Date: **May 14, 2012**

Mitzi Parker
Crown Castle
3530 Toringdon Way Suite 300
Charlotte, NC 28277

FDH Engineering, Inc.
6521 Meridien Drive
Raleigh, NC 27616
(919) 755-1012

Subject: **Structural Analysis Report**

Carrier Designation:	***AT&T Mobility* Co-Locate**	
	Carrier Site Number:	ME5022
	Carrier Site Name:	EAST DEERING
Crown Castle Designation:	**Crown Castle BU Number:**	878783
	Crown Castle Site Name:	PORTLAND NORTH
	Crown Castle JDE Job Number:	180799
	Crown Castle Work Order Number:	474841
	Crown Castle Application Number:	141408 Rev. 3
Engineering Firm Designation:	**FDH Engineering, Inc. Project Number:**	12-03730E S2
Site Data:	**527 Persumpscot, Portland, Cumberland County, ME** **Latitude *43° 41' 58.53"*, Longitude *-70° 15' 30.64"*** **178 Foot - Monopole Tower**	

Dear Mitzi Parker,

FDH Engineering, Inc. is pleased to submit this **"Structural Analysis Report"** to determine the structural integrity of the above mentioned tower. This analysis has been performed in accordance with the Crown Castle Structural 'Statement of Work' and the terms of Crown Castle Purchase Order Number 456072, in accordance with application 141408, revision 3.

The purpose of the analysis is to determine acceptability of the tower stress level. Based on our analysis we have determined the tower stress level for the structure and foundation, under the following load case, to be:

LC4: Modified Tower with Existing + Reserved + Proposed Equipment **Sufficient Capacity**
Note: See Table I and Table II for the proposed and existing/reserved loading, respectively.

The analysis has been performed in accordance with the TIA-222-G standard based upon a wind speed of 100 mph 3-second gust, exposure category C with topographic category 1 and crest height of 0 feet.

All modifications and equipment proposed in this report shall be installed in accordance with the attached drawings for the determined available structural capacity to be effective.

We at *FDH Engineering, Inc.* appreciate the opportunity of providing our continuing professional services to you and Crown Castle. If you have any questions or need further assistance on this or any other projects please give us a call.

Structural analysis prepared by:

Daniel Chang, EI
Project Engineer

Christopher M. Murphy, PE
President
ME PE License No. 11228

STATE OF MAINE
CHRISTOPHER MICHAEL MURPHY
No. 11228
LICENSED PROFESSIONAL ENGINEER
5/14/12

tnxTower Report - version 6.0.4.0

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1) INTRODUCTION

This tower is a 178 ft Monopole tower designed by PITTSBURG MONOPOLE in December of 1996. The tower was originally designed for a wind speed of 85 mph per TIA/EIA-222-F. Anchor rod reinforcements were designed for the tower in May of 2012 and were included in this analysis.

2) ANALYSIS CRITERIA

The structural analysis was performed for this tower in accordance with the requirements of TIA-222-G Structural Standards for Steel Antenna Towers and Antenna Supporting Structures using a 3-second gust wind speed of 100 mph with no ice, 40 mph with 1 inch ice thickness and 60 mph under service loads, exposure category C with topographic category 1 and crest height of 0 feet.

Table 1 - Proposed Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
162.0	162.0	6	Ericsson	RRUS-11	2 1	3/4 3/8	---
		1	Crown Mounts	Side Arm Mount [SO 701-3]			
160.0	160.0	1	Andrew	SBNH-1D6565C w/ Mount Pipe			
		1	Kmw Communications	AM-X-CD-16-65-00T-RET w/ Mount Pipe			
		1	Powerwave Technologies	P65-17-XLH-RR w/ Mount Pipe			
		1	Raycap	DC6-48-60-18-8F			

Table 2 - Existing and Reserved Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
178.0	180.0	2	Decibel	DB978G30E-M w/ Mount Pipe	6	1-5/8	1
		4	Decibel	DB978H65E-M w/ Mount Pipe			
	178.0	1	Crown Mounts	Platform Mount [LP 713-1]			
168.0	171.0	3	Ericsson	KRY 112 144/1	12	1-5/8	1
		3	RFS Celwave	APX16DWV-16DWV-S-E-A20 w/ Mount Pipe			
	170.0	6	Ericsson	KRY 112 71			
		6	RFS Celwave	APXV18-206517-C w/ Mount Pipe			
	168.0	1	Crown Mounts	Platform Mount [LP 305-1]			
160.0	160.0	1	Crown Mounts	T-Arm Mount [TA 602-3]	12	1-5/8	1
		6	Powerwave Technologies	7020.00			
		3	Powerwave	7391.00 w/ Mount Pipe			

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
			Technologies				
		6	Powerwave Technologies	7770.00 w/ Mount Pipe			
		6	Powerwave Technologies	LGP21401			
		6	Powerwave Technologies	LGP21903			
149.0	151.0	2	Andrew	DB846F65ZAXY w/ Mount Pipe	6	1-5/8	2
		1	Andrew	HBX-6517DS-T2M w/ Mount Pipe			
		2	Andrew	LNX-6514DS-VTM w/ Mount Pipe			
	150.0	4	Andrew	DB846F65ZAXY w/ Mount Pipe			
		2	Andrew	HBX-6517DS-T2M w/ Mount Pipe			
		1	Andrew	LNX-6514DS-VTM w/ Mount Pipe			
	151.0	6	Decibel	DB948P85E-M w/ Mount Pipe	---	---	3
	150.0	6	Decibel	DB844H80-XY w/ Mount Pipe			
	149.0	1	Crown Mounts	Platform Mount [LP 713-1]	12	1-5/8	1
134.0	135.0	3	Ericsson	KRC 115 032/2	6 1	1-5/8 3/8	2
		3	Powerwave Technologies	P65-17-XL-R w/ Mount Pipe			
		6	Antel	BSA-185065/10CF w/ Mount Pipe	6	1-5/8	1
	134.0	1	Crown Mounts	Platform Mount [LP 401-1]			

Notes:
1) Existing Equipment
2) Reserved Equipment
3) Equipment To Be Removed

Table 3 - Design Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)
180	180	12	--	4 sq. ft.	---	---
		1	--	Platform		
170	170	2	--	6' Dishes	---	--
160	160	12	--	4 sq. ft.	---	---
		1	--	Platform		

3) ANALYSIS PROCEDURE

Table 4 - Documents Provided

Document	Remarks	Reference	Source
4-GEOTECHNICAL REPORTS	Gemini Geotechnical Associates (September 30, 1996)	1620506	CCISITES
4-TOWER FOUNDATION DRAWINGS/DESIGN/SPECS	Pittsburg (December 18, 1996)	1620582	CCISITES
4-TOWER MANUFACTURER DRAWINGS	Pittsburg (December 18, 1996)	1619399	CCISITES
4-TOWER REINFORCEMENT DESIGN/DRAWINGS/DATA	PSG Engineering, Inc. (August 28, 2008)	2415719	CCISITES
4-TOWER REINFORCEMENT DESIGN/DRAWINGS/DATA	FDH Engineering, Inc. (May 15, 2012)	Appendix D	FDH Project No. 12-03730E S2

3.1) Analysis Method

tnxTower (version 6.0.4.0), a commercially available analysis software package, was used to create a three-dimensional model of the tower and calculate member stresses for various loading cases. Selected output from the analysis is included in Appendix A.

3.2) Assumptions

1) Tower and structures were built in accordance with the manufacturer's specifications.
2) The tower and structures have been maintained in accordance with the manufacturer's specification.
3) The configuration of antennas, transmission cables, mounts and other appurtenances are as specified in Tables 1 and 2 and the referenced drawings.

This analysis may be affected if any assumptions are not valid or have been made in error. FDH Engineering, Inc. should be notified to determine the effect on the structural integrity of the tower.

4) ANALYSIS RESULTS

Table 5 - Section Capacity (Summary)

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
L1	178 - 140	Pole	P24x1/2	1	-14.76	1162.78	69.9	Pass
L2	140 - 100	Pole	P36x1/2	2	-29.08	1756.54	104.0	Pass
L3	100 - 60	Pole	P48x5/8	3	-47.27	2930.15	86.2	Pass
L4	60 - 20	Pole	P54x5/8	4	-67.65	3301.25	104.7	Pass
L5	20 - 0	Pole	P60x5/8	5	-78.87	3649.51	101.7	Pass
							Summary	
						Pole (L4)	104.7	Pass
						RATING =	**104.7**	**Pass**

Table 6 - Tower Component Stresses vs. Capacity – LC4

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Flange Plate & Bolts	20	31.5 & 103.5	Pass
1	Flange Plate & Bolts	60	33.4 & 90.5	Pass
1	Flange Plate & Bolts	100	69.0 & 94.8	Pass
1	Flange Plate & Bolts	140	72.3 & 88.0	Pass
1	Anchor Rods	0	89.7	Pass
1	Base Plate	0	37.4	Pass
1	Base Foundation	0	109.1	Pass

Structure Rating (max from all components) =	109.1%[3]

Notes:
1) See additional documentation in "Appendix C – Additional Calculations" for calculations supporting the % capacity consumed.
2) Capacities up to 105% are considered acceptable based on analysis methods used.
3) Soil capacities up to 110% are considered acceptable based on analysis methods used.

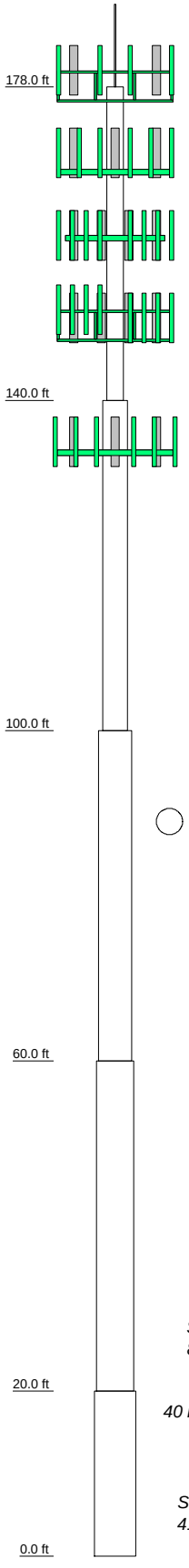
4.1) Recommendations

1) Coax must be installed as shown in Appendix B.
2) The modifications outlined in the FDH Engineering, Inc. Modification Drawings for a 178' Monopole (see FDH Project No. 12-03730E S2) must be installed correctly per the referenced drawings for this report to be valid.

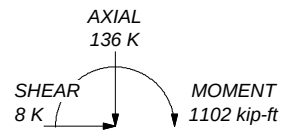
APPENDIX A

TNXTOWER OUTPUT

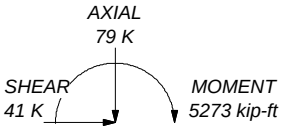
Section	Size	Length (ft)	Grade	Weight (K)
1	P24x1/2	38.00	A53-B-35	4.8
2	P36x1/2	40.00		7.6
3	P48x5/8	40.00		12.7
4	P54x5/8	40.00		14.3
5	P60x5/8	20.00		7.9
				47.2



ALL REACTIONS ARE FACTORED



TORQUE 0 kip-ft
40 mph WIND - 1.0000 in ICE



TORQUE 2 kip-ft
REACTIONS - 100 mph WIND

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Lightning Rod	178	(2) LGP21401	160
(2) DB978G30E-M w/ Mount Pipe	178	(2) LGP21903	160
(2) DB978H65E-M w/ Mount Pipe	178	SBNH-1D6565C w/ Mount Pipe	160
(2) DB978H65E-M w/ Mount Pipe	178	7391.00 w/ Mount Pipe	160
Platform Mount [LP 713-1]	178	(2) 7020.00	160
(2) Empty Pipe Mount	178	7391.00 w/ Mount Pipe	160
(2) Empty Pipe Mount	178	(2) 7770.00 w/ Mount Pipe	160
(2) Empty Pipe Mount	178	(2) LGP21401	160
KRY 112 144/1	168	(2) LGP21903	160
(2) KRY 112 71	168	(2) 7770.00 w/ Mount Pipe	160
APX16DWV-16DWV-S-E-A20 w/ Mount Pipe	168	AM-X-CD-16-65-00T-RET w/ Mount Pipe	160
(2) APXV18-206517-C w/ Mount Pipe	168	T-Arm Mount [TA 602-3]	160
KRY 112 144/1	168	(2) LGP21401	160
(2) KRY 112 71	168	(2) DB846F65ZAXY w/ Mount Pipe	149
APX16DWV-16DWV-S-E-A20 w/ Mount Pipe	168	HBX-6517DS-T2M w/ Mount Pipe	149
(2) APXV18-206517-C w/ Mount Pipe	168	LNX-6514DS-VTM w/ Mount Pipe	149
KRY 112 144/1	168	(2) DB846F65ZAXY w/ Mount Pipe	149
(2) KRY 112 71	168	HBX-6517DS-T2M w/ Mount Pipe	149
APX16DWV-16DWV-S-E-A20 w/ Mount Pipe	168	LNX-6514DS-VTM w/ Mount Pipe	149
(2) APXV18-206517-C w/ Mount Pipe	168	(2) DB846F65ZAXY w/ Mount Pipe	149
Platform Mount [LP 305-1]	168	HBX-6517DS-T2M w/ Mount Pipe	149
(2) RRUS-11	162	LNX-6514DS-VTM w/ Mount Pipe	149
(2) RRUS-11	162	Platform Mount [LP 713-1]	149
(2) RRUS-11	162	(2) BSA-185065/10CF w/ Mount Pipe	134
Side Arm Mount [SO 701-3]	162	KRC 115 032/2	134
(2) LGP21903	160	P65-17-XL-R w/ Mount Pipe	134
(2) 7020.00	160	(2) BSA-185065/10CF w/ Mount Pipe	134
P65-17-XLH-RR w/ Mount Pipe	160	KRC 115 032/2	134
DC6-48-60-18-8F	160	P65-17-XL-R w/ Mount Pipe	134
(2) 7020.00	160	(2) BSA-185065/10CF w/ Mount Pipe	134
7391.00 w/ Mount Pipe	160	KRC 115 032/2	134
(2) 7770.00 w/ Mount Pipe	160	P65-17-XL-R w/ Mount Pipe	134
		Platform Mount [LP 401-1]	134

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A53-B-35	35 ksi	63 ksi			

TOWER DESIGN NOTES

1. Tower is located in Cumberland County, Maine.
2. Tower designed for Exposure C to the TIA-222-G Standard.
3. Tower designed for a 100 mph basic wind in accordance with the TIA-222-G Standard.
4. Tower is also designed for a 40 mph basic wind with 1.00 in ice. Ice is considered to increase in thickness with height.
5. Deflections are based upon a 60 mph wind.
6. Tower Structure Class II.
7. Topographic Category 1 with Crest Height of 0.00 ft
8. TOWER RATING: 104.7%

FDH Engineering, Inc.
6521 Meridian Drive
Raleigh, NC 27616
Phone: (919) 755-1012
FAX: (919) 755-1031
Tower Analysis

Job: Portland North BU# 878783			
Project: 12-03730E S2			
Client: Crown Castle	Drawn by: Daniel Chang	App'd:	
Code: TIA-222-G	Date: 05/14/12	Scale: NTS	
Path:		Dwg No. E-1	

Tower Input Data

There is a pole section.
This tower is designed using the TIA-222-G standard.
The following design criteria apply:

Tower is located in Cumberland County, Maine.
Basic wind speed of 100 mph.
Structure Class II.
Exposure Category C.
Topographic Category 1.
Crest Height 0.00 ft.
Nominal ice thickness of 1.0000 in.
Ice thickness is considered to increase with height.
Ice density of 56 pcf.
A wind speed of 40 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 60 mph.
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in pole design is 1.
Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

Options

Consider Moments - Legs	Distribute Leg Loads As Uniform	Treat Feedline Bundles As Cylinder
Consider Moments - Horizontals	Assume Legs Pinned	Use ASCE 10 X-Brace Ly Rules
Consider Moments - Diagonals	√ Assume Rigid Index Plate	√ Calculate Redundant Bracing Forces
Use Moment Magnification	√ Use Clear Spans For Wind Area	Ignore Redundant Members in FEA
√ Use Code Stress Ratios	√ Use Clear Spans For KL/r	SR Leg Bolts Resist Compression
√ Use Code Safety Factors - Guys	√ Retension Guys To Initial Tension	√ All Leg Panels Have Same Allowable
Escalate Ice	√ Bypass Mast Stability Checks	Offset Girt At Foundation
Always Use Max Kz	√ Use Azimuth Dish Coefficients	√ Consider Feedline Torque
Use Special Wind Profile	√ Project Wind Area of Appurt.	Include Angle Block Shear Check
√ Include Bolts In Member Capacity	√ Autocalc Torque Arm Areas	Poles
√ Leg Bolts Are At Top Of Section	SR Members Have Cut Ends	Include Shear-Torsion Interaction
√ Secondary Horizontal Braces Leg	Sort Capacity Reports By Component	Always Use Sub-Critical Flow
Use Diamond Inner Bracing (4 Sided)	√ Triangulate Diamond Inner Bracing	Use Top Mounted Sockets
Add IBC .6D+W Combination		

Pole Section Geometry

Section	Elevation ft	Section Length ft	Pole Size	Pole Grade	Socket Length ft
L1	178.00-140.00	38.00	P24x1/2	A53-B-35 (35 ksi)	
L2	140.00-100.00	40.00	P36x1/2	A53-B-35 (35 ksi)	
L3	100.00-60.00	40.00	P48x5/8	A53-B-35	

Section	Elevation ft	Section Length ft	Pole Size	Pole Grade	Socket Length ft
L4	60.00-20.00	40.00	P54x5/8	(35 ksi) A53-B-35 (35 ksi)	
L5	20.00-0.00	20.00	P60x5/8	A53-B-35 (35 ksi)	

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
L1 178.00-140.00				1	1	1		
L2 140.00-100.00				1	1	1		
L3 100.00-60.00				1	1	1		
L4 60.00-20.00				1	1	1		
L5 20.00-0.00				1	1	1		

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Sector	Component Type	Placement ft	Total Number	Number Per Row	Start/End Position	Width or Diameter in	Perimeter in	Weight plf
LDF7-50A(1-5/8")	B	Surface Ar (CaAa)	149.00 - 0.00	6	6	0.000 0.000	1.9800		0.82
860 10014(3/8)	C	Surface Ar (CaAa)	134.00 - 0.00	1	1	0.000 0.000	0.3750		0.00
LCF158-50JA-A7(1 5/8")	C	Surface Ar (CaAa)	134.00 - 0.00	6	6	0.000 0.000	1.9800		0.80
***									
Climbing Ladder	C	Surface Af (CaAa)	178.00 - 0.00	1	1	0.000 0.000	0.8800	0.0000	7.90

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
LDF7-50A(1-5/8")	A	No	Inside Pole	178.00 - 0.00	6	No Ice	0.00	0.82
						1/2" Ice	0.00	0.82
						1" Ice	0.00	0.82
***								
LDF7-50A(1-5/8")	B	No	Inside Pole	168.00 - 0.00	12	No Ice	0.00	0.82
						1/2" Ice	0.00	0.82
						1" Ice	0.00	0.82
***								
AL7-50(1 5/8")	A	No	Inside Pole	160.00 - 0.00	12	No Ice	0.00	0.52
						1/2" Ice	0.00	0.52
						1" Ice	0.00	0.52
FB-L98B-002-75000(	A	No	Inside Pole	160.00 - 0.00	1	No Ice	0.00	0.06

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
3/8")						1/2" Ice	0.00	0.06
						1" Ice	0.00	0.06
WR-VG86ST-BRD(3/4)	A	No	Inside Pole	160.00 - 0.00	2	No Ice	0.00	0.59
						1/2" Ice	0.00	0.59
						1" Ice	0.00	0.59
***								
LDF7-50A(1-5/8")	B	No	Inside Pole	149.00 - 0.00	12	No Ice	0.00	0.82
						1/2" Ice	0.00	0.82
						1" Ice	0.00	0.82
***								
LDF7-50A(1-5/8")	C	No	Inside Pole	134.00 - 0.00	6	No Ice	0.00	0.82
						1/2" Ice	0.00	0.82
						1" Ice	0.00	0.82

