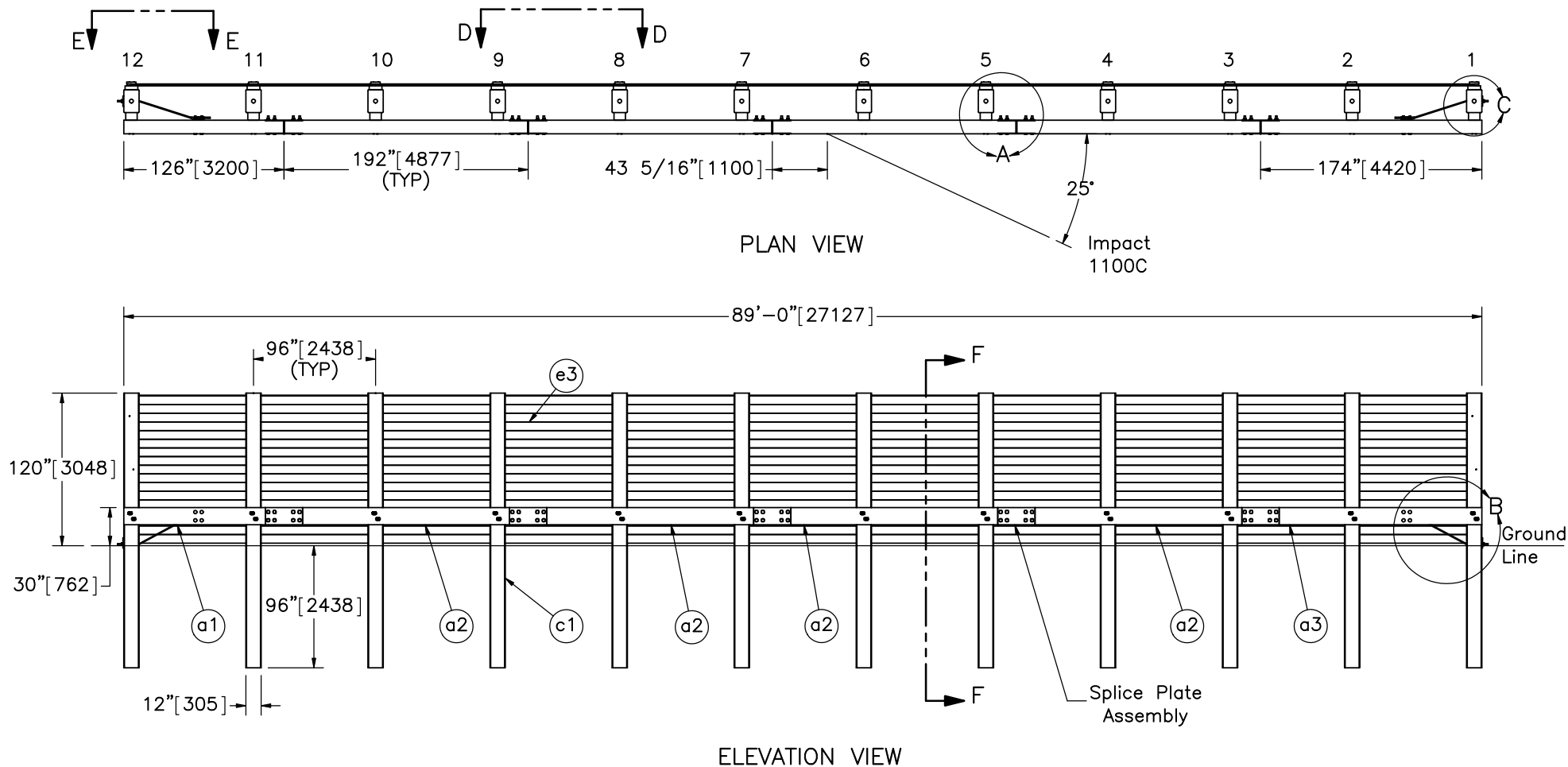




- Notes:
- (1) Test shall be performed according to test designation no. 3-10 of MASH.
 - (2) The impact location is 43 5/16" [1,100] upstream of the centerline of the splice upstream of post no. 7.
 - (3) Post nos. 1 and 12 (c1) have $\phi 2 \frac{1}{2}$ " [64] through hole near groundline.



Midwest Roadside
Safety Facility

MNDOT Noise Wall
Timber Rail
Test No. MNNW-2

System Layout

DWG. NAME.
MNNW-2_R8

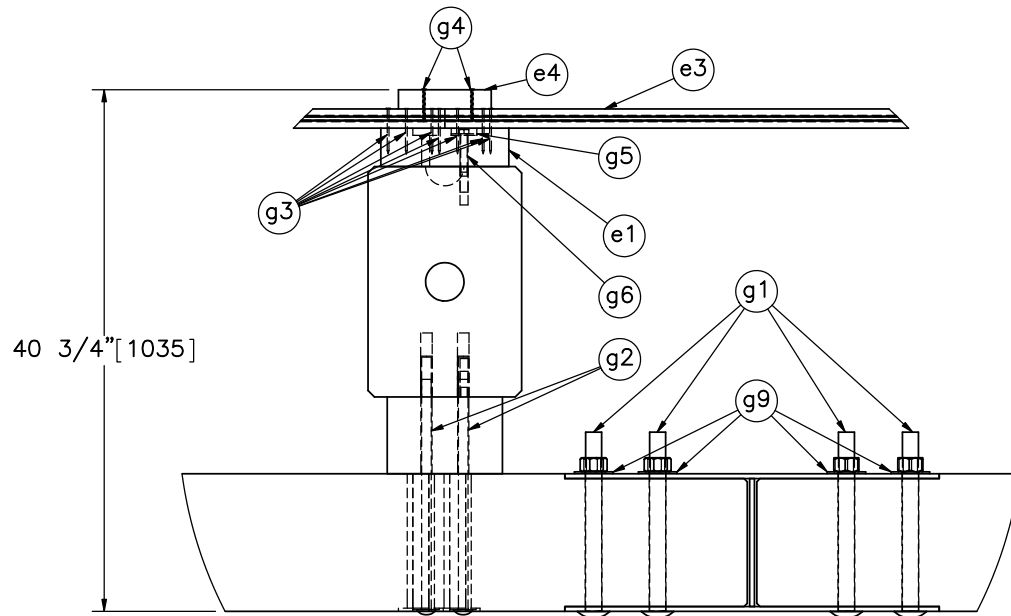
SCALE: 1:120
UNITS: in./mm

SHEET:
1 of 17

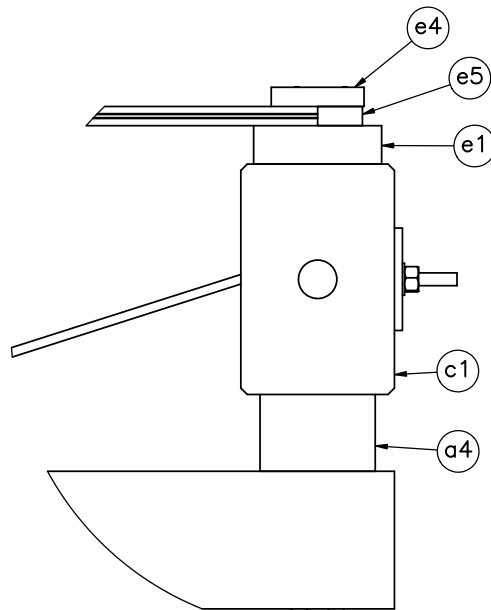
DATE:
11/15/2018

DRAWN BY:
DTM/MES/
JEK/DJW

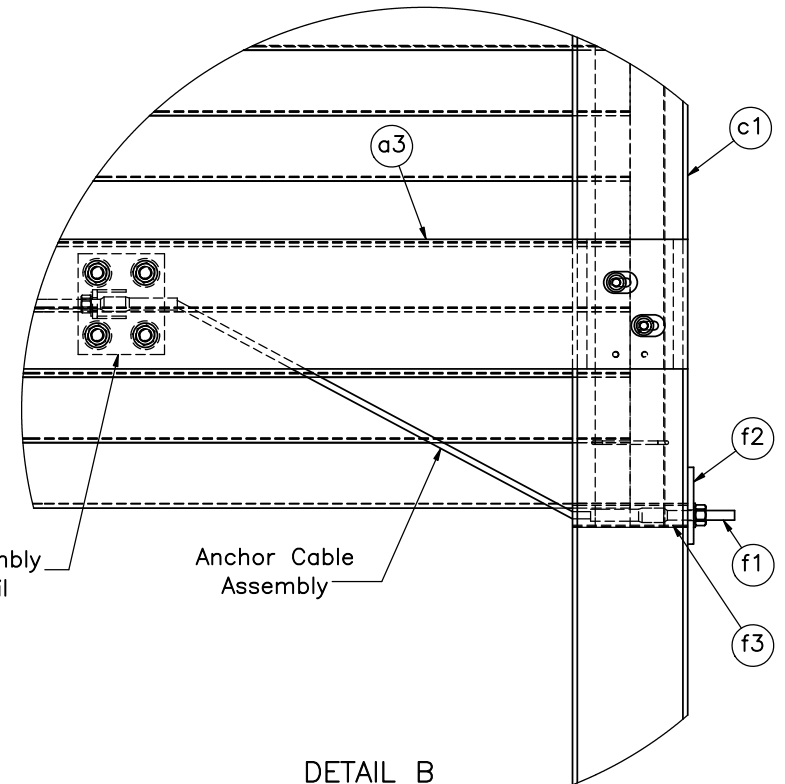
REV. BY:
JEK/RKF/
JDS/JCH



DETAIL A



DETAIL C



DETAIL B
SCALE 1:20

Anchor Plate Assembly
on Backside of Rail

Anchor Cable
Assembly

- Notes: (1) Reinforcing bars in concrete post (part c1) not shown.
(2) Part e5 used only on post nos. 1 and 12.



