



Florida Department of Transportation

**RICK SCOTT
GOVERNOR**

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**ANANTH PRASAD, P.E.
SECRETARY**

December 10, 2014

DCE MEMORANDUM NO. 25-14
(FHWA Approved: 12/10/2014)

This Memo Has Expired

TO: DISTRICT CONSTRUCTION ENGINEERS

FROM: David A. Sadler, P.E., Director, Office of Construction 

COPIES: Tom Byron, Rudy Powell, Bob Burleson, Nick Finch, Chad Thompson, Rafiq Darji

SUBJECT: STRUCTURAL GROUT PADS – MAST ARMS AND CANTILEVER SIGN STRUCTURES

Currently, mast arm structures and cantilever overhead sign structures have a vermin screen installed between the drilled shaft and the base plate. Effective with January 2015 lettings, these structures will have a structural grout pad installed between the drilled shaft and the base plate.

Specification Subarticles 649-5, 649-7, and 700-2.2.3 and Design Standards Indexes 11310 - Cantilever Sign Structure and 17745 - Mast Arm Assemblies have been modified to depict construction of the structural grout pad for affected structures.

Existing construction contracts which include the construction of cantilever overhead sign structures or mast arm structures shall incorporate the 2015 Design Standards Indexes 11310 and 17745 (attached) and Specification Subarticles 649-5, 649-7 and 700-2.2.3 (attached) from the 2015 Standard Specifications for Road and Bridge Construction. For installations where the vermin screen has already been installed, remove the vermin screen and install the structural grout pad. However, if installation of the structural grout pad will cause a delay in the Final Acceptance of the contract do not install the structural grout pad.

This memorandum serves as blanket approval to process a contract change to incorporate the attached documents into contracts let prior to January 2015. Attach a copy of this memorandum with attached documents to the Work Order or Supplemental Agreement. This memorandum will expire July 1, 2015.

If you have any questions, please call Dan Hurtado at 850-414-4155.

DAS/dh
Attachments

649-5 Installation.

Install foundations in accordance with Section 455. Do not install poles, mast arm poles, or monotubes until the foundation has achieved 70% of the specified 28-day concrete strength and verifying test results have been provided to the Engineer. Determine concrete strength from tests on a minimum of two test cylinders prepared and tested in accordance with ASTM C31 and ASTM C39. Before erecting the pole, clean the top of the foundation of any laitance, oils, grease or any other deleterious materials. Erect strain poles in an orientation which considering the rake and the application, cable forces will produce a plumb pole. Erect monotubes plumb at the time of installation. Plumb the pole supporting mast arms after the mast arms, traffic signals or sign panels have been placed.

If the traffic signals and/or sign panels are not in place within two working days after the mast arm is erected, furnish and install a 3 foot x 2 foot blank sign panel on the bottom of each mast arm within 6 feet of the mast arm tip and plumb the pole. Re-plumb the pole supporting mast arms after installation of traffic signals and sign panels.

Install ASTM A325 bolt, nut and washer assemblies in accordance with the following. Use bolt, nut and washer assemblies that are free of rust and corrosion and are lubricated properly as demonstrated by being able to easily hand turn the nut on the bolt thread for its entire length. Tighten nuts to a snug tight condition to bring the faying surfaces of the assembly into full contact which is referred to as snug-tight. Snug-tight is defined as the maximum nut rotation resulting from the full effort of one person using a 12 inch long wrench or equivalent. After bringing the faying surfaces to a snug-tight condition, tighten nuts in accordance with Table 460-7, Nut Rotation from the Snug Tight Condition. Maintain uniform contact pressure on the faying surfaces during snugging and turn-of-nut process, by using a bolt tightening pattern that balances the clamping force of each bolt, as closely as possible, with the equal clamping force of a companion bolt.

Base plate installation steps are as follows:

- 1) Verify that the nuts can be turned onto the bolts past the elevation corresponding to the bottom of each in-place leveling nut and be backed off by the effort of one person on a 12 inch long wrench, without employing a pipe extension on the wrench handle.
- 2) Clean and lubricate the exposed threads of all anchor bolts. Clean and lubricate the threads and bearing surfaces of all leveling nuts. Re-lubricate the exposed threads of the anchor bolts and the threads of the leveling nuts if more than 24 hours has elapsed since earlier lubrication, or if the anchor bolts and leveling nuts have become wet since they were first lubricated.
- 3) Turn the leveling nuts onto the anchor bolts and align the nuts to the same elevation.
- 4) Place structural plate washers on top of the leveling nuts; one washer corresponding to each anchor bolt.
- 5) Install the base plate onto the leveling nut washers, place structural plate washers on top of the base plate; one washer corresponding to each anchor bolt, and turn the top nuts onto the anchor bolts.
- 6) Tighten top nuts to a snug-tight condition in a star pattern. A star tightening pattern is one in which the nuts on opposite or near opposite sides of the bolt circle are successively tightened in a pattern resembling a star. For an 8 bolt circle with bolts sequentially numbered 1 to 8, tighten nuts in the following bolt order: (1, 5, 7, 3, 8, 4, 6, 2).

7) Tighten leveling nuts to a snug-tight condition in a star pattern. The distance from the bottom of the leveling nuts to the top of the concrete must not exceed one anchor bolt diameter.

8) Before final tightening of the top nuts, mark the reference position of each top nut in a snug-tight condition with a suitable marking on one flat with a corresponding reference mark on the base plate at each bolt. Then incrementally turn the top nuts using a star pattern until achieving the required nut rotation specified in Table A. Turn the nuts at least 2 full tightening cycles (passes). After tightening, verify the nut rotation. Do not exceed the Table A value by more than 20 degrees.

9) Tighten each retainer or jam nut until it is in firm contact with the top surface of the anchor bolt nut; then while preventing the anchor bolt nut from rotating, tighten the jam nut until it is snug tight.

10) Install a screen over the gap between the base plate and foundation concrete in accordance with 649-6, or place a structural grout pad in accordance with 649-7.

Anchor Bolt Diameter (inches)	Nut Rotation from Snug-Tight Condition
$\leq 1-1/2$	1/3 turn
$> 1-1/2$	1/6 turn

649-7 Structural Grout Pads.

On mast arm support structures, install a structural grout pad in accordance with the Design Standards and manufacturer's instructions. Prior to grout placement, flush the top of the foundation with water to remove any dirt and debris.

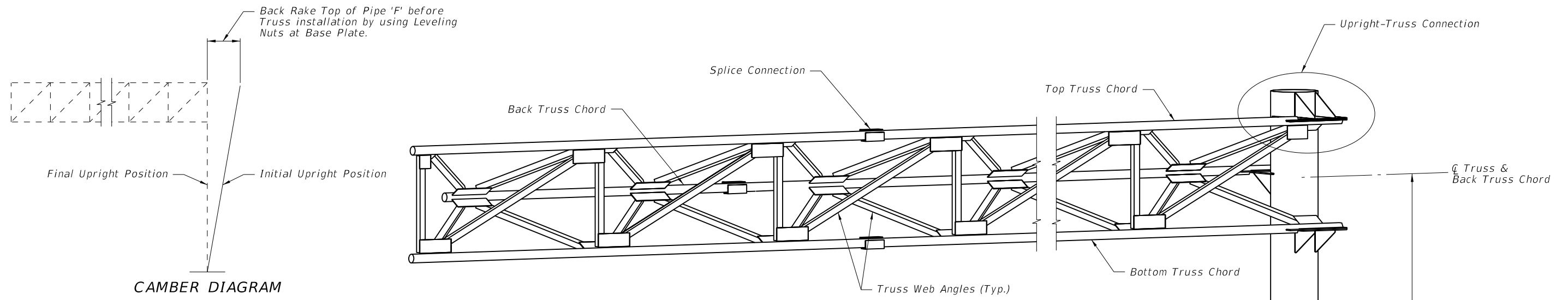
Mix grout to a fluid state with an efflux time of 20 to 30 seconds. Test the grout fluidity using ASTM C939 Flow Cone Method. Discard any grout with an unacceptable efflux time.

Do not use mechanical means to push or vibrate the grout. Clean any excess grout from the base plate. Verify that water inside the pole will drain freely through the installed drain hole.

700-2.2.3 Installation: Install nuts on anchor bolts in accordance with Section 649 with the following exception. For cantilever overhead sign structures, after placement of the upright and prior to installation of the truss, adjust the leveling nuts beneath the base plate to achieve the back rake shown on the Camber Diagram. If the top surface of the base plate has a slope that exceeds 1:40, use beveled washers under the top nuts. For span overhead sign structures, install a screen around the base plate in accordance with 649-6. For cantilever overhead sign structures, install a structural grout pad in accordance with 649-7.

Use ASTM A325 bolt, nut and washer assemblies for all installations other than anchor bolts as follows. Use bolt, nut and washer assemblies that are free of rust and corrosion and are lubricated properly as demonstrated by being able to easily hand turn the nut on the bolt thread for its entire length. Tighten nuts to a snug-tight condition to bring the faying surfaces of the assembly into full contact which is referred to as snug-tight. Snug-tight is defined as the maximum nut rotation resulting from the full effort of one person using a 12 inch long wrench or equivalent. After bringing the faying surfaces of the assembly into full contact and to a snug-tight condition, tighten nuts to achieve the minimum torque as specified in Table 700-1 unless the connection is an alternate splice connection of a span sign structure, in which case, tighten nuts in accordance with Table 460-7, Nut Rotation from the Snug Tight Condition. Maintain uniform contact pressure on the faying surfaces during snugging and the subsequent final tightening process by using a bolt tightening pattern that balances the clamping force of each bolt, as closely as possible, with the equal clamping force of a companion bolt. Within 24 hours after final tightening, the Engineer will witness a check of the minimum torque using a calibrated torque wrench for three bolts or a minimum of 10% of the bolts, whichever is greater, for each connection. However, do not perform this check on alternate splice connections of span sign structures.

Bolt Diameter (inches)	Minimum Torque (ft.-lbs.)
3/8	15
1/2	37
5/8	74
3/4	120
7/8	190
1	275
1-1/8	375
1-1/4	525



