THESE STANDARDS ARE SOLELY FOR USE BY SEMINOLE COUNTY, FLORIDA FOR MAST ARM INSTALLATIONS IN SEMINOLE COUNTY, FLORIDA

SEMINOLE COUNTY
2017-18
STANDARD MAST ARM DRAWINGS

SEMINOLE COUNTY TRAFFIC ENGINEER: CHARLES WETZEL II, P.E., P.T.O.E.

PREPARED FOR

SEMINOLE COUNTY TRAFFIC ENGINEERING
140 BUSH LOOP
SANDFORD, FL 32773
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PREPARED BY:

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CERTIFICATION OF AUTHORIZATION No. 27770

PROJECT MANANGER - FURSAN MUNJED, P.E.
PROJECT NO. SMC-17038

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GENERAL NOTES

1. These Standards are solely for use by Seminole County, Florida for mast arm installations in Seminole County.

2. These Standards address only the structural details of the Mast Arm and the Drilled Shaft Foundation. Users of these Standards remain responsible for verifying that the complete Mast Arm assembly (structure, foundation, signal heads, sign panels, and luminaries) meets all of the criteria and requirements of the appropriate governing agencies, including, but not limited to, providing adequate vertical & horizontal clearances, adequate sight distance, appropriate signalization, appropriate signal placement, and adequate sign panel size/positioning.

3. Utilities: Adequate provision shall be made for the protection and/or relocation of existing utilities. Users of these standards are cautioned to verify that there will be no interference between the utilities and the mast arm foundation.

The Standard Foundation Details assume that the ground slope at the Mast Arm is 4:1 (Horizontal to Vertical) or flatter for a minimum of 8 feet from the center of the Drilled Shaft Foundation in all directions and that no other significant conditions exist nearby that will adversely impact the Drilled Shaft Foundation capacity (underground vaults, manholes, inlets, large diameter utilities, ditches, drop-offs, curbs, etc.).

The Mast Arm Designer is responsible for verifying these conditions and shall use the Standard Foundation Details only where all of the above conditions are met.

ATTACHMENT OF TRAFFIC SIGNAL HEADS & ILLUMINATED SIGNS

1. Mast arm shop drawings shall include the attachment details.

2. Signal and power cables shall be completely encased in hollow tubes and hollow brackets between the mast arm and the signal head/sign.

3. The support brackets shall attach to the arm using metal bands. Fastening to and/or welding to the arm is prohibited.

4. Field drill entry holes for signal cables and power cables. Fit holes with rubber grommet.

5. Illuminated Signs shall be attached below the arm using a free-swinging bracket. No other attachment position or method is permitted.

GEOTECHNICAL REQUIREMENTS & SOILS DATA LETTER

1. Site-specific Geotechnical Data is required for all Mast Arms. A Soil Boring shall be performed for each Mast Arm.

2. A Soils Data Letter shall be prepared by a Geotechnical Engineer and shall be submitted with the Mast Arm Structure Design Calculations and Shop Drawings. The Soils Data Letter shall be based upon a Soil Boring (SPT) not less than 30 feet in depth. Use of methods other than SPT is not permitted.

   The Soils Data Letter shall clearly state the following:
   - Applicable Standard Soil Type(s)
   - Internal Angle of Friction (Phi Angle)
   - Recommended Water Table Elevation for Design
   - Soil Dry Unit Weight
   - Soil Saturated Unit Weight
   - Soil Effective Unit Weight (Saturated Unit Weight minus Water Unit Weight)
   - SPT Blow Count (Uncorrected)
   - Minimum Tip Elevation (if applicable)
   - Shaft Length Extension due to Clay Layer (if applicable)
   - Special Conditions Encountered (Loose Soils, Hardpan, Voids, etc.)

3. The Geotechnical Engineer is advised that the Foundation Capacities have been determined assuming a single soil layer for the entire embedded length of the Drilled Shaft Foundation. The Geotechnical Engineer shall exercise appropriate engineering judgement when using weighted-average and/or other measures to ensure the single-layer soil properties will accurately model the actual existing multi-layer soil conditions. For highly variable soils, more than one Standard Soil Type may need to be provided. For example, one Standard Soil Type may be applicable for a Drilled Shaft Foundation less than 16'-0" long while a different Standard Soil Type may be applicable for a Drilled Shaft Foundation longer than 16'-0". In all cases, the provided Standard Soil Type(s) must be applicable for the entire length of the Drilled Shaft Foundation. I.e., do not provide a Standard Soil Type for the upper soil layers and a different soil type for the lower soil layers.

4. Drilled Shaft Foundations shall not terminate in a soil layer with an uncorrected SPT Blow Count (N) of 4 or less. The Soils Data Letter shall specifically note all such layers and shall provide a Minimum Tip Elevation. Where the Ground Elevation is not known, the Minimum Tip Elevation shall be expressed as a Minimum Tip Depth Below Grade.

5. The following criteria must be met in order to qualify as a Standard Soil Type:
   - A. The average soils parameters must meet all of the minimum values of the Standard Soil Type.
   - B. Within the limit of the Drilled Shaft Foundation, there can be no more than 5'-0" of soils with an uncorrected SPT Blow Count (N) of 4 or less.
   - C. At the discretion of the Geotechnical Engineer, the soils within the length of the Drilled Shaft Foundation may contain a clay layer not exceeding 3'-0" thick (see Note #6).

6. At the discretion of the Geotechnical Engineer, the following procedure may be used for a soil profile that contains a clay layer not exceeding 3'-0" in thickness, but that otherwise fully meets all of the parameters for a Standard Soil Type:
   - A. The Drilled Shaft Foundation capacity shall be based upon the Standard Soil Type.
   - B. The Drilled Shaft Foundation shall be extended a minimum of 3'-0" longer than the length required by the Table of Foundation Capacities.

7. For each location where a Standard Soil Type applies, the standard foundation details shall be used. A Special Foundation Design is not required for that location.

8. For locations where no Standard Soil Type is applicable, a Special Foundation Design is required. The Special Foundation shall be designed and detailed using the actual Mast Arm base reactions and the specific soils parameters provided in the Soils Data Letter. The Special Foundation shall be designed by a professional engineer registered in the State of Florida. Signed and sealed design calculations and foundation details shall be submitted concurrently with the mast arm design calculations and shop drawings. The Drilled Shaft Foundation design methodology shall comply with the Foundation Capacity Criteria used for these Standards (see Sheet 16).

SUBMITTAL REQUIREMENTS

The following information shall be provided for every Mast Arm structure:

1. Mast Arm Design Calculations
2. Mast Arm Shop Drawings
3 Soils Data Letter (with Soil Boring Log)
4. Special Foundation Design (required only for non-standard soils)

SPECIAL CONSTRUCTION REQUIREMENTS

1. All Construction shall comply with the Florida Department of Transportation "Standard Specifications for Road and Bridge Construction" except for method of payment.

2. Mast Arm Shop Drawings are required and fabrication shall not begin until the Shop Drawings are approved. Mast Arm Shop Drawings shall include the anchor rod orientation with respect to the arm(s) and the direction of traffic.

3. Foundation Materials:
   - A. Concrete: FDOT Class IV (Drilled Shaft) Minimum 28-Day Compressive Strength = 4,000 psi
   - B. Reinforcing Steel: ASTM A615, Grade 60

   Special Requirements apply to FDOT District 5 Submittals. Contact the FDOT District 5 Geotechnical Department for Environmental Classification based upon the FDOT District 5 Corrosion Maps.

4. The Soils Data Letter may require a Minimum Tip Elevation in order to locate the bottom of the drilled shaft in a competent soil layer or to account for a clay layer. Drilled Shaft Foundations shall not be terminated above the stated Minimum Tip Elevation.

5. The top of the Drilled Shaft Foundation shall extend a minimum of one inch (1") but not more than six inches (6") above the adjacent finish ground line. The top of Drilled Shaft Foundations located within or abutting a sidewalk shall match the top of sidewalk elevation unless otherwise noted in the Mast Arm Designer's plans.

6. Natural Slurry shall not be relied upon to prevent caving of the soils and/or to maintain an open hole. Adequate measures shall be taken to control Artesian Water Conditions where encountered. Temporary Casing or other measures may be used. Permanent Casing is prohibited.

7. The Pole shall not be erected until the foundation concrete has achieved the specified 28-day compressive strength.

8. If the traffic signals or sign panels are not in place within two working days after the arm is erected, a 3.0 foot by 2.0 foot blank ⅛" thick aluminum sign panel shall be attached to the bottom of the arm within six feet of the arm tip and shall remain in place until the signals and signs are installed.

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NOTES

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MAST ARM STRUCTURAL DESIGN CRITERIA

1. Mast Arm Structure Design shall comply with:
   - A. American Society of State Highway and Transportation Officials "LRFD Specifications for Structural Supports for Highway Signs, Luminares, and Traffic Signals" (1st Edition with Interim Revisions through 2017)
   - B. Florida Department of Transportation Structures Manual (January 2017 Edition).
   - C. Fatigue shall be considered in accordance with the requirements of the Florida Department of Transportation Structures Manual (January 2017 Edition).

2. Basic Wind Speed: 150 mph

3. The Mast Arm Design Calculations shall clearly state the Foundation Reactions.

4. To ensure constructability of the drilled shaft foundations, the Mast Arm Anchor Rod Bolt Circle shall not exceed 24" without prior approval of Seminole County Traffic Engineering. An Anchor Rod Bolt Circle larger than 24" will require more stringent construction tolerances for the Drilled Shaft Construction than those in the FDOT Specifications, including more precise fabrication/placement of the reinforcing bar cage and more precise placement of the anchor rods.

5. A grout pad is required.

6. The mast arm structure details shown herein are not complete details. The details only indicate the appearance of the mast arm structure and the connection styles. The fabricator shall be responsible for the complete design and detailing of the mast arm structure. Calculations and Shop Drawings shall be signed and sealed by a professional engineer registered in the State of Florida in compliance with Florida laws and regulations.

MAST ARM STRUCTURE REQUIREMENTS

1. Materials:

   Split-lock washers and self-locking nuts are not permitted.

