May 23, 2016

Sean Dempsey
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Subject:	**Structural Analysis Report**	
Carrier Designation:	***Verizon Wireless* Co-Locate**	
	Carrier Site Name:	Portland 12 ME
Crown Castle Designation:	**Crown Castle BU Number:**	878782
	Crown Castle Site Name:	Portland Warren Ave
	Crown Castle JDE Job Number:	356689
	Crown Castle Work Order Number:	1232451
	Crown Castle Application Number:	321952 Rev. 13
Engineering Firm Designation:	**B+T Group Project Number:**	86959.008.01
Site Data:	**188 Warren Ave, Portland, Cumberland County, ME** **Latitude *43° 41' 15.16"*, Longitude *-70° 18' 14.96"*** **180 Foot - Monopole Tower**	

Dear Sean Dempsey,

B+T Group is pleased to submit this **"Structural Analysis Report"** to determine the structural integrity of the above mentioned tower. This analysis has been performed in accordance with the Crown Castle Structural 'Statement of Work' and the terms of Crown Castle Purchase Order Number 904844, in accordance with application 321952, revision 13.

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:

LC7: Existing + Reserved + Proposed Equipment **Sufficient Capacity**
Note: See Table 1 and Table 2 for the proposed and existing/reserved loading, respectively.

The analysis has been performed in accordance with the TIA-222-G standard and 2009 International Building Code based upon a wind speed of 100 mph 3-second gust, exposure category C.

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

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

Respectfully submitted by:
B+T Engineering, Inc.

STATE OF MAINE
SCOTT S. VANCE
14168
LICENSED
PROFESSIONAL ENGINEER

5/23/16

Leena Kantheti, E.I.T.
Project Engineer

Scott S. Vance, P.E.
Engineer of Record

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1) INTRODUCTION

This is a 180 ft. monopole designed by Pittsburg Monopole Division in February of 1997. The monopole was originally designed for a wind speed of 85 mph per TIA/EIA-222-F. This monopole has been modified by Crown Castle in April of 2012, B+T Group in March of 2013 and July 2015 and Crown Castle in February of 2016 and those modifications were incorporated in this analysis.

2) ANALYSIS CRITERIA

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

Table 1 - Proposed Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
110.0	110.0	3	Alcatel Lucent	B13 RRH 4X30	2	1-5/8	--
		3	Alcatel Lucent	B25 RRH4X30			
		3	Alcatel Lucent	RRH2X60-AWS			
		6	Commscope	SBNHH-1D65C			
		2	Rfs Celwave	DB-B1-6C-12AB-0Z			
		1	--	Platform Mount [LP 1301-1]			

Matches Antenna Rec dated 4/30/16

Table 2 - Existing and Reserved Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
177.0	179.0	1	RFS Celwave	APXV9ERR18-C-A20	3	1-1/4	1
		2	RFS Celwave	APXVSPP18-C-A20			
		3	RFS Celwave	IBC1900BB-1			
		3	RFS Celwave	IBC1900HG-2A			
	177.0	1	--	Platform Mount [LP 715-1]			
175.0	176.0	3	Alcatel Lucent	PCS 1900MHz 4x45W-65MHz	--	--	1
	175.0	1	--	Side Arm Mount [SO 102-3]			
171.0	171.0	**6**	**DAPA**	**58010**	**6**	**1-5/8**	**3**
		1	**--**	**Platform Mount [LP 401-1]**			
162.0	162.0	2	KMW Comm.	AM-X-CD-16-65-00T-RET	--	--	1
		3	Powerwave Tech.	7020.00			
		3	Powerwave Tech.	7770.00			
		1	Powerwave Tech.	P65-17-XLH-RR			
		1	Raycap	DC6-48-60-18-8F			
		2	CCI Antennas	HPA-65R-BUU-H6	12 4 2	1-5/8 5/8 3/8	2
		1	CCI Antennas	HPA-65R-BUU-H8			
		2	CCI Antennas	OPA-65R-LCUU-H6			
		1	CCI Antennas	OPA-65R-LCUU-H8			

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
		3	Ericsson	RRUS 11			
		3	Ericsson	WCS RRUS-32-B30			
		1	Raycap	DC6-48-60-18-8F			
		1	--	Platform Mount [LP 1301-1]			
	161.0	3	Ericsson	RRUS A2			
		4	Powerwave Tech.	LGP21401			
		1	Powerwave Tech.	TT19-08BP111-001			
		6	Ericsson	RRUS-11	--	--	1

Notes:
1) Existing Equipment
2) Reserved Equipment
3) Equipment To Be Removed; Not Considered in This Analysis

Table 3 - Design Antenna and Cable Information

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

3) ANALYSIS PROCEDURE

Table 4 - Documents Provided

Document	Remarks	Reference	Source
Online Application	Verizon Wireless Co-Locate, Rev# 13	321952	CCI Sites
Tower Manufacturer Drawings	Pittsburg Monopole Division, Project No. 96088-88	1451234	CCI Sites
Foundation Drawings	Pittsburg Monopole Division, Project No. 96088-88	1480918	CCI Sites
Geotech Report	GGA Inc., Project No. 96127ME	1562092	CCI Sites
Tower Modification Drawings	Crown Castle, Project No. 489572	3160195	CCI Sites
Post Modification Inspection	TEP, Project No. 127768	3360218	CCI Sites
Tower Modification Drawings	B+T Group, Project No. 86959.001.01	3671974	CCI Sites
Post Modification Inspection	TEP, Project No. 30386.4873	4138879	CCI Sites
Tower Modification Drawings	B+T Group, Project No. 86959.005.01	5755010	CCI Sites
Tower Modification Drawings	Crown Castle, Project No. 1183035	6110071	CCI Sites
Antenna Configuration	Crown CAD Package	Date:05/05/2016	CCI Sites

3.1) Analysis Method

tnxTower (version 7.0.5.1), a commercially available analysis software package, was used to create a three-dimensional model of the tower and calculate member stresses for various loading cases. Selected output from the analysis is included in Appendix A.

3.2) Assumptions

1) Tower and structures were built in accordance with the manufacturer's specifications.
2) The tower and structures have been maintained in accordance with the manufacturer's specification.
3) The configuration of antennas, transmission cables, mounts and other appurtenances are as specified in Tables 1 and 2 and the referenced drawings.
4) Mount areas and weights are assumed based on photographs provided.
5) The existing base plate grout was not considered in this analysis.

This analysis may be affected if any assumptions are not valid or have been made in error. B+T Group should be notified to determine the effect on the structural integrity of the tower.

4) ANALYSIS RESULTS

Table 5 - Section Capacity (Summary)

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
L1	180 - 145.7	Pole	P24x3/8	1	-10.679	901.775	68.4	Pass
L2	145.7 - 140	Pole	P24x3/8 [0.677164]	2	-11.840	2026.420	50.7	Pass
L3	140 - 106.42	Pole	P36x1/2	3	-23.518	1806.730	75.9	Pass
L4	106.42 - 100	Pole	P36x1/2 [0.759201]	4	-25.816	3354.020	59.6	Pass
L5	100 - 86.25	Pole	P42x1/2	5	-29.923	2112.090	86.3	Pass
L6	86.25 - 78	Pole	P42x1/2 [0.732342]	6	-33.456	3686.900	71.6	Pass
L7	78 - 60	Pole	P42x1/2 [0.914993]	7	-42.981	4586.050	73.6	Pass
L8	60 - 46.25	Pole	P48x5/8	8	-48.727	3013.870	91.8	Pass
L9	46.25 - 32.67	Pole	P48x5/8 [0.826841]	9	-56.171	3753.930	84.1	Pass
L10	32.67 - 20	Pole	P48x5/8 [0.983981]	10	-64.391	5731.410	79.6	Pass
L11	20 - 11.25	Pole	P54x5/8	11	-68.515	3395.570	104.8	Pass[2]
L12	11.25 - 9	Pole	P54x5/8 [0.793292]	12	-69.864	4116.960	87.1	Pass
L13	9 - 0	Pole	P54x5/8 [0.884318]	13	-75.746	4480.350	84.7	Pass
							Summary	
						Pole (L11)	104.8	Pass[2]
						Rating =	104.8	Pass[2]

Table 6 - Tower Component Stresses vs. Capacity - LC7

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Bridge Stiffeners	140	28.6	Pass
1	Flange Bolts	140	13.0	Pass
1	Flange Plate	140	10.3	Pass
1	Bridge Stiffeners	100	75.2	Pass
1	Flange Bolts	100	46.0	Pass
1	Flange Plate	100	20.5	Pass
1	Bridge Stiffeners	60	82.4	Pass
1	Flange Bolts	60	40.3	Pass
1	Flange Plate	60	18.4	Pass
1	Bridge Stiffeners	20	62.3	Pass
1	Flange Bolts	20	37.4	Pass
1	Flange Plate	20	16.8	Pass

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1,2	Anchor Rods	Base	103.7	Pass
1	Base Plate	Base	43.1	Pass
1	Base Foundation	Base	86.7	Pass

Structure Rating (max from all components) =	104.8%

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

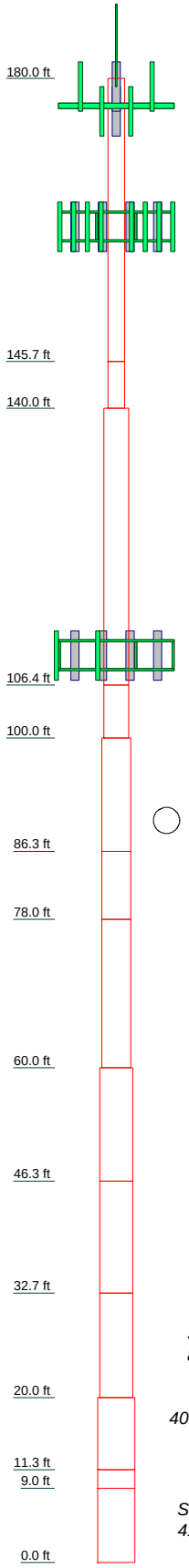
4.1) Recommendations

The tower and its foundation have sufficient capacity to carry the existing, reserved, and proposed loads. No modifications are required at this time.

APPENDIX A

TNXTOWER OUTPUT

Section	Size	Length (ft)	Grade	Weight (K)
1	P24x3/8	34.300	A36	3.2
2	P24x3/8 [0.677164]	5.700	45.379688ksi	0.9
3	P36x1/2	33.580	A36	6.4
4	P36x1/2 [0.759201]	6.420	44.3375ksi	1.8
5	P42x1/2 [0.732342]	13.750	A36	3.1
6	P42x1/2 [0.732342]	8.250	43.146429ksi	2.7
7	P42x1/2 [0.914993]	18.000	43.146429ksi	7.4
8	P48x5/8	13.750	A36	4.4
9	P48x5/8 [0.826841]	13.580	34.039003ksi	5.8
10	P48x5/8 [0.983981]	12.670	43.816406ksi	6.4
11	P48x5/8 [1.079324]	8.750	A36	3.1
12	[illegible]	2.250	[illegible]	1.0
13	P54x5/8 [0.983981]	9.000	[illegible]	4.6
Section	Size	Length (ft)	Grade	Weight (K)
				50.8



ALL REACTIONS ARE FACTORED

AXIAL 131 K

SHEAR 8 K

MOMENT 1051 kip-ft

TORQUE 1 kip-ft
40 mph WIND - 1.000 in ICE

AXIAL 76 K

SHEAR 41 K

MOMENT 5033 kip-ft

TORQUE 9 kip-ft
REACTIONS - 100 mph WIND

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Lighting Rod 5/8" x 8' (E)	184	DC6-48-60-18-8F (E)	162
APXVSPP18-C-A20 w/ Mount Pipe (E)	177	HPA-65R-BUU-H8 (R)	162
APXV9ERR18-C-A20 w/ Mount Pipe (E)	177	HPA-65R-BUU-H6 (R)	162
APXVSPP18-C-A20 w/ Mount Pipe (E)	177	HPA-65R-BUU-H6 (R)	162
IBC1900BB-1 (E)	177	OPA-65R-LCUU-H8 (R)	162
IBC1900BB-1 (E)	177	OPA-65R-LCUU-H6 (R)	162
IBC1900BB-1 (E)	177	OPA-65R-LCUU-H6 (R)	162
IBC1900HG-2A (E)	177	TT19-08BP111-001 (R)	162
IBC1900HG-2A (E)	177	RRUS A2 (R)	162
IBC1900HG-2A (E)	177	RRUS A2 (R)	162
(3) 3' x 2" Pipe Mount (E)	177	RRUS A2 (R)	162
(3) 3' x 2" Pipe Mount (E)	177	RRUS 11 (R)	162
(3) 3' x 2" Pipe Mount (E)	177	RRUS 11 (R)	162
Platform Mount [LP 715-1] (E)	177	RRUS 11 (R)	162
PCS 1900MHz 4x45W-65MHz (E)	175	WCS RRUS-32-B30 (R)	162
PCS 1900MHz 4x45W-65MHz (E)	175	WCS RRUS-32-B30 (R)	162
PCS 1900MHz 4x45W-65MHz (E)	175	WCS RRUS-32-B30 (R)	162
PCS 1900MHz 4x45W-65MHz (E)	175	(2) LGP21401 (R)	162
4' x 2" Pipe Mount (E)	175	(2) LGP21401 (R)	162
4' x 2" Pipe Mount (E)	175	DC6-48-60-18-8F (R)	162
4' x 2" Pipe Mount (E)	175	Platform Mount [LP 1301-1] (R-4M.P/Sec)	162
Side Arm Mount [SO 102-3] (E)	175	Bridge Stiffener (48"x1.25"x11.5") (E)	140
7770.00 (E)	162	Bridge Stiffener (48"x1.25"x11.5") (E)	140
7770.00 (E)	162	Bridge Stiffener (48"x1.25"x11.5") (E)	140
7770.00 (E)	162	(2) DB-B1-6C-12AB-0Z (P)	110
P65-17-XLH-RR (E)	162	(3) RRH2X60-AWS (P)	110
AM-X-CD-16-65-00T-RET (E)	162	(3) B25 RRH4X30 (P)	110
AM-X-CD-16-65-00T-RET (E)	162	Platform Mount [LP 1301-1] (P-4M.P/Sec)	110
7020.00 (E)	162	(4) SBNHH-1D65C (P)	110
7020.00 (E)	162	(2) SBNHH-1D65C (P)	110
7020.00 (E)	162	(3) B13 RRH 4X30 (P)	110
(2) RRUS-11 (E)	162		
(2) RRUS-11 (E)	162		
(2) RRUS-11 (E)	162		

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A36	36 ksi	58 ksi	34.039003ksi	34 ksi	49 ksi
45.379688ksi	45 ksi	60 ksi	43.816406ksi	44 ksi	59 ksi
44.3375ksi	44 ksi	59 ksi	34.497269ksi	34 ksi	49 ksi
43.146429ksi	43 ksi	58 ksi	33.7356ksi	34 ksi	49 ksi

TOWER DESIGN NOTES

1. Tower is located in Cumberland County, Maine.
2. Tower designed for Exposure C to the TIA-222-G Standard.
3. Tower designed for a 100 mph basic wind in accordance with the TIA-222-G Standard.
4. Tower is also designed for a 40 mph basic wind with 1.00 in ice. Ice is considered to increase in thickness with height.
5. Deflections are based upon a 60 mph wind.
6. Tower Structure Class II.
7. Topographic Category 1 with Crest Height of 0.000 ft
8. TOWER RATING: 104.8%

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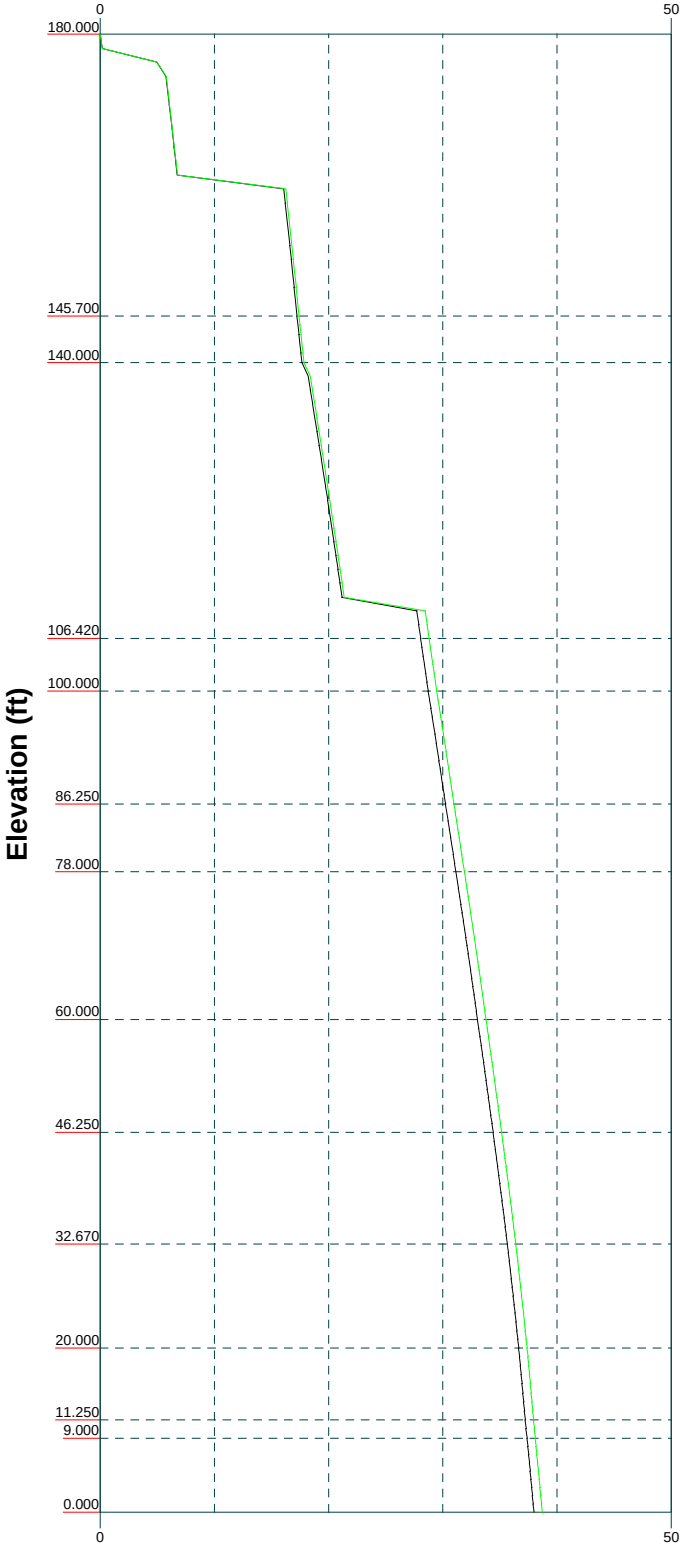
Job: 86959.008.01 - PORTLAND WARREN AVE, ME (BU# 87878.		
Project:		
Client: Crown Castle	Drawn by: T. Baindur	App'd:
Code: TIA-222-G	Date: 05/21/16	Scale: NTS
Path:		Dwg No. E-1

TIA-222-G - 100 mph/40 mph 1.000 in Ice Exposure C

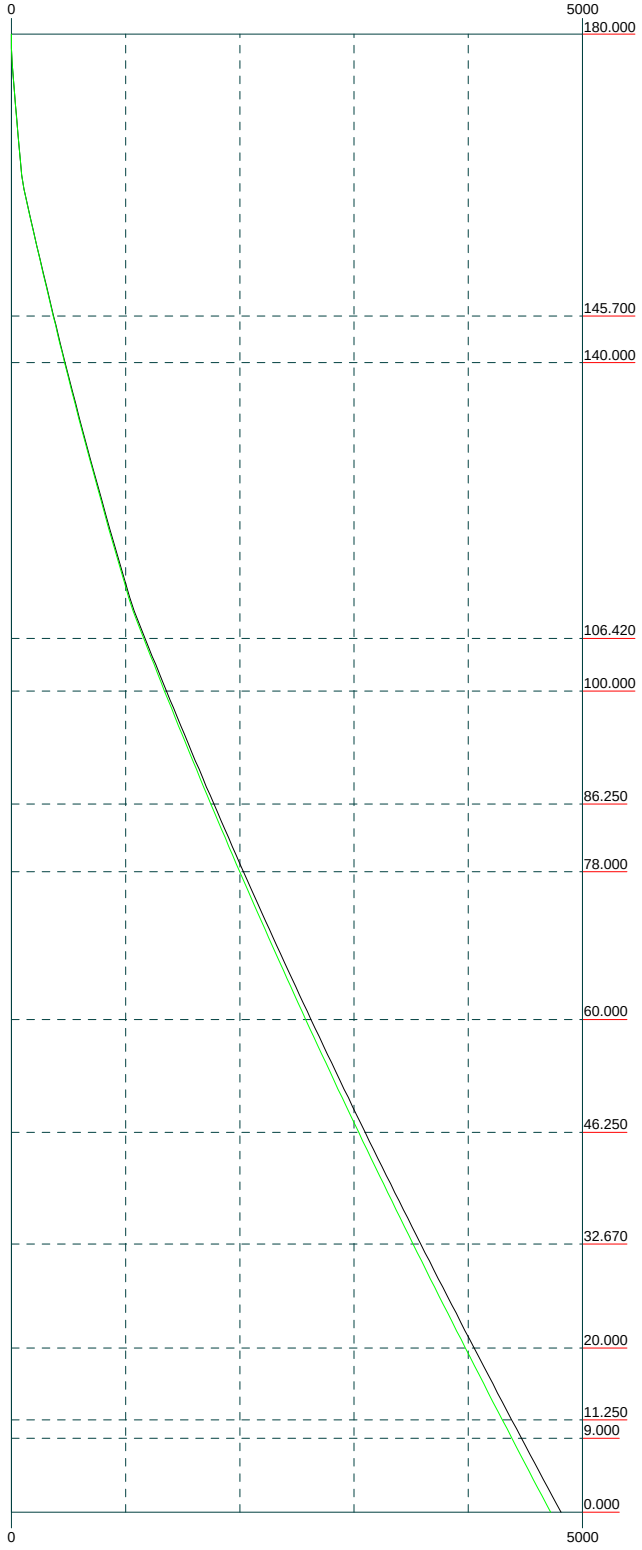
Maximum Values

Vx Vz Mx Mz

Global Mast Shear (K)



