STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL
Ten Franklin Square, New Britain, CT 06051
Phone: (860) 827-2935 Fax: (860) 827-2950
E-Mail: siting.council@ct.gov
Web Site: portal.ct.gov/csc

VIA ELECTRONIC MAIL

July 28, 2020

Anne Marie Zsamba
Site Acquisition Specialist
Crown Castle
3 Corporate Park Drive, Suite 101
Clifton Park, NY 12065

RE: **EM-T-MOBILE-064-200709** – T-Mobile notice of intent to modify an existing telecommunications facility located at 92 Weston Street, Hartford, Connecticut.

Dear Ms. Zsamba:

The Connecticut Siting Council (Council) is in receipt of your correspondence of July 24, 2020 submitted in response to the Council's July 17, 2020 notification of an incomplete request for exempt modification with regard to the above-referenced matter.

The submission renders the request for exempt modification complete and the Council will process the request in accordance with the Federal Communications Commission 60-day timeframe.

Thank you for your attention and cooperation.

Sincerely,

s/ Melanie A. Bachman

Melanie A. Bachman
Executive Director

MAB/IN/emr

Crown Castle
3 Corporate Park Drive, Suite 101
Clifton Park, NY 12065

July 24, 2020

Melanie A. Bachman
Executive Director
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

RE: **Notice of Exempt Modification for T-Mobile:**
876325 - T-Mobile Site ID: CT11062B
92 Weston Street, Hartford, CT 06103
Latitude: 41° 47′ 12.30″ / Longitude: -72° 39′ 44.42″

Dear Ms. Bachman:

In response to the Council's correspondence dated July 17, 2020 wherein T-Mobile's Exempt Modification, EM-T-MOBILE-064-200709, was deemed incomplete due to the failure to account for Verizon's loading as approved by the Council in TS-VER-064-200407, enclosed please find a Structural Analysis Report by Black & Veatch dated January 8, 2020 which captures all proposed and approved loading for this monopole tower.

The enclosed Structural Analysis was generated for Verizon, therefore their approved loading lists as the proposed equipment configuration, however the intention of the document is to capture that T-Mobile's proposed equipment under application EM-T-MOBILE-064-200709 is considered on page four, within "Table 2 – Other Considered Equipment," at the mounting level of 74'. Overall, with the structural reinforcements as previously approved and still to be completed the tower shall have sufficient capacity of 89.8% should T-Mobile's proposed work become approved.

Please confirm that the enclosed Structural Analysis Report renders T-Mobile's application complete. Thank you kindly.

Best,

Anne Marie Zsamba

Anne Marie Zsamba
Site Acquisition Specialist
3 Corporate Park Drive, Suite 101
Clifton Park, NY 12065
(201) 236-9224
AnneMarie.Zsamba@crowncastle.com

Enclosure

Date: **January 08, 2020**

Chanhdara Ratsavong
Crown Castle
3530 Toringdon Way
Charlotte, NC 28277

Black & Veatch Corp.
6800 W 115th St. Suite 2292
Overland Park, KS 66211
(913) 458 - 6984

Subject:	**Structural Modification Report**	
Carrier Designation:	***Verizon Wireless* Co-Locate** **Carrier Site Name:**	 HARTFORD 17 CT - A
Crown Castle Designation:	**Crown Castle BU Number:** **Crown Castle Site Name:** **Crown Castle JDE Job Number:** **Crown Castle Work Order Number:** **Crown Castle Order Number:**	876325 WESTON SQUARE 595801 1819530 508994 Rev. 0
Engineering Firm Designation:	**Black & Veatch Corp. Project Number:**	400087
Site Data:	**92 Weston Street, Hartford, Hartford County, CT** **Latitude *41° 47' 12.3"*, Longitude *-72° 39' 44.42"*** **110 Foot - Monopole Tower**	

Dear Chanhdara Ratsavong,

Black & Veatch Corp. is pleased to submit this **"Structural Modification Report"** to determine the structural integrity of the above mentioned tower.

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 Structure w/ Proposed Equipment Configuration **Sufficient Capacity - 89.8%**

This analysis utilizes an ultimate 3-second gust wind speed of 125 mph as required by the 2018 Connecticut State Building Code. Applicable Standard references and design criteria are listed in Section 2 - Analysis Criteria.

Structural analysis prepared by: Anthony M. Reyes

Respectfully submitted by:

Josh J. Riley, P.E.
Professional Engineer

01/21/2020

TABLE OF CONTENTS

1) INTRODUCTION

This tower is a 110 ft Monopole tower designed by Rohn Industries, Inc.

The tower has been modified multiple times in the past to accommodate additional loading.

The tower has been modified per reinforcement drawings prepared by B&T Engineering, Inc., in December of 2008. Reinforcement consists of addition of reinforcement plates from 0.5' – 10.5', additional anchor rods, and base plate stiffeners. Refer to Post Modification Inspection Report by B&T Engineering, Inc. in November of 2009. This modification has been considered effective in this analysis.

The tower was later modified per reinforcement drawings prepared by Paul J. Ford and Company, in May of 2012. Reinforcement consists of addition of reinforcement plates from 30.5' – 40.5', and bridge stiffeners at 30'. Refer to Modification Inspection Report by Tower Engineering Professionals, Inc. in October of 2012. This modification has been considered effective in this analysis.

The tower was later modified per reinforcement drawings prepared by Paul J. Ford and Company, in February of 2013. Reinforcement consists of addition of reinforcement plates from 6' – 21' and transition stiffeners. Refer to Modification Inspection Report by Tower Engineering Professionals, Inc. in August of 2013. This modification has been considered effective in this analysis.

The tower was later modified per reinforcement drawings prepared by Paul J. Ford and Company, in February of 2017. Reinforcement consists of addition of reinforcement plates from 4.5' – 26.5', jump plates at 30', and additional foundation reinforcement. Refer to Modification Inspection Report by Engineered Tower Solutions, Pllc. in August of 2017. This modification has been considered effective in this analysis.

2) ANALYSIS CRITERIA

TIA-222 Revision:	TIA-222-H
Risk Category:	II
Wind Speed:	125 mph
Exposure Category:	C
Topographic Factor:	1
Ice Thickness:	2 in
Wind Speed with Ice:	50 mph
Service Wind Speed:	60 mph

Table 1 - Proposed Equipment Configuration

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)
64.0	64.0	3	commscope	BSAMNT-SBS-1-2 Side By Side Bracket	2	1-7/8
		6	commscope	NHH-65B-R2B		
		1	pole mounts	Perfect Vision PV-LPP12M-HR-B 12.5' Platform w/ Handrail		
		2	raycap	RVZDC-6627-PF-48		
		3	samsung telecommunications	20W CBRS		
		3	samsung telecommunications	RFV01U-D1A		
		3	samsung telecommunications	RFV01U-D2A		

Table 2 - Other Considered Equipment

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)
107.0	108.0	3	alcatel lucent	TD-RRH8x20-25	1 3	5/8 1-1/4
		3	rfs celwave	APXVSPP18-C-A20 w/ Mount Pipe		
		3	rfs celwave	APXVTM14-C-120 w/ Mount Pipe		
	107.0	1	cci tower mounts (v2.1)	T-Arm Mount [TA 702-3]		
105.0	108.0	3	alcatel lucent	800MHz 2X50W RRH w/ Filter	-	-
		3	alcatel lucent	PCS 1900MHz 4x45W-65MHz		
	107.0	3	rfs celwave	IBC1900BB-1		
		3	rfs celwave	IBC1900HG-2A		
	105.0	1	cci tower mounts (v2.1)	Side Arm Mount [SO 102-3]		
89.0	90.0	3	cci antennas	HPA-65R-BUU-H6 w/ Mount Pipe	2 4 12 2	3/8 3/4 1-5/8 2” Conduit
		3	ericsson	RRUS 11 B12		
		3	ericsson	RRUS 32		
		3	ericsson	RRUS 32 B2		
		3	ericsson	RRUS 32 B66		
		3	powerwave technologies	7750.00 w/ Mount Pipe		
		6	powerwave technologies	LGP21901		
		3	quintel technology	QS66512-2 w/ Mount Pipe		
		2	raycap	DC6-48-60-18-8F		
	89.0	1	cci tower mounts (v2.1)	Platform Mount [LP 502-1]		
74.0	76.0	3	ericsson	AIR 32 B2a/B66Aa w/ Mount Pipe	6 3	7/8 1-5/8
		3	ericsson	ERICSSON AIR 21 B2A B4P w/ Mount Pipe		
		3	ericsson	KRY 112 144/1		
		3	ericsson	RADIO 4449 B12/B71		
		3	rfs celwave	APXVAARR24_43-U-NA20 w/ Mount Pipe		
	74.0	1	cci tower mounts (v2.1)	Platform Mount [LP 303-1_HR-1]		

3) ANALYSIS PROCEDURE

Table 3 - Documents Provided

Document	Remarks	Reference	Source
4-GEOTECHNICAL REPORTS	FDH Engineering, Inc.	2192540	CCISITES
4-TOWER FOUNDATION DRAWINGS/DESIGN/SPECS	Rohn Industries, Inc.	1615433	CCISITES
4-TOWER MANUFACTURER DRAWINGS	Rohn Industries, Inc.	1615400	CCISITES
4-TOWER REINFORCEMENT DESIGN/DRAWINGS/DATA	B&T Engineering, Inc	2356066	CCISITES
4-POST-MODIFICATION INSPECTION	B&T Engineering, Inc	2561266	CCISITES
4-TOWER REINFORCEMENT DESIGN/DRAWINGS/DATA	Paul J. Ford and Company	3187227	CCISITES
4-POST-MODIFICATION INSPECTION	Tower Engineering Professionals, Inc.	3355603	CCISITES
4-TOWER REINFORCEMENT DESIGN/DRAWINGS/DATA	Paul J. Ford and Company	3667858	CCISITES
4-POST-MODIFICATION INSPECTION	Tower Engineering Professionals, Inc.	4075332	CCISITES
4-TOWER REINFORCEMENT DESIGN/DRAWINGS/DATA	Paul J. Ford and Company	6702634	CCISITES
4-POST-MODIFICATION INSPECTION	Engineered Tower Solution, Pllc.	6996864	CCISITES
4-TOWER STRUCTURAL ANALYSIS REPORTS	Black & Veatch, Corp.	8842021	CCISITES

3.1) Analysis Method

tnxTower (version 8.0.5.0), 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.

tnxTower was used to determine the loads on the modified structure. Additional calculations were performed to determine the stresses in the pole and in the reinforcing elements. These calculations are presented in Appendix C.

3.2) Assumptions

1) Tower and structures were built and maintained in accordance with the manufacturer's specifications.
2) The configuration of antennas, transmission cables, mounts and other appurtenances are as specified in Tables 1 and 2 and the referenced drawings.
3) The wind loading EPA of the panel antennas has been analyzed and determined by the tower owner. Verification of its accuracy is outside the scope of this structural analysis/design. Black & Veatch does not assume any responsibility for its accuracy.
4) The wind loading Exposure Category/Topographic Category for this site have been analyzed and determined by the tower owner. Black & Veatch does not assume any responsibility for its accuracy.
5) This analysis was performed under the assumption that all information provided to Black & Veatch is current and correct. This is to include site data, appurtenance loading, tower/foundation details, and geotechnical data. The loading on the structure is based on CAD level drawings and carrier orders provided by the owner. If any of this information is not current and correct, this report should be considered obsolete and further analysis will be required.

This analysis may be affected if any assumptions are not valid or have been made in error. Black & Veatch Corp. should be notified to determine the effect on the structural integrity of the tower.

4) ANALYSIS RESULTS

Table 4 - Section Capacity (Summary)

Elevation (ft)	Component Type	Size	Critical Element	% Capacity	Pass / Fail
110 - 105	Pole	TP24x24x0.25	Pole	1.6%	Pass
105 - 100	Pole	TP24x24x0.25	Pole	6.6%	Pass
100 - 95	Pole	TP24x24x0.25	Pole	11.4%	Pass
95 - 90	Pole	TP24x24x0.25	Pole	16.6%	Pass
90 - 85	Pole	TP24x24x0.375	Pole	17.9%	Pass
85 - 80	Pole	TP24x24x0.375	Pole	25.3%	Pass
80 - 75	Pole	TP24x24x0.375	Pole	33.0%	Pass
75 - 70	Pole	TP24x24x0.375	Pole	44.5%	Pass
70 - 65	Pole	TP24x24x0.375	Pole	55.6%	Pass
65 - 60	Pole	TP24x24x0.375	Pole	69.8%	Pass
60 - 55	Pole	TP30x30x0.375	Pole	55.8%	Pass
55 - 50	Pole	TP30x30x0.375	Pole	65.6%	Pass
50 - 45	Pole	TP30x30x0.375	Pole	75.6%	Pass
45 - 40	Pole	TP30x30x0.375	Pole	85.7%	Pass
40 - 39.33	Pole	TP30x30x0.375	Pole	87.1%	Pass
39.33 - 39.08	Pole + Reinf.	TP30x30x0.4875	Pole	68.4%	Pass
39.08 - 34.08	Pole + Reinf.	TP30x30x0.4875	Pole	76.5%	Pass
34.08 - 30	Pole + Reinf.	TP30x30x0.4875	Pole	83.2%	Pass
30 - 29.75	Pole	TP30x30x0.5	Pole	77.6%	Pass
29.75 - 25	Pole	TP30x30x0.5	Pole	84.9%	Pass
25 - 24.75	Pole + Reinf.	TP30x30x0.5563	Pole	76.8%	Pass
24.75 - 19.75	Pole + Reinf.	TP30x30x0.5563	Pole	84.0%	Pass
19.75 - 18.58	Pole + Reinf.	TP30x30x0.5563	Pole	85.7%	Pass
18.58 - 18.33	Pole + Reinf.	TP30x30x0.6875	Pole	74.4%	Pass
18.33 - 13.33	Pole + Reinf.	TP30x30x0.6875	Pole	80.8%	Pass
13.33 - 8.42	Pole + Reinf.	TP30x30x0.6875	Pole	87.3%	Pass
8.42 - 8.07	Pole + Reinf.	TP30x30x0.8625	Pole	67.2%	Pass
8.07 - 7.83	Pole + Reinf.	TP30x30x0.8625	Pole	67.5%	Pass
7.83 - 6	Pole + Reinf.	TP30x30x0.8625	Pole	69.3%	Pass
6 - 5.75	Pole + Reinf.	TP30x30x0.8	Pole	74.5%	Pass
5.75 - 2	Pole + Reinf.	TP30x30x0.8	Pole	78.6%	Pass
2 - 1.75	Pole + Reinf.	TP30x30x1.25	Reinf. 4 Weldment	76.4%	Pass
1.75 - 0	Pole + Reinf.	TP30x30x1.225	Reinf. 1 Weldment	76.5%	Pass
				Summary	
			Pole	87.3%	Pass
			Reinforcement	77.5%	Pass
			Overall	87.3%	Pass

Table 5 - Tower Component Stresses vs. Capacity - LC4

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1, 2	Flange Connection	90.0	16.6	Pass
1, 2	Flange Connection	60.0	69.8	Pass
1	Bridge Stiffeners	30.0	55.0	Pass
1	Jump Plates	30.0	46.1	Pass
1	Flange Bolts	30.0	0.0	Pass
1	Flange Plate	30.0	1.2	Pass
1	Anchor Rods	0.0	59.6	Pass
1	Anchor Rods (Existing Modification)	0.0	89.8	Pass
1	Anchor Rods (Proposed Modification)	0.0	73.8	Pass
1	Base Plate	0.0	57.8	Pass
1	Base Foundation	0.0	81.5	Pass
1	Base Foundation Soil Interaction	0.0	25.3	Pass

Structure Rating (max from all components) =	89.8%

Notes:
1) See additional documentation in “Appendix C – Additional Calculations” for calculations supporting the % capacity. Rating per TIA-222-H Section 15.5.
2) Flange plates are assumed to have the same capacity as their respective splice bolts or shaft.

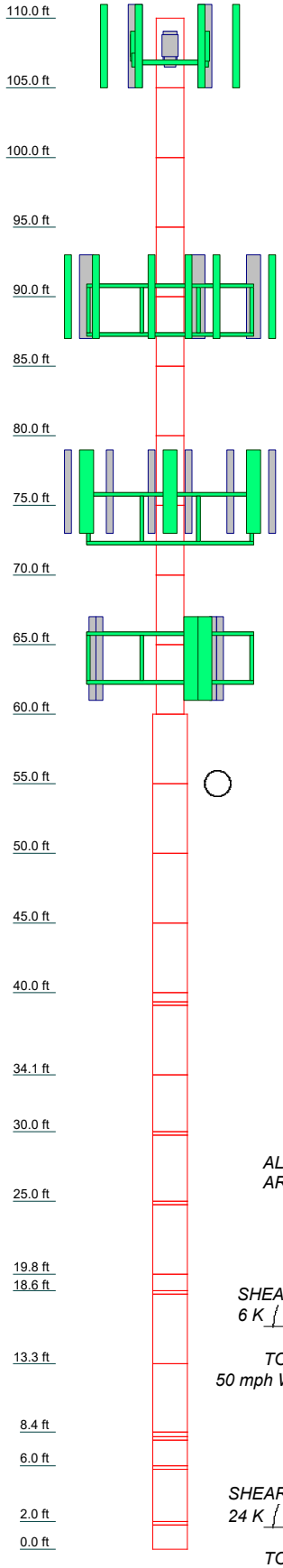
4.1) Recommendations

The tower and its foundation will have sufficient capacity to carry the proposed loading configuration after proper installation of the proposed reinforcements shown in Appendix D.

APPENDIX A

TNXTOWER OUTPUT

Section	Size	Length (ft)	Grade	Weight (K)
1	P24x0.25	5.00	A53-B-42	0.3
2	P24x0.25	5.00		0.3
3	P24x0.25	5.00		0.3
4	P24x0.25	5.00		0.3
5	P24x0.375	5.00		0.5
6	P24x0.375	5.00		0.5
7	P24x0.375	5.00		0.5
8	P24x0.375	5.00		0.5
9	P24x0.375	5.00		0.5
10	P24x0.375	5.00		0.5
11	P30x0.375	5.00		0.6
12	P30x0.375	5.00		0.6
13	P30x0.375	5.00		0.6
14	P30x0.375	5.00		0.6
15	P30x0.375	0.25		0.0
16	P30x0.375	0.25		0.0
17	P30x0.487	5.00		0.7
18	P30x0.487	4.08		0.6
19	P30x0.487	0.25		0.0
20	P30x0.487	4.75		0.7
21	P30x0.487	0.25		0.1
22	P30x0.487	5.00		1.1
23	P30x0.487	0.25		0.1
24	P30x0.487	0.17		0.0
25	P30x0.487	5.00		1.4
26	P30x0.6875	4.91		1.4
27	P30x0.6875	0.25		0.1
28	P30x0.6875	0.25		0.1
29	P30x0.6875	0.25		0.1
30	P30x0.6875	0.25		0.1
31	P30x0.6875	3.75		0.9
32	P30x0.6875	1.75		0.6
33	P30x0.6875	2.50		0.6



MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A53-B-42	42 ksi	63 ksi			

TOWER DESIGN NOTES

1. Tower is located in Hartford County, Connecticut.
2. Tower designed for Exposure C to the TIA-222-H Standard.
3. Tower designed for a 125 mph basic wind in accordance with the TIA-222-H Standard.
4. Tower is also designed for a 50 mph basic wind with 2.00 in ice. Ice is considered to increase in thickness with height.
5. Deflections are based upon a 60 mph wind.
6. Tower Risk Category II.
7. Topographic Category 1 with Crest Height of 0.00 ft

ALL REACTIONS ARE FACTORED

AXIAL 75 K

SHEAR 6 K *MOMENT 500 kip-ft*

TORQUE 0 kip-ft
50 mph WIND - 2.0000 in ICE

AXIAL 39 K

SHEAR 24 K *MOMENT 1710 kip-ft*

TORQUE 1 kip-ft
REACTIONS - 125 mph WIND

BLACK & VEATCH
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Black & Veatch Corp.
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Overland Park, KS 66211
Phone: (913) 458 - 6984
FAX: (913) 458 - 8136

Job: ***WESTON SQUARE (BU# 876325)***			
Project: ***400087 (876325.1819530)***			
Client: Crown Castle	Drawn by: Anthony M. Reyes	App'd:	
Code: TIA-222-H	Date: 01/07/20	Scale: NTS	
Path:		Dwg No. E-1	

Tower Input Data

The tower is a monopole.
This tower is designed using the TIA-222-H standard.
The following design criteria apply:

6) Tower is located in Hartford County, Connecticut.
7) Tower base elevation above sea level: 10.00 ft.
8) Basic wind speed of 125 mph.
9) Risk Category II.
10) Exposure Category C.
11) Simplified Topographic Factor Procedure for wind speed-up calculations is used.
12) Topographic Category: 1.
13) Crest Height: 0.00 ft.
14) Nominal ice thickness of 2.0000 in.
15) Ice thickness is considered to increase with height.
16) Ice density of 56 pcf.
17) A wind speed of 50 mph is used in combination with ice.
18) Temperature drop of 50 °F.
19) Deflections calculated using a wind speed of 60 mph.
20) A non-linear (P-delta) analysis was used.
21) Pressures are calculated at each section.
22) Stress ratio used in pole design is 1.05.
23) Tower analysis based on target reliabilities in accordance with Annex S.
24) Load Modification Factors used: $K_{es}(F_w) = 0.95$, $K_{es}(t_i) = 0.85$.
25) Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Options

Consider Moments - Legs	Distribute Leg Loads As Uniform	Use ASCE 10 X-Brace Ly Rules
Consider Moments - Horizontals	Assume Legs Pinned	Calculate Redundant Bracing Forces
Consider Moments - Diagonals	√ Assume Rigid Index Plate	Ignore Redundant Members in FEA
Use Moment Magnification	√ Use Clear Spans For Wind Area	SR Leg Bolts Resist Compression
Use Code Stress Ratios	Use Clear Spans For KL/r	All Leg Panels Have Same Allowable
√ Use Code Safety Factors - Guys	Retension Guys To Initial Tension	Offset Girt At Foundation
Escalate Ice	√ Bypass Mast Stability Checks	√ Consider Feed Line Torque
Always Use Max Kz	√ Use Azimuth Dish Coefficients	Include Angle Block Shear Check
Use Special Wind Profile	√ Project Wind Area of Appurt.	Use TIA-222-H Bracing Resist. Exemption
Include Bolts In Member Capacity	Autocalc Torque Arm Areas	Use TIA-222-H Tension Splice Exemption
Leg Bolts Are At Top Of Section	Add IBC .6D+W Combination	Poles
Secondary Horizontal Braces Leg	Sort Capacity Reports By Component	√ Include Shear-Torsion Interaction
Use Diamond Inner Bracing (4 Sided)	Triangulate Diamond Inner Bracing	Always Use Sub-Critical Flow
SR Members Have Cut Ends	Treat Feed Line Bundles As Cylinder	Use Top Mounted Sockets
SR Members Are Concentric	Ignore KL/ry For 60 Deg. Angle Legs	Pole Without Linear Attachments
		Pole With Shroud Or No Appurtenances
		Outside and Inside Corner Radii Are Known

Pole Section Geometry

Section	*Elevation*	*Section Length*	*Pole Size*	*Pole Grade*	*Socket Length*
	ft	*ft*			*ft*
L1	110.00-105.00	5.00	P24x0.25	A53-B-42 (42 ksi)	
L2	105.00-100.00	5.00	P24x0.25	A53-B-42	

Section	*Elevation* *ft*	*Section Length* *ft*	*Pole Size*	*Pole Grade*	*Socket Length* *ft*
L3	100.00-95.00	5.00	P24x0.25	A53-B-42 (42 ksi)	
L4	95.00-90.00	5.00	P24x0.25	A53-B-42 (42 ksi)	
L5	90.00-85.00	5.00	P24x0.375	A53-B-42 (42 ksi)	
L6	85.00-80.00	5.00	P24x0.375	A53-B-42 (42 ksi)	
L7	80.00-75.00	5.00	P24x0.375	A53-B-42 (42 ksi)	
L8	75.00-70.00	5.00	P24x0.375	A53-B-42 (42 ksi)	
L9	70.00-65.00	5.00	P24x0.375	A53-B-42 (42 ksi)	
L10	65.00-60.00	5.00	P24x0.375	A53-B-42 (42 ksi)	
L11	60.00-55.00	5.00	P30x0.375	A53-B-42 (42 ksi)	
L12	55.00-50.00	5.00	P30x0.375	A53-B-42 (42 ksi)	
L13	50.00-45.00	5.00	P30x0.375	A53-B-42 (42 ksi)	
L14	45.00-40.00	5.00	P30x0.375	A53-B-42 (42 ksi)	
L15	40.00-39.33	0.67	P30x0.375	A53-B-42 (42 ksi)	
L16	39.33-39.08	0.25	P30x0.4875	A53-B-42 (42 ksi)	
L17	39.08-34.08	5.00	P30x0.4875	A53-B-42 (42 ksi)	
L18	34.08-30.00	4.08	P30x0.4875	A53-B-42 (42 ksi)	
L19	30.00-29.75	0.25	P30x0.5	A53-B-42 (42 ksi)	
L20	29.75-25.00	4.75	P30x0.5	A53-B-42 (42 ksi)	
L21	25.00-24.75	0.25	P30x0.55625	A53-B-42 (42 ksi)	
L22	24.75-19.75	5.00	P30x0.55625	A53-B-42 (42 ksi)	
L23	19.75-18.58	1.17	P30x0.55625	A53-B-42 (42 ksi)	
L24	18.58-18.33	0.25	P30x0.6875	A53-B-42 (42 ksi)	
L25	18.33-13.33	5.00	P30x0.6875	A53-B-42 (42 ksi)	
L26	13.33-8.42	4.91	P30x0.6875	A53-B-42 (42 ksi)	
L27	8.42-8.07	0.35	P30x0.8625	A53-B-42 (42 ksi)	
L28	8.07-7.83	0.24	P30x0.8625	A53-B-42 (42 ksi)	
L29	7.83-6.00	1.83	P30x0.8625	A53-B-42 (42 ksi)	
L30	6.00-5.75	0.25	P30x0.8	A53-B-42 (42 ksi)	
L31	5.75-2.00	3.75	P30x0.8	A53-B-42 (42 ksi)	
L32	2.00-1.75	0.25	P30x1.25	A53-B-42 (42 ksi)	
L33	1.75-0.00	1.75	P30x1.225	A53-B-42 (42 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	Double Angle Stitch Bolt Spacing Redundants in
L1 110.00-105.00				1	1	1			
L2 105.00-100.00				1	1	1			
L3 100.00-95.00				1	1	1			
L4 95.00-90.00				1	1	1			
L5 90.00-85.00				1	1	1			
L6 85.00-80.00				1	1	1			
L7 80.00-75.00				1	1	1			
L8 75.00-70.00				1	1	1			
L9 70.00-65.00				1	1	1			
L10 65.00-60.00				1	1	1			
L11 60.00-55.00				1	1	1			
L12 55.00-50.00				1	1	1			
L13 50.00-45.00				1	1	1			
L14 45.00-40.00				1	1	1			
L15 40.00-39.33				1	1	1			
L16 39.33-39.08				1	1	0.965972			
L17 39.08-34.08				1	1	0.965972			
L18 34.08-30.00				1	1	0.965972			
L19 30.00-29.75				1	1	1			
L20 29.75-25.00				1	1	1			
L21 25.00-24.75				1	1	1.25043			
L22 24.75-19.75				1	1	1.25043			
L23 19.75-18.58				1	1	1.25043			
L24 18.58-18.33				1	1	1.28397			
L25 18.33-13.33				1	1	1.28397			
L26 13.33-8.42				1	1	1.28397			
L27 8.42-8.07				1	1	1.10116			
L28 8.07-7.83				1	1	1.10116			
L29 7.83-6.00				1	1	1.10116			
L30 6.00-5.75				1	1	0.939375			
L31 5.75-2.00				1	1	0.939375			
L32 2.00-1.75				1	1	0.843115			
L33 1.75-0.00				1	1	0.859574			

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Sector	Exclude From Torque Calculation	Component Type	Placement ft	Total Number	Number Per Row	Start/End Position	Width or Diameter in	Perimeter in	Weight plf
*** Misc ***										
Safety Line 3/8	B	No	Surface Ar (CaAa)	110.00 - 8.00	1	1	0.037 0.050	0.3750		0.22
(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	C	No	Surface Ar (CaAa)	89.00 - 0.00	4	4	0.100 0.377	2.0000		0.82
*** 74' ***										
(1) MLE Hybrid 9Power/18Fiber RL 2(1-5/8) + (6) 810921-001(7/8) + (2) HCS 6X12 4AWG(1-5/8)	A	No	Surface Ar (CaAa)	74.00 - 0.00	6	6	-0.450 -0.110	1.6600		2.40
*** 64' ***										
HB158-U12S24-160-LI(1-7/8)	C	No	Surface Ar (CaAa)	64.00 - 0.00	2	2	-0.500 -0.366	1.9760		3.20
*** Existing Modifications ***										
Aero Channel MP305	A	No	Surface Af (CaAa)	10.50 - 0.50	1	1	0.000 0.000	5.3125	14.8400	0.00
Aero Channel MP305	B	No	Surface Af (CaAa)	10.50 - 0.50	1	1	0.000 0.000	5.3125	14.8400	0.00
Aero Channel MP305	C	No	Surface Af (CaAa)	10.50 - 0.50	1	1	0.000 0.000	5.3125	14.8400	0.00
Aero Channel MP305	C	No	Surface Af (CaAa)	10.50 - 0.50	1	1	0.000 0.000	5.3125	14.8400	0.00
*										
Aero Channel MP303	A	No	Surface Af (CaAa)	40.50 - 30.50	1	1	0.000 0.000	4.0625	11.2600	0.00
Aero Channel MP303	B	No	Surface Af (CaAa)	40.50 - 30.50	1	1	0.000 0.000	4.0625	11.2600	0.00
Aero Channel MP303	C	No	Surface Af (CaAa)	40.50 - 30.50	1	1	0.000 0.000	4.0625	11.2600	0.00
*										
Aero Channel MP305	A	No	Surface Af (CaAa)	21.00 - 6.00	1	1	0.000 0.000	5.3125	14.8400	0.00
Aero Channel MP305	B	No	Surface Af (CaAa)	21.00 - 6.00	1	1	0.000 0.000	5.3125	14.8400	0.00
Aero Channel MP305	C	No	Surface Af (CaAa)	21.00 - 6.00	1	1	0.000 0.000	5.3125	14.8400	0.00
*										
CCI-SFP-045100	A	No	Surface Af (CaAa)	26.50 - 4.50	1	1	0.000 0.000	4.5000	11.0000	0.00
CCI-SFP-045100	B	No	Surface Af (CaAa)	26.50 - 4.50	1	1	0.000 0.000	4.5000	11.0000	0.00
CCI-SFP-045100	C	No	Surface Af (CaAa)	26.50 - 4.50	1	1	0.000 0.000	4.5000	11.0000	0.00
CCI-SFP-045100	C	No	Surface Af (CaAa)	26.50 - 4.50	1	1	0.000 0.000	4.5000	11.0000	0.00
***										

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
*** 107' ***									
HB114-1-08U4-M5J(1-1/4)	C	No	No	Inside Pole	107.00 - 0.00	3	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	1.08 1.08 1.08 1.08
HB058-M12-XXXF(5/8)	C	No	No	Inside Pole	107.00 - 0.00	1	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.24 0.24 0.24 0.24
*** 89' ***									

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
LDF7-50A(1-5/8)	C	No	No	Inside Pole	89.00 - 0.00	9	No Ice	0.00	0.82
							1/2" Ice	0.00	0.82
							1" Ice	0.00	0.82
							2" Ice	0.00	0.82
FB-L98B-034-XXX(3/8)	C	No	No	Inside Pole	89.00 - 0.00	2	No Ice	0.00	0.06
							1/2" Ice	0.00	0.06
							1" Ice	0.00	0.06
							2" Ice	0.00	0.06
WR-VG86ST-BRD(3/4)	C	No	No	Inside Pole	89.00 - 0.00	4	No Ice	0.00	0.58
							1/2" Ice	0.00	0.58
							1" Ice	0.00	0.58
							2" Ice	0.00	0.58
2" innerduct conduit	C	No	No	Inside Pole	89.00 - 0.00	1	No Ice	0.00	0.20
							1/2" Ice	0.00	0.20
							1" Ice	0.00	0.20
							2" Ice	0.00	0.20
***									

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	110.00-105.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.188	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.01
L2	105.00-100.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.188	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.02
L3	100.00-95.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.188	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.02
L4	95.00-90.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.188	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.02
L5	90.00-85.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.188	0.000	0.00
		C	0.000	0.000	3.200	0.000	0.07
L6	85.00-80.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.188	0.000	0.00
		C	0.000	0.000	4.000	0.000	0.08
L7	80.00-75.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.188	0.000	0.00
		C	0.000	0.000	4.000	0.000	0.08
L8	75.00-70.00	A	0.000	0.000	3.984	0.000	0.06
		B	0.000	0.000	0.188	0.000	0.00
		C	0.000	0.000	4.000	0.000	0.08
L9	70.00-65.00	A	0.000	0.000	4.980	0.000	0.07
		B	0.000	0.000	0.188	0.000	0.00
		C	0.000	0.000	4.000	0.000	0.08
L10	65.00-60.00	A	0.000	0.000	4.980	0.000	0.07
		B	0.000	0.000	0.188	0.000	0.00
		C	0.000	0.000	5.581	0.000	0.11
L11	60.00-55.00	A	0.000	0.000	4.980	0.000	0.07
		B	0.000	0.000	0.188	0.000	0.00
		C	0.000	0.000	5.976	0.000	0.12
L12	55.00-50.00	A	0.000	0.000	4.980	0.000	0.07
		B	0.000	0.000	0.188	0.000	0.00
		C	0.000	0.000	5.976	0.000	0.12
L13	50.00-45.00	A	0.000	0.000	4.980	0.000	0.07
		B	0.000	0.000	0.188	0.000	0.00
		C	0.000	0.000	5.976	0.000	0.12
L14	45.00-40.00	A	0.000	0.000	5.319	0.000	0.07

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
		B	0.000	0.000	0.526	0.000	0.00
		C	0.000	0.000	6.315	0.000	0.12
L15	40.00-39.33	A	0.000	0.000	1.121	0.000	0.01
		B	0.000	0.000	0.479	0.000	0.00
		C	0.000	0.000	1.254	0.000	0.02
L16	39.33-39.08	A	0.000	0.000	0.418	0.000	0.00
		B	0.000	0.000	0.179	0.000	0.00
		C	0.000	0.000	0.468	0.000	0.01
L17	39.08-34.08	A	0.000	0.000	8.365	0.000	0.07
		B	0.000	0.000	3.573	0.000	0.00
		C	0.000	0.000	9.361	0.000	0.12
L18	34.08-30.00	A	0.000	0.000	6.488	0.000	0.06
		B	0.000	0.000	2.577	0.000	0.00
		C	0.000	0.000	7.300	0.000	0.09
L19	30.00-29.75	A	0.000	0.000	0.249	0.000	0.00
		B	0.000	0.000	0.009	0.000	0.00
		C	0.000	0.000	0.299	0.000	0.01
L20	29.75-25.00	A	0.000	0.000	5.856	0.000	0.07
		B	0.000	0.000	1.303	0.000	0.00
		C	0.000	0.000	7.927	0.000	0.11
L21	25.00-24.75	A	0.000	0.000	0.437	0.000	0.00
		B	0.000	0.000	0.197	0.000	0.00
		C	0.000	0.000	0.674	0.000	0.01
L22	24.75-19.75	A	0.000	0.000	9.837	0.000	0.07
		B	0.000	0.000	5.044	0.000	0.00
		C	0.000	0.000	14.583	0.000	0.12
L23	19.75-18.58	A	0.000	0.000	3.079	0.000	0.02
		B	0.000	0.000	1.957	0.000	0.00
		C	0.000	0.000	4.189	0.000	0.03
L24	18.58-18.33	A	0.000	0.000	0.658	0.000	0.00
		B	0.000	0.000	0.418	0.000	0.00
		C	0.000	0.000	0.895	0.000	0.01
L25	18.33-13.33	A	0.000	0.000	13.157	0.000	0.07
		B	0.000	0.000	8.365	0.000	0.00
		C	0.000	0.000	17.903	0.000	0.12
L26	13.33-8.42	A	0.000	0.000	14.639	0.000	0.07
		B	0.000	0.000	9.933	0.000	0.00
		C	0.000	0.000	21.018	0.000	0.11
L27	8.42-8.07	A	0.000	0.000	1.210	0.000	0.01
		B	0.000	0.000	0.875	0.000	0.00
		C	0.000	0.000	1.832	0.000	0.01
L28	8.07-7.83	A	0.000	0.000	0.830	0.000	0.00
		B	0.000	0.000	0.593	0.000	0.00
		C	0.000	0.000	1.256	0.000	0.01
L29	7.83-6.00	A	0.000	0.000	6.328	0.000	0.03
		B	0.000	0.000	4.505	0.000	0.00
		C	0.000	0.000	9.577	0.000	0.04
L30	6.00-5.75	A	0.000	0.000	0.643	0.000	0.00
		B	0.000	0.000	0.394	0.000	0.00
		C	0.000	0.000	1.087	0.000	0.01
L31	5.75-2.00	A	0.000	0.000	7.771	0.000	0.05
		B	0.000	0.000	4.036	0.000	0.00
		C	0.000	0.000	12.555	0.000	0.09
L32	2.00-1.75	A	0.000	0.000	0.456	0.000	0.00
		B	0.000	0.000	0.207	0.000	0.00
		C	0.000	0.000	0.712	0.000	0.01
L33	1.75-0.00	A	0.000	0.000	2.776	0.000	0.03
		B	0.000	0.000	1.033	0.000	0.00
		C	0.000	0.000	4.157	0.000	0.04

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	110.00-105.00	A	1.913	0.000	0.000	0.000	0.000	0.00

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
		B		0.000	0.000	2.101	0.000	0.03
		C		0.000	0.000	0.000	0.000	0.01
L2	105.00-100.00	A	1.904	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	2.092	0.000	0.03
		C		0.000	0.000	0.000	0.000	0.02
L3	100.00-95.00	A	1.895	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	2.082	0.000	0.03
		C		0.000	0.000	0.000	0.000	0.02
L4	95.00-90.00	A	1.885	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	2.072	0.000	0.03
		C		0.000	0.000	0.000	0.000	0.02
L5	90.00-85.00	A	1.874	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	2.062	0.000	0.03
		C		0.000	0.000	5.874	0.000	0.15
L6	85.00-80.00	A	1.863	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	2.051	0.000	0.03
		C		0.000	0.000	7.329	0.000	0.18
L7	80.00-75.00	A	1.852	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	2.039	0.000	0.03
		C		0.000	0.000	7.314	0.000	0.18
L8	75.00-70.00	A	1.839	0.000	0.000	6.819	0.000	0.14
		B		0.000	0.000	2.027	0.000	0.03
		C		0.000	0.000	7.299	0.000	0.18
L9	70.00-65.00	A	1.826	0.000	0.000	8.508	0.000	0.18
		B		0.000	0.000	2.014	0.000	0.03
		C		0.000	0.000	7.283	0.000	0.17
L10	65.00-60.00	A	1.812	0.000	0.000	8.490	0.000	0.17
		B		0.000	0.000	2.000	0.000	0.03
		C		0.000	0.000	11.053	0.000	0.25
L11	60.00-55.00	A	1.797	0.000	0.000	8.471	0.000	0.17
		B		0.000	0.000	1.985	0.000	0.02
		C		0.000	0.000	11.963	0.000	0.26
L12	55.00-50.00	A	1.781	0.000	0.000	8.451	0.000	0.17
		B		0.000	0.000	1.968	0.000	0.02
		C		0.000	0.000	11.922	0.000	0.26
L13	50.00-45.00	A	1.763	0.000	0.000	8.429	0.000	0.17
		B		0.000	0.000	1.951	0.000	0.02
		C		0.000	0.000	11.878	0.000	0.26
L14	45.00-40.00	A	1.744	0.000	0.000	8.850	0.000	0.18
		B		0.000	0.000	2.376	0.000	0.03
		C		0.000	0.000	12.274	0.000	0.26
L15	40.00-39.33	A	1.732	0.000	0.000	1.720	0.000	0.03
		B		0.000	0.000	0.853	0.000	0.01
		C		0.000	0.000	2.177	0.000	0.04
L16	39.33-39.08	A	1.730	0.000	0.000	0.642	0.000	0.01
		B		0.000	0.000	0.318	0.000	0.00
		C		0.000	0.000	0.812	0.000	0.02
L17	39.08-34.08	A	1.718	0.000	0.000	12.812	0.000	0.23
		B		0.000	0.000	6.345	0.000	0.08
		C		0.000	0.000	16.204	0.000	0.31
L18	34.08-30.00	A	1.695	0.000	0.000	9.979	0.000	0.18
		B		0.000	0.000	4.707	0.000	0.06
		C		0.000	0.000	12.724	0.000	0.25
L19	30.00-29.75	A	1.683	0.000	0.000	0.416	0.000	0.01
		B		0.000	0.000	0.094	0.000	0.00
		C		0.000	0.000	0.584	0.000	0.01
L20	29.75-25.00	A	1.669	0.000	0.000	9.521	0.000	0.17
		B		0.000	0.000	3.389	0.000	0.04
		C		0.000	0.000	14.310	0.000	0.27
L21	25.00-24.75	A	1.653	0.000	0.000	0.685	0.000	0.01
		B		0.000	0.000	0.362	0.000	0.00
		C		0.000	0.000	1.120	0.000	0.02
L22	24.75-19.75	A	1.634	0.000	0.000	15.097	0.000	0.23
		B		0.000	0.000	8.651	0.000	0.09
		C		0.000	0.000	23.769	0.000	0.37
L23	19.75-18.58	A	1.610	0.000	0.000	4.532	0.000	0.07
		B		0.000	0.000	3.025	0.000	0.03
		C		0.000	0.000	6.548	0.000	0.10
L24	18.58-18.33	A	1.604	0.000	0.000	0.967	0.000	0.01

