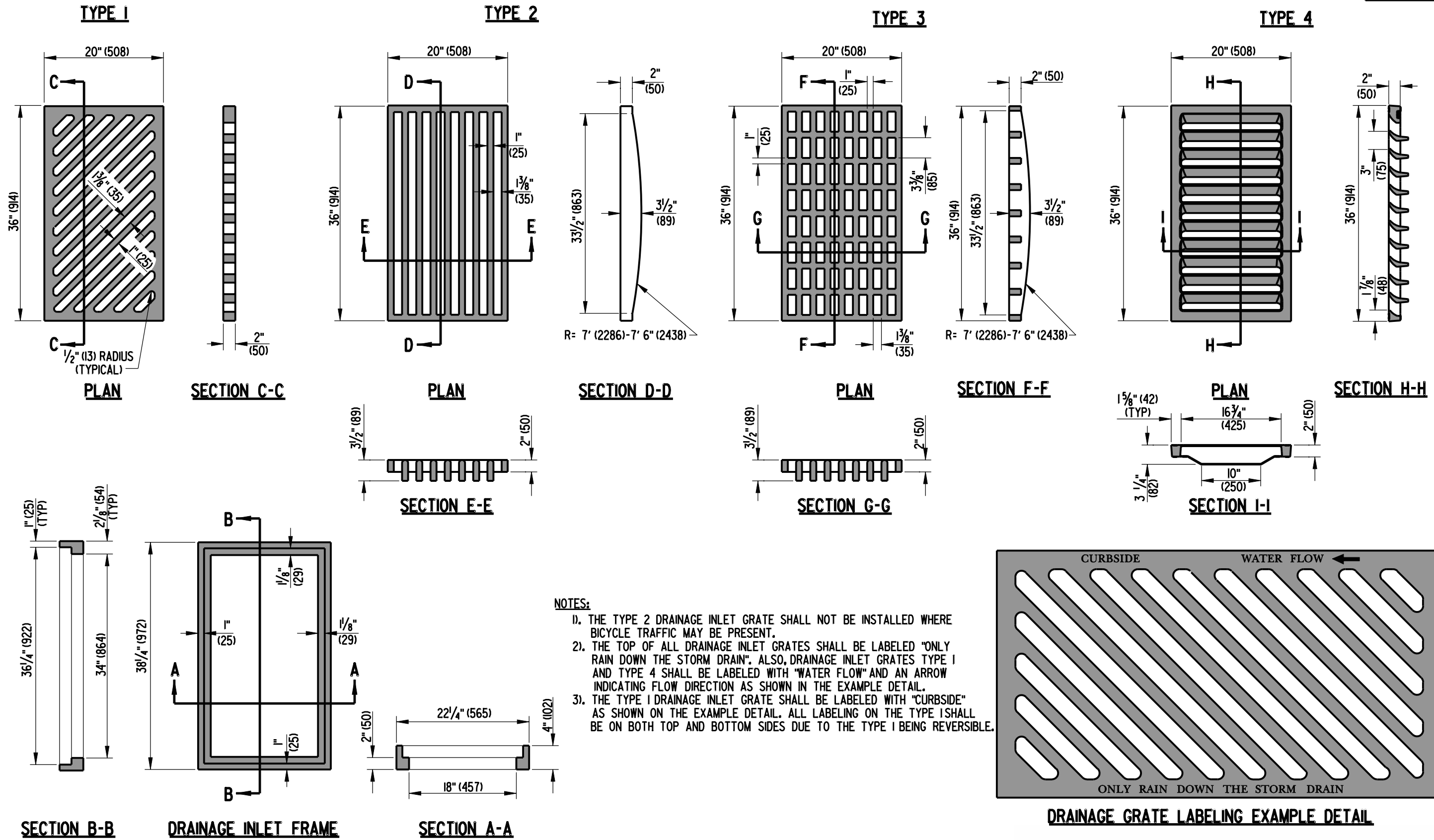
RECOMMENDED

[Signature]
DESIGN ENGINEER

11/17/08
DATE

DRAINAGE INLET FRAME AND GRATES

SCALE : N.T.S.



DELAWARE
DEPARTMENT OF TRANSPORTATION

DRAINAGE INLET DETAILS

STANDARD NO. D-5 (2007)

