

NOTE: SEE GRATE DIMENSION TABLE FOR GRATE TYPE I & II DIMENSIONS

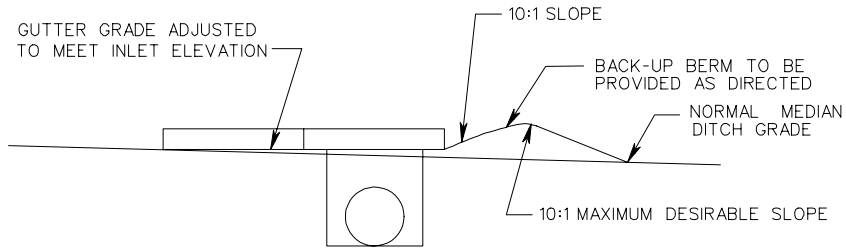
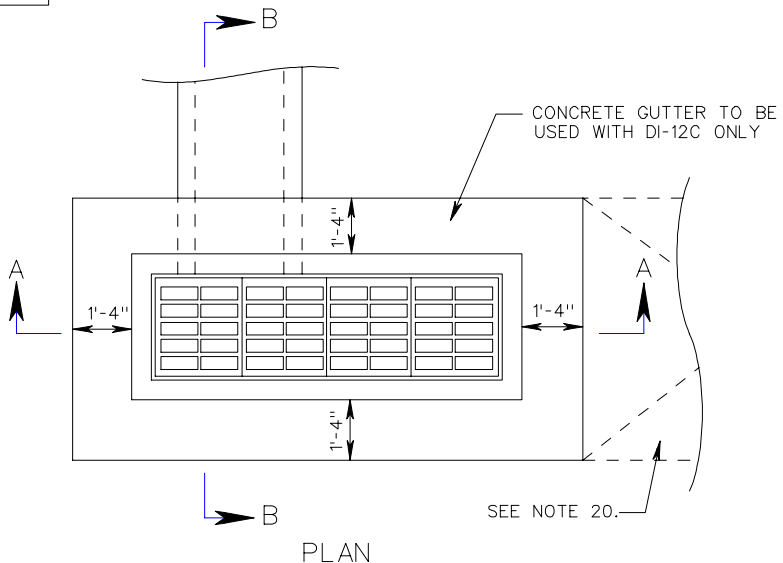
GRATE DIMENSIONS				
GRATE TYPE	OPENING WIDTH (1)	BAR THICKNESS (2)	END SECTION WIDTH (3)	GRATE THICKNESS (4)
TYPE I	3 1/4"	1 3/8"	2 1/8"	3 3/4"
TYPE II	1 1/2"	1 3/8"	2 3/16"	3 3/4"

- NOTES:
- TYPE I GRATE: LIMITED ACCESS AND RURAL UNLIMITED ACCESS: PEDESTRIAN ACCESS UNLIKELY
 - TYPE II GRATE: URBAN AREAS: PEDESTRIAN ACCESSIBLE AREAS.
 - SEE GRATE DIMENSION TABLE FOR SIZE AND NUMBER OF GRATE OPENINGS REQUIRED FOR TYPE I AND TYPE II GRATE.
 - PAVED DITCHES ARE TO BE TRANSITIONED TO MEET INLET GUTTER AS SHOWN IN STANDARD PG-2A.
 - 3" DIAMETER WEEP HOLE WITH 12" X 12" PLASTIC HARDWARE CLOTH 1/4" MESH OR GALVANIZED STEEL WIRE, MINIMUM WIRE DIAMETER 0.03", NUMBER 4 MESH HARDWARE CLOTH ANCHORED FIRMLY TO OUTSIDE OF STRUCTURE.
 - IF NORMAL DITCH GRADE IS TOO FLAT TO ALLOW FOR ADJUSTED GRADE TO INLET, A SPECIAL GUTTER DETAIL WILL BE REQUIRED ON PLANS.
 - GRATE BARS TO BE PARALLEL TO DITCH FLOW.
 - DI-12 AND DI-12A ARE NOT TO BE UTILIZED IN LOCATIONS NORMALLY SUBJECT TO TRAFFIC.

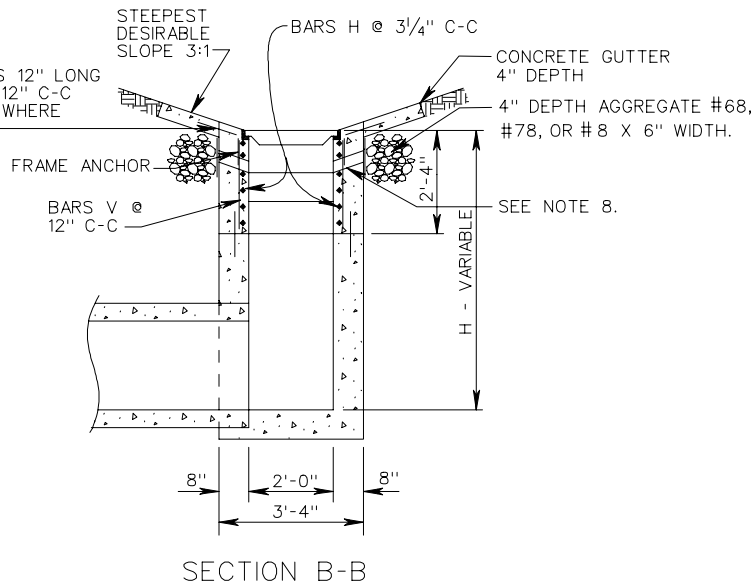
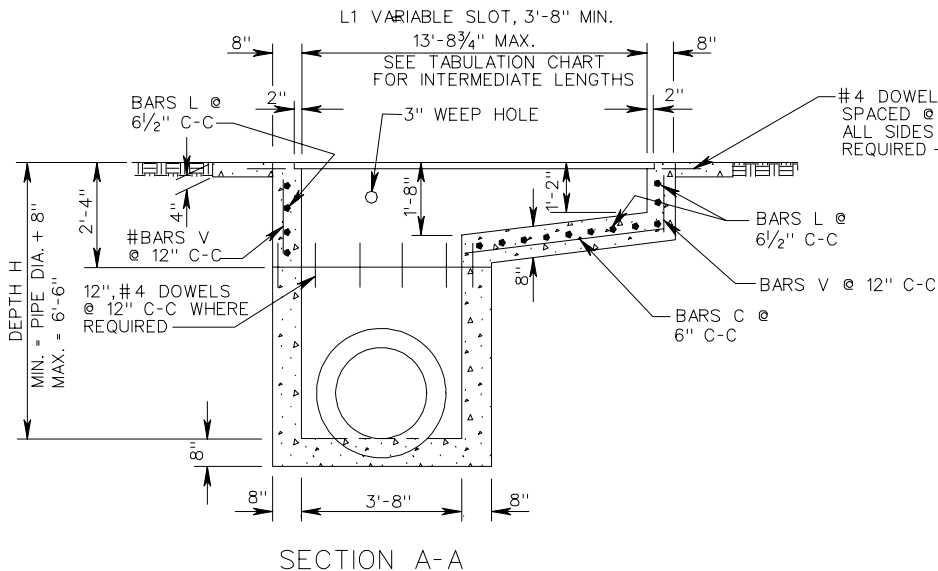
MULTIGRATE DROP INLET
FOR PIPE SIZES 12" TO 72"
VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE
233
302

DI-12B,12C



LONGITUDINAL SECTION
(WHEN INLET IS LOCATED ABOVE NORMAL DITCH GRADE)
SEE NOTE 16.



SHEET 1 OF 2

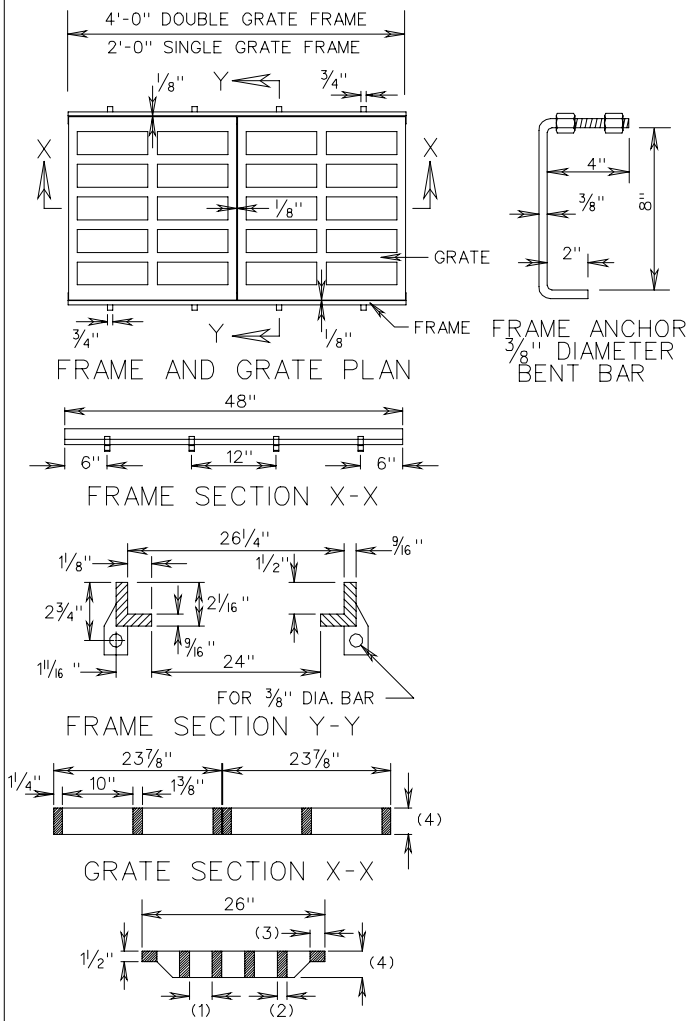
MULTIGRATE DROP INLET
FOR PIPE SIZES 12" TO 36"
VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE

241
503

REV. 2/06

104.33



NOTES

1. DEPTH OF INLET (H) TO BE SHOWN ON PLANS. FOR DEPTH GREATER THAN 6'-6", USE ST'D. DI-12, DI-12A.
2. THE "H" DIMENSION SHOWN ON THE STANDARDS AND SPECIFIED ON THE PLANS WILL BE MEASURED FROM THE INVERT OF THE OUTFALL PIPE TO THE TOP OF THE STRUCTURE. PLAN "H" DIMENSIONS ARE APPROXIMATE ONLY FOR ESTIMATING PURPOSES AND THE ACTUAL DIMENSIONS SHALL BE DETERMINED BY THE CONTRACTOR FROM FIELD CONDITIONS.
3. WHEN SPECIFIED ON THE PLANS THE INVERT IS TO BE SHAPED IN ACCORDANCE WITH STANDARD IS-1. THE COST OF FURNISHING AND PLACING ALL MATERIALS INCIDENTAL TO THE SHAPING IS TO BE INCLUDED IN THE BID PRICE FOR THE STRUCTURE.
4. IN THE EVENT THE INVERT OF THE OUTFALL PIPE IS HIGHER THAN THE BOTTOM OF THE STRUCTURE, THE INVERT OF THE STRUCTURE SHALL BE SHAPED WITH CEMENT MORTAR TO PREVENT STANDING OR PONDING OF WATER IN THE STRUCTURE. THE COST OF FURNISHING AND PLACING ALL MATERIALS INCIDENTAL TO THE SHAPING IS TO BE INCLUDED IN THE BID PRICE FOR THE STRUCTURE.
5. STEPS ARE TO BE PROVIDED WHEN H IS 4'-0" OR GREATER. FOR DETAILS SEE STANDARD ST-1.
6. THIS ITEM MAY BE PRECAST OR CAST-IN-PLACE.
7. # 4 DOWELS 12" LONG, 12" C-C TO BE PLACED IN ALL AREAS ADJACENT TO ABUTTING CONCRETE TO PREVENT SETTLEMENT.
8. 3" DIAMETER WEEP HOLE 12"X12" PLASTIC HARDWARE CLOTH 1/4" MESH OR GALVANIZED STEEL WIRE, MINIMUM WIRE DIAMETER 0.03", NUMBER 4 MESH HARDWARE CLOTH ANCHORED FIRMLY TO THE OUTSIDE OF THE STRUCTURE.
9. ALL REINFORCING STEEL SHALL HAVE A MIN. COVER OF 2".
10. ALL REINFORCING STEEL TO BE CUT CLEAR OF ALL OPENINGS BY 2".
11. CAST-IN PLACE CONCRETE IS TO BE CLASS A3 (3000 PSI). PRECAST CONCRETE IS TO BE 4000 PSI.
12. LENGTH OF SLOT (L) WILL, IN EVERY CASE, BE SHOWN ON PLANS.
13. ALL REINFORCING BARS TO BE #4.
14. DI-12C CONCRETE GUTTER INCREMENT: ADD 0.07 CU. YDS. CLASS A3 CONCRETE FOR EACH ADDITIONAL FOOT OF SLOT LENGTH GREATER THAN MINIMUM 3'-8".
15. GRATE BARS TO BE INSTALLED SO THEY WILL BE ALIGNED PARALLEL TO THE DITCH FLOW.
16. IF NORMAL DITCH GRADE IS TOO FLAT TO ALLOW FOR ADJUSTED GRADE TO INLET A SPECIAL GUTTER DETAIL WILL BE REQUIRED ON PLANS.
17. DI-12B----NO GUTTER. DI-12C----PERIPHERAL GUTTER.
18. PAVED DITCHES ARE TO BE TRANSITIONED TO MEET INLET GUTTER AS SHOWN IN STANDARD PG-2A.
19. QUANTITIES SHOWN ARE FOR INLETS WITHOUT PIPES. PIPE DISPLACEMENTS MUST BE DEDUCTED TO OBTAIN TRUE QUANTITIES.
20. PAVED TRANSITION WHERE REQUIRED ON PLANS. TRANSITION IS TO BE SHAPED TO CONFORM TO ROUNDED CONCRETE GUTTER OF DI-12C.
21. TYPE I GRATE: LIMITED ACCESS AND RURAL UNLIMITED ACCESS. PEDESTRIAN ACCESS UNLIKELY.
22. TYPE II GRATE: URBAN AREAS; PEDESTRIAN ACCESSIBLE AREAS.
23. L = LENGTH ROUNDED FOR PLAN USE.
24. DI-12C: FOR APPROX. QUANTITIES FOR DI-12C, ADD 0.36 CU. YDS. OF CLASS A3 CONCRETE TO DI-12B QUANTITIES FOR CONCRETE GUTTER. QUANTITY SHOWN IS FOR A MINIMUM SLOT LENGTH OF 3'-8". FOR OTHER LENGTHS SEE CONCRETE GUTTER INCREMENT BELOW.
25. DI-12B AND DI-12C ARE NOT TO BE UTILIZED IN LOCATIONS NORMALLY SUBJECT TO TRAFFIC.

TABULATION CHARTS

APPROXIMATE QUANTITIES DI-12B ONLY (SEE NOTES 19 & 24)					
(MINIMUM HEIGHT) SLOT 4' TO 14' (SEE NOTE 23)					
L (SEE NOTE 23)	L1	CONCRETE CU. YDS.	REINFORCING STEEL LBS.	NUMBER GRATES	CONCRETE CHAMBER INCREMENTS PER FOOT CU. YDS.
4	3'-8"	0.99	81.27	2	.35
6	5'-8 3/4"	1.28	122.81	3	
8	7'-8"	1.48	161.90	4	
10	9'-8 3/4"	1.79	203.37	5	
12	11'-8"	2.09	242.45	6	
14	13'-8 3/4"	2.40	283.93	7	

NOTE: SEE GRATE DIMENSION TABLE FOR GRATE TYPE I & II DIMENSIONS

GRATE DIMENSIONS				
GRATE TYPE	OPENING WIDTH (1)	BAR THICKNESS (2)	END SECTION WIDTH (3)	GRATE THICKNESS (4)
TYPE I	3 1/4" 5 OPENINGS	1 3/8" 4 BARS	2 1/8"	3 3/4"
TYPE II	1 1/2" 8 OPENINGS	1 3/8" 7 BARS	2 3/16"	3 3/4"

SHEET 2 OF 2

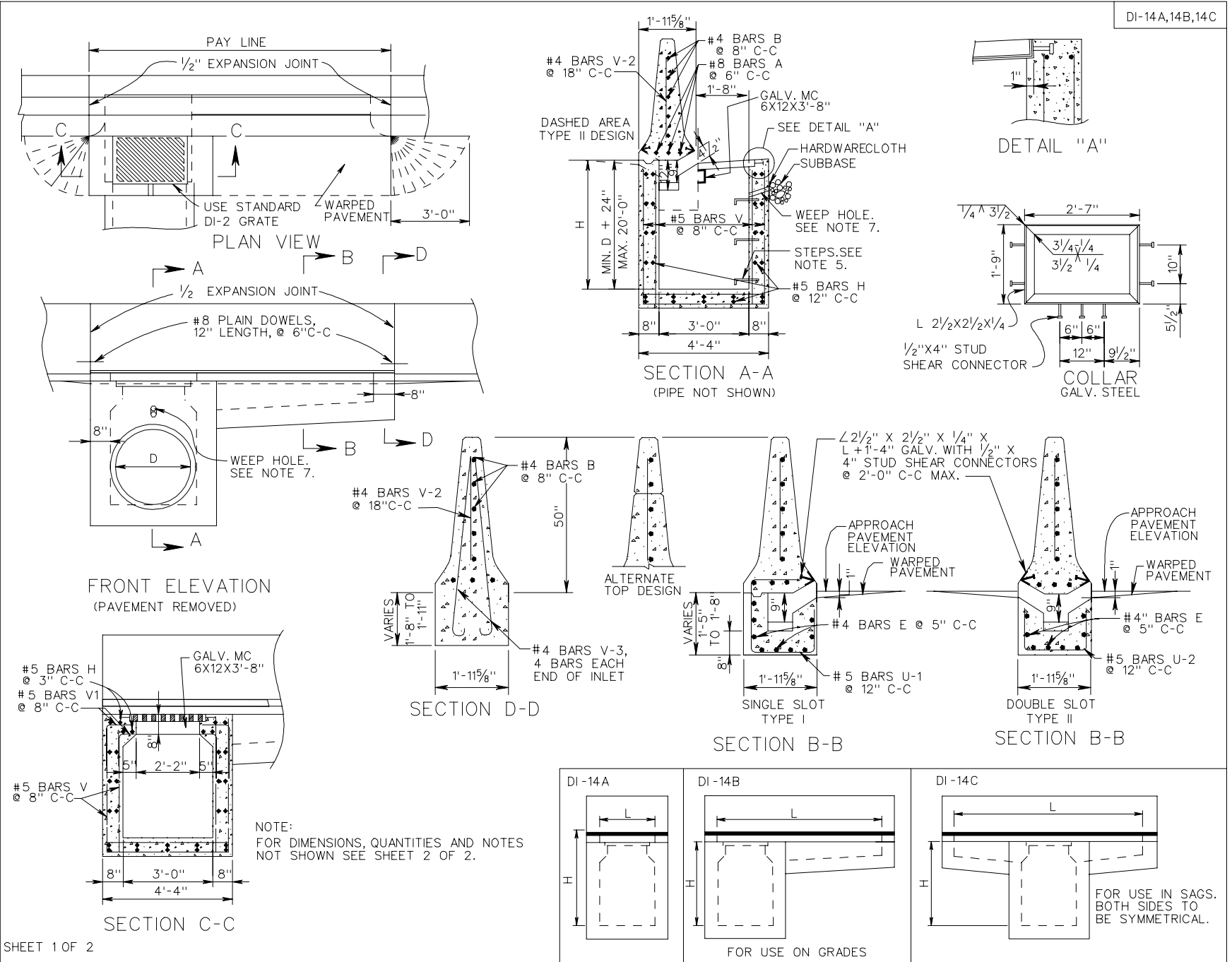
SPECIFICATION REFERENCE
241 503

MULTIGRATE DROP INLET
FOR PIPE SIZES 12" TO 36"

VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 2/06

104.34



SHEET 1 OF 2

SPECIFICATION REFERENCE
233 302

CONCRETE MEDIAN BARRIER DROP INLET
 12"-36" PIPE: DEPTH (H)=20'-0" MAX.

VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 2/06
 104.38

DI-14A, 14B, 14C

TABLE OF QUANTITIES

TYPE	L	CONCRETE				REINFORCING STEEL																			
		Type I	Type II	BARS A		BARS B		BARS E		BARS H		BARS U-1		BARS U-2		BARS V		BARS V-1		BARS V-2		BARS V-3		TYPE I	TYPE II
		FT.	CU. YD.	CU. YD.	NO.	LN.*FT.	NO.	LN.*FT.	NO.	LN.*FT.	NO.	LN.*FT.	NO.	LN.*FT.	NO.	LN.*FT.	NO.	LN.*FT.	NO.	LN.*FT.	NO.	LN.*FT.	NO.	LN.*FT.	Lbs.
DI-14A	3'	2.23	2.20	3	4'-0"	5	4'-0"	-	-	38	4'-0"	-	-	-	-	48	3'-4"	12	2'-6"	3	3'-8"	8	5'-9"	455	455
DI-14B	4'	2.45	2.44	3	5'-0"	5	5'-0"	8	1'-4"	38	4'-0"	2	5'-2" TO 5'-8"	2	3'-1" TO 3'-7"	48	3'-4"	12	2'-6"	4	3'-8"	8	5'-9"	485	480
	6'	2.91	2.89	3	7'-0"	5	7'-0"	8	3'-4"	38	4'-0"	4	5'-2" TO 5'-8"	4	3'-1" TO 3'-7"	48	3'-4"	12	2'-6"	5	3'-8"	8	5'-9"	528	519
	8'	3.36	3.34	3	9'-0"	5	9'-0"	8	5'-4"	38	4'-0"	6	5'-2" TO 5'-8"	6	3'-1" TO 3'-7"	48	3'-4"	12	2'-6"	7	3'-8"	8	5'-9"	573	560
	10'	3.82	3.78	3	11'-0"	5	11'-0"	8	7'-4"	38	4'-0"	8	5'-2" TO 5'-8"	8	3'-1" TO 3'-7"	48	3'-4"	12	2'-6"	8	3'-8"	8	5'-9"	617	600
	12'	4.28	4.24	3	13'-0"	5	13'-0"	8	9'-4"	38	4'-0"	10	5'-2" TO 5'-8"	10	3'-1" TO 3'-7"	48	3'-4"	12	2'-6"	9	3'-8"	8	5'-9"	660	639
	14'	4.74	4.69	3	15'-0"	5	15'-0"	8	11'-4"	38	4'-0"	12	5'-2" TO 5'-8"	12	3'-1" TO 3'-7"	48	3'-4"	12	2'-6"	11	3'-8"	8	5'-9"	706	679
	16'	5.20	5.14	3	17'-0"	5	17'-0"	8	13'-4"	38	4'-0"	14	5'-2" TO 5'-8"	14	3'-1" TO 3'-7"	48	3'-4"	12	2'-6"	12	3'-8"	8	5'-9"	749	719
	18'	5.67	5.61	3	19'-0"	5	19'-0"	8	15'-4"	38	4'-0"	16	5'-2" TO 5'-8"	16	3'-1" TO 3'-7"	48	3'-4"	12	2'-6"	13	3'-8"	8	5'-9"	793	758
	20'	6.13	6.06	3	21'-0"	5	21'-0"	8	17'-4"	38	4'-0"	18	5'-2" TO 5'-8"	18	3'-1" TO 3'-7"	48	3'-4"	12	2'-6"	15	3'-8"	8	5'-9"	838	799
DI-14C	6'	2.91	2.89	3	7'-0"	5	7'-0"	16	2'-0"	38	4'-0"	6	5'-2" TO 5'-8"	6	3'-1" TO 3'-7"	48	3'-4"	12	2'-6"	5	3'-8"	8	5'-9"	543	530
	8'	3.36	3.34	3	9'-0"	5	9'-0"	16	3'-0"	38	4'-0"	8	5'-2" TO 5'-8"	8	3'-1" TO 3'-7"	48	3'-4"	12	2'-6"	7	3'-8"	8	5'-9"	588	571
	10'	3.82	3.79	3	11'-0"	5	11'-0"	16	4'-0"	38	4'-0"	10	5'-2" TO 5'-8"	10	3'-1" TO 3'-7"	48	3'-4"	12	2'-6"	8	3'-8"	8	5'-9"	632	610
	12'	4.28	4.24	3	13'-0"	5	13'-0"	16	5'-0"	38	4'-0"	12	5'-2" TO 5'-8"	12	3'-1" TO 3'-7"	48	3'-4"	12	2'-6"	9	3'-8"	8	5'-9"	675	646
	14'	4.74	4.69	3	15'-0"	5	15'-0"	16	6'-0"	38	4'-0"	14	5'-2" TO 5'-8"	14	3'-1" TO 3'-7"	48	3'-4"	12	2'-6"	11	3'-8"	8	5'-9"	720	690
	16'	5.20	5.14	3	17'-0"	5	17'-0"	16	7'-0"	38	4'-0"	16	5'-2" TO 5'-8"	16	3'-1" TO 3'-7"	48	3'-4"	12	2'-6"	12	3'-8"	8	5'-9"	764	729
	18'	5.67	5.61	3	19'-0"	5	19'-0"	16	8'-0"	38	4'-0"	18	5'-2" TO 5'-8"	18	3'-1" TO 3'-7"	48	3'-4"	12	2'-6"	13	3'-8"	8	5'-9"	807	768
	20'	6.13	6.06	3	21'-0"	5	21'-0"	16	9'-0"	38	4'-0"	20	5'-2" TO 5'-8"	20	3'-1" TO 3'-7"	48	3'-4"	12	2'-6"	15	3'-8"	8	5'-9"	853	809

NOTES

- DEPTH OF INLET (H) TO BE SHOWN ON PLANS.
- THE "H" DIMENSION SHOWN ON THE STANDARDS AND SPECIFIED ON THE PLANS WILL BE MEASURED FROM THE INVERT OF THE OUTFALL PIPE TO THE TOP OF THE STRUCTURE. PLAN "H" DIMENSIONS ARE APPROXIMATE ONLY FOR ESTIMATING PURPOSES AND THE ACTUAL DIMENSIONS SHALL BE DETERMINED BY THE CONTRACTOR FROM FIELD CONDITIONS.
- WHEN SPECIFIED ON THE PLANS THE INVERT IS TO BE SHAPED IN ACCORDANCE WITH STANDARD IS-1. THE COST OF FURNISHING AND PLACING ALL MATERIALS INCIDENTAL TO THE SHAPING IS TO BE INCLUDED IN THE BID PRICE FOR THE STRUCTURE.
- IN THE EVENT THE INVERT OF THE OUTFALL PIPE IS HIGHER THAN THE BOTTOM OF THE STRUCTURE, THE INVERT OF THE STRUCTURE SHALL BE SHAPED WITH CEMENT MORTAR TO PREVENT STANDING OR PONDING OF WATER IN THE STRUCTURE. THE COST OF FURNISHING AND PLACING ALL MATERIALS INCIDENTAL TO THE SHAPING IS TO BE INCLUDED IN THE BID PRICE FOR THE STRUCTURE.
- STEPS ARE TO BE PROVIDED WHEN H IS 4'-0" OR GREATER. FOR DETAILS SEE STANDARD ST-1.
- THIS ITEM MAY BE PRECAST OR CAST-IN-PLACE.
- 3" DIAMETER WEEP HOLE TO BE LOCATED TO DRAIN SUBBASE MATERIAL. WEEP HOLE WITH 12"X12" PLASTIC HARDWARE CLOTH 1/4" MESH OR GALVANIZED STEEL WIRE, MINIMUM WIRE DIAMETER 0.03", NUMBER 4 MESH HARDWARE CLOTH ANCHORED FIRMLY TO THE OUTSIDE OF THE STRUCTURE.
- ALL REINFORCING STEEL SHALL HAVE A MIN. COVER OF 2".
- ALL REINFORCING STEEL TO BE CUT CLEAR OF ALL OPENINGS BY 2".
- CAST-IN PLACE CONCRETE IS TO BE CLASS A3 (3000 PSI). PRECAST CONCRETE IS TO BE 4000 PSI.
- LENGTH OF SLOT (L) WILL, IN EVERY CASE, BE SHOWN ON PLANS.
- CONCRETE QUANTITIES SHOWN ARE FOR DEPTH (H) OF 3'-0" WITHOUT PIPES. THE AMOUNT DISPLACED BY PIPES MUST BE DEDUCTED TO OBTAIN TRUE QUANTITIES. FOR INLETS OF DIFFERENT DEPTHS ADD OR SUBTRACT 0.36 CUBIC YARDS OF CONCRETE FOR EACH FOOT OF DEPTH. AND 84 LBS. OF REINFORCING STEEL.
- LENGTH OF ANGLE IRON AS SHOWN ON SHEET 1 OF 2 IS TO BE L +16" AT 4.10 LBS./FT..
- * DENOTES LENGTH OF ONE (1) BAR.
- GRATE TO BE INSTALLED SO SLOTS WILL DIRECT WATER TOWARD THE INLET THROAT. GRATE MUST BE REVERSIBLE (RIGHT HAND GRATE IS SHOWN).
- PROVIDE SAFETY SLABS WHEN SPECIFIED ON THE PLANS.
- FOR DETAILS AND DIMENSIONS NOT SHOWN FOR MEDIAN BARRIER SEE STANDARD MB-12.
- QUANTITIES INCLUDE MB-12.

