STATE OF CONNECTICUT

CONNECTICUT SITING COUNCIL

Ten Franklin Square, New Britain, CT 06051

Phone: (860) 827-2935 Fax: (860) 827-2950

E-Mail: siting.council@ct.gov

www.ct.gov/csc

VIA ELECTRONIC MAIL

May 23, 2019

Kenneth C. Baldwin, Esq.
Robinson & Cole LLP
280 Trumbull Street
Hartford, CT 06103-3597

RE: **EM-VER-047-190403** – Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facilty located at 104 Prospect Hill Road, East Windsor, Connecticut.

Dear Attorney Baldwin:

The Connecticut Siting Council (Council) is in receipt of your correspondence of May 20, 2019, submitted in response to the Council's notification of an incomplete request for April 5, 2019 with regard to the above-referenced matter.

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

Thank you for your attention and cooperation.

Sincerely,

Melanie A. Bachman
Executive Director

MAB/IN/emr

Robidoux, Evan

From:	Dandeneau, Kathleen <KDANDENEAU@RC.com>
Sent:	Monday, May 20, 2019 3:06 PM
To:	Bachman, Melanie; CSC-DL Siting Council
Cc:	Baldwin, Kenneth; Mayo, Rachel
Subject:	EM-VER-047-190403 - 104 Prospect Hill Road, East Windsor, CT - Structural Analysis Report
Attachments:	East Windsor_001.pdf

The original has been mailed to the Siting Council.

Kathleen M. Dandeneau
Legal Administrative Assistant

Robinson & Cole LLP
280 Trumbull Street
Hartford, CT 06103
Direct 860 541 2689 | Fax 860 275 8299
kdandeneau@rc.com | www.rc.com

Robinson+Cole
Boston | Hartford | New York | Providence | Miami | Stamford
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Robinson+Cole

KENNETH C. BALDWIN

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Hartford, CT 06103-3597
Main (860) 275-8200
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Direct (860) 275-8345

Also admitted in Massachusetts

May 20, 2019

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

Re: **EM-VER-047-190403 – Cellco Partnership d/b/a Verizon Wireless Notice of Intent to Modify an Existing Telecommunications Facility Located at 104 Prospect Hill Road, East Windsor, Connecticut**

Dear Ms. Bachman:

Pursuant to your request, enclosed is a copy of a Structural Analysis Report for the Connecticut Water Company tank at 104 Prospect Hill Road, East Windsor, CT. An electronic copy of this filing has also been sent to your office.

Please do not hesitate to contact me if you have any questions or need any additional information.

Sincerely,

Kenneth C. Baldwin

KCB/kmd
Enclosure

19387104-v1

STRUCTURAL ANALYSIS REPORT

FOR

EAST WINDSOR 2 CT
104 PROSPECT HILL RD
EAST WINDSOR, CT 06088

PREPARED FOR:

verizon

WIRELESS COMMUNICATIONS FACILITY
20 ALEXANDER DRIVE
WALLINGFORD, CT 06492

On Air Engineering, LLC
88 FOUNDRY POND ROAD
COLD SPRING, NY 10516
ONAIR@OPTONLINE.NET
201-456-4624

PBA ENGINEERING, P.C
Structural Engineers
12 KULICK ROAD
FAIRFIELD, NEW JERSEY 07004-3363
PHONE: (973) 276-1700
FAX: (973) 276-9766

PROJECT NO. N-517
DATE: 5/15/2019

CONTENTS

1. PURPOSE

The purpose of this analysis is to determine whether the existing water tank structure located at 104 Prospect Road, East Windsor, Connecticut, is adequate to support the proposed modifications to Verizon's antennas and equipment.

2. REFERENCES

1. Construction drawings prepared by On Air Engineering, LLC, dated May 4, 2019.

2. Existing tank elevation drawing prepared by Chicago Bridge & Iron Company, dated May 3, 1963. This document was provided by Verizon.

3. BUILDING CODES

1. 2018 Connecticut State Building Code

2. 2015 International Building Code

3. ASCE/SEI 7-10 (Minimum Design Loads for Buildings and Other Structures)

4. ANSI/AWWA D100-11 (Welded Carbon Steel Tanks for Water Storage)

4. EXISTING STRUCTURE & FIELD OBSERVATIONS

The existing water tank structure is 104.5 feet in height with a diameter of 65 feet. The tank consists of welded steel plates that vary in thickness from the base to the top of the tank. The roof consists of a parabolic dome structure consisting of welded steel plates. The antennas and equipment are currently supported by steel pipe posts supported by HSS outriggers fastened to the tank shell with welded studs. See construction documents referenced above for more detail on the existing support members.

On Air Engineering, LLC, performed an onsite visual review of the existing condition on September 21, 2018. The tank had been observed to be recently painted and generally appeared to be in good condition. The tank was observed to be supporting T-Mobile, AT&T, Sprint and municipal equipment in addition to the Verizon equipment.

5. PROPOSED VERIZON ANTENNA/EQUIPMENT CONFIGURATION

a. Relocate (6) existing antennas to "side-by-side" (SBS) mounting brackets (2 antennas per bracket located at each sector, using an existing pipe mast)

b. Existing (6) 'CDMA' antennas to remain (2 per sector)

c. Remove (3) 'PCS' antennas (1 per sector)

d. Replace (6) remote radio heads (RRH's) with (6) new "dual band" RRH's (2 per sector)

e. Remove (3) existing RRH's (1 per sector)

f. Existing (3) Raycap 'Upper' OVP's to remain (1 per sector)

6. RESULTS

1. Water Tank

The existing water tank weight without water is approximately 624,979 pounds. The Verizon equipment weight is approximately 5,070 pounds which is inclusive of all sectors with proposed changes. The combined weight of AT&T, T-Mobile and Sprint, using conservative values, is approximately 7,500 pounds. Thus, the gravity load is increased by 2.01 percent. If the tank were full then the gravity load percentage increase would be lower. The lateral forces applied from the tank and its contents are detailed in the attached calculations which indicate that seismic force controls rather than wind forces. The percentage increase in seismic lateral force applied from all of the existing carriers including Verizon's proposed changes is 0.15 percent.

2. Antenna/Equipment Mounts

Based on our analysis, the existing pipe posts supporting the antennas and equipment will be stressed to 31.2 percent of their capacity with the proposed modifications. The existing HSS outriggers supporting the existing pipe posts will be stressed to 7.4 percent of their capacity with the proposed modifications. The existing steel plate welded to the existing outriggers will be stressed to 9.1 percent of their capacity with the proposed modifications. The threaded studs welded to the existing tank supporting the existing plate will be stressed to 33.9 percent of their capacity with the proposed modifications.

