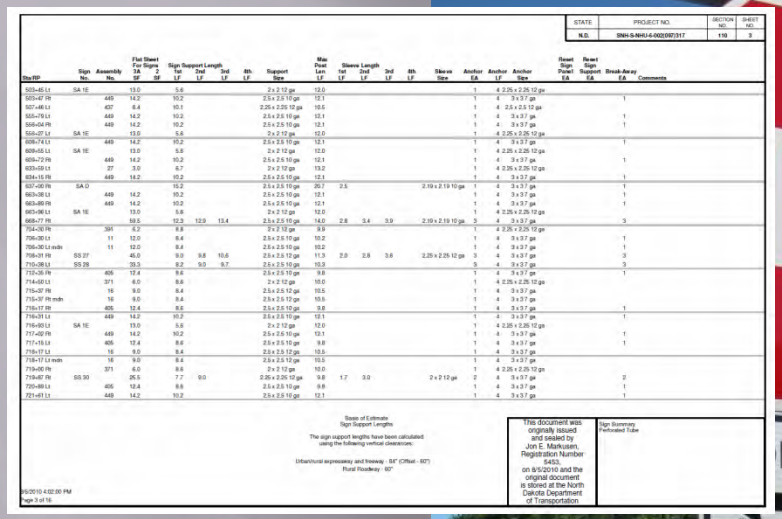
Sign Installation

Guard Rail
Lighting
Signals
ITS

Lyle Landstrom
Fargo District

SIGNS



Sta/RP	Sign No.	Assembly No.	Flat Sheet For Signs SF	Sign Support Length 1st LF	2nd LF	3rd LF	4th LF	Support Size	Max Post Len LF	Sleeve Length 1st LF	2nd LF	3rd LF	4th LF	Sleeve Size	Anchor EA	Anchor LF	Anchor Size	Reset Sign Panel EA	Reset Sign Support EA	Break-Away EA	Comments
503+45 Lt	SA 1E		13.0	5.6				2 x 2 12 ga	12.0						1	4	2.25 x 2.25 12 ga				
503+47 Rt		449	14.2	10.2				2.5 x 2.5 10 ga	12.1						1	4	3 x 3.7 ga			1	
507+46 Lt		437	8.4	10.1				2.25 x 2.25 12 ga	10.5						1	4	2.5 x 2.5 12 ga				
555+79 Lt		449	14.2	10.2				2.5 x 2.5 10 ga	12.1						1	4	3 x 3.7 ga			1	
556+04 Rt		449	14.2	10.2				2.5 x 2.5 10 ga	12.1						1	4	3 x 3.7 ga			1	
556+27 Lt	SA 1E		13.0	5.6				2 x 2 12 ga	12.0						1	4	2.25 x 2.25 12 ga				
608+74 Lt		449	14.2	10.2				2.5 x 2.5 10 ga	12.1						1	4	3 x 3.7 ga			1	
609+55 Lt	SA 1E		13.0	5.6				2 x 2 12 ga	12.0						1	4	2.25 x 2.25 12 ga				
609+72 Rt		449	14.2	10.2				2.5 x 2.5 10 ga	12.1						1	4	3 x 3.7 ga			1	
633+09 Lt		27	3.0	6.7				2 x 2 12 ga	13.2						1	4	2.25 x 2.25 12 ga				
634+16 Rt		449	14.2	10.2				2.5 x 2.5 10 ga	12.1						1	4	3 x 3.7 ga			1	
637+08 Rt	SA D			15.2				2.5 x 2.5 10 ga	20.7	2.5				2.19 x 2.19 10 ga	1	4	3 x 3.7 ga			1	
663+38 Lt		449	14.2	10.2				2.5 x 2.5 10 ga	12.1						1	4	3 x 3.7 ga			1	
663+86 Rt		449	14.2	10.2				2.5 x 2.5 10 ga	12.1						1	4	3 x 3.7 ga			1	
665+36 Lt	SA 1E		13.0	5.6				2 x 2 12 ga	12.0						1	4	2.25 x 2.25 12 ga				
668+77 Rt			59.5	12.3	12.9	13.4		2.5 x 2.5 10 ga	14.0	2.8	3.4	3.9		2.19 x 2.19 10 ga	3	4	3 x 3.7 ga			3	
704+32 Rt		391	8.2	8.8				2 x 2 12 ga	9.9						1	4	2.25 x 2.25 12 ga				
706+30 Lt		11	12.0	8.4				2.5 x 2.5 10 ga	10.2						1	4	3 x 3.7 ga			1	
706+30 Lt mdn		11	12.0	8.4				2.5 x 2.5 10 ga	10.2						1	4	3 x 3.7 ga			1	
706+31 Rt	SS 27		40.0	9.0	9.8	10.6		2.5 x 2.5 12 ga	11.3	2.0	2.8	3.6		2.25 x 2.25 12 ga	3	4	3 x 3.7 ga			3	
710+38 Lt	SS 28		33.3	8.2	9.0	9.7		2.5 x 2.5 10 ga	10.3						3	4	3 x 3.7 ga			3	
712+35 Rt		405	17.4	9.6				2.5 x 2.5 10 ga	9.8						1	4	3 x 3.7 ga			1	
714+60 Lt		371	6.0	8.6				2 x 2 12 ga	10.0						1	4	2.25 x 2.25 12 ga				
715+37 Rt		16	9.0	8.4				2.5 x 2.5 12 ga	10.5						1	4	3 x 3.7 ga				
715+37 Rt mdn		16	9.0	8.4				2.5 x 2.5 12 ga	10.5						1	4	3 x 3.7 ga				
716+17 Rt		405	12.4	8.6				2.5 x 2.5 10 ga	9.8						1	4	3 x 3.7 ga			1	
716+93 Lt		449	14.2	10.2				2.5 x 2.5 10 ga	12.1						1	4	3 x 3.7 ga			1	
716+93 Lt	SA 1E		13.0	5.6				2 x 2 12 ga	12.0						1	4	2.25 x 2.25 12 ga				
717+42 Rt		449	14.2	10.2				2.5 x 2.5 10 ga	12.1						1	4	3 x 3.7 ga			1	
717+70 Lt		405	17.4	8.6				2.5 x 2.5 10 ga	9.8						1	4	3 x 3.7 ga			1	
718+17 Lt		16	9.0	8.4				2.5 x 2.5 12 ga	10.5						1	4	3 x 3.7 ga				
718+17 Lt mdn		16	9.0	8.4				2.5 x 2.5 12 ga	10.5						1	4	3 x 3.7 ga				
719+82 Rt		371	6.0	8.6				2 x 2 12 ga	10.0						1	4	2.25 x 2.25 12 ga				
719+87 Rt	SS 30		25.5	7.7	9.0			2.25 x 2.25 12 ga	9.8	1.7	3.0			2 x 2 12 ga	2	4	3 x 3.7 ga			2	
720+89 Lt		405	12.4	8.6				2.5 x 2.5 10 ga	9.8						1	4	3 x 3.7 ga			1	
721+41 Lt		449	14.2	10.2				2.5 x 2.5 10 ga	12.1						1	4	3 x 3.7 ga				

Basis of Estimate:
Sign Support Lengths

The sign support lengths have been calculated using the following vertical clearances:

Urban/rural expressway and freeway - 84" (Offset - 60")
Rural Roadway - 60"

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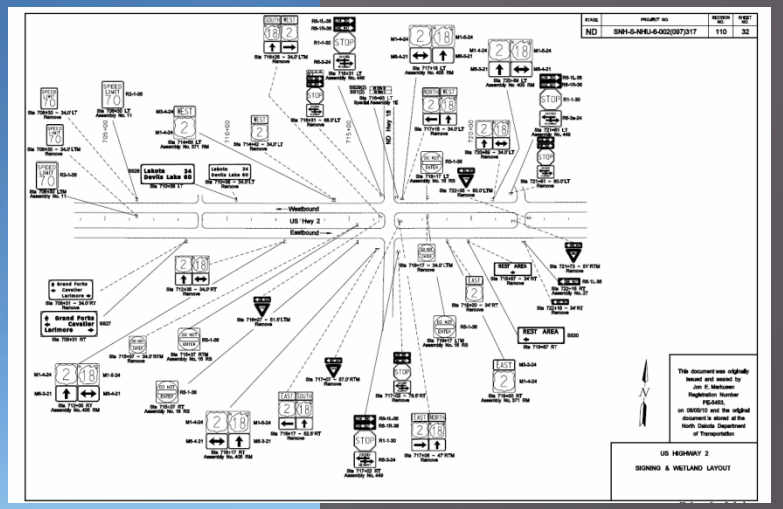
Sign Summary
Perforated Tube



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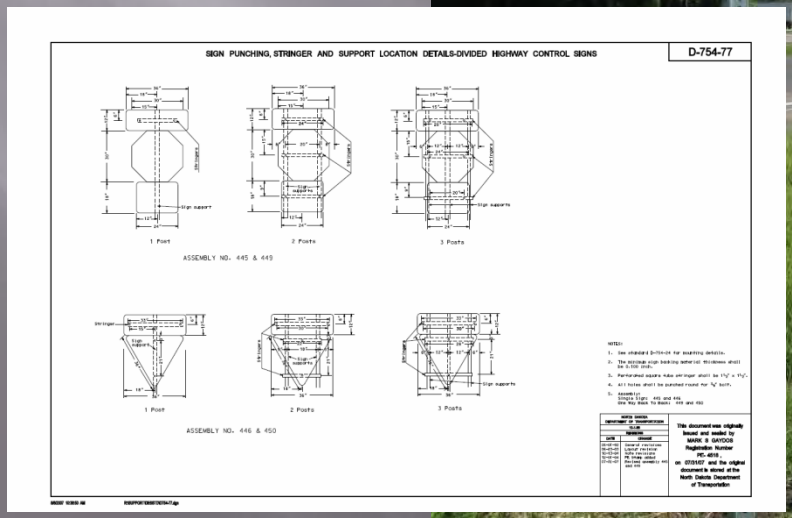
US HIGHWAY 2
SIGNING & WETLAND LAYOUT



