

# ***TOWERKRAFT ENGINEERING, P.C.***

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**DESIGN AND ANALYSIS OF COMMUNICATION STRUCTURES**

**ENGINEERING EVALUATION  
185' S.S.**

Tower Site:  
Dryden West  
Mt. Pleasant Road, NY.

Prepared For:  
Mid States C & E  
185 Clear Road  
Oriskany, NY 13424

Prepared By:  
Steven Fehlhafer, P.E.  
Towerkraft Engineering  
August 21, 2015

Project No. 8102

## **SCOPE**

As requested by Mid-State Communications and Electronics, Towerkraft Engineering has performed a structural stress analysis on the 185' Glen Martin Engineering self supporting tower located at Dryden West, Mt. Pleasant Road, NY. The analysis was performed using the original design wind speed of 100 MPH 3-second gust basic wind speed with no ice and 60 mph wind with 3/4" ice per ANSI design standard TIA-222-G (Telecommunications Industry Association Structural Standard for Antenna Supporting Structures and Antennas)).

The following factors and structure class were used in the analysis:

- Exposure Category C: "Open terrain with scattered obstructions having heights generally less than 30ft. This category includes flat, open country, grasslands and shorelines in hurricane prone regions" (ANSI/TIA-222-G, section 2.6.5.1, page 12).
- Topographic Category 1: "No abrupt changes in general topography, e.g. flat or rolling terrain..."(ANSI/TIA-222-G, section 2.6.6.2, page 13).
- Structure Class II: "Structures used for services that may be provided by other means such as: commercial wireless communications; television and radio broadcasting; cellular, PCS, CATV, and microwave communications" (ANSI/TIA-222-G, Annex A, section A.2.2, spage 124).

The purpose of this analysis is to determine the structural capacity of the tower to withstand the loading of the antennas listed below.

**ANTENNAS**

<u>Elev.</u>	<u>Item</u>	<u>Leg</u>	<u>Feedline</u>	<u>Remarks</u>
184'	TX/RX 101-90-06-0-01N	X	LDF6-50	Existing
184'	DB806E-XT	Y	LDF6-50	Existing
184'	TX/RX 101-90-06-0-01N	Z	LDF6-50	Existing
184'	(3) 6' Side Arms	X,Y,Z	na	Existing
174'	800 MHz Pre-amp	X	na	Existing
173'	TX/RX 101-90-06-0-01N	X	LDF5-50	Existing
173'	DB806E-XT	Y	LDF6-50	Existing
173'	TX/RX 101-90-06-0-01N	Z	LDF5-50	Existing
173'	(3) 6' Side Arms	X,Y,Z	na	Existing
161'	DB806E-XT on 6' side arm	Z	LDF6-50	Existing
157'	DB222E on DB5001 mount	Y	LDF5-50	Existing
155'	(2) WiMax 300616 on mount	Y,Z	2 CAT5e	Existing
155'	(2) WiMax 300616 on mount	X,Z	2 CAT5e	Existing
150'	TX/RX 101-68-10-0-03N	X	LDF5-50	Existing
134'	DB222E on DB5001 mount	Y	LDF5-50	Existing
129'	TX/RX 101-68-10-0-03N	X	LDF5-50	Existing
129'	TX/RX 101-68-10-0-03N	Z	LDF5-50	Existing
129'	(2) 6' side arms	X,Z	na	Existing
<b>120'</b>	<b>Commscope VHLP6-6WA-6GR</b>	<b>**</b>	<b>CAT5e</b>	<b>Proposed</b>
<b>120'</b>	<b>Ceragon IP20C ODU</b>	<b>**</b>	<b>na</b>	<b>Proposed</b>
111'	DB222E on DB5001 Mount	Y	LDF5-50	Future
<b>110'</b>	<b>Commscope VHLP6-6WA-6GR</b>	<b>**</b>	<b>CAT5e</b>	<b>Proposed</b>
<b>110'</b>	<b>Ceragon IP20C ODU</b>	<b>**</b>	<b>na</b>	<b>Proposed</b>
107'	TX/RX 101-68-10-0-03N	Z	LDF5-50	Existing
107'	TX/RX 101-68-10-0-03N	X	LDF5-50	Existing
107'	(2) 6' side arms	X,Z	LDF5-50	Existing
106'	Ubiquiti NBM5-25 & mount	X	CAT5e	Existing
106'	Andrew VHLP2.5	Y	LMR400	Existing
102'	Ubiquiti NBM5-25 & mount	X	CAT5e	Existing
100'	Andrew PL4-107 w/rad. (61.9°)	Z	EW90	Existing
90'	(12) RFS AX612C2 on (3) frames	X,Y,Z	***	Existing
75'	(12) RFS AX612C2 on (3) frames	X,Y,Z	***	Existing
71'	Andrew VHLP2.5 across face	X,Z	LMR400	Existing

65'	Andrew PAR6-59 w/rad (157.5°)	X	EW63	Existing
60'	Andrew PL4-107E w/rad (205°)	Y	EW90	Existing
39'	Ubiquiti 5G-34 & mount	X	CAT5e	Existing
21'	GPS	Z	LDF4-50	Existing

\*\* Proposed may be mounted on any leg as required.

