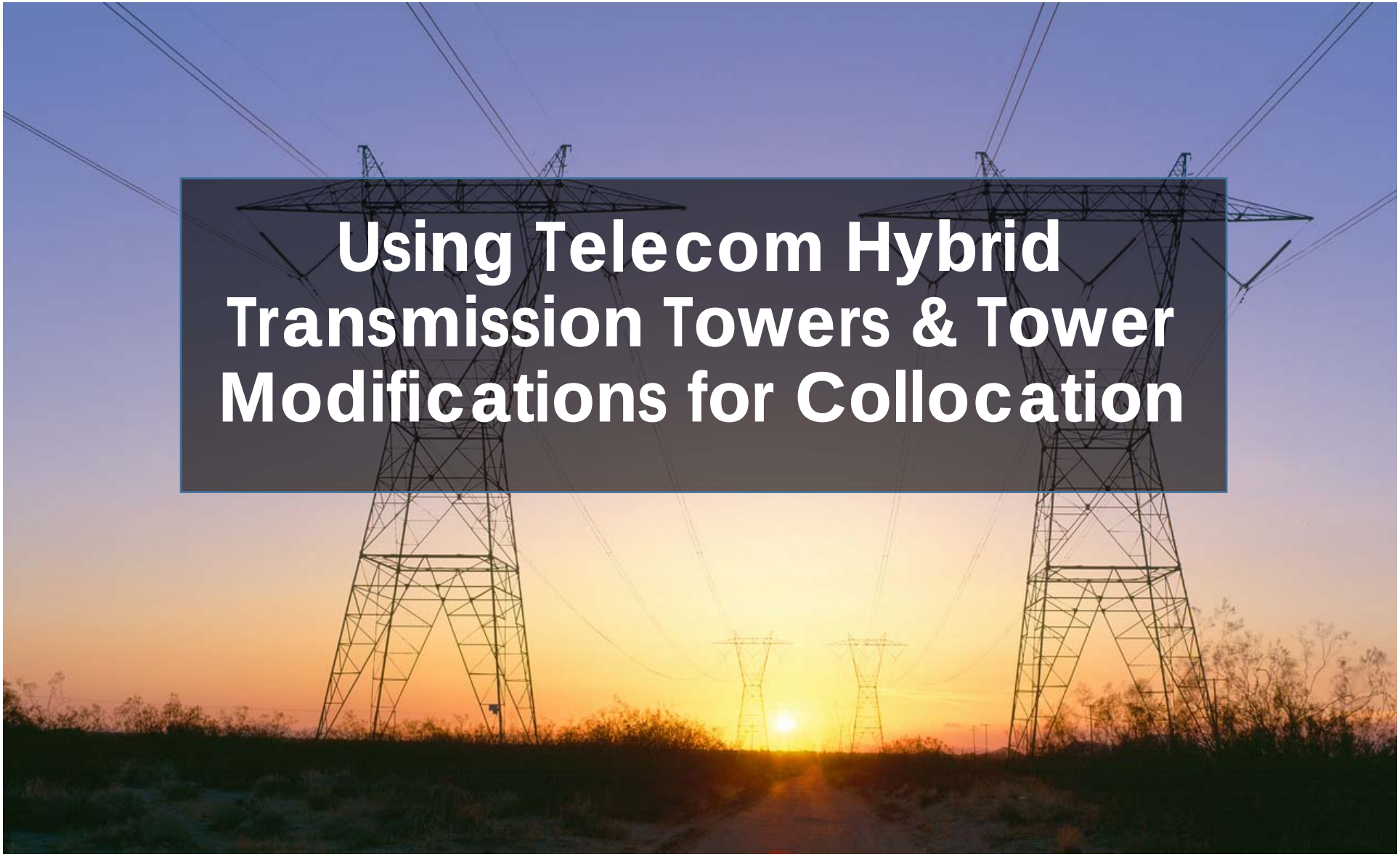


Using Telecom Hybrid Transmission Towers & Tower Modifications for Collocation

Utilities Technology Council™

PAUL J. FORD & COMPANY

Reese TOWER SERVICES

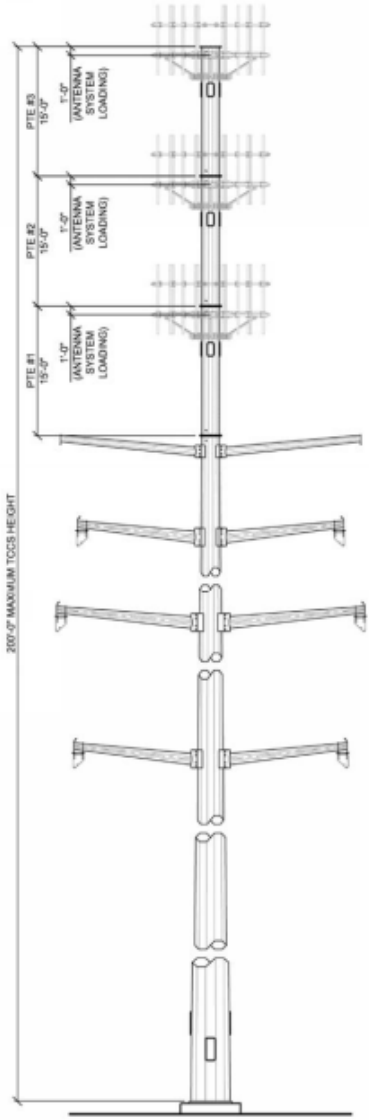
utc.org

Introduction

- Chad Hines, PE, SE – Paul J. Ford & Company
- Brian Reese, PE, CWI – Reese Tower Services

