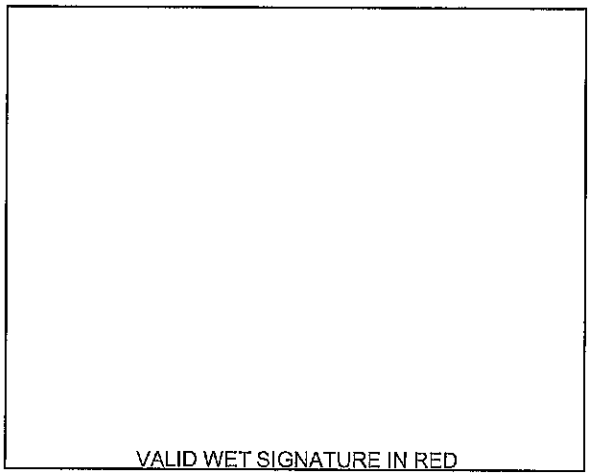
STRUCTURAL CALCULATIONS
for
WATERTOWN
at
655 BASSETT ROAD
WATERTOWN, CT 06795
for
LARSON CAMOUFLAGE (611200)



BY: **ROGER T. ALWORTH, S.E.**
PRINCIPAL

PROJECT #: **U1223-226-121**

DATE: **July 24, 2012**

NOTE: **The calculations presented in this package are intended for a single use at the location indicated above, for the client listed above. These calculations shall not be reproduced, reused, "card filed", sold to a third party, or altered in any way without the written authorization of Vector Structural Engineers, PC.**

VECTOR ENGINEERS

JOB NO.: U1223-226-121 **DESIGNED:** LCC
DATE: 07/24/12 **CHECKED:** JSP

SHEET **OF**

PROJECT: WATERTOWN

Design Criteria:

Code: Structural design is based on the California Building Code, 2010 Edition (2009 IBC)

Wind: Basic wind speed = 100 mph (3-second gust) per the TIA-222-G standard

Wind importance factor, I = 1
Structure class: II
Wind exposure: C
Topographic category: 1
Crest height: 0 ft

Ice: 1" radial ice @ 40 mph basic wind speed (3-second gust) per the TIA-222-G standard

Seismic: Seismic loads are based on the California Building Code, 2010 Edition (2009 IBC) and the TIA-222-G standard
Seismic importance factor, I = 1
Structure Class: II
Mapped spectral response accelerations: S_S = 0.250442g S_1 = 0.064682g
Site class: D
Spectral response coefficients: S_{DS} = 0.267g S_{D1} = 0.103g
Seismic design category: D
Basic seismic-force-resisting-system: Telecommunication Tower: Steel Pole
Seismic base shear, V = 2.7 k
Seismic response coefficient, Cs = 0.09
Response modification factor, R = 1.5
Analysis procedure: Equivalent lateral force

General Notes:

1 The contractor shall verify dimensions, conditions and elevations before starting work. The engineer shall be notified immediately if any discrepancies are found.
2 The typical notes and details shall apply in all cases unless specifically detailed elsewhere. Where no detail is shown, the construction shall be as shown for other similar work and as required by the building code.
3 These calculations are limited to the structural members shown in these calculations only. The connection of the members shown in these calculations to the existing structure shall be by others.
4 The contractor shall be responsible for compliance with local construction safety orders. Approval of shop drawings by the architect or structural engineer shall not be construed as accepting this responsibility.
5 All structural framing members shall be adequately shored and braced during erection and until full lateral and vertical support is provided by adjoining members.

VECTOR ENGINEERS

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Structural Steel:

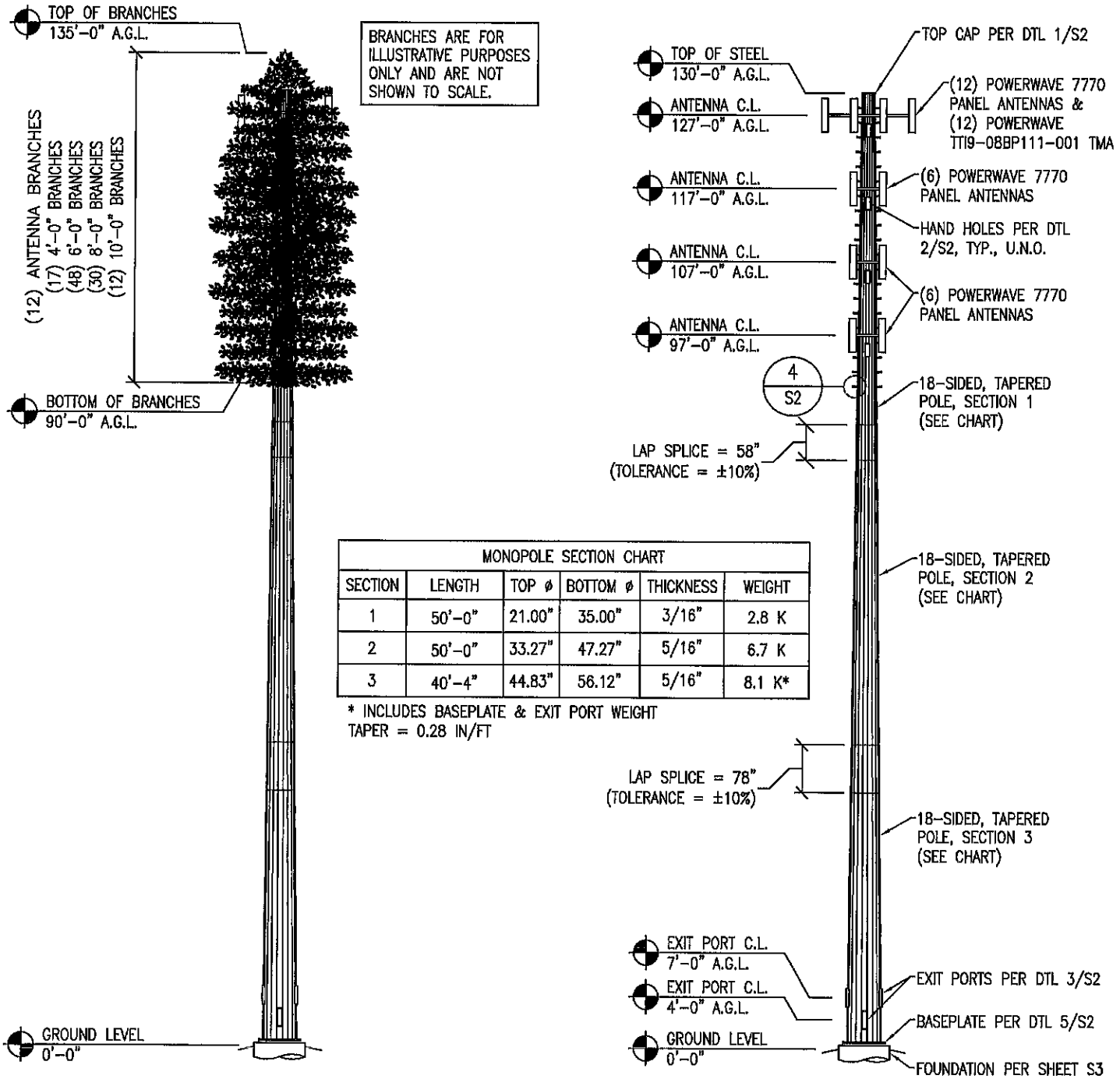
1 All structural steel code checks based on the AISC-LRFD, 3rd Edition per the TIA-222-G standard
2 All 18-sided, tapered shaft steel to be per ASTM A572 GR. 65, U.N.O.
3 The design length of slip splices is equal to 1.67 times the inside width of the base of the upper section. Slip splice length tolerance is equal to ± 10% of the design slip splice length.
4 All other structural steel shapes & plates shall be per ASTM A36, U.N.O.
5 All anchor bolts shall be per ASTM A615 GR. 75, U.N.O.
6 All bolts for steel-to-steel connections shall be per ASTM A325N, U.N.O.
7 All bolted connections shall be tightened to "snug tight" condition as defined by AISC
8 All welding shall be performed by certified welders in accordance with the latest edition of the American Welding Society (AWS) D1.1
9 All steel surfaces shall be galvanized in accordance with the ASTM A123 and ASTM A153 standards, U.N.O.

Foundation / Concrete:

1 All concrete mixing, placement, forming, and reinforcing installation shall be performed in accordance with the requirements of "Building Code Requirements for Reinforced Concrete", ACI 318-08. Foundation installation shall be in accordance with the requirements of "Standard Specifications for the Construction of Drilled Piers", ACI 336, latest edition
2 All concrete shall have a minimum compressive strength of 4000 psi at 28 days.
3 Cement for all concrete shall be Type I or II with a minimum of 6% entrained air. Maximum aggregate size shall be ¾".
4 Reinforcing steel shall be per ASTM A615 Gr. 60, U.N.O.
5 Foundation design is based upon the project soils report prepared by:

Geotech: Berkshire Geo-Technologies
Date: 16-Jul-12

6 Approximate concrete volume for mat foundation = 55.4 cubic yards



MONOPOLE SECTION CHART					
SECTION	LENGTH	TOP ø	BOTTOM ø	THICKNESS	WEIGHT
1	50'-0"	21.00"	35.00"	3/16"	2.8 K
2	50'-0"	33.27"	47.27"	5/16"	6.7 K
3	40'-4"	44.83"	56.12"	5/16"	8.1 K*

* INCLUDES BASEPLATE & EXIT PORT WEIGHT
TAPER = 0.28 IN/FT

VECTOR ENGINEERS

JOB NO.: U1223-226-121 **DESIGNED:** LCC
DATE: 07/24/12 **CHECKED:** JSP

SHEET **OF**

PROJECT: WATERTOWN

Monopine Branch Layout

Eff. Area Factor:	0.84	
Top Crown Radius:	5	ft
C_A Factor:	0.6	
Bott. Branch Elev. (ft):	90.0	ft
Top Branch Elev. (ft):	130.0	ft

Branch Layout Along Pole:

Branch Length (ft)	Qty	Elevation		Branch Wt. (lbs)	Total Wt. (lbs)	Wind Area		
		Start (ft)	Stop (ft)			Gross (ft^2)	Eff. (ft^2)	C_AA_E (ft^2)
4	26	121.0	130.0	26.0	676	88.4	74.2	44.5
6	24	112.8	121.0	40.0	960	115.5	97.0	58.2
6	24	104.5	112.8	40.0	960	116.3	97.7	58.6
8	15	99.3	104.5	50.0	750	93.7	78.7	47.2
8	15	94.1	99.3	50.0	750	94.0	78.9	47.4
10	12	90.0	94.1	66.0	792	91.9	77.2	46.3
				Total (lbs):	4888			

Top Crown:

Branch Length (ft)	Qty	Total Wt.	Total Wt.
4	3	78	
6	1	40	
			118

Gross Area (ft2):	39.3
Eff. Area (ft2):	33.0
C_AA_E (ft^2):	19.8

Random Branch Distribution:

Total C_AA_E (ft^2):	302.2
C_AA_E per ft (ft^2/ft):	7.56
Wt. per ft (lbs/ft):	122.2

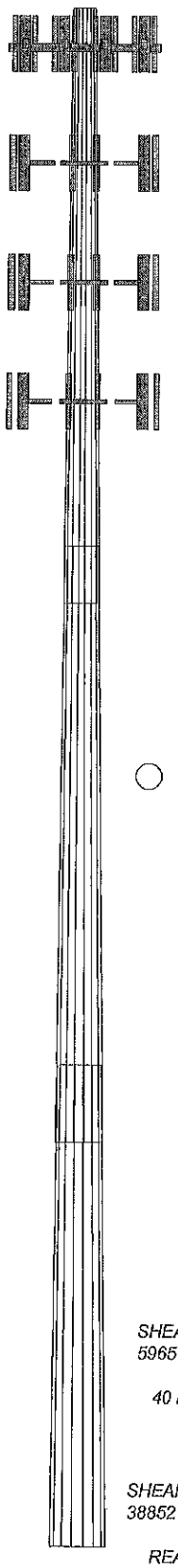
Section	1	2	3
Length (ft)	50.00	50.00	40.33
Number of Sides	18	18	18
Thickness (in)	0.1875	0.3125	0.3125
Socket Length (ft)	4.83	6.50	
Top Dia (in)	21.0000	33.2726	44.8276
Bot Dia (in)	35.0000	47.2726	56.1200
Grade	A572-65		
Weight (lb)	2816.1	6743.6	6827.9