SHT. 2 OF 9

APPROVED

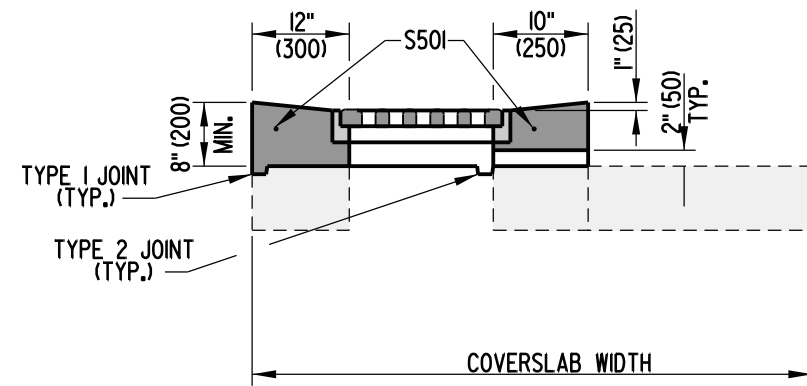
CHIEF ENGINEER

10/24/07
DATE

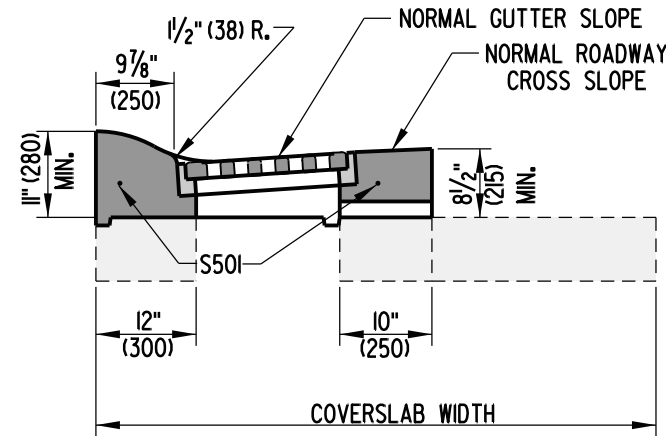
RECOMMENDED

DESIGN ENGINEER

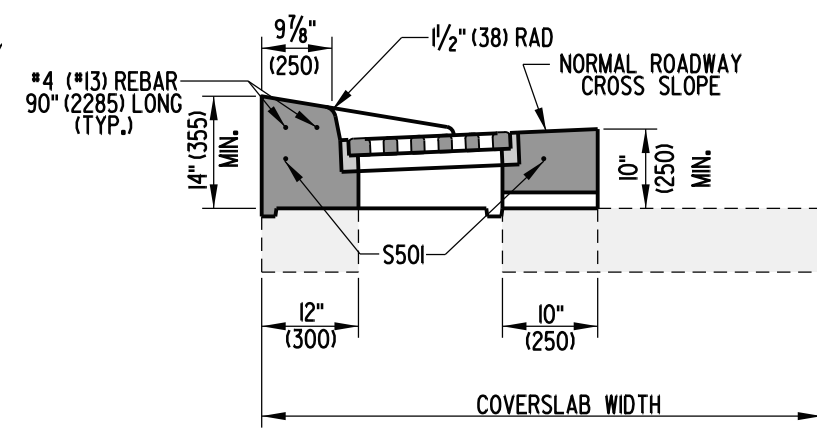
10/23/07
DATE



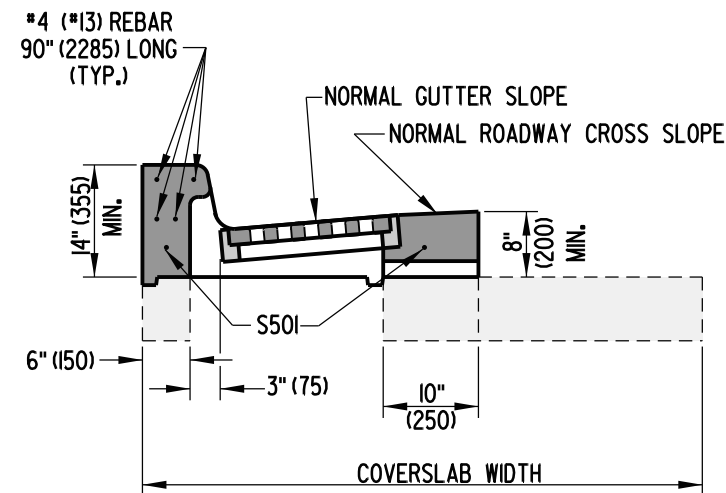
TYPE A



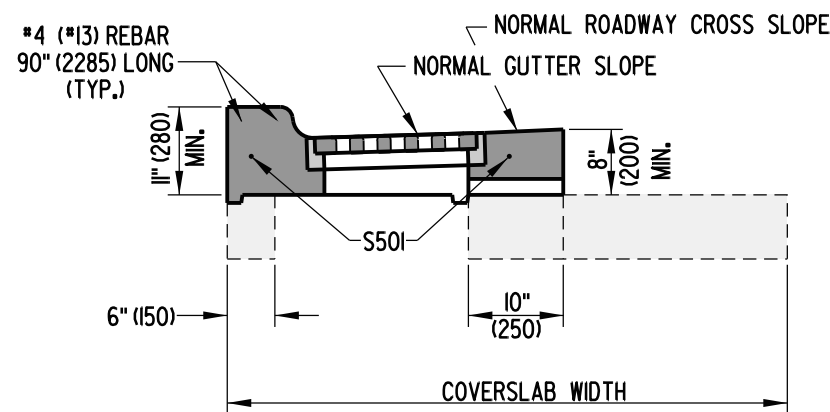
TYPE D



TYPE E

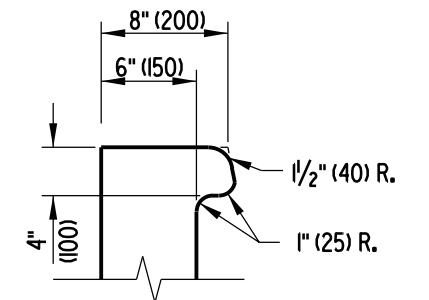


TYPE B

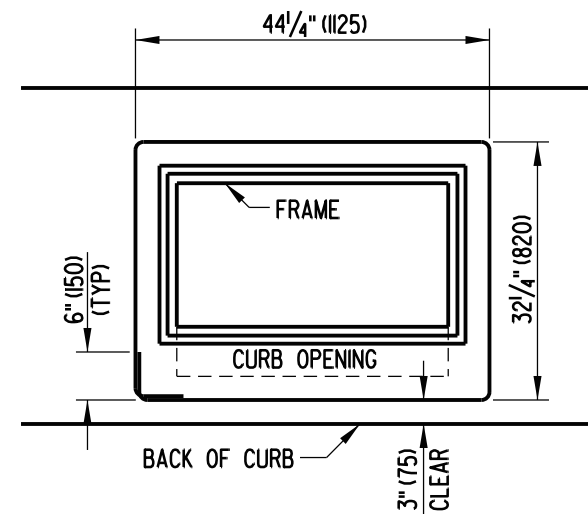


TYPE C

INLET TOP UNIT APPLICATIONS	
TOP UNIT	CURB
TYPE A	USE IN DRAINAGE SWALE
TYPE B	INTEGRAL PCC CURB & GUTTER, TYPE 1 & 3, PCC CURB TYPE 1
TYPE C	INTEGRAL PCC CURB & GUTTER, TYPE 4, PCC CURB TYPE 3
TYPE D	INTEGRAL PCC CURB & GUTTER, TYPE 2
TYPE E	PCC CURB TYPE 2

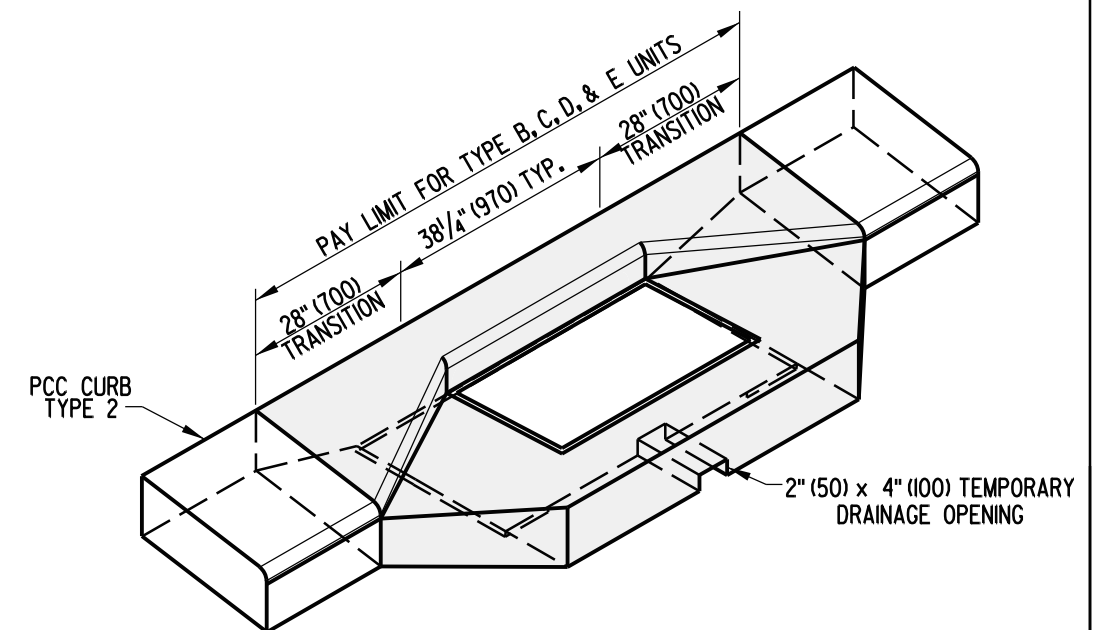


CURB OPENING DETAIL



S501 BENDING DIAGRAM

S501 IS NOT REQUIRED TO BE ONE CONTINUOUS BAR. IF MORE THAN ONE BAR IS USED, THERE MUST BE A 12" (300) OVERLAP BETWEEN BARS.



ISOMETRIC VIEW

TYPE E UNIT SHOWN



DELAWARE
DEPARTMENT OF TRANSPORTATION

DRAINAGE INLET TOP UNITS

STANDARD NO.

D-5 (2008)