Overview

- Hybrid Transmission Structure
  - ✓Facilitates T-Line & Wireless
  - ✓Up to 200’ Tall
- Ugly on Ugly – Zoning Friendly
- Revenue Stream from Wireless
- Pre-Planned or Replacement
- Flanged Expansion Options



Overview

- PPL Electric Utilities – Modification Case Study
  - ✓Substation pole structure
  - ✓115 ft – 69 kV transmission Summit Manufacturing pole
- AT&T Co-Location
- Antenna Upgrade & Structural Modifications
- Harrisburg, PA


06.08.2017 15:05

Loading

- AT&T antenna change-out to meet increased demand

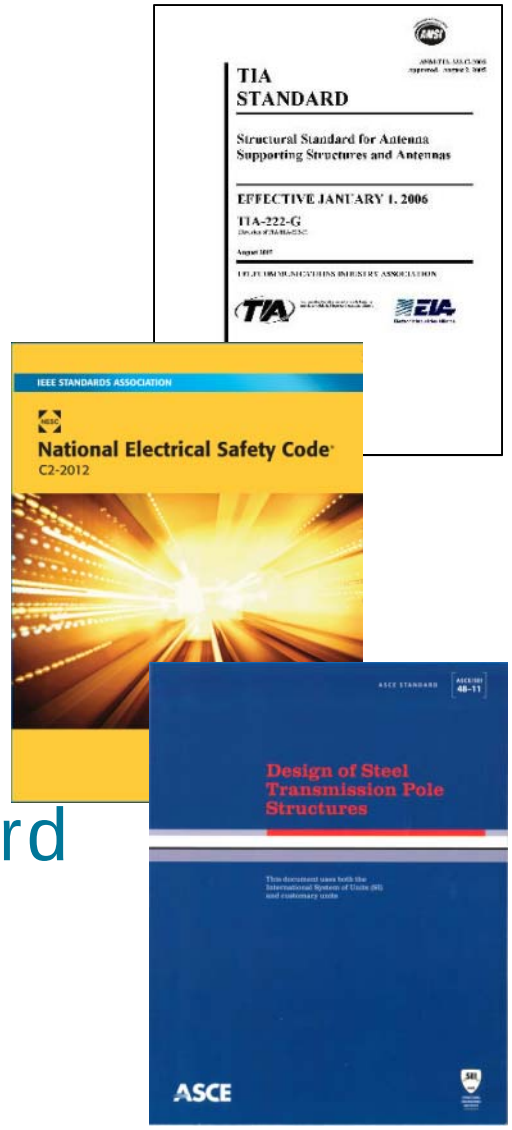
Table 1 – Antenna and Cable Information

Mounting Level (feet)	Center Line Elevation (feet)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines[1]	Feed Line Size (inches)	Note
115	116	3	Andrew	SBNHH-1D65C	18 (I) 12 (E)	1-5/8	1
115	116	1	CSS	XDUO4-80-V-3P			
115	116	2	CSS	XDUO4-80-V-OP			
115	116	3	Powerwave	P65-17-XLH-RR			
115	116	12	-	Diplexers			
115	116	6	Commscope	CDX723A Diplexers			
115	116	1	-	Low Profile Platform			

		No. of Antenna	Height (in)	Width (in)	Thickness (in)	Weight (lbs)	Area (ft^2)
1	CDX723A-DS Diplexer	**18**	8.9	4.9	2.4	6.2	0.30
2	SBNHH-1D65C	**3**	96.0	11.9	7.1	49.6	7.93
3	XDUO4-80-V-0	**1**	50.5	12.5	7.1	34.0	4.38
4	XDUO4-80-V-0	**2**	50.5	12.5	7.1	34.0	4.38
5	P65-17-XLH-RR	**3**	96.0	12.0	6.0	70.0	8.00

Standards

- TIA-222-G – Mounts & Equipment
- NESC – Structure Loads
- ASCE 48-11 – Pole Design Standard



Evaluation

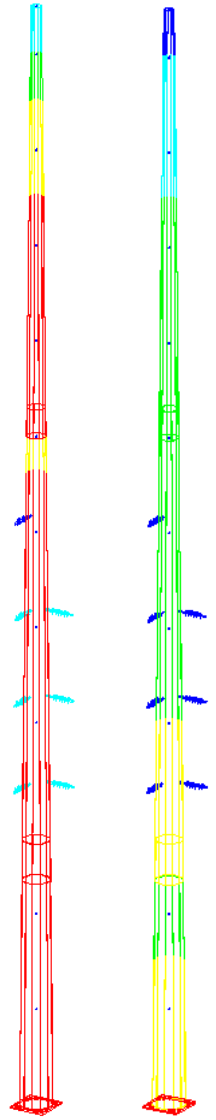
- Overview –
  - First Analysis – Using Standard Criteria (Conservative)
    - Shaft Reinforcement – Base to EL 97’-10”
    - Base Plate Reinforcement
    - Foundation Mat Reinforcement (13’x13’x6’ Eccentric)
  - Utility says OK… But….Uh, Well, Perhaps we should investigate further!!
  - Value Engineering (Actual equipment & Actual wire loads)
    - Base Plate Reinforcement Only! – Easy --- Yeah!
- Modeling program / technique – PLS Pole & Custom Calcs
- Structure components:

  Shaft - 95 %

  Base plate: Unreinforced - 125 % --- Reinforced – 48%

  Anchors - 64 %

  Foundations - 83 %
- Overstress conditions – Base Plate Bending



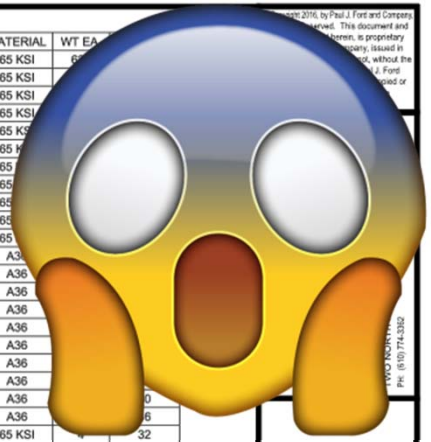
Modification Design

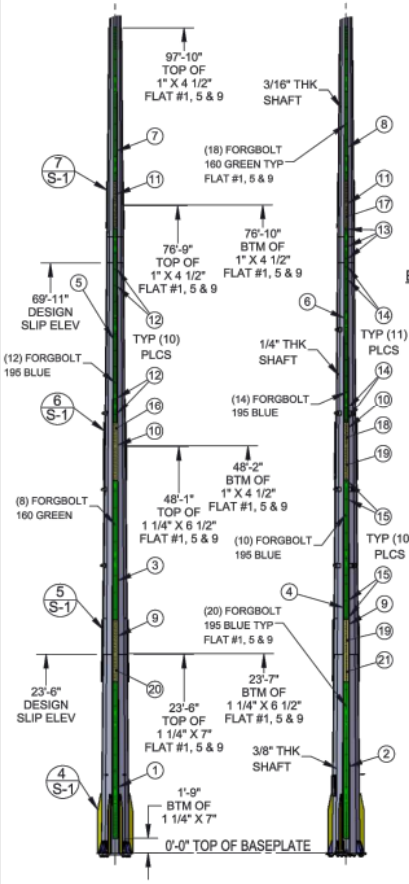
- Initial Design
  - Bolted shaft reinforcement
  - Base Plate Reinforcement
  - Foundation Reinforcement
- Final Design
  - ✓Install base plate stiffeners
  - ✓Install foot pads
  - ✓Install grout under foot pads
  - ✓Modification Inspection & Close-Out

NOTE:
1. CONTRACTOR TO PROVIDE NON-SHRINK GROUT (NS GROUT BY EUCLID OR APPROVED EQUAL; 7500 PSI MIN.) BELOW NEW BEARING PLATES. GROUT SHALL BE INSTALLED TIGHT UNDER NEW BEARING PLATES WITH NO VOIDS REMAINING BETWEEN TOP OF EXISTING CONCRETE AND UNDERSIDE OF NEW BEARING PLATES.

NOTE: DRAWINGS INCLUDE COLOR CODED PARTS FOR CLARITY

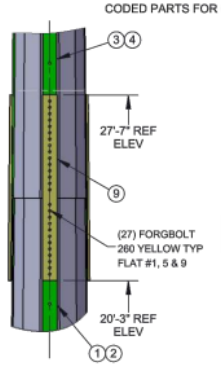
ITEM NO	QTY.	PART NUMBER	DESCRIPTION	MATERIAL	WT EA	
1	2	PLATE-1	PLATE 1 1/4" X 7" X 21'-9" LG	65 KSI		
2	1	PLATE-1A	PLATE 1 1/4" X 7" X 21'-9" LG	65 KSI		
3	2	PLATE-2	PLATE 1 1/4" X 6 1/2" X 24'-6" LG	65 KSI		
4	1	PLATE-2A	PLATE 1 1/4" X 6 1/2" X 24'-6" LG	65 KSI		
5	2	PLATE-3	PLATE 1" X 4 1/2" X 28'-7" LG	65 KSI		
6	1	PLATE-3A	PLATE 1" X 4 1/2" X 28'-7" LG	65 KSI		
7	2	PLATE-4	PLATE 1" X 4 1/2" X 21'-0" LG	65 KSI		
8	1	PLATE-4A	PLATE 1" X 4 1/2" X 21'-0" LG	65 KSI		
9	3	SPLICE-1	PLATE 1 1/4" X 7" X 7'-4" LG	65 KSI		
10	3	SPLICE-2	PLATE 1 1/4" X 6 1/2" X 6'-10" LG	65 KSI		
11	3	SPLICE-3	PLATE 1" X 4 1/2" X 5'-7" LG	65 KSI		
12	20	55-18-SHIM	PLATE 3/16" THK X 5 1/2" X 5 1/2" LG	A36		
13	3	55-31-SHIM	PLATE 5/16" THK X 5 1/2" X 5 1/2" LG	A36		
14	11	55-50-SHIM	PLATE 1/2" THK X 5 1/2" X 5 1/2" LG	A36		
15	10	75-55-50-SHIM	PLATE 1/2" THK X 5 1/2" X 7 1/2" LG	A36		
16	2	35-32-18-SHIM	PLATE 3/16" THK X 3 1/2" X 2'-8" LG	A36		
17	2	35-32-31-SHIM	PLATE 5/16" THK X 3 1/2" X 2'-8" LG	A36		
18	1	35-32-50-SHIM	PLATE 1/2" THK X 3 1/2" X 2'-8" LG	A36		
19	2	55-47-50-SHIM	PLATE 1/2" THK X 5 1/2" X 3'-11" LG	A36		
20	2	60-38-25-SHIM	PLATE 1/4" THK X 6" X 3'-2" LG	A36		0
21	1	60-38-75-SHIM	PLATE 3/4" THK X 6" X 3'-2" LG	A36		6
22	8	BP	PLATE 3/4" THK X 3" x 6 1/2" LG	65 KSI		32
23	10	BPS	PLATE 3/4" THK X 6 3/16" X 1'-6" LG	65 KSI	14	140
24	6	TS	PLATE 3/4" THK X 6 7/8" X 7'-0" LG	65 KSI	103	618
					TOTAL WEIGHT	8662



