



COMMONWEALTH of VIRGINIA

DEPARTMENT OF TRANSPORTATION
1401 EAST BROAD STREET
RICHMOND, VIRGINIA 23219-2000

PHILIP A. SHUCET
COMMISSIONER

MOHAMMAD MIRSHAHI, P.E.
STATE LOCATION AND DESIGN ENGINEER

August 1, 2002

MEMORANDUM

To: All Holders of the Virginia Department of Transportation's 2001 Road and Bridge Standards

The following is a list of standards contained in the 2001 Road and Bridge Standards that have been revised. Please add these pages to your copy of the standards. An insertable sheet will not be required in plan assemblies.

STANDARD	PAGE	REVISION
DI-3D, E, F	104.12	Corrected dimensioning error in Section A-A.
PR-2	301.01	Deleted steel fabric reinforcement from plain concrete side of Typical Cross Section Concrete Pavement.
RW-3	401.02	Corrected dimensioning error.

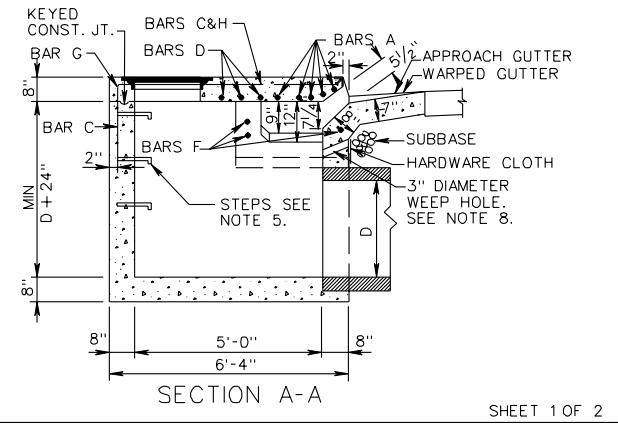
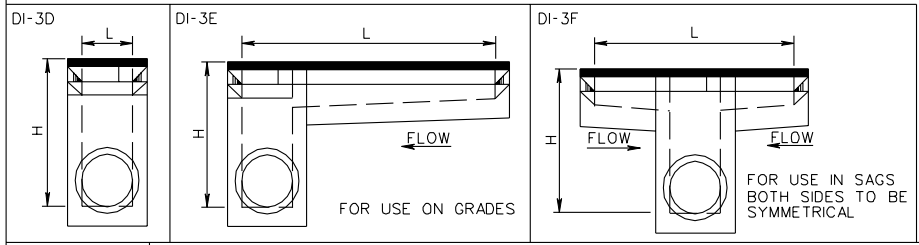
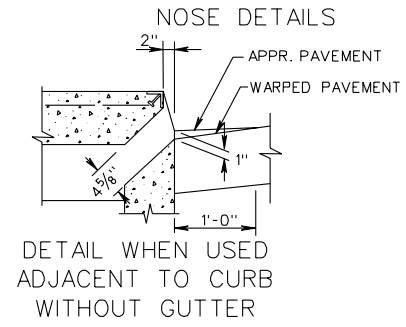
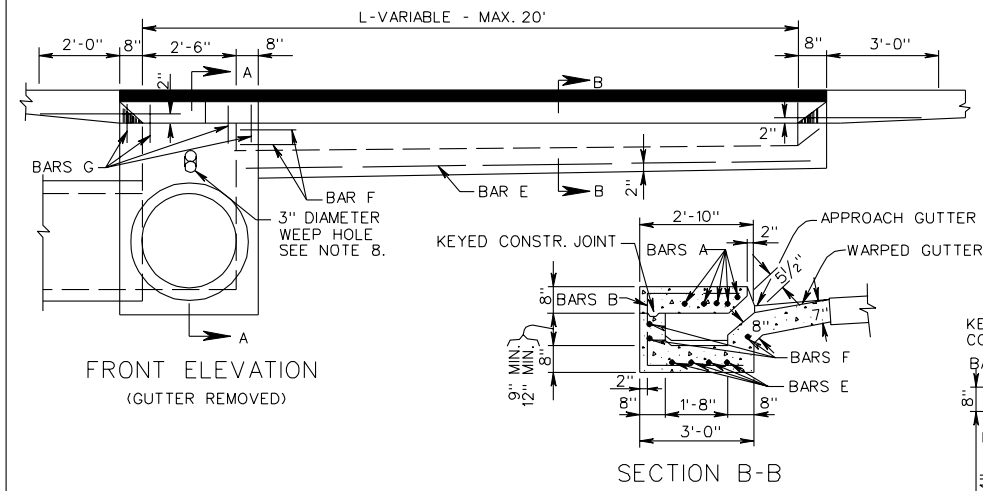
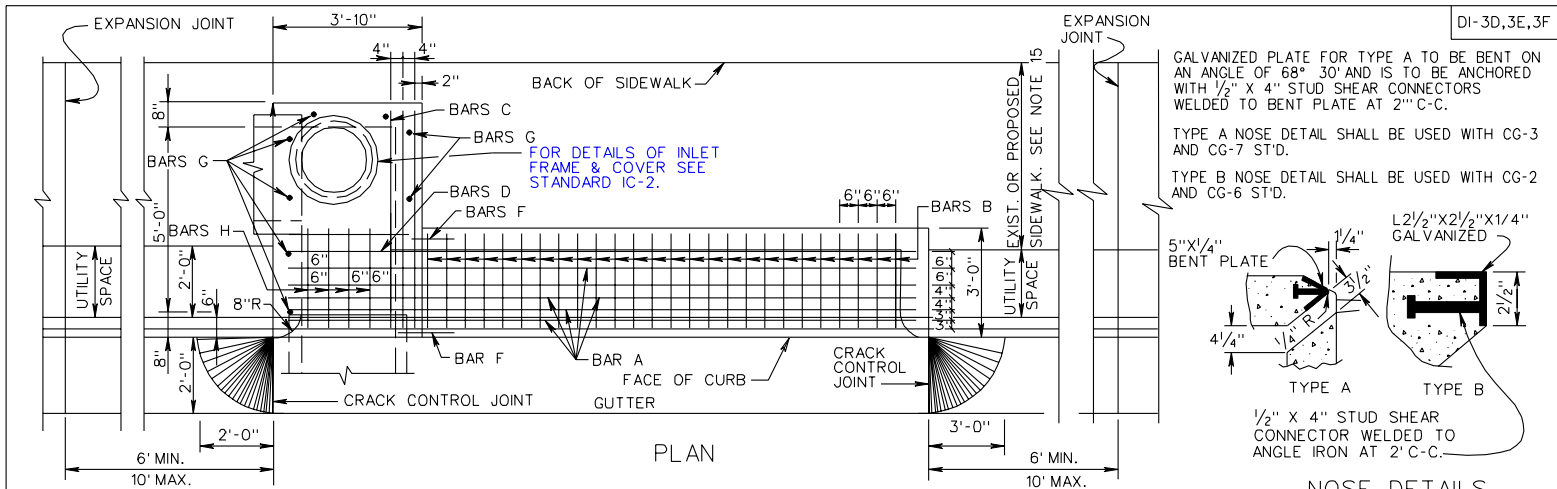
The following is a list of revised standards to the 2001 Road and Bridge Standards that do require an insertable sheet to be included in your plan assembly until the next edition of the imperial standards is published. Please add these pages to your copy of the standards. The respective insertable sheet number has been placed with the revised standard in parenthesis. An insertable sheet is available for each of these revised standards. The insertable sheets are available on VDOT's web site on the FTP server and in Falcon DMS for VDOT personnel. These insertable sheets will be required in plan assemblies for projects utilizing the standard items listed below that have not been turned in for first submission.

STANDARD	PAGE	REVISION
DI-10J, K, L (A100)	104.29	Corrected typographical error in Note 1.
MH-1 (A20)	106.04	Specified that Cover A is for non-traffic conditions and Cover B is for traffic conditions.
PG-2A (ISD 570)	109.01	Revised to show curtain wall as a separate detail.
PG-7 (ISD 564A)	109.05	Revised flume connector to show taper from 4' width at Standard PG-5 connection to 3' width at standard PG-4 connection.

STANDARD	PAGE	REVISION
GR-6 (A132)	501.09	Revised post spacing at terminal anchorage.
GR-7 (A89)	501.11 501.12	Revised Note 3. Revised number of posts.
GR-9 (ISD 2390)	501.18	Deleted wood post requirement for GR-2 installation used to transition from GR-9 terminal and GR-2 weak post guardrail.
GR-11 (A145)	501.21	New standard terminal for run off conditions on divided highways.
GR-INS (A146)	501.33	Revised to include the use of the GR-11 terminal.
MB-10A (ISD 1276A)	501.51 501.52	Revised to meet NCHRP 350 criteria.
MB-INS (ISD 2063A)	501.62 501.63	Revised to meet current FHWA instructions.
S-1 (A144)	601.01	Revised to meet BOCA Code requirements.
S-2 (A144)	601.03	Revised to meet BOCA Code requirements.

If you have any questions or comments regarding the listed revisions to this publications, please contact Mrs. N. E. Berry of the Engineering Services Section at (804) 786-2543.

Mohammad Mirshahi, P.E.
State Location and Design Engineer



<p>SPECIFICATION REFERENCE</p> <p>233</p> <p>302</p>	<p>STANDARD CURB DROP INLET (WITH UTILITY SPACE)</p> <p>12" - 30" PIPE: MAXIMUM DEPTH (H) = 8'</p> <p>VIRGINIA DEPARTMENT OF TRANSPORTATION</p>	<p>SHEET 1 OF 2</p> <p>REV. 7/02</p> <p>104.12</p>
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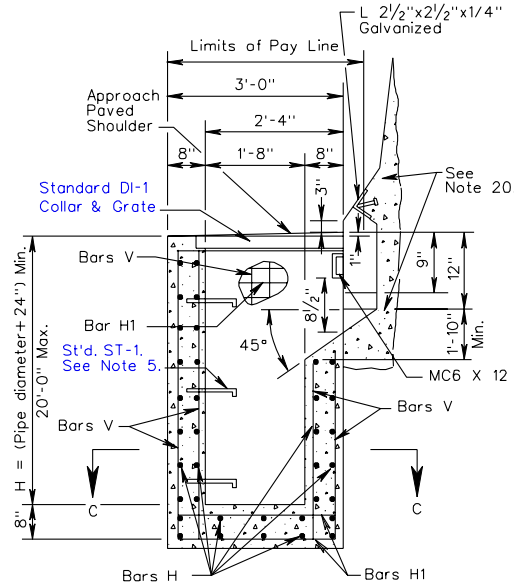
DI-10J, 10K, 10L

TYPE I & III INLET

REINFORCING STEEL				
MARK	SIZE	NO.	LENGTH	SPACE
A	#4	6	L - 2'-6"	AS SHOWN
See Note 9	#4	See Note 7	See Note 8	
A-1	#4	(2xL)+2	4'-0"	12
See Note 11	#4			
B	#3	2x(L-4)	1'-1"	12
See Note 9	#3			
B-1	#4	9	L+(2'-4")	8
See Note 11	#4			
DOWELS	#4	See Note 6	1'-0"	6
F	#5	See Note 10	1'-6"	6
See Note 9	#5	See Note 10	1'-6"	
H	#5	(4xH)+10	3'-2"	12
H1	#5	(4xH)+8	2'-8"	10

TYPE - II INLET

REINFORCING STEEL				
MARK	SIZE	NO.	LENGTH	SPA.
A-1	#4	(2xL) 2	4'-0"	12"
B-1	#4	9	L+(2'-4")	8"
H-2	#5	See Note 12	7'-8"	10"
V-1	#4	12	H - (1'-2")	8"
V-2	#4	30	LENGTH = H	8"
A	#4	12	L - (2'-6")	AS SHOWN
See Note 15	#4	See Note 14	See Note 8	
B	#3	4(L-4)	1'-1"	12"
See Note 15	#3			
DOWELS	#4	DOUBLE NO. SHOWN FOR TYPE I	1'-0"	6"
F	#5	6	1-6"	6"
See Note 15	#5	See Note 13	See Note 13	
H	#5	(4 + H)+8	3'-2"	12"
H-1	#5	(4 + H)+16	2'-8"	10"
V	#4	30	LENGTH = H	8"
M-1	#5	5	3'-2"	5"
M	#4	4	1'-8"	12"

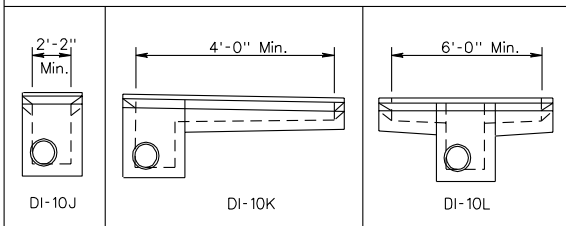


FOR USE ADJACENT TO WALL OR BARRIER WITH SAFETY SHAPE (TYPE III)

21. TYPE I DENOTES INLET WITH SINGLE THROAT AND CHAMBER. TYPE II DENOTES INLET WITH DOUBLE THROAT AND CHAMBER. TYPE III DENOTES INLET WITH SINGLE THROAT AND CHAMBER ADJACENT TO WALL OR BARRIER.
22. MAXIMUM PIPE SIZE IS 24" DIAMETER.
23. 3" DIAMETER WEEP HOLE TO BE LOCATED TO DRAIN SUBBASE MATERIAL. WEEP HOLE WITH 12" X 12" PLASTIC HARDWARE CLOTH 1/4" MESH OR GALV. STEEL WIRE, MIN. WIRE DIAMETER 0.03", #4 MESH HARDWARE CLOTH ANCHORED FIRMLY TO OUTSIDE OF THE STRUCTURE.
24. PROVIDE SAFETY SLABS WHEN SPECIFIED ON THE PLANS.
25. WHEN SPECIFIED ON THE PLANS, THE INVERT IS TO BE SHAPED IN ACCORDANCE WITH THE 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.