130.0 ft

80.0 ft

34.8 ft

1.0 ft



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Top Hat with (3) 4 ft, and (1) 6 ft branches	132.5	(2) Powerwave 7770.00 w/ Mount Pipe	117
(4) Powerwave 7770.00 w/ Mount Pipe	127	(24) 6 ft branches	116.9
(4) Powerwave 7770.00 w/ Mount Pipe	127	(24) 6 ft branches	108.6
12'-0" T-Arm	127	4'-0" T-Arm	107
12'-0" T-Arm	127	4'-0" T-Arm	107
12'-0" T-Arm	127	4'-0" T-Arm	107
(4) Powerwave TT19-08BP111-001 TMA	127	(2) Powerwave 7770.00 w/ Mount Pipe	107
(4) Powerwave TT19-08BP111-001 TMA	127	(2) Powerwave 7770.00 w/ Mount Pipe	107
(4) Powerwave TT19-08BP111-001 TMA	127	(2) Powerwave 7770.00 w/ Mount Pipe	107
(4) Powerwave 7770.00 w/ Mount Pipe	127	(15) 8 ft branches	101.9
(26) 4 ft branches	126.5	4'-0" T-Arm	97
(2) Powerwave 7770.00 w/ Mount Pipe	117	4'-0" T-Arm	97
4'-0" T-Arm	117	(2) Powerwave 7770.00 w/ Mount Pipe	97
4'-0" T-Arm	117	(2) Powerwave 7770.00 w/ Mount Pipe	97
4'-0" T-Arm	117	(2) Powerwave 7770.00 w/ Mount Pipe	97
(2) Powerwave 7770.00 w/ Mount Pipe	117	4'-0" T-Arm	97
		(15) 8 ft branches	96.7
		(12) 10 ft branches	92.1

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A572-65	65 ksi	80 ksi			

TOWER DESIGN NOTES

1. Tower is located in Litchfield County, Connecticut.
2. Tower designed for Exposure C to the TIA-222-G Standard.
3. Tower designed for a 100 mph basic wind in accordance with the TIA-222-G Standard.
4. Tower is also designed for a 40 mph basic wind with 1.00 in ice. Ice is considered to increase in thickness with height.
5. Deflections are based upon a 60 mph wind.
6. Tower Structure Class II.
7. Topographic Category 1 with Crest Height of 0.00 ft
8. TOWER RATING: 99.4%

ALL REACTIONS ARE FACTORED

AXIAL 63626 lb

SHEAR 5965 lb *MOMENT 561376 lb-ft*

40 mph WIND - 1.0000 in ICE

AXIAL 35283 lb

SHEAR 38852 lb *MOMENT 3734952 lb-ft*

REACTIONS - 100 mph WIND

Vector Structural Engineers
9138 S. State St., Suite 101
Sandy, UT
Phone: 801-990-1175
FAX: 801-990-1176

Job:			
Project:			
Client:		Drawn by: Lindsey Cahoon	App'd:
Code: TIA-222-G		Date: 07/24/12	Scale: NTS
Path: N:\2012 Projects\U1223 Larson Camouflage\U1223-226-121 811200 Watertown\ENG\TOWER\Watertown.eri			Dwg No. E-1

Tower Input Data

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

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

Options

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

Tapered Pole Section Geometry

Section	Elevation	Section Length	Splice Length	Number of Sides	Top Diameter	Bottom Diameter	Wall Thickness	Bend Radius	Pole Grade
	ft	ft	ft		in	in	in	in	
L1	130.00-80.00	50.00	4.83	18	21.0000	35.0000	0.1875	0.7500	A572-65 (65 ksi)
L2	80.00-34.83	50.00	6.50	18	33.2726	47.2726	0.3125	1.2500	A572-65 (65 ksi)
L3	34.83-1.00	40.33		18	44.8276	56.1200	0.3125	1.2500	A572-65

Section	Elevation	Section Length	Splice Length	Number of Sides	Top Diameter	Bottom Diameter	Wall Thickness	Bend Radius	Pole Grade
	ft	ft	ft		in	in	in	in	
									(65 ksi)

Tapered Pole Properties

Section	Tip Dia.	Area	I	r	C	I/C	J	I/Q	w	w/t
	in	in²	in⁴	in	in	in³	in⁴	in²	in	
L1	21.3240	12.3860	677.8263	7.3884	10.6680	63.5383	1356.5444	6.1942	3.3660	17.952
	35.5399	20.7178	3172.1322	12.3584	17.7800	178.4101	6348.4384	10.3609	5.8300	31.093
L2	35.1591	32.6923	4487.0402	11.7008	16.9025	265.4664	8979.9845	16.3493	5.3060	16.979
	48.0019	46.5785	12977.2130	16.6708	24.0145	540.3912	25971.5018	23.2937	7.7700	24.864
L3	47.3672	44.1534	11053.9235	15.8029	22.7724	485.4084	22122.3920	22.0809	7.3397	23.487
	56.9857	55.3541	21780.7133	19.8117	28.5090	763.9954	43590.0862	27.6823	9.3271	29.847

Tower Elevation	Gusset Area (per face)	Gusset Thickness	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_s	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals	Double Angle Stitch Bolt Spacing Horizontals
	ft²	in					in	in
L1				1	1	1		
130.00-80.00								
L2 80.00-34.83				1	1	1		
L3 34.83-1.00				1	1	1		

Monopole Base Plate Data

Base Plate Data	
Base plate is square	
Base plate is grouted	
Anchor bolt grade	A615-75
Anchor bolt size	2.2500 in
Number of bolts	14
Embedment length	72.0000 in
f'_c	6 ksi
Grout space	3.0000 in
Base plate grade	A572-50
Base plate thickness	2.5000 in
Bolt circle diameter	63.5000 in
Outer diameter	69.5000 in
Inner diameter	50.0000 in
Base plate type	Plain Plate

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement	Total Number		C_AA_A	Weight
				ft			ft²/ft	plf
AVA7-50 (1-5/8 LOW DENSI. FOAM)	C	No	Inside Pole	127.00 - 1.00	24	No Ice	0.00	0.72
						1/2" Ice	0.00	0.72
						1" Ice	0.00	0.72

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft²/ft	Weight plf
AVA7-50 (1-5/8 LOW DENSI. FOAM)	C	No	Inside Pole	117.00 - 1.00	12	No Ice	0.00	0.72
						1/2" Ice	0.00	0.72
						1" Ice	0.00	0.72
AVA7-50 (1-5/8 LOW DENSI. FOAM)	C	No	Inside Pole	107.00 - 1.00	12	No Ice	0.00	0.72
						1/2" Ice	0.00	0.72
						1" Ice	0.00	0.72
AVA7-50 (1-5/8 LOW DENSI. FOAM)	C	No	Inside Pole	97.00 - 1.00	12	No Ice	0.00	0.72
						1/2" Ice	0.00	0.72
						1" Ice	0.00	0.72

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft²	A_F ft²	C_AA_A In Face ft²	C_AA_A Out Face ft²	Weight lb
L1	130.00-80.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	1512.00
L2	80.00-34.83	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	1951.34
L3	34.83-1.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	1461.46

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft²	A_F ft²	C_AA_A In Face ft²	C_AA_A Out Face ft²	Weight lb
L1	130.00-80.00	A	2.242	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	1512.00
L2	80.00-34.83	A	2.111	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	1951.34
L3	34.83-1.00	A	1.881	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	1461.46

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice

User Defined Loads

Description	Elevation ft	Offset From Centroid ft	Azimuth Angle °		Weight lb	F_a lb	F_s lb	Wind Force lb	C_AA_C ft²
(12) 10 ft branches	92.10	0.00	0.0000	No Ice	792.00	0.00	0.00	1540.69	46.30
				Ice	871.20	0.00	0.00	271.53	51.00
				Service	792.00	0.00	0.00	496.27	46.30
(15) 8 ft branches	96.70	0.00	0.0000	No Ice	750.00	0.00	0.00	1593.56	47.40
				Ice	825.00	0.00	0.00	280.25	52.10
				Service	750.00	0.00	0.00	513.30	47.40
(15) 8 ft branches	101.90	0.00	0.0000	No Ice	750.00	0.00	0.00	1604.43	47.20
				Ice	825.00	0.00	0.00	282.27	51.90
				Service	750.00	0.00	0.00	516.80	47.20
(24) 6 ft branches	108.60	0.00	0.0000	No Ice	960.00	0.00	0.00	2018.83	58.60
				Ice	1056.00	0.00	0.00	355.53	64.50
				Service	960.00	0.00	0.00	650.28	58.60
(24) 6 ft branches	116.90	0.00	0.0000	No Ice	960.00	0.00	0.00	2036.38	58.20
				Ice	1056.00	0.00	0.00	358.29	64.00
				Service	960.00	0.00	0.00	655.93	58.20
(26) 4 ft branches	125.50	0.00	0.0000	No Ice	676.00	0.00	0.00	1580.47	44.50
				Ice	743.60	0.00	0.00	278.45	49.00
				Service	676.00	0.00	0.00	509.08	44.50
Top Hat with (3) 4 ft, and (1) 6 ft branches	132.50	0.00	0.0000	No Ice	118.00	0.00	0.00	711.30	19.80
				Ice	129.80	0.00	0.00	125.30	21.80
				Service	118.00	0.00	0.00	229.11	19.80

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft	Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft²	C_AA_A Side ft²	Weight lb
(4) Powerwave 7770.00 w/ Mount Pipe	A	From Face	3.00	0.00	0.0000	127.00	No Ice	6.25	4.38	60.90
			0.00				1/2" Ice	6.80	5.23	107.22
			0.00				1" Ice	7.33	5.95	163.48
(4) Powerwave 7770.00 w/ Mount Pipe	B	From Face	3.00	0.00	0.0000	127.00	No Ice	6.25	4.38	60.90
			0.00				1/2" Ice	6.80	5.23	107.22
			0.00				1" Ice	7.33	5.95	163.48
(4) Powerwave 7770.00 w/ Mount Pipe	C	From Face	3.00	0.00	0.0000	127.00	No Ice	6.25	4.38	60.90
			0.00				1/2" Ice	6.80	5.23	107.22
			0.00				1" Ice	7.33	5.95	163.48
12'-0" T-Arm	A	From Face	3.00	0.00	0.0000	127.00	No Ice	4.20	4.20	220.00
			0.00				1/2" Ice	5.44	5.44	249.84
			0.00				1" Ice	6.69	6.69	287.51
12'-0" T-Arm	B	From Face	3.00	0.00	0.0000	127.00	No Ice	4.20	4.20	220.00
			0.00				1/2" Ice	5.44	5.44	249.84
			0.00				1" Ice	6.69	6.69	287.51
12'-0" T-Arm	C	From Face	3.00	0.00	0.0000	127.00	No Ice	4.20	4.20	220.00
			0.00				1/2" Ice	5.44	5.44	249.84
			0.00				1" Ice	6.69	6.69	287.51
(4) Powerwave TT19-08BP111-001 TMA	A	From Face	3.00	0.00	0.0000	127.00	No Ice	0.64	0.52	16.00
			0.00				1/2" Ice	0.76	0.62	21.80
			0.00				1" Ice	0.88	0.74	29.22
(4) Powerwave TT19-08BP111-001 TMA	B	From Face	3.00	0.00	0.0000	127.00	No Ice	0.64	0.52	16.00
			0.00				1/2" Ice	0.76	0.62	21.80
			0.00				1" Ice	0.88	0.74	29.22

