NORTHEAST SITE SOLUTIONS
Turnkey Wireless Development

Northeast Site Solutions
Denise Sabo
199 Brickyard Rd Farmington, CT 06032
860-209-4690
denise@northeastsitesolutions.com

January 25, 2016

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

RE: Notice of Exempt Modification
2 Willruss Street, Pole 1102 Line 1880, Norwalk CT 06850
Latitude: 41.12576
Longitude: -73.43270
T-Mobile Site#: CT11356C_L700

Dear Ms. Bachman,

T-Mobile currently maintains six antennas at the 114-foot level of the existing 94-foot utility tower at 2 Willruss Street, Pole 1102 Line 1880, Norwalk CT 06850. The tower is owned by CL&P d/b/a Eversource Energy. The property is owned by CL&P d/b/a Eversource Energy. T-Mobile now intends to replace three (3) of its existing antennas with three (3) new 700 MHz antenna. The antenna would be installed at the 114-foot level of the tower. T-Mobile also intends to remove six (6) TMA, install three (3) Andrew ATSBT-BOTTOM-MF (Bias-T) at the 114-foot level and three (3) RRU on proposed post at ground level.

This facility was approved by the Council in Petition #734 on October 3, 2005. This approval included no site specific condition(s). See attached exhibit.

Please accept this letter as notification pursuant to Regulations of Connecticut State Agencies§ 16- SOj-73, for construction that constitutes an exempt modification pursuant to R.C.S.A. § 16-50j-72(b)(2). In accordance with R.C.SA. § 16-SOj-73, a copy of this letter is being sent to Brandon Robertson, Town Manager for the Town of Avon, as well as the property owner and the tower owner.

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

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

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

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

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

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

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

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

Sincerely,

Denise Sabo
Mobile: 860-209-4690
Fax: 413-521-0558
Office: 199 Brickyard Rd, Farmington, CT 06032
Email: denise@northeastsitesolutions.com

Attachments

cc: Harry W. Riling- Mayor - as elected official
CL&P d/b/a Eversource Energy - as tower owner
CL&P d/b/a Eversource Energy - as property owner

Exhibit A

EVERSOURCE ENERGY

56 Prospect Street,
Hartford, CT 06103

P.O. Box 270
Hartford, CT 06141-0270
(860) 665-5000

Jan 25, 2016

Mr. Mark Richard
T-Mobile
35 Griffin Rd.
Bloomfield, CT 06002

RE: T-Mobile Antenna Site, CT11356C, 2 Willruss St., Norwalk CT, structure 1102.

Dear Mr. Richard:

Based on our reviews of the site drawings, the structural analysis and foundation review provided by Paul J Ford & Co, along with a third party review performed by Commonwealth Associates we have reviewed for acceptance this modification.

Since there are no outstanding structural or site related issues to resolve at this time, construction at these locations may begin as soon as scheduling allows. You may contact Mr. O'Brien (860-665-6987); for lease requirements.

Sincerely,

Robert Gray
Transmission Line Engineering

Ref: 31215-0012.002_Structural Analysis Report_TMobile CT11356C.pdf
CT11356C-L700-CD-S&S-V3 (PJF .002).pdf

Exhibit B

STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL
10 Franklin Square
New Britain, Connecticut 06051
Phone: (860) 827-2935
Fax: (860) 827-2950

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

April 13, 2000

Christopher B. Fisher, Esq.
Cuddy & Feder & Worby LLP
90 Maple Avenue
White Plains, New York 10601-5196

RE: PETITION NO. 446 - Connecticut Light & Power Company petition for a declaratory ruling that no Certificate of Environmental Compatibility and Public Need is required for the modification of an existing Connecticut Light and Power electric transmission facility located off Will Russ Court in Norwalk, Connecticut.

Dear Attorney Fisher :

At a public meeting held on April 12, 2000, the Connecticut Siting Council (Council) considered and ruled that this proposal would not have a substantial adverse environmental effect, and pursuant to General Statutes § 16-50k would not require a Certificate of Environmental Compatibility and Public Need.

This decision is under the exclusive jurisdiction of the Council and is not applicable to any other modification or construction. All work is to be implemented as specified in the petition, dated February 24, and March 24, 2000.

Enclosed for your information is a copy of the staff report on this project.

Very truly yours,

Mortimer A. Gelston
Chairman

MAG/FOC

Enclosure: Staff Report dated April 12, 2000

C: Honorable Frank J. Esposito, Mayor, City of Norwalk
Dorian E. Hill, Manager of Transmission Engineering, CL&P

STATE OF CONNECTICUT

CONNECTICUT SITING COUNCIL

Ten Franklin Square
New Britain, Connecticut 06051
Phone: (860) 827-2935
Fax: (860) 827-2950

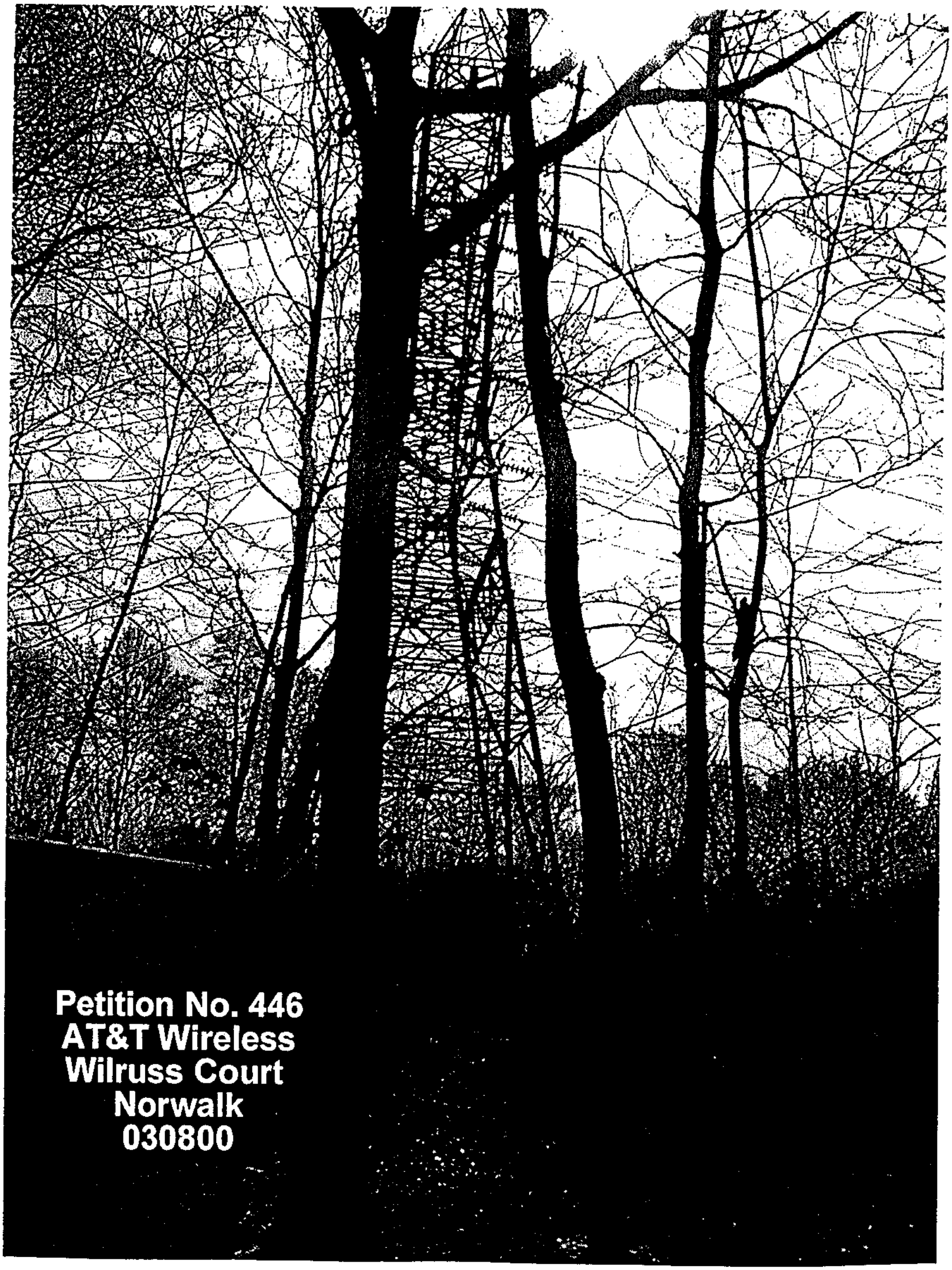
Petition No. 446
AT&T Wireless PCS, Inc.
Staff Report
April 12, 2000

