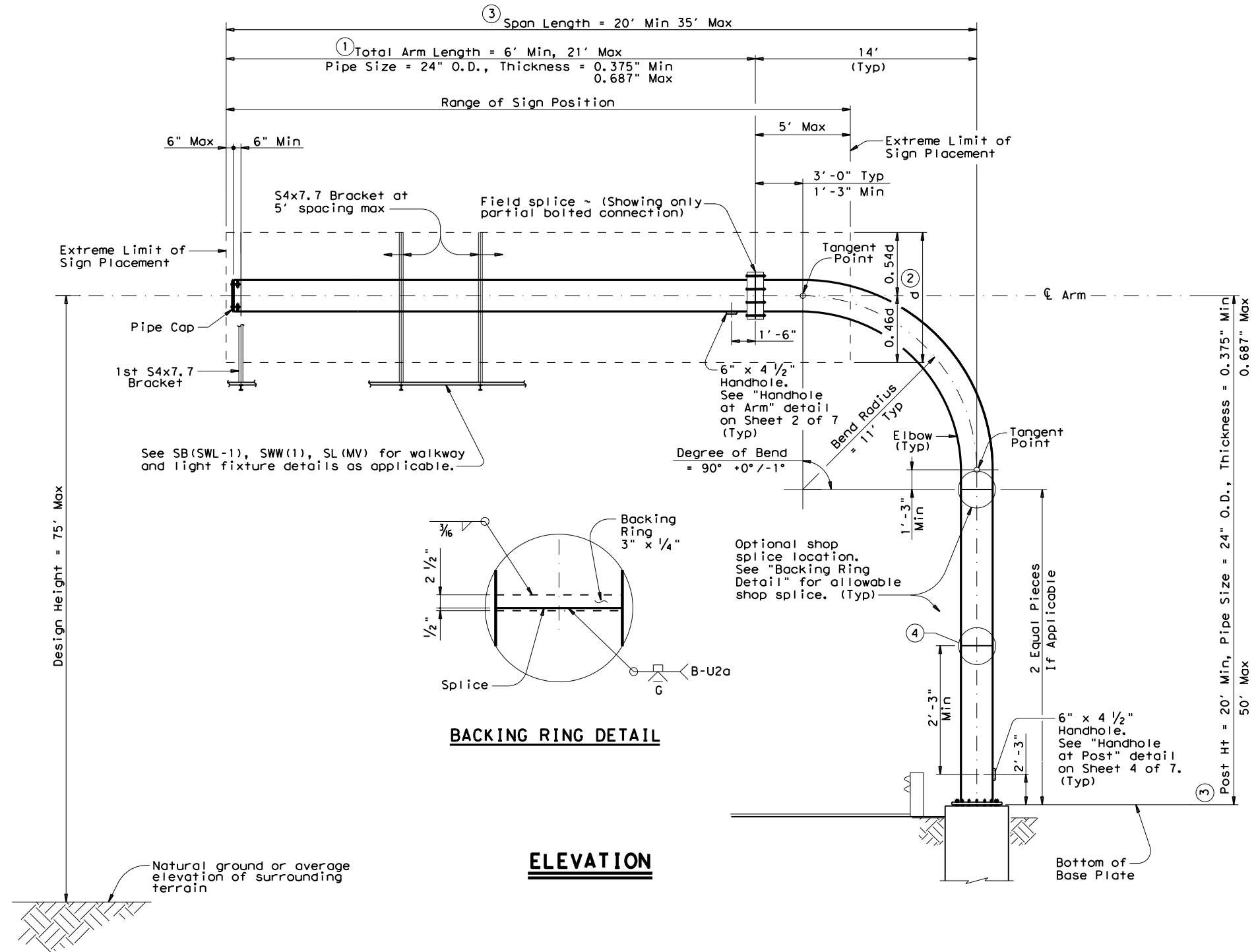


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- ① Adjust arm length to accommodate the span length shown on the structural layout sheet.
- ② When signs of different depths are used, aligning the bottom edges of all signs is permissible. Where this is done, position all signs so that the bottom edges are 0.46 of the depth of the deepest sign below the centerline of mast arm.
- ③ See Monotube Design Tables on Sheets 5 & 6 of 7 for specific design details such as post height, pipe wall thicknesses, and weld sizes for various span lengths.
- ④ Extra optional shop splice at mid height of straight portion of post. This splice is only applicable on certain post heights and thicknesses. See Sheets 5 & 6 of 7 for applicable designs.

MATERIAL DATA		
COMPONENT	ASTM DESIGNATION	MIN. YIELD (ksi)
Arm & Post Pipe	A53 Gr. B, Type E or S or A106 Grade B	35
Base Plate and Handhole Frame Ground Sleeve, Backing Ring	A572 Gr. 50, A36 or A588	36
Connection Bolts	A325	92
Anchor Bolts	F1554 Gr 55, A193-B7	55
U Rods	A307	
Anchor Bolt Templates	A36	36
Heavy Hex (H.H.) Nuts	A563, or A194 Gr 2H	
Hardened Washers	F436	

GENERAL NOTES:

Designed according to 2013 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals.

Determine the minimum design pipe thickness for both post and arm members from Sheets 5 and 6 of 7. Select applicable pipe thickness in accordance with specified connection - type (socket or ground sleeve) between posts and base plate. Missing specified span length and post height from Tables on Sheets 5 and 6 of 7 indicate those designs are not available.

For span lengths and post heights falling between those shown in the Design Tables on Sheets 5 & 6 of 7, use the design information for the longer span and/or taller post height.

Design wind speeds are 90 mph and 130 mph (3-second gust wind speed). Design height is up to 75 ft.

Each structure is designed to support signs of equivalent area to a 10 ft deep sign panel over 80 percent of the span length.

The analyses are based on locating an equivalent area within the range of sign position as necessary to produce maximum stress. Place sign panel such that the overlap onto elbow does not exceed 5 ft from field splice. Design includes 3 lbs per square ft for sign panel, 20 lbs per ft for lane control signal (LCS) and 50 lbs per ft for walkway, all placed as specified for the design sign panel. Dynamic message sign (DMS) is NOT considered in the design. Engineer approval is required to use DMS as part of the sign panel.

Form elbow for tubular frame by hot bending methods which do not crimp or buckle the interior radius of pipe bend, and do not change the physical characteristics of the material. For each seam-welded pipe, locate a longitudinal seam weld at the neutral axis during the bending process. Bend elbow in accordance with TPA-IBS-98 "Recommended Standards for Induction Bending of Pipe and Tube."

Arm consists of only one section.

Obtain Engineer's approval for the locations of drilled holes that accommodate 1/2 inch threaded couplings and CGB connectors for cord and cable fitting on arm.

Fabricate and weld in accordance with Item 441, "Steel Structures", AWS D1.1 Structural Welding Code, and the details shown on the plans. Galvanize all steel parts in accordance with Item 445, "Galvanizing" after fabrication unless noted elsewhere. During galvanizing process, drain acid to prevent acid entrapment under backing ring.

Construct foundations in accordance with Item 416, "Drilled Shaft Foundations". Use Class C concrete. Use Grade 60 reinforcing steel.

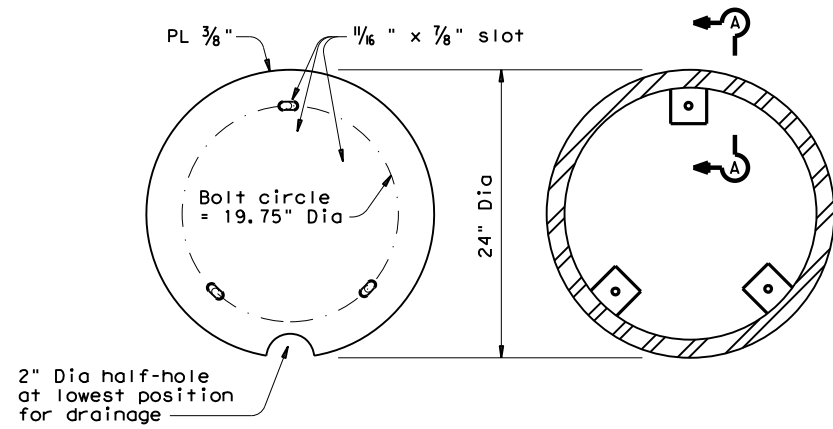
Shop assemble post and arm in accordance with Item 441. During shop assembly, first bring the field splice to a snug tight condition with the required bolts in all holes through each ply in the connection. Then verify camber and span length prior to disassembly. Demonstrate to the Engineer that the preassembled span length of the frame in the no load condition is within 2 inch (+/-) of the design span length.