SHEET 2 OF 2

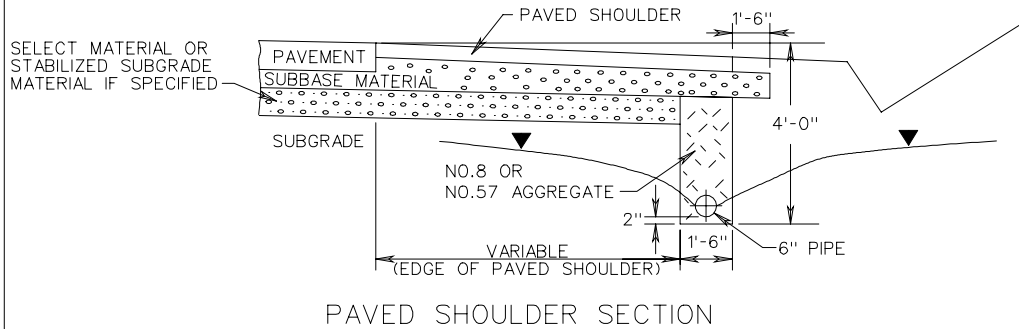
CONCRETE MEDIAN BARRIER DROP INLET
 12"-36" PIPE: DEPTH (H) = 20'-0" MAX.
 VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION
 REFERENCE

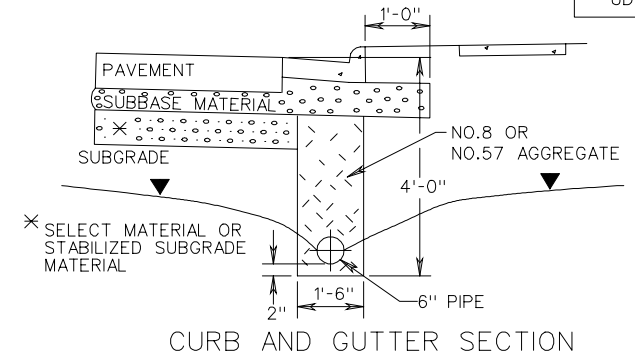
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REV. 2/06

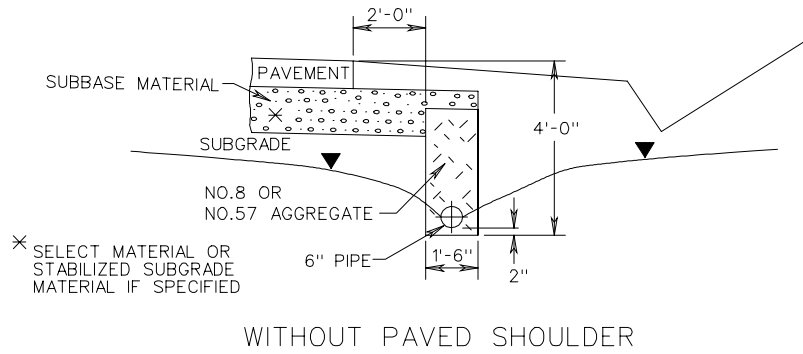
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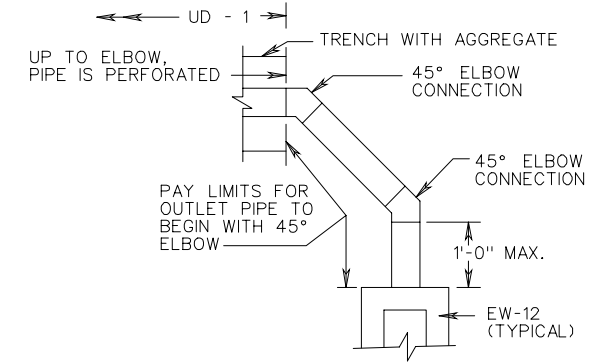
PAVED SHOULDER SECTION



CURB AND GUTTER SECTION



WITHOUT PAVED SHOULDER



PLAN VIEW OF OUTLET PIPE AT FILL

LONGITUDINAL PERFORATED PIPE

TYPE OF PIPE	CRUSHING STRENGTH	
	W.T.	6" NOMINAL DIAMETER
SMOOTH WALL PVC	.153	
CORRUGATED PE		AASHTO M-252

NON-PERFORATED OUTLET PIPE

TYPE OF PIPE	CRUSHING STRENGTH	
	W.T.	6" NOMINAL DIAMETER
SMOOTH WALL PVC	.153	
SMOOTH WALL PE		70 PSI ***

※ WALL THICKNESS (MIN) - INCHES
 *** TESTED ACCORDING TO ASTM D-2412 AT 5% DEFLECTION.

NOTES:

- WHERE THE LONGITUDINAL PERFORATED PIPE ALIGNS WITH A DRAINAGE STRUCTURE (DROP INLET, MANHOLE, ETC.), A NON-PERFORATED OUTLET PIPE IS NOT REQUIRED. INSTEAD, THE PERFORATED PIPE IS TO BE CONNECTED DIRECTLY TO THE DRAINAGE STRUCTURE. WHERE THE LONGITUDINAL PERFORATED PIPE IS CONTINUOUS, IT SHALL BE CONNECTED TO EACH SIDE OF THE DRAINAGE STRUCTURE.
- INVERT ELEVATION AT OUTLET END OF OUTLET PIPE TO BE A MINIMUM OF 1'-0" ABOVE INVERT ELEVATION OF RECEIVING DRAINAGE DITCH OR STRUCTURE.
- ALL CONNECTIONS (ELBOWS, WYES, ETC.) WITHIN PAY LIMITS FOR OUTLET PIPE ARE TO BE OF THE SAME CRUSHING STRENGTH AS THE OUTLET PIPE.
- OUTLET PIPE ARE TO BE INSTALLED ON 2% MIN. (3% DESIRABLE) GRADE.
- THE NORMAL DEPTH OF UNDERDRAIN IS TO BE 4'-0" BELOW THE NEAR EDGE OF PAVEMENT AS SHOWN. THE LONGITUDINAL GRADE OF THE UNDERDRAIN SHALL FOLLOW THAT OF THE ROADWAY WITH A MINIMUM GRADE OF 0.2 %
- WHERE THE BOTTOM OF SELECT MATERIAL IS GREATER THAN 4'-0" BELOW THE PAVEMENT, THE BOTTOM OF THE UNDERDRAIN IS TO BE COINCIDENT WITH THE BOTTOM OF SELECT MATERIAL AND THE TRENCH DEPTH AND BACKFILL QUANTITY INCREASED ACCORDINGLY.
- WHEN USED WITH STABILIZED OPEN-GRADED DRAINAGE LAYER, THE BOTTOM OF THE CURB AND GUTTER SHALL BE CONSTRUCTED PARALLEL TO THE SLOPE OF SUBBASE COURSES OUT TO THE DEPTH OF THE PAVEMENT.
- OUTLET PIPE TO BE SECURELY CONNECTED TO EW-12 OR OTHER DRAINAGE STRUCTURE.
- ▼ DENOTES WATER TABLE.
- OUTLET PIPE CONFIGURATION TO PROVIDE FOR PASSAGE OF INSPECTION CAMERA WITH 2 1/2" I. D. HEAD.

SPECIFICATION REFERENCE
240
501
701

STANDARD GROUNDWATER UNDERDRAIN

VIRGINIA DEPARTMENT OF TRANSPORTATION

UD-2

LONGITUDINAL PERFORATED PIPE

TYPE OF PIPE	CRUSHING STRENGTH	
	W.T.	6" NOMINAL DIAMETER
SMOOTH WALL PVC	0.153	
CORRUGATED PE		AASHTO M-252

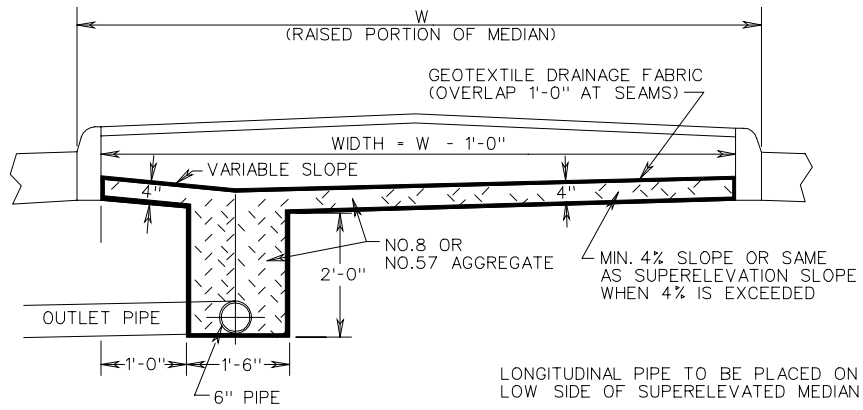
NON-PERFORATED OUTLET PIPE

TYPE OF PIPE	CRUSHING STRENGTH	
	W.T.	6" NOMINAL DIAMETER
SMOOTH WALL PVC	0.153	
SMOOTH WALL PE		70 PSI ×××

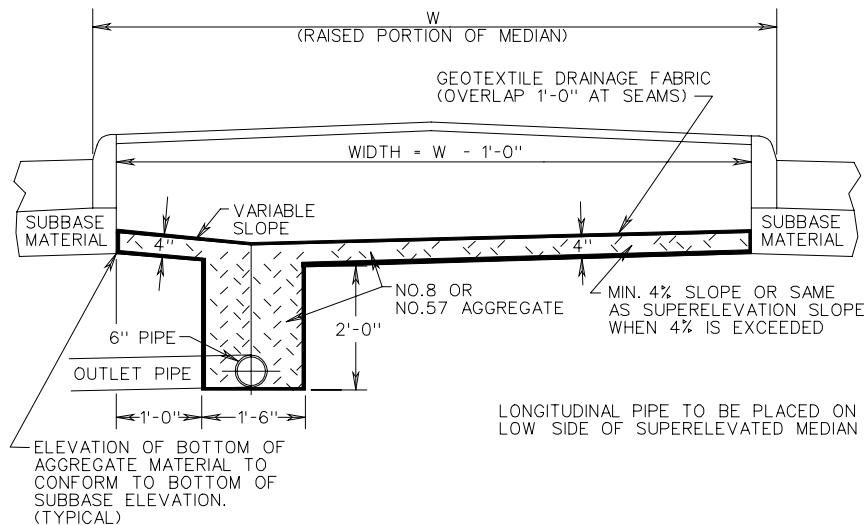
× WALL THICKNESS (MIN) - INCHES
 ××× TESTED ACCORDING TO ASTM D-2412 AT 5% DEFLECTION.

NOTES:

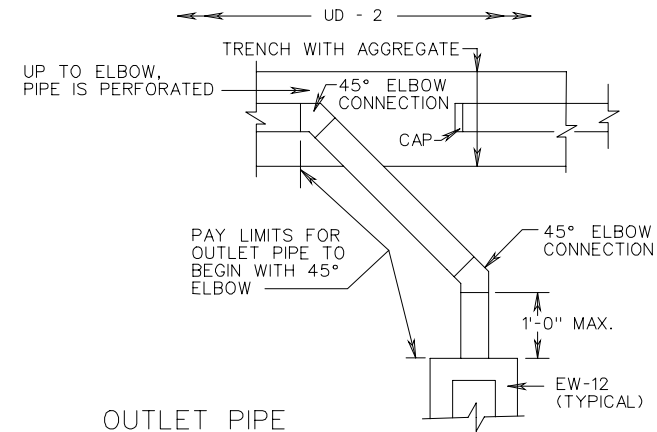
1. WHERE THE LONGITUDINAL PERFORATED PIPE ALIGNS WITH A DRAINAGE STRUCTURE (DROP INLET, MANHOLE, ETC.), A NON-PERFORATED OUTLET PIPE IS NOT REQUIRED. INSTEAD, THE PERFORATED PIPE IS TO BE CONNECTED DIRECTLY TO THE DRAINAGE STRUCTURE. WHERE THE LONGITUDINAL PERFORATED PIPE IS CONTINUOUS, IT SHALL BE CONNECTED TO EACH SIDE OF THE DRAINAGE STRUCTURE.
2. INVERT ELEVATION AT OUTLET END OF OUTLET PIPE TO BE A MINIMUM OF 1'-0" ABOVE INVERT ELEVATION OF RECEIVING DRAINAGE DITCH OR STRUCTURE.
3. ALL CONNECTIONS (ELBOWS, WYES, ETC.) WITHIN PAY LIMITS FOR OUTLET PIPE ARE TO BE OF THE SAME CRUSHING STRENGTH AS THE OUTLET PIPE.
4. OUTLET PIPE ARE TO BE INSTALLED ON 2% MIN. (3% DESIRABLE) GRADE AND LOCATED AT A MAXIMUM OF 500' APART.
5. OUTLET PIPE TO BE SECURELY CONNECTED TO EW-12 OR OTHER DRAINAGE STRUCTURE.
6. WHEN UNDERDRAIN MUST TRAVERSE UNDER CROSSOVER LOCATIONS, NON-PERFORATED OUTLET PIPE ONLY IS TO BE USED UNDER CROSSOVER PAVEMENT.



WITHOUT SUBBASE MATERIAL



WITH SUBBASE MATERIAL



OUTLET PIPE

STANDARD UNDERDRAIN FOR USE WITH RAISED GRASS MEDIAN STRIPS

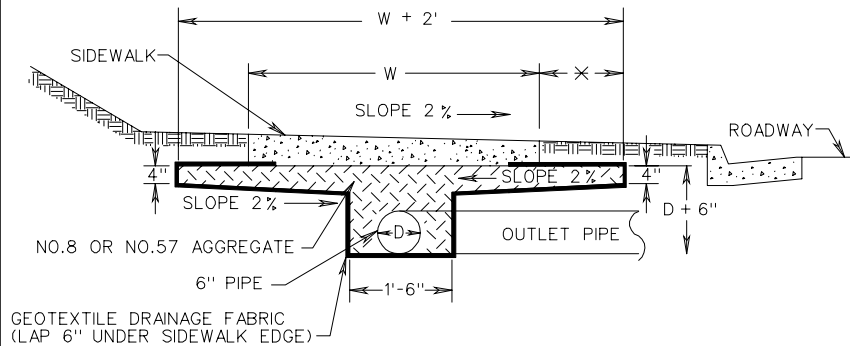
VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE

240
501
701

REV. 2/06

108.02



✗ THIS PORTION TO BE DELETED WHEN SIDEWALK IS ADJACENT TO CURB OR CURB AND GUTTER WITH NO BUFFER STRIP.

NOTES:

1. WHERE THE LONGITUDINAL PERFORATED PIPE ALIGNS WITH A DRAINAGE STRUCTURE (DROP INLET, MANHOLE, ETC.), A NON-PERFORATED OUTLET PIPE IS NOT REQUIRED. INSTEAD, THE PERFORATED PIPE IS TO BE CONNECTED DIRECTLY TO THE DRAINAGE STRUCTURE. WHERE THE LONGITUDINAL PERFORATED PIPE IS CONTINUOUS, IT SHALL BE CONNECTED TO EACH SIDE OF THE DRAINAGE STRUCTURE.
2. INVERT ELEVATION AT OUTLET END OF OUTLET PIPE TO BE A MINIMUM OF 1'-0" ABOVE INVERT ELEVATION OF RECEIVING DRAINAGE DITCH OR STRUCTURE.
3. ALL CONNECTIONS (ELBOWS, WYES, ETC.) WITHIN PAY LIMITS FOR OUTLET PIPE ARE TO BE OF THE SAME CRUSHING STRENGTH AS THE OUTLET PIPE.
4. OUTLET PIPE ARE TO BE INSTALLED ON 2 1/2% MIN. (3 1/2% DESIRABLE) GRADE.
5. OUTLET PIPE TO BE SECURELY CONNECTED TO EW-12 OR OTHER DRAINAGE STRUCTURE.
6. SIDEWALK UNDERDRAIN IS TO BE USED WHEN THE SIDEWALK LONGITUDINAL GRADIENT IS 3% OR MORE AND WHEN THE UNDERLYING SOIL HAS 34% OR MORE PASSING THE NO. 200 SIEVE, AND HAS A P10F 13 OR LESS, AND THE AREA HAS A HISTORY OF SIDEWALK UNDERMINING.
7. SIDEWALK UNDERDRAINS SHOULD BE TIED INTO THE STORM SEWER SYSTEM AT POINTS APPROXIMATELY A CITY BLOCK APART. UNDERDRAIN RUNS MUST NOT EXCEED 1,000 FEET IN LENGTH WITHOUT DISCHARGING INTO THE STORM DRAIN SYSTEM OR INTO AN OPEN DRAIN.
8. WITHIN THE LIMITS OF A COMMERCIAL ENTRANCE, NON-PERFORATED PIPE SHALL BE UTILIZED IN LIEU OF PERFORATED PIPE.

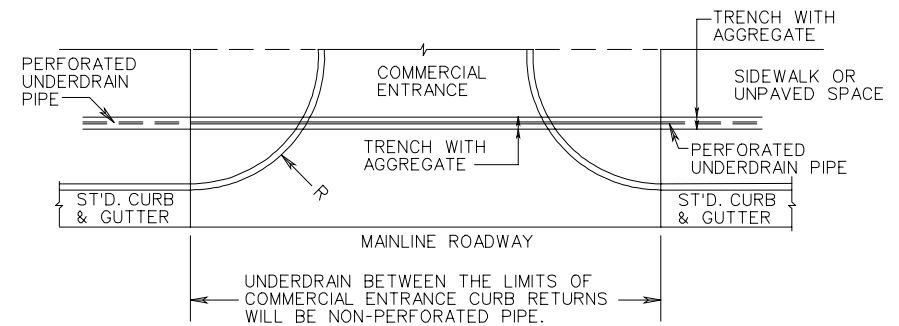
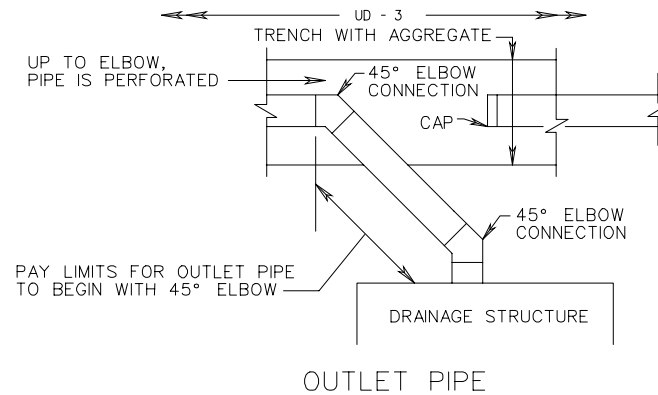
LONGITUDINAL PERFORATED PIPE

TYPE OF PIPE	CRUSHING STRENGTH	
	✗ W.T.	6" NOMINAL DIAMETER
SMOOTH WALL PVC	0.153	
CORRUGATED PE		AASHTO M-252

NON-PERFORATED PIPE FOR USE UNDER COMMERCIAL ENTRANCES AND FOR OUTLETS

TYPE OF PIPE	CRUSHING STRENGTH	
	✗ W.T.	6" NOMINAL DIAMETER
SMOOTH WALL PVC	0.153	
SMOOTH WALL PE		70 PSI ✗✗✗

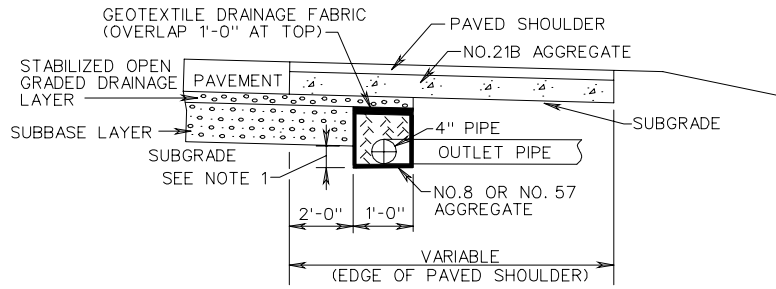
✗ WALL THICKNESS (MIN) - INCHES
 ✗✗✗ TESTED ACCORDING TO ASTM D-2412 AT 5% DEFLECTION.



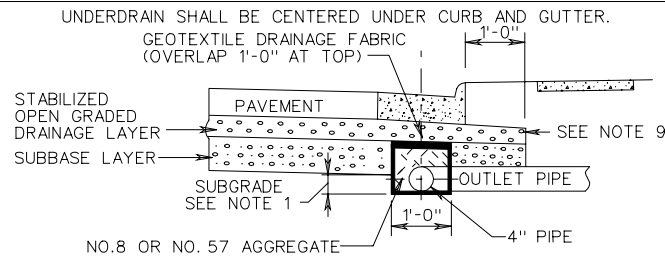
SPECIFICATION REFERENCE
232
501
701

STANDARD SIDEWALK UNDERDRAIN

UD-4



PAVED SHOULDER SECTION
(FOR USE WITH STABILIZED OPEN-GRADED DRAINAGE LAYER)



CURB AND GUTTER SECTION
(FOR USE WITH STABILIZED OPEN-GRADED DRAINAGE LAYER)

NOTES:

- 4" MINIMUM, PROVIDED ATTAINING MINIMUM 4" OF AGGREGATE ON TOP OF PIPE.
- WHERE THE LONGITUDINAL PERFORATED PIPE ALIGNS WITH A DRAINAGE STRUCTURE (DROP INLET, MANHOLE, ETC.), A NON-PERFORATED OUTLET PIPE IS NOT REQUIRED. INSTEAD, THE PERFORATED PIPE IS TO BE CONNECTED DIRECTLY TO THE DRAINAGE STRUCTURE. WHERE THE LONGITUDINAL PERFORATED PIPE IS CONTINUOUS, IT SHALL BE CONNECTED TO EACH SIDE OF THE DRAINAGE STRUCTURE.
- INVERT ELEVATION AT OUTLET END OF OUTLET PIPE TO BE A MINIMUM OF 1'-0" ABOVE INVERT ELEVATION OF RECEIVING DRAINAGE DITCH OR STRUCTURE.
- ALL CONNECTIONS (ELBOWS, WYES, ETC.) WITHIN PAY LIMITS FOR OUTLET PIPE ARE TO BE OF THE SAME CRUSHING STRENGTH AS THE OUTLET PIPE.
- OUTLET PIPES ARE TO BE INSTALLED ON 2% MIN. (3% DESIRABLE) GRADE AND LOCATED EVERY 350' MAXIMUM OR AS NOTED ON PLANS.
- OUTLET PIPE TO BE SECURELY CONNECTED TO EW-12 OR OTHER DRAINAGE STRUCTURE.
- WITHIN THE LIMITS OF A COMMERCIAL ENTRANCE, NON-PERFORATED PIPE SHALL BE UTILIZED IN LIEU OF PERFORATED PIPE.
- THE LENGTH OF PIPE BETWEEN THE WYE CONNECTION AND THE EW-12 SHALL BE LIMITED TO NO MORE THAN 1'-0" TO PERMIT CAMERA INSPECTION OF THE MAIN LINE IN EITHER DIRECTION.
- IN SITUATIONS WHEN FULL DEPTH OF STABILIZED OPEN-GRADED MATERIAL CANNOT BE MAINTAINED UNDER CURB AND GUTTER, NO. 21B AGGREGATE SHALL BE USED UNDER CURB AND GUTTER. NO. 21B AGGREGATE MAY ALSO BE USED FROM TOP OF STABILIZED OPEN-GRADED MATERIAL LAYER AND CURB AND GUTTER.

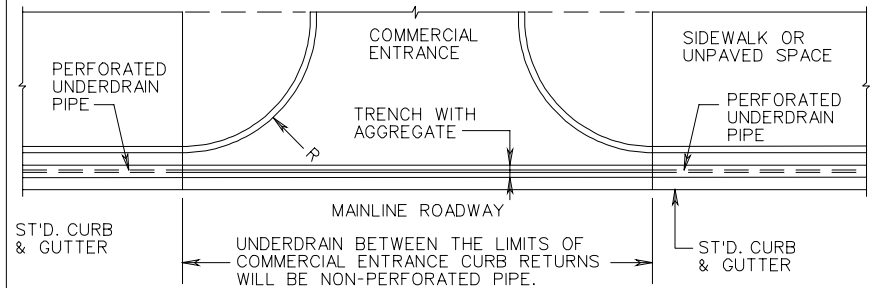
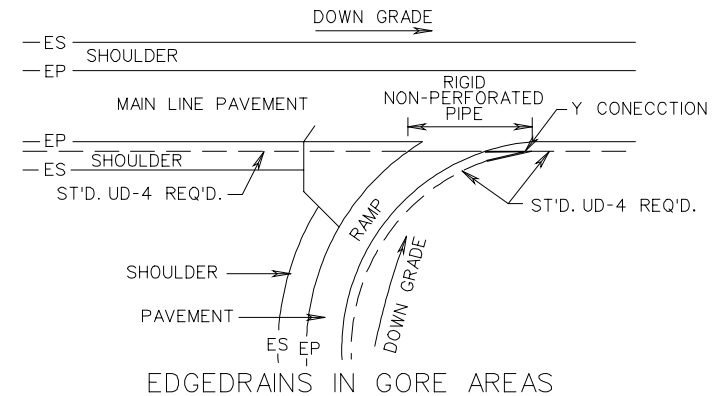
LONGITUDINAL PERFORATED PIPE

TYPE OF PIPE	CRUSHING STRENGTH	
	W.T.	4" NOM. DIAMETER
SMOOTH WALL PVC	.103	
CORRUGATED PE		AASHTO M-252

NON-PERFORATED OUTLET PIPE FOR USE UNDER COMMERCIAL ENTRANCES AND FOR OUTLETS

TYPE OF PIPE	CRUSHING STRENGTH	
	W.T.	4" NOM. DIAMETER
SMOOTH WALL PVC	.103	
SMOOTH WALL PE		70 PSI ***

※ WALL THICKNESS (MIN) - INCHES
*** TESTED ACCORDING TO ASTM D-2412 AT 5% DEFLECTION.