\*\*\* (24) LDF6-50 feedlines to elevations 90' and 75' each (48 total).

This tower has been analyzed per EIA for the following load cases:

- a) 90 MPH wind at the face of the tower - no ice.
- b) 90 MPH wind at the apex of the tower - no ice.
- c) 90 MPH wind parallel to the face of the tower - no ice.
- d) 40 MPH wind at the face of the tower - 3/4" ice.
- e) 40 MPH wind at the apex of the tower - 3/4" ice.
- f) 40 MPH wind parallel to the face of the tower - 3/4" ice.

**RESULTS:**

**MEMBER USAGE**

<u>Elevation</u>	<u>Leg Percent Usage</u>	<u>Diagonal Percent Usage</u>	<u>Horizontal Percent Usage</u>
185'-176'	4%	9%	6%
176'-147'	19%	18%	na
147'-117'	31%	34%	na
117'-88'	43%	45%	na
88'-59'	45%	45%	na
59'-29'	44%	67%	na
29'-0'	57%	57%	na

The maximum usage in the members allowed by TIA-222-G is 100%.  
The tower meets the requirements of TIA.

## **FOUNDATION**

The reaction forces determined in this analysis are:

Axial = 299.5 kips/leg  
Corresponding Shear = 32.6 kips

Uplift = 260.8 kips/leg  
Corresponding Shear = 29.7 kips

The base forces determined in this analysis are less than the original design values.

## **COMMENTS**

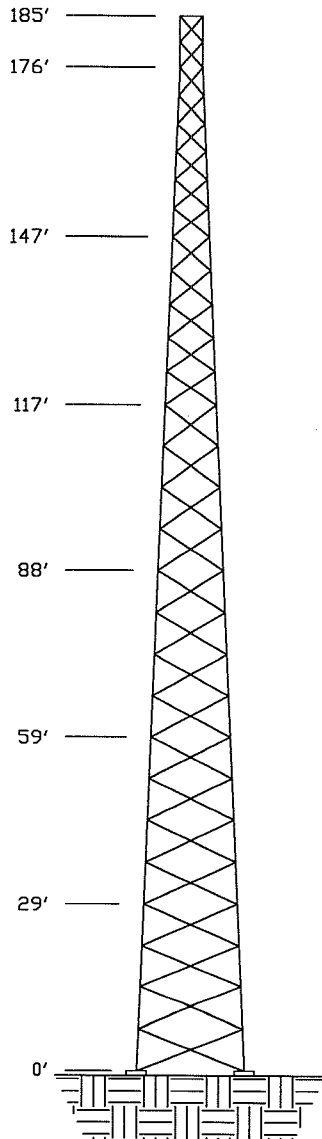
If any item on the existing tower varies from what is stated in this report or on the drawings, the certification by Towerkraft Engineering shall be considered invalid and Towerkraft Engineering shall be notified immediately for revised analysis.

## **CONCLUSION**

The existing tower meets the requirements of TIA-222-G with the existing and proposed loads shown on page 1 of this report.

This report is based on the following:

- ANSI/TIA 222-G.
- Proposed antenna loading supplied by Mid-State C & E.
- Leg steel analyzed as 50 ksi. All bracing steel analyzed as 50 ksi.
- Antenna dimensions per manufacturer's specifications (when possible).
- Original GME design drawings.
- Structural analysis and engineering by Towerkraft Engineering.



## TOWER MEETS TIA-222-G

### MEMBER SIZES

ELEVATION	TOP WIDTH	BOTTOM WIDTH	LEG SIZE	DIAGONAL SIZE	HORIZONTAL SIZE
186'-176'	4'-0"	4'-0"	2 1/2 SCH 40	1 1/2 X 1 1/2 X 3/16	1 1/2 X 1 1/2 X 3/16
176'-147'	4'-0"	6'-6"	4 SCH 40	2 X 2 X 3/16	NA
147'-117'	6'-6"	9'-0"	5 SCH 40	2 1/2 X 2 1/2 X 3/16	NA
117'-88'	9'-0"	11'-6"	6 SCH 40	3 X 3 X 3/16	NA
88'-59'	11'-6"	14'-0"	8 SCH 40	3 1/2 X 3 1/2 X 1/4	NA
59'-29'	14'-0"	16'-6"	10 SCH 40	3 1/2 X 3 1/2 X 1/4	NA
29'-0'	16'-6"	19'-0"	10 SCH 40	4 X 4 X 1/4	NA