SHT. 3

OF 9

APPROVED

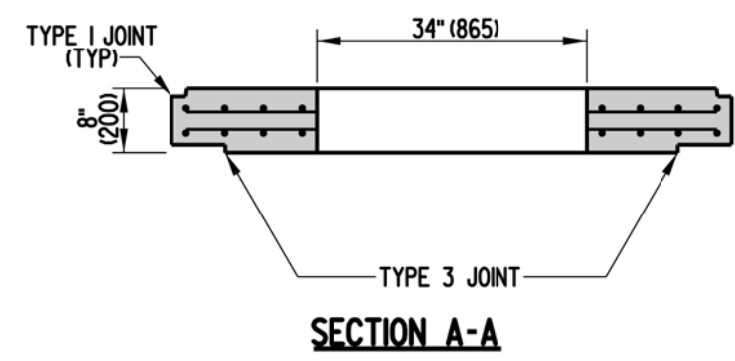
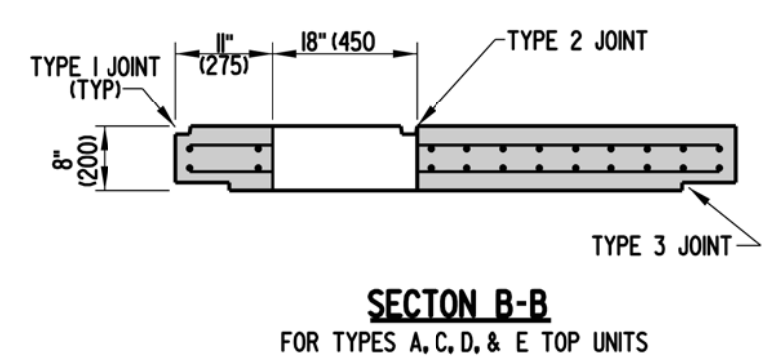
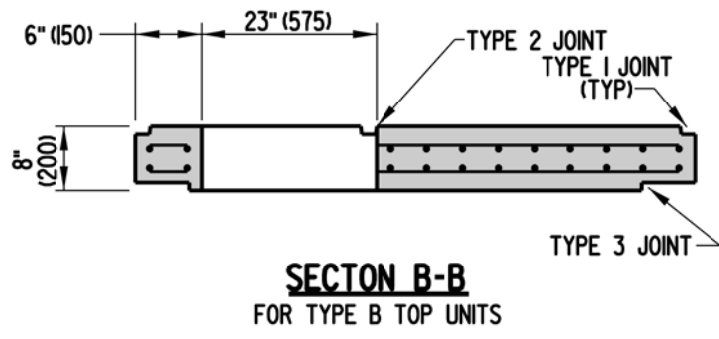
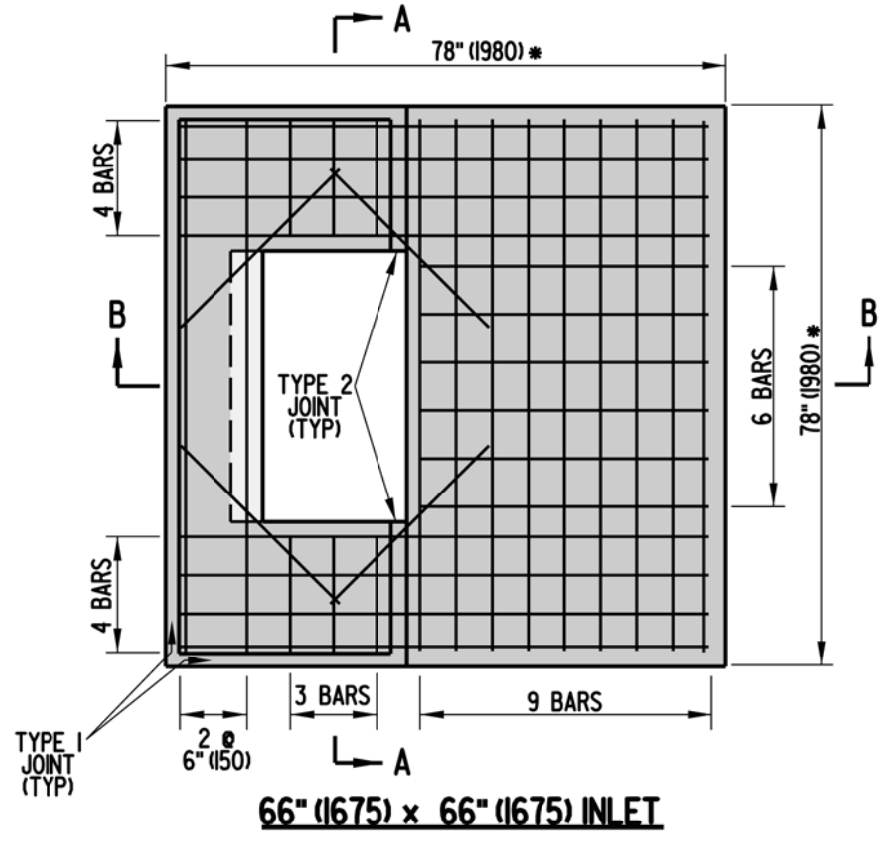
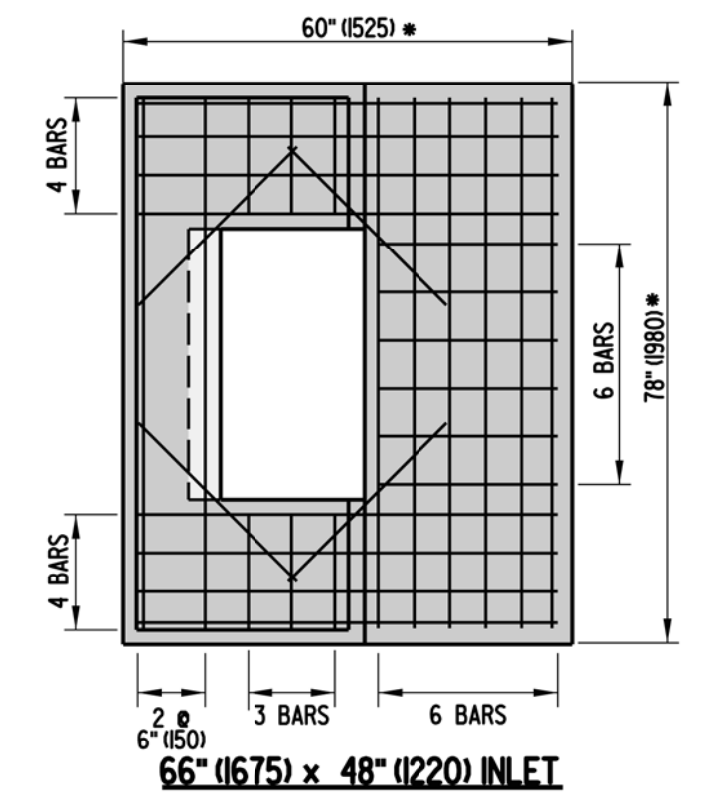
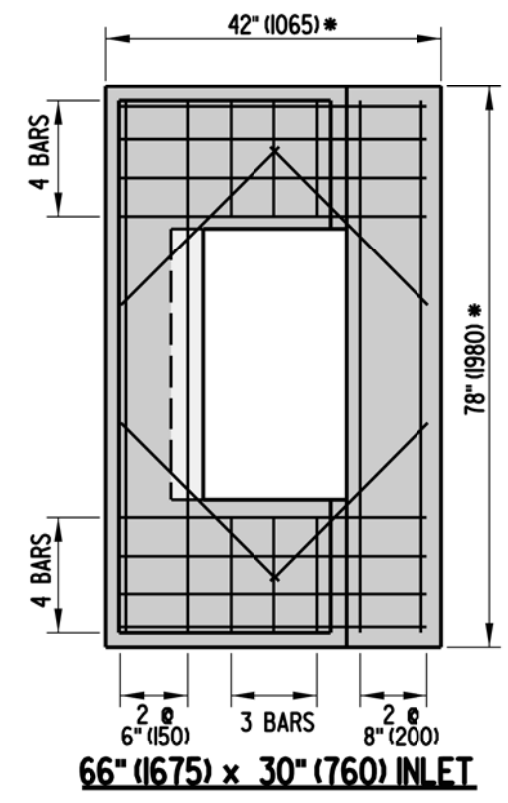
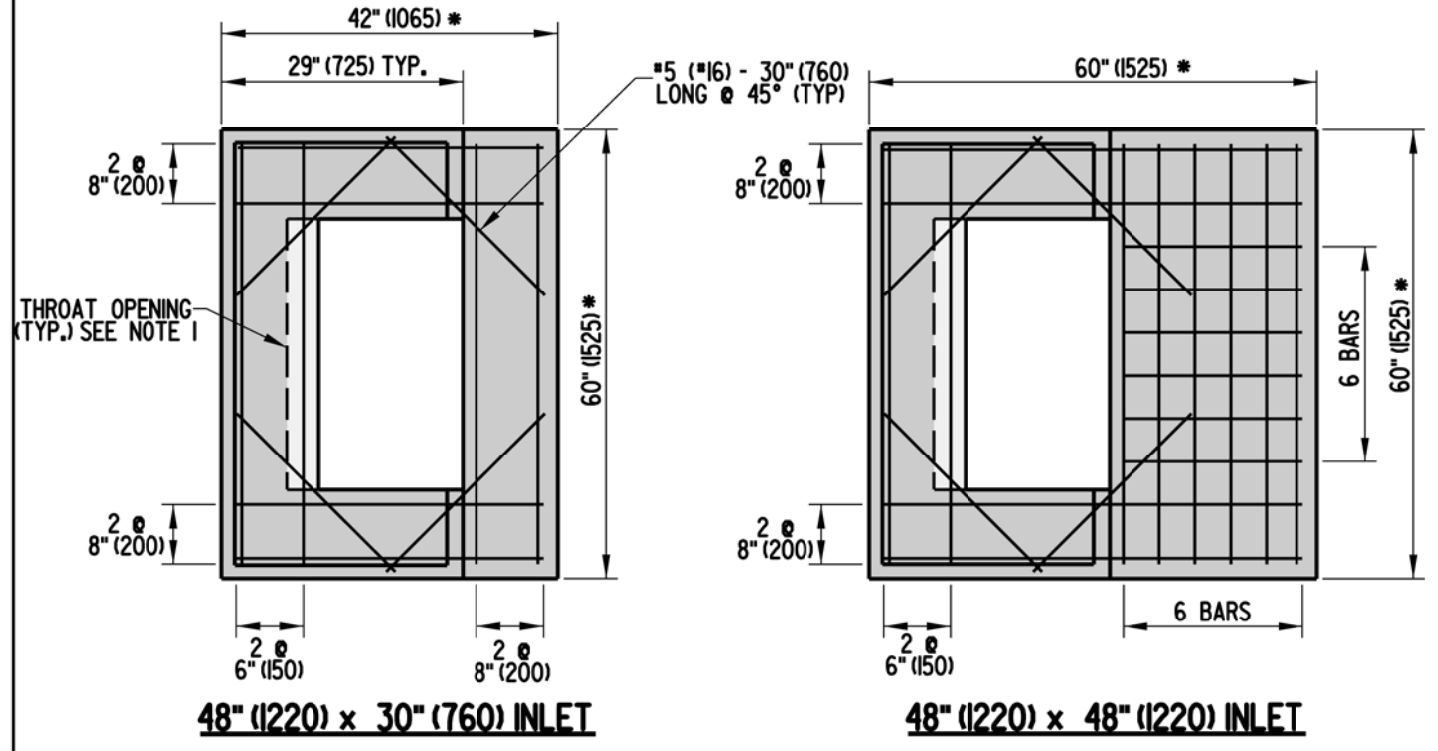
[Signature]
CHIEF ENGINEER