SHEET 2 OF 2

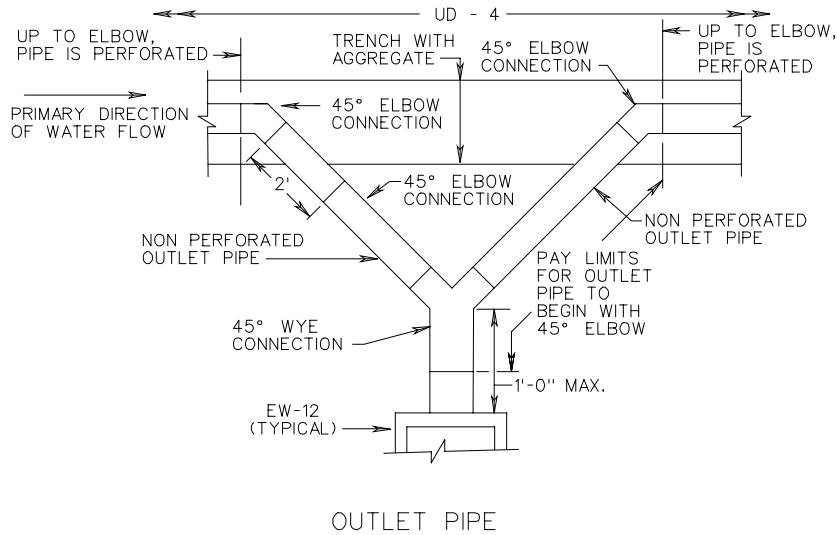
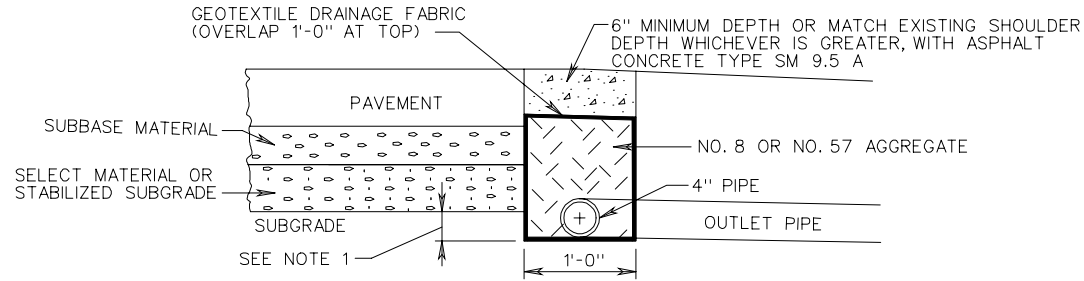
SPECIFICATION REFERENCE
240
258
501
701

STANDARD PAVEMENT EDGEDRAIN

VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 2/06

108.07



NOTES:

1. 4" MINIMUM, PROVIDED ATTAINING MINIMUM 4" OF AGGREGATE ON TOP OF PIPE.
2. WHERE THE LONGITUDINAL PERFORATED PIPE ALIGNS WITH A DRAINAGE STRUCTURE (DROP INLET, MANHOLE, ETC.), A NON-PERFORATED OUTLET PIPE IS NOT REQUIRED. INSTEAD, THE PERFORATED PIPE IS TO BE CONNECTED DIRECTLY TO THE DRAINAGE STRUCTURE. WHERE THE LONGITUDINAL PERFORATED PIPE IS CONTINUOUS, IT SHALL BE CONNECTED TO EACH SIDE OF THE DRAINAGE STRUCTURE.
3. INVERT ELEVATION AT OUTLET END OF OUTLET PIPE TO BE A MINIMUM OF 1'-0" ABOVE INVERT ELEVATION OF RECEIVING DRAINAGE DITCH OR STRUCTURE.
4. ALL CONNECTIONS (ELBOWS, WYES, ETC.) WITHIN PAY LIMITS FOR OUTLET PIPE ARE TO BE OF THE SAME CRUSHING STRENGTH AS THE OUTLET PIPE.
5. OUTLET PIPES ARE TO BE INSTALLED ON 2% MIN. (3% DESIRABLE) GRADE AND LOCATED EVERY 350' MAXIMUM OR AS NOTED ON PLANS.
6. OUTLET PIPE TO BE SECURELY CONNECTED TO EW-12 OR OTHER DRAINAGE STRUCTURE.
7. WITHIN THE LIMITS OF A COMMERCIAL ENTRANCE, NON-PERFORATED PIPE SHALL BE UTILIZED IN LIEU OF PERFORATED PIPE.
8. THE LENGTH OF PIPE BETWEEN THE WYE CONNECTION AND THE EW-12 SHALL BE LIMITED TO NO MORE THAN 1'-0" TO PERMIT CAMERA INSPECTION OF THE MAIN LINE IN EITHER DIRECTION.
9. EXISTING ASPHALT SHOULDER TO BE SAWED TO ACHIEVE A SMOOTH JOINT.

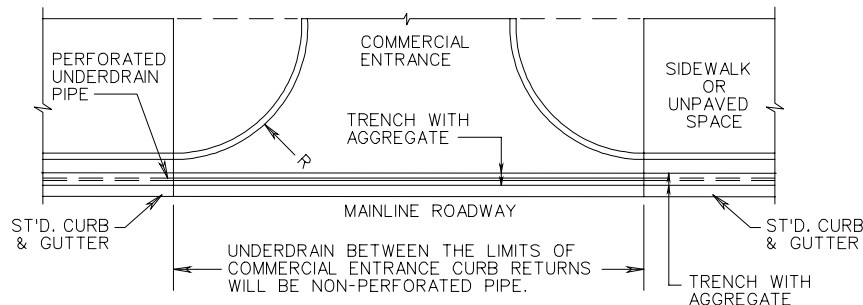
LONGITUDINAL PERFORATED PIPE

TYPE OF PIPE	CRUSHING STRENGTH	
	W.T.	4" NOM. DIAMETER
SMOOTH WALL PVC	.103	
CORRUGATED PE		AASHTO M-252

NON-PERFORATED OUTLET PIPE FOR USE UNDER COMMERCIAL ENTRANCES AND FOR OUTLETS

TYPE OF PIPE	CRUSHING STRENGTH	
	W.T.	4" NOM. DIAMETER
SMOOTH WALL PVC	.103	
SMOOTH WALL PE		70 PSI ***

* WALL THICKNESS (MIN) - INCHES
 *** TESTED ACCORDING TO ASTM D-2412 AT 5% DEFLECTION.

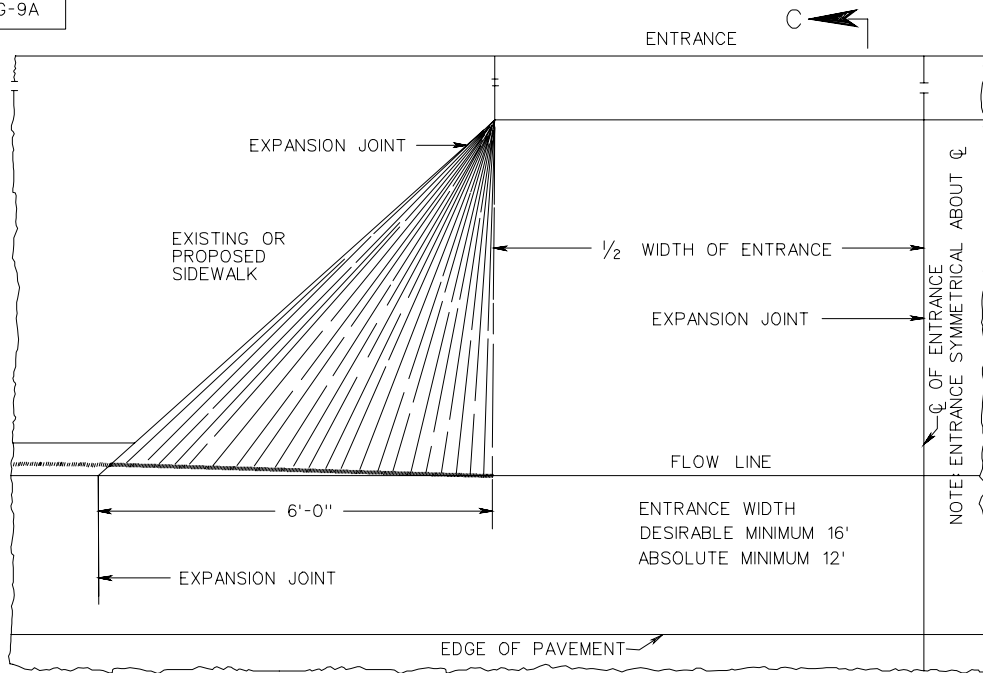


SPECIFICATION REFERENCE
240
501
701

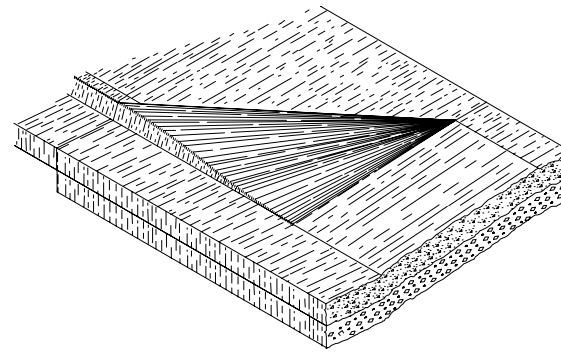
STANDARD RETROFIT EDGEDRAIN

VIRGINIA DEPARTMENT OF TRANSPORTATION

CG-9A

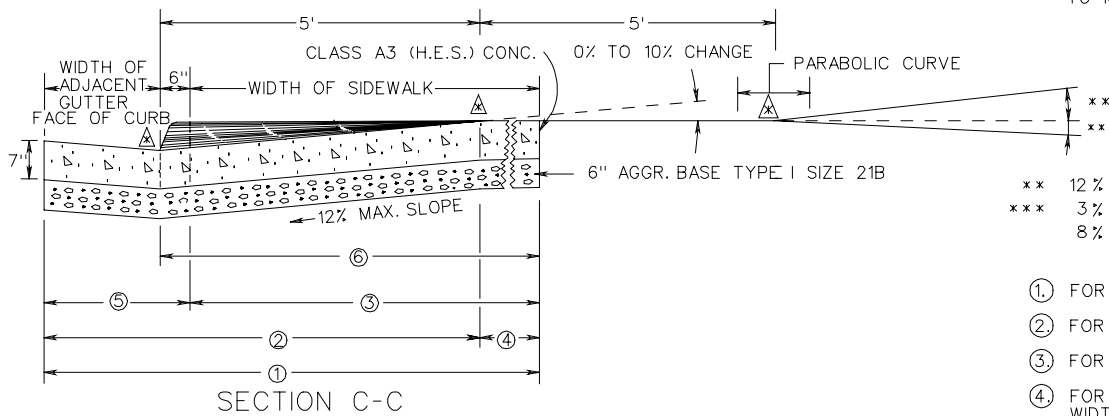


HALF - PLAN



ISOMETRIC VIEW

WHEN USED IN CONJUNCTION WITH STANDARD CG-3 OR CG-7, THE CURB FACE ON THIS STANDARD IS TO BE ADJUSTED TO MATCH THE MOUNTABLE CURB CONFIGURATION.



SECTION C-C

- ** 12% MAXIMUM INCREASE IN SLOPE AT MINIMUM 10' INTERVALS
- *** 3% MAXIMUM DECREASE IN SLOPE FOR FIRST 10' INTERVAL AND 8% MAXIMUM DECREASE FOR SUCCEEDING MINIMUM 10' INTERVALS

- ① FOR SIDEWALK, CURB AND GUTTER - BUILT CONCURRENTLY.
- ② FOR INITIAL CURB AND GUTTER ONLY.
- ③ FOR INITIAL SIDEWALK ONLY - 7" SIDEWALK TO BE DIPPED.
- ④ FOR PEDESTRIAN ACCESS ROUTE - MINIMUM 4'-0" TRAVERSABLE WIDTH IS REQUIRED WITH A MAXIMUM 2% CROSS SLOPE.
- ⑤ FOR CURB AND GUTTER ONLY - AFTER INITIAL SIDEWALK.
- ⑥ FOR CURB AND SIDEWALK ONLY - WITHOUT GUTTER.
- △ INDICATES POINT OF GRADE CHANGE.

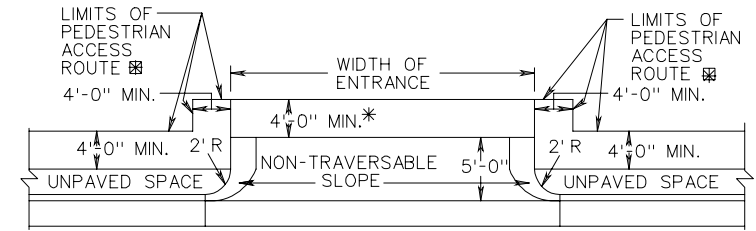
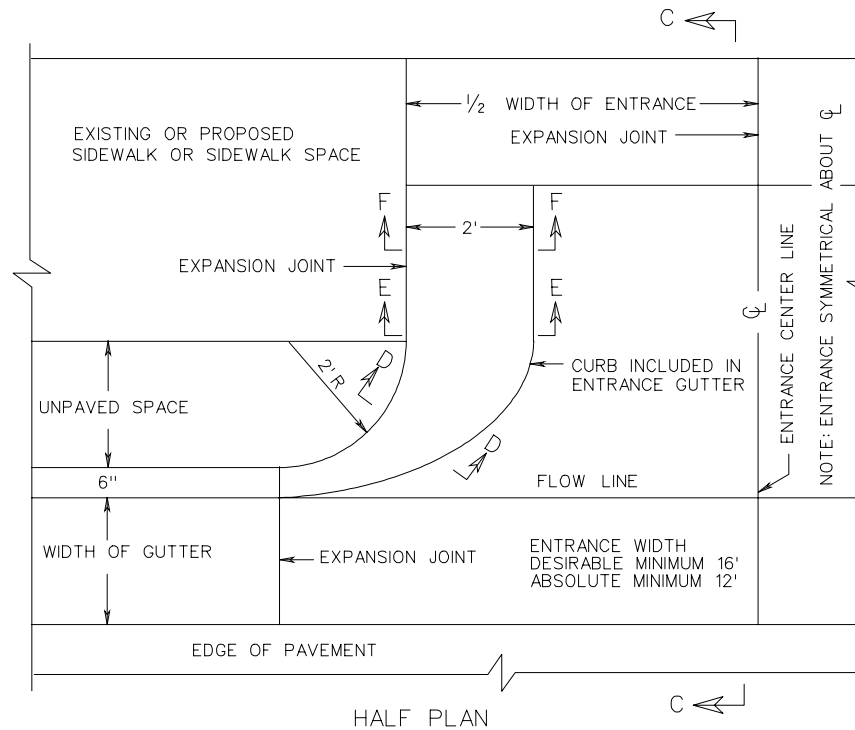
STANDARD ENTRANCE GUTTER WITH FLARED OPENING FOR USE ACROSS SIDEWALK

SPECIFICATION REFERENCE

502

REV. 2/06

203.01

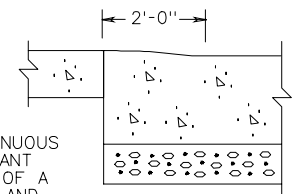


PEDESTRIAN ACCESS ROUTE DETAIL

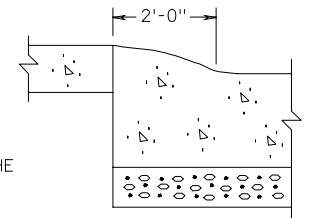
ADDITIONAL RIGHT-OF-WAY IS REQUIRED IF THE LIMITS OF PEDESTRIAN ACCESS ROUTE \boxtimes EXTEND BEYOND EXISTING OR PROPOSED VDOT RIGHT-OF-WAY.

\boxtimes PEDESTRIAN ACCESS ROUTES PROVIDE A CONTINUOUS UNOBSTRUCTED, STABLE, FIRM AND SLIP RESISTANT PATH CONNECTING ALL ACCESSIBLE ELEMENTS OF A FACILITY THAT CAN BE APPROACHED, ENTERED AND USED BY PEDESTRIANS.

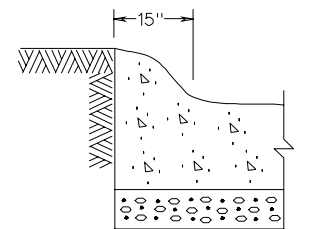
* IF PEDESTRIAN ACCESS ROUTES \boxtimes ARE BEING PROVIDED, A MINIMUM 4' TRAVERSABLE WIDTH IS REQUIRED WITH A MAX. 2% CROSS SLOPE.



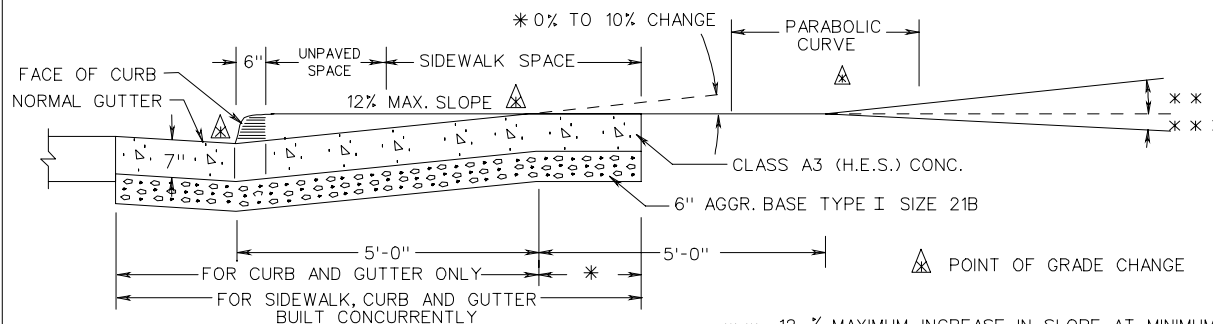
SECTION F-F



SECTION E-E



SECTION D-D



SECTION C-C

* * 12 % MAXIMUM INCREASE IN SLOPE AT MINIMUM 10' INTERVALS
 * * * 3 % MAXIMUM DECREASE IN SLOPE FOR FIRST 10' INTERVAL AND
 8 % MAXIMUM DECREASE FOR SUCCEEDING MINIMUM 10' INTERVALS

SPECIFICATION REFERENCE

502

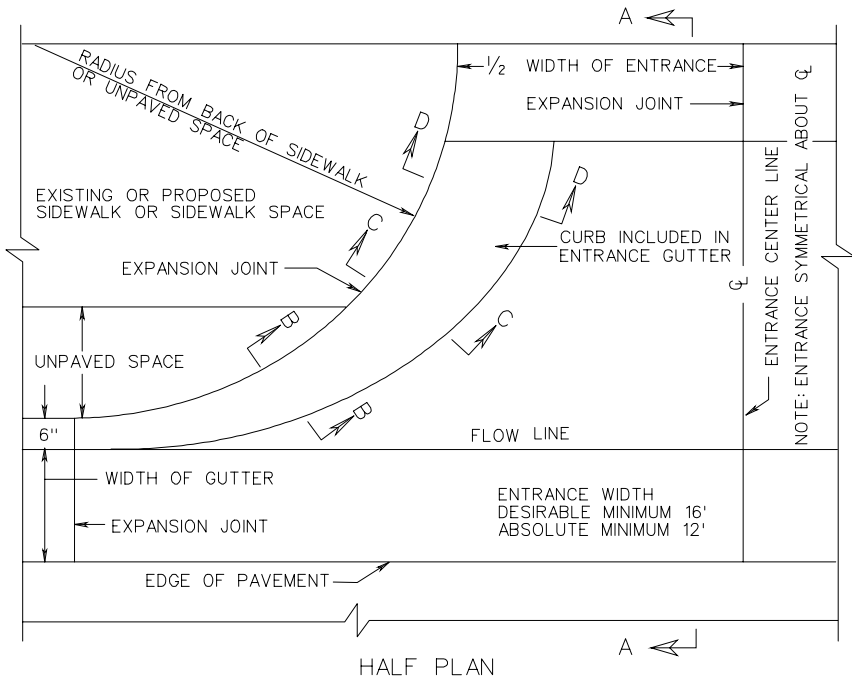
STANDARD ENTRANCE GUTTER FOR USE WITH UNPAVED SPACE BETWEEN CURB & SIDEWALK

VIRGINIA DEPARTMENT OF TRANSPORTATION

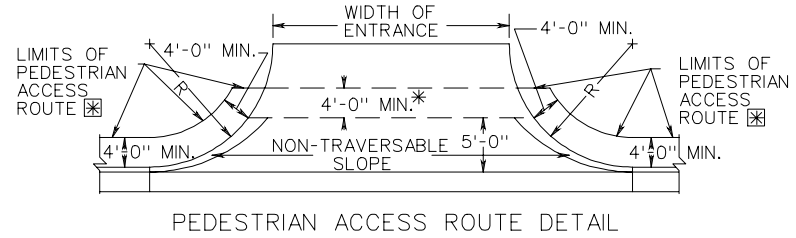
REV. 2/06

203.02

CG-9D



HALF PLAN



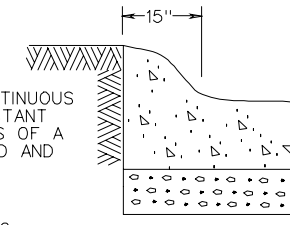
PEDESTRIAN ACCESS ROUTE DETAIL

ADDITIONAL RIGHT-OF-WAY IS REQUIRED IF THE LIMITS OF PEDESTRIAN ACCESS ROUTE \boxtimes EXTEND BEYOND EXISTING OR PROPOSED VDOT RIGHT-OF-WAY.

DETAIL TO BE USED WHEN THE COMBINED WIDTH OF UNPAVED SPACE AND SIDEWALK SPACE IS LESS THAN 7'.

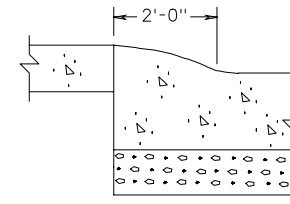
\boxtimes PEDESTRIAN ACCESS ROUTES PROVIDE A CONTINUOUS UNOBSTRUCTED, STABLE, FIRM AND SLIP RESISTANT PATH CONNECTING ALL ACCESSIBLE ELEMENTS OF A FACILITY THAT CAN BE APPROACHED, ENTERED AND USED BY PEDESTRIANS.

* IF PEDESTRIAN ACCESS ROUTES \boxtimes ARE BEING PROVIDED, A MINIMUM 4' TRAVERSABLE WIDTH IS REQUIRED WITH A MAX. 2% CROSS SLOPE.

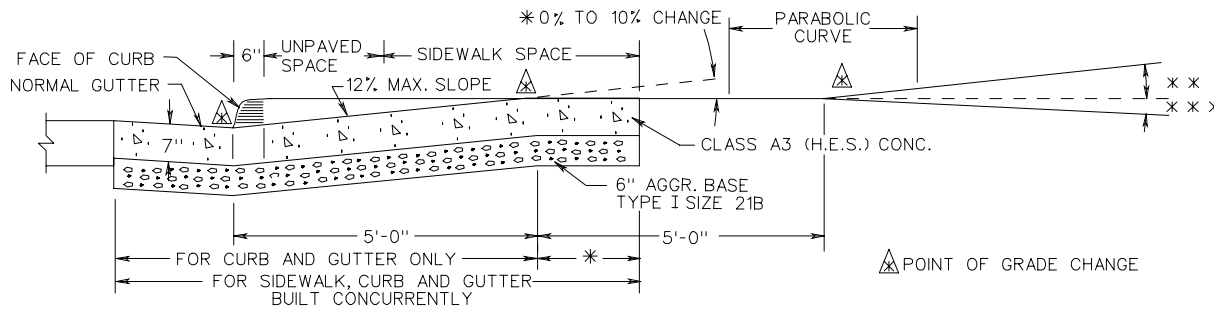


SECTION B-B

WHEN USED IN CONJUNCTION WITH STANDARD CG-3 OR CG-7, THE CURB FACE ON THIS STANDARD IS TO BE ADJUSTED TO MATCH THE MOUNTABLE CURB CONFIGURATION.

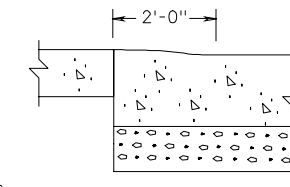


SECTION C-C



SECTION A-A

* * 12 % MAXIMUM INCREASE IN SLOPE AT MINIMUM 10' INTERVALS
 * * * 3 % MAXIMUM DECREASE IN SLOPE FOR FIRST 10' INTERVAL AND
 8 % MAXIMUM DECREASE FOR SUCCEEDING MINIMUM 10' INTERVALS



SECTION D-D

STANDARD ENTRANCE GUTTER

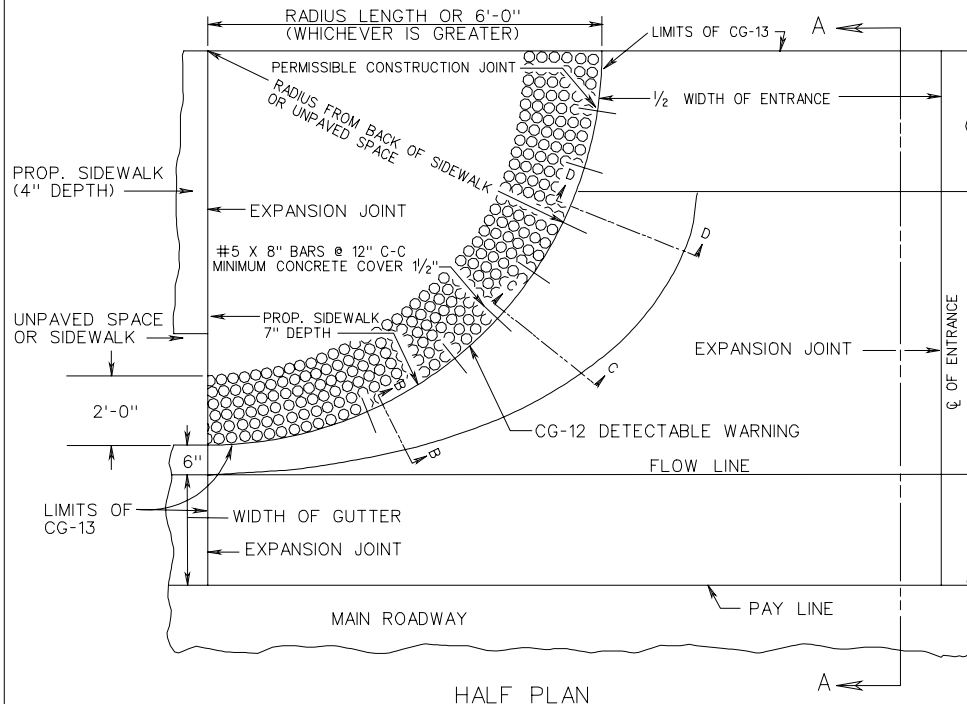
VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE

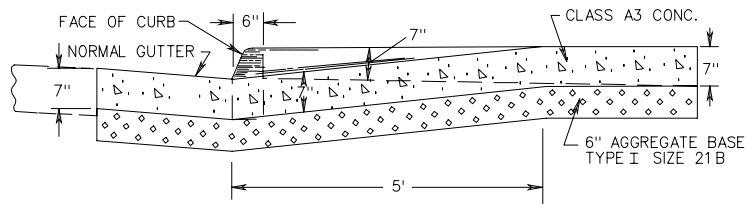
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REV. 2/06

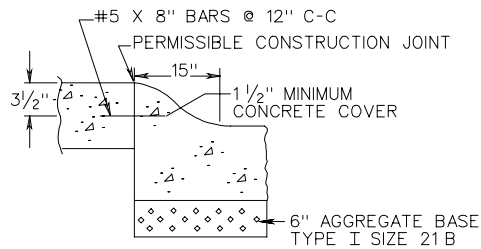
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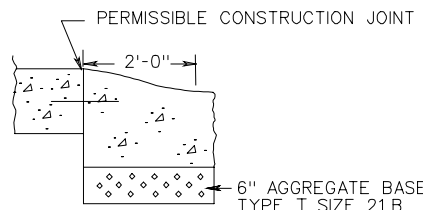
HALF PLAN



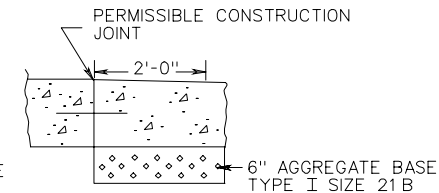
SECTION A-A



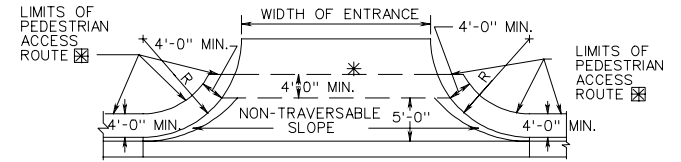
SECTION B-B



SECTION C-C



SECTION D-D



PEDESTRIAN ACCESS ROUTE DETAIL

ADDITIONAL RIGHT-OF-WAY IS REQUIRED IF THE LIMITS OF PEDESTRIAN ACCESS ROUTE EXTEND BEYOND EXISTING OR PROPOSED VDOT RIGHT-OF-WAY.