SEE PAGE 2 OF 2 FOR ANTENNA LOADS

**INDIVIDUAL FOUNDATION LOADS:**  
 VERTICAL = 299.5 KIPS/LEG  
 CORRESPONDING SHEAR = 32.6 KIPS/LEG  
 UPLIFT = 260.8 KIPS/LEG  
 CORRESPONDING SHEAR = 29.7 KIPS/LEG

**TOTAL FORCES**  
 O.T.M. = 4706.1 KIP-FT  
 AXIAL (TOTAL) = 40.0 KIPS  
 SHEAR (TOTAL) = 56.7 KIPS



SITE: DRYDEN WEST, NY
HEIGHT: 185' GME S.S.T.
TIA STANDARD: TIA-222-G
WIND: 100 MPH WITH NO ICE 60 MPH WITH 3/4" ICE
EXPOSURE CATEGORY: C
TOPOGRAPHIC CATEGORY: 1
STRUCTURE CLASS: 2
REVISION:

TOMPKINS COUNTY, NY

### NOTES

- DESIGN MEETS THE REQUIREMENTS OF TIA DESIGN STANDARD LISTED ABOVE.
- LEG STEEL ANALYZED AS 50 KSI. BRACING STEEL ANALYZED AS 50 KSI.
- ALL CONNECTIONS ARE CONSIDERED TO DEVELOP THE CAPACITY OF THE CONNECTING MEMBERS.
- TOWER SECTIONS ARE EXISTING AND HAVE NOT BEEN INSPECTED BY TOWER-KRAFT ENGINEERING. IF ANY CORROSION, ABNORMALITIES, ETC ARE DISCOVERED TOWERKRAFT ENGINEERING SHALL BE NOTIFIED IMMEDIATELY.

<b>MID STATE C &amp; E</b>	
185 CLEAR ROAD ORISKANY, NY 13424	
TOWERKRAFT PROJECT NO.	8102
TITLE: TOWER DATA SHEET	
TOWERKRAFT ENGINEERING 216 EAST 3RD STREET ALLIANCE, NE 69301 (308) 762-5002	BY: SJF DATE: 8-21-15
DWG. NO. 8102-DS	PAGE 1 OF 2

**LOADS**

ELEV.	ITEM	LINE
184'	TX/RX 101-90-06-0-01N	LDF6-50
184'	DB806E-XT	LDF6-50
184'	TX/RX 101-90-06-0-01N	LDF6-50
184'	(3) 6' SIDE ARMS	NA
174'	800 MHZ PRE-AMP	NA
173'	TX/RX 101-90-06-0-01N	LDF5-50
173'	DB806E-XT	LDF6-50
173'	TX/RX 101-90-06-0-01N	LDF5-50
173'	(3) 6' SIDE ARMS	NA
161'	DB806E-XT ON 6' SIDE ARM	LDF6-50
157'	DB222E ON DB5001 MOUNT	LDF5-50
155'	(2) WIMAX 300616 ON MOUNT	(2) CAT5E
155'	(2) WIMAX 300616 ON MOUNT	(2) CAT5E
150'	TX/RX 101-68-10-0-03N	LDF5-50
134'	DB222E ON DB5001 MOUNT	LDF5-50
129'	TX/RX 101-68-10-0-03N	LDF5-50
129'	TX/RX 101-68-10-0-03N	LDF5-50
129'	(2) 6' SIDE ARMS	NA
* 120'	COMMSCOPE VHLP6-6WA-6GR	CAT5E
* 120'	CERAGON IP20C ODU	NA
111'	DB222E ON DB5001 MOUNT	LDF5-50
* 110'	COMMSCOPE VHLP6-6WA-6GR	CAT5E
* 110'	CERAGON IP20C ODU	NA
107'	TX/RX 101-68-10-0-03N	LDF5-50
107'	TX/RX 101-68-10-0-03N	LDF5-50
107'	(2) 6' SIDE ARMS	LDF5-50
106'	UBIQUITI NBMS-25	CAT5E
106'	ANDREW VHLP2.5	LMR400
102'	UBIQUITI NBMS-25	CAT5E
100'	ANDREW PL4-107 W/RAD. AT 61.9°	EW90
90'	(12) RFS AX612C2 ON (3) SECTOR FRAMES	(24) LDF6-50
75'	(12) RFS AX612C2 ON (3) SECTOR FRAMES	(24) LDF6-50
71'	ANDREW VHLP2.5	LMR400
65'	ANDREW PAR6-59 W/RAD. @ 157.5°	EW63
60'	ANDREW PL4-107E W/RAD. @ 205°	EW90
39'	UBIQUITI 5G-34 AND MOUNT	CAT5E
21'	GPS	LDF4-50

