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GRAFTON, MA

STRUCTURAL ANALYSIS REPORT

For

4WL0968A

LELAND HILL WATER TANK

29 Leland Hill Road
Grafton, MA 01757

Antennas on New FRP Enclosed Steel Lattice Structure on Water Tank Lid; Equipment on Concrete Pad on Ground

Prepared for:

CENTERLINE COMMUNICATIONS

T-Mobile

Dated: February 6, 2017

Prepared by:

Hudson Design Group LLC

COMMONWEALTH OF MASSACHUSETTS
DANIEL P. HAMM
CIVIL
No. 40720
REGISTERED PROFESSIONAL ENGINEER

2-6-2017

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Hudson Design Group LLC

SCOPE OF WORK:

Hudson Design Group LLC (HDG) has been authorized by T-Mobile to conduct a structural evaluation of the structure supporting the proposed T-Mobile equipment located in the areas depicted in the latest HDG's Construction Drawings.

This report represents this office's findings, conclusions and recommendations pertaining to the support of T-Mobile's proposed equipment.

HDG's sub-consultant, ProVertic LLC, performed an on-site visual survey and mapping of the existing water tank on January 18, 2017.

CONCLUSION SUMMARY:

Water tank plans were not available and could not bet obtained for our use. A limited visual survey of the structure was completed in or near the areas of the proposed work.

Based on our evaluation, we have determined that the existing structure **IS CAPABLE** of supporting the proposed equipment loading within or near the proposed locations.

APPURTENANCE/EQUIPMENT CONFIGURATION:

(3) CMA-BDHH/6521/E0-6/RMU/TB05 Antennas (81.1"x14.7"x5.2" - Wt. = 62 lbs. /each)

(3) LNX-6515DS-A1M Antennas (96.6"x11.9"x7.1" – Wt. = 44 lbs/each)

(3) Future Antennas (81.1"x14.7"x5.2" - Wt. = 62 lbs. /each)

(9) RRUS-11 RRH's (19.7"x17"x7.2" – Wt. = 51 lbs/each)

(1) SP2-5.2 Microwave Dish (24"ø - Wt. = 26 lbs. /each)

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DESIGN CRITERIA:

1. Massachusetts State Building code, 8th edition and ASCE 7-05, Minimum Design Loads for Buildings and Other Structures:

   Wind Analysis:

Reference Wind Speed:	100 mph	(780 CMR 1604.10)
Exposure Category:	B	(ASCE 7-05 Section 6.5.6.3)

2. EIA/TIA -222- G Structural Standards for Steel Antenna Towers and Antenna Supporting Structures:

Town/City:	Grafton
County:	Worcester
Wind Load:	105 mph
Ice Thickness:	1 inch

3. Approximate height above grade to the centerline of the antennas:

   65'-0"+/-

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ANTENNA/RRH SUPPORT RECOMMENDATIONS:

The new antennas and RRH's are proposed to be mounted on a new steel lattice structure secured to the top of the water tank by way of capacitor discharge (CD) stud welding. The structure is to be shrouded within a cylindrical FRP enclosure to reduce wind load.

EQUIPMENT SUPPORT RECOMMENDATIONS:

The new equipment cabinets are proposed to be mounted on a new concrete pad at ground level.

Limitations and assumptions:

1. Reference the latest HDG construction drawings for all the equipment locations details.
2. Mount all equipment per manufacturer's specifications.
3. All structural members and their connections are assumed to be in good condition and are free from defects with no deterioration to its member capacities.
4. All antennas, coax cables and waveguide cables are assumed to be properly installed and supported as per the manufacturer requirements.
5. HDG is not responsible for any modifications completed prior to and hereafter which HDG was not directly involved.
6. HDG did not perform a condition assessment on the water tank. HDG is under the assumption that the tank has been constructed properly and is in good condition.
7. If field conditions differ from what is assumed in this report, then the engineer of record is to be notified as soon as possible.

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FIELD PHOTOS:

Photo 1: Sample photo illustrating the existing water tank lid where the new lattice tower will be located.

Photo 2: Sample photo illustrating the existing compound where the new T-Mobile equipment pad will be located.

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Calculations

Date: 02-03-2017
Project Name: Leland Hill Water Tank
Project Number: 4WL0968A
Designed By: GH Checked By: MSC

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Wind Analysis → Antenna Enclosure

Reference Codes:

-*Massachusetts State Building Code, 8 th Edition*

-*International Building Code 2009 (IBC 2009)*

-*Minimum Design Loads for Buildings and Other Structures (ASCE 7-05)*

Structure Classification		II		(ASCE 7-05 Table 1-1)
Basic Wind Speed, V		100	mph	(MSBS Table 1604.10)
Importance Factor, I		1		(ASCE 7-05 Table 6-1)
Exposure Category		B		(ASCE 7-05 Section 6.5.6.3)
Height Above Ground Level, z		70	ft	(Top of Enclosure)
Exposure Coeficient, K_z		0.89		(ASCE 7-05 Table 6-3)
Wind Directionality Coef., K_d		0.95		(ASCE 7-05 Table 6-4)
Topographic Facto, K_{zt}		1.00		(ASCE 7-05 Section 6.5.7.2)
Velocity Pressure, q_z	$= 0.00256K_zK_{zt}K_dV^2I$			(ASCE 7-05 Equation 6-15)
	= **21.64** psf			
Gust Factor, G		0.85		(ASCE 7-05 Section 6.5.8)
Net Force Coeficient, C_f		0.50		(ASCE 7-05 Figure 6.21)
Projected Area Normal to Wind, A_f		140	ft^2	(14 ft. W x 10 ft. H)
Wind Force, F	$= q_zGC_fA_f$			(ASCE 7-05 Equation 6-28)
	= **1287.87** lbs			