Midwest Roadside
Safety Facility

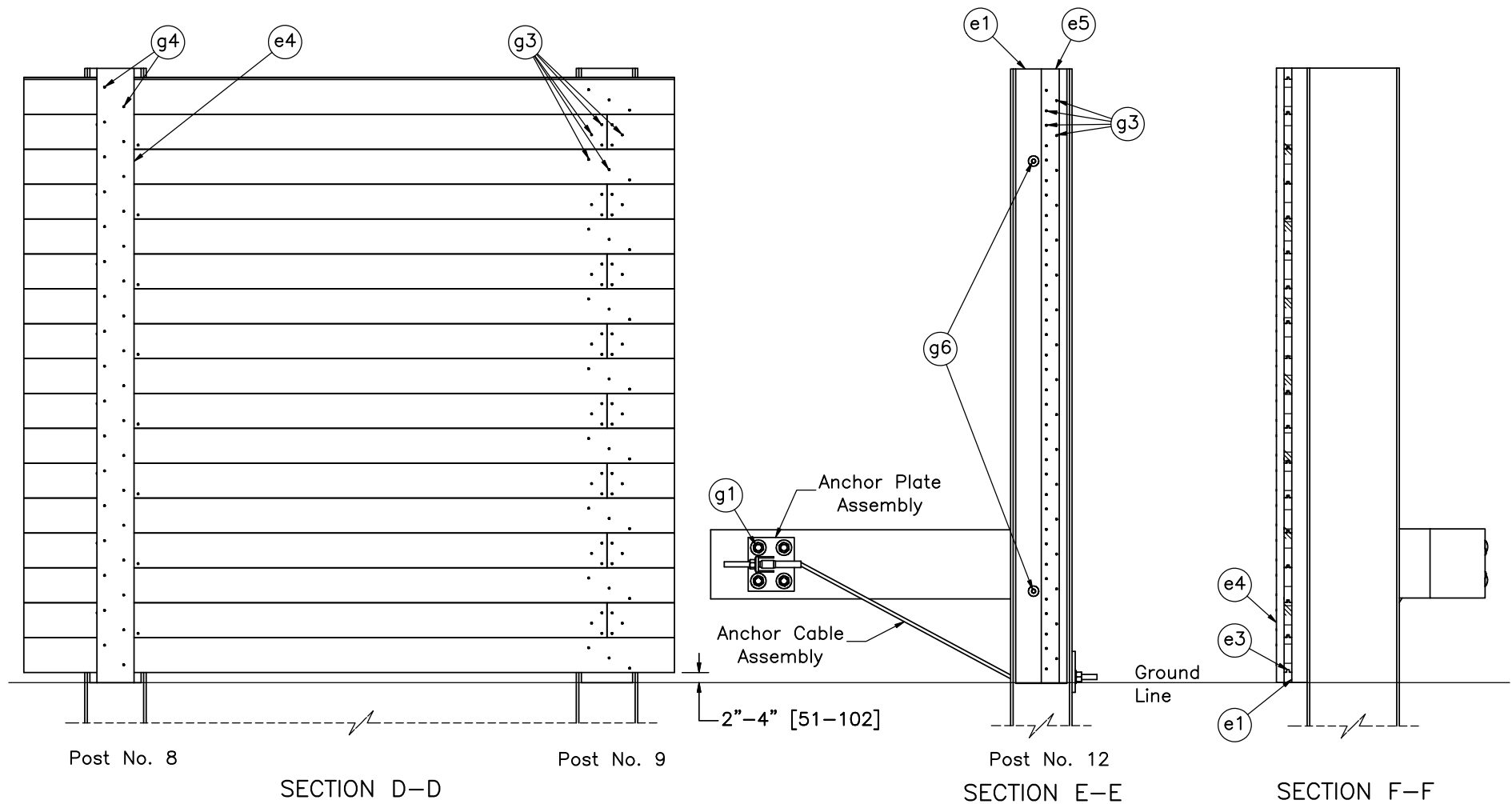
MNDOT Noise Wall
Timber Rail
Test No. MNNW-2

Rail Section Details

DWG. NAME:
MNNW-2_R8

SCALE: 1:15
UNITS: in./mm

SHEET:
2 of 17
DATE:
11/15/2018
DRAWN BY:
DTM/MES/
JEK/DJW
REV. BY:
JEK/RKF/
JDS/JCH



- Notes:
- (1) Wall components hidden in Section E-E for clarity.
 - (2) Batten (part e4) and batten screws (part g4) hidden on post nos. 9 and 12 to show plank-to-vertical nailer attachment nailing pattern.
 - (3) No more than 2/3 of panel splices may occur at one location.
 - (4) Alternate parts e2 and e3 on upstream and downstream ends of wall to create panel splice configuration described in note 3.



Midwest Roadside
Safety Facility

MNDOT Noise Wall
Timber Rail
Test No. MNNW-2

Noise Wall Details

DWG. NAME.
MNNW-2_R8

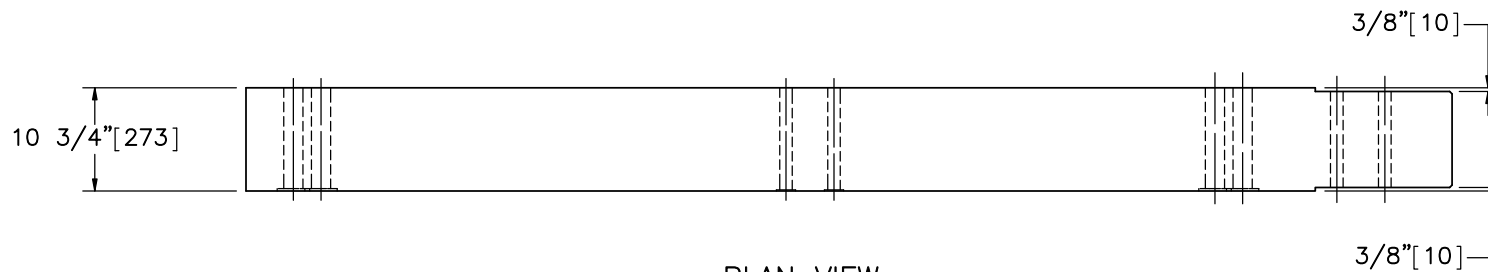
SCALE: 1:30
UNITS: in./mm

SHEET:
3 of 17

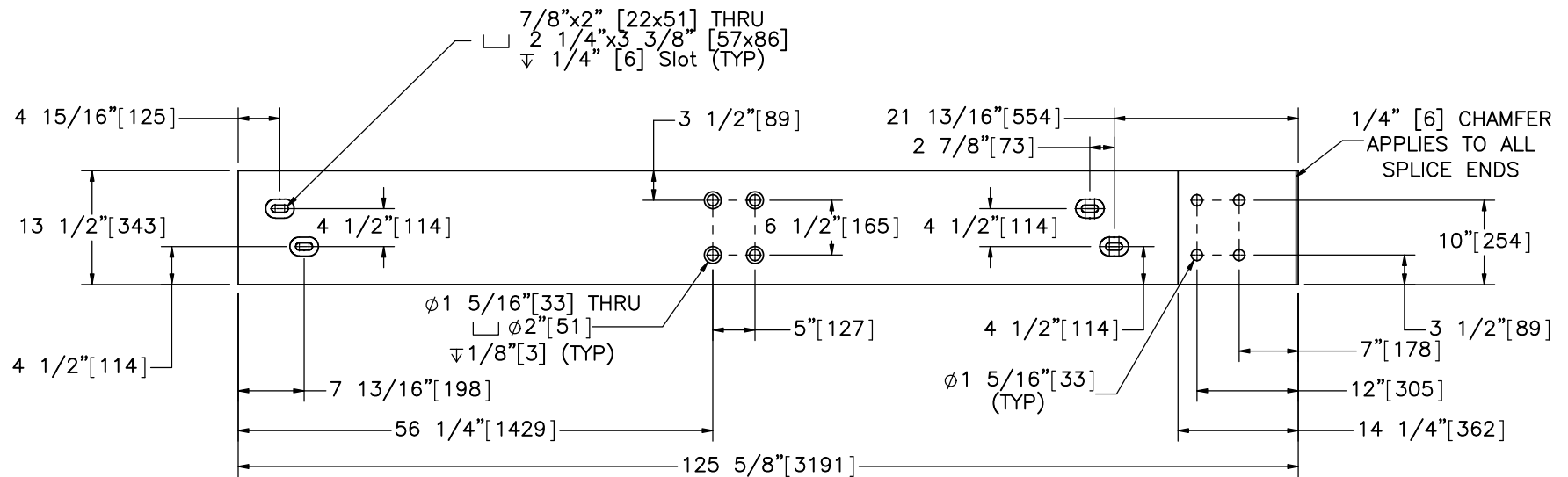
DATE:
11/15/2018

DRAWN BY:
DTM/MES/
JEK/DJW

REV. BY:
JEK/RKF/
JDS/JCH



PLAN VIEW



ELEVATION VIEW
Part a1

Note: (1) Slots in all rail segments must be countersunk to a diameter of 2 1/4" [57], a length of 3 3/8" [86], and a depth of 1/4" [6].