Global Mast Moment (kip-ft)



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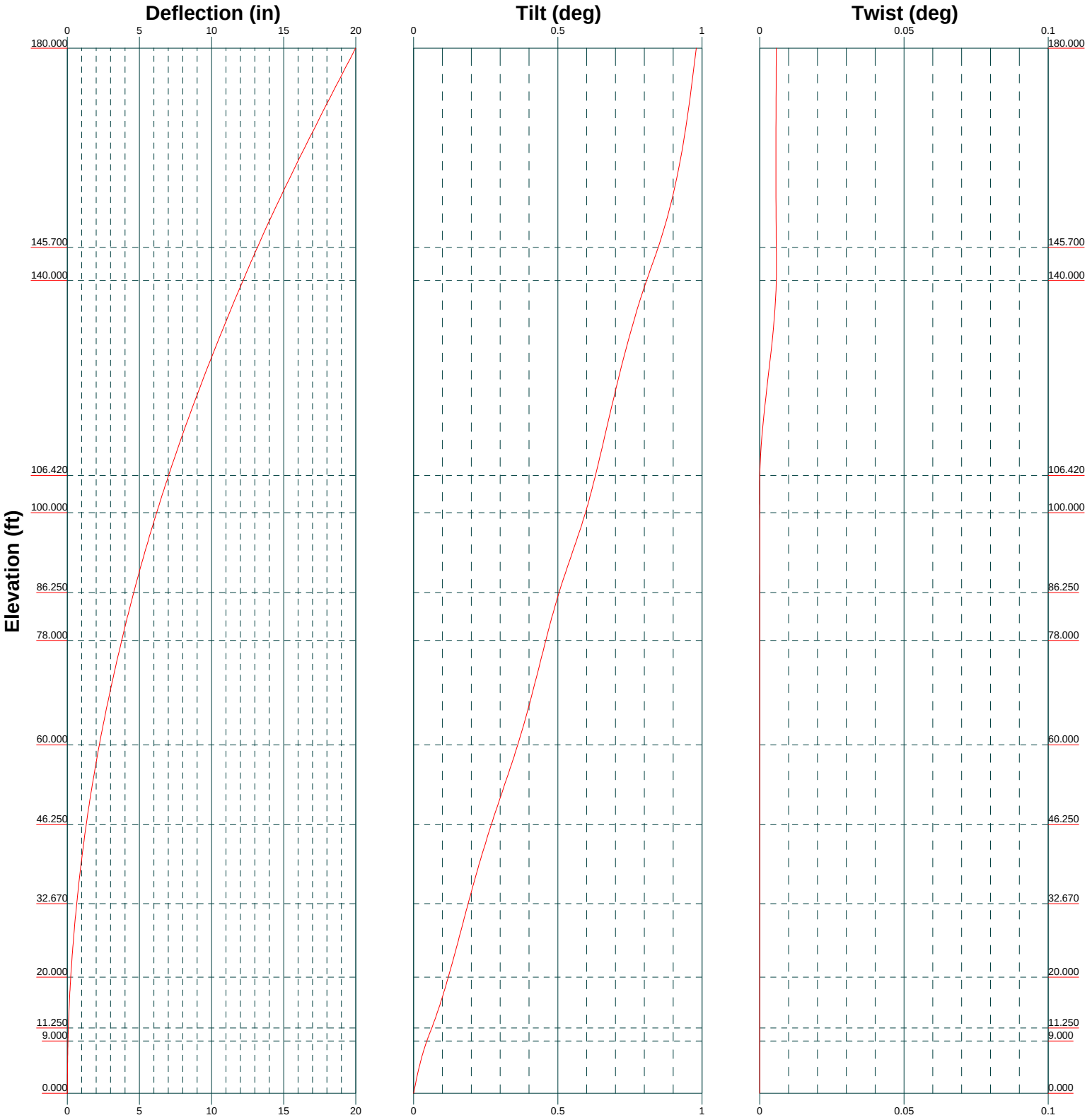
Job: ***86959.008.01 - PORTLAND WARREN AVE, ME (BU# 87878.***		
Project:		
Client: Crown Castle	Drawn by: T. Baindur	App'd:
Code: TIA-222-G	Date: 05/21/16	Scale: NTS
Path:		Dwg No. E-4

TIA-222-G - Service - 60 mph

Maximum Values



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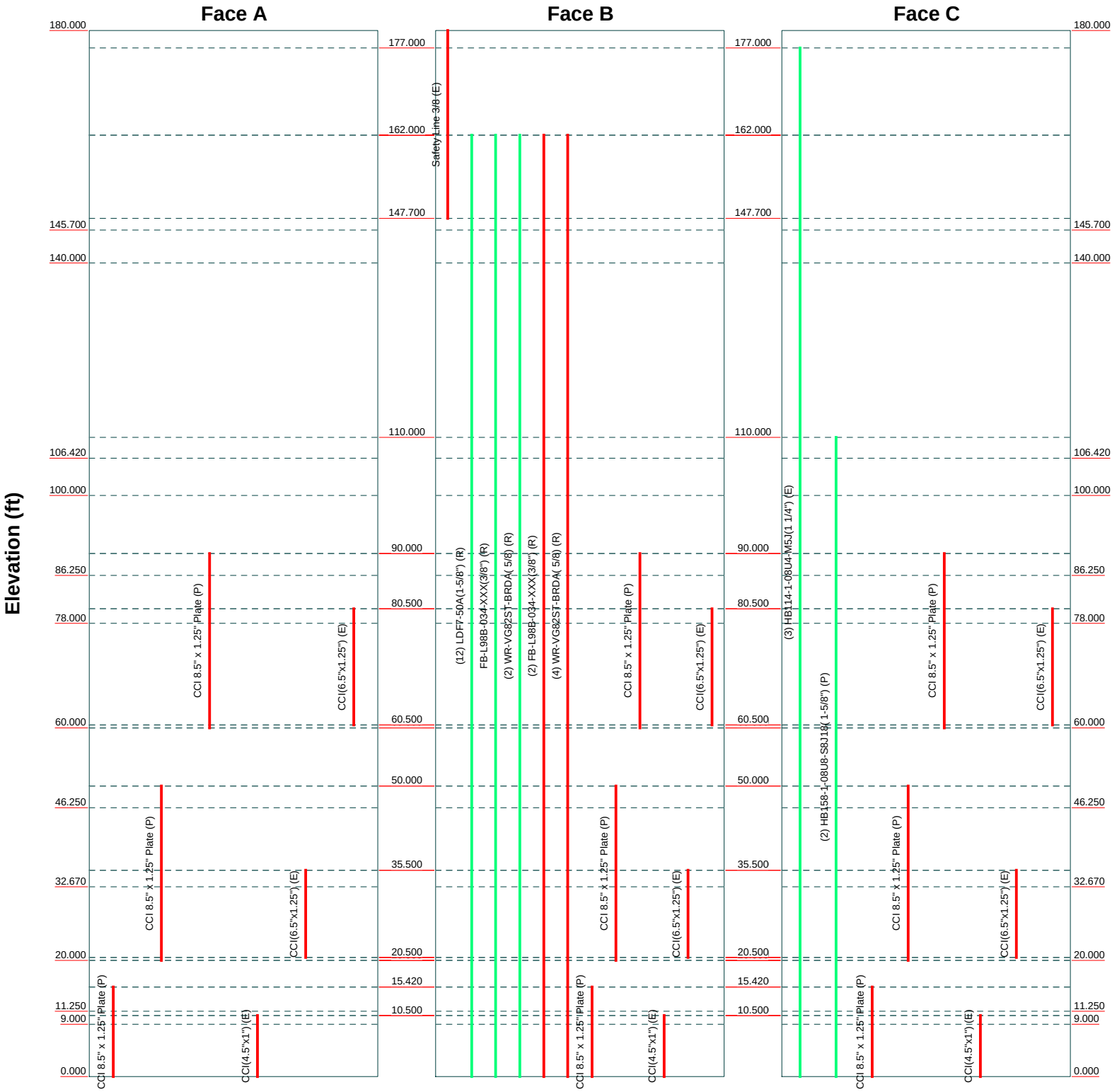
Job: ***86959.008.01 - PORTLAND WARREN AVE, ME (BU# 87878***			
Project:			
Client: Crown Castle	Drawn by: T. Baindur	App'd:	
Code: TIA-222-G	Date: 05/21/16	Scale: NTS	
Path:		Dwg No. E-5	

Feed Line Distribution Chart
0' - 180'

Round | Flat | App In Face | App Out Face | Truss Leg



B+T Group 1717 S. Boulder, Suite 300 Tulsa, OK 74119 Phone: (918) 587-4630 FAX: (918) 295-0265	Job: ***86959.008.01 - PORTLAND WARREN AVE, ME (BU# 87878*** Project:		
	Client: Crown Castle	Drawn by: T. Baindur	App'd:
	Code: TIA-222-G	Date: 05/21/16	Scale: NTS
	Path:		Dwg No. E-7

Tower Input Data

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

Tower is located in Cumberland County, Maine.
Basic wind speed of 100 mph.
Structure Class II.
Exposure Category C.
Topographic Category 1.
Crest Height 0.000 ft.
Nominal ice thickness of 1.000 in.
Ice thickness is considered to increase with height.
Ice density of 56.000 pcf.
A wind speed of 40 mph is used in combination with ice.
Temperature drop of 50.000 °F.
Deflections calculated using a wind speed of 60 mph.
TOWER RATING: 104.8%.
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in pole design is 1.
Local bending stresses due to climbing loads, 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-G Bracing Resist. Exemption
	Include Bolts In Member Capacity		Autocalc Torque Arm Areas		Use TIA-222-G 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				

Pole Section Geometry

Section	*Elevation* *ft*	*Section Length* *ft*	*Pole Size*	*Pole Grade*	*Socket Length* *ft*
L1	180.000-145.700	34.300	P24x3/8	A36 (36 ksi)	
L2	145.700-140.000	5.700	P24x3/8	45.379688ksi	

Section	Elevation ft	Section Length ft	Pole Size	Pole Grade	Socket Length ft
			[0.677164]	(45 ksi)	
L3	140.000-106.420	33.580	P36x1/2	A36 (36 ksi)	
L4	106.420-100.000	6.420	P36x1/2 [0.759201]	44.3375ksi (44 ksi)	
L5	100.000-86.250	13.750	P42x1/2	A36 (36 ksi)	
L6	86.250-78.000	8.250	P42x1/2 [0.732342]	43.146429ksi (43 ksi)	
L7	78.000-60.000	18.000	P42x1/2 [0.914993]	43.146429ksi (43 ksi)	
L8	60.000-46.250	13.750	P48x5/8	A36 (36 ksi)	
L9	46.250-32.670	13.580	P48x5/8 [0.826841]	34.039003ksi (34 ksi)	
L10	32.670-20.000	12.670	P48x5/8 [0.983981]	43.816406ksi (44 ksi)	
L11	20.000-11.250	8.750	P54x5/8	A36 (36 ksi)	
L12	11.250-9.000	2.250	P54x5/8 [0.793292]	34.497269ksi (34 ksi)	
L13	9.000-0.000	9.000	P54x5/8 [0.884318]	33.7356ksi (34 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 180.000-145.700				1	1	1			
L2 145.700-140.000				1	1	0.924207			
L3 140.000-106.420				1	1	1			
L4 106.420-100.000				1	1	0.953911			
L5 100.000-86.250				1	1	1			
L6 86.250-78.000				1	1	1.02282			
L7 78.000-60.000				1	1	1.02878			
L8 60.000-46.250				1	1	1			
L9 46.250-32.670				1	1	1.01977			
L10 32.670-20.000				1	1	1.02757			
L11 20.000-11.250				1	1	1			
L12 11.250-9.000				1	1	1.03125			

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
L13 9.000-0.000				1	1	1.01822			

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Sector	Component Type	Placement ft	Total Number	Number Per Row	Start/End Position	Width or Diameter in	Perimeter in	Weight klf
*******									
Safety Line 3/8 (E)	B	Surface Ar (CaAa)	180.000 - 147.700	1	1	0.000 0.000	0.375		0.000
*******									
FB-L98B-034-XXX(3/8") (R)	B	Surface Ar (CaAa)	162.000 - 0.000	2	1	-0.300 -0.250	0.394		0.000
WR-VG82ST-BRDA(5/8) (R)	B	Surface Ar (CaAa)	162.000 - 0.000	4	1	-0.230 -0.210	0.645		0.000
////									
CCI 8.5" x 1.25" Plate (P)	A	Surface Af (CaAa)	15.420 - 0.000	1	1	0.000 0.000	8.500	19.500	0.000
CCI 8.5" x 1.25" Plate (P)	B	Surface Af (CaAa)	15.420 - 0.000	1	1	0.000 0.000	8.500	19.500	0.000
CCI 8.5" x 1.25" Plate (P)	C	Surface Af (CaAa)	15.420 - 0.000	1	1	0.000 0.000	8.500	19.500	0.000
*									
CCI 8.5" x 1.25" Plate (P)	A	Surface Af (CaAa)	50.000 - 20.000	1	1	0.000 0.000	8.500	19.500	0.000
CCI 8.5" x 1.25" Plate (P)	B	Surface Af (CaAa)	50.000 - 20.000	1	1	0.000 0.000	8.500	19.500	0.000
CCI 8.5" x 1.25" Plate (P)	C	Surface Af (CaAa)	50.000 - 20.000	1	1	0.000 0.000	8.500	19.500	0.000
*									
CCI 8.5" x 1.25" Plate (P)	A	Surface Af (CaAa)	90.000 - 60.000	1	1	0.000 0.000	8.500	19.500	0.000
CCI 8.5" x 1.25" Plate (P)	B	Surface Af (CaAa)	90.000 - 60.000	1	1	0.000 0.000	8.500	19.500	0.000
CCI 8.5" x 1.25" Plate (P)	C	Surface Af (CaAa)	90.000 - 60.000	1	1	0.000 0.000	8.500	19.500	0.000
*									
CCI(4.5"x1") (E)	A	Surface Af (CaAa)	10.500 - 0.000	1	1	0.000 0.000	4.500	11.000	0.000
CCI(4.5"x1") (E)	B	Surface Af (CaAa)	10.500 - 0.000	1	1	0.000 0.000	4.500	11.000	0.000
CCI(4.5"x1") (E)	C	Surface Af (CaAa)	10.500 - 0.000	1	1	0.000 0.000	4.500	11.000	0.000
*									
CCI(6.5"x1.25") (E)	A	Surface Af (CaAa)	35.500 - 20.500	1	1	0.000 0.000	6.500	15.500	0.000
CCI(6.5"x1.25") (E)	B	Surface Af (CaAa)	35.500 - 20.500	1	1	0.000 0.000	6.500	15.500	0.000
CCI(6.5"x1.25") (E)	C	Surface Af (CaAa)	35.500 - 20.500	1	1	0.000 0.000	6.500	15.500	0.000
*									
CCI(6.5"x1.25") (E)	A	Surface Af (CaAa)	80.500 - 60.500	1	1	0.000 0.000	6.500	15.500	0.000
CCI(6.5"x1.25")	B	Surface Af	80.500 - 60.500	1	1	0.000	6.500	15.500	0.000

Description	Sector	Component Type	Placement ft	Total Number	Number Per Row	Start/End Position	Width or Diameter in	Perimeter in	Weight klf
(E) CCI(6.5"x1.25") (E)	C	(CaAa) Surface Af (CaAa)	80.500 - 60.500	1	1	0.000 0.000 0.000	6.500	15.500	0.000

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight klf
HB114-1-08U4-M5J(1 1/4") (E) ******* ******* ******* ******* ******* ***	C	No	Inside Pole	177.000 - 0.000	3	No Ice 1/2" Ice 1" Ice	0.000 0.000 0.000	0.001 0.001 0.001
LDF7-50A(1-5/8") (R)	B	No	Inside Pole	162.000 - 0.000	12	No Ice 1/2" Ice 1" Ice	0.000 0.000 0.000	0.001 0.001 0.001
FB-L98B-034-XXX(3/8") (R)	B	No	Inside Pole	162.000 - 0.000	1	No Ice 1/2" Ice 1" Ice	0.000 0.000 0.000	0.000 0.000 0.000
WR-VG82ST-BRDA(5/8) (R) *//*//	B	No	Inside Pole	162.000 - 0.000	2	No Ice 1/2" Ice 1" Ice	0.000 0.000 0.000	0.000 0.000 0.000
HB158-1-08U8-S8J18(1-5/8") (P)	C	No	Inside Pole	110.000 - 0.000	2	No Ice 1/2" Ice 1" Ice	0.000 0.000 0.000	0.001 0.001 0.001

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	180.000-145.700	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	2.904	0.000	0.200
		C	0.000	0.000	0.000	0.000	0.101
L2	145.700-140.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.592	0.000	0.068
		C	0.000	0.000	0.000	0.000	0.018
L3	140.000-106.420	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	3.488	0.000	0.398
		C	0.000	0.000	0.000	0.000	0.118
L4	106.420-100.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.667	0.000	0.076
		C	0.000	0.000	0.000	0.000	0.037
L5	100.000-86.250	A	0.000	0.000	5.313	0.000	0.000
		B	0.000	0.000	6.741	0.000	0.163
		C	0.000	0.000	5.313	0.000	0.080
L6	86.250-78.000	A	0.000	0.000	14.396	0.000	0.000
		B	0.000	0.000	15.253	0.000	0.098
		C	0.000	0.000	14.396	0.000	0.048

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
L7	78.000-60.000	A	0.000	0.000	44.458	0.000	0.000
		B	0.000	0.000	46.328	0.000	0.213
		C	0.000	0.000	44.458	0.000	0.105
L8	60.000-46.250	A	0.000	0.000	5.313	0.000	0.000
		B	0.000	0.000	6.741	0.000	0.163
		C	0.000	0.000	5.313	0.000	0.080
L9	46.250-32.670	A	0.000	0.000	22.304	0.000	0.000
		B	0.000	0.000	23.715	0.000	0.161
		C	0.000	0.000	22.304	0.000	0.079
L10	32.670-20.000	A	0.000	0.000	31.133	0.000	0.000
		B	0.000	0.000	32.449	0.000	0.150
		C	0.000	0.000	31.133	0.000	0.074
L11	20.000-11.250	A	0.000	0.000	5.907	0.000	0.000
		B	0.000	0.000	6.816	0.000	0.104
		C	0.000	0.000	5.907	0.000	0.051
L12	11.250-9.000	A	0.000	0.000	4.313	0.000	0.000
		B	0.000	0.000	4.546	0.000	0.027
		C	0.000	0.000	4.313	0.000	0.013
L13	9.000-0.000	A	0.000	0.000	19.500	0.000	0.000
		B	0.000	0.000	20.435	0.000	0.107
		C	0.000	0.000	19.500	0.000	0.053

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	180.000-145.700	A	2.346	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	33.359	0.000	1.267
		C		0.000	0.000	0.000	0.000	0.101
L2	145.700-140.000	A	2.316	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	5.872	0.000	0.346
		C		0.000	0.000	0.000	0.000	0.018
L3	140.000-106.420	A	2.282	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	34.138	0.000	1.995
		C		0.000	0.000	0.000	0.000	0.118
L4	106.420-100.000	A	2.242	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	6.423	0.000	0.372
		C		0.000	0.000	0.000	0.000	0.037
L5	100.000-86.250	A	2.219	0.000	0.000	6.976	0.000	0.090
		B		0.000	0.000	20.607	0.000	0.875
		C		0.000	0.000	6.976	0.000	0.171
L6	86.250-78.000	A	2.191	0.000	0.000	19.055	0.000	0.246
		B		0.000	0.000	27.142	0.000	0.708
		C		0.000	0.000	19.055	0.000	0.294
L7	78.000-60.000	A	2.153	0.000	0.000	59.412	0.000	0.763
		B		0.000	0.000	76.783	0.000	1.748
		C		0.000	0.000	59.412	0.000	0.868
L8	60.000-46.250	A	2.098	0.000	0.000	6.886	0.000	0.084
		B		0.000	0.000	19.850	0.000	0.809
		C		0.000	0.000	6.886	0.000	0.164
L9	46.250-32.670	A	2.036	0.000	0.000	28.560	0.000	0.345
		B		0.000	0.000	41.031	0.000	1.032
		C		0.000	0.000	28.560	0.000	0.424
L10	32.670-20.000	A	1.955	0.000	0.000	39.114	0.000	0.471
		B		0.000	0.000	50.340	0.000	1.078
		C		0.000	0.000	39.114	0.000	0.545
L11	20.000-11.250	A	1.856	0.000	0.000	6.403	0.000	0.080