NOTES

1. VARIES GREATER THAN: 0' TO 18" MAX. TYPE I CHAMBER. 4" TO 3' MAX. TYPE I CHAMBER.
2. FOR DETAILS AND DIMENSIONS NOT SHOWN FOR MEDIAN BARRIER, SEE STANDARD MB-8A.
3. GALVANIZED MC-6 X 12 IS TO BE WELDED UNDER THE COLLAR AND EXTENDED INTO SIDEWALLS TO WITHIN 2" OF OUTSIDE FACE.
4. ALL REINFORCING BARS ARE TO BE GRADE 60 STEEL WITH MIN. OF 1/2" CONCRETE COVER. ANY BAR IN CONFLICT WITH PIPE SHELL AND/OR TOP SLAB OPENING ARE TO BE FIELD CUT TO PROVIDE THE REQUIRED COVER.
5. DO NOT LOCATE STANDARD ST-1 STEPS ON CHAMBER WALLS THAT HAVE PIPES WHEN POSSIBLE.
6. 8 DOWELS REQUIRED FOR DI-10L, MIN. L = 7'-0". ADD 2 DOWELS FOR EACH ADDITIONAL FOOT. 4 DOWELS REQUIRED FOR DI-10K, MIN. L = 4'-0". ADD 2 DOWELS FOR EACH ADDITIONAL FOOT.
7. 12 BARS A REQUIRED FOR DI-10L.
8. LENGTH OF BARS A, DI-10L = $\frac{L - (2'-6")}{2}$
9. DO NOT USE WITH DI-10J.
10. USE 6 BARS F FOR DI-10L TYPE I.
11. DO NOT USE WITH TYPE III.
12. ADD 4 ADDITIONAL BARS FOR EACH EXTRA FOOT OF DEPTH.
13. USE 12 BARS F FOR DI-10L TYPE II.
14. 24 BARS A ARE REQUIRED FOR DI-10L.
15. DO NOT USE WITH DI-10J.
16. A MINIMUM 22" FOOTING DEPTH IS REQUIRED FOR FORMING THE INLET SLOT. SEE PLANS FOR LENGTH "L".
17. REFER TO PLANS FOR STRUCTURE LOCATIONS, DATA AND DIMENSIONS.
18. REFER TO PLANS FOR LOCATIONS OF PIPES AND INVERTS.
19. FOR TYPE III, COST OF ACCOMMODATION OF INLET THROAT IS TO BE INCLUDED IN COST OF WALL BARRIER.
20. FOR TYPE III, SEE WALL PLANS FOR WALL FOOTING DETAILS.



REV. 7/02
104.29

CONCRETE BARRIER DROP INLET (WITH MB-8A)
12"-24" PIPE: DEPTH (H) = 20' MAX.

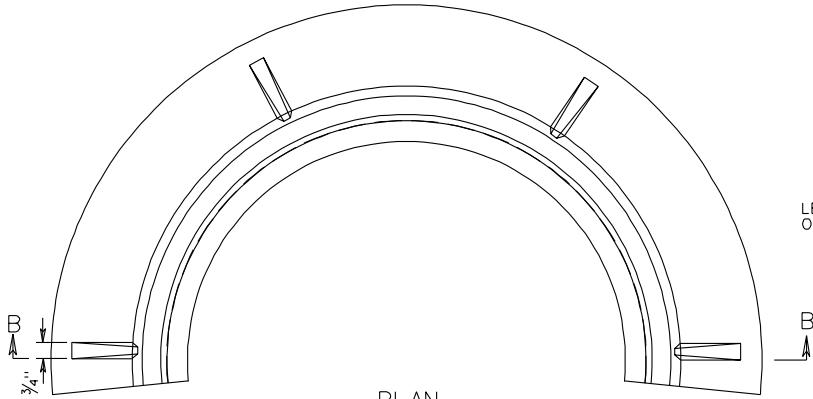
VIRGINIA DEPARTMENT OF TRANSPORTATION

Sheet 2 of 2

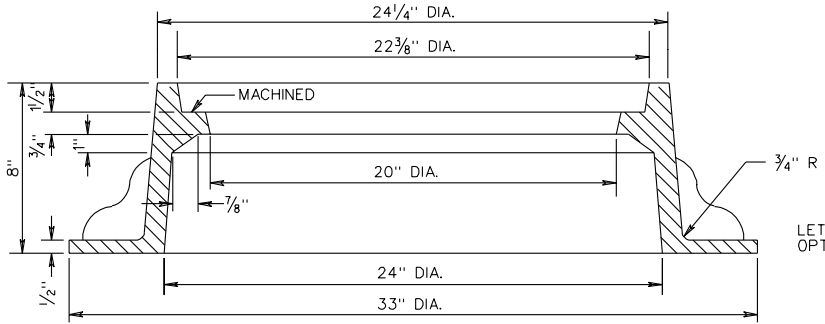
SPECIFICATION REFERENCE

233
302

MH-1

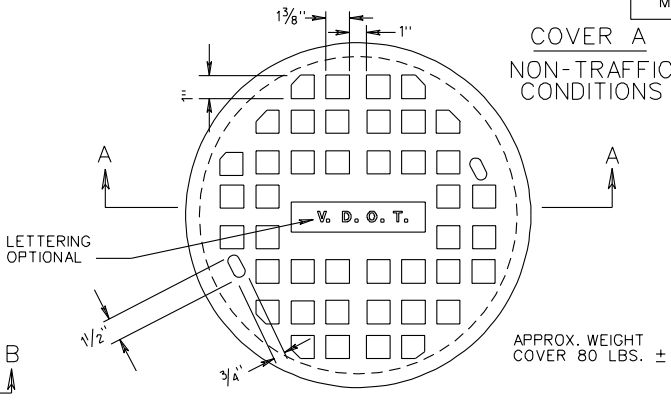


PLAN



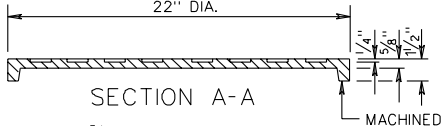
FRAME

EITHER COVER A OR B MAY BE USED WITH FRAME.
APPROX. WEIGHT COVER 170 LBS. ±

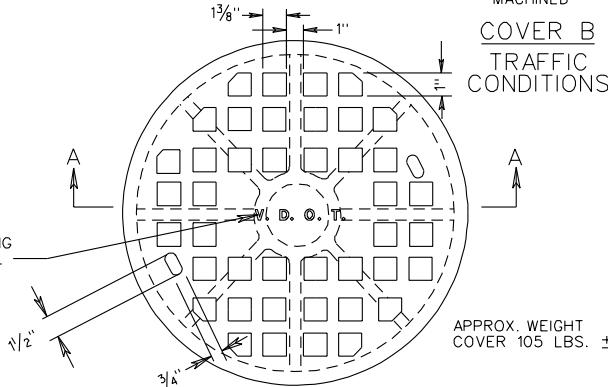


COVER A
NON-TRAFFIC
CONDITIONS

TOP
22" DIA.

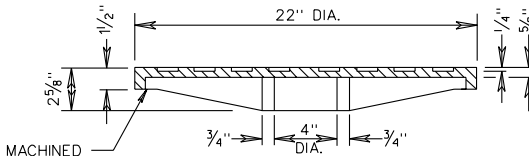


SECTION A-A



COVER B
TRAFFIC
CONDITIONS

TOP



SECTION A-A

SHEET 4 OF 5

SPECIFICATION REFERENCE
224
302

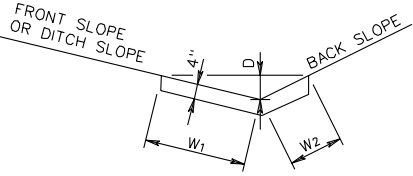
STANDARD MANHOLE FRAME AND COVER

VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 7/02

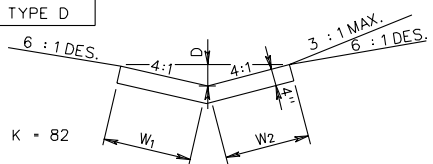
106.04

OUTSIDE ROAD DITCHES



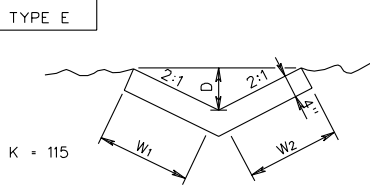
TYPE	D	FRONT SLOPE	BACK SLOPE	W1	W2	K	SQ. YDS. SURFACE AREA/LIN. FT.
A1	6"	6:1	4:1	3'-0"	2'-1"	48	0.565
A1	8"	6:1	4:1	4'-1"	2'-9"	104	0.759
A2	6"	6:1	3:1	3'-0"	1'-7"	42	0.509
A2	8"	6:1	3:1	4'-1"	2'-1"	92	0.685
A3	6"	6:1	2:1	3'-0"	1'-2"	38	0.463
A3	8"	6:1	2:1	4'-1"	1'-6"	82	0.620
B1	6"	4:1	4:1	2'-1"	2'-1"	38	0.463
B1	8"	4:1	4:1	2'-9"	2'-9"	82	0.611
B2	8"	4:1	3:1	2'-9"	2'-1"	72	0.537
B2	10"	4:1	3:1	3'-5"	2'-8"	130	0.676
B3	8"	4:1	2:1	2'-9"	1'-6"	60	0.472
B3	10"	4:1	2:1	3'-5"	1'-10"	111	0.583
B4	8"	4:1	1 1/2:1	2'-9"	1'-2"	55	0.435
B4	10"	4:1	1 1/2:1	3'-5"	1'-6"	101	0.546
C1	8"	3:1	2:1	2'-1"	1'-6"	50	0.398
C1	10"	3:1	2:1	2'-8"	1'-10"	92	0.500
C2	10"	3:1	1 1/2:1	2'-8"	1'-6"	80	0.463
C3	10"	3:1	1:1	2'-8"	1'-2"	70	0.426

MEDIAN DITCH



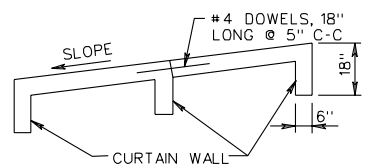
D = DEPTH	W ₁	W ₂	SQ. YDS. SURFACE AREA PER LIN. FT.
8"	2'-9"	2'-9"	0.611

DITCH AT TOE OF FILL OR TOP OF CUT



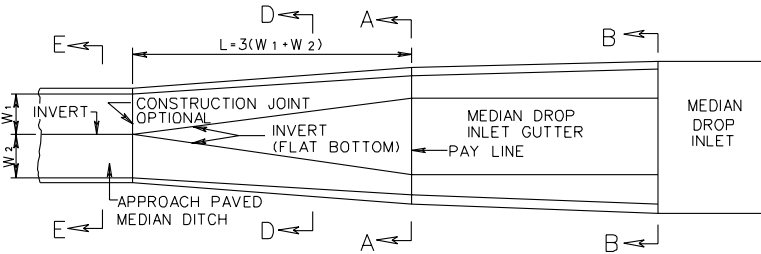
D	W ₁	W ₂	SQ. YDS. SURFACE AREA PER LIN. FT.
12"	2'-3"	2'-3"	0.500

CURTAIN WALL DETAIL

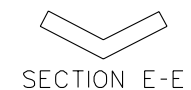
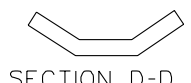


CURTAIN WALL TO BE LOCATED AT BEGINNING AND ON THE LOWER END OF EACH EXPANSION JOINT.

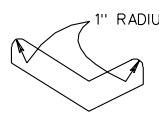
PLAN FOR TRANSITION OF PAVED MEDIAN DITCH TO MEDIAN DROP INLET GUTTER



NOTES:
 FOR SECTION A-A AND B-B SEE STANDARDS DI-7, 7A AND 7B.
 TRADITIONAL PORTION OF PAVED DITCH TO BE PAID FOR AT THE SAME PRICE BID PER SQ. YARD FOR APPROACH PAVED MEDIAN DITCH.
 STANDARD PG-2A DITCHES TO BE CLASS A3 CONCRETE.



ALTERNATE METHOD OF FORMING DITCHES



NOTE:
 ALL DITCHES MAY BE CONSTRUCTED WITH VERTICAL SIDES AT THE OPTION OF THE CONTRACTOR.