CANTILEVER SIGN STRUCTURE NOTES

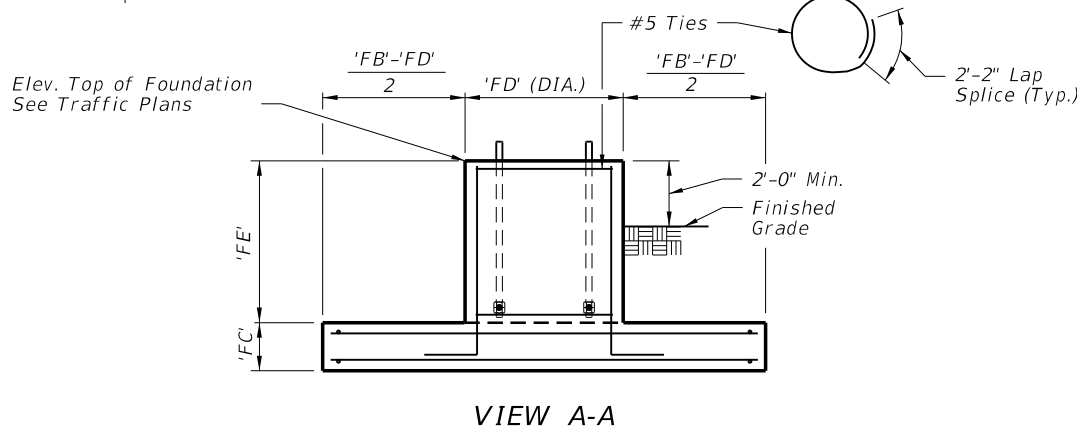
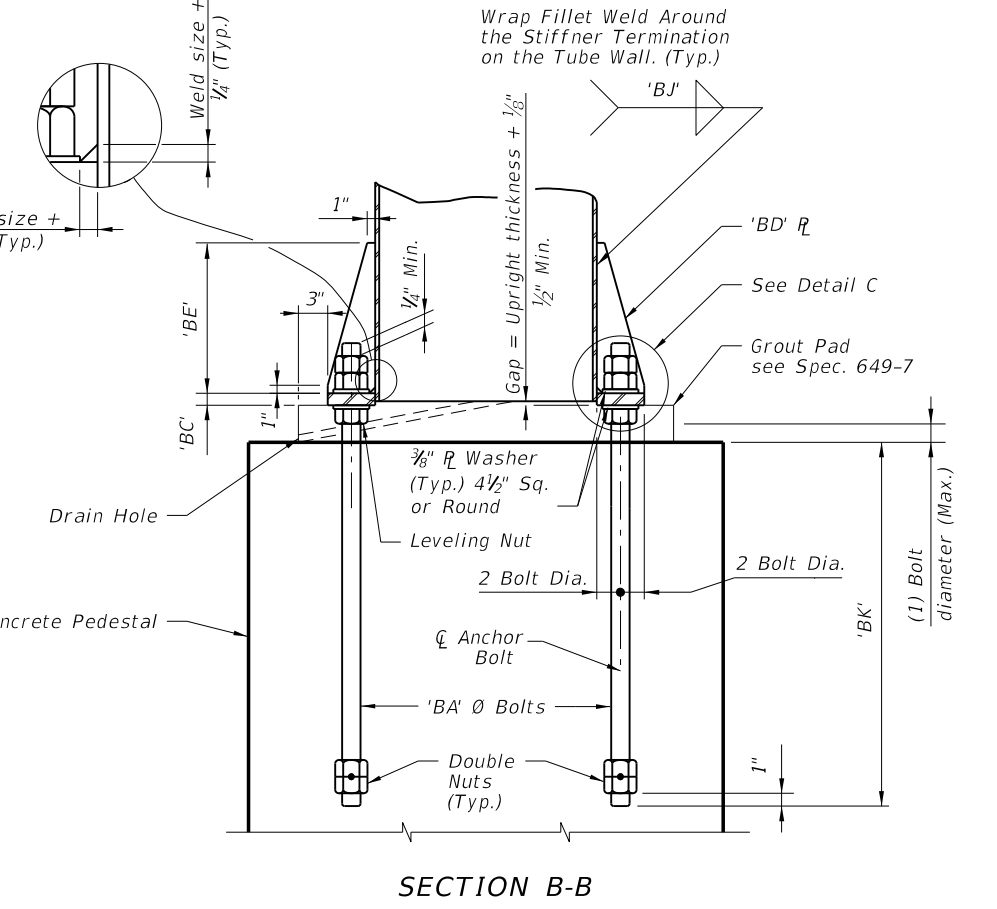
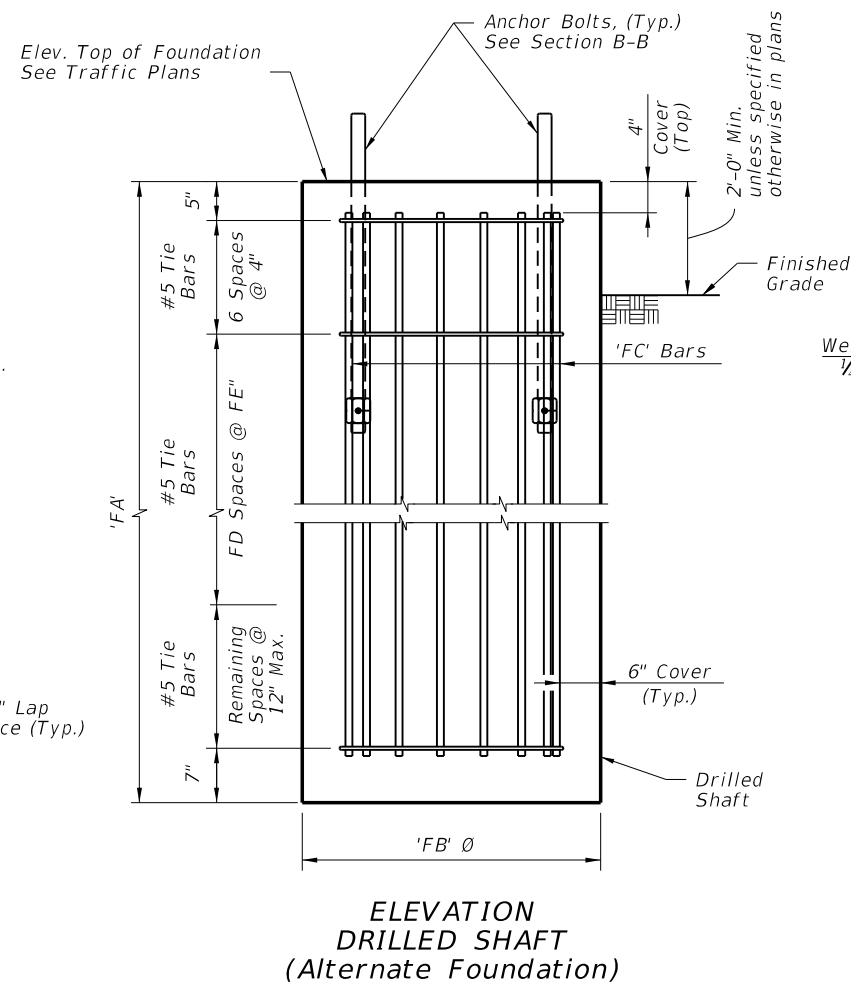
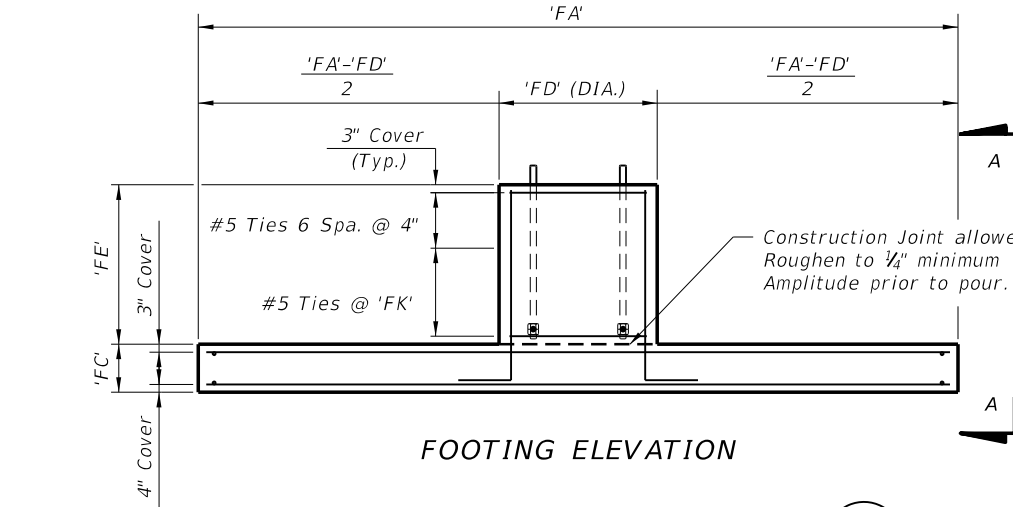
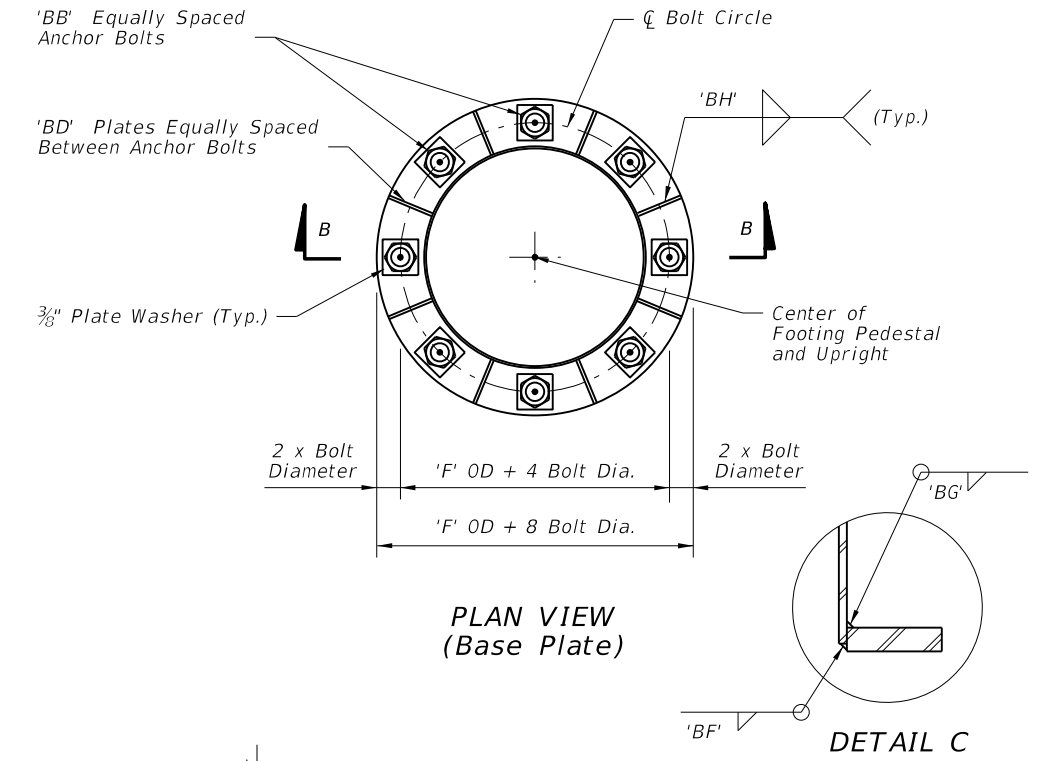
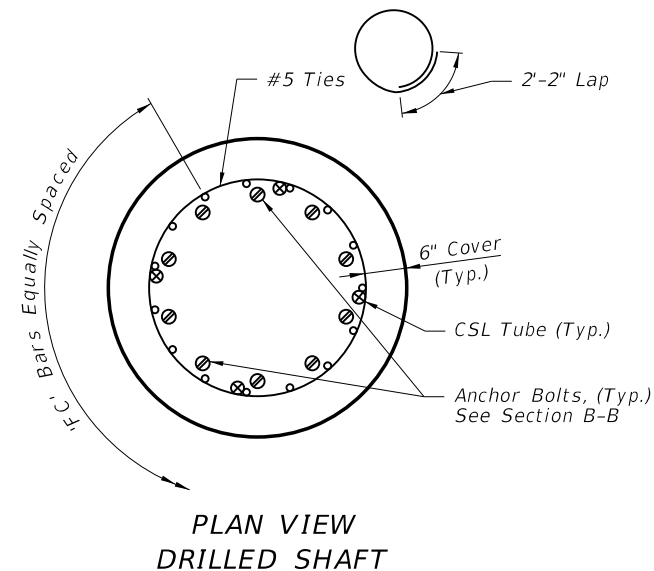
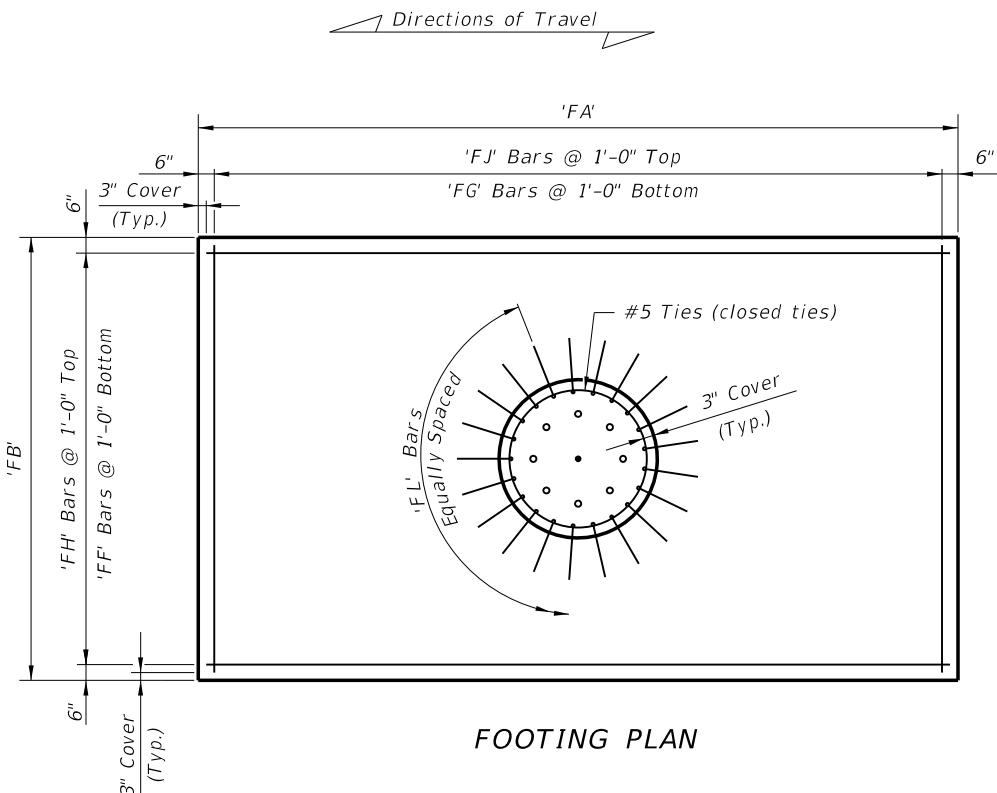
1. Design according to FDOT Structures Manual. Alternate Designs are not allowed.
2. Submit shop drawings for all work. Include:
 - a. Field verification of all upright heights.
 - b. Foundation elevations necessary to insure minimum vertical clearances as per traffic plans.
 - c. Anchor bolt orientation with respect to centerline of truss and the direction of traffic.
 - d. Show chord splices a minimum distance of 2 truss panel lengths apart. "SD" Panel from upright is the closest panel in which a chord splice may be used. See plans for Cantilever Sign Structure Data Table. Upright splices are not allowed.
3. Shop Fabrication, Assembly, Handling and Shipping:
 - a. Do not begin fabrication before receiving shop drawing approval.
 - b. Welding: Conform to American Welding Society Structural Welding Code (Steel) ANSI/AWS D1. 1 (current edition).
 - c. Shop assemble the entire structure after galvanizing and prior to shipment.
 - d. If necessary, disassemble and secure components for shipment.
4. Sign Structure Materials:
 - a. Upright and Chords (Steel Pipe): API -5L-X42, 42 ksi yield or ASTM A500, Grade B (min.).
 - b. Steel Angles: ASTM A 709, Grade 36.
 - c. Steel Plates: ASTM A 709, Grade 36.
 - d. Weld Metal: E70XX.
 - e. Bolts: ASTM A325 Type 1, (install per Specification Section 700) with single, self-locking nuts.
 - f. Anchor Bolts: ASTM F1554, Grade 55 with ASTM A563 Grade A heavy-hex double nuts.
 - g. Install all nuts per manufacturer's instructions.
 - h. Bolt hole diameters: equal to the bolt diameter plus 1/16".
 - i. Anchor bolt hole diameters: equal to the bolt diameter plus 1/2".
 - j. Use of split lock washers is not permitted.
5. Galvanization; Nuts, bolts and washers: ASTM F2329. Other steel items: ASTM A123
6. Sign Panels: Aluminum. See Elevation drawing for sizes and locations.
7. Foundation Materials:
 - a. Reinforcing Steel: ASTM A615, Grade 60.
 - b. Concrete: Class IV, minimum 5.5 ksi compressive strength at 28-days for all environmental classifications for Spread Footing.
Class IV (Drilled Shaft), minimum 4.0 ksi compressive strength at 28-days for all environmental classifications for Drilled Shaft.
8. Construct the Sign Structure foundation in accordance with FDOT Specification Section 455.
9. Prior to erection, record the as-built anchor locations and provide to the Engineer.
10. After placement of the upright and prior to installation of the truss, adjust the leveling nuts beneath the base plate to achieve the back rake shown on the Camber Diagram.
11. Place backfill above the footing prior to installation of the sign panels. Do not remove or reduce in height without prior approval of the Engineer.
12. Install sign panels as shown on the Elevation drawing.
13. Verify CSL access tubes will not interfere with anchor bolt installation before excavating the shaft. When CSL access tube locations conflict with anchor bolt locations, move the CSL access tube location ± two inches along the inner circumference of the reinforcing cage. Notify the Engineer before excavating the shaft if the CSL access tube locations cannot be moved out of conflict with anchor bolt locations.
14. Handhole at pole base is required for DMS Structures. See Index 18300 for details.