   - A. Poles, Mast Arms & Backing Rings:
     - 1) Less than 3/16": ASTM A1011 Grade 50, 55, 60, or 65
     - 2) Greater than or equal to 3/16": ASTM A572 Grade 50, 55, 60, or 65
     - 3) All thicknesses: ASTM A595 Grade A (55 ksi yield) or Grade B (60 ksi yield)
   - B. Steel Plates: ASTM A36
   - C. Weld Metal: E70XX
   - D. Bolts, Nuts, and Washers:
     - 1) High Strength Bolts: ASTM F3125, Grade A325, Type 1
     - 2) Nuts: ASTM A563 DH Heavy-Hex
     - 3) Washers: ASTM F436, Type 1 (one under turned element)
   - E. Anchor Rods, Nuts, & Washers:
     - 1) Anchor Rods: ASTM F1554 Grade 55
     - 2) Nuts for Anchor Rods: ASTM A563 Grade A Heavy Hex (5 per anchor rod)
     - 3) Plate Washers: ASTM A36 (2 per anchor rod)
   - F. Threaded Bars/Studs: ASTM A36 or ASTM A307
   - G. Handhole Frame: ASTM A709 Grade 36 or ASTM A36
   - H. Handhole Cover: ASTM A1011 Grade 50, 55, 60, or 65
   - I. Aluminum Pole Caps and Nut Covers: ASTM B26 (319-F)
   - J. Stainless Steel Screws: AISI Type 316

2. Fabrication
   - A. Pole and Mast Arm Taper: Change diameter at a uniform rate of 0.14 inches per foot
   - B. Upright (Pole) splices are not allowed. Transverse welds in pole are only permitted at the base.
   - C. Arm camber shall comply with requirements shown on these Standards.
   - D. Provide bolt hole diameters as follows:
     1. Bolts (excludes Anchor Rods): Bolt diameter plus 1/16", prior to galvanizing.
     2. Anchor Rods: Anchor Rod diameter plus 1/2", prior to galvanizing.
   - E. Unless specifically shown otherwise in the Signalization Plans, face the handhole:
     Single Arm Structures: Perpendicular to arm
     Double Arm Structures: Perpendicular to first arm
   - F. Seam weld on bottom side of arm. Seam weld under Arm 1 side of pole.
   - G. Provide "J" or "C" hook at the top of the pole for signal wiring support.
   - H. Perform all welding in accordance with Specification Article 460-6.4.
   - I. Hot Dip Galvanize and Paint after fabrication.

3. Coatings:
   - A. All Nuts, Bolts, Washers, and Threaded Bars/Studs: ASTM F2329
   - B. All other steel items: ASTM A123
   - C. Paint the entire structure after fabrication in accordance with Specification Article 649-4. Surfaces that will not be exposed after erection need not be painted.

4. Construction:
   - A. Foundation: Specification Section 455 Drilled Shaft, except for method of payment.
   - B. Install Pole vertically.
   - C. Place structural grout pad with drain between the top of the foundation and the bottom of the baseplate in accordance with Specification Article 649-7.
   - D. Attach Sign Panels and Signals centered on the elevation of the Mast Arm.
   - E. Wire Access holes shall be 1½" or less in diameter.

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STRUCTURAL DESIGN CRITERIA
&
MAST ARM STRUCTURE REQUIREMENTS

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SPECIFICATION OF MAST ARMS

The information shown in this table shall be specificed for Mast Arm Structures constructed using these standards.
Provide addtional information and requirements as required and appropriate.

POLE I.D.	POLE TYPE	POLE STYLE	ARM STYLE	COLOR	LUMINAIRE	BASE	BANNER	FIRST ARM LENGTH	SECOND ARM LENGTH	ANGLE BETWEEN ARMS
POLE A										
POLE B										
POLE C										
POLE D										

AVAILABLE OPTIONS

POLE TYPE	POLE STYLE	ARM STYLE	COLOR	LUMINAIRE	BASE	BANNER
POLE TYPE 1	ROUND	CURVED	HUNTER GREEN	SHOE BOX	NUT COVERS	TYPE 1
POLE TYPE 2	FLUTED	STRAIGHT	BLACK	ACORN	DECORATIVE	TYPE 2
POLE TYPE 3				NONE	NONE	NONE
POLE TYPE 4						
POLE TYPE 5						
POLE TYPE 6						

NOTE: MAST ARM STYLE SHALL BE CONSISTENT WITHIN EACH INTERSECTION.

FOR EACH INTERSECTION,
USE EITHER ALL ROUND POLES OR ALL FLUTED POLES,
USE EITHER ALL STRAIGHT ARMS OR ALL CURVED ARMS.

A MIXTURE OF POLES WITH LUMINAIRES AND WITHOUT LUMINAIRES IS PERMITTED.

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POLE SCHEDULE

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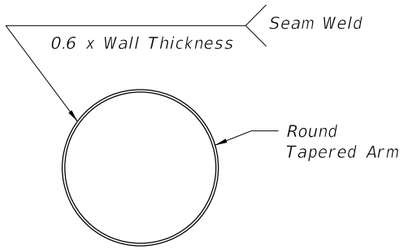
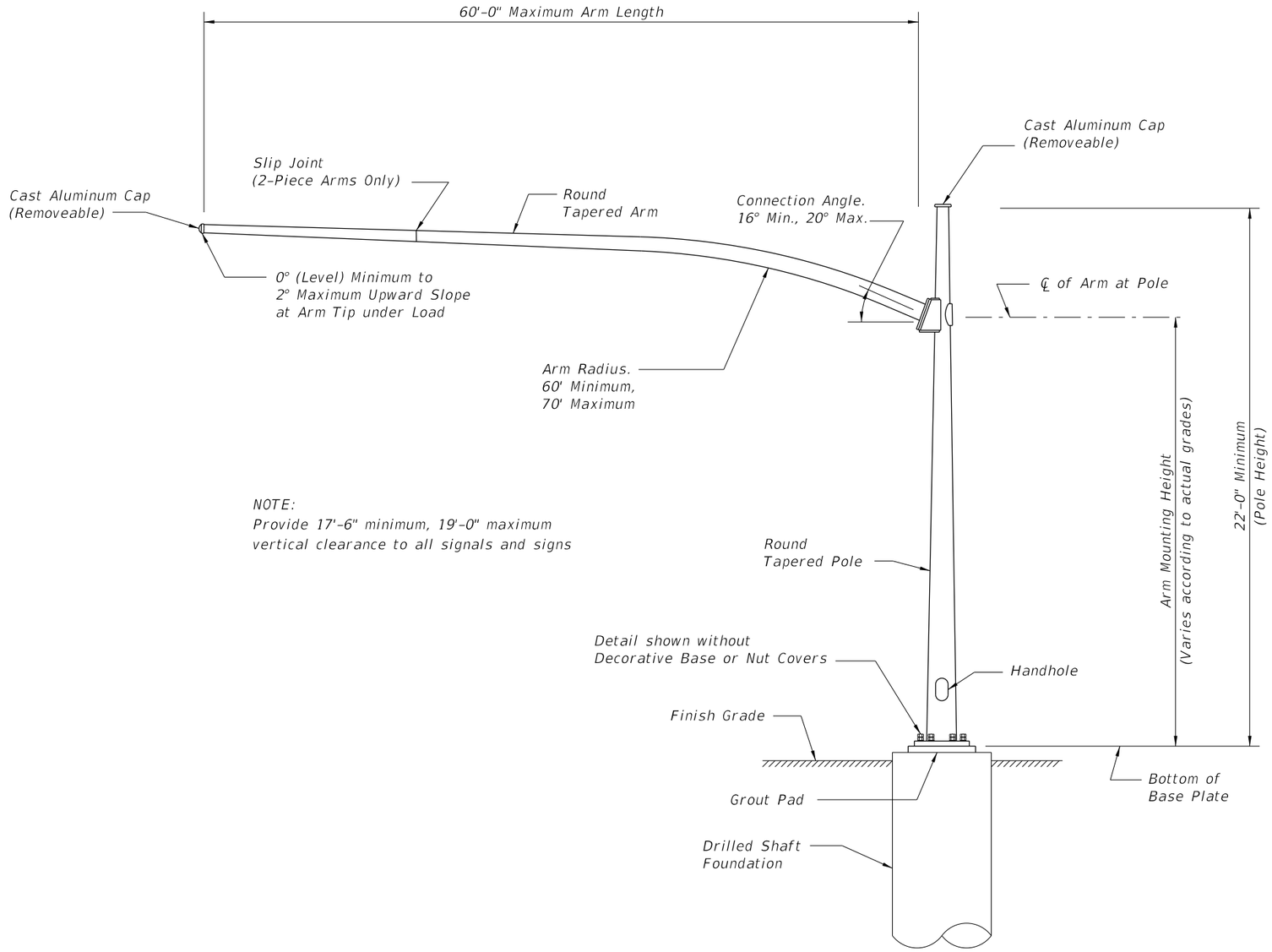
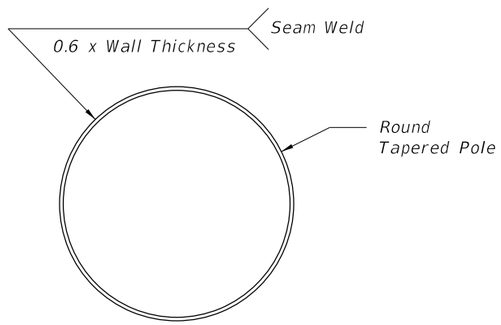


TYPICAL SECTION THROUGH ARM





TYPICAL SECTION THROUGH POLE

ELEVATION - POLE TYPE 1

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POLE TYPE 1
ROUND POLE
CURVED ARM

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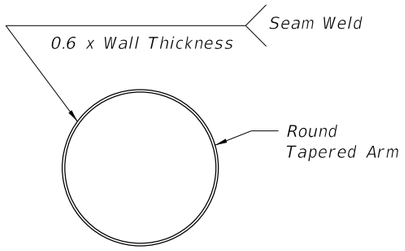

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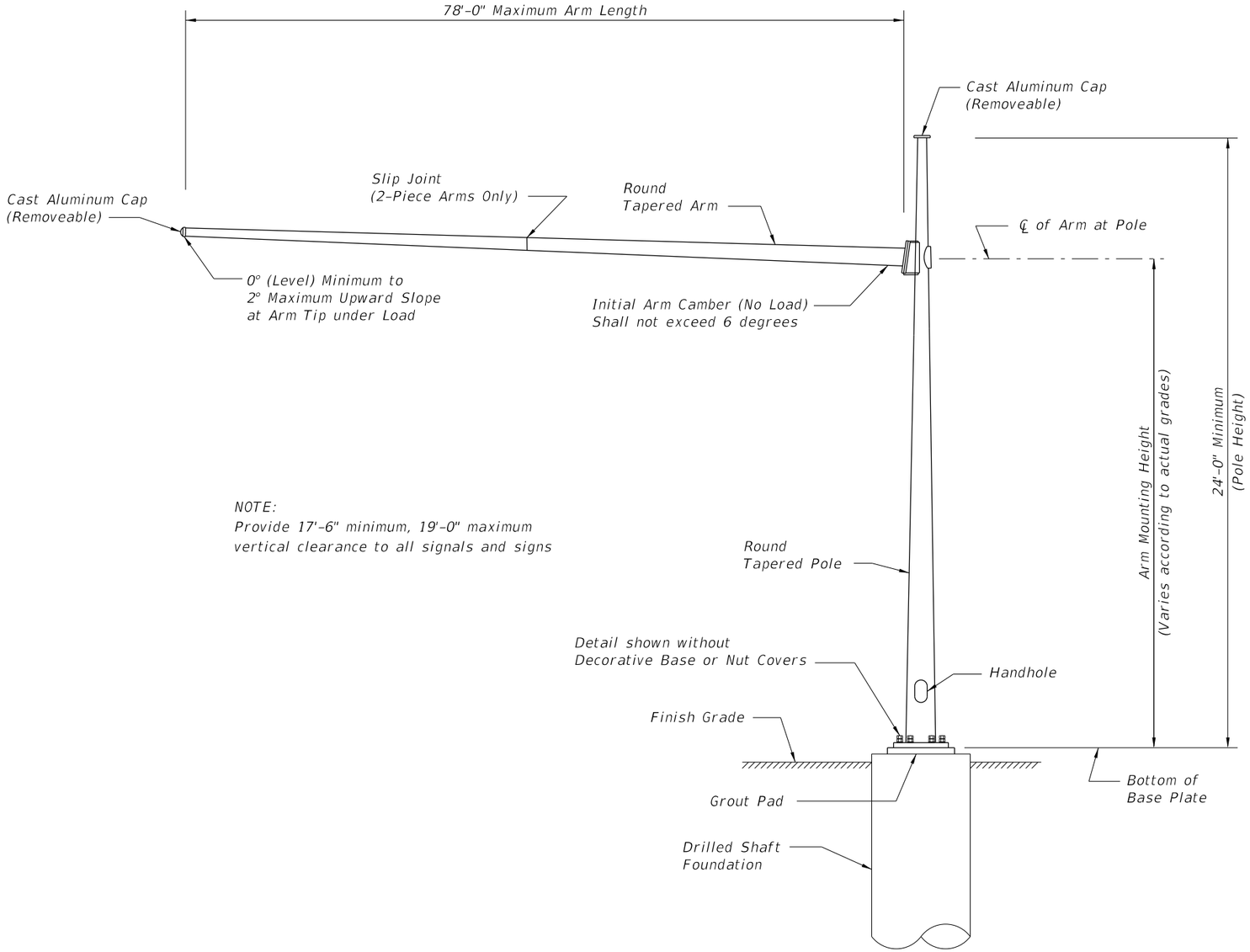