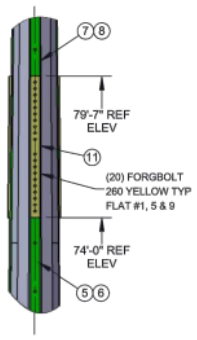


TOWER ELEVATION 2 S-1 FLAT #1 & 5

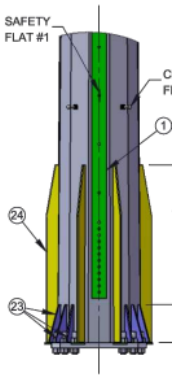
TOWER ELEVATION 3 S-1 FLAT #9



BTM SPLICE ELEV 5 S-1

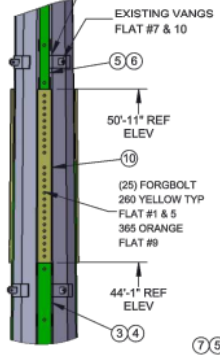


TOP SPLICE ELEV 7 S-1



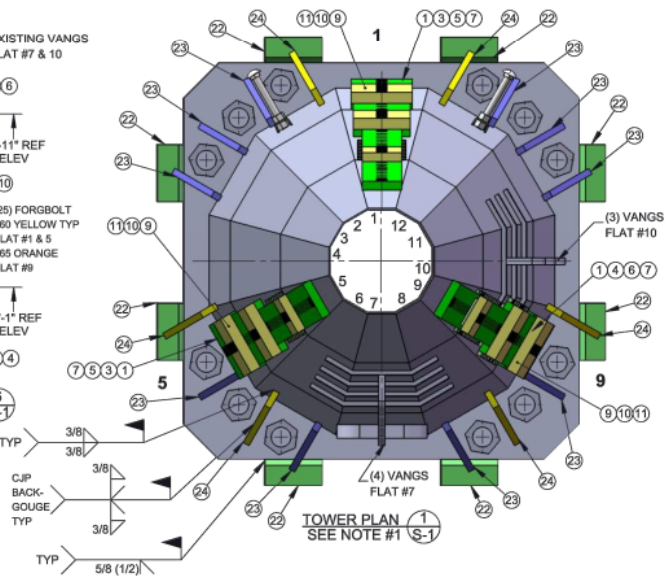
BASE ELEVATION 4 S-1

PLATES ON FLAT #9 ARE SHIMMED TO MATCH EXISTING DOUBLER PLATES



MID SPLICE ELEV 6 S-1

FORGBOLTS				
SIZE	160	195	260	365
QTY	70	108	191	25
COLOR	GREEN	BLUE	YELLOW	ORANGE



TOWER PLAN 1 S-1 SEE NOTE #1

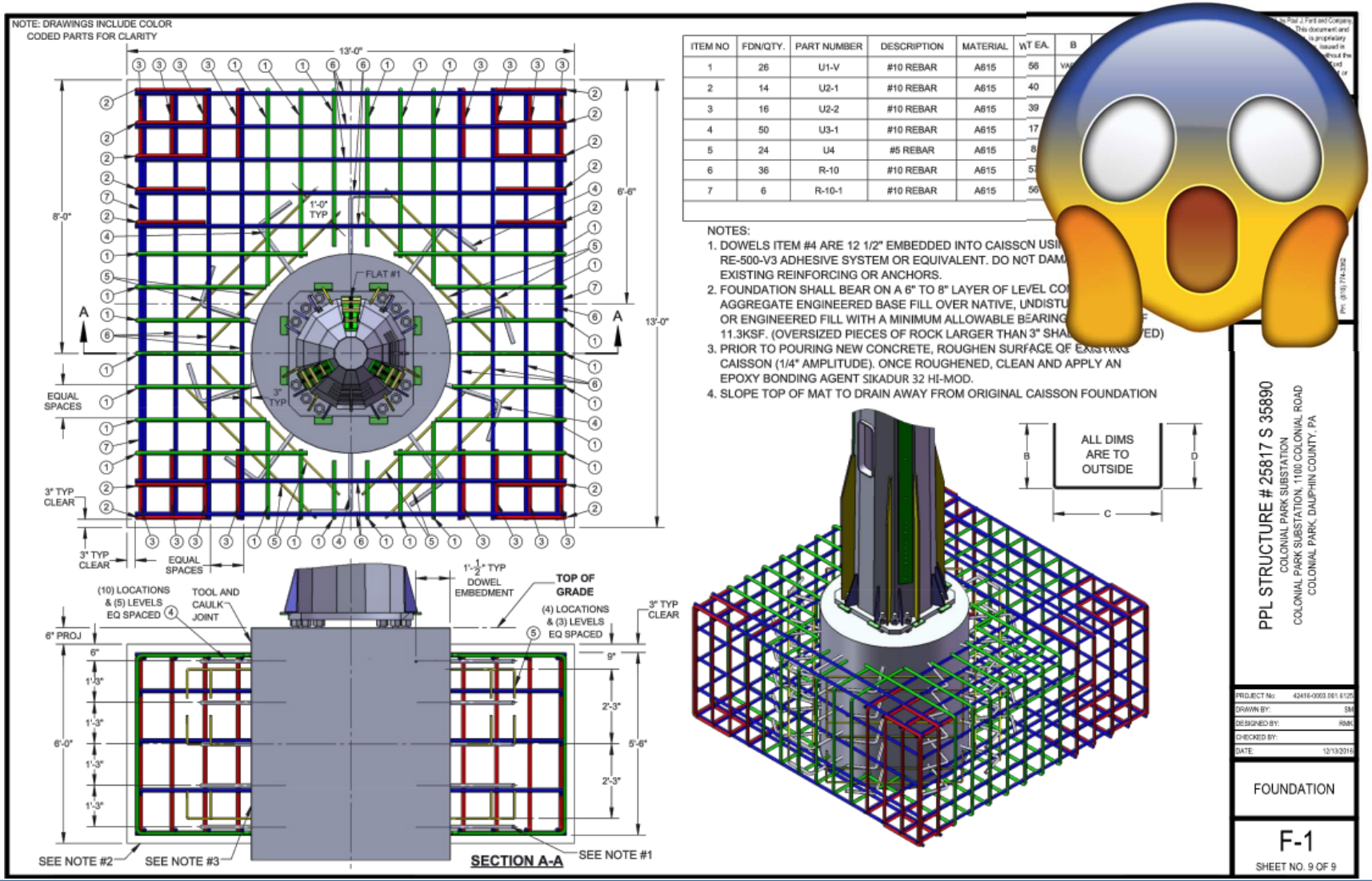
PPL STRUCTURE # 25817 S 35890
COLONIAL PARK SUBSTATION
COLONIAL PARK SUBSTATION, 1100 COLONIAL ROAD
COLONIAL PARK, DAUPHIN COUNTY, PA