ICE WEIGHT CALCULATIONS

Project: 4WL0968A

Thickness of ice:	1	in.
Density of ice:	56	pcf

Enclosure

Per foot weight of ice:		
diameter (in):	168	
hieght (ft):	10	
Per foot weight of ice on object:		205 plf
Total weight of ice on object:		2054 lbs

2-7/8" Pipe

Per foot weight of ice:		
diameter (in):	2.38	
Per foot weight of ice on object:		3 plf

Bentley

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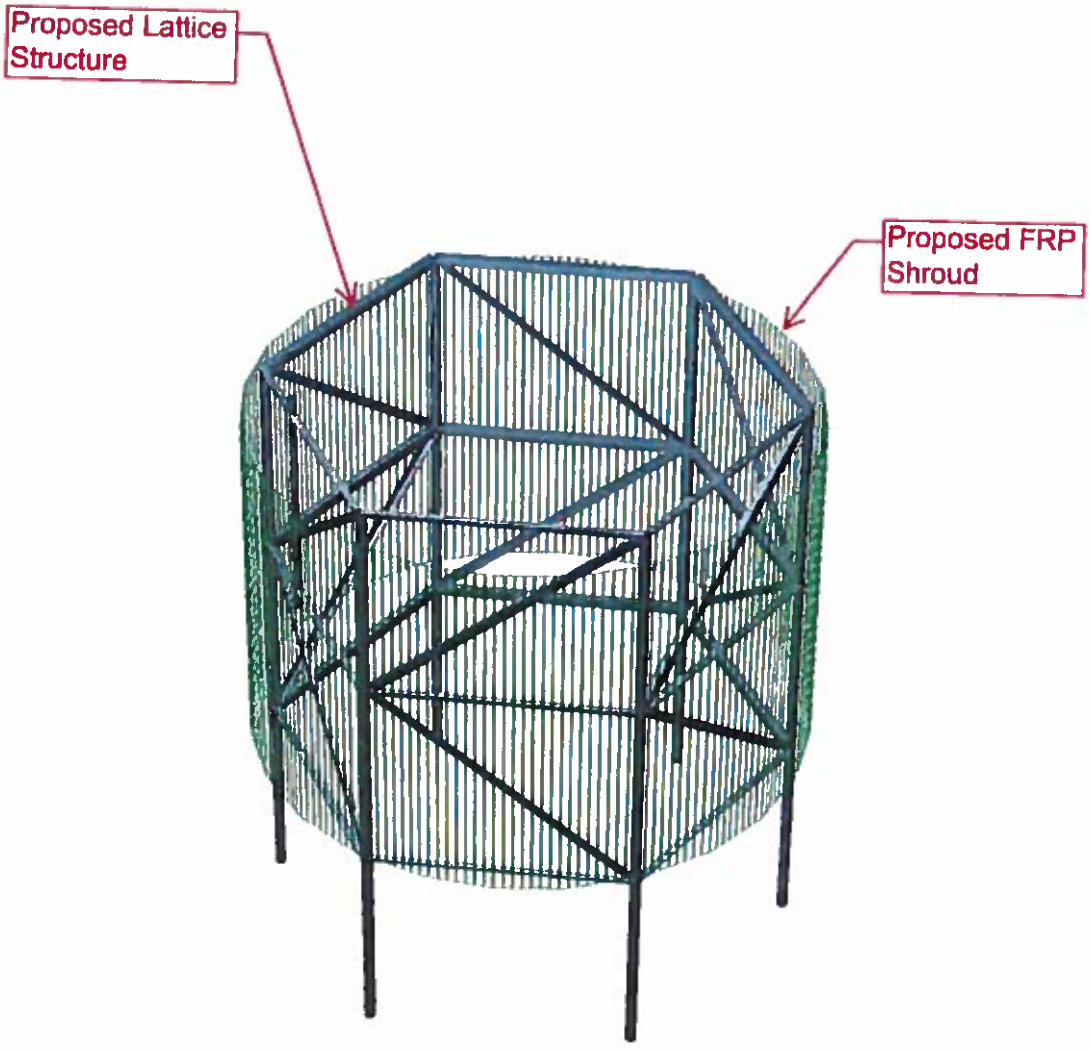