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	13.807	0.000	0.471
		C		0.000	0.000	6.403	0.000	0.131
L12	11.250-9.000	A	1.777	0.000	0.000	4.888	0.000	0.059
		B		0.000	0.000	6.721	0.000	0.154
		C		0.000	0.000	4.888	0.000	0.072
L13	9.000-0.000	A	1.639	0.000	0.000	22.205	0.000	0.246
		B		0.000	0.000	29.039	0.000	0.591
		C		0.000	0.000	22.205	0.000	0.299

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	180.000-145.700	0.087	-0.095	0.629	-0.647
L2	145.700-140.000	0.088	-0.145	0.521	-0.882
L3	140.000-106.420	0.086	-0.141	0.575	-0.975
L4	106.420-100.000	0.086	-0.141	0.569	-0.965
L5	100.000-86.250	0.064	-0.106	0.445	-0.755
L6	86.250-78.000	0.035	-0.057	0.239	-0.405
L7	78.000-60.000	0.028	-0.046	0.188	-0.319
L8	60.000-46.250	0.066	-0.109	0.450	-0.764
L9	46.250-32.670	0.038	-0.063	0.258	-0.437
L10	32.670-20.000	0.030	-0.050	0.199	-0.337
L11	20.000-11.250	0.058	-0.096	0.391	-0.663
L12	11.250-9.000	0.037	-0.062	0.243	-0.413
L13	9.000-0.000	0.035	-0.058	0.213	-0.361

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
L1	13	Safety Line 3/8	147.70 - 180.00	1.0000	1.0000
L1	26	FB-L98B-034-XXX(3/8")	145.70 - 162.00	1.0000	1.0000
L1	27	WR-VG82ST-BRDA(5/8)	145.70 - 162.00	1.0000	1.0000
L2	26	FB-L98B-034-XXX(3/8")	140.00 - 145.70	1.0000	1.0000
L2	27	WR-VG82ST-BRDA(5/8)	140.00 - 145.70	1.0000	1.0000
L3	26	FB-L98B-034-XXX(3/8")	106.42 - 140.00	1.0000	1.0000
L3	27	WR-VG82ST-BRDA(5/8)	106.42 - 140.00	1.0000	1.0000
L4	26	FB-L98B-034-XXX(3/8")	100.00 - 106.42	1.0000	1.0000
L4	27	WR-VG82ST-BRDA(5/8)	100.00 - 106.42	1.0000	1.0000
L5	26	FB-L98B-034-XXX(3/8")	86.25 - 100.00	1.0000	1.0000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
L5	27	WR-VG82ST-BRDA(5/8)	86.25 - 100.00	1.0000	1.0000
L5	39	CCI 8.5" x 1.25" Plate	86.25 - 90.00	1.0000	1.0000
L5	40	CCI 8.5" x 1.25" Plate	86.25 - 90.00	1.0000	1.0000
L5	41	CCI 8.5" x 1.25" Plate	86.25 - 90.00	1.0000	1.0000
L6	26	FB-L98B-034-XXX(3/8")	78.00 - 86.25	1.0000	1.0000
L6	27	WR-VG82ST-BRDA(5/8)	78.00 - 86.25	1.0000	1.0000
L6	39	CCI 8.5" x 1.25" Plate	78.00 - 86.25	1.0000	1.0000
L6	40	CCI 8.5" x 1.25" Plate	78.00 - 86.25	1.0000	1.0000
L6	41	CCI 8.5" x 1.25" Plate	78.00 - 86.25	1.0000	1.0000
L6	51	CCI(6.5"x1.25")	78.00 - 80.50	1.0000	1.0000
L6	52	CCI(6.5"x1.25")	78.00 - 80.50		1.0000
L6	53	CCI(6.5"x1.25")	78.00 - 80.50	1.0000	1.0000
L7	26	FB-L98B-034-XXX(3/8")	60.00 - 78.00	1.0000	1.0000
L7	27	WR-VG82ST-BRDA(5/8)	60.00 - 78.00	1.0000	1.0000
L7	39	CCI 8.5" x 1.25" Plate	60.00 - 78.00	1.0000	1.0000
L7	40	CCI 8.5" x 1.25" Plate	60.00 - 78.00	1.0000	1.0000
L7	41	CCI 8.5" x 1.25" Plate	60.00 - 78.00	1.0000	1.0000
L7	51	CCI(6.5"x1.25")	60.50 - 78.00	1.0000	1.0000
L7	52	CCI(6.5"x1.25")	60.50 - 78.00	1.0000	1.0000
L7	53	CCI(6.5"x1.25")	60.50 - 78.00	1.0000	1.0000
L8	26	FB-L98B-034-XXX(3/8")	46.25 - 60.00	1.0000	1.0000
L8	27	WR-VG82ST-BRDA(5/8)	46.25 - 60.00	1.0000	1.0000
L8	35	CCI 8.5" x 1.25" Plate	46.25 - 50.00	1.0000	1.0000
L8	36	CCI 8.5" x 1.25" Plate	46.25 - 50.00	1.0000	1.0000
L8	37	CCI 8.5" x 1.25" Plate	46.25 - 50.00	1.0000	1.0000
L9	26	FB-L98B-034-XXX(3/8")	32.67 - 46.25	1.0000	1.0000
L9	27	WR-VG82ST-BRDA(5/8)	32.67 - 46.25	1.0000	1.0000
L9	35	CCI 8.5" x 1.25" Plate	32.67 - 46.25	1.0000	1.0000
L9	36	CCI 8.5" x 1.25" Plate	32.67 - 46.25	1.0000	1.0000
L9	37	CCI 8.5" x 1.25" Plate	32.67 - 46.25	1.0000	1.0000
L9	47	CCI(6.5"x1.25")	32.67 - 35.50	1.0000	1.0000
L9	48	CCI(6.5"x1.25")	32.67 - 35.50	1.0000	1.0000
L9	49	CCI(6.5"x1.25")	32.67 - 35.50	1.0000	1.0000
L10	26	FB-L98B-034-XXX(3/8")	20.00 - 32.67	1.0000	1.0000
L10	27	WR-VG82ST-BRDA(5/8)	20.00 - 32.67	1.0000	1.0000
L10	35	CCI 8.5" x 1.25" Plate	20.00 - 32.67	1.0000	1.0000
L10	36	CCI 8.5" x 1.25" Plate	20.00 - 32.67	1.0000	1.0000
L10	37	CCI 8.5" x 1.25" Plate	20.00 - 32.67	1.0000	1.0000
L10	47	CCI(6.5"x1.25")	20.50 - 32.67	1.0000	1.0000
L10	48	CCI(6.5"x1.25")	20.50 - 32.67	1.0000	1.0000
L10	49	CCI(6.5"x1.25")	20.50 - 32.67	1.0000	1.0000
L11	26	FB-L98B-034-XXX(3/8")	11.25 - 20.00	1.0000	1.0000
L11	27	WR-VG82ST-BRDA(5/8)	11.25 - 20.00	1.0000	1.0000
L11	31	CCI 8.5" x 1.25" Plate	11.25 - 15.42	1.0000	1.0000
L11	32	CCI 8.5" x 1.25" Plate	11.25 - 15.42	1.0000	1.0000
L11	33	CCI 8.5" x 1.25" Plate	11.25 - 15.42	1.0000	1.0000
L12	26	FB-L98B-034-XXX(3/8")	9.00 - 11.25	1.0000	1.0000
L12	27	WR-VG82ST-BRDA(5/8)	9.00 - 11.25	1.0000	1.0000
L12	31	CCI 8.5" x 1.25" Plate	9.00 - 11.25	1.0000	1.0000
L12	32	CCI 8.5" x 1.25" Plate	9.00 - 11.25	1.0000	1.0000
L12	33	CCI 8.5" x 1.25" Plate	9.00 - 11.25	1.0000	1.0000
L12	43	CCI(4.5"x1")	9.00 - 10.50	1.0000	1.0000
L12	44	CCI(4.5"x1")	9.00 - 10.50	1.0000	1.0000
L12	45	CCI(4.5"x1")	9.00 - 10.50	1.0000	1.0000
L13	26	FB-L98B-034-XXX(3/8")	0.00 - 9.00	1.0000	1.0000
L13	27	WR-VG82ST-BRDA(5/8)	0.00 - 9.00	1.0000	1.0000
L13	31	CCI 8.5" x 1.25" Plate	0.00 - 9.00	1.0000	1.0000
L13	32	CCI 8.5" x 1.25" Plate	0.00 - 9.00	1.0000	1.0000
L13	33	CCI 8.5" x 1.25" Plate	0.00 - 9.00	1.0000	1.0000
L13	43	CCI(4.5"x1")	0.00 - 9.00	1.0000	1.0000
L13	44	CCI(4.5"x1")	0.00 - 9.00	1.0000	1.0000
L13	45	CCI(4.5"x1")	0.00 - 9.00	1.0000	1.0000

Discrete Tower Loads

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
Lighting Rod 5/8" x 8'	C	None		0.000	184.000	No Ice	0.500	0.500	0.031
(E)						1/2" Ice	1.314	1.314	0.037
						1" Ice	2.144	2.144	0.047
*******									
APXVSPP18-C-A20 w/	A	From Leg	4.000	0.000	177.000	No Ice	8.262	6.946	0.083
Mount Pipe			0.000			1/2" Ice	8.822	8.127	0.151
(E)			2.000			1" Ice	9.346	9.021	0.227
APXV9ERR18-C-A20 w/	B	From Leg	4.000	0.000	177.000	No Ice	8.262	7.471	0.088
Mount Pipe			0.000			1/2" Ice	8.822	8.656	0.158
(E)			2.000			1" Ice	9.346	9.556	0.237
APXVSPP18-C-A20 w/	C	From Leg	4.000	0.000	177.000	No Ice	8.262	6.946	0.083
Mount Pipe			0.000			1/2" Ice	8.822	8.127	0.151
(E)			2.000			1" Ice	9.346	9.021	0.227
IBC1900BB-1	A	From Leg	4.000	0.000	177.000	No Ice	0.966	0.463	0.022
(E)			0.000			1/2" Ice	1.091	0.558	0.030
			2.000			1" Ice	1.223	0.660	0.039
IBC1900BB-1	B	From Leg	4.000	0.000	177.000	No Ice	0.966	0.463	0.022
(E)			0.000			1/2" Ice	1.091	0.558	0.030
			2.000			1" Ice	1.223	0.660	0.039
IBC1900BB-1	C	From Leg	4.000	0.000	177.000	No Ice	0.966	0.463	0.022
(E)			0.000			1/2" Ice	1.091	0.558	0.030
			2.000			1" Ice	1.223	0.660	0.039
IBC1900HG-2A	A	From Leg	4.000	0.000	177.000	No Ice	0.966	0.463	0.022
(E)			0.000			1/2" Ice	1.091	0.558	0.030
			2.000			1" Ice	1.223	0.660	0.039
IBC1900HG-2A	B	From Leg	4.000	0.000	177.000	No Ice	0.966	0.463	0.022
(E)			0.000			1/2" Ice	1.091	0.558	0.030
			2.000			1" Ice	1.223	0.660	0.039
IBC1900HG-2A	C	From Leg	4.000	0.000	177.000	No Ice	0.966	0.463	0.022
(E)			0.000			1/2" Ice	1.091	0.558	0.030
			2.000			1" Ice	1.223	0.660	0.039
(3) 3' x 2" Pipe Mount	A	From Leg	4.000	0.000	177.000	No Ice	0.583	0.583	0.011
(E)			0.000			1/2" Ice	0.770	0.770	0.017
			0.000			1" Ice	0.967	0.967	0.024
(3) 3' x 2" Pipe Mount	B	From Leg	4.000	0.000	177.000	No Ice	0.583	0.583	0.011
(E)			0.000			1/2" Ice	0.770	0.770	0.017
			0.000			1" Ice	0.967	0.967	0.024
(3) 3' x 2" Pipe Mount	C	From Leg	4.000	0.000	177.000	No Ice	0.583	0.583	0.011
(E)			0.000			1/2" Ice	0.770	0.770	0.017
			0.000			1" Ice	0.967	0.967	0.024
Platform Mount [LP 715-1]	C	None		0.000	177.000	No Ice	44.210	44.210	1.775
(E)						1/2" Ice	53.970	53.970	2.323
						1" Ice	63.730	63.730	2.871
*******									
PCS 1900MHz	A	From Leg	1.000	0.000	175.000	No Ice	2.322	2.238	0.060
4x45W-65MHz			0.000			1/2" Ice	2.527	2.441	0.083
(E)			1.000			1" Ice	2.739	2.651	0.110

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
PCS 1900MHz	B	From Leg	1.000	0.000	175.000	No Ice	2.322	2.238	0.060
4x45W-65MHz			0.000			1/2" Ice	2.527	2.441	0.083
(E)			1.000			1" Ice	2.739	2.651	0.110
PCS 1900MHz	C	From Leg	1.000	0.000	175.000	No Ice	2.322	2.238	0.060
4x45W-65MHz			0.000			1/2" Ice	2.527	2.441	0.083
(E)			1.000			1" Ice	2.739	2.651	0.110
4' x 2" Pipe Mount	A	From Leg	0.500	0.000	175.000	No Ice	0.785	0.785	0.029
(E)			0.000			1/2" Ice	1.028	1.028	0.035
			0.000			1" Ice	1.281	1.281	0.044
4' x 2" Pipe Mount	B	From Leg	0.500	0.000	175.000	No Ice	0.785	0.785	0.029
(E)			0.000			1/2" Ice	1.028	1.028	0.035
			0.000			1" Ice	1.281	1.281	0.044
4' x 2" Pipe Mount	C	From Leg	0.500	0.000	175.000	No Ice	0.785	0.785	0.029
(E)			0.000			1/2" Ice	1.028	1.028	0.035
			0.000			1" Ice	1.281	1.281	0.044
Side Arm Mount [SO 102-3]	C	None		0.000	175.000	No Ice	3.000	3.000	0.081
(E)						1/2" Ice	3.480	3.480	0.111
						1" Ice	3.960	3.960	0.141
*******									
*******									
7770.00	A	From Leg	4.000	0.000	162.000	No Ice	5.508	2.928	0.035
(E)			0.000			1/2" Ice	5.867	3.273	0.068
			0.000			1" Ice	6.233	3.625	0.105
7770.00	B	From Leg	4.000	0.000	162.000	No Ice	5.508	2.928	0.035
(E)			0.000			1/2" Ice	5.867	3.273	0.068
			0.000			1" Ice	6.233	3.625	0.105
7770.00	C	From Leg	4.000	0.000	162.000	No Ice	5.508	2.928	0.035
(E)			0.000			1/2" Ice	5.867	3.273	0.068
			0.000			1" Ice	6.233	3.625	0.105
P65-17-XLH-RR	A	From Leg	4.000	0.000	162.000	No Ice	11.467	6.800	0.059
(E)			0.000			1/2" Ice	12.083	7.384	0.121
			0.000			1" Ice	12.707	7.976	0.191
AM-X-CD-16-65-00T-RET	B	From Leg	4.000	0.000	162.000	No Ice	8.024	4.642	0.049
(E)			0.000			1/2" Ice	8.480	5.088	0.095
			0.000			1" Ice	8.943	5.542	0.147
AM-X-CD-16-65-00T-RET	C	From Leg	4.000	0.000	162.000	No Ice	8.024	4.642	0.049
(E)			0.000			1/2" Ice	8.480	5.088	0.095
			0.000			1" Ice	8.943	5.542	0.147
7020.00	A	From Leg	4.000	0.000	162.000	No Ice	0.102	0.175	0.002
(E)			0.000			1/2" Ice	0.147	0.239	0.005
			0.000			1" Ice	0.199	0.311	0.009
7020.00	B	From Leg	4.000	0.000	162.000	No Ice	0.102	0.175	0.002
(E)			0.000			1/2" Ice	0.147	0.239	0.005
			0.000			1" Ice	0.199	0.311	0.009
7020.00	C	From Leg	4.000	0.000	162.000	No Ice	0.102	0.175	0.002
(E)			0.000			1/2" Ice	0.147	0.239	0.005
			0.000			1" Ice	0.199	0.311	0.009
(2) RRUS-11	A	From Leg	4.000	0.000	162.000	No Ice	2.784	1.187	0.048
(E)			0.000			1/2" Ice	2.992	1.334	0.068
			-1.000			1" Ice	3.207	1.490	0.092
(2) RRUS-11	B	From Leg	4.000	0.000	162.000	No Ice	2.784	1.187	0.048
(E)			0.000			1/2" Ice	2.992	1.334	0.068
			-1.000			1" Ice	3.207	1.490	0.092
(2) RRUS-11	C	From Leg	4.000	0.000	162.000	No Ice	2.784	1.187	0.048
(E)			0.000			1/2" Ice	2.992	1.334	0.068
			-1.000			1" Ice	3.207	1.490	0.092
DC6-48-60-18-8F	B	From Leg	4.000	0.000	162.000	No Ice	0.917	0.917	0.019

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(E)			0.000			1/2" Ice	1.458	1.458	0.037
			0.000			1" Ice	1.643	1.643	0.057
HPA-65R-BUU-H8	A	From Leg	4.000	0.000	162.000	No Ice	12.976	7.516	0.068
(R)			0.000			1/2" Ice	13.558	8.087	0.142
			0.000			1" Ice	14.147	8.666	0.223
HPA-65R-BUU-H6	B	From Leg	4.000	0.000	162.000	No Ice	9.658	6.450	0.051
(R)			0.000			1/2" Ice	10.128	6.913	0.114
			0.000			1" Ice	10.606	7.384	0.183
HPA-65R-BUU-H6	C	From Leg	4.000	0.000	162.000	No Ice	9.658	6.450	0.051
(R)			0.000			1/2" Ice	10.128	6.913	0.114
			0.000			1" Ice	10.606	7.384	0.183
OPA-65R-LCUU-H8	A	From Leg	4.000	0.000	162.000	No Ice	12.746	7.246	0.088
(R)			0.000			1/2" Ice	13.328	7.817	0.159
			0.000			1" Ice	13.916	8.396	0.238
OPA-65R-LCUU-H6	B	From Leg	4.000	0.000	162.000	No Ice	9.658	5.517	0.073
(R)			0.000			1/2" Ice	10.128	5.971	0.131
			0.000			1" Ice	10.606	6.434	0.196
OPA-65R-LCUU-H6	C	From Leg	4.000	0.000	162.000	No Ice	9.658	5.517	0.073
(R)			0.000			1/2" Ice	10.128	5.971	0.131
			0.000			1" Ice	10.606	6.434	0.196
TT19-08BP111-001	A	From Leg	4.000	0.000	162.000	No Ice	0.545	0.442	0.016
(R)			0.000			1/2" Ice	0.641	0.530	0.022
			-1.000			1" Ice	0.743	0.626	0.029
RRUS A2	A	From Leg	4.000	0.000	162.000	No Ice	2.066	0.498	0.022
(R)			0.000			1/2" Ice	2.245	0.607	0.035
			-1.000			1" Ice	2.431	0.724	0.050
RRUS A2	B	From Leg	4.000	0.000	162.000	No Ice	2.066	0.498	0.022
(R)			0.000			1/2" Ice	2.245	0.607	0.035
			-1.000			1" Ice	2.431	0.724	0.050
RRUS A2	C	From Leg	4.000	0.000	162.000	No Ice	2.066	0.498	0.022
(R)			0.000			1/2" Ice	2.245	0.607	0.035
			-1.000			1" Ice	2.431	0.724	0.050
RRUS 11	A	From Leg	4.000	0.000	162.000	No Ice	2.784	1.187	0.048
(R)			0.000			1/2" Ice	2.992	1.334	0.068
			0.000			1" Ice	3.207	1.490	0.092
RRUS 11	B	From Leg	4.000	0.000	162.000	No Ice	2.784	1.187	0.048
(R)			0.000			1/2" Ice	2.992	1.334	0.068
			0.000			1" Ice	3.207	1.490	0.092
RRUS 11	C	From Leg	4.000	0.000	162.000	No Ice	2.784	1.187	0.048
(R)			0.000			1/2" Ice	2.992	1.334	0.068
			0.000			1" Ice	3.207	1.490	0.092
WCS RRUS-32-B30	A	From Leg	4.000	0.000	162.000	No Ice	3.314	2.424	0.077
(R)			0.000			1/2" Ice	3.558	2.638	0.105
			0.000			1" Ice	3.809	2.860	0.136
WCS RRUS-32-B30	B	From Leg	4.000	0.000	162.000	No Ice	3.314	2.424	0.077
(R)			0.000			1/2" Ice	3.558	2.638	0.105
			0.000			1" Ice	3.809	2.860	0.136
WCS RRUS-32-B30	C	From Leg	4.000	0.000	162.000	No Ice	3.314	2.424	0.077
(R)			0.000			1/2" Ice	3.558	2.638	0.105
			0.000			1" Ice	3.809	2.860	0.136
(2) LGP21401	B	From Leg	4.000	0.000	162.000	No Ice	1.104	0.207	0.014
(R)			0.000			1/2" Ice	1.239	0.274	0.021
			-1.000			1" Ice	1.381	0.348	0.030
(2) LGP21401	C	From Leg	4.000	0.000	162.000	No Ice	1.104	0.207	0.014
(R)			0.000			1/2" Ice	1.239	0.274	0.021
			-1.000			1" Ice	1.381	0.348	0.030
DC6-48-60-18-8F	B	From Leg	4.000	0.000	162.000	No Ice	0.917	0.917	0.019

