Transcend Wireless

10 Industrial Ave,
Suite 3
Mahwah NJ 07430

Phone: 201.684.0055
Fax: 201.684.0066

May 12, 2020

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

T-Mobile Northeast LLC – CTHA524A
Tower Share Application
1542 Boston Post Road, Westbrook, CT 06498
Latitude- 41.2818000000
Longitude- -72.4375000000

Dear Ms. Bachman,

This letter and the attachments are submitted on behalf of T-Mobile Northeast LLC ("T-Mobile"). T-Mobile plans to install antennas and related equipment at the tower site located at 1542 Boston Post Road in Westbrook, Connecticut (also known as 1546 Boston Post Road). This tower was approved by the Connecticut Siting Council via Docket No. 485 on August 25, 2019. The T-Mobile equipment is currently situated on the temporary tower at the same address that was approved by the Siting Council on December 7, 2017 via Petition No. 1330. The T-Mobile equipment on the temporary tower will be removed and relocated.

T-Mobile will install six (6) 600/700/1900/2100 MHz panel antennas, and three (3) RRUs at the 104' level of the existing 130' monopole tower. Three (3) hybrid cables will also be installed. T-Mobile's equipment cabinets will be placed on a new concrete slab within the existing ground facility. The proposed ground equipment will include a 25kw diesel back-up generator. Included are plans by Centek Engineering, dated May 5, 2020, depicting the proposed site and attached as **Exhibit A**. Also included is a structural analysis prepared by Centek Engineering, dated May 5, 2020, confirming that the existing tower is structurally capable of supporting the proposed equipment. This is attached and detailed in **Exhibit B**. Additionally, an analysis of the proposed mounts is attached and incorporated as **Exhibit C**.

Please accept this letter as notification pursuant to Regulations of Connecticut State Agencies 16-50aa, of T-Mobile's intent to share a telecommunications facility pursuant to R.C.S.A. 16-50j-88. In accordance with R.C.S.A., a copy of this letter is being sent to Noel Bishop, First Selectmen of the Town of Westbrook, Eric Knapp, Planning, Zoning & Development Coordinator for the Town of Westbrook, the tower owner, MCM Communications, LLC, and the property owner, Connecticut Water Company. Please see the attached letter from MCM Communications, LLC authorizing the proposed shared use of this facility attached as **Exhibit D**.

The planned modifications of the facility fall squarely within those activities explicitly provided for in R.C.S.A. 16-50j-89.

1. The proposed modification will not result in an increase in the height of the existing structure. The top of the monopole tower is 130'; T-Mobile's proposed antennas will be located at a center line height of 104'.

2. The proposed modifications will not result in the increase of the site boundary, as depicted on the attached site plan.

3. The proposed modifications will not increase noise levels at the facility by six decibels or more, or to levels that exceed local and state criteria. T-Mobile's plans include the installation of an emergency back-up generator; noise associated with this installation is exempt from State and local noise standards. The incremental effect of the proposed changes will be negligible.

4. The operation of the proposed antennas will not increase radio frequency emissions at the facility to a level at or above the Federal Communications Commission safety standard. As indicated in the attached power density calculations, the site operations will result in a total power density of 6.18%, as evidenced by **Exhibit E**.

Connecticut General Statutes 16-50aa indicates that the Council must approve the shared use of a telecommunications facility provided it finds the shared use is technically, legally, environmentally, and economically feasible and meets public safety concerns. As demonstrated in this letter, T-Mobile respectfully submits that the shared use of this facility satisfies these criteria.

A. Technical Feasibility. The existing monopole tower has been deemed structurally capable of supporting T-Mobile's proposed loading. The structural analysis is included as **Exhibit B**.
B. Legal Feasibility. As referenced above, C.G.S. 16-50aa has been authorized to issue orders approving the shared use of an existing tower such as this monopole tower in Westbrook. Under the authority granted to the Council, an order of the Council approving the requested shared use would permit T-Mobile to obtain a building permit for the proposed installation. Further, a Letter of Authorization is included as **Exhibit D**, authorizing T-Mobile to file this application for shared use.
C. Environmental Feasibility. The proposed shared use of this facility would have minimal environmental impact. The installation of T-Mobile equipment at the 104' level of the existing 130' tower would have an insignificant visual impact on the area around the tower. T-Mobile's ground equipment would be installed on a concrete slab within the existing facility compound. T-Mobile's shared use would therefore not cause any significant alteration in the physical or environmental characteristics of the existing site. Additionally, as evidenced by **Exhibit E**, the proposed antennas would not increase radio frequency emissions to a level at or above the Federal Communications Commission safety standard.
D. Economic Feasibility. T-Mobile will be entering into an agreement with the owner of this facility to mutually agreeable terms. As previously mentioned, the Letter of Authorization has been provided by the owner to assist T-Mobile with this tower sharing application.
E. Public Safety Concerns. As discussed above, the monopole tower is structurally capable of supporting T-Mobile's proposed loading. T-Mobile is not aware of any public safety concerns relative to the proposed sharing of the existing tower. T-Mobile's intentions of providing new and improved wireless service through the shared use of this facility is expected to enhance the safety and welfare of local residents and individuals traveling through Westbrook and nearby the facility.

Sincerely,

*Kyle Richers*

Kyle Richers
Transcend Wireless
10 Industrial Ave., Suite 3
Mahwah, New Jersey
krichers@transcendwireless.com
908-447-4716

CC: Noel Bishop- First Selectmen
Eric Knapp- Zoning Official
MCM Communications, LLC- Tower Owner
Connecticut Water Company- Property Owner

**UPS Internet Shipping: View/Print Label**

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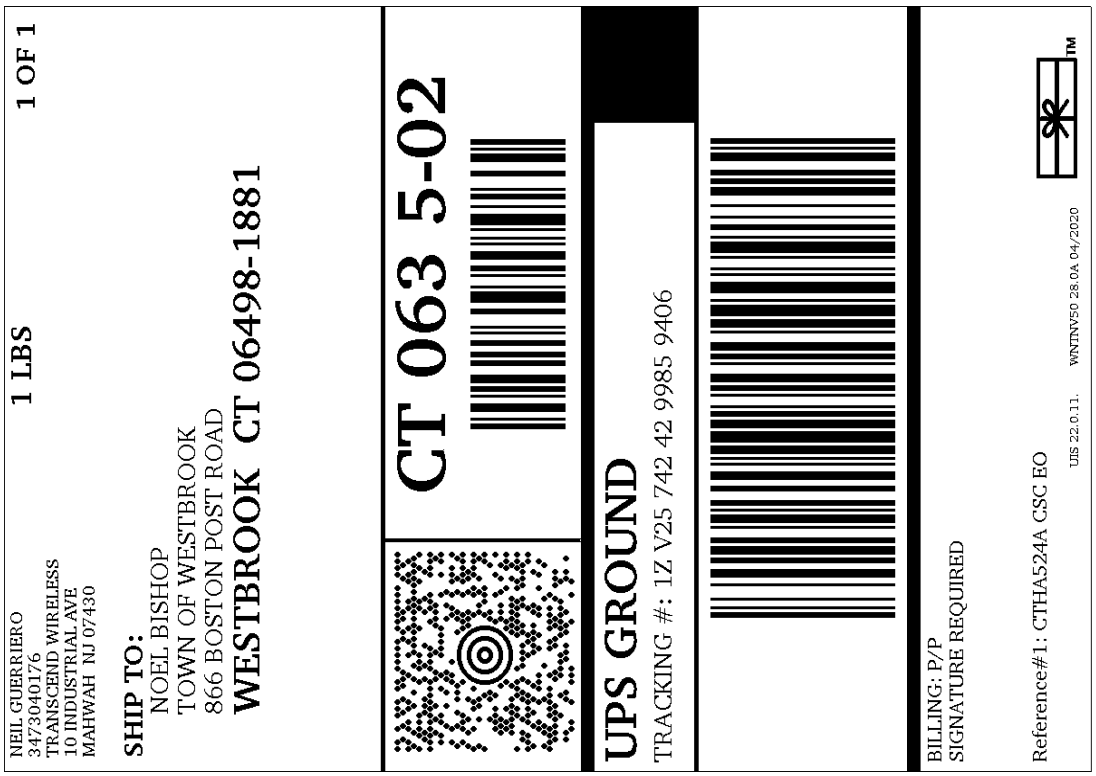

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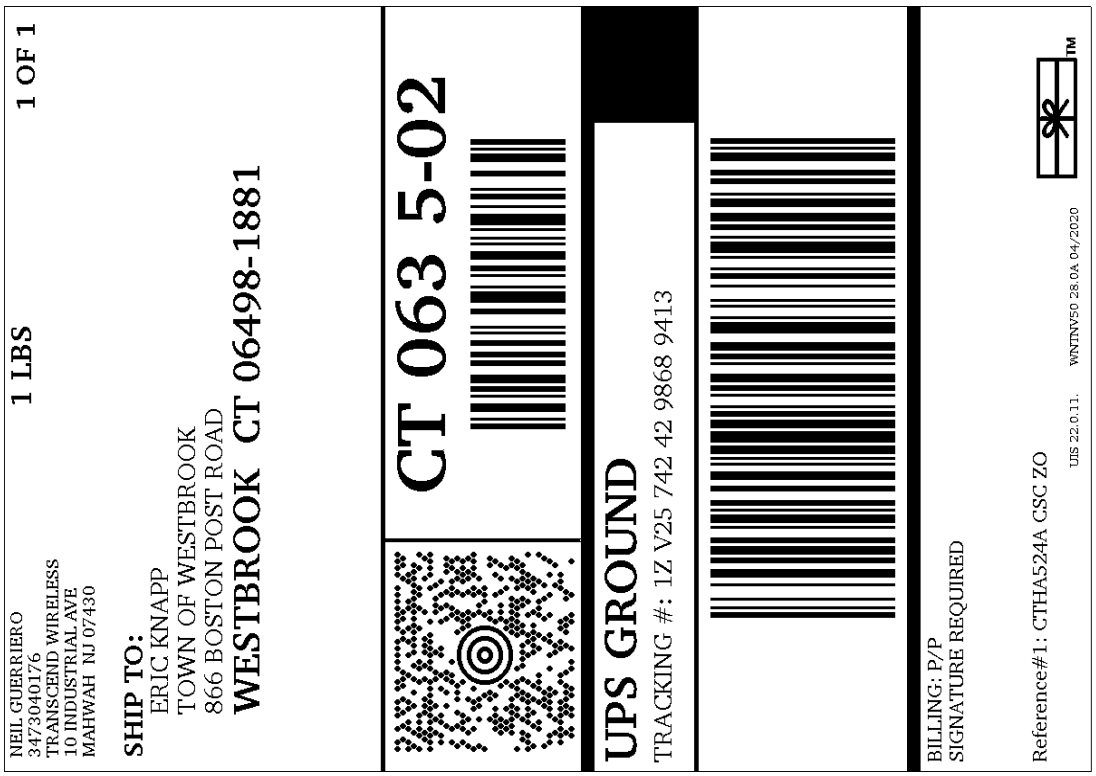

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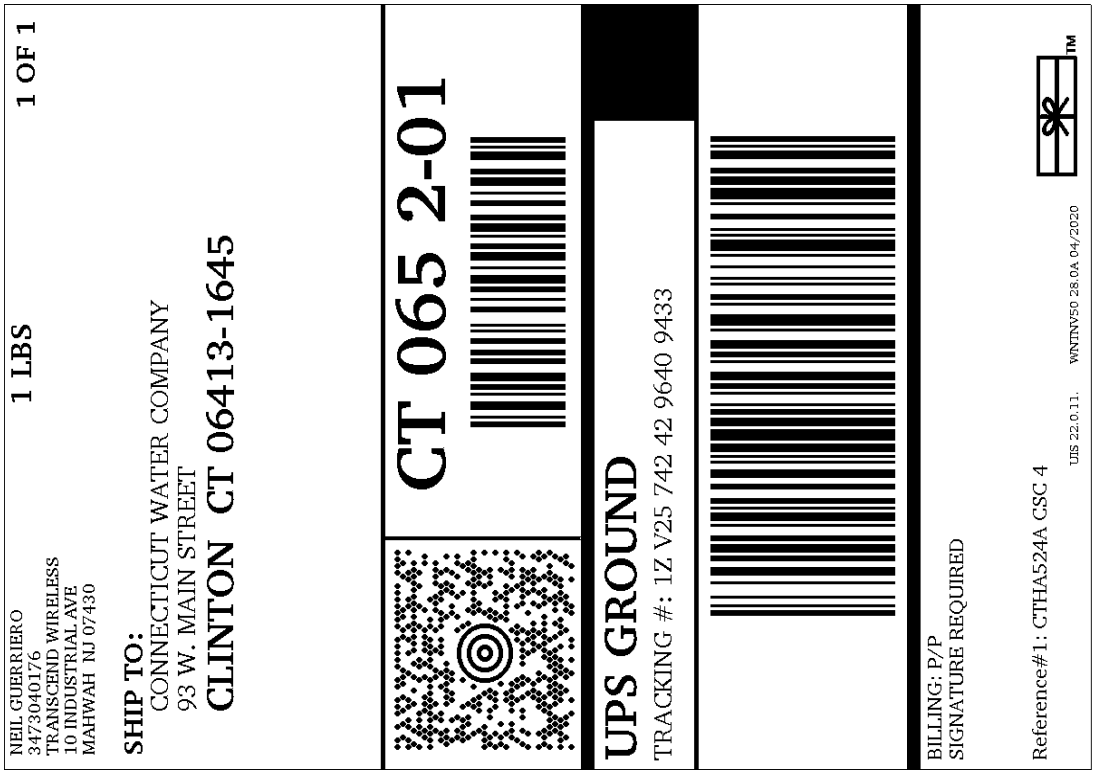


# 1542 BOSTON POST RD

| | | | |
|---|---|---|---|
| **Location** | 1542 BOSTON POST RD | **Mblu** | 182/ / 007/ / |
| **Acct#** | C0071600 | **Owner** | CONN WATER CO |
| **Assessment** | $325,720 | **Appraisal** | $465,300 |
| **PID** | 770 | **Building Count** | 1 |

### Current Value

| Appraisal | | | |
|---|---|---|---|
| **Valuation Year** | **Improvements** | **Land** | **Total** |
| 2016 | $64,020 | $401,280 | $465,300 |
| **Assessment** | | | |
| **Valuation Year** | **Improvements** | **Land** | **Total** |
| 2016 | $44,820 | $280,900 | $325,720 |

### Owner of Record

| | | | |
|---|---|---|---|
| **Owner** | CONN WATER CO | **Sale Price** | $0 |
| **Co-Owner** | | **Certificate** | |
| **Address** | 93 W MAIN ST<br>CLINTON, CT 06413 | **Book & Page** | 15/287 |
| | | **Sale Date** | 01/01/1901 |
| | | **Instrument** | 25 |

### Ownership History

| Ownership History | | | | | |
|---|---|---|---|---|---|
| **Owner** | **Sale Price** | **Certificate** | **Book & Page** | **Instrument** | **Sale Date** |
| CONN WATER CO | $0 | | 15/287 | 25 | 01/01/1901 |

### Building Information

#### Building 1 : Section 1

**Year Built:**
**Living Area:** 0
**Replacement Cost:** $0
**Building Percent Good:**
**Replacement Cost Less Depreciation:** $0

| Building Attributes |
|---|

| Field | Description |
|---|---|
| Style | Vacant Commercial |
| Model | |
| Grade: | |
| 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: | |
| Full Bthrms: | |
| Half Baths: | |
| Extra Fixtures | |
| Total Rooms: | |
| Bath Style: | |
| Kitchen Style: | |
| Extra Kitchens | |
| Fireplace(s) | |
| Usrfld 103 | |
| Gas Fireplace(s) | |
| Stacks | |
| Bsmt Garage(s) | |
| Usrfld 107 | |
| Callback | |
| Fireplaces | |
| Fin Bsmnt | |
| Fin Bsmnt Qual | |
| Bsmt Heat | |
| Int Vs Ext | |
| Usrfld 300 | |
| Usrfld 301 | |

## Building Photo

(http://images.vgsi.com/photos2/WestbrookCTPhotos//\00\00\84\50.jpg)

## Building Layout

(http://images.vgsi.com/photos2/WestbrookCTPhotos//Sketches/770_770.j

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

## Extra Features

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

## Land

### Land Use

| | |
|---|---|
| **Use Code** | 200 |
| **Description** | Comm Land |
| **Zone** | NCD |
| **Neighborhood** | BP |
| **Alt Land Appr** | No |
| **Category** | |

### Land Line Valuation

| | |
|---|---|
| **Size (Acres)** | 0.61 |
| **Depth** | |
| **Assessed Value** | $280,900 |
| **Appraised Value** | $401,280 |

## Outbuildings

| Outbuildings | | | | | | | Legend |
|---|---|---|---|---|---|---|---|
| **Code** | **Description** | **Sub Code** | **Sub Description** | **Size** | **Value** | **Bldg #** | **Comment** |
| TCM | Telecomm | | | 360.00 S.F.&HGT | $10,710 | 1 | |
| TCS | Telecomm Site | | | 1.00 UNITS | $540 | 1 | |
| TCS | Telecomm Site | | | 1.00 UNITS | $540 | 1 | |
| TCS | Telecomm Site | | | 1.00 UNITS | $540 | 1 | |
| TCM | Telecomm | | | 1.00 S.F.&HGT | $20 | 1 | |
| TCS | Telecomm Site | | | 0.00 UNITS | $51,670 | 1 | |

## Valuation History

| Appraisal | | | |
|---|---|---|---|
| **Valuation Year** | **Improvements** | **Land** | **Total** |
| 2019 | $64,020 | $401,280 | $465,300 |
| 2018 | $64,020 | $401,280 | $465,300 |
| 2017 | $587,350 | $401,280 | $988,630 |

| Assessment | | | |
|---|---|---|---|
| **Valuation Year** | **Improvements** | **Land** | **Total** |
| 2019 | $44,820 | $280,900 | $325,720 |
| 2018 | $44,820 | $280,900 | $325,720 |
| 2017 | $411,150 | $280,900 | $692,050 |

# CTHA524A


**Property Information**

| | |
|---|---|
| **Property ID** | 182/007 |
| **Location** | 1542 BOSTON POST RD |
| **Owner** | CONN WATER CO |

MAP FOR REFERENCE ONLY
NOT A LEGAL DOCUMENT

Town of Westbrook, CT makes no claims and no warranties, expressed or implied, concerning the validity or accuracy of the GIS data presented on this map.

Geometry updated October 2018
Data updated 11/19/2018

| | | |
|---|---|---|
| **DOCKET NO. 485** – MCM Holdings, LLC and Cellco Partnership d/b/a Verizon Wireless application for a Certificate of Environmental Compatibility and Public Need for the construction, maintenance, and operation of a telecommunications facility at one of two sites: 1542 Boston Post Road or at the end of Kirtland Street, Westbrook, Connecticut. | } | Connecticut |
| | } | Siting |
| | } | Council |

August 15, 2019

**Decision and Order**

Pursuant to Connecticut General Statutes §16-50p, and the foregoing Findings of Fact and Opinion, the Connecticut Siting Council (Council) finds that the effects associated with the construction, maintenance, and operation of a telecommunications facility, including effects on the natural environment, ecological balance, public health and safety, scenic, historic, and recreational values, agriculture, forests and parks, air and water purity, and fish, aquaculture 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 MCM Holdings, LLC, hereinafter referred to as the Certificate Holder, for a telecommunications facility at Site A, located at 1542 Boston Post Road, Westbrook, Connecticut. The Council denies certification of Site B, located at the end of Kirtland Street, Westbrook, Connecticut.

Unless otherwise approved by the Council, the Site A facility shall be constructed, operated, 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 at a height of 130 feet above ground level to provide the proposed wireless services, sufficient to accommodate the antennas of Cellco Partnership d/b/a Verizon Wireless and other entities, both public and private. The height of the tower may be extended after the date of this Decision and Order pursuant to regulations of the Federal Communications Commission.

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 submitted to and approved by the Council prior to the commencement of facility construction and shall include:
    a) final site plan(s) for development of the facility that employ the governing standard in the State of Connecticut for tower design in accordance with the currently adopted International Building Code and include specifications for the tower, tower foundation, antennas and any modifications to the equipment compound including, but not limited to, fencing, radio equipment, access road, utility installation and emergency backup generator;
    b) the tower shall be designed with a yield point to ensure that the tower setback radius remains within the boundaries of the subject property;
    c) construction plans for site clearing, grading, water drainage and stormwater control, and erosion and sedimentation controls consistent with the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control, as amended;
    d) provisions for landscaping;
    e) proposed hours and days of the week for construction activities; and
    f) a schedule for the removal of the existing temporary tower.

3. Prior to the commencement of operation, the Certificate Holder shall 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 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 provide the Council with a copy of necessary permits from any other state or federal agency with concurrent jurisdiction prior to the commencement of construction.

6. 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.

7. Unless otherwise approved by the Council, if the facility authorized herein is not fully constructed with at least one fully operational wireless telecommunications carrier providing wireless service 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. 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.

8. 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 Westbrook.

9. 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 within 90 days from the one year period of cessation of service. The Certificate Holder may submit a written request to the Council for an extension of the 90 day period not later than 60 days prior to the expiration of the 90 day period.

10. Any nonfunctioning antenna, and associated antenna mounting equipment, on this facility shall be removed within 60 days of the date the antenna ceased to function.

11. 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.

12. The Certificate Holder shall remit timely payments associated with annual assessments and invoices submitted by the Council for expenses attributable to the facility under Conn. Gen. Stat. §16-50v.

13. This Certificate may be transferred in accordance with Conn. Gen. Stat. §16-50k(b), provided both the Certificate Holder/transferor and the transferee are current with payments to the Council for their respective annual assessments and invoices under Conn. Gen. Stat. §16-50v. In addition, both the Certificate Holder/transferor and the transferee shall provide the Council a written agreement as to the entity responsible for any quarterly assessment charges under Conn. Gen. Stat. §16-50v(b)(2) that may be associated with this facility.

14. The Certificate Holder shall maintain the facility and associated equipment, including but not limited to, the tower, tower foundation, antennas, equipment compound, radio equipment, access road, utility line and landscaping in a reasonable physical and operational condition that is consistent with this Decision and Order and a Development and Management Plan to be approved by the Council.

15. If the Certificate Holder is a wholly-owned subsidiary of a corporation or other entity and is sold/transferred to another corporation or other entity, the Council shall be notified of such sale and/or transfer and of any change in contact information for the individual or representative responsible for management and operations of the Certificate Holder within 30 days of the sale and/or transfer.

16. This Certificate may be surrendered by the Certificate Holder upon written notification and acknowledgment by the Council.

We hereby direct that a copy of the Findings of Fact, Opinion, and Decision and Order be served on each person listed in the Service List, dated April 4, 2019, and notice of issuance published in the *Harbor News*.

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.

# Exhibit A

## Construction Drawings

# T-Mobile

# *WIRELESS COMMUNICATIONS FACILITY*

# WESTBROOK SOUTH
# SITE ID: CTHA524A
# 1542 BOSTON POST ROAD
# WESTBROOK, CT 06498

## GENERAL NOTES

1. ALL WORK SHALL BE IN ACCORDANCE WITH THE 2015 INTERNATIONAL BUILDING CODE AS MODIFIED BY THE 2018 CONNECTICUT SUPPLEMENT, INCLUDING THE TIA/EIA-222 REVISION "G" "STRUCTURAL STANDARDS FOR STEEL ANTENNA TOWERS AND SUPPORTING STRUCTURES." 2017 CONNECTICUT FIRE SAFETY CODE, NATIONAL ELECTRICAL CODE AND LOCAL CODES.
2. CONTRACTOR SHALL REVIEW ALL DRAWINGS AND SPECIFICATIONS IN THE CONTRACT DOCUMENT SET. CONTRACTOR SHALL COORDINATE ALL WORK SHOWN IN THE SET OF DRAWINGS. THE CONTRACTOR SHALL PROVIDE A COMPLETE SET OF DRAWINGS TO ALL SUBCONTRACTORS AND ALL RELATED PARTIES. THE SUBCONTRACTORS SHALL EXAMINE ALL THE DRAWINGS AND SPECIFICATIONS FOR THE INFORMATION THAT AFFECTS THEIR WORK.
3. CONTRACTOR SHALL PROVIDE A COMPLETE BUILD-OUT WITH ALL FINISHES, STRUCTURAL, MECHANICAL, AND ELECTRICAL COMPONENTS AND PROVIDE ALL ITEMS AS SHOWN OR INDICATED ON THE DRAWINGS OR IN THE WRITTEN SPECIFICATIONS.
4. CONTRACTOR SHALL FURNISH ALL MATERIAL, LABOR AND EQUIPMENT TO COMPLETE THE WORK AND FURNISH A COMPLETED JOB ALL IN ACCORDANCE WITH LOCAL AND STATE GOVERNING AUTHORITIES AND OTHER AUTHORITIES HAVING LAWFUL JURISDICTION OVER THE WORK.
5. CONTRACTOR SHALL SECURE AND PAY FOR ALL PERMITS AND ALL INSPECTIONS REQUIRED AND SHALL ALSO PAY FEES REQUIRED FOR THE GENERAL CONSTRUCTION, PLUMBING, ELECTRICAL AND HVAC. PERMITS SHALL BE PAID FOR BY THE RESPECTIVE SUBCONTRACTORS.
6. CONTRACTOR SHALL MAINTAIN A CURRENT SET OF DRAWINGS AND SPECIFICATIONS ON SITE AT ALL TIMES AND INSURE DISTRIBUTION OF NEW DRAWINGS TO SUBCONTRACTORS AND OTHER RELEVANT PARTIES AS SOON AS THEY ARE MADE AVAILABLE. ALL OLD DRAWINGS SHALL BE MARKED VOID AND REMOVED FROM THE CONTRACT AREA. THE CONTRACTOR SHALL FURNISH AN "AS-BUILT" SET OF DRAWINGS TO OWNER UPON COMPLETION OF PROJECT.
7. LOCATION OF EQUIPMENT, AND WORK SUPPLIED BY OTHERS THAT IS DIAGRAMMATICALLY INDICATED ON THE DRAWINGS SHALL BE DETERMINED BY THE CONTRACTOR. THE CONTRACTOR SHALL DETERMINE LOCATIONS AND DIMENSIONS SUBJECT TO STRUCTURAL CONDITIONS AND WORK OF THE SUBCONTRACTORS.
8. THE CONTRACTOR IS SOLELY RESPONSIBLE TO DETERMINE CONSTRUCTION PROCEDURE AND SEQUENCE, AND TO ENSURE THE SAFETY OF THE EXISTING STRUCTURES AND ITS COMPONENT PARTS DURING CONSTRUCTION. THIS INCLUDES THE ADDITION OF WHATEVER SHORING, BRACING, UNDERPINNING, ETC. THAT MAY BE NECESSARY.
9. DRAWINGS INDICATE THE MINIMUM STANDARDS, BUT IF ANY WORK SHOULD BE INDICATED TO BE SUBSTANDARD TO ANY ORDINANCES, LAWS, CODES, RULES, OR REGULATIONS BEARING ON THE WORK, THE CONTRACTOR SHALL INCLUDE IN HIS WORK AND SHALL EXECUTE THE WORK CORRECTLY IN ACCORDANCE WITH SUCH ORDINANCES, LAWS, CODES, RULES OR REGULATIONS WITH NO INCREASE IN COSTS.
10. ALL UTILITY WORK SHALL BE IN ACCORDANCE WITH LOCAL UTILITY COMPANY REQUIREMENTS AND SPECIFICATIONS.
11. ALL EQUIPMENT AND PRODUCTS PURCHASED ARE TO BE REVIEWED BY CONTRACTOR AND ALL APPLICABLE SUBCONTRACTORS FOR ANY CONDITION PER MFR.'S RECOMMENDATIONS. CONTRACTOR TO SUPPLY THESE ITEMS AT NO COST TO OWNER OR CONSTRUCTION MANAGER.
12. ANY AND ALL ERRORS, DISCREPANCIES, AND "MISSED" ITEMS ARE TO BE BROUGHT TO THE ATTENTION OF THE T-MOBILE CONSTRUCTION MANAGER DURING THE BIDDING PROCESS BY THE CONTRACTOR. ALL THESE ITEMS ARE TO BE INCLUDED IN THE BID. NO 'EXTRA' WILL BE ALLOWED FOR MISSED ITEMS.
13. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL ON-SITE SAFETY FROM THE TIME THE JOB IS AWARDED UNTIL ALL WORK IS COMPLETE AND ACCEPTED BY THE OWNER.
14. CONTRACTOR TO REVIEW ALL SHOP DRAWINGS AND SUBMIT COPY TO ENGINEER FOR APPROVAL. DRAWINGS MUST BEAR THE CHECKER'S INITIALS BEFORE SUBMITTING TO THE CONSTRUCTION MANAGER FOR REVIEW.
15. THE CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS, ELEVATIONS, ANGLES, AND EXISTING CONDITIONS AT THE SITE, PRIOR TO FABRICATION AND/OR INSTALLATION OF ANY WORK IN THE CONTRACT AREA.
16. COORDINATION, LAYOUT, FURNISHING AND INSTALLATION OF CONDUIT AND ALL APPURTENANCES REQUIRED FOR PROPER INSTALLATION OF ELECTRICAL AND TELECOMMUNICATION SERVICE SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR.
17. ALL DAMAGE CAUSED TO ANY EXISTING STRUCTURE SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR WILL BE HELD LIABLE FOR ALL REPAIRS REQUIRED FOR EXISTING STRUCTURES IF DAMAGED DURING CONSTRUCTION ACTIVITIES.
18. THE CONTRACTOR SHALL CONTACT "CALL BEFORE YOU DIG" AT LEAST 48 HOURS PRIOR TO ANY EXCAVATIONS AT 1-800-922-4455. ALL UTILITIES SHALL BE IDENTIFIED AND CLEARLY MARKED. CONTRACTOR SHALL MAINTAIN AND PROTECT MARKED UTILITIES THROUGHOUT PROJECT COMPLETION.
19. CONTRACTOR SHALL COMPLY WITH OWNERS ENVIRONMENTAL ENGINEER ON ALL METHODS AND PROVISIONS FOR ALL EXCAVATION ACTIVITIES INCLUDING SOIL DISPOSAL. ALL BACKFILL MATERIALS TO BE PROVIDED BY THE CONTRACTOR.

## SITE DIRECTIONS

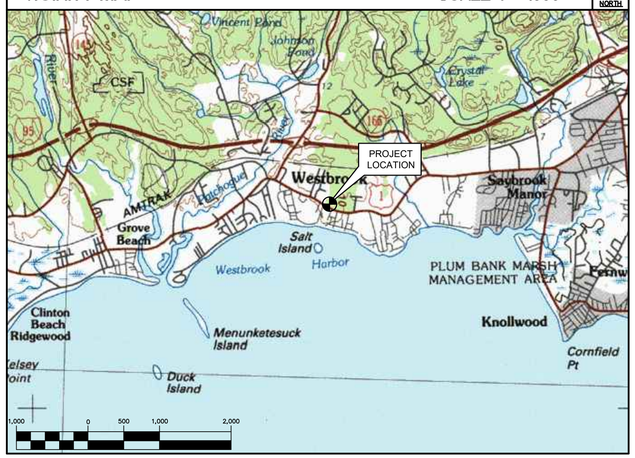
**FROM:** 35 GRIFFIN ROAD SOUTH
BLOOMFIELD, CT 06002

**TO:** 1542 BOSTON POST ROAD
WESTBROOK, CT 06498

| | | |
|---|---|---|
| 1. | HEAD NORTH ON GRIFFIN ROAD S. TOWARD HARTMAN RD. | |
| 2. | TAKE THE 2ND RIGHT ONTO DAY HILL RD. | 0.30 MI. |
| 3. | TAKE THE 1ST RIGHT ONTO BLUE HILLS AVENUE EXT/CT-187. CONTINUE TO FOLLOW CT-187. | 0.14 MI. |
| 4. | STAY STRAIGHT TO GO ONTO BLUE HILLS AVE/CT-187. | 0.64 MI. |
| 5. | TURN LEFT ONTO OLD WINDSOR RD/CT-305. CONTINUE TO FOLLOW CT-305. | 1.24 MI. |
| 6. | MERGE ONTO I-91 S TOWARD HARTFORD. | 2.33 MI. |
| 7. | MERGE ONTO CT-9 S VIA EXIT 22S ON THE LEFT TOWARD MIDDLETOWN/OLD SAYBROOK. | 16.58 MI. |
| 8. | MERGE ONTO I-95 S TOWARD N Y CITY/NEW HAVEN. | 29.24 MI. |
| 9. | TAKE THE CT-166/SPENCER PLAIN ROAD EXIT, EXIT 66. | 3.48 MI. |
| 10. | TURN LEFT ONTO SPENCER PLAIN RD/CT-166. | 0.32 MI. |
| 9. | TURN RIGHT ONTO BOSTON POST RD/US-1 S. | 0.39 MI. |
| 10. | 1542 BOSTON POST RD, WESTBROOK, CT IS ON THE RIGHT. | 1.32 MI. |

## VICINITY MAP

SCALE: 1" = 1000'




## T-MOBILE RF CONFIGURATION

67D97DB_1xAIR+1OP

## PROJECT SUMMARY

1. THE PROPOSED SCOPE OF WORK CONSISTS OF A MODIFICATION TO THE EXISTING UNMANNED TELECOMMUNICATIONS FACILITY INCLUDING THE FOLLOWING:

   A. REMOVE (6) EXISTING ANTENNAS, TYP. (2) PER SECTOR
   B. INSTALL (3) NEW RFS ANTENNAS, TYP. (1) PER SECTOR
   C. INSTALL (3) NEW AIR32 ANTENNAS, TYP. (1) SECTOR
   D. INSTALL (3) NEW RADIO 4449 B71+B12, TYP. (1) PER SECTOR
   E. REMOVE EXISTING ANTENNA MOUNT
   F. INSTALL (1) NEW QUAD ANTENNA MOUNTING PLATFORM
   G. INSTALL (3) NEW 6x12 HYBRID CABLES
   H. REMOVE EXISTING UTILITY CABINET
   I. INSTALL NEW PPC CABINET
   J. REMOVE EXISTING ODE EQUIPMENT CABINET FOR NEW ERICSSON RBS 6102
   K. EXPAND EXISTING CONC. SLAB-ON-GRADE TO A 10'X20' CONC. SLAB-ON-GRADE
   L. INSTALL NEW COAX CABLE ICE BRIDGE
   M. INSTALL NEW AC DC DIESEL GENERATOR

## PROJECT INFORMATION

| | |
|---|---|
| SITE NAME: | WESTBROOK SOUTH |
| SITE ID: | CTHA524A |
| SITE ADDRESS: | 1542 BOSTON POST ROAD<br>WESTBROOK, CT 06498 |
| APPLICANT: | T-MOBILE NORTHEAST, LLC<br>35 GRIFFIN ROAD SOUTH<br>BLOOMFIELD, CT 06002 |
| CONTACT PERSON: | DAN REID (PROJECT MANAGER)<br>TRANSCEND WIRELESS, LLC<br>(203) 592-8291 |
| ENGINEER: | CENTEK ENGINEERING, INC.<br>63-2 NORTH BRANFORD RD.<br>BRANFORD, CT 06405 |
| PROJECT COORDINATES: | LATITUDE: 41°-16'-55.01" N<br>LONGITUDE: 72°-26'-14.78" W<br>GROUND ELEVATION: 50'± AMSL<br><br>SITE COORDINATES AND GROUND ELEVATION REFERENCED FROM GOOGLE EARTH. |

## SHEET INDEX

| SHT. NO. | DESCRIPTION | REV. |
|---|---|---|
| T-1 | TITLE SHEET | C |
| N-1 | GENERAL NOTES AND SPECIFICATIONS | C |
| C-1 | SITE LOCATION PLAN | C |
| C-2 | COMPOUND PLAN AND ELEVATION | C |
| C-3 | EQUIPMENT LAYOUT PLANS | C |
| C-4 | ANTENNA PLANS | C |
| C-5 | DETAILS | C |
| C-6 | DETAILS | C |
| E-1 | TYPICAL ELECTRICAL DETAILS | C |
| E-2 | ELECTRICAL RISER DIAGRAM | C |

| REV. | DATE | DRAWN BY | CHK'D BY | DESCRIPTION |
|---|---|---|---|---|
| C | 05/05/20 | KAW/JR | CAG | PRELIMINARY CDs – REVISED PER CLIENT COMMENTS |
| B | 04/28/20 | KAW/JR | CAG | PRELIMINARY CDs – REVISED PER CLIENT COMMENTS |
| A | 04/15/20 | KAW/JR | CAG | PRELIMINARY CDs – ISSUED FOR CLIENT REVIEW |

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T-MOBILE NORTHEAST LLC
WIRELESS COMMUNICATIONS FACILITY
**WESTBROOK SOUTH**
**SITE ID: CTHA524A**
1542 BOSTON POST ROAD
WESTBROOK, CT 06498

DATE: 04/01/20
SCALE: AS NOTED
JOB NO. 19027.46

TITLE SHEET

**T-1**

## DESIGN BASIS:

GOVERNING CODE: 2015 INTERNATIONAL BUILDING (IBC) AS MODIFIED BY THE 2018 CT STATE BUILDING CODE AND AMENDMENTS.

1. DESIGN CRITERIA:

- RISK CATEGORY: II (BASED ON IBC TABLE 1604.5)
- ULTIMATE DESIGN SPEED (OTHER STRUCTURE): 125 MPH (ULT) (EXPOSURE B/IMPORTANCE FACTOR 1.0 BASED ON ASCE 7-10) PER 2012 INTERNATIONAL BUILDING CODE (IBC) AS MODIFIED BY THE 2016 CONNECTICUT STATE BUILDING CODE.
- SEISMIC LOAD (DOES NOT CONTROL): PER ASCE 7-10 MINIMUM DESIGN LOADS FOR BUILDING AND OTHER STRUCTURES.

## GENERAL NOTES:

1. ALL CONSTRUCTION SHALL BE IN COMPLIANCE WITH THE GOVERNING BUILDING CODE.
2. DRAWINGS INDICATE THE MINIMUM STANDARDS, BUT IF ANY WORK SHOULD BE INDICATED TO BE SUBSTANDARD TO ANY ORDINANCES, LAWS, CODES, RULES, OR REGULATIONS BEARING ON THE WORK, THE CONTRACTOR SHALL INCLUDE IN HIS WORK AND SHALL EXECUTE THE WORK CORRECTLY IN ACCORDANCE WITH SUCH ORDINANCES, LAWS, CODES, RULES OR REGULATIONS WITH NO INCREASE IN COSTS.
3. BEFORE BEGINNING THE WORK, THE CONTRACTOR IS RESPONSIBLE FOR MAKING SUCH INVESTIGATIONS CONCERNING PHYSICAL CONDITIONS (SURFACE AND SUBSURFACE) AT OR CONTIGUOUS TO THE SITE WHICH MAY AFFECT PERFORMANCE AND COST OF THE WORK.
4. DIMENSIONS AND DETAILS SHALL BE CHECKED AGAINST EXISTING FIELD CONDITIONS.
5. THE CONTRACTOR SHALL VERIFY AND COORDINATE THE SIZE AND LOCATION OF ALL OPENINGS, SLEEVES AND ANCHOR BOLTS AS REQUIRED BY ALL TRADES.
6. ALL DIMENSIONS, ELEVATIONS, AND OTHER REFERENCES TO EXISTING STRUCTURES, SURFACE, AND SUBSURFACE CONDITIONS ARE APPROXIMATE. NO GUARANTEE IS MADE FOR THE ACCURACY OR COMPLETENESS OF THE INFORMATION SHOWN. THE CONTRACTOR SHALL VERIFY AND COORDINATE ALL DIMENSIONS, ELEVATIONS, ANGLES WITH EXISTING CONDITIONS AND WITH ARCHITECTURAL AND SITE DRAWINGS BEFORE PROCEEDING WITH ANY WORK.
7. AS THE WORK PROGRESSES, THE CONTRACTOR SHALL NOTIFY THE OWNER OF ANY CONDITIONS WHICH ARE IN CONFLICT OR OTHERWISE NOT CONSISTENT WITH THE CONSTRUCTION DOCUMENTS AND SHALL NOT PROCEED WITH SUCH WORK UNTIL THE CONFLICT IS SATISFACTORILY RESOLVED.
8. THE CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE SAFETY CODES AND REGULATIONS DURING ALL PHASES OF CONSTRUCTION. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR PROVIDING AND MAINTAINING ADEQUATE SHORING, BRACING, AND BARRICADES AS MAY BE REQUIRED FOR THE PROTECTION OF EXISTING PROPERTY, CONSTRUCTION WORKERS, AND FOR PUBLIC SAFETY.
9. THE CONTRACTOR IS SOLELY RESPONSIBLE TO DETERMINE CONSTRUCTION PROCEDURE AND SEQUENCE, AND TO ENSURE THE SAFETY OF THE EXISTING STRUCTURES AND ITS COMPONENT PARTS DURING CONSTRUCTION. THIS INCLUDES THE ADDITION OF WHATEVER SHORING, BRACING, UNDERPINNING, ETC. THAT MAY BE NECESSARY. MAINTAIN EXISTING SITE OPERATIONS, COORDINATE WORK WITH NORTHEAST UTILITIES
10. THE STRUCTURE IS DESIGNED TO BE SELF-SUPPORTING AND STABLE AFTER FOUNDATION REMEDIATION WORK IS COMPLETE. IT IS THE CONTRACTOR'S SOLE RESPONSIBILITY TO DETERMINE ERECTION PROCEDURE AND SEQUENCE AND TO ENSURE THE SAFETY OF THE STRUCTURE AND ITS COMPONENT PARTS DURING ERECTION. THIS INCLUDES THE ADDITION OF WHATEVER SHORING, TEMPORARY BRACING, GUYS OR TIEDOWNS, WHICH MIGHT BE NECESSARY.
11. ALL DAMAGE CAUSED TO ANY EXISTING STRUCTURE SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR WILL BE HELD LIABLE FOR ALL REPAIRS REQUIRED FOR EXISTING STRUCTURES IF DAMAGED DURING CONSTRUCTION ACTIVITIES.
12. SHOP DRAWINGS, CONCRETE MIX DESIGNS, TEST REPORTS, AND OTHER SUBMITTALS PERTAINING TO STRUCTURAL WORK SHALL BE FORWARDED TO THE OWNER FOR REVIEW BEFORE FABRICATION AND/OR INSTALLATION IS MADE. SHOP DRAWINGS SHALL INCLUDE ERECTION DRAWINGS AND COMPLETE DETAILS OF CONNECTIONS AS WELL AS MANUFACTURER'S SPECIFICATION DATA WHERE APPROPRIATE. SHOP DRAWINGS SHALL BE CHECKED BY THE CONTRACTOR AND BEAR THE CHECKER'S INITIALS BEFORE BEING SUBMITTED FOR REVIEW.
13. NO DRILLING WELDING OR TAPING ON EVERSOURCE OWNED EQUIPMENT.
14. REFER TO DRAWING T1 FOR ADDITIONAL NOTES AND REQUIREMENTS.

## STRUCTURAL STEEL

1. ALL STRUCTURAL STEEL IS DESIGNED BY ALLOWABLE STRESS DESIGN (ASD)

   A. STRUCTURAL STEEL (W SHAPES)---ASTM A992 (FY = 50 KSI)
   B. STRUCTURAL STEEL (OTHER SHAPES)---ASTM A36 (FY = 36 KSI)
   C. STRUCTURAL HSS (RECTANGULAR SHAPES)---ASTM A500 GRADE B, (FY = 46 KSI)
   D. STRUCTURAL HSS (ROUND SHAPES)---ASTM A500 GRADE B, (FY = 42 KSI)
   E. PIPE---ASTM A53 (FY = 35 KSI)
   F. CONNECTION BOLTS---ASTM A325-N
   G. U-BOLTS---ASTM A36
   H. ANCHOR RODS---ASTM F 1554
   I. WELDING ELECTRODE---ASTM E 70XX

2. CONTRACTOR TO REVIEW ALL SHOP DRAWINGS AND SUBMIT COPY TO ENGINEER FOR APPROVAL. DRAWINGS MUST BEAR THE CHECKER'S INITIALS BEFORE SUBMITTING TO THE ENGINEER FOR REVIEW. SHOP DRAWINGS SHALL INCLUDE THE FOLLOWING: SECTION PROFILES, SIZES, CONNECTION ATTACHMENTS, REINFORCING, ANCHORAGE, SIZE AND TYPE OF FASTENERS AND ACCESSORIES. INCLUDE ERECTION DRAWINGS, ELEVATIONS AND DETAILS.
3. STRUCTURAL STEEL SHALL BE DETAILED, FABRICATED AND ERECTED IN ACCORDANCE WITH THE LATEST PROVISIONS OF AISC MANUAL OF STEEL CONSTRUCTION.
4. PROVIDE ALL PLATES, CLIP ANGLES, CLOSURE PIECES, STRAP ANCHORS, MISCELLANEOUS PIECES AND HOLES REQUIRED TO COMPLETE THE STRUCTURE.
5. FIT AND SHOP ASSEMBLE FABRICATIONS IN THE LARGEST PRACTICAL SECTIONS FOR DELIVERY TO SITE.
6. INSTALL FABRICATIONS PLUMB AND LEVEL, ACCURATELY FITTED, AND FREE FROM DISTORTIONS OR DEFECTS.
7. AFTER ERECTION OF STRUCTURES, TOUCHUP ALL WELDS, ABRASIONS AND NON-GALVANIZED SURFACES WITH A 95% ORGANIC ZINC RICH PAINT IN ACCORDANCE WITH ASTM 780.
8. ALL STEEL MATERIAL (EXPOSED TO WEATHER) SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123 "ZINC (HOT DIPPED GALVANIZED) COATINGS" ON IRONS AND STEEL PRODUCTS.
9. ALL BOLTS, ANCHORS AND MISCELLANEOUS HARDWARE SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A153 "ZINC COATING (HOT-DIP) ON IRON AND STEEL HARDWARE".
10. THE ENGINEER SHALL BE NOTIFIED OF ANY INCORRECTLY FABRICATED, DAMAGED OR OTHERWISE MISFITTING OR NON CONFORMING MATERIALS OR CONDITIONS TO REMEDIAL OR CORRECTIVE ACTION. ANY SUCH ACTION SHALL REQUIRE ENGINEER REVIEW.
11. CONNECTION ANGLES SHALL HAVE A MINIMUM THICKNESS OF 1/4 INCHES.
12. STRUCTURAL CONNECTION BOLTS SHALL CONFORM TO ASTM A325. ALL BOLTS SHALL BE 3/4" DIAMETER MINIMUM AND SHALL HAVE A MINIMUM OF TWO BOLTS, UNLESS OTHERWISE ON THE DRAWINGS.
13. LOCK WASHER ARE NOT PERMITTED FOR A325 STEEL ASSEMBLIES.
14. SHOP CONNECTIONS SHALL BE WELDED OR HIGH STRENGTH BOLTED.
15. MILL BEARING ENDS OF COLUMNS, STIFFENERS, AND OTHER BEARING SURFACES TO TRANSFER LOAD OVER ENTIRE CROSS SECTION.
16. FABRICATE BEAMS WITH MILL CAMBER UP.
17. LEVEL AND PLUMB INDIVIDUAL MEMBERS OF THE STRUCTURE TO AN ACCURACY OF 1:500, BUT NOT TO EXCEED 1/4" IN THE FULL HEIGHT OF THE COLUMN.
18. COMMENCEMENT OF STRUCTURAL STEEL WORK WITHOUT NOTIFYING THE ENGINEER OF ANY DISCREPANCIES WILL BE CONSIDERED ACCEPTANCE OF PRECEDING WORK.
19. INSPECTION AND TESTING OF ALL WELDING AND HIGH STRENGTH BOLTING SHALL BE PERFORMED BY AN INDEPENDENT TESTING LABORATORY.
20. FOUR COPIES OF ALL INSPECTION TEST REPORTS SHALL BE SUBMITTED TO THE ENGINEER WITHIN TEN (10) WORKING DAYS OF THE DATE OF INSPECTION.

| REV. | DATE | DRAWN BY | CHK'D BY | DESCRIPTION |
|---|---|---|---|---|
| C | 05/05/20 | KAW/JR | CAG | PRELIMINARY CDs - REVISED PER CLIENT COMMENTS |
| B | 04/28/20 | KAW/JR | CAG | PRELIMINARY CDs - REVISED PER CLIENT COMMENTS |
| A | 04/15/20 | KAW/JR | CAG | PRELIMINARY CDs - ISSUED FOR CLIENT REVIEW |

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Transcend Wireless


CENTEK engineering
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T-MOBILE NORTHEAST LLC
WIRELESS COMMUNICATIONS FACILITY

# WESTBROOK SOUTH
# SITE ID: CTHA524A

1542 BOSTON POST ROAD
WESTBROOK, CT 06498

DATE: 04/01/20
SCALE: AS NOTED
JOB NO. 19027.46

GENERAL NOTES AND SPECIFICATIONS

N-1


1 C-1 **SITE LOCATION PLAN**
SCALE: NOT TO SCALE

TRUE NORTH

PROFESSIONAL ENGINEER SEAL

| REV. | DATE | DRAWN BY | CHK'D BY | DESCRIPTION |
|---|---|---|---|---|
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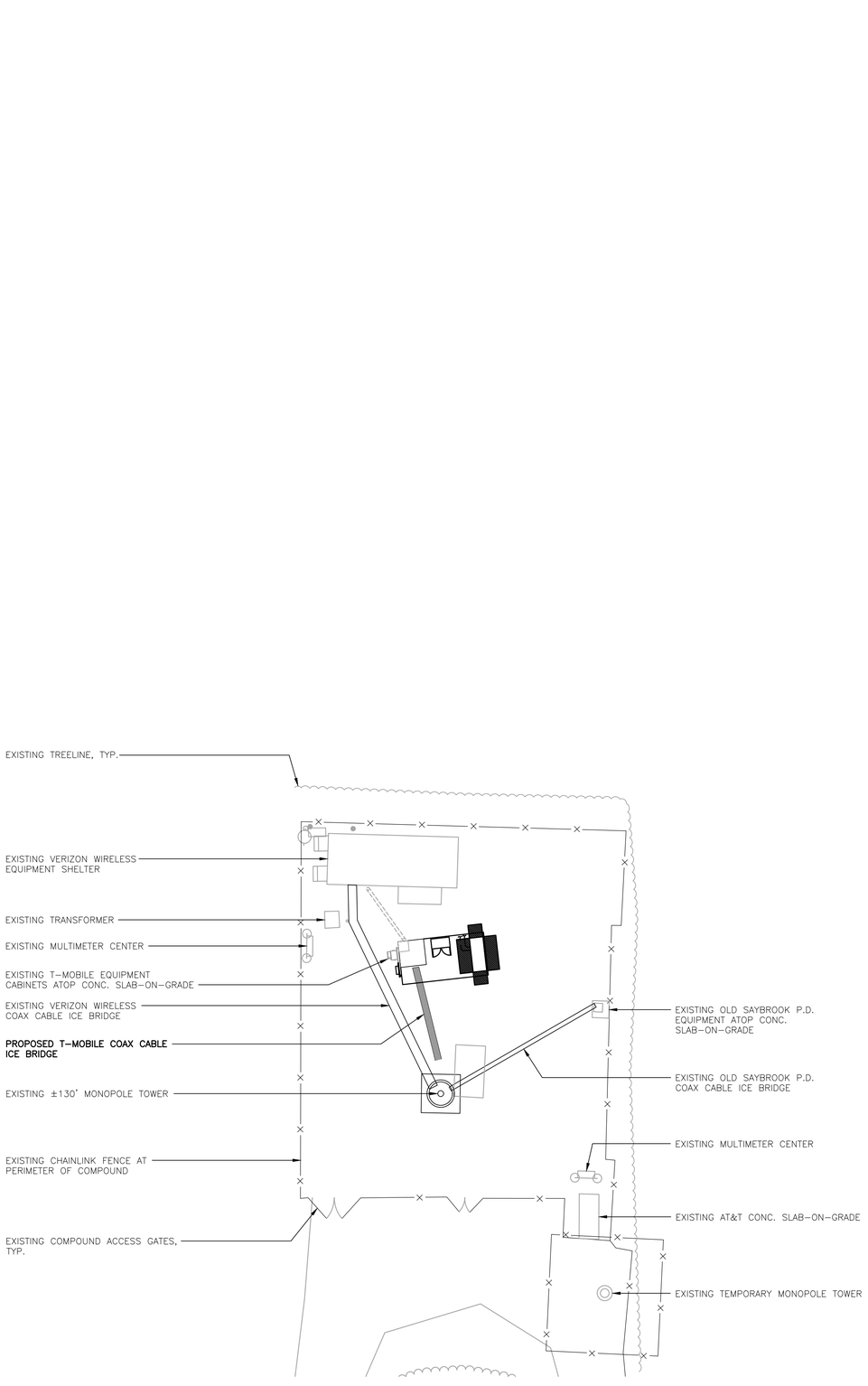
| | |
|---|---|
| DATE: | 04/01/20 |
| SCALE: | AS NOTED |
| JOB NO. | 19027.46 |

SITE LOCATION PLAN

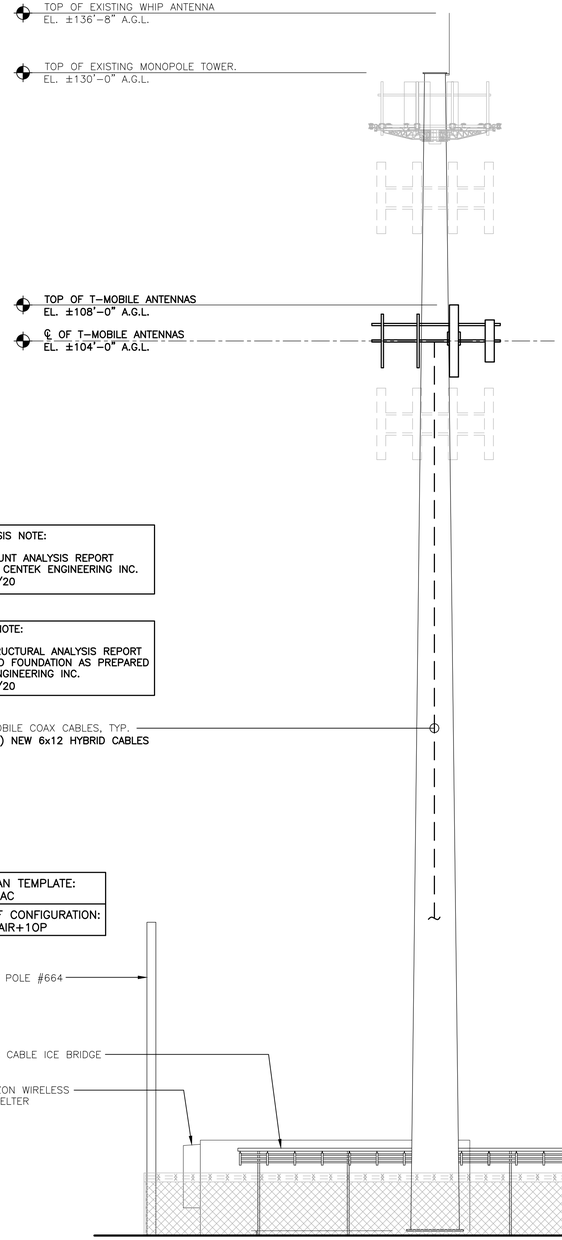
C-1

Sheet No. 3 of 10




1 C–2 **COMPOUND PLAN**
SCALE: 1" = 15'

APPROXIMATE NORTH




MOUNT ANALYSIS NOTE:

REFER TO MOUNT ANALYSIS REPORT PREPARED BY CENTEK ENGINEERING INC. DATED 05/04/20

STRUCTURAL NOTE:

REFER TO STRUCTURAL ANALYSIS REPORT OF TOWER AND FOUNDATION AS PREPARED BY CENTEK ENGINEERING INC. DATED 05/05/20

T–MOBILE RAN TEMPLATE: 67D97DB MUAC

T–MOBILE RF CONFIGURATION: 67D97DB_1xAIR+1OP

NOTE:

ALL CURRENT COAX LINES RAN TO THE TEMP TOWER FROM OUR EXISTING EQUIPMENT NEED TO BE REMOVED

2 C–2 **SOUTH ELEVATION – PROPOSED**
SCALE: 1/8" = 1'–0"

| REV. | DATE | DRAWN BY | CHK'D BY | DESCRIPTION |
|---|---|---|---|---|
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# WESTBROOK SOUTH
## SITE ID: CTHA524A