SIGN PUNCHING, STRINGER AND SUPPORT LOCATION DETAILS-DIVIDED HIGHWAY CONTROL SIGNS

D-754-77

1 Post | 2 Posts | 3 Posts

ASSEMBLY NO. 445 & 449

1 Post | 2 Posts | 3 Posts

ASSEMBLY NO. 446 & 450

NOTES:
1. See standard D-754-04 for mounting details.
2. The minimum sign backing material thickness shall be 0.100 inch.
3. Perforated square tube stringer shall be 1½" x 1½".
4. All holes shall be punched round for ¾" bolt.
5. Assembly:
Single Signs: 445 and 446
One Way Back to Back: 449 and 450

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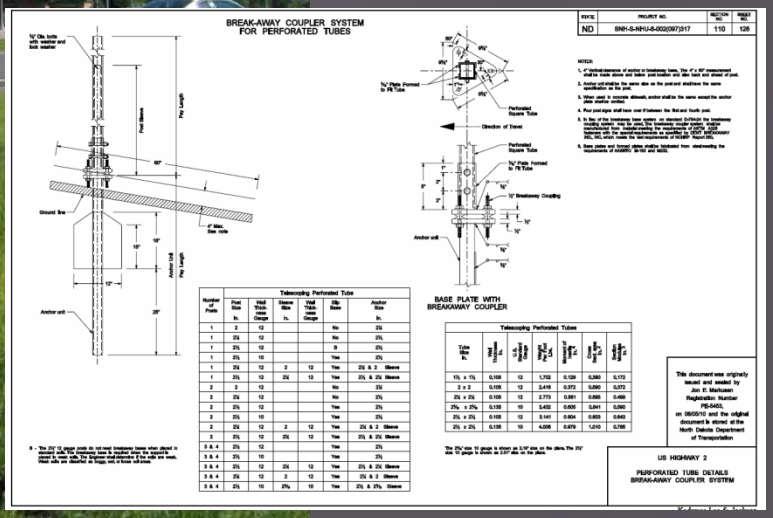

BREAK-AWAY COUPLER SYSTEM FOR PERFORATED TUBES

Telescoping Perforated Tube

Number of Posts	Post Size In.	Wall Thickness Gauge	Sleeve Size In.	Wall Thickness Gauge	Slip Base	Anchor Size In.
1	2	12			No	2½
1	2½	12			No	2½
1	3½	12			S	2½
1	3½	10			Yes	2½
1	3½	12	2	12	Yes	2½ & 3 Sleeve
1	3½	12	2½	12	Yes	2½ & 3½ Sleeve
2	2	12			No	2½
2	2½	12			No	2½
2	2½	12			Yes	2½
2	3½	10			Yes	2½
2	2½	12	2	12	Yes	2½ & 3 Sleeve
2	3½	12	2½	12	Yes	2½ & 3½ Sleeve
3 & 4	2½	12			Yes	2½
3 & 4	2½	10			Yes	2½
3 & 4	3½	12	2½	12	Yes	2½ & 3½ Sleeve
3 & 4	3½	12	3	12	Yes	3½ & 3 Sleeve
3 & 4	3½	10	2½	10	Yes	2½ & 3½ Sleeve

BASE PLATE WITH BREAKAWAY COUPLER

Telescoping Perforated Tubes

Tube Size In.	Wall Thickness Gauge	Wall Thickness In.	Weight Per Ft. Lbs.	Section Modulus In.³	Moment of Inertia In.⁴
1½ x 1½	0.105	12	1.702	0.126	0.380
2 x 2	0.105	12	2.418	0.272	0.680
2½ x 2½	0.105	12	2.773	0.391	0.856
2½ x 2½	0.135	10	3.452	0.805	0.841
3½ x 3½	0.105	12	3.141	0.804	0.843
3½ x 3½	0.135	10	4.008	0.979	1.210

The 2½" size 10 gauge is shown as 3.14" dia. on the plans. The 2½" size 10 gauge is shown as 3.07" dia. on the plans.

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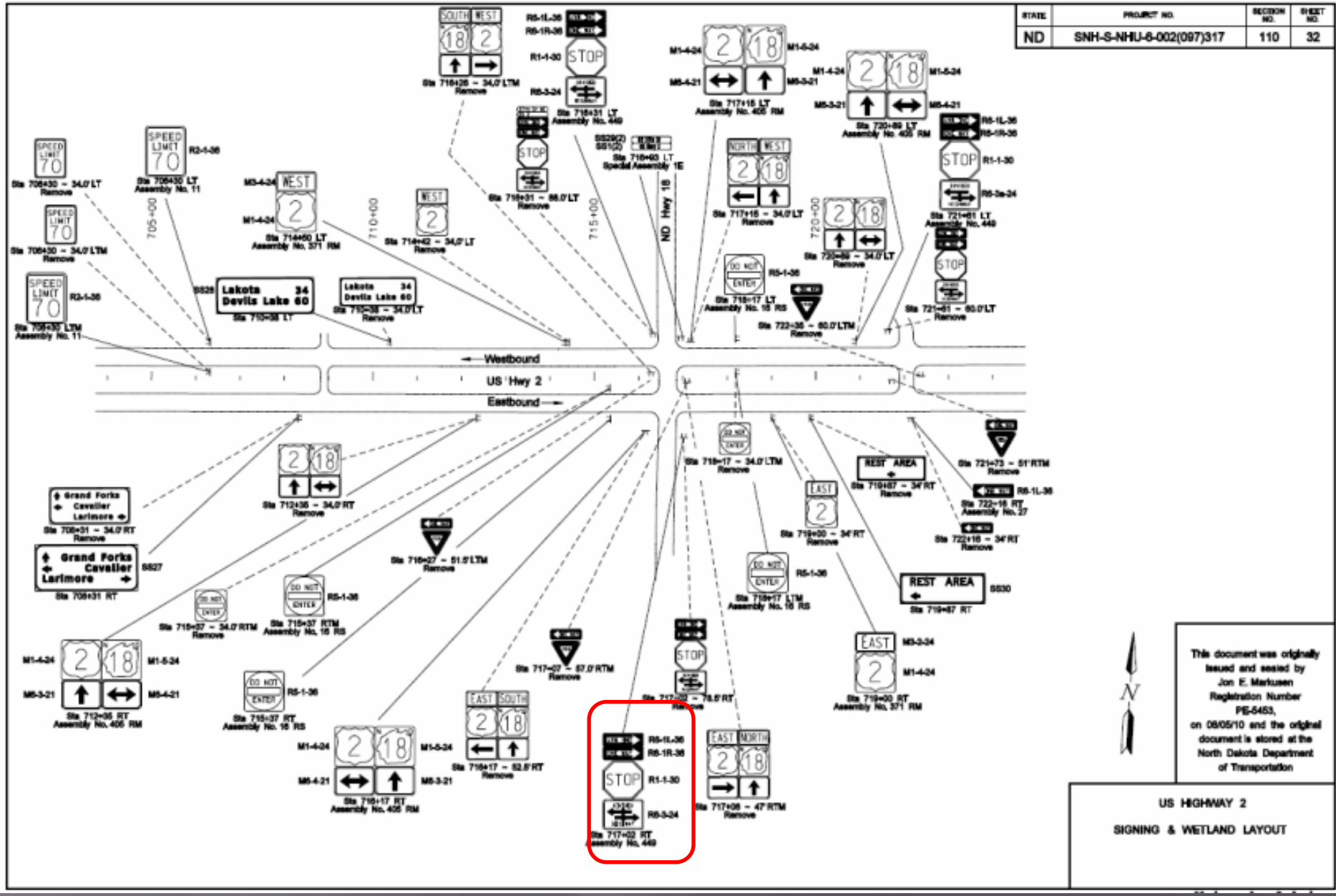
US HIGHWAY 2
PERFORATED TUBE DETAILS
BREAK-AWAY COUPLER SYSTEM


STATE
PROJECT NO.
SECTION NO.
SHEET NO.
ND
SNH-S-NHU-6-002(097)317
110
32
Westbound
US Hwy 2
Eastbound
ND Hwy 18
705+00
710+00
715+00
720+00
Lakota 34
Devils Lake 60
Grand Forks
Cavalier
Larimore
REST AREA
STOP
DO NOT ENTER
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US HIGHWAY 2
SIGNING & WETLAND LAYOUT