On March 8, 2000, Connecticut Siting Council (Council) member Gerald J. Heffernan, and Fred Cunliffe of Council staff met AT&T Wireless PCS (AT&T) representatives Michael Murphy and Daniel Garber and Michael Austin of Pinnacle Site Development for inspection of a Connecticut Light & Power Company (CL&P) electric transmission line structure (no. 1102) located off Willruss Court in Norwalk. AT&T, with the agreement of CL&P, proposes to modify the transmission structure for telecommunications use and is petitioning the Council for a declaratory ruling that no Certificate of Environmental Compatibility and Public Need (Certificate) is required for the modification.

AT&T proposes to attach an 8.6-inch diameter pipe extending the existing structure height of 94 feet by 12 feet for a total height of 106 feet. AT&T proposes a low profile antenna cluster mount at the top of the pipe and placing associated equipment cabinets on a steel frame within the base of the existing structure. The proposed site is on property owned by CL&P within an urban setting consisting primarily of residential homes. Eight residences are within approximately 200 feet of the proposed site. Buffers of vegetation exist on both sides of the right-of-way.

Minor clearing of vegetation and debris is expected both for the site and to improve an existing access from Willruss Court to the structure. A 30 ft. by 40 ft., 8-foot high chain link fence would surround the structure. Utilities would be routed underground within the access drive approximately 100 feet from an existing utility pole to the site.

The worst case power density for the telecommunications operations at the site has been calculated to be less than 2.6% of the applicable standard for uncontrolled environments. AT&T contends that the proposed installation will not cause a substantial adverse environmental effect, and for this reason would not require a Certificate.



Petition No. 446
AT&T Wireless
Wilruss Court
Norwalk
030800

Exhibit C

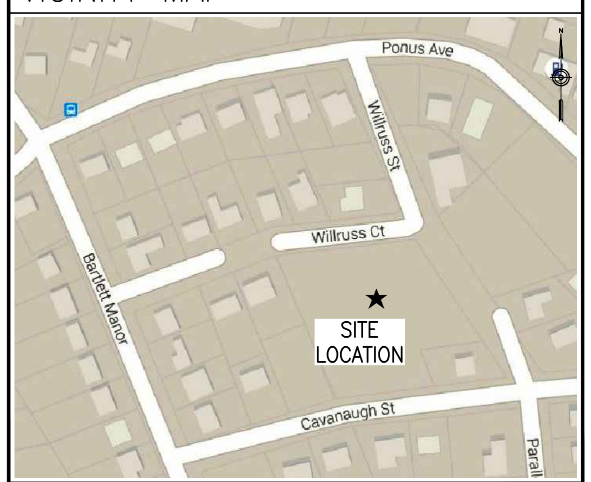
T-MOBILE NORTHEAST LLC

SITE #: CT11356C

SITE NAME: CT356/CL&P TOWER - RT.123

SITE ADDRESS:
2 WILLRUSS STREET POLE #1102 LINE # 1880
NORWALK, CT, 06850
WIRELESS BROADBAND FACILITY
CONSTRUCTION DRAWINGS
(704BU CONFIGURATION)

VICINITY MAP



DO NOT SCALE DRAWINGS

CONTRACTOR SHALL VERIFY PLANS AND EXISTING DIMENSIONS AND CONDITIONS ON THE JOB SITE AND SHALL IMMEDIATELY NOTIFY THE ARCHITECT IN WRITING OF ANY DISCREPANCIES BEFORE PROCEEDING WITH THE WORK OR BE RESPONSIBLE FOR SAME.

CALL BEFORE YOU DIG:

WWW.CBYD.COM

CALL 800 922 4455, OR 811

CALL THREE WORKING DAYS PRIOR TO DIGGING

SAFETY PRECAUTIONS SHALL BE IMPLEMENTED BY CONTRACTOR(S) AT ALL TRENCHING IN ACCORDANCE WITH CURRENT OSHA STANDARDS.

COLOR CODE FOR UTILITY LOCATIONS

ELECTRIC	– RED	SEWER	– GREEN
GAS/OIL	– YELLOW	SURVEY	– PINK
TEL/CATV	– ORANGE	PROPOSED EXCAVATION	– WHITE
WATER	– BLUE	RECLAIMED WATER	– PURPLE