7. CONCLUSION

According to the 2015 IBC/IEBC, which is referenced in the 2018 Connecticut Building Code, a 5% or less increase in gravity loads and 10% or less increase in lateral loads does not require an analysis of the existing water tank as stated in sections 707.2 and 807.5. Since the increase in each of those forces are less than 5 and 10 percent respectively, the existing water tank is found to be adequate to support the modifications to the Verizon equipment as stated in this report. The members supporting the telecommunications equipment were all found to be adequate to support the modifications as seen in the calculations.

This analysis is based on the information provided to our office and is assumed to correctly depict the existing condition. The existing water tank structure and foundation are assumed to be installed properly and in a professional manner per the original design documents. From the time the tank was initially constructed, it is assumed that the tank has undergone regular maintenance and will continue in the same manner.

Should you have any questions concerning the items contained within this report, please do not hesitate to contact our office.

Sincerely,
PBA ENGINEERING, P.C.

Paul C. Beck, P.E.
Connecticut Professional Engineer
License No: 12949

PCB/mf

L:\WP61\LTR\CELLULAR JOBS\N-517 Structural Analysis Report, Verizon, 104 Prospect Hill Rd., East Windsor, CT (Rev).docx

APPENDIX

(APPENDIX N) MUNICIPALITY - SPECIFIC STRUCTURAL DESIGN PARAMETERS												
				Wind Design Parameters								
Municipality	Ground Snow Load (psf)	MCE Spectral Accelerations (%g)		Ultimate Design Wind Speeds, V_{ult} (mph)			Nominal Design Wind Speeds, V_{asd} (mph)			Wind-Borne Debris Regions[1]		Hurricane-Prone Regions
		S_s	S_1	Risk Cat.I	Risk Cat.II	Risk Cat III-IV	Risk Cat. I	Risk Cat. II	Risk Cat. III-IV	Risk Cat. II & III except Occup I-2	Risk Cat III Occup I-2 & Risk Cat. IV	
East Hampton	30	0.177	0.062	120	130	140	93	101	108			Yes
East Hartford	30	0.180	0.064	115	125	135	89	97	105			Yes
East Haven	30	0.182	0.062	120	130	140	93	101	108		Type B	Yes
East Lyme	30	0.164	0.059	125	135	145	97	105	112	Type B	Type A	Yes
Easton	30	0.215	0.066	110	120	130	85	93	101			Yes
East Windsor	35	0.177	0.064	115	125	135	89	97	105			Yes
Ellington	35	0.176	0.064	115	125	135	89	97	105			Yes
Enfield	35	0.176	0.065	110	125	130	85	97	101			Yes
Essex	30	0.168	0.059	120	135	145	93	105	112		Type A	Yes
Fairfield	30	0.215	0.065	115	125	135	89	97	105		Type B	Yes
Farmington	35	0.183	0.064	115	125	135	89	97	105			Yes
Franklin	30	0.171	0.061	120	130	140	93	101	108		Type A	Yes
Glastonbury	30	0.180	0.063	115	125	135	89	97	105			Yes
Goshen	40	0.181	0.065	105	115	125	81	89	97			
Granby	35	0.176	0.065	110	120	130	85	93	101			Yes
Greenwich	30	0.259	0.070	110	120	130	85	93	101			Yes
Griswold	30	0.168	0.060	125	135	145	97	105	112		Type A	Yes
Groton	30	0.160	0.058	125	135	145	97	105	112	Type B	Type A	Yes
Guilford	30	0.176	0.061	120	130	140	93	101	108		Type B	Yes
Haddam	30	0.175	0.061	120	130	140	93	101	108			Yes
Hamden	30	0.185	0.063	115	125	135	89	97	105			Yes
Hampton	35	0.172	0.062	120	130	140	93	101	108			Yes
Hartford	30	0.181	0.064	115	125	135	89	97	105			Yes
Hartland	40	0.175	0.065	110	120	125	85	93	97			Yes
Harwinton	35	0.183	0.065	110	120	130	85	93	101			Yes
Hebron	30	0.177	0.063	120	130	140	93	101	108			Yes
Kent	40	0.188	0.065	105	115	120	81	89	93			
Killingly	40	0.171	0.062	120	130	140	93	101	108			Yes
Killingworth	30	0.173	0.061	120	130	140	93	101	108			Yes
Lebanon	30	0.173	0.062	120	130	140	93	101	108			Yes
Ledyard	30	0.163	0.059	125	135	145	97	105	112		Type A	Yes
Lisbon	30	0.169	0.061	125	135	145	97	105	112		Type A	Yes
Litchfield	40	0.184	0.065	110	120	125	85	93	97			Yes
Lyme	30	0.164	0.059	125	135	145	97	105	112		Type A	Yes
Madison	30	0.173	0.060	120	130	140	93	101	108		Type B	Yes
Manchester	30	0.178	0.064	115	125	135	89	97	105			Yes
Mansfield	35	0.173	0.062	120	130	140	93	101	108			Yes
Marlborough	30	0.177	0.062	120	130	140	93	101	108			Yes
Meriden	30	0.183	0.063	115	125	135	89	97	105			Yes
Middlebury	35	0.191	0.064	110	120	130	85	93	101			Yes
Middlefield	30	0.181	0.063	115	125	135	89	97	105			Yes
Middletown	30	0.180	0.063	115	130	135	89	101	105			Yes
Milford	30	0.194	0.063	115	125	135	89	97	105		Type B	Yes
Monroe	30	0.205	0.065	110	120	130	85	93	101			Yes

WIND LOAD ON TELECOM EQUIP.