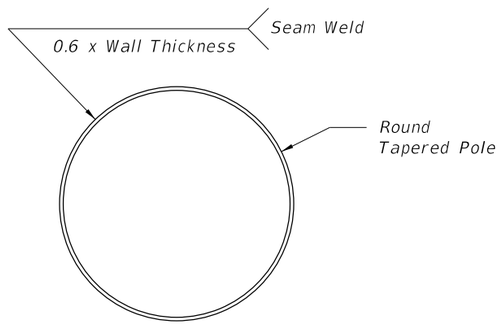

TYPICAL SECTION THROUGH POLE

ELEVATION - POLE TYPE 2

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POLE TYPE 2
ROUND POLE
STRAIGHT ARM

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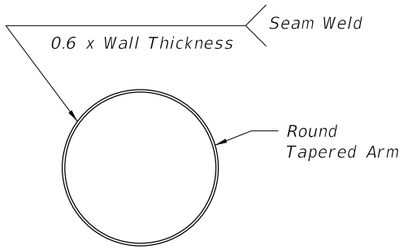

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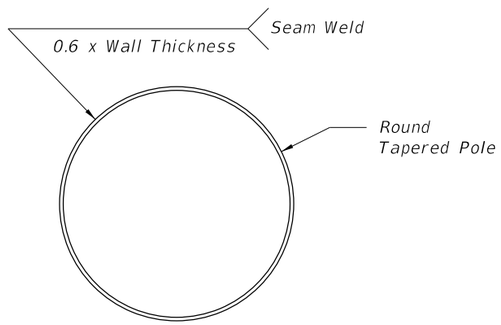
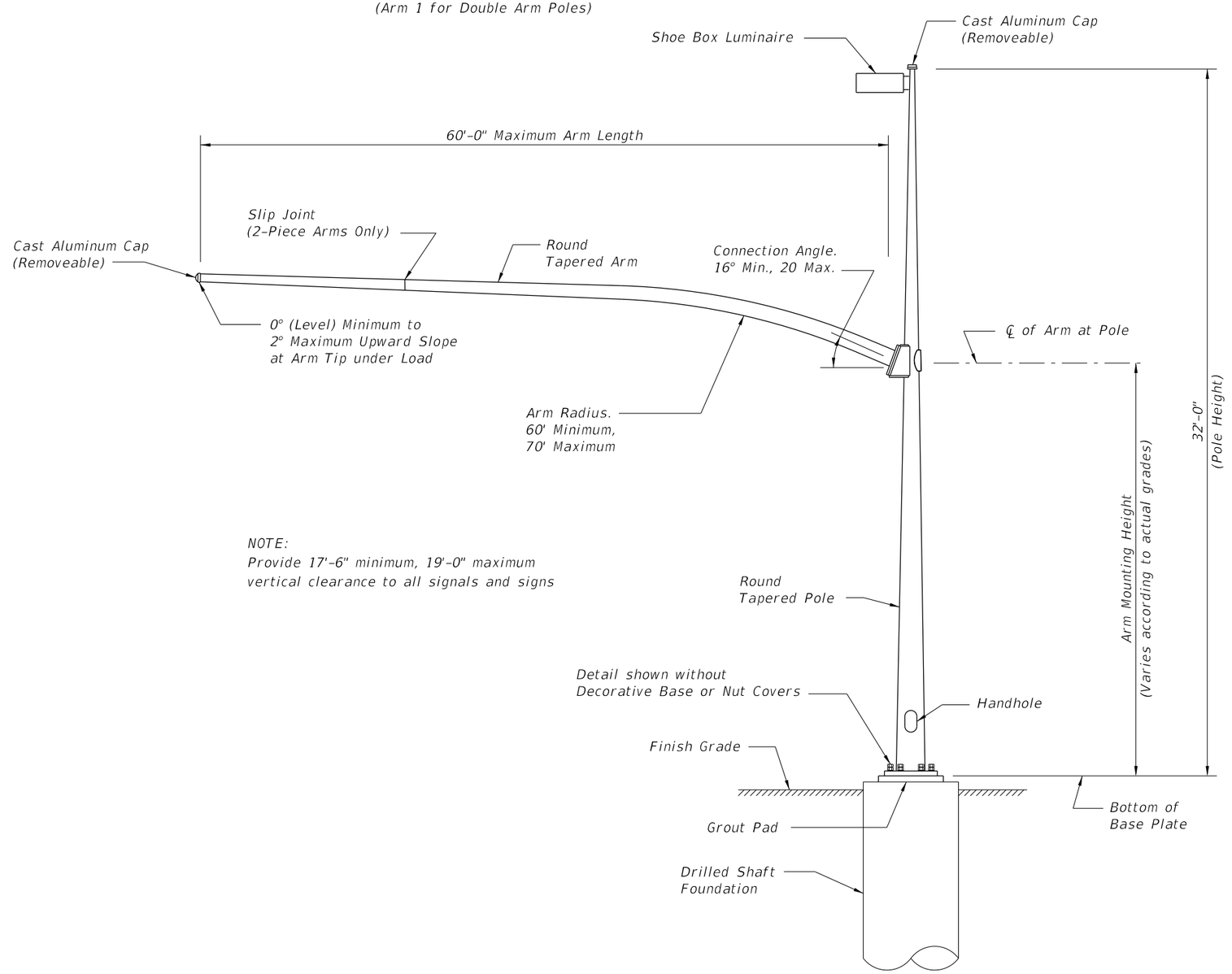


TYPICAL SECTION THROUGH POLE

NOTE:
Designer shall detail orientation of luminaire with respect to Signal Arm (Arm 1 for Double Arm Poles)

NOTE:
Provide 17'-6" minimum, 19'-0" maximum vertical clearance to all signals and signs



ELEVATION - POLE TYPE 3

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POLE TYPE 3
ROUND POLE WITH LUMINAIRE
CURVED ARM

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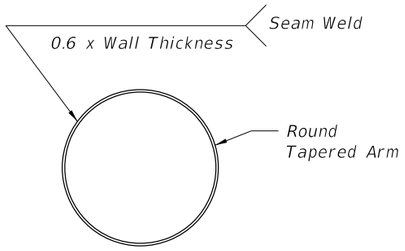

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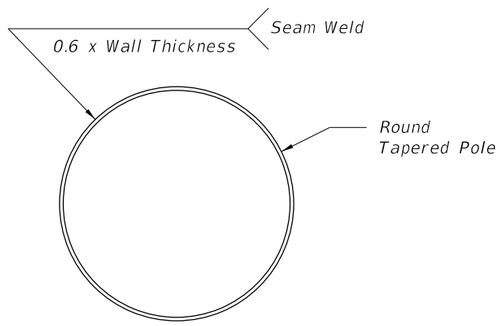
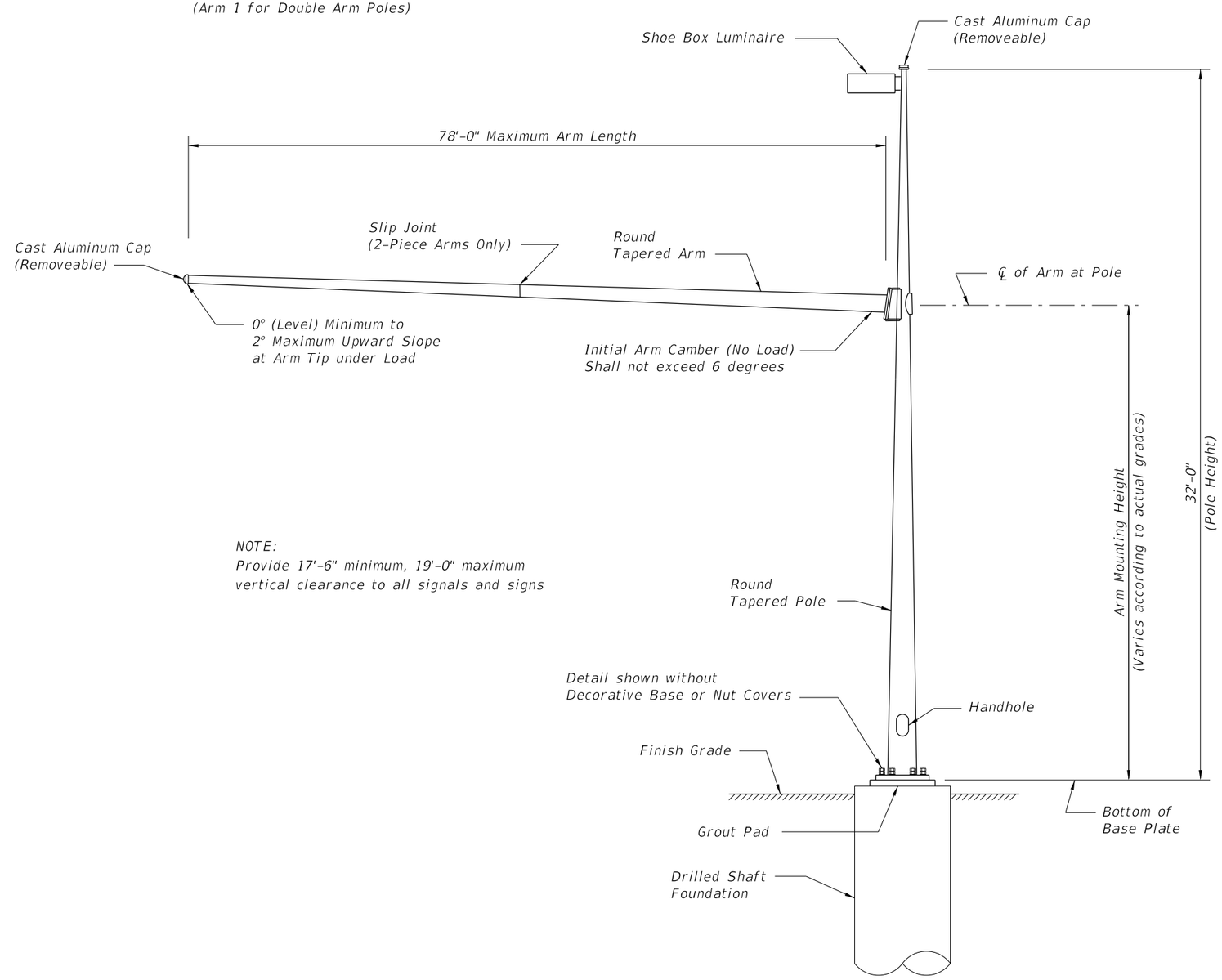