ISOMETRIC VIEW
 * NOTE: Contractor shall verify these Dimensions prior to Fabrication of Upright.

NOTE: See Plans for Cantilever Sign Structure Data Table.

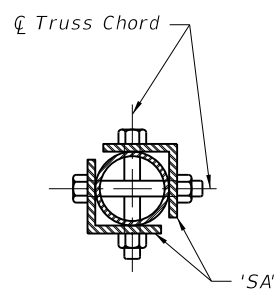
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LAST REVISION 07/01/14	REVISION	DESCRIPTION:	 2015 DESIGN STANDARDS	CANTILEVER SIGN STRUCTURE	INDEX NO. 11310	SHEET NO. 1 of 5
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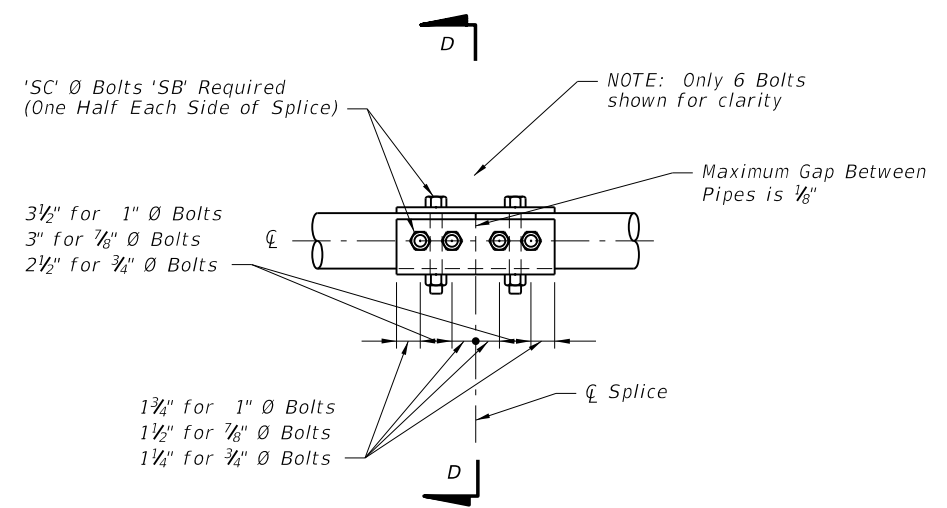


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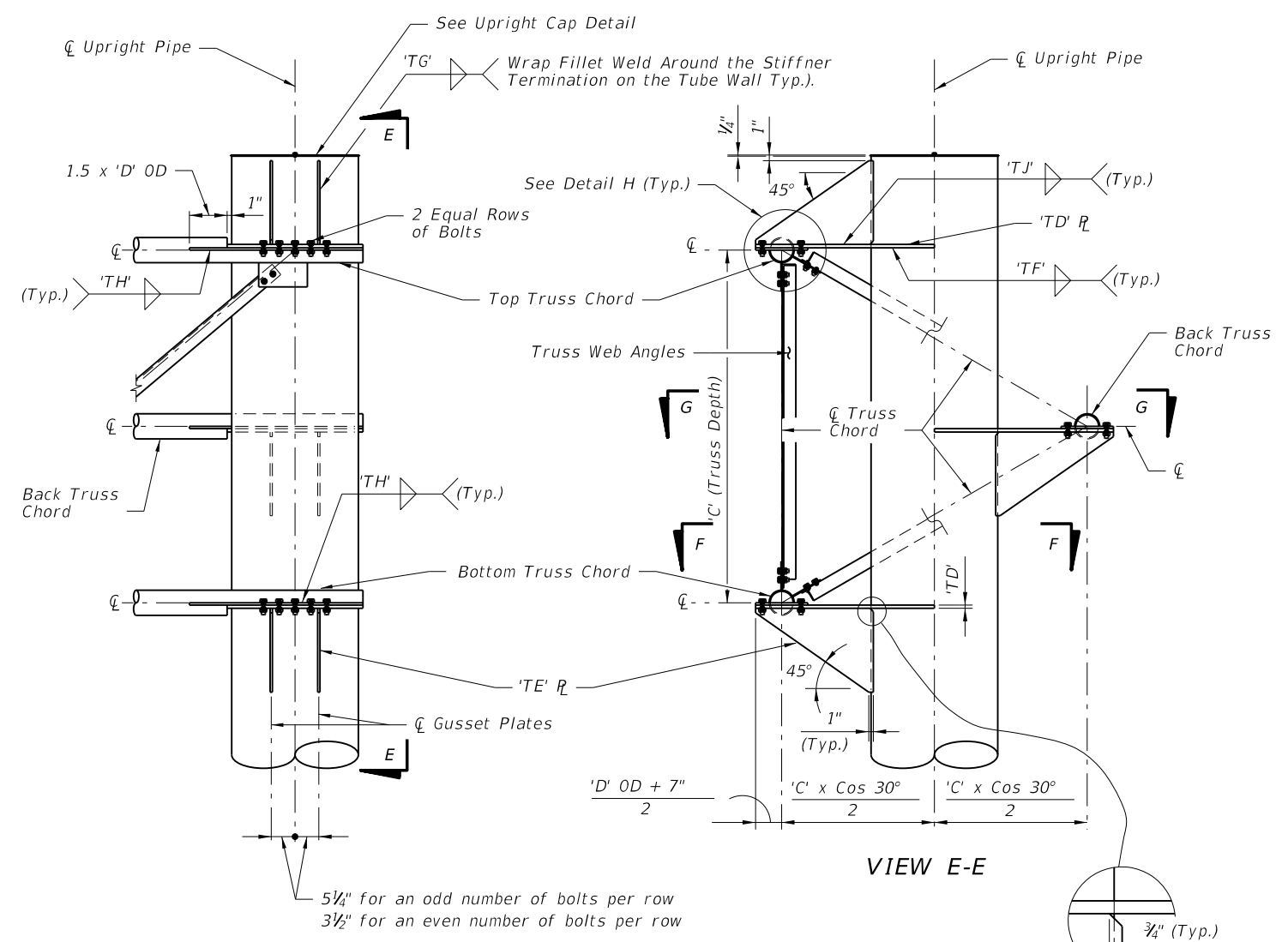
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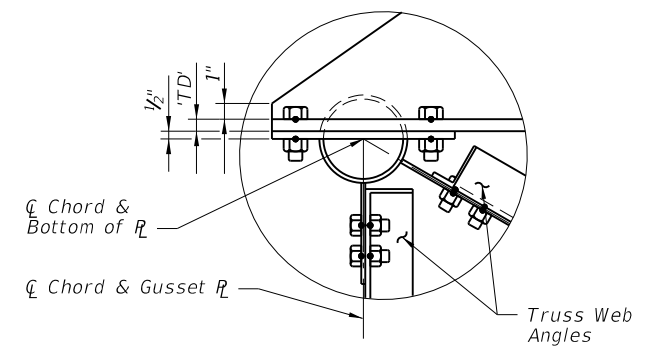
SECTION D-D



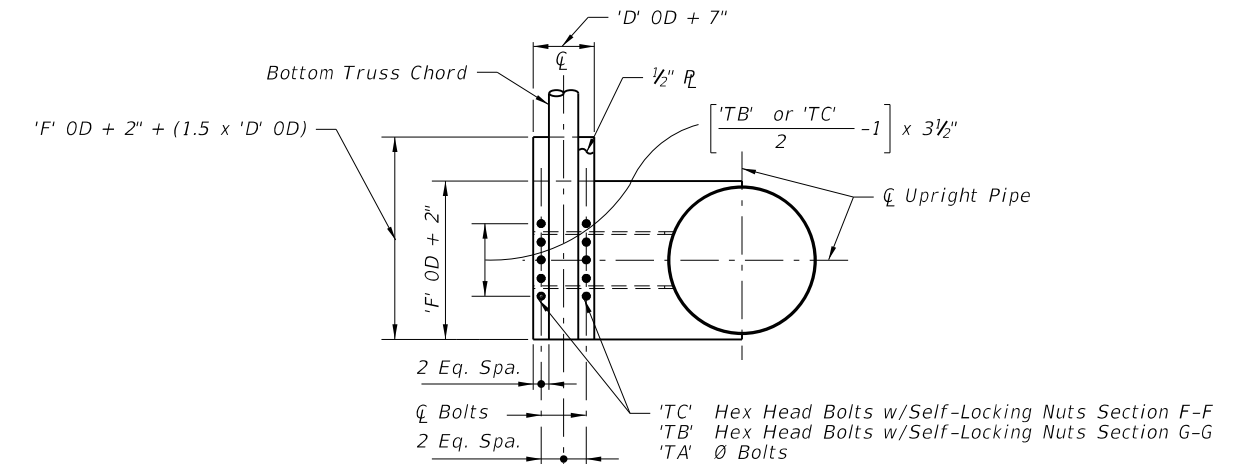
SPLICE CONNECTION DETAIL
 (Splice not allowed for trusses $\leq 40'$
 Splice optional for trusses $> 40'$)



UPRIGHT-TRUSS CONNECTION DETAIL
 (Web Members from back Truss Chord omitted for clarity)



DETAIL H

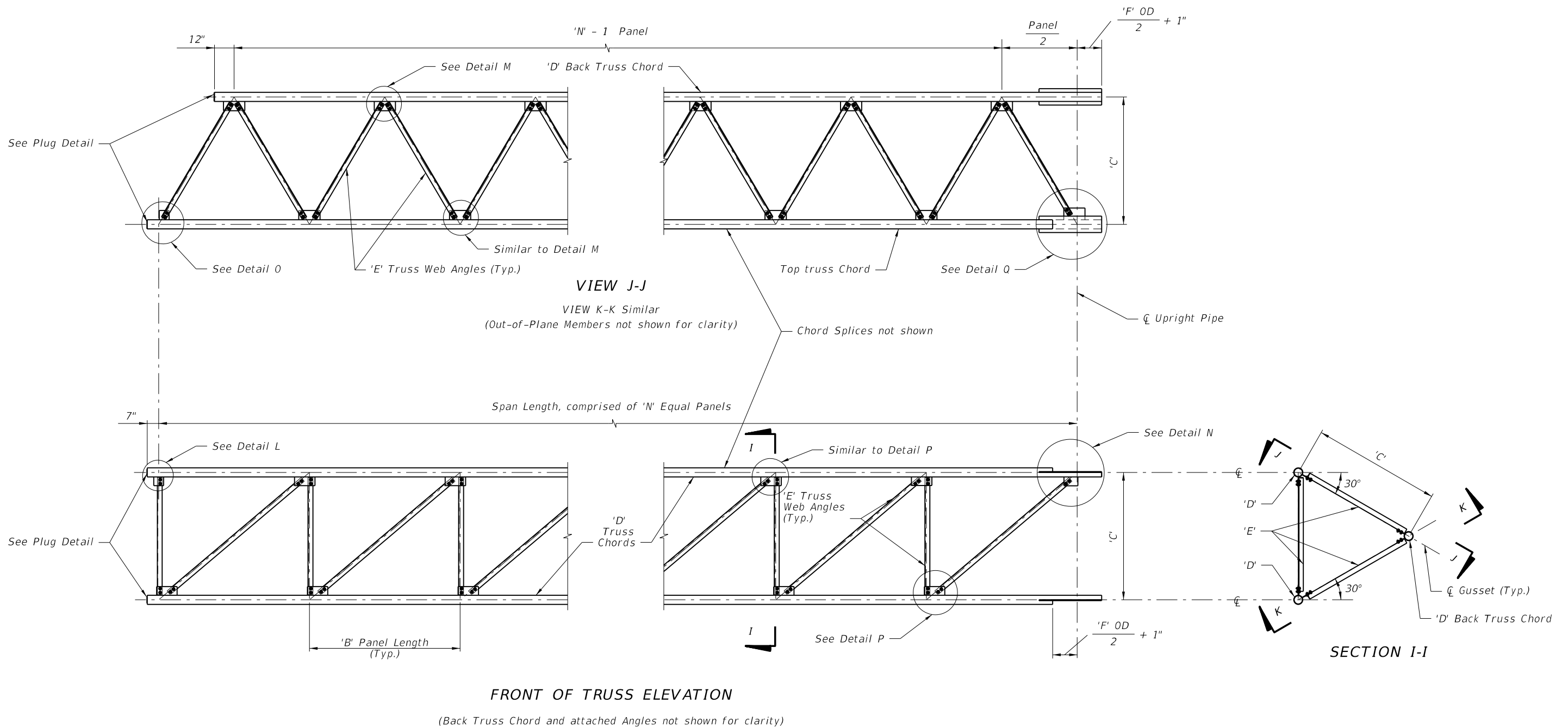


SECTION F-F, SECTION G-G SIMILAR
 (With Gusset Plate & Angles omitted for clarity)