If the tubular frame is erected as one unit, adequately suspend the frame to avoid distortions. Support the structure by the crane during the anchor bolts tightening process.

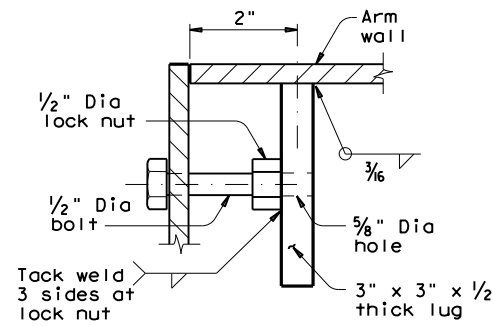
SHEET 1 OF 7

<h2>MONOTUBE SIGN STRUCTURE (CANTILEVER)</h2> <h3>MC(1)-22</h3>			
FILE:	mc-22.dgn	DN:	TxDOT
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REVISIONS		OW:	TxDOT
03-15	10-22: Removed 0.968" designs.	CR:	TxDOT
		CON:	SECT:
		JOB:	HIGHWAY:
		DIST:	COUNTY:
			SHEET NO.:

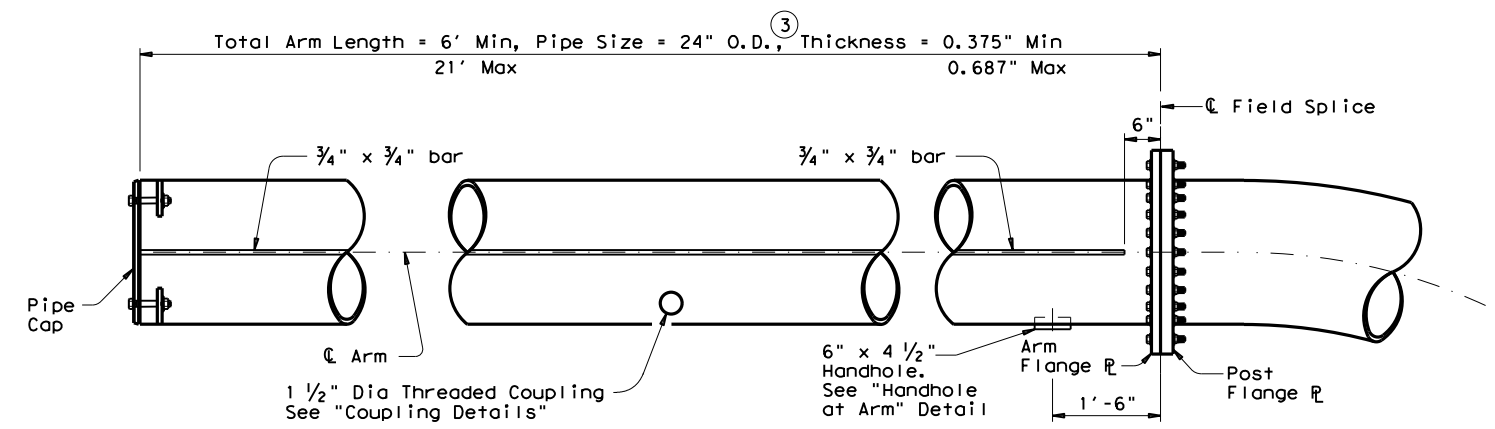
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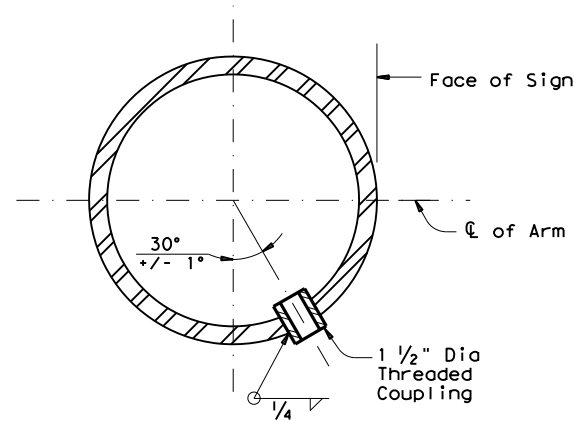
CAP AND ATTACHMENT