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
		B		0.000	0.000	0.646	0.000	0.01
		C		0.000	0.000	1.398	0.000	0.02
L25	18.33-13.33	A	1.580	0.000	0.000	19.282	0.000	0.28
		B		0.000	0.000	12.849	0.000	0.14
		C		0.000	0.000	27.831	0.000	0.41
L26	13.33-8.42	A	1.521	0.000	0.000	20.839	0.000	0.29
		B		0.000	0.000	14.537	0.000	0.15
		C		0.000	0.000	31.168	0.000	0.44
L27	8.42-8.07	A	1.480	0.000	0.000	1.676	0.000	0.02
		B		0.000	0.000	1.227	0.000	0.01
		C		0.000	0.000	2.604	0.000	0.04
L28	8.07-7.83	A	1.474	0.000	0.000	1.148	0.000	0.02
		B		0.000	0.000	0.784	0.000	0.01
		C		0.000	0.000	1.784	0.000	0.02
L29	7.83-6.00	A	1.454	0.000	0.000	8.732	0.000	0.11
		B		0.000	0.000	5.788	0.000	0.06
		C		0.000	0.000	13.559	0.000	0.18
L30	6.00-5.75	A	1.431	0.000	0.000	0.905	0.000	0.01
		B		0.000	0.000	0.505	0.000	0.01
		C		0.000	0.000	1.561	0.000	0.02
L31	5.75-2.00	A	1.372	0.000	0.000	10.895	0.000	0.16
		B		0.000	0.000	4.940	0.000	0.05
		C		0.000	0.000	18.056	0.000	0.27
L32	2.00-1.75	A	1.276	0.000	0.000	0.632	0.000	0.01
		B		0.000	0.000	0.241	0.000	0.00
		C		0.000	0.000	1.016	0.000	0.02
L33	1.75-0.00	A	1.182	0.000	0.000	3.891	0.000	0.06
		B		0.000	0.000	1.195	0.000	0.01
		C		0.000	0.000	6.039	0.000	0.09

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	110.00-105.00	0.3353	-0.1548	1.4515	-0.6701
L2	105.00-100.00	0.3353	-0.1548	1.4469	-0.6679
L3	100.00-95.00	0.3353	-0.1548	1.4420	-0.6657
L4	95.00-90.00	0.3353	-0.1548	1.4369	-0.6633
L5	90.00-85.00	-1.9016	3.7879	-0.5577	2.2890
L6	85.00-80.00	-2.2413	4.3866	-0.8555	2.7276
L7	80.00-75.00	-2.2413	4.3866	-0.8586	2.7290
L8	75.00-70.00	-5.2110	3.3799	-3.0479	2.1665
L9	70.00-65.00	-5.7096	3.2108	-3.4302	2.0704
L10	65.00-60.00	-4.2052	3.6632	-2.0696	2.4426
L11	60.00-55.00	-4.3912	4.2591	-2.0741	2.9110
L12	55.00-50.00	-4.3912	4.2591	-2.0806	2.9120
L13	50.00-45.00	-4.3912	4.2591	-2.0879	2.9130
L14	45.00-40.00	-4.1643	4.0390	-2.0402	2.8368
L15	40.00-39.33	-2.8426	2.7571	-1.6502	2.2897
L16	39.33-39.08	-2.8426	2.7571	-1.6508	2.2897
L17	39.08-34.08	-2.8426	2.7571	-1.6543	2.2898
L18	34.08-30.00	-2.9710	2.8816	-1.7060	2.3519
L19	30.00-29.75	-4.3912	4.2591	-2.1209	2.9178
L20	29.75-25.00	-3.5015	4.1813	-1.8629	3.0375
L21	25.00-24.75	-1.9674	3.3050	-1.4615	3.1920
L22	24.75-19.75	-1.8136	3.0467	-1.3769	2.9973
L23	19.75-18.58	-1.4692	2.4681	-1.1681	2.5316
L24	18.58-18.33	-1.4692	2.4681	-1.1693	2.5314
L25	18.33-13.33	-1.4692	2.4681	-1.1743	2.5309
L26	13.33-8.42	-1.2907	2.6113	-1.0727	2.6393
L27	8.42-8.07	-1.1076	2.7582	-0.9553	2.7584
L28	8.07-7.83	-1.1345	2.7746	-1.1196	2.8595
L29	7.83-6.00	-1.1455	2.7814	-1.1891	2.9003
L30	6.00-5.75	-1.4167	3.4398	-1.4356	3.4958

Section	Elevation	CP_X	CP_Z	CP_X Ice	CP_Z Ice
	ft	in	in	in	in
L31	5.75-2.00	-1.7351	3.4166	-1.7365	3.4705
L32	2.00-1.75	-1.9547	3.4007	-1.9458	3.4509
L33	1.75-0.00	-2.2219	3.3670	-2.1646	3.4230

Note: For pole sections, center of pressure calculations do not consider feed line shielding.

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
L1	2	Safety Line 3/8	105.00 - 110.00	1.0000	1.0000
L2	2	Safety Line 3/8	100.00 - 105.00	1.0000	1.0000
L3	2	Safety Line 3/8	95.00 - 100.00	1.0000	1.0000
L4	2	Safety Line 3/8	90.00 - 95.00	1.0000	1.0000
L5	2	Safety Line 3/8	85.00 - 90.00	1.0000	1.0000
L5	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	85.00 - 89.00	1.0000	1.0000
L6	2	Safety Line 3/8	80.00 - 85.00	1.0000	1.0000
L6	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	80.00 - 85.00	1.0000	1.0000
L7	2	Safety Line 3/8	75.00 - 80.00	1.0000	1.0000
L7	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	75.00 - 80.00	1.0000	1.0000
L8	2	Safety Line 3/8	70.00 - 75.00	1.0000	1.0000
L8	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	70.00 - 75.00	1.0000	1.0000
L8	13	(1) MLE Hybrid 9Power/18Fiber RL 2(1-5/8) + (6) 810921-001(7/8) + (2) HCS 6X12 4AWG(1-5/8)	70.00 - 74.00	1.0000	1.0000
L9	2	Safety Line 3/8	65.00 - 70.00	1.0000	1.0000
L9	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	65.00 - 70.00	1.0000	1.0000
L9	13	(1) MLE Hybrid 9Power/18Fiber RL 2(1-5/8) + (6) 810921-001(7/8) + (2) HCS 6X12 4AWG(1-5/8)	65.00 - 70.00	1.0000	1.0000
L10	2	Safety Line 3/8	60.00 - 65.00	1.0000	1.0000
L10	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	60.00 - 65.00	1.0000	1.0000
L10	13	(1) MLE Hybrid 9Power/18Fiber RL 2(1-5/8) + (6) 810921-001(7/8) + (2) HCS 6X12 4AWG(1-5/8)	60.00 - 65.00	1.0000	1.0000
L10	15	HB158-U12S24-160-LI(1-7/8)	60.00 - 64.00	1.0000	1.0000
L11	2	Safety Line 3/8	55.00 - 60.00	1.0000	1.0000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
L11	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	55.00 - 60.00	1.0000	1.0000
L11	13	(1) MLE Hybrid 9Power/18Fiber RL 2(1-5/8) + (6) 810921-001(7/8) + (2) HCS 6X12 4AWG(1-5/8)	55.00 - 60.00	1.0000	1.0000
L11	15	HB158-U12S24-160-LI(1-7/8)	55.00 - 60.00	1.0000	1.0000
L12	2	Safety Line 3/8	50.00 - 55.00	1.0000	1.0000
L12	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	50.00 - 55.00	1.0000	1.0000
L12	13	(1) MLE Hybrid 9Power/18Fiber RL 2(1-5/8) + (6) 810921-001(7/8) + (2) HCS 6X12 4AWG(1-5/8)	50.00 - 55.00	1.0000	1.0000
L12	15	HB158-U12S24-160-LI(1-7/8)	50.00 - 55.00	1.0000	1.0000
L13	2	Safety Line 3/8	45.00 - 50.00	1.0000	1.0000
L13	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	45.00 - 50.00	1.0000	1.0000
L13	13	(1) MLE Hybrid 9Power/18Fiber RL 2(1-5/8) + (6) 810921-001(7/8) + (2) HCS 6X12 4AWG(1-5/8)	45.00 - 50.00	1.0000	1.0000
L13	15	HB158-U12S24-160-LI(1-7/8)	45.00 - 50.00	1.0000	1.0000
L14	2	Safety Line 3/8	40.00 - 45.00	1.0000	1.0000
L14	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	40.00 - 45.00	1.0000	1.0000
L14	13	(1) MLE Hybrid 9Power/18Fiber RL 2(1-5/8) + (6) 810921-001(7/8) + (2) HCS 6X12 4AWG(1-5/8)	40.00 - 45.00	1.0000	1.0000
L14	15	HB158-U12S24-160-LI(1-7/8)	40.00 - 45.00	1.0000	1.0000
L14	22	Aero Channel MP303	40.00 - 40.50	1.0000	1.0000
L14	23	Aero Channel MP303	40.00 - 40.50	1.0000	1.0000
L14	24	Aero Channel MP303	40.00 - 40.50	1.0000	1.0000
L15	2	Safety Line 3/8	39.33 - 40.00	1.0000	1.0000
L15	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	39.33 - 40.00	1.0000	1.0000
L15	13	(1) MLE Hybrid 9Power/18Fiber RL 2(1-5/8) + (6) 810921-001(7/8) + (2) HCS 6X12 4AWG(1-5/8)	39.33 - 40.00	1.0000	1.0000
L15	15	HB158-U12S24-160-LI(1-7/8)	39.33 - 40.00	1.0000	1.0000
L15	22	Aero Channel MP303	39.33 - 40.00	1.0000	1.0000
L15	23	Aero Channel MP303	39.33 - 40.00	1.0000	1.0000
L15	24	Aero Channel MP303	39.33 - 40.00	1.0000	1.0000
L16	2	Safety Line 3/8	39.08 - 39.33	1.0000	1.0000
L16	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	39.08 - 39.33	1.0000	1.0000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
L16	13	(1) MLE Hybrid 9Power/18Fiber RL 2(1-5/8) + (6) 810921-001(7/8) + (2) HCS 6X12 4AWG(1-5/8)	39.08 - 39.33	1.0000	1.0000
L16	15	HB158-U12S24-160-LI(1-7/8)	39.08 - 39.33	1.0000	1.0000
L16	22	Aero Channel MP303	39.08 - 39.33	1.0000	1.0000
L16	23	Aero Channel MP303	39.08 - 39.33	1.0000	1.0000
L16	24	Aero Channel MP303	39.08 - 39.33	1.0000	1.0000
L17	2	Safety Line 3/8	34.08 - 39.08	1.0000	1.0000
L17	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	34.08 - 39.08	1.0000	1.0000
L17	13	(1) MLE Hybrid 9Power/18Fiber RL 2(1-5/8) + (6) 810921-001(7/8) + (2) HCS 6X12 4AWG(1-5/8)	34.08 - 39.08	1.0000	1.0000
L17	15	HB158-U12S24-160-LI(1-7/8)	34.08 - 39.08	1.0000	1.0000
L17	22	Aero Channel MP303	34.08 - 39.08	1.0000	1.0000
L17	23	Aero Channel MP303	34.08 - 39.08	1.0000	1.0000
L17	24	Aero Channel MP303	34.08 - 39.08	1.0000	1.0000
L18	2	Safety Line 3/8	30.00 - 34.08	1.0000	1.0000
L18	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	30.00 - 34.08	1.0000	1.0000
L18	13	(1) MLE Hybrid 9Power/18Fiber RL 2(1-5/8) + (6) 810921-001(7/8) + (2) HCS 6X12 4AWG(1-5/8)	30.00 - 34.08	1.0000	1.0000
L18	15	HB158-U12S24-160-LI(1-7/8)	30.00 - 34.08	1.0000	1.0000
L18	22	Aero Channel MP303	30.50 - 34.08	1.0000	1.0000
L18	23	Aero Channel MP303	30.50 - 34.08	1.0000	1.0000
L18	24	Aero Channel MP303	30.50 - 34.08	1.0000	1.0000
L19	2	Safety Line 3/8	29.75 - 30.00	1.0000	1.0000
L19	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	29.75 - 30.00	1.0000	1.0000
L19	13	(1) MLE Hybrid 9Power/18Fiber RL 2(1-5/8) + (6) 810921-001(7/8) + (2) HCS 6X12 4AWG(1-5/8)	29.75 - 30.00	1.0000	1.0000
L19	15	HB158-U12S24-160-LI(1-7/8)	29.75 - 30.00	1.0000	1.0000
L20	2	Safety Line 3/8	25.00 - 29.75	1.0000	1.0000
L20	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	25.00 - 29.75	1.0000	1.0000
L20	13	(1) MLE Hybrid 9Power/18Fiber RL 2(1-5/8) + (6) 810921-001(7/8) + (2) HCS 6X12 4AWG(1-5/8)	25.00 - 29.75	1.0000	1.0000
L20	15	HB158-U12S24-160-LI(1-7/8)	25.00 - 29.75	1.0000	1.0000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
L20	30	CCI-SFP-045100	25.00 - 26.50	1.0000	1.0000
L20	31	CCI-SFP-045100	25.00 - 26.50	1.0000	1.0000
L20	32	CCI-SFP-045100	25.00 - 26.50	1.0000	1.0000
L20	33	CCI-SFP-045100	25.00 - 26.50	1.0000	1.0000
L21	2	Safety Line 3/8	24.75 - 25.00	1.0000	1.0000
L21	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	24.75 - 25.00	1.0000	1.0000
L21	13	(1) MLE Hybrid 9Power/18Fiber RL 2(1-5/8) + (6) 810921-001(7/8) + (2) HCS 6X12 4AWG(1-5/8)	24.75 - 25.00	1.0000	1.0000
L21	15	HB158-U12S24-160-LI(1-7/8)	24.75 - 25.00	1.0000	1.0000
L21	30	CCI-SFP-045100	24.75 - 25.00	1.0000	1.0000
L21	31	CCI-SFP-045100	24.75 - 25.00	1.0000	1.0000
L21	32	CCI-SFP-045100	24.75 - 25.00	1.0000	1.0000
L21	33	CCI-SFP-045100	24.75 - 25.00	1.0000	1.0000
L22	2	Safety Line 3/8	19.75 - 24.75	1.0000	1.0000
L22	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	19.75 - 24.75	1.0000	1.0000
L22	13	(1) MLE Hybrid 9Power/18Fiber RL 2(1-5/8) + (6) 810921-001(7/8) + (2) HCS 6X12 4AWG(1-5/8)	19.75 - 24.75	1.0000	1.0000
L22	15	HB158-U12S24-160-LI(1-7/8)	19.75 - 24.75	1.0000	1.0000
L22	26	Aero Channel MP305	19.75 - 21.00	1.0000	1.0000
L22	27	Aero Channel MP305	19.75 - 21.00	1.0000	1.0000
L22	28	Aero Channel MP305	19.75 - 21.00	1.0000	1.0000
L22	30	CCI-SFP-045100	19.75 - 24.75	1.0000	1.0000
L22	31	CCI-SFP-045100	19.75 - 24.75	1.0000	1.0000
L22	32	CCI-SFP-045100	19.75 - 24.75	1.0000	1.0000
L22	33	CCI-SFP-045100	19.75 - 24.75	1.0000	1.0000
L23	2	Safety Line 3/8	18.58 - 19.75	1.0000	1.0000
L23	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	18.58 - 19.75	1.0000	1.0000
L23	13	(1) MLE Hybrid 9Power/18Fiber RL 2(1-5/8) + (6) 810921-001(7/8) + (2) HCS 6X12 4AWG(1-5/8)	18.58 - 19.75	1.0000	1.0000
L23	15	HB158-U12S24-160-LI(1-7/8)	18.58 - 19.75	1.0000	1.0000
L23	26	Aero Channel MP305	18.58 - 19.75	1.0000	1.0000
L23	27	Aero Channel MP305	18.58 - 19.75	1.0000	1.0000
L23	28	Aero Channel MP305	18.58 - 19.75	1.0000	1.0000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
L23	30	CCI-SFP-045100	18.58 - 19.75	1.0000	1.0000
L23	31	CCI-SFP-045100	18.58 - 19.75	1.0000	1.0000
L23	32	CCI-SFP-045100	18.58 - 19.75	1.0000	1.0000
L23	33	CCI-SFP-045100	18.58 - 19.75	1.0000	1.0000
L24	2	Safety Line 3/8	18.33 - 18.58	1.0000	1.0000
L24	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	18.33 - 18.58	1.0000	1.0000
L24	13	(1) MLE Hybrid 9Power/18Fiber RL 2(1-5/8) + (6) 810921-001(7/8) + (2) HCS 6X12 4AWG(1-5/8)	18.33 - 18.58	1.0000	1.0000
L24	15	HB158-U12S24-160-LI(1-7/8)	18.33 - 18.58	1.0000	1.0000
L24	26	Aero Channel MP305	18.33 - 18.58	1.0000	1.0000
L24	27	Aero Channel MP305	18.33 - 18.58	1.0000	1.0000
L24	28	Aero Channel MP305	18.33 - 18.58	1.0000	1.0000
L24	30	CCI-SFP-045100	18.33 - 18.58	1.0000	1.0000
L24	31	CCI-SFP-045100	18.33 - 18.58	1.0000	1.0000
L24	32	CCI-SFP-045100	18.33 - 18.58	1.0000	1.0000
L24	33	CCI-SFP-045100	18.33 - 18.58	1.0000	1.0000
L25	2	Safety Line 3/8	13.33 - 18.33	1.0000	1.0000
L25	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	13.33 - 18.33	1.0000	1.0000
L25	13	(1) MLE Hybrid 9Power/18Fiber RL 2(1-5/8) + (6) 810921-001(7/8) + (2) HCS 6X12 4AWG(1-5/8)	13.33 - 18.33	1.0000	1.0000
L25	15	HB158-U12S24-160-LI(1-7/8)	13.33 - 18.33	1.0000	1.0000
L25	26	Aero Channel MP305	13.33 - 18.33	1.0000	1.0000
L25	27	Aero Channel MP305	13.33 - 18.33	1.0000	1.0000
L25	28	Aero Channel MP305	13.33 - 18.33	1.0000	1.0000
L25	30	CCI-SFP-045100	13.33 - 18.33	1.0000	1.0000
L25	31	CCI-SFP-045100	13.33 - 18.33	1.0000	1.0000
L25	32	CCI-SFP-045100	13.33 - 18.33	1.0000	1.0000
L25	33	CCI-SFP-045100	13.33 - 18.33	1.0000	1.0000
L26	2	Safety Line 3/8	8.42 - 13.33	1.0000	1.0000
L26	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	8.42 - 13.33	1.0000	1.0000
L26	13	(1) MLE Hybrid 9Power/18Fiber RL 2(1-5/8) + (6) 810921-001(7/8) + (2) HCS 6X12 4AWG(1-5/8)	8.42 - 13.33	1.0000	1.0000
L26	15	HB158-U12S24-160-LI(1-7/8)	8.42 - 13.33	1.0000	1.0000
L26	17	Aero Channel MP305	8.42 - 10.50	1.0000	1.0000

Tower Section	*Feed Line Record No.*	*Description*	*Feed Line Segment Elev.*	*K_a No Ice*	*K_a Ice*
L26	18	Aero Channel MP305	8.42 - 10.50	1.0000	1.0000
L26	19	Aero Channel MP305	8.42 - 10.50	1.0000	1.0000
L26	20	Aero Channel MP305	8.42 - 10.50	1.0000	1.0000
L26	26	Aero Channel MP305	8.42 - 13.33	1.0000	1.0000
L26	27	Aero Channel MP305	8.42 - 13.33	1.0000	1.0000
L26	28	Aero Channel MP305	8.42 - 13.33	1.0000	1.0000
L26	30	CCI-SFP-045100	8.42 - 13.33	1.0000	1.0000
L26	31	CCI-SFP-045100	8.42 - 13.33	1.0000	1.0000
L26	32	CCI-SFP-045100	8.42 - 13.33	1.0000	1.0000
L26	33	CCI-SFP-045100	8.42 - 13.33	1.0000	1.0000
L27	2	Safety Line 3/8	8.07 - 8.42	1.0000	1.0000
L27	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	8.07 - 8.42	1.0000	1.0000
L27	13	(1) MLE Hybrid 9Power/18Fiber RL 2(1-5/8) + (6) 810921-001(7/8) + (2) HCS 6X12 4AWG(1-5/8)	8.07 - 8.42	1.0000	1.0000
L27	15	HB158-U12S24-160-LI(1-7/8)	8.07 - 8.42	1.0000	1.0000
L27	17	Aero Channel MP305	8.07 - 8.42	1.0000	1.0000
L27	18	Aero Channel MP305	8.07 - 8.42	1.0000	1.0000
L27	19	Aero Channel MP305	8.07 - 8.42	1.0000	1.0000
L27	20	Aero Channel MP305	8.07 - 8.42	1.0000	1.0000
L27	26	Aero Channel MP305	8.07 - 8.42	1.0000	1.0000
L27	27	Aero Channel MP305	8.07 - 8.42	1.0000	1.0000
L27	28	Aero Channel MP305	8.07 - 8.42	1.0000	1.0000
L27	30	CCI-SFP-045100	8.07 - 8.42	1.0000	1.0000
L27	31	CCI-SFP-045100	8.07 - 8.42	1.0000	1.0000
L27	32	CCI-SFP-045100	8.07 - 8.42	1.0000	1.0000
L27	33	CCI-SFP-045100	8.07 - 8.42	1.0000	1.0000
L28	2	Safety Line 3/8	8.00 - 8.07	1.0000	1.0000
L28	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	7.83 - 8.07	1.0000	1.0000
L28	13	(1) MLE Hybrid 9Power/18Fiber RL 2(1-5/8) + (6) 810921-001(7/8) + (2) HCS 6X12 4AWG(1-5/8)	7.83 - 8.07	1.0000	1.0000
L28	15	HB158-U12S24-160-LI(1-7/8)	7.83 - 8.07	1.0000	1.0000
L28	17	Aero Channel MP305	7.83 - 8.07	1.0000	1.0000
L28	18	Aero Channel MP305	7.83 - 8.07	1.0000	1.0000
L28	19	Aero Channel MP305	7.83 - 8.07	1.0000	1.0000
L28	20	Aero Channel MP305	7.83 - 8.07	1.0000	1.0000
L28	26	Aero Channel MP305	7.83 - 8.07	1.0000	1.0000
L28	27	Aero Channel MP305	7.83 - 8.07	1.0000	1.0000
L28	28	Aero Channel MP305	7.83 - 8.07	1.0000	1.0000
L28	30	CCI-SFP-045100	7.83 - 8.07	1.0000	1.0000
L28	31	CCI-SFP-045100	7.83 - 8.07	1.0000	1.0000
L28	32	CCI-SFP-045100	7.83 - 8.07	1.0000	1.0000
L28	33	CCI-SFP-045100	7.83 - 8.07	1.0000	1.0000
L29	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	6.00 - 7.83	1.0000	1.0000
L29	13	(1) MLE Hybrid 9Power/18Fiber RL 2(1-5/8) + (6) 810921-001(7/8) + (2) HCS 6X12 4AWG(1-5/8)	6.00 - 7.83	1.0000	1.0000
L29	15	HB158-U12S24-160-LI(1-7/8)	6.00 - 7.83	1.0000	1.0000
L29	17	Aero Channel MP305	6.00 - 7.83	1.0000	1.0000
L29	18	Aero Channel MP305	6.00 - 7.83	1.0000	1.0000
L29	19	Aero Channel MP305	6.00 - 7.83	1.0000	1.0000
L29	20	Aero Channel MP305	6.00 - 7.83	1.0000	1.0000
L29	26	Aero Channel MP305	6.00 - 7.83	1.0000	1.0000
L29	27	Aero Channel MP305	6.00 - 7.83	1.0000	1.0000
L29	28	Aero Channel MP305	6.00 - 7.83	1.0000	1.0000
L29	30	CCI-SFP-045100	6.00 - 7.83	1.0000	1.0000

Tower Section	*Feed Line Record No.*	*Description*	*Feed Line Segment Elev.*	*K_a No Ice*	*K_a Ice*
L29	31	CCI-SFP-045100	6.00 - 7.83	1.0000	1.0000
L29	32	CCI-SFP-045100	6.00 - 7.83	1.0000	1.0000
L29	33	CCI-SFP-045100	6.00 - 7.83	1.0000	1.0000
L30	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	5.75 - 6.00	1.0000	1.0000
L30	13	(1) MLE Hybrid 9Power/18Fiber RL 2(1-5/8) + (6) 810921-001(7/8) + (2) HCS 6X12 4AWG(1-5/8)	5.75 - 6.00	1.0000	1.0000
L30	15	HB158-U12S24-160-LI(1-7/8)	5.75 - 6.00	1.0000	1.0000
L30	17	Aero Channel MP305	5.75 - 6.00	1.0000	1.0000
L30	18	Aero Channel MP305	5.75 - 6.00	1.0000	1.0000
L30	19	Aero Channel MP305	5.75 - 6.00	1.0000	1.0000
L30	20	Aero Channel MP305	5.75 - 6.00	1.0000	1.0000
L30	30	CCI-SFP-045100	5.75 - 6.00	1.0000	1.0000
L30	31	CCI-SFP-045100	5.75 - 6.00	1.0000	1.0000
L30	32	CCI-SFP-045100	5.75 - 6.00	1.0000	1.0000
L30	33	CCI-SFP-045100	5.75 - 6.00	1.0000	1.0000
L31	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	2.00 - 5.75	1.0000	1.0000
L31	13	(1) MLE Hybrid 9Power/18Fiber RL 2(1-5/8) + (6) 810921-001(7/8) + (2) HCS 6X12 4AWG(1-5/8)	2.00 - 5.75	1.0000	1.0000
L31	15	HB158-U12S24-160-LI(1-7/8)	2.00 - 5.75	1.0000	1.0000
L31	17	Aero Channel MP305	2.00 - 5.75	1.0000	1.0000
L31	18	Aero Channel MP305	2.00 - 5.75	1.0000	1.0000
L31	19	Aero Channel MP305	2.00 - 5.75	1.0000	1.0000
L31	20	Aero Channel MP305	2.00 - 5.75	1.0000	1.0000
L31	30	CCI-SFP-045100	4.50 - 5.75	1.0000	1.0000
L31	31	CCI-SFP-045100	4.50 - 5.75	1.0000	1.0000
L31	32	CCI-SFP-045100	4.50 - 5.75	1.0000	1.0000
L31	33	CCI-SFP-045100	4.50 - 5.75	1.0000	1.0000
L32	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	1.75 - 2.00	1.0000	1.0000
L32	13	(1) MLE Hybrid 9Power/18Fiber RL 2(1-5/8) + (6) 810921-001(7/8) + (2) HCS 6X12 4AWG(1-5/8)	1.75 - 2.00	1.0000	1.0000
L32	15	HB158-U12S24-160-LI(1-7/8)	1.75 - 2.00	1.0000	1.0000
L32	17	Aero Channel MP305	1.75 - 2.00	1.0000	1.0000
L32	18	Aero Channel MP305	1.75 - 2.00	1.0000	1.0000
L32	19	Aero Channel MP305	1.75 - 2.00	1.0000	1.0000
L32	20	Aero Channel MP305	1.75 - 2.00	1.0000	1.0000
L33	11	(3) LDF7-50A(1-5/8) + (1) 2" innerduct conduit	0.00 - 1.75	1.0000	1.0000
L33	13	(1) MLE Hybrid 9Power/18Fiber RL 2(1-5/8) + (6) 810921-001(7/8) + (2) HCS 6X12 4AWG(1-5/8)	0.00 - 1.75	1.0000	1.0000
L33	15	HB158-U12S24-160-LI(1-7/8)	0.00 - 1.75	1.0000	1.0000
L33	17	Aero Channel MP305	0.50 - 1.75	1.0000	1.0000
L33	18	Aero Channel MP305	0.50 - 1.75	1.0000	1.0000
L33	19	Aero Channel MP305	0.50 - 1.75	1.0000	1.0000
L33	20	Aero Channel MP305	0.50 - 1.75	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
*** 107' ***									
T-Arm Mount [TA 702-3]	C	None		0.0000	107.00	No Ice	4.75	4.75	0.34
						1/2" Ice	5.82	5.82	0.43
						1" Ice	6.98	6.98	0.55
						2" Ice	9.72	9.72	0.87
APXVSPP18-C-A20 w/ Mount Pipe	A	From Leg	3.00 2.50 1.00	0.0000	107.00	No Ice	4.60	4.01	0.10
						1/2" Ice	5.05	4.45	0.16
						1" Ice	5.50	4.89	0.23
						2" Ice	6.44	5.82	0.42
APXVSPP18-C-A20 w/ Mount Pipe	B	From Leg	3.00 2.50 1.00	0.0000	107.00	No Ice	4.60	4.01	0.10
						1/2" Ice	5.05	4.45	0.16
						1" Ice	5.50	4.89	0.23
						2" Ice	6.44	5.82	0.42
APXVSPP18-C-A20 w/ Mount Pipe	C	From Leg	3.00 2.50 1.00	0.0000	107.00	No Ice	4.60	4.01	0.10
						1/2" Ice	5.05	4.45	0.16
						1" Ice	5.50	4.89	0.23
						2" Ice	6.44	5.82	0.42
APXVTM14-C-120 w/ Mount Pipe	A	From Leg	3.00 -2.50 1.00	0.0000	107.00	No Ice	4.09	2.86	0.08
						1/2" Ice	4.48	3.23	0.13
						1" Ice	4.88	3.61	0.19
						2" Ice	5.71	4.40	0.33
APXVTM14-C-120 w/ Mount Pipe	B	From Leg	3.00 -2.50 1.00	0.0000	107.00	No Ice	4.09	2.86	0.08
						1/2" Ice	4.48	3.23	0.13
						1" Ice	4.88	3.61	0.19
						2" Ice	5.71	4.40	0.33
APXVTM14-C-120 w/ Mount Pipe	C	From Leg	3.00 -2.50 1.00	0.0000	107.00	No Ice	4.09	2.86	0.08
						1/2" Ice	4.48	3.23	0.13
						1" Ice	4.88	3.61	0.19
						2" Ice	5.71	4.40	0.33
TD-RRH8x20-25	A	From Leg	3.00 0.00 1.00	0.0000	107.00	No Ice	4.05	1.53	0.07
						1/2" Ice	4.30	1.71	0.10
						1" Ice	4.56	1.90	0.13
						2" Ice	5.10	2.30	0.20
TD-RRH8x20-25	B	From Leg	3.00 0.00 1.00	0.0000	107.00	No Ice	4.05	1.53	0.07
						1/2" Ice	4.30	1.71	0.10
						1" Ice	4.56	1.90	0.13
						2" Ice	5.10	2.30	0.20
TD-RRH8x20-25	C	From Leg	3.00 0.00 1.00	0.0000	107.00	No Ice	4.05	1.53	0.07
						1/2" Ice	4.30	1.71	0.10
						1" Ice	4.56	1.90	0.13
						2" Ice	5.10	2.30	0.20
*** 105' ***									
Side Arm Mount [SO 102-3]	C	None		0.0000	105.00	No Ice	3.60	3.60	0.07
						1/2" Ice	4.18	4.18	0.11
						1" Ice	4.75	4.75	0.14
						2" Ice	5.90	5.90	0.20
(3) 5'x2" Mount Pipe	A	From Leg	1.00 0.00 0.00	0.0000	105.00	No Ice	1.19	1.19	0.02
						1/2" Ice	1.50	1.50	0.03
						1" Ice	1.81	1.81	0.04
						2" Ice	2.46	2.46	0.08

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
(3) 5'x2" Mount Pipe	B	From Leg	1.00 0.00 0.00	0.0000	105.00	No Ice 1/2" Ice 1" Ice 2" Ice	1.19 1.50 1.81 2.46	1.19 1.50 1.81 2.46	0.02 0.03 0.04 0.08
(3) 5'x2" Mount Pipe	C	From Leg	1.00 0.00 0.00	0.0000	105.00	No Ice 1/2" Ice 1" Ice 2" Ice	1.19 1.50 1.81 2.46	1.19 1.50 1.81 2.46	0.02 0.03 0.04 0.08
800MHz 2X50W RRH W/FILTER	A	From Leg	2.00 0.00 3.00	0.0000	105.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.06 2.24 2.43 2.83	1.93 2.11 2.29 2.68	0.06 0.09 0.11 0.17
800MHz 2X50W RRH W/FILTER	B	From Leg	2.00 0.00 3.00	0.0000	105.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.06 2.24 2.43 2.83	1.93 2.11 2.29 2.68	0.06 0.09 0.11 0.17
800MHz 2X50W RRH W/FILTER	C	From Leg	2.00 0.00 3.00	0.0000	105.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.06 2.24 2.43 2.83	1.93 2.11 2.29 2.68	0.06 0.09 0.11 0.17
PCS 1900MHz 4x45W-65MHz	A	From Leg	2.00 0.00 3.00	0.0000	105.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.32 2.53 2.74 3.19	2.24 2.44 2.65 3.09	0.06 0.08 0.11 0.17
PCS 1900MHz 4x45W-65MHz	B	From Leg	2.00 0.00 3.00	0.0000	105.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.32 2.53 2.74 3.19	2.24 2.44 2.65 3.09	0.06 0.08 0.11 0.17
PCS 1900MHz 4x45W-65MHz	C	From Leg	2.00 0.00 3.00	0.0000	105.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.32 2.53 2.74 3.19	2.24 2.44 2.65 3.09	0.06 0.08 0.11 0.17
IBC1900BB-1	A	From Leg	2.00 0.00 2.00	0.0000	105.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.97 1.09 1.22 1.51	0.46 0.56 0.66 0.89	0.02 0.03 0.04 0.06
IBC1900BB-1	B	From Leg	2.00 0.00 2.00	0.0000	105.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.97 1.09 1.22 1.51	0.46 0.56 0.66 0.89	0.02 0.03 0.04 0.06
IBC1900BB-1	C	From Leg	2.00 0.00 2.00	0.0000	105.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.97 1.09 1.22 1.51	0.46 0.56 0.66 0.89	0.02 0.03 0.04 0.06
IBC1900HG-2A	A	From Leg	2.00 0.00 2.00	0.0000	105.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.97 1.09 1.22 1.51	0.46 0.56 0.66 0.89	0.02 0.03 0.04 0.06
IBC1900HG-2A	B	From Leg	2.00 0.00 2.00	0.0000	105.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.97 1.09 1.22 1.51	0.46 0.56 0.66 0.89	0.02 0.03 0.04 0.06

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
IBC1900HG-2A	C	From Leg	2.00 0.00 2.00	0.0000	105.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.97 1.09 1.22 1.51	0.46 0.56 0.66 0.89	0.02 0.03 0.04 0.06
*** 89' ***									
Platform Mount [LP 502-1]	C	None		0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	18.28 23.54 28.53 38.85	18.28 23.54 28.53 38.85	0.93 1.43 2.07 3.71
6'x2" Mount Pipe	A	From Leg	4.00 -2.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	1.43 1.92 2.29 3.06	1.43 1.92 2.29 3.06	0.02 0.03 0.05 0.09
6'x2" Mount Pipe	B	From Leg	4.00 -2.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	1.43 1.92 2.29 3.06	1.43 1.92 2.29 3.06	0.02 0.03 0.05 0.09
6'x2" Mount Pipe	C	From Leg	4.00 -2.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	1.43 1.92 2.29 3.06	1.43 1.92 2.29 3.06	0.02 0.03 0.05 0.09
(3) 4'x2" Mount Pipe	A	From Leg	4.00 0.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.87 1.11 1.36 1.90	0.87 1.11 1.36 1.90	0.01 0.02 0.03 0.06
(3) 4'x2" Mount Pipe	B	From Leg	4.00 0.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.87 1.11 1.36 1.90	0.87 1.11 1.36 1.90	0.01 0.02 0.03 0.06
(3) 4'x2" Mount Pipe	C	From Leg	4.00 0.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.87 1.11 1.36 1.90	0.87 1.11 1.36 1.90	0.01 0.02 0.03 0.06
HPA-65R-BUU-H6 w/ Mount Pipe	A	From Leg	4.00 -6.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	9.22 9.98 10.76 12.36	6.25 6.96 7.70 9.22	0.07 0.14 0.22 0.42
HPA-65R-BUU-H6 w/ Mount Pipe	B	From Leg	4.00 -6.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	9.22 9.98 10.76 12.36	6.25 6.96 7.70 9.22	0.07 0.14 0.22 0.42
HPA-65R-BUU-H6 w/ Mount Pipe	C	From Leg	4.00 -6.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	9.22 9.98 10.76 12.36	6.25 6.96 7.70 9.22	0.07 0.14 0.22 0.42
7750.00 w/ Mount Pipe	A	From Leg	4.00 6.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	5.75 6.18 6.61 7.49	4.25 5.01 5.71 7.16	0.06 0.10 0.16 0.29
7750.00 w/ Mount Pipe	B	From Leg	4.00 6.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice	5.75 6.18 6.61 7.49	4.25 5.01 5.71 7.16	0.06 0.10 0.16 0.29

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
						2" Ice			
7750.00 w/ Mount Pipe	C	From Leg	4.00 6.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	5.75 6.18 6.61 7.49	4.25 5.01 5.71 7.16	0.06 0.10 0.16 0.29
QS66512-2 w/ Mount Pipe	A	From Leg	4.00 2.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	4.04 4.42 4.82 5.63	4.18 4.57 4.97 5.79	0.14 0.21 0.29 0.48
QS66512-2 w/ Mount Pipe	B	From Leg	4.00 2.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	4.04 4.42 4.82 5.63	4.18 4.57 4.97 5.79	0.14 0.21 0.29 0.48
QS66512-2 w/ Mount Pipe	C	From Leg	4.00 2.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	4.04 4.42 4.82 5.63	4.18 4.57 4.97 5.79	0.14 0.21 0.29 0.48
RRUS 11 B12	A	From Leg	4.00 0.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.83 3.04 3.26 3.71	1.18 1.33 1.48 1.83	0.05 0.07 0.10 0.15
RRUS 11 B12	B	From Leg	4.00 0.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.83 3.04 3.26 3.71	1.18 1.33 1.48 1.83	0.05 0.07 0.10 0.15
RRUS 11 B12	C	From Leg	4.00 0.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.83 3.04 3.26 3.71	1.18 1.33 1.48 1.83	0.05 0.07 0.10 0.15
RRUS 32	A	From Leg	4.00 0.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.86 3.08 3.32 3.81	1.78 1.97 2.17 2.58	0.06 0.08 0.10 0.16
RRUS 32	B	From Leg	4.00 0.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.86 3.08 3.32 3.81	1.78 1.97 2.17 2.58	0.06 0.08 0.10 0.16
RRUS 32	C	From Leg	4.00 0.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.86 3.08 3.32 3.81	1.78 1.97 2.17 2.58	0.06 0.08 0.10 0.16
RRUS 32 B2	A	From Leg	4.00 0.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.73 2.95 3.18 3.66	1.67 1.86 2.05 2.46	0.05 0.07 0.10 0.16
RRUS 32 B2	B	From Leg	4.00 0.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.73 2.95 3.18 3.66	1.67 1.86 2.05 2.46	0.05 0.07 0.10 0.16
RRUS 32 B2	C	From Leg	4.00 0.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice	2.73 2.95 3.18 3.66	1.67 1.86 2.05 2.46	0.05 0.07 0.10 0.16