NOTE:
 Abbreviation
 OD ~ Outside Diameter

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LAST REVISION 07/01/14	REVISION	DESCRIPTION:	2015 DESIGN STANDARDS	CANTILEVER SIGN STRUCTURE	INDEX NO. 11310	SHEET NO. 3 of 5
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NOTE:
Abbreviation
OD ~ Outside Diameter

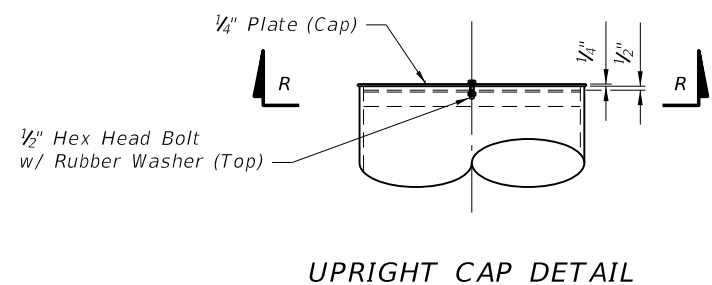
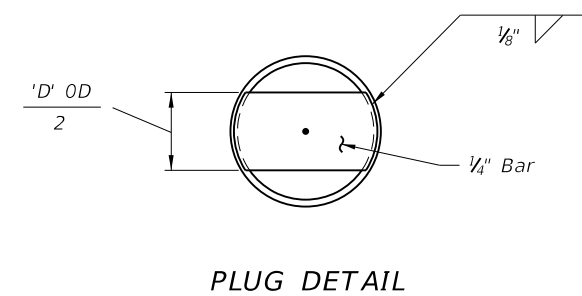
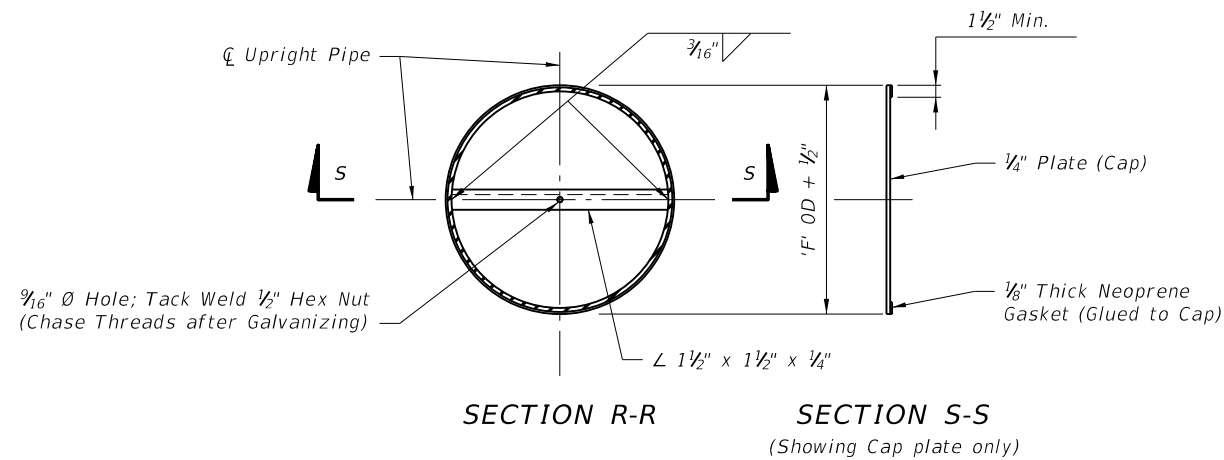
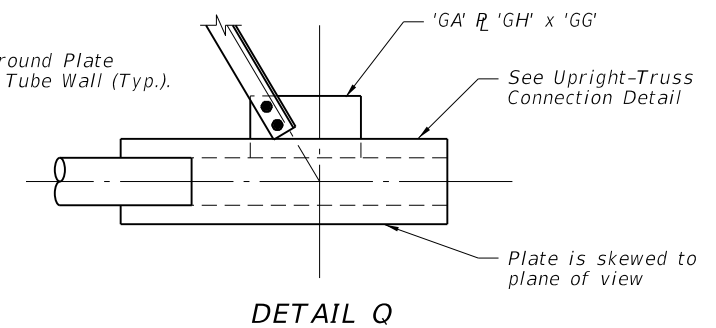
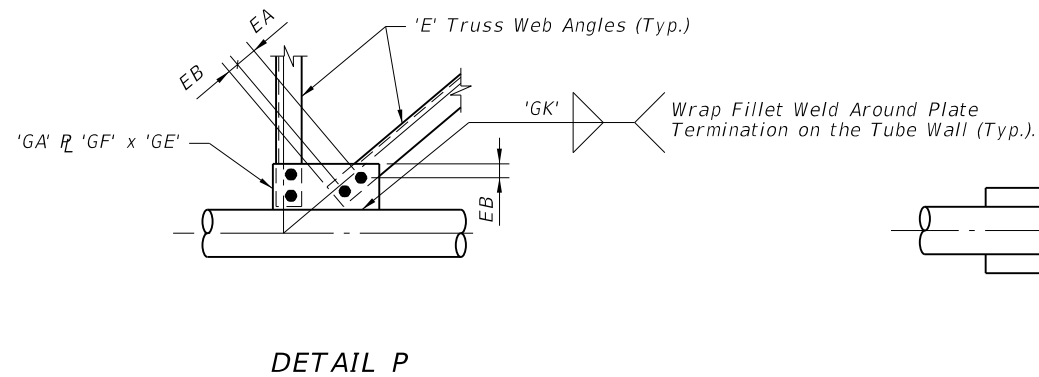
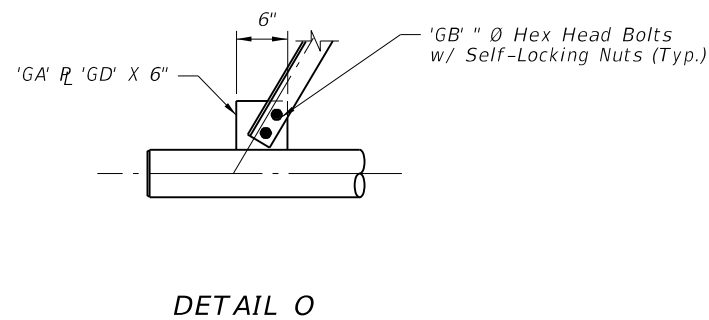
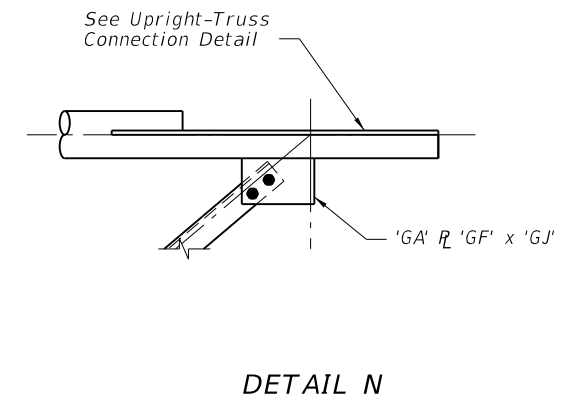
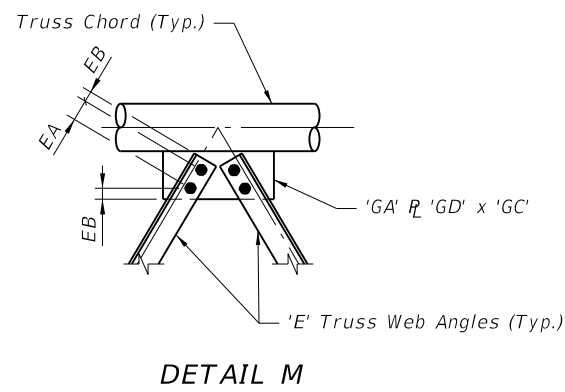
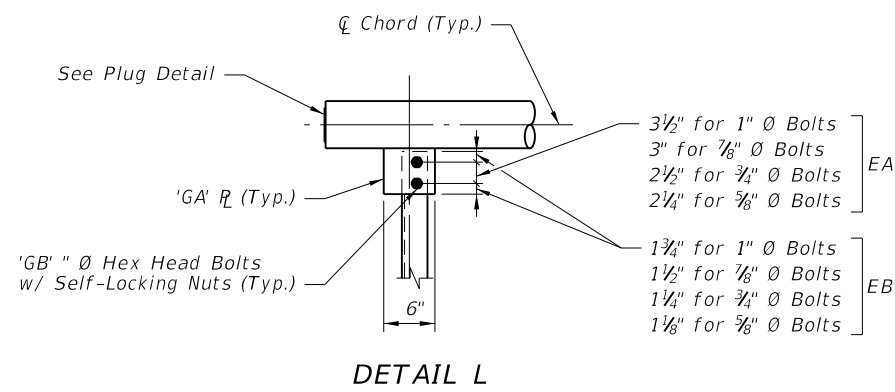
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LAST REVISION	DESCRIPTION:
07/01/05	



CANTILEVER SIGN STRUCTURE

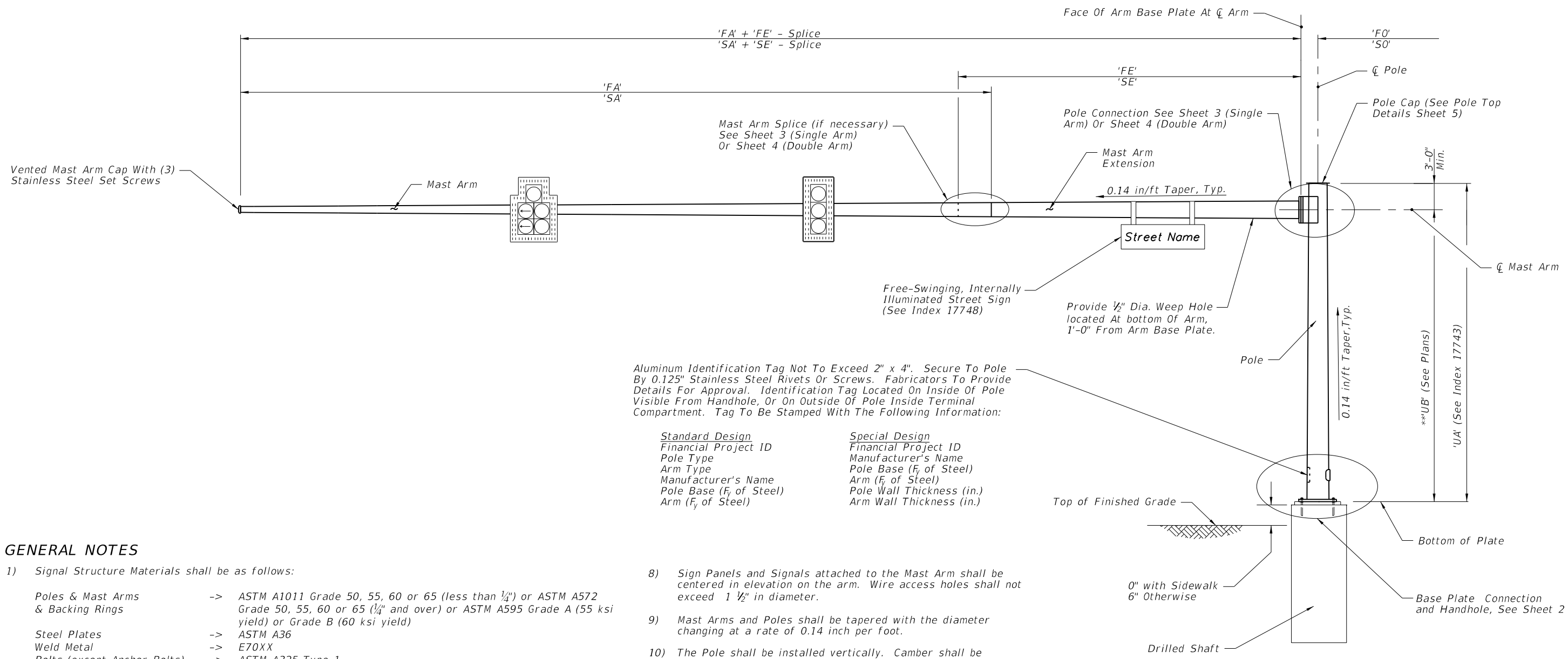
INDEX NO.	SHEET NO.
11310	4 of 5



NOTE:
Abbreviation
OD ~ Outside Diameter

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LAST REVISION 07/01/14	REVISION	DESCRIPTION:	 2015 DESIGN STANDARDS	CANTILEVER SIGN STRUCTURE	INDEX NO. 11310	SHEET NO. 5 of 5
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Aluminum Identification Tag Not To Exceed 2" x 4". Secure To Pole By 0.125" Stainless Steel Rivets Or Screws. Fabricators To Provide Details For Approval. Identification Tag Located On Inside Of Pole Visible From Handhole, Or On Outside Of Pole Inside Terminal Compartment. Tag To Be Stamped With The Following Information:

Standard Design	Special Design
Financial Project ID	Financial Project ID
Pole Type	Manufacturer's Name
Arm Type	Pole Base (F _y of Steel)
Manufacturer's Name	Arm (F _y of Steel)
Pole Base (F _y of Steel)	Pole Wall Thickness (in.)
Arm (F _y of Steel)	Arm Wall Thickness (in.)