11/18/08
DATE

RECOMMENDED

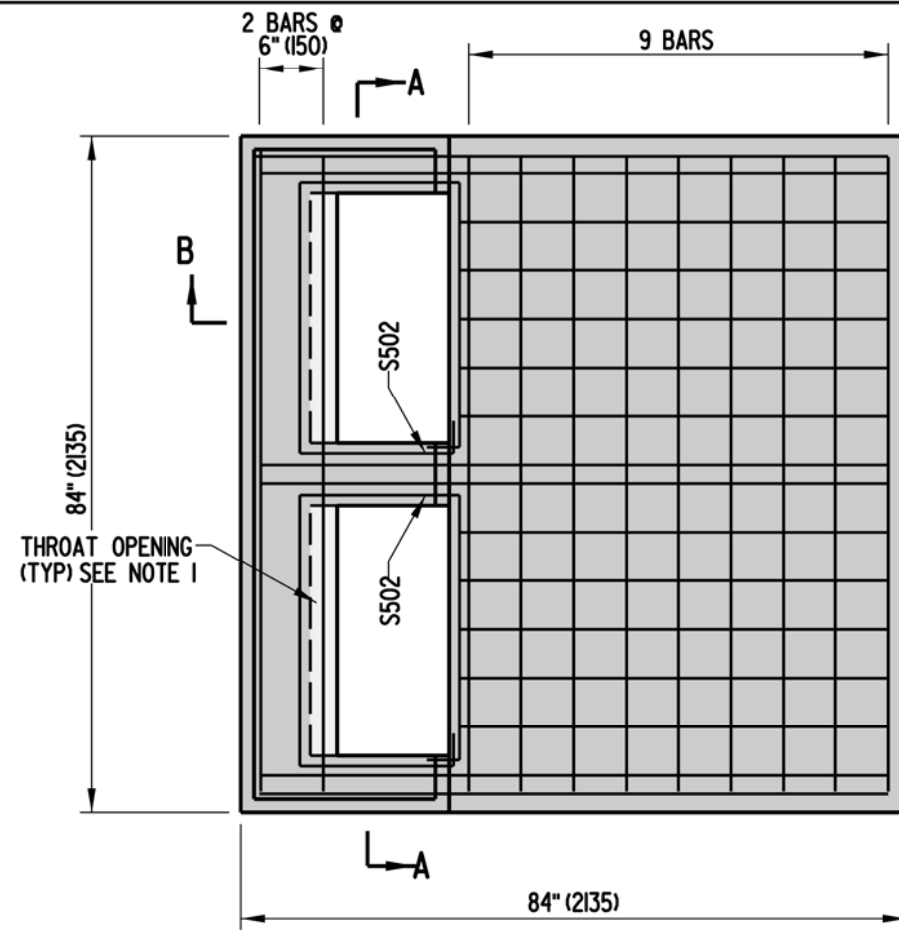
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DESIGN ENGINEER

11/17/08
DATE

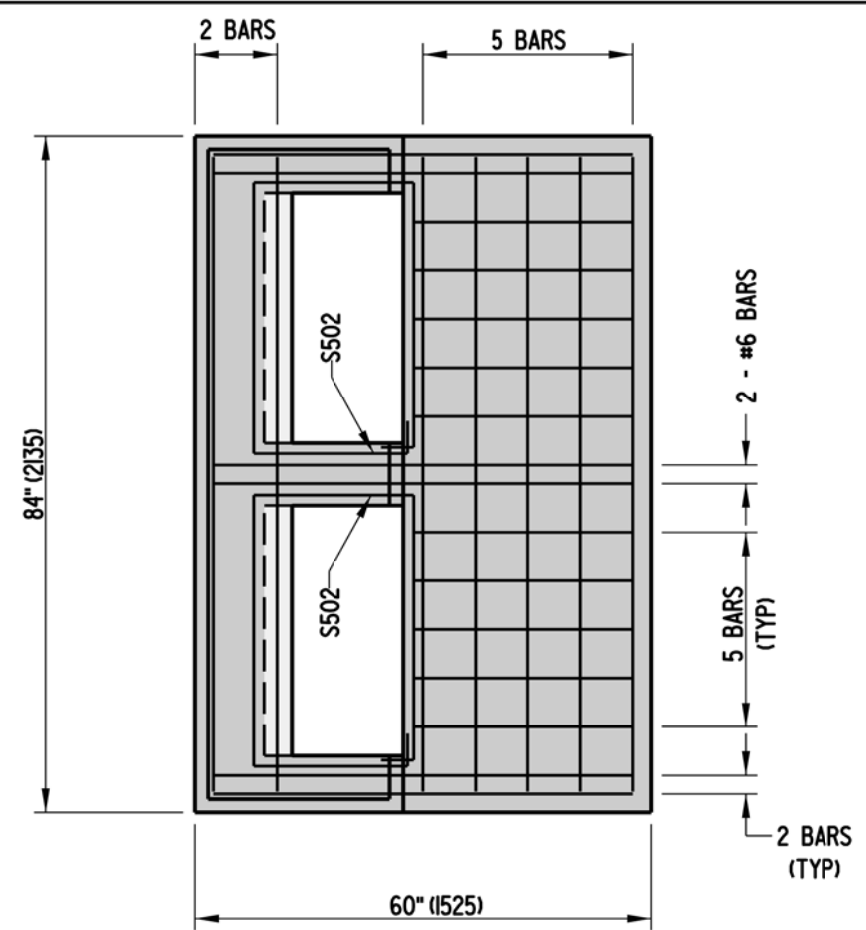


- NOTES :
- 1). 5" (125) THROAT IS FOR TYPE B TOP UNIT ONLY.
 - 2). RELOCATE ENCROACHING REINFORCING BARS WHEN USING TYPE B UNIT.
 - 3). COVER SLABS SHALL BE PRE-CAST AND MUST BE SIZED TO FIT INLET BOX DIMENSIONS.
 - 4). ALL BARS ARE TO BE #5 (#16) SPACED @ 6" (150) ± UNLESS NOTED OTHERWISE. TOP REINFORCEMENT SHALL BE 0.11 IN² (70 mm²) HORIZONTAL REINFORCEMENT PER FOOT IN BOTH DIRECTIONS.
 - 5). MINIMUM BAR COVER = 1 1/2" (38)
- * - DIMENSIONS TO MATCH OUTSIDE TO OUTSIDE DIMENSIONS OF BOX.

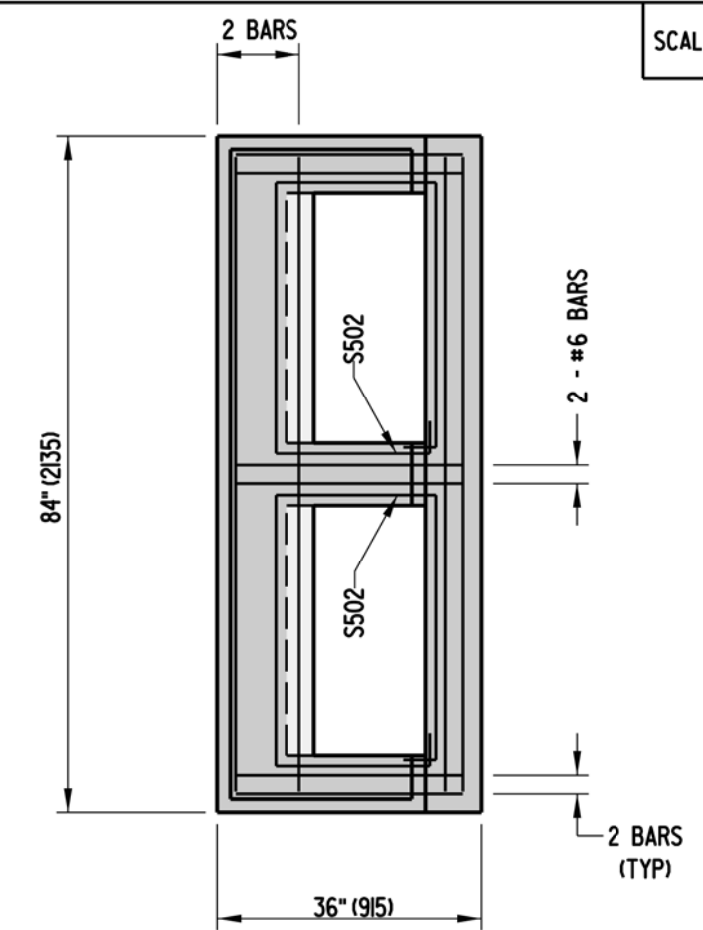
SCALE : N.T.S.