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
						2" Ice			
RRUS 32 B66	A	From Leg	4.00 0.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.74 2.96 3.19 3.68	1.67 1.86 2.05 2.46	0.05 0.07 0.10 0.16
RRUS 32 B66	B	From Leg	4.00 0.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.74 2.96 3.19 3.68	1.67 1.86 2.05 2.46	0.05 0.07 0.10 0.16
RRUS 32 B66	C	From Leg	4.00 0.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	2.74 2.96 3.19 3.68	1.67 1.86 2.05 2.46	0.05 0.07 0.10 0.16
(2) LGP21901	A	From Leg	4.00 0.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.23 0.29 0.36 0.53	0.16 0.21 0.28 0.42	0.01 0.01 0.01 0.02
(2) LGP21901	B	From Leg	4.00 0.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.23 0.29 0.36 0.53	0.16 0.21 0.28 0.42	0.01 0.01 0.01 0.02
(2) LGP21901	C	From Leg	4.00 0.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.23 0.29 0.36 0.53	0.16 0.21 0.28 0.42	0.01 0.01 0.01 0.02
(2) DC6-48-60-18-8F	A	From Leg	1.00 0.00 1.00	0.0000	89.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.92 1.46 1.64 2.04	0.92 1.46 1.64 2.04	0.02 0.04 0.06 0.11
*** 74' ***									
Platform Mount [LP 303-1_HR-1]	C	None		0.0000	74.00	No Ice 1/2" Ice 1" Ice 2" Ice	17.09 21.47 25.72 33.96	17.09 21.47 25.72 33.96	1.50 1.88 2.35 3.52
AIR 32 B2a/B66Aa w/ Mount Pipe	A	From Face	4.00 6.00 2.00	0.0000	74.00	No Ice 1/2" Ice 1" Ice 2" Ice	6.75 7.20 7.65 8.57	6.07 6.87 7.58 9.06	0.15 0.21 0.28 0.44
AIR 32 B2a/B66Aa w/ Mount Pipe	B	From Face	4.00 6.00 2.00	0.0000	74.00	No Ice 1/2" Ice 1" Ice 2" Ice	6.75 7.20 7.65 8.57	6.07 6.87 7.58 9.06	0.15 0.21 0.28 0.44
AIR 32 B2a/B66Aa w/ Mount Pipe	C	From Face	4.00 6.00 2.00	0.0000	74.00	No Ice 1/2" Ice 1" Ice 2" Ice	6.75 7.20 7.65 8.57	6.07 6.87 7.58 9.06	0.15 0.21 0.28 0.44
ERICSSON AIR 21 B2A B4P w/ Mount Pipe	A	From Face	4.00 -6.00 2.00	0.0000	74.00	No Ice 1/2" Ice 1" Ice 2" Ice	6.33 6.78 7.21 8.12	5.64 6.43 7.13 8.59	0.11 0.17 0.23 0.38
ERICSSON AIR 21 B2A B4P w/ Mount Pipe	B	From Face	4.00 -6.00 2.00	0.0000	74.00	No Ice 1/2" Ice	6.33 6.78 7.21	5.64 6.43 7.13	0.11 0.17 0.23

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
						1" Ice 2" Ice	8.12	8.59	0.38
ERICSSON AIR 21 B2A B4P w/ Mount Pipe	C	From Face	4.00 -6.00 2.00	0.0000	74.00	No Ice 1/2" Ice 1" Ice 2" Ice	6.33 6.78 7.21 8.12	5.64 6.43 7.13 8.59	0.11 0.17 0.23 0.38
APXVAARR24_43-U-NA20 w/ Mount Pipe	A	From Face	4.00 0.00 2.00	0.0000	74.00	No Ice 1/2" Ice 1" Ice 2" Ice	14.69 15.46 16.23 17.82	6.87 7.55 8.25 9.67	0.19 0.31 0.46 0.79
APXVAARR24_43-U-NA20 w/ Mount Pipe	B	From Face	4.00 0.00 2.00	0.0000	74.00	No Ice 1/2" Ice 1" Ice 2" Ice	14.69 15.46 16.23 17.82	6.87 7.55 8.25 9.67	0.19 0.31 0.46 0.79
APXVAARR24_43-U-NA20 w/ Mount Pipe	C	From Face	4.00 0.00 2.00	0.0000	74.00	No Ice 1/2" Ice 1" Ice 2" Ice	14.69 15.46 16.23 17.82	6.87 7.55 8.25 9.67	0.19 0.31 0.46 0.79
KRY 112 144/1	A	From Face	4.00 0.00 2.00	0.0000	74.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.35 0.43 0.51 0.70	0.17 0.23 0.30 0.46	0.01 0.01 0.02 0.03
KRY 112 144/1	B	From Face	4.00 0.00 2.00	0.0000	74.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.35 0.43 0.51 0.70	0.17 0.23 0.30 0.46	0.01 0.01 0.02 0.03
KRY 112 144/1	C	From Face	4.00 0.00 2.00	0.0000	74.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.35 0.43 0.51 0.70	0.17 0.23 0.30 0.46	0.01 0.01 0.02 0.03
RADIO 4449 B12/B71	A	From Face	4.00 0.00 2.00	0.0000	74.00	No Ice 1/2" Ice 1" Ice 2" Ice	1.65 1.81 1.98 2.34	1.30 1.44 1.60 1.92	0.08 0.09 0.11 0.16
RADIO 4449 B12/B71	B	From Face	4.00 0.00 2.00	0.0000	74.00	No Ice 1/2" Ice 1" Ice 2" Ice	1.65 1.81 1.98 2.34	1.30 1.44 1.60 1.92	0.08 0.09 0.11 0.16
RADIO 4449 B12/B71	C	From Face	4.00 0.00 2.00	0.0000	74.00	No Ice 1/2" Ice 1" Ice 2" Ice	1.65 1.81 1.98 2.34	1.30 1.44 1.60 1.92	0.08 0.09 0.11 0.16
*** 64' ***									
Perfect Vision PV-LPP12M-HR-B 12.5' Platform w/ Handrail	C	None		0.0000	64.00	No Ice 1/2" Ice 1" Ice 2" Ice	34.40 43.00 51.60 68.80	34.40 43.00 51.60 68.80	1.52 1.98 2.44 3.35
(4) 8'x2" Mount Pipe	A	From Face	4.00 0.00 0.00	0.0000	64.00	No Ice 1/2" Ice 1" Ice 2" Ice	1.90 2.73 3.40 4.40	1.90 2.73 3.40 4.40	0.03 0.04 0.06 0.12
(4) 8'x2" Mount Pipe	B	From Face	4.00 0.00	0.0000	64.00	No Ice	1.90 2.73	1.90 2.73	0.03 0.04

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
			0.00			1/2" Ice	3.40 4.40	3.40 4.40	0.06 0.12
						1" Ice			
						2" Ice			
(4) 8'x2" Mount Pipe	C	From Face	4.00 0.00 0.00	0.0000	64.00	No Ice 1/2" Ice 1" Ice 2" Ice	1.90 2.73 3.40 4.40	1.90 2.73 3.40 4.40	0.03 0.04 0.06 0.12
BSAMNT-SBS-1-2 Side By Side Bracket	A	From Face	4.00 -2.00 0.00	0.0000	64.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.03 0.03 0.04 0.06
BSAMNT-SBS-1-2 Side By Side Bracket	B	From Face	4.00 -2.00 0.00	0.0000	64.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.03 0.03 0.04 0.06
BSAMNT-SBS-1-2 Side By Side Bracket	C	From Face	4.00 -2.00 0.00	0.0000	64.00	No Ice 1/2" Ice 1" Ice 2" Ice	0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.00	0.03 0.03 0.04 0.06
NHH-65B-R2B	A	From Face	4.00 -1.50 0.00	0.0000	64.00	No Ice 1/2" Ice 1" Ice 2" Ice	4.16 4.56 4.98 5.84	2.49 2.88 3.27 4.08	0.04 0.09 0.15 0.28
NHH-65B-R2B	B	From Face	4.00 -1.50 0.00	0.0000	64.00	No Ice 1/2" Ice 1" Ice 2" Ice	4.16 4.56 4.98 5.84	2.49 2.88 3.27 4.08	0.04 0.09 0.15 0.28
NHH-65B-R2B	C	From Face	4.00 -1.50 0.00	0.0000	64.00	No Ice 1/2" Ice 1" Ice 2" Ice	4.16 4.56 4.98 5.84	2.49 2.88 3.27 4.08	0.04 0.09 0.15 0.28
NHH-65B-R2B	A	From Face	4.00 -2.50 0.00	0.0000	64.00	No Ice 1/2" Ice 1" Ice 2" Ice	4.16 4.56 4.98 5.84	2.49 2.88 3.27 4.08	0.04 0.09 0.15 0.28
NHH-65B-R2B	B	From Face	4.00 -2.50 0.00	0.0000	64.00	No Ice 1/2" Ice 1" Ice 2" Ice	4.16 4.56 4.98 5.84	2.49 2.88 3.27 4.08	0.04 0.09 0.15 0.28
NHH-65B-R2B	C	From Face	4.00 -2.50 0.00	0.0000	64.00	No Ice 1/2" Ice 1" Ice 2" Ice	4.16 4.56 4.98 5.84	2.49 2.88 3.27 4.08	0.04 0.09 0.15 0.28
RVZDC-6627-PF-48	A	From Face	4.00 0.00 0.00	0.0000	64.00	No Ice 1/2" Ice 1" Ice 2" Ice	3.79 4.04 4.30 4.84	2.51 2.73 2.95 3.42	0.03 0.06 0.10 0.18
RVZDC-6627-PF-48	C	From Face	4.00 0.00 0.00	0.0000	64.00	No Ice 1/2" Ice 1" Ice 2" Ice	3.79 4.04 4.30 4.84	2.51 2.73 2.95 3.42	0.03 0.06 0.10 0.18
20W CBRS	A	From Face	4.00	0.0000	64.00	No Ice	0.86	0.42	0.02

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*
			0.00			1/2"	0.98	0.51	0.03
			0.00			Ice	1.10	0.61	0.03
						1" Ice	1.37	0.83	0.06
						2" Ice			
20W CBRS	B	From Face	4.00	0.0000	64.00	No Ice	0.86	0.42	0.02
			0.00			1/2"	0.98	0.51	0.03
			0.00			Ice	1.10	0.61	0.03
						1" Ice	1.37	0.83	0.06
						2" Ice			
20W CBRS	C	From Face	4.00	0.0000	64.00	No Ice	0.86	0.42	0.02
			0.00			1/2"	0.98	0.51	0.03
			0.00			Ice	1.10	0.61	0.03
						1" Ice	1.37	0.83	0.06
						2" Ice			
RFV01U-D1A	A	From Face	4.00	0.0000	64.00	No Ice	1.88	1.25	0.08
			0.00			1/2"	2.05	1.39	0.10
			0.00			Ice	2.22	1.54	0.12
						1" Ice	2.60	1.86	0.18
						2" Ice			
RFV01U-D1A	B	From Face	4.00	0.0000	64.00	No Ice	1.88	1.25	0.08
			0.00			1/2"	2.05	1.39	0.10
			0.00			Ice	2.22	1.54	0.12
						1" Ice	2.60	1.86	0.18
						2" Ice			
RFV01U-D1A	C	From Face	4.00	0.0000	64.00	No Ice	1.88	1.25	0.08
			0.00			1/2"	2.05	1.39	0.10
			0.00			Ice	2.22	1.54	0.12
						1" Ice	2.60	1.86	0.18
						2" Ice			
RFV01U-D2A	A	From Face	4.00	0.0000	64.00	No Ice	1.88	1.01	0.07
			0.00			1/2"	2.05	1.14	0.09
			0.00			Ice	2.22	1.28	0.11
						1" Ice	2.60	1.59	0.15
						2" Ice			
RFV01U-D2A	B	From Face	4.00	0.0000	64.00	No Ice	1.88	1.01	0.07
			0.00			1/2"	2.05	1.14	0.09
			0.00			Ice	2.22	1.28	0.11
						1" Ice	2.60	1.59	0.15
						2" Ice			
RFV01U-D2A	C	From Face	4.00	0.0000	64.00	No Ice	1.88	1.01	0.07
			0.00			1/2"	2.05	1.14	0.09
			0.00			Ice	2.22	1.28	0.11
						1" Ice	2.60	1.59	0.15
						2" Ice			
*** Flange Modifications ***									
Bridge Stiffener 72" x 1.25" x 11"	A	From Face	0.00	0.0000	30.00	No Ice	1.13	8.99	0.28
			0.00			1/2"	2.07	9.70	0.33
			0.00			Ice	3.02	10.41	0.37
						1" Ice	5.02	11.89	0.46
						2" Ice			
Bridge Stiffener 72" x 1.25" x 11"	B	From Face	0.00	0.0000	30.00	No Ice	1.13	8.99	0.28
			0.00			1/2"	2.07	9.70	0.33
			0.00			Ice	3.02	10.41	0.37
						1" Ice	5.02	11.89	0.46
						2" Ice			
Bridge Stiffener 72" x 1.25" x 11"	C	From Face	0.00	0.0000	30.00	No Ice	1.13	8.99	0.28
			0.00			1/2"	2.07	9.70	0.33
			0.00			Ice	3.02	10.41	0.37
						1" Ice	5.02	11.89	0.46
						2" Ice			
*									
Jump Plate 116" x 6" x 1"	A	From Face	0.00	0.0000	30.00	No Ice	8.75	7.79	1.07
			0.00			1/2"	10.30	8.74	1.14
			0.00			Ice	11.87	9.70	1.19
						1" Ice	15.09	11.66	1.31

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*
						2" Ice			
Jump Plate 116" x 6" x 1"	B	From Face	0.00	0.0000	30.00	No Ice	8.75	7.79	1.07
			0.00			1/2"	10.30	8.74	1.14
			0.00			Ice	11.87	9.70	1.19
						1" Ice	15.09	11.66	1.31
						2" Ice			
Jump Plate 116" x 6" x 1"	C	From Face	0.00	0.0000	30.00	No Ice	8.75	7.79	1.07
			0.00			1/2"	10.30	8.74	1.14
			0.00			Ice	11.87	9.70	1.19
						1" Ice	15.09	11.66	1.31
						2" Ice			
*****									

Load Combinations

Comb. No.	*Description*
1	Dead Only
2	1.2 Dead+1.0 Wind 0 deg - No Ice
3	0.9 Dead+1.0 Wind 0 deg - No Ice
4	1.2 Dead+1.0 Wind 30 deg - No Ice
5	0.9 Dead+1.0 Wind 30 deg - No Ice
6	1.2 Dead+1.0 Wind 60 deg - No Ice
7	0.9 Dead+1.0 Wind 60 deg - No Ice
8	1.2 Dead+1.0 Wind 90 deg - No Ice
9	0.9 Dead+1.0 Wind 90 deg - No Ice
10	1.2 Dead+1.0 Wind 120 deg - No Ice
11	0.9 Dead+1.0 Wind 120 deg - No Ice
12	1.2 Dead+1.0 Wind 150 deg - No Ice
13	0.9 Dead+1.0 Wind 150 deg - No Ice
14	1.2 Dead+1.0 Wind 180 deg - No Ice
15	0.9 Dead+1.0 Wind 180 deg - No Ice
16	1.2 Dead+1.0 Wind 210 deg - No Ice
17	0.9 Dead+1.0 Wind 210 deg - No Ice
18	1.2 Dead+1.0 Wind 240 deg - No Ice
19	0.9 Dead+1.0 Wind 240 deg - No Ice
20	1.2 Dead+1.0 Wind 270 deg - No Ice
21	0.9 Dead+1.0 Wind 270 deg - No Ice
22	1.2 Dead+1.0 Wind 300 deg - No Ice
23	0.9 Dead+1.0 Wind 300 deg - No Ice
24	1.2 Dead+1.0 Wind 330 deg - No Ice
25	0.9 Dead+1.0 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

Comb. No.	Description
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	110 - 105	Pole	Max Tension	21	0.00	-0.00	-0.00
			Max. Compression	26	-4.52	-0.02	0.01
			Max. Mx	8	-1.52	-5.75	0.00
			Max. My	2	-1.52	-0.00	5.75
			Max. Vy	20	-2.08	5.75	0.00
			Max. Vx	14	2.08	-0.00	-5.75
			Max. Torque	2			-0.00
L2	105 - 100	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-7.62	-0.04	0.03
			Max. Mx	8	-2.68	-25.81	0.00
			Max. My	14	-2.67	-0.00	-25.81
			Max. Vy	20	-3.79	25.81	0.00
			Max. Vx	14	3.79	-0.00	-25.81
			Max. Torque	2			-0.00
L3	100 - 95	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-8.35	-0.06	0.04
			Max. Mx	8	-3.06	-45.60	0.00
			Max. My	14	-3.06	-0.00	-45.61
			Max. Vy	20	-4.12	45.59	0.00
			Max. Vx	14	4.12	-0.00	-45.61
			Max. Torque	2			-0.00
L4	95 - 90	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-9.07	-0.08	0.05
			Max. Mx	8	-3.44	-67.01	0.00
			Max. My	14	-3.44	-0.00	-67.02
			Max. Vy	20	-4.44	67.01	0.00
			Max. Vx	14	4.44	-0.00	-67.02
			Max. Torque	2			-0.00
L5	90 - 85	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-20.45	-0.09	0.37
			Max. Mx	8	-6.85	-112.55	0.07
			Max. My	2	-6.85	0.01	112.64
			Max. Vy	20	-9.50	112.55	0.07
			Max. Vx	14	9.50	-0.00	-112.50
			Max. Torque	8			0.15
L6	85 - 80	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-21.53	-0.10	0.26
			Max. Mx	8	-7.51	-160.85	0.05
			Max. My	2	-7.51	0.01	160.92
			Max. Vy	20	-9.82	160.85	0.06
			Max. Vx	14	9.83	0.00	-160.83
			Max. Torque	8			0.15
L7	80 - 75	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-22.61	-0.11	0.14
			Max. Mx	20	-8.18	210.74	0.04
			Max. My	2	-8.18	0.01	210.80
			Max. Vy	20	-10.14	210.74	0.04
			Max. Vx	14	10.14	0.00	-210.76
			Max. Torque	8			0.15
L8	75 - 70	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-32.89	0.03	0.11
			Max. Mx	20	-12.41	283.44	0.05
			Max. My	2	-12.41	0.09	283.45

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Vy	20	-14.32	283.44	0.05
			Max. Vx	14	14.32	0.07	-283.40
			Max. Torque	8			0.15
L9	70 - 65	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-34.15	0.21	0.09
			Max. Mx	20	-13.21	355.78	0.08
			Max. My	2	-13.21	0.17	355.74
			Max. Vy	20	-14.59	355.78	0.08
			Max. Vx	14	14.60	0.15	-355.66
			Max. Torque	8			0.15
L10	65 - 60	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-43.65	1.13	-0.44
			Max. Mx	20	-17.18	445.37	0.08
			Max. My	14	-17.17	0.28	-445.23
			Max. Vy	20	-18.79	445.37	0.08
			Max. Vx	14	18.81	0.28	-445.23
			Max. Torque	14			-0.41
L11	60 - 55	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-45.21	1.35	-0.59
			Max. Mx	20	-18.16	540.18	0.16
			Max. My	14	-18.16	0.28	-540.10
			Max. Vy	20	-19.11	540.18	0.16
			Max. Vx	14	19.14	0.28	-540.10
			Max. Torque	14			-0.41
L12	55 - 50	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-46.77	1.56	-0.73
			Max. Mx	20	-19.16	636.57	0.25
			Max. My	14	-19.15	0.28	-636.57
			Max. Vy	20	-19.42	636.57	0.25
			Max. Vx	14	19.45	0.28	-636.57
			Max. Torque	14			-0.41
L13	50 - 45	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-48.31	1.77	-0.88
			Max. Mx	20	-20.17	734.43	0.33
			Max. My	14	-20.16	0.28	-734.50
			Max. Vy	20	-19.70	734.43	0.33
			Max. Vx	14	19.73	0.28	-734.50
			Max. Torque	14			-0.41
L14	45 - 40	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-49.87	1.98	-1.02
			Max. Mx	20	-21.19	833.60	0.42
			Max. My	14	-21.18	0.28	-833.74
			Max. Vy	20	-19.95	833.60	0.42
			Max. Vx	14	19.98	0.28	-833.74
			Max. Torque	14			-0.41
L15	40 - 39.33	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-50.10	2.00	-1.04
			Max. Mx	20	-21.33	846.99	0.43
			Max. My	14	-21.32	0.28	-847.15
			Max. Vy	20	-19.98	846.99	0.43
			Max. Vx	14	20.05	0.28	-847.15
			Max. Torque	14			-0.41
L16	39.33 - 39.08	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-50.19	2.01	-1.04
			Max. Mx	20	-21.40	851.99	0.43
			Max. My	14	-21.39	0.28	-852.17
			Max. Vy	20	-19.99	851.99	0.43
			Max. Vx	14	20.08	0.28	-852.17
			Max. Torque	14			-0.41
L17	39.08 - 34.08	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-52.08	2.20	-1.17
			Max. Mx	20	-22.59	952.64	0.52
			Max. My	14	-22.57	0.28	-953.97
			Max. Vy	20	-20.25	952.64	0.52
			Max. Vx	14	20.65	0.28	-953.97
			Max. Torque	14			-0.41
L18	34.08 - 30	Pole	Max Tension	1	0.00	0.00	0.00

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Compression	26	-53.59	2.34	-1.27
			Max. Mx	20	-23.57	1035.64	0.58
			Max. My	14	-23.55	0.28	-1039.05
			Max. Vy	20	-20.42	1035.64	0.58
			Max. Vx	14	21.07	0.28	-1039.05
			Max. Torque	14			-0.41
L19	30 - 29.75	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-59.60	2.35	-1.27
			Max. Mx	20	-28.48	1040.79	0.59
			Max. My	14	-28.45	0.28	-1044.35
			Max. Vy	20	-20.57	1040.79	0.59
			Max. Vx	14	21.22	0.28	-1044.35
			Max. Torque	14			-0.41
L20	29.75 - 25	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-61.32	2.53	-1.41
			Max. Mx	20	-29.68	1138.94	0.67
			Max. My	14	-29.66	0.27	-1145.53
			Max. Vy	20	-20.74	1138.94	0.67
			Max. Vx	14	21.39	0.27	-1145.53
			Max. Torque	14			-0.41
L21	25 - 24.75	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-61.44	2.54	-1.42
			Max. Mx	20	-29.77	1144.13	0.67
			Max. My	14	-29.75	0.27	-1150.88
			Max. Vy	20	-20.73	1144.13	0.67
			Max. Vx	14	21.40	0.27	-1150.88
			Max. Torque	14			-0.41
L22	24.75 - 19.75	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-63.80	2.71	-1.61
			Max. Mx	20	-31.41	1248.33	0.76
			Max. My	14	-31.38	0.27	-1259.01
			Max. Vy	20	-20.92	1248.33	0.76
			Max. Vx	14	21.86	0.27	-1259.01
			Max. Torque	14			-0.41
L23	19.75 - 18.58	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-64.39	2.76	-1.65
			Max. Mx	20	-31.79	1272.87	0.77
			Max. My	14	-31.77	0.27	-1284.64
			Max. Vy	20	-21.02	1272.87	0.77
			Max. Vx	14	21.97	0.27	-1284.64
			Max. Torque	14			-0.41
L24	18.58 - 18.33	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-64.53	2.77	-1.66
			Max. Mx	20	-31.90	1278.13	0.78
			Max. My	14	-31.88	0.27	-1290.13
			Max. Vy	20	-21.03	1278.13	0.78
			Max. Vx	14	21.98	0.27	-1290.13
			Max. Torque	14			-0.41
L25	18.33 - 13.33	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-67.35	2.94	-1.85
			Max. Mx	20	-33.87	1384.36	0.86
			Max. My	14	-33.86	0.26	-1401.18
			Max. Vy	20	-21.44	1384.36	0.86
			Max. Vx	14	22.45	0.26	-1401.18
			Max. Torque	24			0.44
L26	13.33 - 8.42	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-70.19	3.11	-2.05
			Max. Mx	20	-35.83	1490.95	0.94
			Max. My	14	-35.82	0.26	-1512.39
			Max. Vy	20	-21.97	1490.95	0.94
			Max. Vx	14	22.88	0.26	-1512.39
			Max. Torque	12			-0.49
L27	8.42 - 8.07	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-70.40	3.13	-2.07
			Max. Mx	20	-35.98	1498.64	0.95

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. My	14	-35.97	0.26	-1520.40
			Max. Vy	20	-22.00	1498.64	0.95
			Max. Vx	14	22.90	0.26	-1520.40
			Max. Torque	12			-0.49
L28	8.07 - 7.83	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-70.55	3.14	-2.08
			Max. Mx	20	-36.09	1503.93	0.95
			Max. My	14	-36.08	0.26	-1525.89
			Max. Vy	20	-22.02	1503.93	0.95
			Max. Vx	14	22.92	0.26	-1525.89
			Max. Torque	12			-0.49
L29	7.83 - 6	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-71.67	3.20	-2.18
			Max. Mx	20	-36.84	1544.47	0.98
			Max. My	14	-36.83	0.26	-1567.99
			Max. Vy	20	-22.27	1544.47	0.98
			Max. Vx	14	23.12	0.26	-1567.99
			Max. Torque	12			-0.51
L30	6 - 5.75	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-71.80	3.21	-2.19
			Max. Mx	20	-36.94	1550.04	0.99
			Max. My	14	-36.93	0.26	-1573.77
			Max. Vy	20	-22.28	1550.04	0.99
			Max. Vx	14	23.11	0.26	-1573.77
			Max. Torque	12			-0.51
L31	5.75 - 2	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-73.56	3.35	-2.34
			Max. Mx	20	-38.24	1634.28	1.05
			Max. My	14	-38.23	0.26	-1660.96
			Max. Vy	20	-22.64	1634.28	1.05
			Max. Vx	14	23.40	0.26	-1660.96
			Max. Torque	12			-0.51
L32	2 - 1.75	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-73.70	3.36	-2.35
			Max. Mx	20	-38.36	1639.94	1.05
			Max. My	14	-38.36	0.26	-1666.81
			Max. Vy	20	-22.63	1639.94	1.05
			Max. Vx	14	23.40	0.26	-1666.81
			Max. Torque	12			-0.51
L33	1.75 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-74.63	3.42	-2.40
			Max. Mx	20	-39.14	1679.62	1.08
			Max. My	14	-39.13	0.26	-1707.88
			Max. Vy	20	-22.71	1679.62	1.08
			Max. Vx	14	23.55	0.26	-1707.88
			Max. Torque	12			-0.51

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	34	74.63	3.14	-5.45
	Max. H_x	21	29.36	22.68	0.02
	Max. H_z	2	39.15	0.02	22.82
	Max. M_x	2	1683.83	0.02	22.82
	Max. M_z	8	1676.43	-22.68	-0.02
	Max. Torsion	24	0.51	11.76	20.37
	Min. Vert	19	29.36	19.26	-11.12
	Min. H_x	9	29.36	-22.68	-0.02
	Min. H_z	14	39.15	-0.02	-23.53
	Min. M_x	14	-1707.88	-0.02	-23.53
	Min. M_z	20	-1679.62	22.68	0.02
	Min. Torsion	12	-0.51	-11.52	-19.96

Tower Mast Reaction Summary

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 Only	32.62	0.00	0.00	0.21	1.28	0.00
1.2 Dead+1.0 Wind 0 deg - No Ice	39.15	-0.02	-22.82	-1683.83	2.94	-0.40
0.9 Dead+1.0 Wind 0 deg - No Ice	29.36	-0.02	-22.82	-1666.54	2.51	-0.40
1.2 Dead+1.0 Wind 30 deg - No Ice	39.15	11.67	-20.25	-1467.62	-844.34	-0.30
0.9 Dead+1.0 Wind 30 deg - No Ice	29.36	11.67	-20.25	-1452.62	-836.06	-0.30
1.2 Dead+1.0 Wind 60 deg - No Ice	39.15	20.46	-11.81	-853.19	-1476.62	-0.13
0.9 Dead+1.0 Wind 60 deg - No Ice	29.36	20.46	-11.81	-844.53	-1461.91	-0.13
1.2 Dead+1.0 Wind 90 deg - No Ice	39.15	22.68	0.02	1.60	-1676.43	0.21
0.9 Dead+1.0 Wind 90 deg - No Ice	29.36	22.68	0.02	1.52	-1659.52	0.21
1.2 Dead+1.0 Wind 120 deg - No Ice	39.15	19.28	11.16	839.25	-1448.90	0.27
0.9 Dead+1.0 Wind 120 deg - No Ice	29.36	19.28	11.16	830.51	-1434.30	0.27
1.2 Dead+1.0 Wind 150 deg - No Ice	39.15	11.52	19.96	1468.90	-846.32	0.51
0.9 Dead+1.0 Wind 150 deg - No Ice	29.36	11.52	19.96	1453.72	-838.01	0.51
1.2 Dead+1.0 Wind 180 deg - No Ice	39.15	0.02	23.53	1707.88	0.26	0.41
0.9 Dead+1.0 Wind 180 deg - No Ice	29.36	0.02	23.53	1690.34	-0.14	0.40
1.2 Dead+1.0 Wind 210 deg - No Ice	39.15	-11.43	19.84	1461.82	843.88	0.30
0.9 Dead+1.0 Wind 210 deg - No Ice	29.36	-11.43	19.84	1446.70	834.79	0.30
1.2 Dead+1.0 Wind 240 deg - No Ice	39.15	-19.26	11.12	836.93	1450.75	0.13
0.9 Dead+1.0 Wind 240 deg - No Ice	29.36	-19.26	11.12	828.21	1435.35	0.13
1.2 Dead+1.0 Wind 270 deg - No Ice	39.15	-22.68	-0.02	-1.08	1679.62	-0.21
0.9 Dead+1.0 Wind 270 deg - No Ice	29.36	-22.68	-0.02	-1.14	1661.89	-0.21
1.2 Dead+1.0 Wind 300 deg - No Ice	39.15	-20.48	-11.85	-855.51	1481.15	-0.28
0.9 Dead+1.0 Wind 300 deg - No Ice	29.36	-20.48	-11.85	-846.83	1465.61	-0.27
1.2 Dead+1.0 Wind 330 deg - No Ice	39.15	-11.76	-20.37	-1474.62	853.12	-0.51
0.9 Dead+1.0 Wind 330 deg - No Ice	29.36	-11.76	-20.37	-1459.56	843.98	-0.51
1.2 Dead+1.0 Ice+1.0 Temp	74.63	-0.00	0.00	2.40	3.42	0.00
1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp	74.63	-0.00	-6.19	-492.98	3.78	-0.10
1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp	74.63	3.15	-5.47	-427.91	-244.66	-0.08
1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp	74.63	5.39	-3.11	-245.36	-425.72	-0.05
1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp	74.63	6.27	0.00	2.71	-492.20	0.03
1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp	74.63	5.34	3.09	250.24	-425.14	0.05
1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp	74.63	3.15	5.46	432.97	-245.03	0.12
1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp	74.63	0.00	6.21	498.26	3.28	0.10

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
1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp	74.63	-3.14	5.45	432.56	251.55	0.08
1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp	74.63	-5.33	3.08	249.81	431.94	0.05
1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp	74.63	-6.27	-0.00	2.21	499.26	-0.03
1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp	74.63	-5.40	-3.12	-245.79	433.02	-0.05
1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp	74.63	-3.17	-5.49	-428.32	252.24	-0.12
Dead+Wind 0 deg - Service	32.62	-0.00	-4.95	-363.05	1.61	-0.09
Dead+Wind 30 deg - Service	32.62	2.53	-4.39	-316.42	-181.15	-0.07
Dead+Wind 60 deg - Service	32.62	4.44	-2.56	-183.89	-317.55	-0.03
Dead+Wind 90 deg - Service	32.62	4.92	0.00	0.50	-360.63	0.05
Dead+Wind 120 deg - Service	32.62	4.18	2.42	181.18	-311.55	0.06
Dead+Wind 150 deg - Service	32.62	2.50	4.33	317.01	-181.58	0.11
Dead+Wind 180 deg - Service	32.62	0.00	5.11	368.57	1.03	0.09
Dead+Wind 210 deg - Service	32.62	-2.48	4.31	315.48	183.01	0.07
Dead+Wind 240 deg - Service	32.62	-4.18	2.41	180.68	313.90	0.03
Dead+Wind 270 deg - Service	32.62	-4.92	-0.00	-0.07	363.28	-0.05
Dead+Wind 300 deg - Service	32.62	-4.44	-2.57	-184.39	320.49	-0.06
Dead+Wind 330 deg - Service	32.62	-2.55	-4.42	-317.93	185.01	-0.11

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	-32.62	0.00	0.00	32.62	0.00	0.000%
2	-0.02	-39.15	-22.82	0.02	39.15	22.82	0.000%
3	-0.02	-29.36	-22.82	0.02	29.36	22.82	0.000%
4	11.67	-39.15	-20.25	-11.67	39.15	20.25	0.000%
5	11.67	-29.36	-20.25	-11.67	29.36	20.25	0.000%
6	20.46	-39.15	-11.81	-20.46	39.15	11.81	0.000%
7	20.46	-29.36	-11.81	-20.46	29.36	11.81	0.000%
8	22.68	-39.15	0.02	-22.68	39.15	-0.02	0.000%
9	22.68	-29.36	0.02	-22.68	29.36	-0.02	0.000%
10	19.28	-39.15	11.16	-19.28	39.15	-11.16	0.000%
11	19.28	-29.36	11.16	-19.28	29.36	-11.16	0.000%
12	11.52	-39.15	19.96	-11.52	39.15	-19.96	0.000%
13	11.52	-29.36	19.96	-11.52	29.36	-19.96	0.000%
14	0.02	-39.15	23.53	-0.02	39.15	-23.53	0.000%
15	0.02	-29.36	23.53	-0.02	29.36	-23.53	0.000%
16	-11.43	-39.15	19.84	11.43	39.15	-19.84	0.000%
17	-11.43	-29.36	19.84	11.43	29.36	-19.84	0.000%
18	-19.26	-39.15	11.12	19.26	39.15	-11.12	0.000%
19	-19.26	-29.36	11.12	19.26	29.36	-11.12	0.000%
20	-22.68	-39.15	-0.02	22.68	39.15	0.02	0.000%
21	-22.68	-29.36	-0.02	22.68	29.36	0.02	0.000%
22	-20.48	-39.15	-11.85	20.48	39.15	11.85	0.000%
23	-20.48	-29.36	-11.85	20.48	29.36	11.85	0.000%
24	-11.76	-39.15	-20.37	11.76	39.15	20.37	0.000%
25	-11.76	-29.36	-20.37	11.76	29.36	20.37	0.000%
26	0.00	-74.63	0.00	0.00	74.63	-0.00	0.000%
27	-0.00	-74.63	-6.19	0.00	74.63	6.19	0.000%
28	3.15	-74.63	-5.47	-3.15	74.63	5.47	0.000%
29	5.39	-74.63	-3.11	-5.39	74.63	3.11	0.000%
30	6.27	-74.63	0.00	-6.27	74.63	-0.00	0.000%

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
31	5.34	-74.63	3.09	-5.34	74.63	-3.09	0.000%
32	3.15	-74.63	5.46	-3.15	74.63	-5.46	0.000%
33	0.00	-74.63	6.21	-0.00	74.63	-6.21	0.000%
34	-3.14	-74.63	5.45	3.14	74.63	-5.45	0.000%
35	-5.33	-74.63	3.08	5.33	74.63	-3.08	0.000%
36	-6.27	-74.63	-0.00	6.27	74.63	0.00	0.000%
37	-5.40	-74.63	-3.12	5.40	74.63	3.12	0.000%
38	-3.17	-74.63	-5.49	3.17	74.63	5.49	0.000%
39	-0.00	-32.62	-4.95	0.00	32.62	4.95	0.000%
40	2.53	-32.62	-4.39	-2.53	32.62	4.39	0.000%
41	4.44	-32.62	-2.56	-4.44	32.62	2.56	0.000%
42	4.92	-32.62	0.00	-4.92	32.62	-0.00	0.000%
43	4.18	-32.62	2.42	-4.18	32.62	-2.42	0.000%
44	2.50	-32.62	4.33	-2.50	32.62	-4.33	0.000%
45	0.00	-32.62	5.11	-0.00	32.62	-5.11	0.000%
46	-2.48	-32.62	4.31	2.48	32.62	-4.31	0.000%
47	-4.18	-32.62	2.41	4.18	32.62	-2.41	0.000%
48	-4.92	-32.62	-0.00	4.92	32.62	0.00	0.000%
49	-4.44	-32.62	-2.57	4.44	32.62	2.57	0.000%
50	-2.55	-32.62	-4.42	2.55	32.62	4.42	0.000%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	4	0.00000001	0.00000001
2	Yes	5	0.00000001	0.00010131
3	Yes	5	0.00000001	0.00004226
4	Yes	6	0.00000001	0.00011274
5	Yes	6	0.00000001	0.00003788
6	Yes	6	0.00000001	0.00011523
7	Yes	6	0.00000001	0.00003870
8	Yes	5	0.00000001	0.00007554
9	Yes	4	0.00000001	0.00080676
10	Yes	6	0.00000001	0.00011470
11	Yes	6	0.00000001	0.00003867
12	Yes	6	0.00000001	0.00011343
13	Yes	6	0.00000001	0.00003808
14	Yes	5	0.00000001	0.00009559
15	Yes	5	0.00000001	0.00003911
16	Yes	6	0.00000001	0.00011544
17	Yes	6	0.00000001	0.00003884
18	Yes	6	0.00000001	0.00011323
19	Yes	6	0.00000001	0.00003811
20	Yes	5	0.00000001	0.00007431
21	Yes	4	0.00000001	0.00078382
22	Yes	6	0.00000001	0.00011446
23	Yes	6	0.00000001	0.00003835
24	Yes	6	0.00000001	0.00011688
25	Yes	6	0.00000001	0.00003925
26	Yes	4	0.00000001	0.00025094
27	Yes	6	0.00000001	0.00041525
28	Yes	6	0.00000001	0.00045811
29	Yes	6	0.00000001	0.00045810
30	Yes	6	0.00000001	0.00041367
31	Yes	6	0.00000001	0.00046112
32	Yes	6	0.00000001	0.00046186
33	Yes	6	0.00000001	0.00041850
34	Yes	6	0.00000001	0.00046716
35	Yes	6	0.00000001	0.00046658
36	Yes	6	0.00000001	0.00041957
37	Yes	6	0.00000001	0.00046441
38	Yes	6	0.00000001	0.00046430
39	Yes	4	0.00000001	0.00032136
40	Yes	4	0.00000001	0.00080870
41	Yes	4	0.00000001	0.00084318
42	Yes	4	0.00000001	0.00031226
43	Yes	4	0.00000001	0.00083913
44	Yes	4	0.00000001	0.00081262
45	Yes	4	0.00000001	0.00032281
46	Yes	4	0.00000001	0.00085652
47	Yes	4	0.00000001	0.00082180
48	Yes	4	0.00000001	0.00031435
49	Yes	4	0.00000001	0.00083244
50	Yes	4	0.00000001	0.00087223

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	110 - 105	13.802	49	0.9434	0.0005
L2	105 - 100	12.814	49	0.9430	0.0005
L3	100 - 95	11.828	49	0.9391	0.0005
L4	95 - 90	10.849	49	0.9309	0.0005
L5	90 - 85	9.881	49	0.9178	0.0005
L6	85 - 80	8.926	49	0.9037	0.0005
L7	80 - 75	7.991	49	0.8822	0.0005
L8	75 - 70	7.082	49	0.8528	0.0005
L9	70 - 65	6.208	49	0.8138	0.0005
L10	65 - 60	5.381	49	0.7634	0.0005