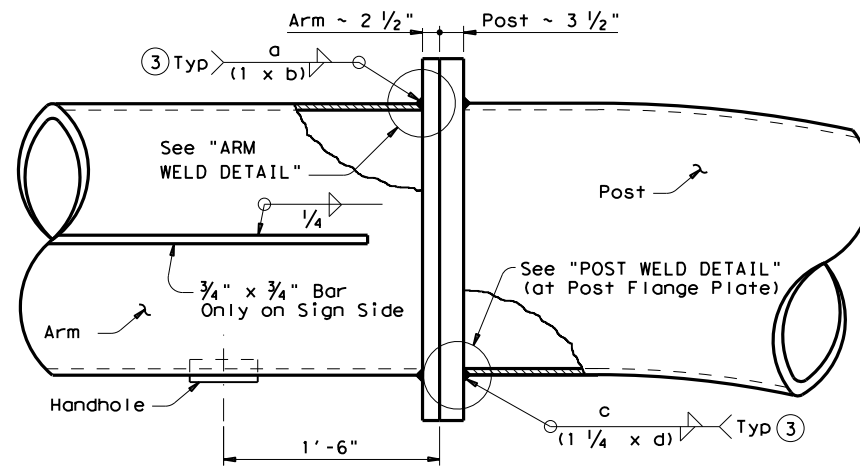
SECTION A-A



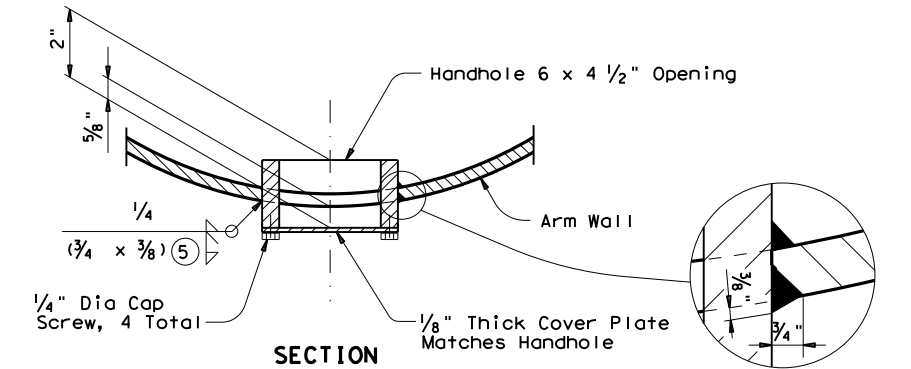
ELEVATION



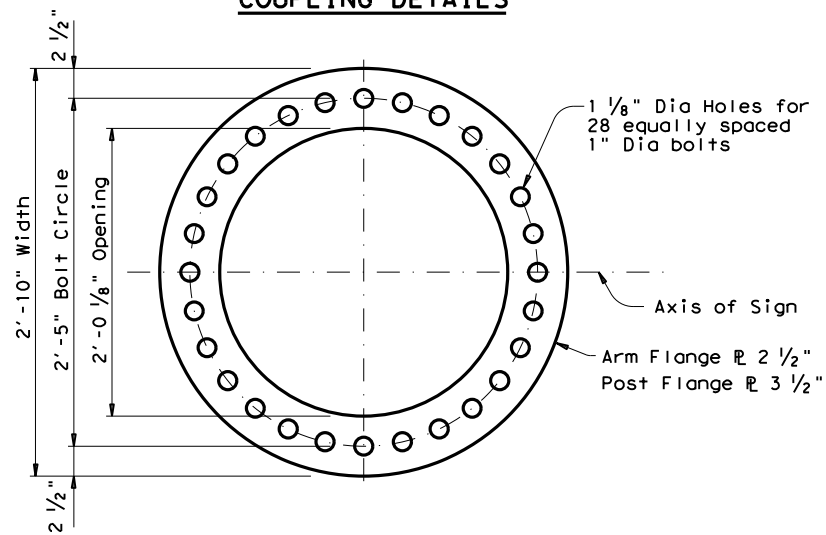
COUPLING DETAILS



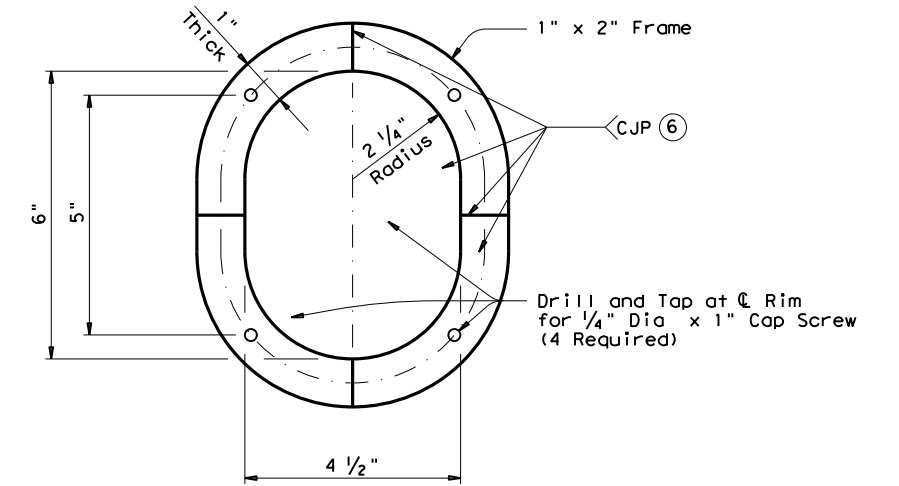
FIELD SPLICE ELEVATION



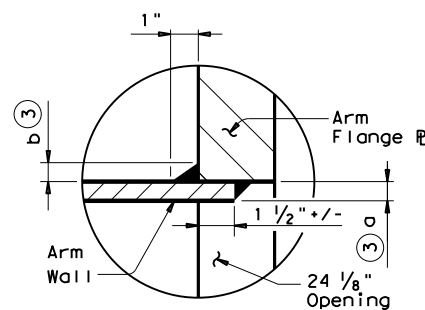
SECTION



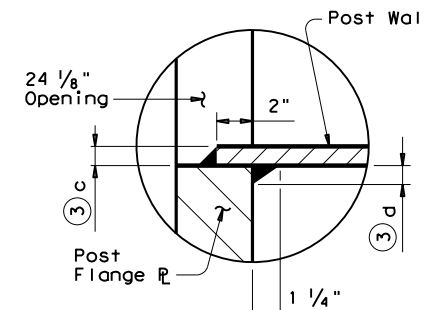
FLANGE PLATE DETAIL



**PLAN VIEW
HANDHOLE AT ARM**



**ARM WELD DETAIL
(Socket Type Connection)**



**POST WELD DETAIL
(at Post Flange Plate)
(Socket Type Connection)**

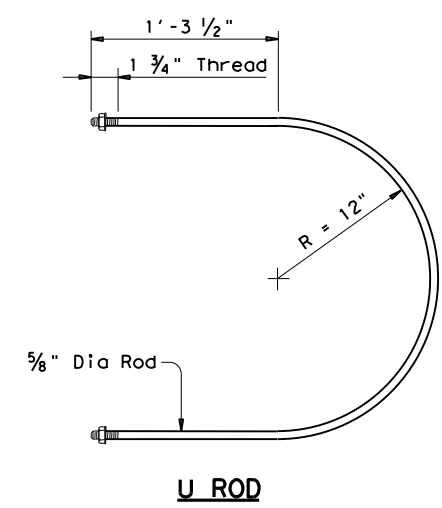
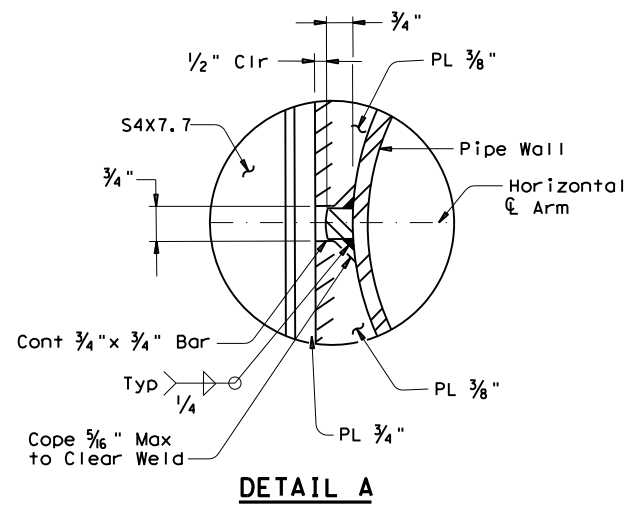
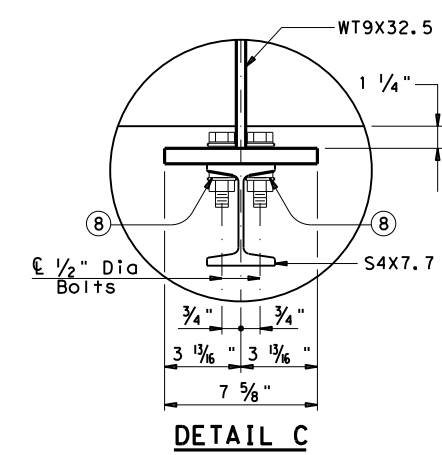
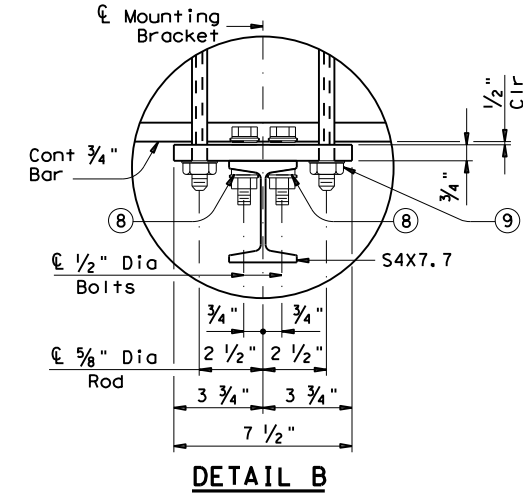
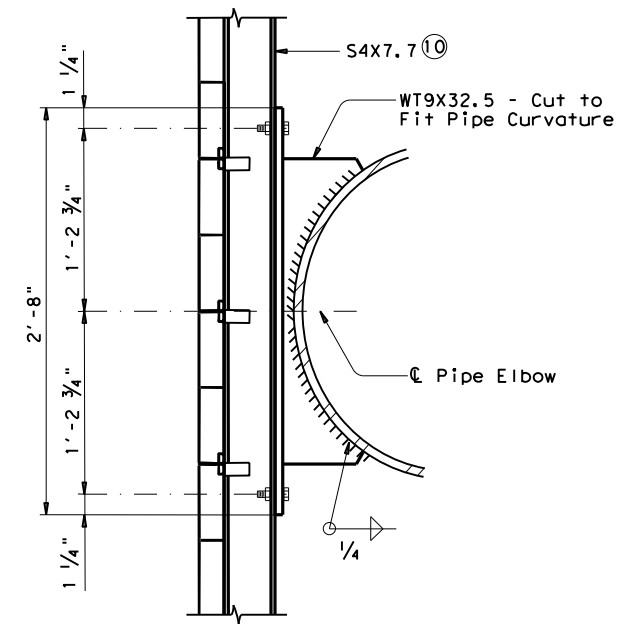
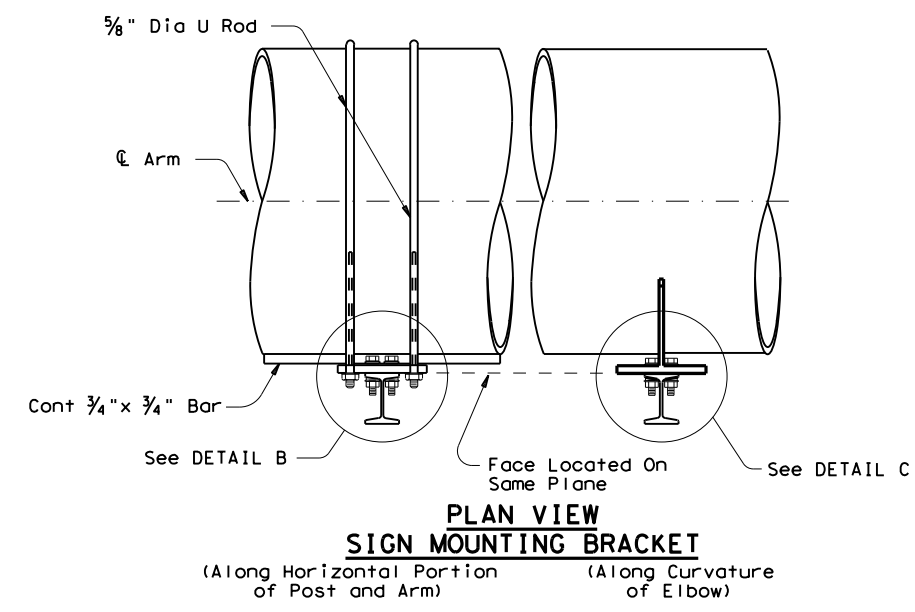
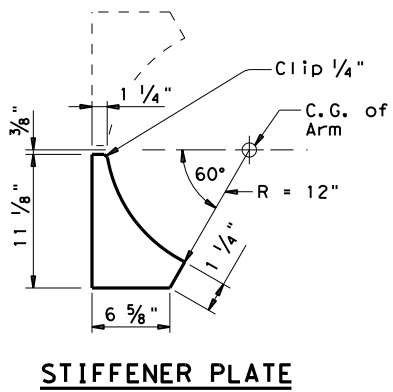
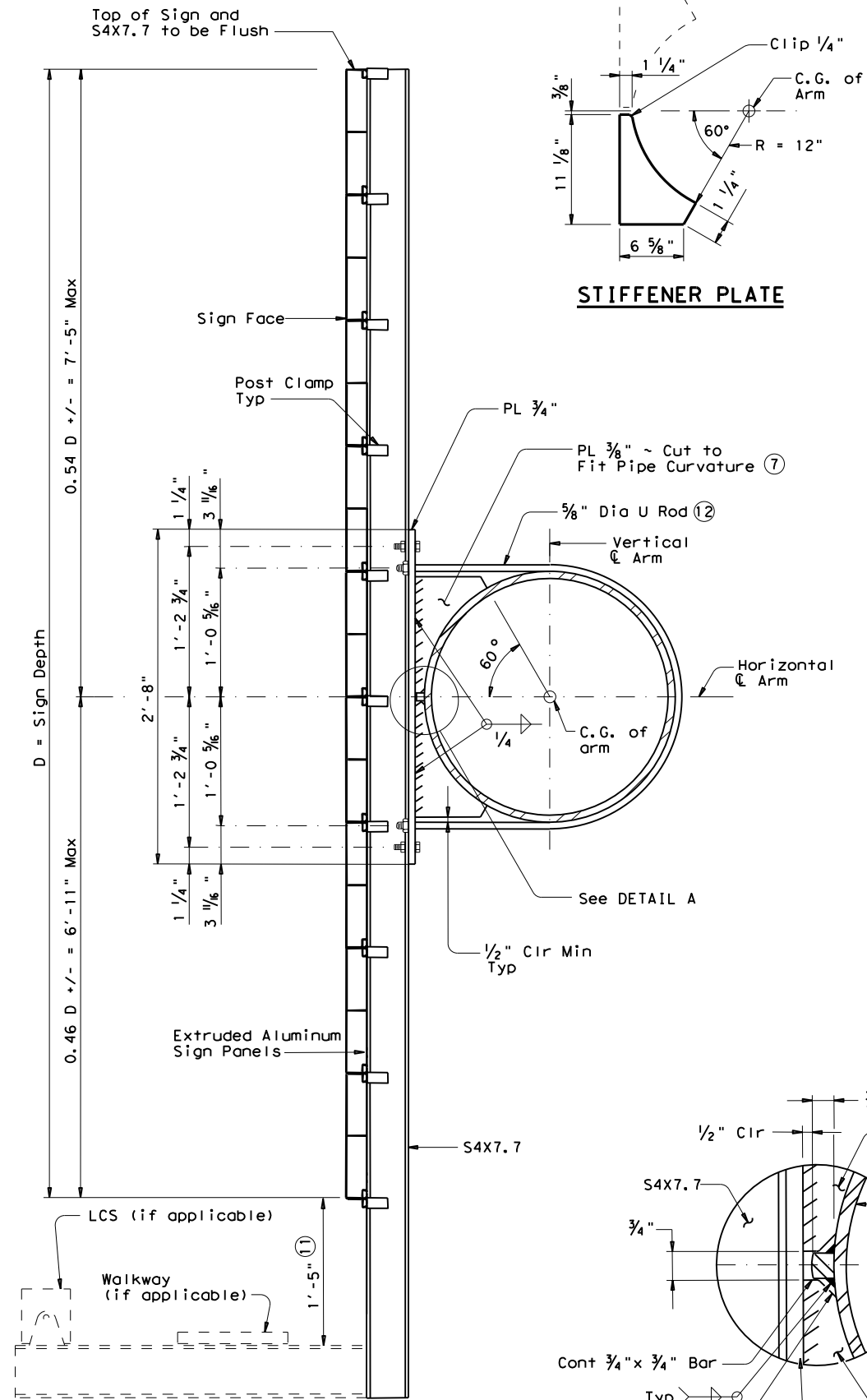
SHEET 2 OF 7

