July 19, 2019

Members of the Siting Council
Connecticut Siting Council
Ten Franklin Square
New Britain, CT 06051

RE: Notice of Exempt Modification
15 Orchard Park Road, Madison, CT 06443
Latitude: 41.283218
Longitude: -72.625557
T-Mobile Site#: CTNH808A – L600

Dear Ms. Bachman:

T-Mobile currently maintains nine (9) antennas at the 97-foot level of the existing 98-foot lattice tower at 15 Orchard Park Road, Madison, CT. The 98-foot lattice tower and property are owned by American Tower Corporation. T-Mobile now intends to replace three (3) of its existing antennas with three (3) new 600/700/1900/2100 MHz antenna. The new antennas would be installed at the same 97-foot level of the tower.

**Planned Modifications:**
**Tower:**
Remove
(6) 1-5/8" Coax

Remove and Replace:
(3) Commscope LNX-6515DS Antenna (REMOVE) – (3) APXVAARR24_43-U-NA20 Antenna (REPLACE)
(3) RRUS11B12 (REMOVE) – Radio 4449 B12B71 (REPLACE)
(3) TMAs (REMOVE) – (3) KRY 112 144/1 TMA (REPLACE)

Install New:
(3) 1-5/8" Hybrid Cables

Existing to Remain:
(6) AIR 21 Panels
(1) 1-5/8" Hybrid Cable
(6) 1-5/8" Coax

**Ground:**
Install New: Equipment inside existing 6131 cabinet

This facility was originally by the Council in Docket No. 390 dated March 26, 2010. This modification complies with the approval.

Please accept this letter as notification pursuant to Regulations of Connecticut State Agencies§ 16- SOj-73, for construction that constitutes an exempt modification pursuant to R.C.S.A. § 16-50j-72(b)(2). In accordance with R.C.SA. § 16-SOj-73, a copy of this letter is being sent to First Selectman -Tom Banisch, Elected Official, for the Town of Madison, David Anderson, Town Planner for Town of Madison, and the property and tower owner.

The planned modifications to the facility fall squarely within those activities explicitly provided for in
R.C.S;A. § 16-50j-72(b)(2).

1. The proposed modifications will not result in an increase in the height of the existing structure.

2. The proposed modifications will not require the extension of the site boundary.

3. The proposed modifications will not increase noise levels at the facility by six decibels or more, or to levels that exceed state and local criteria.

4. The operation of the replacement antennas will not increase radio frequency emissions at the facility to a level at or above the Federal Communications Commission safety standard.

5. The proposed modifications will not cause a change or alteration in the physical or environmental characteristics of the site.

6. The existing structure and its foundation can support the proposed loading.

For the foregoing reasons, T-Mobile respectfully submits that the proposed modifications to the above referenced telecommunications facility constitute an exempt modification under R.C.S.A. § 16-50j-72(b)(2).

Sincerely,

**Austin Cofrancesco**
Transcend Wireless
Cell:  203-909-1781
Email: acofrancesco@transcendwireless.com

Attachments
cc: Tom Banisch- Madison First Selectman
David Anderson- Madison Town Planner
American Tower Corporation- Owner

# 15 ORCHARD PARK RD

| | | | |
|---|---|---|---|
| **Location** | 15 ORCHARD PARK RD | **MBLU** | 36/ 3/ CELL/ / |
| **Acct#** | 3630001 | **Owner** | FLORIDA TOWER PARTNERS |
| **Assessment** | $355,700 | **Appraisal** | $508,300 |
| **PID** | 104169 | **Building Count** | 1 |

## Current Value

| Appraisal | | | | | |
|---|---|---|---|---|---|
| **Valuation Year** | **Building** | **Extra Features** | **Outbuildings** | **Land** | **Total** |
| 2018 | $0 | $0 | $508,300 | $0 | $508,300 |
| **Assessment** | | | | | |
| **Valuation Year** | **Building** | **Extra Features** | **Outbuildings** | **Land** | **Total** |
| 2018 | $0 | $0 | $355,700 | $0 | $355,700 |

## Parcel Addreses

| Additional Addresses |
|---|
| No Additional Addresses available for this parcel |

## Owner of Record

| | | | |
|---|---|---|---|
| **Owner** | FLORIDA TOWER PARTNERS | **Sale Price** | $0 |
| **Co-Owner** | | **Book & Page** | 0/ 00 |
| **Care Of** | | **Sale Date** | 01/01/1900 |

## Ownership History

| Ownership History | | | |
|---|---|---|---|
| **Owner** | **Sale Price** | **Book & Page** | **Sale Date** |
| FLORIDA TOWER PARTNERS | $0 | 0/ 00 | 01/01/1900 |

## Building Information

### Building 1 : Section 1

**Year Built:**
**Living Area:** 0

| Building Attributes |
|---|

| Field | Description |
|---|---|
| Style | Outbuildings |
| Model | |
| Stories: | |
| Occupancy | |
| Exterior Wall 1 | |
| Exterior Wall 2 | |
| Roof Structure: | |
| Roof Cover | |
| Interior Wall 1 | |
| Interior Wall 2 | |
| Interior Flr 1 | |
| Interior Flr 2 | |
| Heat Fuel | |
| Heat Type: | |
| AC Type: | |
| Total Bedrooms: | |
| Total Bthrms: | |
| Total Half Baths: | |
| Total Xtra Fixtrs: | |
| Total Rooms: | |
| Fireplace(s) | |
| Xtra FPL Open | |

### Building Photo

(http://images.vgsi.com/photos/MadisonCTPhotos//\01\01\63/66

### Building Layout

Building Layout

(http://images.vgsi.com/photos/MadisonCTPhotos//Sketches/104

| Building Sub-Areas (sq ft) |
|---|
| No Data for Building Sub-Areas |

### Extra Features

| Extra Features |
|---|
| No Data for Extra Features |

## Land

### Land Use

**Use Code** 4310
**Description** TEL REL TW
**Zone**

### Land Line Valuation

**Size (Acres)** 0

### Outbuildings

| Outbuildings | | | | | | |
|---|---|---|---|---|---|---|
| **Code** | **Description** | **Sub Code** | **Sub Description** | **Size** | **Value** | **Bldg #** |
| CEL | Cell Tower | | | 2 UNITS | $327,200 | 1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| FN4 | Fence 8' | | | 150 L.F. | $1,200 | 1 |
| SHD7 | Cell Shed | | | 150 S.F. | $15,000 | 1 |
| LNT | Lean To | | | 288 S.F. | $1,300 | 1 |
| CEL | Cell Tower | | | 1 UNITS | $163,600 | 1 |

# South Central Regional COG


## Legend

## Location

## Notes

CTNH808A

437 0 219 437

Feet

1: 2,624

N

| | | |
|---|---|---|
| **DOCKET NO. 390** – T-Mobile Northeast LLC application for a Certificate of Environmental Compatibility and Public Need for the construction, management, and maintenance of a telecommunications facility at 15 Orchard Park Road, Madison, Connecticut. | } | Connecticut |
| | } | Siting |
| | } | Council |

March 26, 2010

**Decision and Order**

Pursuant to the foregoing Findings of Fact and Opinion, the Connecticut Siting Council (Council) finds that the effects associated with the construction, management, and maintenance of a telecommunications facility, including effects on the natural environment; ecological integrity and balance; public health and safety; scenic, historic, and recreational values; forests and parks; air and water purity; and fish and wildlife are not disproportionate, either alone or cumulatively with other effects, when compared to need, are not in conflict with the policies of the State concerning such effects, and are not sufficient reason to deny the application, and therefore directs that a Certificate of Environmental Compatibility and Public Need, as provided by General Statutes § 16-50k, be issued to T-Mobile Northeast LLC, hereinafter referred to as the Certificate Holder, for a telecommunications facility at 15 Orchard Park Road, located in Madison, Connecticut.

Unless otherwise approved by the Council, the facility shall be constructed, managed, and maintained substantially as specified in the Council's record in this matter, and subject to the following conditions:

1. The tower shall be constructed as a monopole, no taller than necessary to provide the proposed telecommunications services, sufficient to accommodate the antennas of T-Mobile Northeast LLC and other entities, both public and private, but such tower shall not exceed a height of 100 feet above ground level. The tower shall be designed so that its height may be extendable to 120 feet above ground level.

2. The Certificate Holder shall prepare a Development and Management (D&M) Plan for this site in compliance with Sections 16-50j-75 through 16-50j-77 of the Regulations of Connecticut State Agencies. The D&M Plan shall be served on the Town of Madison for comment, and all parties and intervenors as listed in the service list, and submitted to and approved by the Council prior to the commencement of facility construction and shall include:
    a) a final site plan(s) of site development to include specifications for the tower, tower foundation, antennas, equipment compound, radio equipment, access road, utility line, and landscaping;
    b) construction plans for site clearing, grading, landscaping, water drainage, and erosion and sedimentation controls consistent with the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control, as amended, including extra controls to protect nearby wetlands;
    c) a tower with a yield point at approximately 83 feet above ground level;
    d) privacy slats installed in the chain link fence enclosing the compound; and
    e) a grading plan that drains the facility to the south.

3. The Certificate Holder shall, prior to the commencement of operation, provide the Council worst-case modeling of the electromagnetic radio frequency power density of all proposed entities' antennas at the closest point of uncontrolled access to the tower base, consistent with Federal Communications Commission, Office of Engineering and Technology, Bulletin No. 65, August 1997. The Certificate Holder shall ensure a recalculated report of the electromagnetic radio frequency power density be submitted to the Council if and when circumstances in operation cause a change in power density above the levels calculated and provided pursuant to this Decision and Order.

4. Upon the establishment of any new State or federal radio frequency standards applicable to frequencies of this facility, the facility granted herein shall be brought into compliance with such standards.

5. The Certificate Holder shall permit public or private entities to share space on the proposed tower for fair consideration, or shall provide any requesting entity with specific legal, technical, environmental, or economic reasons precluding such tower sharing.

6. The Certificate Holder shall provide reasonable space on the tower for no compensation for any Town of Madison public safety services (police, fire and medical services), provided such use can be accommodated and is compatible with the structural integrity of the tower.

7. Unless otherwise approved by the Council, if the facility authorized herein is not fully constructed and providing wireless services within eighteen months from the date of the mailing of the Council's Findings of Fact, Opinion, and Decision and Order (collectively called "Final Decision"), this Decision and Order shall be void, and the Certificate Holder shall dismantle the tower and remove all associated equipment or reapply for any continued or new use to the Council before any such use is made. The time between the filing and resolution of any appeals of the Council's Final Decision shall not be counted in calculating this deadline.

8. At least one wireless telecommunications carrier shall install their equipment and shall become operational not later than 120 days after the tower is erected. Authority to monitor and modify this schedule, as necessary, is delegated to the Executive Director. The Certificate Holder shall provide written notice to the Executive Director of any schedule changes as soon as is practicable.

9. Any request for extension of the time period referred to in Condition 7 shall be filed with the Council not later than 60 days prior to the expiration date of this Certificate and shall be served on all parties and intervenors, as listed in the service list, and the Town of Madison. Any proposed modifications to this Decision and Order shall likewise be so served.

10. If the facility ceases to provide wireless services for a period of one year, this Decision and Order shall be void, and the Certificate Holder shall dismantle the tower and remove all associated equipment or reapply for any continued or new use to the Council before any such use is made.

11. The Certificate Holder shall remove any nonfunctioning antenna, and associated antenna mounting equipment, within 60 days of the date the antenna ceased to function.

12. In accordance with Section 16-50j-77 of the Regulations of Connecticut State Agencies, the Certificate Holder shall provide the Council with written notice two weeks prior to the commencement of site construction activities. In addition, the Certificate Holder shall provide the Council with written notice of the completion of site construction, and the commencement of site operation.

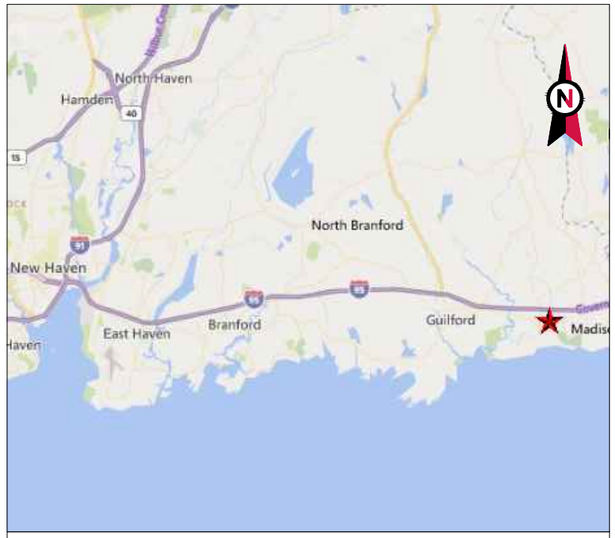
Pursuant to General Statutes § 16-50p, the Council hereby directs that a copy of the Findings of Fact, Opinion, and Decision and Order be served on each person listed below, and notice of issuance shall be published in the New Haven Register.

By this Decision and Order, the Council disposes of the legal rights, duties, and privileges of each party named or admitted to the proceeding in accordance with Section 16-50j-17 of the Regulations of Connecticut State Agencies.

The parties and intervenors to this proceeding are:

| **Applicant** | **Its Representative** |
|---|---|
| T-Mobile Northeast, LLC | Julie D. Kohler, Esq.<br>Jesse A. Langer, Esq.<br>Cohen and Wolf, P.C.<br>1115 Broad Street<br>Bridgeport, CT 06604 |

| **Party** | **Its Representative** |
|---|---|
| Town of Madison | Marilyn Ozols<br>Planning and Zoning Administrator<br>Town of Madison<br>8 Campus Drive<br>Madison, CT 06443 |




VICINITY MAP

AMERICAN TOWER®

# ATC SITE NAME: MADISON CT
# ATC SITE NUMBER: 283421
# T-MOBILE SITE ID: CNTH808A
# SITE ADDRESS: 15 ORCHARD PARK ROAD MADISON, CT 06443

## T-MOBILE L600 ANTENNA AMENDMENT
## 67D02C CONFIGURATION


LOCATION MAP

## COMPLIANCE CODE

ALL WORK SHALL BE PERFORMED AND MATERIALS INSTALLED IN ACCORDANCE WITH THE CURRENT EDITIONS OF THE FOLLOWING CODES AS ADOPTED BY THE LOCAL GOVERNMENT AUTHORITIES. NOTHING IN THESE PLANS IS TO BE CONSTRUED TO PERMIT WORK NOT CONFORMING TO THESE CODES.

1. INTERNATIONAL BUILDING CODE (IBC)
2. NATIONAL ELECTRIC CODE (NEC)
3. LOCAL BUILDING CODE
4. CITY/COUNTY ORDINANCES

## UTILITY COMPANIES

POWER COMPANY: EVERSOURCE
PHONE: (877) 659-6326

TELEPHONE COMPANY: FRONTIER COMMUNICATIONS
PHONE: (877) 641-3250

811 Know what's **below.** **Call** before you dig.

## PROJECT SUMMARY

SITE ADDRESS:

15 ORCHARD PARK ROAD
MADISON, CT 06443
COUNTY: NEW HAVEN

1A CERTIFICATE SUMMARY:

LATITUDE: 41° 16' 59.10" N

LONGITUDE: 72° 37' 23.07" W

GROUND ELEVATION: 21' AMSL

TOWER HEIGHT: 100' AGL

HIGHEST APPURTENANCE: 121' AGL

## PROJECT TEAM

TOWER OWNER:

AMERICAN TOWER
10 PRESIDENTIAL WAY
WOBURN, MA 01801

ENGINEER:

ATC TOWER SERVICES, LLC
3500 REGENCY PKWY STE 100
CARY, NC 27518

PROPERTY OWNER:

15 ORCHARD PARK ROAD LLC
40 MUNGERTOWN RD
MADISON, CT, 06443

## PROJECT DESCRIPTION

THE PROPOSED PROJECT INCLUDES MODIFYING GROUND BASED AND TOWER MOUNTED EQUIPMENT AS INDICATED PER BELOW:

REMOVE (3) PANELS, (3) TTAs, (3) RRUs, AND (6) 1-5/8" COAX CABLES

INSTALL (3) NEW PANELS, (3) TTAs, (3) RRUs, (3) 1-5/8" HYBRID CABLES, AND MOUNT MODIFICATIONS DESIGNED BY CLS ENGINEERING

EXISTING (6) PANELS, (3) T-FRAMES, (1) 1-5/8" HYBRID CABLE, AND (6) 1-5/8" COAX CABLES TO REMAIN

## PROJECT NOTES

1. THE FACILITY IS UNMANNED.
2. A TECHNICIAN WILL VISIT THE SITE APPROXIMATELY ONCE A MONTH FOR ROUTINE INSPECTION AND MAINTENANCE.
3. THE PROJECT WILL NOT RESULT IN ANY SIGNIFICANT LAND DISTURBANCE OR EFFECT OF STORM WATER DRAINAGE.
4. NO SANITARY SEWER, POTABLE WATER OR TRASH DISPOSAL IS REQUIRED.
5. HANDICAP ACCESS IS NOT REQUIRED.

## PROJECT LOCATION DIRECTIONS

FROM DOWNTOWN NEW HAVEN CT START OUT GOING NORTHEAST ON CHURCH ST TOWARD WALL ST. CHURCH ST BECOMES WHITNEY AVE. TURN RIGHT ONTO TRUMBULL ST. TURN SLIGHT LEFT TO TAKE THE I-91 S/I-91 N RAMP. MERGE ONTO I-91 S TOWARD I-95/NEW LONDON/N.Y.CITY. MERGE ONTO I-95 N/GOVERNOR JOHN DAVIS LODGE TPKE N VIA THE EXIT ON THE LEFT TOWARD NEW LONDON. TAKE THE GOOSE LANE EXIT, EXIT 59. TURN RIGHT ONTO GOOSE LN. TAKE THE 1ST LEFT ONTO BOSTON POST RD/US-1 N. TURN LEFT ONTO MUNGERTOWN RD. TAKE THE 2ND RIGHT ONTO ORCHARD PARK RD.

## SHEET INDEX

| SHEET NO: | DESCRIPTION: | REV: | DATE: | BY: |
|---|---|---|---|---|
| G-001 | TITLE SHEET | 2 | 07/18/19 | TR |
| G-002 | GENERAL NOTES | 0 | 05/30/19 | EF |
| C-101 | DETAILED SITE PLAN & TOWER ELEVATION | 2 | 07/18/19 | TR |
| C-501 | ANTENNA INFORMATION & SCHEDULE | 2 | 07/18/19 | TR |
| E-501 | GROUNDING DETAILS | 0 | 05/30/19 | EF |
| R-601 | SUPPLEMENTAL | | | |
| R-602 | SUPPLEMENTAL | | | |
| R-603 | SUPPLEMENTAL | | | |
| R-604 | SUPPLEMENTAL | | | |

AMERICAN TOWER®
A.T. ENGINEERING SERVICE, PLLC
3500 REGENCY PARKWAY
SUITE 100
CARY, NC 27518
PHONE: (919) 468-0112
COA: PEC.0001553



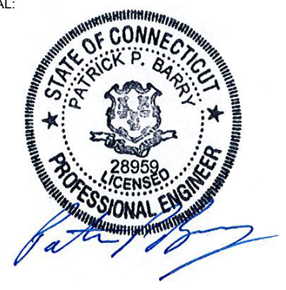
| REV. | DESCRIPTION | BY | DATE |
|---|---|---|---|
| 0 | FOR CONSTRUCTION | EF | 05/30/19 |
| 1 | ADDED HANDRAILS | TR | 06/11/19 |
| 2 | NEW MA | TR | 07/18/19 |
| | | | |
| | | | |

ATC SITE NUMBER:
283421

ATC SITE NAME:
MADISON CT

SITE ADDRESS:
15 ORCHARD PARK ROAD
MADISON, CT 06443

SEAL:




Authorized by "EOR"
Jul 18 2019 2:45 PM

T-Mobile design

| | |
|---|---|
| DRAWN BY: | EF |
| APPROVED BY: | PB |
| DATE DRAWN: | 05/30/19 |
| ATC JOB NO: | 12951859 |

TITLE SHEET

| SHEET NUMBER: | REVISION: |
|---|---|
| G-001 | 2 |

## GENERAL CONSTRUCTION NOTES:

1. ALL WORK SHALL CONFORM TO ALL CURRENT APPLICABLE FEDERAL, STATE, AND LOCAL CODES, INCLUDING ANSI/EIA/TIA-222, AND COMPLY WITH ATC MASTER SPECIFICATIONS.
2. CONTRACTOR SHALL CONTACT LOCAL 811 FOR IDENTIFICATION OF UNDERGROUND UTILITIES PRIOR TO START OF CONSTRUCTION.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING ALL REQUIRED INSPECTIONS.
4. ALL DIMENSIONS TO, OF, AND ON EXISTING BUILDINGS, DRAINAGE STRUCTURES, AND SITE IMPROVEMENTS SHALL BE VERIFIED IN FIELD BY CONTRACTOR WITH ALL DISCREPANCIES REPORTED TO THE ENGINEER.
5. DO NOT CHANGE SIZE OR SPACING OF STRUCTURAL ELEMENTS.
6. DETAILS SHOWN ARE TYPICAL; SIMILAR DETAILS APPLY TO SIMILAR CONDITIONS UNLESS OTHERWISE NOTED.
7. THESE DRAWINGS DO NOT INCLUDE NECESSARY COMPONENTS FOR CONSTRUCTION SAFETY WHICH SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR.
8. CONTRACTOR SHALL BRACE STRUCTURES UNTIL ALL STRUCTURAL ELEMENTS NEEDED FOR STABILITY ARE INSTALLED. THESE ELEMENTS ARE AS FOLLOWS: LATERAL BRACING, ANCHOR BOLTS, ETC.
9. CONTRACTOR SHALL DETERMINE EXACT LOCATION OF EXISTING UTILITIES, GROUNDS DRAINS, DRAIN PIPES, VENTS, ETC. BEFORE COMMENCING WORK.
10. INCORRECTLY FABRICATED, DAMAGED, OR OTHERWISE MISFITTING OR NONCONFORMING MATERIALS OR CONDITIONS SHALL BE REPORTED TO THE T-MOBILE WIRELESS REP PRIOR TO REMEDIAL OR CORRECTIVE ACTION. ANY SUCH REMEDIAL ACTION SHALL REQUIRE WRITTEN APPROVAL BY THE T-MOBILE WIRELESS REP PRIOR TO PROCEEDING.
11. EACH CONTRACTOR SHALL COOPERATE WITH THE T-MOBILE WIRELESS REP, AND COORDINATE HIS WORK WITH THE WORK OF OTHERS.
12. CONTRACTOR SHALL REPAIR ANY DAMAGE CAUSED BY CONSTRUCTION OF THIS PROJECT TO MATCH EXISTING PRE-CONSTRUCTION CONDITIONS TO THE SATISFACTION OF THE T-MOBILE WIRELESS CONSTRUCTION MANAGER.
13. ALL CABLE/CONDUIT ENTRY/EXIT PORTS SHALL BE WEATHERPROOFED DURING INSTALLATION USING A SILICONE SEALANT.
14. WHERE EXISTING CONDITIONS DO NOT MATCH THOSE SHOWN IN THIS PLAN SET, CONTRACTOR SHALL NOTIFY THE T-MOBILE WIRELESS REP IMMEDIATELY.
15. CONTRACTOR SHALL ENSURE ALL SUBCONTRACTORS ARE PROVIDED WITH A COMPLETE AND CURRENT SET OF DRAWINGS AND SPECIFICATIONS FOR THIS PROJECT.
16. CONTRACTOR SHALL REMOVE ALL RUBBISH AND DEBRIS FROM THE SITE AT THE END OF EACH DAY.
17. CONTRACTOR SHALL COORDINATE WORK SCHEDULE WITH LANDLORD AND TAKE PRECAUTIONS TO MINIMIZE IMPACT AND DISRUPTION OF OTHER OCCUPANTS OF THE FACILITY.
18. CONTRACTOR SHALL FURNISH T-MOBILE WIRELESS WITH A PDF MARKED UP AS-BUILT SET OF DRAWINGS UPON COMPLETION OF WORK.
19. PRIOR TO SUBMISSION OF BID, CONTRACTOR SHALL COORDINATE WITH T-MOBILE WIRELESS REP TO DETERMINE WHAT, IF ANY, ITEMS WILL BE PROVIDED. ALL ITEMS NOT PROVIDED SHALL BE PROVIDED AND INSTALLED BY THE CONTRACTOR. CONTRACTOR WILL INSTALL ALL ITEMS PROVIDED.
20. PRIOR TO SUBMISSION OF BID, CONTRACTOR SHALL COORDINATE WITH T-MOBILE WIRELESS REP TO DETERMINE IF ANY PERMITS WILL BE OBTAINED BY CONTRACTOR. ALL REQUIRED PERMITS NOT OBTAINED BY T-MOBILE WIRELESS MUST BE OBTAINED, AND PAID FOR, BY THE CONTRACTOR.
21. CONTRACTOR SHALL INSTALL ALL SITE SIGNAGE IN ACCORDANCE WITH T-MOBILE WIRELESS SPECIFICATIONS AND REQUIREMENTS.
22. CONTRACTOR SHALL SUBMIT ALL SHOP DRAWINGS TO T-MOBILE WIRELESS FOR REVIEW AND APPROVAL PRIOR TO FABRICATION.
23. ALL EQUIPMENT SHALL BE INSTALLED ACCORDING TO MANUFACTURER'S SPECIFICATIONS AND LOCATED ACCORDING TO T-MOBILE WIRELESS SPECIFICATIONS, AND AS SHOWN IN THESE PLANS.
24. THE CONTRACTOR SHALL SUPERVISE AND DIRECT THE PROJECT DESCRIBED HEREIN. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ALL THE CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES AND PROCEDURES AND FOR COORDINATING ALL PORTIONS OF THE WORK UNDER THE CONTRACT.
25. CONTRACTOR SHALL NOTIFY T-MOBILE WIRELESS REP A MINIMUM OF 48 HOURS IN ADVANCE OF POURING CONCRETE OR BACKFILLING ANY UNDERGROUND UTILITIES, FOUNDATIONS OR SEALING ANY WALL, FLOOR OR ROOF PENETRATIONS FOR ENGINEERING REVIEW AND APPROVAL.
26. CONTRACTOR SHALL BE RESPONSIBLE FOR SITE SAFETY INCLUDING COMPLIANCE WITH ALL APPLICABLE OSHA STANDARDS AND RECOMMENDATIONS AND SHALL PROVIDE ALL NECESSARY SAFETY DEVICES INCLUDING PPE AND PPM AND CONSTRUCTION DEVICES SUCH AS WELDING AND FIRE PREVENTION, TEMPORARY SHORING, SCAFFOLDING, TRENCH BOXES/SLOPING, BARRIERS, ETC.
27. THE CONTRACTOR SHALL PROTECT AT HIS OWN EXPENSE, ALL EXISTING FACILITIES AND SUCH OF HIS NEW WORK LIABLE TO INJURY DURING THE CONSTRUCTION PERIOD. ANY DAMAGE CAUSED BY NEGLECT ON THE PART OF THIS CONTRACTOR OR HIS REPRESENTATIVES, OR BY THE ELEMENTS DUE TO NEGLECT ON THE PART OF THIS CONTRACTOR OR HIS REPRESENTATIVES, EITHER TO THE EXISTING WORK, OR TO HIS WORK OR THE WORK OF ANY OTHER CONTRACTOR, SHALL BE REPAIRED AT HIS EXPENSE TO THE OWNER'S SATISFACTION.
28. ALL WORK SHALL BE INSTALLED IN A FIRST CLASS, NEAT AND WORKMANLIKE MANNER BY MECHANICS SKILLED IN THE TRADE INVOLVED. THE QUALITY OF WORKMANSHIP SHALL BE SUBJECT TO THE APPROVAL OF THE T-MOBILE WIRELESS REP. ANY WORK FOUND BY THE T-MOBILE WIRELESS REP TO BE OF INFERIOR QUALITY AND/OR WORKMANSHIP SHALL BE REPLACED AND/OR REWORKED AT CONTRACTOR EXPENSE UNTIL APPROVAL IS OBTAINED.
29. IN ORDER TO ESTABLISH STANDARDS OF QUALITY AND PERFORMANCE, ALL TYPES OF MATERIALS LISTED HEREINAFTER BY MANUFACTURER'S NAMES AND/OR MANUFACTURER'S CATALOG NUMBER SHALL BE PROVIDED BY THESE MANUFACTURERS AS SPECIFIED.

## STRUCTURAL STEEL NOTES:

1. STRUCTURAL STEEL SHALL CONFORM TO THE LATEST EDITION OF THE AISC "SPECIFICATION FOR THE DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS."
2. STRUCTURAL STEEL ROLLED SHAPES, PLATES AND BARS SHALL CONFORM TO THE FOLLOWING ASTM DESIGNATIONS:
   A. ASTM A-572, GRADE 50 - ALL W SHAPES, UNLESS NOTED OR A992 OTHERWISE
   B. ASTM A-36 - ALL OTHER ROLLED SHAPES, PLATES AND BARS UNLESS NOTED OTHERWISE.
   C. ASTM A-500, GRADE B - HSS SECTION (SQUARE, RECTANGULAR, AND ROUND)
   D. ASTM A-325, TYPE SC OR N - ALL BOLTS FOR CONNECTING STRUCTURAL MEMBERS
   E. ASTM F-1554 07 - ALL ANCHOR BOLTS, UNLESS NOTED OTHERWISE
3. ALL EXPOSED STRUCTURAL STEEL MEMBERS SHALL BE HOT-DIPPED GALVANIZED AFTER FABRICATION PER ASTM A123. EXPOSED STEEL HARDWARE AND ANCHOR BOLTS SHALL BE GALVANIZED PER ASTM A153 OR B695.
4. ALL FIELD CUT SURFACES, FIELD DRILLED HOLES AND GROUND SURFACES WHERE EXISTING PAINT OR GALVANIZATION REMOVAL WAS REQUIRED SHALL BE REPAIRED WITH (2) BRUSHED COATS OF ZRC GALVILITE COLD GALVANIZING COMPOUND PER ASTM A780 AND MANUFACTURER'S RECOMMENDATIONS.
5. DO NOT DRILL HOLES THROUGH STRUCTURAL STEEL MEMBERS EXCEPT AS SHOWN AND DETAILED ON STRUCTURAL DRAWINGS.
6. CONNECTIONS:
   A. ALL WELDING TO BE PERFORMED BY AWS CERTIFIED WELDERS AND CONDUCTED IN ACCORDANCE WITH THE LATEST EDITION OF THE AWS WELDING CODE D1.1.
   B. ALL WELDS SHALL BE INSPECTED VISUALLY. 25% OF WELDS SHALL BE INSPECTED WITH DYE PENETRANT OR MAGNETIC PARTICLE TO MEET THE ACCEPTANCE CRITERIA OF AWS D1.1. REPAIR ALL WELDS AS NECESSARY.
   C. INSPECTION SHALL BE PERFORMED BY AN AWS CERTIFIED WELD INSPECTOR.
   D. IT IS THE CONTRACTORS RESPONSIBILITY TO PROVIDE BURNING/WELDING PERMITS AS REQUIRED BY LOCAL GOVERNING AUTHORITY AND IF REQUIRED SHALL HAVE FIRE DEPARTMENT DETAIL FOR ANY WELDING ACTIVITY.
   E. ALL ELECTRODES TO BE LOW HYDROGEN, MATCHING FILLER METAL, PER AWS D1.1, UNLESS NOTED OTHERWISE.
   F. MINIMUM WELD SIZE TO BE 0.1875 INCH FILLET WELDS, UNLESS NOTED OTHERWISE.
   G. PRIOR TO FIELD WELDING GALVANIZING MATERIAL, CONTRACTOR SHALL GRIND OFF GALVANIZING ½" BEYOND ALL FIELD WELD SURFACES. AFTER WELD AND WELD INSPECTION IS COMPLETE, REPAIR ALL GROUND AND WELDED SURFACES WITH ZRC GALVILITE COLD GALVANIZING COMPOUND PER ASTM A780 AND MANUFACTURERS RECOMMENDATIONS.

AMERICAN TOWER®
A.T. ENGINEERING SERVICE, PLLC
3500 REGENCY PARKWAY
SUITE 100
CARY, NC 27518
PHONE: (919) 468-0112
COA: PEC.0001553



| REV. | DESCRIPTION | BY | DATE |
|---|---|---|---|
| 0 | FOR CONSTRUCTION | EF | 05/30/19 |
| | | | |
| | | | |
| | | | |
| | | | |

ATC SITE NUMBER:
283421

ATC SITE NAME:
MADISON CT

SITE ADDRESS:
15 ORCHARD PARK ROAD
MADISON, CT 06443

SEAL:


Authorized by "EOR"
Jul 18 2019 2:45 PM

T-Mobile cosign

| | |
|---|---|
| DRAWN BY: | EF |
| APPROVED BY: | PB |
| DATE DRAWN: | 05/30/19 |
| ATC JOB NO: | 12951859 |

GENERAL NOTES

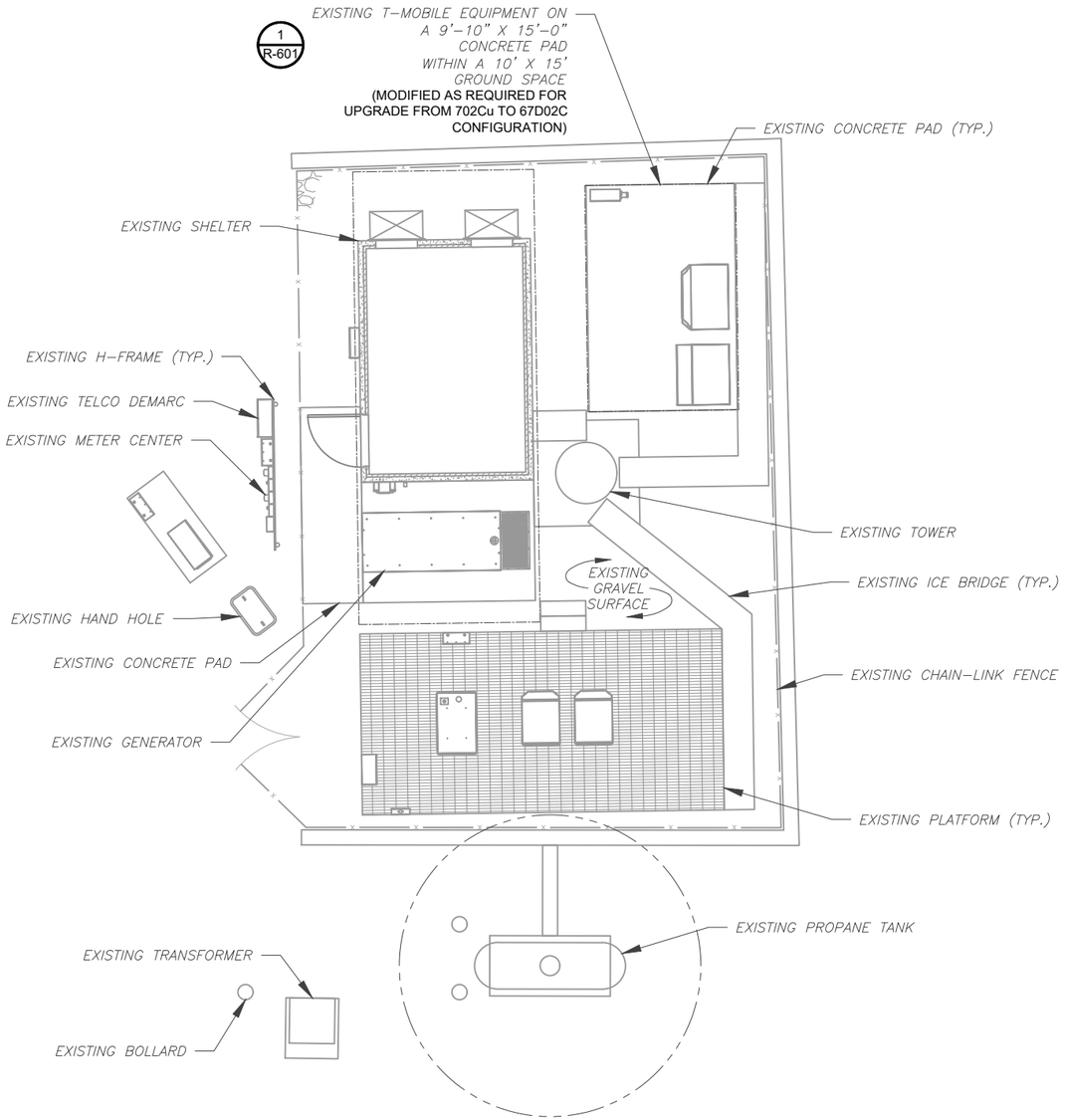
| SHEET NUMBER: | REVISION: |
|---|---|
| G-002 | 0 |

SITE PLAN NOTES:

1. THIS SITE PLAN REPRESENTS THE BEST PRESENT KNOWLEDGE AVAILABLE TO THE ENGINEER AT THE TIME OF THIS DESIGN. THE CONTRACTOR SHALL VISIT THE SITE PRIOR TO CONSTRUCTION AND VERIFY ALL EXISTING CONDITIONS RELATED TO THE SCOPE OF WORK FOR THIS PROJECT.

2. ICE BRIDGE, CABLE LADDER, COAX PORT, AND COAX CABLE ARE SHOWN FOR REFERENCE ONLY. CONTRACTOR SHALL CONFIRM THE EXACT LOCATION OF ALL PROPOSED AND EXISTING EQUIPMENT AND STRUCTURES DEPICTED ON THIS PLAN. BEFORE UTILIZING EXISTING CABLE SUPPORTS, COAX PORTS, INSTALLING NEW PORTS OR ANY OTHER EQUIPMENT, CONTRACTOR SHALL VERIFY ALL ASPECTS OF THE COMPONENTS MEET THE ATC SPECIFICATIONS.

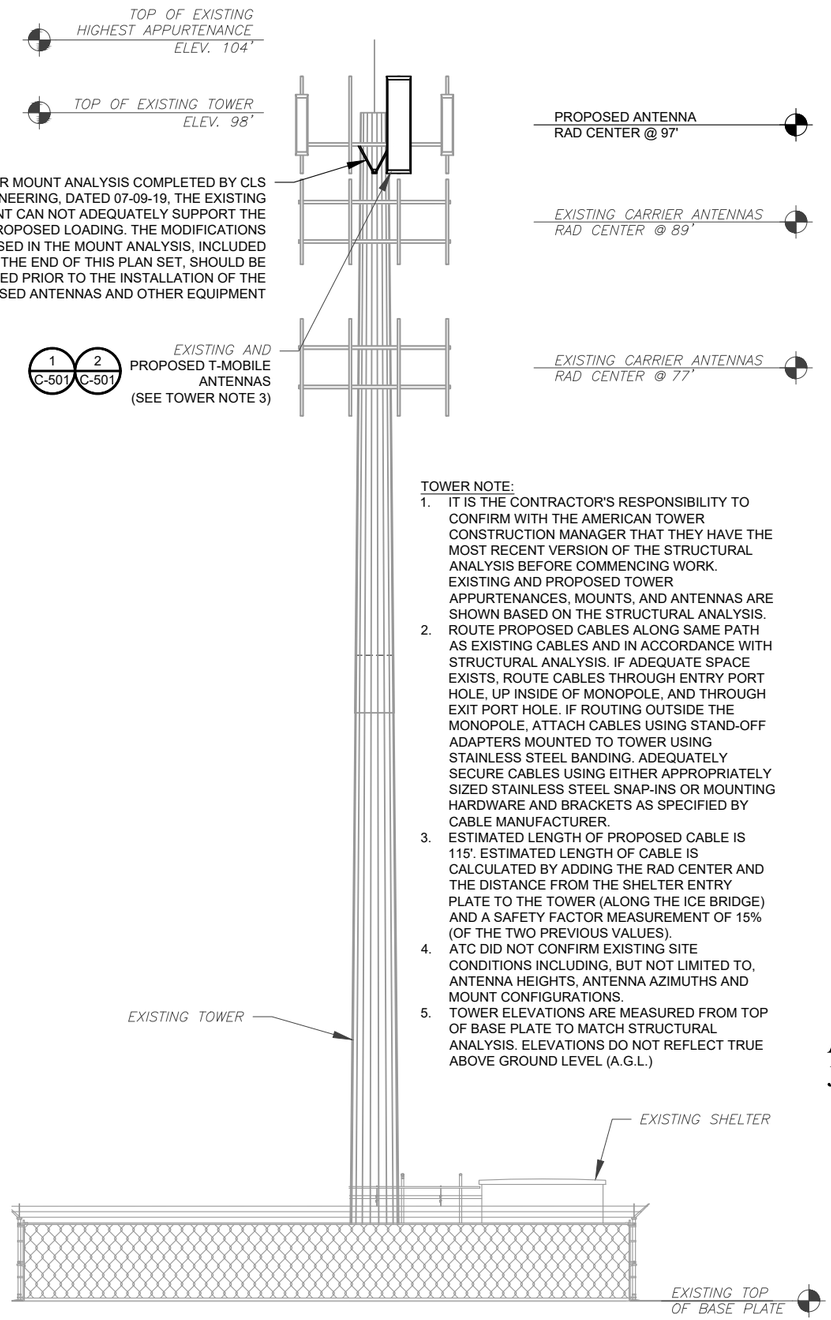
3. THIS PROJECT INCLUDES NO INSTALL OR MODIFICATION AT GRADE.