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(R)			0.000			1/2" Ice	1.458	1.458	0.037
			0.000			1" Ice	1.643	1.643	0.057
Platform Mount [LP 1301-1]	C	None		0.000	162.000	No Ice	51.700	51.700	2.262
(R-4M.P/Sec)						1/2" Ice	62.700	62.700	2.935
						1" Ice	73.700	73.700	3.608
*******									
(4) SBNHH-1D65C	A	From Leg	4.000	0.000	110.000	No Ice	11.389	7.656	0.050
(P)			0.000			1/2" Ice	12.005	8.246	0.115
			0.000			1" Ice	12.629	8.843	0.188
(2) SBNHH-1D65C	C	From Leg	4.000	0.000	110.000	No Ice	11.389	7.656	0.050
(P)			0.000			1/2" Ice	12.005	8.246	0.115
			0.000			1" Ice	12.629	8.843	0.188
(3) B13 RRH 4X30	A	From Leg	4.000	0.000	110.000	No Ice	2.055	1.320	0.056
(P)			0.000			1/2" Ice	2.241	1.475	0.073
			0.000			1" Ice	2.433	1.638	0.093
(2) DB-B1-6C-12AB-0Z	A	From Leg	4.000	0.000	110.000	No Ice	3.364	2.192	0.021
(P)			0.000			1/2" Ice	3.597	2.395	0.050
			0.000			1" Ice	3.838	2.606	0.082
(3) RRH2X60-AWS	C	From Leg	4.000	0.000	110.000	No Ice	3.500	1.816	0.060
(P)			0.000			1/2" Ice	3.761	2.052	0.083
			0.000			1" Ice	4.029	2.289	0.109
(3) B25 RRH4X30	C	From Leg	4.000	0.000	110.000	No Ice	2.200	1.742	0.055
(P)			0.000			1/2" Ice	2.393	1.920	0.075
			0.000			1" Ice	2.593	2.106	0.099
Platform Mount [LP 1301-1]	C	None		0.000	110.000	No Ice	51.700	51.700	2.262
(P-4M.P/Sec)						1/2" Ice	62.700	62.700	2.935
						1" Ice	73.700	73.700	3.608
*******									
Bridge Stiffener	A	From Leg	0.000	0.000	140.000	No Ice	0.833	4.200	0.000
(48"x1.25"x11.5")			0.000			1/2" Ice	1.296	4.574	0.000
(E)			0.000			1" Ice	1.596	4.956	0.000
Bridge Stiffener	B	From Leg	0.000	0.000	140.000	No Ice	0.833	4.200	0.000
(48"x1.25"x11.5")			0.000			1/2" Ice	1.296	4.574	0.000
(E)			0.000			1" Ice	1.596	4.956	0.000
Bridge Stiffener	C	From Leg	0.000	0.000	140.000	No Ice	0.833	4.200	0.000
(48"x1.25"x11.5")			0.000			1/2" Ice	1.296	4.574	0.000
(E)			0.000			1" Ice	1.596	4.956	0.000
*******									

Load Combinations

Comb. No.	Description
1	Dead Only
2	1.2 Dead+1.6 Wind 0 deg - No Ice
3	0.9 Dead+1.6 Wind 0 deg - No Ice
4	1.2 Dead+1.6 Wind 30 deg - No Ice
5	0.9 Dead+1.6 Wind 30 deg - No Ice
6	1.2 Dead+1.6 Wind 60 deg - No Ice
7	0.9 Dead+1.6 Wind 60 deg - No Ice
8	1.2 Dead+1.6 Wind 90 deg - No Ice

Comb. No.	Description
9	0.9 Dead+1.6 Wind 90 deg - No Ice
10	1.2 Dead+1.6 Wind 120 deg - No Ice
11	0.9 Dead+1.6 Wind 120 deg - No Ice
12	1.2 Dead+1.6 Wind 150 deg - No Ice
13	0.9 Dead+1.6 Wind 150 deg - No Ice
14	1.2 Dead+1.6 Wind 180 deg - No Ice
15	0.9 Dead+1.6 Wind 180 deg - No Ice
16	1.2 Dead+1.6 Wind 210 deg - No Ice
17	0.9 Dead+1.6 Wind 210 deg - No Ice
18	1.2 Dead+1.6 Wind 240 deg - No Ice
19	0.9 Dead+1.6 Wind 240 deg - No Ice
20	1.2 Dead+1.6 Wind 270 deg - No Ice
21	0.9 Dead+1.6 Wind 270 deg - No Ice
22	1.2 Dead+1.6 Wind 300 deg - No Ice
23	0.9 Dead+1.6 Wind 300 deg - No Ice
24	1.2 Dead+1.6 Wind 330 deg - No Ice
25	0.9 Dead+1.6 Wind 330 deg - No Ice
26	1.2 Dead+1.0 Ice+1.0 Temp
27	1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp
28	1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp
29	1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp
30	1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp
31	1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp
32	1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp
33	1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp
34	1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp
35	1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp
36	1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp
37	1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp
38	1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp
39	Dead+Wind 0 deg - Service
40	Dead+Wind 30 deg - Service
41	Dead+Wind 60 deg - Service
42	Dead+Wind 90 deg - Service
43	Dead+Wind 120 deg - Service
44	Dead+Wind 150 deg - Service
45	Dead+Wind 180 deg - Service
46	Dead+Wind 210 deg - Service
47	Dead+Wind 240 deg - Service
48	Dead+Wind 270 deg - Service
49	Dead+Wind 300 deg - Service
50	Dead+Wind 330 deg - Service

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	180 - 145.7	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	26	-30.520	-1.968	1.546
			Max. Mx	8	-10.757	-365.882	0.607
			Max. My	2	-10.725	-0.651	369.044
			Max. Vy	20	-17.232	365.406	-0.384
			Max. Vx	2	-17.412	-0.651	369.044
			Max. Torque	11			1.028
L2	145.7 - 140	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	26	-32.393	-2.133	1.911
			Max. Mx	8	-11.965	-465.317	0.733
			Max. My	2	-11.933	-0.734	469.514

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	-17.668	464.835	-0.444
			Max. Vx	2	-17.848	-0.734	469.514
			Max. Torque	11			1.329
L3	140 - 106.42	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	26	-56.217	6.251	13.441
			Max. Mx	20	-23.690	1158.251	-0.862
			Max. My	2	-23.626	0.032	1169.911
			Max. Vy	20	-28.066	1158.251	-0.862
			Max. Vx	2	-28.809	0.032	1169.911
			Max. Torque	18			-8.758
L4	106.42 - 100	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	26	-59.423	6.018	14.002
			Max. Mx	20	-25.988	1340.497	-2.653
			Max. My	2	-25.927	-1.788	1356.954
			Max. Vy	20	-28.727	1340.497	-2.653
			Max. Vx	2	-29.471	-1.788	1356.954
			Max. Torque	18			-8.755
L5	100 - 86.25	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	26	-65.916	5.431	15.299
			Max. Mx	20	-30.085	1745.867	-6.502
			Max. My	2	-30.032	-5.705	1772.621
			Max. Vy	20	-30.237	1745.867	-6.502
			Max. Vx	2	-30.982	-5.705	1772.621
			Max. Torque	18			-8.753
L6	86.25 - 78	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	26	-71.441	5.080	16.050
			Max. Mx	20	-33.612	1999.033	-8.819
			Max. My	2	-33.562	-8.061	2031.970
			Max. Vy	20	-31.151	1999.033	-8.819
			Max. Vx	2	-31.897	-8.061	2031.970
			Max. Torque	18			-8.748
L7	78 - 60	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	26	-85.905	4.327	17.626
			Max. Mx	20	-43.118	2576.933	-13.892
			Max. My	2	-43.078	-13.217	2623.379
			Max. Vy	20	-33.044	2576.933	-13.892
			Max. Vx	2	-33.791	-13.217	2623.379
			Max. Torque	18			-8.746
L8	60 - 46.25	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	26	-93.999	3.691	18.874
			Max. Mx	20	-48.836	3040.681	-17.769
			Max. My	2	-48.805	-17.163	3097.434
			Max. Vy	20	-34.417	3040.681	-17.769
			Max. Vx	2	-35.160	-17.163	3097.434
			Max. Torque	18			-8.741
L9	46.25 - 32.67	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	26	-104.467	3.080	19.957
			Max. Mx	20	-56.253	3516.461	-21.591
			Max. My	2	-56.231	-21.051	3583.348
			Max. Vy	20	-35.664	3516.461	-21.591
			Max. Vx	2	-36.403	-21.051	3583.348
			Max. Torque	18			-8.737
L10	32.67 - 20	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	26	-115.845	2.539	20.833
			Max. Mx	20	-64.444	3974.533	-25.145
			Max. My	2	-64.430	-24.666	4050.821
			Max. Vy	20	-36.657	3974.533	-25.145
			Max. Vx	2	-37.392	-24.666	4050.821
			Max. Torque	18			-8.735
L11	20 - 11.25	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	26	-121.411	2.157	21.450

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Mx	20	-68.544	4297.674	-27.586
			Max. My	2	-68.536	-27.153	4380.414
			Max. Vy	20	-37.236	4297.674	-27.586
			Max. Vx	2	-37.965	-27.153	4380.414
			Max. Torque	18			-8.733
L12	11.25 - 9	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	26	-123.233	2.065	21.598
			Max. Mx	20	-69.887	4381.578	-28.212
			Max. My	2	-69.881	-27.790	4465.968
			Max. Vy	20	-37.388	4381.578	-28.212
			Max. Vx	2	-38.116	-27.790	4465.968
			Max. Torque	18			-8.732
L13	9 - 0	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	26	-130.925	1.746	22.114
			Max. Mx	20	-75.747	4720.685	-30.704
			Max. My	2	-75.747	-30.330	4811.652
			Max. Vy	20	-37.998	4720.685	-30.704
			Max. Vx	2	-38.720	-30.330	4811.652
			Max. Torque	18			-8.732

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	26	130.925	0.000	0.000
	Max. H_x	20	75.755	37.981	-0.279
	Max. H_z	2	75.755	-0.279	38.703
	Max. M_x	2	4811.652	-0.279	38.703
	Max. M_z	8	4716.385	-37.981	0.279
	Max. Torsion	6	8.731	-33.031	19.593
	Min. Vert	7	56.817	-33.031	19.593
	Min. H_x	8	75.755	-37.981	0.279
	Min. H_z	14	75.755	0.279	-38.703
	Min. M_x	14	-4808.071	0.279	-38.703
	Min. M_z	20	-4720.685	37.981	-0.279
	Min. Torsion	18	-8.732	33.031	-19.593

Tower Mast Reaction Summary

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead Only	63.130	0.000	0.000	-1.423	1.702	0.000
1.2 Dead+1.6 Wind 0 deg - No Ice	75.755	0.279	-38.703	-4811.652	-30.330	-4.993
0.9 Dead+1.6 Wind 0 deg - No Ice	56.817	0.279	-38.703	-4767.407	-30.634	-4.980
1.2 Dead+1.6 Wind 30 deg - No Ice	75.755	19.232	-33.657	-4183.468	-2385.187	-7.923
0.9 Dead+1.6 Wind 30 deg - No Ice	56.817	19.232	-33.657	-4144.967	-2364.016	-7.910
1.2 Dead+1.6 Wind 60 deg - No	75.755	33.031	-19.593	-2434.840	-4100.409	-8.731

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Ice						
0.9 Dead+1.6 Wind 60 deg - No Ice	56.817	33.031	-19.593	-2412.275	-4063.586	-8.722
1.2 Dead+1.6 Wind 90 deg - No Ice	75.755	37.981	-0.279	-34.225	-4716.385	-7.201
0.9 Dead+1.6 Wind 90 deg - No Ice	56.817	37.981	-0.279	-33.517	-4673.926	-7.197
1.2 Dead+1.6 Wind 120 deg - No Ice	75.755	35.315	20.590	2533.804	-4342.840	-4.037
0.9 Dead+1.6 Wind 120 deg - No Ice	56.817	35.315	20.590	2511.322	-4304.081	-4.040
1.2 Dead+1.6 Wind 150 deg - No Ice	75.755	18.793	33.455	4152.790	-2332.020	0.725
0.9 Dead+1.6 Wind 150 deg - No Ice	56.817	18.793	33.455	4115.437	-2311.274	0.716
1.2 Dead+1.6 Wind 180 deg - No Ice	75.755	-0.279	38.703	4808.071	34.598	4.995
0.9 Dead+1.6 Wind 180 deg - No Ice	56.817	-0.279	38.703	4764.756	33.792	4.982
1.2 Dead+1.6 Wind 210 deg - No Ice	75.755	-19.232	33.657	4179.917	2389.436	7.925
0.9 Dead+1.6 Wind 210 deg - No Ice	56.817	-19.232	33.657	4142.337	2367.159	7.913
1.2 Dead+1.6 Wind 240 deg - No Ice	75.755	-33.031	19.593	2431.319	4104.674	8.732
0.9 Dead+1.6 Wind 240 deg - No Ice	56.817	-33.031	19.593	2409.667	4066.741	8.723
1.2 Dead+1.6 Wind 270 deg - No Ice	75.755	-37.981	0.279	30.705	4720.685	7.199
0.9 Dead+1.6 Wind 270 deg - No Ice	56.817	-37.981	0.279	30.910	4677.107	7.195
1.2 Dead+1.6 Wind 300 deg - No Ice	75.755	-35.315	-20.590	-2537.346	4347.161	4.034
0.9 Dead+1.6 Wind 300 deg - No Ice	56.817	-35.315	-20.590	-2513.946	4307.277	4.038
1.2 Dead+1.6 Wind 330 deg - No Ice	75.755	-18.793	-33.455	-4156.370	2336.323	-0.726
0.9 Dead+1.6 Wind 330 deg - No Ice	56.817	-18.793	-33.455	-4118.087	2314.457	-0.717
1.2 Dead+1.0 Ice+1.0 Temp	130.925	-0.000	-0.000	-22.114	1.746	-0.001
1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp	130.925	0.029	-7.446	-964.437	-1.772	-0.726
1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp	130.925	3.712	-6.463	-839.986	-467.700	-1.120
1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp	130.925	6.401	-3.748	-496.443	-807.835	-1.215
1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp	130.925	7.497	-0.029	-25.859	-939.873	-0.985
1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp	130.925	7.199	4.175	498.587	-895.947	-0.543
1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp	130.925	3.760	6.605	801.420	-467.122	0.135
1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp	130.925	-0.029	7.446	919.795	5.306	0.723
1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp	130.925	-3.712	6.463	795.345	471.235	1.118
1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp	130.925	-6.401	3.748	451.803	811.371	1.213
1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp	130.925	-7.497	0.029	-18.782	943.410	0.983
1.2 Dead+1.0 Wind 300	130.925	-7.199	-4.175	-543.229	899.483	0.540

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
deg+1.0 Ice+1.0 Temp						
1.2 Dead+1.0 Wind 330	130.925	-3.760	-6.605	-846.063	470.657	-0.137
deg+1.0 Ice+1.0 Temp						
Dead+Wind 0 deg - Service	63.130	0.056	-7.792	-964.701	-4.725	-1.008
Dead+Wind 30 deg - Service	63.130	3.872	-6.776	-838.906	-476.300	-1.601
Dead+Wind 60 deg - Service	63.130	6.650	-3.944	-488.726	-819.775	-1.765
Dead+Wind 90 deg - Service	63.130	7.646	-0.056	-7.989	-943.114	-1.456
Dead+Wind 120 deg - Service	63.130	7.110	4.145	506.333	-868.420	-0.757
Dead+Wind 150 deg - Service	63.130	3.783	6.735	830.495	-465.645	0.145
Dead+Wind 180 deg - Service	63.130	-0.056	7.792	961.732	8.286	1.008
Dead+Wind 210 deg - Service	63.130	-3.872	6.776	835.938	479.861	1.601
Dead+Wind 240 deg - Service	63.130	-6.650	3.944	485.759	823.336	1.765
Dead+Wind 270 deg - Service	63.130	-7.646	0.056	5.022	946.676	1.456
Dead+Wind 300 deg - Service	63.130	-7.110	-4.145	-509.301	871.983	0.757
Dead+Wind 330 deg - Service	63.130	-3.783	-6.735	-833.464	469.208	-0.145

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
1	0.000	-63.130	0.000	0.000	63.130	0.000	0.000%
2	0.279	-75.755	-38.703	-0.279	75.755	38.703	0.000%
3	0.279	-56.817	-38.703	-0.279	56.817	38.703	0.000%
4	19.232	-75.755	-33.657	-19.232	75.755	33.657	0.000%
5	19.232	-56.817	-33.657	-19.232	56.817	33.657	0.000%
6	33.031	-75.755	-19.593	-33.031	75.755	19.593	0.000%
7	33.031	-56.817	-19.593	-33.031	56.817	19.593	0.000%
8	37.981	-75.755	-0.279	-37.981	75.755	0.279	0.000%
9	37.981	-56.817	-0.279	-37.981	56.817	0.279	0.000%
10	35.315	-75.755	20.590	-35.315	75.755	-20.590	0.000%
11	35.315	-56.817	20.590	-35.315	56.817	-20.590	0.000%
12	18.793	-75.755	33.455	-18.793	75.755	-33.455	0.000%
13	18.793	-56.817	33.455	-18.793	56.817	-33.455	0.000%
14	-0.279	-75.755	38.703	0.279	75.755	-38.703	0.000%
15	-0.279	-56.817	38.703	0.279	56.817	-38.703	0.000%
16	-19.232	-75.755	33.657	19.232	75.755	-33.657	0.000%
17	-19.232	-56.817	33.657	19.232	56.817	-33.657	0.000%
18	-33.031	-75.755	19.593	33.031	75.755	-19.593	0.000%
19	-33.031	-56.817	19.593	33.031	56.817	-19.593	0.000%
20	-37.981	-75.755	0.279	37.981	75.755	-0.279	0.000%
21	-37.981	-56.817	0.279	37.981	56.817	-0.279	0.000%
22	-35.315	-75.755	-20.590	35.315	75.755	20.590	0.000%
23	-35.315	-56.817	-20.590	35.315	56.817	20.590	0.000%
24	-18.793	-75.755	-33.455	18.793	75.755	33.455	0.000%
25	-18.793	-56.817	-33.455	18.793	56.817	33.455	0.000%
26	0.000	-130.925	0.000	0.000	130.925	0.000	0.000%
27	0.029	-130.925	-7.446	-0.029	130.925	7.446	0.000%
28	3.712	-130.925	-6.463	-3.712	130.925	6.463	0.000%
29	6.401	-130.925	-3.748	-6.401	130.925	3.748	0.000%
30	7.497	-130.925	-0.029	-7.497	130.925	0.029	0.000%
31	7.199	-130.925	4.175	-7.199	130.925	-4.175	0.000%
32	3.760	-130.925	6.605	-3.760	130.925	-6.605	0.000%
33	-0.029	-130.925	7.446	0.029	130.925	-7.446	0.000%
34	-3.712	-130.925	6.463	3.712	130.925	-6.463	0.000%
35	-6.401	-130.925	3.748	6.401	130.925	-3.748	0.000%
36	-7.497	-130.925	0.029	7.497	130.925	-0.029	0.000%
37	-7.199	-130.925	-4.175	7.199	130.925	4.175	0.000%