MecaWind Pro v2.2.8.2 per ASCE 7-10

Developed by MECA Enterprises, Inc. Copyright www.mecaenterprises.com

Date	: 5/2/2019	Project No.	: N-517
Company Name	: PBA Engineering	Designed By	: WJZ
Address	: 12 Kulick Rd	Description	: Antenna Support
City	: Fairfield	Customer Name	: OAE
State	: NJ	Proj Location	: East Windsor, CT

File Location: C:\Users\BillZ\AppData\Roaming\MecaWind\Default.wnd

Input Parameters: Other Structures & Building Appurtances MWFRS (Ch 29)

Basic Wind Speed(V)	= 125.00 mph		
Structural Category	= II	Exposure Category	= C
Natural Frequency	= N/A	Flexible Structure	= No
Importance Factor	= 1.00	Kd Directional Factor	= 0.85
Alpha	= 9.50	Zg	= 900.00 ft
At	= 0.11	Bt	= 1.00
Am	= 0.15	Bm	= 0.65
Cc	= 0.20	l	= 500.00 ft
Epsilon	= 0.20	Zmin	= 15.00 ft
B - Horizontal Dim.	= 0.51 ft	Ht- Grade to Top of Sign	= 92.20 ft
W - Sign Depth	= 0.23 ft	S - Vertical Sign Dim.	= 6.41 ft
Bs- Ratio of B / S	= 0.08	Sh- Ratio of S / Ht	= 0.07
E - Solidity Ratio	= 100.00 %	Elb - Base Elevation	= .00 ft

Gust Factor Calculations

Gust Factor Category I Rigid Structures - Simplified Method
Gust1: For Rigid Structures (Nat. Freq.>1 Hz) use 0.85 = 0.85

Gust Factor Category II Rigid Structures - Complete Analysis

Zm:	0.6*Ht	= 55.32 ft
lzm:	Cc*(33/Zm)^0.167	= 0.18
Lzm:	l*(Zm/33)^Epsilon	= 554.43 ft
Q:	(1/(1+0.63*((B+Ht)/Lzm)^0.63))^0.5	= 0.91
Gust2:	0.925*((1+1.7*lzm*3.4*Q)/(1+1.7*3.4*lzm))	= 0.88

Gust Factor Summary
Not a Flexible Structure use the Lessor of Gust1 or Gust2 = 0.85

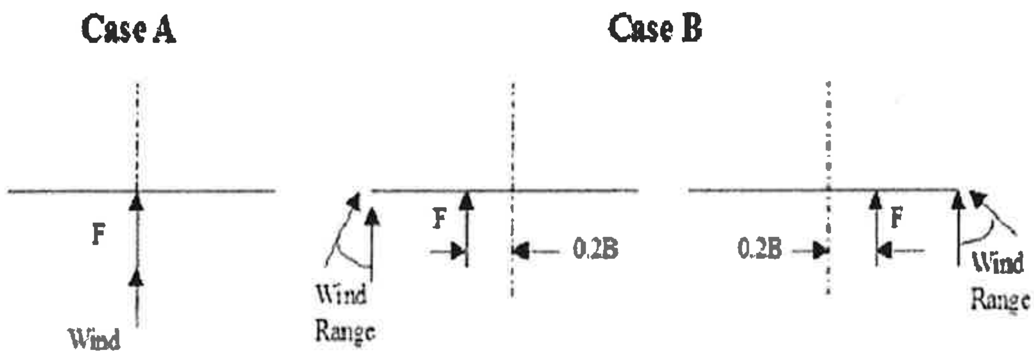
Design Wind Pressure - Other Structures

Elev ft	Kz	Kzt	qz psf	W_Pres_Cf(1.92) psf
92.20	1.24	1.00	42.302	69.04
91.00	1.24	1.00	42.185	68.85
90.00	1.24	1.00	42.087	68.69
89.00	1.23	1.00	41.988	68.52
88.00	1.23	1.00	41.888	68.36
87.00	1.23	1.00	41.788	68.20
86.00	1.23	1.00	41.686	68.03
85.00	1.22	1.00	41.584	67.86
84.00	1.22	1.00	41.480	67.70
83.00	1.22	1.00	41.376	67.53
82.00	1.21	1.00	41.270	67.35
81.00	1.21	1.00	41.164	67.18
80.00	1.21	1.00	41.056	67.00
79.00	1.20	1.00	40.948	66.83
78.00	1.20	1.00	40.838	66.65
77.00	1.20	1.00	40.727	66.47
76.00	1.19	1.00	40.615	66.28
75.00	1.19	1.00	40.502	66.10
74.00	1.19	1.00	40.388	65.91
73.00	1.18	1.00	40.272	65.72
72.00	1.18	1.00	40.156	65.53
71.00	1.18	1.00	40.038	65.34
70.00	1.17	1.00	39.918	65.15
69.00	1.17	1.00	39.797	64.95
68.00	1.17	1.00	39.675	64.75
67.00	1.16	1.00	39.552	64.55
66.00	1.16	1.00	39.427	64.34
65.00	1.16	1.00	39.300	64.14
64.00	1.15	1.00	39.172	63.93
63.00	1.15	1.00	39.043	63.72
62.00	1.14	1.00	38.911	63.50
61.00	1.14	1.00	38.778	63.29
60.00	1.14	1.00	38.644	63.07

59.00	1.13	1.00	38.507	62.84
58.00	1.13	1.00	38.369	62.62
57.00	1.12	1.00	38.228	62.39
56.00	1.12	1.00	38.086	62.16
55.00	1.12	1.00	37.942	61.92
54.00	1.11	1.00	37.796	61.68
53.00	1.11	1.00	37.647	61.44
52.00	1.10	1.00	37.497	61.19
51.00	1.10	1.00	37.344	60.94
50.00	1.09	1.00	37.188	60.69
49.00	1.09	1.00	37.031	60.43
48.00	1.08	1.00	36.870	60.17
47.00	1.08	1.00	36.707	59.91
46.00	1.07	1.00	36.541	59.64
45.00	1.07	1.00	36.373	59.36
44.00	1.06	1.00	36.201	59.08
43.00	1.06	1.00	36.026	58.79
42.00	1.05	1.00	35.848	58.50
41.00	1.05	1.00	35.667	58.21
40.00	1.04	1.00	35.482	57.91
39.00	1.04	1.00	35.293	57.60
38.00	1.03	1.00	35.101	57.28
37.00	1.03	1.00	34.904	56.96
36.00	1.02	1.00	34.703	56.64
35.00	1.01	1.00	34.498	56.30
34.00	1.01	1.00	34.288	55.96
33.00	1.00	1.00	34.073	55.61
32.00	1.00	1.00	33.853	55.25
31.00	0.99	1.00	33.628	54.88
30.00	0.98	1.00	33.397	54.50
29.00	0.98	1.00	33.159	54.12
28.00	0.97	1.00	32.915	53.72
27.00	0.96	1.00	32.664	53.31
26.00	0.95	1.00	32.405	52.89
25.00	0.95	1.00	32.139	52.45
24.00	0.94	1.00	31.864	52.00
23.00	0.93	1.00	31.580	51.54
22.00	0.92	1.00	31.286	51.06
21.00	0.91	1.00	30.981	50.56
20.00	0.90	1.00	30.664	50.04
19.00	0.89	1.00	30.335	49.51
18.00	0.88	1.00	29.991	48.95
17.00	0.87	1.00	29.633	48.36
16.00	0.86	1.00	29.257	47.75
15.00	0.85	1.00	28.862	47.10
14.00	0.85	1.00	28.862	47.10
13.00	0.85	1.00	28.862	47.10
12.00	0.85	1.00	28.862	47.10
11.00	0.85	1.00	28.862	47.10
10.00	0.85	1.00	28.862	47.10
9.00	0.85	1.00	28.862	47.10
8.00	0.85	1.00	28.862	47.10
7.00	0.85	1.00	28.862	47.10
6.00	0.85	1.00	28.862	47.10
5.00	0.85	1.00	28.862	47.10
4.00	0.85	1.00	28.862	47.10
3.00	0.85	1.00	28.862	47.10
2.00	0.85	1.00	28.862	47.10
1.00	0.85	1.00	28.862	47.10

