

DESIGN DATA				
Traffic	Average Daily			Max.Hr.
Current 2012	Pass: 2440	Trucks: 365	Total: 2735	275
Forecast 2032	Pass: 2980	Trucks: 360	Total: 3340	335
Clear Zone Distance:		Design Speed:		
Minimum Sight Dist. for Stopping:		Bridges: 0094-294.283		
Sight Dist. for No Passing Zone:		Box Culverts: 0094-931.897		
Pavement Design Life (years)		Design ESALs:		

JOB # 25 NORTH DAKOTA

DEPARTMENT OF TRANSPORTATION

S-NHU-2-094(123)931
 FHWA Limited Involvement
 Barnes County
 I-94 Business Loop East
 East City Limits East to I-94
 3" Overlay, Guardrail Replacement,
 Subcut Repair, and Incidentals

STATE	PROJECT NO.	PCN	SECTION NO.	SHEET NO.
ND	S-NHU-2-094(123)931	20100	1	1

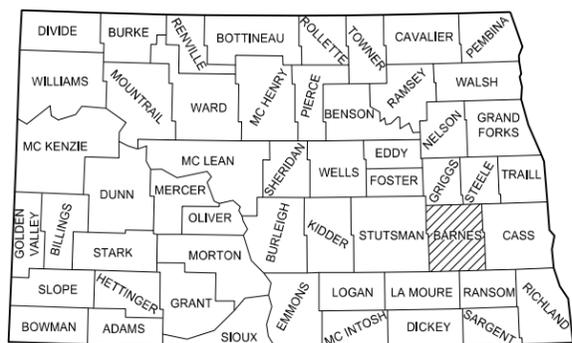
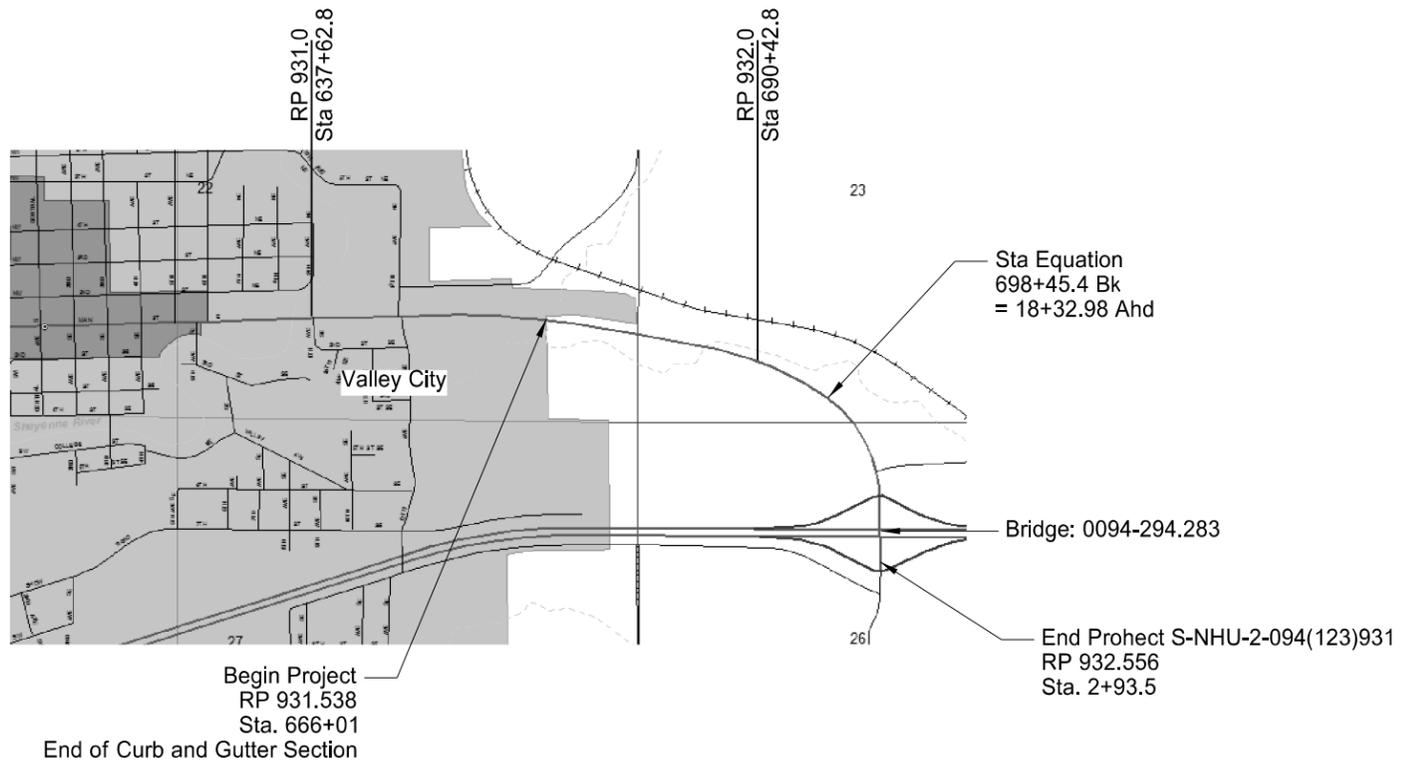
GOVERNING SPECIFICATIONS:

Standard Specifications adopted by the North Dakota Department of Transportation October 2008; Standard Drawings currently in effect; and other Contract Provisions submitted herein.

PROJECT NUMBER \ DESCRIPTION	NET MILES	GROSS MILES
S-NHU-2-094(123)931	0.716	1.018
Exception for Project		
S-NHU-2-094(126)932	-0.263	
Bridge 0094-294.283	-0.039	



T 140 N
R 58 W



STATE COUNTY MAP

DESIGNERS
Adam McMahon /s/

APPROVED DATE 9/3/2013
 Jay Praska /s/
 Valley City District Engineer
 ND DEPARTMENT OF TRANSPORTATION

I hereby certify that the attached plans were prepared by me or under my direct supervision and that I am a duly registered professional engineer under the laws of the state of ND.
 APPROVED DATE 9/3/2013
 Daniel R. Viau /s/
 NDDOT Valley City District

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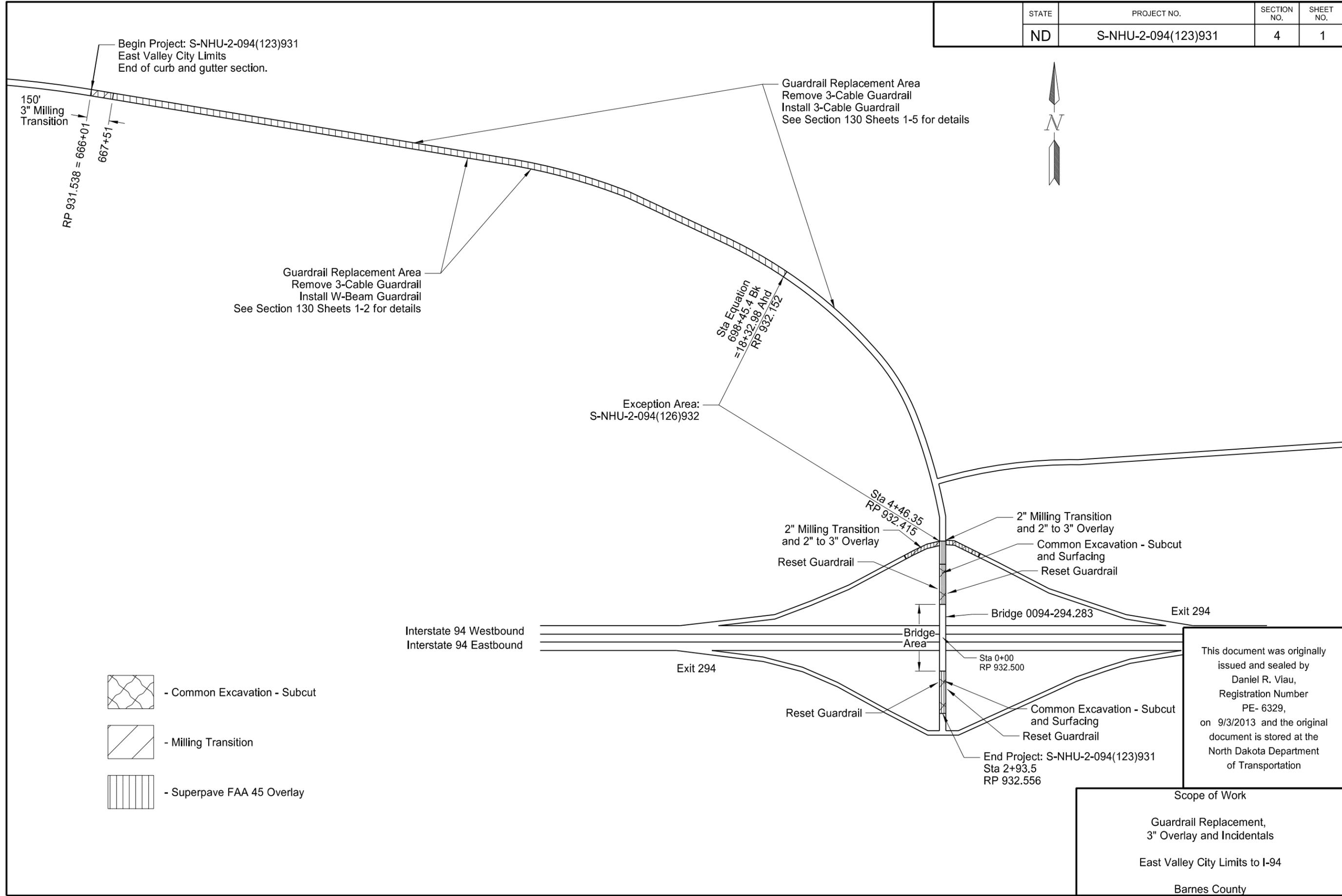
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SP 1101(08)		Split Sampling and Testing Requirements for Aggregate Base
SP 1010(08)		Temporary Erosion and Sediment Best Management Practices

LIST OF STANDARD DRAWINGS

<u>Standard No.</u>	<u>Description</u>
D-20-1, 2, & 3	NDDOT Abbreviations
D-20-10	NDDOT Utility Company Abbreviations
D-20-20 & 21	Line Styles
D-20-30, 31, & 32	Symbols
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D-704-7	Breakaway System for Construction Zone Signs
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D-704-14, 15, & 26	Construction Sign and Barricade Assembly Details
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D-762-2	Interstate Pavement Marking 4 Lane Divided Highway
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D-762-6	Short-Term Pavement Marking
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D-764-2B	ET-2000 – LET Terminal Assembly
D-764-2C	Flared Energy Absorbing Terminal for Steel Breakaway System
D-764-2D	Sequential Linking Terminal
D-764-3	W-Beam Transition to Concrete Jersey Barrier with Approach Curb
D-764-7A	Guardrail at Bridge Ends – 55 MPH Design Speed
D-764-11A	Typical Grading at Bridge Ends with Glared W-Beam Guardrail – 55 MPF Design Speed
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-  - Common Excavation - Subcut
-  - Milling Transition
-  - Superpave FAA 45 Overlay

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Scope of Work
Guardrail Replacement,
3" Overlay and Incidentals
East Valley City Limits to I-94
Barnes County

NOTES

- 107-P01 HAUL ROADS: Contractor shall check with county commissioners or local road authority for load limits for roads which will be considered haul roads for this project.
- 203-P01 COMMON EXCAVATION – SUBCUT: The subcut area shall be removed to a depth 18 inches from the top of the existing surface. Geotextile Fabric – Type R1 shall be placed and 12 inches of Salvaged Base Course shall be placed and compacted.
- 203-P02 COMMON EXCAVATION – SUBCUT: The Contractor shall maintain one lane of traffic during subcut work. Work shall be scheduled so that one half of the roadway can be closed, surface removed, Geotextile Fabric – Type R1 laid, Salvaged Base Course laid and compacted in one day. The ends shall be tapered to transition traffic up to the existing surface, until it is paved.
- 203-P03 COMMON EXCAVATION - SUBCUT: The following item shall not be measured in the field, but shall be paid for at plan quantity – “Common Excavation – Subcut”, as per Specification 203.03 B.
- 203-P04 GUARDRAIL EMBANKMENT: All costs for the removal of existing surfacing, aggregate base, and any excavation needed for guardrail replacement shall be included in price bid for other removal items involved with guardrails.
- 216-P01 WATER: Water used for compacting Salvaged Base Course shall be included in the bid price for “Salvaged Base Course”.
- 410-P01 SUPERPAVE FAA 45: The mix design will be developed using the aggregate source and asphalt cement that is to be used on the project.

The following aggregate and mix design properties are required.

Test	Criteria	Reference
Coarse Aggregate Angularity	85% min	NDDOT Field Sampling/Testing Manual
Fine Aggregate Angularity	45% min	AASHTO T 304
Gyratory Effort, # Gyration	N _{ini} =7, N _{des} =75, N _{max} =115	AASHTO R 35
Voids Filled with Asphalt	65-75%	AASHTO M 323, T 166
%G _{mm} @ N _{ini}	89% max	AASHTO M 323, T 166

- 410-P02 SUPERPAVE FAA 45: Compaction for the Superpave FAA 45 will be per specification 410.05 C on all lifts, except the 70 Foot transition taper on the third lift in the subcut area at Sta 2+85.5 to 2+15.5.
- 410-P03 SUPERPAVE FAA 45: The 3 inches of Superpave FAA 45, from Sta 666+01 to 698+45.4 and Sta 4+46.35 to 2+85.5, shall be laid in 2 equal lifts.

411-P01 MILLING PAVEMENT SURFACE: There will be 1.5 inches milled off of the shoulders adjacent to the Subcut areas. These areas are detailed in Section 20 Sheet 1, and Section 30 Sheets 2 and 3.

411-P02 MILLING PAVEMENT SURFACE: The milled bituminous material shall become property of the NDDOT. The milled material shall be hauled and stockpiled at the NDDOT Valley City District Maintenance yard. The contact person will be:

Kathy Beach
(701)845-8815
Email: kbeach@nd.gov

All costs for the work of hauling and stockpiling shall be included in the bid price for “Milling Pavement Surface”.

411-P03 TEMPORARY ASPHALT WEDGES: The contractor shall place temporary asphalt or milled material wedges at the milled taper locations and subcut locations to allow for a smooth passage of vehicles. All costs associated with labor, materials, and equipment for the installation, maintenance, and removal of the wedges shall be included in the price for “Milling Pavement Surface.”

704-251 TRAFFIC CONTROL FOR UNEVEN LANES: The contractor has the option of making the paving lanes even at the end of each day’s paving operation or signing for the uneven pavement and providing the following devices: Install “Uneven Lanes” signs (Sign No. W8-11-48) and a supplemental plate (Sign No. W20-52-54), identifying the distance, on the right shoulder (both directions) in advance of the beginning of the uneven pavement and at major intersections. A major intersection shall be defined as a CMC, State, U.S. highway, or Interstate ramp. Install “Do Not Pass” signs (Sign No. R4-1-48) on the right shoulder (both directions) between the uneven pavement sign and the beginning of the uneven pavement and at major intersections. If uneven pavement exists at any location longer than one night, tubular markers shall be installed. Tubular markers shall be spaced at two times the posted speed limit on the centerline where uneven pavement exists.

These traffic control devices shall be left in place until the lanes are even. These signs and tubular markers are included in the “Traffic Control Devices List and will be measured and paid for at the contract unit price for each device. No extra compensation will be allowed for relocation due to work progression.

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NOTES

704-P01 TRAFFIC CONTROL FOR GUARDRAIL: Traffic control for the guardrail removals and installation shall consist of a temporary road closure, flagging, and a pilot car. Traffic Control Devices shall comply with the following Standard Drawings:

1. Standard D-704-15, Layout A: For temporary roadway closure during removals and installation.

The tubular markers, used for centerline during paving, shall be used during the guardrail operations. They will only be paid for once during the project.

704-P02 TRAFFIC CONTROL FOR BITUMINOUS SURFACING: Traffic control for the paving shall consist of a temporary road closure, flagging, and a pilot car. Traffic Control Devices shall comply with the following Standard Drawings:

1. Standard D-704-2: For coring operations.
2. Standard D-704-7, 8, 9, 10, 11, 13, and 14 are all applicable.
3. Standard D-704-15, Layout A: For temporary roadway closure during paving, milling and Subcut operations.
4. Standard D-704-20, Layout G: For construction signing during paving, milling and Subcut operations.
5. Standard D-704-22, Layouts K, L, and O: For trucks hauling material.
6. Standard D-704-26, Layouts CC, EE, FF, and GG: For paving operations.

Quantities have been developed based on the entire project length for paving operations. The required traffic control signs and devices are included in the "Traffic Control Devices List" and will be measured and paid for at the Contract Unit Price for each device. Additional devices required to accommodate the Contractor's operation shall be the Contractor's responsibility.

704-P03 TRAFFIC CONTROL: A quantity of 65 Tubular Markers have been provided for uneven lane marking during paving or as needed throughout the project as directed by the Engineer.

704-P04 TRAFFIC CONTROL: There will be a tied project, S-NHU-2-094(126)932, going on at the same time as this project. Flagging, skid mounted signs and pilot car used for paving the 3" Superpave FAA 45 overlay through both projects, on the Business Loop, shall only be paid for once on this project.

704-P05 DELINEATOR DRUMS: A quantity of 100 drums has been provided in the Traffic Control Device List and shall be used during the removal and installation of the 3-Cable Guardrail and W-Beam Guardrail operations. These drums will be counted and paid for once. No extra compensation shall be made for moving these drums throughout the project.

762-P01 PAVEMENT MARKING EDGELINES: All lines shall be continued through private drives and broken for intersections.

766-P01 MAILBOX – ALL TYPES: The 2 mailboxes that are attached to the guardrail, at Sta 686+32 and Sta 689+00, shall be removed and reinstalled on new supports in the same locations as removed. The new supports shall be installed behind the guardrail so that the U.S. Post Office carrier is able to access the box without exiting the vehicle.

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ESTIMATE OF QUANTITIES

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	S-NHU-2-094(123)931	8	1

SPEC CODE	ITEM DESCRIPTION	UNIT	MAINLINE	TOTAL
-----	-----	-----	-----	-----
103	0100 CONTRACT BOND	L SUM	0.42	0.42
202	0132 REMOVAL OF BITUMINOUS SURFACING	SY	1,153	1,153
202	0153 SAW BITUMINOUS SURFACING-FULL DEPTH	LF	854	854
203	0109 TOPSOIL	CY	486	486
203	0138 COMMON EXCAVATION-SUBCUT	CY	288	288
203	0140 BORROW-EXCAVATION	CY	1,156	1,156
302	0100 SALVAGED BASE COURSE	TON	1,225	1,225
401	0100 MC70 OR 250 LIQUID ASPHALT	GAL	878	878
401	0150 SS1H OR CSS1H OR MS1 EMULSIFIED ASPHALT	GAL	1,392	1,392
401	0160 BLOTTER MATERIAL CL 44	TON	26	26
410	0215 SUPERPAVE FAA 45	TON	2,730	2,730
410	0460 PG 64-28 ASPHALT CEMENT	TON	164	164
410	0910 CORED SAMPLE	EA	45	45
411	0105 MILLING PAVEMENT SURFACE	SY	1,690	1,690
702	0100 MOBILIZATION	L SUM	0.42	0.42
704	0100 FLAGGING	MHR	234	234
704	1000 TRAFFIC CONTROL SIGNS	UNIT	1,509	1,509
704	1052 TYPE III BARRICADE	EA	4	4
704	1060 DELINEATOR DRUMS	EA	100	100
704	1067 TUBULAR MARKERS	EA	60	60
704	1185 PILOT CAR	HR	78	78
706	0300 FIELD LABORATORY-TYPE C	EA	0.42	0.42
708	2240 SEEDING-TYPE B-CL II	ACRE	0.6	0.6
708	2290 SEEDING-TYPE B-CL VI	ACRE	0.6	0.6
708	5500 MULCHING	ACRE	0.6	0.6
709	0701 GEOTEXTILE FABRIC-TYPE R1	SY	1,154	1,154
748	0141 CURB & GUTTER-TYPE 1 SPECIAL	LF	80	80
754	0112 FLAT SHEET FOR SIGNS-TYPE IV REFL SHEETING	SF	36	36
754	0206 STEEL GALV POSTS-TELESCOPING PERFORATED TUBE	LF	68	68
762	0430 SHORT TERM 4IN LINE-TYPE NR	LF	6,303	6,303
762	1104 PVMT MK PAINTED 4IN LINE	LF	10,486	10,486
762	1124 PVMT MK PAINTED 24IN LINE	LF	64	64
764	0115 3-CABLE GUARDRAIL	LF	750	750

ESTIMATE OF QUANTITIES

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	S-NHU-2-094(123)931	8	2

SPEC CODE	ITEM DESCRIPTION	UNIT	MAINLINE	TOTAL
-----	-----	-----	-----	-----
764 0131	W-BEAM GUARDRAIL	LF	570	570
764 0145	W-BEAM GUARDRAIL END TERMINAL	EA	2	2
764 0151	REMOVE W-BEAM GUARDRAIL & POSTS	LF	183	183
764 1010	RESET 3-CABLE GUARDRAIL	LF	1,175	1,175
764 1050	RESET W-BEAM GUARDRAIL	LF	50	50
764 1059	RESET W-BEAM GUARDRAIL END TERMINAL	EA	4	4
764 1990	REMOVE CONCRETE SAFETY SHAPE TRANSITION	EA	4	4
764 2020	REMOVE 3-CABLE GUARDRAIL & POSTS	LF	1,816	1,816
764 2081	REMOVE END TREATMENT & TRANSITION	EA	4	4
766 0100	MAILBOX-ALL TYPES	EA	3	3

BASIS OF ESTIMATE

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Typical	Item Description	# of Applications	Unit	Rate	Average Area	Length	Quantity
A	SS1H or CSS1H or MS1 Emulsified Asphalt	2	Gal	0.05 Gal / SY	31' Wide	3,244 LF	1,117.3 Gal
	Superpave FAA 45	1	Ton	2.0 Ton / CY	7.416 SF	3,244 LF	1,782 Ton
	PG 64-28 Asphalt Cement	1	Ton	6.0%			107 Ton
B	SS1H or CSS1H or MS1 Emulsified Asphalt	2	Gal	0.05 Gal / SY	42' Wide	160.85 LF	75.1 Gal
	Superpave FAA 45	1	Ton	2.0 Ton / CY	10.500 SF	160.85 LF	125.1 Ton
	PG 64-28 Asphalt Cement	1	Ton	6.0%			7.5 Ton
C ₁	MC 70 or 250	1	Gal	0.25 Gal / SY	29' Wide	181 LF	145.8 Gal
	Blotter Material - CI 44	1	Ton	15 Lb / SY	29' Wide	181 LF	4.4 Ton
	SS1H or CSS1H or MS1 Emulsified Asphalt	1	Gal	0.05 Gal / SY	29' Wide	181 LF	29.2 Gal
	Superpave FAA 45	1	Ton	2.0 Ton / CY	10.875 SF	181 LF	145.8 Ton
	PG 64-28 Asphalt Cement	1	Ton	6.0%			8.7 Ton
C ₂	SS1H or CSS1H or MS1 Emulsified Asphalt	1	Gal	0.05 Gal / SY	42' Wide	181 LF	42.2 Gal
	Superpave FAA 45	1	Ton	2.0 Ton / CY	5.069 SF	181 LF	68.0 Ton
	PG 64-28 Asphalt Cement	1	Ton	6.0%			4.1 Ton
C ₃	SS1H or CSS1H or MS1 Emulsified Asphalt	1	Gal	0.05 Gal / SY	29' Wide	70 LF	11.3 Gal
	Superpave FAA 45	1	Ton	2.0 Ton / CY	2.625 SF	70 LF	13.6 Ton
	PG 64-28 Asphalt Cement	1	Ton	6.0%			0.8 Ton
D ₁	MC 70 or 250	1	Gal	0.25 Gal / SY	27' Wide	190 LF	142.5 Gal
	Blotter Material - CI 44	1	Ton	15 Lb / SY	27' Wide	190 LF	4.3 Ton
	SS1H or CSS1H or MS1 Emulsified Asphalt	1	Gal	0.05 Gal / SY	27' Wide	190 LF	28.5 Gal
	Superpave FAA 45	1	Ton	2.0 Ton / CY	10.125 SF	190 LF	142.5 Ton
	PG 64-28 Asphalt Cement	1	Ton	6.0%			8.6 Ton
D ₂	SS1H or CSS1H or MS1 Emulsified Asphalt	1	Gal	0.05 Gal / SY	42' Wide	190 LF	44.3 Gal
	Superpave FAA 45	1	Ton	2.0 Ton / CY	5.069 SF	190 LF	71.3 Ton
	PG 64-28 Asphalt Cement	1	Ton	6.0%			4.3 Ton
NW Ramp	SS1H or CSS1H or MS1 Emulsified Asphalt	1	Gal	0.05 Gal / SY	364 SY	Varies	18.2 Gal
	Superpave FAA 45	1	Ton	2.0 Ton / CY	3,277 SF	Varies	50.6 Ton
	PG 64-28 Asphalt Cement	1	Ton	6.0%			3.0 Ton
NE Ramp	SS1H or CSS1H or MS1 Emulsified Asphalt	1	Gal	0.05 Gal / SY	375 SY	Varies	18.8 Gal
	Superpave FAA 45	1	Ton	2.0 Ton / CY	3,372 SF	Varies	52.0 Ton
	PG 64-28 Asphalt Cement	1	Ton	6.0%			3.1 Ton
Guardrail Quantities	MC70 or 250	1	Gal	0.25 Gal / SY	2,358 SY		589.5 Gal
	Blotter Material - CI 44	1	Ton	15 # / SY	2,358 SY		17.7 Ton
	Superpave FAA 45	1	Ton	2.0 Ton / CY	21,222 SF	2" Deep	262.0 Ton
	PG 64-28	1	Ton	6.0%			15.7 Ton

C₁ and D₁ are bottom lifts for the typical section
 C₂ and D₂ are top lifts for the typical section
 C₃ is the taper wedge for the transition from 0 inches at Sta 2+15.5 to 1.5 inches at Sta 2+85.5

Salvaged Base Course

Sta 1+03.5 to 2+93.5
 12" deep X 27' wide X 190 LF ÷ 27 (CF / CY) X 1.875 (Ton / CY) = 356.3 Ton
 Sta -1+04.5 to -2+85.5
 12" deep X 29' wide X 181 LF ÷ 27 (CF / CY) X 1.875 (Ton / CY) = 364.5 Ton
720.8 Ton

Approaches
 5 each @ 2.7 tons per each = **13.5 Tons**

Guardrail Quantities

3-Cable Guardrail: 4" deep x 13,559 SF / 27 = 167.4 CY x 1.875 = 313.9 Ton
 W-Beam Guardrail: 4" deep x 4,899 SF / 27 = 60.5 CY x 1.875 = 113.4 Ton
 Bridge Approach (2): 4" deep x 1,017 SF / 27 = 12.6 CY x 1.875 x 2 ea = 47.3 Ton
 Bridge Depart (2): 4" deep x 365 SF / 27 = 4.5 CY x 1.875 x 2 ea = 16.9 Ton
491.5 Ton

Pavement Marking Quantities

Short Term 4" Line - 2 applications (once for the first lift and once for second lift)
 Centerline, 4" Yellow Skips (10' line, 30' skip)
 Sta 666+01 to 690+15 = 2,414 LF * 0.25(10' per 40') = 603.5 LF
 603.5 LF x 2 = **1,207 LF**

Centerline, 4" Yellow Double Barrier
 Sta 690+15 to 698+45 = 830 LF * 2 = 1,660 LF
 Sta 1+04.5 to 3+58. = 254 LF * 2 = 508 LF
 Sta -1+03.5 to -2+93.5 = 190 LF * 2 = 380 LF
 2,548 LF x 2 = **5,096 LF**

Pvmt MK Painted 4 IN Line

Centerline, 4" Yellow Skips (10' line, 30' skip)
 Sta 666+01 to 690+15 = 2,414 LF * 0.25(10' per 40') = 603.5 LF
603.5 LF

Centerline, 4" Yellow Double Barrier
 Sta 690+15 to 698+45 = 830 LF * 2 = 1,660 LF
 Sta 1+04.5 to 3+58.5 = 254 LF * 2 = 508 LF
 Sta -1+03.5 to -2+93.5 = 190 LF * 2 = 380 LF
2,548 LF

Edgeline 4" White and Yellow
 Sta 666+01 to 698+45 = 3244 LF * 2 = 6,488 LF
 Sta 1+04.5 to 3+65 (includes radius) = 381 LF
 Sta 3+90 to 4+46 (includes radius) = 85 LF
 Sta -1+03.5 to -2+93.5 = 190 LF * 2 = 380 LF
7,334 LF

Pvmt MK Painted 24 IN Line

Northeast Exit Ramp = **64 LF**

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BASIS OF ESTIMATE

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Cored Samples

$(666+01 \text{ to } 698+45.4) + (4+46.35 \text{ to } 2+85.5) = 3,405.25 \text{ LF} / 2000 \text{ Ft per sub lot} = 1.7026 \text{ sublots} = \text{rounds to}$
2 sub lots x 2 lanes x 2 lifts x 2 Core per sub lot = 16 Cores

Subcut

1+04.5 to 2+85.5 = 181 LF = 1 sub lot x 2 lanes x 3 lifts x 2 Cores per sub lot = 12 Cores
-2+93.5 to -1+03.5 = 190 LF = 1 sub lot x 2 lanes x 3 lifts x 2 Cores per sub lot = 12 Cores

Ramps

2 ramps x 2 cores / ramp = 4 Cores

Full Depth District Cores

1 core / mile X project length (1.018) = 1 Core.

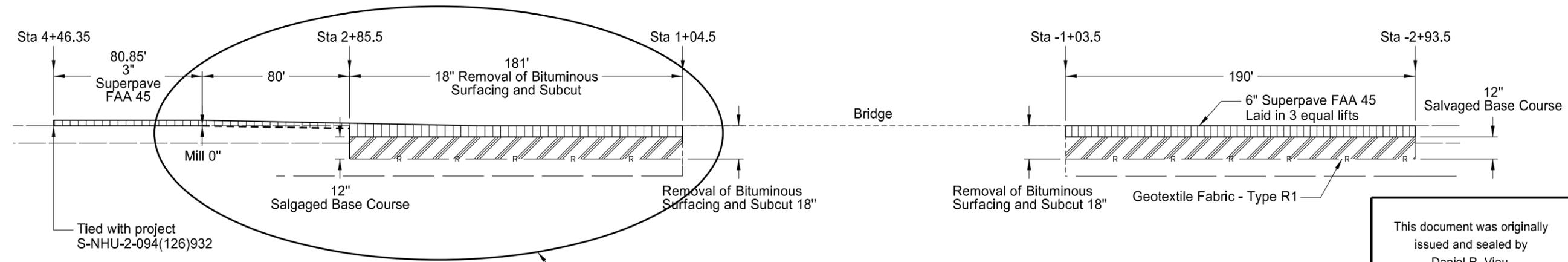
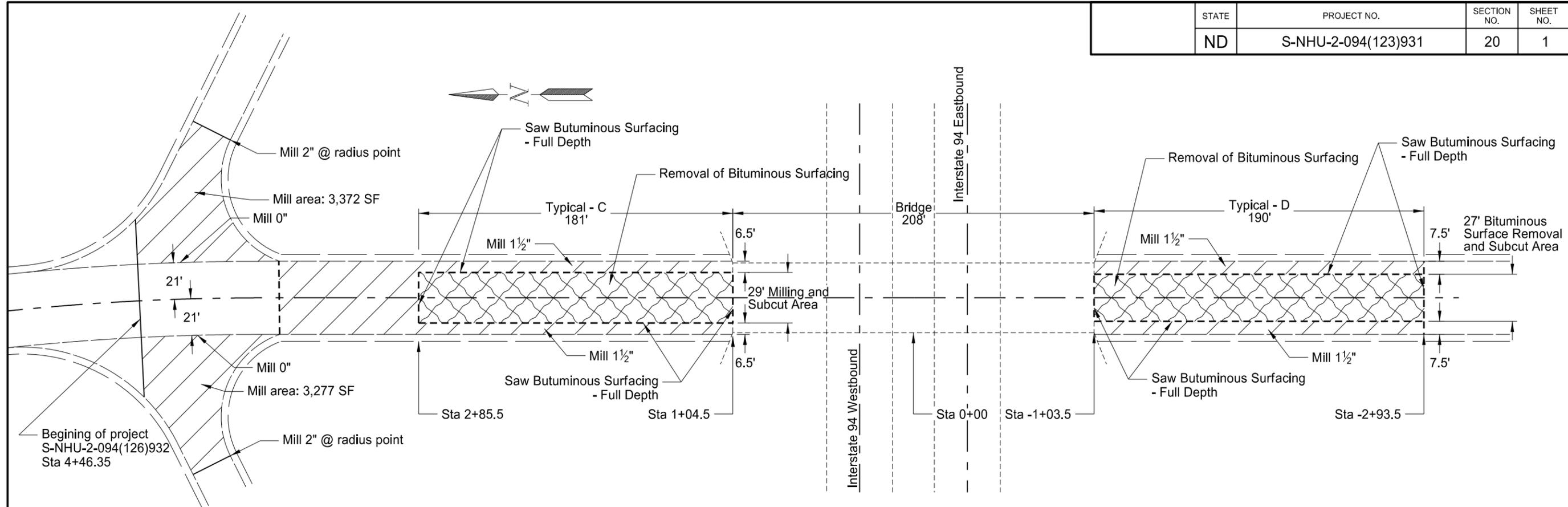
Total Cores: **45 Cores**

Mailbox – All Types – 3 Total

Multiple Support @ Sta 880+99 Left
Single Support @ Sta 686+32 Left
Single Support @ Sta 689+00 Left

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Detail A
See Section 20 Sheet 2 for details

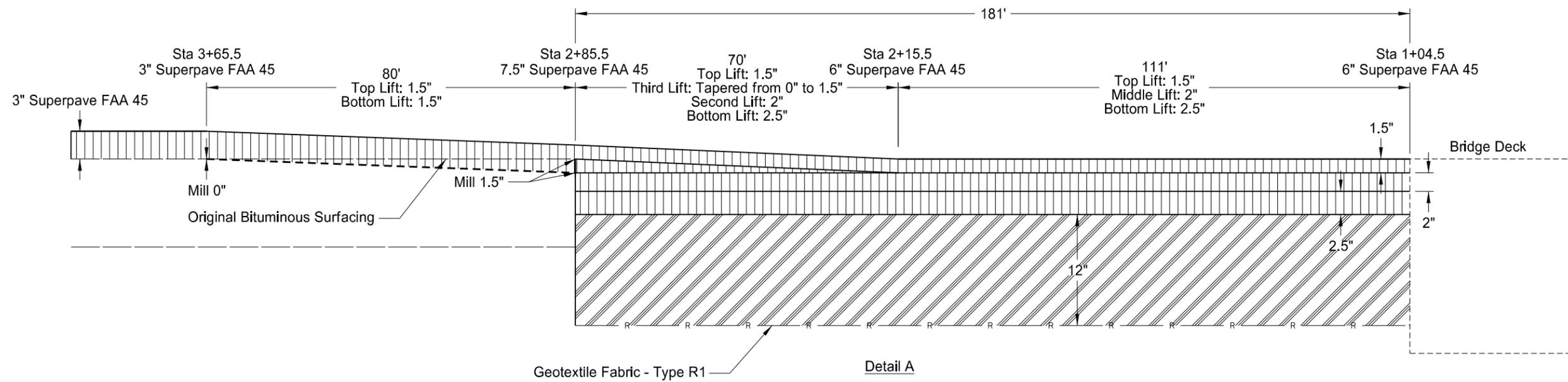
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Legend

- Common Excavation - Subcut
- Milling Pavement Surface
- Superpave FAA 45
- Salvaged Base Course

Subcut Repair Details
Guardrail Replacement
3" Overlay and Incidentals
East Valley City Interchange
Barnes County

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	S-NHU-2-094(123)931	20	2



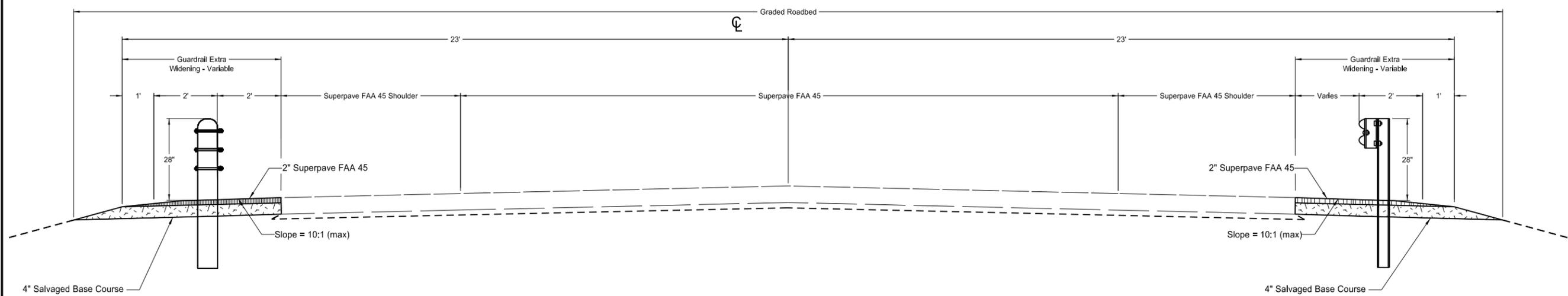
Legend

-  - Superpave FAA 45
-  - Salvaged Base Course

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Subcut Repair Details
 Detail A
 Guardrail Replacement
 3" Overlay and Incidentals
 East Valley City Interchange
 Barnes County

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	S-NHU-2-094(123)931	20	3

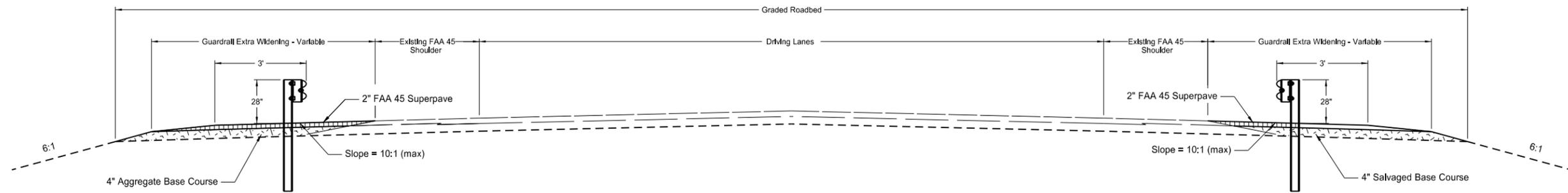


3-Cable Guardrail		
Sta 682+48.64 to 698+45.4 Bk = 18+32.98 Ahd to 15+67.63		
	<u>UNIT</u>	<u>LT</u>
Salvaged Base Course	Ton	313.9
MC 70 or 240	GAL	376.6
Superpave FAA 45	TON	167.4
PG 64 - 28	TON	10.0

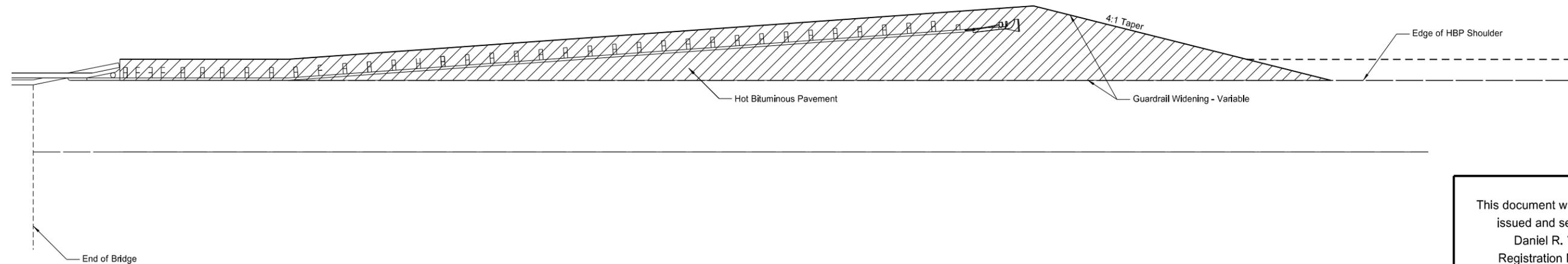
W-Beam Guardrail		
Sta 682+14.33 to 685+77.88		
	<u>UNIT</u>	<u>RT</u>
Salvaged Base Course	Ton	113.4
MC 70 or 240	GAL	136.1
Superpave FAA 45	TON	60.5
PG 64 - 28	TON	3.6

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Typical Surfacing at 3-Cable Guardrail Locations
 Guardrail Replacement
 3" Overlay and Incidentals
 East Valley City Interchange
 Barnes County

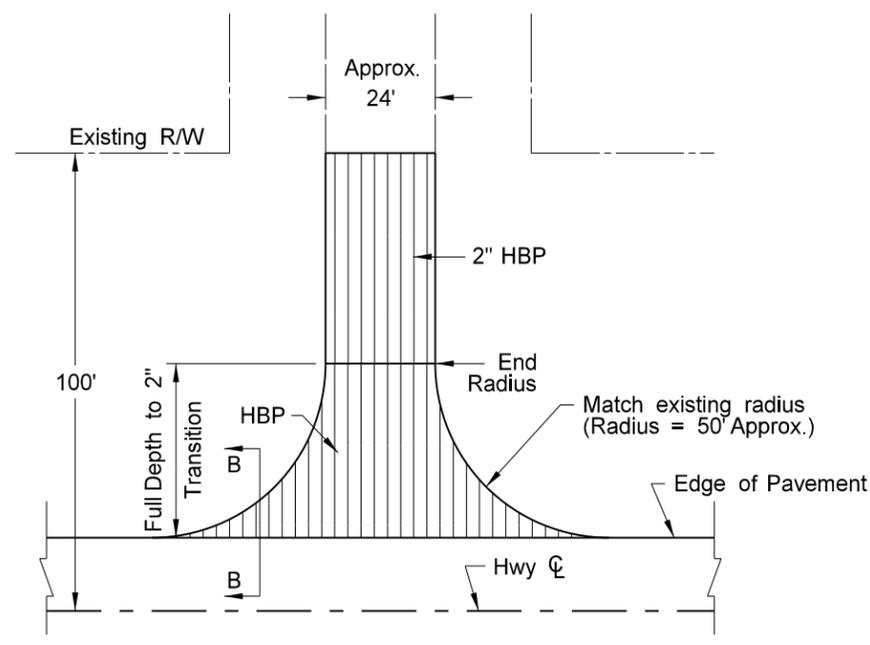


EAST VALLEY CITY INTERCHANGE CROSSROAD							
NORTH BRIDGE END				SOUTH BRIDGE END			
	UNIT	RT	LT		UNIT	RT	LT
PRIME	GAL	28	10	PRIME	GAL	28	10
FAA 45	TON	13	5	FAA 45	TON	13	5
PG 64-28	TON	0.7	0.3	PG 64-28	TON	0.7	0.3

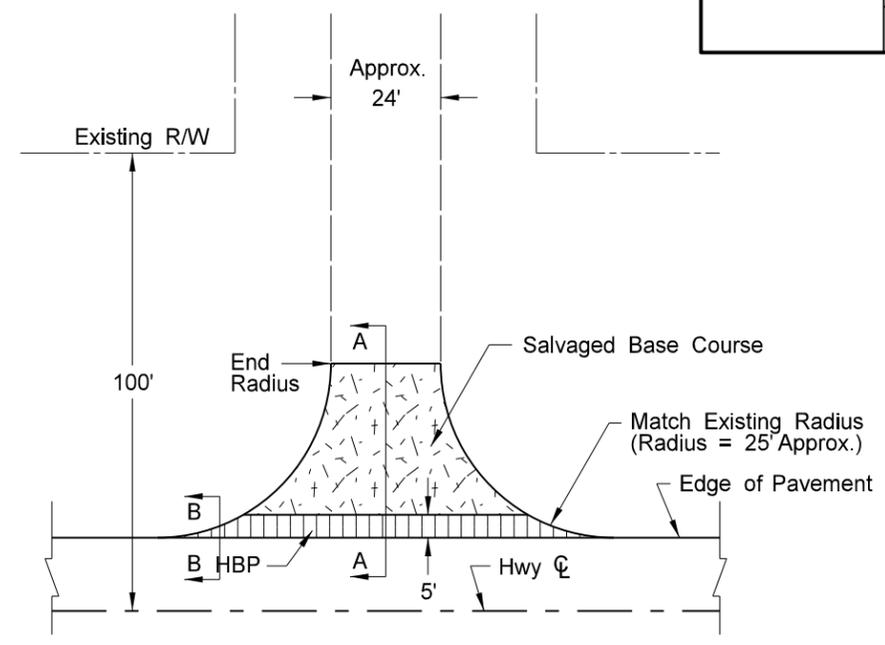


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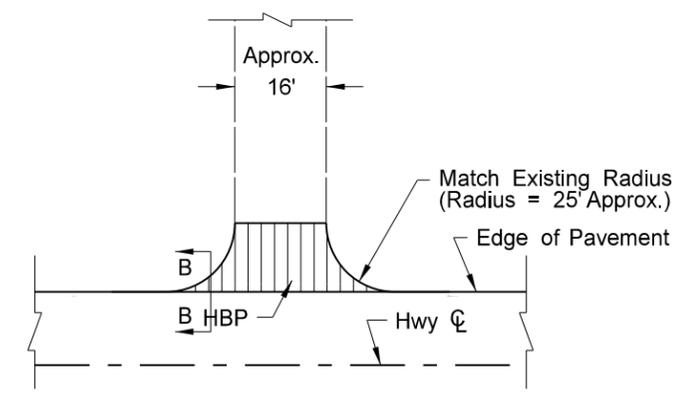
Typical Surfacing at Bridge Ends with Guardrail
 Guardrail Replacement
 3" Overlay and Incidentals
 East Valley City Interchange
 Barnes County



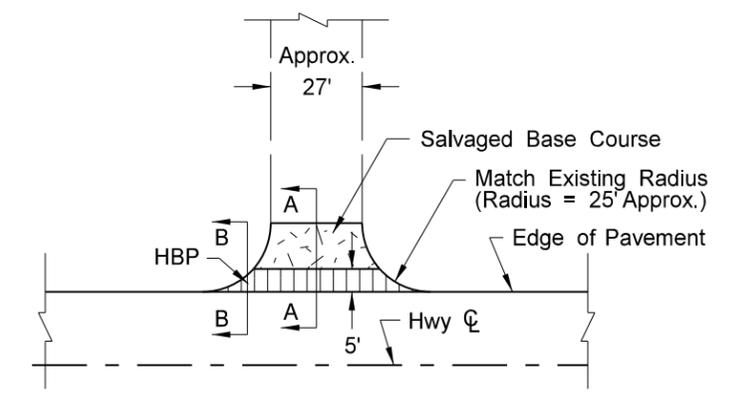
(1) Paved Section Line, County Road, or Street Approach



(2) Gravel Section Line, County Road, or Street Approach

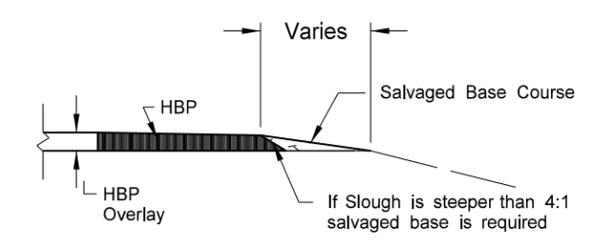


(3) Paved Private Drive Approach

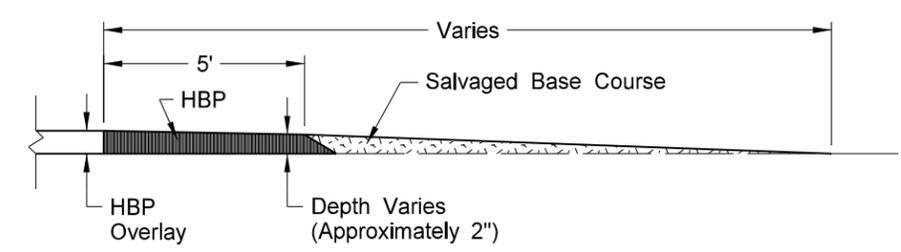


(4) Gravel Private Drive or Field Drive Approach

- Notes:
1. A longer HBP wedge may be needed if an existing elevation difference between the mainline and the approach exists. Actual HBP paving and salvaged base locations may vary in the field for situations, as approved by the Engineer.
 2. Quantity totals have been included in the bid items of the "Estimate of Quantities" of the plans.
 3. Approximately 11 tons of salvaged base have been provided to fill in around the radii. This material will be required when sloughs are steeper than 4:1. See B-B.



Section B-B



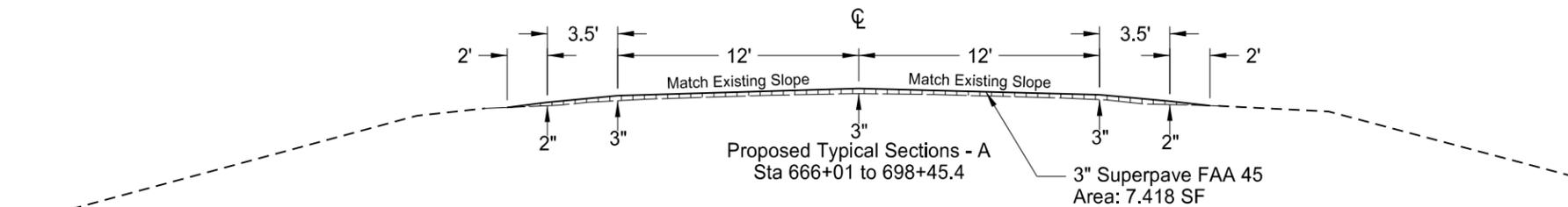
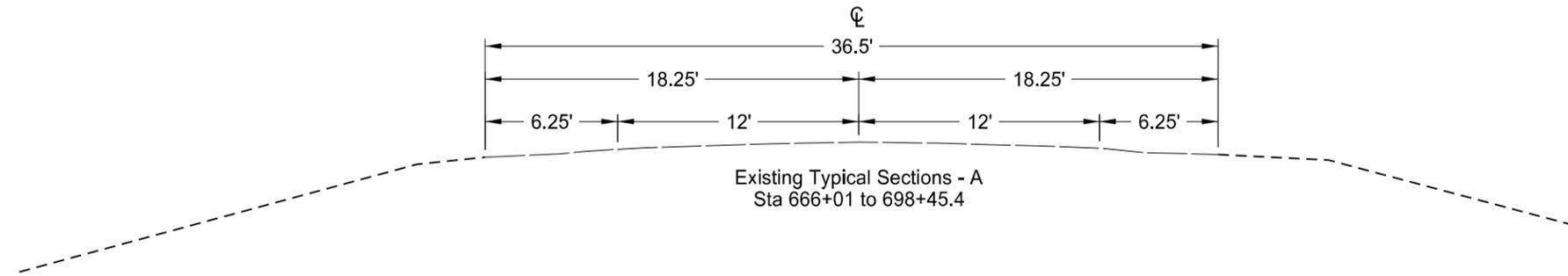
Section A-A

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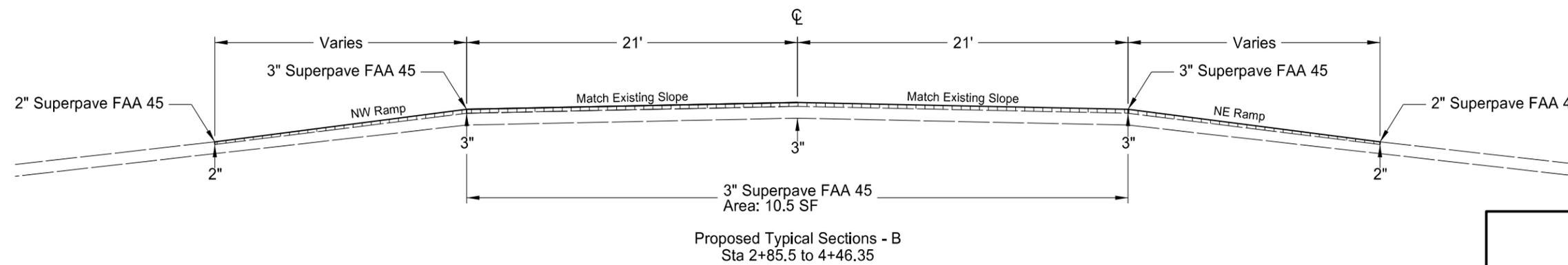
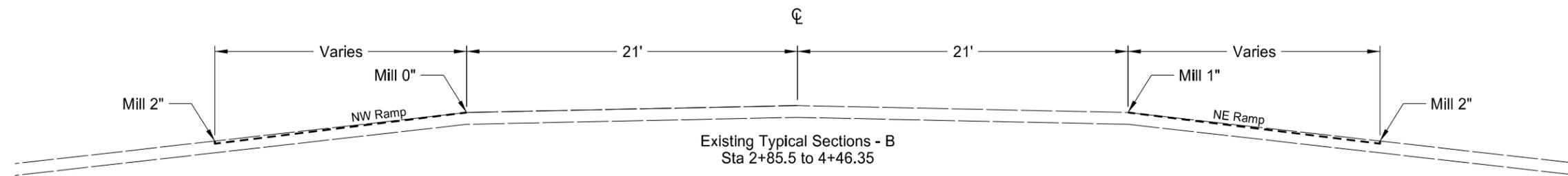
BASIS OF ESTIMATE		(1)	(2)	(3)	(4)	TOTALS
ITEM	UNIT	Paved Section Line	Gravel Section Line	Paved Private Drive	Gravel Field/Private Drive	
Number of Locations	#	0	0	1	5	6
Salvaged Base	TON	0	0	0.6	2	10.6
Tack Coat	GAL	0	0	3.0	0.8	7
Superpave FAA 45	TON	0	0	6.4	2.1	16.9
Asphalt Cement	TON	0	0	0.4	0.1	0.9

Approach Paving Details
Guardrail Replacement
3" Overlay and Incidentals
East Valley City Interchange
Barnes County

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	S-NHU-2-094(123)931	30	1



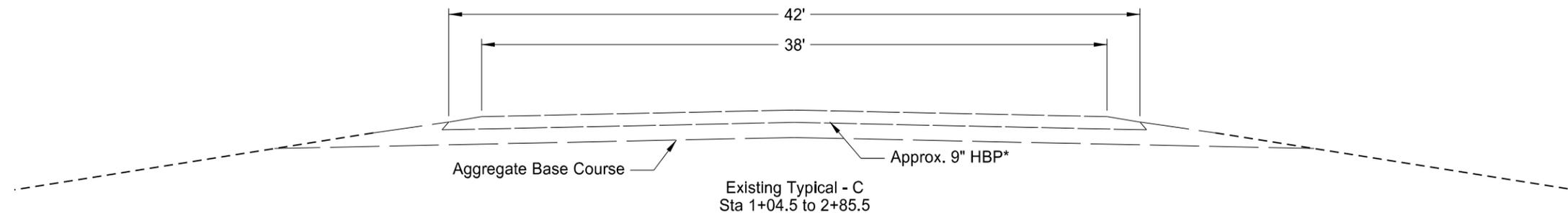
* Superlevation is the same as tangent sections.