TYPICAL SECTION THROUGH POLE

NOTE:
Designer shall detail orientation of luminaire with respect to Signal Arm (Arm 1 for Double Arm Poles)

NOTE:
Provide 17'-6" minimum, 19'-0" maximum vertical clearance to all signals and signs



ELEVATION - POLE TYPE 4

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POLE TYPE 4
ROUND POLE WITH LUMINAIRE
STRAIGHT ARM

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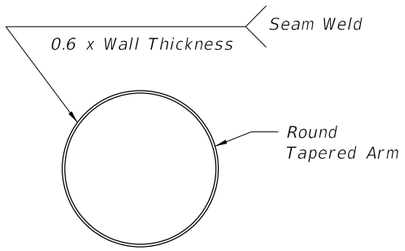

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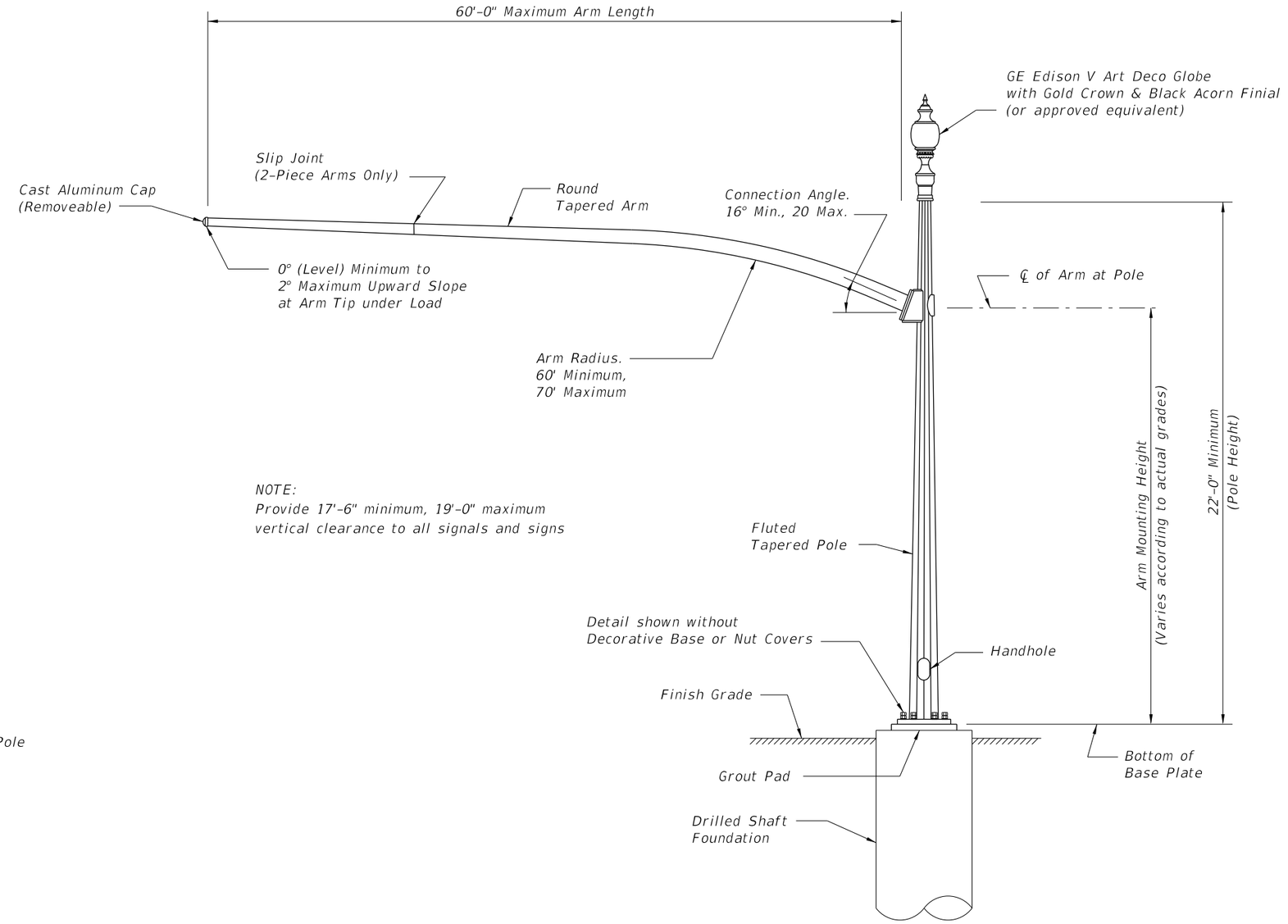

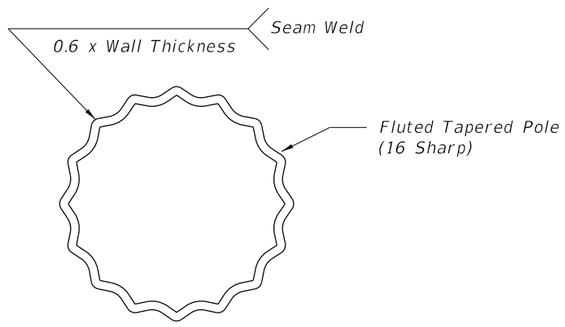

TYPICAL SECTION THROUGH POLE

ELEVATION - POLE TYPE 5

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POLE TYPE 5
FLUTED POLE
CURVED ARM

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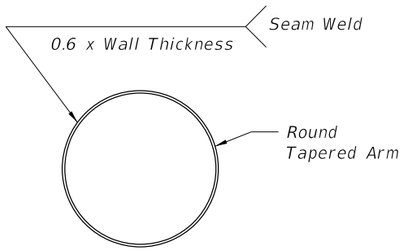

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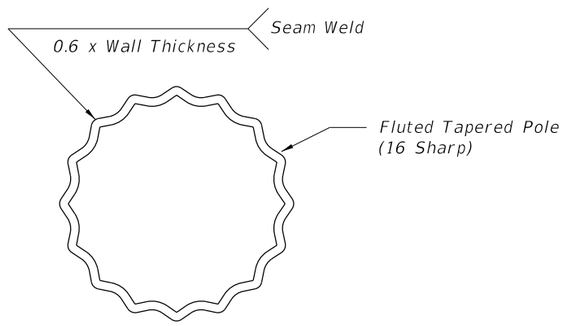

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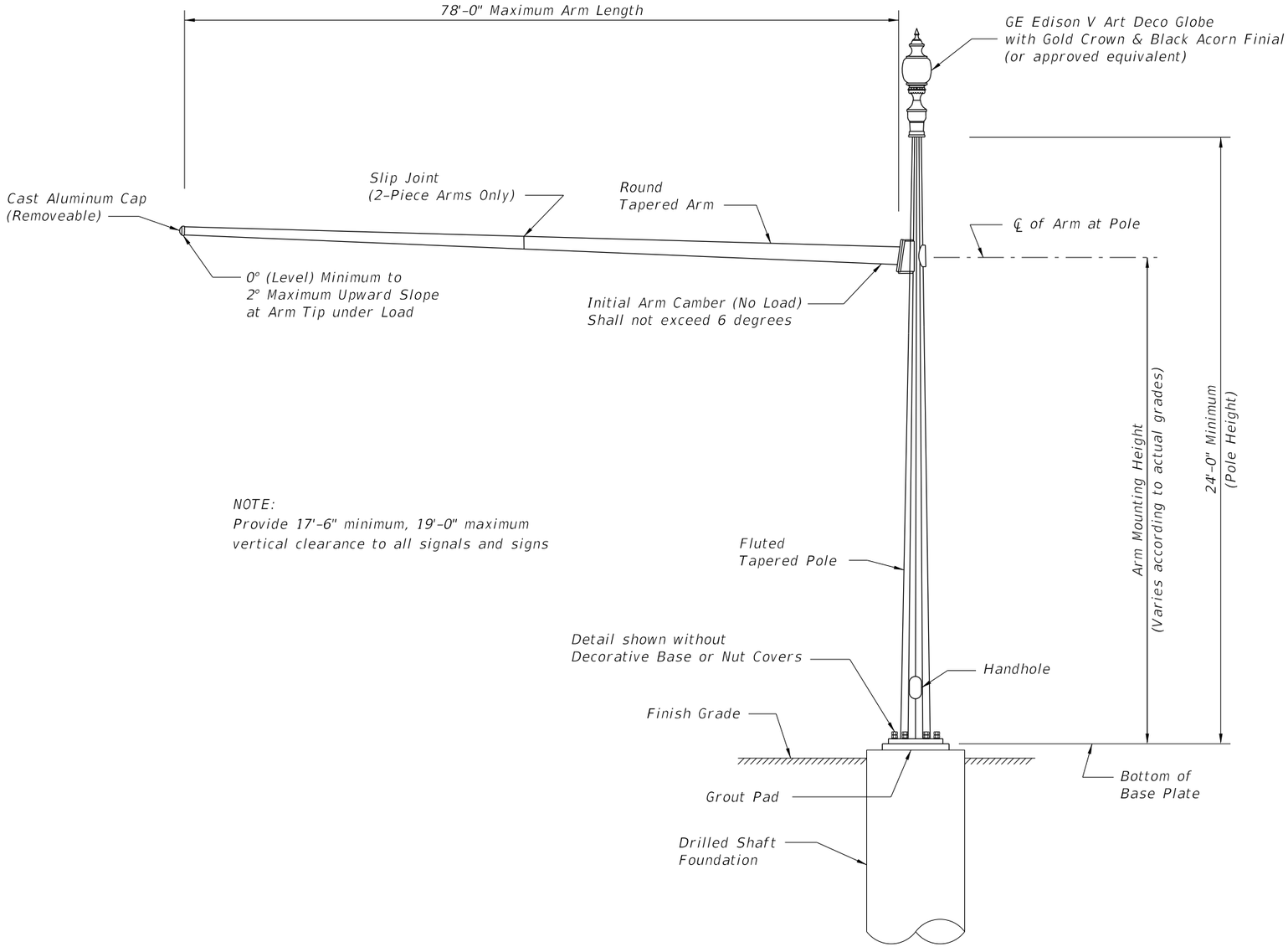