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
38	-3.760	-130.925	-6.605	3.760	130.925	6.605	0.000%
39	0.056	-63.130	-7.792	-0.056	63.130	7.792	0.000%
40	3.872	-63.130	-6.776	-3.872	63.130	6.776	0.000%
41	6.650	-63.130	-3.944	-6.650	63.130	3.944	0.000%
42	7.646	-63.130	-0.056	-7.646	63.130	0.056	0.000%
43	7.110	-63.130	4.145	-7.110	63.130	-4.145	0.000%
44	3.783	-63.130	6.735	-3.783	63.130	-6.735	0.000%
45	-0.056	-63.130	7.792	0.056	63.130	-7.792	0.000%
46	-3.872	-63.130	6.776	3.872	63.130	-6.776	0.000%
47	-6.650	-63.130	3.944	6.650	63.130	-3.944	0.000%
48	-7.646	-63.130	0.056	7.646	63.130	-0.056	0.000%
49	-7.110	-63.130	-4.145	7.110	63.130	4.145	0.000%
50	-3.783	-63.130	-6.735	3.783	63.130	6.735	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	0.00011332
3	Yes	5	0.00000001	0.00005450
4	Yes	5	0.00000001	0.00097734
5	Yes	5	0.00000001	0.00045184
6	Yes	6	0.00000001	0.00004895
7	Yes	5	0.00000001	0.00055840
8	Yes	5	0.00000001	0.00020073
9	Yes	5	0.00000001	0.00009741
10	Yes	6	0.00000001	0.00004522
11	Yes	5	0.00000001	0.00051217
12	Yes	6	0.00000001	0.00004197
13	Yes	5	0.00000001	0.00047792
14	Yes	5	0.00000001	0.00014472
15	Yes	5	0.00000001	0.00006953
16	Yes	6	0.00000001	0.00004868
17	Yes	5	0.00000001	0.00055440
18	Yes	5	0.00000001	0.00097415
19	Yes	5	0.00000001	0.00045109
20	Yes	5	0.00000001	0.00016976
21	Yes	5	0.00000001	0.00008256
22	Yes	6	0.00000001	0.00005011
23	Yes	5	0.00000001	0.00056762
24	Yes	6	0.00000001	0.00004290
25	Yes	5	0.00000001	0.00048793
26	Yes	4	0.00000001	0.00025725
27	Yes	5	0.00000001	0.00083304
28	Yes	5	0.00000001	0.00087481
29	Yes	5	0.00000001	0.00086769
30	Yes	5	0.00000001	0.00080122
31	Yes	5	0.00000001	0.00091124
32	Yes	5	0.00000001	0.00082538
33	Yes	5	0.00000001	0.00078143
34	Yes	5	0.00000001	0.00083411
35	Yes	5	0.00000001	0.00083587
36	Yes	5	0.00000001	0.00080857
37	Yes	5	0.00000001	0.00095863
38	Yes	5	0.00000001	0.00088050

39	Yes	4	0.00000001	0.00015660
40	Yes	4	0.00000001	0.00028623
41	Yes	4	0.00000001	0.00043320
42	Yes	4	0.00000001	0.00021117
43	Yes	4	0.00000001	0.00029947
44	Yes	4	0.00000001	0.00027717
45	Yes	4	0.00000001	0.00016139
46	Yes	4	0.00000001	0.00042233
47	Yes	4	0.00000001	0.00029756
48	Yes	4	0.00000001	0.00020654
49	Yes	4	0.00000001	0.00038341
50	Yes	4	0.00000001	0.00029573

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	180 - 145.7	19.987	49	0.982	0.004
L2	145.7 - 140	13.179	49	0.851	0.003
L3	140 - 106.42	12.186	49	0.810	0.003
L4	106.42 - 100	7.020	49	0.632	0.003
L5	100 - 86.25	6.194	49	0.596	0.002
L6	86.25 - 78	4.604	49	0.505	0.002
L7	78 - 60	3.770	49	0.459	0.002
L8	60 - 46.25	2.219	49	0.360	0.001
L9	46.25 - 32.67	1.309	49	0.270	0.001
L10	32.67 - 20	0.651	49	0.191	0.001
L11	20 - 11.25	0.237	49	0.119	0.000
L12	11.25 - 9	0.071	49	0.061	0.000
L13	9 - 0	0.046	49	0.048	0.000

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
184.000	Lighting Rod 5/8" x 8'	49	19.987	0.982	0.004	46268
177.000	APXVSPP18-C-A20 w/ Mount Pipe	49	19.362	0.975	0.004	46268
175.000	PCS 1900MHz 4x45W-65MHz	49	18.945	0.970	0.004	46268
162.000	7770.00	49	16.282	0.932	0.003	12852
140.000	Bridge Stiffener (48"x1.25"x11.5")	49	12.186	0.810	0.003	12437
110.000	(4) SBNHH-1D65C	49	7.506	0.651	0.003	8683

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	180 - 145.7	99.536	22	4.899	0.017
L2	145.7 - 140	65.636	22	4.242	0.016

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L3	140 - 106.42	60.695	22	4.040	0.015
L4	106.42 - 100	34.980	22	3.151	0.014
L5	100 - 86.25	30.867	22	2.968	0.012
L6	86.25 - 78	22.946	22	2.517	0.009
L7	78 - 60	18.793	22	2.288	0.008
L8	60 - 46.25	11.064	22	1.792	0.005
L9	46.25 - 32.67	6.527	22	1.347	0.004
L10	32.67 - 20	3.244	22	0.953	0.002
L11	20 - 11.25	1.180	22	0.595	0.001
L12	11.25 - 9	0.355	22	0.302	0.001
L13	9 - 0	0.228	22	0.239	0.001

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
184.000	Lighting Rod 5/8" x 8'	22	99.536	4.899	0.018	9421
177.000	APXVSPP18-C-A20 w/ Mount Pipe	22	96.421	4.864	0.018	9421
175.000	PCS 1900MHz 4x45W-65MHz	22	94.348	4.840	0.018	9421
162.000	7770.00	22	81.088	4.651	0.017	2615
140.000	Bridge Stiffener (48"x1.25"x11.5")	22	60.695	4.040	0.016	2525
110.000	(4) SBNHH-1D65C	22	37.398	3.243	0.015	1755

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	180 - 145.7 (1)	P24x3/8	34.300	0.000	0.0	27.833	-10.679	901.775	0.012
L2	145.7 - 140 (2)	P24x3/8 [0.677164]	5.700	0.000	0.0	49.616	-11.840	2026.420	0.006
L3	140 - 106.42 (3)	P36x1/2	33.580	0.000	0.0	55.763	-23.518	1806.730	0.013
L4	106.42 - 100 (4)	P36x1/2 [0.759201]	6.420	0.000	0.0	84.053	-25.816	3354.020	0.008
L5	100 - 86.25 (5)	P42x1/2	13.750	0.000	0.0	65.188	-29.923	2112.090	0.014
L6	86.25 - 78 (6)	P42x1/2 [0.732342]	8.250	0.000	0.0	94.945	-33.456	3686.900	0.009
L7	78 - 60 (7)	P42x1/2 [0.914993]	18.000	0.000	0.0	118.100	-42.981	4586.050	0.009
L8	60 - 46.25 (8)	P48x5/8	13.750	0.000	0.0	93.021	-48.727	3013.870	0.016
L9	46.25 - 32.67 (9)	P48x5/8 [0.826841]	13.580	0.000	0.0	122.537	-56.171	3753.930	0.015
L10	32.67 - 20 (10)	P48x5/8 [0.983981]	12.670	0.000	0.0	145.339	-64.391	5731.410	0.011
L11	20 - 11.25 (11)	P54x5/8 4.8.2 (1.05 CR) - 11	8.750	0.000	0.0	104.802	-68.515	3395.570	0.020
L12	11.25 - 9 (12)	P54x5/8 [0.793292]	2.250	0.000	0.0	132.602	-69.864	4116.960	0.017
L13	9 - 0 (13)	P54x5/8 [0.884318]	9.000	0.000	0.0	147.564	-75.746	4480.350	0.017

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	180 - 145.7 (1)	P24x3/8	370.271	550.881	0.672	0.000	550.881	0.000
L2	145.7 - 140 (2)	P24x3/8 [0.677164]	473.074	1254.008	0.377	0.000	1254.008	0.000
L3	140 - 106.42 (3)	P36x1/2	1210.858	1623.158	0.746	0.000	1623.158	0.000
L4	106.42 - 100 (4)	P36x1/2 [0.759201]	1404.142	3100.258	0.453	0.000	3100.258	0.000
L5	100 - 86.25 (5)	P42x1/2	1835.808	2162.842	0.849	0.000	2162.842	0.000
L6	86.25 - 78 (6)	P42x1/2 [0.732342]	2106.308	3871.308	0.544	0.000	3871.308	0.000
L7	78 - 60 (7)	P42x1/2 [0.914993]	2725.933	4998.758	0.545	0.000	4998.758	0.000
L8	60 - 46.25 (8)	P48x5/8	3224.542	3573.958	0.902	0.000	3573.958	0.000
L9	46.25 - 32.67 (9)	P48x5/8 [0.826841]	3736.575	4697.800	0.795	0.000	4697.800	0.000
L10	32.67 - 20 (10)	P48x5/8 [0.983981]	4229.942	7046.283	0.600	0.000	7046.283	0.000
L11	20 - 11.25 (11)	P54x5/8	4578.033	4453.000	1.028	0.000	4453.000	0.000
L12	11.25 - 9 (12)	P54x5/8 [0.793292]	4668.392	5647.225	0.827	0.000	5647.225	0.000
L13	9 - 0 (13)	P54x5/8 [0.884318]	5033.483	6313.117	0.797	0.000	6313.117	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	180 - 145.7 (1)	P24x3/8	17.490	450.887	0.039	1.026	874.033	0.001
L2	145.7 - 140 (2)	P24x3/8 [0.677164]	18.591	1013.210	0.018	1.327	1915.292	0.001
L3	140 - 106.42 (3)	P36x1/2	29.711	903.365	0.033	4.046	2635.858	0.002
L4	106.42 - 100 (4)	P36x1/2 [0.759201]	30.519	1677.010	0.018	4.045	4823.308	0.001
L5	100 - 86.25 (5)	P42x1/2	32.267	1056.050	0.031	4.043	3609.208	0.001
L6	86.25 - 78 (6)	P42x1/2 [0.732342]	33.321	1843.450	0.018	4.041	6230.983	0.001
L7	78 - 60 (7)	P42x1/2 [0.914993]	35.507	2293.020	0.015	4.039	7683.517	0.001
L8	60 - 46.25 (8)	P48x5/8	37.020	1506.930	0.025	4.037	5872.808	0.001
L9	46.25 - 32.67 (9)	P48x5/8 [0.826841]	38.396	1876.970	0.020	4.036	7253.658	0.001
L10	32.67 - 20 (10)	P48x5/8 [0.983981]	39.494	2865.710	0.014	4.035	11002.500	0.000
L11	20 - 11.25 (11)	P54x5/8	40.100	1697.790	0.024	4.035	7465.225	0.001
L12	11.25 - 9 (12)	P54x5/8 [0.793292]	40.259	2058.480	0.020	4.034	8995.000	0.000
L13	9 - 0 (13)	P54x5/8 [0.884318]	40.897	2240.180	0.018	4.034	9756.000	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	180 - 145.7 (1)	0.012	0.672	0.000	0.039	0.001	0.686	1.000	4.8.2 ✔
L2	145.7 - 140 (2)	0.006	0.377	0.000	0.018	0.001	0.383 ✔	1.000	4.8.2 ✔

Section No.	Elevation ft	Ratio $P_u/\phi P_n$	Ratio $M_{ux}/\phi M_{nx}$	Ratio $M_{uy}/\phi M_{ny}$	Ratio $V_u/\phi V_n$	Ratio $T_u/\phi T_n$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L3	140 - 106.42 (3)	0.013	0.746	0.000	0.033	0.002	0.760 ✔	1.000	4.8.2 ✔
L4	106.42 - 100 (4)	0.008	0.453	0.000	0.018	0.001	0.461 ✔	1.000	4.8.2 ✔
L5	100 - 86.25 (5)	0.014	0.849	0.000	0.031	0.001	0.864 ✔	1.000	4.8.2 ✔
L6	86.25 - 78 (6)	0.009	0.544	0.000	0.018	0.001	0.554 ✔	1.000	4.8.2 ✔
L7	78 - 60 (7)	0.009	0.545	0.000	0.015	0.001	0.555 ✔	1.000	4.8.2 ✔
L8	60 - 46.25 (8)	0.016	0.902	0.000	0.025	0.001	0.919 ✔	1.000	4.8.2 ✔
L9	46.25 - 32.67 (9)	0.015	0.795	0.000	0.020	0.001	0.811 ✔	1.000	4.8.2 ✔
L10	32.67 - 20 (10)	0.011	0.600	0.000	0.014	0.000	0.612 ✔	1.000	4.8.2 ✔
L11	20 - 11.25 (11)	0.020	1.028	0.000	0.024	0.001	1.049 ✔	1.000	4.8.2 ✔
L12	11.25 - 9 (12)	0.017	0.827	0.000	0.020	0.000	0.844 ✔	1.000	4.8.2 ✔
L13	9 - 0 (13)	0.017	0.797	0.000	0.018	0.000	0.815 ✔	1.000	4.8.2 ✔

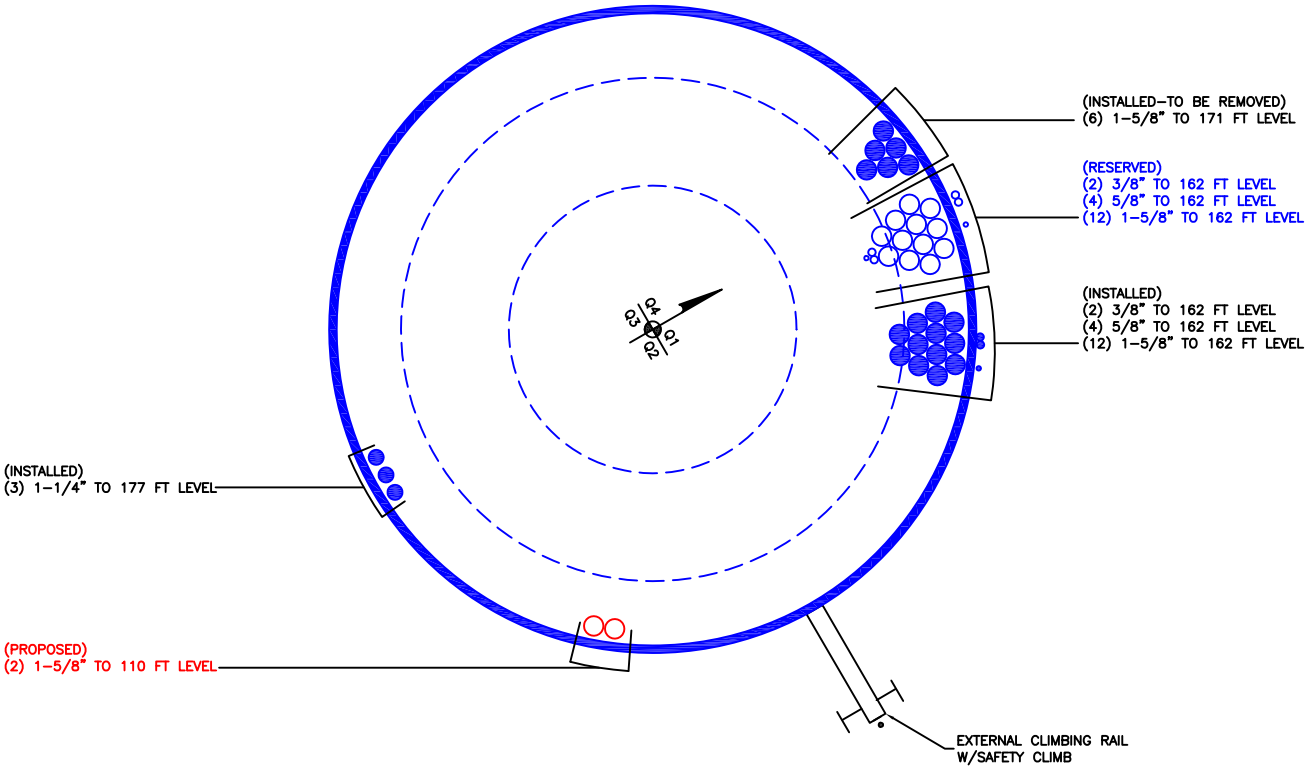
Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	ϕP_{allow} K	% Capacity	Pass Fail
L1	180 - 145.7	Pole	P24x3/8	1	-10.679	901.775	**	**
L2	145.7 - 140	Pole	P24x3/8 [0.677164]	2	-11.840	2026.420	**	**
L3	140 - 106.42	Pole	P36x1/2	3	-23.518	1806.730	**	**
L4	106.42 - 100	Pole	P36x1/2 [0.759201]	4	-25.816	3354.020	**	**
L5	100 - 86.25	Pole	P42x1/2	5	-29.923	2112.090	**	**
L6	86.25 - 78	Pole	P42x1/2 [0.732342]	6	-33.456	3686.900	**	**
L7	78 - 60	Pole	P42x1/2 [0.914993]	7	-42.981	4586.050	**	**
L8	60 - 46.25	Pole	P48x5/8	8	-48.727	3013.870	**	**
L9	46.25 - 32.67	Pole	P48x5/8 [0.826841]	9	-56.171	3753.930	**	**
L10	32.67 - 20	Pole	P48x5/8 [0.983981]	10	-64.391	5731.410	**	**
L11	20 - 11.25	Pole	P54x5/8	11	-68.515	3395.570	**	**
L12	11.25 - 9	Pole	P54x5/8 [0.793292]	12	-69.864	4116.960	**	**
L13	9 - 0	Pole	P54x5/8 [0.884318]	13	-75.746	4480.350	**	**
							Summary	
						Pole (L11)	**	**
						RATING =	**	**

** See additional Calc in Appendix C

APPENDIX B

BASE LEVEL DRAWING



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APPENDIX C

ADDITIONAL CALCULATIONS

Reinforcement 1

Bottom	Top	QTY	Type	Position	Gap	Ten/Comp
0	9	3	CCI-1x4.5	F	0	T&C
20	32.67	3	CCI-1.25x6.5	F	0	T&C
60	78	3	CCI-1.25x6.5	F	0	T&C
100	106.42	3	CCI-1.25x6.5	F	0	T&C
140	145.7	3	CCI-1x6	F	0	T&C
				F	0	T&C
				F	0	T&C
				F	0	T&C
				F	0	T&C
				F	0	T&C

Reinforcement 2

Bottom	Top	QTY	Type	Position	Gap	Ten/Comp
0	11.25	3	CCI-1.25x8.5	F	0	T&C
20	46.25	3	CCI-1.25x8.5	F	0	T&C
60	86.25	3	CCI-1.25x8.5	F	0	T&C
				F	0	T&C
				F	0	T&C
				F	0	T&C
				F	0	T&C
				F	0	T&C
				F	0	T&C

Reinforcement 3

Bottom	Top	QTY	Type	Position	Gap	Ten/Comp
				F	0	T&C
				F	0	T&C
				F	0	T&C
				F	0	T&C
				F	0	T&C
				F	0	T&C
				F	0	T&C
				F	0	T&C
				F	0	T&C
				F	0	T&C

Bottom Elevation	Top Elevation	Original Thickness	Original Yield Stress	Original Ultimate Stress	Reinforced Shaft Capacity	Reinf. 1 QTY	Reinf. 1 Type	Rein. 1 Capacity	Reinf. 2 QTY	Reinf. 2 Type	Rein. 2 Capacity	Reinf. 3 QTY	Reinf. 3 Type	Rein. 3 Capacity	Control Stress Ratio	Top Height	Section Length	Lap Splice	# of Sides	Top Diameter	Bottom Diameter	Equivalent Shaft Thickness	Equivalent Shaft Fy	Equivalent Weight Mult.		Bottom Elevation Failure	Top Elevation Failure	Section Failure %
145.7000	180.0000	0.3750	36	58	68.4%										**68.4%**	180.0000	34.3000	0.0000	Round	24.0000	24.0000	0.3750	36.0	1.00	1	11	14	107.2%
140.0000	145.7000	0.3750	36	58	50.7%	3	CCI-1x6	44.6%							**50.7%**	145.7000	5.7000	0.0000	Round	24.0000	24.0000	0.6772	45.4	0.92	2			
106.4200	140.0000	0.5000	36	58	75.9%										**75.9%**	140.0000	33.5800	0.0000	Round	36.0000	36.0000	0.5000	36.0	1.00	3			
100.0000	106.4200	0.5000	36	58	59.6%	3	CCI-1.25x6.5	49.9%							**59.6%**	106.4200	6.4200	0.0000	Round	36.0000	36.0000	0.7592	44.3	0.95	4			
86.2500	100.0000	0.5000	36	58	86.3%										**86.3%**	100.0000	13.7500	0.0000	Round	42.0000	42.0000	0.5000	36.0	1.00	5			
78.0000	86.2500	0.5000	36	58	71.6%				3	CCI-1.25x8.5	51.2%				**71.6%**	86.2500	8.2500	0.0000	Round	42.0000	42.0000	0.7323	43.1	1.02	6			
60.0000	78.0000	0.5000	36	58	73.6%	3	CCI-1.25x6.5	57.5%	3	CCI-1.25x8.5	54.3%				**73.6%**	78.0000	18.0000	0.0000	Round	42.0000	42.0000	0.9150	43.1	1.03	7			
46.2500	60.0000	0.6250	36	58	91.8%										**91.8%**	60.0000	13.7500	0.0000	Round	48.0000	48.0000	0.6250	36.0	1.00	8			
32.6700	46.2500	0.6250	36	58	84.1%				3	CCI-1.25x8.5	61.8%				**84.1%**	46.2500	13.5800	0.0000	Round	48.0000	48.0000	0.8268	34.0	1.02	9			
20.0000	32.6700	0.6250	36	58	79.6%	3	CCI-1.25x6.5	62.9%	3	CCI-1.25x8.5	59.7%				**79.6%**	32.6700	12.6700	0.0000	Round	48.0000	48.0000	0.9840	43.8	1.03	10			
11.2500	20.0000	0.6250	36	58	104.8%										**104.8%**	20.0000	8.7500	0.0000	Round	54.0000	54.0000	0.6250	36.0	1.00	11			
9.0000	11.2500	0.6250	36	58	87.1%				3	CCI-1.25x8.5	59.6%				**87.1%**	11.2500	2.2500	0.0000	Round	54.0000	54.0000	0.7933	34.5	1.03	12			
0.0000	9.0000	0.6250	36	58	84.7%	3	CCI-1x4.5	75.4%	3	CCI-1.25x8.5	58.0%				**84.7%**	9.0000	9.0000	0.0000	Round	54.0000	54.0000	0.8843	33.7	1.02	13			
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Section / Loads / Pole