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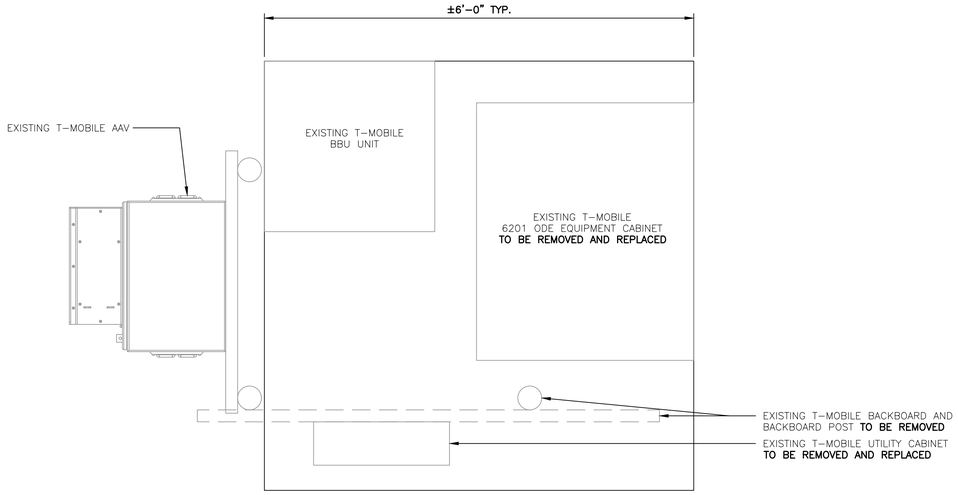
WESTBROOK, CT 06498

DATE: 04/01/20
SCALE: AS NOTED
JOB NO. 19027.46

COMPOUND PLAN & AND ELEVATION

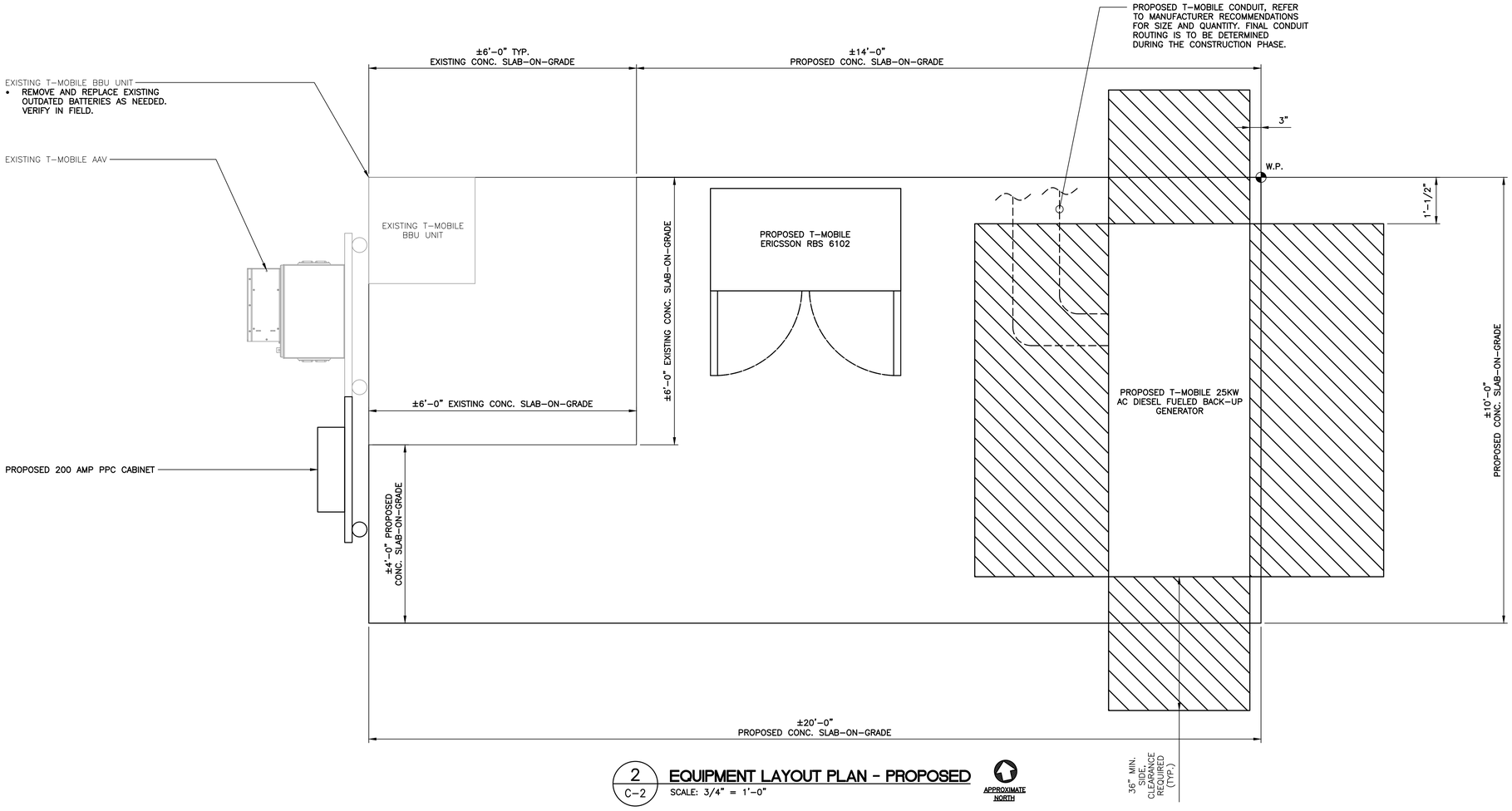
C–2

Sheet No. 4 of 10




1 / C-2 **EQUIPMENT LAYOUT PLAN - EXISTING**
SCALE: 1" = 1'-0"

APPROXIMATE NORTH




2 / C-2 **EQUIPMENT LAYOUT PLAN - PROPOSED**
SCALE: 3/4" = 1'-0"

APPROXIMATE NORTH

| REV. | DATE | DRAWN BY | CHK'D BY | DESCRIPTION |
|---|---|---|---|---|
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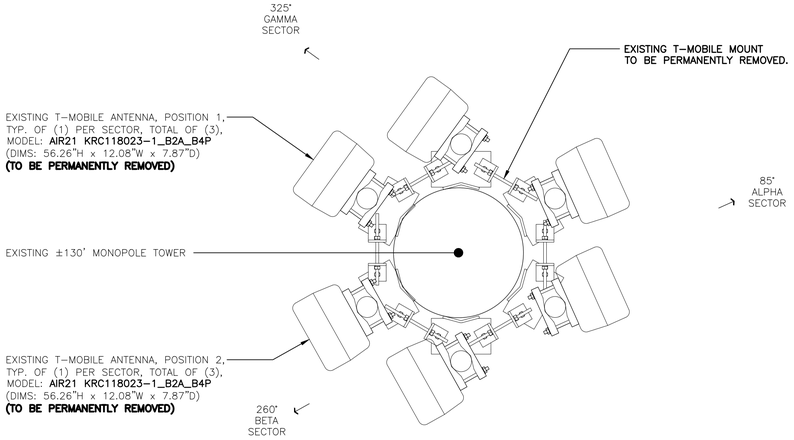
JOB NO. 19027.46

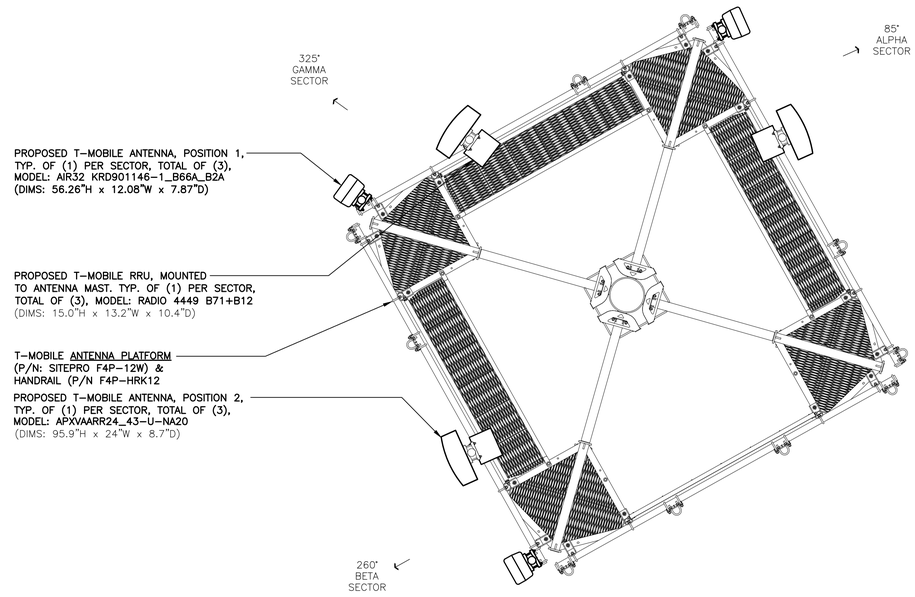
EQUIPMENT PLAN

**C-3**

Sheet No. 5 of 10



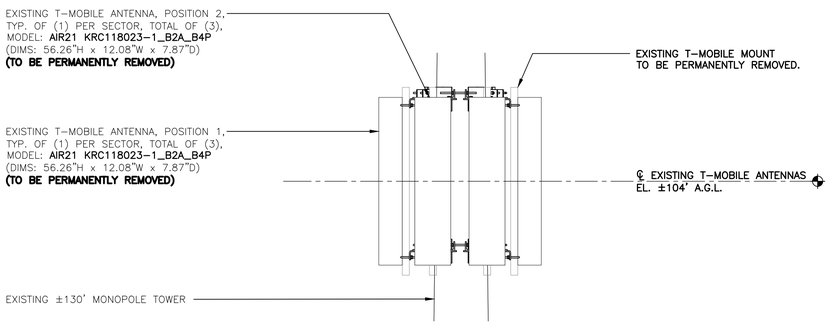

1 C–3 **EXISTING ANTENNA MOUNTING CONFIGURATION TYP.**
SCALE: 1" = 1'–0" **104'–0" ELEVATION**




2 C–3 **PROPOSED ANTENNA MOUNTING CONFIGURATION TYP.**
SCALE: 3/8" = 1'–0" **104'–0" ELEVATION**

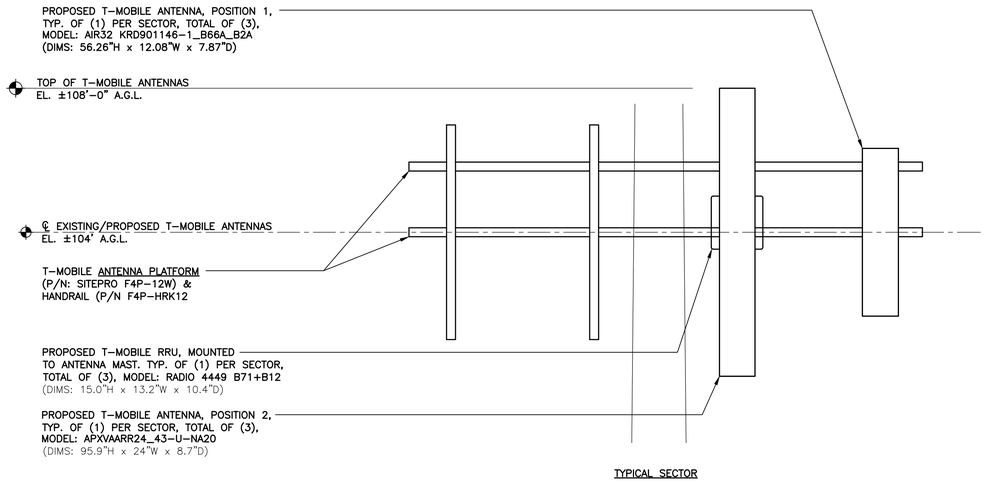
**ADDITIONAL ANTENNA MAST NOTE:**

REPLACE EXISTING PIPE MAST WITH 2" STD (O.D = 2.5") x 8'–0" LONG PIPE @ RFS APXVAARR24_43–U–NA20




TYPICAL SECTOR

3 C–3 **ANTENNA ELEVATION – EXISTING**
SCALE: 1" = 1'–0"




TYPICAL SECTOR

4 C–3 **ANTENNA ELEVATION – PROPOSED**
SCALE: 3/8" = 1'–0"

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|---|---|---|---|---|
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T-MOBILE NORTHEAST LLC
WIRELESS COMMUNICATIONS FACILITY
**WESTBROOK SOUTH**
**SITE ID: CTHA524A**
1542 BOSTON POST ROAD
WESTBROOK, CT 06498

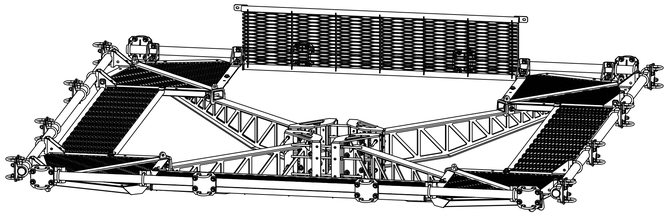
| | |
|---|---|
| DATE: | 04/01/20 |
| SCALE: | AS NOTED |
| JOB NO. | 19027.46 |

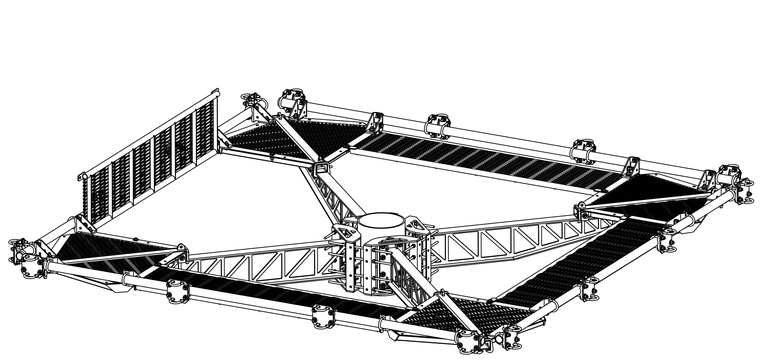
ANTENNA PLANS

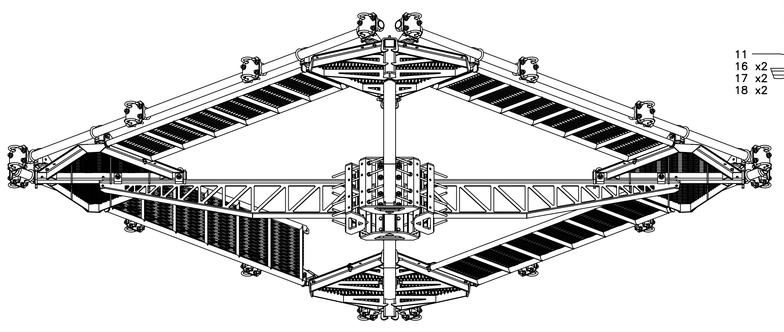
C-4

Sheet No. 6 of 10

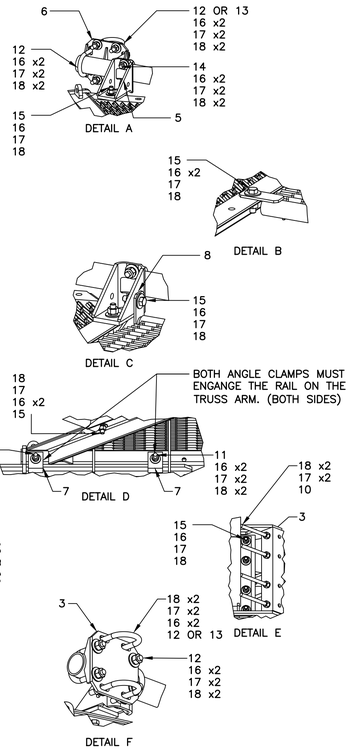
| SITEPRO QUAD ANTENNA PLATFORM P/N: F4P-12W PARTS LIST | | | | | | |
|---|---|---|---|---|---|---|
| ITEM | QTY | PART NO. | PART DESCRIPTION | LENGTH | UNIT WT. | NET WT. |
| 1 | 4 | X-LPP-CW | LOW PROFILE PLATFORM CORNER WELDMENT | | 198.75 | 795.01 |
| 2 | 4 | X-LPP-SA14 | SIDE ARM WELDMENT FOR 14' LOW PROFILE PLATFORM | | 151.68 | 606.71 |
| 3 | 4 | X-RM4HD | WELDMENT FOR 4-SIDED HEAVY DUTY RING MOUNT | | 71.27 | 285.08 |
| 4 | 4 | X-LPP-W14 | WALKWAY FOR 14' LOW PROFILE PLATFORM | | 116.45 | 465.81 |
| 5 | 16 | X-LPP-PC | FACE PIPE CONNECTION BRACKET FORTRESS PLATFORM | | 7.01 | 112.15 |
| 6 | 16 | X-SCX3-FR | FORTRESS CROSSOVER PLATE | | 6.61 | 105.82 |
| 7 | 16 | X-LPP-A7 | CORNER WELDMENT ATTACHMENT ANGLE | 2 1/2 IN | 1.27 | 20.33 |
| 8 | 8 | X-LPP-H | HINGE FOR LOW PROFILE PLATFORM WALKWAY | | 2.78 | 22.22 |
| 9 | 4 | P30174 | 2-7/8" O.D. x 174" SCH.40 PIPE | 174 IN | 84.20 | 336.78 |
| 10 | 16 | G58R-48 | 5/8" x 48" THREADED ROD (HDG.) | 48 IN | 0.40 | 6.38 |
| 10 | 16 | G58R-24 | 5/8" x 24" THREADED ROD (HDG.) | 24 IN | 0.40 | 6.38 |
| 11 | 8 | G58R-8 | 5/8" x 8" THREADED ROD (HDG.) | | 0.70 | 5.58 |
| 12 | 64 | X-UB5300 | 5/8" x 3" x 5-1/4" x 2-1/2" U-BOLT (HDG.) | | 1.15 | 73.56 |
| 13 | 32 | X-UB5258 | 5/8" x 2-5/8" x 4-1/2" x 2" U-BOLT (HDG.) | | 1.00 | 32.00 |
| 14 | 16 | X-UB5304 | 5/8" x 3" x 4-1/4" x 2-1/2" U-BOLT (HDG.) | | 0.98 | 15.60 |
| 15 | 64 | G58214 | 5/8" x 2-1/4" HDG HEX BOLT GR5 | | 0.29 | 18.66 |
| 16 | 256 | G58FW | 5/8" HDG USS FLATWASHER | 1/8 IN | 0.07 | 18.04 |
| 17 | 272 | G58LW | 5/8" HDG LOCKWASHER | | 0.03 | 7.10 |
| 18 | 272 | G58NUT | 5/8" HDG HEAVY 2H HEX NUT | | 0.13 | 35.33 |
| | | | | TOTAL WT.# | | 3056.14 |

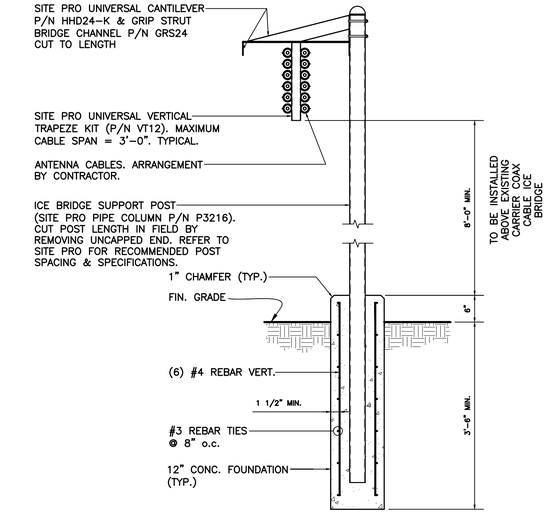




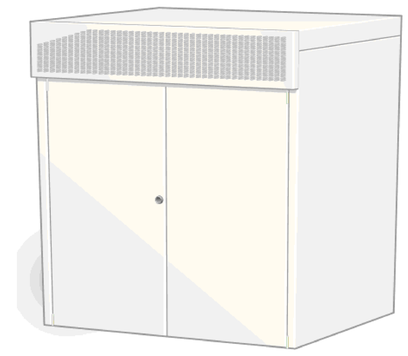


1 C-5 **QUAD-PLATFROM MOUNT ASSEMBLY**
NOT TO SCALE



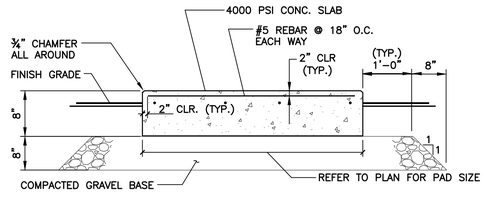




2 C-5 **SINGLE-POST ICE BRIDGE DETAIL**
NOT TO SCALE



| EQUIPMENT CABINET | | |
|---|---|---|
| EQUIPMENT | DIMENSIONS | WEIGHT |
| MAKE: ERICSSON<br>MODEL: 6102 | 57.09"H x 51.18"W x 27.56"D | 727.53-LBS |

3 C-5 **ERICSSON RADIO CABINET DETAIL**
SCALE: NTS




4 C-5 **TYPICAL CONCRETE PAD DETAIL**
NOT TO SCALE

| REV. | DATE | DRAWN BY | CHK'D BY | DESCRIPTION |
|---|---|---|---|---|
| C | 05/05/20 | KAWJR | CAG | PRELIMINARY CDs - REVISED PER CLIENT COMMENTS |
| B | 04/28/20 | KAWJR | CAG | PRELIMINARY CDs - REVISED PER CLIENT COMMENTS |
| A | 04/15/20 | KAWJR | CAG | PRELIMINARY CDs - ISSUED FOR CLIENT REVIEW |

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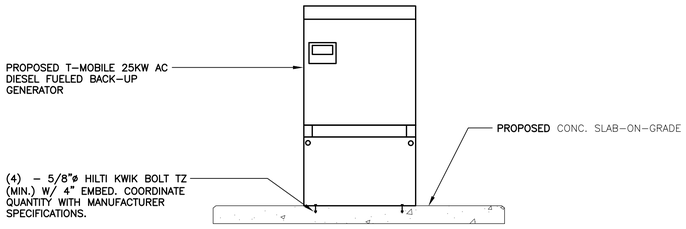
JOB NO. 19027.46

DETAILS

**C-5**

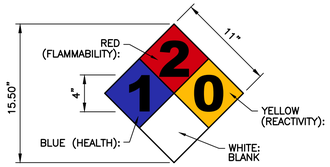
Sheet No. 7 of 10




1 C-6 **EQUIPMENT FASTENING DETAIL**
SCALE: 1/2" = 1'-0"

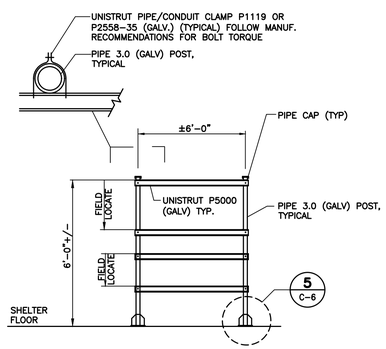

| BACKUP POWER GENERATOR | |
|---|---|
| EQUIPMENT | DIMENSIONS |
| MAKE: GENERAC<br>MODEL: 25 KW AC DIESEL (211 GALLON TANK) | 95.0"L x 38.0"W x 99.0"H |
| NOTES:<br>1. CONTRACTOR TO COORDINATE FINAL EQUIPMENT MODEL SELECTION WITH T-MOBILE CONSTRUCTION MANAGER PRIOR TO ORDERING. | |

2 C-6 **BACK-UP GENERATOR DETAIL**
NOT TO SCALE

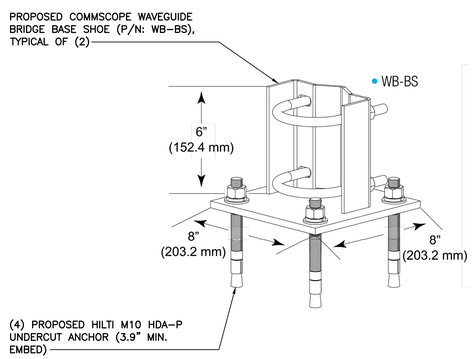



| | |
|---|---|
| SIGN NAME: | REGULATORY, NFPA 704 HAZARD ID |
| DESCRIPTION: | MOUNT ON GENERATOR ACCESS DOOR. CONSULT WITH GENERATOR MANUFACTURER MSDS SHEET FOR BLUE AND RES POSITIONS |
| NOTES: | 1) SIGNS EXPOSED TO WEATHER SHOULD BE CHECKED ANNUALLY FOR READABILITY. |
| | 2) SIGNS MUST BE UPDATED IF CHEMICAL STORAGE OR HAZARD INFORMATION FOR THE LOCATION CHANGES. |
| | 3) THE GC MUST REVIEW WITH LOCAL JURISDICTION WHEN FILLING FOR PERMITS, AS EACH JURISDICTION MAY HAVE DIFFERENT REQUIREMENTS AND COMPLY WITH POSTING REQUIREMENTS OR DIRECTIVES FROM THE LOCAL JURISDICTION. |

3 C-6 **NFPA 704 DIAMOND SIGNAGE DETAIL**
1 1/2" = 1'




4 C-6 **PROPOSED EQUIPMENT MOUNTING FRAME DETAIL**
SCALE: NOT TO SCALE




5 C-6 **EQUIPMENT FRAME POST ATTACHMENT DETAIL**
SCALE: NOT TO SCALE

| REV. | DATE | DRAWN BY | CHK'D BY | DESCRIPTION |
|---|---|---|---|---|
| C | 05/05/20 | KAWJR | CAG | PRELIMINARY CDs – REVISED PER CLIENT COMMENTS |
| B | 04/28/20 | KAWJR | CAG | PRELIMINARY CDs – REVISED PER CLIENT COMMENTS |
| A | 04/15/20 | KAWJR | CAG | PRELIMINARY CDs – ISSUED FOR CLIENT REVIEW |

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# WESTBROOK SOUTH
## SITE ID: CTHA524A
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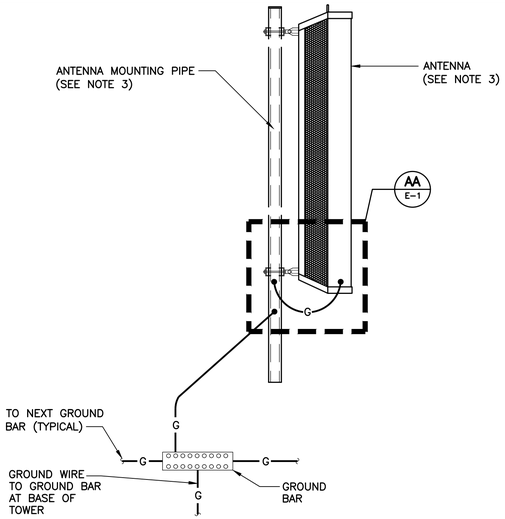
WESTBROOK, CT 06498

| | |
|---|---|
| DATE: | 04/01/20 |
| SCALE: | AS NOTED |
| JOB NO. | 19027.46 |

DETAILS

C-6

Sheet No. 8 of 10

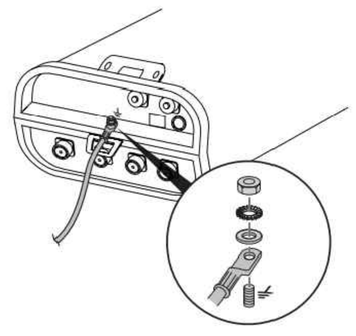



NOTES:

1. BOND COAXIAL CABLE GROUND KITS TO EACH OWNER'S GROUND BAR ALONG ENTIRE COAX RUN FROM ANTENNA TO SHELTER.
2. BOND ALL EQUIPMENT TO GROUND PER NEC AND MANUFACTURERS SPECIFICATIONS.
3. DETAIL IS TYPICAL FOR ALL ANTENNA SECTORS, INCLUDING GPS ANTENNA.

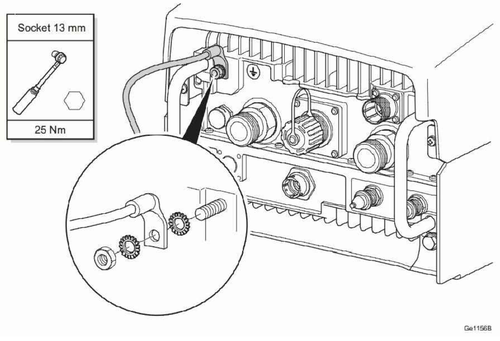
## 1 E-1 TYPICAL ANTENNA GROUNDING DETAIL

SCALE: NONE



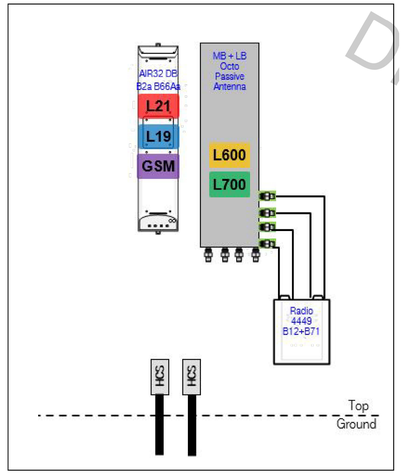
## 2 E-1 TYPICAL ANTENNA GROUNDING DETAIL

SCALE: NOT TO SCALE



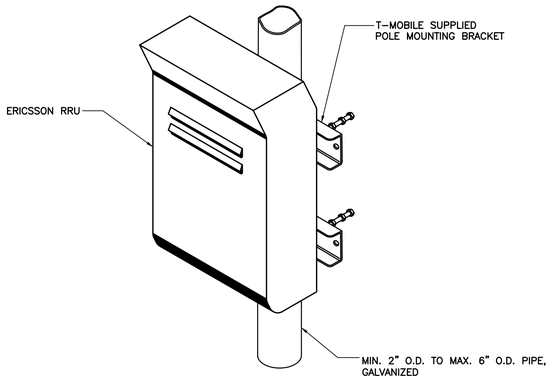

## 3 E-1 TYPICAL RRU GROUNDING DETAIL

NOT TO SCALE




## 4 E-1 PROPOSED PLUMBING DIAGRAM

SCALE: NONE




ISOMETRIC VIEW

NOTES:

1. T-MOBILE SHALL SUPPLY RRU, AND RRU POLE-MOUNTING BRACKET. CONTRACTOR SHALL SUPPLY POLE/PIPE AND INSTALL ALL MOUNTING HARDWARE INCLUDING ERICSSON RRU POLE-MOUNTING BRACKET. CONTRACTOR SHALL INSTALLS RRU AND MAKES CABLE TERMINATIONS.
2. NO PAINTING OF THE RRU OR SOLAR SHIELD IS ALLOWED.

## 5 E-1 TYPICAL RRUS MOUNTING DETAILS

SCALE: NOT TO SCALE

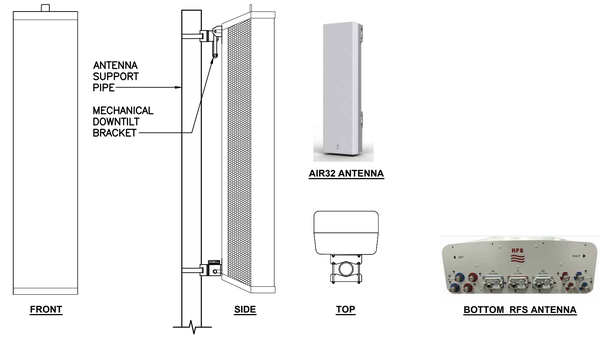
ISOMETRIC VIEW

| RRU (REMOTE RADIO UNIT) | | | |
|---|---|---|---|
| EQUIPMENT | DIMENSIONS | WEIGHT | CLEARANCES |
| MAKE: ERICSSON<br>MODEL: RADIO 4449 B71B12 | 14.9"L x 13.2"W x 10.4"D | 74 LBS. | ABOVE: 16" MIN.<br>BELOW: 12" MIN.<br>FRONT: 36" MIN. |

NOTES:
1. CONTRACTOR TO COORDINATE FINAL EQUIPMENT MODEL SELECTION WITH T-MOBILE CONSTRUCTION MANAGER PRIOR TO ORDERING.

## 6 E-1 PROPOSED RRU DETAIL

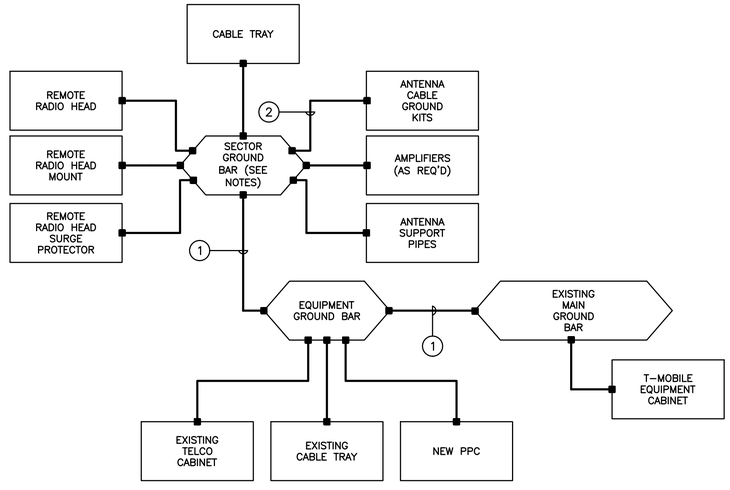
SCALE: NOT TO SCALE




| ALPHA/BETA/GAMMA ANTENNA | | |
|---|---|---|
| EQUIPMENT | DIMENSIONS | WEIGHT |
| MAKE: ERICSSON<br>MODEL: AIR32 KRD901146-1 | 56.6"L x 12.9"W x 8.7"D | 132.2 LBS. |
| MAKE: RFS<br>MODEL: APXVAARR24_43-U-NA20 | 95.9"L x 24"W x 8.7"D | 153 LBS. |

## 7 E-1 PROPOSED ANTENNA DETAIL

SCALE: NONE




## GROUNDING SCHEMATIC NOTES

(1) #2 AWG

(2) #6 AWG

GENERAL NOTES:

1. ALL SURGE SUPPRESSION EQUIPMENT SHALL BE BONDED TO GROUND PER MANUFACTURER'S SPECIFICATIONS
2. UNLESS OTHERWISE NOTED OR REQUIRED BY CODE, GROUND CONDUCTORS SHOWN SHALL BE #2 AWG (SOLID TINNED BCW - EXTERIOR; STRANDED GREEN INSULATED - INTERIOR).
3. ALL SECTOR GROUND BARS SHALL BE BONDED TOGETHER WITH #2 AWG SOLID TINNED BCW.
4. BOND ALL EQUIPMENT CABINETS AND BATTERY CABINETS TO GROUND PER MANUFACTURER'S SPECIFICATIONS.
5. COORDINATE ALL ROOF MOUNTED EQUIPMENT WITH OWNER.
6. ALL ROOF MOUNTED AMPLIFIERS AND ASSOCIATED EQUIPMENT SHALL BE BONDED TO THE SECTOR GROUND BAR PER MANUFACTURER'S SPECIFICATIONS.
7. ALL GROUNDING SHALL BE IN ACCORDANCE WITH NEC AND OWNER'S REQUIREMENTS.

## 8 E-1 TYPICAL GROUNDING SCHEMATIC DETAIL

SCALE: NOT TO SCALE

| REV. | DATE | DRAWN BY | CHK'D BY | DESCRIPTION |
|---|---|---|---|---|
| C | 05/05/20 | KAWJR | CAG | PRELIMINARY CDs - REVISED PER CLIENT COMMENTS |
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# SITE ID: CTHA524A

1542 BOSTON POST ROAD
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JOB NO. 19027.46

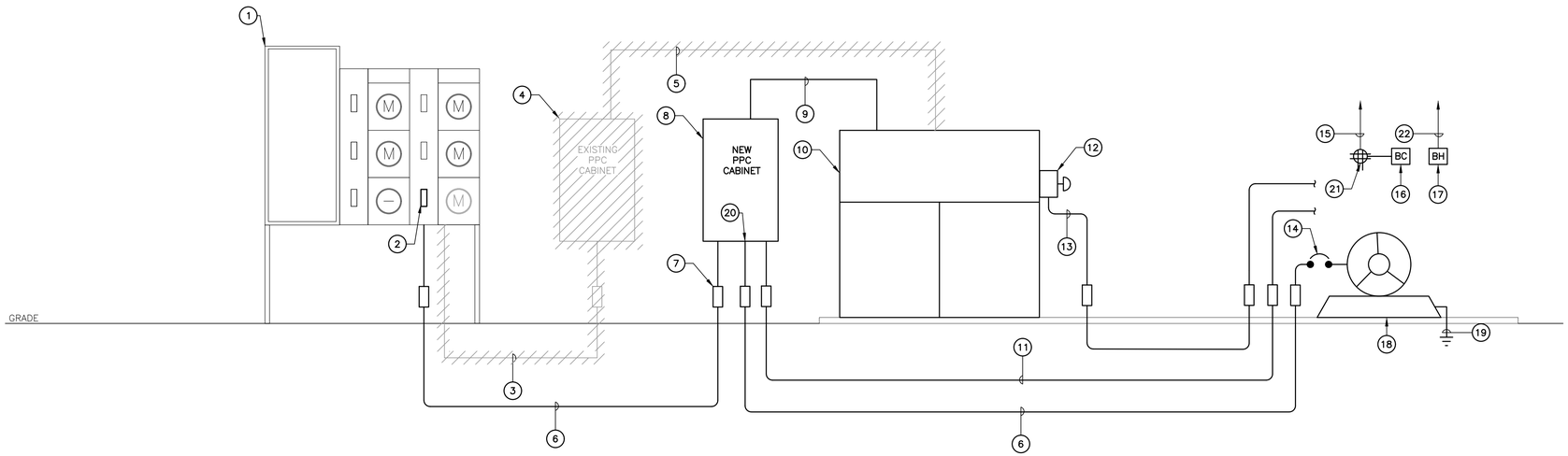
TYPICAL ELECTRICAL DETAILS

E-1

Sheet No. 9 of 10

## RISER DIAGRAM NOTES

1. EXISTING METER CENTER
2. REPLACE EXISTING T–MOBILE 100A/2P CIRCUIT BREAKER WITH NEW 200A/2P CIRCUIT BREAKER.
3. CONDUITS AND CONDUCTORS FEEDING EXISTING 100A PPC TO BE REMOVED.
4. EXISTING 100A PPC CABINET TO BE REMOVED AND REPLACED.
5. CONDUITS AND CONDUCTORS SERVING EXISTING RADIO EQUIPMENT CABINETS TO BE REMOVED
6. (3) #3/0 AWG, (1) #6 AWG GROUND, 2" CONDUIT.
7. EXPANSION COUPLING (TYPICAL).
8. NEW 200A PPC CABINET WITH INTEGRAL AUTOMATIC TRANSFER SWITCH.
9. (3) #1 AWG, (1) #6 AWG GROUND, 1–1/4" CONDUIT CONNECTED TO NEW 125A/2P CIRCUIT BREAKER IN PPC.
10. NEW T–MOBILE EQUIPMENT CABINET.
11. 1" CONDUIT WITH CONTROL AND ALARM CONDUCTORS FROM GENERATOR TO TRANSFER SWITCH IN PPC CABINET. INSTALL CONDUCTORS AS REQUIRED BY MANUFACTURER.
12. REMOTE GENERATOR SHUT OFF SWITCH IN BREAK GLASS ENCLOSURE MOUNTED IN LOCATION APPROVED BY LOCAL FIRE MARSHAL. INSTALL ALL REQUIRED SIGNAGE.
13. 3/4" CONDUIT AND CONDUCTORS REQUIRED FOR PROPER OPERATION OF EMERGENCY GENERATOR SHUT OFF SWITCH.
14. 200A, 240V, MAIN CIRCUIT BREAKER AT GENERATOR OUTPUT.
15. DEDICATED 20A, 120V, CIRCUIT IN 3/4" CONDUIT FROM PPC TO GENERATOR BATTERY CHARGER AND DUPLEX RECEPTACLE.
16. GENERATOR BATTERY CHARGER.
17. GENERATOR BLOCK HEATER.
18. 25 KW AC DIESEL FUELED BACK UP GENERATOR
19. GROUND GENERATOR PER NEC AND MANUFACTURER'S SPECIFICATIONS.
20. EXTEND GENERATOR POWER OUTPUT CONDUCTORS TO EMERGENCY LUGS IN TRANSFER SWITCH IN PPC CABINET.
21. DUPLEX GFCI RECEPTACLE IN WEATHERPROOF ENCLOSURE MOUNT IN CONVENIENT LOCATION AT GENERATOR.
22. DEDICATED 20A, 120V, CIRCUIT IN 3/4" CONDUIT FROM PPC TO GENERATOR BLOCK HEATER.




1 / E–2 **ELECTRICAL RISER DIAGRAM**
NOT TO SCALE

| REV. | DATE | DRAWN BY | CHK'D BY | DESCRIPTION |
|---|---|---|---|---|
| C | 05/05/20 | KAWJR | CAG | PRELIMINARY CDs – REVISED PER CLIENT COMMENTS |
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## SITE ID: CTHA524A
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ELECTRICAL RISER DETAILS

E-2

Sheet No. 10 of 10

# Exhibit B

# Structural Analysis

CENTEK engineering

Centered on Solutions℠

# Structural Analysis Report

130-ft Rohn Monopole

Proposed T-Mobile
Antenna Upgrade (L600)

T-Mobile Site Ref: CTHA524A

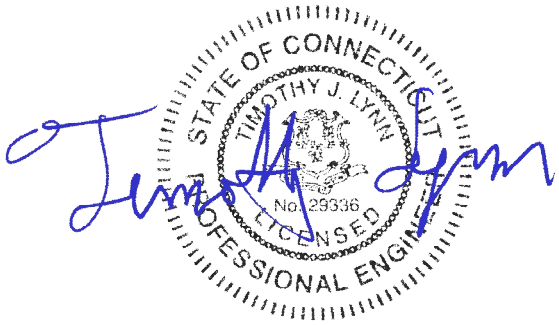
1546 Boston Post Road
Westbrook, CT

Centek Project No. 19027.46

~~Date: April 14, 2020~~

Rev 2: May 5, 2020

Max Stress Ratio = 60.6%




**Prepared for:**

T-Mobile USA
35 Griffin Road
Bloomfield, CT 06002

# Table of Contents

## *Introduction*

The purpose of this report is to summarize the results of the non-linear, P-Δ structural analysis of the antenna installation proposed by T-Mobile on the monopole (tower) located in Westbrook, CT.

The host tower is a 130-ft tall, three-section, eighteen sided, tapered monopole, originally designed and manufactured by Rohn job no; 231452, dated November 18, 2019. The tower geometry, structure member sizes and foundation system information were obtained from the original design documents.

Antenna and appurtenance information were obtained from a previous structural analysis report prepared by All-Points Technology Corp.; job no; CT1931591 dated January 17, 2020.

The tower is made up of three (3) tapered vertical sections consisting of A572-65 pole sections. The vertical tower sections are slip joint connected. The diameter of the pole (flat-flat) is 28.0-in at the top and 65.0-in at the base.

## *Antenna and Appurtenance Summary*

- VERIZON (Reserved):
  Antennas: Nine (9) NHH-65B-R2B panel antennas, nine (9) Remote Radio Heads and two (2) raycap main distribution boxes mounted on a 13-ft platform with rails with a RAD center elevation of 126-ft above the existing tower base plate.
  Coax Cables: Nine (9) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- AT&T (Existing to Remain):
  Antennas: Three (3) KMW EPBQ-654L8H8-L2 panel antennas, three (3) Ericsson 4415 B25 remote radio heads, three (3) Ericsson 4449 B5 remote radio heads and two (2) surge arrestors mounted on (3) 12-ft V-frames with a RAD center elevation of 115-ft above grade.
  Coax Cables: One (1) fiber trunk and four (4) DC trunks running on the inside of the existing tower.
- **T-MOBILE (Proposed):**
  **Antennas: Three (3) RFS APXVAARR24_43 panel antennas, three (3) Ericsson AIR32 panel antennas and three (3) Ericsson 4449 B71 B12 remote radio heads mounted on a 14-ft platform with rails (SitePro F4P-12W / HRK12) with a RAD center elevation of 104-ft above the existing tower base plate.**
  **Coax Cables: Three (3) 6x12 fiber cables running on the inside of the existing tower.**

## *Primary Assumptions Used in the Analysis*

- The tower structure's theoretical capacity not including any assessment of the condition of the tower.
- The tower carries the horizontal and vertical loads due to the weight of antennas, ice load and wind.
- Tower is properly installed and maintained.
- Tower is in plumb condition.
- Tower loading for antennas and mounts as listed in this report.
- All bolts are appropriately tightened providing the necessary connection continuity.
- All welds are fabricated with ER-70S-6 electrodes.
- All members are assumed to be as specified in the original tower design documents or reinforcement drawings.
- All members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
- All member protective coatings are in good condition.
- All tower members were properly designed, detailed, fabricated, installed and have been properly maintained since erection.
- Any deviation from the analyzed antenna loading will require a new analysis for verification of structural adequacy.
- All existing coax cables to be installed as indicated in this report.

## *Analysis*

The existing tower was analyzed using a comprehensive computer program entitled tnxTower. The program analyzes the tower, considering the worst case loading condition. The tower is considered as loaded by concentric forces along the tower, and the model assumes that the tower members are subjected to bending, axial, and shear forces.

The existing tower was analyzed for the controlling basic wind speed (3-second gust) with no ice and the applicable wind and ice combination to determine stresses in members as per guidelines of TIA-222-G-2005 entitled "Structural Standard for Antenna Support Structures and Antennas", the American Institute of Steel Construction (AISC) and the Manual of Steel Construction; Load and Resistance Factor Design (LRFD).

The controlling wind speed is determined by evaluating the local available wind speed data as provided in Appendix N of the CSBC[1] and the wind speed data available in the TIA-222-G-2005 Standard.

## *Tower Loading*

Tower loading was determined by the basic wind speed as applied to projected surface areas with modification factors per TIA-222-G-2005, gravity loads of the tower structure and its components, and the application of 0.75" radial ice on the tower structure and its components.

| | | |
|---|---|---|
| Basic Wind Speed: | Westbrook; v = 105 mph ($V_{asd}$) | *[Appendix N of the 2018 CT Building Code]* |
| Load Cases: | Load Case 1; 105 mph wind speed w/ no ice plus gravity load – used in calculation of tower stresses and rotation. | *[Appendix N of the 2018 CT Building Code]* |
| | Load Case 2; 50 mph wind speed w/ 0.75" radial ice plus gravity load – used in calculation of tower stresses. | *[Annex B of TIA-222-G-2005]* |

[1] The 2015 International Building Code as amended by the 2018 Connecticut State Building Code (CSBC).

## *Tower Capacity*

- Calculated stresses were found to be within allowable limits. This tower was found to be at **34.2%** of its total capacity.

| Tower Section | Elevation | Stress Ratio (percentage of capacity) | Result |
|---|---|---|---|
| Pole Shaft (L1) | 83.71'-130.00' | 34.2% | **PASS** |

## *Foundation and Anchors*

The foundation consists of an 8.25-ft diameter x 4.5-ft long reinforced concrete pier on a 32.0-ft x 2.0-ft thick reinforce concrete pad. The sub-grade conditions used in the analysis of the foundation were obtained from the aforementioned original design documents. The base of the tower is connected to the foundation by means of (22) 2.25"∅, ASTM A615-75 anchor bolts embedded approximately 6-ft into the concrete foundation structure.

- The tower base reactions developed from the governing Load Case 1 were used in the verification of the foundation and its anchors:

| Location | Vector | Proposed Reactions |
|---|---|---|
| Base | Shear | 43 kips |
| | Compression | 63 kips |
| | Moment | 3941 kip-ft |

- The foundation was found to be within allowable limits.

| Foundation | Design Limit | TIA-222-G Section 9.4 FS[(1)] | Proposed Loading (FS)[(1)] | Result |
|---|---|---|---|---|
| Reinforced Concrete Pad and Pier | OTM[(2)] | 1.0 | 2.83 | **PASS** |

*Note 1: FS denotes Factor of Safety.*
*Note 2: OTM denotes Overturning Moment.*

- The anchor bolts and base plate were found to be within allowable limits.

| Tower Component | Design Limit | Stress Ratio (percentage of capacity) | Result |
|---|---|---|---|
| Anchor Bolts | Combined Axial and Shear | 39.0% | **PASS** |
| Base Plate | Bending | 60.6% | **PASS** |

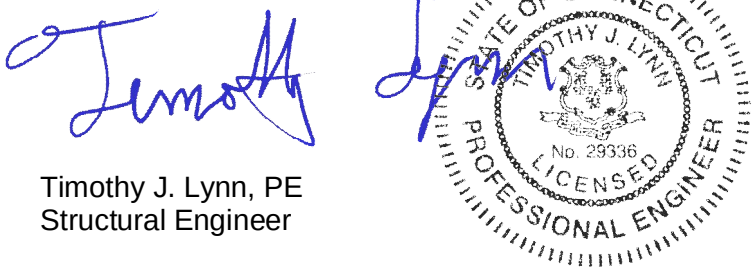
## *Conclusion*

This analysis shows that the subject tower **is adequate** to support the proposed modified antenna configuration.

The analysis is based, in part, on the information provided to this office by T-Mobile. If the existing conditions are different than the information in this report, Centek Engineering, Inc. must be contacted for resolution of any potential issues.

Please feel free to call with any questions or comments.

Respectfully Submitted by:




Timothy J. Lynn, PE
Structural Engineer

## *Standard Conditions for Furnishing of Professional Engineering Services on Existing Structures*

All engineering services are performed on the basis that the information used is current and correct. This information may consist of, but is not necessarily limited to:

- Information supplied by the client regarding the structure itself, its foundations, the soil conditions, the antenna and feed line loading on the structure and its components, or other relevant information.
- Information from the field and/or drawings in the possession of Centek Engineering, Inc. or generated by field inspections or measurements of the structure.
- It is the responsibility of the client to ensure that the information provided to Centek Engineering, Inc. and used in the performance of our engineering services is correct and complete. In the absence of information to the contrary, we assume that all structures were constructed in accordance with the drawings and specifications and are in an un-corroded condition and have not deteriorated. It is therefore assumed that its capacity has not significantly changed from the "as new" condition.
- All services will be performed to the codes specified by the client, and we do not imply to meet any other codes or requirements unless explicitly agreed in writing. If wind and ice loads or other relevant parameters are to be different from the minimum values recommended by the codes, the client shall specify the exact requirement. In the absence of information to the contrary, all work will be performed in accordance with the latest revision of ANSI/ASCE10 & ANSI/EIA-222
- All services performed, results obtained, and recommendations made are in accordance with generally accepted engineering principles and practices. Centek Engineering, Inc. is not responsible for the conclusions, opinions and recommendations made by others based on the information we supply.

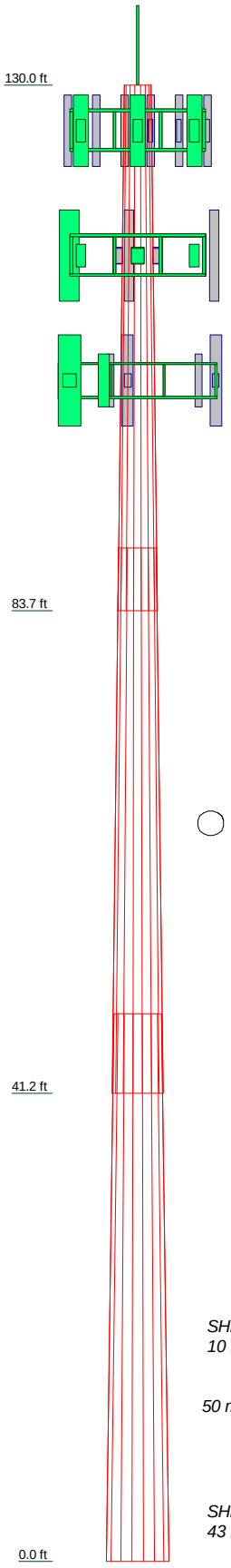
## GENERAL DESCRIPTION OF STRUCTURAL ANALYSIS PROGRAM

TnxTower, is an integrated structural analysis and design software package for Designed specifically for the telecommunications industry, TnxTower, formerly ERITower, automates much of the tower analysis and design required by the TIA/EIA 222 Standard.