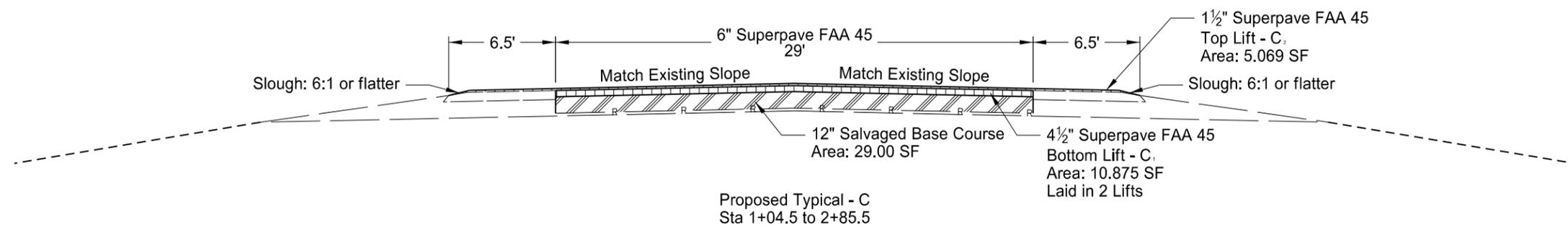
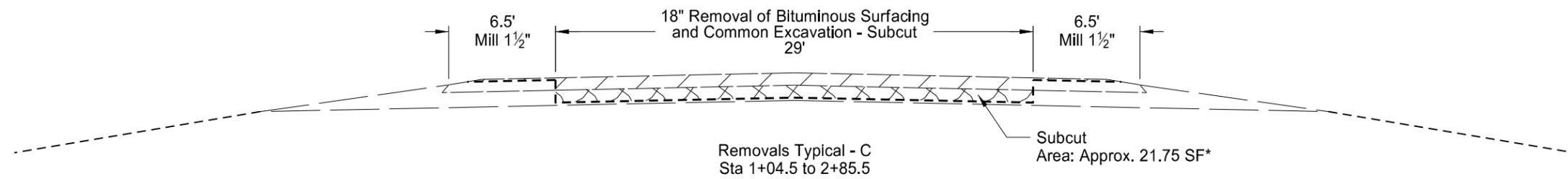
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Typical Sections
Guardrail Replacement,
3" Overlay and Incidentals
East Valley City Limits to I-94
Barnes County

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	S-NHU-2-094(123)931	30	2



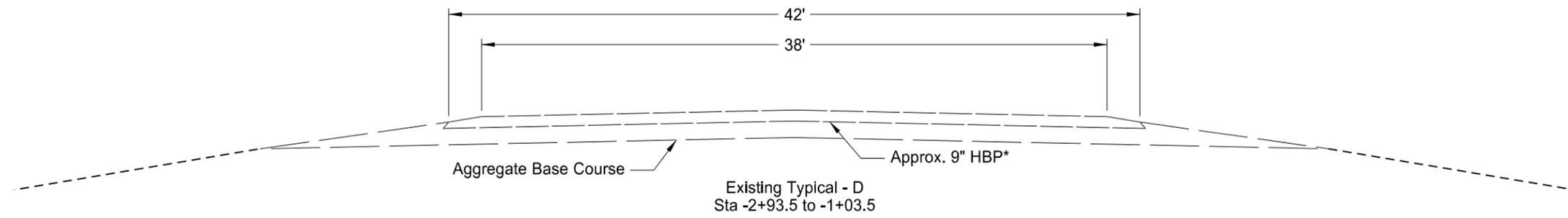
* HBP depth varies due to maintenance patching.



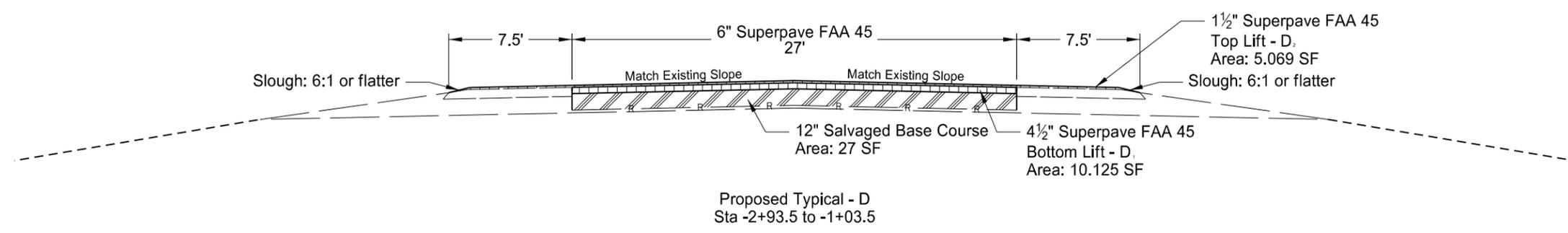
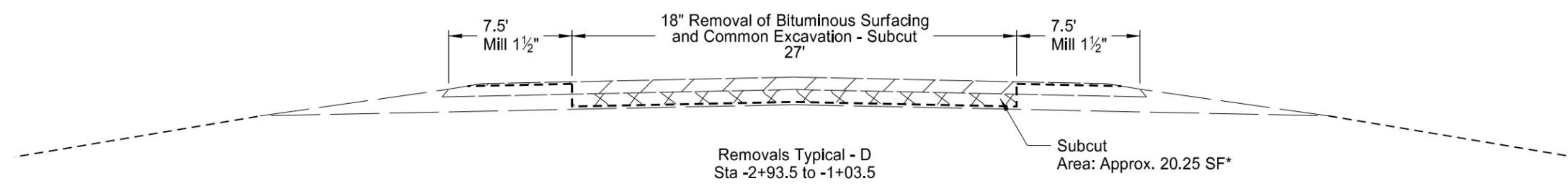
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Subcut Typical Sections
 North of Bridge
 Guardrail Replacement
 3" Overlay and Incidentals
 East Valley City Interchange
 Barnes County

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	S-NHU-2-094(123)931	30	3



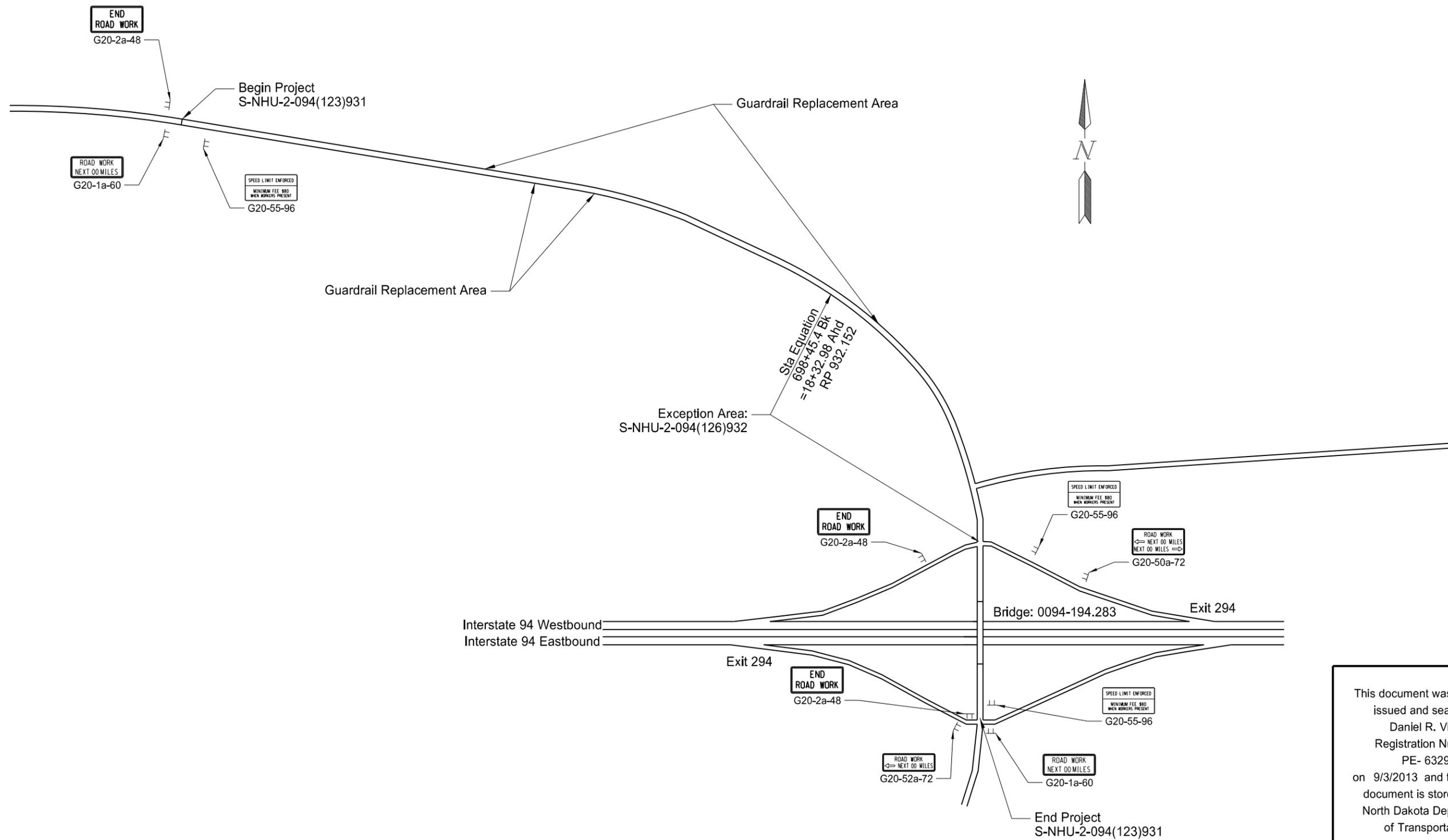
* Pavement depth varies due to maintenance patching.



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Subcut Typical Sections
 South of Bridge
 Guardrail Replacement
 3" Overlay and Incidentals
 East Valley City Interchange
 Barnes County

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	S-NHU-2-094(123)931	100	2



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Construction Sign Layout
Guardrail Replacement,
3" Overlay and Incidentals
East Valley City Limits to I-94
Barnes County

NDDOT ABBREVIATIONS

Abn	abandoned	BV	butterfly valve	Co	County	EL	electric locker
Abut	abutment	Byp	bypass	Crse	course	E Mtr	electric meter
Ac	acres	C Gdrl	cable guardrail	C Gr	course gravel	Elec	electric/al
Adj	adjusted	Calc	calculate	CS	course sand	EDM	electronic distance meter
Aggr	aggregate	Cd	candela	Ct	Court	Elev or El	elevation
Ahd	ahead	CIP	cast iron pipe	Xarm	cross arm	Ellipt	elliptical
ARV	air release valve	CB	catch basin	Xbuck	cross buck	Emb	embankment
Align	alignment	CRS	cationic rapid setting	Xsec	cross sections	Emuls	emulsion/emulsified
Al	alley	C Gd	cattle guard	Xing	crossing	ES	end section
Alt	alternate	C To C	center to center	Xrd	Crossroad	Engr	engineer
Alum	aluminum	Cl or C	centerline	Crn	crown	ESS	Environmental Sensor Station
A	ampere	Cm	centimeter	CF	cubic feet	Eq	equal
&	and	Ch	chain	M3	cubic meter	Eq	equation
Appr	approach	Chnlk	chain-link	M3/s	cubic meters per second	Evgr	evergreen
Approx	approximate	Ch Blk	channel block	CY	cubic yard	Exc	excavation
ACP	asbestos cement pipe	Ch Ch	channel change	Cy/mi	cubic yards per mile	Exst	existing
Asph	asphalt	Chk	check	Culv	culvert	Exp	expansion
AC	asphalt cement	Chsld	chiseled	C&G	curb & gutter	Expy	Expressway
Assmd	assumed	Cir	circle	CI	curb inlet	E	external of curve
@	at	Cl	class	CR	curb ramp	Extru	extruded
Atten	attenuation	Cl	clay	CS	curve to spiral	FOS	factor of safety
ATR	Automatic Traffic Recorder	Cl F	clay fill	C	cut	F	Fahrenheit
Ave	Avenue	Cl Hvy	clay heavy	Dd Ld	dead load	FS	far side
Avg	average	Cl Lm	clay loam	Defl	deflection	F	farad
ADT	average daily traffic	Clnt	clean-out	Defm	deformed	Fed	Federal
Az	azimuth	Clr	clear	Deg or D	degree	FHWA	Federal Highway Administration
Bk	back	Cl&gr	clearing & grubbing	DInt	delineate	FP	feed point
BF	back face	Co S	coal slack	DIntr	delineator	Ft	feet/foot
Bs	backsight	Comb.	combination	Depr	depression	Fn	fence
Balc	balcony	Coml	commercial	Desc	description	Fn P	fence post
B Wire	barbed wire	Compr	compression	Det	detail	FO	fiber optic
Barr	barricade	CADD	computer aided drafting & design	DWp	detectable warning panel	FB	field book
Btry	battery	Conc	concrete	Dtr	detour	FD	field drive
Brg	bearing	Cond	conductor	Dia	diameter	F	fill
BI	beehive inlet	Const	construction	Dir	direction	FAA	fine aggregate angularity
Beg	begin	Cont	continuous	Dist	distance	FS	fine sand
BM	bench mark	CSB	continuous split barrel sample	DM	disturbed material	FH	fire hydrant
Bkwy	bikeway	Contr	contraction	DB	ditch block	FI	flange
Bit	bituminous	Contr	contractor	DG	ditch grade	Flrd	flared
Blk	block	CP	control point	Dbl	double	FES	flared end section
Bd Ft	board feet	Coord	coordinate	Dn	down		
BH	bore hole	Cor	corner	Dwg	drawing		
BS	both sides	Corr	corrected	Dr	drive		
Bot	bottom	CAES	corrugated aluminum end section	Drwy	driveway		
Bldv	Boulevard	CAP	corrugated aluminum pipe	DI	drop inlet		
Bndry	boundary	CMES	corrugated metal end section	D	dry density		
BC	brass cap	CMP	corrugated metal pipe	Ea	each		
Brkwy	breakaway	CPVCP	corrugated poly-vinyl chloride pipe	Esmt	easement		
Br	bridge	CSES	corrugated steel end section	E	East		
Bldg	building	CSP	corrugated steel pipe	EB	Eastbound		
BLM	Bureau of Land Management	C	coulomb	Elast	elastomeric		

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
06-15-10	
REVISIONS	
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04-20-11 03-15-13	Added Items Added Items

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NDDOT ABBREVIATIONS

D-20-2

F Bcn	flashing beacon	Hor	horizontal	Long.	longitude	NB	Northbound
FA	flight auger sample	HBP	hot bituminous pavement	Lp	loop	No. or #	number
FL	flow line	Hr	hour(s)	LD	loop detector	Obsc	obscure(d)
Ftg	footing	Hyd	hydrant	Lm	lumen	Obsn	observation
FM	force main	Ph	hydrogen ion content	Lum	luminaire	Ocpd	occupied
Fs	foresight	Id	identification	L Sum	lump sum	Ocpy	occupy
Fnd	found	In or "	inch	Lx	lux	Off Loc	office location
Fdn	foundation	Incl	inclinometer tube	ML	main line	O/s	offset
Frac	fractional	IMH	inlet manhole	M Hr	man hour	OC	on center
Frwy	freeway	ID	inside diameter	MH	manhole	C	one dimensional consolidation
Frt	front	Inst	instrument	Mkd	marked	OC	organic content
FF	front face	Intchg	interchange	Mkr	marker	Orig	original
F Disp	fuel dispenser	Intmdt	intermediate	Mkg	marking	O To O	out to out
FFP	fuel filler pipes	Intscn	intersection	MA	mast arm	OD	outside diameter
FLS	fuel leak sensor	Inv	invert	Matl	material	OH	overhead
Furn	furnish/ed	IM	iron monument	Max	maximum	PMT	pad mounted transformer
Gal	gallon	I Pn	Iron Pin	MC	meander corner	Pg	pages
Galv	galvanized	IP	iron Pipe	Meas	measure	Pntd	painted
Gar	garage	Jt	joint	Mdn	median	Pr	pair
Gs L	gas line	J	joule	MD	median drain	Pnl	panel
G Reg	gas line regulator	Jct	junction	MC	medium curing	Pk	park
GMV	gas main valve	K	kelvin	M	mega	PK	Parker-Kalon nail
G Mtr	gas meter	Kn	kilo newton	Mer	meridian	Pa	pascal
GSV	gas service valve	Kpa	kilo pascal	M	meter	PSD	passing sight distance
GVP	gas vent pipe	Kg	kilogram	M/s	meters per second	Pvmt	pavement
GV	gate valve	Kg/m3	kilogram per cubic meter	M	mid ordinate of curve	Ped	pedestal
Ga	gauge	Km	kilometer	Mi	mile	Ped	pedestrian
Geod	geodetic	K	Kip(s)	MM	mile marker	PPP	pedestrian pushbutton post
GIS	Geographical Information System	LS	Land Surveyor (licensed)	MP	mile post	Pen.	penetration
G	giga	LSIT	Land Surveyor In Training	MI	milliliter	Perf	perforated
GPS	Global Positioning System	Ln	lane	Mm	millimeter	Per.	perimeter
Gov	government	Lg	large	Mm/hr	millimeters per hour	PL	pipeline
Grd	graded/grade	Lat	latitude	Min	minimum	PI	place
Gr	gravel	Lt	left	Misc	miscellaneous	P&P	plan & profile
Grnd	ground	L	length of curve	Mon	monument	PL	plastic limit
GWM	ground water monitor	Lens	lenses	Mnd	mound	PI	plate
Gdrl	guardrail	Lvl	level	Mtbl	mountable	Pt	point
Gtr	gutter	LB	level book	Mtd	mounted	PCC	point of compound curve
H Plg	H piling	LvIng	leveling	Mtg	mounting	PC	point of curve
Hdwl	headwall	Lht	light	Mk	muck	PI	point of intersection
Ha	hectare	LP	light pole	Mun	municipal	PRC	point of reverse curvature
Ht	height	Ltg	lighting	N	nano		
HI	height of instrument	Lig Co	lignite coal	NGS	National Geodetic Survey		
Hel	helical	Lig SI	lignite slack	NS	near side		
H	henry	LF	linear foot	Neop	neoprene		
H _z	hertz	Liq	liquid	Ntwk	network		
HDPE	High Density Polyethylene	LL	liquid limit	N	newton		
HM	high mast	L	litre	N	North		
HP	high pressure	Lm	loam	NDDOT	North Dakota Department of Transportation		
HPS	high pressure sodium	Loc	location	NE	North East		
Hwy	highway	LC	long chord	NW	North West		

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06-15-10	
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NDDOT ABBREVIATIONS

PT	point of tangent	Rdbd	road bed	M2	square meter	TP	traverse point
POC	point on curve	Rdwy	roadway	SY	square yard	Trtd	treated
POT	point on tangent	RWIS	Roadway Weather Information System	Stk	stake	Trmt	treatment
PE	polyethylene	Rk	rock	Std	standard	Qc	triaxial compression
PVC	polyvinyl chloride	Rt	route	N	standard penetration test	TERO	Tribal Employment Rights Ordinance
PCC	Portland Cement concrete	Salv	salvage(d)	Std Specs	Standard Specifications	Tpl	triple
Lb or #	pounds	Sd	sand	Sta	station	TP	turning point
PP	power pole	Sdy Cl	sandy clay	Sta Yd	station yards	Typ	typical
Preempt	preemption	Sdy Cl Lm	sandy clay loam	Stm L	steam line	Qu	unconfined compressive strength
Prefab	prefabricated	Sdy Fl	sandy fill	SEC	steel encased concrete	Ugrnd	underground
Prfmd	performed	Sdy Lm	sandy loam	SSD	stopping sight distance	USC&G	US Coast & Geodetic Survey
Prep	preparation	San	sanitary sewer line	SD	storm drain	USGS	US Geologic Survey
Press.	pressure	Sc	scoria	St	street	Util	utility
PRV	pressure relief valve	Sec	seconds	SPP	structural plate pipe	VG	valley gutter
Prestr	prestressed	Sec	section	SPPA	structural plate pipe arch	Vap	vapor
Pvt	private	SL	section line	Str	structure	Vert	vertical
PD	private drive	Sep	separation	Subd	subdivision	VC	vertical curve
Prod.	production/produce	Seq	sequence	Sub	subgrade	VCP	vitrified clay pipe
Prog	programmed	Serv	service	Sub Prep	subgrade preparation	V	volt
Prop.	property	Sh	shale	Ss	subsoil	Vol	volume
Prop Ln	property line	Sht	sheet	SE	superelevation	Wkwy	walkway
Ppsd	proposed	Shtng	sheeting	SS	supplement specification	W	water content
PB	pull box	Shldr	shoulder	Supp	supplemental	WGV	water gate valve
Qty	quantity	Sw	sidewalk	Surf	surfacing	WL	water line
Qtr	quarter	S	siemens	Surv	survey	WM	water main
Rad or R	radius	SD	sight distance	Sym	symmetrical	WMV	water main valve
RR	railroad	Sig	signal	SI	Systems International	W Mtr	water meter
Rlwy	railway	Si Cl	silt clay	Tan	tangent	WSV	water service valve
Rsd	raised	Si Cl Lm	silty clay loam	T	tangent (semi)	WW	water well
RTP	random traverse point	Si Lm	silty loam	TS	tangent to spiral	W	watt
Rge or R	range	Sgl	single	Tel	telephone	Wrng	wearing
RC	rapid curing	SC	slow curing	Tel B	Telephone Booth	Wb	weber
Rec	record	SS	slow setting	Tel P	telephone pole	WIM	weigh in motion
Rcy	recycle	Sm	small	Tv	television	W	West
RPCC	recycled Portland cement concrete	S	South	Temp	temperature	WB	Westbound
Ref	reference	SE	South East	Temp	temporary	Wrng	wiring
R Mkr	reference marker	SW	South West	TBM	temporary bench mark	W/	with
RM	reference monument	SB	Southbound	T	tesla	W/o	without
Refl	reflectorized	Sp	spaces	T	thinwall tube sample	WC	witness corner
RCB	reinforced concrete box	Spcl	special	T/mi	tons per mile	WGS	World Geodetic System
RCES	reinforced concrete end section	SP	special provisions	Ts	topsoil	Z	zenith
RCP	reinforced concrete pipe	G	specific gravity	Twp or T	township		
RCPS	reinforced concrete pipe sewer	Spk	spike	Traf	traffic		
Reinf	reinforcement	SC	spiral to curve	TSCB	traffic signal control box		
Res	reservation	ST	spiral to tangent	Tr	trail		
Ret	retaining	SB	split barrel sample	Transf	transformer		
Rev	reverse	SH	sprinkler head	TB	transit book		
Rt	right	SV	sprinkler valve	Trans	transition		
R/W	right of way	Sq	square	TT	transmission tower		
Riv	river	SF	square feet	Trans	transverse		
Rd	road	Km2	square kilometer	Trav	traverse		

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
06-15-10	
REVISIONS	
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NDDOT UTILITY COMPANY ABBREVIATIONS

702COM 702 Communications
 ACCENT Accent Communications
 AGASSIZ WU Agassiz Water Users Incorporated
 All PI Alliance Pipeline
 ALL SEAS WU All Seasons Water Users Association
 AMOCO PI Amoco Pipeline Company
 AMRDA HESS Amerada Hess Corporation
 AT&T AT&T Corporation
 B PAW Bear Paw Energy Incorporated
 BASIN ELEC Basin Electric Cooperative Incorporated
 BEK TEL Bek Communications Cooperative
 BELLE PL Belle Fourche Pipeline Company
 BNSF Burlington Northern Santa Fe Railway
 BOEING Boeing
 BRNS RWD Barnes Rural Water District
 BURK-DIV ELEC Burke-Divide Electric Cooperative
 BURL WU Burleigh Water Users
 Cable One Cable One
 CABLE SERV Cable Services
 CAP ELEC Capital Electric Cooperative Incorporated
 CASS CO ELEC Cass County Electric Cooperative
 CASS RWU Cass Rural Water Users Incorporated
 CAV ELEC Cavalier Rural Electric Cooperative
 CBLCOM Cablecom Of Fargo
 CENEX PL Cenex Pipeline
 CENT PWR ELEC Central Power Electric Cooperative
 CONS TEL Consolidated Telephone
 CONT RES Continental Resource Inc
 CPR Canadian Pacific Railway
 D O E Department Of Energy
 DAK CARR Dakota Carrier Network
 DAK CENT TEL Dakota Central Telephone
 DAK RWD Dakota Rural Water District
 DGC Dakota Gasification Company
 DICKEY R NET Dickey Rural Networks
 DICKEY RWU Dickey Rural Water Users Association
 DICKEY TEL Dickey Telephone
 DNRR Dakota Northern Railroad
 DOME PL Dome Pipeline Company
 DVELEC Dakota Valley Electric Cooperative
 DVMW Dakota, Missouri Valley & Western
 ENBRDG Enbridge Pipelines Incorporated
 FALK MNG Falkirk Mining Company
 G FKS-TRL WD Grand Forks-trail Water District
 GETTY TRD & TRAN Getty Trading & Transportation
 GLDN W ELEC Golden West Electric Cooperative
 GRGS CO TEL Griggs County Telephone
 GT PLNS NAT GAS Great Plains Natural Gas Company
 HALS TEL Halstad Telephone Company
 INT-COMM TEL Inter-Community Telephone Company
 KANEB PL Kaneb Pipeline Company

KEM ELEC Kem Electric Cooperative Incorporated
 KOCH GATH SYS Koch Gathering Systems Incorporated
 LKHD PL Lakehead Pipeline Company
 LNGDN RWU Langdon Rural Water Users Incorporated
 LWR YELL R ELEC Lower Yellowstone Rural Electric
 MCKNZ CON McKenzie Consolidated Telcom
 MCKNZ WRD McKenzie County Water Resource District
 MCKNZ ELEC McKenzie Electric Cooperative
 MCLEOD Mcleod USA
 MCLN ELEC Mclean Electric Cooperative
 MCLN-SHRDN R WAT Mclean-Sheridan Rural Water
 MDU Montana-dakota Utilities
 MID-CONT CABLE Mid-Continent Cable
 MIDSTATE TEL Midstate Telephone Company
 MINOT CABLE Minot Cable Television
 MINOT TEL Minot Telephone Company
 MISS W W S Missouri West Water System
 MNKOTA PWR Minnkota Power
 MRE LBTY TEL Moore & Liberty Telephone
 MOR-GRAN-SOU ELEC Mor-gran-sou Electric Cooperative
 MOUNT-WILLI ELEC Mountrail-williams Electric Cooperative
 MUNICIPAL City Of '.....'
 MUNICIPAL City Water And Sewer
 N CENT ELEC North Central Electric Cooperative
 N VALL W DIST North Valley Water District
 ND PKS & REC North Dakota Parks And Recreation
 ND TEL North Dakota Telephone Company
 NDDOT North Dakota Department of Transportation
 NDSU SOIL SCI DEPT Ndsu Soil Science Department
 NEMONT TEL Nemont Telephone
 NODAK R ELEC Nodak Rural Electric Cooperative
 NOON FRMS TEL Noonan Farmers Telephone Company
 NPR Northern Plains Railroad
 NSP Northern States Power
 NTH PRAIR RW Northern Prairie Rural Water Association
 NTHN BRDR PL Northern Border Pipeline
 NTHN PLNS ELEC Northern Plains Electric Cooperative Incorporated
 NTHWSTRN REF Northwestern Refinery Company
 NW COMM Northwest Communication Cooperation
 OTTR TL PWR Otter Tail Power Company
 P L E M Prairielands Energy Marketing
 POLAR COM Polar Communications
 QWEST Qwest Communications
 R&T W SUPPLY R & T Water Supply Association
 RAMSEY R SEW Ramsey Rural Sewer Association
 RAMSEY RW Ramsey Rural Water Association
 RAMSEY UTIL Ramsey County Rural Utilities
 RED RIV TEL Red River Rural Telephone
 RESVTN TEL Reservation Telephone
 ROBRTS TEL Roberts Company Telephone
 R-RIDER ELEC Roughrider Electric Coop

RRVW Red River Valley & Western Railroad
 RSR ELEC R.S.R. Electric Cooperative
 S E W U South East Water Users Incorporated
 SCOTT CABLE Scott Cable Television Dickinson
 SHERDN ELEC Sheridan Electric Cooperative
 SHEYN VLY ELEC Sheyenne Valley Electric Cooperative
 SKYTECH Skyland Technologies Incorporated
 SLOPE ELEC Slope Electric Cooperative
 SLOPE ELEC Slope Electric Cooperative Incorporated
 SOURIS RIV TELCOM Souris River Telecommunications
 ST WAT COMM State Water Commission
 STATE LN WATER State Line Water Cooperative
 STUT RWU Stutsman Rural Water Users
 T M C Turtle Mountain Communications
 TCI TCI of North Dakota
 TRI-CNTY WU Tri-County Water Users Incorporated
 TRL CO RWU Traill County Rural Water Users
 UNTD TEL United Telephone
 UPPR SOUR WUA Upper Souris Water Users Association
 US SPRINT U.S. Sprint
 USAF MSL CABLE U.S.A.F. Missile Cable
 USW COMM U.S. West Communications
 VRNDRY ELEC Verendrye Electric Cooperative
 W RIV TEL West River Telephone Incorporated
 WEB W. E. B. Water Development Association
 WILLI RWA Williams Rural Water Association
 WILSTN BAS PL Williston Basin Interstate Pipeline Company
 WLSH RWD Walsh Water Rural Water District
 WOLVRTN TEL Wolverton Telephone
 XLENER Xcel Energy
 YSVR Yellowstone Valley Railroad

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
6-15-10	
REVISIONS	
DATE	CHANGE
04-20-11 03-15-13	Added Items Added Items

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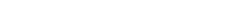
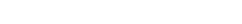
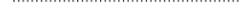
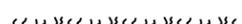
Line Styles

.....	Limits of Const Transition Line	—— s —— s ——	Floating Silt Curtain	—— ——— ———	Existing Aggregate (Cross Section View)	- - - - -	Existing Centerline
.....	Bale Check	—— ——— T ——	Existing Telephone Line	—— ——— ———	Existing Curb and Gutter (Cross Section View)	- - - - -	Supplemental Contour
.....	Rock Check	—— ——— TV ——	Existing TV Line	—— ——— ———	Existing Riprap	—— - - - - -	Right of Way
.....	Sight Distance Triangle Line	Void — void — void — v	Existing Assumed Ground (Not Surveyed)	—— ——— ———	Existing Underground Vault or Lift Station	—— - - - - -	Existing Right of Way
- - - - -	Small Hidden Object	Void — void — void — v	Tentative Ground Line	—— ——— ———	Tangent Line	—— - - - - -	Existing Right of Way Railroad
- - - - -	Dimension Leader	—— ——— w ——	Existing Water or Steam Line	- - - - -	Hidden Object	- - - - -	Failure Line
- - - - -	Existing Ground	=====	Existing Under Drain	—— ——— ———	Existing Dirt Surface	- - - - -	Existing Conditions
- - - - -	Existing Topsoil (Cross Section View)	=====	Under Drain	—— ——— ———	Existing Conduit	- - - - -	Existing Ground (Details)
—— ——— ———	Large Hidden Object	=====	Wall	—— ——— ———	Topsoil Profile	—— - - - - -	Existing Sixteenth Section Line
—— ——— ———	Edge Drain	=====	Existing Slotted Drain	- - - - -	Existing Conductor	- - - - -	Existing Right of Way Not State Owned
—— D —— D ——	Geotextile Fabric Type D	—— + —— + ——	Existing Cemetary Boundary	- - - - -	Conductor	- - - - -	Phantom Object
—— ——— E ——	Existing Electrical	—— ——— ———	Centerline Pavement Marking	- - - - -	Fiber Optic	- - - - -	Centerline Main
—— ——— FO ——	Existing Fiber Optic Line	=====	Barrier with Centerline Pavement Marking	- - - - -	Existing Loop Detector	-	Existing Guardrail Cable
—— ——— FO ——	Existing TV Fiber Optic	=====	Barrier Pavement Marking	- - - - -	Subgrade, Subcut or Ditch Grade	— . — . — . — .	Existing Guardrail Metal
—— ——— G ——	Existing Gas Pipe	- - - - -	Stripe 4 IN Dotted Extension White	—— ——— ———	Existing Asphalt Surface	—— . ——— . ——— .	Existing Edge of Water
—— Geo —— Geo ——	Geogrid	- - - - -	Stripe 8 IN Dotted Extension White	—— ——— ———	Existing Asphalt (Cross Section View)	- - - - -	Excavation Limits
—— ——— OH ——	Existing Overhead Utility Line	- - - - -	Stripe 8 IN Lane Drop	—— ——— ———	Existing Reinforcement Rebar	—— ———	Existing Government Lot Line
—— ——— P ——	Existing Power	—— v v v v ——	Wetland Mitigation	—— ——— ———	Existing Tie Point Line	.....	Existing Adjacent Block Lines
—— ——— PL ——	Existing Fuel Pipeline	- - - - -	Existing Box Culvert Bridge	—— ——— ———	Existing State or International Line	.....	Existing Adjacent Lot Lines
—— ——— PL ——	Existing Undefined Above Ground Pipe Line	- - - - -	Existing Concrete Surface	—— ——— ———	Existing Quarter Section Line	.....	Existing Adjacent Property Line
—— ——— R —— R ——	Geotextile Fabric Type R	- - - - -	Existing Drainage Structure	—— ——— ———	Existing County	.....	Existing Adjacent Subdivision Lines
—— ——— R —— R ——	Geotextile Fabric Type R1	- - - - -	Easement	—— ——— ———	Existing Section Line	.....
—— REMOVE —— REMOVE ——	Remove Line	- - - - -	Existing Concrete	—— ——— ———	Existing Township	.....
—— RR —— RR ——	Geotextile Fabric Type RR	- - - - -	Existing Easement	—— ——— ———	Existing Railroad Centerline	
—— ——— S —— S ——	Geotextile Fabric Type S	—— ——— ———	Existing Gravel Surface	—— ——— ———	Centerline	

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Line Styles

	Subgrade Reinforcement		Existing Railroad Switch		Sheet Piling
	Existing Down Guy Wire Down Guy		Overhead Sign Structure Cantilever		W-Beam w Posts
	Existing Fence		24 Inch Pipe		Existing W-Beam Guardrail with Posts
	Existing Railroad		Reinforced Concrete Pipe		Exst Wet Area-Vegetation Break
	Existing Sanitary Sewer		Signal Head with Mast Arm		Existing Wetland Delineated
	Existing Sanitary Force Main		Existing Signal Head with Mast Arm		
	Existing Storm Drain		Tie Bar at Random Spacing		
	Existing Storm Drain Force Main		3-Cable w Posts		
	Fence		Existing 3-Cable w Posts		
	Silt Fence		Site Boundary		
	Existing Field Line		Fiber Rolls		
	Exst Flow		Doweled Joint		
	Flow		Tie Bar 30 Inch 4 Foot Center to Center		
	Existing Culvert		Tie Bar 18 Inch 3 Foot Center to Center		
	Existing Curb		Existing Berm, Dike, Pit, or Earth Dam		
	Existing Valley Gutter		Existing Ditch Block		
	Existing Driveway Gutter		Depression Contours		
	Existing Curb and Gutter		Existing City Corporate Limits or Reservation Boundary		
	Existing Mountable Curb and Gutter		Gravel Pit - Borrow Area		
	Existing Double Micro Loop Detector		Existing Tree Boundary		
	Micro Loop Detector Double		Tree Row		
	Existing Overhead Sign Structure		Existing Brush or Shrub Boundary		
	Existing Micro Loop Detector		Existing Retaining Wall		
	Micro Loop Detector		Existing Planter or Wall		
	Existing Overhead Sign Structure Cantilever		Retaining Wall (Plan View)		

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Symbols

	North Arrow (Half Scale)		Attenuation Device		Existing Railroad Battery Box		Existing Delineator Type E
	Truck Mounted Attenuator		Diamond Grade Delineator Type A		Existing Bush or Shrub		Existing EFB Misc
	Type I Barricade		Diamond Grade Delineator Type B		Existing Gas Cap or Stub		Existing Flashing Beacon
	Type II Barricade		Diamond Grade Delineator Type C		Existing Sanitary Cap or Stub		Existing Pipe Mounted Flasher
	Type III Barricade		Diamond Grade Delineator Type D		Existing Storm Drain Cap or Stub		Existing Pad Mounted Feed Point
	Catch Basin		Diamond Grade Delineator Type E		Existing Water Cap or Stub		Existing Pipe Mounted Feed Point with Pad
	Cairn or Stone Circle		Flexible Delineator		Existing Sanitary Cleanout		Existing Pole Mounted Feed Point
	Video Detection Camera		Flexible Delineator Type A		Existing Concrete Foundation		Existing Railroad Frog
	Storm Drain Cap or Stub		Flexible Delineator Type B		Existing Traffic Signal Controller		Existing Snow Gate 18
	Corrugated Metal End Section 18 Inch		Flexible Delineator Type C		Existing Pad Mounted Signal Controller		Existing Snow Gate 28
	Corrugated Metal End Section 24 Inch		Flexible Delineator Type D		Existing Sixteenth Section Corner		Existing Snow Gate 40
	Corrugated Metal End Section 30 Inch		Flexible Delineator Type E		Existing Quarter Section Corner		Existing Headwall
	Corrugated Metal End Section 36 Inch		Delineator Type A		Existing Section Corner		Existing Pedestrian Head with Number
	Corrugated Metal End Section 42 Inch		Delineator Type A Reset		Existing Railroad Crossbuck		Existing Signal Head
	Corrugated Metal End Section 48 Inch		Delineator Type B		Existing Satellite Dish		Existing Sprinkler Head
	Concrete Foundation		Delineator Type B Reset		Existing Fuel Dispensers		Existing Fire Hydrant
	Ground Connection Conductor		Delineator Type C		Existing Flexible Delineator Type A		Existing Catch Basin Drop Inlet
	Neutral Connection Conductor		Delineator Type D		Existing Flexible Delineator Type B		Existing Curb Inlet
	Phase 1 Connection Conductor		Delineator Type E		Existing Flexible Delineator Type C		Existing Manhole Inlet
	Phase 2 Connection Conductor		Delineator Drums		Existing Flexible Delineator Type D		Existing Junction Box
	Traffic Cone		Spot Elevation		Existing Flexible Delineator Type E		
	Signal Controller		Existing Access Control Arrow		Existing Delineator Type A		
	Pad Mounted Signal Controller		Existing Artifact		Existing Delineator Type B		
	Alignment Data Point		Existing Flashing Beacon		Existing Delineator Type C		
	Emergency Vehicle Detector		Existing Benchmark		Existing Delineator Type D		

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Symbols

	Existing Light Standard		Existing Manhole with Valve Water		Existing Telephone Pole		Existing Undefined Manhole
	Existing High Mast Light Standard 10 Luminaire		Existing Water Manhole		Existing Wood Pole		Existing Undefined Pull Box
	Existing High Mast Light Standard 3 Luminaire		Existing Mile Post Type A		Existing Post		Existing Undefined Pedestal
	Existing High Mast Light Standard 4 Luminaire		Existing Mile Post Type B		Existing Pedestrian Push Button Post		Existing Undefined Valve
	Existing High Mast Light Standard 5 Luminaire		Existing Mile Post Type C		Existing Control Point CP		Existing Undefined Pipe Vent
	Existing High Mast Light Standard 6 Luminaire		Existing Reference Marker		Existing Control Point GPS-RTK		Existing Gas Valve
	Existing High Mast Light Standard 7 Luminaire		Existing RW Marker		Existing Control Point TRI		Existing Water Valve
	Existing High Mast Light Standard 8 Luminaire		Existing Utility Marker		Existing Reference Marker Point NGS		Existing Fuel Pipe Vent
	Existing High Mast Light Standard 9 Luminaire		Existing Monument Found		Existing Pull Box		Existing Gas Pipe Vent
	Existing Overhead Sign Structure Load Center		Existing Monument set		Existing Intelligent Transportation Pull Box		Existing Sanitary Pipe Vent
	Existing Luminaire		Existing RW Property Monument Found		Existing Water Pump		Existing Storm Drain Pipe Vent
	Existing Light Standard Luminaire		Existing RW Property Monument set		Existing Slotted Reinforced Concrete Pipe		Existing Water Pipe Vent
	Existing Federal Mailbox		Existing Object Marker Type I		Existing RR Profile Spot		Existing Weather Station
	Existing Private Mailbox		Existing Object Marker Type II		Existing Fuel Leak Sensors		Existing Ground Water Well Bore Hole
	Existing Meander Section Corner		Existing Object Marker Type III		Existing Highway Sign		Existing Windmill or Tower
	Existing Meter		Existing Electrical Pedestal		Existing Miscellaneous Spot		Existing Witness Corner
	Existing Electrical Manhole		Existing Telephone Pedestal		Existing Lighting Standard Pole		Flashing Beacon
	Existing Gas Manhole		Existing Fiber Optic Telephone Pedestal		Existing Traffic Signal Standard		Flagger
	Existing Sanitary Manhole		Existing TV Pedestal		Existing Transformer		Pipe Mounted Flasher
	Existing Sanitary Force Main Manhole		Existing Fiber Optic TV Pedestal		Existing Large Evergreen Tree		Sanitary Force Main with Valve
	Existing Sanitary Manhole with Valve		Existing Fuel Filler Pipes		Existing Small Evergreen Tree		
	Existing Storm Drain Manhole		Existing Traverse PI Aerial Panel		Existing Large Tree		
	Existing Force Main Storm Drain Manhole		Existing Pole		Existing Small Tree		
	Existing Force Main Storm Drain Manhole with Valve		Existing Power Pole		Existing Tree Trunk		
	Existing Telephone Manhole		Existing Power Pole with Transformer		Existing Pad Mounted Traffic Signal Control Box		

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Symbols

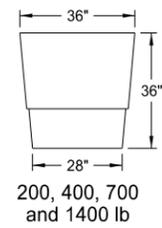
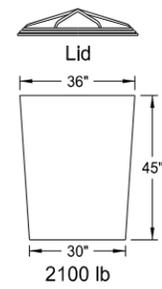
D-20-32

 Pad Mounted Feed Point  Pipe Mounted Feed Point with Pad  Pole Mounted Feed Point  Headwall  Double Headwall with Vegetation Barrier  Single Headwall with Vegetation Barrier  Pole Mounted Head  Sprinkler Head  Fire Hydrant  Inlet Type 1  Inlet Type 2  Double Inlet Type 2  Inlet Grate Type 2  Junction Box  High Mast Light Standard 10 Luminaire  High Mast Light Standard 3 Luminaire  High Mast Light Standard 4 Luminaire  High Mast Light Standard 5 Luminaire  High Mast Light Standard 6 Luminaire  High Mast Light Standard 7 Luminaire  High Mast Light Standard 8 Luminaire  High Mast Light Standard 9 Luminaire  Relocate Light Standard  Overhead Sign Structure Load Center  Light Standard 100 Watt High Pressure Sodium Vapor Luminaire	 Light Standard 1000 Watt High Pressure Sodium Vapor Luminaire  Light Standard 150 Watt High Pressure Sodium Vapor Luminaire  Light Standard 175 Watt High Pressure Sodium Vapor Luminaire  Light Standard 200 Watt High Pressure Sodium Vapor Luminaire  Light Standard 250 Watt High Pressure Sodium Vapor Luminaire  Light Standard 310 Watt High Pressure Sodium Vapor Luminaire  Light Standard 35 Watt High Pressure Sodium Vapor Luminaire  Light Standard 400 Watt High Pressure Sodium Vapor Luminaire  Light Standard 50 Watt High Pressure Sodium Vapor Luminaire  Light Standard 70 Watt High Pressure Sodium Vapor Luminaire  Light Standard 700 Watt High Pressure Sodium Vapor Luminaire  Manhole  Manhole 48 Inch  Sanitary Force Main Manhole  Sanitary Sewer Manhole  Storm Drain Manhole  Storm Drain Manhole with Inlet  Reset Mile Post  Mile Post Type A  Mile Post Type B  Mile Post Type C  Right of Way Marker  Tubular Marker  Concrete Monument to Be Set  RW Property Monument to Be Set	 Object Marker Type I  Object Marker Type II  Object Marker Type III  Caution Mode Arrow Panel  Back to Back Vertical Panel Sign  Double Direction Arrow Panel  Left Directional Arrow Panel  Right Directional Arrow Panel  Sequencing Arrow Panel  Truck Mounted Arrow Panel  Power Pole  Wood Pole  Pedestrian Push Button Post  Property Corner  Pull Box  Intelligent Transportation Pull Box  Sanitary Pump  Storm Drain Pump  Reinforced Pavement  Reinforced Concrete End Section 15 Inch  Reinforced Concrete End Section 18 Inch  Reinforced Concrete End Section 24 Inch  Reinforced Concrete End Section 30 Inch  Reinforced Concrete End Section 36 Inch  Reinforced Concrete End Section 42 Inch	 Reinforced Concrete End Section 48 Inch  Reinforced Concrete End Section 54 Inch  Reset Right of Way Marker  Reset USGS Marker  Right of Way Markers  Riser 30 Inch  Continuous Split Barrel Sample  Flight Auger Sample  Split Barrel Sample  Thinwall Tube Sample  Highway Sign  SNOW GATE 18 FT  SNOW GATE 28 FT  SNOW GATE 40 FT  Standard Penetration Test  Transformer  Inclinometer Tube  Underdrain Cleanout  Excavation Unit  Water Valve
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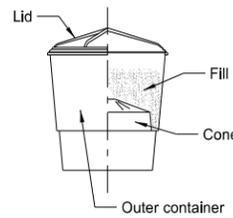
ATTENUATION DEVICE



Outer Containers

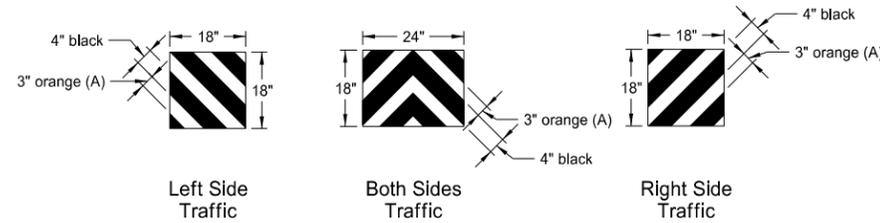


Cones



Typical Assembly

Typical Module Construction Detail

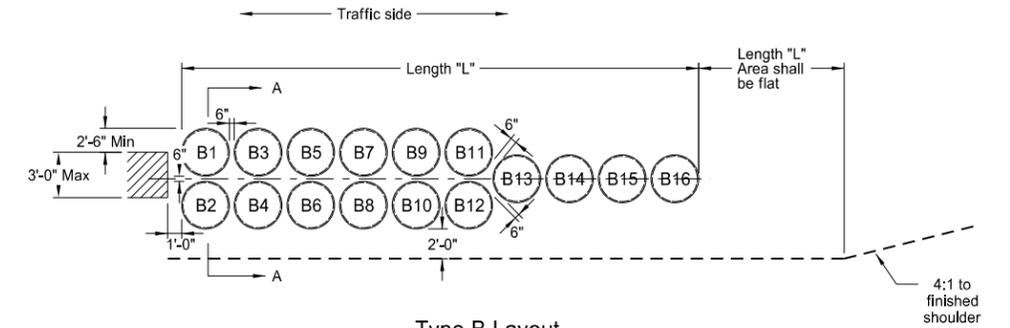


Reflective Sheet Detail

Note:
The last attenuation device facing traffic shall have a reflective sheet, following the details above, directly applied to the outer container. The sheet may also be applied to a metallic sheet and attached to the container with approved fasteners. The reflective sheeting shall be Type III C as specified in NDDOT Standard Specifications.

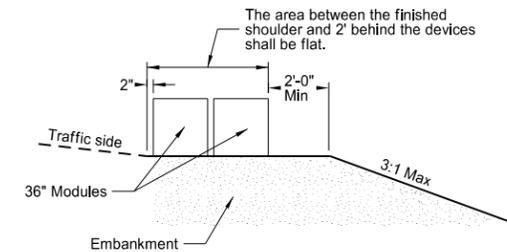
(A) 3" orange sheeting shall be used for temporary installations, and 3" yellow sheeting shall be used for permanent installations.

	Fill Chart				
	Module Weights (LBS)				
Distance from top edge	200	400	700	1400	2100
	8 1/2"	5"	4"	3"	0"



Type B Layout

Note:
When attenuation devices are placed at piers offset from roadway, they shall be angled 10 degrees towards traffic.



Section A-A (Type B Layout)

Type B Attenuation Device												
Module Number	Dash Number											
	75	70	65	60	55	50	45	40	35	30	25	
Module Weights (LBS)												
B1	2100											
B2	2100											
B3	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100		
B4	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100		
B5	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
B6	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
B7	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
B8	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
B9	700	700	700	700	700	700	700	700	700	700	700	700
B10	700	700	700	700	700	700	700	700	700	700	700	700
B11	700	700	700	700	700	700	700	700	700	700	700	700
B12	700	700	700	700	700	700	700	700	700	700	700	700
B13	700	700	700	700	700	700	700	700	700	700	700	700
B14	400	400	400	400	400	400	400	400	400	400	400	400
B15	400	400	400	400	400	400	400	400	400	400	400	400
B16	200	200	200	200	200	200	200	200	200	200	200	200
Length (L)	34.2'	30.7'	30.7'	30.7'	30.7'	30.7'	30.7'	30.7'	30.7'	27.2'	27.2'	
Module Weights (LBS)	Replacement Module											
	2100	1	1	1	1	1	1	1	1	1		
	1400	1	1	1	1	1	1	1	1	1	1	1
	700	2	2	2	2	2	2	2	2	2	2	2
	400	1	1	1	1	1	1	1	1	1	1	1
200	2	2	2	1	1	1	1	1	1	1	1	1

Notes:

- Materials
 - Modules shall be manufactured from a frangible polyethylene material which will shatter upon impact.
 - Modules shall be filled with class 43 aggregate meeting the requirements for aggregate according to NDDOT Standard Specifications. The fill unit weight shall be at least 100 pounds per cubic foot. Fill left over winter shall have a moisture content of 2% or less.
- Modules

The modules shall be provided in two sizes to contain volumes of either 2, 4, 7, 14, or 21 cubic feet as a minimum.