Section	Elevation (ft)	Moment (ft-kip)	Compression (kip)	Shear (kip)	Torsion (kip-ft)	Number of Sides	OD (in)	Thickness (in)	Yield Strength (ksi)	Flat Width (in)	Area (in²)	Moment of Inertia (in⁴)	Percent of Composite Moment of Inertia	Angle Offset to Pole Flat	Distance to Extreme Fiber (in)
Section	*Elevation*	*Moment*	*Compressio*	*Shear*	*Torsion*	*PoleSides*	*PoleOD*	*PoleT*	*PoleFy*	*PoleW*	*PoleA*	*PoleI*	*PoleIPer*	*PoleCPoin*	*PoleC*
1	180	0.1	0.0	0.0	0.0	Round	24.0000	0.5000	36	0.00	36.9	2549	100%	TRUE	12.00
2	145.7	370.3	10.7	17.5	1.0	Round	24.0000	0.3750	36	0.00	27.8	1942	100%	TRUE	12.00
3	140	473.1	11.8	18.6	1.3	Round	24.0000	0.3750	36	0.00	27.8	1942	58%	TRUE	12.00
4	106.42	1210.9	23.5	29.7	4.0	Round	36.0000	0.5000	36	0.00	55.8	8786	100%	TRUE	18.00
5	100	1404.1	25.8	30.5	4.0	Round	36.0000	0.5000	36	0.00	55.8	8786	67%	TRUE	18.00
6	86.25	1835.8	29.9	32.3	4.0	Round	42.0000	0.5000	36	0.00	65.2	14036	100%	TRUE	21.00
7	78	2106.3	33.5	33.3	4.0	Round	42.0000	0.5000	36	0.00	65.2	14072	70%	TRUE	21.75
8	60	2725.9	43.0	35.5	4.0	Round	42.0000	0.5000	36	0.00	65.2	14038	56%	TRUE	21.20
9	46.25	3224.5	48.7	37.0	4.0	Round	48.0000	0.6250	36	0.00	93.0	26101	100%	TRUE	24.00
10	32.67	3736.6	56.2	38.4	4.0	Round	48.0000	0.6250	36	0.00	93.0	26142	77%	TRUE	24.66
11	20	4229.9	64.4	39.5	4.0	Round	48.0000	0.6250	36	0.00	93.0	26105	65%	TRUE	24.19
12	11.25	4578.0	68.5	40.1	4.0	Round	54.0000	0.6250	36	0.00	104.8	37326	100%	TRUE	27.00
13	9	4668.4	69.9	40.2	4.0	Round	54.0000	0.6250	36	0.00	104.8	37357	80%	TRUE	27.54
14	0	5033.5	75.7	40.9	4.0	Round	54.0000	0.6250	36	0.00	104.8	37351	72%	TRUE	27.49

Unreinforced Pole - Rev. G

Section	Section Modulus (in³)	Torsion Constant (in⁴)	Effective Yield Stress (ksi)	Nominal Bending Moment Strength (ft-kip)	Strength Resistance Factor	Design Bending Moment Strength (ft-kip)	Nominal Compressive Strength (kip)	Strength Resistance Factor	Design Compressive Strength (kip)	Nominal Shear Strength (kip)	Strength Resistance Factor	Design Shear Strength (kip)	Nominal Torsion Shear Strength (kip-ft)	Strength Resistance Factor	Design Torsion Shear Strength (kip-ft)	Stress Ratio
Section	*PoleS*	*PoleJ*	*PoleFye*	*PoleMn*	*PolePhiF*	*PolePhiMn*	*PolePn*	*PolePhiC*	*PolePhiPn*	*PoleVn*	*PolePhiV*	*PolePhiVn*	*PoleVtn*	*PolePhiVt*	*PolepPhiVt*	***PoleSRG***
1	212	5099	36.0	828.5	0.9	745.7	1328.9	0.9	1196.0	664.4	0.9	598.0	15296.1	0.9	13766.5	**0.000**
2	162	3885	36.0	612.1	0.9	550.9	1002.0	0.9	901.8	501.0	0.9	450.9	11653.8	0.9	10488.4	**0.685**
3	162	3885	36.0	612.1	0.9	550.9	1002.0	0.9	901.8	501.0	0.9	450.9	11653.8	0.9	10488.4	**0.874**
4	488	17572	36.0	1803.5	0.9	1623.2	2007.5	0.9	1806.7	1003.7	0.9	903.4	35144.8	0.9	31630.3	**0.760**
5	488	17572	36.0	1803.5	0.9	1623.2	2007.5	0.9	1806.7	1003.7	0.9	903.4	35144.8	0.9	31630.3	**0.881**
6	668	28072	36.0	2403.2	0.9	2162.8	2346.8	0.9	2112.1	1173.4	0.9	1056.0	48122.7	0.9	43310.5	**0.864**
7	647	28072	36.0	2326.5	0.9	2093.9	2346.8	0.9	2112.1	1173.4	0.9	1056.0	46467.8	0.9	41821.0	**1.023**
8	662	28072	36.0	2380.9	0.9	2142.8	2346.8	0.9	2112.1	1173.4	0.9	1056.0	47669.0	0.9	42902.1	**1.294**
9	1088	52203	36.0	3971.1	0.9	3574.0	3348.7	0.9	3013.9	1674.4	0.9	1506.9	78304.1	0.9	70473.7	**0.919**
10	1060	52203	36.0	3870.5	0.9	3483.5	3348.7	0.9	3013.9	1674.4	0.9	1506.9	76202.5	0.9	68582.2	**1.092**
11	1079	52203	36.0	3941.1	0.9	3547.0	3348.7	0.9	3013.9	1674.4	0.9	1506.9	77704.5	0.9	69934.0	**1.215**
12	1382	74652	36.0	4947.8	0.9	4453.0	3772.9	0.9	3395.6	1886.4	0.9	1697.8	99536.4	0.9	89582.7	**1.049**
13	1356	74652	36.0	4854.9	0.9	4369.4	3772.9	0.9	3395.6	1886.4	0.9	1697.8	97588.1	0.9	87829.3	**1.090**
14	1359	74652	36.0	4862.8	0.9	4376.5	3772.9	0.9	3395.6	1886.4	0.9	1697.8	97760.1	0.9	87984.1	**1.173**
																1.294

Reinforced Pole / Rev. G

Section	Moment in Pole when Reinforced	Bending Stress (ksi)	Axial Stress (ksi)	Shear Stress (ksi)	Torsion Shear Stress (ksi)	Allowable Bending Stress (ksi)	Allowable Compressive Stress (ksi)	Allowable Shear Stress (ksi)	Allowable Torsion Shear Stress (ksi)	Reinforced Pole Stress Ratio
Section	*PoleMome*	*RPoleFbAc*	*RPoleFaAc*	*RPoleFvAc*	*RPoleFvtAc*	*PoleFbG*	*PoleFpG*	*PoleFvG*	*PoleFvtG*	***RPoleSRG***
1	0.1	0.0	0.00	0.00	0.00	42.1	32.4	32.4	32.4	**0.000**
2	370.3	27.5	0.38	0.00	0.00	40.8	32.4	32.4	32.4	**0.684**
3	272.1	20.2	0.43	0.00	0.00	40.8	32.4	32.4	32.4	**0.507**
4	1210.9	29.8	0.42	0.00	0.00	39.9	32.4	32.4	32.4	**0.759**
5	944.8	23.2	0.46	0.00	0.00	39.9	32.4	32.4	32.4	**0.596**
6	1835.8	33.0	0.46	0.00	0.00	38.8	32.4	32.4	32.4	**0.863**
7	1465.4	27.2	0.51	0.00	0.00	38.8	32.4	32.4	32.4	**0.716**
8	1534.5	27.8	0.66	0.00	0.00	38.8	32.4	32.4	32.4	**0.736**
9	3224.5	35.6	0.52	0.00	0.00	39.4	32.4	32.4	32.4	**0.918**
10	2863.6	32.4	0.60	0.00	0.00	39.4	32.4	32.4	32.4	**0.841**
11	2747.5	30.5	0.69	0.00	0.00	39.4	32.4	32.4	32.4	**0.796**
12	4578.0	39.7	0.65	0.00	0.00	38.7	32.4	32.4	32.4	**1.048**
13	3713.7	32.9	0.67	0.00	0.00	38.7	32.4	32.4	32.4	**0.871**
14	3610.0	31.9	0.72	0.00	0.00	38.7	32.4	32.4	32.4	**0.847**
										1.048

Reinforcement 1

Section	Qty	Model	Position (F-Flat, C-Corner)	Gap Between Pole and Back of Rein. (in)	Tension only or Tension & Comp.	Total Moment of Inertia (in⁴)	Axial Force (kip)	Stress Ratio
Section	*Rein1Qty*	***Rein1Model***	*Rein1Pos*	*Rein1Gap*	*Rein1TC*	*Rein1ITotal*	*Rein1P*	***Rein1SR***
1								
2								
3	**3**	**CCI-1x6**	**F**	0	T&C	1434	126.2	**0.446**
4								
5	**3**	**CCI-1.25x6.5**	**F**	0	T&C	4272	195.3	**0.499**
6								
7								
8	**3**	**CCI-1.25x6.5**	**F**	0	T&C	4603	224.9	**0.575**
9								
10								
11	**3**	**CCI-1.25x6.5**	**F**	0	T&C	5947	246.1	**0.629**
12								
13								
14	**3**	**CCI-1x4.5**	**F**	0	T&C	5120	145.6	**0.754**
								0.754

Reinforcement 2

Section	Qty	Model	Position (F-Flat, C-Corner)	Gap Between Pole and Back of Rein. (in)	Tension only or Tension & Comp.	Total Moment of Inertia (in⁴)	Axial Force (kip)	Stress Ratio
Section	*Rein2Qty*	***Rein2Model***	*Rein2Pos*	*Rein2Gap*	*Rein2TC*	*Rein2ITotal*	*Rein2P*	***Rein2SR***
1								
2								
3								
4								
5								
6								
7	**3**	**CCI-1.25x8.5**	**F**	0	T&C	6155	277.3	**0.512**
8	**3**	**CCI-1.25x8.5**	**F**	0	T&C	6297	294.2	**0.543**
9								
10	**3**	**CCI-1.25x8.5**	**F**	0	T&C	7969	334.8	**0.618**
11	**3**	**CCI-1.25x8.5**	**F**	0	T&C	8138	323.1	**0.597**
12								
13	**3**	**CCI-1.25x8.5**	**F**	0	T&C	9603	322.6	**0.596**
14	**3**	**CCI-1.25x8.5**	**F**	0	T&C	9609	314.2	**0.580**
								0.618

Composite

Section	Centroid Offset (in)	Area (in²)	Moment of Inertia (in⁴)	Controlling Stress Ratio	Thickness (in)	Weight Multiplier	Derated Yield Stress (ksi)	% Error in Derated Yield Stress
Section	*CompYBar*	*CompA*	*CompI*	***CompSR***	***EPoleT***	***EPoleWM***	***EDPoleFy***	***EDPoleSRCheck***
1	0.000	36.9	2549	**0.000**	**0.5000**	**1.00**	**36.0**	**0.0%**
2	0.000	27.8	1942	**0.684**	**0.3750**	**1.00**	**36.0**	**0.2%**
3	0.000	45.8	3376	**0.507**	**0.6772**	**0.92**	**45.4**	**24.4%**
4	0.000	55.8	8786	**0.759**	**0.5000**	**1.00**	**36.0**	**0.1%**
5	0.000	80.1	13058	**0.596**	**0.7592**	**0.95**	**44.3**	**22.7%**
6	0.000	65.2	14036	**0.863**	**0.5000**	**1.00**	**36.0**	**0.0%**
7	0.748	97.1	20227	**0.716**	**0.7323**	**1.02**	**43.1**	**22.7%**
8	0.200	121.4	24938	**0.736**	**0.9150**	**1.03**	**43.1**	**24.6%**
9	0.000	93.0	26101	**0.918**	**0.6250**	**1.00**	**36.0**	**0.0%**
10	0.662	124.9	34112	**0.841**	**0.8268**	**1.02**	**34.0**	**3.6%**
11	0.185	149.3	40190	**0.796**	**0.9840**	**1.03**	**43.8**	**23.2%**
12	0.000	104.8	37326	**1.048**	**0.6250**	**1.00**	**36.0**	**0.0%**
13	-0.539	136.7	46960	**0.871**	**0.7933**	**1.03**	**34.5**	**3.1%**
14	-0.491	150.2	52080	**0.847**	**0.8843**	**1.02**	**33.7**	**3.8%**
				1.048				

Rein1

Bottom	Top	Qty	Model	Position	T or T&C
0	9	3	CCI-1x4.5	F	T&C
20	32.67	3	CI-1.25x6.5	F	T&C
60	78	3	CI-1.25x6.5	F	T&C
100	106.42	3	CI-1.25x6.5	F	T&C
140	145.7	3	CCI-1x6	F	T&C
				F	T&C
				F	T&C
				F	T&C
				F	T&C

Flats (Used for relative orientation only. Actual flat numbers may vary.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1	1															
1	1	1															
1	1	1															
1	1	1															
1	1	1															

Rein2

Bottom	Top	Qty	Model	Position	T or T&C
0	11.25	3	CI-1.25x8.5	F	T&C
20	46.25	3	CI-1.25x8.5	F	T&C
60	86.25	3	CI-1.25x8.5	F	T&C
				F	T&C
				F	T&C
				F	T&C
				F	T&C
				F	T&C
				F	T&C

1	2	3
1	1	1
1	1	1
1	1	1

Rein3

Bottom	Top	Qty	Model	Position	T or T&C
				F	T&C
				F	T&C
				F	T&C
				F	T&C
				F	T&C
				F	T&C
				F	T&C
				F	T&C
				F	T&C

Reinforcement Capacity

AeroSolutions LLC
Optimizing Your Tower Infrastructure

5500 Flatirons Parkway, Suite 100
Boulder, CO 80301
720-304-6882

Dimensions and Properties														Compression				Axial				
																		ASD-9			LRFD	
Model	Weight (lb/ft)	Area (in^2)	Moment of Inertia (in^4)	Moment of Inertia (in^4)	Centroid from Mating Edge (in)	Centroid from Bolt Hole Center (in)	Web Thickness (in)	Width (in)	Flange Width (in)	Flange Thickness (in)	Hole Diameter (in)	Yield Stress (ksi)	Ultimate Stress (ksi)	Slender. Ratio Coefficient	Unbraced Length (in)	Slender. Ratio Coefficient	Unbraced Length (in)	Allowable Axial (kip)	Allowable Axial w/ increase (kip)	Governing Axial	Design Axial Strength (kip)	Governing Axial
Model	*Wt*	*A*	*Ix*	*Iy*	*Y*	*X*	*Tw*	*W*	*Wf*	*Tf*	*Dh*	*Fy*	*Fu*	*Kx*	*Lx*	*Ky*	*Ly*	*PAll*	*Pall.inc*	*Ptype.ASD*	*phiPn*	*Ptype.LRFD*
CCI-1x4.5	15.3	4.50	0.38	7.59	0.5	0	1	4.5	0	0	1.21875	65	80	0.80	20	1.00	20	128.8	171.7	Rupture	193.1	Rupture
CCI-1x6	20.4	6.00	0.50	18.00	0.5	0	1	6	0	0	1.21875	65	80	0.80	16	1.00	16	188.8	251.7	Rupture	283.1	Rupture
CCI-1.25x6.5	27.6	8.13	1.06	28.61	0.625	0	1.25	6.5	0	0	1.21875	65	80	0.80	19	1.00	19	260.4	347.2	Compress.	391.4	Rupture
CCI-1.25x8.5	36.2	10.63	1.38	63.97	0.625	0	1.25	8.5	0	0	1.21875	65	80	0.80	17	1.00	17	350.9	467.9	Compress.	541.4	Rupture

PROJECT	**86959.008.01 - PORTLAND WARREN AVE, ME**		
SUBJECT	**Welded Existing Bridge Stiffener @ 140 ft**		
DATE	**05/21/16**	PAGE 1	OF 2

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Tulsa, OK 74159
(918) 587-4630

Rev. Type: G

Determine Load to Bridge Stiffener:

M	=	**473.07**	k-ft	From tnx Model
I	=	**8416.89**	in^4	From AutoCAD Sketch
y_{bar}	=	**21.00**	in	
S	=	400.804	in^3	I/y
fc	=	14.164	ksi	M/S
A_g	=	6.250	in^2	
P_u	=	88.523	k	fc x Ag

Stiffener Width	=	**5.000**	in
Stiffener Thickness	=	**1.250**	in
Stiffener Height	=	**48.000**	in
Fy	=	**65**	ksi
Step Width	=	**6.00**	in
Fillet Weld to Pole	=	**3/8**	in
Bolt Circle	=	**29.50**	in
Number of Bolts	=	**24**	
Bolt Size	=	**3/4**	in
Bolt Area	=	0.44	in^2
Notch	=	**2.000**	in

Determine ΦPn (Allowable Axial Load):

$P_n = F_{cr} \times A_g$ — Eqn E3-1, AISC 13th Edition, Section E3.

K	=	1		
l	=	**8.000**	in	Unsupported Length
I_y	=	0.814	in^4	Local Weak Axis Moment of Intertia
A_g	=	6.250	in^2	Stiffener Cross Sectional Area
r_y	=	0.361	in	Radius of Gyration (Weak Axis)
kl/r	=	22.170		

$4.71 \times \sqrt{(E/F_y)}$ = 99.49 — Limit State Equation for Flexural Buckling - AISC 13th Edition, Section E3.

F_e	=	582.31	ksi	Eqn E3-4 - AISC 13th Edition, Section E3. Elastic Critical Buckling Stress
F_{cr}	=	62.03	ksi	Eqn E3-2, AISC 13th Edition, Section E3 Critical Buckling Stress
P_n	=	387.71	k	Nominal Compressive Strength
ΦP_n	=	348.94	k	Allowable Compressive Strength

Unity% = 25.4 %

Determine ΦMn (Allowable Strong Axis Moment on Bridge Stiffener):

P_u	=	88.52	k	From Above
e	=	5.50	in	Eccentricity
M_u	=	486.88	k-in	Moment Due to Eccentric Load on Bridge Stiffener
M_p	=	23400.00	k-in	Plastic Moment - Eqn F11-1, AISC 13th Edition, Section F11.
$L_b d/t^2$	=	76.80		For All Bridge Stiffeners, Eqn F11-2 Will Control.
M_y	=	31200.00	k-in	Moment at Yield
M_n	=	45952.43	k-in	Nominal moment - Eqn F11-2, AISC 13th Edition, Section F11.
ΦM_n	=	41357.18	k-in	Allowable Strong Axis Moment

Unity% = 2.1 %

Moment to Existing Bolt Group:

I(Bolts) = 1153.4 in^4

I(Total) = 8416.89

$$\frac{I(Bolts)}{I(Total)} = \frac{1153.39}{8416.89} = 0.137$$

Meq = 64.83 k-ft <-------Insert into Flange Spreadsheet

PROJECT	**86959.008.01 - PORTLAND WARREN AVE, ME**			
SUBJECT	**Welded Existing Bridge Stiffener @ 140 ft**			
DATE	**05/21/16**	PAGE 2	OF 2	

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Check for Welded Connection

Weld Size = **3/8** D = 6 in
Weld grade = **70 ksi**
Plate Dia = **36 in**

	Upper pole	Lower Pole
Pole dia	**24 in**	**36 in**
Weld Length	**20 in**	**20 in**
Eccentricity	10.500 in	4.5
a	0.53	0.23
C1	1	1
K	0	0
C	2.211	3.413
P(Allowable)	198.96 K	307.14 K
Unity (%)	**44.5%**	**28.8%**

Unity% = 44.5%

PROJECT	**86959.008.01 - Portland Warren Ave, ME**				
SUBJECT	**Existing Flat Plate Bridge Stiffeners @ 140'**				
DATE	**05/21/16**	PAGE	1	OF	1

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0

Determine Load to Bridge Stiffener:

M =	473.1 k-ft	From Risa Model	**Stiffener Width**	**6.000 in**
I =	8416.9 in^4	From AutoCAD Sketch	**Stiffener Thickness**	**1.000 in**
ybar =	18.500 in			
S =	454.97 in^3	I/y	**Fy**	**65 ksi**
fc =	12.48 ksi	M/S	**Fu**	**80 ksi**
Ag =	6.000 in^2			
Pu =	74.87 k	fc x Ag	**Bolt Circle**	**29.50 in**
			Number of Bolts	**24**
			Bolt Size	**3/4**
			Gap @ Flange	**6.00 in**

Determine ΦPn (Allowable Axial Load):