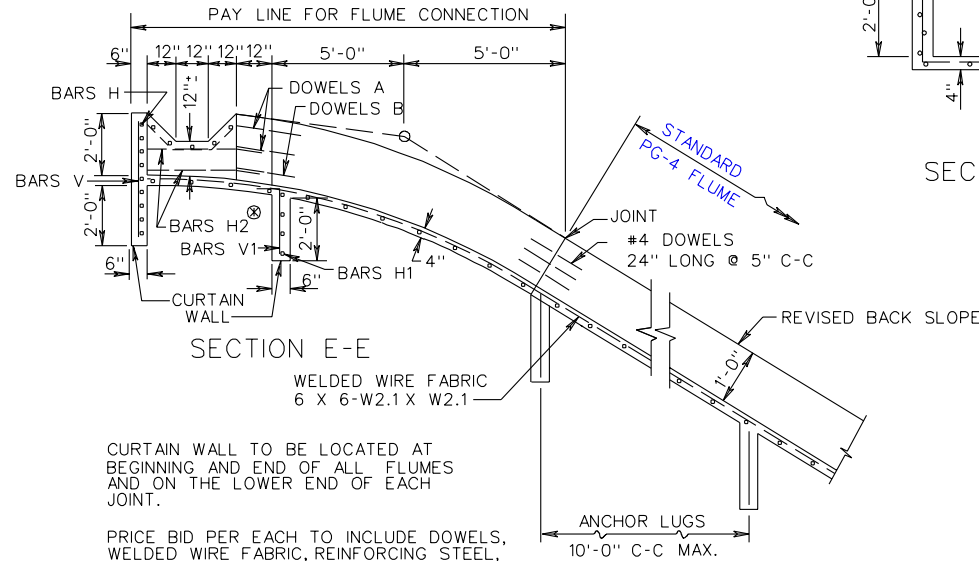
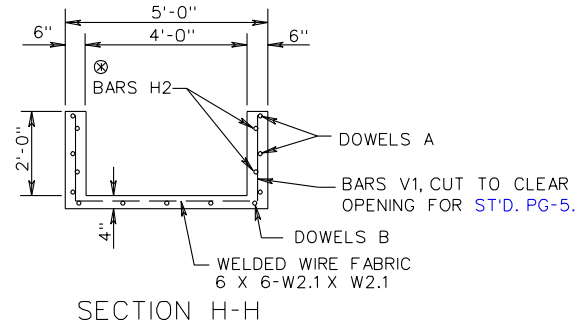
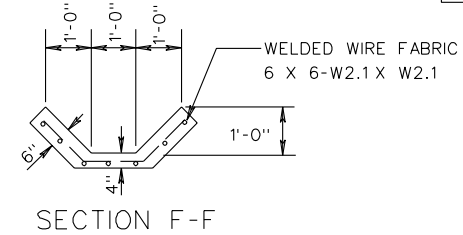
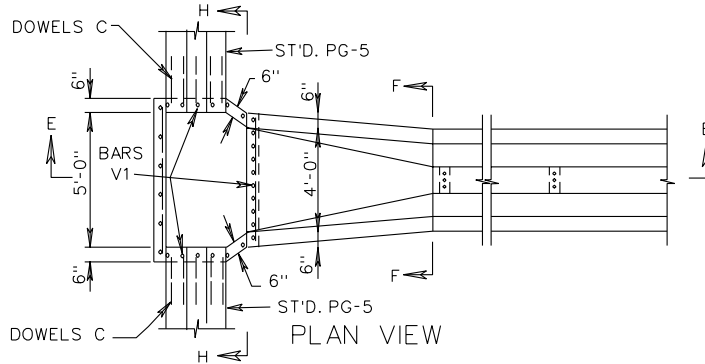
SPECIFICATION REFERENCE
502

STANDARD PAVED DITCHES

VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 7/02

109.01



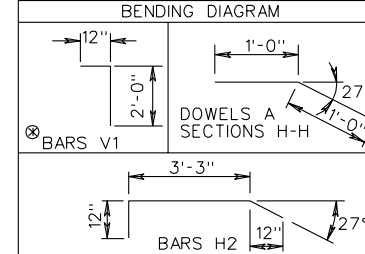
CURTAIN WALL TO BE LOCATED AT BEGINNING AND END OF ALL FLUMES AND ON THE LOWER END OF EACH JOINT.

PRICE BID PER EACH TO INCLUDE DOWELS, WELDED WIRE FABRIC, REINFORCING STEEL, ANCHOR LUGS AND CURTAIN WALL, AND CLASS A-3 CONC.

⊗ FIELD CUT BARS V1 & BARS H2 TO CLEAR OPENING FOR ST'D. PG-5.

APPROXIMATE QUANTITIES	
REINFORCING STEEL 132.9 LBS.	CLASS A3 CONC. 1.7 CU. YDS.

REINFORCING STEEL SCHEDULE				
MARK	SIZE	NO.	SPACING	LENGTH
H	#3	9	6"	5'-8"
H1	#3	4	6"	4'-8"
H2	#3	6	6"	5'-3"
V	#4	6	12"	4'-0"
V1	#4	24	6"	3'-0"
DOWELS A	#4	12	10"	2'-0"
DOWELS B	#4	6	10"	2'-0"
DOWELS C	#4	10	10"	1'-0"
W.W.F.	8GA			83 S.F.



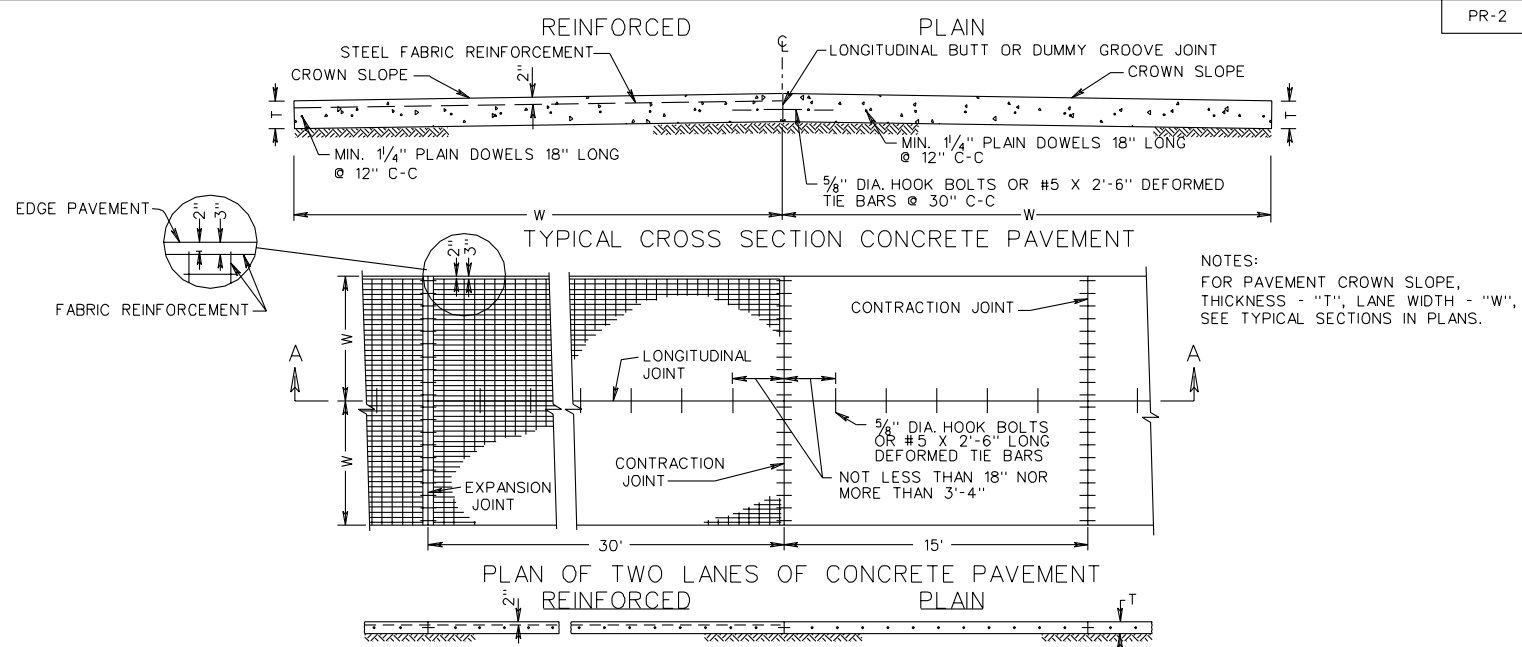
SPECIFICATION REFERENCE
502

DITCH FLUME CONNECTOR

VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 7/02

109.05



NOTES:
FOR PAVEMENT CROWN SLOPE,
THICKNESS - "T", LANE WIDTH - "W",
SEE TYPICAL SECTIONS IN PLANS.

STEEL FABRIC REINFORCEMENT: STEEL FABRIC REINFORCEMENT SHALL CONSIST OF MEMBERS RIGIDLY ATTACHED AT ALL JOINTS OR POINTS OF INTERSECTION EXCEPT AS NOTED BELOW:(-). LONGITUDINAL MEMBERS SHALL BE OF NO. 2 GAGE WIRE SPACED AT 6" ON CENTERS. TRAVERSE MEMBERS SHALL BE NO. 4 GAGE WIRE, SPACED AT 12" ON CENTERS. (WIRE REINFORCEMENT STEEL INSTITUTE DESIGNATION 6 X 12 - W5.5 X W4).

THE WIDTHS OF STEEL FABRIC SHEETS SHALL BE 4" LESS THAN THE WIDTH OF THE SLAB. THE NUMBER OF SHEETS ALLOWABLE BETWEEN CONTRACTION JOINTS, OR BETWEEN CONTRACTION AND EXPANSION JOINTS, SHALL NOT EXCEED 3.

ALL MEMBERS, LONGITUDINAL OR TRANSVERSE, SHALL BE SO CUT THAT THE PROJECTING ENDS WILL EXTEND NOT LESS THAN 1" NOR MORE THAN 11" FROM THE JOINTS OR POINTS OF INTERSECTION OF THE FABRIC MEMBERS.

WHEN IT IS NECESSARY TO LAP STEEL FABRIC REINFORCEMENT, THE MINIMUM AMOUNT OF LAP SHALL BE EQUIVALENT TO THE SPACING OF THE WIRES PARALLEL TO THE LAP.

OTHER TYPES OF MESH REINFORCEMENT MAY BE USED ON WRITTEN PERMISSION OF THE ENGINEER. THE WIDTH OF SHEETS AND OTHER GENERAL REQUIREMENTS, WHICH APPLY, SHALL BE THE SAME AS FOR STEEL FABRIC REINFORCEMENT.

DOWELS AT CONTRACTION JOINTS MAY BE PLACED IN THE FULL THICKNESS OF PAVEMENT BY MECHANICAL DEVICE IN LIEU OF DOWEL BASKETS.

* HINGED STEEL REINFORCEMENT MAY BE USED IN LIEU OF RIGID SHEETS.

EXPANSION AND CONTRACTION JOINTS:
CONSTRUCTION JOINTS IN BOTH PLAIN AND REINFORCED PAVEMENT SHALL HAVE THE SAME LOAD TRANSFER DEVICES AS NOTED FOR CONTRACTION JOINTS IN REINFORCED PAVEMENT.

CONTRACTION JOINTS OF THE TYPE SPECIFIED ON SHEET 2 SHALL BE SPACED AT 30 FOOT INTERVALS FOR REINFORCED CONCRETE PAVEMENT AND AT 15 FOOT INTERVALS FOR PLAIN CONCRETE PAVEMENT UNLESS OTHERWISE NOTED ON JOINT LAYOUTS IN PLANS.

ADJACENT TO RIGID STRUCTURES: CONCRETE STREET INTERSECTIONS, OR R.R. GRADE X-INGS, BRIDGE APPROACH EXPANSION JOINTS AND/OR TRANSVERSE EXPANSION JOINTS ARE TO BE PLACED AS SHOWN ON SHEET 2 OF 3. OTHER EXPANSION JOINTS ARE TO BE USED AS SPECIFIED ON PLANS.

IF ASPHALT CONCRETE IS TO BE APPLIED, ALL TRANSVERSE JOINTS ARE TO BE SAWED, BUT NOT WIDENED, EXCEPT AT THE END OF A DAYS RUN AND WHEN INTERRUPTIONS OCCUR IN THE CONCRETE OPERATIONS OF MORE THAN 30 MINUTES DURATION. IN THESE CASES, BUTT CONSTRUCTION JOINTS ARE TO BE USED.

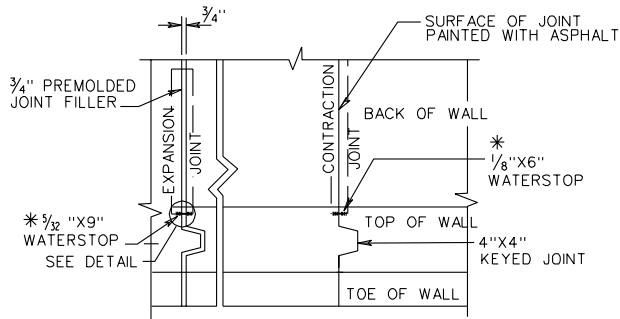
PAVED SHOULDERS: WHEN ASPHALT CONCRETE PAVED SHOULDERS ARE TO BE USED ADJACENT TO EITHER PLAIN OR REINFORCED CEMENT CONCRETE PAVEMENT, THE EDGE OF THE CONCRETE SLAB IS TO BE PAINTED, TO ITS FULL DEPTH, WITH ASPHALTIC MATERIAL EITHER CRS-2 OR RC-250 AS DIRECTED BY THE ENGINEER.

LONGITUDINAL JOINTS: THE CONTRACTOR WILL BE PERMITTED TO CONSTRUCT THE CONCRETE PAVEMENT IN DUAL LANES, SIMULTANEOUSLY, WHERE THE SUM OF THE LANE WIDTHS DOES NOT EXCEED 25 FEET, PROVIDED A SATISFACTORY AND TRUE LONGITUDINAL DUMMY GROOVE JOINT IS OBTAINED. THIS IS TO BE DONE BY THE USE OF AN APPROVED FORMING STRIP OR BY SAWING, AT THE CONTRACTOR'S OPTION. WHERE LANES ARE POURED SEPARATELY, THE HOOK BOLTS OR TIE BOLTS SHALL BE IN ACCORDANCE WITH THE DETAILS SHOWN ON SHEET 2. WHERE BOTH LANES ARE POURED SIMULTANEOUSLY, TIE BARS SHALL BE AS DETAILED ON SHEET 2. THE MAXIMUM WIDTH OF PAVEMENT THAT MAY BE CONSTRUCTED WITHOUT A LONGITUDINAL JOINT IS 14'-0". FOR WIDTHS GREATER THAN 14 FEET THE LONGITUDINAL JOINT SHALL BE IN THE CENTER. NO OTHER DEVIATIONS ARE TO BE ALLOWED UNLESS SHOWN ON JOINT LAYOUT IN PLANS, OR DIRECTED BY THE ENGINEER.