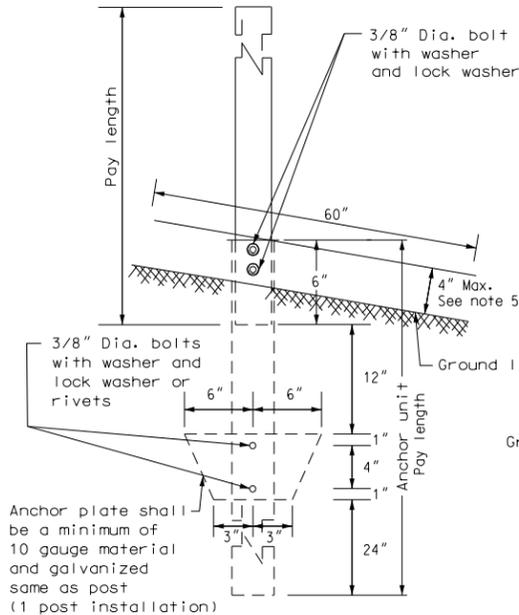
 - The module for the 2, 4 or 7 cubic foot container shall consist of three components:
 - A 14 C.F., yellow outer container.
 - A black lid which locks securely over the top lip of the container.
 - A cone-shaped supporting insert. The insert shall be varied to allow for the three sizes of modules and capable of supporting 200, 400, or 700 pounds of sand mass. The cone inserts shall be placed inside the 14 cubic foot container.
 - The module for the 21 cubic foot container shall consist of two components:
 - A 36" height X 36" width yellow outer container.
 - A black lid which locks securely over the top of the container.
- For temporary use: The modules shall be Energite or Fitch attenuation barrels manufactured by Energy Absorption Systems of Chicago, IL, TrafFix barrels manufactured by TrafFix Devices, Inc. of San Clemente, CA, or an approved equal. The attenuation devices may be placed on pallets to facilitate maintenance. Pallets shall have a maximum thickness of 3 1/2".
- For permanent use: Barrel Attenuation Device installations, the outer sand container portion of the modules shall consist of a one-piece container with separate detachable lid. The modules which meet these requirements are Energite attenuation barrels manufactured by Energy Absorption Systems of Chicago, IL, TrafFix barrels manufactured by TrafFix Devices, Inc. of San Clemente, CA, or an approved equal. Modules having outer sand containers assembled from multiple pieces shall not be accepted for permanent installations.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
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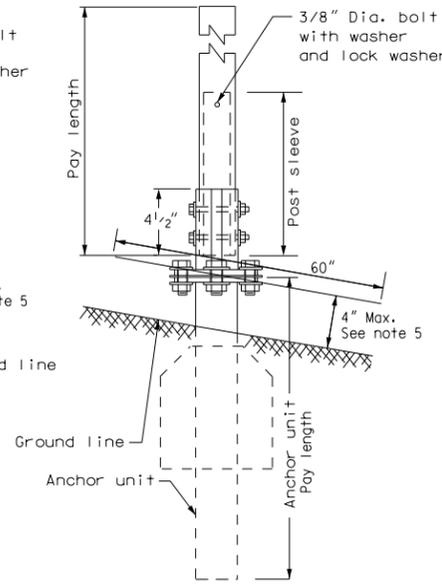
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BREAKAWAY SYSTEMS FOR CONSTRUCTION ZONE SIGNS

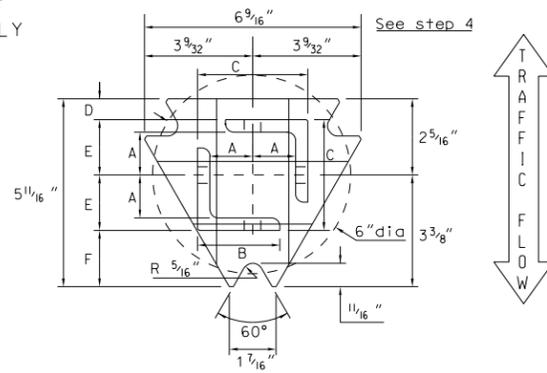
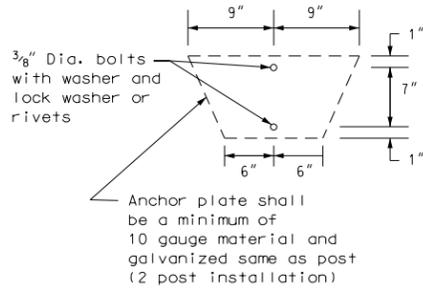
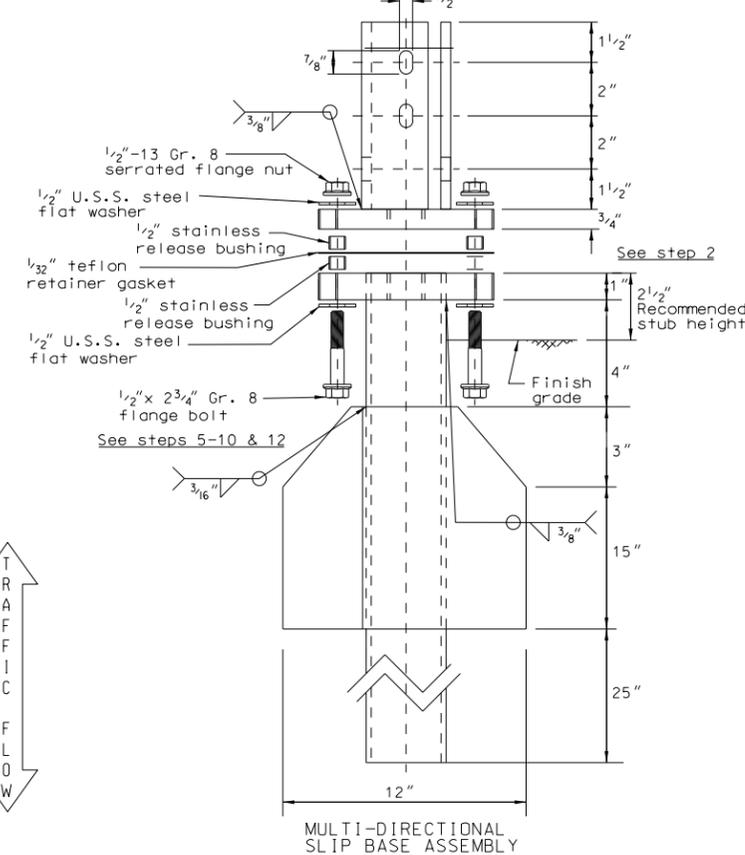
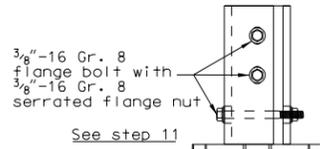
PERFORATED TUBE



ANCHOR UNIT AND POST ASSEMBLY



SLIP BASE ANCHOR UNIT AND POST SLEEVE ASSEMBLY

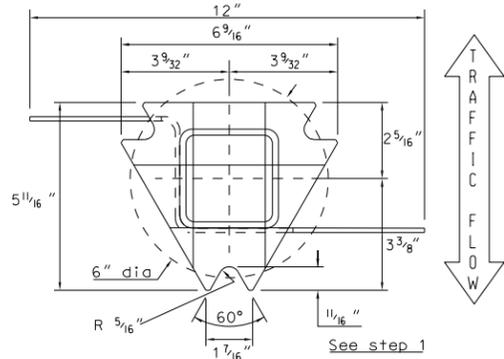


TOP POST RECEIVER

Materials: Plate - ASTM A572 grade 50
Angle receiver - 2 1/2" x 2 1/2" x 3/8" ASTM A36 structural angle

TOP POST RECEIVER DATA TABLE						
Square Post Sizes	A	B	C	D	E	F
2 3/16" x 10 Ga. Square Post	1 9/64"	2 1/2"	3 1/32"	2 3/32"	1 33/64"	1 7/8"
2 1/2" x 10 Ga. Square Post	1 9/32"	2 1/2"	3 5/16"	5/8"	1 21/32"	1 3/4"

2 3/16" x 10 gauge may be inserted into 2 1/2" x 10 gauge for additional wind load.



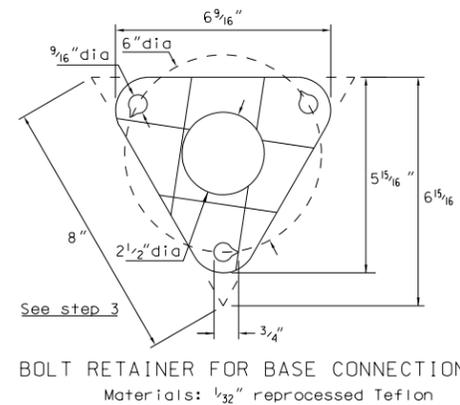
Materials: Tube - 3" x 3" x 7 gauge ASTM A500 Gr B tube
Stabilizing Wing - 7 gauge H.R.P.O. ASTM A 569
Plate - ASTM A572 grade 50

- Notes
- Slip base bolts shall be torqued as specified by the manufacturer.
 - The 2 3/16" size 10 gauge is shown as 2.19" size on the plans. The 2 1/2" size 10 gauge is shown as 2.51" size on the plans.
 - Anchor for 2", 2 1/4", and 2 1/2" posts.
 - Anchor material shall be 7 gauge H.R.P.O. Commercial quality ASTM A569 and 3" x 3" x 7 gauge ASTM A500 Grade B. Anchor shall have a yield strength of 43.9 KSI and tensile strength of 59.3 KSI. Anchor shall be hot dipped galvanized per ASTM A123/A153. All tolerances on anchor unit and slip base bottom assembly are ± 0.005 unless otherwise noted.
 - 4" vertical clearance of anchor or breakaway base. The 4" x 60" measurement shall be made above and below post location and also back and ahead of post.
 - When used in concrete sidewalk, anchor shall be the same except without the wings.
 - Four post signs shall have over 8' between the first and fourth posts.

Number of Posts	Telescoping Perforated Tube					
	Post Size In.	Wall Thickness Gauge	Sleeve Size In.	Wall Thickness Gauge	Slip Base	Anchor Size Without Slip Base In.
1	2	12			No	2 1/4
1	2 1/4	12			No	2 1/2
1	2 1/2	12			B	3
1	2 1/2	10			Yes	
1	2 1/4	12	2	12	Yes	
1	2 1/2	12	2 1/4	12	Yes	
2	2	12			No	2 1/4
2	2 1/4	12			No	2 1/2
2	2 1/2	12			Yes	
2	2 1/2	10			Yes	
2	2 1/4	12	2	12	Yes	
2	2 1/2	12	2 1/4	12	Yes	
3 & 4	2 1/2	12			Yes	
3 & 4	2 1/2	10			Yes	
3 & 4	2 1/2	12	2 1/4	12	Yes	
3 & 4	2 1/4	12	2	12	Yes	
3 & 4	2 1/2	10	2 3/8	10	Yes	

B - The 2 1/2", 12 gauge posts do not need breakaway bases when placed in standard soils, but require a shim as specified by the manufacturer. The breakaway base is required when the support is placed in weak soils. The Engineer shall determine if the soils are weak. Weak soils are classified as boggy, wet, or loose soil areas.

MULTI-DIRECTIONAL SLIP BASE ASSEMBLY	
STEP	INSTALLATION PROCEDURE
1.	Install bottom soil anchor stub plumb and squared up with road, with point of plate facing oncoming traffic.
2.	Depth of imbedment to leave 2 1/2" from grade to top of anchor plate.
3.	Place teflon bolt retainer gasket on top of bottom plate (make sure that notches in holes are pointing counter clockwise).
4.	Place top post receiver on to retainer gasket, properly indexed so that angle receivers are squared up with road.
5.	Slide 1 each 1/2" flat washer on to 1 each inverted 1/2"-13 gr. 8 flange bolt, followed by 1 each stainless steel release bushing.
6.	Insert above bolt with washer and bushing up through notched points of top and bottom plates, passing through hole in gasket.
7.	Slide second bushing down on to above bolt until it rests on top of gasket followed by second washer.
8.	Complete by threading 1/2"-13 gr. 8 serrated flange nut snugly down against top of washer.
9.	Repeat steps 5,6,7 & 8 at the two remaining notched triangle points.
10.	Insert sign post into angle receivers on top half until post(s) bottom out. *NOTE: Where higher wind load is desired, insert the next size smaller square post inside bottom of main upright post (Minimum of 48", not to exceed beyond bottom edge of sign).
11.	Secure posts into receivers using 3 each 3/8"-16 gr. 8 flange bolts and 3 each 3/8"-16 serrated flange nuts in receiver slots (top 2 bolts should be parallel to highway) do not tighten nuts until all bolts are in place.
12.	After all sub-assembly hardware is tightened, then torque the three 1/2"-13 nuts to 42 ft-lbs, in a circular pattern until all bolt assemblies reach the required torque. *NOTE: On multi-leg installations, be sure that all anchors are squared and lined up with each other.



BOLT RETAINER FOR BASE CONNECTION
Materials: 1/2" reprocessed Teflon

Telescoping Perforated Tubes						
Tube Size In.	Wall Thickness In.	U.S. Standard Gauge	Weight Per Foot Lbs.	Moment of Inertia In. 4	Cross Sect. Area In. 2	Section Modulus In. 3
1 1/2 x 1 1/2	0.105	12	1.702	0.129	0.380	0.172
2 x 2	0.105	12	2.416	0.372	0.590	0.372
2 1/4 x 2 1/4	0.105	12	2.773	0.561	0.695	0.499
2 3/16 x 2 3/16	0.135	10	3.432	0.605	0.841	0.590
2 1/2 x 2 1/2	0.105	12	3.141	0.804	0.803	0.643
2 1/2 x 2 1/2	0.135	10	4.006	0.979	1.010	0.785
4 x 4	0.250	1/4	6.600	3.040	1.940	1.050

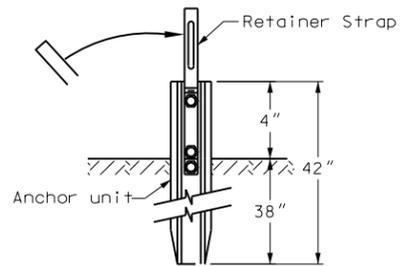
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
11-21-02	
REVISIONS	
DATE	CHANGE
12-01-04	PE stamp added

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BREAKAWAY SYSTEMS FOR CONSTRUCTION ZONE SIGNS

D-704-8

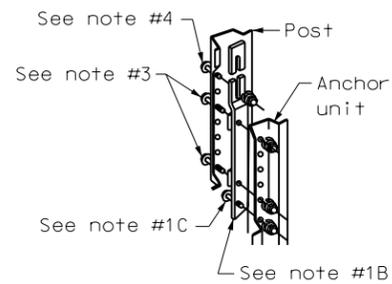
FLANGED CHANNEL



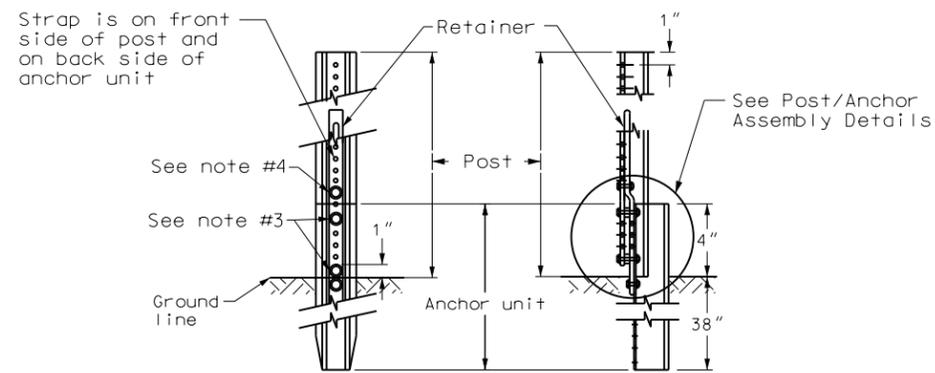
Anchor Unit & Strap Assembly Detail

STEPS OF INSTALLATION

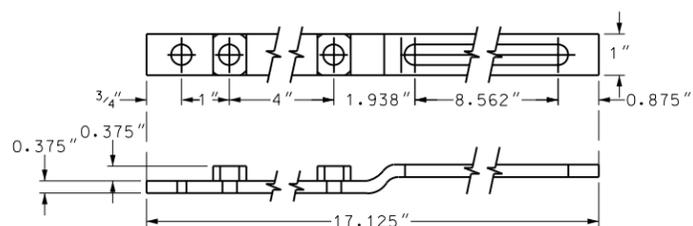
1. A) Drive anchor unit to within 12" of ground level.
B) Proper assembly established by lining up the top 3/4" slot of retainer spacer strap with top hole of anchor unit.
C) Assemble strap to back of anchor unit using 3/8"-16 UNC x 2.0" long bolt, lock washer and nut.
D) Rotate strap 90° to left.
2. A) Drive anchor unit to 4" dimension.
B) Rotate strap to vertical position.
3. A) Place 3/8"-16 UNC x 2" bolt, lock washer & nut in bottom of sign post to facilitate alignment of sign post with proper hole in anchor unit (this coincides with the bottom 3/4" slot in the strap).
B) Alternately tighten two connector bolts.
4. A) Complete assembly by tightening 3/8"-16 UNC x 2" long retainer bolt (this fastens sign post to retainer spacer strap).
5. The base post, strap & sign post shall be properly nested. Proper nesting occurs when all flat surfaces of the base post, strap and sign post at the bolts have full contact across the entire width.



Post/Anchor Assembly Details



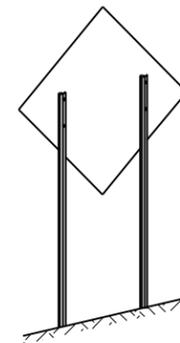
Front View Side View Sign Post Assembly Detail



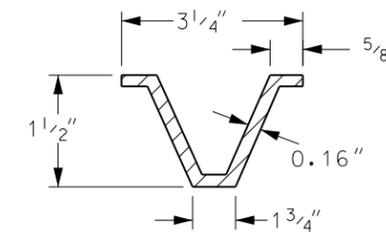
Retainer/Spacer Strap Detail

CHANNEL SIZE IN.	WALL THICKNESS IN.	WEIGHT PER FOOT LBS.	MOMENT OF INERTIA IN. 4	CROSS SECT. AREA IN. 2	SECTION MODULUS IN. 3
1.516 x 3.125"	.116	2.00	.179	.590	.225
1.532 x 3.125"	.124	2.25	.201	.648	.254
1.562 x 3.125"	.132	2.50	.233	.748	.289
1.578 x 3.125"	.140	2.75	.271	.819	.329
1.750 x 3.500"	.150	3.00	.372	.918	.403
1.750 x 3.500"	.175	4.00	.500	1.190	.560

3 LB/FT U POSTS



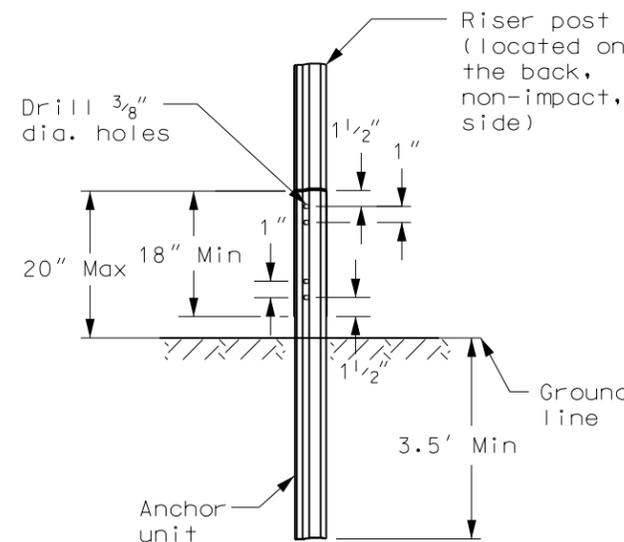
Typical Installation



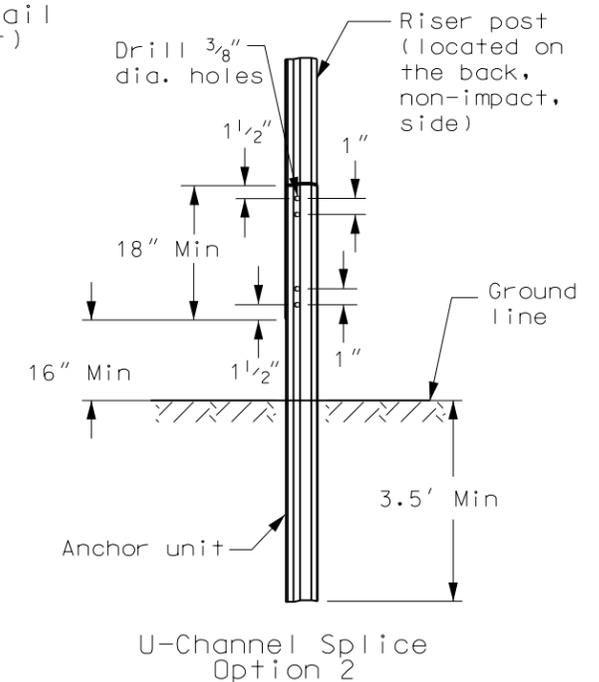
U-Post Detail (3 lb/ft)

Notes

1. Use 3 lb/ft riser anchor units and risers
2. Driven riser posts shall be at least 7' long and embedded at least 3.5'.
3. A splice shall overlap a minimum of 18".
4. Use 4 bolts 5/16" diameter with washers and nuts. Two at top and two at bottom of splice.
5. Anchor unit for guy wires shall be no more than 4" above ground and embedded at least 3.5'.



U-Channel Splice Option 1



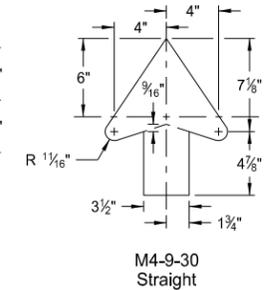
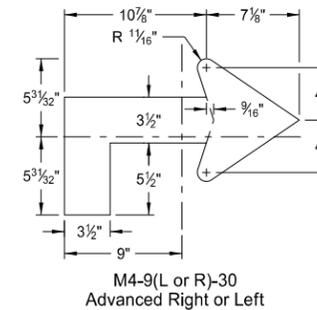
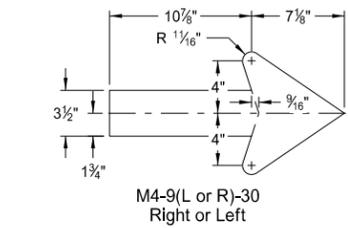
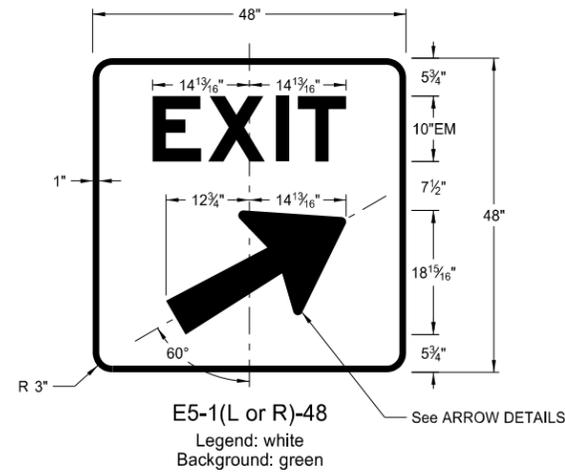
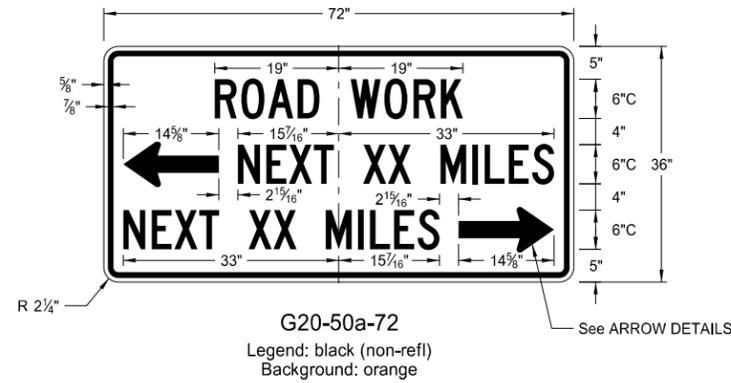
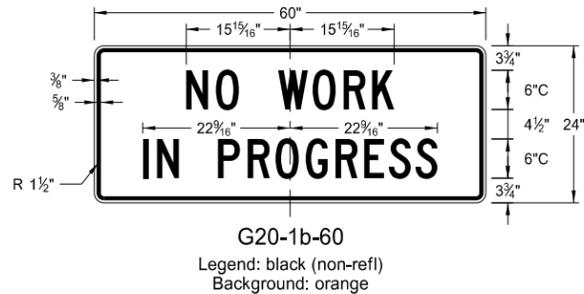
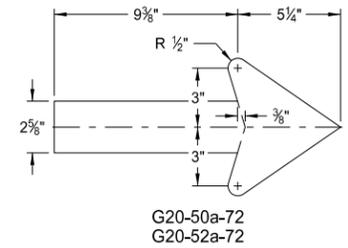
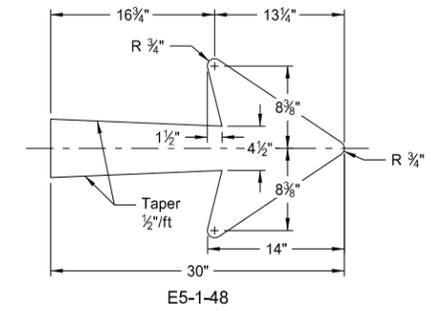
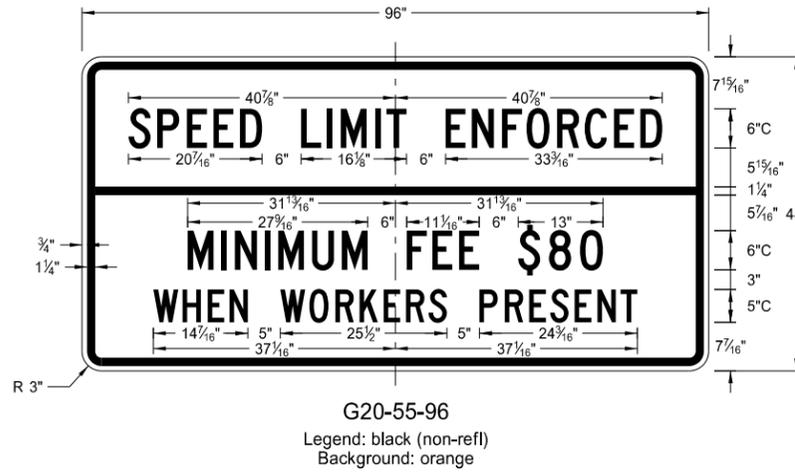
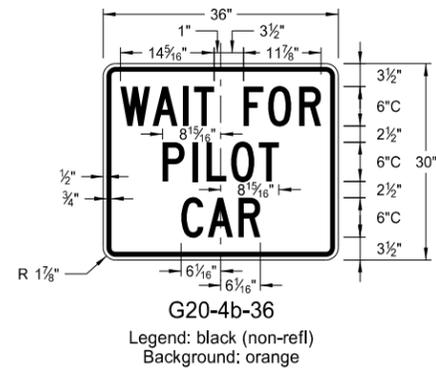
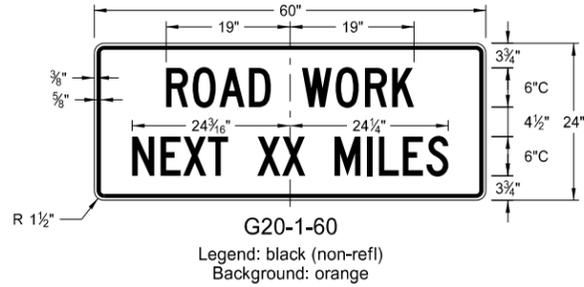
U-Channel Splice Option 2

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
07-28-93	
REVISIONS	
DATE	CHANGE
03-07-01	Revised U-post details
11-21-02	Deleted perforated tube
05-08-03	Revised U-Channel splice
12-01-04	PE stamp added
06-29-05	Revised flanged channel note

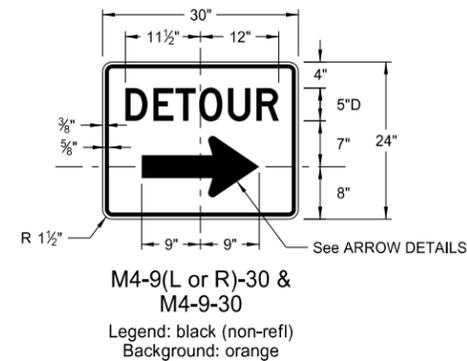
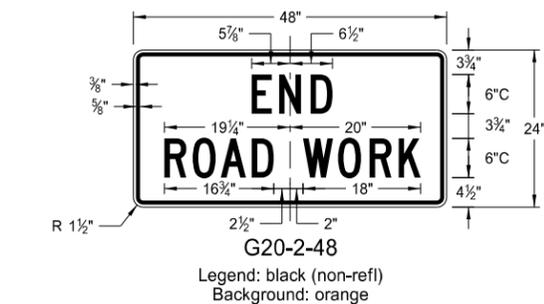
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CONSTRUCTION SIGN DETAILS
 TERMINAL AND GUIDE SIGNS

D-704-9



ARROW DETAILS



NOTES:

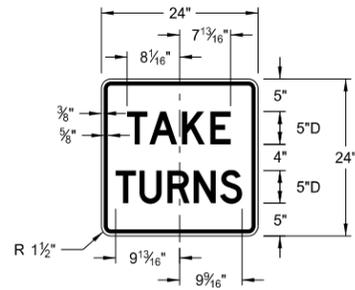
(A) Arrow may be right or left of the legend to indicate construction to the right or left.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-13-13	
REVISIONS	
DATE	CHANGE

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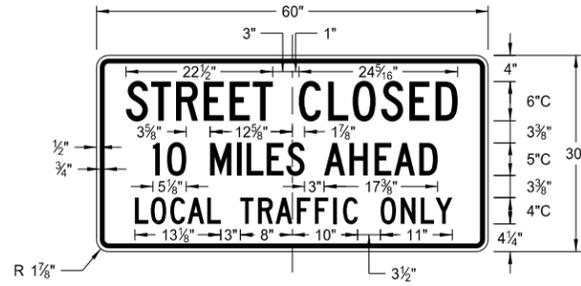
CONSTRUCTION SIGN DETAILS
REGULATORY SIGNS

D-704-10



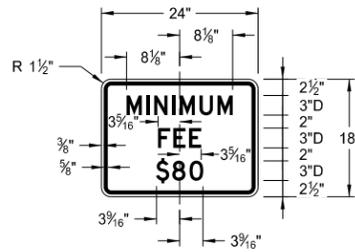
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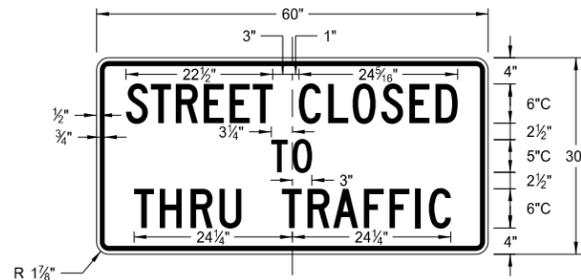
R11-3c-60

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R2-1a-24

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R11-4a-60

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R11-2a-48

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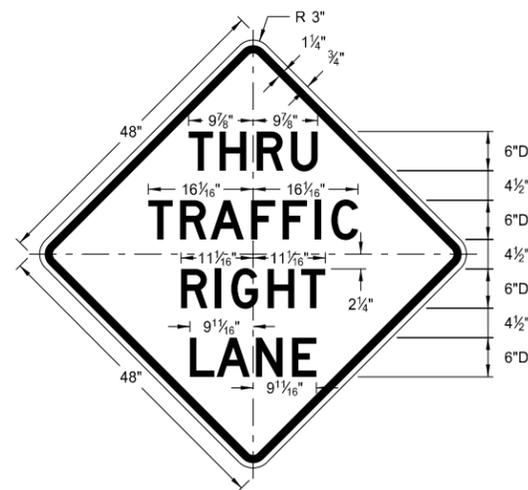
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-13-13	
REVISIONS	
DATE	CHANGE

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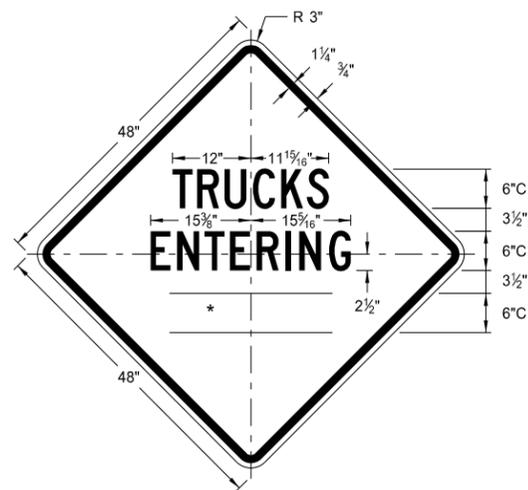
CONSTRUCTION SIGN DETAILS
WARNING SIGNS

WORD	LETTER SPACING
AHEAD	Standard
200 FT	Standard
350 FT	Standard
500 FT	Standard
1000 FT	Reduce 40%
1500 FT	Reduce 40%
½ MILE	Reduce 50%
1 MILE	Standard

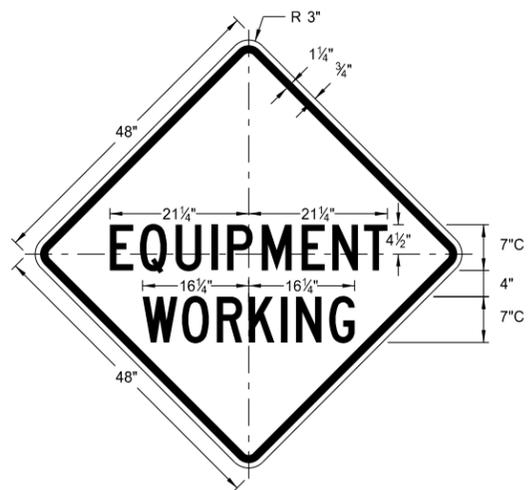
* DISTANCE MESSAGES



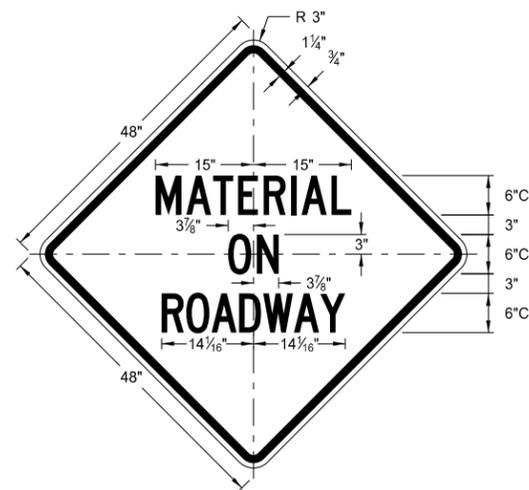
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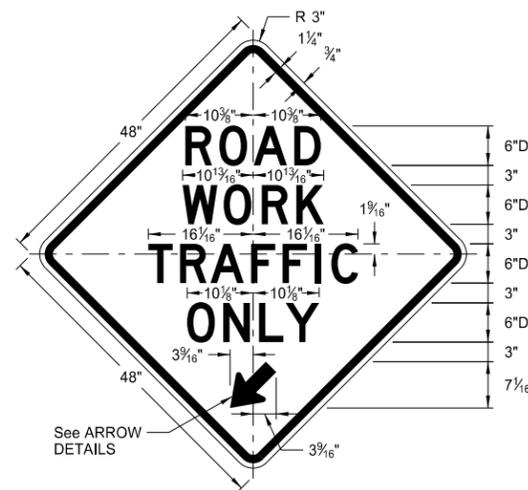
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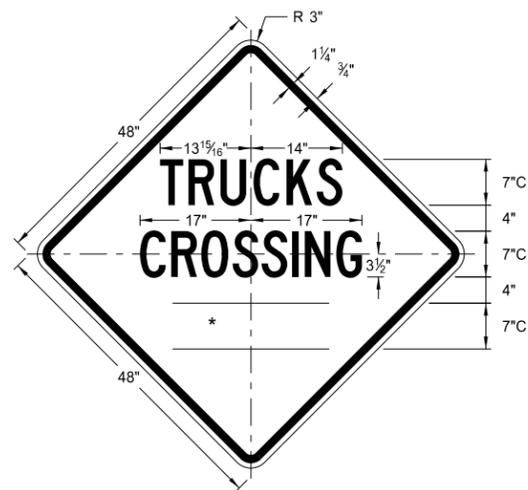
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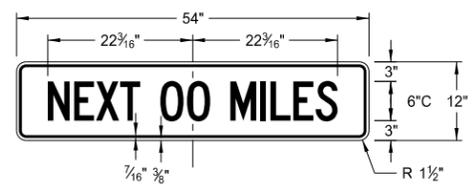
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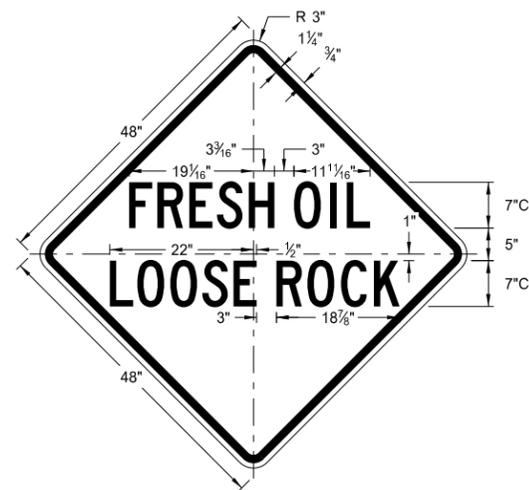
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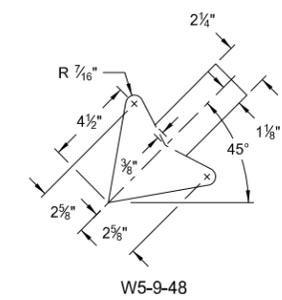
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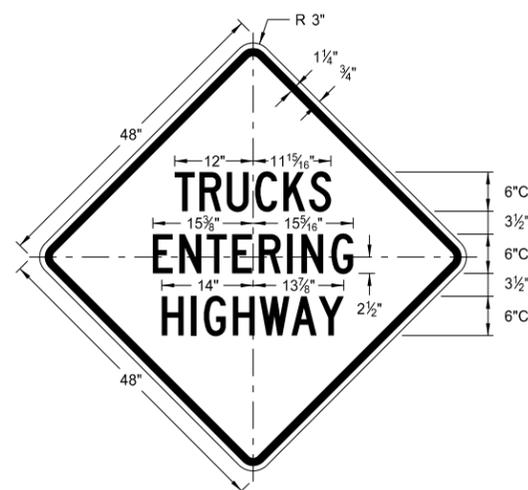
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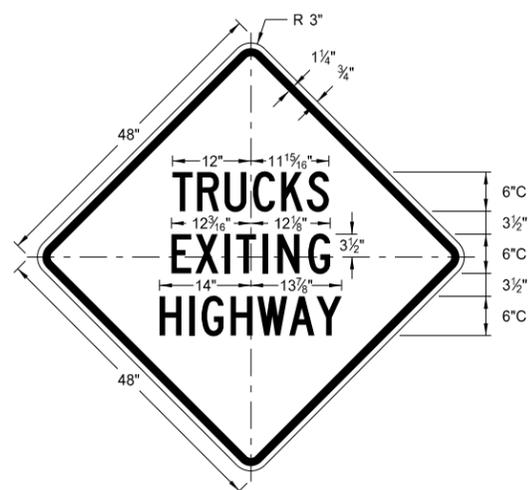
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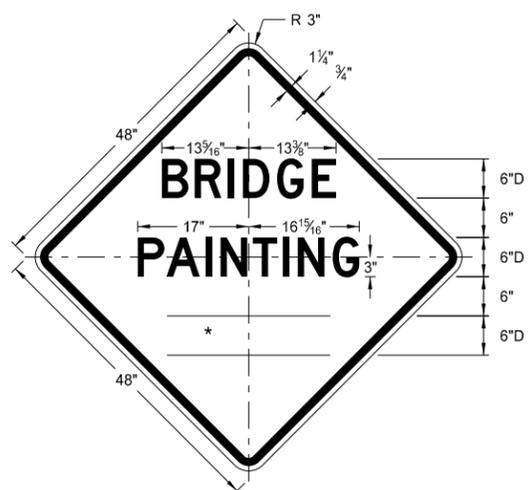
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ARROW DETAILS



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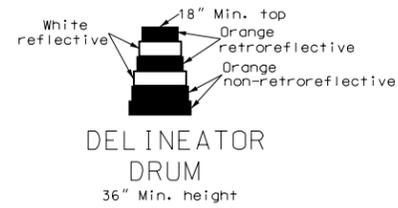
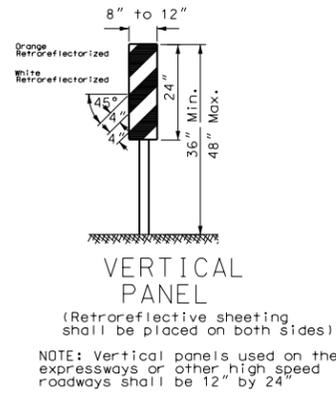
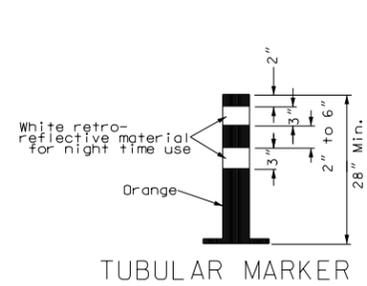


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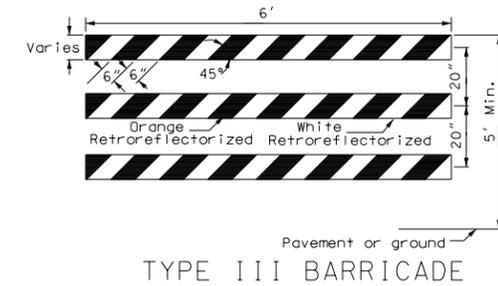
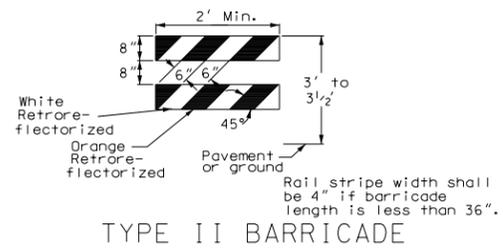
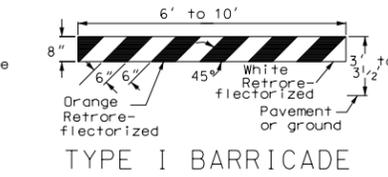
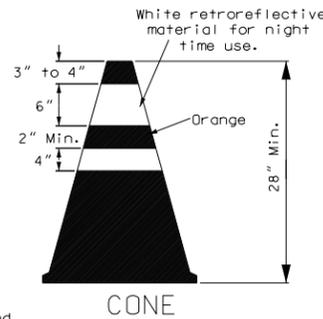
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-13-13	
REVISIONS	
DATE	CHANGE

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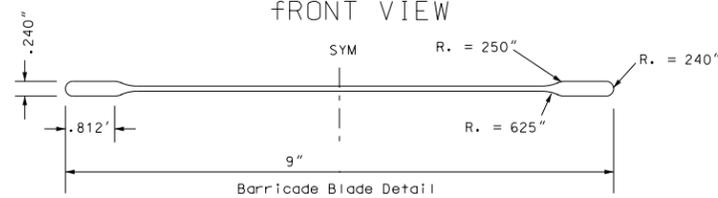
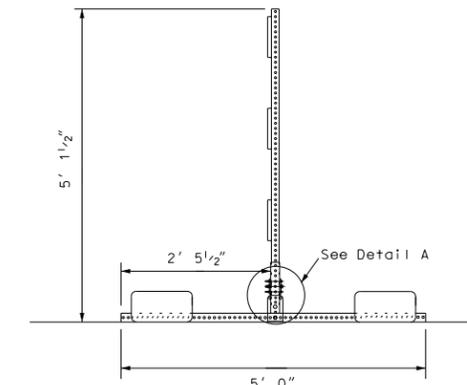
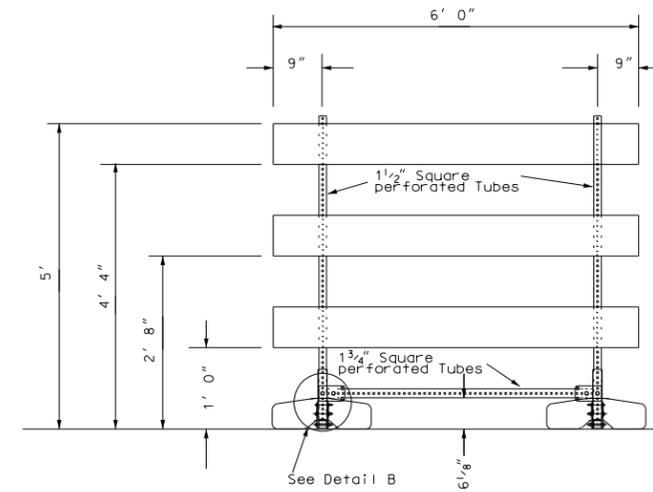
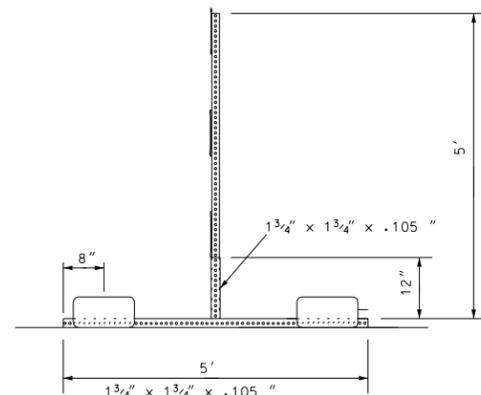
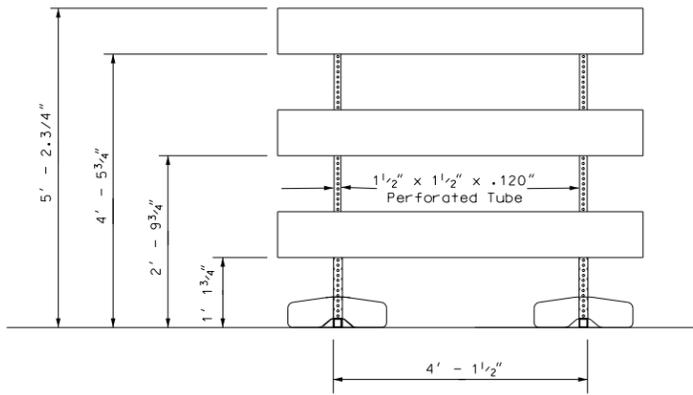
BARRICADE DETAILS AND CHANNELIZING DEVICES



The markings on drums shall be orange and white stripes 4 to 6 inches wide. There shall be at least two orange and two white stripes. Where drums have ribs or indentations, there shall be no retroreflective sheeting in this area. This space shall be no more than 2 inches wide. The drum surface shall be prepared as recommended by the sheeting manufacturer before retro reflective sheeting is applied.



BARRICADES:
Number of retroreflectored rail faces:
Type I - 2 (One each direction)
Type II - 4 (Two each direction)
Type III - 6 (Three in each direction)

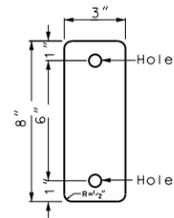


Ballast = 45lb sandbag at the end of each leg.
Barricade blade fastened to vertical supports with 2" corner bolts.
Vertical portion of leg is welded to horizontal portion on all four sides.
Masts slide inside vertical portion of legs. No bolts or fastenings devices used.

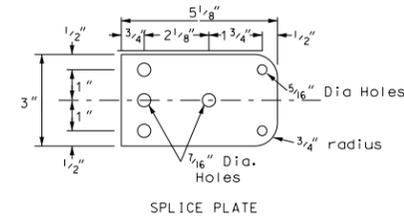
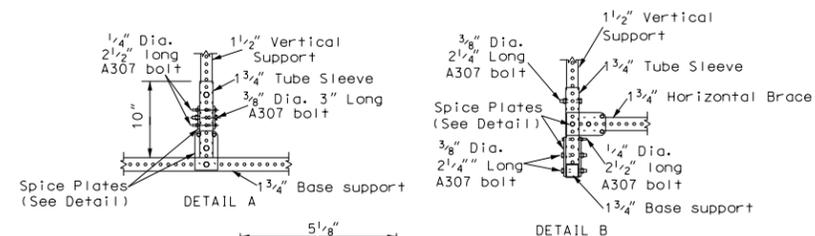
BARRICADE ASSEMBLY DETAIL
(Use when aluminum blade as detailed above)



Delineator reflector shall meet the requirements of section 894



3"x8" - 18 Gauge galvanized steel sheet or 0.080" aluminum plate with white retroreflective sheeting (Type 3A or 3B) as specified in section 894 of the Standard Specifications.



BARRICADE ASSEMBLY DETAIL
(Use when Plastic I-Beam w/ 1.5" Hollow Core Flanges or 1" x 8" x 72" wood boards.)