STATE	PROJECT NO.
N.D.	SNH-S-NHU-6-002(097)31

Sta/RP	Sign No.	Assembly No.	Flat Sheet For Signs 3A SF	Flat Sheet For Signs 2 SF	Sign Support Length 1st LF	Sign Support Length 2nd LF	Sign Support Length 3rd LF	Sign Support Length 4th LF	Support Size	Max Post Len LF	Sleeve Length 1st LF	Sleeve Length 2nd LF	Sleeve Length 3rd LF	Sleeve Length 4th LF	Sleeve Size	Anchor EA	Anchor LF	Anchor Size	Reset Sign Panel EA	Reset Sign Support EA	Break-Away EA	Comments
503+45 Lt	SA 1E		13.0		5.6				2 x 2 12 ga	12.0						1	4	2.25 x 2.25 12 ga				
503+47 Rt		449	14.2		10.2				2.5 x 2.5 10 ga	12.1						1	4	3 x 3 7 ga			1	
507+46 Lt		437	8.4		10.1				2.25 x 2.25 12 ga	10.5						1	4	2.5 x 2.5 12 ga				
555+79 Lt		449	14.2		10.2				2.5 x 2.5 10 ga	12.1						1	4	3 x 3 7 ga			1	
556+04 Rt		449	14.2		10.2				2.5 x 2.5 10 ga	12.1						1	4	3 x 3 7 ga			1	
556+27 Lt	SA 1E		13.0		5.6				2 x 2 12 ga	12.0						1	4	2.25 x 2.25 12 ga				
608+74 Lt		449	14.2		10.2				2.5 x 2.5 10 ga	12.1						1	4	3 x 3 7 ga			1	
609+55 Lt	SA 1E		13.0		5.6				2 x 2 12 ga	12.0						1	4	2.25 x 2.25 12 ga				
609+72 Rt		449	14.2		10.2				2.5 x 2.5 10 ga	12.1						1	4	3 x 3 7 ga			1	
633+59 Lt		27	3.0		6.7				2 x 2 12 ga	13.2						1	4	2.25 x 2.25 12 ga				
634+15 Rt		449	14.2		10.2				2.5 x 2.5 10 ga	12.1						1	4	3 x 3 7 ga			1	
637+00 Rt	SA D				15.2				2.5 x 2.5 10 ga	20.7	2.5				2.19 x 2.19 10 ga	1	4	3 x 3 7 ga			1	
663+38 Lt		449	14.2		10.2				2.5 x 2.5 10 ga	12.1						1	4	3 x 3 7 ga			1	
663+89 Rt		449	14.2		10.2				2.5 x 2.5 10 ga	12.1						1	4	3 x 3 7 ga			1	
663+96 Lt	SA 1E		13.0		5.6				2 x 2 12 ga	12.0						1	4	2.25 x 2.25 12 ga				
668+77 Rt			59.5		12.3	12.9	13.4		2.5 x 2.5 10 ga	14.0	2.8	3.4	3.9		2.19 x 2.19 10 ga	3	4	3 x 3 7 ga			3	
704+30 Rt		391	6.2		8.8				2 x 2 12 ga	9.9						1	4	2.25 x 2.25 12 ga				
706+30 Lt		11	12.0		8.4				2.5 x 2.5 10 ga	10.2						1	4	3 x 3 7 ga			1	
706+30 Lt mdn		11	12.0		8.4				2.5 x 2.5 10 ga	10.2						1	4	3 x 3 7 ga			1	
708+31 Rt	SS 27		45.0		9.0	9.8	10.6		2.5 x 2.5 12 ga	11.3	2.0	2.8	3.6		2.25 x 2.25 12 ga	3	4	3 x 3 7 ga			3	
710+38 Lt	SS 28		33.3		8.2	9.0	9.7		2.5 x 2.5 10 ga	10.3						3	4	3 x 3 7 ga			3	
712+35 Rt		405	12.4		9.6				2.5 x 2.5 10 ga	9.8						1	4	3 x 3 7 ga			1	
714+50 Lt		371	6.0		9.6				2 x 2 12 ga	10.0						1	4	2.25 x 2.25 12 ga				
715+37 Rt		16	9.0		9.4				2.5 x 2.5 12 ga	10.5						1	4	3 x 3 7 ga				
715+37 Rt mdn		16	9.0		9.4				2.5 x 2.5 12 ga	10.5						1	4	3 x 3 7 ga				
716+17 Rt		405	12.4		9.6				2.5 x 2.5 10 ga	9.8						1	4	3 x 3 7 ga			1	
716+31 Lt		449	14.2		10.2				2.5 x 2.5 10 ga	12.1						1	4	3 x 3 7 ga			1	
716+93 Lt	SA 1E		13.0		5.6				2 x 2 12 ga	12.0						1	4	2.25 x 2.25 12 ga				
717+02 Rt		449	14.2		10.2				2.5 x 2.5 10 ga	12.1						1	4	3 x 3 7 ga			1	
717+15 Lt		405	12.4		9.6				2.5 x 2.5 10 ga	9.8						1	4	3 x 3 7 ga			1	
718+17 Lt		16	9.0		9.4				2.5 x 2.5 12 ga	10.5						1	4	3 x 3 7 ga				
718+17 Lt mdn		16	9.0		9.4				2.5 x 2.5 12 ga	10.5						1	4	3 x 3 7 ga				
719+00 Rt		371	6.0		9.6				2 x 2 12 ga	10.0						1	4	2.25 x 2.25 12 ga				
719+87 Rt	SS 30		25.5		7.7	9.0			2.25 x 2.25 12 ga	9.8	1.7	3.0			2 x 2 12 ga	2	4	3 x 3 7 ga			2	
720+89 Lt		405	12.4		9.6				2.5 x 2.5 10 ga	9.8						1	4	3 x 3 7 ga			1	
721+61 Lt		449	14.2		10.2				2.5 x 2.5 10 ga	12.1						1	4	3 x 3 7 ga			1	

Basis of Estimate
Sign Support Lengths

The sign support lengths have been calculated using the following vertical clearances:

Urban/rural expressway and freeway - 84" (Offset - 60")
Rural Roadway - 60"

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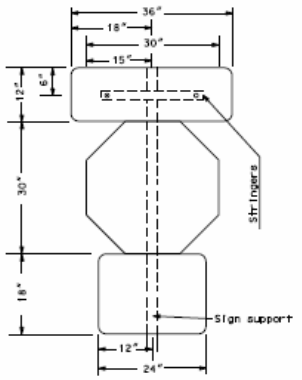
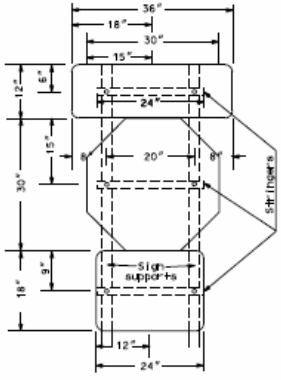
Sign Summary
Perforated Tube

SIGN PUNCHING, STRINGER AND SUPPORT LOCATION DETAILS-DIVIDED HIGHWAY CONTROL SIGNS

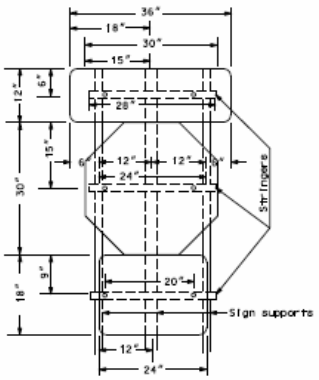
D-754-77



1 Post

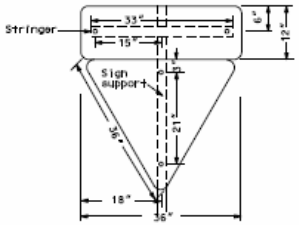


2 Posts



3 Posts

ASSEMBLY NO. 445 & 449



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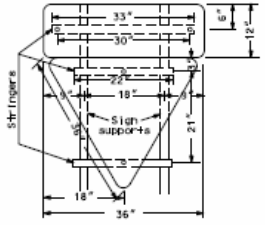
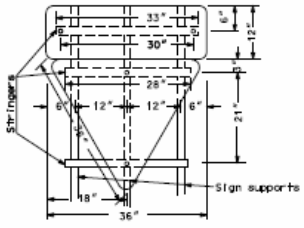


2 Posts



3 Posts

ASSEMBLY NO. 446 & 450

NOTES:

1. See standard D-754-24 for mounting details.
2. The minimum sign backing material thickness shall be 0.100 inch.
3. Perforated square tube stringer shall be 1½" x 1½".
4. All holes shall be punched round for ⅜" bolt.
5. Assembly:
   Single Sign: 445 and 446
   One Way Back To Back: 449 and 450

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-5-88	
REVISIONS	
DATE	CHANGE
05-01-92	General revisions
06-23-03	Layout revision
10-13-04	Note revisions
12-01-04	PE Stamp added
07-31-07	Revised assembly 445 and 449

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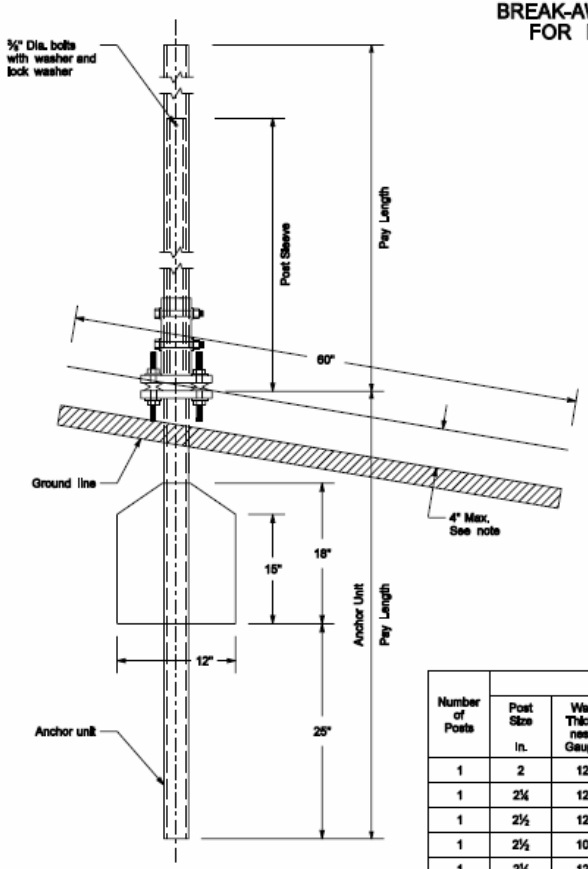
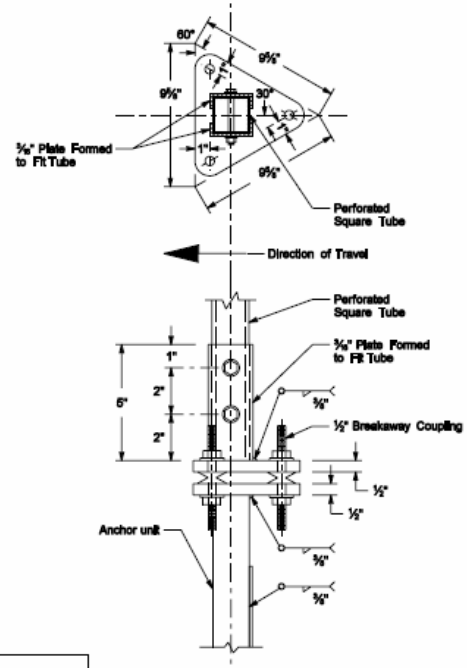
8/6/2007 10:38:50 AM R:\SUPPORT\DESIGN\D754-77.dgn

BREAK-AWAY COUPLER SYSTEM FOR PERFORATED TUBES

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	SNH-S-NHU-8-002(097)317	110	128





BASE PLATE WITH BREAKAWAY COUPLER

NOTES:

1. 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.
2. Anchor unit shall be the same size as the post and shall have the same specification as the post.
3. When used in concrete sidewalk, anchor shall be the same except the anchor plate shall be omitted.
4. Four post signs shall have over 8' between the first and fourth post.
5. In lieu of the breakaway base system on standard D-754-24 the breakaway coupling system may be used. The breakaway coupler system shall be manufactured from material meeting the requirements of ASTM A325 fasteners with the special requirements as specified by DSNT BREAKAWAY IND., INC. which meets the test requirements of NCHRP Report 350.
6. Base plates and formed plates shall be fabricated from steel meeting the requirements of AASHTO M-183 and M232.