GENERAL NOTES

- Signal Structure Materials shall be as follows:
 - Poles & Mast Arms & Backing Rings -> ASTM A1011 Grade 50, 55, 60 or 65 (less than 1/4") or ASTM A572 Grade 50, 55, 60 or 65 (1/4" and over) or ASTM A595 Grade A (55 ksi yield) or Grade B (60 ksi yield)
 - Steel Plates -> ASTM A36
 - Weld Metal -> E70XX
 - Bolts (except Anchor Bolts) -> ASTM A325 Type 1
 - Anchor Bolts -> ASTM F1554 Grade 55 ksi
 - Nuts for Anchor Bolts -> ASTM A563 Grade A Heavy Hex
 - Handhole Frame -> ASTM A709 Grade 36 ksi or ASTM A36
 - Handhole Cover -> ASTM A1011 Grade 50, 55, 60 or 65 ksi
 - Caps -> ASTM A1011 Grade 50, 55, 60 or 65 ksi or ASTM B209
 - Nut Covers -> ASTM B26 (319-F)
 - Stainless Steel Screws -> AISI Type 316
 - Threaded Bars/Studs -> ASTM A36 or ASTM A307
- Reinforcing Steel shall be ASTM A615 Grade 60 ksi.
- Concrete shall be Class IV (Drilled Shaft) with a minimum 28-day compressive strength of 4,000 psi for all environmental classifications.
- Perform all welding in accordance with the American Welding Society Structural Welding Code (Steel) ANSI/AWS D1.1 (current edition). For additional welding requirements see AASHTO Standard Specification for Structural Supports for Highway Signs, Luminaires and Traffic Signals, Section 5.15, Welded Connections.
- All steel items shall be galvanized as follows:
 - All Nuts, Bolts, Washers and Threaded Bars/Studs -> F2329
 - All other steel items (including Pole & Mast Arm) -> ASTM A123
- Locate handhole 180° from arm on single arm poles or 180° from first arm of double arm poles or see special instructions on Mast Arm Tabulation Sheet.
- Except for Anchor Bolts, all bolt hole diameters shall be equal to the bolt diameter plus 1/16", prior to galvanizing. Hole diameters for Anchor Bolts shall not exceed the bolt diameter plus 1/2".

- Sign Panels and Signals attached to the Mast Arm shall be centered in elevation on the arm. Wire access holes shall not exceed 1 1/2" in diameter.
- Mast Arms and Poles shall be tapered with the diameter changing at a rate of 0.14 inch per foot.
- The Pole shall be installed vertically. Camber shall be accounted for in the Mast Arm connection as detailed.
- If a Mast Arm damping device is required by the Engineer, it shall be installed within eight feet of the Mast Arm tip.
- Design according to FDOT Structures Manual. Alternate Designs for Special Mast Arm Assemblies are not allowed.
- Provide "J", or "C"-Hook at top of pole for signal cable support.
- First and Second Arm Camber Angle = 2°.
- Details for Signal and Sign Locations, Signal Head attachment, Sign Attachment, Pedestrian Head Attachment, and Foundation Conduit are not shown for clarity.
- Use of split lock washer is not permitted.
- This Design Standard is considered fully detailed and no shop drawings are necessary. Submit shop drawings for minor modifications not detailed in the plans.
- Verify CSL access tubes will not interfere with anchor bolt installation before excavating the shaft. When CSL access tube locations conflict with anchor bolt locations, move the CSL access tube location +/- two inches along the inner circumference of the reinforcing cage. Notify the Engineer before excavating the shaft if the CSL access tube locations cannot be moved out of conflict with anchor bolt locations.

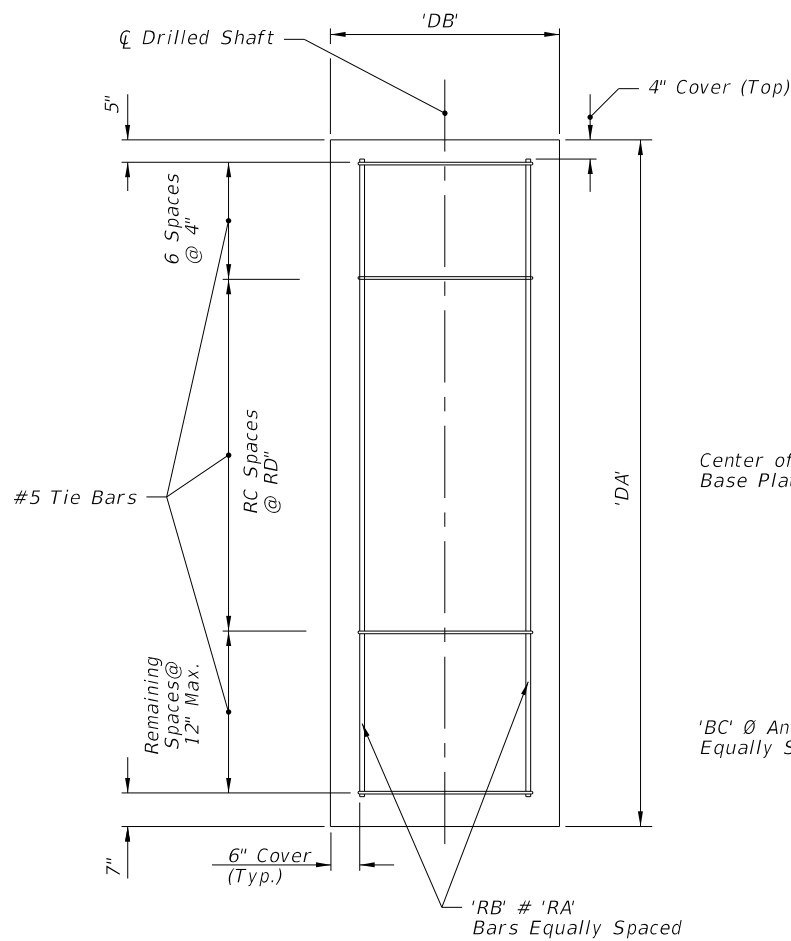
ELEVATION VIEW
(Single Arm Shown, Double Arm Similar)
(Luminaire Arm Not Shown)

** NOTE: Contractor shall verify this Dimension prior to fabrication of Pole.

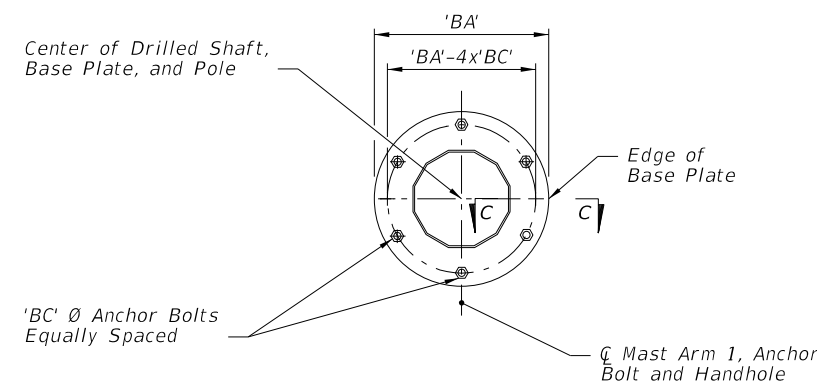
TYPICAL ELEVATION AND NOTES

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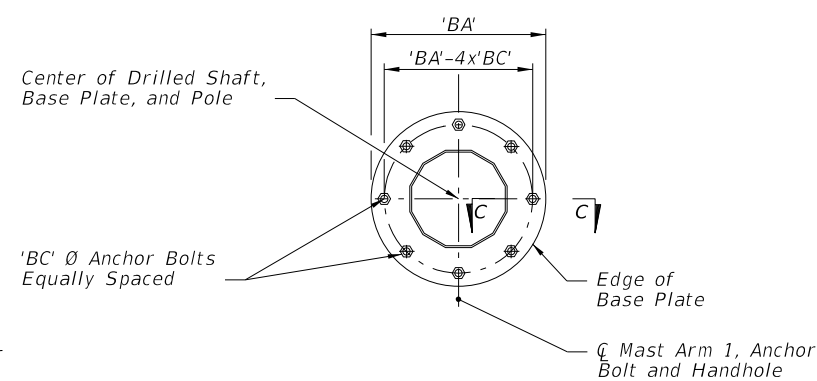
LAST REVISION 07/01/14	REVISION	DESCRIPTION:	 2015 DESIGN STANDARDS	MAST ARM ASSEMBLIES	INDEX NO. 17745	SHEET NO. 1 of 5
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SECTION A-A

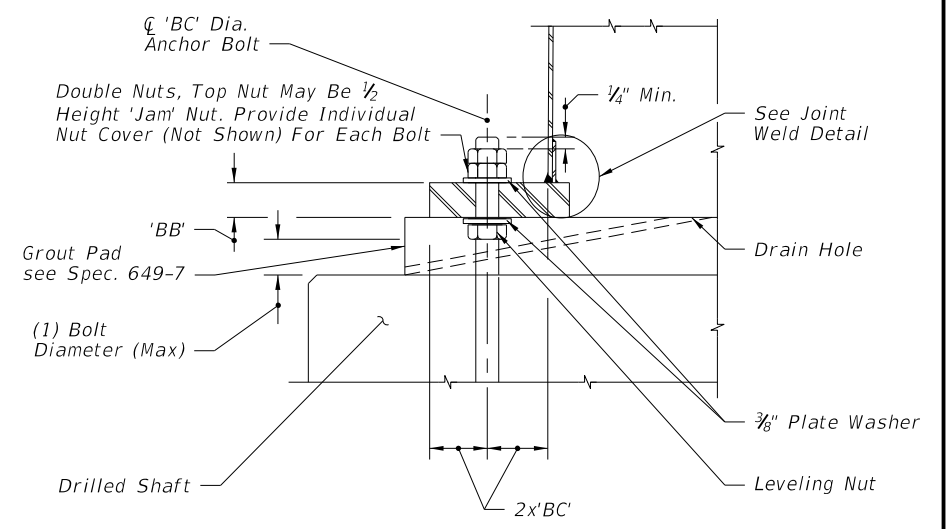


SECTION B-B
(6 Anchor Bolts)

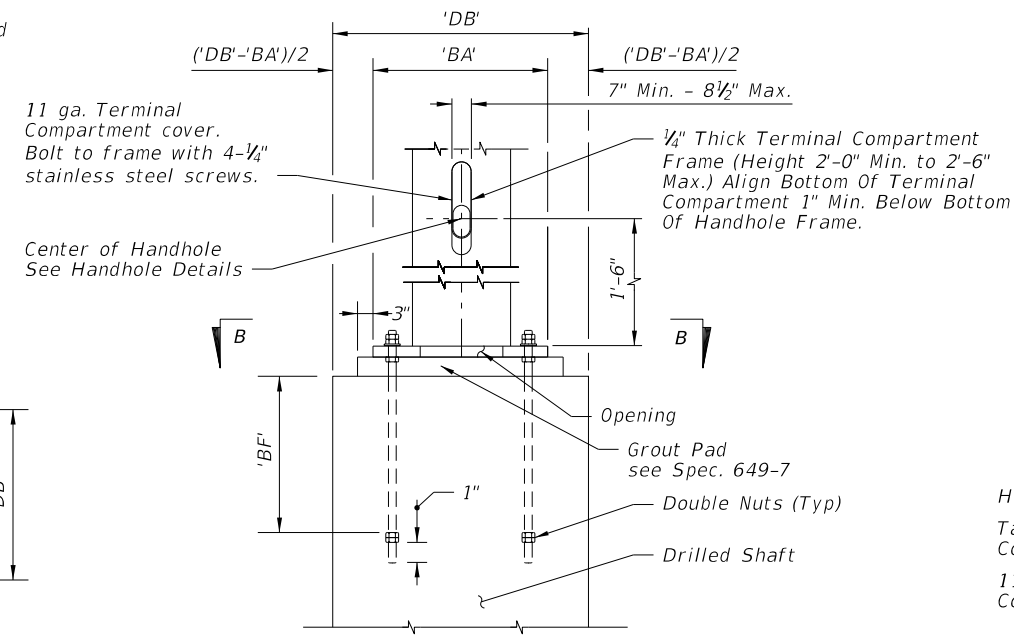


SECTION B-B
Alternate Detail
(8 Anchor Bolts)

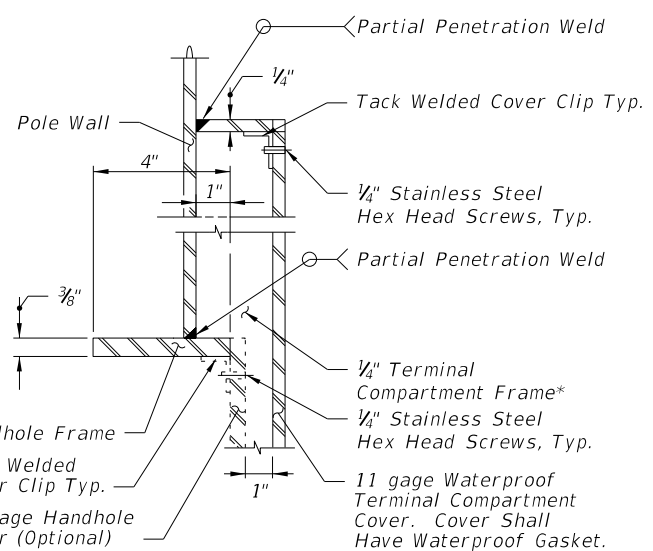
NOTE:
See Index No. 17743 and the
plans for actual quantity of bolts.