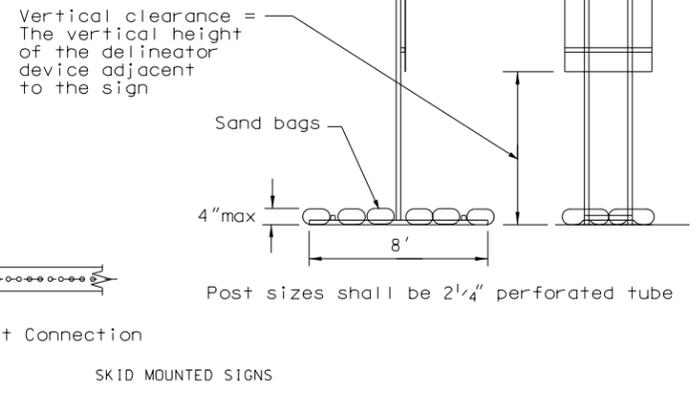
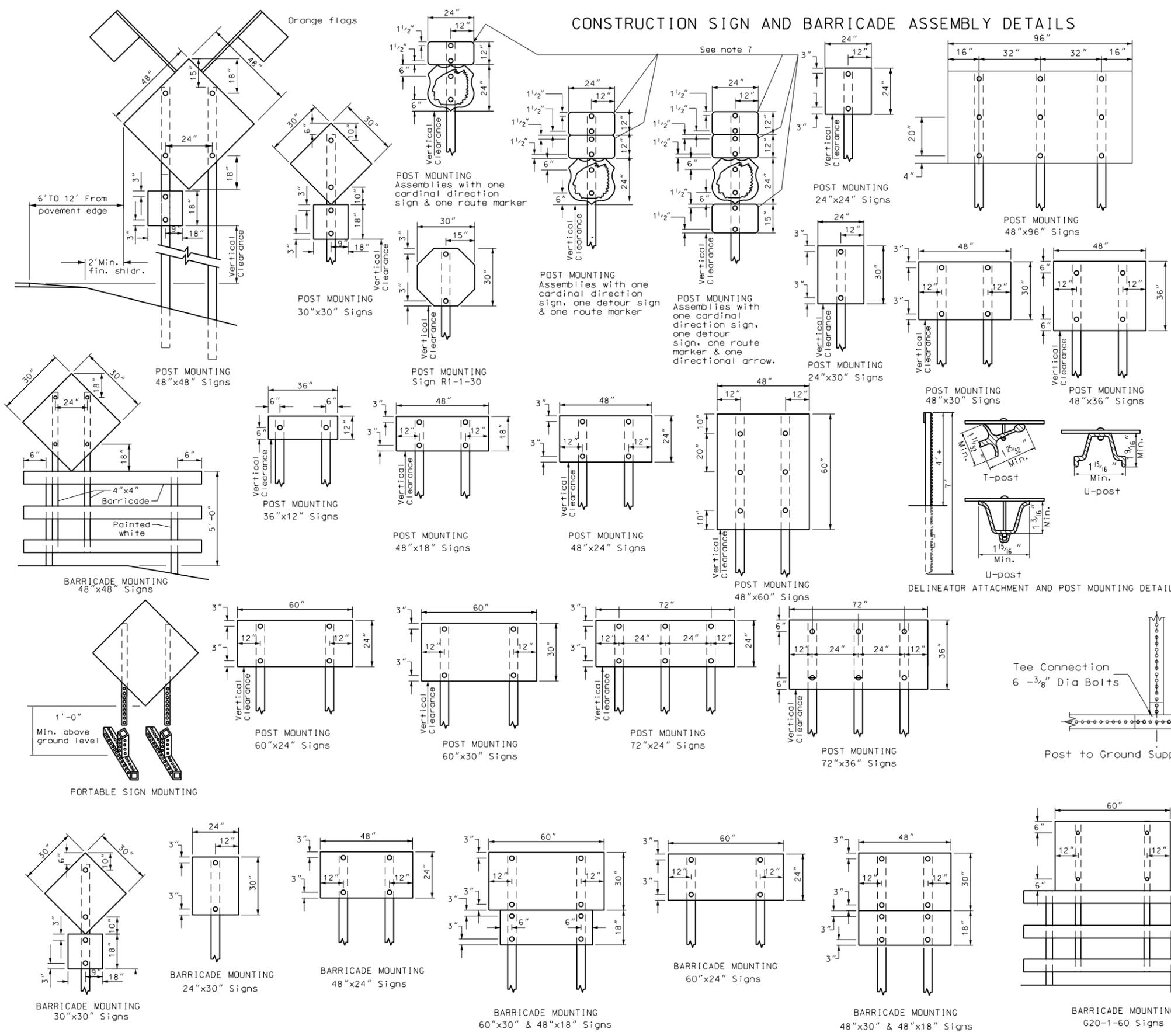
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-1-86	
REVISIONS	
DATE	CHANGE
08-03-87	Type sheeting
10-01-87	Delineator drum note
06-08-88	Barricade type III
06-01-92	General revision
06-10-93	General revision
09-23-93	Vertical panel
06-09-95	Reflective sheeting
03-01-02	Barricade type III assembly details
04-01-02	Type III barricade
12-01-04	PE stamp added
06-29-05	Revised Type II barricade stripe

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CONSTRUCTION SIGN AND BARRICADE ASSEMBLY DETAILS

NOTES:

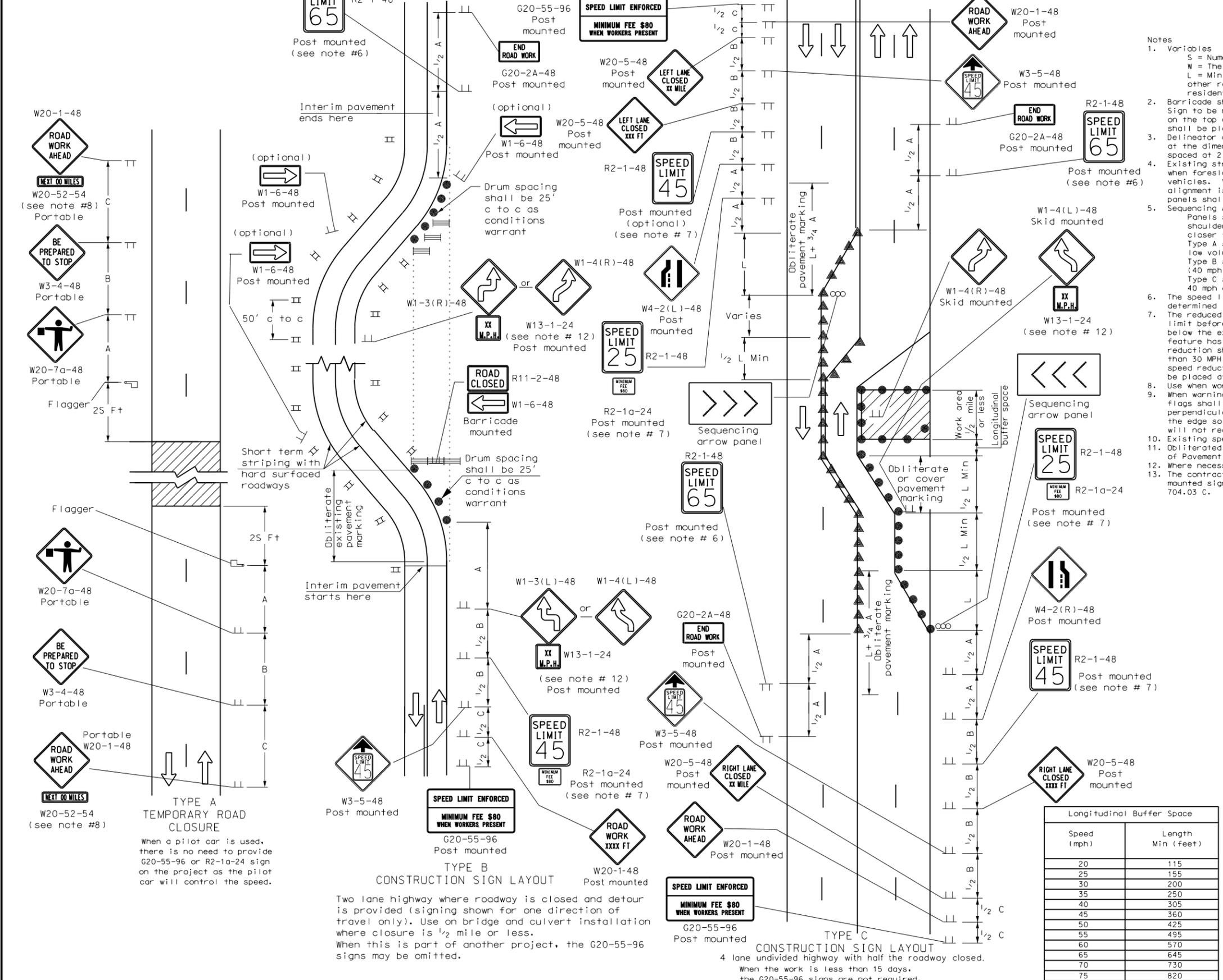
- Barricade and Sign Supports: Wooden supports shall be painted white. Steel supports shall be galvanized or painted.
- Barricade Mounting Signs: The bottom of the sign shall be flush with the top of the top rail. Wood sign posts shall be 4"x4" min. SFS or equivalent steel posts. All barricades and barricade mounted signs shall be assembled with 3/8" bolts.
- Sign Supports: Sign supports shall be 4"x4" min. SFS or equivalent steel post. The anchor for steel supports shall have a stub height of 4" or less. Wood posts more than 4"x4" shall be breakaway. Sign supports shall be imbedded to a sufficient depth so that signs will remain plumb throughout duration of project. It is suggested that wood posts have a min. depth of embedment of 5' and steel posts be embedded a min. 3'-6". Material: All signs shall be 0.100" aluminum, 12 gauge steel, 1/2" plywood or other approved material. Holes: All holes to be punched round for 3/8" bolts.
- Alternate Messages: The signs that have alternate messages may have these alternate messages placed on a reflectorized plate without a border and this plate installed and removed as required.
- Advance Warning Flashing or Sequencing Arrow Panels: The minimum mounting height shall be 7 feet above the roadway to the bottom of the panel, except on vehicle mounted panels which shall be as high as practicable.
- Delineator Posts: Typical fence post sections are shown in Attachment Details. Other types of metal fence posts may be substituted upon approval of the engineer. These substituted posts shall have reflectors attached similar to the ones shown.
- Route Marker Auxiliary Signs: The route marker auxiliary signs such as the cardinal direction and directional arrows shall have background colors the same as the route marker they are used with (Interstate route markers, blue background, US and State route markers, white background, Interstate Business loop and spur, green background, and County route markers, blue background).
- Vertical Clearance: Post mounted signs placed in rural areas shall have a vertical clearance of at least 5 feet measured from the bottom of the sign to the near edge of the roadway. In business, commercial and residential districts where parking and/or pedestrian movement is likely to occur or where other obstructions to view, the distance between the bottom of the sign to the near edge of the driving lane shall be at least 7 feet. The height to the bottom of secondary signs mounted below another sign may be 1 foot less than the appropriate height specified. Large signs having an area exceeding 50 square feet that are installed on multiple breakaway posts shall be mounted a minimum of 7 feet above the ground.



NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-1-86	
REVISIONS	
DATE	CHANGE
08-01-88	Sign assembly
05-01-92	Sign assembly
03-30-93	Sign supports note
03-04-96	Sign height
08-15-96	Note 8
07-10-97	Note revision
07-31-98	Note & portable sign
10-01-99	Skid mounted sign
02-07-03	Vertical clearance note
11-30-04	Third post added to some signs
12-01-04	PE stamp added

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CONSTRUCTION SIGN AND BARRICADE LOCATION DETAILS



- Notes
- Variables
 - S = Numerical value of speed limit or 85th percentile.
 - W = The width of taper.
 - L = Minimum length of taper, or S x W for freeways, expressways, and all other roads with speeds of 45 mph or greater, or W x S²/60 for urban, residential, and other streets with speeds of 40 mph or less.
 - Barricade shown to be placed on roadway shall be on a movable assembly. Sign to be mounted on barricades shall be mounted with the sign bottom on the top of the top barricade bar. Sign shown to be placed on roadway shall be placed on skid mounted assemblies.
 - Delineator drums, barricades or cones used for tapering traffic shall be spaced at the dimension "S". Delineator drums or cones used for tangents shall be spaced at 2 times dimension "S".
 - Existing striping shall be removed as required. Delineators will only be used when foreslope is 1V:4H or better and roadway alignment is visible to approaching vehicles. Vertical panels shall be used where roadways has steep slopes and alignment is not visible to approaching vehicles. Delineators and vertical panels shall be installed back to back.
 - Sequencing Arrow Panels
 - Panel should normally be placed at the beginning of the taper. Where shoulder width does not provide sufficient room, the panel should be moved closer to the work area so that it can be placed on the roadway surface.
 - Type A shall be used on roadways with slow moving traffic speeds and low volume (25 mph and 750 ADT or less).
 - Type B shall be used on roadways with moderate traffic speeds and volumes (40 mph and 5000 ADT or less).
 - Type C shall be used on roadways with high traffic speeds and volumes (over 40 mph and 5000 ADT).
 - The speed limit shall be re-established. The exact speed limit shall be determined in the field, dependent on location and conditions.
 - The reduced speed limit shall be determined dependent on the in place speed limit before construction. The speed limit reduction should not exceed 10 mph below the existing speed limit, unless the design speed of the work zone feature has been reduced below the 10 mph. In this case, the speed limit reduction shall not exceed 30 MPH. Where speed limits are to be reduced more than 30 MPH, a second speed limit sign shall be installed with the desired speed reduction but shall not exceed 30 MPH. The second speed limit sign shall be placed at 1/2 B.
 - Use when work area is 1 mile or longer.
 - When warning signs are used in urban areas and the signs are not portable, flags shall be installed. The flags shall be 24 inches square, mounted perpendicular to the edges of the diamond sign, and at such a distance above the edge so that when the flag is limp it will not touch the sign. Rural areas will not require flags.
 - Existing speed limit signs within a reduced speed zone shall be covered.
 - Obliterated or covered pavement marking shall be paid for as Obliteration of Pavement Marking. The covering shall be approved by the engineer.
 - Where necessary, safe speed to be determined by the Engineer.
 - The contractor has the option of using portable sign supports in lieu of post mounted sign as shown on the standard drawings as specified in section 704.03 C.

Road Type	ADVANCE WARNING SIGN SPACING		
	Distance Between Signs Min. (ft)		
	A	B	C
Urban - Low Speed (30 mph or less)	150	150	150
Urban - Low Speed (over 30 to 40 mph)	280	280	280
Urban - High Speed (over 40 mph to 50 mph)	360	360	360
Rural - High Speed (over 50 mph to 65 mph)	720	720	720
Urban Expressway and Freeway (55 mph to 60 mph)	850	1350	2200
Rural Expressway and Freeway (70 mph to 75 mph)	1000	1500	2640
Interstate/4-Lane Divided (Maintenance and Surveying)	750	1000	1500

KEY

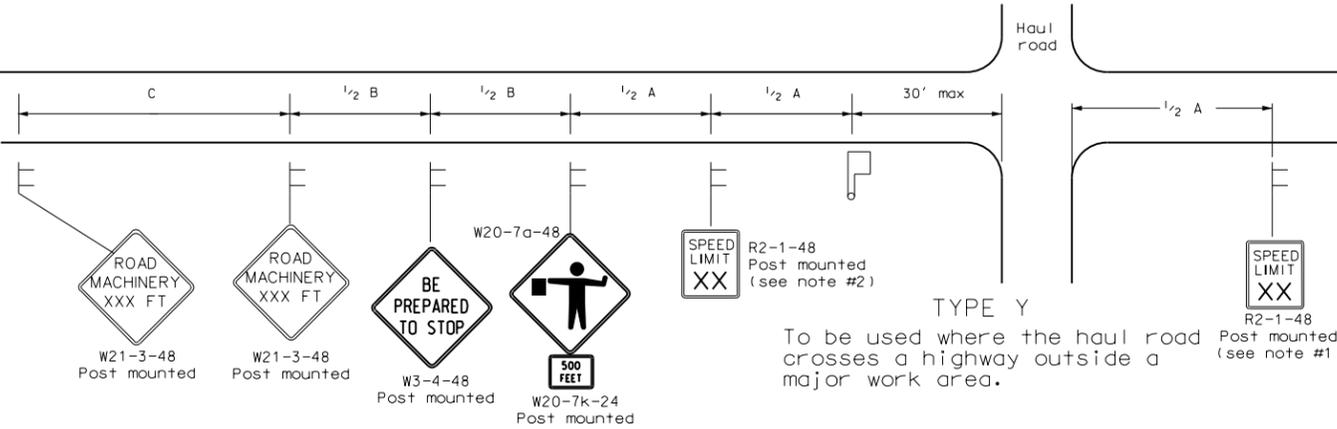
	Type I barricade		Work area
	Type II barricade		Flagger
	Type III barricade		Sequencing arrow panel
	Sign		Type A delineator or vertical panels back to back
	Delineator drum		
	Cones		

Longitudinal Buffer Space	
Speed (mph)	Length Min (feet)
20	115
25	155
30	200
35	250
40	305
45	360
50	425
55	495
60	570
65	645
70	730
75	820

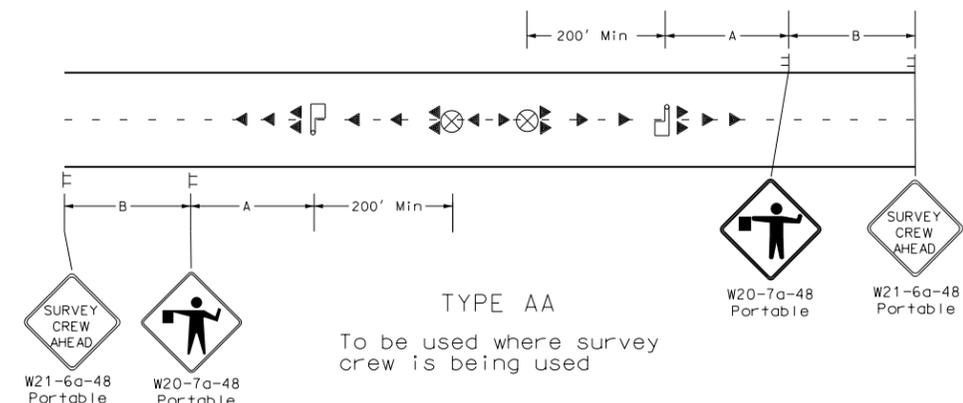
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-1-86	
REVISIONS	
DATE	CHANGE
01-05-01	Revised note 3
07-19-02	Revised End Road Work & Speed Signs
07-25-03	Revised R2-1, R2-1a and W20-1
04-01-04	Change Fee Sign, Warning & Buffer Spacing
12-18-03	Relocated reverse curve PE stamp added
12-01-04	PE stamp added
06-29-05	Revised W4-2, Replaced R2-5a with W3-5, Rev. Adv. Warning Table, Rev. Note 7, Changed W20-7b to W3-4
07-05-05	

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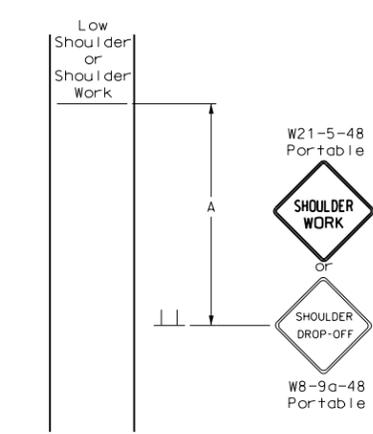
CONSTRUCTION SIGN AND BARRICADE LOCATION DETAILS



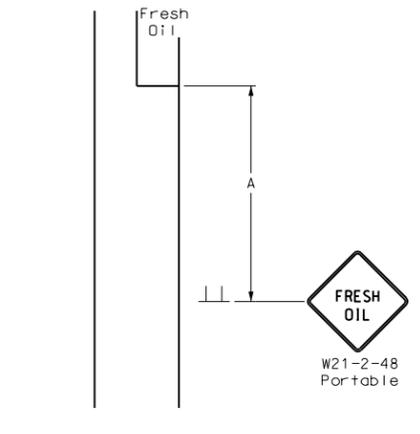
TYPE Y
To be used where the haul road crosses a highway outside a major work area.



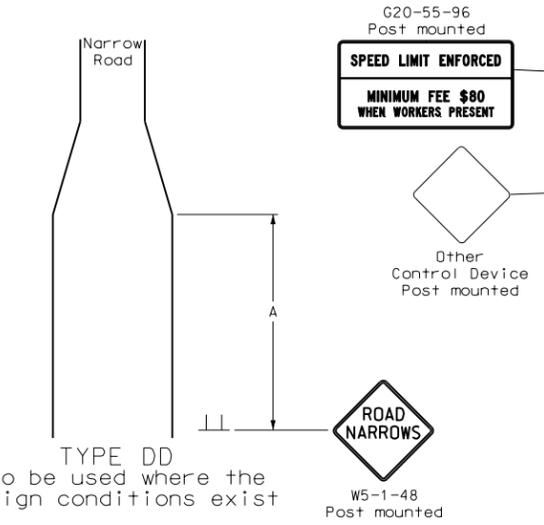
TYPE AA
To be used where survey crew is being used



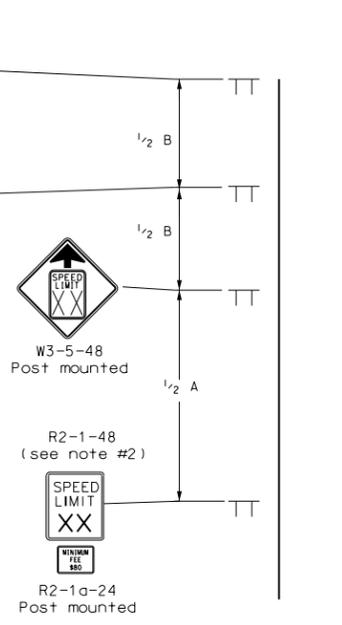
TYPE BB
To be used within a major work area where the sign conditions exist



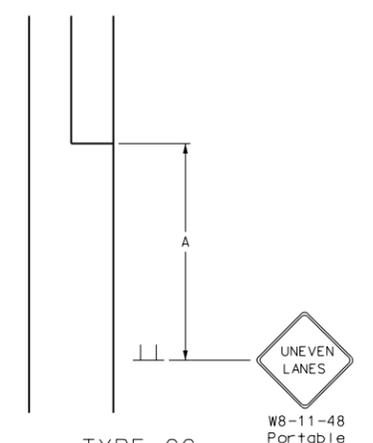
TYPE CC
To be used where the sign conditions exist



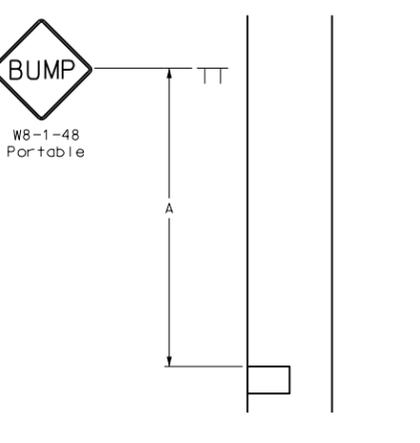
TYPE DD
To be used where the sign conditions exist



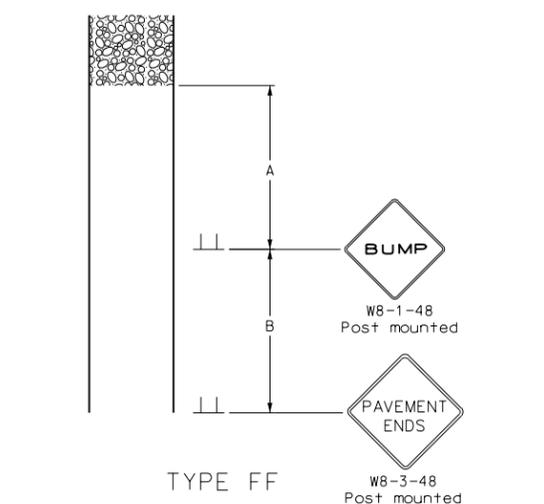
TYPE Z
To be used where speed zone is needed



TYPE GG
To be used where a difference of elevation between lanes exist



TYPE EE
To be used where the sign conditions exist



TYPE FF
To be used where the sign conditions exist

- Notes**
- The speed limit shall be re-established. The exact speed limit shall be determined in the field, dependent on location and conditions.
 - The reduced speed limit shall be determined dependent on the in place speed limit before construction. The speed limit reduction should not exceed 10 mph below the existing speed limit, unless the design speed of the work zone feature has been reduced below the 10 mph. In this case, the speed limit reduction shall not exceed 30 MPH. Where speed limits are to be reduced more than 30 MPH, a second speed limit sign shall be installed with the desired speed reduction but shall not exceed 30 MPH. The second speed limit sign shall be placed at 1/2 B.
 - When warning signs are used in urban areas and the signs are not portable, flags shall be installed. The flags shall be 24 inches square, mounted perpendicular to the edges of the diamond sign, and at such a distance above the edge so that when the flag is limp it will not touch the sign. Rural areas will not require flags.
 - Existing speed limit signs within a reduced speed zone shall be covered.
 - The contractor has the option of using portable sign supports in lieu of post mounted sign as shown on the standard drawings as specified in section 704.03 C.
 - G20-55-96 or R2-1a-24 signs are not required if this standard is part of other traffic control layouts, or the work is less than 5 days.

KEY

	Type I barricade		Work area
	Type II barricade		Flagger
	Type III barricade		Sequencing arrow panel
	Sign		Type A delineator or vertical panels back to back
	Delineator drum		
	Cones		

ADVANCE WARNING SIGN SPACING

Road Type	Distance Between Signs Min. (ft)		
	A	B	C
Urban - Low Speed (30 mph or less)	150	150	150
Urban - Low Speed (over 30 to 40 mph)	280	280	280
Urban - High Speed (over 40 mph to 50 mph)	360	360	360
Rural - High Speed (over 50 mph to 65 mph)	720	720	720
Urban Expressway and Freeway (55 mph to 60 mph)	850	1350	2200
Rural Expressway and Freeway (70 mph to 75 mph)	1000	1500	2640
Interstate/4-Lane Divided (Maintenance and Surveying)	750	1000	1500

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION
10-1-86

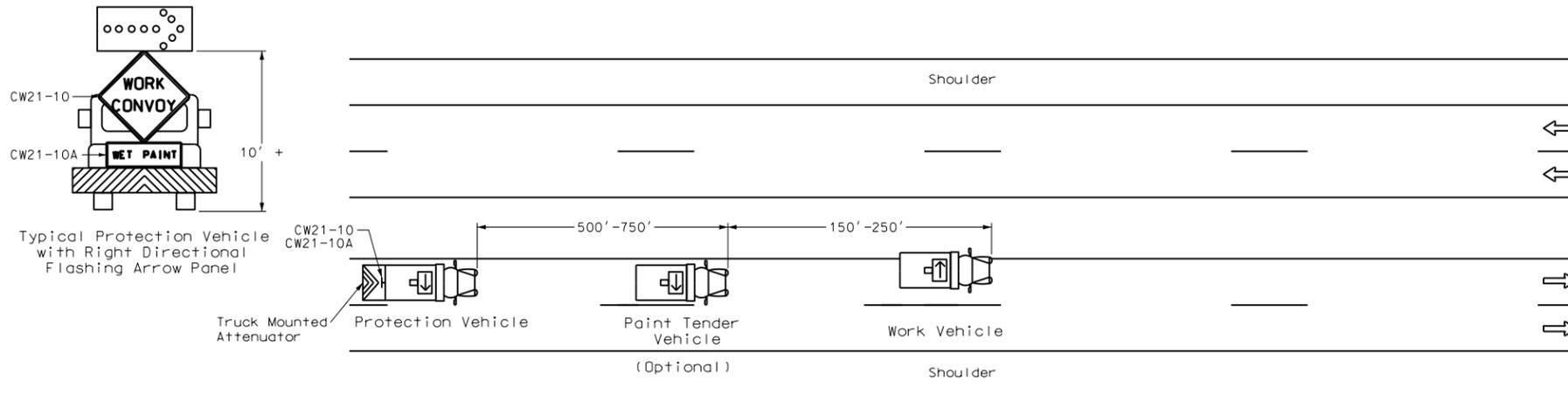
REVISIONS	
DATE	CHANGE
09-03-96	70 mph
01-31-97	Sign spacing
10-01-99	General Revision
07-19-02	Revised spacing of Speed Limit Signs
01-30-03	Pavement end sign
07-25-03	Revised R2-1a
04-01-04	Rev. fee sign & warning sign spacing. Add note 6
12-01-04	PE Stamp added
06-29-05	Replaced R2-5a with W3-5.
	Rev. Adv. Warning Table, Rev. Note 2
07-05-05	Changed W20-7b to W3-4

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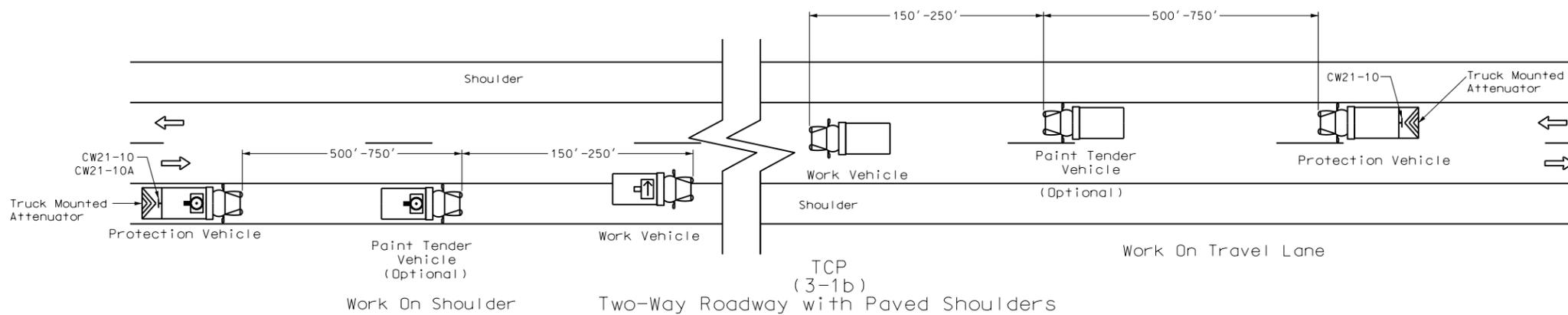
TRAFFIC CONTROL PLAN FOR MOVING OPERATIONS ON CONVENTIONAL HIGHWAYS (Pavement Marking)

D-704-27

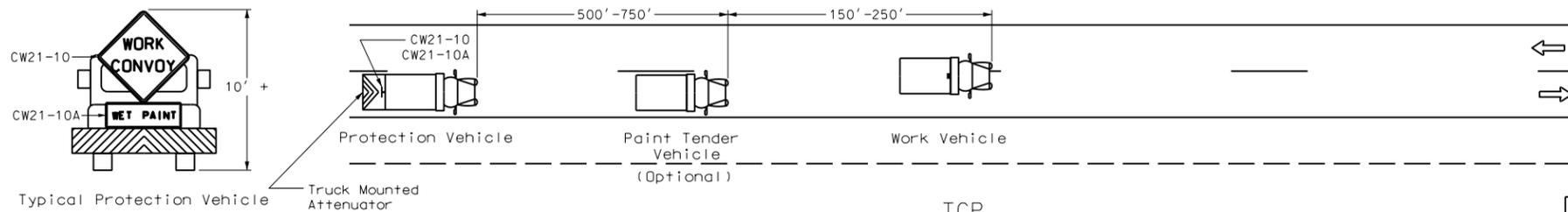
- Notes
1. If the contractor chooses to place more vehicles in the convoy than are shown, these vehicles shall have the truck mounted attenuator and shall be at the contractor's expense.
 2. All traffic control devices shall be in accordance with the "Manual on Uniform Traffic Control Devices" (MUTCD), latest edition.
 3. The use of yellow rotating beacons or strobe lights on vehicles is required unless otherwise stated elsewhere in the plans.
 4. Flashing arrow panels shall be Type B or Type C. The panel operation shall be controlled from inside the vehicle.
 5. Each vehicle shall have two-way radio communication capability.
 6. When work convoys must change lanes, the protection vehicle should change lanes first to shadow other convoy vehicles.
 7. Vehicle spacing between the protection vehicle and paint tender vehicle will vary depending on sight distance restrictions. Motorists approaching the work convoy should be able to see the protection vehicle in time to slow down and/or change lanes as they approach the trail vehicle.
 8. Sign Colors
Letters = Black
Border = Black
Background = Orange



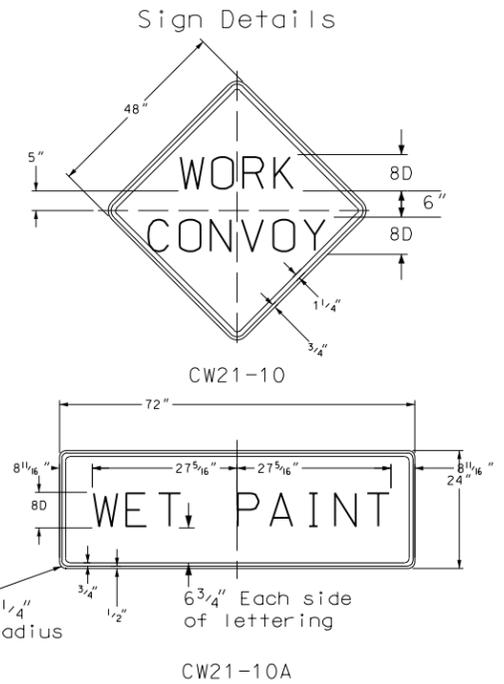
TCP
(3-1a)
Undivided Multi Lane Roadway



TCP
(3-1b)
Two-Way Roadway with Paved Shoulders



TCP
(3-1c)
Two-Way Roadway without Paved Shoulders



KEY

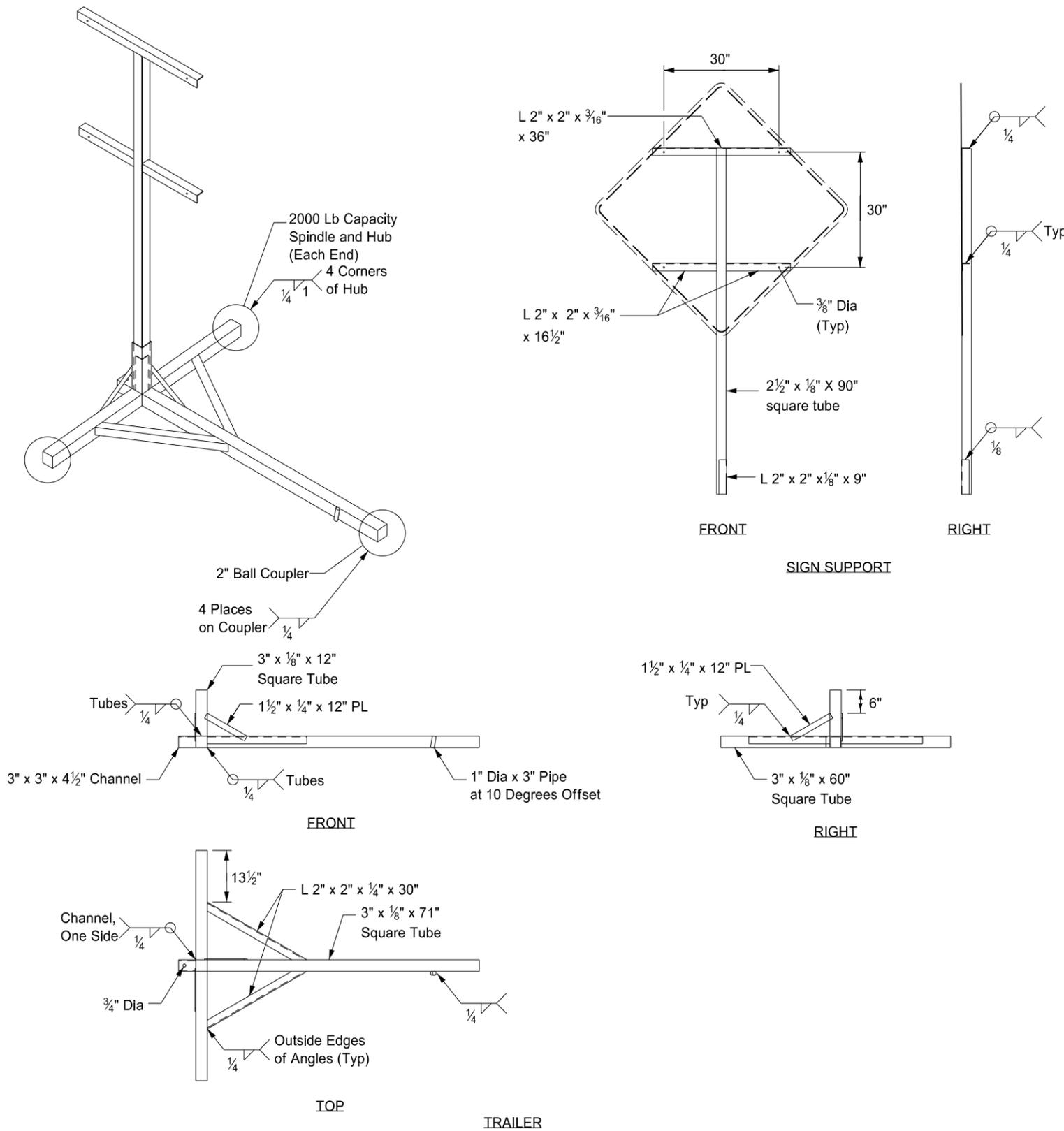
	Truck mounted attenuator
	Flashing arrow panels:
	Right directional
	Left directional
	Double arrow directional
	Caution Mode

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
01-22-92	
REVISIONS	
DATE	CHANGE
02-24-93	General
03-15-95	General
06-21-95	Remove caution mode
10-01-99	General Revisions
07-25-00	General Revisions
12-01-04	PE Stamp added

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PORTABLE SIGN SUPPORT ASSEMBLY

D-704-50



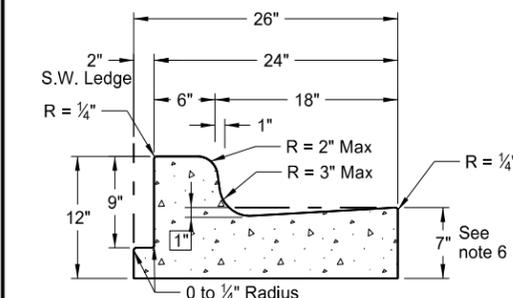
Notes:

- ① The maximum weight of the assembly is 250 pounds.
- ② Use a 14" wheel and tire.
- ③ Automotive and equipment axle assemblies may not be used for trailer-mounted sign supports.
- ④ Other NCHRP 350 crash tested assemblies are acceptable.

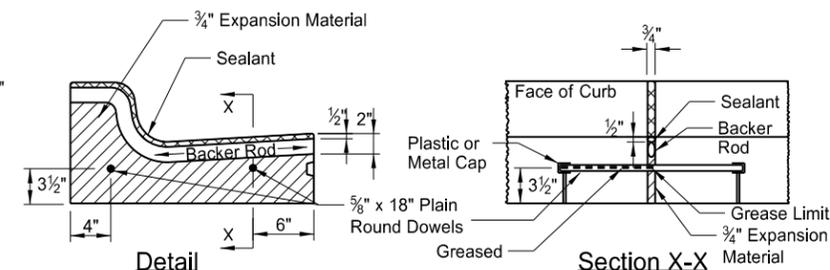
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
11-23-10	
REVISIONS	
DATE	CHANGE

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 Roger Weigel
 Registration Number PE-2930,
 on 11/23/10 and the original document is stored at the
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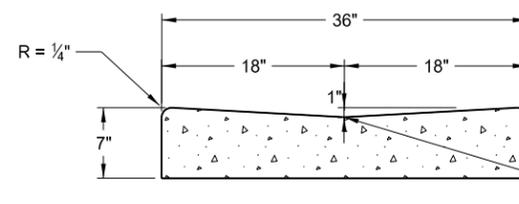
Curb & Gutter and Valley Gutter



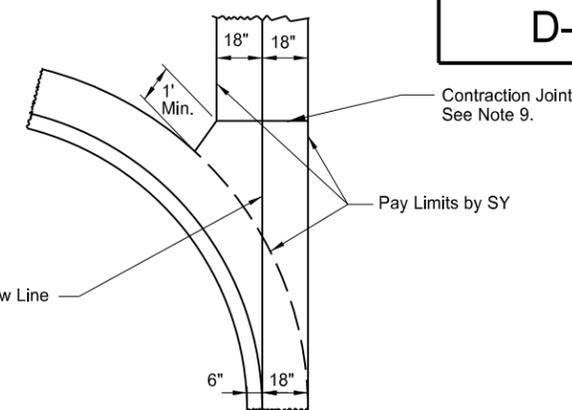
Curb & Gutter Type 1 (Sec. A & B)
Adjacent to Concrete Sidewalk,
Median, or Parking Lot.
(Sec. A shown. See Sec B for
additional details.)



Isolation Joint



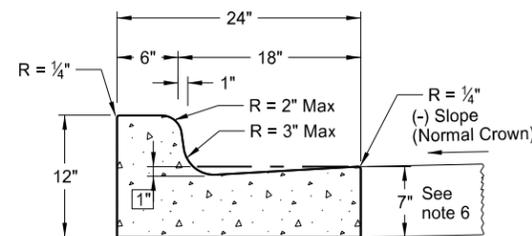
36" Concrete Valley Gutter Detail



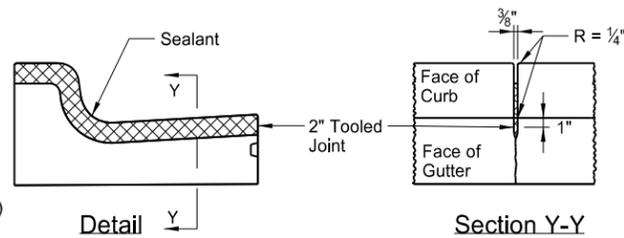
36" Concrete Valley Gutter Plan

NOTES:

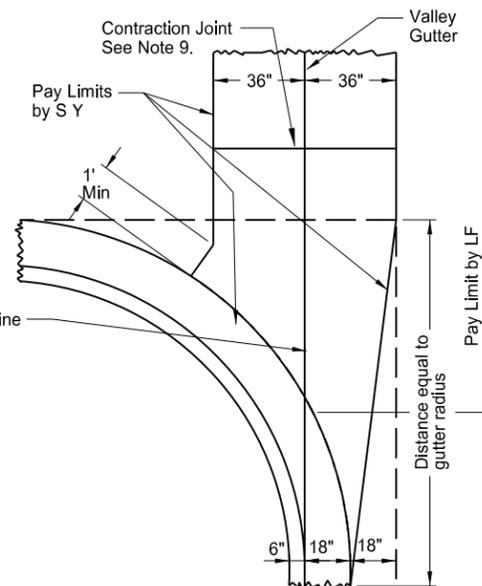
1. Curb and Gutter Type 1 (Sec. A & B) to be used. Section "A" to be used with (-) pavement slopes and section "B" to be used with (+) pavement slopes.
2. Contraction Joints: Tool the Curb & Gutter 2" as shown on the contraction joint details.
3. Isolation Joints: Isolation joint material shall be 3/4" preformed expansion joint filler conforming to the standard specifications. The opening for the backer rod and joint sealant shall be formed by a pre-cut piece of wood or other material approved by the engineer. Dowel supports are not required on the second pour at a cold joint, plastic or metal caps and greased dowels shall be installed in the cold joint for the second pour.
4. Joint Spacing: For hot bituminous pavements the joint spacing for the curb and gutter shall be 10' max. with the panels on each side of the inlets. For concrete pavements the joint spacing for the curb and gutter shall match the pavement joint on PCC Pavements of approximately 15' spacing.
5. Joint sealing: All contraction and isolation joints shall be sealed as shown in the details. The joint sealant for contraction joints shall conform to section 826.02B. The sealant for expansion joints shall be as specified in note 3 above. The sealant shall be tooled and installed in accordance with the manufacturer's recommendations.
6. Depth of Face of Gutter: For hot bituminous pavement the depth of gutter shall be 7" as shown. For PCC pavements, the Contractor has the option to match the depth of gutter to the depth of the adjacent PCC pavement or to construct a 7" depth as shown.
7. When the curb and gutter abuts PCC pavement, it shall be tied to the PCC pavement. The tie bar shall consist of a No. 3 bar, 1'-6" in length spaced 4' center to center.
8. On street returns and other locations where the new curb and gutter ends and does not abut existing curb and gutter, the end two (2) feet of the curb shall be tapered from 6" in height to 0". A 1/2" preformed isolation joint which is full depth and the same shape as the curb and gutter shall be installed just ahead of the taper. An 18" tie bar shall be installed across the joint.
9. Valley Gutter Joints: Contraction joints are required at approx. 10' intervals. The contraction joints shall be 1/8" min. to 3/8" max. in width. The joints shall be formed by sawing or scoring to a minimum depth of 2". The joint sealant shall be a hot poured elastic type joint sealer in accordance with Section 826.02A.2 of the Standard Specifications. The joint and sealant shall be included in the price bid for Valley Gutter.



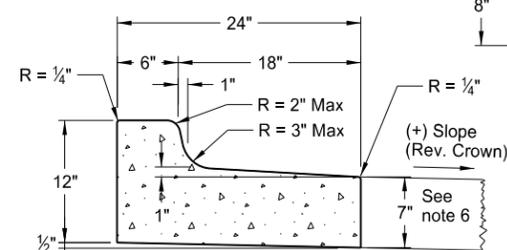
Curb & Gutter Type 1 (Sec. A)



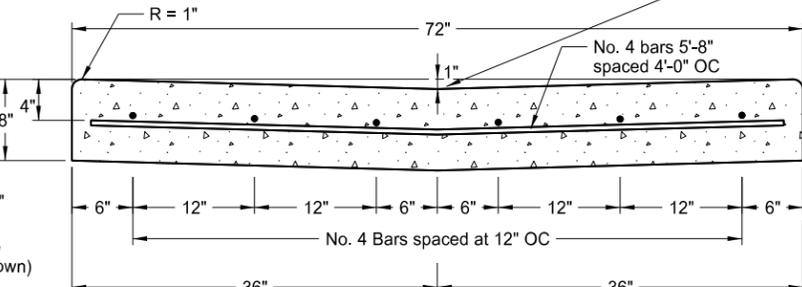
Contraction Joint



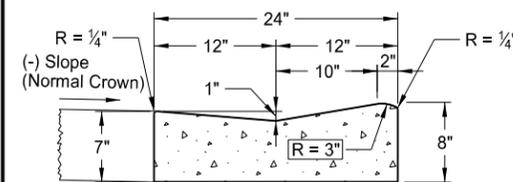
72" Concrete Valley Gutter Plan



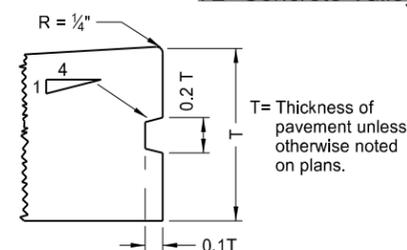
Curb & Gutter Type 1 (Sec. B)



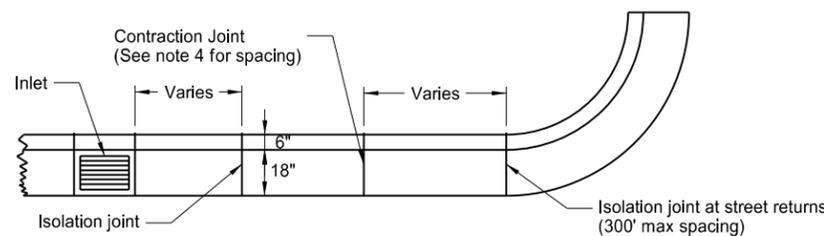
72" Concrete Valley Gutter Detail



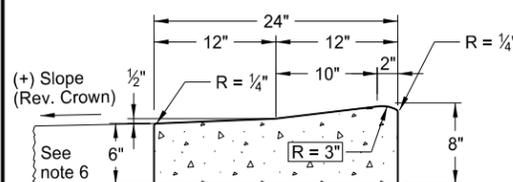
Mountable Curb & Gutter Type 1 (Sec. A)



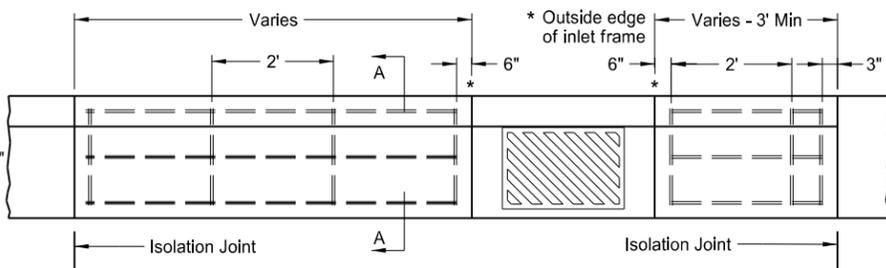
Keyway Detail for Curb & Gutter
(To be used with PCC Pavement and Drives)



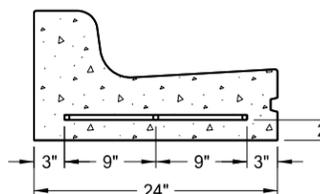
Joint Location Detail



Mountable Curb & Gutter Type 1 (Sec. B)



Curb & Gutter Reinforcing at Inlets



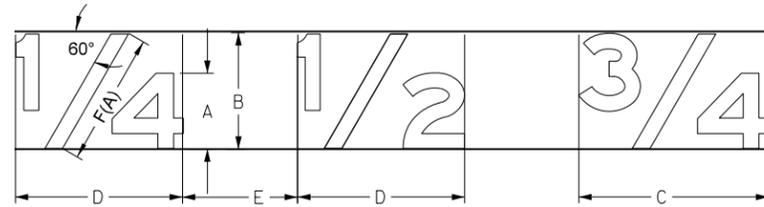
Section A-A

NOTE: All bars shall be #4 deformed reinforcing bars. Splices will not be permitted. Reinforcing bars at inlet locations will not be paid for separately, but shall be included in the price bid for "Curb and Gutter - Type 1." This includes inlets located on radii. The reinforcement shall be extended to the second joint (rebar placed through the first joint) in cases where the 3' min. panel length cannot be obtained.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-7-2013	
REVISIONS	
DATE	CHANGE

This document was originally issued and sealed by
Roger Weigel
Registration Number
PE-2930,
on 08/07/2013 and the original document is stored at the
North Dakota Department
of Transportation

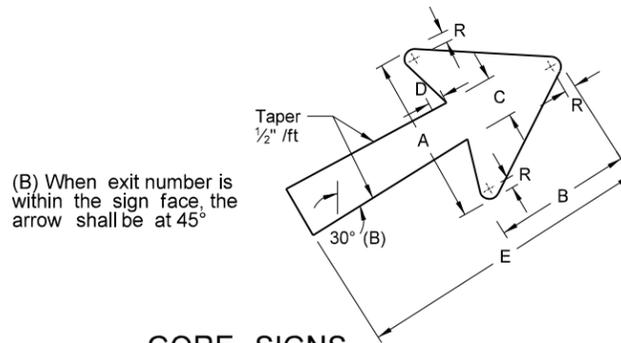
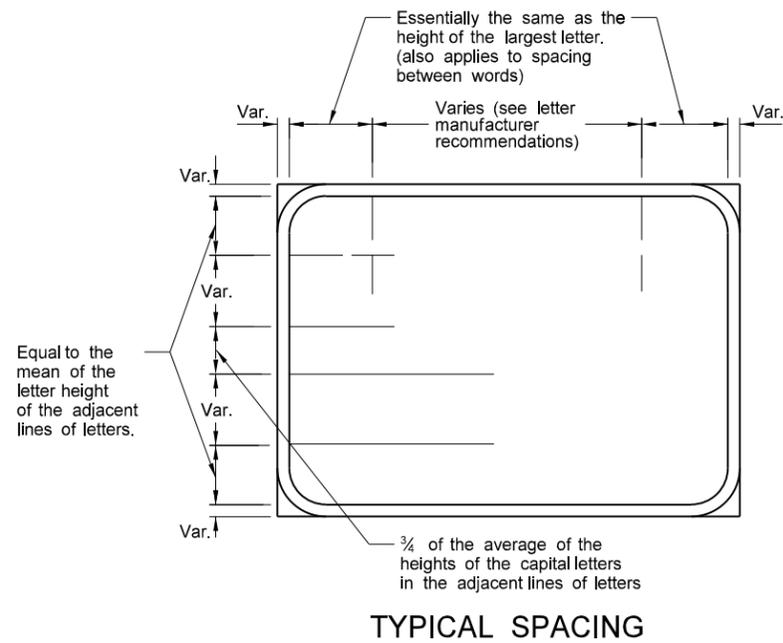
LETTER AND ARROW DETAILS FOR VARIABLE LENGTH SIGNS



SIZE OF THE FRACTION IS DETERMINED AS FOLLOWS:

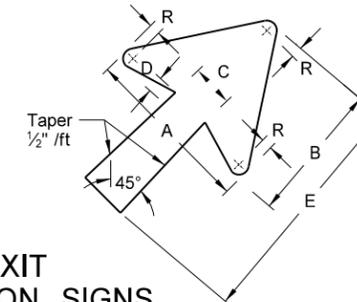
SYMBOL	TITLE	RATIO TO HEIGHT OF CAPITAL OR UPPER CASE
A	Letter height	1.0 of capital or upper case
B	Fraction height	1.5 X A
C	Fraction width	2.5 X A
D	Fraction width	2 X A
E	Space to next character	1 to 1.5 X A
F(A)	Length of diagonal	1.75 X A

(A) Diagonal stroke of fraction is to be centered optically.



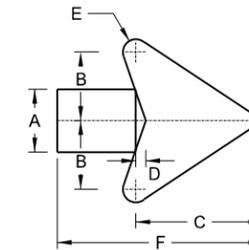
GORE SIGNS

"EXIT" LETTER SIZE (Upper Case)	A	B	C	D	E	R
8"	15 1/8"	11 1/16"	3 3/4"	1 5/16"	25"	13 1/16"
10" - 13 1/3"	18 1/4"	14"	4 1/2"	1 1/2"	30"	3/4"



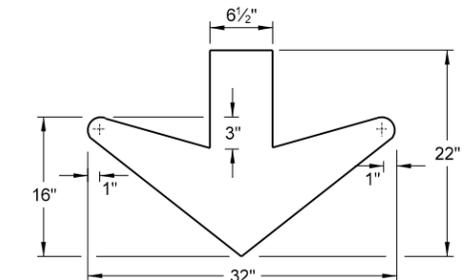
EXIT DIRECTION SIGNS

LETTER SIZE (Upper Case)	A	B	C	D	E	R
8"	15 1/8"	11 1/16"	3 3/4"	1 5/16"	17"	13 1/16"
10" - 13 1/3"	18 1/4"	14"	4 1/2"	1 1/2"	20"	3/4"
16" - 20"	22 1/4"	17"	5 3/8"	1 3/4"	25"	1"



DISTANCE AND DESTINATION SIGNS

LETTER SIZE (Upper Case)	A	B	C	D	E	F
6"	2 3/4"	3"	5 1/16"	7/16"	9/16"	9"
8"	3 1/2"	4"	7 1/8"	9/16"	1 1/16"	12"
12"	5 1/4"	6"	10 5/8"	1 3/16"	1 1/16"	18"



DOWN ARROW

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-3-11	
REVISIONS	
DATE	CHANGE

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NOTES:

1. Curbed Roadways: The clearance from the face of the curb should be 3' except where right of way or sidewalk width is limited, a minimum clearance of 2' shall be provided. The horizontal clearance may need to be increased to maintain a minimum sidewalk clear width of 4' from the sign support, not including any attached curb.