Pn = Fcr x Ag		Eqn E3-1, AISC 13th Edition, Section E3.
K =	1	
l =	16.000 in	Unsupported Length
Iy =	.500 in^4	Local Weak Axis Moment of Intertia
Ag =	6.000 in^2	Stiffener Cross Sectional Area
ry =	.289 in	Radius of Gyration (Weak Axis)
kl/r =	55.43	
4.71 x √(E/Fy) =	99.49	Limit State Equation for Flexural Buckling - AISC 13th Edition, Section E3.
Fe =	93.17 ksi	Eqn E3-4 - AISC 13th Edition, Section E3. Elastic Critical Buckling Stress
Fcr =	48.54 ksi	Eqn E3-2, AISC 13th Edition, Section E3 Critical Buckling Stress
Pn =	291.24 k	Nominal Compressive Strength
ΦPn =	262.12 k	Allowable Compressive Strength

Unity% = 28.6 %

Tension Rupture Check: AISC 13th Edition, Chapter J4.1

Hole Size	1.25	
U =	1	Shear Lag Factor - Table D3.1 and TIA222-G
Ag =	6.000 in^2	Gross Area
An =	4.750 in^2	Net Area
Ae =	4.750 in^2	Effective Area
ΦRn =	351.00 k	Tension Yielding: Eqn J4-1
ΦRn =	285.00 k	Tension Rupture: Eqn J4-2
ΦRn(Equiv)	285.00 ksi	

Unity% 26.3 %

Moment to Existing Bolt Group:

S_{BG} =	570.64 in^3	# Bolts Acting	6
ft =	9.95 ksi		
Ab =	.442 in^2		
T =	26.37 k		
Arm =	29.50 ksi		
M_{EQ} =	64.8 k-ft	**<-------Insert into Crown Spreadsheet**	

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

Reactions		
Mu	64.83	ft-kips
Axial, Pu:	11.84	kips
Shear, Vu:	18.59	kips
Elevation:	140	feet

Bolt Threads:
X-Excluded
φVn=φ(0.55*Ab*Fu)
φ=0.75, φ*Vn (kips):
21.87

Site Data

BU#: *878782*
Site Name: *Portland Warren Ave, ME*
App #: *321952 Revision # 13*

Pole Manufacturer:	Other

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

Bolt Data			
Qty:	24		
Diameter (in.):	0.75	Bolt Fu:	120
Bolt Material:	A325	Bolt Fy:	92
N/A:		<-- Disregard	
N/A:		<-- Disregard	
Circle (in.):	29.5		

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

Stiffener Data (Welding at Both Sides)		
Config:	0	*
Weld Type:		
Groove Depth:		in **
Groove Angle:		degrees
Fillet H. Weld:		<-- Disregard
Fillet V. Weld:		in
Width:		in
Height:		in
Thick:		in
Notch:		in
Grade:		ksi
Weld str.:		ksi

Pole Data		
Diam:	24	in
Thick:	0.375	in
Grade:	36	ksi
# of Sides:	0	"0" IF Round
Fu	58	ksi
Reinf. Fillet Weld	0	"0" if None

Flange Bolt Results

			Rigid
Bolt Tension Capacity, φ*Tn,**B1**:	30.06	kips	φ*Tn
Adjusted φ*Tn (due to Vu=Vu/Qty), **B**:	30.04	kips	φTn[(1-(Vu/φVn)^2]^0.5
Max Bolt directly applied Tu:	3.90	Kips	
Min. PL "tc" for **B** cap. **w/o** Pry:	1.319	in	
Min PL "treq" for actual **T w/ Pry**:	0.360	in	
Min PL "t1" for actual **T w/o Pry**:	0.475	in	
T allowable w/o Prying:	30.06	kips	α'<0 case
Prying Force, q:	0.00	kips	
Total Bolt Tension=Tu+q:	3.90	kips	
Non-Prying Bolt Stress Ratio, Tu/B:	13.0%	**Pass**	

Exterior Flange Plate Results Flexural Check

			Rigid
Compression Side Plate Stress:	2.7	ksi	TIA G
Allowable Plate Stress:	32.4	ksi	φ*Fy
Compression Plate Stress Ratio:	8.5%	**Pass**	Comp. Y.L. Length:
No Prying			17.15
Tension Side Stress Ratio, (treq/t)^2:	3.7%	**Pass**	

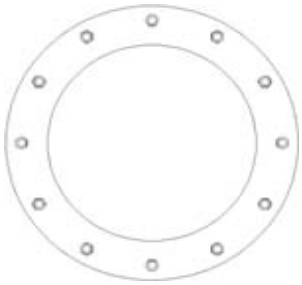
n/a

Stiffener Results

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

Pole Results

Pole Punching Shear Check: n/a



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

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

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

Site Data

BU#: *878782*
Site Name: *Portland Warren Ave, ME*
App #: *321952 Revision # 13*

Manufacturer:	Other

Reactions		
Moment:	64.83	ft-kips
Axial:	11.84	kips
Shear:	18.59	kips
Exterior Flange Run, T+q:	3.9	kips

Bolt Threads:
X-Excluded
φVn=φ(0.55*Ab*Fu)
φ=0.75, φ*Vn (kips):
21.87

Elevation: 140 feet

Bolt Data			
Qty:	24		
Diam:	0.75	Bolt Fu:	120
Bolt Material:	A325	Bolt Fy:	92
N/A:		<-- Disregard	
N/A:		<-- Disregard	
Circle:	29.5	in	

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

Stiffener Data (Welding at Both Sides)		
Config:	0	*
Weld Type:		
Groove Depth:		in **
Groove Angle:		degrees
Fillet H. Weld:		<-- Disregard
Fillet V. Weld:		in
Width:		in
Height:		in
Thick:		in
Notch:		in
Grade:		ksi
Weld str.:		ksi

Pole Data		
Pole OuterDiam:	36	in
Thick:	0.5	in
Pole Inner Diam:	35	in
Grade:	36	ksi
# of Sides:	0	"0" IF Round
Fu	58	ksi

Interior Flange Bolt Results

Maximum Bolt Tension, Tu:	3.9	Kips, Ext. Tu=Interior Tu
Adjusted φ*Tn (due to Vu=Vu/Qty),	30.0	Kips
Bolt Stress Ratio:	13.0%	**Pass**

Interior Flange Plate Results Flexural Check

Controlling Bolt Axial Force:	4.9	Kips, Ext. Cu=Interior Cu
Plate Stress:	3.3	ksi
Allowable Plate Stress, φ*Fy:	32.4	ksi
Plate Stress Ratio:	10.3%	**Pass**

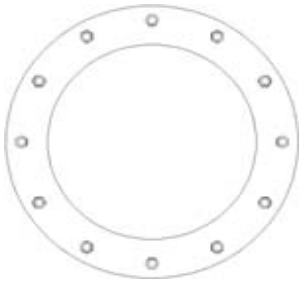
n/a

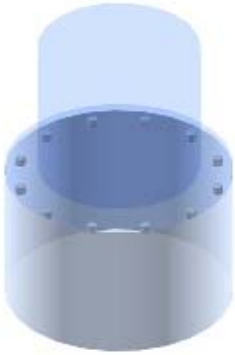
Stiffener Results

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

Pole Results

Pole Punching Shear Check: n/a





* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt
** Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

PROJECT	**86959.008.01 - Portland Warren Ave, ME**				
SUBJECT	**Existing Flat Plate Bridge Stiffeners @ 100'**				
DATE	**05/21/16**	PAGE	1	OF	1

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0

Determine Load to Bridge Stiffener:

M =	1404.1 k-ft	From Risa Model	**Stiffener Width**	**6.500 in**
I =	10001.1 in^4	From AutoCAD Sketch	**Stiffener Thickness**	**1.250 in**
ybar =	21.625 in			
S =	462.48 in^3	I/y	**Fy**	**65 ksi**
fc =	36.43 ksi	M/S	**Fu**	**80 ksi**
Ag =	8.125 in^2			
Pu =	296.02 k	fc x Ag	**Bolt Circle**	**38.50 in**
			Number of Bolts	**52**
			Bolt Size	**3/4**
			Gap @ Flange	**6.00 in**

Determine ΦPn (Allowable Axial Load):

Pn = Fcr x Ag — Eqn E3-1, AISC 13th Edition, Section E3.

K =	1	
l =	16.000 in	Unsupported Length
Iy =	1.058 in^4	Local Weak Axis Moment of Intertia
Ag =	8.125 in^2	Stiffener Cross Sectional Area
ry =	.361 in	Radius of Gyration (Weak Axis)
kl/r =	44.34	

4.71 x √(E/Fy) = 99.49 — Limit State Equation for Flexural Buckling - AISC 13th Edition, Section E3.

Fe =	145.58 ksi	Eqn E3-4 - AISC 13th Edition, Section E3. Elastic Critical Buckling Stress
Fcr =	53.92 ksi	Eqn E3-2, AISC 13th Edition, Section E3 Critical Buckling Stress
Pn =	438.10 k	Nominal Compressive Strength
ΦPn =	394.29 k	Allowable Compressive Strength

Unity% = 75.1 %

Tension Rupture Check: AISC 13th Edition, Chapter J4.1

Hole Size	1.25	
U =	1	Shear Lag Factor - Table D3.1 and TIA222-G
Ag =	8.125 in^2	Gross Area
An =	6.563 in^2	Net Area
Ae =	6.563 in^2	Effective Area
ΦRn =	475.31 k	Tension Yielding: Eqn J4-1
ΦRn =	393.75 k	Tension Rupture: Eqn J4-2
ΦRn(Equiv)	393.75 ksi	

Unity% 75.2 %

Moment to Existing Bolt Group:

S_{BG} =	519.54 in^3	# Bolts Acting	13
ft =	32.43 ksi		
Ab =	.442 in^2		
T =	186.26 k		
Arm =	38.50 ksi		
M_{EQ} =	597.6 k-ft	**<-------Insert into Crown Spreadsheet**	

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

Site Data

BU#: *878782*
Site Name: *Portland Warren Ave,ME*
App #: *321952 Revision # 13*

Reactions		
Mu	597.6	ft-kips
Axial, Pu:	25.816	kips
Shear, Vu:	30.519	kips
Elevation:	100	feet

Bolt Threads:
X-Excluded
φVn=φ(0.55*Ab*Fu)
φ=0.75, φ*Vn (kips):
21.87

Pole Manufacturer:	Other

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

Bolt Data			
Qty:	52		
Diameter (in.):	0.75	Bolt Fu:	120
Bolt Material:	A325	Bolt Fy:	92
N/A:		<-- Disregard	
N/A:		<-- Disregard	
Circle (in.):	38.5		

Plate Data		
Diam:	40.75	in
Thick, t:	2.125	in
Grade (Fy):	36	ksi
Strength, Fu:	58	ksi
Single-Rod B-eff:	2.17	in

Stiffener Data (Welding at Both Sides)		
Config:	0	*
Weld Type:		
Groove Depth:		in **
Groove Angle:		degrees
Fillet H. Weld:		<-- Disregard
Fillet V. Weld:		in
Width:		in
Height:		in
Thick:		in
Notch:		in
Grade:		ksi
Weld str.:		ksi

Pole Data		
Diam:	36	in
Thick:	0.5	in
Grade:	36	ksi
# of Sides:	0	"0" IF Round
Fu	58	ksi
Reinf. Fillet Weld	0	"0" if None

Flange Bolt Results

			Rigid
Bolt Tension Capacity, φ*Tn,**B1**:	30.06	kips	φ*Tn
Adjusted φ*Tn (due to Vu=Vu/Qty), **B**:	30.05	kips	φTn[(1-(Vu/φVn)^2]^0.5
Max Bolt directly applied Tu:	13.83	Kips	
Min. PL "tc" for **B** cap. **w/o** Pry:	0.962	in	
Min PL "treq" for actual **T w/ Pry**:	0.512	in	
Min PL "t1" for actual **T w/o Pry**:	0.653	in	
T allowable w/o Prying:	30.06	kips	α'<0 case
Prying Force, q:	0.00	kips	
Total Bolt Tension=Tu+q:	13.83	kips	
Non-Prying Bolt Stress Ratio, Tu/B:	46.0%	**Pass**	

Exterior Flange Plate Results

			Flexural Check	Rigid
Compression Side Plate Stress:	4.8	ksi		TIA G
Allowable Plate Stress:	32.4	ksi		φ*Fy
Compression Plate Stress Ratio:	14.8%	**Pass**		Comp. Y.L. Length:
No Prying				13.65
Tension Side Stress Ratio, (treq/t)^2:	5.8%	**Pass**		

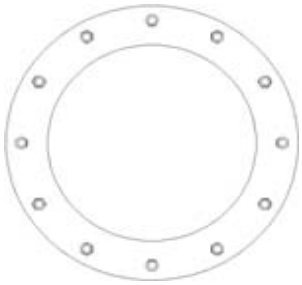
n/a

Stiffener Results

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

Pole Results

Pole Punching Shear Check: n/a



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

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

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

Site Data

BU#: *878782*
Site Name: *Portland Warren Ave,ME*
App #: *321952 Revision # 13*

Manufacturer:	Other

Reactions		
Moment:	597.6	ft-kips
Axial:	25.816	kips
Shear:	30.519	kips
Exterior Flange Run, T+q:	13.83	kips

Bolt Threads:
X-Excluded
φVn=φ(0.55*Ab*Fu)
φ=0.75, φ*Vn (kips):
21.87

Elevation: 100 feet

Bolt Data			
Qty:	52		
Diam:	0.75	Bolt Fu:	120
Bolt Material:	A325	Bolt Fy:	92
N/A:		<-- Disregard	
N/A:		<-- Disregard	
Circle:	38.5	in	

Plate Data		
Plate Outer Diam:	41	in
Plate Inner Diam:	36.25	in (Hole @ Ctr)
Thick:	2.125	in
Grade:	36	ksi
Effective Width:	2.48	in

Stiffener Data (Welding at Both Sides)		
Config:	0	*
Weld Type:		
Groove Depth:		in **
Groove Angle:		degrees
Fillet H. Weld:		<-- Disregard
Fillet V. Weld:		in
Width:		in
Height:		in
Thick:		in
Notch:		in
Grade:		ksi
Weld str.:		ksi

Pole Data		
Pole OuterDiam:	42	in
Thick:	0.5	in
Pole Inner Diam:	41	in
Grade:	36	ksi
# of Sides:	0	"0" IF Round
Fu	58	ksi

Interior Flange Bolt Results

Maximum Bolt Tension, Tu:	13.8	Kips, Ext. Tu=Interior Tu
Adjusted φ*Tn (due to Vu=Vu/Qty),	30.0	Kips
Bolt Stress Ratio:	46.0%	**Pass**

Interior Flange Plate Results Flexural Check

Controlling Bolt Axial Force:	14.8	Kips, Ext. Cu=Interior Cu
Plate Stress:	6.6	ksi
Allowable Plate Stress, φ*Fy:	32.4	ksi
Plate Stress Ratio:	20.5%	**Pass**

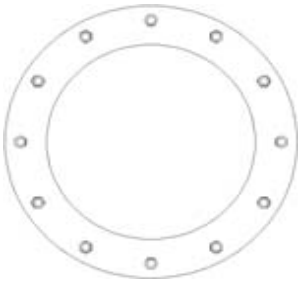
n/a

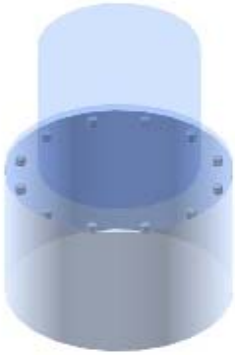
Stiffener Results

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

Pole Results

Pole Punching Shear Check: n/a





* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt
** Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

PROJECT	**86959.008.01 - Portland Warren Ave, ME**				
SUBJECT	**Existing Flat Plate Bridge Stiffeners @ 60'**				
DATE	**05/21/16**	PAGE	1	OF	1

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Tulsa, OK 74159
(918) 587-4630

0

Determine Load to Bridge Stiffener:

M =	2725.9 k-ft	From Risa Model	**Stiffener Width**	**6.500 in**
I =	20174.7 in^4	From AutoCAD Sketch	**Stiffener Thickness**	**1.250 in**
ybar =	24.625 in			
S =	819.28 in^3	I/y	**Fy**	**65 ksi**
fc =	39.93 ksi	M/S	**Fu**	**80 ksi**
Ag =	8.125 in^2			
Pu =	324.41 k	fc x Ag	**Bolt Circle**	**44.38 in**
			Number of Bolts	**56**
			Bolt Size	**3/4**
			Gap @ Flange	**6.00 in**

Determine ΦPn (Allowable Axial Load):

Pn = Fcr x Ag — Eqn E3-1, AISC 13th Edition, Section E3.

K =	1	
l =	16.000 in	Unsupported Length
Iy =	1.058 in^4	Local Weak Axis Moment of Intertia
Ag =	8.125 in^2	Stiffener Cross Sectional Area
ry =	.361 in	Radius of Gyration (Weak Axis)
kl/r =	44.34	

4.71 x √(E/Fy) = 99.49 — Limit State Equation for Flexural Buckling - AISC 13th Edition, Section E3.

Fe =	145.58 ksi	Eqn E3-4 - AISC 13th Edition, Section E3. Elastic Critical Buckling Stress
Fcr =	53.92 ksi	Eqn E3-2, AISC 13th Edition, Section E3 Critical Buckling Stress
Pn =	438.10 k	Nominal Compressive Strength
ΦPn =	394.29 k	Allowable Compressive Strength

Unity% = 82.3 %

Tension Rupture Check: AISC 13th Edition, Chapter J4.1

Hole Size	1.25	
U =	1	Shear Lag Factor - Table D3.1 and TIA222-G
Ag =	8.125 in^2	Gross Area
An =	6.563 in^2	Net Area
Ae =	6.563 in^2	Effective Area
ΦRn =	475.31 k	Tension Yielding: Eqn J4-1
ΦRn =	393.75 k	Tension Rupture: Eqn J4-2
ΦRn(Equiv)	393.75 ksi	

Unity% 82.4 %

Moment to Existing Bolt Group:

S_{BG} =	909.28 in^3	# Bolts Acting	14
ft =	35.97 ksi		
Ab =	.442 in^2		
T =	222.50 k		
Arm =	44.38 ksi		
M_{EQ} =	822.8 k-ft	**<-------Insert into Crown Spreadsheet**	

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

Site Data

BU#: *878782*
Site Name: *Portland Warren Ave, ME*
App #: *321952 Revision # 13*

Reactions		
Mu	822.8	ft-kips
Axial, Pu:	42.981	kips
Shear, Vu:	35.507	kips
Elevation:	60	feet

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

Pole Manufacturer:	Other

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

Bolt Data			
Qty:	56		
Diameter (in.):	0.75	Bolt Fu:	150
Bolt Material:	A490	Bolt Fy:	130
N/A:		<-- Disregard	
N/A:		<-- Disregard	
Circle (in.):	44.375		

Plate Data		
Diam:	46.5	in
Thick, t:	2.25	in
Grade (Fy):	36	ksi
Strength, Fu:	58	ksi
Single-Rod B-eff:	2.36	in

Stiffener Data (Welding at Both Sides)		
Config:	0	*
Weld Type:		
Groove Depth:		in **
Groove Angle:		degrees
Fillet H. Weld:		<-- Disregard
Fillet V. Weld:		in
Width:		in
Height:		in
Thick:		in
Notch:		in
Grade:		ksi
Weld str.:		ksi

Pole Data		
Diam:	42	in
Thick:	0.5	in
Grade:	36	ksi
# of Sides:	0	"0" IF Round
Fu	58	ksi
Reinf. Fillet Weld	0	"0" if None

Flange Bolt Results

			Rigid
Bolt Tension Capacity, φ*Tn,**B1**:	37.58	kips	φ*Tn
Adjusted φ*Tn (due to Vu=Vu/Qty), **B**:	37.56	kips	φTn[(1-(Vu/φVn)^2]^0.5
Max Bolt directly applied Tu:	15.13	Kips	
Min. PL "tc" for **B** cap. **w/o** Pry:	0.996	in	
Min PL "treq" for actual **T w/ Pry**:	0.491	in	
Min PL "t1" for actual **T w/o Pry**:	0.632	in	
T allowable w/o Prying:	37.58	kips	α'<0 case
Prying Force, q:	0.00	kips	
Total Bolt Tension=Tu+q:	15.13	kips	
Non-Prying Bolt Stress Ratio, Tu/B:	40.3%	**Pass**	

Exterior Flange Plate Results Flexural Check

			Rigid
Compression Side Plate Stress:	4.3	ksi	TIA G
Allowable Plate Stress:	32.4	ksi	φ*Fy
Compression Plate Stress Ratio:	13.2%	**Pass**	Comp. Y.L. Length:
No Prying			14.32
Tension Side Stress Ratio, (treq/t)^2:	4.8%	**Pass**	

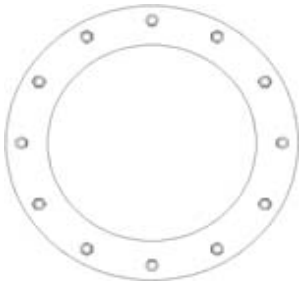
n/a

Stiffener Results

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

Pole Results

Pole Punching Shear Check: n/a



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

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

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

Site Data

BU#: *878782*
Site Name: *Portland Warren Ave, ME*
App #: *321952 Revision # 13*

Manufacturer:	Other

Reactions		
Moment:	822.8	ft-kips
Axial:	42.981	kips
Shear:	35.507	kips
Exterior Flange Run, T+q:	15.13	kips