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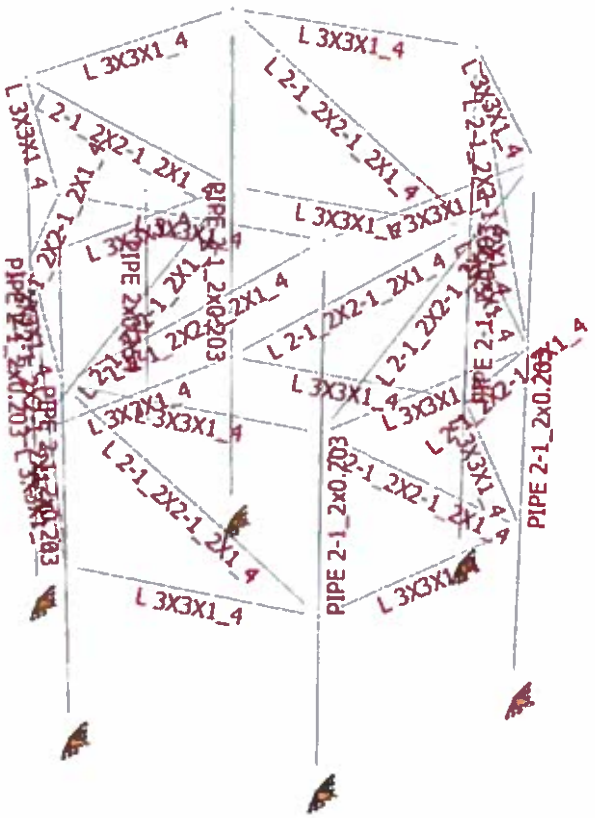

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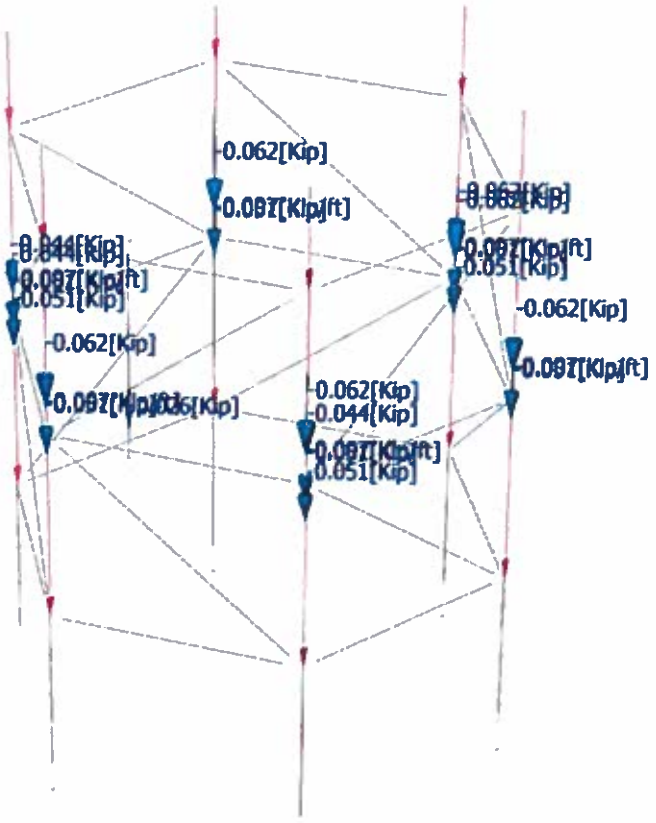
Load condition: DL=Dead Load

Loads

- Global distributed - Members
- Local distributed - Members
- Concentrated - Members



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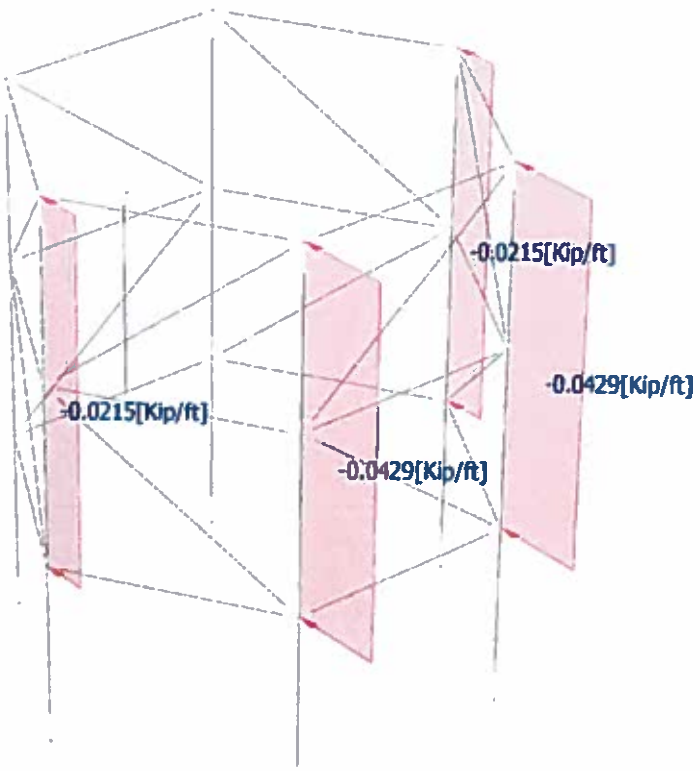
Load condition: W=Wind Load