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 lb
(4) Powerwave TT19-08BP111-001 TMA	C	From Face	3.00	0.0000	127.00	No Ice	0.64	0.52	16.00
			0.00			1/2" Ice	0.76	0.62	21.80
			0.00			1" Ice	0.88	0.74	29.22
(2) Powerwave 7770.00 w/ Mount Pipe	A	From Face	3.00	0.0000	117.00	No Ice	6.25	4.38	60.90
			0.00			1/2" Ice	6.80	5.23	107.22
			0.00			1" Ice	7.33	5.95	163.48
(2) Powerwave 7770.00 w/ Mount Pipe	B	From Face	3.00	0.0000	117.00	No Ice	6.25	4.38	60.90
			0.00			1/2" Ice	6.80	5.23	107.22
			0.00			1" Ice	7.33	5.95	163.48
(2) Powerwave 7770.00 w/ Mount Pipe	C	From Face	3.00	0.0000	117.00	No Ice	6.25	4.38	60.90
			0.00			1/2" Ice	6.80	5.23	107.22
			0.00			1" Ice	7.33	5.95	163.48
4'-0" T-Arm	A	From Face	3.00	0.0000	117.00	No Ice	0.93	0.93	45.00
			0.00			1/2" Ice	1.23	1.23	114.75
			0.00			1" Ice	1.53	1.53	189.72
4'-0" T-Arm	B	From Face	3.00	0.0000	117.00	No Ice	0.93	0.93	45.00
			0.00			1/2" Ice	1.23	1.23	114.75
			0.00			1" Ice	1.53	1.53	189.72
4'-0" T-Arm	C	From Face	3.00	0.0000	117.00	No Ice	0.93	0.93	45.00
			0.00			1/2" Ice	1.23	1.23	114.75
			0.00			1" Ice	1.53	1.53	189.72
(2) Powerwave 7770.00 w/ Mount Pipe	A	From Face	3.00	0.0000	107.00	No Ice	6.25	4.38	60.90
			0.00			1/2" Ice	6.80	5.23	107.22
			0.00			1" Ice	7.33	5.95	163.48
(2) Powerwave 7770.00 w/ Mount Pipe	B	From Face	3.00	0.0000	107.00	No Ice	6.25	4.38	60.90
			0.00			1/2" Ice	6.80	5.23	107.22
			0.00			1" Ice	7.33	5.95	163.48
(2) Powerwave 7770.00 w/ Mount Pipe	C	From Face	3.00	0.0000	107.00	No Ice	6.25	4.38	60.90
			0.00			1/2" Ice	6.80	5.23	107.22
			0.00			1" Ice	7.33	5.95	163.48
4'-0" T-Arm	A	From Face	3.00	0.0000	107.00	No Ice	0.93	0.93	45.00
			0.00			1/2" Ice	1.23	1.23	114.75
			0.00			1" Ice	1.53	1.53	189.72
4'-0" T-Arm	B	From Face	3.00	0.0000	107.00	No Ice	0.93	0.93	45.00
			0.00			1/2" Ice	1.23	1.23	114.75
			0.00			1" Ice	1.53	1.53	189.72
4'-0" T-Arm	C	From Face	3.00	0.0000	107.00	No Ice	0.93	0.93	45.00
			0.00			1/2" Ice	1.23	1.23	114.75
			0.00			1" Ice	1.53	1.53	189.72
(2) Powerwave 7770.00 w/ Mount Pipe	A	From Face	3.00	0.0000	97.00	No Ice	6.25	4.38	60.90
			0.00			1/2" Ice	6.80	5.23	107.22
			0.00			1" Ice	7.33	5.95	163.48
(2) Powerwave 7770.00 w/ Mount Pipe	B	From Face	3.00	0.0000	97.00	No Ice	6.25	4.38	60.90
			0.00			1/2" Ice	6.80	5.23	107.22
			0.00			1" Ice	7.33	5.95	163.48
(2) Powerwave 7770.00 w/ Mount Pipe	C	From Face	3.00	0.0000	97.00	No Ice	6.25	4.38	60.90
			0.00			1/2" Ice	6.80	5.23	107.22
			0.00			1" Ice	7.33	5.95	163.48
4'-0" T-Arm	A	From Face	3.00	0.0000	97.00	No Ice	0.93	0.93	45.00
			0.00			1/2" Ice	1.23	1.23	114.75
			0.00			1" Ice	1.53	1.53	189.72
4'-0" T-Arm	B	From Face	3.00	0.0000	97.00	No Ice	0.93	0.93	45.00
			0.00			1/2" Ice	1.23	1.23	114.75
			0.00			1" Ice	1.53	1.53	189.72
4'-0" T-Arm	C	From Face	3.00	0.0000	97.00	No Ice	0.93	0.93	45.00
			0.00			1/2" Ice	1.23	1.23	114.75
			0.00			1" Ice	1.53	1.53	189.72

Tower Pressures - No Ice

$G_H = 1.100$

Section Elevation ft	z ft	K_z	q_z psf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1	103.23	1.274	31	118.466	A	0.000	118.466	118.466	100.00	0.000	0.000
130.00-80.00					B	0.000	118.466		100.00	0.000	0.000
					C	0.000	118.466		100.00	0.000	0.000
L2 80.00-34.83	56.73	1.123	27	156.516	A	0.000	156.516	156.516	100.00	0.000	0.000
					B	0.000	156.516		100.00	0.000	0.000
					C	0.000	156.516		100.00	0.000	0.000
L3 34.83-1.00	17.89	0.881	22	147.094	A	0.000	147.094	147.094	100.00	0.000	0.000
					B	0.000	147.094		100.00	0.000	0.000
					C	0.000	147.094		100.00	0.000	0.000

Tower Pressure - With Ice

$G_H = 1.100$

Section Elevation ft	z ft	K_z	q_z psf	t_z in	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1 130.00-80.00	103.23	1.274	5	2.2416	137.146	A	0.000	137.146	137.146	100.00	0.000	0.000
						B	0.000	137.146		100.00	0.000	0.000
						C	0.000	137.146		100.00	0.000	0.000
L2 80.00-34.83	56.73	1.123	4	2.1113	173.391	A	0.000	173.391	173.391	100.00	0.000	0.000
						B	0.000	173.391		100.00	0.000	0.000
						C	0.000	173.391		100.00	0.000	0.000
L3 34.83-1.00	17.89	0.881	4	1.8812	158.999	A	0.000	158.999	158.999	100.00	0.000	0.000
						B	0.000	158.999		100.00	0.000	0.000
						C	0.000	158.999		100.00	0.000	0.000

Tower Pressure - Service

$G_H = 1.100$

Section Elevation ft	z ft	K_z	q_z psf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1	103.23	1.274	10	118.466	A	0.000	118.466	118.466	100.00	0.000	0.000
130.00-80.00					B	0.000	118.466		100.00	0.000	0.000
					C	0.000	118.466		100.00	0.000	0.000
L2 80.00-34.83	56.73	1.123	9	156.516	A	0.000	156.516	156.516	100.00	0.000	0.000
					B	0.000	156.516		100.00	0.000	0.000

Section Elevation ft	z ft	K_z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L3 34.83-1.00	17.89	0.881	7	147.094	C	0.000	156.516		100.00	0.000	0.000
					A	0.000	147.094	147.094	100.00	0.000	0.000
					B	0.000	147.094		100.00	0.000	0.000
					C	0.000	147.094		100.00	0.000	0.000

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1	1512.00	2816.14	A	1	0.65	31	1	1	118.466	2619.89	52.40	C
130.00-80.00			B	1	0.65		1	1	118.466			
			C	1	0.65		1	1	118.466			
L2	1951.34	6743.56	A	1	0.65	27	1	1	156.516	3041.51	67.33	C
80.00-34.83			B	1	0.65		1	1	156.516			
			C	1	0.65		1	1	156.516			
L3 34.83-1.00	1461.46	6827.93	A	1	0.65	22	1	1	147.094	2302.12	68.05	C
			B	1	0.65		1	1	147.094			
			C	1	0.65		1	1	147.094			
Sum Weight:	4924.80	16387.63						OTM	476184.71 lb-ft	7963.52		

Tower Forces - No Ice - Wind 60 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1	1512.00	2816.14	A	1	0.65	31	1	1	118.466	2619.89	52.40	C
130.00-80.00			B	1	0.65		1	1	118.466			
			C	1	0.65		1	1	118.466			
L2	1951.34	6743.56	A	1	0.65	27	1	1	156.516	3041.51	67.33	C
80.00-34.83			B	1	0.65		1	1	156.516			
			C	1	0.65		1	1	156.516			
L3 34.83-1.00	1461.46	6827.93	A	1	0.65	22	1	1	147.094	2302.12	68.05	C
			B	1	0.65		1	1	147.094			
			C	1	0.65		1	1	147.094			
Sum Weight:	4924.80	16387.63						OTM	476184.71 lb-ft	7963.52		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1	1512.00	2816.14	A	1	0.65	31	1	1	118.466	2619.89	52.40	C
130.00-80.00			B	1	0.65		1	1	118.466			
			C	1	0.65		1	1	118.466			
L2	1951.34	6743.56	A	1	0.65	27	1	1	156.516	3041.51	67.33	C
80.00-34.83			B	1	0.65		1	1	156.516			
			C	1	0.65		1	1	156.516			
L3 34.83-1.00	1461.46	6827.93	A	1	0.65	22	1	1	147.094	2302.12	68.05	C
			B	1	0.65		1	1	147.094			
			C	1	0.65		1	1	147.094			
Sum Weight:	4924.80	16387.63						OTM	476184.71 lb-ft	7963.52		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1	1512.00	6999.87	A	1	1.2	5	1	1	137.146	895.90	17.92	C
130.00-80.00			B	1	1.2		1	1	137.146			
			C	1	1.2		1	1	137.146			
L2	1951.34	11812.46	A	1	1.2	4	1	1	173.391	995.28	22.03	C
80.00-34.83			B	1	1.2		1	1	173.391			
			C	1	1.2		1	1	173.391			
L3 34.83-1.00	1461.46	11012.09	A	1	1.2	4	1	1	158.999	755.04	21.73	C
			B	1	1.2		1	1	158.999			
			C	1	1.2		1	1	158.999			
Sum Weight:	4924.80	29824.43						OTM	159459.09 lb-ft	2626.23		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1	1512.00	6999.87	A	1	1.2	5	1	1	137.146	895.90	17.92	C
130.00-80.00			B	1	1.2		1	1	137.146			
			C	1	1.2		1	1	137.146			
L2	1951.34	11812.46	A	1	1.2	4	1	1	173.391	995.28	22.03	C
80.00-34.83			B	1	1.2		1	1	173.391			
			C	1	1.2		1	1	173.391			
L3 34.83-1.00	1461.46	11012.09	A	1	1.2	4	1	1	158.999	755.04	21.73	C
			B	1	1.2		1	1	158.999			
			C	1	1.2		1	1	158.999			
Sum Weight:	4924.80	29824.43						OTM	159459.09 lb-ft	2626.23		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1	1512.00	6999.87	A	1	1.2	5	1	1	137.146	895.90	17.92	C
130.00-80.00			B	1	1.2		1	1	137.146			
			C	1	1.2		1	1	137.146			
L2	1951.34	11812.46	A	1	1.2	4	1	1	173.391	995.28	22.03	C
80.00-34.83			B	1	1.2		1	1	173.391			
			C	1	1.2		1	1	173.391			
L3 34.83-1.00	1461.46	11012.09	A	1	1.2	4	1	1	158.999	735.04	21.73	C
			B	1	1.2		1	1	158.999			
			C	1	1.2		1	1	158.999			
Sum Weight:	4924.80	29824.43						OTM	159459.09 lb-ft	2626.23		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1	1512.00	2816.14	A	1	0.65	10	1	1	118.466	843.88	16.88	C
130.00-80.00			B	1	0.65		1	1	118.466			
			C	1	0.65		1	1	118.466			
L2	1951.34	6743.56	A	1	0.65	9	1	1	156.516	979.69	21.69	C
80.00-34.83			B	1	0.65		1	1	156.516			
			C	1	0.65		1	1	156.516			
L3 34.83-1.00	1461.46	6827.93	A	1	0.65	7	1	1	147.094	741.52	21.92	C
			B	1	0.65		1	1	147.094			
			C	1	0.65		1	1	147.094			
Sum Weight:	4924.80	16387.63						OTM	153381.60 lb-ft	2565.09		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1	1512.00	2816.14	A	1	0.65	10	1	1	118.466	843.88	16.88	C
130.00-80.00			B	1	0.65		1	1	118.466			
			C	1	0.65		1	1	118.466			
L2	1951.34	6743.56	A	1	0.65	9	1	1	156.516	979.69	21.69	C
80.00-34.83			B	1	0.65		1	1	156.516			
			C	1	0.65		1	1	156.516			

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L3 34.83-1.00	1461.46	6827.93	A	1	0.65	7	1	1	147.094	741.52	21.92	C
			B	1	0.65		1	1	147.094			
			C	1	0.65		1	1	147.094			
Sum Weight:	4924.80	16387.63						OTM	153381.60 lb-ft	2565.09		

Tower Forces - Service - Wind 90 To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F lb	w plf	Ctrl. Face
L1	1512.00	2816.14	A	1	0.65	10	1	1	118.466	843.88	16.88	C
130.00-80.00			B	1	0.65		1	1	118.466			
			C	1	0.65		1	1	118.466			
L2	1951.34	6743.56	A	1	0.65	9	1	1	156.516	979.69	21.69	C
80.00-34.83			B	1	0.65		1	1	156.516			
			C	1	0.65		1	1	156.516			
L3 34.83-1.00	1461.46	6827.93	A	1	0.65	7	1	1	147.094	741.52	21.92	C
			B	1	0.65		1	1	147.094			
			C	1	0.65		1	1	147.094			
Sum Weight:	4924.80	16387.63						OTM	153381.60 lb-ft	2565.09		

Force Totals

Load Case	Vertical Forces lb	Sum of Forces X lb	Sum of Forces Z lb	Sum of Overturning Moments, M_x lb-ft	Sum of Overturning Moments, M_z lb-ft	Sum of Torques lb-ft
Leg Weight	16387.63					
Bracing Weight	0.00					
Total Member Self-Weight	16387.63			0.00	0.00	
Total Weight	29402.43			0.00	0.00	
Wind 0 deg - No Ice		0.00	-24283.00	-2277142.37	0.00	0.00
Wind 90 deg - No Ice		24283.00	0.00	0.00	-2277142.37	0.00
Wind 180 deg - No Ice		0.00	24283.00	2277142.37	0.00	0.00
Member Ice	13436.80					
Total Weight Ice	56399.72			0.00	0.00	
Wind 0 deg - Ice		0.00	-5965.42	-530412.40	0.00	0.00
Wind 90 deg - Ice		5965.42	0.00	0.00	-530412.40	0.00
Wind 180 deg - Ice		0.00	5965.42	530412.40	0.00	0.00
Total Weight	29402.43			0.00	0.00	
Wind 0 deg - Service		0.00	-7821.68	-733479.54	0.00	0.00
Wind 90 deg - Service		7821.68	0.00	0.00	-733479.54	0.00
Wind 180 deg - Service		0.00	7821.68	733479.54	0.00	0.00