		Traffic Safety Division Standard	
MONOTUBE SIGN STRUCTURE (CANTILEVER) (SIGN SUPPORT DETAILS) MC (2) - 22			
FILE: mc-22.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
© TxDOT October 2022	CONT	SECT	JOB
REVISIONS		HIGHWAY	
03-15	DIST	COUNTY	SHEET NO.
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DATE: FILE:

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- ⑦ Total of 4 ~ per assembly. See Stiffener Plate detail.
- ⑧ 1/2" Dia bolt with 1 hardened washer, 1 beveled washer and 1 lock washer
- ⑨ 5/8" Dia prevailing torque lock nut and washer ~ Typ
- ⑩ Raise sign bracket on elbow to match others located on arm.
- ⑪ Bracket extension required only if light fixture or walkway is selected.
- ⑫ See U Rod detail.

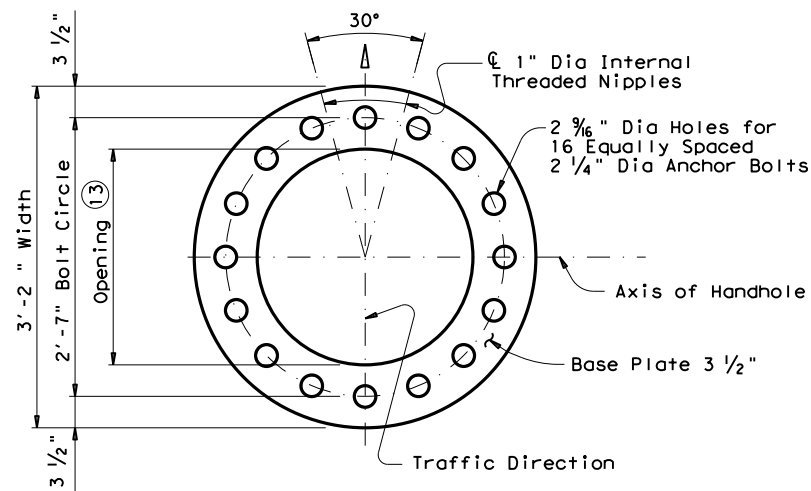
SHEET 3 OF 7

		Traffic Safety Division Standard	
MONOTUBE SIGN STRUCTURE (CANTILEVER) (SIGN SUPPORT DETAILS) MC (3) - 22			
FILE: mc-22.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT
© TxDOT October 2022	CONT	SECT	JOB
REVISIONS			
03-15	DIST	COUNTY	SHEET NO.