ELEVATION - POLE TYPE 6

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POLE TYPE 6
FLUTED POLE
STRAIGHT ARM

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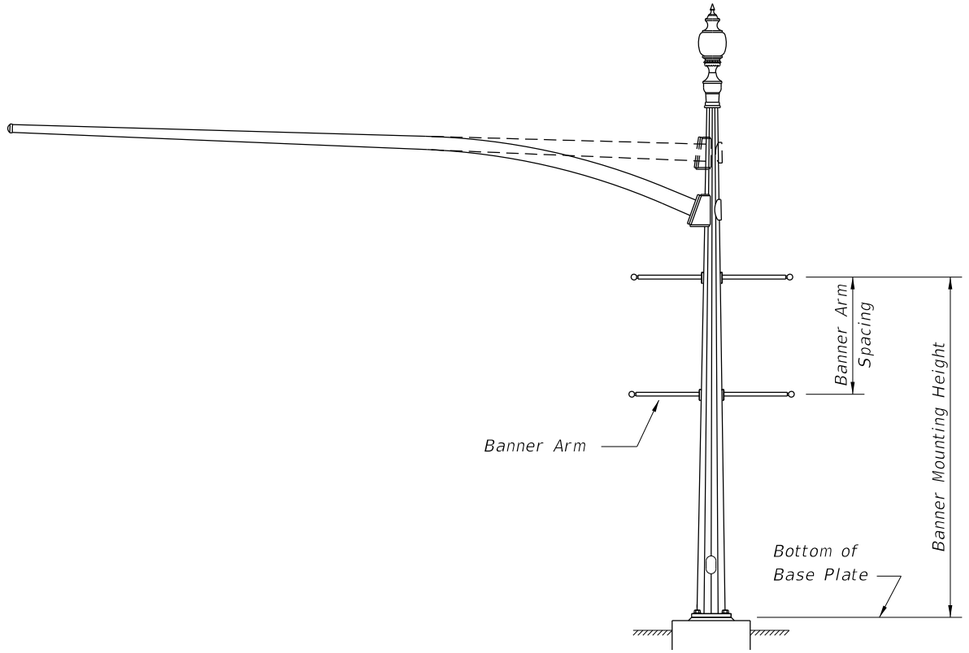
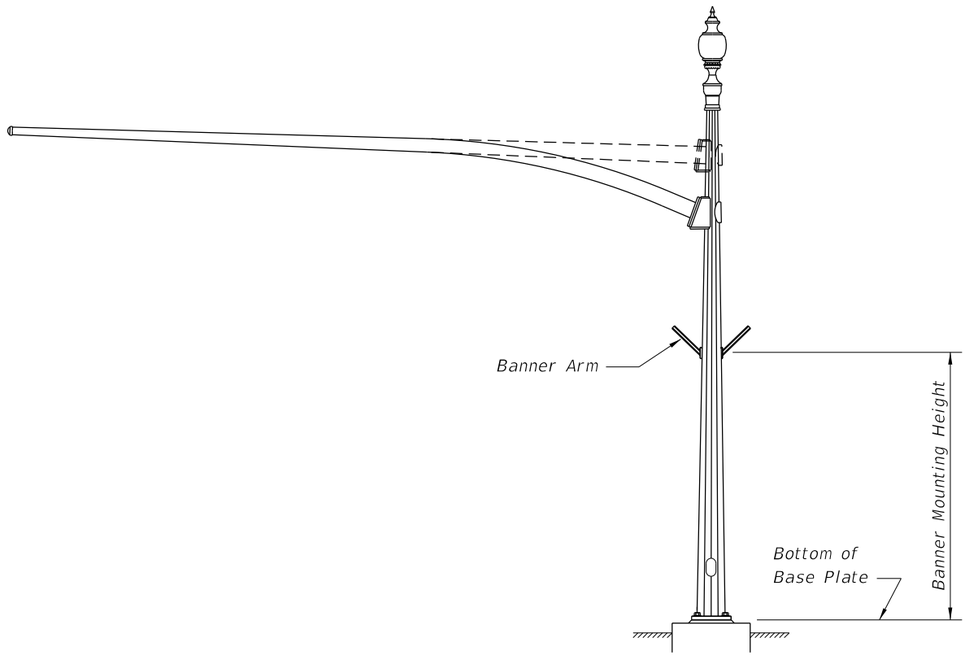
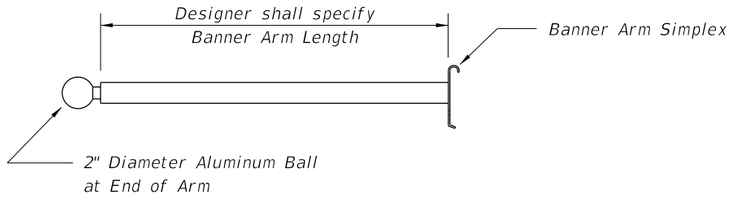


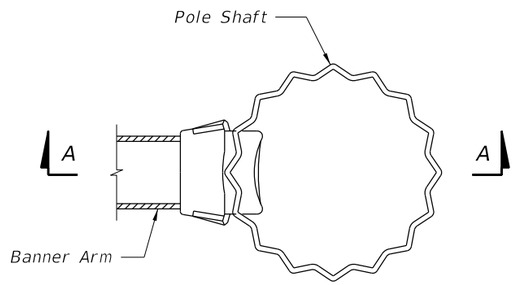
ELEVATION - BANNER TYPE 1



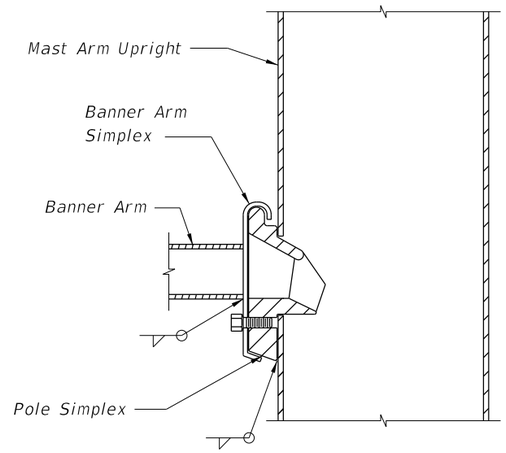
ELEVATION - BANNER TYPE 2



BANNER ARM



PLAN SECTION THROUGH CONNECTION



SECTION A-A

BANNER ARM ATTACHMENT DETAILS

NOTE:
Designer must specify complete Banner Arm Details including:
- Banner Arm Type (Type 1, Type 2, or None),
- Banner Arm Location (inside, outside, or both sides),
- Banner Arm Mounting Height & Banner Arm Spacing,
- Banner Arm Length,
- Banner Arm Angle (Type 2 Banners only),
- and all special requirements

Designer shall include appropriate notes & details as required.

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BANNER DETAILS

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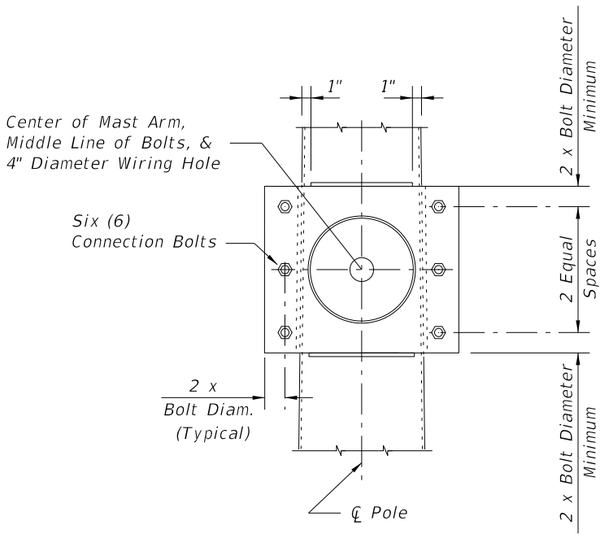
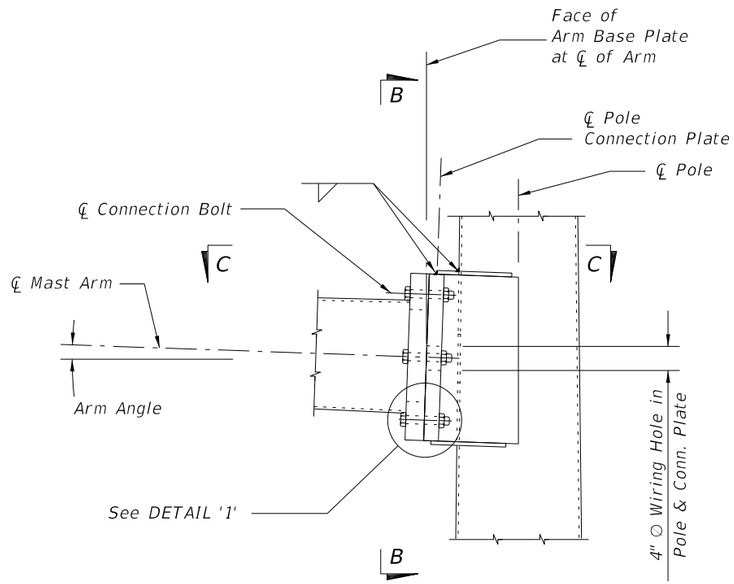
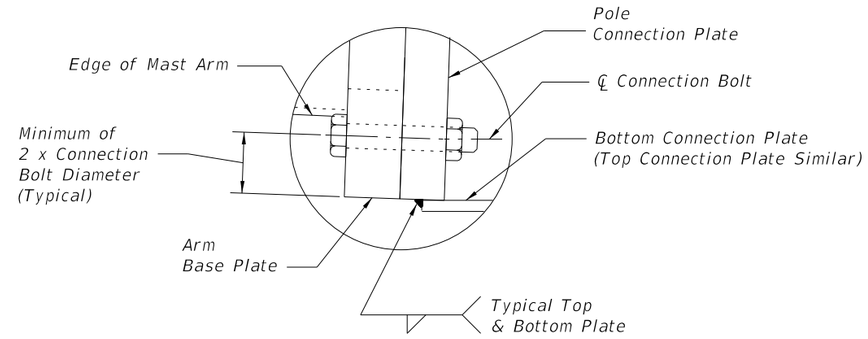


SECTION B-B

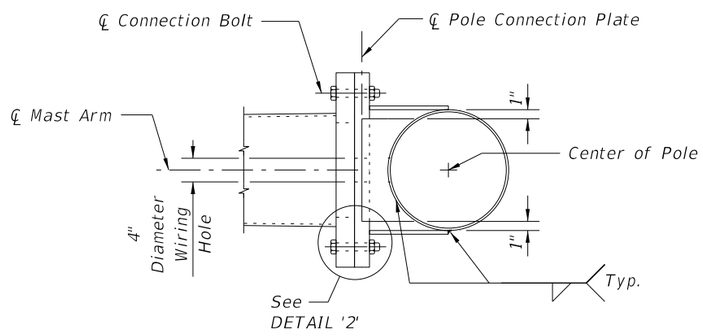


ELEVATION

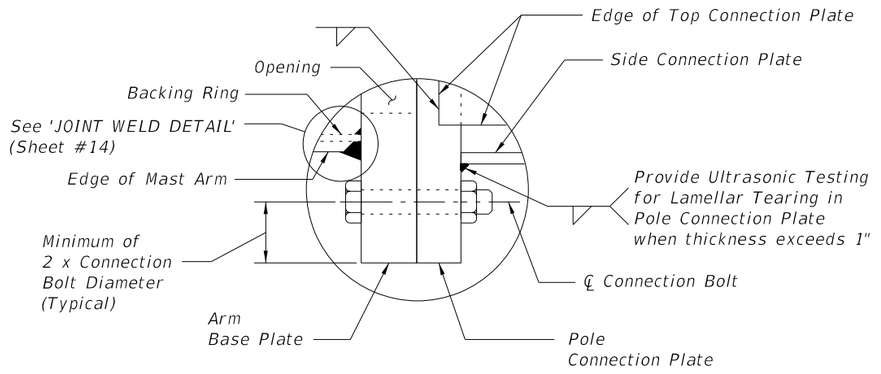
NOTE:
Details drawn for round pole,
Details for fluted pole similar.