DETAIL TO BE USED WHEN THE COMBINED WIDTH OF UNPAVED SPACE AND SIDEWALK SPACE IS LESS THAN 7'.

PEDESTRIAN ACCESS ROUTES PROVIDE A CONTINUOUS UNOBSTRUCTED, STABLE, FIRM AND SLIP RESISTANT PATH CONNECTING ALL ACCESSIBLE ELEMENTS OF A FACILITY THAT CAN BE APPROACHED, ENTERED AND USED BY PEDESTRIANS.

* IF PEDESTRIAN ACCESS ROUTES ARE BEING PROVIDED, A MINIMUM 4' TRAVERSABLE WIDTH IS REQUIRED WITH MAX. 2% CROSS SLOPE.

NOTES:

1. PROP. 7" SIDEWALK IS TO BE POURED MONOLITHICALLY WITH ENTRANCE OR BY USING PERMISSIBLE CONSTRUCTION JOINT WITH REQUIRED BARS.
2. PROPOSED 7" SIDEWALK TO BE CLASS A-3 CONCRETE.
3. REQUIRED BARS ARE TO BE NO. 5X8" PLACED 1' CENTER TO CENTER ALONG BACK OF CURB, MID-DEPTH OF SIDEWALK. MINIMUM CONCRETE COVER 1/2".
4. ALL DETAILS AND DIMENSIONS NOT SHOWN ARE THE SAME AS STANDARD CG-9D.
5. THIS DESIGN MAY ALSO BE APPLIED TO OTHER ENTRANCE STANDARDS AS THE NEED ARISES.
6. WHEN USED IN CONJUNCTION WITH STANDARD CG-3 OR CG-7, THE CURB FACE ON THIS STANDARD IS TO BE ADJUSTED TO MATCH THE MOUNTABLE CURB CONFIGURATION.
7. SEE INSERTABLE SHEET A59 FOR STANDARD CG-12 DETECTABLE WARNING DETAILS.

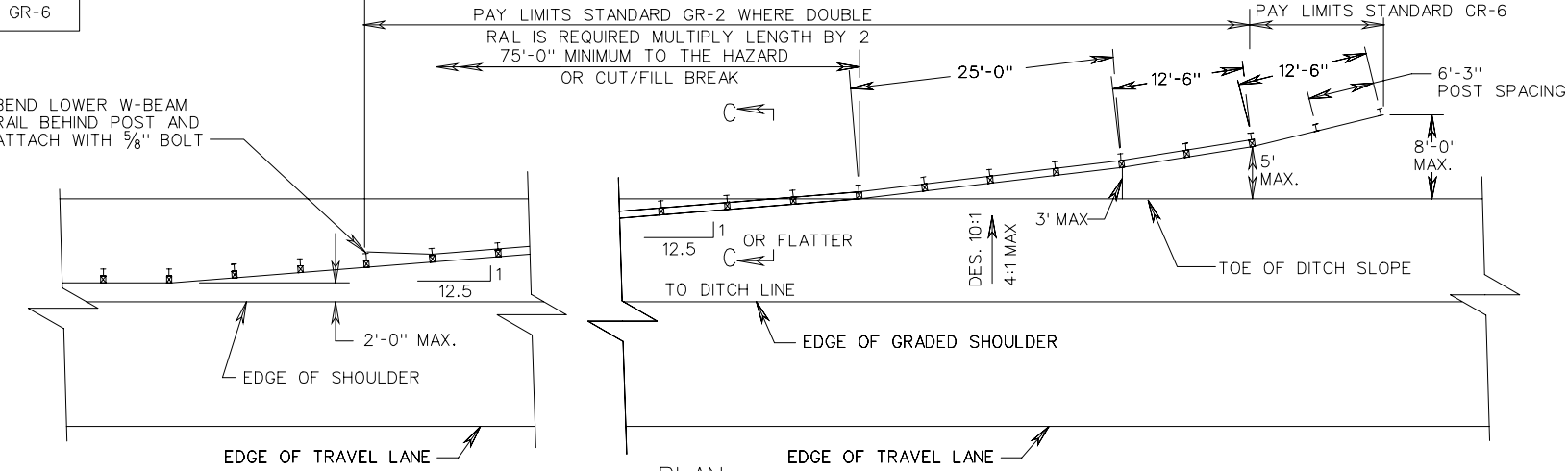
SPECIFICATION REFERENCE
502

COMMERCIAL ENTRANCE
(HEAVY TRUCK TRAFFIC ANTICIPATED)

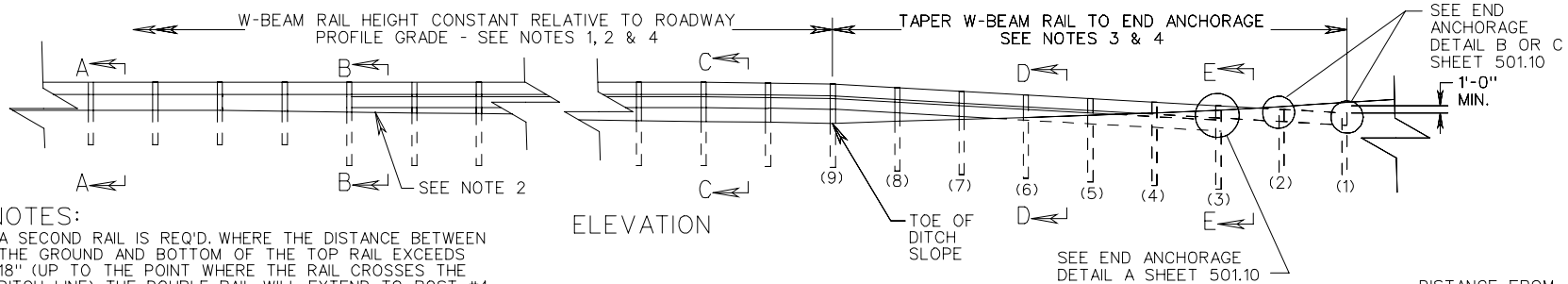
VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 2/06

203.08



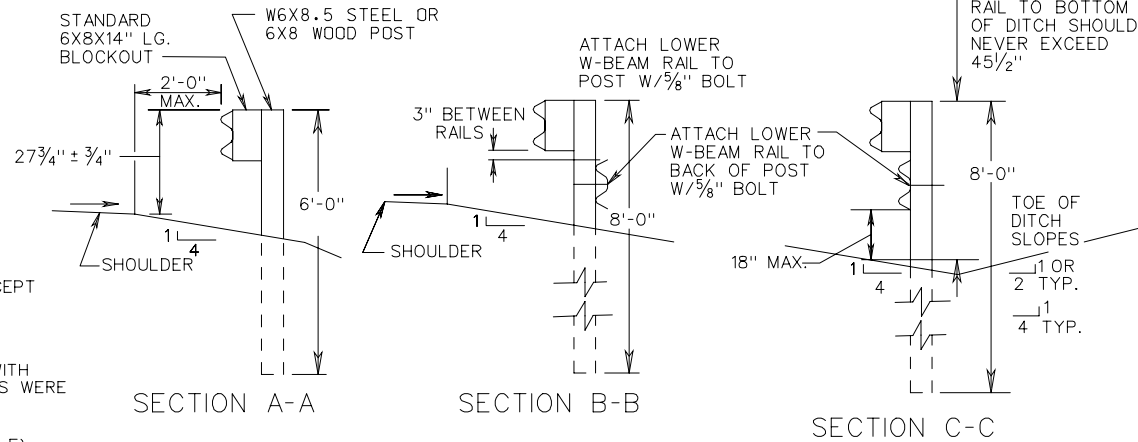
PLAN



ELEVATION

NOTES:

1. A SECOND RAIL IS REQ'D. WHERE THE DISTANCE BETWEEN THE GROUND AND BOTTOM OF THE TOP RAIL EXCEEDS 18" (UP TO THE POINT WHERE THE RAIL CROSSES THE DITCH LINE). THE DOUBLE RAIL WILL EXTEND TO POST #4.
2. MAXIMUM DISTANCE BETWEEN BOTTOM OF THE LOWER W-BEAM RAIL AND GROUND LINE IS 18". WHEN DOUBLE RAIL IS REQ'D., TAPER BOTH W-BEAM RAILS TO MAINTAIN THE 18" DISTANCE FROM THE GROUND.
3. TAPER BOTH W-BEAM RAILS FROM HEIGHT AT TOE OF DITCH SLOPES TO 1'-0" BELOW FINISHED GRADE AT POST #1 (8'-0" OFFSET).
4. A 8'-0" LONG POST MUST BE USED WHEN UPPER AND LOWER W-BEAM RAILS ARE REQUIRED. FROM THE BEGINNING OF THE LOWER RAIL THROUGH POST #3.
5. STANDARD GR-6 TERMINAL TREATMENT MAY BE USED AT THE RUN-ON END OF DIVIDED HIGHWAYS (LEFT AND RIGHT OF TRAFFIC) AND AT THE RUN-ON AND RUN-OFF ENDS ON UNDIVIDED HIGHWAYS.
6. ALL POST SPACING 6'-3" C-C UNLESS OTHERWISE NOTED. THE POST MAY BE W6 X 8.5 STEEL OR 6 X 8 WOOD EXCEPT THE LAST 3 TERMINAL POSTS MUST BE W6 X 8.5 STEEL.
7. FOR SECTIONS D-D & E-E, AND END ANCHORAGE DETAILS SEE SHEET 501.10.
8. ALL TERMINAL RUN-ON OR RUN-OFF MUST BE INSTALLED WITH LAPPING THE RAILS IN THE DIRECTION THAT THE TERMINALS WERE INSTALLED WHEN TESTED TO NCHRP 350 REQUIREMENTS.
9. IF THE BACKSLOPE IS 1:1 OR STEEPER THE W-BEAM MAY BE ANCHORED PER SOLID ROCK CUT INSTALLATION (DETAIL F).



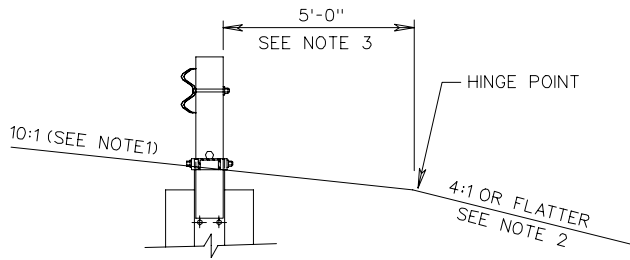
SECTION A-A

SECTION B-B

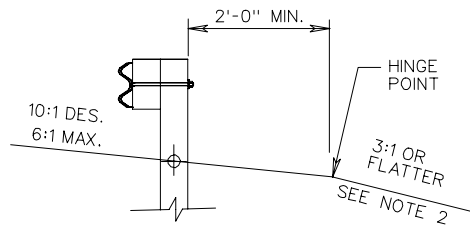
SECTION C-C

TERMINAL TREATMENT FOR W BEAM GUARDRAIL

SPECIFICATION REFERENCE



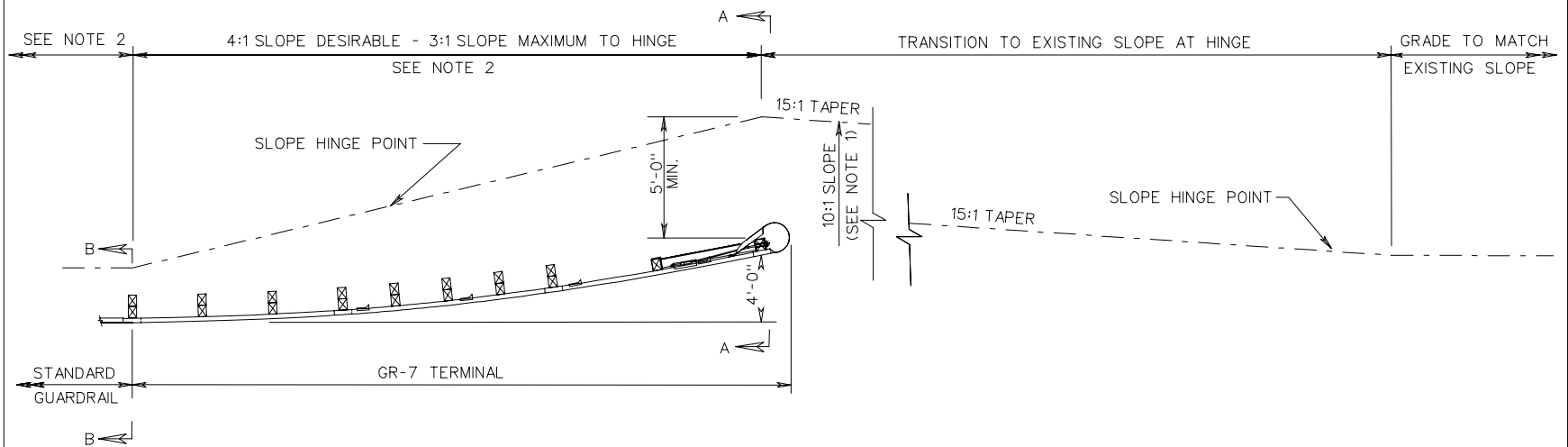
SECTION A-A



SECTION B-B

NOTES:

1. THE CROSS SLOPE OF THE GRADE APPROACHING THE GUARDRAIL TERMINAL, AND ADJACENT TO FOR ITS FULL LENGTH, MUST BE 10:1. IF THE EXISTING GRADE IS FLAT OR IS A POSITIVE SLOPE DUE TO THE SUPERELEVATION OF THE ROADWAY PAVEMENT, THE MIN. OFFSET FROM BEHIND THE POST TO THE HINGE POINT, AS SHOWN, IS REQUIRED.
2. THE AREA IMMEDIATELY BEHIND AND BEYOND THE TERMINAL SHOULD BE TRAVERSABLE AND FREE FROM FIXED OBJECTS. IF A CLEAR RUN OUT IS NOT ATTAINABLE THIS AREA SHOULD AT LEAST BE SIMILAR IN CHARACTER TO THE UPSTREAM UNSHIELDED ROADSIDE AREAS.
3. FOR NEW CONSTRUCTION, RECONSTRUCTION, AND 3R WORK THE 10:1 SLOPE GRADING MUST EXTEND A MINIMUM OF 5'-0" BEHIND THE END POST.
4. FOR PROPRIETARY GUARDRAIL TERMINALS THE MANUFACTURER'S SITE PREPARATION REQUIREMENTS TAKE PRECEDENCE OVER THIS STANDARD.

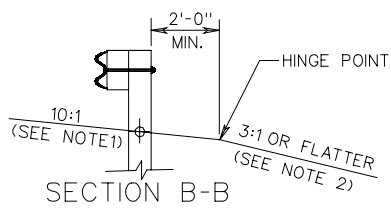
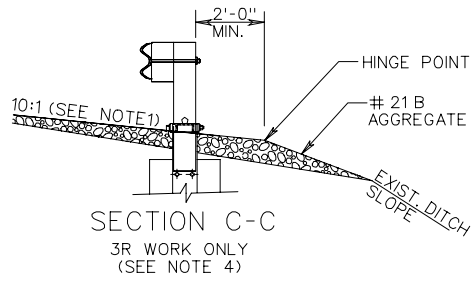
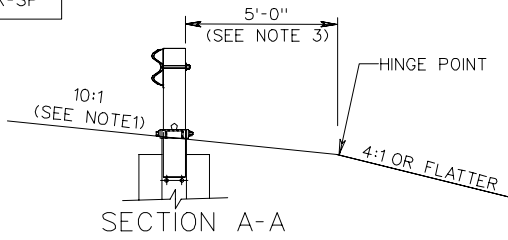


SPECIFICATION REFERENCE

GUARDRAIL TERMINAL INSTALLATION SITE PREPARATION REQUIREMENTS FOR GR-7

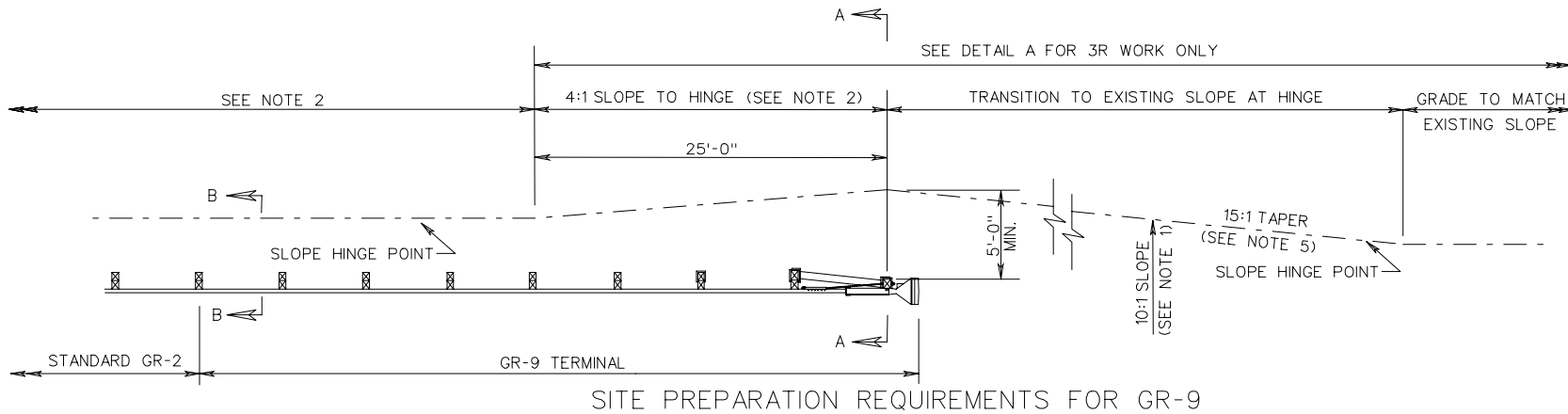
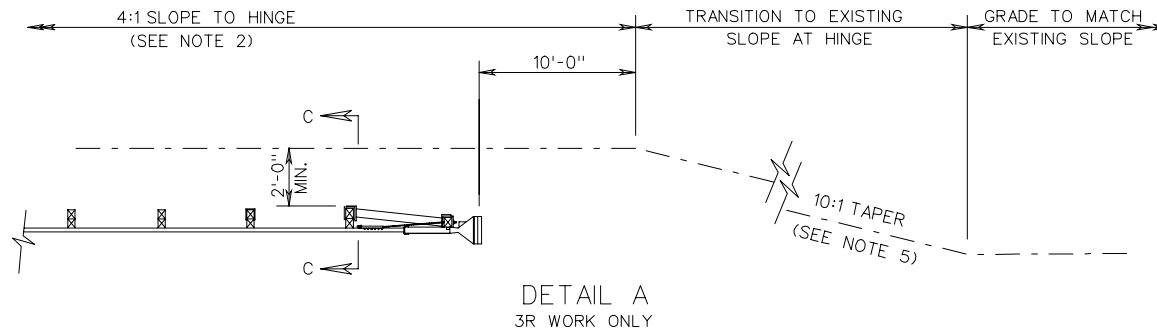
VIRGINIA DEPARTMENT OF TRANSPORTATION

GR-SP



NOTES:

1. THE CROSS SLOPE OF THE GRADE APPROACHING THE GUARDRAIL TERMINAL, AND ADJACENT TO FOR ITS FULL LENGTH, MUST BE 10:1. IF THE EXISTING GRADE IS FLAT OR IS A POSITIVE SLOPE DUE TO THE SUPERELEVATION OF THE ROADWAY PAVEMENT, THE MINIMUM OFFSET FROM BEHIND THE POST TO THE HINGE POINT, AS SHOWN, IS REQUIRED.
2. THE AREA IMMEDIATELY BEHIND AND BEYOND THE TERMINAL SHOULD BE TRAVERSABLE AND FREE FROM FIXED OBJECTS. IF A CLEAR RUN OUT IS NOT ATTAINABLE THIS AREA SHOULD AT LEAST BE SIMILAR IN CHARACTER TO THE UPSTREAM UNSHIELDED ROADSIDE AREAS.
3. FOR NEW CONSTRUCTION AND RECONSTRUCTION THE 10:1 SLOPE GRADING MUST EXTEND A MINIMUM OF 5'-0" BEHIND THE END POST.
4. FOR 3R WORK, THE GRADING SHOULD BE AS CLOSE AS POSSIBLE TO THE NEW CONSTRUCTION WITH SLOPE EXTENDING A MINIMUM OF 2'-0" BEHIND THE BLOCKED OUT POST. FROM THE HINGE POINT, TIE THE GRADED SLOPE INTO THE EXISTING DITCH SLOPE TO COVER THE FOUNDATION TUBES AND SOIL PLATES WITHOUT EXTENDING THIS SLOPE BEYOND THE DITCH BOTTOM. USE #21B AGGREGATE, OR OTHER SUITABLE MATERIAL AS APPROVED BY THE ENGINEER, AT ROADWAY SHOULDERS.
5. THE TAPER FOR NEW CONSTRUCTION WILL BE 15:1. FOR 3R WORK THE MINIMUM ALLOWABLE TAPER IS 10:1.
6. FOR PROPRIETARY GUARDRAIL TERMINALS THE MANUFACTURER'S SITE PREPARATION REQUIREMENTS TAKE PRECEDENCE OVER THIS STANDARD.



SHEET 2 OF 2

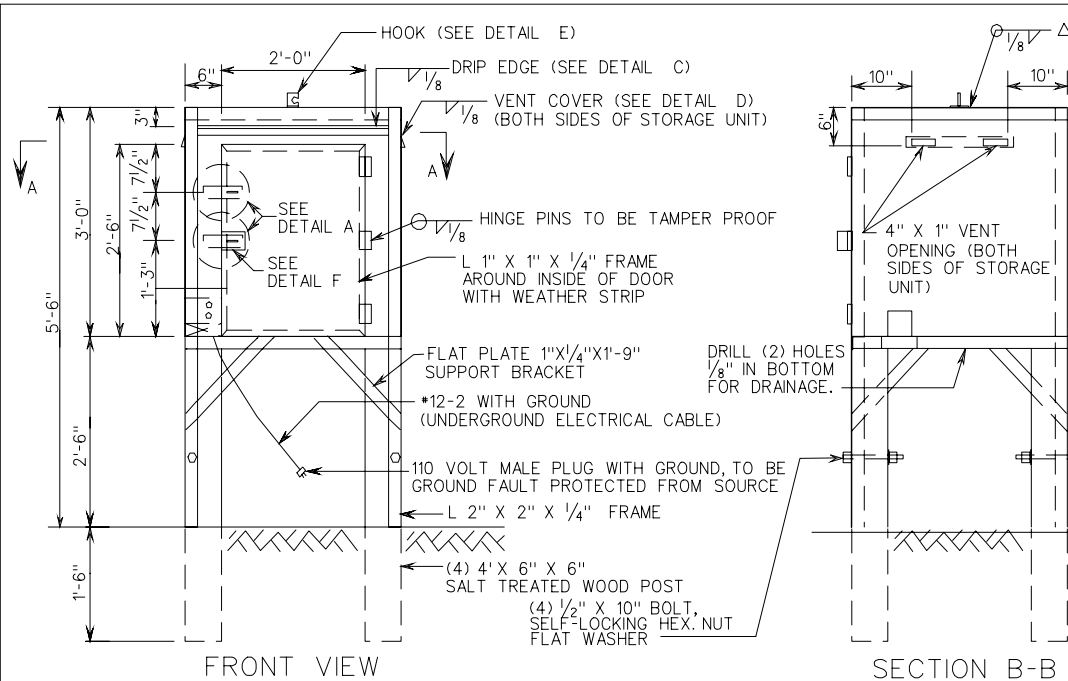
GUARDRAIL TERMINAL INSTALLATION SITE PREPARATION REQUIREMENTS FOR GR-9

VIRGINIA DEPARTMENT OF TRANSPORTATION

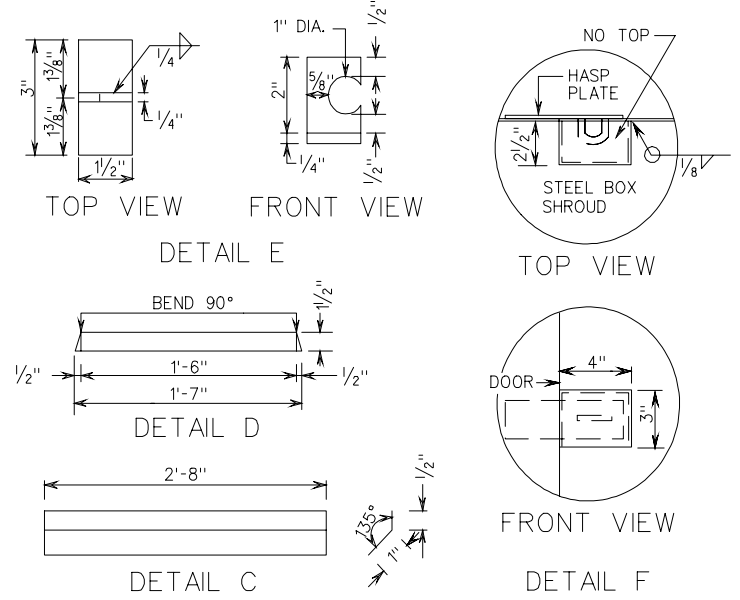
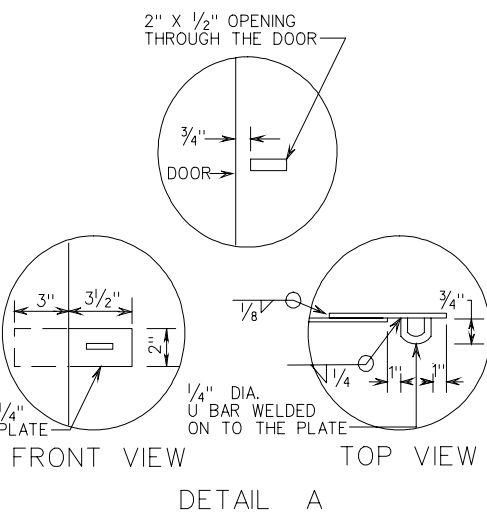
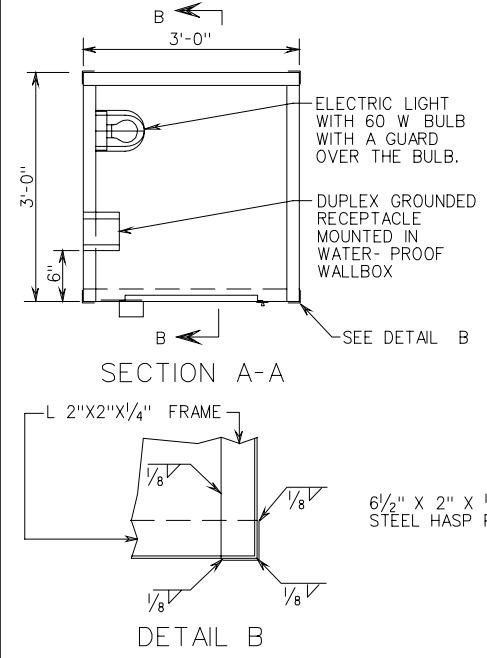
SPECIFICATION REFERENCE