1 DETAILED SITE PLAN

0 10' 20'

SCALE: 1"=10' (11X17)
1"=5' (22X34)




2 TOWER ELEVATION

SCALE: NOT TO SCALE

TOWER NOTE:

1. IT IS THE CONTRACTOR'S RESPONSIBILITY TO CONFIRM WITH THE AMERICAN TOWER CONSTRUCTION MANAGER THAT THEY HAVE THE MOST RECENT VERSION OF THE STRUCTURAL ANALYSIS BEFORE COMMENCING WORK. EXISTING AND PROPOSED TOWER APPURTENANCES, MOUNTS, AND ANTENNAS ARE SHOWN BASED ON THE STRUCTURAL ANALYSIS.
2. ROUTE PROPOSED CABLES ALONG SAME PATH AS EXISTING CABLES AND IN ACCORDANCE WITH STRUCTURAL ANALYSIS. IF ADEQUATE SPACE EXISTS, ROUTE CABLES THROUGH ENTRY PORT HOLE, UP INSIDE OF MONOPOLE, AND THROUGH EXIT PORT HOLE. IF ROUTING OUTSIDE THE MONOPOLE, ATTACH CABLES USING STAND-OFF ADAPTERS MOUNTED TO TOWER USING STAINLESS STEEL BANDING. ADEQUATELY SECURE CABLES USING EITHER APPROPRIATELY SIZED STAINLESS STEEL SNAP-INS OR MOUNTING HARDWARE AND BRACKETS AS SPECIFIED BY CABLE MANUFACTURER.
3. ESTIMATED LENGTH OF PROPOSED CABLE IS 115'. ESTIMATED LENGTH OF CABLE IS CALCULATED BY ADDING THE RAD CENTER AND THE DISTANCE FROM THE SHELTER ENTRY PLATE TO THE TOWER (ALONG THE ICE BRIDGE) AND A SAFETY FACTOR MEASUREMENT OF 15% (OF THE TWO PREVIOUS VALUES).
4. ATC DID NOT CONFIRM EXISTING SITE CONDITIONS INCLUDING, BUT NOT LIMITED TO, ANTENNA HEIGHTS, ANTENNA AZIMUTHS AND MOUNT CONFIGURATIONS.
5. TOWER ELEVATIONS ARE MEASURED FROM TOP OF BASE PLATE TO MATCH STRUCTURAL ANALYSIS. ELEVATIONS DO NOT REFLECT TRUE ABOVE GROUND LEVEL (A.G.L.)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| REV. | DESCRIPTION | BY | DATE |
|---|---|---|---|
| 0 | FOR CONSTRUCTION | EF | 05/30/19 |
| 1 | ADDED HANDRAILS | TR | 06/11/19 |
| 2 | NEW MA | TR | 07/18/19 |
| | | | |
| | | | |

ATC SITE NUMBER:
283421

ATC SITE NAME:
MADISON CT

SITE ADDRESS:
15 ORCHARD PARK ROAD
MADISON, CT 06443

SEAL:

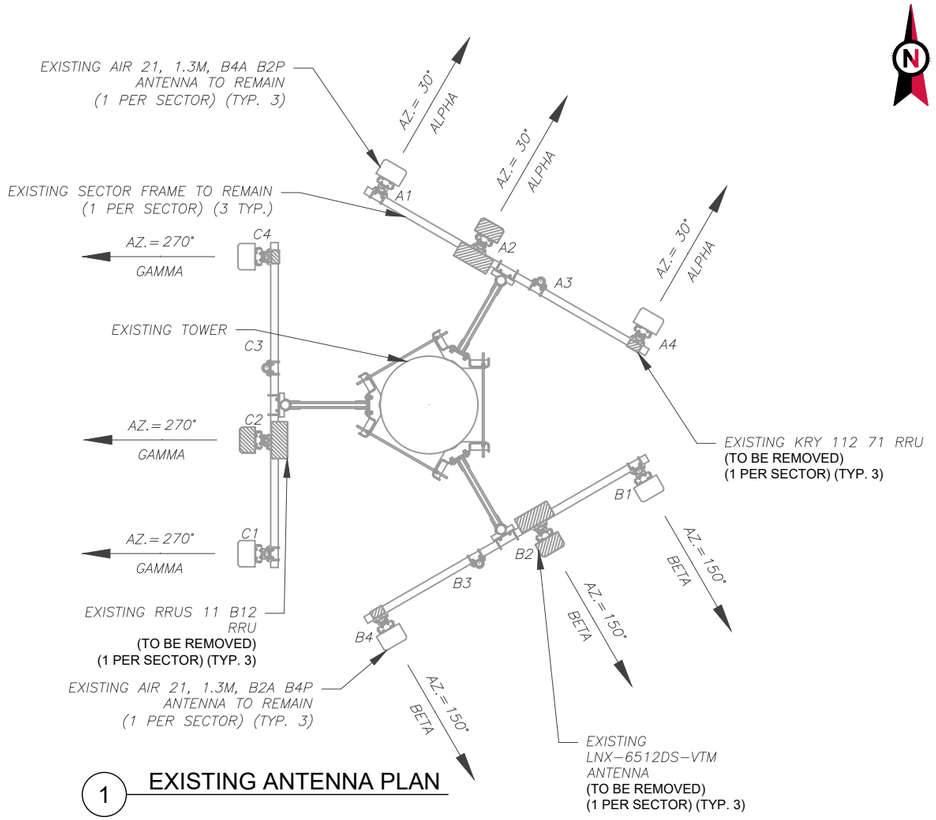

Authorized by "EOR"
Jul 18 2019 2:45 PM

T-Mobile cosign

| | |
|---|---|
| DRAWN BY: | EF |
| APPROVED BY: | PB |
| DATE DRAWN: | 05/30/19 |
| ATC JOB NO: | 12951859 |

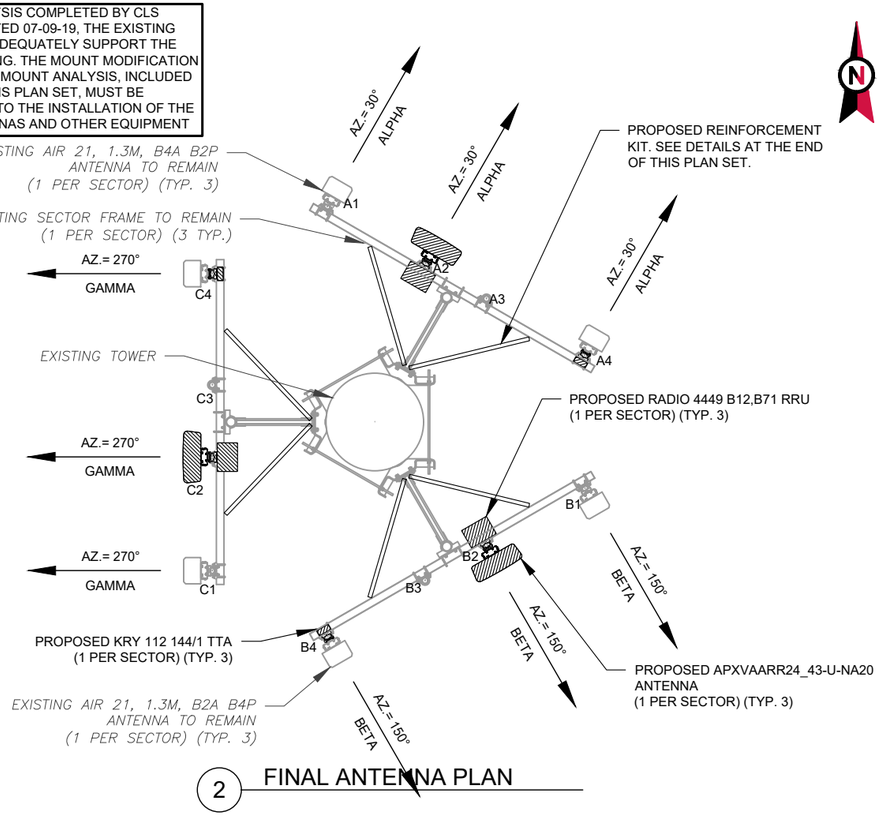
DETAILED SITE PLAN & TOWER ELEVATION

| SHEET NUMBER: | REVISION: |
|---|---|
| C-101 | 2 |




1 EXISTING ANTENNA PLAN

PER MOUNT ANALYSIS COMPLETED BY CLS ENGINEERING, DATED 07-09-19, THE EXISTING MOUNT CAN NOT ADEQUATELY SUPPORT THE PROPOSED LOADING. THE MOUNT MODIFICATION PROPOSED IN THE MOUNT ANALYSIS, INCLUDED AT THE END OF THIS PLAN SET, MUST BE INSTALLED PRIOR TO THE INSTALLATION OF THE PROPOSED ANTENNAS AND OTHER EQUIPMENT




2 FINAL ANTENNA PLAN

EXISTING ANTENNA / EQUIPMENT SCHEDULE

| SECTOR | ANT. | MANUFACTURER (MODEL #) | RAD CENTER | AZIMUTH (TN) | MECH. D-TILT | ELEC. D-TILT | ADDITIONAL TOWER MOUNTED EQUIPMENT |
|---|---|---|---|---|---|---|---|
| ALPHA | A1 | AIR 21, 1.3M, B4A B2P | 97'-0" | 30° | 0° | 2° | – |
| ALPHA | A2 | LNX-6512DS-VTM | 97'-0" | 30° | 0° | 2° | RRUS 11 B12 |
| ALPHA | A3 | – | | | | | |
| ALPHA | A4 | AIR 21, 1.3M, B2A B4P | 97'-0" | 30° | 0° | 2° | KRY 112 72 |
| BETA | B1 | AIR 21, 1.3M, B4A B2P | 97'-0" | 150° | 0° | 2° | – |
| BETA | B2 | LNX-6512DS-VTM | 97'-0" | 150° | 0° | 2° | RRUS 11 B12 |
| BETA | B3 | – | | | | | |
| BETA | B4 | AIR 21, 1.3M, B2A B4P | 97'-0" | 150° | 0° | 2° | KRY 112 72 |
| GAMMA | C1 | AIR 21, 1.3M, B4A B2P | 97'-0" | 270° | 0° | 2° | – |
| GAMMA | C2 | LNX-6512DS-VTM | 97'-0" | 270° | 0° | 2° | RRUS 11 B12 |
| GAMMA | C3 | – | | | | | |
| GAMMA | C4 | AIR 21, 1.3M, B2A B4P | 97'-0" | 270° | 0° | 2° | KRY 112 72 |

NOTES

1. BASED ON APPROVED ATC APPLICATION 12927138, DATED 04/02/2019. CONFIRM WITH T-MOBILE REP FOR APPLICABLE UPDATES/REVISIONS AND MOST RECENT RFDS FOR NSN CONFIGURATION (CONFIG). GC TO CAP ALL UNUSED PORTS.
2. ATC HAS NOT YET VERIFIED ANY EXISTING ANTENNA CONFIG OR MOUNT CONFIG. CONTRACTOR TO VERIFY MOUNT CONFIG HAS SUFFICIENT SPACE FOR PROPOSED LESSEE EQUIPMENT (EQUIP) (I.E. CLEARANCES, MOUNT PIPE, SUFFICIENT LENGTH, ETC.) ATC DID NOT ANALYZE ANTENNA MOUNT TO DETERMINE ADEQUATE STRUCTURAL CAPACITY FOR ANY LESSEE LOADING.
3. ALL PROPOSED EQUIP INCLUDING ANTENNAS, COAX, ETC. SHALL BE MOUNTED IN ACCORDANCE WITH THE TOWER STRUCTURAL ANALYSIS ON FILE WITH ATC'S CM.
4. CONFIRM SPACING OF PROPOSED EQUIP DOES NOT CAUSE TOWER CONFLICTS NOR IMPEDE TOWER CLIMBING PEGS.
5. POSITIONS START WITH FIRST PIPE ON THE LEFT SIDE (AS VIEWED FROM BEHIND THE MOUNT).

FINAL ANTENNA / EQUIPMENT SCHEDULE

| SECTOR | ANT. | MANUFACTURER (MODEL #) | RAD CENTER | AZIMUTH (TN) | MECH. D-TILT | ELEC. D-TILT | ADDITIONAL TOWER MOUNTED EQUIPMENT |
|---|---|---|---|---|---|---|---|
| ALPHA | A1 | AIR 21, 1.3M, B4A B2P | 97'-0" | 30° | 0° | 2° | - |
| ALPHA | A2 | APXVAARR24_43-U-NA20 | 97'-0" | 30° | 0° | 2° | RADIO 4449 B12,B71 |
| ALPHA | A3 | - | - | - | - | - | - |
| ALPHA | A4 | AIR 21, 1.3M, B2A B4P | 97'-0" | 30° | 0° | 2° | KRY 112 144/1 |
| BETA | B1 | AIR 21, 1.3M, B4A B2P | 97'-0" | 150° | 0° | 2° | - |
| BETA | B2 | APXVAARR24_43-U-NA20 | 97'-0" | 150° | 0° | 2° | RADIO 4449 B12,B71 |
| BETA | B3 | - | - | - | - | - | - |
| BETA | B4 | AIR 21, 1.3M, B2A B4P | 97'-0" | 150° | 0° | 2° | KRY 112 144/1 |
| GAMMA | C1 | AIR 21, 1.3M, B4A B2P | 97'-0" | 270° | 0° | 2° | - |
| GAMMA | C2 | APXVAARR24_43-U-NA20 | 97'-0" | 270° | 0° | 2° | RADIO 4449 B12,B71 |
| GAMMA | C3 | - | - | - | - | - | - |
| GAMMA | C4 | AIR 21, 1.3M, B2A B4P | 97'-0" | 270° | 0° | 2° | KRY 112 144/1 |

| CURRENT FIBER DISTRIBUTION/OVP BOX | | CURRENT CABLING SUMMARY | | |
|---|---|---|---|---|
| MODEL NUMBER | STATUS | COAX | HYBRID | STATUS |
| – | – | (6) 1-5/8" | (1) 1-5/8" | RMN |
| – | – | **(6) 1-5/8"** | – | RMV |

STATUS ABBREVIATIONS
RMV: TO BE REMOVED
RMN: TO REMAIN
REL: TO BE RELOCATED
DSC: TO BE DISCONNECTED & REMAIN
ADD: TO BE ADDED

3 ANTENNA SCHEDULE

| PROPOSED FIBER DISTRIBUTION/OVP BOX | | PROPOSED CABLING SUMMARY | | |
|---|---|---|---|---|
| MODEL NUMBER | STATUS | COAX | HYBRID | STATUS |
| - | - | (6) 1-5/8" | (1) 1-5/8" | RMN |
| - | - | - | (3) 1-5/8" | ADD |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COA: PEC.0001553




| REV. | DESCRIPTION | BY | DATE |
|---|---|---|---|
| 0 | FOR CONSTRUCTION | EF | 05/30/19 |
| 1 | ADDED HANDRAILS | TR | 06/11/19 |
| 2 | NEW MA | TR | 07/18/19 |
| | | | |
| | | | |

ATC SITE NUMBER:
283421
ATC SITE NAME:
MADISON CT

SITE ADDRESS:
15 ORCHARD PARK ROAD
MADISON, CT 06443

SEAL:

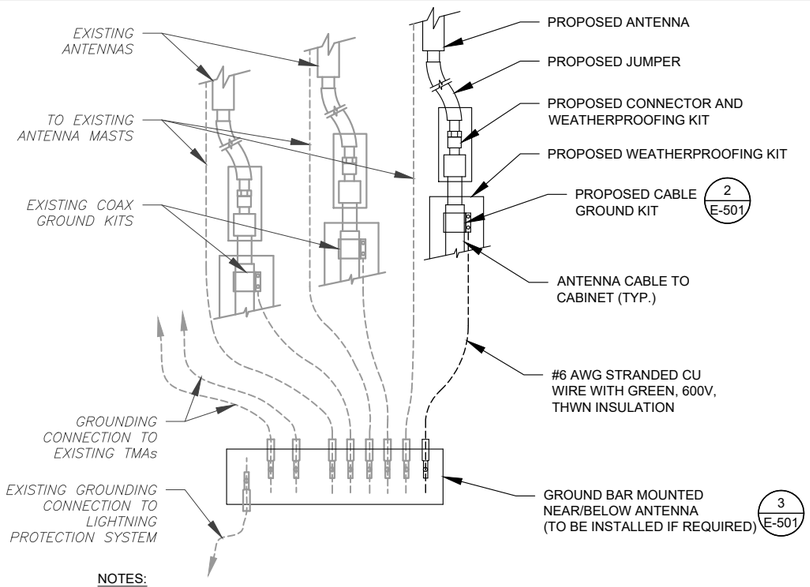

Authorized by "EOR"
Jul 18 2019 2:45 PM

T-Mobile cosign

| | |
|---|---|
| DRAWN BY: | EF |
| APPROVED BY: | PB |
| DATE DRAWN: | 05/30/19 |
| ATC JOB NO: | 12951859 |

ANTENNA INFORMATION & SCHEDULE

| SHEET NUMBER: | REVISION: |
|---|---|
| C-501 | 2 |

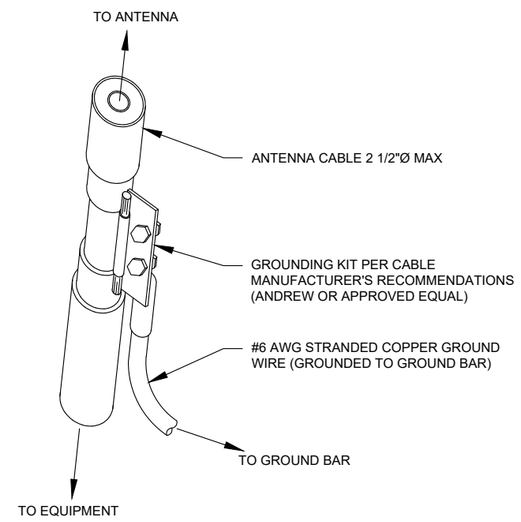



NOTES:

1. THIS DETAIL IS INTENDED TO SHOW THE GENERAL GROUNDING REQUIREMENTS. SLIGHT ADJUSTMENTS MAY BE REQUIRED BASED ON EXISTING SITE CONDITIONS. THE CONTRACTOR SHALL MAKE FIELD ADJUSTMENTS AS NEEDED AND INFORM THE CONSTRUCTION MANAGER OF ANY CONFLICTS.
2. SITE GROUNDING SHALL COMPLY WITH T-MOBILE GROUNDING STANDARDS, LATEST EDITION, AND COMPLY WITH T-MOBILE GROUNDING CHECKLIST, LATEST VERSION. WHEN NATIONAL AND LOCAL GROUNDING CODES ARE MORE STRINGENT THEY SHALL GOVERN.

## 1 TYPICAL ANTENNA GROUNDING DIAGRAM

SCALE: NOT TO SCALE

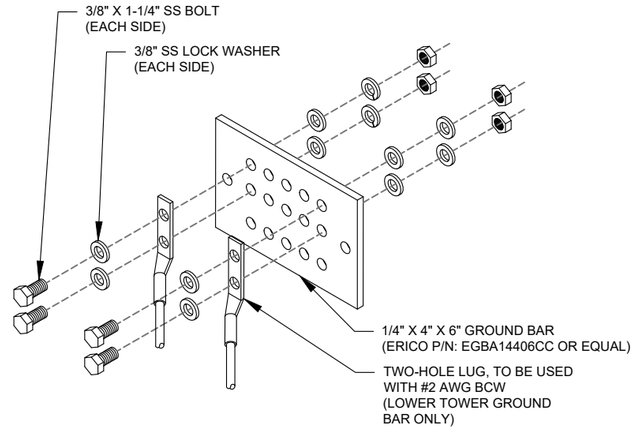



GROUND KIT NOTES:

1. DO NOT INSTALL CABLE GROUND KIT AT A BEND AND ALWAYS DIRECT GROUND WIRE DOWN TO GROUND BAR.
2. CONTRACTOR SHALL PROVIDE WEATHERPROOFING KIT (ANDREW PART NUMBER 221213) AND INSTALL/TAPE PER MANUFACTURER'S SPECIFICATIONS.

## 2 CABLE GROUND KIT CONNECTION DETAIL

SCALE: NOT TO SCALE




GROUND BAR NOTES:

1. GROUND BAR KITS COME WITH ALL HARDWARE, NUTS, BOLTS, WASHERS, ETC. EXCEPT THE STRUCTURAL MOUNTING MEMBER(S).
2. GROUND BAR TO BE BONDED DIRECTLY TO TOWER.

## 3 TOWER GROUND BAR DETAIL

SCALE: NOT TO SCALE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SUITE 100
CARY, NC 27518
PHONE: (919) 468-0112
COA: PEC.0001553




| REV. | DESCRIPTION | BY | DATE |
|---|---|---|---|
| 0 | FOR CONSTRUCTION | EF | 05/30/19 |
| | | | |
| | | | |
| | | | |
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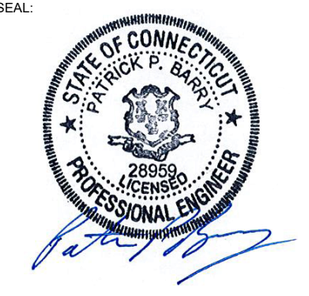
ATC SITE NUMBER:
283421

ATC SITE NAME:
MADISON CT

SITE ADDRESS:
15 ORCHARD PARK ROAD
MADISON, CT 06443

SEAL:

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T-Mobile design

| | |
|---|---|
| DRAWN BY: | EF |
| APPROVED BY: | PB |
| DATE DRAWN: | 05/30/19 |
| ATC JOB NO: | 12951859 |

GROUNDING DETAILS

| SHEET NUMBER: | REVISION: |
|---|---|
| E-501 | 0 |

| Existing RAN Equipment | | |
|---|---|---|
| Template: 702Cu | | |
| Enclosure | 1 | 2 |
| Enclosure Type | RBS 6131 | S18000 Outdoor |
| Baseband | DUW30 (x 2) DUG20 DUS41 | |
| Hybrid Cable System | Ericsson 9x18 HCS *Select Length* | |
| Radio | RU22 (x 6) | |

| Proposed RAN Equipment | | |
|---|---|---|
| Template: 67D02C Outdoor | | |
| Enclosure | 1 | 2 |
| Enclosure Type | RBS 6131 | S18000 Outdoor |
| Baseband | DUW30 U2100 / DUW30 U1900 / DUG20 G1900 / BB 6630 L2100 L700 L600 / BB 6630 N600 (DARK) | |
| Hybrid Cable System | Ericsson 9x18 HCS *Select Length*<br>Ericsson 6x12 HCS *Select Length & AWG* (x 3) | |
| Radio | RU22 (x 6) U2100 | |

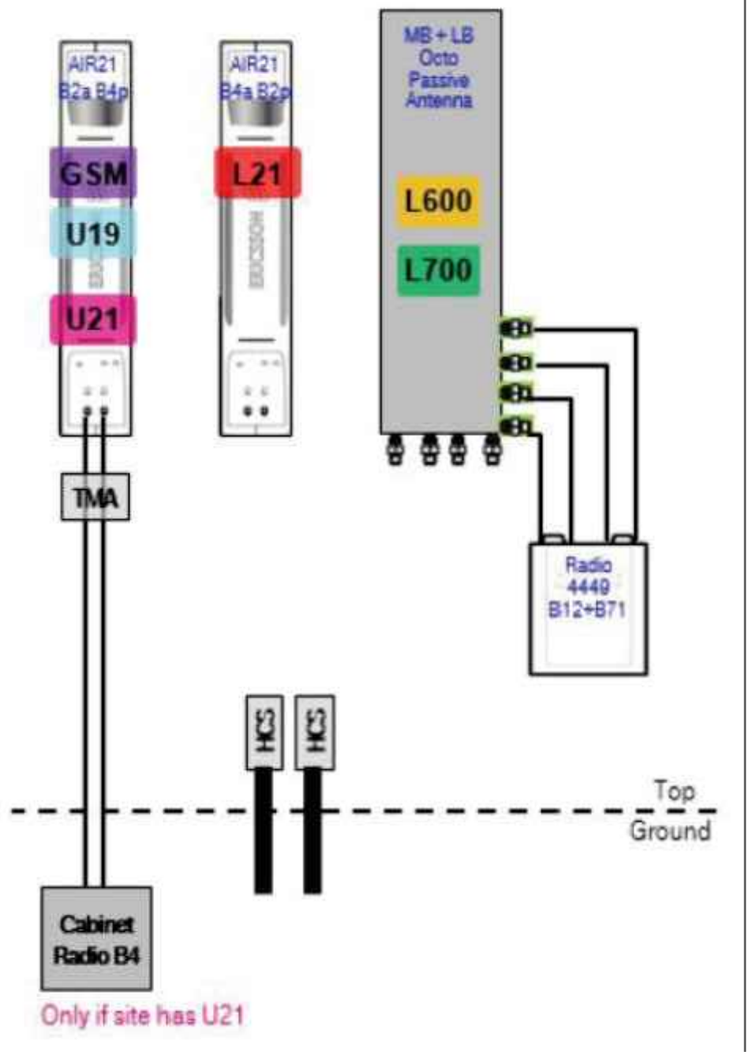
RAN Scope of Work:

Replace (1) DUS41 with (1) BB6630 for L2100, L700, and L600.
Add (1) BB6630 for future 5G N600.
Add (3) 6X12 HCS, Length and AWG will decide by Dev.

Swap (3) LNX 6515 Antennas with (3) 8' Octo port antennas. Swap (3) RRUS11 B12 with (3) Radios 4449.

Existing: (12) 1-5/8; (1) 9X18 HCS. Remove (6) Coaxial Lines.

67D02C.JPG




2 ANTENNA CONFIGURATION
SCALE: NOT TO SCALE

NOTE: THIS SHEET CREATED BY OTHERS AND PROVIDED BY REQUEST OF CUSTOMER WITHOUT EDIT.

SUPPLEMENTAL

| SHEET NUMBER: | REVISION: |
|---|---|
| R-601 | 0 |

# Mount Analysis of Existing T-Arms for American Tower on behalf of T-Mobile
## 283421 - Madison CT, CT
## Project #: 12927138

**T-Mobile Site ID: CTNH808A**
**Program: L600**

**CLS Engineering PLLC Project #41124-12927138-01-MA-R1**
**July 9, 2019**

| | |
|---|---|
| MOUNT DESCRIPTION | Existing T-Arms at 96 ft AGL |
| ANTENNA ELEVATION | Nominal Rad. Elevation of 97 ft AGL (Eccentricity of ~1 ft) |
| SITE DESCRIPTION | 98 ft Monopole |
| SITE ADDRESS | 15 Orchard Park Road, Madison, CT, 06443-2268, New Haven County |
| GPS COORDINATES | 41.28308333, -72.623075 |
| ANALYSIS STANDARD | 2015 IBC / 2018 Connecticut State Building Code / TIA-222-G |
| LOADING CRITERIA | 130 mph, $V_{ult}$ / 100.7 mph, $V_{asd}$ (3-Second Gust) w/o ice & 50 mph (3-Second Gust) w/ 0.75" |

■ **ANALYSIS RESULT:** **Pass (Conditional)**

| | | |
|---|---|---|
| MEMBER USAGE | 87% | Pass |
| COLLAR USAGE | 99% | Pass |

***A maintenance live load of 250 lb has been applied at each mounting pipe location.***

**Modifications are proposed to bring mounts into compliance; see conclusion for details.**

Prepared by:
**Sean Rock, E.I.**

Reviewed and Approved by:
**Tyler M. Barker, P.E.**

STATE OF CONNECTICUT · TYLER M BARKER · No. 32402 · LICENSED PROFESSIONAL ENGINEER

Tyler M. Barker
CLS Engineering, PLLC
Director of Engineering
PE # 32402 Exp. 1/31/2020
COA # PEC.0001853 Exp. 8/14/2019

IdenTrust a part of HID Global

Digitally signed by Tyler Barker
DN: c=US, o=Telamon Corporation, ou=A01427E0000016A4525ADF8000001D17, cn=Tyler Barker
Date: 2019.07.09 13:47:05 -04'00'





## ■ CONCLUSION AND RECOMMENDATIONS

According to our structural analysis, the mounts have been found to **CONDITIONALLY PASS.** The mounting configuration considered in this analysis will be capable of supporting the referenced loading pursuant to referenced standards once the following scope is executed:

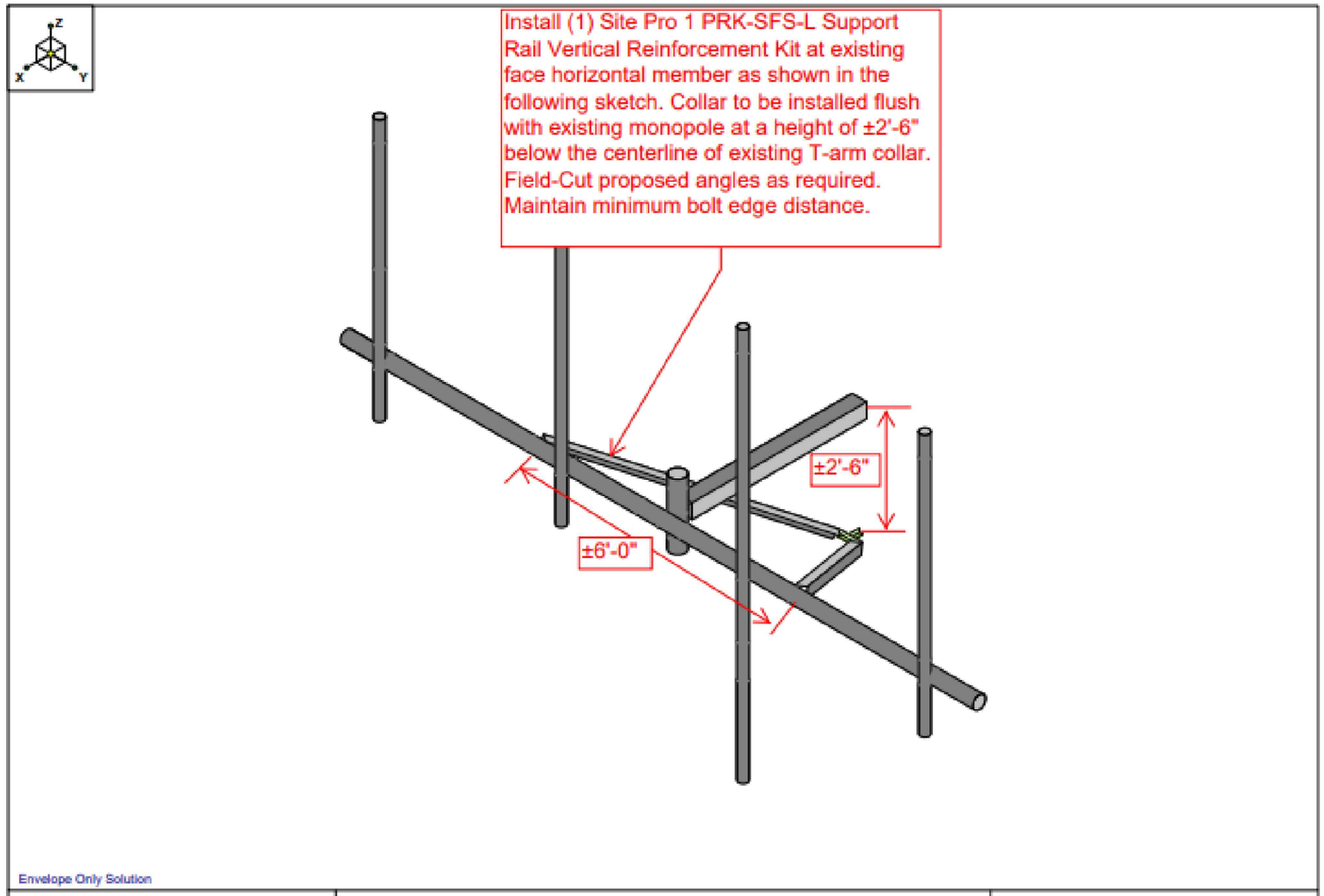
- **Install (1) Site Pro 1 PRK-SFS-L Support Rail Vertical Reinforcement Kit at existing face horizontal member as shown in the following sketch. Collar to be installed flush with existing monopole at a height of ±2.5 ft. below the centerline of existing T-arm collar. Field-Cut proposed angles as required. Maintain minimum bolt edge distance.**

See following sketches and Site Pro 1 assembly drawings for additional details.

NOTE: THIS SHEET CREATED BY OTHERS AND PROVIDED BY REQUEST OF CUSTOMER WITHOUT EDIT.

SUPPLEMENTAL

SHEET NUMBER: R-602
REVISION: 0



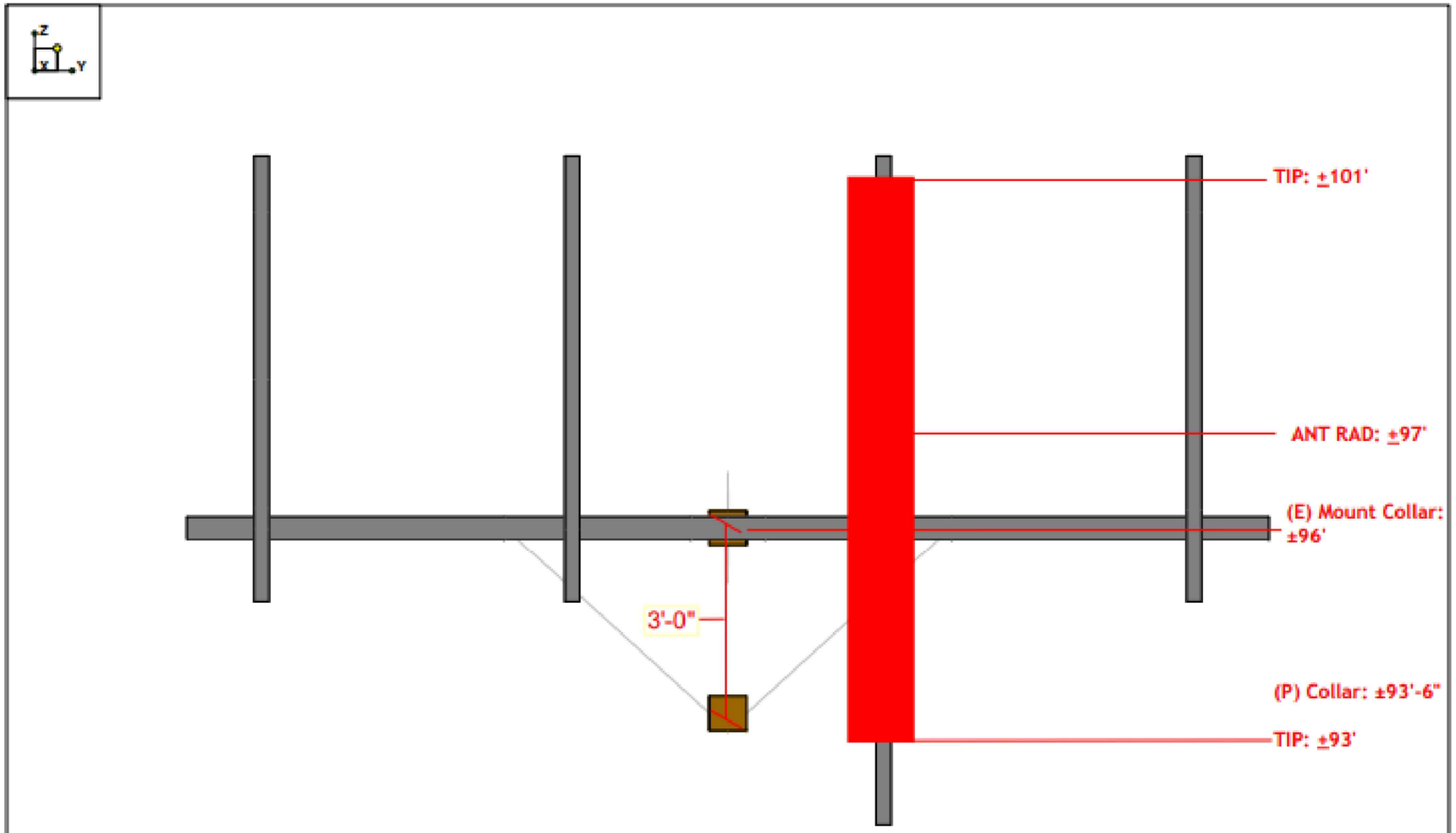

Envelope Only Solution

| | | |
|---|---|---|
| CLS | 41124-12927138-Madison CT, CT-283421 | SK - 0 |
| SMR | | Apr 11, 2019 at 2:00 PM |
| 41124-12927138-01-MA | Proposed Modifications - Rendered | 41124-12927138-01-MA.r3d |

NOTE: THIS SHEET CREATED BY OTHERS AND PROVIDED BY REQUEST OF CUSTOMER WITHOUT EDIT.

SUPPLEMENTAL

| SHEET NUMBER: | REVISION: |
|---|---|
| R-603 | 0 |




| | | |
|---|---|---|
| CLS | 41124-12927138-Madison CT, CT-283421 | SK - 0 |
| SMR | | Apr 12, 2019 at 4:20 PM |
| 41124-12927138-01-MA | Installation Sketch | 41124-12927138-01-MA.r3d |

NOTE: THIS SHEET CREATED BY OTHERS AND PROVIDED BY REQUEST OF CUSTOMER WITHOUT EDIT.

SUPPLEMENTAL

| SHEET NUMBER: | REVISION: |
|---|---|
| R-604 | 0 |

AMERICAN TOWER®
CORPORATION

# Structural Analysis Report

| | | |
|---|---|---|
| **Structure** | : | **98 ft Monopole** |
| **ATC Site Name** | : | **MADISON CT, CT** |
| **ATC Site Number** | : | **283421** |
| **Engineering Number** | : | **12927138_C3_02** |
| **Proposed Carrier** | : | **T-MOBILE** |
| **Carrier Site Name** | : | **Amtrak_Madison** |
| **Carrier Site Number** | : | **CTNH808A** |
| **Site Location** | : | **15 Orchard Park Road**<br>**Madison, CT 06443-2268**<br>**41.283100,-72.623100** |
| **County** | : | **New Haven** |
| **Date** | : | **July 19, 2019** |
| **Max Usage** | : | **51%** |
| **Result** | : | **Pass** |

Prepared By:
Aaron McMillan, E.I.
Structural Engineer I

Reviewed By:

STATE OF CONNECTICUT
ESHA KAUSHAL MODI
32593
LICENSED
PROFESSIONAL ENGINEER

Authorized by "EOR"
Jul 23 2019 5:40 PM cosign

**COA: PEC.0001553**

AMERICAN TOWER®
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## Table of Contents

## Introduction

The purpose of this report is to summarize results of a structural analysis performed on the 98 ft monopole to reflect the change in loading by T-MOBILE.

## Supporting Documents

| | |
|---|---|
| **Tower Drawings** | Sabre Drawing #30257-MM, dated July 7, 2010 |
| **Foundation Drawing** | KJT Job #30257, dated March 21, 2011 |
| **Geotechnical Report** | RCI Project #J2095225, dated December 21, 2009 |
| **Mount Analysis** | CLS Engineering PLLC Project #41124-12927138-01-MA-R1, dated July 9, 2019 |

## Analysis

The tower was analyzed using American Tower Corporation's tower analysis software. This program considers an elastic three-dimensional model and second-order effects per ANSI/TIA-222.

| | |
|---|---|
| **Basic Wind Speed:** | 101 mph (3-Second Gust, Vasd) / 130 mph (3-Second Gust, Vult) |
| **Basic Wind Speed w/ Ice:** | 50 mph (3-Second Gust) w/ 3/4" radial ice concurrent |
| **Code:** | ANSI/TIA-222-G / 2015 IBC / 2018 Connecticut State Building Code |
| **Structure Class:** | II |
| **Exposure Category:** | D |
| **Topographic Category:** | 1 |
| **Crest Height:** | 0 ft |
| **Spectral Response:** | Ss = 0.17, $S_1$ = 0.06 |
| **Site Class:** | D - Stiff Soil |

## Conclusion

Based on the analysis results, the structure meets the requirements per the applicable codes listed above. The tower and foundation can support the equipment as described in this report.

If you have any questions or require additional information, please contact American Tower via email at Engineering@americantower.com. Please include the American Tower site name, site number, and engineering number in the subject line for any questions.

**Existing and Reserved Equipment**

| Elev.[1] (ft) | Qty | Antenna | Mount Type | Lines | Carrier |
|---|---|---|---|---|---|
| 97.0 | - | - | T-Arms | (6) 1 5/8" Coax | T-MOBILE |
| 90.0 | 9 | Ericsson RRUS-11 | Platform with Handrails | (2) 0.40" (10.3mm) Fiber<br>(8) 0.78" (19.7mm) 8 AWG 6<br>(3) 3/8" (0.38"-9.5mm) RET Control Cable<br>(5) 3" conduit | AT&T MOBILITY |
| | 3 | Ericsson RRUS E2 B29 | | | |
| | 6 | Ericsson RRUS 12 | | | |
| | 3 | Ericsson RRUS 32 (50.8 lbs) | | | |
| | 12 | CCI HPA-65R-BUU-H8 | | | |
| | 6 | Ericsson RRUS A2 | | | |
| | 4 | Raycap DC6-48-60-18-8F | | | |
| 76.0 | 12 | Andrew SBNHH-1D65B | Platform with Handrails | (2) 1 5/8" Hybriflex | VERIZON WIRELESS |
| | 2 | Raycap RxxDC-3315-PF-48 (32 lbs) | | | |
| | 3 | Alcatel-Lucent RRH4x45-B66 w/o Solar Shield | | | |
| | 3 | Alcatel-Lucent 1900 MHz 4X45 RRH | | | |
| | 3 | Alcatel-Lucent B13 RRH4x30-4R 700U | | | |

**Equipment to be Removed**

| Elev.[1] (ft) | Qty | Antenna | Mount Type | Lines | Carrier |
|---|---|---|---|---|---|
| 97.0 | 3 | Ericsson KRY 112 71 | - | (1) 1 5/8" Hybriflex<br>(6) 1 5/8" Coax | T-MOBILE |
| | 6 | Ericsson AIR 21 | | | |
| 95.0 | 3 | Commscope LNX-6512DS-VTM | | | |
| 91.0 | 3 | Ericsson RRUS 11 (Band 12) | | | |

**Proposed Equipment**

| Elev.[1] (ft) | Qty | Antenna | Mount Type | Lines | Carrier |
|---|---|---|---|---|---|
| 97.0 | 3 | Ericsson KRY 112 144/1 | T-Arms with Reinforcement kit | (4) 1 5/8" (1.63"-41.3mm) Fiber | T-MOBILE |
| | 3 | Ericsson Radio 4449 B12,B71 | | | |
| | 3 | Ericsson AIR 21, 1.3 M, B2A B4P | | | |
| | 3 | Ericsson AIR 21, 1.3M, B4A B2P | | | |
| 95.0 | 3 | RFS APXVAARR24_43-U-NA20 | | | |

[1] Contracted elevations are shown for appurtenances within contracted installation tolerances. Appurtenances outside of contract limits are shown at installed elevations.

Install proposed coax inside the pole shaft.

## Structure Usages

| Structural Component | Controlling Usage | Pass/Fail |
|---|---|---|
| Anchor Bolts | 47% | Pass |
| Shaft | 46% | Pass |
| Base Plate | 20% | Pass |

## Foundations

| Reaction Component | Analysis Reactions | % of Usage |
|---|---|---|
| Moment (Kips-Ft) | 2,182.6 | 51% |
| Axial (Kips) | 36.5 | 21% |
| Shear (Kips) | 29.2 | 33% |

The structure base reactions resulting from this analysis were found to be acceptable through analysis based on geotechnical and foundation information, therefore no modification or reinforcement of the foundation will be required.

## Deflection and Sway*

| Antenna Elevation (ft) | Antenna | Carrier | Deflection (ft) | Sway (Rotation) (°) |
|---|---|---|---|---|
| 97.0 | Ericsson KRY 112 144/1 | T-MOBILE | 0.451 | 0.445 |
| | Ericsson Radio 4449 B12,B71 | | | |
| | Ericsson AIR 21, 1.3 M, B2A B4P | | | |
| | Ericsson AIR 21, 1.3M, B4A B2P | | | |
| 95.0 | RFS APXVAARR24_43-U-NA20 | | 0.436 | |

***Deflection and Sway was evaluated considering a design wind speed of 60 mph (3-Second Gust) per ANSI/TIA-222-G**

## Standard Conditions

All engineering services performed by A.T. Engineering Service, PLLC are prepared on the basis that the information used is current and correct. This information may consist of, but is not limited to the following:

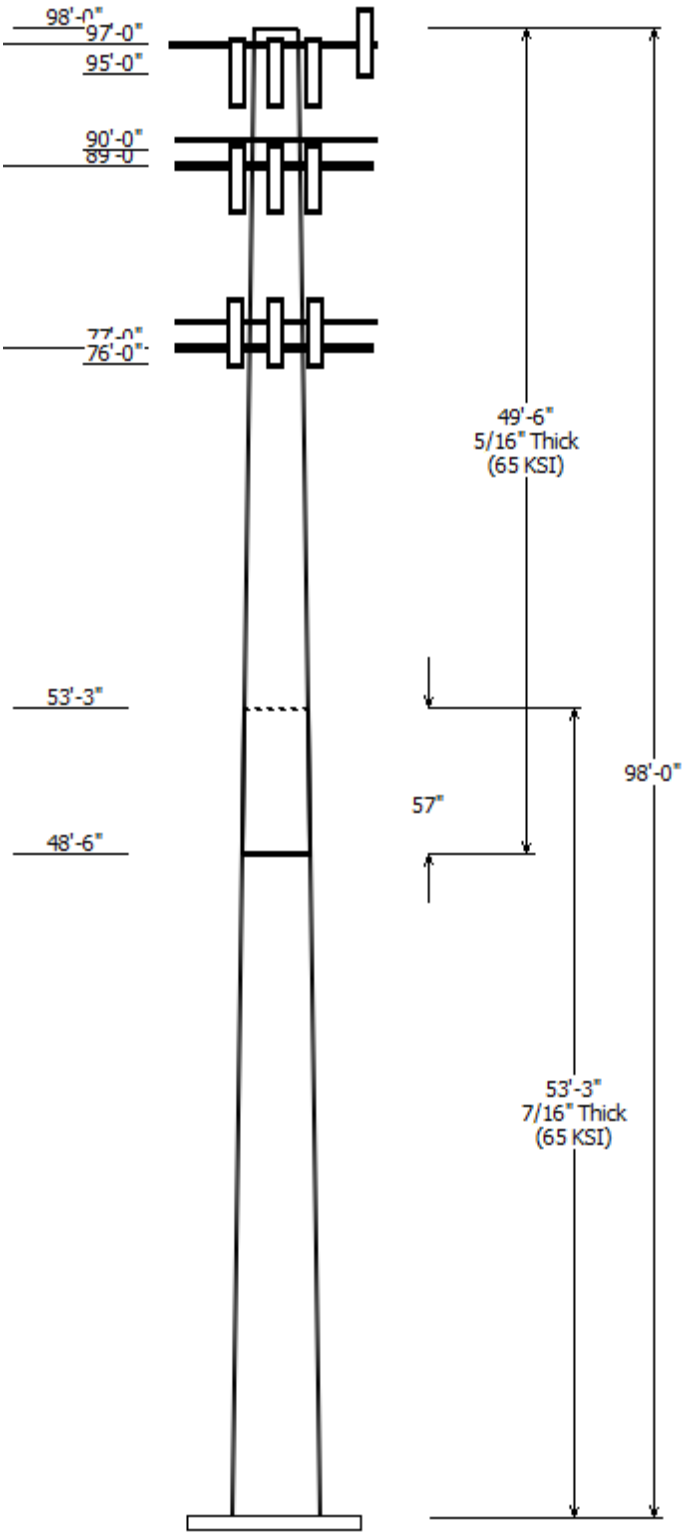
- Information supplied by the client regarding antenna, mounts and feed line loading
- Information from drawings, design and analysis documents, and field notes in the possession of A.T. Engineering Service, PLLC

It is the responsibility of the client to ensure that the information provided to A.T. Engineering Service, PLLC and used in the performance of our engineering services is correct and complete.

