WESTCHESTER
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Date: **August 6, 2021**

Eric Laugesen
Project Manager
LCC Telecom Services
10700 W. Higgins Rd., Ste. 240
Rosemont, IL 60018

Subject: Structural Analysis Report

T-Mobile	
Site Number:	ML22218E
Site Name:	Shorehaven RT
Engineering Firm Designation:	**Westchester Services, LLC**
Site Data:	**1305 W. Wisconsin Ave., Oconomowoc, WI 53066** **Waukesha County – 50ft Rooftop**

Eric Laugesen,

Westchester Services, LLC is pleased to submit this **"Structural Analysis Report"** to determine the structural integrity of the above mentioned structure.

The purpose of the analysis is to determine acceptability of the structure stress level. Based on our analysis we have determined the stress levels for the structure under the following load case to be:

Existing and Proposed Equipment **Sufficient Capacity**
Note: See Table 2-1 for the existing and proposed loading.

Member Type	Result	Pass/Fail
Overall	Negligible change	Pass

The analysis has been performed in accordance with the TIA-222-G standard and local code requirements.

We at Westchester Services, LLC appreciate the opportunity of providing our continuing professional services to you. If you have any questions or need further assistance on this or any other projects please give us a call.

I certify that this report was prepared by me or under my direct supervision and that I am a licensed Professional Engineer under the laws of the State of Wisconsin.

Philip Koziol, PE
Professional Engineer

PHILIP KOZIOL
44373-6
BARRINGTON
IL

8/6/21

Exp. 7/31/22

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1) INTRODUCTION

This is an 50ft tall rooftop located in Waukesha County, WI. The proposed equipment will be mounted on an existing equipment platform.

2) ANALYSIS CRITERIA

The structural analysis was performed for this structure in accordance with the requirements of TIA-222-G Structural Standards for Antenna Supporting Structures and Antennas using an ultimate gust wind speed of 115 mph (converted to 89 mph 3-second gust) with no ice, 40 mph with 0.75 inch ice thickness, structure class II, exposure category D with topographic category 1 and crest height of 0 feet

Table 2-1 – Proposed Final Antenna Configuration

(New antennas in **bold**)

Center Line Elevation (ft)	Sector	Pos.	Antenna	Radio(s)	Note
56	Alpha	1	**(1) FFVV-65C-R3-V1**	**(1) AHLOA** **(1) AHFIG**	
		2	**(1) AEHC MIMO**		
		3			
		4		**(1) HCS 2.0 Breakout Box**	
56	Beta	1	**(1) FFVV-65C-R3-V1**	**(1) AHLOA** **(1) AHFIG**	
		2	**(1) AEHC MIMO**		
		3			
		4		**(1) HCS 2.0 Breakout Box**	
56	Gamma	1	**(1) FFVV-65C-R3-V1**	**(1) AHLOA** **(1) AHFIG**	
		2	**(1) AEHC MIMO**		
		3			
		4		**(1) HCS 2.0 Breakout Box**	
T-Mobile Feedlines:			**(3) HCS 2.0 Trunk**		

Table 2-2 – Equipment Platform Configuration

(New equipment in **bold**, to be removed in ~~strikethrough~~)

Final Proposed Platform Loading	Weight/each
~~All existing equipment cabinets~~	
(1) PPC Cabinet	220lbs
(1) Ciena	100lbs
(1) LB3 Battery Cabinet	**3000lbs (fully loaded)**
(1) HPL3 Power Cab	**1300lbs (fully loaded)**
(3) HCS 2.0 JBox	**50lbs**

3) ANALYSIS PROCEDURE

Table 3-1 – Documents Provided

Document	Remarks	Reference	Date	Source
Most Recent Site Photos	N/A	N/A	April 2021	
Structural Letter	Edge	N/A	5/28/03	LCC

Table 3-2 – Companion Document

Document	Remarks	Date	Note
Preliminary Construction Drawings	Westchester Services	5/4/21	Rev B
Scoping Document	LCC	3/17/21	
Mount Analysis	Westchester Services	8/6/21	

3.1) Analysis Method

Mathcad 15 is a mathematics software program used for creating hand calc templates. The output of these calculations can be found in Appendix A.

4) ANALYSIS RESULTS

Table 4-1 – Critical Section Capacity (Summary)

Member Type	% Capacity	Pass/Fail
Equipment Platform	Negligible Change	Pass
Local Structure (equipment platform)	Negligible Change	Pass
Overall		Pass

4.1) Recommendations

The equipment frame and local structure have sufficient capacity to carry the existing and proposed loads.

5) ASSUMPTIONS

- The analysis performed is to the theoretical capacity of the members and connections. No accommodations are taken for any damaged, rusted, deteriorated, or otherwise compromised member conditions. To this, the tower or structure is assumed to be properly maintained and monitored and this analysis cannot be considered to be a condition assessment of the structure.

- The analysis is performed to the minimum design wind, ice, and other environmental loading prescribed by the governing building codes and standards. Any higher loading conditions required by the local jurisdiction or structure owner should be made known to Westchester immediately for analysis. No lesser conditions will be accommodated.

- Member sizes are assumed to be of standard AISC or manufacturer designations unless explicitly specified otherwise. The geometry of the tower or structure is assumed as schematic. Steel grade and concrete strength are assumed to be conservative standard and fully developed unless otherwise specified.