REV.2/06

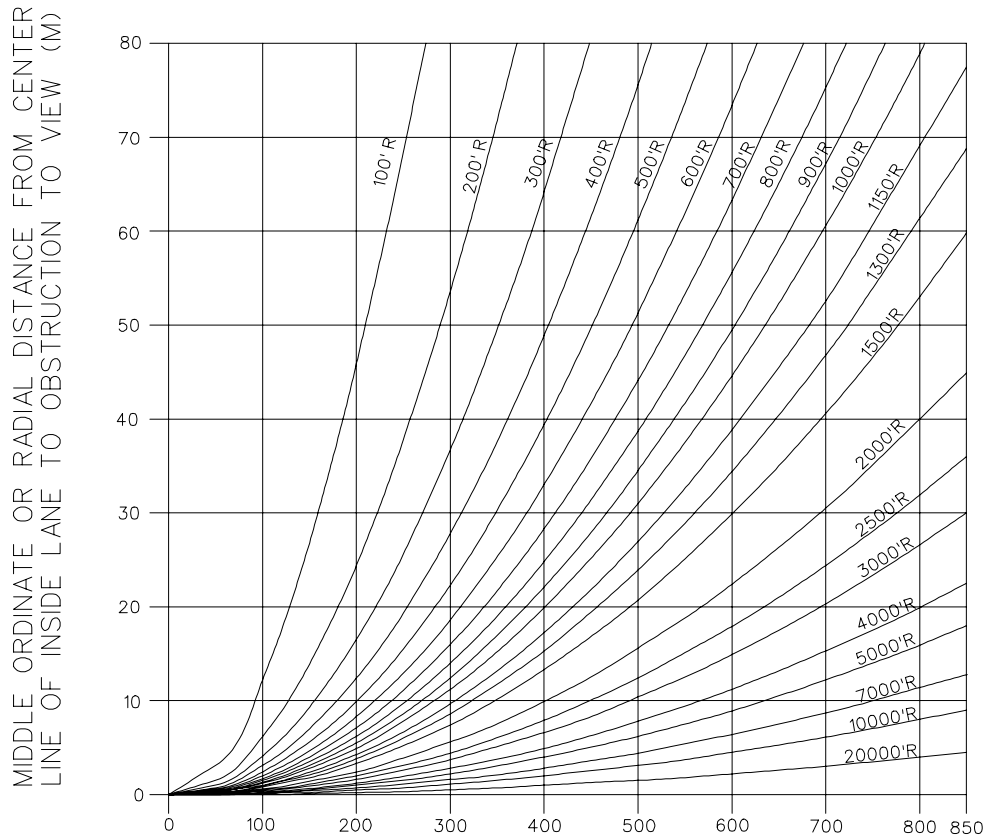
501.17



NOTES:
 NO SEPARATE PAYMENT WILL BE MADE FOR FURNISHING, INSTALLING AND PROVIDING MAINTENANCE OF THE STORAGE FACILITY FOR NUCLEAR GAUGE AND THE PRICE THEREOF SHALL BE INCLUDED IN THE PRICE BID FOR FIELD OFFICE (TYPE) SPECIFIED, IN ACCORDANCE WITH SECTION 514 OF THE CURRENT ROAD AND BRIDGE SPECIFICATIONS.
 BOX TO BE CONSTRUCTED OF A-36 SHEET STEEL 1/8" MIN. THICKNESS. WHEN WELDING TO FRAME USE 1/8" FILLET WELDS.
 ALL FRAME WORK IS TO BE A-36 STEEL ANGLE L 2" X 2" X 1/4". ALL FRAME WELDS ARE TO BE 1/4" FILLET OR BUTT WELDED ACCORDINGLY.
 METAL SCREEN SHALL HAVE A MAXIMUM OF 50 SQUARES PER INCH TO A MINIMUM OF 25 SQUARES PER INCH AND BE SPOT WELDED TO INSIDE OF THE BOX OVER VENT OPENINGS.
 Δ THE HOOK SHALL BE WELDED TO THE CENTER OF THE TOP. VENT OPENINGS SHALL BE PARTIALLY COVERED EXTERNALLY BY METAL VENT COVERS.
 STORAGE UNIT SHALL BE PAINTED INTERNALLY AND EXTERNALLY WITH A ONE COAT ACRYLIC DIRECT TO METAL (DTM) COATING, WITH A THICKNESS OF 4-6 MILS (WET MIL THICKNESS). COLOR SHALL BE EQUAL TO FEDERAL STANDARD COLOR NO. 595-17886 (WHITE).
 THE DESIGN IS TO BE 4" ID AND MOUNTED AT A 45° ANGLE OVER THE HASP OPENING IN THE DOOR.
 OPTIONAL SHROUD DESIGN IS TO BE SUBMITTED FOR THE ENGINEERS REVIEW AND APPROVAL.
 CONTRASTING PAINT IS REQUIRED TO DEPICT STORAGE AREA. STORAGE UNIT TO HAVE TWO (2) TAMPER-RESISTANT HASPS WITH A LOCK BOX EACH, OPEN ON THE BOTTOM AND TOP.



STORAGE FACILITY FOR NUCLEAR GAUGE

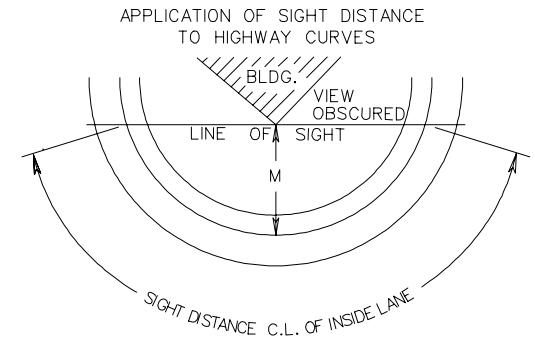


LENGTH OF ARC SUBTENDED OR CLEAR SIGHT DISTANCE MEASURED ALONG CENTER LINE OF INSIDE LANE (S)

INTERMEDIATE VALUES OF S AND M NOT LISTED ON GRAPH CAN

MARK EQUAL TO 10' SIGHT DISTANCE (S) AND 1' OF RADIAL DISTANCE (M).

- * 2.0 FEET STOPPING
- 3.5 FEET PASSING
- LINE OF SIGHT AT MID POINT TO BE 2.0' ABOVE EDGE OF PAVEMENT FOR STOPPING SIGHT DISTANCE, AND 4.0' FOR PASSING SIGHT DISTANCE.



SIGHT DISTANCES ON HORIZONTAL CURVES
 HEIGHT OF EYE 3.5 FT.; HEIGHT OF OBJECT 2.0 AND 3.5 FT.

SD-4		When S>L: $S = \frac{1079.15}{A} + \frac{L}{2}$																			When S<L: $S = 46.454\sqrt{\frac{L}{A}}$		S = Sight Distance in Feet		Sheet 1 of 2		A = Algebraic Difference of Grades in Percent
A = Algebraic Difference of Grades in Percent	L = Length of Vertical Curve in Feet																										
	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000							
2.0	565	590	615	640	665	690	715	740	765	790	815	840	865	890	915	940	965	990	1015	1040	2.0						
2.5	457	482	507	532	557	582	607	632	657	682	707	732	757	782	807	832	857	881	906	929	2.5						
3.0	385	410	435	460	485	510	535	560	585	610	635	660	685	710	735	759	782	805	827	848	3.0						
3.5	333	358	383	408	433	458	483	508	533	558	583	608	633	657	680	702	724	745	765	785	3.5						
4.0	295	320	345	370	395	420	445	470	495	520	545	569	592	615	636	657	677	697	716	735	4.0						
4.5	265	290	315	340	365	390	415	440	465	490	514	536	558	579	600	619	638	657	675	692	4.5						
5.0	241	266	291	316	341	366	391	416	441	465	487	509	530	550	569	588	606	623	640	657	5.0						
5.5	221	246	271	296	321	346	371	396	420	443	465	485	505	524	542	560	577	594	611	626	5.5						
6.0	205	230	255	280	305	330	355	379	402	424	445	465	484	502	519	536	553	569	585	600	6.0						
6.5	191	216	241	266	291	316	341	364	387	407	427	446	465	482	499	515	531	547	562	576	6.5						
7.0	179	204	229	254	279	304	328	351	372	393	412	430	448	465	481	497	512	527	541	555	7.0						
7.5	169	194	219	244	269	294	317	339	360	379	398	415	432	449	465	480	495	509	523	536	7.5						
8.0	160	185	210	235	260	284	307	328	348	367	385	402	419	435	450	465	479	493	506	519	8.0						
8.5	152	177	202	227	252	276	298	319	338	356	374	390	406	422	436	451	465	478	491	504	8.5						
9.0	145	170	195	220	245	268	290	310	328	346	363	379	395	410	424	438	451	465	477	490	9.0						
9.5	139	164	189	214	238	261	282	301	320	337	353	369	384	399	413	426	439	452	465	477	9.5						
10.0	133	158	183	208	232	254	275	294	312	328	345	360	375	389	402	415	428	441	453	465	10.0						
10.5	128	153	178	203	227	248	268	287	304	321	336	351	365	379	393	405	418	430	442	453	10.5						
11.0	123	148	173	198	221	243	262	280	297	313	328	343	357	371	384	396	408	420	432	443	11.0						
11.5	119	144	169	194	217	237	256	274	291	306	321	336	349	362	375	387	399	411	422	433	11.5						
12.0	115	140	165	190	212	232	251	268	284	300	314	328	342	355	367	379	391	402	413	424	12.0						
12.5	111	136	161	186	208	228	246	263	279	294	308	322	335	348	360	372	383	394	405	415	12.5						
13.0	108	133	158	182	204	223	241	258	273	288	302	316	328	342	353	364	376	387	397	407	13.0						
13.5	105	130	155	179	200	219	237	253	268	283	297	310	322	335	346	358	369	379	390	400	13.5						
14.0	102	127	152	176	196	215	232	248	263	278	291	304	317	328	340	351	362	372	383	393	14.0						
14.5	99	124	149	173	193	211	228	244	259	273	286	299	311	323	334	345	356	366	376	386	14.5						
15.0	97	122	147	170	190	208	224	240	254	268	281	294	306	317	328	339	350	360	370	379	15.0						
16.0	92	117	142	164	184	201	217	232	246	260	272	284	296	307	318	328	339	348	358	367	16.0						
17.0	88	113	138	159	178	195	211	225	239	252	264	276	287	298	309	319	328	338	347	356	17.0						
18.0	85	110	134	155	173	190	205	219	232	245	257	268	279	290	300	310	319	328	337	346	18.0						
19.0	82	107	131	151	169	185	199	213	226	238	250	261	272	282	292	301	311	320	328	337	19.0						
20.0	79	104	127	147	164	180	194	208	220	232	244	254	265	275	284	294	303	312	320	328	19.0						

STOPPING SIGHT DISTANCE ON CREST VERTICAL CURVES

REV. 02/06

HEIGHT OF EYE = 3.5 FEET

HEIGHT OF OBJECT = 2.00 FEET

608.06

VIRGINIA DEPARTMENT OF TRANSPORTATION

A = Algebraic Difference of Grades in Percent	When S > L: $S = \frac{1079.15}{A} + \frac{L}{2}$																				When S < L: $S = 46.454\sqrt{\frac{L}{A}}$																				S = Sight Distance in Feet																				Sheet 2 of 2																				SD-4
	L = Length of Vertical Curve in Feet																																								A = Algebraic Difference of Grades in Percent																																								
	1050	1100	1150	1200	1250	1300	1350	1400	1450	1500	1550	1600	1650	1700	1750	1800	1850	1900	1950	2000	A =																																																												
2.0	1065	1089	1114	1138	1161	1184	1207	1229	1251	1272	1293	1314	1334	1354	1374	1394	1413	1432	1451	1469	2.0																																																												
2.5	952	974	996	1018	1039	1059	1079	1099	1119	1138	1157	1175	1193	1211	1229	1246	1264	1281	1297	1314	2.5																																																												
3.0	869	890	910	929	948	967	985	1004	1021	1039	1056	1073	1089	1106	1122	1138	1154	1169	1184	1199	3.0																																																												
3.5	805	824	842	860	878	895	912	929	946	962	978	993	1009	1024	1039	1053	1068	1082	1096	1110	3.5																																																												
4.0	753	770	788	805	821	837	853	869	884	900	914	929	943	958	972	985	999	1012	1026	1039	4.0																																																												
4.5	710	726	743	759	774	790	805	819	834	848	862	876	890	903	916	929	942	955	969	979	4.5																																																												
5.0	673	689	705	720	735	749	763	777	791	805	818	831	844	857	869	881	894	906	917	929	5.0																																																												
5.5	642	657	672	686	700	714	728	741	754	767	780	792	805	817	829	840	852	863	875	886	5.5																																																												
6.0	615	629	643	657	671	684	697	710	722	735	747	759	770	782	793	805	816	827	837	848	6.0																																																												
6.5	590	604	618	631	644	657	669	682	694	706	717	729	740	751	762	773	784	794	805	815	6.5																																																												
7.0	569	582	595	608	621	633	645	657	669	680	691	702	713	724	735	745	755	765	775	785	7.0																																																												
7.5	550	563	575	588	600	612	623	635	646	657	668	679	689	699	710	720	730	739	749	759	7.5																																																												
8.0	532	545	557	569	581	592	603	615	625	636	647	657	667	677	687	697	706	716	725	735	8.0																																																												
8.5	516	528	540	552	563	574	585	596	607	617	627	637	647	657	667	676	685	695	704	713	8.5																																																												
9.0	502	514	525	536	547	558	569	579	590	600	610	619	629	638	648	657	666	675	684	692	9.0																																																												
9.5	488	500	511	522	533	543	554	564	574	584	593	603	612	621	630	639	648	657	666	674	9.5																																																												
10.0	476	487	498	509	519	530	540	550	559	569	578	588	597	606	615	623	632	640	649	657	10.0																																																												
10.5	465	475	486	497	507	517	527	536	546	555	564	573	582	591	600	608	617	625	633	641	10.5																																																												
11.0	454	465	475	485	495	505	515	524	533	542	551	560	569	577	586	594	602	611	619	626	11.0																																																												
11.5	444	454	465	475	484	494	503	513	522	531	539	548	556	565	573	581	589	597	605	613	11.5																																																												
12.0	435	445	455	465	474	484	493	502	511	519	528	536	545	553	561	569	577	585	592	600	12.0																																																												
12.5	426	436	446	455	465	474	483	492	500	509	517	526	534	542	550	557	565	573	580	588	12.5																																																												
13.0	417	427	437	446	456	465	473	482	491	499	507	515	523	531	539	547	554	562	569	576	13.0																																																												
13.5	410	419	429	438	447	456	465	473	481	490	498	506	514	521	529	536	544	551	558	565	13.5																																																												
14.0	402	412	421	430	439	448	456	465	473	481	489	497	504	512	519	527	534	541	548	555	14.0																																																												
14.5	395	405	414	423	431	440	448	456	465	472	480	488	496	503	510	518	525	532	539	546	14.5																																																												
15.0	389	398	407	415	424	432	441	449	457	465	472	480	487	495	502	509	516	523	530	536	15.0																																																												
16.0	376	385	394	402	411	419	427	435	442	450	457	465	472	479	486	493	500	506	513	519	16.0																																																												
17.0	365	374	382	390	398	406	414	422	429	436	444	451	458	465	471	478	485	491	498	504	17.0																																																												
18.0	355	363	371	379	387	395	402	410	417	424	431	438	445	451	458	465	471	477	484	490	18.0																																																												
19.0	345	353	361	369	377	384	392	399	406	413	420	426	433	439	446	452	458	465	471	477	19.0																																																												
20.0	337	345	352	360	367	375	382	389	396	402	409	415	422	428	435	441	447	453	459	465	20.0																																																												

STOPPING SIGHT DISTANCE ON CREST VERTICAL CURVES

HEIGHT OF EYE = 3.5 FEET

HEIGHT OF OBJECT = 2.00 FEET

VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 02/06

608.07

SD-5		When S>L: $S = \frac{1400}{A} + \frac{L}{2}$																			When S<L: $S = 52.915 \sqrt{\frac{L}{A}}$		S = Sight Distance in Feet		Sheet 1 of 2	
A = Algebraic Difference of Grades in Percent	L = Length of Vertical Curve in Feet																				A = Algebraic Difference of Grades in Percent					
	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000						
2.0	725	750	775	800	825	850	875	900	925	950	975	1000	1025	1050	1075	1100	1125	1150	1175	1200	2.0					
2.5	585	610	635	660	685	710	735	760	785	810	835	860	885	910	935	960	985	1010	1035	1060	2.5					
3.0	492	517	542	567	592	617	642	667	692	717	742	767	792	817	842	867	892	917	942	966	3.0					
3.5	425	450	475	500	525	550	575	600	625	650	675	700	725	750	775	800	825	849	872	894	3.5					
4.0	375	400	425	450	475	500	525	550	575	600	625	650	675	700	725	748	771	794	815	837	4.0					
4.5	336	361	386	411	436	461	486	511	536	561	586	611	636	660	683	706	727	748	769	789	4.5					
5.0	305	330	355	380	405	430	455	480	505	530	555	580	603	626	648	669	690	710	729	748	5.0					
5.5	280	305	330	355	380	405	430	455	480	505	529	553	575	597	618	638	658	677	695	714	5.5					
6.0	258	283	308	333	358	383	408	433	458	483	507	529	551	572	592	611	630	648	666	683	6.0					
6.5	240	265	290	315	340	365	390	415	440	464	487	508	529	549	568	587	605	623	640	656	6.5					
7.0	225	250	275	300	325	350	375	400	424	447	469	490	510	529	548	566	583	600	616	632	7.0					
7.5	212	237	262	287	312	337	362	386	410	432	453	473	493	511	529	547	563	580	596	611	7.5					
8.0	200	225	250	275	300	325	350	374	397	418	439	458	477	495	512	529	545	561	577	592	8.0					
8.5	190	215	240	265	290	315	340	363	385	406	426	445	463	480	497	513	529	544	559	574	8.5					
9.0	181	206	231	256	281	306	330	353	374	394	414	432	450	467	483	499	514	529	544	558	9.0					
9.5	172	197	222	247	272	297	321	343	364	384	403	421	438	454	470	486	501	515	529	543	9.5					
10.0	165	190	215	240	265	290	313	335	355	374	392	410	427	443	458	473	488	502	516	529	10.0					
10.5	158	183	208	233	258	283	306	327	346	365	383	400	416	432	447	462	476	490	503	516	10.5					
11.0	152	177	202	227	252	276	298	319	338	357	374	391	407	422	437	451	465	479	492	505	11.0					
11.5	147	172	197	222	247	270	292	312	331	349	366	382	398	413	427	441	455	468	481	493	11.5					
12.0	142	167	192	217	242	265	286	306	324	342	358	374	389	404	418	432	445	458	471	483	12.0					
12.5	137	162	187	212	237	259	280	299	317	335	351	367	382	396	410	423	436	449	461	473	12.5					
13.0	133	158	183	208	232	254	275	294	311	328	344	359	374	388	402	415	428	440	452	464	13.0					
13.5	129	154	179	204	228	249	269	288	306	322	338	353	367	381	394	407	420	432	444	455	13.5					
14.0	125	150	175	200	224	245	265	283	300	316	332	346	361	374	387	400	412	424	436	447	14.0					
14.5	122	147	172	197	220	241	260	278	295	311	326	340	354	368	381	393	405	417	428	439	14.5					
15.0	118	143	168	193	216	237	256	273	290	306	320	335	348	361	374	386	398	410	421	432	15.0					
16.0	113	138	163	187	209	229	247	265	281	296	310	324	337	350	362	374	386	397	408	418	16.0					
17.0	107	132	157	181	203	222	240	257	272	287	301	314	327	340	351	363	374	385	396	406	17.0					
18.0	103	128	153	176	197	216	233	249	265	279	292	306	318	330	342	353	364	374	384	394	18.0					
19.0	99	124	149	172	192	210	227	243	258	271	285	297	309	321	332	343	354	364	374	384	19.0					
20.0	95	120	145	167	187	205	221	237	251	265	277	290	302	313	324	335	345	355	365	374	20.0					

PASSING SIGHT DISTANCE ON CREST VERTICAL CURVES

HEIGHT OF EYE = 3.5 FEET

HEIGHT OF OBJECT = 3.5 FEET

REV. 02/06

608.08

VIRGINIA DEPARTMENT OF TRANSPORTATION

A = Algebraic Difference of Grades in Percent	When S > L: $S = \frac{1400}{A} + \frac{L}{2}$																				When S < L: $S = 52.915 \sqrt{\frac{L}{A}}$																				S = Sight Distance in Feet																				Sheet 2 of 2																				SD-5
	L = Length of Vertical Curve in Feet																																								A = Algebraic Difference of Grades in Percent																																								
	1050	1100	1150	1200	1250	1300	1350	1400	1450	1500	1550	1600	1650	1700	1750	1800	1850	1900	1950	2000	1050	1100	1150	1200	1250	1300	1350	1400	1450	1500	1550	1600	1650	1700	1750	1800	1850	1900	1950	2000	A =																																								
2.0	1225	1250	1275	1300	1325	1350	1375	1400	1425	1449	1473	1497	1520	1543	1565	1587	1609	1631	1652	1673	2.0																																																												
2.5	1085	1100	1135	1159	1183	1207	1230	1252	1274	1296	1318	1339	1359	1380	1400	1420	1439	1459	1478	1497	2.5																																																												
3.0	990	1013	1036	1058	1080	1102	1122	1143	1163	1183	1203	1222	1241	1260	1278	1296	1314	1332	1349	1366	3.0																																																												
3.5	917	938	959	980	1000	1020	1039	1058	1077	1095	1114	1131	1149	1166	1183	1200	1217	1233	1249	1265	3.5																																																												
4.0	857	877	897	917	935	954	972	990	1007	1025	1042	1058	1075	1091	1107	1122	1138	1153	1168	1183	4.0																																																												
4.5	808	827	846	864	882	899	917	933	950	966	982	998	1013	1028	1043	1058	1073	1087	1102	1116	4.5																																																												
5.0	767	785	802	820	837	853	869	885	901	917	932	947	961	976	990	1004	1018	1032	1045	1058	5.0																																																												
5.5	731	748	765	782	798	814	829	844	859	874	888	903	917	930	944	957	970	983	996	1009	5.5																																																												
6.0	700	716	733	748	764	779	794	808	823	837	850	864	877	891	904	917	929	942	954	966	6.0																																																												
6.5	673	688	704	719	734	748	763	777	790	804	817	830	843	856	868	881	893	905	917	928	6.5																																																												
7.0	648	663	678	693	707	721	735	748	762	775	787	800	812	825	837	849	860	872	883	894	7.0																																																												
7.5	626	641	655	669	683	697	710	723	736	748	761	773	785	797	808	820	831	842	853	864	7.5																																																												
8.0	606	620	634	648	661	675	687	700	712	725	737	748	760	771	783	794	805	815	826	837	8.0																																																												
8.5	588	602	615	629	642	654	667	679	691	703	715	726	737	748	759	770	781	791	801	812	8.5																																																												
9.0	572	585	598	611	624	636	648	660	672	683	694	706	716	727	738	748	759	769	779	789	9.0																																																												
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18.0	404	414	423	432	441	450	458	467	475	483	491	499	507	514	522	529	536	544	551	558	18.0																																																												
19.0	393	403	412	421	429	438	446	454	462	470	478	486	493	501	508	515	522	529	536	543	19.0																																																												
20.0	383	392	401	410	418	427	435	443	451	458	466	473	481	488	495	502	509	516	522	529	20.0																																																												

PASSING SIGHT DISTANCE ON CREST VERTICAL CURVES

HEIGHT OF EYE = 3.5 FEET

HEIGHT OF OBJECT = 3.5 FEET

VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 02/06

608.09

URBAN LOW SPEED DESIGN TABLE						
DV/NC (MPH)	45	40	35	30	25	20
MAX. f	0.150	0.160	0.180	0.200	0.230	0.270

FRICTION FACTORS (f) FOR ODD VELOCITIES NOT LISTED SHOULD BE DERIVED BY INTERPOLATION.

LEGEND

e- SUPERELEVATION RATE.

f- FRICTION FACTOR.

R- RADIUS OF CURVE.

DV- DESIGN VELOCITY UTILIZING SUPERELEVATION.

NC- MAXIMUM VELOCITY WITH NO SUPERELEVATION
(NORMAL CROWN).

GENERAL DESIGN CONSIDERATIONS

1. WHEN "URBAN LOW SPEED" DESIGNS UTILIZE SUPERELEVATION, THEY WILL BE SUPERELEVATED BY AN AMOUNT EQUAL TO THE NORMAL CROWN (TYPICALLY 2.0%) AND THE APPROXIMATE MAXIMUM SAFE SPEED (DV) AFFORDED THEREBY.
2. WHEN "URBAN LOW SPEED DESIGN" WITH NO SUPERELEVATION, THE APPROXIMATE MAXIMUM SAFE SPEED (NC) IS CALCULATED USING A NEGATIVE NORMAL CROWN (TYPICALLY -2.0 %).
3. WHEN THE CURVE IS SUPERELEVATED, THE LS IS APPLIED IN THE SAME MANNER AS IN URBAN CONDITIONS WITH THE CROWN RUNOFF (CR) BEING EQUAL TO THE LS VALUE. THE CROWN RUNOFF (CR) IS ALWAYS ACHIEVED OUTSIDE OF THE TRANSITION (LS).
4. PLEASE NOTE THAT THE RADIUS VALUES LISTED ON PAGE 802.24A HAVE BEEN ROUNDED UP TO THE NEAREST FOOT.

EXAMPLES

DV = 21 mph

e = +2.0 %

f = MAX f ± INTERPOLATED DIFFERENCE BETWEEN LISTED FRICTION FACTORS

f = $0.270 - [1/5(0.270 - 0.230)] = 0.262$

Rmin. = $DV^2 / 15(e + f)$

Rmin. = $(21)^2 / 15(0.02 + 0.262) = 104.2553191$ FT.

NC = 37 mph

e = -2.0 %

f = MAX f ± INTERPOLATED DIFFERENCE BETWEEN LISTED FRICTION FACTORS

f = $0.18 - [2/5(0.18 - 0.16)] = 0.172$

Rmin. = $NC^2 / 15(-e + f)$

Rmin. = $(37)^2 / 15(-0.02 + 0.172) = 600.4385965$ FT.

