

December 8, 2020

U.S. Cellular
8410 W. Bryn Mawr Ave., Suite 700
Chicago, IL 60631
Contact: Randy Mattson

**SUBJECT: LOADING ADDITION LETTER – WATER TOWER & MOUNT
MMWAVE INSTALLATION
CASE [783314]
RACINE, WISCONSIN
EDGE PROJECT 27828**

Mr. Mattson:

Edge Consulting Engineers, Inc. has reviewed the proposed loading associated with the mmWave installation for the above mentioned site. The loading used in this assessment was calculated with the current AWWA standard. The scope of work for this letter consists of considering the effect of proposed loading with respect to the previous analysis to determine if a full structural analysis is necessary. Conducting a rigorous stress analysis was considered to be outside the scope of this assessment.

ASSUMPTIONS

The following assumptions were utilized when reaching the conclusions below (*additional limitations and restrictions have been provided at the end of this letter*):

- The water tower and mount have performed adequately to date and do not exhibit visible signs of structural distress.
- The water tower, foundation, and mount have been properly installed and maintained per the manufacturer's specifications and recommendations.
- When significant loading changes have occurred, or if significant alterations have been implemented on the water tower, mount or foundation, the loading change or alteration has been properly analyzed by the engineer of record under the governing code and they determined the structure can safely support the loading. Additionally, this analysis assumes that all installed modification designs were thoroughly reviewed and approved by the respective engineer of record and are able to carry the intended design capacity.
- All past work has been completed in accordance with plans specifications, the applicable codes/standards (AWWA, AISC, ACI, AWS, etc.) and associated structural analysis.
- All recommendations outlined in the previous analysis report and all industry standard best practices have been followed.
- The current loading condition remains essentially unchanged from that previously analyzed, and all proposed appurtenances shall match existing heights as outlined in the

proposed Edge construction drawings. See loading confirmation references noted below for what is considered the current loading condition.

If any of the assumptions are incorrect, or if any party has knowledge of an existing defect or significant structural issue with the existing installation, this should be brought to the attention of Edge Consulting and the conclusions reevaluated. The contractor should inspect the existing mounts and attachments for integrity at the time of installation and report any identified issues. If the proposed loading condition is altered from that assessed, this letter shall be deemed obsolete and further analysis will be required.

BACKGROUND INFORMATION

- Structural analysis: Apex Eng. File: EC11-016 dated 8/23/2019
- Mount analysis: Apex Eng. File: EC11-016 dated 8/23/2019
- Tower inventory report: Edge Eng. File: 21252 dated 4/30/2018
- Tower inventory confirmation per Edge drone flight dated 10/15/2020
- Proposed antenna and feedline loading configuration

PROPOSED LOADING

#	Appurtenance	Status	Relative Location
3	Ericsson AIR5331	Proposed	Mast pipe below LAA

CONCLUSION

Based on the previous analysis documented above, the water tower catwalk railing is currently operating at 94.2% of its capacity under conservatively modeled conditions. The proposed mmWave addition results in an increase in local weight and wind loads of less than 5% and is considered to be within its remaining structural capacity limits. **Therefore, it is anticipated that the catwalk railing will be structurally capable of supporting the proposed loading.**

The previous structural analysis considered the mast pipe mounts to be adequate for the considered loading. The wind loading for the mmWave installation is less than what was considered in the previous analysis for the CDMA panels with the same diameter pipe. Based on engineering judgement, the three extra pounds of weight is negligible. **Therefore, the existing mast pipe mount is considered to be structurally capable of supporting the proposed mmWave addition.**

Furthermore, the additional mmWave weight and wind force is negligible compared to the overall water tower loads. Since the past structural analysis found the existing water tower to be adequate for supporting the prior change with room for additional demand, **it is anticipated that the global water tower will be capable of supporting the proposed loading.**

If the proposed loading condition is altered from that analyzed, or the assumptions noted above are considered invalid, this analysis shall be deemed obsolete and further analysis will be required.

Refer to the Case Construction Drawings created by Edge Consulting Engineers for all applicable plan work, notes, and details.

Please feel free to contact us if you have any questions or concerns.

Sincerely,
Edge Consulting Engineers, Inc.