Note: W_Pres_Cf is Wind Pressure based on Cf(Force Coefficient)

Figure 29.4-1: Wind Loads for Solid Signs & Freestanding Walls



Cf - Force Coefficient	=	1.92
Rd - Reduction Factor (1-(1-E)^1.5)	=	1.00
Kz	=	1.24
Kzt	=	1.00
Qz	=	42.30 psf
Wind Pressure at Elevation 92.20417 ft	=	69.04 psf

Notes: 1) Signs with openings comprising < 30% of gross area are considered solid signs
2) Force Coefficients for solid signs with openings shall be multiplied by Rd
3) Case C only applies when Bs >= 2

Project Title:
Engineer:
Project ID:
Project Descr:

Title Block Line 6

Printed: 2 MAY 2019, 11:13AM

Steel Beam

File = U:\Bill\N-517 East Windsor, CT Water Tank\N-517.ec6 .
Software copyright ENERCALC, INC. 1983-2018, Build:10.18.12.13 .

Lic. # : KW-06000304

Licensee : PBA ENGINEERING, P.C.

Description : Antenna Pipe Post

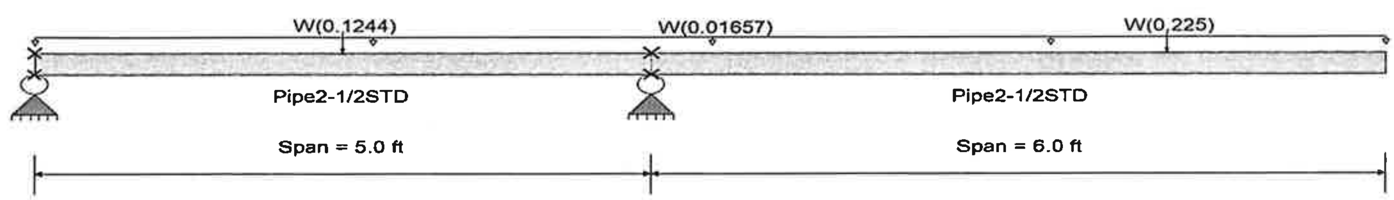
CODE REFERENCES

Calculations per AISC 360-10, IBC 2015, CBC 2016, ASCE 7-10
Load Combination Set : ASCE 7-10

Material Properties

Analysis Method : Allowable Strength Design
Beam Bracing : Completely Unbraced
Bending Axis : Major Axis Bending

Fy : Steel Yield : 35.0 ksi
E: Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Loads on all spans...
Uniform Load on ALL spans : W = 0.06904 ksf, Tributary Width = 0.240 ft

Load(s) for Span Number 1
Point Load : W = 0.1244 k @ 2.50 ft, (RRH)

Load(s) for Span Number 2
Point Load : W = 0.2250 k @ 4.20 ft, (Antenna)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.312** : 1	Maximum Shear Stress Ratio =	**0.021** : 1
Section used for this span	**Pipe2-1/2STD**	Section used for this span	**Pipe2-1/2STD**
Ma : Applied	0.746 k-ft	Va : Applied	0.2114 k
Mn / Omega : Allowable	2.393 k-ft	Vn/Omega : Allowable	10.123 k
Load Combination	+D+0.60W+H	Load Combination	+D+0.60W+H
Location of maximum on span	5.000ft	Location of maximum on span	5.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.926 in	Ratio =	155 >=120
Max Upward Transient Deflection	-0.064 in	Ratio =	934 >=120
Max Downward Total Deflection	0.556 in	Ratio =	259 >=120
Max Upward Total Deflection	-0.039 in	Ratio =	1557 >=120

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx	Vnx/Omega
+D+H													
Dsgn. L = 5.00 ft	1		0.000				4.00	2.39	1.00	1.00	-0.00	16.91	10.12
Dsgn. L = 6.00 ft	2		0.000				4.00	2.39	1.00	1.00	-0.00	16.91	10.12
+D+L+H													
Dsgn. L = 5.00 ft	1		0.000				4.00	2.39	1.00	1.00	-0.00	16.91	10.12
Dsgn. L = 6.00 ft	2		0.000				4.00	2.39	1.00	1.00	-0.00	16.91	10.12
+D+Lr+H													
Dsgn. L = 5.00 ft	1		0.000				4.00	2.39	1.00	1.00	-0.00	16.91	10.12
Dsgn. L = 6.00 ft	2		0.000				4.00	2.39	1.00	1.00	-0.00	16.91	10.12
+D+S+H													
Dsgn. L = 5.00 ft	1		0.000				4.00	2.39	1.00	1.00	-0.00	16.91	10.12
Dsgn. L = 6.00 ft	2		0.000				4.00	2.39	1.00	1.00	-0.00	16.91	10.12
+D+0.750Lr+0.750L+H													
Dsgn. L = 5.00 ft	1		0.000				4.00	2.39	1.00	1.00	-0.00	16.91	10.12
Dsgn. L = 6.00 ft	2		0.000				4.00	2.39	1.00	1.00	-0.00	16.91	10.12

Project Title:
Engineer:
Project ID:
Project Descr:

Title Block Line 6

Printed: 2 MAY 2019, 11:13AM

Steel Beam

File = U:\Bill\N-517 East Windsor, CT Water Tank\N-517.ec6
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Licensee : PBA ENGINEERING, P.C.