GENERAL NOTES

1. THE CONTRACTOR SHALL GIVE ALL NOTICES AND COMPLY WITH ALL LAWS, ORDINANCES. RULES, REGULATIONS AND LAWFUL ORDERS OF ANY PUBLIC AUTHORITY, MUNICIPAL AND UTILITY COMPANY SPECIFICATIONS, AND LOCAL AND STATE JURISDICTIONAL CODES BEARING ON THE PERFORMANCE OF WORK. THE WORK PERFORMED ON THE PROJECT AND THE MATERIALS INSTALLED SHALL BE IN STRICT ACCORDANCE WITH ALL APPLICABLE CODES, REGULATIONS AND ORDINANCES.
2. THE ARCHITECT/ENGINEER HAVE MADE EVERY EFFORT TO SET FORTH IN THE CONSTRUCTION AND CONSTRUCT DOCUMENTS THE COMPLETE SCOPE OF WORK. THE CONTRACTOR BIDDING THE JOB IS NEVERTHELESS CAUTIONED THAT MINOR OMISSIONS OR ERRORS IN THE DRAWINGS AND OR SPECIFICATIONS SHALL NOT EXCUSE SAID CONTRACTOR FROM COMPLETING THE PROJECT AND IMPROVEMENTS IN ACCORDANCE WITH THE INTENT OF THESE DOCUMENTS.
3. THE CONTRACTOR OR BIDDER SHALL BEAR THE RESPONSIBILITY OF NOTIFYING (IN WRITING) THE T–MOBILE REPRESENTATIVE OF ANY CONFLICTS, ERRORS, OR OMISSIONS PRIOR TO THE SUBMISSION OF THE CONTRACTOR'S PROPOSAL OR PERFORMANCE OF WORK. IN THE EVENT OF DISCREPANCIES, THE CONTRACTOR SHALL PRICE THE MORE COSTLY OR EXPENSIVE WORK, UNLESS DIRECTED IN WRITING OTHERWISE.
4. THE SCOPE OF WORK SHALL INCLUDE FURNISHING OF ALL MATERIALS, EQUIPMENT, LABOR AND ALL OTHER MATERIALS AND LABOR DEEMED NECESSARY TO COMPLETE THE WORK/PROJECT AS DESCRIBED HEREIN.
5. THE CONTRACTOR SHALL VISIT THE JOB SITE PRIOR TO THE SUBMISSION OF BIDS OR PERFORMING WORK TO FAMILIARIZE HIMSELF WITH THE FIELD CONDITIONS AND TO VERIFY THAT THE PROJECT CAN BE CONSTRUCTED IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
6. THE CONTRACTOR SHALL OBTAIN AUTHORIZATION TO PROCEED WITH CONSTRUCTION PRIOR TO STARTING WORK ON ANY ITEM NOT CLEARLY DEFINED BY THE CONSTRUCTION DRAWINGS/CONTRACT DOCUMENTS.
7. THE CONTRACTOR SHALL INSTALL ALL EQUIPMENT AND MATERIALS ACCORDING TO THE MANUFACTURER'S/VENDOR'S SPECIFICATIONS UNLESS NOTED OTHERWISE OR WHERE LOCAL CODES OR ORDINANCES TAKE PRECEDENCE.
8. THE CONTRACTOR SHALL PROVIDE A FULL SET OF CONSTRUCTION DOCUMENTS AT THE SITE UPDATED WITH THE LATEST REVISIONS AND ADDENDUM OR CLARIFICATIONS AVAILABLE FOR THE USE BY ALL PERSONNEL INVOLVED WITH THE PROJECT.
9. THE CONTRACTOR SHALL SUPERVISE AND DIRECT THE PROJECT DESCRIBED HEREIN. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ALL CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES, AND PROCEDURES AND FOR COORDINATING ALL PORTIONS OF THE WORK UNDER CONTRACT.
10. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ANY PERMITS AND INSPECTIONS WHICH ARE REQUIRED FOR THE WORK BY THE ARCHITECT/ENGINEER, THE STATE, COUNTY, OR LOCAL GOVERNMENT AUTHORITY.
11. THE CONTRACTOR SHALL MAKE NECESSARY PROVISIONS TO PROTECT EXISTING IMPROVEMENTS, EASEMENTS, PAVING, CURBING, ETC., DURING CONSTRUCTION. UPON COMPLETION OF WORK, THE CONTRACTOR SHALL REPAIR ANY DAMAGE THAT MAY HAVE OCCURRED DUE TO CONSTRUCTION ON OR ABOUT THE PROPERTY.
12. THE CONTRACTOR SHALL KEEP THE GENERAL WORK AREA CLEAN AND HAZARD FREE DURING CONSTRUCTION AND DISPOSE OF ALL DIRT, DEBRIS, RUBBISH AND REMOVE EQUIPMENT NOT SPECIFIED AS REMAINING ON PROPERTY. PREMISES SHALL BE LEFT IN CLEAN CONDITION AND FREE FROM PAINT SPOTS, DUST, OR SMUDGES OF ANY NATURE.
13. THE CONTRACTOR SHALL COMPLY WITH ALL OSHA REQUIREMENTS, AS WELL AS THE LATEST EDITIONS OF ANY PERTINENT STATE SAFETY REGULATIONS.
14. THE CONTRACTOR SHALL NOTIFY THE T–MOBILE REPRESENTATIVE WHERE A CONFLICT OCCURS ON ANY OF THE CONTRACT DOCUMENTS. THE CONTRACTOR IS NOT TO ORDER MATERIAL OR CONSTRUCT ANY PORTION OF THE WORK THAT IS IN CONFLICT UNTIL CONFLICT IS RESOLVED BY THE T–MOBILE REPRESENTATIVE.
15. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, ELEVATIONS, PROPERTY LINES, ETC., ON THE JOB.
16. THE CONTRACTOR SHALL RETURN ALL DISTURBED AREAS TO THEIR ORIGINAL CONDITION AT THE COMPLETION OF WORK.
17. STRUCTURAL ANALYSIS PENDING

SITE INFORMATION

SITE NUMBER:	CT11356C
SITE NAME:	CT356/CL&P TOWER – RT.123
SITE ADDRESS:	2 WILLRUSS STREET POLE #1102 LINE # 1880 NORWALK, CT, 06850
LAT./LONG.:	N 41.12576 / W –73.4327
JURISDICTION:	FAIRFIELD COUNTY
PROPERTY OWNER:	HANK O'BRIEN, REAL ESTATE ANALYST, T&D ROW & SURVEY ENGINEERING, 860–665–6987 HENRY.OBRIEN@NU.COM 107 SELDEN STREET

CODE COMPLIANCE

CONNECTICUT STATE BUILDING CODE

2005 CONNECTICUT BUILDING CODE WITH 2013 AMENDMENT
2011 NATIONAL ELECTRICAL CODE

CONSTRUCTION TYPE: 2B USE GROUP: N/A

PROJECT SUB–CONTRACTORS

APPLICANT:	T–MOBILE NORTHEAST, LLC. 35 GRIFFIN ROAD SOUTH BLOOMFIELD, CT 06002 (860) 692–7100
PROJECT MANAGER	LISA LIN ALLEN NORTHEAST SITE SOLUTIONS 54 MAIN STREET STURBRIDGE, MA 01566 (508) 434–5237
ARCHITECT/ENGINEER:	ATLANTIS DESIGN GROUP INC. 286 OLD CONNECTICUT PATH, WAYLAND, MA 01778 (617)–852–3611