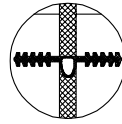
METHOD OF FINISHING AT EXPANSION JOINTS: A PROTECTIVE CAP OR INSTALLATION SHIELD OF 1/6" STEEL SHALL BE PLACED OVER THE TOP OF THE EXPANSION JOINT FILLER. THE FINISHING MACHINE SHALL THEN BE ALLOWED TO PASS OVER THE JOINT, LEAVING IT AS SHOWN IN FIGURE 1, SHEET 2. PRIOR TO THE INITIAL SET THE SHIELD SHALL BE REMOVED AND A RECTANGULAR BAR 1/4" LESS IN WIDTH THAN THE PREFORMED FILLER PLACED ON TOP OF THE FILLER, THE CONCRETE SQUEEGE FINISHED ADJACENT TO IT AS SHOWN IN FIGURE 2, AND THE EDGES ROUNDED WITH HAND TOOLS, USING THE BAR AS A GUIDE. THE BAR SHALL THEN BE WITHDRAWN, LEAVING A JOINT GAP OF THE SAME WIDTH AS THE FILLER.

SPECIFICATION REFERENCE 316	<h2 style="margin: 0;">PLAIN AND REINFORCED CONCRETE PAVEMENT</h2> <h3 style="margin: 0;">SHOWING REINFORCEMENT, LONGITUDINAL AND TRANSVERSE JOINTS</h3> <p style="margin: 0;">VIRGINIA DEPARTMENT OF TRANSPORTATION</p>	REV. 7/02 301.01
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RW-3



CONTRACTION JOINTS AT INTERVALS NOT EXCEEDING 30'.
 EXPANSION JOINTS AT INTERVALS NOT EXCEEDING 90'.
 * WATER STOPS TO BE ELASTOMERIC OR OTHER APPROVED MATERIAL. DIMENSIONS SHOWN ARE ABSOLUTE MINIMUM.

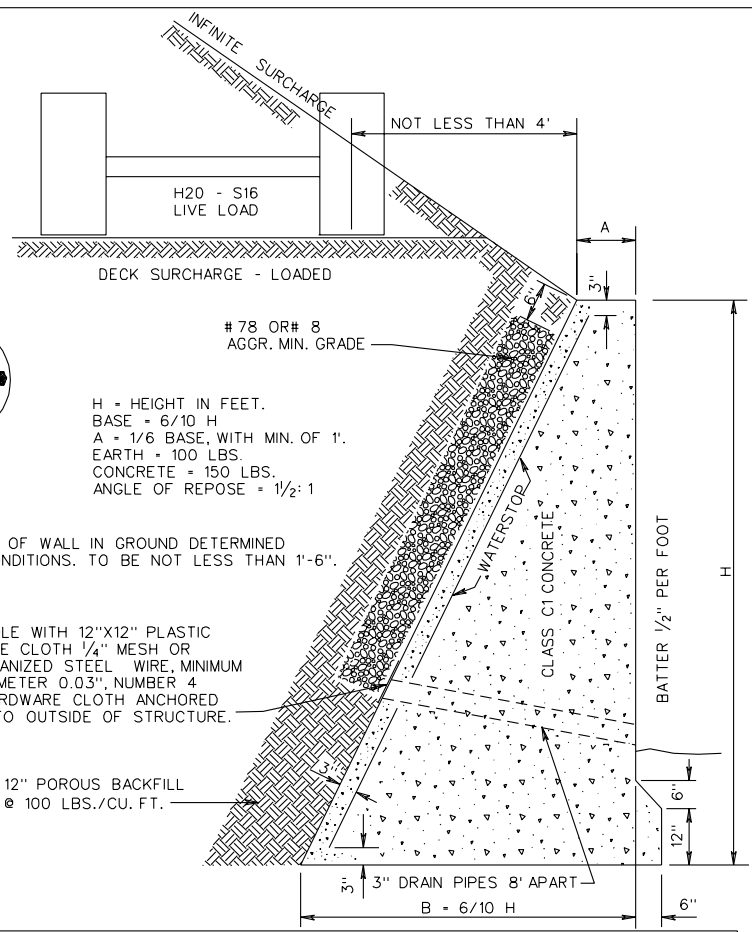


WATERSTOP
DETAIL

NOTE:
 DEPTH OF WALL IN GROUND DETERMINED
 BY CONDITIONS. TO BE NOT LESS THAN 1'-6".

WEEP HOLE WITH 12"x12" PLASTIC
 HARDWARE CLOTH 1/4" MESH OR
 OR GALVANIZED STEEL WIRE, MINIMUM
 WIRE DIAMETER 0.03", NUMBER 4
 MESH HARDWARE CLOTH ANCHORED
 FIRMLY TO OUTSIDE OF STRUCTURE.

12" POROUS BACKFILL
 @ 100 LBS./CU. FT.



SAFE BEARING CAPACITY OF SOIL	
ROCK MINIMUM	10,000 - 20,000 LBS. SQ. FT.
GRAVEL AND COARSE SAND, WELL CEMENTED	16,000 - 20,000 LBS. SQ. FT.
CLAY IN THICK BEDS, ALWAYS DRY	12,000 - 16,000 LBS. SQ. FT.
CLAY IN THICK BEDS, MODERATELY DRY	8,000 - 12,000 LBS. SQ. FT.
CLAY, SOFT	2,000 - 4,000 LBS. SQ. FT.
SAND, DRY, COMPACT, AND WELL CEMENTED	8,000 - 12,000 LBS. SQ. FT.
SAND, CLEAN, DRY	4,000 - 8,000 LBS. SQ. FT.
ALLUVIAL SOILS, ETC	1,000 - 2,000 LBS. SQ. FT.

NOTE: IF COMPRESSION AT TOE EXCEEDS SAFE BEARING CAPACITY
 OF SOIL, A SPECIAL FOOTING IS TO BE USED.

HEIGHT OF WALL "H" IN FEET	THICKNESS AT TOP "A" IN FEET	THICKNESS AT BASE B = 6H	COMPRESSION AT TOE LBS. SQ. FT.	AREA OF SECTION SQ. FT.
3	1'-0"	1'-9 5/8"	856	4.83
4	1'-0"	2'-4 3/4"	1141	7.43
5	1'-0"	3'-0"	1427	10.63
6	1'-0"	3'-7 1/4"	1712	14.43
7	1'-0"	4'-2 3/8"	1997	18.83
8	1'-0"	4'-9 5/8"	2283	23.83
9	1'-0"	5'-4 3/4"	2568	29.43
10	1'-0"	6'-0"	2853	35.63
11	1'-1 1/4 "	6'-7 1/4"	3139	42.98
12	1'-2 3/8 "	7'-2 3/8"	3424	51.03
13	1'-3 5/8 "	7'-9 5/8"	3709	59.78
14	1'-4 3/4 "	8'-4 3/4"	3995	69.23
15	1'-6"	9'-0"	4280	79.38

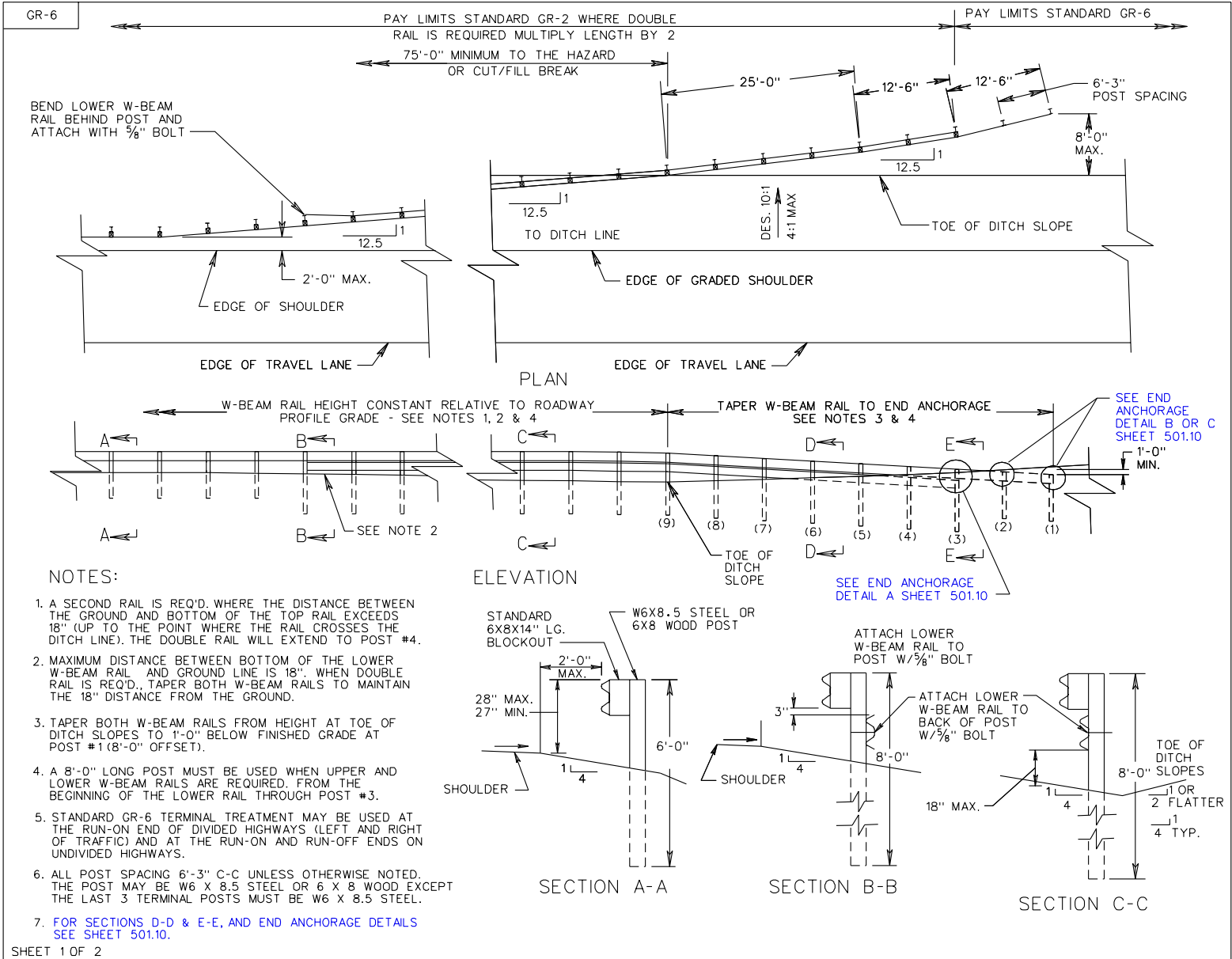
CONCRETE GRAVITY RETAINING WALLS INFINITE SURCHARGE AND DECK SURCHARGE - LOADED

REV. 7/02
 401.02

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION
 REFERENCE

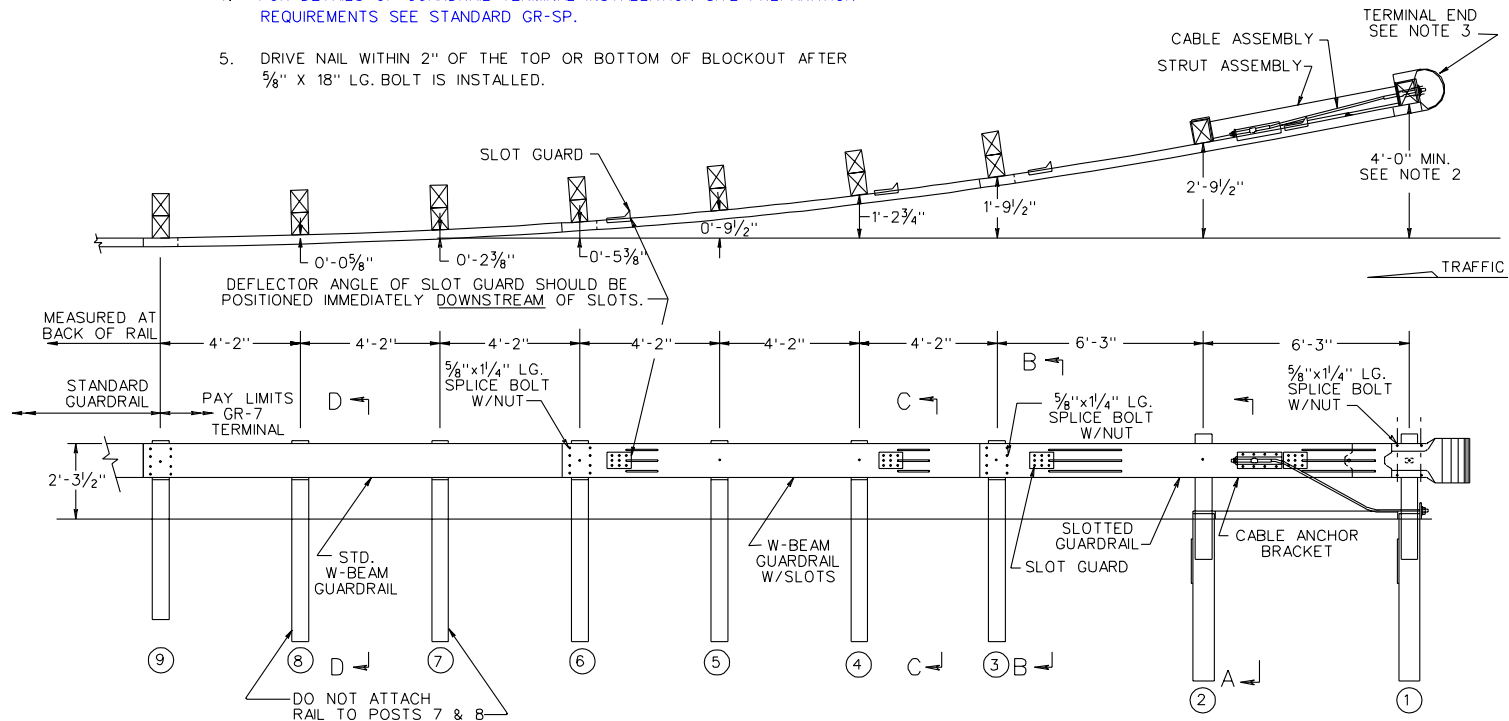
506



GR-7

NOTES:

1. GUARDRAIL TERMINAL, STD. GR-7 IS TO BE SRT 350 (AS SHOWN) MANUFACTURED BY SYRO STEEL COMPANY, THE FLEAT 350 MANUFACTURED BY ROAD SYSTEMS, INC., OR OTHER VDOT APPROVED EQUAL MEETING NCHRP 350 TESTING CRITERIA UTILIZING A 4 FT. OFFSET.
2. THE POST OFFSET DIMENSION ARE GIVEN TO THE CENTER OF THE TRAFFIC FACE OF THE BLOCKOUTS EXCEPT AT THE FIRST TWO POST, WHERE THE DIMENSION IS TO THE CENTER OF THE TRAFFIC FACE OF THE POST. OFFSET POINTS ARE TO BE LOCATED BY CHORD MEASUREMENT AT THE BACK OF THE RAIL EQUAL TO THE NOMINAL POST SPACINGS SHOWN. POST ARE TO BE SET APPROXIMATELY RADIAL TO THE RAILING AT EACH POST LOCATION.
3. YELLOW 8" X 36" REFLECTIVE SHEETING, IN ACCORDANCE WITH VDOT SPECIFICATIONS, SHOULD BE APPLIED IN TERMINALS EMPLOYING W-BEAM END SECTIONS. FOR TERMINALS EMPLOYING IMPACT (EXTRUDER) HEADS, AMBER (YELLOW) REFLECTIVE SHEETING WITH BLACK DIAGONAL STRIPES SHOULD BE APPLIED TO THE FULL AREA INSIDE THE IMPACT HEAD WITH THE DIRECTION OF THE BLACK DIAGONAL STRIPES CONFORMING TO CURRENT MUTCD APPLICATION FOR TYPE 3 OBJECT MARKERS (OM-3).
4. FOR DETAILS OF GUARDRAIL TERMINAL INSTALLATION SITE PREPARATION REQUIREMENTS SEE STANDARD GR-SP.
5. DRIVE NAIL WITHIN 2" OF THE TOP OR BOTTOM OF BLOCKOUT AFTER 5/8" X 18" LG. BOLT IS INSTALLED.



SHEET 1 OF 3

BREAKAWAY CABLE TERMINAL
4' FLARE

REV. 7/02

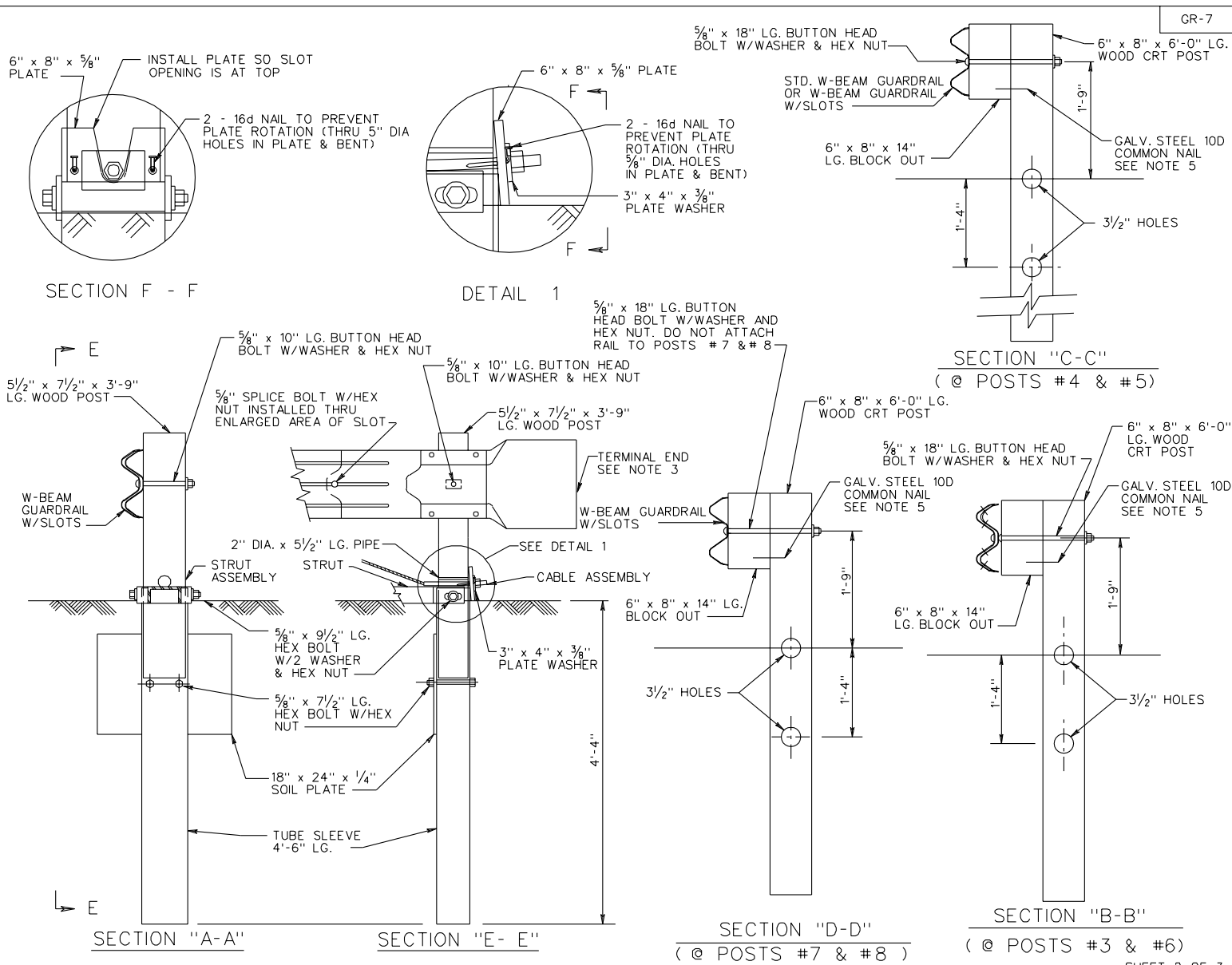
501.11

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION
REFERENCE

221
505

GR-7

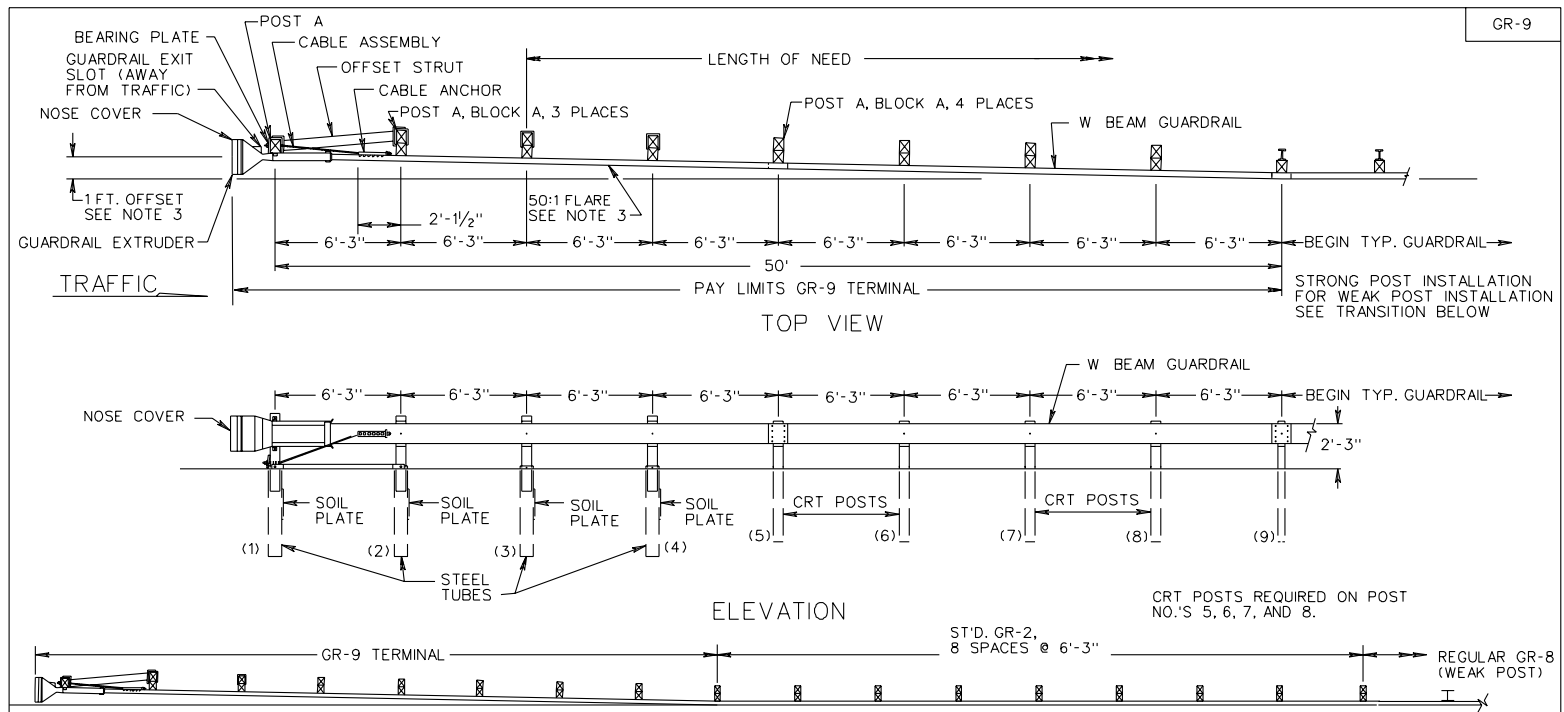


SPECIFICATION REFERENCE
221 505

BREAKAWAY CABLE TERMINAL
 4' FLARE

VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 7/02
501.12

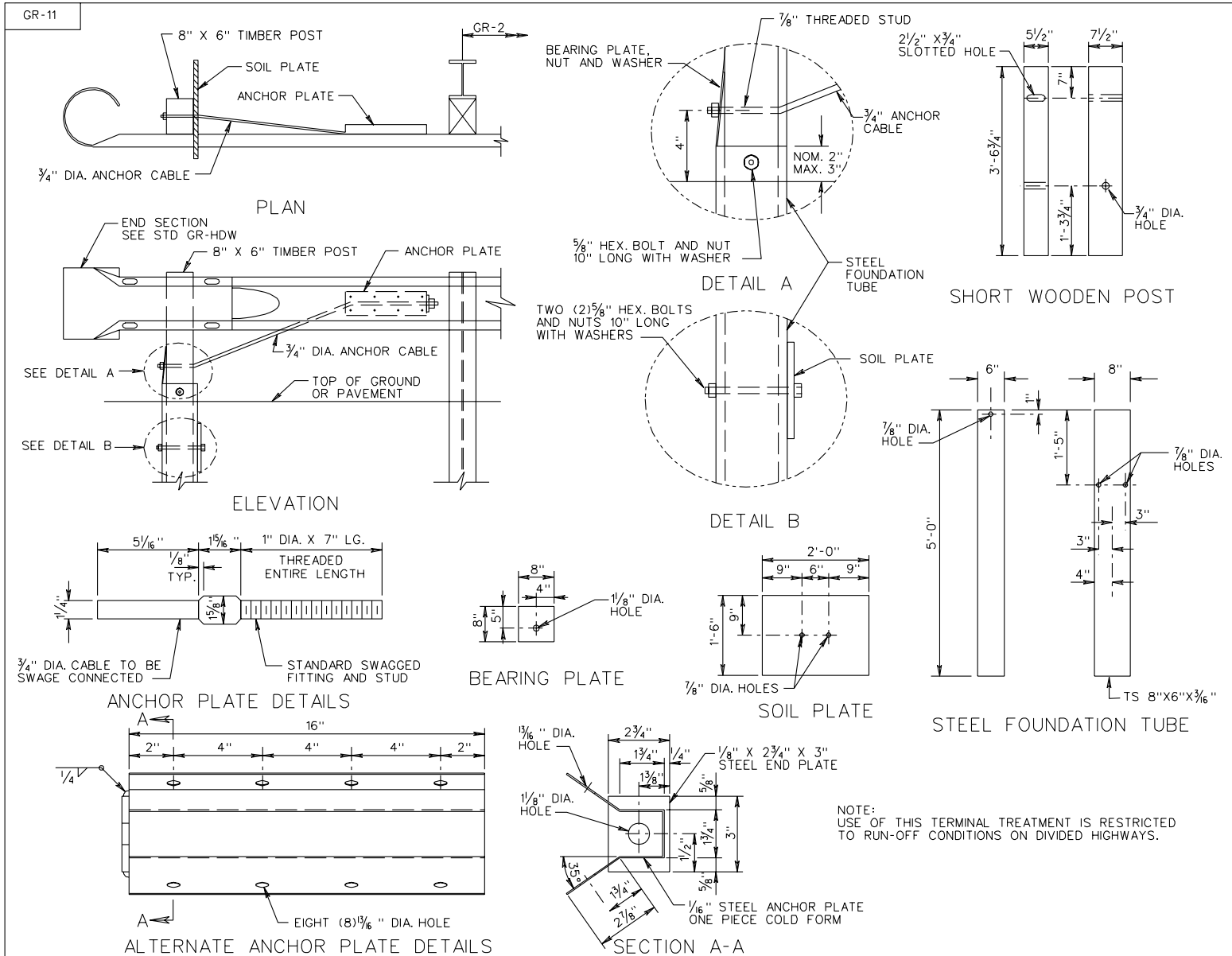


TRANSITION FROM GR-9 TERMINAL TO WEAK POST GUARDRAIL

NOTES:

1. THIS DESIGN SHALL BE USED AFTER AN ANALYSIS INDICATES IT IS MORE COST EFFECTIVE THAN PROVIDING THE FLARE FOR A STANDARD GR-7 OR EXTENDING THE GUARDRAIL TO PROVIDE A STANDARD GR-6 TERMINAL
2. ALTERNATE BREAKAWAY CABLE TERMINAL (GR-9) IS TO BE ET-2000 (AS SHOWN), OR CAT AS MANUFACTURED BY SYRO STEEL COMPANY, BRAKEMASTER AS MANUFACTURED BY ENERGY ABSORPTION SYSTEMS, INC., THE BEST SYSTEM AS MANUFACTURED BY INTERSTATE STEEL CORPORATION, THE SKT-350 AS MANUFACTURED BY ROAD SYSTEMS INC., OR OTHER VDOT APPROVED EQUAL MEETING NCHRP 350 TESTING CRITERIA. ALL TERMINALS SHALL BE INSTALLED ACCORDING TO THE MANUFACTURER'S INSTALLATION INSTRUCTIONS.
3. ALL STANDARD GR-9 TERMINALS WILL BE INSTALLED WITH AN OFFSET TO PREVENT THE GUARDRAIL EXTRUDER FROM ENCROACHING ON THE SHOULDER. PLEASE REFER TO THE MANUFACTURER'S INSTALLATION INSTRUCTIONS FOR SPECIFIC INFORMATION ON THEIR TERMINAL SYSTEM'S RECOMMENDED OFFSETS AND STRAIGHT LINE FLARE RATES.
4. FOR DETAILS, DIMENSIONS, QUANTITIES, AND OTHER INFORMATION NOT SHOWN HEREON, SEE INDIVIDUAL MANUFACTURER'S PLANS.
5. THE GUARDRAIL AND MEDIAN BARRIER COMPONENTS DEPICTED IN A.R.T.B.A. TECHNICIAN BULLETIN NUMBER 268B MAY BE SUBSTITUTED IF INTERCHANGEABLE WITH THE STANDARDS FOR GUARDRAIL (GR) OR MEDIAN BARRIER (MB) AND APPROVED BY THE ENGINEER.
6. CRT POSTS REQUIRED ON POST NUMBERS 5, 6, 7, AND 8.
7. DIRECTION OF TAPE SHALL CONFORM TO MUTCD APPLICATION FOR DIAGONAL STRIPES ON OBJECT MARKERS AND BRIDGE END PANELS. COLOR OF TAPE SHALL BE AMBER (YELLOW).

SPECIFICATION REFERENCE	<p>ALTERNATE BREAKAWAY CABLE TERMINAL NO FLARE</p> <p>VIRGINIA DEPARTMENT OF TRANSPORTATION</p>	REV. 7/2002
505		501.18



TRAILING END TERMINAL TREATMENT

NEW 7/02

501.21

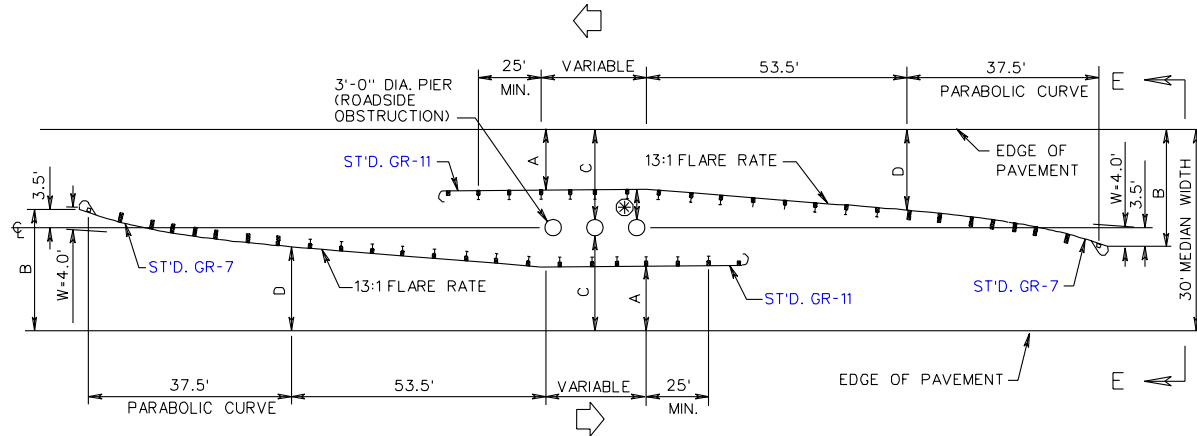
VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE

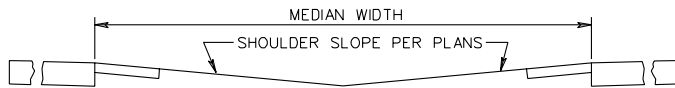
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221

GR-INS

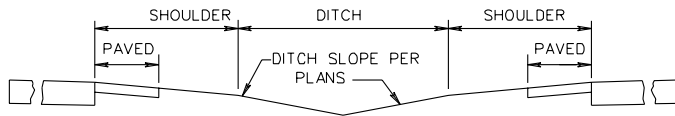
⊗ FACE OF GUARDRAIL IS TO BE 6' FROM FACE OF OBJECT.
 FOR MEDIAN WIDTHS LESS THAN 27' SEE SHEET 501.35.
 THE GUARDRAIL DESIGN AND PLACEMENT SHOWN ABOVE
 MAY ALSO BE USED FOR SHIELDING AN OVERHEAD SIGN
 SUPPORT, FIXED OBJECTS OR OTHER TYPES OF ROAD
 SIDE OBSTRUCTIONS.



PLAN VIEW



SECTION E-E



TYPICAL SECTION

DETAIL OF GUARDRAIL AT BRIDGE PIERS USING STANDARD GR-2

OFFSETS (Y) FOR INTRODUCED GUARDRAIL TRANSITIONS ☆		
LENGTH L	X	Y
		W=4'
37.50'	X ₁ 6.25	0.12'
	X ₂ 12.50	0.44'
	X ₃ 18.75	1.00'
	X ₄ 25.00	1.78'
	X ₅ 31.25	2.78'
	X ₆ 37.50	4.00'

MEDIAN WIDTH	* DIMENSIONS			
	A	B	C	D
30'	7.5'	18.5'	13.5'	11.6'
40'	12.5'	23.5'	18.5'	16.6'
60'	22.5'	33.5'	28.5'	26.6'

* THE DIMENSIONS AS SHOWN HERE ARE FOR A 3' DIAMETER PIER. THESE DIMENSIONS WILL VARY AS ROADSIDE OBSTRUCTION DIMENSIONS DIFFER.

☆ SEE TABLE III, PAGE 501.36 OF THE ROAD AND BRIDGE STANDARDS FOR DEFINITION OF "X" AND "Y".

SHEET 1 OF 8

SHEET 1 OF 8

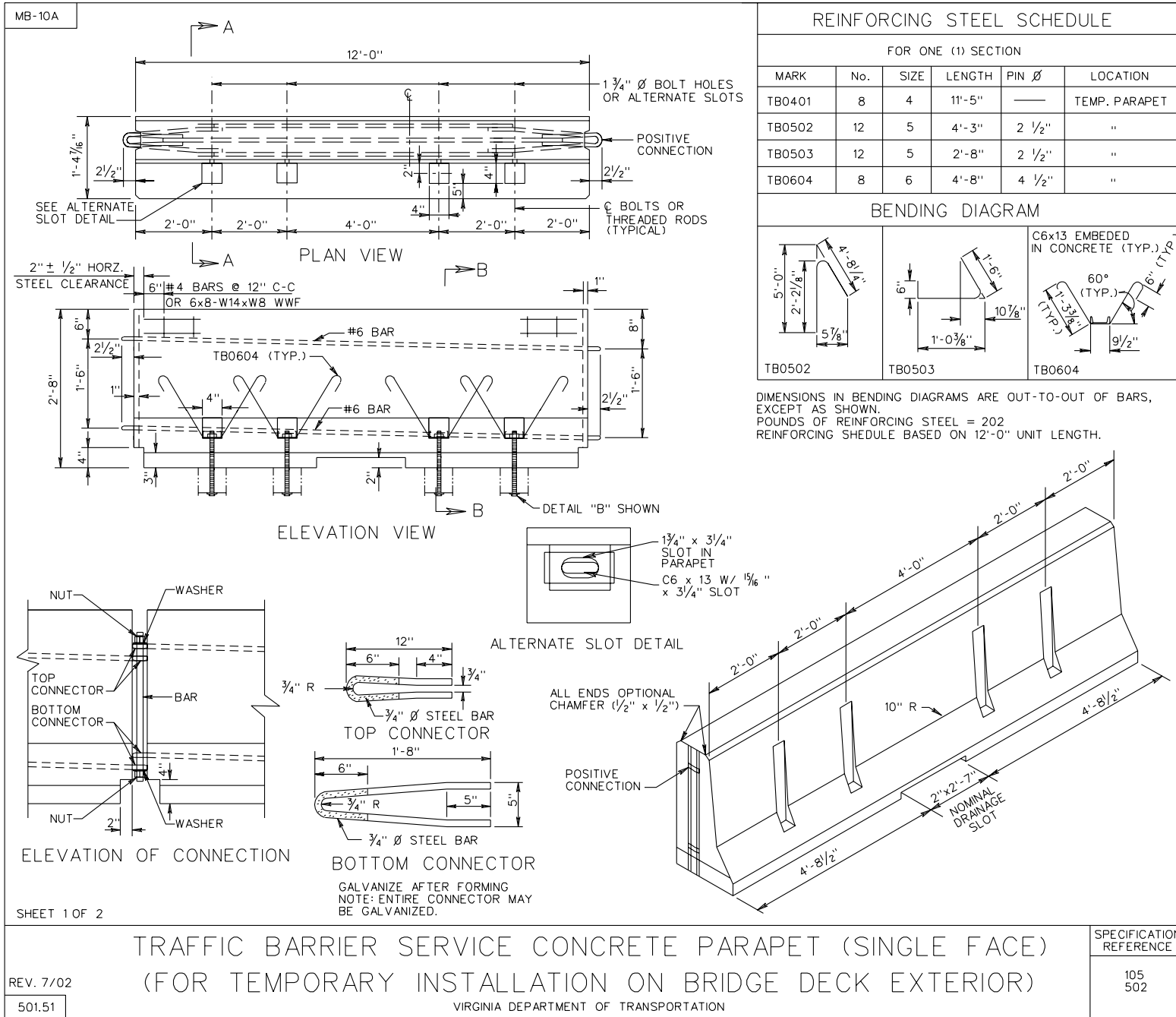
W BEAM GUARDRAIL INSTALLATION CRITERIA

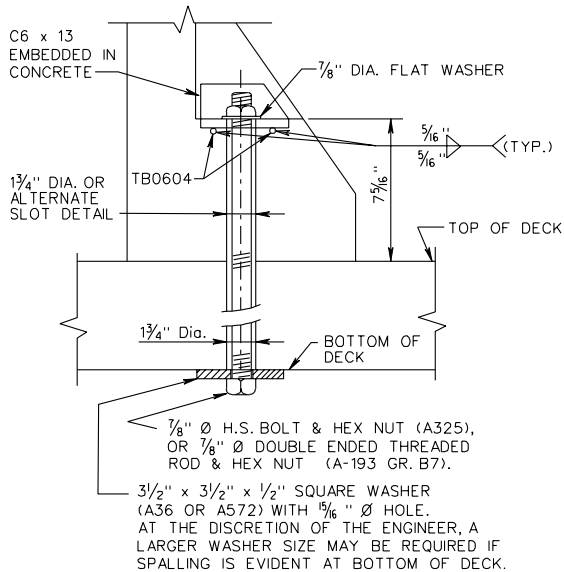
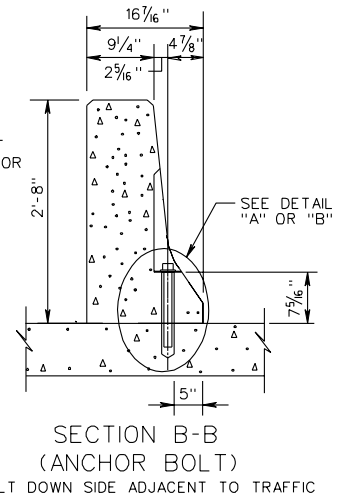
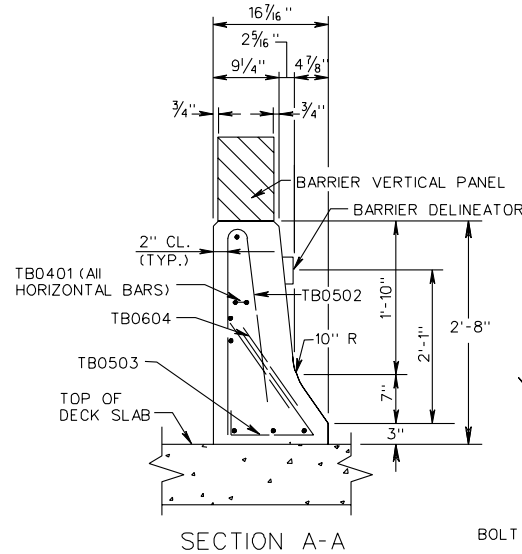
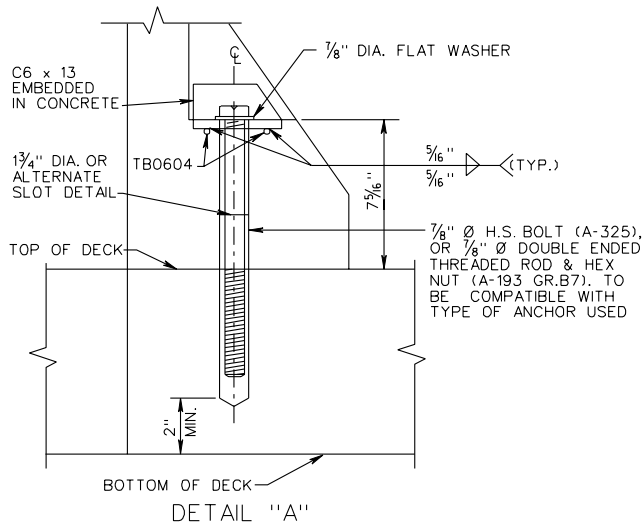
REV. 7/02
501.33