Number of Posts	Telescoping Perforated Tube					
	Post Size In.	Wall Thickness Gauge	Sleeve Size In.	Wall Thickness Gauge	Slip Base	Anchor Size In.
1	2	12			No	2¼
1	2¼	12			No	2½
1	2½	12			B	2½
1	2½	10			Yes	2½
1	2¼	12	2	12	Yes	2¼ & 2 Sleeve
1	2½	12	2¼	12	Yes	2½ & 2¼ Sleeve
2	2	12			No	2¼
2	2¼	12			No	2½
2	2½	12			Yes	2½
2	2½	10			Yes	2½
2	2¼	12	2	12	Yes	2¼ & 2 Sleeve
2	2½	12	2¼	12	Yes	2½ & 2¼ Sleeve
3 & 4	2½	12			Yes	2½
3 & 4	2½	10			Yes	2½
3 & 4	2½	12	2¼	12	Yes	2½ & 2¼ Sleeve
3 & 4	2¼	12	2	12	Yes	2¼ & 2 Sleeve
3 & 4	2½	10	2⅜	10	Yes	2½ & 2⅜ Sleeve

B - The 2½" 12 gauge posts do not need breakaway bases when placed in standard soils. 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.

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
1½ x 1½	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
2¼ x 2¼	0.105	12	2.773	0.561	0.695	0.499
2⅜ x 2⅜	0.135	10	3.432	0.805	0.841	0.690
2½ x 2½	0.105	12	3.141	0.804	0.803	0.643
2½ x 2½	0.135	10	4.006	0.979	1.010	0.785

The 2¾" size 10 gauge is shown as 2.19" size on the plans. The 2½" size 10 gauge is shown as 2.61" size on the plans.

This document was originally issued and sealed by Jon E. Markusen Registration Number PE-5453, on 08/05/10 and the original document is stored at the North Dakota Department of Transportation

US HIGHWAY 2

PERFORATED TUBE DETAILS
BREAK-AWAY COUPLER SYSTEM

How could this have been prevented ?

Prior to Construction

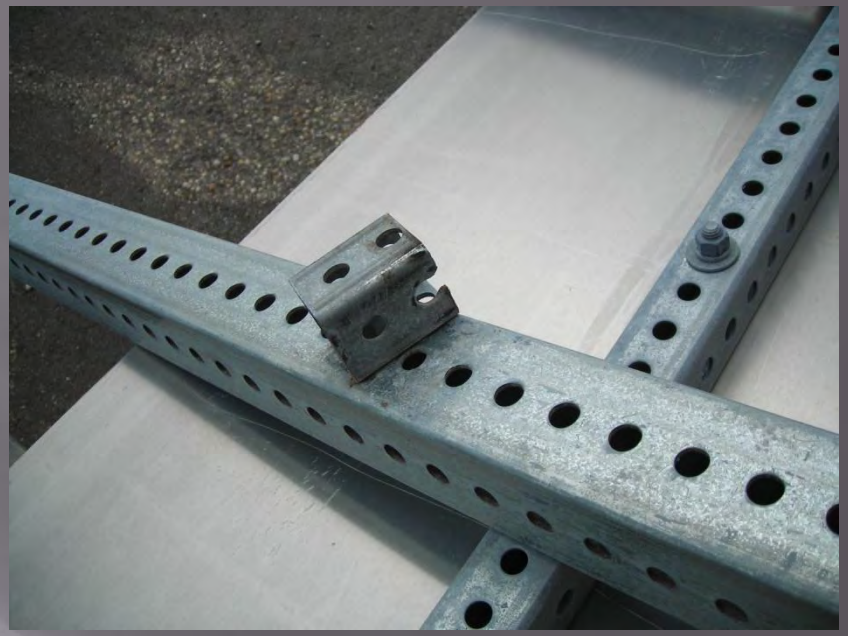
Field Review

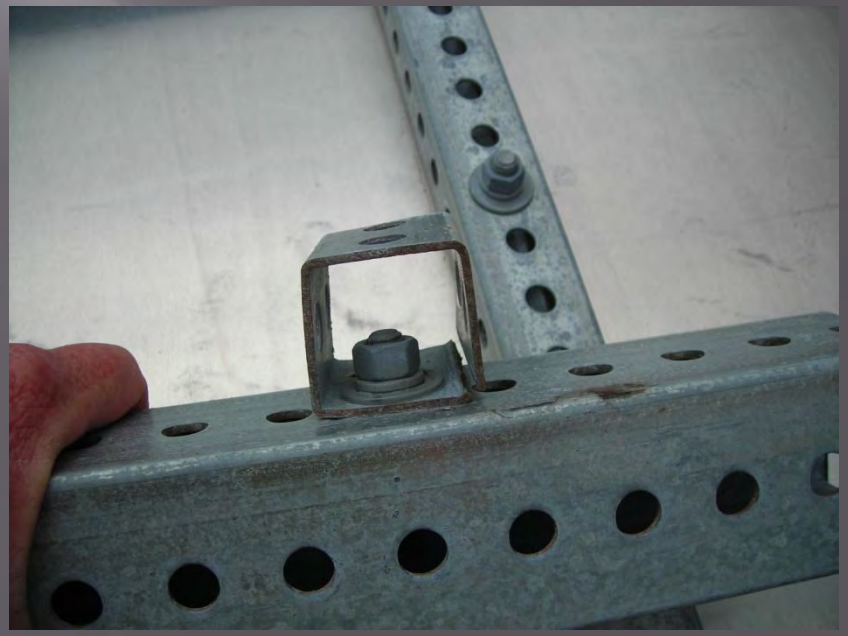
PS&E Meeting

During Construction

Designer Input

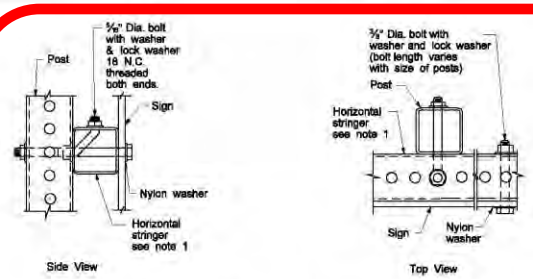
Inspection



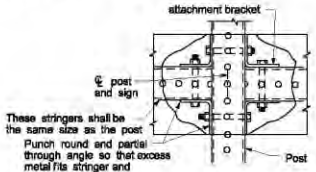


Mounting Details Perforated Tube

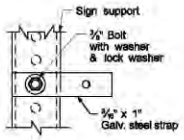
D-754-25

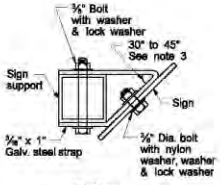


STRINGER MOUNTING
(WITH STRINGER IN FRONT OF POST)

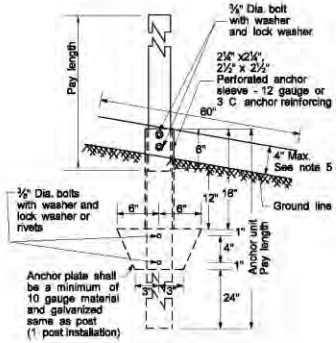


STREET NAME SIGNS
AND ONE WAY SIGNS
SINGLE POST ASSEMBLY
ONE STRINGER OR
BACK TO BACK MOUNTING

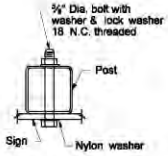




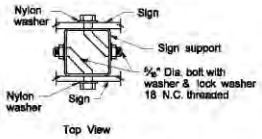
STRAP DETAIL



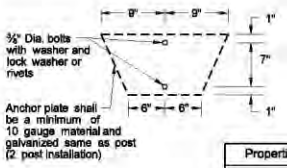
ANCHOR UNIT AND
POST ASSEMBLY



BOLT MOUNTING



BACK TO BACK
MOUNTING



Note:

1. Horizontal stringers - In lieu of perforated tubes, the contractor may substitute z bar stringers. The z bar stringers shall be 1⅝" x ⅝" thick, 1.08 lbs./ft aluminum or 3.16 lbs./ft steel.
2. Metal washers used on sign face shall have a minimum outside diameter of ⅝" ± 1/16" and 10 gauge thickness.
3. 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."
4. 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.
5. 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.

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	2¼	12
1	2¼	12			No	2½	12
1	2½	12			(B)	3(C)	7
1	2½	10			Yes		7
1	2¼	12	2½(D)	12	Yes		7
1	2½	12	2¼	12	Yes		7
2	2½	10			Yes		7
2	2¼	12	2½(D)	12	Yes		7
2	2½	12	2¼	12	Yes		7
3 & 4	2½	12			Yes		7
3 & 4	2½	10			Yes		7
3 & 4	2½	12	2¼	12	Yes		7
3 & 4	2¼	12	2½(D)	12	Yes		7
3 & 4	2½	10	2⅜	10	Yes		7

(B) - The 2½", 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) - 2½" x 12 ga. x 18" minimum length external sleeve required.