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

Elevation: 60 feet

Bolt Data			
Qty:	56		
Diam:	0.75	Bolt Fu:	150
Bolt Material:	A490	Bolt Fy:	130
N/A:		<-- Disregard	
N/A:		<-- Disregard	
Circle:	44.375	in	

Interior Flange Bolt Results

Maximum Bolt Tension, Tu:	15.1	Kips, Ext. Flange Tu+q
Adjusted φ*Tn (due to Vu=Vu/Qty),	37.6	Kips
Bolt Stress Ratio:	40.3%	**Pass**

Plate Data		
Plate Outer Diam:	46.75	in
Plate Inner Diam:	42.25	in (Hole @ Ctr)
Thick:	2.25	in
Grade:	36	ksi
Effective Width:	2.62	in

Interior Flange Plate Results Flexural Check

Controlling Bolt Axial Force:	16.7	Kips, Ext. Cu=Interior Cu
Plate Stress:	6.0	ksi
Allowable Plate Stress, φ*Fy:	32.4	ksi
Plate Stress Ratio:	18.4%	**Pass**

Stiffener Data (Welding at Both Sides)		
Config:	0	*
Weld Type:		
Groove Depth:		in **
Groove Angle:		degrees
Fillet H. Weld:		<-- Disregard
Fillet V. Weld:		in
Width:		in
Height:		in
Thick:		in
Notch:		in
Grade:		ksi
Weld str.:		ksi

n/a

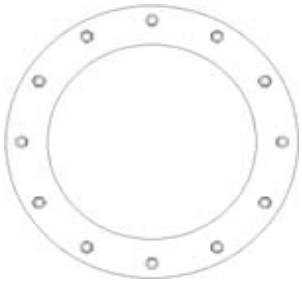
Stiffener Results

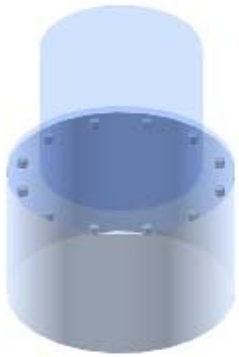
Horizontal Weld :	n/a
Vertical Weld:	n/a
Plate Flex+Shear, fb/Fb+(fv/Fv)^2:	n/a
Plate Tension+Shear, ft/Ft+(fv/Fv)^2:	n/a
Plate Comp. (AISC Bracket):	n/a

Pole Results

Pole Punching Shear Check: n/a

Pole Data		
Pole OuterDiam:	48	in
Thick:	0.625	in
Pole Inner Diam:	46.75	in
Grade:	36	ksi
# of Sides:	0	"0" IF Round
Fu	58	ksi





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

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

PROJECT	**86959.008.01 - Portland Warren Ave, ME**		
SUBJECT	**Exist/Prop Flat Plate Bridge Stiffeners @ 20'**		
DATE	**05/21/16**	PAGE 1 OF 1	

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0

Determine Load to Bridge Stiffener:

M =	4229.9 k-ft	From Risa Model	**Stiffener Width**	**6.500 in**
I =	46471.2 in^4	From AutoCAD Sketch	**Stiffener Thickness**	**1.250 in**
ybar =	27.625 in			
S =	1682.22 in^3	I/y	**Fy**	**65 ksi**
fc =	30.17 ksi	M/S	**Fu**	**80 ksi**
Ag =	8.125 in^2			
Pu =	245.16 k	fc x Ag	**Bolt Circle**	**50.38 in**
			Number of Bolts	**52**
			Bolt Size	**1**
			Gap @ Flange	**6.00 in**

Determine ΦPn (Allowable Axial Load):

Pn = Fcr x Ag		Eqn E3-1, AISC 13th Edition, Section E3.
K =	1	
l =	16.000 in	Unsupported Length
Iy =	1.058 in^4	Local Weak Axis Moment of Intertia
Ag =	8.125 in^2	Stiffener Cross Sectional Area
ry =	.361 in	Radius of Gyration (Weak Axis)
kl/r =	44.34	
4.71 x √(E/Fy) =	99.49	Limit State Equation for Flexural Buckling - AISC 13th Edition, Section E3.
Fe =	145.58 ksi	Eqn E3-4 - AISC 13th Edition, Section E3. Elastic Critical Buckling Stress
Fcr =	53.92 ksi	Eqn E3-2, AISC 13th Edition, Section E3 Critical Buckling Stress
Pn =	438.10 k	Nominal Compressive Strength
ΦPn =	394.29 k	Allowable Compressive Strength

Unity% = 62.2 %

Tension Rupture Check: AISC 13th Edition, Chapter J4.1

Hole Size	1.25	
U =	1	Shear Lag Factor - Table D3.1 and TIA222-G
Ag =	8.125 in^2	Gross Area
An =	6.563 in^2	Net Area
Ae =	6.563 in^2	Effective Area
ΦRn =	475.31 k	Tension Yielding: Eqn J4-1
ΦRn =	393.75 k	Tension Rupture: Eqn J4-2
ΦRn(Equiv)	393.75 ksi	

Unity% 62.3 %

Moment to Existing Bolt Group:

S_{BG} =	1845.01 in^3	# Bolts Acting	13
ft =	27.51 ksi		
Ab =	.785 in^2		
T =	280.90 k		
Arm =	50.38 ksi		
M_{EQ} =	1179.2 k-ft	**<-------Insert into Crown Spreadsheet**	

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

Site Data

BU#: *878782*
Site Name: *Portland Warren Ave, ME*
App #: *321952 Revision # 13*

Reactions		
Mu	1179.2	ft-kips
Axial, Pu:	64.391	kips
Shear, Vu:	39.494	kips
Elevation:	20	feet

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

Pole Manufacturer:	Other

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

Bolt Data			
Qty:	52		
Diameter (in.):	1	Bolt Fu:	120
Bolt Material:	A325	Bolt Fy:	92
N/A:		<-- Disregard	
N/A:		<-- Disregard	
Circle (in.):	50.375		

Plate Data		
Diam:	52.5	in
Thick, t:	2.5	in
Grade (Fy):	36	ksi
Strength, Fu:	58	ksi
Single-Rod B-eff:	2.90	in

Stiffener Data (Welding at Both Sides)		
Config:	0	*
Weld Type:		
Groove Depth:		in **
Groove Angle:		degrees
Fillet H. Weld:		<-- Disregard
Fillet V. Weld:		in
Width:		in
Height:		in
Thick:		in
Notch:		in
Grade:		ksi
Weld str.:		ksi

Pole Data		
Diam:	48	in
Thick:	0.625	in
Grade:	36	ksi
# of Sides:	0	"0" IF Round
Fu	58	ksi
Reinf. Fillet Weld	0	"0" if None

Flange Bolt Results

			Rigid
Bolt Tension Capacity, φ*Tn,**B1**:	54.54	kips	φ*Tn
Adjusted φ*Tn (due to Vu=Vu/Qty), **B**:	54.53	kips	φTn[(1-(Vu/φVn)^2]^0.5
Max Bolt directly applied Tu:	20.37	Kips	
Min. PL "tc" for **B** cap. **w/o** Pry:	0.995	in	
Min PL "treq" for actual **T w/ Pry**:	0.476	in	
Min PL "t1" for actual **T w/o Pry**:	0.608	in	
T allowable w/o Prying:	54.54	kips	α'<0 case
Prying Force, q:	0.00	kips	
Total Bolt Tension=Tu+q:	20.37	kips	
Non-Prying Bolt Stress Ratio, Tu/B:	37.4%	**Pass**	

Exterior Flange Plate Results Flexural Check

			Rigid
Compression Side Plate Stress:	3.9	ksi	TIA G
Allowable Plate Stress:	32.4	ksi	φ*Fy
Compression Plate Stress Ratio:	12.0%	**Pass**	Comp. Y.L. Length:
No Prying			15.29
Tension Side Stress Ratio, (treq/t)^2:	3.6%	**Pass**	

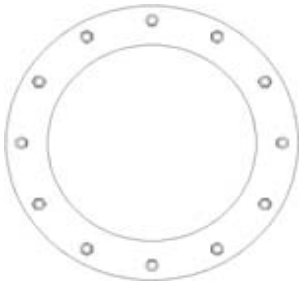
n/a

Stiffener Results

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

Pole Results

Pole Punching Shear Check: n/a



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

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

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

Site Data

BU#: *878782*
Site Name: *Portland Warren Ave, ME*
App #: *321952 Revision # 13*

Manufacturer:	Other

Reactions		
Moment:	1179.2	ft-kips
Axial:	64.391	kips
Shear:	39.494	kips
Exterior Flange Run, T+q:	20.37	kips

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

Elevation: 20 feet

Bolt Data			
Qty:	52		
Diam:	1	Bolt Fu:	120
Bolt Material:	A325	Bolt Fy:	92
N/A:		<-- Disregard	
N/A:		<-- Disregard	
Circle:	50.375	in	

Plate Data		
Plate Outer Diam:	52.75	in
Plate Inner Diam:	48.25	in (Hole @ Ctr)
Thick:	2.5	in
Grade:	36	ksi
Effective Width:	3.19	in

Stiffener Data (Welding at Both Sides)		
Config:	0	*
Weld Type:		
Groove Depth:		in **
Groove Angle:		degrees
Fillet H. Weld:		<-- Disregard
Fillet V. Weld:		in
Width:		in
Height:		in
Thick:		in
Notch:		in
Grade:		ksi
Weld str.:		ksi

Pole Data		
Pole OuterDiam:	54	in
Thick:	0.625	in
Pole Inner Diam:	52.75	in
Grade:	36	ksi
# of Sides:	0	"0" IF Round
Fu	58	ksi

Interior Flange Bolt Results

Maximum Bolt Tension, Tu:	20.4	Kips, Ext. Flange Tu+q
Adjusted φ*Tn (due to Vu=Vu/Qty),	54.5	Kips
Bolt Stress Ratio:	37.4%	**Pass**

Interior Flange Plate Results Flexural Check

Controlling Bolt Axial Force:	22.8	Kips, Ext. Cu=Interior Cu
Plate Stress:	5.4	ksi
Allowable Plate Stress, φ*Fy:	32.4	ksi
Plate Stress Ratio:	16.8%	**Pass**

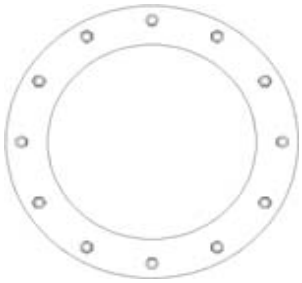
n/a

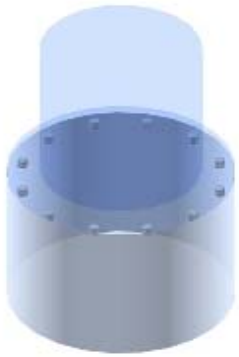
Stiffener Results

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

Pole Results

Pole Punching Shear Check: n/a





* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt
** Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

Anchor Rod Information for TIA/EIA-222-F and TIA-222-G-2

Site Information	
ID:	878782
Name:	PORTLAND WARREN AVE
App. #:	321952 Revision # 13

AeroSolutions LLC
Optimizing Your Tower Infrastructure

Base Reactions		
Moment:	5033	ft-kip
Axial:	76	kip
Shear:	41	kip
Base Plate Type:	Circular	

Design Information	
TIA Code:	G
ASIF:	1.000
Failure:	105%
eta Factor:	0.50

Original Anchor Rod Data

Quantity:	28	
Diameter:	2.00	in
Material:	A36	
Bolt Circle:	60.1	in
Bolt Spacing:		in
Bolt Group Area:	87.96	in^2
Bolt Group MOIx:	39749	in^4

Reactions Seen by Original AR Group

Moment:	4020.0	kip-ft
Axial:	75.7	kip
Shear:	40.9	kip

Original AR Capacity Check

Combined Load:	120.2	kip
Allowable load:	115.9	kip
AR Capacity:	103.7%	Pass

First Added Anchor Rod Data

Quantity:	4	
Diameter:	2.25	in
Material:	F1554 GR 105	
Bolt Circle:	71.0	in
Bolt Group Area:	15.90	in^2
Bolt Group MOIx:	10022	in^4

Reactions Seen by First Added AR Group

Moment:	1013.5	kip-ft
Axial:	0.0	kip
Shear:	0.0	kip

First Added AR Capacity Check

Combined Load:	170.2	kip
Allowable load:	324.8	kip
AR Capacity:	52.4%	Pass

Second Added Anchor Rod Data

Quantity:		
Diameter:		in
Material:		
Bolt Circle:		in
Bolt Group Area:	0.00	in^2
Bolt Group MOIx:	0	in^4

Reactions Seen by Second Added AR Group

Moment:	0.0	kip-ft
Axial:	0.0	kip
Shear:	0.0	kip

Second Added AR Capacity Check

Combined Load:	0.0	kip
Allowable load:	0.0	kip
AR Capacity:	0.0%	

Third Added Anchor Rod Data

Quantity:		
Diameter:		in
Material:		
Bolt Circle:		in
Bolt Group Area:	0.00	in^2
Bolt Group MOIx:	0	in^4

Reactions Seen by Second Added AR Group

Moment:	0.0	kip-ft
Axial:	0.0	kip
Shear:	0.0	kip

Second Added AR Capacity Check

Combined Load:	0.0	kip
Allowable load:	0.0	kip
AR Capacity:	0.0%	

Rev.4.1

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

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

Site Data

BU#:	*878782*
Site Name:	*PORTLAND WARREN AV*
App #:	*321952 Revision # 13*
Pole Manufacturer:	*Other*

Reactions		
Mu:	4019.9554	ft-kips
Axial, Pu:	75.7457	kips
Shear, Vu:	40.897139	kips
Eta Factor, η	0.5	TIA G (Fig. 4-4)

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

Anchor Rod Data		
Qty:	28	
Diam:	2	in
Rod Material:	Other	
Strength (Fu):	58	ksi
Yield (Fy):	36	ksi
Bolt Circle:	60.125	in

Anchor Rod Results

Max Rod (Cu+ Vu/ή):	120.2	Kips
Allowable Axial, Φ*Fu*Anet:	116.0	Kips
Anchor Rod Stress Ratio:	103.7%	**Pass**

Plate Data		
Diam:	66	in
Thick:	3.25	in
Grade:	36	ksi
Single-Rod B-eff:	6.06	in

Base Plate Results Flexural Check

Base Plate Stress:	14.0	ksi
Allowable Plate Stress:	32.4	ksi
Base Plate Stress Ratio:	43.1%	**Pass**

Stiffener Data (Welding at both sides)		
Config:	0	*
Weld Type:		
Groove Depth:		in **
Groove Angle:		degrees
Fillet H. Weld:		<-- Disregard
Fillet V. Weld:		in
Width:		in
Height:		in
Thick:		in
Notch:		in
Grade:		ksi
Weld str.:		ksi

n/a

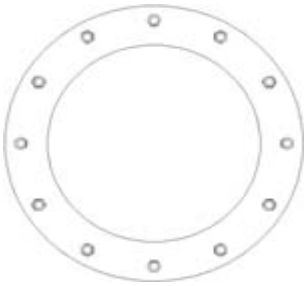
Stiffener Results

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

Pole Results

Pole Punching Shear Check:	n/a

Pole Data		
Diam:	54	in
Thick:	0.625	in
Grade:	36	ksi
# of Sides:	0	"0" IF Round
Fu	58	ksi
Reinf. Fillet Weld	0	"0" if None



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

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

Proj. Number	86959.008.01
Proj. Name	PORTLAND WARREN AVE, ME
Code	Rev. G

Proposed Anchor Rods

Diameter	2.25	in
Grade	F1554-105	
Quantity	4	
Bolt Circle	71	in
AR Capacity	325	kips

Existing Anchor Rods

Diameter	2	in
Quantity	28	
Bolt Circle	60.125	in

Summary Output

- Anchor Rod Checks

Specified Embedment Depth:	AR is too large for existing pad thickness	ft
Min. Pull Test Value:	190	kips
6 inch Tape Length	No Good	

- Anchor Rod Bracket Checks

Tube Stress:	99.6%
Bracket Plate Check:	OK
Max. Weld Stress:	72.0%

Tower Properties

Fy_{pole} =	36	ksi
Fu_{pole} =	58	ksi
Fy_{base} =	36	ksi
Fu_{base} =	58	ksi

Foundation Properties

Type	Pad	
Pad Thickness	5	ft
f'_c	4000	psi
Clear Cover	3	inch
Pad Width	12	ft
	10	
	18	
	3	
	60	
Seismic controlled?	☐	

Anchor Rod Bracket Properties

Gusset Properties

Thickness	1.25	inch
Pole to Tube CL	8.5	inch
Height	36	inch
Width at Tube	6	inch
Fy_{plate} =	65	ksi
Fu_{plate} =	80	ksi
Gap =	0	inch
Notch =	0.75	inch

Pipe /Tube Properties

Size	HSS5x5x1/2	
L_{pipe} =	33	inch
F_{ypipe} =	46	ksi
D_{pipe} =	5	inch
t_{pipe} =	0.5	inch
A_{pipe} =	7.88	$inch^2$
I_{pipe} =	26	$inch^4$
r_{pipe} =	1.82	inch

Weld Properties

F_{EXX} =	70	ksi	Weld Material Grade
- Bracket to Tube Weld			
D_{vpipe} =	6		Vertical fillet weld size *in sixteenths*
$l_{vweldpipe}$ =	33	inch	Length of Vertical Weld to Pipe
- Bracket to Pole Weld			
D_{vpole} =	6		Vertical fillet weld size *in sixteenths*
H =	36	inch	Height of vertical weld from base plate
- Base Plate Welds			
D_{Hbp} =	0.5625	inch	Gusset Bevel Size
D_{Hp} =	8		Pipe to Baseplate weld in sixteenths

Additional Variables

C_1 =	1.00		Electrode Strength Coefficient
k_{rt} =	0		Transverse Reinforcement Index :
ψ_t =	1		Rebar Location Factor :
ψ_e =	1		Rebar Coatig Factor :
ψ_s =	1		Rebar Size Factor :
λ =	1	vpsi	Concrete Weight Factor :
S_b =	1325	psi	Epoxy Bond Strength:

PROJECT **86959.008.01 - Portland Warren Ave, ME**
SUBJECT **Foundation Analysis**
DATE **05/21/16** PAGE 1 OF 1

B+T GRP
1717 S. Boulder, Suite 300
Tulsa, OK 74119
(918) 587-4630

Weight of Concrete

Wc= γ*w1*w2*D

= .15*12*12*5

= 108 kips

MOI of Anchor Group

I/A= Σn*d^2

= [2*14*5.6'^2+2*2*(4.7'^2+3.9'^2+3.0'^2+2.15'^2+1.3'^2+0.43'^2)]*144

= 156854.82 in^4/in^2

Effective Moment at Anchors

Me= M+V*D

= 5033 + 41 * 5

= 5238 k-ft

Max Comp. in Anchor

Cu= (P+ϕWc)/N+ Me*c/(I/A)

= (71k+1*108k)/52 + (5148*12)k-in * (7.95*12)in / (156854in^4/in^2)

= 41.8 kips

Max Tension in Anchor

Tu= (-P+ϕWc)/N+ Me*c/(I/A)

= (-71k+.9*108k)/52 + (5148*12)k-in * (7.95*12)in / (156854in^4/in^2)

= 38.6 kips

Axial Capacity of Anchor

ϕPn= ϕFy*Ay

= 0.9*60ksi*1.0in^2

= 54.0 kips

% Capacity

= 77.3%

Rock to Grout Bond

P_{RG}= ϕ*SA*Fb

= 0.5*2.5in*π * (45ksi*8ft*12)

= 169.6 kips

Ultimate Bond Stength
450 psi

% Capacity

= 22.8%

Factored Loads

M	5033	k-ft
P	76	k
V	41	k

Block

W1	12	ft
W2	12	ft
D	5	ft

Anchor

Size	1.128	
Qty	14	per face
Spacing	10.77	in
Grade	60	ksi
Hole Size	2.5	in

Steel to Grout Bond

P_{RG}= ϕ*SA*Fb

= 0.5*1.125in*π * (.32ksi*8ft*12)

= 54.4 kips

Steel-to-Grout Bond

4.2*sqrt(f'c)

- f'c of SikaGrout 212 >= 5800psi

= 320psi

% Capacity

= 99.2%

Rock Group Forces

Moment Resistance from Concrete Weigth

ϕMc= 0.9 * 108k * 2.8284ft

= 274.9 k-ft (Diagonal)

ϕMc= 0.9 * 108k * 6ft

= 583.2 k-ft (Orthogonal)

Group Uplift Force

Diagonal

Ugd= 560.8 kips

Orthogonal

Ugo= 455.5 kips

Rock Group Weight

ϕRw= ϕ*Vol*γ_{rock}

= 0.75 * 581.6 ft′ *

= 69.8 kips

γ_{rock}

0.16kcf

Rock Shear Strength

ϕRs= ϕ*SA*v_{rock}*cos(30)

= 576.8 kips

ϕ 0.75

SA 222 ft^2

v_{rock} 4 ksf

% Capacity

= 86.7%

Soil Bearing

σ= P/A+M/S

= 76 / 12^2 + 5033 / 203.6

= 25.2 ksf

q_{all} 30 ksf

S=(12^3/6/sqrt(2))

= 203.6 ft^3

% Capacity

= 84.1%