\* INDICATES PROPOSED ANTENNAS

SITE: DRYDEN WEST, NY
HEIGHT: 185' GME S.S.T.
TIA STANDARD: TIA-222-G
WIND: 100 MPH WITH NO ICE 60 MPH WITH 3/4' ICE
EXPOSURE CATEGORY: C
TOPOGRAPHIC CATEGORY: 1
STRUCTURE CLASS: 2
REVISION:

TOMPKINS COUNTY, NY

<b>MID STATE C &amp; E</b>	
185 CLEAR ROAD ORISKANY, NY 13424	
TOWERKRAFT PROJECT NO. 8102	
TITLE: TOWER DATA SHEET	
TOWERKRAFT ENGINEERING 216 EAST 3RD STREET ALLIANCE, NE 69301 (308) 762-5002	BY: SJF DATE: 8-21-15
DWG. NO. 8102-DS	PAGE 2 OF 2

Project Name : PN8102 Analysis for Mid-State C & E  
 Project Notes: 185' Glen Martin S.S. at Dryden West, Mt. Pleasant Road, NY  
 Project File : c:\pls\tower\8102s.tow  
 Date run : 10:15:03 AM Friday, August 21, 2015  
 by : Tower Version 11.00  
 Licensed to : TowerKraft Engineering

Successfully performed nonlinear analysis

The model has 0 warnings.

Member check option: ANSI/TIA 222-G-1  
 Connection rupture check: ANSI/TIA 222-G-1  
 Crossing diagonal check: ANSI/TIA 222-G-1 [Alternate Unsupported RLOUT = 1]  
 Loads from file: c:\pls\tower\8102s.eia

\*\*\* Analysis Results:

Maximum element usage is 66.97% for Angle "g781" in load case " LC3 100 mph wind no ice parallel to the face (1.2D + 1.6W) "

Summary of Joint Support Reactions For All Load Cases:

Load Case	Joint Label	Long. Force (kips)	Tran. Force (kips)	Vert. Force (kips)	Shear Force (kips)	Tran. Moment (ft-k)	Long. Moment (ft-k)	Vert. Moment (ft-k)	Bending Moment (ft-k)	Found. Usage %
LC1 100 mph wind no ice at the face (1.2D + 1.6W)	HP	-32.57	0.06	299.45	32.57	-0.08	-11.38	-0.00	11.38	0.00
LC1 100 mph wind no ice at the face (1.2D + 1.6W)	H1	-11.50	-10.91	-129.74	15.85	1.69	-7.90	0.30	8.08	0.00
LC1 100 mph wind no ice at the face (1.2D + 1.6W)	H2	-11.60	10.85	-129.60	15.89	-1.62	-8.03	-0.30	8.19	0.00
LC2 100 mph wind no ice at the apex (1.2D + 1.6W)	HP	29.46	-0.06	-257.58	29.46	0.07	10.39	0.00	10.40	0.00
LC2 100 mph wind no ice at the apex (1.2D + 1.6W)	H1	11.44	11.67	148.78	16.35	-1.99	7.51	-0.27	7.77	0.00
LC2 100 mph wind no ice at the apex (1.2D + 1.6W)	H2	11.55	-11.61	148.91	16.38	1.91	7.64	0.28	7.88	0.00
LC3 100 mph wind no ice parallel to the face (1.2D + 1.6W)	HP	-0.81	-4.94	13.36	5.00	6.62	-0.20	0.33	6.62	0.00
LC3 100 mph wind no ice parallel to the face (1.2D + 1.6W)	H1	-10.70	-23.60	-224.61	25.91	9.57	-1.65	-0.17	9.71	0.00
LC3 100 mph wind no ice parallel to the face (1.2D + 1.6W)	H2	11.51	-24.73	251.36	27.28	9.83	1.93	-0.16	10.02	0.00
LC4 100 mph wind no ice at the face (0.9D + 1.6W)	HP	-32.36	0.06	295.94	32.36	-0.08	-11.33	-0.00	11.33	0.00
LC4 100 mph wind no ice at the face (0.9D + 1.6W)	H1	-11.60	-11.08	-132.98	16.05	1.73	-7.93	0.30	8.11	0.00
LC4 100 mph wind no ice at the face (0.9D + 1.6W)	H2	-11.71	11.03	-132.87	16.08	-1.66	-8.06	-0.30	8.23	0.00
LC5 100 mph wind no ice at the apex (0.9D + 1.6W)	HP	29.66	-0.06	-260.75	29.66	0.07	10.44	0.00	10.44	0.00
LC5 100 mph wind no ice at the apex (0.9D + 1.6W)	H1	11.34	11.49	145.37	16.15	-1.94	7.49	-0.27	7.74	0.00
LC5 100 mph wind no ice at the apex (0.9D + 1.6W)	H2	11.45	-11.43	145.47	16.18	1.87	7.62	0.28	7.85	0.00
LC6 100 mph wind no ice parallel to the face (0.9D + 1.6W)	HP	-0.60	-4.94	10.03	4.98	6.62	-0.15	0.33	6.63	0.00
LC6 100 mph wind no ice parallel to the face (0.9D + 1.6W)	H1	-10.80	-23.77	-227.79	26.11	9.62	-1.67	-0.17	9.76	0.00
LC6 100 mph wind no ice parallel to the face (0.9D + 1.6W)	H2	11.40	-24.55	247.86	27.07	9.79	1.90	-0.16	9.97	0.00
LC7 60 mph wind 3/4" ice at the face (1.2D + 1.0D1 + 1.0W)	HP	-6.80	0.04	176.43	6.80	-0.05	7.09	-0.00	7.09	0.00
LC7 60 mph wind 3/4" ice at the face (1.2D + 1.0D1 + 1.0W)	H1	-10.07	-13.09	-28.05	16.52	11.70	-10.13	0.14	15.48	0.00
LC7 60 mph wind 3/4" ice at the face (1.2D + 1.0D1 + 1.0W)	H2	-10.12	13.05	-27.65	16.52	-11.66	-10.20	-0.15	15.50	0.00
LC8 60 mph wind 3/4" ice at the apex (1.2D + 1.0D1 + 1.0W)	HP	23.78	-0.03	-92.84	23.78	0.04	17.79	0.00	17.79	0.00
LC8 60 mph wind 3/4" ice at the apex (1.2D + 1.0D1 + 1.0W)	H1	1.27	-1.98	106.59	2.35	9.94	-2.48	-0.14	10.24	0.00
LC8 60 mph wind 3/4" ice at the apex (1.2D + 1.0D1 + 1.0W)	H2	1.33	2.01	106.99	2.41	-9.99	-2.40	0.14	10.27	0.00
LC9 60 mph wind 3/4" ice parallel to the face (1.2D + 1.0D1 + 1.0W)	HP	8.62	-2.49	40.40	8.98	3.36	12.49	0.17	12.94	0.00
LC9 60 mph wind 3/4" ice parallel to the face (1.2D + 1.0D1 + 1.0W)	H1	-9.84	-19.53	-76.02	21.86	15.65	-7.11	-0.08	17.18	0.00
LC9 60 mph wind 3/4" ice parallel to the face (1.2D + 1.0D1 + 1.0W)	H2	1.21	-4.51	156.36	4.67	-6.01	-5.36	-0.08	8.05	0.00

Summary of Joint Support Reactions For All Load Cases in Direction of Leg:

Load Case	Support Joint	Origin Joint	Leg Member	Force In Leg Dir. (kips)	Residual Perpendicular To Leg (kips)	Residual Shear Horizontal To Leg - Res. (kips)	Residual Shear Horizontal To Leg - Res. (kips)	Residual Shear Horizontal To Leg - Res. (kips)	Residual Shear Horizontal To Leg - Res. (kips)	Total Long. Force (kips)	Total Tran. Force (kips)	Total Vert. Force (kips)
LC1 100 mph wind no ice at the face (1.2D + 1.6W)	HP	G4S	g29P	300.691	17.820	17.842	17.842	-0.060	-32.57	0.06	299.45	
LC1 100 mph wind no ice at the face (1.2D + 1.6W)	H1	G41	g291	-130.329	9.890	9.900	8.308	5.384	-11.50	-10.91	-129.74	
LC1 100 mph wind no ice at the face (1.2D + 1.6W)	H2	G42	g292	-130.194	9.952	9.961	8.416	-5.330	-11.60	10.85	-129.60	
LC2 100 mph wind no ice at the apex (1.2D + 1.6W)	HP	G4S	g29P	-258.717	16.774	16.795	-16.794	0.059	29.46	-0.06	-257.58	
LC2 100 mph wind no ice at the apex (1.2D + 1.6W)	H1	G41	g291	149.376	9.429	9.438	-7.786	-5.334	11.44	11.67	148.78	
LC2 100 mph wind no ice at the apex (1.2D + 1.6W)	H2	G42	g292	149.510	9.478	9.487	-7.889	5.270	11.55	-11.61	148.91	
LC3 100 mph wind no ice parallel to the face (1.2D + 1.6W)	HP	G4S	g29P	13.386	4.938	4.938	0.151	4.936	-0.81	-4.94	13.36	
LC3 100 mph wind no ice parallel to the face (1.2D + 1.6W)	H1	G41	g291	-225.608	14.937	14.954	5.179	14.029	-10.70	-23.60	-224.61	
LC3 100 mph wind no ice parallel to the face (1.2D + 1.6W)	H2	G42	g292	252.391	14.985	15.002	-5.329	14.024	11.51	-24.73	251.36	
LC4 100 mph wind no ice at the face (0.9D + 1.6W)	HP	G4S	g29P	297.174	17.783	17.805	17.805	-0.059	-32.36	0.06	295.94	
LC4 100 mph wind no ice at the face (0.9D + 1.6W)	H1	G41	g291	-133.573	9.931	9.941	8.333	5.421	-11.60	-11.08	-132.98	
LC4 100 mph wind no ice at the face (0.9D + 1.6W)	H2	G42	g292	-133.471	9.992	10.001	8.440	-5.366	-11.71	11.03	-132.87	
LC5 100 mph wind no ice at the apex (0.9D + 1.6W)	HP	G4S	g29P	-261.893	16.820	16.841	-16.841	0.059	29.66	-0.06	-260.75	
LC5 100 mph wind no ice at the apex (0.9D + 1.6W)	H1	G41	g291	145.962	9.395	9.404	-7.770	-5.298	11.34	11.49	145.37	
LC5 100 mph wind no ice at the apex (0.9D + 1.6W)	H2	G42	g292	146.063	9.445	9.454	-7.872	5.235	11.45	-11.43	145.47	
LC6 100 mph wind no ice parallel to the face (0.9D + 1.6W)	HP	G4S	g29P	10.044	4.941	4.941	0.110	4.940	-0.60	-4.94	10.03	
LC6 100 mph wind no ice parallel to the face (0.9D + 1.6W)	H1	G41	g291	-228.794	14.982	15.000	5.200	14.070	-10.80	-23.77	-227.79	
LC6 100 mph wind no ice parallel to the face (0.9D + 1.6W)	H2	G42	g292	248.881	14.949	14.966	-5.309	13.993	11.40	-24.55	247.86	



LC7 60 mph wind 3/4" ice at the face (1.2D + 1.0Di + 1.0W)	HP	G4S	g29P	176.553	1.876	1.879	-1.878	-0.039	-6.80	0.04	176.43
LC7 60 mph wind 3/4" ice at the face (1.2D + 1.0Di + 1.0W)	H1	G41	g291	-28.818	15.133	15.150	9.379	11.898	-10.07	-13.09	-28.05
LC7 60 mph wind 3/4" ice at the face (1.2D + 1.0Di + 1.0W)	H2	G42	g292	-28.417	15.155	15.173	9.444	-11.876	-10.12	13.05	-27.65
LC8 60 mph wind 3/4" ice at the apex (1.2D + 1.0Di + 1.0W)	HP	G4S	g29P	-93.899	19.193	19.216	-19.216	0.031	23.78	-0.03	-92.84
LC8 60 mph wind 3/4" ice at the apex (1.2D + 1.0Di + 1.0W)	H1	G41	g291	106.408	6.653	6.660	1.356	6.520	1.27	-1.98	106.59
LC8 60 mph wind 3/4" ice at the apex (1.2D + 1.0Di + 1.0W)	H2	G42	g292	106.809	6.688	6.695	1.297	-6.568	1.33	2.01	106.99
LC9 60 mph wind 3/4" ice parallel to the face (1.2D + 1.0Di + 1.0W)	HP	G4S	g29P	39.924	10.888	10.901	-10.611	2.494	8.62	-2.49	40.40
LC9 60 mph wind 3/4" ice parallel to the face (1.2D + 1.0Di + 1.0W)	H1	G41	g291	-77.003	18.112	18.133	7.969	16.288	-9.84	-19.53	-76.02
LC9 60 mph wind 3/4" ice parallel to the face (1.2D + 1.0Di + 1.0W)	H2	G42	g292	156.397	3.392	3.396	2.632	-2.147	1.21	-4.51	156.36

EIA Sections Information:

Section Label	Top Z (ft)	Bottom Z (ft)	Joint Count	Member Count	Top Width (ft)	Bottom Width (ft)	Gross Area (ft^2)	Face Adjust Factor	Face Adjust Factor	Ar Adjust Factor	Dead Load
A	185.000	176.000	9	21	4.00	4.00	35.98	1.0000	1.0000	1.050	
B	176.000	146.670	21	54	4.00	6.50	153.89	1.0000	1.0000	1.050	
C	146.670	117.330	18	45	6.50	8.99	227.25	1.0000	1.0000	1.050	
D	117.330	88.000	15	36	8.99	11.49	300.45	1.0000	1.0000	1.050	
E	88.000	58.670	15	36	11.49	13.99	373.73	1.0000	1.0000	1.050	
F	58.670	29.330	15	36	13.99	16.49	447.16	1.0000	1.0000	1.050	
G	29.330	0.000	15	36	16.49	18.99	520.29	1.0000	1.0000	1.050	

Printed capacities do not include the strength factor entered for each load case. The Group Summary reports on the member and load case that resulted in maximum usage which may not necessarily be the same as that which produces maximum force.

Group Summary (Compression Portion):

Group Label	Group Desc.	Angle Type	Angle Size	Steel Strength (ksi)	Max Usage (%)	Max Use Comp. (%)	Comp. Control In Member	Comp. Force (kips)	Comp. Control Case	L/R Capacity (kips)	Comp. Shear Capacity (kips)	Comp. Bearing Capacity (kips)	RLX	RLY	RLZ	L/R	KL/R	Length (ft)	Curve No.	No. Of Bolts Comp.
IA	Leg	PIP	2 1/2" STD	50.0	3.84	3.84	g2P	-2.319	LC1 100	60.313	0.000	0.000	1.000	1.000	1.000	57.02	57.02	4.500	1	0
LB	Leg	PIP	4" STD	50.0	19.33	19.33	g8P	-24.686	LC1 100	127.707	0.000	0.000	1.000	1.000	1.000	38.90	38.90	4.895	1	0
LC	Leg	PIP	5" STD	50.0	31.23	31.23	g13P	-54.534	LC1 100	174.592	0.000	0.000	1.000	1.000	1.000	37.50	37.50	5.875	1	0
LD	Leg	PIP	6" STD	50.0	43.32	43.32	g17P	-97.232	LC1 100	224.474	0.000	0.000	1.000	1.000	1.000	39.15	39.15	7.341	1	0
LE	Leg	PIP	8" STD	50.0	44.50	44.50	g21P	-157.524	LC1 100	353.980	0.000	0.000	1.000	1.000	1.000	29.96	29.96	7.341	1	0
LF	Leg	PIP	10" STD	50.0	43.95	43.95	g25P	-225.651	LC1 100	513.392	0.000	0.000	1.000	1.000	1.000	24.01	24.01	7.341	1	0
LG	Leg	PIP	10" STD	50.0	56.85	56.85	g29P	-291.870	LC1 100	513.407	0.000	0.000	1.000	1.000	1.000	24.00	24.00	7.341	1	0
DA	Diagonal	SAE	1.5X1.5X0.1875	50.0	9.01	9.01	g322	-0.710	LC1 100	7.881	0.000	0.000	0.500	0.750	0.500	123.26	123.26	6.019	4	0
DB	Diagonal	SAE	2X2X0.1875	50.0	17.98	17.98	g441	-1.960	LC3 100	10.900	0.000	0.000	0.500	0.750	0.500	121.31	121.31	7.966	4	0
DC	Diagonal	SAE	2.5X2.5X0.1875	50.0	34.24	34.24	g541	-4.282	LC3 100	12.503	0.000	0.000	0.500	0.750	0.500	127.66	127.66	10.532	4	0
DD	Diagonal	SAE	3X3X0.1875	50.0	45.38	45.38	g621	-6.166	LC3 100	13.589	0.000	0.000	0.500	0.750	0.500	134.62	134.62	13.372	4	0
DE	Diagonal	SAE	3.5X3.5X0.25	50.0	44.95	44.95	g701	-9.531	LC3 100	21.202	0.000	0.000	0.500	0.750	0.500	134.19	134.19	15.522	4	0
DF	Diagonal	SAE	3.5X3.5X0.25	50.0	66.97	66.97	g781	-10.841	LC3 100	16.187	0.000	0.000	0.500	0.750	0.500	153.58	153.58	17.764	4	0
DG	Diagonal	SAE	4X4X0.25	50.0	57.43	57.43	g841	-11.640	LC6 100	20.267	0.000	0.000	0.500	0.750	0.500	147.05	147.05	19.485	4	0
HA	Horizontal	SAE	1.5X1.5X0.1875	50.0	5.58	5.58	g881	-0.249	LC2 100	4.467	0.000	0.000	1.000	1.000	1.000	163.72	163.72	3.998	4	0