PROJECT No:	42416-0003.001.6125
DRAWN BY:	SM
DESIGNED BY:	RMK
CHECKED BY:	
DATE:	12/13/2016

ELEVATION & BOM

S-1

SHEET NO. 5 OF 9



ITEM NO	FDN/QTY.	PART NUMBER	DESCRIPTION	MATERIAL	WT EA.	B
1	26	U1-V	#10 REBAR	A615	56	
2	14	U2-1	#10 REBAR	A615	40	
3	16	U2-2	#10 REBAR	A615	39	
4	50	U3-1	#10 REBAR	A615	17	
5	24	U4	#5 REBAR	A615	8	
6	36	R-10	#10 REBAR	A615	57	
7	6	R-10-1	#10 REBAR	A615	56	

NOTES:
1. DOWELS ITEM #4 ARE 12 1/2" EMBEDDED INTO CAISSON USI RE-500-V3 ADHESIVE SYSTEM OR EQUIVALENT. DO NOT DAMA EXISTING REINFORCING OR ANCHORS.
2. FOUNDATION SHALL BEAR ON A 6" TO 8" LAYER OF LEVEL CO AGGREGATE ENGINEERED BASE FILL OVER NATIVE, UNDISTU OR ENGINEERED FILL WITH A MINIMUM ALLOWABLE BEARING 11.3KSF. (OVERSIZED PIECES OF ROCK LARGER THAN 3" SHA ED)
3. PRIOR TO POURING NEW CONCRETE, ROUGHEN SURFACE OF EXISTING CAISSON (1/4" AMPLITUDE). ONCE ROUGHENED, CLEAN AND APPLY AN EPOXY BONDING AGENT SIKADUR 32 HI-MOD.
4. SLOPE TOP OF MAT TO DRAIN AWAY FROM ORIGINAL CAISSON FOUNDATION

PPL STRUCTURE # 25817 S 35890
COLONIAL PARK SUBSTATION
COLONIAL PARK SUBSTATION, 1100 COLONIAL ROAD
COLONIAL PARK, DAUPHIN COUNTY, PA

PROJECT No:	42416-0003.001.01/25
DRAWN BY:	SM
DESIGNED BY:	RMK
CHECKED BY:	
DATE:	12/13/2016

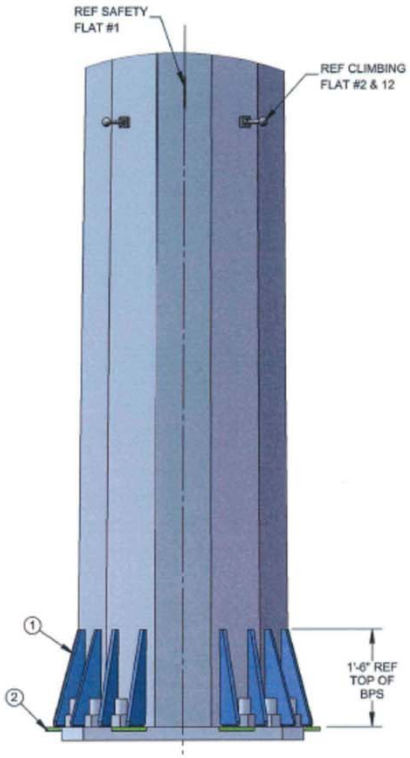
FOUNDATION

F-1
SHEET NO. 9 OF 9

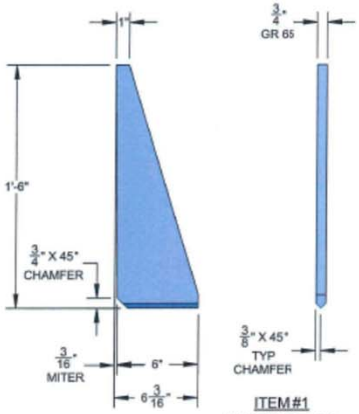
NOTE:
1. CONTRACTOR TO PROVIDE NON-SHRINK GROUT (NS GROUT BY EUCLID OR APPROVED EQUAL; 7500 PSI MIN.) BELOW NEW BEARING PLATES. GROUT SHALL BE INSTALLED TIGHT UNDER NEW BEARING PLATES WITH NO VOIDS REMAINING BETWEEN TOP OF EXISTING CONCRETE AND UNDERSIDE OF NEW BEARING PLATES.