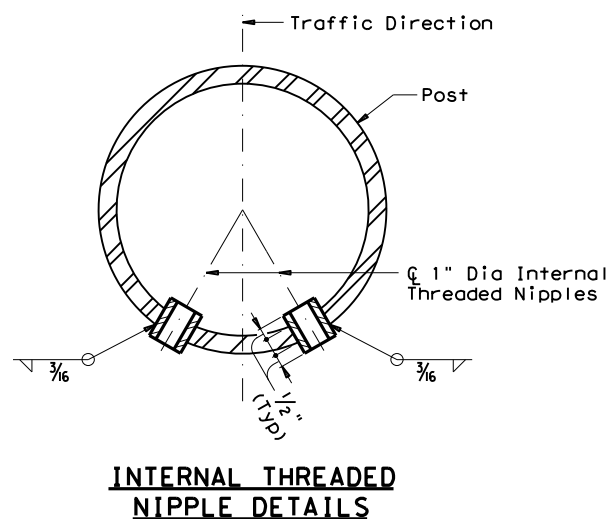
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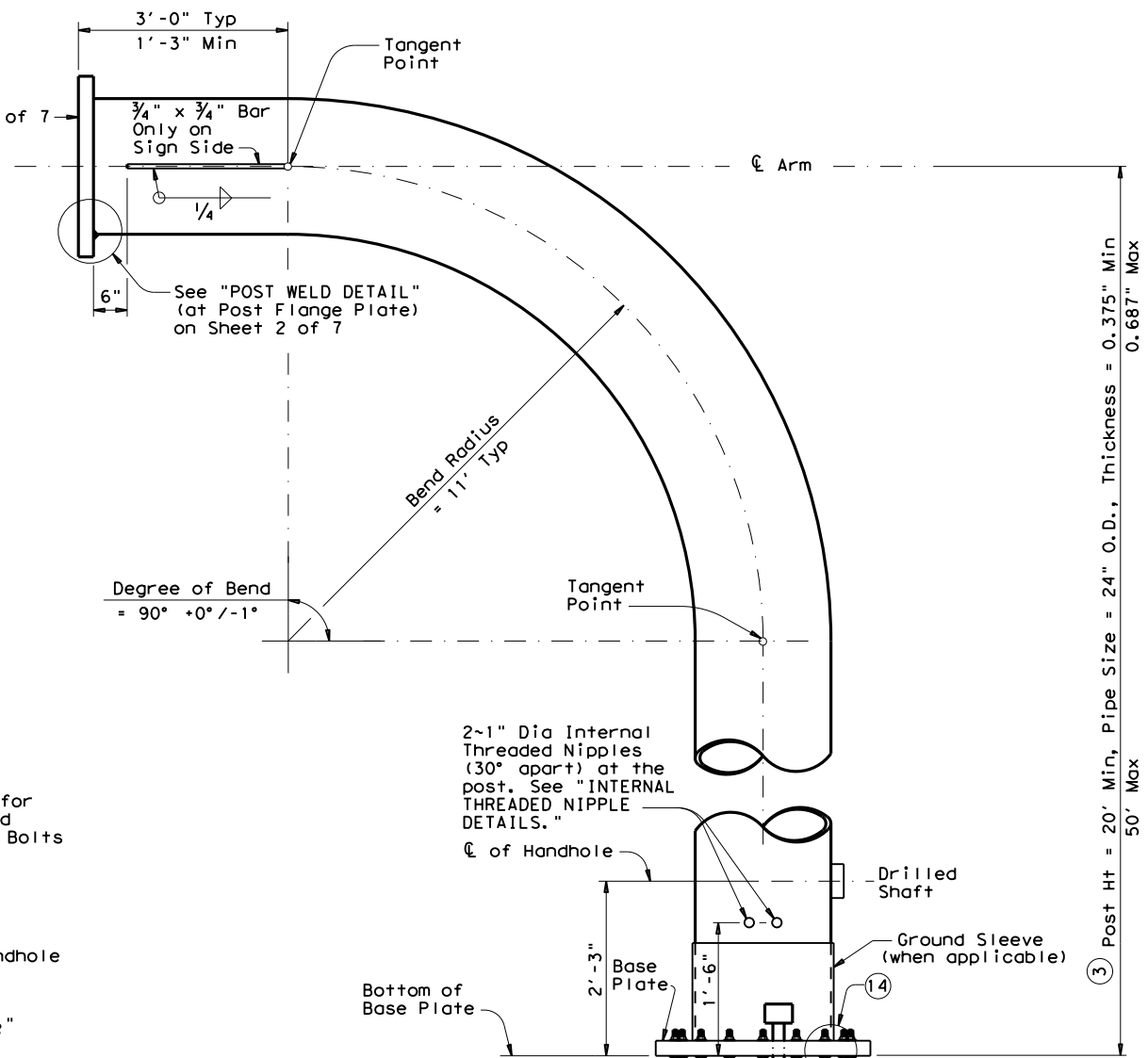
- ③ See Monotube Design Tables on Sheets 5 & 6 of 7 for specific design details such as post height, pipe wall thicknesses, and weld sizes for various span lengths.
- ⑤ 85% Minimum penetration
- ⑥ A welded handhole frame is permissible. Maximum of two (2) splices is allowed. Splice located at either position as indicated is acceptable.
- ⑬ See Sheets 5 & 6 of 7 for the opening dimension in base plate.
- ⑭ See Sheets 5 & 6 of 7 for post to base plate connection details.
- ⑮ See Sheet 7 of 7 for foundation details.



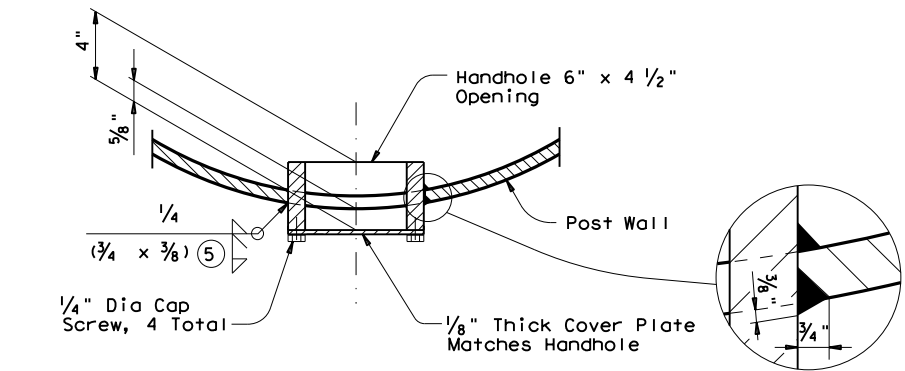
BASE PLATE DETAIL



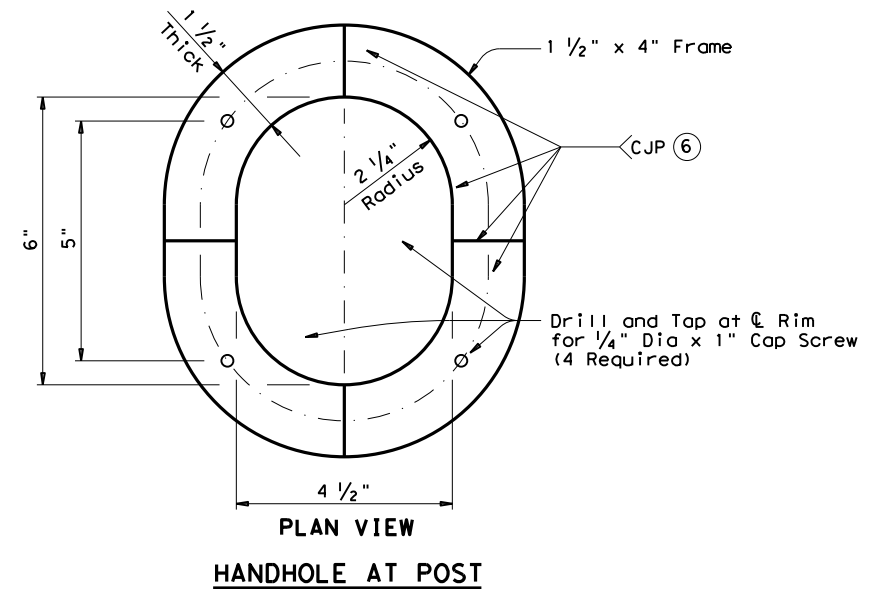
INTERNAL THREADED NIPPLE DETAILS



POST ELEVATION



SECTION



**PLAN VIEW
HANDHOLE AT POST**

SHEET 4 OF 7



**MONOTUBE
SIGN STRUCTURE
(CANTILEVER)
(POST DETAILS)
MC (4) - 22**

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REVISIONS				
03-15	DIST	COUNTY	SHEET NO.	
10-22: Removed 0.968" designs.				

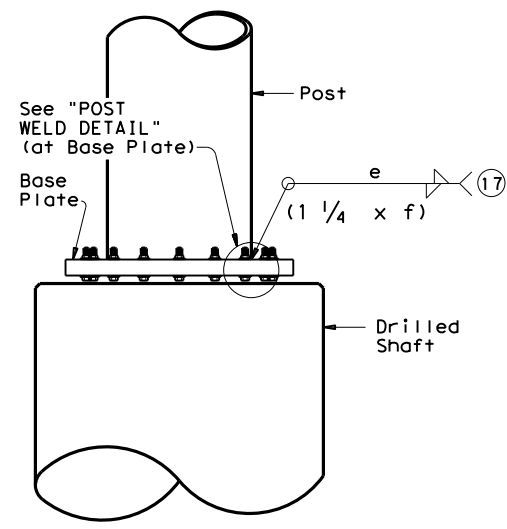
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MONOTUBE DESIGN TABLE 1A (SOCKET CONNECTIONS ONLY)