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	178.00-140.00	A	0.000	0.000	0.000	0.000	0.34
		B	0.000	0.000	10.692	0.000	0.41
		C	0.000	0.000	5.573	0.000	0.30
L2	140.00-100.00	A	0.000	0.000	0.000	0.000	0.50
		B	0.000	0.000	47.520	0.000	0.98
		C	0.000	0.000	47.534	0.000	0.65
L3	100.00-60.00	A	0.000	0.000	0.000	0.000	0.50
		B	0.000	0.000	47.520	0.000	0.98
		C	0.000	0.000	54.887	0.000	0.70
L4	60.00-20.00	A	0.000	0.000	0.000	0.000	0.50
		B	0.000	0.000	47.520	0.000	0.98
		C	0.000	0.000	54.887	0.000	0.70
L5	20.00-0.00	A	0.000	0.000	0.000	0.000	0.25
		B	0.000	0.000	23.760	0.000	0.49
		C	0.000	0.000	27.443	0.000	0.35

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	178.00-140.00	A	2.341	0.000	0.000	0.000	0.000	0.34
		B		0.000	0.000	18.632	0.000	0.70
		C		0.000	0.000	23.363	0.000	0.67
L2	140.00-100.00	A	2.276	0.000	0.000	0.000	0.000	0.50
		B		0.000	0.000	82.159	0.000	2.22
		C		0.000	0.000	110.661	0.000	2.32
L3	100.00-60.00	A	2.186	0.000	0.000	0.000	0.000	0.50
		B		0.000	0.000	81.259	0.000	2.17
		C		0.000	0.000	123.600	0.000	2.50
L4	60.00-20.00	A	2.042	0.000	0.000	0.000	0.000	0.50
		B		0.000	0.000	79.816	0.000	2.08
		C		0.000	0.000	119.847	0.000	2.34
L5	20.00-0.00	A	1.775	0.000	0.000	0.000	0.000	0.25
		B		0.000	0.000	38.575	0.000	0.96
		C		0.000	0.000	56.457	0.000	1.03

Feed Line Center of Pressure

Section	Elevation	CP_X	CP_Z	CP_X Ice	CP_Z Ice
	ft	in	in	in	in
L1	178.00-140.00	0.3259	-0.0069	0.3734	0.2839
L2	140.00-100.00	0.9085	0.5169	0.8697	0.8265
L3	100.00-60.00	0.9798	0.7344	0.9926	1.1486
L4	60.00-20.00	1.0197	0.7651	1.0656	1.2124
L5	20.00-0.00	1.0543	0.7917	1.1322	1.2420

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
L1	11	LDF7-50A(1-5/8")	140.00 - 149.00	1.0000	1.0000
L1	17	Climbing Ladder	140.00 - 178.00	1.0000	1.0000
L2	11	LDF7-50A(1-5/8")	100.00 - 140.00	1.0000	1.0000
L2	14	860 10014(3/8)	100.00 - 134.00	1.0000	1.0000
L2	15	LCF158-50JA-A7(1 5/8")	100.00 - 134.00	1.0000	1.0000
L2	17	Climbing Ladder	100.00 - 140.00	1.0000	1.0000
L3	11	LDF7-50A(1-5/8")	60.00 - 100.00	1.0000	1.0000
L3	14	860 10014(3/8)	60.00 - 100.00	1.0000	1.0000
L3	15	LCF158-50JA-A7(1 5/8")	60.00 - 100.00	1.0000	1.0000
L3	17	Climbing Ladder	60.00 - 100.00	1.0000	1.0000
L4	11	LDF7-50A(1-5/8")	20.00 - 60.00	1.0000	1.0000
L4	14	860 10014(3/8)	20.00 - 60.00	1.0000	1.0000
L4	15	LCF158-50JA-A7(1 5/8")	20.00 - 60.00	1.0000	1.0000
L4	17	Climbing Ladder	20.00 - 60.00	1.0000	1.0000
L5	11	LDF7-50A(1-5/8")	0.00 - 20.00	1.0000	1.0000
L5	14	860 10014(3/8)	0.00 - 20.00	1.0000	1.0000
L5	15	LCF158-50JA-A7(1 5/8")	0.00 - 20.00	1.0000	1.0000
L5	17	Climbing Ladder	0.00 - 20.00	1.0000	1.0000

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
Lightning Rod	A	From Leg	0.00	0.0000	178.00	No Ice	1.00	1.00	0.04
			0.00			1/2" Ice	2.02	2.02	0.05
			5.00			1" Ice	3.05	3.05	0.06
***									
(2) DB978G30E-M w/ Mount Pipe	A	From Leg	4.00	0.0000	178.00	No Ice	6.68	4.33	0.04
			0.00			1/2" Ice	7.17	5.01	0.08
			2.00			1" Ice	7.66	5.67	0.14
(2) DB978H65E-M w/ Mount Pipe	B	From Leg	4.00	0.0000	178.00	No Ice	3.14	2.81	0.03
			0.00			1/2" Ice	3.52	3.41	0.05
			2.00			1" Ice	3.93	4.02	0.09
(2) DB978H65E-M w/ Mount Pipe	C	From Leg	4.00	0.0000	178.00	No Ice	3.14	2.81	0.03
			0.00			1/2" Ice	3.52	3.41	0.05
			2.00			1" Ice	3.93	4.02	0.09
Platform Mount [LP 713-1]	C	None		0.0000	178.00	No Ice	31.27	31.27	1.51
						1/2" Ice	39.68	39.68	1.93
						1" Ice	48.09	48.09	2.35
(2) Empty Pipe Mount	A	From Leg	4.00	0.0000	178.00	No Ice	1.00	1.00	0.01
			0.00			1/2" Ice	1.39	1.39	0.02
			0.00			1" Ice	1.70	1.70	0.03
(2) Empty Pipe Mount	B	From Leg	4.00	0.0000	178.00	No Ice	1.00	1.00	0.01
			0.00			1/2" Ice	1.39	1.39	0.02
			0.00			1" Ice	1.70	1.70	0.03
(2) Empty Pipe Mount	C	From Leg	4.00	0.0000	178.00	No Ice	1.00	1.00	0.01
			0.00			1/2" Ice	1.39	1.39	0.02
			0.00			1" Ice	1.70	1.70	0.03
***									
KRY 112 144/1	A	From Leg	4.00	0.0000	168.00	No Ice	0.41	0.19	0.01
			0.00			1/2" Ice	0.50	0.26	0.01
			3.00			1" Ice	0.60	0.33	0.02
(2) KRY 112 71	A	From Leg	4.00	0.0000	168.00	No Ice	0.68	0.45	0.01
			0.00			1/2" Ice	0.80	0.56	0.02
			2.00			1" Ice	0.93	0.68	0.03
APX16DWV-16DWV-S-E-A20 w/ Mount Pipe	A	From Leg	4.00	0.0000	168.00	No Ice	7.47	3.49	0.06
			0.00			1/2" Ice	7.99	4.26	0.11
			3.00			1" Ice	8.52	4.96	0.16
(2) APXV18-206517-C w/ Mount Pipe	A	From Leg	4.00	0.0000	168.00	No Ice	5.40	4.70	0.05
			0.00			1/2" Ice	5.96	5.86	0.09
			2.00			1" Ice	6.48	6.73	0.15
KRY 112 144/1	B	From Leg	4.00	0.0000	168.00	No Ice	0.41	0.19	0.01
			0.00			1/2" Ice	0.50	0.26	0.01
			3.00			1" Ice	0.60	0.33	0.02
(2) KRY 112 71	B	From Leg	4.00	0.0000	168.00	No Ice	0.68	0.45	0.01
			0.00			1/2" Ice	0.80	0.56	0.02
			2.00			1" Ice	0.93	0.68	0.03
APX16DWV-16DWV-S-E-A20 w/ Mount Pipe	B	From Leg	4.00	0.0000	168.00	No Ice	7.47	3.49	0.06
			0.00			1/2" Ice	7.99	4.26	0.11
			3.00			1" Ice	8.52	4.96	0.16
(2) APXV18-206517-C w/ Mount Pipe	B	From Leg	4.00	0.0000	168.00	No Ice	5.40	4.70	0.05
			0.00			1/2" Ice	5.96	5.86	0.09
			2.00			1" Ice	6.48	6.73	0.15
KRY 112 144/1	C	From Leg	4.00	0.0000	168.00	No Ice	0.41	0.19	0.01
			0.00			1/2" Ice	0.50	0.26	0.01
			3.00			1" Ice	0.60	0.33	0.02
(2) KRY 112 71	C	From Leg	4.00	0.0000	168.00	No Ice	0.68	0.45	0.01
			0.00			1/2" Ice	0.80	0.56	0.02
			2.00			1" Ice	0.93	0.68	0.03
APX16DWV-16DWV-S-E-A	C	From Leg	4.00	0.0000	168.00	No Ice	7.47	3.49	0.06

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
20 w/ Mount Pipe			0.00			1/2" Ice	7.99	4.26	0.11
			3.00			1" Ice	8.52	4.96	0.16
(2) APXV18-206517-C w/ Mount Pipe	C	From Leg	4.00	0.0000	168.00	No Ice	5.40	4.70	0.05
			0.00			1/2" Ice	5.96	5.86	0.09
			2.00			1" Ice	6.48	6.73	0.15
Platform Mount [LP 305-1]	C	None		0.0000	168.00	No Ice	18.01	18.01	1.12
						1/2" Ice	23.33	23.33	1.35
						1" Ice	28.65	28.65	1.58
***									
(2) 7020.00	A	From Leg	4.00	0.0000	160.00	No Ice	0.12	0.20	0.00
			0.00			1/2" Ice	0.17	0.28	0.01
			0.00			1" Ice	0.23	0.36	0.01
7391.00 w/ Mount Pipe	A	From Leg	4.00	0.0000	160.00	No Ice	5.91	4.08	0.04
			0.00			1/2" Ice	6.40	4.80	0.08
			0.00			1" Ice	6.89	5.48	0.13
(2) 7770.00 w/ Mount Pipe	A	From Leg	4.00	0.0000	160.00	No Ice	6.12	4.25	0.06
			0.00			1/2" Ice	6.63	5.01	0.10
			0.00			1" Ice	7.13	5.71	0.16
(2) LGP21401	A	From Leg	4.00	0.0000	160.00	No Ice	1.29	0.23	0.01
			0.00			1/2" Ice	1.45	0.31	0.02
			0.00			1" Ice	1.61	0.40	0.03
(2) LGP21903	A	From Leg	4.00	0.0000	160.00	No Ice	0.27	0.18	0.01
			0.00			1/2" Ice	0.34	0.25	0.01
			0.00			1" Ice	0.43	0.32	0.02
(2) RRUS-11	A	From Leg	4.00	0.0000	162.00	No Ice	2.94	1.52	0.05
			0.00			1/2" Ice	3.17	1.69	0.08
			0.00			1" Ice	3.41	1.88	0.10
P65-17-XLH-RR w/ Mount Pipe	A	From Leg	4.00	0.0000	160.00	No Ice	11.70	8.94	0.09
			0.00			1/2" Ice	12.42	10.45	0.17
			0.00			1" Ice	13.15	11.99	0.27
DC6-48-60-18-8F	A	From Leg	4.00	0.0000	160.00	No Ice	2.57	4.32	0.02
			0.00			1/2" Ice	2.80	4.60	0.05
			0.00			1" Ice	3.04	4.88	0.09
(2) 7020.00	B	From Leg	4.00	0.0000	160.00	No Ice	0.12	0.20	0.00
			0.00			1/2" Ice	0.17	0.28	0.01
			0.00			1" Ice	0.23	0.36	0.01
7391.00 w/ Mount Pipe	B	From Leg	4.00	0.0000	160.00	No Ice	5.91	4.08	0.04
			0.00			1/2" Ice	6.40	4.80	0.08
			0.00			1" Ice	6.89	5.48	0.13
(2) 7770.00 w/ Mount Pipe	B	From Leg	4.00	0.0000	160.00	No Ice	6.12	4.25	0.06
			0.00			1/2" Ice	6.63	5.01	0.10
			0.00			1" Ice	7.13	5.71	0.16
(2) LGP21401	B	From Leg	4.00	0.0000	160.00	No Ice	1.29	0.23	0.01
			0.00			1/2" Ice	1.45	0.31	0.02
			0.00			1" Ice	1.61	0.40	0.03
(2) LGP21903	B	From Leg	4.00	0.0000	160.00	No Ice	0.27	0.18	0.01
			0.00			1/2" Ice	0.34	0.25	0.01
			0.00			1" Ice	0.43	0.32	0.02
SBNH-1D6565C w/ Mount Pipe	B	From Leg	4.00	0.0000	160.00	No Ice	11.68	9.84	0.10
			0.00			1/2" Ice	12.40	11.37	0.19
			0.00			1" Ice	13.14	12.91	0.29
(2) RRUS-11	B	From Leg	4.00	0.0000	162.00	No Ice	2.94	1.52	0.05
			0.00			1/2" Ice	3.17	1.69	0.08
			0.00			1" Ice	3.41	1.88	0.10
(2) 7020.00	C	From Leg	4.00	0.0000	160.00	No Ice	0.12	0.20	0.00
			0.00			1/2" Ice	0.17	0.28	0.01
			0.00			1" Ice	0.23	0.36	0.01

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
7391.00 w/ Mount Pipe	C	From Leg	4.00 0.00 0.00	0.0000	160.00	No Ice 1/2" Ice 1" Ice	5.91 6.40 6.89	4.08 4.80 5.48	0.04 0.08 0.13
(2) 7770.00 w/ Mount Pipe	C	From Leg	4.00 0.00 0.00	0.0000	160.00	No Ice 1/2" Ice 1" Ice	6.12 6.63 7.13	4.25 5.01 5.71	0.06 0.10 0.16
(2) LGP21401	C	From Leg	4.00 0.00 0.00	0.0000	160.00	No Ice 1/2" Ice 1" Ice	1.29 1.45 1.61	0.23 0.31 0.40	0.01 0.02 0.03
(2) LGP21903	C	From Leg	4.00 0.00 0.00	0.0000	160.00	No Ice 1/2" Ice 1" Ice	0.27 0.34 0.43	0.18 0.25 0.32	0.01 0.01 0.02
(2) RRUS-11	C	From Leg	4.00 0.00 0.00	0.0000	162.00	No Ice 1/2" Ice 1" Ice	2.94 3.17 3.41	1.52 1.69 1.88	0.05 0.08 0.10
AM-X-CD-16-65-00T-RET w/ Mount Pipe	C	From Leg	4.00 0.00 0.00	0.0000	160.00	No Ice 1/2" Ice 1" Ice	8.50 9.15 9.77	6.30 7.48 8.37	0.07 0.14 0.21
T-Arm Mount [TA 602-3]	C	None		0.0000	160.00	No Ice 1/2" Ice 1" Ice	11.59 15.44 19.29	11.59 15.44 19.29	0.77 0.99 1.21
Side Arm Mount [SO 701-3]	C	None		0.0000	162.00	No Ice 1/2" Ice 1" Ice	2.83 3.92 5.01	2.83 3.92 5.01	0.20 0.24 0.28
***									
(2) DB846F65ZAXY w/ Mount Pipe	A	From Leg	4.00 0.00 1.00	0.0000	149.00	No Ice 1/2" Ice 1" Ice	7.27 7.88 8.48	7.82 9.01 9.91	0.05 0.11 0.19
HBX-6517DS-T2M w/ Mount Pipe	A	From Leg	4.00 0.00 1.00	0.0000	149.00	No Ice 1/2" Ice 1" Ice	5.48 6.05 6.59	5.02 6.22 7.17	0.04 0.08 0.14
LNX-6514DS-VTM w/ Mount Pipe	A	From Leg	4.00 0.00 1.00	0.0000	149.00	No Ice 1/2" Ice 1" Ice	8.57 9.22 9.84	7.00 8.19 9.08	0.06 0.12 0.20
(2) DB846F65ZAXY w/ Mount Pipe	B	From Leg	4.00 0.00 1.00	0.0000	149.00	No Ice 1/2" Ice 1" Ice	7.27 7.88 8.48	7.82 9.01 9.91	0.05 0.11 0.19
HBX-6517DS-T2M w/ Mount Pipe	B	From Leg	4.00 0.00 1.00	0.0000	149.00	No Ice 1/2" Ice 1" Ice	5.48 6.05 6.59	5.02 6.22 7.17	0.04 0.08 0.14
LNX-6514DS-VTM w/ Mount Pipe	B	From Leg	4.00 0.00 2.00	0.0000	149.00	No Ice 1/2" Ice 1" Ice	8.57 9.22 9.84	7.00 8.19 9.08	0.06 0.12 0.20
(2) DB846F65ZAXY w/ Mount Pipe	C	From Leg	4.00 0.00 2.00	0.0000	149.00	No Ice 1/2" Ice 1" Ice	7.27 7.88 8.48	7.82 9.01 9.91	0.05 0.11 0.19
HBX-6517DS-T2M w/ Mount Pipe	C	From Leg	4.00 0.00 2.00	0.0000	149.00	No Ice 1/2" Ice 1" Ice	5.48 6.05 6.59	5.02 6.22 7.17	0.04 0.08 0.14
LNX-6514DS-VTM w/ Mount Pipe	C	From Leg	4.00 0.00 2.00	0.0000	149.00	No Ice 1/2" Ice 1" Ice	8.57 9.22 9.84	7.00 8.19 9.08	0.06 0.12 0.20
Platform Mount [LP 713-1]	C	None		0.0000	149.00	No Ice 1/2" Ice 1" Ice	31.27 39.68 48.09	31.27 39.68 48.09	1.51 1.93 2.35
***									
(2) BSA-185065/10CF w/	A	From Leg	4.00	0.0000	134.00	No Ice	4.15	3.10	0.03

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
Mount Pipe			0.00			1/2" Ice	4.61	4.11	0.06
			1.00			1" Ice	5.06	4.84	0.11
KRC 115 032/2	A	From Leg	4.00	0.0000	134.00	No Ice	0.19	0.14	0.00
			0.00			1/2" Ice	0.25	0.19	0.00
			1.00			1" Ice	0.33	0.26	0.01
P65-17-XL-R w/ Mount Pipe	A	From Leg	4.00	0.0000	134.00	No Ice	11.70	8.94	0.09
			0.00			1/2" Ice	12.42	10.45	0.17
			1.00			1" Ice	13.15	11.99	0.27
(2) BSA-185065/10CF w/ Mount Pipe	B	From Leg	4.00	0.0000	134.00	No Ice	4.15	3.10	0.03
			0.00			1/2" Ice	4.61	4.11	0.06
			1.00			1" Ice	5.06	4.84	0.11
KRC 115 032/2	B	From Leg	4.00	0.0000	134.00	No Ice	0.19	0.14	0.00
			0.00			1/2" Ice	0.25	0.19	0.00
			1.00			1" Ice	0.33	0.26	0.01
P65-17-XL-R w/ Mount Pipe	B	From Leg	4.00	0.0000	134.00	No Ice	11.70	8.94	0.09
			0.00			1/2" Ice	12.42	10.45	0.17
			1.00			1" Ice	13.15	11.99	0.27
(2) BSA-185065/10CF w/ Mount Pipe	C	From Leg	4.00	0.0000	134.00	No Ice	4.15	3.10	0.03
			0.00			1/2" Ice	4.61	4.11	0.06
			1.00			1" Ice	5.06	4.84	0.11
KRC 115 032/2	C	From Leg	4.00	0.0000	134.00	No Ice	0.19	0.14	0.00
			0.00			1/2" Ice	0.25	0.19	0.00
			1.00			1" Ice	0.33	0.26	0.01
P65-17-XL-R w/ Mount Pipe	C	From Leg	4.00	0.0000	134.00	No Ice	11.70	8.94	0.09
			0.00			1/2" Ice	12.42	10.45	0.17
			1.00			1" Ice	13.15	11.99	0.27
Platform Mount [LP 401-1]	C	None		0.0000	134.00	No Ice	24.33	24.33	1.65
						1/2" Ice	30.22	30.22	2.03
						1" Ice	36.11	36.11	2.41