Description : Antenna Pipe Post

Load Combination Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
+D+0.750L+0.750S+H													
Dsgn. L = 5.00 ft	1		0.000				4.00	2.39	1.00	1.00	-0.00	16.91	10.12
Dsgn. L = 6.00 ft	2		0.000				4.00	2.39	1.00	1.00	-0.00	16.91	10.12
+D+0.60W+H													
Dsgn. L = 5.00 ft	1	0.312	0.021		-0.75	0.75	4.00	2.39	1.99	1.00	0.21	16.91	10.12
Dsgn. L = 6.00 ft	2	0.312	0.019		-0.75	0.75	4.00	2.39	1.00	1.00	0.19	16.91	10.12
+D+0.70E+H													
Dsgn. L = 5.00 ft	1		0.000				4.00	2.39	1.00	1.00	-0.00	16.91	10.12
Dsgn. L = 6.00 ft	2		0.000				4.00	2.39	1.00	1.00	-0.00	16.91	10.12
+D+0.750Lr+0.750L+0.450W+H													
Dsgn. L = 5.00 ft	1	0.234	0.016		-0.56	0.56	4.00	2.39	1.99	1.00	0.16	16.91	10.12
Dsgn. L = 6.00 ft	2	0.234	0.014		-0.56	0.56	4.00	2.39	1.00	1.00	0.15	16.91	10.12
+D+0.750L+0.750S+0.450W+H													
Dsgn. L = 5.00 ft	1	0.234	0.016		-0.56	0.56	4.00	2.39	1.99	1.00	0.16	16.91	10.12
Dsgn. L = 6.00 ft	2	0.234	0.014		-0.56	0.56	4.00	2.39	1.00	1.00	0.15	16.91	10.12
+D+0.750L+0.750S+0.5250E+H													
Dsgn. L = 5.00 ft	1		0.000				4.00	2.39	1.00	1.00	-0.00	16.91	10.12
Dsgn. L = 6.00 ft	2		0.000				4.00	2.39	1.00	1.00	-0.00	16.91	10.12
+0.60D+0.60W+0.60H													
Dsgn. L = 5.00 ft	1	0.312	0.021		-0.75	0.75	4.00	2.39	1.99	1.00	0.21	16.91	10.12
Dsgn. L = 6.00 ft	2	0.312	0.019		-0.75	0.75	4.00	2.39	1.00	1.00	0.19	16.91	10.12
+0.60D+0.70E+0.60H													
Dsgn. L = 5.00 ft	1		0.000				4.00	2.39	1.00	1.00	-0.00	16.91	10.12
Dsgn. L = 6.00 ft	2		0.000				4.00	2.39	1.00	1.00	-0.00	16.91	10.12

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
	1	0.0000	0.000	W Only	-0.0642	3.040
W Only	2	0.9259	6.000		0.0000	3.040

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Overall MAXimum	-0.145	0.677	
Overall MINimum	-0.065	0.305	
+D+H			
+D+L+H			
+D+Lr+H			
+D+S+H			
+D+0.750Lr+0.750L+H			
+D+0.750L+0.750S+H			
+D+0.60W+H	-0.087	0.406	
+D+0.70E+H			
+D+0.750Lr+0.750L+0.450W+H	-0.065	0.305	
+D+0.750L+0.750S+0.450W+H	-0.065	0.305	
+D+0.750L+0.750S+0.5250E+H			
+0.60D+0.60W+0.60H	-0.087	0.406	
+0.60D+0.70E+0.60H			
D Only			
Lr Only			
L Only			
S Only			
W Only	-0.145	0.677	
E Only			
H Only			

Project Title:
Engineer:
Project ID:
Project Descr:

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Steel Beam

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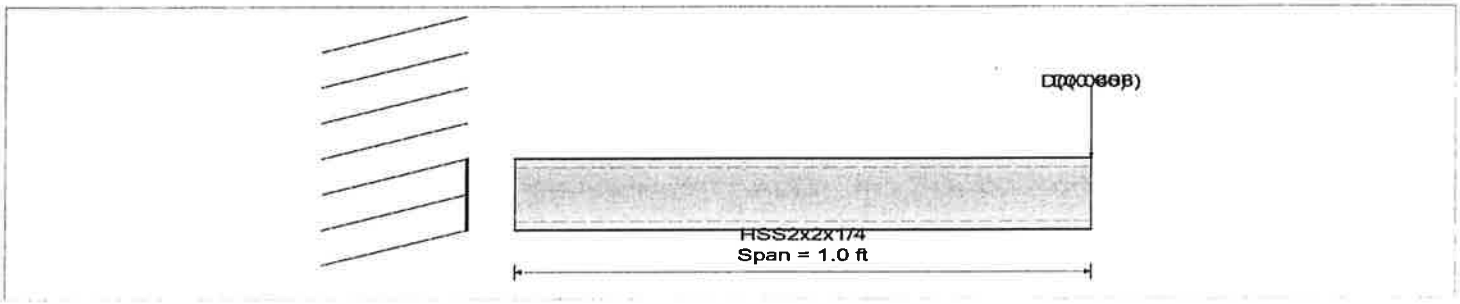
Description : HSS Outrigger

CODE REFERENCES

Calculations per AISC 360-10, IBC 2015, CBC 2016, ASCE 7-10
Load Combination Set : ASCE 7-10

Material Properties

Analysis Method :	Allowable Strength Design	Fy : Steel Yield :	46 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Load(s) for Span Number 1
Point Load : D = 0.06380 k @ 1.0 ft, (Pipe Post)

Point Load : D = 0.04060 k @ 1.0 ft, (Antenna)

Point Load : D = 0.060 k @ 1.0 ft, (RRH)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.074** : 1	Maximum Shear Stress Ratio =	**0.016** : 1
Section used for this span	**HSS2x2x1/4**	Section used for this span	**HSS2x2x1/4**
Ma : Applied	0.164 k-ft	Va : Applied	0.1644 k
Mn / Omega : Allowable	2.213 k-ft	Vn/Omega : Allowable	10.020 k
Load Combination	+D+H	Load Combination	+D+H
Location of maximum on span	0.000 ft	Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.000 in	Ratio =	0 <120
Max Upward Transient Deflection	0.000 in	Ratio =	0 <120
Max Downward Total Deflection	0.004 in	Ratio =	5502 >=120
Max Upward Total Deflection	0.000 in	Ratio =	0 <120