Group Summary (Tension Portion):

Group Label	Group Desc.	Angle Type	Angle Size	Steel Strength (ksi)	Max Usage (%)	Max Use Tens. (%)	Tension Control In Member	Tension Force (kips)	Tension Control Case	Net Section Capacity (kips)	Tension Shear Capacity (kips)	Tension Bearing Capacity (kips)	Tension Rupture Capacity (kips)	Length (ft)	No. Of Bolts	No. Of Holes	Hole Diameter (in)
IA	Leg	PIP	2 1/2" STD	50.0	3.84	2.51	g2P	1.918	LC5 100	76.500	0.000	0.000	0.000	4.500	0	0	0.000
LB	Leg	PIP	4" STD	50.0	19.33	15.08	g8P	21.518	LC5 100	142.650	0.000	0.000	0.000	4.895	0	0	0.000
LC	Leg	PIP	5" STD	50.0	31.23	24.69	g13P	47.771	LC5 100	193.500	0.000	0.000	0.000	5.875	0	0	0.000
LD	Leg	PIP	6" STD	50.0	43.32	34.18	g17P	85.818	LC5 100	251.100	0.000	0.000	0.000	7.341	0	0	0.000
LE	Leg	PIP	8" STD	50.0	44.50	36.29	g21P	137.160	LC5 100	377.999	0.000	0.000	0.000	7.341	0	0	0.000
LF	Leg	PIP	10" STD	50.0	43.95	36.82	g25P	197.180	LC5 100	535.499	0.000	0.000	0.000	7.344	0	0	0.000
LG	Leg	PIP	10" STD	50.0	56.85	47.58	g29P	254.784	LC5 100	535.499	0.000	0.000	0.000	7.341	0	0	0.000
DA	Diagonal	SAE	1.5X1.5X0.1875	50.0	9.01	2.84	g322	0.676	LC5 100	23.850	0.000	0.000	0.000	6.019	0	0	0.000
DB	Diagonal	SAE	2X2X0.1875	50.0	17.98	6.08	g431	1.942	LC3 100	31.950	0.000	0.000	0.000	7.640	0	0	0.000
DC	Diagonal	SAE	2.5X2.5X0.1875	50.0	34.24	9.39	g55P	3.811	LC2 100	40.590	0.000	0.000	0.000	10.532	0	0	0.000
DD	Diagonal	SAE	3X3X0.1875	50.0	45.38	12.56	g611	6.158	LC3 100	49.050	0.000	0.000	0.000	12.854	0	0	0.000
DE	Diagonal	SAE	3.5X3.5X0.25	50.0	44.95	12.06	g691	9.174	LC3 100	76.050	0.000	0.000	0.000	14.974	0	0	0.000
DF	Diagonal	SAE	3.5X3.5X0.25	50.0	66.97	14.09	g791	10.719	LC6 100	76.050	0.000	0.000	0.000	17.764	0	0	0.000
DG	Diagonal	SAE	4X4X0.25	50.0	57.43	13.22	g851	11.538	LC3 100	87.300	0.000	0.000	0.000	19.485	0	0	0.000
HA	Horizontal	SAE	1.5X1.5X0.1875	50.0	5.58	1.05	g881	0.251	LC4 100	23.850	0.000	0.000	0.000	3.998	0	0	0.000

\*\*\* Maximum Stress Summary for Each Load Case

Summary of Maximum Usages by Load Case:

	Load Case	Maximum Usage %	Element Label	Element Type
	LC1 100 mph wind no ice at the face (1.2D + 1.6W)	61.20	g782	Angle
	LC2 100 mph wind no ice at the apex (1.2D + 1.6W)	57.17	g792	Angle
	LC3 100 mph wind no ice parallel to the face (1.2D + 1.6W)	66.97	g781	Angle
	LC4 100 mph wind no ice at the face (0.9D + 1.6W)	61.16	g782	Angle
	LC5 100 mph wind no ice at the apex (0.9D + 1.6W)	57.13	g792	Angle
	LC6 100 mph wind no ice parallel to the face (0.9D + 1.6W)	66.94	g781	Angle
	LC7 60 mph wind 3/4" ice at the face (1.2D + 1.0Di + 1.0W)	35.54	g842	Angle
	LC8 60 mph wind 3/4" ice at the apex (1.2D + 1.0Di + 1.0W)	35.89	g852	Angle
	LC9 60 mph wind 3/4" ice parallel to the face (1.2D + 1.0Di + 1.0W)	39.17	g841	Angle

\*\*\* Weight of structure (lbs):  
Weight of Angles\*Section DLF: 25157.5  
Total: 25157.5

\*\*\* End of Report