Load Combinations

Comb. No.	Description
1	Dead Only
2	1.2 Dead+1.6 Wind 0 deg - No Ice
3	0.9 Dead+1.6 Wind 0 deg - No Ice
4	1.2 Dead+1.6 Wind 30 deg - No Ice
5	0.9 Dead+1.6 Wind 30 deg - No Ice
6	1.2 Dead+1.6 Wind 60 deg - No Ice
7	0.9 Dead+1.6 Wind 60 deg - No Ice
8	1.2 Dead+1.6 Wind 90 deg - No Ice
9	0.9 Dead+1.6 Wind 90 deg - No Ice
10	1.2 Dead+1.6 Wind 120 deg - No Ice
11	0.9 Dead+1.6 Wind 120 deg - No Ice
12	1.2 Dead+1.6 Wind 150 deg - No Ice
13	0.9 Dead+1.6 Wind 150 deg - No Ice
14	1.2 Dead+1.6 Wind 180 deg - No Ice
15	0.9 Dead+1.6 Wind 180 deg - No Ice
16	1.2 Dead+1.6 Wind 210 deg - No Ice
17	0.9 Dead+1.6 Wind 210 deg - No Ice

Comb. No.	Description
18	1.2 Dead+1.6 Wind 240 deg - No Ice
19	0.9 Dead+1.6 Wind 240 deg - No Ice
20	1.2 Dead+1.6 Wind 270 deg - No Ice
21	0.9 Dead+1.6 Wind 270 deg - No Ice
22	1.2 Dead+1.6 Wind 300 deg - No Ice
23	0.9 Dead+1.6 Wind 300 deg - No Ice
24	1.2 Dead+1.6 Wind 330 deg - No Ice
25	0.9 Dead+1.6 Wind 330 deg - No Ice
26	1.2 Dead+1.0 Ice+1.0 Temp
27	1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp
28	1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp
29	1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp
30	1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp
31	1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp
32	1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp
33	1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp
34	1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp
35	1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp
36	1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp
37	1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp
38	1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp
39	Dead+Wind 0 deg - Service
40	Dead+Wind 30 deg - Service
41	Dead+Wind 60 deg - Service
42	Dead+Wind 90 deg - Service
43	Dead+Wind 120 deg - Service
44	Dead+Wind 150 deg - Service
45	Dead+Wind 180 deg - Service
46	Dead+Wind 210 deg - Service
47	Dead+Wind 240 deg - Service
48	Dead+Wind 270 deg - Service
49	Dead+Wind 300 deg - Service
50	Dead+Wind 330 deg - Service

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	178 - 140	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-41.35	-1.19	2.16
			Max. Mx	8	-14.79	-488.73	0.01
			Max. My	14	-14.76	-0.04	-496.61
			Max. Vy	8	22.25	-488.73	0.01
			Max. Vx	14	22.43	-0.04	-496.61
			Max. Torque	22			-2.23
L2	140 - 100	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-67.42	-3.46	-0.27
			Max. Mx	8	-29.09	-1605.87	-0.35
			Max. My	14	-29.08	-0.10	-1621.41
			Max. Vy	8	30.47	-1605.87	-0.35
			Max. Vx	14	30.65	-0.10	-1621.41
			Max. Torque	22			-2.22
L3	100 - 60	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-93.58	-6.09	-3.79
			Max. Mx	8	-47.28	-2927.80	-1.04
			Max. My	14	-47.27	-0.25	-2951.16
			Max. Vy	8	35.43	-2927.80	-1.04
			Max. Vx	14	35.61	-0.25	-2951.16

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Torque	22			-2.22
L4	60 - 20	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-121.64	-8.74	-7.39
			Max. Mx	8	-67.66	-4432.19	-1.88
			Max. My	14	-67.65	-0.44	-4463.31
			Max. Vy	8	39.50	-4432.19	-1.88
			Max. Vx	14	39.67	-0.44	-4463.31
			Max. Torque	22			-2.21
L5	20 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-136.30	-10.03	-9.14
			Max. Mx	8	-78.87	-5237.61	-2.36
			Max. My	14	-78.87	-0.56	-5272.54
			Max. Vy	8	41.03	-5237.61	-2.36
			Max. Vx	14	41.20	-0.56	-5272.54
			Max. Torque	22			-2.21

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	26	136.30	0.00	0.00
	Max. H_x	21	59.16	41.01	-0.01
	Max. H_z	3	59.16	-0.01	41.18
	Max. M_x	2	5265.46	-0.01	41.18
	Max. M_z	8	5237.61	-41.01	0.01
	Max. Torsion	10	2.18	-35.51	-20.59
	Min. Vert	15	59.16	0.01	-41.18
	Min. H_x	9	59.16	-41.01	0.01
	Min. H_z	15	59.16	0.01	-41.18
	Min. M_x	14	-5272.54	0.01	-41.18
	Min. M_z	20	-5234.09	41.01	-0.01
	Min. Torsion	22	-2.21	35.51	20.59

Tower Mast Reaction Summary

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead Only	65.73	0.00	0.00	2.86	-1.41	0.00
1.2 Dead+1.6 Wind 0 deg - No Ice	78.88	0.01	-41.18	-5265.46	-2.96	0.71
0.9 Dead+1.6 Wind 0 deg - No Ice	59.16	0.01	-41.18	-5216.12	-2.49	0.72
1.2 Dead+1.6 Wind 30 deg - No Ice	78.88	20.51	-35.67	-4561.08	-2620.88	-0.46
0.9 Dead+1.6 Wind 30 deg - No Ice	59.16	20.51	-35.67	-4518.15	-2595.31	-0.46
1.2 Dead+1.6 Wind 60 deg - No Ice	78.88	35.52	-20.60	-2632.54	-4537.05	-1.50
0.9 Dead+1.6 Wind 60 deg - No Ice	59.16	35.52	-20.60	-2608.15	-4493.11	-1.49
1.2 Dead+1.6 Wind 90 deg - No	78.88	41.01	-0.01	2.36	-5237.61	-2.12

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Ice						
0.9 Dead+1.6 Wind 90 deg - No Ice	59.16	41.01	-0.01	1.46	-5187.08	-2.12
1.2 Dead+1.6 Wind 120 deg - No Ice	78.88	35.51	20.59	2637.58	-4535.83	-2.18
0.9 Dead+1.6 Wind 120 deg - No Ice	59.16	35.51	20.59	2611.37	-4491.90	-2.18
1.2 Dead+1.6 Wind 150 deg - No Ice	78.88	20.50	35.66	4566.97	-2618.79	-1.66
0.9 Dead+1.6 Wind 150 deg - No Ice	59.16	20.50	35.66	4522.25	-2593.25	-1.67
1.2 Dead+1.6 Wind 180 deg - No Ice	78.88	-0.01	41.18	5272.54	-0.56	-0.71
0.9 Dead+1.6 Wind 180 deg - No Ice	59.16	-0.01	41.18	5221.38	-0.12	-0.72
1.2 Dead+1.6 Wind 210 deg - No Ice	78.88	-20.51	35.67	4568.17	2617.35	0.43
0.9 Dead+1.6 Wind 210 deg - No Ice	59.16	-20.51	35.67	4523.42	2592.69	0.42
1.2 Dead+1.6 Wind 240 deg - No Ice	78.88	-35.52	20.60	2639.66	4533.51	1.47
0.9 Dead+1.6 Wind 240 deg - No Ice	59.16	-35.52	20.60	2613.43	4490.47	1.46
1.2 Dead+1.6 Wind 270 deg - No Ice	78.88	-41.01	0.01	4.76	5234.09	2.12
0.9 Dead+1.6 Wind 270 deg - No Ice	59.16	-41.01	0.01	3.83	5184.47	2.12
1.2 Dead+1.6 Wind 300 deg - No Ice	78.88	-35.51	-20.59	-2630.47	4532.33	2.21
0.9 Dead+1.6 Wind 300 deg - No Ice	59.16	-35.51	-20.59	-2606.09	4489.32	2.21
1.2 Dead+1.6 Wind 330 deg - No Ice	78.88	-20.50	-35.66	-4559.88	2615.29	1.70
0.9 Dead+1.6 Wind 330 deg - No Ice	59.16	-20.50	-35.66	-4516.96	2590.64	1.70
1.2 Dead+1.0 Ice+1.0 Temp	136.30	-0.00	-0.00	9.14	-10.03	-0.00
1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp	136.30	0.00	-8.28	-1079.94	-11.10	0.10
1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp	136.30	4.13	-7.17	-934.27	-554.25	-0.08
1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp	136.30	7.16	-4.14	-535.72	-951.71	-0.23
1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp	136.30	8.26	-0.00	8.91	-1096.98	-0.33
1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp	136.30	7.15	4.13	553.69	-951.15	-0.33
1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp	136.30	4.13	7.16	952.65	-553.28	-0.25
1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp	136.30	-0.00	8.28	1098.88	-9.98	-0.10
1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp	136.30	-4.13	7.17	953.21	533.17	0.07
1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp	136.30	-7.16	4.14	554.66	930.63	0.23
1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp	136.30	-8.26	0.00	10.03	1075.91	0.33
1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp	136.30	-7.15	-4.13	-534.75	930.07	0.33
1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp	136.30	-4.13	-7.16	-933.71	532.20	0.25
Dead+Wind 0 deg - Service	65.73	0.00	-8.29	-1051.95	-1.70	0.15

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	K	K	K	kip-ft	kip-ft	kip-ft
Dead+Wind 30 deg - Service	65.73	4.13	-7.18	-910.74	-525.72	-0.09
Dead+Wind 60 deg - Service	65.73	7.15	-4.15	-524.71	-909.26	-0.30
Dead+Wind 90 deg - Service	65.73	8.25	-0.00	2.70	-1049.56	-0.43
Dead+Wind 120 deg - Service	65.73	7.15	4.14	530.18	-909.02	-0.44
Dead+Wind 150 deg - Service	65.73	4.13	7.18	916.38	-525.30	-0.34
Dead+Wind 180 deg - Service	65.73	-0.00	8.29	1057.83	-1.22	-0.15
Dead+Wind 210 deg - Service	65.73	-4.13	7.18	916.62	522.80	0.09
Dead+Wind 240 deg - Service	65.73	-7.15	4.15	530.59	906.34	0.30
Dead+Wind 270 deg - Service	65.73	-8.25	0.00	3.18	1046.64	0.43
Dead+Wind 300 deg - Service	65.73	-7.15	-4.14	-524.30	906.10	0.45
Dead+Wind 330 deg - Service	65.73	-4.13	-7.18	-910.50	522.38	0.34

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX	PY	PZ	PX	PY	PZ	% Error
	K	K	K	K	K	K	
1	0.00	-65.73	0.00	-0.00	65.73	-0.00	0.000%
2	0.01	-78.88	-41.18	-0.01	78.88	41.18	0.008%
3	0.01	-59.16	-41.18	-0.01	59.16	41.18	0.007%
4	20.51	-78.88	-35.67	-20.51	78.88	35.67	0.000%
5	20.51	-59.16	-35.67	-20.51	59.16	35.67	0.000%
6	35.52	-78.88	-20.60	-35.52	78.88	20.60	0.000%
7	35.52	-59.16	-20.60	-35.52	59.16	20.60	0.000%
8	41.01	-78.88	-0.01	-41.01	78.88	0.01	0.003%
9	41.01	-59.16	-0.01	-41.01	59.16	0.01	0.002%
10	35.51	-78.88	20.59	-35.51	78.88	-20.59	0.000%
11	35.51	-59.16	20.59	-35.51	59.16	-20.59	0.000%
12	20.50	-78.88	35.66	-20.50	78.88	-35.66	0.000%
13	20.50	-59.16	35.66	-20.50	59.16	-35.66	0.000%
14	-0.01	-78.88	41.18	0.01	78.88	-41.18	0.008%
15	-0.01	-59.16	41.18	0.01	59.16	-41.18	0.007%
16	-20.51	-78.88	35.67	20.51	78.88	-35.67	0.000%
17	-20.51	-59.16	35.67	20.51	59.16	-35.67	0.000%
18	-35.52	-78.88	20.60	35.52	78.88	-20.60	0.000%
19	-35.52	-59.16	20.60	35.52	59.16	-20.60	0.000%
20	-41.01	-78.88	0.01	41.01	78.88	-0.01	0.003%
21	-41.01	-59.16	0.01	41.01	59.16	-0.01	0.002%
22	-35.51	-78.88	-20.59	35.51	78.88	20.59	0.000%
23	-35.51	-59.16	-20.59	35.51	59.16	20.59	0.000%
24	-20.50	-78.88	-35.66	20.50	78.88	35.66	0.000%
25	-20.50	-59.16	-35.66	20.50	59.16	35.66	0.000%
26	0.00	-136.30	0.00	0.00	136.30	0.00	0.001%
27	0.00	-136.30	-8.28	-0.00	136.30	8.28	0.000%
28	4.13	-136.30	-7.17	-4.13	136.30	7.17	0.000%
29	7.16	-136.30	-4.14	-7.16	136.30	4.14	0.000%
30	8.26	-136.30	-0.00	-8.26	136.30	0.00	0.000%
31	7.15	-136.30	4.13	-7.15	136.30	-4.13	0.000%
32	4.13	-136.30	7.17	-4.13	136.30	-7.16	0.000%
33	-0.00	-136.30	8.28	0.00	136.30	-8.28	0.000%
34	-4.13	-136.30	7.17	4.13	136.30	-7.17	0.000%
35	-7.16	-136.30	4.14	7.16	136.30	-4.14	0.000%
36	-8.26	-136.30	0.00	8.26	136.30	-0.00	0.000%
37	-7.15	-136.30	-4.13	7.15	136.30	4.13	0.000%
38	-4.13	-136.30	-7.17	4.13	136.30	7.16	0.000%
39	0.00	-65.73	-8.29	-0.00	65.73	8.29	0.002%
40	4.13	-65.73	-7.18	-4.13	65.73	7.18	0.002%
41	7.15	-65.73	-4.15	-7.15	65.73	4.15	0.002%

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
42	8.26	-65.73	-0.00	-8.25	65.73	0.00	0.002%
43	7.15	-65.73	4.14	-7.15	65.73	-4.14	0.002%
44	4.13	-65.73	7.18	-4.13	65.73	-7.18	0.002%
45	-0.00	-65.73	8.29	0.00	65.73	-8.29	0.002%
46	-4.13	-65.73	7.18	4.13	65.73	-7.18	0.002%
47	-7.15	-65.73	4.15	7.15	65.73	-4.15	0.002%
48	-8.26	-65.73	0.00	8.25	65.73	-0.00	0.002%
49	-7.15	-65.73	-4.14	7.15	65.73	4.14	0.002%
50	-4.13	-65.73	-7.18	4.13	65.73	7.18	0.002%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	6	0.00000001	0.00000001
2	Yes	12	0.00013224	0.00014157
3	Yes	12	0.00009061	0.00012893
4	Yes	16	0.00000001	0.00006760
5	Yes	15	0.00000001	0.00014706
6	Yes	16	0.00000001	0.00006907
7	Yes	16	0.00000001	0.00005275
8	Yes	13	0.00004857	0.00008338
9	Yes	13	0.00003257	0.00007239
10	Yes	16	0.00000001	0.00006597
11	Yes	15	0.00000001	0.00014339
12	Yes	16	0.00000001	0.00006963
13	Yes	16	0.00000001	0.00005314
14	Yes	12	0.00013223	0.00014036
15	Yes	12	0.00009061	0.00012798
16	Yes	16	0.00000001	0.00006846
17	Yes	15	0.00000001	0.00014895
18	Yes	16	0.00000001	0.00006655
19	Yes	15	0.00000001	0.00014472
20	Yes	13	0.00004857	0.00008213
21	Yes	13	0.00003258	0.00007141
22	Yes	16	0.00000001	0.00006955
23	Yes	16	0.00000001	0.00005316
24	Yes	16	0.00000001	0.00006634
25	Yes	15	0.00000001	0.00014430
26	Yes	8	0.00000001	0.00001149
27	Yes	14	0.00000001	0.00010001
28	Yes	14	0.00000001	0.00010639
29	Yes	14	0.00000001	0.00010667
30	Yes	14	0.00000001	0.00010110
31	Yes	14	0.00000001	0.00010701
32	Yes	14	0.00000001	0.00010717
33	Yes	14	0.00000001	0.00010084
34	Yes	14	0.00000001	0.00010579
35	Yes	14	0.00000001	0.00010518
36	Yes	14	0.00000001	0.00009903
37	Yes	14	0.00000001	0.00010460
38	Yes	14	0.00000001	0.00010479
39	Yes	12	0.00000001	0.00003212
40	Yes	12	0.00000001	0.00002681
41	Yes	12	0.00000001	0.00003059
42	Yes	12	0.00000001	0.00003277

43	Yes	12	0.00000001	0.00002444
44	Yes	12	0.00000001	0.00003147
45	Yes	12	0.00000001	0.00003226
46	Yes	12	0.00000001	0.00002870
47	Yes	12	0.00000001	0.00002509
48	Yes	12	0.00000001	0.00003267
49	Yes	12	0.00000001	0.00003210
50	Yes	12	0.00000001	0.00002497

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	178 - 140	18.890	45	0.9515	0.0029
L2	140 - 100	11.643	45	0.8005	0.0012
L3	100 - 60	5.855	45	0.5319	0.0005
L4	60 - 20	2.148	45	0.3337	0.0002
L5	20 - 0	0.233	45	0.1081	0.0001

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
178.00	Lightning Rod	45	18.890	0.9515	0.0029	64019
168.00	KRY 112 144/1	45	16.899	0.9197	0.0024	32009
162.00	(2) RRUS-11	45	15.720	0.8992	0.0021	20006
160.00	(2) 7020.00	45	15.331	0.8919	0.0021	17783
149.00	(2) DB846F65ZAXY w/ Mount Pipe	45	13.250	0.8466	0.0016	11037
134.00	(2) BSA-185065/10CF w/ Mount Pipe	45	10.632	0.7642	0.0011	8493

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	178 - 140	94.239	14	4.7526	0.0144
L2	140 - 100	58.082	14	3.9964	0.0060
L3	100 - 60	29.209	14	2.6549	0.0024
L4	60 - 20	10.713	14	1.6652	0.0012
L5	20 - 0	1.160	14	0.5389	0.0003

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
178.00	Lightning Rod	14	94.239	4.7526	0.0149	12967
168.00	KRY 112 144/1	14	84.305	4.5932	0.0123	6482
162.00	(2) RRUS-11	14	78.423	4.4903	0.0108	4050
160.00	(2) 7020.00	14	76.484	4.4539	0.0103	3600
149.00	(2) DB846F65ZAXY w/ Mount Pipe	14	66.101	4.2271	0.0079	2232
134.00	(2) BSA-185065/10CF w/ Mount Pipe	14	53.041	3.8150	0.0053	1714

Compression Checks

Pole Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
L1	178 - 140 (1)	P24x1/2	38.00	0.00	0.0	36.9137	-14.76	1162.78	0.013
L2	140 - 100 (2)	P36x1/2 4.8.2 (1.04 CR) - 2	40.00	0.00	0.0	55.7633	-29.08	1756.54	0.017
L3	100 - 60 (3)	P48x5/8	40.00	0.00	0.0	93.0206	-47.27	2930.15	0.016
L4	60 - 20 (4)	P54x5/8 4.8.2 (1.05 CR) - 4	40.00	0.00	0.0	104.8020	-67.65	3301.25	0.020
L5	20 - 0 (5)	P60x5/8 4.8.2 (1.02 CR) - 5	20.00	0.00	0.0	116.5830	-78.87	3649.51	0.022