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 Sectional Area $In.^2$	Section Modulus $In.^3$
1⅛ x 1⅛	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
2¼ x 2¼	0.105	12	2.773	0.561	0.695	0.496
2⅜ x 2⅜	0.135	10	3.432	0.805	0.841	0.690
2½ x 2½	0.105	12	3.141	0.804	0.803	0.643
2½ x 2½	0.136	10	4.006	0.979	1.010	0.783

The 2⅜" size 10 gauge is shown as 2.19" size on the plans.
The 2½" size is shown as 2.51" size on the plans.

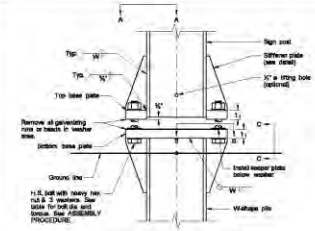
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
6-5-09	
REVISIONS	
DATE	CHANGE

This document was originally issued and sealed by Roger Weigel, Registration Number PE- 2930 , on 06/06/09 and the original document is stored at the North Dakota Department of Transportation

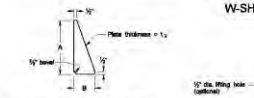

EXIT 138
32nd Ave S
1 MILE
NEXT EXIT 8 MILES

STRUCTURAL DETAILS
W-SHAPE SUPPORTS

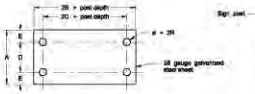
D-754-13



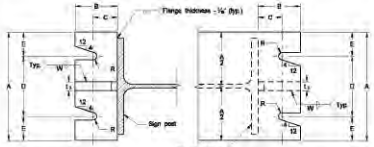
SIGN POST ELEVATION



STIFFENER PLATE DETAIL



KEEPER PLATE



SECTION A-A SECTION B-B

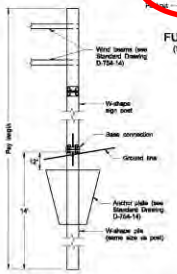
Sections shown are for installations on right shoulder and in gore. Installations on the left shoulder shall have the plate slot bevels reversed.

Maximum projection of base plate shall not extend above a line, 4" parallel to any chord, which is perpendicular to (or aligned radially to) the center line of the highway and has the chord's end points on the ground surface on opposite sides of the stub post.

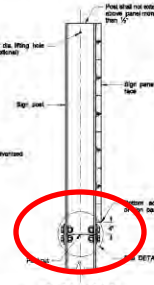
SECTION C-C

Furnish 2 - .012"± thick and 2 - .032"± thick shims per post. Shims shall be fabricated from brass shim stock or strip conforming to ASTM B36.

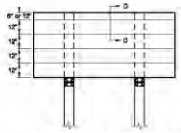
SHIM DETAIL



SIGN SUPPORT DETAIL

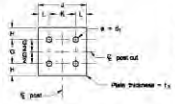


FUSE JOINT
(SIDE VIEW)

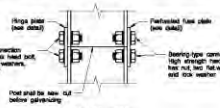


TYPICAL PANEL MOUNTING

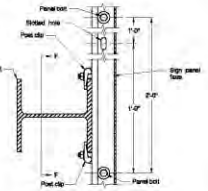
PERFORATED FUSE PLATE DETAIL



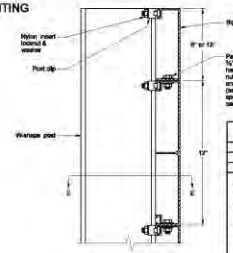
HINGE PLATE DETAIL



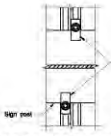
DETAIL "A"



SECTION E-E

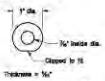


SECTION D-D



Note: Post clips shall be installed on both sides of each post at each panel joint as indicated.

SECTION F-F



FLAT WASHER DETAIL

NOTES:

Structural steel shall conform to Section 894.06 B.6 of the Standard Specifications. High strength bolts shall conform to ASTM A-325.

Refer to "Sign Summary" sheet for specific data on each individual sign installation.

Perforated fuse plate shall be installed on side of post facing traffic.

All posts shall be saw cut. Plates may be sheared or flame cut using a mechanically guided cutting torch in accordance with Section 754.03 E.6.b. of the Standard Specifications. Edge preparation shall be in accordance with Section 754.03 E.6.c of the Standard Specifications.

ASSEMBLY PROCEDURE:

1. Assemble base plates together with bolts and with one flat washer between top base plate and the keeper plate.
2. Shim as required to plumb post.
3. Tighten all base connection bolts the maximum possible with 12" to 15" wrench to bed washers and shims and to clean bolt threads.
4. Loosen each bolt in turn and retighten in a systematic order to the prescribed torque (see table.)
5. Assemble perforated fuse and hinge plates to post with bolts and with one flat washer and lock washer under nut. Tighten all bolts the maximum possible with a 12" to 15" wrench to bed washers and shims and to clean bolt threads. Loosen, and retighten bolts in a systematic order.

W-SHAPE POST AND PILE SIZE	BASE CONNECTION DIMENSIONS										FUSE AND HINGE PLATE DIMENSIONS									
	BOLT SIZE AND TORQUE	A	B	C	D	E	t_1	t_2	W	R	G	H	J	K	L	M	d_1	d_2	t_3	BOLT DIA
W4x13	⅜" ø x 3½" Torque = 600 in-lb	6"	2½"	1½"	3½"	1¼"	1"	½"	¼"	5/16"	2"	1¼"	4"	2¼"	¾"	1"	7/16"	⅜"	⅜"	⅜"
W6x16	⅜" ø x 3½" Torque = 600 in-lb	6"	2½"	1½"	3½"	1¼"	1"	½"	¼"	5/16"	2½"	1¼"	5"	2¾"	1¼"	1¼"	7/16"	⅜"	⅜"	⅜"
W8x20	¾" ø x 4½" Torque = 800 in-lb	8"	3"	1¾"	4"	2"	1¼"	½"	¼"	5/16"	2½"	1¼"	6"	3½"	1⅛"	1⅝"	⅝"	1⅛"	⅜"	⅜"
W8x24	¾" ø x 4½" Torque = 800 in-lb	8"	3"	1¾"	4"	2"	1⅝"	½"	¼"	⅝"	2½"	1½"	6½"	3½"	1½"	1⅝"	⅝"	1⅜"	½"	½"
W8x28	1" ø x 6" Torque = 1000 in-lb	8"	3"	2"	4"	2"	1½"	⅜"	⅝"	⅞"	2½"	1½"	6½"	3½"	1½"	1⅝"	⅝"	1⅜"	½"	1"
W8x31	1⅛" ø x 5" Torque = 1200 in-lb	8"	3½"	2"	5"	2"	1½"	⅜"	⅝"	⅞"	3"	1⅜"	8"	5½"	1⅜"	2"	1⅜"	1½"	½"	1"
W10x39	1⅛" ø x 5" Torque = 1200 in-lb	9"	3½"	2"	5"	2"	1½"	⅜"	⅝"	⅞"	3"	1⅜"	8"	5½"	1⅜"	1⅞"	1⅜"	1⅜"	½"	1⅛"

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

07-19-94

REVISIONS	
DATE	CHANGE
09-30-96	Notes
09-28-98	Pay length
03-01-00	Flat washers
04-03-01	Remove splice plate
11-25-02	Revised note
03-26-04	Removed hex bts and added lock washer
09-20-04	Removed stub post
12-01-04	PE Stamp added
05-19-05	Added wind beams and anchor plates
04-23-07	Revised details and notes

This document was originally issued and sealed by MARK S GAYDOS, Registration Number PE- 4518 , on 04/23/07 and the original document is stored at the North Dakota Department of Transportation

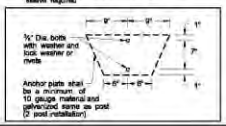
4/26/2007 1:44:26 PM R:\SUPPORTDESSTD\D754-13.dgn

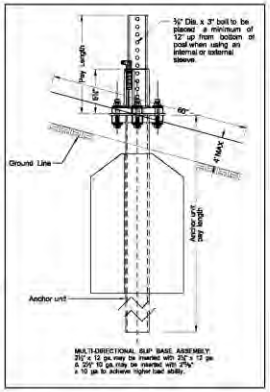
Mounting Details Perforated Tube

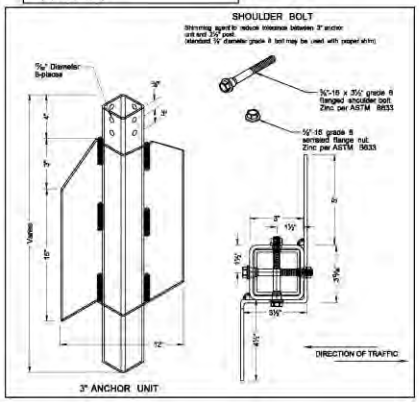
D-754-24

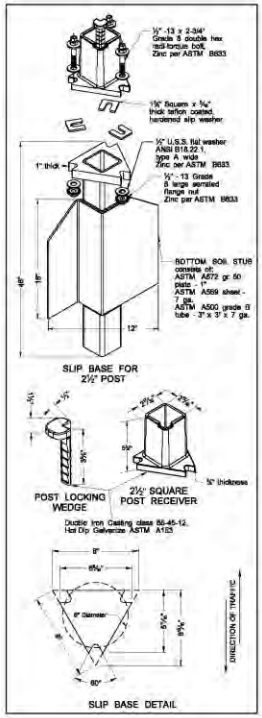
Telescoping Perforated Tube							
Number of Posts	Post Size In.	Wall Thickness Gauge	Sleeve Size In.	Wall Thickness Gauge	Slip Base	Anchor Size Without Slip Base In.	Anchor Wall Thickness Gauge
1	2	12			No	2½	12
1	2½	12			No	2½	12
1	2½	12			(B)	3(C)	7
1	2½	10			Yes		7
1	2⅜	12	2½(D)	12	Yes		7
1	2½	12	2¼	12	Yes		7
2	2½	10			Yes		7
2	2⅜	12	2½(D)	12	Yes		7
2	2½	12	2¼	12	Yes		7
3 & 4	2⅜	12			Yes		7
3 & 4	2½	10			Yes		7
3 & 4	2½	12	2¼	12	Yes		7
3 & 4	2¼	12	2½(D)	12	Yes		7
3 & 4	2⅜	10	2⅜	10	Yes		7