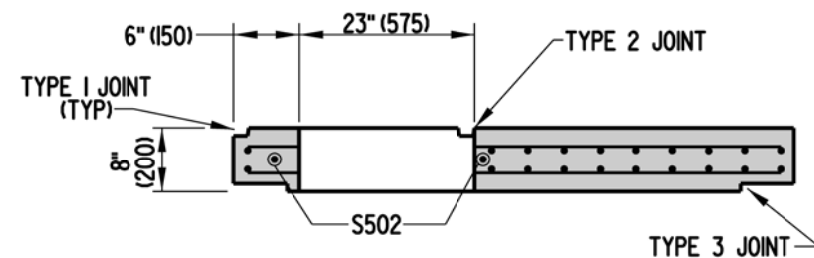
72" (1830) x 72" (1830) INLET



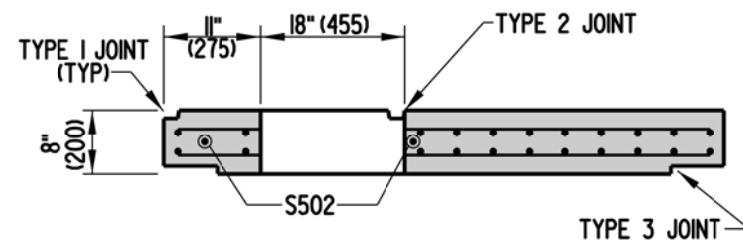
72" (1830) x 48" (1220) INLET



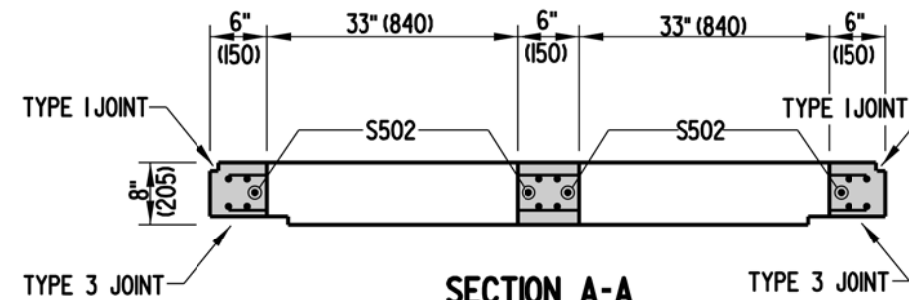
72" (1830) x 24" (610) INLET



SECTION B-B
FOR TYPE B TOP UNITS



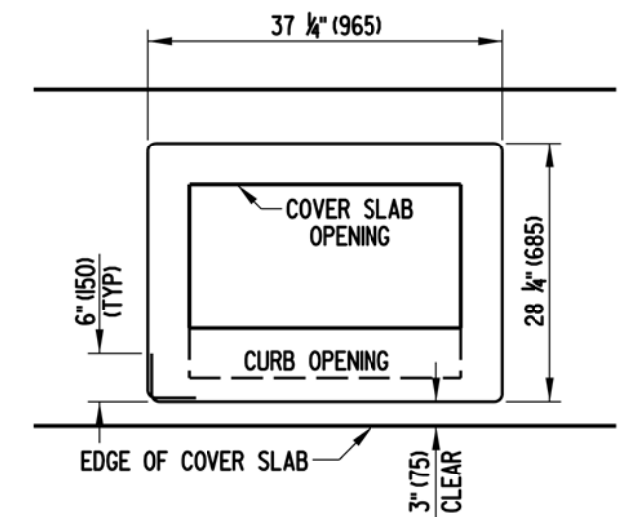
SECTION B-B
FOR TYPES A, C, D, & E TOP UNITS



SECTION A-A

NOTES :

- 1). 5" (125) THROAT IS FOR TYPE B TOP UNITS ONLY.
- 2). RELOCATE ENCROACHING REINFORCING BARS WHEN USING TYPE B TOP UNITS
- 3). COVER SLABS ARE TO BE PRECAST AND MUST BE SIZED TO FIT INLET BOX DIMENSIONS.
- 4). ALL BARS ARE TO BE #5 (#16) SPACED @ 6" (150) ± UNLESS NOTED OTHERWISE. TOP REINFORCEMENTS SHALL BE 0.11 IN² (70 mm²) MIN. HORIZONTAL REINFORCEMENT PER FOOT IN BOTH DIRECTIONS.
- 5). MINIMUM BAR COVER = 1 1/2" (38).



S502 BENDING DIAGRAM

S502 IS NOT REQUIRED TO BE ONE CONTINUOUS BAR. IF MORE THAN ONE BAR IS USED, THERE MUST BE A 12" (300) OVERLAP BETWEEN BARS.



DELAWARE
DEPARTMENT OF TRANSPORTATION

DOUBLE INLET COVER SLAB DETAILS

STANDARD NO. **D-5 (2008)**

SHT. **5** OF **9**

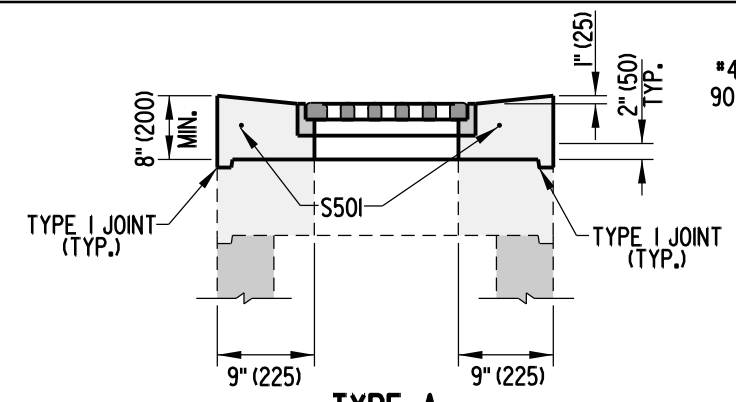
APPROVED

[Signature] **11/18/08**
CHIEF ENGINEER DATE

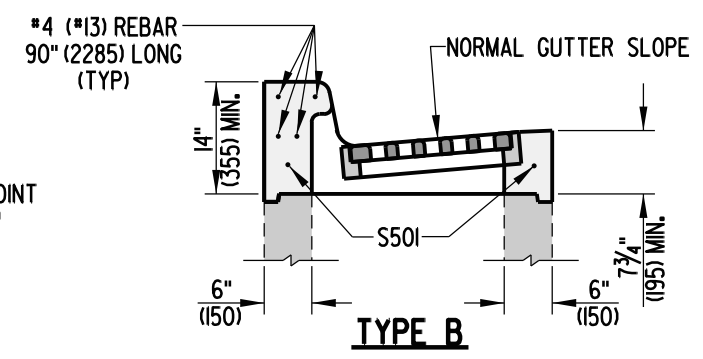
RECOMMENDED

[Signature] **11/17/08**
DESIGN ENGINEER DATE

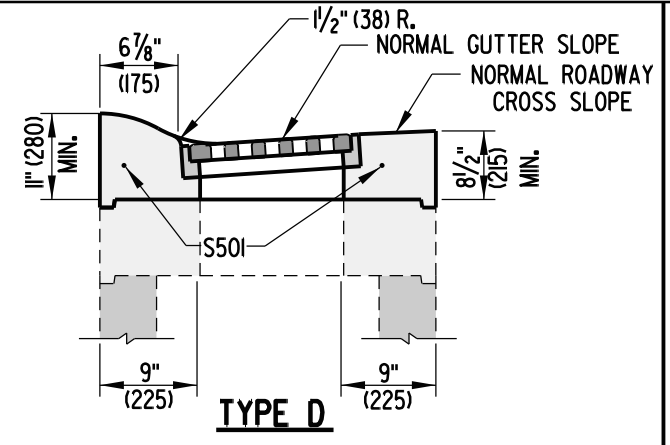
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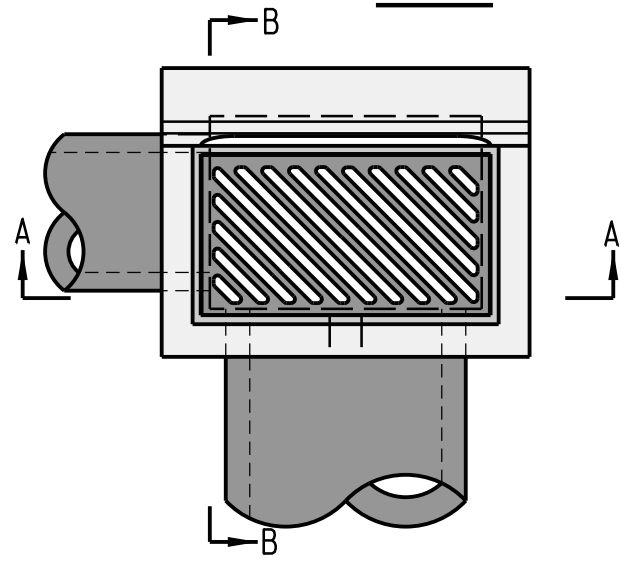
TYPE A