DETAIL '1'



SECTION C-C



DETAIL '2'

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ARM-TO-POLE CONNECTION
SINGLE ARM

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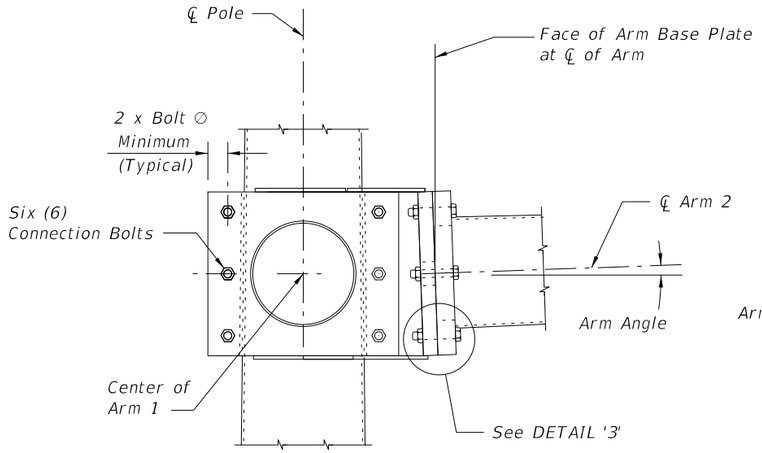
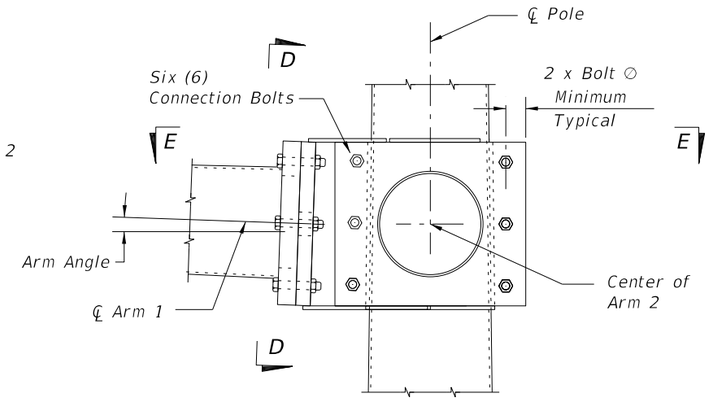
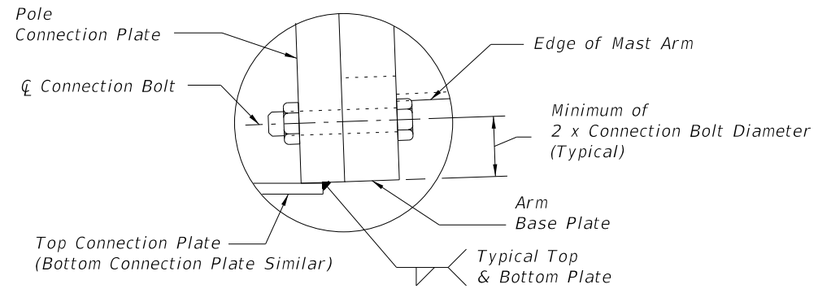


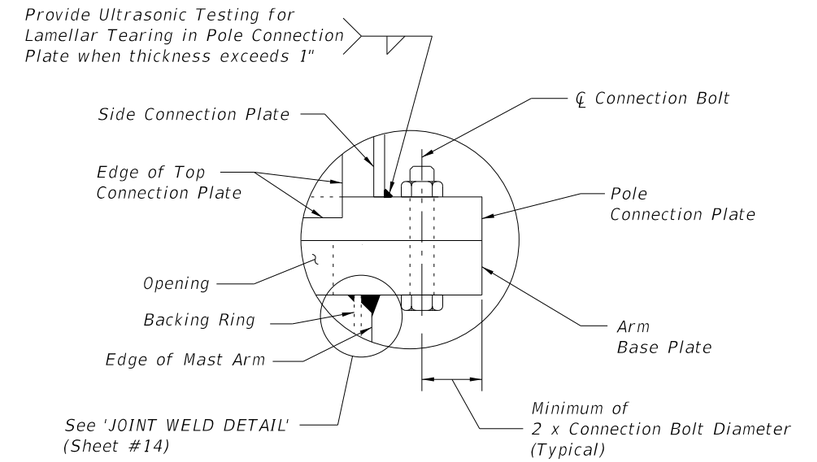
SECTION D-D



ELEVATION



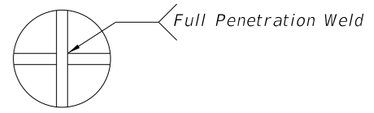
DETAIL '3'



DETAIL '4'

SECTION E-E

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



DETAIL '5'

NOTE:
Details drawn for round pole,
Details for fluted pole similar.

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ARM-TO-POLE CONNECTION
DOUBLE ARM

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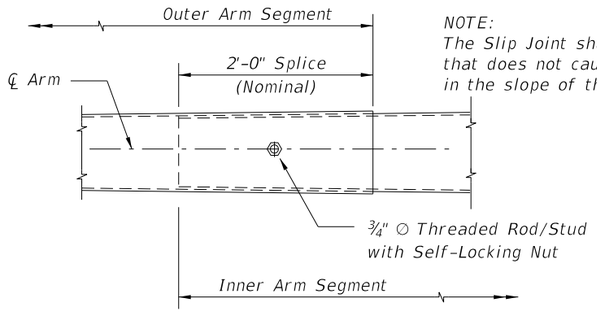
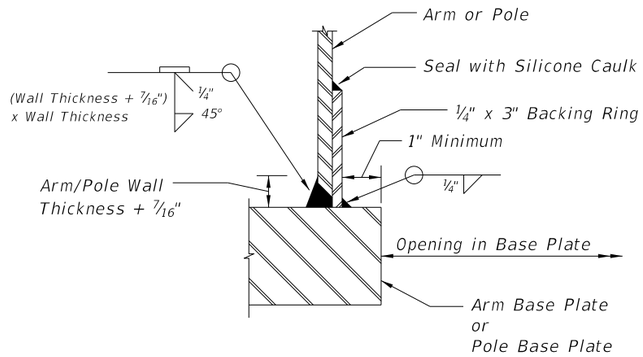


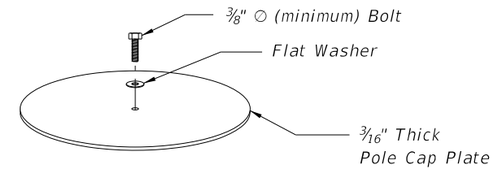
NOTE:
The Slip Joint shall be a tight fit that does not cause any change in the slope of the Mast Arm.

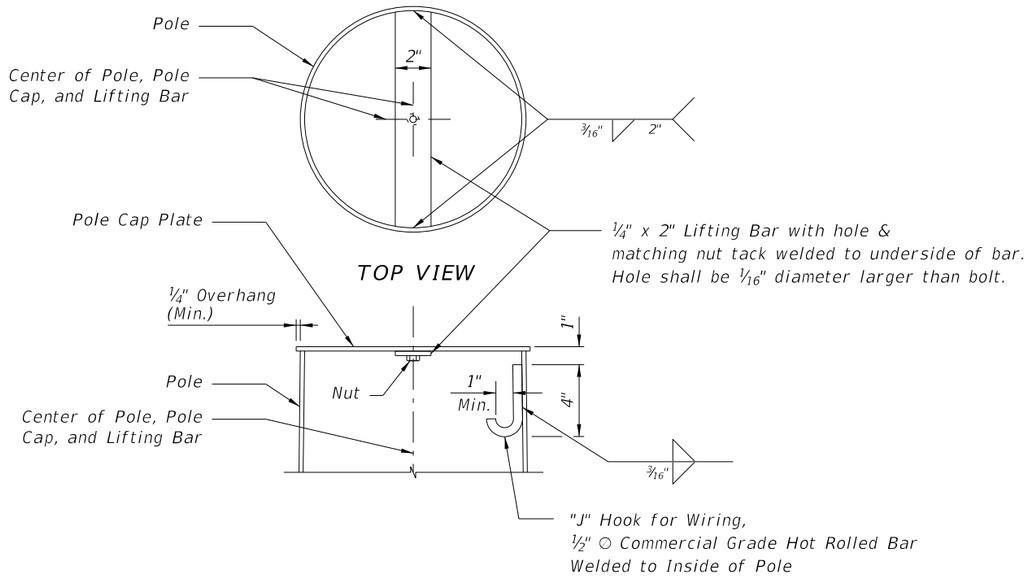
ARM SPLICE DETAIL



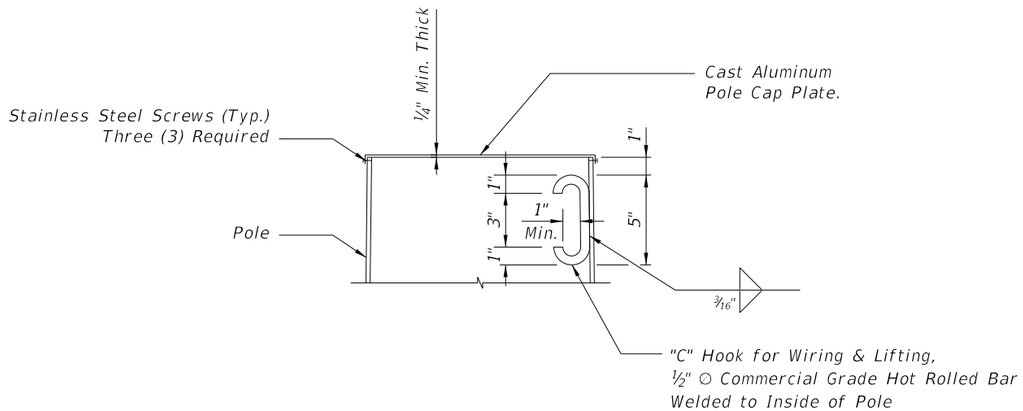
JOINT WELD DETAIL

Arm To Connection Plate
&
Pole To Base Plate





OPTION "A"



OPTION "B"

TOP OF POLE DETAILS

NOTE:
Any combination of the details shown in the two options may be used, provided both lifting and wiring are accommodated.