Loads

Global distributed - Members
Local distributed - Members



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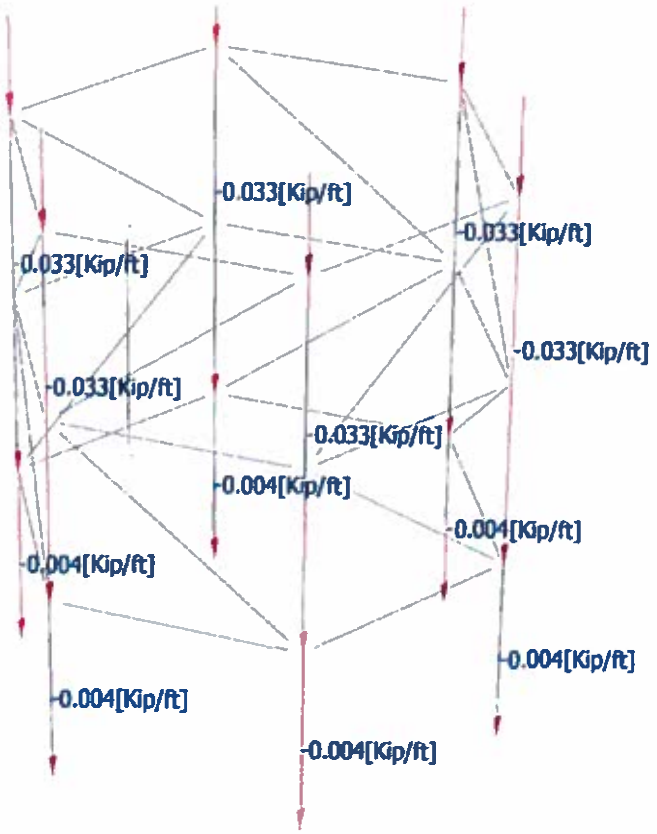
Load condition: 1=Ice Load



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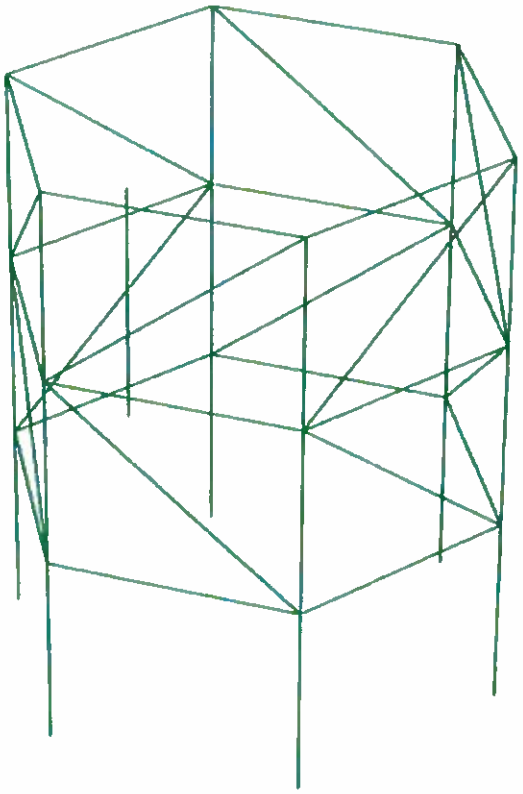
Design status

- Not designed
- Error on design
- Design O.K.
- With warnings



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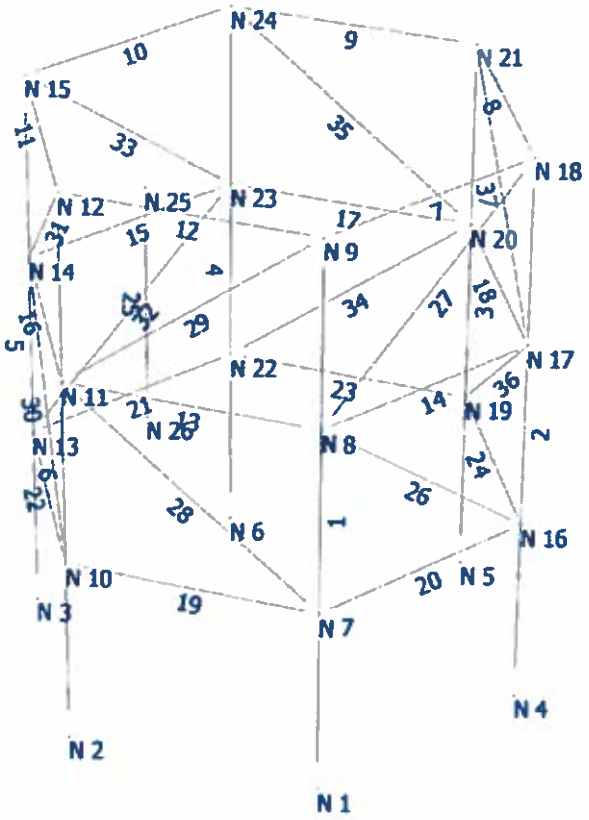

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Steel Code Check

Report: Summary - For all selected load conditions

Load conditions to be included in design :