SECTION C-C

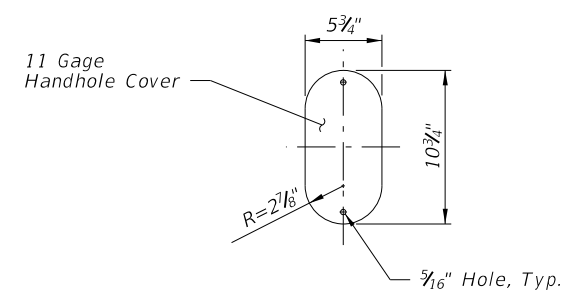


BASE PLATE AND ANCHORAGE ELEVATION
(Reinforcement Not Shown)



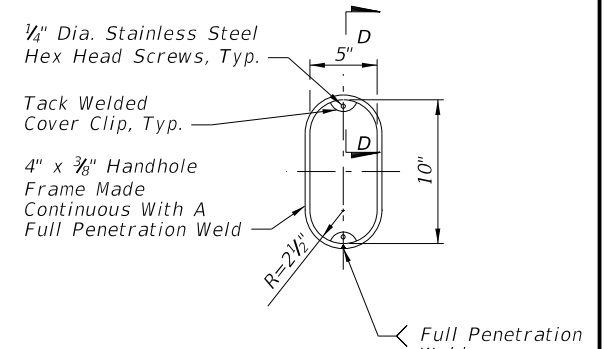
SECTION D-D
(Thru Handhole & Terminal Compartment)

* Terminal Compartment is optional.
See Mast Arm Tabulation to see
if required and for locations.

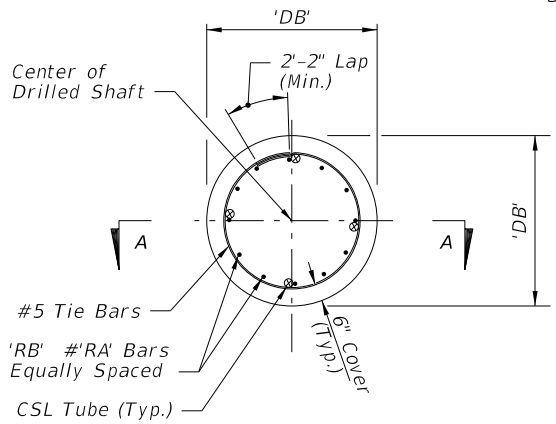


HANDHOLE COVER

Note:
Handhole Cover may be omitted when
Terminal Compartment is provided.



HANDHOLE FRAME
(w/Terminal Compartment Omitted)

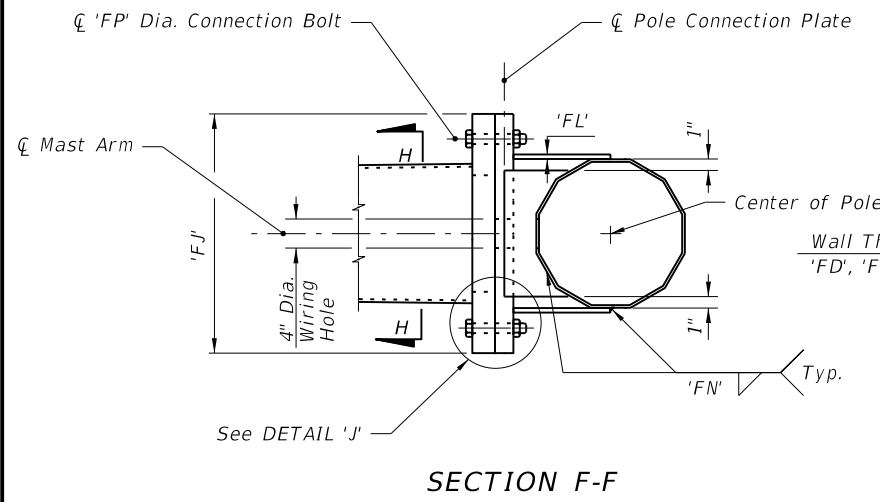


FOUNDATION PLAN

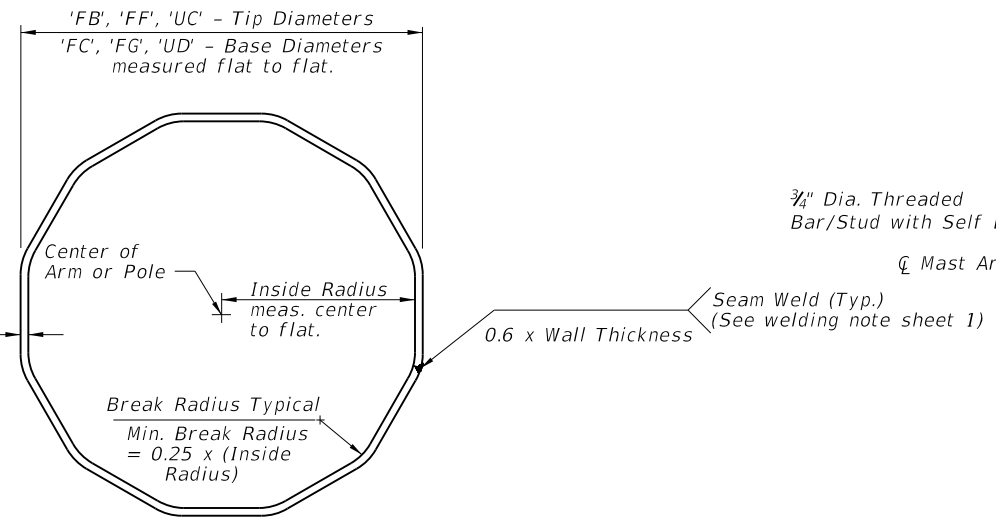
TYPICAL FOUNDATION AND BASE PLATE DETAILS

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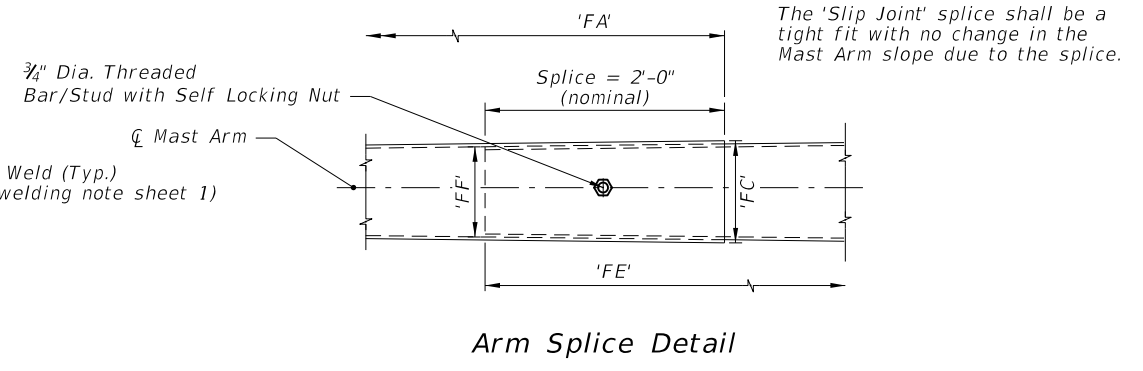
LAST REVISION 07/01/14	REVISION	DESCRIPTION:	 2015 DESIGN STANDARDS	MAST ARM ASSEMBLIES	INDEX NO. 17745	SHEET NO. 2 of 5
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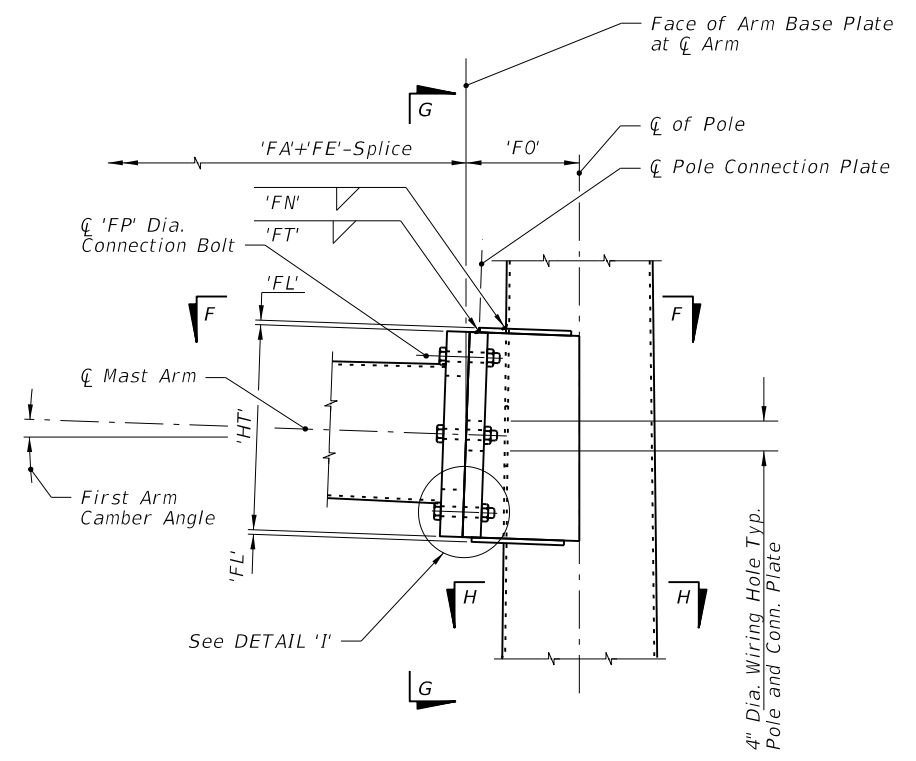
SECTION F-F



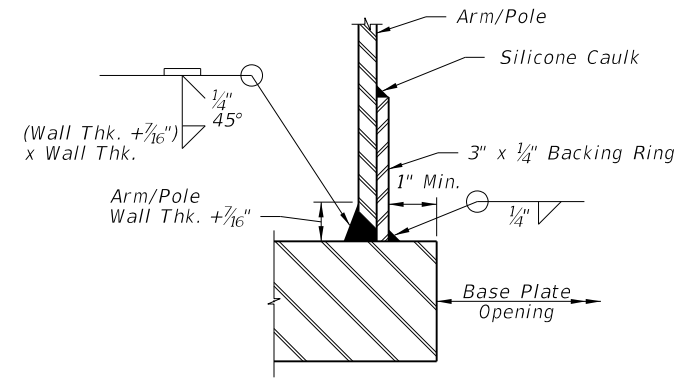
SECTION H-H



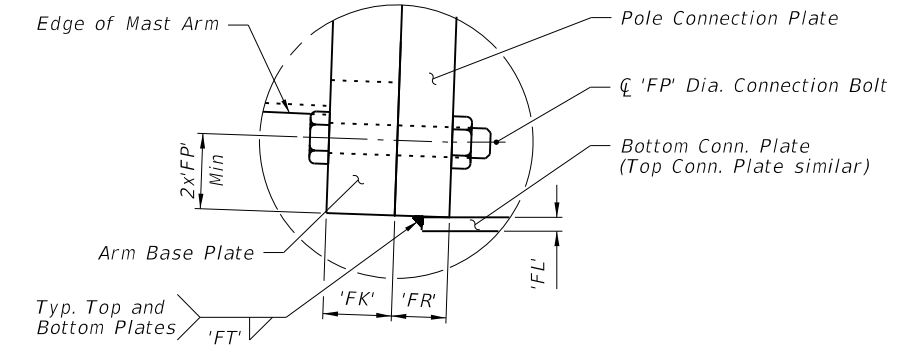
Arm Splice Detail



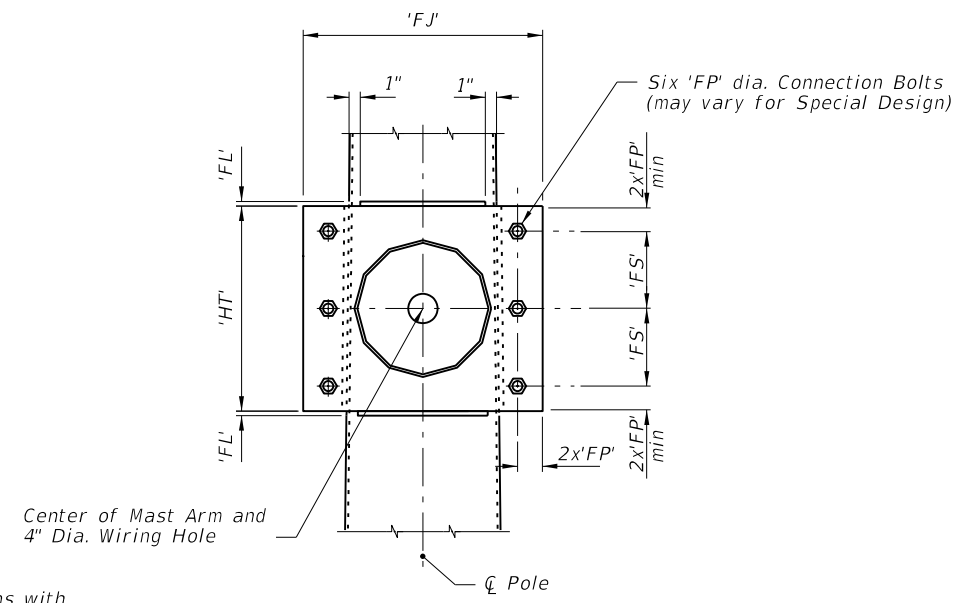
ELEVATION
(Single Arm Connection)