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 90 deg - No Ice
5	0.9 Dead+1.6 Wind 90 deg - No Ice
6	1.2 Dead+1.6 Wind 180 deg - No Ice
7	0.9 Dead+1.6 Wind 180 deg - No Ice
8	1.2 Dead+1.0 Ice+1.0 Temp
9	1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp
10	1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp
11	1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp
12	Dead+Wind 0 deg - Service
13	Dead+Wind 90 deg - Service
14	Dead+Wind 180 deg - Service

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
L1	130 - 80	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	8	-31665.90	0.00	-0.00
			Max. Mx	4	-12005.06	-800243.56	-0.00
			Max. My	6	-12005.06	0.00	-800243.56
			Max. Vy	4	30826.71	-800243.56	-0.00
			Max. Vx	6	30826.71	0.00	-800243.56
L2	80 - 34.83	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	8	-46412.09	0.00	-0.00
			Max. Mx	4	-22557.94	-2236840.25	-0.00
			Max. My	2	-22557.94	0.00	2236840.25
			Max. Vy	4	35230.36	-2236840.25	-0.00
			Max. Vx	2	-35230.36	0.00	2236840.25
L3	34.83 - 1	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	8	-63626.15	0.00	0.00
			Max. Mx	4	-35253.14	-3734951.87	0.00
			Max. My	2	-35253.14	0.00	3734951.87
			Max. Vy	4	38878.01	-3734951.87	0.00
			Max. Vx	2	-38878.01	0.00	3734951.87

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical lb	Horizontal, X lb	Horizontal, Z lb
Pole	Max. Vert	8	63626.15	0.00	0.00
	Max. H_x	14	29402.41	0.00	-7820.59
	Max. H_z	3	26462.12	0.00	38851.61

Location	Condition	Gov. Load Comb.	Vertical lb	Horizontal, X lb	Horizontal, Z lb
	Max. M_x	2	3734951.87	0.00	38851.08
	Max. M_z	4	3734951.87	-38851.08	0.00
	Max. Torsion	10	0.00	-5964.86	0.00
	Min. Vert	5	26462.12	-38851.61	0.00
	Min. H_x	5	26462.12	-38851.61	0.00
	Min. H_z	7	26462.12	0.00	-38851.61
	Min. M_x	6	-3734951.87	0.00	-38851.08
	Min. M_z	1	0.00	0.00	0.00
	Min. Torsion	1	0.00	0.00	0.00

Tower Mast Reaction Summary

Load Combination	Vertical lb	$Shear_x$ lb	$Shear_z$ lb	Overturning Moment, M_x lb-ft	Overturning Moment, M_z lb-ft	Torque lb-ft
Dead Only	29402.43	0.00	0.00	0.00	0.00	0.00
1.2 Dead+1.6 Wind 0 deg - No Ice	35282.81	0.00	-38851.08	-3734951.87	0.00	0.00
0.9 Dead+1.6 Wind 0 deg - No Ice	26462.12	0.00	-38851.61	-3710118.76	0.00	0.00
1.2 Dead+1.6 Wind 90 deg - No Ice	35282.81	38851.08	0.00	0.00	-3734951.87	0.00
0.9 Dead+1.6 Wind 90 deg - No Ice	26462.12	38851.61	0.00	0.00	-3710118.76	0.00
1.2 Dead+1.6 Wind 180 deg - No Ice	35282.81	0.00	38851.08	3734951.87	0.00	0.00
0.9 Dead+1.6 Wind 180 deg - No Ice	26462.12	0.00	38851.61	3710118.76	0.00	0.00
1.2 Dead+1.0 Ice+1.0 Temp	63626.15	0.00	0.00	0.00	0.00	0.00
1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp	63626.14	0.00	-5964.86	-561375.91	0.00	0.00
1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp	63626.14	5964.86	0.00	0.00	-561375.91	0.00
1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp	63626.14	0.00	5964.86	561375.91	0.00	0.00
Dead+Wind 0 deg - Service	29402.41	0.00	-7820.59	-749634.74	0.00	0.00
Dead+Wind 90 deg - Service	29402.41	7820.59	0.00	0.00	-749634.74	0.00
Dead+Wind 180 deg - Service	29402.41	0.00	7820.59	749634.74	0.00	0.00

Solution Summary

Load Comb.	Sum of Applied Forces PX lb	PY lb	PZ lb	Sum of Reactions PX lb	PY lb	PZ lb	% Error
1	0.00	-29402.43	0.00	0.00	29402.43	0.00	0.000%
2	0.00	-35282.91	-38852.79	0.00	35282.81	38851.08	0.003%
3	0.00	-26462.18	-38852.79	0.00	26462.12	38851.61	0.003%
4	38852.79	-35282.91	0.00	-38851.08	35282.81	0.00	0.003%
5	38852.79	-26462.18	0.00	-38851.61	26462.12	0.00	0.003%
6	0.00	-35282.91	38852.79	0.00	35282.81	-38851.08	0.003%
7	0.00	-26462.18	38852.79	0.00	26462.12	-38851.61	0.003%
8	0.00	-63626.15	0.00	0.00	63626.15	0.00	0.000%
9	0.00	-63626.15	-5965.42	0.00	63626.14	5964.86	0.001%
10	5965.42	-63626.15	0.00	-5964.86	63626.14	0.00	0.001%

Load Comb.	Sum of Applied Forces PX lb	PY lb	PZ lb	Sum of Reactions PX lb	PY lb	PZ lb	% Error
11	0.00	-63626.15	5965.42	0.00	63626.14	-5964.86	0.001%
12	0.00	-29402.43	-7821.68	0.00	29402.41	7820.59	0.004%
13	7821.68	-29402.43	0.00	-7820.59	29402.41	0.00	0.004%
14	0.00	-29402.43	7821.68	0.00	29402.41	-7820.59	0.004%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	6	0.00000001	0.00000001
2	Yes	11	0.00003711	0.00008812
3	Yes	11	0.00000001	0.00007049
4	Yes	11	0.00003711	0.00008812
5	Yes	11	0.00000001	0.00007049
6	Yes	11	0.00003711	0.00008812
7	Yes	11	0.00000001	0.00007049
8	Yes	6	0.00000001	0.00000001
9	Yes	11	0.00000001	0.00013079
10	Yes	11	0.00000001	0.00013079
11	Yes	11	0.00000001	0.00013079
12	Yes	10	0.00000001	0.00010114
13	Yes	10	0.00000001	0.00010114
14	Yes	10	0.00000001	0.00010114

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	130 - 80	18.100	12	1.2386	0.0000
L2	84.83 - 34.83	7.559	12	0.8603	0.0000
L3	41.33 - 1	1.747	12	0.3935	0.0000

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
132.50	Top Hat with (3) 4 ft, and (1) 6 ft branches	12	18.100	1.2386	0.0000	39342
127.00	(4) Powerwave 7770.00 w/ Mount Pipe	12	17.338	1.2156	0.0000	39342
125.50	(26) 4 ft branches	12	16.958	1.2041	0.0000	39342
117.00	(2) Powerwave 7770.00 w/ Mount Pipe	12	14.819	1.1382	0.0000	15131
116.90	(24) 6 ft branches	12	14.794	1.1374	0.0000	15016
108.60	(24) 6 ft branches	12	12.762	1.0711	0.0000	9191
107.00	(2) Powerwave 7770.00 w/ Mount	12	12.379	1.0581	0.0000	8552

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
	Pipe					
101.90	(15) 8 ft branches	12	11.185	1.0155	0.0000	6999
97.00	(2) Powerwave 7770.00 w/ Mount Pipe	12	10.080	0.9731	0.0000	5960
96.70	(15) 8 ft branches	12	10.014	0.9705	0.0000	5906
92.10	(12) 10 ft branches	12	9.023	0.9291	0.0000	5189

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	130 - 80	90.105	4	6.1718	0.0000
L2	84.83 - 34.83	37.658	4	4.2876	0.0000
L3	41.33 - 1	8.704	4	1.9614	0.0000

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
132.50	Top Hat with (3) 4 ft, and (1) 6 ft branches	4	90.105	6.1718	0.0000	8051
127.00	(4) Powerwave 7770.00 w/ Mount Pipe	4	86.313	6.0572	0.0000	8051
125.50	(26) 4 ft branches	4	84.420	5.9999	0.0000	8051
117.00	(2) Powerwave 7770.00 w/ Mount Pipe	4	73.782	5.6717	0.0000	3095
116.90	(24) 6 ft branches	4	73.658	5.6678	0.0000	3071
108.60	(24) 6 ft branches	4	63.547	5.3379	0.0000	1878
107.00	(2) Powerwave 7770.00 w/ Mount Pipe	4	61.644	5.2727	0.0000	1747
101.90	(15) 8 ft branches	4	55.703	5.0606	0.0000	1428
97.00	(2) Powerwave 7770.00 w/ Mount Pipe	4	50.208	4.8497	0.0000	1215
96.70	(15) 8 ft branches	4	49.873	4.8366	0.0000	1204
92.10	(12) 10 ft branches	4	44.943	4.6306	0.0000	1057

Base Plate Design Data

Plate Thickness in	Number of Anchor Bolts	Anchor Bolt Size in	Actual Allowable Ratio Bolt Tension lb	Actual Allowable Ratio Bolt Compression lb	Actual Allowable Ratio Plate Stress ksi	Actual Allowable Ratio Stiffener Stress ksi	Controlling Condition	Ratio
2.5000	14	2.2500	194088.02 223654.40	199124.18 371266.30	37.341 45.000		Bolt T	0.87

Plate Thickness	Number of Anchor Bolts	Anchor Bolt Size	Actual Allowable Ratio Bolt Tension	Actual Allowable Ratio Bolt Compression	Actual Allowable Ratio Plate Stress	Actual Allowable Ratio Stiffener Stress	Controlling Condition	Ratio
in		in	lb	lb	ksi	ksi		
			0.87	0.54	0.83			✓

Compression Checks

Pole Design Data

Section No.	Elevation	Size	L	L_u	Kl/r	A	P_u	ϕP_n	Ratio $\frac{P_u}{\phi P_n}$
	ft		ft	ft		in^2	lb	lb	
L1	130 - 127.623	TP35x21x0.1875	50.00	0.00	0.0	12.7822	-208.60	915151.00	0.000
	127.623 - 125.245					13.1783	-2417.66	934798.00	0.003
	125.245 - 122.868					13.5745	-2616.74	953921.00	0.003
	122.868 - 120.491					13.9706	-2821.17	972519.00	0.003
	120.491 - 118.113					14.3668	-3030.94	990594.00	0.003
	118.113 - 115.736					14.7630	-4482.82	1008140.00	0.004
	115.736 - 113.358					15.1591	-4708.76	1025170.00	0.005
	113.358 - 110.981					15.5553	-4941.80	1041670.00	0.005
	110.981 - 108.604					15.9514	-5181.67	1057650.00	0.005
	108.604 - 106.226					16.3476	-6698.25	1073110.00	0.006
	106.226 - 103.849					16.7437	-6961.21	1088040.00	0.006
	103.849 - 101.472					17.1399	-7882.57	1102440.00	0.007
	101.472 - 99.0942					17.5360	-8167.73	1116320.00	0.007
	99.0942 - 96.7168					17.9322	-8923.42	1129680.00	0.008
	96.7168 - 94.3395					18.3283	-9900.58	1142520.00	0.009
	94.3395 - 91.9621					18.7245	-10958.80	1154830.00	0.009
	91.9621 - 89.5847					19.1206	-11298.00	1166610.00	0.010
	89.5847 - 87.2074					19.5168	-11646.90	1177870.00	0.010
	87.2074 - 84.83					19.9129	-12005.10	1188610.00	0.010
	84.83 - 80					20.7178	-5073.83	1208810.00	0.004
L2	84.83 - 80	TP47.2726x33.2726x0.3125	50.00	0.00	0.0	34.0337	-8218.35	2466790.00	0.003
	80 - 77.8517					34.6304	-13763.50	2497620.00	0.006
	77.8517 - 75.7033					35.2270	-14229.80	2528020.00	0.006