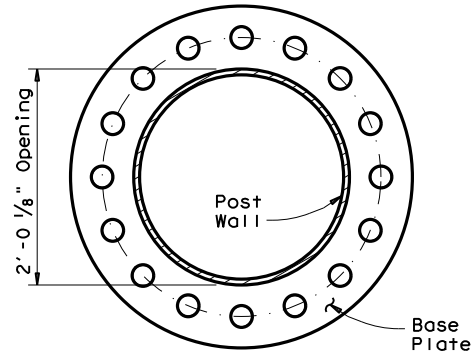
130 MPH WIND SPEED		Pipe to Plate Connections									
Span Length	Post Height	24" Dia Pipe Wall Thck		Socket						Min Required Camber (in) (16)	
		Arm	Post & Elbow	Arm Weld Sizes		Post Weld Sizes (Post Flange Plate)		Post Weld Sizes (Base Plate)			
		a	b	c	d	e	f	X	Y		
20'	20'	0.375"	0.562"	5/16"	5/16"	1/2"	1/2"	1/2"	1/2"	1/4"	3/8"
	25'	0.375"	0.562"	5/16"	5/16"	1/2"	1/2"	1/2"	1/2"	1/4"	1/16"
	30'	0.375"	0.562"	5/16"	5/16"	1/2"	1/2"	1/2"	1/2"	1/4"	1/16"
	40'	0.375"	0.687"	5/16"	5/16"	1/2"	1/2"	1/2"	1/2"	1/4"	1/2"
25'	20' (20)										
	25' (20)										
	30' (20)										
30'	20' (20)										
	25' (20)										
	30' (20)										
35'	20' (20)										

MONOTUBE DESIGN TABLE 1B (SOCKET CONNECTIONS ONLY)

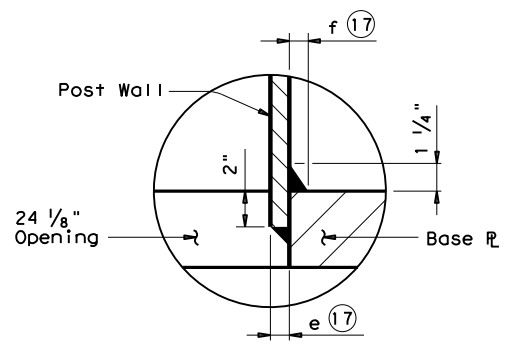
90 MPH WIND SPEED		Pipe to Plate Connections									
Span Length	Post Height	24" Dia Pipe Wall Thck		Socket						Min Required Camber (in) (16)	
		Arm	Post & Elbow	Arm Weld Sizes		Post Weld Sizes (Post Flange Plate)		Post Weld Sizes (Base Plate)			
		a	b	c	d	e	f	X	Y		
20'	20'	0.375"	0.562"	5/16"	5/16"	1/2"	1/2"	1/2"	1/2"	1/4"	3/8"
	25'	0.375"	0.562"	5/16"	5/16"	1/2"	1/2"	1/2"	1/2"	1/4"	3/8"
	30'	0.375"	0.562"	5/16"	5/16"	1/2"	1/2"	1/2"	1/2"	1/4"	3/8"
	40'	0.375"	0.687"	5/16"	5/16"	1/2"	1/2"	1/2"	1/2"	1/4"	1/2"
25'	20' (20)										
	25' (20)										
	30' (20)										
30'	20' (20)										
	25' (20)										
	30' (20)										
35'	20' (20)										
	25' (20)										
	30' (20)										
40'	20' (20)										
	25' (20)										
	30' (20)										



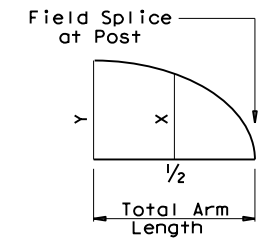
POST ELEVATION



BASE PLATE DETAIL (18)
(Socket Type Connection)



POST WELD DETAIL
(at Base Plate)
(Socket Type Connection)



DEAD LOAD CAMBER DIAGRAM
Note: X and Y values shown in table are minimum required.

- (16) See Dead Load Camber Diagram.
- (17) See Monotube Design Tables 1A & 1B (Socket Connections Only) for weld sizes of the various spans and post heights.
- (18) Showing Base Plate opening dimension only. See Sheet 4 of 7 for all other base plate details.
- (19) An extra optional splice in the straight portion of the post is permissible. Splice the post at mid height creating two equal pieces spliced together.
- (20) See Monotube Design Tables 2A & 2B (Socket/Ground Sleeve Connections) on Sheet 6 of 7 for design details.

<p>MONOTUBE SIGN STRUCTURE (CANTILEVER) (SOCKET/SOCKET CONNECTION DESIGN DETAILS) MC (5) - 22</p>			
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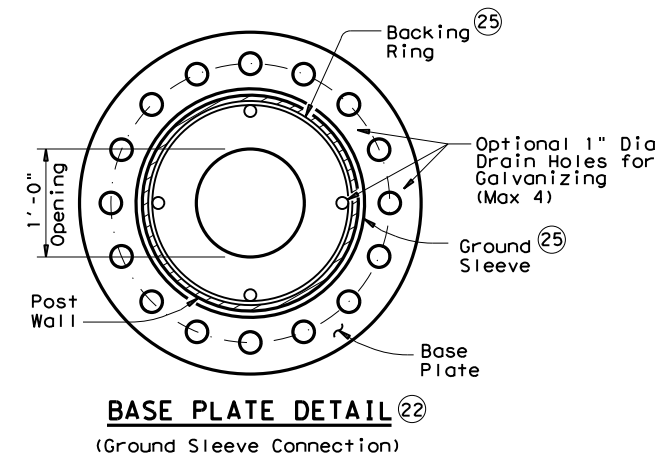
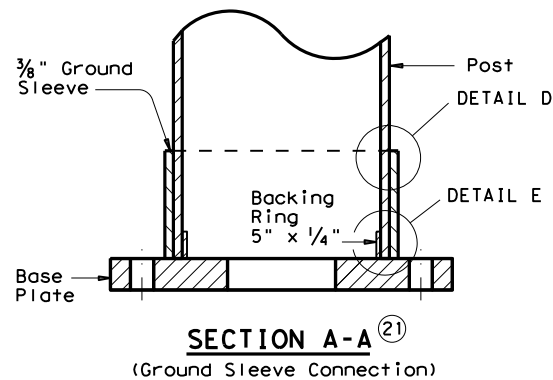
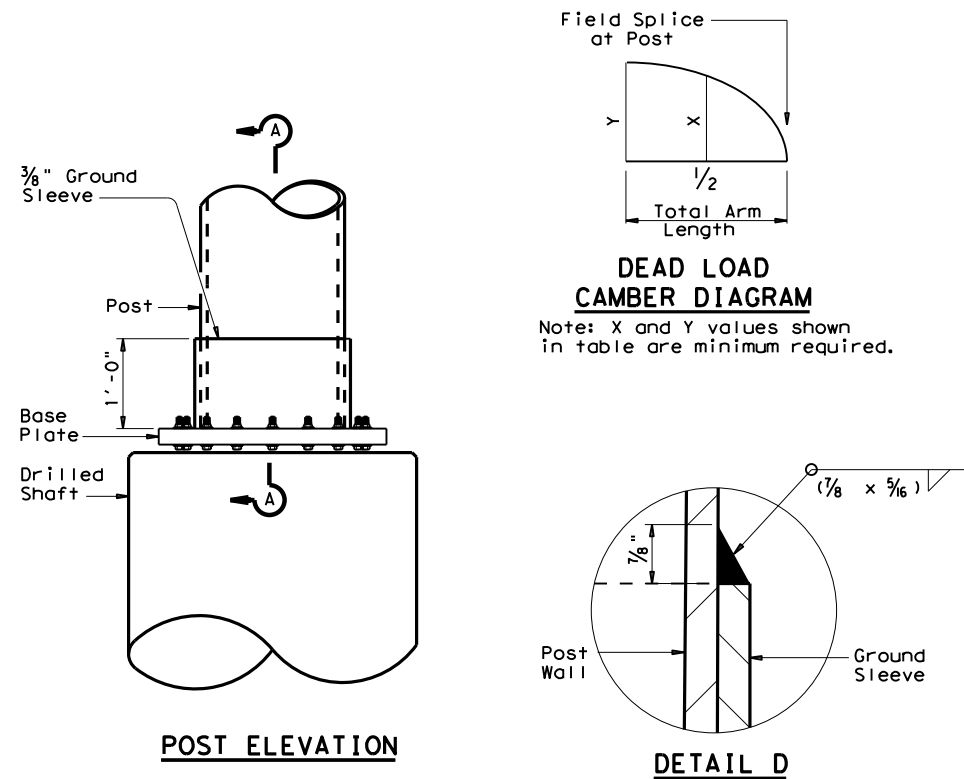
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MONOTUBE DESIGN TABLE 2A (SOCKET/GROUND SLEEVE CONN.)