LC1=1.2DL+1.6W
LC2=0.9DL+1.6W
LC3=1.2DL+W+I
LC4=1.2DL
LC5=0.9DL

Description	Section	Member	Ctrl Eq.	Ratio	Status	Reference
	L 2-1_2X2-1_2X1_4	26	LC1 at 0.00%	0.46	OK	Eq. H1-1b
			LC2 at 0.00%	0.46	OK	Eq. H1-1b
			LC3 at 0.00%	0.28	OK	Eq. H1-1b
			LC4 at 0.00%	0.03	OK	Eq. H1-1b
			LC5 at 0.00%	0.02	OK	Eq. H1-1b
		27	LC1 at 100.00%	0.08	OK	Eq. H1-1b
			LC2 at 100.00%	0.08	OK	Eq. H1-1b
			LC3 at 100.00%	0.06	OK	Eq. H1-1b
			LC4 at 0.00%	0.03	OK	Eq. H1-1b
			LC5 at 0.00%	0.02	OK	Eq. H1-1b
		28	LC1 at 50.00%	0.07	OK	Eq. H1-1b
			LC2 at 50.00%	0.06	OK	Eq. H1-1b
			LC3 at 50.00%	0.06	OK	Eq. H1-1b
			LC4 at 50.00%	0.04	OK	Eq. H1-1b
			LC5 at 50.00%	0.03	OK	Eq. H1-1b
		29	LC1 at 0.00%	0.41	OK	Eq. H1-1b
			LC2 at 0.00%	0.41	OK	Eq. H1-1b
			LC3 at 0.00%	0.24	OK	Eq. H1-1b
			LC4 at 0.00%	0.03	OK	Eq. H1-1b
			LC5 at 0.00%	0.03	OK	Eq. H1-1b
		30	LC1 at 0.00%	0.30	OK	Eq. H1-1b
			LC2 at 0.00%	0.31	OK	Eq. H1-1b
			LC3 at 0.00%	0.18	OK	Eq. H1-1b
			LC4 at 0.00%	0.03	OK	Eq. H1-1b
			LC5 at 0.00%	0.02	OK	Eq. H1-1b
		31	LC1 at 0.00%	0.27	OK	Eq. H1-1b
			LC2 at 0.00%	0.26	OK	Eq. H1-1b
			LC3 at 0.00%	0.18	OK	Eq. H1-1b
			LC4 at 0.00%	0.03	OK	Eq. H1-1b
			LC5 at 0.00%	0.02	OK	Eq. H1-1b
		32	LC1 at 0.00%	0.46	OK	Eq. H1-1b
			LC2 at 0.00%	0.45	OK	Eq. H1-1b
			LC3 at 0.00%	0.29	OK	Eq. H1-1b
			LC4 at 0.00%	0.03	OK	Eq. H1-1b
			LC5 at 0.00%	0.02	OK	Eq. H1-1b
		33	LC1 at 0.00%	0.13	OK	Eq. H1-1b
			LC2 at 0.00%	0.13	OK	Eq. H1-1b

		LC3 at 0.00%	0.09	OK	Eq. H1-1b
		LC4 at 0.00%	0.03	OK	Eq. H1-1b
		LC5 at 0.00%	0.02	OK	Eq. H1-1b
	34	LC1 at 0.00%	**0.19**	**OK**	Sec. E1
		LC2 at 0.00%	0.19	OK	Sec. E1
		LC3 at 0.00%	0.12	OK	Sec. E1
		LC4 at 50.00%	0.05	OK	Eq. H1-1b
		LC5 at 50.00%	0.03	OK	Eq. H1-1b
	35	LC1 at 100.00%	**0.12**	**OK**	Eq. H1-1b
		LC2 at 100.00%	0.12	OK	Eq. H1-1b
		LC3 at 100.00%	0.08	OK	Eq. H1-1b
		LC4 at 0.00%	0.03	OK	Eq. H1-1b
		LC5 at 0.00%	0.02	OK	Eq. H1-1b
	36	LC1 at 0.00%	**0.41**	**OK**	Eq. H1-1a
		LC2 at 0.00%	0.41	OK	Eq. H1-1a
		LC3 at 0.00%	0.21	OK	Eq. H1-1b
		LC4 at 0.00%	0.03	OK	Eq. H1-1b
		LC5 at 0.00%	0.02	OK	Eq. H1-1b
	37	LC1 at 100.00%	0.12	OK	Eq. H1-1b
		LC2 at 100.00%	**0.13**	**OK**	Eq. H1-1b
		LC3 at 93.75%	0.07	OK	Eq. H1-1b
		LC4 at 0.00%	0.03	OK	Eq. H1-1b
		LC5 at 0.00%	0.02	OK	Eq. H1-1b
L 3X3X1_4	7	LC1 at 0.00%	0.29	OK	Eq. H1-1b
		LC2 at 0.00%	**0.30**	**OK**	Eq. H1-1b
		LC3 at 0.00%	0.18	OK	Eq. H1-1b
		LC4 at 0.00%	0.02	OK	Eq. H1-1b
		LC5 at 0.00%	0.02	OK	Eq. H1-1b
	8	LC1 at 100.00%	**0.23**	**OK**	Eq. H1-1b
		LC2 at 100.00%	0.23	OK	Eq. H1-1b
		LC3 at 100.00%	0.15	OK	Eq. H1-1b
		LC4 at 0.00%	0.02	OK	Eq. H1-1b
		LC5 at 0.00%	0.02	OK	Eq. H1-1b
	9	LC1 at 0.00%	**0.27**	**OK**	Eq. H1-1b
		LC2 at 0.00%	0.27	OK	Eq. H1-1b
		LC3 at 0.00%	0.18	OK	Eq. H1-1b
		LC4 at 0.00%	0.02	OK	Eq. H1-1b
		LC5 at 0.00%	0.02	OK	Eq. H1-1b
	10	LC1 at 87.50%	0.16	OK	Eq. H1-1b
		LC2 at 100.00%	**0.16**	**OK**	Eq. H1-1b
		LC3 at 68.75%	0.10	OK	Eq. H1-1b
		LC4 at 100.00%	0.02	OK	Eq. H1-1b
		LC5 at 100.00%	0.02	OK	Eq. H1-1b
	11	LC1 at 100.00%	**0.25**	**OK**	Eq. H1-1b
		LC2 at 100.00%	0.25	OK	Eq. H1-1b
		LC3 at 100.00%	0.16	OK	Eq. H1-1b
		LC4 at 0.00%	0.02	OK	Eq. H1-1b
		LC5 at 0.00%	0.02	OK	Eq. H1-1b
	12	LC1 at 0.00%	**0.43**	**OK**	Eq. H1-1b
		LC2 at 0.00%	0.42	OK	Eq. H1-1b
		LC3 at 0.00%	0.28	OK	Eq. H1-1b
		LC4 at 0.00%	0.03	OK	Eq. H1-1b
		LC5 at 0.00%	0.02	OK	Eq. H1-1b