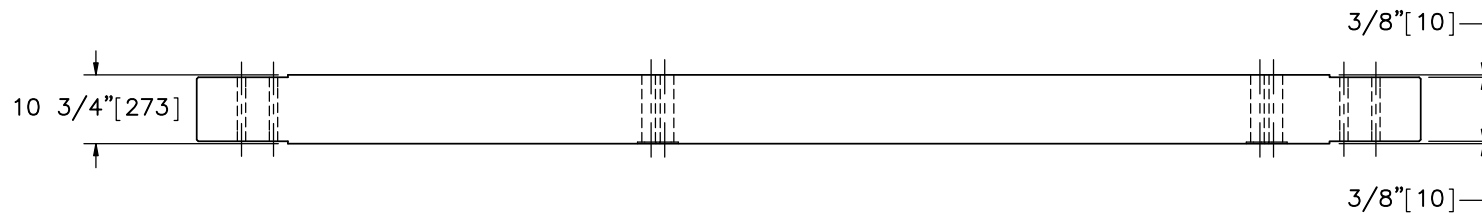
Midwest Roadside
Safety Facility

MNDOT Noise Wall
Timber Rail
Test No. MNNW-2
Timber Rail Downstream End
Segment Details

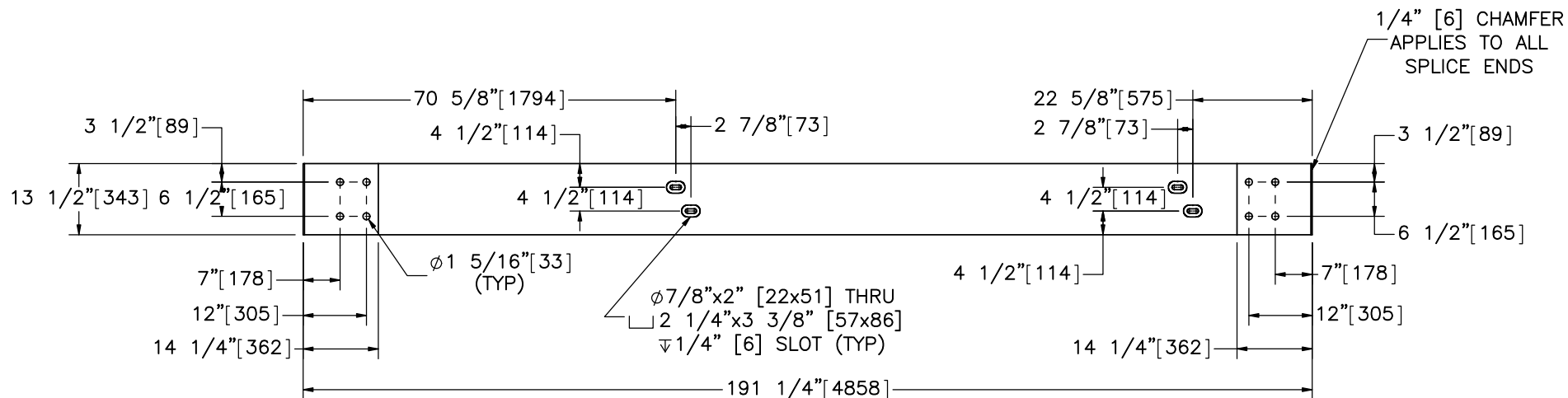
DWG. NAME:
MNNW-2_R8

SCALE: 1:20
UNITS: in./mm

SHEET:
4 of 17
DATE:
11/15/2018
DRAWN BY:
DTM/MES/
JEK/DJW
REV. BY:
JEK/RKF/
JDS/JCH



PLAN VIEW



ELEVATION VIEW
Part a2



Midwest Roadside
Safety Facility

MNDOT Noise Wall
Timber Rail
Test No. MNNW-2

Timber Rail

DWG. NAME.
MNNW-2_R8

SCALE: 1:30
UNITS: in./mm

SHEET:
5 of 17

DATE:
11/15/2018

DRAWN BY:
DTM/MES/
JEK/DJW

REV. BY:
JEK/RKF/
JDS/JCH

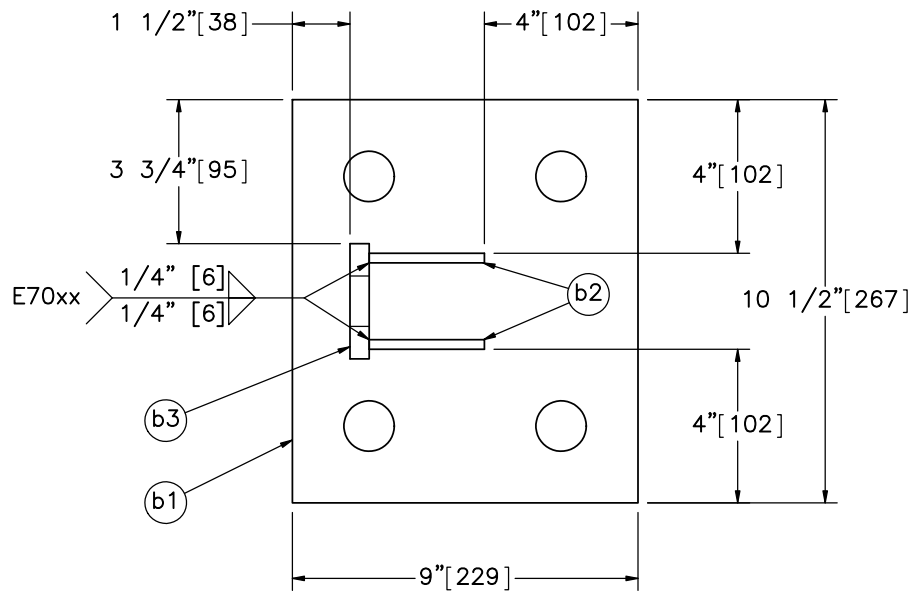


Part a3

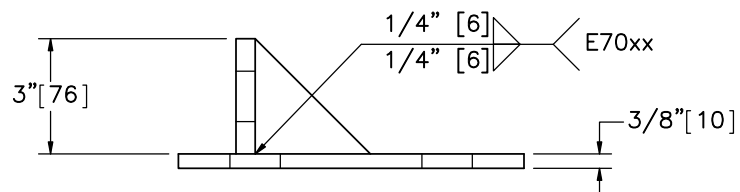


SCALE: 1:25
UNITS: in.[mm]

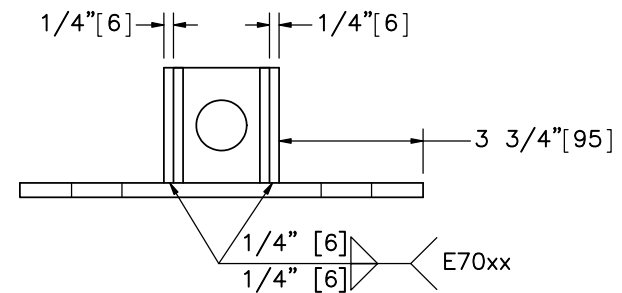
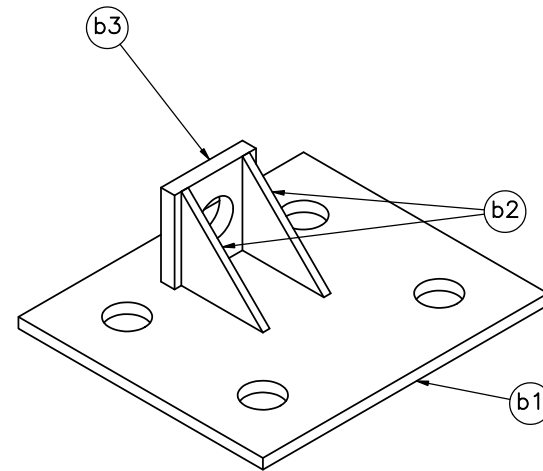
REV. BY:
JEK/RKF/
JDS/JCH