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L11	60 - 55	4.614	49	0.7003	0.0004
L12	55 - 50	3.900	49	0.6608	0.0003
L13	50 - 45	3.232	49	0.6136	0.0003
L14	45 - 40	2.618	49	0.5587	0.0003
L15	40 - 39.33	2.065	49	0.4958	0.0002
L16	39.33 - 39.08	1.996	49	0.4868	0.0002
L17	39.08 - 34.08	1.971	49	0.4841	0.0002
L18	34.08 - 30	1.493	49	0.4278	0.0002
L19	30 - 29.75	1.148	49	0.3770	0.0002
L20	29.75 - 25	1.129	49	0.3739	0.0002
L21	25 - 24.75	0.788	49	0.3105	0.0001
L22	24.75 - 19.75	0.772	49	0.3073	0.0001
L23	19.75 - 18.58	0.484	49	0.2409	0.0001
L24	18.58 - 18.33	0.427	49	0.2245	0.0001
L25	18.33 - 13.33	0.415	49	0.2216	0.0001
L26	13.33 - 8.42	0.215	49	0.1608	0.0001
L27	8.42 - 8.07	0.082	49	0.0962	0.0000
L28	8.07 - 7.83	0.075	49	0.0923	0.0000
L29	7.83 - 6	0.071	49	0.0896	0.0000
L30	6 - 5.75	0.040	49	0.0688	0.0000
L31	5.75 - 2	0.037	49	0.0657	0.0000
L32	2 - 1.75	0.004	49	0.0180	0.0000
L33	1.75 - 0	0.003	49	0.0158	0.0000

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
107.00	T-Arm Mount [TA 702-3]	49	13.209	0.9434	0.0005	152115
105.00	Side Arm Mount [SO 102-3]	49	12.814	0.9430	0.0005	152115
89.00	Platform Mount [LP 502-1]	49	9.688	0.9152	0.0005	20475
74.00	Platform Mount [LP 303-1_HR-1]	49	6.904	0.8458	0.0005	8026
64.00	Perfect Vision PV-LPP12M-HR-B 12.5' Platform w/ Handrail	49	5.223	0.7506	0.0004	5030
30.00	Bridge Stiffener 72" x 1.25" x 11"	49	1.148	0.3770	0.0002	4470

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	110 - 105	63.868	22	4.3718	0.0021
L2	105 - 100	59.298	22	4.3701	0.0021
L3	100 - 95	54.737	22	4.3522	0.0021
L4	95 - 90	50.206	22	4.3137	0.0021
L5	90 - 85	45.726	22	4.2529	0.0021
L6	85 - 80	41.311	22	4.1878	0.0021
L7	80 - 75	36.982	22	4.0877	0.0021
L8	75 - 70	32.775	22	3.9517	0.0021
L9	70 - 65	28.733	22	3.7706	0.0021
L10	65 - 60	24.907	22	3.5364	0.0021
L11	60 - 55	21.355	22	3.2440	0.0018
L12	55 - 50	18.053	22	3.0610	0.0016
L13	50 - 45	14.962	22	2.8423	0.0014
L14	45 - 40	12.117	22	2.5875	0.0012
L15	40 - 39.33	9.558	22	2.2961	0.0010
L16	39.33 - 39.08	9.239	22	2.2542	0.0010
L17	39.08 - 34.08	9.122	22	2.2420	0.0010
L18	34.08 - 30	6.909	22	1.9809	0.0009
L19	30 - 29.75	5.316	22	1.7458	0.0007

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L20	29.75 - 25	5.225	22	1.7311	0.0007
L21	25 - 24.75	3.647	22	1.4374	0.0006
L22	24.75 - 19.75	3.572	22	1.4228	0.0006
L23	19.75 - 18.58	2.241	22	1.1153	0.0005
L24	18.58 - 18.33	1.977	22	1.0394	0.0004
L25	18.33 - 13.33	1.923	22	1.0259	0.0004
L26	13.33 - 8.42	0.994	22	0.7444	0.0003
L27	8.42 - 8.07	0.381	22	0.4450	0.0002
L28	8.07 - 7.83	0.349	22	0.4270	0.0002
L29	7.83 - 6	0.327	22	0.4146	0.0002
L30	6 - 5.75	0.187	22	0.3184	0.0001
L31	5.75 - 2	0.171	22	0.3041	0.0001
L32	2 - 1.75	0.018	22	0.0834	0.0000
L33	1.75 - 0	0.013	22	0.0733	0.0000

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
107.00	T-Arm Mount [TA 702-3]	22	61.126	4.3721	0.0022	33193
105.00	Side Arm Mount [SO 102-3]	22	59.298	4.3701	0.0022	33193
89.00	Platform Mount [LP 502-1]	22	44.837	4.2408	0.0022	4463
74.00	Platform Mount [LP 303-1_HR-1]	22	31.952	3.9190	0.0021	1745
64.00	Perfect Vision PV-LPP12M-HR-B 12.5' Platform w/ Handrail	22	24.174	3.4773	0.0021	1093
30.00	Bridge Stiffener 72" x 1.25" x 11"	22	5.316	1.7458	0.0007	966

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	110 - 105 (1)	P24x0.25	5.00	0.00	0.0	18.6532	-1.51	662.26	0.002
L2	105 - 100 (2)	P24x0.25	5.00	0.00	0.0	18.6532	-2.67	662.26	0.004
L3	100 - 95 (3)	P24x0.25	5.00	0.00	0.0	18.6532	-3.06	662.26	0.005
L4	95 - 90 (4)	P24x0.25	5.00	0.00	0.0	18.6532	-3.44	662.26	0.005
L5	90 - 85 (5)	P24x0.375	5.00	0.00	0.0	27.8325	-6.84	1052.07	0.007
L6	85 - 80 (6)	P24x0.375	5.00	0.00	0.0	27.8325	-7.51	1052.07	0.007
L7	80 - 75 (7)	P24x0.375	5.00	0.00	0.0	27.8325	-8.18	1052.07	0.008
L8	75 - 70 (8)	P24x0.375	5.00	0.00	0.0	27.8325	-12.40	1052.07	0.012
L9	70 - 65 (9)	P24x0.375	5.00	0.00	0.0	27.8325	-13.20	1052.07	0.013
L10	65 - 60 (10)	P24x0.375	5.00	0.00	0.0	27.8325	-17.16	1052.07	0.016
L11	60 - 55 (11)	P30x0.375	5.00	0.00	0.0	34.9011	-18.15	1311.06	0.014

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
L12	55 - 50 (12)	P30x0.375	5.00	0.00	0.0	34.9011	-19.14	1311.06	0.015
L13	50 - 45 (13)	P30x0.375	5.00	0.00	0.0	34.9011	-20.15	1311.06	0.015
L14	45 - 40 (14)	P30x0.375	5.00	0.00	0.0	34.9011	-21.18	1311.06	0.016
L15	40 - 39.33 (15)	P30x0.375	0.67	0.00	0.0	34.9011	-21.32	1311.06	0.016
L16	39.33 - 39.08 (16)	P30x0.4875	0.25	0.00	0.0	45.1992	-21.38	1708.53	0.013
L17	39.08 - 34.08 (17)	P30x0.4875	5.00	0.00	0.0	45.1992	-22.57	1708.53	0.013
L18	34.08 - 30 (18)	P30x0.4875	4.08	0.00	0.0	45.1992	-23.56	1708.53	0.014
L19	30 - 29.75 (19)	P30x0.5	0.25	0.00	0.0	46.3385	-28.46	1751.60	0.016
L20	29.75 - 25 (20)	P30x0.5	4.75	0.00	0.0	46.3385	-29.65	1751.60	0.017
L21	25 - 24.75 (21)	P30x0.55625	0.25	0.00	0.0	51.4533	-29.75	1944.93	0.015
L22	24.75 - 19.75 (22)	P30x0.55625	5.00	0.00	0.0	51.4533	-31.38	1944.93	0.016
L23	19.75 - 18.58 (23)	P30x0.55625	1.17	0.00	0.0	51.4533	-31.77	1944.93	0.016
L24	18.58 - 18.33 (24)	P30x0.6875	0.25	0.00	0.0	63.3105	-31.88	2393.14	0.013
L25	18.33 - 13.33 (25)	P30x0.6875	5.00	0.00	0.0	63.3105	-33.85	2393.14	0.014
L26	13.33 - 8.42 (26)	P30x0.6875	4.91	0.00	0.0	63.3105	-35.81	2393.14	0.015
L27	8.42 - 8.07 (27)	P30x0.8625	0.35	0.00	0.0	78.9517	-35.97	2984.37	0.012
L28	8.07 - 7.83 (28)	P30x0.8625	0.24	0.00	0.0	78.9517	-36.08	2984.37	0.012
L29	7.83 - 6 (29)	P30x0.8625	1.83	0.00	0.0	78.9517	-36.83	2984.37	0.012
L30	6 - 5.75 (30)	P30x0.8	0.25	0.00	0.0	73.3876	-36.93	2774.05	0.013
L31	5.75 - 2 (31)	P30x0.8	3.75	0.00	0.0	73.3876	-38.23	2774.05	0.014
L32	2 - 1.75 (32)	P30x1.25	0.25	0.00	0.0	112.9010	-38.36	4267.66	0.009
L33	1.75 - 0 (33)	P30x1.225	1.75	0.00	0.0	110.7390	-39.13	4185.94	0.009

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	110 - 105 (1)	P24x0.25	5.75	396.68	0.014	0.00	396.68	0.000
L2	105 - 100 (2)	P24x0.25	25.82	396.68	0.065	0.00	396.68	0.000
L3	100 - 95 (3)	P24x0.25	45.61	396.68	0.115	0.00	396.68	0.000
L4	95 - 90 (4)	P24x0.25	67.03	396.68	0.169	0.00	396.68	0.000
L5	90 - 85 (5)	P24x0.375	112.65	623.72	0.181	0.00	623.72	0.000
L6	85 - 80 (6)	P24x0.375	160.95	623.72	0.258	0.00	623.72	0.000
L7	80 - 75 (7)	P24x0.375	210.84	623.72	0.338	0.00	623.72	0.000
L8	75 - 70 (8)	P24x0.375	283.60	623.72	0.455	0.00	623.72	0.000
L9	70 - 65 (9)	P24x0.375	356.14	623.72	0.571	0.00	623.72	0.000
L10	65 - 60 (10)	P24x0.375	446.05	623.72	0.715	0.00	623.72	0.000
L11	60 - 55 (11)	P30x0.375	541.45	947.86	0.571	0.00	947.86	0.000
L12	55 - 50 (12)	P30x0.375	638.51	947.86	0.674	0.00	947.86	0.000
L13	50 - 45 (13)	P30x0.375	737.08	947.86	0.778	0.00	947.86	0.000
L14	45 - 40 (14)	P30x0.375	837.03	947.86	0.883	0.00	947.86	0.000

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 $\frac{M_{uy}}{\phi M_{ny}}$
L15	40 - 39.33 (15)	P30x0.375	850.53	947.86	0.897	0.00	947.86	0.000
L16	39.33 - 39.08 (16)	P30x0.4875	855.58	1273.78	0.672	0.00	1273.78	0.000
L17	39.08 - 34.08 (17)	P30x0.4875	957.23	1273.78	0.751	0.00	1273.78	0.000
L18	34.08 - 30 (18)	P30x0.4875	1041.22	1273.78	0.817	0.00	1273.78	0.000
L19	30 - 29.75 (19)	P30x0.5	1046.44	1311.10	0.798	0.00	1311.10	0.000
L20	29.75 - 25 (20)	P30x0.5	1146.25	1311.10	0.874	0.00	1311.10	0.000
L21	25 - 24.75 (21)	P30x0.55625	1151.60	1481.77	0.777	0.00	1481.77	0.000
L22	24.75 - 19.75 (22)	P30x0.55625	1259.87	1481.77	0.850	0.00	1481.77	0.000
L23	19.75 - 18.58 (23)	P30x0.55625	1285.54	1481.77	0.868	0.00	1481.77	0.000
L24	18.58 - 18.33 (24)	P30x0.6875	1291.04	1861.09	0.694	0.00	1861.09	0.000
L25	18.33 - 13.33 (25)	P30x0.6875	1402.38	1861.09	0.754	0.00	1861.09	0.000
L26	13.33 - 8.42 (26)	P30x0.6875	1514.01	1861.09	0.814	0.00	1861.09	0.000
L27	8.42 - 8.07 (27)	P30x0.8625	1522.05	2307.28	0.660	0.00	2307.28	0.000
L28	8.07 - 7.83 (28)	P30x0.8625	1527.58	2307.28	0.662	0.00	2307.28	0.000
L29	7.83 - 6 (29)	P30x0.8625	1569.86	2307.28	0.680	0.00	2307.28	0.000
L30	6 - 5.75 (30)	P30x0.8	1575.66	2149.19	0.733	0.00	2149.19	0.000
L31	5.75 - 2 (31)	P30x0.8	1663.28	2149.19	0.774	0.00	2149.19	0.000
L32	2 - 1.75 (32)	P30x1.25	1669.16	3256.64	0.513	0.00	3256.64	0.000
L33	1.75 - 0 (33)	P30x1.225	1710.47	3196.97	0.535	0.00	3196.97	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	110 - 105 (1)	P24x0.25	2.08	201.86	0.010	0.00	324.23	0.000
L2	105 - 100 (2)	P24x0.25	3.79	201.86	0.019	0.00	324.23	0.000
L3	100 - 95 (3)	P24x0.25	4.12	201.86	0.020	0.00	324.23	0.000
L4	95 - 90 (4)	P24x0.25	4.45	201.86	0.022	0.00	324.23	0.000
L5	90 - 85 (5)	P24x0.375	9.50	315.62	0.030	0.08	655.57	0.000
L6	85 - 80 (6)	P24x0.375	9.83	315.62	0.031	0.08	655.57	0.000
L7	80 - 75 (7)	P24x0.375	10.14	315.62	0.032	0.08	655.57	0.000
L8	75 - 70 (8)	P24x0.375	14.35	315.62	0.045	0.08	655.57	0.000
L9	70 - 65 (9)	P24x0.375	14.65	315.62	0.046	0.08	655.57	0.000
L10	65 - 60 (10)	P24x0.375	18.91	315.62	0.060	0.39	655.57	0.001
L11	60 - 55 (11)	P30x0.375	19.25	395.78	0.049	0.39	994.73	0.000
L12	55 - 50 (12)	P30x0.375	19.57	395.78	0.049	0.39	994.73	0.000
L13	50 - 45 (13)	P30x0.375	19.86	395.78	0.050	0.39	994.73	0.000
L14	45 - 40 (14)	P30x0.375	20.13	395.78	0.051	0.39	994.73	0.000
L15	40 - 39.33 (15)	P30x0.375	20.16	395.78	0.051	0.39	994.73	0.000
L16	39.33 - 39.08 (16)	P30x0.4875	20.17	512.56	0.039	0.39	1329.93	0.000
L17	39.08 - 34.08 (17)	P30x0.4875	20.48	512.56	0.040	0.39	1329.93	0.000
L18	34.08 - 30 (18)	P30x0.4875	20.70	512.56	0.040	0.39	1329.93	0.000
L19	30 - 29.75 (19)	P30x0.5	20.85	525.48	0.040	0.39	1362.88	0.000
L20	29.75 - 25 (20)	P30x0.5	21.39	525.48	0.041	0.28	1362.88	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 $\frac{T_u}{\phi T_n}$
L21	25 - 24.75 (21)	P30x0.55625	21.40	583.48	0.037	0.28	1510.43	0.000
L22	24.75 - 19.75 (22)	P30x0.55625	21.89	583.48	0.038	0.28	1510.43	0.000
L23	19.75 - 18.58 (23)	P30x0.55625	22.01	583.48	0.038	0.28	1510.43	0.000
L24	18.58 - 18.33 (24)	P30x0.6875	22.02	717.94	0.031	0.28	1850.21	0.000
L25	18.33 - 13.33 (25)	P30x0.6875	22.50	717.94	0.031	0.28	1850.21	0.000
L26	13.33 - 8.42 (26)	P30x0.6875	22.97	717.94	0.032	0.28	1850.21	0.000
L27	8.42 - 8.07 (27)	P30x0.8625	22.99	895.31	0.026	0.28	2293.54	0.000
L28	8.07 - 7.83 (28)	P30x0.8625	23.01	895.31	0.026	0.28	2293.54	0.000
L29	7.83 - 6 (29)	P30x0.8625	23.21	895.31	0.026	0.28	2293.54	0.000
L30	6 - 5.75 (30)	P30x0.8	23.21	832.22	0.028	0.28	2136.47	0.000
L31	5.75 - 2 (31)	P30x0.8	23.52	832.22	0.028	0.28	2136.47	0.000
L32	2 - 1.75 (32)	P30x1.25	23.52	1280.30	0.018	0.28	3236.15	0.000
L33	1.75 - 0 (33)	P30x1.225	23.68	1255.78	0.019	0.28	3176.94	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	110 - 105 (1)	0.002	0.014	0.000	0.010	0.000	0.017	1.050	4.8.2
L2	105 - 100 (2)	0.004	0.065	0.000	0.019	0.000	0.069	1.050	4.8.2
L3	100 - 95 (3)	0.005	0.115	0.000	0.020	0.000	0.120	1.050	4.8.2
L4	95 - 90 (4)	0.005	0.169	0.000	0.022	0.000	0.175	1.050	4.8.2
L5	90 - 85 (5)	0.007	0.181	0.000	0.030	0.000	0.188	1.050	4.8.2
L6	85 - 80 (6)	0.007	0.258	0.000	0.031	0.000	0.266	1.050	4.8.2
L7	80 - 75 (7)	0.008	0.338	0.000	0.032	0.000	0.347	1.050	4.8.2
L8	75 - 70 (8)	0.012	0.455	0.000	0.045	0.000	0.469	1.050	4.8.2
L9	70 - 65 (9)	0.013	0.571	0.000	0.046	0.000	0.586	1.050	4.8.2
L10	65 - 60 (10)	0.016	0.715	0.000	0.060	0.001	0.735	1.050	4.8.2
L11	60 - 55 (11)	0.014	0.571	0.000	0.049	0.000	0.587	1.050	4.8.2
L12	55 - 50 (12)	0.015	0.674	0.000	0.049	0.000	0.691	1.050	4.8.2
L13	50 - 45 (13)	0.015	0.778	0.000	0.050	0.000	0.796	1.050	4.8.2
L14	45 - 40 (14)	0.016	0.883	0.000	0.051	0.000	0.902	1.050	4.8.2
L15	40 - 39.33 (15)	0.016	0.897	0.000	0.051	0.000	0.916	1.050	4.8.2
L16	39.33 - 39.08 (16)	0.013	0.672	0.000	0.039	0.000	0.686	1.050	4.8.2
L17	39.08 - 34.08 (17)	0.013	0.751	0.000	0.040	0.000	0.766	1.050	4.8.2
L18	34.08 - 30 (18)	0.014	0.817	0.000	0.040	0.000	0.833	1.050	4.8.2
L19	30 - 29.75 (19)	0.016	0.798	0.000	0.040	0.000	0.816	1.050	4.8.2
L20	29.75 - 25 (20)	0.017	0.874	0.000	0.041	0.000	0.893	1.050	4.8.2
L21	25 - 24.75 (21)	0.015	0.777	0.000	0.037	0.000	0.794	1.050	4.8.2
L22	24.75 - 19.75 (22)	0.016	0.850	0.000	0.038	0.000	0.868	1.050	4.8.2
L23	19.75 - 18.58 (23)	0.016	0.868	0.000	0.038	0.000	0.885	1.050	4.8.2
L24	18.58 - 18.33 (24)	0.013	0.694	0.000	0.031	0.000	0.708	1.050	4.8.2
L25	18.33 - 13.33 (25)	0.014	0.754	0.000	0.031	0.000	0.769	1.050	4.8.2

Section No.	Elevation ft	Ratio P_u / ϕP_n	Ratio M_{ux} / ϕM_{nx}	Ratio M_{uy} / ϕM_{ny}	Ratio V_u / ϕV_n	Ratio T_u / ϕT_n	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L26	13.33 - 8.42 (26)	0.015	0.814	0.000	0.032	0.000	0.830	1.050	4.8.2
L27	8.42 - 8.07 (27)	0.012	0.660	0.000	0.026	0.000	0.672	1.050	4.8.2
L28	8.07 - 7.83 (28)	0.012	0.662	0.000	0.026	0.000	0.675	1.050	4.8.2
L29	7.83 - 6 (29)	0.012	0.680	0.000	0.026	0.000	0.693	1.050	4.8.2
L30	6 - 5.75 (30)	0.013	0.733	0.000	0.028	0.000	0.747	1.050	4.8.2
L31	5.75 - 2 (31)	0.014	0.774	0.000	0.028	0.000	0.788	1.050	4.8.2
L32	2 - 1.75 (32)	0.009	0.513	0.000	0.018	0.000	0.522	1.050	4.8.2
L33	1.75 - 0 (33)	0.009	0.535	0.000	0.019	0.000	0.545	1.050	4.8.2

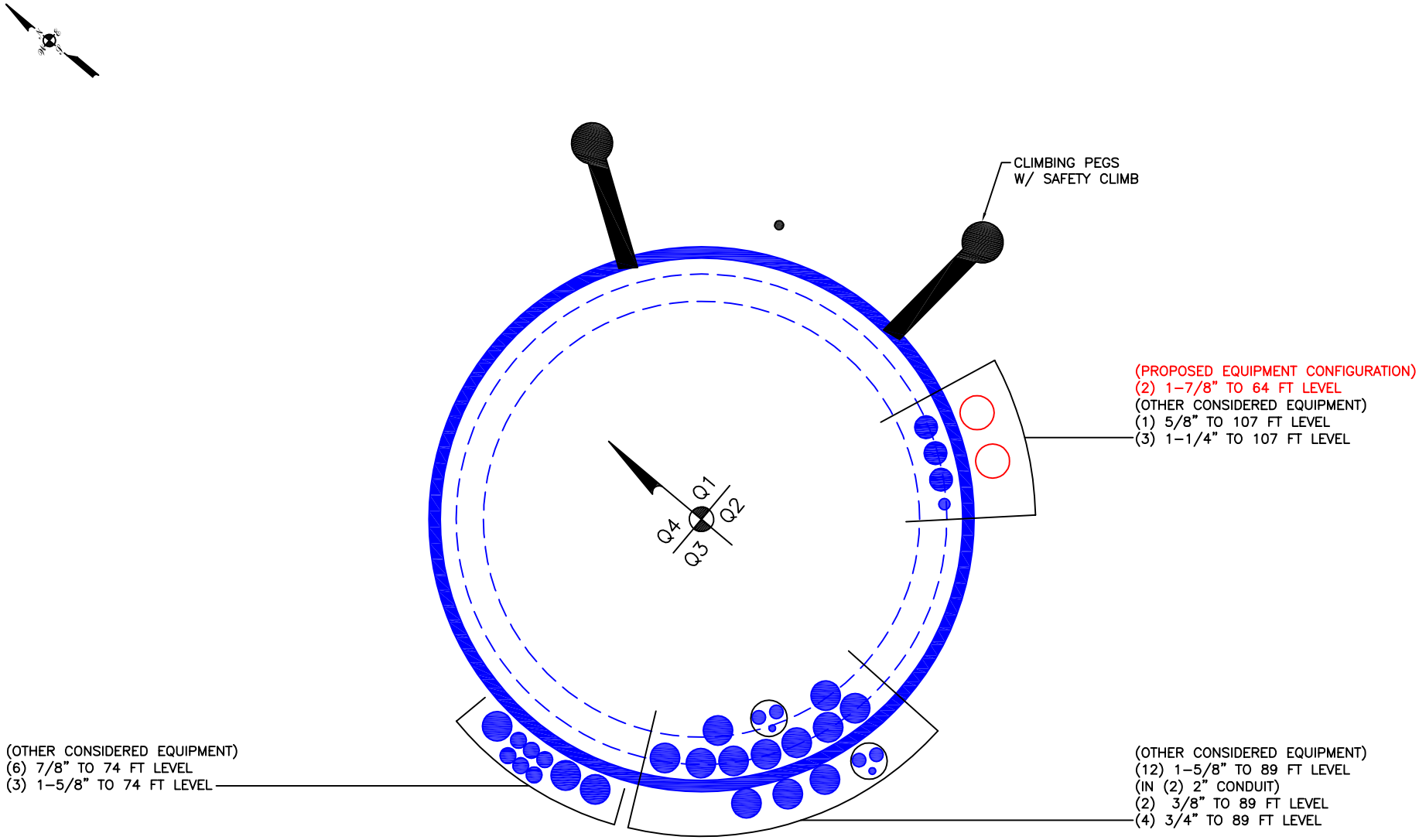
Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	ϕP_{allow} K	% Capacity	Pass Fail
L1	110 - 105	Pole	P24x0.25	1	-1.51	695.38	1.6	Pass
L2	105 - 100	Pole	P24x0.25	2	-2.67	695.38	6.6	Pass
L3	100 - 95	Pole	P24x0.25	3	-3.06	695.38	11.4	Pass
L4	95 - 90	Pole	P24x0.25	4	-3.44	695.38	16.6	Pass
L5	90 - 85	Pole	P24x0.375	5	-6.84	1104.67	17.9	Pass
L6	85 - 80	Pole	P24x0.375	6	-7.51	1104.67	25.3	Pass
L7	80 - 75	Pole	P24x0.375	7	-8.18	1104.67	33.0	Pass
L8	75 - 70	Pole	P24x0.375	8	-12.40	1104.67	44.6	Pass
L9	70 - 65	Pole	P24x0.375	9	-13.20	1104.67	55.8	Pass
L10	65 - 60	Pole	P24x0.375	10	-17.16	1104.67	70.0	Pass
L11	60 - 55	Pole	P30x0.375	11	-18.15	1376.61	56.0	Pass
L12	55 - 50	Pole	P30x0.375	12	-19.14	1376.61	65.8	Pass
L13	50 - 45	Pole	P30x0.375	13	-20.15	1376.61	75.8	Pass
L14	45 - 40	Pole	P30x0.375	14	-21.18	1376.61	85.9	Pass
L15	40 - 39.33	Pole	P30x0.375	15	-21.32	1376.61	87.3	Pass
L16	39.33 - 39.08	Pole	P30x0.4875	16	-21.38	1793.96	65.3	Pass
L17	39.08 - 34.08	Pole	P30x0.4875	17	-22.57	1793.96	73.0	Pass
L18	34.08 - 30	Pole	P30x0.4875	18	-23.56	1793.96	79.3	Pass
L19	30 - 29.75	Pole	P30x0.5	19	-28.46	1839.18	77.7	Pass
L20	29.75 - 25	Pole	P30x0.5	20	-29.65	1839.18	85.0	Pass
L21	25 - 24.75	Pole	P30x0.55625	21	-29.75	2042.18	75.6	Pass
L22	24.75 - 19.75	Pole	P30x0.55625	22	-31.38	2042.18	82.6	Pass
L23	19.75 - 18.58	Pole	P30x0.55625	23	-31.77	2042.18	84.3	Pass
L24	18.58 - 18.33	Pole	P30x0.6875	24	-31.88	2512.80	67.4	Pass
L25	18.33 - 13.33	Pole	P30x0.6875	25	-33.85	2512.80	73.2	Pass
L26	13.33 - 8.42	Pole	P30x0.6875	26	-35.81	2512.80	79.0	Pass
L27	8.42 - 8.07	Pole	P30x0.8625	27	-35.97	3133.59	64.0	Pass
L28	8.07 - 7.83	Pole	P30x0.8625	28	-36.08	3133.59	64.3	Pass
L29	7.83 - 6	Pole	P30x0.8625	29	-36.83	3133.59	66.0	Pass
L30	6 - 5.75	Pole	P30x0.8	30	-36.93	2912.75	71.2	Pass
L31	5.75 - 2	Pole	P30x0.8	31	-38.23	2912.75	75.1	Pass
L32	2 - 1.75	Pole	P30x1.25	32	-38.36	4481.04	49.7	Pass
L33	1.75 - 0	Pole	P30x1.225	33	-39.13	4395.24	51.9	Pass
							Summary	
						Pole (L15)	87.3	Pass
						RATING =	**87.3**	**Pass**

***NOTE: Above stress ratios for reinforced sections are approximate. More exact calculations are presented in Appendix C.**

APPENDIX B

BASE LEVEL DRAWING



BUSINESS UNIT: 876325 TOWER ID: C_BASELEVEL

APPENDIX C

ADDITIONAL CALCULATIONS

CCIpole

per TIA-222- H

Site BU: 876325

Work Order: 1815154

Pole Geometry

	Pole Height Above Base (ft)	Section Length (ft)	Lap Splice Length (ft)	Number of Sides	Top Diameter (in)	Bottom Diameter (in)	Wall Thickness (in)	Bend Radius (in)	Pole Material
1	110	20		0	24	24	0.25		A53-B-42
2	90	30		0	24.00	24	0.375		A53-B-42
3	60	30		0	30.00	30	0.375		A53-B-42
4	30	30		0	30.00	30	0.5		A53-B-42

Reinforcement Configuration

	Bottom Effective Elevation (ft)	Top Effective Elevation (ft)	Type	Model	Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	0	8.08	channel	MP3-05 (Bottom Weld	4	45	135	225	315														
2	30	39.33	channel	MP3-03 (1.1875in)	3	105	225	345															
3	8.42	18.58	channel	MP3-05 (1.1875in)	3	0	90	270															
4	0	2	plate	TS 7"x1.25"	3	110	248	345															
5	6	25	plate	CCI-SFP-045100	4	70	110	250	290														
6																							
7																							
8																							
9																							
10																							

Reinforcement Details

	B (in)	H (in)	Gross Area (in^2)	Pole Face to Centroid (in)	Bottom Termination Length (in)	Top Termination Length (in)	L_u (in)	Net Area (in^2)	Bolt Hole Size (in)	Reinforcement Material
1	5.33	2.09	5.65	0.79	n/a	29.000	18.000	5.025	1.1875	A572-65
2	4.06	1.57	2.92	0.59	14.000	14.000	18.000	2.545	1.1875	A572-65
3	5.33	2.09	5.65	0.79	29.000	29.000	18.000	5.025	1.1875	A572-65
4	1.25	7	8.75	3.5	n/a	n/a	0.000	8.750	0.0000	A572-65
5	4.5	1	4.5	0.5	18.000	18.000	20.000	3.250	1.1875	A572-65

TNX Geometry Input

Increment (ft): 5

	Section Height (ft)	Section Length (ft)	Lap Splice Length (ft)	Number of Sides	Top Diameter (in)	Bottom Diameter (in)	Wall Thickness (in)	Tapered Pole Grade	Weight Multiplier
1	110 - 105	5		0	24.000	24.000	0.25	A53-B-42	1.000
2	105 - 100	5		0	24.000	24.000	0.25	A53-B-42	1.000
3	100 - 95	5		0	24.000	24.000	0.25	A53-B-42	1.000
4	95 - 90	5	0	0	24.000	24.000	0.25	A53-B-42	1.000
5	90 - 85	5		0	24.000	24.000	0.375	A53-B-42	1.000
6	85 - 80	5		0	24.000	24.000	0.375	A53-B-42	1.000
7	80 - 75	5		0	24.000	24.000	0.375	A53-B-42	1.000
8	75 - 70	5		0	24.000	24.000	0.375	A53-B-42	1.000
9	70 - 65	5		0	24.000	24.000	0.375	A53-B-42	1.000
10	65 - 60	5	0	0	24.000	24.000	0.375	A53-B-42	1.000
11	60 - 55	5		0	30.000	30.000	0.375	A53-B-42	1.000
12	55 - 50	5		0	30.000	30.000	0.375	A53-B-42	1.000
13	50 - 45	5		0	30.000	30.000	0.375	A53-B-42	1.000
14	45 - 40	5		0	30.000	30.000	0.375	A53-B-42	1.000
15	40 - 39.33	0.67		0	30.000	30.000	0.375	A53-B-42	1.000
16	39.33 - 39.08	0.25		0	30.000	30.000	0.4875	A53-B-42	0.966
17	39.08 - 34.08	5		0	30.000	30.000	0.4875	A53-B-42	0.966
18	34.08 - 30	4.08	0	0	30.000	30.000	0.4875	A53-B-42	0.966
19	30 - 29.75	0.25		0	30.000	30.000	0.5	A53-B-42	1.000
20	29.75 - 25	4.75		0	30.000	30.000	0.5	A53-B-42	1.000
21	25 - 24.75	0.25		0	30.000	30.000	0.55625	A53-B-42	1.250
22	24.75 - 19.75	5		0	30.000	30.000	0.55625	A53-B-42	1.250
23	19.75 - 18.58	1.17		0	30.000	30.000	0.55625	A53-B-42	1.250
24	18.58 - 18.33	0.25		0	30.000	30.000	0.6875	A53-B-42	1.284
25	18.33 - 13.33	5		0	30.000	30.000	0.6875	A53-B-42	1.284
26	13.33 - 8.42	4.91		0	30.000	30.000	0.6875	A53-B-42	1.284
27	8.42 - 8.07	0.35		0	30.000	30.000	0.8625	A53-B-42	1.101
28	8.07 - 7.83	0.24		0	30.000	30.000	0.8625	A53-B-42	1.101
29	7.83 - 6	1.83		0	30.000	30.000	0.8625	A53-B-42	1.101
30	6 - 5.75	0.25		0	30.000	30.000	0.8	A53-B-42	0.939
31	5.75 - 2	3.75		0	30.000	30.000	0.8	A53-B-42	0.939
32	2 - 1.75	0.25		0	30.000	30.000	1.25	A53-B-42	0.843
33	1.75 - 0	1.75		0	30.000	30.000	1.225	A53-B-42	0.860

TNX Section Forces

Increment (ft):	5	TNX Output		
	Section Height (ft)	P_u (K)	M_{ux} (kip-ft)	V_u (K)
1	110 - 105	1.51	5.75	2.08
2	105 - 100	2.67	25.82	3.80
3	100 - 95	3.06	45.61	4.12
4	95 - 90	3.44	67.03	4.45
5	90 - 85	6.84	112.65	9.50
6	85 - 80	7.51	160.95	9.83
7	80 - 75	8.18	210.84	10.14
8	75 - 70	12.40	283.60	14.35
9	70 - 65	13.20	356.14	14.65
10	65 - 60	17.16	446.05	18.91
11	60 - 55	18.15	541.45	19.25
12	55 - 50	19.14	638.51	19.57
13	50 - 45	20.15	737.08	19.86
14	45 - 40	21.18	837.04	20.13
15	40 - 39.33	21.32	850.53	20.16
16	39.33 - 39.08	21.38	855.57	20.17
17	39.08 - 34.08	22.57	957.22	20.48
18	34.08 - 30	23.56	1041.23	20.70
19	30 - 29.75	28.46	1046.44	20.85
20	29.75 - 25	29.65	1146.25	21.39
21	25 - 24.75	29.75	1151.60	21.40
22	24.75 - 19.75	31.38	1259.86	21.89
23	19.75 - 18.58	31.77	1285.54	22.01
24	18.58 - 18.33	31.88	1291.04	22.02
25	18.33 - 13.33	33.85	1402.38	22.50
26	13.33 - 8.42	35.81	1514.01	22.97
27	8.42 - 8.07	35.97	1522.05	22.99
28	8.07 - 7.83	36.08	1527.57	23.01
29	7.83 - 6	36.83	1569.86	23.21
30	6 - 5.75	36.93	1575.66	23.21
31	5.75 - 2	38.23	1663.28	23.52
32	2 - 1.75	38.36	1669.16	23.52
33	1.75 - 0	39.13	1710.46	23.68

Analysis Results

Elevation (ft)	Component Type	Size	Critical Element	% Capacity	Pass / Fail
110 - 105	Pole	TP24x24x0.25	Pole	1.6%	Pass
105 - 100	Pole	TP24x24x0.25	Pole	6.6%	Pass
100 - 95	Pole	TP24x24x0.25	Pole	11.4%	Pass
95 - 90	Pole	TP24x24x0.25	Pole	16.6%	Pass
90 - 85	Pole	TP24x24x0.375	Pole	17.9%	Pass
85 - 80	Pole	TP24x24x0.375	Pole	25.3%	Pass
80 - 75	Pole	TP24x24x0.375	Pole	33.0%	Pass
75 - 70	Pole	TP24x24x0.375	Pole	44.5%	Pass
70 - 65	Pole	TP24x24x0.375	Pole	55.6%	Pass
65 - 60	Pole	TP24x24x0.375	Pole	69.8%	Pass
60 - 55	Pole	TP30x30x0.375	Pole	55.8%	Pass
55 - 50	Pole	TP30x30x0.375	Pole	65.6%	Pass
50 - 45	Pole	TP30x30x0.375	Pole	75.6%	Pass
45 - 40	Pole	TP30x30x0.375	Pole	85.7%	Pass
40 - 39.33	Pole	TP30x30x0.375	Pole	87.1%	Pass
39.33 - 39.08	Pole + Reinf.	TP30x30x0.4875	Pole	68.4%	Pass
39.08 - 34.08	Pole + Reinf.	TP30x30x0.4875	Pole	76.5%	Pass
34.08 - 30	Pole + Reinf.	TP30x30x0.4875	Pole	83.2%	Pass
30 - 29.75	Pole	TP30x30x0.5	Pole	77.6%	Pass
29.75 - 25	Pole	TP30x30x0.5	Pole	84.9%	Pass
25 - 24.75	Pole + Reinf.	TP30x30x0.5563	Pole	76.8%	Pass
24.75 - 19.75	Pole + Reinf.	TP30x30x0.5563	Pole	84.0%	Pass
19.75 - 18.58	Pole + Reinf.	TP30x30x0.5563	Pole	85.7%	Pass
18.58 - 18.33	Pole + Reinf.	TP30x30x0.6875	Pole	74.4%	Pass
18.33 - 13.33	Pole + Reinf.	TP30x30x0.6875	Pole	80.8%	Pass
13.33 - 8.42	Pole + Reinf.	TP30x30x0.6875	Pole	87.3%	Pass
8.42 - 8.07	Pole + Reinf.	TP30x30x0.8625	Pole	67.2%	Pass
8.07 - 7.83	Pole + Reinf.	TP30x30x0.8625	Pole	67.5%	Pass
7.83 - 6	Pole + Reinf.	TP30x30x0.8625	Pole	69.3%	Pass
6 - 5.75	Pole + Reinf.	TP30x30x0.8	Pole	74.5%	Pass
5.75 - 2	Pole + Reinf.	TP30x30x0.8	Pole	78.6%	Pass
2 - 1.75	Pole + Reinf.	TP30x30x1.25	Reinf. 4 Weldment	76.4%	Pass
1.75 - 0	Pole + Reinf.	TP30x30x1.225	Reinf. 1 Weldment	76.5%	Pass
				Summary	
			Pole	87.3%	Pass
			Reinforcement	77.5%	Pass
			Overall	87.3%	Pass

Additional Calculations

Section Elevation (ft)	Moment of Inertia (in^4)			Area (in^2)			% Capacity*					
	Pole	Reinf.	Total	Pole	Reinf.	Total	Pole	R1	R2	R3	R4	R5
110 - 105	1315	n/a	1315	18.65	n/a	18.65	1.6%					
105 - 100	1315	n/a	1315	18.65	n/a	18.65	6.6%					
100 - 95	1315	n/a	1315	18.65	n/a	18.65	11.4%					
95 - 90	1315	n/a	1315	18.65	n/a	18.65	16.6%					
90 - 85	1942	n/a	1942	27.83	n/a	27.83	17.9%					
85 - 80	1942	n/a	1942	27.83	n/a	27.83	25.3%					
80 - 75	1942	n/a	1942	27.83	n/a	27.83	33.0%					
75 - 70	1942	n/a	1942	27.83	n/a	27.83	44.5%					
70 - 65	1942	n/a	1942	27.83	n/a	27.83	55.6%					
65 - 60	1942	n/a	1942	27.83	n/a	27.83	69.8%					
60 - 55	3829	n/a	3829	34.90	n/a	34.90	55.8%					
55 - 50	3829	n/a	3829	34.90	n/a	34.90	65.6%					
50 - 45	3829	n/a	3829	34.90	n/a	34.90	75.6%					
45 - 40	3829	n/a	3829	34.90	n/a	34.90	85.7%					
40 - 39.33	3829	n/a	3829	34.90	n/a	34.90	87.1%					
39.33 - 39.08	3829	1067	4897	34.90	8.76	43.66	68.4%		63.8%			
39.08 - 34.08	3829	1067	4897	34.90	8.76	43.66	76.5%		71.3%			
34.08 - 30	3829	1067	4897	34.90	8.76	43.66	83.1%		77.5%			
30 - 29.75	5042	n/a	5042	46.34	n/a	46.34	77.6%					
29.75 - 25	5042	n/a	5042	46.34	n/a	46.34	84.9%					
25 - 24.75	5042	533	5575	46.34	18.00	64.34	76.8%					60.2%
24.75 - 19.75	5042	533	5575	46.34	18.00	64.34	84.0%					65.8%
19.75 - 18.58	5042	533	5575	46.34	18.00	64.34	85.7%					67.2%
18.58 - 18.33	5098	1801	6899	46.34	34.95	81.29	74.4%			61.6%		55.6%
18.33 - 13.33	5098	1801	6899	46.34	34.95	81.29	80.8%			66.8%		60.4%
13.33 - 8.42	5098	1801	6899	46.34	34.95	81.29	87.3%			72.1%		65.1%
8.42 - 8.07	5042	3365	8407	46.34	40.60	86.94	67.2%	56.4%				57.5%
8.07 - 7.83	5042	3365	8407	46.34	40.60	86.94	67.5%	56.6%				57.8%
7.83 - 6	5042	3365	8407	46.34	40.60	86.94	69.3%	58.2%				59.3%
6 - 5.75	5042	2832	7874	46.34	22.60	68.94	74.5%	70.9%				
5.75 - 2	5042	2832	7874	46.34	22.60	68.94	78.6%	74.8%				
2 - 1.75	5052	6543	11595	46.34	48.85	95.19	55.6%	51.5%			76.4%	
1.75 - 0	5043	6419	11462	46.34	48.85	95.19	56.3%	76.5%			70.3%	

Note: Section capacity checked in 5 degree increments.
Rating per TIA-222-H Section 15.5.