TnxTower Features:

- TnxTower can analyze and design 3- and 4-sided guyed towers, 3- and 4-sided self-supporting towers and either round or tapered ground mounted poles with or without guys.
- The program analyzes towers using the TIA-222-G (2005) standard or any of the previous TIA/EIA standards back to RS-222 (1959). Steel design is checked using the AISC ASD 9th Edition or the AISC LRFD specifications.
- Linear and non-linear (P-delta) analyses can be used in determining displacements and forces in the structure. Wind pressures and forces are automatically calculated.
- Extensive graphics plots include material take-off, shear-moment, leg compression, displacement, twist, feed line, guy anchor and stress plots.
- TnxTower contains unique features such as True Cable behavior, hog rod take-up, foundation stiffness and much more.

| Section | Length (ft) | Number of Sides | Thickness (in) | Socket Length (ft) | Top Dia (in) | Bot Dia (in) | Grade | Weight (K) |
|---|---|---|---|---|---|---|---|---|
| 1 | 46.290 | 18 | 0.313 | 5.500 | 28.000 | 41.530 | | 5.4 |
| 2 | 48.000 | 18 | 0.625 | 7.000 | 39.297 | 53.780 | A572-65 | 14.9 |
| 3 | 48.210 | 18 | 0.750 | | 50.418 | 65.000 | | 22.2 |
| | | | | | | | | 42.5 |




*ALL REACTIONS ARE FACTORED*

*AXIAL 89 K*

*SHEAR 10 K*

*MOMENT 854 kip-ft*

*TORQUE 0 kip-ft*
*50 mph WIND - 0.750 in ICE*

*AXIAL 63 K*

*SHEAR 43 K*

*MOMENT 3941 kip-ft*

*TORQUE 2 kip-ft*
*REACTIONS - 105 mph WIND*

## DESIGNED APPURTENANCE LOADING

| TYPE | ELEVATION | TYPE | ELEVATION |
|---|---|---|---|
| BOA4357 | 130 | 4415 B25 (ATI) | 115 |
| (3) NHH-65B-R2B (Verizon) | 126 | (2) DC6-48-60-18-8F Surge Arrestor (ATI) | 115 |
| (3) NHH-65B-R2B (Verizon) | 126 | | |
| (3) NHH-65B-R2B (Verizon) | 126 | 12' V-Frame (ATI) | 115 |
| (3) RRH2x40-AWS (Verizon) | 126 | 12' V-Frame (ATI) | 115 |
| (3) RRH2x40-AWS (Verizon) | 126 | 12' V-Frame (ATI) | 115 |
| (3) RRH2x40-AWS (Verizon) | 126 | AIR32 (T-Mobile) | 104 |
| (2) RC2DC-3315-PF-48 (Verizon) | 126 | APXVAARR24-43 (T-Mobile) | 104 |
| 13' Platform w/Rails (Verizon) | 126 | AIR32 (T-Mobile) | 104 |
| EPBQ-654L8H8-L2 (ATI) | 115 | APXVAARR24-43 (T-Mobile) | 104 |
| EPBQ-654L8H8-L2 (ATI) | 115 | AIR32 (T-Mobile) | 104 |
| EPBQ-654L8H8-L2 (ATI) | 115 | APXVAARR24-43 (T-Mobile) | 104 |
| 4449 B5/B12 (ATI) | 115 | Radio 4449 B71 B12 (T-Mobile) | 104 |
| 4449 B5/B12 (ATI) | 115 | Radio 4449 B71 B12 (T-Mobile) | 104 |
| 4449 B5/B12 (ATI) | 115 | Radio 4449 B71 B12 (T-Mobile) | 104 |
| 4415 B25 (ATI) | 115 | F4P-12W Quad Platform w/ Handrail (T-Mobile) | 104 |
| 4415 B25 (ATI) | 115 | | |

## MATERIAL STRENGTH

| GRADE | Fy | Fu | GRADE | Fy | Fu |
|---|---|---|---|---|---|
| A572-65 | 65 ksi | 80 ksi | | | |

## TOWER DESIGN NOTES

1. Tower designed for Exposure D to the TIA-222-G Standard.
2. Tower designed for a 105 mph basic wind in accordance with the TIA-222-G Standard.
3. Tower is also designed for a 50 mph basic wind with 0.75 in ice. Ice is considered to increase in thickness with height.
4. Deflections are based upon a 60 mph wind.
5. Tower Structure Class II.
6. Topographic Category 1 with Crest Height of 0.000 ft
7. TOWER RATING: 34.2%


**Centek Engineering Inc.**
63-2 North Branford Rd.
Branford, CT 06405
Phone: (203) 488-0580
FAX: (203) 488-8587


| | | | |
|---|---|---|---|
| Job: | ***19027.46 - CTHA524A*** | | |
| Project: | ***130-ft Rohn Monopole - 1546 Boston Post Rd., Westbrook, CT*** | | |
| Client: T-Mobile | Drawn by: TJL | App'd: | |
| Code: TIA-222-G | Date: 05/05/20 | Scale: NTS | |
| Path: J:\Jobs\1902700.WI\46_CTHA524A\05_Structural\Tower\Backup Documentation\Rev (Z)\Calcs\ER Files\137 Monopole_Westbrook_CT.eri | | Dwg No. E-1 | |

## Tower Input Data

The tower is a monopole.
This tower is designed using the TIA-222-G standard.
The following design criteria apply:

Basic wind speed of 105 mph.
Structure Class II.
Exposure Category D.
Topographic Category 1.
Crest Height 0.000 ft.
Nominal ice thickness of 0.750 in.
Ice thickness is considered to increase with height.
Ice density of 56 pcf.
A wind speed of 50 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 60 mph.
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in pole design is 1.
Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

## Options

| | | | | | |
|---|---|---|---|---|---|
| | Consider Moments - Legs | | Distribute Leg Loads As Uniform | | Use ASCE 10 X-Brace Ly Rules |
| | Consider Moments - Horizontals | | Assume Legs Pinned | | Calculate Redundant Bracing Forces |
| | Consider Moments - Diagonals | √ | Assume Rigid Index Plate | | Ignore Redundant Members in FEA |
| | Use Moment Magnification | | Use Clear Spans For Wind Area | | SR Leg Bolts Resist Compression |
| √ | Use Code Stress Ratios | | Use Clear Spans For KL/r | | All Leg Panels Have Same Allowable |
| √ | Use Code Safety Factors - Guys | | Retension Guys To Initial Tension | | Offset Girt At Foundation |
| | Escalate Ice | √ | Bypass Mast Stability Checks | | Consider Feed Line Torque |
| | Always Use Max Kz | | Use Azimuth Dish Coefficients | | Include Angle Block Shear Check |
| | Use Special Wind Profile | √ | Project Wind Area of Appurt. | | Use TIA-222-G Bracing Resist. Exemption |
| | Include Bolts In Member Capacity | | Autocalc Torque Arm Areas | | Use TIA-222-G Tension Splice Exemption |
| | Leg Bolts Are At Top Of Section | | Add IBC .6D+W Combination | | Poles |
| | Secondary Horizontal Braces Leg | √ | Sort Capacity Reports By Component | √ | Include Shear-Torsion Interaction |
| | Use Diamond Inner Bracing (4 Sided) | | Triangulate Diamond Inner Bracing | | Always Use Sub-Critical Flow |
| | SR Members Have Cut Ends | | Treat Feed Line Bundles As Cylinder | | Use Top Mounted Sockets |
| | SR Members Are Concentric | | Ignore KL/ry For 60 Deg. Angle Legs | | Pole Without Linear Attachments |
| | | | | | Pole With Shroud Or No Appurtenances |
| | | | | | Outside and Inside Corner Radii Are Known |

## Tapered Pole Section Geometry

| *Section* | *Elevation* ft | *Section Length* ft | *Splice Length* ft | *Number of Sides* | *Top Diameter* in | *Bottom Diameter* in | *Wall Thickness* in | *Bend Radius* in | *Pole Grade* |
|---|---|---|---|---|---|---|---|---|---|
| L1 | 130.000-83.710 | 46.290 | 5.500 | 18 | 28.000 | 41.530 | 0.313 | 1.250 | A572-65 (65 ksi) |

| Section | Elevation<br>ft | Section Length<br>ft | Splice Length<br>ft | Number of Sides | Top Diameter<br>in | Bottom Diameter<br>in | Wall Thickness<br>in | Bend Radius<br>in | Pole Grade |
|---|---|---|---|---|---|---|---|---|---|
| L2 | 83.710-41.210 | 48.000 | 7.000 | 18 | 39.297 | 53.780 | 0.625 | 2.500 | A572-65 (65 ksi) |
| L3 | 41.210-0.000 | 48.210 | | 18 | 50.418 | 65.000 | 0.750 | 3.000 | A572-65 (65 ksi) |

## Tapered Pole Properties

| Section | Tip Dia.<br>in | Area<br>$in^2$ | I<br>$in^4$ | r<br>in | C<br>in | I/C<br>$in^3$ | J<br>$in^4$ | It/Q<br>$in^2$ | w<br>in | w/t |
|---|---|---|---|---|---|---|---|---|---|---|
| L1 | 28.384 | 27.463 | 2659.779 | 9.829 | 14.224 | 186.992 | 5323.059 | 13.734 | 4.378 | 14.01 |
| | 42.122 | 40.883 | 8774.843 | 14.632 | 21.097 | 415.924 | 17561.231 | 20.445 | 6.759 | 21.63 |
| L2 | 41.492 | 76.716 | 14495.338 | 13.729 | 19.963 | 726.107 | 29009.749 | 38.365 | 5.816 | 9.306 |
| | 54.513 | 105.446 | 37640.619 | 18.870 | 27.320 | 1377.756 | 75330.767 | 52.733 | 8.365 | 13.384 |
| L3 | 53.230 | 118.235 | 36849.748 | 17.632 | 25.612 | 1438.751 | 73747.984 | 59.129 | 7.554 | 10.071 |
| | 65.887 | 152.947 | 79767.326 | 22.809 | 33.020 | 2415.728 | 159639.611 | 76.488 | 10.120 | 13.493 |

| Tower Elevation<br>ft | Gusset Area (per face)<br>$ft^2$ | Gusset Thickness<br>in | Gusset Grade | Adjust. Factor $A_f$ | Adjust. Factor $A_r$ | Weight Mult. | Double Angle Stitch Bolt Spacing Diagonals<br>in | Double Angle Stitch Bolt Spacing Horizontals<br>in | Double Angle Stitch Bolt Spacing Redundants<br>in |
|---|---|---|---|---|---|---|---|---|---|
| L1 130.000-83.710 | | | | 1 | 1 | 1 | | | |
| L2 83.710-41.210 | | | | 1 | 1 | 1 | | | |
| L3 41.210-0.000 | | | | 1 | 1 | 1 | | | |

## Feed Line/Linear Appurtenances - Entered As Area

| Description | Face or Leg | Allow Shield | Exclude From Torque Calculation | Component Type | Placement<br>ft | Total Number | | $C_AA_A$<br>$ft^2/ft$ | Weight<br>klf |
|---|---|---|---|---|---|---|---|---|---|
| 7/8 | C | No | Yes | Inside Pole | 130.000 - 0.000 | 1 | No Ice | 0.000 | 0.001 |
| | | | | | | | 1/2" Ice | 0.000 | 0.001 |
| | | | | | | | 1" Ice | 0.000 | 0.001 |
| 1 5/8 (Verizon) | B | No | Yes | Inside Pole | 126.000 - 3.000 | 9 | No Ice | 0.000 | 0.001 |
| | | | | | | | 1/2" Ice | 0.000 | 0.001 |
| | | | | | | | 1" Ice | 0.000 | 0.001 |
| RG6-Fiber (AT&T) | C | No | Yes | Inside Pole | 116.000 - 3.000 | 1 | No Ice | 0.000 | 0.001 |
| | | | | | | | 1/2" Ice | 0.000 | 0.001 |
| | | | | | | | 1" Ice | 0.000 | 0.001 |
| #8 AWG Copper WIre (AT&T) | C | No | Yes | Inside Pole | 116.000 - 3.000 | 4 | No Ice | 0.000 | 0.000 |
| | | | | | | | 1/2" Ice | 0.000 | 0.000 |
| | | | | | | | 1" Ice | 0.000 | 0.000 |
| HYBRIFLEX 1-1/4" (T-Mobile) | A | No | Yes | Inside Pole | 104.000 - 3.000 | 3 | No Ice | 0.000 | 0.001 |
| | | | | | | | 1/2" Ice | 0.000 | 0.001 |
| | | | | | | | 1" Ice | 0.000 | 0.001 |

## Feed Line/Linear Appurtenances Section Areas

| Tower Section | Tower Elevation ft | Face | $A_R$ $ft^2$ | $A_F$ $ft^2$ | $C_AA_A$ In Face $ft^2$ | $C_AA_A$ Out Face $ft^2$ | Weight K |
|---|---|---|---|---|---|---|---|
| L1 | 130.000-83.710 | A | 0.000 | 0.000 | 0.000 | 0.000 | 0.079 |
| | | B | 0.000 | 0.000 | 0.000 | 0.000 | 0.396 |
| | | C | 0.000 | 0.000 | 0.000 | 0.000 | 0.064 |
| L2 | 83.710-41.210 | A | 0.000 | 0.000 | 0.000 | 0.000 | 0.166 |
| | | B | 0.000 | 0.000 | 0.000 | 0.000 | 0.398 |
| | | C | 0.000 | 0.000 | 0.000 | 0.000 | 0.074 |
| L3 | 41.210-0.000 | A | 0.000 | 0.000 | 0.000 | 0.000 | 0.149 |
| | | B | 0.000 | 0.000 | 0.000 | 0.000 | 0.358 |
| | | C | 0.000 | 0.000 | 0.000 | 0.000 | 0.068 |

## Feed Line/Linear Appurtenances Section Areas - With Ice

| Tower Section | Tower Elevation ft | Face or Leg | Ice Thickness in | $A_R$ $ft^2$ | $A_F$ $ft^2$ | $C_AA_A$ In Face $ft^2$ | $C_AA_A$ Out Face $ft^2$ | Weight K |
|---|---|---|---|---|---|---|---|---|
| L1 | 130.000-83.710 | A | 1.685 | 0.000 | 0.000 | 0.000 | 0.000 | 0.079 |
| | | B | | 0.000 | 0.000 | 0.000 | 0.000 | 0.396 |
| | | C | | 0.000 | 0.000 | 0.000 | 0.000 | 0.064 |
| L2 | 83.710-41.210 | A | 1.597 | 0.000 | 0.000 | 0.000 | 0.000 | 0.166 |
| | | B | | 0.000 | 0.000 | 0.000 | 0.000 | 0.398 |
| | | C | | 0.000 | 0.000 | 0.000 | 0.000 | 0.074 |
| L3 | 41.210-0.000 | A | 1.430 | 0.000 | 0.000 | 0.000 | 0.000 | 0.149 |
| | | B | | 0.000 | 0.000 | 0.000 | 0.000 | 0.358 |
| | | C | | 0.000 | 0.000 | 0.000 | 0.000 | 0.068 |

## Shielding Factor Ka

| Tower Section | Feed Line Record No. | Description | Feed Line Segment Elev. | $K_a$ No Ice | $K_a$ Ice |
|---|---|---|---|---|---|

## Discrete Tower Loads

| Description | Face or Leg | Offset Type | Offsets: Horz Lateral ft<br>Vert ft<br>ft | Azimuth Adjustment ° | Placement ft | | $C_AA_A$ Front $ft^2$ | $C_AA_A$ Side $ft^2$ | Weight K |
|---|---|---|---|---|---|---|---|---|---|
| BOA4357 | C | From Face | 1.000<br>0.000<br>3.500 | 0.000 | 130.000 | No Ice<br>1/2" Ice<br>1" Ice | 1.383<br>2.100<br>2.637 | 1.383<br>2.100<br>2.637 | 0.007<br>0.018<br>0.033 |
| (3) NHH-65B-R2B (Verizon) | A | From Face | 3.000<br>0.000 | 0.000 | 126.000 | No Ice<br>1/2" Ice | 11.187<br>11.691 | 8.687<br>9.169 | 0.071<br>0.150 |

| Description | Face or Leg | Offset Type | Offsets: Horz Lateral ft / Vert ft / ft | Azimuth Adjustment ° | Placement ft | | $C_AA_A$ Front $ft^2$ | $C_AA_A$ Side $ft^2$ | Weight K |
|---|---|---|---|---|---|---|---|---|---|
| | | | 0.000 | | | 1" Ice | 12.202 | 9.658 | 0.236 |
| (3) NHH-65B-R2B | B | From Face | 3.000 | 0.000 | 126.000 | No Ice | 11.187 | 8.687 | 0.071 |
| (Verizon) | | | 0.000 | | | 1/2" Ice | 11.691 | 9.169 | 0.150 |
| | | | 0.000 | | | 1" Ice | 12.202 | 9.658 | 0.236 |
| (3) NHH-65B-R2B | C | From Face | 3.000 | 0.000 | 126.000 | No Ice | 11.187 | 8.687 | 0.071 |
| (Verizon) | | | 0.000 | | | 1/2" Ice | 11.691 | 9.169 | 0.150 |
| | | | 0.000 | | | 1" Ice | 12.202 | 9.658 | 0.236 |
| (3) RRH2x40-AWS | A | From Face | 3.000 | 0.000 | 126.000 | No Ice | 2.161 | 1.420 | 0.044 |
| (Verizon) | | | 0.000 | | | 1/2" Ice | 2.360 | 1.590 | 0.061 |
| | | | 0.000 | | | 1" Ice | 2.565 | 1.768 | 0.082 |
| (3) RRH2x40-AWS | B | From Face | 3.000 | 0.000 | 126.000 | No Ice | 2.161 | 1.420 | 0.044 |
| (Verizon) | | | 0.000 | | | 1/2" Ice | 2.360 | 1.590 | 0.061 |
| | | | 0.000 | | | 1" Ice | 2.565 | 1.768 | 0.082 |
| (3) RRH2x40-AWS | C | From Face | 3.000 | 0.000 | 126.000 | No Ice | 2.161 | 1.420 | 0.044 |
| (Verizon) | | | 0.000 | | | 1/2" Ice | 2.360 | 1.590 | 0.061 |
| | | | 0.000 | | | 1" Ice | 2.565 | 1.768 | 0.082 |
| (2) RC2DC-3315-PF-48 | C | From Face | 3.000 | 0.000 | 126.000 | No Ice | 3.015 | 1.965 | 0.025 |
| (Verizon) | | | 0.000 | | | 1/2" Ice | 3.234 | 2.153 | 0.051 |
| | | | 0.000 | | | 1" Ice | 3.460 | 2.349 | 0.081 |
| 13' Platform w/Rails | C | None | | 0.000 | 126.000 | No Ice | 31.300 | 31.300 | 1.822 |
| (Verizon) | | | | | | 1/2" Ice | 40.200 | 40.200 | 2.452 |
| | | | | | | 1" Ice | 49.100 | 49.100 | 3.082 |
| EPBQ-654L8H8-L2 | A | From Face | 3.000 | 0.000 | 115.000 | No Ice | 18.089 | 7.033 | 0.095 |
| (AT&T) | | | 6.000 | | | 1/2" Ice | 18.722 | 7.619 | 0.188 |
| | | | 0.000 | | | 1" Ice | 19.362 | 8.213 | 0.290 |
| EPBQ-654L8H8-L2 | B | From Face | 3.000 | 0.000 | 115.000 | No Ice | 18.089 | 7.033 | 0.095 |
| (AT&T) | | | 6.000 | | | 1/2" Ice | 18.722 | 7.619 | 0.188 |
| | | | 0.000 | | | 1" Ice | 19.362 | 8.213 | 0.290 |
| EPBQ-654L8H8-L2 | C | From Face | 3.000 | 0.000 | 115.000 | No Ice | 18.089 | 7.033 | 0.095 |
| (AT&T) | | | 6.000 | | | 1/2" Ice | 18.722 | 7.619 | 0.188 |
| | | | 0.000 | | | 1" Ice | 19.362 | 8.213 | 0.290 |
| 4449 B5/B12 | A | From Face | 0.500 | 0.000 | 115.000 | No Ice | 1.968 | 1.408 | 0.071 |
| (AT&T) | | | 0.000 | | | 1/2" Ice | 2.144 | 1.564 | 0.090 |
| | | | 0.000 | | | 1" Ice | 2.328 | 1.727 | 0.111 |
| 4449 B5/B12 | B | From Face | 0.500 | 0.000 | 115.000 | No Ice | 1.968 | 1.408 | 0.071 |
| (AT&T) | | | 0.000 | | | 1/2" Ice | 2.144 | 1.564 | 0.090 |
| | | | 0.000 | | | 1" Ice | 2.328 | 1.727 | 0.111 |
| 4449 B5/B12 | C | From Face | 0.500 | 0.000 | 115.000 | No Ice | 1.968 | 1.408 | 0.071 |
| (AT&T) | | | 0.000 | | | 1/2" Ice | 2.144 | 1.564 | 0.090 |
| | | | 0.000 | | | 1" Ice | 2.328 | 1.727 | 0.111 |
| 4415 B25 | A | From Face | 0.500 | 0.000 | 115.000 | No Ice | 1.843 | 0.820 | 0.046 |
| (AT&T) | | | 0.000 | | | 1/2" Ice | 2.012 | 0.943 | 0.060 |
| | | | 0.000 | | | 1" Ice | 2.190 | 1.075 | 0.077 |
| 4415 B25 | B | From Face | 0.500 | 0.000 | 115.000 | No Ice | 1.843 | 0.820 | 0.046 |
| (AT&T) | | | 0.000 | | | 1/2" Ice | 2.012 | 0.943 | 0.060 |
| | | | 0.000 | | | 1" Ice | 2.190 | 1.075 | 0.077 |
| 4415 B25 | C | From Face | 0.500 | 0.000 | 115.000 | No Ice | 1.843 | 0.820 | 0.046 |
| (AT&T) | | | 0.000 | | | 1/2" Ice | 2.012 | 0.943 | 0.060 |
| | | | 0.000 | | | 1" Ice | 2.190 | 1.075 | 0.077 |
| (2) DC6-48-60-18-8F Surge | C | From Face | 0.500 | 0.000 | 115.000 | No Ice | 1.909 | 1.909 | 0.020 |
| Arrestor | | | 0.000 | | | 1/2" Ice | 2.098 | 2.098 | 0.039 |
| (AT&T) | | | 0.000 | | | 1" Ice | 2.294 | 2.294 | 0.062 |
| 12' V-Frame | A | None | | 0.000 | 115.000 | No Ice | 9.220 | 12.970 | 0.300 |
| (AT&T) | | | | | | 1/2" Ice | 9.220 | 12.970 | 0.400 |
| | | | | | | 1" Ice | 9.220 | 12.970 | 0.500 |
| 12' V-Frame | B | None | | 0.000 | 115.000 | No Ice | 9.220 | 12.970 | 0.300 |
| (AT&T) | | | | | | 1/2" Ice | 9.220 | 12.970 | 0.400 |

| Description | Face or Leg | Offset Type | Offsets: Horz Lateral ft / Vert ft / ft | Azimuth Adjustment ° | Placement ft | | $C_AA_A$ Front $ft^2$ | $C_AA_A$ Side $ft^2$ | Weight K |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 1" Ice | 9.220 | 12.970 | 0.500 |
| 12' V-Frame (AT&T) | C | None | | 0.000 | 115.000 | No Ice | 9.220 | 12.970 | 0.300 |
| | | | | | | 1/2" Ice | 9.220 | 12.970 | 0.400 |
| | | | | | | 1" Ice | 9.220 | 12.970 | 0.500 |
| AIR32 | A | From Face | 3.000 | 0.000 | 104.000 | No Ice | 6.510 | 4.712 | 0.133 |
| (T-Mobile) | | | 3.000 | | | 1/2" Ice | 6.887 | 5.068 | 0.179 |
| | | | 0.000 | | | 1" Ice | 7.271 | 5.431 | 0.230 |
| APXVAARR24-43 | A | From Face | 3.000 | 0.000 | 104.000 | No Ice | 20.243 | 8.889 | 0.153 |
| (T-Mobile) | | | 6.000 | | | 1/2" Ice | 20.890 | 9.487 | 0.266 |
| | | | 0.000 | | | 1" Ice | 21.544 | 10.092 | 0.387 |
| AIR32 | B | From Face | 3.000 | 0.000 | 104.000 | No Ice | 6.510 | 4.712 | 0.133 |
| (T-Mobile) | | | 3.000 | | | 1/2" Ice | 6.887 | 5.068 | 0.179 |
| | | | 0.000 | | | 1" Ice | 7.271 | 5.431 | 0.230 |
| APXVAARR24-43 | B | From Face | 3.000 | 0.000 | 104.000 | No Ice | 20.243 | 8.889 | 0.153 |
| (T-Mobile) | | | 6.000 | | | 1/2" Ice | 20.890 | 9.487 | 0.266 |
| | | | 0.000 | | | 1" Ice | 21.544 | 10.092 | 0.387 |
| AIR32 | C | From Face | 3.000 | 0.000 | 104.000 | No Ice | 6.510 | 4.712 | 0.133 |
| (T-Mobile) | | | 3.000 | | | 1/2" Ice | 6.887 | 5.068 | 0.179 |
| | | | 0.000 | | | 1" Ice | 7.271 | 5.431 | 0.230 |
| APXVAARR24-43 | C | From Face | 3.000 | 0.000 | 104.000 | No Ice | 20.243 | 8.889 | 0.153 |
| (T-Mobile) | | | 6.000 | | | 1/2" Ice | 20.890 | 9.487 | 0.266 |
| | | | 0.000 | | | 1" Ice | 21.544 | 10.092 | 0.387 |
| Radio 4449 B71 B12 | A | From Face | 3.000 | 0.000 | 104.000 | No Ice | 1.639 | 1.291 | 0.074 |
| (T-Mobile) | | | 6.000 | | | 1/2" Ice | 1.799 | 1.436 | 0.091 |
| | | | 0.000 | | | 1" Ice | 1.966 | 1.587 | 0.111 |
| Radio 4449 B71 B12 | B | From Face | 3.000 | 0.000 | 104.000 | No Ice | 1.639 | 1.291 | 0.074 |
| (T-Mobile) | | | 6.000 | | | 1/2" Ice | 1.799 | 1.436 | 0.091 |
| | | | 0.000 | | | 1" Ice | 1.966 | 1.587 | 0.111 |
| Radio 4449 B71 B12 | C | From Face | 3.000 | 0.000 | 104.000 | No Ice | 1.639 | 1.291 | 0.074 |
| (T-Mobile) | | | 6.000 | | | 1/2" Ice | 1.799 | 1.436 | 0.091 |
| | | | 0.000 | | | 1" Ice | 1.966 | 1.587 | 0.111 |
| F4P-12W Quad Platform w/ Handrail | C | None | | 0.000 | 104.000 | No Ice | 35.000 | 35.000 | 2.500 |
| | | | | | | 1/2" Ice | 41.000 | 41.000 | 3.100 |
| (T-Mobile) | | | | | | 1" Ice | 47.000 | 47.000 | 3.700 |

## Tower Pressures - No Ice

$G_H$ = 1.100

| Section Elevation ft | z ft | $K_Z$ | $q_z$ ksf | $A_G$ $ft^2$ | Face | $A_F$ $ft^2$ | $A_R$ $ft^2$ | $A_{leg}$ $ft^2$ | Leg % | $C_AA_A$ In Face $ft^2$ | $C_AA_A$ Out Face $ft^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| L1 | 105.568 | 1.446 | 0.039 | 135.989 | A | 0.000 | 135.989 | 135.989 | 100.00 | 0.000 | 0.000 |
| 130.000-83.71 | | | | | B | 0.000 | 135.989 | | 100.00 | 0.000 | 0.000 |
| 0 | | | | | C | 0.000 | 135.989 | | 100.00 | 0.000 | 0.000 |
| L2 | 61.816 | 1.318 | 0.035 | 170.010 | A | 0.000 | 170.010 | 170.010 | 100.00 | 0.000 | 0.000 |
| 83.710-41.210 | | | | | B | 0.000 | 170.010 | | 100.00 | 0.000 | 0.000 |
| | | | | | C | 0.000 | 170.010 | | 100.00 | 0.000 | 0.000 |
| L3 | 20.517 | 1.088 | 0.029 | 204.534 | A | 0.000 | 204.534 | 204.534 | 100.00 | 0.000 | 0.000 |

| Section Elevation ft | z ft | $K_Z$ | $q_z$ ksf | $A_G$ ft² | Face | $A_F$ ft² | $A_R$ ft² | $A_{leg}$ ft² | Leg % | $C_AA_A$ In Face ft² | $C_AA_A$ Out Face ft² |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 41.210-0.000 | | | | | B | 0.000 | 204.534 | | 100.00 | 0.000 | 0.000 |
| | | | | | C | 0.000 | 204.534 | | 100.00 | 0.000 | 0.000 |

## Tower Pressure - With Ice

$G_H$ = 1.100

| Section Elevation ft | z ft | $K_Z$ | $q_z$ ksf | $t_Z$ in | $A_G$ ft² | Face | $A_F$ ft² | $A_R$ ft² | $A_{leg}$ ft² | Leg % | $C_AA_A$ In Face ft² | $C_AA_A$ Out Face ft² |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L1 | 105.568 | 1.446 | 0.009 | 1.685 | 148.988 | A | 0.000 | 148.988 | 148.988 | 100.00 | 0.000 | 0.000 |
| 130.000-83.710 | | | | | | B | 0.000 | 148.988 | | 100.00 | 0.000 | 0.000 |
| | | | | | | C | 0.000 | 148.988 | | 100.00 | 0.000 | 0.000 |
| L2 | 61.816 | 1.318 | 0.008 | 1.597 | 181.945 | A | 0.000 | 181.945 | 181.945 | 100.00 | 0.000 | 0.000 |
| 83.710-41.210 | | | | | | B | 0.000 | 181.945 | | 100.00 | 0.000 | 0.000 |
| | | | | | | C | 0.000 | 181.945 | | 100.00 | 0.000 | 0.000 |
| L3 41.210-0.000 | 20.517 | 1.088 | 0.007 | 1.430 | 215.504 | A | 0.000 | 215.504 | 215.504 | 100.00 | 0.000 | 0.000 |
| | | | | | | B | 0.000 | 215.504 | | 100.00 | 0.000 | 0.000 |
| | | | | | | C | 0.000 | 215.504 | | 100.00 | 0.000 | 0.000 |

## Tower Pressure - Service

$G_H$ = 1.100

| Section Elevation ft | z ft | $K_Z$ | $q_z$ ksf | $A_G$ ft² | Face | $A_F$ ft² | $A_R$ ft² | $A_{leg}$ ft² | Leg % | $C_AA_A$ In Face ft² | $C_AA_A$ Out Face ft² |
|---|---|---|---|---|---|---|---|---|---|---|---|
| L1 | 105.568 | 1.446 | 0.011 | 135.989 | A | 0.000 | 135.989 | 135.989 | 100.00 | 0.000 | 0.000 |
| 130.000-83.71 | | | | | B | 0.000 | 135.989 | | 100.00 | 0.000 | 0.000 |
| 0 | | | | | C | 0.000 | 135.989 | | 100.00 | 0.000 | 0.000 |
| L2 | 61.816 | 1.318 | 0.010 | 170.010 | A | 0.000 | 170.010 | 170.010 | 100.00 | 0.000 | 0.000 |
| 83.710-41.210 | | | | | B | 0.000 | 170.010 | | 100.00 | 0.000 | 0.000 |
| | | | | | C | 0.000 | 170.010 | | 100.00 | 0.000 | 0.000 |
| L3 | 20.517 | 1.088 | 0.009 | 204.534 | A | 0.000 | 204.534 | 204.534 | 100.00 | 0.000 | 0.000 |
| 41.210-0.000 | | | | | B | 0.000 | 204.534 | | 100.00 | 0.000 | 0.000 |
| | | | | | C | 0.000 | 204.534 | | 100.00 | 0.000 | 0.000 |

## Tower Forces - No Ice - Wind Normal To Face

| Section Elevation ft | Add Weight K | Self Weight K | Face | e | $C_F$ | $q_z$ ksf | $D_F$ | $D_R$ | $A_E$ ft² | F K | w klf | Ctrl. Face |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L1 | 0.539 | 5.383 | A | 1 | 0.65 | 0.039 | 1 | 1 | 135.989 | 3.767 | 0.081 | C |
| 130.000-83.71 | | | B | 1 | 0.65 | | 1 | 1 | 135.989 | | | |
| 0 | | | C | 1 | 0.65 | | 1 | 1 | 135.989 | | | |
| L2 | 0.637 | 14.877 | A | 1 | 0.65 | 0.035 | 1 | 1 | 170.010 | 4.283 | 0.101 | C |

| Section Elevation ft | Add Weight K | Self Weight K | Face | e | $C_F$ | $q_z$ ksf | $D_F$ | $D_R$ | $A_E$ $ft^2$ | F K | w klf | Ctrl. Face |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 83.710-41.210 | | | B | 1 | 0.65 | | 1 | 1 | 170.010 | | | |
| | | | C | 1 | 0.65 | | 1 | 1 | 170.010 | | | |
| L3 | 0.575 | 22.243 | A | 1 | 0.65 | 0.029 | 1 | 1 | 204.534 | 4.293 | 0.104 | C |
| 41.210-0.000 | | | B | 1 | 0.65 | | 1 | 1 | 204.534 | | | |
| | | | C | 1 | 0.65 | | 1 | 1 | 204.534 | | | |
| Sum Weight: | 1.751 | 42.503 | | | | | | OTM | 750.441 kip-ft | 12.342 | | |

## Tower Forces - No Ice - Wind 45 To Face

| Section Elevation ft | Add Weight K | Self Weight K | Face | e | $C_F$ | $q_z$ ksf | $D_F$ | $D_R$ | $A_E$ $ft^2$ | F K | w klf | Ctrl. Face |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L1 | 0.539 | 5.383 | A | 1 | 0.65 | 0.039 | 1 | 1 | 135.989 | 3.767 | 0.081 | C |
| 130.000-83.71 | | | B | 1 | 0.65 | | 1 | 1 | 135.989 | | | |
| 0 | | | C | 1 | 0.65 | | 1 | 1 | 135.989 | | | |
| L2 | 0.637 | 14.877 | A | 1 | 0.65 | 0.035 | 1 | 1 | 170.010 | 4.283 | 0.101 | C |
| 83.710-41.210 | | | B | 1 | 0.65 | | 1 | 1 | 170.010 | | | |
| | | | C | 1 | 0.65 | | 1 | 1 | 170.010 | | | |
| L3 | 0.575 | 22.243 | A | 1 | 0.65 | 0.029 | 1 | 1 | 204.534 | 4.293 | 0.104 | C |
| 41.210-0.000 | | | B | 1 | 0.65 | | 1 | 1 | 204.534 | | | |
| | | | C | 1 | 0.65 | | 1 | 1 | 204.534 | | | |
| Sum Weight: | 1.751 | 42.503 | | | | | | OTM | 750.441 kip-ft | 12.342 | | |

## Tower Forces - No Ice - Wind 60 To Face

| Section Elevation ft | Add Weight K | Self Weight K | Face | e | $C_F$ | $q_z$ ksf | $D_F$ | $D_R$ | $A_E$ $ft^2$ | F K | w klf | Ctrl. Face |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L1 | 0.539 | 5.383 | A | 1 | 0.65 | 0.039 | 1 | 1 | 135.989 | 3.767 | 0.081 | C |
| 130.000-83.71 | | | B | 1 | 0.65 | | 1 | 1 | 135.989 | | | |
| 0 | | | C | 1 | 0.65 | | 1 | 1 | 135.989 | | | |
| L2 | 0.637 | 14.877 | A | 1 | 0.65 | 0.035 | 1 | 1 | 170.010 | 4.283 | 0.101 | C |
| 83.710-41.210 | | | B | 1 | 0.65 | | 1 | 1 | 170.010 | | | |
| | | | C | 1 | 0.65 | | 1 | 1 | 170.010 | | | |
| L3 | 0.575 | 22.243 | A | 1 | 0.65 | 0.029 | 1 | 1 | 204.534 | 4.293 | 0.104 | C |
| 41.210-0.000 | | | B | 1 | 0.65 | | 1 | 1 | 204.534 | | | |
| | | | C | 1 | 0.65 | | 1 | 1 | 204.534 | | | |
| Sum Weight: | 1.751 | 42.503 | | | | | | OTM | 750.441 kip-ft | 12.342 | | |

## Tower Forces - No Ice - Wind 90 To Face

| Section Elevation ft | Add Weight K | Self Weight K | Face | e | $C_F$ | $q_z$ ksf | $D_F$ | $D_R$ | $A_E$ $ft^2$ | F K | w klf | Ctrl. Face |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L1 | 0.539 | 5.383 | A | 1 | 0.65 | 0.039 | 1 | 1 | 135.989 | 3.767 | 0.081 | C |
| 130.000-83.71 | | | B | 1 | 0.65 | | 1 | 1 | 135.989 | | | |
| 0 | | | C | 1 | 0.65 | | 1 | 1 | 135.989 | | | |
| L2 | 0.637 | 14.877 | A | 1 | 0.65 | 0.035 | 1 | 1 | 170.010 | 4.283 | 0.101 | C |
| 83.710-41.210 | | | B | 1 | 0.65 | | 1 | 1 | 170.010 | | | |
| | | | C | 1 | 0.65 | | 1 | 1 | 170.010 | | | |
| L3 | 0.575 | 22.243 | A | 1 | 0.65 | 0.029 | 1 | 1 | 204.534 | 4.293 | 0.104 | C |
| 41.210-0.000 | | | B | 1 | 0.65 | | 1 | 1 | 204.534 | | | |
| | | | C | 1 | 0.65 | | 1 | 1 | 204.534 | | | |
| Sum Weight: | 1.751 | 42.503 | | | | | | OTM | 750.441 kip-ft | 12.342 | | |

## Tower Forces - With Ice - Wind Normal To Face

| Section Elevation ft | Add Weight K | Self Weight K | Face | e | $C_F$ | $q_z$ ksf | $D_F$ | $D_R$ | $A_E$ $ft^2$ | F K | w klf | Ctrl. Face |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L1 | 0.539 | 8.892 | A | 1 | 1.2 | 0.009 | 1 | 1 | 148.988 | 1.728 | 0.037 | C |
| 130.000-83.71 | | | B | 1 | 1.2 | | 1 | 1 | 148.988 | | | |
| 0 | | | C | 1 | 1.2 | | 1 | 1 | 148.988 | | | |
| L2 | 0.637 | 18.979 | A | 1 | 1.2 | 0.008 | 1 | 1 | 181.945 | 1.919 | 0.045 | C |
| 83.710-41.210 | | | B | 1 | 1.2 | | 1 | 1 | 181.945 | | | |
| | | | C | 1 | 1.2 | | 1 | 1 | 181.945 | | | |
| L3 | 0.575 | 26.623 | A | 1 | 1.2 | 0.007 | 1 | 1 | 215.504 | 1.894 | 0.046 | C |
| 41.210-0.000 | | | B | 1 | 1.2 | | 1 | 1 | 215.504 | | | |
| | | | C | 1 | 1.2 | | 1 | 1 | 215.504 | | | |
| Sum Weight: | 1.751 | 54.495 | | | | | | OTM | 339.826 kip-ft | 5.540 | | |

## Tower Forces - With Ice - Wind 45 To Face

| Section Elevation ft | Add Weight K | Self Weight K | Face | e | $C_F$ | $q_z$ ksf | $D_F$ | $D_R$ | $A_E$ $ft^2$ | F K | w klf | Ctrl. Face |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L1 | 0.539 | 8.892 | A | 1 | 1.2 | 0.009 | 1 | 1 | 148.988 | 1.728 | 0.037 | C |
| 130.000-83.71 | | | B | 1 | 1.2 | | 1 | 1 | 148.988 | | | |
| 0 | | | C | 1 | 1.2 | | 1 | 1 | 148.988 | | | |
| L2 | 0.637 | 18.979 | A | 1 | 1.2 | 0.008 | 1 | 1 | 181.945 | 1.919 | 0.045 | C |
| 83.710-41.210 | | | B | 1 | 1.2 | | 1 | 1 | 181.945 | | | |
| | | | C | 1 | 1.2 | | 1 | 1 | 181.945 | | | |
| L3 | 0.575 | 26.623 | A | 1 | 1.2 | 0.007 | 1 | 1 | 215.504 | 1.894 | 0.046 | C |
| 41.210-0.000 | | | B | 1 | 1.2 | | 1 | 1 | 215.504 | | | |
| | | | C | 1 | 1.2 | | 1 | 1 | 215.504 | | | |
| Sum Weight: | 1.751 | 54.495 | | | | | | OTM | 339.826 | 5.540 | | |

| Section Elevation | Add Weight | Self Weight | Face | e | $C_F$ | $q_z$ | $D_F$ | $D_R$ | $A_E$ | F | w | Ctrl. Face |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ft | K | K | | | | ksf | | | $ft^2$ | K | klf | |
| | | | | | | | | | kip-ft | | | |

## Tower Forces - With Ice - Wind 60 To Face

| Section Elevation | Add Weight | Self Weight | Face | e | $C_F$ | $q_z$ | $D_F$ | $D_R$ | $A_E$ | F | w | Ctrl. Face |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ft | K | K | | | | ksf | | | $ft^2$ | K | klf | |
| L1 | 0.539 | 8.892 | A | 1 | 1.2 | 0.009 | 1 | 1 | 148.988 | 1.728 | 0.037 | C |
| 130.000-83.71 | | | B | 1 | 1.2 | | 1 | 1 | 148.988 | | | |
| 0 | | | C | 1 | 1.2 | | 1 | 1 | 148.988 | | | |
| L2 | 0.637 | 18.979 | A | 1 | 1.2 | 0.008 | 1 | 1 | 181.945 | 1.919 | 0.045 | C |
| 83.710-41.210 | | | B | 1 | 1.2 | | 1 | 1 | 181.945 | | | |
| | | | C | 1 | 1.2 | | 1 | 1 | 181.945 | | | |
| L3 | 0.575 | 26.623 | A | 1 | 1.2 | 0.007 | 1 | 1 | 215.504 | 1.894 | 0.046 | C |
| 41.210-0.000 | | | B | 1 | 1.2 | | 1 | 1 | 215.504 | | | |
| | | | C | 1 | 1.2 | | 1 | 1 | 215.504 | | | |
| Sum Weight: | 1.751 | 54.495 | | | | | | OTM | 339.826 | 5.540 | | |
| | | | | | | | | | kip-ft | | | |

## Tower Forces - With Ice - Wind 90 To Face

| Section Elevation | Add Weight | Self Weight | Face | e | $C_F$ | $q_z$ | $D_F$ | $D_R$ | $A_E$ | F | w | Ctrl. Face |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ft | K | K | | | | ksf | | | $ft^2$ | K | klf | |
| L1 | 0.539 | 8.892 | A | 1 | 1.2 | 0.009 | 1 | 1 | 148.988 | 1.728 | 0.037 | C |
| 130.000-83.71 | | | B | 1 | 1.2 | | 1 | 1 | 148.988 | | | |
| 0 | | | C | 1 | 1.2 | | 1 | 1 | 148.988 | | | |
| L2 | 0.637 | 18.979 | A | 1 | 1.2 | 0.008 | 1 | 1 | 181.945 | 1.919 | 0.045 | C |
| 83.710-41.210 | | | B | 1 | 1.2 | | 1 | 1 | 181.945 | | | |
| | | | C | 1 | 1.2 | | 1 | 1 | 181.945 | | | |
| L3 | 0.575 | 26.623 | A | 1 | 1.2 | 0.007 | 1 | 1 | 215.504 | 1.894 | 0.046 | C |
| 41.210-0.000 | | | B | 1 | 1.2 | | 1 | 1 | 215.504 | | | |
| | | | C | 1 | 1.2 | | 1 | 1 | 215.504 | | | |
| Sum Weight: | 1.751 | 54.495 | | | | | | OTM | 339.826 | 5.540 | | |
| | | | | | | | | | kip-ft | | | |

## Tower Forces - Service - Wind Normal To Face

| Section Elevation | Add Weight | Self Weight | Face | e | $C_F$ | $q_z$ | $D_F$ | $D_R$ | $A_E$ | F | w | Ctrl. Face |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ft | K | K | | | | ksf | | | $ft^2$ | K | klf | |

| Section Elevation ft | Add Weight K | Self Weight K | Face | e | $C_F$ | $q_z$ ksf | $D_F$ | $D_R$ | $A_E$ $ft^2$ | F K | w klf | Ctrl. Face |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L1 | 0.539 | 5.383 | A | 1 | 0.65 | 0.011 | 1 | 1 | 135.989 | 1.100 | 0.024 | C |
| 130.000-83.71 | | | B | 1 | 0.65 | | 1 | 1 | 135.989 | | | |
| 0 | | | C | 1 | 0.65 | | 1 | 1 | 135.989 | | | |
| L2 | 0.637 | 14.877 | A | 1 | 0.65 | 0.010 | 1 | 1 | 170.010 | 1.251 | 0.029 | C |
| 83.710-41.210 | | | B | 1 | 0.65 | | 1 | 1 | 170.010 | | | |
| | | | C | 1 | 0.65 | | 1 | 1 | 170.010 | | | |
| L3 | 0.575 | 22.243 | A | 1 | 0.65 | 0.009 | 1 | 1 | 204.534 | 1.254 | 0.030 | C |
| 41.210-0.000 | | | B | 1 | 0.65 | | 1 | 1 | 204.534 | | | |
| | | | C | 1 | 0.65 | | 1 | 1 | 204.534 | | | |
| Sum Weight: | 1.751 | 42.503 | | | | | | OTM | 219.248 kip-ft | 3.606 | | |

## Tower Forces - Service - Wind 45 To Face

| Section Elevation ft | Add Weight K | Self Weight K | Face | e | $C_F$ | $q_z$ ksf | $D_F$ | $D_R$ | $A_E$ $ft^2$ | F K | w klf | Ctrl. Face |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L1 | 0.539 | 5.383 | A | 1 | 0.65 | 0.011 | 1 | 1 | 135.989 | 1.100 | 0.024 | C |
| 130.000-83.71 | | | B | 1 | 0.65 | | 1 | 1 | 135.989 | | | |
| 0 | | | C | 1 | 0.65 | | 1 | 1 | 135.989 | | | |
| L2 | 0.637 | 14.877 | A | 1 | 0.65 | 0.010 | 1 | 1 | 170.010 | 1.251 | 0.029 | C |
| 83.710-41.210 | | | B | 1 | 0.65 | | 1 | 1 | 170.010 | | | |
| | | | C | 1 | 0.65 | | 1 | 1 | 170.010 | | | |
| L3 | 0.575 | 22.243 | A | 1 | 0.65 | 0.009 | 1 | 1 | 204.534 | 1.254 | 0.030 | C |
| 41.210-0.000 | | | B | 1 | 0.65 | | 1 | 1 | 204.534 | | | |
| | | | C | 1 | 0.65 | | 1 | 1 | 204.534 | | | |
| Sum Weight: | 1.751 | 42.503 | | | | | | OTM | 219.248 kip-ft | 3.606 | | |

## Tower Forces - Service - Wind 60 To Face

| Section Elevation ft | Add Weight K | Self Weight K | Face | e | $C_F$ | $q_z$ ksf | $D_F$ | $D_R$ | $A_E$ $ft^2$ | F K | w klf | Ctrl. Face |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L1 | 0.539 | 5.383 | A | 1 | 0.65 | 0.011 | 1 | 1 | 135.989 | 1.100 | 0.024 | C |
| 130.000-83.71 | | | B | 1 | 0.65 | | 1 | 1 | 135.989 | | | |
| 0 | | | C | 1 | 0.65 | | 1 | 1 | 135.989 | | | |
| L2 | 0.637 | 14.877 | A | 1 | 0.65 | 0.010 | 1 | 1 | 170.010 | 1.251 | 0.029 | C |
| 83.710-41.210 | | | B | 1 | 0.65 | | 1 | 1 | 170.010 | | | |
| | | | C | 1 | 0.65 | | 1 | 1 | 170.010 | | | |
| L3 | 0.575 | 22.243 | A | 1 | 0.65 | 0.009 | 1 | 1 | 204.534 | 1.254 | 0.030 | C |
| 41.210-0.000 | | | B | 1 | 0.65 | | 1 | 1 | 204.534 | | | |
| | | | C | 1 | 0.65 | | 1 | 1 | 204.534 | | | |
| Sum Weight: | 1.751 | 42.503 | | | | | | OTM | 219.248 kip-ft | 3.606 | | |

## Tower Forces - Service - Wind 90 To Face

| Section Elevation ft | Add Weight K | Self Weight K | Face | e | $C_F$ | $q_z$ ksf | $D_F$ | $D_R$ | $A_E$ $ft^2$ | F K | w klf | Ctrl. Face |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L1 | 0.539 | 5.383 | A | 1 | 0.65 | 0.011 | 1 | 1 | 135.989 | 1.100 | 0.024 | C |
| 130.000-83.71 | | | B | 1 | 0.65 | | 1 | 1 | 135.989 | | | |
| 0 | | | C | 1 | 0.65 | | 1 | 1 | 135.989 | | | |
| L2 | 0.637 | 14.877 | A | 1 | 0.65 | 0.010 | 1 | 1 | 170.010 | 1.251 | 0.029 | C |
| 83.710-41.210 | | | B | 1 | 0.65 | | 1 | 1 | 170.010 | | | |
| | | | C | 1 | 0.65 | | 1 | 1 | 170.010 | | | |
| L3 | 0.575 | 22.243 | A | 1 | 0.65 | 0.009 | 1 | 1 | 204.534 | 1.254 | 0.030 | C |
| 41.210-0.000 | | | B | 1 | 0.65 | | 1 | 1 | 204.534 | | | |
| | | | C | 1 | 0.65 | | 1 | 1 | 204.534 | | | |
| Sum Weight: | 1.751 | 42.503 | | | | | | OTM | 219.248 kip-ft | 3.606 | | |

## Force Totals

| Load Case | Vertical Forces K | Sum of Forces X K | Sum of Forces Z K | Sum of Overturning Moments, $M_x$ kip-ft | Sum of Overturning Moments, $M_z$ kip-ft | Sum of Torques kip-ft |
|---|---|---|---|---|---|---|
| Leg Weight | 42.503 | | | | | |
| Bracing Weight | 0.000 | | | | | |
| Total Member Self-Weight | 42.503 | | | 0.300 | 0.000 | |
| Total Weight | 52.324 | | | 0.300 | 0.000 | |
| Wind 0 deg - No Ice | | 0.000 | -26.816 | -2438.151 | 0.000 | 0.000 |
| Wind 30 deg - No Ice | | 13.362 | -23.223 | -2111.461 | -1213.403 | 0.584 |
| Wind 45 deg - No Ice | | 18.896 | -18.962 | -1723.945 | -1716.011 | 0.826 |
| Wind 60 deg - No Ice | | 23.143 | -13.408 | -1218.926 | -2101.676 | 1.011 |
| Wind 90 deg - No Ice | | 26.724 | 0.000 | 0.300 | -2426.806 | 1.168 |
| Wind 120 deg - No Ice | | 23.143 | 13.408 | 1219.525 | -2101.676 | 1.011 |
| Wind 135 deg - No Ice | | 18.896 | 18.962 | 1724.545 | -1716.011 | 0.826 |
| Wind 150 deg - No Ice | | 13.362 | 23.223 | 2112.060 | -1213.403 | 0.584 |
| Wind 180 deg - No Ice | | 0.000 | 26.816 | 2438.751 | 0.000 | 0.000 |
| Wind 210 deg - No Ice | | -13.362 | 23.223 | 2112.060 | 1213.403 | -0.584 |
| Wind 225 deg - No Ice | | -18.896 | 18.962 | 1724.545 | 1716.011 | -0.826 |
| Wind 240 deg - No Ice | | -23.143 | 13.408 | 1219.525 | 2101.676 | -1.011 |
| Wind 270 deg - No Ice | | -26.724 | 0.000 | 0.300 | 2426.806 | -1.168 |
| Wind 300 deg - No Ice | | -23.143 | -13.408 | -1218.926 | 2101.676 | -1.011 |
| Wind 315 deg - No Ice | | -18.896 | -18.962 | -1723.945 | 1716.011 | -0.826 |
| Wind 330 deg - No Ice | | -13.362 | -23.223 | -2111.461 | 1213.403 | -0.584 |
| Member Ice | 11.992 | | | | | |
| Total Weight Ice | 76.809 | | | 1.615 | 0.000 | |
| Wind 0 deg - Ice | | 0.000 | -9.793 | -835.478 | 0.000 | 0.000 |
| Wind 30 deg - Ice | | 4.885 | -8.481 | -723.329 | -417.095 | 0.194 |
| Wind 45 deg - Ice | | 6.908 | -6.925 | -590.299 | -589.861 | 0.274 |
| Wind 60 deg - Ice | | 8.461 | -4.896 | -416.931 | -722.429 | 0.336 |
| Wind 90 deg - Ice | | 9.770 | 0.000 | 1.615 | -834.190 | 0.388 |
| Wind 120 deg - Ice | | 8.461 | 4.896 | 420.161 | -722.429 | 0.336 |
| Wind 135 deg - Ice | | 6.908 | 6.925 | 593.529 | -589.861 | 0.274 |
| Wind 150 deg - Ice | | 4.885 | 8.481 | 726.559 | -417.095 | 0.194 |

| Load Case | Vertical Forces K | Sum of Forces X K | Sum of Forces Z K | Sum of Overturning Moments, $M_x$ kip-ft | Sum of Overturning Moments, $M_z$ kip-ft | Sum of Torques kip-ft |
|---|---|---|---|---|---|---|
| Wind 180 deg - Ice | | 0.000 | 9.793 | 838.708 | 0.000 | 0.000 |
| Wind 210 deg - Ice | | -4.885 | 8.481 | 726.559 | 417.095 | -0.194 |
| Wind 225 deg - Ice | | -6.908 | 6.925 | 593.529 | 589.861 | -0.274 |
| Wind 240 deg - Ice | | -8.461 | 4.896 | 420.161 | 722.429 | -0.336 |
| Wind 270 deg - Ice | | -9.770 | 0.000 | 1.615 | 834.190 | -0.388 |
| Wind 300 deg - Ice | | -8.461 | -4.896 | -416.931 | 722.429 | -0.336 |
| Wind 315 deg - Ice | | -6.908 | -6.925 | -590.299 | 589.861 | -0.274 |
| Wind 330 deg - Ice | | -4.885 | -8.481 | -723.329 | 417.095 | -0.194 |
| Total Weight | 52.324 | | | 0.300 | 0.000 | |
| Wind 0 deg - Service | | 0.000 | -7.835 | -712.115 | 0.000 | 0.000 |
| Wind 30 deg - Service | | 3.904 | -6.785 | -616.670 | -354.507 | 0.171 |
| Wind 45 deg - Service | | 5.521 | -5.540 | -503.454 | -501.348 | 0.241 |
| Wind 60 deg - Service | | 6.762 | -3.917 | -355.908 | -614.023 | 0.295 |
| Wind 90 deg - Service | | 7.808 | 0.000 | 0.300 | -709.013 | 0.341 |
| Wind 120 deg - Service | | 6.762 | 3.917 | 356.508 | -614.023 | 0.295 |
| Wind 135 deg - Service | | 5.521 | 5.540 | 504.054 | -501.348 | 0.241 |
| Wind 150 deg - Service | | 3.904 | 6.785 | 617.270 | -354.507 | 0.171 |
| Wind 180 deg - Service | | 0.000 | 7.835 | 712.715 | 0.000 | 0.000 |
| Wind 210 deg - Service | | -3.904 | 6.785 | 617.270 | 354.507 | -0.171 |
| Wind 225 deg - Service | | -5.521 | 5.540 | 504.054 | 501.348 | -0.241 |
| Wind 240 deg - Service | | -6.762 | 3.917 | 356.508 | 614.023 | -0.295 |
| Wind 270 deg - Service | | -7.808 | 0.000 | 0.300 | 709.013 | -0.341 |
| Wind 300 deg - Service | | -6.762 | -3.917 | -355.908 | 614.023 | -0.295 |
| Wind 315 deg - Service | | -5.521 | -5.540 | -503.454 | 501.348 | -0.241 |
| Wind 330 deg - Service | | -3.904 | -6.785 | -616.670 | 354.507 | -0.171 |

## Load Combinations

| Comb. No. | Description |
|---|---|
| 1 | Dead Only |
| 2 | 1.2 Dead+1.6 Wind 0 deg - No Ice |
| 3 | 0.9 Dead+1.6 Wind 0 deg - No Ice |
| 4 | 1.2 Dead+1.6 Wind 30 deg - No Ice |
| 5 | 0.9 Dead+1.6 Wind 30 deg - No Ice |
| 6 | 1.2 Dead+1.6 Wind 45 deg - No Ice |
| 7 | 0.9 Dead+1.6 Wind 45 deg - No Ice |
| 8 | 1.2 Dead+1.6 Wind 60 deg - No Ice |
| 9 | 0.9 Dead+1.6 Wind 60 deg - No Ice |
| 10 | 1.2 Dead+1.6 Wind 90 deg - No Ice |
| 11 | 0.9 Dead+1.6 Wind 90 deg - No Ice |
| 12 | 1.2 Dead+1.6 Wind 120 deg - No Ice |
| 13 | 0.9 Dead+1.6 Wind 120 deg - No Ice |
| 14 | 1.2 Dead+1.6 Wind 135 deg - No Ice |
| 15 | 0.9 Dead+1.6 Wind 135 deg - No Ice |
| 16 | 1.2 Dead+1.6 Wind 150 deg - No Ice |
| 17 | 0.9 Dead+1.6 Wind 150 deg - No Ice |
| 18 | 1.2 Dead+1.6 Wind 180 deg - No Ice |
| 19 | 0.9 Dead+1.6 Wind 180 deg - No Ice |
| 20 | 1.2 Dead+1.6 Wind 210 deg - No Ice |
| 21 | 0.9 Dead+1.6 Wind 210 deg - No Ice |
| 22 | 1.2 Dead+1.6 Wind 225 deg - No Ice |
| 23 | 0.9 Dead+1.6 Wind 225 deg - No Ice |
| 24 | 1.2 Dead+1.6 Wind 240 deg - No Ice |
| 25 | 0.9 Dead+1.6 Wind 240 deg - No Ice |
| 26 | 1.2 Dead+1.6 Wind 270 deg - No Ice |

| Comb. No. | Description |
|---|---|
| 27 | 0.9 Dead+1.6 Wind 270 deg - No Ice |
| 28 | 1.2 Dead+1.6 Wind 300 deg - No Ice |
| 29 | 0.9 Dead+1.6 Wind 300 deg - No Ice |
| 30 | 1.2 Dead+1.6 Wind 315 deg - No Ice |
| 31 | 0.9 Dead+1.6 Wind 315 deg - No Ice |
| 32 | 1.2 Dead+1.6 Wind 330 deg - No Ice |
| 33 | 0.9 Dead+1.6 Wind 330 deg - No Ice |
| 34 | 1.2 Dead+1.0 Ice+1.0 Temp |
| 35 | 1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp |
| 36 | 1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp |
| 37 | 1.2 Dead+1.0 Wind 45 deg+1.0 Ice+1.0 Temp |
| 38 | 1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp |
| 39 | 1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp |
| 40 | 1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp |
| 41 | 1.2 Dead+1.0 Wind 135 deg+1.0 Ice+1.0 Temp |
| 42 | 1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp |
| 43 | 1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp |
| 44 | 1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp |
| 45 | 1.2 Dead+1.0 Wind 225 deg+1.0 Ice+1.0 Temp |
| 46 | 1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp |
| 47 | 1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp |
| 48 | 1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp |
| 49 | 1.2 Dead+1.0 Wind 315 deg+1.0 Ice+1.0 Temp |
| 50 | 1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp |
| 51 | Dead+Wind 0 deg - Service |
| 52 | Dead+Wind 30 deg - Service |
| 53 | Dead+Wind 45 deg - Service |
| 54 | Dead+Wind 60 deg - Service |
| 55 | Dead+Wind 90 deg - Service |
| 56 | Dead+Wind 120 deg - Service |
| 57 | Dead+Wind 135 deg - Service |
| 58 | Dead+Wind 150 deg - Service |
| 59 | Dead+Wind 180 deg - Service |
| 60 | Dead+Wind 210 deg - Service |
| 61 | Dead+Wind 225 deg - Service |
| 62 | Dead+Wind 240 deg - Service |
| 63 | Dead+Wind 270 deg - Service |
| 64 | Dead+Wind 300 deg - Service |
| 65 | Dead+Wind 315 deg - Service |
| 66 | Dead+Wind 330 deg - Service |

## Maximum Member Forces

| Section No. | Elevation ft | Component Type | Condition | Gov. Load Comb. | Axial K | Major Axis Moment kip-ft | Minor Axis Moment kip-ft |
|---|---|---|---|---|---|---|---|
| L1 | 130 - 83.71 | Pole | Max Tension | 34 | 0.000 | 0.000 | 0.000 |
| | | | Max. Compression | 34 | -31.398 | 0.000 | -1.675 |
| | | | Max. Mx | 10 | -15.141 | -740.103 | -0.342 |
| | | | Max. My | 18 | -15.133 | 0.000 | -745.963 |
| | | | Max. Vy | 10 | 28.582 | -740.103 | -0.342 |
| | | | Max. Vx | 18 | 28.732 | 0.000 | -745.963 |
| | | | Max. Torque | 10 | | | -1.873 |
| L2 | 83.71 - 41.21 | Pole | Max Tension | 1 | 0.000 | 0.000 | 0.000 |
| | | | Max. Compression | 34 | -52.287 | 0.000 | -1.675 |
| | | | Max. Mx | 10 | -31.908 | -2042.586 | -0.363 |
| | | | Max. My | 18 | -31.904 | 0.000 | -2054.601 |
| | | | Max. Vy | 10 | 35.060 | -2042.586 | -0.363 |
| | | | Max. Vx | 18 | 35.210 | 0.000 | -2054.601 |

| Section No. | Elevation ft | Component Type | Condition | Gov. Load Comb. | Axial K | Major Axis Moment kip-ft | Minor Axis Moment kip-ft |
|---|---|---|---|---|---|---|---|
| | | | Max. Torque | 10 | | | -1.872 |
| L3 | 41.21 - 0 | Pole | Max Tension | 1 | 0.000 | 0.000 | 0.000 |
| | | | Max. Compression | 34 | -88.549 | 0.000 | -1.675 |
| | | | Max. Mx | 10 | -62.777 | -3922.220 | -0.366 |
| | | | Max. My | 18 | -62.777 | 0.000 | -3941.430 |
| | | | Max. Vy | 10 | 42.775 | -3922.220 | -0.366 |
| | | | Max. Vx | 18 | 42.923 | 0.000 | -3941.430 |
| | | | Max. Torque | 10 | | | -1.872 |