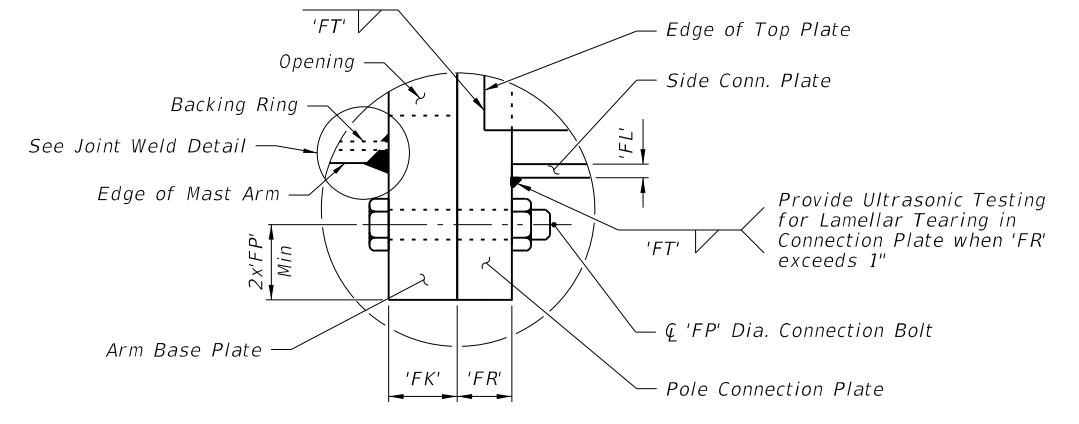
JOINT WELD DETAIL



DETAIL 'I'



SECTION G-G



DETAIL 'J'

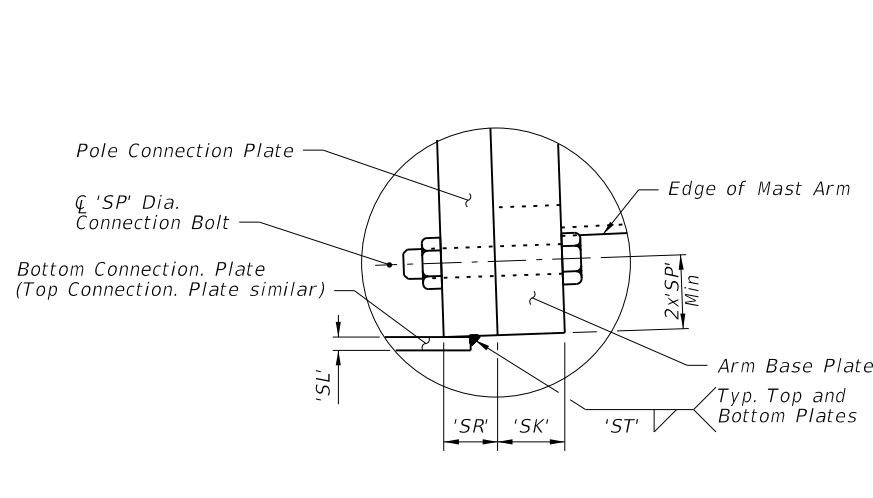
TYPICAL SINGLE ARM CONNECTION DETAILS

- NOTE:
1. Details shown on this sheet are for 12 sided pole sections. However, sections with more than 12 sides and round sections are permitted provided outside diameter and wall thickness are not reduced.
 2. Mast Arm and Connection Plates shall be match marked to ensure proper assembly.

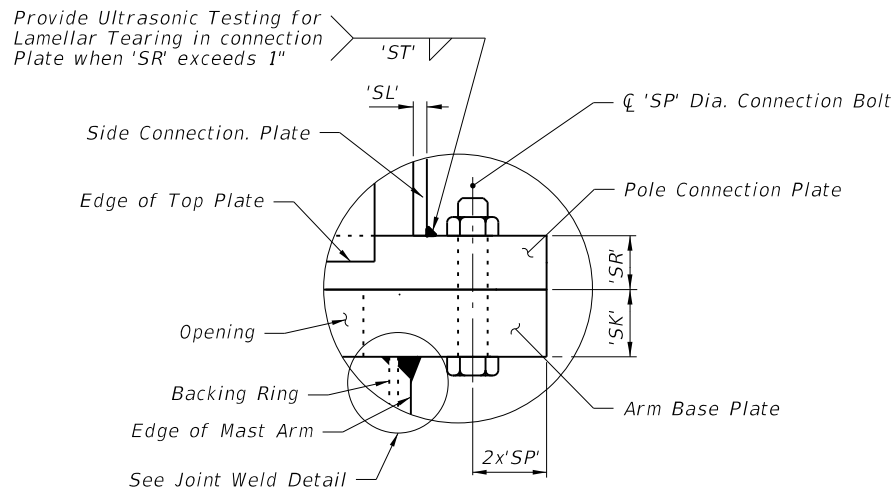
6/30/2014 11:14:50 AM

LAST REVISION 07/01/13	REVISION	DESCRIPTION:	 2015 DESIGN STANDARDS	MAST ARM ASSEMBLIES	INDEX NO. 17745	SHEET NO. 3 of 5
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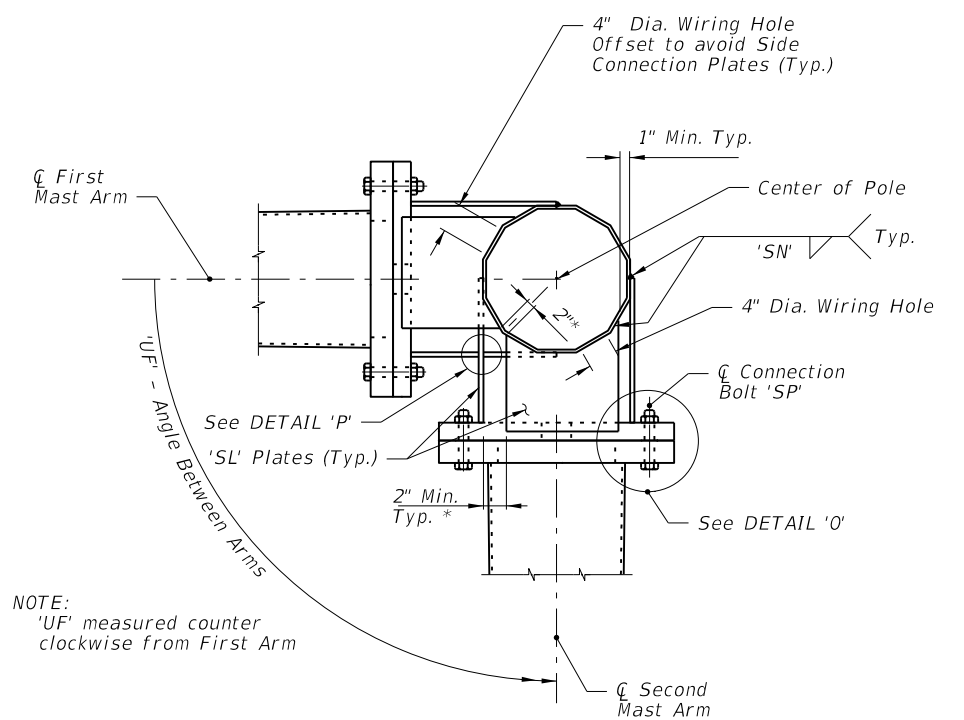
6/30/2014 11:14:51 AM



DETAIL 'N'



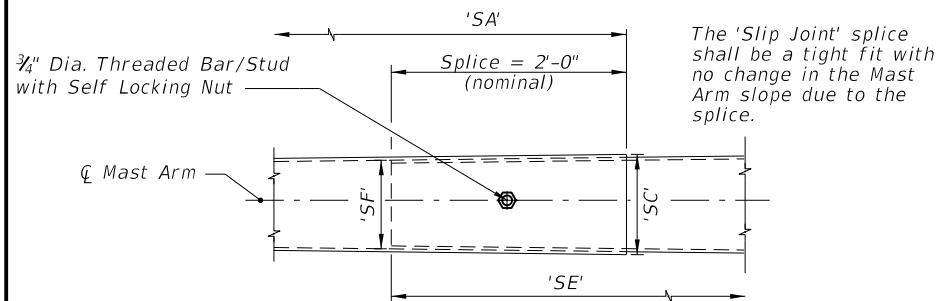
DETAIL 'O'



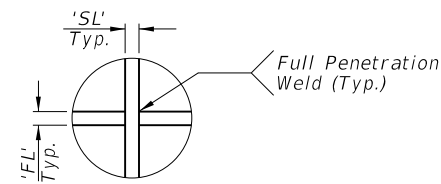
SECTION K-K

NOTE:
'UF' measured counter clockwise from First Arm

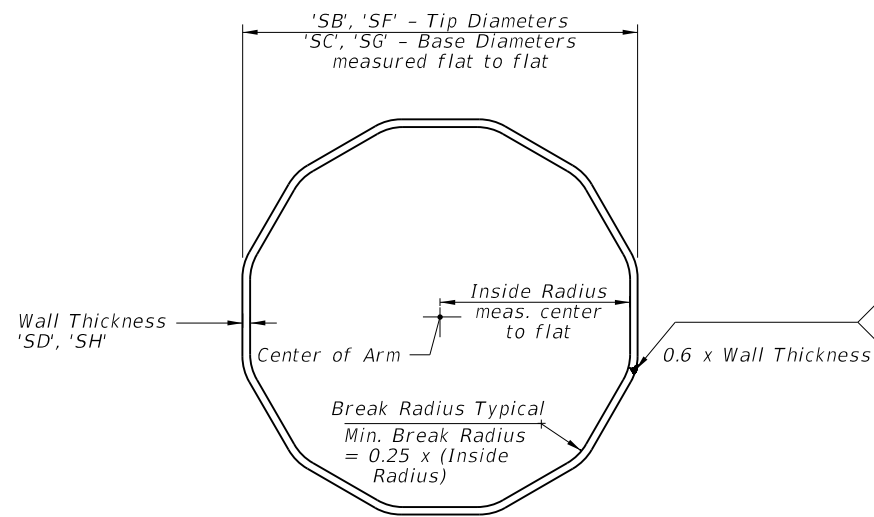
* Adjust width of top and bottom Connection Plates to maintain minimum clearance shown