(B) - The 2½", 12 gauge posts do not need breakaway bases when placed in standard soils, but require a stain 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) - 2½" x 12 ga. x 18" minimum length external sleeve required







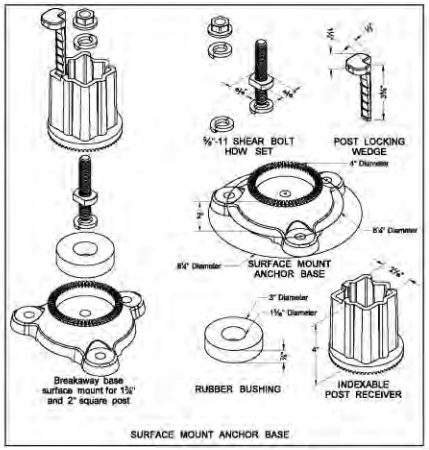


Properties of Telescoping Perforated Tubes						
Tube Size In.	Wall Thickness In.	U.S. Standard Gauge	Weight Per Ft. Lbs.	Moment of Inertia I In.⁴	Cross Section Area In.²	Section Modulus S In.³
1½ x 1½	0.105	12	1.702	0.129	0.380	0.172
2 x 2	0.105	12	2.418	0.373	0.580	0.372
2¼ x 2¼	0.105	12	2.773	0.561	0.665	0.496
2⅝ x 2⅝	0.135	10	3.432	0.825	0.841	0.596
2½ x 2½	0.105	12	3.141	0.804	0.863	0.643
2½ x 2½	0.135	10	4.008	0.978	1.010	0.783

The 2 ⅜" size, 10 gauge is shown as 2.19" size on the plans; The 2½" size is shown as 2.51" size on the plans.

NOTE

1. 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.
2. 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 43.8 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.
3. When used in concrete sidewalk, anchor shall be the same compact without the wings.
4. Four post signs shall have over 8' between the first and fourth posts.
5. Installation procedures as per manufacturers recommendation.
6. Concrete fasteners for surface mount breakaway base shall be a minimum ½" diameter x 4" grade 8.



NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
S-8-08	
REVISIONS	
DATE	CHANGE

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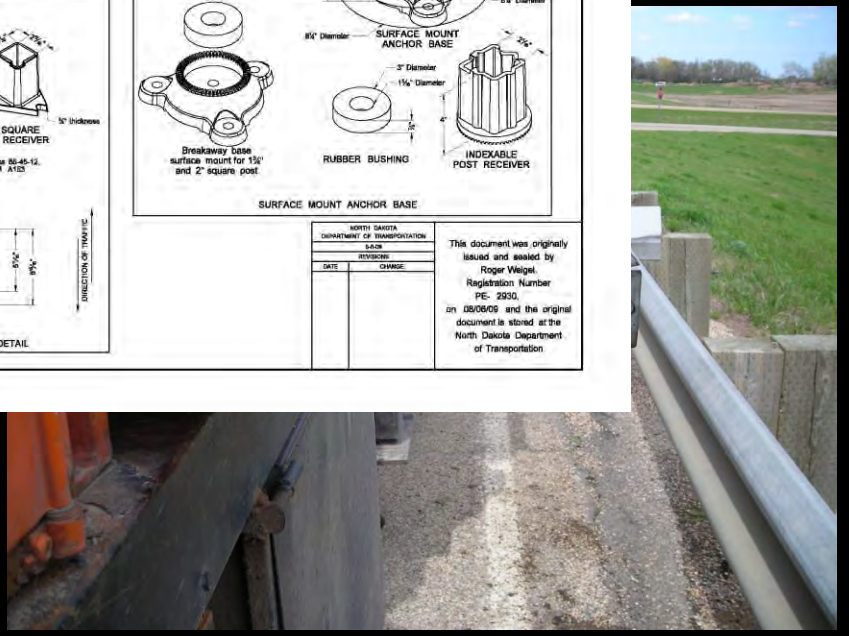



Which Base?
One Directional
Breakaway Base
Multi-Directional
Slip Base

SIZE MATTERS

LOCATION MATTERS

Offset Matters

Condition Matters


ROAD
CLOSED
1/2 MILE

GENERAL RULES

1. Break-Away at 4”
2. No perforated tube on the Interstate.
3. On Interstate, one post = round pipe
4. On Interstate 2 or more posts = W-Shape
5. Gore Signs (Exit Signs) are round pipe.
6. Multi-Directional bases are used where traffic is multi-directional.
7. In general, vertical clearance = 5’ for rural locations.
8. In general, vertical clearance = 7’ for Interstate & urban.

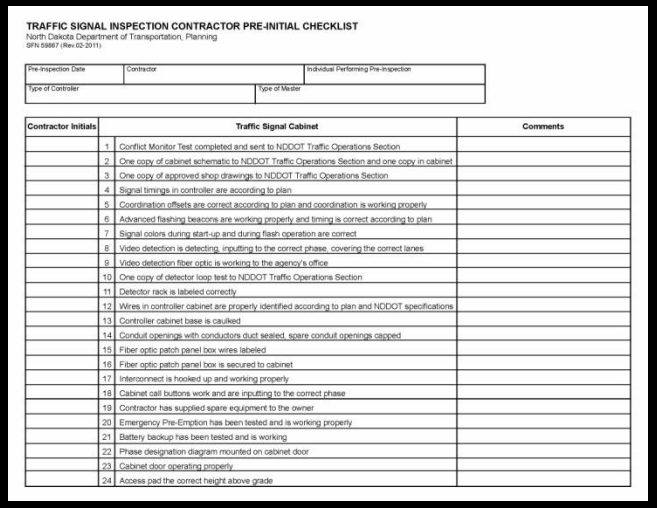
Keep Sign Shop in the loop.

1. PS & E Meeting.
2. Up to date with changes.

Expect Changes

1. Get feedback from designer

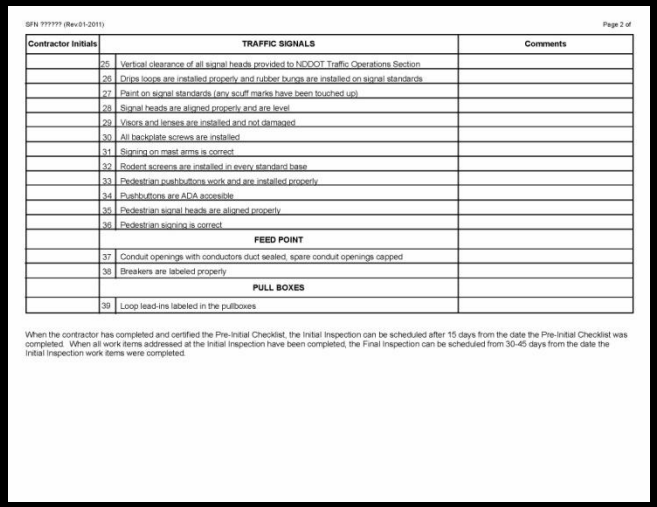
Traffic Signals



TRAFFIC SIGNAL INSPECTION CONTRACTOR PRE-INITIAL CHECKLIST
North Dakota Department of Transportation, Planning
SFN 59867 (Rev.02-2011)

Pre-Inspection Date	Contractor	Individual Performing Pre-Inspection
Type of Controller	Type of Master	

Contractor Initials		Traffic Signal Cabinet	Comments
	1	Conflict Monitor Test completed and sent to NDDOT Traffic Operations Section	
	2	One copy of cabinet schematic to NDDOT Traffic Operations Section and one copy in cabinet	
	3	One copy of approved shop drawings to NDDOT Traffic Operations Section	
	4	Signal timings in controller are according to plan	
	5	Coordination offsets are correct according to plan and coordination is working properly	
	6	Advanced flashing beacons are working properly and timing is correct according to plan	
	7	Signal colors during start-up and during flash operation are correct	
	8	Video detection is detecting, inputting to the correct phase, covering the correct lanes	
	9	Video detection fiber optic is working to the agency's office	
	10	One copy of detector loop test to NDDOT Traffic Operations Section	
	11	Detector rack is labeled correctly	
	12	Wires in controller cabinet are properly identified according to plan and NDDOT specifications	
	13	Controller cabinet base is caulked	
	14	Conduit openings with conductors duct sealed, spare conduit openings capped	
	15	Fiber optic patch panel box wires labeled	
	16	Fiber optic patch panel box is secured to cabinet	
	17	Interconnect is hooked up and working properly	
	18	Cabinet call buttons work and are inputting to the correct phase	
	19	Contractor has supplied spare equipment to the owner	
	20	Emergency Pre-Emption has been tested and is working properly	
	21	Battery backup has been tested and is working	
	22	Phase designation diagram mounted on cabinet door	
	23	Cabinet door operating properly	
	24	Access pad the correct height above grade	



SFN ?????? (Rev.01-2011) Page 2 of

Contractor Initials		TRAFFIC SIGNALS	Comments
	25	Vertical clearance of all signal heads provided to NDDOT Traffic Operations Section	
	26	Drips loops are installed properly and rubber bungs are installed on signal standards	
	27	Paint on signal standards (any scuff marks have been touched up)	
	28	Signal heads are aligned properly and are level	
	29	Visors and lenses are installed and not damaged	
	30	All backplate screws are installed	
	31	Signing on mast arms is correct	
	32	Rodent screens are installed in every standard base	
	33	Pedestrian pushbuttons work and are installed properly	
	34	Pushbuttons are ADA accesible	
	35	Pedestrian signal heads are aligned properly	
	36	Pedestrian signing is correct	
		FEED POINT	
	37	Conduit openings with conductors duct sealed, spare conduit openings capped	
	38	Breakers are labeled properly	
		PULL BOXES	
	39	Loop lead-ins labeled in the pullboxes	

When the contractor has completed and certified the Pre-Initial Checklist, the Initial Inspection can be scheduled after 15 days from the date the Pre-Initial Checklist was completed. When all work items addressed at the Initial Inspection have been completed, the Final Inspection can be scheduled from 30-45 days from the date the Initial Inspection work items were completed.