NOTE: DRAWINGS INCLUDE COLOR CODED PARTS FOR CLARITY

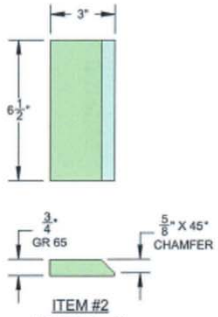
ITEM NO	QTY.	PART NUMBER	DESCRIPTION	MATERIAL	WT E
1	16	BPS	PLATE 3/4" THK X 6 3/16" X 1'-6" LG	65 KSI	
2	8	BP	PLATE 3/4" THK X 3" x 6 1/2" LG	65 KSI	
				TOTA	



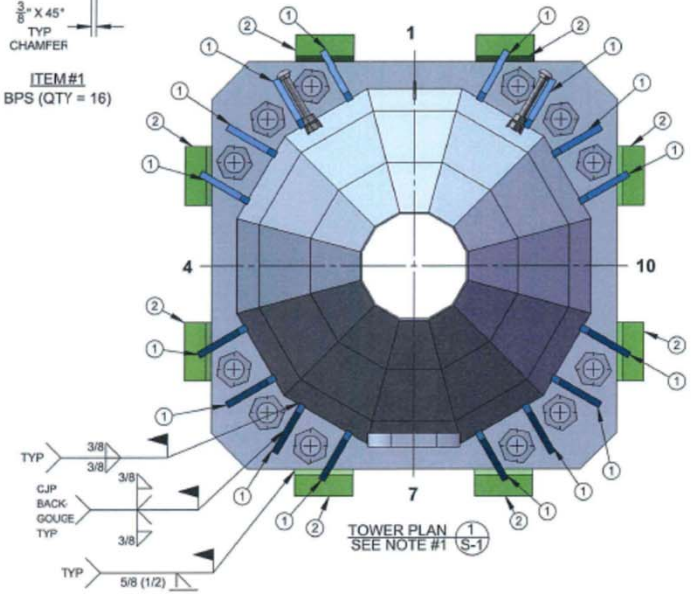
BASE ELEVATION 2 / S-1



ITEM #1
BPS (QTY = 16)



ITEM #2
BP (QTY = 8)



TOWER PLAN SEE NOTE #1 1 / S-1

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
JAMES R. ANTOSZEWSKI
ENGINEER
PE083568
1/26/2017

AT&T
TWO NORTH NINTH
PH: (610) 774-3362

PPL STRUCTURE # 25817 S 35890
COLONIAL PARK SUBSTATION
COLONIAL PARK SUBSTATION, 1100 COLONIAL ROAD
COLONIAL PARK, DAUPHIN COUNTY, PA

PROJECT No:	42416-0003.002.6125
DRAWN BY:	SM
DESIGNED BY:	RMK
CHECKED BY:	CBH
DATE:	01/26/2017

ELEVATION & BOM

S-1
SHEET NO. 4 OF 4

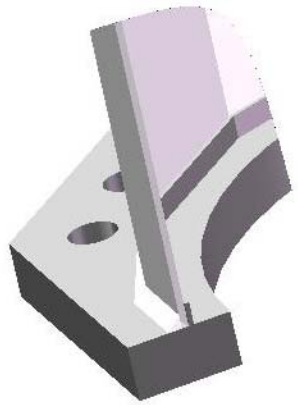
42416-0003.002.6125.DWG


INFORMATION
CAUTION
INFORMACION
07.12.2017 07:39


07.12.2017 07:40

Pre-Construction Inspection

- Perform non-destructive examination of the pole to base plate welded connection
  - ✓ Visual examination
  - ✓ Magnetic particle examination
  - ✓ Ultrasonic testing
- Purpose to verify integrity of base weld connection (toe crack defects)