Monopole Flange Plate Connection

Elevation = 90 ft.

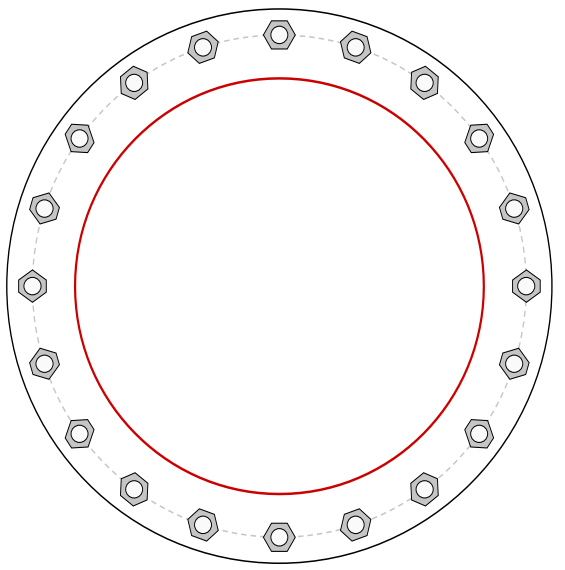
BU #	876325
Site Name	WESTON SQUARE
Order #	508994 Rev. 0

TIA-222 Revision	H

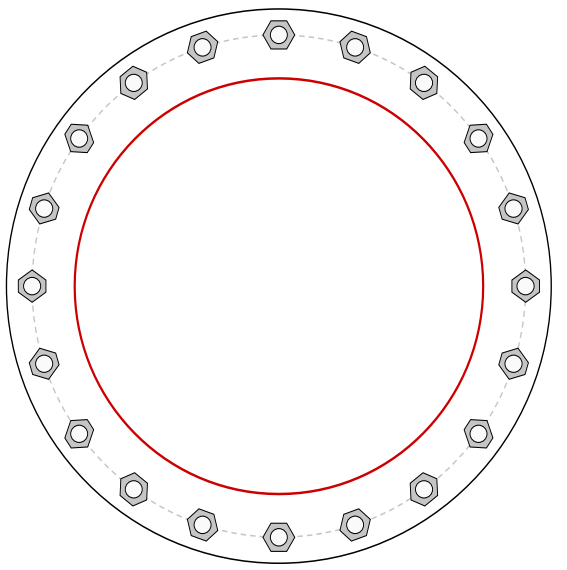
Applied Loads	
Moment (kip-ft)	67.02
Axial Force (kips)	3.44
Shear Force (kips)	4.44

**TIA-222-H Section 15.5 Applied*

Top Plate - External



Bottom Plate - External



Connection Properties

Bolt Data

(20) 1" ø bolts (A325 N; Fy=92 ksi, Fu=120 ksi) on 29" BC

Top Plate Data

32" OD x 1.5" Plate (A36; Fy=36 ksi, Fu=58 ksi)

Bottom Plate Data

32" OD x 1.5" Plate (A36; Fy=36 ksi, Fu=58 ksi)

Top Stiffener Data

N/A

Bottom Stiffener Data

N/A

Top Pole Data

24" x 0.25" round pole (A53-B-42; Fy=42 ksi, Fu=63 ksi)

Bottom Pole Data

24" x 0.375" round pole (A53-B-42; Fy=42 ksi, Fu=63 ksi)

Analysis Results

Bolt Capacity

Max Load (kips)	5.37	
Allowable (kips)	54.54	
Stress Rating:	**9.4%**	**Pass**

Top Plate Capacity

Max Stress (ksi):	-
Allowable Stress (ksi):	-
Stress Rating:	**Rohn OK**
Tension Side Stress Rating:	**Rohn OK**

Bottom Plate Capacity

Max Stress (ksi):	-
Allowable Stress (ksi):	-
Stress Rating:	**Rohn OK**
Tension Side Stress Rating:	**Rohn OK**

Monopole Flange Plate Connection

Elevation = 60 ft.

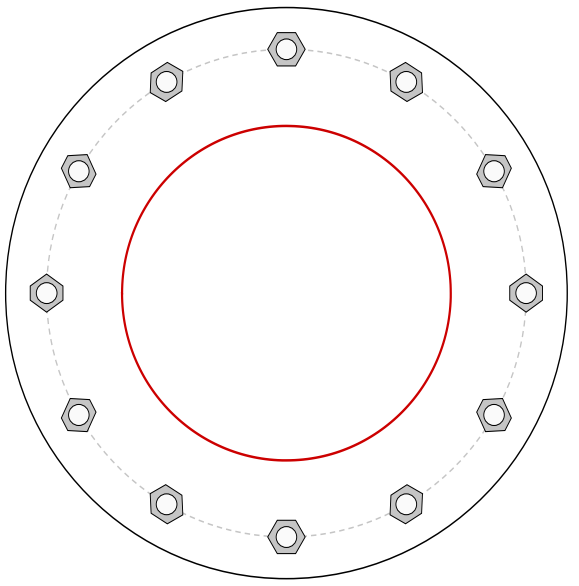
BU #	876325
Site Name	WESTON SQUARE
Order #	508994 Rev. 0

TIA-222 Revision	H

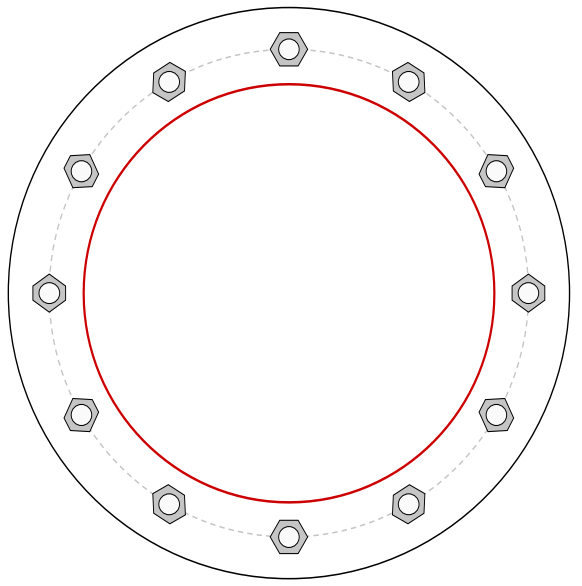
Applied Loads	
Moment (kip-ft)	445.96
Axial Force (kips)	17.17
Shear Force (kips)	18.91

**TIA-222-H Section 15.5 Applied*

Top Plate - External



Bottom Plate - External



Connection Properties

Bolt Data

(12) 1-1/2" ø bolts (A325 N; Fy=81 ksi, Fu=105 ksi) on 35" BC

Top Plate Data

41" OD x 2" Plate (A36; Fy=36 ksi, Fu=58 ksi)

Top Stiffener Data

N/A

Top Pole Data

24" x 0.375" round pole (A53-B-42; Fy=42 ksi, Fu=63 ksi)

Bottom Plate Data

41" OD x 2" Plate (A36; Fy=36 ksi, Fu=58 ksi)

Bottom Stiffener Data

N/A

Bottom Pole Data

30" x 0.375" round pole (A53-B-42; Fy=42 ksi, Fu=63 ksi)

Analysis Results

Bolt Capacity

Max Load (kips)	49.50	
Allowable (kips)	111.01	
Stress Rating:	**42.5%**	**Pass**

Top Plate Capacity

Max Stress (ksi):	-
Allowable Stress (ksi):	-
Stress Rating:	**Rohn OK**
Tension Side Stress Rating:	**Rohn OK**

Bottom Plate Capacity

Max Stress (ksi):	-
Allowable Stress (ksi):	-
Stress Rating:	**Rohn OK**
Tension Side Stress Rating:	**Rohn OK**

Welded-Plate Monopole Bridge Stiffeners
per TIA-222-H

CROWN CASTLE

Site Data

BU#: *876325*
Site Name: *WESTON SQUARE*
Order #: *508994 Rev 0*

Factored Loads at Splice Elevation		
Moment:	577.2	ft-kips
Axial:	0	kips
Shear:	0	kips

Elevation:	30	ft

Splice Bolt Data		
Quantity:	0	
Bolt Diameter:	1.5	in
Bolt Circle:	35	in

Pole Data		
Upper Diam:	30	in
Upper Thickness	0.375	in
Lower Diam:	30	in
Lower Thickness	0.5	in
Pipe Steel (Fy):	42	ksi

Bridge Stiffener Data		
Quantity:	3	
Total Length:	72.0	in
Plate Thickness:	1.250	in
Steel Grade (Fy):	65.0	ksi
Steel Ultimate (Fu):	80.0	ksi
Weld Type:	Fillet (both sides)	
Weld Size:	0.375	in
Weld Strength:	80	ksi
Upper Weld Length:	34	in
Upper Weld, C:	3.31	
Upper Plate Width:	11	in
Lower Weld Length:	32.375	in
Lower Weld, C:	3.25	
Lower Plate Width:	11	in
Gap PL Length:	5.6	in
Gap PL Width:	5	in

Stress Increase Factor		
ASIF:	1.000	

Stiffener Results	55.0%	
Maximum Compression:	196.5	kips
Allowable Compression:	357.3	kips
Compression Stress Ratio:	55.0%	
Maximum Tension:	196.5	kips
Allowable Tension:	365.6	kips
Tension Stress Ratio:	53.7%	
Maximum Flexure:	1670.2	in.kips
Allowable Flexure:	12774.2	in.kips
Bending&Shear Stress Ratio:	11.3%	

Weld Results	41.4%	
Upper Weld Eccentric Load:	196.49	kip
Allowable Weld Strength:	506.43	kip
Upper Weld Strength Ratio:	38.8%	
Upper Weld Eccentric Load:	196.49	kip
Allowable Weld Strength:	474.18	kip
Lower Weld Strength Ratio:	41.4%	

Pole Results	25.3%	
Punching Shear Stress:	9.56	kip/in
Allowable Punching Stress:	37.80	kip/in
Punching Shear Stress Ratio:	25.3%	

Loads to Use to Check Flange and Bolts w / CCIPlate		
Moment:	0	ft.kips
Axial:	0.0	kips
Shear:	0.0	kips

Bolted Bridge Stiffeners Reinforcement Check

TIA Rev. H

Description:

This sheet is for evaluation of the reinforcement of a flange connection using bolted bridge stiffeners.

Assumptions / Notes:

1. *For design purposes, it is assumed that the proposed bridge stiffeners are to take the full load.*
2. *The plastification of the pole is not considered.*
3. *All shear and axial loads are taken by the flange bolts.*

1. PARAMETERS

Analysis
Design

Flange Elevation: 30'- 0"

1.1 tnxTower Reactions

Apply TIA-222-H Section 15.5? No / Yes

Moment: $M := 463.8kip \cdot ft$

Axial Load: $P := 23.56kip$

Shear Load: $V := 20.70kip$

1.2 Shaft Properties at the Flange

Upper Shaft Diameter: $D_{shaft1} := 30in$

Upper Shaft Thickness: (inches) $t_1 := 0.375$

Lower Shaft Diameter: $D_{shaft2} := 30in$

Lower Shaft Thickness: (inches) $t_2 := 0.5$

Shaft Grade: $Fy_{shaft} := 42ksi$ $Fu_{shaft} := 60ksi$

1.3 Existing Bridge Stiffeners Properties

Number of Existing Bridge Stiffeners: $N_{new} := 3$

Thickness of Existing Bridge Stiffeners: $t_{new} := 1.25in$

Width of Existing Bridge Stiffeners: $w_{new} := 6in$

Diameter to the centroid of Existing Bridge Stiffeners: $BC_{new} := 43in$

Gross Area of One Exisnting Bridge Stiffener: $A_{g\_new} := w_{new} \cdot t_{new} = 7.5 \cdot in^2$

Radius of Gyration about x-axis: $r_x := \frac{t_{new}}{\sqrt{12}} = 0.361 \cdot in$

Moment of Inertia of Proposed Bridge Stiffeners: $I_{new} := \frac{N_{new} \cdot BC_{new}^2 \cdot A_{g\_new}}{8} = 5200.313 \cdot in^4$

1.5 Flange Bolt Properties

Number of Flange Bolts: $N_b := 0$

Diameter of Flange Bolts: 1"

Bolt Circle of Flange Bolts: $BC_{bolts} := 35in$

Gross Area of One Flange Bolt: $A_{g\_bolts} := \frac{\pi}{4} \cdot D_{bolts}^{2} = 0.785 \cdot in^2$

Moment of Inertia of Flange Bolts: $I_{bolts} := \frac{N_b \cdot BC_{bolts}^{2} \cdot A_{g\_bolts}}{8} = 0 \cdot in^4$

1.6 Division of Forces

Total Gross Area: $A_{g\_total} := N_{new} \cdot A_{g\_new} + N_b \cdot A_{g\_bolts} = 22.5 \cdot in^2$

Total Moment of Inertia: $I_{total} := I_{new} + I_{bolts} = 5200.313 \cdot in^4$

1.8 Reactions to Proposed Bridge Stiffeners

Moment Reaction to Proposed Bridge Stiffeners: $M_{new} := M \cdot \left(\frac{I_{new}}{I_{total}} \right) = 463.8 \cdot kip \cdot ft$

Axial Reaction to Proposed Bridge Stiffeners: $P_{new} := 0kip$

Shear Reaction to Proposed Bridge Stiffeners: $V_{new} := 0kip$

1.9 Reactions to Flange Bolts

(It is assumed that all shear and axial loads are taken by the flange bolts)

Moment Reaction to Flange Bolts: $M_{bolts} := M \cdot \left(\frac{I_{bolts}}{I_{total}} \right) = 0 \cdot kip \cdot ft$

Axial Reaction to Flange Bolts: $P_{bolts} := P = 23.56 \cdot kip$

Shear Reaction to Flange Bolts: $V_{bolts} := V = 20.7 \cdot kip$

Check Flange Connection in CCIplate with these Reactions

2. Determine Maximum Forces on Bridge Stiffener

2.1 Division of Forces For New Bridge Stiffener Design

Number of Flange Bolts:

$$N_{bolts} := \begin{cases} 0 & \text{if AorD = "Design"} \\ N_b & \text{if AorD = "Analysis"} \end{cases} = 0$$

Moment of Inertia of Flange Bolts:

$$I_{bolts} := \frac{N_{bolts} \cdot BC_{bolts}^{2} \cdot A_{g\_bolts}}{8} = 0 \cdot in^4$$

Total Gross Area:

$$A_{g\_total} := N_{new} \cdot A_{g\_new} + N_{bolts} \cdot A_{g\_bolts} = 22.5 \cdot in^2$$

Total Moment of Inertia:

$$I_{total} := I_{new} + I_{bolts} = 5200.313 \cdot in^4$$

2.2 Reactions to Proposed Bridge Stiffeners

Moment Reaction to Proposed Bridge Stiffeners:

$$M_{new} := M \cdot \left(\frac{I_{new}}{I_{total}} \right) = 463.8 \cdot kip \cdot ft$$

Axial Reaction to Proposed Bridge Stiffeners:

$$P_{new} := 0kip$$

Shear Reaction to Proposed Bridge Stiffeners:

$$V_{new} := 0kip$$

2.3 Maximum Axial Forces in Single Proposed Bridge Stiffener

Outer Radius of Bolt Circle:

$$C := \frac{BC_{new}}{2} = 21.5 \cdot in$$

Critical Compression Bending Stress:

$$P_{comp} := \frac{M_{new} \cdot C}{I_{new}} \cdot A_{g\_new} + \frac{P_{new}}{N_{new}} = 172.577 \cdot kip$$

Critical Tension Bending Stress:

$$P_{tens} := \frac{M_{new} \cdot C}{I_{new}} \cdot A_{g\_new} - \frac{P_{new}}{N_{new}} = 172.577 \cdot kip$$

3. Bridge Stiffener Calculations

3.1 Available Compression Strength

[AISC 15th Edition E3-1]

Resistance Factor: $\phi_c := 0.9$

Unbraced Length: $L_u := 14in$

Effective Length Factor: $K := 1.0$

Strength of Bridge Stiffener: $F_y := 65ksi$ $F_u := 80ksi$

Effective Length of Member: $L_c := K \cdot L_u = 14 \cdot in$ [AISC 15th Edition E3-2]

Elastic Buckling Stress:
[AISC 15th Ed., Eq.E3-4]

$$F_e := \frac{\pi^2 \cdot 29000ksi}{\left(\frac{L_c}{r_x}\right)^2} = 190.143 \cdot ksi$$

Determination of Crticial Stress:
[AISC 15th Ed., Eqs. E3-2 and E3-3]

$$F_{cr} := \begin{cases} \left(0.658^{\frac{F_y}{F_e}} \cdot F_y\right) & \text{if } 4.71 \cdot \sqrt{\frac{E}{F_y}} \geq \frac{L_c}{r_x} \\ \left(0.877 \cdot F_e\right) & \text{otherwise} \end{cases}$$

$F_{cr} = 56.334 \cdot ksi$

Allowable Compressive Strength:
[AISC 15th Ed., Eqs. J4-6 and E3-1]

$$\phi P_n := \begin{cases} \left(\phi_c \cdot F_y \cdot A_{g\_new}\right) & \text{if } \frac{L_c}{r_x} \leq 25 \\ \left(\phi_c \cdot F_{cr} \cdot A_{g\_new}\right) & \text{otherwise} \end{cases}$$

$\phi P_n = 380.258 \cdot kip$

Check Compressive Strength:

$$Check_{comp} := \begin{cases} \text{"OK"} & \text{if } Capacity_{comp} \leq 100\% \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

$Check_{comp} = \text{"OK"}$

$Capacity_{comp} = 43.223 \cdot \%$

3.2 Available Tension Strength

Gross Section Yield [AISC 15th Edition Ch. D2]

Available Tension Yield Strength: $\phi P_{ty} := 0.9 \cdot F_y \cdot A_{g\_new} = 438.75 \cdot kip$

Net Section Fracture

Bolt Hole Diameter: $BH := 1.1875in$

Thickness: $T := t_{new} = 1.25 \cdot in$

Net Area: $A_{net} := A_{g\_new} - \left(BH + \frac{1}{16} in \right) \cdot T = 5.937 \cdot in^2$

Net Area Limitation: $A_e := A_{net} = 5.937 \cdot in^2$

Available Fractile Strength: $\phi P_{tr} := 0.75 \cdot F_u \cdot A_e = 356.25 \cdot kip$

Tension Check

Controlling Mode of Failure:

$$Check_{mode} := \begin{cases} \text{"Fracture Controls"} & \text{if } \frac{P_{tens}}{\phi P_{tr}} > \frac{P_{tens}}{\phi P_{ty}} \\ \text{"Yield Controls"} & \text{otherwise} \end{cases}$$

$Check_{mode} = \text{"Fracture Controls"}$

$$\phi P_{nt} := \begin{cases} \phi P_{tr} & \text{if } Check_{mode} = \text{"Fracture Controls"} \\ \phi P_{ty} & \text{otherwise} \end{cases}$$

Controlling Tension Mode Check:

$$Check_{tension} := \begin{cases} \text{"OK"} & \text{if } Capacity_{tension} \le 100\% \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

$Check_{tension} = \text{"OK"}$

$Capacity_{tension} = 46.136 \cdot \%$

4. Bolt Checks

4.1 Evaluate Bolts for Controlling Capacity of the Plate or Controlling Axial Demand

Controlling Capacity Ratio:

$$Capacity_{max} := \begin{cases} \max\left(\frac{P_{comp}}{\phi P_n}, \frac{P_{tens}}{\phi P_{ty}}, \frac{P_{tens}}{\phi P_{tr}}\right) & \text{if S15Allowable = "No"} \\ \max\left(\frac{P_{comp}}{\phi P_n}, \frac{P_{tens}}{\phi P_{ty}}, \frac{P_{tens}}{\phi P_{tr}}\right) \cdot \left(\frac{1}{1.05}\right) & \text{if S15Allowable = "Yes"} \end{cases} = 46.136 \cdot \%$$

Controlling Capacity/Demand: $P_{max} = 172.577 \cdot kip$

4.2 Blind Bolt Properties

[ENG-STD-10183]

AJAX - Standard Sleeve
AJAX - Hi Shear Sleeve
NextGen2
FORGBolt
Design
Default

Number of Bolts in the Eccentric Bolt Group: $N_{be} := 14$

Number of Bolts in Shear-Only Group: $N_{bs} := 0$

Intermediate Bolt Spacing: $L_b := 3in$

Eccentricity: $ecc := \frac{BC_{new} - D_{shaft1}}{2} = 6.5 \cdot in$

Bolt Diameter: $D_b := 20mm$

Bolt Hole Diameter: $D_h := 1.1875in$

Sleeve Diameter: $D_s := 1.14173in$

Washer Diameter: $D_w := 42mm = 1.654 \cdot in$

Ultimate Strength: $Fu_{bolt} := 120ksi$

Gross Area: $A_{gb} := \frac{\pi}{4} \cdot D_b^{\,2} = 0.487 \cdot in^2$

Allowable Shear: $\phi R_{nv} = 53.98 \cdot kip$

4.4 Eccentric Connection

Bolt Shear Capacity:

$$\phi R_{nv1} := \begin{cases} \phi R_{nv} & \text{if } N_{be} \cdot L_b \le 38\text{in} \\ \left(\phi R_{nv} \cdot 0.833\right) & \text{if } N_{be} \cdot L_b > 38\text{in} \end{cases}$$

[AISC 15th Edition Table J3.2 Note (b)]

$$\phi R_{nv1} = 44.965 \cdot \text{kip}$$

Applied Bolt Shear:

$$V_{max} := \frac{P_{max}}{N_{be}} = 12.327 \cdot \text{kip}$$

$$Check_{ecc1} := \begin{cases} \text{"OK"} & \text{if } Capacity_{shear.eccentric} \le 100\% \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

$$Check_{ecc1} = \text{"OK"}$$

5. Pole/ Shaft Checks

5.1 Shaft Bearing

[AISC 15th Ed., Eqs. J3-6a and J3-6c]

Minimum Thickness to Bear On: $t := \min(t_1, t_2) \cdot in = 0.375 \cdot in$

Clear Distance from Edge of Hole to Edge of Adjacent Hole: $L_{ca} := L_b - D_h = 1.812 \cdot in$

Bearing By Tear-out: $Rn_{shaft1} := 1.2 \cdot L_c \cdot t \cdot Fu_{shaft} = 48.937 \cdot kip$

Bearing By Hole Deformation: $Rn_{shaft2} := 2.4 \cdot D_s \cdot t \cdot Fu_{shaft} = 61.653 \cdot kip$

Bearing Capacity: $\phi Rn_{shaft} := 0.75 \cdot \min(Rn_{shaft1}, Rn_{shaft2}) = 36.703 \cdot kip$

$$Check_{bearing} := \begin{cases} \text{"OK"} & \text{if } Capacity_{shaft.bearing} \le 100\% \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

$Check_{bearing} = \text{"OK"}$

5.2 Pull-Out Check (through shaft wall)

AISC Design Guide 24 Ch. 3

Reduction Factor: $\phi := 0.67$

Hollow Member Pull-Out Capacity: $\phi R_n := \phi \cdot (0.6 \cdot \pi \, D_w \cdot t) \cdot Fu_{shaft} = 46.987 \cdot kip$

$r_{ut} = 7.631 \cdot kip$

$$Check_{pull} := \begin{cases} \text{"OK"} & \text{if } Capacity_{pullout} \le 100\% \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

$Check_{pull} = \text{"OK"}$

6. Weld Connection to Filler Plates

6.1 Weld Sizing

Thickness of Filler Plate: 6"

Interpolation per AISC SCM Table 8-4:

13th Edition
14th Edition
15th Edition

Length of Filler Plate: $L_{be} := N_{be} \cdot L_b = 42 \cdot in$

Weld Material Grade: (•) E70XX ( ) E80XX

Electrode Strength Coefficient: $C_1 = 1$

Coefficient for Eccentrically Loaded Weld Groups: $C = 3.645$

Weld Reduction Factor: $\phi_w := 0.75$

Minimum Weld Size for Eccentrically Loaded Weld:

$$D_{min} := \frac{P_{max}}{\phi_w \cdot C \cdot C_1 \cdot L_{be} \cdot \frac{kip}{in^2}} = 1.503 \cdot in$$ *(In sixteenths of an inch)*

$$D_{min1} := ceil\left(\frac{D_{min}}{in}\right) \cdot in = 2 \cdot in$$ *(In sixteenths of an inch)*

Minimum Fillet Size per Material Thickness (In sixteenths of an inch): $D_{min2} = 5 \cdot in$ [AISC 15th Edition Table J2.3]

Design Weld Size (In sixteenths of an inch): $D := \max(D_{min1}, D_{min2}) = 5 \cdot in$

6.2 Weld Capacity

Weld Capacity:

$$\phi R_w := \phi_w \cdot C \cdot C_1 \cdot L_{be} \cdot D \cdot \frac{kip}{in^2} = 574.125 \cdot kip$$

Check Weld Does Not Control:

$$Check_{weld} := \begin{cases} \text{"OK"} & \text{if } Capacity_{weld} \le 100\% \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

$Check_{weld} = \text{"OK"}$

Weld Size Used: $D = \frac{5}{16} \cdot in$

Monopole Flange Plate Connection

Elevation = 30 ft.

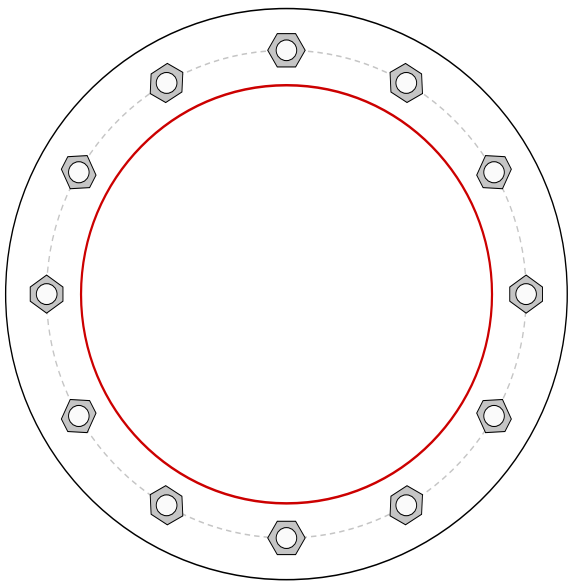
BU #	876325
Site Name	WESTON SQUARE
Order #	508994 Rev. 0

TIA-222 Revision	H

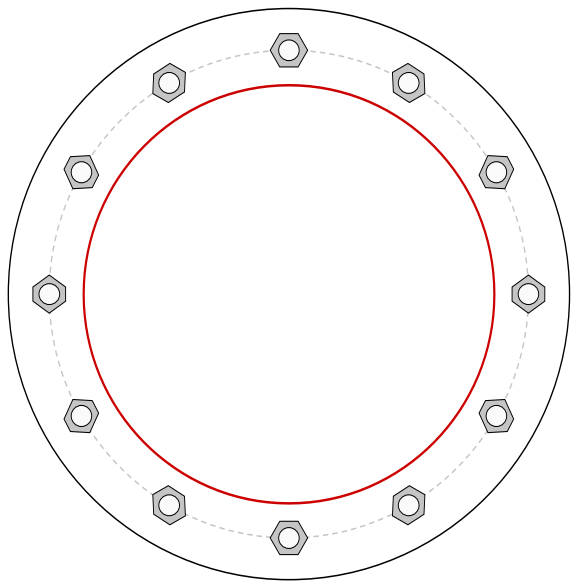
Applied Loads	
Moment (kip-ft)	0.00
Axial Force (kips)	23.56
Shear Force (kips)	20.70

**TIA-222-H Section 15.5 Applied*

Top Plate - External



Bottom Plate - External



Connection Properties

Bolt Data

(12) 1-1/2" ø bolts (A325 N; Fy=81 ksi, Fu=105 ksi) on 35" BC

Top Plate Data

41" OD x 2" Plate (A36; Fy=36 ksi, Fu=58 ksi)

Top Stiffener Data

N/A

Top Pole Data

30" x 0.375" round pole (A53-B-42; Fy=42 ksi, Fu=63 ksi)

Bottom Plate Data

41" OD x 2" Plate (A36; Fy=36 ksi, Fu=58 ksi)

Bottom Stiffener Data

N/A

Bottom Pole Data

30" x 0.5" round pole (A53-B-42; Fy=42 ksi, Fu=63 ksi)

Analysis Results

Bolt Capacity

Max Load (kips)	0.00	
Allowable (kips)	111.00	
Stress Rating:	**0.0%**	**Pass**

Top Plate Capacity

Max Stress (ksi):	0.41	(Flexural)
Allowable Stress (ksi):	32.40	
Stress Rating:	**1.2%**	**Pass**
Tension Side Stress Rating:	**0.0%**	**Pass**

Bottom Plate Capacity

Max Stress (ksi):	0.41	(Flexural)
Allowable Stress (ksi):	32.40	
Stress Rating:	**1.2%**	**Pass**
Tension Side Stress Rating:	**0.0%**	**Pass**

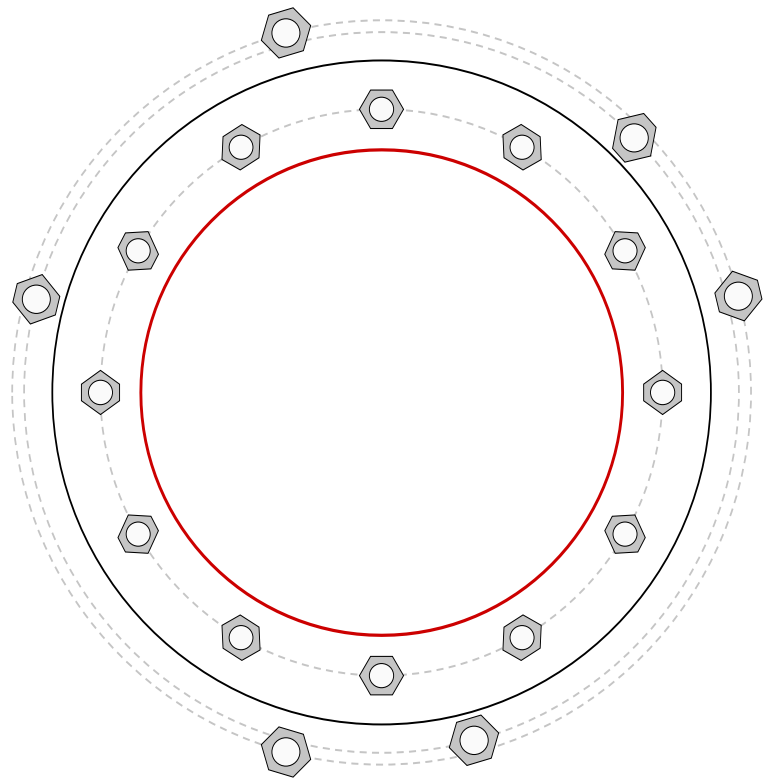
Monopole Base Plate Connection

Site Info	
BU #	876325
Site Name	WESTON SQUARE
Order #	508994 Rev. 0

Analysis Considerations	
TIA-222 Revision	H
Grout Considered:	No
l_{ar} (in)	0.5

Applied Loads	
Moment (kip-ft)	1710.00
Axial Force (kips)	39.21
Shear Force (kips)	23.68

**TIA-222-H Section 15.5 Applied*



Connection Properties

Anchor Rod Data

GROUP 1: (12) 1-1/2" ø bolts (A354-BC N; Fy=109 ksi, Fu=125 ksi) on 35" BC
GROUP 2: (3) 1-3/4" ø bolts (A722 N; Fy=120 ksi, Fu=125 ksi) on 44.5" BC
GROUP 3: (3) 1-3/4" ø bolts (A193 Gr. B7 N; Fy=105 ksi, Fu=125 ksi) on 46" BC
pos. (deg): 15, 105, 255

Base Plate Data

41" OD x 2" Plate (A36; Fy=36 ksi, Fu=58 ksi)

Stiffener Data

N/A

Pole Data

30" x 0.5" round pole (A53-B-42; Fy=42 ksi, Fu=63 ksi)

Analysis Results

Anchor Rod Summary *(units of kips, kip-in)*

GROUP 1:		
Pu_c = 95.87	ϕPn_c = 153.69	**Stress Rating**
Vu = 1.97	ϕVn = 46.11	**59.6%**
Mu = n/a	ϕMn = n/a	**Pass**
GROUP 2:		
Pu_c = 223.38	ϕPn_c = 237.03	**Stress Rating**
Vu = 0	ϕVn = 93.6	**89.8%**
Mu = 0	ϕMn = 108.42	**Pass**
GROUP 3:		
Pu_c = 154.51	ϕPn_c = 199.5	**Stress Rating**
Vu = 0	ϕVn = 59.85	**73.8%**
Mu = 0	ϕMn = 59.26	**Pass**

Base Plate Summary

Max Stress (ksi):	19.67	(Flexural)
Allowable Stress (ksi):	32.4	
Stress Rating:	**57.8%**	**Pass**

Anchor Rod Bracket Calculations:

Additional Anchor Rod Group:

$N_{new} := 3$ $D_{new} := 1.75 \cdot in$ $Fu_{rod} := 125 ksi$

$BC_{new} := 44.5 \cdot in$ $A_{net\_new} := 2.6 \cdot in^2$ $Fy_{rod} := 120 ksi$

$A_{n\_new} := N_{new} \cdot A_{net\_new} = 7.8 \cdot in^2$

Anchor Rod Bracket Calculations

Analysis
Design

Comment = "Design the anchor rod brackets to resist the full capacity of the anchor rod"

Anchor Rod Demand Force:

$P_{umax} := 0 kip$

Bracket Loading:

$$P_u := \begin{cases} \phi P_n & \text{if AorD = "Design"} \\ P_{umax} & \text{if AorD = "Analysis"} \end{cases} = 312 \cdot kip$$

Tube Design (HSS)

Member Size: HSS 4 1/2 x 4 1/2 x 1/2

Apply TIA-222-H Section 15.5? No / Yes

Member Properties (AISC 15th Ed., Table 1-12):

Outside Diameter: $OD_{HSS} := 4.5 \cdot in$

Area: $A_{HSS} := 6.95 \cdot in^2$ $A_{e\_HSS} := 0.75 \cdot A_{HSS} = 5.21 \cdot in^2$

Thickness: $t_{HSS} := .465 \cdot in$

Yield Strength: $F_{y\_HSS} := 50 \cdot ksi$ $F_{u\_HSS} := 62 \cdot ksi$

Length: $L_{HSS} := 13 \cdot in$

Moment of Inertia: $I_{HSS} := 18.1 \cdot in^4$

Radius of Gyration: $r_{HSS} := 1.61 \cdot in$

Inside Dimension: $ID_{HSS} := OD_{HSS} - 2 \cdot t_{HSS} = 3.57 \cdot in$

Bearing Check
(AISC 15th Ed., Equation J7-1):

$\phi_b := 0.75$

$Pu\_c = \phi_b \cdot R_n = \phi_b \cdot 1.8 \cdot F_{y\_HSS} \cdot A_{pb}$

$A_{pb} := \frac{P_u}{\phi_b \cdot 1.8 \cdot F_{y\_HSS}} = 4.62 \cdot in^2$

$Check_{bear} := \begin{cases} \text{"OK"} & \text{if } A_{HSS} \geq A_{pb} \\ \text{"N/G"} & \text{otherwise} \end{cases}$

$Check_{bear} = \text{"OK"}$

Compression Check
(AISC 15th Ed., Eqs. E3-1 to E3-4):

$\phi_c := 0.9$

$K := 1$

$\phi P_{u\_comp} = \phi_c \cdot F_{cr} \cdot A_g$

$L_c := K \cdot L_{HSS} = 13 \cdot in$

$F_e := \frac{\pi^2 \cdot 29000ksi}{\left(\frac{L_c}{r_{HSS}}\right)^2} = 4389.98 \cdot ksi$

$\frac{L_c}{r_{HSS}} = 8.07 \quad < \quad 4.71 \cdot \sqrt{\frac{29000 \cdot ksi}{F_{y\_HSS}}} = 113.43$

$$\therefore \quad F_{cr} := 0.658^{\frac{F_{y\_HSS}}{F_e}} \cdot F_{y\_HSS} = 49.76 \cdot ksi$$

(AISC 15th Ed., Equation J4-6):

$$\phi P_{u\_comp} := \begin{cases} \phi_c \cdot F_{y\_HSS} \cdot A_{HSS} & \text{if } \frac{L_c}{r_{HSS}} \le 25 \\ \phi_c \cdot F_{cr} \cdot A_{HSS} & \text{otherwise} \end{cases}$$

$$\phi P_{u\_comp} = 312.75 \cdot kip$$

$$Check_{comp} := \begin{cases} \text{"OK"} & \text{if } Rating_{comp} < 100\% \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

$Check_{comp} = \text{"OK"}$

Gusset Plate Design

Gusset Plate width: $w_{plate} := 4.5 \cdot in$

Gusset Plate thickness: $t_{plate} := 1in$

$L_{plate1} := 26in$

$L_{plate2} := 13in$

Gusset Plate Strength: $Fy_{plate} := 65ksi$

$Fu_{plate} := 80ksi$

Pole thickness: $t_{pole} := 0.5in$

Shear Check
(AISC 15th Ed., Eqs. J4-3 and J4-4):

$A_g := t_{plate} \cdot L_{plate2} = 13 \cdot in^2$

$A_{nv} := A_g = 13 \cdot in^2$

Shear Yielding

$\phi_v := 1$

$\phi V_{plate} := \phi_v \cdot 0.6 \cdot A_g \cdot Fy_{plate} = 507 \cdot kip$

$$Check_{shear} := \begin{cases} \text{"OK"} & \text{if } Rating_{sheary} < 100\% \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

$Check_{shear} = \text{"OK"}$

Shear Rupture

$\phi_v := 0.75$

$\phi V_{plate} := \phi_v \cdot 0.6 \cdot A_{nv} \cdot Fu_{plate} = 468 \cdot kip$

$$Check_{shear} := \begin{cases} \text{"OK"} & \text{if } Rating_{shearr} < 100\% \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

$Check_{shear} = \text{"OK"}$

Gusset Plate to Tower and Base Plate Weld Design (Horizontal and

Vertical Weld):
(AISC 15th Ed., Part 8)

Gusset plate thickness: $t_{plate} = 1 \cdot in$

Tower Grade: $Fy_{pole} := 42ksi$ $Fu_{pole} := 63ksi$

Base Plate Grade: $Fy_{base} := 36ksi$ $Fu_{base} := 58ksi$

Gussett Plate Grade: $Fy_{plate} = 65 \cdot ksi$ $Fu_{plate} = 80 \cdot ksi$

Height of vertical weld from base plate: $H := L_{plate1} = 26 \cdot in$

$Notch_{horiz} := .75 \cdot in$

$Notch_{vert} := 1 \cdot in$

Gap between Base Plate and HSS: $Gap := 0in$

Vertical fillet weld size to pole:
(in sixteenths of an inch) $D_{vpole} := 8$

$$weldsize_{pole} := \frac{D_{vpole}}{16} = \frac{1}{2}$$

Electrode Strength:

$$Check := \begin{cases} \text{"OK"} & \text{if } Rating_{weld2} < 100\% \\ \text{"INSUFFICIENT"} & \text{otherwise} \end{cases}$$

Check = "OK"

Gusset Plate to HSS Weld Design
(AISC 15th Ed., Table 8-4)

Interpolation per AISC SCM Table 8-4:

Electrode Strength:

Fillet Weld Size (in sixteenths of an inch): $D := 5$

Groove Weld:

Groove Depth (inches): $GD := .5in$

Assume the worst-case installation scenario where the rod is positioned directly against the far side of the HSS.

$$ecc_2 := OD_{HSS} - t_{HSS} - \frac{D_{new}}{2} = 3.16 \cdot in$$

Load not in plane with weld group:

$k := 0$

$$a := \frac{ecc_2}{L_{plate2}} = 0.24$$

$C_1 = 1.03$

$Coeff_1 = 3.34$

$\phi_w := 0.75$

$$D_{min1} := ceil\left(\frac{P_u \cdot in}{\phi_w \cdot Coeff_1\, C_1 \cdot L_{plate2} \cdot kip}\right) = 10$$

$$minweldsize := \frac{D_{min1}}{16} = \frac{5}{8}$$

$$Check_{weld} := \begin{cases} \text{"OK"} & \text{if } D_1 \geq D_{min1} \wedge D_1 \geq Min_{weldsize} \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

$Check_{weld} = \text{"OK"}$

$\phi Rn_{weld1} := \phi_w \cdot Coeff_1\, ksi \cdot in \cdot C_1 \cdot D_1 \cdot L_{plate2} = 452.01 \cdot kip$

$$Check_{weld1} := \begin{cases} \text{"OK"} & \text{if } Rating_{weld1} < 100\% \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

$Check_{weld1} = \text{"OK"}$

Gusset Plate to Pole Punching Shear Check (max per unit length): (AISC 15th Ed., Section J4.2)

What is the bracket welded to?