Supplemental Specifications
772.03 Tests and Acceptance 10/15/10

SFN 59867
Traffic Signal Inspection Contractor Pre-Initial Checklist

Given to Contractor during Pre-Con.

TRAFFIC SIGNAL INSPECTION CONTRACTOR PRE-INITIAL CHECKLIST

North Dakota Department of Transportation, Planning

SFN 59867 (Rev.02-2011)

Pre-Inspection Date	Contractor	Individual Performing Pre-Inspection
Type of Controller	Type of Master	

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	6	Advanced flashing beacons are working properly and timing is correct according to plan	
	7	Signal colors during start-up and during flash operation are correct	
	8	Video detection is detecting, inputting to the correct phase, covering the correct lanes	
	9	Video detection fiber optic is working to the agency's office	
	10	One copy of detector loop test to NDDOT Traffic Operations Section	
	11	Detector rack is labeled correctly	
	12	Wires in controller cabinet are properly identified according to plan and NDDOT specifications	
	13	Controller cabinet base is caulked	
	14	Conduit openings with conductors duct sealed, spare conduit openings capped	
	15	Fiber optic patch panel box wires labeled	
	16	Fiber optic patch panel box is secured to cabinet	
	17	Interconnect is hooked up and working properly	
	18	Cabinet call buttons work and are inputting to the correct phase	
	19	Contractor has supplied spare equipment to the owner	
	20	Emergency Pre-Emption has been tested and is working properly	
	21	Battery backup has been tested and is working	
	22	Phase designation diagram mounted on cabinet door	
	23	Cabinet door operating properly	
	24	Access pad the correct height above grade	

Contractor Initials		TRAFFIC SIGNALS	Comments
	25	Vertical clearance of all signal heads provided to NDDOT Traffic Operations Section	
	26	Drips loops are installed properly and rubber bungs are installed on signal standards	
	27	Paint on signal standards (any scuff marks have been touched up)	
	28	Signal heads are aligned properly and are level	
	29	Visors and lenses are installed and not damaged	
	30	All backplate screws are installed	
	31	Signing on mast arms is correct	
	32	Rodent screens are installed in every standard base	
	33	Pedestrian pushbuttons work and are installed properly	
	34	Pushbuttons are ADA accesible	
	35	Pedestrian signal heads are aligned properly	
	36	Pedestrian signing is correct	
		FEED POINT	
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	38	Breakers are labeled properly	
		PULL BOXES	
	39	Loop lead-ins labeled in the pullboxes	

When the contractor has completed and certified the Pre-Initial Checklist, the Initial Inspection can be scheduled after 15 days from the date the Pre-Initial Checklist was completed. When all work items addressed at the Initial Inspection have been completed, the Final Inspection can be scheduled from 30-45 days from the date the Initial Inspection work items were completed.

Inside Cabinet

Cabinet Drawings

Conflict Monitor Test Report

Loop Meg Test Reports

Spare Load Switches

Spare Detectors

Labels !

Detector Rack

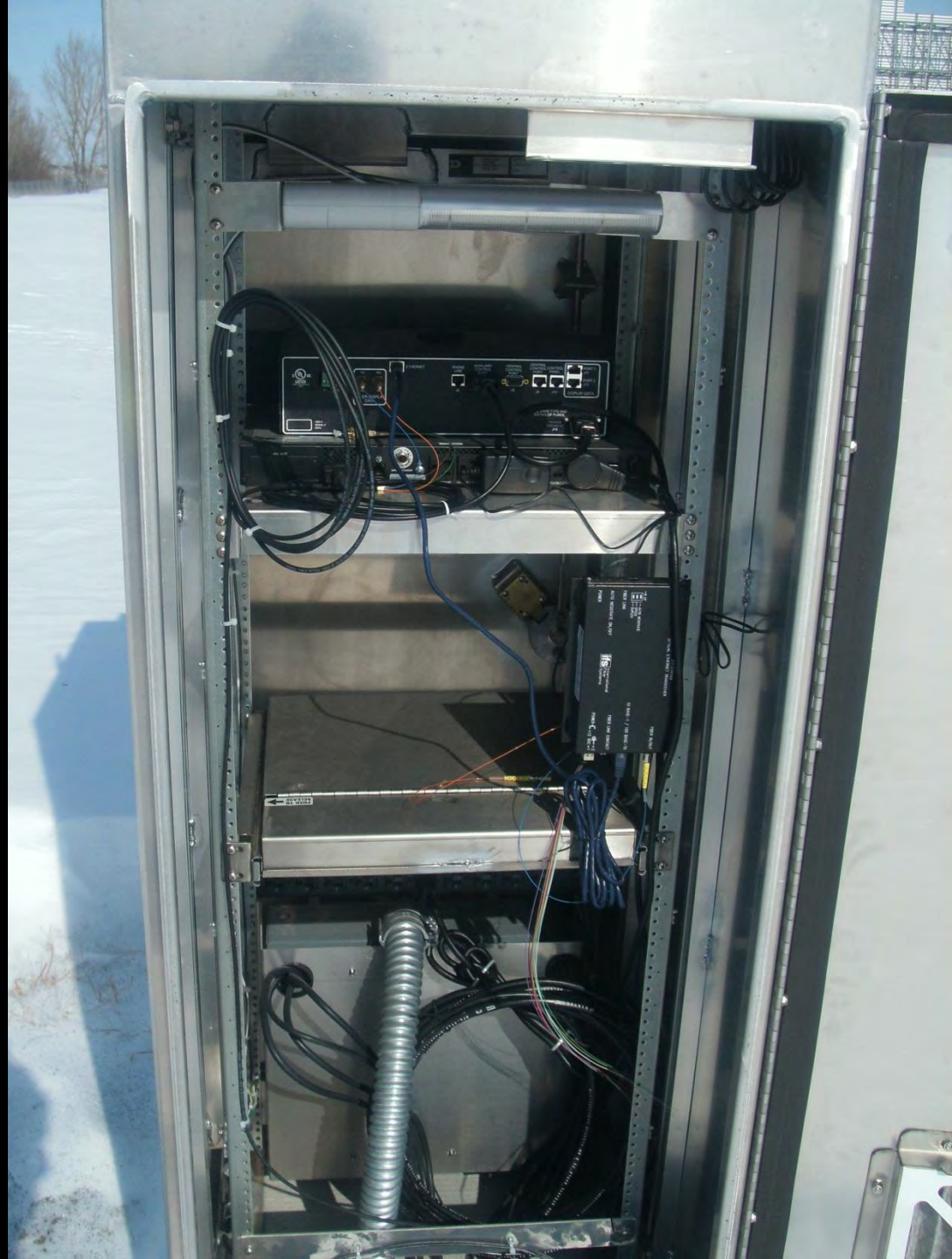
Fiber-Optic Panel

Field Wiring

No fiber-optic Patch Panel

Improper # of terminations

No labels



Not the Best

Tranceiver mounted too close to door.

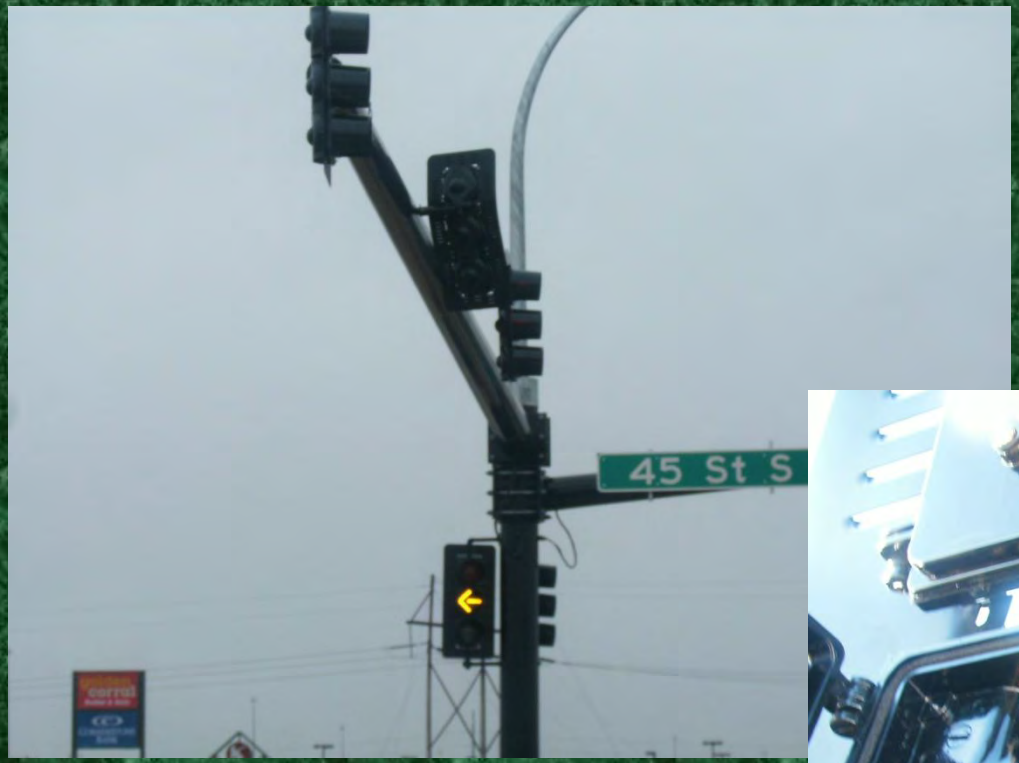
Fiber patch cable too small of radius.