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MAST ARM DETAILS

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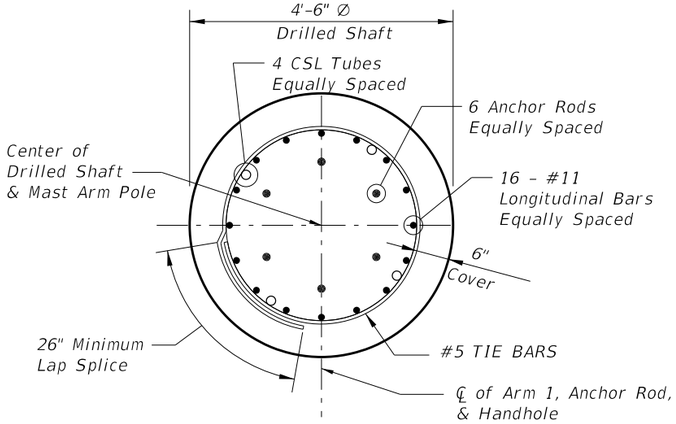
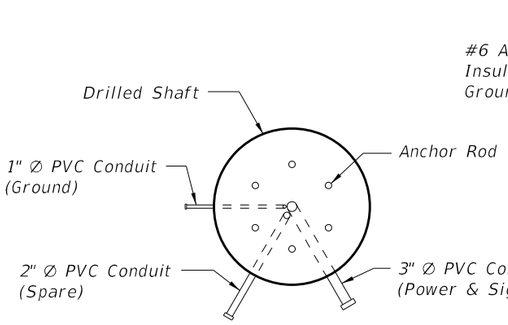
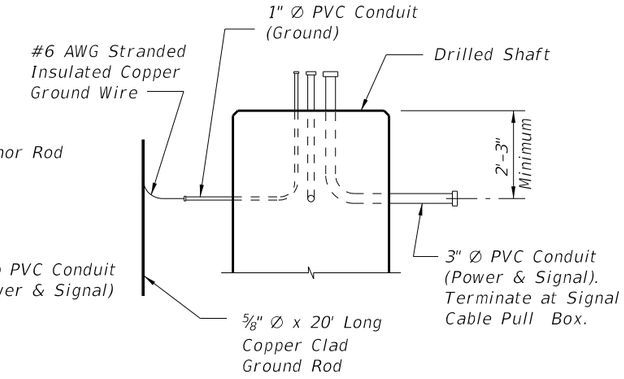


SECTION F-F

(Conduits Not Shown)



PLAN VIEW

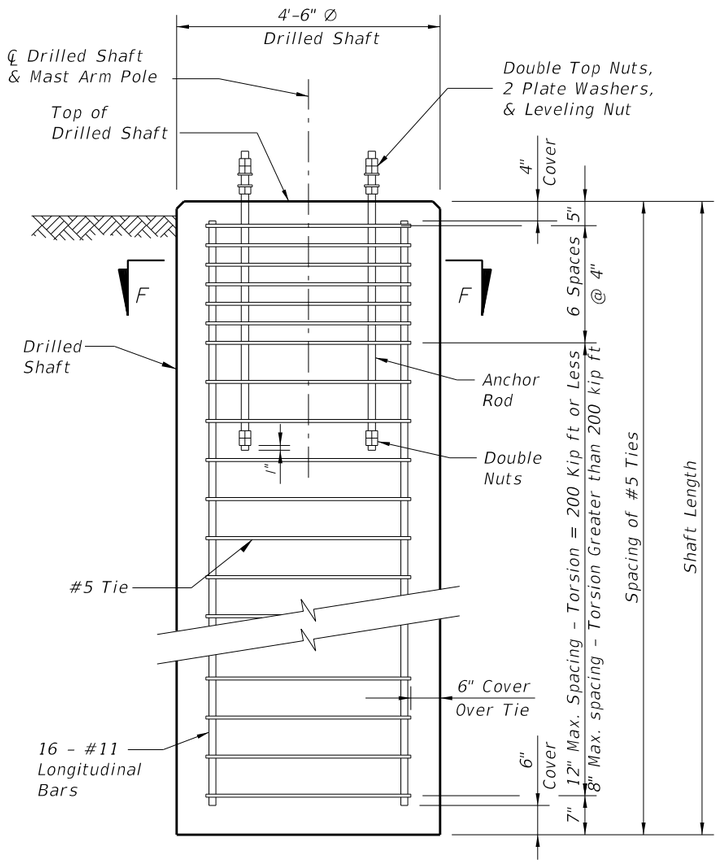


ELEVATION

NOTE:
See MAST ARM STRUCTURAL DESIGN CRITERIA, Note #4 on Sheet #3 for restriction on diameter of Anchor Rod Bolt Circle.

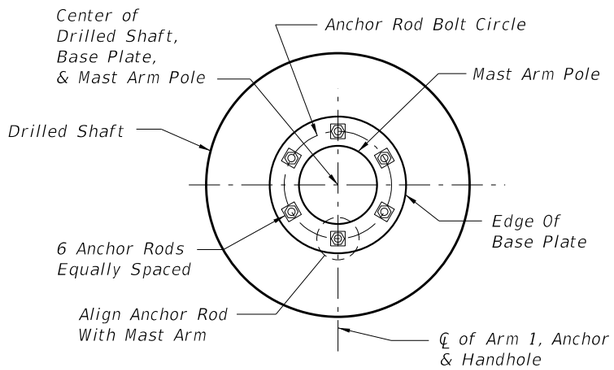
FOUNDATION CONDUIT DETAIL

Conduit Notes:
1. Details shown are schematic.
2. Adjust Conduit Orientation as required to clear Anchor Rods, Drilled Shaft Reinforcing, and CSL tubes.
3. Extend Conduits to 1" below bottom of Mast Arm Handhole.



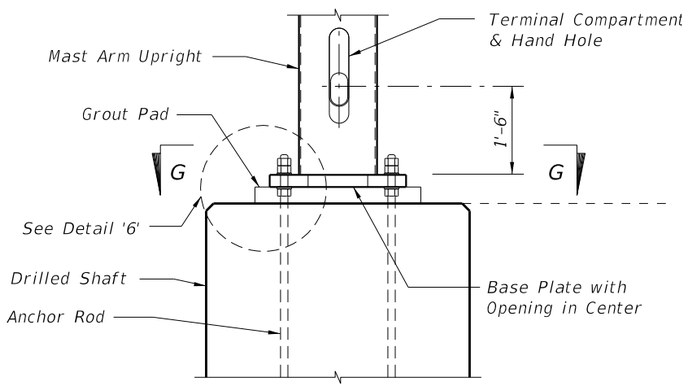
ELEVATION - DRILLED SHAFT

(CSL Tubes & Conduits Not Shown)



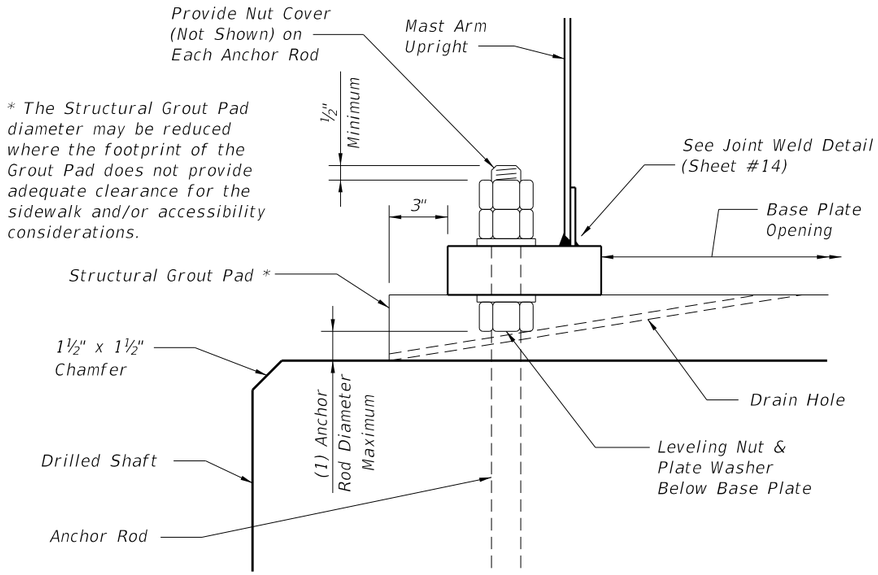
SECTION G-G

(CSL Tubes, & Conduits Not Shown)



BASE PLATE & ANCHORAGE ELEVATION

(Shaft Reinforcing, CSL Tubes & Conduits Not Shown)



* The Structural Grout Pad diameter may be reduced where the footprint of the Grout Pad does not provide adequate clearance for the sidewalk and/or accessibility considerations.

DETAIL '6'
PARTIAL SECTION THROUGH BASE PLATE
AT CENTER OF BASE PLATE

(Shaft Reinforcing, CSL Tubes, & Conduits Not Shown)

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FOUNDATION DETAILS

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TABLE NOTES

1. The Moment and Torsion Capacities are LRFD Capacities.
   The values in the Table of Foundation Capacities are limited to:
   Overturning Moment: 300 kip*ft
   Torsion: 375 kip*ft

2. The foundation information and details shown are for foundations meeting specific soil properties:
   Internal Angle of Friction (Phi Angle)
   Soil Effective Unit Weight (saturated unit weight minus water unit weight)
   SPT Blow Count (blows per foot) (uncorrected)
   These parameters are assumed to exist for the entire embedded depth of the drilled shaft.

3. The information provided in the Table of Foundation Capacities is only valid if all of the following conditions are met:

   A. The existing soil conditions meet all of the parameters listed for the standard soil type (see GEOTECHNICAL REQUIREMENTS & SOILS DATA LETTER, Note #6 on Sheet 2 for exception).

   B. The ground surface slope is 4:1 (Horizontal to Vertical) or flatter for a minimum of 8 feet from the center of the foundation in all directions.

   C. The foundations are constructed in accordance with these standards.

   If any of these conditions are not met, then the foundation information and details shown herein do not apply and a special foundation must be designed. See Sheet 2 for foundation design and submittal requirements.

4. If the Base Moment or Base Torsion exceed the values shown in the Table of Foundation Capacities, then a special foundation must be designed. See requirements this sheet and Sheet 2 for foundation design criteria and submittal requirements.

5. See Sheet 2 for additional notes.

FOUNDATION CAPACITY CRITERIA

1. The Drilled Shaft Moment and Torsion Capacities are determined in accordance with the FDOT Structures Manual (January 2017 Edition) with parameters and modifications as listed herein.

2. Design Parameters:
   Resistance Factor – Overturning: 0.60
   Resistance Factor – Torsion: 0.90
   Horizontal Shear (Applied at Top of Drilled Shaft): 10.0 Kips

3. The foundation capacity assumes that:
   a) The top of the foundation extends 6" above grade
   b) The top 18" of soil is loose or disturbed
   To account for these assumptions, the top 2'-0" of the shaft length is considered to provide no contribution to the overturning or torsion resistance and therefore the soil within that limit is totally neglected.