All assets of American Tower Corporation, its affiliates and subsidiaries (collectively "American Tower") are inspected at regular intervals. Based upon these inspections and in the absence of information to the contrary, American Tower assumes that all structures were constructed in accordance with the drawings and specifications.

Unless explicitly agreed by both the client and A.T. Engineering Service, PLLC, all services will be performed in accordance with the current revision of ANSI/TIA-222.

All services are performed, results obtained, and recommendations made in accordance with generally accepted engineering principles and practices. A.T. Engineering Service, PLLC is not responsible for the conclusions, opinions and recommendations made by others based on the information supplied herein.




## Job Information

| | | | |
|---|---|---|---|
| Client : | T-MOBILE | | |
| Pole : | 283421 | Code: | ANSI/TIA-222-G |
| Location : | MADISON CT, CT | | |
| Description : | 98 ft Monopole | Struct Class : | II |
| Shape : | 18 Sides | Exposure : | D |
| Height : | 98.00 (ft) | Topo : | 1 |
| Base Elev (ft): | 0.00 | | |
| Taper: | 0.224949 (in/ft) | | |

## Sections Properties

| Shaft Section | Length (ft) | Diameter (in) Accross Flats Top | Bottom | Thick (in) | Joint Type | Overlap Length (in) | Shape | Steel Grade (ksi) |
|---|---|---|---|---|---|---|---|---|
| 1 | 53.250 | 36.69 | 48.67 | 0.438 | | 0.000 | 18 Sides | 65 |
| 2 | 49.500 | 27.25 | 38.38 | 0.313 | Slip Joint | 57.000 | 18 Sides | 65 |

## Discrete Appurtenance

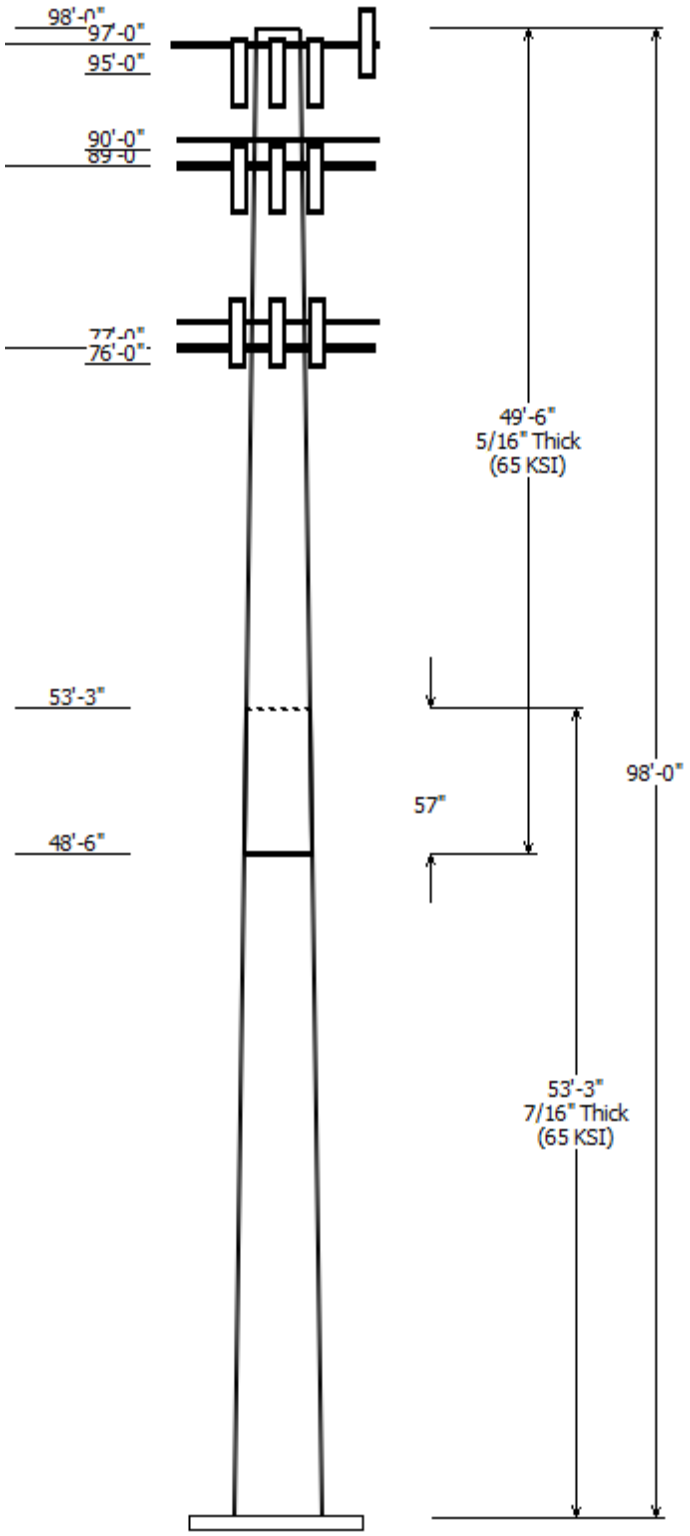
| Attach Elev (ft) | Force Elev (ft) | Qty | Description |
|---|---|---|---|
| 97.000 | 97.000 | 3 | Round T-Arm |
| 97.000 | 97.000 | 3 | Ericsson AIR 21, 1.3M, B4A B2P |
| 97.000 | 97.000 | 3 | Ericsson AIR 21, 1.3 M, B2A B4 |
| 97.000 | 97.000 | 3 | Ericsson Radio 4449 B12,B71 |
| 97.000 | 97.000 | 3 | Ericsson KRY 112 144/1 |
| 95.000 | 95.000 | 3 | RFS APXVAARR24_43-U-NA20 |
| 90.000 | 89.000 | 12 | CCI HPA-65R-BUU-H8 |
| 90.000 | 89.000 | 9 | Ericsson RRUS-11 |
| 90.000 | 90.000 | 3 | Ericsson RRUS E2 B29 |
| 90.000 | 89.000 | 6 | Ericsson RRUS 12 |
| 90.000 | 90.000 | 3 | Ericsson RRUS 32 (50.8 lbs) |
| 90.000 | 89.000 | 6 | Ericsson RRUS A2 |
| 90.000 | 89.000 | 4 | Raycap DC6-48-60-18-8F |
| 89.000 | 89.000 | 1 | Round Platform w/ Handrails |
| 77.000 | 77.000 | 1 | Round Platform w/ Handrails |
| 76.000 | 77.000 | 12 | Andrew SBNHH-1D65B |
| 76.000 | 77.000 | 2 | Raycap RxxDC-3315-PF-48 (32 lb |
| 76.000 | 77.000 | 3 | Alcatel-Lucent RRH4x45-B66 |
| 76.000 | 77.000 | 3 | Alcatel-Lucent 1900 MHz 4X45 |
| 76.000 | 77.000 | 3 | Alcatel-Lucent B13 RRH4x30- |

## Linear Appurtenance

| Elev (ft) From | To | Description | Exposed To Wind |
|---|---|---|---|
| 0.000 | 76.000 | 1 5/8" Hybriflex | No |
| 0.000 | 89.000 | 3" conduit | No |
| 0.000 | 90.000 | 0.40" (10.3mm) | No |
| 0.000 | 90.000 | 0.78" (19.7mm) 8 | No |
| 0.000 | 90.000 | 3/8" (0.38"- | No |
| 0.000 | 95.000 | 1 5/8" (1.63"- | No |
| 0.000 | 97.000 | 1 5/8" Coax | No |

## Load Cases

| | |
|---|---|
| 1.2D + 1.6W | 101 mph with No Ice |
| 0.9D + 1.6W | 101 mph with No Ice (Reduced DL) |
| 1.2D + 1.0Di + 1.0Wi | 50 mph with 0.75 in Radial Ice |
| (1.2 + 0.2Sds) * DL + E | Seismic Equivalent Lateral Forces Method |
| (1.2 + 0.2Sds) * DL + E | Seismic Equivalent Modal Analysis Method |
| (0.9 - 0.2Sds) * DL + E | Seismic (Reduced DL) Equivalent Lateral |
| (0.9 - 0.2Sds) * DL + E | Seismic (Reduced DL) Equivalent Modal |
| 1.0D + 1.0W | Serviceability 60 mph |

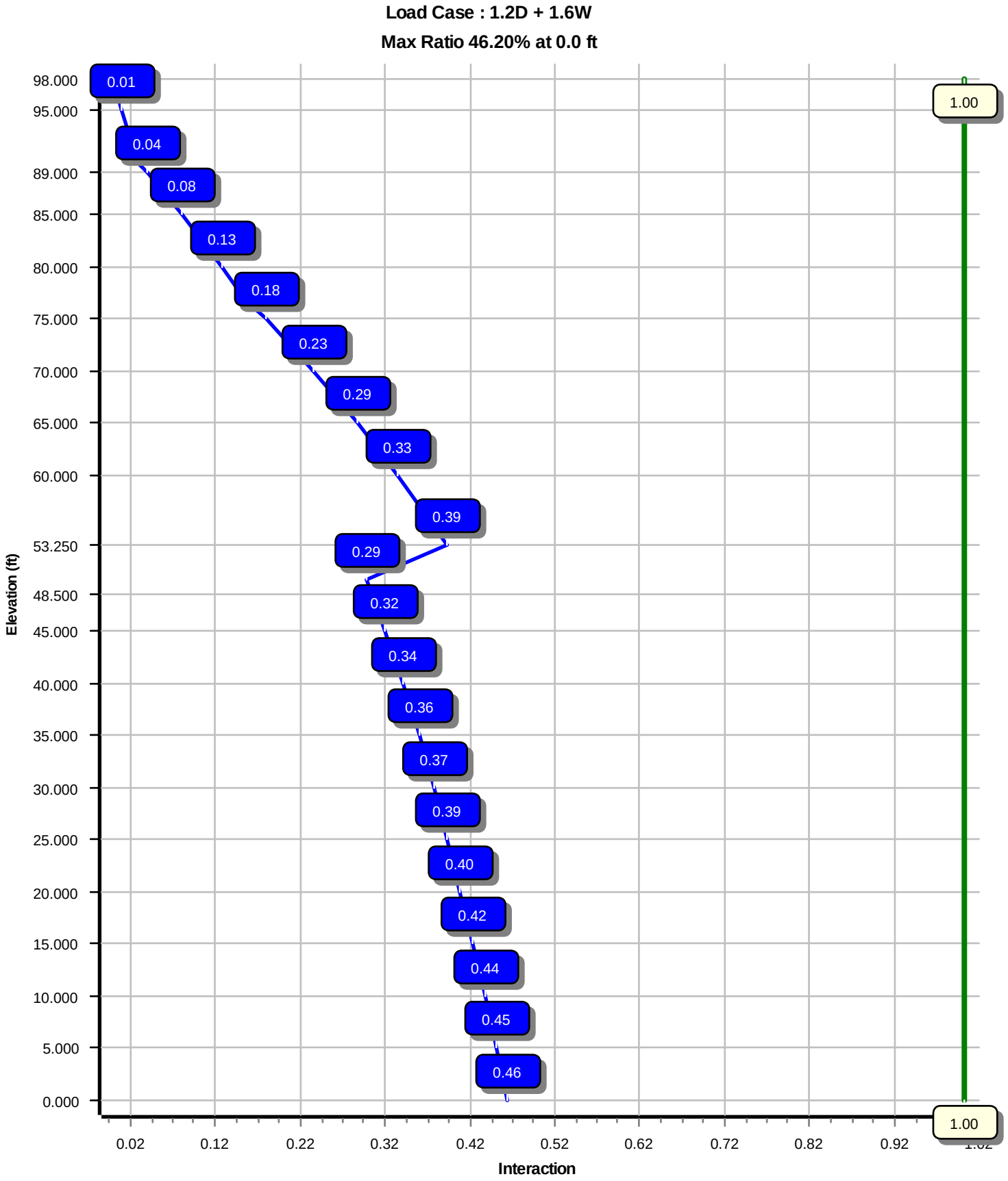



## Reactions

| Load Case | Moment (kip-ft) | Shear (kip) | Axial (kip) |
|---|---|---|---|
| 1.2D + 1.6W | 2182.62 | 29.25 | 36.48 |
| 0.9D + 1.6W | 2172.95 | 29.23 | 27.35 |
| 1.2D + 1.0Di + 1.0Wi | 528.31 | 7.31 | 52.67 |
| (1.2 + 0.2Sds) * DL + E ELFM | 160.93 | 2.14 | 35.89 |
| (1.2 + 0.2Sds) * DL + E EMAM | 186.48 | 2.32 | 35.89 |
| (0.9 - 0.2Sds) * DL + E ELFM | 160.12 | 2.14 | 25.05 |
| (0.9 - 0.2Sds) * DL + E EMAM | 185.48 | 2.32 | 25.05 |
| 1.0D + 1.0W | 429.57 | 5.77 | 30.43 |

## Dish Deflections

| Load Case | Attach Elev (ft) | Deflection (in) | Rotation (deg) |
|---|---|---|---|
| | 0.00 | 0.000 | 0.000 |


Load Case : 1.2D + 1.6W
Max Ratio 46.20% at 0.0 ft
Elevation (ft)
98.000
95.000
89.000
85.000
80.000
75.000
70.000
65.000
60.000
53.250
48.500
45.000
40.000
35.000
30.000
25.000
20.000
15.000
10.000
5.000
0.000
0.01
0.04
0.08
0.13
0.18
0.23
0.29
0.33
0.39
0.29
0.32
0.34
0.36
0.37
0.39
0.40
0.42
0.44
0.45
0.46
1.00
1.00
0.02
0.12
0.22
0.32
0.42
0.52
0.62
0.72
0.82
0.92
Interaction

Site Number: 283421 Code: ANSI/TIA-222-G 

Site Name: MADISON CT, CT Engineering Number:12927138_C3_02 7/19/2019 4:18:40 PM

Customer: T-MOBILE

## Analysis Parameters

| | | | |
|---|---|---|---|
| Location : | New Haven County, CT | Height (ft) : | 98 |
| Code : | ANSI/TIA-222-G | Base Diameter (in) : | 48.67 |
| Shape : | 18 Sides | Top Diameter (in) : | 27.25 |
| Pole Type : | Taper | Taper (in/ft) : | 0.225 |
| Pole Manfacturer : | | Rotation (deg) : | 0.00 |

## Ice & Wind Parameters

| | | | |
|---|---|---|---|
| Structure Class: | II | Design Wind Speed Without Ice: | 101 mph |
| Exposure Category: | D | Design Wind Speed With Ice: | 50 mph |
| Topographic Category: | 1 | Operational Wind Speed: | 60 mph |
| Crest Height: | 0 ft | Design Ice Thickness: | 0.75 in |

## Seismic Parameters

| | | | | | |
|---|---|---|---|---|---|
| Analysis Method: | Equivalent Modal Analysis & Equivalent Lateral Force Methods | | | | |
| Site Class: | D - Stiff Soil | | | | |
| Period Based on Rayleigh Method (sec): | 1.19 | | | | |
| $T_L$ (sec): | 6 | p: | 1.3 | $C_s$: | 0.054 |
| $S_s$: | 0.172 | $S_1$: | 0.060 | $C_s$ Max: | 0.054 |
| $F_a$: | 1.600 | $F_v$: | 2.400 | $C_s$ Min: | 0.030 |
| $S_{ds}$: | 0.183 | $S_{d1}$: | 0.096 | | |

## Load Cases

| | |
|---|---|
| 1.2D + 1.6W | 101 mph with No Ice |
| 0.9D + 1.6W | 101 mph with No Ice (Reduced DL) |
| 1.2D + 1.0Di + 1.0Wi | 50 mph with 0.75 in Radial Ice |
| (1.2 + 0.2Sds) * DL + E ELFM | Seismic Equivalent Lateral Forces Method |
| (1.2 + 0.2Sds) * DL + E EMAM | Seismic Equivalent Modal Analysis Method |
| (0.9 - 0.2Sds) * DL + E ELFM | Seismic (Reduced DL) Equivalent Lateral Forces Method |
| (0.9 - 0.2Sds) * DL + E EMAM | Seismic (Reduced DL) Equivalent Modal Analysis Method |
| 1.0D + 1.0W | Serviceability 60 mph |

Site Number: 283421 Code: ANSI/TIA-222-G 

Site Name: MADISON CT, CT Engineering Number:12927138_C3_02 7/19/2019 4:18:40 PM

Customer: T-MOBILE

## Shaft Section Properties

| Sect Info | Length (ft) | Thick (in) | Fy (ksi) | Joint Type | Slip Joint Len (in) | Weight (lb) | Bottom Dia (in) | Bottom Elev (ft) | Bottom Area (in²) | Bottom Ix (in⁴) | Bottom W/t Ratio | Bottom D/t Ratio | Top Dia (in) | Top Elev (ft) | Top Area (in²) | Top Ix (in⁴) | Top W/t Ratio | Top D/t Ratio | Taper (in/ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1-18 | 53.250 | 0.4375 | 65 | | 0.00 | 10,629 | 48.67 | 0.00 | 66.97 | 19685.3 | 17.85 | 111.25 | 36.69 | 53.25 | 50.34 | 8359.7 | 13.02 | 83.87 | 0.224949 |
| 2-18 | 49.500 | 0.3125 | 65 | Slip | 57.00 | 5,430 | 38.38 | 48.50 | 37.76 | 6915.6 | 19.90 | 122.83 | 27.25 | 98.00 | 26.72 | 2449.4 | 13.61 | 87.20 | 0.224949 |
| | | | | Shaft Weight | | 16,059 | | | | | | | | | | | | | |

## Discrete Appurtenance Properties

| Attach Elev (ft) | Description | Qty | Ka | Vert Ecc (ft) | No Ice Weight (lb) | No Ice EPAa (sf) | No Ice Orientation Factor | Ice Weight (lb) | Ice EPAa (sf) | Ice Orientation Factor |
|---|---|---|---|---|---|---|---|---|---|---|
| 97.00 | Ericsson KRY 112 144/1 | 3 | 0.80 | 0.000 | 11.00 | 0.350 | 0.50 | 21.31 | 0.738 | 0.50 |
| 97.00 | Ericsson Radio 4449 B12,B71 | 3 | 0.80 | 0.000 | 74.00 | 1.640 | 0.50 | 127.65 | 2.449 | 0.50 |
| 97.00 | Ericsson AIR 21, 1.3 M, B2A B4P | 3 | 0.80 | 0.000 | 83.00 | 6.050 | 0.71 | 222.86 | 8.122 | 0.71 |
| 97.00 | Ericsson AIR 21, 1.3M, B4A B2P | 3 | 0.80 | 0.000 | 81.50 | 6.090 | 0.70 | 220.85 | 8.164 | 0.70 |
| 97.00 | Round T-Arm | 3 | 0.75 | 0.000 | 250.00 | 9.700 | 0.67 | 450.28 | 17.601 | 0.67 |
| 95.00 | RFS APXVAARR24_43-U-NA20 | 3 | 0.80 | 0.000 | 127.90 | 20.240 | 0.63 | 502.73 | 23.781 | 0.63 |
| 90.00 | Raycap DC6-48-60-18-8F | 4 | 0.75 | -1.000 | 20.00 | 1.260 | 1.00 | 70.11 | 1.886 | 1.00 |
| 90.00 | Ericsson RRUS A2 | 6 | 0.75 | -1.000 | 15.00 | 1.600 | 0.50 | 49.55 | 2.396 | 0.50 |
| 90.00 | Ericsson RRUS 32 (50.8 lbs) | 3 | 0.75 | 0.000 | 50.80 | 2.690 | 0.67 | 118.86 | 3.789 | 0.67 |
| 90.00 | Ericsson RRUS 12 | 6 | 0.75 | -1.000 | 50.00 | 3.150 | 0.62 | 126.97 | 4.255 | 0.62 |
| 90.00 | Ericsson RRUS E2 B29 | 3 | 0.75 | 0.000 | 60.00 | 3.150 | 0.62 | 136.97 | 4.255 | 0.62 |
| 90.00 | Ericsson RRUS-11 | 9 | 0.75 | -1.000 | 55.00 | 3.790 | 0.61 | 140.43 | 5.011 | 0.61 |
| 90.00 | CCI HPA-65R-BUU-H8 | 12 | 0.75 | -1.000 | 68.00 | 12.980 | 0.67 | 312.52 | 16.388 | 0.67 |
| 89.00 | Round Platform w/ Handrails | 1 | 1.00 | 0.000 | 2,000.00 | 27.200 | 1.00 | 3,229.60 | 50.396 | 1.00 |
| 77.00 | Round Platform w/ Handrails | 1 | 1.00 | 0.000 | 2,000.00 | 27.200 | 1.00 | 3,213.89 | 50.099 | 1.00 |
| 76.00 | Alcatel-Lucent B13 RRH4x30-4R | 3 | 0.75 | 1.000 | 57.20 | 2.170 | 0.67 | 121.47 | 3.112 | 0.67 |
| 76.00 | Alcatel-Lucent 1900 MHz 4X45 | 3 | 0.75 | 1.000 | 60.00 | 2.320 | 0.67 | 135.40 | 3.330 | 0.67 |
| 76.00 | Alcatel-Lucent RRH4x45-B66 w/o | 3 | 0.75 | 1.000 | 63.30 | 2.470 | 0.67 | 122.71 | 3.512 | 0.67 |
| 76.00 | Raycap RxxDC-3315-PF-48 (32 | 2 | 0.75 | 1.000 | 32.00 | 2.510 | 0.67 | 106.48 | 3.483 | 0.67 |
| 76.00 | Andrew SBNHH-1D65B | 12 | 0.75 | 1.000 | 50.70 | 8.170 | 0.69 | 214.87 | 10.817 | 0.69 |
| Totals | Num Loadings:20 | 86 | | | 9,209.50 | | | 22,131.73 | | |

## Linear Appurtenance Properties

Load Case Azimuth (deg) :

| Elev From (ft) | Elev To (ft) | Qty | Description | Coax Dia (in) | Coax Wt (lb/ft) | Flat | Max Coax / Row | Dist Between Rows (in) | Dist Between Cols (in) | Azimuth (deg) | Dist From Face (in) | Exposed To Wind | Carrier |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | 97.00 | 6 | 1 5/8" Coax | 1.98 | 0.82 | N | 0 | 0.00 | 0.00 | 0 | 0.00 | N | T-MOBILE |
| 0.00 | 95.00 | 4 | 1 5/8" (1.63"-41.3mm) | 1.63 | 1.61 | N | 0 | 0.00 | 0.00 | 0 | 0.00 | N | T-MOBILE |
| 0.00 | 90.00 | 2 | 0.40" (10.3mm) Fiber | 0.40 | 0.09 | N | 0 | 0.00 | 0.00 | 0 | 0.00 | N | AT&T MOBILITY |
| 0.00 | 90.00 | 8 | 0.78" (19.7mm) 8 AWG | 0.78 | 0.59 | N | 0 | 0.00 | 0.00 | 0 | 0.00 | N | AT&T MOBILITY |
| 0.00 | 90.00 | 3 | 3/8" (0.38"- 9.5mm) | 0.38 | 0.23 | N | 0 | 0.00 | 0.00 | 0 | 0.00 | N | AT&T MOBILITY |
| 0.00 | 89.00 | 5 | 3" conduit | 3.50 | 7.58 | N | 0 | 0.00 | 0.00 | 0 | 0.00 | N | AT&T MOBILITY |
| 0.00 | 76.00 | 2 | 1 5/8" Hybriflex | 1.98 | 1.30 | N | 0 | 0.00 | 0.00 | 0 | 0.00 | N | VERIZON WIRELESS |

## Segment Properties (Max Len : 5. ft)

| Seg Top Elev (ft) | Description | Thick (in) | Flat Dia (in) | Area ($in^2$) | Ix ($in^4$) | W/t Ratio | D/t Ratio | F'y (ksi) | S ($in^3$) | Z ($in^3$) | Weight (lb) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | | 0.4375 | 48.670 | 66.974 | 19,685.3 | 17.85 | 111.25 | 80.4 | 796.6 | 0.0 | 0.0 |
| 5.00 | | 0.4375 | 47.545 | 65.413 | 18,340.0 | 17.40 | 108.67 | 80.9 | 759.8 | 0.0 | 1,126.2 |
| 10.00 | | 0.4375 | 46.421 | 63.851 | 17,057.5 | 16.95 | 106.10 | 81.5 | 723.7 | 0.0 | 1,099.6 |
| 15.00 | | 0.4375 | 45.296 | 62.289 | 15,836.2 | 16.49 | 103.53 | 82.0 | 688.6 | 0.0 | 1,073.1 |
| 20.00 | | 0.4375 | 44.171 | 60.727 | 14,674.6 | 16.04 | 100.96 | 82.5 | 654.3 | 0.0 | 1,046.5 |
| 25.00 | | 0.4375 | 43.046 | 59.165 | 13,571.2 | 15.59 | 98.39 | 82.6 | 621.0 | 0.0 | 1,019.9 |
| 30.00 | | 0.4375 | 41.922 | 57.604 | 12,524.6 | 15.13 | 95.82 | 82.6 | 588.5 | 0.0 | 993.3 |
| 35.00 | | 0.4375 | 40.797 | 56.042 | 11,533.3 | 14.68 | 93.25 | 82.6 | 556.8 | 0.0 | 966.8 |
| 40.00 | | 0.4375 | 39.672 | 54.480 | 10,595.7 | 14.23 | 90.68 | 82.6 | 526.0 | 0.0 | 940.2 |
| 45.00 | | 0.4375 | 38.547 | 52.918 | 9,710.3 | 13.77 | 88.11 | 82.6 | 496.2 | 0.0 | 913.6 |
| 48.50 | Bot - Section 2 | 0.4375 | 37.760 | 51.825 | 9,120.8 | 13.46 | 86.31 | 82.6 | 475.8 | 0.0 | 623.7 |
| 50.00 | | 0.4375 | 37.423 | 51.357 | 8,875.7 | 13.32 | 85.54 | 82.6 | 467.1 | 0.0 | 455.2 |
| 53.25 | Top - Section 1 | 0.3125 | 37.316 | 36.702 | 6,349.5 | 19.29 | 119.41 | 78.7 | 335.1 | 0.0 | 972.2 |
| 55.00 | | 0.3125 | 36.923 | 36.312 | 6,149.0 | 19.07 | 118.15 | 79.0 | 328.0 | 0.0 | 217.4 |
| 60.00 | | 0.3125 | 35.798 | 35.196 | 5,599.5 | 18.44 | 114.55 | 79.7 | 308.1 | 0.0 | 608.3 |
| 65.00 | | 0.3125 | 34.673 | 34.080 | 5,083.8 | 17.80 | 110.95 | 80.5 | 288.8 | 0.0 | 589.3 |
| 70.00 | | 0.3125 | 33.549 | 32.965 | 4,600.7 | 17.17 | 107.36 | 81.2 | 270.1 | 0.0 | 570.4 |
| 75.00 | | 0.3125 | 32.424 | 31.849 | 4,149.2 | 16.53 | 103.76 | 82.0 | 252.0 | 0.0 | 551.4 |
| 76.00 | | 0.3125 | 32.199 | 31.626 | 4,062.7 | 16.40 | 103.04 | 82.1 | 248.5 | 0.0 | 108.0 |
| 77.00 | | 0.3125 | 31.974 | 31.403 | 3,977.3 | 16.28 | 102.32 | 82.3 | 245.0 | 0.0 | 107.2 |
| 80.00 | | 0.3125 | 31.299 | 30.734 | 3,728.3 | 15.90 | 100.16 | 82.6 | 234.6 | 0.0 | 317.2 |
| 85.00 | | 0.3125 | 30.174 | 29.618 | 3,336.9 | 15.26 | 96.56 | 82.6 | 217.8 | 0.0 | 513.4 |
| 89.00 | | 0.3125 | 29.275 | 28.726 | 3,044.3 | 14.75 | 93.68 | 82.6 | 204.8 | 0.0 | 397.1 |
| 90.00 | | 0.3125 | 29.050 | 28.503 | 2,973.9 | 14.63 | 92.96 | 82.6 | 201.6 | 0.0 | 97.4 |
| 95.00 | | 0.3125 | 27.925 | 27.387 | 2,638.2 | 13.99 | 89.36 | 82.6 | 186.1 | 0.0 | 475.4 |
| 97.00 | | 0.3125 | 27.475 | 26.941 | 2,511.3 | 13.74 | 87.92 | 82.6 | 180.0 | 0.0 | 184.9 |
| 98.00 | | 0.3125 | 27.250 | 26.718 | 2,449.4 | 13.61 | 87.20 | 82.6 | 177.0 | 0.0 | 91.3 |
| | | | | | | | | | | | 16,059.1 |

Load Case: 1.2D + 1.6W 101 mph with No Ice 18 Iterations

Gust Response Factor :1.10 Wind Importance Factor 1.00
Dead Load Factor :1.20
Wind Load Factor :1.60

## Applied Segment Forces Summary

| Seg Elev (ft) | Description | Shaft Forces Wind FX (lb) | Shaft Forces Dead Load (lb) | Discrete Forces Wind FX (lb) | Discrete Forces Torsion MY (lb-ft) | Discrete Forces Moment MZ (lb-ft) | Discrete Forces Dead Load (lb) | Linear Forces Wind FX (lb) | Linear Forces Dead Load (lb) | Sum of Forces Wind FX (lb) | Sum of Forces Dead Load (lb) | Sum of Forces Torsion MY (lb-ft) | Sum of Forces Moment MZ (lb) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | | 297.5 | 0.0 | | | | | 0.0 | 0.0 | 297.5 | 0.0 | 0.0 | 0.0 |
| 5.00 | | 588.0 | 1,351.5 | | | | | 0.0 | 344.7 | 588.0 | 1,696.2 | 0.0 | 0.0 |
| 10.00 | | 574.1 | 1,319.6 | | | | | 0.0 | 344.7 | 574.1 | 1,664.3 | 0.0 | 0.0 |
| 15.00 | | 567.8 | 1,287.7 | | | | | 0.0 | 344.7 | 567.8 | 1,632.4 | 0.0 | 0.0 |
| 20.00 | | 573.7 | 1,255.8 | | | | | 0.0 | 344.7 | 573.7 | 1,600.5 | 0.0 | 0.0 |
| 25.00 | | 581.4 | 1,223.9 | | | | | 0.0 | 344.7 | 581.4 | 1,568.6 | 0.0 | 0.0 |
| 30.00 | | 584.6 | 1,192.0 | | | | | 0.0 | 344.7 | 584.6 | 1,536.7 | 0.0 | 0.0 |
| 35.00 | | 584.5 | 1,160.1 | | | | | 0.0 | 344.7 | 584.5 | 1,504.8 | 0.0 | 0.0 |
| 40.00 | | 581.8 | 1,128.2 | | | | | 0.0 | 344.7 | 581.8 | 1,472.9 | 0.0 | 0.0 |
| 45.00 | | 491.3 | 1,096.4 | | | | | 0.0 | 344.7 | 491.3 | 1,441.1 | 0.0 | 0.0 |
| 48.50 | Bot - Section 2 | 288.5 | 748.5 | | | | | 0.0 | 241.3 | 288.5 | 989.8 | 0.0 | 0.0 |
| 50.00 | | 275.0 | 546.3 | | | | | 0.0 | 103.4 | 275.0 | 649.7 | 0.0 | 0.0 |
| 53.25 | Top - Section 1 | 288.3 | 1,166.7 | | | | | 0.0 | 224.1 | 288.3 | 1,390.7 | 0.0 | 0.0 |
| 55.00 | | 384.6 | 260.9 | | | | | 0.0 | 120.6 | 384.6 | 381.5 | 0.0 | 0.0 |
| 60.00 | | 563.5 | 730.0 | | | | | 0.0 | 344.7 | 563.5 | 1,074.7 | 0.0 | 0.0 |
| 65.00 | | 553.4 | 707.2 | | | | | 0.0 | 344.7 | 553.4 | 1,051.9 | 0.0 | 0.0 |
| 70.00 | | 542.4 | 684.4 | | | | | 0.0 | 344.7 | 542.4 | 1,029.1 | 0.0 | 0.0 |
| 75.00 | | 321.3 | 661.6 | | | | | 0.0 | 344.7 | 321.3 | 1,006.3 | 0.0 | 0.0 |
| 76.00 | Appurtenance(s) | 105.6 | 129.6 | 3,811.4 | 0.0 | 3,811.4 | 1,456.7 | 0.0 | 68.9 | 3,917.0 | 1,655.2 | 0.0 | 0.0 |
| 77.00 | Appurtenance(s) | 209.3 | 128.7 | 1,626.2 | 0.0 | 0.0 | 2,400.0 | 0.0 | 65.8 | 1,835.5 | 2,594.5 | 0.0 | 0.0 |
| 80.00 | | 412.3 | 380.6 | | | | | 0.0 | 197.5 | 412.3 | 578.0 | 0.0 | 0.0 |
| 85.00 | | 455.4 | 616.1 | | | | | 0.0 | 329.1 | 455.4 | 945.2 | 0.0 | 0.0 |
| 89.00 | Appurtenance(s) | 248.9 | 476.5 | 1,667.7 | 0.0 | 0.0 | 2,400.0 | 0.0 | 263.3 | 1,916.6 | 3,139.8 | 0.0 | 0.0 |
| 90.00 | Appurtenance(s) | 291.0 | 116.8 | 7,265.9 | 0.0 | -6,746.9 | 2,536.1 | 0.0 | 20.3 | 7,556.9 | 2,673.3 | 0.0 | 0.0 |
| 95.00 | Appurtenance(s) | 336.4 | 570.5 | 1,897.7 | 0.0 | 0.0 | 460.4 | 0.0 | 68.2 | 2,234.1 | 1,099.1 | 0.0 | 0.0 |
| 97.00 | Appurtenance(s) | 141.5 | 221.8 | 2,337.0 | 0.0 | 0.0 | 1,798.2 | 0.0 | 11.8 | 2,478.6 | 2,031.8 | 0.0 | 0.0 |
| 98.00 | | 46.9 | 109.6 | | | | | 0.0 | 0.0 | 46.9 | 109.6 | 0.0 | 0.0 |
| | | | | | | | | Totals: | | 29,495.1 | 36,517.6 | 0.00 | 0.00 |

Load Case: 1.2D + 1.6W 101 mph with No Ice 18 Iterations

Gust Response Factor :1.10 Wind Importance Factor 1.00
Dead Load Factor :1.20
Wind Load Factor :1.60

## Calculated Forces

| Seg Elev (ft) | Pu FY (-) (kips) | Vu FX (-) (kips) | Tu MY (ft-kips) | Mu MZ (ft-kips) | Mu MX (ft-kips) | Resultant Moment (ft-kips) | phi Pn (kips) | phi Vn (kips) | phi Tn (ft-kips) | phi Mn (ft-kips) | Total Deflect (in) | Rotation (deg) | Ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | -36.48 | -29.25 | 0.00 | -2,182.62 | 0.00 | 2,182.62 | 4,846.45 | 2,423.23 | 9,593.57 | 4,803.92 | 0.00 | 0.00 | 0.462 |
| 5.00 | -34.71 | -28.75 | 0.00 | -2,036.39 | 0.00 | 2,036.39 | 4,764.82 | 2,382.41 | 9,210.06 | 4,611.88 | 0.08 | -0.15 | 0.449 |
| 10.00 | -32.97 | -28.26 | 0.00 | -1,892.64 | 0.00 | 1,892.64 | 4,681.70 | 2,340.85 | 8,831.34 | 4,422.23 | 0.32 | -0.30 | 0.435 |
| 15.00 | -31.27 | -27.76 | 0.00 | -1,751.36 | 0.00 | 1,751.36 | 4,597.07 | 2,298.54 | 8,457.59 | 4,235.08 | 0.73 | -0.46 | 0.420 |
| 20.00 | -29.60 | -27.25 | 0.00 | -1,612.56 | 0.00 | 1,612.56 | 4,510.95 | 2,255.47 | 8,089.05 | 4,050.54 | 1.29 | -0.61 | 0.405 |
| 25.00 | -27.97 | -26.72 | 0.00 | -1,476.31 | 0.00 | 1,476.31 | 4,395.70 | 2,197.85 | 7,677.66 | 3,844.53 | 2.00 | -0.76 | 0.391 |
| 30.00 | -26.37 | -26.18 | 0.00 | -1,342.70 | 0.00 | 1,342.70 | 4,279.67 | 2,139.83 | 7,275.67 | 3,643.24 | 2.88 | -0.91 | 0.375 |
| 35.00 | -24.82 | -25.64 | 0.00 | -1,211.79 | 0.00 | 1,211.79 | 4,163.63 | 2,081.82 | 6,884.49 | 3,447.36 | 3.91 | -1.05 | 0.358 |
| 40.00 | -23.29 | -25.08 | 0.00 | -1,083.62 | 0.00 | 1,083.62 | 4,047.60 | 2,023.80 | 6,504.12 | 3,256.89 | 5.08 | -1.19 | 0.339 |
| 45.00 | -21.81 | -24.60 | 0.00 | -958.21 | 0.00 | 958.21 | 3,931.57 | 1,965.78 | 6,134.56 | 3,071.84 | 6.41 | -1.33 | 0.318 |
| 48.50 | -20.80 | -24.31 | 0.00 | -872.11 | 0.00 | 872.11 | 3,850.34 | 1,925.17 | 5,882.29 | 2,945.52 | 7.42 | -1.42 | 0.302 |
| 50.00 | -20.14 | -24.04 | 0.00 | -835.64 | 0.00 | 835.64 | 3,815.53 | 1,907.77 | 5,775.80 | 2,892.19 | 7.87 | -1.46 | 0.294 |
| 53.25 | -18.73 | -23.74 | 0.00 | -757.49 | 0.00 | 757.49 | 2,599.91 | 1,299.95 | 3,950.87 | 1,978.37 | 8.90 | -1.55 | 0.390 |
| 55.00 | -18.31 | -23.38 | 0.00 | -715.95 | 0.00 | 715.95 | 2,580.79 | 1,290.39 | 3,879.74 | 1,942.75 | 9.47 | -1.59 | 0.376 |
| 60.00 | -17.20 | -22.83 | 0.00 | -599.06 | 0.00 | 599.06 | 2,525.14 | 1,262.57 | 3,678.48 | 1,841.97 | 11.22 | -1.74 | 0.332 |
| 65.00 | -16.12 | -22.28 | 0.00 | -484.93 | 0.00 | 484.93 | 2,468.00 | 1,234.00 | 3,480.29 | 1,742.73 | 13.12 | -1.88 | 0.285 |
| 70.00 | -15.06 | -21.73 | 0.00 | -373.55 | 0.00 | 373.55 | 2,409.36 | 1,204.68 | 3,285.38 | 1,645.13 | 15.16 | -2.00 | 0.234 |
| 75.00 | -14.05 | -21.38 | 0.00 | -264.91 | 0.00 | 264.91 | 2,349.22 | 1,174.61 | 3,093.96 | 1,549.28 | 17.31 | -2.10 | 0.177 |
| 76.00 | -12.53 | -17.41 | 0.00 | -239.72 | 0.00 | 239.72 | 2,337.01 | 1,168.51 | 3,056.11 | 1,530.33 | 17.75 | -2.12 | 0.162 |
| 77.00 | -10.00 | -15.49 | 0.00 | -222.30 | 0.00 | 222.30 | 2,324.75 | 1,162.37 | 3,018.41 | 1,511.45 | 18.19 | -2.13 | 0.152 |
| 80.00 | -9.43 | -15.06 | 0.00 | -175.84 | 0.00 | 175.84 | 2,283.36 | 1,141.68 | 2,900.87 | 1,452.59 | 19.55 | -2.17 | 0.125 |
| 85.00 | -8.49 | -14.58 | 0.00 | -100.53 | 0.00 | 100.53 | 2,200.48 | 1,100.24 | 2,693.09 | 1,348.55 | 21.86 | -2.23 | 0.079 |
| 89.00 | -5.42 | -12.54 | 0.00 | -42.22 | 0.00 | 42.22 | 2,134.18 | 1,067.09 | 2,532.43 | 1,268.09 | 23.74 | -2.25 | 0.036 |
| 90.00 | -3.05 | -4.88 | 0.00 | -29.69 | 0.00 | 29.69 | 2,117.60 | 1,058.80 | 2,493.03 | 1,248.37 | 24.21 | -2.26 | 0.025 |
| 95.00 | -2.04 | -2.61 | 0.00 | -5.27 | 0.00 | 5.27 | 2,034.72 | 1,017.36 | 2,300.69 | 1,152.06 | 26.58 | -2.26 | 0.006 |
| 97.00 | -0.11 | -0.05 | 0.00 | -0.05 | 0.00 | 0.05 | 2,001.57 | 1,000.78 | 2,225.92 | 1,114.61 | 27.52 | -2.26 | 0.000 |
| 98.00 | 0.00 | -0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 1,984.99 | 992.49 | 2,188.99 | 1,096.12 | 28.00 | -2.26 | 0.000 |

Site Number: 283421 Code: ANSI/TIA-222-G 

Site Name: MADISON CT, CT Engineering Number:12927138_C3_02 7/19/2019 4:18:42 PM

Customer: T-MOBILE

Load Case: 0.9D + 1.6W 101 mph with No Ice (Reduced DL) 18 Iterations

Gust Response Factor :1.10 Wind Importance Factor 1.00

Dead Load Factor :0.90

Wind Load Factor :1.60

## Applied Segment Forces Summary

| Seg Elev (ft) | Description | Shaft Forces Wind FX (lb) | Shaft Forces Dead Load (lb) | Discrete Forces Wind FX (lb) | Discrete Forces Torsion MY (lb-ft) | Discrete Forces Moment MZ (lb-ft) | Discrete Forces Dead Load (lb) | Linear Forces Wind FX (lb) | Linear Forces Dead Load (lb) | Sum of Forces Wind FX (lb) | Sum of Forces Dead Load (lb) | Sum of Forces Torsion MY (lb-ft) | Sum of Forces Moment MZ (lb) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | | 297.5 | 0.0 | | | | | 0.0 | 0.0 | 297.5 | 0.0 | 0.0 | 0.0 |
| 5.00 | | 588.0 | 1,013.6 | | | | | 0.0 | 258.5 | 588.0 | 1,272.1 | 0.0 | 0.0 |
| 10.00 | | 574.1 | 989.7 | | | | | 0.0 | 258.5 | 574.1 | 1,248.2 | 0.0 | 0.0 |
| 15.00 | | 567.8 | 965.8 | | | | | 0.0 | 258.5 | 567.8 | 1,224.3 | 0.0 | 0.0 |
| 20.00 | | 573.7 | 941.8 | | | | | 0.0 | 258.5 | 573.7 | 1,200.4 | 0.0 | 0.0 |
| 25.00 | | 581.4 | 917.9 | | | | | 0.0 | 258.5 | 581.4 | 1,176.5 | 0.0 | 0.0 |
| 30.00 | | 584.6 | 894.0 | | | | | 0.0 | 258.5 | 584.6 | 1,152.5 | 0.0 | 0.0 |
| 35.00 | | 584.5 | 870.1 | | | | | 0.0 | 258.5 | 584.5 | 1,128.6 | 0.0 | 0.0 |
| 40.00 | | 581.8 | 846.2 | | | | | 0.0 | 258.5 | 581.8 | 1,104.7 | 0.0 | 0.0 |
| 45.00 | | 491.3 | 822.3 | | | | | 0.0 | 258.5 | 491.3 | 1,080.8 | 0.0 | 0.0 |
| 48.50 | Bot - Section 2 | 288.5 | 561.4 | | | | | 0.0 | 181.0 | 288.5 | 742.3 | 0.0 | 0.0 |
| 50.00 | | 275.0 | 409.7 | | | | | 0.0 | 77.6 | 275.0 | 487.3 | 0.0 | 0.0 |
| 53.25 | Top - Section 1 | 288.3 | 875.0 | | | | | 0.0 | 168.0 | 288.3 | 1,043.1 | 0.0 | 0.0 |
| 55.00 | | 384.6 | 195.7 | | | | | 0.0 | 90.5 | 384.6 | 286.1 | 0.0 | 0.0 |
| 60.00 | | 563.5 | 547.5 | | | | | 0.0 | 258.5 | 563.5 | 806.0 | 0.0 | 0.0 |
| 65.00 | | 553.4 | 530.4 | | | | | 0.0 | 258.5 | 553.4 | 788.9 | 0.0 | 0.0 |
| 70.00 | | 542.4 | 513.3 | | | | | 0.0 | 258.5 | 542.4 | 771.8 | 0.0 | 0.0 |
| 75.00 | | 321.3 | 496.2 | | | | | 0.0 | 258.5 | 321.3 | 754.8 | 0.0 | 0.0 |
| 76.00 | Appurtenance(s) | 105.6 | 97.2 | 3,811.4 | 0.0 | 3,811.4 | 1,092.5 | 0.0 | 51.7 | 3,917.0 | 1,241.4 | 0.0 | 0.0 |
| 77.00 | Appurtenance(s) | 209.3 | 96.5 | 1,626.2 | 0.0 | 0.0 | 1,800.0 | 0.0 | 49.4 | 1,835.5 | 1,945.9 | 0.0 | 0.0 |
| 80.00 | | 412.3 | 285.4 | | | | | 0.0 | 148.1 | 412.3 | 433.5 | 0.0 | 0.0 |
| 85.00 | | 455.4 | 462.1 | | | | | 0.0 | 246.8 | 455.4 | 708.9 | 0.0 | 0.0 |
| 89.00 | Appurtenance(s) | 248.9 | 357.4 | 1,667.7 | 0.0 | 0.0 | 1,800.0 | 0.0 | 197.5 | 1,916.6 | 2,354.8 | 0.0 | 0.0 |
| 90.00 | Appurtenance(s) | 291.0 | 87.6 | 7,265.9 | 0.0 | -6,746.9 | 1,902.1 | 0.0 | 15.3 | 7,556.9 | 2,004.9 | 0.0 | 0.0 |
| 95.00 | Appurtenance(s) | 336.4 | 427.9 | 1,897.7 | 0.0 | 0.0 | 345.3 | 0.0 | 51.1 | 2,234.1 | 824.4 | 0.0 | 0.0 |
| 97.00 | Appurtenance(s) | 141.5 | 166.4 | 2,337.0 | 0.0 | 0.0 | 1,348.6 | 0.0 | 8.9 | 2,478.6 | 1,523.9 | 0.0 | 0.0 |
| 98.00 | | 46.9 | 82.2 | | | | | 0.0 | 0.0 | 46.9 | 82.2 | 0.0 | 0.0 |
| | | | | | | | | Totals: | | 29,495.1 | 27,388.2 | 0.00 | 0.00 |