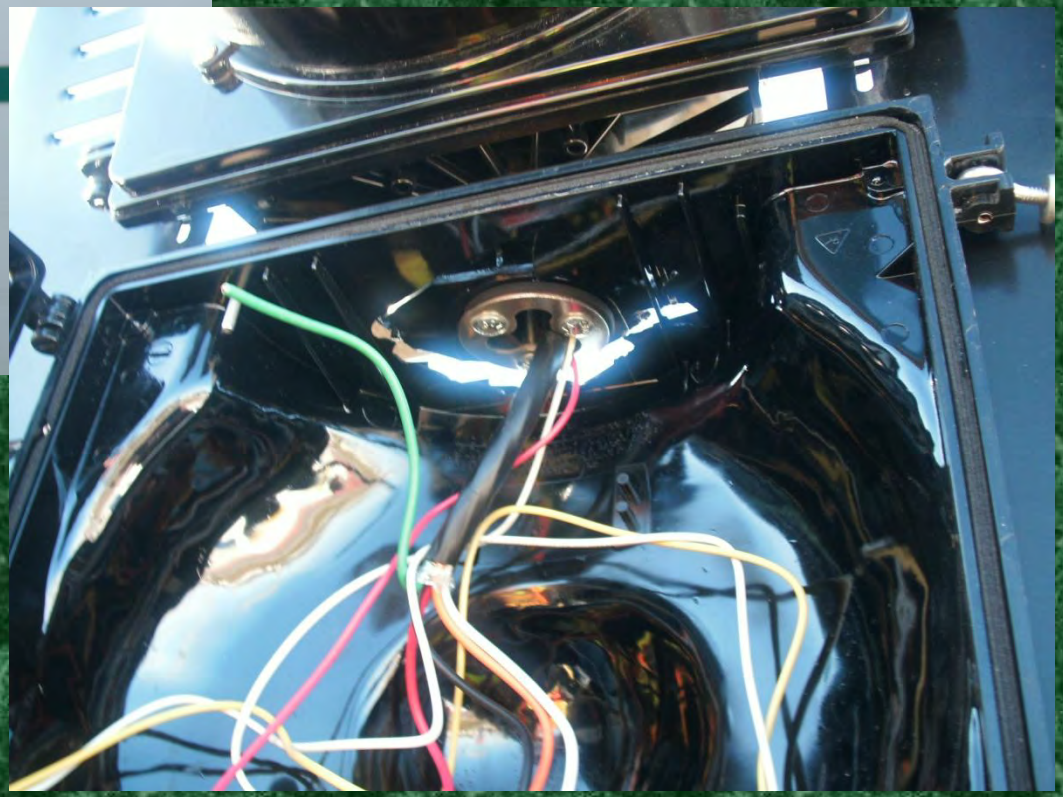
Signal Mechanical Problems

Broken Backplates
Missing Visors
Loose Heads
Broken Astrobrackets

Stripped Screws
Loose Cameras
Missing Confirm Lights
Poor/Corroded Splices

Broken Heads





Reinforcement Plates

Required

Plan Note
Supplemental Spec.


Galvanic Corrosion
Anti-Seize is a new requirement

Traffic Signals

1. Use SFN 59867 Traffic Signal Checklist
2. Read Plan Notes & Special Provisions
3. Read the Standard Specifications
4. Understand the Plans
5. Be Prepared for Changes
6. Make sure you understand the Inspection / Acceptance Process:

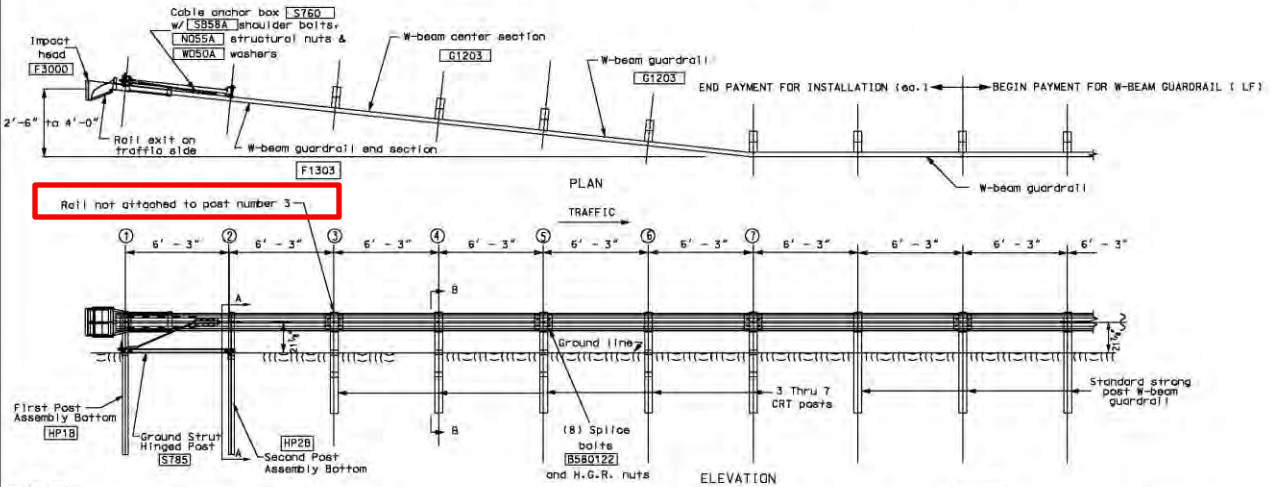
    Initial Inspection after 14 days
    Final Inspection 30 days after Initial
    Acceptance 14 days after Final Inspection

Guardrail


03/02/2012

FLARED ENERGY ABSORBING TERMINAL FOR STEEL BREAKAWAY SYSTEM

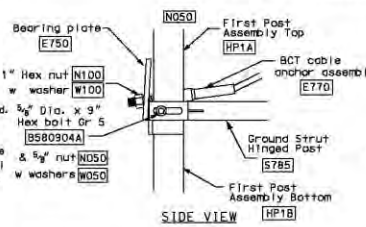
D-764-2C

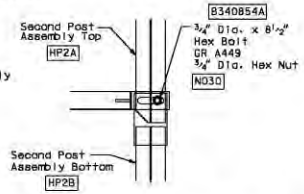


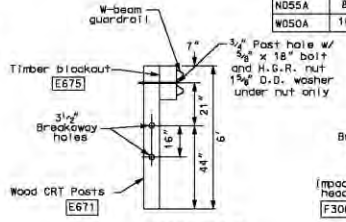
ITEM #	QTY	BILL OF MATERIALS
F3000	1	IMPACT HEAD
F1303	1	W-BEAM GUARDRAIL END SECTION, 12 GA.
G1203	2	W-BEAM GUARDRAIL, 12 GA.
HP1A	1	FIRST POST ASSEMBLY TOP
HP1B	1	FIRST POST ASSEMBLY BOTTOM
HP2A	1	SECOND POST ASSEMBLY TOP
HP2B	1	SECOND POST ASSEMBLY BOTTOM
P671	5	WOOD CRT POST
P675	5	TIMBER BLOCKOUT 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
S858A	8	CABLE ANCHOR BOX SHOULDER BOLT
N055A	8	1/2 A325 STRUCTURAL NUT
W050A	16	1 1/16 OD x 3/16 ID A325 STR. WASHER

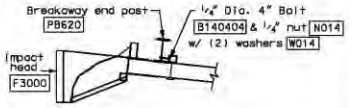
GENERAL NOTES

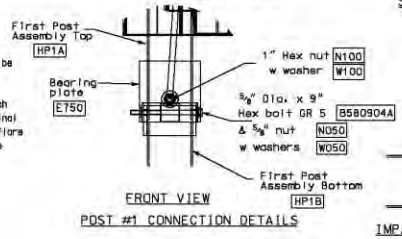
1. Wood posts are required with the Flared Energy Absorbing Terminal except post 1 and 2.
2. All bolts, nuts, cable assemblies, cable anchors and bearing plates shall be galvanized.
3. The lower sections of the posts shall not protrude more than 4 inches above the ground (measured along a 60 inch cord). Site grading may be necessary to meet this requirement.
4. Lower post sections shall not be driven with the upper post attached. If the 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.

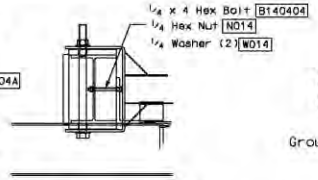


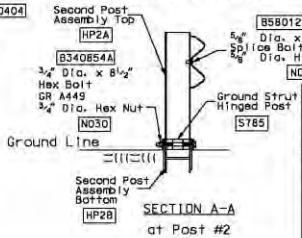












NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
09-01-98	
REVISIONS	
DATE	CHANGE
12-21-00	Flared energy absorbing terminal note
06-29-01	Added steel breakaway post
04-16-02	Adjusted post spacing and eliminated one post
12-01-04	PE Stamp added
05-03-05	Revised posts 1 & 2, Revised notes
04-05-06	Changed CRT post & blockout Qty. to 5 and added 7 to section B-B
01-04-07	General revisions
08-12-07	Rev. dimension to center of guardrail to 21 1/8"

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

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Guardrail

1. Know what type
2. Know which standard
3. Records to Maintenance.

Feed Points


Common Problems
1. No Labels on Breakers
2. Improper Locks
3. Improper Grading
4. Less than Ideal Location
11/29/2011 12:30:43


11/29/2011 12:27:48


11/29/2011 12:12:53


ROAD
WORK
AHEAD
END
ROAD WORK


KEEP
RIGHT


PUNXSUTAWNEY 8
PARADISE 3
DESIRE 5
PANIC 7


DO NOT
ENTER
ENTER
ONLY