Section No.	Elevation	Size	L	L_u	Kl/r	A	P_u	ϕP_n	Ratio $\frac{P_u}{\phi P_n}$
	ft		ft	ft		in^2	lb	lb	
	75.7033 - 73.555					35.8236	-14703.00	2557990.00	0.006
	73.555 - 71.4067					36.4203	-15182.90	2587330.00	0.006
	71.4067 - 69.2583					37.0169	-15669.50	2616640.00	0.006
	69.2583 - 67.11					37.6136	-16162.60	2645330.00	0.006
	67.11 - 64.9617					38.2102	-16662.00	2673590.00	0.006
	64.9617 - 62.8133					38.8069	-17167.80	2701420.00	0.006
	62.8133 - 60.665					39.4035	-17679.80	2728820.00	0.006
	60.665 - 58.5167					40.0002	-18198.00	2755800.00	0.007
	58.5167 - 56.3683					40.5968	-18722.30	2782340.00	0.007
	56.3683 - 54.22					41.1935	-19252.60	2808460.00	0.007
	54.22 - 52.0717					41.7901	-19788.80	2834160.00	0.007
	52.0717 - 49.9233					42.3868	-20331.00	2859420.00	0.007
	49.9233 - 47.775					42.9834	-20879.00	2884250.00	0.007
	47.775 - 45.6267					43.5800	-21432.90	2908660.00	0.007
	45.6267 - 43.4783					44.1767	-21992.50	2932640.00	0.007
	43.4783 - 41.33					44.7733	-22557.90	2956190.00	0.008
	41.33 - 34.83					46.5785	-12848.30	3024840.00	0.004
L3	41.33 - 34.83	TP56.12x44.8276x0.3125	40.33	0.00	0.0	45.9586	-12520.10	3001710.00	0.004
	34.83 - 33.0495					46.4531	-25879.70	3020200.00	0.009
	33.0495 - 31.2689					46.9476	-26368.70	3038400.00	0.009
	31.2689 - 29.4884					47.4421	-26861.50	3056300.00	0.009
	29.4884 - 27.7079					47.9366	-27358.20	3073910.00	0.009
	27.7079 - 25.9274					48.4311	-27858.50	3091220.00	0.009
	25.9274 - 24.1468					48.9256	-28362.70	3108250.00	0.009
	24.1468 - 22.3663					49.4201	-28870.60	3124970.00	0.009
	22.3663 - 20.5858					49.9146	-29382.20	3141410.00	0.009
	20.5858 - 18.8053					50.4091	-29897.50	3157540.00	0.009
	18.8053 - 17.0247					50.9036	-30416.60	3173390.00	0.010
	17.0247 - 15.2442					51.3981	-30939.30	3188940.00	0.010
	15.2442 - 13.4637					51.8926	-31465.70	3204200.00	0.010
	13.4637 - 11.6832					52.3871	-31995.80	3219160.00	0.010

Section No.	Elevation	Size	L	L_u	K/r	A	P_u	ϕP_n	Ratio $\frac{P_u}{\phi P_n}$
	ft		ft	ft		in^2	lb	lb	
	11.6832 - 9.90263					52.8816	-32529.60	3233830.00	0.010
	9.90263 - 8.1221					53.3761	-33067.00	3248210.00	0.010
	8.1221 - 6.34158					53.8706	-33608.10	3262290.00	0.010
	6.34158 - 4.56105					54.3651	-34152.80	3276070.00	0.010
	4.56105 - 2.78053					54.8596	-34701.20	3289570.00	0.011
	2.78053 - 1					55.3541	-35253.10	3302770.00	0.011

Pole Bending Design Data

Section No.	Elevation	Size	M_{ux}	ϕM_{nx}	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M_{uy}	ϕM_{ny}	Ratio $\frac{M_{uy}}{\phi M_{ny}}$
	ft		lb-ft	lb-ft		lb-ft	lb-ft	
L1	130 - 127.623	TP35x21x0.1875	5784.65	403858.33	0.014	0.00	403838.33	0.000
	127.623 - 125.245		16806.08	425403.33	0.040	0.00	425403.33	0.000
	125.245 - 122.868		36273.33	447265.00	0.081	0.00	447265.00	0.000
	122.868 - 120.491		56192.33	469400.83	0.120	0.00	469400.83	0.000
	120.491 - 118.113		76571.58	491790.00	0.156	0.00	491790.00	0.000
	118.113 - 115.736		103366.67	514410.83	0.201	0.00	514410.83	0.000
	115.736 - 113.358		136504.17	537240.83	0.254	0.00	537240.83	0.000
	113.358 - 110.981		170122.50	560259.17	0.304	0.00	560259.17	0.000
	110.981 - 108.604		204227.50	583443.33	0.350	0.00	583443.33	0.000
	108.604 - 106.226		247949.17	606771.67	0.409	0.00	606771.67	0.000
	106.226 - 103.849		294706.67	630223.33	0.468	0.00	630223.33	0.000
	103.849 - 101.472		343096.67	653776.67	0.525	0.00	653776.67	0.000
	101.472 - 99.0942		397132.50	677409.17	0.586	0.00	677409.17	0.000
	99.0942 - 96.7168		452110.83	701099.17	0.645	0.00	701099.17	0.000
	96.7168 - 94.3395		517005.83	724825.83	0.713	0.00	724825.83	0.000
	94.3395 - 91.9621		582800.83	748566.67	0.779	0.00	748566.67	0.000
	91.9621 - 89.5847		654777.50	772300.00	0.848	0.00	772300.00	0.000
	89.5847 - 87.2074		727258.33	796005.00	0.914	0.00	796005.00	0.000
	87.2074 - 84.83		800243.33	819659.17	0.976	0.00	819659.17	0.000
	84.83 - 80		366400.83	867466.67	0.422	0.00	867466.67	0.000
L2	84.83 - 80	TP47.2726x33.2726x0.3125	583934.17	1738358.33	0.336	0.00	1738358.33	0.000

Section No.	Elevation	Size	M_{ux}	ϕM_{nx}	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M_{uy}	ϕM_{ny}	Ratio $\frac{M_{uy}}{\phi M_{ny}}$
	ft		lb-ft	lb-ft		lb-ft	lb-ft	
	80 - 77.8517		1017900.00	1791216.67	0.568	0.00	1791216.67	0.000
	77.8517 - 75.7033		1085925.00	1844533.33	0.589	0.00	1844533.33	0.000
	75.7033 - 73.555		1154408.33	1898283.33	0.608	0.00	1898283.33	0.000
	73.555 - 71.4067		1223341.67	1952466.67	0.627	0.00	1952466.67	0.000
	71.4067 - 69.2583		1292741.67	2007058.33	0.644	0.00	2007058.33	0.000
	69.2583 - 67.11		1362600.00	2062033.33	0.661	0.00	2062033.33	0.000
	67.11 - 64.9617		1432908.33	2117391.67	0.677	0.00	2117391.67	0.000
	64.9617 - 62.8133		1503683.33	2173108.33	0.692	0.00	2173108.33	0.000
	62.8133 - 60.665		1574925.00	2229166.67	0.707	0.00	2229166.67	0.000
	60.665 - 58.5167		1646616.67	2285558.33	0.720	0.00	2285558.33	0.000
	58.5167 - 56.3683		1718775.00	2342258.33	0.734	0.00	2342258.33	0.000
	56.3683 - 54.22		1791391.67	2399258.33	0.747	0.00	2399258.33	0.000
	54.22 - 52.0717		1864475.00	2456533.33	0.759	0.00	2456533.33	0.000
	52.0717 - 49.9233		1938016.67	2514083.33	0.771	0.00	2514083.33	0.000
	49.9233 - 47.775		2012025.00	2571875.00	0.782	0.00	2571875.00	0.000
	47.775 - 45.6267		2086500.00	2629891.67	0.793	0.00	2629891.67	0.000
	45.6267 - 43.4783		2161441.67	2688133.33	0.804	0.00	2688133.33	0.000
	43.4783 - 41.33		2236841.67	2746575.00	0.814	0.00	2746575.00	0.000
	41.33 - 34.83		1259566.67	2924450.00	0.431	0.00	2924450.00	0.000
L3	41.33 - 34.83	TP56.12x44.8276x0.3125	1208616.67	2863200.00	0.422	0.00	2863200.00	0.000
	34.83 - 33.0495		2532383.33	2912041.67	0.870	0.00	2912041.67	0.000
	33.0495 - 31.2689		2596866.67	2960983.33	0.877	0.00	2960983.33	0.000
	31.2689 - 29.4884		2661633.33	3010008.33	0.884	0.00	3010008.33	0.000
	29.4884 - 27.7079		2726683.33	3059108.33	0.891	0.00	3059108.33	0.000
	27.7079 - 25.9274		2792016.67	3108275.00	0.898	0.00	3108275.00	0.000
	25.9274 - 24.1468		2857616.67	3157508.33	0.905	0.00	3157508.33	0.000
	24.1468 - 22.3663		2923500.00	3206783.33	0.912	0.00	3206783.33	0.000
	22.3663 - 20.5858		2989658.33	3256108.33	0.918	0.00	3256108.33	0.000
	20.5858 - 18.8053		3056091.67	3305458.33	0.925	0.00	3305458.33	0.000
	18.8053 - 17.0247		3122791.67	3354833.33	0.931	0.00	3354833.33	0.000
	17.0247 - 15.2442		3189758.33	3404216.67	0.937	0.00	3404216.67	0.000
	15.2442 -		3256991.67	3453616.67	0.943	0.00	3453616.67	0.000

Section No.	Elevation ft	Size	M_{ux} lb-ft	ϕM_{nx} lb-ft	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M_{uy} lb-ft	ϕM_{ny} lb-ft	Ratio $\frac{M_{uy}}{\phi M_{ny}}$
	13.4637							
	13.4637 - 11.6832		3324491.67	3503000.00	0.949	0.00	3503000.00	0.000
	11.6832 - 9.90263		3392258.33	3552375.00	0.955	0.00	3552375.00	0.000
	9.90263 - 8.1221		3460283.33	3601725.00	0.961	0.00	3601725.00	0.000
	8.1221 - 6.34158		3528566.67	3651050.00	0.966	0.00	3651050.00	0.000
	6.34158 - 4.56105		3597108.33	3700325.00	0.972	0.00	3700325.00	0.000
	4.56105 - 2.78053		3665900.00	3749558.33	0.978	0.00	3749558.33	0.000
	2.78053 - 1		3734950.00	3798725.00	0.983	0.00	3798725.00	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V_u lb	ϕV_n lb	Ratio $\frac{V_u}{\phi V_n}$	Actual T_u lb-ft	ϕT_n lb-ft	Ratio $\frac{T_u}{\phi T_n}$
L1	130 - 127.623	TP55x21x0.1875	1326.99	437576.00	0.003	0.00	808665.00	0.000
	127.623 - 125.245		8095.11	467399.00	0.017	0.00	851850.00	0.000
	125.245 - 122.868		8283.57	476960.00	0.017	0.00	895625.00	0.000
	122.868 - 120.491		8475.72	486260.00	0.017	0.00	939950.00	0.000
	120.491 - 118.113		8671.49	495297.00	0.018	0.00	984783.33	0.000
	118.113 - 115.736		13840.90	504072.00	0.027	0.00	1030083.33	0.000
	115.736 - 113.358		14042.30	512585.00	0.027	0.00	1075791.67	0.000
	113.358 - 110.981		14246.40	520836.00	0.027	0.00	1121891.67	0.000
	110.981 - 108.604		14453.40	528826.00	0.027	0.00	1168316.67	0.000
	108.604 - 106.226		19569.50	536553.00	0.036	0.00	1215025.00	0.000
	106.226 - 103.849		19779.30	544018.00	0.036	0.00	1261991.67	0.000
	103.849 - 101.472		22632.50	551221.00	0.041	0.00	1309150.00	0.000
	101.472 - 99.0942		22844.90	558162.00	0.041	0.00	1356475.00	0.000
	99.0942 - 96.7168		24601.50	564841.00	0.044	0.00	1403916.67	0.000
	96.7168 - 94.3395		27435.20	571258.00	0.048	0.00	1451425.00	0.000
	94.3395 - 91.9621		30186.50	577413.00	0.052	0.00	1498966.67	0.000
	91.9621 - 89.5847		30399.10	583306.00	0.052	0.00	1546491.67	0.000
	89.5847 - 87.2074		30612.50	588937.00	0.052	0.00	1593958.33	0.000
	87.2074 -		30826.70	594306.00	0.052	0.00	1641325.00	0.000