Load Case: 0.9D + 1.6W 101 mph with No Ice (Reduced DL) 18 Iterations

Gust Response Factor :1.10 Wind Importance Factor 1.00
Dead Load Factor :0.90
Wind Load Factor :1.60

## Calculated Forces

| Seg Elev (ft) | Pu FY (-) (kips) | Vu FX (-) (kips) | Tu MY (ft-kips) | Mu MZ (ft-kips) | Mu MX (ft-kips) | Resultant Moment (ft-kips) | phi Pn (kips) | phi Vn (kips) | phi Tn (ft-kips) | phi Mn (ft-kips) | Total Deflect (in) | Rotation (deg) | Ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | -27.35 | -29.23 | 0.00 | -2,172.95 | 0.00 | 2,172.95 | 4,846.45 | 2,423.23 | 9,593.57 | 4,803.92 | 0.00 | 0.00 | 0.458 |
| 5.00 | -26.00 | -28.71 | 0.00 | -2,026.78 | 0.00 | 2,026.78 | 4,764.82 | 2,382.41 | 9,210.06 | 4,611.88 | 0.08 | -0.15 | 0.445 |
| 10.00 | -24.68 | -28.20 | 0.00 | -1,883.21 | 0.00 | 1,883.21 | 4,681.70 | 2,340.85 | 8,831.34 | 4,422.23 | 0.32 | -0.30 | 0.431 |
| 15.00 | -23.39 | -27.69 | 0.00 | -1,742.21 | 0.00 | 1,742.21 | 4,597.07 | 2,298.54 | 8,457.59 | 4,235.08 | 0.72 | -0.45 | 0.417 |
| 20.00 | -22.12 | -27.16 | 0.00 | -1,603.79 | 0.00 | 1,603.79 | 4,510.95 | 2,255.47 | 8,089.05 | 4,050.54 | 1.28 | -0.60 | 0.401 |
| 25.00 | -20.88 | -26.62 | 0.00 | -1,467.99 | 0.00 | 1,467.99 | 4,395.70 | 2,197.85 | 7,677.66 | 3,844.53 | 1.99 | -0.75 | 0.387 |
| 30.00 | -19.67 | -26.07 | 0.00 | -1,334.91 | 0.00 | 1,334.91 | 4,279.67 | 2,139.83 | 7,275.67 | 3,643.24 | 2.86 | -0.90 | 0.371 |
| 35.00 | -18.49 | -25.51 | 0.00 | -1,204.57 | 0.00 | 1,204.57 | 4,163.63 | 2,081.82 | 6,884.49 | 3,447.36 | 3.89 | -1.04 | 0.354 |
| 40.00 | -17.34 | -24.95 | 0.00 | -1,077.03 | 0.00 | 1,077.03 | 4,047.60 | 2,023.80 | 6,504.12 | 3,256.89 | 5.06 | -1.19 | 0.335 |
| 45.00 | -16.22 | -24.47 | 0.00 | -952.29 | 0.00 | 952.29 | 3,931.57 | 1,965.78 | 6,134.56 | 3,071.84 | 6.37 | -1.32 | 0.314 |
| 48.50 | -15.46 | -24.18 | 0.00 | -866.67 | 0.00 | 866.67 | 3,850.34 | 1,925.17 | 5,882.29 | 2,945.52 | 7.38 | -1.42 | 0.298 |
| 50.00 | -14.95 | -23.91 | 0.00 | -830.40 | 0.00 | 830.40 | 3,815.53 | 1,907.77 | 5,775.80 | 2,892.19 | 7.83 | -1.45 | 0.291 |
| 53.25 | -13.89 | -23.61 | 0.00 | -752.71 | 0.00 | 752.71 | 2,599.91 | 1,299.95 | 3,950.87 | 1,978.37 | 8.85 | -1.54 | 0.386 |
| 55.00 | -13.57 | -23.24 | 0.00 | -711.40 | 0.00 | 711.40 | 2,580.79 | 1,290.39 | 3,879.74 | 1,942.75 | 9.42 | -1.58 | 0.372 |
| 60.00 | -12.73 | -22.68 | 0.00 | -595.22 | 0.00 | 595.22 | 2,525.14 | 1,262.57 | 3,678.48 | 1,841.97 | 11.16 | -1.73 | 0.329 |
| 65.00 | -11.91 | -22.13 | 0.00 | -481.81 | 0.00 | 481.81 | 2,468.00 | 1,234.00 | 3,480.29 | 1,742.73 | 13.05 | -1.87 | 0.282 |
| 70.00 | -11.11 | -21.58 | 0.00 | -371.15 | 0.00 | 371.15 | 2,409.36 | 1,204.68 | 3,285.38 | 1,645.13 | 15.07 | -1.99 | 0.231 |
| 75.00 | -10.35 | -21.25 | 0.00 | -263.23 | 0.00 | 263.23 | 2,349.22 | 1,174.61 | 3,093.96 | 1,549.28 | 17.21 | -2.09 | 0.175 |
| 76.00 | -9.25 | -17.29 | 0.00 | -238.18 | 0.00 | 238.18 | 2,337.01 | 1,168.51 | 3,056.11 | 1,530.33 | 17.65 | -2.10 | 0.160 |
| 77.00 | -7.36 | -15.39 | 0.00 | -220.89 | 0.00 | 220.89 | 2,324.75 | 1,162.37 | 3,018.41 | 1,511.45 | 18.10 | -2.12 | 0.149 |
| 80.00 | -6.93 | -14.96 | 0.00 | -174.73 | 0.00 | 174.73 | 2,283.36 | 1,141.68 | 2,900.87 | 1,452.59 | 19.44 | -2.16 | 0.123 |
| 85.00 | -6.23 | -14.49 | 0.00 | -99.90 | 0.00 | 99.90 | 2,200.48 | 1,100.24 | 2,693.09 | 1,348.55 | 21.74 | -2.21 | 0.077 |
| 89.00 | -3.95 | -12.48 | 0.00 | -41.96 | 0.00 | 41.96 | 2,134.18 | 1,067.09 | 2,532.43 | 1,268.09 | 23.60 | -2.24 | 0.035 |
| 90.00 | -2.24 | -4.85 | 0.00 | -29.48 | 0.00 | 29.48 | 2,117.60 | 1,058.80 | 2,493.03 | 1,248.37 | 24.07 | -2.24 | 0.025 |
| 95.00 | -1.51 | -2.59 | 0.00 | -5.22 | 0.00 | 5.22 | 2,034.72 | 1,017.36 | 2,300.69 | 1,152.06 | 26.43 | -2.25 | 0.005 |
| 97.00 | -0.08 | -0.05 | 0.00 | -0.05 | 0.00 | 0.05 | 2,001.57 | 1,000.78 | 2,225.92 | 1,114.61 | 27.37 | -2.25 | 0.000 |
| 98.00 | 0.00 | -0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 1,984.99 | 992.49 | 2,188.99 | 1,096.12 | 27.84 | -2.25 | 0.000 |

Load Case: 1.2D + 1.0Di + 1.0Wi 50 mph with 0.75 in Radial Ice 17 Iterations

Gust Response Factor :1.10 Ice Dead Load Factor :1.00 Wind Importance Factor :1.00
Dead Load Factor :1.20 Ice Importance Factor :1.00
Wind Load Factor :1.00

## Applied Segment Forces Summary

| Seg Elev (ft) | Description | Shaft Forces Wind FX (lb) | Shaft Forces Dead Load (lb) | Discrete Forces Wind FX (lb) | Discrete Forces Torsion MY (lb-ft) | Discrete Forces Moment MZ (lb-ft) | Discrete Forces Dead Load (lb) | Linear Forces Wind FX (lb) | Linear Forces Dead Load (lb) | Sum of Forces Wind FX (lb) | Sum of Forces Dead Load (lb) | Sum of Forces Torsion MY (lb-ft) | Sum of Forces Moment MZ (lb) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | | 88.1 | 0.0 | | | | | 0.0 | 0.0 | 88.1 | 0.0 | 0.0 | 0.0 |
| 5.00 | | 174.7 | 1,705.0 | | | | | 0.0 | 344.7 | 174.7 | 2,049.7 | 0.0 | 0.0 |
| 10.00 | | 171.5 | 1,706.2 | | | | | 0.0 | 344.7 | 171.5 | 2,050.9 | 0.0 | 0.0 |
| 15.00 | | 170.2 | 1,685.5 | | | | | 0.0 | 344.7 | 170.2 | 2,030.2 | 0.0 | 0.0 |
| 20.00 | | 172.5 | 1,657.7 | | | | | 0.0 | 344.7 | 172.5 | 2,002.4 | 0.0 | 0.0 |
| 25.00 | | 175.4 | 1,626.2 | | | | | 0.0 | 344.7 | 175.4 | 1,970.9 | 0.0 | 0.0 |
| 30.00 | | 176.9 | 1,592.3 | | | | | 0.0 | 344.7 | 176.9 | 1,937.0 | 0.0 | 0.0 |
| 35.00 | | 177.3 | 1,556.9 | | | | | 0.0 | 344.7 | 177.3 | 1,901.6 | 0.0 | 0.0 |
| 40.00 | | 177.0 | 1,520.2 | | | | | 0.0 | 344.7 | 177.0 | 1,864.9 | 0.0 | 0.0 |
| 45.00 | | 149.8 | 1,482.6 | | | | | 0.0 | 344.7 | 149.8 | 1,827.3 | 0.0 | 0.0 |
| 48.50 | Bot - Section 2 | 88.1 | 1,016.2 | | | | | 0.0 | 241.3 | 88.1 | 1,257.5 | 0.0 | 0.0 |
| 50.00 | | 84.1 | 662.4 | | | | | 0.0 | 103.4 | 84.1 | 765.9 | 0.0 | 0.0 |
| 53.25 | Top - Section 1 | 88.3 | 1,415.0 | | | | | 0.0 | 224.1 | 88.3 | 1,639.0 | 0.0 | 0.0 |
| 55.00 | | 118.0 | 393.9 | | | | | 0.0 | 120.6 | 118.0 | 514.5 | 0.0 | 0.0 |
| 60.00 | | 173.3 | 1,101.2 | | | | | 0.0 | 344.7 | 173.3 | 1,445.9 | 0.0 | 0.0 |
| 65.00 | | 170.8 | 1,070.4 | | | | | 0.0 | 344.7 | 170.8 | 1,415.1 | 0.0 | 0.0 |
| 70.00 | | 168.0 | 1,039.2 | | | | | 0.0 | 344.7 | 168.0 | 1,383.9 | 0.0 | 0.0 |
| 75.00 | | 99.7 | 1,007.6 | | | | | 0.0 | 344.7 | 99.7 | 1,352.3 | 0.0 | 0.0 |
| 76.00 | Appurtenance(s) | 32.9 | 198.6 | 784.6 | 0.0 | 784.6 | 3,337.9 | 0.0 | 68.9 | 817.4 | 3,605.5 | 0.0 | 0.0 |
| 77.00 | Appurtenance(s) | 65.2 | 197.4 | 458.8 | 0.0 | 0.0 | 3,213.9 | 0.0 | 65.8 | 524.0 | 3,477.1 | 0.0 | 0.0 |
| 80.00 | | 128.7 | 583.0 | | | | | 0.0 | 197.5 | 128.7 | 780.5 | 0.0 | 0.0 |
| 85.00 | | 142.6 | 943.6 | | | | | 0.0 | 329.1 | 142.6 | 1,272.7 | 0.0 | 0.0 |
| 89.00 | Appurtenance(s) | 78.1 | 732.5 | 473.3 | 0.0 | 0.0 | 3,229.6 | 0.0 | 263.3 | 551.4 | 4,225.4 | 0.0 | 0.0 |
| 90.00 | Appurtenance(s) | 91.7 | 180.6 | 1,446.6 | 0.0 | -1,337.0 | 6,016.8 | 0.0 | 20.3 | 1,538.3 | 6,217.7 | 0.0 | 0.0 |
| 95.00 | Appurtenance(s) | 106.2 | 878.6 | 341.5 | 0.0 | 0.0 | 1,247.1 | 0.0 | 68.2 | 447.7 | 2,193.9 | 0.0 | 0.0 |
| 97.00 | Appurtenance(s) | 44.8 | 343.7 | 552.1 | 0.0 | 0.0 | 2,969.8 | 0.0 | 11.8 | 596.9 | 3,325.3 | 0.0 | 0.0 |
| 98.00 | | 14.8 | 170.1 | | | | | 0.0 | 0.0 | 14.8 | 170.1 | 0.0 | 0.0 |
| | | | | | | | | Totals: | | 7,385.60 | 52,677.1 | 0.00 | 0.00 |

Load Case: 1.2D + 1.0Di + 1.0Wi 50 mph with 0.75 in Radial Ice 17 Iterations

Gust Response Factor :1.10 Ice Dead Load Factor :1.00 Wind Importance Factor :1.00
Dead Load Factor :1.20 Ice Importance Factor :1.00
Wind Load Factor :1.00

## Calculated Forces

| Seg Elev (ft) | Pu FY (-) (kips) | Vu FX (-) (kips) | Tu MY (ft-kips) | Mu MZ (ft-kips) | Mu MX (ft-kips) | Resultant Moment (ft-kips) | phi Pn (kips) | phi Vn (kips) | phi Tn (ft-kips) | phi Mn (ft-kips) | Total Deflect (in) | Rotation (deg) | Ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | -52.67 | -7.31 | 0.00 | -528.31 | 0.00 | 528.31 | 4,846.45 | 2,423.23 | 9,593.57 | 4,803.92 | 0.00 | 0.00 | 0.121 |
| 5.00 | -50.62 | -7.17 | 0.00 | -491.74 | 0.00 | 491.74 | 4,764.82 | 2,382.41 | 9,210.06 | 4,611.88 | 0.02 | -0.04 | 0.117 |
| 10.00 | -48.57 | -7.03 | 0.00 | -455.88 | 0.00 | 455.88 | 4,681.70 | 2,340.85 | 8,831.34 | 4,422.23 | 0.08 | -0.07 | 0.113 |
| 15.00 | -46.53 | -6.89 | 0.00 | -420.74 | 0.00 | 420.74 | 4,597.07 | 2,298.54 | 8,457.59 | 4,235.08 | 0.18 | -0.11 | 0.109 |
| 20.00 | -44.52 | -6.74 | 0.00 | -386.31 | 0.00 | 386.31 | 4,510.95 | 2,255.47 | 8,089.05 | 4,050.54 | 0.31 | -0.15 | 0.105 |
| 25.00 | -42.55 | -6.58 | 0.00 | -352.63 | 0.00 | 352.63 | 4,395.70 | 2,197.85 | 7,677.66 | 3,844.53 | 0.48 | -0.18 | 0.101 |
| 30.00 | -40.61 | -6.42 | 0.00 | -319.72 | 0.00 | 319.72 | 4,279.67 | 2,139.83 | 7,275.67 | 3,643.24 | 0.69 | -0.22 | 0.097 |
| 35.00 | -38.71 | -6.26 | 0.00 | -287.61 | 0.00 | 287.61 | 4,163.63 | 2,081.82 | 6,884.49 | 3,447.36 | 0.94 | -0.25 | 0.093 |
| 40.00 | -36.84 | -6.10 | 0.00 | -256.30 | 0.00 | 256.30 | 4,047.60 | 2,023.80 | 6,504.12 | 3,256.89 | 1.22 | -0.29 | 0.088 |
| 45.00 | -35.01 | -5.95 | 0.00 | -225.82 | 0.00 | 225.82 | 3,931.57 | 1,965.78 | 6,134.56 | 3,071.84 | 1.54 | -0.32 | 0.082 |
| 48.50 | -33.75 | -5.87 | 0.00 | -204.99 | 0.00 | 204.99 | 3,850.34 | 1,925.17 | 5,882.29 | 2,945.52 | 1.78 | -0.34 | 0.078 |
| 50.00 | -32.98 | -5.79 | 0.00 | -196.19 | 0.00 | 196.19 | 3,815.53 | 1,907.77 | 5,775.80 | 2,892.19 | 1.89 | -0.35 | 0.076 |
| 53.25 | -31.34 | -5.70 | 0.00 | -177.38 | 0.00 | 177.38 | 2,599.91 | 1,299.95 | 3,950.87 | 1,978.37 | 2.13 | -0.37 | 0.102 |
| 55.00 | -30.83 | -5.59 | 0.00 | -167.41 | 0.00 | 167.41 | 2,580.79 | 1,290.39 | 3,879.74 | 1,942.75 | 2.27 | -0.38 | 0.098 |
| 60.00 | -29.38 | -5.42 | 0.00 | -139.48 | 0.00 | 139.48 | 2,525.14 | 1,262.57 | 3,678.48 | 1,841.97 | 2.69 | -0.41 | 0.087 |
| 65.00 | -27.96 | -5.25 | 0.00 | -112.37 | 0.00 | 112.37 | 2,468.00 | 1,234.00 | 3,480.29 | 1,742.73 | 3.14 | -0.45 | 0.076 |
| 70.00 | -26.58 | -5.09 | 0.00 | -86.10 | 0.00 | 86.10 | 2,409.36 | 1,204.68 | 3,285.38 | 1,645.13 | 3.62 | -0.47 | 0.063 |
| 75.00 | -25.23 | -4.98 | 0.00 | -60.66 | 0.00 | 60.66 | 2,349.22 | 1,174.61 | 3,093.96 | 1,549.28 | 4.13 | -0.50 | 0.050 |
| 76.00 | -21.63 | -4.13 | 0.00 | -54.90 | 0.00 | 54.90 | 2,337.01 | 1,168.51 | 3,056.11 | 1,530.33 | 4.24 | -0.50 | 0.045 |
| 77.00 | -18.15 | -3.58 | 0.00 | -50.76 | 0.00 | 50.76 | 2,324.75 | 1,162.37 | 3,018.41 | 1,511.45 | 4.34 | -0.50 | 0.041 |
| 80.00 | -17.37 | -3.45 | 0.00 | -40.02 | 0.00 | 40.02 | 2,283.36 | 1,141.68 | 2,900.87 | 1,452.59 | 4.66 | -0.51 | 0.035 |
| 85.00 | -16.10 | -3.30 | 0.00 | -22.77 | 0.00 | 22.77 | 2,200.48 | 1,100.24 | 2,693.09 | 1,348.55 | 5.21 | -0.53 | 0.024 |
| 89.00 | -11.88 | -2.71 | 0.00 | -9.57 | 0.00 | 9.57 | 2,134.18 | 1,067.09 | 2,532.43 | 1,268.09 | 5.65 | -0.53 | 0.013 |
| 90.00 | -5.68 | -1.11 | 0.00 | -6.87 | 0.00 | 6.87 | 2,117.60 | 1,058.80 | 2,493.03 | 1,248.37 | 5.77 | -0.53 | 0.008 |
| 95.00 | -3.49 | -0.64 | 0.00 | -1.30 | 0.00 | 1.30 | 2,034.72 | 1,017.36 | 2,300.69 | 1,152.06 | 6.32 | -0.53 | 0.003 |
| 97.00 | -0.17 | -0.02 | 0.00 | -0.02 | 0.00 | 0.02 | 2,001.57 | 1,000.78 | 2,225.92 | 1,114.61 | 6.55 | -0.53 | 0.000 |
| 98.00 | 0.00 | -0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 1,984.99 | 992.49 | 2,188.99 | 1,096.12 | 6.66 | -0.53 | 0.000 |

Load Case: 1.0D + 1.0W Serviceability 60 mph 17 Iterations

Gust Response Factor :1.10 Wind Importance Factor 1.00
Dead Load Factor :1.00
Wind Load Factor :1.00

## Applied Segment Forces Summary

| Seg Elev (ft) | Description | Shaft Forces Wind FX (lb) | Shaft Forces Dead Load (lb) | Discrete Forces Wind FX (lb) | Discrete Forces Torsion MY (lb-ft) | Discrete Forces Moment MZ (lb-ft) | Discrete Forces Dead Load (lb) | Linear Forces Wind FX (lb) | Linear Forces Dead Load (lb) | Sum of Forces Wind FX (lb) | Sum of Forces Dead Load (lb) | Sum of Forces Torsion MY (lb-ft) | Sum of Forces Moment MZ (lb) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | | 58.7 | 0.0 | | | | | 0.0 | 0.0 | 58.7 | 0.0 | 0.0 | 0.0 |
| 5.00 | | 116.1 | 1,126.2 | | | | | 0.0 | 287.2 | 116.1 | 1,413.5 | 0.0 | 0.0 |
| 10.00 | | 113.3 | 1,099.6 | | | | | 0.0 | 287.2 | 113.3 | 1,386.9 | 0.0 | 0.0 |
| 15.00 | | 112.1 | 1,073.1 | | | | | 0.0 | 287.2 | 112.1 | 1,360.3 | 0.0 | 0.0 |
| 20.00 | | 113.2 | 1,046.5 | | | | | 0.0 | 287.2 | 113.2 | 1,333.7 | 0.0 | 0.0 |
| 25.00 | | 114.7 | 1,019.9 | | | | | 0.0 | 287.2 | 114.7 | 1,307.2 | 0.0 | 0.0 |
| 30.00 | | 115.4 | 993.3 | | | | | 0.0 | 287.2 | 115.4 | 1,280.6 | 0.0 | 0.0 |
| 35.00 | | 115.4 | 966.8 | | | | | 0.0 | 287.2 | 115.4 | 1,254.0 | 0.0 | 0.0 |
| 40.00 | | 114.8 | 940.2 | | | | | 0.0 | 287.2 | 114.8 | 1,227.5 | 0.0 | 0.0 |
| 45.00 | | 96.9 | 913.6 | | | | | 0.0 | 287.2 | 96.9 | 1,200.9 | 0.0 | 0.0 |
| 48.50 | Bot - Section 2 | 56.9 | 623.7 | | | | | 0.0 | 201.1 | 56.9 | 824.8 | 0.0 | 0.0 |
| 50.00 | | 54.3 | 455.2 | | | | | 0.0 | 86.2 | 54.3 | 541.4 | 0.0 | 0.0 |
| 53.25 | Top - Section 1 | 56.9 | 972.2 | | | | | 0.0 | 186.7 | 56.9 | 1,159.0 | 0.0 | 0.0 |
| 55.00 | | 75.9 | 217.4 | | | | | 0.0 | 100.5 | 75.9 | 317.9 | 0.0 | 0.0 |
| 60.00 | | 111.2 | 608.3 | | | | | 0.0 | 287.2 | 111.2 | 895.6 | 0.0 | 0.0 |
| 65.00 | | 109.2 | 589.3 | | | | | 0.0 | 287.2 | 109.2 | 876.6 | 0.0 | 0.0 |
| 70.00 | | 107.0 | 570.4 | | | | | 0.0 | 287.2 | 107.0 | 857.6 | 0.0 | 0.0 |
| 75.00 | | 63.4 | 551.4 | | | | | 0.0 | 287.2 | 63.4 | 838.6 | 0.0 | 0.0 |
| 76.00 | Appurtenance(s) | 20.8 | 108.0 | 752.2 | 0.0 | 752.2 | 1,213.9 | 0.0 | 57.5 | 773.0 | 1,379.3 | 0.0 | 0.0 |
| 77.00 | Appurtenance(s) | 41.3 | 107.2 | 320.9 | 0.0 | 0.0 | 2,000.0 | 0.0 | 54.9 | 362.2 | 2,162.1 | 0.0 | 0.0 |
| 80.00 | | 81.4 | 317.2 | | | | | 0.0 | 164.5 | 81.4 | 481.7 | 0.0 | 0.0 |
| 85.00 | | 89.9 | 513.4 | | | | | 0.0 | 274.2 | 89.9 | 787.7 | 0.0 | 0.0 |
| 89.00 | Appurtenance(s) | 49.1 | 397.1 | 329.1 | 0.0 | 0.0 | 2,000.0 | 0.0 | 219.4 | 378.2 | 2,616.5 | 0.0 | 0.0 |
| 90.00 | Appurtenance(s) | 57.4 | 97.4 | 1,433.9 | 0.0 | -1,331.5 | 2,113.4 | 0.0 | 16.9 | 1,491.4 | 2,227.7 | 0.0 | 0.0 |
| 95.00 | Appurtenance(s) | 66.4 | 475.4 | 374.5 | 0.0 | 0.0 | 383.7 | 0.0 | 56.8 | 440.9 | 915.9 | 0.0 | 0.0 |
| 97.00 | Appurtenance(s) | 27.9 | 184.9 | 461.2 | 0.0 | 0.0 | 1,498.5 | 0.0 | 9.8 | 489.1 | 1,693.2 | 0.0 | 0.0 |
| 98.00 | | 9.3 | 91.3 | | | | | 0.0 | 0.0 | 9.3 | 91.3 | 0.0 | 0.0 |
| | | | | | | | | Totals: | | 5,820.84 | 30,431.4 | 0.00 | 0.00 |

Load Case: 1.0D + 1.0W Serviceability 60 mph 17 Iterations

Gust Response Factor :1.10 Wind Importance Factor 1.00
Dead Load Factor :1.00
Wind Load Factor :1.00

## Calculated Forces

| Seg Elev (ft) | Pu FY (-) (kips) | Vu FX (-) (kips) | Tu MY (ft-kips) | Mu MZ (ft-kips) | Mu MX (ft-kips) | Resultant Moment (ft-kips) | phi Pn (kips) | phi Vn (kips) | phi Tn (ft-kips) | phi Mn (ft-kips) | Total Deflect (in) | Rotation (deg) | Ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | -30.43 | -5.77 | 0.00 | -429.57 | 0.00 | 429.57 | 4,846.45 | 2,423.23 | 9,593.57 | 4,803.92 | 0.00 | 0.00 | 0.096 |
| 5.00 | -29.01 | -5.67 | 0.00 | -400.72 | 0.00 | 400.72 | 4,764.82 | 2,382.41 | 9,210.06 | 4,611.88 | 0.02 | -0.03 | 0.093 |
| 10.00 | -27.62 | -5.57 | 0.00 | -372.37 | 0.00 | 372.37 | 4,681.70 | 2,340.85 | 8,831.34 | 4,422.23 | 0.06 | -0.06 | 0.090 |
| 15.00 | -26.26 | -5.47 | 0.00 | -344.53 | 0.00 | 344.53 | 4,597.07 | 2,298.54 | 8,457.59 | 4,235.08 | 0.14 | -0.09 | 0.087 |
| 20.00 | -24.92 | -5.37 | 0.00 | -317.18 | 0.00 | 317.18 | 4,510.95 | 2,255.47 | 8,089.05 | 4,050.54 | 0.25 | -0.12 | 0.084 |
| 25.00 | -23.61 | -5.26 | 0.00 | -290.36 | 0.00 | 290.36 | 4,395.70 | 2,197.85 | 7,677.66 | 3,844.53 | 0.39 | -0.15 | 0.081 |
| 30.00 | -22.33 | -5.15 | 0.00 | -264.05 | 0.00 | 264.05 | 4,279.67 | 2,139.83 | 7,275.67 | 3,643.24 | 0.57 | -0.18 | 0.078 |
| 35.00 | -21.08 | -5.04 | 0.00 | -238.29 | 0.00 | 238.29 | 4,163.63 | 2,081.82 | 6,884.49 | 3,447.36 | 0.77 | -0.21 | 0.074 |
| 40.00 | -19.85 | -4.93 | 0.00 | -213.08 | 0.00 | 213.08 | 4,047.60 | 2,023.80 | 6,504.12 | 3,256.89 | 1.00 | -0.23 | 0.070 |
| 45.00 | -18.64 | -4.84 | 0.00 | -188.41 | 0.00 | 188.41 | 3,931.57 | 1,965.78 | 6,134.56 | 3,071.84 | 1.26 | -0.26 | 0.066 |
| 48.50 | -17.82 | -4.78 | 0.00 | -171.48 | 0.00 | 171.48 | 3,850.34 | 1,925.17 | 5,882.29 | 2,945.52 | 1.46 | -0.28 | 0.063 |
| 50.00 | -17.28 | -4.73 | 0.00 | -164.31 | 0.00 | 164.31 | 3,815.53 | 1,907.77 | 5,775.80 | 2,892.19 | 1.55 | -0.29 | 0.061 |
| 53.25 | -16.12 | -4.67 | 0.00 | -148.94 | 0.00 | 148.94 | 2,599.91 | 1,299.95 | 3,950.87 | 1,978.37 | 1.75 | -0.30 | 0.081 |
| 55.00 | -15.80 | -4.60 | 0.00 | -140.77 | 0.00 | 140.77 | 2,580.79 | 1,290.39 | 3,879.74 | 1,942.75 | 1.86 | -0.31 | 0.079 |
| 60.00 | -14.90 | -4.49 | 0.00 | -117.79 | 0.00 | 117.79 | 2,525.14 | 1,262.57 | 3,678.48 | 1,841.97 | 2.21 | -0.34 | 0.070 |
| 65.00 | -14.02 | -4.38 | 0.00 | -95.35 | 0.00 | 95.35 | 2,468.00 | 1,234.00 | 3,480.29 | 1,742.73 | 2.58 | -0.37 | 0.060 |
| 70.00 | -13.16 | -4.27 | 0.00 | -73.45 | 0.00 | 73.45 | 2,409.36 | 1,204.68 | 3,285.38 | 1,645.13 | 2.98 | -0.39 | 0.050 |
| 75.00 | -12.33 | -4.20 | 0.00 | -52.09 | 0.00 | 52.09 | 2,349.22 | 1,174.61 | 3,093.96 | 1,549.28 | 3.40 | -0.41 | 0.039 |
| 76.00 | -10.95 | -3.42 | 0.00 | -47.14 | 0.00 | 47.14 | 2,337.01 | 1,168.51 | 3,056.11 | 1,530.33 | 3.49 | -0.42 | 0.035 |
| 77.00 | -8.79 | -3.05 | 0.00 | -43.71 | 0.00 | 43.71 | 2,324.75 | 1,162.37 | 3,018.41 | 1,511.45 | 3.58 | -0.42 | 0.033 |
| 80.00 | -8.31 | -2.96 | 0.00 | -34.58 | 0.00 | 34.58 | 2,283.36 | 1,141.68 | 2,900.87 | 1,452.59 | 3.85 | -0.43 | 0.027 |
| 85.00 | -7.52 | -2.87 | 0.00 | -19.77 | 0.00 | 19.77 | 2,200.48 | 1,100.24 | 2,693.09 | 1,348.55 | 4.30 | -0.44 | 0.018 |
| 89.00 | -4.91 | -2.47 | 0.00 | -8.30 | 0.00 | 8.30 | 2,134.18 | 1,067.09 | 2,532.43 | 1,268.09 | 4.67 | -0.44 | 0.009 |
| 90.00 | -2.69 | -0.96 | 0.00 | -5.84 | 0.00 | 5.84 | 2,117.60 | 1,058.80 | 2,493.03 | 1,248.37 | 4.76 | -0.44 | 0.006 |
| 95.00 | -1.78 | -0.51 | 0.00 | -1.03 | 0.00 | 1.03 | 2,034.72 | 1,017.36 | 2,300.69 | 1,152.06 | 5.23 | -0.45 | 0.002 |
| 97.00 | -0.09 | -0.01 | 0.00 | -0.01 | 0.00 | 0.01 | 2,001.57 | 1,000.78 | 2,225.92 | 1,114.61 | 5.41 | -0.45 | 0.000 |
| 98.00 | 0.00 | -0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 1,984.99 | 992.49 | 2,188.99 | 1,096.12 | 5.51 | -0.45 | 0.000 |

## Equivalent Lateral Forces Method Analysis

(Based on ASCE7-10 Chapters 11, 12, 15)

| | | |
|---|---|---|
| Spectral Response Acceleration for Short Period ($S_s$): | 0.17 | |
| Spectral Response Acceleration at 1.0 Second Period ($S_1$): | 0.06 | |
| Long-Period Transition Period ($T_L$): | 6 | |
| Importance Factor ($I_E$): | 1.00 | |
| Site Coefficient $F_a$: | 1.60 | |
| Site Coeffiecient $F_v$: | 2.40 | |
| Response Modification Coefficient (R): | 1.50 | |
| Design Spectral Response Acceleration at Short Period ($S_{ds}$): | 0.18 | |
| Design Spectral Response Acceleration at 1.0 Second Period ($S_{d1}$): | 0.10 | |
| Seismic Response Coefficient ($C_s$): | 0.05 | |
| Upper Limit $C_s$ | 0.05 | |
| Lower Limit $C_s$ | 0.03 | |
| Period based on Rayleigh Method (sec): | 1.19 | |
| Redundancy Factor (p): | 1.30 | |
| Seismic Force Distribution Exponent (k): | 1.34 | |
| Total Unfactored Dead Load: | 30.43 | k |
| Seismic Base Shear (E): | 2.13 | k |

Load Case (1.2 + 0.2Sds) * DL + E ELFM Seismic Equivalent Lateral Forces Method

| Segment | Height Above Base (ft) | Weight (lb) | $W_z$ (lb-ft) | $C_{vx}$ | Horizontal Force (lb) | Vertical Force (lb) |
|---|---|---|---|---|---|---|
| 26 | 97.50 | 91 | 43 | 0.006 | 13 | 113 |
| 25 | 96.00 | 195 | 89 | 0.012 | 26 | 241 |
| 24 | 92.50 | 532 | 233 | 0.032 | 69 | 658 |
| 23 | 89.50 | 114 | 48 | 0.007 | 14 | 141 |
| 22 | 87.00 | 616 | 248 | 0.034 | 73 | 762 |
| 21 | 82.50 | 788 | 295 | 0.041 | 87 | 974 |
| 20 | 78.50 | 482 | 169 | 0.023 | 50 | 596 |
| 19 | 76.50 | 162 | 55 | 0.008 | 16 | 200 |
| 18 | 75.50 | 165 | 55 | 0.008 | 16 | 205 |
| 17 | 72.50 | 839 | 264 | 0.037 | 78 | 1,037 |
| 16 | 67.50 | 858 | 246 | 0.034 | 73 | 1,061 |
| 15 | 62.50 | 877 | 226 | 0.031 | 67 | 1,084 |
| 14 | 57.50 | 896 | 207 | 0.029 | 61 | 1,108 |
| 13 | 54.13 | 318 | 68 | 0.009 | 20 | 393 |
| 12 | 51.63 | 1,159 | 232 | 0.032 | 69 | 1,433 |
| 11 | 49.25 | 541 | 102 | 0.014 | 30 | 670 |
| 10 | 46.75 | 825 | 144 | 0.020 | 43 | 1,020 |
| 9 | 42.50 | 1,201 | 185 | 0.026 | 55 | 1,485 |
| 8 | 37.50 | 1,227 | 160 | 0.022 | 47 | 1,518 |
| 7 | 32.50 | 1,254 | 135 | 0.019 | 40 | 1,551 |
| 6 | 27.50 | 1,281 | 110 | 0.015 | 33 | 1,584 |
| 5 | 22.50 | 1,307 | 86 | 0.012 | 25 | 1,617 |
| 4 | 17.50 | 1,334 | 62 | 0.009 | 18 | 1,649 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 3 | 12.50 | 1,360 | 40 | 0.006 | 12 | 1,682 |
| 2 | 7.50 | 1,387 | 21 | 0.003 | 6 | 1,715 |
| 1 | 2.50 | 1,413 | 5 | 0.001 | 1 | 1,748 |
| Ericsson KRY 112 144 | 97.00 | 33 | 15 | 0.002 | 5 | 41 |
| Ericsson Radio 4449 | 97.00 | 222 | 103 | 0.014 | 31 | 275 |
| Ericsson AIR 21, 1.3 | 97.00 | 249 | 116 | 0.016 | 34 | 308 |
| Ericsson AIR 21, 1.3 | 97.00 | 244 | 114 | 0.016 | 34 | 302 |
| Round T-Arm | 97.00 | 750 | 350 | 0.048 | 103 | 928 |
| RFS APXVAARR24_43-U- | 95.00 | 384 | 174 | 0.024 | 51 | 475 |
| Raycap DC6-48-60-18- | 90.00 | 80 | 34 | 0.005 | 10 | 99 |
| Ericsson RRUS A2 | 90.00 | 90 | 38 | 0.005 | 11 | 111 |
| Ericsson RRUS 32 (50 | 90.00 | 152 | 64 | 0.009 | 19 | 188 |
| Ericsson RRUS 12 | 90.00 | 300 | 126 | 0.018 | 37 | 371 |
| Ericsson RRUS E2 B29 | 90.00 | 180 | 76 | 0.011 | 22 | 223 |
| Ericsson RRUS-11 | 90.00 | 495 | 209 | 0.029 | 62 | 612 |
| CCI HPA-65R-BUU-H8 | 90.00 | 816 | 344 | 0.048 | 102 | 1,009 |
| Round Platform w/ Ha | 89.00 | 2,000 | 830 | 0.115 | 246 | 2,473 |
| Round Platform w/ Ha | 77.00 | 2,000 | 684 | 0.095 | 202 | 2,473 |
| Alcatel-Lucent B13 R | 76.00 | 172 | 58 | 0.008 | 17 | 212 |
| Alcatel-Lucent 1900 | 76.00 | 180 | 60 | 0.008 | 18 | 223 |
| Alcatel-Lucent RRH4x | 76.00 | 190 | 64 | 0.009 | 19 | 235 |
| Raycap RxxDC-3315-PF | 76.00 | 64 | 21 | 0.003 | 6 | 79 |
| Andrew SBNHH-1D65B | 76.00 | 608 | 204 | 0.028 | 60 | 752 |
| | | 30,431 | 7,211 | 1.000 | 2,134 | 37,634 |

Load Case (0.9 - 0.2Sds) * DL + E ELFM Seismic (Reduced DL) Equivalent Lateral Forces Method

| Segment | Height Above Base (ft) | Weight (lb) | $W_z$ (lb-ft) | $C_{vx}$ | Horizontal Force (lb) | Vertical Force (lb) |
|---|---|---|---|---|---|---|
| 26 | 97.50 | 91 | 43 | 0.006 | 13 | 79 |
| 25 | 96.00 | 195 | 89 | 0.012 | 26 | 168 |
| 24 | 92.50 | 532 | 233 | 0.032 | 69 | 459 |
| 23 | 89.50 | 114 | 48 | 0.007 | 14 | 99 |
| 22 | 87.00 | 616 | 248 | 0.034 | 73 | 532 |
| 21 | 82.50 | 788 | 295 | 0.041 | 87 | 680 |
| 20 | 78.50 | 482 | 169 | 0.023 | 50 | 416 |
| 19 | 76.50 | 162 | 55 | 0.008 | 16 | 140 |
| 18 | 75.50 | 165 | 55 | 0.008 | 16 | 143 |
| 17 | 72.50 | 839 | 264 | 0.037 | 78 | 724 |
| 16 | 67.50 | 858 | 246 | 0.034 | 73 | 740 |
| 15 | 62.50 | 877 | 226 | 0.031 | 67 | 757 |
| 14 | 57.50 | 896 | 207 | 0.029 | 61 | 773 |
| 13 | 54.13 | 318 | 68 | 0.009 | 20 | 274 |
| 12 | 51.63 | 1,159 | 232 | 0.032 | 69 | 1,001 |
| 11 | 49.25 | 541 | 102 | 0.014 | 30 | 467 |
| 10 | 46.75 | 825 | 144 | 0.020 | 43 | 712 |
| 9 | 42.50 | 1,201 | 185 | 0.026 | 55 | 1,037 |
| 8 | 37.50 | 1,227 | 160 | 0.022 | 47 | 1,060 |
| 7 | 32.50 | 1,254 | 135 | 0.019 | 40 | 1,083 |
| 6 | 27.50 | 1,281 | 110 | 0.015 | 33 | 1,106 |
| 5 | 22.50 | 1,307 | 86 | 0.012 | 25 | 1,128 |
| 4 | 17.50 | 1,334 | 62 | 0.009 | 18 | 1,151 |
| 3 | 12.50 | 1,360 | 40 | 0.006 | 12 | 1,174 |
| 2 | 7.50 | 1,387 | 21 | 0.003 | 6 | 1,197 |
| 1 | 2.50 | 1,413 | 5 | 0.001 | 1 | 1,220 |
| Ericsson KRY 112 144 | 97.00 | 33 | 15 | 0.002 | 5 | 28 |
| Ericsson Radio 4449 | 97.00 | 222 | 103 | 0.014 | 31 | 192 |
| Ericsson AIR 21, 1.3 | 97.00 | 249 | 116 | 0.016 | 34 | 215 |
| Ericsson AIR 21, 1.3 | 97.00 | 244 | 114 | 0.016 | 34 | 211 |
| Round T-Arm | 97.00 | 750 | 350 | 0.048 | 103 | 647 |

| | | | | | | |
|---|---|---|---|---|---|---|
| RFS APXVAARR24_43-U- | 95.00 | 384 | 174 | 0.024 | 51 | 331 |
| Raycap DC6-48-60-18- | 90.00 | 80 | 34 | 0.005 | 10 | 69 |
| Ericsson RRUS A2 | 90.00 | 90 | 38 | 0.005 | 11 | 78 |
| Ericsson RRUS 32 (50 | 90.00 | 152 | 64 | 0.009 | 19 | 132 |
| Ericsson RRUS 12 | 90.00 | 300 | 126 | 0.018 | 37 | 259 |
| Ericsson RRUS E2 B29 | 90.00 | 180 | 76 | 0.011 | 22 | 155 |
| Ericsson RRUS-11 | 90.00 | 495 | 209 | 0.029 | 62 | 427 |
| CCI HPA-65R-BUU-H8 | 90.00 | 816 | 344 | 0.048 | 102 | 704 |
| Round Platform w/ Ha | 89.00 | 2,000 | 830 | 0.115 | 246 | 1,727 |
| Round Platform w/ Ha | 77.00 | 2,000 | 684 | 0.095 | 202 | 1,727 |
| Alcatel-Lucent B13 R | 76.00 | 172 | 58 | 0.008 | 17 | 148 |
| Alcatel-Lucent 1900 | 76.00 | 180 | 60 | 0.008 | 18 | 155 |
| Alcatel-Lucent RRH4x | 76.00 | 190 | 64 | 0.009 | 19 | 164 |
| Raycap RxxDC-3315-PF | 76.00 | 64 | 21 | 0.003 | 6 | 55 |
| Andrew SBNHH-1D65B | 76.00 | 608 | 204 | 0.028 | 60 | 525 |
| | | 30,431 | 7,211 | 1.000 | 2,134 | 26,272 |