Pole Bending Design Data

Section No.	Elevation ft	Size	M_{ux} kip-ft	ϕM_{nx} kip-ft	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M_{uy} kip-ft	ϕM_{ny} kip-ft	Ratio $\frac{M_{uy}}{\phi M_{ny}}$
L1	178 - 140 (1)	P24x1/2	496.61	724.94	0.685	0.00	724.94	0.000
L2	140 - 100 (2)	P36x1/2	1621.42	1586.55	1.022	0.00	1586.55	0.000
L3	100 - 60 (3)	P48x5/8	2951.16	3492.39	0.845	0.00	3492.39	0.000
L4	60 - 20 (4)	P54x5/8	4463.31	4349.32	1.026	0.00	4349.32	0.000
L5	20 - 0 (5)	P60x5/8	5272.53	5299.02	0.995	0.00	5299.02	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V_u K	ϕV_n K	Ratio $\frac{V_u}{\phi V_n}$	Actual T_u kip-ft	ϕT_n kip-ft	Ratio $\frac{T_u}{\phi T_n}$
L1	178 - 140 (1)	P24x1/2	22.43	581.39	0.039	0.72	1115.34	0.001
L2	140 - 100 (2)	P36x1/2	30.65	878.27	0.035	0.72	2562.64	0.000
L3	100 - 60 (3)	P48x5/8	35.61	1465.07	0.024	0.72	5709.67	0.000
L4	60 - 20 (4)	P54x5/8	39.67	1650.62	0.024	0.71	7257.86	0.000

Section No.	Elevation ft	Size	Actual V_u K	ϕV_n K	Ratio $\frac{V_u}{\phi V_n}$	Actual T_u kip-ft	ϕT_n kip-ft	Ratio $\frac{T_u}{\phi T_n}$
L5	20 - 0 (5)	P60x5/8	41.20	1824.75	0.023	0.71	8935.67	0.000

Pole Interaction Design Data

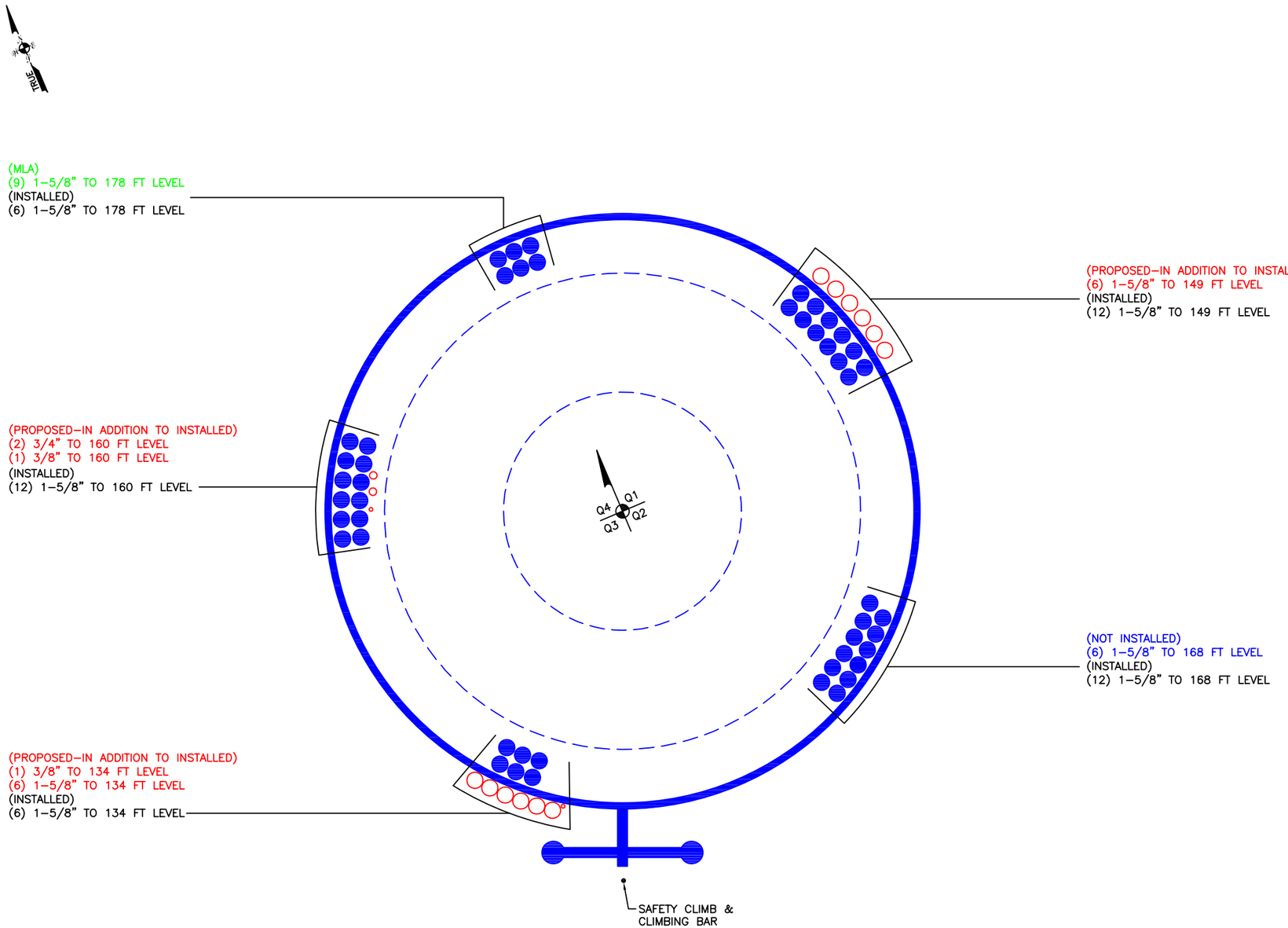
Section No.	Elevation ft	Ratio $\frac{P_u}{\phi P_n}$	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	Ratio $\frac{M_{uy}}{\phi M_{ny}}$	Ratio $\frac{V_u}{\phi V_n}$	Ratio $\frac{T_u}{\phi T_n}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	178 - 140 (1)	0.013	0.685	0.000	0.039	0.001	0.699 ✓	1.000	4.8.2 ✓
L2	140 - 100 (2)	0.017	1.022	0.000	0.035	0.000	**1.040** ✗	1.000	4.8.2 ✗
L3	100 - 60 (3)	0.016	0.845	0.000	0.024	0.000	0.862 ✓	1.000	4.8.2 ✓
L4	60 - 20 (4)	0.020	1.026	0.000	0.024	0.000	**1.047** ✗	1.000	4.8.2 ✗
L5	20 - 0 (5)	0.022	0.995	0.000	0.023	0.000	**1.017** ✗	1.000	4.8.2 ✗

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	ϕP_{allow} K	% Capacity	Pass Fail
L1	178 - 140	Pole	P24x1/2	1	-14.76	1162.78	69.9	Pass
L2	140 - 100	Pole	P36x1/2	2	-29.08	1756.54	104.0	Fail ✗
L3	100 - 60	Pole	P48x5/8	3	-47.27	2930.15	86.2	Pass
L4	60 - 20	Pole	P54x5/8	4	-67.65	3301.25	104.7	Fail ✗
L5	20 - 0	Pole	P60x5/8	5	-78.87	3649.51	101.7	Fail ✗
							Summary	
						Pole (L4)	104.7	Fail ✗
						RATING =	**104.7**	**Fail** ✗

APPENDIX B

BASE LEVEL DRAWING



BUSINESS UNIT: 878783 TOWER ID: C_BASELEVEL

CROWN REGION ADDRESS

USA

13/08/07	NEW BUILD PER WORK ORDER # 159546	DJA
20/05/08	APPLICATION ADDED PER WORK ORDER # 211329	BH
03/03/09	APPLICATION ADDED PER WORK ORDER # 257025	ESG
27/01/11	AS-BUILT INFORMATION ADDED PER WORK ORDER # 373506	KLB
19/04/11	APPLICATION ADDED PER WORK ORDER # 403604	BBF
06/05/11	APPLICATION ADDED PER WORK ORDER # 409085	ESG
24/05/11	AS-BUILT INFORMATION ADDED PER WORK ORDER # 412540	PLW
05/03/12	APPLICATION ADDED PER WORK ORDER # 474840	LAN

DRAWN BY: **DJA**
CHECKED BY: **BBF**
DRAWING DATE: **13/08/07**

SITE NUMBER:
SITE NAME:

SITE NAME

PORTLAND NORTH

BUSINESS UNIT NUMBER

878783

SITE ADDRESS

527 PERSUMPSCOT
PORTLAND, ME 04101
CUMBERLAND COUNTY
USA

SHEET TITLE

BASE LEVEL

SHEET NUMBER

A1-0

BASE LEVEL DRAWING

SCALE: 1" = 1'-0" | 1

PLOT DATE: 3/5/2012 FILE NAME: 878783_BASELEVEL.DWG

APPENDIX C

ADDITIONAL CALCULATIONS

Stiffened or Unstiffened, Exterior Flange Plate - Any Bolt Material TIA Rev G

Site Data

BU#:	
Site Name:	
App #:	

Reactions		
Mu	4463.31	ft-kips
Axial, Pu:	67.65	kips
Shear, Vu:	39.67	kips
Elevation:	20	feet

Bolt Threads:
X-Excluded
φVn=φ(0.55*Ab*Fu)
φ=0.75, φ*Vn (kips):
43.05

Pole Manufacturer:	Other

If No stiffeners, Criteria:	TIA G	<-Only Applcable to Unstiffened Cases

Bolt Data

Qty:	60		
Diameter (in.):	1.125	Bolt Fu:	105
Bolt Material:	A325	Bolt Fy:	81
N/A:	75	<-- Disregard	
N/A:	55	<-- Disregard	
Circle (in.):	56.375		

Plate Data

Diam:	58.5	in
Thick, t:	3.125	in
Grade (Fy):	36	ksi
Strength, Fu:	58	ksi
Single-Rod B-eff:	2.83	in

Stiffener Data (Welding at Both Sides)

Config:	0	*
Weld Type:	Fillet	
Groove Depth:	0.25	<-- Disregard
Groove Angle:	45	<-- Disregard
Fillet H. Weld:	0.3125	in
Fillet V. Weld:	0.3125	in
Width:	3	in
Height:	18	in
Thick:	0.75	in
Notch:	0.5	in
Grade:	36	ksi
Weld str.:	70	ksi

Pole Data

Diam:	54	in
Thick:	0.625	in
Grade:	35	ksi
# of Sides:	0	"0" IF Round
Fu	63	ksi
Reinf. Fillet Weld	0	"0" if None

Flange Bolt Results

				Rigid
Bolt Tension Capacity, φ*Tn, **B1**:	60.09	kips		φ*Tn
Adjusted φ*Tn (due to Vu=Vu/Qty), **B**:	60.08	kips		φTn[(1-(Vu/φVn)^2]^0.5
Max Bolt directly applied Tu:	62.21	Kips		
Min. PL "tc" for **B** cap. **w/o** Pry:	Tu>B N/A	in		
Min PL "treq" for actual **T w/ Pry**:	1.026	in		
Min PL "t1" for actual **T w/o Pry**:	Tu>B N/A	in		
T allowable w/o Prying:	60.09	kips		
Prying Force, q:	0.00	kips	T>B	Case
Total Bolt Tension=Tu+q:	62.21	kips		
Non-Prying Bolt Stress Ratio, Tu/B:	103.5%	**Pass**		

Exterior Flange Plate Results Flexural Check

				Rigid
Compression Side Plate Stress:	7.2	ksi		TIA G
Allowable Plate Stress:	32.4	ksi		φ*Fy
Compression Plate Stress Ratio:	22.1%	**Pass**		Comp. Y.L. Length:
No Prying Check for Tu>B				16.19
Tension Side Stress Ratio, (treq/t)^2:	10.8%	**Pass**		

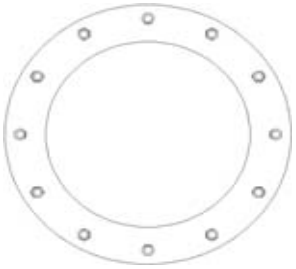
n/a

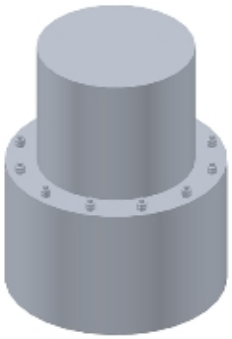
Stiffener Results

Horizontal Weld :	n/a
Vertical Weld:	n/a
Plate Flex+Shear, fb/Fb+(fv/Fv)^2:	n/a
Plate Tension+Shear, ft/Ft+(fv/Fv)^2:	n/a
Plate Comp. (AISC Bracket):	n/a

Pole Results

Pole Punching Shear Check: n/a





* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt

** Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

Stiffened or Unstiffened, Interior Flange Plate - Any Bolt Material TIA Rev G

Site Data

BU#:	
Site Name:	
App #:	

Manufacturer:	Other

Reactions		
Moment:	4463.31	ft-kips
Axial:	67.65	kips
Shear:	39.67	kips
Exterior Flange Run, T+q:	62.21	kips

Bolt Threads:
X-Excluded
φVn=φ(0.55*Ab*Fu)
φ=0.75, φ*Vn (kips):
43.05

Elevation: 20 feet

Bolt Data			
Qty:	60		
Diam:	1.125	Bolt Fu:	105
Bolt Material:	A325	Bolt Fy:	81
N/A:	100	<-- Disregard	
N/A:	75	<-- Disregard	
Circle:	56.375	in	

Interior Flange Bolt Results

Maximum Bolt Tension, Tu:	62.2	Kips, Ext. Flange Tu+q
Adjusted φ*Tn (due to Vu=Vu/Qty), I	60.1	Kips
Bolt Stress Ratio:	103.5%	**Pass**

Plate Data		
Plate Outer Diam:	58.75	in
Plate Inner Diam:	54.25	in (Hole @ Ctr)
Thick:	3.125	in
Grade:	36	ksi
Effective Width:	3.08	in

Interior Flange Plate Results Flexural Check

Controlling Bolt Axial Force:	64.5	Kips, Ext. Cu=Interior Cu
Plate Stress:	10.2	ksi
Allowable Plate Stress, φ*Fy:	32.4	ksi
Plate Stress Ratio:	31.5%	**Pass**

Stiffener Data (Welding at Both Sides)		
Config:	0	*
Weld Type:	Fillet	
Groove Depth:	0.375	<-- Disregard
Groove Angle:	45	<-- Disregard
Fillet H. Weld:	0.3125	in
Fillet V. Weld:	0.3125	in
Width:	3	in
Height:	18	in
Thick:	0.75	in
Notch:	0.5	in
Grade:	36	ksi
Weld str.:	70	ksi

n/a

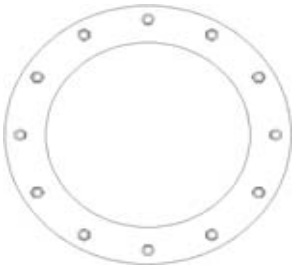
Stiffener Results

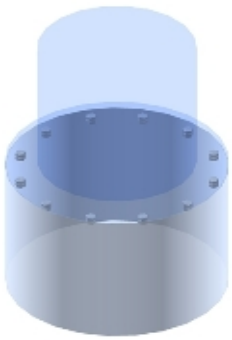
Horizontal Weld :	n/a
Vertical Weld:	n/a
Plate Flex+Shear, fb/Fb+(fv/Fv)^2:	n/a
Plate Tension+Shear, ft/Ft+(fv/Fv)^2:	n/a
Plate Comp. (AISC Bracket):	n/a

Pole Results

Pole Punching Shear Check: n/a

Pole Data		
Pole OuterDiam:	60	in
Thick:	0.625	in
Pole Inner Diam:	58.75	in
Grade:	36	ksi
# of Sides:	0	"0" IF Round
Fu	63	ksi





* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt

** Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

Stiffened or Unstiffened, Exterior Flange Plate - Any Bolt Material TIA Rev G

Site Data

BU#:	
Site Name:	
App #:	

Reactions		
Mu	2951.16	ft-kips
Axial, Pu:	47.27	kips
Shear, Vu:	35.61	kips
Elevation:	60	feet

Bolt Threads:
X-Excluded
φVn=φ(0.55*Ab*Fu)
φ=0.75, φ*Vn (kips):
38.88

Pole Manufacturer:	Other

If No stiffeners, Criteria:	TIA G	<-Only Applcable to Unstiffened Cases

Bolt Data

Qty:	56		
Diameter (in.):	1	Bolt Fu:	120
Bolt Material:	A325	Bolt Fy:	92
N/A:	75	<-- Disregard	
N/A:	55	<-- Disregard	
Circle (in.):	50.375		

Plate Data

Diam:	52.5	in
Thick, t:	2.75	in
Grade (Fy):	36	ksi
Strength, Fu:	58	ksi
Single-Rod B-eff:	2.69	in

Stiffener Data (Welding at Both Sides)

Config:	0	*
Weld Type:	Fillet	
Groove Depth:	0.25	<-- Disregard
Groove Angle:	45	<-- Disregard
Fillet H. Weld:	0.3125	in
Fillet V. Weld:	0.3125	in
Width:	3	in
Height:	18	in
Thick:	0.75	in
Notch:	0.5	in
Grade:	36	ksi
Weld str.:	70	ksi

Pole Data

Diam:	48	in
Thick:	0.625	in
Grade:	35	ksi
# of Sides:	0	"0" IF Round
Fu	63	ksi
Reinf. Fillet Weld	0	"0" if None

Flange Bolt Results

			Rigid
Bolt Tension Capacity, φ*Tn, **B1**:	54.54	kips	φ*Tn
Adjusted φ*Tn (due to Vu=Vu/Qty), **B**:	54.53	kips	φTn[(1-(Vu/φVn)^2]^0.5
Max Bolt directly applied Tu:	49.37	Kips	
Min. PL "tc" for **B** cap. **w/o** Pry:	1.032	in	
Min PL "treq" for actual **T w/ Pry**:	0.858	in	
Min PL "t1" for actual **T w/o Pry**:	0.982	in	
T allowable w/o Prying:	54.54	kips	α'<0 case
Prying Force, q:	0.00	kips	
Total Bolt Tension=Tu+q:	49.37	kips	
Non-Prying Bolt Stress Ratio, Tu/B:	90.5%	**Pass**	

Exterior Flange Plate Results Flexural Check

			Rigid
Compression Side Plate Stress:	7.6	ksi	TIA G
Allowable Plate Stress:	32.4	ksi	φ*Fy
Compression Plate Stress Ratio:	23.6%	**Pass**	Comp. Y.L. Length:
No Prying			15.29
Tension Side Stress Ratio, (treq/t)^2:	9.7%	**Pass**	

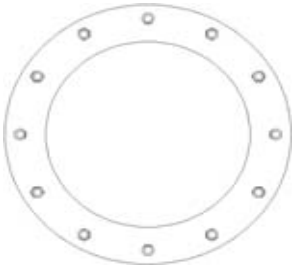
n/a

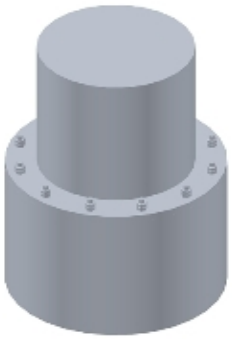
Stiffener Results

Horizontal Weld :	n/a
Vertical Weld:	n/a
Plate Flex+Shear, fb/Fb+(fv/Fv)^2:	n/a
Plate Tension+Shear, ft/Ft+(fv/Fv)^2:	n/a
Plate Comp. (AISC Bracket):	n/a