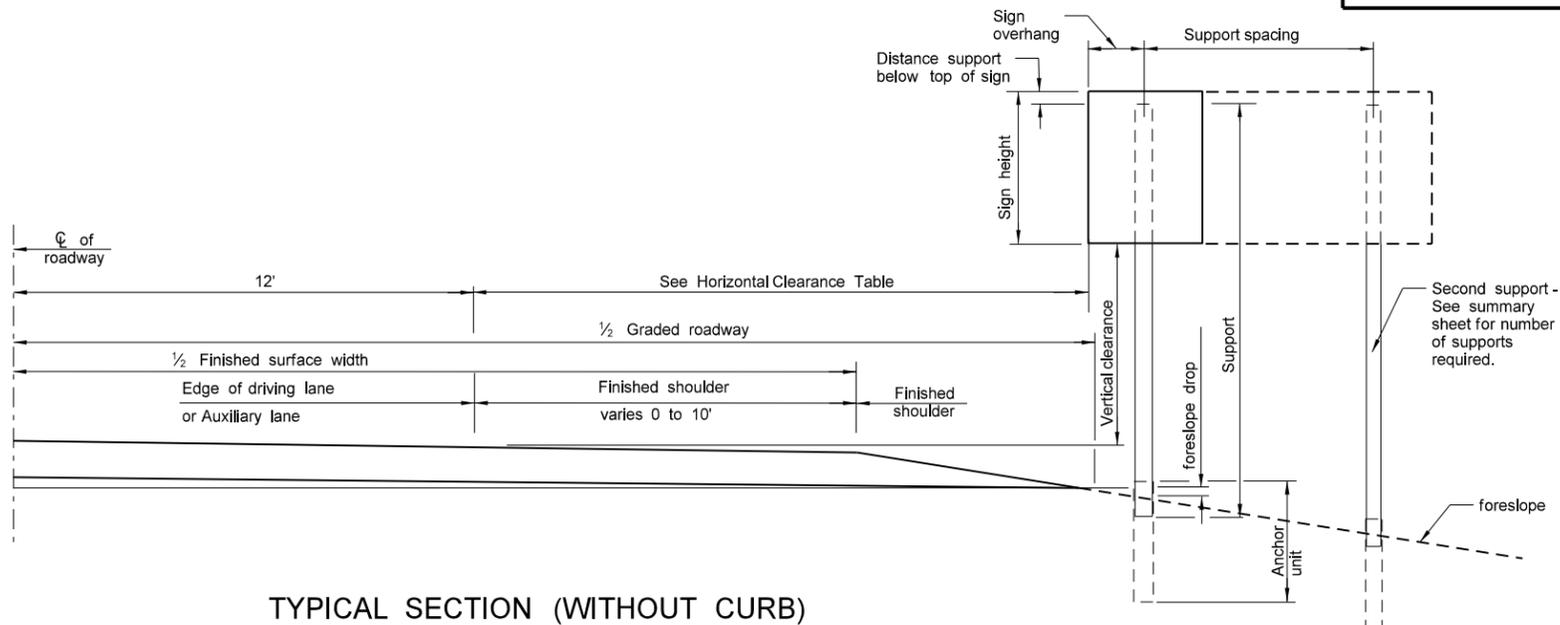
2. Minimum Vertical clearance: Signs installed at the side of the road in rural districts shall be at least 5' measured from the bottom of the sign to the edge of the driving lane or auxiliary lane. Where parking or pedestrian movements occur, the clearance to the bottom of the sign shall be at least 7'.

Directional signs on expressways and freeways shall be installed with a minimum height of 7'. If the secondary sign is mounted below another sign, the major sign shall be installed at least 8' and the secondary sign shall be installed at least 5' above the edge of the driving lane. All route signs, warning signs, and regulatory signs on expressways and freeways shall be at least 7' above the edge of the driving lane. Where signs are placed at least 30 feet or more from the edge of the traveled way, the height to the bottom of such sign shall be 5' above the edge of the driving lane.

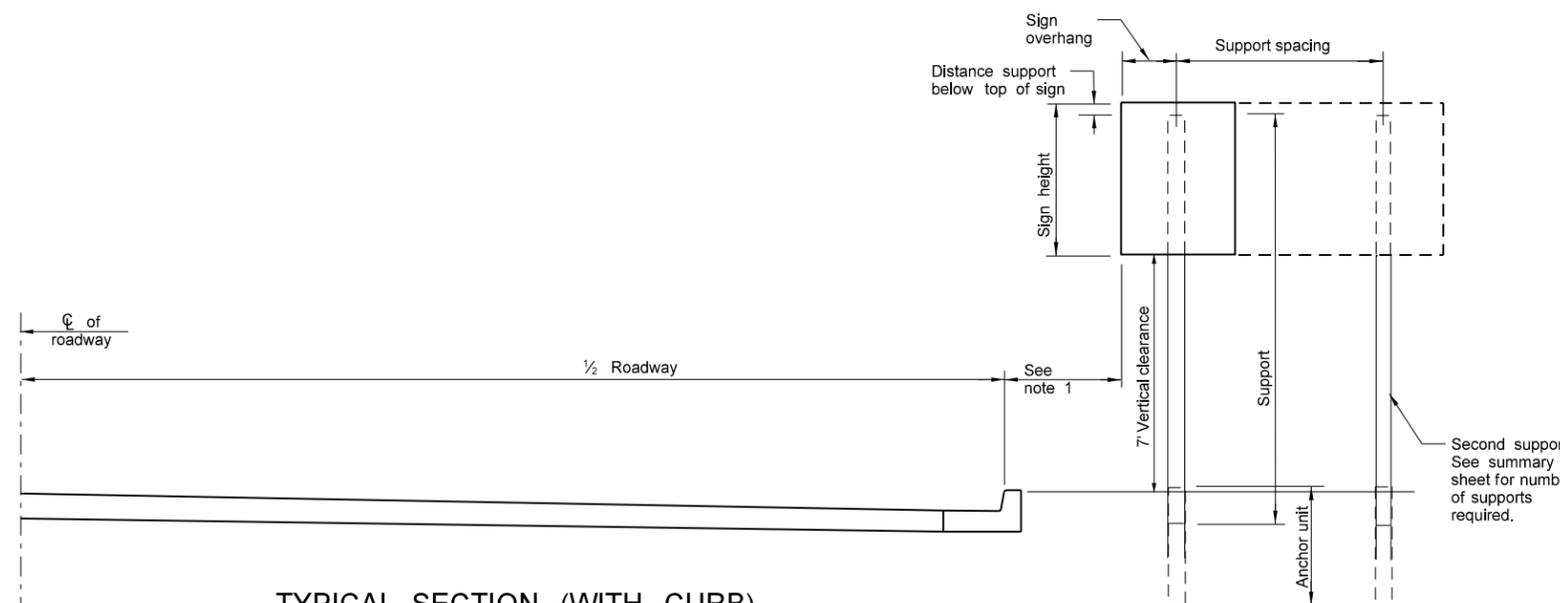
The vertical clearance shall have a maximum height of 6" above the vertical clearance specified above.

HORIZONTAL CLEARANCE TABLE	
SHOULDER WIDTH ft	OFFSET ft
0 to 2	16
>2 to 4	18
>4 to 6	20
>6 to 8	22
>8 to 10	24

ASSEMBLY DETAILS

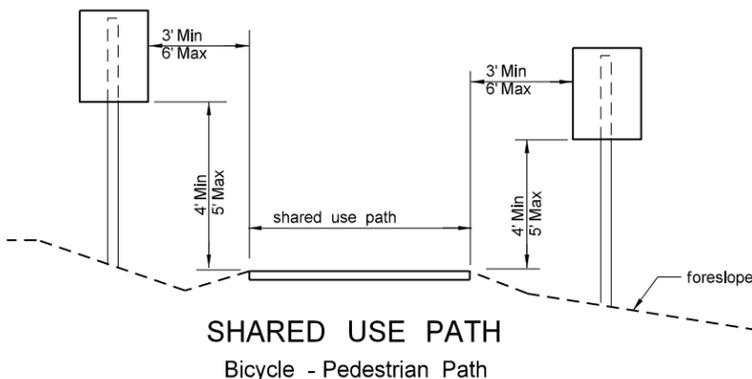


TYPICAL SECTION (WITHOUT CURB)



TYPICAL SECTION (WITH CURB)

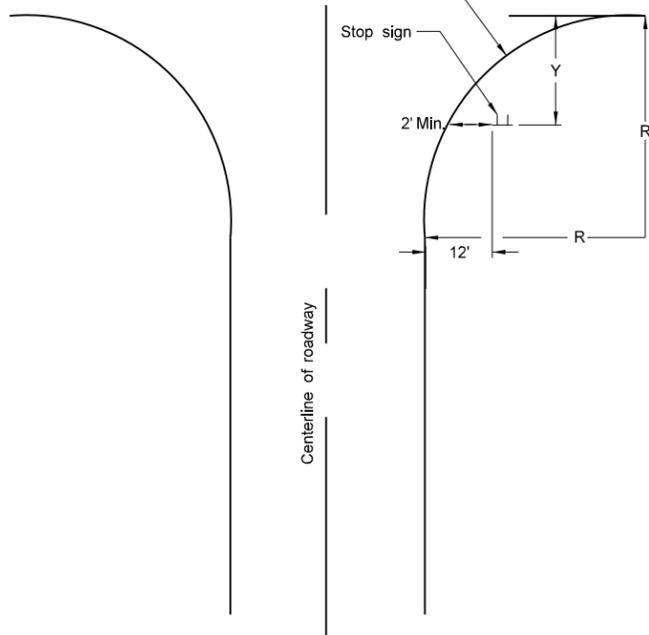
Residential or Business District



SHARED USE PATH

Bicycle - Pedestrian Path

Face of curb or edge of driving lane



STOP SIGN LOCATION WIDE THROAT INTERSECTION

Note: This layout is to be used for the placement of "Stop" signs.

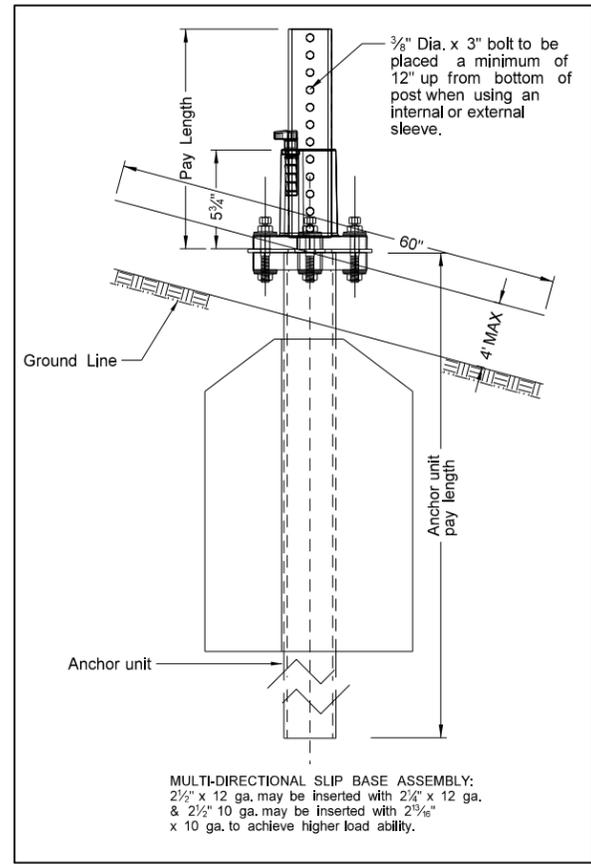
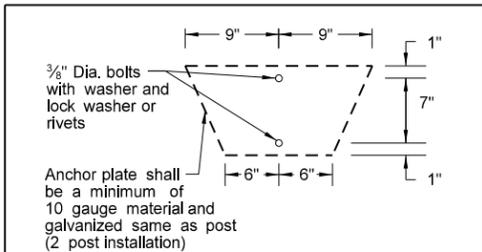
R=Radius	Y-Max	Y-Min
40'	50'	15'
45'	50'	18'
50'	50'	21'
55'	50'	25'
60'	50'	28'
65'	50'	32'
70'	50'	35'
75'	50'	39'
80'	50'	43'

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
12-1-10	
REVISIONS	
DATE	CHANGE

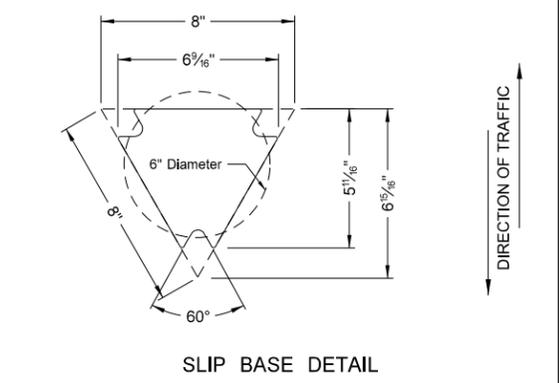
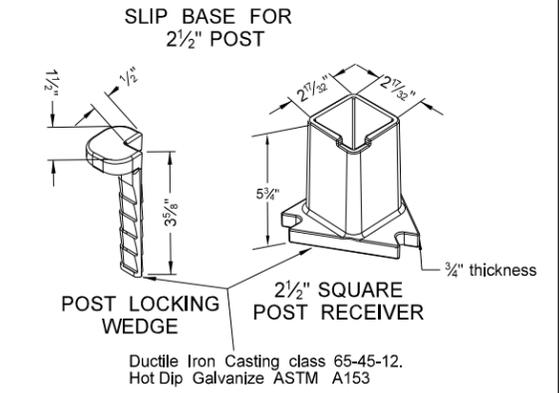
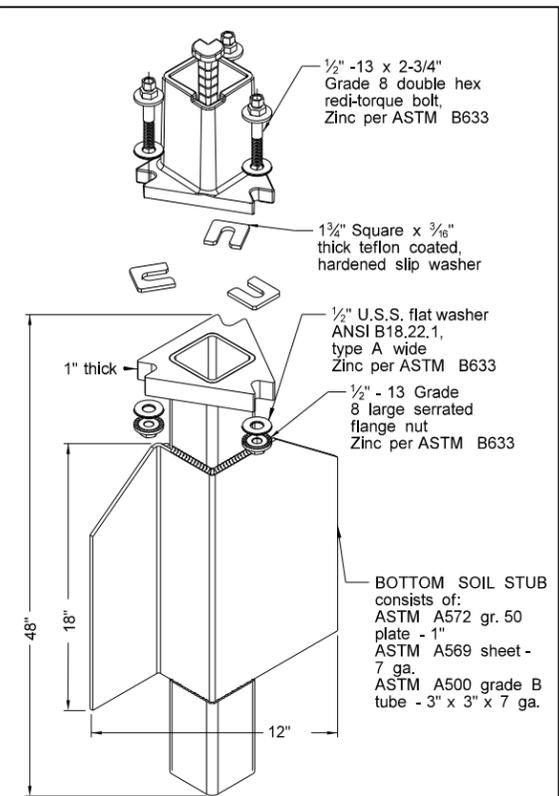
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Telescoping Perforated Tube							
Number of Posts	Post Size In.	Wall Thickness Gauge	Sleeve Size In.	Wall Thickness Gauge	Slip Base	Anchor Size Without Slip Base In.	Anchor Wall Thickness Gauge
1	2	12			No	2 1/4	12
1	2 1/4	12			No	2 1/2	12
1	2 1/2	12			(B)	3(C)	7
1	2 1/2	10			Yes		7
1	2 1/4	12	2 1/2(D)	12	Yes		7
1	2 1/2	12	2 1/4	12	Yes		7
2	2 1/2	10			Yes		7
2	2 1/4	12	2 1/2(D)	12	Yes		7
2	2 1/2	12	2 1/4	12	Yes		7
3 & 4	2 1/2	12			Yes		7
3 & 4	2 1/2	10			Yes		7
3 & 4	2 1/2	12	2 1/4	12	Yes		7
3 & 4	2 1/2	12	2 1/2(D)	12	Yes		7
3 & 4	2 1/2	10	2 1/8	10	Yes		7

(B) - The 2 1/2", 12 gauge posts do not need breakaway bases when placed in standard soils, but require a shim as specified by the manufacturer. The breakaway base is required when the support is placed in weak soils. The Engineer shall determine if the soils are weak. Weak soils are classified as boggy, wet, or loose soil areas.
 (C) - 3" anchor unit
 (D) - 2 1/2" x 12 ga. x 18" minimum length external sleeve required.



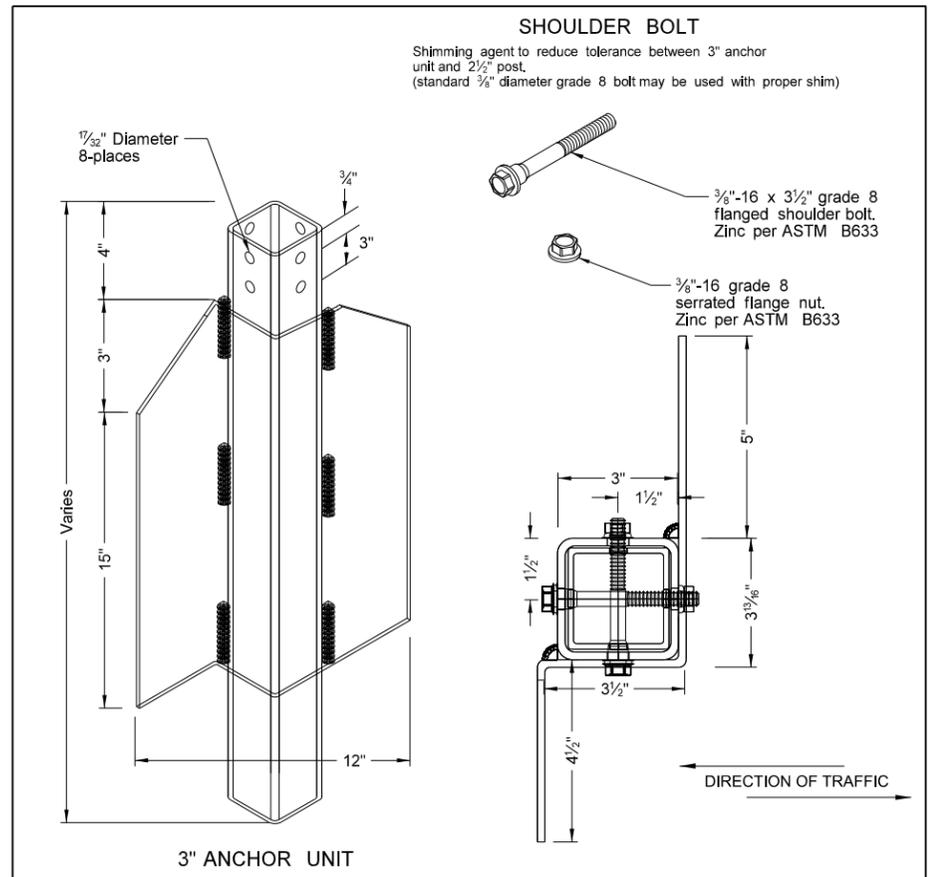
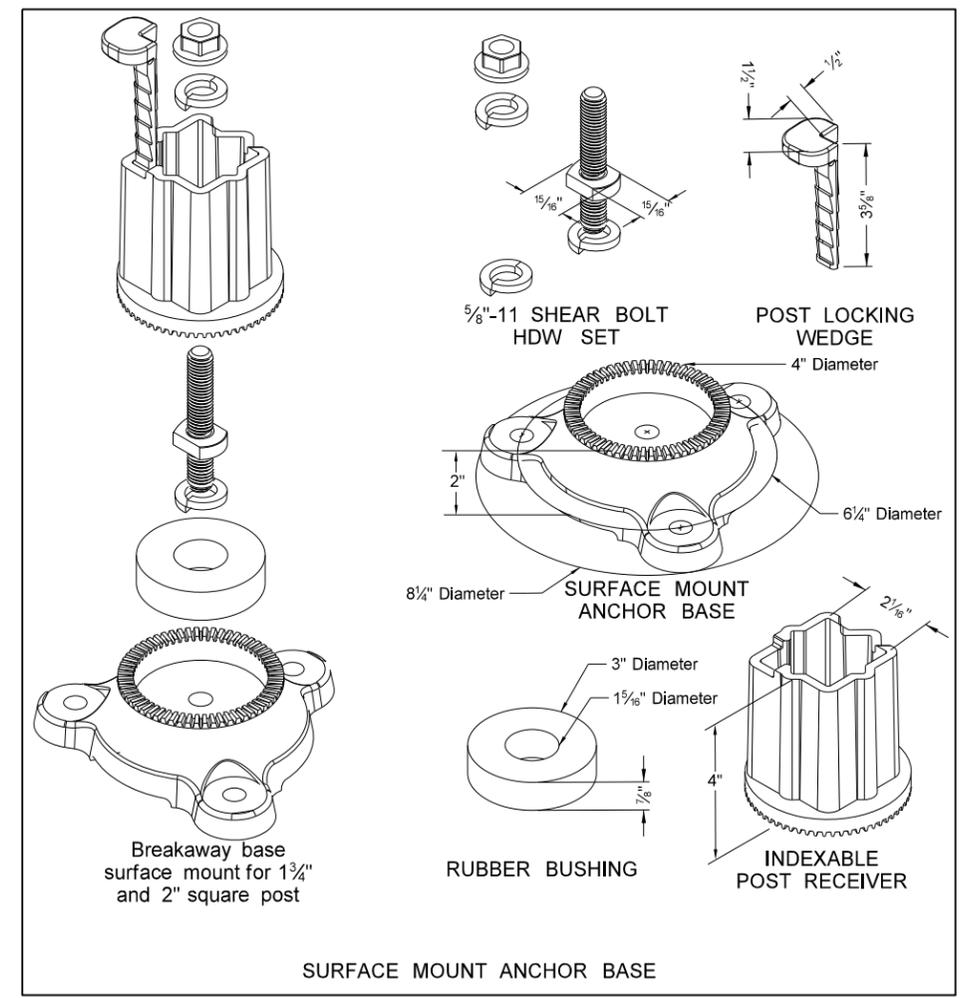
Mounting Details Perforated Tube



Properties of Telescoping Perforated Tubes							
Tube Size In.	Wall Thickness In.	U.S. Standard Gauge	Weight Per Foot Lbs.	Moment of Inertia In. ⁴	Cross Sect. Area In. ²	Section Modulus In. ³	
1 1/2 x 1 1/2	0.105	12	1.702	0.129	0.380	0.172	
2 x 2	0.105	12	2.416	0.372	0.590	0.372	
2 1/4 x 2 1/4	0.105	12	2.773	0.561	0.695	0.499	
2 3/8 x 2 3/8	0.135	10	3.432	0.605	0.841	0.590	
2 1/2 x 2 1/2	0.105	12	3.141	0.804	0.803	0.643	
2 1/2 x 2 1/2	0.135	10	4.006	0.979	1.010	0.783	

The 2 3/8" size 10 gauge is shown as 2.19" size on the plans;
 The 2 1/2" size is shown as 2.51" size on the plans.

- NOTE:
- 4" Vertical clearance of anchor or breakaway base. The 4" x 60" measurement shall be made above and below post location and also back and ahead of post.
 - Anchor material shall be 7 gauge H.R.P.O. Commercial quality ASTM A569 and 3" x 3" x 7" gauge ASTM A500 grade B. Anchor shall have a yield strength 43.9 KSI and tensile strength of 59.3 KSI. Anchor shall be hot dipped galvanized per ASTM A123/153. All tolerances on anchor unit and slip base bottom assembly are +/- 0.005" unless otherwise noted.
 - When used in concrete sidewalk, anchor shall be the same concept without the wings.
 - Four post signs shall have over 8" between the first and fourth posts.
 - Installation procedures as per manufacturers recommendation.
 - Concrete fasteners for surface mount breakaway base shall be a minimum 1/2" diameter x 4" grade 8.



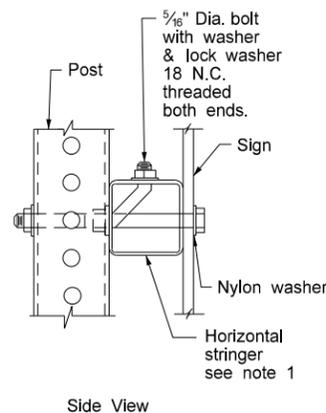
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8-6-09	
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DATE	CHANGE

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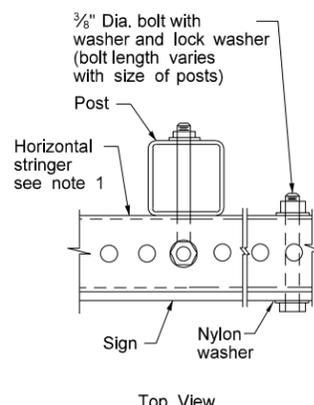
Mounting Details Perforated Tube

Note:

- Horizontal stringers - In lieu of perforated tubes, the contractor may substitute z bar stringers. The z bar stringers shall be 1 3/4" x 3/16" thick, 1.08 lbs./ft aluminum or 3.16 lbs./ft steel.
- Metal washers used on sign face shall have a minimum outside diameter of 15/16" ± 1/16" and 10 gauge thickness.
- No Parking Signs: All no parking signs with directional arrows shall be placed at a 30 to 45 degree angle with the line of traffic flow. No parking signs required at the above angles may have the support turned to the correct angle. If the no parking sign is placed with another sign that has to be placed at a 90 degree angle with the line of traffic flow, the detailed angle strap should be used to mount the no parking sign. Flat washers and lock washers shall be used with all nylon washers. Material used for the attachment strap shall be included in the price bid for "Flat sheet for signs."
- In lieu of using the bent bolt to attach the post to the stringer, the contractor may choose to punch the sign backing and place the bolt through the sign, the stringer and the post.
- 4" vertical clearance of anchor or breakaway base. The 4" x 60" measurement shall be made above and below post location and also back and ahead of post.

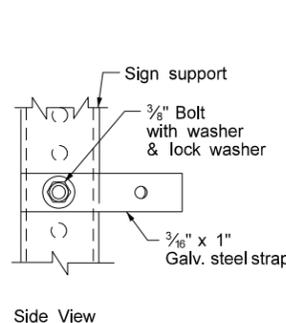


Side View

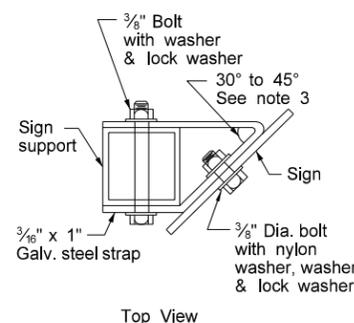


Top View

STRINGER MOUNTING
(WITH STRINGER IN FRONT OF POST)

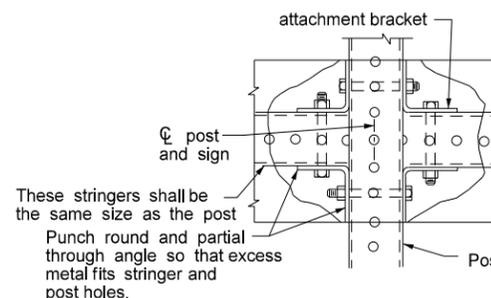


Side View



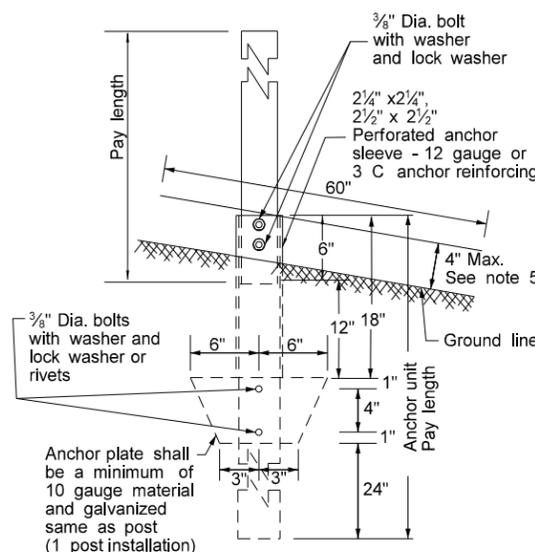
Top View

STRAP DETAIL



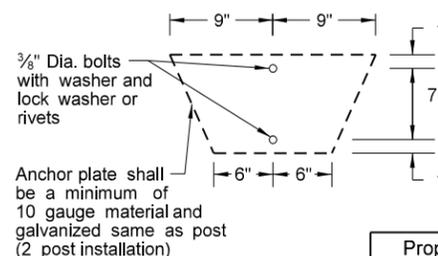
These stringers shall be the same size as the post. Punch round and partial through angle so that excess metal fits stringer and post holes.

STREET NAME SIGNS
AND ONE WAY SIGNS
SINGLE POST ASSEMBLY
ONE STRINGER OR
BACK TO BACK MOUNTING

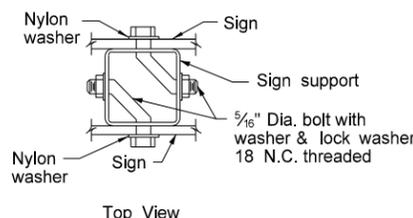


Anchor plate shall be a minimum of 10 gauge material and galvanized same as post (1 post installation)

ANCHOR UNIT AND
POST ASSEMBLY

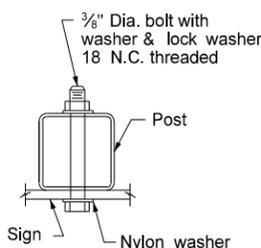


Anchor plate shall be a minimum of 10 gauge material and galvanized same as post (2 post installation)



Top View

BACK TO BACK
MOUNTING



BOLT MOUNTING

Properties of Telescoping Perforated Tubes						
Tube Size In.	Wall Thickness In.	U.S. Standard Gauge	Weight Per Foot Lbs.	Moment of Inertia In. ⁴	Cross Sect. area In. ²	Section Modulus In. ³
1 1/2" x 1 1/2"	0.105	12	1.702	0.129	0.380	0.172
2" x 2"	0.105	12	2.416	0.372	0.590	0.372
2 1/4" x 2 1/4"	0.105	12	2.773	0.561	0.695	0.499
2 3/8" x 2 3/8"	0.135	10	3.432	0.605	0.841	0.590
2 1/2" x 2 1/2"	0.105	12	3.141	0.804	0.803	0.643
2 1/2" x 2 1/2"	0.135	10	4.006	0.979	1.010	0.783

The 2 3/8" size 10 gauge is shown as 2.19" size on the plans. The 2 1/2" size is shown as 2.51" size on the plans.

Number of Posts	Telescoping Perforated Tube						
	Post Size In.	Wall Thickness Gauge	Sleeve Size In.	Wall Thickness Gauge	Slip Base	Anchor Size Without Slip Base In.	Anchor Wall Thickness Gauge
1	2	12			No	2 1/4	12
1	2 1/4	12			No	2 1/2	12
1	2 1/2	12			(B)	3(C)	7
1	2 1/2	10			Yes		7
1	2 1/4	12	2 1/2(D)	12	Yes		7
1	2 1/2	12	2 1/4	12	Yes		7
2	2 1/2	10			Yes		7
2	2 1/4	12	2 1/2(D)	12	Yes		7
2	2 1/2	12	2 1/4	12	Yes		7
3 & 4	2 1/2	12			Yes		7
3 & 4	2 1/2	10			Yes		7
3 & 4	2 1/2	12	2 1/4	12	Yes		7
3 & 4	2 1/4	12	2 1/2(D)	12	Yes		7
3 & 4	2 1/2	10	2 3/8	10	Yes		7

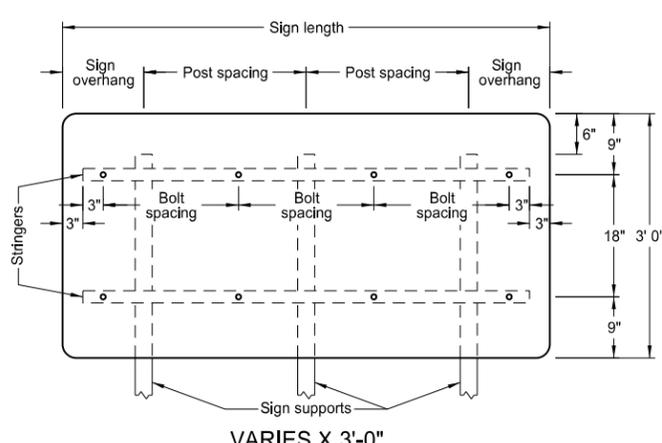
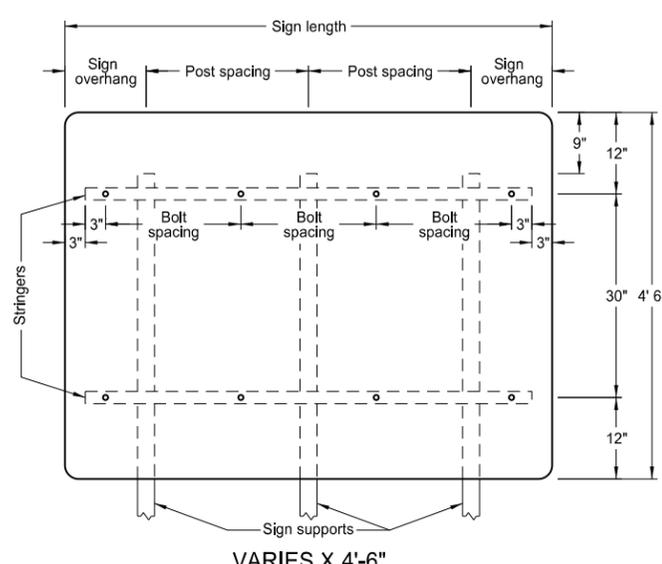
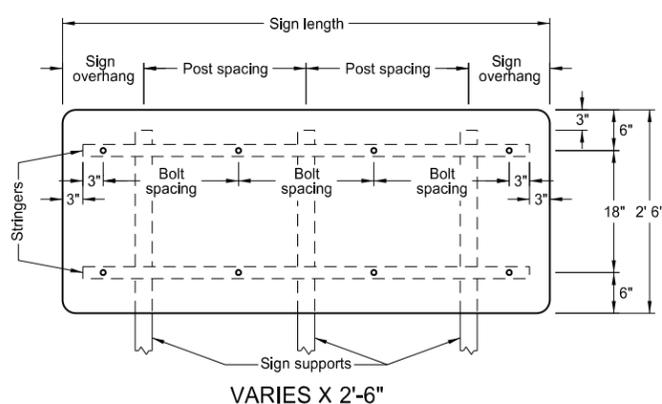
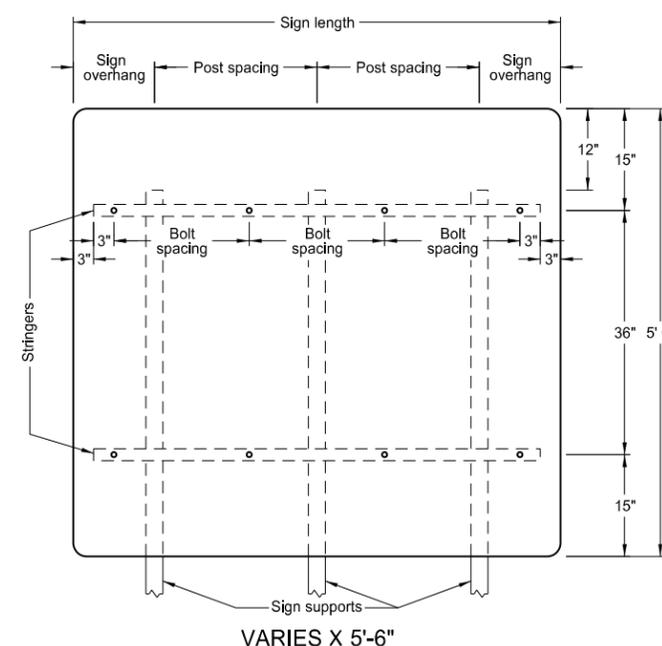
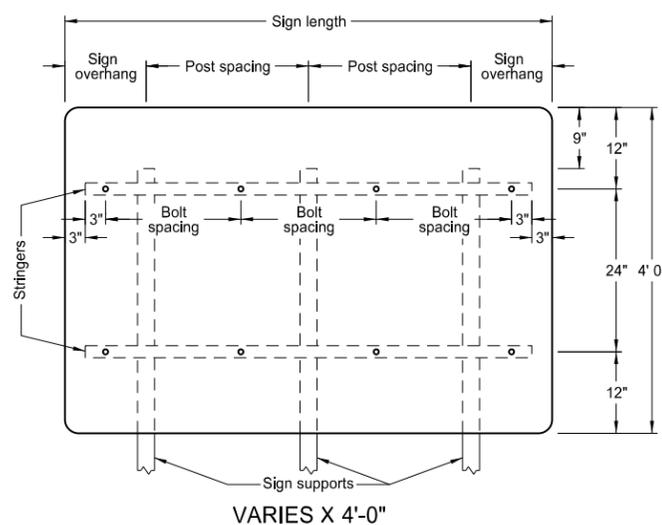
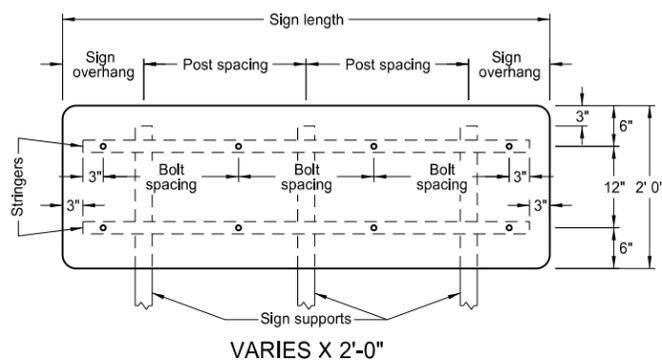
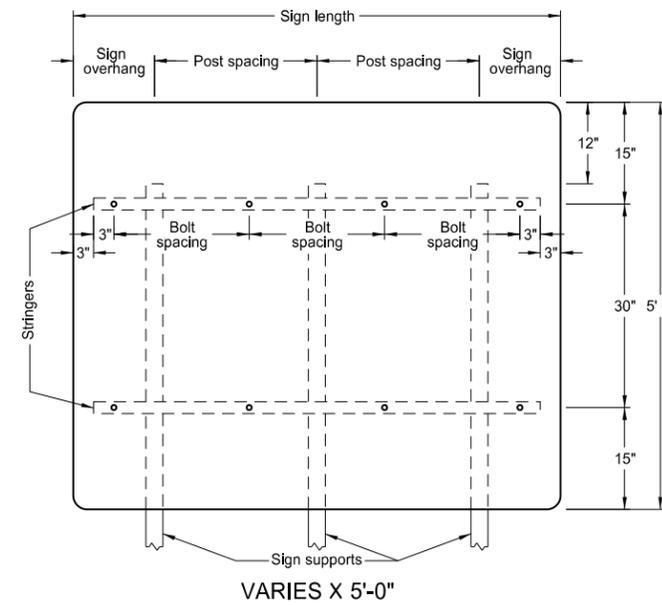
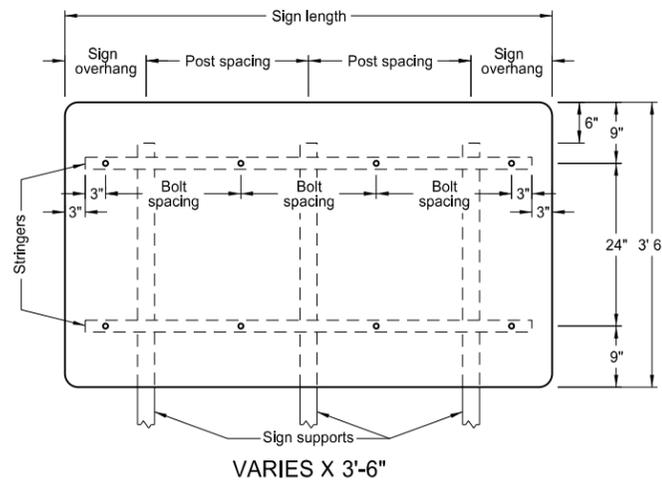
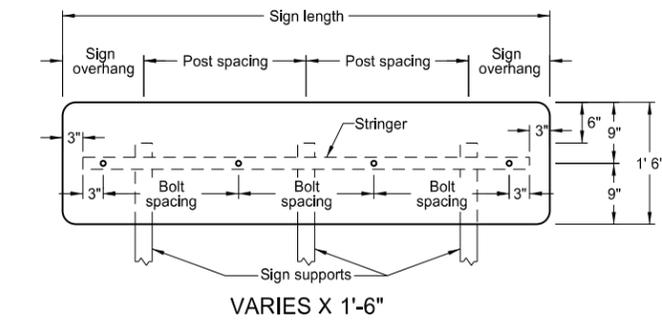
(B) - The 2 1/2", 12 gauge posts do not need breakaway bases when placed in standard soils, but require a shim as specified by the manufacturer. The breakaway base is required when the support is placed in weak soils. The Engineer shall determine if the soils are weak. Weak soils are classified as boggy, wet, or loose soil areas.
(C) - 3" anchor unit
(D) - 2 1/2" x 12 ga. x 18" minimum length external sleeve required.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-6-09	
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SIGN PUNCHING, STRINGER AND SUPPORT LOCATION DETAILS FOR VARIABLE LENGTH SIGNS

D-754-49



3 POSTS			
Sign Length	Sign Overhang	Post Spacing	Bolt Spacing
4'-0"	0'-6"	1'-6"	18"
4'-6"	0'-6"	1'-9"	21"
5'-0"	0'-6"	2'-0"	24"
5'-6"	1'-3"	1'-6"	18"
6'-0"	1'-0"	2'-0"	20"
6'-6"	1'-3"	2'-0"	22"
7'-0"	1'-6"	2'-0"	24"
7'-6"	1'-6"	2'-3"	2-20" & 2-19"
8'-0"	1'-9"	2'-3"	21"
8'-6"	2'-0"	2'-3"	2-22" & 2-23"
9'-0"	1'-6"	3'-0"	24"
9'-6"	1'-9"	3'-0"	4-20" & 1-22"
10'-0"	1'-9"	3'-3"	2-21" & 3-22"
10'-6"	1'-9"	3'-6"	4-23" & 1-22"
11'-0"	2'-0"	3'-6"	24"
11'-6"	2'-3"	3'-6"	21"
12'-0"	2'-4"	3'-8"	22"
12'-6"	2'-5"	3'-10"	23"
13'-0"	2'-6"	4'-0"	24"
13'-6"	2'-9"	4'-0"	3-22" & 4-21"
14'-0"	3'-0"	4'-0"	2-23" & 5-22"
14'-6"	3'-3"	4'-0"	6-23" & 1-24"
15'-0"	3'-6"	4'-0"	24"
15'-6"	2'-4"	5'-5"	6-22" & 2-21"
16'-0"	2'-5"	5'-7"	4-23" & 4-22"
16'-6"	2'-5"	5'-10"	6-23" & 2-24"
17'-0"	2'-6"	6'-0"	24"
17'-6"	3'-3"	5'-6"	22"
18'-0"	3'-6"	5'-6"	6-23" & 3-22"
18'-6"	3'-9"	5'-6"	6-23" & 3-24"
19'-0"	3'-6"	6'-0"	24"
19'-6"	4'-3"	5'-6"	8-22" & 2-23"
20'-0"	4'-4"	5'-8"	8-23" & 2-22"

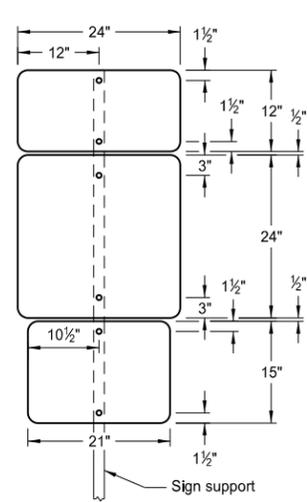
- Notes:
- The minimum sign backing material thickness shall be 0.100 inch.
 - Perforated square tube stringer shall be 1½" x 1½".
 - All holes shall be punched round for ⅜" bolt.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-25-12	
REVISIONS	
DATE	CHANGE

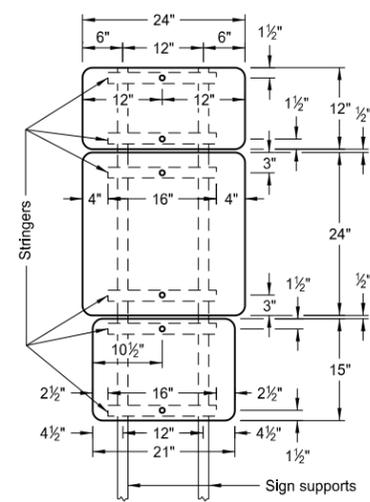
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SIGN PUNCHING, STRINGER AND SUPPORT LOCATION DETAILS - ROUTE MARKER SIGNS

D-754-53

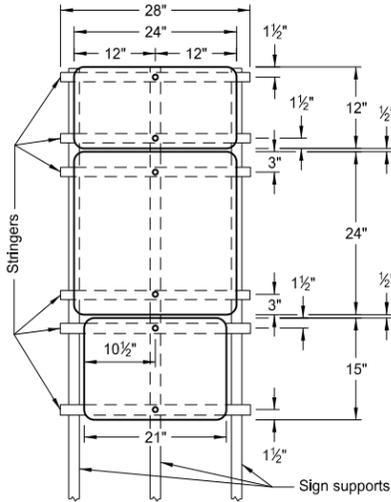


1 Post

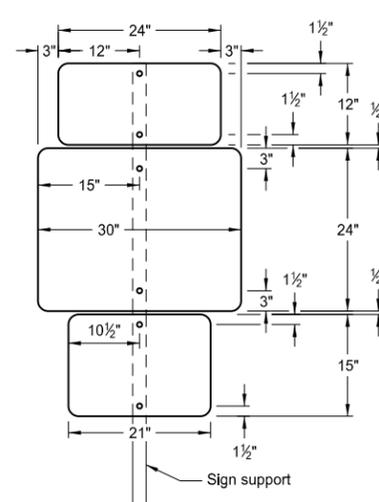


2 Posts

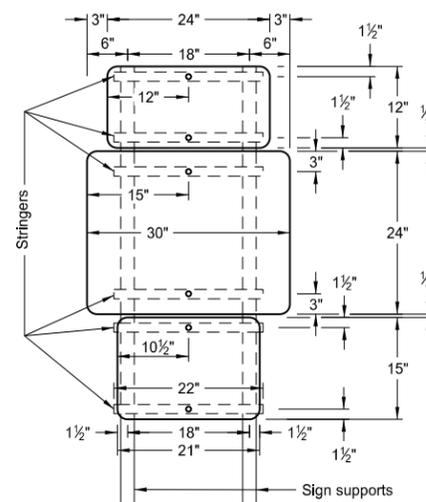
ASSEMBLY NO. 379



3 Posts

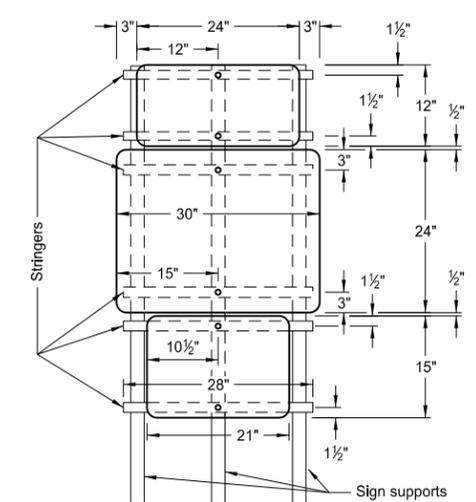


1 Post

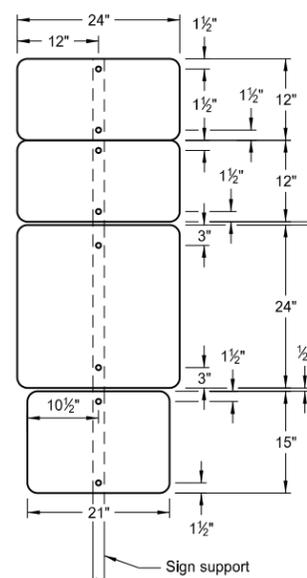


2 Posts

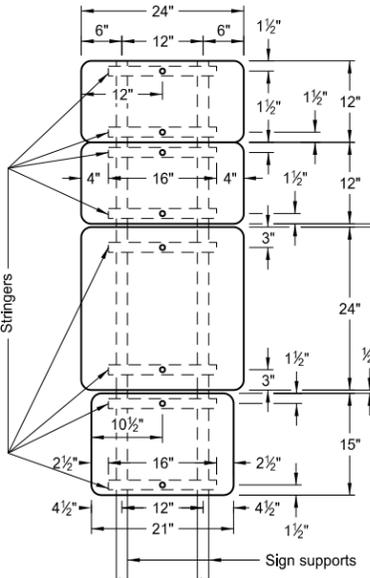
ASSEMBLY NO. 380



3 Posts

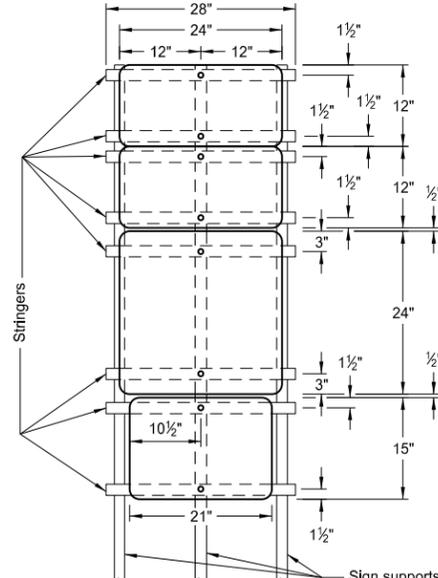


1 Post

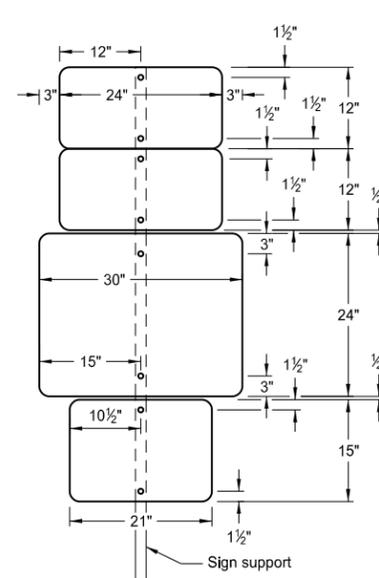


2 Posts

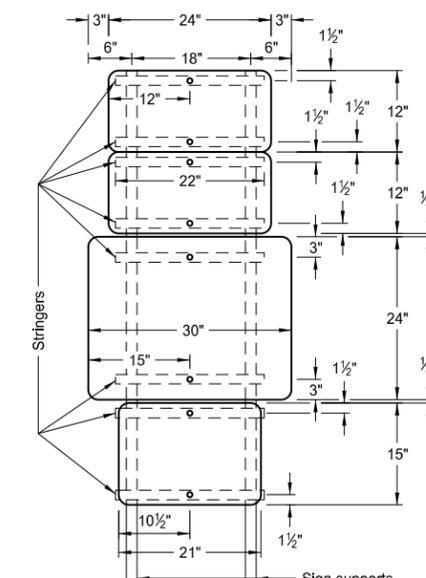
ASSEMBLY NO. 381



3 Posts

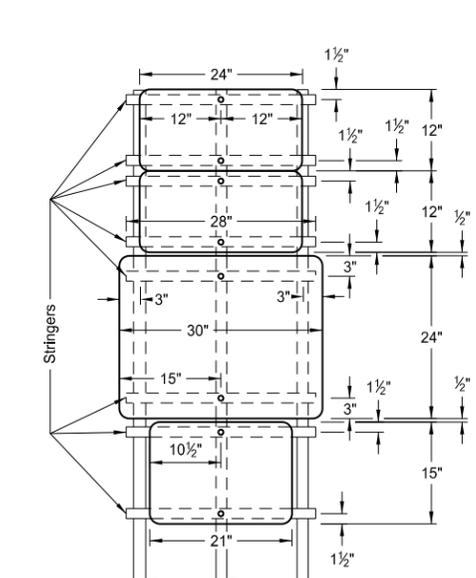


1 Post



2 Posts

ASSEMBLY NO. 382



3 Posts

Notes:

1. The minimum sign backing material thickness shall be 0.100 inch.
2. Perforated square tube stringer shall be 1 1/2"x1 1/2".
3. All holes shall be punched round for 3/8" bolt.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-22-12	
REVISIONS	
DATE	CHANGE

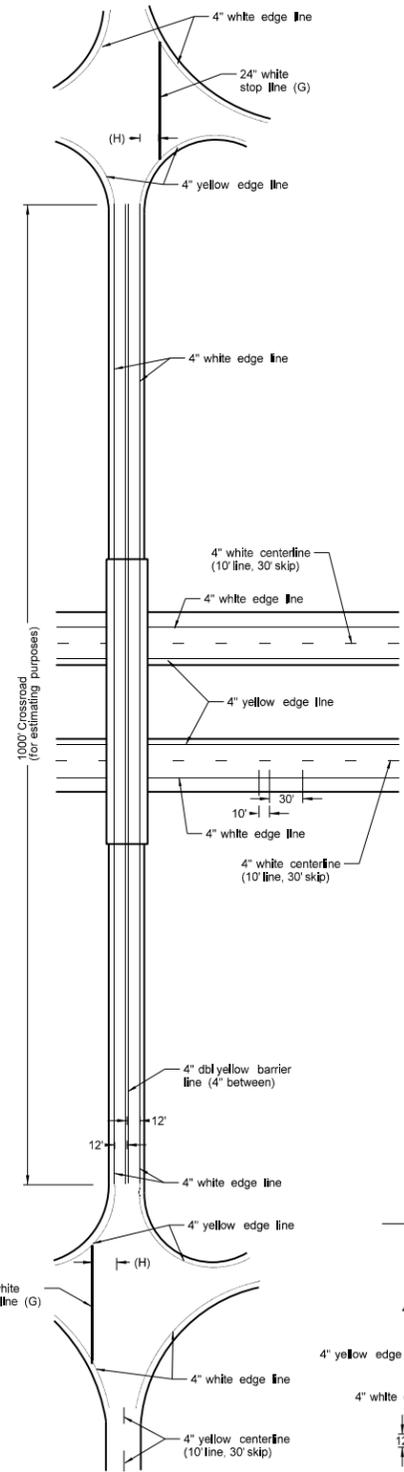
This document was originally issued and sealed by Roger Weigel Registration Number PE-2930, on 8/22/12 and the original document is stored at the North Dakota Department of Transportation

INTERSTATE PAVEMENT MARKING 4 LANE DIVIDED HIGHWAY

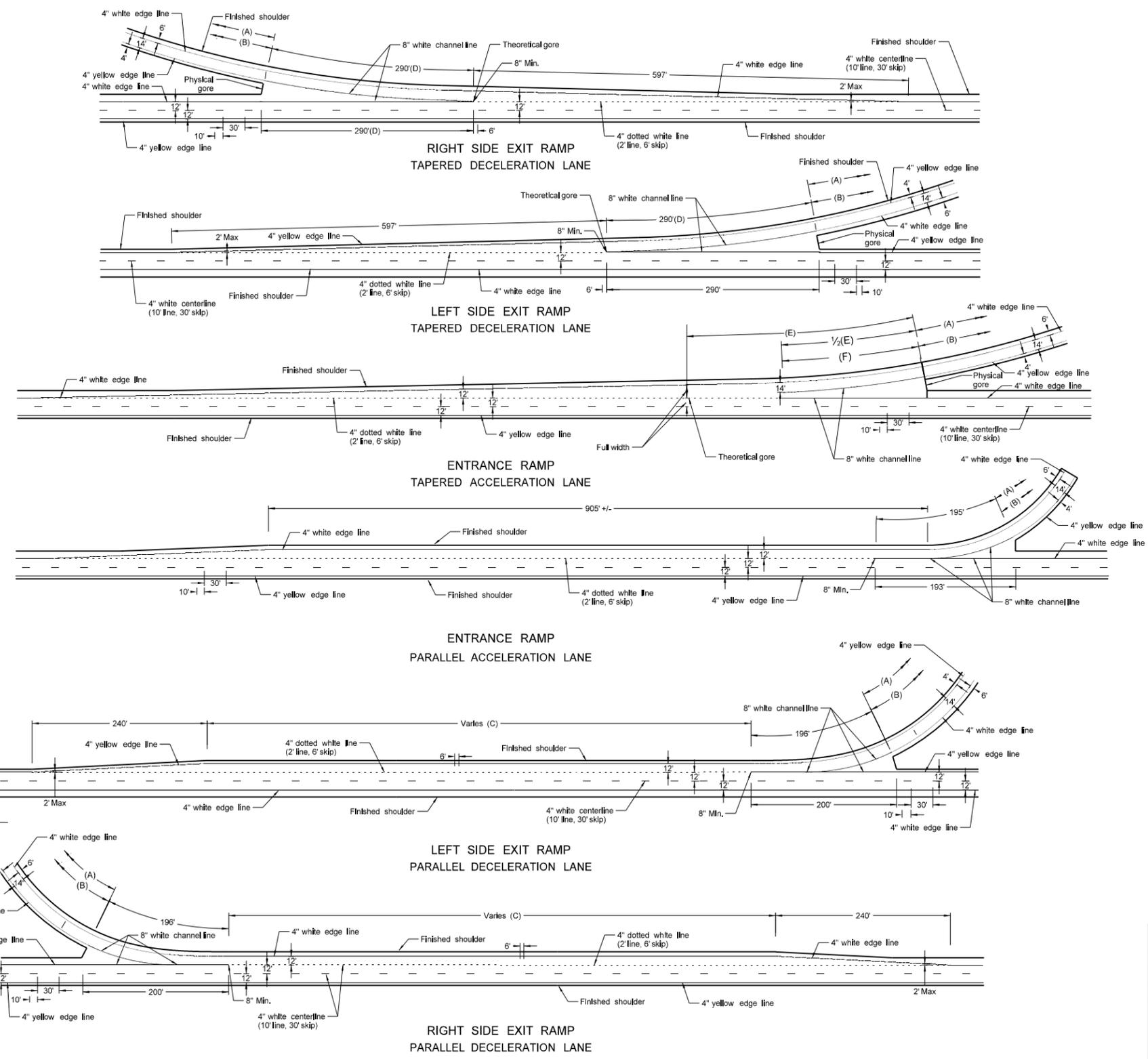
D-762-2

NOTE:

- (A) 4" White edge line
- (B) 4" Yellow edge line
- (C) Assume "varies" to equal 790' for purpose of estimate. The pavement marking shall begin at the beginning of the taper and end at the 8" line.
- (D) Beginning of physical gore to theoretical gore.
- (E) If the distance is less than 350' then extend the 8" channel line to the theoretical gore, otherwise use 195'.
- (F) 195' was used for estimating purposes.
- (G) Not required when crossroad approaches have gravel surface.
- (H) 4' minimum, 15' maximum from the nearest edge of the intersection traveled way.