Load Case (1.2 + 0.2Sds) * DL + E ELFM Seismic Equivalent Lateral Forces Method

Calculated Forces

| Seg Elev (ft) | Pu FY (-) (kips) | Vu FX (-) (kips) | Tu MY (ft-kips) | Mu MZ (ft-kips) | Mu MX (ft-kips) | Resultant Moment (ft-kips) | phi Pn (kips) | phi Vn (kips) | phi Tn (ft-kips) | phi Mn (ft-kips) | Total Deflect (in) | Rotation (deg) | Ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | -35.89 | -2.14 | 0.00 | -160.93 | 0.00 | 160.93 | 4,846.45 | 2,423.23 | 9,593.57 | 4,803.92 | 0.00 | 0.00 | 0.041 |
| 5.00 | -34.17 | -2.14 | 0.00 | -150.25 | 0.00 | 150.25 | 4,764.82 | 2,382.41 | 9,210.06 | 4,611.88 | 0.01 | -0.01 | 0.040 |
| 10.00 | -32.49 | -2.13 | 0.00 | -139.57 | 0.00 | 139.57 | 4,681.70 | 2,340.85 | 8,831.34 | 4,422.23 | 0.02 | -0.02 | 0.039 |
| 15.00 | -30.84 | -2.12 | 0.00 | -128.92 | 0.00 | 128.92 | 4,597.07 | 2,298.54 | 8,457.59 | 4,235.08 | 0.05 | -0.03 | 0.037 |
| 20.00 | -29.22 | -2.10 | 0.00 | -118.33 | 0.00 | 118.33 | 4,510.95 | 2,255.47 | 8,089.05 | 4,050.54 | 0.09 | -0.04 | 0.036 |
| 25.00 | -27.64 | -2.07 | 0.00 | -107.85 | 0.00 | 107.85 | 4,395.70 | 2,197.85 | 7,677.66 | 3,844.53 | 0.15 | -0.06 | 0.034 |
| 30.00 | -26.09 | -2.03 | 0.00 | -97.51 | 0.00 | 97.51 | 4,279.67 | 2,139.83 | 7,275.67 | 3,643.24 | 0.21 | -0.07 | 0.033 |
| 35.00 | -24.57 | -1.99 | 0.00 | -87.36 | 0.00 | 87.36 | 4,163.63 | 2,081.82 | 6,884.49 | 3,447.36 | 0.29 | -0.08 | 0.031 |
| 40.00 | -23.08 | -1.93 | 0.00 | -77.43 | 0.00 | 77.43 | 4,047.60 | 2,023.80 | 6,504.12 | 3,256.89 | 0.37 | -0.09 | 0.029 |
| 45.00 | -22.06 | -1.89 | 0.00 | -67.76 | 0.00 | 67.76 | 3,931.57 | 1,965.78 | 6,134.56 | 3,071.84 | 0.47 | -0.10 | 0.028 |
| 48.50 | -21.39 | -1.86 | 0.00 | -61.14 | 0.00 | 61.14 | 3,850.34 | 1,925.17 | 5,882.29 | 2,945.52 | 0.54 | -0.10 | 0.026 |
| 50.00 | -19.96 | -1.79 | 0.00 | -58.34 | 0.00 | 58.34 | 3,815.53 | 1,907.77 | 5,775.80 | 2,892.19 | 0.58 | -0.11 | 0.025 |
| 53.25 | -19.57 | -1.77 | 0.00 | -52.51 | 0.00 | 52.51 | 2,599.91 | 1,299.95 | 3,950.87 | 1,978.37 | 0.65 | -0.11 | 0.034 |
| 55.00 | -18.46 | -1.71 | 0.00 | -49.41 | 0.00 | 49.41 | 2,580.79 | 1,290.39 | 3,879.74 | 1,942.75 | 0.69 | -0.12 | 0.033 |
| 60.00 | -17.37 | -1.65 | 0.00 | -40.84 | 0.00 | 40.84 | 2,525.14 | 1,262.57 | 3,678.48 | 1,841.97 | 0.82 | -0.13 | 0.029 |
| 65.00 | -16.31 | -1.57 | 0.00 | -32.61 | 0.00 | 32.61 | 2,468.00 | 1,234.00 | 3,480.29 | 1,742.73 | 0.96 | -0.13 | 0.025 |
| 70.00 | -15.28 | -1.50 | 0.00 | -24.74 | 0.00 | 24.74 | 2,409.36 | 1,204.68 | 3,285.38 | 1,645.13 | 1.10 | -0.14 | 0.021 |
| 75.00 | -15.07 | -1.48 | 0.00 | -17.27 | 0.00 | 17.27 | 2,349.22 | 1,174.61 | 3,093.96 | 1,549.28 | 1.26 | -0.15 | 0.018 |
| 76.00 | -13.37 | -1.34 | 0.00 | -15.79 | 0.00 | 15.79 | 2,337.01 | 1,168.51 | 3,056.11 | 1,530.33 | 1.29 | -0.15 | 0.016 |
| 77.00 | -10.30 | -1.08 | 0.00 | -14.45 | 0.00 | 14.45 | 2,324.75 | 1,162.37 | 3,018.41 | 1,511.45 | 1.32 | -0.15 | 0.014 |
| 80.00 | -9.33 | -0.99 | 0.00 | -11.22 | 0.00 | 11.22 | 2,283.36 | 1,141.68 | 2,900.87 | 1,452.59 | 1.41 | -0.15 | 0.012 |
| 85.00 | -8.57 | -0.91 | 0.00 | -6.27 | 0.00 | 6.27 | 2,200.48 | 1,100.24 | 2,693.09 | 1,348.55 | 1.58 | -0.16 | 0.009 |
| 89.00 | -5.95 | -0.65 | 0.00 | -2.62 | 0.00 | 2.62 | 2,134.18 | 1,067.09 | 2,532.43 | 1,268.09 | 1.71 | -0.16 | 0.005 |
| 90.00 | -2.68 | -0.30 | 0.00 | -1.97 | 0.00 | 1.97 | 2,117.60 | 1,058.80 | 2,493.03 | 1,248.37 | 1.74 | -0.16 | 0.003 |
| 95.00 | -1.97 | -0.22 | 0.00 | -0.45 | 0.00 | 0.45 | 2,034.72 | 1,017.36 | 2,300.69 | 1,152.06 | 1.91 | -0.16 | 0.001 |
| 97.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2,001.57 | 1,000.78 | 2,225.92 | 1,114.61 | 1.98 | -0.16 | 0.000 |
| 98.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1,984.99 | 992.49 | 2,188.99 | 1,096.12 | 2.01 | -0.16 | 0.000 |

Load Case (0.9 - 0.2Sds) * DL + E ELFM Seismic (Reduced DL) Equivalent Lateral Forces Method

Calculated Forces

| Seg Elev (ft) | Pu FY (-) (kips) | Vu FX (-) (kips) | Tu MY (ft-kips) | Mu MZ (ft-kips) | Mu MX (ft-kips) | Resultant Moment (ft-kips) | phi Pn (kips) | phi Vn (kips) | phi Tn (ft-kips) | phi Mn (ft-kips) | Total Deflect (in) | Rotation (deg) | Ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | -25.05 | -2.14 | 0.00 | -160.12 | 0.00 | 160.12 | 4,846.45 | 2,423.23 | 9,593.57 | 4,803.92 | 0.00 | 0.00 | 0.039 |
| 5.00 | -23.85 | -2.13 | 0.00 | -149.44 | 0.00 | 149.44 | 4,764.82 | 2,382.41 | 9,210.06 | 4,611.88 | 0.01 | -0.01 | 0.037 |
| 10.00 | -22.68 | -2.13 | 0.00 | -138.77 | 0.00 | 138.77 | 4,681.70 | 2,340.85 | 8,831.34 | 4,422.23 | 0.02 | -0.02 | 0.036 |
| 15.00 | -21.53 | -2.11 | 0.00 | -128.15 | 0.00 | 128.15 | 4,597.07 | 2,298.54 | 8,457.59 | 4,235.08 | 0.05 | -0.03 | 0.035 |
| 20.00 | -20.40 | -2.09 | 0.00 | -117.59 | 0.00 | 117.59 | 4,510.95 | 2,255.47 | 8,089.05 | 4,050.54 | 0.09 | -0.04 | 0.034 |
| 25.00 | -19.29 | -2.06 | 0.00 | -107.15 | 0.00 | 107.15 | 4,395.70 | 2,197.85 | 7,677.66 | 3,844.53 | 0.15 | -0.06 | 0.032 |
| 30.00 | -18.21 | -2.02 | 0.00 | -96.86 | 0.00 | 96.86 | 4,279.67 | 2,139.83 | 7,275.67 | 3,643.24 | 0.21 | -0.07 | 0.031 |
| 35.00 | -17.15 | -1.98 | 0.00 | -86.75 | 0.00 | 86.75 | 4,163.63 | 2,081.82 | 6,884.49 | 3,447.36 | 0.29 | -0.08 | 0.029 |
| 40.00 | -16.11 | -1.92 | 0.00 | -76.87 | 0.00 | 76.87 | 4,047.60 | 2,023.80 | 6,504.12 | 3,256.89 | 0.37 | -0.09 | 0.028 |
| 45.00 | -15.40 | -1.88 | 0.00 | -67.26 | 0.00 | 67.26 | 3,931.57 | 1,965.78 | 6,134.56 | 3,071.84 | 0.47 | -0.10 | 0.026 |
| 48.50 | -14.93 | -1.85 | 0.00 | -60.68 | 0.00 | 60.68 | 3,850.34 | 1,925.17 | 5,882.29 | 2,945.52 | 0.54 | -0.10 | 0.024 |
| 50.00 | -13.93 | -1.78 | 0.00 | -57.91 | 0.00 | 57.91 | 3,815.53 | 1,907.77 | 5,775.80 | 2,892.19 | 0.57 | -0.11 | 0.024 |
| 53.25 | -13.66 | -1.76 | 0.00 | -52.12 | 0.00 | 52.12 | 2,599.91 | 1,299.95 | 3,950.87 | 1,978.37 | 0.65 | -0.11 | 0.032 |
| 55.00 | -12.88 | -1.70 | 0.00 | -49.03 | 0.00 | 49.03 | 2,580.79 | 1,290.39 | 3,879.74 | 1,942.75 | 0.69 | -0.11 | 0.030 |
| 60.00 | -12.13 | -1.63 | 0.00 | -40.53 | 0.00 | 40.53 | 2,525.14 | 1,262.57 | 3,678.48 | 1,841.97 | 0.81 | -0.12 | 0.027 |
| 65.00 | -11.39 | -1.56 | 0.00 | -32.36 | 0.00 | 32.36 | 2,468.00 | 1,234.00 | 3,480.29 | 1,742.73 | 0.95 | -0.13 | 0.023 |
| 70.00 | -10.66 | -1.48 | 0.00 | -24.55 | 0.00 | 24.55 | 2,409.36 | 1,204.68 | 3,285.38 | 1,645.13 | 1.10 | -0.14 | 0.019 |
| 75.00 | -10.52 | -1.47 | 0.00 | -17.13 | 0.00 | 17.13 | 2,349.22 | 1,174.61 | 3,093.96 | 1,549.28 | 1.25 | -0.15 | 0.016 |
| 76.00 | -9.33 | -1.33 | 0.00 | -15.66 | 0.00 | 15.66 | 2,337.01 | 1,168.51 | 3,056.11 | 1,530.33 | 1.28 | -0.15 | 0.014 |
| 77.00 | -7.19 | -1.07 | 0.00 | -14.34 | 0.00 | 14.34 | 2,324.75 | 1,162.37 | 3,018.41 | 1,511.45 | 1.31 | -0.15 | 0.013 |
| 80.00 | -6.51 | -0.98 | 0.00 | -11.13 | 0.00 | 11.13 | 2,283.36 | 1,141.68 | 2,900.87 | 1,452.59 | 1.41 | -0.15 | 0.011 |
| 85.00 | -5.98 | -0.91 | 0.00 | -6.22 | 0.00 | 6.22 | 2,200.48 | 1,100.24 | 2,693.09 | 1,348.55 | 1.57 | -0.16 | 0.007 |
| 89.00 | -4.15 | -0.64 | 0.00 | -2.60 | 0.00 | 2.60 | 2,134.18 | 1,067.09 | 2,532.43 | 1,268.09 | 1.70 | -0.16 | 0.004 |
| 90.00 | -1.87 | -0.30 | 0.00 | -1.96 | 0.00 | 1.96 | 2,117.60 | 1,058.80 | 2,493.03 | 1,248.37 | 1.73 | -0.16 | 0.002 |
| 95.00 | -1.37 | -0.22 | 0.00 | -0.45 | 0.00 | 0.45 | 2,034.72 | 1,017.36 | 2,300.69 | 1,152.06 | 1.90 | -0.16 | 0.001 |
| 97.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2,001.57 | 1,000.78 | 2,225.92 | 1,114.61 | 1.97 | -0.16 | 0.000 |
| 98.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1,984.99 | 992.49 | 2,188.99 | 1,096.12 | 2.00 | -0.16 | 0.000 |

## Equivalent Modal Analysis Method

(Based on ASCE7-10 Chapters 11, 12 & 15 and ANSI/TIA-G, section 2.7)

| | |
|---|---|
| Spectral Response Acceleration for Short Period ($S_s$): | 0.17 |
| Spectral Response Acceleration at 1.0 Second Period ($S_1$): | 0.06 |
| Importance Factor ($I_E$): | 1.00 |
| Site Coefficient $F_a$: | 1.60 |
| Site Coefficient $F_v$ | 2.40 |
| Response Modification Coefficient (R): | 1.50 |
| Design Spectral Response Acceleration at Short Period ($S_{ds}$): | 0.18 |
| Desing Spectral Response Acceleration at 1.0 Second Period ($S_{d1}$): | 0.10 |
| Period Based on Rayleigh Method (sec): | 1.19 |
| Redundancy Factor (p): | 1.30 |

## Load Case (1.2 + 0.2Sds) * DL + E EMAM Seismic Equivalent Modal Analysis Method

| Segment | Height Above Base (ft) | Weight (lb) | a | b | c | Saz | Horizontal Force (lb) | Vertical Force (lb) |
|---|---|---|---|---|---|---|---|---|
| 26 | 97.50 | 91 | 1.871 | 1.880 | 1.104 | 0.361 | 29 | 113 |
| 25 | 96.00 | 195 | 1.814 | 1.601 | 1.001 | 0.328 | 55 | 241 |
| 24 | 92.50 | 532 | 1.684 | 1.062 | 0.790 | 0.257 | 119 | 658 |
| 23 | 89.50 | 114 | 1.576 | 0.707 | 0.638 | 0.204 | 20 | 141 |
| 22 | 87.00 | 616 | 1.490 | 0.476 | 0.530 | 0.165 | 88 | 762 |
| 21 | 82.50 | 788 | 1.339 | 0.179 | 0.372 | 0.107 | 73 | 974 |
| 20 | 78.50 | 482 | 1.213 | 0.017 | 0.264 | 0.069 | 29 | 596 |
| 19 | 76.50 | 162 | 1.152 | -0.036 | 0.220 | 0.054 | 8 | 200 |
| 18 | 75.50 | 165 | 1.122 | -0.057 | 0.201 | 0.047 | 7 | 205 |
| 17 | 72.50 | 839 | 1.034 | -0.100 | 0.149 | 0.032 | 23 | 1,037 |
| 16 | 67.50 | 858 | 0.897 | -0.122 | 0.086 | 0.018 | 14 | 1,061 |
| 15 | 62.50 | 877 | 0.769 | -0.105 | 0.045 | 0.017 | 13 | 1,084 |
| 14 | 57.50 | 896 | 0.651 | -0.071 | 0.021 | 0.022 | 17 | 1,108 |
| 13 | 54.13 | 318 | 0.577 | -0.044 | 0.012 | 0.027 | 8 | 393 |
| 12 | 51.63 | 1,159 | 0.524 | -0.025 | 0.008 | 0.031 | 31 | 1,433 |
| 11 | 49.25 | 541 | 0.477 | -0.008 | 0.006 | 0.035 | 16 | 670 |
| 10 | 46.75 | 825 | 0.430 | 0.008 | 0.006 | 0.038 | 27 | 1,020 |
| 9 | 42.50 | 1,201 | 0.355 | 0.031 | 0.008 | 0.041 | 43 | 1,485 |
| 8 | 37.50 | 1,227 | 0.277 | 0.050 | 0.014 | 0.042 | 44 | 1,518 |
| 7 | 32.50 | 1,254 | 0.208 | 0.062 | 0.022 | 0.040 | 44 | 1,551 |
| 6 | 27.50 | 1,281 | 0.149 | 0.068 | 0.030 | 0.038 | 42 | 1,584 |
| 5 | 22.50 | 1,307 | 0.100 | 0.071 | 0.037 | 0.034 | 39 | 1,617 |
| 4 | 17.50 | 1,334 | 0.060 | 0.072 | 0.041 | 0.031 | 36 | 1,649 |
| 3 | 12.50 | 1,360 | 0.031 | 0.068 | 0.041 | 0.028 | 33 | 1,682 |
| 2 | 7.50 | 1,387 | 0.011 | 0.056 | 0.033 | 0.023 | 27 | 1,715 |
| 1 | 2.50 | 1,413 | 0.001 | 0.026 | 0.014 | 0.011 | 13 | 1,748 |
| Ericsson KRY 112 144 | 97.00 | 33 | 1.852 | 1.784 | 1.069 | 0.350 | 10 | 41 |
| Ericsson Radio 4449 | 97.00 | 222 | 1.852 | 1.784 | 1.069 | 0.350 | 67 | 275 |
| Ericsson AIR 21, 1.3 | 97.00 | 249 | 1.852 | 1.784 | 1.069 | 0.350 | 76 | 308 |
| Ericsson AIR 21, 1.3 | 97.00 | 244 | 1.852 | 1.784 | 1.069 | 0.350 | 74 | 302 |
| Round T-Arm | 97.00 | 750 | 1.852 | 1.784 | 1.069 | 0.350 | 227 | 928 |
| RFS APXVAARR24_43-U- | 95.00 | 384 | 1.776 | 1.432 | 0.937 | 0.307 | 102 | 475 |
| Raycap DC6-48-60-18- | 90.00 | 80 | 1.594 | 0.760 | 0.662 | 0.212 | 15 | 99 |
| Ericsson RRUS A2 | 90.00 | 90 | 1.594 | 0.760 | 0.662 | 0.212 | 17 | 111 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Ericsson RRUS 32 (50 | 90.00 | 152 | 1.594 | 0.760 | 0.662 | 0.212 | 28 | 188 |
| Ericsson RRUS 12 | 90.00 | 300 | 1.594 | 0.760 | 0.662 | 0.212 | 55 | 371 |
| Ericsson RRUS E2 B29 | 90.00 | 180 | 1.594 | 0.760 | 0.662 | 0.212 | 33 | 223 |
| Ericsson RRUS-11 | 90.00 | 495 | 1.594 | 0.760 | 0.662 | 0.212 | 91 | 612 |
| CCI HPA-65R-BUU-H8 | 90.00 | 816 | 1.594 | 0.760 | 0.662 | 0.212 | 150 | 1,009 |
| Round Platform w/ Ha | 89.00 | 2,000 | 1.559 | 0.657 | 0.616 | 0.196 | 339 | 2,473 |
| Round Platform w/ Ha | 77.00 | 2,000 | 1.167 | -0.024 | 0.231 | 0.057 | 99 | 2,473 |
| Alcatel-Lucent B13 R | 76.00 | 172 | 1.137 | -0.047 | 0.210 | 0.050 | 7 | 212 |
| Alcatel-Lucent 1900 | 76.00 | 180 | 1.137 | -0.047 | 0.210 | 0.050 | 8 | 223 |
| Alcatel-Lucent RRH4x | 76.00 | 190 | 1.137 | -0.047 | 0.210 | 0.050 | 8 | 235 |
| Raycap RxxDC-3315-PF | 76.00 | 64 | 1.137 | -0.047 | 0.210 | 0.050 | 3 | 79 |
| Andrew SBNHH-1D65B | 76.00 | 608 | 1.137 | -0.047 | 0.210 | 0.050 | 26 | 752 |
| | | 30,431 | 50.412 | 21.936 | 18.508 | 6.144 | 2,332 | 37,634 |

Load Case (0.9 - 0.2Sds) * DL + E EMAM Seismic (Reduced DL) Equivalent Modal Analysis Method

| Segment | Height Above Base (ft) | Weight (lb) | a | b | c | Saz | Horizontal Force (lb) | Vertical Force (lb) |
|---|---|---|---|---|---|---|---|---|
| 26 | 97.50 | 91 | 1.871 | 1.880 | 1.104 | 0.361 | 29 | 79 |
| 25 | 96.00 | 195 | 1.814 | 1.601 | 1.001 | 0.328 | 55 | 168 |
| 24 | 92.50 | 532 | 1.684 | 1.062 | 0.790 | 0.257 | 119 | 459 |
| 23 | 89.50 | 114 | 1.576 | 0.707 | 0.638 | 0.204 | 20 | 99 |
| 22 | 87.00 | 616 | 1.490 | 0.476 | 0.530 | 0.165 | 88 | 532 |
| 21 | 82.50 | 788 | 1.339 | 0.179 | 0.372 | 0.107 | 73 | 680 |
| 20 | 78.50 | 482 | 1.213 | 0.017 | 0.264 | 0.069 | 29 | 416 |
| 19 | 76.50 | 162 | 1.152 | -0.036 | 0.220 | 0.054 | 8 | 140 |
| 18 | 75.50 | 165 | 1.122 | -0.057 | 0.201 | 0.047 | 7 | 143 |
| 17 | 72.50 | 839 | 1.034 | -0.100 | 0.149 | 0.032 | 23 | 724 |
| 16 | 67.50 | 858 | 0.897 | -0.122 | 0.086 | 0.018 | 14 | 740 |
| 15 | 62.50 | 877 | 0.769 | -0.105 | 0.045 | 0.017 | 13 | 757 |
| 14 | 57.50 | 896 | 0.651 | -0.071 | 0.021 | 0.022 | 17 | 773 |
| 13 | 54.13 | 318 | 0.577 | -0.044 | 0.012 | 0.027 | 8 | 274 |
| 12 | 51.63 | 1,159 | 0.524 | -0.025 | 0.008 | 0.031 | 31 | 1,001 |
| 11 | 49.25 | 541 | 0.477 | -0.008 | 0.006 | 0.035 | 16 | 467 |
| 10 | 46.75 | 825 | 0.430 | 0.008 | 0.006 | 0.038 | 27 | 712 |
| 9 | 42.50 | 1,201 | 0.355 | 0.031 | 0.008 | 0.041 | 43 | 1,037 |
| 8 | 37.50 | 1,227 | 0.277 | 0.050 | 0.014 | 0.042 | 44 | 1,060 |
| 7 | 32.50 | 1,254 | 0.208 | 0.062 | 0.022 | 0.040 | 44 | 1,083 |
| 6 | 27.50 | 1,281 | 0.149 | 0.068 | 0.030 | 0.038 | 42 | 1,106 |
| 5 | 22.50 | 1,307 | 0.100 | 0.071 | 0.037 | 0.034 | 39 | 1,128 |
| 4 | 17.50 | 1,334 | 0.060 | 0.072 | 0.041 | 0.031 | 36 | 1,151 |
| 3 | 12.50 | 1,360 | 0.031 | 0.068 | 0.041 | 0.028 | 33 | 1,174 |
| 2 | 7.50 | 1,387 | 0.011 | 0.056 | 0.033 | 0.023 | 27 | 1,197 |
| 1 | 2.50 | 1,413 | 0.001 | 0.026 | 0.014 | 0.011 | 13 | 1,220 |
| Ericsson KRY 112 144 | 97.00 | 33 | 1.852 | 1.784 | 1.069 | 0.350 | 10 | 28 |
| Ericsson Radio 4449 | 97.00 | 222 | 1.852 | 1.784 | 1.069 | 0.350 | 67 | 192 |
| Ericsson AIR 21, 1.3 | 97.00 | 249 | 1.852 | 1.784 | 1.069 | 0.350 | 76 | 215 |
| Ericsson AIR 21, 1.3 | 97.00 | 244 | 1.852 | 1.784 | 1.069 | 0.350 | 74 | 211 |
| Round T-Arm | 97.00 | 750 | 1.852 | 1.784 | 1.069 | 0.350 | 227 | 647 |
| RFS APXVAARR24_43-U- | 95.00 | 384 | 1.776 | 1.432 | 0.937 | 0.307 | 102 | 331 |
| Raycap DC6-48-60-18- | 90.00 | 80 | 1.594 | 0.760 | 0.662 | 0.212 | 15 | 69 |
| Ericsson RRUS A2 | 90.00 | 90 | 1.594 | 0.760 | 0.662 | 0.212 | 17 | 78 |
| Ericsson RRUS 32 (50 | 90.00 | 152 | 1.594 | 0.760 | 0.662 | 0.212 | 28 | 132 |
| Ericsson RRUS 12 | 90.00 | 300 | 1.594 | 0.760 | 0.662 | 0.212 | 55 | 259 |
| Ericsson RRUS E2 B29 | 90.00 | 180 | 1.594 | 0.760 | 0.662 | 0.212 | 33 | 155 |
| Ericsson RRUS-11 | 90.00 | 495 | 1.594 | 0.760 | 0.662 | 0.212 | 91 | 427 |
| CCI HPA-65R-BUU-H8 | 90.00 | 816 | 1.594 | 0.760 | 0.662 | 0.212 | 150 | 704 |
| Round Platform w/ Ha | 89.00 | 2,000 | 1.559 | 0.657 | 0.616 | 0.196 | 339 | 1,727 |
| Round Platform w/ Ha | 77.00 | 2,000 | 1.167 | -0.024 | 0.231 | 0.057 | 99 | 1,727 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Alcatel-Lucent B13 R | 76.00 | 172 | 1.137 | -0.047 | 0.210 | 0.050 | 7 | 148 |
| Alcatel-Lucent 1900 | 76.00 | 180 | 1.137 | -0.047 | 0.210 | 0.050 | 8 | 155 |
| Alcatel-Lucent RRH4x | 76.00 | 190 | 1.137 | -0.047 | 0.210 | 0.050 | 8 | 164 |
| Raycap RxxDC-3315-PF | 76.00 | 64 | 1.137 | -0.047 | 0.210 | 0.050 | 3 | 55 |
| Andrew SBNHH-1D65B | 76.00 | 608 | 1.137 | -0.047 | 0.210 | 0.050 | 26 | 525 |
| | | 30,431 | 50.412 | 21.936 | 18.508 | 6.144 | 2,332 | 26,272 |

Load Case (1.2 + 0.2Sds) * DL + E EMAM Seismic Equivalent Modal Analysis Method

Calculated Forces

| Seg Elev (ft) | Pu FY (-) (kips) | Vu FX (-) (kips) | Tu MY (ft-kips) | Mu MZ (ft-kips) | Mu MX (ft-kips) | Resultant Moment (ft-kips) | phi Pn (kips) | phi Vn (kips) | phi Tn (ft-kips) | phi Mn (ft-kips) | Total Deflect (in) | Rotation (deg) | Ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | -35.89 | -2.32 | 0.00 | -186.48 | 0.00 | 186.48 | 4,846.45 | 2,423.23 | 9,593.57 | 4,803.92 | 0.00 | 0.00 | 0.046 |
| 5.00 | -34.17 | -2.30 | 0.00 | -174.87 | 0.00 | 174.87 | 4,764.82 | 2,382.41 | 9,210.06 | 4,611.88 | 0.01 | -0.01 | 0.045 |
| 10.00 | -32.49 | -2.28 | 0.00 | -163.35 | 0.00 | 163.35 | 4,681.70 | 2,340.85 | 8,831.34 | 4,422.23 | 0.03 | -0.03 | 0.044 |
| 15.00 | -30.84 | -2.25 | 0.00 | -151.96 | 0.00 | 151.96 | 4,597.07 | 2,298.54 | 8,457.59 | 4,235.08 | 0.06 | -0.04 | 0.043 |
| 20.00 | -29.22 | -2.21 | 0.00 | -140.73 | 0.00 | 140.73 | 4,510.95 | 2,255.47 | 8,089.05 | 4,050.54 | 0.11 | -0.05 | 0.041 |
| 25.00 | -27.64 | -2.18 | 0.00 | -129.66 | 0.00 | 129.66 | 4,395.70 | 2,197.85 | 7,677.66 | 3,844.53 | 0.17 | -0.07 | 0.040 |
| 30.00 | -26.09 | -2.14 | 0.00 | -118.78 | 0.00 | 118.78 | 4,279.67 | 2,139.83 | 7,275.67 | 3,643.24 | 0.25 | -0.08 | 0.039 |
| 35.00 | -24.57 | -2.10 | 0.00 | -108.10 | 0.00 | 108.10 | 4,163.63 | 2,081.82 | 6,884.49 | 3,447.36 | 0.34 | -0.09 | 0.037 |
| 40.00 | -23.08 | -2.06 | 0.00 | -97.62 | 0.00 | 97.62 | 4,047.60 | 2,023.80 | 6,504.12 | 3,256.89 | 0.44 | -0.10 | 0.036 |
| 45.00 | -22.06 | -2.03 | 0.00 | -87.34 | 0.00 | 87.34 | 3,931.57 | 1,965.78 | 6,134.56 | 3,071.84 | 0.56 | -0.12 | 0.034 |
| 48.50 | -21.39 | -2.02 | 0.00 | -80.24 | 0.00 | 80.24 | 3,850.34 | 1,925.17 | 5,882.29 | 2,945.52 | 0.65 | -0.13 | 0.033 |
| 50.00 | -19.96 | -1.98 | 0.00 | -77.21 | 0.00 | 77.21 | 3,815.53 | 1,907.77 | 5,775.80 | 2,892.19 | 0.68 | -0.13 | 0.032 |
| 53.25 | -19.56 | -1.98 | 0.00 | -70.77 | 0.00 | 70.77 | 2,599.91 | 1,299.95 | 3,950.87 | 1,978.37 | 0.78 | -0.14 | 0.043 |
| 55.00 | -18.46 | -1.96 | 0.00 | -67.31 | 0.00 | 67.31 | 2,580.79 | 1,290.39 | 3,879.74 | 1,942.75 | 0.83 | -0.14 | 0.042 |
| 60.00 | -17.37 | -1.95 | 0.00 | -57.52 | 0.00 | 57.52 | 2,525.14 | 1,262.57 | 3,678.48 | 1,841.97 | 0.98 | -0.16 | 0.038 |
| 65.00 | -16.31 | -1.94 | 0.00 | -47.78 | 0.00 | 47.78 | 2,468.00 | 1,234.00 | 3,480.29 | 1,742.73 | 1.15 | -0.17 | 0.034 |
| 70.00 | -15.27 | -1.91 | 0.00 | -38.10 | 0.00 | 38.10 | 2,409.36 | 1,204.68 | 3,285.38 | 1,645.13 | 1.33 | -0.18 | 0.030 |
| 75.00 | -15.07 | -1.91 | 0.00 | -28.54 | 0.00 | 28.54 | 2,349.22 | 1,174.61 | 3,093.96 | 1,549.28 | 1.53 | -0.19 | 0.025 |
| 76.00 | -13.37 | -1.84 | 0.00 | -26.64 | 0.00 | 26.64 | 2,337.01 | 1,168.51 | 3,056.11 | 1,530.33 | 1.57 | -0.19 | 0.023 |
| 77.00 | -10.30 | -1.70 | 0.00 | -24.80 | 0.00 | 24.80 | 2,324.75 | 1,162.37 | 3,018.41 | 1,511.45 | 1.61 | -0.19 | 0.021 |
| 80.00 | -9.32 | -1.63 | 0.00 | -19.69 | 0.00 | 19.69 | 2,283.36 | 1,141.68 | 2,900.87 | 1,452.59 | 1.73 | -0.20 | 0.018 |
| 85.00 | -8.56 | -1.54 | 0.00 | -11.55 | 0.00 | 11.55 | 2,200.48 | 1,100.24 | 2,693.09 | 1,348.55 | 1.95 | -0.21 | 0.012 |
| 89.00 | -5.95 | -1.17 | 0.00 | -5.40 | 0.00 | 5.40 | 2,134.18 | 1,067.09 | 2,532.43 | 1,268.09 | 2.12 | -0.21 | 0.007 |
| 90.00 | -2.68 | -0.65 | 0.00 | -4.23 | 0.00 | 4.23 | 2,117.60 | 1,058.80 | 2,493.03 | 1,248.37 | 2.16 | -0.21 | 0.005 |
| 95.00 | -1.96 | -0.49 | 0.00 | -0.98 | 0.00 | 0.98 | 2,034.72 | 1,017.36 | 2,300.69 | 1,152.06 | 2.38 | -0.21 | 0.002 |
| 97.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2,001.57 | 1,000.78 | 2,225.92 | 1,114.61 | 2.47 | -0.21 | 0.000 |
| 98.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1,984.99 | 992.49 | 2,188.99 | 1,096.12 | 2.51 | -0.21 | 0.000 |

Load Case (0.9 - 0.2Sds) * DL + E EMAM Seismic (Reduced DL) Equivalent Modal Analysis Method

Calculated Forces

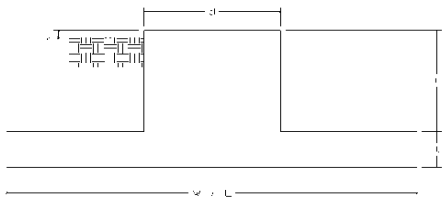
| Seg Elev (ft) | Pu FY (-) (kips) | Vu FX (-) (kips) | Tu MY (ft-kips) | Mu MZ (ft-kips) | Mu MX (ft-kips) | Resultant Moment (ft-kips) | phi Pn (kips) | phi Vn (kips) | phi Tn (ft-kips) | phi Mn (ft-kips) | Total Deflect (in) | Rotation (deg) | Ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.00 | -25.05 | -2.32 | 0.00 | -185.48 | 0.00 | 185.48 | 4,846.45 | 2,423.23 | 9,593.57 | 4,803.92 | 0.00 | 0.00 | 0.044 |
| 5.00 | -23.85 | -2.30 | 0.00 | -173.87 | 0.00 | 173.87 | 4,764.82 | 2,382.41 | 9,210.06 | 4,611.88 | 0.01 | -0.01 | 0.043 |
| 10.00 | -22.68 | -2.27 | 0.00 | -162.37 | 0.00 | 162.37 | 4,681.70 | 2,340.85 | 8,831.34 | 4,422.23 | 0.03 | -0.03 | 0.042 |
| 15.00 | -21.53 | -2.24 | 0.00 | -151.01 | 0.00 | 151.01 | 4,597.07 | 2,298.54 | 8,457.59 | 4,235.08 | 0.06 | -0.04 | 0.040 |
| 20.00 | -20.40 | -2.20 | 0.00 | -139.82 | 0.00 | 139.82 | 4,510.95 | 2,255.47 | 8,089.05 | 4,050.54 | 0.11 | -0.05 | 0.039 |
| 25.00 | -19.29 | -2.17 | 0.00 | -128.80 | 0.00 | 128.80 | 4,395.70 | 2,197.85 | 7,677.66 | 3,844.53 | 0.17 | -0.07 | 0.038 |
| 30.00 | -18.21 | -2.12 | 0.00 | -117.97 | 0.00 | 117.97 | 4,279.67 | 2,139.83 | 7,275.67 | 3,643.24 | 0.25 | -0.08 | 0.037 |
| 35.00 | -17.15 | -2.08 | 0.00 | -107.34 | 0.00 | 107.34 | 4,163.63 | 2,081.82 | 6,884.49 | 3,447.36 | 0.34 | -0.09 | 0.035 |
| 40.00 | -16.11 | -2.04 | 0.00 | -96.93 | 0.00 | 96.93 | 4,047.60 | 2,023.80 | 6,504.12 | 3,256.89 | 0.44 | -0.10 | 0.034 |
| 45.00 | -15.40 | -2.02 | 0.00 | -86.72 | 0.00 | 86.72 | 3,931.57 | 1,965.78 | 6,134.56 | 3,071.84 | 0.55 | -0.12 | 0.032 |
| 48.50 | -14.93 | -2.00 | 0.00 | -79.67 | 0.00 | 79.67 | 3,850.34 | 1,925.17 | 5,882.29 | 2,945.52 | 0.64 | -0.12 | 0.031 |
| 50.00 | -13.93 | -1.97 | 0.00 | -76.67 | 0.00 | 76.67 | 3,815.53 | 1,907.77 | 5,775.80 | 2,892.19 | 0.68 | -0.13 | 0.030 |
| 53.25 | -13.66 | -1.96 | 0.00 | -70.27 | 0.00 | 70.27 | 2,599.91 | 1,299.95 | 3,950.87 | 1,978.37 | 0.77 | -0.14 | 0.041 |
| 55.00 | -12.88 | -1.94 | 0.00 | -66.84 | 0.00 | 66.84 | 2,580.79 | 1,290.39 | 3,879.74 | 1,942.75 | 0.82 | -0.14 | 0.039 |
| 60.00 | -12.13 | -1.93 | 0.00 | -57.11 | 0.00 | 57.11 | 2,525.14 | 1,262.57 | 3,678.48 | 1,841.97 | 0.98 | -0.15 | 0.036 |
| 65.00 | -11.38 | -1.92 | 0.00 | -47.45 | 0.00 | 47.45 | 2,468.00 | 1,234.00 | 3,480.29 | 1,742.73 | 1.14 | -0.17 | 0.032 |
| 70.00 | -10.66 | -1.90 | 0.00 | -37.85 | 0.00 | 37.85 | 2,409.36 | 1,204.68 | 3,285.38 | 1,645.13 | 1.33 | -0.18 | 0.027 |
| 75.00 | -10.52 | -1.89 | 0.00 | -28.37 | 0.00 | 28.37 | 2,349.22 | 1,174.61 | 3,093.96 | 1,549.28 | 1.52 | -0.19 | 0.023 |
| 76.00 | -9.33 | -1.83 | 0.00 | -26.48 | 0.00 | 26.48 | 2,337.01 | 1,168.51 | 3,056.11 | 1,530.33 | 1.56 | -0.19 | 0.021 |
| 77.00 | -7.19 | -1.69 | 0.00 | -24.65 | 0.00 | 24.65 | 2,324.75 | 1,162.37 | 3,018.41 | 1,511.45 | 1.60 | -0.19 | 0.019 |
| 80.00 | -6.51 | -1.62 | 0.00 | -19.57 | 0.00 | 19.57 | 2,283.36 | 1,141.68 | 2,900.87 | 1,452.59 | 1.72 | -0.20 | 0.016 |
| 85.00 | -5.98 | -1.53 | 0.00 | -11.49 | 0.00 | 11.49 | 2,200.48 | 1,100.24 | 2,693.09 | 1,348.55 | 1.93 | -0.20 | 0.011 |
| 89.00 | -4.15 | -1.16 | 0.00 | -5.37 | 0.00 | 5.37 | 2,134.18 | 1,067.09 | 2,532.43 | 1,268.09 | 2.11 | -0.21 | 0.006 |
| 90.00 | -1.87 | -0.65 | 0.00 | -4.21 | 0.00 | 4.21 | 2,117.60 | 1,058.80 | 2,493.03 | 1,248.37 | 2.15 | -0.21 | 0.004 |
| 95.00 | -1.37 | -0.49 | 0.00 | -0.98 | 0.00 | 0.98 | 2,034.72 | 1,017.36 | 2,300.69 | 1,152.06 | 2.37 | -0.21 | 0.002 |
| 97.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2,001.57 | 1,000.78 | 2,225.92 | 1,114.61 | 2.45 | -0.21 | 0.000 |
| 98.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1,984.99 | 992.49 | 2,188.99 | 1,096.12 | 2.50 | -0.21 | 0.000 |

## Analysis Summary

| | Reactions | | | | | | Max Usage | |
|---|---|---|---|---|---|---|---|---|
| Load Case | Shear FX (kips) | Shear FZ (kips) | Axial FY (kips) | Moment MX (ft-kips) | Moment MY (ft-kips) | Moment MZ (ft-kips) | Elev (ft) | Interaction Ratio |
| 1.2D + 1.6W | 29.25 | 0.00 | 36.48 | 0.00 | 0.00 | 2182.62 | 0.00 | 0.46 |
| 0.9D + 1.6W | 29.23 | 0.00 | 27.35 | 0.00 | 0.00 | 2172.95 | 0.00 | 0.46 |
| 1.2D + 1.0Di + 1.0Wi | 7.31 | 0.00 | 52.67 | 0.00 | 0.00 | 528.31 | 0.00 | 0.12 |
| (1.2 + 0.2Sds) * DL + E ELFM | 2.14 | 0.00 | 35.89 | 0.00 | 0.00 | 160.93 | 0.00 | 0.04 |
| (1.2 + 0.2Sds) * DL + E EMAM | 2.32 | 0.00 | 35.89 | 0.00 | 0.00 | 186.48 | 0.00 | 0.05 |
| (0.9 - 0.2Sds) * DL + E ELFM | 2.14 | 0.00 | 25.05 | 0.00 | 0.00 | 160.12 | 0.00 | 0.04 |
| (0.9 - 0.2Sds) * DL + E EMAM | 2.32 | 0.00 | 25.05 | 0.00 | 0.00 | 185.48 | 0.00 | 0.04 |
| 1.0D + 1.0W | 5.77 | 0.00 | 30.43 | 0.00 | 0.00 | 429.57 | 0.00 | 0.10 |

| | |
|---|---|
| Site Name: | Madison CT, CT |
| Site Number: | 283421 |
| Engineering Number: | 12927138 |
| Engineer: | Aaron.McMillan |
| Date: | 07/22/19 |
| Tower Type: | MP |

*Program Last Updated:* *5/13/2014*



**Design Loads (Factored) - Analysis per TIA-222-G Standards**

| | | | | | |
|---|---|---|---|---|---|
| Design / Analysis / Mapping: | Analysis | | | | |
| Compression/Leg: | 36.5 | k | Concrete Strength ($f'_c$): | 4000 | psi |
| Uplift/Leg: | 0 | k | Pad Tension Steel Depth: | 20.0 | in |
| Total Shear: | 29.3 | k | $\phi_{Shear}$: | 0.75 | |
| Moment: | 2182.6 | k-ft | $\phi_{Flexure\ /\ Tension}$: | 0.9 | |
| Tower + Appurtenance Weight: | 36.5 | k | $\phi_{Compression:}$ | 0.65 | |
| Depth to Base of Foundation (l + t - h): | 7 | ft | $\beta$: | 0.85 | |
| Diameter of Pier (d): | 7 | ft | Bottom Pad Rebar Size #: | 9 | |
| Height of Pier above Ground (h): | 1 | ft | # of Bottom Pad Rebar: | 34 | |
| Width of Pad (W): | 22 | ft | Pad Bottom Steel Area: | 34 | $in^2$ |
| Length of Pad (L): | 22 | ft | Pad Steel $F_y$: | 60000 | psi |
| Thickness of Pad (t): | 2 | ft | Top Pad Rebar Size #: | 9 | |
| Tower Leg Center to Center: | 0 | ft | # of Top Pad Rebar: | 34 | |
| Number of Tower Legs: | 1 | (1 if MP or GT) | Pad Top Steel Area: | 34 | $in^2$ |
| Tower Center from Mat Center: | 3 | ft | Pier Rebar Size #: | 8 | |
| Depth Below Ground Surface to Water Table: | 8 | ft | Pier Steel Area (Single Bar): | 0.79 | $in^2$ |
| Unit Weight of Concrete: | 150 | pcf | # of Pier Rebar: | 36 | |
| Unit Weight of Soil Above Water Table: | 120 | pcf | Pier Steel $F_y$: | 60000 | psi |
| Unit Weight of Water: | 62.4 | pcf | Pier Cage Diameter: | 76.0 | in |
| Unit Weight of Soil Below Water Table: | 57.6 | pcf | Rebar Strain Limit: | 0.008 | |
| Friction Angle of Uplift: | 15 | Degrees | Steel Elastic Modulus: | 29000 | ksi |
| Ultimate Coefficient of Shear Friction: | 0.35 | | Tie Rebar Size #: | 4 | |
| Ultimate Compressive Bearing Pressure: | 14008 | psf | Tie Steel Area (Single Bar): | 0.2 | $in^2$ |
| Ultimate Passive Pressure on Pad Face: | 0 | psf | Tie Spacing: | 12 | in |
| $\phi_{Soil\ and\ Concrete\ Weight}$: | 0.9 | | Tie Steel $F_y$: | 60000 | psi |
| $\phi_{Soil}$: | 0.75 | | | | |