ELEVATION VIEW



PLAN VIEW



PROFILE VIEW



Midwest Roadside
Safety Facility

MNDOT Noise Wall
Timber Rail
Test No. MNNW-2

Anchor Plate Assembly

DWG. NAME.
MNNW-2_RB

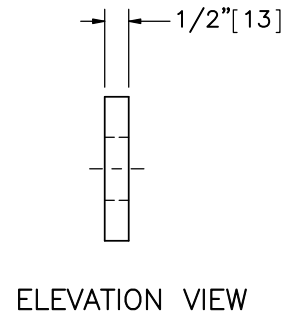
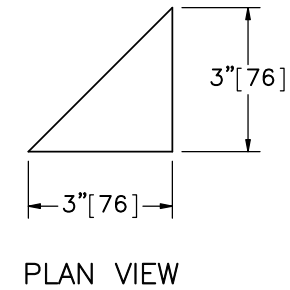
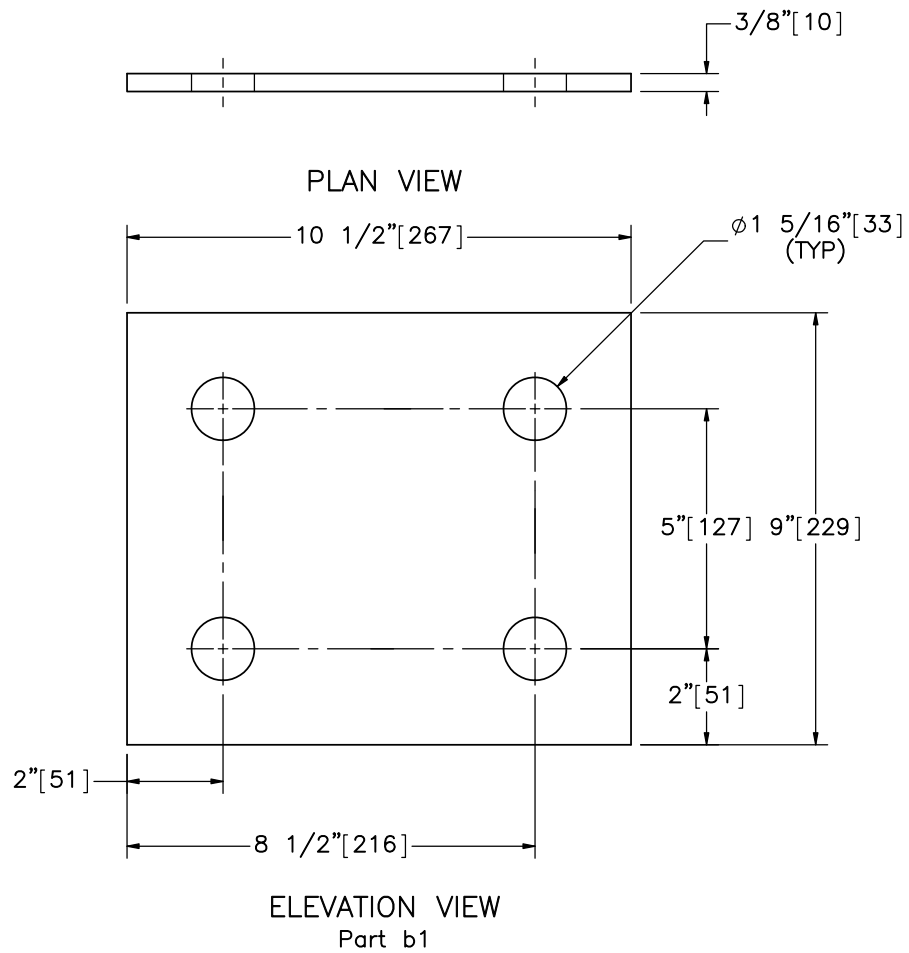
SCALE: 1:5
UNITS: in.[mm]

SHEET:
7 of 17

DATE:
11/15/2018

DRAWN BY:
DTM/MES/
JEK/DJW

REV. BY:
JEK/RKF/
JDS/JCH



Midwest Roadside
Safety Facility

MNDOT Noise Wall
Timber Rail
Test No. MNNW-2

Cable Anchor Plate Components

DWG. NAME.
MNNW-2_R8

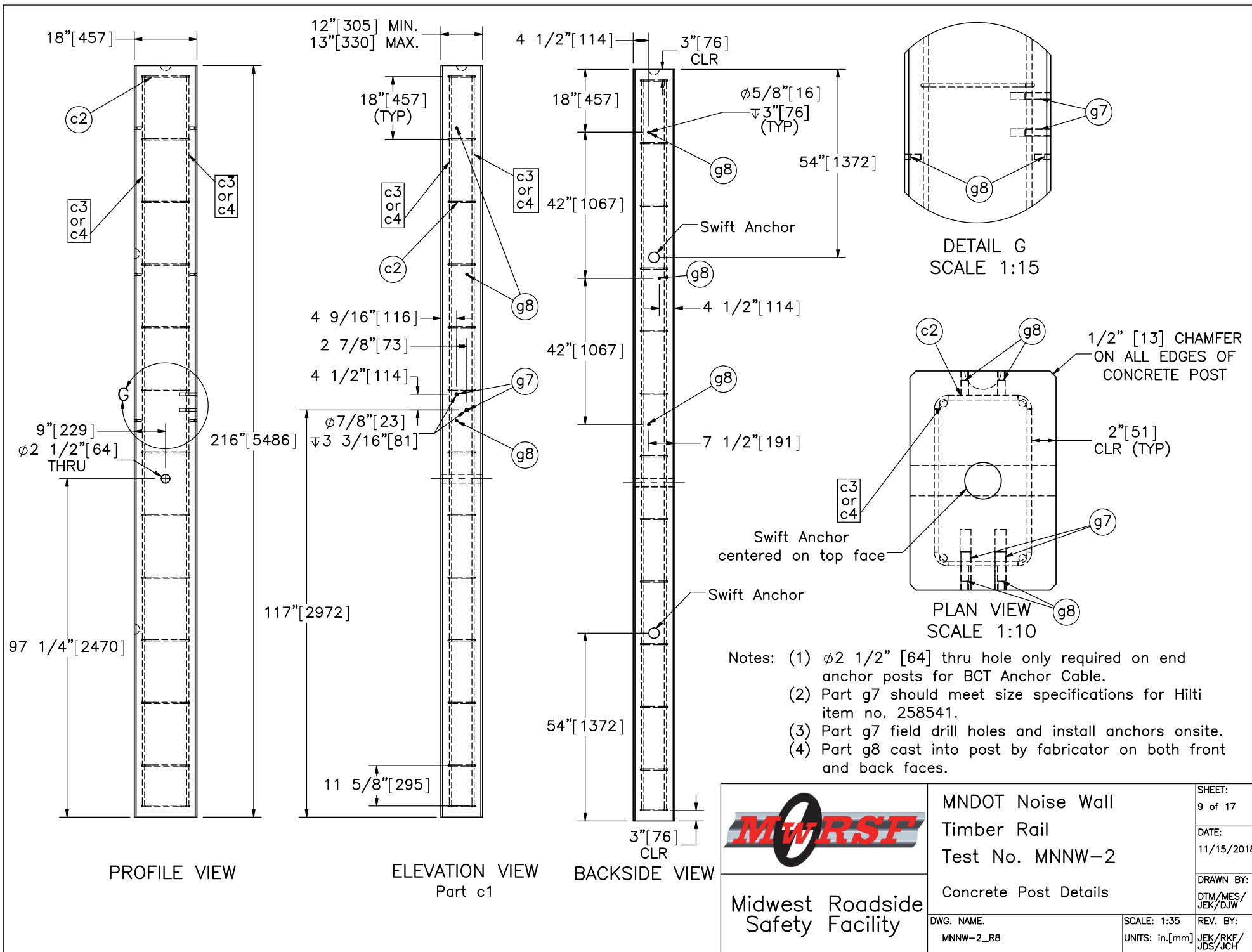
SCALE: 1:4
UNITS: in.[mm]