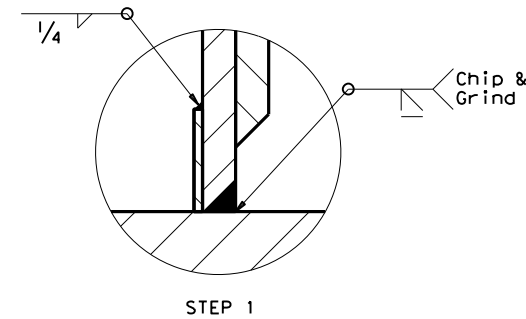
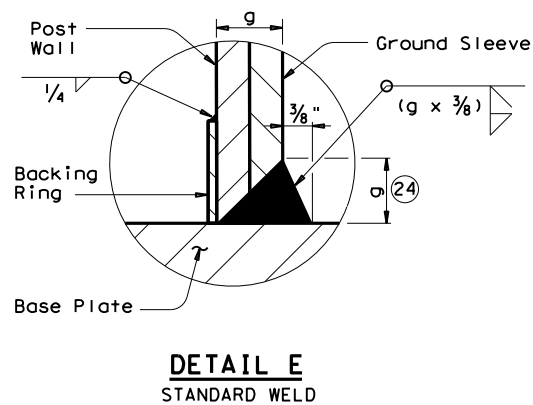
130 MPH WIND SPEED		Pipe to Plate Connections								
Span Length	Post Height	24" Dia Pipe Wall Thck		Socket				Ground Sleeve	Min Required Camber (in) (16)	
		Arm	Post & Elbow	Arm Weld Sizes		Post Weld Sizes (Post Flange Plate)		g	X	Y
				a	b	c	d			
20'	20'	0.375"	0.500"	5/16"	5/16"	7/16"	7/16"	7/8"	3/8"	5/16"
	25'	0.375"	0.500"	5/16"	5/16"	7/16"	7/16"	7/8"	1/4"	3/8"
	30'	(23)								
25'	20'	0.375"	0.687"	5/16"	5/16"	1/2"	1/2"	1 1/16"	3/8"	5/8"
	25'	(26)								
	30'	(26)								
30'	25'	(26)								
	30'	(26)								
35'	20'	(26)								

MONOTUBE DESIGN TABLE 2B (SOCKET/GROUND SLEEVE CONN.)

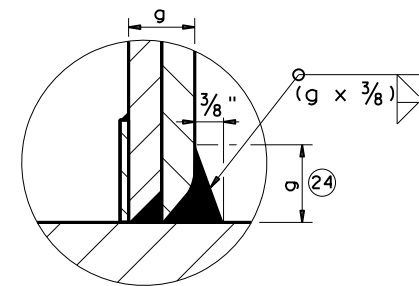
90 MPH WIND SPEED		Pipe to Plate Connections								
Span Length	Post Height	24" Dia Pipe Wall Thck		Socket				Ground Sleeve	Min Required Camber (in) (16)	
		Arm	Post & Elbow	Arm Weld Sizes		Post Weld Sizes (Post Flange Plate)		g	X	Y
				a	b	c	d			
20'	20'	0.375"	0.375"	5/16"	5/16"	5/16"	5/16"	3/4"	1/4"	3/8"
	25'	0.375"	0.375"	5/16"	5/16"	5/16"	5/16"	3/4"	1/4"	7/16"
	30'	0.375"	0.375"	5/16"	5/16"	5/16"	5/16"	3/4"	5/16"	1/2"
	40'	0.375"	0.500"	5/16"	5/16"	7/16"	7/16"	7/8"	5/16"	1/2"
	50'	0.375"	0.500"	5/16"	5/16"	7/16"	7/16"	7/8"	3/8"	5/8"
25'	20'	0.375"	0.375"	5/16"	5/16"	5/16"	5/16"	3/4"	1/2"	7/8"
	25'	0.375"	0.375"	5/16"	5/16"	5/16"	5/16"	3/4"	5/16"	1
	30'	0.375"	0.500"	5/16"	5/16"	7/16"	7/16"	7/8"	5/16"	1
	40'	0.375"	0.562"	5/16"	5/16"	1/2"	1/2"	15/16"	5/8"	1 1/8"
	50'	0.375"	0.687"	5/16"	5/16"	1/2"	1/2"	1 1/16"	5/8"	1 3/16"
30'	20'	0.500"	0.500"	7/16"	7/16"	7/16"	7/16"	7/8"	1/2"	1 1/2"
	25'	0.500"	0.500"	7/16"	7/16"	7/16"	7/16"	7/8"	15/16"	1 13/16"
	30'	0.500"	0.500"	7/16"	7/16"	7/16"	7/16"	7/8"	1 1/16"	2 1/16"
	40'	0.500"	0.687"	7/16"	7/16"	1/2"	1/2"	1 1/16"	1 1/16"	2 1/16"
	50'	(26)								
35'	20'	0.687"	0.687"	1/2"	1/2"	1/2"	1/2"	1 1/16"	1 1/4"	2 7/16"
	25'	0.687"	0.687"	1/2"	1/2"	1/2"	1/2"	1 1/16"	1 1/2"	2 13/16"
	30'	0.687"	0.687"	1/2"	1/2"	1/2"	1/2"	1 1/16"	1 1/16"	3 1/4"
	40'	(26)								
	50'	(26)								
40'	20'	(26)								
	25'	(26)								
	30'	(26)								
	40'	(26)								



- (16) See Dead Load Camber Diagram.
- (19) An extra optional splice in the straight portion of the post is permissible. Splice the post at mid height creating two equal pieces spliced together.
- (21) Optional 4 - 1" dia vent holes placed in pipe and backing ring to release pressure during galvanizing is permissible. Stagger holes vertically in pipe to ensure all 4 holes are not in one cross-section.
- (22) Showing Base Plate opening dimension and drain hole details. See Sheet 4 of 7 for all other base plate details.
- (23) See Monotube Design Tables 1A & 1B (Socket Connections Only) on Sheet 5 of 7 for design details.
- (24) See Monotube Design Tables 2A & 2B for value of "g".
- (25) Maximum of 2 splices allowed at backing ring and ground sleeve with 100% longitudinal seam weld
- (26) Due to lack of material availability, standard designs are no longer provided for these heights and span combinations.



- (a) Weld backing ring to post.
- (b) Prepare post and ground sleeve.
- (c) Weld post to base plate, chip and grind flush (1/8" max radius.)



- (d) Position ground sleeve.
- (e) Weld to base plate with tapered reinforcement.

DETAIL E
OPTIONAL WELD

Texas Department of Transportation
Traffic Safety Division Standard

MONOTUBE SIGN STRUCTURE (CANTILEVER) (SOCKET/GROUND SLEEVE CONNECTION DESIGN DETAILS) MC (6) - 22

FILE: mc-22.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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03-15	DIST	COUNTY	SHEET NO.	
10-22: Removed 0.968" designs.				

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DATE: FILE:

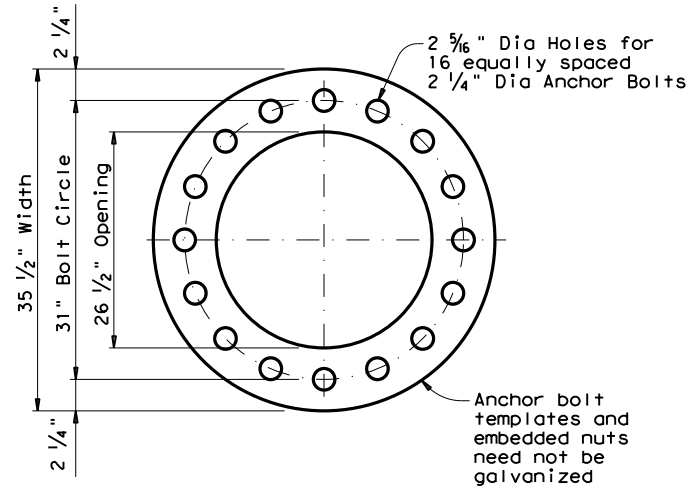
TOP OF DRILLED SHAFT DESIGN LOADS					
90 MPH WIND SPEED					
Span Length	Post Height	Axial (kips)	Moment (k-ft)	Torsion (k-ft)	Shear (kips)
20'	20'	9	138	77	6
	25'	9	166	77	6
	30'	10	195	77	7
	40'	13	256	77	7
	50'	19	321	77	7
25'	20'	13	189	121	8
	25'	14	225	121	8
	30'	15	262	121	8
	40'	18	340	121	9
	50'	16	418	121	8
30'	20'	11	234	167	9
	25'	12	277	167	9
	30'	12	320	167	9
	40'	16	413	167	10
	50'	(26)			
35'	20'	15	305	223	11
	25'	16	352	223	11
	30'	17	401	223	11
	40'	(26)			
	50'	(26)			
40'	20'	(26)			
	25'	(26)			
	30'	(26)			
	40'	(26)			
	50'	(26)			