CROSS-ROAD & STRUCTURE
The engineer in the field shall determine the length to be striped.

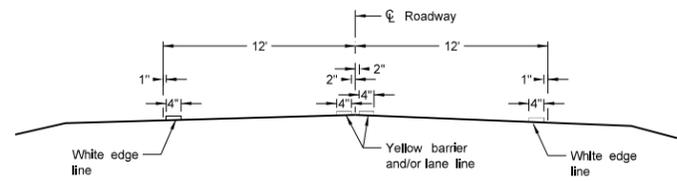


BASIS OF ESTIMATE		
LOCATION	ITEM	
Right or Left Side Exit Ramp TAPERED	8" White channel line	580 LF
	24" White stop line	60 LF
	4" White dotted line	148 LF
	4" White edge line	1115 LF
	4" Yellow edge line	1075 LF
Entrance Ramp TAPERED	8" White channel line	390 LF
	4" White dotted line	258 LF
	4" White edge line	1270 LF
	4" Yellow edge line	1075 LF
Right or Left Side Exit Ramp PARALLEL	8" White channel line	396 LF
	24" White stop line	60 LF
	4" White dotted line (C)	258 LF
	4" White edge line	1115 LF
	4" Yellow edge line	1075 LF
Entrance Ramp PARALLEL	8" White channel line	388 LF
	4" White dotted line	283 LF
	4" White edge line	1275 LF
	4" Yellow edge line	1075 LF
Main Line (Both Roadways)	4" White line, 10' line, 30' skip	2840 LF/M
	4" White edge line	10,560 LF/M
	4" Yellow edge line	10,560 LF/M
Cross Road	4" White edge line	2000 LF
	4" Dotted yellow barrier line (4" between)	2000 LF

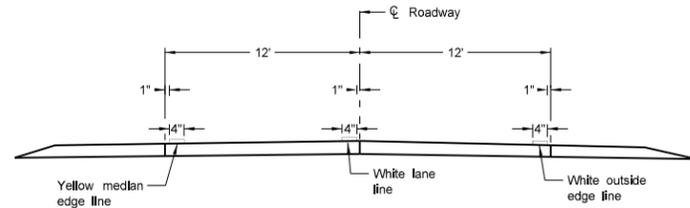
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-3-11	
REVISIONS	
DATE	CHANGE

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Roger Weigel,
 Registration Number
PE-2930,
 on **08/03/11** and the original document is stored at the
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 of Transportation

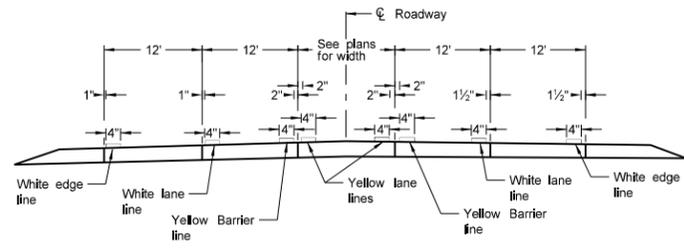
PAVEMENT MARKING



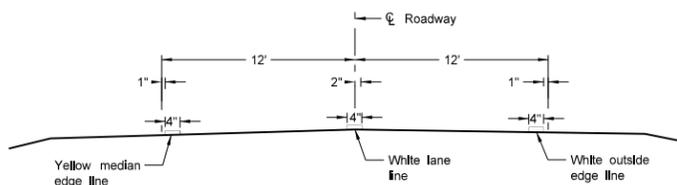
Two Lane Two Way
RURAL ROADWAY



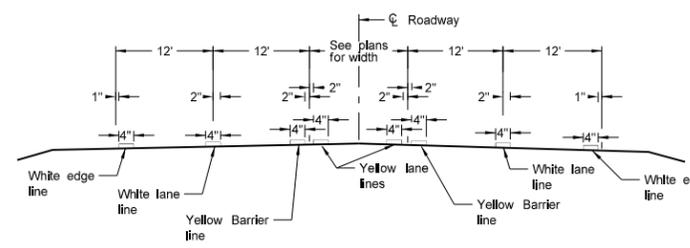
Two Lane Roadway
INTERSTATE HIGHWAY
Concrete Section



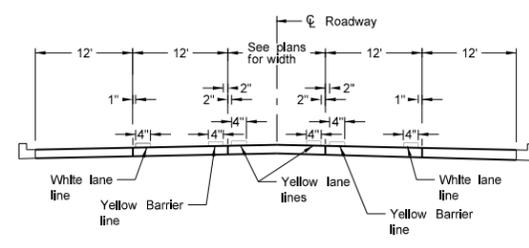
RURAL FIVE LANE ROADWAY
Concrete Section



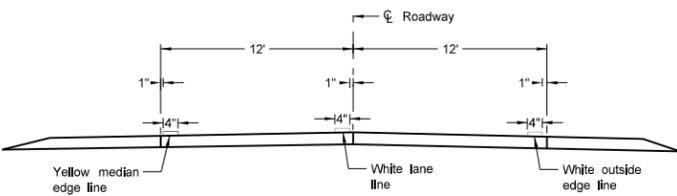
Two Lane Divided
Rural Roadway
PRIMARY HIGHWAY
Asphalt Section



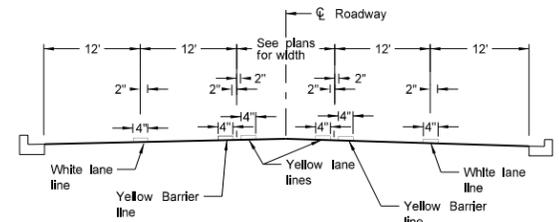
RURAL FIVE LANE ROADWAY
Asphalt Section



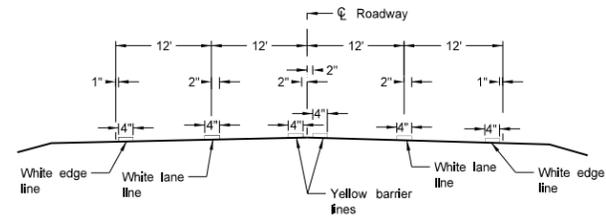
URBAN FIVE LANE SECTION
Concrete Section



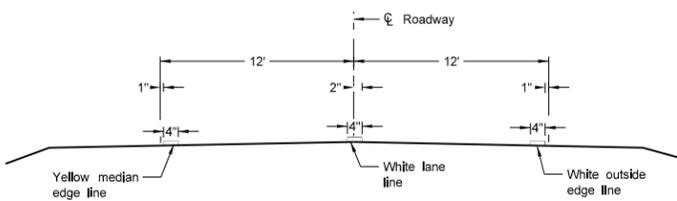
Two Lane Roadway
PRIMARY HIGHWAY
Concrete Section



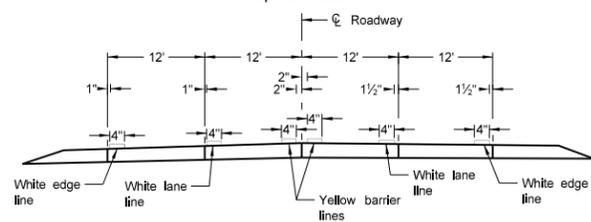
URBAN FIVE LANE SECTION
Asphalt Section



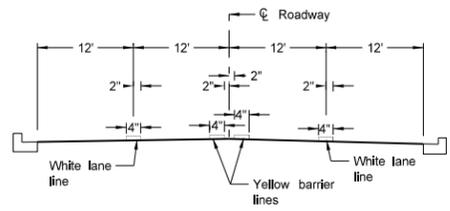
RURAL FOUR LANE ROADWAY
Asphalt Section



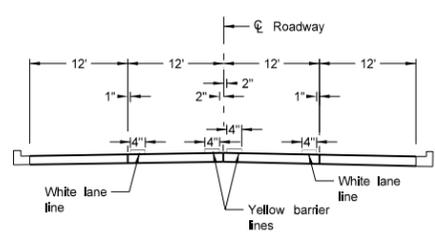
Two Lane Roadway
INTERSTATE HIGHWAY
Asphalt Section



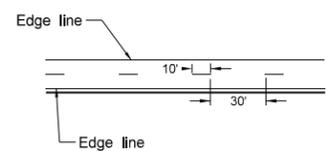
RURAL FOUR LANE ROADWAY
Concrete Section



URBAN FOUR LANE SECTION
Asphalt Section



URBAN FOUR LANE SECTION
Concrete Section



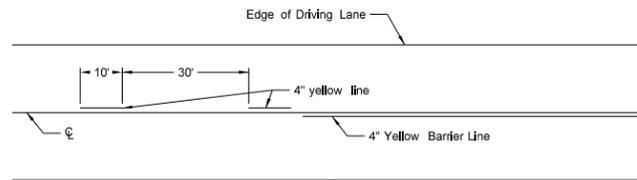
CENTERLINE PAVEMENT MARKING SKIP SPACING DETAIL

NOTES:
1. Edge lines shall be continued through private drives and field drives and broken for intersections.

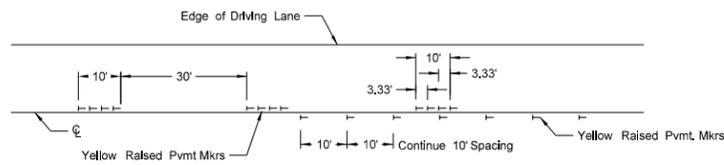
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
12-1-10	
REVISIONS	
DATE	CHANGE

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SHORT-TERM PAVEMENT MARKING

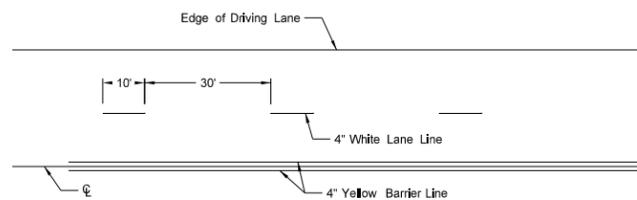


Painted or Tape Lines

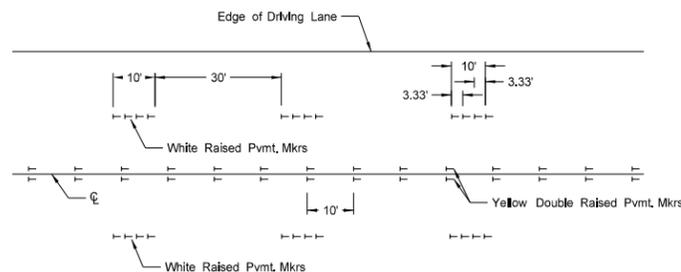


Raised Pavement Markers

TWO-LANE TWO-WAY ROADWAY

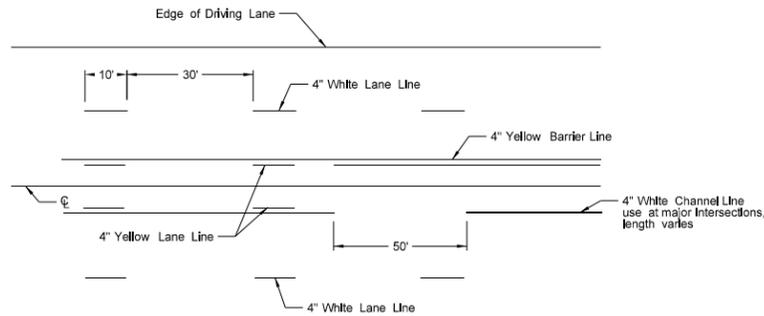


Painted or Tape Lines

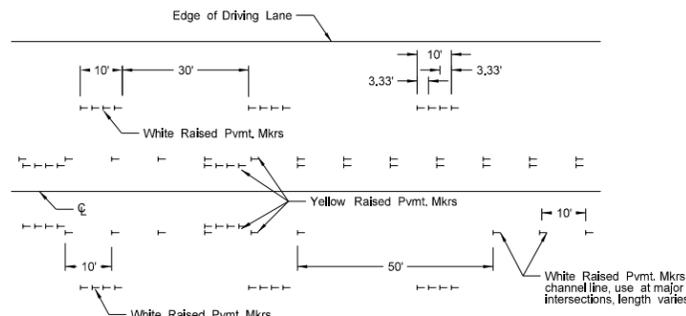


Raised Pavement Markers

FOUR LANE ROADWAY

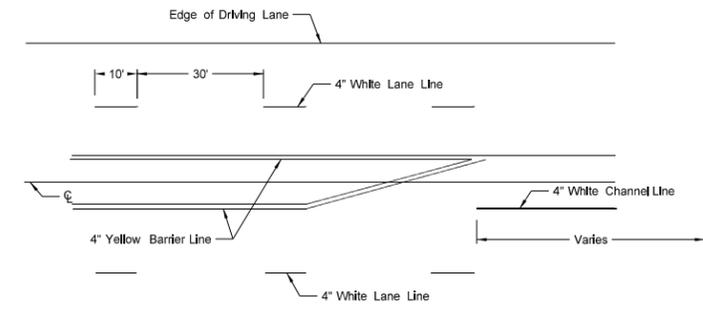


Painted or Tape Lines

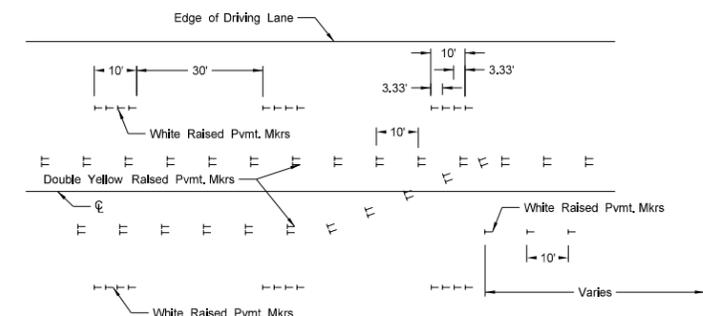


Raised Pavement Markers

FIVE LANE ROADWAY TWO WAY LEFT TURN



Painted or Tape Lines



Raised Pavement Markers

FIVE LANE ROADWAY WITH MARKED ISLANDS

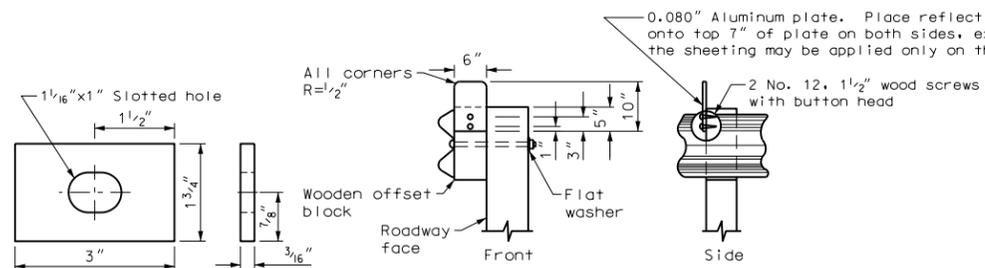
NOTES:

- Two-lane two-way roadways shall have no passing zones placed as shown. No passing zone signs may be placed in lieu of short term no passing zone pavement markings. These signs will be allowed to remain in place for three days, at which time the short term no passing zone pavement marking shall be placed.
- Short term center line stripe (paint) on top lift shall be carefully placed with exact spacing so that the permanent stripe will match when applied.
- Raised markers and tape markings shall be removed after permanent pavement marking has been installed. Removed markings shall become the property of the contractor.

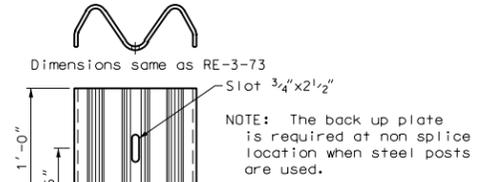
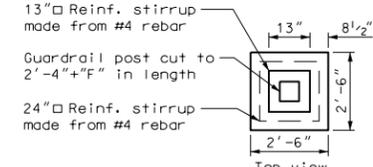
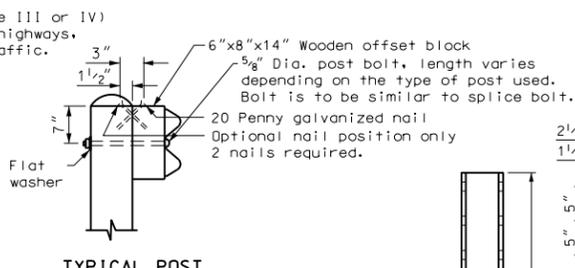
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
12-1-10	
REVISIONS	
DATE	CHANGE

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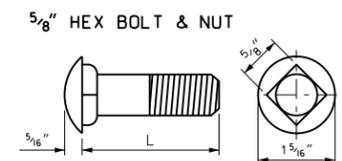
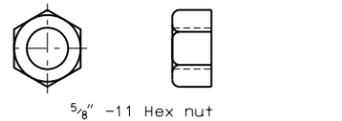
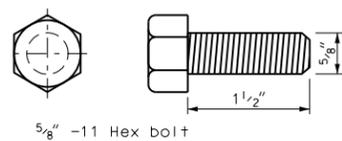
BEAM GUARDRAIL GENERAL DETAILS



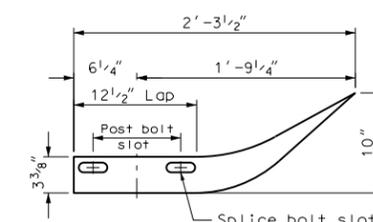
REFLECTORIZED PLATE DETAIL
2 additional reflectors are added to the w-beam guardrail quantities for placement on end treatment.



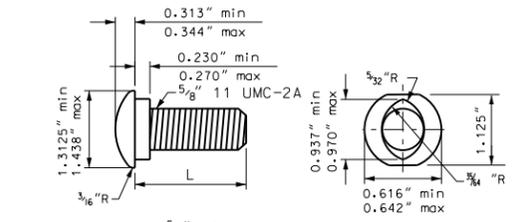
RECTANGULAR PLATE WASHER



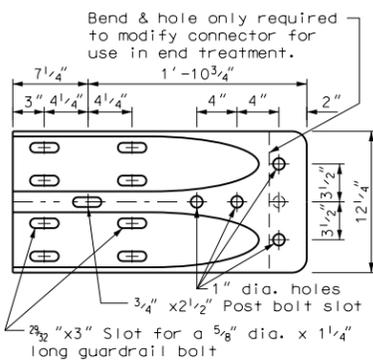
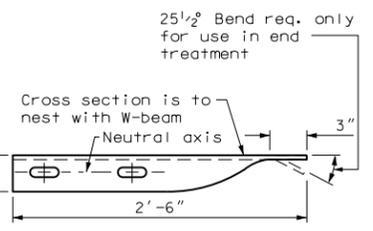
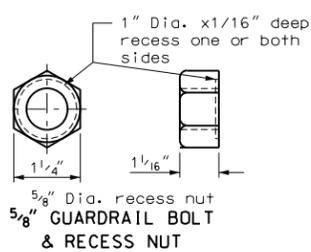
L	THREAD LENGTH
1 1/2"	Full length thread
3"	1 1/2" Min thread length
11"	1 3/4" Min thread length
13"	1 3/4" Min thread length



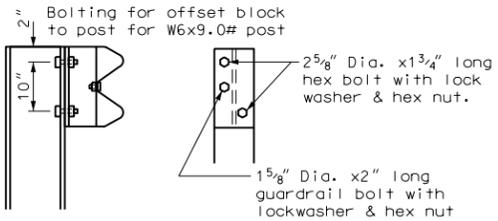
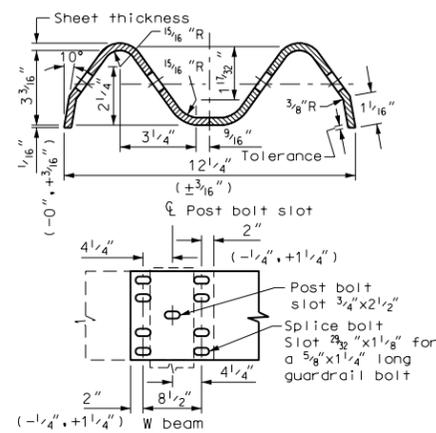
W BEAM END SECTION (FLARED)



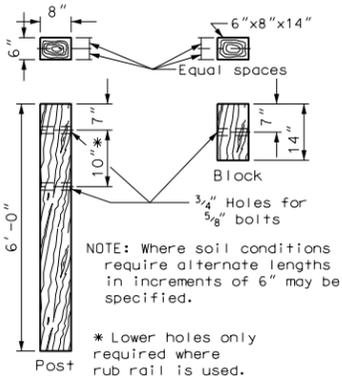
L	THREAD LENGTH
1 1/4"	Full length thread
2"	1 3/4" Min thread length
9 1/2"	4" Min thread length
18"	4" Min thread length
20"	4" Min thread length
22"	4" Min thread length
25"	4" Min thread length



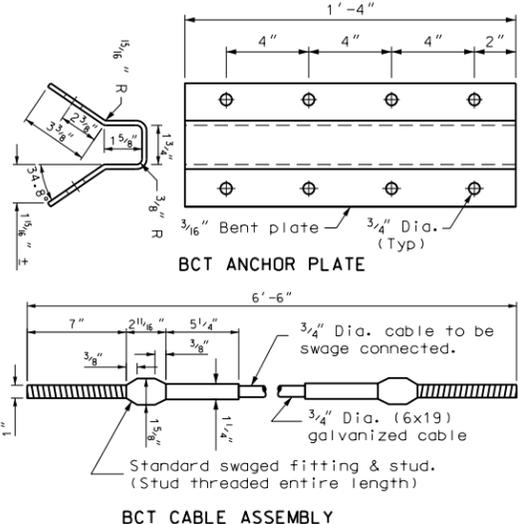
W BEAM TERMINAL CONNECTOR



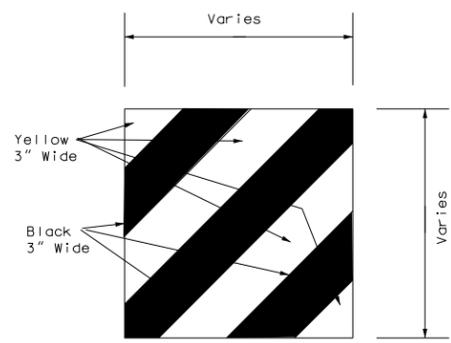
TYPICAL W POST ATTACHMENT DETAIL



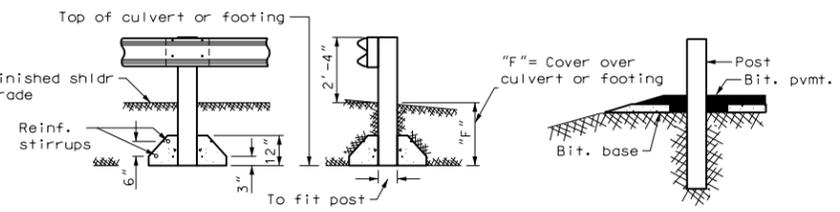
6x8 TIMBER POST & BLOCK



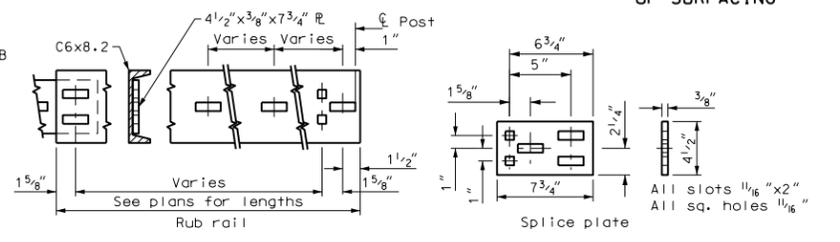
BCT CABLE ASSEMBLY



IMPACT HEAD OBJECT MARKER



DETAIL OF CONCRETE PEDESTAL FOR POSTS



C6x8 RUB RAIL AND SPLICE PLATE

NOTES:

ReflectORIZED plates: Reflector plates shall begin at first post and be spaced at 25' centers on guardrail less than 250' in length and at 50' centers for guardrail over 250' in length. The reflector shall be the same color as the pavement marking adjacent to that reflector unless noted otherwise on the plans.

Detail of concrete pedestal for posts: To be used over culverts or footings when dimension "F" is less than 3'-8". When round posts are used and the pedestal required, the post hole in the pedestal shall be varied as required by the post shape.

Manner of replacing bit. material at guardrail post: All excess earth from excavations for guard posts shall be disposed of as directed by the engineer. Replace bit. material wherever guardrail is installed after mat has been laid. Cost of excavation and replacing of bit. material to be included in the price bid for other items.

The Object Marker shall fit within the vertical edges of the Impact Plate. The retroreflective sheeting shall be type IIIA sheeting meeting the requirements of Section 894.02.b of the standard specifications. The sheeting shall be applied to .100 Aluminum sheeting meeting the requirements Section 894.01.a. The Object Marker shall attached to the Impact Head plate with rivets or some other attachment device. The rivets or attachment device shall be non-rust. The Stripes shall slope downward toward the roadway side.

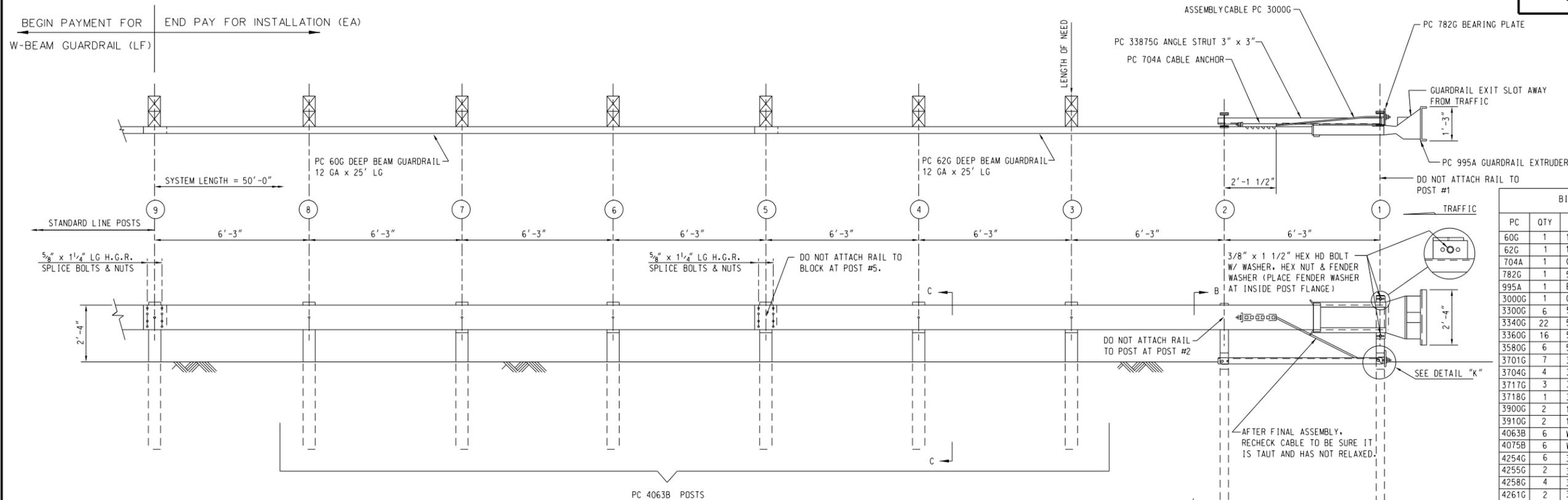
Guardrail installation height tolerance = ± 1".

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
09-01-88	
REVISIONS	
DATE	CHANGE
11-22-02	Delete Z post, rev. note
12-01-04	PE Stamp added
01-30-07	Revised impact head object marker
09-12-07	Revised guardrail height from 27" to 28" and added gdr height tolerance to notes

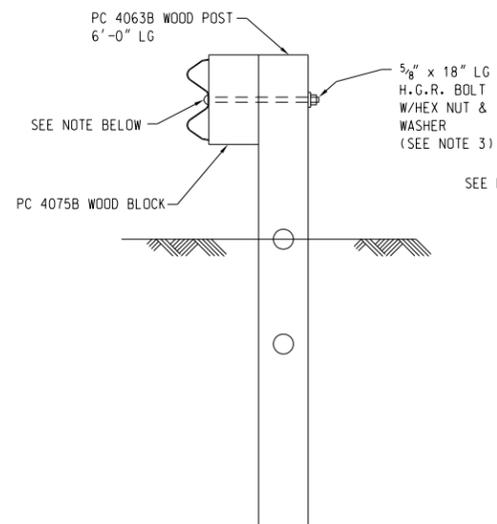
This document was originally issued and sealed by Mark S Gaydos, Registration Number PE-4518, on 09/12/07 and the original document is stored at the North Dakota Department of Transportation

ET-2000 - LET TERMINAL ASSEMBLY

D-764-2B

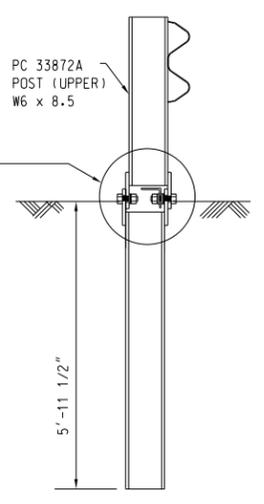


BILL OF MATERIAL		
PC	QTY	DESCRIPTION
60G	1	12/25'/6'3"/5 (GUARDRAIL)
62G	1	12/25'/6'3"/5 ANC (GUARDRAIL)
704A	1	CABLE ANCHOR BRACKET
782G	1	5/8" x 8" x 8" BEARING PLATE
995A	1	ET-2000 PLUS EXTRUDER
3000G	1	CABLE 3/4 x 6'-6"
3300G	6	5/8" WASHER
3340G	22	5/8" HEX NUT
3360G	16	5/8" x 1 1/4" SPLICE BOLT
3580G	6	5/8" x 18" POST BOLT
3701G	7	3/4" WASHER
3704G	4	3/4" HEX NUT
3717G	3	3/4" x 2 1/2" HEX HD BOLT
3718G	1	3/4" x 3" HEX HD BOLT
3900G	2	1" WASHER
3910G	2	1" HEX NUT
4063B	6	WD 6'-0" POST 6" x 8"
4075B	6	WD BLOCK 1'-2" x 6" x 8" DR
4254G	6	3/8" WASHER
4255G	2	3/8" FENDER WASHER (1 1/2" OD)
4258G	4	3/8" LOCKWASHER
4261G	2	3/8" x 1 1/2" HEX HD BOLT
4699G	4	3/4" LOCKWASHER
6321G	4	3/8" x 2" HEX HD BOLT
6405G	6	3/8" HEX NUT
33871A	1	ET2000 HBA POST #1 TOP
33872A	1	ET2000 HBA POST #2 TOP
33873A	2	ET2000 HBA POST #1-#2 BOTTOM
33875G	1	6'-6" ANGLE STRUT ET HBA

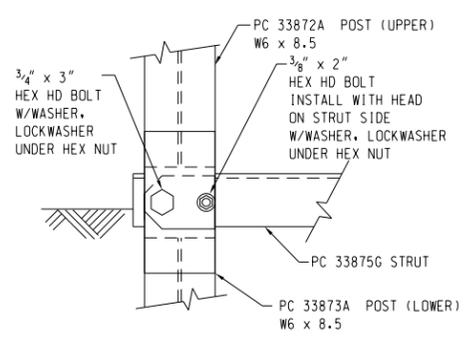


NOTE:
SECTION "C-C" IS SIMILAR AT POST #5.
EXCEPT RAIL IS NOT ATTACHED.

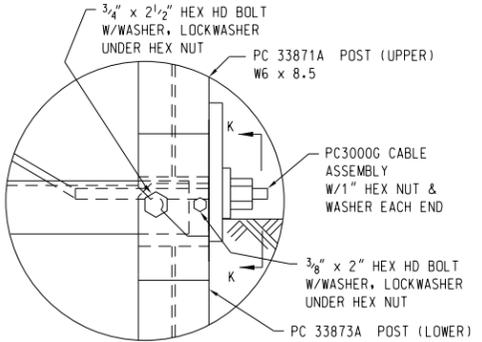
SECTION "C-C"
(TYP @ POSTS #3, 4, 6, 7 & 8)



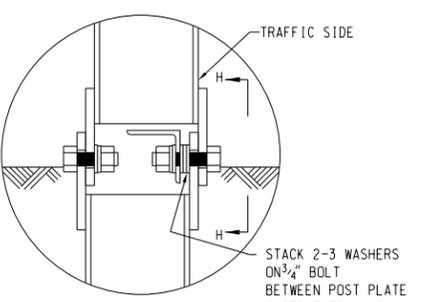
SECTION "B-B"
(POST #2)



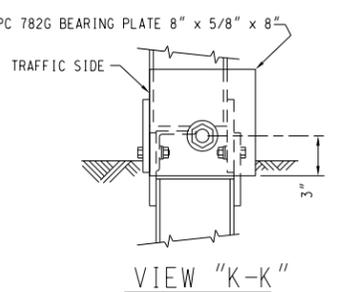
VIEW "H-H"
(POST #2)



DETAIL "K-K"
(POST #1)



DETAIL "H"
(POST #2)



VIEW "K-K"
(POST #2)

NOTES:

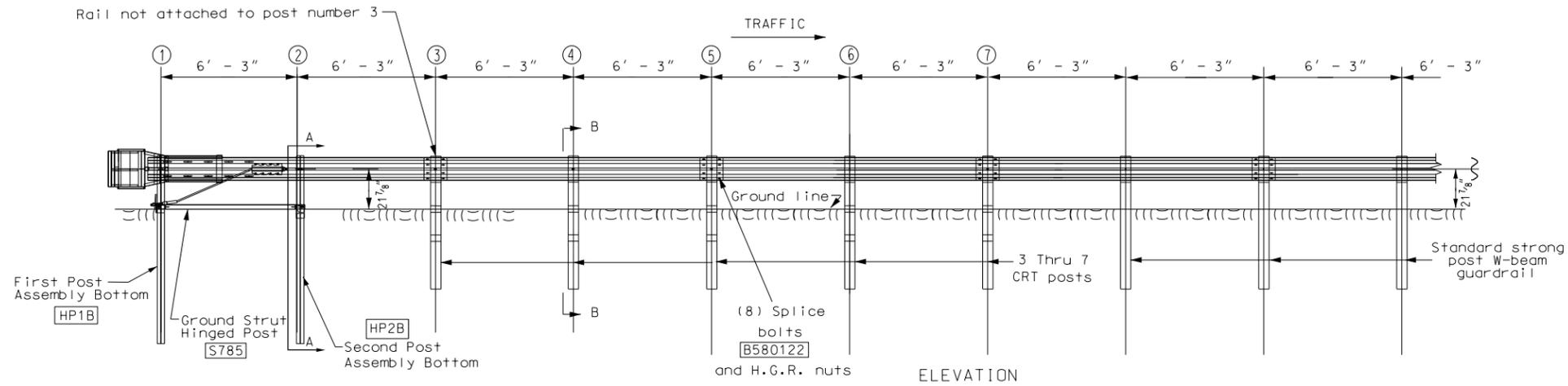
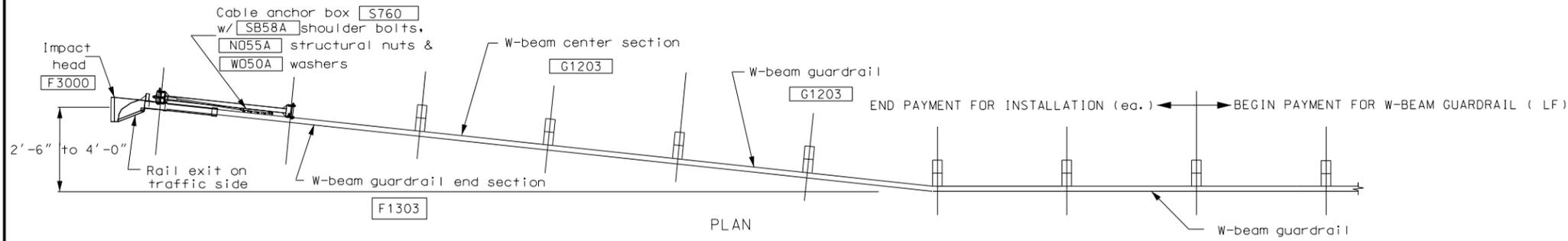
- Wood posts are required from 3 to 9.
- All bolts, nuts, cable assembly, cable anchors, and bearing plates shall be galvanized.
- This end terminal shall only be installed at locations where the flare rate is 25:1 or flatter, relative to the traveled way. The end terminal can be flared at a rate of 50:1 for the first 50' of the system to prevent the impact head from encroaching on the shoulder. The 25:1 flare rate is recommended with curb installations. See plans for when taper is used or not.
- Do not attach guardrail to post #1.
- Do not attach guardrail to post block at post #5.
- The 5/8" flat washer is used under the nut, behind the post only, no washer is used at the rail.
- An impact head object marker shall be placed.
- The wood blockouts shall be "toe nailed" to the rectangular wood posts to prevent them from turning when wood shrinks. The nails shall be 20 penny and galvanized.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
04-02-02	
REVISIONS	
DATE	CHANGE
12-01-04	PE Stamp added
01-04-07	Revised note 3
09-12-07	Revised guardrail height from 27" to 28"

This document was originally issued and sealed by
Mark S Gaydos,
Registration Number
PE- 4518 ,
on **09/12/07** and the original document is stored at the
North Dakota Department
of Transportation

FLARED ENERGY ABSORBING TERMINAL FOR STEEL BREAKAWAY SYSTEM

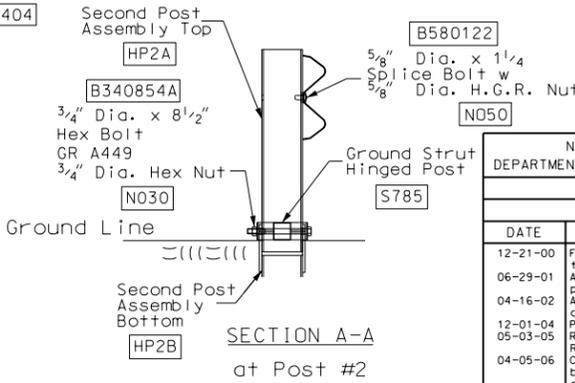
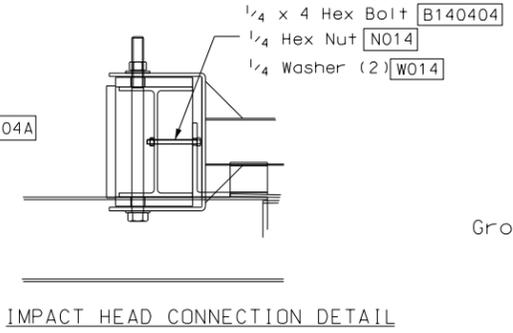
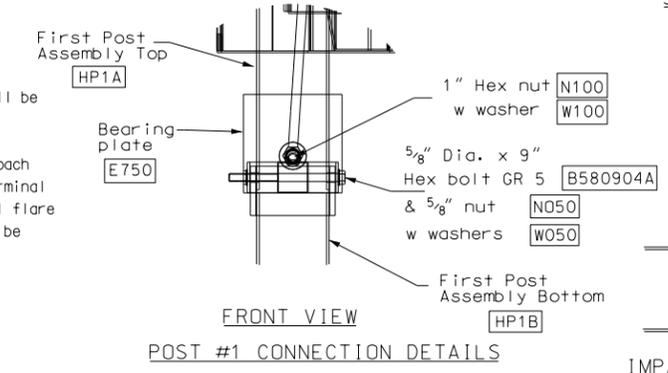
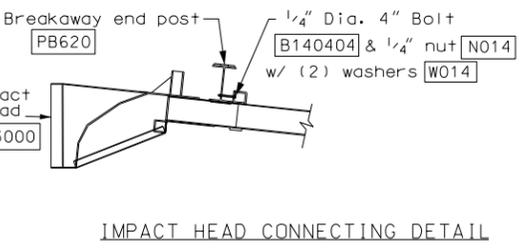
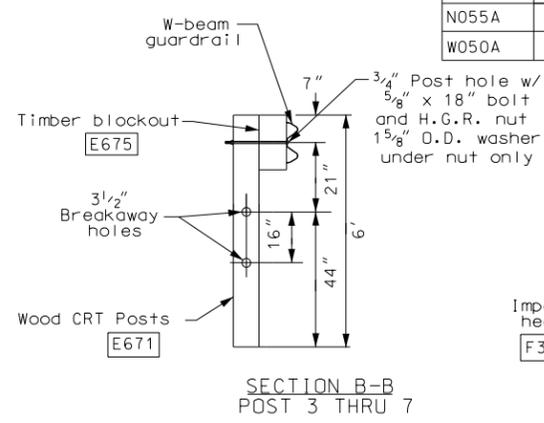
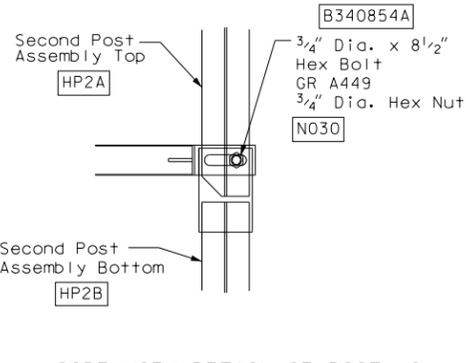
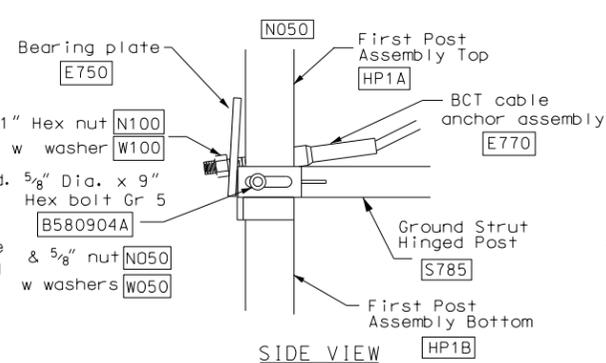
D-764-2C



ITEM #	QTY	BILL OF MATERIALS
F3000	1	IMPACT HEAD
F1303	1	W-BEAM GUARDRAIL END SECTION, 12 GA.
G1203	2	W-BEAM GUARDRAIL, 12 GA.
HP1A	1	FIRST POST ASSEMBLY TOP
HP1B	1	FIRST POST ASSEMBLY BOTTOM
HP2A	1	SECOND POST ASSEMBLY TOP
HP2B	1	SECOND POST ASSEMBLY BOTTOM
P671	5	WOOD CRT POST
P675	5	TIMBER BLOCKOUT OR RECYCLED EQUIV.
E750	1	BEARING PLATE
S760	1	CABLE ANCHOR BOX
E770	1	BCT CABLE ANCHOR ASSEMBLY
S785	1	GROUND STRUT HINGED POST
HARDWARE (ALL DIMENSIONS IN INCHES)		
B140404	2	1/4 Dia. x 4 HEX BOLT
W014	4	1/4 WASHER
N014	2	1/4 HEX NUT
B580122	17	5/8 Dia. x 1 1/4 SPLICE BOLT
B581802	4	5/8 Dia. x 10" H.G.R. BOLT (POSTS 3 THRU 6)
B580904A	1	5/8 Dia. x 9 HEX BOLT GR 5
W050	5	5/8 WASHER
N050	22	5/8 Dia. H.G.R. NUT
B340854A	1	3/4 Dia. x 8 1/2 HEX BOLT GR A449
N030	1	3/4 Dia. HEX NUT
N100	2	1 ANCHOR CABLE HEX NUT
W100	2	1 ANCHOR CABLE WASHER
SB58A	8	CABLE ANCHOR BOX SHOULDER BOLT
N055A	8	A325 STRUCTURAL NUT
W050A	16	1 1/16 OD x 3/16 ID A325 STR. WASHER

GENERAL NOTES

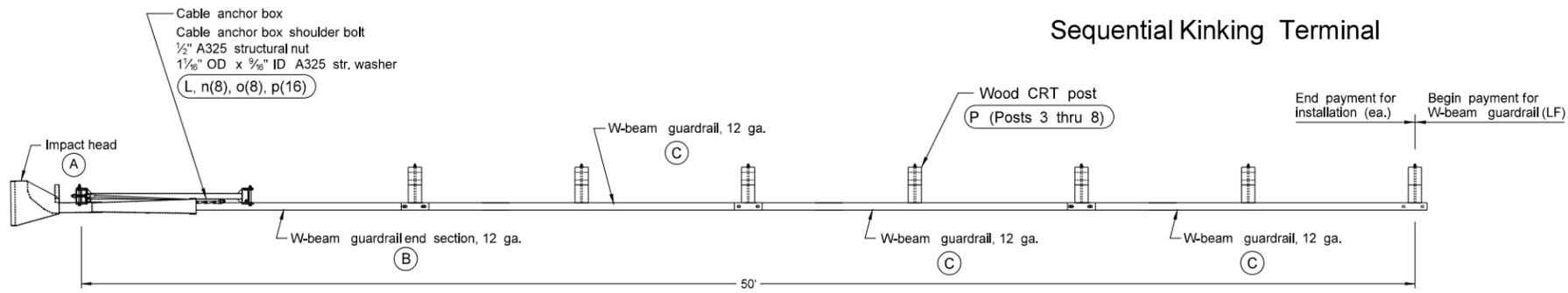
1. Wood posts are required with the Flared Energy Absorbing Terminal except post 1 and 2.
2. All bolts, nuts, cable assemblies, cable anchors and bearing plates shall be galvanized.
3. The lower sections of the posts shall not protrude more than 4 inches above the ground (measured along a 60 inch cord). Site grading may be necessary to meet this requirement.
4. Lower post sections shall not be driven with the upper post attached. If the post is placed in a drilled hole, the backfill material must be satisfactory compacted to prevent settlement.
5. When rock is encountered during excavation, a 12" diameter post hole 20" deep may be used if approved by the Engineer. Granular material will be placed in the bottom of the hole approximately 2 1/2" deep to provide drainage. The soil tubes shall be field cut to length, placed in the hole and back filled with adequately compacted material excavated from the hole.
6. The breakaway cable assembly shall be taut. A locking device (vice grips or channel lock pliers) should be used to prevent cable from twisting when tightening nuts.
7. The wood blockouts shall be "toe nailed" to the rectangular wood posts to prevent them from turning when wood shrinks. The nail shall be 20 penny and galvanized.
8. The Flared Energy Absorbing Terminal shall be flared only when the approach guardrail is parallel with the roadway. When the approach guardrail is flared at 16:1 to 10:1, the Flared Energy Absorbing Terminal shall have only the flare rate of the guardrail. When the guardrail flare is between 10:1 and 7:1, the Flared Energy Absorbing Terminal shall be turned parallel to the roadway.