**Overturning Moment Usage**

| | | |
|---|---|---|
| Design OTM: | 2526.1 | k-ft |
| OTM Resistance: | 4998.5 | k-ft |
| Design OTM / OTM Resistance: | 0.51 | Result: OK |

**Soil Bearing Pressure Usage**

| | | |
|---|---|---|
| Net Bearing Pressure: | 2247 | psf |
| Factored Nominal Bearing Pressure: | 10506 | psf |
| Net Bearing Pressure/Factored Nominal Bearing Pressure: | 0.21 | Result: OK |
| Load Direction Controling Design Bearing Pressure: | Diagonal to Pad Edge | |

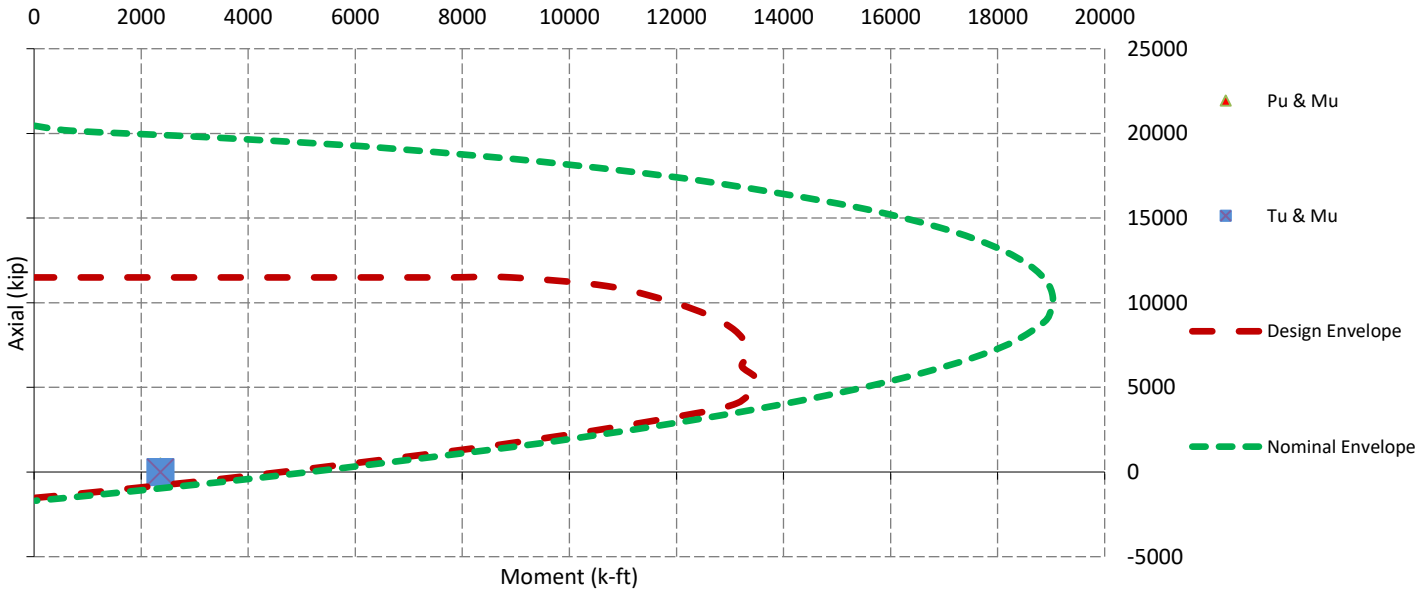
**Sliding Factor of Safety**

| | | |
|---|---|---|
| Total Factored Sliding Resistance: | 125.4 | k |
| Sliding Design / Sliding Resistance: | 0.23 | Result: OK |

**One Way Shear, Flexual Capacity, and Punching Shear**

| | | |
|---|---|---|
| Factored One Way Shear ($V_u$): | 164.1 | k |
| One Way Shear Capacity ($\phi V_c$): | 500.9 | k - ACI11.3.1.1 |
| $V_u$ / $\phi V_c$: | 0.33 | Result: OK |
| Load Direction Controling Shear Capacity: | Parallel to Pad Edge | |
| Lower Steel Pad Factored Moment ($M_u$): | 824.5 | k-ft |
| Lower Steel Pad Moment Capacity ($\phi M_n$): | 2912.2 | k-ft - ACI10.3 |
| $M_u$ / $\phi M_n$: | 0.28 | Result: OK |
| Load Direction Controling Flexural Capacity: | Parallel to Pad Edge | |
| Upper Steel Pad Factored Moment ($M_u$): | 593.5 | k-ft |
| Upper Steel Pad Moment Capacity ($\phi M_n$): | 2912.2 | k-ft |
| $M_u$ / $\phi M_n$: | 0.20 | Result: OK |
| Lower Pad Flexural Reinforcement Ratio: | 0.0064 | OK - Minimum Reinforcement Ratio Met - ACI10.5.1 |
| Upper Pad Flexural Reinforcement Ratio: | 0.0064 | OK - Minimum Reinforcement Ratio Met - ACI10.5.1 |
| Lower Pad Reinforcement Spacing: | 8 | in - Pad Reinforcing Spacing OK - ACI7.12.2.2 & 10.5.4 |
| Upper Pad Reinforcement Spacing: | 8 | in - Pad Reinforcing Spacing OK - ACI7.12.2.2 & 10.5.4 |
| Factored Punching Shear ($V_u$): | 0.0 | k |
| Nominal Punching Shear Capacity ($\phi_c V_n$): | 1239.8 | k - ACI11.12.2.1 |
| $V_u$ / $\phi V_c$: | 0.00 | Result: OK |
| Factored Moment in Pier ($M_u$): | 2358.1 | k-ft |
| Pier Moment Capacity ($\phi M_n$): | 4756.5 | k-ft |
| $M_u$ / $\phi M_n$: | 0.50 | Result: OK |
| Factored Shear in Pier ($V_u$): | 29.3 | k |
| Pier Shear Capacity ($\phi V_n$): | 527.5 | k |
| $V_u$ / $\phi V_c$: | 0.06 | Result: OK |
| Pier Shear Reinforcement Ratio: | 0.0004 | No Ties Necessary for Shear - ACI11.5.6.1 |
| Factored Tension in Pier ($T_u$): | 0.0 | k |
| Pier Tension Capacity ($\phi T_n$): | 1535.8 | k |
| $T_u$ / $\phi T_n$: | 0.00 | Result: OK |
| Factored Compression in Pier ($P_u$): | 36.5 | k |
| Pier Compression Capacity ($\phi P_n$): | 9747.6 | k - ACI10.3.6.2 |
| $P_u$ / $\phi P_n$: | 0.00 | Result: OK |
| Pier Compression Reinforcement Ratio: | 0.005 | OK - Reinforcement Ratio Met - ACI10.9.1 & 10.8.4 |
| $M_u/\phi_B M_n + T_u/\phi_T T_n$: | 0.50 | Result: OK |

Nominal and Design Moment Capacity and Factored Design Loads



# Base Plate & Anchor Rod Analysis

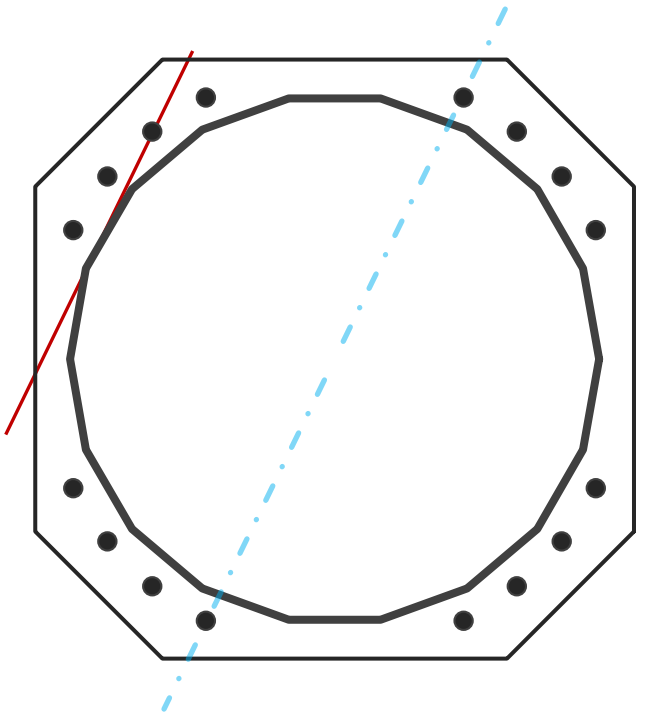
| Pole Dimensions | | |
|---|---|---|
| Number of Sides | 18 | - |
| Diameter | 48.67 | in |
| Thickness | 0.4375 | in |
| Orientation Offset | 0 | ° |

| Base Reactions | | |
|---|---|---|
| Moment, Mu | 2182.6 | k-ft |
| Axial, Pu | 36.5 | k |
| Shear, Vu | 29.3 | k |
| Neutral Axis | 64 | ° |

| Report Capacities | | |
|---|---|---|
| Component | Capacity | Result |
| Base Plate | 20% | Pass |
| Anchor Rods | 47% | Pass |
| Dwyidag | - | - |

| Base Plate | | |
|---|---|---|
| Shape | Square | - |
| Width | 56.5 | in |
| Thickness | 3 | in |
| Grade | A572-50 | - |
| Yield Strength, Fy | 50 | ksi |
| Tensile Strength, Fu | 65 | ksi |
| Clip | 12 | in |
| Orientation Offset | 0 | ° |
| Anchor Rod Detail | d | η=0.5 |
| Clear Distance | 4.5 | in |
| Applied Moment, Mu | 649.7 | k |
| Bending Stress, ϕMn | 3263.6 | k |

| Original Anchor Rods | | |
|---|---|---|
| Arrangement | Cluster | - |
| Quantity | 16 | - |
| Diameter, ø | 2 1/4 | in |
| Bolt Circle | 55 | in |
| Grade | A615-75 | |
| Yield Strength, Fy | 75 | ksi |
| Tensile Strength, Fu | 100 | ksi |
| Spacing | 6.0 | in |
| Orientation Offset | 0 | ° |
| Applied Force, Pu | 121.2 | k |
| Anchor Rods, ϕPn | 259.8 | k |



# Calculations for Monopole Base Plate & Anchor Rod Analysis

**Reaction Distribution**

| Reaction | Shear Vu | Moment Mu | Factor |
|---|---|---|---|
| - | k | k-ft | - |
| Base Forces | 29.3 | 2182.6 | 1.00 |
| Anchor Rod Forces | 29.3 | 2182.6 | 1.00 |
| Additional Bolt (Grp1) Forces | 0.0 | 0.0 | 0.00 |
| Additional Bolt (Grp2) Forces | 0.0 | 0.0 | 0.00 |
| Dywidag Forces | 0.0 | 0.0 | 0.00 |
| Stiffener Forces | 0.0 | 0.0 | 0.00 |

**Geometric Properties**

| Section | Gross Area | Net Area | Individual Inertia | Threads per Inch | Moment of Inertia |
|---|---|---|---|---|---|
| - | $in^2$ | $in^2$ | $in^4$ | # | $in^4$ |
| Pole | 65.9570 | 3.6643 | 0.2348 | | 19184.29 |
| Bolt | 3.9761 | 3.2477 | 0.8393 | 4.5 | 19661.95 |
| Bolt1 | 0.0000 | 0.0000 | 0.0000 | 0 | 0.00 |
| Bolt2 | 0.0000 | 0.0000 | 0.0000 | 0 | 0.00 |
| Dywidag | 0.0000 | 0.0000 | 0.0000 | | 0.00 |
| Stiffener | 0.0000 | 0.0000 | 0.0000 | | 0.00 |

| Base Plate | | |
|---|---|---|
| Shape | Square | - |
| Width, W | 56.5 | in |
| Thickness, t | 3 | in |
| Yield Strength, Fy | 50 | ksi |
| Tensile Strength, Fu | 65 | ksi |
| Base Plate Chord | 28.696 | in |
| Detail Type | d | - |
| Detail Factor | 0.50 | - |
| Clear Distance | 4.5 | - |

| Anchor Rods | | |
|---|---|---|
| Anchor Rod Quantity, N | 16 | - |
| Rod Diameter, d | 2.25 | in |
| Bolt Circle, BC | 55 | in |
| Yield Strength, Fy | 75 | ksi |
| Tensile Strength, Fu | 100 | ksi |
| Applied Axial, Pu | 121.2 | k |
| Applied Shear, Vu | 0.0 | k |
| Compressive Capacity, ϕPn | 259.8 | k |
| Tensile Capacity, ϕRnt | 0.467 | OK |
| Interaction Capacity | 0.218 | OK |

| External Base Plate | | |
|---|---|---|
| Chord Length AA | 30.733 | in |
| Additional AA | 1.500 | in |
| Section Modulus, Z | 72.524 | $in^3$ |
| Applied Moment, Mu | 649.7 | k-ft |
| Bending Capacity, ϕMn | 3263.6 | k-ft |
| Capacity, Mu/ϕMn | 0.199 | OK |
| | | |
| Chord Length AB | 29.975 | in |
| Additional AB | 1.500 | in |
| Section Modulus, Z | 70.818 | $in^3$ |
| Applied Moment, Mu | 527.2 | k-ft |
| Bending Capacity, ϕMn | 3186.8 | k-ft |
| Capacity, Mu/ϕMn | 0.165 | OK |
| | | |
| Bend Line Length | 0.000 | in |
| Additional Bend Line | 0.000 | in |
| Section Modulus, Z | 0.000 | $in^3$ |
| Applied Moment, Mu | 0.0 | k-ft |
| Bending Capacity, ϕMn | 0.0 | k-ft |
| Capacity, Mu/ϕMn | | |

| Internal Base Plate | | |
|---|---|---|
| Arc Length | 0.000 | in |
| Section Modulus, Z | 0.000 | $in^3$ |
| Moment Arm | 0.000 | in |
| Applied Moment, Mu | 0.0 | k-ft |
| Bending Capacity, ϕMn | 0.0 | k-ft |
| Capacity, Mu/ϕMn | | |

# Mount Analysis of Existing T-Arms for American Tower on behalf of T-Mobile
# 283421 - Madison CT, CT
# Project #: 12927138

**T-Mobile Site ID: CTNH808A**

**Program: L600**

**CLS Engineering PLLC Project #41124-12927138-01-MA-R1**

**July 9, 2019**

| | |
|---|---|
| **MOUNT DESCRIPTION** | Existing T-Arms at 96 ft AGL |
| **ANTENNA ELEVATION** | Nominal Rad. Elevation of 97 ft AGL (Eccentricity of ~1 ft) |
| **SITE DESCRIPTION** | 98 ft Monopole |
| **SITE ADDRESS** | 15 Orchard Park Road, Madison, CT, 06443-2268, New Haven County |
| **GPS COORDINATES** | 41.28308333, -72.623075 |
| **ANALYSIS STANDARD** | 2015 IBC / 2018 Connecticut State Building Code / TIA-222-G |
| **LOADING CRITERIA** | 130 mph, $V_{ult}$ / 100.7 mph, $V_{asd}$ (3-Second Gust) w/o ice & 50 mph (3-Second Gust) w/ 0.75" |

■ **ANALYSIS RESULT:** **Pass (Conditional)**

| | | |
|---|---|---|
| **MEMBER USAGE** | **87%** | **Pass** |
| **COLLAR USAGE** | **99%** | **Pass** |

***A maintenance live load of 250 lb has been applied at each mounting pipe location.***

**Modifications are proposed to bring mounts into compliance; see conclusion for details.**

Prepared by:
**Sean Rock, E.I.**

Reviewed and Approved by:
**Tyler M. Barker, P.E.**

STATE OF CONNECTICUT
TYLER M BARKER
No. 32402
LICENSED PROFESSIONAL ENGINEER

Tyler M. Barker
CLS Engineering, PLLC
Director of Engineering
PE # 32402 Exp. 1/31/2020
COA # PEC.001833 Exp. 8/14/2019

IdenTrust part of HID Global

Digitally signed by Tyler Barker
DN: c=US, o=Telamon Corporation, ou=A01427E0000016A4525ADF800001D17, cn=Tyler Barker
Date: 2019.07.09 13:47:05 -04'00'

## ■ INTRODUCTION

The proposed equipment is to be mounted to the existing T-Arms. This proposed mounting configuration was analyzed using RISA-3D, a commercially available finite element analysis software package. A selection of input and output from our analysis is attached to the end of this report.

## ■ STRUCTURAL DOCUMENTS PROVIDED

| | |
|---|---|
| **STRUCTURAL DATA** | Site Photos, dated March 9, 2018<br>Assembly Drawings by Site Pro 1, Part No. PRK-SFS-L, dated September 8, 2017 |
| **PREVIOUS ANALYSES** | Structural Analysis by ATC, Eng. #OAA735021_C3_03, dated June 22, 2018 |
| **LOADING DATA** | ATC Application, Project #12927138, dated April 02, 2019 |

## ■ ANALYSIS CRITERIA

| | |
|---|---|
| **STANDARD** | 2015 IBC / 2018 Connecticut State Building Code / TIA-222-G |
| **BASIC WIND SPEED** | 130 mph, $V_{ult}$ / 100.7 mph, $V_{asd}$ (3-Second Gust) |
| **BASIC WIND SPEED W/ ICE** | 50 mph (3-Second Gust) w/ 0.75" Radial Ice (Escalating) |
| **EXPOSURE CATEGORY** | B |
| **MAX. TOPOGRAPHIC FACTOR, $K_{zt}$** | 1.00 |
| **RISK CATEGORY** | II |
| **MAINTENANCE LIVE LOAD** | $L_M$: 250 lb |

## ■ FINAL EQUIPMENT

| ELEVATION (ft) | | ANTENNAS | |
|---|---|---|---|
| **MOUNT** | **RAD.** | **#** | **NAME** |
| 96.0 | 97.0 | 3 | Ericsson AIR 21, 1.3 M, B4A B2P |
| | | 3 | Ericsson AIR 21, 1.3 M, B2A B4P |
| | | 3 | Ericsson RADIO 4449 B12/B71 |
| | | 3 | Ericsson KRY 112 144/1 |
| | | 3 | RFS Celwave APXVAARR24_43-U-NA20 |

## ■ RESULTS SUMMARY

| COMPONENT | PEAK USAGE | RESULT |
|---|---|---|
| Collar Reactions | 99% | Pass |
| Stand-Off Horizontals | 87% | Pass |
| Mount Pipes | 76% | Pass |
| Face Horizontals | 70% | Pass |
| Reinforcement Members | 24% | Pass |
| Bracing Members | 20% | Pass |

## ■ CONCLUSION AND RECOMMENDATIONS

According to our structural analysis, the mounts have been found to **CONDITIONALLY PASS**. The mounting configuration considered in this analysis will be capable of supporting the referenced loading pursuant to referenced standards once the following scope is executed:

- **Install (1) Site Pro 1 PRK-SFS-L Support Rail Vertical Reinforcement Kit at existing face horizontal member as shown in the following sketch. Collar to be installed flush with existing monopole at a height of ±2.5 ft. below the centerline of existing T-arm collar. Field-Cut proposed angles as required. Maintain minimum bolt edge distance.**

See following sketches and Site Pro 1 assembly drawings for additional details.

## ■ ASSUMPTIONS AND CONDITIONS

This analysis is inclusive of the antenna supporting frames/mounts and all recorded connections that will support the equipment listed in this report. It considers only the theoretical capacity of structural components and it is not a condition assessment. The validity of the analysis may be dependent on the accuracy of structural information supplied by others. The client is responsible for verifying this information. If any provided information is revised after completion of this analysis, CLS Engineering PLLC should be notified immediately to revise results.

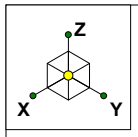
This analysis assumes the following:

1. The tower or other superstructure and mounts (if existing) were properly constructed as per the original design and have been properly maintained in accordance with applicable code standards.
2. Member sizes and strengths are accurate as supplied or are assumed as stated in the calculations.
3. In the absence of sufficient design information, all welds and connections are assumed to develop at least the capacity of the connected member, unless otherwise stated in this analysis.
4. All prior structural modifications, if any, are assumed to be correctly installed and fully effective.
5. The loading configuration is complete and accurate as supplied and/or as modeled in the previous analysis. All appurtenances are assumed to be properly installed and supported as per manufacturer requirements.
6. Some conservative assumptions may be used regarding appurtenances and their projected areas based on careful interpretation of data supplied, previous experience and standard industry practice.

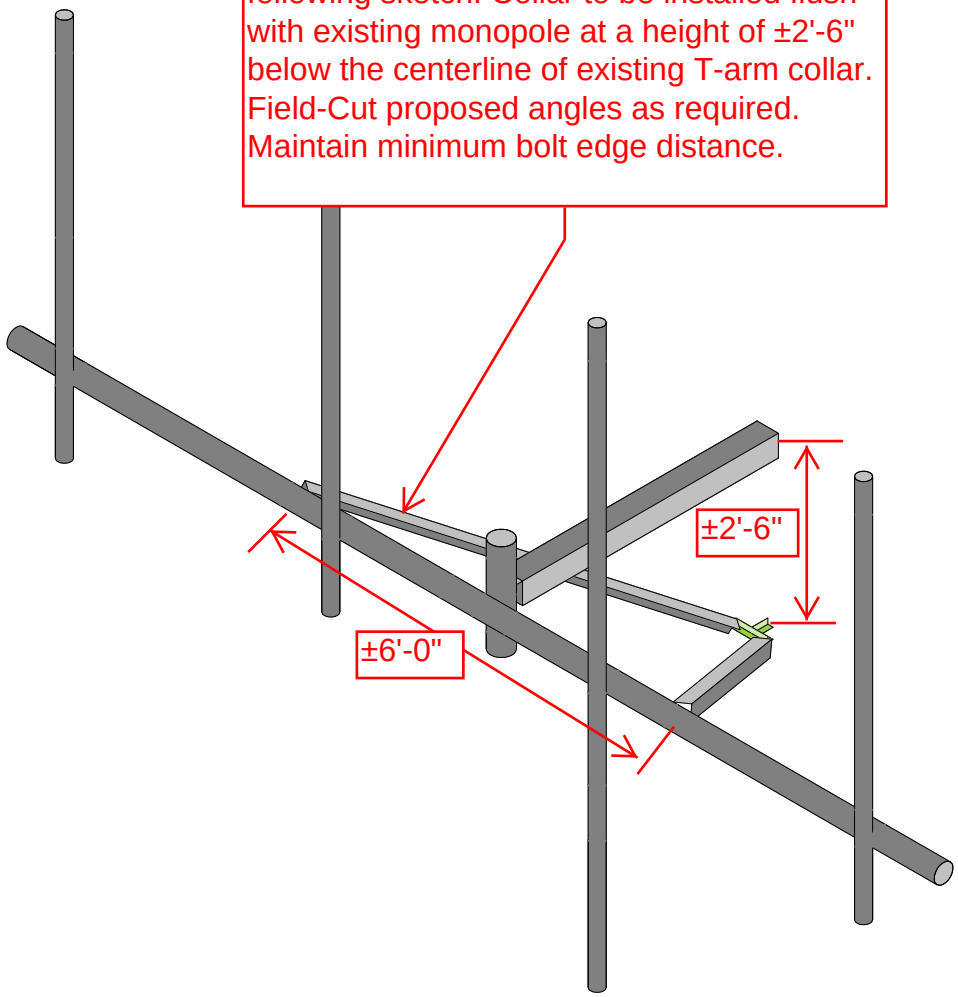
All opinions and conclusions are considered accurate to a reasonable degree of engineering certainty based upon the evidence available at the time of the report. All opinions and conclusions contained herein are subject to revision based upon receipt of new or updated information. All services are provided exercising a level of care and diligence equivalent to the standard of our profession. No warranty or guarantee, either expressed or implied, is offered. All services are confidential in nature and this report will not be released to any other party without the client's consent. The use of this analysis is limited to the expressed purpose for which it was commissioned and it may not be reused, copied or disseminated for any other purpose without consent from CLS Engineering PLLC.

All services were performed, results obtained and recommendations made in accordance with generally accepted engineering principles and practices. CLS Engineering PLLC is not responsible for the conclusions, opinions or recommendations made by others based on the information supplied in this analysis.

It is not possible to have the fully detailed information necessary to perform a complete and thorough analysis of every structural sub-component of an existing structure. The structural analysis by CLS Engineering PLLC verifies the adequacy of the primary members of the structure. CLS Engineering PLLC provides a limited scope of service in that we cannot verify the adequacy of every weld, bolt, gusset, etc.

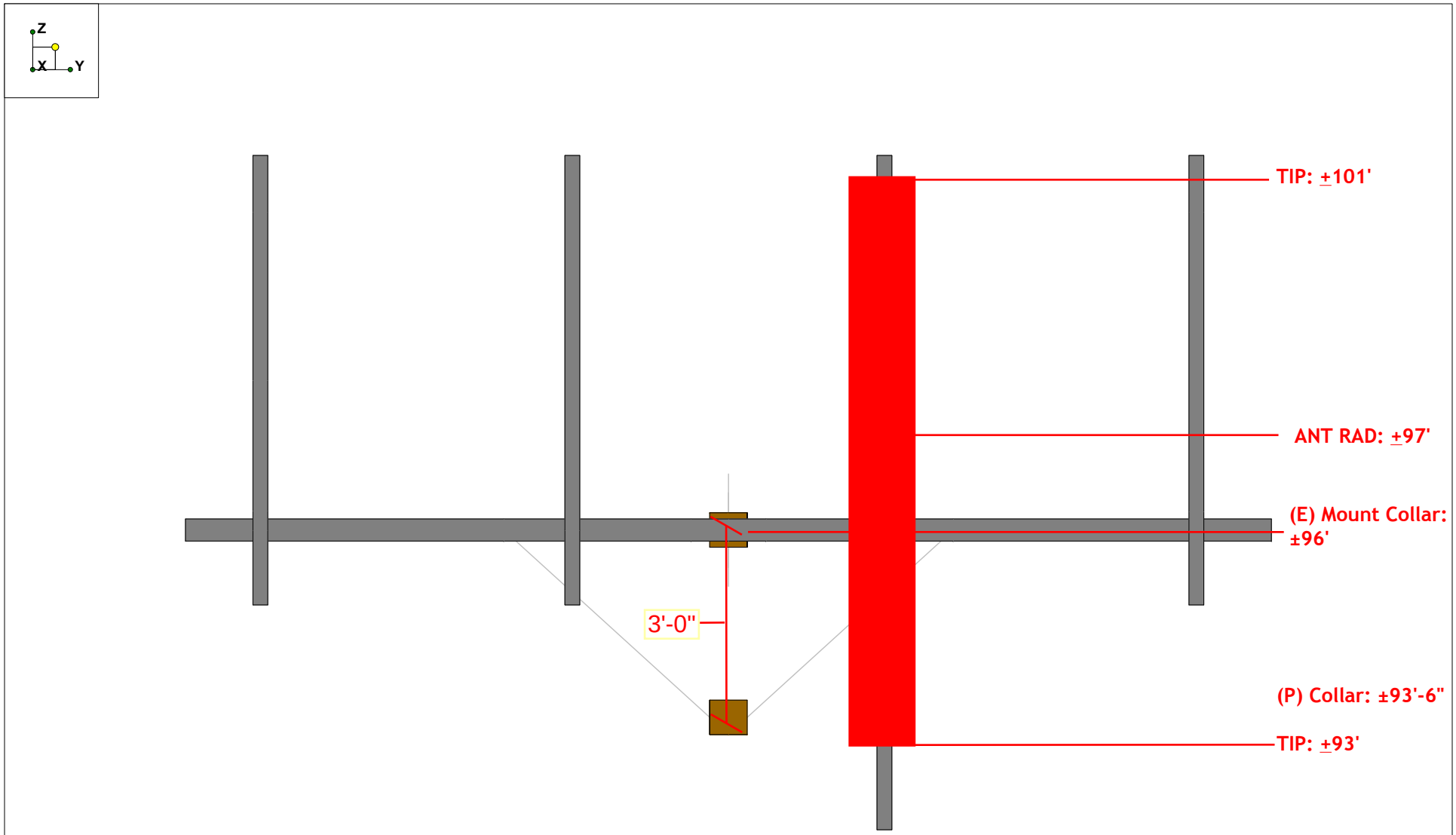



Install (1) Site Pro 1 PRK-SFS-L Support Rail Vertical Reinforcement Kit at existing face horizontal member as shown in the following sketch. Collar to be installed flush with existing monopole at a height of ±2'-6" below the centerline of existing T-arm collar. Field-Cut proposed angles as required. Maintain minimum bolt edge distance.

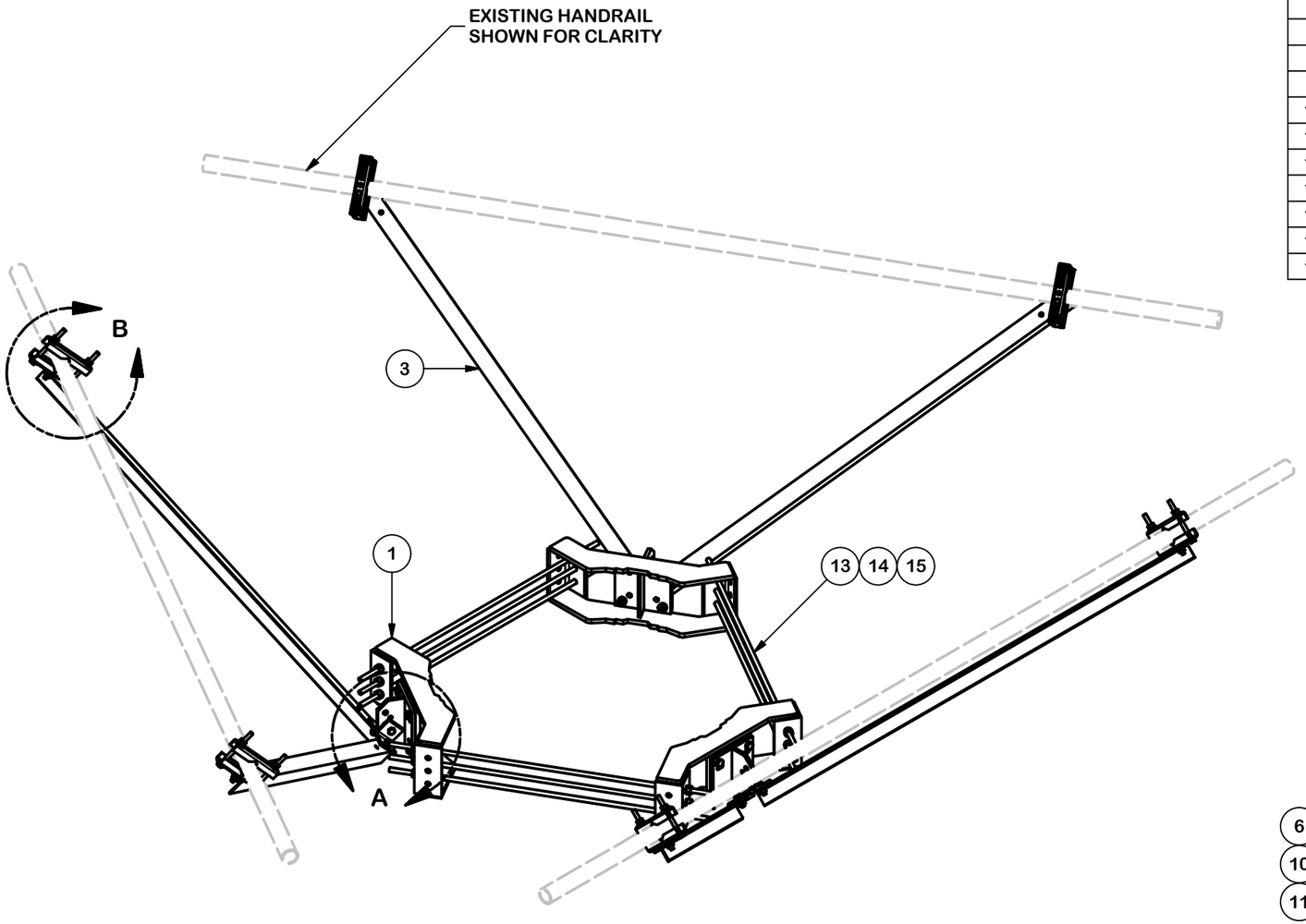



Envelope Only Solution

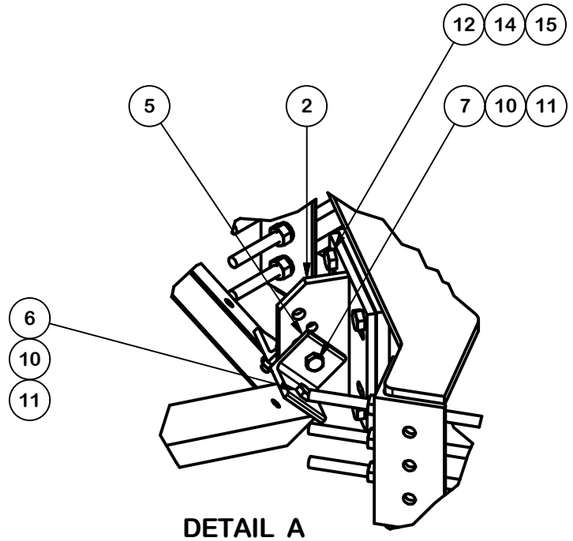
| | | |
|---|---|---|
| CLS | | SK - 0 |
| SMR | 41124-12927138-Madison CT, CT-283421 | Apr 11, 2019 at 2:00 PM |
| 41124-12927138-01-MA | Proposed Modifications - Rendered | 41124-12927138-01-MA.r3d |



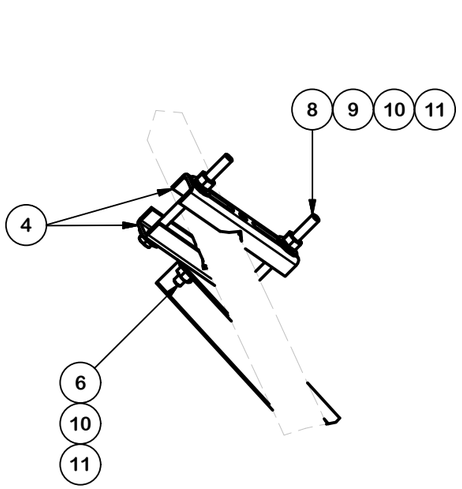

| | | |
|---|---|---|
| CLS | 41124-12927138-Madison CT, CT-283421 | SK - 0 |
| SMR | | Apr 12, 2019 at 4:20 PM |
| 41124-12927138-01-MA | Installation Sketch | 41124-12927138-01-MA.r3d |




| PARTS LIST | | | | | | |
|---|---|---|---|---|---|---|
| ITEM | QTY | PART NO. | PART DESCRIPTION | LENGTH | UNIT WT. | NET WT. |
| 1 | 3 | X-LWRM | RING MOUNT WELDMENT | | 68.81 | 206.42 |
| 2 | 3 | X-TBW | T-BRACKET WELDMENT | | 13.60 | 40.80 |
| 3 | 6 | X-254924 | DIAGONAL ANGLE - SITE PRO 1 | 72 in | 19.71 | 118.24 |
| 4 | 12 | X-STU | STIFF ARM CHANNEL BRACKET | 8 1/2 in | 1.37 | 16.46 |
| 5 | 6 | SHCM-T | CHAIN MOUNT TIGHTENER BRACKET | 3 in | 1.86 | 11.15 |
| 6 | 12 | G12112 | 1/2" x 1-1/2" HDG HEX BOLT GR5 | 1/2 in | 0.15 | 1.77 |
| 7 | 3 | G12212 | 1/2" x 2-1/2" HDG HEX BOLT GR5 | 2 1/2 in | 0.20 | 0.61 |
| 8 | 12 | G12065 | 1/2" x 6-1/2" HDG HEX BOLT GR5 FULL THREAD | 6 1/2 in | 0.41 | 4.91 |
| 9 | 24 | G12FW | 1/2" HDG USS FLATWASHER | 3/32 in | 0.03 | 0.82 |
| 10 | 27 | G12LW | 1/2" HDG LOCKWASHER | 1/8 in | 0.01 | 0.38 |
| 11 | 27 | G12NUT | 1/2" HDG HEAVY 2H HEX NUT | | 0.07 | 1.93 |
| 12 | 12 | A582114 | 5/8" x 2-1/4" HDG A325 HEX BOLT | 2 1/4 in | 0.31 | 3.75 |
| 13 | 9 | G58R-24 | 5/8" x 24" THREADED ROD (HDG.) | 24 in | 0.40 | 3.59 |
| 13 | 9 | G58R-48 | 5/8" x 48" THREADED ROD (HDG.) | 48 in | 0.40 | 3.59 |
| 14 | 30 | G58LW | 5/8" HDG LOCKWASHER | | 0.03 | 0.78 |
| 15 | 30 | G58NUT | 5/8" HDG HEAVY 2H HEX NUT | | 0.13 | 3.90 |
| | | | | | TOTAL WT. # | 642.04 |




DETAIL A




DETAIL B

| REV | DESCRIPTION OF REVISIONS | CPD | BY | DATE |
|---|---|---|---|---|
| A | CHANGED MAX. DIA. FOR HANDRAIL CONNECTION | SP1 | BC | 10/25/2017 |
| REVISION HISTORY | | | | |

## TOLERANCE NOTES

TOLERANCES ON DIMENSIONS, UNLESS OTHERWISE NOTED ARE:
SAWED, SHEARED AND GAS CUT EDGES (± 0.030")
DRILLED AND GAS CUT HOLES (± 0.030") - NO CONING OF HOLES
LASER CUT EDGES AND HOLES (± 0.010") - NO CONING OF HOLES
BENDS ARE ± 1/2 DEGREE
ALL OTHER MACHINING (± 0.030")
ALL OTHER ASSEMBLY (± 0.060")

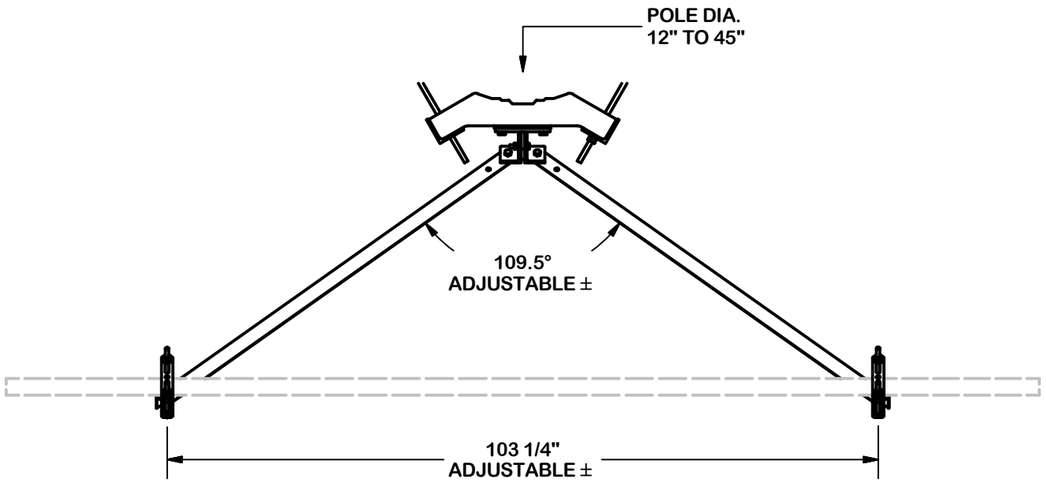


DESCRIPTION
HANDRAIL REINFORCEMENT KIT (LONG)

| CPD NO. | DRAWN BY | ENG. APPROVAL | PART NO. |
|---|---|---|---|
| SP1 | CSL3 2/23/2017 | 3RD PARTY | PRK-SFS-L |

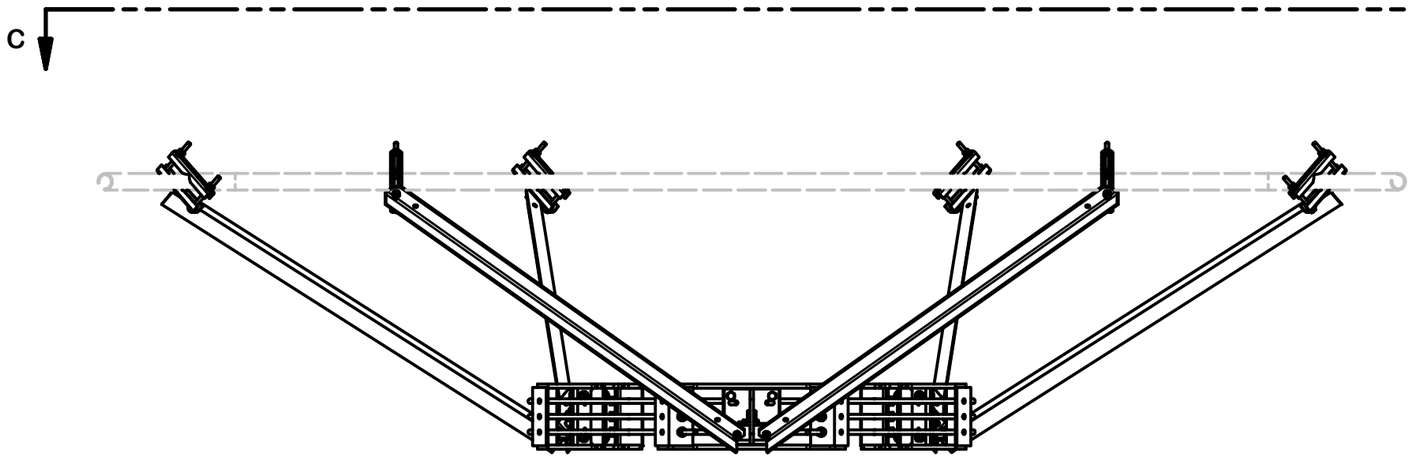
| CLASS | SUB | DRAWING USAGE | CHECKED BY | DWG. NO. |
|---|---|---|---|---|
| 81 | 02 | SHOP | BMC 9/8/2017 | PRK-SFS-L |

SITE PRO 1
A valmont COMPANY
Engineering Support Team: 1-888-753-7446
Locations:
New York, NY
Atlanta, GA
Los Angeles, CA
Plymouth, IN
Salem, OR
Dallas, TX

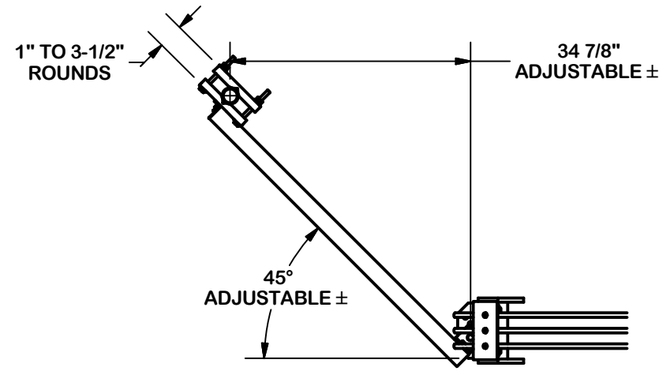



PARTIAL VIEW C-C

VERTICAL POSITION








PARTIAL VIEW D-D

| REV | DESCRIPTION OF REVISIONS | CPD | BY | DATE |
|---|---|---|---|---|
| A | CHANGED MAX. DIA. FOR HANDRAIL CONNECTION | SP1 | BC | 10/25/2017 |

REVISION HISTORY

## TOLERANCE NOTES

TOLERANCES ON DIMENSIONS, UNLESS OTHERWISE NOTED ARE:
SAWED, SHEARED AND GAS CUT EDGES (± 0.030")
DRILLED AND GAS CUT HOLES (± 0.030") - NO CONING OF HOLES
LASER CUT EDGES AND HOLES (± 0.010") - NO CONING OF HOLES
BENDS ARE ± 1/2 DEGREE
ALL OTHER MACHINING (± 0.030")
ALL OTHER ASSEMBLY (± 0.060")