DRILLED SHAFT EMBEDMENT LENGTHS					
90 MPH WIND SPEED					
Span Length	Post Height	TCP 10 bl/ft (ft)	TCP 20 bl/ft (ft)	TCP 30 bl/ft (ft)	TCP 40 bl/ft (ft)
20'	20'	35	31	29	27
	25'	36	31	29	27
	30'	37	31	29	27
	40'	38	31	29	27
	50'	40	31	29	27
25'	20'	37	31	29	27
	25'	38	31	29	27
	30'	39	31	29	27
	40'	41	31	29	27
	50'	42	31	29	27
30'	20'	38	31	29	27
	25'	39	31	29	27
	30'	40	31	29	27
	40'	42	31	29	27
	50'	(26)			
35'	20'	41	31	29	27
	25'	41	31	29	27
	30'	42	31	29	27
	40'	(26)			
	50'	(26)			
40'	20'	(26)			
	25'	(26)			
	30'	(26)			
	40'	(26)			
	50'	(26)			

TOP OF DRILLED SHAFT DESIGN LOADS					
130 MPH WIND SPEED					
Span Length	Post Height	Axial (kips)	Moment (k-ft)	Torsion (k-ft)	Shear (kips)
20'	20'	8	257	162	12
	25'	8	317	162	12
	30'	9	294	121	10
	40'	11	395	121	11
25'	20'	10	344	253	16
30'	25'	(26)			
	30'	(26)			
	40'	(26)			
35'	20'	(26)			
	25'	(26)			

DRILLED SHAFT EMBEDMENT LENGTHS					
130 MPH WIND SPEED					
Span Length	Post Height	TCP 10 bl/ft (ft)	TCP 20 bl/ft (ft)	TCP 30 bl/ft (ft)	TCP 40 bl/ft (ft)
20'	20'	41	32	30	28
	25'	42	32	30	28
	30'	41	32	30	28
	40'	43	32	30	28
25'	20'	46	32	30	28
30'	25'	(26)			
	30'	(26)			
	40'	(26)			
35'	20'	(26)			
	25'	(26)			

- (26) Due to lack of material availability, standard designs are no longer provided for these heights and span combinations.
- (27) When the elevation is more than 3'-3" above finished grade, a special foundation design is required.



TOP AND BOTTOM TEMPLATE

FOUNDATION NOTES:

After the structure has been aligned in its final position and anchor bolts have been tightened, tack weld anchor bolt nuts to washer in two (2) places and tack weld washers to base plate in two (2) places. Repair galvanizing damage in accordance with Item 445, "Galvanizing".

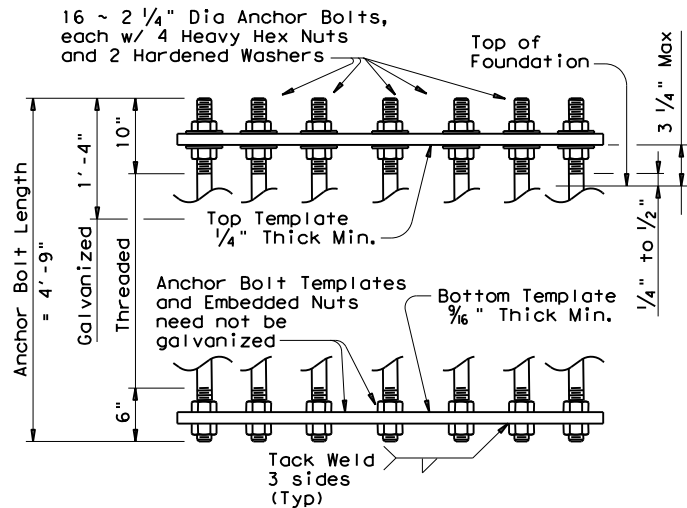
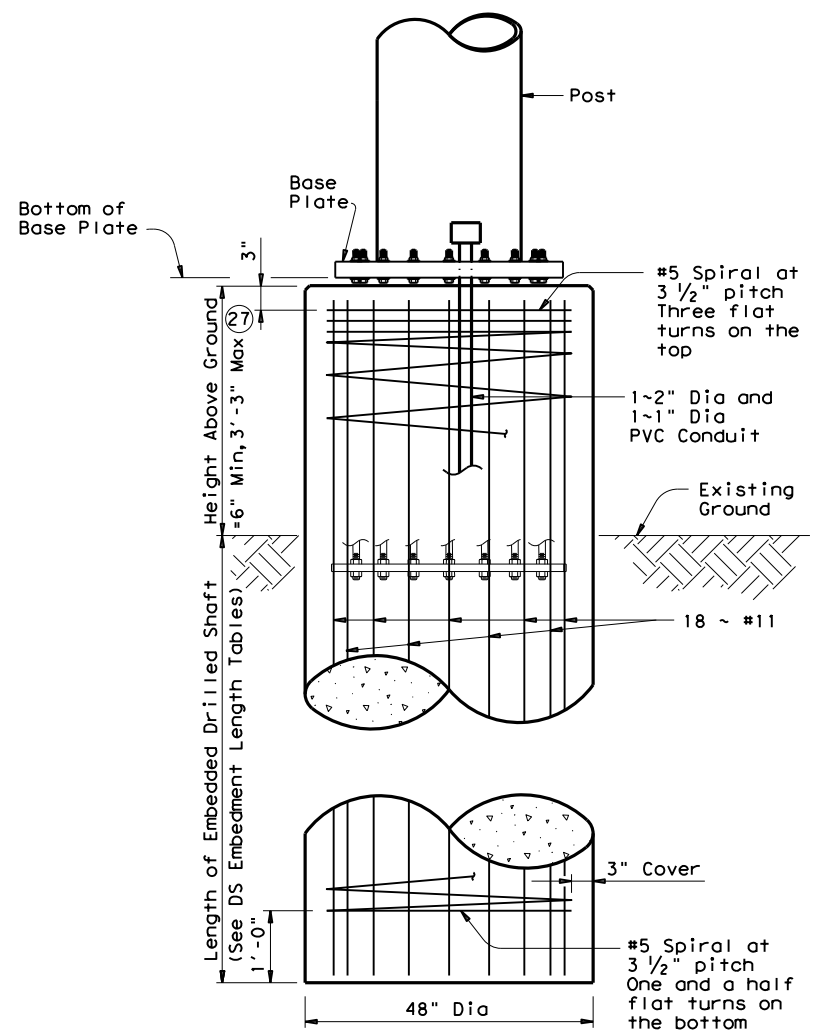
Determine foundation embedment length based on the blow counts in the upper 20 ft of soil.

Terminate shafts encountering rock with a minimum rock penetration of 13 ft, while maintaining a minimum shaft embedment length of 25 ft.

For Texas Cone Penetrometer (TCP) blow count data that falls between two of the listed values in the tables, it is permissible to use linear interpolation between the two nearest blow count values to determine foundation embedment length.

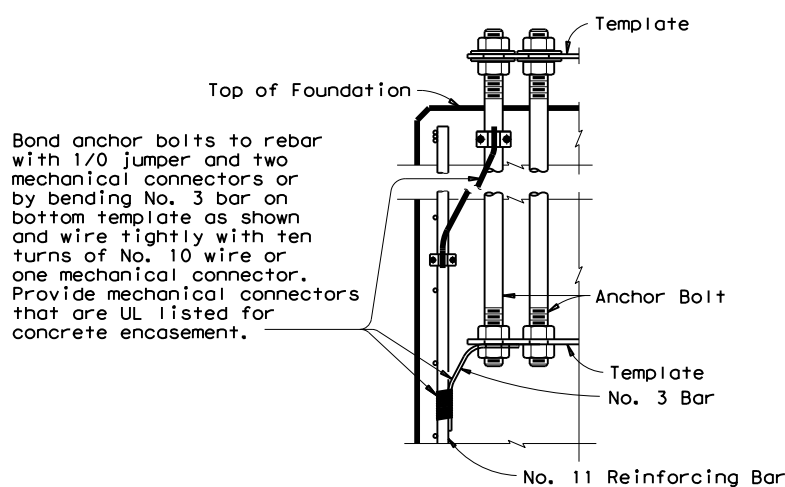
SHEET 7 OF 7

<p>MONOTUBE SIGN STRUCTURE (CANTILEVER) (FOUNDATION DETAILS) MC (7) - 22</p>			
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REVISIONS			
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ANCHOR BOLT ASSEMBLY

Some bolts not shown for clarity



LIGHTNING PROTECTION SYSTEM

Bond anchor bolts to rebar with 1/0 jumper and two mechanical connectors or by bending No. 3 bar on bottom template as shown and wire tightly with ten turns of No. 10 wire or one mechanical connector. Provide mechanical connectors that are UL listed for concrete encasement.