07.12.2017 07:45


07.12.2017 07:44


07.12.2017 07:55


07.12.2017 07:58

Construction

- Reinforce base plate
  - ✓Stiffeners
  - ✓Foot pads
  - ✓Grout installation

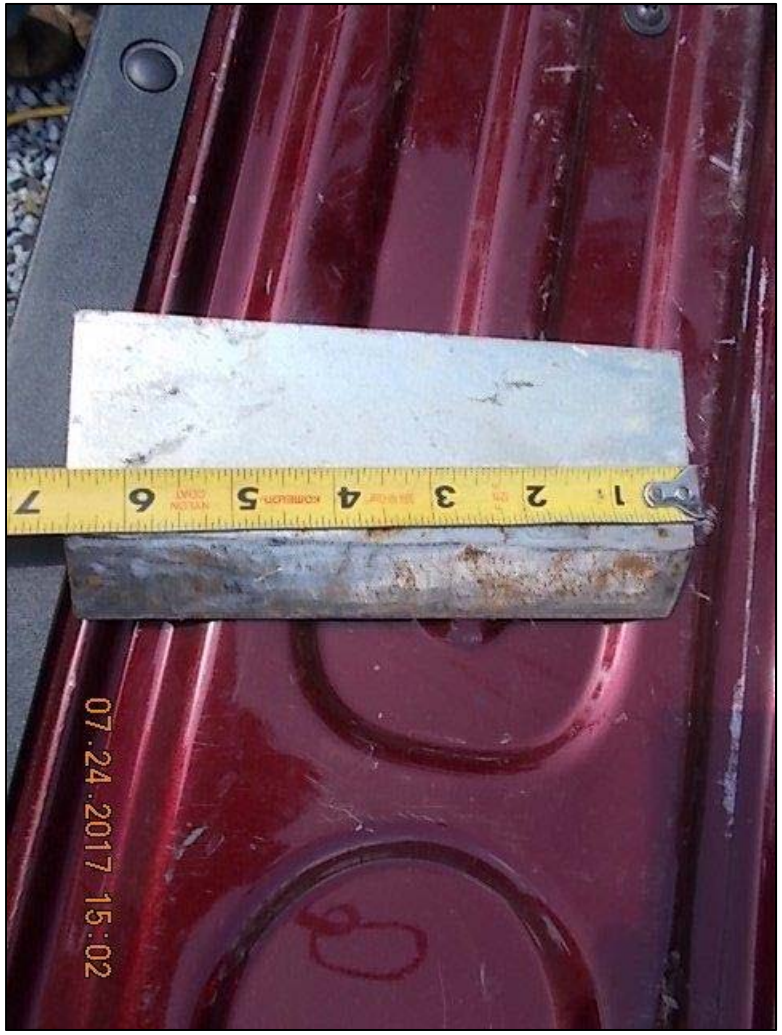
Construction

- Materials
- Safety
- Welding
- Inspection
- Close-out

Materials

- Stiffeners and foot pads ASTM A572 Grade 65 high strength steel
- Steel material certifications available
- High-strength, non-metallic, non shrink base plate grout – 8,000 psi
- Parts cut, beveled, and galvanized before shipment


07.24.2017 15:01


07.24.2017 15:02


07.24.2017 16:37

Safety

- Site signage
- Site specific hazards analysis
- Job Safety Analysis (JSA) meeting
- Fire prevention
- Personal protective equipment (PPE)


NO TRESPASSING
CHECK IN FOR SAFETY BRIEFING BEFORE ENTERING SITE
NOTICE
AUTHORIZED PERSONNEL ONLY
DANGER
HARD HAT REQUIRED
CAUTION
RADIO FREQUENCY HAZARD
WARNING
ELECTRICAL HAZARD
DANGER
SAFETY GLASSES REQUIRED
NOTICE
REPORT ALL INJURIES AT ONCE
DANGER
FALL PROTECTION REQUIRED
CAUTION
CHECK SDS SHEETS ON ALL CHEMICALS BEFORE USING
EMERGENCY
DIAL 911
CAUTION
KEEP OUT
FROM UNDER SUSPENDED LOADS
CAUTION
10
SITE SPEED LIMIT
DANGER
WORKERS ABOVE
WATCH FOR FALLING MATERIAL
07.25.2017 07:22


KENEDYNE
07.25.2017 07:39


07.24.2017 15:09


07.25.2017 07:38

Welding

- All welding per AWS D1.1
- Qualified welder – welder performance qualification (WPQ)
- Appropriate welding procedure specifications (WPS)

Welding

- Layout
- Proper surface preparation – removal of galvanizing
- Pre-heat per AWS requirements
- Monitor joint fit-up
- Witness welding


07.25.2017 07:26


07.25.2017 09:24


07.24.2017 17:08


07.25.2017 08:26


07.25.2017 08:25


07.25.2017 08:29


07.25.2017 08:32


07.25.2017 09:38

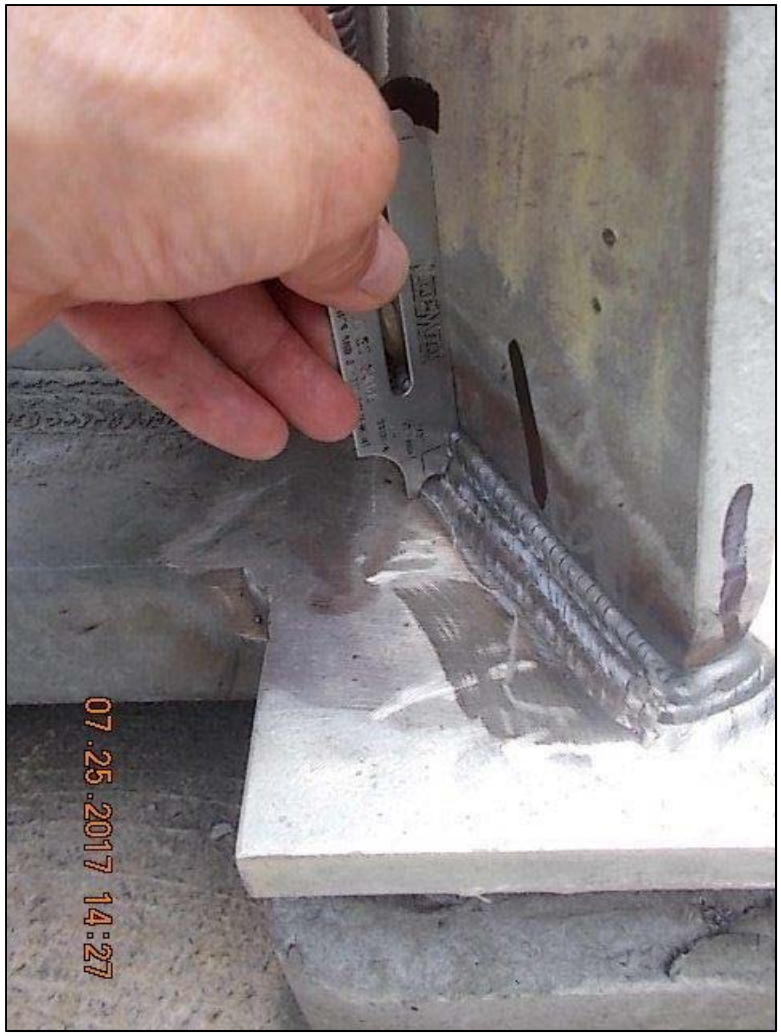

07.25.2017 13:46

Inspection

- 100% continuous weld inspection
- Pre non-destructive weld examination and post non-destructive weld examination – Level II ASNT technician
  - ✓Magnetic particle examination
  - ✓Ultrasonic testing