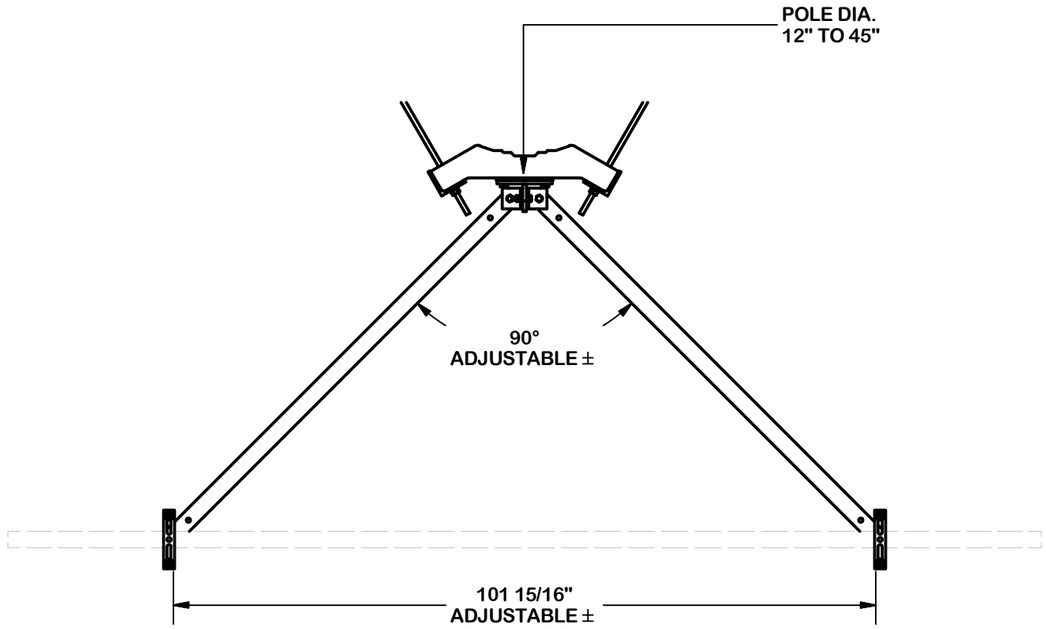


DESCRIPTION: HANDRAIL REINFORCEMENT KIT (LONG)

SITE PRO 1
A valmont COMPANY
Engineering Support Team: 1-888-753-7446
Locations: New York, NY; Atlanta, GA; Los Angeles, CA; Plymouth, IN; Salem, OR; Dallas, TX

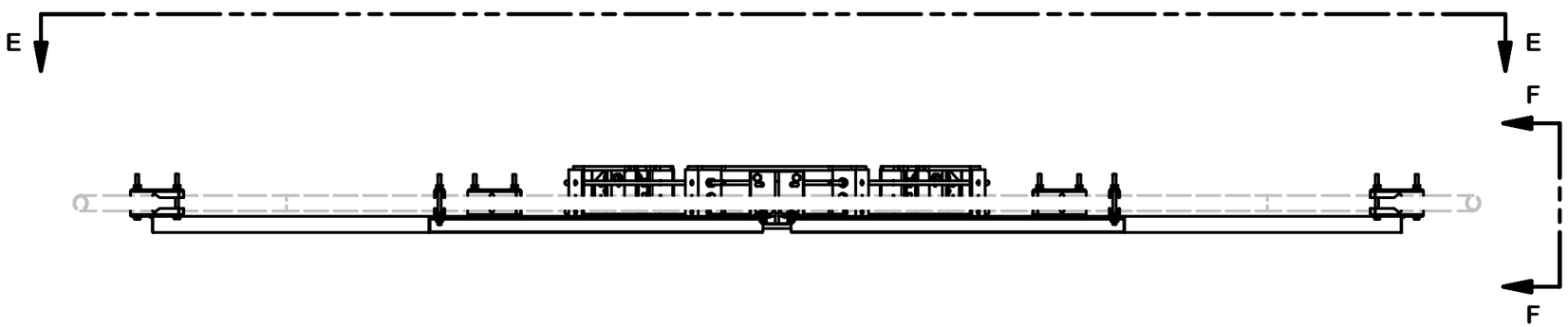
| CPD NO. | DRAWN BY | ENG. APPROVAL | PART NO. |
|---|---|---|---|
| SP1 | CSL3 2/23/2017 | 3RD PARTY | PRK-SFS-L |

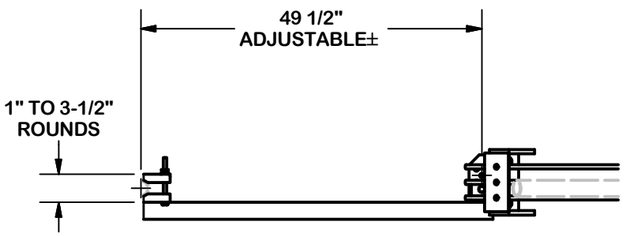
| CLASS | SUB | DRAWING USAGE | CHECKED BY | DWG. NO. |
|---|---|---|---|---|
| 81 | 02 | SHOP | BMC 9/8/2017 | PRK-SFS-L |




PARTIAL VIEW E-E

HORIZONTAL POSITION




PARTIAL VIEW F-F

## TOLERANCE NOTES

TOLERANCES ON DIMENSIONS, UNLESS OTHERWISE NOTED ARE:
SAWED, SHEARED AND GAS CUT EDGES (± 0.030")
DRILLED AND GAS CUT HOLES (± 0.030") - NO CONING OF HOLES
LASER CUT EDGES AND HOLES (± 0.010") - NO CONING OF HOLES
BENDS ARE ± 1/2 DEGREE
ALL OTHER MACHINING (± 0.030")
ALL OTHER ASSEMBLY (± 0.060")

| REV | DESCRIPTION OF REVISIONS | CPD | BY | DATE |
|---|---|---|---|---|
| A | CHANGED MAX. DIA. FOR HANDRAIL CONNECTION | SP1 | BC | 10/25/2017 |

REVISION HISTORY



DESCRIPTION
HANDRAIL REINFORCEMENT KIT (LONG)

SITE PRO 1
A valmont COMPANY

Engineering Support Team:
1-888-753-7446

Locations:
New York, NY
Atlanta, GA
Los Angeles, CA
Plymouth, IN
Salem, OR
Dallas, TX

| CPD NO. | DRAWN BY | ENG. APPROVAL | PART NO. |
|---|---|---|---|
| SP1 | CSL3 2/23/2017 | 3RD PARTY | PRK-SFS-L |

| CLASS | SUB | DRAWING USAGE | CHECKED BY | DWG. NO. |
|---|---|---|---|---|
| 81 | 02 | SHOP | BMC 9/8/2017 | PRK-SFS-L |

## Wind & Ice Loading

| | | | |
|---|---|---|---|
| **Nominal Mount Elevation (AGL), $z_{mount}$** | 96 ft | **$K_a$** | 0.90 |
| **Nominal Rad Elevation (AGL), $z_{rad}$** | 97 ft | **$K_d$** | 0.95 |
| **Elevation AMSL (ft)** | - | **$K_e$** | - |
| **TIA Standard** | G | **$K_z$** | 0.98 |
| **Basic Wind Speed, $V_{ult}$ (bare)** | 130 mph | **$K_{zt}$** | 1.00 |
| **Basic Wind Speed, V (ice)** | 50 mph | **$K_s$** | - |
| **Design Ice Thickness, $t_i$** | 3/4 in | **$t_{iz}$** | 1.67 in |
| **Exposure Category** | B | **$G_h$** | 1.00 |
| **Risk Category** | II | **$q_z$ (bare)** | 40.1 psf |
| **Seismic Response Coeff., $C_s$** | - | **$q_z$ (ice)** | 5.9 psf |

## Live Loading

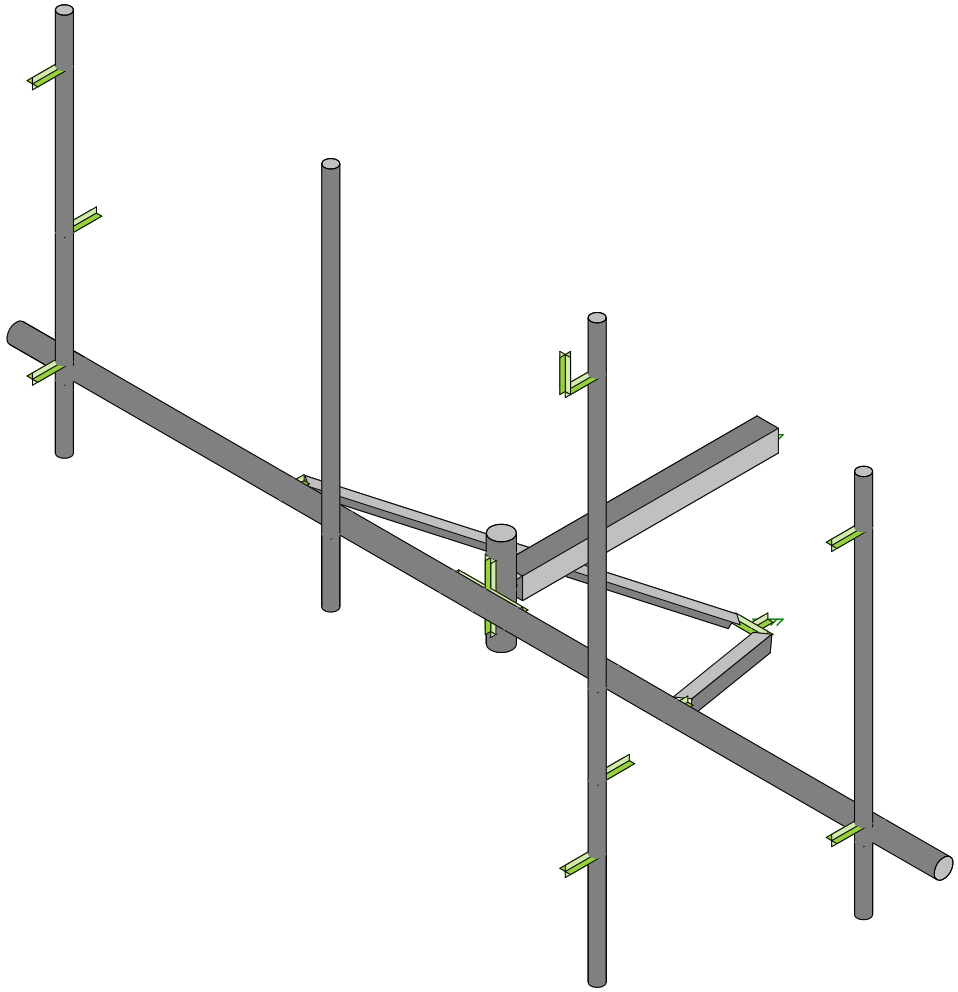
| | |
|---|---|
| At Mount Pipes, $L_M$ | 250 lb |
| Joint Labels Considered | M1 |
| | M2 |
| | M4 |
| | |
| | |

## Member Distributed Loading

| Section Set Label | Shape Label | $F_A$ (lb/ft) | | Ice Wt. (lb/ft) |
|---|---|---|---|---|
| | | Bare | Ice | |
| Standoff Arm | HSS4X4X3 | 24.09 | 2.05 | 13.79 |
| Standoff Pipe | PIPE_3.5 | 14.45 | 3.92 | 11.56 |
| Face Horizontal | HSS3.500X0.250 | 12.65 | 3.65 | 10.54 |
| Mount Pipe | PIPE_2.0 | 8.58 | 3.05 | 8.25 |
| MOD PRK | L2.5x2.5x3 | 15.05 | 1.95 | 9.66 |

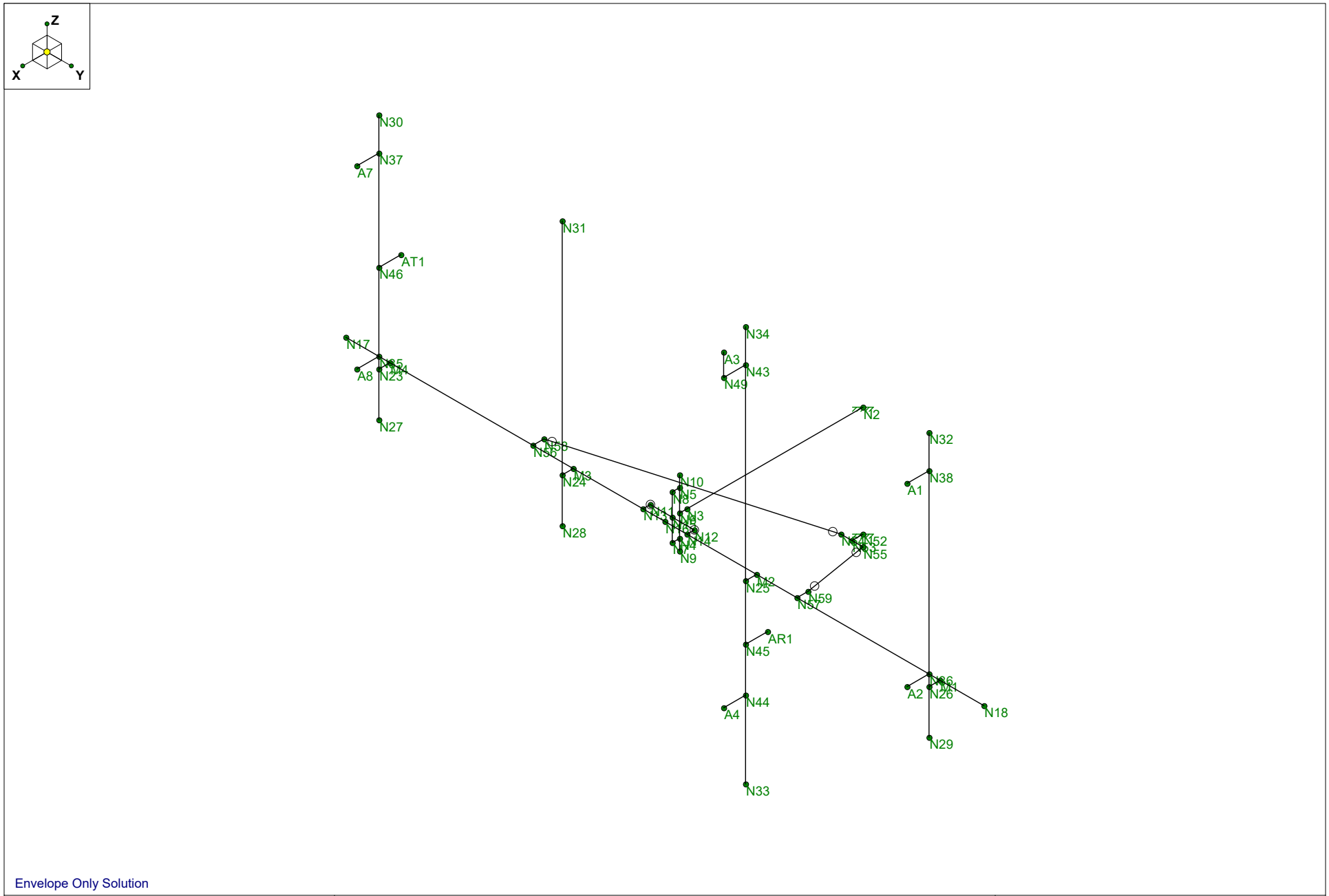
## Appurtenances

| Appurtenance Model | Status | Azimuth Offset (°, ↻) | Rad Elev. Override (ft) | Swap Width & Depth | Area Factor | | Qty. | Total Qty. Override | 0° Joints | | Height (in) | Width (in) | Depth (in) | Weight (Bare) (lb) | Shape | Weight of Ice (lb) | $EPA_A$ (Bare) ($ft^2$) | | $EPA_A$ (Ice) ($ft^2$) | | $F_A$ (Bare) (lb) | | $F_A$ (Ice) (lb) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Front | Side | 0° | | 1 | 2 | | | | | | | N | T | N | T | N | T | N | T |
| APXVAARR24_43-U-NA20 | | | | ☐ | | | 1 | ***3*** | A3 | A4 | 0 | 0 | 0 | 153.3 | Generic | 376.22 | 14.67 | 5.32 | 17.21 | 7.56 | 531.62 | 192.79 | 92.26 | 40.52 |
| AIR 21, 1.3 M, B4A B2P | | | | ☐ | | | 1 | ***3*** | A1 | A2 | 56 | 12 | 8 | 132.2 | Flat | 160.39 | 6.05 | 4.36 | 7.97 | 6.18 | 219.22 | 157.84 | 42.73 | 33.11 |
| AIR 21, 1.3 M, B2A B4P | | | | ☐ | | | 1 | ***3*** | A7 | A8 | 56 | 12 | 8 | 83 | Flat | 140.02 | 6.05 | 4.36 | 7.97 | 6.18 | 219.22 | 157.84 | 42.73 | 33.11 |
| KRY 112 144/1 | | | | ☐ | 0 | | 1 | ***3*** | AT1 | | 7 | 6 | 3 | 11 | Flat | 10.61 | 0.00 | 0.18 | 0.00 | 0.55 | 0.00 | 6.34 | 0.00 | 2.93 |
| RADIO 4449 B12/B71 | | | | ☐ | | | 1 | ***3*** | AR1 | | 15 | 13.2 | 10.4 | 75 | Flat | 57.49 | 1.65 | 1.30 | 2.53 | 2.10 | 59.79 | 47.11 | 13.55 | 11.26 |



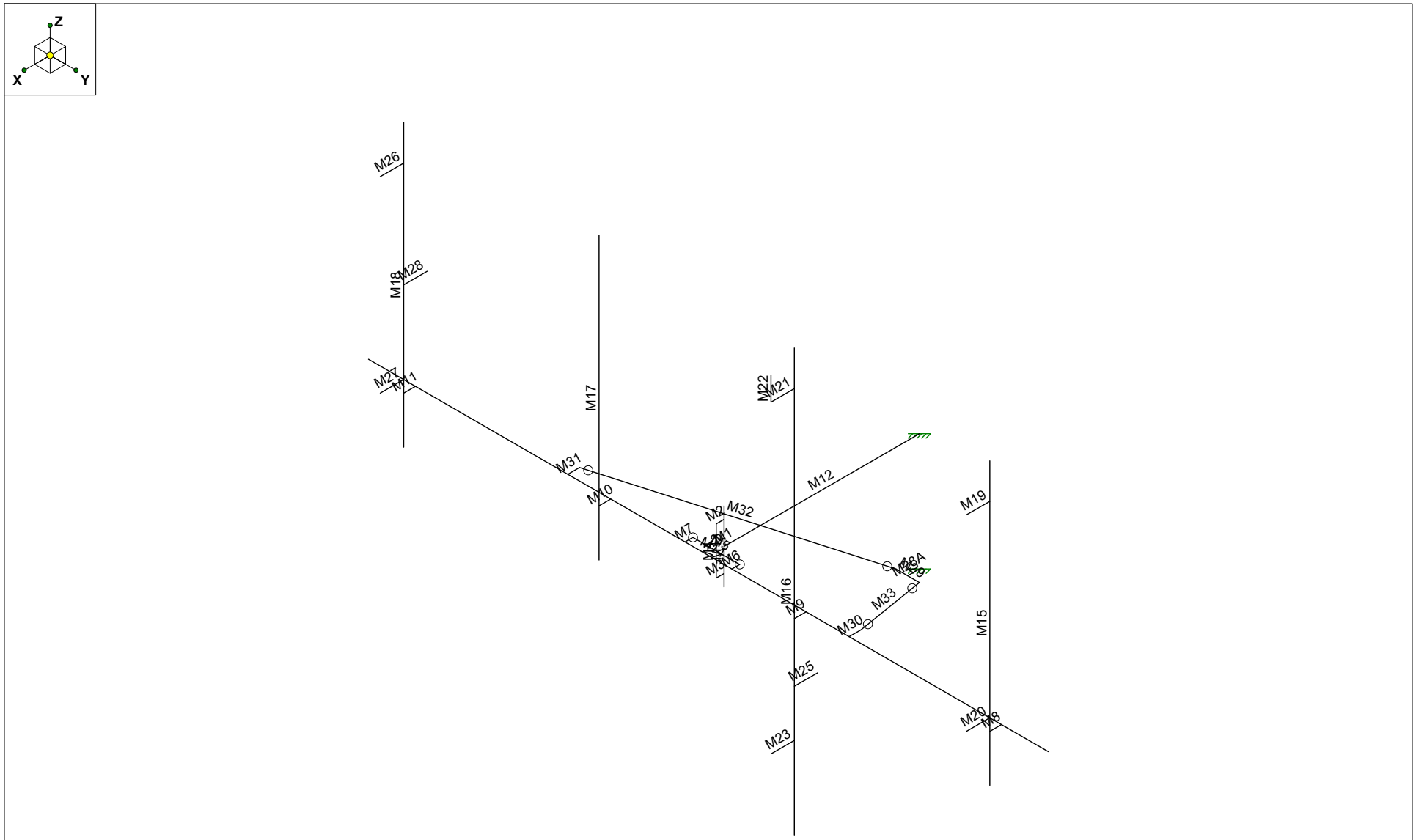

Envelope Only Solution

| | | |
|---|---|---|
| CLS | 41124-12927138-Madison CT, CT-283421 | SK - 1 |
| SMR | | July 9, 2019 at 11:30 AM |
| 41124-12927138-01-MA-R1 | Rendered | 41124-12927138-01-MA-R1.r3d |



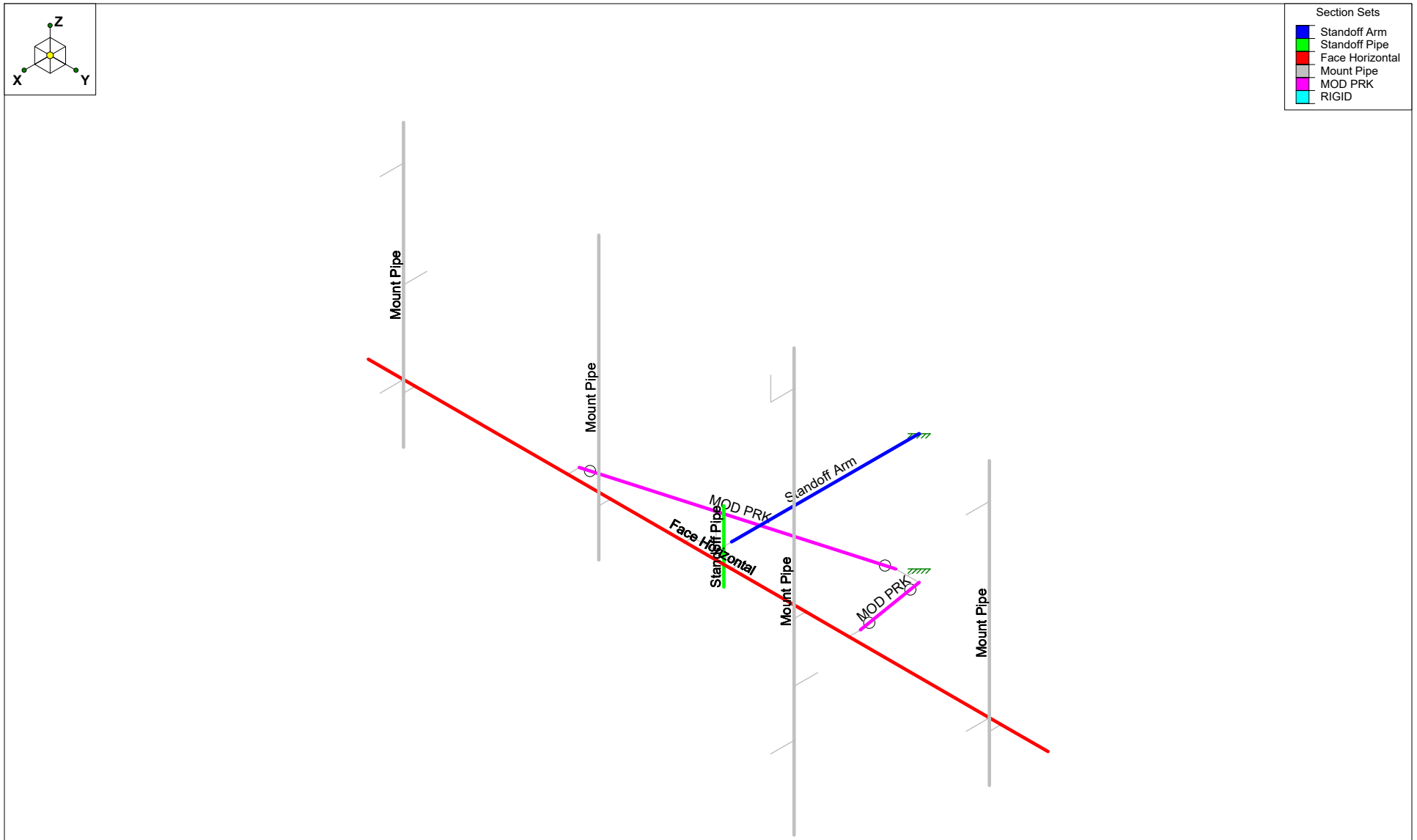

Envelope Only Solution

| | | |
|---|---|---|
| CLS | 41124-12927138-Madison CT, CT-283421 | SK - 2 |
| SMR | | July 9, 2019 at 11:31 AM |
| 41124-12927138-01-MA-R1 | Joint Labels | 41124-12927138-01-MA-R1.r3d |



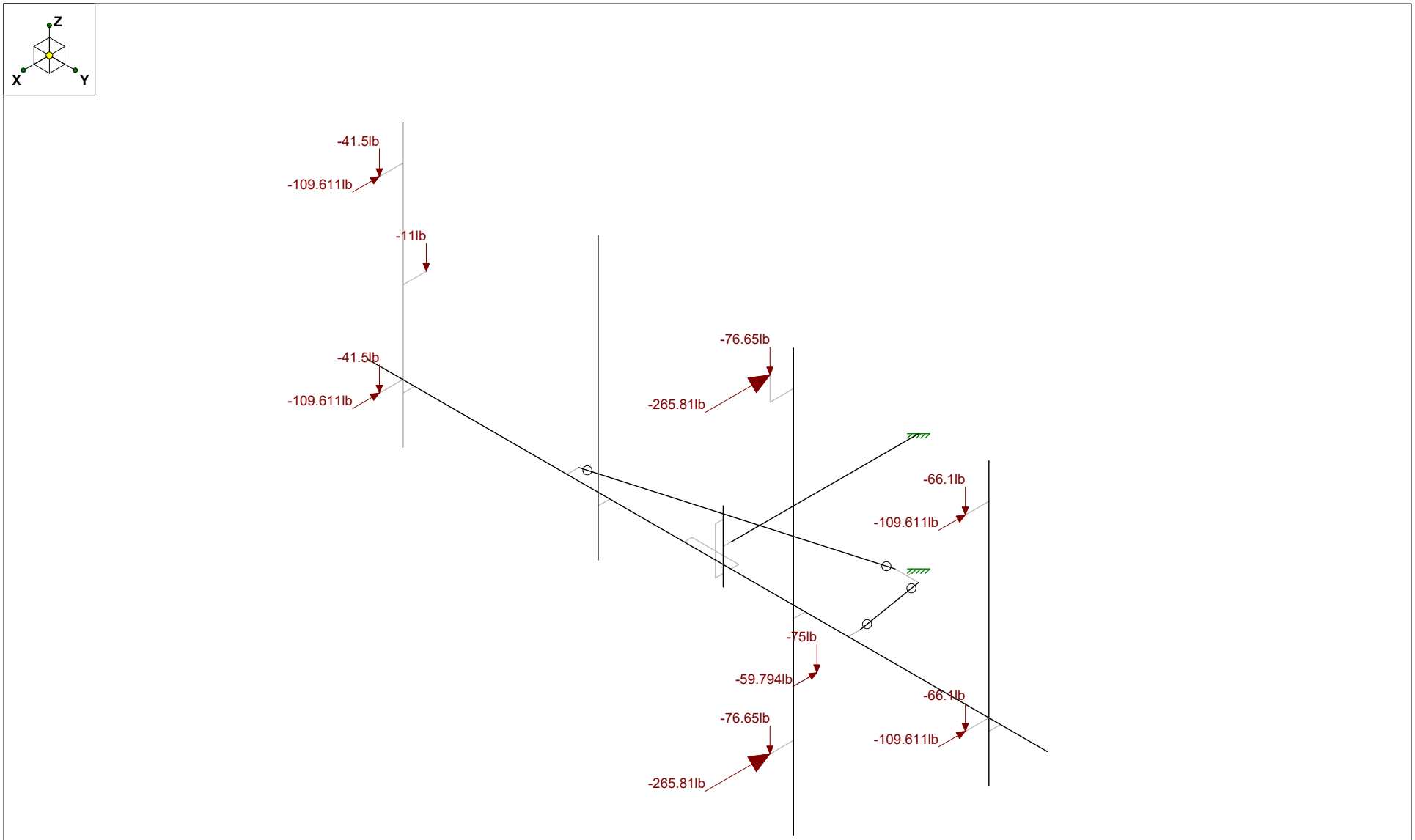

Envelope Only Solution

| | | |
|---|---|---|
| CLS | 41124-12927138-Madison CT, CT-283421 | SK - 3 |
| SMR | | July 9, 2019 at 11:31 AM |
| 41124-12927138-01-MA-R1 | Member Labels | 41124-12927138-01-MA-R1.r3d |



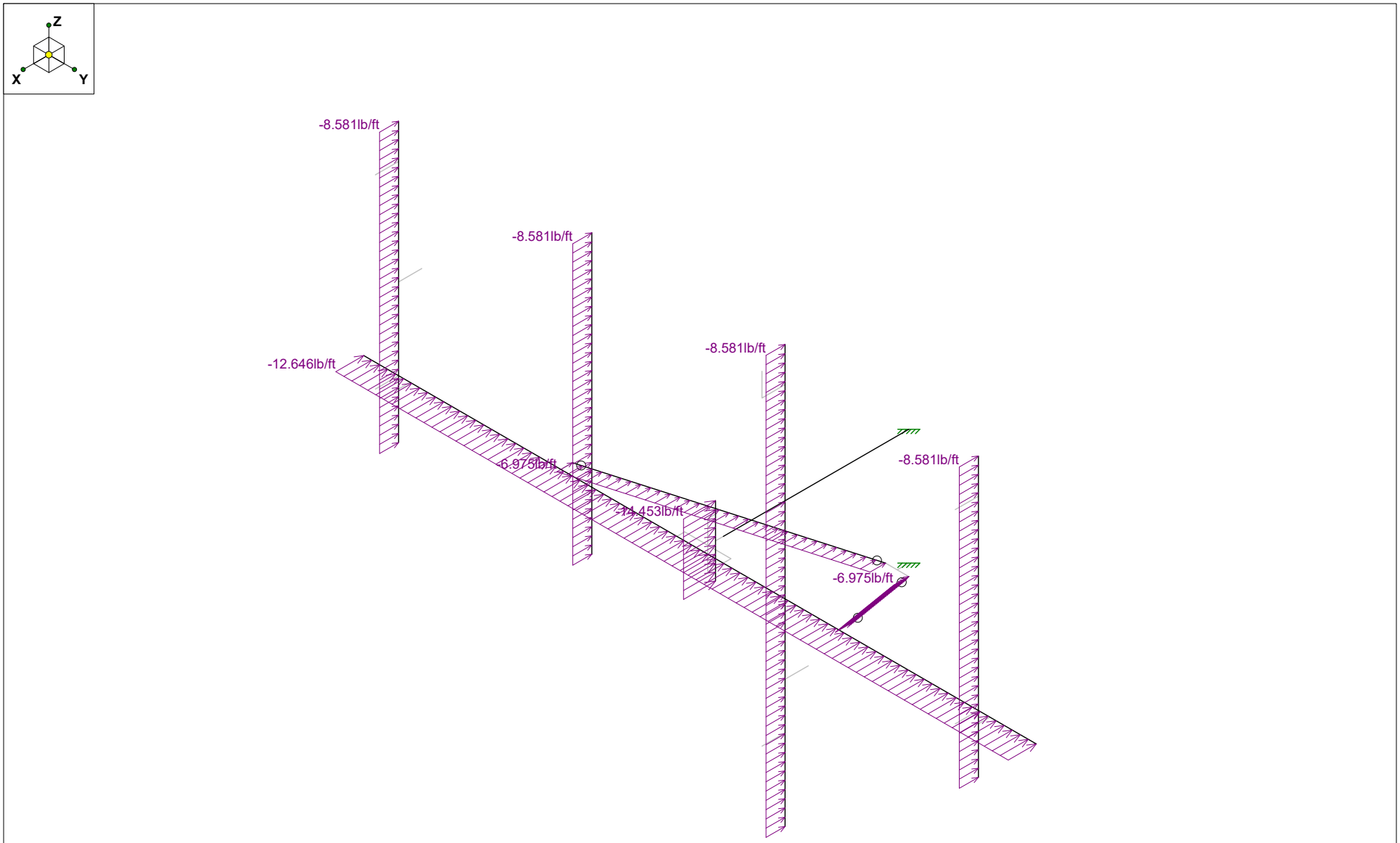

Envelope Only Solution

| | | |
|---|---|---|
| CLS | 41124-12927138-Madison CT, CT-283421 | SK - 4 |
| SMR | | July 9, 2019 at 11:31 AM |
| 41124-12927138-01-MA-R1 | Section Sets | 41124-12927138-01-MA-R1.r3d |



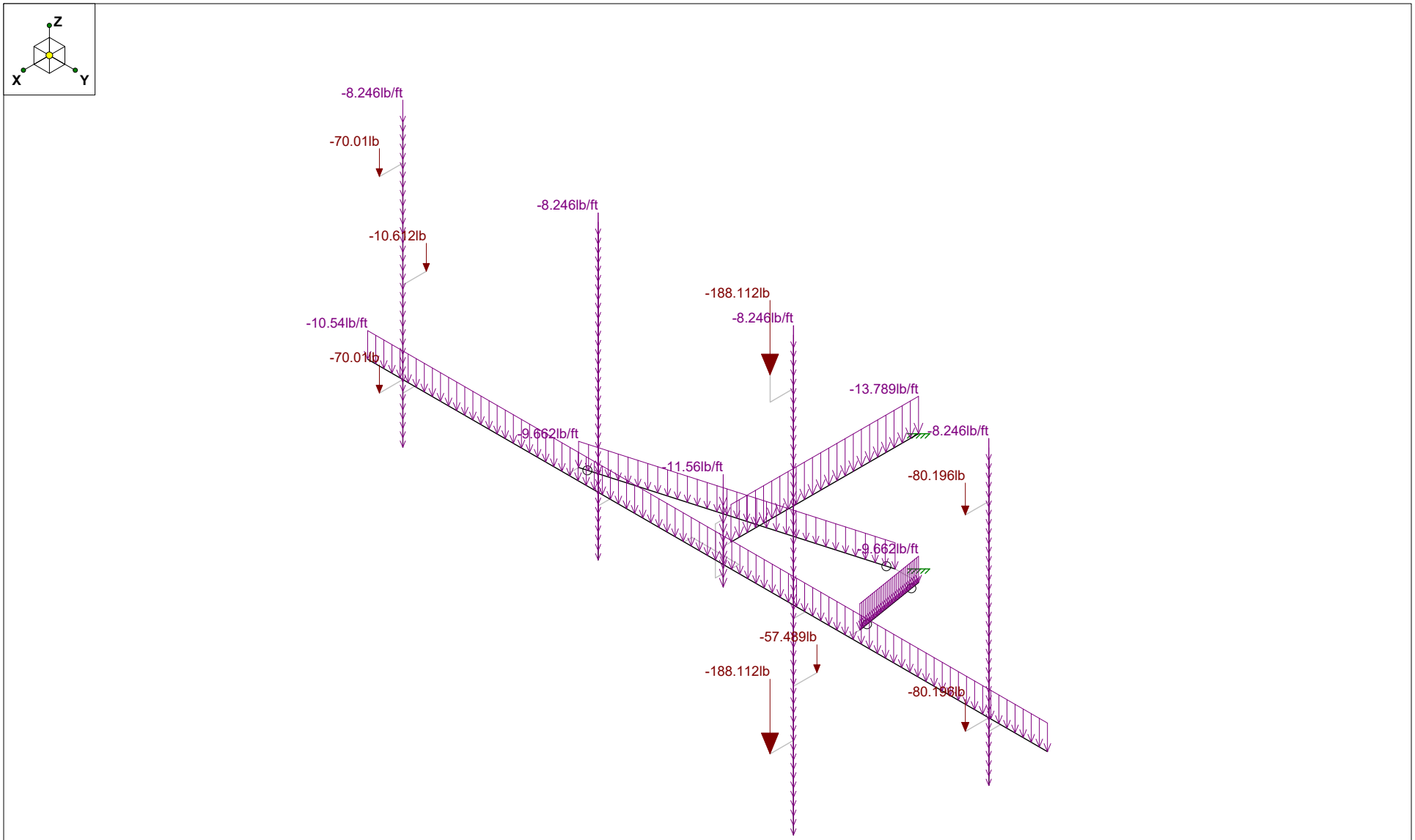

Loads: LC 1, DISPLAY (1.0D + 1.0W_0°)
Envelope Only Solution

| | | |
|---|---|---|
| CLS | | SK - 5 |
| SMR | 41124-12927138-Madison CT, CT-283421 | July 9, 2019 at 11:31 AM |
| 41124-12927138-01-MA-R1 | Joint Loads - Dead and Normal Wind | 41124-12927138-01-MA-R1.r3d |



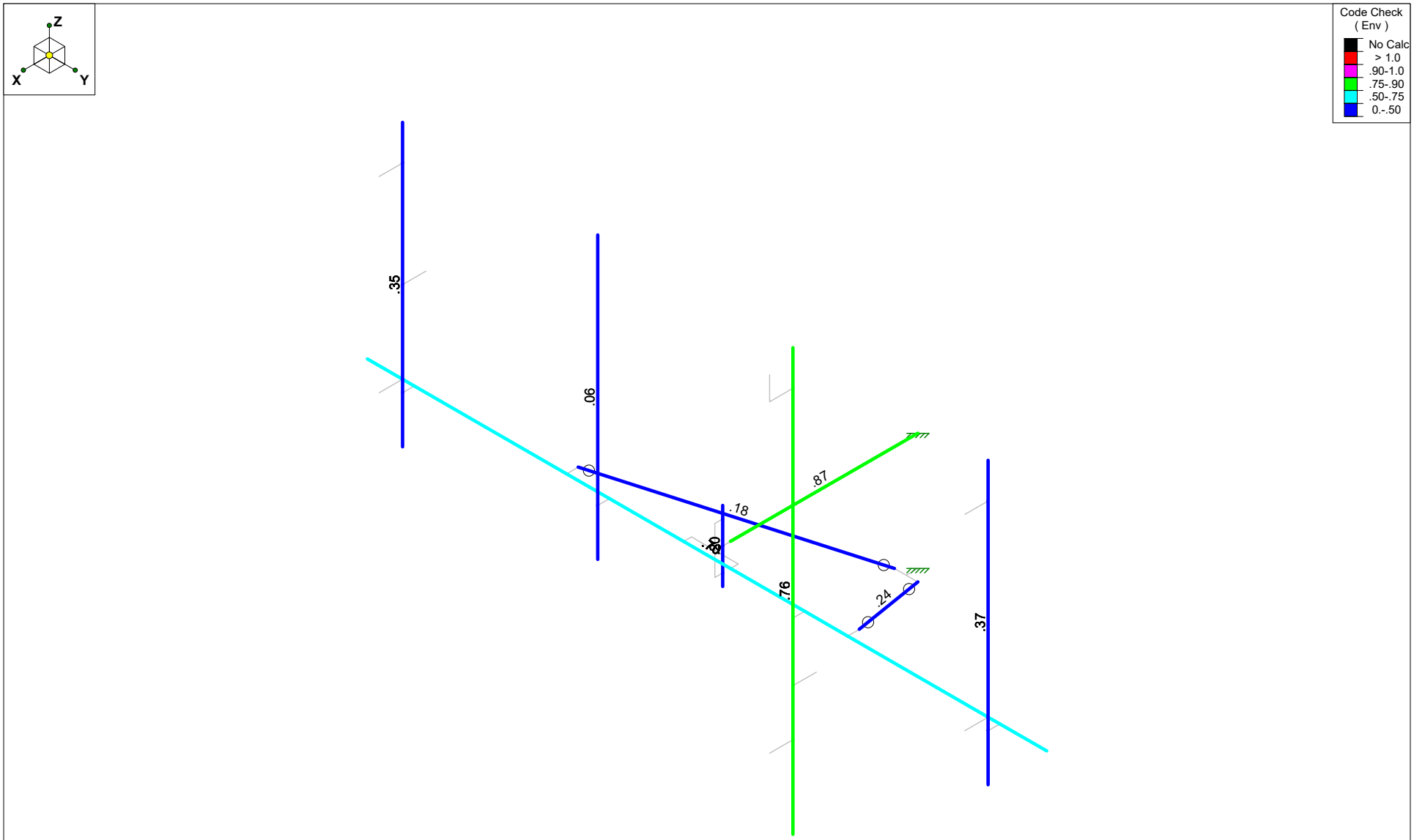

Loads: BLC 4, Structure Wind 0°
Envelope Only Solution

| | | |
|---|---|---|
| CLS | 41124-12927138-Madison CT, CT-283421 | SK - 6 |
| SMR | | July 9, 2019 at 11:32 AM |
| 41124-12927138-01-MA-R1 | Distributed Load - Normal Wind | 41124-12927138-01-MA-R1.r3d |



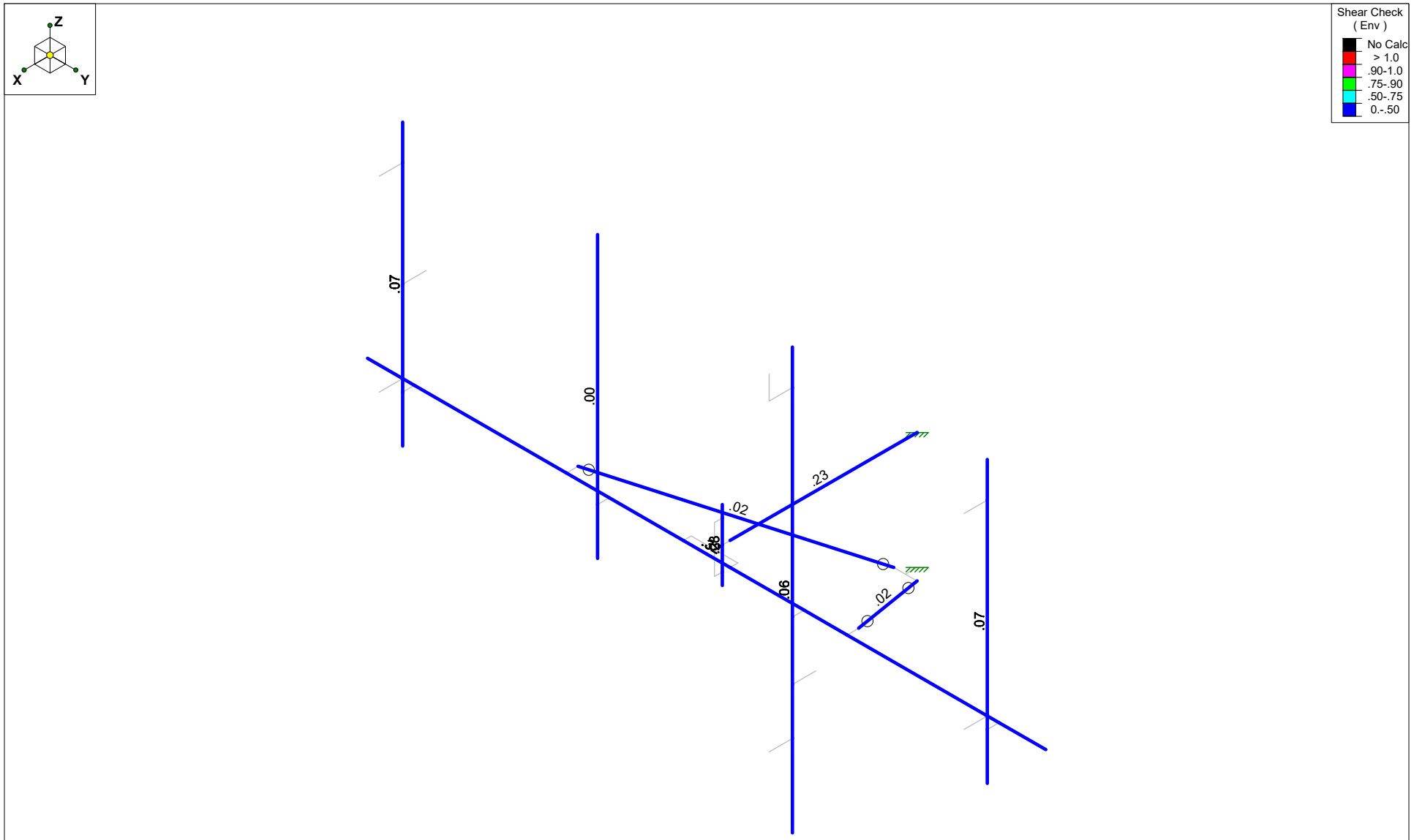

Loads: BLC 2, Ice Dead
Envelope Only Solution

| | | |
|---|---|---|
| CLS | 41124-12927138-Madison CT, CT-283421 | SK - 7 |
| SMR | | July 9, 2019 at 11:32 AM |
| 41124-12927138-01-MA-R1 | Ice Dead Loads | 41124-12927138-01-MA-R1.r3d |