SHEET INDEX

SHEET	DESCRIPTION
T–1	TITLE SHEET
N–1	GENERAL AND ELECTRICAL NOTES
A–1	SITE PLAN AND ELEVATION
A–2	DETAILS
E–1	GROUNDING DIAGRAM
E–2	GROUNDING DETAILS

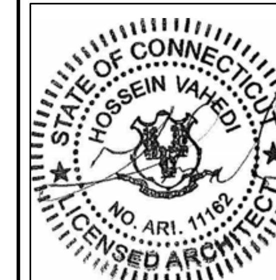
T-MOBILE NORTHEAST, LLC
35 GRIFFIN ROAD SOUTH
BLOOMFIELD, CT 06002
OFFICE: (860) 692-7100
FAX:(860) 692-7159

ATLANTIS DESIGN GROUP, INC.
286 Old Connecticut Path,
Wayland, MA 01778
Phone number: 617–852–3611
Fax Number : 781–742–2247

SUBMITTALS		
DATE	DESCRIPTION	REVISION
10/13/15	ISSUED FOR REVIEW	A
10/19/15	FINAL CD	0

DEPT.	DATE	APP'D	REVISIONS
RFE			
RF MAN.			
ZONING			
OPS			
CONSTR.			
SITE AC.			

PROJECT NO:	CT11356C
DRAWN BY:	MB
CHECKED BY:	KM



PROFESSIONAL SEAL

SITE NUMBER
CT11356C

SITE NAME
CT356/CL&P TOWER - RT.123

SITE ADDRESS
2 WILLRUSS STREET
POLE #1102 LINE # 1880
NORWALK, CT, 06850

SHEET TITLE
TITLE SHEET

SHEET NUMBER
T-1

ELECTRICAL NOTES:

WORK INCLUDED

1. INCLUDE ALL LABOR, MATERIALS, EQUIPMENT, PLANT SERVICES AND ADMINISTRATIVE TASKS REQUIRED TO COMPLETE AND MAKE OPERABLE THE ELECTRICAL WORK SHOWN ON THE DRAWINGS AND SPECIFIED HEREIN, INCLUDING BUT NOT LIMITED TO THE FOLLOWING:
   A. PREPARE AND SUBMIT SHOP DRAWINGS, DIAGRAMS AND ILLUSTRATIONS.
   B. PROCURE ALL NECESSARY PERMITS AND APPROVALS AND PAY ALL REQUIRED FEES AND CHARGES IN CONNECTION WITH THE WORK OF THIS CONTRACT.
   C. SUBMIT AS-BUILT DRAWINGS, OPERATING AND MAINTENANCE INSTRUCTIONS AND MANUALS.
   D. EXECUTE ALL CUTTING, DRILLING, ROUGH AND FINISH PATCHING OF EXISTING OR NEWLY INSTALLED CONSTRUCTION REQUIRED FOR THE WORK OF THIS CONTRACT. FOR SLAB PENETRATIONS THROUGH POST TENSION SLABS, X-RAY EXACT AREA OF PENETRATION PRIOR TO PERFORMING WORK. COORDINATE ALL X-RAY WORK WITH BUILDING ENGINEER.
   E. PROVIDE HANGERS, SUPPORTS, FOUNDATIONS, STRUCTURAL FRAMING SUPPORTS, AND BASES FOR CONDUIT AND EQUIPMENT PROVIDED OR INSTALLED UNDER THE WORK OF HIS CONTRACT. PROVIDE COUNTER FLASHING, SLEEVES AND SEALS FOR FLOOR AND WALL PENETRATIONS.
   F. MAINTAIN ALL EXISTING ELECTRICAL SERVICES IN THE BUILDING AREAS NOT AFFECTED BY THE ALTERATION DURING THE PROGRESS OF THE WORK INCLUDING PROVIDING ALL TEMPORARY JUMPERS, CONDUITS, CAPS, PROTECTIVE DEVICES, CONNECTIONS AND EQUIPMENT REQUIRED. PROVIDE TEMPORARY LIGHT AND POWER FOR CONSTRUCTION PURPOSES.
2. IT IS THE INTENT OF THESE DRAWINGS AND SPECIFICATIONS TO CALL FOR AN INSTALLATION THAT IS COMPLETE IN EVERY RESPECT. IT IS NOT THE INTENT TO GIVE EVERY DETAIL ON THE DRAWINGS AND IN THE SPECIFICATIONS. IF AN ITEM OF WORK IS INDICATED IN THE DRAWINGS, IT IS CONSIDERED SUFFICIENT FOR INCLUSION IN THE CONTRACT. FURNISH AND INSTALL ALL MATERIAL AND EQUIPMENT USUALLY FURNISHED OR NEEDED TO MAKE A COMPLETE INSTALLATION WHETHER OR NOT SPECIFICALLY MENTIONED IN THE CONTRACT DOCUMENTS.