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx	Vnx/Omega
+D+H													
Dsgn. L = 1.00 ft	1	0.074	0.016		-0.16	0.16	3.70	2.21	1.00	1.00	0.16	16.73	10.02
+D+L+H													
Dsgn. L = 1.00 ft	1	0.074	0.016		-0.16	0.16	3.70	2.21	1.00	1.00	0.16	16.73	10.02
+D+Lr+H													
Dsgn. L = 1.00 ft	1	0.074	0.016		-0.16	0.16	3.70	2.21	1.00	1.00	0.16	16.73	10.02
+D+S+H													
Dsgn. L = 1.00 ft	1	0.074	0.016		-0.16	0.16	3.70	2.21	1.00	1.00	0.16	16.73	10.02
+D+0.750Lr+0.750L+H													
Dsgn. L = 1.00 ft	1	0.074	0.016		-0.16	0.16	3.70	2.21	1.00	1.00	0.16	16.73	10.02
+D+0.750L+0.750S+H													
Dsgn. L = 1.00 ft	1	0.074	0.016		-0.16	0.16	3.70	2.21	1.00	1.00	0.16	16.73	10.02
+D+0.60W+H													
Dsgn. L = 1.00 ft	1	0.074	0.016		-0.16	0.16	3.70	2.21	1.00	1.00	0.16	16.73	10.02
+D+0.70E+H													
Dsgn. L = 1.00 ft	1	0.074	0.016		-0.16	0.16	3.70	2.21	1.00	1.00	0.16	16.73	10.02
+D+0.750Lr+0.750L+0.450W+H													

Steel Beam

Description : HSS Outrigger

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
Dsgn. L = 1.00 ft	1	0.074	0.016		-0.16	0.16	3.70	2.21	1.00	1.00	0.16	16.73	10.02
+D+0.750L+0.750S+0.450W+H													
Dsgn. L = 1.00 ft	1	0.074	0.016		-0.16	0.16	3.70	2.21	1.00	1.00	0.16	16.73	10.02
+D+0.750L+0.750S+0.5250E+H													
Dsgn. L = 1.00 ft	1	0.074	0.016		-0.16	0.16	3.70	2.21	1.00	1.00	0.16	16.73	10.02
+0.60D+0.60W+0.60H													
Dsgn. L = 1.00 ft	1	0.045	0.010		-0.10	0.10	3.70	2.21	1.00	1.00	0.10	16.73	10.02
+0.60D+0.70E+0.60H													
Dsgn. L = 1.00 ft	1	0.045	0.010		-0.10	0.10	3.70	2.21	1.00	1.00	0.10	16.73	10.02

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
D Only	1	0.0044	1.000		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	0.164	
Overall MINimum	0.099	
+D+H	0.164	
+D+L+H	0.164	
+D+Lr+H	0.164	
+D+S+H	0.164	
+D+0.750Lr+0.750L+H	0.164	
+D+0.750L+0.750S+H	0.164	
+D+0.60W+H	0.164	
+D+0.70E+H	0.164	
+D+0.750Lr+0.750L+0.450W+H	0.164	
+D+0.750L+0.750S+0.450W+H	0.164	
+D+0.750L+0.750S+0.5250E+H	0.164	
+0.60D+0.60W+0.60H	0.099	
+0.60D+0.70E+0.60H	0.099	
D Only	0.164	
Lr Only		
L Only		
S Only		
W Only		
E Only		
H Only		

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– STEEL PLATE CHECK

APPLIED MOMENT = $\frac{PL}{4} = \frac{(677\#)(5'')}{4} = 846.25$ lb·in.

F_B (ALLOW.) = $0.66 F_y = 0.66(36000) = 23760$ PSI

F_B (APPLIED) = $\frac{M}{S} = \frac{(846.25 \text{ lb·in.})}{\left[\frac{(6'') \times (0.625'')^2}{6}\right]} = 2167$ PSI < 23760 PSI

OK

– THREADED STUD CHECK

REACTION FORCES @ PLATE:
AXIAL = 677 #
MOMENT = 1968 lb·in.

MAX TENSION FORCE @ BOLT:
$= \frac{677\#}{8 \text{ BOLTS}} + \frac{(1968 \text{ lb·in.})/(6'')}{2 \text{ TOP BOLTS}} = 249$ #/BOLT

ALLOW. BOLT TENSION = 0.38 (F_u)
= 0.38 (1934 #)
= 735 # ∴ 249 # < 735 #

OK

MAX SHEAR FORCE @ BOLT:
$= \frac{164\ \#}{8 \text{ BOLTS}} = 21$ #/BOLT

ALLOW. BOLT SHEAR = 0.2 (F_u)
= 0.2 (1934 #)
= 387 # ∴ 21 # < 387 #

OK

General Stud Specifications

Standard Arc Welding Studs (AWS Type A) —Tensile and Torque Strengths

Mild Steel – 61,000psi Minimum Ultimate, 49,000 psi Minimum Yield

Thread Diameter	META[1] (sq. in.)	Yield Load[2] (lbs.) at 49,000 psi	Ultimate Tensile Load (lbs) at 61,000 psi	Yield Torque[2] (ft-lbs) at 49,000 psi	Ultimate Torque (ft-lbs) at 61,000 psi	Shear Strength (75% of Tensile Strength)
10-24 UNC	0.0174	853	1,061	2.7	3.4	796
10-32 UNF	0.0199	975	1,214	3.1	3.8	910
1/4-20 UNC	0.0317	1,553	1,934	6.5	8.1	1,450
1/4-28 UNF	0.0362	1,774	2,208	7.4	9.2	1,656
5/16-18 UNC	0.0522	2,558	3,184	13.3	16.6	2,388
5/16-24 UNF	0.0579	2,837	3,532	14.8	18.4	2,649
3/8-16 UNC	0.0773	3,788	4,715	23.7	29.5	3,536
3/8-24 UNF	0.0876	4,292	5,344	26.8	33.4	4,008
7/16-14 UNC	0.1060	5,194	6,466	37.9	47.1	4,850
7/16-20 UNF	0.1185	5,807	7,229	42.3	52.7	5,421
1/2-13 UNC	0.1416	6,938	8,638	57.8	72.0	6,478
1/2-20 UNF	0.1597	7,825	9,742	65.2	81.2	7,306
5/8-11 UNC	0.2256	11,054	13,762	115.2	143.4	10,321
5/8-18 UNF	0.2555	12,520	15,586	130.4	162.3	11,689
3/4-10 UNC	0.3340	16,366	20,374	204.6	254.7	15,281
3/4-16 UNF	0.3724	18,248	22,716	228.1	284.0	17,037
7/8-9 UNC	0.4612	22,599	28,133	329.6	410.3	21,100
7/8-14 UNF	0.5088	24,931	31,037	363.6	452.6	23,278
1-8 UNC	0.6051	29,650	36,911	494.2	615.2	27,683
1-14 UNF	0.6791	33,276	41,425	554.6	690.4	31,069

*Torque figures based on assumption that excessive deformation of thread has not taken relationship between torque/tension out of its proportional range.