Pole Results

Pole Punching Shear Check: n/a





* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt

** Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

Stiffened or Unstiffened, Interior Flange Plate - Any Bolt Material TIA Rev G

Site Data

BU#:	
Site Name:	
App #:	

Manufacturer:	Other

Reactions		
Moment:	2951.16	ft-kips
Axial:	47.27	kips
Shear:	35.61	kips
Exterior Flange Run, T+q:	49.37	kips

Bolt Threads:
X-Excluded
φVn=φ(0.55*Ab*Fu)
φ=0.75, φ*Vn (kips):
38.88

Elevation: 60 feet

Bolt Data			
Qty:	56		
Diam:	1	Bolt Fu:	120
Bolt Material:	A325	Bolt Fy:	92
N/A:	100	<-- Disregard	
N/A:	75	<-- Disregard	
Circle:	50.375	in	

Interior Flange Bolt Results

Maximum Bolt Tension, Tu:	49.4	Kips, Ext. Tu=Interior Tu
Adjusted φ*Tn (due to Vu=Vu/Qty), I	54.5	Kips
Bolt Stress Ratio:	90.5%	**Pass**

Plate Data		
Plate Outer Diam:	52.75	in
Plate Inner Diam:	48.25	in (Hole @ Ctr)
Thick:	2.75	in
Grade:	36	ksi
Effective Width:	2.96	in

Interior Flange Plate Results Flexural Check

Controlling Bolt Axial Force:	51.1	Kips, Ext. Cu=Interior Cu
Plate Stress:	10.8	ksi
Allowable Plate Stress, φ*Fy:	32.4	ksi
Plate Stress Ratio:	33.4%	**Pass**

Stiffener Data (Welding at Both Sides)		
Config:	0	*
Weld Type:	Fillet	
Groove Depth:	0.375	<-- Disregard
Groove Angle:	45	<-- Disregard
Fillet H. Weld:	0.3125	in
Fillet V. Weld:	0.3125	in
Width:	3	in
Height:	18	in
Thick:	0.75	in
Notch:	0.5	in
Grade:	36	ksi
Weld str.:	70	ksi

n/a

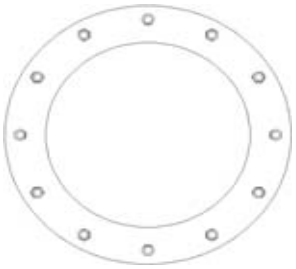
Stiffener Results

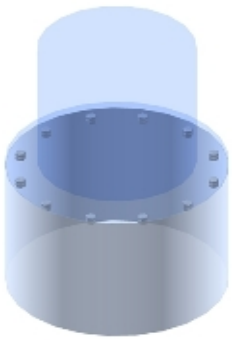
Horizontal Weld :	n/a
Vertical Weld:	n/a
Plate Flex+Shear, fb/Fb+(fv/Fv)^2:	n/a
Plate Tension+Shear, ft/Ft+(fv/Fv)^2:	n/a
Plate Comp. (AISC Bracket):	n/a

Pole Results

Pole Punching Shear Check: n/a

Pole Data		
Pole OuterDiam:	54	in
Thick:	0.625	in
Pole Inner Diam:	52.75	in
Grade:	35	ksi
# of Sides:	0	"0" IF Round
Fu	63	ksi





* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt

** Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

Stiffened or Unstiffened, Exterior Flange Plate - Any Bolt Material TIA Rev G

Site Data

BU#:	
Site Name:	
App #:	

Reactions		
Mu	1621.42	ft-kips
Axial, Pu:	29.08	kips
Shear, Vu:	30.65	kips
Elevation:	100	feet

Bolt Threads:
X-Excluded
φVn=φ(0.55*Ab*Fu)
φ=0.75, φ*Vn (kips):
27.34

Pole Manufacturer:	Other

If No stiffeners, Criteria:	TIA G

<-Only Applcable to Unstiffened Cases

Bolt Data

Qty:	52		
Diameter (in.):	0.75	Bolt Fu:	150
Bolt Material:	Other	Bolt Fy:	113
Strength (Fu):	150	ksi	
Yield (Fy):	113	ksi	
Circle (in.):	41.375		

Plate Data

Diam:	46.5	in
Thick, t:	2.5	in
Grade (Fy):	36	ksi
Strength, Fu:	58	ksi
Single-Rod B-eff:	2.17	in

Stiffener Data (Welding at Both Sides)

Config:	0	*
Weld Type:	Fillet	
Groove Depth:	0.25	<-- Disregard
Groove Angle:	45	<-- Disregard
Fillet H. Weld:	0.3125	in
Fillet V. Weld:	0.3125	in
Width:	3	in
Height:	18	in
Thick:	0.75	in
Notch:	0.5	in
Grade:	36	ksi
Weld str.:	70	ksi

Pole Data

Diam:	36	in
Thick:	0.5	in
Grade:	36	ksi
# of Sides:	0	"0" IF Round
Fu	63	ksi
Reinf. Fillet Weld	0	"0" if None

Flange Bolt Results

			Rigid
Bolt Tension Capacity, φ*Tn, **B1**:	37.58	kips	φ*Tn
Adjusted φ*Tn (due to Vu=Vu/Qty), **B**:	37.57	kips	φTn[(1-(Vu/φVn)^2]^0.5
Max Bolt directly applied Tu:	35.61	Kips	
Min. PL "tc" for **B** cap. **w/o** Pry:	1.749	in	
Min PL "treq" for actual **T w/ Pry**:	1.642	in	
Min PL "t1" for actual **T w/o Pry**:	1.703	in	
T allowable w/o Prying:	37.58	kips	α'<0 case
Prying Force, q:	0.00	kips	
Total Bolt Tension=Tu+q:	35.61	kips	
Non-Prying Bolt Stress Ratio, Tu/B:	94.8%	**Pass**	

Exterior Flange Plate Results Flexural Check

			Rigid
Compression Side Plate Stress:	17.1	ksi	TIA G
Allowable Plate Stress:	32.4	ksi	φ*Fy
Compression Plate Stress Ratio:	52.9%	**Pass**	Comp. Y.L. Length:
No Prying			20.39
Tension Side Stress Ratio, (treq/t)^2:	43.2%	**Pass**	

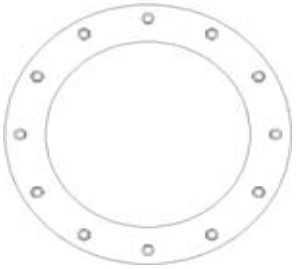
n/a

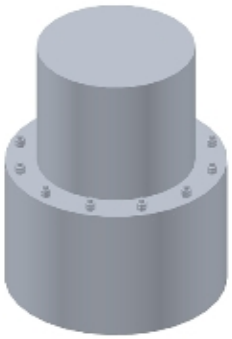
Stiffener Results

Horizontal Weld :	n/a
Vertical Weld:	n/a
Plate Flex+Shear, fb/Fb+(fv/Fv)^2:	n/a
Plate Tension+Shear, ft/Ft+(fv/Fv)^2:	n/a
Plate Comp. (AISC Bracket):	n/a

Pole Results

Pole Punching Shear Check: n/a





* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt

** Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

Stiffened or Unstiffened, Interior Flange Plate - Any Bolt Material TIA Rev G

Site Data	
BU#:	
Site Name:	
App #:	

Reactions		
Moment:	1621.42	ft-kips
Axial:	29.08	kips
Shear:	30.65	kips
Exterior Flange Run, T+q:	35.61	kips

Bolt Threads:
X-Excluded
φVn=φ(0.55*Ab*Fu)
φ=0.75, φ*Vn (kips):
27.34

Manufacturer:	Other

Elevation: 100 feet

Bolt Data			
Qty:	52		
Diam:	0.75	Bolt Fu:	150
Bolt Material:	Other	Bolt Fy:	113
Strength (Fu):	150	ksi	
Yield (Fy):	113	ksi	
Circle:	41.375	in	

Interior Flange Bolt Results

Maximum Bolt Tension, Tu:	35.6	Kips, Ext. Tu=Interior Tu
Adjusted φ*Tn (due to Vu=Vu/Qty), I	37.6	Kips
Bolt Stress Ratio:	94.8%	**Pass**

Plate Data		
Plate Outer Diam:	46.75	in
Plate Inner Diam:	36.25	in (Hole @ Ctr)
Thick:	2.5	in
Grade:	36	ksi
Effective Width:	2.82	in

Interior Flange Plate Results Flexural Check

Controlling Bolt Axial Force:	36.7	Kips, Ext. Cu=Interior Cu
Plate Stress:	22.4	ksi
Allowable Plate Stress, φ*Fy:	32.4	ksi
Plate Stress Ratio:	69.0%	**Pass**

Stiffener Data (Welding at Both Sides)		
Config:	0	*
Weld Type:	Fillet	
Groove Depth:	0.375	<-- Disregard
Groove Angle:	45	<-- Disregard
Fillet H. Weld:	0.3125	in
Fillet V. Weld:	0.3125	in
Width:	3	in
Height:	18	in
Thick:	0.75	in
Notch:	0.5	in
Grade:	36	ksi
Weld str.:	70	ksi

n/a

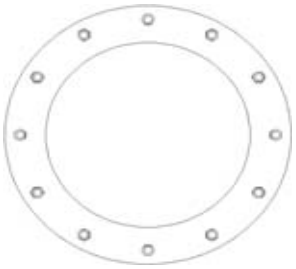
Stiffener Results

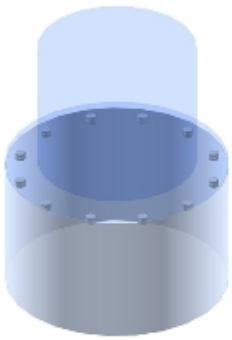
Horizontal Weld :	n/a
Vertical Weld:	n/a
Plate Flex+Shear, fb/Fb+(fv/Fv)^2:	n/a
Plate Tension+Shear, ft/Ft+(fv/Fv)^2:	n/a
Plate Comp. (AISC Bracket):	n/a

Pole Results

Pole Punching Shear Check:	n/a

Pole Data		
Pole OuterDiam:	48	in
Thick:	0.625	in
Pole Inner Diam:	46.75	in
Grade:	36	ksi
# of Sides:	0	"0" IF Round
Fu	63	ksi





* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt

** Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

Stiffened or Unstiffened, Exterior Flange Plate - Any Bolt Material TIA Rev G

Site Data

BU#:	
Site Name:	
App #:	

Reactions		
Mu	496.61	ft-kips
Axial, Pu:	14.76	kips
Shear, Vu:	22.43	kips
Elevation:	140	feet

Bolt Threads:
X-Excluded
φVn=φ(0.55*Ab*Fu)
φ=0.75, φ*Vn (kips):
27.34

Pole Manufacturer:	Other

If No stiffeners, Criteria: TIA G <-Only Applcable to Unstiffened Cases

Bolt Data				
Qty:	24			
Diameter (in.):	0.75	Bolt Fu:	150	
Bolt Material:	Other	Bolt Fy:	113	
Strength (Fu):	150	ksi		
Yield (Fy):	113	ksi		
Circle (in.):	29.5			

Plate Data		
Diam:	34.75	in
Thick, t:	1.875	in
Grade (Fy):	36	ksi
Strength, Fu:	58	ksi
Single-Rod B-eff:	3.14	in

Stiffener Data (Welding at Both Sides)		
Config:	0	*
Weld Type:	Fillet	
Groove Depth:	0.25	<-- Disregard
Groove Angle:	45	<-- Disregard
Fillet H. Weld:	0.3125	in
Fillet V. Weld:	0.3125	in
Width:	3	in
Height:	18	in
Thick:	0.75	in
Notch:	0.5	in
Grade:	36	ksi
Weld str.:	70	ksi

Pole Data		
Diam:	24	in
Thick:	0.5	in
Grade:	36	ksi
# of Sides:	0	"0" IF Round
Fu	63	ksi
Reinf. Fillet Weld	0	"0" if None

Flange Bolt Results | Rigid

Bolt Tension Capacity, φ*Tn, **B1**:	37.58	kips	φ*Tn
Adjusted φ*Tn (due to Vu=Vu/Qty), **B**:	37.55	kips	φTn[(1-(Vu/φVn)^2]^0.5
Max Bolt directly applied Tu:	33.05	Kips	
Min. PL "tc" for **B** cap. **w/o** Pry:	1.474	in	
Min PL "treq" for actual **T w/ Pry**:	1.259	in	
Min PL "t1" for actual **T w/o Pry**:	1.383	in	
T allowable w/o Prying:	37.58	kips	α'<0 case
Prying Force, q:	0.00	kips	
Total Bolt Tension=Tu+q:	33.05	kips	
Non-Prying Bolt Stress Ratio, Tu/B:	88.0%	**Pass**	

Exterior Flange Plate Results Flexural Check | Rigid

Compression Side Plate Stress:	19.2	ksi	TIA G
Allowable Plate Stress:	32.4	ksi	φ*Fy
Compression Plate Stress Ratio:	59.2%	**Pass**	Comp. Y.L. Length:
No Prying			17.15
Tension Side Stress Ratio, (treq/t)^2:	45.1%	**Pass**	

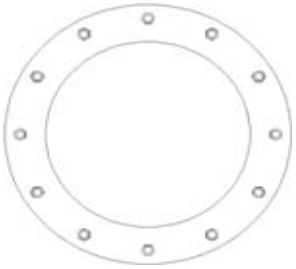
n/a

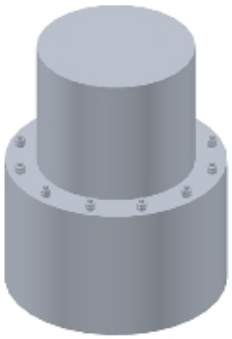
Stiffener Results

Horizontal Weld :	n/a
Vertical Weld:	n/a
Plate Flex+Shear, fb/Fb+(fv/Fv)^2:	n/a
Plate Tension+Shear, ft/Ft+(fv/Fv)^2:	n/a
Plate Comp. (AISC Bracket):	n/a

Pole Results

Pole Punching Shear Check: n/a





* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt

** Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

Stiffened or Unstiffened, Interior Flange Plate - Any Bolt Material TIA Rev G

Site Data	
BU#:	
Site Name:	
App #:	

Reactions		
Moment:	496.61	ft-kips
Axial:	14.76	kips
Shear:	22.43	kips
Exterior Flange Run, T+q:	33.05	kips

Bolt Threads:
X-Excluded
φVn=φ(0.55*Ab*Fu)
φ=0.75, φ*Vn (kips):
27.34

Manufacturer:	Other

Elevation: 140 feet

Bolt Data			
Qty:	24		
Diam:	0.75	Bolt Fu:	150
Bolt Material:	Other	Bolt Fy:	113
Strength (Fu):	150	ksi	
Yield (Fy):	113	ksi	
Circle:	29.5	in	

Interior Flange Bolt Results

Maximum Bolt Tension, Tu:	33.1	Kips, Ext. Tu=Interior Tu
Adjusted φ*Tn (due to Vu=Vu/Qty), I	37.6	Kips
Bolt Stress Ratio:	88.0%	**Pass**

Plate Data		
Plate Outer Diam:	35	in
Plate Inner Diam:	24.25	in (Hole @ Ctr)
Thick:	1.875	in
Grade:	36	ksi
Effective Width:	4.58	in

Interior Flange Plate Results Flexural Check

Controlling Bolt Axial Force:	34.3	Kips, Ext. Cu=Interior Cu
Plate Stress:	23.4	ksi
Allowable Plate Stress, φ*Fy:	32.4	ksi
Plate Stress Ratio:	72.3%	**Pass**

Stiffener Data (Welding at Both Sides)		
Config:	0	*
Weld Type:	Fillet	
Groove Depth:	0.375	<-- Disregard
Groove Angle:	45	<-- Disregard
Fillet H. Weld:	0.3125	in
Fillet V. Weld:	0.3125	in
Width:	3	in
Height:	18	in
Thick:	0.75	in
Notch:	0.5	in
Grade:	36	ksi
Weld str.:	70	ksi

n/a

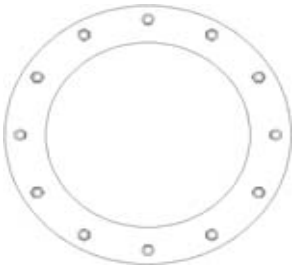
Stiffener Results

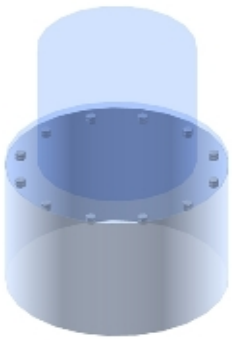
Horizontal Weld :	n/a
Vertical Weld:	n/a
Plate Flex+Shear, fb/Fb+(fv/Fv)^2:	n/a
Plate Tension+Shear, ft/Ft+(fv/Fv)^2:	n/a
Plate Comp. (AISC Bracket):	n/a

Pole Results

Pole Punching Shear Check:	n/a

Pole Data		
Pole OuterDiam:	36	in
Thick:	0.5	in
Pole Inner Diam:	35	in
Grade:	35	ksi
# of Sides:	0	"0" IF Round
Fu	63	ksi





* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt

** Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

(Bearing and Stability Checks) Tool for TIA Rev F or G - Any application (MP, SST, GT)

Site Data

BU#: *xxxxxx*
Site Name: *Site-name*
App #: *####*

Loads Already Factored		
For P (DL)	1.2	<----Disregard
For P,V, and M (WL)	1.35	<----Disregard

Pad & Pier Data		
Base PL Dist. Above Pier:	0	in
Pier Dist. Above Grade:	0	in
Pad Bearing Depth, D:	4.5	ft
Pad Thickness, T:	5	ft
Pad Width=Length, L:	26.5	ft
Pier Cross Section Shape:	Round	<--Pull Down
Enter Pier Diameter:	0	ft
Concrete Density:	150.0	pcf
Pier Cross Section Area:	0.00	ft^2
Pier Height:	-0.50	ft
Soil (above pad) Height:	-0.50	ft

Soil Parameters		
Unit Weight, γ:	125.0	pcf
Ultimate Bearing Capacity, qn:	6.00	ksf
Strength Reduct. factor, ϕ:	0.75	
Angle of Friction, Φ:	30.0	degrees
Undrained Shear Strength, Cu:	0.00	ksf
Allowable Bearing: ϕ*qn:	4.50	ksf
Passive Pres. Coeff., Kp	3.00	

Forces/Moments due to Wind and Lateral Soil		
Factored Pad Passive Force:	99.4	kips
Pad Force Location Above D:	1.46	ft
ϕ(Passive Pressure Moment):	108.69	ft-kips
Factored O.T. M(WL), "1.6W":	5055.5	ft-kips
Factored OT (MW-Msoil), M1	4946.81	ft-kips

Resistance due to Foundation Gravity		
Soil Wedge Projection grade, a:	-0.29	ft
Sum of Soil Wedges Wt:	0.35	kips
Soil Wedges ecc, K1:	12.12	ft
Ftg+Soil above Pad wt:	482.8	kips
Unfactored (Total ftg-soil Wt):	483.15	kips
1.2D. **No Soil Wedges**.	657.36	kips
0.9D. **With Soil Wedges**	493.33	kips

Resistance due to Cohesion (Vertical)		
ϕ*(1/2*Cu)(Total Vert. Planes)	0.00	kips
Cohesion Force Eccentricity, K2	0.00	ft

Monopole Base Reaction Forces		
TIA Revision:	G	<--Pull Down
Factored DL Axial, PDu:	78	kips
Factored WL Axial, PWu:	0	kips
Factored WL Shear, Vu:	39	kips
Factored WL Moment, Mu:	4880	ft-kips

Load Factor	Shaft Factored Loads		
1.00	1.2D+1.6W, Pu:	78	kips
0.90	0.9D+1.6W, Pu:	58.5	kips
1.00	Vu:	39	kips
	Mu:	4880	ft-kips

1.2D+1.6W Load Combination, Bearing Results:

(**No Soil Wedges**) [Reaction+Conc+Soil]	657.36	P1="1.2D+1.6W" (Kips)
Factored "1.6W" Overturning Moment (MW-Msoil), M1	4946.81	ft-kips

Orthogonal Direction:

ecc1 = M1/P1 =	7.53	ft
Orthogonal qu=	2.17	ksf
qu/ϕ*qn Ratio=	**48.15%**	**Pass**

Diagonal Direction:

ecc2 = (0.707M1)/P1 =	5.32	ft
Diagonal qu=	3.70	ksf
qu/ϕ*qn Ratio=	**82.14%**	**Pass**

Run <-- Press Upon Completing All Input

Overturning Stability Check

0.9D+1.6W Load Combination, Bearing Results:

(**w/ Soil Wedges**) [Reaction+Conc+Soil]	493.33	P2="0.9D+1.6W" (Kips)
Factored "1.6W" Overturning Moment (MW-Msoil) - 0.9(M of Wedge + M of Cohesion), M2	4942.97	ft-kips

Orthogonal ecc3 = M2/P2 =	10.02	ft
Ortho Non Bearing Length,NBL=	6.46	ft
Orthogonal qu=	2.88	ksf
Diagonal qu=	4.59	ksf

Max Reaction Moment (ft-kips) so that qu=ϕ*qn = 100% Capacity Rating			
Actual M:	4880.00		
M Orthogonal:	5452.61	**89.50%**	**Pass**
M Diagonal:	4837.74	**100.87%**	**Pass**

(Bearing and Stability Checks) Tool for TIA Rev F or G - Any application (MP, SST, GT)

Site Data

BU#:
Site Name:
App #:

Loads Already Factored		
For P (DL)	1.2	<----Disregard
For P,V, and M (WL)	1.35	<----Disregard

Pad & Pier Data		
Base PL Dist. Above Pier:	0	in
Pier Dist. Above Grade:	0	in
Pad Bearing Depth, D:	4.5	ft
Pad Thickness, T:	5	ft
Pad Width=Length, L:	26.5	ft
Pier Cross Section Shape:	Round	<--Pull Down
Enter Pier Diameter:	0	ft
Concrete Density:	150.0	pcf
Pier Cross Section Area:	0.00	ft^2
Pier Height:	-0.50	ft
Soil (above pad) Height:	-0.50	ft

Soil Parameters		
Unit Weight, γ:	125.0	pcf
Ultimate Bearing Capacity, qn:	6.00	ksf
Strength Reduct. factor, ϕ:	0.75	
Angle of Friction, Φ:	30.0	degrees
Undrained Shear Strength, Cu:	0.00	ksf
Allowable Bearing: ϕ*qn:	4.50	ksf
Passive Pres. Coeff., Kp	3.00	

Forces/Moments due to Wind and Lateral Soil		
Factored Pad Passive Force:	99.4	kips
Pad Force Location Above D:	1.46	ft
ϕ(Passive Pressure Moment):	108.69	ft-kips
Factored O.T. M(WL), "1.6W":	5457.5	ft-kips
Factored OT (MW-Msoil), M1	5348.81	ft-kips

Resistance due to Foundation Gravity		
Soil Wedge Projection grade, a:	-0.29	ft
Sum of Soil Wedges Wt:	0.35	kips
Soil Wedges ecc, K1:	12.12	ft
Ftg+Soil above Pad wt:	482.8	kips
Unfactored (Total ftg-soil Wt):	483.15	kips
1.2D. **No Soil Wedges**.	658.36	kips
0.9D. **With Soil Wedges**	494.08	kips

Resistance due to Cohesion (Vertical)		
ϕ*(1/2*Cu)(Total Vert. Planes)	0.00	kips
Cohesion Force Eccentricity, K2	0.00	ft

Monopole Base Reaction Forces		
TIA Revision:	G	<--Pull Down
Factored DL Axial, PDu:	79	kips
Factored WL Axial, PWu:	0	kips
Factored WL Shear, Vu:	41	kips
Factored WL Moment, Mu:	5273	ft-kips

Load Factor	Shaft Factored Loads		
1.00	1.2D+1.6W, Pu:	79	kips
0.90	0.9D+1.6W, Pu:	59.25	kips
1.00	Vu:	41	kips
	Mu:	5273	ft-kips

1.2D+1.6W Load Combination, Bearing Results:

(**No Soil Wedges**) [Reaction+Conc+Soil]	658.36	P1="1.2D+1.6W" (Kips)
Factored "1.6W" Overturning Moment (MW-Msoil), M1	5348.81	ft-kips

Orthogonal Direction:

ecc1 = M1/P1 =	8.12	ft
Orthogonal qu=	2.42	ksf
qu/ϕ*qn Ratio=	**53.86%**	**Pass**

Diagonal Direction:

ecc2 = (0.707M1)/P1 =	5.74	ft
Diagonal qu=	4.13	ksf
qu/ϕ*qn Ratio=	**91.81%**	**Pass**

Run <-- Press Upon Completing All Input

Overturning Stability Check

0.9D+1.6W Load Combination, Bearing Results:

(**w/ Soil Wedges**) [Reaction+Conc+Soil]	494.08	P2="0.9D+1.6W" (Kips)
Factored "1.6W" Overturning Moment (MW-Msoil) - 0.9(M of Wedge + M of Cohesion), M2	5344.97	ft-kips

Orthogonal ecc3 = M2/P2 =	10.82	ft
Ortho Non Bearing Length,NBL=	4.86	ft
Orthogonal qu=	3.83	ksf
Diagonal qu=	5.57	ksf

Max Reaction Moment (ft-kips) so that qu=ϕ*qn = 100% Capacity Rating			
Actual M:	5273.00		
M Orthogonal:	5450.44	**96.74%**	**Pass**
M Diagonal:	4832.89	**109.11%**	**Pass**

FDH Engineering, Inc., 2730 Rowland Rd. Raleigh, NC 27615, Ph. 919.755.1012, Fax 919.755.1031

Site Name:	
Job No. :	
Elevation:	
	Input Cells in Blue

Code (F or G):	G	
Anchor Bolts (Yes or No)	Yes	
P (from RISA)	79	kips
V (from RISA)	41	kips
M (from RISA)	5273	ft-kips

Existing Bolts

y	33	in
No. Bolts	32	
BC	66	in
I	54739.11	in^4
d	2	in
Ag	3.141593	in^2
Ae	2.5	in^2
Fy	36	ksi
Fu	58	ksi

Itot	61724.05	in^4

T	104.0221	kips
V	1.171429	kips

New Bolts

y new	38.5	in
No. Bolts new	3	
BC new	77	in
Inew	6,985	in^4
d new	2.00	in
Ag new	3.141593	in^2
Ae new	2.5	in^2
Fy new	75	ksi
Fu new	100	ksi

Tnew	121.7353	kips
Vnew	1.171429	kips

				% Capacity
Tn/Ω	80.17344	kips		
Tn/Ω, new	138.2301	kips		
øTn	116	kips	**OK**	**89.67%**
øTn, new	200	kips	**OK**	**60.87%**

Req'd Embedment Length for New Bolts

f'c, caisson's concrete strength	4000	psi
fy, rebar yield strength	60000	psi
d_b, diameter of vertical rebar	0	in
vertical rebar cage BC ø	0	in
vertical rebar top cover distance	3	in
τ, Ultimate Hilti Bond Resistance	2.2	ksi

l_d (vertical rebar dev. Length)	0.0000	in
l_{dH} (Hilti dev. length)	43.4059	in
G/1.5	-25.6667	in

Total Embed. Length of New Bolts	43.41	in
	3.62	ft

Equations:

T = (M*y*Ag)/Itot-P*(Ag/Atotal)

Tn/Ω = 0.33*Fu*Ag*(4/3)

øTn = 0.8*Fu*Ae (anchor bolts only)

øTn = 0.75*Fu*Ae (non anchor bolts)

I = (No. Bolts/8)*BC²*Ag

l_d = [(fy*ψ,ψ$_e$λ)/(20*√f'c)]*d_b PER ACI 12.2.2

l_{dH} = (øTn*FS)/(τ*pi*d_{new})

See Worksheet "New (Design Procedure)" for diagram

Notes:

***Ag and Ae are taken from AISC 13th Ed. Manual (pg. 7-83)**

***I calc. will only work for symmetric bolt group, otherwise use CAD**

Interaction Equation Checks per Rev. G: See section 4.9.9 (works for Rev F also)

Detail Type (see sheet 2)	c	(see sheet 2 for Detail Type)	a
η	0.55		b
l_{ar}, for Detail Type d only	2.25	in (length from top of concrete to bottom of leveling nut)	c
			d

øRnt	116	kips
øRnv	61.49668	kips
øRnm	38.4	kip-in
Mu	1.713214	kip-in

(Pu+Vu/η)/øRnt	0.915103	<1?	OK

$(Vu/øRnv)^2 + ((Pu/øRnt)+(Mu/øRnm))^2$	NA		(only applicable for Detail Type d)

Stiffened or Unstiffened, Ungrouted, Circular Base Plate - Any Rod Material

TIA Rev G Assumption: Clear space between bottom of leveling nut and top of concrete **not** exceeding (1)*(Rod Diameter)

Site Data

BU#: *878272*
Site Name: *PCS Services-FL*
App #:

Pole Manufacturer:	*Other*

Reactions		
Mu:	4356	ft-kips
Axial, Pu:	79	kips
Shear, Vu:	41	kips
Eta Factor, η	0.5	TIA G (Fig. 4-4)

If No stiffeners, Criteria:	AISC LRFD	<-Only Applcable to Unstiffened Cases

Anchor Rod Data		
Qty:	32	
Diam:	2	in
Rod Material:	Other	
Strength (Fu):	58	ksi
Yield (Fy):	36	ksi
Bolt Circle:	66	in

Anchor Rod Results

Max Rod (Cu+ Vu/ή):	104.0	Kips	Rigid
Allowable Axial, Φ*Fu*Anet:	116.0	Kips	AISC LRFD
Anchor Rod Stress Ratio:	89.7%	**Pass**	φ*Tn

Plate Data		
Diam:	72	in
Thick:	3.25	in
Grade:	36	ksi
Single-Rod B-eff:	5.89	in

Base Plate Results Flexural Check

Base Plate Stress:	12.1	ksi	Rigid
Allowable Plate Stress:	32.4	ksi	AISC LRFD
Base Plate Stress Ratio:	37.4%	**Pass**	φ*Fy
			Y.L. Length:
			27.50

Stiffener Data (Welding at both sides)		
Config:	0	*
Weld Type:	Fillet	
Groove Depth:	0.25	<-- Disregard
Groove Angle:	45	<-- Disregard
Fillet H. Weld:	0.25	in
Fillet V. Weld:	0.3125	in
Width:	5	in
Height:	18	in
Thick:	0.75	in
Notch:	0.5	in
Grade:	36	ksi
Weld str.:	70	ksi

n/a

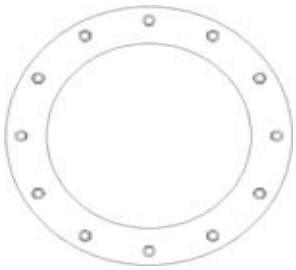
Stiffener Results

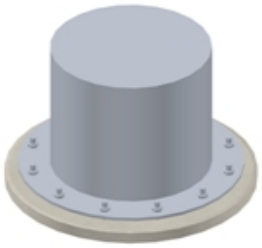
Horizontal Weld :	n/a
Vertical Weld:	n/a
Plate Flex+Shear, fb/Fb+(fv/Fv)^2:	n/a
Plate Tension+Shear, ft/Ft+(fv/Fv)^2:	n/a
Plate Comp. (AISC Bracket):	n/a

Pole Results

Pole Punching Shear Check: n/a

Pole Data		
Diam:	60	in
Thick:	0.625	in
Grade:	35	ksi
# of Sides:	0	"0" IF Round
Fu	63	ksi
Reinf. Fillet Weld	0	"0" if None





* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt

** Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

APPENDIX D

MODIFICATION DRAWINGS

FOR STRUCTURAL ANALYSIS SEE FDH ENGINEERING, P.C.
PROJECT NO. 12-03730E S1 DATED MARCH 30, 2012.

FOR PASSING STRUCTURAL ANALYSIS WITH MODIFICATIONS IN PLACE SEE FDH ENGINEERING, INC. PROJECT NO. 12-03730E S2 DATED MAY 14, 2012.

ALL DIMENSIONS, MEASUREMENTS, QUANTITIES, PART NUMBERS AND COAX/ANTENNA PLACEMENTS TO BE FIELD VERIFIED BY CONTRACTOR PRIOR TO MATERIAL ORDERS AND CONSTRUCTION.

PROJECT DESCRIPTION:

MODIFICATION DRAWINGS FOR A 178.0' MONOPOLE

SITE NAME:

PORTLAND NORTH

SITE NUMBER:

878783

SITE ADDRESS:

527 PERSUMPSCOT
PORTLAND, ME 04101

COORDINATES:

LATITUDE: 43.6996°
LONGITUDE: -70.2585°

SHEET INDEX

SHT. NO.	DESCRIPTION
T-1	TITLE SHEET
N-1	MODIFICATION INSPECTION NOTES
N-2	GENERAL NOTES
S-1	MODIFICATION SCHEDULE
S-2	ANCHOR ROD INSTALLATION DETAILS I
S-3	ANCHOR ROD INSTALLATION DETAILS II

PREPARED BY:

FDH
6521 MERIDIEN DRIVE
RALEIGH, NC 27616
PHONE: 919-755-1012
FAX: 919-755-1031
ENGINEERING INNOVATION

PREPARED FOR:

CROWN CASTLE INTERNATIONAL

STATE OF MAINE
CHRISTOPHER MICHAEL MURPHY
No. 11228
LICENSED PROFESSIONAL ENGINEER

05/15/12
CHRISTOPHER M. MURPHY, P.E.
MAINE LIC. NO. 11228

DRAWN BY:	PF
CHECKED BY:	DMC
ENG APPV'D:	CMM
PROJECT NO:	12-03730E S2

SUBMITTALS

DATE	DESCRIPTION	REV
05/15/12	CONSTRUCTION	1

SITE NAME:
PORTLAND NORTH

SITE NUMBER:
878783

SITE ADDRESS:
527 PERSUMPSCOT
PORTLAND, ME 04101

SHEET TITLE
TITLE SHEET

SHEET NUMBER
T-1

MI CHECKLIST

CONSTRUCTION/INSTALLATION INSPECTIONS AND TESTING REQUIRED (COMPLETED BY EOR)	REPORT ITEM
PRE-CONSTRUCTION	
X	MI CHECKLIST DRAWING
X	EOR APPROVED SHOP DRAWINGS
X	FABRICATION INSPECTION
X	FABRICATOR CERTIFIED WELD INSPECTION
X	MATERIAL TEST REPORT (MTR)
N/A	FABRICATOR NDE INSPECTION
N/A	NDE REPORT OF MONOPOLE BASE PLATE (AS REQUIRED)
X	PACKING SLIPS
ADDITIONAL TESTING AND INSPECTIONS:	
CONSTRUCTION	
X	CONSTRUCTION INSPECTIONS
X	FOUNDATION INSPECTIONS
N/A	CONCRETE COMP. STRENGTH AND SLUMP TESTS
X	POST INSTALLED ANCHOR ROD VERIFICATION
X	BASE PLATE GROUT VERIFICATION
X	CONTRACTOR'S CERTIFIED WELD INSPECTION
N/A	EARTHWORK: LIFT AND DENSITY
X	ON SITE COLD GALVANIZING VERIFICATION
N/A	GUY WIRE TENSION REPORT
X	GC AS-BUILT DOCUMENTS
ADDITIONAL TESTING AND INSPECTIONS:	
POST-CONSTRUCTION	
X	MI INSPECTOR REDLINE OR RECORD DRAWING(S)
X	POST INSTALLED ANCHOR ROD PULL-OUT TESTING
X	PHOTOGRAPHS
ADDITIONAL TESTING AND INSPECTIONS:	

NOTE: X DENOTES A DOCUMENT NEEDED FOR THE PMI REPORT
NA DENOTES A DOCUMENT THAT IS NOT REQUIRED FOR THE PMI REPORT

MODIFICATION INSPECTION NOTES:

GENERAL

THE MODIFICATION INSPECTION (MI) IS A VISUAL INSPECTION OF TOWER MODIFICATIONS AND A REVIEW OF CONSTRUCTION INSPECTIONS AND OTHER REPORTS TO ENSURE THE INSTALLATION WAS CONSTRUCTED IN ACCORDANCE WITH THE CONTRACT DOCUMENTS, NAMELY THE MODIFICATION DRAWINGS, AS DESIGNED BY THE ENGINEER OF RECORD (EOR).

THE MI IS TO CONFIRM INSTALLATION CONFIGURATION AND WORKMANSHIP ONLY AND IS NOT A REVIEW OF THE MODIFICATION DESIGN ITSELF, NOR DOES THE MI INSPECTOR TAKE OWNERSHIP OF THE MODIFICATION DESIGN. OWNERSHIP OF THE STRUCTURAL MODIFICATION DESIGN EFFECTIVENESS AND INTEGRITY RESIDES WITH THE EOR AT ALL TIMES.

ALL MI'S SHALL BE CONDUCTED BY A CROWN ENGINEERING VENDOR (AEV) OR ENGINEERING SERVICE VENDOR (AESV) THAT IS APPROVED TO PERFORM ELEVATED WORK FOR CROWN. SEE ENG-BUL-10173 LIST OF APPROVED MI VENDORS.

TO ENSURE THAT THE REQUIREMENTS OF THE MI ARE MET, IT IS VITAL THAT THE GENERAL CONTRACTOR (GC) AND THE MI INSPECTOR BEGIN COMMUNICATING AND COORDINATING AS SOON AS A PO IS RECEIVED. IT IS EXPECTED THAT EACH PARTY WILL BE PROACTIVE IN REACHING OUT TO THE OTHER PARTY. IF CONTACT INFORMATION IS NOT KNOWN, CONTACT YOUR CROWN POINT OF CONTACT (POC).

REFER TO ENG-SOW-10007 : MODIFICATION INSPECTION SOW FOR FURTHER DETAILS AND REQUIREMENTS.

MI INSPECTOR

THE MI INSPECTOR IS REQUIRED TO CONTACT THE GC AS SOON AS RECEIVING A PO FOR THE MI TO, AT A MINIMUM:

- REVIEW THE REQUIREMENTS OF THE MI CHECKLIST
- WORK WITH THE GC TO DEVELOP A SCHEDULE TO CONDUCT ON-SITE INSPECTIONS, INCLUDING FOUNDATION INSPECTIONS

THE MI INSPECTOR IS RESPONSIBLE FOR COLLECTING ALL GENERAL CONTRACTOR (GC) INSPECTION AND TEST REPORTS, REVIEWING THE DOCUMENTS FOR ADHERENCE TO THE CONTRACT DOCUMENTS, CONDUCTING THE IN-FIELD INSPECTIONS, AND SUBMITTING THE MI REPORT TO CROWN.

GENERAL CONTRACTOR

THE GC IS REQUIRED TO CONTACT THE MI INSPECTOR AS SOON AS RECEIVING A PO FOR THE MODIFICATION INSTALLATION OR TURNKEY PROJECT TO, AT A MINIMUM:

- REVIEW THE REQUIREMENTS OF THE MI CHECKLIST
- WORK WITH THE MI INSPECTOR TO DEVELOP A SCHEDULE TO CONDUCT ON-SITE MI INSPECTIONS, INCLUDING FOUNDATION INSPECTIONS
- BETTER UNDERSTAND ALL INSPECTION AND TESTING REQUIREMENTS

THE GC SHALL PERFORM AND RECORD THE TEST AND INSPECTION RESULTS IN ACCORDANCE WITH THE REQUIREMENTS OF THE MI CHECKLIST AND ENG-SOW-10007.