GENERAL REQUIREMENTS

1. PROVIDE ALL WORK IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC) AND LOCAL AND STATE ELECTRICAL CODES.
2. THE ELECTRICAL PLANS ARE DIAGRAMMATIC ONLY. REFER TO THE ARCHITECTURAL PLANS FOR THE EXACT DIMENSIONS OF THE BUILDING.
3. LOAD CALCULATIONS ARE BASED ON EXISTING BUILDING INFORMATION/DRAWINGS PROVIDED TO ENGINEERING. CONTRACTOR IS TO VERIFY ALL EXISTING RATINGS AND LOADS PRIOR TO PURCHASING OF SPECIFIED EQUIPMENT FOR COMPLIANCE TO NEC. CONTRACTOR TO NOTIFY ENGINEER OF ANY DISCREPANCIES AND REQUEST FURTHER DIRECTION BY ENGINEER.
4. EXISTING BUILDING EQUIPMENT IS NOTED ON THE DRAWINGS. NEW OR RELOCATED EQUIPMENT IS SHOWN WITH SOLID LINES. FUTURE EQUIPMENT (NOT IN THIS CONTRACT) IS DEPICTED WITH SHADED LINES. REQUEST CLARIFICATION OF DRAWINGS OR OF SPECIFICATIONS PRIOR TO PRICING OR INSTALLATION.
5. GENERAL
   A. AFTER CAREFULLY STUDYING THE DRAWINGS AND SPECIFICATIONS, AND BEFORE SUBMITTING THE PROPOSAL, MAKE A MANDATORY SITE VISIT TO ASCERTAIN CONDITIONS OF THE SITE, AND THE NATURE AND EXACT QUANTITY OF WORK TO BE PERFORMED. NO EXTRA COMPENSATION WILL BE ALLOWED FOR FAILURE TO NOTIFY THE OWNER, IN WRITING, OF ANY DISCREPANCIES THAT MAY HAVE BEEN NOTED BETWEEN THE EXISTING CONDITIONS AND THE DRAWINGS AND SPECIFICATIONS.
   B. VERIFY ALL MEASUREMENTS AT THE SITE AND BE RESPONSIBLE FOR CORRECTNESS OF SAME.
6. QUALITY, WORKMANSHIP, MATERIALS AND SAFETY
   A. PROVIDE NEW MATERIALS AND EQUIPMENT OF A DOMESTIC MANUFACTURER BY THOSE REGULARLY ENGAGED IN THE PRODUCTION AND MANUFACTURE OF SPECIFIED MATERIALS AND EQUIPMENT. WHERE UL, OR OTHER AGENCY, HAS ESTABLISHED STANDARDS FOR MATERIALS, PROVIDE MATERIALS WHICH ARE LISTED AND LABELED ACCORDINGLY. THE COMMERCIALLY STANDARD ITEMS OF EQUIPMENT AND THE SPECIFIC NAMES MENTIONED HEREIN ARE INTENDED FOR THE PROPER FUNCTIONING OF THE WORK.
   B. WORK SHALL BE PERFORMED BY WORKMEN SKILLED IN THE TRADE REQUIRED FOR THE WORK. INSTALL MATERIALS AND EQUIPMENT TO PRESENT A NEAT APPEARANCE WHEN COMPLETED AND IN ACCORDANCE WITH THE APPROVED RECOMMENDATIONS OF THE MANUFACTURER AND IN ACCORDANCE WITH CONTRACT DOCUMENTS.
   C. PROVIDE LABOR, MATERIALS, APPARATUS AND APPLIANCES ESSENTIAL TO THE FUNCTIONING OF THE SYSTEMS DESCRIBED OR INDICATED HEREIN, OR WHICH MAY BE REASONABLY IMPLIED AS ESSENTIAL WHENEVER MENTIONED IN THE CONTRACT DOCUMENT OR NOT.
   D. MAKE WRITTEN REQUESTS FOR SUPPLEMENTARY INSTRUCTIONS TO ARCHITECT/ENGINEER IN CASE OF DOUBT AS TO WORK INTENDED OR IN EVENT OF NEED FOR EXPLANATION THEREOF.
   E. PERFORMANCE AND MATERIAL REQUIREMENTS SCHEDULED OR SPECIFIED ARE MINIMUM STANDARD ACCEPTABLE. THE RIGHT TO JUDGE THE QUALITY OF EQUIPMENT THAT DEVIATES FROM THE CONTRACT DOCUMENT REMAINS SOLELY WITH ARCHITECT/ENGINEER. CONTRACT DOCUMENT OR NOT.

GUARANTEE

1. GUARANTEE MATERIALS, PARTS AND LABOR FOR WORK FOR ONE YEAR FROM THE DATE OF ISSUANCE OF OCCUPANCY PERMIT. DURING THAT PERIOD, MAKE GOOD FAULTS OR IMPERFECTIONS THAT MAY ARISE DUE TO DEFECTS OR OMISSIONS IN MATERIALS OR WORKMANSHIP WITH NO ADDITIONAL COMPENSATION AND AS DIRECTED BY ARCHITECT.

CLEANING

1. REMOVE ALL CONSTRUCTION DEBRIS RESULTING FROM THE WORK.
2. CLEAN EQUIPMENT AND SYSTEMS FOLLOWING THE COMPLETION OF THE PROJECT TO THE SATISFACTION OF THE ENGINEER.

COORDINATION AND SUPERVISION

1. CAREFULLY LAY OUT ALL WORK IN ADVANCE TO AVOID UNNECESSARY CUTTING, CHANNELING, CHASING OR DRILLING OF FLOORS, WALLS, PARTITIONS, CEILINGS OR OTHER SURFACES. WHERE SUCH WORK IS NECESSARY, HOWEVER, PATCH AND REPAIR THE WORK IN AN APPROVED MANNER BY SKILLED MECHANICS AT NO ADDITIONAL COST TO THE OWNER. RENDER FULL COOPERATION TO OTHER TRADES WHERE WORK WILL BE INSTALLED IN CLOSE PROXIMITY TO WORK OF OTHER TRADES. ASSIST IN WORKING OUT SPACE CONDITIONS. IF WORK IS INSTALLED BEFORE COORDINATION WITH OTHER TRADES, OR CAUSES INTERFERENCE, MAKE CHANGES NECESSARY TO CORRECT CONDITIONS WITHOUT EXTRA CHARGE.

SUBMITTALS

1. AS-BUILT DRAWINGS:
   A. UPON COMPLETION OF THE WORK, FURNISH TO THE OWNER "AS-BUILT" DRAWINGS.
2. SERVICE MANUALS:
   A. UPON COMPLETION OF THE WORK, FULLY INSTRUCT T-MOBILE AS TO THE OPERATION AND MAINTENANCE OF ALL MATERIAL, EQUIPMENT AND SYSTEMS.
   B. PROVIDE 3 COMPLETE BOUND SETS OF INSTRUCTIONS FOR OPERATING AND MAINTAINING ALL SYSTEMS AND EQUIPMENT.

CUTTING AND PATCHING

1. PROVIDE ALL CUTTING, DRILLING, ROUGH AND FINISH PATCHING REQUIRED TO COMPLETE THE WORK.
2. OBTAIN OWNER APPROVAL PRIOR TO CUTTING THROUGH FLOORS OR WALLS FOR PIPING OR CONDUIT.

TESTS, INSPECTION AND APPROVAL

1. BEFORE ENERGIZING ANY ELECTRICAL INSTALLATION, INSPECT EACH UNIT IN DETAIL. TIGHTEN ALL BOLTS AND CONNECTIONS (TORQUE-TIGHTEN WHERE REQUIRED) AND DETERMINE THAT ALL COMPONENTS ARE ALIGNED, AND THE EQUIPMENT IS IN SAFE, OPERATIONAL CONDITION.
2. PROVIDE THE COMPLETE ELECTRICAL SYSTEM FREE OF GROUND FAULTS AND SHORT CIRCUITS SUCH THAT THE SYSTEM WILL OPERATE SATISFACTORILY UNDER FULL LOAD CONDITIONS, WITHOUT EXCESSIVE HEATING AT ANY POINT IN THE SYSTEM.

SPECIAL REQUIREMENTS

1. DO NOT LEAVE ANY WORK INCOMPLETE NOR ANY HAZARDOUS SITUATIONS CREATED WHICH WILL AFFECT THE LIFE OR SAFETY OF THE PUBLIC AND/OR BUILDING OCCUPANTS. DO NOT INTERFERE WITH OR CUTOFF ANY OF THE EXISTING SERVICES WITHOUT THE OWNER'S WRITTEN PERMISSION.
2. WHEN NECESSARY TO TEMPORARILY DISCONNECT ANY EXISTING BUILDING UTILITIES AND SERVICE SYSTEMS, INCLUDING FEEDER OR BRANCH CIRCUITING SUPPLYING EXISTING FACILITIES, CONFER WITH THE OWNER AND ARRANGE THE PERIOD OF INTERRUPTION FOR A TIME MUTUALLY AGREED UPON.
   SHUTDOWN NOTE: SCHEDULE AND NOTIFY OWNER 48 HOURS PRIOR TO SHUTDOWN. ALL SHUTDOWN WORK TO BE SCHEDULED AT A TIME CONVENIENT TO OWNER.