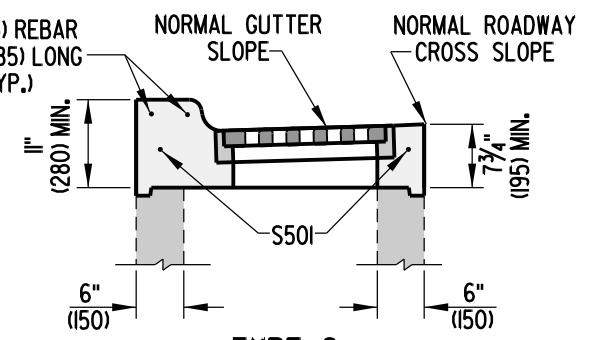
TYPE B



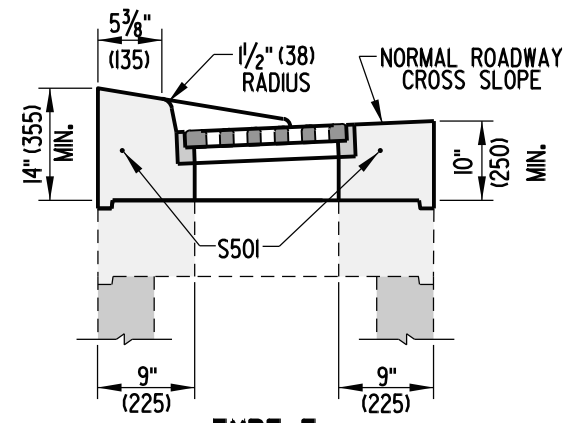
TYPE D



TOP VIEW

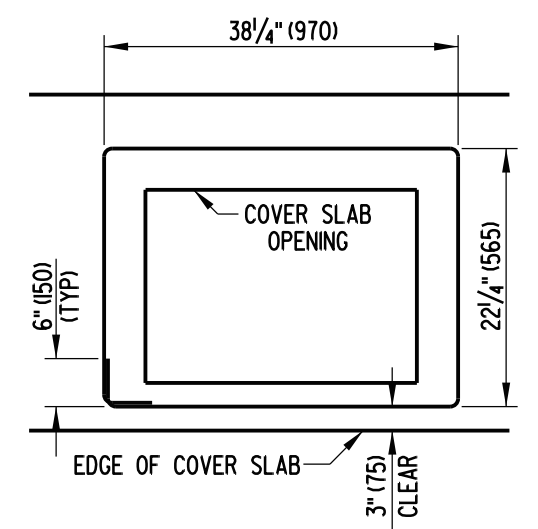


TYPE C



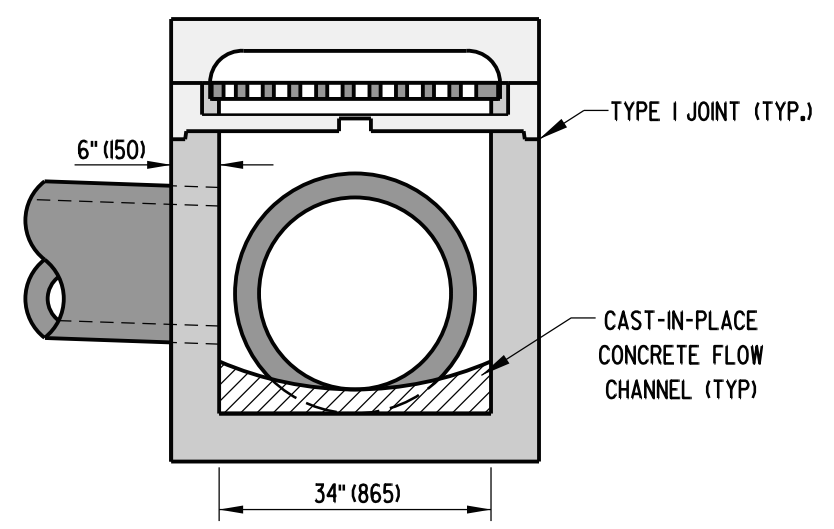
TYPE E

TOP UNIT DETAILS

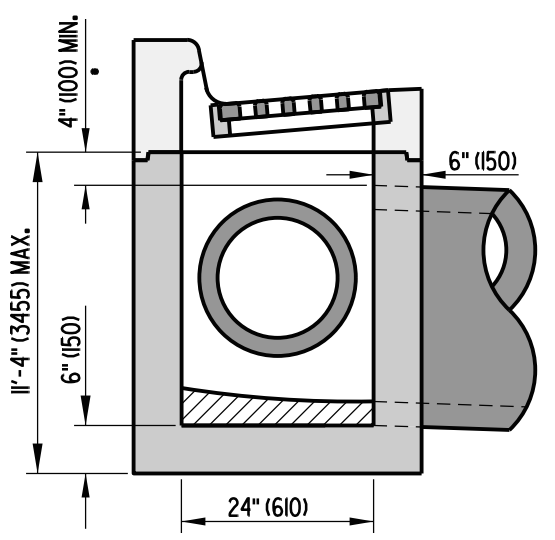


S503 BENDING DIAGRAM

S503 IS NOT REQUIRED TO BE ONE CONTINUOUS BAR. IF MORE THAN ONE BAR IS USED, THERE MUST BE A 12" (300) OVERLAP BETWEEN BARS.



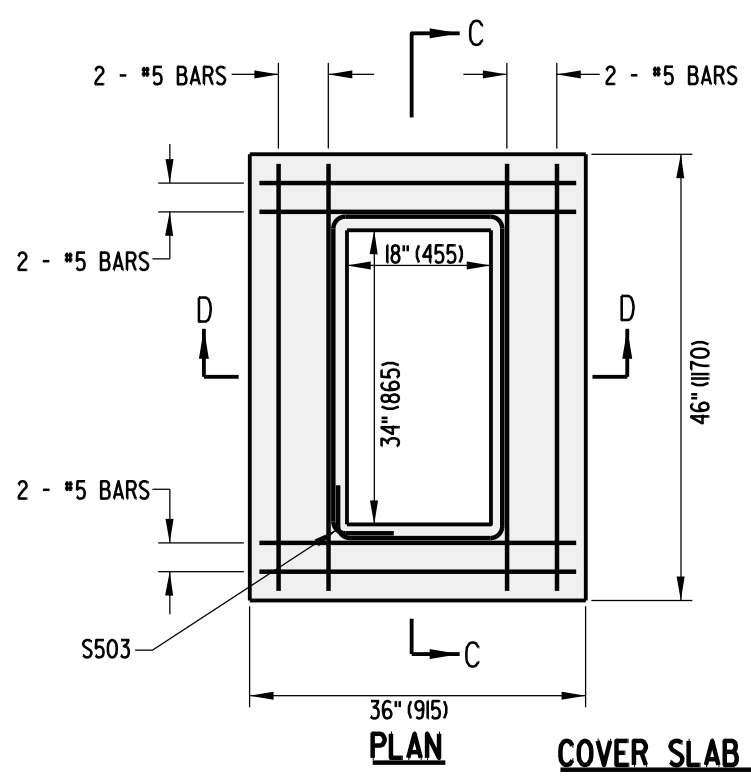
SECTION A-A



SECTION B-B

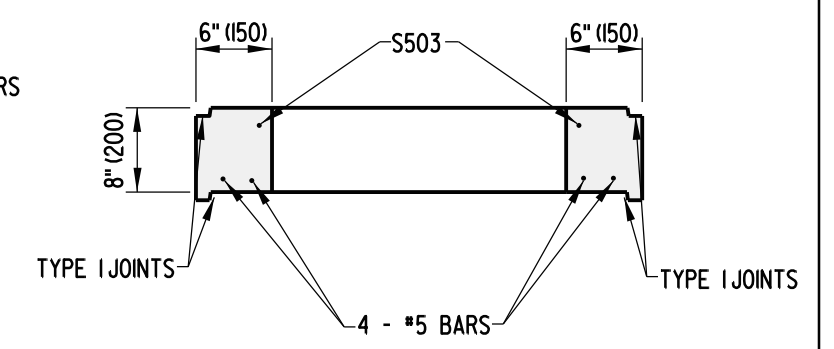
DRAINAGE INLET DETAILS

NOTE: REFER TO PREVIOUS SHEETS FOR REINFORCING REQUIREMENTS
• - SEE OPTIONAL PIPE OPENING DETAIL ON STANDARD NO. D-4, SHEET 1 OF 1