SHEET:
8 of 17

DATE:
11/15/2018

DRAWN BY:
DTM/MES/
JEK/DJW

REV. BY:
JEK/RKF/
JDS/JCH



Midwest Roadside
Safety Facility

MNDOT Noise Wall
Timber Rail
Test No. MNNW-2

Concrete Post Details

DWG. NAME.
MNNW-2_R8

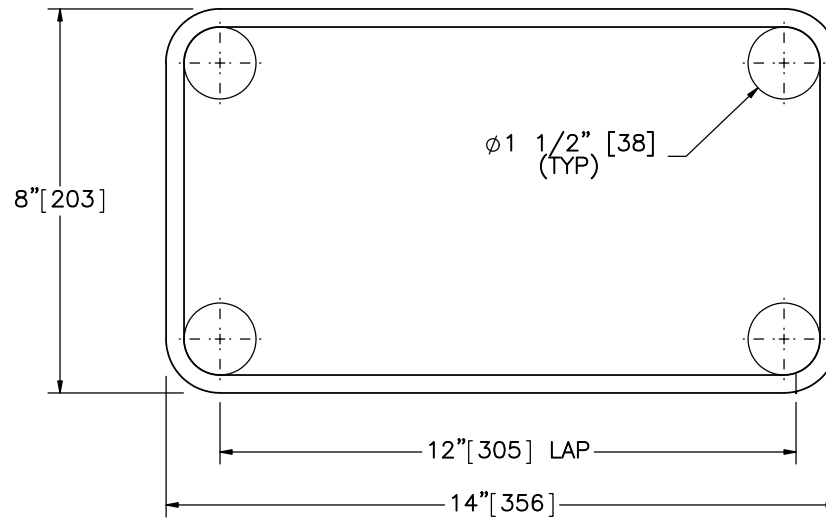
SCALE: 1:35
UNITS: in./mm

SHEET:
9 of 17

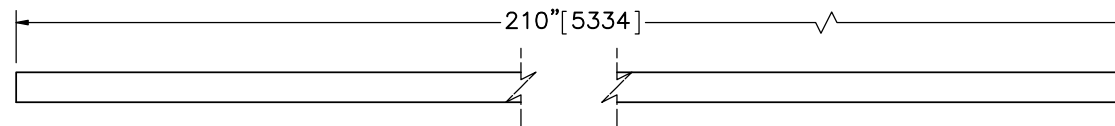
DATE:
11/15/2018

DRAWN BY:
DTM/MES/
JEK/DJW

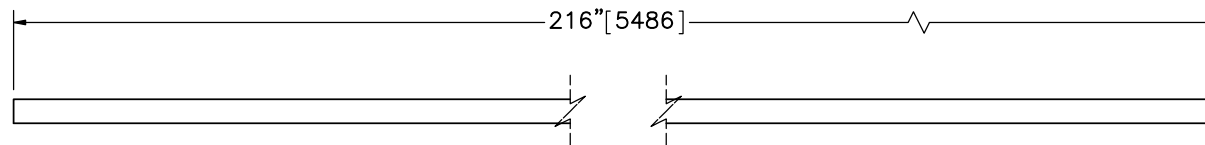
REV. BY:
JEK/RKF/
JDS/JCH



Part c2



Part c3



Part c4

BILL OF BARS

ITEM NO.	QTY. PER POST	BAR SIZE	TOTAL LENGTH
c2	13	#3	53" [1,346]
c3	4	#5	210" [5,334]
c4	4	1/2" [13]	216" [5,486]

- Notes: (1) Splices not allowed in part c3.
(2) Prestressed strands (part c4) may be used in lieu of c3 reinforcement bars. $\phi 1 \frac{1}{2}" [13]$ low-relaxation, 270 ksi [1,862 MPa] ultimate strength Initial prestress = 30,900 lb [137.5 kN] per strand; cut strands flush with concrete.



Midwest Roadside
Safety Facility

MNDOT Noise Wall
Timber Rail
Test No. MNNW-2

Concrete Post Reinforcement

DWG. NAME.
MNNW-2_R8

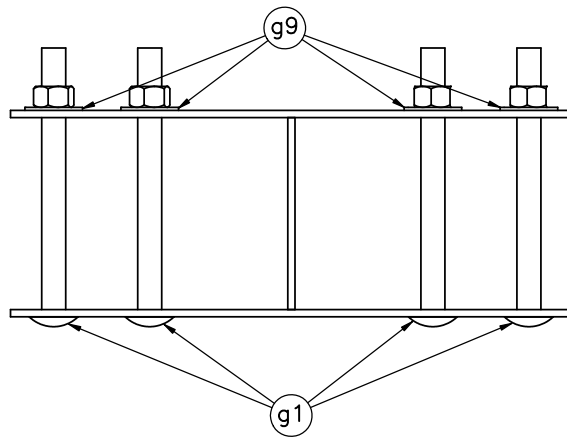
SCALE: 1:4
UNITS: in.[mm]

SHEET:
10 of 17

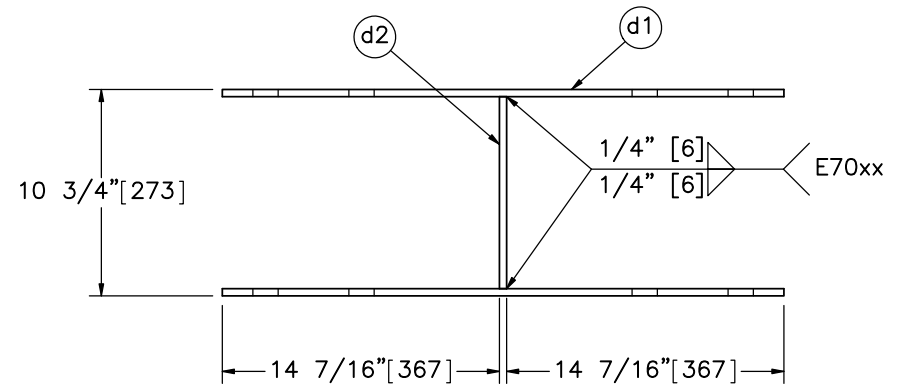
DATE:
11/15/2018

DRAWN BY:
DTM/MES/
JEK/DJW

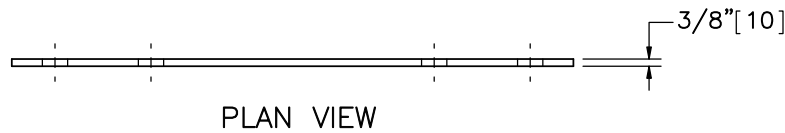
REV. BY:
JEK/RKF/
JDS/JCH



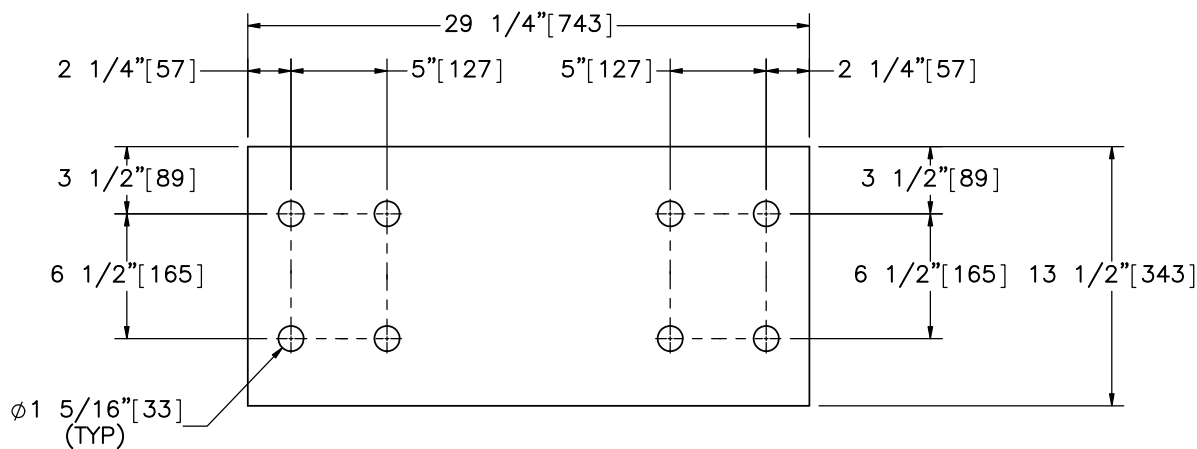
PLAN VIEW
Splice Plate Assembly



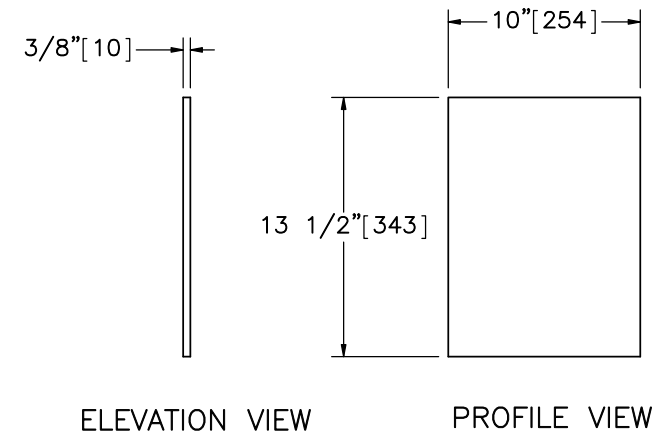
PLAN VIEW



PLAN VIEW



ELEVATION VIEW
Part d1



ELEVATION VIEW

PROFILE VIEW

Part d2

Note: (1) $\frac{3}{16}" [5]$ gap is provided between each rail end and side of steel mid-plate. Total distance between rail end to adjacent rail end is $\frac{3}{4}" [19]$.