METHODOLOGIES FOR CALCULATING TC-5.04 VALUES FOR URBAN LOW-SPEED STREETS

MINIMUM RADII AND TRANSITION LENGTHS FOR +2% SUPERELEVATION

RADIUS (FEET)	E (%)	f	DV (MPH)	LENGTH OF SUPERELEVATION TRANSITION (LS) IN FEET						
				PAVEMENT WIDTH (W)						W > 72'
				24' (1@12')	36' (1.5@12')	48' (2@12')	60' (3@10')	66' (3@11')	72' (3@12')	
> 795	2.0	0.150	45	45	56	67	75	82	90	x
593	2.0	0.160	40	42	52	63	70	77	84	x
408	2.0	0.180	35	39	49	59	65	72	78	x
273	2.0	0.200	30	37	46	55	61	67	74	x
167	2.0	0.230	25	35	43	52	58	64	69	x
92	2.0	0.270	20	33	41	49	55	60	66	x

* FOR PAVEMENT WIDTHS GREATER THAN 72 FEET USE LS VALUES DEVELOPED BY THE DESIGN SOFTWARE.

MINIMUM RADII FOR DESIGNS
UTILIZING -2% SUPERELEVATION NORMAL PAVEMENT CROWN

RADIUS (FEET)	f	NC (MPH)
> 1039	.150	45
762	.160	40
510	.180	35
333	.200	30
198	.230	25
107	.270	20

SUMMARY OF STD. TC-5.04 ULS (URBAN-LOW SPEED) DESIGN FACTORS

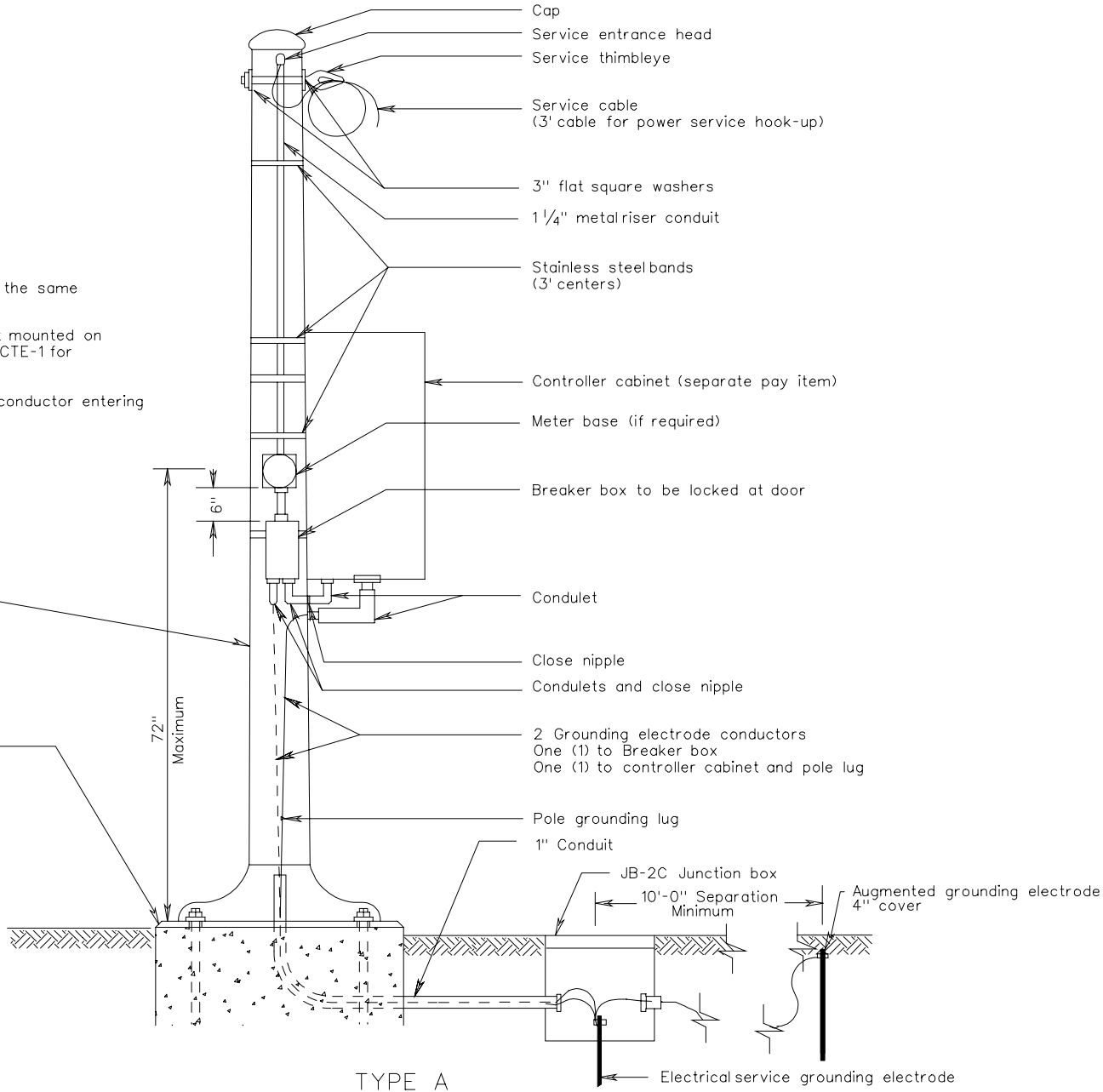
SE-1

Notes:

No other conductors shall be run in the same conduit with electrical service cable.

Concrete pad required when cabinet mounted on pole in earth areas. (See Standard CTE-1 for pad detail).

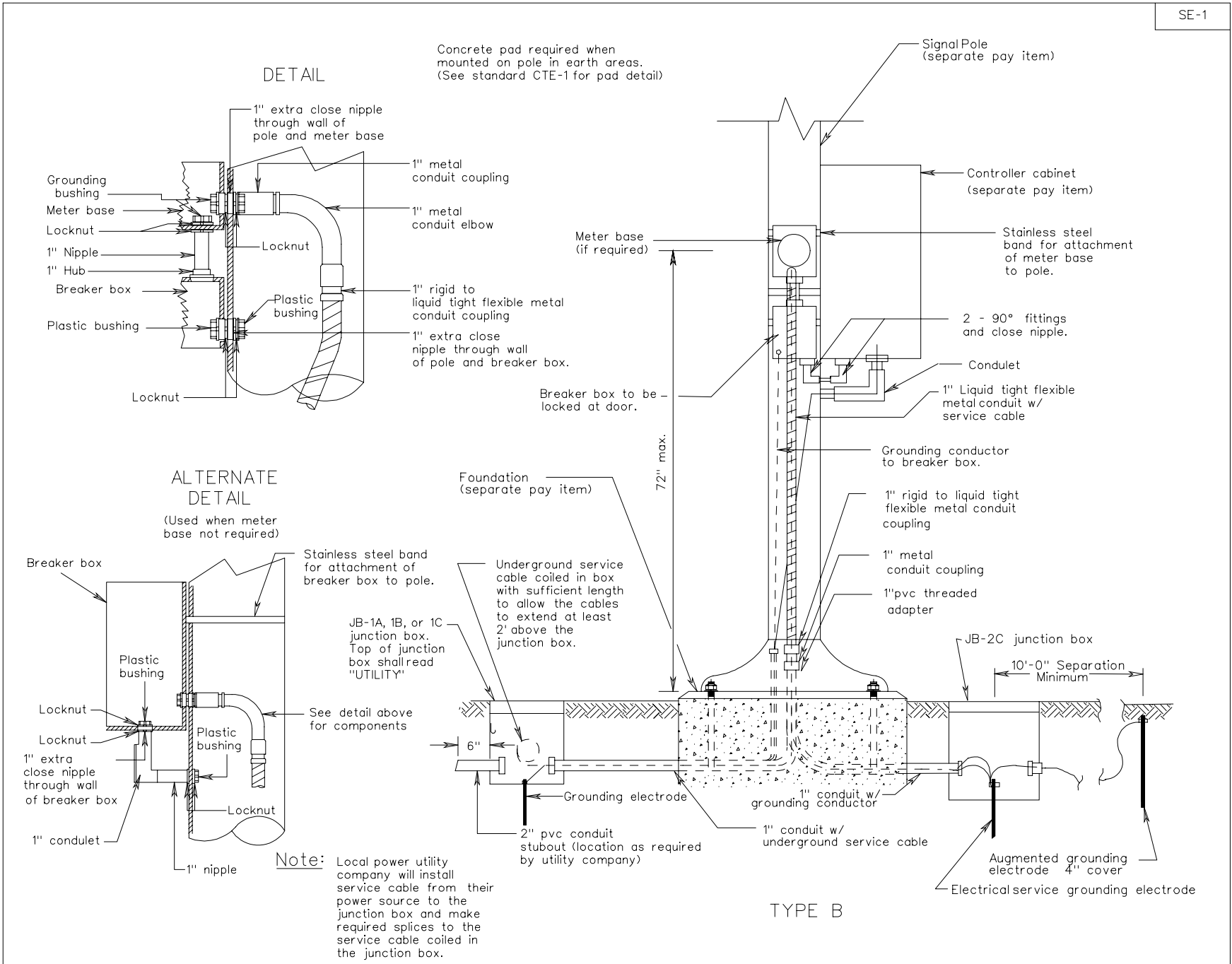
For alternate method of grounding conductor entering breaker box see Standard SE-5.



ELECTRICAL SERVICE DETAILS
SIGNAL INSTALLATIONS

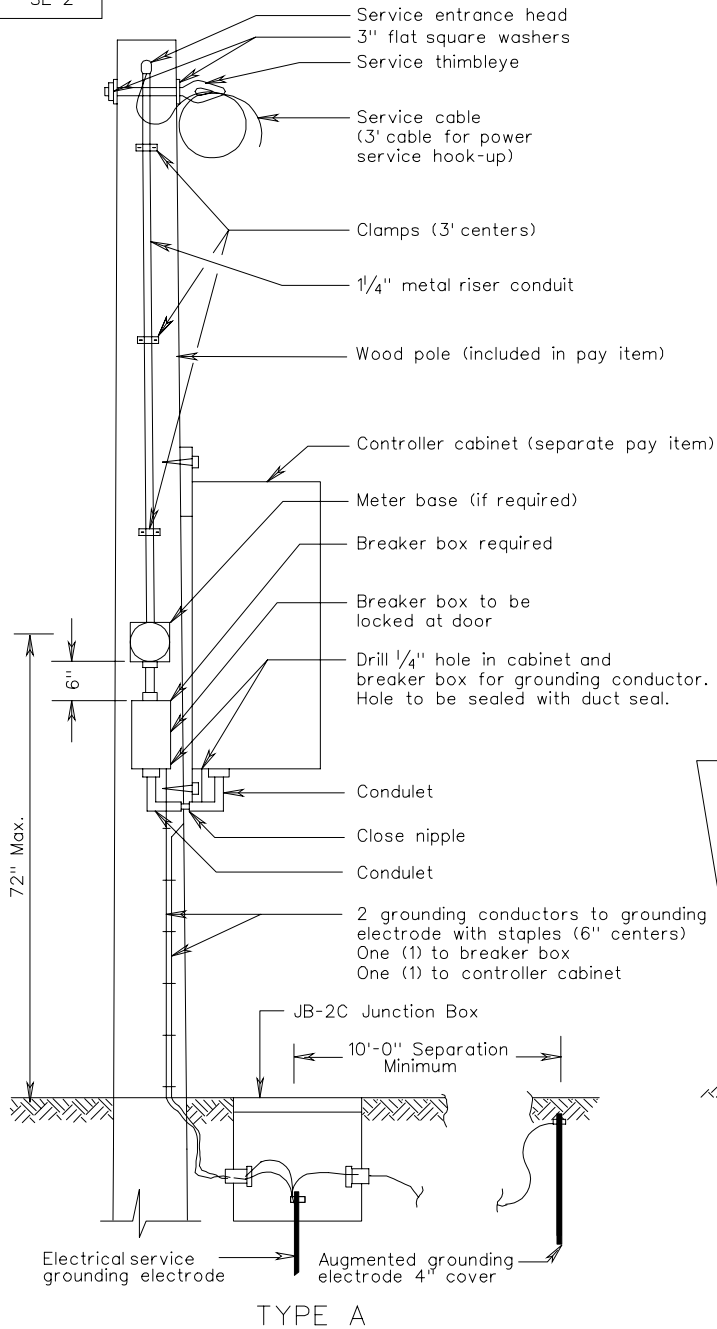
REV 2/06

1301.30



ELECTRICAL SERVICE DETAILS
SIGNAL INSTALLATION

SE-2



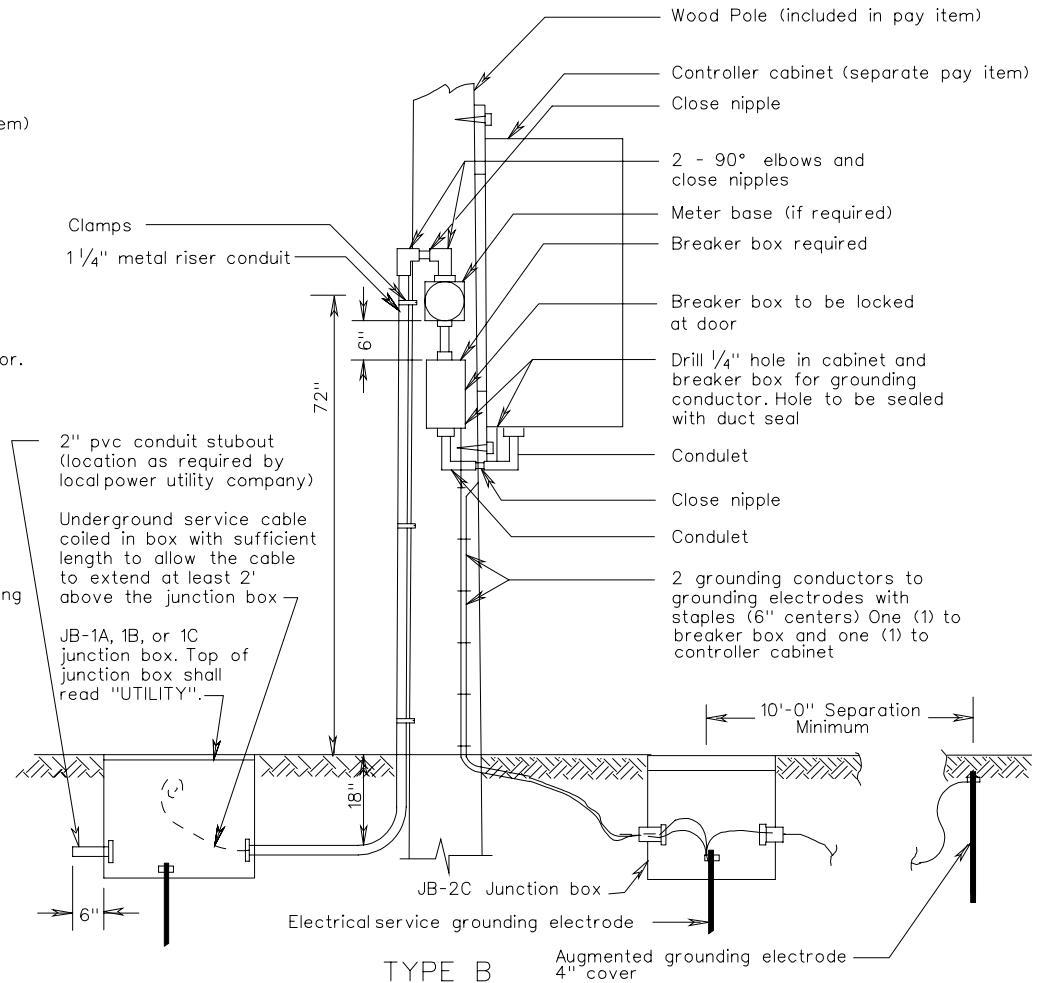
TYPE A

Notes:

No other conductors shall be run in the same conduit with electrical service cable.

Concrete pad required when cabinet mounted on pole in earth areas. The pad shall be 18" from pole. (See standard CTE-1 for pad detail).

For underground service installations, local power utility company will install service power utility cable from their power source to the junction box and make required splices to the service cable coiled in the junction box.



TYPE B

ELECTRICAL SERVICE DETAILS
SIGNAL INSTALLATION

VIRGINIA DEPARTMENT OF TRANSPORTATION

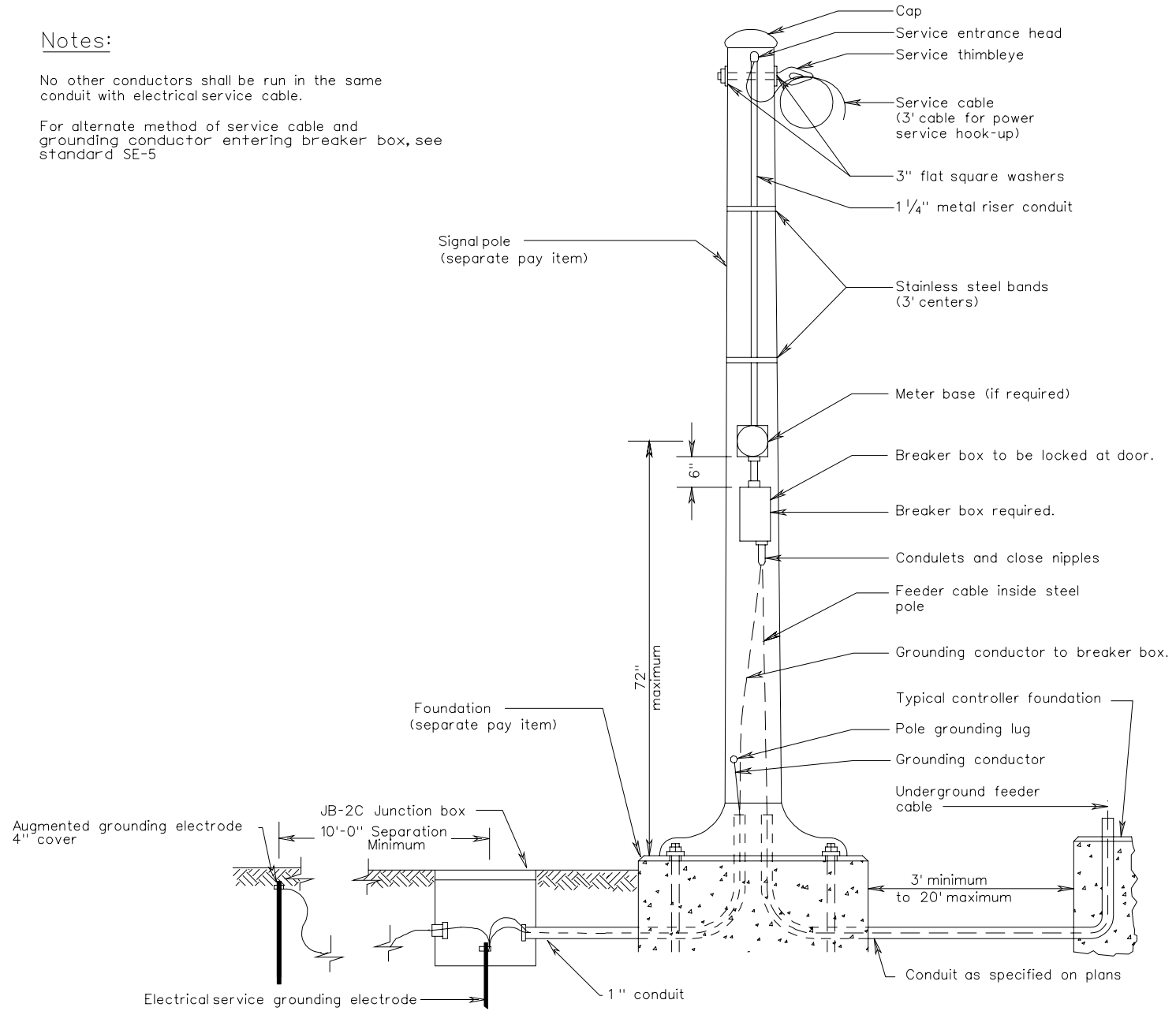
REV. 2/06

1301.32

Notes:

No other conductors shall be run in the same conduit with electrical service cable.

For alternate method of service cable and grounding conductor entering breaker box, see standard SE-5

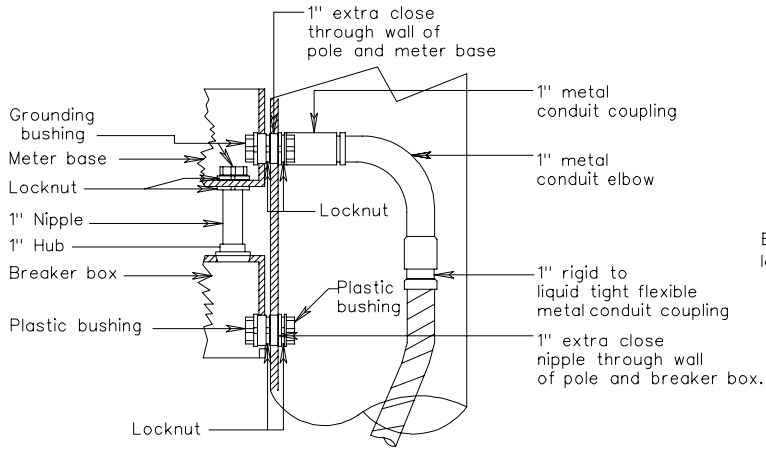


TYPE A

ELECTRICAL SERVICE DETAILS
 SIGNAL INSTALLATION
 VIRGINIA DEPARTMENT OF TRANSPORTATION

SE-3

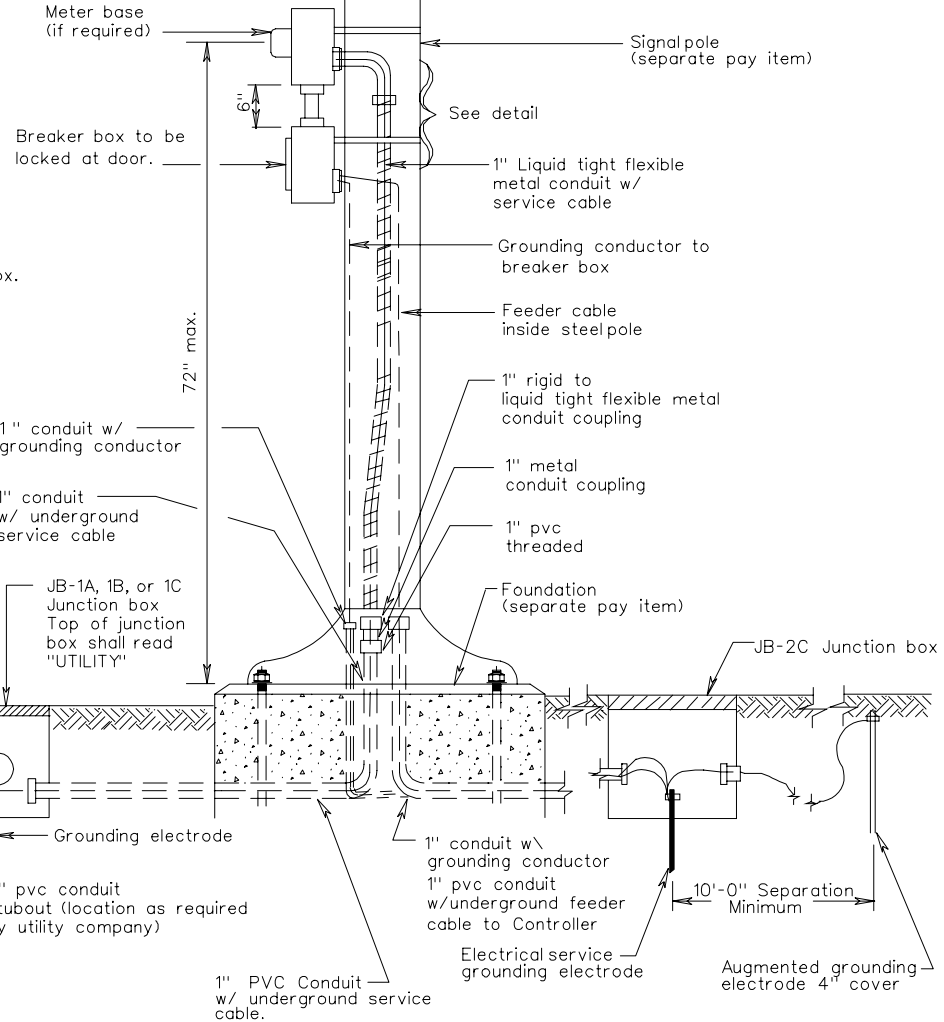
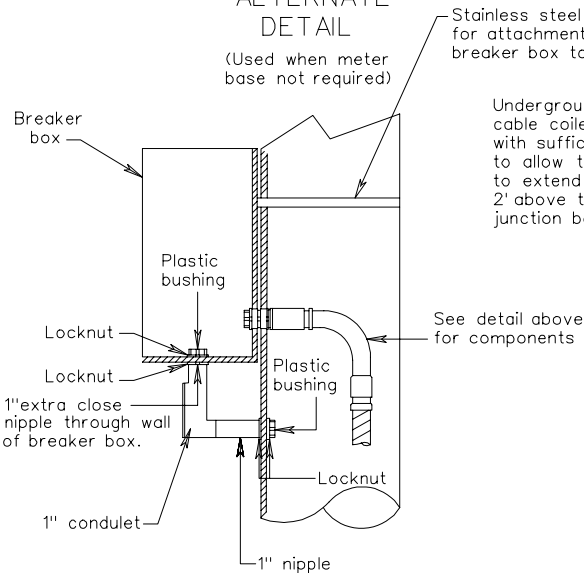
DETAIL



Note:

Local power utility company will install service cable from their power source to the junction box and make required splices to the service cable coiled in the junction box.