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION REFERENCE

221
505

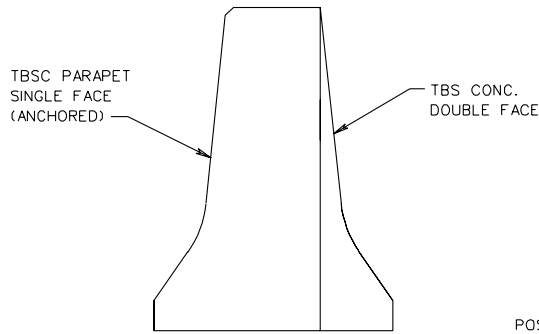




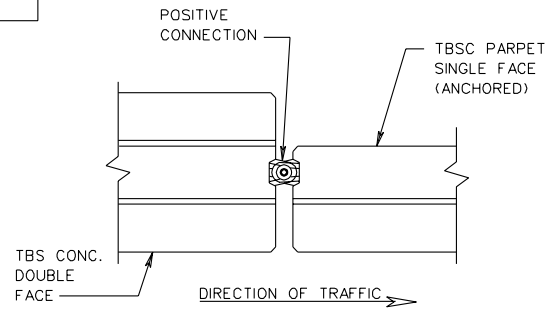
NOTES:

1. BARRIER DELINEATOR TO BE SPACED IN ACCORDANCE WITH SECTION 702, OF THE ROAD AND BRIDGE SPECIFICATIONS AND THE BARRIER VERTICAL PANELS TO BE SPACED IN ACCORDANCE WITH VIRGINIA WORK AREA PROTECTION MANUAL. REFLECTIVE SURFACE, IN ALL INSTANCES, TO BE FACING ONCOMING TRAFFIC.
2. CONCRETE 4000 PSI(MIN.). REINFORCING STEEL GRADE 60.
3. AFTER REMOVING TEMPORARY BARRIER, CUT 7/8" Ø BOLT OR THREADED ROD AS LOW AS PRACTICAL BELOW ROADWAY SURFACE AND FILL, RECESS WITH EPOXY BONDING COMPOUND EP-4 (DETAIL "A") OR REMOVE 7/8" Ø BOLTS OR THREADED RODS AND FILL HOLES WITH GROUT BONDED WITH EPOXY BONDING COMPOUND EP-4 (DETAIL "B").
4. ANCHOR SYSTEM SHOWN IN DETAIL "A" SHALL BE TESTED TO PROVIDE A MINIMUM PULLOUT OF 32,000 LBS. AND INSTALLED ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.
5. COST OF BARRIER DELINEATOR AND BARRIER VERTICAL PANELS TO BE INCLUDED IN PRICE BID PER LINEAR FOOT OF BARRIER SERVICE.
6. WHEN BARRIER IS LOCATED ON VERTICAL AND/OR HORIZONTAL CURVES, THE OPENING AT THE JOINT IS NOT TO EXCEED 1".
7. DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT.
8. FOR POSITIVE CONNECTION DETAILS AND DIMENSIONS SEE STANDARD SHEETS 501.59 - 501.61.

MB-INS

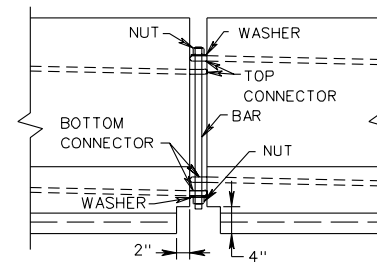


SECTION B-B

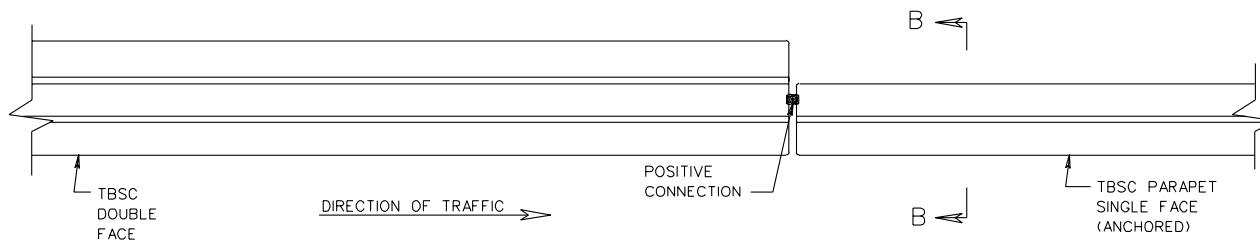


PLAN OF POSITIVE CONNECTION

- NOTES:
1. BASIS OF PAYMENT:
TRAFFIC BARRIER SERVICE LATERAL SUPPORT WILL BE MEASURED AND PAID FOR IN UNITS OF EACH COMPLETE IN PLACE AND SHALL INCLUDE FURNISHING AND PLACING PRECAST CONCRETE BARRIERS (TBS CONCRETE) AND SAND BAGS, MAINTENANCE, REMOVAL WHEN NO LONGER NECESSARY, AND ALL MATERIALS, LABOR, TOOLS, EQUIPMENTS, AND INCIDENTALS NECESSARY TO COMPLETE THE WORK.
 2. FOR POSITIVE CONNECTION DETAILS AND DIMENSIONS SEE STANDARD MB-INS, SHEETS 501.59 - 501.61
 3. FOR DIMENSIONS NOT SHOWN, REFER TO ST'D. MB-7D AND MB-10A.



ELEVATION OF POSITIVE CONNECTION

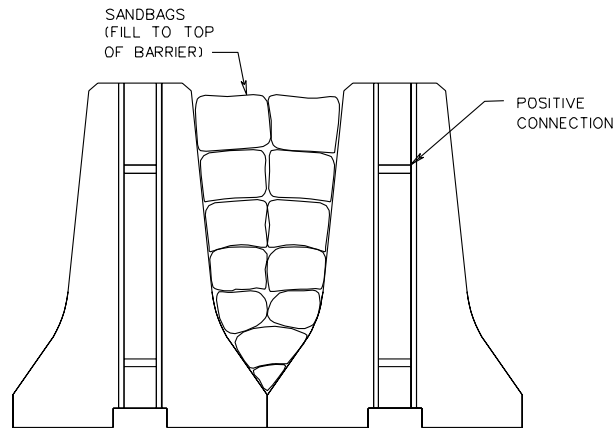


PLAN VIEW
METHOD A

SHEET 4 OF 5

SPECIFICATION REFERENCE	<p>BUTTING TRAFFIC BARRIER SERVICE TO SINGLE FACE PARAPET SERVICE</p> <p>VIRGINIA DEPARTMENT OF TRANSPORTATION</p>	REV. 7/02
		501.62

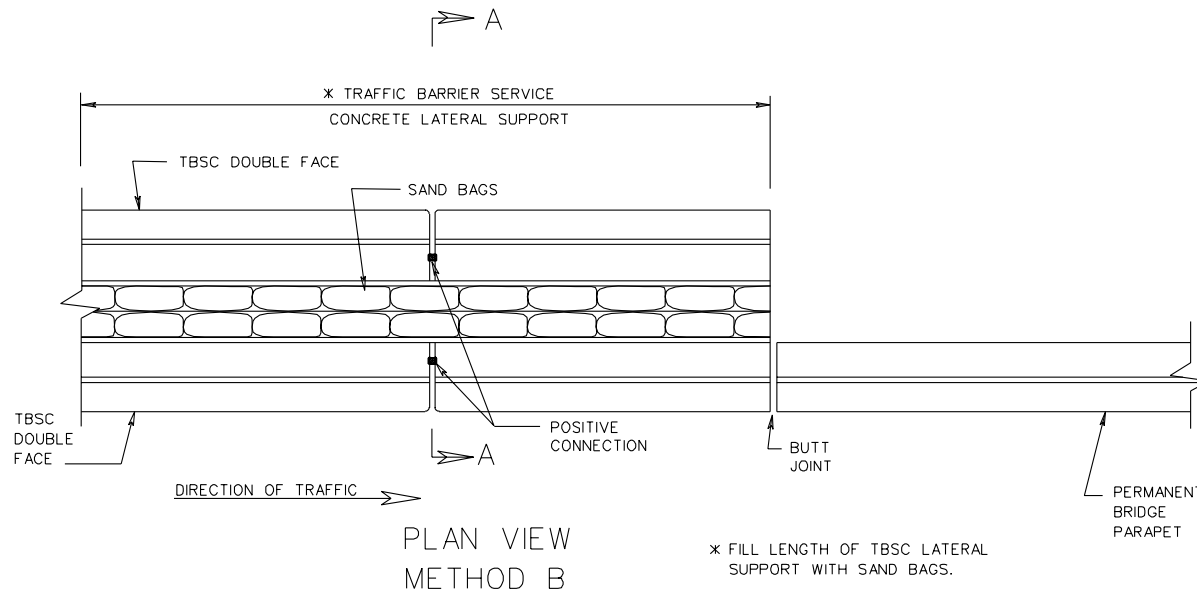
MB-INS



SECTION A-A

NOTES:

1. BASIS OF PAYMENT:
TRAFFIC BARRIER SERVICE LATERAL SUPPORT WILL BE MEASURED AND PAID FOR IN UNITS OF EACH COMPLETE IN PLACE AND SHALL INCLUDE FURNISHING AND PLACING PRECAST CONCRETE BARRIERS (TBS CONCRETE) AND SAND BAGS, MAINTENANCE, REMOVAL WHEN NO LONGER NECESSARY, AND ALL MATERIALS, LABOR, TOOLS, EQUIPMENTS, AND INCIDENTALS NECESSARY TO COMPLETE THE WORK.
2. FOR POSITIVE CONNECTION DETAILS AND DIMENSIONS SEE STANDARD MB-INS, SHEETS 501.59 - 501.61
3. FOR DIMENSIONS NOT SHOWN, REFER TO ST'D. MB-7D AND MB-10A.