## Maximum Reactions

| Location | Condition | Gov. Load Comb. | Vertical K | Horizontal, X K | Horizontal, Z K |
|---|---|---|---|---|---|
| Pole | Max. Vert | 34 | 88.549 | 0.000 | 0.000 |
| | Max. $H_x$ | 26 | 62.789 | 42.758 | 0.000 |
| | Max. $H_z$ | 2 | 62.789 | 0.000 | 42.906 |
| | Max. $M_x$ | 2 | 3940.696 | 0.000 | 42.906 |
| | Max. $M_z$ | 10 | 3922.220 | -42.758 | 0.000 |
| | Max. Torsion | 26 | 1.871 | 42.758 | 0.000 |
| | Min. Vert | 31 | 47.091 | 30.234 | 30.339 |
| | Min. $H_x$ | 10 | 62.789 | -42.758 | 0.000 |
| | Min. $H_z$ | 18 | 62.789 | 0.000 | -42.906 |
| | Min. $M_x$ | 18 | -3941.430 | 0.000 | -42.906 |
| | Min. $M_z$ | 26 | -3922.220 | 42.758 | 0.000 |
| | Min. Torsion | 10 | -1.871 | -42.758 | 0.000 |

## Tower Mast Reaction Summary

| Load Combination | Vertical K | $Shear_x$ K | $Shear_z$ K | Overturning Moment, $M_x$ kip-ft | Overturning Moment, $M_z$ kip-ft | Torque kip-ft |
|---|---|---|---|---|---|---|
| Dead Only | 52.324 | 0.000 | 0.000 | 0.300 | 0.000 | 0.000 |
| 1.2 Dead+1.6 Wind 0 deg - No Ice | 62.789 | 0.000 | -42.906 | -3940.696 | 0.000 | 0.000 |
| 0.9 Dead+1.6 Wind 0 deg - No Ice | 47.091 | 0.000 | -42.906 | -3930.675 | 0.000 | 0.000 |
| 1.2 Dead+1.6 Wind 30 deg - No Ice | 62.789 | 21.379 | -37.157 | -3412.696 | -1961.107 | 0.935 |
| 0.9 Dead+1.6 Wind 30 deg - No Ice | 47.091 | 21.379 | -37.157 | -3404.029 | -1956.078 | 0.935 |
| 1.2 Dead+1.6 Wind 45 deg - No Ice | 62.789 | 30.234 | -30.339 | -2786.389 | -2773.426 | 1.323 |
| 0.9 Dead+1.6 Wind 45 deg - No Ice | 47.091 | 30.234 | -30.339 | -2779.329 | -2766.313 | 1.322 |
| 1.2 Dead+1.6 Wind 60 deg - No Ice | 62.789 | 37.029 | -21.453 | -1970.168 | -3396.741 | 1.620 |
| 0.9 Dead+1.6 Wind 60 deg - No Ice | 47.091 | 37.029 | -21.453 | -1965.204 | -3388.029 | 1.619 |
| 1.2 Dead+1.6 Wind 90 deg - No Ice | 62.789 | 42.758 | 0.000 | 0.366 | -3922.220 | 1.871 |
| 0.9 Dead+1.6 Wind 90 deg - No Ice | 47.091 | 42.758 | 0.000 | 0.273 | -3912.161 | 1.870 |

| Load Combination | Vertical | $Shear_x$ | $Shear_z$ | Overturning Moment, $M_x$ | Overturning Moment, $M_z$ | Torque |
|---|---|---|---|---|---|---|
| | K | K | K | kip-ft | kip-ft | kip-ft |
| 1.2 Dead+1.6 Wind 120 deg - No Ice | 62.789 | 37.029 | 21.453 | 1970.900 | -3396.742 | 1.621 |
| 0.9 Dead+1.6 Wind 120 deg - No Ice | 47.091 | 37.029 | 21.453 | 1965.750 | -3388.030 | 1.620 |
| 1.2 Dead+1.6 Wind 135 deg - No Ice | 62.789 | 30.234 | 30.339 | 2787.121 | -2773.427 | 1.324 |
| 0.9 Dead+1.6 Wind 135 deg - No Ice | 47.091 | 30.234 | 30.339 | 2779.876 | -2766.314 | 1.323 |
| 1.2 Dead+1.6 Wind 150 deg - No Ice | 62.789 | 21.379 | 37.157 | 3413.429 | -1961.108 | 0.936 |
| 0.9 Dead+1.6 Wind 150 deg - No Ice | 47.091 | 21.379 | 37.157 | 3404.576 | -1956.079 | 0.935 |
| 1.2 Dead+1.6 Wind 180 deg - No Ice | 62.789 | 0.000 | 42.906 | 3941.430 | 0.000 | 0.000 |
| 0.9 Dead+1.6 Wind 180 deg - No Ice | 47.091 | 0.000 | 42.906 | 3931.222 | 0.000 | 0.000 |
| 1.2 Dead+1.6 Wind 210 deg - No Ice | 62.789 | -21.379 | 37.157 | 3413.429 | 1961.108 | -0.936 |
| 0.9 Dead+1.6 Wind 210 deg - No Ice | 47.091 | -21.379 | 37.157 | 3404.576 | 1956.079 | -0.935 |
| 1.2 Dead+1.6 Wind 225 deg - No Ice | 62.789 | -30.234 | 30.339 | 2787.121 | 2773.427 | -1.324 |
| 0.9 Dead+1.6 Wind 225 deg - No Ice | 47.091 | -30.234 | 30.339 | 2779.876 | 2766.314 | -1.323 |
| 1.2 Dead+1.6 Wind 240 deg - No Ice | 62.789 | -37.029 | 21.453 | 1970.900 | 3396.742 | -1.621 |
| 0.9 Dead+1.6 Wind 240 deg - No Ice | 47.091 | -37.029 | 21.453 | 1965.750 | 3388.030 | -1.620 |
| 1.2 Dead+1.6 Wind 270 deg - No Ice | 62.789 | -42.758 | 0.000 | 0.366 | 3922.220 | -1.871 |
| 0.9 Dead+1.6 Wind 270 deg - No Ice | 47.091 | -42.758 | 0.000 | 0.273 | 3912.161 | -1.870 |
| 1.2 Dead+1.6 Wind 300 deg - No Ice | 62.789 | -37.029 | -21.453 | -1970.168 | 3396.741 | -1.620 |
| 0.9 Dead+1.6 Wind 300 deg - No Ice | 47.091 | -37.029 | -21.453 | -1965.204 | 3388.029 | -1.619 |
| 1.2 Dead+1.6 Wind 315 deg - No Ice | 62.789 | -30.234 | -30.339 | -2786.389 | 2773.426 | -1.323 |
| 0.9 Dead+1.6 Wind 315 deg - No Ice | 47.091 | -30.234 | -30.339 | -2779.329 | 2766.313 | -1.322 |
| 1.2 Dead+1.6 Wind 330 deg - No Ice | 62.789 | -21.379 | -37.157 | -3412.696 | 1961.107 | -0.935 |
| 0.9 Dead+1.6 Wind 330 deg - No Ice | 47.091 | -21.379 | -37.157 | -3404.029 | 1956.078 | -0.935 |
| 1.2 Dead+1.0 Ice+1.0 Temp | 88.549 | 0.000 | 0.000 | 1.675 | 0.000 | 0.000 |
| 1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp | 88.549 | 0.000 | -9.793 | -850.387 | 0.000 | 0.000 |
| 1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp | 88.549 | 4.885 | -8.481 | -736.224 | -424.581 | 0.197 |
| 1.2 Dead+1.0 Wind 45 deg+1.0 Ice+1.0 Temp | 88.549 | 6.908 | -6.925 | -600.805 | -600.448 | 0.278 |
| 1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp | 88.549 | 8.461 | -4.896 | -424.323 | -735.396 | 0.340 |
| 1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp | 88.549 | 9.770 | 0.000 | 1.741 | -849.162 | 0.393 |
| 1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp | 88.549 | 8.461 | 4.896 | 427.804 | -735.396 | 0.340 |
| 1.2 Dead+1.0 Wind 135 deg+1.0 Ice+1.0 Temp | 88.549 | 6.908 | 6.925 | 604.286 | -600.448 | 0.278 |
| 1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp | 88.549 | 4.885 | 8.481 | 739.705 | -424.581 | 0.197 |

| Load Combination | Vertical | $Shear_x$ | $Shear_z$ | Overturning Moment, $M_x$ | Overturning Moment, $M_z$ | Torque |
|---|---|---|---|---|---|---|
| | K | K | K | kip-ft | kip-ft | kip-ft |
| 1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp | 88.549 | 0.000 | 9.793 | 853.868 | 0.000 | 0.000 |
| 1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp | 88.549 | -4.885 | 8.481 | 739.705 | 424.581 | -0.197 |
| 1.2 Dead+1.0 Wind 225 deg+1.0 Ice+1.0 Temp | 88.549 | -6.908 | 6.925 | 604.286 | 600.448 | -0.278 |
| 1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp | 88.549 | -8.461 | 4.896 | 427.804 | 735.396 | -0.340 |
| 1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp | 88.549 | -9.770 | 0.000 | 1.741 | 849.162 | -0.393 |
| 1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp | 88.549 | -8.461 | -4.896 | -424.323 | 735.396 | -0.340 |
| 1.2 Dead+1.0 Wind 315 deg+1.0 Ice+1.0 Temp | 88.549 | -6.908 | -6.925 | -600.805 | 600.448 | -0.278 |
| 1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp | 88.549 | -4.885 | -8.481 | -736.224 | 424.581 | -0.197 |
| Dead+Wind 0 deg - Service | 52.324 | 0.000 | -7.835 | -718.192 | 0.000 | 0.000 |
| Dead+Wind 30 deg - Service | 52.324 | 3.904 | -6.785 | -621.932 | -357.531 | 0.171 |
| Dead+Wind 45 deg - Service | 52.324 | 5.521 | -5.540 | -507.749 | -505.625 | 0.242 |
| Dead+Wind 60 deg - Service | 52.324 | 6.762 | -3.917 | -358.944 | -619.262 | 0.296 |
| Dead+Wind 90 deg - Service | 52.324 | 7.808 | 0.000 | 0.305 | -715.062 | 0.342 |
| Dead+Wind 120 deg - Service | 52.324 | 6.762 | 3.917 | 359.554 | -619.262 | 0.296 |
| Dead+Wind 135 deg - Service | 52.324 | 5.521 | 5.540 | 508.359 | -505.625 | 0.242 |
| Dead+Wind 150 deg - Service | 52.324 | 3.904 | 6.785 | 622.542 | -357.531 | 0.171 |
| Dead+Wind 180 deg - Service | 52.324 | 0.000 | 7.835 | 718.802 | 0.000 | 0.000 |
| Dead+Wind 210 deg - Service | 52.324 | -3.904 | 6.785 | 622.542 | 357.531 | -0.171 |
| Dead+Wind 225 deg - Service | 52.324 | -5.521 | 5.540 | 508.359 | 505.625 | -0.242 |
| Dead+Wind 240 deg - Service | 52.324 | -6.762 | 3.917 | 359.554 | 619.262 | -0.296 |
| Dead+Wind 270 deg - Service | 52.324 | -7.808 | 0.000 | 0.305 | 715.062 | -0.342 |
| Dead+Wind 300 deg - Service | 52.324 | -6.762 | -3.917 | -358.944 | 619.262 | -0.296 |
| Dead+Wind 315 deg - Service | 52.324 | -5.521 | -5.540 | -507.749 | 505.625 | -0.242 |
| Dead+Wind 330 deg - Service | 52.324 | -3.904 | -6.785 | -621.932 | 357.531 | -0.171 |

# Solution Summary

| | Sum of Applied Forces | | | Sum of Reactions | | | |
|---|---|---|---|---|---|---|---|
| Load Comb. | PX | PY | PZ | PX | PY | PZ | % Error |
| | K | K | K | K | K | K | |
| 1 | 0.000 | -52.324 | 0.000 | 0.000 | 52.324 | 0.000 | 0.000% |
| 2 | 0.000 | -62.789 | -42.906 | 0.000 | 62.789 | 42.906 | 0.000% |
| 3 | 0.000 | -47.091 | -42.906 | 0.000 | 47.091 | 42.906 | 0.000% |
| 4 | 21.379 | -62.789 | -37.157 | -21.379 | 62.789 | 37.157 | 0.000% |
| 5 | 21.379 | -47.091 | -37.157 | -21.379 | 47.091 | 37.157 | 0.000% |
| 6 | 30.234 | -62.789 | -30.339 | -30.234 | 62.789 | 30.339 | 0.000% |
| 7 | 30.234 | -47.091 | -30.339 | -30.234 | 47.091 | 30.339 | 0.000% |
| 8 | 37.029 | -62.789 | -21.453 | -37.029 | 62.789 | 21.453 | 0.000% |
| 9 | 37.029 | -47.091 | -21.453 | -37.029 | 47.091 | 21.453 | 0.000% |
| 10 | 42.758 | -62.789 | 0.000 | -42.758 | 62.789 | 0.000 | 0.000% |
| 11 | 42.758 | -47.091 | 0.000 | -42.758 | 47.091 | 0.000 | 0.000% |
| 12 | 37.029 | -62.789 | 21.453 | -37.029 | 62.789 | -21.453 | 0.000% |
| 13 | 37.029 | -47.091 | 21.453 | -37.029 | 47.091 | -21.453 | 0.000% |
| 14 | 30.234 | -62.789 | 30.339 | -30.234 | 62.789 | -30.339 | 0.000% |
| 15 | 30.234 | -47.091 | 30.339 | -30.234 | 47.091 | -30.339 | 0.000% |
| 16 | 21.379 | -62.789 | 37.157 | -21.379 | 62.789 | -37.157 | 0.000% |
| 17 | 21.379 | -47.091 | 37.157 | -21.379 | 47.091 | -37.157 | 0.000% |
| 18 | 0.000 | -62.789 | 42.906 | 0.000 | 62.789 | -42.906 | 0.000% |
| 19 | 0.000 | -47.091 | 42.906 | 0.000 | 47.091 | -42.906 | 0.000% |
| 20 | -21.379 | -62.789 | 37.157 | 21.379 | 62.789 | -37.157 | 0.000% |

| | Sum of Applied Forces | | | Sum of Reactions | | | |
|---|---|---|---|---|---|---|---|
| Load Comb. | PX K | PY K | PZ K | PX K | PY K | PZ K | % Error |
| 21 | -21.379 | -47.091 | 37.157 | 21.379 | 47.091 | -37.157 | 0.000% |
| 22 | -30.234 | -62.789 | 30.339 | 30.234 | 62.789 | -30.339 | 0.000% |
| 23 | -30.234 | -47.091 | 30.339 | 30.234 | 47.091 | -30.339 | 0.000% |
| 24 | -37.029 | -62.789 | 21.453 | 37.029 | 62.789 | -21.453 | 0.000% |
| 25 | -37.029 | -47.091 | 21.453 | 37.029 | 47.091 | -21.453 | 0.000% |
| 26 | -42.758 | -62.789 | 0.000 | 42.758 | 62.789 | 0.000 | 0.000% |
| 27 | -42.758 | -47.091 | 0.000 | 42.758 | 47.091 | 0.000 | 0.000% |
| 28 | -37.029 | -62.789 | -21.453 | 37.029 | 62.789 | 21.453 | 0.000% |
| 29 | -37.029 | -47.091 | -21.453 | 37.029 | 47.091 | 21.453 | 0.000% |
| 30 | -30.234 | -62.789 | -30.339 | 30.234 | 62.789 | 30.339 | 0.000% |
| 31 | -30.234 | -47.091 | -30.339 | 30.234 | 47.091 | 30.339 | 0.000% |
| 32 | -21.379 | -62.789 | -37.157 | 21.379 | 62.789 | 37.157 | 0.000% |
| 33 | -21.379 | -47.091 | -37.157 | 21.379 | 47.091 | 37.157 | 0.000% |
| 34 | 0.000 | -88.549 | 0.000 | 0.000 | 88.549 | 0.000 | 0.000% |
| 35 | 0.000 | -88.549 | -9.793 | 0.000 | 88.549 | 9.793 | 0.000% |
| 36 | 4.885 | -88.549 | -8.481 | -4.885 | 88.549 | 8.481 | 0.000% |
| 37 | 6.908 | -88.549 | -6.925 | -6.908 | 88.549 | 6.925 | 0.000% |
| 38 | 8.461 | -88.549 | -4.896 | -8.461 | 88.549 | 4.896 | 0.000% |
| 39 | 9.770 | -88.549 | 0.000 | -9.770 | 88.549 | -0.000 | 0.000% |
| 40 | 8.461 | -88.549 | 4.896 | -8.461 | 88.549 | -4.896 | 0.000% |
| 41 | 6.908 | -88.549 | 6.925 | -6.908 | 88.549 | -6.925 | 0.000% |
| 42 | 4.885 | -88.549 | 8.481 | -4.885 | 88.549 | -8.481 | 0.000% |
| 43 | 0.000 | -88.549 | 9.793 | 0.000 | 88.549 | -9.793 | 0.000% |
| 44 | -4.885 | -88.549 | 8.481 | 4.885 | 88.549 | -8.481 | 0.000% |
| 45 | -6.908 | -88.549 | 6.925 | 6.908 | 88.549 | -6.925 | 0.000% |
| 46 | -8.461 | -88.549 | 4.896 | 8.461 | 88.549 | -4.896 | 0.000% |
| 47 | -9.770 | -88.549 | 0.000 | 9.770 | 88.549 | -0.000 | 0.000% |
| 48 | -8.461 | -88.549 | -4.896 | 8.461 | 88.549 | 4.896 | 0.000% |
| 49 | -6.908 | -88.549 | -6.925 | 6.908 | 88.549 | 6.925 | 0.000% |
| 50 | -4.885 | -88.549 | -8.481 | 4.885 | 88.549 | 8.481 | 0.000% |
| 51 | 0.000 | -52.324 | -7.835 | 0.000 | 52.324 | 7.835 | 0.000% |
| 52 | 3.904 | -52.324 | -6.785 | -3.904 | 52.324 | 6.785 | 0.000% |
| 53 | 5.521 | -52.324 | -5.540 | -5.521 | 52.324 | 5.540 | 0.000% |
| 54 | 6.762 | -52.324 | -3.917 | -6.762 | 52.324 | 3.917 | 0.000% |
| 55 | 7.808 | -52.324 | 0.000 | -7.808 | 52.324 | 0.000 | 0.000% |
| 56 | 6.762 | -52.324 | 3.917 | -6.762 | 52.324 | -3.917 | 0.000% |
| 57 | 5.521 | -52.324 | 5.540 | -5.521 | 52.324 | -5.540 | 0.000% |
| 58 | 3.904 | -52.324 | 6.785 | -3.904 | 52.324 | -6.785 | 0.000% |
| 59 | 0.000 | -52.324 | 7.835 | 0.000 | 52.324 | -7.835 | 0.000% |
| 60 | -3.904 | -52.324 | 6.785 | 3.904 | 52.324 | -6.785 | 0.000% |
| 61 | -5.521 | -52.324 | 5.540 | 5.521 | 52.324 | -5.540 | 0.000% |
| 62 | -6.762 | -52.324 | 3.917 | 6.762 | 52.324 | -3.917 | 0.000% |
| 63 | -7.808 | -52.324 | 0.000 | 7.808 | 52.324 | 0.000 | 0.000% |
| 64 | -6.762 | -52.324 | -3.917 | 6.762 | 52.324 | 3.917 | 0.000% |
| 65 | -5.521 | -52.324 | -5.540 | 5.521 | 52.324 | 5.540 | 0.000% |
| 66 | -3.904 | -52.324 | -6.785 | 3.904 | 52.324 | 6.785 | 0.000% |

## Non-Linear Convergence Results

| Load Combination | Converged? | Number of Cycles | Displacement Tolerance | Force Tolerance |
|---|---|---|---|---|
| 1 | Yes | 4 | 0.00000001 | 0.00000001 |
| 2 | Yes | 4 | 0.00000001 | 0.00000467 |
| 3 | Yes | 4 | 0.00000001 | 0.00000001 |
| 4 | Yes | 4 | 0.00000001 | 0.00008606 |
| 5 | Yes | 4 | 0.00000001 | 0.00005341 |

| | | | | |
|---|---|---|---|---|
| 6 | Yes | 4 | 0.00000001 | 0.00009521 |
| 7 | Yes | 4 | 0.00000001 | 0.00005887 |
| 8 | Yes | 4 | 0.00000001 | 0.00007785 |
| 9 | Yes | 4 | 0.00000001 | 0.00004815 |
| 10 | Yes | 4 | 0.00000001 | 0.00001378 |
| 11 | Yes | 4 | 0.00000001 | 0.00000852 |
| 12 | Yes | 4 | 0.00000001 | 0.00008858 |
| 13 | Yes | 4 | 0.00000001 | 0.00005504 |
| 14 | Yes | 4 | 0.00000001 | 0.00009518 |
| 15 | Yes | 4 | 0.00000001 | 0.00005884 |
| 16 | Yes | 4 | 0.00000001 | 0.00007983 |
| 17 | Yes | 4 | 0.00000001 | 0.00004938 |
| 18 | Yes | 4 | 0.00000001 | 0.00000467 |
| 19 | Yes | 4 | 0.00000001 | 0.00000001 |
| 20 | Yes | 4 | 0.00000001 | 0.00007983 |
| 21 | Yes | 4 | 0.00000001 | 0.00004938 |
| 22 | Yes | 4 | 0.00000001 | 0.00009518 |
| 23 | Yes | 4 | 0.00000001 | 0.00005884 |
| 24 | Yes | 4 | 0.00000001 | 0.00008858 |
| 25 | Yes | 4 | 0.00000001 | 0.00005504 |
| 26 | Yes | 4 | 0.00000001 | 0.00001378 |
| 27 | Yes | 4 | 0.00000001 | 0.00000852 |
| 28 | Yes | 4 | 0.00000001 | 0.00007785 |
| 29 | Yes | 4 | 0.00000001 | 0.00004815 |
| 30 | Yes | 4 | 0.00000001 | 0.00009521 |
| 31 | Yes | 4 | 0.00000001 | 0.00005887 |
| 32 | Yes | 4 | 0.00000001 | 0.00008606 |
| 33 | Yes | 4 | 0.00000001 | 0.00005341 |
| 34 | Yes | 4 | 0.00000001 | 0.00000001 |
| 35 | Yes | 4 | 0.00000001 | 0.00011907 |
| 36 | Yes | 4 | 0.00000001 | 0.00012074 |
| 37 | Yes | 4 | 0.00000001 | 0.00012126 |
| 38 | Yes | 4 | 0.00000001 | 0.00012068 |
| 39 | Yes | 4 | 0.00000001 | 0.00011920 |
| 40 | Yes | 4 | 0.00000001 | 0.00012141 |
| 41 | Yes | 4 | 0.00000001 | 0.00012221 |
| 42 | Yes | 4 | 0.00000001 | 0.00012184 |
| 43 | Yes | 4 | 0.00000001 | 0.00012034 |
| 44 | Yes | 4 | 0.00000001 | 0.00012184 |
| 45 | Yes | 4 | 0.00000001 | 0.00012221 |
| 46 | Yes | 4 | 0.00000001 | 0.00012141 |
| 47 | Yes | 4 | 0.00000001 | 0.00011920 |
| 48 | Yes | 4 | 0.00000001 | 0.00012068 |
| 49 | Yes | 4 | 0.00000001 | 0.00012126 |
| 50 | Yes | 4 | 0.00000001 | 0.00012074 |
| 51 | Yes | 4 | 0.00000001 | 0.00000001 |
| 52 | Yes | 4 | 0.00000001 | 0.00000001 |
| 53 | Yes | 4 | 0.00000001 | 0.00000001 |
| 54 | Yes | 4 | 0.00000001 | 0.00000001 |
| 55 | Yes | 4 | 0.00000001 | 0.00000001 |
| 56 | Yes | 4 | 0.00000001 | 0.00000001 |
| 57 | Yes | 4 | 0.00000001 | 0.00000001 |
| 58 | Yes | 4 | 0.00000001 | 0.00000001 |
| 59 | Yes | 4 | 0.00000001 | 0.00000001 |
| 60 | Yes | 4 | 0.00000001 | 0.00000001 |
| 61 | Yes | 4 | 0.00000001 | 0.00000001 |
| 62 | Yes | 4 | 0.00000001 | 0.00000001 |
| 63 | Yes | 4 | 0.00000001 | 0.00000001 |
| 64 | Yes | 4 | 0.00000001 | 0.00000001 |
| 65 | Yes | 4 | 0.00000001 | 0.00000001 |
| 66 | Yes | 4 | 0.00000001 | 0.00000001 |

## Maximum Tower Deflections - Service Wind

| Section No. | Elevation<br>ft | Horz. Deflection<br>in | Gov. Load Comb. | Tilt<br>° | Twist<br>° |
|---|---|---|---|---|---|
| L1 | 130 - 83.71 | 4.918 | 59 | 0.343 | 0.001 |
| L2 | 89.21 - 41.21 | 2.255 | 59 | 0.243 | 0.000 |
| L3 | 48.21 - 0 | 0.648 | 59 | 0.123 | 0.000 |

## Critical Deflections and Radius of Curvature - Service Wind

| Elevation<br>ft | Appurtenance | Gov. Load Comb. | Deflection<br>in | Tilt<br>° | Twist<br>° | Radius of Curvature<br>ft |
|---|---|---|---|---|---|---|
| 130.000 | BOA4357 | 59 | 4.918 | 0.343 | 0.001 | 124606 |
| 126.000 | (3) NHH-65B-R2B | 59 | 4.635 | 0.333 | 0.001 | 124606 |
| 115.000 | EPBQ-654L8H8-L2 | 59 | 3.869 | 0.308 | 0.001 | 41535 |
| 104.000 | AIR32 | 59 | 3.138 | 0.282 | 0.001 | 23963 |

## Maximum Tower Deflections - Design Wind

| Section No. | Elevation<br>ft | Horz. Deflection<br>in | Gov. Load Comb. | Tilt<br>° | Twist<br>° |
|---|---|---|---|---|---|
| L1 | 130 - 83.71 | 26.954 | 18 | 1.876 | 0.007 |
| L2 | 89.21 - 41.21 | 12.363 | 18 | 1.335 | 0.002 |
| L3 | 48.21 - 0 | 3.554 | 18 | 0.674 | 0.001 |

## Critical Deflections and Radius of Curvature - Design Wind

| Elevation<br>ft | Appurtenance | Gov. Load Comb. | Deflection<br>in | Tilt<br>° | Twist<br>° | Radius of Curvature<br>ft |
|---|---|---|---|---|---|---|
| 130.000 | BOA4357 | 18 | 26.954 | 1.876 | 0.007 | 22818 |
| 126.000 | (3) NHH-65B-R2B | 18 | 25.407 | 1.826 | 0.006 | 22818 |
| 115.000 | EPBQ-654L8H8-L2 | 18 | 21.209 | 1.688 | 0.005 | 7605 |
| 104.000 | AIR32 | 18 | 17.203 | 1.545 | 0.003 | 4387 |

## *Compression Checks*

## Pole Design Data

| Section No. | Elevation ft | Size | L ft | $L_u$ ft | Kl/r | A $in^2$ | $P_u$ K | $\phi P_n$ K | Ratio $\frac{P_u}{\phi P_n}$ |
|---|---|---|---|---|---|---|---|---|---|
| L1 | 130 - 83.71 (1) | TP41.53x28x0.313 | 46.290 | 0.000 | 0.0 | 39.288 | -15.133 | 2723.550 | 0.006 |
| L2 | 83.71 - 41.21 (2) | TP53.78x39.297x0.625 | 48.000 | 0.000 | 0.0 | 101.256 | -31.904 | 7522.850 | 0.004 |
| L3 | 41.21 - 0 (3) | TP65x50.418x0.75 | 48.210 | 0.000 | 0.0 | 152.947 | -62.777 | 11363.200 | 0.006 |

## Pole Bending Design Data

| Section No. | Elevation ft | Size | $M_{ux}$ kip-ft | $\phi M_{nx}$ kip-ft | Ratio $\frac{M_{ux}}{\phi M_{nx}}$ | $M_{uy}$ kip-ft | $\phi M_{ny}$ kip-ft | Ratio $\frac{M_{uy}}{\phi M_{ny}}$ |
|---|---|---|---|---|---|---|---|---|
| L1 | 130 - 83.71 (1) | TP41.53x28x0.313 | 745.962 | 2218.300 | 0.336 | 0.000 | 2218.300 | 0.000 |
| L2 | 83.71 - 41.21 (2) | TP53.78x39.297x0.625 | 2054.600 | 7861.858 | 0.261 | 0.000 | 7861.858 | 0.000 |
| L3 | 41.21 - 0 (3) | TP65x50.418x0.75 | 3941.433 | 14956.333 | 0.264 | 0.000 | 14956.333 | 0.000 |

## Pole Shear Design Data

| Section No. | Elevation ft | Size | Actual $V_u$ K | $\phi V_n$ K | Ratio $\frac{V_u}{\phi V_n}$ | Actual $T_u$ kip-ft | $\phi T_n$ kip-ft | Ratio $\frac{T_u}{\phi T_n}$ |
|---|---|---|---|---|---|---|---|---|
| L1 | 130 - 83.71 (1) | TP41.53x28x0.313 | 28.732 | 1361.780 | 0.021 | 0.000 | 4447.308 | 0.000 |
| L2 | 83.71 - 41.21 (2) | TP53.78x39.297x0.625 | 35.210 | 3761.420 | 0.009 | 0.000 | 15771.916 | 0.000 |
| L3 | 41.21 - 0 (3) | TP65x50.418x0.75 | 42.923 | 5681.600 | 0.008 | 0.000 | 30001.917 | 0.000 |

## Pole Interaction Design Data

| Section No. | Elevation ft | Ratio $\frac{P_u}{\phi P_n}$ | Ratio $\frac{M_{ux}}{\phi M_{nx}}$ | Ratio $\frac{M_{uy}}{\phi M_{ny}}$ | Ratio $\frac{V_u}{\phi V_n}$ | Ratio $\frac{T_u}{\phi T_n}$ | Comb. Stress Ratio | Allow. Stress Ratio | Criteria |
|---|---|---|---|---|---|---|---|---|---|
| L1 | 130 - 83.71 (1) | 0.006 | 0.336 | 0.000 | 0.021 | 0.000 | 0.342 ✔ | 1.000 | 4.8.2 ✔ |
| L2 | 83.71 - 41.21 (2) | 0.004 | 0.261 | 0.000 | 0.009 | 0.000 | 0.266 ✔ | 1.000 | 4.8.2 ✔ |
| L3 | 41.21 - 0 (3) | 0.006 | 0.264 | 0.000 | 0.008 | 0.000 | 0.269 ✔ | 1.000 | 4.8.2 ✔ |

## Section Capacity Table

| Section No. | Elevation ft | Component Type | Size | Critical Element | P K | $\phi P_{allow}$ K | % Capacity | Pass Fail |
|---|---|---|---|---|---|---|---|---|
| L1 | 130 - 83.71 | Pole | TP41.53x28x0.313 | 1 | -15.133 | 2723.550 | 34.2 | Pass |
| L2 | 83.71 - 41.21 | Pole | TP53.78x39.297x0.625 | 2 | -31.904 | 7522.850 | 26.6 | Pass |
| L3 | 41.21 - 0 | Pole | TP65x50.418x0.75 | 3 | -62.777 | 11363.200 | 26.9 | Pass |
| | | | | | | | Summary | |
| | | | | | | Pole (L1) | 34.2 | Pass |
| | | | | | | **RATING =** | **34.2** | **Pass** |

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| | |
|---|---|
| Subject: | Anchor Bolt and Baseplate Analysis |
| Location: | 130-FT Rohn Monopole<br>Westbrook, CT |
| Rev. 2: 5/5/20 | Prepared by: T.J.L. Checked by: C.A.G.<br>Job No. 19027.46 |

## Anchor Bolt and Base Plate Analysis:

### Input Data:

Tower Reactions:

| | | |
|---|---|---|
| Overturning Moment = | $M_u := 3941 \cdot ft \cdot kips$ | (Input From tnxTower) |
| Shear Force = | $Shear := 43 \cdot kips$ | (Input From tnxTower) |
| Axial Force = | $R_u := 63 \cdot kips$ | (Input From tnxTower) |

Anchor Bolt Data:

ASTMA615 Grade 75

| | | |
|---|---|---|
| Number of Anchor Bolts = | $N := 22$ | (User Input) |
| Diameter of Bolt Circle = | $D_{BC} := 71.5 \cdot in$ | (User Input) |
| Bolt "Column" Distance = | $l := 3.0 \cdot in$ | (User Input) |
| Bolt Ultimate Strength = | $F_u := 100 \cdot ksi$ | (User Input) |
| Bolt Yield Strength = | $F_y := 75 \cdot ksi$ | (User Input) |
| Bolt Modulus = | $E := 29000 \cdot ksi$ | (User Input) |
| Diameter of Anchor Bolts = | $D := 2.25 \cdot in$ | (User Input) |
| Threads per Inch = | $n := 4.5$ | (User Input) |
| Top of Concrete to Bot Leveling Nut = | $l_{ar} := 2 \cdot in$ | (User Input) |
| Anchor Rod Force Correction Factor = | $n_c = 1$ | Table 2-1 Addendum 3 |

Base Plate Data:

Use AST MA572 Grade 50

| | | |
|---|---|---|
| Plate Yield Strength = | $F_{yf} := 50 \cdot ksi$ | (User Input) |
| Base Plate Thickness = | $t_{TP} := 2.5 \cdot in$ | (User Input) |
| Base Plate Diameter = | $D_{OD} := 76.5 \cdot in$ | (User Input) |
| Outer Pole Diameter = | $D_T := 65 \cdot in$ | (User Input) |
| Pole Wall Thickness = | $t_T := 0.75 \cdot in$ | (User Input) |
| Pole Design Yield Strength = | $F_{yp} := 65 \cdot ksi$ | (User Input) |
| | $\eta := 0.5$ | For Ungrouted Base Plate per TIA-222-G Section 4.9.9 |

## Anchor Bolt Analysis:

Gross Area of Bolt = $A_g := \frac{\pi}{4} \cdot D^2 = 3.976 \cdot in^2$

Net Area of Bolt = $A_n := \frac{\pi}{4} \cdot \left( D - \frac{0.9743 \cdot in}{n} \right)^2 = 3.248 \cdot in^2$

Tensile Root Diameter = $d_{rt} := D - \frac{0.9743 \cdot in}{n} = 2.033 \cdot in$

Plastic Section Modulus = $Z := \frac{d_{rt}^3}{6} = 1.401 \cdot in^3$

Maximum Anchor Rod Force = $P_u := \frac{n_c \cdot \pi \cdot M_u}{N \cdot D_{BC}} + \frac{R_u}{N} = 97.3 \cdot kips$

Maximum Shear Force = $V_u := \frac{Shear}{N} = 2 \cdot kips$

Design Tensile Strength = $\Phi R_{nt} := 0.8 \cdot F_u \cdot A_n = 259.815 \cdot k$

Bolt % of Capacity = $\frac{\left( P_u + \frac{V_u}{\eta} \right)}{\Phi R_{nt}} \cdot 100 = 39$

Condition1 = $Condition1 := if\left[ \frac{\left( P_u + \frac{V_u}{\eta} \right)}{\Phi R_{nt}} \le 1.00, "OK", "Overstressed" \right]$

Condition1 = "OK"

Design Shear Strength = $\Phi R_{nv} := 0.75 \cdot 0.45 \cdot F_u \cdot A_g = 134.193 \cdot k$

Design Flexural Strength = $\Phi R_{nm} := 0.9 \cdot F_y \cdot Z = 94.597 \cdot in \cdot k$

$M_u := \begin{cases} 0 & \text{if } l_{ar} < D \\ 0.65 \cdot l_{ar} \cdot V_u & \text{otherwise} \end{cases} = 0 \cdot in \cdot k$

Bolt % of Capacity = $\left[ \left( \frac{V_u}{\Phi R_{nv}} \right)^2 + \left( \frac{P_u}{\Phi R_{nt}} + \frac{M_u}{\Phi R_{nm}} \right)^2 \right] \cdot 100 = 14.1$

Condition2 = $Condition2 := if\left[ \left( \frac{V_u}{\Phi R_{nv}} \right)^2 + \left( \frac{P_u}{\Phi R_{nt}} + \frac{M_u}{\Phi R_{nm}} \right)^2 \le 1.00, "OK", "Overstressed" \right]$

Condition2 = "OK"

## Base Plate Analysis:

Strength Resistance Factor for Yielding due to Bending = $\phi_b := 0.9$

Strength Resistance Factor for Yielding due to Shear = $\phi_v := 1.0$

Outside Fillet Horizontal Leg Dimension = $w_1 := 0.25 \cdot in$

Effective Pole Outside Diameter = $D_e := D_T + w_1 = 65.25 \cdot in$

Effective Base Plate Outside Diameter = $D_{oe} := \begin{cases} D_{OD} & \text{if } D_{OD} \le \left(D_{BC} + 6 \cdot t_{TP}\right) \\ \left(D_{BC} + 6 \cdot t_{TP}\right) & \text{otherwise} \end{cases} = 76.5 \cdot in$

Half-Angle Between Radial Lines Extending from Pole Centerline Through Midpoints Between Adjacent Anchor Rods = $\theta_1 := \frac{\pi}{N} = 0.143$

Angle Defining Limiting Effective Base Plate Width Based on Plate Thickness = $\theta_2 := \operatorname{asin}\left(\frac{12 \cdot t_{TP}}{D_{BC}}\right) = 0.433$

Angle Defining Limiting Effective Base Plate Width Based on Distance Between Anchor Rod Bolt Circle and Effective Pole Outside Diameter = $\theta_3 := \operatorname{acos}\left(\frac{D_{BC} + D_e}{2 \cdot D_{BC}}\right) = 0.297$

Governing Angle Defining Effective Base Plate Width Resisting Bending = $\theta := \min\left(\theta_1, \theta_2, \theta_3\right) = 0.143$

Effective Moment Arm of Anchor Rod Force = $x := 0.5 \cdot \left(D_{BC} - D_e\right) = 3.125 \cdot in$

Effective Base Plate Width Resisting Bending from Transverse Bend Line = $B_{et} := D_{BC} \cdot \sin(\theta) = 10.176 \cdot in$

Effective Base Plate Width Resisting Bending from Radial Bend Lines = $B_{er} := \left(D_{oe} - D_e\right) \cdot \sin(\theta) = 1.601 \cdot in$

Total Effective Base Plate Width Resisting Bending = $B_{eff} := B_{et} + B_{er} = 11.777 \cdot in$

Required Base Plate Thickness = $t_{TP.Req} := \sqrt{\frac{4 \cdot P_u \cdot x}{\phi_b \cdot F_{yf} \cdot B_{eff}}} = 1.515 \cdot in$

Plate Bending Stress % of Capacity = $\frac{t_{TP.Req}}{t_{TP}} = 60.6 \cdot \%$

Condition2 = $Condition3 := if\left(\frac{t_{TP.Req}}{t_{TP}} < 1.00, \text{"Ok"}, \text{"Overstressed"}\right)$

Condition3 = "Ok"

Required Base Plate Thickness = $t_{TP.Req} := \frac{\phi_b \cdot t_T \cdot F_{yp}}{\phi_v \cdot 0.6 \cdot F_{yf}} = 1.463 \cdot in$

Plate Bending Stress % of Capacity = $\frac{t_{TP.Req}}{t_{TP}} = 58.5 \cdot \%$

Condition2 = $Condition4 := if\left(\frac{t_{TP.Req}}{t_{TP}} < 1.00, \text{"Ok"}, \text{"Overstressed"}\right)$

Condition4 = "Ok"

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| | |
|---|---|
| Subject: | FOUNDATION ANALYSIS |
| Location: | 130-ft Rohn Monopole<br>Westbrook, CT |
| Rev. 2: 5/5/20 | Prepared by: T.J.L Checked by: C.A.G.<br>Job no. 19027.46 |

## Standard Monopole Foundation:

### Input Data:

Tower Data

| | | | |
|---|---|---|---|
| Overturning Moment = | $OM := 3941 \cdot ft \cdot kips$ | (User Input) | |
| Shear Force = | $Shear := 43 \cdot kip$ | (User Input) | |
| Axial Force = | $Axial := 53 \cdot kip$ | (User Input) | |
| Tower Height = | $H_t := 130 \cdot ft$ | (User Input) | |

Footing Data:

| | | | |
|---|---|---|---|
| Overall Depth of Footing = | $D_f := 6 \cdot ft$ | (User Input) | |
| Length of Pier = | $L_p := 4.5 \cdot ft$ | (User Input) | |
| Extension of Pier Above Grade = | $L_{pag} := 0.5 \cdot ft$ | (User Input) | |
| Diameter of Pier = | $d_p := 8.25 \cdot ft$ | (User Input) | |
| Thickness of Footing = | $T_f := 2 \cdot ft$ | (User Input) | |
| Width of Footing = | $W_f := 32 \cdot ft$ | (User Input) | |

Anchor Bolt Data:

| | | | |
|---|---|---|---|
| Length of Anchor Bolts= | $L_{st} := 84 \cdot in$ | (User Input) | |
| Projection of Anchor Bolts Above Pier = | $A_{BP} := 12 \cdot in$ | (User Input) | |
| Anchor Bolt Diameter = | $d_{anchor} := 2.25 \cdot in$ | (User Input) | |
| Base Plate Bolt Circle = | $MP := 71.5 \cdot in$ | (User Input) | |

Material Properties:

| | | | |
|---|---|---|---|
| Concrete Compressive Strength = | $f_c := 4500 \cdot psi$ | (User Input) | |
| Steel Reinforcment Yield Strength = | $f_y := 60000 \cdot psi$ | (User Input) | |
| Anchor Bolt Yield Strength = | $f_{ya} := 75000 \cdot psi$ | (User Input) | |
| Internal Friction Angle of Soil = | $\Phi_s := 30 \cdot deg$ | (User Input) | |
| Ultimate Soil Bearing Capacity = | $q_u := 12000 \cdot psf$ | (User Input) | |
| Allowable Soil Bearing Capacity = | $q_a := \frac{q_u}{2} = 6000 \cdot psf$ | (User Input) | |
| Unit Weight of Soil = | $\gamma_{soil} := 110 \cdot pcf$ | (User Input) | |
| Unit Weight of Concrete = | $\gamma_{conc} := 150 \cdot pcf$ | (User Input) | |
| Foundation Bouyancy = | $Bouyancy := 0$ | (User Input) | (Yes=1 / No=0) |
| Depth to Neglect = | $n := 0 \cdot ft$ | (User Input) | |
| Cohesion of Clay Type Soil = | $c := 0 \cdot ksf$ | (User Input) | (Use 0 for Sandy Soil) |
| Seismic Zone Factor = | $Z := 2$ | (User Input) | (UBC-1997 Fig 23-2) |
| Coefficient of Friction Between Concrete = | $\mu := 0.45$ | (User Input) | |

Pier Reinforcement:

| | | | |
|---|---|---|---|
| Bar Size = | $BS_{pier} := 11$ | (User Input) | |
| Bar Diameter = | $d_{bpier} := 1.41 \cdot in$ | (User Input) | |
| Number of Bars = | $NB_{pier} := 38$ | (User Input) | |
| Clear Cover of Reinforcement = | $Cvr_{pier} := 3 \cdot in$ | (User Input) | |
| Reinforcement Location Factor = | $\alpha_{pier} := 1.0$ | (User Input) | (ACI-2008 12.2.4) |
| Coating Factor = | $\beta_{pier} := 1.0$ | (User Input) | (ACI-2008 12.2.4) |
| Concrete Strength Factor = | $\lambda_{pier} := 1.0$ | (User Input) | (ACI-2008 12.2.4) |
| Reinforcement Size Factor = | $\gamma_{pier} := 1.0$ | (User Input) | (ACI-2008 12.2.4) |
| Diameter of Tie = | $d_{Tie} := 3 \cdot in$ | (User Input) | |

Pad Reinforcement:

| | | | |
|---|---|---|---|
| Bar Size = | $BS_{top} := 10$ | (User Input) | (Top of Pad) |
| Bar Diameter = | $d_{btop} := 1.27 \cdot in$ | (User Input) | (Top of Pad) |
| Number of Bars = | $NB_{top} := 62$ | (User Input) | (Top of Pad) |
| Bar Size = | $BS_{bot} := 10$ | (User Input) | (Bottom of Pad) |
| Bar Diameter = | $d_{bbot} := 1.27 \cdot in$ | (User Input) | (Bottom of Pad) |
| Number of Bars = | $NB_{bot} := 62$ | (User Input) | (Bottom of Pad) |
| Clear Cover of Reinforcement = | $Cvr_{pad} := 3.0 \cdot in$ | (User Input) | |
| Reinforcement Location Factor = | $\alpha_{pad} := 1.0$ | (User Input) | (ACI-2008 12.2.4) |
| Coating Factor = | $\beta_{pad} := 1.0$ | (User Input) | (ACI-2008 12.2.4) |
| Concrete Strength Factor = | $\lambda_{pad} := 1.0$ | (User Input) | (ACI-2008 12.2.4) |
| Reinforcement Size Factor = | $\gamma_{pad} := 1.0$ | (User Input) | (ACI-2008 12.2.4) |

## Calculated Factors:

Pier Reinforcement Bar Area = $A_{bpier} := \frac{\pi \cdot d_{bpier}^2}{4} = 1.561 \cdot in^2$

Pad Top Reinforcement Bar Area = $A_{btop} := \frac{\pi \cdot d_{btop}^2}{4} = 1.267 \cdot in^2$

Pad Bottom Reinforcement Bar Area = $A_{bbot} := \frac{\pi \cdot d_{bbot}^2}{4} = 1.267 \cdot in^2$

Coefficient of Lateral Soil Pressure = $K_p := \frac{1 + \sin(\Phi_s)}{1 - \sin(\Phi_s)} = 3$

## Stability of Footing:

Adjusted Concrete Unit Weight =

$$\gamma_c := \text{if}\left(\text{Bouyancy} = 1, \gamma_{conc} - 62.4pcf, \gamma_{conc}\right) = 150 \cdot pcf$$

Adjusted Soil Unit Weight =

$$\gamma_s := \text{if}\left(\text{Bouyancy} = 1, \gamma_{soil} - 62.4pcf, \gamma_{soil}\right) = 110 \cdot pcf$$

Passive Pressure =

$$P_{pn} := K_p \cdot \gamma_s \cdot n + c \cdot 2 \cdot \sqrt{K_p} = 0 \cdot ksf$$

$$P_{pt} := K_p \cdot \gamma_s \cdot \left(D_f - T_f\right) + c \cdot 2 \cdot \sqrt{K_p} = 1.32 \cdot ksf$$

$$P_{top} := \text{if}\left[n < \left(D_f - T_f\right), P_{pt}, P_{pn}\right] = 1.32 \cdot ksf$$

$$P_{bot} := K_p \cdot \gamma_s \cdot D_f + c \cdot 2 \cdot \sqrt{K_p} = 1.98 \cdot ksf$$

$$P_{ave} := \frac{P_{top} + P_{bot}}{2} = 1.65 \cdot ksf$$

$$T_p := \text{if}\left[n < \left(D_f - T_f\right), T_f, \left(D_f - n\right)\right] = 2$$

$$A_p := W_f \cdot T_p = 64$$

Ultimate Shear =

$$S_u := P_{ave} \cdot A_p = 105.6 \cdot kip$$

Weight of Concrete Pad =

$$WT_c := \left[\left(W_f^2 \cdot T_f\right) + d_p^2 L_p\right] \cdot \gamma_c = 353.142 \cdot kip$$

Weight of Soil Above Footing =

$$WT_{s1} := \left[\left(W_f^2 - d_p^2\right) \cdot \left(\left|L_p - L_{pag} - n\right|\right)\right] \cdot \gamma_s = 420.61 \cdot kip$$

Weight of Soil Wedge at Back Face =

$$WT_{s2} := \left(\frac{D_f^2 \cdot \tan\left(\Phi_s\right)}{2} \cdot W_f\right) \cdot \gamma_s = 36.581 \cdot kip$$

Weight of Soil Wedge at back face Corners =

$$WT_{s3} := 2 \cdot \left[\left(D_f\right)^3 \cdot \frac{\tan\left(\Phi_s\right)}{3}\right] \cdot \gamma_s = 9.145 \cdot kips$$

Total Weight =

$$WT_{tot} := WT_c + WT_{s1} + Axial = 826.755 \cdot kip$$

Resisting Weight =

$$WT_R := 0.9 \cdot WT_c + 0.75 \cdot WT_{s1} + 0.75 \cdot Axial = 673.037 \cdot kip$$

Resisting Moment =

$$M_r := \left(WT_R\right) \cdot \frac{W_f}{2} + 0.75 \cdot S_u \cdot \frac{T_f}{3} + 0.75 \cdot \left[\left(WT_{s2} + WT_{s3}\right) \cdot \left(W_f + \frac{D_f \cdot \tan\left(\Phi_s\right)}{3}\right)\right] = 11958 \cdot kip \cdot ft$$

Overturning Moment =

$$M_{ot} := OM + Shear \cdot \left(L_p + T_f\right) = 4221 \cdot kip \cdot ft$$

Factor of Safety Actual =

$$FS := \frac{M_r}{M_{ot}} = 2.83$$

Factor of Safety Required =

$$FS_{req} := 1$$

$$OverTurning\_Moment\_Check := \text{if}\left(FS \geq FS_{req}, \text{"Okay"}, \text{"No Good"}\right)$$

OverTurning_Moment_Check = "Okay"

### Shear Capacity in Pier:

Shear Resistance of Pier = $S_p := \frac{P_{ave} \cdot A_p + \mu \cdot WT_{tot}}{FS_{req}} = 477.64 \cdot kips$

$Shear\_Check := if(S_p > Shear, "Okay", "No Good")$

Shear_Check = "Okay"

### Bearing Pressure Caused by Footing:

Area of the Mat = $A_{mat} := W_f^2 = 1.024 \times 10^3$

Section Modulus of Mat = $S := \frac{W_f^3}{6} = 5461.33 \cdot ft^3$

Maximum Pressure in Mat = $P_{max} := \frac{WT_{tot}}{A_{mat}} + \frac{M_{ot}}{S} = 1.58 \cdot ksf$

$Max\_Pressure\_Check := if(P_{max} < .75 \cdot q_u, "Okay", "No Good")$

Max_Pressure_Check = "Okay"

Minimum Pressure in Mat = $P_{min} := \frac{WT_{tot}}{A_{mat}} - \frac{M_{ot}}{S} = 0.035 \cdot ksf$

$Min\_Pressure\_Check := if\left[(P_{min} \geq 0) \cdot (P_{min} < .75 \cdot q_u), "Okay", "No Good"\right]$

Min_Pressure_Check = "Okay"

Distance to Resultant of Pressure Distribution = $X_p := \frac{P_{max}}{\frac{P_{max} - P_{min}}{W_f}} \cdot \frac{1}{3} = 10.905$

Distance to Kern = $X_k := \frac{W_f}{6} = 5.333$

Since Resultant Force is Not in Kern, Area to which Pressure is Applied Must be Reduced.

Eccentricity = $e := \frac{\frac{M_{ot}}{1.6}}{WT_{tot}} = 3.191$

Adjusted Soil Pressure = $P_a := \frac{2 \cdot WT_{tot}}{3 \cdot W_f \cdot \left(\frac{W_f}{2} - e\right)} = 1.345 \cdot ksf$

$q_{adj} := if(P_{min} < 0, P_a, P_{max}) = 1.58 \cdot ksf$

$Pressure\_Check := if(q_{adj} < q_a, "Okay", "No Good")$

Pressure_Check = "Okay"

## Concrete Bearing Capacity:

Strength Reduction Factor = $\Phi_c := 0.65$ (ACI-2008 9.3.2.2)

Bearing Strength Between Pier and Pad = $P_b := \Phi_c \cdot 0.85 \cdot f_c \cdot \frac{\pi \cdot d_p^2}{4} = 1.914 \times 10^4 \cdot kips$ (ACI-2008 10.14)

$Bearing\_Check := if(P_b > Axial, "Okay", "No Good")$

Bearing_Check = "Okay"

## Shear Strength of Concrete:

Beam Shear: (Critical section located at a distance d from the face of Pier) (ACI 11.3.1.1)

$\phi_c := 0.85$ (ACI 9.3.2.5)

$d := T_f - Cvr_{pad} - d_{bbot} = 1.644$

$d_1 := \frac{W_f}{2} - \frac{d_p}{2}$

$d_2 := d_1 - d$

$L := \left(\frac{W_f}{2} - e\right) \cdot 3$

$Slope := if\left(L > W_f, \frac{P_{max} - P_{min}}{W_f}, \frac{q_{adj}}{L}\right)$

$V_{req} := \left[\left(q_{adj} - Slope \cdot d_1\right) + \left(\frac{Slope \cdot d_1}{2}\right)\right] \cdot W_f \cdot d_1$

$V_{Avail} := \phi_c \cdot 2 \cdot \sqrt{f_c \cdot psi} \cdot W_f \cdot d$ (ACI-2008 11.2.1.1)

$Beam\_Shear\_Check := if(V_{req} < V_{Avail}, "Okay", "No Good")$

Beam_Shear_Check = "Okay"

Punching Shear: (Critical Section Located at a distance of d/2 from the face of pier) (ACI 11.11.1.2)

Critical Perimeter of Punching Shear = $b_o := \left(d_p + d\right) \cdot \pi = 31.1$

Area Included Inside Perimeter = $A_{bo} := \frac{\pi \cdot \left(d_p + d\right)^2}{4} = 76.9$

Area Outside of Perimeter = $A_{out} := A_{mat} - A_{bo} = 947.1$

Guess Value = $v_u := 1ksf$

(From "Foundation Analysis and design", By Joseph Bowles, Eq. 8-9)

Given $d^2 + d_p \cdot d = \frac{WT_{tot}}{\pi \cdot v_u}$

$v_u := Find(v_u) = 16.2 \cdot ksf$

$V_u := v_u \cdot d \cdot W_f = 851.1 \cdot kips$

Required Shear Strength = $V_{req} := V_u = 851.1 \cdot kips$

Available Shear Strength = $V_{Avail} := \phi_c \cdot 4 \cdot \sqrt{f_c \cdot psi} \cdot b_o \cdot d = 1678.5 \cdot kip$ (ACI-2008 11.11.2.1)

$Punching\_Shear\_Check := if(V_{req} < V_{Avail}, "Okay", "No Good")$

Punching_Shear_Check = "Okay"

## Steel Reinforcement in Pad:

Required Reinforcement for Bending:

Strength Reduction Factor = $\phi_m := .90$ (ACI-2008 9.3.2.1)

$q_b := q_{adj} - d_1 \cdot Slope = 1.007 \cdot ksf$

Maximum Bending at Face of Pier = $M_n := \frac{1}{\phi_m} \cdot \left[ (q_{adj} - q_b) \cdot \frac{d_1^2}{3} + q_b \cdot \frac{d_1^2}{2} \right] \cdot W_f = 3482.1 \cdot kip \cdot ft$

$$\beta := \begin{cases} 0.85 & \text{if } 2500 \cdot psi \le f_c \le 4000 \cdot psi \\ 0.65 & \text{if } f_c > 8000 \cdot psi \\ \left[ 0.85 - \left[ \frac{\left( \frac{f_c}{psi} - 4000 \right)}{1000} \right] \cdot 0.5 \right] & \text{otherwise} \end{cases} = 0.6$$

(ACI-200810.2.7.3)

$R_n := \frac{M_n}{W_f \cdot d^2} = 279.5 \cdot psi$

$\rho := \frac{0.85 \cdot f_c}{f_y} \left( 1 - \sqrt{1 - \frac{2 \cdot R_n}{0.85 \cdot f_c}} \right) = 0.0048$

$\rho_{min} := \rho = 0.00484$

Required Reinforcement for Temperature and Shrinkage:

$$\rho_{sh} := \begin{cases} .0018 & \text{if } f_y \geq 60000 \cdot psi \\ .0020 & \text{otherwise} \end{cases}$$ (ACI-2008 7.12.2.1)

Check Bottom Bars:

$$As := \begin{cases} \rho_{min} \cdot W_f \cdot d & \text{if } \rho_{min} > \frac{\rho_{sh}}{2} \\ \rho_{sh} \cdot W_f \cdot \frac{d}{2} & \text{otherwise} \end{cases} = 36.691 \cdot in^2$$

$As_{prov.bot} := A_{bbot} \cdot NB_{bot} = 78.5 \cdot in^2$

$Pad\_Reinforcement\_Bot := if(As_{prov.bot} > As, "Okay", "No Good")$

Pad_Reinforcement_Bot = "Okay"

Check Temp Shrinkage Reinforcement:

$As := \rho_{sh} \cdot (W_f \cdot T_f) = 16.6 \cdot in^2$

$As_{prov.top} := A_{btop} \cdot NB_{top} = 78.5 \cdot in^2$

$As_{prov.tot} := As_{prov.bot} + As_{prov.top} = 157.1 \cdot in^2$

$Pad\_Reinforcement\_Temp := if(As_{prov.tot} > As, "Okay", "No Good")$

Pad_Reinforcement_Temp = "Okay"

## Developement Length Pad Reinforcement:

Bar Spacing =

$$B_{sPad} := \frac{W_f - 2 \cdot Cvr_{pad} - NB_{bot} \cdot d_{bbot}}{NB_{bot} - 1} = 4.91 \cdot in$$

Spacing or Cover Dimension =

$$c := if\left(Cvr_{pad} < \frac{B_{sPad}}{2}, Cvr_{pad}, \frac{B_{sPad}}{2}\right) = 2.453 \cdot in$$

Transverse Reinforcement Index =

$k_{tr} := 0$ (ACI-2008 12.2.3)

$$L_{dbt} := \frac{3 \cdot f_y \alpha_{pad} \cdot \beta_{pad} \cdot \gamma_{pad} \cdot \lambda_{pad}}{40 \cdot \sqrt{f_c \cdot psi} \cdot \frac{c + k_{tr}}{d_{bbot}}} \cdot d_{bbot} = 44.1 \cdot in$$

Minimum Development Length =

$L_{dbmin} := 12 \cdot in$ (ACI-2008 12.2.1)

$L_{dbtCheck} := if(L_{dbt} \geq L_{dbmin}, "Use L.dbt", "Use L.dbmin")$

Available Length in Pad =

$$L_{Pad} := \frac{W_f}{2} - \frac{d_p}{2} - Cvr_{pad} = 139.5 \cdot in$$

$Lpad\_Check := if(L_{Pad} > L_{dbt}, "Okay", "No Good")$

Lpad_Check = "Okay"

## Steel Reinforcement in Pier:

Area of Pier = $A_p := d_p^2 = 9801 \cdot in^2$

$A_{smin} := 0.01 \cdot 0.5 \cdot A_p = 49.01 \cdot in^2$ (ACI-2008 10.8.4 & 10.9.1)

$A_{sprov} := NB_{pier} \cdot A_{bpier} = 59.34 \cdot in^2$

$Steel\_Area\_Check := if\left(A_{sprov} > A_{smin}, "Okay", "No Good"\right)$

Steel_Area_Check = "Okay"

**NOTE:** Anchor Bolts are not accounted for in reinforcement calculation and will provide additional reinforcement to satisfy minimum requirement of steel.