13	LC1 at 100.00%	0.31	OK	Eq. H1-1b
	LC2 at 100.00%	0.30	OK	Eq. H1-1b
	LC3 at 100.00%	0.20	OK	Eq. H1-1b
	LC4 at 100.00%	0.03	OK	Eq. H1-1b
	LC5 at 100.00%	0.02	OK	Eq. H1-1b
14	LC1 at 0.00%	0.24	OK	Eq. H1-1b
	LC2 at 0.00%	0.24	OK	Eq. H1-1b
	LC3 at 0.00%	0.14	OK	Eq. H1-1b
	LC4 at 100.00%	0.02	OK	Eq. H1-1b
	LC5 at 100.00%	0.02	OK	Eq. H1-1b
15	LC1 at 18.75%	0.20	OK	Eq. H1-1b
	LC2 at 12.50%	0.20	OK	Eq. H1-1b
	LC3 at 37.50%	0.12	OK	Eq. H1-1b
	LC4 at 0.00%	0.02	OK	Eq. H1-1b
	LC5 at 0.00%	0.02	OK	Eq. H1-1b
16	LC1 at 100.00%	0.52	OK	Eq. H1-1b
	LC2 at 100.00%	0.52	OK	Eq. H1-1b
	LC3 at 100.00%	0.34	OK	Eq. H1-1b
	LC4 at 100.00%	0.03	OK	Eq. H1-1b
	LC5 at 100.00%	0.02	OK	Eq. H1-1b
17	LC1 at 0.00%	0.40	OK	Eq. H1-1b
	LC2 at 0.00%	0.40	OK	Eq. H1-1b
	LC3 at 0.00%	0.26	OK	Eq. H1-1b
	LC4 at 100.00%	0.02	OK	Eq. H1-1b
	LC5 at 100.00%	0.02	OK	Eq. H1-1b
18	LC1 at 0.00%	0.14	OK	Eq. H1-1b
	LC2 at 0.00%	0.14	OK	Eq. H1-1b
	LC3 at 0.00%	0.09	OK	Eq. H1-1b
	LC4 at 100.00%	0.02	OK	Eq. H1-1b
	LC5 at 100.00%	0.02	OK	Eq. H1-1b
19	LC1 at 50.00%	0.05	OK	Eq. H1-1b
	LC2 at 50.00%	0.04	OK	Eq. H1-1b
	LC3 at 50.00%	0.04	OK	Eq. H1-1b
	LC4 at 50.00%	0.03	OK	Eq. H1-1b
	LC5 at 50.00%	0.02	OK	Eq. H1-1b
20	LC1 at 100.00%	0.25	OK	Eq. H1-1b
	LC2 at 100.00%	0.25	OK	Eq. H1-1b
	LC3 at 100.00%	0.15	OK	Eq. H1-1b
	LC4 at 0.00%	0.02	OK	Eq. H1-1b
	LC5 at 0.00%	0.02	OK	Eq. H1-1b
21	LC1 at 0.00%	0.32	OK	Eq. H1-1b
	LC2 at 0.00%	0.33	OK	Eq. H1-1b
	LC3 at 0.00%	0.20	OK	Eq. H1-1b
	LC4 at 100.00%	0.02	OK	Eq. H1-1b
	LC5 at 100.00%	0.02	OK	Eq. H1-1b
22	LC1 at 0.00%	0.06	OK	Sec. E1
	LC2 at 0.00%	0.06	OK	Sec. E1
	LC3 at 50.00%	0.05	OK	Eq. H1-1b
	LC4 at 50.00%	0.03	OK	Eq. H1-1b
	LC5 at 50.00%	0.02	OK	Eq. H1-1b
23	LC1 at 100.00%	0.60	OK	Eq. H1-1b
	LC2 at 100.00%	0.59	OK	Eq. H1-1b