4. Torsion resistance is computed solely for skin friction.
   No contribution from bottom friction is considered.

TABLE LEGEND

Φ: Soil Internal Angle of Friction (Phi Angle)
γ: Soil Effective Unit Weight
N: SPT Blow Count (Blows per Foot) (Uncorrected)

TABLE OF FOUNDATION CAPACITIES

SOIL TYPE: 28-40-06 Φ: 28 DEGREES γ: 40 PCF N: 9 > N ≥ 6	LENGTH (FEET)	12	13	14	15	16	17	18	19	20	21	22	23	24
	MOMENT (KIP*FEET)	29	68	116	175	245	300	300	300	300	300	300	300	300
	TORSION (KIP*FEET)	34	42	49	58	67	77	88	99	111	124	137	151	166
SOIL TYPE: 28-40-09 Φ: 28 DEGREES γ: 40 PCF N: 12 > N ≥ 9	LENGTH (FEET)	12	13	14	15	16	17	18	19	20	21	22	23	24
	MOMENT (KIP*FEET)	29	68	116	175	245	300	300	300	300	300	300	300	300
	TORSION (KIP*FEET)	52	62	74	87	101	116	132	149	167	186	206	227	249
SOIL TYPE: 28-40-12 Φ: 28 DEGREES γ: 40 PCF N: 15 > N ≥ 12	LENGTH (FEET)	12	13	14	15	16	17	18	19	20	21	22	23	24
	MOMENT (KIP*FEET)	29	68	116	175	245	300	300	300	300	300	300	300	300
	TORSION (KIP*FEET)	69	83	99	116	135	155	176	199	223	248	275	303	333
SOIL TYPE: 28-40-15 Φ: 28 DEGREES γ: 40 PCF N: N ≥ 15	LENGTH (FEET)	12	13	14	15	16	17	18	19	20	21	22	23	
	MOMENT (KIP*FEET)	29	68	116	175	245	300	300	300	300	300	300	300	
	TORSION (KIP*FEET)	86	104	124	145	168	193	220	248	278	310	344	375	
SOIL TYPE: 28-50-06 Φ: 28 DEGREES γ: 50 PCF N: 9 > N ≥ 6	LENGTH (FEET)	12	13	14	15	16	17	18	19	20	21	22	23	24
	MOMENT (KIP*FEET)	66	116	179	256	300	300	300	300	300	300	300	300	300
	TORSION (KIP*FEET)	43	52	62	73	84	97	110	124	139	155	172	189	208
SOIL TYPE: 28-50-09 Φ: 28 DEGREES γ: 50 PCF N: 12 > N ≥ 9	LENGTH (FEET)	12	13	14	15	16	17	18	19	20	21	22	23	24
	MOMENT (KIP*FEET)	66	116	179	256	300	300	300	300	300	300	300	300	300
	TORSION (KIP*FEET)	64	78	93	109	126	145	165	186	209	233	258	284	312
SOIL TYPE: 28-50-12 Φ: 28 DEGREES γ: 50 PCF N: 15 > N ≥ 12	LENGTH (FEET)	12	13	14	15	16	17	18	19	20	21	22	23	
	MOMENT (KIP*FEET)	66	116	179	256	300	300	300	300	300	300	300	300	
	TORSION (KIP*FEET)	86	104	124	145	168	193	220	248	278	310	344	375	
SOIL TYPE: 28-50-15 Φ: 28 DEGREES γ: 50 PCF N: N ≥ 15	LENGTH (FEET)	12	13	14	15	16	17	18	19	20	21			
	MOMENT (KIP*FEET)	66	116	179	256	300	300	300	300	300	300			
	TORSION (KIP*FEET)	107	130	155	181	210	242	275	310	348	375			
SOIL TYPE: 28-60-06 Φ: 28 DEGREES γ: 60 PCF N: 9 > N ≥ 6	LENGTH (FEET)	12	13	14	15	16	17	18	19	20	21	22	23	24
	MOMENT (KIP*FEET)	102	165	243	300	300	300	300	300	300	300	300	300	300
	TORSION (KIP*FEET)	52	62	74	87	101	116	132	149	167	186	206	227	249
SOIL TYPE: 28-60-09 Φ: 28 DEGREES γ: 60 PCF N: 12 > N ≥ 9	LENGTH (FEET)	12	13	14	15	16	17	18	19	20	21	22	23	24
	MOMENT (KIP*FEET)	102	165	243	300	300	300	300	300	300	300	300	300	300
	TORSION (KIP*FEET)	77	94	111	131	151	174	198	223	250	279	309	341	374
SOIL TYPE: 28-60-12 Φ: 28 DEGREES γ: 60 PCF N: 15 > N ≥ 12	LENGTH (FEET)	12	13	14	15	16	17	18	19	20	21	22		
	MOMENT (KIP*FEET)	102	165	243	300	300	300	300	300	300	300	300		
	TORSION (KIP*FEET)	103	125	148	174	202	232	264	298	334	372	375		
SOIL TYPE: 28-60-15 Φ: 28 DEGREES γ: 60 PCF N: N ≥ 15	LENGTH (FEET)	12	13	14	15	16	17	18	19	20				
	MOMENT (KIP*FEET)	102	165	243	300	300	300	300	300	300				
	TORSION (KIP*FEET)	129	156	186	218	252	290	330	372	375				

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FOUNDATION CAPACITIES (1 OF 2)

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TABLE OF FOUNDATION CAPACITIES

SOIL TYPE: 30-40-06 Φ: 30 DEGREES γ: 40 PCF N: 9 > N ≥ 6	LENGTH (FEET)	12	13	14	15	16	17	18	19	20	21	22	23	24
	MOMENT (KIP*FEET)	41	84	137	202	279	300	300	300	300	300	300	300	300
	TORSION (KIP*FEET)	34	42	49	58	67	77	88	99	111	124	137	151	166
SOIL TYPE: 30-40-09 Φ: 30 DEGREES γ: 40 PCF N: 12 > N ≥ 9	LENGTH (FEET)	12	13	14	15	16	17	18	19	20	21	22	23	24
	MOMENT (KIP*FEET)	41	84	137	202	279	300	300	300	300	300	300	300	300
	TORSION (KIP*FEET)	52	62	74	87	101	116	132	149	167	186	206	227	249
SOIL TYPE: 30-40-12 Φ: 30 DEGREES γ: 40 PCF N: 15 > N ≥ 12	LENGTH (FEET)	12	13	14	15	16	17	18	19	20	21	22	23	24
	MOMENT (KIP*FEET)	41	84	137	202	279	300	300	300	300	300	300	300	300
	TORSION (KIP*FEET)	69	83	99	116	135	155	176	199	223	248	275	303	333
SOIL TYPE: 30-40-15 Φ: 30 DEGREES γ: 40 PCF N: N ≥ 15	LENGTH (FEET)	12	13	14	15	16	17	18	19	20	21	22	23	
	MOMENT (KIP*FEET)	41	84	137	202	279	300	300	300	300	300	300	300	
	TORSION (KIP*FEET)	86	104	124	145	168	193	220	248	278	310	344	375	
SOIL TYPE: 30-50-06 Φ: 30 DEGREES γ: 50 PCF N: 9 > N ≥ 6	LENGTH (FEET)	12	13	14	15	16	17	18	19	20	21	22	23	24
	MOMENT (KIP*FEET)	81	137	206	289	300	300	300	300	300	300	300	300	300
	TORSION (KIP*FEET)	43	52	62	73	84	97	110	124	139	155	172	189	208
SOIL TYPE: 30-50-09 Φ: 30 DEGREES γ: 50 PCF N: 12 > N ≥ 9	LENGTH (FEET)	12	13	14	15	16	17	18	19	20	21	22	23	24
	MOMENT (KIP*FEET)	81	137	206	289	300	300	300	300	300	300	300	300	300
	TORSION (KIP*FEET)	64	78	93	109	126	145	165	186	209	233	258	284	312
SOIL TYPE: 30-50-12 Φ: 30 DEGREES γ: 50 PCF N: 15 > N ≥ 12	LENGTH (FEET)	12	13	14	15	16	17	18	19	20	21	22	23	
	MOMENT (KIP*FEET)	81	137	206	289	300	300	300	300	300	300	300	300	
	TORSION (KIP*FEET)	86	104	124	145	168	193	220	248	278	310	344	375	
SOIL TYPE: 30-50-15 Φ: 30 DEGREES γ: 50 PCF N: N ≥ 15	LENGTH (FEET)	12	13	14	15	16	17	18	19	20	21			
	MOMENT (KIP*FEET)	81	137	206	289	300	300	300	300	300	300			
	TORSION (KIP*FEET)	107	130	155	181	210	242	275	310	348	375			
SOIL TYPE: 30-60-06 Φ: 30 DEGREES γ: 60 PCF N: 9 > N ≥ 6	LENGTH (FEET)	12	13	14	15	16	17	18	19	20	21	22	23	24
	MOMENT (KIP*FEET)	121	190	274	300	300	300	300	300	300	300	300	300	300
	TORSION (KIP*FEET)	52	62	74	87	101	116	132	149	167	186	206	227	249
SOIL TYPE: 30-60-09 Φ: 30 DEGREES γ: 60 PCF N: 12 > N ≥ 9	LENGTH (FEET)	12	13	14	15	16	17	18	19	20	21	22	23	24
	MOMENT (KIP*FEET)	121	190	274	300	300	300	300	300	300	300	300	300	300
	TORSION (KIP*FEET)	77	94	111	131	151	174	198	223	250	279	309	341	374
SOIL TYPE: 30-60-12 Φ: 30 DEGREES γ: 60 PCF N: 15 > N ≥ 12	LENGTH (FEET)	12	13	14	15	16	17	18	19	20	21	22		
	MOMENT (KIP*FEET)	121	190	274	300	300	300	300	300	300	300	300		
	TORSION (KIP*FEET)	103	125	148	174	202	232	264	298	334	372	375		
SOIL TYPE: 30-60-15 Φ: 30 DEGREES γ: 60 PCF N: N ≥ 15	LENGTH (FEET)	12	13	14	15	16	17	18	19	20				
	MOMENT (KIP*FEET)	121	190	274	300	300	300	300	300	300				
	TORSION (KIP*FEET)	129	156	186	218	252	290	330	372	375				

NOTE:
See Sheet 16 for Table Notes &
Criteria used for Foundation Capacities.

TABLE LEGEND

Φ: Soil Internal Angle of Friction (Phi Angle)
γ: Soil Effective Unit Weight
N: SPT Blow Count (Blows per Foot) (Uncorrected)

REVISIONS		
DATE	BY	DESCRIPTION

SEMINOLE COUNTY
FLORIDA'S NATURAL CHOICE

2017-18
STANDARD MAST ARM DRAWINGS

SEMINOLE COUNTY TRAFFIC ENGINEERING
140 BUSH LOOP - SANFORD, FL 32773
407-665-5677

FOUNDATION CAPACITIES
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