Derek D. Sachs, E.I.T.
(2) Attachments



David C. Lyshek, P.E.
Professional Engineer

LIMITATIONS AND RESTRICTIONS

1. This report was prepared in accordance with generally accepted structural engineering practices common to the tower industry and makes no other warranties, either expressed or implied, as to the professional advice provided under the terms of the agreement between Engineer and Client. This report has not been prepared for uses or parties other than those specifically named, or for uses or applications other than those enumerated herein. The report may contain insufficient or inaccurate information for other purposes, applications, and/or other uses.
2. This report is intended for the use of the client, and cannot be utilized or relied upon by other parties without the written consent of Edge Consulting Engineers.
3. Edge Consulting Engineers is not responsible for any, and all, water tower/mount modifications completed prior to, or hereafter, which Edge Consulting Engineers was not, or will not, be directly involved.
4. The model, conclusions, and recommendations contained within this report are based upon the supplied and attained information as described within the report and supplemented with historical information available to Edge Consulting Engineers. If it is known, or becomes known, that any item(s) are in conflict with what is described within this document, this report should be considered void and Edge Consulting Engineers should be contacted immediately.
5. Edge Consulting Engineers disclaims all liability for any information, conclusion, or recommendation that is not expressly stated or represented within this report.
6. Edge Consulting Engineers shall not be liable for any incidental, consequential, indirect, special or punitive damages arising out of any claim associated with the use of this report.
7. The scope of work performed for this analysis is limited to the items in which we were furnished complete and accurate information.
8. Accessories and appurtenances such as antenna mounts, feed line ladders, climbing ladders, lighting mounts, etc. were not analyzed as part of this work, and Edge Consulting Engineers, Inc. makes no claim as to their adequacy of their design or their installation.
9. This analysis was performed under the assumption that all water tower and mount elements are in like new condition, free from rust and other deterioration. Additionally, this analysis assumes that all installed modification designs were thoroughly reviewed and approved by the respective engineer of record and are able to carry their intended design capacity. It is also assumed the water tower and mount were properly installed per construction documents, and that the water tower, mount, and all associated appurtenances were originally designed and fabricated in accordance with all applicable codes and standards. Edge Consulting Engineers cannot account for, nor be held responsible, if tower elements are deteriorated, damaged, and/or missing.
10. This water tower analysis was performed based upon the antenna, feed line and other appurtenance loading and placement as described within this report. Any alterations to the described loading or placement will require re-analysis of the water tower, and the findings contained in this report are not valid.
11. The loading conditions utilized for this analysis are based on information provided by the client, and readily available manufacturer/vendor information (antenna and mount projected areas, weight and shape factors). However, if the described loading criteria and design assumptions within this report are not accurate, are altered, or changed in any form, this analysis shall be considered void and an additional analysis must be performed.
12. It is the responsibility of the client and water tower owner to thoroughly review the existing and proposed loading, and bring any discrepancy to the attention of Edge Consulting Engineers.
13. Site-specific loading or local building code requirements may be more stringent than the minimum loading requirements specified in the Standard. These and other unique loads or loading combination requirements are to be specified by the owner (in the procurement specifications).
14. The service loads and deformation limits specified in the Standard are minimum requirements. When more stringent requirements are required for a specific application, the serviceability limit state basic wind speed and, if required, the serviceability limit state design ice thickness; the deformation limitations (twist, sway and horizontal displacement) and the location/elevation where the deformation limitations apply are to be included in the procurement specification.
15. This analysis provided by Edge Consulting Engineers, Inc. addresses the structural adequacy or deficiencies of the primary structural members of the water tower and mount. The evaluation of each bolt, plate connection detail, weld, etc. is outside the scope of this analysis.
16. The water tower and mount were analyzed according to the minimum design wind loads recommended by the American Water Works Association standard (AWWA D100-11). If the owner or state/local authorities require a higher design wind or ice load, Edge Consulting Engineers, Inc. should be made aware of such a requirement.
17. If during the antenna installation the contractor identifies condition issues or concerns with the adequacy of the water tower or mount, this information should be relayed to the engineer prior to proceeding with the installation.

Antenna Wind Load Calculations - Mast Pipe Comparison

Project Name - CASE (783314)
 Racine, Wisconsin
 Edge #27828



Completed By: DDS _____
 Checked By: DCL _____

Base Wind Pressure Calculation:

Elevation of Antennas (z) = 124 ft
 Exposure Category = C
 $K_z = 1.32$
 $V = 90$ mph
 $I = 1.15$
 $q_z = 31.54$ psf

$$F = q_z \cdot C_f \cdot A$$

$$q_z = 0.00256 \cdot K_z \cdot V^2 \cdot I$$

Wind Force/Weight Calculation:

#	Appurtenance	Type	Normal Orientation	Position	q_z psf	Weight (P) lbs	Bracket lbs	Height (H) in	Width (W) in	Depth in	Front (C_d)	Side (C_d)	EPA_{norm} ft ²	EPA_{tot} ft ²	Total Weight lbs
1	Antel BXA-80063-8CF-EDIN-X	Antenna	Front	1	31.54	24.00	15.00	94.70	11.20	4.50	1.00	1.00	7.37	2.96	39.00
1	Ericsson RRU's 2205 (with antenna)	RRU	Front	2	31.54	12.25	N/A	7.88	7.88	4.69	1.00	1.00	0.43	0.26	12.25
1	Ericsson AIR 5331*	AIR	Front	2	31.54	30.00	N/A	24.00	11.80	4.30	1.00	1.00	1.97	0.72	30.00

Summation of Wind Force:

Antenna Designation	1	2
Normal Force on Antenna	232.3	75.6
Tangential Force on Antenna	93.4	30.7
Total Weight	39.00	42.25