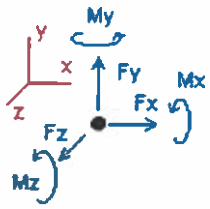
		LC3 at 100.00%	0.38	OK	Eq. H1-1b
		LC4 at 0.00%	0.02	OK	Eq. H1-1b
		LC5 at 0.00%	0.02	OK	Eq. H1-1b
	24	LC1 at 0.00%	0.94	OK	Eq. H1-1b
		LC2 at 0.00%	0.94	OK	Eq. H1-1b
		LC3 at 0.00%	0.58	OK	Eq. H1-1b
		LC4 at 0.00%	0.02	OK	Eq. H1-1b
		LC5 at 0.00%	0.02	OK	Eq. H1-1b
PIPE 2-1_2x0.203	1	LC1 at 66.67%	0.75	OK	Eq. H1-1b
		LC2 at 66.67%	0.75	OK	Eq. H1-1b
		LC3 at 66.67%	0.49	OK	Eq. H1-1b
		LC4 at 100.00%	0.08	OK	Sec. E1
		LC5 at 100.00%	0.06	OK	Sec. E1
	2	LC1 at 66.67%	0.78	OK	Eq. H1-1b
		LC2 at 66.67%	0.79	OK	Eq. H1-1b
		LC3 at 66.67%	0.49	OK	Eq. H1-1b
		LC4 at 100.00%	0.06	OK	Sec. E1
		LC5 at 100.00%	0.05	OK	Sec. E1
	3	LC1 at 66.67%	0.93	OK	Eq. H1-1b
		LC2 at 66.67%	0.92	OK	Eq. H1-1b
		LC3 at 66.67%	0.60	OK	Eq. H1-1b
		LC4 at 100.00%	0.08	OK	Sec. E1
		LC5 at 100.00%	0.06	OK	Sec. E1
	4	LC1 at 66.67%	0.77	OK	Eq. H1-1b
		LC2 at 66.67%	0.76	OK	Eq. H1-1b
		LC3 at 66.67%	0.49	OK	Eq. H1-1b
		LC4 at 100.00%	0.06	OK	Sec. E1
		LC5 at 100.00%	0.05	OK	Sec. E1
	5	LC1 at 66.67%	0.80	OK	Eq. H1-1b
		LC2 at 66.67%	0.79	OK	Eq. H1-1b
		LC3 at 66.67%	0.51	OK	Eq. H1-1b
		LC4 at 100.00%	0.08	OK	Sec. E1
		LC5 at 100.00%	0.06	OK	Sec. E1
	6	LC1 at 66.67%	0.82	OK	Eq. H1-1b
		LC2 at 66.67%	0.81	OK	Eq. H1-1b
		LC3 at 66.67%	0.52	OK	Eq. H1-1b
		LC4 at 100.00%	0.07	OK	Sec. E1
		LC5 at 100.00%	0.05	OK	Sec. E1
PIPE 2x0.154	25	LC1 at 90.63%	0.13	OK	Eq. H1-1b
		LC2 at 90.63%	0.13	OK	Eq. H1-1b
		LC3 at 90.63%	0.08	OK	Eq. H1-1b
		LC4 at 62.50%	0.03	OK	Eq. H1-1b
		LC5 at 62.50%	0.02	OK	Eq. H1-1b

Bentley

Current Date: 2/3/2017 4:34 PM
Units system: English
File name: W:\STRUCTURAL DEPARTMENT\ANALYSIS SOFTWARE\RAM Elements\RAM Projects\4WL0968A\4WL0968A (Shroud).etz\

Analysis result

Reactions



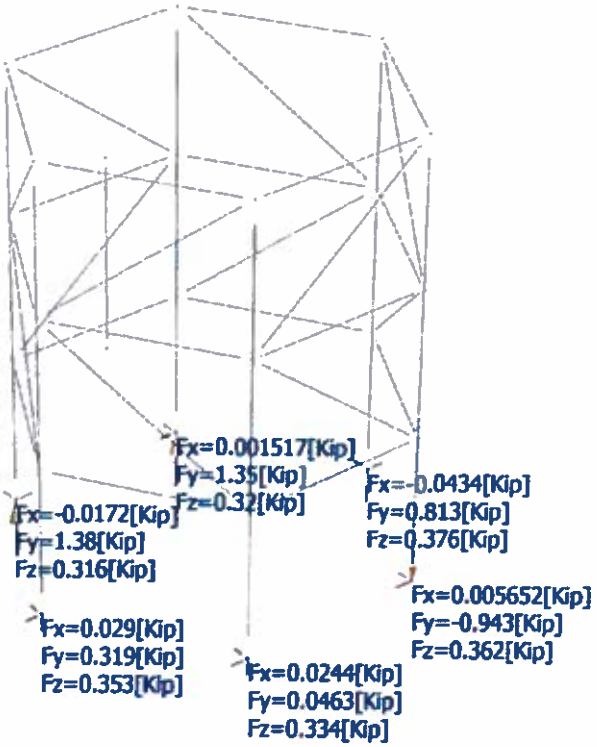
Direction of positive forces and moments

Node	Forces [Kip] FX	FY	FZ	Moments [Kip*ft] MX	MY	MZ
Condition LC1=1.2DL+1.6W						
1	0.02445	0.04632	0.33397	0.00000	0.00000	0.00000
2	0.02895	0.31897	0.35274	0.00000	0.00000	0.00000
3	-0.01716	1.37642	0.31567	0.00000	0.00000	0.00000
4	0.00565	-0.94303	0.36226	0.00000	0.00000	0.00000
5	-0.04341	0.81342	0.37596	0.00000	0.00000	0.00000
6	0.00152	1.34766	0.32020	0.00000	0.00000	0.00000
SUM	0.00000	2.95975	2.06080	0.00000	0.00000	0.00000
Condition LC2=0.9DL+1.6W						
1	0.02395	-0.09203	0.33366	0.00000	0.00000	0.00000
2	0.02882	0.20104	0.35296	0.00000	0.00000	0.00000
3	-0.01765	1.24828	0.31570	0.00000	0.00000	0.00000
4	0.00597	-1.05095	0.36266	0.00000	0.00000	0.00000
5	-0.04301	0.67391	0.37588	0.00000	0.00000	0.00000
6	0.00192	1.23956	0.31993	0.00000	0.00000	0.00000
SUM	0.00000	2.21982	2.06080	0.00000	0.00000	0.00000
Condition LC3=1.2DL+W+I						
1	0.01803	0.23646	0.20920	0.00000	0.00000	0.00000
2	0.01829	0.37625	0.22014	0.00000	0.00000	0.00000
3	-0.01000	1.05246	0.19725	0.00000	0.00000	0.00000
4	0.00305	-0.42751	0.22580	0.00000	0.00000	0.00000
5	-0.02772	0.71765	0.23510	0.00000	0.00000	0.00000
6	0.00034	1.00444	0.20051	0.00000	0.00000	0.00000
SUM	0.00000	2.95975	1.28800	0.00000	0.00000	0.00000
Condition LC4=1.2DL						
1	0.00201	0.55337	0.00124	0.00000	0.00000	0.00000
2	0.00051	0.47172	-0.00088	0.00000	0.00000	0.00000
3	0.00194	0.51254	-0.00011	0.00000	0.00000	0.00000
4	-0.00128	0.43168	-0.00162	0.00000	0.00000	0.00000
5	-0.00157	0.55804	0.00033	0.00000	0.00000	0.00000
6	-0.00162	0.43240	0.00105	0.00000	0.00000	0.00000
SUM	0.00000	2.95975	0.00000	0.00000	0.00000	0.00000