GROUNDING

1. ROUTE ALL GROUNDING CONDUCTORS AS SHOWN ON CONDUIT/GROUNDING RISER.
2. ROUTE 500 KCMIL CU. THHN CONDUCTOR FROM THE MGB LOCATION TO BUILDING STEEL. VERIFY BUILDING STEEL IS EFFECTIVELY GROUNDED PER NEC TO THE MAIN SERVICE GROUNDING ELECTRODE CONDUCTOR (GEC).
3. MAKE ALL GROUND CONNECTIONS FROM MGB TO ELECTRICAL EQUIPMENT WITH 2 HOLE, CRIMP TYPE, BURNDY COMPRESSION TERMINATIONS, SIZED AS REQUIRED.
4. USE 1 HOLE, CRIMP TYPE, BURNDY COMPRESSIONS TERMINATIONS, SIZED AS REQUIRED, AT EQUIPMENT GROUND CONNECTIONS.
5. HIRE AN INDEPENDENT LAB TO PERFORM THE SPECIFIED OHMS TESTING. PROVIDE 4 SETS OF THE CERTIFIED DOCUMENTS TO THE OWNER FOR VERIFICATION PRIOR TO THE PROJECT COMPLETION.

RACEWAYS

1. ALL WIRING TO BE INSTALLED IN CONDUIT SYSTEMS IN ACCORDANCE WITH THE FOLLOWING:
   A. EXTERIOR FEEDERS AND CONTROL, WHERE UNDERGROUND, TO BE IN SCH 40 PVC.
   B. EXTERIOR, ABOVE GROUND POWER CONDUITS TO BE GALVANIZED RIGID STEEL (RGS).
   C. ALL TELECOMMUNICATION CONDUITS, INTERIOR/EXTERIOR, TO BE EMT.
   D. INSTALL PULL ROPES IN ALL NEW EMPTY CONDUITS INSTALLED ON THIS PROJECT.
   E. ALL TELECOM CONDUITS AND PULL BOXES INSTALLED ON THIS PROJECT TO BE LABELED "T-MOBILE". OWNER WILL PROVIDE LABELS FOR CONTRACTOR TO INSTALL.
   F. INTERIOR FEEDERS TO BE INSTALLED IN E.M.T. WITH STEEL COMPRESSION FITTINGS.
   G. MINIMUM SIZE CONDUIT TO BE ¾" TRADE SIZE UNLESS OTHERWISE INDICATED ON THE DRAWINGS.
   H. FINAL CONNECTIONS TO MOTORS AND VIBRATING EQUIPMENT TO BE INSTALLED IN LIQUID-TIGHT FLEXIBLE METAL CONDUIT.
   I. CONDUIT TO BE RUN CONCEALED IN CEILINGS, FINISHED AREAS OR DRYWALL PARTITIONS, UNLESS OTHERWISE NOTED.
   J. THE ROUTING OF CONDUITS INDICATED ON THE DRAWINGS IS DIAGRAMMATIC. BEFORE INSTALLING ANY WORK, EXAMINE THE WORKING LAYOUTS AND SHOP DRAWINGS OF THE OTHER TRADES TO DETERMINE THE EXACT LOCATIONS AND CLEARANCES.
   K. ALL EXTERIOR MOUNTING HARDWARE TO BE GALVANIZED STEEL. COORDINATE WITH BUILDING ENGINEER PRIOR TO ATTACHING TO BUILDING STRUCTURE.

RACEWAYS CONT'D

   L. PENETRATIONS OF WALLS, FLOORS AND ROOFS, FOR THE PASSAGE OF ELECTRICAL RACEWAYS, TO BE PROPERLY SEALED AFTER INSTALLATION OF RACEWAYS SO AS TO MAINTAIN THE STRUCTURAL OR WATERPROOF INTEGRITY OF THE WALL, FLOOR OR ROOF SYSTEM TO BE PENETRATED. SEAL ALL CONDUIT PENETRATIONS THROUGH FIRE OR SMOKE RATED WALLS, CEILINGS OR SMOKE TIGHT CORRIDOR PARTITIONS TO MAINTAIN PROPER RATING OF WALL OR CEILING.
   M. PROVIDE ALL CONDUIT ENDS WITH INSULATED METALLIC GROUNDING BUSHINGS.
   N. CONDUIT TO BE SUPPORTED AT MAXIMUM DISTANCE OF 8'-0", OR AS REQUIRED BY NEC, IN HORIZONTAL AND VERTICAL DIRECTIONS.
   O. PROVIDE STAINLESS STEEL BLANK COVER PLATES FOR ALL JUNCTION BOXES AND/OR OUTLET BOXES NOT USED IN EXPOSED AREAS. PROVIDE ALL OTHER UNUSED BOXES WITH STANDARD STEEL COVER PLATES.
   P. WHERE APPLICABLE, PROVIDE ROOFTOP CONDUIT SUPPORT SYSTEM, CONFORMING TO ROOFTOP WARRANTY REQUIREMENTS, PER BUILDING.

WIRES AND CABLES

1. CONTRACTOR TO COORDINATE WITH EQUIPMENT SUPPLIER AND VENDOR FOR EXACT EQUIPMENT OVER-CURRENT PROTECTION VOLTAGE, WIRE SIZE AND PLUG CONFIGURATION, IF APPLICABLE, PRIOR TO BID.
2. ALL EQUIPMENT/DEVICES TO BE PROVIDED WITH INSULATED GROUND CONDUCTOR.
3. ALL WIRE AND CABLE TO BE 600VOLT, COPPER, WITH THWN/THHN INSULATION, EXCEPT AS NOTED.
4. WIRE FOR POWER AND LIGHTING WILL NOT BE LESS THAN NO. 12AWG. ALL WIRE NO. 8 AND LARGER TO BE STRANDED.
5. CONTROL WIRING IS NOT TO BE LESS THAN NO. 14AWG, FLEXIBLE IN SINGLE CONDUCTORS OR MULTI-CONDUCTOR CABLES. CONTROL WIRING WILL CONSIST OF MULTI-CONDUCTOR CABLES WHEREVER POSSIBLE. CABLES TO BE PROVIDED WITH AN OVERALL FLAME-RETARDANT, EXTRUDED JACKET AND RATED FOR PLENUM USE. ALL CONTROL WIRE TO BE 600VOLT RATED.
6. WIRE PREVIOUSLY PULLED INTO CONDUIT IS CONSIDERED USED AND IS NOT TO BE RE-PULLED.
7. HOME RUNS AND BRANCH CIRCUIT WIRING FOR 20A, 120V CIRCUITS:

LENGTH (FT.)	HOME RUN WIRE SIZE
0 TO 50	NO. 12
51 TO 100	NO. 10
101 TO 150	NO. 8

8. VOLTAGE DROP IS NOT TO EXCEED 3%.
9. MAKE ALL CONNECTIONS WITH UL APPROVED, SOLDERLESS, PRESSURE TYPE INSULATED CONNECTORS: SCOTCHLOK OR AND APPROVED EQUAL.