ALTERNATE DETAIL
(Used when meter base not required)



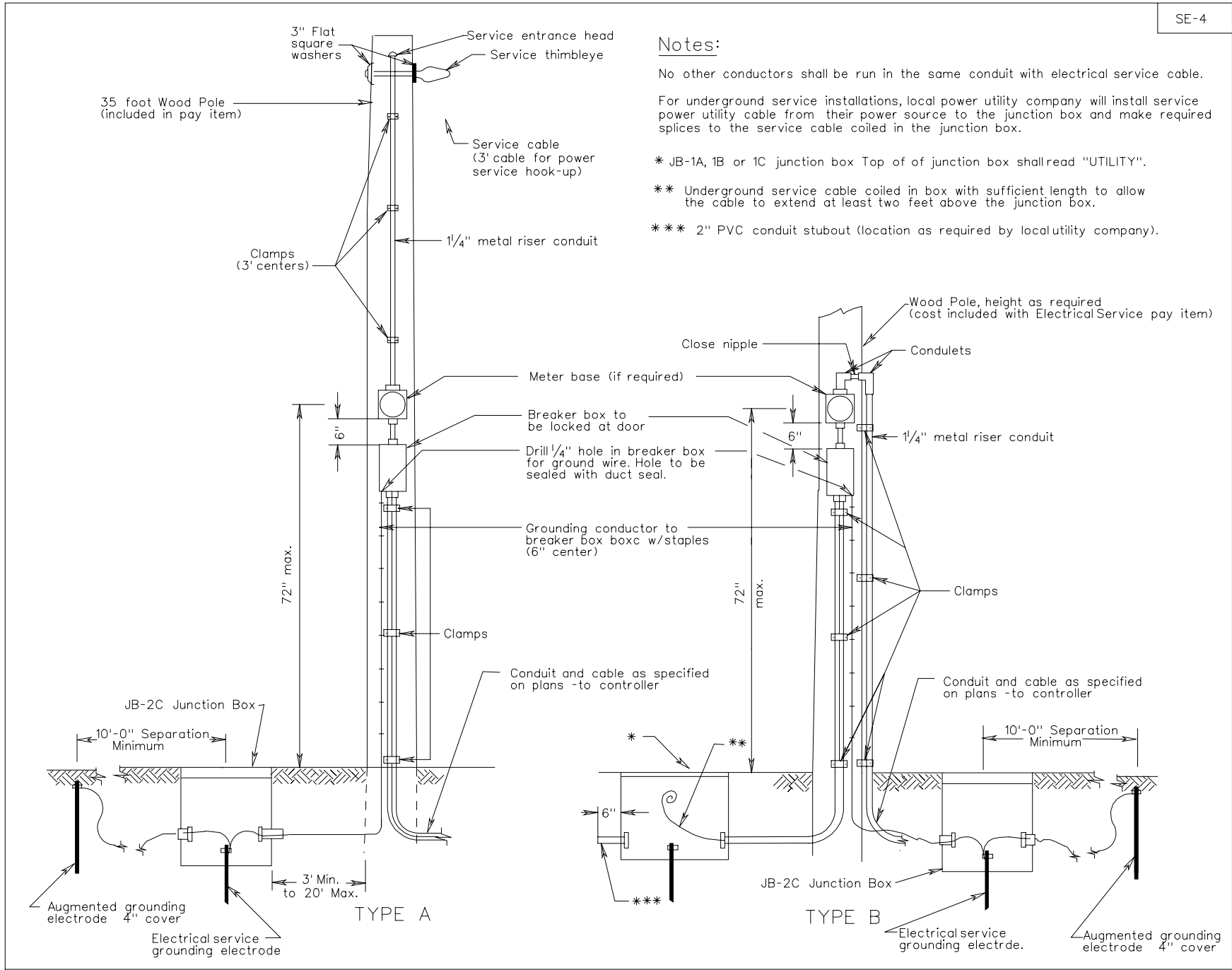
TYPE B

ELECTRICAL SERVICE DETAILS
SIGNAL INSTALLATION

VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 2/06

1301.34



ELECTRICAL SERVICE DETAILS
SIGNAL INSTALLATION

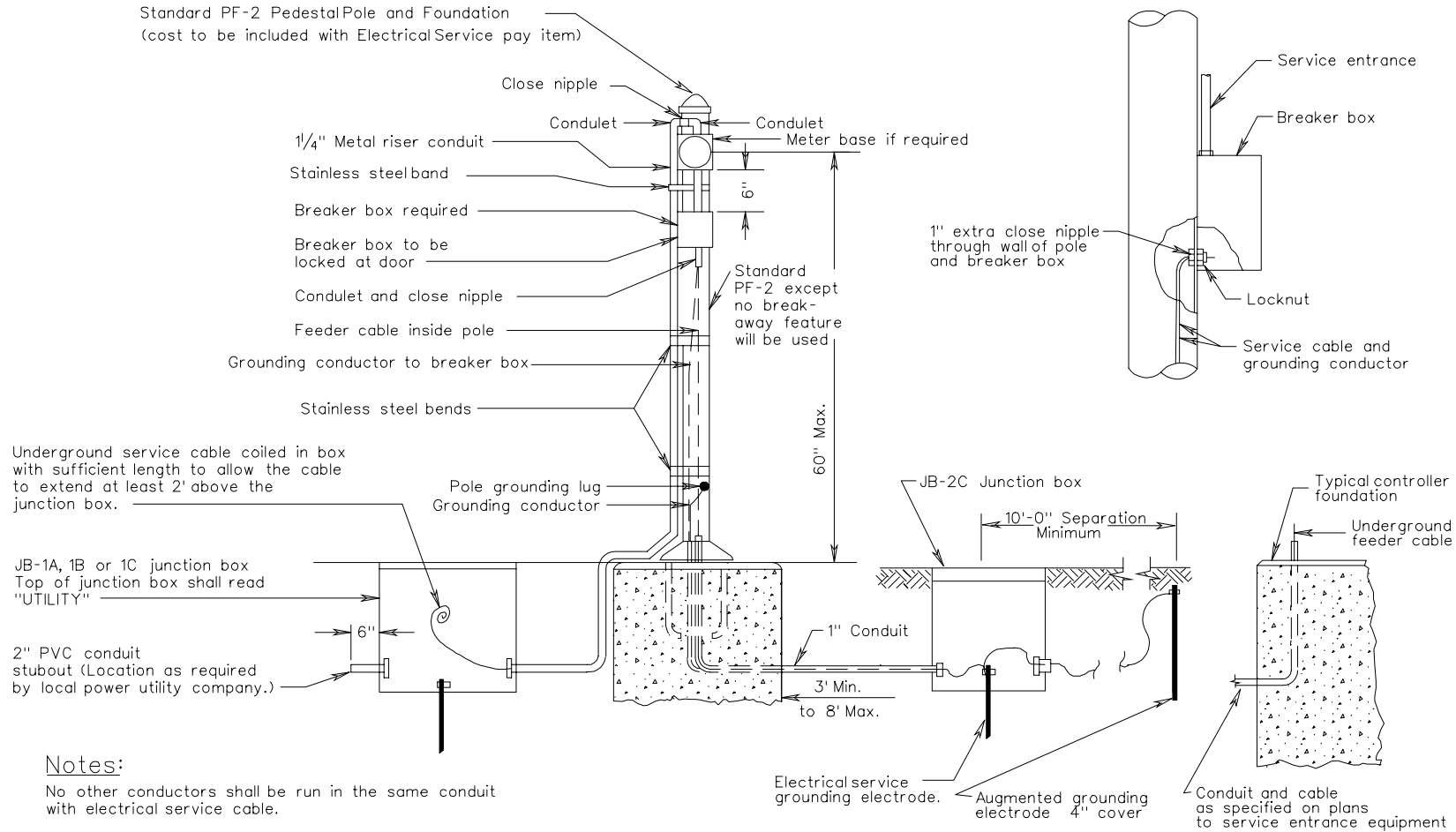
VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 2/06

1301.35

SE-5

ALTERNATE METHOD OF SERVICE CABLE AND GROUNDING CONDUCTOR ENTERING BREAKER BOX



Underground service cable coiled in box with sufficient length to allow the cable to extend at least 2' above the junction box.

JB-1A, 1B or 1C junction box
Top of junction box shall read "UTILITY"

2" PVC conduit stubout (Location as required by local power utility company.)

Notes:

No other conductors shall be run in the same conduit with electrical service cable.

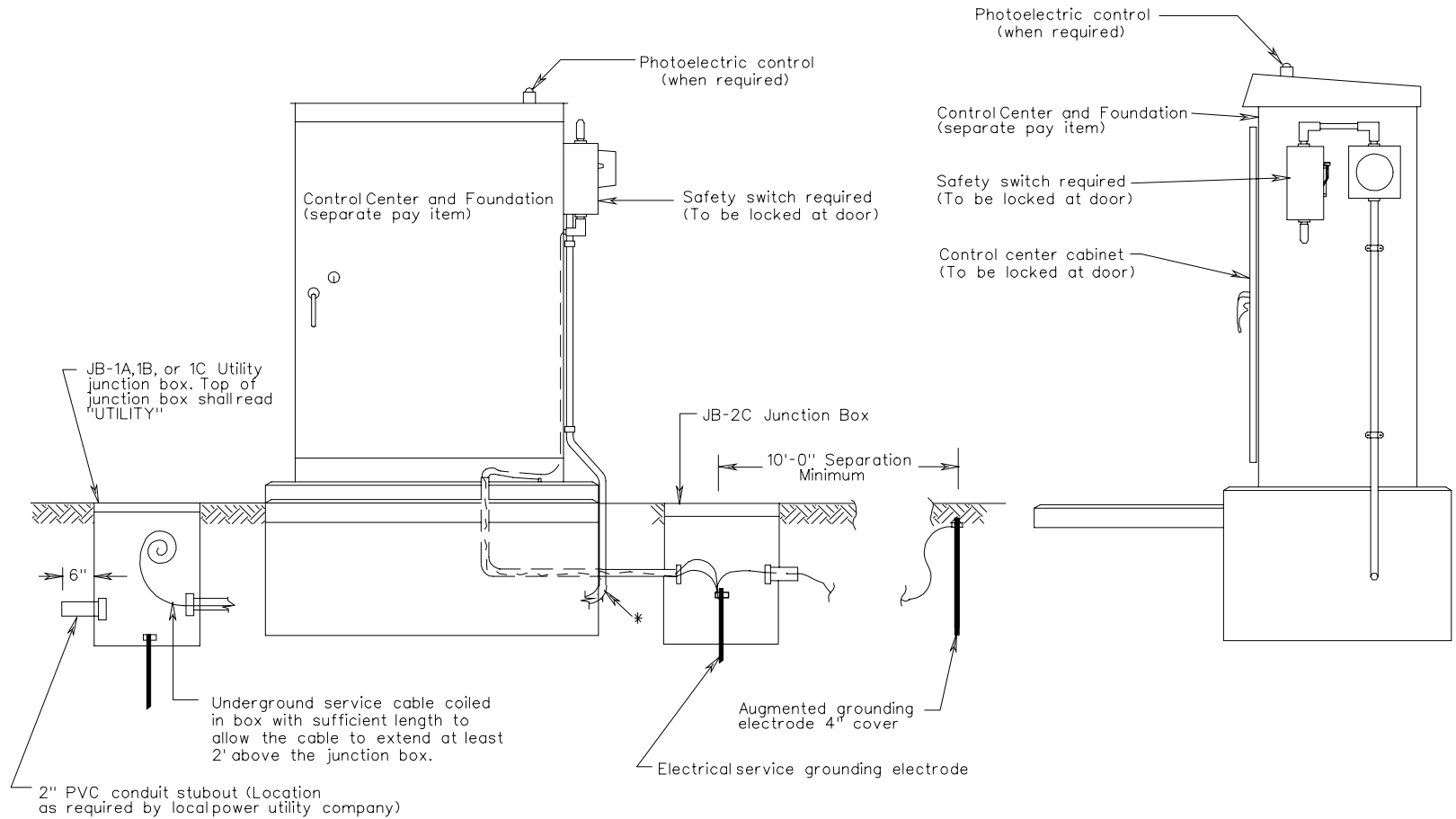
Local power utility company will install service power utility cable from their power source to the junction box and make required splices to the service cable coiled in the junction box.

PEDESTAL POLE WITH GROUND MOUNTED CABINET

ELECTRICAL SERVICE DETAILS
SIGNAL INSTALLATION

VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 2/06
1301.36



Notes:

* The conduit and service cable shall extend from the cabinet to the utility junction box.

The control center cabinet at the inside and outside foundation joints shall be sealed with a silicone sealant

For alternate method of service cable entering safety switch see Standard SE-5.

When 200 amp or greater service is required, service shall enter meter base at right bottom.

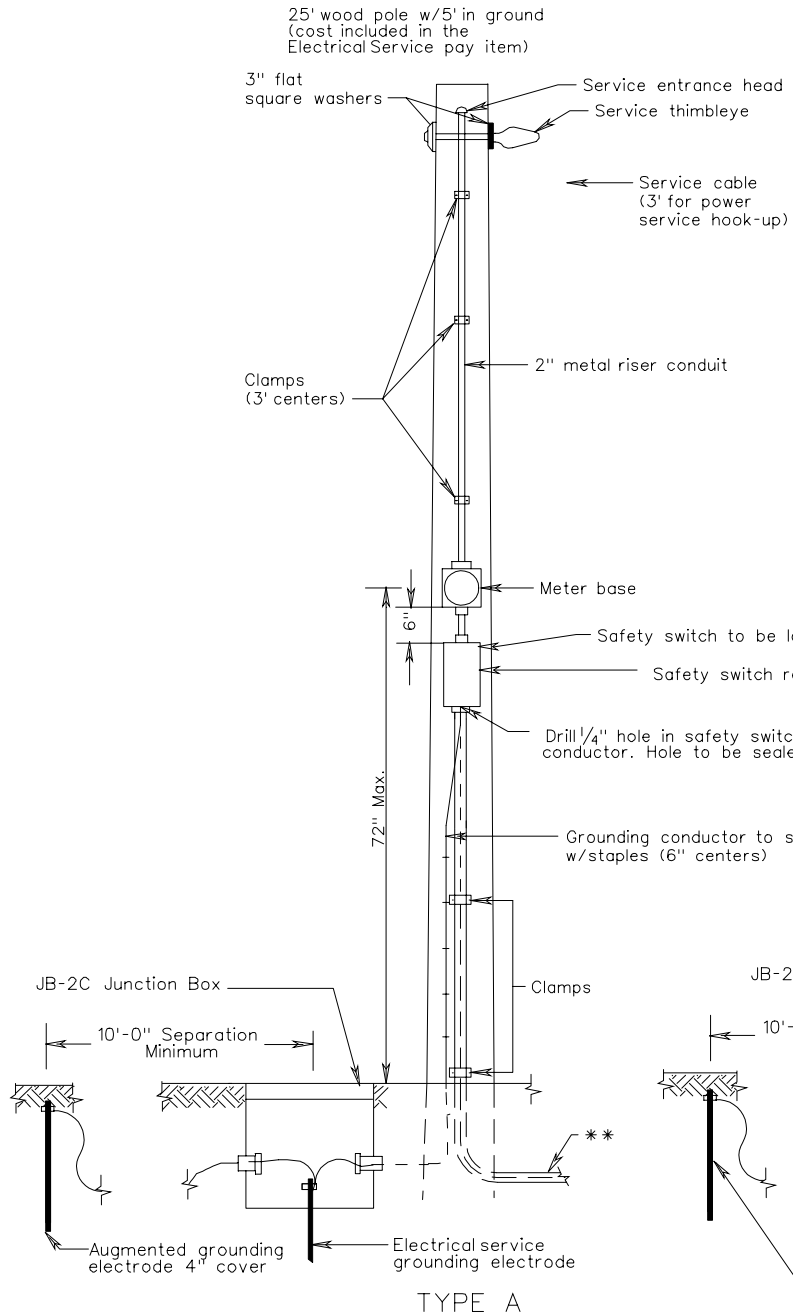
No other conductors shall be run in the same conduit with electrical service cable.

Local power utility company will install service power utility cable from their power source to the junction box and make required splices to the service cable coiled in the junction box.

This standard is applicable for all electrical services other than 480Y/277. For 480Y/277 service, see Standard SE-9.

ELECTRICAL SERVICE DETAILS
SIGN AND LIGHTING INSTALLATIONS
VIRGINIA DEPARTMENT OF TRANSPORTATION

SE-7



Notes:

This standard is applicable for all electrical services other than 480Y/277.

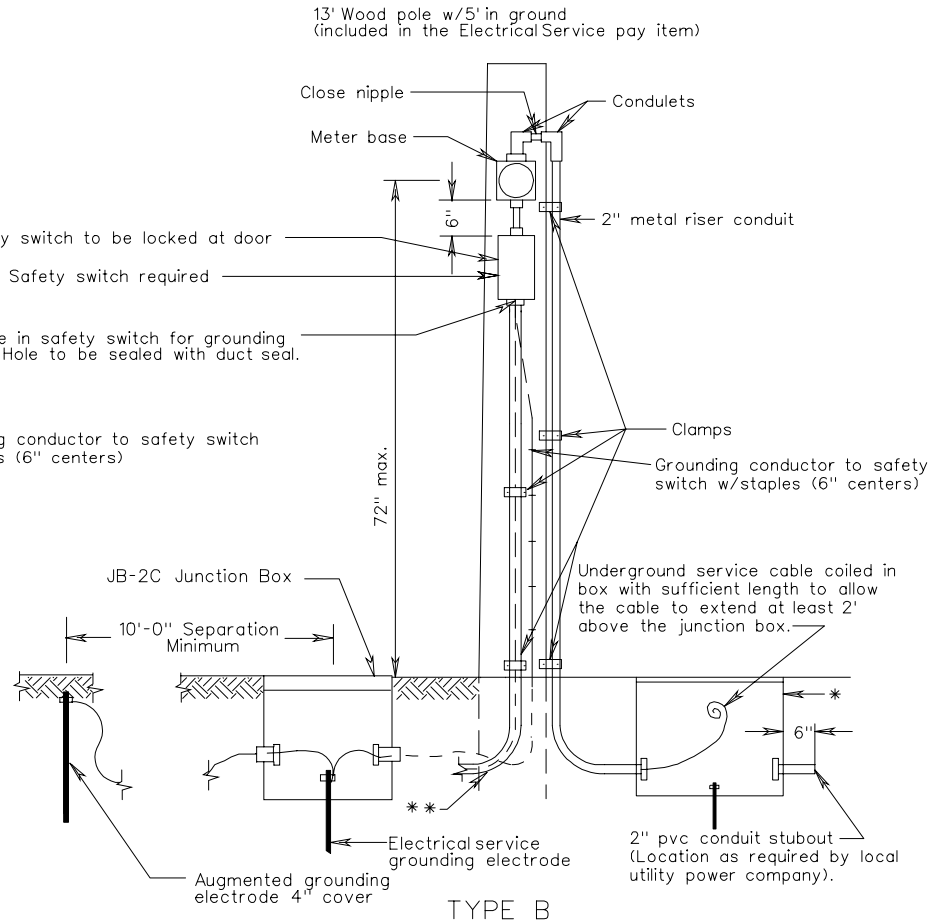
No other conductors shall be run in the same conduit with electrical service cable.

When 200 amp or greater service is required, service shall enter meter base at right bottom.

For underground service installations, local power utility company will install service power utility cable from their power source to the junction box and make required splices to the service cable coiled in the junction box.

* JB-1A, 1B or 1C junction box Top of junction box shall read "UTILITY"

** Conductor cables and Conduit as specified on plans.

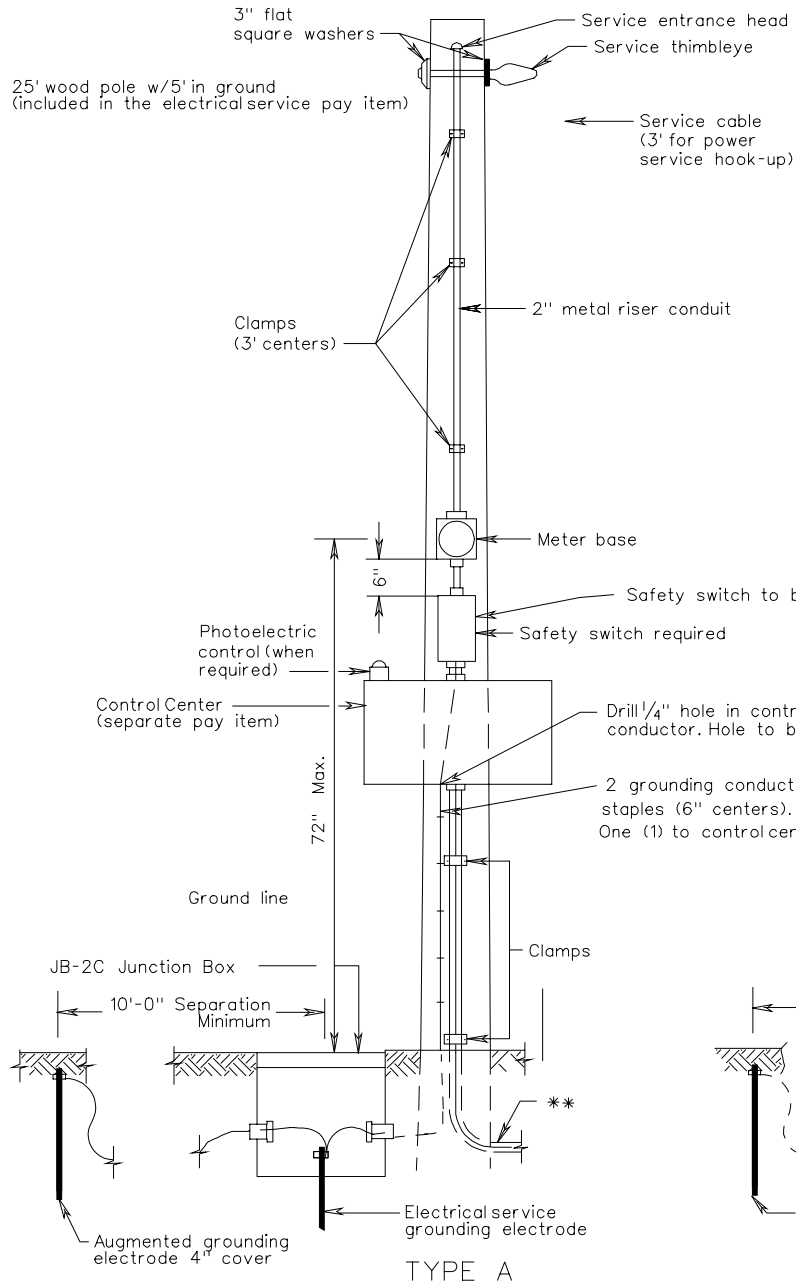


ELECTRICAL SERVICE DETAILS
SIGN AND LIGHTING INSTALLATION

VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 2/06

1301.38



Notes:

This standard is applicable for all electrical services other than 480Y/277. For 480Y/277 service, see standard SE-9.

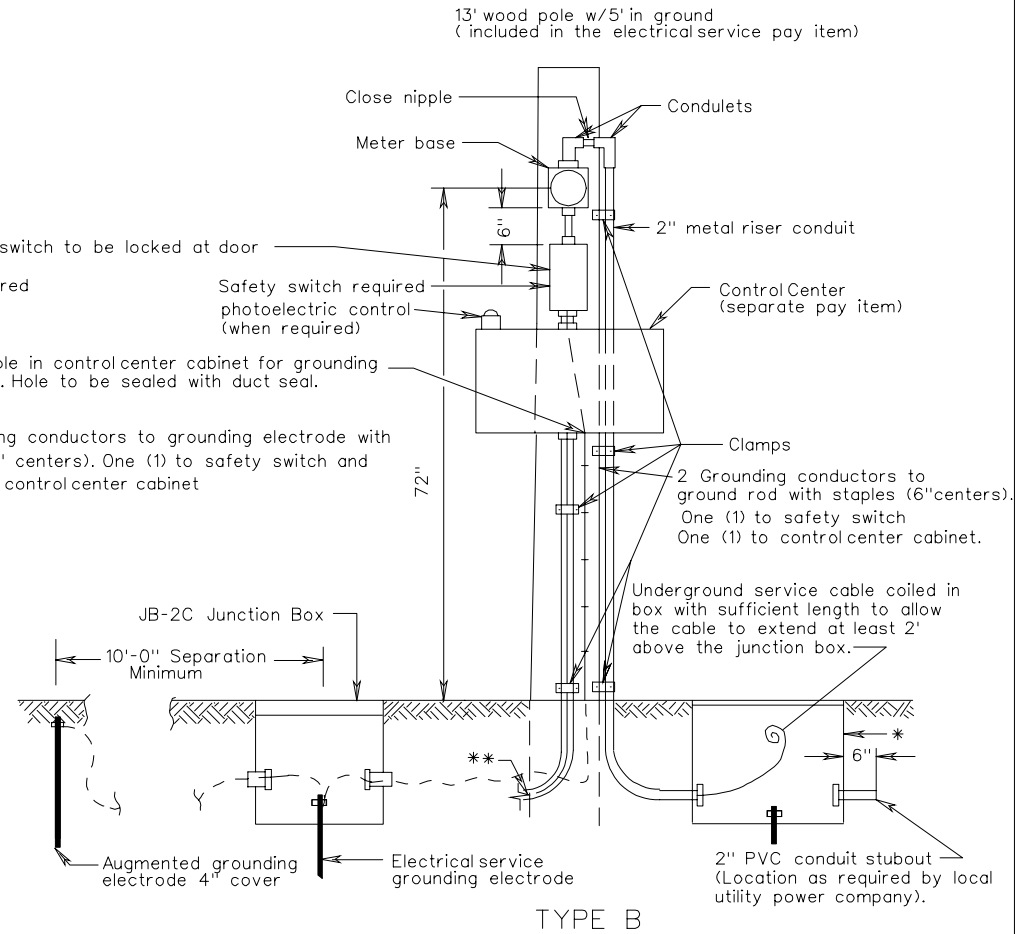
No other conductors shall be run in the same conduit with electrical service cable.

When 200 amp or greater service is required, service shall enter meter base at right bottom.

For underground service installations, local power utility company will install service power utility cable from their power source to the junction box and make required splices to the service cable coiled in the junction box.

* JB-1A, 1B or 1C junction box Top of junction box shall read "UTILITY".

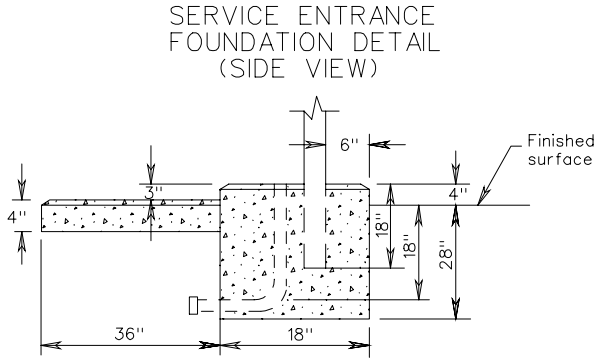
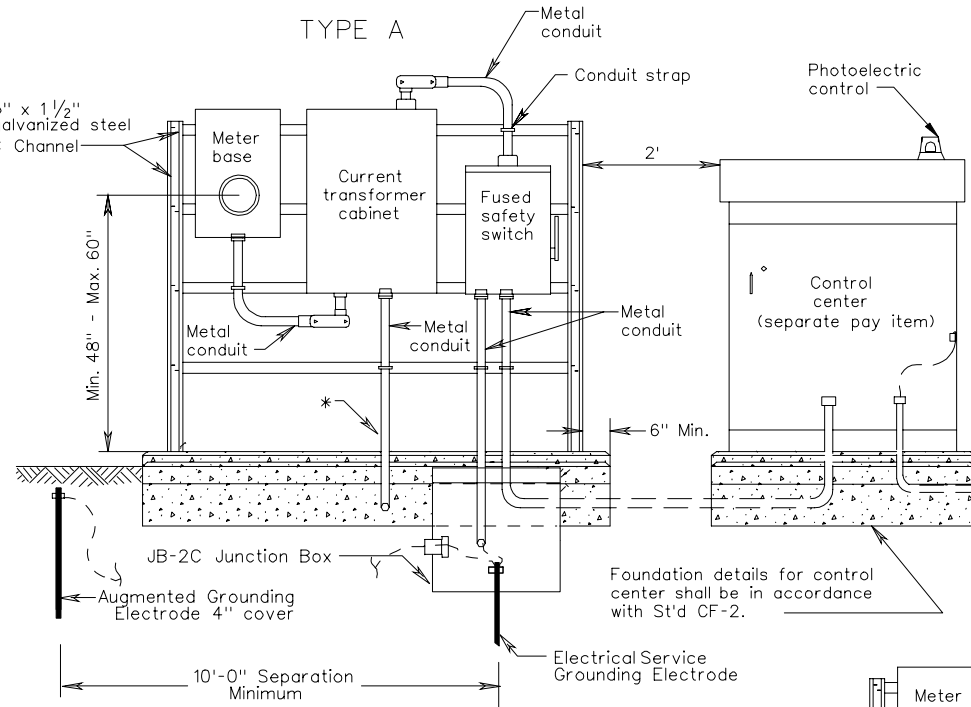
** The conduit and conductor cable shall be as specified on the plans.