Condition LC5=0.9DL						
1	0.00151	0.41503	0.00093	0.00000	0.00000	0.00000
2	0.00039	0.35379	-0.00066	0.00000	0.00000	0.00000
3	0.00146	0.38440	-0.00008	0.00000	0.00000	0.00000
4	-0.00096	0.32376	-0.00122	0.00000	0.00000	0.00000
5	-0.00118	0.41853	0.00024	0.00000	0.00000	0.00000
6	-0.00121	0.32430	0.00078	0.00000	0.00000	0.00000
SUM	0.00000	2.21982	0.00000	0.00000	0.00000	0.00000

Bentley

Current Date: 2/3/2017 4:34 PM
Units system: English
File name: W:\STRUCTURAL DEPARTMENT\ANALYSIS SOFTWARE\RAM Elements\RAM Projects\4WL0968A\4WL0968A (Shroud).etz\
Load condition: LC1=1.2DL+1.6W



REACTIONS (WORST CASE)

Site Name:	Leland Hill Water Tank		
Site No.	4WL0968A		
Done by:	GH	**Checked by:**	MSC
Date:	02-06-2017		

CHECK BENDING ON THE WATER TANK:

*Water tank plans were not available. ProVertic conducted an on-site survey and mapping of the existing AT&T antenna mounts on January 18, 2017.

Lid Thickness, t_l	0.253	in.	
Assumed Effective Width, b	24	in.	
Span, L	30	in.	
Vertical Reaction, P	1380	lbs.	(See analysis results)

M_u = PL/4

= **10350.00 lb-in**

S = $(b \times t_l 2)/6$

= **0.256 in^3**

Z = $(b \times t_l 2)/4$

= **0.384 in^3**

ϕMn_z = 0.9 x 36000 psi x Z

= **12443.35 lb-in** ← CONTROLS

ϕMn_s = 36000 psi x 1.6 x S

= **13272.91 lb-in**

$\phi Mn_z > M_{max}$

12443.35 lb-in > 10350.00 lb-in OK !

Conclusion

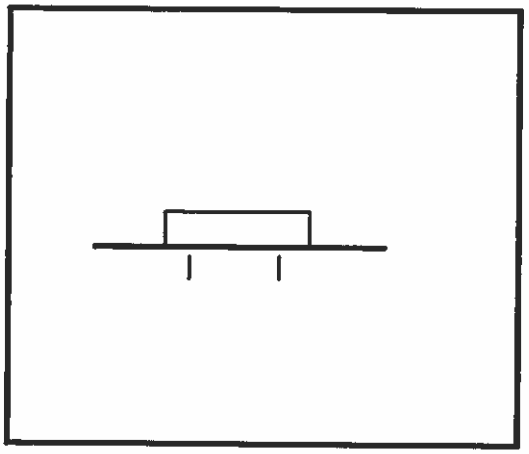
The water tank lid is capable of supporting the proposed loads.

Site Number: 4WL0968A
Site Name: Leland Hill Water Tank
Done by: GH **Checked by:** MSC
Date: 2/6/2017

CHECK STUD WELD CAPACITY

Reference: Cox Industries Stud Welding

Stud Material =	Low-Carbon Copper Flashed Steel
Stud Weld Size =	5/16-18 (Min.)
Ultimate Tensile Load =	3930 lbs.
Maximum Shear Load =	2948 lbs.
Safety Factor =	4



Allowable Tensile Load =

F_{Tall} = 982.5 lbs.

Allowable Shear Load =

F_{Vall} = 737 lbs.

TENSILE FORCES

Reaction f_t = 1380 lbs.

SHEAR FORCES

Reaction 317 lbs.

No. of Supports = 1
No. of Studs / Support = 4

Tension Design Load / Stud =

f_t = 345.00 lbs. < 982.5 lbs. **Therefore, OK !**

Shear Design Load / Stud=

f_v = 79.25 lbs. < 737 lbs. **Therefore, OK !**

CHECK COMBINED TENSION AND SHEAR

f_t / F_T	+	f_v / F_V	≤	1.0			
0.351	+	0.108	=	0.459	<	1.0	**Therefore, OK !**