Reinforcement Thickness: $t_{ref} := 0in$

Reinforcement Grade: $F_{y\_ref} := 0ksi$

$F_{u\_ref} := 0ksi$

Assume the worst-case installation scenario where the rod is positioned directly against the far side of the HSS.

$\phi_{sy} := 1.0$

$\phi_{sr} := 0.75$

$ecc_1 := w_{plate} + OD_{HSS} - t_{HSS} - \frac{D_{new}}{2} = 7.66 \cdot in$

$M_1 := P_u \cdot ecc_1 = 2389.92 \cdot kip \cdot in$

$S_1 := \frac{t_{plate} \cdot L_{plate1}^2}{6} = 112.67 \cdot in^3$

$f_v := \frac{M_1}{S_1} \cdot t_{plate} \cdot 1in = 21.21 \cdot kip$

AISC 15th Ed., Equation J4-3:

$\phi F_{sy} := \phi_{sy} \cdot 0.6 \cdot Fy_{pole} \cdot 2 \cdot t_{pole} \cdot 1in$

$\phi F_{sy\_ref} := \phi_{sy} \cdot 0.6 \cdot F_{y\_ref} \cdot 2 \cdot t_{ref} \cdot 1in$

AISC 15th Ed., Equation J4-4:

$\phi F_{sr} := \phi_{sr} \cdot 0.6 \cdot Fu_{pole} \cdot 2 \cdot t_{pole} \cdot 1in$ $\phi F_{sr\_ref} := \phi_{sr} \cdot 0.6 \cdot F_{u\_ref} \cdot 2 \cdot t_{ref} \cdot 1in$

$\phi F_v = 25.2 \cdot kip$

$$Check_{PS1} := \begin{cases} \text{"OK"} & \text{if } Rating_{PS1} < 100\% \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

$Check_{PS1} = \text{"OK"}$

Gusset Plate to HSS Punching Shear Check (max per unit length): (AISC 15th Ed., Section J4.2)

Assume the worst-case installation scenario where the rod is positioned directly against the far side of the HSS.

$ecc_2 := OD_{HSS} - t_{HSS} - \frac{D_{new}}{2} = 3.16 \cdot in$

$M_2 := P_u \cdot ecc_2 = 985.92 \cdot kip \cdot in$

$S_2 := \frac{t_{plate} \cdot L_{plate2}^2}{6} = 28.17 \cdot in^3$

$f_v := \frac{M_2}{S_2} \cdot t_{plate} \cdot 1in = 35 \cdot kip$

AISC 15th Ed., Equation J4-3:

$\phi F_{sy} := \phi_{sy} \cdot 0.6 \cdot F_{y\_HSS} \cdot 2 \cdot 2 \cdot t_{HSS} \cdot 1in = 55.8 \cdot kip$

AISC 15th Ed., Equation J4-4:

$\phi F_{sr} := \phi_{sr} \cdot 0.6 \cdot F_{u\_HSS} \cdot 2 \cdot 2 \cdot t_{HSS} \cdot 1in = 51.89 \cdot kip$

$\phi F_w := \min(\phi F_{sy}, \phi F_{sr}) = 51.89 \cdot kip$

$$Check_{PS2} := \begin{cases} \text{"OK"} & \text{if } Rating_{PS2} < 100\% \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

$Check_{PS2} = \text{"OK"}$

Embedment Depth Calculations

Projected Embedment Depth: $L_{em} := 8 \cdot ft$

Concrete Strength: $f'_c := 3000psi$

Are anchor rods installed in piers?:

Yield Strength of Rebar: $f_y := 60ksi$

Transverse Reinforcement Index: $k_{tr} := 0$ Can be taken as 0 for design per ACI 318-14

Epoxy Factor: $\psi_e := 1$

Rebar Size Factor: $\psi_s := 1$

Casting Position Factor: $\psi_t := 1$

Concrete Weight Factor: $\lambda := 1 \cdot \sqrt{psi}$

Pier Diameter: $D_{pier} := 5ft$

Cover: $c_c := 3in$

Rebar Size: $d_s := 9$

$d_b := \left| vlookup\left(d_s, d_{btable}, 2\right) \right| \cdot in = 1.13 \cdot in$

Tie Size: $Tie := 4$

Number of Vertical Rebar: $n := 16$

The embedment depth shall be analyzed based on the design tension capacity of the anchor rods.

Design Load:

$\phi P_{nt} := 0.75 \cdot Fu_{rod} \cdot A_{net\_new} = 243.75 \cdot kip$

Development Length (ACI 318-14 Chapter 25):

$BC_{rebar} := D_{pier} - 2 \cdot c_c - \frac{Tie \cdot in}{4} - d_b = 51.87 \cdot in$

$S_{rebar} := \frac{\pi \cdot BC_{rebar}}{n} = 10.185 \cdot in$

$c_b := \min\left(c_c + \frac{Tie}{8} in + \frac{d_b}{2}, S_{rebar} \cdot 0.5 \right) = 4.06 \cdot in$

ACI 318-14, Equation 25.4.2.3a:

$l_d := \left[\frac{3}{40} \cdot \frac{f_y}{\lambda \cdot \sqrt{f'_c}} \cdot \frac{\psi_t \cdot \psi_e \cdot \psi_s}{\min\left[\left(\frac{c_b + k_{tr}}{d_b} \right), 2.5 \right]} \right] \cdot d_b = 37.07 \cdot in$

Calculate Max Distance Between Rebar and New Anchor Rods:

$A := \frac{1}{2} \cdot S_{rebar} = 5.093 \cdot in$

$B := \frac{BC_{rebar}}{2} - \frac{BC_{new}}{2} = 3.686 \cdot in$

$G := \sqrt{A^2 + B^2} = 6.287 \cdot in$

$l'_d := l_d + \frac{G}{1.5} + 3in = 3.69\ ft$

Epoxy Development Length: Bond Strength:

Epoxy :=

$$S_b := \begin{cases} S_{bh} & \text{if Epoxy} = 0 \\ S_{bA} & \text{if Epoxy} = 1 \wedge \left(f'_c = 4000\text{psi} \vee f'_c > 4000\cdot\text{psi}\right) \\ 0.94 S_{bA} & \text{if Epoxy} = 1 \wedge \left(f'_c = 3000\text{psi} \vee f'_c < 3000\cdot\text{psi}\right) \\ E_{bond} & \text{if Epoxy} = 1 \wedge f'_c > 3000\text{psi} \wedge f'_c < 4000\text{psi} \end{cases} = 1130\,\text{psi}$$

$$\phi_{bond} := 0.65$$

$$L_{be} := \frac{\phi P_{nt}}{\pi \cdot D_{new} \cdot S_b \cdot \phi_{bond}} = 60.36\cdot\text{in}$$

Required Embedment Length:

Length of Breaker Tape: $L_{BT} := 0\cdot\text{in}$

$$L_{min} := \begin{cases} \max\left(L_{be} + L_{BT}, l'_d + 0.25\cdot L_{be}\right) & \text{if Piers} = \text{"Yes"} \\ \left(L_{be} + L_{BT}\right) & \text{if Piers} = \text{"No"} \end{cases} = 5.03\,\text{ft}$$

$$\text{Check} := \begin{cases} \text{"OK"} & \text{if } L_{min} \le L_{em} \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

Check = "OK"

Anchor Rod Bracket Summary

Bracket HSS Compression:	$Rating_{comp} = 95.01 \cdot \%$
Bracket Plate Shear Yielding:	$Rating_{sheary} = 58.61 \cdot \%$
Bracket Plate Shear Rupture:	$Rating_{shearr} = 63.49 \cdot \%$
Bracket Plate to Pole Weld:	$Rating_{weld2} = 89.53 \cdot \%$
Bracket Plate to HSS Weld:	$Rating_{weld1} = 65.74 \cdot \%$
Bracket Plate to Pole Punching Shear:	$Rating_{PS1} = 80.17 \cdot \%$
Bracket Plate to HSS Punching Shear:	$Rating_{PS2} = 64.24 \cdot \%$

BU: 876325
WO: 1819530
Existing AR Modified Brackets
On Channel

Done By: A. Reyes
Checked By:
Date: 1/8/2020

BLACK & VEATCH
Building a world of difference.

Anchor Rod Bracket Calculations:

Additional Anchor Rod Group:

$N_{new} := 3$ $D_{new} := 1.75 \cdot in$ $Fu_{rod} := 125 ksi$

$BC_{new} := 44.5 \cdot in$ $A_{net\_new} := 2.6 \cdot in^2$ $Fy_{rod} := 120 ksi$

$A_{n\_new} := N_{new} \cdot A_{net\_new} = 7.8 \cdot in^2$

Anchor Rod Bracket Calculations

Analysis
Design

Comment = "Design the anchor rod brackets to resist the full capacity of the anchor rod"

Anchor Rod Demand Force:

$P_{umax} := 0 kip$

Bracket Loading:

$$P_u := \begin{cases} \phi P_n & \text{if AorD = "Design"} \\ P_{umax} & \text{if AorD = "Analysis"} \end{cases} = 312 \cdot kip$$

Tube Design (HSS)

Member Size: HSS 4 1/2 x 4 1/2 x 1/2

Apply TIA-222-H Section 15.5? No / Yes

Member Properties (AISC 15th Ed., Table 1-12):

Outside Diameter: $OD_{HSS} := 4.5 \cdot in$

Area: $A_{HSS} := 6.95 \cdot in^2$ $A_{e\_HSS} := 0.75 \cdot A_{HSS} = 5.21 \cdot in^2$

Thickness: $t_{HSS} := .465 \cdot in$

Yield Strength: $F_{y\_HSS} := 50 \cdot ksi$ $F_{u\_HSS} := 62 \cdot ksi$

Length: $L_{HSS} := 16 \cdot in$

Moment of Inertia: $I_{HSS} := 18.1 \cdot in^4$

Radius of Gyration: $r_{HSS} := 1.61 \cdot in$

Inside Dimension: $ID_{HSS} := OD_{HSS} - 2 \cdot t_{HSS} = 3.57 \cdot in$

Bearing Check
(AISC 15th Ed., Equation J7-1):

$\phi_b := 0.75$

$Pu\_c = \phi_b \cdot R_n = \phi_b \cdot 1.8 \cdot F_{y\_HSS} \cdot A_{pb}$

$A_{pb} := \frac{P_u}{\phi_b \cdot 1.8 \cdot F_{y\_HSS}} = 4.62 \cdot in^2$

$Check_{bear} := \begin{cases} \text{"OK"} & \text{if } A_{HSS} \geq A_{pb} \\ \text{"N/G"} & \text{otherwise} \end{cases}$

$Check_{bear} = \text{"OK"}$

Compression Check
(AISC 15th Ed., Eqs. E3-1 to E3-4):

$\phi_c := 0.9$

$K := 1$

$\phi P_{u\_comp} = \phi_c \cdot F_{cr} \cdot A_g$

$L_c := K \cdot L_{HSS} = 16 \cdot in$

$F_e := \frac{\pi^2 \cdot 29000ksi}{\left(\frac{L_c}{r_{HSS}}\right)^2} = 2898.07 \cdot ksi$

$\frac{L_c}{r_{HSS}} = 9.94 \quad < \quad 4.71 \cdot \sqrt{\frac{29000 \cdot ksi}{F_{y\_HSS}}} = 113.43$

$$\therefore \quad F_{cr} := 0.658^{\frac{F_{y\_HSS}}{F_e}} \cdot F_{y\_HSS} = 49.64 \cdot ksi$$

(AISC 15th Ed., Equation J4-6):

$$\phi P_{u\_comp} := \begin{cases} \phi_c \cdot F_{y\_HSS} \cdot A_{HSS} & \text{if } \frac{L_c}{r_{HSS}} \le 25 \\ \phi_c \cdot F_{cr} \cdot A_{HSS} & \text{otherwise} \end{cases}$$

$$\phi P_{u\_comp} = 312.75 \cdot kip$$

$$Check_{comp} := \begin{cases} \text{"OK"} & \text{if } Rating_{comp} < 100\% \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

$Check_{comp} = \text{"OK"}$

Gusset Plate Design

Gusset Plate width: $w_{plate} := 4 \cdot in$

Gusset Plate thickness: $t_{plate} := 1in$

$L_{plate1} := 36in$

$L_{plate2} := 16in$

Gusset Plate Strength: $Fy_{plate} := 65ksi$

$Fu_{plate} := 80ksi$

Pole thickness: $t_{pole} := 0.5in$

Shear Check
(AISC 15th Ed., Eqs. J4-3 and J4-4):

$A_g := t_{plate} \cdot L_{plate2} = 16 \cdot in^2$

$A_{nv} := A_g = 16 \cdot in^2$

Shear Yielding

$\phi_v := 1$

$\phi V_{plate} := \phi_v \cdot 0.6 \cdot A_g \cdot Fy_{plate} = 624 \cdot kip$

$$Check_{shear} := \begin{cases} \text{"OK"} & \text{if } Rating_{sheary} < 100\% \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

$Check_{shear} = \text{"OK"}$

Shear Rupture

$\phi_w := 0.75$

$\phi V_{plate} := \phi_v \cdot 0.6 \cdot A_{nv} \cdot Fu_{plate} = 576 \cdot kip$

$$Check_{shear} := \begin{cases} \text{"OK"} & \text{if } Rating_{shearr} < 100\% \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

$Check_{shear} = \text{"OK"}$

Gusset Plate to Tower and Base Plate Weld Design (Horizontal and

Vertical Weld):
(AISC 15th Ed., Part 8)

Gusset plate thickness: $t_{plate} = 1 \cdot in$

Tower Grade: $Fy_{pole} := 42ksi$ $Fu_{pole} := 63ksi$

Base Plate Grade: $Fy_{base} := 36ksi$ $Fu_{base} := 58ksi$

Gussett Plate Grade: $Fy_{plate} = 65 \cdot ksi$ $Fu_{plate} = 80 \cdot ksi$

Height of vertical weld from base plate: $H := L_{plate1} = 36 \cdot in$

$Notch_{horiz} := .75 \cdot in$

$Notch_{vert} := 1 \cdot in$

Gap between Base Plate and HSS: $Gap := 0.5in$

Vertical fillet weld size to pole:
(in sixteenths of an inch) $D_{vpole} := 5$

$$weldsize_{pole} := \frac{D_{vpole}}{16} = \frac{5}{16}$$

Electrode Strength:

$$Check := \begin{cases} \text{"OK"} & \text{if } Rating_{weld2} < 100\% \\ \text{"INSUFFICIENT"} & \text{otherwise} \end{cases}$$

Check = "OK"

Gusset Plate to HSS Weld Design
(AISC 15th Ed., Table 8-4)

Interpolation per AISC SCM Table 8-4:

Electrode Strength:

Fillet Weld Size (in sixteenths of an inch): $D := 5$

Groove Weld:

Groove Depth (inches): $GD := .5in$

Assume the worst-case installation scenario where the rod is positioned directly against the far side of the HSS.

$$ecc_2 := OD_{HSS} - t_{HSS} - \frac{D_{new}}{2} = 3.16 \cdot in$$

Load not in plane with weld group:

$k := 0$

$$a := \frac{ecc_2}{L_{plate2}} = 0.2$$

$C_1 = 1.03$

$Coeff_1 = 3.52$

$\phi_w := 0.75$

$$D_{min1} := ceil\left(\frac{P_u \cdot in}{\phi_w \cdot Coeff_1\, C_1 \cdot L_{plate2} \cdot kip}\right) = 8$$

$$minweldsize := \frac{D_{min1}}{16} = \frac{1}{2}$$

$$Check_{weld} := \begin{cases} \text{"OK"} & \text{if } D_1 \geq D_{min1} \wedge D_1 \geq Min_{weldsize} \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

$Check_{weld} = \text{"OK"}$

$$\phi Rn_{weld1} := \phi_w \cdot Coeff_1\, ksi \cdot in \cdot C_1 \cdot D_1 \cdot L_{plate2} = 586.37 \cdot kip$$

$$Check_{weld1} := \begin{cases} \text{"OK"} & \text{if } Rating_{weld1} < 100\% \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

$Check_{weld1} = \text{"OK"}$

Gusset Plate to Pole Punching Shear Check (max per unit length): (AISC 15th Ed., Section J4.2)

What is the bracket welded to?

Reinforcement Thickness: $t_{ref} := 0.5in$

Reinforcement Grade: $F_{y\_ref} := 65ksi$

$F_{u\_ref} := 80ksi$

Assume the worst-case installation scenario where the rod is positioned directly against the far side of the HSS.

$\phi_{sy} := 1.0$

$\phi_{sr} := 0.75$

$ecc_1 := w_{plate} + OD_{HSS} - t_{HSS} - \frac{D_{new}}{2} = 7.16 \cdot in$

$M_1 := P_u \cdot ecc_1 = 2233.92 \cdot kip \cdot in$

$S_1 := \frac{t_{plate} \cdot L_{plate1}^2}{6} = 216 \cdot in^3$

$f_v := \frac{M_1}{S_1} \cdot t_{plate} \cdot 1in = 10.34 \cdot kip$

AISC 15th Ed., Equation J4-3:

$\phi F_{sy} := \phi_{sy} \cdot 0.6 \cdot Fy_{pole} \cdot 2 \cdot t_{pole} \cdot 1in$

$\phi F_{sy\_ref} := \phi_{sy} \cdot 0.6 \cdot F_{y\_ref} \cdot 2 \cdot t_{ref} \cdot 1in$

AISC 15th Ed., Equation J4-4:

$\phi F_{sr} := \phi_{sr} \cdot 0.6 \cdot Fu_{pole} \cdot 2 \cdot t_{pole} \cdot 1in$ $\phi F_{sr\_ref} := \phi_{sr} \cdot 0.6 \cdot F_{u\_ref} \cdot 2 \cdot t_{ref} \cdot 1in$

$\phi F_v = 25.2 \cdot kip$

$Check_{PS1} := \begin{cases} \text{"OK"} & \text{if } Rating_{PS1} < 100\% \\ \text{"N/G"} & \text{otherwise} \end{cases}$

$Check_{PS1} = \text{"OK"}$

Gusset Plate to HSS Punching Shear Check (max per unit length): (AISC 15th Ed., Section J4.2)

Assume the worst-case installation scenario where the rod is positioned directly against the far side of the HSS.

$ecc_2 := OD_{HSS} - t_{HSS} - \frac{D_{new}}{2} = 3.16 \cdot in$

$M_2 := P_u \cdot ecc_2 = 985.92 \cdot kip \cdot in$

$S_2 := \frac{t_{plate} \cdot L_{plate2}^2}{6} = 42.67 \cdot in^3$

$f_w := \frac{M_2}{S_2} \cdot t_{plate} \cdot 1in = 23.11 \cdot kip$

AISC 15th Ed., Equation J4-3:

$\phi F_{sy} := \phi_{sy} \cdot 0.6 \cdot F_{y\_HSS} \cdot 2 \cdot t_{HSS} \cdot 1in = 27.9 \cdot kip$

AISC 15th Ed., Equation J4-4:

$\phi F_{sr} := \phi_{sr} \cdot 0.6 \cdot F_{u\_HSS} \cdot 2 \cdot t_{HSS} \cdot 1in = 25.95 \cdot kip$

$\phi F_w := \min(\phi F_{sy}, \phi F_{sr}) = 25.95 \cdot kip$

$Check_{PS2} := \begin{cases} \text{"OK"} & \text{if } Rating_{PS2} < 100\% \\ \text{"N/G"} & \text{otherwise} \end{cases}$

$Check_{PS2} = \text{"OK"}$

Embedment Depth Calculations

Projected Embedment Depth: $L_{em} := 8 \cdot ft$

Concrete Strength: $f'_c := 3000psi$

Are anchor rods installed in piers?:

Yield Strength of Rebar: $f_y := 60ksi$

Transverse Reinforcement Index: $k_{tr} := 0$ Can be taken as 0 for design per ACI 318-14

Epoxy Factor: $\psi_e := 1$

Rebar Size Factor: $\psi_s := 1$

Casting Position Factor: $\psi_t := 1$

Concrete Weight Factor: $\lambda := 1 \cdot \sqrt{psi}$

Pier Diameter: $D_{pier} := 5ft$

Cover: $c_c := 3in$

Rebar Size: $d_s := 9$ $\quad d_b := \left|vlookup\left(d_s, d_{btable}, 2\right)\right| \cdot in = 1.13 \cdot in$

Tie Size: $Tie := 4$

Number of Vertical Rebar: $n := 16$

The embedment depth shall be analyzed based on the design tension capacity of the anchor rods.

Design Load:

$$\phi P_{nt} := 0.75 \cdot Fu_{rod} \cdot A_{net\_new} = 243.75 \cdot kip$$

Development Length (ACI 318-14 Chapter 25):

$$BC_{rebar} := D_{pier} - 2 \cdot c_c - \frac{Tie \cdot in}{4} - d_b = 51.87 \cdot in$$

$$S_{rebar} := \frac{\pi \cdot BC_{rebar}}{n} = 10.185 \cdot in$$

$$c_b := \min\left(c_c + \frac{Tie}{8}in + \frac{d_b}{2}, S_{rebar} \cdot 0.5\right) = 4.06 \cdot in$$

ACI 318-14, Equation 25.4.2.3a:

$$l_d := \left[\frac{3}{40} \cdot \frac{f_y}{\lambda \cdot \sqrt{f'_c}} \cdot \frac{\psi_t \cdot \psi_e \cdot \psi_s}{\min\left[\left(\frac{c_b + k_{tr}}{d_b}\right), 2.5\right]}\right] \cdot d_b = 37.07 \cdot in$$

Calculate Max Distance Between Rebar and New Anchor Rods:

$$A := \frac{1}{2} \cdot S_{rebar} = 5.093 \cdot in$$

$$B := \frac{BC_{rebar}}{2} - \frac{BC_{new}}{2} = 3.686 \cdot in$$

$$G := \sqrt{A^2 + B^2} = 6.287 \cdot in$$

$$l'_d := l_d + \frac{G}{1.5} + 3in = 3.69\,ft$$

Epoxy Development Length: Bond Strength:

Epoxy :=

$$S_b := \begin{cases} S_{bh} & \text{if Epoxy} = 0 \\ S_{bA} & \text{if Epoxy} = 1 \wedge \left(f'_c = 4000\text{psi} \vee f'_c > 4000\cdot\text{psi}\right) \\ 0.94 S_{bA} & \text{if Epoxy} = 1 \wedge \left(f'_c = 3000\text{psi} \vee f'_c < 3000\cdot\text{psi}\right) \\ E_{bond} & \text{if Epoxy} = 1 \wedge f'_c > 3000\text{psi} \wedge f'_c < 4000\text{psi} \end{cases} = 1130\,\text{psi}$$

$$\phi_{bond} := 0.65$$

$$L_{be} := \frac{\phi P_{nt}}{\pi \cdot D_{new} \cdot S_b \cdot \phi_{bond}} = 60.36\cdot\text{in}$$

Required Embedment Length:

Length of Breaker Tape: $L_{BT} := 0\cdot\text{in}$

$$L_{min} := \begin{cases} \max\left(L_{be} + L_{BT}, l'_d + 0.25\cdot L_{be}\right) & \text{if Piers} = \text{"Yes"} \\ \left(L_{be} + L_{BT}\right) & \text{if Piers} = \text{"No"} \end{cases} = 5.03\,\text{ft}$$

$$\text{Check} := \begin{cases} \text{"OK"} & \text{if } L_{min} \le L_{em} \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

Check = "OK"

Anchor Rod Bracket Summary

Bracket HSS Compression:	$Rating_{comp} = 95.01 \cdot \%$
Bracket Plate Shear Yielding:	$Rating_{sheary} = 47.62 \cdot \%$
Bracket Plate Shear Rupture:	$Rating_{shearr} = 51.59 \cdot \%$
Bracket Plate to Pole Weld:	$Rating_{weld2} = 84.12 \cdot \%$
Bracket Plate to HSS Weld:	$Rating_{weld1} = 50.67 \cdot \%$
Bracket Plate to Pole Punching Shear:	$Rating_{PS1} = 39.09 \cdot \%$
Bracket Plate to HSS Punching Shear:	$Rating_{PS2} = 84.82 \cdot \%$

Anchor Rod Bracket Calculations:

Additional Anchor Rod Group:

$N_{new} := 3$ $\quad D_{new} := 1.75 \cdot in$ $\quad Fu_{rod} := 125 ksi$

$BC_{new} := 46 \cdot in$ $\quad A_{net\_new} := 1.9 \cdot in^2$ $\quad Fy_{rod} := 105 ksi$

$A_{n\_new} := N_{new} \cdot A_{net\_new} = 5.7 \cdot in^2$

Anchor Rod Bracket Calculations

Analysis
Design

Comment = "Design the anchor rod brackets to resist the full capacity of the anchor rod"

Anchor Rod Demand Force:

$P_{umax} := 178.95 kip$

Bracket Loading:

$$P_u := \begin{cases} \phi P_n & \text{if AorD = "Design"} \\ P_{umax} & \text{if AorD = "Analysis"} \end{cases} = 199.5 \cdot kip$$

Tube Design (Square HSS)

Member Size: 4x4x1/2 HSS

Apply TIA-222-H Section 15.5? No / Yes

Member Properties (AISC 15th Ed., Table 1-12):

Outside Diameter: $OD_{HSS} := 4 \cdot in$

Area: $A_{HSS} := 6.02 \cdot in^2$ $\quad A_{e\_HSS} := 0.75 \cdot A_{HSS} = 4.51 \cdot in^2$

Thickness: $t_{HSS} := 0.465 \cdot in$

Yield Strength: $F_{y\_HSS} := 50 \cdot ksi$ $\quad F_{u\_HSS} := 62 \cdot ksi$

Length: $L_{HSS} := 20 \cdot in$

Moment of Inertia: $I_{HSS} := 11.9 \cdot in^4$

Radius of Gyration: $r_{HSS} := 1.41 \cdot in$

Inside Dimension: $ID_{HSS} := OD_{HSS} - 2 \cdot t_{HSS} = 3.07 \cdot in$

Bearing Check
(AISC 15th Ed., Equation J7-1):

$\phi_b := 0.75$

$Pu\_c = \phi_b \cdot R_n = \phi_b \cdot 1.8 \cdot F_{y\_HSS} \cdot A_{pb}$

$$A_{pb} := \frac{P_u}{\phi_b \cdot 1.8 \cdot F_{y\_HSS}} = 2.96 \cdot in^2$$

$$Check_{bear} := \begin{cases} \text{"OK"} & \text{if } A_{HSS} \geq A_{pb} \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

$Check_{bear} = \text{"OK"}$

Compression Check
(AISC 15th Ed., Eqs. E3-1 to E3-4):

$\phi_c := 0.9$

$K := 1$

$\phi P_{u\_comp} = \phi_c \cdot F_{cr} \cdot A_g$

$L_c := K \cdot L_{HSS} = 20 \cdot in$

$$F_e := \frac{\pi^2 \cdot 29000ksi}{\left(\frac{L_c}{r_{HSS}}\right)^2} = 1422.58 \cdot ksi$$

$$\frac{L_c}{r_{HSS}} = 14.18 < 4.71 \cdot \sqrt{\frac{29000 \cdot ksi}{F_{y\_HSS}}} = 113.43$$

$$\therefore \quad F_{cr} := 0.658^{\frac{F_{y\_HSS}}{F_e}} \cdot F_{y\_HSS} = 49.27 \cdot ksi$$

(AISC 15th Ed., Equation J4-6):

$$\phi P_{u\_comp} := \begin{cases} \phi_c \cdot F_{y\_HSS} \cdot A_{HSS} & \text{if } \frac{L_c}{r_{HSS}} \le 25 \\ \phi_c \cdot F_{cr} \cdot A_{HSS} & \text{otherwise} \end{cases}$$

$$\phi P_{u\_comp} = 270.9 \cdot kip$$

$$Check_{comp} := \begin{cases} \text{"OK"} & \text{if } Rating_{comp} < 100\% \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

$Check_{comp} = \text{"OK"}$

Gusset Plate Design

Gusset Plate width: $w_{plate} := 6 \cdot in$

Gusset Plate thickness: $t_{plate} := 1.25in$

$L_{plate1} := 23in$

$L_{plate2} := 17in$

Gusset Plate Strength: $Fy_{plate} := 65ksi$

$Fu_{plate} := 80ksi$

Pole thickness: $t_{pole} := 0.5in$

Shear Check
(AISC 15th Ed., Eqs. J4-3 and J4-4):

$A_g := t_{plate} \cdot L_{plate2} = 21.25 \cdot in^2$

$A_{nv} := A_g = 21.25 \cdot in^2$

Shear Yielding

$\phi_v := 1$

$\phi V_{plate} := \phi_v \cdot 0.6 \cdot A_g \cdot Fy_{plate} = 828.75 \cdot kip$

$$Check_{shear} := \begin{cases} \text{"OK"} & \text{if } Rating_{sheary} < 100\% \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

$Check_{shear} = \text{"OK"}$

Shear Rupture

$\phi_v := 0.75$

$\phi V_{plate} := \phi_v \cdot 0.6 \cdot A_{nv} \cdot Fu_{plate} = 765 \cdot kip$

$$Check_{shear} := \begin{cases} \text{"OK"} & \text{if } Rating_{shearr} < 100\% \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

$Check_{shear} = \text{"OK"}$

Gusset Plate to Tower and Base Plate Weld Design (Horizontal and

Vertical Weld):
(AISC 15th Ed., Part 8)

Gusset plate thickness: $t_{plate} = 1.25 \cdot in$

Tower Grade: $Fy_{pole} := 42ksi$ $Fu_{pole} := 63ksi$

Base Plate Grade: $Fy_{base} := 36ksi$ $Fu_{base} := 58ksi$

Gussett Plate Grade: $Fy_{plate} = 65 \cdot ksi$ $Fu_{plate} = 80 \cdot ksi$

Height of vertical weld from base plate: $H := L_{plate1} = 23 \cdot in$

$Notch_{horiz} := .75 \cdot in$

$Notch_{vert} := 1.25 \cdot in$

Gap between Base Plate and HSS: $Gap := 0.5in$

Vertical fillet weld size to pole:
(in sixteenths of an inch) $D_{vpole} := 6$

$$weldsize_{pole} := \frac{D_{vpole}}{16} = \frac{3}{8}$$

Electrode Strength: 70ksi / 80ksi

$$Check := \begin{cases} \text{"OK"} & \text{if } Rating_{weld2} < 100\% \\ \text{"INSUFFICIENT"} & \text{otherwise} \end{cases}$$

Check = "OK"

Gusset Plate to HSS Weld Design
(AISC 15th Ed., Table 8-4)

Interpolation per AISC SCM Table 8-4:

13th Edition
14th Edition
15th Edition

Electrode Strength: 70ksi / 80ksi

Fillet Weld Size (in sixteenths of an inch): D := 6

Groove Depth (inches): GD := 0in

Groove Weld: None / 45 PJP / 60 PJP / CJP

Assume the worst-case installation scenario where the rod is positioned directly against the far side of the HSS.

$$ecc_2 := OD_{HSS} - t_{HSS} - \frac{D_{new}}{2} = 2.66 \cdot in$$

Load not in plane with weld group:

$k := 0$

$$a := \frac{ecc_2}{L_{plate2}} = 0.16$$

$C_1 = 1.03$

$Coeff_1 = 3.65$

$\phi_w := 0.75$

$$D_{min1} := ceil\left(\frac{P_u \cdot in}{\phi_w \cdot Coeff_1\, C_1 \cdot L_{plate2} \cdot kip}\right) = 5$$

$$minweldsize := \frac{D_{min1}}{16} = \frac{5}{16}$$

$$Check_{weld} := \begin{cases} \text{"OK"} & \text{if } D_1 \geq D_{min1} \wedge D_1 \geq Min_{weldsize} \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

$Check_{weld} = \text{"OK"}$

$$\phi Rn_{weld1} := \phi_w \cdot Coeff_1\, ksi \cdot in \cdot C_1 \cdot D_1 \cdot L_{plate2} = 287.55 \cdot kip$$

$$Check_{weld1} := \begin{cases} \text{"OK"} & \text{if } Rating_{weld1} < 100\% \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

$Check_{weld1} = \text{"OK"}$

Gusset Plate to Pole Punching Shear Check (max per unit length): (AISC 15th Ed., Section J4.2)

What is the bracket welded to? Tower Only / Tower & Reinforcement / Reinforcement Only

Reinforcement Thickness: $t_{ref} := 0in$

Reinforcement Grade: $F_{y\_ref} := 0ksi$

$F_{u\_ref} := 0ksi$

Assume the worst-case installation scenario where the rod is positioned directly against the far side of the HSS.

$\phi_{sy} := 1.0$

$\phi_{sr} := 0.75$

$ecc_1 := w_{plate} + OD_{HSS} - t_{HSS} - \frac{D_{new}}{2} = 8.66 \cdot in$

$M_1 := P_u \cdot ecc_1 = 1727.67 \cdot kip \cdot in$

$S_1 := \frac{t_{plate} \cdot L_{plate1}^2}{6} = 110.21 \cdot in^3$

$f_v := \frac{M_1}{S_1} \cdot t_{plate} \cdot 1in = 19.6 \cdot kip$

AISC 15th Ed., Equation J4-3:

$\phi F_{sy} := \phi_{sy} \cdot 0.6 \cdot Fy_{pole} \cdot 2 \cdot t_{pole} \cdot 1in$

$\phi F_{sy\_ref} := \phi_{sy} \cdot 0.6 \cdot F_{y\_ref} \cdot 2 \cdot t_{ref} \cdot 1in$

AISC 15th Ed., Equation J4-4:

$\phi F_{sr} := \phi_{sr} \cdot 0.6 \cdot Fu_{pole} \cdot 2 \cdot t_{pole} \cdot 1in$ $\phi F_{sr\_ref} := \phi_{sr} \cdot 0.6 \cdot F_{u\_ref} \cdot 2 \cdot t_{ref} \cdot 1in$

$\phi F_v = 25.2 \cdot kip$

$$Check_{PS1} := \begin{cases} \text{"OK"} & \text{if } Rating_{PS1} < 100\% \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

$Check_{PS1} = \text{"OK"}$

Gusset Plate to HSS Punching Shear Check (max per unit length): (AISC 15th Ed., Section J4.2)

Assume the worst-case installation scenario where the rod is positioned directly against the far side of the HSS.

$ecc_2 := OD_{HSS} - t_{HSS} - \frac{D_{new}}{2} = 2.66 \cdot in$

$M_2 := P_u \cdot ecc_2 = 530.67 \cdot kip \cdot in$

$S_2 := \frac{t_{plate} \cdot L_{plate2}^2}{6} = 60.21 \cdot in^3$

$f_v := \frac{M_2}{S_2} \cdot t_{plate} \cdot 1in = 11.02 \cdot kip$

AISC 15th Ed., Equation J4-3:

$\phi F_{sy} := \phi_{sy} \cdot 0.6 \cdot F_{y\_HSS} \cdot 2 \cdot t_{HSS} \cdot 1in = 27.9 \cdot kip$

AISC 15th Ed., Equation J4-4:

$\phi F_{sr} := \phi_{sr} \cdot 0.6 \cdot F_{u\_HSS} \cdot 2 \cdot t_{HSS} \cdot 1in = 25.95 \cdot kip$

$\phi F_w := \min(\phi F_{sy}, \phi F_{sr}) = 25.95 \cdot kip$

$$Check_{PS2} := \begin{cases} \text{"OK"} & \text{if } Rating_{PS2} < 100\% \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

$Check_{PS2} = \text{"OK"}$

Embedment Depth Calculations

Projected Embedment Depth: $L_{em} := 5 \cdot ft$

Concrete Strength: $f'_c := 3000psi$

Are anchor rods installed in piers?: Yes / No

Yield Strength of Rebar: $f_y := 60ksi$

Transverse Reinforcement Index: $k_{tr} := 0$ Can be taken as 0 for design per ACI 318-14

Epoxy Factor: $\psi_e := 1$

Rebar Size Factor: $\psi_s := 1$

Casting Position Factor: $\psi_t := 1$

Concrete Weight Factor: $\lambda := 1 \cdot \sqrt{psi}$

Pier Diameter: $D_{pier} := 5ft$

Cover: $c_c := 3in$

Rebar Size: $d_s := 9$

$d_b := \left| vlookup\left(d_s, d_{btable}, 2\right) \right| \cdot in = 1.13 \cdot in$

Tie Size: $Tie := 4$

Number of Vertical Rebar: $n := 16$

The embedment depth shall be analyzed based on the design tension capacity of the anchor rods.