Member Code Checks Displayed (Enveloped)
Envelope Only Solution

| | | |
|---|---|---|
| CLS | | SK - 8 |
| SMR | 41124-12927138-Madison CT, CT-283421 | July 9, 2019 at 11:32 AM |
| 41124-12927138-01-MA-R1 | Envelope Member Unity Check Results - Bending | 41124-12927138-01-MA-R1.r3d |




Member Shear Checks Displayed (Enveloped)
Envelope Only Solution

| | | |
|---|---|---|
| CLS | | SK - 9 |
| SMR | 41124-12927138-Madison CT, CT-283421 | July 9, 2019 at 11:32 AM |
| 41124-12927138-01-MA-R1 | Envelope Member Check Results - Shear | 41124-12927138-01-MA-R1.r3d |

## Basic Load Cases

| | BLC Description | Category | X Gravity | Y Gravity | Z Gravity | Joint | Point | Distributed | Area(Me... | Surface(... |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Dead | DL | | | -1 | 8 | | | | |
| 2 | Ice Dead | RL | | | | 8 | | 9 | | |
| 4 | Structure Wind 0Á | None | | | | | | 8 | | |
| 5 | Structure Wind 30Á | None | | | | | | 18 | | |
| 6 | Structure Wind 45Á | None | | | | | | 18 | | |
| 7 | Structure Wind 60Á | None | | | | | | 18 | | |
| 8 | Structure Wind 90Á | None | | | | | | 8 | | |
| 9 | Structure Wind 120Á | None | | | | | | 18 | | |
| 10 | Structure Wind 135Á | None | | | | | | 18 | | |
| 11 | Structure Wind 150Á | None | | | | | | 18 | | |
| 12 | Structure Wind w/ Ice 0Á | None | | | | | | 8 | | |
| 13 | Structure Wind w/ Ice 30Á | None | | | | | | 18 | | |
| 14 | Structure Wind w/ Ice 45Á | None | | | | | | 18 | | |
| 15 | Structure Wind w/ Ice 60Á | None | | | | | | 18 | | |
| 16 | Structure Wind w/ Ice 90Á | None | | | | | | 8 | | |
| 17 | Structure Wind w/ Ice 120Á | None | | | | | | 18 | | |
| 18 | Structure Wind w/ Ice 135Á | None | | | | | | 18 | | |
| 19 | Structure Wind w/ Ice 150Á | None | | | | | | 18 | | |
| 20 | Antenna Wind 0Á | None | | | | 7 | | | | |
| 21 | Antenna Wind 30Á | None | | | | 16 | | | | |
| 22 | Antenna Wind 45Á | None | | | | 16 | | | | |
| 23 | Antenna Wind 60Á | None | | | | 16 | | | | |
| 24 | Antenna Wind 90Á | None | | | | 8 | | | | |
| 25 | Antenna Wind 120Á | None | | | | 16 | | | | |
| 26 | Antenna Wind 135Á | None | | | | 16 | | | | |
| 27 | Antenna Wind 150Á | None | | | | 16 | | | | |
| 28 | Antenna Wind w/ Ice 0Á | None | | | | 7 | | | | |
| 29 | Antenna Wind w/ Ice 30Á | None | | | | 16 | | | | |
| 30 | Antenna Wind w/ Ice 45Á | None | | | | 16 | | | | |
| 31 | Antenna Wind w/ Ice 60Á | None | | | | 16 | | | | |
| 32 | Antenna Wind w/ Ice 90Á | None | | | | 8 | | | | |
| 33 | Antenna Wind w/ Ice 120Á | None | | | | 16 | | | | |
| 34 | Antenna Wind w/ Ice 135Á | None | | | | 16 | | | | |
| 35 | Antenna Wind w/ Ice 150Á | None | | | | 16 | | | | |
| 39 | Maintenance Live 500 (1) | OL1 | | | | 1 | | | | |
| 40 | Maintenance Live 500 (2) | OL2 | | | | 1 | | | | |
| 41 | Maintenance Live 500 (3) | OL3 | | | | 1 | | | | |

## Load Combinations

| | Description | Solve | PDe.. | SRSS | BLC | Fac.. | BLC | Fac.. | BLC | Fac.. | BLC | Fac.. | BLC | Fac.. | BLC | Fac.. | BLC | Fac.. | BLC | Fac.. | BLC | Fac.. | BLC | Fac.. | BLC | Fac... |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | DISPLAY (1.0D + ... | Yes | Y | | DL | 1 | 20 | 1 | | | | | | | | | | | | | | | | | | |
| 2 | 1.4D | Yes | Y | | DL | 1.4 | | | | | | | | | | | | | | | | | | | | |
| 3 | 1.2D + 1.0W_0Á | Yes | Y | | DL | 1.2 | 4 | 1 | 20 | 1 | | | | | | | | | | | | | | | | |
| 4 | 1.2D + 1.0W_30Á | Yes | Y | | DL | 1.2 | 5 | 1 | 21 | 1 | | | | | | | | | | | | | | | | |
| 5 | 1.2D + 1.0W_45Á | Yes | Y | | DL | 1.2 | 6 | 1 | 22 | 1 | | | | | | | | | | | | | | | | |
| 6 | 1.2D + 1.0W_60Á | Yes | Y | | DL | 1.2 | 7 | 1 | 23 | 1 | | | | | | | | | | | | | | | | |
| 7 | 1.2D + 1.0W_90Á | Yes | Y | | DL | 1.2 | 8 | 1 | 24 | 1 | | | | | | | | | | | | | | | | |
| 8 | 1.2D + 1.0W_120Á | Yes | Y | | DL | 1.2 | 9 | 1 | 25 | 1 | | | | | | | | | | | | | | | | |
| 9 | 1.2D + 1.0W_135Á | Yes | Y | | DL | 1.2 | 10 | 1 | 26 | 1 | | | | | | | | | | | | | | | | |

## *Load Combinations (Continued)*

| | Description | Solve | PDe.. | SRSS | BLC | Fac.. | BLC | Fac.. | BLC | Fac.. | BLC | Fac.. | BLC | Fac.. | BLC | Fac.. | BLC | Fac.. | BLC | Fac.. | BLC | Fac.. | BLC | Fac.. | BLC | Fac... |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 1.2D + 1.0W_150Á | Yes | Y | | DL | 1.2 | 11 | 1 | 27 | 1 | | | | | | | | | | | | | | | | |
| 11 | 1.2D + 1.0W_180Á | Yes | Y | | DL | 1.2 | 4 | -1 | 20 | -1 | | | | | | | | | | | | | | | | |
| 12 | 1.2D + 1.0W_210Á | Yes | Y | | DL | 1.2 | 5 | -1 | 21 | -1 | | | | | | | | | | | | | | | | |
| 13 | 1.2D + 1.0W_225Á | Yes | Y | | DL | 1.2 | 6 | -1 | 22 | -1 | | | | | | | | | | | | | | | | |
| 14 | 1.2D + 1.0W_240Á | Yes | Y | | DL | 1.2 | 7 | -1 | 23 | -1 | | | | | | | | | | | | | | | | |
| 15 | 1.2D + 1.0W_270Á | Yes | Y | | DL | 1.2 | 8 | -1 | 24 | -1 | | | | | | | | | | | | | | | | |
| 16 | 1.2D + 1.0W_300Á | Yes | Y | | DL | 1.2 | 9 | -1 | 25 | -1 | | | | | | | | | | | | | | | | |
| 17 | 1.2D + 1.0W_315Á | Yes | Y | | DL | 1.2 | 10 | -1 | 26 | -1 | | | | | | | | | | | | | | | | |
| 18 | 1.2D + 1.0W_330Á | Yes | Y | | DL | 1.2 | 11 | -1 | 27 | -1 | | | | | | | | | | | | | | | | |
| 19 | 1.2D + 1.0Di + 1.0... | Yes | Y | | DL | 1.2 | 12 | 1 | 28 | 1 | RL | 1 | | | | | | | | | | | | | | |
| 20 | 1.2D + 1.0Di + 1.0... | Yes | Y | | DL | 1.2 | 13 | 1 | 29 | 1 | RL | 1 | | | | | | | | | | | | | | |
| 21 | 1.2D + 1.0Di + 1.0... | Yes | Y | | DL | 1.2 | 14 | 1 | 30 | 1 | RL | 1 | | | | | | | | | | | | | | |
| 22 | 1.2D + 1.0Di + 1.0... | Yes | Y | | DL | 1.2 | 15 | 1 | 31 | 1 | RL | 1 | | | | | | | | | | | | | | |
| 23 | 1.2D + 1.0Di + 1.0... | Yes | Y | | DL | 1.2 | 16 | 1 | 32 | 1 | RL | 1 | | | | | | | | | | | | | | |
| 24 | 1.2D + 1.0Di + 1.0... | Yes | Y | | DL | 1.2 | 17 | 1 | 33 | 1 | RL | 1 | | | | | | | | | | | | | | |
| 25 | 1.2D + 1.0Di + 1.0... | Yes | Y | | DL | 1.2 | 18 | 1 | 34 | 1 | RL | 1 | | | | | | | | | | | | | | |
| 26 | 1.2D + 1.0Di + 1.0... | Yes | Y | | DL | 1.2 | 19 | 1 | 35 | 1 | RL | 1 | | | | | | | | | | | | | | |
| 27 | 1.2D + 1.0Di + 1.0... | Yes | Y | | DL | 1.2 | 12 | -1 | 28 | -1 | RL | 1 | | | | | | | | | | | | | | |
| 28 | 1.2D + 1.0Di + 1.0... | Yes | Y | | DL | 1.2 | 13 | -1 | 29 | -1 | RL | 1 | | | | | | | | | | | | | | |
| 29 | 1.2D + 1.0Di + 1.0... | Yes | Y | | DL | 1.2 | 14 | -1 | 30 | -1 | RL | 1 | | | | | | | | | | | | | | |
| 30 | 1.2D + 1.0Di + 1.0... | Yes | Y | | DL | 1.2 | 15 | -1 | 31 | -1 | RL | 1 | | | | | | | | | | | | | | |
| 31 | 1.2D + 1.0Di + 1.0... | Yes | Y | | DL | 1.2 | 16 | -1 | 32 | -1 | RL | 1 | | | | | | | | | | | | | | |
| 32 | 1.2D + 1.0Di + 1.0... | Yes | Y | | DL | 1.2 | 17 | -1 | 33 | -1 | RL | 1 | | | | | | | | | | | | | | |
| 33 | 1.2D + 1.0Di + 1.0... | Yes | Y | | DL | 1.2 | 18 | -1 | 34 | -1 | RL | 1 | | | | | | | | | | | | | | |
| 34 | 1.2D + 1.0Di + 1.0... | Yes | Y | | DL | 1.2 | 19 | -1 | 35 | -1 | RL | 1 | | | | | | | | | | | | | | |
| 35 | 1.2D + 1.5Lm_1 +... | Yes | Y | | DL | 1.2 | 4 | .056 | 20 | .056 | OL1 | 1.5 | | | | | | | | | | | | | | |
| 36 | 1.2D + 1.5Lm_1 +... | Yes | Y | | DL | 1.2 | 5 | .056 | 21 | .056 | OL1 | 1.5 | | | | | | | | | | | | | | |
| 37 | 1.2D + 1.5Lm_1 +... | Yes | Y | | DL | 1.2 | 6 | .056 | 22 | .056 | OL1 | 1.5 | | | | | | | | | | | | | | |
| 38 | 1.2D + 1.5Lm_1 +... | Yes | Y | | DL | 1.2 | 7 | .056 | 23 | .056 | OL1 | 1.5 | | | | | | | | | | | | | | |
| 39 | 1.2D + 1.5Lm_1 +... | Yes | Y | | DL | 1.2 | 8 | .056 | 24 | .056 | OL1 | 1.5 | | | | | | | | | | | | | | |
| 40 | 1.2D + 1.5Lm_1 +... | Yes | Y | | DL | 1.2 | 9 | .056 | 25 | .056 | OL1 | 1.5 | | | | | | | | | | | | | | |
| 41 | 1.2D + 1.5Lm_1 +... | Yes | Y | | DL | 1.2 | 10 | .056 | 26 | .056 | OL1 | 1.5 | | | | | | | | | | | | | | |
| 42 | 1.2D + 1.5Lm_1 +... | Yes | Y | | DL | 1.2 | 11 | .056 | 27 | .056 | OL1 | 1.5 | | | | | | | | | | | | | | |
| 43 | 1.2D + 1.5Lm_1 +... | Yes | Y | | DL | 1.2 | 4 | -.056 | 20 | -.056 | OL1 | 1.5 | | | | | | | | | | | | | | |
| 44 | 1.2D + 1.5Lm_1 +... | Yes | Y | | DL | 1.2 | 5 | -.056 | 21 | -.056 | OL1 | 1.5 | | | | | | | | | | | | | | |
| 45 | 1.2D + 1.5Lm_1 +... | Yes | Y | | DL | 1.2 | 6 | -.056 | 22 | -.056 | OL1 | 1.5 | | | | | | | | | | | | | | |
| 46 | 1.2D + 1.5Lm_1 +... | Yes | Y | | DL | 1.2 | 7 | -.056 | 23 | -.056 | OL1 | 1.5 | | | | | | | | | | | | | | |
| 47 | 1.2D + 1.5Lm_1 +... | Yes | Y | | DL | 1.2 | 8 | -.056 | 24 | -.056 | OL1 | 1.5 | | | | | | | | | | | | | | |
| 48 | 1.2D + 1.5Lm_1 +... | Yes | Y | | DL | 1.2 | 9 | -.056 | 25 | -.056 | OL1 | 1.5 | | | | | | | | | | | | | | |
| 49 | 1.2D + 1.5Lm_1 +... | Yes | Y | | DL | 1.2 | 10 | -.056 | 26 | -.056 | OL1 | 1.5 | | | | | | | | | | | | | | |
| 50 | 1.2D + 1.5Lm_1 +... | Yes | Y | | DL | 1.2 | 11 | -.056 | 27 | -.056 | OL1 | 1.5 | | | | | | | | | | | | | | |
| 51 | 1.2D + 1.5Lm_2 +... | Yes | Y | | DL | 1.2 | 4 | .056 | 20 | .056 | OL2 | 1.5 | | | | | | | | | | | | | | |
| 52 | 1.2D + 1.5Lm_2 +... | Yes | Y | | DL | 1.2 | 5 | .056 | 21 | .056 | OL2 | 1.5 | | | | | | | | | | | | | | |
| 53 | 1.2D + 1.5Lm_2 +... | Yes | Y | | DL | 1.2 | 6 | .056 | 22 | .056 | OL2 | 1.5 | | | | | | | | | | | | | | |
| 54 | 1.2D + 1.5Lm_2 +... | Yes | Y | | DL | 1.2 | 7 | .056 | 23 | .056 | OL2 | 1.5 | | | | | | | | | | | | | | |
| 55 | 1.2D + 1.5Lm_2 +... | Yes | Y | | DL | 1.2 | 8 | .056 | 24 | .056 | OL2 | 1.5 | | | | | | | | | | | | | | |
| 56 | 1.2D + 1.5Lm_2 +... | Yes | Y | | DL | 1.2 | 9 | .056 | 25 | .056 | OL2 | 1.5 | | | | | | | | | | | | | | |
| 57 | 1.2D + 1.5Lm_2 +... | Yes | Y | | DL | 1.2 | 10 | .056 | 26 | .056 | OL2 | 1.5 | | | | | | | | | | | | | | |
| 58 | 1.2D + 1.5Lm_2 +... | Yes | Y | | DL | 1.2 | 11 | .056 | 27 | .056 | OL2 | 1.5 | | | | | | | | | | | | | | |
| 59 | 1.2D + 1.5Lm_2 +... | Yes | Y | | DL | 1.2 | 4 | -.056 | 20 | -.056 | OL2 | 1.5 | | | | | | | | | | | | | | |
| 60 | 1.2D + 1.5Lm_2 +... | Yes | Y | | DL | 1.2 | 5 | -.056 | 21 | -.056 | OL2 | 1.5 | | | | | | | | | | | | | | |
| 61 | 1.2D + 1.5Lm_2 +... | Yes | Y | | DL | 1.2 | 6 | -.056 | 22 | -.056 | OL2 | 1.5 | | | | | | | | | | | | | | |

## Load Combinations (Continued)

| | Description | Solve | PDe.. | SRSS | BLC | Fac.. | BLC | Fac.. | BLC | Fac.. | BLC | Fac.. | BLC | Fac.. | BLC | Fac.. | BLC | Fac.. | BLC | Fac.. | BLC | Fac.. | BLC | Fac.. | BLC | Fac... |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 62 | 1.2D + 1.5Lm_2 +... | Yes | Y | | DL | 1.2 | 7 | -.056 | 23 | -.056 | OL2 | 1.5 | | | | | | | | | | | | | | |
| 63 | 1.2D + 1.5Lm_2 +... | Yes | Y | | DL | 1.2 | 8 | -.056 | 24 | -.056 | OL2 | 1.5 | | | | | | | | | | | | | | |
| 64 | 1.2D + 1.5Lm_2 +... | Yes | Y | | DL | 1.2 | 9 | -.056 | 25 | -.056 | OL2 | 1.5 | | | | | | | | | | | | | | |
| 65 | 1.2D + 1.5Lm_2 +... | Yes | Y | | DL | 1.2 | 10 | -.056 | 26 | -.056 | OL2 | 1.5 | | | | | | | | | | | | | | |
| 66 | 1.2D + 1.5Lm_2 +... | Yes | Y | | DL | 1.2 | 11 | -.056 | 27 | -.056 | OL2 | 1.5 | | | | | | | | | | | | | | |
| 67 | 1.2D + 1.5Lm_3 +... | Yes | Y | | DL | 1.2 | 4 | .056 | 20 | .056 | OL3 | 1.5 | | | | | | | | | | | | | | |
| 68 | 1.2D + 1.5Lm_3 +... | Yes | Y | | DL | 1.2 | 5 | .056 | 21 | .056 | OL3 | 1.5 | | | | | | | | | | | | | | |
| 69 | 1.2D + 1.5Lm_3 +... | Yes | Y | | DL | 1.2 | 6 | .056 | 22 | .056 | OL3 | 1.5 | | | | | | | | | | | | | | |
| 70 | 1.2D + 1.5Lm_3 +... | Yes | Y | | DL | 1.2 | 7 | .056 | 23 | .056 | OL3 | 1.5 | | | | | | | | | | | | | | |
| 71 | 1.2D + 1.5Lm_3 +... | Yes | Y | | DL | 1.2 | 8 | .056 | 24 | .056 | OL3 | 1.5 | | | | | | | | | | | | | | |
| 72 | 1.2D + 1.5Lm_3 +... | Yes | Y | | DL | 1.2 | 9 | .056 | 25 | .056 | OL3 | 1.5 | | | | | | | | | | | | | | |
| 73 | 1.2D + 1.5Lm_3 +... | Yes | Y | | DL | 1.2 | 10 | .056 | 26 | .056 | OL3 | 1.5 | | | | | | | | | | | | | | |
| 74 | 1.2D + 1.5Lm_3 +... | Yes | Y | | DL | 1.2 | 11 | .056 | 27 | .056 | OL3 | 1.5 | | | | | | | | | | | | | | |
| 75 | 1.2D + 1.5Lm_3 +... | Yes | Y | | DL | 1.2 | 4 | -.056 | 20 | -.056 | OL3 | 1.5 | | | | | | | | | | | | | | |
| 76 | 1.2D + 1.5Lm_3 +... | Yes | Y | | DL | 1.2 | 5 | -.056 | 21 | -.056 | OL3 | 1.5 | | | | | | | | | | | | | | |
| 77 | 1.2D + 1.5Lm_3 +... | Yes | Y | | DL | 1.2 | 6 | -.056 | 22 | -.056 | OL3 | 1.5 | | | | | | | | | | | | | | |
| 78 | 1.2D + 1.5Lm_3 +... | Yes | Y | | DL | 1.2 | 7 | -.056 | 23 | -.056 | OL3 | 1.5 | | | | | | | | | | | | | | |
| 79 | 1.2D + 1.5Lm_3 +... | Yes | Y | | DL | 1.2 | 8 | -.056 | 24 | -.056 | OL3 | 1.5 | | | | | | | | | | | | | | |
| 80 | 1.2D + 1.5Lm_3 +... | Yes | Y | | DL | 1.2 | 9 | -.056 | 25 | -.056 | OL3 | 1.5 | | | | | | | | | | | | | | |
| 81 | 1.2D + 1.5Lm_3 +... | Yes | Y | | DL | 1.2 | 10 | -.056 | 26 | -.056 | OL3 | 1.5 | | | | | | | | | | | | | | |
| 82 | 1.2D + 1.5Lm_3 +... | Yes | Y | | DL | 1.2 | 11 | -.056 | 27 | -.056 | OL3 | 1.5 | | | | | | | | | | | | | | |

## Hot Rolled Steel Properties

| | Label | E [ksi] | G [ksi] | Nu | Therm (\1... | Density[k/ft... | Yield[ksi] | Ry | Fu[ksi] | Rt |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | A992 | 29000 | 11154 | .3 | .65 | .49 | 50 | 1.1 | 65 | 1.1 |
| 2 | A36 Gr.36 | 29000 | 11154 | .3 | .65 | .49 | 36 | 1.5 | 58 | 1.2 |
| 3 | A572 Gr.50 | 29000 | 11154 | .3 | .65 | .49 | 50 | 1.1 | 65 | 1.1 |
| 4 | A500 Gr.B RND | 29000 | 11154 | .3 | .65 | .527 | 42 | 1.4 | 58 | 1.3 |
| 5 | A500 Gr.B Rect | 29000 | 11154 | .3 | .65 | .527 | 46 | 1.4 | 58 | 1.3 |
| 6 | A53 Gr.B | 29000 | 11154 | .3 | .65 | .49 | 35 | 1.6 | 60 | 1.2 |
| 7 | A1085 | 29000 | 11154 | .3 | .65 | .49 | 50 | 1.4 | 65 | 1.3 |

## Hot Rolled Steel Section Sets

| | Label | Shape | Type | Design List | Material | Design Ru... | A [in2] | Iyy [in4] | Izz [in4] | J [in4] |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Standoff Arm | HSS4X4X3 | Beam | Tube | A36 Gr.36 | Typical | 2.58 | 6.21 | 6.21 | 10 |
| 2 | Standoff Pipe | PIPE_3.5 | Column | Pipe | A53 Gr.B | Typical | 2.5 | 4.52 | 4.52 | 9.04 |
| 3 | Face Horizontal | HSS3.500X0.2... | Beam | Pipe | A36 Gr.36 | Typical | 2.39 | 3.21 | 3.21 | 6.41 |
| 4 | Mount Pipe | PIPE_2.0 | Column | Pipe | A53 Gr.B | Typical | 1.02 | .627 | .627 | 1.25 |
| 5 | MOD PRK | L2.5x2.5x3 | Beam | Single An... | A36 Gr.36 | Typical | .901 | .535 | .535 | .011 |

## Hot Rolled Steel Design Parameters

| | Label | Shape | Length[in] | Lbyy[in] | Lbzz[in] | Lcomp top[... | Lcomp... | L-tor... | Kyy | Kzz | Cb | Functi... |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | M12 | Standoff Arm | 48 | | | Lbyy | | | | | | Lateral |
| 2 | M13 | Standoff Pipe | 18 | | | | | | | | | Lateral |
| 3 | M14 | Face Horizontal | 174 | | | Lbyy | | | | | | Lateral |
| 4 | M15 | Mount Pipe | 72 | | | | | | | | | Lateral |
| 5 | M16 | Mount Pipe | 108 | | | | | | | | | Lateral |

## Hot Rolled Steel Design Parameters (Continued)

| | Label | Shape | Length[in] | Lbyy[in] | Lbzz[in] | Lcomp top[... | Lcomp... | L-tor... | Kyy | Kzz | Cb | Functi... |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | M17 | Mount Pipe | 72 | | | | | | | | | Lateral |
| 7 | M18 | Mount Pipe | 72 | | | | | | | | | Lateral |
| 8 | M32 | MOD PRK | 65.521 | | | Lbyy | | | | | | Lateral |
| 9 | M33 | MOD PRK | 65.521 | | | Lbyy | | | | | | Lateral |

## Envelope Joint Reactions

| | Joint | | X [lb] | LC | Y [lb] | LC | Z [lb] | LC | MX [lb-ft] | LC | MY [lb-ft] | LC | MZ [lb-ft] | LC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | N2 | max | 171.228 | 3 | 1330.241 | 14 | 776.716 | 27 | 1675.761 | 43 | 1365.28 | 3 | 4938.185 | 14 |
| 2 | | min | -2547.984 | 27 | -1637.764 | 6 | 38.713 | 3 | -740.952 | 67 | -4825.987 | 27 | -4911.561 | 6 |
| 3 | N52 | max | 2408.535 | 19 | 654.162 | 5 | 1545.425 | 19 | 154.453 | 5 | -86.614 | 11 | 56.058 | 13 |
| 4 | | min | 493.378 | 11 | -345.996 | 13 | 345.45 | 11 | -83.404 | 13 | -385.839 | 19 | -89.14 | 6 |
| 5 | Totals: | max | 1542.749 | 3 | 1034.357 | 15 | 2195.263 | 27 | | | | | | |
| 6 | | min | -1542.692 | 11 | -1034.352 | 7 | 747.484 | 1 | | | | | | |

## Envelope AISC 14th(360-10): LRFD Steel Code Checks

| | Member | Shape | Code Ch... | Loc[in] | LC | Shear ... | Loc[in] | ... | LC | phi*Pnc ... | phi*Pnt [... | phi*Mn y-y [... | phi*Mn z... | Cb | Eqn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | M12 | HSS4X4X3 | .869 | 0 | 12 | .229 | 0 | z | 42 | 79483.9... | 83592 | 9909 | 9909 | 1.237 | H1-1b |
| 2 | M16 | PIPE_2.0 | .756 | 59.116 | 11 | .062 | 59.116 | | 9 | 12143.9... | 32130 | 1871.625 | 1871.625 | 1.628 | H1-1b |
| 3 | M14 | HSS3.500... | .696 | 93.411 | 26 | .315 | 93.411 | | 11 | 23952.2... | 77436 | 6723 | 6723 | 2.22 | H1-1b |
| 4 | M15 | PIPE_2.0 | .372 | 59.874 | 11 | .069 | 59.874 | | 7 | 20866.7... | 32130 | 1871.625 | 1871.625 | 1.672 | H1-1b |
| 5 | M18 | PIPE_2.0 | .349 | 59.874 | 11 | .067 | 59.874 | | 15 | 20866.7... | 32130 | 1871.625 | 1871.625 | 1.762 | H1-1b |
| 6 | M33 | L2.5x2.5x3 | .239 | 32.416 | 22 | .024 | 65.521 | z | 44 | 11015.3... | 29192.4 | 872.574 | 1624.554 | 1.14 | H2-1 |
| 7 | M13 | PIPE_3.5 | .197 | 8.905 | 11 | .282 | 8.905 | | 42 | 78031.0... | 78750 | 7953.75 | 7953.75 | 1.528 | H1-1b |
| 8 | M32 | L2.5x2.5x3 | .177 | 33.105 | 31 | .016 | 0 | z | 68 | 11015.3... | 29192.4 | 872.574 | 1624.554 | 1.14 | H2-1 |
| 9 | M17 | PIPE_2.0 | .058 | 59.874 | 11 | .004 | 59.874 | | 11 | 20866.7... | 32130 | 1871.625 | 1871.625 | 1.479 | H1-1b |

EBI Consulting

environmental | engineering | due diligence

# RADIO FREQUENCY EMISSIONS ANALYSIS REPORT
# EVALUATION OF HUMAN EXPOSURE POTENTIAL TO NON-IONIZING EMISSIONS

T-Mobile Existing Facility

Site ID: CTNH808A

Amtrak_Madison
15 Orchard Park Road
Madison, Connecticut 06443

**May 30, 2019**

**EBI Project Number: 6219001996**

| **Site Compliance Summary** | |
|---|---|
| Compliance Status: | **COMPLIANT** |
| Site total MPE% of FCC general population allowable limit: | **14.77%** |

May 30, 2019

T-Mobile
Attn: Jason Overbey, RF Manager
35 Griffin Road South
Bloomfield, Connecticut 06002

Emissions Analysis for Site: CTNH808A - Amtrak_Madison

EBI Consulting was directed to analyze the proposed T-Mobile facility located at **15 Orchard Park Road** in **Madison, Connecticut** for the purpose of determining whether the emissions from the Proposed T-Mobile Antenna Installation located on this property are within specified federal limits.

All information used in this report was analyzed as a percentage of current Maximum Permissible Exposure (% MPE) as listed in the FCC OET Bulletin 65 Edition 97-01and ANSI/IEEE Std C95.1. The FCC regulates Maximum Permissible Exposure in units of microwatts per square centimeter ($\mu W/cm^2$). The number of $\mu W/cm^2$ calculated at each sample point is called the power density. The exposure limit for power density varies depending upon the frequencies being utilized. Wireless Carriers and Paging Services use different frequency bands each with different exposure limits; therefore, it is necessary to report results and limits in terms of percent MPE rather than power density.

All results were compared to the FCC (Federal Communications Commission) radio frequency exposure rules, 47 CFR 1.1307(b)(1) – (b)(3), to determine compliance with the Maximum Permissible Exposure (MPE) limits for General Population/Uncontrolled environments as defined below.

General population/uncontrolled exposure limits apply to situations in which the general population may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Therefore, members of the general population would always be considered under this category when exposure is not employment related, for example, in the case of a telecommunications tower that exposes persons in a nearby residential area.

Public exposure to radio frequencies is regulated and enforced in units of microwatts per square centimeter ($\mu W/cm^2$). The general population exposure limits for the 600 MHz and 700 MHz frequency bands are approximately 400 $\mu W/cm^2$ and 467 $\mu W/cm^2$, respectively. The general population exposure limit for the 1900 MHz (PCS), 2100 MHz (AWS) and 11 GHz frequency bands is 1000 $\mu W/cm^2$. Because each carrier will be using different frequency bands, and each frequency band has different exposure limits, it is necessary to report percent of MPE rather than power density.

Occupational/controlled exposure limits apply to situations in which persons are exposed as a consequence of their employment and in which those persons who are exposed have been made fully aware of the potential for exposure and can exercise control over their exposure. Occupational/controlled exposure limits also apply where exposure is of a transient nature as a result of incidental passage through a location where exposure levels may be above general population/uncontrolled limits (see below), as long as the exposed person has been made fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Additional details can be found in FCC OET 65.

## CALCULATIONS

Calculations were done for the proposed T-Mobile Wireless antenna facility located at 15 Orchard Park Road in Madison, Connecticut using the equipment information listed below. All calculations were performed per the specifications under FCC OET 65. Since T-Mobile is proposing highly focused directional panel antennas, which project most of the emitted energy out toward the horizon, all calculations were performed assuming a lobe representing the maximum gain of the antenna per the antenna manufacturer's supplied specifications, minus 10 dB for directional panel antennas and 20 dB for highly focused parabolic microwave dishes, was focused at the base of the tower. For this report, the sample point is the top of a 6-foot person standing at the base of the tower.

For all calculations, all equipment was calculated using the following assumptions:

1) 2 LTE channels (600 MHz Band) were considered for each sector of the proposed installation. These Channels have a transmit power of 30 Watts per Channel.

2) 2 LTE channels (700 MHz Band) were considered for each sector of the proposed installation. These Channels have a transmit power of 30 Watts per Channel.

3) 4 GSM channels (PCS Band - 1900 MHz) were considered for each sector of the proposed installation. These Channels have a transmit power of 30 Watts per Channel.

4) 2 UMTS channels (PCS Band - 1900 MHz) were considered for each sector of the proposed installation. These Channels have a transmit power of 30 Watts per Channel.

5) 2 UMTS channels (AWS Band - 2100 MHz) were considered for each sector of the proposed installation. These Channels have a transmit power of 30 Watts per Channel.

6) 2 LTE channels (AWS Band – 2100 MHz) were considered for each sector of the proposed installation. These Channels have a transmit power of 60 Watts per Channel.

7) All radios at the proposed installation were considered to be running at full power and were uncombined in their RF transmissions paths per carrier prescribed configuration. Per FCC OET Bulletin No. 65 - Edition 97-01 recommendations to achieve the maximum anticipated value at each sample point, all power levels emitting from the proposed antenna installation are increased by a factor of 2.56 to account for possible in-phase reflections from the surrounding environment. This is rarely the case, and if so, is never continuous.

8) For the following calculations, the sample point was the top of a 6-foot person standing at the base of the tower. The maximum gain of the antenna per the antenna manufacturer's supplied specifications, minus 10 dB for directional panel antennas and 20 dB for highly focused parabolic microwave dishes, was used in this direction. This value is a very conservative estimate as gain reductions for these particular antennas are typically much higher in this direction.

9) The antennas used in this modeling are the Ericsson AIR 21 for the 1900 MHz / 1900 MHz / 2100 MHz channel(s), the RFS APXVAARR24_43-U-NA20 for the 600 MHz / 700 MHz channel(s), the Ericsson AIR 21 for the 2100 MHz channel(s) in Sector A, the Ericsson AIR 21 for the 1900 MHz / 1900 MHz / 2100 MHz channel(s), the RFS APXVAARR24_43-U-NA20 for the 600 MHz / 700 MHz channel(s), the Ericsson AIR 21 for the 2100 MHz channel(s) in Sector B, the Ericsson AIR 21 for the 1900 MHz / 1900 MHz / 2100 MHz channel(s), the RFS APXVAARR24_43-U-NA20 for the 600 MHz / 700 MHz channel(s), the Ericsson AIR 21 for the 2100 MHz channel(s) in Sector C. This is based on feedback from the carrier with regard to anticipated antenna selection. All Antenna gain values and associated transmit power levels are shown in the Site Inventory and Power Data table below. The maximum gain of the antenna per the antenna manufacturer's supplied specifications, minus 10 dB for directional panel antennas and 20 dB for highly focused parabolic microwave dishes, was used for all calculations. This value is a very conservative estimate as gain reductions for these particular antennas are typically much higher in this direction.

10) The antenna mounting height centerlines of the proposed antennas are 95 and 97 feet above ground level (AGL).

11) Emissions values for additional carriers were taken from the Connecticut Siting Council active database. Values in this database are provided by the individual carriers themselves.

12) All calculations were done with respect to uncontrolled / general population threshold limits.

# T-Mobile Site Inventory and Power Data

| Sector: | A | Sector: | B | Sector: | C |
|---|---|---|---|---|---|
| Antenna #: | **1** | Antenna #: | **1** | Antenna #: | **1** |
| Make / Model: | Ericsson AIR 21 | Make / Model: | Ericsson AIR 21 | Make / Model: | Ericsson AIR 21 |
| Frequency Bands: | 1900 MHz / 1900 MHz / 2100 MHz | Frequency Bands: | 1900 MHz / 1900 MHz / 2100 MHz | Frequency Bands: | 1900 MHz / 1900 MHz / 2100 MHz |
| Gain: | 15.35 dBd / 15.35 dBd / 15.35 dBd | Gain: | 15.35 dBd / 15.35 dBd / 15.35 dBd | Gain: | 15.35 dBd / 15.35 dBd / 15.35 dBd |
| Height (AGL): | 97 feet | Height (AGL): | 97 feet | Height (AGL): | 97 feet |
| Channel Count: | 8 | Channel Count: | 8 | Channel Count: | 8 |
| Total TX Power (W): | 240 Watts | Total TX Power (W): | 240 Watts | Total TX Power (W): | 240 Watts |
| ERP (W): | 8,226.43 | ERP (W): | 8,226.43 | ERP (W): | 8,226.43 |
| Antenna A1 MPE %: | **3.14%** | Antenna B1 MPE %: | **3.14%** | Antenna C1 MPE %: | **3.14%** |
| Antenna #: | **3** | Antenna #: | **3** | Antenna #: | **3** |
| Make / Model: | RFS APXVAARR24_43-U-NA20 | Make / Model: | RFS APXVAARR24_43-U-NA20 | Make / Model: | RFS APXVAARR24_43-U-NA20 |
| Frequency Bands: | 600 MHz / 700 MHz | Frequency Bands: | 600 MHz / 700 MHz | Frequency Bands: | 600 MHz / 700 MHz |
| Gain: | 12.95 dBd / 13.35 dBd | Gain: | 12.95 dBd / 13.35 dBd | Gain: | 12.95 dBd / 13.35 dBd |
| Height (AGL): | 95 feet | Height (AGL): | 95 feet | Height (AGL): | 95 feet |
| Channel Count: | 4 | Channel Count: | 4 | Channel Count: | 4 |
| Total TX Power (W): | 120 Watts | Total TX Power (W): | 120 Watts | Total TX Power (W): | 120 Watts |
| ERP (W): | 2,481.08 | ERP (W): | 2,481.08 | ERP (W): | 2,481.08 |
| Antenna A3 MPE %: | **2.29%** | Antenna B3 MPE %: | **2.29%** | Antenna C3 MPE %: | **2.29%** |
| Antenna #: | **4** | Antenna #: | **4** | Antenna #: | **4** |
| Make / Model: | Ericsson AIR 21 | Make / Model: | Ericsson AIR 21 | Make / Model: | Ericsson AIR 21 |
| Frequency Bands: | 2100 MHz | Frequency Bands: | 2100 MHz | Frequency Bands: | 2100 MHz |
| Gain: | 15.35 dBd | Gain: | 15.35 dBd | Gain: | 15.35 dBd |
| Height (AGL): | 97 feet | Height (AGL): | 97 feet | Height (AGL): | 97 feet |
| Channel Count: | 2 | Channel Count: | 2 | Channel Count: | 2 |
| Total TX Power (W): | 120 Watts | Total TX Power (W): | 120 Watts | Total TX Power (W): | 120 Watts |
| ERP (W): | 4,113.21 | ERP (W): | 4,113.21 | ERP (W): | 4,113.21 |
| Antenna A4 MPE %: | **1.57%** | Antenna B4 MPE %: | **1.57%** | Antenna C4 MPE %: | **1.57%** |

| Site Composite MPE % | |
|---|---|
| **Carrier** | **MPE %** |
| T-Mobile (Max at Sector A): | 7.00% |
| Verizon | 5.59% |
| AT&T | 2.18% |
| **Site Total MPE % :** | 14.77% |

| T-Mobile MPE % Per Sector | |
|---|---|
| T-Mobile Sector A Total: | 7.00% |
| T-Mobile Sector B Total: | 7.00% |
| T-Mobile Sector C Total: | 7.00% |
| | |
| Site Total MPE % : | 14.77% |

## T-Mobile Maximum MPE Power Values (Sector A)

| T-Mobile Frequency Band / Technology (Sector A) | # Channels | Watts ERP (Per Channel) | Height (feet) | Total Power Density (μW/cm²) | Frequency (MHz) | Allowable MPE (μW/cm²) | Calculated % MPE |
|---|---|---|---|---|---|---|---|
| T-Mobile 1900 MHz GSM | 4 | 1028.30 | 97.0 | 15.72 | 1900 MHz GSM | 1000 | 1.57% |
| T-Mobile 1900 MHz UMTS | 2 | 1028.30 | 97.0 | 7.86 | 1900 MHz UMTS | 1000 | 0.79% |
| T-Mobile 2100 MHz UMTS | 2 | 1028.30 | 97.0 | 7.86 | 2100 MHz UMTS | 1000 | 0.79% |
| T-Mobile 600 MHz LTE | 2 | 591.73 | 95.0 | 4.71 | 600 MHz LTE | 400 | 1.18% |
| T-Mobile 700 MHz LTE | 2 | 648.82 | 95.0 | 5.17 | 700 MHz LTE | 467 | 1.11% |
| T-Mobile 2100 MHz LTE | 2 | 2056.61 | 97.0 | 15.72 | 2100 MHz LTE | 1000 | 1.57% |
| | | | | | | **Total:** | **7.00%** |

• NOTE: Totals may vary by approximately 0.01% due to summation of remainders in calculations.

## Summary

All calculations performed for this analysis yielded results that were **within** the allowable limits for general population exposure to RF Emissions.

The anticipated maximum composite contributions from the T-Mobile facility as well as the site composite emissions value with regards to compliance with FCC's allowable limits for general population exposure to RF Emissions are shown here:

| T-Mobile Sector | Power Density Value (%) |
|---|---|
| Sector A: | 7.00% |
| Sector B: | 7.00% |
| Sector C: | 7.00% |
| T-Mobile Maximum MPE % (Sector A): | 7.00% |
| | |
| Site Total: | 14.77% |
| | |
| Site Compliance Status: | **COMPLIANT** |

The anticipated composite MPE value for this site assuming all carriers present is **14.77%** of the allowable FCC established general population limit sampled at the ground level. This is based upon values listed in the Connecticut Siting Council database for existing carrier emissions.

FCC guidelines state that if a site is found to be out of compliance (over allowable thresholds), that carriers over a 5% contribution to the composite value will require measures to bring the site into compliance. For this facility, the composite values calculated were well within the allowable 100% threshold standard per the federal government.

NEIL GUERRIERO
3473040176
TRANSCEND WIRELESS
10 INDUSTRIAL AVE
MAHWAH NJ 07430

**2 LBS**

**1 OF 1**

DWT: 13,11,2

**SHIP TO:**
CONTACTS MANAGEMENT
AMERICAN TOWER CORPORATION
10 PRESIDENTIAL WAY
**WOBURN MA 01801**

**MA 018 9-04**

**UPS 2ND DAY AIR**

**2**

TRACKING #: 1Z V25 742 02 9868 8070

BILLING: P/P

XOL 19.07.33 NV45 15.0A 07/2019

NEIL GUERRIERO
3473040176
TRANSCEND WIRELESS
10 INDUSTRIAL AVE
MAHWAH NJ 07430

**2 LBS**

**1 OF 1**

DWT: 13,11,2

**SHIP TO:**
TOM BANISCH
8 CAMPUS DRIVE
**MADISON CT 06443**

**CT 065 2-03**

**UPS 2ND DAY AIR** **2**

TRACKING #: 1Z V25 742 02 9640 8054

BILLING: P/P

XOL 19.07.33 NV45 15.0A 07/2019

# View/Print Label

1. **Ensure there are no other shipping or tracking labels attached to your package.** Select the Print button on the print dialogue box that appears. Note: If your browser does not support this function, select Print from the File menu to print the label.

2. **Fold the printed label at the solid line below.** Place the label in a UPS Shipping Pouch. If you do not have a pouch, affix the folded label using clear plastic shipping tape over the entire label.

3. **GETTING YOUR SHIPMENT TO UPS**
   **Customers with a scheduled Pickup**
   - Your driver will pickup your shipment(s) as usual.

   **Customers without a scheduled Pickup**
   - Schedule a Pickup on ups.com to have a UPS driver pickup all of your packages.
   - Take your package to any location of The UPS Store®, UPS Access Point(TM) location, UPS Drop Box, UPS Customer Center, Staples® or Authorized Shipping Outlet near you. To find the location nearest you, please visit the 'Locations' Quick link at ups.com.

UPS Access Point™
THE UPS STORE
115 FRANKLIN TPKE
MAHWAH NJ

UPS Access Point™
THE UPS STORE
120 E MAIN ST
RAMSEY NJ

UPS Access Point™
POSTNET NY137
74 LAFAYETTE AVE
SUFFERN NY

FOLD HERE