Bar Spacing In Pier = $B_{sPier} := \frac{d_p \cdot \pi}{NB_{pier}} - d_{bpier} = 6.775 \cdot in$

Diameter of Reinforcement Cage = $Diam_{cage} := d_p - 2 \cdot Cvr_{pier} = 93 \cdot in$

Maximum Moment in Pier = $M_p := \left[OM + Shear \cdot \left(L_p + \frac{A_{BP}}{2}\right)\right] = 49872 \cdot in \cdot kips$

Pier Check evaluated from outside program and results are listed below;

$\left(D \;\; N \;\; n \;\; P_u \;\; M_{xu}\right) := \left(d_p \cdot 12 \;\; NB_{pier} \;\; BS_{pier} \;\; \frac{Axial \cdot 1.333}{kips} \;\; \frac{M_p}{in \cdot kips}\right)$

$\left(D \;\; N \;\; n \;\; P_u \;\; M_{xu}\right) = (99 \;\; 38 \;\; 11 \;\; 70.6 \;\; 49872)$

$\left(\phi P_n \;\; \phi M_{xn} \;\; f_{sp} \;\; \rho\right) := (0 \;\; 0 \;\; 0 \;\; 0)$

$\left(\phi P_n \;\; \phi M_{xn} \;\; f_{sp} \;\; \rho\right) := \phi P'_n\left(D, N, n, P_u, M_{xu}\right)^T$

$\left(\phi P_n \;\; \phi M_{xn} \;\; f_{sp} \;\; \rho\right) = \left(190.5 \;\; 1.3 \times 10^5 \;\; -60 \;\; 0\right)$

$Axial\_Load\_Check := if\left(\phi P_n \geq P_u, "Okay", "No Good"\right)$

Axial_Load_Check = "Okay"

$Bending\_Check := if\left(\phi M_{xn} \geq M_{xu}, "Okay", "No Good"\right)$

Bending_Check = "Okay"

## Development Length Pier Reinforcement:

Available Length in Foundation:

$L_{pier} := L_p - Cvr_{pier} = 51 \cdot in$

$L_{pad} := T_f - Cvr_{pad} = 21 \cdot in$

Tension: (ACI-2008 12.2.3)

Spacing or Cover Dimension =

$c := if\left(Cvr_{pier} < \frac{B_{sPier}}{2}, Cvr_{pier}, \frac{B_{sPier}}{2}\right) = 3 \cdot in$

Transverse Reinforcement =

$k_{tr} := 0$ (ACI-2008 12.2.3)

$L_{dbt} := \frac{3 \cdot f_y \cdot \alpha_{pier} \cdot \beta_{pier} \cdot \gamma_{pier} \cdot \lambda_{pier}}{40 \cdot \sqrt{f_c \cdot psi} \cdot \left(\frac{c + k_{tr}}{d_{bpier}}\right)} \cdot d_{bpier} = 44.46 \cdot in$

Minimum Development Length =

$L_{dh} := \frac{1200 \cdot d_{bpier}}{\sqrt{\frac{f_c}{psi}}} \cdot .7 = 17.656 \cdot in$ (ACI 12.2.1)

Pier reinforcement bars are standard 90 degree hooks and therefore developement in the pad is computed as follows:

$L_{db} := \max\left(L_{dbt}, L_{dbmin}\right)$

$L_{tension\_Check} := if\left(L_{pier} + L_{pad} > L_{dbt}, "Okay", "No Good"\right)$

$L_{tension\_Check} = "Okay"$

Compression: (ACI-2008 12.3.2)

$L_{dbc1} := \frac{.02 \cdot d_{bpier} \cdot f_y}{\sqrt{f_c \cdot psi}} = 25.223 \cdot in$

$L_{dbmin} := 0.0003 \cdot \frac{in^2}{lb} \cdot \left(d_{bpier} \cdot f_y\right) = 25.38 \cdot in$

$L_{dbc} := if\left(L_{dbc1} \geq L_{dbmin}, L_{dbc1}, L_{dbmin}\right) = 25.38 \cdot in$

$L_{compression\_Check} := if\left(L_{pier} + L_{pad} > L_{dbc}, "Okay", "No Good"\right)$

$L_{compression\_Check} = "Okay"$

| RAN Template: | A&L Template: |
|---|---|
| 67D97DB MUAC | 67D97DB_1xAIR+1OP |

CTHA524A_L600_3_draft

Standard (2)

## Section 1 - Site Information

**Site ID:** CTHA524A
**Status:** Draft
**Version:** 3
**Project Type:** L600
**Approved:** Not Approved
**Approved By:** Not Approved
**Last Modified:** 6/12/2019 8:0:00 PM
**Last Modified By:** GSM1900\DKallas2

**Site Name:** CT Water Westbrook Watertank
**Site Class:** Watertank
**Site Type:** Structure Non Building
**Plan Year:**
**Market:** CONNECTICUT CT
**Vendor:** Ericsson
**Landlord:** <undefined>

**Latitude:** 41.2818000000
**Longitude:** -72.4375000000
**Address:** 1546 Boston Post Rd
**City, State:** Westbrook, CT
**Region:** NORTHEAST

| RAN Template: 67D97DB MUAC | | | AL Template: 67D97DB_1xAIR+1OP | |
|---|---|---|---|---|
| **Sector Count:** 3 | **Antenna Count:** 6 | **Coax Line Count:** 0 | **TMA Count:** 0 | **RRU Count:** 3 |

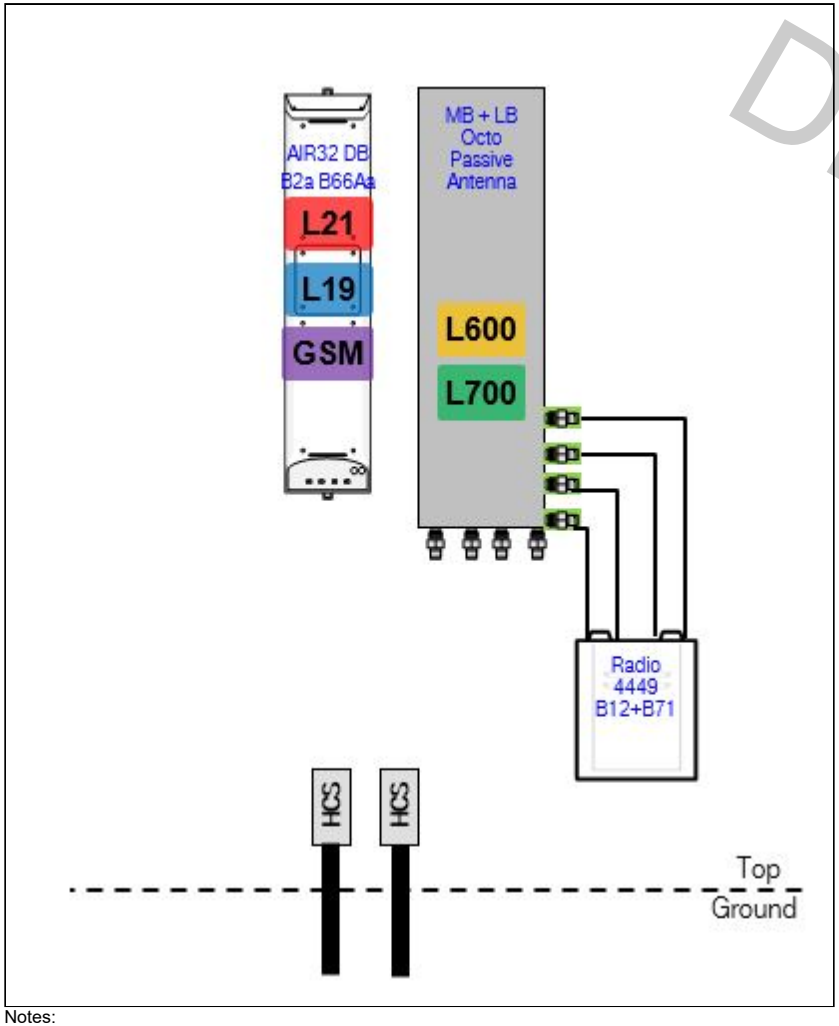


## Section 2 - Existing Template Images

----- This section is intentionally blank. -----

## Section 3 - Proposed Template Images

67D97DB.JPG






Notes:

## Section 4 - Siteplan Images

----- This section is intentionally blank. -----

| RAN Template: | A&L Template: |
|---|---|
| 67D97DB MUAC | 67D97DB_1xAIR+1OP |

CTHA524A_L600_3_draft

Standard (2)

## Section 5 - RAN Equipment



### Existing RAN Equipment

**Template:** 5A U19 Shutdown

| Enclosure | 1 | 2 |
|---|---|---|
| Enclosure Type | Legacy ODE | Ancillary Equipment (Ericsson) |
| Baseband | DUW30, DUS41 | |
| Hybrid Cable System | | Ericsson 9x18 HCS *Select Length*, Ericsson 6x12 HCS *Select Length & AWG* |

### Proposed RAN Equipment

**Template:** 67D97DB MUAC

| Enclosure | 1 |
|---|---|
| Enclosure Type | RBS 6102 MU AC |
| Baseband | DUG20 (G1900); BB 6630 (L2100, L1900, L700, L600); BB 6630 (N600) |
| Hybrid Cable System | Ericsson 6x12 HCS *Select Length & AWG* **(x 2 )** |

**RAN Scope of Work:**

This is a new tower. Must order everything new.

| RAN Template: | A&L Template: |
|---|---|
| 67D97DB MUAC | 67D97DB_1xAIR+1OP |

CTHA524A_L600_3_draft

Standard (2)

## Section 6 - A&L Equipment



**Existing Template:** 5A_2xAIR U19 Shutdown
**Proposed Template:** 67D97DB_1xAIR+1OP

### Sector 1 (Existing) view from behind

| | | | | |
|---|---|---|---|---|
| **Coverage Type** | A - Outdoor Macro | | | |
| **Antenna** | **1** | | **2** | |
| **Antenna Model** | Ericsson - AIR21 KRC118023-1_B2P_B4A (Quad) | | Ericsson - AIR21 KRC118023-1_B2P_B4A (Quad) | |
| **Azimuth** | 85 | | 85 | |
| **M. Tilt** | 0 | | 0 | |
| **Height** | 100 | | 100 | |
| **Ports** | **P1** | **P2** | **P3** | **P4** |
| **Active Tech.** | U2100 | | L2100 | |
| **Dark Tech.** | | | | |
| **Restricted Tech.** | | | | |
| **Decomm. Tech.** | | | | |
| **E. Tilt** | 2 | | 2 | |
| **Cables** | Fiber Jumper - 15 ft. | | Fiber Jumper - 15 ft. | |
| **TMAs** | | | | |
| **Diplexers / Combiners** | | | | |
| **Radio** | | | | |
| **Sector Equipment** | | | | |

**Unconnected Equipment:**

Cable: Fiber Jumper - 15 ft.

Sector Equipment: RRUS11 B12

**Scope of Work:**

| RAN Template: | A&L Template: |
|---|---|
| 67D97DB MUAC | 67D97DB_1xAIR+1OP |

CTHA524A_L600_3_draft

Standard (2)

| Sector 1 (Proposed) view from behind | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Coverage Type | A - Outdoor Macro | | | | | | | |
| Antenna | 1 | | | | 2 | | | |
| Antenna Model | Ericsson - AIR32 KRD901146-1_B66A_B2A (Octo) | | | | RFS - APXVAARR24_43-U-NA20 (Octo) | | | |
| Azimuth | 85 | | | | 85 | | | |
| M. Tilt | 0 | | | | 0 | | | |
| Height | 110 | | | | 110 | | | |
| Ports | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 |
| Active Tech. | L2100 | L2100 | L1900 G1900 | L1900 G1900 | L700 L600 N600 | L700 L600 N600 | | |
| Dark Tech. | | | | | | | | |
| Restricted Tech. | | | | | | | | |
| Decomm. Tech. | | | | | | | | |
| E. Tilt | 2 | 2 | 2 | 2 | 2 | 2 | | |
| Cables | | | | | Coax Jumper **(x2)** | Coax Jumper **(x2)** | | |
| TMAs | | | | | | | | |
| Diplexers / Combiners | | | | | | | | |
| Radio | | | | | Radio 4449 B71+B85 (At Antenna) | SHARED Radio 4449 B71+B85 (At Antenna) | | |
| Sector Equipment | | | | | | | | |

104-ft per T-MOBILE

104-ft per T-MOBILE

**Unconnected Equipment:**

**Scope of Work:**

This is a new tower. Must order everything new.

*A dashed border indicates shared equipment. Any connected equipment is denoted with the SHARED keyword.

| RAN Template: | A&L Template: |
|---|---|
| 67D97DB MUAC | 67D97DB_1xAIR+1OP |

CTHA524A_L600_3_draft

Standard (2)

| Sector 2 (Existing) view from behind | | | | |
|---|---|---|---|---|
| Coverage Type | A - Outdoor Macro | | | |
| Antenna | 1 | | 2 | |
| Antenna Model | Ericsson - AIR21 KRC118023-1_B2P_B4A (Quad) | | Ericsson - AIR21 KRC118023-1_B2P_B4A (Quad) | |
| Azimuth | 260 | | 260 | |
| M. Tilt | 0 | | 0 | |
| Height | 100 | | 100 | |
| Ports | P1 | P2 | P3 | P4 |
| Active Tech. | U2100 | | L2100 | |
| Dark Tech. | | | | |
| Restricted Tech. | | | | |
| Decomm. Tech. | | | | |
| E. Tilt | 2 | | 2 | |
| Cables | Fiber Jumper - 15 ft. | | Fiber Jumper - 15 ft. | |
| TMAs | | | | |
| Diplexers / Combiners | | | | |
| Radio | | | | |
| Sector Equipment | | | | |

**Unconnected Equipment:**

Cable: Fiber Jumper

Sector Equipment: RRUS11 B12

**Scope of Work:**

| RAN Template: | A&L Template: |
|---|---|
| 67D97DB MUAC | 67D97DB_1xAIR+1OP |

CTHA524A_L600_3_draft

Standard (2)

| Sector 2 (Proposed) view from behind | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Coverage Type | A - Outdoor Macro | | | | | | | |
| Antenna | 1 | | | | 2 | | | |
| Antenna Model | Ericsson - AIR32 KRD901146-1_B66A_B2A (Octo) | | | | RFS - APXVAARR24_43-U-NA20 (Octo) | | | |
| Azimuth | 260 | | | | 260 | | | |
| M. Tilt | 0 | | | | 0 | | | |
| Height | 110 | | | | 110 | | | |
| Ports | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 |
| Active Tech. | L2100 | L2100 | L1900 G1900 | L1900 G1900 | L700 L600 N600 | L700 L600 N600 | | |
| Dark Tech. | | | | | | | | |
| Restricted Tech. | | | | | | | | |
| Decomm. Tech. | | | | | | | | |
| E. Tilt | 2 | 2 | 2 | 2 | 2 | 2 | | |
| Cables | | | | | Coax Jumper **(x2)** | Coax Jumper **(x2)** | | |
| TMAs | | | | | | | | |
| Diplexers / Combiners | | | | | | | | |
| Radio | | | | | Radio 4449 B71+B85 (At Antenna) | SHARED Radio 4449 B71+B85 (At Antenna) | | |
| Sector Equipment | | | | | | | | |

104-ft per T-MOBILE

104-ft per T-MOBILE

**Unconnected Equipment:**

**Scope of Work:**

This is a new tower. Must order everything new.

*A dashed border indicates shared equipment. Any connected equipment is denoted with the SHARED keyword.

| RAN Template: | A&L Template: |
|---|---|
| 67D97DB MUAC | 67D97DB_1xAIR+1OP |

CTHA524A_L600_3_draft

Standard (2)

| Sector 3 (Existing) view from behind | | | | |
|---|---|---|---|---|
| Coverage Type | A - Outdoor Macro | | | |
| Antenna | 1 | | 2 | |
| Antenna Model | Ericsson - AIR21 KRC118023-1_B2P_B4A (Quad) | | Ericsson - AIR21 KRC118023-1_B2P_B4A (Quad) | |
| Azimuth | 325 | | 325 | |
| M. Tilt | 0 | | 0 | |
| Height | 100 | | 100 | |
| Ports | P1 | P2 | P3 | P4 |
| Active Tech. | U2100 | | L2100 | |
| Dark Tech. | | | | |
| Restricted Tech. | | | | |
| Decomm. Tech. | | | | |
| E. Tilt | 2 | | 2 | |
| Cables | Fiber Jumper - 15 ft. | | Fiber Jumper - 15 ft. | |
| TMAs | | | | |
| Diplexers / Combiners | | | | |
| Radio | | | | |
| Sector Equipment | | | | |

**Unconnected Equipment:**

Cable: Fiber Jumper - 15 ft.

Sector Equipment: RRUS11 B12

**Scope of Work:**

| RAN Template: | A&L Template: |
|---|---|
| 67D97DB MUAC | 67D97DB_1xAIR+1OP |

CTHA524A_L600_3_draft

Standard (2)

| Sector 3 (Proposed) view from behind | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Coverage Type** | A - Outdoor Macro | | | | | | | |
| **Antenna** | 1 | | | | 2 | | | |
| **Antenna Model** | Ericsson - AIR32 KRD901146-1_B66A_B2A (Octo) | | | | RFS - APXVAARR24_43-U-NA20 (Octo) | | | |
| **Azimuth** | 325 | | | | 325 | | | |
| **M. Tilt** | 0 | | | | 0 | | | |
| **Height** | 110 | | | | 110 | | | |
| **Ports** | **P1** | **P2** | **P3** | **P4** | **P5** | **P6** | **P7** | **P8** |
| **Active Tech.** | L2100 | L2100 | L1900 G1900 | L1900 G1900 | L700 L600 N600 | L700 L600 N600 | | |
| **Dark Tech.** | | | | | | | | |
| **Restricted Tech.** | | | | | | | | |
| **Decomm. Tech.** | | | | | | | | |
| **E. Tilt** | 2 | 2 | 2 | 2 | 2 | 2 | | |
| **Cables** | | | | | Coax Jumper **(x2)** | Coax Jumper **(x2)** | | |
| **TMAs** | | | | | | | | |
| **Diplexers / Combiners** | | | | | | | | |
| **Radio** | | | | | Radio 4449 B71+B85 (At Antenna) | SHARED Radio 4449 B71+B85 (At Antenna) | | |
| **Sector Equipment** | | | | | | | | |

104-ft per T-MOBILE

104-ft per T-MOBILE

**Unconnected Equipment:**

**Scope of Work:**

This is a new tower. Must order everything new.

*A dashed border indicates shared equipment. Any connected equipment is denoted with the SHARED keyword.

| RAN Template: | A&L Template: |
|---|---|
| 67D97DB MUAC | 67D97DB_1xAIR+1OP |

CTHA524A_L600_3_draft

Standard (2)

## Section 7 - Power Systems Equipment



### Existing Power Systems Equipment

----- This section is intentionally blank. -----

### Proposed Power Systems Equipment

RADIO FREQUENCY SYSTEMS
The Clear Choice®

# Dual Slant Polarized Quad Band (8 Port) Antenna, 617-746/617-746/1695-2200/1695-2200MHz, 65deg, 15/15/18/18dBi, 2.4m (8ft), VET, RET, 0-12°/0-12°/2-12°/2-12°


## FEATURES / BENEFITS

**This antenna provides a 8 Port multi-band flexible platform for advanced use for flexible use in deployment scenarios for encompassing 600MHz, 700MHz, AWS & PCS applications.**

- **24 Inch Width For Easier Zoning**
- **Field Replaceable (Integrated) AISG RET platform for reduced environmental exposure and long lasting quality**
- **Superior elevation pattern performance across the entire electrical down tilt range**
- **Includes three AISG RET motors - Includes 0.5m AISG jumper for optional diasy chain of two high band RET motors for one single AISG point of high band tilt control.**
- **Low band arrays driven by a single RET motor**

## Technical Features

### LOW BAND LEFT ARRAY (617-746 MHZ) [R1]

| | | | |
|---|---|---|---|
| **Frequency Band** | MHz | 617-698 | 698-746 |
| **Gain** | dBi | 15.1 | 15.5 |
| **Horizontal Beamwidth @3dB** | Deg | 65 | 62 |
| **Vertical Beamwidth @3dB** | Deg | 11.4 | 10.4 |
| **Electrical Downtilt Range** | Deg | 0-12 | 0-12 |
| **Upper Side Lobe Suppression 0 to +20** | dB | 19 | 20 |
| **Front-to-Back, at +/-30°, Copolar** | dB | 25 | 24 |
| **Cross Polar Discrimination (XPD) @ Boresight** | dB | 19 | 19 |
| **Cross Polar Discrimination (XPD) @ +/-60** | dB | 5 | 3 |
| **3rd Order PIM 2 x 43dBm** | dBc | | -153 |
| **VSWR** | - | 1.5:1 | 1.5:1 |
| **Cross Polar Isolation** | dB | 25 | 25 |
| **Maximum Effective Power per Port** | Watt | 250 | 250 |

### LOW BAND RIGHT ARRAY (617-746 MHZ) [R2]

| | | | |
|---|---|---|---|
| **Frequency Band** | MHz | 617-698 | 698-746 |
| **Gain** | dBi | 14.8 | 15.1 |
| **Horizontal Beamwidth @3dB** | Deg | 65 | 62 |
| **Vertical Beamwidth @3dB** | Deg | 11.4 | 10.3 |
| **Electrical Downtilt Range** | Deg | 0-12 | 0-12 |
| **Upper Side Lobe Suppression 0 to +20** | dB | 19 | 20 |
| **Front-to-Back, at +/-30°, Copolar** | dB | 25 | 23 |
| **Cross Polar Discrimination (XPD) @ Boresight** | dB | 19 | 19 |
| **Cross Polar Discrimination (XPD) @ +/-60** | dB | 5 | 3 |
| **3rd Order PIM 2 x 43dBm** | dBc | | -153 |
| **VSWR** | - | 1.5:1 | 1.5:1 |
| **Cross Polar Isolation** | dB | 25 | 25 |
| **Maximum Effective Power per Port** | Watt | 250 | 250 |

RADIO FREQUENCY SYSTEMS
The Clear Choice®

# Dual Slant Polarized Quad Band (8 Port) Antenna, 617-746/617-746/1695-2200/1695-2200MHz, 65deg, 15/15/18/18dBi, 2.4m (8ft), VET, RET, 0-12°/0-12°/2-12°/2-12°

## ELECTRICAL SPECIFICATIONS

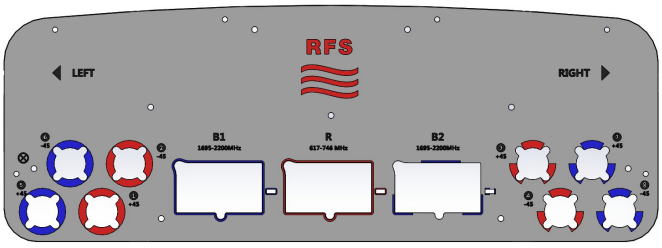
| | | |
|---|---|---|
| **Impedance** | Ohm | 50.0 |
| **Polarization** | Deg | ±45° |

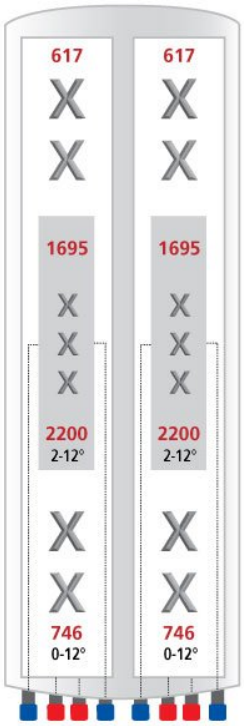
## MECHANICAL SPECIFICATIONS

| | | |
|---|---|---|
| **Dimensions - H x W x D** | mm (in) | 2436 x 609 x 222 (95.9 x 24 x 8.7) |
| **Weight (Antenna Only)** | kg (lb) | 58 (128) |
| **Weight (Mounting Hardware only)** | kg (lb) | 11.5 (25.3) |
| **Shipping Weight** | kg (lb) | 80 (176) |
| **Connector type** | | 8 x 4.3-10 female at bottom + 6 AISG connectors (3 male, 3 female) |
| **Adjustment mechanism** | | Integrated RET solution AISG compliant (Field Replaceable) + Manual Override + External Tilt Indicator |
| **Mounting Hardware Material** | | Galvanized steel |
| **Radome Material / Color** | | Fiber Glass / Light Grey RAL7035 |

## TESTING AND ENVIRONMENTAL

| | | |
|---|---|---|
| **Temperature Range** | °C (°F) | -40 to 60 (-40 to 140 ) |
| **Lightning protection** | | IEC 61000-4-5 |
| **Survival/Rated Wind Velocity** | km/h | 241 (150 ) |
| **Environmental** | | ETSI 300-019-2-4 Class 4.1E |




## ORDERING INFORMATION

| Order No. | Configuration | Mounting Hardware | Mounting pipe Diameter | Shipping Weight |
|---|---|---|---|---|
| **APXVAARR24_43-U-NA20** | Field Replace RET included (3) | APM40-5E Beam tilt kit (included) | 60-120mm | 80 Kg |

# Exhibit C

# Mount Analysis

CENTEK engineering

Centered on Solutions℠

# Structural Analysis Report

Antenna Mount Analysis

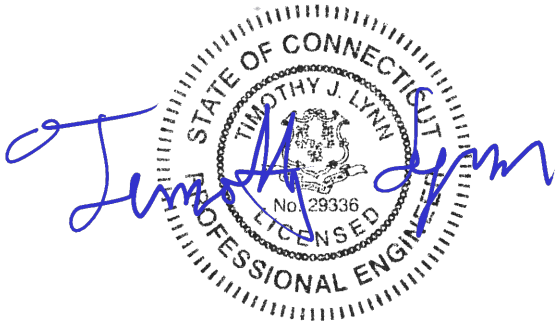
T-Mobile Site #: CTHA524A

1542 Boston Post Road
Westbrook, CT

Centek Project No. 19027.46

~~Date: April 14, 2020~~
Rev 1: May, 2020

Max Stress Ratio = 57.6%




**Prepared for:**

T-Mobile USA
35 Griffin Road
Bloomfield, CT 06002

# ***Table of Contents***

CENTEK engineering

Centered on Solutions℠

Rev.1 May 4, 2020

Mr. Dan Reid
Transcend Wireless
10 Industrial Ave
Mahwah, NJ 07430

*Re: Structural Letter ~ Antenna Mount*
*T-Mobile – Site Ref: CTHA524A*
*1542 Boston Post Road*
*Westbrook, CT 06498*

*Centek Project No. 19027.46*

Dear Mr. Reid,

Centek Engineering, Inc. has reviewed the T-Mobile antenna installation at the above referenced site. The purpose of the review is to determine the structural adequacy of the proposed mount, consisting of one (1) 12-ft Quad Platform (SitePro P/N F4P-12W) and handrail (P/N F4P-HRK12) to support the equipment configuration, using Pipe 2.5 STD X 8'-0" long behind position 2 antennas. The review considered the effects of wind load, dead load and ice load in accordance with the 2015 International Building Code as modified by the 2018 Connecticut State Building Code (CTBC) including ASCE 7-10 and ANSI/TIA-222-G *Structural Standards for Steel Antenna Towers and Supporting Structures*.

The loads considered in this analysis consist of the following:

- **T-Mobile:**
  **Platform: Three (3) RFS APXVAARR24-43-NA20 panel antennas, three (3) Ericsson AIR32 KRD901146-1_B66A_B2A panel antennas, three (3) Ericsson 4449 B71_B12 remote radio units mounted on the quad platform with a RAD center elevation of 104 ft +/- AGL.**

The antenna mount was analyzed per the requirements of the 2015 International Building Code as modified by the 2018 Connecticut State Building Code considering a nominal design wind speed of 105 mph for Westbrook as required in Appendix N of the 2018 Connecticut State Building Code.

A structural analysis of tower and foundation needs to be completed prior to any work.

Based on our review of the installation, it is our opinion that the **subject antenna mount has sufficient capacity** to support the aforementioned antenna configuration. If there are any questions regarding this matter, please feel free to call

Respectfully Submitted by:

Timothy J. Lynn, PE
Structural Engineer

STATE OF CONNECTICUT
TIMOTHY J. LYNN
No. 29336
LICENSED
PROFESSIONAL ENGINEER

Prepared by:

Fernando J. Palacios
Engineer

# ***Section 2 - Calculations***

CENTEK engineering
Centered on Solutions℠ www.centekeng.com
63-2 North Branford Road P: (203) 488-0580
Branford, CT 06405 F: (203) 488-8587

Subject: Loads on Equipment

Location: Westbrook, CT

Rev. 1: 05/04/2020

Prepared by: F.J.P Checked by: T.J.L.
Job No. 19027.46

## Development of Design Heights, Exposure Coefficients, and Velocity Pressures Per TIA-222-G

### Wind Speeds

| | | | |
|---|---|---|---|
| Basic Wind Speed | $V := 105$ | mph | (User Input - 2018 CSBC Appendix N) |
| Basic Wind Speed with Ice | $V_i := 50$ | mph | (User Input per Annex B of TIA-222-G) |

### Input

| | | | |
|---|---|---|---|
| Structure Type = | $Structure\_Type := Pole$ | | (User Input) |
| Structure Category = | $SC := II$ | | (User Input) |
| Exposure Category = | $Exp := D$ | | (User Input) |
| Structure Height = | $h := 130$ | ft | (User Input) |
| Height to Center of Antennas = | $z := 104$ | ft | (User Input) |
| Radial Ice Thickness = | $t_i := 0.75$ | in | (User Input per Annex B of TIA-222-G) |
| Radial Ice Density = | $Id := 56.00$ | pcf | (User Input) |
| Topograpic Factor = | $K_{zt} := 1.0$ | | (User Input) |
| | $K_a := 1.0$ | | (User Input) |
| Gust Response Factor = | $G_H = 1.1$ | | (User Input) |

### Output

Wind Direction Probability Factor =

$$K_d := \begin{cases} 0.95 & \text{if } Structure\_Type = Pole \\ 0.85 & \text{if } Structure\_Type = Lattice \end{cases} = 0.95$$

(Per Table 2-2 of TIA-222-G)

(Per Table 2-3 of TIA-222-G)

Importance Factors =

$$I_{Wind} := \begin{cases} 0.87 & \text{if } SC = 1 \\ 1.00 & \text{if } SC = 2 \\ 1.15 & \text{if } SC = 3 \end{cases} = 1$$

$$I_{Wind\_w\_Ice} := \begin{cases} 0 & \text{if } SC = 1 \\ 1.00 & \text{if } SC = 2 \\ 1.00 & \text{if } SC = 3 \end{cases} = 1$$

$$I_{ice} := \begin{cases} 0 & \text{if } SC = 1 \\ 1.00 & \text{if } SC = 2 \\ 1.25 & \text{if } SC = 3 \end{cases} = 1$$

$$K_{iz} := \left(\frac{z}{33}\right)^{0.1} = 1.122$$

Velocity Pressure Coefficient Antennas =

$$t_{iz} := 2.0 \cdot t_i \cdot I_{ice} \cdot K_{iz} \cdot K_{zt}^{0.35} = 1.682$$

$$Kz := 2.01 \cdot \left(\left(\frac{z}{zg}\right)\right)^{\frac{2}{\alpha}} = 1.443$$

Velocity Pressure w/o Ice Antennas = $qz := 0.00256 \cdot K_d \cdot Kz \cdot V^2 \cdot I_{Wind} = 39$ psf

Velocity Pressure with Ice Antennas = $qz_{ice} := 0.00256 \cdot K_d \cdot Kz \cdot V_i^2 \cdot I_{Wind} = 9$ psf

## Development of Wind & Ice Load on Antennas

### Antenna Data:

| | | | |
|---|---|---|---|
| Antenna Model = | RFS APXVAARR24_43-U-NA20 | | |
| Antenna Shape = | Flat | | (User Input) |
| Antenna Height = | $L_{ant} := 95.9$ | in | (User Input) |
| Antenna Width = | $W_{ant} := 19.7$ | in | (User Input) |
| Antenna Thickness = | $T_{ant} := 8.7$ | in | (User Input) |
| Antenna Weight = | $WT_{ant} := 114.7$ | lbs | (User Input) |
| Number of Antennas = | $N_{ant} := 1$ | | (User Input) |
| Antenna Aspect Ratio = | $Ar_{ant} := \frac{L_{ant}}{W_{ant}} = 4.9$ | | |
| Antenna Force Coefficient = | $Ca_{ant} = 1.31$ | | |

### Wind Load (without ice)

| | | |
|---|---|---|
| Surface Area for One Antenna = | $SA_{antF} := \frac{L_{ant} \cdot W_{ant}}{144} = 13.1$ | sf |
| Total Antenna Wind Force Front = | $F_{ant} := qz \cdot G_H \cdot Ca_{ant} \cdot K_a \cdot SA_{antF} = 729$ | lbs |
| Surface Area for One Antenna = | $SA_{antS} := \frac{L_{ant} \cdot T_{ant}}{144} = 5.8$ | sf |
| Total Antenna Wind Force Side = | $F_{ant} := qz \cdot G_H \cdot Ca_{ant} \cdot K_a \cdot SA_{antS} = 322$ | lbs |

### Wind Load (with ice)

| | | |
|---|---|---|
| Surface Area for One Antenna w/ Ice = | $SA_{ICEantF} := \frac{(L_{ant} + 2 \cdot t_{iz}) \cdot (W_{ant} + 2 \cdot t_{iz})}{144} = 15.9$ | sf |
| Total Antenna Wind Force w/ Ice Front = | $Fi_{ant} := qz_{ice} \cdot G_H \cdot Ca_{ant} \cdot K_a \cdot SA_{ICEantF} = 200$ | lbs |
| Surface Area for One Antenna w/ Ice = | $SA_{ICEantS} := \frac{(L_{ant} + 2 \cdot t_{iz}) \cdot (T_{ant} + 2 \cdot t_{iz})}{144} = 8.3$ | sf |
| Total Antenna Wind Force w/ Ice Side = | $Fi_{ant} := qz_{ice} \cdot G_H \cdot Ca_{ant} \cdot K_a \cdot SA_{ICEantS} = 105$ | lbs |

### Gravity Load (without ice)

| | | |
|---|---|---|
| Weight of All Antennas = | $WT_{ant} \cdot N_{ant} = 115$ | lbs |

### Gravity Loads (ice only)

| | | |
|---|---|---|
| Volume of Each Antenna = | $V_{ant} := L_{ant} \cdot W_{ant} \cdot T_{ant} = 2 \cdot 10^4$ | cu in |
| Volume of Ice on Each Antenna = | $V_{ice} := (L_{ant} + 2 \cdot t_{iz}) \cdot (W_{ant} + 2 \cdot t_{iz}) \cdot (T_{ant} + 2 \cdot t_{iz}) - V_{ant} = 1 \cdot 10^4$ | cu in |
| Weight of Ice on Each Antenna = | $W_{ICEant} := \frac{V_{ice}}{1728} \cdot Id = 363$ | lbs |
| Weight of Ice on All Antennas = | $W_{ICEant} \cdot N_{ant} = 363$ | lbs |

## Development of Wind & Ice Load on Antennas

### Antenna Data:

| | | | |
|---|---|---|---|
| Antenna Model = | Ericsson KRD901146-1_B66A_B2A | | |
| Antenna Shape = | Flat | | (User Input) |
| Antenna Height = | $L_{ant} := 56.65$ | in | (User Input) |
| Antenna Width = | $W_{ant} := 12.77$ | in | (User Input) |
| Antenna Thickness = | $T_{ant} := 8.66$ | in | (User Input) |
| Antenna Weight = | $WT_{ant} := 132.2$ | lbs | (User Input) |
| Number of Antennas = | $N_{ant} := 1$ | | (User Input) |
| Antenna Aspect Ratio = | $Ar_{ant} := \frac{L_{ant}}{W_{ant}} = 4.4$ | | |
| Antenna Force Coefficient = | $Ca_{ant} = 1.29$ | | |

### Wind Load (without ice)

| | | |
|---|---|---|
| Surface Area for One Antenna = | $SA_{antF} := \frac{L_{ant} \cdot W_{ant}}{144} = 5$ | sf |
| Total Antenna Wind Force Front = | $F_{ant} := qz \cdot G_H \cdot Ca_{ant} \cdot K_a \cdot SA_{antF} = 275$ | lbs |
| Surface Area for One Antenna = | $SA_{antS} := \frac{L_{ant} \cdot T_{ant}}{144} = 3.4$ | sf |
| Total Antenna Wind Force Side = | $F_{ant} := qz \cdot G_H \cdot Ca_{ant} \cdot K_a \cdot SA_{antS} = 186$ | lbs |

### Wind Load (with ice)

| | | |
|---|---|---|
| Surface Area for One Antenna w/ Ice = | $SA_{ICEantF} := \frac{(L_{ant} + 2 \cdot t_{iz}) \cdot (W_{ant} + 2 \cdot t_{iz})}{144} = 6.7$ | sf |
| Total Antenna Wind Force w/ Ice Front = | $Fi_{ant} := qz_{ice} \cdot G_H \cdot Ca_{ant} \cdot K_a \cdot SA_{ICEantF} = 83$ | lbs |
| Surface Area for One Antenna w/ Ice = | $SA_{ICEantS} := \frac{(L_{ant} + 2 \cdot t_{iz}) \cdot (T_{ant} + 2 \cdot t_{iz})}{144} = 5$ | sf |
| Total Antenna Wind Force w/ Ice Side = | $Fi_{ant} := qz_{ice} \cdot G_H \cdot Ca_{ant} \cdot K_a \cdot SA_{ICEantS} = 62$ | lbs |

### Gravity Load (without ice)

| | | |
|---|---|---|
| Weight of All Antennas = | $WT_{ant} \cdot N_{ant} = 132$ | lbs |

### Gravity Loads (ice only)

| | | |
|---|---|---|
| Volume of Each Antenna = | $V_{ant} := L_{ant} \cdot W_{ant} \cdot T_{ant} = 6265$ | cu in |
| Volume of Ice on Each Antenna = | $V_{ice} := (L_{ant} + 2 \cdot t_{iz}) \cdot (W_{ant} + 2 \cdot t_{iz}) \cdot (T_{ant} + 2 \cdot t_{iz}) - V_{ant} = 5379$ | cu in |
| Weight of Ice on Each Antenna = | $W_{ICEant} := \frac{V_{ice}}{1728} \cdot Id = 174$ | lbs |
| Weight of Ice on All Antennas = | $W_{ICEant} \cdot N_{ant} = 174$ | lbs |

## Development of Wind & Ice Load on RRUS's

### RRUS Data:

| | | | |
|---|---|---|---|
| RRUS Model = | Ericsson 4449 B71B12 | | |
| RRUS Shape = | Flat | | (User Input) |
| RRUS Height = | $L_{RRUS} := 14.9$ | in | (User Input) |
| RRUS Width = | $W_{RRUS} := 13.2$ | in | (User Input) |
| RRUS Thickness = | $T_{RRUS} := 10.4$ | in | (User Input) |
| RRUS Weight = | $WT_{RRUS} := 74$ | lbs | (User Input) |
| Number of RRUS's = | $N_{RRUS} := 1$ | | |
| RRUS Aspect Ratio = | $Ar_{RRUS} := \frac{L_{RRUS}}{W_{RRUS}} = 1.1$ | | |
| RRUS Force Coefficient = | $Ca_{RRUS} = 1.2$ | | |

### Wind Load (without ice)

| | | |
|---|---|---|
| Surface Area for One RRUS = | $SA_{RRUSF} := \frac{L_{RRUS} \cdot W_{RRUS}}{144} = 1.4$ | sf |
| Total RRUS Wind Force = | $F_{RRUS} := qz \cdot G_H \cdot Ca_{RRUS} \cdot K_a \cdot SA_{RRUSF} = 70$ | lbs |
| Surface Area for One RRUS = | $SA_{RRUSS} := \frac{L_{RRUS} \cdot T_{RRUS}}{144} = 1.1$ | sf |
| Total RRUS Wind Force = | $F_{RRUS} := qz \cdot G_H \cdot Ca_{RRUS} \cdot K_a \cdot SA_{RRUSS} = 55$ | lbs |

### Wind Load (with ice)

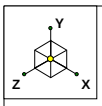
| | | |
|---|---|---|
| Surface Area for One RRUS w/ Ice = | $SA_{ICERRUSF} := \frac{(L_{RRUS} + 2 \cdot t_{iz}) \cdot (W_{RRUS} + 2 \cdot t_{iz})}{144} = 2.1$ | sf |
| Total RRUS Wind Force w/ Ice = | $Fi_{RRUS} := qz_{ice} \cdot G_H \cdot Ca_{RRUS} \cdot K_a \cdot SA_{ICERRUSF} = 24$ | lbs |
| Surface Area for One RRUS w/ Ice = | $SA_{ICERRUSS} := \frac{(L_{RRUS} + 2 \cdot t_{iz}) \cdot (T_{RRUS} + 2 \cdot t_{iz})}{144} = 1.7$ | sf |
| Total RRUS Wind Force w/ Ice = | $Fi_{RRUS} := qz_{ice} \cdot G_H \cdot Ca_{RRUS} \cdot K_a \cdot SA_{ICERRUSS} = 20$ | lbs |

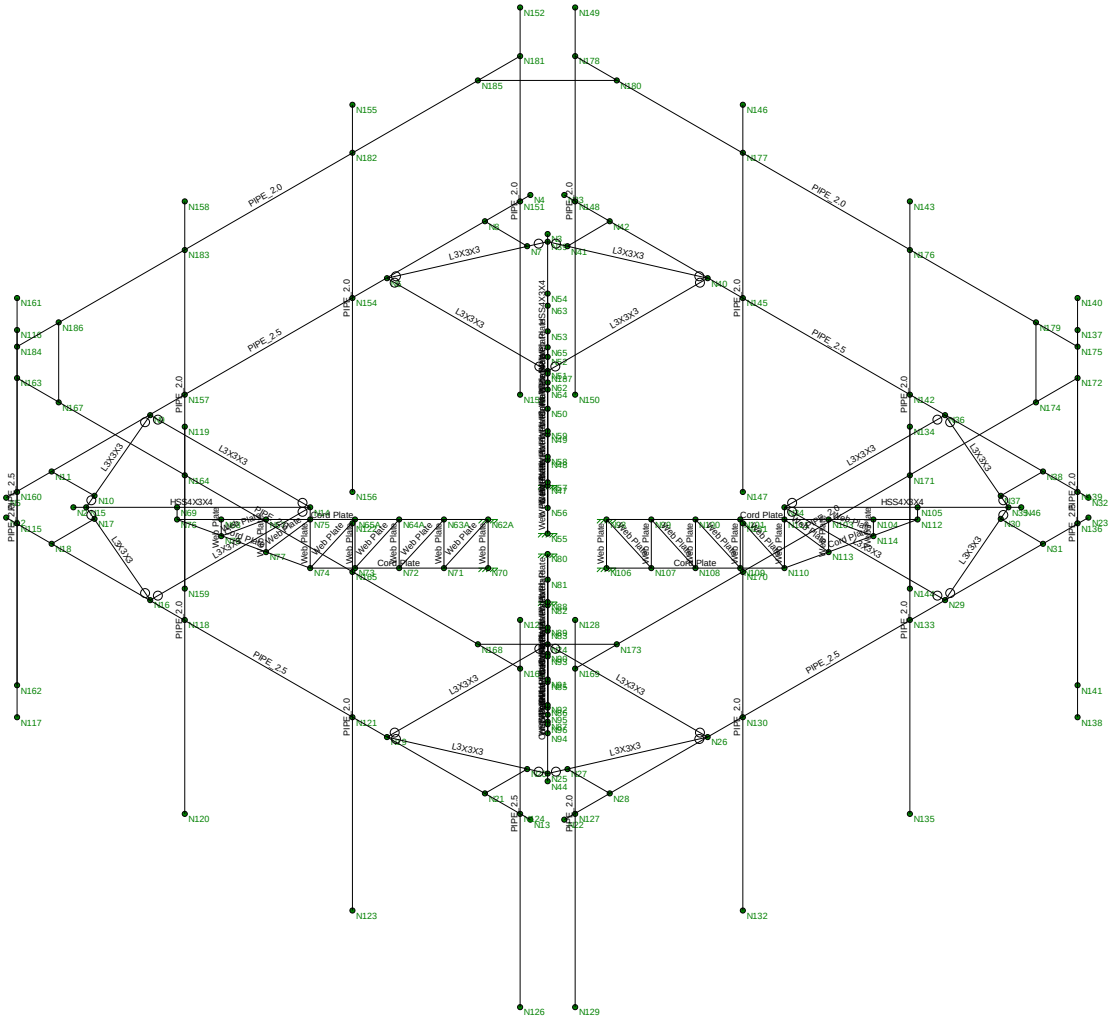
### Gravity Load (without ice)

| | | |
|---|---|---|
| Weight of All RRUSs = | $WT_{RRUS} \cdot N_{RRUS} = 74$ | lbs |

### Gravity Loads (ice only)

| | | |
|---|---|---|
| Volume of Each RRUS = | $V_{RRUS} := L_{RRUS} \cdot W_{RRUS} \cdot T_{RRUS} = 2045$ | cu in |
| Volume of Ice on Each RRUS = | $V_{ice} := (L_{RRUS} + 2 \cdot t_{iz}) \cdot (W_{RRUS} + 2 \cdot t_{iz}) \cdot (T_{RRUS} + 2 \cdot t_{iz}) - V_{RRUS} = 2119$ | cu in |
| Weight of Ice on Each RRUS = | $W_{ICERRUS} := \frac{V_{ice}}{1728} \cdot Id = 69$ | lbs |
| Weight of Ice on All RRUSs = | $W_{ICERRUS} \cdot N_{RRUS} = 69$ | lbs |




Envelope Only Solution

| | | |
|---|---|---|
| Centek | | |
| FJP | CTHA524A - Mount | Apr 13, 2020 at 12:11 PM |
| 19027.46 | Memeber Framing | CTHA524A_AMA.r3d |

## (Global) Model Settings

| | |
|---|---|
| Display Sections for Member Calcs | 5 |
| Max Internal Sections for Member Calcs | 97 |
| Include Shear Deformation? | Yes |
| Increase Nailing Capacity for Wind? | Yes |
| Include Warping? | Yes |
| Trans Load Btwn Intersecting Wood Wall? | Yes |
| Area Load Mesh (in^2) | 144 |
| Merge Tolerance (in) | .12 |
| P-Delta Analysis Tolerance | 0.50% |
| Include P-Delta for Walls? | Yes |
| Automatically Iterate Stiffness for Walls? | Yes |
| Max Iterations for Wall Stiffness | 3 |
| Gravity Acceleration (ft/sec^2) | 32.2 |
| Wall Mesh Size (in) | 24 |
| Eigensolution Convergence Tol. (1.E-) | 4 |
| Vertical Axis | Y |
| Global Member Orientation Plane | XZ |
| Static Solver | Sparse Accelerated |
| Dynamic Solver | Accelerated Solver |

| | |
|---|---|
| Hot Rolled Steel Code | AISC 14th(360-10): LRFD |
| Adjust Stiffness? | Yes(Iterative) |
| RISAConnection Code | AISC 14th(360-10): ASD |
| Cold Formed Steel Code | AISI S100-12: ASD |
| Wood Code | AWC NDS-15: ASD |
| Wood Temperature | < 100F |
| Concrete Code | ACI 318-14 |
| Masonry Code | ACI 530-13: ASD |
| Aluminum Code | AA ADM1-15: ASD - Building |
| Stainless Steel Code | AISC 14th(360-10): ASD |
| Adjust Stiffness? | Yes(Iterative) |

| | |
|---|---|
| Number of Shear Regions | 4 |
| Region Spacing Increment (in) | 4 |
| Biaxial Column Method | Exact Integration |
| Parme Beta Factor (PCA) | .65 |
| Concrete Stress Block | Rectangular |
| Use Cracked Sections? | Yes |
| Use Cracked Sections Slab? | Yes |
| Bad Framing Warnings? | No |
| Unused Force Warnings? | Yes |
| Min 1 Bar Diam. Spacing? | No |
| Concrete Rebar Set | REBAR_SET_ASTMA615 |
| Min % Steel for Column | 1 |
| Max % Steel for Column | 8 |

## (Global) Model Settings, Continued

| | |
|---|---|
| Seismic Code | ASCE 7-10 |
| Seismic Base Elevation (ft) | Not Entered |
| Add Base Weight? | Yes |
| Ct X | .02 |
| Ct Z | .02 |
| T X (sec) | Not Entered |
| T Z (sec) | Not Entered |
| R X | 3 |
| R Z | 3 |
| Ct Exp. X | .75 |
| Ct Exp. Z | .75 |
| SD1 | 1 |
| SDS | 1 |
| S1 | 1 |
| TL (sec) | 5 |
| Risk Cat | I or II |
| Drift Cat | Other |
| Om Z | 1 |
| Om X | 1 |
| Cd Z | 4 |
| Cd X | 4 |
| Rho Z | 1 |
| Rho X | 1 |
| | |

## Hot Rolled Steel Properties

| | Label | E [ksi] | G [ksi] | Nu | Therm (/1... | Density[k/... | 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 ... | A [in2] | Iyy [in4] | Izz [in4] | J [in4] |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2.5" Std. Pipe | PIPE_2.5 | Beam | None | A53 Gr.B | Typical | 1.61 | 1.45 | 1.45 | 2.89 |
| 2 | 2.0" Std. Pipe | PIPE_2.0 | Beam | None | A53 Gr.B | Typical | 1.02 | .627 | .627 | 1.25 |
| 3 | HSS4x3 | HSS4X3X4 | Beam | None | A500 Gr.B R... | Typical | 2.91 | 3.91 | 6.15 | 7.96 |
| 4 | L3x3 | L3X3X3 | Beam | None | A36 Gr.36 | Typical | 1.09 | .948 | .948 | .014 |
| 5 | Cord Plate | Cord Plate | Beam | None | A36 Gr.36 | Typical | 2.25 | 2.668 | .188 | .158 |
| 6 | Web Plate | 1"x3/8" | Beam | None | A36 Gr.36 | Typical | .375 | .004 | .031 | .013 |
| 7 | Handrail | PIPE_2.0 | Beam | None | A53 Gr.B | Typical | 1.02 | .627 | .627 | 1.25 |

## Hot Rolled Steel Design Parameters

| | Label | Shape | Length[ft] | Lbyy[ft] | Lbzz[ft] | Lcomp top[ft] | Lcomp bot[ft] | L-torqu... | Kyy | Kzz | Cb | Function |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | M1 | 2.5" Std. Pipe | 12.5 | | | Lbyy | | | | | | Lateral |
| 2 | M2 | L3x3 | 3.828 | | | Lbyy | | | | | | Lateral |

## Hot Rolled Steel Design Parameters (Continued)

| | Label | Shape | Length[ft] | Lbyy[ft] | Lbzz[ft] | Lcomp top[ft] | Lcomp bot[ft] | L-torqu... | Kyy | Kzz | Cb | Function |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | M3 | L3x3 | 2.911 | | | Lbyy | | | | | | Lateral |
| 4 | M5 | L3x3 | 3.828 | | | Lbyy | | | | | | Lateral |
| 5 | M6 | L3x3 | 2.911 | | | Lbyy | | | | | | Lateral |
| 6 | M8 | 2.5" Std. Pipe | 12.5 | | | Lbyy | | | | | | Lateral |
| 7 | M9 | L3x3 | 3.828 | | | Lbyy | | | | | | Lateral |
| 8 | M10 | L3x3 | 2.911 | | | Lbyy | | | | | | Lateral |
| 9 | M12 | L3x3 | 3.828 | | | Lbyy | | | | | | Lateral |
| 10 | M13 | L3x3 | 2.911 | | | Lbyy | | | | | | Lateral |
| 11 | M15 | 2.5" Std. Pipe | 12.5 | | | Lbyy | | | | | | Lateral |
| 12 | M16 | L3x3 | 3.828 | | | Lbyy | | | | | | Lateral |
| 13 | M17 | L3x3 | 2.911 | | | Lbyy | | | | | | Lateral |
| 14 | M19 | L3x3 | 3.828 | | | Lbyy | | | | | | Lateral |
| 15 | M20 | L3x3 | 2.911 | | | Lbyy | | | | | | Lateral |
| 16 | M22 | 2.5" Std. Pipe | 12.5 | | | Lbyy | | | | | | Lateral |
| 17 | M23 | L3x3 | 3.828 | | | Lbyy | | | | | | Lateral |
| 18 | M24 | L3x3 | 2.911 | | | Lbyy | | | | | | Lateral |
| 19 | M26 | L3x3 | 3.828 | | | Lbyy | | | | | | Lateral |
| 20 | M27 | L3x3 | 2.911 | | | Lbyy | | | | | | Lateral |
| 21 | M29 | HSS4x3 | 4 | | | Lbyy | | | | | | Lateral |
| 22 | M30 | Cord Plate | 5.25 | Segment | Segment | Segment | Segment | Segme... | | | | Lateral |
| 23 | M31 | Cord Plate | 2.462 | Segment | Segment | Segment | Segment | Segme... | | | | Lateral |
| 24 | M32 | Cord Plate | 3 | Segment | Segment | Segment | Segment | Segme... | | | | Lateral |
| 25 | M33 | Web Plate | 1 | | | Lbyy | | | | | | Lateral |
| 26 | M34 | Web Plate | 1 | | | Lbyy | | | | | | Lateral |
| 27 | M35 | Web Plate | 1 | | | Lbyy | | | | | | Lateral |
| 28 | M36 | Web Plate | 1 | | | Lbyy | | | | | | Lateral |
| 29 | M37 | Web Plate | 1 | | | Lbyy | | | | | | Lateral |
| 30 | M38 | Web Plate | .667 | | | Lbyy | | | | | | Lateral |
| 31 | M39 | Web Plate | .333 | | | Lbyy | | | | | | Lateral |
| 32 | M40 | Web Plate | 1.25 | | | Lbyy | | | | | | Lateral |
| 33 | M41 | Web Plate | 1.25 | | | Lbyy | | | | | | Lateral |
| 34 | M42 | Web Plate | 1.25 | | | Lbyy | | | | | | Lateral |
| 35 | M43 | Web Plate | 1.25 | | | Lbyy | | | | | | Lateral |
| 36 | M44 | Web Plate | 1.003 | | | Lbyy | | | | | | Lateral |
| 37 | M45 | Web Plate | .821 | | | Lbyy | | | | | | Lateral |
| 38 | M48 | HSS4x3 | 4 | | | Lbyy | | | | | | Lateral |
| 39 | M49 | Cord Plate | 5.25 | Segment | Segment | Segment | Segment | Segme... | | | | Lateral |
| 40 | M50 | Cord Plate | 2.462 | Segment | Segment | Segment | Segment | Segme... | | | | Lateral |
| 41 | M51 | Cord Plate | 3 | Segment | Segment | Segment | Segment | Segme... | | | | Lateral |
| 42 | M52 | Web Plate | 1 | | | Lbyy | | | | | | Lateral |
| 43 | M53 | Web Plate | 1 | | | Lbyy | | | | | | Lateral |
| 44 | M54 | Web Plate | 1 | | | Lbyy | | | | | | Lateral |
| 45 | M55 | Web Plate | 1 | | | Lbyy | | | | | | Lateral |
| 46 | M56 | Web Plate | 1 | | | Lbyy | | | | | | Lateral |
| 47 | M57 | Web Plate | .667 | | | Lbyy | | | | | | Lateral |
| 48 | M58 | Web Plate | .333 | | | Lbyy | | | | | | Lateral |
| 49 | M59 | Web Plate | 1.25 | | | Lbyy | | | | | | Lateral |
| 50 | M60 | Web Plate | 1.25 | | | Lbyy | | | | | | Lateral |
| 51 | M61 | Web Plate | 1.25 | | | Lbyy | | | | | | Lateral |
| 52 | M62 | Web Plate | 1.25 | | | Lbyy | | | | | | Lateral |
| 53 | M63 | Web Plate | 1.003 | | | Lbyy | | | | | | Lateral |
| 54 | M64 | Web Plate | .821 | | | Lbyy | | | | | | Lateral |