In actual practice, stud should not be used at its yield load. A factor of safety must be applied. It is generally recommended that studs not be used at more than 60% of yield strength, however, the factor of safety may vary up or down according to the particular application in which the studs are being used.

The user of these studs will make this determination.

	Ultimate Tensile	L = SA	Ultimate Torque	T = 0.2 x D x L ÷ 12
	Yield	Z = YA	Yield Torque	T = 0.2 x D x Z ÷ 12
Where	D =	Nominal Thread Diameter (in)	A =	Mean Effective Thread Area (META) (in²)
	S =	Tensile Stress (psi)	Y =	Yield Stress (psi)
	L =	Tensile Load (lbs)	Z =	Yield Load (lbs)
	T =	Torque (ft-lbs)		

1 META is used instead of root area in calculating screw lengths because of closer correlation with actual tensile strength. META is based on mean diameter, which is the diameter of an imaginary co-axial cylinder whose surface would pass through the thread profile approximately midway between the minor and pitch diameters.

2 In actual practice, stud should not be used at its yield load. A factor of safety must be applied. It is generally recommended that studs not be used at more than 60% of yield strength, however, the factor of safety may vary up or down according to the particular application in which the studs are being used. ***The user will make this safety factor determination.***

WIND LOAD ON WATER TANK

MecaWind Pro v2.2.8.2 per ASCE 7-10

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Date	: 5/3/2019	Project No.	: N-517
Company Name	: PBA Engineering	Designed By	: WJZ
Address	: 12 Kulick Rd	Description	: Water Tank
City	: Fairfield	Customer Name	: OAE
State	: NJ	Proj Location	: East Windsor, CT

File Location: C:\Users\BillZ\AppData\Roaming\MecaWind\Default.wnd

Input Parameters: Other Structures & Building Appurtances MWFRS (Ch 29)

Basic Wind Speed(V)	= 135.00 mph		
Structural Category	= IV	Exposure Category	= C
Natural Frequency	= N/A	Flexible Structure	= No
Importance Factor	= 1.00	Kd Directional Factor	= See Below
Alpha	= 9.50	Zg	= 900.00 ft
At	= 0.11	Bt	= 1.00
Am	= 0.15	Bm	= 0.65
Cc	= 0.20	l	= 500.00 ft
Epsilon	= 0.20	Zmin	= 15.00 ft

Gust Factor Calculations

Gust Factor Category I Rigid Structures - Simplified Method
Gust1: For Rigid Structures (Nat. Freq.>1 Hz) use 0.85 = 0.85

Gust Factor Category II Rigid Structures - Complete Analysis

Zm:	0.6*Ht	= 55.32 ft
lzm:	Cc*(33/Zm)^0.167	= 0.18
Lzm:	l*(Zm/33)^Epsilon	= 554.43 ft
Q:	(1/(1+0.63*((B+Ht)/Lzm)^0.63))^0.5	= 0.91
Gust2:	0.925*((1+1.7*lzm*3.4*Q)/(1+1.7*3.4*lzm))	= 0.88

Gust Factor Summary
Not a Flexible Structure use the Lessor of Gust1 or Gust2 = 0.85

Design Wind Pressure - Other Structures

Wind On Chimneys, Tanks, Rooftop Equip. & Similar Structures per Figure 29.5-2:

Elev ft	Kz	Kzt	Kd	qz psf	Pres psf
104.50	1.28	1.00	0.95	56.619	48.126

Top El ft	Btm El ft	Width ft	Type	Cf psf	Addl ft	Tot Wid ft	Shear Kip	Moment K-ft
104.50	.00	65.004		0.510	.000	33.158	166.8	8713.1

Notes:
- Top El = Top elevation of element under consideration relative to grade.
- Btm El = Top elevation of element under consideration relative to grade.
- Width = Dia of circular cross-section & least horizontal dim of square, hexagonal or octagonal cross section.
- Type = (1)Square-Wind on Face, (2)Square-Wind Along Diagonal, (3)Hexag. or Octag. (4)Round-Moderately Smooth, (5)Round-Rough, (6)Round-Very Rough
- Cf = Shape factor per Figure 6-21 based upon H/D ratio and Type selected.
- Addl = Additional Area (Piping, Ladders, platforms, etc..), Cf=1.0 is assumed.
- Tot Wid = Total Wind Width: Cf * Width + Addl
- Shear = Shear @ Btm: Press * Tot Wid + Shear(top)
- Moment = Mom @ Btm: Mom(Top)+Shear(Top)*(Top El-Btm El)+Shear(Btm)*(Top El-Btm El)/2

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SEISMIC LOAD CALCULATION (PER AWWA D100-11)

- SEISMIC USE GROUP = III (TABLE 24)
- IMPORTANCE FACTOR $I_E = 1.5$ (TABLE 24)
- SITE CLASS = D (TABLE 25)
- $S_S = 0.234$ (FIGURE 5)
- $S_1 = 0.064$ (FIGURE 6)
- $F_a = 1.6$ (TABLE 26)
- $F_v = 2.4$ (TABLE 27)
- RESPONSE MODIFICATION FACTORS: (TABLE 28)

  R_i (IMPULSIVE) = 2.5
  R_c (CONVECTIVE) = 1.5

- $S_{MS} = F_a S_S = (1.6)(0.234) = 0.374$ (FIGURE 13-5)
- $S_{M1} = F_v S_1 = (2.4)(0.064) = 0.154$ (FIGURE 13-6)
- $S_{DS} = \left(\frac{2}{3}\right) S_{MS} = \left(\frac{2}{3}\right)(0.374) = 0.250$ (EQ 13-7)
- $S_{D1} = \left(\frac{2}{3}\right) S_{M1} = \left(\frac{2}{3}\right)(0.154) = 0.102$ (EQ 13-8)

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- T_c (NATURAL PERIOD) (EQ 13-22)

$$= 2\pi \sqrt{\frac{D}{3.68\, g \tanh\left(\frac{3.68H}{D}\right)}}$$

$$= 2\pi \sqrt{\frac{65}{3.68(32.2) \tanh\left(\frac{3.68(93.5)}{65}\right)}}$$

$$= 4.654 \text{ SECONDS}$$

- $T_L = 6$ SECONDS (FIGURE 19)