RECOMMENDATIONS

THE FOLLOWING RECOMMENDATIONS AND SUGGESTIONS ARE OFFERED TO ENHANCE THE EFFICIENCY AND EFFECTIVENESS OF DELIVERING A MI REPORT:

- IT IS SUGGESTED THAT THE GC PROVIDE A MINIMUM OF 5 BUSINESS DAYS NOTICE, PREFERABLY 10, TO THE MI INSPECTOR AS TO WHEN THE SITE WILL BE READY FOR THE MI TO BE CONDUCTED.
- THE GC AND MI INSPECTOR COORDINATE CLOSELY THROUGHOUT THE ENTIRE PROJECT.
- WHEN POSSIBLE, IT IS PREFERRED TO HAVE THE GC AND MI INSPECTOR ON-SITE SIMULTANEOUSLY FOR ANY GUY WIRE TENSIONING OR RE-TENSIONING OPERATIONS.
- IT MAY BE BENEFICIAL TO INSTALL ALL TOWER MODIFICATIONS PRIOR TO CONDUCTING THE FOUNDATION INSPECTIONS TO ALLOW FOUNDATION AND MI INSPECTION(S) TO COMMENCE WITH ONE SITE VISIT.
- WHEN POSSIBLE, IT IS PREFERRED TO HAVE THE GC AND MI INSPECTOR ON-SITE DURING THE MI TO HAVE ANY DEFICIENCIES CORRECTED DURING THE INITIAL MI. THEREFORE, THE GC MAY CHOOSE TO COORDINATE THE MI CAREFULLY TO ENSURE ALL CONSTRUCTION FACILITIES ARE AT THEIR DISPOSAL WHEN THE MI INSPECTOR IS ON SITE.

CANCELLATION OR DELAYS IN SCHEDULED MI

IF THE GC AND MI INSPECTOR AGREE TO A DATE ON WHICH THE MI WILL BE CONDUCTED, AND EITHER PARTY CANCELS OR DELAYS, CROWN SHALL NOT BE RESPONSIBLE FOR ANY COSTS, FEES, LOSS OF DEPOSITS AND/OR OTHER PENALTIES RELATED TO THE CANCELLATION OR DELAY INCURRED BY EITHER PARTY FOR ANY TIME (E.G. TRAVEL AND LODGING, COSTS OF KEEPING EQUIPMENT ON-SITE, ETC.). IF CROWN CONTRACTS DIRECTLY FOR A THIRD PARTY MI, EXCEPTIONS MAY BE MADE IN THE EVENT THAT THE DELAY/CANCELLATION IS CAUSED BY WEATHER OR OTHER CONDITIONS THAT MAY COMPROMISE THE SAFETY OF THE PARTIES INVOLVED.

CORRECTION OF FAILING MI'S

IF THE MODIFICATION INSTALLATION WOULD FAIL THE MI ("FAILED MI"), THE GC SHALL WORK WITH CROWN TO COORDINATE A REMEDIATION PLAN IN ONE OF TWO WAYS:

- CORRECT FAILING ISSUES TO COMPLY WITH THE SPECIFICATIONS CONTAINED IN THE ORIGINAL CONTRACT DOCUMENTS AND COORDINATE A SUPPLEMENT MI.
- OR, WITH CROWN'S APPROVAL, THE GC MAY WORK WITH THE EOR TO RE-ANALYZE THE MODIFICATION/REINFORCEMENT USING THE AS-BUILT CONDITION

MI VERIFICATION INSPECTIONS

CROWN RESERVES THE RIGHT TO CONDUCT A MI VERIFICATION INSPECTION TO VERIFY THE ACCURACY AND COMPLETENESS OF PREVIOUSLY COMPLETED MI INSPECTION(S) ON TOWER MODIFICATION PROJECTS.

ALL VERIFICATION INSPECTIONS SHALL BE HELD TO THE SAME SPECIFICATIONS AND REQUIREMENTS IN THE CONTRACT DOCUMENTS AND IN ACCORDANCE WITH ENG-SOW-10007.

VERIFICATION INSPECTION MAY BE CONDUCTED BY AN INDEPENDENT AEV/AESV FIRM AFTER A MODIFICATION PROJECT IS COMPLETED, AS MARKED BY THE DATE OF AN ACCEPTED "PASSING MI" OR "PASS AS NOTED MI" REPORT FOR THE ORIGINAL PROJECT.

REQUIRED PHOTOS

BETWEEN THE GC AND THE MI INSPECTOR THE FOLLOWING PHOTOGRAPHS, AT A MINIMUM, ARE TO BE TAKEN AND INCLUDED IN THE MI REPORT:

- PRE-CONSTRUCTION GENERAL SITE CONDITION
- PHOTOGRAPHS DURING THE REINFORCEMENT MODIFICATION CONSTRUCTION/ERECTION AND INSPECTION
  - RAW MATERIALS
  - PHOTOS OF ALL CRITICAL DETAILS
  - FOUNDATION MODIFICATIONS
  - WELD PREPARATION
  - BOLT INSTALLATION AND TORQUE
  - FINAL INSTALLED CONDITION
  - SURFACE COATING REPAIR
- POST CONSTRUCTION PHOTOGRAPHS
  - FINAL INFIELD CONDITION

PHOTOS OF ELEVATED MODIFICATIONS TAKEN FROM THE GROUND SHALL BE CONSIDERED INADEQUATE.

THIS IS NOT A COMPLETE LIST OF REQUIRED PHOTOS, PLEASE REFER TO ENG-SOW-10007.

PREPARED BY:
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RALEIGH, NC 27616
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FAX: 919-755-1031
ENGINEERING INNOVATION

PREPARED FOR:
CROWN CASTLE INTERNATIONAL

STATE OF MAINE
CHRISTOPHER MICHAEL MURPHY
No. 11228
LICENSED
PROFESSIONAL ENGINEER

05/15/12
CHRISTOPHER M. MURPHY, P.E.
MAINE LIC. NO. 11228

DRAWN BY:	PF
CHECKED BY:	DMC
ENG APPV'D:	CMM
PROJECT NO:	12-03730E S2

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INSPECTION NOTES

SHEET NUMBER
N-1

GENERAL NOTES:

1. ALL WORK SHALL BE DONE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE AND LOCAL CODES AND ORDINANCES. IT IS THE CONTRACTOR'S RESPONSIBILITY TO OBTAIN ALL PERMITS NECESSARY TO COMPLETE THE PROJECT AND ABIDE BY ALL CONDITIONS AND REQUIREMENTS OF THE PERMITS.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFICATION OF ALL DIMENSIONS, ELEVATIONS AND EXISTING CONDITIONS AT THE SITE BEFORE ORDERING ANY MATERIALS OR DOING ANY WORK. NO EXTRA CHARGE OR COMPENSATION SHALL BE ALLOWED DUE TO DIFFERENCE BETWEEN ACTUAL DIMENSIONS AND DIMENSIONS INDICATED ON THE CONSTRUCTION DRAWINGS. ANY SUCH DISCREPANCY IN DIMENSION WHICH MAY BE FOUND SHALL BE SUBMITTED TO FDH ENGINEERING FOR CONSIDERATION BEFORE THE CONTRACTOR PROCEEDS WITH THE WORK IN THE AFFECTED AREAS.
3. INCORRECTLY FABRICATED, DAMAGED, OTHERWISE MISFITTING, OR NON-CONFORMING MATERIALS AND CONDITIONS SHALL BE REPORTED TO FDH ENGINEERING PRIOR TO ANY REMEDIAL OR CORRECTIVE ACTION. ALL ACTIONS SHALL REQUIRE FDH ENGINEERING APPROVAL.
4. IT IS THE CONTRACTOR'S SOLE RESPONSIBILITY TO DETERMINE ERECTION PROCEDURE AND SEQUENCE TO ENSURE THE SAFETY OF THE STRUCTURE AND ITS COMPONENT PARTS DURING ERECTION AND/OR FIELD MODIFICATIONS. THIS INCLUDES, BUT IS NOT LIMITED TO, THE ADDITION OF TEMPORARY BRACING, GUYS OR TIE DOWNS THAT MAY BE NECESSARY. SUCH MATERIAL SHALL BE REMOVED AFTER THE COMPLETION OF THE PROJECT.
5. CONTRACTOR SHALL PROMPTLY REMOVE ANY & ALL DEBRIS FROM SITE AND RESTORE AS BEST AS POSSIBLE TO PRECONSTRUCTION CONDITION.

CONTRACTOR QUALIFICATION NOTES:

1. ALL REPAIRS SHALL BE PERFORMED BY A TOWER CONTRACTOR WITH A MINIMUM 5 YEARS EXPERIENCE IN TOWER ERECTION AND RETROFIT AND WITH WORKING KNOWLEDGE OF THE ANSI/TIA-222-G "STRUCTURAL STANDARD FOR ANTENNA SUPPORTING STRUCTURES AND ANTENNAS".
2. CONTRACTOR IS RESPONSIBLE FOR ALL CONSTRUCTION MEANS AND METHODS. SHOULD THE CONTRACTOR REQUIRE DIRECT CONSULTATION, FDH ENGINEERING, INC. IS WILLING TO OFFER SERVICES BASED UPON AN AGREED FEE FOR THE WORK REQUIRED.
3. ALL SUBMITTAL INFORMATION MUST BE SENT TO FDH ENGINEERING, INC. 6521 MERIDIEN DRIVE, RALEIGH, NC 27616, TEL. (919) 755-1012, FAX. (919) 755-1031, E-MAIL INFO@FDH-INC.COM. ANY VARIATION OF THESE SPECIFICATIONS OR DRAWINGS WITHOUT CONSENT FROM FDH ENGINEERING, INC. WILL VOID ANY RESPONSIBILITY OR LIABILITY FOR DAMAGE (MATERIAL OR PHYSICAL) TOWARDS FDH ENGINEERING, INC.

JOB SITE SAFETY & NOTES:

1. NEITHER THE PROFESSIONAL ACTIVITIES OF FDH ENGINEERING, INC. NOR THE PRESENCE OF FDH ENGINEERING, INC. OR EMPLOYEES AND SUB-CONSULTANTS AT THE CONSTRUCTION SITE, SHALL RELIEVE THE GENERAL CONTRACTOR AND OR SUBCONTRACTORS AND ANY OTHER ENTITY OF THEIR OBLIGATIONS, DUTIES AND RESPONSIBILITIES INCLUDING, BUT NOT LIMITED TO, CONSTRUCTION MEANS, METHODS, SEQUENCE, TECHNIQUES OR PROCEDURES NECESSARY FOR PERFORMING, SUPERINTENDING OR COORDINATING ALL PORTIONS OF THE WORK OF CONSTRUCTION IN ACCORDANCE WITH THE CONTRACT DOCUMENTS AND ANY HEALTH OR SAFETY PRECAUTIONS REQUIRED BY ANY REGULATORY AGENCIES. THE GENERAL CONTRACTOR AND OR SUBCONTRACTOR IS SOLELY RESPONSIBLE FOR JOB SAFETY, AND WARRANTS THAT THIS INTENT IS EVIDENT BY ACCEPTING THIS WORK.

SUBSTITUTES AND/OR EQUALS:

1. IF CONTRACTOR WISHES TO FURNISH OR USE A SUBSTITUTE ITEM OF MATERIAL OR EQUIPMENT, CONTRACTOR SHALL FIRST MAKE WRITTEN APPLICATION TO ENGINEER OF RECORD FOR ACCEPTANCE THEREOF, CERTIFYING THAT THE PROPOSED SUBSTITUTE WILL PERFORM ADEQUATELY THE FUNCTIONS AND ACHIEVE THE RESULTS CALLED FOR BY THE GENERAL DESIGN, BE SIMILAR IN SUBSTANCE TO THAT SPECIFIED AND SUITED TO THE SAME USE AS THAT SPECIFIED. ALL VARIATIONS OF THE PROPOSED SUBSTITUTE FROM THAT SPECIFIED WILL BE IDENTIFIED IN THE APPLICATION AND AVAILABLE MAINTENANCE, REPAIR AND REPLACEMENT SERVICE WILL BE INDICATED. THE APPLICATION WILL ALSO CONTAIN AN ITEMIZED ESTIMATE OF ALL COSTS OR CREDITS THAT WILL RESULT DIRECTLY OR INDIRECTLY FROM ACCEPTANCE OF SUCH SUBSTITUTE INCLUDING COSTS OF REDESIGN AND CLAIMS OF OTHER CONTRACTORS AFFECTED BY THE RESULTING CHANGE, ALL OF WHICH WILL BE CONSIDERED BY ENGINEER OF RECORD IN EVALUATION OF THE PROPOSED SUBSTITUTE. ENGINEER OF RECORD MAY REQUIRE CONTRACTOR TO FURNISH ADDITIONAL DATA ABOUT THE PROPOSED SUBSTITUTE.

STEEL:

1. ALL STRUCTURAL STEEL SHALL BE FABRICATED AND ERECTED IN ACCORDANCE WITH THE LATEST AISC CODE AND ASTM SPECIFICATIONS.

   *ALL PIPE STEEL SHALL BE ASTM A500 GR. C (Fy=50KSI) UNLESS OTHERWISE SPECIFIED.

   *ALL THREADED ROD SHALL BE WILLIAMS ALL-THREAD BAR ASTM A722 (Fu=75 KSI) UNLESS OTHERWISE SPECIFIED.

   *ALL PLATE STEEL SHALL BE ASTM A572 GRADE 65 (Fy=65KSI) UNLESS OTHERWISE SPECIFIED.
2. ALL CONNECTIONS OF STRUCTURAL STEEL MEMBERS SHALL BE MADE USING SPECIFIED WELDS WITH WELDING ELECTRODES E-80XX OR SPECIFIED HIGH STRENGTH BOLTS TO BE ASTM A325N, THREAD INCLUDED WITH SHEAR PLANE (UNLESS OTHERWISE NOTED).
3. ALL BOLTED CONNECTIONS TO BE INSTALLED TO A SNUG-TIGHTENED CONDITION IN ACCORDANCE WITH AISC 13 PART 16.2, "SPECIFICATION FOR STRUCTURAL JOINTS USING ASTM A325 OR A490 BOLTS", SECTION 8.1, UNLESS OTHERWISE SPECIFIED. ALL NUTS SHALL BE HEAVY HEX UNLESS OTHERWISE NOTED.
4. ALL STEEL (EXCEPT A490 BOLTS), AFTER FABRICATION, SHALL BE HOT DIPPED GALVANIZED PER ASTM A-123. ALL DAMAGED SURFACES, WELDED AREAS AND AUTHORIZED NON-GALVANIZED MEMBERS OR PARTS (EXISTING OR NEW) SHALL BE PAINTED WITH 2 COATS OF ZRC OR ZINGA COLD GALVANIZING COMPOUND.
5. ALL SHOP AND FIELD WELDING SHALL BE DONE BY WELDERS QUALIFIED AS DESCRIBED IN THE "AMERICAN WELDING SOCIETY'S STANDARD QUALIFICATION PROCEDURE" TO PERFORM THE TYPE OF WORK REQUIRED. CONTRACTOR IS REQUIRED TO PROVIDE FDH ENGINEERING, INC. WITH A PASSING CERTIFIED WELDING INSPECTION FOR ALL WELDS.
6. STRUCTURAL STEEL MAY NOT BE TORCH CUT FOR FABRICATION. ALL STEEL FABRICATION MUST FOLLOW AISC STANDARDS.

MISC. NOTES:

1. ALL MODIFICATIONS ARE ASSUMED TO BE MADE ON AN EMPTY TOWER. CONTRACTOR IS RESPONSIBLE TO MAKE PROVISIONS TO SUPPORT OR WORK AROUND EXISTING ANTENNAS AND TRANSMISSION LINES. MODIFICATIONS MUST BE CONTINUOUS THROUGH ALL AREAS SHOWN.
2. CONTRACTOR FIELD VERIFY ALL DIMENSIONS PRIOR TO CONSTRUCTION.

FABRICATION NOTES:

1. ALL DIMENSIONS ARE PRELIMINARY UNTIL FIELD VERIFIED BY CONTRACTOR. ANY CHANGES MUST BE APPROVED BY ENGINEER OF RECORD IN WRITING PRIOR TO FABRICATION AND INSTALLATION.
2. NEW STEEL MEMBERS MUST HAVE SINGLE DRILLED HOLES. SLOTTED AND DOUBLE DRILLED HOLES ARE NOT ACCEPTABLE MEANS OF FABRICATION.

EPOXY/HILTI NOTES:

1. EPOXY AGENTS SHOULD BE ALLOWED TO CURE ACCORDING TO MANUFACTURERS RECOMMENDATIONS.
2. ALL HARDWARE ASSEMBLY AND MANUFACTURER'S INSTRUCTIONS SHALL BE FOLLOWED; ANY CONTRADICTION BETWEEN THE MANUFACTURER'S RECOMMENDATIONS AND THESE DRAWINGS ARE TO BE BROUGHT IMMEDIATELY TO THE ATTENTION OF THE ENGINEER AND OWNER.
3. ANY CONTRACTOR INSTALLING ADHESIVE ANCHORING SYSTEMS SHALL BE TRAINED, IN PERSON BY A MANUFACTURER'S REPRESENTATIVE, ON THE PROPER INSTALLATION TECHNIQUES. THIS TRAINING SHALL INCLUDE PROPER DRILLING, HOLE CLEANING, AND INSTALLATION METHODS FOR THE ADHESIVE ANCHORING SYSTEM AND CONSTRUCTION CONDITIONS ON THIS PROJECT. ALL TRAINING TO BE CONDUCTED PRIOR TO CREWS STEPPING ON SITE. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CONTACT MANUFACTURER REPRESENTATIVE TO SET UP TRAINING. FDH IS NOT RESPONSIBLE FOR ANY COST OCCURRED FOR OR DURING ADHESIVE ANCHORING SYSTEM TRAINING.

SURFACE PREPARATION:

1. PREPARE SURFACE TO BE WELDED BY REMOVING PAINT OR GALVANIZATION TO BARE METAL USING POWER WIRE BRUSHING IN ACCORDANCE WITH SSPC-SP11, (STEEL STRUCTURES PAINTING COUNCIL). FOLLOWING POWER WIRE BRUSHING CONTRACTOR SHALL POLISH METAL SURFACE WITH HIGH SPEED GRINDER WITH 400+ GRIT SANDPAPER.
2. AFTER NEW STEEL NSTALLATION CONTRACTOR TO BRUSH PAINT (2) COATS OF ZRC OR ZINGA COLD GALVANIZATION COMPOUND PER MANUFACTURER'S SPECIFICATIONS.

WELDING NOTES:

1. ALL WELDING TO THE EXISTING TOWER SHALL BE PERFORMED BY CERTIFIED WELDERS UTILIZING PROCEDURES QUALIFIED IN ACCORDANCE WITH AWS D1.1 AND AWS C5.4.
2. CONTRACTOR SHALL COMPLY WITH AWS D1.1 FOR PROCEDURES, APPEARANCE AND QUALITY OF WELDS AND FOR METHODS USED IN CORRECTING WELDING. ALL WELDERS AND WELDING PROCESSES SHALL BE QUALIFIED IN ACCORDANCE WITH AWS "STANDARD QUALIFICATION PROCEDURES". CONTRACTOR SHALL SUBMIT CERTIFICATION OF WELDERS TO THE ENGINEER PRIOR TO COMMENCEMENT OF THE WORK.
3. CONTRACTOR RESPONSIBLE FOR TEMPORARY HEAT SHIELDING AS REQUIRED DURING WELDING.
4. CONTRACTOR RESPONSIBLE FOR VIEWING EXISTING TOWER FOR LOOSE AND FLAMMABLE MATERIAL PRIOR TO WELDING FLAT PLATE.
5. ALL WELDS TO BE VISUALLY INSPECTED BY A CERTIFIED WELD INSPECTOR PER AWS D1.1.