Midwest Roadside
Safety Facility

MNDOT Noise Wall
Timber Rail
Test No. MNNW-2

Splice Plate Details

DWG. NAME.
MNNW-2_R8

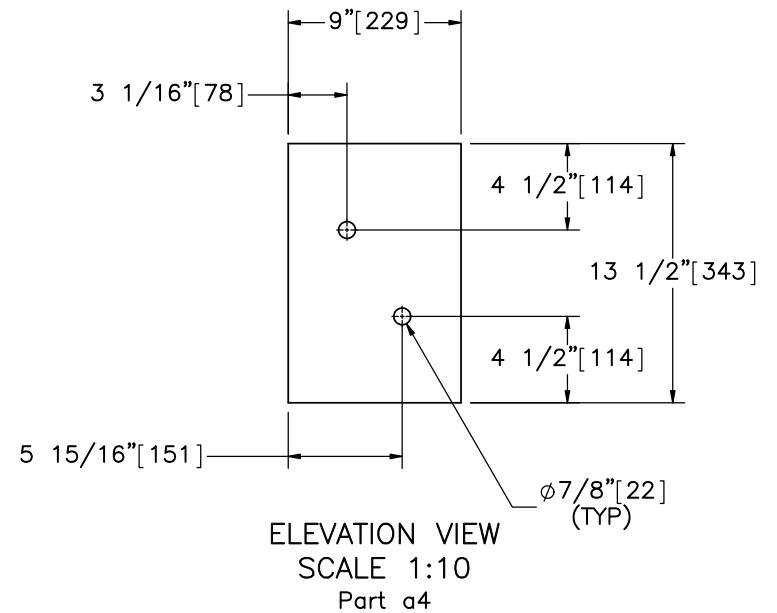
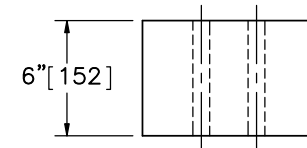
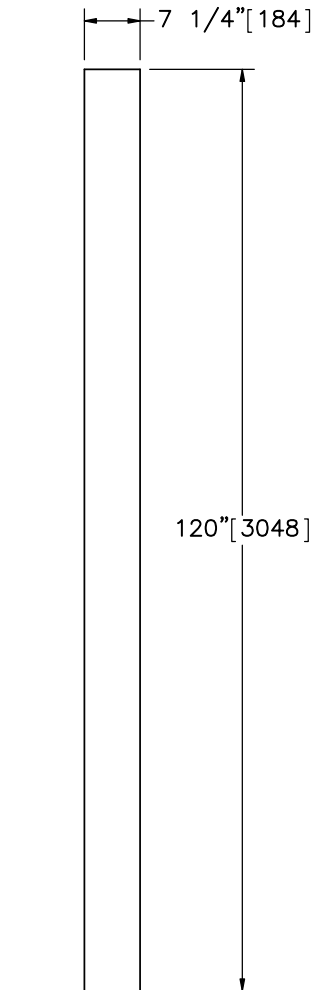
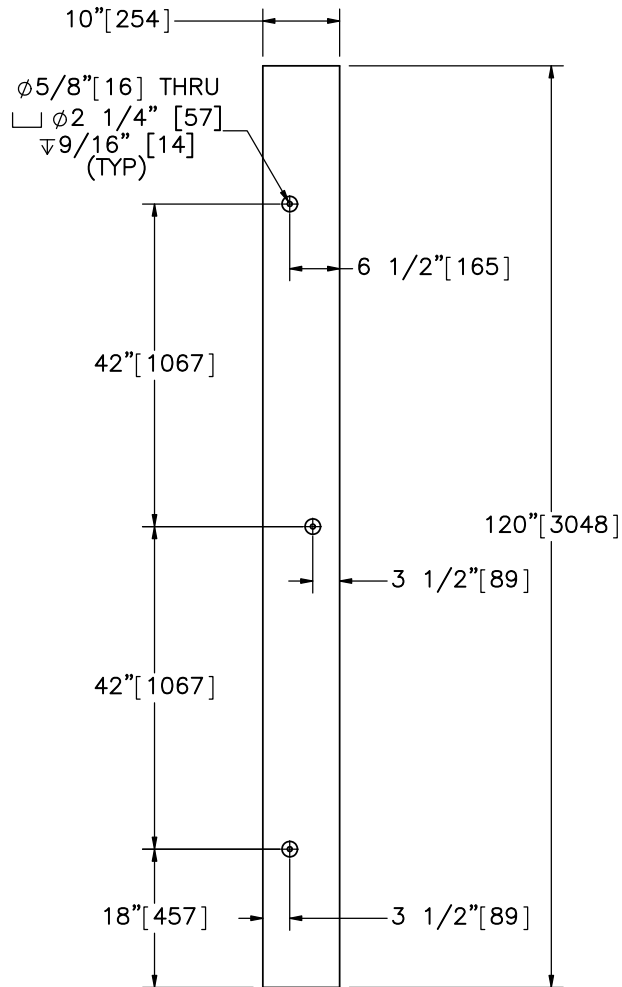
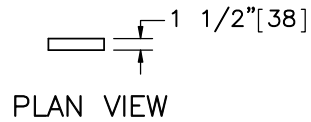
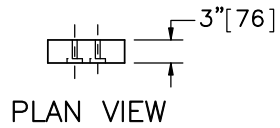
SCALE: 1:10
UNITS: in.[mm]

SHEET:
11 of 17

DATE:
11/15/2018

DRAWN BY:
DTM/MES/
JEK/DJW

REV. BY:
JEK/RKF/
JDS/JCH

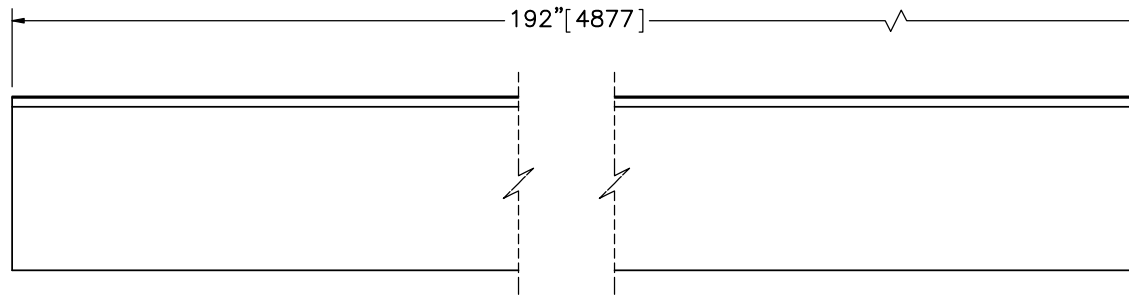


MNDOT Noise Wall
Timber Rail
Test No. MNNW-2
Noise Wall Components

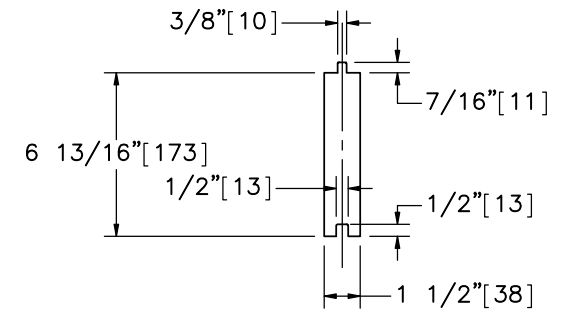
DWG. NAME.
MNNW-2_R8

SCALE: 1:25
UNITS: in.[mm]

SHEET:
12 of 17
DATE:
11/15/2018
DRAWN BY:
DTM/MES/
JEK/DJW
REV. BY:
JEK/RKF/
JDS/JCH

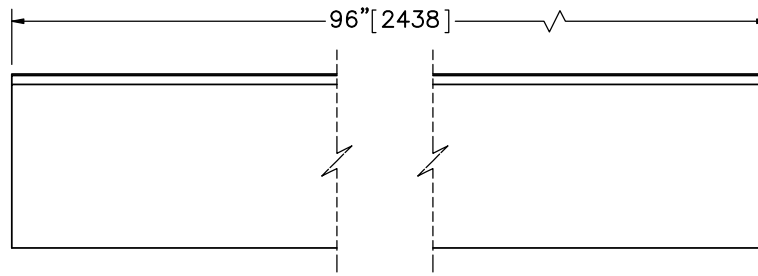


ELEVATION VIEW

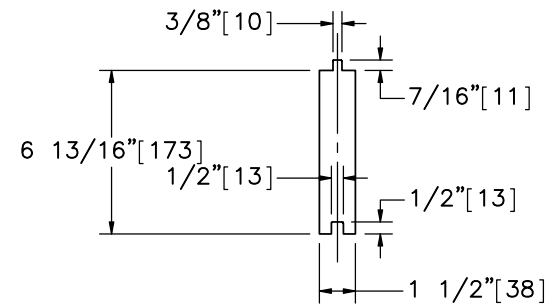


PROFILE VIEW

Part e3

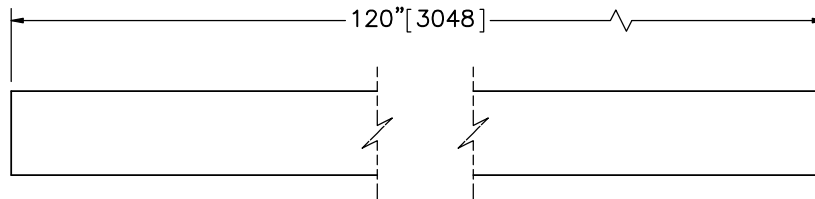


ELEVATION VIEW

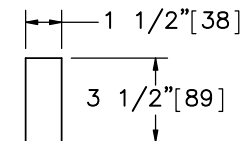


PROFILE VIEW

Part e2



ELEVATION VIEW



PROFILE VIEW

Part e5

Note: (1) Cross-sectional dimensions for parts e2 and e3 are approximate.