- $S_{ac} = \frac{K S_{D1}}{T_c}$ FOR $T_c \leq T_L$ (EQ 13-13)

$$= \frac{(1.5)(0.102)}{4.654}$$

$$= 0.033$$

- A_i (IMPULSIVE DESIGN ACCELERATION) (EQ 13-17)

$$= \frac{S_{DS} I_E}{1.4 R_i}$$

$$= \frac{(0.250)(1.5)}{1.4(2.5)}$$

$$= 0.107$$

- A_c (CONVECTIVE DESIGN ACCELERATION) (EQ 13-18)

$$= \frac{S_{ac} I_E}{1.4 R_i}$$

$$= \frac{(0.033)(1.5)}{(1.4)(2.5)}$$

$$= 0.014$$

- $D/H = (65'/93.5') = 0.695$

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- W_T (WEIGHT OF TANK CONTENTS) (EQ 13-27)

$$= 49\,GHD^2$$
$$= 49(1.0)(93.5)(65)^2$$
$$= 19356.838 \text{ KIPS}$$

- W_i (EFFECTIVE IMPULSE WEIGHT) (EQ 13-25)

$$= \frac{\tanh\left(\frac{0.866D}{H}\right)W_T}{\left(\frac{0.866D}{H}\right)} \quad \text{FOR } \frac{D}{H} < 1.333$$
$$= \frac{\tanh\left(\frac{0.866(65)}{93.5}\right)(19356.838)}{\left(\frac{0.866(65)}{93.5}\right)}$$
$$= 17313.928 \text{ KIPS}$$

- W_c (EFFECTIVE CONVECTIVE WEIGHT) (EQ 13-26)

$$= 0.230\frac{D}{H}\tanh\left(\frac{3.67H}{D}\right)W_T$$
$$= 0.230\left(\frac{65}{93.5}\right)\tanh\left(\frac{3.67(93.5)}{65}\right)(19356.838)$$
$$= 3094.863 \text{ KIPS}$$

- X_i (IMPULSE WEIGHT LATERAL FORCE HEIGHT) (EQ 13-29)

$$= \left[0.5 - 0.094\frac{D}{H}\right]H$$
$$= \left[0.5 - 0.094\left(\frac{65}{93.5}\right)\right](93.5)$$
$$= 40.64'$$

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– X_c (CONVECTIVE WEIGHT LATERAL FORCE HEIGHT) (EQ 13-30)

$$= \left[1.0 - \left(\frac{\cosh\left(\frac{3.67H}{D}\right) - 1}{\frac{3.67H}{D}\sinh\left(\frac{3.67H}{D}\right)}\right)\right]H$$

$$= \left[1.0 - \left(\frac{\cosh\left(\frac{3.67(93.5)}{65}\right) - 1}{\frac{3.67(93.5)}{65}\sinh\left(\frac{3.67(93.5)}{65}\right)}\right)\right](93.5)$$

$$= 75.97'$$

– W_s (WT. OF SHELL OF WATER TANK):

AVG. SHELL THICKNESS = $\frac{1.302 + 0.3125}{2} = 0.80725''$

DENSITY OF STEEL = 490 lb./ft.^{3}

SHELL VOLUME = $\left[\frac{\pi D_{OUTER}^2}{4} - \frac{\pi D_{INNER}^2}{4}\right]H$

$$= \left[\frac{\pi(65)^2}{4} - \frac{\pi\left[65-(0.80725\times 2)\left(\frac{1'}{12''}\right)\right]^2}{4}\right](83.5)$$

$$= 1145.85\ ft.^3 \times \left(\frac{490\ lb}{ft.^3}\right)$$

$$= 561.465\ KIPS$$

– W_r (WT. OF ROOF OF TANK):

STEEL THICKNESS = 0.3125"

STEEL VOLUME = $\left(\frac{\pi D^2}{4}\right)\left(\text{STEEL THK.}\right)(1.5)$ ← ADJUSTMENT FOR CURVATURE

$$= \left(\frac{\pi(65)^2}{4}\right)(0.3125)(1.5)$$

$$= 129.62\ ft.^3 \times \left(490\ \frac{lb}{ft.^3}\right)$$

$$= 63.514\ KIPS$$

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- M_S (OVERTURNING MOMENT @ TANK BASE) (EQ 13-23)

$$= \sqrt{[A_i(W_s X_s + W_r H_t + W_i X_i)]^2 + [A_c W_c X_c]^2}$$

$$= \sqrt{\left[0.107\left(561.465 \times \frac{83.2}{2} + 63.514 \times 83.5 + 17313.928 \times 40.64\right)\right]^2 + [0.014 \times 3094.863 \times 75.97]^2}$$

$$= 78434.040 \text{ KIP} \cdot \text{FT}$$

- GOVERNING LOAD:

$$= \left(\frac{0.7\, M_{SEISMIC}}{0.6\, M_{WIND}}\right)$$

$$= \left(\frac{0.7(78434.040)}{0.6(8713.1)}\right) = 10.5$$

∴ SEISMIC LOAD GOVERNS

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– WEIGHT OF VERIZON EQUIPMENT (PER SECTOR):

EXIST. ANTENNAS	= 2 @ 27 # EA.	= 54 #
NEW ANTENNAS	= 2 @ 40 # EA.	= 80 #
RRH'S	= (1 @ 70#) + (1 @ 84#)	= 154 #
OVP	= 1 @ 27 #	= 27 #
MOUNTS	= 5 @ 75 # EA.	= 375 #
CABLE	= 1000 # PER SECTOR	= 1000 #

TOTAL WT. (PER SECTOR) = 1690 #

(3 SECTORS @ 1690 #/SECTOR) = 5,070 # (ALL VERIZON EQUIP.)

– WEIGHT OF REMAINING CARRIERS:

T-MOBILE	(ALL SECTORS)	= 3000 #
AT&T	(ALL SECTORS)	= 3000 #
SPRINT	(ALL SECTORS)	= 1500 #

TOTAL = 7500 #

– M_{ADD} (ADDITIONAL SEISMIC MOMENT FROM ALL TELECOM CARRIERS)

$= A_i (W_{EQUIP}) H$
$= 0.107 (5070 + 7500)(89')$
$= 119.704$ KIP · FT.

– MOMENT COMPARISON

$$= \frac{M_{ADD}}{M_{S(EXIST.)}} = \frac{119.704}{78434.040} = 0.15\% < 10\% \quad \underline{OK}$$

∴ TANK IS ADEQUATE TO SUPPORT EQUIPMENT