WIRING DEVICES

1. ALL RECEPTACLES INSTALLED IN THIS PROJECT TO BE GROUNDING TYPE, WITH GROUNDING PIN SLOT CONNECTED TO DEVICE GROUND SCREW FOR GROUND WIRE CONNECTION.

DISCONNECT SWITCHES AND FUSES

1. DISCONNECT SWITCHES TO BE VOLTAGE-RATED TO SUIT THE CHARACTERISTICS OF THE SYSTEM FROM WHICH THEY ARE SUPPLIED.
2. PROVIDE HEAVY-DUTY, METAL-ENCLOSED, EXTERNALLY-OPERATED DISCONNECT SWITCHES, FUSED OR UNFUSED, OF SUCH TYPE AND SIZE AS REQUIRED TO PROPERLY PROTECT OR DISCONNECT THE LOAD FOR WHICH THEY ARE INTENDED.
3. PROVIDE NEMA 1 DISCONNECT SWITCHES FOR INTERIOR INSTALLATION, NEMA 3R FOR EXTERIOR INSTALLATION.
4. DISCONNECT SWITCHES TO BE MANUFACTURED BY:
   A. GENERAL ELECTRIC COMPANY
   B. SQUARE-D
5. PROVIDE RK-1 TYPE FUSES, UNLESS NOTED OTHERWISE.

INSTALLATION

1. INSTALL DISCONNECT SWITCHES WHERE INDICATED ON DRAWINGS.
2. INSTALL FUSES IN FUSIBLE DISCONNECT SWITCHES. FUSES MUST MATCH IN TYPE AND RATING.
3. FUSES TO BE MOUNTED SO THAT THE LABELS SHOWING THEIR RATINGS CAN BE READ WITHOUT REQUIRING FUSE REMOVAL.
4. FURNISH AND DEPOSIT SPARE FUSES AT THE JOB SITE AS FOLLOWS:
   A. THREE SPARES FOR EACH TYPE AND SIZE, IN EXCESS OF 60A, USED FOR INITIAL FUSING.
   B. TEN PERCENT SPARES FOR EACH TYPE AND SIZE, UP TO AND INCLUDING 60A, USED FOR INITIAL FUSING. IN NO CASE WILL LESS THAN THREE FUSES OF ONE PARTICULAR TYPE AND SIZE BE FURNISHED.

GENERAL NOTES:

INTENT

1. THESE SPECIFICATIONS AND CONSTRUCTION DRAWINGS ACCOMPANYING THEM DESCRIBE THE WORK TO BE DONE AND THE MATERIALS TO BE FURNISHED FOR CONSTRUCTION.
2. THE DRAWINGS AND SPECIFICATIONS ARE INTENDED TO BE FULLY EXPLANATORY AND SUPPLEMENTARY. HOWEVER, SHOULD ANYTHING BE SHOWN, INDICATED, OR SPECIFIED ON ONE AND NOT THE OTHER, IT SHALL BE DONE THE SAME AS IF SHOWN, INDICATED OR SPECIFIED IN BOTH
3. THE INTENTION OF THE DOCUMENTS IS TO INCLUDE ALL LABOR AND MATERIALS REASONABLY NECESSARY FOR THE PROPER EXECUTION AND COMPLETION OF THE WORK AS STIPULATED IN THE CONTRACT.
4. THE PURPOSE OF THE SPECIFICATIONS IS TO INTERPRET THE INTENT OF THE DRAWINGS AND TO DESIGNATE THE METHOD OF THE PROCEDURE, TYPE AND QUALITY OF MATERIALS REQUIRED TO COMPLETE THE WORK.
5. MINOR DEVIATIONS FROM THE DESIGN LAYOUT ARE ANTICIPATED AND SHALL BE CONSIDERED AS PART OF THE WORK. NO CHANGES THAT ALTER THE CHARACTER OF THE WORK WILL BE MADE OR PERMITTED BY THE OWNER WITHOUT ISSUING A CHANGE ORDER.

CONFLICTS

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFICATIONS OF ALL MEASUREMENTS AT THE SITE BEFORE ORDERING ANY MATERIALS OR DOING ANY WORK. NO EXTRA CHARGE OR COMPENSATION SHALL BE ALLOWED DUE TO DIFFERENCE BETWEEN ACTUAL DIMENSIONS AND DIMENSIONS INDICATED ON THE CONSTRUCTION DRAWINGS. ANY SUCH DISCREPANCY IN DIMENSION WHICH MAY BE FOUND SHALL BE SUBMITTED TO THE OWNER FOR CONSIDERATION BEFORE THE CONTRACTOR PROCEEDS WITH THE WORK IN THE AFFECTED AREAS.
2. THE BIDDER, IF AWARDED THE CONTRACT, WILL NOT BE ALLOWED ANY EXTRA COMPENSATION BY REASON OF ANY MATTER OR THING CONCERNING SUCH BIDDER MIGHT HAVE FULLY INFORMED THEMSELVES PRIOR TO THE BIDDING.
3. NO PLEA OF IGNORANCE OF CONDITIONS THAT EXIST, OR OF DIFFICULTIES OR CONDITIONS THAT MAY BE ENCOUNTERED, OR OF ANY OTHER RELEVANT MATTER CONCERNING THE WORK TO BE PERFORMED IN THE EXECUTION OF THE WORK WILL BE ACCEPTED AS AN EXCUSE FOR ANY FAILURE OR OMISSION ON THE PART OF THE CONTRACTOR TO FULFILL EVERY DETAIL OF ALL THE REQUIREMENTS OF THE CONTRACT DOCUMENTS GOVERNING THE WORK.

CONTRACTS AND WARRANTIES

1. CONTRACTOR IS RESPONSIBLE FOR APPLICATION AND PAYMENT OF CONTRACTOR LICENSES AND BONDS.
2. SEE MASTER CONTRACTION SERVICES AGREEMENT FOR ADDITIONAL DETAILS.

STORAGE

1. ALL MATERIALS MUST BE STORED IN A LEVEL AND DRY FASHION AND IN A MANNER THAT DOES NOT NECESSARILY OBSTRUCT THE FLOW OF OTHER WORK. ANY STORAGE METHOD MUST MEET ALL RECOMMENDATIONS OF THE ASSOCIATED MANUFACTURER.