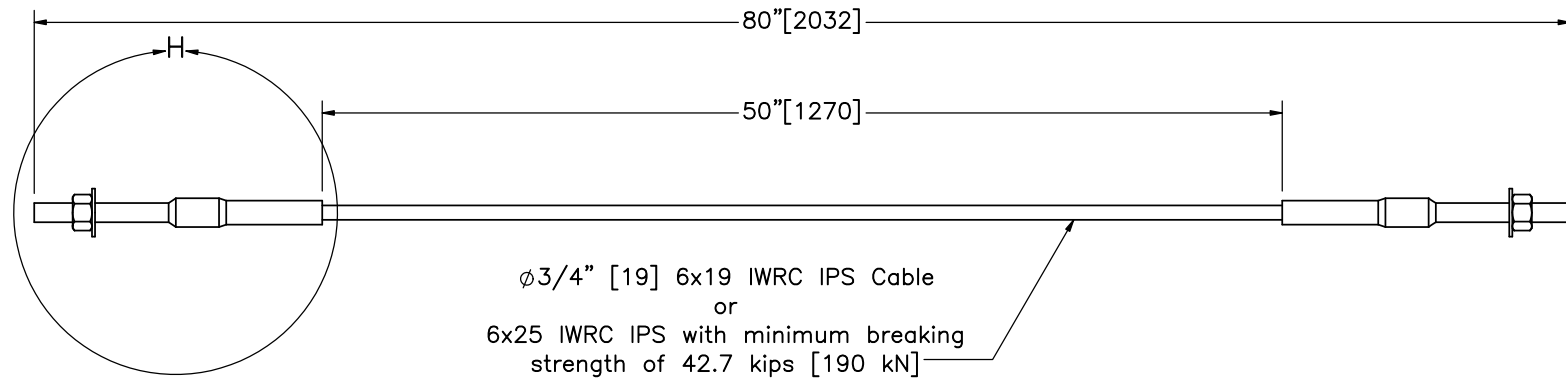
Midwest Roadside
Safety Facility

MNDOT Noise Wall
Timber Rail
Test No. MNNW-2
Wood Plank Details

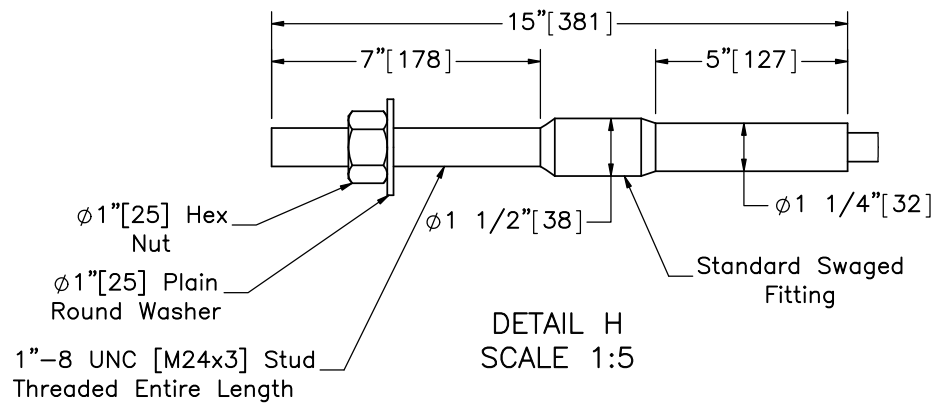
DWG. NAME.
MNNW-2_R8

SCALE: 1:8
UNITS: in.[mm]

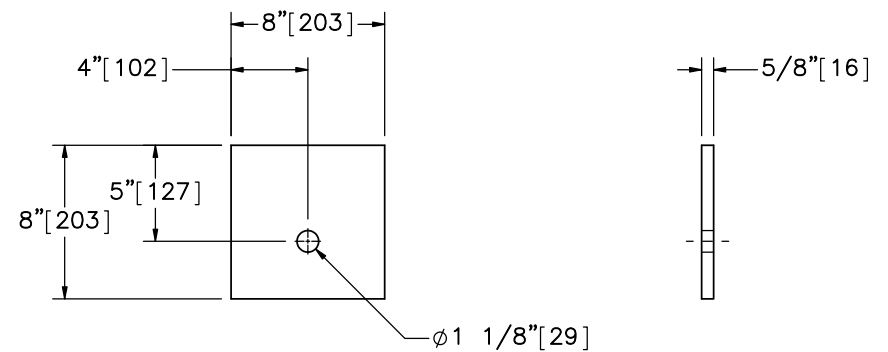
SHEET:
13 of 17
DATE:
11/15/2018
DRAWN BY:
DTM/MES/
JEK/DJW
REV. BY:
JEK/RKF/
JDS/JCH



ELEVATION VIEW
Part f1



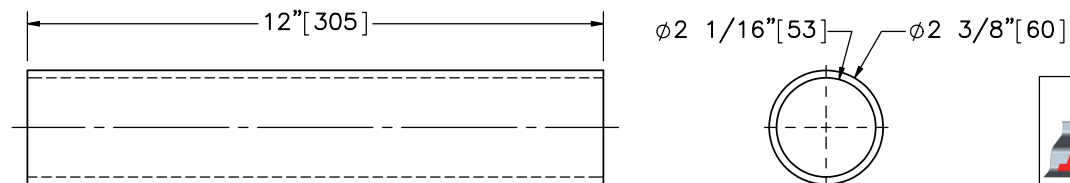
DETAIL H
SCALE 1:5



ELEVATION VIEW

PROFILE VIEW

Part f2



ELEVATION VIEW

PROFILE VIEW

Part f3



Midwest Roadside
Safety Facility

MNDOT Noise Wall
Timber Rail
Test No. MNNW-2

BCT Anchor Cable Assembly
Details

DWG. NAME.
MNNW-2_R8

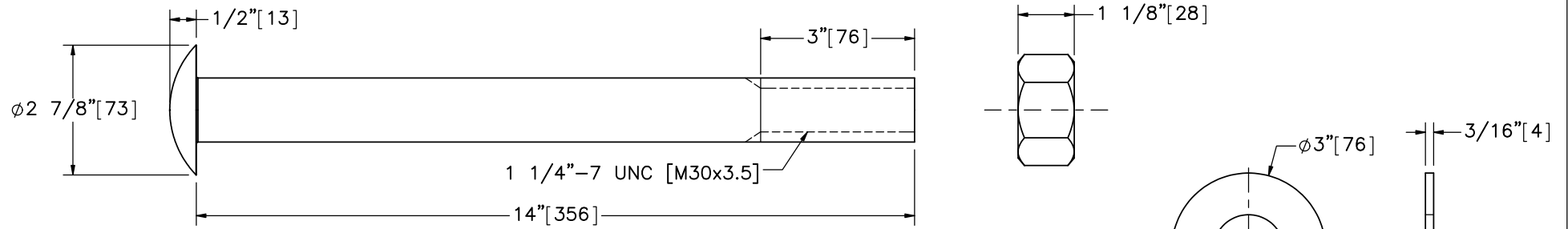
SCALE: 1:10
UNITS: in.[mm]

SHEET:
14 of 17

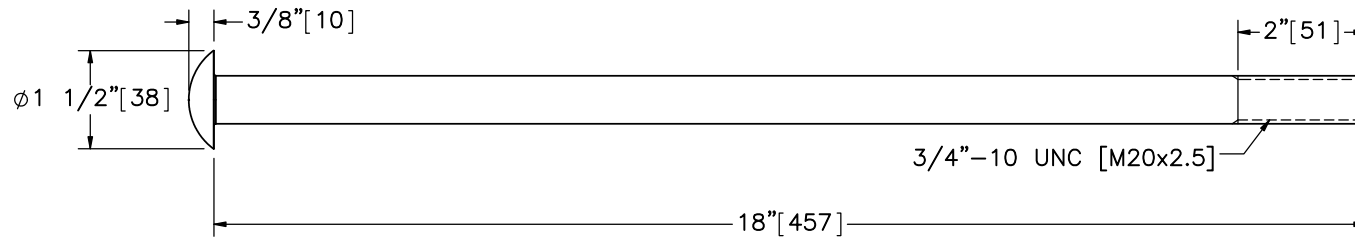
DATE:
11/15/2018

DRAWN BY:
DTM/MES/
JEK/DJW

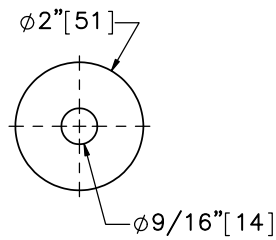
REV. BY:
JEK/RKF/
JDS/JCH



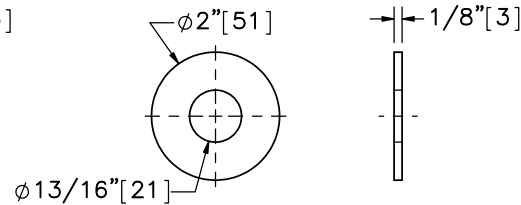
Part g1



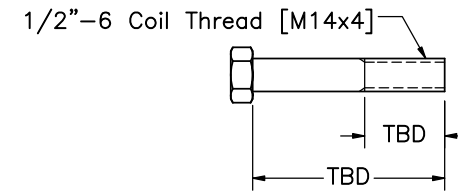
Part g2



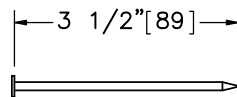
Part g5



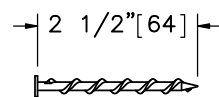
Part g10



Part g6



Part g3



Part g4

- Note: (1) Dome head bolts may have a flat head key in center region, key shapes in the heads, or flattened sides sufficient for an open-ended wrench.
 (2) Bolt and thread lengths for part g6 to be determined after post is fabricated.