Section No.	Elevation ft	Size	Actual V_u lb	ϕV_n lb	Ratio $\frac{V_u}{\phi V_n}$	Actual T_u lb-ft	ϕT_n lb-ft	Ratio $\frac{T_u}{\phi T_n}$
	84.83							
	84.83 - 80		12240.50	604407.00	0.020	0.00	1737058.33	0.000
L2	84.83 - 80	TP47.2726x33.2726x0.3125	19122.10	1233400.00	0.016	0.00	3480975.00	0.000
	80 - 77.8517		31571.10	1248810.00	0.025	0.00	3586816.67	0.000
	77.8517 - 75.7033		31784.60	1264010.00	0.025	0.00	3693575.00	0.000
	75.7033 - 73.555		31998.30	1278990.00	0.025	0.00	3801216.67	0.000
	73.555 - 71.4067		32212.20	1293760.00	0.025	0.00	3909708.33	0.000
	71.4067 - 69.2583		32426.30	1308320.00	0.025	0.00	4019016.67	0.000
	69.2583 - 67.11		32640.60	1322660.00	0.025	0.00	4129108.33	0.000
	67.11 - 64.9617		32855.10	1336790.00	0.025	0.00	4239958.33	0.000
	64.9617 - 62.8133		33069.80	1350710.00	0.024	0.00	4351533.33	0.000
	62.8133 - 60.665		33284.80	1364410.00	0.024	0.00	4463791.67	0.000
	60.665 - 58.5167		33500.00	1377900.00	0.024	0.00	4576708.33	0.000
	58.5167 - 56.3683		33715.40	1391170.00	0.024	0.00	4690250.00	0.000
	56.3683 - 54.22		33931.10	1404230.00	0.024	0.00	4804383.33	0.000
	54.22 - 52.0717		34147.00	1417080.00	0.024	0.00	4919083.33	0.000
	52.0717 - 49.9233		34363.10	1429710.00	0.024	0.00	5034308.33	0.000
	49.9233 - 47.775		34579.60	1442130.00	0.024	0.00	5150033.33	0.000
	47.775 - 45.6267		34796.20	1454330.00	0.024	0.00	5266225.00	0.000
	45.6267 - 43.4783		35013.20	1466320.00	0.024	0.00	5382841.67	0.000
	43.4783 - 41.33		35230.40	1478100.00	0.024	0.00	5499866.67	0.000
	41.33 - 34.83		18564.80	1512420.00	0.012	0.00	5856050.00	0.000
L3	41.33 - 34.83	TP56.12x44.8276x0.3125	17450.90	1500860.00	0.012	0.00	5733408.00	0.000
	34.83 - 33.0495		36159.20	1510100.00	0.024	0.00	5831216.67	0.000
	33.0495 - 31.2689		36319.40	1519200.00	0.024	0.00	5929208.00	0.000
	31.2689 - 29.4884		36478.50	1528150.00	0.024	0.00	6027374.67	0.000
	29.4884 - 27.7079		36636.50	1536950.00	0.024	0.00	6125700.00	0.000
	27.7079 - 25.9274		36793.40	1545610.00	0.024	0.00	6224158.00	0.000
	25.9274 - 24.1468		36949.30	1554120.00	0.024	0.00	6322733.33	0.000
	24.1468 - 22.3663		37104.00	1562490.00	0.024	0.00	6421416.67	0.000
	22.3663 - 20.5858		37257.70	1570700.00	0.024	0.00	6520174.67	0.000
	20.5858 - 18.8053		37410.40	1578770.00	0.024	0.00	6619000.00	0.000
	18.8053 - 17.0247		37561.90	1586690.00	0.024	0.00	6717866.67	0.000

Section No.	Elevation ft	Size	Actual V_u lb	ϕV_n lb	Ratio $\frac{V_u}{\phi V_n}$	Actual T_u lb-ft	ϕT_n lb-ft	Ratio $\frac{T_u}{\phi T_n}$
	17.0247 - 15.2442		37712.40	1594470.00	0.024	0.00	6816766.67	0.000
	15.2442 - 13.4637		37861.80	1602100.00	0.024	0.00	6915674.67	0.000
	13.4637 - 11.6832		38010.10	1609580.00	0.024	0.00	7014574.67	0.000
	11.6832 - 9.90263		38157.40	1616910.00	0.024	0.00	7113441.33	0.000
	9.90263 - 8.1221		38303.70	1624100.00	0.024	0.00	7212266.67	0.000
	8.1221 - 6.34158		38448.80	1631140.00	0.024	0.00	7311024.67	0.000
	6.34158 - 4.56105		38592.90	1638040.00	0.024	0.00	7409708.00	0.000
	4.56105 - 2.78053		38736.00	1644780.00	0.024	0.00	7508283.33	0.000
	2.78053 - 1		38878.00	1651380.00	0.024	0.00	7606741.33	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	130 - 127.623	0.000	0.014	0.000	0.003	0.000	0.015 ✓	1.000	4.8.2 ✓
	127.623 - 125.245	0.003	0.040	0.000	0.017	0.000	0.042 ✓	1.000	4.8.2 ✓
	125.245 - 122.868	0.003	0.081	0.000	0.017	0.000	0.084 ✓	1.000	4.8.2 ✓
	122.868 - 120.491	0.003	0.120	0.000	0.017	0.000	0.123 ✓	1.000	4.8.2 ✓
	120.491 - 118.113	0.003	0.156	0.000	0.018	0.000	0.159 ✓	1.000	4.8.2 ✓
	118.113 - 115.736	0.004	0.201	0.000	0.027	0.000	0.206 ✓	1.000	4.8.2 ✓
	115.736 - 113.358	0.005	0.254	0.000	0.027	0.000	0.259 ✓	1.000	4.8.2 ✓
	113.358 - 110.981	0.005	0.304	0.000	0.027	0.000	0.309 ✓	1.000	4.8.2 ✓
	110.981 - 108.604	0.005	0.350	0.000	0.027	0.000	0.356 ✓	1.000	4.8.2 ✓
	108.604 - 106.226	0.006	0.409	0.000	0.036	0.000	0.416 ✓	1.000	4.8.2 ✓
	106.226 - 103.849	0.006	0.468	0.000	0.036	0.000	0.475 ✓	1.000	4.8.2 ✓
	103.849 - 101.472	0.007	0.525	0.000	0.041	0.000	0.534 ✓	1.000	4.8.2 ✓
	101.472 - 99.0942	0.007	0.586	0.000	0.041	0.000	0.595 ✓	1.000	4.8.2 ✓
	99.0942 - 96.7168	0.008	0.645	0.000	0.044	0.000	0.655 ✓	1.000	4.8.2 ✓

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
	96.7168 - 94.3395	0.009	0.713	0.000	0.048	0.000	0.724 ✓	1.000	4.8.2 ✓
	94.3395 - 91.9621	0.009	0.779	0.000	0.052	0.000	0.791 ✓	1.000	4.8.2 ✓
	91.9621 - 89.5847	0.010	0.848	0.000	0.052	0.000	0.860 ✓	1.000	4.8.2 ✓
	89.5847 - 87.2074	0.010	0.914	0.000	0.052	0.000	0.926 ✓	1.000	4.8.2 ✓
	87.2074 - 84.83	0.010	0.976	0.000	0.052	0.000	0.989 ✓	1.000	4.8.2 ✓
	84.83 - 80	0.004	0.422	0.000	0.020	0.000	0.427 ✓	1.000	4.8.2 ✓
L2	84.83 - 80	0.003	0.336	0.000	0.016	0.000	0.339 ✓	1.000	4.8.2 ✓
	80 - 77.8517	0.006	0.568	0.000	0.025	0.000	0.574 ✓	1.000	4.8.2 ✓
	77.8517 - 75.7033	0.006	0.589	0.000	0.025	0.000	0.595 ✓	1.000	4.8.2 ✓
	75.7033 - 73.555	0.006	0.608	0.000	0.025	0.000	0.615 ✓	1.000	4.8.2 ✓
	73.555 - 71.4067	0.006	0.627	0.000	0.025	0.000	0.633 ✓	1.000	4.8.2 ✓
	71.4067 - 69.2583	0.006	0.644	0.000	0.025	0.000	0.651 ✓	1.000	4.8.2 ✓
	69.2583 - 67.11	0.006	0.661	0.000	0.025	0.000	0.668 ✓	1.000	4.8.2 ✓
	67.11 - 64.9617	0.006	0.677	0.000	0.025	0.000	0.684 ✓	1.000	4.8.2 ✓
	64.9617 - 62.8133	0.006	0.692	0.000	0.024	0.000	0.699 ✓	1.000	4.8.2 ✓
	62.8133 - 60.665	0.006	0.707	0.000	0.024	0.000	0.714 ✓	1.000	4.8.2 ✓
	60.665 - 58.5167	0.007	0.720	0.000	0.024	0.000	0.728 ✓	1.000	4.8.2 ✓
	58.5167 - 56.3683	0.007	0.734	0.000	0.024	0.000	0.741 ✓	1.000	4.8.2 ✓
	56.3683 - 54.22	0.007	0.747	0.000	0.024	0.000	0.754 ✓	1.000	4.8.2 ✓
	54.22 - 52.0717	0.007	0.759	0.000	0.024	0.000	0.767 ✓	1.000	4.8.2 ✓
	52.0717 - 49.9233	0.007	0.771	0.000	0.024	0.000	0.779 ✓	1.000	4.8.2 ✓
	49.9233 - 47.775	0.007	0.782	0.000	0.024	0.000	0.790 ✓	1.000	4.8.2 ✓
	47.775 - 45.6267	0.007	0.793	0.000	0.024	0.000	0.801 ✓	1.000	4.8.2 ✓
	45.6267 - 43.4783	0.007	0.804	0.000	0.024	0.000	0.812 ✓	1.000	4.8.2 ✓
	43.4783 - 41.33	0.008	0.814	0.000	0.024	0.000	0.823 ✓	1.000	4.8.2 ✓
	41.33 - 34.83	0.004	0.431	0.000	0.012	0.000	0.435 ✓	1.000	4.8.2 ✓

Section No.	Elevation ft	Ratio P_u / ϕP_n	Ratio M_{ux} / ϕM_{nx}	Ratio M_{uy} / ϕM_{ny}	Ratio V_u / ϕV_n	Ratio T_u / ϕT_n	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L3	41.33 - 34.83	0.004	0.422	0.000	0.012	0.000	0.426	1.000	4.8.2
	34.83 - 33.0495	0.009	0.870	0.000	0.024	0.000	0.879	1.000	4.8.2
	33.0495 - 31.2689	0.009	0.877	0.000	0.024	0.000	0.886	1.000	4.8.2
	31.2689 - 29.4884	0.009	0.884	0.000	0.024	0.000	0.894	1.000	4.8.2
	29.4884 - 27.7079	0.009	0.891	0.000	0.024	0.000	0.901	1.000	4.8.2
	27.7079 - 25.9274	0.009	0.898	0.000	0.024	0.000	0.908	1.000	4.8.2
	25.9274 - 24.1468	0.009	0.905	0.000	0.024	0.000	0.915	1.000	4.8.2
	24.1468 - 22.3663	0.009	0.912	0.000	0.024	0.000	0.921	1.000	4.8.2
	22.3663 - 20.5858	0.009	0.918	0.000	0.024	0.000	0.928	1.000	4.8.2
	20.5858 - 18.8053	0.009	0.925	0.000	0.024	0.000	0.935	1.000	4.8.2
	18.8053 - 17.0247	0.010	0.931	0.000	0.024	0.000	0.941	1.000	4.8.2
	17.0247 - 15.2442	0.010	0.937	0.000	0.024	0.000	0.947	1.000	4.8.2
	15.2442 - 13.4637	0.010	0.943	0.000	0.024	0.000	0.953	1.000	4.8.2
	13.4637 - 11.6832	0.010	0.949	0.000	0.024	0.000	0.960	1.000	4.8.2
	11.6832 - 9.90263	0.010	0.955	0.000	0.024	0.000	0.966	1.000	4.8.2
	9.90263 - 8.1221	0.010	0.961	0.000	0.024	0.000	0.971	1.000	4.8.2
	8.1221 - 6.34158	0.010	0.966	0.000	0.024	0.000	0.977	1.000	4.8.2
	6.34158 - 4.56105	0.010	0.972	0.000	0.024	0.000	0.983	1.000	4.8.2
	4.56105 - 2.78053	0.011	0.978	0.000	0.024	0.000	0.989	1.000	4.8.2
	2.78053 - 1	0.011	0.983	0.000	0.024	0.000	0.994	1.000	4.8.2

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
L1	130 - 80	Pole	TP35x21x0.1875	1	-12005.10	1188610.00	98.9	Pass
L2	80 - 34.83	Pole	TP47.2726x33.2726x0.3125	2	-22557.90	2956190.00	82.3	Pass