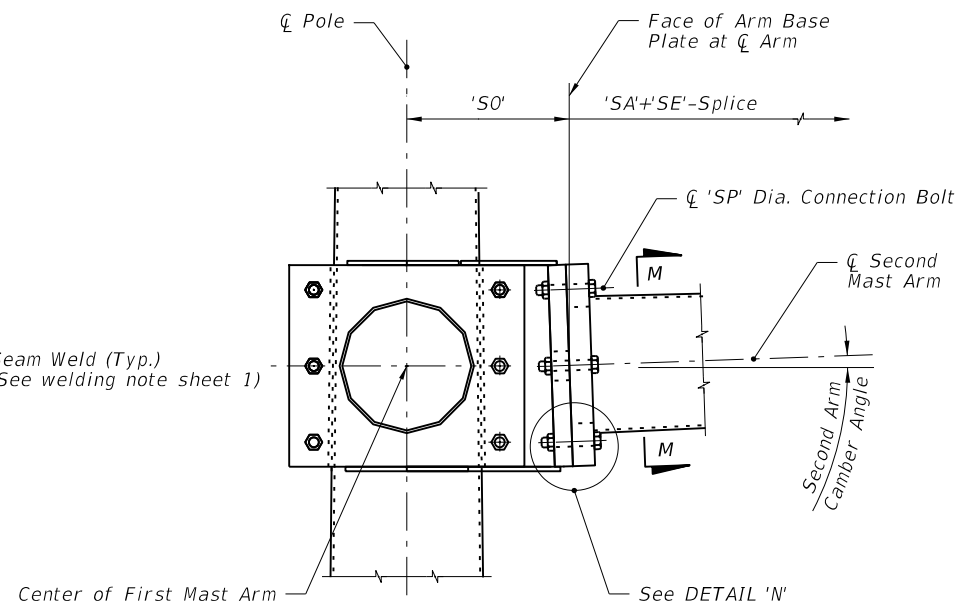
Arm Splice Detail



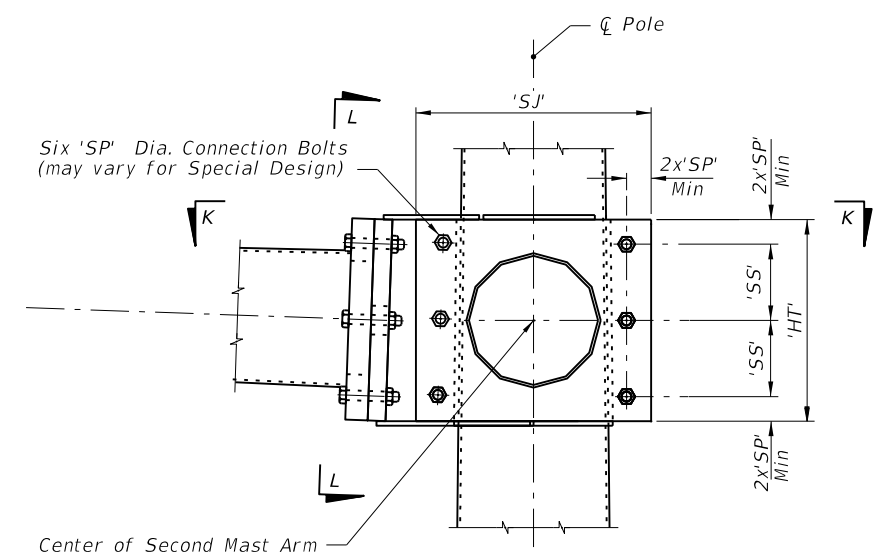
DETAIL 'P'



SECTION M-M



SECTION L-L



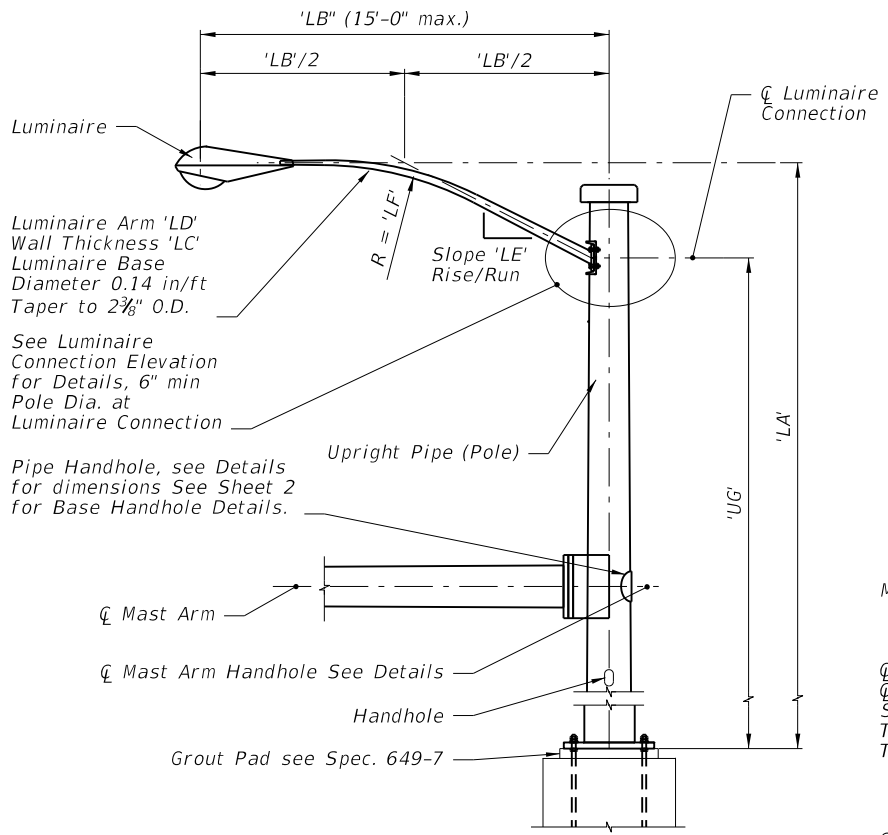
ELEVATION

(Double Arm Connection)

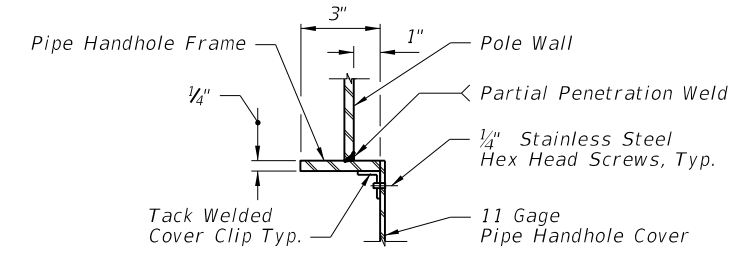
NOTE:
1. Details shown on this sheet are for 12 sided pole sections. However, sections with more than 12 sides and round sections are permitted provided outside diameter and wall thickness are not reduced.
2. Mast Arm and Connection Plates shall be match marked to ensure proper assembly.

TYPICAL DOUBLE ARM CONNECTION DETAILS

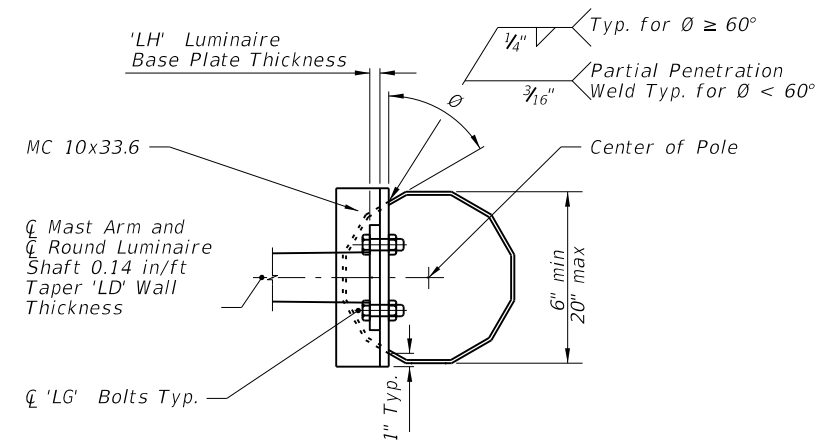
LAST REVISION	DESCRIPTION:	 2015 DESIGN STANDARDS	MAST ARM ASSEMBLIES	INDEX NO. 17745	SHEET NO. 4 of 5
01/01/12					



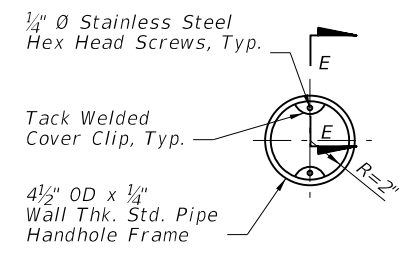
LUMINAIRE ELEVATION



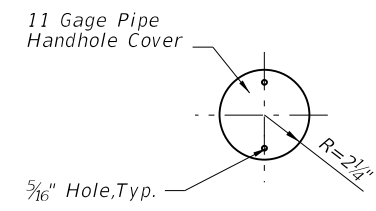
SECTION E-E
(thru Pipe Handhole)



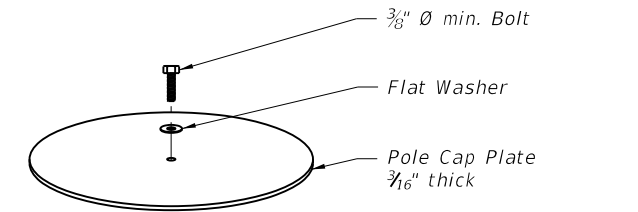
SECTION A-A



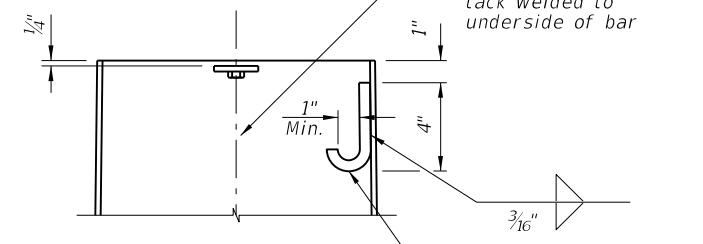
PIPE HANDHOLE FRAME



PIPE HANDHOLE COVER

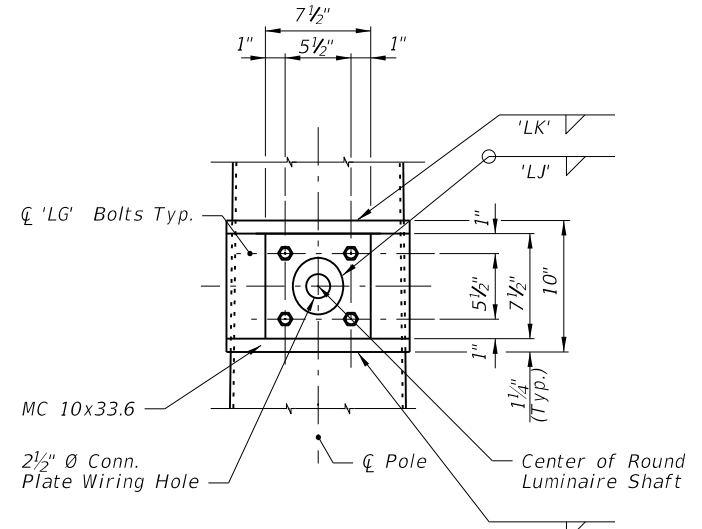


TOP VIEW



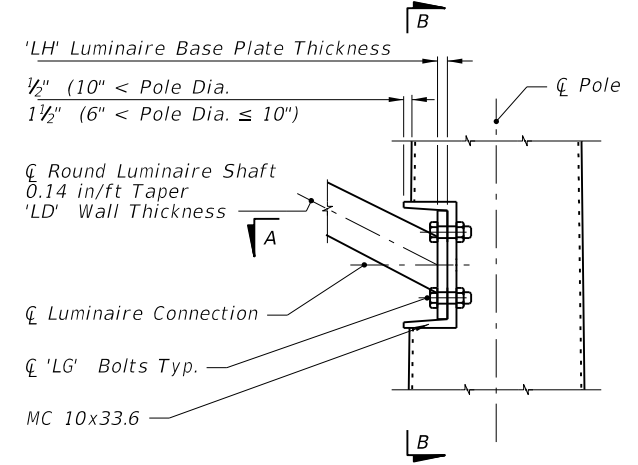
POLE TOP CUT-AWAY
(Option 'a')

'J' Hook for wiring, 1/2" \emptyset commercial grade hot rolled bar welded to inside of pole.



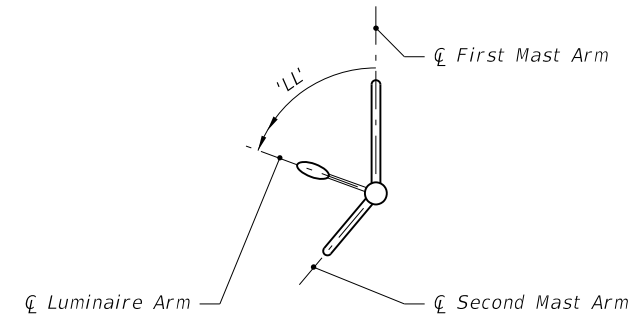
SECTION B-B

NOTE:
The Fabricator may substitute a 1/2" thick bent plate with the same flange width, height, and length as the MC 10x33.6 Channel section.



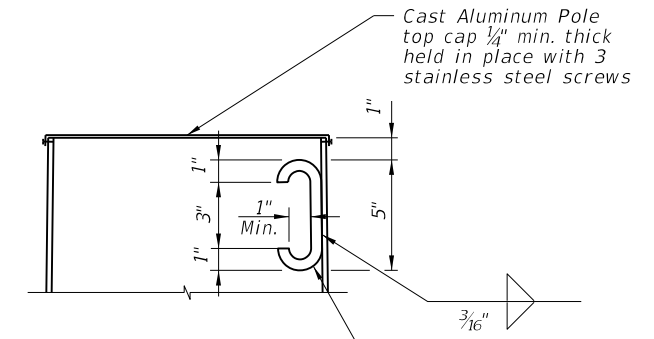
LUMINAIRE CONNECTION ELEVATION

NOTE:
The Pole shown on this sheet is a 12 sided section. However, sections with more than 12 sides and round sections are permitted provided outside diameter and wall thickness are not reduced



LUMINAIRE ORIENTATION

NOTE:
'LL' measured counter clockwise from First Arm.



POLE TOP CUT-AWAY
(Option 'b')

'C' Hook for wiring and lifting, 1/2" \emptyset commercial grade hot rolled bar welded to inside of pole.

POLE TOP DETAILS

NOTE:
Any combination of the above two options may be used, provided both lifting and wiring is accommodated.

TYPICAL LUMINAIRE ARM AND CONNECTION DETAILS

NOTES:

1. Luminaire type and Luminaire to Arm Connection Details can be found elsewhere.
2. Align Luminaire Arm with single Mast Arm or first Arm of Double Mast Arm unless indicated otherwise in plans.

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