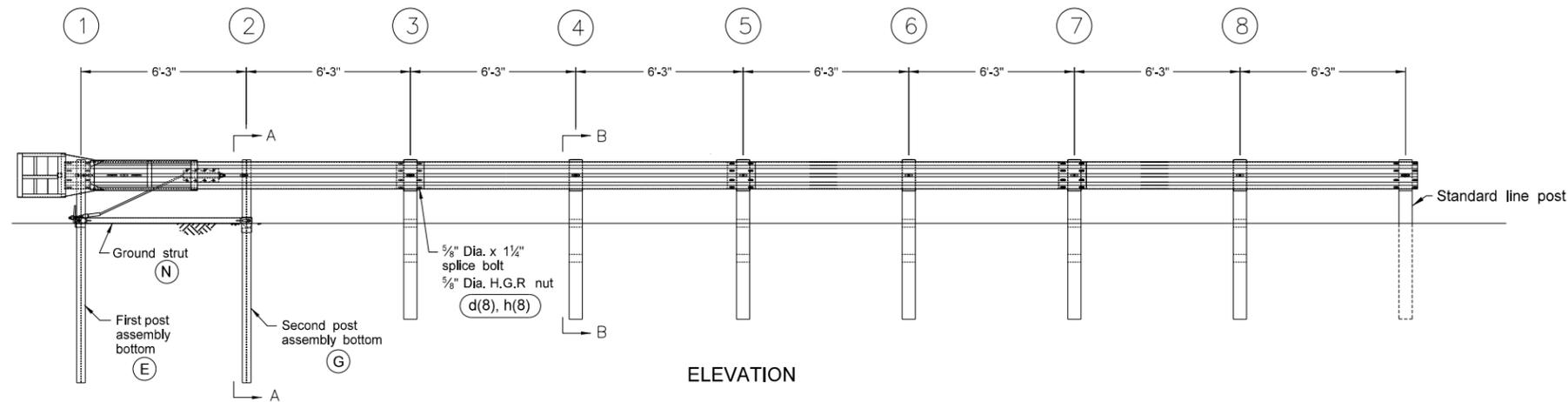
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
09-01-98	
REVISIONS	
DATE	CHANGE
12-21-00	Flared energy absorbing terminal note
06-29-01	Added steel breakaway post
04-16-02	Adjusted post spacing and eliminated one post
12-01-04	PE Stamp added
05-03-05	Revised posts 1 & 2.
04-05-06	Revised notes
01-04-07	Changed CRT post & blackout Qty. to 5 and added 7 to section B-B
09-12-07	General revisions
	Rev. dimension to center of guardrail to 21 1/8"

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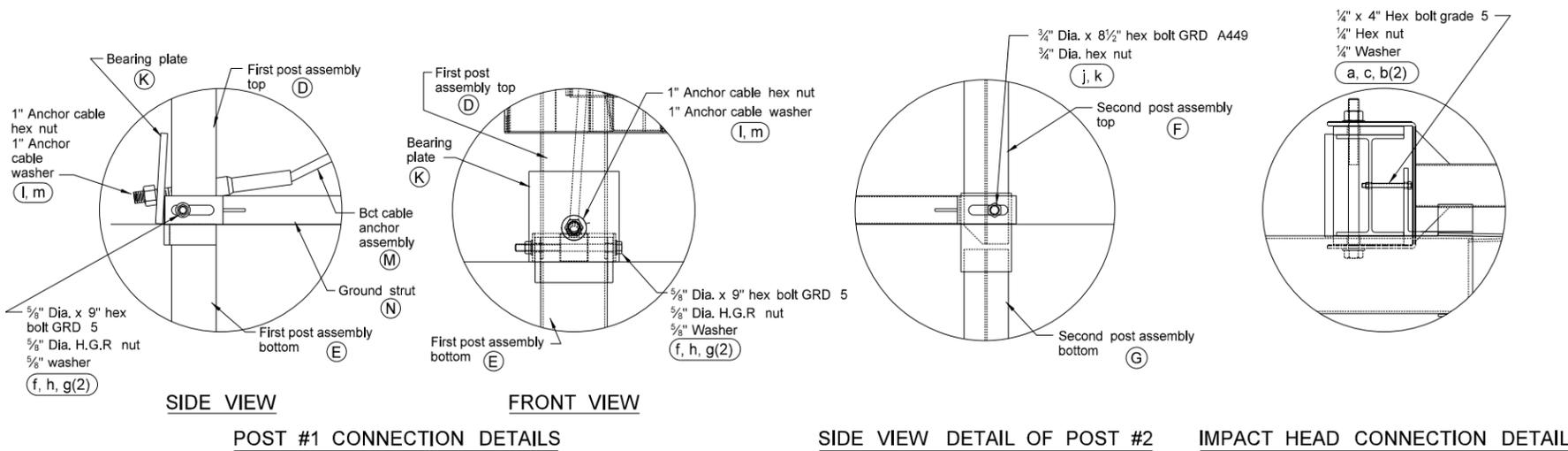
Sequential Kinking Terminal



PLAN



ELEVATION

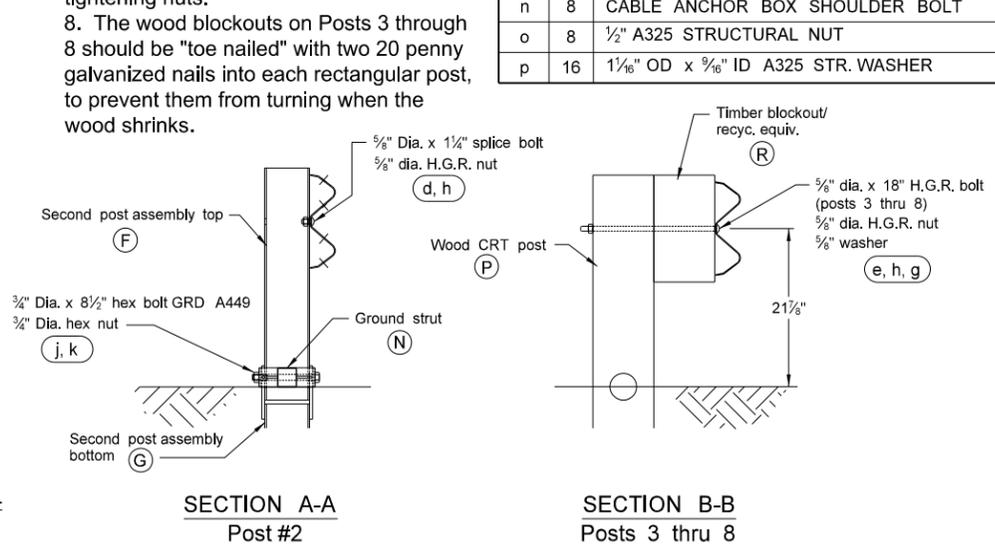


SIDE VIEW

FRONT VIEW

SIDE VIEW DETAIL OF POST #2

IMPACT HEAD CONNECTION DETAIL



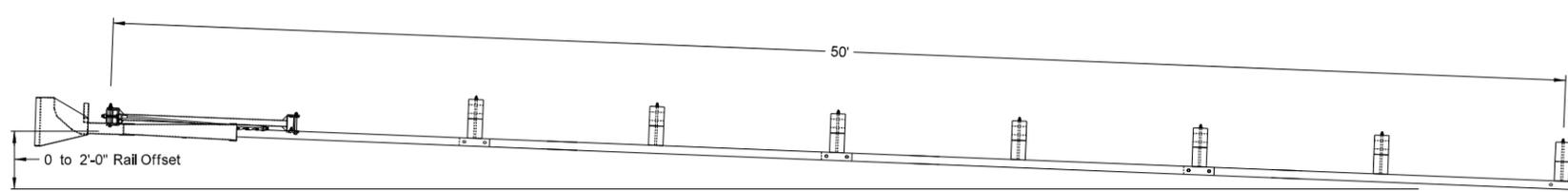
SECTION A-A
Post #2

SECTION B-B
Posts 3 thru 8

GENERAL NOTES:

1. Breakaway posts are required with the SKT.
2. All bolts, nuts, cable assemblies, cable anchors and bearing plates shall be galvanized.
3. The SKT can be flared at a rate of up to 25:1 to prevent the impact head from encroaching on the shoulder.
4. The lower sections of the posts shall not protrude more than 4" above the ground (measured along a 5' cord). Site grading may be necessary to meet this requirement.
5. The lower section of the hinged posts should not be driven with the upper post attached. If the post is placed in a drilled hole, the backfill material must be satisfactorily compacted to prevent settlement.
6. When rock is encountered, a 10" diameter post hole, 20" into the rock surface may be used if approved by the engineer. Granular material will be placed in the bottom of the hole, approximately 2 1/2" deep to provide drainage. Posts 1 & 2 can be field cut to length, placed in the hole and backfilled with adequately compacted material excavated from the hole.
7. The breakaway cable assembly must be taut. A locking device (vice grips or channel lock pliers) should be used to prevent the cable from twisting when tightening nuts.
8. The wood blockouts on Posts 3 through 8 should be "toe nailed" with two 20 penny galvanized nails into each rectangular post, to prevent them from turning when the wood shrinks.

ITEM QTY		BILL OF MATERIALS
A	1	IMPACT HEAD
B	1	W-BEAM GUARDRAIL END SECTION, 12 Ga.
C	3	W-BEAM GUARDRAIL, 12 Ga.
D	1	FIRST POST ASSEMBLY TOP
E	1	FIRST POST ASSEMBLY BOTTOM
F	1	SECOND POST ASSEMBLY TOP
G	1	SECOND POST ASSEMBLY BOTTOM
K	1	BEARING PLATE
L	1	CABLE ANCHOR BOX
M	1	BCT CABLE ANCHOR ASSEMBLY
N	1	GROUND STRUT HINGED POST
P	6	WOOD CRT POST
R	6	TIMBER BLOCKOUT/RECYC. EQUIV.
HARDWARE		
a	2	1/4" x 4" HEX BOLT Grade 5
b	4	1/4" WASHER
c	2	1/4" HEX NUT
d	25	5/8" Dia. x 1 1/4" SPLICE BOLT, POST #2
e	6	5/8" Dia. x 18" H.G.R. BOLT (POSTS 3 THRU 8)
f	1	5/8" Dia. x 9" HEX BOLT GRD 5
g	8	5/8" WASHER
h	32	5/8" Dia. H.G.R. NUT
j	1	3/4" Dia. x 8 1/2" HEX BOLT GRD A449
k	1	3/4" Dia. HEX NUT
l	2	1" ANCHOR CABLE HEX NUT
m	2	1" ANCHOR CABLE WASHER
n	8	CABLE ANCHOR BOX SHOULDER BOLT
o	8	1/2" A325 STRUCTURAL NUT
p	16	1 1/8" OD x 5/8" ID A325 STR. WASHER

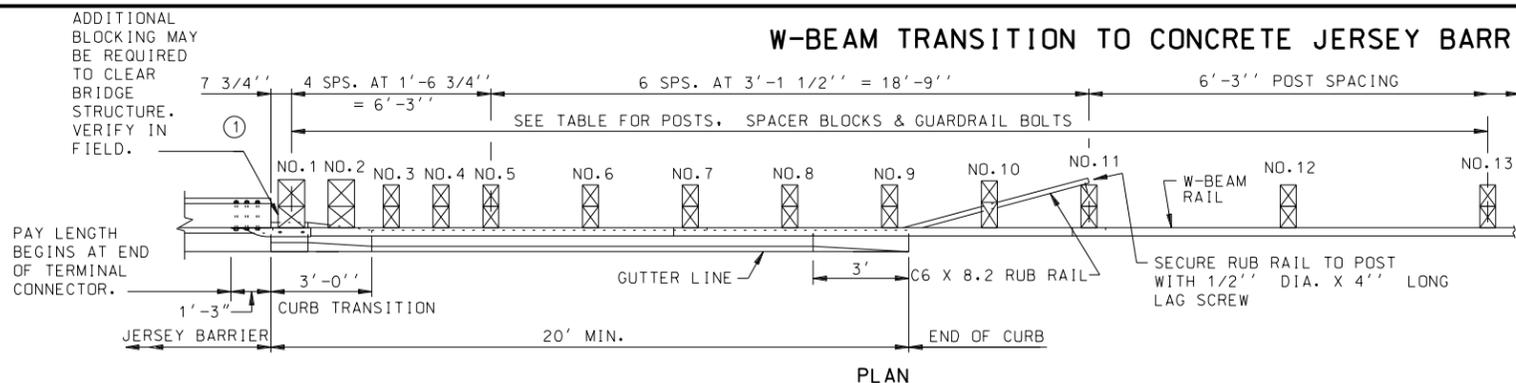


FLARED INSTALLATION
25:1 maximum flare rate

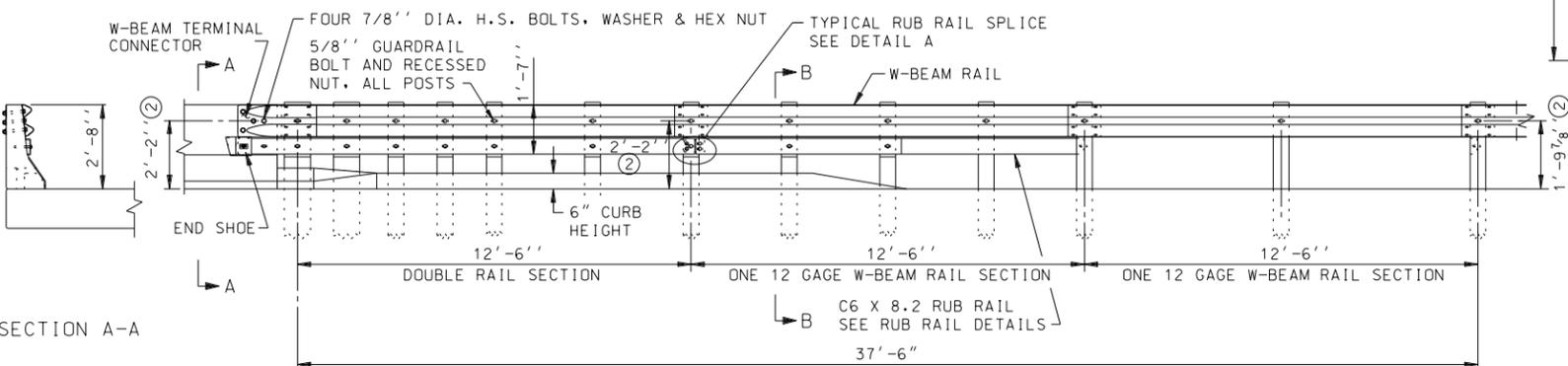
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION 9-12-07	
REVISIONS	
DATE	CHANGE

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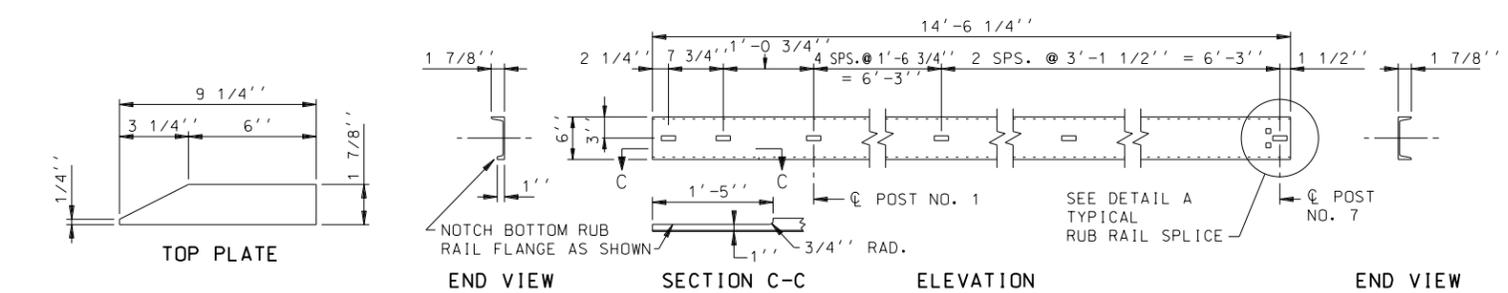
W-BEAM TRANSITION TO CONCRETE JERSEY BARRIER WITH APPROACH CURB



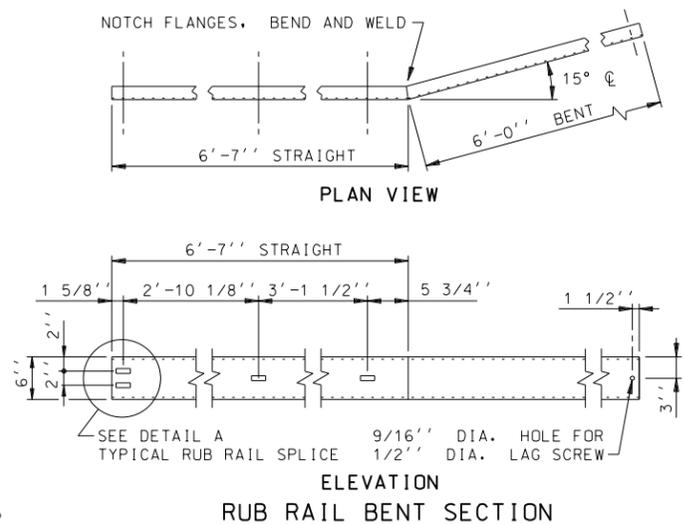
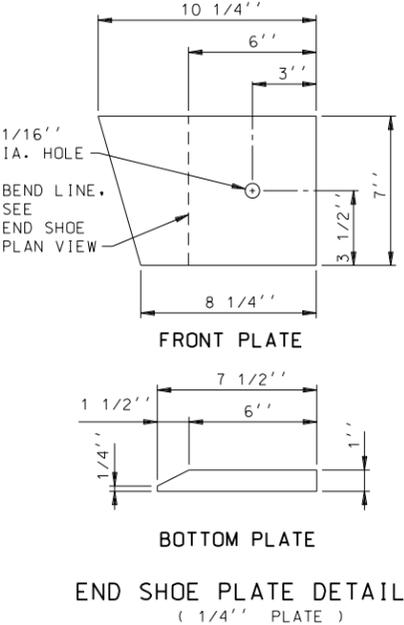
PLAN



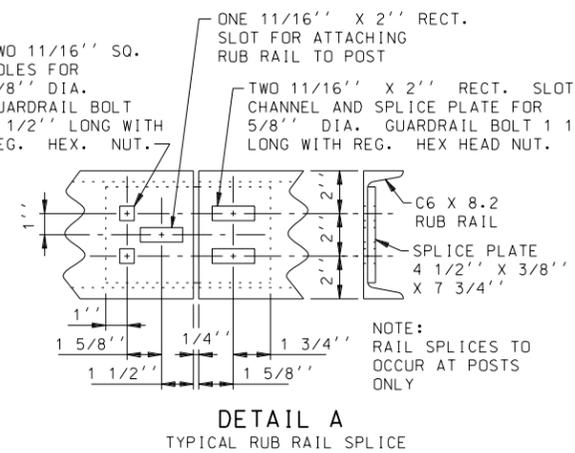
ELEVATION GENERAL ASSEMBLY DETAILS



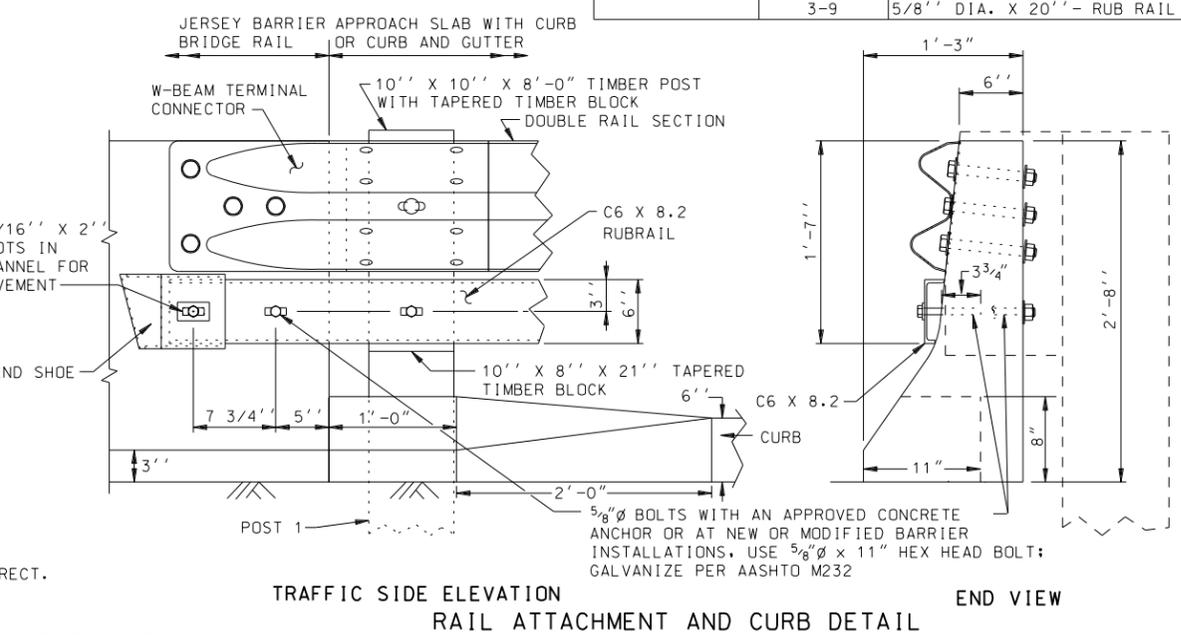
ELEVATION RUB RAIL STRAIGHT SECTION



ELEVATION RUB RAIL BENT SECTION



DETAIL A TYPICAL RUB RAIL SPLICE



TRAFFIC SIDE ELEVATION RAIL ATTACHMENT AND CURB DETAIL

- ① ADDITIONAL BLOCKING MAY BE REQUIRED AT POST NO. 1.
- ② HEIGHT IS 2'-2" FROM 0' TO 12'-6" FROM BRIDGE. HEIGHT TAPERS FROM 2'-2" TO 1'-9 7/8" BETWEEN 12'-6" TO 37'-6" FROM BRIDGE.

NOTES:

C6 X 8.2 RUB RAIL AND STRUCTURAL STEEL SHALL BE AASHTO M270M GRADE 250, AND SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH AASHTO M111.

ALL SLOTTED HOLES ARE 11/16" X 2".

ALL SQUARE HOLES ARE 11/16".

GALVANIZE ALL HARDWARE IN ACCORDANCE WITH AASHTO M232.

ALL POSTS AND BLOCKS FOR THE W-BEAM GUARDRAIL SHALL BE TIMBER.

POST, TIMBER BLOCK & BOLT TABLE

DESCRIPTION	POST NO.	SIZE
POST	1 & 2	10' X 10' X 8'-0" MIN. LONG
	3-5	6' X 8' X 7'-0" MIN. LONG
	6-13	6' X 8' X 6'-0" MIN. LONG
SPACER BLOCK	1-2	10' X 8' X 21" TAPERED BLOCK
	3-9	6' X 8' X 21"
	10	6' X 9 3/4" X 14"
	11-13	6' X 8' X 14"
GUARDRAIL BOLT & RECESSED NUT	1 & 2 & 10	5/8" DIA. X 20" - GUARDRAIL
	3-9, 11-13	5/8" DIA. X 18" - GUARDRAIL
	1-2	5/8" DIA. X 22" - RUB RAIL
	3-9	5/8" DIA. X 20" - RUB RAIL

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

11-19-02

REVISIONS

DATE	CHANGE
02-07-03	Rev rail attachment
12-05-04	PE Stamp added
07-05-06	General revisions
08-24-06	Revised table
09-12-07	Rev. dimension to center of guardrail to 1'-9 7/8"

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GUARDRAIL AT BRIDGE ENDS
55 MPH DESIGN SPEED

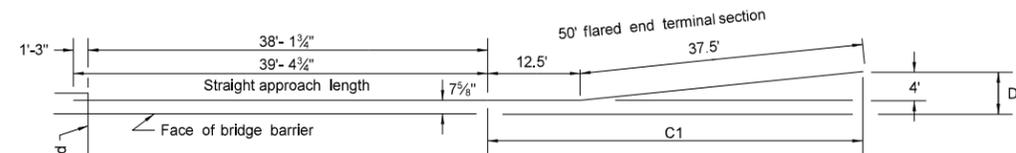
D-764-7A

LENGTH OF NEED TABLE 55 MPH DESIGN SPEED

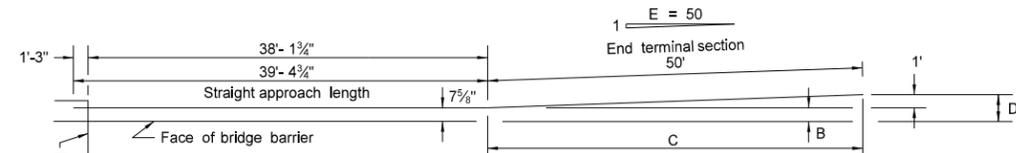
DESIGN TRAFFIC VOLUME	CLEAR ROADWAY WIDTH OF BRIDGE	STRAIGHT APPROACH LENGTH	APPROACH SIDE							OPPOSITE SIDE								
			A	B	C	D	C1	D1	E	TOTAL W-BEAM LENGTH	A	B	C	D	C1	D1	E	TOTAL W-BEAM LENGTH
			FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
UNDER 750 ADT	48	39.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	46	39.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	44	39.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	42	39.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	40	39.4	12.49	1.15	49.83	5.31			12	51.9	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	38	39.4	12.49	1.15	49.83	5.31			12	51.9	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	36	39.4	12.49	1.15	49.83	5.31			12	51.9	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	34	39.4	24.95	2.19	49.83	6.35			12	64.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	32	39.4	24.95	2.19	49.83	6.35			12	64.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	30	39.4	37.40	3.23	49.83	7.38			12	76.9	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	28	39.4	49.86	4.27	49.83	8.42			12	89.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	26	39.4	49.86	4.27	49.83	8.42			12	89.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
24	39.4	62.32	5.31	49.83	9.46			12	101.9	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4	
750 - 1500 ADT	48	39.4	12.49	1.15	49.83	5.31			12	51.9	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	46	39.4	12.49	1.15	49.83	5.31			12	51.9	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	44	39.4	12.49	1.15	49.83	5.31			12	51.9	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	42	39.4	12.49	1.15	49.83	5.31			12	51.9	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	40	39.4	24.95	2.19	49.83	6.35			12	64.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	38	39.4	24.95	2.19	49.83	6.35			12	64.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	36	39.4	37.40	3.23	49.83	7.38			12	76.9	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	34	39.4	49.86	4.27	49.83	8.42			12	89.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	32	39.4	49.86	4.27	49.83	8.42			12	89.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	30	39.4	62.32	5.31	49.83	9.46			12	101.9	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	28	39.4	62.32	5.31	49.83	9.46			12	101.9	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	26	39.4	74.77	6.35	49.83	10.50			12	114.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
24	39.4	74.77	6.35	49.83	10.50			12	114.4	12.49	1.15	49.83	5.31			12	51.9	
1500 - 2000 ADT	48	39.4	12.49	1.15	49.83	5.31			12	51.9	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	46	39.4	24.95	2.19	49.83	6.35			12	64.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	44	39.4	24.95	2.19	49.83	6.35			12	64.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	42	39.4	37.40	3.23	49.83	7.38			12	76.9	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	40	39.4	37.40	3.23	49.83	7.38			12	76.9	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	38	39.4	49.86	4.27	49.83	8.42			12	89.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	36	39.4	49.86	4.27	49.83	8.42			12	89.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	34	39.4	62.32	5.31	49.83	9.46			12	101.9	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	32	39.4	62.32	5.31	49.83	9.46			12	101.9	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	30	39.4	74.77	6.35	49.83	10.50			12	114.4	12.49	1.15	49.83	5.31			12	51.9
	28	39.4	87.23	7.38	49.83	11.54			12	126.9	12.49	1.15	49.83	5.31			12	51.9
	26	39.4	87.23	7.38	49.83	11.54			12	126.9	12.49	1.15	49.83	5.31			12	51.9
24	39.4	99.69	8.42	49.83	12.57			12	139.4	12.49	1.15	49.83	5.31			12	51.9	
2000 - 6000 ADT	48	39.4	24.95	2.19	49.83	6.35			12	64.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	46	39.4	24.95	2.19	49.83	6.35			12	64.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	44	39.4	37.40	3.23	49.83	7.38			12	76.9	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	42	39.4	37.40	3.23	49.83	7.38			12	76.9	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	40	39.4	49.86	4.27	49.83	8.42			12	89.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	38	39.4	49.86	4.27	49.83	8.42			12	89.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	36	39.4	62.32	5.31	49.83	9.46			12	101.9	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	34	39.4	62.32	5.31	49.83	9.46			12	101.9	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	32	39.4	74.77	6.35	49.83	10.50			12	114.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	30	39.4	74.77	6.35	49.83	10.50			12	114.4	12.49	1.15	49.83	5.31			12	51.9
	28	39.4	87.23	7.38	49.83	11.54			12	126.9	12.49	1.15	49.83	5.31			12	51.9
	26	39.4	99.69	8.42	49.83	12.57			12	139.4	12.49	1.15	49.83	5.31			12	51.9
24	39.4	99.69	8.42	49.83	12.57			12	139.4	24.95	2.19	49.83	6.35			12	64.4	
OVER 6000 ADT	48	39.4	24.95	2.19	49.83	6.35			12	64.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	46	39.4	37.40	3.23	49.83	7.38			12	76.9	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	44	39.4	49.86	4.27	49.83	8.42			12	89.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	42	39.4	49.86	4.27	49.83	8.42			12	89.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	40	39.4	62.32	5.31	49.83	9.46			12	101.9	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	38	39.4	62.32	5.31	49.83	9.46			12	101.9	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	36	39.4	74.77	6.35	49.83	10.50			12	114.4	0.00	0.64	49.99	1.64	49.79	4.64	50	39.4
	34	39.4	74.77	6.35	49.83	10.50			12	114.4	12.49	1.15	49.83	5.31			12	51.9
	32	39.4	87.23	7.38	49.83	11.54			12	126.9	12.49	1.15	49.83	5.31			12	51.9
	30	39.4	87.23	7.38	49.83	11.54			12	126.9	12.49	1.15	49.83	5.31			12	51.9
	28	39.4	99.69	8.42	49.83	12.57			12	139.4	12.49	1.15	49.83	5.31			12	51.9
	26	39.4	99.69	8.42	49.83	12.57			12	139.4	24.95	2.19	49.83	6.35			12	64.4
24	39.4	112.14	9.46	49.83	13.61			12	151.9	24.95	2.19	49.83	6.35			12	64.4	

DESIGN SPEED	F	G	H	R
55	0.52	12.49	4.15	150.35

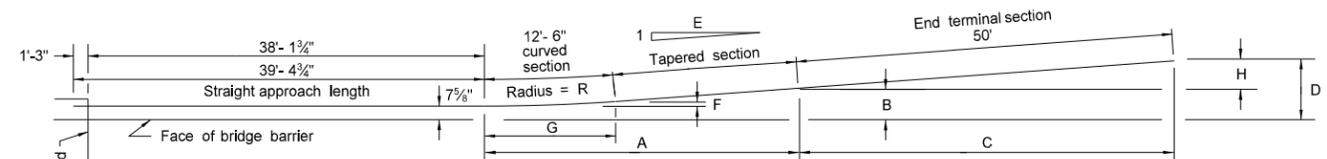
NOTES:
On divided highways use distance from roadway centerline to bridge rail x 2 and use this as clear roadway width of the bridge to determine guardrail length.
The contractor shall use wood posts for W-beam guardrail.



W-BEAM GUARDRAIL DIMENSION LAYOUT WITH FLARED END TERMINAL



W-BEAM GUARDRAIL DIMENSION LAYOUT WITH 50:1 TAPERED END TERMINAL



W-BEAM GUARDRAIL DIMENSION LAYOUT WITH TAPERED SECTION AND NONFLARED END TERMINAL

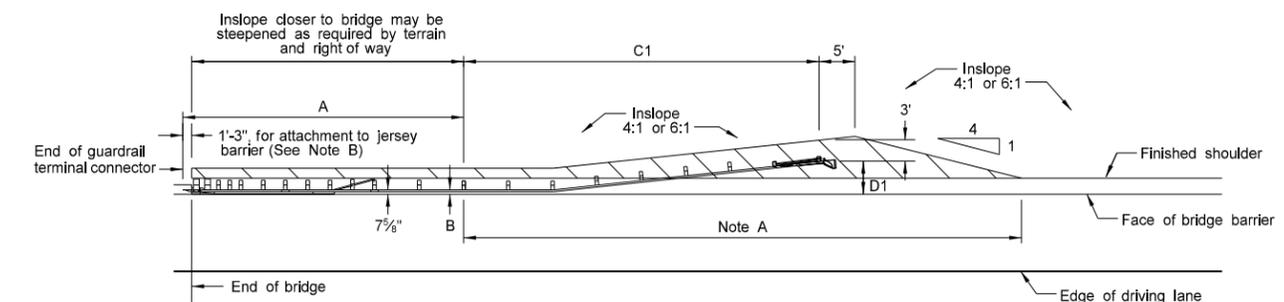
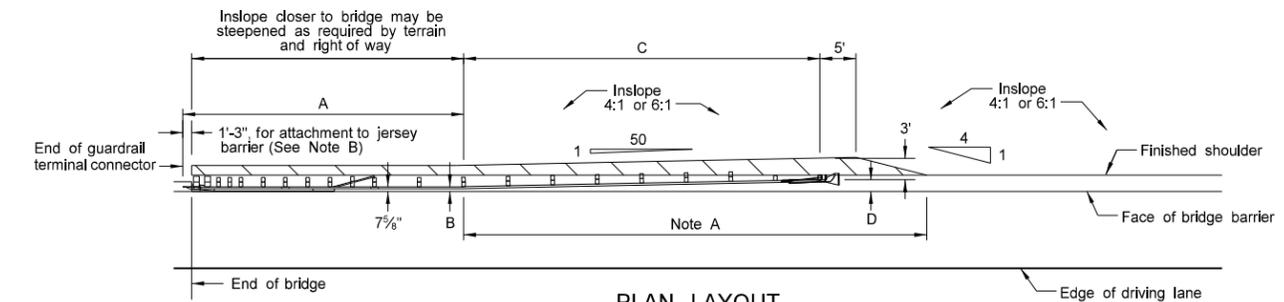
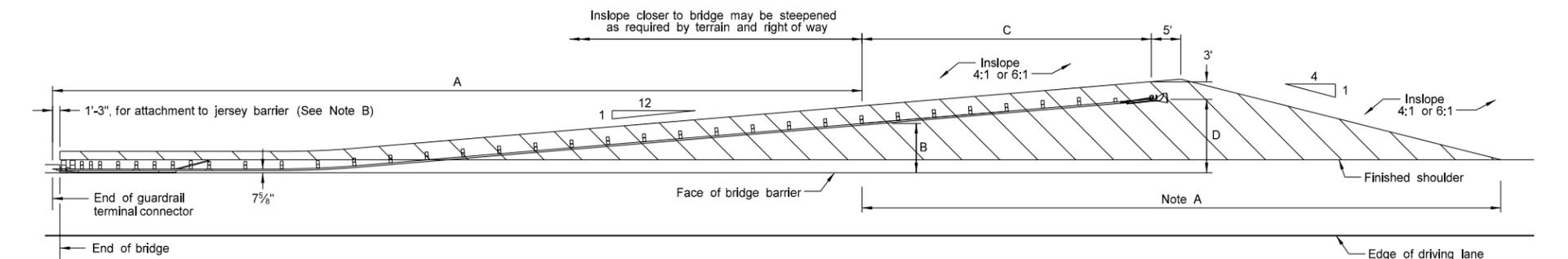
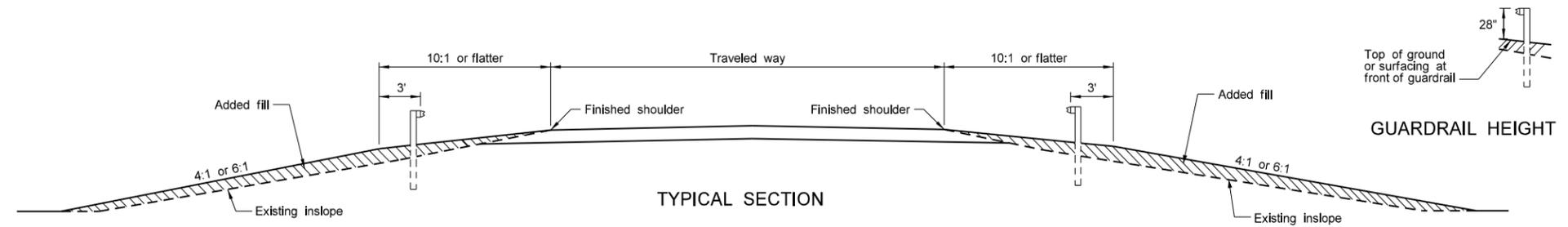
- ① Does not include end terminal section
- ② The 39.4' straight approach length is for use with the transition shown on Standard Drawing D-764-3.
For the transition shown on Standard Drawing D-764-3A, revise straight approach length to 45.65'.
- ③ Dimensions "B", "D" and "D1" include the 7 7/8" (0.64') offset from the lower face of jersey barrier to the rear face of the W-beam guardrail.
For installations using the transition shown on Standard Drawing D-764-3A, subtract 0.64' from the dimensions "B", "D" and "D1", to obtain offset from face of guardrail connection plate.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
09-01-88	
REVISIONS	
DATE	CHANGE
09-01-99	Values in D1
12-21-00	Revised flared end treatment
08-09-01	Revised note
07-05-02	Values in column C
12-13-02	Revised table

TYPICAL GRADING AT BRIDGE ENDS
WITH FLARED W-BEAM GUARDRAIL
55 MPH DESIGN SPEED

GUARDRAIL EMBANKMENT DIMENSION TABLE

CLEAR ROADWAY WIDTH OF BRIDGE	APPROACH SIDE						OPPOSITE SIDE						
	STRAIGHT AND FLARED GUARDRAIL		END TREATMENT TERMINAL NON-FLARED		END TREATMENT TERMINAL FLARED		STRAIGHT AND FLARED GUARDRAIL		END TREATMENT TERMINAL NON-FLARED		END TREATMENT TERMINAL FLARED		
	①	②	②	②	②	②	①	②	②	②	②	②	
	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	
UNDER 750 ADT	48	39.4	0.6	50.0	1.6	49.8	4.6	38.2	0.6	50.0	1.6	49.8	4.6
	46	39.4	0.6	50.0	1.6	49.8	4.6	38.2	0.6	50.0	1.6	49.8	4.6
	44	39.4	0.6	50.0	1.6	49.8	4.6	38.2	0.6	50.0	1.6	49.8	4.6
	42	39.4	0.6	50.0	1.6	49.8	4.6	38.2	0.6	50.0	1.6	49.8	4.6
	40	51.9	1.2	49.8	5.3			38.2	0.6	50.0	1.6	49.8	4.6
	38	51.9	1.2	49.8	5.3			38.2	0.6	50.0	1.6	49.8	4.6
	36	51.9	1.2	49.8	5.3			38.2	0.6	50.0	1.6	49.8	4.6
	34	64.4	2.2	49.8	6.4			38.2	0.6	50.0	1.6	49.8	4.6
	32	64.4	2.2	49.8	6.4			38.2	0.6	50.0	1.6	49.8	4.6
	30	76.8	3.2	49.8	7.4			38.2	0.6	50.0	1.6	49.8	4.6
	28	89.3	4.3	49.8	8.4			38.2	0.6	50.0	1.6	49.8	4.6
	26	89.3	4.3	49.8	8.4			38.2	0.6	50.0	1.6	49.8	4.6
24	101.7	5.3	49.8	9.5			38.2	0.6	50.0	1.6	49.8	4.6	
750 - 1500 ADT	48	51.9	1.2	49.8	5.3			38.2	0.6	50.0	1.6	49.8	4.6
	46	51.9	1.2	49.8	5.3			38.2	0.6	50.0	1.6	49.8	4.6
	44	51.9	1.2	49.8	5.3			38.2	0.6	50.0	1.6	49.8	4.6
	42	51.9	1.2	49.8	5.3			38.2	0.6	50.0	1.6	49.8	4.6
	40	64.4	2.2	49.8	6.4			38.2	0.6	50.0	1.6	49.8	4.6
	38	64.4	2.2	49.8	6.4			38.2	0.6	50.0	1.6	49.8	4.6
	36	76.8	3.2	49.8	7.4			38.2	0.6	50.0	1.6	49.8	4.6
	34	89.3	4.3	49.8	8.4			38.2	0.6	50.0	1.6	49.8	4.6
	32	89.3	4.3	49.8	8.4			38.2	0.6	50.0	1.6	49.8	4.6
	30	101.7	5.3	49.8	9.5			38.2	0.6	50.0	1.6	49.8	4.6
	28	101.7	5.3	49.8	9.5			38.2	0.6	50.0	1.6	49.8	4.6
	26	114.2	6.4	49.8	10.5			38.2	0.6	50.0	1.6	49.8	4.6
24	114.2	6.4	49.8	10.5			63.1	1.2	49.8	5.3			
1500 - 2000 ADT	48	51.9	1.2	49.8	5.3			38.2	0.6	50.0	1.6	49.8	4.6
	46	64.4	2.2	49.8	6.4			38.2	0.6	50.0	1.6	49.8	4.6
	44	64.4	2.2	49.8	6.4			38.2	0.6	50.0	1.6	49.8	4.6
	42	76.8	3.2	49.8	7.4			38.2	0.6	50.0	1.6	49.8	4.6
	40	76.8	3.2	49.8	7.4			38.2	0.6	50.0	1.6	49.8	4.6
	38	89.3	4.3	49.8	8.4			38.2	0.6	50.0	1.6	49.8	4.6
	36	89.3	4.3	49.8	8.4			38.2	0.6	50.0	1.6	49.8	4.6
	34	101.7	5.3	49.8	9.5			38.2	0.6	50.0	1.6	49.8	4.6
	32	101.7	5.3	49.8	9.5			38.2	0.6	50.0	1.6	49.8	4.6
	30	114.2	6.4	49.8	10.5			63.1	1.2	49.8	5.3		
	28	126.6	7.4	49.8	11.5			63.1	1.2	49.8	5.3		
	26	126.6	7.4	49.8	11.5			63.1	1.2	49.8	5.3		
24	139.1	8.4	49.8	12.6			63.1	1.2	49.8	5.3			
2000 - 6000 ADT	48	64.4	2.2	49.8	6.4			38.2	0.6	50.0	1.6	49.8	4.6
	46	64.4	2.2	49.8	6.4			38.2	0.6	50.0	1.6	49.8	4.6
	44	76.8	3.2	49.8	7.4			38.2	0.6	50.0	1.6	49.8	4.6
	42	76.8	3.2	49.8	7.4			38.2	0.6	50.0	1.6	49.8	4.6
	40	89.3	4.3	49.8	8.4			38.2	0.6	50.0	1.6	49.8	4.6
	38	89.3	4.3	49.8	8.4			38.2	0.6	50.0	1.6	49.8	4.6
	36	101.7	5.3	49.8	9.5			38.2	0.6	50.0	1.6	49.8	4.6
	34	101.7	5.3	49.8	9.5			38.2	0.6	50.0	1.6	49.8	4.6
	32	114.2	6.4	49.8	10.5			38.2	0.6	50.0	1.6	49.8	4.6
	30	114.2	6.4	49.8	10.5			63.1	1.2	49.8	5.3		
	28	126.6	7.4	49.8	11.5			63.1	1.2	49.8	5.3		
	26	139.1	8.4	49.8	12.6			63.1	1.2	49.8	5.3		
24	139.1	8.4	49.8	12.6			75.6	2.2	49.8	6.4			
OVER 6000 ADT	48	64.4	2.2	49.8	6.4			38.2	0.6	50.0	1.6	49.8	4.6
	46	76.8	3.2	49.8	7.4			38.2	0.6	50.0	1.6	49.8	4.6
	44	89.3	4.3	49.8	8.4			38.2	0.6	50.0	1.6	49.8	4.6
	42	89.3	4.3	49.8	8.4			38.2	0.6	50.0	1.6	49.8	4.6
	40	101.7	5.3	49.8	9.5			38.2	0.6	50.0	1.6	49.8	4.6
	38	101.7	5.3	49.8	9.5			38.2	0.6	50.0	1.6	49.8	4.6
	36	114.2	6.4	49.8	10.5			38.2	0.6	50.0	1.6	49.8	4.6
	34	114.2	6.4	49.8	10.5			63.1	1.2	49.8	5.3		
	32	126.6	7.4	49.8	11.5			63.1	1.2	49.8	5.3		
	30	126.6	7.4	49.8	11.5			63.1	1.2	49.8	5.3		
	28	139.1	8.4	49.8	12.6			63.1	1.2	49.8	5.3		
	26	139.1	8.4	49.8	12.6			75.6	2.2	49.8	6.4		
24	151.5	9.5	49.8	13.6			75.6	2.2	49.8	6.4			



Note A: This area may have to be placed at flatter than 10:1 to provide the proper guardrail height.

Note B: For guardrail installed in accordance with Standard Drawing D-764-3A, the three beam terminal connector installation location must be determined from the bridge railing plans.

- NOTES:
- The design traffic volumes (ADT) shall be as shown on title sheet under traffic forecast.
 - Where normal inslope is 4:1, the added fill shall be 4:1. Where normal inslope is 6:1, the added fill shall be 6:1.
 - ① The values shown for dimension "A" are applicable for W-beam guardrail installations attached to jersey barrier as shown on Standard Drawing D-764-3.
 - When the guardrail installation is in accordance with Standard Drawing D-764-3A, dimension "A" shall be revised by adding 6.3' to the tabulated value.
 - ② The values shown for dimensions "B", "D" and "D1" are applicable for W-beam guardrail installations attached to jersey barrier as shown on Standard Drawing D-764-3.
 - When the guardrail installation is in accordance with Standard Drawing D-764-3A, dimensions "B", "D", and "D1" shall be revised by subtracting 0.6' from the tabulated value.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
09-01-98	
REVISIONS	
DATE	CHANGE
10-29-98	Offset dimensions
12-21-00	Revised flared end treatment
04-02-02	Revised table
12-13-02	Revised table
12-17-03	Revised flared rate detail
12-01-04	PE Stamp added
01-04-07	Revised table and layouts
02-16-07	Added notes ①, ②, B, revised table and layouts
09-13-07	Revised guardrail height from 27" to 28"

This document was originally issued and sealed by Mark S Gaydos, Registration Number PE- 4518, on 09/13/07 and the original document is stored at the North Dakota Department of Transportation

**GUARDRAIL AT OBSTRUCTIONS
55 MPH DESIGN LENGTH OF NEED TABLES**

D-764-15A

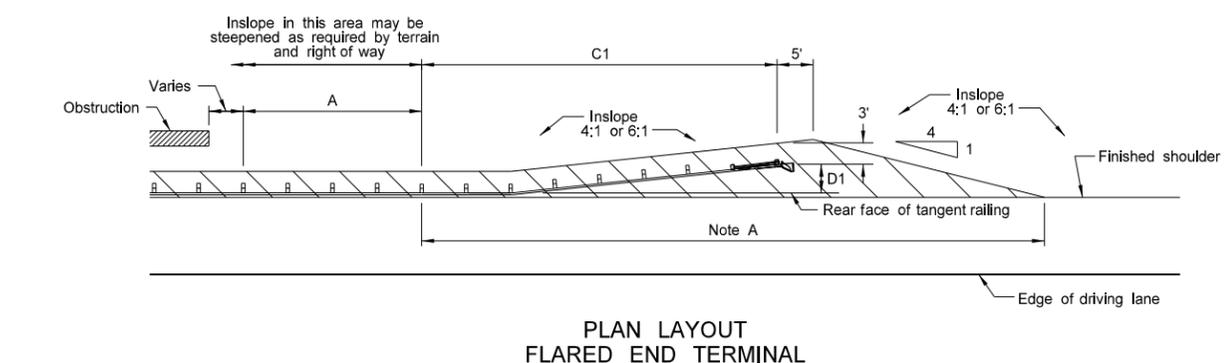
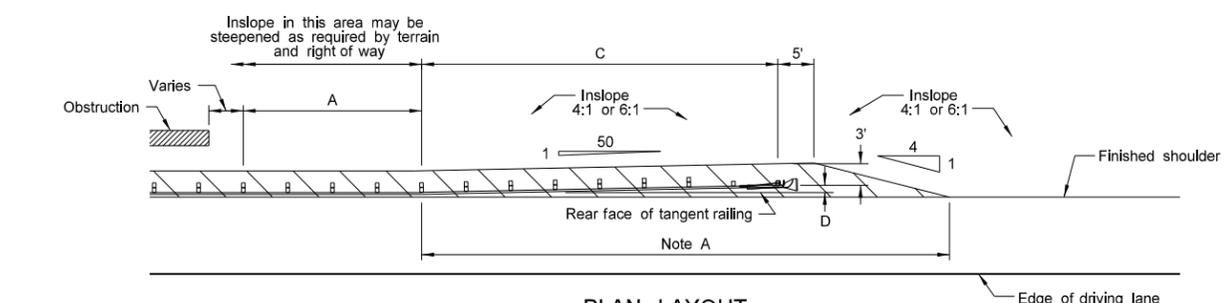
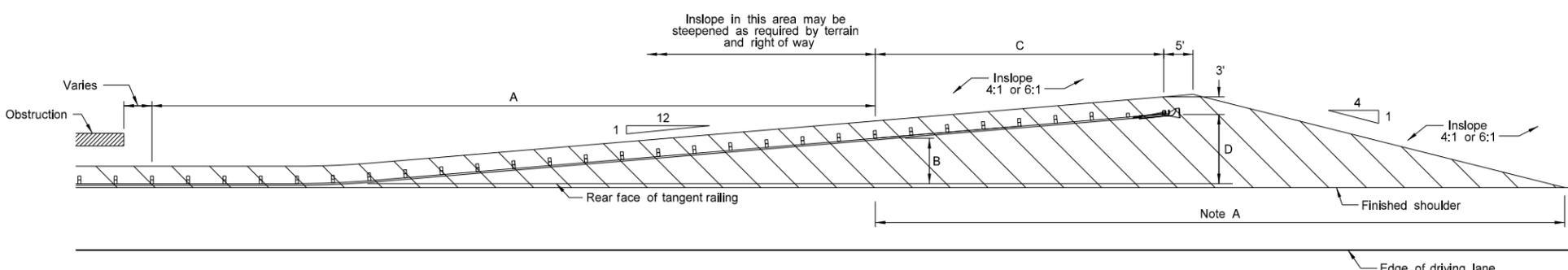
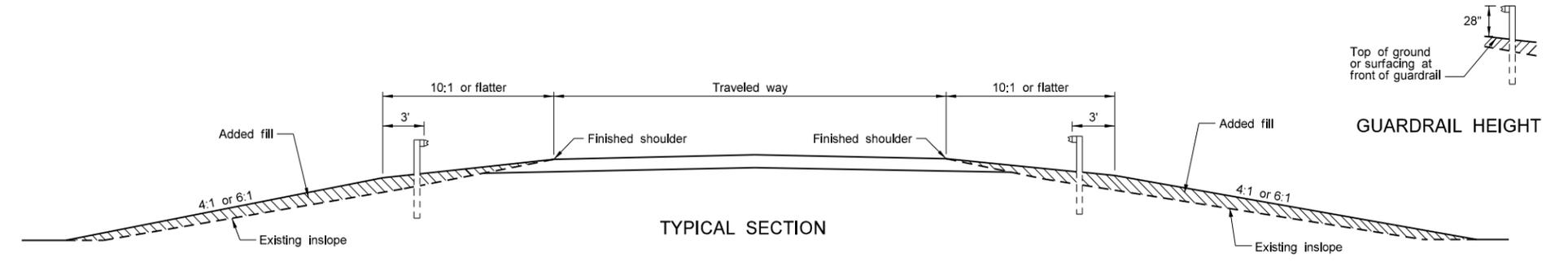
LENGTH OF NEED TABLE 55 MPH DESIGN SPEED