Design Load:

$\phi P_{nt} := 0.75 \cdot Fu_{rod} \cdot A_{net\_new} = 178.13 \cdot kip$

Development Length (ACI 318-14 Chapter 25):

$BC_{rebar} := D_{pier} - 2 \cdot c_c - \frac{Tie \cdot in}{4} - d_b = 51.87 \cdot in$

$S_{rebar} := \frac{\pi \cdot BC_{rebar}}{n} = 10.185 \cdot in$

$c_b := \min\left(c_c + \frac{Tie}{8} in + \frac{d_b}{2}, S_{rebar} \cdot 0.5 \right) = 4.06 \cdot in$

ACI 318-14, Equation 25.4.2.3a:

$l_d := \left[\frac{3}{40} \cdot \frac{f_y}{\lambda \cdot \sqrt{f'_c}} \cdot \frac{\psi_t \cdot \psi_e \cdot \psi_s}{\min\left[\left(\frac{c_b + k_{tr}}{d_b} \right), 2.5 \right]} \right] \cdot d_b = 37.07 \cdot in$

Calculate Max Distance Between Rebar and New Anchor Rods:

$A := \frac{1}{2} \cdot S_{rebar} = 5.093 \cdot in$

$B := \frac{BC_{rebar}}{2} - \frac{BC_{new}}{2} = 2.936 \cdot in$

$G := \sqrt{A^2 + B^2} = 5.878 \cdot in$

$l'_d := l_d + \frac{G}{1.5} + 3in = 3.67\ ft$

Epoxy Development Length: Bond Strength:

Epoxy := AF35LVE

$$S_b := \begin{cases} S_{bh} & \text{if Epoxy} = 0 \\ S_{bA} & \text{if Epoxy} = 1 \wedge \left(f'_c = 4000\text{psi} \vee f'_c > 4000\cdot\text{psi}\right) \\ 0.94 S_{bA} & \text{if Epoxy} = 1 \wedge \left(f'_c = 3000\text{psi} \vee f'_c < 3000\cdot\text{psi}\right) \\ E_{bond} & \text{if Epoxy} = 1 \wedge f'_c > 3000\text{psi} \wedge f'_c < 4000\text{psi} \end{cases} = 1613.98\ \text{psi}$$

$$\phi_{bond} := 0.65$$

$$L_{be} := \frac{\phi P_{nt}}{\pi \cdot D_{new} \cdot S_b \cdot \phi_{bond}} = 30.88\cdot\text{in}$$

Required Embedment Length:

Length of Breaker Tape: $L_{BT} := 12\cdot\text{in}$

$$L_{min} := \begin{cases} \max\left(L_{be} + L_{BT}, l'_d + 0.25\cdot L_{be}\right) & \text{if Piers} = \text{"Yes"} \\ \left(L_{be} + L_{BT}\right) & \text{if Piers} = \text{"No"} \end{cases} = 4.31\ \text{ft}$$

$$\text{Check} := \begin{cases} \text{"OK"} & \text{if } L_{min} \le L_{em} \\ \text{"N/G"} & \text{otherwise} \end{cases}$$

Check = "OK"

Anchor Rod Pullout Test:

$\phi_p := 0.75$

Is this a CA **DSA** site? ○ Yes ◉ No

$$\text{Pullout} := \begin{cases} \dfrac{\phi_p \cdot Fu_{rod} \cdot A_{net\_new}}{1.6} & \text{if CA} = 0 \\ \left(0.8\cdot Fy_{rod} \cdot A_{net\_new}\right) & \text{otherwise} \end{cases} = 111\cdot\text{kip}$$

Drilled Pier Foundation

BU # :	876325
Site Name:	WESTON SQUARE
Order Number:	508994 Rev. 0

TIA-222 Revison:	H
Tower Type:	Monopole

Applied Loads	Comp.	Uplift
Moment (kip-ft)	1710.46	
Axial Force (kips)	39.13	
Shear Force (kips)	23.68	

Material Properties		
Concrete Strength, f'c:	3	ksi
Rebar Strength, Fy:	60	ksi

Pier Design Data		
Depth	37	ft
Ext. Above Grade	0.5	ft
Pier Section 1		
From 0.5' above grade to 23.59' below grade		
Pier Diameter	5	ft
Rebar Quantity	16	
Rebar Size	9	
Clear Cover to Ties	3	in
Tie Size	4	
Rebar Quantity	3	
Rebar Size	10	
Rebar Cage Diameter	44.5	in
Pier Section 2		
From 23.59' below grade to 37' below grade		
Pier Diameter	5	ft
Rebar Quantity	16	
Rebar Size	9	
Clear Cover to Ties	3	in
Tie Size	4	

Analysis Results		
Soil Lateral Capacity	*Compression*	*Uplift*
$D_{v=0}$ (ft from TOC)	9.06	-
Soil Safety Factor	5.92	-
Max Moment (kip-ft)	1868.75	-
Rating*	*21.4%*	-
Soil Vertical Capacity	*Compression*	*Uplift*
Skin Friction (kips)	389.35	-
End Bearing (kips)	135.00	-
Weight of Concrete (kips)	100.19	-
Total Capacity (kips)	524.34	-
Axial (kips)	139.32	-
Rating*	*25.3%*	-
Reinforced Concrete Capacity	*Compression*	*Uplift*
Critical Depth (ft from TOC)	8.79	-
Critical Moment (kip-ft)	1868.57	-
Critical Moment Capacity	2184.15	-
Rating*	*81.5%*	-

Soil Interaction Rating*	**25.3%**
Structural Foundation Rating*	**81.5%**

Check Limitation	
Apply TIA-222-H Section 15.5:	☑
N/A	☐

*Rating per TIA-222-H Section 15.5

Soil Profile			
Groundwater Depth	15	ft	# of Layers: 8

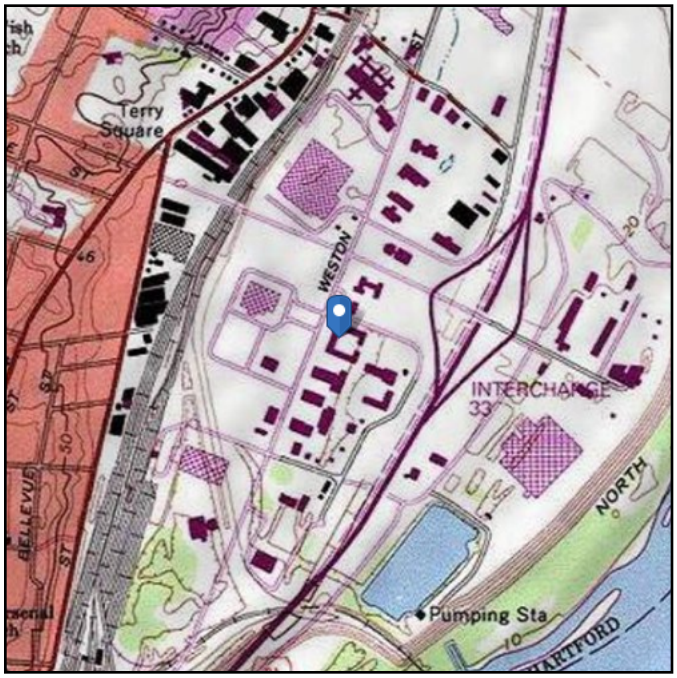
Layer	Top (ft)	Bottom (ft)	Thickness (ft)	γ_{soil} (pcf)	$\gamma_{concrete}$ (pcf)	Cohesion (ksf)	Angle of Friction (degrees)	Calculated Ultimate Skin Friction Comp (ksf)	Calculated Ultimate Skin Friction Uplift (ksf)	Ultimate Skin Friction Comp Override (ksf)	Ultimate Skin Friction Uplift Override (ksf)	Ult. Gross Bearing Capacity (ksf)	SPT Blow Count	Soil Type
1	0	2	2	120	150	0	0	0.000	0.000	0.00	0.00			Cohesionless
2	2	3.33	1.33	110	150	0	0	0.000	0.000	0.00	0.00			Cohesionless
3	3.33	6	2.67	110	150	0	30	0.000	0.000	0.00	0.00			Cohesionless
4	6	13	7	110	150	0.75	0	0.413	0.413	0.48	0.48			Cohesive
5	13	15	2	105	150	0	30	0.000	0.000	1.04	1.04			Cohesionless
6	15	28	13	52.6	87.6	0	32	0.000	0.000	1.72	1.72			Cohesionless
7	28	33	5	37.6	87.6	0.75	0	0.41	0.41	0.41	0.41			Cohesive
8	33	37	4	57.6	87.6	1.5	0	0.83	0.83	0.81	0.81	9.167		Cohesive

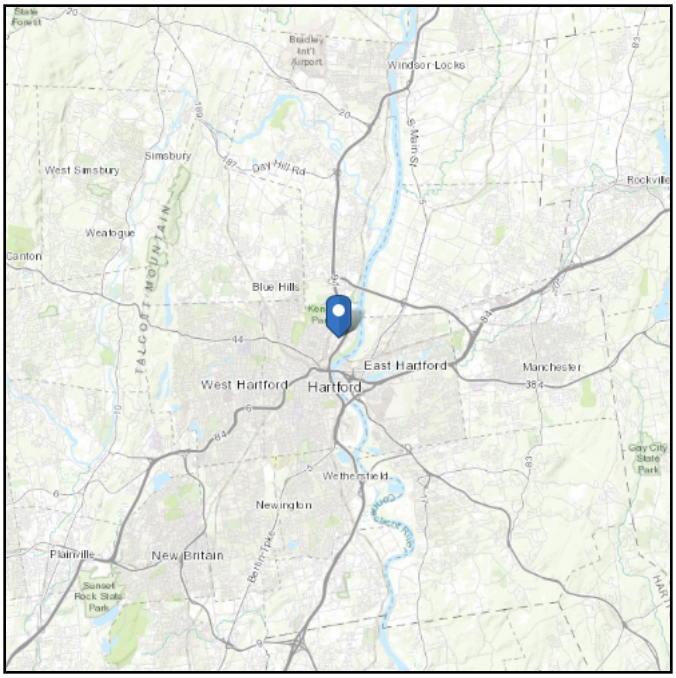
ASCE 7 Hazards Report

Address:
No Address at This Location

Standard: ASCE/SEI 7-10
Risk Category: II
Soil Class: D - Stiff Soil

Elevation: 10.46 ft (NAVD 88)
Latitude: 41.78675
Longitude: -72.662339





Seismic

Site Soil Class: D - Stiff Soil

Results:

S_S :	0.18	S_{DS} :	0.192
S_1 :	0.064	S_{D1} :	0.102
F_a :	1.6	T_L :	6
F_v :	2.4	PGA :	0.09
S_{MS} :	0.288	PGA_M :	0.145
S_{M1} :	0.153	F_{PGA} :	1.6
		I_e :	1

Seismic Design Category B

Data Accessed: Mon Jan 06 2020

Date Source: USGS Seismic Design Maps based on ASCE/SEI 7-10, incorporating Supplement 1 and errata of March 31, 2013, and ASCE/SEI 7-10 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-10 Ch. 21 are available from USGS.

Ice

Results:

Ice Thickness:	1.00 in.
Concurrent Temperature:	5 F
Gust Speed:	50 mph
Data Source:	Standard ASCE/SEI 7-10, Figs. 10-2 through 10-8
Date Accessed:	Mon Jan 06 2020

Ice thicknesses on structures in exposed locations at elevations higher than the surrounding terrain and in valleys and gorges may exceed the mapped values.

Values provided are equivalent radial ice thicknesses due to freezing rain with concurrent 3-second gust speeds, for a 50-year mean recurrence interval, and temperatures concurrent with ice thicknesses due to freezing rain. Thicknesses for ice accretions caused by other sources shall be obtained from local meteorological studies. Ice thicknesses in exposed locations at elevations higher than the surrounding terrain and in valleys and gorges may exceed the mapped values.

APPENDIX D

STRUCTURAL DESIGN DRAWINGS

MONOPOLE REINFORCEMENT DRAWINGS

SITE NAME: WESTON SQUARE
BU NUMBER: 876325

SITE ADDRESS:
92 WESTON STREET
HARTFORD, CT 06103-1217
HARTFORD COUNTY, USA

HOT WORK INCLUDED	
N/A	BASE GRINDING ONLY
X	BASE WELDING (AND GRINDING)
N/A	AERIAL GRINDING ONLY
N/A	AERIAL WELDING (AND GRINDING)

SAFETY CLIMB: 'LOOK UP'
THE INTEGRITY OF THE WIRE ROPE SAFETY CLIMB SYSTEM SHALL BE CONSIDERED DURING ALL STAGES OF DESIGN, INSTALLATION, AND INSPECTION. TOWER REINFORCEMENTS AND EQUIPMENT INSTALLATIONS SHALL NOT COMPROMISE THE INTEGRITY OR FUNCTIONAL USE OF ANY WIRE ROPE SAFETY CLIMB ON THE STRUCTURE. THIS SHALL INCLUDE, BUT NOT BE LIMITED TO: PINCHING OF THE WIRE ROPE, BENDING OF THE WIRE ROPE FROM ITS SUPPORTS, DIRECT CONTACT OR CLOSE PROXIMITY TO THE WIRE ROPE WHICH MAY CAUSE FRICTIONAL WEAR, OR IMPACT TO THE ANCHORAGE POINTS IN ANY WAY. ANY COMPROMISED SAFETY CLIMB MUST BE REPORTED TO YOUR CROWN POC FOR RESOLUTION, INCLUDING EXISTING CONDITIONS.

CODE COMPLIANCE

THIS REINFORCEMENT DESIGN IS BASED ON THE TIA-222-H STRUCTURAL STANDARD USING AN ULTIMATE 3-SECOND GUST WIND SPEED OF 125 MPH FROM THE 2018 CONNECTICUT BUILDING CODE, 50 MPH WITH 2.00 INCH ICE THICKNESS AND 60 MPH UNDER SERVICE LOADS, EXPOSURE CATEGORY C.

TOWER INFORMATION

TOWER MANUFACTURER / CCI DOC #:	ROHN / CCI DOC #2192540
TOWER HEIGHT / TYPE:	110 FT MONOPOLE TOWER
TOWER LOCATION: DATUM: NAD 1983	LATITUDE 41° 47' 12.3" LONGITUDE -72° 39' 44.42"
STRUCTURAL DESIGN DRAWING:	B&V / WO #1819530
STRUCTURAL ANALYSIS REPORT:	B&V / WO #1815154
ORDER ID:	508994 REV #0

PROJECT CONTACTS

CROWN PROJECT MANAGER
DAN VADNEY
(518) 373-3510
DAN.VADNEY@CROWNCASTLE.COM

BLACK & VEATCH CONTACTS
CROWNCASTLERFI@BV.COM
PATRICK DAVIS, P.E.
(913) 458-6984

LOCATION MAP

NO SCALE

DRIVING DIRECTIONS

FROM SPRINGFIELD, TAKE 91 SOUTH TO EXIT 33, BEAR RIGHT ON JENNINGS ROAD. TAKE LEFT ON WESTON STREET AND TOWER ON LEFT AFTER RED ROOF INN.

ATTENTION ALL CONTRACTORS

ANYTIME YOU ACCESS A CROWN SITE FOR ANY REASON YOU ARE TO CALL THE CROWN NOC UPON ARRIVAL AND DEPARTURE, DAILY AT 800-788-7011.

DRAWING INDEX

DO NOT SCALE DRAWINGS

CONTRACTOR SHALL VERIFY ALL PLANS & EXISTING DIMENSIONS & CONDITIONS ON THE JOB SITE & SHALL IMMEDIATELY NOTIFY THE ENGINEER IN WRITING OF ANY DISCREPANCIES BEFORE PROCEEDING WITH THE WORK OR BE RESPONSIBLE FOR SAME

PREPARED FOR:

CROWN CASTLE

BLACK & VEATCH
6800 W 115TH ST, SUITE 2292
OVERLAND PARK, KS 66211

PROJECT NO:	400087
DRAWN BY:	TYW
CHECKED BY:	PD

REV	DATE	DESCRIPTION
0	01/15/20	ISSUED FOR CONSTRUCTION

STATE OF CONNECTICUT
JOSHUA J. RILEY
32308
LICENSED PROFESSIONAL ENGINEER
01/21/2020

BU #876325
WO #1819530
WESTON SQUARE
92 WESTON STREET
HARTFORD, CT 06103-1217
HARTFORD COUNTY, USA

SHEET TITLE
TITLE PAGE

SHEET NUMBER
TM-1

MI CHECKLIST

REQUIRED	REPORT ITEM	APPLICABLE CROWN DOC #	BRIEF DESCRIPTION
PRE–CONSTRUCTION			
X	MI CHECKLIST DRAWING	CED–SOW–10007	THIS CHECKLIST SERVES AS A GUIDELINE FOR THE REQUIRED CONSTRUCTION DOCUMENTS AND INSPECTIONS FOR THIS MODIFICATION.
X	EOR APPROVED SHOP DRAWINGS	CED–SOW–10007	ONCE THE PRE–MODIFICATION MAPPING IS COMPLETE AND PRIOR TO FABRICATION, THE CONTRACTOR SHALL PROVIDE DETAILED ASSEMBLY DRAWINGS AND/OR SHOP DRAWINGS. THESE ARE TO INCLUDE, BUT ARE NOT LIMITED TO, A VISUAL LAYOUT OF NEW REINFORCEMENT, EXISTING REINFORCEMENT CONFIGURATION, PORTHOLES, MOUNTS, STEP PEGS, SAFETY CLIMBS AND ANY OTHER MISCELLANEOUS ITEMS WHICH MAY AFFECT SUCCESSFUL INSTALLATION OF MODIFICATIONS ON THE TOWER. THESE DRAWINGS SHALL BE SUBMITTED TO THE EOR FOR APPROVAL. SHOP DRAWING SUBMISSION SHALL INCLUDE THE EOR RFI FORM DETAILING ANY CHANGES FROM ORIGINAL DESIGN.
X	FABRICATION INSPECTION	CED–SOW–10007	A LETTER FROM THE FABRICATOR, STATING THAT THE WORK WAS PERFORMED IN ACCORDANCE WITH INDUSTRY STANDARDS AND THE CONTRACT DOCUMENTS, SHALL BE PROVIDED TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.
X	FABRICATOR CERTIFIED WELD INSPECTION	CED–SOW–10007 CED–STD–10069	A CWI SHALL INSPECT ALL WELDING PERFORMED ON STRUCTURAL MEMBERS DURING FABRICATION. A WRITTEN REPORT SHALL BE PROVIDED TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.
X	MATERIAL TEST REPORTS (MTR)	CED–SOW–10007	MATERIAL TEST REPORTS SHALL BE PROVIDED FOR MATERIAL USED AS REQUIRED PER SECTION 9.2.5 OF CED–SOW–10007. MTRS SHALL BE PROVIDED TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.
N/A	FABRICATOR NDE INSPECTION REPORT	CED–SOW–10066 CED–STD–10069	CRITICAL SHOP WELDS THAT REQUIRE TESTING ARE NOTED ON THESE CONTRACT DRAWINGS. A CERTIFIED NDT INSPECTOR SHALL PERFORM NON–DESTRUCTIVE EXAMINATION AND A REPORT SHALL BE PROVIDED TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.
N/A	NDE OF MONOPOLE BASE PLATE	ENG–SOW–10033	A NDE OF THE POLE TO BASE PLATE CONNECTION IS REQUIRED AND A WRITTEN REPORT SHALL BE PROVIDED TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.
X	PACKING SLIPS	CED–SOW–10007	PACKING/SHIPPING LIST FOR ALL MATERIAL USED DURING CONSTRUCTION OF THE MODIFICATION.
ADDITIONAL TESTING AND INSPECTIONS:			
N/A			
CONSTRUCTION			
N/A	FOUNDATION INSPECTIONS	CED–SOW–10144	A VISUAL OBSERVATION OF THE EXCAVATION AND REBAR SHALL BE PERFORMED BEFORE PLACING THE CONCRETE. A VISUAL OBSERVATION OF THE REBAR SHALL BE PERFORMED BEFORE PLACING THE EPOXY. A SEALED WRITTEN REPORT SHALL BE PROVIDED TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.
N/A	CONCRETE COMP. STRENGTH AND SLUMP TEST	CED–SOW–10144	THE CONCRETE MIX DESIGN, SLUMP TEST, AND COMPRESSIVE STRENGTH TESTS SHALL BE PROVIDED AS PART OF THE FOUNDATION REPORT.
N/A	EARTHWORK	CED–SOW–10144	FOUNDATION SUB–GRADES SHALL BE INSPECTED AND APPROVED BY AN APPROVED FOUNDATION INSPECTOR AND RESULTS INCLUDED AS PART OF THE FOUNDATION REPORT.
N/A	MICROPILE/ROCK ANCHOR	CED–SOW–10144	MICROPILES/ROCK ANCHORS SHALL BE INSPECTED BY THE FOUNDATION INSPECTION VENDOR AND SHALL BE INCLUDED AS PART OF THE FOUNDATION INSPECTION REPORT, ADDITIONAL TESTING AND/OR INSPECTION REQUIREMENTS ARE NOTED IN THESE CONTRACT DOCUMENTS.
X	POST–INSTALLED ANCHOR ROD VERIFICATION	CED–SOW–10007 CED–FRM–10358	POST INSTALLED ANCHOR ROD VERIFICATION SHALL BE PERFORMED IN ACCORDANCE WITH CROWN REQUIREMENTS AND A REPORT SHALL BE PROVIDED TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.
X	BASE PLATE GROUT VERIFICATION	ENG–STD–10323	THE GENERAL CONTRACTOR SHALL PROVIDE DOCUMENTATION TO THE MI INSPECTOR THAT CERTIFIES THAT THE GROUT WAS REMOVED AND/OR INSTALLED IN ACCORDANCE WITH CROWN REQUIREMENTS FOR INCLUSION IN THE MI REPORT.
X	FIELD CERTIFIED WELD INSPECTION	CED–SOW–10066 CED–STD–10069	A CROWN APPROVED CERTIFIED WELD INSPECTOR SHALL INSPECT AND TEST FIELD WELDS, FOLLOWING ALL PROCEDURES SPECIFIED IN CROWN STANDARD DOCUMENTS APPLICABLE TO WELD INSPECTIONS. A REPORT SHALL BE PROVIDED. NDE OF FIELD WELDS SHALL BE PERFORMED AS REQUIRED BY CROWN STANDARDS AND CONTRACT DOCUMENTS. THE NDE REPORT SHALL BE INCLUDED IN THE CWI REPORT.
X	ON–SITE COLD GALVANIZING VERIFICATION	ENG–STD–10149 CED–FRM–10358	THE GENERAL CONTRACTOR SHALL PROVIDE WRITTEN AND PHOTOGRAPHIC DOCUMENTATION TO THE MI INSPECTOR VERIFYING THAT ANY ON–SITE COLD GALVANIZING WAS APPLIED PER MANUFACTURER SPECIFICATIONS AND APPLICABLE STANDARDS.
N/A	TENSION TWIST AND PLUMB	CED–PRC–10182 CED–STD–10261	THE GENERAL CONTRACTOR SHALL PROVIDE A REPORT IN ACCORDANCE WITH APPLICABLE STANDARDS DOCUMENTING TENSION TWIST AND PLUMB.
X	GC AS–BUILT DRAWINGS	CED–SOW–10007	THE GENERAL CONTRACTOR SHALL SUBMIT A LEGIBLE COPY OF THE ORIGINAL DESIGN DRAWINGS EITHER STATING "INSTALLED AS DESIGNED" OR NOTING ANY CHANGES THAT WERE REQUIRED AND APPROVED BY THE ENGINEER OF RECORD. EOR/RFI FORMS APPROVING ALL CHANGES SHALL BE SUBMITTED.
ADDITIONAL TESTING AND INSPECTIONS:			
N/A			
POST–CONSTRUCTION			
X	CONSTRUCTION COMPLIANCE LETTER	CED–SOW–10007 CED–FRM–10358	A LETTER FROM THE GENERAL CONTRACTOR STATING THAT THE WORKMANSHIP WAS PERFORMED IN ACCORDANCE WITH INDUSTRY STANDARDS AND THESE CONTRACT DRAWINGS, INCLUDING LISTING ADDITIONAL PARTIES TO THE MODIFICATION PROCESS.
X	POST–INSTALLED ANCHOR ROD PULL TESTS	CED–PRC–10119	POST–INSTALLED ANCHOR RODS SHALL BE TESTED BY A CROWN APPROVED PULL TEST INSPECTOR AND A REPORT SHALL BE PROVIDED INDICATING TESTING RESULTS.
X	PHOTOGRAPHS	CED–SOW–10007	PHOTOGRAPHS SHALL BE SUBMITTED TO THE MI. PHOTOS SHALL DOCUMENT ALL PHASES OF THE CONSTRUCTION. THE PHOTOS SHALL BE ORGANIZED IN A MANNER THAT EASILY IDENTIFIES THE EXACT LOCATION OF THE PHOTO.
N/A	BOLT HOLE INSTALLATION VERIFICATION REPORT	CED–SOW–10007	THE MI INSPECTOR SHALL VERIFY THE INSTALLATION AND TIGHTNESS 10% OF ALL NON PRE–TENSIONED BOLTS INSTALLED AS PART OF THE MODIFICATION. THE MI INSPECTOR SHALL LOOSEN THE NUT AND VERIFY THE BOLT HOLE SIZE AND CONDITION. THE MI REPORT SHALL CONTAIN THE COMPLETED BOLT INSTALLATION VERIFICATION REPORT, INCLUDING THE SUPPORTING PHOTOGRAPHS.
X	PUNCHLIST DEVELOPMENT AND CORRECTION DOCUMENTATION	CED–PRC–10283 CED–FRM–10285	FINAL PUNCHLIST INDICATING ALL NONCONFORMANCE(S) IDENTIFIED AND THE FINAL RESOLUTION AND APPROVAL.
X	MI INSPECTOR REDLINE OR RECORD DRAWING(S)	CED–SOW–10007	THE MI INSPECTOR SHALL OBSERVE AND REPORT ANY DISCREPANCIES BETWEEN THE CONTRACTOR'S REDLINE DRAWING AND THE ACTUAL COMPLETED INSTALLATION.
ADDITIONAL TESTING AND INSPECTIONS:			
N/A			

THE MI CHECKLIST SHALL BE REVIEWED PRIOR TO THE START OF CONSTRUCTION. ALL PARTIES TO THE MODIFICATION SHALL UNDERSTAND CROWN REQUIREMENTS AND INSPECTIONS/DOCUMENTATION THAT ARE APPLICABLE TO THE SOW THEY ARE PERFORMING. ERRORS ON THE CHECKLIST DO NOT ABSOLVE THE GC OR MI INSPECTOR FROM PERFORMING/COLLECTING DOCUMENTATION.

MODIFICATION INSPECTION NOTES

GENERAL

1. THE MI IS AN ON–SITE VISUAL AND HANDS–ON INSPECTION OF TOWER MODIFICATIONS INCLUDING A REVIEW OF CONSTRUCTION REPORTS AND ADDITIONAL PERTINENT DOCUMENTATION PROVIDED BY THE GENERAL CONTRACTOR (GC), AS WELL AS ANY INSPECTION DOCUMENTS PROVIDED BY 3RD PARTY INSPECTORS. THE MI IS TO ENSURE THE INSTALLATION WAS CONSTRUCTED IN ACCORDANCE WITH THE CONTRACT DOCUMENTS, NAMELY THE MODIFICATION DRAWINGS; IN ACCORDANCE WITH APPLICABLE CROWN STANDARDS; AND AS DESIGNED BY THE ENGINEER OF RECORD (EOR).
2. NO DOCUMENT, CODE OR POLICY CAN ANTICIPATE EVERY SITUATION THAT MAY ARISE. ACCORDINGLY, THIS CHECKLIST IS INTENDED TO SERVE AS A SOURCE OF GUIDING PRINCIPLES IN ESTABLISHING GUIDELINES FOR MODIFICATION INSPECTION.
3. THE MI IS TO CONFIRM INSTALLATION CONFIGURATION AND WORKMANSHIP ONLY AND IS NOT A REVIEW OF THE MODIFICATION DESIGN ITSELF, AND THE MI INSPECTOR DOES NOT TAKE OWNERSHIP OF THE MODIFICATION DESIGN. OWNERSHIP OF THE STRUCTURAL MODIFICATION DESIGN EFFECTIVENESS AND INTEGRITY RESIDES WITH THE EOR AT ALL TIMES. THE MI INSPECTOR SHALL INSPECT AND NOTE CONFORMANCE/NONCONFORMANCE AND PROVIDE TO THE CROWN POINT OF CONTACT (CROWN POC) FOR EVALUATION.
4. ALL MI'S SHALL BE CONDUCTED BY A CROWN APPROVED MI INSPECTOR, WORKING FOR A CROWN APPROVED MI VENDOR. SEE CROWN CED–LST–10173, "APPROVED MI VENDORS".
5. 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 PURCHASE ORDER (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 THE GC AND/OR INSPECTOR SHALL CONTACT THE CROWN POINT OF CONTACT (CROWN POC).
6. REFER TO CROWN CED–SOW–10007, "MODIFICATION INSPECTION SOW", FOR FURTHER DETAILS AND REQUIREMENTS.

SERVICE LEVEL COMMITMENT

1. THE FOLLOWING RECOMMENDATIONS AND SUGGESTIONS ARE OFFERED TO ENHANCE THE EFFICIENCY AND EFFECTIVENESS OF DELIVERING AN MI REPORT:
   - THE GC SHALL 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.
   - WHEN POSSIBLE, IT IS PREFERRED TO HAVE THE GC AND MI INSPECTOR DURING THE MI TO HAVE ANY MINOR 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.

REQUIRED PHOTOS

1. 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
     - FINAL INSTALLED CONDITION
     - SURFACE COATING REPAIR
   - POST CONSTRUCTION PHOTOGRAPHS
     - FINAL INFIELD CONDITION
2. PHOTOS OF ELEVATED MODIFICATIONS TAKEN ONLY FROM THE GROUND SHALL BE CONSIDERED INADEQUATE.
3. THIS IS NOT A COMPLETE LIST OF REQUIRED PHOTOS, FOR COMPLETE LIST OF PHOTO SEE DOCUMENT # CED–SOW–10007.

PREPARED FOR:

CROWN CASTLE

BLACK & VEATCH

6800 W 115TH ST, SUITE 2292
OVERLAND PARK, KS 66211

PROJECT NO:	400087
DRAWN BY:	TYW
CHECKED BY:	PD

REV	DATE	DESCRIPTION
0	01/15/20	ISSUED FOR CONSTRUCTION

STATE OF CONNECTICUT
JOSHUA J. RILEY
33208
LICENSED PROFESSIONAL ENGINEER
01/21/2020

BU #876325
WO #1819530
WESTON SQUARE
92 WESTON STREET
HARTFORD, CT 06103–1217
HARTFORD COUNTY, USA

SHEET TITLE

MODIFICATION INSPECTION CHECKLIST

SHEET NUMBER

TM-2

GENERAL NOTES

1. The General Contractor (GC) shall reference CED–STD–10159, "Tower Modification Construction Specifications", as a continuation of the following General Notes. The GC shall keep a copy of this document with the Structural Design Drawings (SDD) at all times, and shall ensure that all Contractor Personnel are aware of the information enclosed within the General Notes and CED–STD–10159.

2. The Contract Documents are the property of Crown Castle (Crown). They are provided to the GC and its Lower Tier Contractors and material suppliers for the limited purpose of use in completing the Work for this Site, and shall be kept in strict confidence and not disclosed to any third parties. The Contract Documents shall not be used for any other purpose whatsoever without the prior written consent of Crown.

3. Detail drawings, including notes and tables, shall govern over general notes and typical details. Contact the Crown Point of Contact (POC) and Engineer of Record (EOR) for clarification as needed.

4. Do not scale drawings.

5. Any Work performed without a prefabrication mapping is done at the risk of the GC and/or fabricator. All dimensions of existing structural elements are assumed based on the available documentation and are preliminary until field–verified by the GC, unless noted otherwise (UNO). Where discrepancies are found, GC shall contact the Crown POC and EOR through RFI.

6. For this analysis and modification, the tower has been assumed to be in good condition without any structural defects, UNO. If the GC discovers any indication of an existing structural defect, contact the Crown POC and EOR immediately.

7. All construction means and methods, including but not limited to erection plans, rigging plans, climbing plans, and rescue plans, shall be the responsibility of the GC responsible for the execution of the Work contained herein, and shall meet ANSI/ASSE A10.48 (latest edition); federal, state, and local regulations; and any applicable industry consensus standards related to the construction activities being performed. All rigging plans shall adhere to ANSI/ASSE A10.48 (latest edition) and Crown standard CED–STD–10253, "Rigging Program", including the required involvement of a qualified engineer for class IV construction to certify the supporting structure(s) in accordance with the ANSI/TIA–322 (latest edition).

8. The structural integrity of the modification design extends to the complete condition only. The GC must be cognizant that the removal of any structural component of an existing tower has the potential to cause the partial or complete collapse of the structure. All necessary precautions must be taken to ensure structural integrity, including, but not limited to, engineering assessment of construction stresses with installation maximum wind speed and/or temporary bracing and shoring.

9. Aerial and underground utilities and facilities may or may not be shown on the drawings. The GC shall take every precaution to preserve and protect these items, which may include aerial or underground power lines, telephone lines, water lines, sewer lines, cable television facilities, pipelines, structures and other public and private improvements within or adjacent to the Work area. The responsibility for determining the actual on–site location of these items shall rest exclusively with the GC.

10. All manufacturer's hardware assembly instructions shall be followed, UNO. Conflicting notes shall be brought to the attention of the EOR and the Crown POC.

11. The GC shall fabricate all required items per the materials specified below, UNO on the detail drawing sheets. If the GC finds for any component that the materials have not been clearly specified, the GC shall submit an RFI to the EOR to confirm the required material.

    All structural elements shall be new and shall conform to the following requirements, UNO:

    Monopoles:
    - Structural shapes and plates: ASTM A572 Grade 65 (Fy = 65 KSI)
    - Welding electrodes, SMAW: E80XX
    - Welding electrodes, FCAW: E8XT–XX
    - Welding electrodes, GMAW: ER80S–X

    Self–Support and Guyed Towers:
    - Structural shapes and plates: ASTM A572 Grade 50 (Fy = 50 KSI)
    - Welding electrodes, SMAW: E70XX
    - Welding electrodes, FCAW: E7XT–XX
    - Welding electrodes, GMAW: ER70S–X

    All tower types:
    - Steel angle: ASTM A572 Grade 50 (Fy = 50 KSI)
    - Solid rod: ASTM A36 (Fy = 36 KSI)
    - Pipe/tube (round): ASTM A500 Grade C (Fy = 46 KSI)
    - Pipe/tube (square): ASTM A500 Grade C (Fy = 50 KSI)
    - Bolts: ASTM F3125 Grade A325 Type 1
    - U–bolts: ASTM A307 Grade A, or SAE J429 Grade 2
    - Nuts: ASTM A563 Grade DH
    - Washers: ASTM F436 Type 1
    - Guy Wires: ASTM A475 Grade EHS
    - Bridge Strand: ASTM A586 Grade 1

12. After fabrication, hot–dip galvanize all steel items, UNO. Galvanize per ASTM A123, ASTM A153/A153M, or ASTM A653 G90, as applicable. ASTM A490 bolts shall not be hot–dip galvanized, but shall instead be coated with Magni 565 or EOR approved equivalent, per ASTM F2833.

13. Contractor Personnel shall not drill holes in any new or existing structural members, other than those drilled holes shown on structural drawings, without the approval of the EOR.

14. For a list of Crown–approved cold galvanizing compounds, refer to ENG–STD–10149, "Tower Protective Coatings Guidelines".

15. All exposed structural steel as the result of this scope of Work including welds (after final inspection of the weld by the CWI), field drilled holes, and shaft interiors (where accessible), shall be cleaned and two (2) coats cold galvanizing shall be applied by brush in accordance with ENG–STD–10149, "Tower Protective Coatings Guidelines". Photo documentation is required to be submitted to the MI Inspector.

16. If removal of existing modifications is required per the modification scope, the GC shall clean and cold galvanize any existing empty bolt holes, UNO. If additional unexpected, oversized, or slotted holes are found, the GC shall contact the EOR and Crown POC for guidance prior to proceeding with the modifications.

17. All Work involving base plate grout scope items or resulting in disturbance of base plate grout shall reference ENG–STD–10323, "Base Plate Grout", and shall follow any Base Plate Grout Removal Notes contained herein.

18. All tower grounding affected by the Work shall be repaired or replaced in accordance with OPS–STD–10090, "Tower Grounding", and OPS–BUL–10133, "Grounding Repair Recommendation".

19. If scope of modification requires removal or covering of tower ID tag, the tag must be replaced.

20. Any hardware removed from the existing tower shall be replaced with new hardware of equal size and quality, UNO. No existing fasteners shall be reused.

21. All joints using ASTM A325 or A490 bolts, U–bolts, V–bolts, and threaded rods shall be snug tightened, UNO.

22. A nut locking device shall be installed on all proposed and/or replaced snug tightened ASTM A325 or A490 bolts, U–bolts, V–bolts, and threaded rods.

23. All joints are bearing type connections UNO. If no bolt length is given in the Bill of Materials, the connection may include threads in the shear planes, and the GC is responsible for sizing the length of the bolt.

24. Blind bolts shall be installed per the installation specifications on the corresponding Approved Fastener sheets contained in CED–CAT–10300, "Monopole Standard Drawings and Approved Reinforcement Components".

25. If ASTM A325 or A490 bolts, and/or threaded rods are specified to be pre–tensioned, these shall be installed and tightened to the pretensioned condition according to the requirements of the RCSC Specification for Structural Joints Using ASTM High Strength Bolts.

26. All proposed and/or replaced bolts shall be of sufficient length such that the end of the bolt be at least flush with the face of the nut. It is not permitted for the bolt end to be below the face of the nut after tightening is completed.

PREPARED FOR:

CROWN CASTLE

BLACK & VEATCH

6800 W 115TH ST, SUITE 2292
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PROJECT NO:	400087
DRAWN BY:	TYW
CHECKED BY:	PD

REV	DATE	DESCRIPTION
0	01/15/20	ISSUED FOR CONSTRUCTION

STATE OF CONNECTICUT
JOSHUA J. RILEY
33208
LICENSED PROFESSIONAL ENGINEER
01/21/2020

BU #876325
WO #1819530
WESTON SQUARE
92 WESTON STREET
HARTFORD, CT 06103–1217
HARTFORD COUNTY, USA

SHEET TITLE

NOTES

SHEET NUMBER

TM-3

CONCRETE NOTES

1. All concrete work shall be in accordance with ACI 301 specifications for structural concrete (latest edition). All concrete shall have a minimum 28 day compressive strength of 4500 PSI.
2. Prepare and submit batch tickets for each type and strength of concrete.
3. For field mixing, prepare and submit mix designs for pre–approval for each type and strength of concrete in accordance with ACI 211, "Proportioning Concrete Mixtures", and ACI 301, "Specifications for Structural Concrete".
4. All concrete shall be normal weight concrete.
5. Slump tests shall be made in accordance with ASTM C143. The allowable concrete slump shall be 4 inches (+/– 1") unless admixtures are used. Admixtures shall be in accordance with ASTM C494 standard types A, B, C, D, or E.
6. The engineer shall pre–approve superplasticizer use.
7. Cement shall conform to ASTM C150 Type II. Fine aggregate shall conform to ASTM C33. Coarse aggregate shall be gravel or crushed stone conforming to C33. Maximum aggregate size shall be 3/4".
8. Water shall be clean and free from oils, acids, alkalies, and organic materials. No additional water shall be added to the concrete at the job site.
9. Do not use chloride–containing admixtures.
10. Air entraining admixtures shall conform to ASTM C260.
11. Hot weather concrete placement shall comply with ACI 305R. Cold weather concrete placement shall comply with ACI 306.1.
12. Concrete shall be placed within 24 hours of excavation inspections. The contractor shall be responsible for protecting exposed excavations prior to concrete placement.
13. Place concrete by using a chute or hopper device such that concrete shall not free fall from a height greater than 5 feet. Deposit concrete within the center of the steel reinforcing cage to prevent segregation.
14. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 309R. Do not use vibrators to transport concrete.
15. Concrete shall be cured in accordance with ACI 301. When applicable, curing compounds shall be water clear, styrene acrylate type with a minimum solids content of 30%. Application shall be in conformance with manufacturer's instructions.
16. All concrete testing shall be in accordance with ACI 318. A minimum of two 6"x12" concrete cylinders per anchor block (Guyed towers only) and a minimum six 6"x12" concrete cylinders per batch are required.
17. A chamfer of 3/4" shall be provided at all exposed edges of concrete, unless noted otherwise, in accordance with ACI 301.

CONCRETE REINFORCING STEEL NOTES

1. All reinforcing steel shall be deformed billet steel conforming to ASTM A615, Grade 60 unless noted otherwise.
2. Reinforcing steel shall be detailed, fabricated, bent, and placed in accordance with the CRSI Manual of Standard Practice and ACI 315 (latest edition).
3. Welding of reinforcing and embedments is prohibited.
4. All reinforcing steel shall have a minimum three (3) inches concrete coverage unless noted otherwise.
5. Spacing devices shall be used as required to maintain the side and bottom clearance between the steel reinforcement and excavation.

BASE PLATE GROUT REMOVAL NOTES

1. When base plate grout removal is specified in the tower modification table, the contractor shall take the following steps:
   - A. The GC shall begin this procedure as early as possible during the modification process so that if issues arise, they can be resolved within the anticipated modification timeline.
   - B. If any deteriorated grout exists, begin at this location. Remove deteriorated grout and the grout around the nearest one or two anchor rods to fully expose the leveling nut. If the GC discovers that a half nut or jam nut was used as a leveling nut, or if no leveling nut is present, immediately contact CED and the Crown POC (typically the Mod PM) for a resolution. Do not remove any additional grout until directed to by Crown.
   - C. Otherwise, check the leveling nut for tightness in accordance with Section 7.2.3 of ENG–STD–10323 "Base Plate Grout". If severe corrosion / material loss is found or corrosion exists to the point where the leveling nut is unable to be tightened when obviously loose, immediately notify the Crown POC (typically the Mod PM). Reference ENG–BUL–10114 "Rust Classification" for examples of material loss. Do not remove any additional grout until directed to by Crown.
   - D. In the event that severe corrosion is not encountered, and being sure to check each anchor rod for corrosion per ENG–BUL–10114 "Rust Classification", remove all existing base plate grout while checking each leveling nut for tightness in accordance with Section 1.3.2.3 of ENG–STD–10323 "Base Plate Grout".
   - E. Consistent with Section 7.2.4 of ENG–STD–10323 "Base Plate Grout", hand tool clean to SSPC–SP2 and solvent clean to SSPC–SP1, all exposed structural steel elements, including anchor rods, leveling nuts, and underside of base plate to the greatest extent possible. Ensure that all existing grout is removed to allow cold galvanizing to adhere to the steel.
   - F. Apply by brush two coats of a Crown–approved cold–galvanizing compound to all exposed structural steel elements beneath the base plate, and allow curing in accordance with the manufacturer's recommendation. A list of Crown–approved direct application cold–galvanizing compounds can be found in ENG–STD–10149 "Tower Protective Coatings Guidelines" Section 2.1.1.
   - G. The GC shall provide photos of each anchor rod with leveling nut after cleaning but before cold–galvanization, and also again after cold–galvanization, for inclusion in the MI report.