Midwest Roadside
Safety Facility

MNDOT Noise Wall
Timber Rail
Test No. MNNW-2

Hardware

DWG. NAME.
MNNW-2_R8

SCALE: 1:3
UNITS: in.[mm]

SHEET:
15 of 17

DATE:
11/15/2018

DRAWN BY:
DTM/MES/
JEK/DJW

REV. BY:
JEK/RKF/
JDS/JCH

Item No.	QTY.	Description	Material Specification	Treatment Specification	Hardware Guide
a1	1	125 5/8"x13 1/2"x10 3/4" [3,191x343x273] Timber Rail End Section	GLULAM – Comb. 48(SP) or Comb. 2(Western species)	See Notes 1–3	–
a2	4	191 1/4"x13 1/2"x10 3/4" [4,858x343x273] Timber Rail Section	GLULAM – Comb. 48(SP) or Comb. 2(Western species)	See Notes 1–3	–
a3	1	173 5/8"x13 1/2"x10 3/4" [4,410x343x273] Timber Rail End Section	GLULAM – Comb. 48(SP) or Comb. 2(Western species)	See Notes 1–3	–
a4	12	13 1/2"x9"x6" [343x229x152] Wood Blockout	GLULAM – Comb. 48(SP) or Comb. 2(Western species)	See Notes 1–3	–
b1	2	10 1/2"x9"x3/8" [229x267x10] Steel Plate	ASTM A36	ASTM A123**	–
b2	4	3"x3"x1/4" [76x76x6] Steel Gusset	ASTM A36	ASTM A123**	–
b3	2	3"x3"x1/2" [76x76x13] Steel Plate	ASTM A36	ASTM A123**	–
c1	12	12"x18" [305x457], 18' [5,486] Long Concrete Post	Min. f'c = 5,500 psi [37.9 MPa] MnDOT mix 3W82	–	–
c2	156	3/8" [10] Dia., 53" [1,346] Long Rebar	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	–
c3*	48	5/8" [16] Dia., 210" [5,334] Long Rebar	ASTM A615 Gr. 60	Epoxy Coated (ASTM A775 or A934)	–
c4*	48	1/2" [13] Dia, 7-Wire Pre-Stressing Strand, 216" [5,486] Long	ASTM A416 Gr. 270	–	–
d1	10	29 1/4"x13 1/2"x3/8" [743x343x10] Steel Plate	ASTM A36	ASTM A123**	–
d2	5	13 1/2"x10"x3/8" [343x254x10] Steel Plate	ASTM A36	ASTM A123**	–
e1	12	3"x10" [76x254], 10' [3,048] Long Vertical Wood Nailer	SYP Gr. No. 1 Dense or better standard rough sawn or Douglas Fir–Larch No. 1 or Douglas Fir–Larch (North) Select Structural or Douglas Fir–South Select Structural or equivalent with min F'b = 1,200 psi [8.3 MPa]	See Note 4	–
e2	17	2"x8" [51x203], 8' [2,438] Long Tongue and Groove Wood Plank	SYP Gr. Select Structural Douglas Fir–Larch Select Structural or equivalent with min F'b = 1,500 psi [10.3 MPa]	See Note 4	–
e3	85	2"x8" [51x203], 16' [4,877] Long Tongue and Groove Wood Plank	SYP Gr. Select Structural Douglas Fir–Larch Select Structural or equivalent with min F'b = 1,500 psi [10.3 MPa]	See Note 4	–
e4	12	2"x8" [51x203], 10' [3,048] Long Wood Batten	SYP Gr. Select Structural Douglas Fir–Larch Select Structural or equivalent with min F'b = 1,500 psi [10.3 MPa]	See Note 4	–
e5	2	2"x4" [51x102], 10' [3,048] Long Wood Plank	SYP Gr. Select Structural Douglas Fir–Larch Select Structural or equivalent with min F'b = 1,500 psi [10.3 MPa]	See Note 4	–

*Use either part c3 or c4.

** Weld before galvanization.

- Notes: (1) Timber rail sections and blockouts shall be treated with pentachlorophenol (PCP–A) in heavy oil to a minimum net retention of 0.6 lb/ft³ (9.6 kg/m³) in accordance with AWP Standard U1 to the requirements of Use Category 4A (UC4A).
- (2) Wood shall be cut, drilled, and completely fabricated prior to treatment with preservative. Drain excess chemicals and dry all treated wood at the place of manufacture.
- (3) All field cuts, bore holes, and damages shall be treated with material acceptable to the engineer prior to installation.
- (4) Provide preservative treated timber products per Spec. 3491.



Midwest Roadside
Safety Facility

MNDOT Noise Wall
Timber Rail
Test No. MNNW–2

Bill of Materials

DWG. NAME.
MNNW–2_R8

SCALE: None
UNITS: in./mm

SHEET:
16 of 17
DATE:
11/15/2018
DRAWN BY:
DTM/MES/
JEK/DJW
REV. BY:
JEK/RKF/
JDS/JCH

Item No.	QTY.	Description	Material Specification	Treatment Specification	Hardware Guide
f1	2	BCT Anchor Cable	—	—	FCA01
f2	2	8"x8"x5/8" [203x203x16] Anchor Bearing Plate	ASTM A36	ASTM A123	FPB01
f3	2	2 3/8" [60] O.D. x 12" [305] Long BCT Post Sleeve	ASTM A53 Gr. B Schedule 40	ASTM A123	—
g1	48	1 1/4"—7 UNC [M30x3.5], 14" [356] Long Round Head Bolt and Nut	Bolt — ASTM A307 Gr. A Nut — ASTM A563A	ASTM A153 or B695 Class 55 or F2329	FBB09a
g2	24	3/4"—10 UNC [M20x2.5], 18" [457] Long Round Head Bolt with Flat Head Key	ASTM A307 Gr. A	ASTM A153 or B695 Class 55 or F2329	FBB08a
g3	969	16D Ring Shank Nail	—	—	—
g4	408	No. 8 x 2 1/2" [64] Long Bugle Head Exterior Screw	—	ASTM A153 or B695 Class 55	—
g5	36	1/2" [13] Dia. Round Plate Washer	ASTM F844	ASTM A123 or A153 or F2329	—
g6	36	1/2"—6 Coil Thread [M14x4], 3" [76] Long Hex Head Bolt	ASTM A307 Gr. A	ASTM A153 or B695 Class 55 or F2329	—
g7	24	3/4"—10 UNC [M20x2.5] Drop-In Concrete Anchor	Hilti Item No. 258541	Zinc-Plated	—
g8	72	1/2"—6 Coil Thread [M14x4] Concrete Anchor	As Supplied	Galvanize per spec. 3392 or electroplate per ASTM B633 SC4 Type II	—
g9	48	1 1/4" [32] Dia. Plain Round Washer	ASTM F844	ASTM A123 or A153 or F2329	FWC30a
g10	24	3/4" [19] Dia. Plain Round Washer	ASTM F844	ASTM A123 or A153 or F2329	FWC20a



Midwest Roadside
Safety Facility

MNDOT Noise Wall
Timber Rail
Test No. MNNW-2

Bill of Materials

DWG. NAME.
MNNW-2_R8

SCALE: None
UNITS: in./mm

SHEET:
17 of 17
DATE:
11/15/2018
DRAWN BY:
DTM/MES/
JEK/DJW
REV. BY:
JEK/RKF/
JDS/JCH

REV.	DATE OF ISSUE	Page	NATURE OF CHANGES	REVIEWER	REVISED BY
0	10/4/2017	–	Drawing set created from MNNW-1_R13 Drawing Set.	–	DTM
1	10/23/2017	–	Chaned hole placement in part nos. c1 and e1.	JEK	MES
		1	Removed previous note 3.		
		3	Edited note 2.		
		9	Changed hole placement in part no. c1. Edited part callouts.		
		10	Added part no. a4 on page and in bill of bars. Edited note 2.		
		12	Edited hole placement in part no. e1. Added hole centerline.		
		BOM	Added in part no. c4. Added asterisk note and note 4. Edited galv. Spec. for part nos. e1–e5. Corrected part quantities for par t nos. e4 and g3. Edited material spec. for part nos. c3 and e1–e5. Corrected description for part no. c3.		
2	10/23/2017	BOM	Added in part no. b4. Corrected part quantity for part no. f1. Edited note 1.	JEK	MES
3	10/24/2017	BOM	Note 1 edit, preservation standard updated.	RKF	JEK
4	12/21/2017	9	Added Swift Anchor holes to part no. c1.	JEK	MES
5	2/21/2018	–	New part: g10. Washers added under head of g2 bolts. End anchor plates rotated 180 deg and shifted 5" toward the interior of system.	JCH/RKF/JDS	JEK
		2	Label add (g10 washers).		
		4	Slot counterbore edit. Part a1 anchor bracket hole location edit. Note edit.		
		5	Slot counterbore edit.		
		6	Slot counterbore edit. Part a3 anchor bracket hole location edit.		
		9	Hole depth for anchor installation edited.		
		12	Part e1 thru hole diameter edit.		
		15	Dim adds. Part g10 add. Note add. Metric thread equivalent added. General shift.		
6	2/23/2018	BOM	New: g10. Description: g1, g2, g6–8. Material: g9. Treatment: b1–3, d1–2. Note add (galv/weld). Column header update.	JDS	JEK
		–	Model edit so upstream cable anchor correctly extends thru post 1.		
		1	Impact location edit. Note 2 edit.		
7	7/23/2018	3	Incorrect g6 arrow removed.	–	JEK
		15	Note edits.		

8	11/15/2018	2	Dim add.	JDS	DJW
		10	Note edit.		
		13	Title block edit.		
		15	Dim adds.		
		BOM	Part g2 description update.		