PULLOUT TESTING OF POST INSTALLED ANCHOR RODS:

1. EPOXY AGENTS SHOULD BE ALLOWED TO CURE ACCORDING TO MANUFACTURERS RECOMMENDATIONS.
2. CONTRACTOR SHALL ENSURE THAT CONSTRUCTION DOES NOT GO BEYOND POINT WHERE THE ANCHOR RODS CAN BE EFFECTIVELY TESTED. CONTRUCTION MAY PROCEED AFTER TESTING IS COMPLETED.
3. 50% OF POST INSTALLED ANCHOR RODS SHALL BE TESTED OR A TOTAL OF 4, WHICHEVER IS GREATER.
4. THE ANCHOR ROD SHALL BE TESTED TO A TARGET TENSION OF 80% OF THE MATERIAL MINIMUM YIELD (Fy) STRENGTH ON THE NET AREA THROUGH THREADS. THE TARGET TENSION FOR THIS PULL TEST IS 200K.
5. MAINTAIN COMPLETE LOAD-DISPLACEMENT RECORDS THROUGHOUT THE TEST. LOAD THE ANCHOR IN INCREMENTS OF UP TO 15% OF THE TARGET TENSION.
6. IF A DISPLACEMENT GREATER THAN 0.010" REMAINS AFTER THE INITIAL TEST CYCLE, ADDITIONAL TEST SHALL BE PERFORMED UP TO A MAXIMUM OF 4 TEST CYCLES TO DETERMINE IF THE MOVEMENT CONTINUES TO ACCUMULATE. INCREMENTAL RESIDUAL MOVEMENT RECORDED FROM EACH TEST CYCLE MUST BE DECREASING IN VALUE AND STABILIZE TO A VALUE NO MORE THAN 0.010", OTHERWISE THE ANCHOR SHALL BE CONSIDERED TO FAIL THE TEST. TOTAL RESIDUAL MOVEMENT SHALL NOT BE GREATER THAN 0.10" OR THE ANCHOR SHALL BE CONSIDERED TO FAIL THE TEST.
7. THIS INFORMATION SHALL BE DOCUMENTED AND INCLUDED IN THE POST MODIFICATION INSPECTION REPORT.
8. CONTACT FDH ENGINEERING, INC. IF ANY OF THE ANCHORS FAIL THE PULL TEST.

BASE PLATE GROUT:

1. WORK SHALL BE IN ACCORDANCE WITH THE LATEST VERSION OF ACI 318 - "BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE.
2. AS A MINIMUM, GROUT SHALL DEVELOP A COMPRESSIVE STRENGTH OF 5,000 PSI MIN. IN 28 DAYS.
3. GROUT SHALL BE PLACED IN A MANNER THAT WILL PREVENT SEGREGATION OF GROUT MATERIALS.
4. LOOSE MATERIAL SHALL BE REMOVED PRIOR TO GROUT PLACEMENT. ANY FAYING SURFACES MUST BE FREE OF DIRT, GREASE, SCALE, ETC., AND UNSOUD GROUT MUST BE CHIPPED OUT.
5. MATERIAL SPECIFICATIONS SHALL BE IN ACCORDANCE WITH ASTM C1107-02, STANDARD SPECIFICATIONS FOR PACKAGED DRY, HYDRAULIC-CEMENT GROUT (NONSHRINK).
6. LEVELING NUT TIGHTNESS CHECK: WHEN CHECKING FOR NUT TIGHTNESS, ALWAYS TURN THE SPUD WRENCH IN THE DIRECTION TO TIGHTEN THE NUT AGAINST THE BASE PLATE. USING THE SPUD WRENCH AND THE FULL EFFORT OF A PERSON, CHECK THE LEVELING NUT FOR TIGHTNESS AND THE NUT ATOP THE BASE PLATE FOR TIGHTNESS.
7. PLACEMENT TEMPERATURES AND CURING SHALL BE PER MANUFACTURER'S RECOMMENDATIONS.
8. THE GROUT SHALL BE INSTALLED TO PROVIDE BEARING TO THE ENTIRE BASE PLATE SURFACE.
9. PROVIDE A MINIMUM OF (2) DRAIN HOLES, EQUALLY SPACED, THROUGH GROUT FROM INSIDE OF MONOPOLE USING NON-METALLIC PIPE. PIPE TO BE 1" DIAMETER OR SMALLER IF CLEARANCE DICTATES.

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STATE OF MAINE
CHRISTOPHER MICHAEL MURPHY
No. 11228
LICENSED PROFESSIONAL ENGINEER

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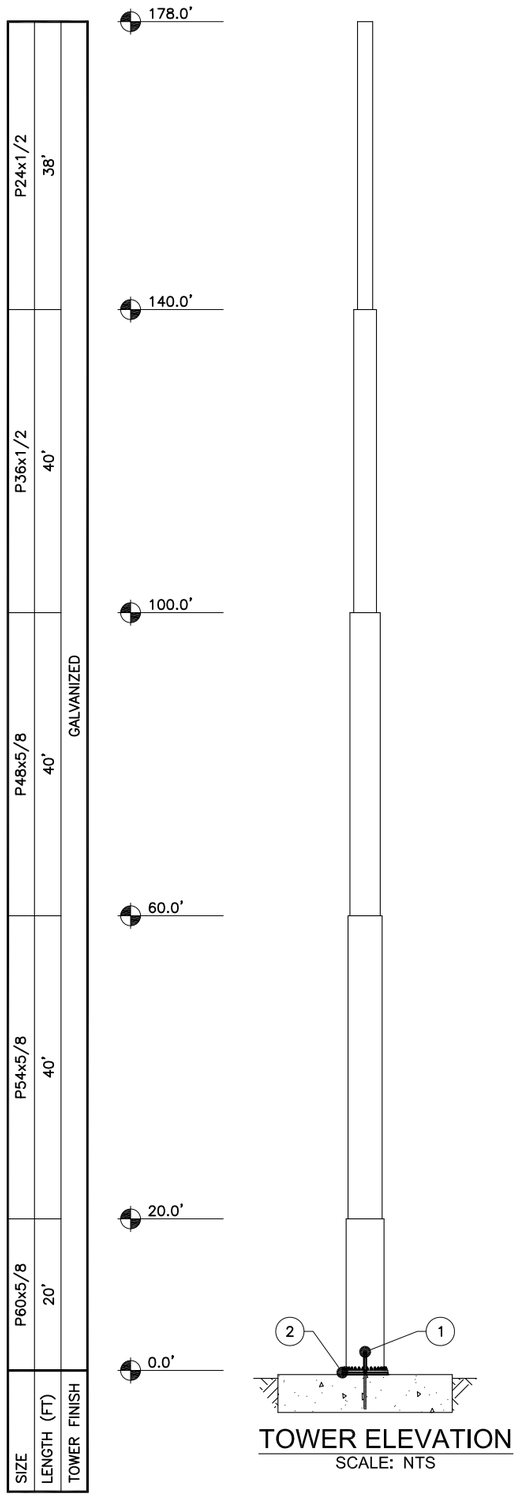

TOWER ELEVATION
SCALE: NTS

- APPURTENANCES MAY INTERFERE WITH PROPOSED MODIFICATIONS.
- ALL MODIFICATIONS TO BE INSTALLED CONTINUOUSLY THROUGH EXISTING EQUIPMENT. ALL EXISTING EQUIPMENT NOT TO BE DAMAGED OR TAKEN OFF AIR DURING INSTALLATION.
- ANTENNA GRAPHICS NOT SHOWN FOR CLARITY. SEE STRUCTURAL ANALYSIS REPORT FOR EXISTING ANTENNA LOADING.

TOWER MODIFICATION SCHEDULE

NO.	TYPE OF MODIFICATION	BOTTOM ELEV. (FT)	TOP ELEV. (FT)
1	INSTALLATION OF NEW ANCHOR RODS. SEE S-2 & S-3 FOR DETAILS.	-5.0±	2.5±
2	INSTALLATION OF REPLACEMENT BASE PLATE GROUT. SEE S-2 FOR DETAILS.	-0.5±	-0.3±

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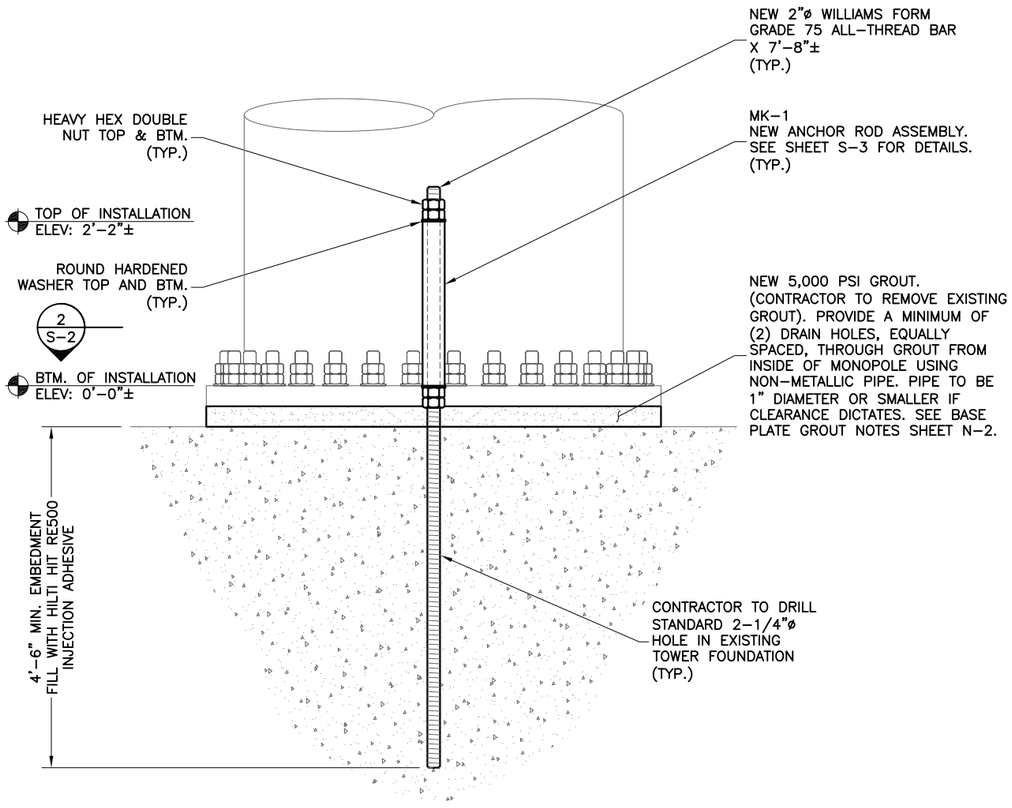
CONTRACTOR TO PROVIDE PHOTOS OF THE ANCHOR ROD HOLES TO FDH CONSTRUCTION MANAGER PRIOR TO INSTALLING NEW ANCHOR RODS. PHOTOS MUST SHOW THE DEPTH AND DIAMETER OF ANCHOR ROD HOLES.

PISTON PLUGS TO BE USED IN ALL INJECTION ADHESIVE APPLICATIONS

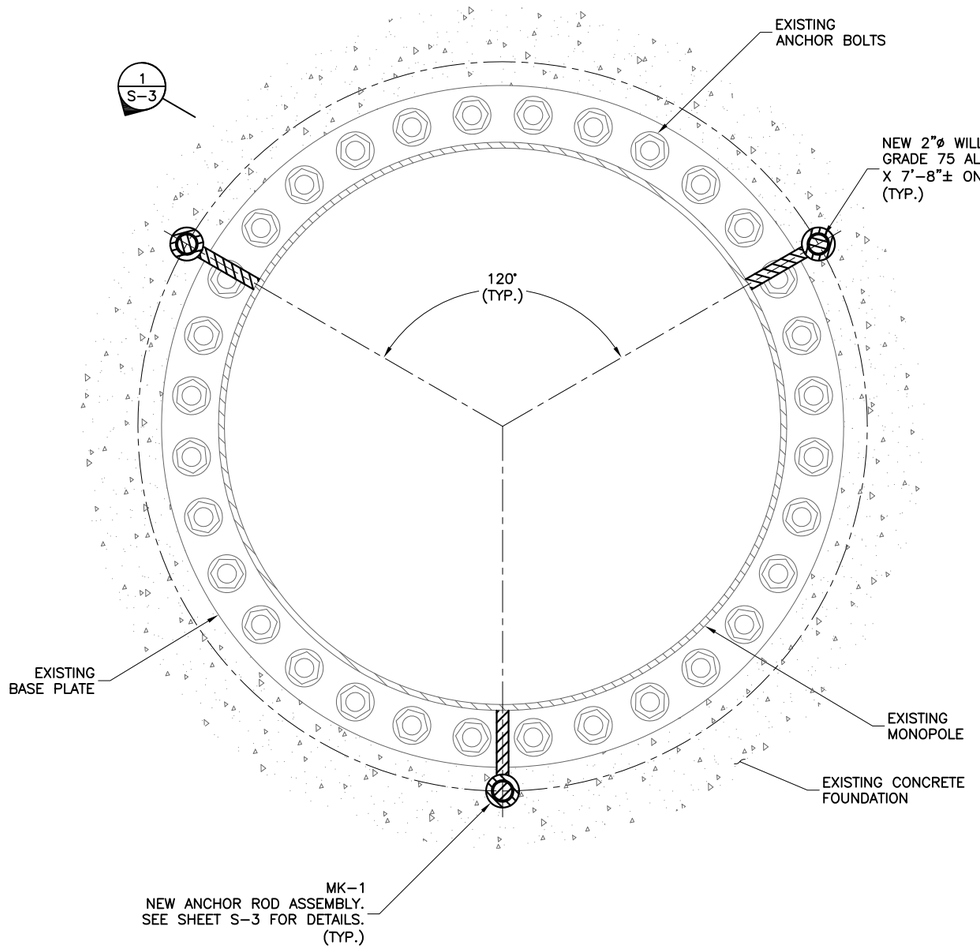
ANCHOR ROD MATERIAL LIST

PART. NO	QTY.	DESCRIPTION	ELEVATION
MK–1	3	ANCHOR ROD ASSEMBLY	0'–0"± TO 2'–2"±
–	3	NEW 2"ø WILLIAMS FORM GRADE 75 ALL–THREAD BAR X 7'–8"±	–5'–0"± TO 2'–6"±
–	6	ROUND HARDENED WASHER	–
–	12	HEAVY HEX NUT	–



ANCHOR ROD LAYOUT
FRONT VIEW

1 / S-2 — ELEVATION
SCALE: 1/2" = 1'-0"



ANCHOR ROD REINFORCEMENT LAYOUT
PLAN VIEW

2 / S-2 — SECTION
SCALE: 3/4" = 1'-0"

PREPARED BY:
FDH
6521 MERIDIEN DRIVE
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PHONE: 919-755-1012
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ENGINEERING INNOVATION

PREPARED FOR:
CROWN CASTLE INTERNATIONAL

STATE OF MAINE
CHRISTOPHER MICHAEL MURPHY
No. 11228
LICENSED PROFESSIONAL ENGINEER

05/15/12
CHRISTOPHER M. MURPHY, P.E.
MAINE LIC. NO. 11228

DRAWN BY:	PF
CHECKED BY:	DMC
ENG APPV'D:	CMM
PROJECT NO:	12–03730E S2

SUBMITTALS

DATE	DESCRIPTION	REV
05/15/12	CONSTRUCTION	1

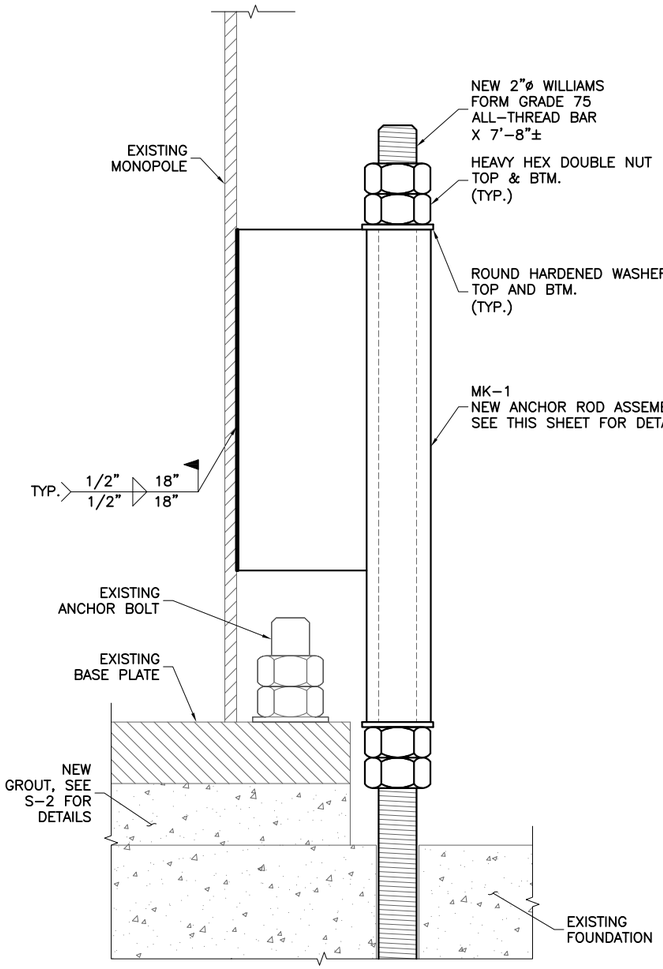
SITE NAME:
PORTLAND NORTH

SITE NUMBER:
878783

SITE ADDRESS:
527 PERSUMPSCOT
PORTLAND, ME 04101

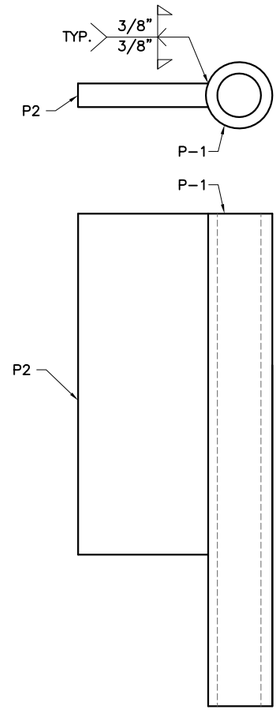
SHEET TITLE
ANCHOR ROD INSTALLATION DETAILS I

SHEET NUMBER
S-2



ANCHOR ROD ASSEMBLY WELD DETAIL
ELEVATION VIEW

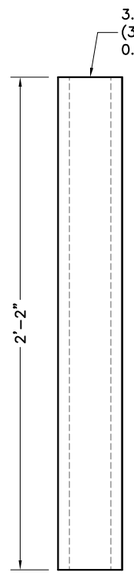
1 / S-3 — ELEVATION
SCALE: 1-1/2" = 1'-0"



ANCHOR ROD ASSEMBLY
TOP & SIDE VIEW

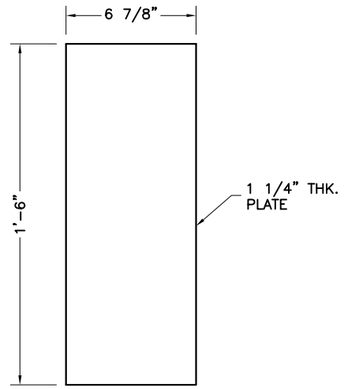
MK-1 / S-3 — SECTION
SCALE: 1-1/2" = 1'-0"

MATERIAL LIST (MK-1)		
PART. NO.	QTY.	DESCRIPTION
P-1	3	ANCHOR ROD SLEEVE
P-2	3	TRANSFER PLATE



ANCHOR ROD SLEEVE
SIDE VIEW

P-1 / S-3 — DETAIL
SCALE: 1-1/2" = 1'-0"



TRANSFER PLATE
SIDE VIEW

P-2 / S-3 — DETAIL
SCALE: 1-1/2" = 1'-0"

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ANCHOR ROD INSTALLATION DETAILS II

SHEET NUMBER
S-3