## *Hot Rolled Steel Design Parameters (Continued)*

| | Label | Shape | Length[ft] | Lbyy[ft] | Lbzz[ft] | Lcomp top[ft] | Lcomp bot[ft] | L-torqu... | Kyy | Kzz | Cb | Function |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 55 | M67 | HSS4x3 | 4 | | | Lbyy | | | | | | Lateral |
| 56 | M68 | Cord Plate | 5.25 | Segment | Segment | Segment | Segment | Segme... | | | | Lateral |
| 57 | M69 | Cord Plate | 2.462 | Segment | Segment | Segment | Segment | Segme... | | | | Lateral |
| 58 | M70 | Cord Plate | 3 | Segment | Segment | Segment | Segment | Segme... | | | | Lateral |
| 59 | M71 | Web Plate | 1 | | | Lbyy | | | | | | Lateral |
| 60 | M72 | Web Plate | 1 | | | Lbyy | | | | | | Lateral |
| 61 | M73 | Web Plate | 1 | | | Lbyy | | | | | | Lateral |
| 62 | M74 | Web Plate | 1 | | | Lbyy | | | | | | Lateral |
| 63 | M75 | Web Plate | 1 | | | Lbyy | | | | | | Lateral |
| 64 | M76 | Web Plate | .667 | | | Lbyy | | | | | | Lateral |
| 65 | M77 | Web Plate | .333 | | | Lbyy | | | | | | Lateral |
| 66 | M78 | Web Plate | 1.25 | | | Lbyy | | | | | | Lateral |
| 67 | M79 | Web Plate | 1.25 | | | Lbyy | | | | | | Lateral |
| 68 | M80 | Web Plate | 1.25 | | | Lbyy | | | | | | Lateral |
| 69 | M81 | Web Plate | 1.25 | | | Lbyy | | | | | | Lateral |
| 70 | M82 | Web Plate | 1.003 | | | Lbyy | | | | | | Lateral |
| 71 | M83 | Web Plate | .821 | | | Lbyy | | | | | | Lateral |
| 72 | M86 | HSS4x3 | 4 | | | Lbyy | | | | | | Lateral |
| 73 | M87 | Cord Plate | 5.25 | Segment | Segment | Segment | Segment | Segme... | | | | Lateral |
| 74 | M88 | Cord Plate | 2.462 | Segment | Segment | Segment | Segment | Segme... | | | | Lateral |
| 75 | M89 | Cord Plate | 3 | Segment | Segment | Segment | Segment | Segme... | | | | Lateral |
| 76 | M90 | Web Plate | 1 | | | Lbyy | | | | | | Lateral |
| 77 | M91 | Web Plate | 1 | | | Lbyy | | | | | | Lateral |
| 78 | M92 | Web Plate | 1 | | | Lbyy | | | | | | Lateral |
| 79 | M93 | Web Plate | 1 | | | Lbyy | | | | | | Lateral |
| 80 | M94 | Web Plate | 1 | | | Lbyy | | | | | | Lateral |
| 81 | M95 | Web Plate | .667 | | | Lbyy | | | | | | Lateral |
| 82 | M96 | Web Plate | .333 | | | Lbyy | | | | | | Lateral |
| 83 | M97 | Web Plate | 1.25 | | | Lbyy | | | | | | Lateral |
| 84 | M98 | Web Plate | 1.25 | | | Lbyy | | | | | | Lateral |
| 85 | M99 | Web Plate | 1.25 | | | Lbyy | | | | | | Lateral |
| 86 | M100 | Web Plate | 1.25 | | | Lbyy | | | | | | Lateral |
| 87 | M101 | Web Plate | 1.003 | | | Lbyy | | | | | | Lateral |
| 88 | M102 | Web Plate | .821 | | | Lbyy | | | | | | Lateral |
| 89 | M105 | 2.0" Std. Pipe | 8 | | | Lbyy | | | | | | Lateral |
| 90 | M106 | 2.0" Std. Pipe | 8 | | | Lbyy | | | | | | Lateral |
| 91 | M107 | 2.0" Std. Pipe | 8 | | | Lbyy | | | | | | Lateral |
| 92 | M108 | 2.5" Std. Pipe | 8 | | | Lbyy | | | | | | Lateral |
| 93 | M109 | 2.0" Std. Pipe | 8 | | | Lbyy | | | | | | Lateral |
| 94 | M110 | 2.0" Std. Pipe | 8 | | | Lbyy | | | | | | Lateral |
| 95 | M111 | 2.0" Std. Pipe | 8 | | | Lbyy | | | | | | Lateral |
| 96 | M112 | 2.5" Std. Pipe | 8 | | | Lbyy | | | | | | Lateral |
| 97 | M113 | 2.0" Std. Pipe | 8 | | | Lbyy | | | | | | Lateral |
| 98 | M114 | 2.0" Std. Pipe | 8 | | | Lbyy | | | | | | Lateral |
| 99 | M115 | 2.0" Std. Pipe | 8 | | | Lbyy | | | | | | Lateral |
| 100 | M116 | 2.0" Std. Pipe | 8 | | | Lbyy | | | | | | Lateral |
| 101 | M117 | 2.0" Std. Pipe | 8 | | | Lbyy | | | | | | Lateral |
| 102 | M118 | 2.0" Std. Pipe | 8 | | | Lbyy | | | | | | Lateral |
| 103 | M119 | 2.0" Std. Pipe | 8 | | | Lbyy | | | | | | Lateral |
| 104 | M120 | 2.5" Std. Pipe | 8 | | | Lbyy | | | | | | Lateral |
| 105 | M121 | Handrail | 12 | | | Lbyy | | | | | | Lateral |
| 106 | M122 | Handrail | 12 | | | Lbyy | | | | | | Lateral |

## Hot Rolled Steel Design Parameters (Continued)

| | Label | Shape | Length[ft] | Lbyy[ft] | Lbzz[ft] | Lcomp top[ft] | Lcomp bot[ft] | L-torqu... | Kyy | Kzz | Cb | Function |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 107 | M123 | Handrail | 12 | | | Lbyy | | | | | | Lateral |
| 108 | M124 | Handrail | 12 | | | Lbyy | | | | | | Lateral |

## Member Primary Data

| | Label | I Joint | J Joint | K Joint | Rotate(de... | Section/Shape | Type | Design List | Material | Design Rules |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | M1 | N4 | N5 | | | 2.5" Std. Pipe | Beam | None | A53 Gr.B | Typical |
| 2 | M2 | N51 | N6 | | | L3x3 | Beam | None | A36 Gr.36 | Typical |
| 3 | M3 | N39 | N6 | | | L3x3 | Beam | None | A36 Gr.36 | Typical |
| 4 | M4 | N7 | N8 | | | RIGID | None | None | RIGID | Typical |
| 5 | M5 | N14 | N9 | | | L3x3 | Beam | None | A36 Gr.36 | Typical |
| 6 | M6 | N15 | N9 | | | L3x3 | Beam | None | A36 Gr.36 | Typical |
| 7 | M7 | N10 | N11 | | | RIGID | None | None | RIGID | Typical |
| 8 | M8 | N12 | N13 | | | 2.5" Std. Pipe | Beam | None | A53 Gr.B | Typical |
| 9 | M9 | N14 | N16 | | | L3x3 | Beam | None | A36 Gr.36 | Typical |
| 10 | M10 | N15 | N16 | | | L3x3 | Beam | None | A36 Gr.36 | Typical |
| 11 | M11 | N17 | N18 | | | RIGID | None | None | RIGID | Typical |
| 12 | M12 | N24 | N19 | | | L3x3 | Beam | None | A36 Gr.36 | Typical |
| 13 | M13 | N25 | N19 | | | L3x3 | Beam | None | A36 Gr.36 | Typical |
| 14 | M14 | N20 | N21 | | | RIGID | None | None | RIGID | Typical |
| 15 | M15 | N22 | N23 | | | 2.5" Std. Pipe | Beam | None | A53 Gr.B | Typical |
| 16 | M16 | N24 | N26 | | | L3x3 | Beam | None | A36 Gr.36 | Typical |
| 17 | M17 | N25 | N26 | | | L3x3 | Beam | None | A36 Gr.36 | Typical |
| 18 | M18 | N27 | N28 | | | RIGID | None | None | RIGID | Typical |
| 19 | M19 | N34 | N29 | | | L3x3 | Beam | None | A36 Gr.36 | Typical |
| 20 | M20 | N35 | N29 | | | L3x3 | Beam | None | A36 Gr.36 | Typical |
| 21 | M21 | N30 | N31 | | | RIGID | None | None | RIGID | Typical |
| 22 | M22 | N32 | N33 | | | 2.5" Std. Pipe | Beam | None | A53 Gr.B | Typical |
| 23 | M23 | N34 | N36 | | | L3x3 | Beam | None | A36 Gr.36 | Typical |
| 24 | M24 | N35 | N36 | | | L3x3 | Beam | None | A36 Gr.36 | Typical |
| 25 | M25 | N37 | N38 | | | RIGID | None | None | RIGID | Typical |
| 26 | M26 | N51 | N40 | | | L3x3 | Beam | None | A36 Gr.36 | Typical |
| 27 | M27 | N39 | N40 | | | L3x3 | Beam | None | A36 Gr.36 | Typical |
| 28 | M28 | N41 | N42 | | | RIGID | None | None | RIGID | Typical |
| 29 | M29 | N51 | N3 | | 90 | HSS4x3 | Beam | None | A500 Gr.... | Typical |
| 30 | M30 | N63 | N47 | | | Cord Plate | Beam | None | A36 Gr.36 | Typical |
| 31 | M31 | N63 | N59 | | | Cord Plate | Beam | None | A36 Gr.36 | Typical |
| 32 | M32 | N59 | N55 | | | Cord Plate | Beam | None | A36 Gr.36 | Typical |
| 33 | M33 | N47 | N55 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 34 | M34 | N48 | N56 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 35 | M35 | N49 | N57 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 36 | M36 | N50 | N58 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 37 | M37 | N62 | N59 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 38 | M38 | N52 | N64 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 39 | M39 | N53 | N65 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 40 | M40 | N47 | N56 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 41 | M41 | N48 | N57 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 42 | M42 | N49 | N58 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 43 | M43 | N50 | N59 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 44 | M44 | N62 | N64 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 45 | M45 | N52 | N65 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |

## *Member Primary Data (Continued)*

| | Label | I Joint | J Joint | K Joint | Rotate(de... | Section/Shape | Type | Design List | Material | Design Rules |
|---|---|---|---|---|---|---|---|---|---|---|
| 46 | M46 | N54 | N63 | | | RIGID | None | None | RIGID | Typical |
| 47 | M47 | N51 | N62 | | | RIGID | None | None | RIGID | Typical |
| 48 | M48 | N14 | N2 | | 90 | HSS4x3 | Beam | None | A500 Gr.... | Typical |
| 49 | M49 | N76 | N62A | | | Cord Plate | Beam | None | A36 Gr.36 | Typical |
| 50 | M50 | N76 | N74 | | | Cord Plate | Beam | None | A36 Gr.36 | Typical |
| 51 | M51 | N74 | N70 | | | Cord Plate | Beam | None | A36 Gr.36 | Typical |
| 52 | M52 | N62A | N70 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 53 | M53 | N63A | N71 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 54 | M54 | N64A | N72 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 55 | M55 | N65A | N73 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 56 | M56 | N75 | N74 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 57 | M57 | N67 | N77 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 58 | M58 | N68 | N78 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 59 | M59 | N62A | N71 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 60 | M60 | N63A | N72 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 61 | M61 | N64A | N73 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 62 | M62 | N65A | N74 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 63 | M63 | N75 | N77 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 64 | M64 | N67 | N78 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 65 | M65 | N69 | N76 | | | RIGID | None | None | RIGID | Typical |
| 66 | M66 | N14 | N75 | | | RIGID | None | None | RIGID | Typical |
| 67 | M67 | N24 | N44 | | 90 | HSS4x3 | Beam | None | A500 Gr.... | Typical |
| 68 | M68 | N94 | N80 | | | Cord Plate | Beam | None | A36 Gr.36 | Typical |
| 69 | M69 | N94 | N92 | | | Cord Plate | Beam | None | A36 Gr.36 | Typical |
| 70 | M70 | N92 | N88 | | | Cord Plate | Beam | None | A36 Gr.36 | Typical |
| 71 | M71 | N80 | N88 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 72 | M72 | N81 | N89 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 73 | M73 | N82 | N90 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 74 | M74 | N83 | N91 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 75 | M75 | N93 | N92 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 76 | M76 | N85 | N95 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 77 | M77 | N86 | N96 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 78 | M78 | N80 | N89 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 79 | M79 | N81 | N90 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 80 | M80 | N82 | N91 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 81 | M81 | N83 | N92 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 82 | M82 | N93 | N95 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 83 | M83 | N85 | N96 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 84 | M84 | N87 | N94 | | | RIGID | None | None | RIGID | Typical |
| 85 | M85 | N24 | N93 | | | RIGID | None | None | RIGID | Typical |
| 86 | M86 | N34 | N46 | | 90 | HSS4x3 | Beam | None | A500 Gr.... | Typical |
| 87 | M87 | N112 | N98 | | | Cord Plate | Beam | None | A36 Gr.36 | Typical |
| 88 | M88 | N112 | N110 | | | Cord Plate | Beam | None | A36 Gr.36 | Typical |
| 89 | M89 | N110 | N106 | | | Cord Plate | Beam | None | A36 Gr.36 | Typical |
| 90 | M90 | N98 | N106 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 91 | M91 | N99 | N107 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 92 | M92 | N100 | N108 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 93 | M93 | N101 | N109 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 94 | M94 | N111 | N110 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 95 | M95 | N103 | N113 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 96 | M96 | N104 | N114 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 97 | M97 | N98 | N107 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |

## Member Primary Data (Continued)

| | Label | I Joint | J Joint | K Joint | Rotate(de... | Section/Shape | Type | Design List | Material | Design Rules |
|---|---|---|---|---|---|---|---|---|---|---|
| 98 | M98 | N99 | N108 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 99 | M99 | N100 | N109 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 100 | M100 | N101 | N110 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 101 | M101 | N111 | N113 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 102 | M102 | N103 | N114 | | | Web Plate | Beam | None | A36 Gr.36 | Typical |
| 103 | M103 | N105 | N112 | | | RIGID | None | None | RIGID | Typical |
| 104 | M104 | N34 | N111 | | | RIGID | None | None | RIGID | Typical |
| 105 | M105 | N116 | N117 | | | 2.0" Std. Pipe | Beam | None | A53 Gr.B | Typical |
| 106 | M106 | N119 | N120 | | | 2.0" Std. Pipe | Beam | None | A53 Gr.B | Typical |
| 107 | M107 | N122 | N123 | | | 2.0" Std. Pipe | Beam | None | A53 Gr.B | Typical |
| 108 | M108 | N125 | N126 | | | 2.5" Std. Pipe | Beam | None | A53 Gr.B | Typical |
| 109 | M109 | N128 | N129 | | | 2.0" Std. Pipe | Beam | None | A53 Gr.B | Typical |
| 110 | M110 | N131 | N132 | | | 2.0" Std. Pipe | Beam | None | A53 Gr.B | Typical |
| 111 | M111 | N134 | N135 | | | 2.0" Std. Pipe | Beam | None | A53 Gr.B | Typical |
| 112 | M112 | N137 | N138 | | | 2.5" Std. Pipe | Beam | None | A53 Gr.B | Typical |
| 113 | M113 | N140 | N141 | | | 2.0" Std. Pipe | Beam | None | A53 Gr.B | Typical |
| 114 | M114 | N143 | N144 | | | 2.0" Std. Pipe | Beam | None | A53 Gr.B | Typical |
| 115 | M115 | N146 | N147 | | | 2.0" Std. Pipe | Beam | None | A53 Gr.B | Typical |
| 116 | M116 | N149 | N150 | | | 2.0" Std. Pipe | Beam | None | A53 Gr.B | Typical |
| 117 | M117 | N152 | N153 | | | 2.0" Std. Pipe | Beam | None | A53 Gr.B | Typical |
| 118 | M118 | N155 | N156 | | | 2.0" Std. Pipe | Beam | None | A53 Gr.B | Typical |
| 119 | M119 | N158 | N159 | | | 2.0" Std. Pipe | Beam | None | A53 Gr.B | Typical |
| 120 | M120 | N161 | N162 | | | 2.5" Std. Pipe | Beam | None | A53 Gr.B | Typical |
| 121 | M121 | N163 | N166 | | | Handrail | Beam | None | A53 Gr.B | Typical |
| 122 | M122 | N169 | N172 | | | Handrail | Beam | None | A53 Gr.B | Typical |
| 123 | M123 | N175 | N178 | | | Handrail | Beam | None | A53 Gr.B | Typical |
| 124 | M124 | N181 | N184 | | | Handrail | Beam | None | A53 Gr.B | Typical |
| 125 | M125 | N186 | N167 | | | RIGID | None | None | RIGID | Typical |
| 126 | M126 | N185 | N180 | | | RIGID | None | None | RIGID | Typical |
| 127 | M127 | N179 | N174 | | | RIGID | None | None | RIGID | Typical |
| 128 | M128 | N168 | N173 | | | RIGID | None | None | RIGID | Typical |

## Joint Coordinates and Temperatures

| | Label | X [ft] | Y [ft] | Z [ft] | Temp [F] | Detach From Diaphragm |
|---|---|---|---|---|---|---|
| 1 | N2 | -5.656854 | 0 | 5.656854 | 0 | |
| 2 | N3 | -5.656854 | 0 | -5.656854 | 0 | |
| 3 | N4 | -6.656854 | 0 | -6.25 | 0 | |
| 4 | N5 | -6.656854 | 0 | 6.25 | 0 | |
| 5 | N6 | -6.656854 | 0 | -2.828427 | 0 | |
| 6 | N7 | -5.644341 | 0 | -5.166667 | 0 | |
| 7 | N8 | -6.656854 | 0 | -5.166667 | 0 | |
| 8 | N9 | -6.656854 | 0 | 2.828427 | 0 | |
| 9 | N10 | -5.644341 | 0 | 5.166667 | 0 | |
| 10 | N11 | -6.656854 | 0 | 5.166667 | 0 | |
| 11 | N12 | -6.25 | 0 | 6.656854 | 0 | |
| 12 | N13 | 6.25 | 0 | 6.656854 | 0 | |
| 13 | N14 | -2.828427 | 0 | 2.828427 | 0 | |
| 14 | N15 | -5.5 | 0 | 5.5 | 0 | |
| 15 | N16 | -2.828427 | 0 | 6.656854 | 0 | |
| 16 | N17 | -5.166667 | 0 | 5.644341 | 0 | |

## Joint Coordinates and Temperatures (Continued)

| | Label | X [ft] | Y [ft] | Z [ft] | Temp [F] | Detach From Diaphragm |
|---|---|---|---|---|---|---|
| 17 | N18 | -5.166667 | 0 | 6.656854 | 0 | |
| 18 | N19 | 2.828427 | 0 | 6.656854 | 0 | |
| 19 | N20 | 5.166667 | 0 | 5.644341 | 0 | |
| 20 | N21 | 5.166667 | 0 | 6.656854 | 0 | |
| 21 | N22 | 6.656854 | 0 | 6.25 | 0 | |
| 22 | N23 | 6.656854 | 0 | -6.25 | 0 | |
| 23 | N24 | 2.828427 | 0 | 2.828427 | 0 | |
| 24 | N25 | 5.5 | 0 | 5.5 | 0 | |
| 25 | N26 | 6.656854 | 0 | 2.828427 | 0 | |
| 26 | N27 | 5.644341 | 0 | 5.166667 | 0 | |
| 27 | N28 | 6.656854 | 0 | 5.166667 | 0 | |
| 28 | N29 | 6.656854 | 0 | -2.828427 | 0 | |
| 29 | N30 | 5.644341 | 0 | -5.166667 | 0 | |
| 30 | N31 | 6.656854 | 0 | -5.166667 | 0 | |
| 31 | N32 | 6.25 | 0 | -6.656854 | 0 | |
| 32 | N33 | -6.25 | 0 | -6.656854 | 0 | |
| 33 | N34 | 2.828427 | 0 | -2.828427 | 0 | |
| 34 | N35 | 5.5 | 0 | -5.5 | 0 | |
| 35 | N36 | 2.828427 | 0 | -6.656854 | 0 | |
| 36 | N37 | 5.166667 | 0 | -5.644341 | 0 | |
| 37 | N38 | 5.166667 | 0 | -6.656854 | 0 | |
| 38 | N39 | -5.5 | 0 | -5.5 | 0 | |
| 39 | N40 | -2.828427 | 0 | -6.656854 | 0 | |
| 40 | N41 | -5.166667 | 0 | -5.644341 | 0 | |
| 41 | N42 | -5.166667 | 0 | -6.656854 | 0 | |
| 42 | N44 | 5.656854 | 0 | 5.656854 | 0 | |
| 43 | N46 | 5.656854 | 0 | -5.656854 | 0 | |
| 44 | N47 | -0.707107 | -.25 | -0.707107 | 0 | |
| 45 | N48 | -1.237437 | -.25 | -1.237437 | 0 | |
| 46 | N49 | -1.767767 | -.25 | -1.767767 | 0 | |
| 47 | N50 | -2.298097 | -.25 | -2.298097 | 0 | |
| 48 | N51 | -2.828427 | 0 | -2.828427 | 0 | |
| 49 | N52 | -3.358757 | -.25 | -3.358757 | 0 | |
| 50 | N53 | -3.889087 | -.25 | -3.889087 | 0 | |
| 51 | N54 | -4.419417 | 0 | -4.419417 | 0 | |
| 52 | N55 | -0.707107 | -1.25 | -0.707107 | 0 | |
| 53 | N56 | -1.237437 | -1.25 | -1.237437 | 0 | |
| 54 | N57 | -1.767767 | -1.25 | -1.767767 | 0 | |
| 55 | N58 | -2.298097 | -1.25 | -2.298097 | 0 | |
| 56 | N59 | -2.828427 | -1.25 | -2.828427 | 0 | |
| 57 | N62 | -2.828427 | -.25 | -2.828427 | 0 | |
| 58 | N63 | -4.419417 | -.25 | -4.419417 | 0 | |
| 59 | N64 | -3.358757 | -0.916667 | -3.358757 | 0 | |
| 60 | N65 | -3.889087 | -0.583333 | -3.889087 | 0 | |
| 61 | N62A | -0.707107 | -.25 | 0.707107 | 0 | |
| 62 | N63A | -1.237437 | -.25 | 1.237437 | 0 | |
| 63 | N64A | -1.767767 | -.25 | 1.767767 | 0 | |
| 64 | N65A | -2.298097 | -.25 | 2.298097 | 0 | |
| 65 | N67 | -3.358757 | -.25 | 3.358757 | 0 | |
| 66 | N68 | -3.889087 | -.25 | 3.889087 | 0 | |
| 67 | N69 | -4.419417 | 0 | 4.419417 | 0 | |
| 68 | N70 | -0.707107 | -1.25 | 0.707107 | 0 | |

## Joint Coordinates and Temperatures (Continued)

| | Label | X [ft] | Y [ft] | Z [ft] | Temp [F] | Detach From Diaphragm |
|---|---|---|---|---|---|---|
| 69 | N71 | -1.237437 | -1.25 | 1.237437 | 0 | |
| 70 | N72 | -1.767767 | -1.25 | 1.767767 | 0 | |
| 71 | N73 | -2.298097 | -1.25 | 2.298097 | 0 | |
| 72 | N74 | -2.828427 | -1.25 | 2.828427 | 0 | |
| 73 | N75 | -2.828427 | -.25 | 2.828427 | 0 | |
| 74 | N76 | -4.419417 | -.25 | 4.419417 | 0 | |
| 75 | N77 | -3.358757 | -0.916667 | 3.358757 | 0 | |
| 76 | N78 | -3.889087 | -0.583333 | 3.889087 | 0 | |
| 77 | N80 | 0.707107 | -.25 | 0.707107 | 0 | |
| 78 | N81 | 1.237437 | -.25 | 1.237437 | 0 | |
| 79 | N82 | 1.767767 | -.25 | 1.767767 | 0 | |
| 80 | N83 | 2.298097 | -.25 | 2.298097 | 0 | |
| 81 | N85 | 3.358757 | -.25 | 3.358757 | 0 | |
| 82 | N86 | 3.889087 | -.25 | 3.889087 | 0 | |
| 83 | N87 | 4.419417 | 0 | 4.419417 | 0 | |
| 84 | N88 | 0.707107 | -1.25 | 0.707107 | 0 | |
| 85 | N89 | 1.237437 | -1.25 | 1.237437 | 0 | |
| 86 | N90 | 1.767767 | -1.25 | 1.767767 | 0 | |
| 87 | N91 | 2.298097 | -1.25 | 2.298097 | 0 | |
| 88 | N92 | 2.828427 | -1.25 | 2.828427 | 0 | |
| 89 | N93 | 2.828427 | -.25 | 2.828427 | 0 | |
| 90 | N94 | 4.419417 | -.25 | 4.419417 | 0 | |
| 91 | N95 | 3.358757 | -0.916667 | 3.358757 | 0 | |
| 92 | N96 | 3.889087 | -0.583333 | 3.889087 | 0 | |
| 93 | N98 | 0.707107 | -.25 | -0.707107 | 0 | |
| 94 | N99 | 1.237437 | -.25 | -1.237437 | 0 | |
| 95 | N100 | 1.767767 | -.25 | -1.767767 | 0 | |
| 96 | N101 | 2.298097 | -.25 | -2.298097 | 0 | |
| 97 | N103 | 3.358757 | -.25 | -3.358757 | 0 | |
| 98 | N104 | 3.889087 | -.25 | -3.889087 | 0 | |
| 99 | N105 | 4.419417 | 0 | -4.419417 | 0 | |
| 100 | N106 | 0.707107 | -1.25 | -0.707107 | 0 | |
| 101 | N107 | 1.237437 | -1.25 | -1.237437 | 0 | |
| 102 | N108 | 1.767767 | -1.25 | -1.767767 | 0 | |
| 103 | N109 | 2.298097 | -1.25 | -2.298097 | 0 | |
| 104 | N110 | 2.828427 | -1.25 | -2.828427 | 0 | |
| 105 | N111 | 2.828427 | -.25 | -2.828427 | 0 | |
| 106 | N112 | 4.419417 | -.25 | -4.419417 | 0 | |
| 107 | N113 | 3.358757 | -0.916667 | -3.358757 | 0 | |
| 108 | N114 | 3.889087 | -0.583333 | -3.889087 | 0 | |
| 109 | N115 | -6 | 0 | 6.656854 | 0 | |
| 110 | N116 | -6 | 4 | 6.656854 | 0 | |
| 111 | N117 | -6 | -4 | 6.656854 | 0 | |
| 112 | N118 | -2 | 0 | 6.656854 | 0 | |
| 113 | N119 | -2 | 4 | 6.656854 | 0 | |
| 114 | N120 | -2 | -4 | 6.656854 | 0 | |
| 115 | N121 | 2 | 0 | 6.656854 | 0 | |
| 116 | N122 | 2 | 4 | 6.656854 | 0 | |
| 117 | N123 | 2 | -4 | 6.656854 | 0 | |
| 118 | N124 | 6 | 0 | 6.656854 | 0 | |
| 119 | N125 | 6 | 4 | 6.656854 | 0 | |
| 120 | N126 | 6 | -4 | 6.656854 | 0 | |

## Joint Coordinates and Temperatures (Continued)

| | Label | X [ft] | Y [ft] | Z [ft] | Temp [F] | Detach From Diaphragm |
|---|---|---|---|---|---|---|
| 121 | N127 | 6.656854 | 0 | 6 | 0 | |
| 122 | N128 | 6.656854 | 4 | 6 | 0 | |
| 123 | N129 | 6.656854 | -4 | 6 | 0 | |
| 124 | N130 | 6.656854 | 0 | 2 | 0 | |
| 125 | N131 | 6.656854 | 4 | 2 | 0 | |
| 126 | N132 | 6.656854 | -4 | 2 | 0 | |
| 127 | N133 | 6.656854 | 0 | -2 | 0 | |
| 128 | N134 | 6.656854 | 4 | -2 | 0 | |
| 129 | N135 | 6.656854 | -4 | -2 | 0 | |
| 130 | N136 | 6.656854 | 0 | -6 | 0 | |
| 131 | N137 | 6.656854 | 4 | -6 | 0 | |
| 132 | N138 | 6.656854 | -4 | -6 | 0 | |
| 133 | N139 | 6 | 0 | -6.656854 | 0 | |
| 134 | N140 | 6 | 4 | -6.656854 | 0 | |
| 135 | N141 | 6 | -4 | -6.656854 | 0 | |
| 136 | N142 | 2 | 0 | -6.656854 | 0 | |
| 137 | N143 | 2 | 4 | -6.656854 | 0 | |
| 138 | N144 | 2 | -4 | -6.656854 | 0 | |
| 139 | N145 | -2 | 0 | -6.656854 | 0 | |
| 140 | N146 | -2 | 4 | -6.656854 | 0 | |
| 141 | N147 | -2 | -4 | -6.656854 | 0 | |
| 142 | N148 | -6 | 0 | -6.656854 | 0 | |
| 143 | N149 | -6 | 4 | -6.656854 | 0 | |
| 144 | N150 | -6 | -4 | -6.656854 | 0 | |
| 145 | N151 | -6.656854 | 0 | -6 | 0 | |
| 146 | N152 | -6.656854 | 4 | -6 | 0 | |
| 147 | N153 | -6.656854 | -4 | -6 | 0 | |
| 148 | N154 | -6.656854 | 0 | -2 | 0 | |
| 149 | N155 | -6.656854 | 4 | -2 | 0 | |
| 150 | N156 | -6.656854 | -4 | -2 | 0 | |
| 151 | N157 | -6.656854 | 0 | 2 | 0 | |
| 152 | N158 | -6.656854 | 4 | 2 | 0 | |
| 153 | N159 | -6.656854 | -4 | 2 | 0 | |
| 154 | N160 | -6.656854 | 0 | 6 | 0 | |
| 155 | N161 | -6.656854 | 4 | 6 | 0 | |
| 156 | N162 | -6.656854 | -4 | 6 | 0 | |
| 157 | N163 | -6 | 3 | 6.656854 | 0 | |
| 158 | N164 | -2 | 3 | 6.656854 | 0 | |
| 159 | N165 | 2 | 3 | 6.656854 | 0 | |
| 160 | N166 | 6 | 3 | 6.656854 | 0 | |
| 161 | N167 | -5 | 3 | 6.656854 | 0 | |
| 162 | N168 | 5 | 3 | 6.656854 | 0 | |
| 163 | N169 | 6.656854 | 3 | 6 | 0 | |
| 164 | N170 | 6.656854 | 3 | 2 | 0 | |
| 165 | N171 | 6.656854 | 3 | -2 | 0 | |
| 166 | N172 | 6.656854 | 3 | -6 | 0 | |
| 167 | N173 | 6.656854 | 3 | 5 | 0 | |
| 168 | N174 | 6.656854 | 3 | -5 | 0 | |
| 169 | N175 | 6 | 3 | -6.656854 | 0 | |
| 170 | N176 | 2 | 3 | -6.656854 | 0 | |
| 171 | N177 | -2 | 3 | -6.656854 | 0 | |
| 172 | N178 | -6 | 3 | -6.656854 | 0 | |

## Joint Coordinates and Temperatures (Continued)

| | Label | X [ft] | Y [ft] | Z [ft] | Temp [F] | Detach From Diaphragm |
|---|---|---|---|---|---|---|
| 173 | N179 | 5 | 3 | -6.656854 | 0 | |
| 174 | N180 | -5 | 3 | -6.656854 | 0 | |
| 175 | N181 | -6.656854 | 3 | -6 | 0 | |
| 176 | N182 | -6.656854 | 3 | -2 | 0 | |
| 177 | N183 | -6.656854 | 3 | 2 | 0 | |
| 178 | N184 | -6.656854 | 3 | 6 | 0 | |
| 179 | N185 | -6.656854 | 3 | -5 | 0 | |
| 180 | N186 | -6.656854 | 3 | 5 | 0 | |
| 181 | N187 | -3.358757 | -0.583333 | -3.358757 | 0 | |

## Joint Boundary Conditions

| | Joint Label | X [k/in] | Y [k/in] | Z [k/in] | X Rot.[k-ft/rad] | Y Rot.[k-ft/rad] | Z Rot.[k-ft/rad] |
|---|---|---|---|---|---|---|---|
| 1 | N47 | Reaction | Reaction | Reaction | Reaction | Reaction | Reaction |
| 2 | N55 | Reaction | Reaction | Reaction | Reaction | Reaction | Reaction |
| 3 | N62A | Reaction | Reaction | Reaction | Reaction | Reaction | Reaction |
| 4 | N70 | Reaction | Reaction | Reaction | Reaction | Reaction | Reaction |
| 5 | N80 | Reaction | Reaction | Reaction | Reaction | Reaction | Reaction |
| 6 | N88 | Reaction | Reaction | Reaction | Reaction | Reaction | Reaction |
| 7 | N98 | Reaction | Reaction | Reaction | Reaction | Reaction | Reaction |
| 8 | N106 | Reaction | Reaction | Reaction | Reaction | Reaction | Reaction |

## Member Point Loads (BLC 2 : Dead Load)

| | Member Label | Direction | Magnitude[k,k-ft] | Location[ft,%] |
|---|---|---|---|---|
| 1 | M108 | Y | -.074 | 3.5 |
| 2 | M120 | Y | -.074 | 3.5 |
| 3 | M112 | Y | -.074 | 3.5 |
| 4 | M105 | Y | -.066 | .5 |
| 5 | M105 | Y | -.066 | 4.167 |
| 6 | M117 | Y | -.066 | .5 |
| 7 | M117 | Y | -.066 | 4.167 |
| 8 | M109 | Y | -.066 | .5 |
| 9 | M109 | Y | -.066 | 4.167 |
| 10 | M108 | Y | -.058 | .5 |
| 11 | M108 | Y | -.058 | 7.5 |
| 12 | M120 | Y | -.058 | .5 |
| 13 | M120 | Y | -.058 | 7.5 |
| 14 | M112 | Y | -.058 | .5 |
| 15 | M112 | Y | -.058 | 7.5 |

## Member Point Loads (BLC 3 : Ice Load)

| | Member Label | Direction | Magnitude[k,k-ft] | Location[ft,%] |
|---|---|---|---|---|
| 1 | M108 | Y | -.182 | 7.5 |
| 2 | M108 | Y | -.182 | .5 |
| 3 | M120 | Y | -.182 | 7.5 |
| 4 | M120 | Y | -.182 | .5 |
| 5 | M112 | Y | -.182 | 7.5 |
| 6 | M112 | Y | -.182 | .5 |
| 7 | M105 | Y | -.087 | .5 |

## Member Point Loads (BLC 3 : Ice Load) (Continued)

| | Member Label | Direction | Magnitude[k,k-ft] | Location[ft,%] |
|---|---|---|---|---|
| 8 | M105 | Y | -.087 | 4.167 |
| 9 | M117 | Y | -.087 | .5 |
| 10 | M117 | Y | -.087 | 4.167 |
| 11 | M109 | Y | -.087 | .5 |
| 12 | M109 | Y | -.087 | 4.167 |
| 13 | M108 | Y | -.069 | 3.5 |
| 14 | M120 | Y | -.069 | 3.5 |
| 15 | M112 | Y | -.069 | 3.5 |

## Member Point Loads (BLC 4 : Wind with Ice X (39psf))

| | Member Label | Direction | Magnitude[k,k-ft] | Location[ft,%] |
|---|---|---|---|---|
| 1 | M120 | X | -.1 | .5 |
| 2 | M120 | X | -.1 | 7.5 |
| 3 | M112 | X | -.1 | .5 |
| 4 | M112 | X | -.1 | 7.5 |
| 5 | M108 | X | -.053 | 7.5 |
| 6 | M108 | X | -.053 | .5 |
| 7 | M117 | X | -.042 | .5 |
| 8 | M117 | X | -.042 | 4.167 |
| 9 | M109 | X | -.042 | .5 |
| 10 | M109 | X | -.042 | 4.167 |
| 11 | M105 | X | -.031 | .5 |
| 12 | M105 | X | -.031 | 4.167 |
| 13 | M108 | X | -.02 | 3.5 |

## Member Point Loads (BLC 5 : Wind X(9 psf))

| | Member Label | Direction | Magnitude[k,k-ft] | Location[ft,%] |
|---|---|---|---|---|
| 1 | M120 | X | -.365 | 7.5 |
| 2 | M120 | X | -.365 | .5 |
| 3 | M112 | X | -.365 | 7.5 |
| 4 | M112 | X | -.365 | .5 |
| 5 | M108 | X | -.161 | 7.5 |
| 6 | M108 | X | -.161 | .5 |
| 7 | M117 | X | -.138 | .5 |
| 8 | M117 | X | -.138 | 4.167 |
| 9 | M109 | X | -.138 | .5 |
| 10 | M109 | X | -.138 | 4.167 |
| 11 | M105 | X | -.093 | .5 |
| 12 | M105 | X | -.093 | 4.167 |
| 13 | M108 | X | -.055 | 3.5 |

## Member Point Loads (BLC 6 : Wind with Ice Z (39psf))

| | Member Label | Direction | Magnitude[k,k-ft] | Location[ft,%] |
|---|---|---|---|---|
| 1 | M108 | Z | -.1 | 7.5 |
| 2 | M108 | Z | -.1 | .5 |
| 3 | M120 | Z | -.053 | .5 |
| 4 | M120 | Z | -.053 | 7.5 |
| 5 | M112 | Z | -.053 | .5 |
| 6 | M112 | Z | -.053 | 7.5 |
| 7 | M105 | Z | -.042 | .5 |

## Member Point Loads (BLC 6 : Wind with Ice Z (39psf)) (Continued)

| | Member Label | Direction | Magnitude[k,k-ft] | Location[ft,%] |
|---|---|---|---|---|
| 8 | M105 | Z | -.042 | 4.167 |
| 9 | M117 | Z | -.031 | .5 |
| 10 | M117 | Z | -.031 | 4.167 |
| 11 | M109 | Z | -.031 | .5 |
| 12 | M109 | Z | -.031 | 4.167 |
| 13 | M120 | Z | -.02 | 3.5 |
| 14 | M112 | Z | -.02 | 3.5 |

## Member Point Loads (BLC 7 : Wind Z (9psf))

| | Member Label | Direction | Magnitude[k,k-ft] | Location[ft,%] |
|---|---|---|---|---|
| 1 | M108 | Z | -.365 | 7.5 |
| 2 | M108 | Z | -.365 | .5 |
| 3 | M120 | Z | -.161 | .5 |
| 4 | M120 | Z | -.161 | 7.5 |
| 5 | M112 | Z | -.161 | .5 |
| 6 | M112 | Z | -.161 | 7.5 |
| 7 | M105 | Z | -.138 | .5 |
| 8 | M105 | Z | -.138 | 4.167 |
| 9 | M117 | Z | -.093 | .5 |
| 10 | M117 | Z | -.093 | 4.167 |
| 11 | M109 | Z | -.093 | .5 |
| 12 | M109 | Z | -.093 | 4.167 |
| 13 | M120 | Z | -.055 | 3.5 |
| 14 | M112 | Z | -.055 | 3.5 |

## Member Distributed Loads (BLC 4 : Wind with Ice X (39psf))

| | Member Label | Direction | Start Magnitude[k/ft... | End Magnitude[k/ft,F,ksf] | Start Location[ft,%] | End Location[ft,%] |
|---|---|---|---|---|---|---|
| 1 | M30 | X | .003 | .003 | 0 | 0 |
| 2 | M31 | X | .003 | .003 | 0 | 0 |
| 3 | M32 | X | .003 | .003 | 0 | 0 |
| 4 | M33 | X | .003 | .003 | 0 | 0 |
| 5 | M34 | X | .003 | .003 | 0 | 0 |
| 6 | M35 | X | -.003 | -.003 | 0 | 0 |
| 7 | M36 | X | -.003 | -.003 | 0 | 0 |
| 8 | M37 | X | -.003 | -.003 | 0 | 0 |
| 9 | M38 | X | -.003 | -.003 | 0 | 0 |
| 10 | M39 | X | -.003 | -.003 | 0 | 0 |
| 11 | M40 | X | -.003 | -.003 | 0 | 0 |
| 12 | M41 | X | -.003 | -.003 | 0 | 0 |
| 13 | M42 | X | -.003 | -.003 | 0 | 0 |
| 14 | M43 | X | -.003 | -.003 | 0 | 0 |
| 15 | M44 | X | -.003 | -.003 | 0 | 0 |
| 16 | M45 | X | -.003 | -.003 | 0 | 0 |
| 17 | M49 | X | -.003 | -.003 | 0 | 0 |
| 18 | M50 | X | -.003 | -.003 | 0 | 0 |
| 19 | M51 | X | -.003 | -.003 | 0 | 0 |
| 20 | M52 | X | -.003 | -.003 | 0 | 0 |
| 21 | M53 | X | -.003 | -.003 | 0 | 0 |
| 22 | M54 | X | -.003 | -.003 | 0 | 0 |
| 23 | M55 | X | -.003 | -.003 | 0 | 0 |

## Member Distributed Loads (BLC 4 : Wind with Ice X (39psf)) (Continued)

| | Member Label | Direction | Start Magnitude[k/ft... | End Magnitude[k/ft,F,ksf] | Start Location[ft,%] | End Location[ft,%] |
|---|---|---|---|---|---|---|
| 24 | M56 | X | -.003 | -.003 | 0 | 0 |
| 25 | M57 | X | -.003 | -.003 | 0 | 0 |
| 26 | M58 | X | -.003 | -.003 | 0 | 0 |
| 27 | M59 | X | -.003 | -.003 | 0 | 0 |
| 28 | M60 | X | -.003 | -.003 | 0 | 0 |
| 29 | M61 | X | -.003 | -.003 | 0 | 0 |
| 30 | M62 | X | -.003 | -.003 | 0 | 0 |
| 31 | M63 | X | -.003 | -.003 | 0 | 0 |
| 32 | M64 | X | -.003 | -.003 | 0 | 0 |
| 33 | M68 | X | -.003 | -.003 | 0 | 0 |
| 34 | M69 | X | -.003 | -.003 | 0 | 0 |
| 35 | M70 | X | -.003 | -.003 | 0 | 0 |
| 36 | M71 | X | -.003 | -.003 | 0 | 0 |
| 37 | M72 | X | -.003 | -.003 | 0 | 0 |
| 38 | M73 | X | -.003 | -.003 | 0 | 0 |
| 39 | M74 | X | -.003 | -.003 | 0 | 0 |
| 40 | M75 | X | -.003 | -.003 | 0 | 0 |
| 41 | M76 | X | -.003 | -.003 | 0 | 0 |
| 42 | M77 | X | -.003 | -.003 | 0 | 0 |
| 43 | M78 | X | -.003 | -.003 | 0 | 0 |
| 44 | M79 | X | -.003 | -.003 | 0 | 0 |
| 45 | M80 | X | -.003 | -.003 | 0 | 0 |
| 46 | M81 | X | -.003 | -.003 | 0 | 0 |
| 47 | M82 | X | -.003 | -.003 | 0 | 0 |
| 48 | M83 | X | -.003 | -.003 | 0 | 0 |
| 49 | M87 | X | -.003 | -.003 | 0 | 0 |
| 50 | M88 | X | -.003 | -.003 | 0 | 0 |
| 51 | M89 | X | -.003 | -.003 | 0 | 0 |
| 52 | M90 | X | -.003 | -.003 | 0 | 0 |
| 53 | M91 | X | -.003 | -.003 | 0 | 0 |
| 54 | M92 | X | -.003 | -.003 | 0 | 0 |
| 55 | M93 | X | -.003 | -.003 | 0 | 0 |
| 56 | M94 | X | -.003 | -.003 | 0 | 0 |
| 57 | M95 | X | -.003 | -.003 | 0 | 0 |
| 58 | M96 | X | -.003 | -.003 | 0 | 0 |
| 59 | M97 | X | -.003 | -.003 | 0 | 0 |
| 60 | M98 | X | -.003 | -.003 | 0 | 0 |
| 61 | M99 | X | -.003 | -.003 | 0 | 0 |
| 62 | M100 | X | -.003 | -.003 | 0 | 0 |
| 63 | M101 | X | -.003 | -.003 | 0 | 0 |
| 64 | M102 | X | -.003 | -.003 | 0 | 0 |
| 65 | M1 | X | -.009 | -.009 | 0 | 0 |
| 66 | M15 | X | -.009 | -.009 | 0 | 0 |
| 67 | M113 | X | -.009 | -.009 | 0 | 0 |
| 68 | M124 | X | -.009 | -.009 | 0 | 0 |
| 69 | M122 | X | -.009 | -.009 | 0 | 0 |
| 70 | M106 | X | -.009 | -.009 | 0 | 0 |
| 71 | M107 | X | -.009 | -.009 | 0 | 0 |
| 72 | M114 | X | -.009 | -.009 | 0 | 0 |
| 73 | M115 | X | -.009 | -.009 | 0 | 0 |
| 74 | M116 | X | -.009 | -.009 | 0 | 0 |
| 75 | M110 | X | -.009 | -.009 | 0 | 0 |

## Member Distributed Loads (BLC 4 : Wind with Ice X (39psf)) (Continued)

| | Member Label | Direction | Start Magnitude[k/ft... | End Magnitude[k/ft,F,ksf] | Start Location[ft,%] | End Location[ft,%] |
|---|---|---|---|---|---|---|
| 76 | M111 | X | -.009 | -.009 | 0 | 0 |
| 77 | M119 | X | -.009 | -.009 | 0 | 0 |
| 78 | M118 | X | -.009 | -.009 | 0 | 0 |
| 79 | M105 | X | -.009 | -.009 | 0 | 0 |
| 80 | M108 | X | -.009 | -.009 | 0 | 0 |

## Member Distributed Loads (BLC 5 : Wind X(9 psf))

| | Member Label | Direction | Start Magnitude[k/ft... | End Magnitude[k/ft,F,ksf] | Start Location[ft,%] | End Location[ft,%] |
|---|---|---|---|---|---|---|
| 1 | M31 | X | -.008 | -.008 | 0 | 0 |
| 2 | M32 | X | -.008 | -.008 | 0 | 0 |
| 3 | M33 | X | -.008 | -.008 | 0 | 0 |
| 4 | M34 | X | -.008 | -.008 | 0 | 0 |
| 5 | M35 | X | -.008 | -.008 | 0 | 0 |
| 6 | M36 | X | -.008 | -.008 | 0 | 0 |
| 7 | M37 | X | -.008 | -.008 | 0 | 0 |
| 8 | M38 | X | -.008 | -.008 | 0 | 0 |
| 9 | M39 | X | -.008 | -.008 | 0 | 0 |
| 10 | M40 | X | -.008 | -.008 | 0 | 0 |
| 11 | M41 | X | -.008 | -.008 | 0 | 0 |
| 12 | M42 | X | -.008 | -.008 | 0 | 0 |
| 13 | M43 | X | -.008 | -.008 | 0 | 0 |
| 14 | M44 | X | -.008 | -.008 | 0 | 0 |
| 15 | M45 | X | -.008 | -.008 | 0 | 0 |
| 16 | M50 | X | -.008 | -.008 | 0 | 0 |
| 17 | M51 | X | -.008 | -.008 | 0 | 0 |
| 18 | M52 | X | -.008 | -.008 | 0 | 0 |
| 19 | M53 | X | -.008 | -.008 | 0 | 0 |
| 20 | M54 | X | -.008 | -.008 | 0 | 0 |
| 21 | M55 | X | -.008 | -.008 | 0 | 0 |
| 22 | M56 | X | -.008 | -.008 | 0 | 0 |
| 23 | M57 | X | -.008 | -.008 | 0 | 0 |
| 24 | M58 | X | -.008 | -.008 | 0 | 0 |
| 25 | M59 | X | -.008 | -.008 | 0 | 0 |
| 26 | M60 | X | -.008 | -.008 | 0 | 0 |
| 27 | M61 | X | -.008 | -.008 | 0 | 0 |
| 28 | M62 | X | -.008 | -.008 | 0 | 0 |
| 29 | M63 | X | -.008 | -.008 | 0 | 0 |
| 30 | M64 | X | -.008 | -.008 | 0 | 0 |
| 31 | M68 | X | -.008 | -.008 | 0 | 0 |
| 32 | M69 | X | -.008 | -.008 | 0 | 0 |
| 33 | M70 | X | -.008 | -.008 | 0 | 0 |
| 34 | M71 | X | -.008 | -.008 | 0 | 0 |
| 35 | M72 | X | -.008 | -.008 | 0 | 0 |
| 36 | M73 | X | -.008 | -.008 | 0 | 0 |
| 37 | M74 | X | -.008 | -.008 | 0 | 0 |
| 38 | M75 | X | -.008 | -.008 | 0 | 0 |
| 39 | M76 | X | -.008 | -.008 | 0 | 0 |
| 40 | M77 | X | -.008 | -.008 | 0 | 0 |
| 41 | M78 | X | -.008 | -.008 | 0 | 0 |
| 42 | M79 | X | -.008 | -.008 | 0 | 0 |
| 43 | M80 | X | -.008 | -.008 | 0 | 0 |

## Member Distributed Loads (BLC 5 : Wind X(9 psf)) (Continued)

| | Member Label | Direction | Start Magnitude[k/ft... | End Magnitude[k/ft,F,ksf] | Start Location[ft,%] | End Location[ft,%] |
|---|---|---|---|---|---|---|
| 44 | M81 | X | -.008 | -.008 | 0 | 0 |
| 45 | M82 | X | -.008 | -.008 | 0 | 0 |
| 46 | M83 | X | -.008 | -.008 | 0 | 0 |
| 47 | M87 | X | -.008 | -.008 | 0 | 0 |
| 48 | M88 | X | -.008 | -.008 | 0 | 0 |
| 49 | M89 | X | -.008 | -.008 | 0 | 0 |
| 50 | M90 | X | -.008 | -.008 | 0 | 0 |
| 51 | M91 | X | -.008 | -.008 | 0 | 0 |
| 52 | M92 | X | -.008 | -.008 | 0 | 0 |
| 53 | M93 | X | -.008 | -.008 | 0 | 0 |
| 54 | M94 | X | -.008 | -.008 | 0 | 0 |
| 55 | M95 | X | -.008 | -.008 | 0 | 0 |
| 56 | M96 | X | -.008 | -.008 | 0 | 0 |
| 57 | M97 | X | -.008 | -.008 | 0 | 0 |
| 58 | M98 | X | -.008 | -.008 | 0 | 0 |
| 59 | M99 | X | -.008 | -.008 | 0 | 0 |
| 60 | M100 | X | -.008 | -.008 | 0 | 0 |
| 61 | M101 | X | -.008 | -.008 | 0 | 0 |
| 62 | M102 | X | -.008 | -.008 | 0 | 0 |
| 63 | M1 | X | -.002 | -.002 | 0 | 0 |
| 64 | M15 | X | -.002 | -.002 | 0 | 0 |
| 65 | M124 | X | -.002 | -.002 | 0 | 0 |
| 66 | M122 | X | -.002 | -.002 | 0 | 0 |
| 67 | M105 | X | -.002 | -.002 | 0 | 0 |
| 68 | M106 | X | -.002 | -.002 | 0 | 0 |
| 69 | M107 | X | -.002 | -.002 | 0 | 0 |
| 70 | M108 | X | -.002 | -.002 | 0 | 0 |
| 71 | M110 | X | -.002 | -.002 | 0 | 0 |
| 72 | M111 | X | -.002 | -.002 | 0 | 0 |
| 73 | M113 | X | -.002 | -.002 | 0 | 0 |
| 74 | M114 | X | -.002 | -.002 | 0 | 0 |
| 75 | M115 | X | -.002 | -.002 | 0 | 0 |
| 76 | M116 | X | -.002 | -.002 | 0 | 0 |
| 77 | M118 | X | -.002 | -.002 | 0 | 0 |
| 78 | M119 | X | -.002 | -.002 | 0 | 0 |

## Member Distributed Loads (BLC 6 : Wind with Ice Z (39psf))

| | Member Label | Direction | Start Magnitude[k/ft... | End Magnitude[k/ft,F,ksf] | Start Location[ft,%] | End Location[ft,%] |
|---|---|---|---|---|---|---|
| 1 | M30 | Z | -.003 | -.003 | 0 | 0 |
| 2 | M31 | Z | -.003 | -.003 | 0 | 0 |
| 3 | M32 | Z | -.003 | -.003 | 0 | 0 |
| 4 | M33 | Z | -.003 | -.003 | 0 | 0 |
| 5 | M34 | Z | -.003 | -.003 | 0 | 0 |
| 6 | M35 | Z | -.003 | -.003 | 0 | 0 |
| 7 | M36 | Z | -.003 | -.003 | 0 | 0 |
| 8 | M37 | Z | -.003 | -.003 | 0 | 0 |
| 9 | M38 | Z | -.003 | -.003 | 0 | 0 |
| 10 | M39 | Z | -.003 | -.003 | 0 | 0 |
| 11 | M40 | Z | -.003 | -.003 | 0 | 0 |
| 12 | M41 | Z | -.003 | -.003 | 0 | 0 |
| 13 | M42 | Z | -.003 | -.003 | 0 | 0 |

## *Member Distributed Loads (BLC 6 : Wind with Ice Z (39psf)) (Continued)*

| | Member Label | Direction | Start Magnitude[k/ft... | End Magnitude[k/ft,F,ksf] | Start Location[ft,%] | End Location[ft,%] |
|---|---|---|---|---|---|---|
| 14 | M43 | Z | -.003 | -.003 | 0 | 0 |
| 15 | M44 | Z | -.003 | -.003 | 0 | 0 |
| 16 | M45 | Z | -.003 | -.003 | 0 | 0 |
| 17 | M49 | Z | -.003 | -.003 | 0 | 0 |
| 18 | M50 | Z | -.003 | -.003 | 0 | 0 |
| 19 | M51 | Z | -.003 | -.003 | 0 | 0 |
| 20 | M52 | Z | -.003 | -.003 | 0 | 0 |
| 21 | M53 | Z | -.003 | -.003 | 0 | 0 |
| 22 | M54 | Z | -.003 | -.003 | 0 | 0 |
| 23 | M55 | Z | -.003 | -.003 | 0 | 0 |
| 24 | M56 | Z | -.003 | -.003 | 0 | 0 |
| 25 | M57 | Z | -.003 | -.003 | 0 | 0 |
| 26 | M58 | Z | -.003 | -.003 | 0 | 0 |
| 27 | M59 | Z | -.003 | -.003 | 0 | 0 |
| 28 | M60 | Z | -.003 | -.003 | 0 | 0 |
| 29 | M61 | Z | -.003 | -.003 | 0 | 0 |
| 30 | M62 | Z | -.003 | -.003 | 0 | 0 |
| 31 | M63 | Z | -.003 | -.003 | 0 | 0 |
| 32 | M64 | Z | -.003 | -.003 | 0 | 0 |
| 33 | M68 | Z | -.003 | -.003 | 0 | 0 |
| 34 | M69 | Z | -.003 | -.003 | 0 | 0 |
| 35 | M70 | Z | -.003 | -.003 | 0 | 0 |
| 36 | M71 | Z | -.003 | -.003 | 0 | 0 |
| 37 | M72 | Z | -.003 | -.003 | 0 | 0 |
| 38 | M73 | Z | -.003 | -.003 | 0 | 0 |
| 39 | M74 | Z | -.003 | -.003 | 0 | 0 |
| 40 | M75 | Z | -.003 | -.003 | 0 | 0 |
| 41 | M76 | Z | -.003 | -.003 | 0 | 0 |
| 42 | M77 | Z | -.003 | -.003 | 0 | 0 |
| 43 | M78 | Z | -.003 | -.003 | 0 | 0 |
| 44 | M79 | Z | -.003 | -.003 | 0 | 0 |
| 45 | M80 | Z | -.003 | -.003 | 0 | 0 |
| 46 | M81 | Z | -.003 | -.003 | 0 | 0 |
| 47 | M82 | Z | -.003 | -.003 | 0 | 0 |
| 48 | M83 | Z | -.003 | -.003 | 0 | 0 |
| 49 | M87 | Z | -.003 | -.003 | 0 | 0 |
| 50 | M88 | Z | -.003 | -.003 | 0 | 0 |
| 51 | M89 | Z | -.003 | -.003 | 0 | 0 |
| 52 | M90 | Z | -.003 | -.003 | 0 | 0 |
| 53 | M91 | Z | -.003 | -.003 | 0 | 0 |
| 54 | M92 | Z | -.003 | -.003 | 0 | 0 |
| 55 | M93 | Z | -.003 | -.003 | 0 | 0 |
| 56 | M94 | Z | -.003 | -.003 | 0 | 0 |
| 57 | M95 | Z | -.003 | -.003 | 0 | 0 |
| 58 | M96 | Z | -.003 | -.003 | 0 | 0 |
| 59 | M97 | Z | -.003 | -.003 | 0 | 0 |
| 60 | M98 | Z | -.003 | -.003 | 0 | 0 |
| 61 | M99 | Z | -.003 | -.003 | 0 | 0 |
| 62 | M100 | Z | -.003 | -.003 | 0 | 0 |
| 63 | M101 | Z | -.003 | -.003 | 0 | 0 |
| 64 | M102 | Z | -.003 | -.003 | 0 | 0 |
| 65 | M8 | Z | -.009 | -.009 | 0 | 0 |