- The information provided to Westchester for analysis is assumed accurate and up to date as supplied. No independent efforts were taken by Westchester to verify the validity of the information supplied. If any additional information is presented at any time that contradicts what is referenced in the analysis, the analysis is invalid and must be performed again with the new information.

- Any reinforcement or modifications are assumed to be fully installed and functional.

- All welds are assumed to have been performed to current welding standards and are assumed to develop their full capacity and to be in good condition. In addition, all bolts and bolt-like anchors are assumed to be fully tightened, fastened, or bonded to the manufacturers' specifications and are assumed to have full capacity.

- Numerous connection details of large-scale structures are unobtainable and are omitted from the structural analysis. This includes, but is not limited to: bolts, welds, flanges, and plates. These connections are considered adequate and are therefore neglected from the analysis. In addition, in the absence of building plans, many wall, floor, and ceiling constructions can only be determined from observable field data and are supplemented by best judgment and experience.

- Antennas, dishes, feedlines, and any other such appurtenances are assumed adequate through manufacturer testing. No analysis is provided for the structural strength or stability of these items unless otherwise specified.

- Equipment mounting systems are assumed structurally sound unless specifically called for in the analysis.

- Soil conditions and foundations are not considered unless specified in the analysis and have no deterioration or defects. For sites located on a building, only local effects of the equipment is considered unless otherwise specified. The overall structure of the building and its foundation are assumed to be unaffected by the telecom equipment.

- Any differences between the scope of work and that found at the site at any time prior to installation must be brought to the attention of Westchester immediately. Any changes or substitutions to any part of the scope of work must be brought to Westchester for explicit approval. Any changes made without prior approval will render the analysis and its conclusions invalid.

APPENDIX A

CALCULATIONS

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References:

1) 2015 International Building Code
2) ANSI TIA-222-G, Structural Standard for Antenna Supporting Structures and Antennas
3) AISC 360-10 Specification for Structural Steel Buildings

Input

Wind Factors (as per TIA-222-G)

$V := 115 \cdot \sqrt{.6} = 89.079$	*mph*	V_{ult} *per Ref. (1) converted to* V_{nom} *for Ref. (2)*
$V_i := 40$	*mph*	*Basic wind speed with ice*
$t_i := .75 \cdot in$		*Design ice thickness*
$G_H := 1.0$		*Ref. (2), Section 2.6.7*
$i_m := 1$		*Importance Factor*
$K_d := 0.95$		*Wind Direction Probability Factor, Ref. (2), Table 2-2*
$Ex := "D"$		*Exposure category. See Ref. (2), Table 2-4*
$TC := "1"$		*Topographic Category. See Ref. (2), Table 2-5*
$H := 0 \cdot ft$		*Crest Height*

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Antennas/Radios

Antenna name/model

"not used"
"FFVV-65C-R3-V1"
"not used"
AEHC MIMO
AHLOA
"not used"
"not used"
AHFIG
"not used"
2.0 Tower Breakout Box

Elevation of antennas

$z_{ant} :=$ | 56 | 56 | 56 | 56 | 56 | 56 | 56 | 56 | 56 | 56 | $\cdot ft$

Number of antenna groups

$N_{antenna} := 10$

*Height of antennas**

$height_{ant} :=$ | 1 | 95.9 | 1 | 38.2 | 22.1 | 1 | 1 | 27.3 | 1 | 12 | $\cdot in$

*Width of antennas**

$width_{ant} :=$ | 1 | 25.2 | 1 | 21.5 | 12.1 | 1 | 1 | 12.1 | 1 | 8 | $\cdot in$

*Depth of antennas**

$depth_{ant} :=$ | 1 | 9.3 | 1 | 5.9 | 7.44 | 1 | 1 | 5.2 | 1 | 3 | $\cdot in$

Weight of antennas

$Weight_{ant} :=$ | 0 | 127.6 | 0 | 108.0 | 83.6 | 0 | 0 | 70.5 | 0 | 20 | $\cdot lbf$

Local Shielding Factor

$LocalShielding :=$ | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |

Antenna Shape?

$SHAPE :=$ | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Shape Guide:
0 = Round
1 = Flat
2 = Dish w/o Radome
3 = Dish w/ Radome
4 = Dish w/ Shroud
5 = Grid Dish

h & w for dishes are outer diameters.
Ellipse shape OK

**Matrix elements with a value of "1" are just placeholder values to prevent divide by 0 / NaN errors.*

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New Equipment Cabinets on Existing Platform

$W_{Motorola.Plinth} := 3800lbf$

$W_{SSC} := 1500lbf$

$W_{PPC} := 220lbf$

$W_{TowerJBox} := 50lbf$

$W_{LargeSSC3} := 1300lbf$

$W_{Batt} := 3000lbf$

$W_{Ciena} := 100lbf$

Weight Existing Equipment

$W_{Existing} := W_{Motorola.Plinth} + W_{SSC} + W_{PPC} + W_{Ciena}$

$W_{Existing} = 5620\,lbf$

$W_{Proposed} := W_{LargeSSC3} + W_{Batt} + W_{PPC} + W_{Ciena} + 3 \cdot W_{TowerJBox}$

$W_{Proposed} = 4770\,lbf$

The equipment platform will have a decrease in loading across the platform. The proposed equipment cabinets are to be installed in the space vacated by the removed cabinets. The platform will remain adequate for the loading considered.