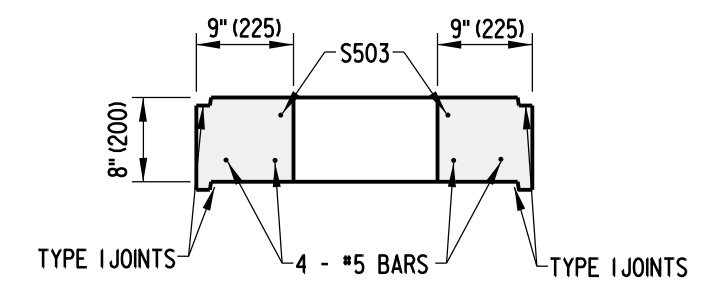


PLAN




COVER SLAB DETAILS

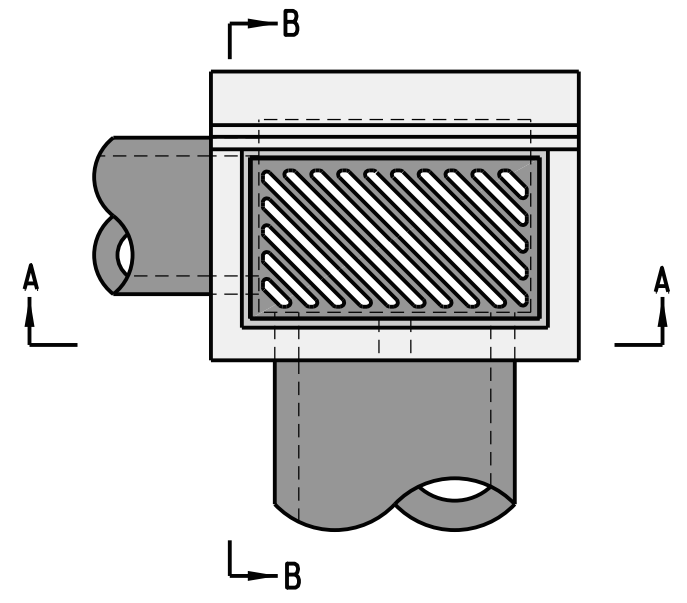


SECTION C-C

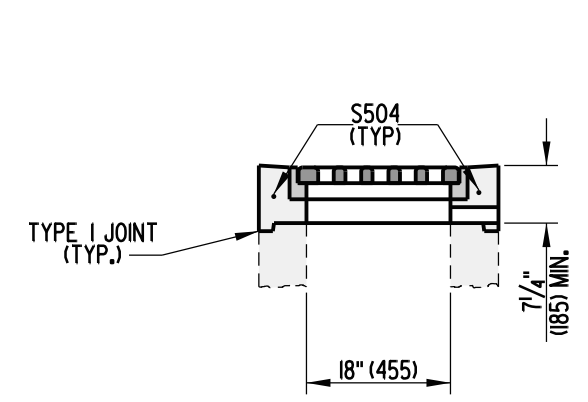


SECTION D-D

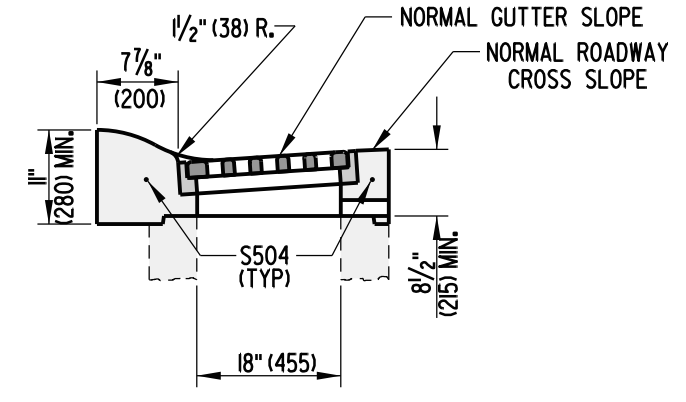
 DELAWARE DEPARTMENT OF TRANSPORTATION	34" (865) x 24" (610) DRAINAGE INLET AND COVER SLAB DETAILS			APPROVED  11/18/08 CHIEF ENGINEER DATE
	STANDARD NO. D-5 (2008)	SHT. 6	OF 9	RECOMMENDED  11/17/08 DESIGN ENGINEER DATE



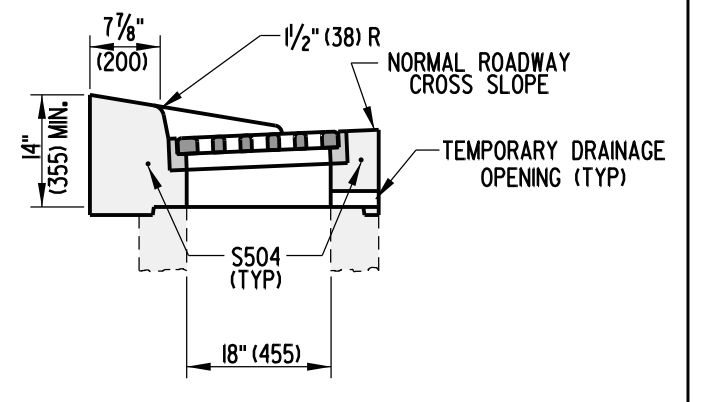
TOP VIEW



TYPE A

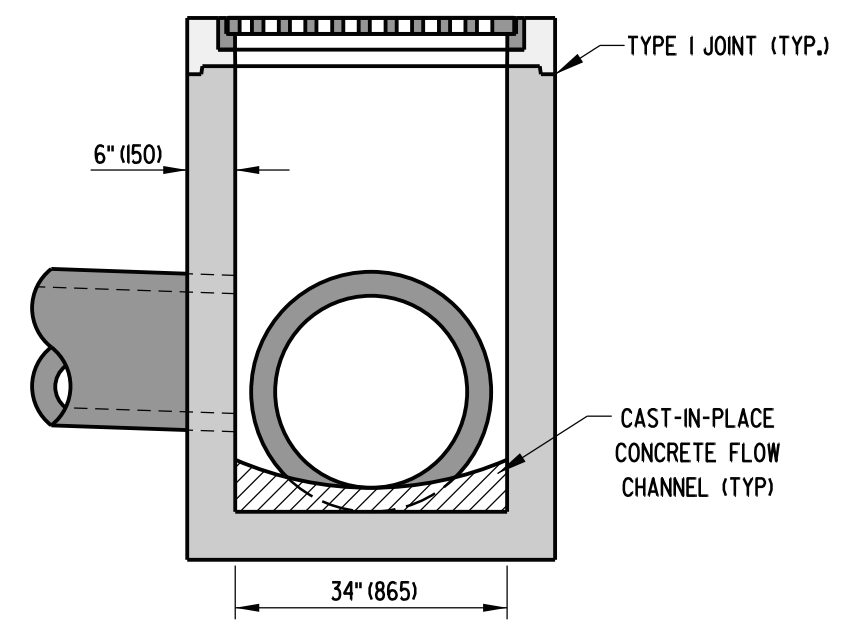


TYPE D

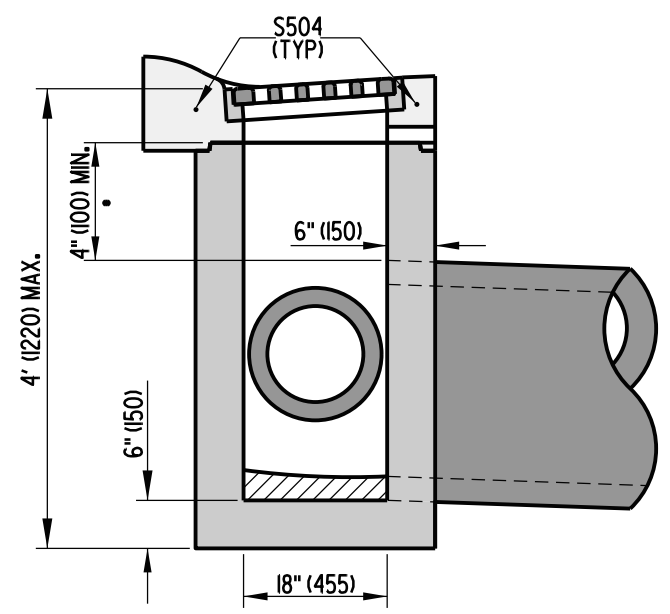


TYPE E

TOP UNIT DETAILS

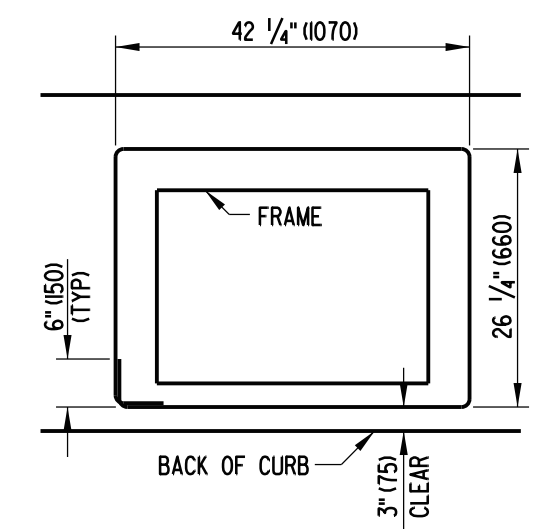


SECTION A-A



SECTION B-B




• - SEE OPTIONAL PIPE OPENING DETAIL ON STANDARD D-4, SHEET 1 OF 1.