ELECTRICAL SERVICE DETAILS
SIGN AND LIGHTING INSTALLATION

VIRGINIA DEPARTMENT OF TRANSPORTATION

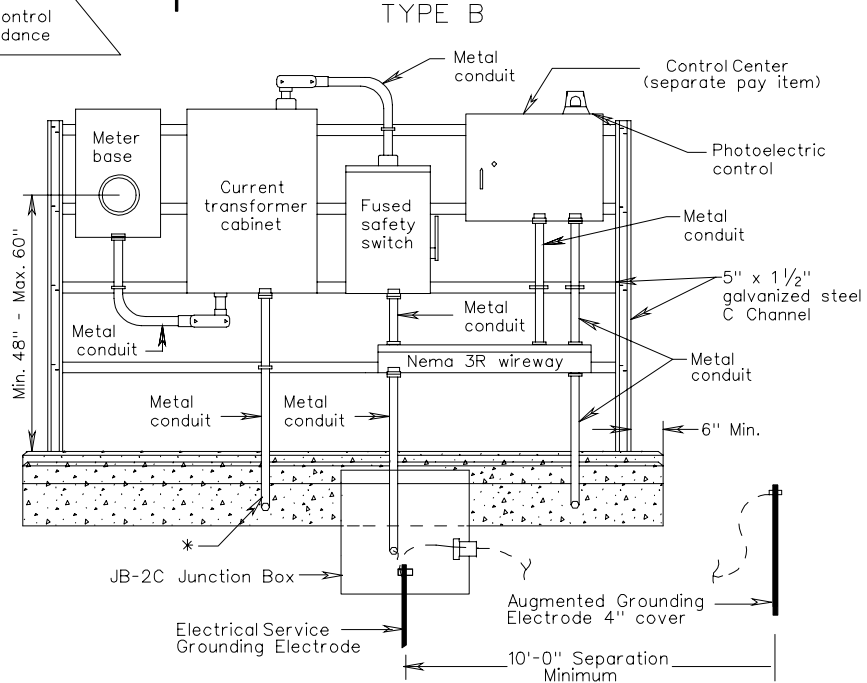
SE-9



AMP RATING	CONDUIT SIZE	CONDUCTOR SIZE
30 AMP	1"	#8
60 AMP	1 1/4"	#6
100 AMP	1 1/2"	#3
200 AMP	2"	#000

Notes:

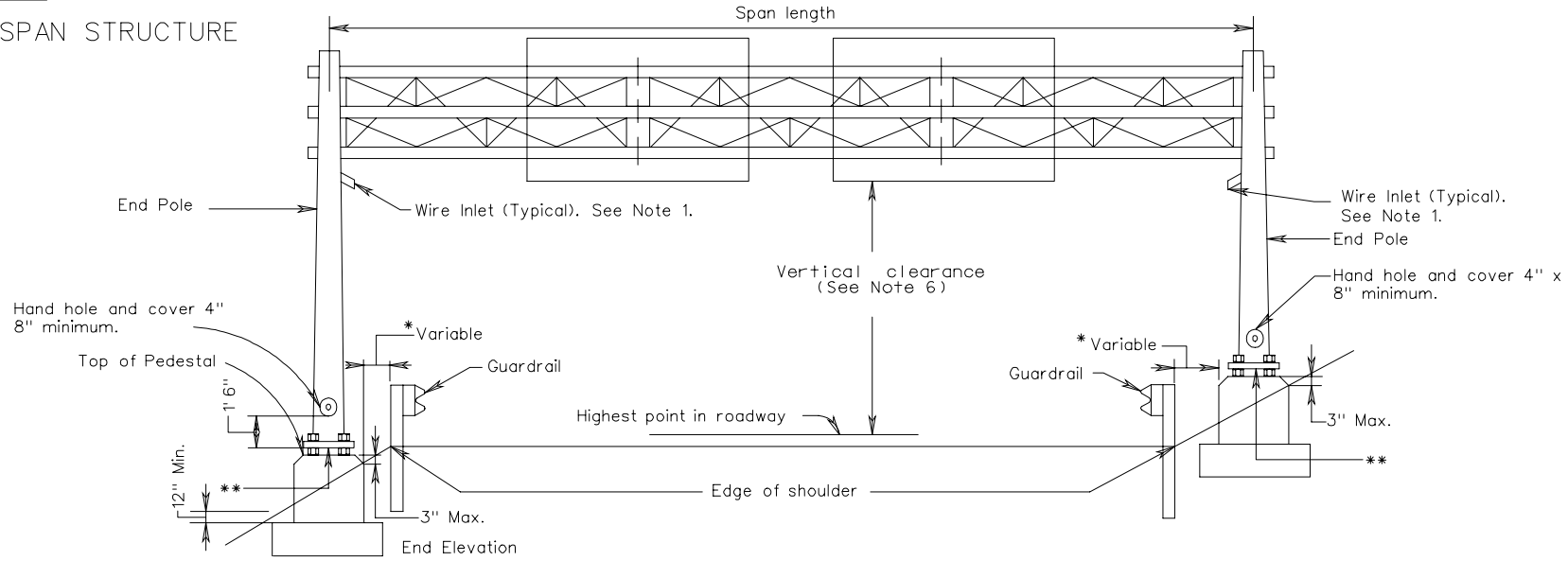
- * Conduit shall be stubbed out 6" past concrete foundation pad. Location of the stubbed conduit shall be as required by the local power company.
- All exposed concrete edges shall be chamfered 3/4".
- Grounding bushings shall be installed on each end of metal conduits.
- Bell ends shall be installed on the ends of PVC conduits.
- Local power company will install service cable from their power source to the current transformer cabinet and meter base.
- Safety switch, meter base, wireway, current transformer cabinet and control center shall be attached with 3/8" galvanized bolts, lock washers and nuts. Four cross channels shall be utilized.
- Each foundation shall be permanently marked to indicate all sides from which conduits pass. This mark shall be made with a trowel when finishing the concrete and shall be 1/4" deep and 4" to 6" long.
- This standard is applicable for 480Y/277 electrical service only.
- The contractor shall leave a sufficient amount of conductor cable coiled inside the current transformer cabinet to permit the local power company to make their connection.



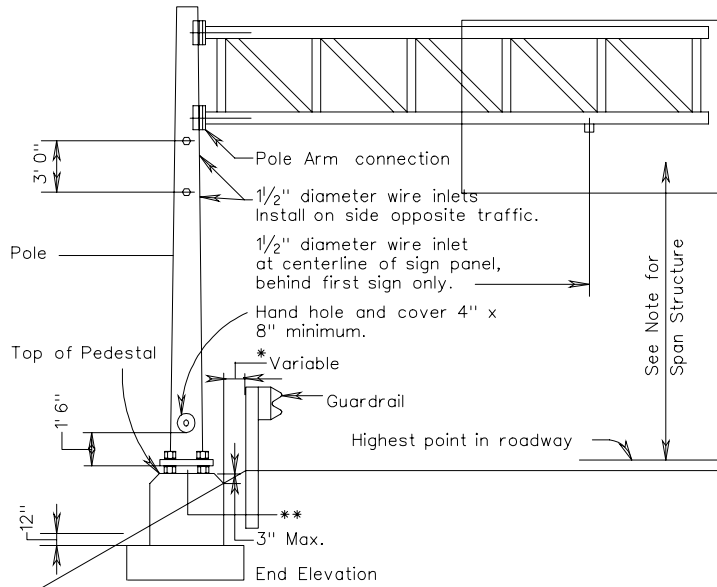
ELECTRICAL SERVICE DETAILS SIGN AND LIGHTING INSTALLATIONS

OSS-1

SPAN STRUCTURE



CANTILEVER STRUCTURE



NOTES:

1. 1/2" diameter wire inlets shall be provided at the following locations:
 - A. On span structures on the front leg of end pole 12" below bottom chord.
 - B. On cantilever structures on pole 12" below bottom chord.
 - C. On span structures below bottom chord at centerline behind first sign panel from each end pole.
 - D. On cantilever structures below bottom chord at centerline behind first sign panel from pole.
2. All unused wire inlets shall be capped water tight.
- *3. Distance shall be no less than the minimum indicated in Standard GR-INS.
4. No mortar, grout, or concrete shall be placed between bottom of base plate and top of pedestal.
- *5. The maximum space between the bottom of the base plate and the top of the foundation shall be no more than the diameter of the anchor bolt plus one inch.
6. Vertical clearance for overhead and bridge mounted sign structures shall be no less than 5.8 meters and no more than 6.4 meters from the bottom of the lowest mounted sign panel to the crown of the roadway, unless otherwise specified on the plans. Luminaire assemblies shall have a vertical clearance of no less than 5.3 meters from the bottom of the assembly to the crown of the roadway.
7. All poles/uprights of overhead sign structures including "butterfly" structures shall have a minimum of six anchor bolts, each having a minimum diameter of 1 1/2". Anchor bolts shall be cast in place. Adhesive anchors with epoxy or non-shrink grout shall not be allowed.

REV. 2/06
 REV. 7/05
 REV. 4/04
 REV. 1/04

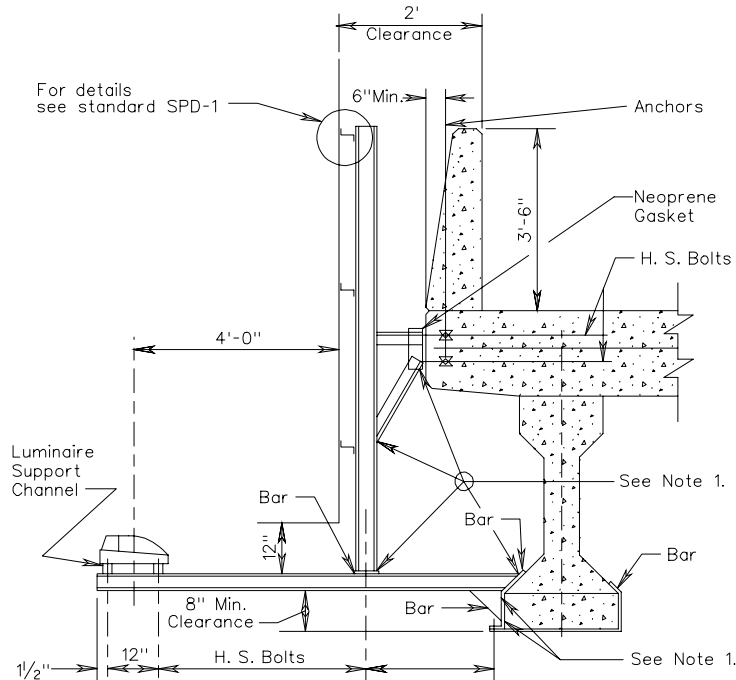
1301.72

TYPICAL DETAILS FOR OVERHEAD
 SIGN STRUCTURES

VIRGINIA DEPARTMENT OF TRANSPORTATION

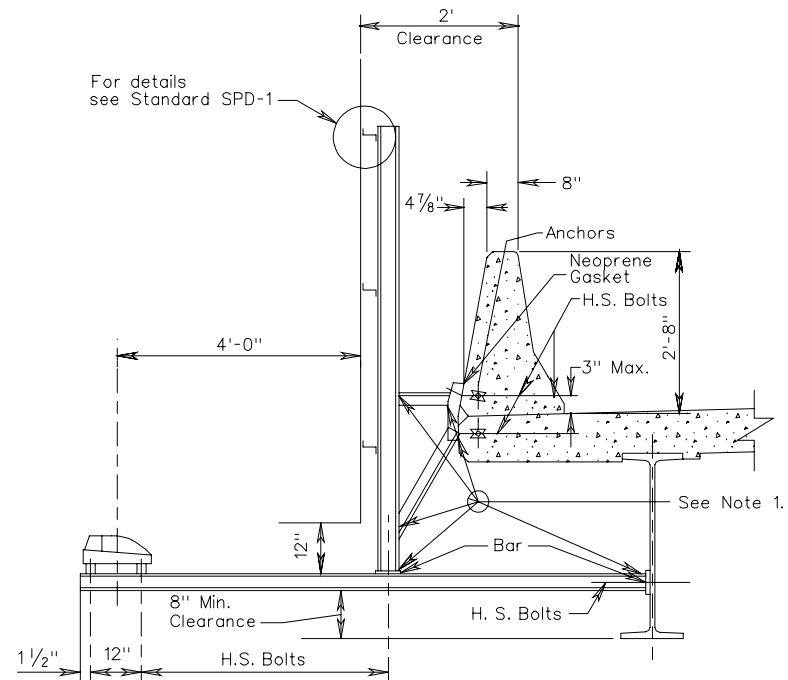
BSS-1

TYPICAL FOR PRESTRESSED CONCRETE BEAM



This parapet is not typical for bridges with a sidewalk.
Bridge plans shall be reviewed for project specific parapet/rail.

TYPICAL FOR STEEL BEAM/GIRDER



Bridge plans shall be reviewed for project specific parapet/rail.

NOTES:

1. The size of members and weld size(s) shall be designed by the contractor for the sign to be supported. Minimum size fillet weld shall be 1/4".
2. Minimum clearances are as specified by AASHTO or approved by the Virginia Department of Transportation.
3. For attachment to concrete superstructures or to painted or galvanized steel superstructures, supporting frame may be either aluminum or galvanized steel. For attachment to unpainted weathering steel superstructures, the supporting frames shall be with weathering steel.
4. The spacing of zees and supports shall be as shown on the plans.
5. Sign supports shall be braced for lateral forces.
6. Bolts shall be High-Strength ASTM A325, galvanized except when attachment is made to unpainted weathering steel in which case bolts shall be ASTM A325 Type 3.
Anchors shall be cast-in-place. Thru-bolting may also be used for attachments to parapets. When cast-in-place anchors are used, they shall develop the strength of the bolts. When thru-bolting is used, anchorage on the traffic side of the parapet shall be flush with the parapet face.
Anchors shall be placed no higher than 3" above top of deck slab. Adhesive anchors (with epoxy or non-shrink grout) shall not be allowed.

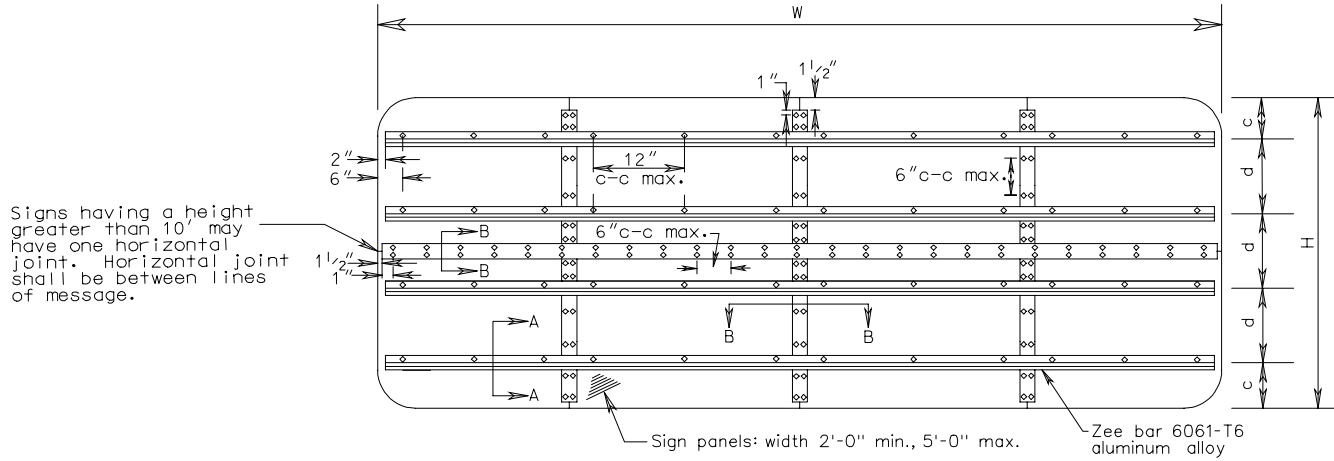
7. When required by the plans bridge mounted sign structure luminaires shall be installed on a luminaire retrieval system with supports and electrical system designed for track mounted luminaires. Retrieval system including the electrical system shall be equal to "LUMI-TRAK" and designed for the number of luminaires as indicated on the plans. Spacing of hangers used to support the retrieval system shall be increased to a maximum 7-foot distance only where hangers do not support sign panels. Turntable end of retrieval system shall be of sufficient length to align with the vertical edge of the outside paved shoulder (±6") or shall extend five feet beyond the vertical edge (±6") of outermost sign luminaire whichever is greater. The opposite end of retrieval system shall extend a minimum of 6 inches past the outermost vertical edge of the sign hanger arm. Luminaire support channels and associated equipment will not be required with the luminaire retrieval system.

TYPICAL BRIDGE PARAPET SIGN
MOUNTING DETAILS

VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 2/06
REV. 7/05

1301.78



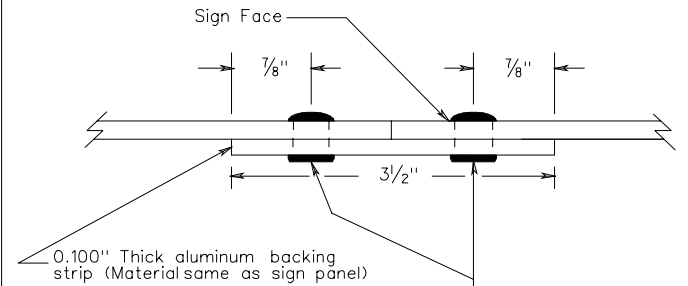
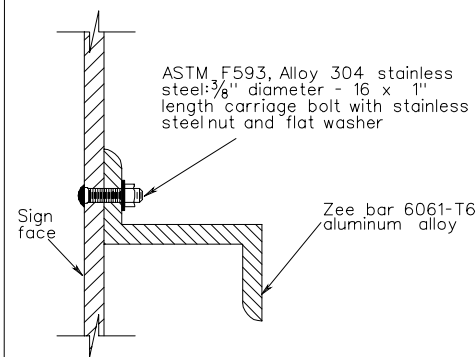
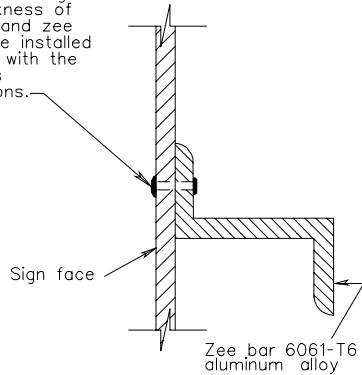
SECTION A-A

SECTION B-B

ALL INSTALLATIONS EXCEPT TOP AND BOTTOM ZEE BARS ON OVERHEAD SIGNS

TOP AND BOTTOM ZEE BAR INSTALLATION ON OVERHEAD SIGNS

3/8" diameter rivet - Rivets shall be dome head, break mandrel, blind rivets conforming to Industrial Fasteners Institute Standard IFI-114, Style 1, Grades 10 or 11 except that the minimum ultimate tensile strength shall be 360 pounds. Rivets shall have a grip range accommodating the combined thickness of the sign panel and zee bar and shall be installed in accordance with the manufacturer's recommendations.

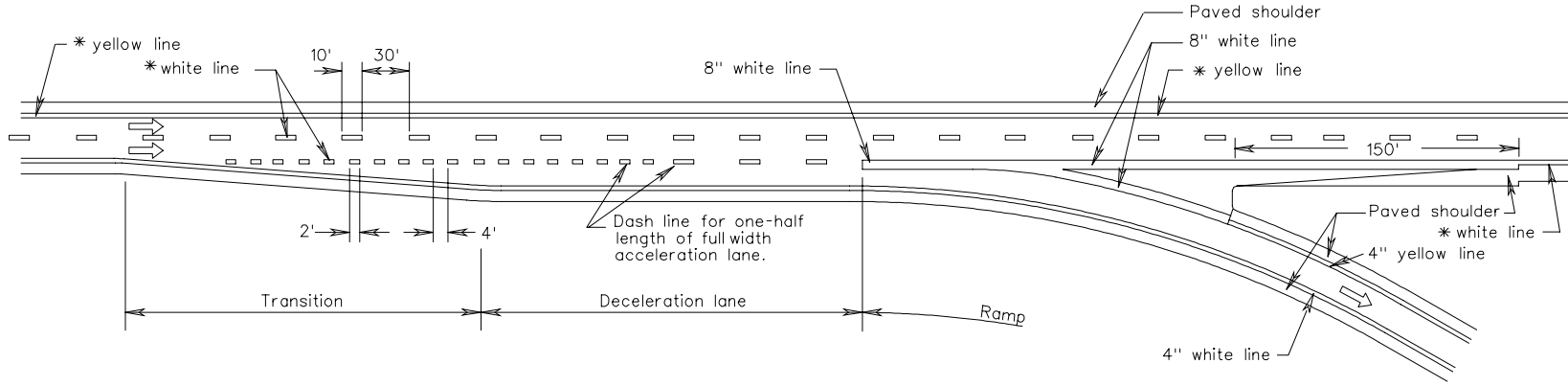


Rivet (Same as used for connecting sign to zee bar). In lieu of using rivets, tape equal to 3M's VHB Double Coated Acrylic Foam Tape may be used except on horizontal backing strip. Tape shall be installed in accordance with the manufacturer's recommendations.

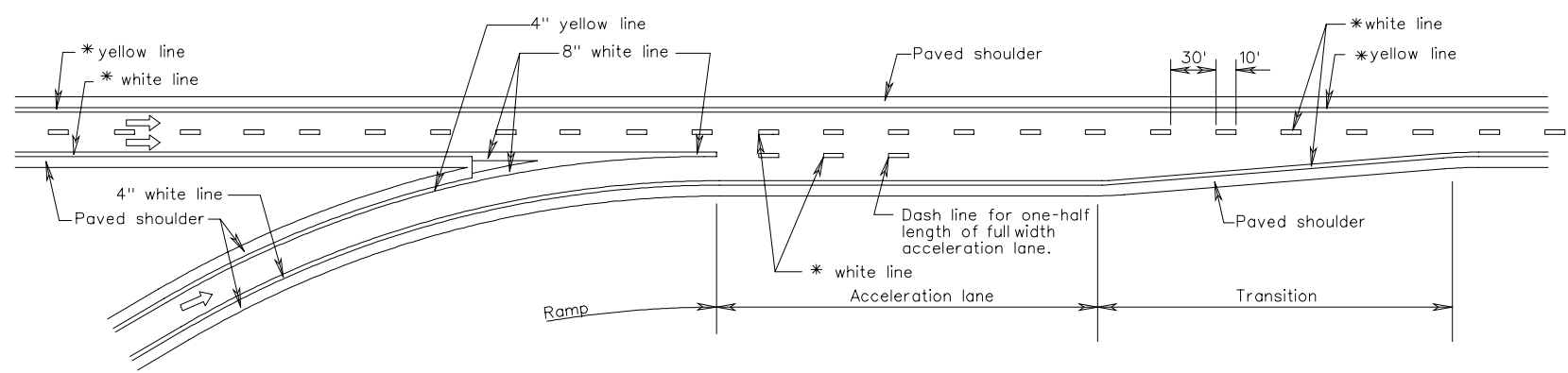
SIGN PANEL DESIGN

PM-1

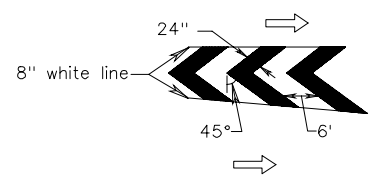
INTERCHANGE EXIT



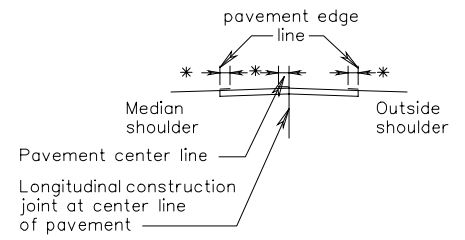
INTERCHANGE ENTRANCE



GORE AREA HATCHING OPTIONAL



LATERAL PLACEMENT FOR PAVEMENT LINE MARKING ON HYDRAULIC CEMENT CONCRETE



Notes:

Place pavement center line marking on center line of bituminous surface.

All pavement markings shall be installed in accordance with the MUTCD.

* The pavement marking for the mainline of Interstate Highways shall be 6" wide; all other highways the pavement marking shall be 4" wide unless otherwise noted on the plans.

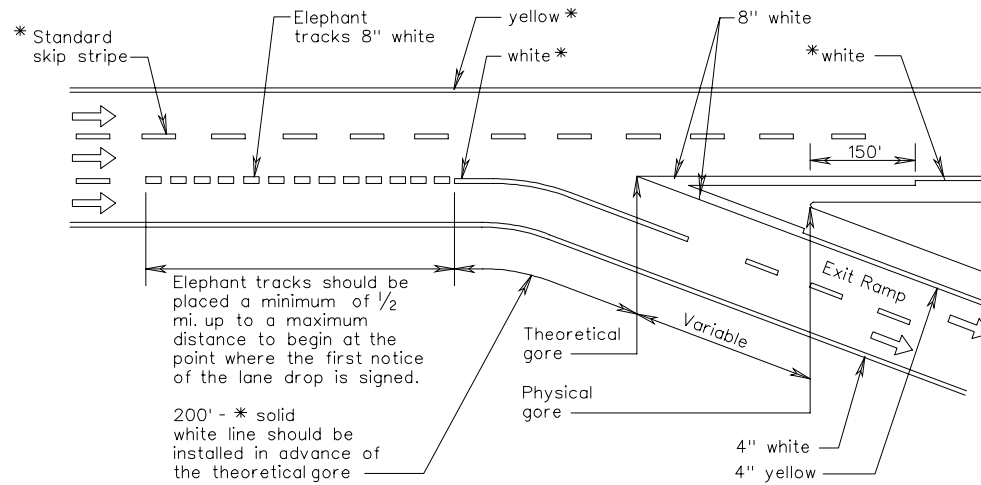
TYPICAL PAVEMENT MARKING DETAILS

VIRGINIA DEPARTMENT OF TRANSPORTATION

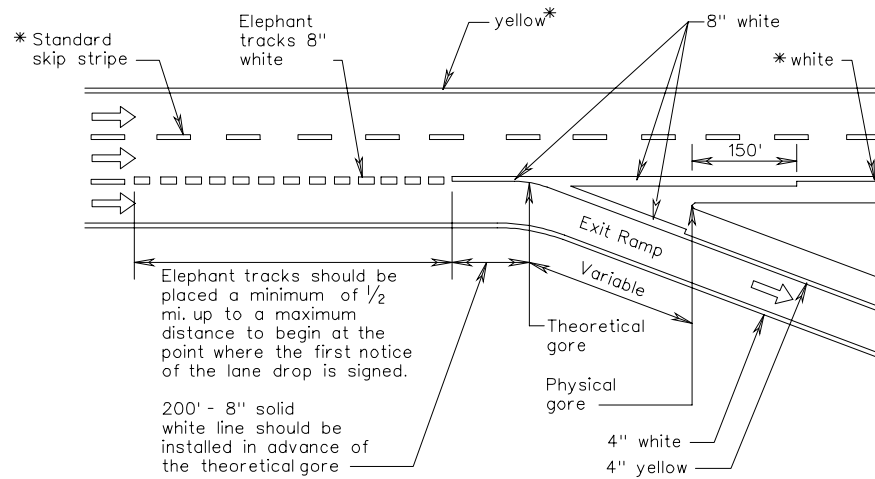
REV. 2/06

1301.86

LIMITED ACCESS LANE DROP EXIT RAMP
BESIDE CHOICE LANE THRU / EXIT

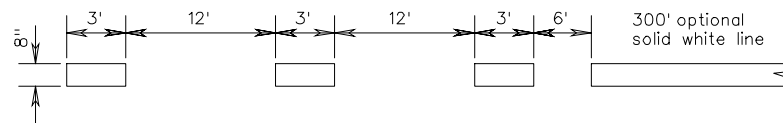


LIMITED ACCESS LANE DROP EXIT RAMP



* The pavement marking for the mainline of Interstate Highways shall be 6" wide; all other highways the pavement marking shall be 4" wide unless otherwise noted on the plans.

STANDARD ELEPHANT TRACKS



TYPICAL PAVEMENT MARKING
DETAILS