1
2
3
4
07.25.2017 14:30


07.25.2017 14:27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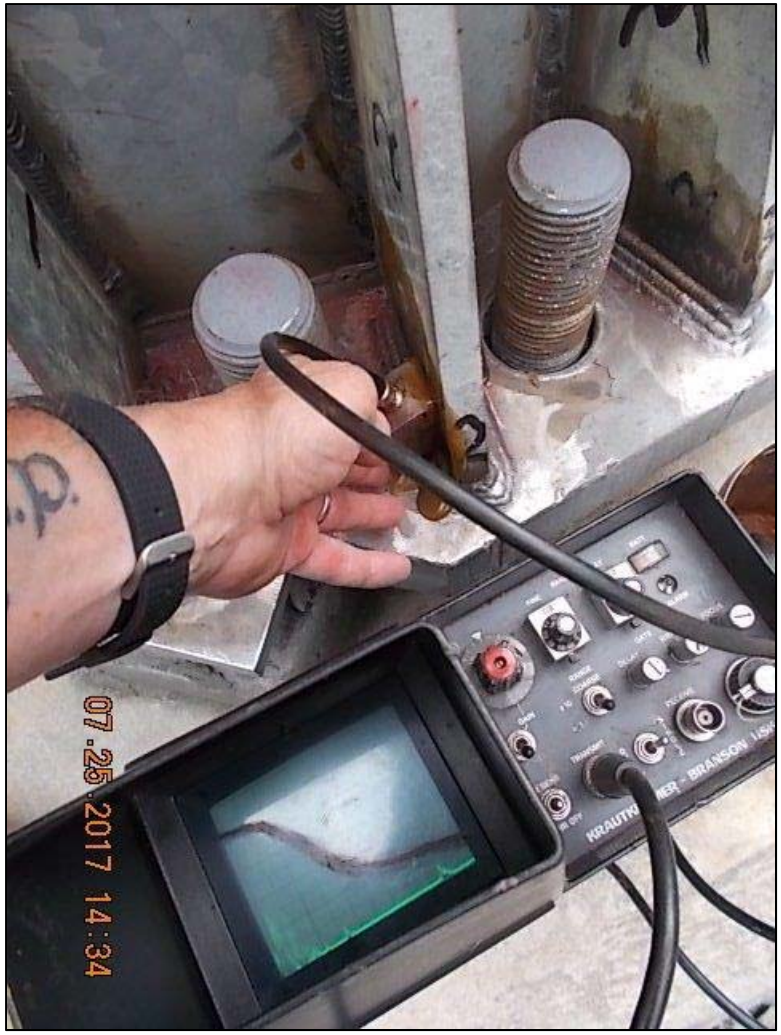
115V AC
07.25.2017 14:31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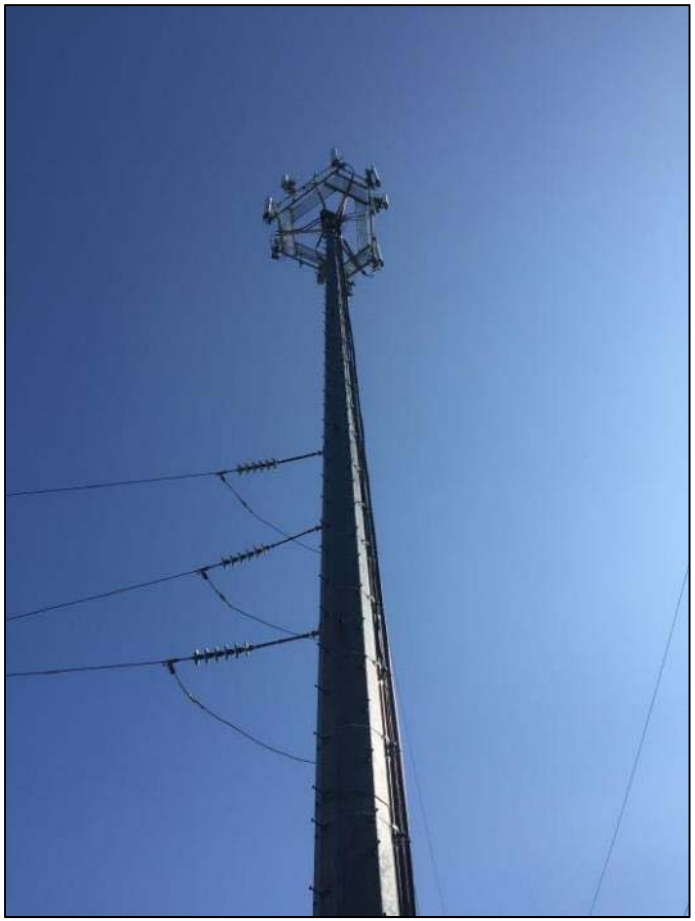
07.26.2017 10:34

Finished!



Close-Out

- Engineer of record final review and approval of project documentation
  - ✓ Review material certs
  - ✓ Review weld inspection reports
  - ✓ Review project red-lines

Questions