PREPARED FOR:

CROWN CASTLE

BLACK & VEATCH

6800 W 115TH ST, SUITE 2292
OVERLAND PARK, KS 66211

PROJECT NO:	400087
DRAWN BY:	TYW
CHECKED BY:	PD

REV	DATE	DESCRIPTION
0	01/15/20	ISSUED FOR CONSTRUCTION

STATE OF CONNECTICUT · JOSHUA J. RILEY · 33208 · LICENSED PROFESSIONAL ENGINEER

01/21/2020

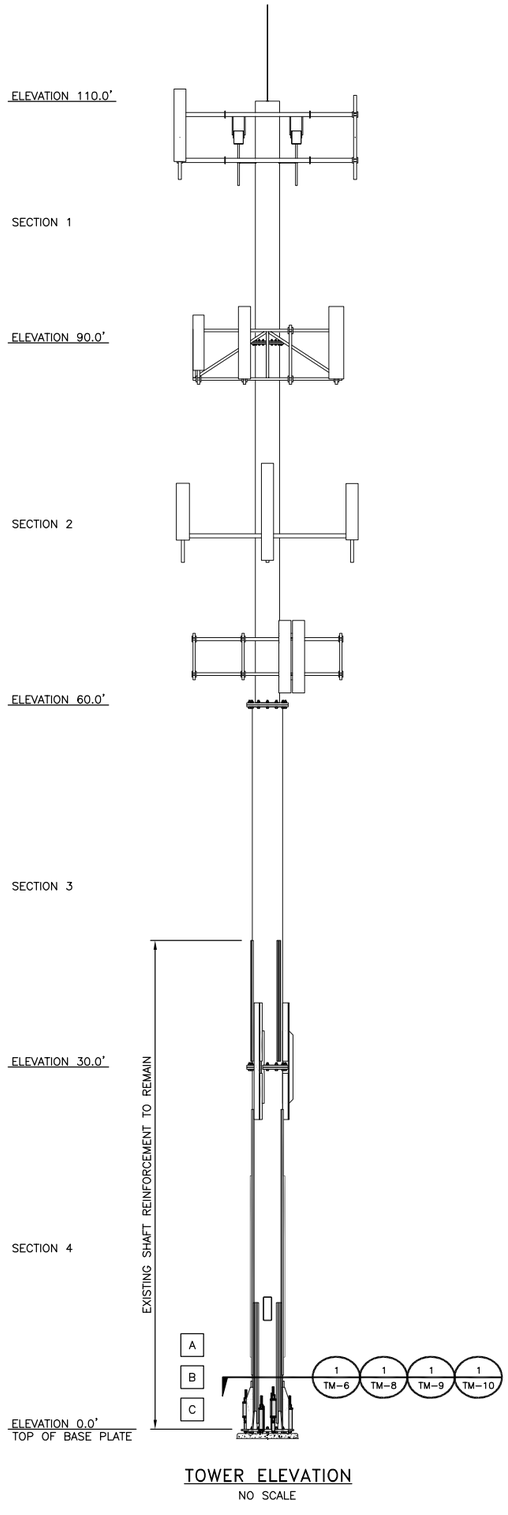
BU #876325
WO #1819530
WESTON SQUARE
92 WESTON STREET
HARTFORD, CT 06103–1217
HARTFORD COUNTY, USA

SHEET TITLE

NOTES

SHEET NUMBER

TM-4



TOWER ELEVATION

NO SCALE

POLE MODIFICATION SCHEDULE

CALLOUT	ELEVATION (FT)	MODIFICATION	REFERENCE SHEET
A	0.0	REMOVE EXISTING BASE PLATE GROUT SEE BASE PLATE GROUT REMOVAL NOTES	TM-4
B	0.0	INSTALL (3) NEW ANCHOR RODS WITH ANCHOR ROD BRACKETS	TM-6 & TM-7
C	0.0	REMOVE (3) EXISTING ANCHOR ROD BRACKETS AND INSTALL (3) NEW ANCHOR RODS WITH ANCHOR ROD BRACKETS	TM-8, TM-9, TM-10, TM-11, & TM-12

FOR PARTS NOT DETAILED WITHIN THE DRAWING AND STARTING WITH "CCI-", SEE THE FOLLOWING CATALOG FOR DETAILS: CED-CAT-10300, MONOPOLE STANDARD DRAWINGS AND APPROVED REINFORCEMENT COMPONENTS.

PRIOR TO FABRICATION AND INSTALLATION, CONTRACTOR SHALL FIELD VERIFY ALL LENGTH AND QUANTITIES GIVEN. LENGTHS AND QUANTITIES GIVEN ARE FOR QUOTING PURPOSES ONLY, AND SHALL NOT BE USED FOR FABRICATION.

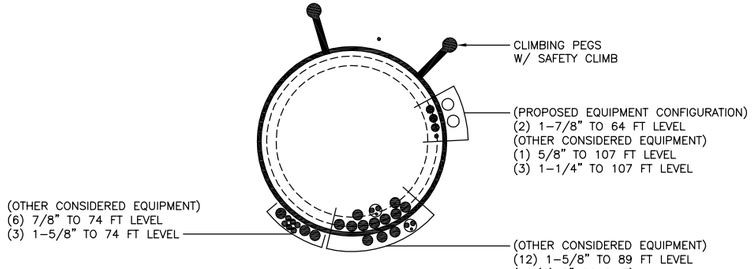
MANUFACTURER POLE SPECIFICATIONS

POLE SHAFT TYPE	ROUND
TAPER	0.00 IN/FT
BASE PLATE STEEL	ASTM A36 GRADE 36
ANCHOR RODS	1 1/2"ø A193 GRADE B7

MANUFACTURER SHAFT SECTION DATA

SHAFT SECTION	SHAFT LENGTH (FT)	THICKNESS (IN)	SECTION GRADE (KSI)	FLANGE PLATE GRADE (KSI)	LAP SPLICE (IN)	DIAMETER ACROSS FLAT (IN)	
						@ TOP	@ BOTTOM
1	20.00	0.2500	42	36	N/A	24.00	24.00
2	30.00	0.3750	42	36		24.00	24.00
3	30.00	0.3750	42	36		30.00	30.00
4	30.00	0.5000	42	36		30.00	30.00

NOTE: DIMENSIONS SHOWN DO NOT INCLUDE GALVANIZING TOLERANCES



COAX FEEDLINE PLAN

NO SCALE

PRIOR TO FABRICATION AND INSTALLATION, CONTRACTOR SHALL FIELD VERIFY ALL LENGTHS AND QUANTITIES GIVEN. LENGTH AND QUANTITIES PROVIDED ARE FOR QUOTING PURPOSES ONLY AND SHALL NOT BE USED FOR FABRICATION.

PREPARED FOR:

CROWN CASTLE

BLACK & VEATCH

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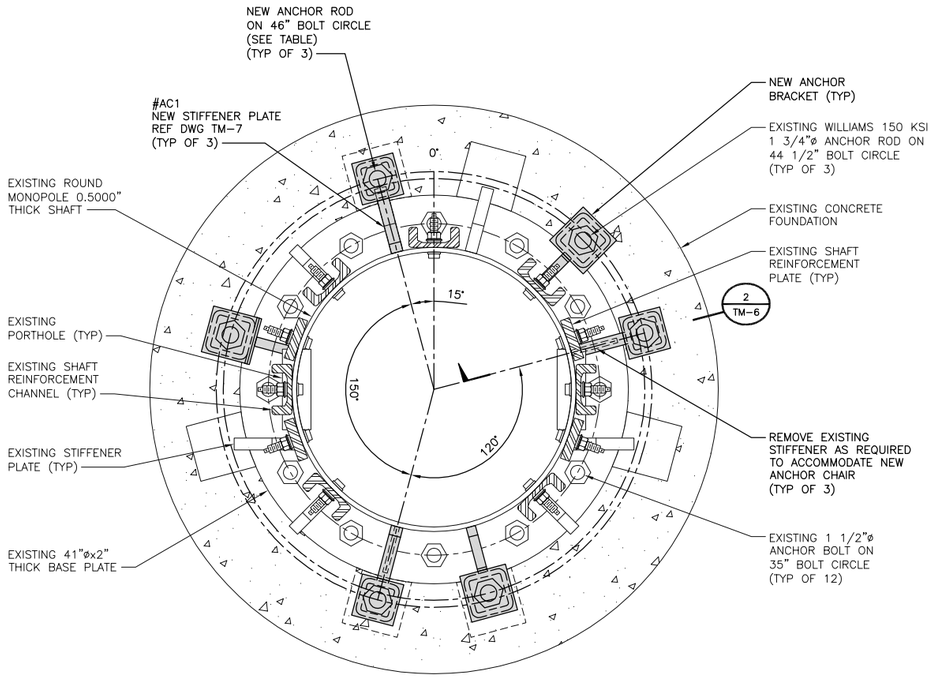
SHEET TITLE

TOWER ELEVATION

SHEET NUMBER

TM-5

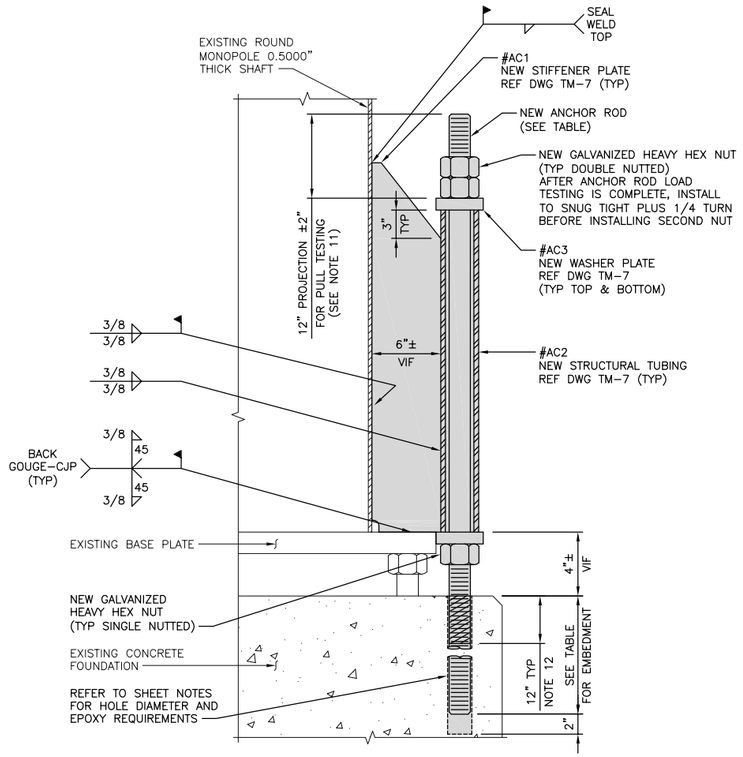
ANCHOR ROD SPECIFICATIONS								
CROWN PART #	ROD DIAMETER (IN)	INSTALLED LENGTH (IN)	MATERIAL	HOLE DIAMETER (IN)	EMBEDMENT DEPTH (IN) (+2",-0")	TARGET TENSION LOAD (KIPS)	EPOXY	CA-ONLY PROOF LOAD (KIPS)
CCI-AR-0175	1.75	96	A193 GR B7	2	60	111	AF35LVE	–



SECTION 1
ANCHOR ROD PLAN
NO SCALE

NOTES

1. PLATE WASHER MUST FULLY BEAR ON THE TUBE.
2. REFERENCE CC APPROVED COMPONENTS (CURRENT VERSION) FOR ANCHOR ROD DIMENSIONS.
3. RODS MUST BE GALVANIZED FROM THE TOP OF THE PROJECTION TO 15" BELOW THE SURFACE OF THE CONCRETE, AT A MINIMUM.
4. CORED HOLES MUST BE MECHANICALLY ROUGHENED USING A CARBIDE HOLE ROUGHENER OR EQUIVALENT. BRUSHING WITH A NYLON OR WIRE BRUSH SHALL BE USED IN THE PROCESS OF HOLE CLEANING, BUT DOES NOT SATISFY THE HOLE ROUGHENING REQUIREMENT.
5. FOLLOW EPOXY MANUFACTURER'S RECOMMENDATIONS FOR HOLE CLEANING.
6. ALL HOLES MUST BE DRY PRIOR TO PLACING EPOXY.
7. FOLLOW EPOXY MANUFACTURER'S RECOMMENDATIONS REGARDING HANDLING OF THREADED ROD AND EPOXY, AS WELL AS ALL INSTALLATION INSTRUCTIONS AND REQUIREMENTS.
8. TAKE ALL MEASUREMENTS NECESSARY TO AVOID DAMAGING EXISTING REINFORCEMENT BARS DURING CORING OPERATIONS, NOTIFY EOR IMMEDIATELY IF EXISTING REINFORCING BARS ARE ENCOUNTERED AND INTERFERE WITH PLACEMENT OF NEW ANCHORS. MINOR ADJUSTMENT TO PROPOSED LOCATIONS OF NEW ANCHORS MAY BE REQUIRED.
9. IF BASE PLATE GROUT REPAIR IS REQUIRED FOR ANCHOR ROD INSTALLATION, SEE ENG-PRC-10012: BASE PLATE GROUT REPAIR, FOR PROCEDURES AND RECOMMENDED MANUFACTURERS. CONTRACTOR TO DETERMINE THE QUANTITY REQUIRED.
10. ONCE ALL RESIN AND GROUT HAVE CURED, NEW ANCHOR ROD REINFORCING SHALL BE TARGET TENSIONED TO THE VALUE LISTED IN THE TABLE ON THIS SHEET. SEE CED-PRC-10119: PULL-OUT TESTING POST-INSTALLED ANCHOR RODS, FOR SPECIFICATIONS.
11. CONTRACTOR TO VERIFY THAT A PULL TEST IS ABLE TO BE PERFORMED USING THE ANCHOR ROD PROJECTIONS SHOWN.
12. ANCHOR ROD TO BE WRAPPED IN ELECTROTAPE 706B BOND BREAKER TAPE OR APPROVED EQUAL FOR 12" FROM TOP OF FOUNDATION. CONTRACTOR TO HAMMER DRILL HOLE WITH CARBIDE BIT (OR EQUIVALENT). FOR CORE DRILLING OPTION, CLEAN AND MECHANICALLY ROUGHEN HOLES PRIOR TO ANCHOR INSTALLATION. REFERENCE TABLE ON THIS SHEET FOR REQUIRED HOLE DIAMETER, EMBEDMENT DEPTH, AND ANCHOR ROD LENGTH.
13. WHEN COMPLETED WITH EPOXY INSTALLATION, THE TOP OF EPOXY SHALL BE EQUAL TO OR HIGHER THAN THE TOP OF FOUNDATION, SUCH THAT WATER IS NOT ABLE TO COLLECT IN ANNULAR AREA AROUND EXPOSED PORTION OF THE ANCHOR ROD.



SECTION 2
NO SCALE

PREPARED FOR:

CROWN CASTLE

BLACK & VEATCH

6800 W 115TH ST, SUITE 2292
OVERLAND PARK, KS 66211

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JOSHUA J. RILEY
33208
LICENSED PROFESSIONAL ENGINEER
01/21/2020

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WO #1819530
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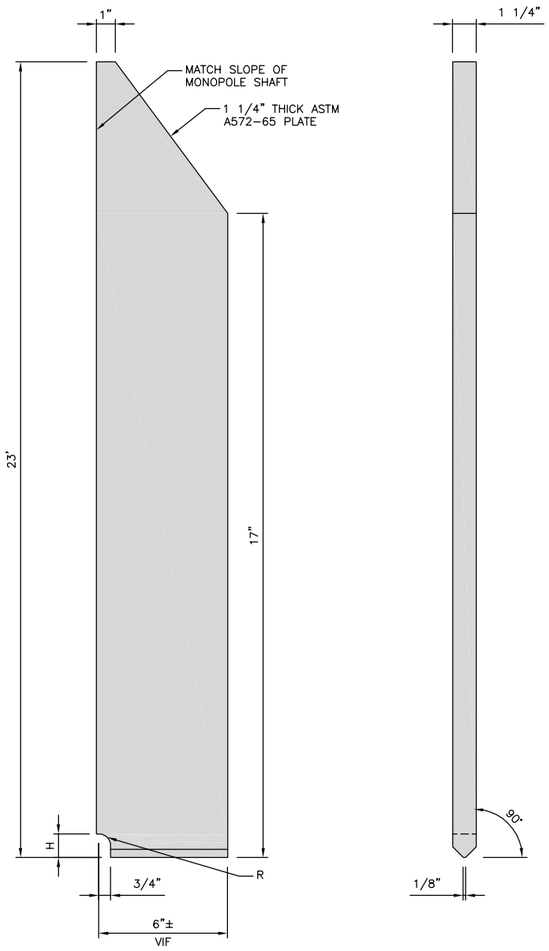
92 WESTON STREET
HARTFORD, CT 06103-1217
HARTFORD COUNTY, USA

SHEET TITLE
BASE PLATE ANCHOR ROD CHAIR DETAILS

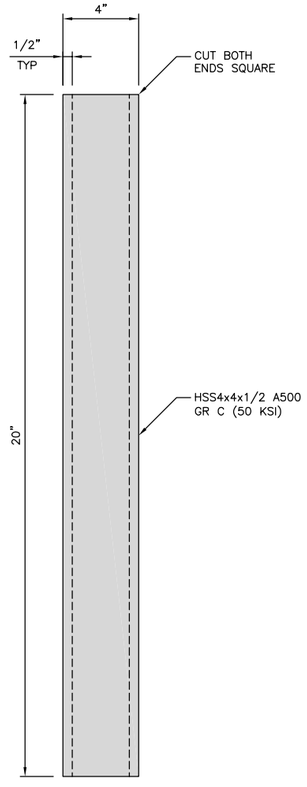
SHEET NUMBER
TM-6



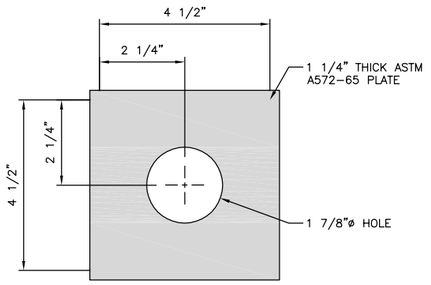
NOTE

R = STIFFENER THICKNESS/2
H = STIFFENER THICKNESS

#AC1
STIFFENER PLATE
NO SCALE



#AC2
STRUCTURAL TUBING
NO SCALE



#AC3
WASHER PLATE
NO SCALE

PREPARED FOR:

CROWN CASTLE

BLACK & VEATCH

6800 W 115TH ST, SUITE 2292
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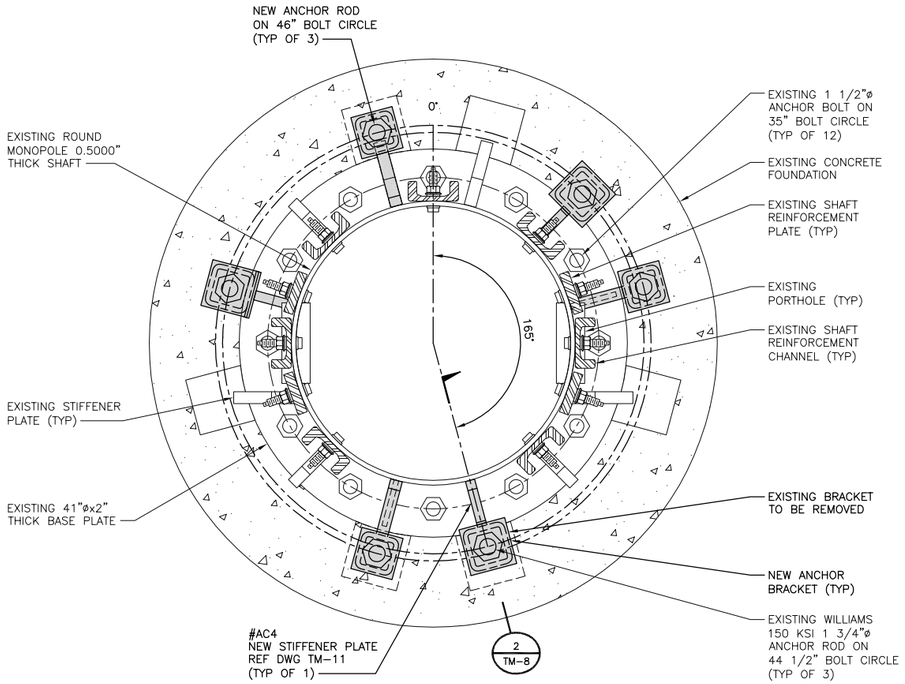
SHEET TITLE

BASE PLATE ANCHOR ROD CHAIR DETAILS

SHEET NUMBER

TM-7

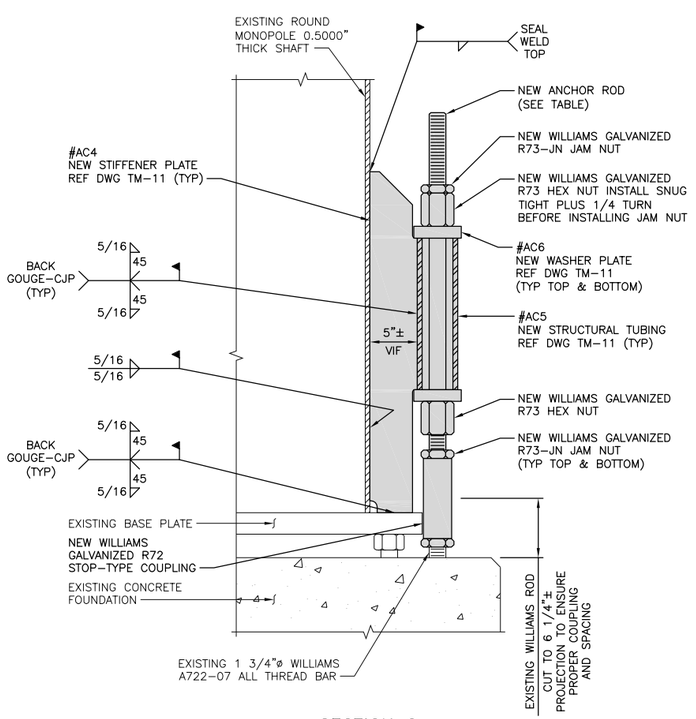
ANCHOR ROD SPECIFICATIONS			
PART #	ROD DIAMETER (IN)	INSTALLED LENGTH (IN)	MATERIAL
WILLIAMS 150 KSI ALL THREAD BARS	1.75	39	ASTM A722-07



SECTION 1
ANCHOR ROD PLAN
NO SCALE

NOTES

1. PLATE WASHER MUST FULLY BEAR ON THE TUBE.



SECTION 2
NO SCALE

PREPARED FOR:

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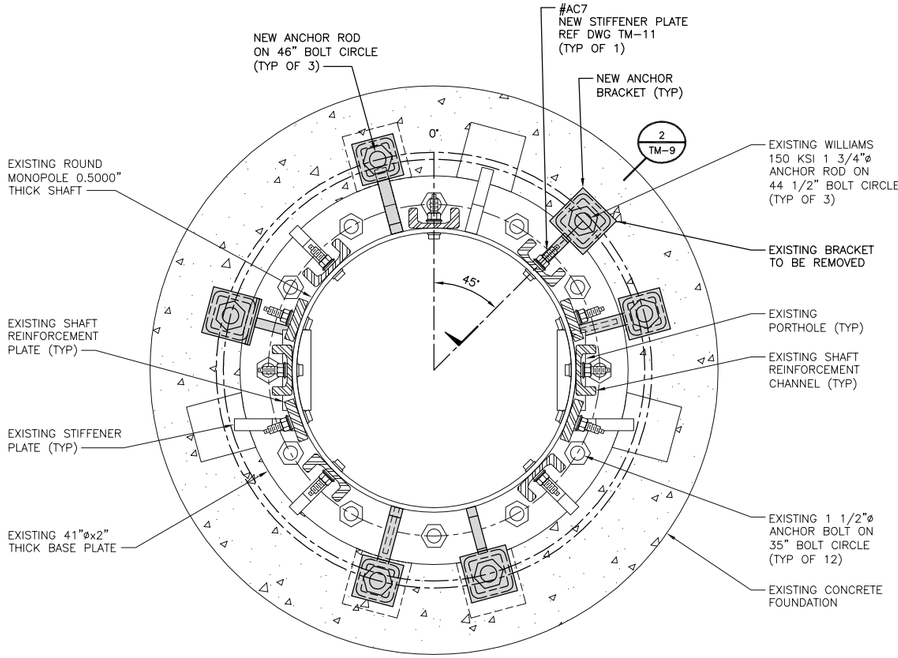
SHEET TITLE

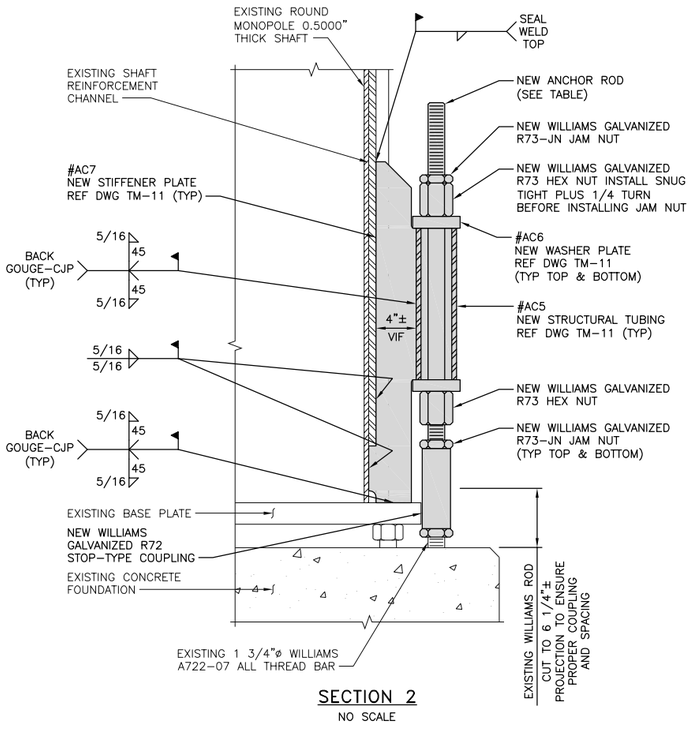
BASE PLATE ANCHOR ROD CHAIR DETAILS

SHEET NUMBER

TM-8



SECTION 1
ANCHOR ROD PLAN
NO SCALE

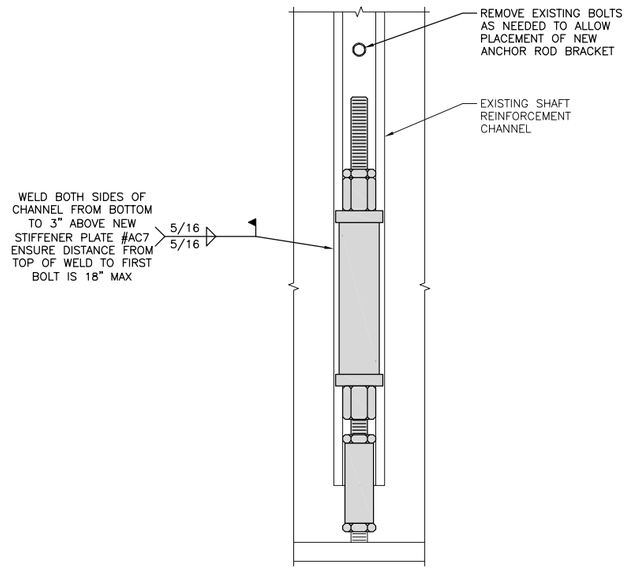


SECTION 2
NO SCALE

NOTES

1. PLATE WASHER MUST FULLY BEAR ON THE TUBE.

ANCHOR ROD SPECIFICATIONS			
PART #	ROD DIAMETER (IN)	INSTALLED LENGTH (IN)	MATERIAL
WILLIAMS 150 KSI ALL THREAD BARS	1.75	39	ASTM A722-07



ADDITIONAL WELDING
EXISTING REINFORCEMENT CHANNEL
NO SCALE

PREPARED FOR:

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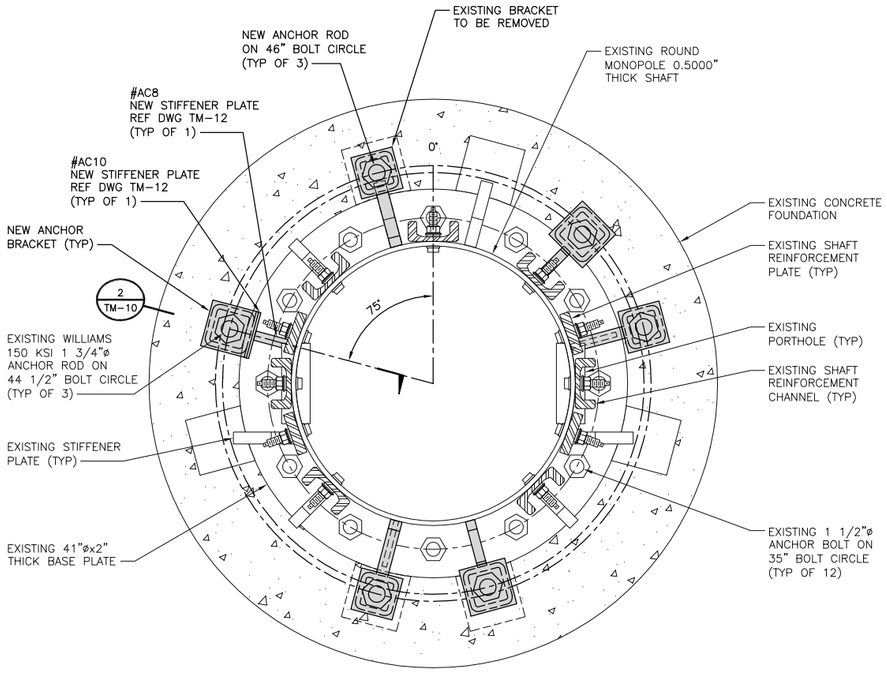
SHEET TITLE

BASE PLATE ANCHOR
ROD CHAIR DETAILS

SHEET NUMBER

TM-9

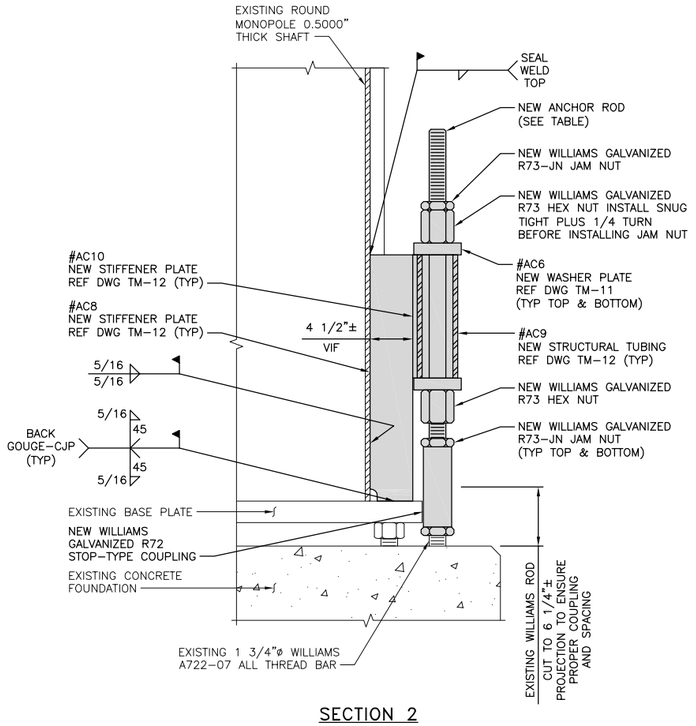
ANCHOR ROD SPECIFICATIONS			
PART #	ROD DIAMETER (IN)	INSTALLED LENGTH (IN)	MATERIAL
WILLIAMS 150 KSI ALL THREAD BARS	1.75	39	ASTM A722–07



SECTION 1
ANCHOR ROD PLAN
NO SCALE

NOTES

1. PLATE WASHER MUST FULLY BEAR ON THE TUBE.
2. CONTRACTOR TO ENSURE THAT THE FULL 26" GUSSET TO POLE SHAFT WELD IS ACHIEVED, IF THIS CANNOT BE ACCOMPLISHED CONTACT THE EOR IMMEDIATELY.



SECTION 2
NO SCALE

PREPARED FOR:

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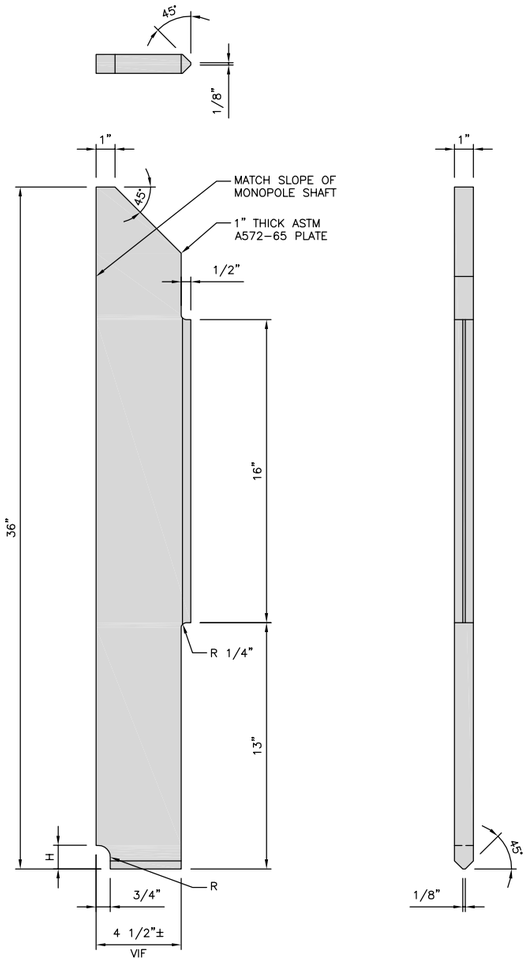
SHEET TITLE

BASE PLATE ANCHOR ROD CHAIR DETAILS

SHEET NUMBER

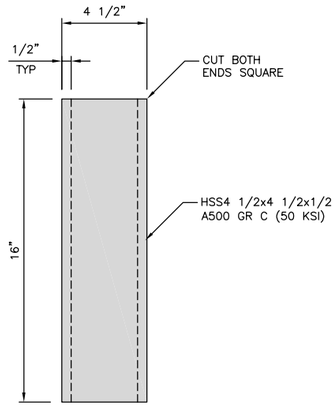
TM-10



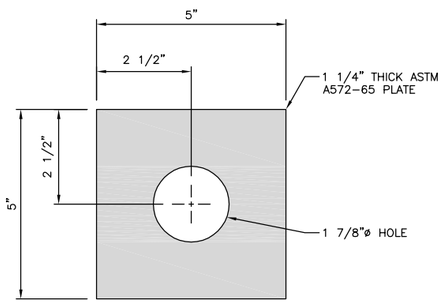
NOTE

R = STIFFENER THICKNESS/2
H = STIFFENER THICKNESS

#AC4
STIFFENER PLATE
NO SCALE



#AC5
STRUCTURAL TUBING
NO SCALE



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WASHER PLATE
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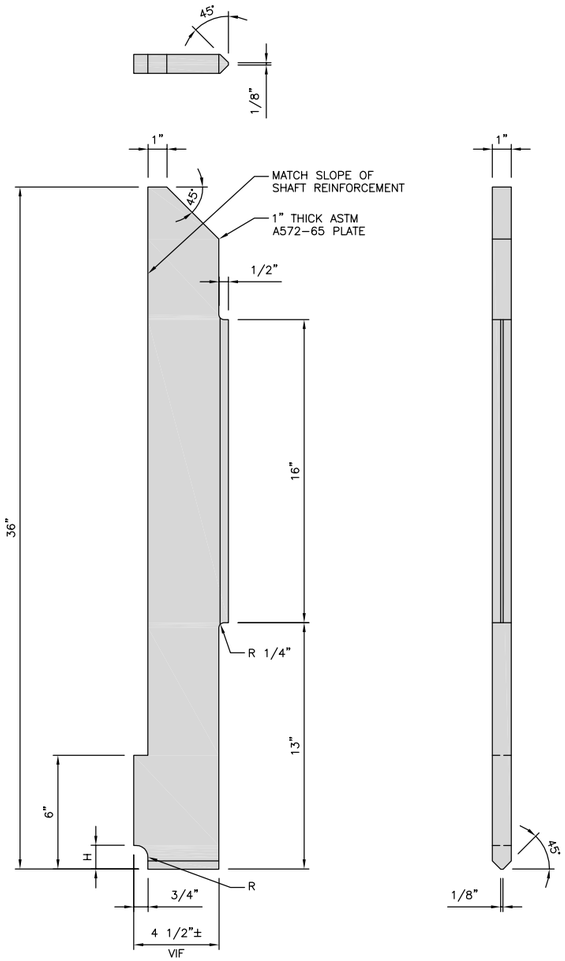

NOTE

R = STIFFENER THICKNESS/2
H = STIFFENER THICKNESS

#AC7
STIFFENER PLATE
NO SCALE

PREPARED FOR:

CROWN CASTLE

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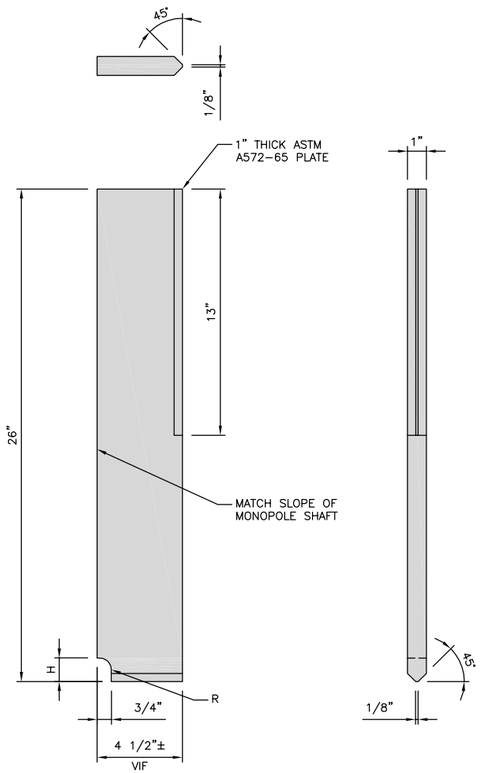
SHEET TITLE

BASE PLATE ANCHOR ROD CHAIR DETAILS

SHEET NUMBER

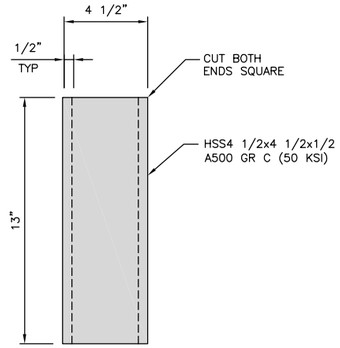
TM-11



NOTE

R = STIFFENER THICKNESS/2
H = STIFFENER THICKNESS

#AC8
STIFFENER PLATE
NO SCALE



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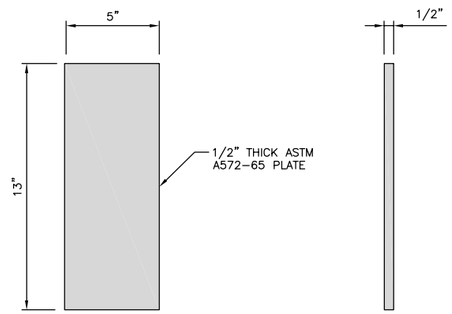
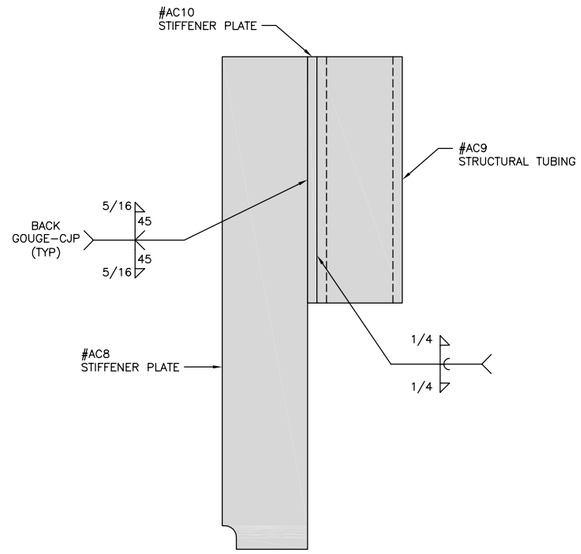
STRUCTURAL TUBING
NO SCALE



#AC10
STIFFENER PLATE
NO SCALE



ADDITIONAL
WELDING DETAIL
NO SCALE

PREPARED FOR:

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WESTON SQUARE
92 WESTON STREET
HARTFORD, CT 06103–1217
HARTFORD COUNTY, USA

SHEET TITLE

BASE PLATE ANCHOR ROD CHAIR DETAILS

SHEET NUMBER

TM-12