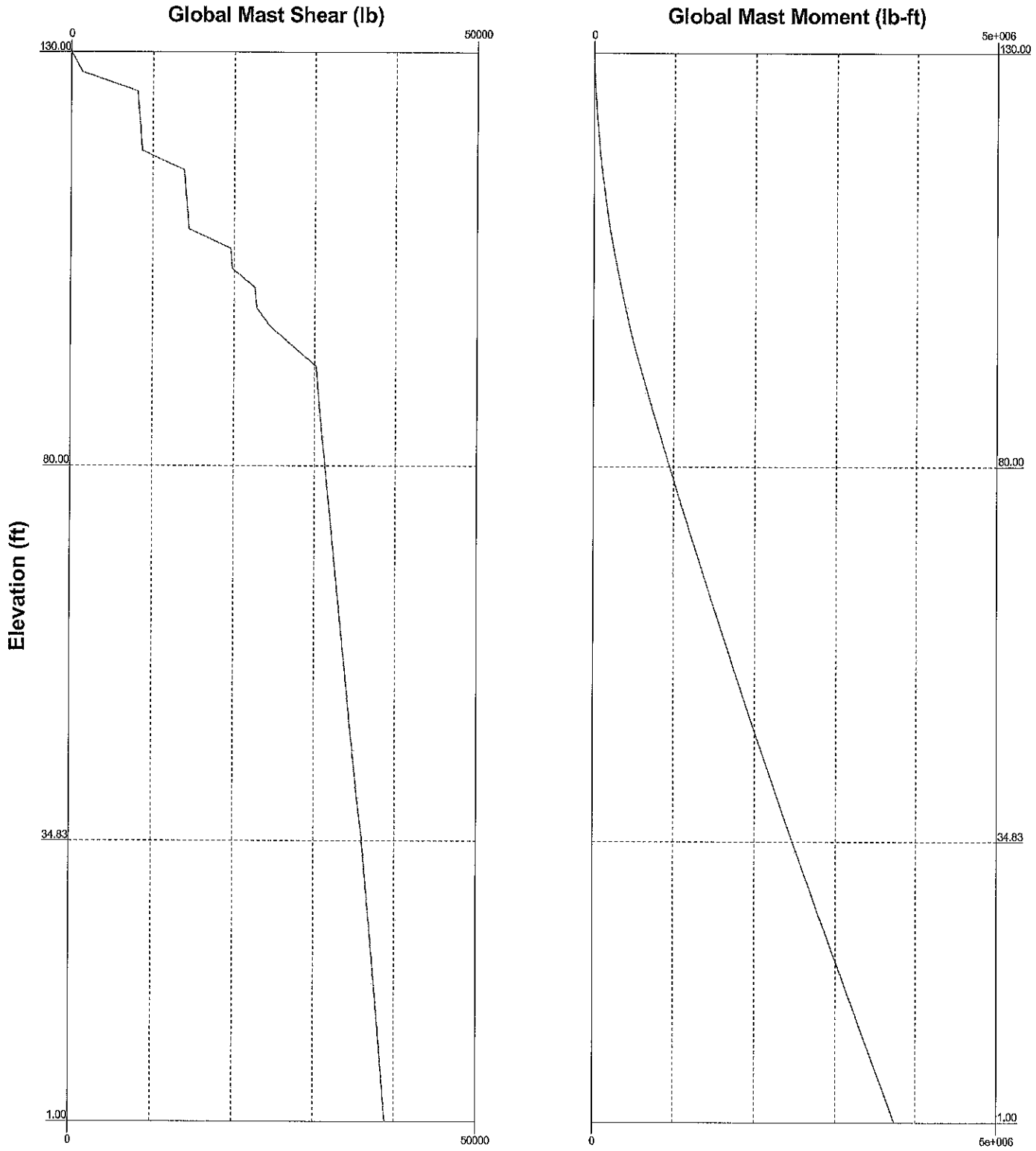
Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
L3	34.83 - 1	Pole	TP56.12x44.8276x0.3125	3	-35253.10	3302770.00	99.4	Pass
							Summary	
						Pole (L3)	99.4	Pass
						Base Plate	86.8	Pass
						RATING =	99.4	Pass

TIA-222-G - 100 mph/40 mph 1.0000 in Ice Exposure C

Vx Vz

Maximum Values

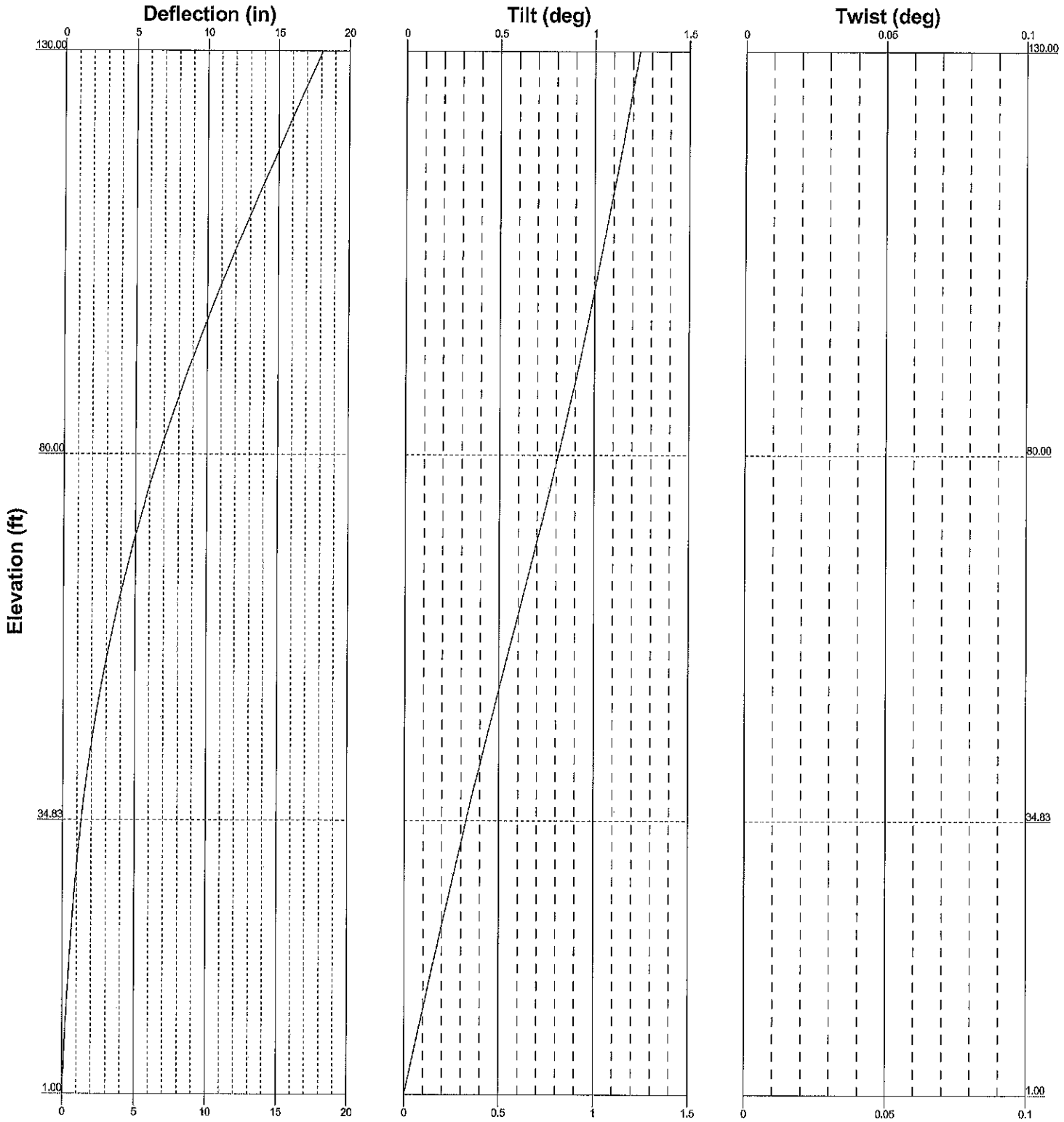
Mx Mz



Vector Structural Engineers
9138 S. State St., Suite 101
Sandy, UT
Phone: 801-990-1175
FAX: 801-990-1176

Job:		
Project:		
Client:	Drawn by: Lindsey Cahoon	App'd:
Code: TIA-222-G	Date: 07/24/12	Scale: NTS
Path: N:\2012 Projects\U1223 Larson Camouflage\U1223-220-121 611200 Wallastown\ENG\TOWER\Wallastown.eri		Dwg No. E-4

TIA-222-G - Service - 60 mph **Maximum Values**



Vector Structural Engineers
9138 S. State St., Suite 101
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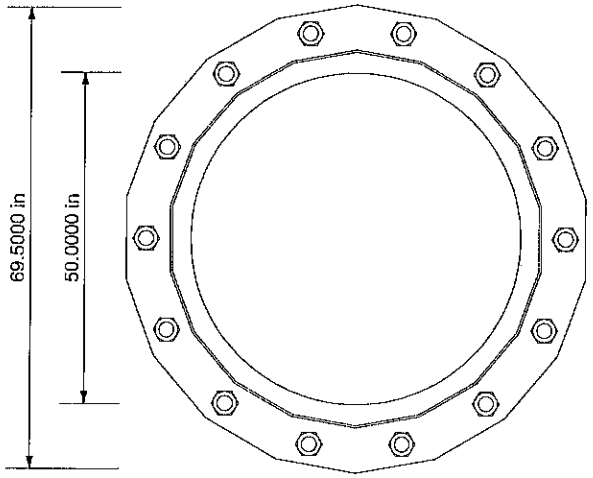
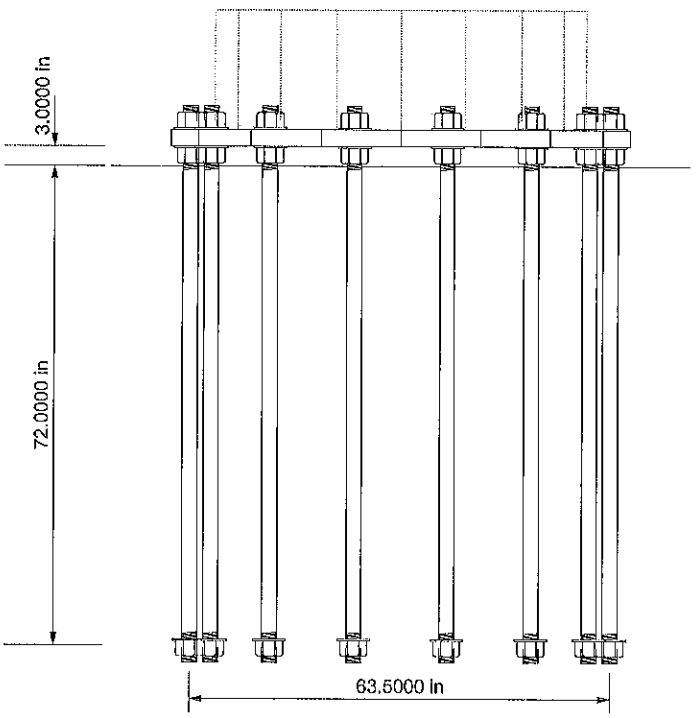
Phone: 801-990-1175
FAX: 801-990-1176

Job:		
Project:		
Client:	Drawn by: Lindsey Cahoon	App'd:
Code: TIA-222-G	Date: 07/24/12	Scale: NTS
Path: N:\2012 Projects\U1223 Larson Camot\Engr\U1223-226-121 611200 Watertown\ENG\TOWER\Watertown.eri		Dwg No. E-5





FOUNDATION NOTES

1. Plate thickness is 2.5000 in.
2. Plate grade is A572-50.
3. Anchor bolt grade is A615-75.
4. f'c is 6 ksi.

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Job:		
Project:		
Client:	Drawn by: Lindsey Cahoon	App'd:
Code: TIA-222-G	Date: 07/24/12	Scale: NTS
Path: N:\2012 Projects\U1223 Larson Camouflage\U1223-226-121 011209 Watertown\ENG\TOWER\Watertown.eri		Dwg No. F-1

VECTOR ENGINEERS

JOB NO.: U1223-226-121 **DESIGNED:** LCC
DATE: 07/24/12 **CHECKED:** JSP

SHEET **OF**

PROJECT: WATERTOWN

Seismic Base Shear Calculations:

Reactions From Wind:
V_u (kips): 38.9
Wt (kips): 29.4

Structure Height
130

Seismic Parameters:
Per California Building Code, 2010 Edition (2009 IBC), ASCE 7-05

Occupancy Category=	II	F_a=	1.60
Seismic Design Category=	D	F_v=	2.40
I_S =	1.00	S_{MS}=	0.40
Site Class=	D	S_{M1}=	0.16
R=	1.50	S_{DS}=	0.27
S_s=	0.250	S_{D1}=	0.10
S_1=	0.065		

Seismic Base Shear:

$C_{S(MIN)}$ = 0.03	0.03	
$C_{S(MIN)}$ = 0.8 x S_1 / (R / I_S) =		(if S_1 >= 0.6)
$C_{S(MAX)}$ = S_{D1} / (T_a x (R / I_S)) =	0.09	
T_a = C_t x h_n^x =	0.77	s
C_s = S_{DS} / (R / I_S) =	0.090	
V = C_s x W =	2.70	kips