DESIGN TRAFFIC VOLUME	GUARDRAIL OFFSET DISTANCE	APPROACH SIDE							OPPOSITE SIDE							TOTAL W-BEAM LENGTH ①							
		A	B	C	D	C1	D1	E	A	B	C	D	C1	D1	E	0' - 12.5' Obstruction width	12.5' - 25' Obstruction width	25' - 37.5' Obstruction width	37.5' - 50' Obstruction width	50' - 62.5' Obstruction width	62.5' - 75' Obstruction width	75' - 87.5' Obstruction width	87.5' - 100' Obstruction width
		FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
Under 750 ADT	12	0.00	0.00	49.99	1.00	49.79	4.00	50	0.00	0.00	49.99	1.00	49.79	4.00	50	62.5	75.0	87.5	100.0	112.5	125.0	137.5	150.0
	11	0.00	0.00	49.99	1.00	49.79	4.00	50	0.00	0.00	49.99	1.00	49.79	4.00	50	62.5	75.0	87.5	100.0	112.5	125.0	137.5	150.0
	10	12.49	0.52	49.83	4.67			12	0.00	0.00	49.99	1.00	49.79	4.00	50	75.0	87.5	100.0	112.5	125.0	137.5	150.0	162.5
	9	12.49	0.52	49.83	4.67			12	0.00	0.00	49.99	1.00	49.79	4.00	50	75.0	87.5	100.0	112.5	125.0	137.5	150.0	162.5
	8	12.49	0.52	49.83	4.67			12	0.00	0.00	49.99	1.00	49.79	4.00	50	75.0	87.5	100.0	112.5	125.0	137.5	150.0	162.5
	7	12.49	0.52	49.83	4.67			12	0.00	0.00	49.99	1.00	49.79	4.00	50	75.0	87.5	100.0	112.5	125.0	137.5	150.0	162.5
	6	24.95	1.56	49.83	5.71			12	0.00	0.00	49.99	1.00	49.79	4.00	50	87.5	100.0	112.5	125.0	137.5	150.0	162.5	175.0
	5	24.95	1.56	49.83	5.71			12	0.00	0.00	49.99	1.00	49.79	4.00	50	87.5	100.0	112.5	125.0	137.5	150.0	162.5	175.0
	4	37.40	2.60	49.83	6.75			12	0.00	0.00	49.99	1.00	49.79	4.00	50	100.0	112.5	125.0	137.5	150.0	162.5	175.0	187.5
	3	49.86	3.63	49.83	7.79			12	0.00	0.00	49.99	1.00	49.79	4.00	50	112.5	125.0	137.5	150.0	162.5	175.0	187.5	200.0
	2	49.86	3.63	49.83	7.79			12	0.00	0.00	49.99	1.00	49.79	4.00	50	112.5	125.0	137.5	150.0	162.5	175.0	187.5	200.0
	1	62.32	4.67	49.83	8.82			12	0.00	0.00	49.99	1.00	49.79	4.00	50	125.0	137.5	150.0	162.5	175.0	187.5	200.0	212.5
0	62.32	4.67	49.83	8.82			12	0.00	0.00	49.99	1.00	49.79	4.00	50	125.0	137.5	150.0	162.5	175.0	187.5	200.0	212.5	
750 - 1500 ADT	12	12.49	0.52	49.83	4.67			12	0.00	0.00	49.99	1.00	49.79	4.00	50	75.0	87.5	100.0	112.5	125.0	137.5	150.0	162.5
	11	12.49	0.52	49.83	4.67			12	0.00	0.00	49.99	1.00	49.79	4.00	50	75.0	87.5	100.0	112.5	125.0	137.5	150.0	162.5
	10	24.95	1.56	49.83	5.71			12	0.00	0.00	49.99	1.00	49.79	4.00	50	87.5	100.0	112.5	125.0	137.5	150.0	162.5	175.0
	9	24.95	1.56	49.83	5.71			12	0.00	0.00	49.99	1.00	49.79	4.00	50	87.5	100.0	112.5	125.0	137.5	150.0	162.5	175.0
	8	37.40	2.60	49.83	6.75			12	0.00	0.00	49.99	1.00	49.79	4.00	50	100.0	112.5	125.0	137.5	150.0	162.5	175.0	187.5
	7	37.40	2.60	49.83	6.75			12	0.00	0.00	49.99	1.00	49.79	4.00	50	100.0	112.5	125.0	137.5	150.0	162.5	175.0	187.5
	6	49.86	3.63	49.83	7.79			12	0.00	0.00	49.99	1.00	49.79	4.00	50	112.5	125.0	137.5	150.0	162.5	175.0	187.5	200.0
	5	49.86	3.63	49.83	7.79			12	0.00	0.00	49.99	1.00	49.79	4.00	50	112.5	125.0	137.5	150.0	162.5	175.0	187.5	200.0
	4	62.32	4.67	49.83	8.82			12	0.00	0.00	49.99	1.00	49.79	4.00	50	125.0	137.5	150.0	162.5	175.0	187.5	200.0	212.5
	3	74.77	5.71	49.83	9.86			12	0.00	0.00	49.99	1.00	49.79	4.00	50	137.5	150.0	162.5	175.0	187.5	200.0	212.5	225.0
	2	74.77	5.71	49.83	9.86			12	0.00	0.00	49.99	1.00	49.79	4.00	50	137.5	150.0	162.5	175.0	187.5	200.0	212.5	225.0
	1	87.23	6.75	49.83	10.90			12	12.49	0.52	49.83	4.67			12	162.5	175.0	187.5	200.0	212.5	225.0	237.5	250.0
0	87.23	6.75	49.83	10.90			12	12.49	0.52	49.83	4.67			12	162.5	175.0	187.5	200.0	212.5	225.0	237.5	250.0	
1500 - 2000 ADT	12	24.95	1.56	49.83	5.71			12	0.00	0.00	49.99	1.00	49.79	4.00	50	87.5	100.0	112.5	125.0	137.5	150.0	162.5	175.0
	11	37.40	2.60	49.83	6.75			12	0.00	0.00	49.99	1.00	49.79	4.00	50	100.0	112.5	125.0	137.5	150.0	162.5	175.0	187.5
	10	37.40	2.60	49.83	6.75			12	0.00	0.00	49.99	1.00	49.79	4.00	50	100.0	112.5	125.0	137.5	150.0	162.5	175.0	187.5
	9	49.86	3.63	49.83	7.79			12	0.00	0.00	49.99	1.00	49.79	4.00	50	112.5	125.0	137.5	150.0	162.5	175.0	187.5	200.0
	8	49.86	3.63	49.83	7.79			12	0.00	0.00	49.99	1.00	49.79	4.00	50	112.5	125.0	137.5	150.0	162.5	175.0	187.5	200.0
	7	62.32	4.67	49.83	8.82			12	0.00	0.00	49.99	1.00	49.79	4.00	50	125.0	137.5	150.0	162.5	175.0	187.5	200.0	212.5
	6	62.32	4.67	49.83	8.82			12	0.00	0.00	49.99	1.00	49.79	4.00	50	125.0	137.5	150.0	162.5	175.0	187.5	200.0	212.5
	5	74.77	5.71	49.83	9.86			12	0.00	0.00	49.99	1.00	49.79	4.00	50	137.5	150.0	162.5	175.0	187.5	200.0	212.5	225.0
	4	74.77	5.71	49.83	9.86			12	12.49	0.52	49.83	4.67			12	150.0	162.5	175.0	187.5	200.0	212.5	225.0	237.5
	3	87.23	6.75	49.83	10.90			12	12.49	0.52	49.83	4.67			12	162.5	175.0	187.5	200.0	212.5	225.0	237.5	250.0
	2	87.23	6.75	49.83	10.90			12	12.49	0.52	49.83	4.67			12	162.5	175.0	187.5	200.0	212.5	225.0	237.5	250.0
	1	99.69	7.79	49.83	11.94			12	24.95	1.56	49.83	5.71			12	187.5	200.0	212.5	225.0	237.5	250.0	262.5	275.0
0	99.69	7.79	49.83	11.94			12	24.95	1.56	49.83	5.71			12	187.5	200.0	212.5	225.0	237.5	250.0	262.5	275.0	
2000 - 6000 ADT	12	24.95	1.56	49.83	5.71			12	0.00	0.00	49.99	1.00	49.79	4.00	50	87.5	100.0	112.5	125.0	137.5	150.0	162.5	175.0
	11	37.40	2.60	49.83	6.75			12	0.00	0.00	49.99	1.00	49.79	4.00	50	100.0	112.5	125.0	137.5	150.0	162.5	175.0	187.5
	10	37.40	2.60	49.83	6.75			12	0.00	0.00	49.99	1.00	49.79	4.00	50	100.0	112.5	125.0	137.5	150.0	162.5	175.0	187.5
	9	49.86	3.63	49.83	7.79			12	0.00	0.00	49.99	1.00	49.79	4.00	50	112.5	125.0	137.5	150.0	162.5	175.0	187.5	200.0
	8	62.32	4.67	49.83	8.82			12	0.00	0.00	49.99	1.00	49.79	4.00	50	125.0	137.5	150.0	162.5	175.0	187.5	200.0	212.5
	7	62.32	4.67	49.83	8.82			12	0.00	0.00	49.99	1.00	49.79	4.00	50	125.0	137.5	150.0	162.5	175.0	187.5	200.0	212.5
	6	74.77	5.71	49.83	9.86			12	0.00	0.00	49.99	1.00	49.79	4.00	50	137.5	150.0	162.5	175.0	187.5	200.0	212.5	225.0
	5	74.77	5.71	49.83	9.86			12	12.49	0.52	49.83	4.67			12	150.0	162.5	175.0	187.5	200.0	212.5	225.0	237.5
	4	87.23	6.75	49.83	10.90			12	12.49	0.52	49.83	4.67			12	162.5	175.0	187.5	200.0	212.5	225.0	237.5	250.0
	3	87.23	6.75	49.83	10.90			12	12.49	0.52	49.83	4.67			12	162.5	175.0	187.5	200.0	212.5	225.0	237.5	250.0
	2	99.69	7.79	49.83	11.94			12	12.49	0.52	49.83	4.67			12	175.0	187.5	200.0	212.5	225.0	237.5	250.0	262.5
	1	99.69	7.79	49.83	11.94			12	24.95	1.56	49.83	5.71			12	187.5	200.0	212.5	225.0	237.5	250.0	262.5	275.0
0	112.14	8.82	49.83	12.98			12	24.95	1.56	49.83	5.71			12	200.0	212.5	225.0	237.5	250.0	262.5	275.0	287.5	
OVER 6000 ADT	12	37.40	2.60	49.83	6.75			12	0.00	0.00	49.99	1.00	49.79	4.00	50	100.0	112.5	125.0	137.5	150.0	162.5	175.0	187.5
	11	49.86	3.63	49.83	7.79			12	0.00	0.00	49.99	1.00	49.79	4.00	50	112.5	125.0	137.5	150.0	162.5	175.0	187.5	200.0
	10	49.86	3.63	49.83	7.79			12	0.00	0.00	49.99	1.00	49.79	4.00	50	112.5	125.0	137.5	150.0	162.5	175.0	187.5	200.0
	9	62.32	4.67	49.83	8.82			12	0.00	0.00	49.99	1.00	49.79	4.00	50	125.0	137.5	150.0	1				

TYPICAL GRADING AT OBSTRUCTIONS WITH FLARED W-BEAM GUARDRAIL 55 MPH DESIGN SPEED

GUARDRAIL EMBANKMENT DIMENSION TABLE

DESIGN TRAFFIC VOLUME	GUARDRAIL OFFSET DISTANCE	APPROACH SIDE						OPPOSITE SIDE					
		TAPERED GUARDRAIL DIMENSIONS		END TERMINAL DIMENSIONS NON-FLARED		END TERMINAL DIMENSIONS FLARED		TAPERED GUARDRAIL DIMENSIONS		END TERMINAL DIMENSIONS NON-FLARED		END TERMINAL DIMENSIONS FLARED	
		A	B	C	D	C1	D1	A	B	C	D	C1	D1
Under 750 ADT	12	25.00	0.00	49.99	1.00	49.79	4.00	25.00	0.00	49.99	1.00	49.79	4.00
	11	25.00	0.00	49.99	1.00	49.79	4.00	25.00	0.00	49.99	1.00	49.79	4.00
	10	37.49	0.52	49.83	4.67			25.00	0.00	49.99	1.00	49.79	4.00
	9	37.49	0.52	49.83	4.67			25.00	0.00	49.99	1.00	49.79	4.00
	8	37.49	0.52	49.83	4.67			25.00	0.00	49.99	1.00	49.79	4.00
	7	37.49	0.52	49.83	4.67			25.00	0.00	49.99	1.00	49.79	4.00
	6	49.95	1.56	49.83	5.71			25.00	0.00	49.99	1.00	49.79	4.00
	5	49.95	1.56	49.83	5.71			25.00	0.00	49.99	1.00	49.79	4.00
	4	62.40	2.60	49.83	6.75			25.00	0.00	49.99	1.00	49.79	4.00
	3	74.86	3.63	49.83	7.79			25.00	0.00	49.99	1.00	49.79	4.00
	2	74.86	3.63	49.83	7.79			25.00	0.00	49.99	1.00	49.79	4.00
	1	87.32	4.67	49.83	8.82			25.00	0.00	49.99	1.00	49.79	4.00
750 - 1500 ADT	0	87.32	4.67	49.83	8.82			25.00	0.00	49.99	1.00	49.79	4.00
	12	37.49	0.52	49.83	4.67			25.00	0.00	49.99	1.00	49.79	4.00
	11	37.49	0.52	49.83	4.67			25.00	0.00	49.99	1.00	49.79	4.00
	10	49.95	1.56	49.83	5.71			25.00	0.00	49.99	1.00	49.79	4.00
	9	49.95	1.56	49.83	5.71			25.00	0.00	49.99	1.00	49.79	4.00
	8	62.40	2.60	49.83	6.75			25.00	0.00	49.99	1.00	49.79	4.00
	7	62.40	2.60	49.83	6.75			25.00	0.00	49.99	1.00	49.79	4.00
	6	74.86	3.63	49.83	7.79			25.00	0.00	49.99	1.00	49.79	4.00
	5	74.86	3.63	49.83	7.79			25.00	0.00	49.99	1.00	49.79	4.00
	4	87.32	4.67	49.83	8.82			25.00	0.00	49.99	1.00	49.79	4.00
	3	99.77	5.71	49.83	9.86			25.00	0.00	49.99	1.00	49.79	4.00
	2	99.77	5.71	49.83	9.86			25.00	0.00	49.99	1.00	49.79	4.00
1500 - 2000 ADT	1	112.23	6.75	49.83	10.90			37.49	0.52	49.83	4.67		
	0	112.23	6.75	49.83	10.90			37.49	0.52	49.83	4.67		
	12	49.95	1.56	49.83	5.71			25.00	0.00	49.99	1.00	49.79	4.00
	11	62.40	2.60	49.83	6.75			25.00	0.00	49.99	1.00	49.79	4.00
	10	62.40	2.60	49.83	6.75			25.00	0.00	49.99	1.00	49.79	4.00
	9	74.86	3.63	49.83	7.79			25.00	0.00	49.99	1.00	49.79	4.00
	8	74.86	3.63	49.83	7.79			25.00	0.00	49.99	1.00	49.79	4.00
	7	87.32	4.67	49.83	8.82			25.00	0.00	49.99	1.00	49.79	4.00
	6	87.32	4.67	49.83	8.82			25.00	0.00	49.99	1.00	49.79	4.00
	5	99.77	5.71	49.83	9.86			25.00	0.00	49.99	1.00	49.79	4.00
	4	99.77	5.71	49.83	9.86			37.49	0.52	49.83	4.67		
	3	112.23	6.75	49.83	10.90			37.49	0.52	49.83	4.67		
2000 - 6000 ADT	2	112.23	6.75	49.83	10.90			37.49	0.52	49.83	4.67		
	1	124.69	7.79	49.83	11.94			49.95	1.56	49.83	5.71		
	0	124.69	7.79	49.83	11.94			49.95	1.56	49.83	5.71		
	12	49.95	1.56	49.83	5.71			25.00	0.00	49.99	1.00	49.79	4.00
	11	62.40	2.60	49.83	6.75			25.00	0.00	49.99	1.00	49.79	4.00
	10	62.40	2.60	49.83	6.75			25.00	0.00	49.99	1.00	49.79	4.00
	9	74.86	3.63	49.83	7.79			25.00	0.00	49.99	1.00	49.79	4.00
	8	87.32	4.67	49.83	8.82			25.00	0.00	49.99	1.00	49.79	4.00
	7	87.32	4.67	49.83	8.82			25.00	0.00	49.99	1.00	49.79	4.00
	6	99.77	5.71	49.83	9.86			25.00	0.00	49.99	1.00	49.79	4.00
	5	99.77	5.71	49.83	9.86			37.49	0.52	49.83	4.67		
	4	112.23	6.75	49.83	10.90			37.49	0.52	49.83	4.67		
OVER 6000 ADT	3	112.23	6.75	49.83	10.90			37.49	0.52	49.83	4.67		
	2	124.69	7.79	49.83	11.94			49.95	1.56	49.83	5.71		
	1	124.69	7.79	49.83	11.94			49.95	1.56	49.83	5.71		
	0	137.14	8.82	49.83	12.98			49.95	1.56	49.83	5.71		
	12	62.40	2.60	49.83	6.75			25.00	0.00	49.99	1.00	49.79	4.00
	11	74.86	3.63	49.83	7.79			25.00	0.00	49.99	1.00	49.79	4.00
	10	74.86	3.63	49.83	7.79			25.00	0.00	49.99	1.00	49.79	4.00
	9	87.32	4.67	49.83	8.82			25.00	0.00	49.99	1.00	49.79	4.00
	8	87.32	4.67	49.83	8.82			25.00	0.00	49.99	1.00	49.79	4.00
	7	99.77	5.71	49.83	9.86			37.49	0.52	49.83	4.67		
	6	112.23	6.75	49.83	10.90			37.49	0.52	49.83	4.67		
	5	112.23	6.75	49.83	10.90			37.49	0.52	49.83	4.67		
4	124.69	7.79	49.83	11.94			37.49	0.52	49.83	4.67			
3	124.69	7.79	49.83	11.94			49.95	1.56	49.83	5.71			
2	137.14	8.82	49.83	12.98			49.95	1.56	49.83	5.71			
1	137.14	8.82	49.83	12.98			62.40	2.60	49.83	6.75			
0	149.60	9.86	49.83	14.01			62.40	2.60	49.83	6.75			



NOTES:

The design traffic volumes (ADT) shall be as shown on title sheet under traffic forecast.

Where normal inslope is 4:1, the added fill shall be 4:1.

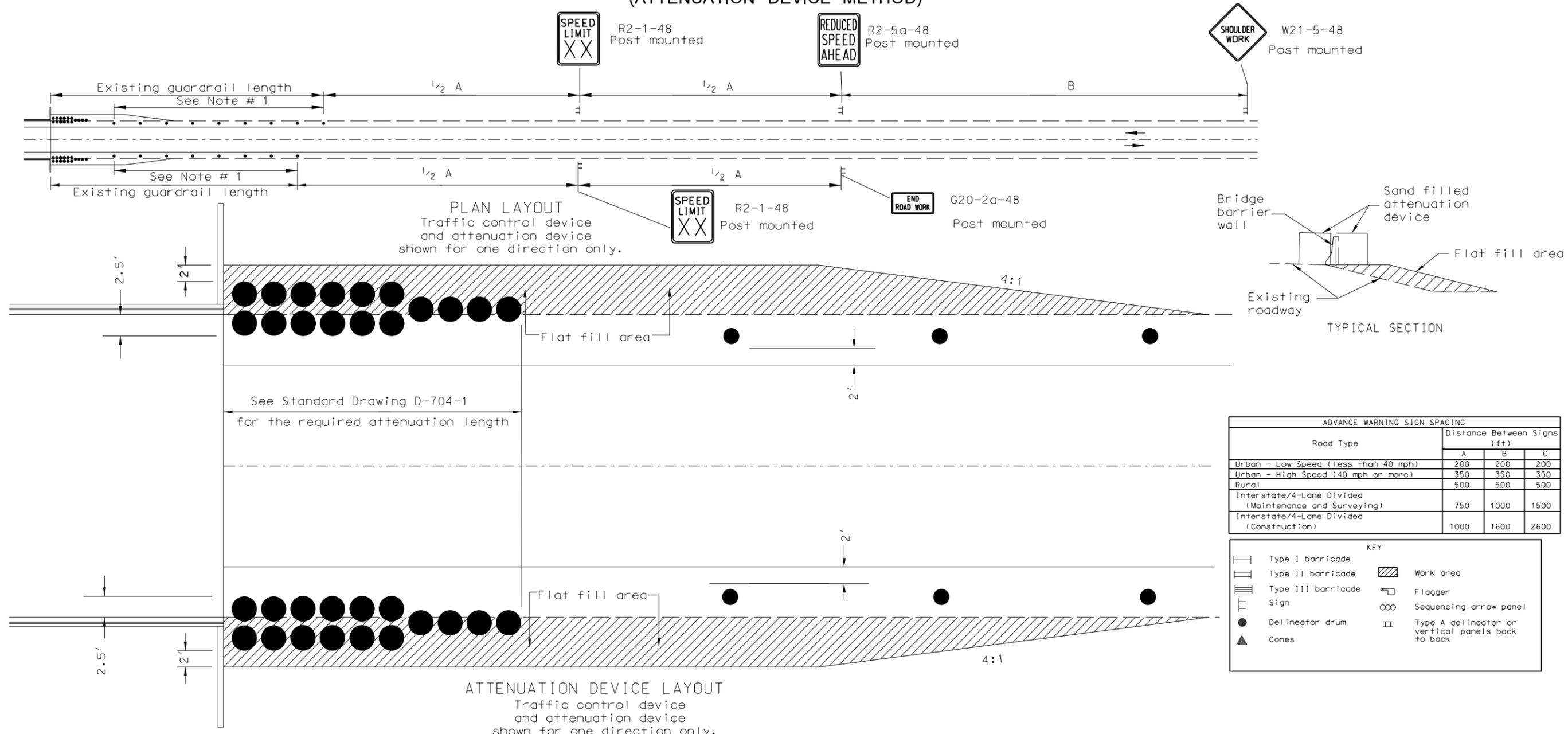
Where normal inslope is 6:1, the added fill shall be 6:1.

Note A: This area may have to be placed at flatter than 10:1 to provide the proper guardrail height.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
09-01-98	
REVISIONS	
DATE	CHANGE
10-29-98	Offset dimensions
12-21-00	Revised flared end treatment
12-17-03	Revised flare rate detail
12-01-04	PE Stamp added
01-04-07	Revised table and layouts
02-16-07	Revised table, typical section
09-12-07	Revised guardrail height from 27" to 28"

This document was originally issued and sealed by Mark S Gaydos, Registration Number PE- 4518, on 09/12/07 and the original document is stored at the North Dakota Department of Transportation

SHORT TERM END TREATMENT FOR BRIDGES
(ATTENUATION DEVICE METHOD)



Road Type	Distance Between Signs (ft)		
	A	B	C
Urban - Low Speed (less than 40 mph)	200	200	200
Urban - High Speed (40 mph or more)	350	350	350
Rural	500	500	500
Interstate/4-Lane Divided (Maintenance and Surveying)	750	1000	1500
Interstate/4-Lane Divided (Construction)	1000	1600	2600

KEY	
	Type I barricade
	Type II barricade
	Type III barricade
	Sign
	Delineator drum
	Cones
	Work area
	Flagger
	Sequencing arrow panel
	Type A delineator or vertical panels back to back

- Note
1. If the shoulder width is less than 3', the vertical panels shall be used and placed as far from the driving lane as possible and still be on the finished shoulder. When there is no shoulder, the vertical panels shall be placed as near as possible to the driving lane on the in slope of the shoulder.
 2. If the bridge is within construction zone signing, the reduced speed ahead sign can be eliminated.
 3. The reduced speed limit shall be determined dependent on the in place speed limit before construction. The speed limit reduction should not exceed 10 mph below the existing speed limit, unless the design speed of the work zone feature has been reduced below the 10 mph. In this case, the speed limit reduction shall not exceed 20 mph. Where speed limits are to be reduced more than 20 mph, a second speed limit sign shall be installed with the desired speed reduction but shall not exceed 20 mph. The second speed limit shall be placed at 1/2 B.

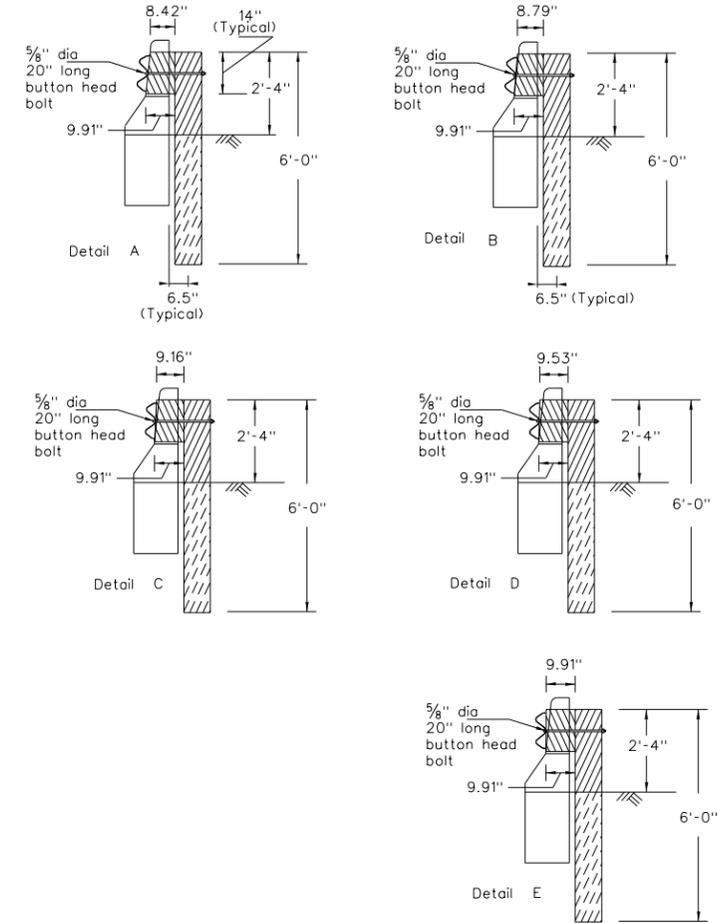
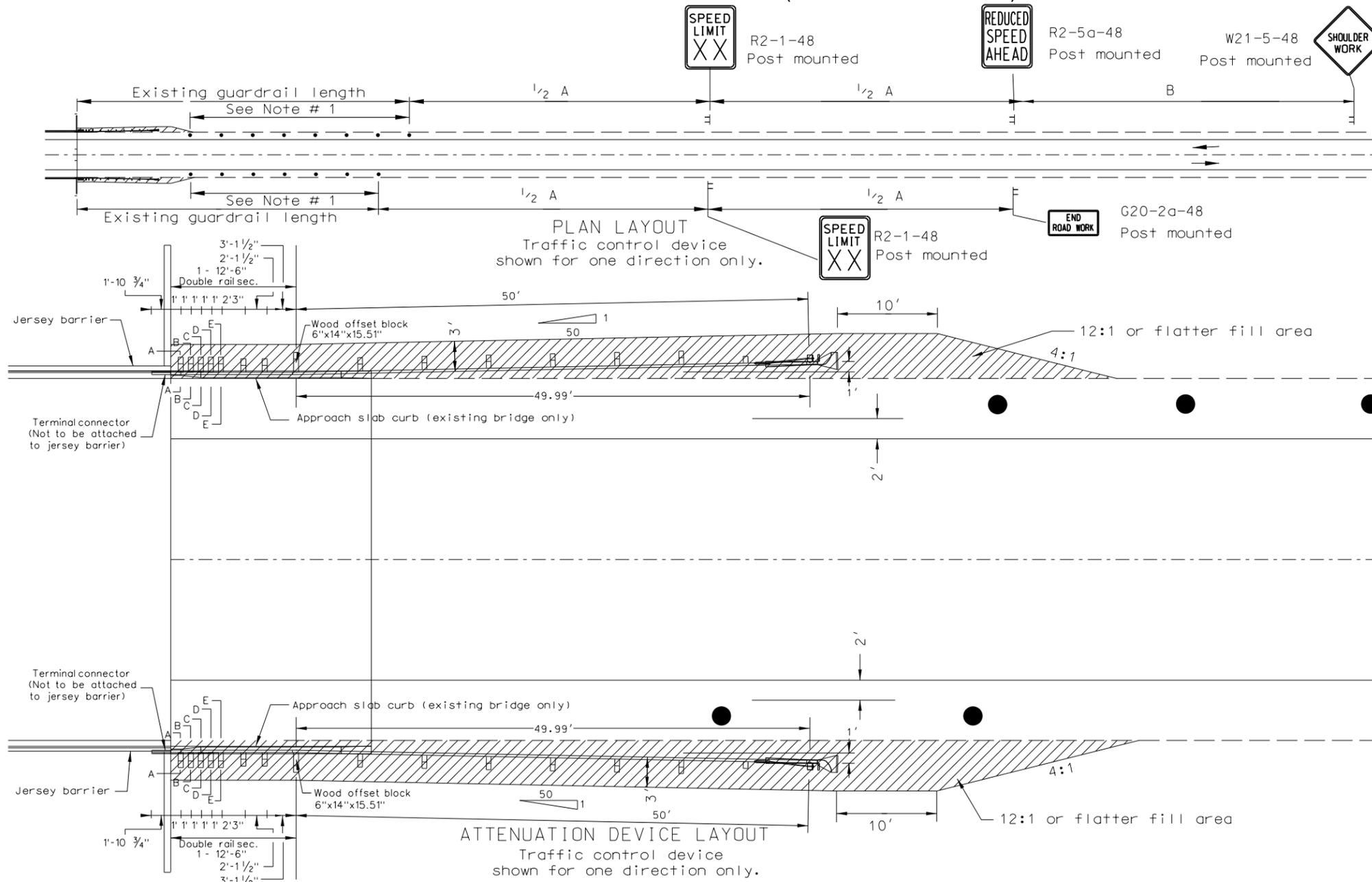
4. The speed limit shall be re-established. The exact speed limit shall be determined in the field, dependent on location and conditions.
5. The reduced speed limit shall be determined dependent on the in place speed limit before construction. The speed limit reduction should not exceed 10 mph below the existing speed limit, unless the design speed of the work zone feature has been reduced below the 10 mph. In this case, the speed limit reduction shall not exceed 20 mph. Where speed limits are to be reduced more than 20 mph, a second speed limit sign shall be installed with the desired speed reduction but shall not exceed 20 mph. The second speed limit sign shall be placed at 1/2 B.
6. Existing speed limit signs within a reduced speed zone shall be covered.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
01-22-04	
REVISIONS	
DATE	CHANGE
12-01-04	PE stamp added

This document was originally issued and sealed by
MARK S. GAYDOS
Registration Number
PE- 4518 ,
on 12/01/04 and the original document is stored at the
North Dakota Department
of Transportation

SHORT TERM END TREATMENT FOR BRIDGES (GUARDRAIL METHOD)

D-764-30



ADVANCE WARNING SIGN SPACING			
Road Type	Distance Between Signs (ft)		
	A	B	C
Urban - Low Speed (less than 40 mph)	200	200	200
Urban - High Speed (40 mph or more)	350	350	350
Rural	500	500	500
Interstate/4-Lane Divided (Maintenance and Surveying)	750	1000	1500
Interstate/4-Lane Divided (Construction)	1000	1600	2600

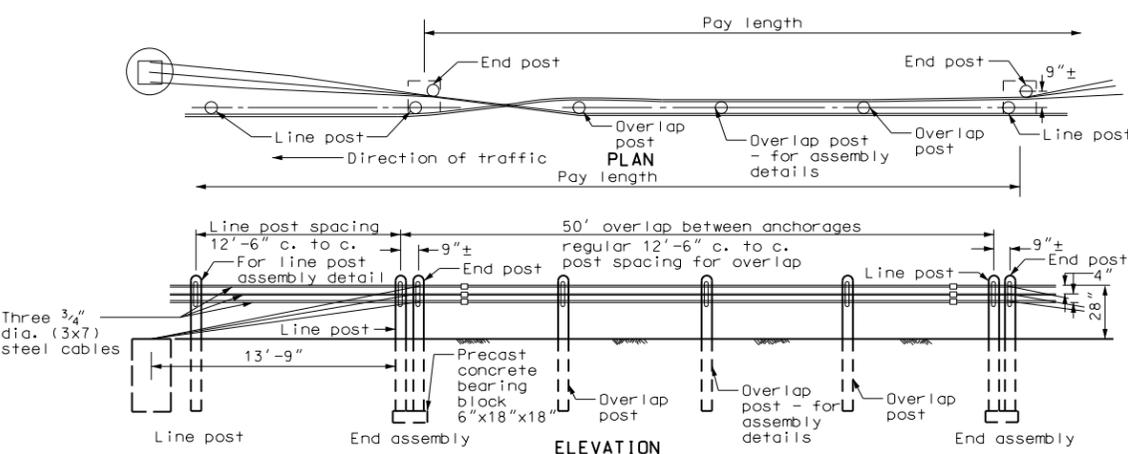
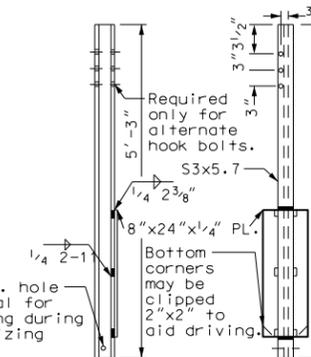
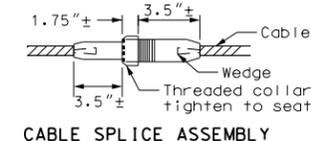
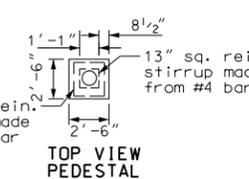
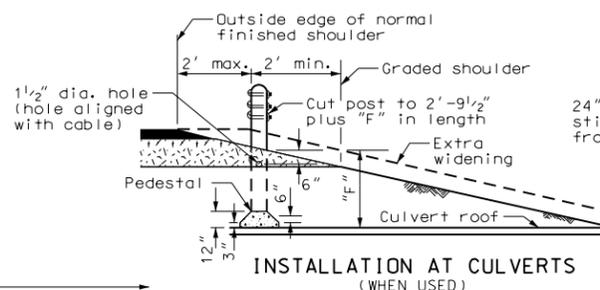
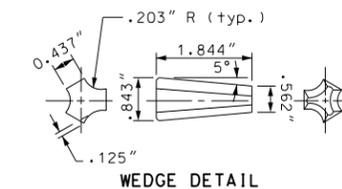
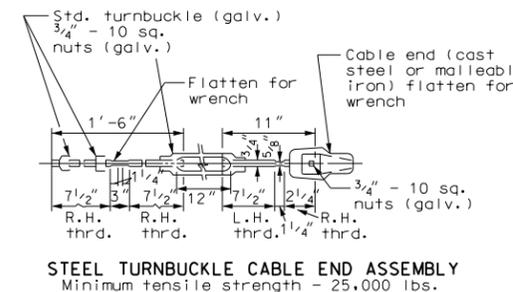
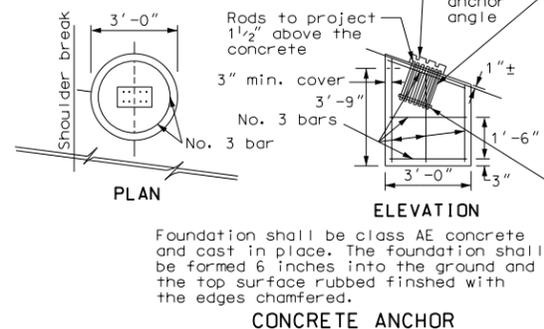
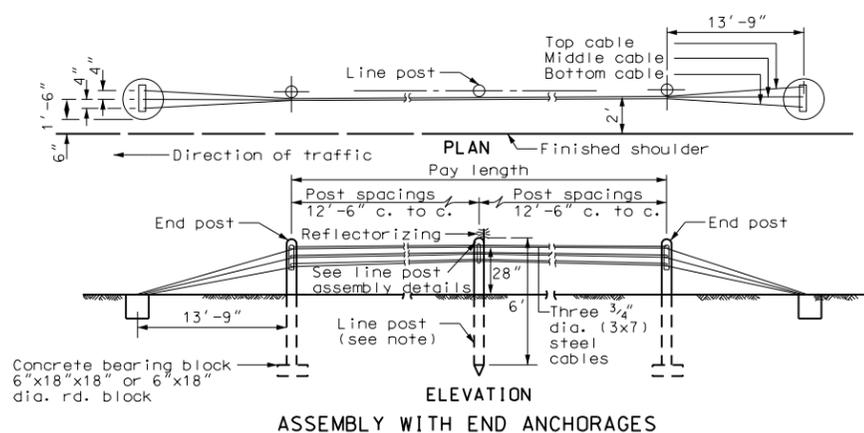
KEY	
[Symbol]	Type I barricade
[Symbol]	Type II barricade
[Symbol]	Type III barricade
[Symbol]	Sign
[Symbol]	Delineator drum
[Symbol]	Cones
[Symbol]	Work area
[Symbol]	Flagger
[Symbol]	Sequencing arrow panel
[Symbol]	Type A delineator or vertical panels back to back

- Note**
1. If the shoulder width is less than 3', the vertical panels shall be used and placed as far from the driving lane as possible and still be on the finished shoulder. When there is no shoulder, the vertical panels shall be placed as near as possible to the driving lane on the inslope of the shoulder.
 2. If the bridge is within construction zone signing, the reduced speed ahead sign can be eliminated.
 3. The reduced speed limit shall be determined dependent on the in place speed limit before construction. The speed limit reduction should not exceed 10 mph below the existing speed limit, unless the design speed of the work zone feature has been reduced below the 10 mph. In this case, the speed limit reduction shall not exceed 20 mph. Where speed limits are to be reduced more than 20 mph, a second speed limit sign shall be installed with the desired speed reduction but shall not exceed 20 mph. The second speed limit sign shall be placed at 1/2 B.
 4. The speed limit shall be re-established. The exact speed limit shall be determined in the field, dependent on location and conditions.
 5. The reduced speed limit shall be determined dependent on the in place speed limit before construction. The speed limit reduction should not exceed 10 mph below the existing speed limit, unless the design speed of the work zone feature has been reduced below the 10 mph. In this case, the speed limit reduction shall not exceed 20 mph. Where speed limits are to be reduced more than 20 mph, a second speed limit sign shall be installed with the desired speed reduction but shall not exceed 20 mph. The second speed limit sign shall be placed at 1/2 B.
 6. Existing speed limit signs within a reduced speed zone shall be covered.

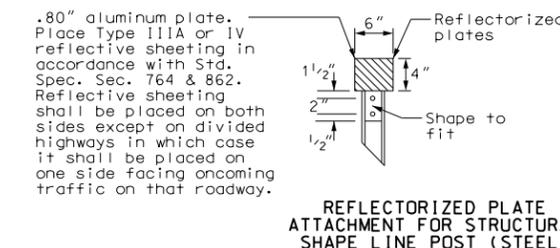
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
01-22-04	
REVISIONS	
DATE	CHANGE
12-01-04	PE Stamp added

This document was originally issued and sealed by
MARK S. GAYDOS
Registration Number
PE- 4518 ,
on 12/01/04 and the original document is stored at the
North Dakota Department
of Transportation

THREE CABLE GUARDRAIL



Detail of concrete pedestal for posts to be used over culverts or footings when dimension "F" is less than 3'-8". When Z or round posts are used and the pedestal required the post hole in the pedestal shall be varied as required by the post shape.



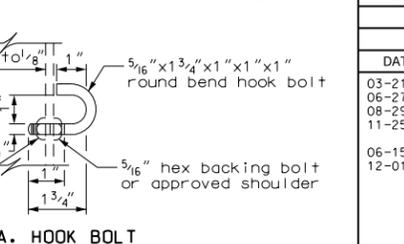
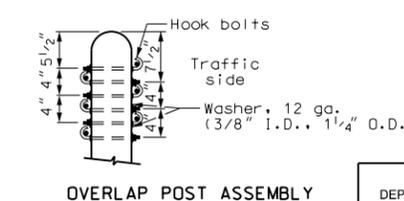
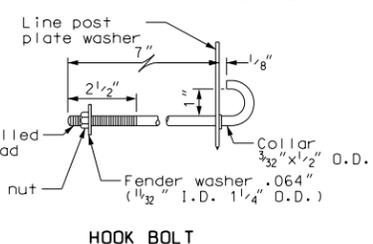
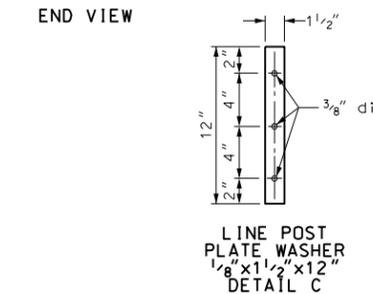
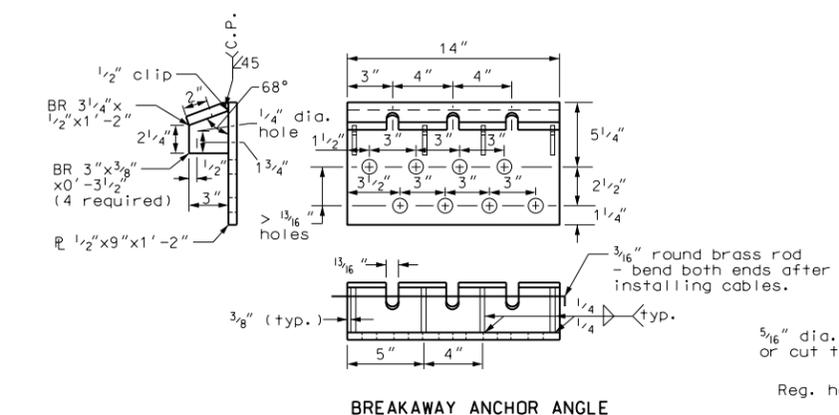
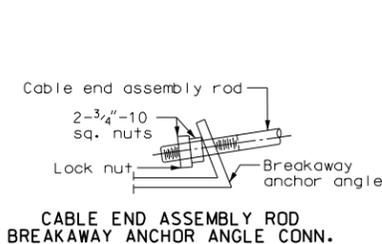
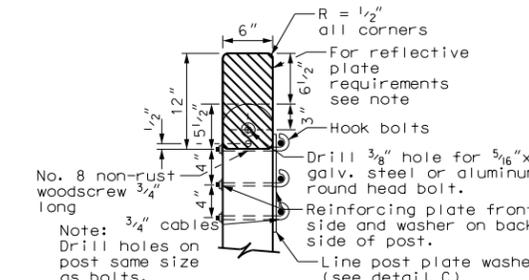
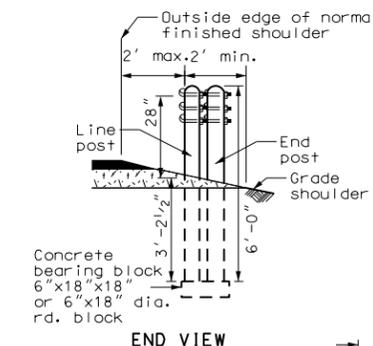
Notes: Reflectorized Plates: Reflector plates shall be on first and last posts. Spacing in-between at 25' centers on guardrail less than 250' in length and at 50' centers for guardrail over 250' in length. The reflector shall be the same color as the pavement marking adjacent to that reflector unless noted otherwise on the plans.

Intermediate anchors shall be equally spaced at intervals not to exceed 1000 ft. on tangents and the outside of horizontal curves. Do not use cable guardrail on the inside of curves sharper than 4°. On the inside of curves 4° or flatter, intermediate anchors shall be spaced at intervals not to exceed:

DEGREE OF CURVE (> MEASUREMENT)	DISTANCE BETWEEN INTERMEDIATE ANCHORS
4°	150 ft.
3°	175 ft.
2°	215 ft.
1°	300 ft.
30 minutes	430 ft.
15 minutes	600 ft.

For intermediate curves, interpolate between values listed above.

ASSEMBLY WITH INTERMEDIATE ANCHORAGES



The pay length shall be from end post to end post. The end posts, hardware, and blocks for the intermediate anchorage assembly shall be included in the price bid for "3 cable guardrail".

Wood posts shall be furnished and installed. The steel post spacing shall be revised to 16' center to center. The last post space will be adjusted to 16'-0", lengthening the overall paylength by the increased length.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-1-86	
REVISIONS	
DATE	CHANGE
03-21-94	General revisions
06-27-94	General revisions
08-29-95	General revisions
11-25-96	Remove cable end assembly detail
06-15-98	Concrete foundation
12-01-04	PE Stamp added

This document was originally issued and sealed by **MARK S. GAYDOS** Registration Number **PE- 4518**, on 12/01/04 and the original document is stored at the North Dakota Department of Transportation

THREE CABLE GUARDRAIL AT OBSTRUCTIONS
55 MPH DESIGN
LENGTH OF NEED TABLES

D-764-34A

LENGTH OF NEED TABLE 55 MPH DESIGN SPEED																					
DESIGN TRAFFIC VOLUME	GUARDRAIL OFFSET DISTANCE	TWO WAY ROADWAYS										DIVIDED HIGHWAY									
		TOTAL THREE CABLE LENGTH (1)										TOTAL THREE CABLE LENGTH (1)									
		A		B		0' - 12.5' Obstruction width		12.5' - 25' Obstruction width		25' - 37.5' Obstruction width		37.5' - 50' Obstruction width		50' - 62.5' Obstruction width		62.5' - 75' Obstruction width		75' - 87.5' Obstruction width		87.5' - 100' Obstruction width	
		FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT	FT
Under 750 ADT	12	62.5	62.5	137.5	150.0	162.5	175.0	187.5	200.0	212.5	225.0	62.5	62.5	137.5	150.0	162.5	175.0	187.5	200.0	212.5	225.0
	11	62.5	62.5	137.5	150.0	162.5	175.0	187.5	200.0	212.5	225.0	62.5	62.5	137.5	150.0	162.5	175.0	187.5	200.0	212.5	225.0
	10	87.5	62.5	162.5	175.0	187.5	200.0	212.5	225.0	237.5	250.0	87.5	62.5	162.5	175.0	187.5	200.0	212.5	225.0	237.5	250.0
	9	112.5	62.5	187.5	200.0	212.5	225.0	237.5	250.0	262.5	275.0	112.5	62.5	187.5	200.0	212.5	225.0	237.5	250.0	262.5	275.0
	8	125.0	62.5	200.0	212.5	225.0	237.5	250.0	262.5	275.0	287.5	125.0	62.5	200.0	212.5	225.0	237.5	250.0	262.5	275.0	287.5
	7	150.0	62.5	225.0	237.5	250.0	262.5	275.0	287.5	300.0	312.5	150.0	62.5	225.0	237.5	250.0	262.5	275.0	287.5	300.0	312.5
	6	162.5	62.5	237.5	250.0	262.5	275.0	287.5	300.0	312.5	325.0	162.5	62.5	237.5	250.0	262.5	275.0	287.5	300.0	312.5	325.0
	5	187.5	62.5	262.5	275.0	287.5	300.0	312.5	325.0	337.5	350.0	187.5	62.5	262.5	275.0	287.5	300.0	312.5	325.0	337.5	350.0
	4	212.5	62.5	287.5	300.0	312.5	325.0	337.5	350.0	362.5	375.0	212.5	62.5	287.5	300.0	312.5	325.0	337.5	350.0	362.5	375.0
	3	225.0	62.5	300.0	312.5	325.0	337.5	350.0	362.5	375.0	387.5	225.0	62.5	300.0	312.5	325.0	337.5	350.0	362.5	375.0	387.5
	2	250.0	62.5	325.0	337.5	350.0	362.5	375.0	387.5	400.0	412.5	250.0	62.5	325.0	337.5	350.0	362.5	375.0	387.5	400.0	412.5
	1	262.5	62.5	337.5	350.0	362.5	375.0	387.5	400.0	412.5	425.0	262.5	62.5	337.5	350.0	362.5	375.0	387.5	400.0	412.5	425.0
0	287.5	62.5	362.5	375.0	387.5	400.0	412.5	425.0	437.5	450.0	287.5	62.5	362.5	375.0	387.5	400.0	412.5	425.0	437.5	450.0	
750 - 1500 ADT	12	112.5	62.5	187.5	200.0	212.5	225.0	237.5	250.0	262.5	275.0	112.5	62.5	187.5	200.0	212.5	225.0	237.5	250.0	262.5	275.0
	11	125.0	62.5	200.0	212.5	225.0	237.5	250.0	262.5	275.0	287.5	125.0	62.5	200.0	212.5	225.0	237.5	250.0	262.5	275.0	287.5
	10	150.0	62.5	225.0	237.5	250.0	262.5	275.0	287.5	300.0	312.5	150.0	62.5	225.0	237.5	250.0	262.5	275.0	287.5	300.0	312.5
	9	162.5	62.5	237.5	250.0	262.5	275.0	287.5	300.0	312.5	325.0	162.5	62.5	237.5	250.0	262.5	275.0	287.5	300.0	312.5	325.0
	8	187.5	62.5	262.5	275.0	287.5	300.0	312.5	325.0	337.5	350.0	187.5	62.5	262.5	275.0	287.5	300.0	312.5	325.0	337.5	350.0
	7	200.0	62.5	275.0	287.5	300.0	312.5	325.0	337.5	350.0	362.5	200.0	62.5	275.0	287.5	300.0	312.5	325.0	337.5	350.0	362.5
	6	212.5	62.5	287.5	300.0	312.5	325.0	337.5	350.0	362.5	375.0	212.5	62.5	287.5	300.0	312.5	325.0	337.5	350.0	362.5	375.0
	5	237.5	62.5	312.5	325.0	337.5	350.0	362.5	375.0	387.5	400.0	237.5	62.5	312.5	325.0	337.5	350.0	362.5	375.0	387.5	400.0
	4	250.0	62.5	325.0	337.5	350.0	362.5	375.0	387.5	400.0	412.5	250.0	62.5	325.0	337.5	350.0	362.5	375.0	387.5	400.0	412.5
	3	275.0	62.5	350.0	362.5	375.0	387.5	400.0	412.5	425.0	437.5	275.0	62.5	350.0	362.5	375.0	387.5	400.0	412.5	425.0	437.5
	2	287.5	75.0	375.0	387.5	400.0	412.5	425.0	437.5	450.0	462.5	287.5	75.0	375.0	387.5	400.0	412.5	425.0	437.5	450.0	462.5
	1	300.0	100.0	412.5	425.0	437.5	450.0	462.5	475.0	500.0	512.5	300.0	100.0	412.5	425.0	437.5	450.0	462.5	475.0	500.0	512.5
0	325.0	112.5	450.0	462.5	475.0	500.0	512.5	525.0	537.5	550.0	325.0	112.5	450.0	462.5	475.0	500.0	512.5	525.0	537.5	550.0	
1500 - 2000 ADT	12	150.0	62.5	225.0	237.5	250.0	262.5	275.0	287.5	300.0	312.5	150.0	62.5	225.0	237.5	250.0	262.5	275.0	287.5	300.0	312.5
	11	162.5	62.5	237.5	250.0	262.5	275.0	287.5	300.0	312.5	325.0	162.5	62.5	237.5	250.0	262.5	275.0	287.5	300.0	312.5	325.0
	10	175.0	62.5	250.0	262.5	275.0	287.5	300.0	312.5	325.0	337.5	175.0	62.5	250.0	262.5	275.0	287.5	300.0	312.5	325.0	337.5
	9	187.5	62.5	262.5	275.0	287.5	300.0	312.5	325.0	337.5	350.0	187.5	62.5	262.5	275.0	287.5	300.0	312.5	325.0	337.5	350.0
	8	212.5	62.5	287.5	300.0	312.5	325.0	337.5	350.0	362.5	375.0	212.5	62.5	287.5	300.0	312.5	325.0	337.5	350.0	362.5	375.0
	7	225.0	62.5	300.0	312.5	325.0	337.5	350.0	362.5	375.0	387.5	225.0	62.5	300.0	312.5	325.0	337.5	350.0	362.5	375.0	387.5
	6	237.5	62.5	312.5	325.0	337.5	350.0	362.5	375.0	387.5	400.0	237.5	62.5	312.5	325.0	337.5	350.0	362.5	375.0	387.5	400.0
	5	250.0	75.0	337.5	350.0	362.5	375.0	387.5	400.0	412.5	425.0	250.0	75.0	337.5	350.0	362.5	375.0	387.5	400.0	412.5	425.0
	4	262.5	87.5	362.5	375.0	387.5	400.0	412.5	425.0	437.5	450.0	262.5	87.5	362.5	375.0	387.5	400.0	412.5	425.0	437.5	450.0
	3	275.0	112.5	400.0	412.5	425.0	437.5	450.0	462.5	475.0	487.5	275.0	112.5	400.0	412.5	425.0	437.5	450.0	462.5	475.0	487.5
	2	287.5	125.0	425.0	437.5	450.0	462.5	475.0	487.5	500.0	512.5	287.5	125.0	425.0	437.5	450.0	462.5	475.0	487.5	500.0	512.5
	1	312.5	137.5	462.5	475.0	487.5	500.0	512.5	525.0	537.5	550.0	312.5	137.5	462.5	475.0	487.5	500.0	512.5	525.0	537.5	550.0
0	325.0	150.0	487.5	500.0	512.5	525.0	537.5	550.0	562.5	575.0	325.0	150.0	487.5	500.0	512.5	525.0	537.5	550.0	562.5	575.0	
2000 - 6000 ADT	12	162.5	62.5	237.5	250.0	262.5	275.0	287.5	300.0	312.5	325.0	162.5	62.5	237.5	250.0	262.5	275.0	287.5	300.0	312.5	325.0
	11	175.0	62.5	250.0	262.5	275.0	287.5	300.0	312.5	325.0	337.5	175.0	62.5	250.0	262.5	275.0	287.5	300.0	312.5	325.0	337.5
	10	200.0	62.5	275.0	287.5	300.0	312.5	325.0	337.5	350.0	362.5	200.0	62.5	275.0	287.5	300.0	312.5	325.0	337.5	350.0	362.5
	9	212.5	62.5	287.5	300.0	312.5	325.0	337.5	350.0	362.5	375.0	212.5	62.5	287.5	300.0	312.5	325.0	337.5	350.0	362.5	375.0
	8	225.0	62.5	300.0	312.5	325.0	337.5	350.0	362.5	375.0	387.5	225.0	62.5	300.0	312.5	325.0	337.5	350.0	362.5	375.0	387.5
	7	237.5	62.5	312.5	325.0	337.5	350.0	362.5	375.0	387.5	400.0	237.5	62.5	312.5	325.0	337.5	350.0	362.5	375.0	387.5	400.0
	6	262.5	75.0	350.0	362.5	375.0	387.5	400.0	412.5	425.0	437.5	262.5	75.0	350.0	362.5	375.0	387.5	400.0	412.5	425.0	437.5
	5	275.0	87.5	375.0	387.5	400.0	412.5	425.0	437.5	450.0	462.5	275.0	87.5	375.0	387.5	400.0	412.5	425.0	437.5	450.0	462.5
	4	287.5	100.0	400.0	412.5	425.0	437.5	450.0	462.5	475.0	487.5	287.5	100.0	400.0	412.5	425.0	437.5	450.0	462.5	475.0	487.5
	3	300.0	112.5	425.0	437.5	450.0	462.5	475.0	487.5	500.0	512.5	300.0	112.5	425.0	437.5	450.0	462.5	475.0	487.5	500.0	512.5
	2	325.0	137.5	475.0	487.5	500.0	512.5	525.0	537.5	550.0	562.5	325.0	137.5	475.0	487.5	500.0	512.5	525.0	537.5	550.0	562.5
	1	337.5	150.0	500.0</																	