PLAN VIEW
METHOD B

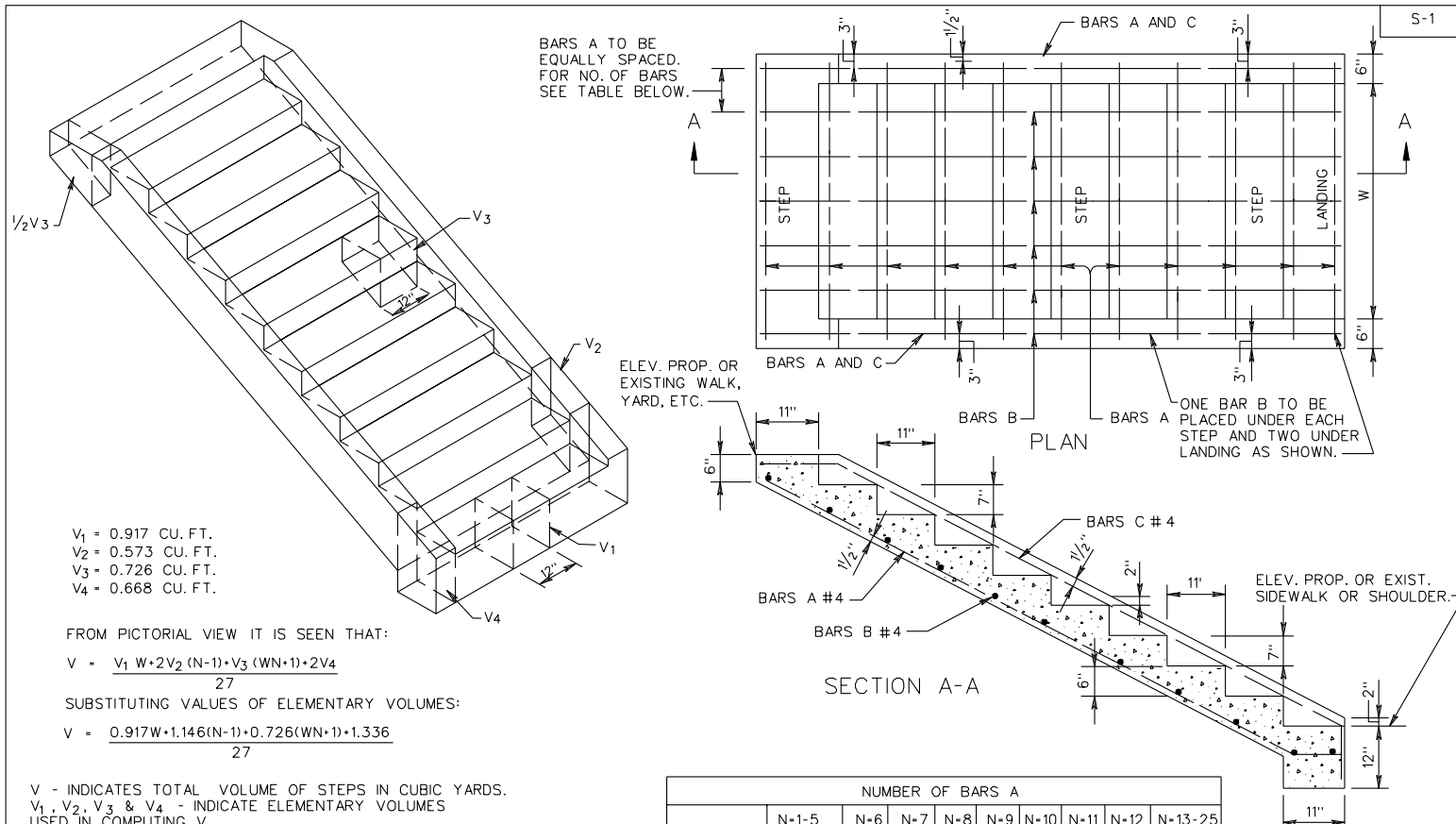
SHEET 5 OF 5

BUTTING TRAFFIC BARRIER SERVICE
TO SINGLE FACE PARAPET SERVICE

VIRGINIA DEPARTMENT OF TRANSPORTATION

SPECIFICATION
REFERENCE

501.63



V₁ = 0.917 CU. FT.
 V₂ = 0.573 CU. FT.
 V₃ = 0.726 CU. FT.
 V₄ = 0.668 CU. FT.

FROM PICTORIAL VIEW IT IS SEEN THAT:

$$V = \frac{V_1 W + 2V_2 (N-1) + V_3 (WN+1) + 2V_4}{27}$$

SUBSTITUTING VALUES OF ELEMENTARY VOLUMES:

$$V = \frac{0.917W + 1.146(N-1) + 0.726(WN+1) + 1.336}{27}$$

V - INDICATES TOTAL VOLUME OF STEPS IN CUBIC YARDS.
 V₁, V₂, V₃ & V₄ - INDICATE ELEMENTARY VOLUMES USED IN COMPUTING V.
 W - INDICATES CLEAR WIDTH OF STEPS, IN FEET, BETWEEN SIDEWALLS.
 N - INDICATES NUMBER OF STEPS IN INSTALLATION EXCLUSIVE OF LANDING.
 L1 - INDICATES LENGTH OF BARS A, IN INCHES. L1 = 13.038N + 8"
 L2 - INDICATES LENGTH OF BARS B, IN INCHES. L2 = 12W + 9"
 L3 - INDICATES LENGTH OF BARS C, IN INCHES. L3 = 13.038N + 18"
 A LANDING IS TO BE PROVIDED WHERE 12 OR MORE STEPS ARE REQUIRED MINIMUM SIZE OF LANDING TO BE W + 1 FOOT X 4 FEET.

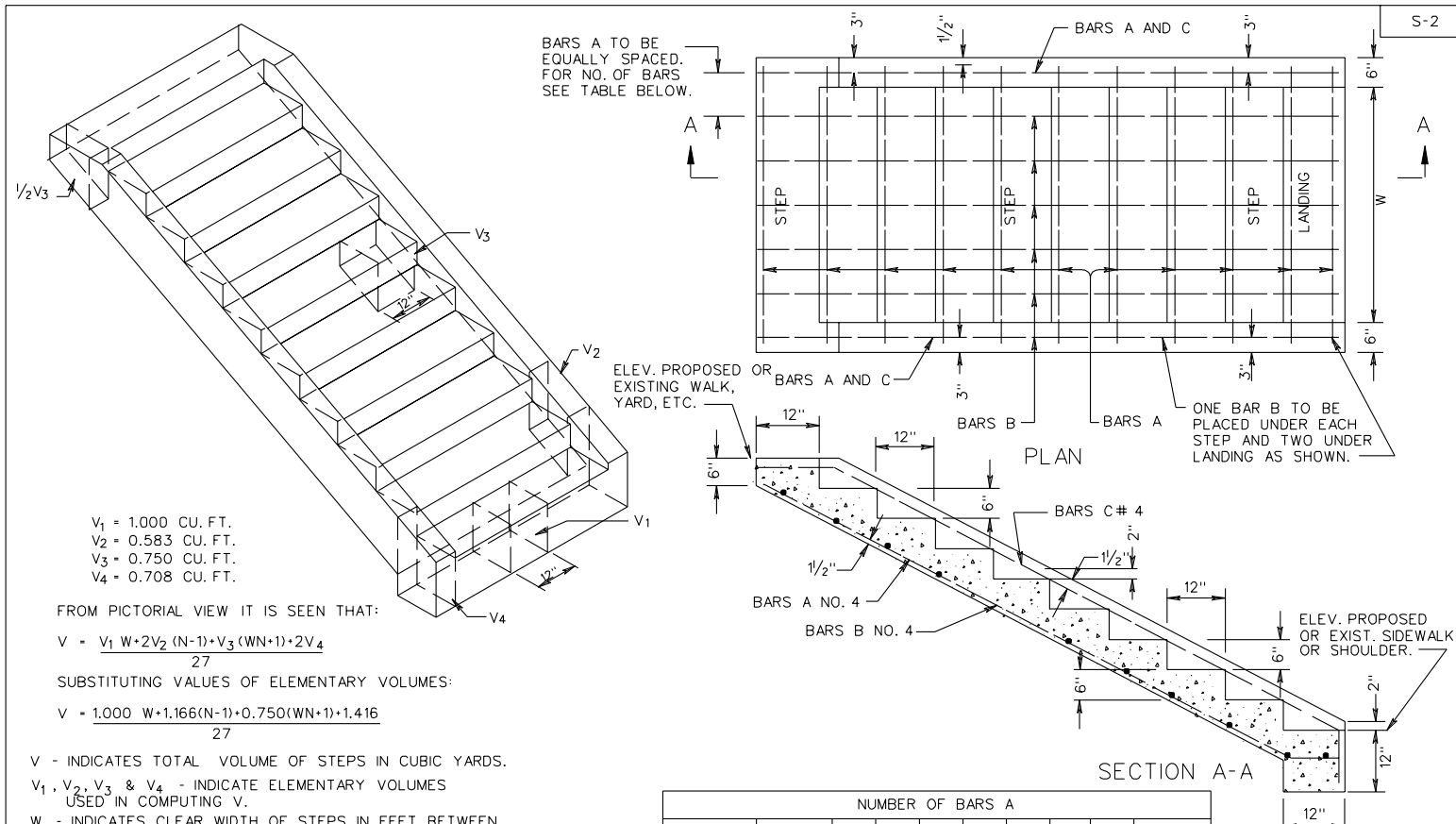
THIS ITEM MAY BE PRECAST OR CAST IN PLACE.
 CONCRETE TO BE CLASS A3 IF CAST IN PLACE, 4000 PSI IF PRECAST.
 FOR OTHER WIDTHS THE APPROXIMATE SPACING OF BARS A IN INCHES WILL BE EQUAL TO 80 ÷ N WITH A MINIMUM SPACING OF 6".
 REINFORCING BARS TO BE USED IN INSTALLATIONS OF 6 OR MORE STEPS.
 FOR TABULATION OF CONCRETE AND STEEL QUANTITIES SEE SHEET 2.

		NUMBER OF BARS A									
		N-1-5	N-6	N-7	N-8	N-9	N-10	N-11	N-12	N-13-25	
NO STEEL	W = 3'	4	5	5	6	6	7	7	8		
	W = 4'	5	6	7	7	8	8	9	10		
	W = 5'	6	7	8	9	9	10	11	12		

HANDRAIL IS TO BE PROVIDED FOR STEPS HAVING THREE OR MORE RISERS, AND WILL MEET THE FOLLOWING CONDITIONS:

- ON STEPS LESS THAN 44 INCHES WIDE HAVING BOTH SIDES ENCLOSED, AT LEAST ONE HANDRAIL, PREFERABLY ON THE RIGHT SIDE DESCENDING.
- ON STEPS LESS THAN 44 INCHES WIDE HAVING ONE SIDE OPEN, ONE HANDRAIL ON EACH SIDE.
- ON STEPS LESS THAN 44 INCHES WIDE HAVING BOTH SIDES OPEN, ONE HANDRAIL ON EACH SIDE.
- ON STEPS MORE THAN 44 INCHES WIDE BUT LESS THAN 88 INCHES WIDE, ONE HANDRAIL ON EACH SIDE.
- ON STEPS 88 OR MORE INCHES WIDE, ONE HANDRAIL ON EACH SIDE, AND ONE INTERMEDIATE HANDRAIL LOCATED APPROXIMATELY MIDWAY OF THE WIDTH.

SPECIFICATION REFERENCE	<h1>STANDARD CONCRETE STEPS FOR 1 1/2 : 1 SLOPE</h1>	VIRGINIA DEPARTMENT OF TRANSPORTATION	REV. 7/02 601.01
105 504			601.01



V₁ = 1.000 CU. FT.
 V₂ = 0.583 CU. FT.
 V₃ = 0.750 CU. FT.
 V₄ = 0.708 CU. FT.

FROM PICTORIAL VIEW IT IS SEEN THAT:

$$V = \frac{V_1 W + 2V_2 (N-1) + V_3 (WN+1) + 2V_4}{27}$$

SUBSTITUTING VALUES OF ELEMENTARY VOLUMES:

$$V = \frac{1.000 W + 1.166(N-1) + 0.750(WN+1) + 1.416}{27}$$

- V - INDICATES TOTAL VOLUME OF STEPS IN CUBIC YARDS.
- V₁, V₂, V₃ & V₄ - INDICATE ELEMENTARY VOLUMES USED IN COMPUTING V.
- W - INDICATES CLEAR WIDTH OF STEPS, IN FEET, BETWEEN SIDEWALLS.
- N - INDICATES NUMBER OF STEPS IN INSTALLATION EXCLUSIVE OF LANDING.
- L1 - INDICATES LENGTH OF BARS A, IN INCHES. L1 = 13.416N + 8"
- L2 - INDICATES LENGTH OF BARS B, IN INCHES. L2 = 12W + 9"
- L3 - INDICATES LENGTH OF BARS C, IN INCHES. L3 = 13.416N + 18"

A LANDING IS TO BE PROVIDED WHERE 12 OR MORE STEPS ARE REQUIRED. MINIMUM SIZE OF LANDING TO BE W + 1 FOOT X 4 FEET.

THIS ITEM MAY BE PRECAST OR CAST IN PLACE. CONCRETE TO BE CLASS A3 IF CAST IN PLACE, 4000 PSI IF PRECAST. FOR OTHER WIDTHS THE APPROXIMATE SPACING OF BARS A IN INCHES WILL BE EQUAL TO 80/N WITH A MINIMUM SPACING OF 6". REINFORCING BARS TO BE USED IN INSTALLATIONS OF 6 OR MORE STEPS. FOR TABULATION OF CONCRETE AND STEEL QUANTITIES SEE SHEET 2.

		NUMBER OF BARS A								
		N+1-5	N+6	N+7	N+8	N+9	N+10	N+11	N+12	N+13-25
NO STEEL	W = 3'	4	5	5	6	6	7	7	8	
	W = 4'	5	6	7	7	8	8	9	10	
	W = 5'	6	7	8	9	9	10	11	12	

HANDRAIL IS TO BE PROVIDED FOR STEPS HAVING THREE OR MORE RISERS, AND WILL MEET THE FOLLOWING CONDITIONS:

1. ON STEPS LESS THAN 44 INCHES WIDE HAVING BOTH SIDES ENCLOSED, AT LEAST ONE HANDRAIL, PREFERABLY ON THE RIGHT SIDE DESCENDING.
2. ON STEPS LESS THAN 44 INCHES WIDE HAVING ONE SIDE OPEN, ONE HANDRAIL ON EACH SIDE.
3. ON STEPS LESS THAN 44 INCHES WIDE HAVING BOTH SIDES OPEN, ONE HANDRAIL ON EACH SIDE.
4. ON STEPS MORE THAN 44 INCHES WIDE BUT LESS THAN 88 INCHES WIDE, ONE HANDRAIL ON EACH SIDE.
5. ON STEPS 88 OR MORE INCHES WIDE, ONE HANDRAIL ON EACH SIDE, AND ONE INTERMEDIATE HANDRAIL LOCATED APPROXIMATELY MIDWAY OF THE WIDTH.

SPECIFICATION REFERENCE
105 504

STANDARD CONCRETE STEPS FOR 2 : 1 SLOPE

VIRGINIA DEPARTMENT OF TRANSPORTATION

REV. 7/02
601.03