## Member Distributed Loads (BLC 6 : Wind with Ice Z (39psf)) (Continued)

| | Member Label | Direction | Start Magnitude[k/ft... | End Magnitude[k/ft,F,ksf] | Start Location[ft,%] | End Location[ft,%] |
|---|---|---|---|---|---|---|
| 66 | M22 | Z | -.009 | -.009 | 0 | 0 |
| 67 | M121 | Z | -.009 | -.009 | 0 | 0 |
| 68 | M123 | Z | -.009 | -.009 | 0 | 0 |
| 69 | M106 | Z | -.009 | -.009 | 0 | 0 |
| 70 | M107 | Z | -.009 | -.009 | 0 | 0 |
| 71 | M109 | Z | -.009 | -.009 | 0 | 0 |
| 72 | M110 | Z | -.009 | -.009 | 0 | 0 |
| 73 | M111 | Z | -.009 | -.009 | 0 | 0 |
| 74 | M113 | Z | -.009 | -.009 | 0 | 0 |
| 75 | M114 | Z | -.009 | -.009 | 0 | 0 |
| 76 | M115 | Z | -.009 | -.009 | 0 | 0 |
| 77 | M116 | Z | -.009 | -.009 | 0 | 0 |
| 78 | M117 | Z | -.009 | -.009 | 0 | 0 |
| 79 | M118 | Z | -.009 | -.009 | 0 | 0 |
| 80 | M119 | Z | -.009 | -.009 | 0 | 0 |

## Member Distributed Loads (BLC 7 : Wind Z (9psf))

| | Member Label | Direction | Start Magnitude[k/ft... | End Magnitude[k/ft,F,ksf] | Start Location[ft,%] | End Location[ft,%] |
|---|---|---|---|---|---|---|
| 1 | M30 | Z | -.008 | -.008 | 0 | 0 |
| 2 | M31 | Z | -.008 | -.008 | 0 | 0 |
| 3 | M32 | Z | -.008 | -.008 | 0 | 0 |
| 4 | M33 | Z | -.008 | -.008 | 0 | 0 |
| 5 | M34 | Z | -.008 | -.008 | 0 | 0 |
| 6 | M35 | Z | -.008 | -.008 | 0 | 0 |
| 7 | M36 | Z | -.008 | -.008 | 0 | 0 |
| 8 | M37 | Z | -.008 | -.008 | 0 | 0 |
| 9 | M38 | Z | -.008 | -.008 | 0 | 0 |
| 10 | M39 | Z | -.008 | -.008 | 0 | 0 |
| 11 | M40 | Z | -.008 | -.008 | 0 | 0 |
| 12 | M41 | Z | -.008 | -.008 | 0 | 0 |
| 13 | M42 | Z | -.008 | -.008 | 0 | 0 |
| 14 | M43 | Z | -.008 | -.008 | 0 | 0 |
| 15 | M44 | Z | -.008 | -.008 | 0 | 0 |
| 16 | M45 | Z | -.008 | -.008 | 0 | 0 |
| 17 | M49 | Z | -.008 | -.008 | 0 | 0 |
| 18 | M50 | Z | -.008 | -.008 | 0 | 0 |
| 19 | M51 | Z | -.008 | -.008 | 0 | 0 |
| 20 | M52 | Z | -.008 | -.008 | 0 | 0 |
| 21 | M53 | Z | -.008 | -.008 | 0 | 0 |
| 22 | M54 | Z | -.008 | -.008 | 0 | 0 |
| 23 | M55 | Z | -.008 | -.008 | 0 | 0 |
| 24 | M56 | Z | -.008 | -.008 | 0 | 0 |
| 25 | M57 | Z | -.008 | -.008 | 0 | 0 |
| 26 | M58 | Z | -.008 | -.008 | 0 | 0 |
| 27 | M59 | Z | -.008 | -.008 | 0 | 0 |
| 28 | M60 | Z | -.008 | -.008 | 0 | 0 |
| 29 | M61 | Z | -.008 | -.008 | 0 | 0 |
| 30 | M62 | Z | -.008 | -.008 | 0 | 0 |
| 31 | M63 | Z | -.008 | -.008 | 0 | 0 |
| 32 | M64 | Z | -.008 | -.008 | 0 | 0 |
| 33 | M68 | Z | -.008 | -.008 | 0 | 0 |

## Member Distributed Loads (BLC 7 : Wind Z (9psf)) (Continued)

| | Member Label | Direction | Start Magnitude[k/ft... | End Magnitude[k/ft,F,ksf] | Start Location[ft,%] | End Location[ft,%] |
|---|---|---|---|---|---|---|
| 34 | M69 | Z | -.008 | -.008 | 0 | 0 |
| 35 | M70 | Z | -.008 | -.008 | 0 | 0 |
| 36 | M71 | Z | -.008 | -.008 | 0 | 0 |
| 37 | M72 | Z | -.008 | -.008 | 0 | 0 |
| 38 | M73 | Z | -.008 | -.008 | 0 | 0 |
| 39 | M74 | Z | -.008 | -.008 | 0 | 0 |
| 40 | M75 | Z | -.008 | -.008 | 0 | 0 |
| 41 | M76 | Z | -.008 | -.008 | 0 | 0 |
| 42 | M77 | Z | -.008 | -.008 | 0 | 0 |
| 43 | M78 | Z | -.008 | -.008 | 0 | 0 |
| 44 | M79 | Z | -.008 | -.008 | 0 | 0 |
| 45 | M80 | Z | -.008 | -.008 | 0 | 0 |
| 46 | M81 | Z | -.008 | -.008 | 0 | 0 |
| 47 | M82 | Z | -.008 | -.008 | 0 | 0 |
| 48 | M83 | Z | -.008 | -.008 | 0 | 0 |
| 49 | M87 | Z | -.008 | -.008 | 0 | 0 |
| 50 | M88 | Z | -.008 | -.008 | 0 | 0 |
| 51 | M89 | Z | -.008 | -.008 | 0 | 0 |
| 52 | M90 | Z | -.008 | -.008 | 0 | 0 |
| 53 | M91 | Z | -.008 | -.008 | 0 | 0 |
| 54 | M92 | Z | -.008 | -.008 | 0 | 0 |
| 55 | M93 | Z | -.008 | -.008 | 0 | 0 |
| 56 | M94 | Z | -.008 | -.008 | 0 | 0 |
| 57 | M95 | Z | -.008 | -.008 | 0 | 0 |
| 58 | M96 | Z | -.008 | -.008 | 0 | 0 |
| 59 | M97 | Z | -.008 | -.008 | 0 | 0 |
| 60 | M98 | Z | -.008 | -.008 | 0 | 0 |
| 61 | M99 | Z | -.008 | -.008 | 0 | 0 |
| 62 | M100 | Z | -.008 | -.008 | 0 | 0 |
| 63 | M101 | Z | -.008 | -.008 | 0 | 0 |
| 64 | M102 | Z | -.008 | -.008 | 0 | 0 |
| 65 | M8 | Z | -.002 | -.002 | 0 | 0 |
| 66 | M22 | Z | -.002 | -.002 | 0 | 0 |
| 67 | M121 | Z | -.002 | -.002 | 0 | 0 |
| 68 | M123 | Z | -.002 | -.002 | 0 | 0 |
| 69 | M106 | Z | -.002 | -.002 | 0 | 0 |
| 70 | M107 | Z | -.002 | -.002 | 0 | 0 |
| 71 | M109 | Z | -.002 | -.002 | 0 | 0 |
| 72 | M110 | Z | -.002 | -.002 | 0 | 0 |
| 73 | M111 | Z | -.002 | -.002 | 0 | 0 |
| 74 | M112 | Z | -.002 | -.002 | 0 | 0 |
| 75 | M113 | Z | -.002 | -.002 | 0 | 0 |
| 76 | M114 | Z | -.002 | -.002 | 0 | 0 |
| 77 | M115 | Z | -.002 | -.002 | 0 | 0 |
| 78 | M116 | Z | -.002 | -.002 | 0 | 0 |
| 79 | M117 | Z | -.002 | -.002 | 0 | 0 |
| 80 | M118 | Z | -.002 | -.002 | 0 | 0 |
| 81 | M119 | Z | -.002 | -.002 | 0 | 0 |
| 82 | M120 | Z | -.002 | -.002 | 0 | 0 |

## Member Distributed Loads (BLC 8 : BLC 2 Transient Area Loads)

| Member Label | Direction | Start Magnitude[k/ft | End Magnitude[k/ft,F,ksf] | Start Location[ft,%] | End Location[ft,%] |
|---|---|---|---|---|---|

## Member Distributed Loads (BLC 8 : BLC 2 Transient Area Loads) (Continued)

| | Member Label | Direction | Start Magnitude[k/ft... | End Magnitude[k/ft,F,ksf] | Start Location[ft,%] | End Location[ft,%] |
|---|---|---|---|---|---|---|
| 1 | M2 | Y | -.004 | -.004 | 0 | 3.063 |
| 2 | M3 | Y | -.007 | -.007 | .174 | 2.721 |
| 3 | M29 | Y | -.012 | -.012 | .989 | 2.609 |
| 4 | M26 | Y | -.003 | -.006 | 0 | 3.063 |
| 5 | M27 | Y | -.007 | -.007 | .174 | 2.721 |
| 6 | M23 | Y | -.003 | -.006 | 0 | 3.063 |
| 7 | M24 | Y | -.007 | -.007 | .174 | 2.721 |
| 8 | M86 | Y | -.012 | -.012 | .989 | 2.609 |
| 9 | M19 | Y | -.003 | -.006 | 0 | 3.063 |
| 10 | M20 | Y | -.007 | -.007 | .174 | 2.721 |
| 11 | M12 | Y | -.003 | -.006 | 0 | 3.063 |
| 12 | M13 | Y | -.007 | -.007 | .174 | 2.721 |
| 13 | M67 | Y | -.012 | -.012 | .989 | 2.609 |
| 14 | M16 | Y | -.003 | -.006 | 0 | 3.063 |
| 15 | M17 | Y | -.007 | -.007 | .174 | 2.721 |
| 16 | M9 | Y | -.003 | -.006 | 0 | 3.063 |
| 17 | M10 | Y | -.007 | -.007 | .174 | 2.721 |
| 18 | M48 | Y | -.012 | -.012 | .989 | 2.609 |
| 19 | M5 | Y | -.003 | -.006 | 0 | 3.063 |
| 20 | M6 | Y | -.007 | -.007 | .174 | 2.721 |

## Basic Load Cases

| | BLC Description | Category | X Gravity | Y Gravity | Z Gravity | Joint | Point | Distribu... | Area(M... | Surface... |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Self Weight | None | | -1 | | | | | | |
| 2 | Dead Load | None | | | | | 15 | | 8 | |
| 3 | Ice Load | None | | | | | 15 | | | |
| 4 | Wind with Ice X (39psf) | None | | | | | 13 | 80 | | |
| 5 | Wind X(9 psf) | None | | | | | 13 | 78 | | |
| 6 | Wind with Ice Z (39psf) | None | | | | | 14 | 80 | | |
| 7 | Wind Z (9psf) | None | | | | | 14 | 82 | | |
| 8 | BLC 2 Transient Area Loads | None | | | | | | 20 | | |

## Load Combinations

| | Description | Solve | PDelta | SR... | B... | Fa... | BLC | Fa... | B... | Fa... | B... | Fa... | B... | Fa... | B... | Fa... | B... | Fa... | B... | Fa... | B... | Fa... | B... | Fa... |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.2D + 1.6W (X-directi... | Yes | Y | | 1 | 1.2 | 2 | 1.2 | 5 | 1.6 | | | | | | | | | | | | | | |
| 2 | 0.9D + 1.6W (X-directi... | Yes | Y | | 1 | .9 | 2 | .9 | 5 | 1.6 | | | | | | | | | | | | | | |
| 3 | 1.2D + 1.0Di + 1.0Wi (... | Yes | Y | | 1 | 1.2 | 2 | 1.2 | 3 | 1 | 4 | 1 | | | | | | | | | | | | |
| 4 | 1.2D + 1.6W (Z-directi... | Yes | Y | | 1 | 1.2 | 2 | 1.2 | 7 | 1.6 | | | | | | | | | | | | | | |
| 5 | 0.9D + 1.6W (Z-directi... | Yes | Y | | 1 | .9 | 2 | .9 | 7 | 1.6 | | | | | | | | | | | | | | |
| 6 | 1.2D + 1.0Di + 1.0Wi (... | Yes | Y | | 1 | 1.2 | 2 | 1.2 | 3 | 1 | 6 | 1 | | | | | | | | | | | | |

## Envelope Joint Reactions

| | Joint | | X [k] | LC | Y [k] | LC | Z [k] | LC | MX [k-ft] | LC | MY [k-ft] | LC | MZ [k-ft] | LC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | N47 | max | 3.302 | 4 | .858 | 6 | 3.482 | 1 | .045 | 1 | .83 | 1 | -.015 | 2 |
| 2 | | min | 2.261 | 6 | .601 | 2 | 2.263 | 3 | .021 | 5 | -.556 | 4 | -.042 | 4 |
| 3 | N55 | max | -2.453 | 2 | .044 | 6 | -2.509 | 5 | .032 | 1 | .085 | 2 | -.007 | 2 |
| 4 | | min | -3.437 | 6 | .024 | 2 | -3.41 | 6 | .014 | 5 | -.02 | 6 | -.027 | 4 |

## Envelope Joint Reactions (Continued)

| | Joint | | X [k] | LC | Y [k] | LC | Z [k] | LC | MX [k-ft] | LC | MY [k-ft] | LC | MZ [k-ft] | LC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | N62A | max | 6.409 | 3 | 1.642 | 3 | -.547 | 5 | -.032 | 2 | 1.313 | 1 | -.022 | 5 |
| 6 | | min | .452 | 5 | .628 | 5 | -6.102 | 3 | -.076 | 3 | -.484 | 4 | -.076 | 3 |
| 7 | N70 | max | -2.284 | 5 | .075 | 3 | 7.29 | 3 | -.013 | 2 | .281 | 2 | -.011 | 5 |
| 8 | | min | -7.319 | 3 | .034 | 5 | 2.445 | 5 | -.047 | 6 | -.028 | 5 | -.048 | 3 |
| 9 | N80 | max | .213 | 2 | 1.532 | 6 | .014 | 5 | -.026 | 5 | 1.222 | 1 | .071 | 6 |
| 10 | | min | -4.619 | 6 | .607 | 2 | -4.563 | 3 | -.078 | 3 | -1.051 | 4 | .02 | 2 |
| 11 | N88 | max | 6.589 | 6 | .074 | 6 | 6.571 | 6 | -.01 | 5 | .326 | 2 | .044 | 6 |
| 12 | | min | 2.233 | 2 | .032 | 2 | 2.181 | 2 | -.051 | 3 | -.242 | 5 | .003 | 2 |
| 13 | N98 | max | .066 | 2 | 1.231 | 6 | 4.273 | 6 | .061 | 6 | .674 | 1 | .052 | 6 |
| 14 | | min | -4.066 | 6 | .5 | 2 | -.208 | 2 | .018 | 2 | -.862 | 4 | .025 | 5 |
| 15 | N106 | max | 5.267 | 6 | .058 | 3 | -1.674 | 2 | .04 | 6 | .111 | 2 | .031 | 3 |
| 16 | | min | 1.85 | 2 | .028 | 5 | -5.254 | 6 | .009 | 2 | -.273 | 5 | .009 | 5 |
| 17 | Totals: | max | 5.701 | 2 | 5.409 | 6 | 5.183 | 4 | | | | | | |
| 18 | | min | 0 | 6 | 2.691 | 2 | 0 | 2 | | | | | | |

## Envelope Joint Displacements

| | Joint | | X [in] | LC | Y [in] | LC | Z [in] | LC | X Rotation [... | LC | Y Rotation [... | LC | Z Rotation [... | LC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | N2 | max | .135 | 5 | -.04 | 5 | .136 | 4 | 3.738e-3 | 4 | 2.926e-3 | 4 | 6.673e-3 | 1 |
| 2 | | min | -.21 | 1 | -.157 | 3 | -.198 | 2 | -2.637e-3 | 2 | -3.522e-3 | 1 | -1.422e-3 | 5 |
| 3 | N3 | max | .189 | 1 | -.058 | 5 | .132 | 4 | 1.423e-3 | 5 | 2.831e-3 | 4 | 4.042e-3 | 4 |
| 4 | | min | -.139 | 4 | -.071 | 1 | -.196 | 1 | -5.014e-3 | 1 | -3.95e-3 | 1 | -2.416e-3 | 2 |
| 5 | N4 | max | .212 | 1 | -.096 | 2 | .165 | 4 | 1.303e-3 | 3 | 2.527e-3 | 4 | 3.e-3 | 3 |
| 6 | | min | -.156 | 4 | -.121 | 4 | -.241 | 1 | -6.943e-4 | 5 | -3.444e-3 | 1 | 2.153e-3 | 5 |
| 7 | N5 | max | .153 | 4 | -.058 | 5 | .166 | 4 | 1.664e-3 | 3 | 2.622e-3 | 4 | 3.387e-3 | 3 |
| 8 | | min | -.255 | 1 | -.253 | 3 | -.242 | 1 | 3.465e-4 | 2 | -5.121e-3 | 1 | -3.511e-3 | 2 |
| 9 | N6 | max | .062 | 1 | -.098 | 5 | .165 | 4 | 1.639e-3 | 3 | 2.131e-3 | 4 | 3.224e-3 | 3 |
| 10 | | min | -.048 | 4 | -.176 | 3 | -.241 | 1 | 3.956e-5 | 5 | -3.186e-3 | 1 | 1.861e-3 | 5 |
| 11 | N7 | max | .166 | 1 | -.059 | 5 | .132 | 4 | 1.687e-3 | 3 | 2.675e-3 | 4 | 4.073e-3 | 3 |
| 12 | | min | -.122 | 4 | -.076 | 3 | -.196 | 1 | -1.059e-4 | 5 | -3.762e-3 | 2 | 2.91e-3 | 2 |
| 13 | N8 | max | .166 | 1 | -.095 | 5 | .165 | 4 | 1.687e-3 | 3 | 2.675e-3 | 4 | 4.073e-3 | 3 |
| 14 | | min | -.122 | 4 | -.126 | 3 | -.241 | 1 | -1.059e-4 | 5 | -3.762e-3 | 2 | 2.91e-3 | 2 |
| 15 | N9 | max | .043 | 5 | -.072 | 5 | .166 | 4 | 8.952e-5 | 3 | 2.211e-3 | 4 | 4.458e-3 | 3 |
| 16 | | min | -.089 | 1 | -.228 | 3 | -.241 | 1 | -1.199e-3 | 4 | -2.982e-3 | 1 | 6.37e-4 | 5 |
| 17 | N10 | max | .119 | 5 | -.039 | 5 | .135 | 4 | 7.369e-4 | 3 | 2.536e-3 | 5 | 6.471e-3 | 3 |
| 18 | | min | -.192 | 1 | -.155 | 3 | -.196 | 2 | -1.831e-4 | 4 | -3.756e-3 | 1 | -5.761e-4 | 2 |
| 19 | N11 | max | .119 | 5 | -.051 | 5 | .166 | 4 | 7.369e-4 | 3 | 2.536e-3 | 5 | 6.471e-3 | 3 |
| 20 | | min | -.192 | 1 | -.234 | 3 | -.242 | 1 | -1.831e-4 | 4 | -3.756e-3 | 1 | -5.761e-4 | 2 |
| 21 | N12 | max | .17 | 4 | -.056 | 5 | .15 | 4 | 5.262e-3 | 3 | 2.377e-3 | 4 | 6.822e-4 | 3 |
| 22 | | min | -.252 | 1 | -.249 | 3 | -.224 | 2 | 6.106e-4 | 2 | -3.565e-3 | 1 | -6.949e-4 | 4 |
| 23 | N13 | max | .175 | 4 | -.05 | 2 | .23 | 1 | 7.673e-3 | 4 | 3.965e-3 | 4 | -9.201e-5 | 4 |
| 24 | | min | -.25 | 1 | -.223 | 6 | -.183 | 5 | 2.51e-4 | 2 | -3.785e-3 | 1 | -6.67e-4 | 2 |
| 25 | N14 | max | .042 | 5 | -.013 | 5 | .043 | 4 | 2.541e-3 | 4 | 2.467e-3 | 4 | 5.347e-3 | 1 |
| 26 | | min | -.089 | 1 | -.04 | 3 | -.078 | 2 | -3.715e-3 | 2 | -3.705e-3 | 1 | -2.206e-3 | 5 |
| 27 | N15 | max | .129 | 5 | -.036 | 5 | .131 | 4 | 3.738e-3 | 4 | 2.926e-3 | 4 | 6.673e-3 | 1 |
| 28 | | min | -.204 | 1 | -.144 | 3 | -.191 | 2 | -2.637e-3 | 2 | -3.522e-3 | 1 | -1.422e-3 | 5 |
| 29 | N16 | max | .171 | 4 | -.094 | 2 | .042 | 4 | 4.58e-3 | 3 | 2.324e-3 | 4 | 1.686e-4 | 2 |
| 30 | | min | -.252 | 1 | -.25 | 3 | -.079 | 2 | 4.662e-4 | 2 | -3.028e-3 | 1 | -1.247e-3 | 4 |
| 31 | N17 | max | .135 | 4 | -.045 | 5 | .118 | 4 | 6.868e-3 | 3 | 2.896e-3 | 4 | 1.647e-4 | 2 |
| 32 | | min | -.209 | 1 | -.158 | 3 | -.178 | 2 | 9.782e-4 | 2 | -3.504e-3 | 2 | -1.195e-3 | 4 |
| 33 | N18 | max | .17 | 4 | -.066 | 5 | .118 | 4 | 6.868e-3 | 3 | 2.896e-3 | 4 | 1.647e-4 | 2 |

## *Envelope Joint Displacements (Continued)*

| | Joint | | X [in] | LC | Y [in] | LC | Z [in] | LC | X Rotation [... | LC | Y Rotation [... | LC | Z Rotation [... | LC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 34 | | min | -.252 | 1 | -.242 | 3 | -.178 | 2 | 9.782e-4 | 2 | -3.504e-3 | 2 | -1.195e-3 | 4 |
| 35 | N19 | max | .174 | 4 | -.068 | 2 | .079 | 1 | 4.434e-3 | 3 | 2.022e-3 | 4 | 1.296e-3 | 1 |
| 36 | | min | -.25 | 1 | -.24 | 3 | -.065 | 5 | 5.715e-4 | 2 | -3.058e-3 | 1 | 2.23e-4 | 5 |
| 37 | N20 | max | .145 | 4 | -.035 | 2 | .181 | 1 | 7.184e-3 | 4 | 2.433e-3 | 5 | 5.295e-4 | 3 |
| 38 | | min | -.203 | 1 | -.138 | 6 | -.135 | 5 | 8.815e-4 | 2 | -3.9e-3 | 1 | 2.459e-4 | 6 |
| 39 | N21 | max | .175 | 4 | -.045 | 2 | .181 | 1 | 7.184e-3 | 4 | 2.433e-3 | 5 | 5.295e-4 | 3 |
| 40 | | min | -.25 | 1 | -.219 | 6 | -.135 | 5 | 8.815e-4 | 2 | -3.9e-3 | 1 | 2.459e-4 | 6 |
| 41 | N22 | max | .163 | 4 | -.046 | 2 | .244 | 1 | 7.549e-4 | 3 | 2.418e-3 | 4 | -4.015e-4 | 2 |
| 42 | | min | -.233 | 1 | -.217 | 6 | -.178 | 4 | -6.098e-4 | 2 | -3.991e-3 | 1 | -4.434e-3 | 6 |
| 43 | N23 | max | .197 | 1 | -.093 | 5 | .24 | 1 | 1.683e-3 | 4 | 2.737e-3 | 4 | -1.842e-3 | 5 |
| 44 | | min | -.159 | 5 | -.178 | 6 | -.18 | 4 | 1.023e-4 | 2 | -2.298e-3 | 1 | -7.381e-3 | 1 |
| 45 | N24 | max | .064 | 4 | -.012 | 2 | .08 | 1 | 4.172e-3 | 1 | 2.663e-3 | 4 | 3.959e-3 | 2 |
| 46 | | min | -.079 | 2 | -.035 | 6 | -.064 | 5 | -3.371e-3 | 5 | -3.715e-3 | 1 | -3.601e-3 | 4 |
| 47 | N25 | max | .143 | 4 | -.032 | 2 | .196 | 1 | 5.275e-3 | 1 | 2.362e-3 | 4 | 3.131e-3 | 2 |
| 48 | | min | -.196 | 2 | -.123 | 6 | -.142 | 5 | -2.425e-3 | 5 | -3.631e-3 | 1 | -4.765e-3 | 4 |
| 49 | N26 | max | .063 | 4 | -.087 | 2 | .244 | 1 | -4.464e-4 | 3 | 2.128e-3 | 4 | -5.657e-4 | 2 |
| 50 | | min | -.081 | 2 | -.227 | 6 | -.178 | 4 | -1.191e-3 | 1 | -2.925e-3 | 1 | -4.037e-3 | 6 |
| 51 | N27 | max | .132 | 4 | -.039 | 2 | .202 | 1 | -5.292e-5 | 3 | 2.542e-3 | 4 | -1.305e-3 | 2 |
| 52 | | min | -.183 | 1 | -.137 | 6 | -.147 | 5 | -1.111e-3 | 1 | -3.486e-3 | 2 | -6.144e-3 | 6 |
| 53 | N28 | max | .132 | 4 | -.055 | 2 | .244 | 1 | -5.292e-5 | 3 | 2.542e-3 | 4 | -1.305e-3 | 2 |
| 54 | | min | -.183 | 1 | -.211 | 6 | -.178 | 4 | -1.111e-3 | 1 | -3.486e-3 | 2 | -6.144e-3 | 6 |
| 55 | N29 | max | .057 | 1 | -.122 | 2 | .24 | 1 | 1.129e-3 | 3 | 2.189e-3 | 4 | -2.243e-3 | 5 |
| 56 | | min | -.052 | 5 | -.213 | 6 | -.179 | 4 | 3.364e-4 | 2 | -3.182e-3 | 1 | -3.905e-3 | 6 |
| 57 | N30 | max | .163 | 1 | -.034 | 2 | .192 | 1 | 1.411e-3 | 4 | 2.643e-3 | 5 | -3.133e-3 | 5 |
| 58 | | min | -.124 | 5 | -.116 | 6 | -.148 | 4 | 4.993e-4 | 2 | -3.936e-3 | 1 | -6.662e-3 | 1 |
| 59 | N31 | max | .163 | 1 | -.106 | 2 | .24 | 1 | 1.411e-3 | 4 | 2.643e-3 | 5 | -3.133e-3 | 5 |
| 60 | | min | -.124 | 5 | -.183 | 6 | -.179 | 4 | 4.993e-4 | 2 | -3.936e-3 | 1 | -6.662e-3 | 1 |
| 61 | N32 | max | .236 | 1 | -.071 | 2 | .219 | 1 | -1.622e-3 | 3 | 2.623e-3 | 4 | 3.122e-4 | 1 |
| 62 | | min | -.171 | 4 | -.15 | 6 | -.166 | 4 | -2.981e-3 | 1 | -3.871e-3 | 1 | -6.392e-4 | 6 |
| 63 | N33 | max | .234 | 1 | -.083 | 3 | .15 | 4 | -7.323e-4 | 3 | 2.59e-3 | 5 | 3.926e-4 | 2 |
| 64 | | min | -.171 | 4 | -.11 | 4 | -.222 | 1 | -2.851e-3 | 4 | -3.75e-3 | 1 | -5.746e-4 | 6 |
| 65 | N34 | max | .058 | 1 | -.009 | 2 | .058 | 2 | 2.793e-3 | 2 | 2.644e-3 | 4 | 2.089e-3 | 5 |
| 66 | | min | -.052 | 5 | -.029 | 6 | -.059 | 4 | -3.29e-3 | 4 | -3.492e-3 | 1 | -2.834e-3 | 1 |
| 67 | N35 | max | .182 | 1 | -.023 | 2 | .183 | 1 | 2.216e-3 | 2 | 2.589e-3 | 4 | 1.299e-3 | 5 |
| 68 | | min | -.135 | 5 | -.101 | 6 | -.143 | 4 | -4.283e-3 | 4 | -4.176e-3 | 1 | -3.834e-3 | 1 |
| 69 | N36 | max | .235 | 1 | -.094 | 2 | .059 | 1 | -9.049e-4 | 3 | 2.108e-3 | 4 | 7.822e-4 | 1 |
| 70 | | min | -.171 | 4 | -.147 | 6 | -.06 | 4 | -2.147e-3 | 1 | -3.074e-3 | 1 | 7.623e-5 | 6 |
| 71 | N37 | max | .189 | 1 | -.032 | 2 | .168 | 1 | -2.318e-3 | 5 | 2.6e-3 | 4 | 6.967e-4 | 1 |
| 72 | | min | -.139 | 5 | -.107 | 6 | -.132 | 4 | -3.987e-3 | 1 | -3.855e-3 | 2 | -9.37e-5 | 6 |
| 73 | N38 | max | .236 | 1 | -.075 | 2 | .168 | 1 | -2.318e-3 | 5 | 2.6e-3 | 4 | 6.967e-4 | 1 |
| 74 | | min | -.171 | 4 | -.144 | 6 | -.132 | 4 | -3.987e-3 | 1 | -3.855e-3 | 2 | -9.37e-5 | 6 |
| 75 | N39 | max | .182 | 1 | -.053 | 5 | .127 | 4 | 1.423e-3 | 5 | 2.831e-3 | 4 | 4.042e-3 | 4 |
| 76 | | min | -.134 | 4 | -.065 | 1 | -.189 | 1 | -5.014e-3 | 1 | -3.95e-3 | 1 | -2.416e-3 | 2 |
| 77 | N40 | max | .234 | 1 | -.098 | 2 | .042 | 4 | -3.968e-4 | 3 | 2.223e-3 | 4 | -2.589e-4 | 2 |
| 78 | | min | -.171 | 4 | -.137 | 4 | -.068 | 1 | -2.282e-3 | 4 | -3.018e-3 | 1 | -9.347e-4 | 6 |
| 79 | N41 | max | .188 | 1 | -.059 | 2 | .116 | 4 | -1.626e-3 | 3 | 2.657e-3 | 5 | -1.177e-4 | 2 |
| 80 | | min | -.139 | 4 | -.074 | 4 | -.174 | 1 | -3.396e-3 | 4 | -3.806e-3 | 1 | -8.976e-4 | 6 |
| 81 | N42 | max | .234 | 1 | -.087 | 3 | .116 | 4 | -1.626e-3 | 3 | 2.657e-3 | 5 | -1.177e-4 | 2 |
| 82 | | min | -.171 | 4 | -.115 | 4 | -.174 | 1 | -3.396e-3 | 4 | -3.806e-3 | 1 | -8.976e-4 | 6 |
| 83 | N44 | max | .147 | 4 | -.035 | 2 | .203 | 1 | 5.275e-3 | 1 | 2.362e-3 | 4 | 3.131e-3 | 2 |
| 84 | | min | -.203 | 1 | -.135 | 6 | -.147 | 5 | -2.425e-3 | 5 | -3.631e-3 | 1 | -4.765e-3 | 4 |
| 85 | N46 | max | .19 | 1 | -.025 | 2 | .191 | 1 | 2.216e-3 | 2 | 2.589e-3 | 4 | 1.299e-3 | 5 |

## *Envelope Joint Displacements (Continued)*

| | Joint | | X [in] | LC | Y [in] | LC | Z [in] | LC | X Rotation [... | LC | Y Rotation [... | LC | Z Rotation [... | LC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 86 | | min | -.139 | 5 | -.11 | 6 | -.148 | 4 | -4.283e-3 | 4 | -4.176e-3 | 1 | -3.835e-3 | 1 |
| 87 | N47 | max | 0 | 6 | 0 | 6 | 0 | 6 | 0 | 6 | 0 | 6 | 0 | 6 |
| 88 | | min | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| 89 | N48 | max | .004 | 2 | -.003 | 2 | .002 | 5 | 5.891e-5 | 5 | 8.817e-4 | 4 | 6.722e-4 | 4 |
| 90 | | min | -.003 | 4 | -.004 | 6 | -.005 | 1 | -1.009e-3 | 1 | -1.301e-3 | 1 | -3.295e-4 | 2 |
| 91 | N49 | max | .015 | 2 | -.007 | 2 | .01 | 5 | 5.461e-4 | 5 | 1.584e-3 | 4 | 1.235e-3 | 4 |
| 92 | | min | -.012 | 4 | -.009 | 6 | -.017 | 1 | -1.801e-3 | 1 | -2.312e-3 | 1 | -1.028e-3 | 2 |
| 93 | N50 | max | .032 | 2 | -.011 | 5 | .022 | 4 | 1.284e-3 | 5 | 2.108e-3 | 4 | 1.922e-3 | 4 |
| 94 | | min | -.024 | 4 | -.014 | 6 | -.035 | 1 | -2.706e-3 | 1 | -3.041e-3 | 1 | -1.966e-3 | 2 |
| 95 | N51 | max | .062 | 2 | -.015 | 5 | .042 | 5 | 2.094e-3 | 5 | 2.455e-3 | 4 | 3.075e-3 | 4 |
| 96 | | min | -.048 | 4 | -.019 | 6 | -.068 | 1 | -4.104e-3 | 1 | -3.505e-3 | 1 | -3.033e-3 | 2 |
| 97 | N52 | max | .075 | 1 | -.019 | 5 | .052 | 4 | 2.226e-3 | 5 | 2.526e-3 | 4 | 2.763e-3 | 4 |
| 98 | | min | -.055 | 4 | -.023 | 1 | -.079 | 1 | -3.706e-3 | 1 | -3.597e-3 | 1 | -3.104e-3 | 2 |
| 99 | N53 | max | .098 | 1 | -.022 | 5 | .068 | 4 | 2.181e-3 | 5 | 2.604e-3 | 4 | 2.955e-3 | 4 |
| 100 | | min | -.071 | 4 | -.028 | 1 | -.102 | 1 | -3.936e-3 | 1 | -3.683e-3 | 1 | -3.138e-3 | 2 |
| 101 | N54 | max | .131 | 1 | -.028 | 5 | .091 | 4 | 2.073e-3 | 5 | 2.696e-3 | 4 | 3.234e-3 | 4 |
| 102 | | min | -.098 | 4 | -.034 | 1 | -.138 | 1 | -4.243e-3 | 1 | -3.789e-3 | 1 | -3.037e-3 | 2 |
| 103 | N55 | max | 0 | 6 | 0 | 6 | 0 | 6 | 0 | 6 | 0 | 6 | 0 | 6 |
| 104 | | min | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| 105 | N56 | max | .001 | 1 | -.002 | 2 | 0 | 4 | 6.881e-5 | 5 | 9.804e-5 | 5 | 6.009e-4 | 4 |
| 106 | | min | 0 | 5 | -.003 | 6 | 0 | 2 | -9.76e-4 | 1 | -2.29e-4 | 2 | -3.796e-4 | 2 |
| 107 | N57 | max | .004 | 1 | -.006 | 2 | .003 | 4 | 6.593e-4 | 5 | 3.338e-4 | 5 | 1.333e-3 | 4 |
| 108 | | min | 0 | 5 | -.008 | 6 | -.002 | 2 | -2.026e-3 | 1 | -5.955e-4 | 2 | -1.261e-3 | 2 |
| 109 | N58 | max | .01 | 1 | -.01 | 2 | .006 | 4 | 1.653e-3 | 5 | 6.673e-4 | 4 | 2.502e-3 | 4 |
| 110 | | min | -.003 | 5 | -.013 | 6 | -.007 | 2 | -3.567e-3 | 1 | -1.056e-3 | 2 | -2.612e-3 | 2 |
| 111 | N59 | max | .018 | 1 | -.015 | 5 | .012 | 4 | 3.497e-3 | 5 | 1.05e-3 | 4 | 4.142e-3 | 4 |
| 112 | | min | -.009 | 5 | -.019 | 6 | -.015 | 2 | -5.774e-3 | 1 | -1.556e-3 | 2 | -4.872e-3 | 2 |
| 113 | N62 | max | .053 | 1 | -.015 | 5 | .036 | 4 | 2.094e-3 | 5 | 2.455e-3 | 4 | 3.075e-3 | 4 |
| 114 | | min | -.039 | 4 | -.019 | 6 | -.056 | 1 | -4.104e-3 | 1 | -3.505e-3 | 1 | -3.033e-3 | 2 |
| 115 | N63 | max | .122 | 1 | -.028 | 5 | .085 | 4 | 2.073e-3 | 5 | 2.696e-3 | 4 | 3.234e-3 | 4 |
| 116 | | min | -.088 | 4 | -.034 | 1 | -.126 | 1 | -4.243e-3 | 1 | -3.789e-3 | 1 | -3.037e-3 | 2 |
| 117 | N64 | max | .05 | 1 | -.019 | 5 | .034 | 4 | 2.739e-3 | 5 | 1.999e-3 | 4 | 3.264e-3 | 4 |
| 118 | | min | -.032 | 5 | -.023 | 1 | -.049 | 2 | -4.438e-3 | 1 | -2.864e-3 | 1 | -3.83e-3 | 2 |
| 119 | N65 | max | .086 | 1 | -.022 | 5 | .059 | 4 | 2.376e-3 | 5 | 2.487e-3 | 4 | 3.109e-3 | 4 |
| 120 | | min | -.059 | 4 | -.028 | 1 | -.086 | 1 | -4.171e-3 | 1 | -3.509e-3 | 1 | -3.384e-3 | 2 |
| 121 | N62A | max | 0 | 6 | 0 | 6 | 0 | 6 | 0 | 6 | 0 | 6 | 0 | 6 |
| 122 | | min | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| 123 | N63A | max | .003 | 5 | -.003 | 5 | .003 | 4 | 8.923e-4 | 6 | 7.925e-4 | 4 | 9.819e-4 | 1 |
| 124 | | min | -.007 | 1 | -.007 | 3 | -.006 | 2 | -1.081e-4 | 2 | -1.925e-3 | 1 | -1.61e-4 | 5 |
| 125 | N64A | max | .01 | 5 | -.006 | 5 | .01 | 4 | 1.368e-3 | 4 | 1.474e-3 | 4 | 1.983e-3 | 1 |
| 126 | | min | -.025 | 1 | -.018 | 3 | -.022 | 2 | -9.557e-4 | 2 | -3.152e-3 | 1 | -6.586e-4 | 5 |
| 127 | N65A | max | .021 | 5 | -.01 | 5 | .021 | 4 | 1.976e-3 | 4 | 2.033e-3 | 4 | 3.221e-3 | 1 |
| 128 | | min | -.048 | 1 | -.029 | 3 | -.044 | 2 | -2.29e-3 | 2 | -3.73e-3 | 1 | -1.227e-3 | 5 |
| 129 | N67 | max | .052 | 5 | -.014 | 5 | .052 | 4 | 2.469e-3 | 4 | 2.568e-3 | 4 | 4.679e-3 | 1 |
| 130 | | min | -.096 | 1 | -.049 | 3 | -.09 | 2 | -3.832e-3 | 2 | -3.622e-3 | 1 | -2.073e-3 | 5 |
| 131 | N68 | max | .068 | 4 | -.016 | 5 | .068 | 4 | 2.538e-3 | 4 | 2.667e-3 | 4 | 4.981e-3 | 1 |
| 132 | | min | -.119 | 1 | -.058 | 3 | -.113 | 2 | -3.715e-3 | 2 | -3.547e-3 | 1 | -2.18e-3 | 5 |
| 133 | N69 | max | .092 | 5 | -.017 | 5 | .094 | 4 | 2.816e-3 | 4 | 2.773e-3 | 4 | 5.485e-3 | 1 |
| 134 | | min | -.158 | 1 | -.072 | 3 | -.146 | 2 | -3.582e-3 | 2 | -3.519e-3 | 1 | -2.084e-3 | 5 |
| 135 | N70 | max | 0 | 6 | 0 | 6 | 0 | 6 | 0 | 6 | 0 | 6 | 0 | 6 |
| 136 | | min | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| 137 | N71 | max | .001 | 6 | -.002 | 5 | 0 | 5 | 8.018e-4 | 4 | 1.189e-4 | 5 | 1.087e-3 | 1 |

## *Envelope Joint Displacements (Continued)*

| | Joint | | X [in] | LC | Y [in] | LC | Z [in] | LC | X Rotation [... | LC | Y Rotation [... | LC | Z Rotation [... | LC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 138 | | min | 0 | 2 | -.005 | 3 | -.002 | 1 | -3.345e-4 | 2 | -4.913e-4 | 2 | -2.02e-4 | 5 |
| 139 | N72 | max | .003 | 4 | -.005 | 5 | 0 | 5 | 1.522e-3 | 4 | 3.591e-4 | 5 | 2.286e-3 | 1 |
| 140 | | min | -.005 | 2 | -.015 | 3 | -.008 | 1 | -1.301e-3 | 2 | -9.806e-4 | 2 | -8.107e-4 | 5 |
| 141 | N73 | max | .006 | 4 | -.009 | 5 | .004 | 5 | 2.593e-3 | 4 | 6.845e-4 | 5 | 3.953e-3 | 1 |
| 142 | | min | -.012 | 2 | -.027 | 3 | -.016 | 1 | -2.676e-3 | 2 | -1.459e-3 | 2 | -1.775e-3 | 5 |
| 143 | N74 | max | .012 | 4 | -.013 | 5 | .009 | 5 | 4.078e-3 | 4 | 1.052e-3 | 5 | 5.985e-3 | 1 |
| 144 | | min | -.023 | 2 | -.041 | 3 | -.027 | 1 | -4.97e-3 | 2 | -1.917e-3 | 1 | -3.447e-3 | 5 |
| 145 | N75 | max | .036 | 5 | -.013 | 5 | .036 | 4 | 2.541e-3 | 4 | 2.467e-3 | 4 | 5.347e-3 | 1 |
| 146 | | min | -.072 | 1 | -.04 | 3 | -.067 | 2 | -3.715e-3 | 2 | -3.705e-3 | 1 | -2.206e-3 | 5 |
| 147 | N76 | max | .086 | 4 | -.017 | 5 | .085 | 4 | 2.816e-3 | 4 | 2.773e-3 | 4 | 5.485e-3 | 1 |
| 148 | | min | -.141 | 1 | -.072 | 3 | -.135 | 2 | -3.582e-3 | 2 | -3.519e-3 | 1 | -2.084e-3 | 5 |
| 149 | N77 | max | .035 | 4 | -.014 | 5 | .032 | 5 | 2.997e-3 | 4 | 2.043e-3 | 4 | 5.118e-3 | 1 |
| 150 | | min | -.059 | 2 | -.049 | 3 | -.062 | 1 | -4.268e-3 | 2 | -2.888e-3 | 1 | -2.682e-3 | 5 |
| 151 | N78 | max | .06 | 4 | -.016 | 5 | .058 | 4 | 2.725e-3 | 4 | 2.551e-3 | 4 | 5.116e-3 | 1 |
| 152 | | min | -.099 | 1 | -.058 | 3 | -.098 | 1 | -3.91e-3 | 2 | -3.349e-3 | 1 | -2.367e-3 | 5 |
| 153 | N80 | max | 0 | 6 | 0 | 6 | 0 | 6 | 0 | 6 | 0 | 6 | 0 | 6 |
| 154 | | min | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| 155 | N81 | max | .005 | 4 | -.003 | 2 | .006 | 1 | 1.146e-3 | 3 | 1.52e-3 | 4 | 3.301e-4 | 2 |
| 156 | | min | -.006 | 2 | -.007 | 6 | -.005 | 5 | -9.849e-5 | 5 | -1.811e-3 | 1 | -7.317e-4 | 4 |
| 157 | N82 | max | .019 | 4 | -.006 | 2 | .022 | 1 | 1.86e-3 | 1 | 2.442e-3 | 4 | 1.191e-3 | 2 |
| 158 | | min | -.022 | 2 | -.016 | 6 | -.018 | 5 | -8.263e-4 | 5 | -3.007e-3 | 1 | -1.427e-3 | 4 |
| 159 | N83 | max | .036 | 4 | -.009 | 2 | .044 | 1 | 2.979e-3 | 1 | 2.809e-3 | 4 | 2.254e-3 | 2 |
| 160 | | min | -.044 | 2 | -.026 | 6 | -.036 | 5 | -1.793e-3 | 5 | -3.627e-3 | 1 | -2.419e-3 | 4 |
| 161 | N85 | max | .07 | 4 | -.013 | 2 | .091 | 1 | 3.99e-3 | 1 | 2.559e-3 | 4 | 3.63e-3 | 2 |
| 162 | | min | -.091 | 1 | -.042 | 6 | -.07 | 5 | -3.081e-3 | 5 | -3.671e-3 | 1 | -3.39e-3 | 4 |
| 163 | N86 | max | .086 | 4 | -.014 | 2 | .114 | 1 | 4.054e-3 | 1 | 2.46e-3 | 4 | 3.777e-3 | 2 |
| 164 | | min | -.114 | 1 | -.05 | 6 | -.086 | 5 | -3.178e-3 | 5 | -3.62e-3 | 1 | -3.473e-3 | 4 |
| 165 | N87 | max | .112 | 4 | -.015 | 2 | .15 | 1 | 4.39e-3 | 1 | 2.403e-3 | 4 | 3.765e-3 | 2 |
| 166 | | min | -.149 | 2 | -.06 | 6 | -.111 | 5 | -3.15e-3 | 5 | -3.611e-3 | 1 | -3.793e-3 | 4 |
| 167 | N88 | max | 0 | 6 | 0 | 6 | 0 | 6 | 0 | 6 | 0 | 6 | 0 | 6 |
| 168 | | min | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| 169 | N89 | max | 0 | 5 | -.002 | 2 | .001 | 2 | 1.159e-3 | 1 | 4.056e-4 | 5 | 5.732e-4 | 2 |
| 170 | | min | -.002 | 1 | -.005 | 6 | -.002 | 4 | -2.909e-4 | 5 | -5.494e-4 | 2 | -8.025e-4 | 4 |
| 171 | N90 | max | .004 | 5 | -.005 | 2 | .006 | 2 | 2.256e-3 | 1 | 7.782e-4 | 5 | 1.574e-3 | 2 |
| 172 | | min | -.008 | 1 | -.014 | 6 | -.006 | 4 | -1.058e-3 | 5 | -1.061e-3 | 2 | -1.65e-3 | 4 |
| 173 | N91 | max | .01 | 5 | -.008 | 2 | .014 | 2 | 3.694e-3 | 1 | 1.119e-3 | 4 | 2.926e-3 | 2 |
| 174 | | min | -.016 | 1 | -.025 | 6 | -.013 | 4 | -2.109e-3 | 5 | -1.536e-3 | 2 | -2.796e-3 | 4 |
| 175 | N92 | max | .018 | 5 | -.012 | 2 | .025 | 2 | 5.524e-3 | 1 | 1.429e-3 | 4 | 4.927e-3 | 2 |
| 176 | | min | -.028 | 1 | -.036 | 6 | -.021 | 4 | -3.767e-3 | 5 | -1.97e-3 | 2 | -4.156e-3 | 4 |
| 177 | N93 | max | .053 | 4 | -.012 | 2 | .067 | 1 | 4.172e-3 | 1 | 2.663e-3 | 4 | 3.959e-3 | 2 |
| 178 | | min | -.067 | 2 | -.035 | 6 | -.053 | 5 | -3.371e-3 | 5 | -3.715e-3 | 1 | -3.601e-3 | 4 |
| 179 | N94 | max | .101 | 4 | -.015 | 2 | .137 | 1 | 4.39e-3 | 1 | 2.403e-3 | 4 | 3.765e-3 | 2 |
| 180 | | min | -.137 | 1 | -.06 | 6 | -.102 | 5 | -3.15e-3 | 5 | -3.611e-3 | 1 | -3.793e-3 | 4 |
| 181 | N95 | max | .044 | 5 | -.013 | 2 | .06 | 2 | 4.467e-3 | 1 | 2.044e-3 | 4 | 4.198e-3 | 2 |
| 182 | | min | -.062 | 1 | -.042 | 6 | -.047 | 4 | -3.364e-3 | 5 | -2.967e-3 | 1 | -3.585e-3 | 4 |
| 183 | N96 | max | .072 | 4 | -.014 | 2 | .097 | 1 | 4.241e-3 | 1 | 2.31e-3 | 4 | 3.96e-3 | 2 |
| 184 | | min | -.099 | 1 | -.05 | 6 | -.074 | 4 | -3.278e-3 | 5 | -3.433e-3 | 1 | -3.553e-3 | 4 |
| 185 | N98 | max | 0 | 6 | 0 | 6 | 0 | 6 | 0 | 6 | 0 | 6 | 0 | 6 |
| 186 | | min | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| 187 | N99 | max | .004 | 1 | -.002 | 2 | .004 | 2 | 1.357e-4 | 2 | 1.275e-3 | 4 | 8.241e-5 | 5 |
| 188 | | min | -.004 | 5 | -.005 | 6 | -.005 | 4 | -8.92e-4 | 6 | -1.101e-3 | 1 | -6.223e-4 | 1 |
| 189 | N100 | max | .014 | 1 | -.005 | 2 | .014 | 2 | 7.115e-4 | 2 | 2.116e-3 | 4 | 5.824e-4 | 5 |

## *Envelope Joint Displacements (Continued)*

| | Joint | | X [in] | LC | Y [in] | LC | Z [in] | LC | X Rotation [... | LC | Y Rotation [... | LC | Z Rotation [... | LC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 190 | | min | -.015 | 5 | -.013 | 6 | -.017 | 4 | -1.444e-3 | 4 | -2.049e-3 | 1 | -1.146e-3 | 1 |
| 191 | N101 | max | .029 | 1 | -.007 | 2 | .03 | 1 | 1.457e-3 | 2 | 2.56e-3 | 4 | 1.317e-3 | 5 |
| 192 | | min | -.029 | 5 | -.022 | 6 | -.032 | 4 | -2.126e-3 | 4 | -2.843e-3 | 1 | -1.924e-3 | 1 |
| 193 | N103 | max | .072 | 1 | -.009 | 2 | .073 | 1 | 2.623e-3 | 2 | 2.621e-3 | 4 | 2.168e-3 | 5 |
| 194 | | min | -.062 | 5 | -.035 | 6 | -.066 | 4 | -2.83e-3 | 4 | -3.649e-3 | 1 | -2.823e-3 | 1 |
| 195 | N104 | max | .096 | 1 | -.01 | 2 | .097 | 1 | 2.77e-3 | 2 | 2.587e-3 | 4 | 2.141e-3 | 5 |
| 196 | | min | -.079 | 5 | -.042 | 6 | -.083 | 4 | -3.044e-3 | 4 | -3.801e-3 | 1 | -2.925e-3 | 1 |
| 197 | N105 | max | .129 | 1 | -.01 | 2 | .129 | 1 | 2.739e-3 | 2 | 2.579e-3 | 4 | 2.016e-3 | 5 |
| 198 | | min | -.101 | 5 | -.051 | 6 | -.109 | 4 | -3.379e-3 | 4 | -3.961e-3 | 1 | -3.112e-3 | 1 |
| 199 | N106 | max | 0 | 6 | 0 | 6 | 0 | 6 | 0 | 6 | 0 | 6 | 0 | 6 |
| 200 | | min | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| 201 | N107 | max | 0 | 2 | -.002 | 2 | .001 | 1 | 2.295e-4 | 2 | 4.448e-4 | 5 | 3.024e-4 | 5 |
| 202 | | min | -.002 | 4 | -.004 | 6 | 0 | 5 | -9.688e-4 | 4 | -2.712e-4 | 2 | -6.199e-4 | 1 |
| 203 | N108 | max | .003 | 2 | -.004 | 2 | .004 | 1 | 1.004e-3 | 2 | 8.322e-4 | 5 | 9.261e-4 | 5 |
| 204 | | min | -.007 | 4 | -.011 | 6 | -.005 | 5 | -1.777e-3 | 4 | -6.708e-4 | 2 | -1.438e-3 | 1 |
| 205 | N109 | max | .009 | 2 | -.007 | 2 | .01 | 1 | 2.307e-3 | 2 | 1.17e-3 | 5 | 1.749e-3 | 5 |
| 206 | | min | -.014 | 4 | -.02 | 6 | -.011 | 5 | -2.807e-3 | 4 | -1.154e-3 | 1 | -2.789e-3 | 1 |
| 207 | N110 | max | .017 | 2 | -.009 | 2 | .02 | 1 | 4.659e-3 | 2 | 1.463e-3 | 5 | 3.067e-3 | 5 |
| 208 | | min | -.022 | 4 | -.03 | 6 | -.019 | 5 | -4.006e-3 | 4 | -1.669e-3 | 1 | -4.865e-3 | 1 |
| 209 | N111 | max | .049 | 1 | -.009 | 2 | .05 | 1 | 2.793e-3 | 2 | 2.644e-3 | 4 | 2.089e-3 | 5 |
| 210 | | min | -.046 | 5 | -.029 | 6 | -.049 | 4 | -3.29e-3 | 4 | -3.492e-3 | 1 | -2.834e-3 | 1 |
| 211 | N112 | max | .12 | 1 | -.01 | 2 | .122 | 1 | 2.739e-3 | 2 | 2.579e-3 | 4 | 2.016e-3 | 5 |
| 212 | | min | -.095 | 4 | -.051 | 6 | -.099 | 4 | -3.379e-3 | 4 | -3.961e-3 | 1 | -3.112e-3 | 1 |
| 213 | N113 | max | .049 | 2 | -.009 | 2 | .051 | 1 | 3.499e-3 | 2 | 2.148e-3 | 4 | 2.562e-3 | 5 |
| 214 | | min | -.046 | 4 | -.035 | 6 | -.044 | 5 | -3.223e-3 | 4 | -2.987e-3 | 1 | -3.611e-3 | 1 |
| 215 | N114 | max | .083 | 1 | -.01 | 2 | .085 | 1 | 3.064e-3 | 2 | 2.455e-3 | 4 | 2.288e-3 | 5 |
| 216 | | min | -.07 | 4 | -.042 | 6 | -.071 | 4 | -3.167e-3 | 4 | -3.659e-3 | 1 | -3.194e-3 | 1 |
| 217 | N115 | max | .17 | 4 | -.058 | 5 | .143 | 4 | 5.262e-3 | 3 | 2.377e-3 | 4 | 6.821e-4 | 3 |
| 218 | | min | -.252 | 1 | -.247 | 3 | -.213 | 2 | 6.106e-4 | 2 | -3.565e-3 | 1 | -6.949e-4 | 4 |
| 219 | N116 | max | .202 | 4 | -.058 | 5 | .043 | 4 | -7.077e-5 | 2 | 2.336e-3 | 4 | 2.538e-3 | 2 |
| 220 | | min | -.354 | 1 | -.247 | 3 | -.218 | 2 | -3.325e-3 | 4 | -3.376e-3 | 2 | -9.21e-4 | 4 |
| 221 | N117 | max | .138 | 5 | -.058 | 5 | .1 | 5 | 5.224e-3 | 3 | 2.377e-3 | 4 | 2.403e-4 | 6 |
| 222 | | min | -.237 | 1 | -.247 | 3 | -.295 | 3 | 6.089e-4 | 2 | -3.565e-3 | 1 | -6.923e-4 | 4 |
| 223 | N118 | max | .171 | 4 | -.091 | 2 | .021 | 4 | 3.766e-3 | 3 | 1.872e-3 | 4 | 4.769e-4 | 2 |
| 224 | | min | -.251 | 1 | -.253 | 3 | -.052 | 2 | 2.842e-4 | 2 | -2.491e-3 | 1 | -9.668e-4 | 4 |
| 225 | N119 | max | .201 | 4 | -.091 | 2 | .05 | 3 | 4.548e-4 | 3 | 9.932e-4 | 5 | 7.136e-4 | 2 |
| 226 | | min | -.332 | 1 | -.253 | 3 | -.062 | 2 | -1.513e-3 | 5 | -2.87e-3 | 1 | -7.623e-4 | 4 |
| 227 | N120 | max | .128 | 5 | -.091 | 2 | -.033 | 5 | 4.072e-3 | 6 | 1.872e-3 | 4 | 1.051e-4 | 2 |
| 228 | | min | -.246 | 1 | -.253 | 3 | -.193 | 3 | 2.84e-4 | 2 | -2.491e-3 | 1 | -1.107e-3 | 3 |
| 229 | N121 | max | .174 | 4 | -.08 | 2 | .051 | 1 | 3.777e-3 | 3 | 1.543e-3 | 4 | 1.207e-3 | 1 |
| 230 | | min | -.25 | 1 | -.249 | 3 | -.048 | 5 | 4.608e-4 | 2 | -2.508e-3 | 1 | -1.273e-4 | 5 |
| 231 | N122 | max | .196 | 5 | -.08 | 2 | .095 | 3 | 6.896e-4 | 3 | 2.195e-3 | 4 | 7.382e-4 | 1 |
| 232 | | min | -.333 | 1 | -.249 | 3 | -.086 | 5 | -1.632e-3 | 5 | -2.384e-3 | 2 | -3.959e-4 | 5 |
| 233 | N123 | max | .173 | 4 | -.08 | 2 | .028 | 2 | 4.258e-3 | 6 | 1.543e-3 | 4 | 8.349e-4 | 1 |
| 234 | | min | -.21 | 2 | -.249 | 3 | -.207 | 6 | 4.606e-4 | 2 | -2.508e-3 | 1 | -2.499e-4 | 3 |
| 235 | N124 | max | .175 | 4 | -.048 | 2 | .219 | 1 | 7.673e-3 | 4 | 3.965e-3 | 4 | -9.193e-5 | 4 |
| 236 | | min | -.25 | 1 | -.222 | 6 | -.172 | 5 | 2.51e-4 | 2 | -3.785e-3 | 1 | -6.67e-4 | 2 |
| 237 | N125 | max | .198 | 5 | -.048 | 2 | .194 | 1 | -3.48e-4 | 3 | 3.024e-3 | 5 | 3.276e-3 | 1 |
| 238 | | min | -.363 | 1 | -.222 | 6 | -.251 | 5 | -4.795e-3 | 4 | -3.815e-3 | 1 | -5.184e-4 | 5 |
| 239 | N126 | max | .17 | 4 | -.048 | 2 | .205 | 2 | 2.295e-2 | 4 | 3.965e-3 | 4 | -9.178e-5 | 4 |
| 240 | | min | -.518 | 1 | -.222 | 6 | -1.062 | 4 | 2.507e-4 | 2 | -3.785e-3 | 1 | -7.575e-3 | 2 |
| 241 | N127 | max | .156 | 4 | -.048 | 2 | .244 | 1 | 7.548e-4 | 3 | 2.418e-3 | 4 | -4.015e-4 | 2 |