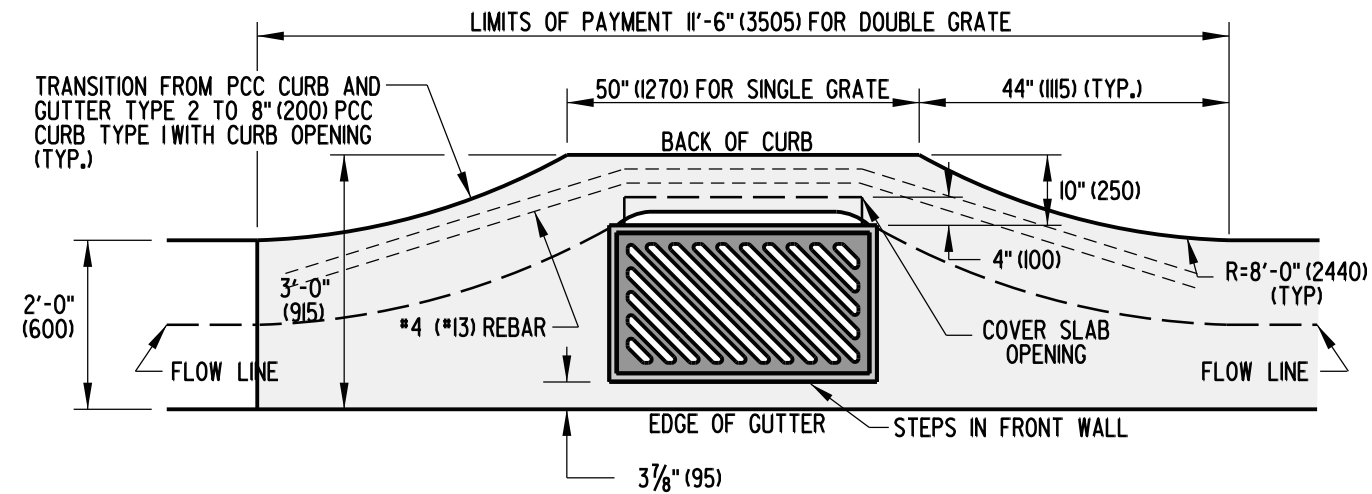


S504 BENDING DIAGRAM

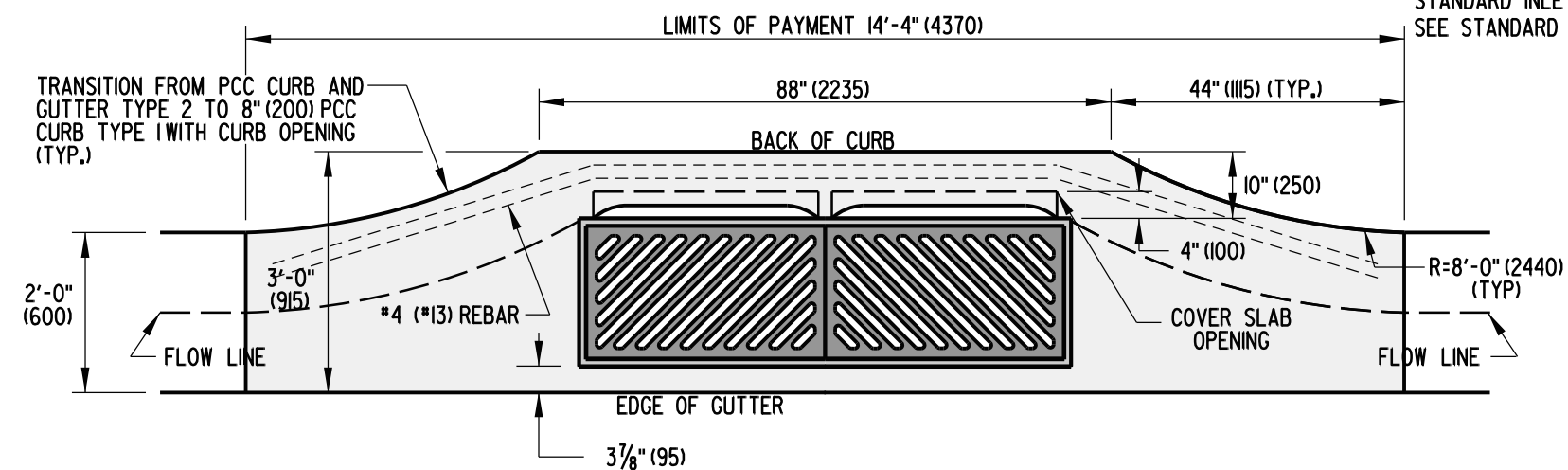
S504 IS NOT REQUIRED TO BE ONE CONTINUOUS BAR. IF MORE THAN ONE BAR IS USED, THERE MUST BE A 12" (300) OVERLAP BETWEEN BARS.

- NOTES:
- 1.) REFER TO PREVIOUS SHEETS FOR REINFORCEMENT REQUIREMENTS
 - 2.) THE HEIGHT OF THIS INLET IS LIMITED TO 4' (1220) MAXIMUM, THEREFORE STEPS WILL NOT BE REQUIRED AND SHOULD NOT BE INSTALLED ON THIS INLET.

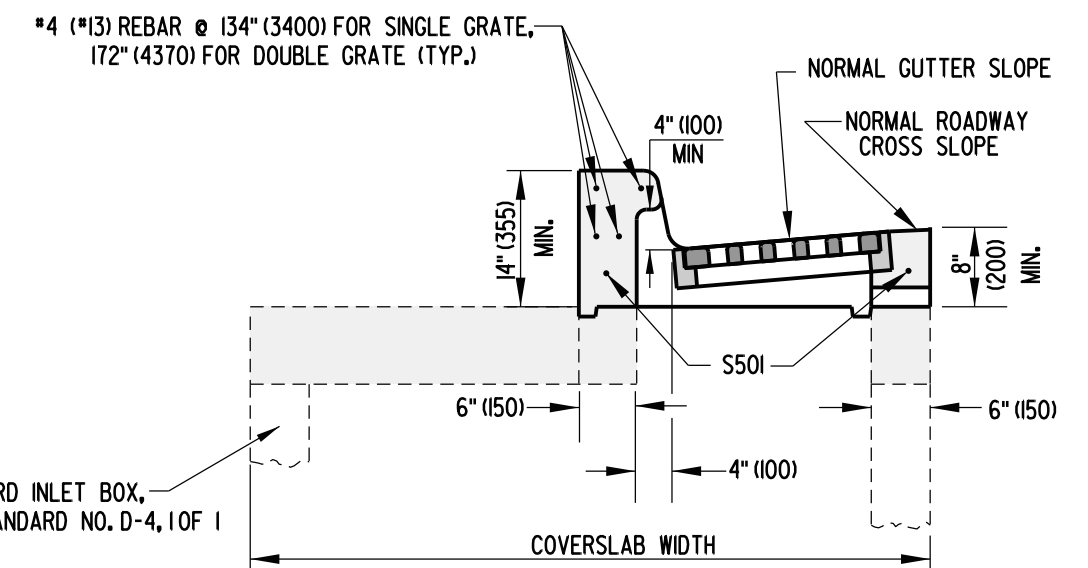
 DELAWARE DEPARTMENT OF TRANSPORTATION	34" (865) x 18" (455) DRAINAGE INLET DETAILS			APPROVED  11/18/08 CHIEF ENGINEER DATE
	STANDARD NO. D-5 (2008)	SHT. 7	OF 9	RECOMMENDED  11/17/08 DESIGN ENGINEER DATE



SINGLE GRATE SETUP



DOUBLE GRATE SETUP



SUBDIVISION TOP & CONFIGURATION

NOTES:

- 1). MINIMUM BOX SIZE TO BE 34" (850) X 24" (600).
- 2). PIPE OPENINGS IN THE FRONT WALL SHALL NOT INTERFERE WITH THE STEPS. THE PIPE SHALL BE SHIFTED HORIZONTALLY TO AVOID THE STEPS. IT MAY BE NECESSARY TO USE A LARGER BOX TO AVOID CONFLICT BETWEEN STEPS AND PIPE OPENING.
- 3). SEE DETAIL D-5, SHEET 3 OF 9 FOR S501 BAR DIAGRAM.



DELAWARE
DEPARTMENT OF TRANSPORTATION

SUBDIVISION INLET DETAILS

STANDARD NO. D-5 (2008)

SHT. 8 OF 9

APPROVED 
CHIEF ENGINEER

RECOMMENDED *Dennis*
DESIGN ENGINEER

DATE 11/18/08

11/17/08
DATE