Total Seismic Shear (V_u):	**2.7**	**Kips**
Total Wind Shear:	**38.9**	**Kips**

Base Shear From Wind Loading Governs

VECTOR ENGINEERS

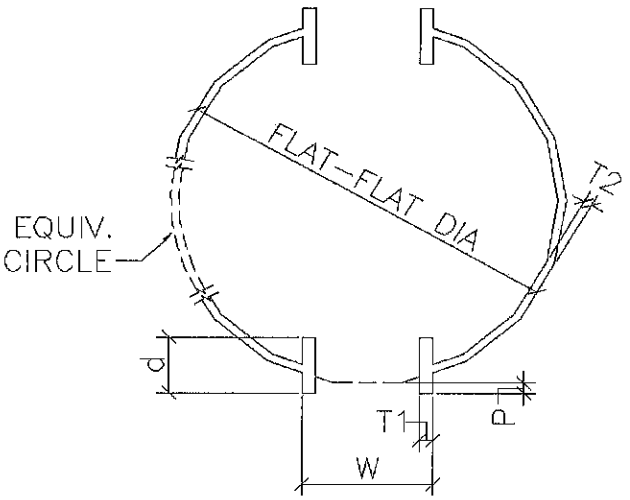
JOB NO.: U1223-226-121 **DESIGNED:** LCC
DATE: 07/24/12 **CHECKED:** JSP
SHEET **OF**

PROJECT: WATERTOWN

Reinforced Access Port Analysis

Reinforced Access Port:

Width, w:	10	inches
Height	30	inches
Thickness, t_1:	0.75	inches
Depth, d:	6	inches
Projection, p:	0.5	inches



Pole Shaft Loading:

M_u:	3735	kip-ft
P_u:	35.3	kips
V_u:	38.9	kips

Properties @ Access Port:

Flat-Flat Dia:	56.4	in
Pole Thickness, t_2:	0.3125	in

$A_{PoleNoAccess}$:	55.1	in^2
$I_{PoleNoAccess}$:	21653.0	in^4
$S_{PoleNoAccess}$:	767.8	in^3
$A_{reinforced}$:	66.8	in^2
$I_{reinforced}$:	21986.5	in^4
$S_{reinforced}$:	779.7	in^3

E:	29000	ksi
Rim F_y:	50	ksi
Pole F_y:	65	ksi

K:	1	
L:	130	ft
r:	18.14	in
F'_y:	66.0	ksi
KL/r:	86.0	
λ_c:	1.3	
F_{cr}:	32.3	ksi

Note:
Section properities are base on an equivalent circular tube as shown in the illustration above. The outer diameter of the circle is equal to the flat-flat diameter of the polygon thus the properties are conservative.

Mn:	4291.0	kip-ft
Pn:	2160.0	kip
Vn:	2205.2	kip
Interaction Check:	0.987	**OKAY**

Added Weight Per Port	75	lbs

VECTOR ENGINEERS

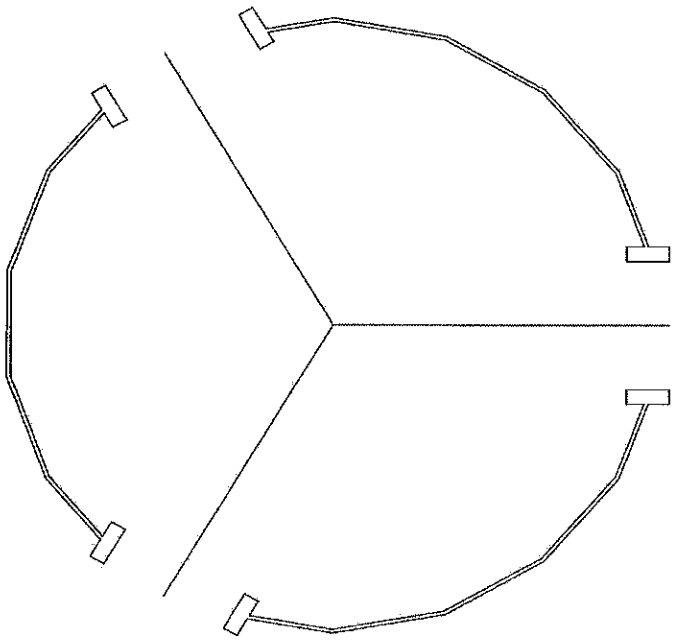
JOB NO.: U1223-226-121 **DESIGNED:** LCC
DATE: 07/24/12 **CHECKED:** JSP
SHEET **OF**

PROJECT: WATERTOWN

Reinforced Access Port Analysis

Reinforced Access Port:

Width, w:	8	inches
Height	22	inches
Thickness, t_1:	0.75	inches
Depth, d:	2	inches
Projection, p:	0.5	inches



Pole Shaft Loading:

M_u:	517	kip-ft
P_u:	11.0	kips
V_u:	30.2	kips

Properties @ Access Port:

Flat-Flat Dia:	30.8	in
Pole Thickness, t_2:	0.1875	in

$A_{PoleNoAccess}$:	18.0	in^2
$I_{PoleNoAccess}$:	2112.4	in^4
$S_{PoleNoAccess}$:	137.2	in^3
$A_{reinforced}$:	21.0	in^2
$I_{reinforced}$:	2637.2	in^4
$S_{reinforced}$:	171.2	in^3

E:	29000	ksi
Rim F_y:	50	ksi
Pole F_y:	65	ksi

K:	1	
L:	130	ft
r:	11.21	in
F'_y:	69.4	ksi
KL/r:	139.2	
λ_c:	2.2	
F_{cr}:	9.7	ksi

Note:
Section properities are base on an equivalent circular tube as shown in the illustration above. The outer diameter of the circle is equal to the flat-flat diameter of the polygon thus the properties are conservative.

Mn:	990.5	kip-ft
Pn:	203.9	kip
Vn:	728.7	kip
Interaction Check:	0.645	**OKAY**

Added Weight Per Port: 16 lbs

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Foundation Design

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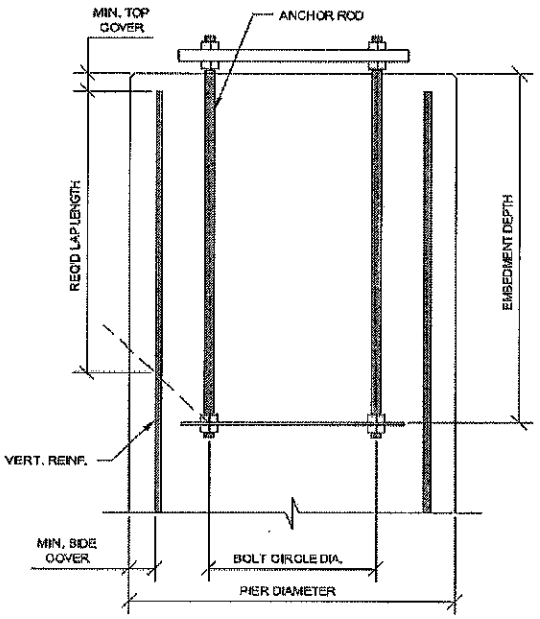
Anchorage Embedment Design

Vertical Bar Size:	#8	
Conc. Comp. Strength:	4000	psi
Pier Diameter:	7	ft
Pier Depth:	4	ft
Top of Pier Elevation:	6	inches
Concrete Volume	6.4	yards
Side Conc. Cover:	4	inches
Top Conc. Cover:	3	inches
Bolt Circle Dia.:	63.5	inches
Horizontal Tie Size:	#5	
# Anchor Rods:	14	
Anchor Rod Dia:	2.25	inches



ψ_t (bar loc. factor):	1.0	ACI 12.2.4a
ψ_e (epoxy coating factor):	1.0	ACI 12.2.4b
ψ_s (bar size factor):	1.0	ACI 12.2.4.c
λ (concrete type factor):	1.0	ACI 12.2.4.d
Bar Diameter:	1.0	in
Horiz. Tie Diameter:	0.6	in
Min.Clr Dist. Btwn Anchor & Rod:	3.5	in
Max. Clr Dist. Btwn Anchor & Rod:	7.6	in
Req'd Lap Length:	37.0	in ACI 12.2.2
Min. Required Embedment Depth:	49.2	**in**
Available Pullout with Heavy Hex Nut:	133963	**lbs**

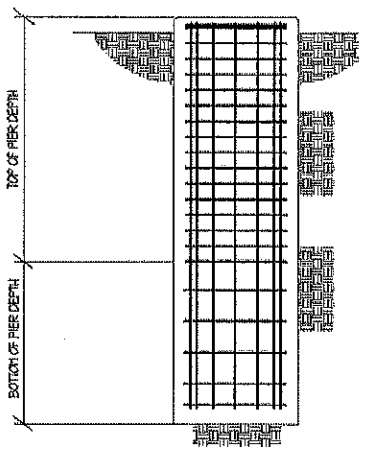
Required Lap Length + Max distance between anchor and rod + 0.5*Bar diameter + 0.5*Anchor diameter + Top cover

8*Abrg*f'c - (Per ACI D15)

Transverse Reinforcement Design

(see 2009 IBC Sections 1810.3.9.4.1 and 1810.3.9.4.2)

Seismic Design Category:	D	
Site Class:	D	
Type of Transverse Reinforcement:	Spiral	
Transverse f_{yt}:	40	ksi
Seismic Hooks Required?	Yes	
Tie Size OK?	Yes	
Spacing at Top of Pier:	2	in
Spacing at Bottom of Pier:	12	in
Total Pier Length	4.5	ft
Top Pier Length:	21	ft
Bottom Pier Length:	-16.5	ft



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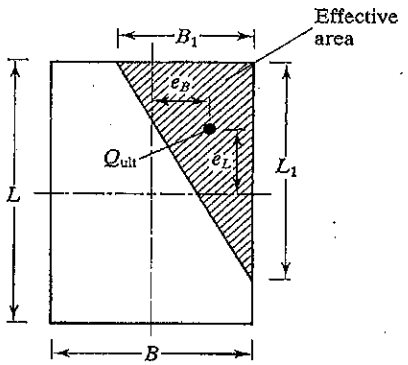
Square Mat Foundation Design (Resultant Lies Outside Footing Kern)

Design Loads (Factored / ϕ_s):

Max. Base Shear, V_u / 0.75:	51.8	k
Max. Overturning Moment, M_u / 0.75:	4,979.9	k-ft
Max. Down, $P_{u\text{-down}}$ / 0.75:	84.8	k
Structure Weight:	29.4	k
Moment Components, $M_y = M_x$:	3521.3	k-ft



Mat Properties:

Mat Width, L = B:	21.0	ft
Mat Thickness, t:	3.0	ft
Pier Diameter, b:	7.0	ft
Height of Pier:	4.5	ft
Depth of Soil Above Mat:	4.0	ft
Unit Weight of Soil:	110.0	pcf
Number of Legs:	1	

Volume of Concrete:	1496	ft^3
Volume of Concrete:	55.4	yd^3
Weight of Concrete:	224.4	k
Weight of Soil:	177.1	k

Soil Properties:

Allow. Bearing Pressure:	12,000	psf
Factor of Safety:	1	
1/3 increase for short term loads?	No	

Eff. Bearing Pressure:	12000 psf

Passive Pressure:	1200	pcf
Factor of Safety:	1	
Max. Passive Pressure (opt'l):		psf
1/3 increase for short term loads?	No	
Top Depth to Ignore:	0.0	ft

Coefficient of Friction:	0.70
Factor of Safety:	1.5
% Passive for Sliding:	100.00
% Friction for Sliding:	0.00

Check Bearing:

Total Moment, $M_y = M_x$:	3,796.1	k-ft
Total Axial Load, Q:	727.3	k
Load eccentricity, $e_L = e_B$:	5.22	ft
Effective Mat Brg Width, $B_1 = L_1$:	15.84	ft
Effective Area, $A' = 1/2(B_1)(L_1)$:	125.47	ft^2
Allowable axial load:	1506	k

Bearing Capacity OK.

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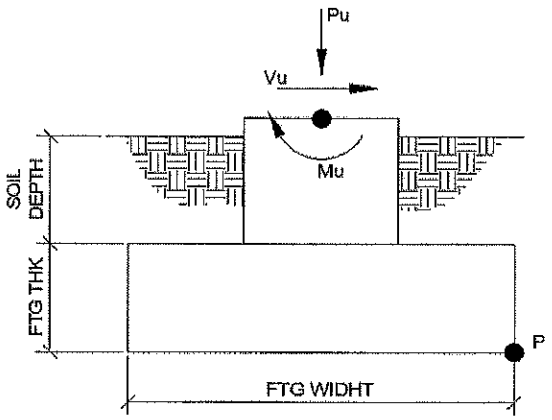
Square Mat Foundation Design (cont.)

Check Overturning:

Base Shear (1.6W), V_u:	38.9	k
Overturning Moment (1.6W), M_u :	3,735.0	k-ft
Down (0.9 D), P_u:	26.5	k
OTM about point P (1.6W):	4026.342	k-ft
Resisting Moment (0.9D):	4072.3	k-ft

Overturning OK.



Check Sliding:

Sliding Resistance from Friction:	0.0	k
Sliding Resistance from Passive:	113.4	k
Total Sliding Resistance:	113.4	k

Sliding resistance OK.