## *Envelope Joint Displacements (Continued)*

| | Joint | | X [in] | LC | Y [in] | LC | Z [in] | LC | X Rotation [... | LC | Y Rotation [... | LC | Z Rotation [... | LC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 242 | | min | -.221 | 1 | -.215 | 6 | -.178 | 4 | -6.099e-4 | 2 | -3.991e-3 | 1 | -4.434e-3 | 6 |
| 243 | N128 | max | .164 | 5 | -.048 | 2 | .22 | 1 | 1.248e-4 | 3 | 2.915e-3 | 4 | 3.753e-3 | 1 |
| 244 | | min | -.346 | 1 | -.215 | 6 | -.237 | 5 | -2.149e-3 | 5 | -3.984e-3 | 2 | 1.006e-3 | 5 |
| 245 | N129 | max | -.02 | 5 | -.048 | 2 | .272 | 2 | 1.601e-3 | 6 | 2.418e-3 | 4 | -4.306e-4 | 2 |
| 246 | | min | -.271 | 1 | -.215 | 6 | -.189 | 4 | -6.081e-4 | 2 | -3.991e-3 | 1 | -4.402e-3 | 6 |
| 247 | N130 | max | .044 | 4 | -.097 | 2 | .243 | 1 | -1.452e-4 | 3 | 1.796e-3 | 4 | -3.028e-4 | 2 |
| 248 | | min | -.057 | 2 | -.231 | 6 | -.178 | 4 | -9.007e-4 | 1 | -2.179e-3 | 1 | -3.287e-3 | 6 |
| 249 | N131 | max | .086 | 4 | -.097 | 2 | .221 | 1 | 2.874e-4 | 3 | 1.482e-3 | 5 | 2.157e-3 | 1 |
| 250 | | min | -.136 | 2 | -.231 | 6 | -.216 | 5 | -7.045e-4 | 2 | -3.821e-3 | 1 | -5.148e-5 | 5 |
| 251 | N132 | max | -.078 | 5 | -.097 | 2 | .286 | 1 | 7.776e-4 | 6 | 1.796e-3 | 4 | -6.742e-4 | 2 |
| 252 | | min | -.16 | 3 | -.231 | 6 | -.162 | 5 | -9.002e-4 | 1 | -2.179e-3 | 1 | -3.285e-3 | 6 |
| 253 | N133 | max | .029 | 1 | -.123 | 2 | .24 | 1 | 8.189e-4 | 3 | 1.845e-3 | 4 | -1.927e-3 | 5 |
| 254 | | min | -.032 | 5 | -.222 | 6 | -.179 | 4 | -5.396e-5 | 2 | -2.464e-3 | 1 | -3.312e-3 | 6 |
| 255 | N134 | max | .058 | 6 | -.123 | 2 | .226 | 1 | 4.367e-4 | 3 | 2.486e-3 | 4 | 9.053e-4 | 2 |
| 256 | | min | -.008 | 5 | -.222 | 6 | -.209 | 5 | -3.539e-4 | 2 | -2.526e-3 | 2 | -6.529e-4 | 6 |
| 257 | N135 | max | -.091 | 2 | -.123 | 2 | .242 | 2 | 1.731e-3 | 6 | 1.845e-3 | 4 | -1.926e-3 | 5 |
| 258 | | min | -.167 | 6 | -.222 | 6 | -.201 | 4 | -5.393e-5 | 2 | -2.464e-3 | 1 | -3.659e-3 | 3 |
| 259 | N136 | max | .19 | 1 | -.097 | 5 | .24 | 1 | 1.683e-3 | 4 | 2.737e-3 | 4 | -1.842e-3 | 5 |
| 260 | | min | -.151 | 5 | -.179 | 6 | -.18 | 4 | 1.024e-4 | 2 | -2.298e-3 | 1 | -7.381e-3 | 1 |
| 261 | N137 | max | .117 | 1 | -.098 | 5 | .225 | 1 | 9.032e-4 | 3 | 2.441e-3 | 5 | 4.554e-3 | 1 |
| 262 | | min | -.144 | 5 | -.18 | 6 | -.232 | 5 | -1.772e-3 | 5 | -2.926e-3 | 1 | 1.131e-4 | 6 |
| 263 | N138 | max | -.181 | 6 | -.098 | 5 | .234 | 2 | 8.587e-3 | 4 | 2.737e-3 | 4 | -1.84e-3 | 5 |
| 264 | | min | -.687 | 1 | -.18 | 6 | -.497 | 4 | 1.023e-4 | 2 | -2.298e-3 | 1 | -2.266e-2 | 1 |
| 265 | N139 | max | .236 | 1 | -.072 | 2 | .207 | 1 | -1.622e-3 | 3 | 2.623e-3 | 4 | 3.122e-4 | 1 |
| 266 | | min | -.171 | 4 | -.148 | 6 | -.158 | 4 | -2.981e-3 | 1 | -3.871e-3 | 1 | -6.392e-4 | 6 |
| 267 | N140 | max | .177 | 1 | -.072 | 2 | .22 | 1 | 2.096e-3 | 3 | 2.946e-3 | 4 | 1.768e-3 | 1 |
| 268 | | min | -.166 | 5 | -.149 | 6 | -.191 | 5 | -1.291e-4 | 5 | -3.132e-3 | 2 | -1.028e-4 | 6 |
| 269 | N141 | max | .237 | 1 | -.072 | 2 | .35 | 1 | -9.963e-4 | 6 | 2.623e-3 | 4 | 2.333e-4 | 4 |
| 270 | | min | -.161 | 5 | -.148 | 6 | -.079 | 5 | -2.979e-3 | 1 | -3.871e-3 | 1 | -1.359e-3 | 3 |
| 271 | N142 | max | .235 | 1 | -.1 | 2 | .034 | 2 | -3.138e-4 | 3 | 1.575e-3 | 4 | 5.987e-4 | 1 |
| 272 | | min | -.171 | 4 | -.147 | 6 | -.041 | 4 | -1.842e-3 | 4 | -2.19e-3 | 1 | -1.647e-4 | 6 |
| 273 | N143 | max | .192 | 1 | -.1 | 2 | .066 | 3 | 1.912e-3 | 3 | 1.372e-3 | 5 | 5.056e-4 | 1 |
| 274 | | min | -.166 | 5 | -.147 | 6 | -.098 | 5 | -8.281e-4 | 5 | -2.863e-3 | 1 | -3.108e-4 | 6 |
| 275 | N144 | max | .251 | 1 | -.1 | 2 | .105 | 1 | 2.693e-6 | 6 | 1.575e-3 | 4 | 2.856e-4 | 4 |
| 276 | | min | -.159 | 5 | -.147 | 6 | -.007 | 6 | -1.491e-3 | 1 | -2.19e-3 | 1 | -9.697e-4 | 3 |
| 277 | N145 | max | .235 | 1 | -.1 | 2 | .023 | 4 | 4.037e-5 | 3 | 1.756e-3 | 4 | 8.977e-6 | 2 |
| 278 | | min | -.171 | 4 | -.142 | 4 | -.043 | 1 | -1.886e-3 | 4 | -2.172e-3 | 1 | -7.383e-4 | 6 |
| 279 | N146 | max | .195 | 1 | -.1 | 2 | .072 | 3 | 2.122e-3 | 3 | 1.987e-3 | 4 | 2.787e-4 | 2 |
| 280 | | min | -.162 | 5 | -.142 | 4 | -.066 | 2 | -6.819e-4 | 5 | -2.145e-3 | 2 | -7.046e-4 | 6 |
| 281 | N147 | max | .221 | 2 | -.1 | 2 | .1 | 4 | 3.954e-4 | 6 | 1.756e-3 | 4 | -2.766e-4 | 5 |
| 282 | | min | -.189 | 4 | -.142 | 4 | -.014 | 6 | -1.597e-3 | 1 | -2.172e-3 | 1 | -1.545e-3 | 3 |
| 283 | N148 | max | .234 | 1 | -.084 | 3 | .142 | 4 | -7.323e-4 | 3 | 2.59e-3 | 5 | 3.925e-4 | 2 |
| 284 | | min | -.171 | 4 | -.111 | 4 | -.211 | 1 | -2.851e-3 | 4 | -3.75e-3 | 1 | -5.747e-4 | 6 |
| 285 | N149 | max | .19 | 1 | -.084 | 3 | .088 | 4 | 2.546e-3 | 3 | 2.163e-3 | 5 | 7.072e-4 | 2 |
| 286 | | min | -.16 | 5 | -.111 | 4 | -.212 | 2 | -6.335e-4 | 5 | -4.266e-3 | 1 | -1.062e-3 | 6 |
| 287 | N150 | max | .239 | 2 | -.084 | 3 | .266 | 4 | -5.211e-5 | 6 | 2.59e-3 | 5 | 2.076e-5 | 2 |
| 288 | | min | -.186 | 4 | -.111 | 4 | -.121 | 2 | -2.478e-3 | 4 | -3.75e-3 | 1 | -1.237e-3 | 3 |
| 289 | N151 | max | .202 | 1 | -.095 | 2 | .165 | 4 | 1.303e-3 | 3 | 2.527e-3 | 4 | 3.e-3 | 3 |
| 290 | | min | -.148 | 4 | -.119 | 4 | -.241 | 1 | -6.942e-4 | 5 | -3.444e-3 | 1 | 2.153e-3 | 5 |
| 291 | N152 | max | .141 | 1 | -.095 | 2 | .091 | 4 | 1.501e-3 | 3 | 2.564e-3 | 4 | 1.34e-3 | 2 |
| 292 | | min | -.144 | 5 | -.12 | 4 | -.247 | 2 | -1.703e-3 | 5 | -2.834e-3 | 2 | -1.401e-3 | 6 |
| 293 | N153 | max | .334 | 1 | -.095 | 2 | .183 | 5 | 1.983e-3 | 6 | 2.527e-3 | 4 | 2.973e-3 | 3 |

## *Envelope Joint Displacements (Continued)*

| | Joint | | X [in] | LC | Y [in] | LC | Z [in] | LC | X Rotation [... | LC | Y Rotation [... | LC | Z Rotation [... | LC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 294 | | min | -.044 | 5 | -.119 | 4 | -.243 | 1 | -3.009e-4 | 5 | -3.444e-3 | 1 | 2.147e-3 | 5 |
| 295 | N154 | max | .033 | 1 | -.097 | 5 | .165 | 4 | 1.362e-3 | 3 | 1.537e-3 | 4 | 2.923e-3 | 3 |
| 296 | | min | -.03 | 4 | -.191 | 3 | -.241 | 1 | -2.955e-4 | 5 | -2.577e-3 | 1 | 1.467e-3 | 5 |
| 297 | N155 | max | -.021 | 6 | -.097 | 5 | .101 | 4 | 1.092e-3 | 3 | 1.678e-3 | 5 | 1.403e-3 | 3 |
| 298 | | min | -.095 | 3 | -.191 | 3 | -.249 | 2 | -7.781e-4 | 5 | -3.018e-3 | 1 | -1.601e-4 | 6 |
| 299 | N156 | max | .116 | 1 | -.097 | 5 | .165 | 5 | 2.184e-3 | 6 | 1.537e-3 | 4 | 2.13e-3 | 6 |
| 300 | | min | .04 | 5 | -.191 | 3 | -.249 | 1 | -1.206e-5 | 2 | -2.577e-3 | 1 | 1.255e-3 | 2 |
| 301 | N157 | max | .025 | 5 | -.083 | 5 | .166 | 4 | 4.122e-4 | 3 | 1.607e-3 | 4 | 3.742e-3 | 3 |
| 302 | | min | -.063 | 1 | -.226 | 3 | -.241 | 1 | -1.09e-3 | 4 | -2.309e-3 | 1 | 5.118e-4 | 5 |
| 303 | N158 | max | .044 | 5 | -.084 | 5 | .103 | 4 | 9.885e-4 | 3 | 2.465e-3 | 4 | 1.925e-3 | 2 |
| 304 | | min | -.162 | 1 | -.226 | 3 | -.251 | 2 | -5.357e-4 | 5 | -2.749e-3 | 2 | -6.984e-4 | 4 |
| 305 | N159 | max | .136 | 6 | -.083 | 5 | .205 | 4 | 1.18e-3 | 6 | 1.607e-3 | 4 | 2.88e-3 | 6 |
| 306 | | min | -.022 | 2 | -.226 | 3 | -.223 | 2 | -7.173e-4 | 4 | -2.309e-3 | 1 | 5.115e-4 | 5 |
| 307 | N160 | max | .145 | 4 | -.055 | 5 | .166 | 4 | 1.664e-3 | 3 | 2.622e-3 | 4 | 3.387e-3 | 3 |
| 308 | | min | -.24 | 1 | -.248 | 3 | -.242 | 1 | 3.464e-4 | 2 | -5.121e-3 | 1 | -3.511e-3 | 2 |
| 309 | N161 | max | .18 | 4 | -.055 | 5 | .075 | 4 | 8.721e-4 | 3 | 2.516e-3 | 5 | 4.533e-3 | 2 |
| 310 | | min | -.358 | 1 | -.249 | 3 | -.253 | 2 | -2.895e-3 | 5 | -4.741e-3 | 1 | -1.205e-3 | 4 |
| 311 | N162 | max | .179 | 4 | -.055 | 5 | -.082 | 6 | 7.937e-3 | 4 | 2.622e-3 | 4 | 3.224e-3 | 6 |
| 312 | | min | -.93 | 2 | -.249 | 3 | -.264 | 1 | 3.46e-4 | 2 | -5.121e-3 | 1 | -1.881e-2 | 2 |
| 313 | N163 | max | .191 | 5 | -.058 | 5 | .082 | 4 | -7.076e-5 | 2 | 2.336e-3 | 4 | 2.348e-3 | 2 |
| 314 | | min | -.325 | 1 | -.247 | 3 | -.217 | 2 | -3.051e-3 | 4 | -3.376e-3 | 2 | -9.208e-4 | 4 |
| 315 | N164 | max | .192 | 5 | -.091 | 2 | .044 | 3 | 4.548e-4 | 3 | 9.932e-4 | 5 | 7.078e-4 | 2 |
| 316 | | min | -.324 | 1 | -.253 | 3 | -.059 | 2 | -1.507e-3 | 5 | -2.87e-3 | 1 | -7.623e-4 | 4 |
| 317 | N165 | max | .192 | 5 | -.08 | 2 | .087 | 3 | 6.896e-4 | 3 | 2.195e-3 | 4 | 7.324e-4 | 1 |
| 318 | | min | -.324 | 1 | -.249 | 3 | -.066 | 5 | -1.627e-3 | 5 | -2.384e-3 | 2 | -3.959e-4 | 5 |
| 319 | N166 | max | .192 | 5 | -.048 | 2 | .206 | 1 | -3.479e-4 | 3 | 3.024e-3 | 5 | 3.136e-3 | 1 |
| 320 | | min | -.324 | 1 | -.222 | 6 | -.195 | 5 | -4.482e-3 | 4 | -3.815e-3 | 1 | -5.184e-4 | 5 |
| 321 | N167 | max | .191 | 5 | -.07 | 5 | .053 | 4 | 4.743e-4 | 2 | 2.815e-3 | 4 | 6.918e-4 | 2 |
| 322 | | min | -.325 | 1 | -.243 | 3 | -.176 | 2 | -1.605e-3 | 4 | -3.57e-3 | 2 | -1.205e-3 | 4 |
| 323 | N168 | max | .192 | 5 | -.075 | 2 | .161 | 1 | -1.015e-4 | 3 | 2.466e-3 | 4 | 1.894e-3 | 1 |
| 324 | | min | -.324 | 1 | -.232 | 3 | -.162 | 5 | -1.299e-3 | 4 | -3.416e-3 | 1 | 9.09e-4 | 6 |
| 325 | N169 | max | .176 | 4 | -.048 | 2 | .229 | 1 | 1.248e-4 | 3 | 2.915e-3 | 4 | 3.479e-3 | 1 |
| 326 | | min | -.301 | 1 | -.215 | 6 | -.211 | 5 | -1.958e-3 | 5 | -3.984e-3 | 2 | 1.006e-3 | 5 |
| 327 | N170 | max | .086 | 4 | -.097 | 2 | .229 | 1 | 2.874e-4 | 3 | 1.482e-3 | 5 | 2.152e-3 | 1 |
| 328 | | min | -.111 | 2 | -.231 | 6 | -.211 | 5 | -7.045e-4 | 2 | -3.821e-3 | 1 | -5.148e-5 | 5 |
| 329 | N171 | max | .05 | 6 | -.123 | 2 | .229 | 1 | 4.367e-4 | 3 | 2.486e-3 | 4 | 8.995e-4 | 2 |
| 330 | | min | -.008 | 5 | -.222 | 6 | -.211 | 5 | -3.538e-4 | 2 | -2.526e-3 | 2 | -6.528e-4 | 6 |
| 331 | N172 | max | .172 | 1 | -.098 | 5 | .229 | 1 | 9.029e-4 | 3 | 2.441e-3 | 5 | 4.241e-3 | 1 |
| 332 | | min | -.139 | 5 | -.18 | 6 | -.211 | 5 | -1.631e-3 | 5 | -2.926e-3 | 1 | 1.13e-4 | 6 |
| 333 | N173 | max | .143 | 5 | -.059 | 2 | .229 | 1 | -1.015e-4 | 3 | 2.466e-3 | 4 | 1.894e-3 | 1 |
| 334 | | min | -.256 | 1 | -.224 | 6 | -.211 | 5 | -1.299e-3 | 4 | -3.416e-3 | 1 | 9.09e-4 | 6 |
| 335 | N174 | max | .135 | 1 | -.091 | 5 | .229 | 1 | 2.062e-3 | 3 | 2.849e-3 | 4 | 8.385e-4 | 1 |
| 336 | | min | -.109 | 5 | -.187 | 6 | -.211 | 5 | 2.499e-4 | 5 | -3.218e-3 | 2 | -4.877e-4 | 6 |
| 337 | N175 | max | .198 | 1 | -.072 | 2 | .202 | 1 | 2.096e-3 | 3 | 2.946e-3 | 4 | 1.762e-3 | 1 |
| 338 | | min | -.165 | 5 | -.149 | 6 | -.19 | 5 | -1.233e-4 | 5 | -3.132e-3 | 2 | -1.028e-4 | 6 |
| 339 | N176 | max | .198 | 1 | -.1 | 2 | .045 | 1 | 1.912e-3 | 3 | 1.372e-3 | 5 | 4.998e-4 | 1 |
| 340 | | min | -.165 | 5 | -.147 | 6 | -.088 | 5 | -8.222e-4 | 5 | -2.863e-3 | 1 | -3.108e-4 | 6 |
| 341 | N177 | max | .197 | 1 | -.1 | 2 | .046 | 3 | 2.122e-3 | 3 | 1.987e-3 | 4 | 2.729e-4 | 2 |
| 342 | | min | -.165 | 5 | -.142 | 4 | -.066 | 2 | -6.761e-4 | 5 | -2.145e-3 | 2 | -7.046e-4 | 6 |
| 343 | N178 | max | .197 | 1 | -.084 | 3 | .092 | 4 | 2.546e-3 | 3 | 2.163e-3 | 5 | 7.014e-4 | 2 |
| 344 | | min | -.165 | 5 | -.111 | 4 | -.218 | 2 | -6.276e-4 | 5 | -4.266e-3 | 1 | -1.062e-3 | 6 |
| 345 | N179 | max | .198 | 1 | -.09 | 2 | .166 | 1 | 2.062e-3 | 3 | 2.849e-3 | 4 | 8.385e-4 | 1 |

## Envelope Joint Displacements (Continued)

| | Joint | | X [in] | LC | Y [in] | LC | Z [in] | LC | X Rotation [... | LC | Y Rotation [... | LC | Z Rotation [... | LC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 346 | | min | -.165 | 5 | -.148 | 6 | -.156 | 5 | 2.499e-4 | 5 | -3.218e-3 | 2 | -4.877e-4 | 6 |
| 347 | N180 | max | .197 | 1 | -.087 | 2 | .067 | 4 | 2.347e-3 | 3 | 2.122e-3 | 5 | 2.327e-4 | 2 |
| 348 | | min | -.165 | 5 | -.119 | 4 | -.168 | 2 | -1.013e-4 | 5 | -4.048e-3 | 1 | -6.683e-4 | 6 |
| 349 | N181 | max | .154 | 1 | -.095 | 2 | .109 | 4 | 1.501e-3 | 3 | 2.564e-3 | 4 | 1.066e-3 | 2 |
| 350 | | min | -.152 | 4 | -.12 | 4 | -.247 | 2 | -1.513e-3 | 5 | -2.834e-3 | 2 | -1.4e-3 | 6 |
| 351 | N182 | max | -.011 | 2 | -.097 | 5 | .109 | 4 | 1.092e-3 | 3 | 1.678e-3 | 5 | 1.388e-3 | 3 |
| 352 | | min | -.078 | 3 | -.191 | 3 | -.247 | 2 | -7.723e-4 | 5 | -3.018e-3 | 1 | -1.601e-4 | 6 |
| 353 | N183 | max | .036 | 5 | -.084 | 5 | .109 | 4 | 9.885e-4 | 3 | 2.465e-3 | 4 | 1.919e-3 | 2 |
| 354 | | min | -.139 | 1 | -.226 | 3 | -.247 | 2 | -5.299e-4 | 5 | -2.749e-3 | 2 | -6.984e-4 | 4 |
| 355 | N184 | max | .167 | 5 | -.055 | 5 | .109 | 4 | 8.718e-4 | 3 | 2.516e-3 | 5 | 4.22e-3 | 2 |
| 356 | | min | -.306 | 1 | -.249 | 3 | -.247 | 2 | -2.754e-3 | 5 | -4.741e-3 | 1 | -1.205e-3 | 4 |
| 357 | N185 | max | .117 | 1 | -.09 | 5 | .109 | 4 | 2.347e-3 | 3 | 2.122e-3 | 5 | 2.327e-4 | 2 |
| 358 | | min | -.123 | 5 | -.133 | 3 | -.247 | 2 | -1.013e-4 | 5 | -4.048e-3 | 1 | -6.683e-4 | 6 |
| 359 | N186 | max | .136 | 5 | -.079 | 5 | .109 | 4 | 4.743e-4 | 2 | 2.815e-3 | 4 | 6.918e-4 | 2 |
| 360 | | min | -.254 | 1 | -.242 | 3 | -.247 | 2 | -1.605e-3 | 4 | -3.57e-3 | 2 | -1.205e-3 | 4 |
| 361 | N187 | max | .064 | 1 | -.019 | 5 | .043 | 4 | 2.068e-3 | 5 | 2.263e-3 | 4 | 2.727e-3 | 4 |
| 362 | | min | -.044 | 4 | -.023 | 1 | -.064 | 1 | -3.605e-3 | 1 | -3.231e-3 | 1 | -2.976e-3 | 2 |

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

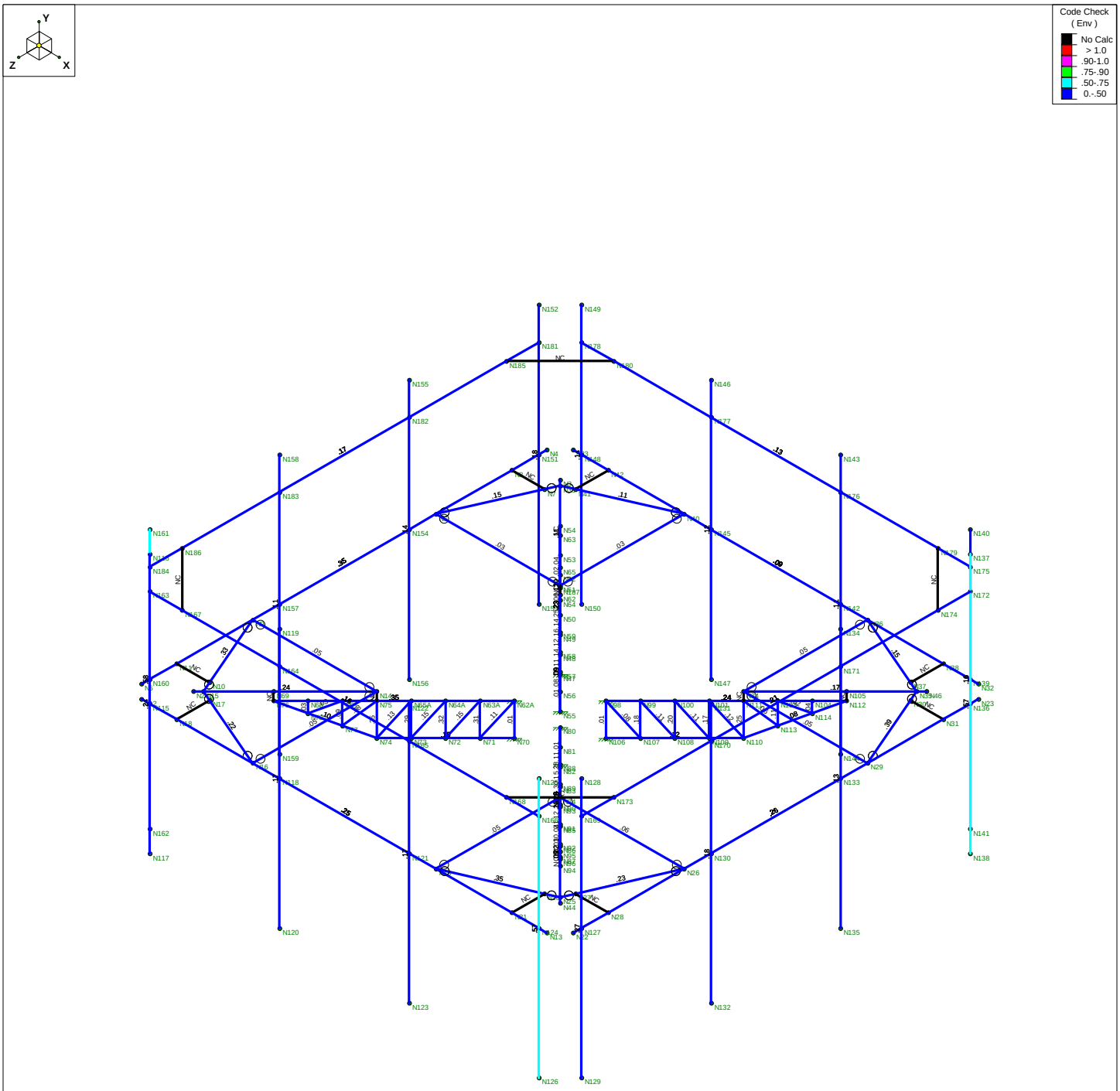
| | Member | Shape | Code Check | Loc[ft] | LC | Shear ... | Loc[ft] | Dir | LC | phi*Pnc ... | phi*Pnt [k] | phi*Mn y... | phi*Mn z... | Cb | Eqn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | M1 | PIPE_2.5 | .349 | 11.458 | 1 | .355 | 11.458 | | 1 | 14.559 | 50.715 | 3.596 | 3.596 | 3.... | H3-6 |
| 2 | M2 | L3X3X3 | .035 | 1.874 | 6 | .011 | 0 | y | 1 | 23.991 | 35.316 | 1.32 | 2.598 | 1.... | H2-1 |
| 3 | M3 | L3X3X3 | .152 | .334 | 6 | .091 | 0 | y | 1 | 27.173 | 35.316 | 1.32 | 2.833 | 1.... | H2-1 |
| 4 | M5 | L3X3X3 | .048 | 1.954 | 4 | .009 | 0 | y | 4 | 23.991 | 35.316 | 1.32 | 2.6 | 1.... | H2-1 |
| 5 | M6 | L3X3X3 | .331 | .334 | 1 | .200 | 0 | z | 2 | 27.173 | 35.316 | 1.32 | 2.833 | 1.... | H2-1 |
| 6 | M8 | PIPE_2.5 | .255 | 11.458 | 4 | .255 | 11.458 | | 3 | 14.559 | 50.715 | 3.596 | 3.596 | 2.... | H1-1b |
| 7 | M9 | L3X3X3 | .052 | 1.954 | 6 | .012 | 0 | y | 1 | 23.991 | 35.316 | 1.32 | 2.6 | 1.... | H2-1 |
| 8 | M10 | L3X3X3 | .219 | .334 | 6 | .107 | 0 | y | 3 | 27.173 | 35.316 | 1.32 | 2.833 | 1.... | H2-1 |
| 9 | M12 | L3X3X3 | .053 | 1.954 | 6 | .009 | 0 | y | 4 | 23.991 | 35.316 | 1.32 | 2.6 | 1.... | H2-1 |
| 10 | M13 | L3X3X3 | .348 | .334 | 4 | .244 | 0 | z | 4 | 27.173 | 35.316 | 1.32 | 2.833 | 4.... | H2-1 |
| 11 | M15 | PIPE_2.5 | .258 | 11.458 | 1 | .229 | 11.458 | | 6 | 14.559 | 50.715 | 3.596 | 3.596 | 2.... | H1-1b |
| 12 | M16 | L3X3X3 | .060 | 1.954 | 1 | .012 | 0 | y | 1 | 23.991 | 35.316 | 1.32 | 2.6 | 1.... | H2-1 |
| 13 | M17 | L3X3X3 | .231 | .334 | 3 | .090 | 0 | y | 3 | 27.173 | 35.316 | 1.32 | 2.833 | 1.... | H2-1 |
| 14 | M19 | L3X3X3 | .051 | 1.954 | 3 | .009 | 0 | y | 4 | 23.991 | 35.316 | 1.32 | 2.6 | 1.... | H2-1 |
| 15 | M20 | L3X3X3 | .394 | .334 | 1 | .189 | 0 | z | 1 | 27.173 | 35.316 | 1.32 | 2.833 | 4.... | H2-1 |
| 16 | M22 | PIPE_2.5 | .091 | 3.516 | 1 | .107 | 1.042 | | 1 | 14.559 | 50.715 | 3.596 | 3.596 | 2.... | H1-1b |
| 17 | M23 | L3X3X3 | .046 | 1.954 | 3 | .009 | 0 | y | 1 | 23.991 | 35.316 | 1.32 | 2.6 | 1.... | H2-1 |
| 18 | M24 | L3X3X3 | .147 | .334 | 3 | .112 | 0 | y | 1 | 27.173 | 35.316 | 1.32 | 2.833 | 1.... | H2-1 |
| 19 | M26 | L3X3X3 | .034 | 1.954 | 3 | .009 | 0 | y | 4 | 23.991 | 35.316 | 1.32 | 2.6 | 1.... | H2-1 |
| 20 | M27 | L3X3X3 | .108 | .334 | 6 | .070 | 0 | y | 4 | 27.173 | 35.316 | 1.32 | 2.833 | 4.... | H2-1 |
| 21 | M29 | HSS4X3X4 | .111 | 2.25 | 6 | .028 | 2.25 | z | 6 | 107.349 | 120.474 | 10.764 | 13.144 | 1.... | H1-1b |
| 22 | M30 | Cord Plate | .227 | 5.25 | 1 | .010 | 2.297 | y | 2 | 69.264 | 72.9 | 5.442 | 1.08 | 1.... | H1-1b |
| 23 | M31 | Cord Plate | .103 | 2.462 | 1 | .010 | 1.667 | y | 1 | 68.567 | 72.9 | 5.442 | 1.08 | 1.... | H1-1b |
| 24 | M32 | Cord Plate | .093 | 0 | 4 | .014 | .719 | y | 1 | 69.264 | 72.9 | 5.442 | 1.08 | 1.... | H1-1b |
| 25 | M33 | 1"x3/8" | .011 | 1 | 4 | .001 | 0 | y | 2 | 6.363 | 12.15 | .095 | .252 | 1 | H1-1b |
| 26 | M34 | 1"x3/8" | .122 | 1 | 6 | .021 | 1 | y | 2 | 6.363 | 12.15 | .095 | .253 | 2.... | H1-1b* |
| 27 | M35 | 1"x3/8" | .135 | 1 | 6 | .034 | 1 | y | 2 | 6.363 | 12.15 | .095 | .253 | 2.... | H1-1b* |
| 28 | M36 | 1"x3/8" | .160 | 1 | 1 | .041 | 1 | y | 1 | 6.363 | 12.15 | .095 | .253 | 2.... | H1-1b |
| 29 | M37 | 1"x3/8" | .253 | 1 | 1 | .048 | 1 | y | 1 | 6.363 | 12.15 | .095 | .253 | 2.... | H1-1b |
| 30 | M38 | 1"x3/8" | .117 | .667 | 1 | .029 | .667 | y | 1 | 9.114 | 12.15 | .095 | .253 | 2.... | H1-1b |

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

| | Member | Shape | Code Check | Loc[ft] | LC | Shear ... | Loc[ft] | Dir | LC | phi*Pnc ... | phi*Pnt [k] | phi*Mn y... | phi*Mn z... | Cb | Eqn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 31 | M39 | 1"x3/8" | .038 | .333 | 1 | .012 | .333 | y | 1 | 11.307 | 12.15 | .095 | .253 | 1... | H1-1b |
| 32 | M40 | 1"x3/8" | .076 | 1.25 | 1 | .012 | 0 | y | 1 | 4.413 | 12.15 | .095 | .253 | 1... | H1-1b |
| 33 | M41 | 1"x3/8" | .106 | 1.25 | 1 | .007 | 0 | y | 1 | 4.413 | 12.15 | .095 | .253 | 2... | H1-1b |
| 34 | M42 | 1"x3/8" | .119 | 1.25 | 1 | .009 | 0 | y | 1 | 4.413 | 12.15 | .095 | .253 | 2... | H1-1b |
| 35 | M43 | 1"x3/8" | .139 | 1.25 | 1 | .021 | 0 | y | 1 | 4.413 | 12.15 | .095 | .253 | 2... | H1-1b |
| 36 | M44 | 1"x3/8" | .059 | 1.003 | 1 | .006 | 0 | y | 6 | 6.335 | 12.15 | .095 | .253 | 2... | H1-1b |
| 37 | M45 | 1"x3/8" | .016 | 0 | 4 | .010 | .821 | y | 1 | 7.859 | 12.15 | .095 | .253 | 1... | H1-1b |
| 38 | M48 | HSS4X3X4 | .235 | 2.25 | 3 | .058 | 2.25 | z | 3 | 107.349 | 120.474 | 10.764 | 13.144 | 1... | H1-1b |
| 39 | M49 | Cord Plate | .354 | 5.25 | 1 | .017 | 2.297 | z | 1 | 69.264 | 72.9 | 5.442 | 1.08 | 1... | H1-1b |
| 40 | M50 | Cord Plate | .097 | 0 | 3 | .008 | 1.667 | y | 4 | 68.567 | 72.9 | 5.442 | 1.08 | 1... | H1-1b |
| 41 | M51 | Cord Plate | .149 | 2.25 | 3 | .017 | .75 | y | 1 | 69.264 | 72.9 | 5.442 | 1.08 | 1... | H1-1b* |
| 42 | M52 | 1"x3/8" | .011 | 1 | 4 | .001 | 0 | y | 2 | 6.363 | 12.15 | .095 | .252 | 1 | H1-1b |
| 43 | M53 | 1"x3/8" | .305 | 0 | 3 | .032 | 0 | y | 1 | 6.363 | 12.15 | .095 | .253 | 2... | H1-1a |
| 44 | M54 | 1"x3/8" | .325 | 0 | 3 | .045 | 0 | y | 1 | 6.363 | 12.15 | .095 | .253 | 2... | H1-1a |
| 45 | M55 | 1"x3/8" | .292 | 1 | 3 | .048 | 0 | y | 1 | 6.363 | 12.15 | .095 | .253 | 2... | H1-1a |
| 46 | M56 | 1"x3/8" | .248 | 1 | 1 | .050 | 0 | y | 1 | 6.363 | 12.15 | .095 | .253 | 2... | H1-1b |
| 47 | M57 | 1"x3/8" | .094 | .667 | 2 | .027 | 0 | y | 2 | 9.114 | 12.15 | .095 | .253 | 2... | H1-1b |
| 48 | M58 | 1"x3/8" | .033 | .333 | 1 | .016 | 0 | y | 2 | 11.307 | 12.15 | .095 | .253 | 2... | H1-1b |
| 49 | M59 | 1"x3/8" | .107 | 1.25 | 6 | .015 | 0 | y | 2 | 4.413 | 12.15 | .095 | .253 | 1... | H1-1b |
| 50 | M60 | 1"x3/8" | .147 | 1.25 | 6 | .008 | 0 | y | 1 | 4.413 | 12.15 | .095 | .253 | 2... | H1-1b |
| 51 | M61 | 1"x3/8" | .149 | 1.25 | 6 | .008 | 1.25 | y | 4 | 4.413 | 12.15 | .095 | .253 | 2... | H1-1b |
| 52 | M62 | 1"x3/8" | .131 | 1.25 | 4 | .017 | 1.25 | y | 4 | 4.413 | 12.15 | .095 | .253 | 2... | H1-1b |
| 53 | M63 | 1"x3/8" | .076 | 0 | 1 | .009 | 0 | y | 1 | 6.335 | 12.15 | .095 | .253 | 2... | H1-1b |
| 54 | M64 | 1"x3/8" | .029 | 0 | 3 | .008 | 0 | y | 4 | 7.859 | 12.15 | .095 | .253 | 1... | H1-1b |
| 55 | M67 | HSS4X3X4 | .219 | 2.25 | 6 | .055 | 2.25 | z | 3 | 107.349 | 120.474 | 10.764 | 13.144 | 1... | H1-1b |
| 56 | M68 | Cord Plate | .280 | 5.25 | 1 | .015 | 2.953 | z | 1 | 69.264 | 72.9 | 5.442 | 1.08 | 1... | H1-1b |
| 57 | M69 | Cord Plate | .094 | 0 | 3 | .008 | 1.667 | y | 1 | 68.567 | 72.9 | 5.442 | 1.08 | 1... | H1-1b |
| 58 | M70 | Cord Plate | .134 | 3 | 6 | .013 | .75 | y | 1 | 69.264 | 72.9 | 5.442 | 1.08 | 1... | H1-1b* |
| 59 | M71 | 1"x3/8" | .011 | 1 | 4 | .001 | 0 | y | 2 | 6.363 | 12.15 | .095 | .252 | 1 | H1-1b |
| 60 | M72 | 1"x3/8" | .282 | 0 | 6 | .025 | 0 | y | 2 | 6.363 | 12.15 | .095 | .253 | 2... | H1-1a |
| 61 | M73 | 1"x3/8" | .302 | 1 | 6 | .037 | 0 | y | 1 | 6.363 | 12.15 | .095 | .253 | 2... | H1-1a |
| 62 | M74 | 1"x3/8" | .277 | 1 | 6 | .041 | 0 | y | 1 | 6.363 | 12.15 | .095 | .253 | 2... | H1-1a |
| 63 | M75 | 1"x3/8" | .214 | 1 | 1 | .045 | 0 | y | 1 | 6.363 | 12.15 | .095 | .253 | 2... | H1-1b |
| 64 | M76 | 1"x3/8" | .097 | .667 | 1 | .027 | 0 | y | 1 | 9.114 | 12.15 | .095 | .253 | 2... | H1-1b |
| 65 | M77 | 1"x3/8" | .035 | .333 | 1 | .015 | 0 | y | 1 | 11.307 | 12.15 | .095 | .253 | 1... | H1-1b |
| 66 | M78 | 1"x3/8" | .108 | 1.25 | 3 | .018 | 1.25 | y | 1 | 4.413 | 12.15 | .095 | .253 | 1... | H1-1b |
| 67 | M79 | 1"x3/8" | .148 | 1.25 | 3 | .010 | 1.25 | y | 1 | 4.413 | 12.15 | .095 | .253 | 2... | H1-1b |
| 68 | M80 | 1"x3/8" | .148 | 1.25 | 3 | .008 | 1.25 | y | 1 | 4.413 | 12.15 | .095 | .253 | 2... | H1-1b |
| 69 | M81 | 1"x3/8" | .117 | 1.25 | 3 | .015 | 1.25 | y | 1 | 4.413 | 12.15 | .095 | .253 | 2... | H1-1b |
| 70 | M82 | 1"x3/8" | .043 | 0 | 2 | .008 | 0 | y | 5 | 6.335 | 12.15 | .095 | .253 | 2... | H1-1b |
| 71 | M83 | 1"x3/8" | .026 | 0 | 6 | .006 | 0 | y | 1 | 7.859 | 12.15 | .095 | .253 | 2... | H1-1b |
| 72 | M86 | HSS4X3X4 | .169 | 2.25 | 6 | .043 | 2.25 | z | 6 | 107.349 | 120.474 | 10.764 | 13.144 | 1... | H1-1b |
| 73 | M87 | Cord Plate | .243 | 5.25 | 4 | .010 | 2.953 | z | 5 | 69.264 | 72.9 | 5.442 | 1.08 | 1... | H1-1b |
| 74 | M88 | Cord Plate | .078 | 2.462 | 4 | .009 | 1.641 | y | 1 | 68.567 | 72.9 | 5.442 | 1.08 | 1... | H1-1b |
| 75 | M89 | Cord Plate | .119 | 3 | 4 | .016 | .75 | y | 1 | 69.264 | 72.9 | 5.442 | 1.08 | 1... | H1-1b |
| 76 | M90 | 1"x3/8" | .011 | 1 | 4 | .001 | 0 | y | 2 | 6.363 | 12.15 | .095 | .252 | 1 | H1-1b |
| 77 | M91 | 1"x3/8" | .176 | 1 | 6 | .020 | 1 | y | 1 | 6.363 | 12.15 | .095 | .253 | 2... | H1-1b* |
| 78 | M92 | 1"x3/8" | .197 | 1 | 6 | .030 | 1 | y | 1 | 6.363 | 12.15 | .095 | .253 | 2... | H1-1b* |
| 79 | M93 | 1"x3/8" | .174 | 1 | 6 | .038 | 1 | y | 1 | 6.363 | 12.15 | .095 | .253 | 2... | H1-1b* |
| 80 | M94 | 1"x3/8" | .246 | 1 | 1 | .047 | 1 | y | 1 | 6.363 | 12.15 | .095 | .253 | 2... | H1-1b |
| 81 | M95 | 1"x3/8" | .108 | .667 | 2 | .026 | .667 | y | 2 | 9.114 | 12.15 | .095 | .253 | 2... | H1-1b |
| 82 | M96 | 1"x3/8" | .039 | .333 | 1 | .010 | .333 | y | 1 | 11.307 | 12.15 | .095 | .253 | 1... | H1-1b |

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

| | Member | Shape | Code Check | Loc[ft] | LC | Shear ... | Loc[ft] | Dir | LC | phi*Pnc ... | phi*Pnt [k] | phi*Mn y... | phi*Mn z... | Cb | Eqn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 83 | M97 | 1"x3/8" | .084 | 1.25 | 6 | .014 | 0 | y | 4 | 4.413 | 12.15 | .095 | .253 | 1.... | H1-1b |
| 84 | M98 | 1"x3/8" | .115 | 1.25 | 6 | .009 | 0 | y | 4 | 4.413 | 12.15 | .095 | .253 | 2.... | H1-1b |
| 85 | M99 | 1"x3/8" | .113 | 1.25 | 6 | .012 | 1.25 | y | 1 | 4.413 | 12.15 | .095 | .253 | 2.... | H1-1b |
| 86 | M100 | 1"x3/8" | .119 | 1.25 | 1 | .025 | 1.25 | y | 1 | 4.413 | 12.15 | .095 | .253 | 1.... | H1-1b |
| 87 | M101 | 1"x3/8" | .059 | 0 | 4 | .010 | 0 | y | 1 | 6.335 | 12.15 | .095 | .253 | 2.... | H1-1b |
| 88 | M102 | 1"x3/8" | .019 | .821 | 1 | .012 | 0 | y | 1 | 7.859 | 12.15 | .095 | .253 | 1.... | H1-1b |
| 89 | M105 | PIPE_2.0 | .243 | 4 | 6 | .040 | 4 | | 3 | 14.916 | 32.13 | 1.872 | 1.872 | 2.... | H1-1b |
| 90 | M106 | PIPE_2.0 | .171 | 4 | 1 | .034 | 4 | | 3 | 14.916 | 32.13 | 1.872 | 1.872 | 1.... | H1-1b |
| 91 | M107 | PIPE_2.0 | .168 | 4 | 6 | .025 | 4 | | 6 | 14.916 | 32.13 | 1.872 | 1.872 | 1.... | H1-1b |
| 92 | M108 | PIPE_2.5 | .569 | 4 | 5 | .066 | 1 | | 4 | 30.038 | 50.715 | 3.596 | 3.596 | 1.... | H1-1b |
| 93 | M109 | PIPE_2.0 | .270 | 4 | 3 | .039 | 1 | | 3 | 14.916 | 32.13 | 1.872 | 1.872 | 1.... | H1-1b |
| 94 | M110 | PIPE_2.0 | .183 | 4 | 3 | .043 | 4 | | 1 | 14.916 | 32.13 | 1.872 | 1.872 | 1.... | H1-1b |
| 95 | M111 | PIPE_2.0 | .133 | 4 | 4 | .028 | 4 | | 4 | 14.916 | 32.13 | 1.872 | 1.872 | 1.... | H1-1b |
| 96 | M112 | PIPE_2.5 | .571 | 4 | 2 | .056 | 1 | | 1 | 30.038 | 50.715 | 3.596 | 3.596 | 1.... | H1-1b |
| 97 | M113 | PIPE_2.0 | .157 | 4 | 1 | .024 | 4 | | 1 | 14.916 | 32.13 | 1.872 | 1.872 | 1.... | H1-1b |
| 98 | M114 | PIPE_2.0 | .112 | 4 | 1 | .023 | 4 | | 1 | 14.916 | 32.13 | 1.872 | 1.872 | 1.... | H1-1b |
| 99 | M115 | PIPE_2.0 | .121 | 4 | 1 | .023 | 4 | | 3 | 14.916 | 32.13 | 1.872 | 1.872 | 1.... | H1-1b |
| 100 | M116 | PIPE_2.0 | .143 | 4 | 3 | .030 | 4 | | 3 | 14.916 | 32.13 | 1.872 | 1.872 | 1.5 | H1-1b |
| 101 | M117 | PIPE_2.0 | .181 | 4 | 6 | .035 | 4 | | 1 | 14.916 | 32.13 | 1.872 | 1.872 | 1.... | H1-1b |
| 102 | M118 | PIPE_2.0 | .141 | 4 | 4 | .029 | 4 | | 6 | 14.916 | 32.13 | 1.872 | 1.872 | 1.... | H1-1b |
| 103 | M119 | PIPE_2.0 | .107 | 1 | 5 | .029 | 4 | | 4 | 14.916 | 32.13 | 1.872 | 1.872 | 1.... | H1-1b |
| 104 | M120 | PIPE_2.5 | .576 | 4 | 1 | .049 | 1 | | 2 | 30.038 | 50.715 | 3.596 | 3.596 | 1.... | H1-1b |
| 105 | M121 | PIPE_2.0 | .156 | 11 | 4 | .210 | 11 | | 5 | 6.831 | 32.13 | 1.872 | 1.872 | 3.... | H1-1b |
| 106 | M122 | PIPE_2.0 | .209 | 11 | 1 | .230 | 11 | | 1 | 6.831 | 32.13 | 1.872 | 1.872 | 3.... | H1-1b |
| 107 | M123 | PIPE_2.0 | .129 | 1 | 1 | .050 | 0 | | 1 | 6.831 | 32.13 | 1.872 | 1.872 | 3.... | H1-1b |
| 108 | M124 | PIPE_2.0 | .171 | 11 | 1 | .241 | 12 | | 1 | 6.831 | 32.13 | 1.872 | 1.872 | 4.... | H1-1b |




Member Code Checks Displayed (Enveloped)
Envelope Only Solution

| | | |
|---|---|---|
| Centek | | |
| FJP | CTHA524A - Mount | May 4, 2020 at 6:33 PM |
| 19027.46 | Member Unity Check | CTHA524A_AMA.r3d |

# Exhibit D

## Letter of Authorization

MCM

KEEP YOUR SITES ON US®

March 9, 2020

**Connecticut Siting Council**
**10 Franklin Square**
**New Britain, CT 06051**

**Re: Letter of Authorization**
**Applicant: T-Mobile Northeast, LLC**
**Site Address: 1542 Boston Post Road, Westbrook, CT 06498**

To Whom it May Concern:

T-Mobile Northeast LLC is seeking to install an antenna facility at the above referenced location. MCM Holdings, LLC is the owner of the tower at the above referenced address, which was previously approved for construction by the CT Siting Council under docket #485.
Permission is hereby granted to T-Mobile Northeast LLC and its agents for the purpose of consummating any applications necessary to gain the required land use approvals or permits on the above-referenced structure from the CT Siting Council and/or Town of Westbrook.

Any fees or charges associated with all applications or permits, and any conditions placed on the Applicant shall be the responsibility of T-Mobile Northeast LLC, its subsidiaries and agents.

Sincerely,

By: _____

Name: Robert M. Stanford

Title: National Site Development Manager
Hereunto Duly Authorized

# Exhibit E

# Emissions Analysis Report

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: CTHA524A

CT Water Westbrook Watertank
1546 Boston Post Road
Westbrook, Connecticut 06498

**May 6, 2020**

**EBI Project Number: 6219001696**

| **Site Compliance Summary** | |
|---|---|
| Compliance Status: | **COMPLIANT** |
| Site total MPE% of FCC general population allowable limit: | **6.18%** |

21 B Street, Burlington, MA 01803 · Tel: (781) 273.2500 · Fax: (781) 273.3311

May 6, 2020

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

Emissions Analysis for Site: CTHA524A - CT Water Westbrook Watertank

EBI Consulting was directed to analyze the proposed T-Mobile facility located at **1546 Boston Post Road** in **Westbrook, 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 1546 Boston Post Road in Westbrook, 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 LTE channels (PCS Band - 1900 MHz) were considered for each sector of the proposed installation. These Channels have a transmit power of 60 Watts per Channel.

5) 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.

6) 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.

7) 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.

8) The antennas used in this modeling are the Ericsson AIR32 for the 1900 MHz / 1900 MHz / 2100 MHz channel(s), the RFS APXVAARR24_43-U-NA20 for the 600 MHz / 700 MHz channel(s) in Sector A, the Ericsson AIR32 for the 1900 MHz / 1900 MHz / 2100 MHz channel(s), the RFS APXVAARR24_43-U-NA20 for the 600 MHz / 700 MHz channel(s) in Sector B, the Ericsson AIR32 for the 1900 MHz / 1900 MHz / 2100 MHz channel(s), the RFS APXVAARR24_43-U-NA20 for the 600 MHz / 700 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.

9) The antenna mounting height centerline of the proposed antennas is 104 feet above ground level (AGL).

10) 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.

11) **No emissions for additional carriers were included because the site location is not in the Connecticut Siting Council active database.**

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 AIR32 | Make / Model: | Ericsson AIR32 | Make / Model: | Ericsson AIR32 |
| 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 / 15.85 dBd | Gain: | 15.35 dBd / 15.35 dBd / 15.85 dBd | Gain: | 15.35 dBd / 15.35 dBd / 15.85 dBd |
| Height (AGL): | 104 feet | Height (AGL): | 104 feet | Height (AGL): | 104 feet |
| Channel Count: | 8 | Channel Count: | 8 | Channel Count: | 8 |
| Total TX Power (W): | 360 Watts | Total TX Power (W): | 360 Watts | Total TX Power (W): | 360 Watts |
| ERP (W): | 12,841.53 | ERP (W): | 12,841.53 | ERP (W): | 12,841.53 |
| Antenna A1 MPE %: | **4.27%** | Antenna B1 MPE %: | **4.27%** | Antenna C1 MPE %: | **4.27%** |
| Antenna #: | 2 | Antenna #: | 2 | Antenna #: | 2 |
| 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): | 104 feet | Height (AGL): | 104 feet | Height (AGL): | 104 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 A2 MPE %: | **1.91%** | Antenna B2 MPE %: | **1.91%** | Antenna C2 MPE %: | **1.91%** |

| Site Composite MPE % | |
|---|---|
| **Carrier** | **MPE %** |
| T-Mobile (Max at Sector A): | 6.18% |
| **Site Total MPE % :** | 6.18% |

| | |
|---|---|
| T-Mobile Sector A Total: | 6.18% |
| T-Mobile Sector B Total: | 6.18% |
| T-Mobile Sector C Total: | 6.18% |
| | |
| Site Total: | 6.18% |

## 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 | 110.0 | 12.22 | 1900 MHz GSM | 1000 | 1.22% |
| T-Mobile 1900 MHz LTE | 2 | 2056.61 | 110.0 | 12.22 | 1900 MHz LTE | 1000 | 1.22% |
| T-Mobile 2100 MHz LTE | 2 | 2307.55 | 110.0 | 13.71 | 2100 MHz LTE | 1000 | 1.37% |
| T-Mobile 600 MHz LTE | 2 | 591.73 | 110.0 | 3.52 | 600 MHz LTE | 400 | 0.88% |
| T-Mobile 700 MHz LTE | 2 | 648.82 | 110.0 | 3.86 | 700 MHz LTE | 467 | 0.83% |
| | | | | | | **Total:** | **6.18%** |

## 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: | 6.18% |
| Sector B: | 6.18% |
| Sector C: | 6.18% |
| T-Mobile Maximum MPE % (Sector A): | 6.18% |
| | |
| Site Total: | 6.18% |
| | |
| Site Compliance Status: | **COMPLIANT** |

The anticipated composite MPE value for this site assuming all carriers present is **6.18%** 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.