Antenna Wind Load Calculations - Catwalk Mount Check



Project Name - CASE (783314)
 Racine, Wisconsin
 Edge #27828

Completed By: DDS
 Checked By: DCL

Base Wind Pressure Calculation:

Elevation of Antennas (z) = 124 ft
 Exposure Category = C
 $K_z = 1.32$
 $V = 90$ mph
 $I = 1.15$
 $q_z = 31.54$ psf $q_z = 0.00256 \cdot K_z \cdot V^2 \cdot I$

Wind Force/Weight Calculation:

Apex #EC11-016, dated 8/23/19

#	Appurtenance	Type	Carrier	Source	q_z psf	Weight lbs	Bracket lbs	Height (H) in	Width (W) in	Depth in	Front (C_{df})	Side (C_{ds})	EPA_{norm} ft ²	EPA_{ant} ft ²	Total Weight lbs
2	Dengyo OCT8-2LX2HX-BW65	Antenna	USC	Apex SA	31.54	88.20	13.20	95.90	21.00	6.30	1.00	1.00	13.99	4.20	101.40
1	Ericsson RRU4449*	RRU	USC	Apex SA	31.54	70.40	N/A	17.90	13.20	9.40	1.00	1.00	1.64	1.17	70.40
1	Ericsson RRU4415 B2	RRU	USC	Apex SA	31.54	47.00	N/A	16.50	13.50	6.70	1.00	1.00	1.55	0.77	47.00
1	Ericsson RRU11	RRU	USC	Apex SA	31.54	51.00	N/A	19.70	17.00	7.20	1.00	1.00	2.33	0.99	51.00
1	Raycap RUSDC-6267-PF-48	SPD	USC	Apex SA	31.54	20.00	N/A	20.60	18.90	5.80	1.00	1.00	2.70	0.83	20.00
1	Ericsson RRU4415 B2	RRU	USC	Apex SA	31.54	12.25	N/A	7.88	7.88	4.69	1.00	1.00	0.43	0.26	12.25
3	Mast Pipe - 9 ft 2" Std	Mount Pipe	USC	Apex SA	31.54	32.94	N/A	108.00	2.38	2.38	0.60	0.60	1.07	1.07	32.94
2	Mast Pipe - 10 ft 2.5" Std	Mount Pipe	USC	Apex SA	31.54	58.00	N/A	120.00	2.88	2.88	0.60	0.60	1.44	1.44	58.00

Proposed Condition

#	Appurtenance	Type	Carrier	Status	q_z psf	Weight lbs	Bracket lbs	Height (H) in	Width (W) in	Depth in	Front (C_{df})	Side (C_{ds})	EPA_{norm} ft ²	EPA_{ant} ft ²	Total Weight lbs
2	Dengyo OCT8-2LX2HX-BW65	Antenna	USC	To Remain	31.54	88.20	13.20	95.90	21.00	6.30	1.00	1.00	13.99	4.20	101.40
1	Ericsson RRU4449*	RRU	USC	To Remain	31.54	70.40	N/A	17.90	13.20	9.40	1.00	1.00	1.64	1.17	70.40
1	Ericsson RRU4415 B2	RRU	USC	To Remain	31.54	47.00	N/A	16.50	13.50	6.70	1.00	1.00	1.55	0.77	47.00
1	Ericsson RRU11	RRU	USC	To Remain	31.54	51.00	N/A	19.70	17.00	7.20	1.00	1.00	2.33	0.99	51.00
1	Raycap RUSDC-6267-PF-48	SPD	USC	To Remain	31.54	20.00	N/A	20.60	18.90	5.80	1.00	1.00	2.70	0.83	20.00
1	Ericsson RRU4415 B2	RRU	USC	To Remain	31.54	12.25	N/A	7.88	7.88	4.69	1.00	1.00	0.43	0.26	12.25
3	Mast Pipe - 9 ft 2" Std	Mount Pipe	USC	To Remain	31.54	32.94	N/A	108.00	2.38	2.38	0.60	0.60	1.07	1.07	32.94
2	Mast Pipe - 10 ft 2.5" Std	Mount Pipe	USC	To Remain	31.54	58.00	N/A	120.00	2.88	2.88	0.60	0.60	1.44	1.44	58.00
1	Ericsson AIR 5331*	AIR	USC	Proposed	31.54	30.00	N/A	24.00	11.80	4.30	1.00	1.00	1.97	0.72	30.00

Summation of Wind Area/Weight:

Apex SA	
Front Force (lbs)	1347
Side Force (lb)	583
Weight (lbs)	618

	Exist. Force/Wt. To Remain	Exist. Force/Wt. To Remove	Force/Wt. Proposed	Summary	
				Existing	Proposed
Front Force (lbs)	1347	0	62	1347	1409
Side Force (lbs)	583	0	23	583	606
Weight (lbs)	618	0	30	618	648

	Exist. %Δ from SA	Proposed %Δ from SA
Front Force (lbs)	0.0%	4.6%
Side Force (lbs)	0.0%	3.9%
Weight (lbs)	0.0%	4.9%