CLEANUP

1. THE CONTRACTORS SHALL, AT ALL TIMES, KEEP THE SITE FREE FROM ACCUMULATION OF WASTE MATERIALS OR RUBBISH CAUSED BY THEIR EMPLOYEES AT WORK AND AT THE COMPLETION OF THE WORK. THEY SHALL REMOVE ALL RUBBISH FROM AND ABOUT THE BUILDING AREA, INCLUDING ALL THEIR TOOLS, SCAFFOLDING AND SURPLUS MATERIALS AND SHALL LEAVE THEIR WORK CLEAN AND READY TO USE.
2. EXTERIOR
   A. VISUALLY INSPECT EXTERIOR SURFACES AND REMOVE ALL TRACES OF SOIL, WASTE MATERIALS, SMUDGES AND OTHER FOREIGN MATTER.
   B. REMOVE ALL TRACES OF SPLASHED MATERIALS FROM ADJACENT SURFACES.
   C. IF NECESSARY, TO ACHIEVE A UNIFORM DEGREE OF CLEANLINESS, HOSE DOWN THE EXTERIOR OF THE STRUCTURE.
3. INTERIOR
   A. VISUALLY INSPECT INTERIOR SURFACE AND REMOVE ALL TRACES OF SOIL, WASTE MATERIALS, SMUDGES AND OTHER FOREIGN MATTER FROM WALLS, FLOOR, AND CEILING.
   B. REMOVE ALL TRACES OF SPLASHED MATERIALS FROM ADJACENT SURFACES.
   C. REMOVE PAINT DROPPINGS, SPOTS, STAINS, AND DIRT FROM FINISHED SURFACES.

CHANGE ORDER PROCEDURE:

1. REFER TO SECTION 17 OF SIGNED MCSA: SEE PROFESSIONAL SERVICE AGREEMENT FOR MCSA.

RELATED DOCUMENTS AND COORDINATION

1. GENERAL CARPENTRY, ELECTRICAL AND ANTENNA DRAWINGS ARE INTERRELATED. IN PERFORMANCE OF THE WORK, THE CONTRACTOR MUST REFER TO ALL DRAWINGS. ALL COORDINATION TO BE THE RESPONSIBILITY OF THE CONTRACTOR.

SHOP DRAWINGS

1. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS AS REQUIRED AND LISTED IN THESE SPECIFICATIONS TO THE OWNER FOR APPROVAL.
2. ALL SHOP DRAWINGS SHALL BE REVIEWED, CHECKED AND CORRECTED BY CONTRACTOR PRIOR TO SUBMITTAL TO THE OWNER.

PRODUCTS AND SUBSTITUTIONS

1. SUBMIT 3 COPIES OF EACH REQUEST FOR SUBSTITUTION. IN EACH REQUEST, IDENTIFY THE PRODUCT OR FABRICATION OR INSTALLATION METHOD TO BE REPLACED BY THE SUBSTITUTION. INCLUDE RELATED SPECIFICATION SECTION AND DRAWING NUMBERS AND COMPLETE DOCUMENTATION SHOWING COMPLIANCE WITH THE REQUIREMENTS FOR SUBSTITUTIONS.
2. SUBMIT ALL NECESSARY PRODUCT DATA AND CUT SHEETS WHICH PROPERLY INDICATE AND DESCRIBE THE ITEMS, PRODUCTS AND MATERIALS BEING INSTALLED. THE CONTRACTOR SHALL, IF DEEMED NECESSARY BY THE OWNER, SUBMIT ACTUAL SAMPLES TO THE OWNER FOR APPROVAL IN LIEU OF CUT SHEETS.

QUALITY ASSURANCE

1. ALL WORK SHALL BE IN ACCORDANCE WITH APPLICABLE LOCAL, STATE AND FEDERAL REGULATIONS. THESE SHALL INCLUDE, BUT NOT BE LIMITED TO THE APPLICABLE CODES SET FORTH BY THE LOCAL GOVERNING BODY. SEE "CODE COMPLIANCE" T-1.

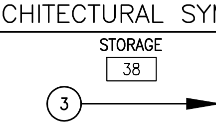
ADMINISTRATION

1. BEFORE THE COMMENCEMENT OF ANY WORK, THE CONTRACTOR WILL ASSIGN A PROJECT MANAGER WHO WILL ACT AS A SINGLE POINT OF CONTACT FOR ALL PERSONNEL INVOLVED IN THIS PROJECT. THIS PROJECT MANAGER WILL DEVELOP A MASTER SCHEDULE FOR THE PROJECT WHICH WILL BE SUBMITTED TO THE OWNER PRIOR TO THE COMMENCEMENT OF ANY WORK.
2. SUBMIT A BAR TYPE PROGRESS CHART, NOT MORE THAN 3 DAYS AFTER THE DATE ESTABLISHED FOR COMMENCEMENT OF THE WORK ON THE SCHEDULE, INDICATING A TIME BAR FOR EACH MAJOR CATEGORY OR UNIT OF WORK TO BE PERFORMED AT THE SITE, PROPERLY SEQUENCED AND COORDINATED WITH OTHER ELEMENTS OF WORK AND SHOWING COMPLETION OF THE WORK SUFFICIENTLY IN ADVANCE OF THE DATE ESTABLISHED FOR SUBSTANTIAL COMPLETION OF THE WORK.
3. PRIOR TO COMMENCING CONSTRUCTION, THE OWNER SHALL SCHEDULE AN ON-SITE MEETING WITH ALL MAJOR PARTIES. THIS WOULD INCLUDE, BUT NOT LIMITED TO, THE OWNER, PROJECT MANAGER, CONTRACTOR, LAND OWNER REPRESENTATIVE, LOCAL TELEPHONE COMPANY, TOWER ERECTION FOREMAN (IF SUBCONTRACTED).
4. CONTRACTOR SHALL BE EQUIPPED WITH SOME MEANS OF CONSTANT COMMUNICATIONS, SUCH AS A MOBILE PHONE OR A BEEPER. THIS EQUIPMENT WILL NOT BE SUPPLIED BY THE OWNER, NOR WILL WIRELESS SERVICE BE ARRANGED.
5. DURING CONSTRUCTION, CONTRACTOR MUST ENSURE THAT EMPLOYEES AND SUBCONTRACTORS WEAR HARD HATS AT ALL TIMES. CONTRACTOR WILL COMPLY WITH ALL WPCS SAFETY REQUIREMENTS IN THEIR AGREEMENT.
6. PROVIDE WRITTEN DAILY UPDATES ON SITE PROGRESS TO THE OWNER.
7. COMPLETE INVENTORY OF CONSTRUCTION MATERIALS AND EQUIPMENT IS REQUIRED PRIOR TO START OF CONSTRUCTION.
8. NOTIFY THE OWNER/PROJECT MANAGER IN WRITING NO LESS THAN 48 HOURS IN ADVANCE OF CONCRETE POURS, TOWER ERECTIONS, AND EQUIPMENT CABINET PLACEMENTS.

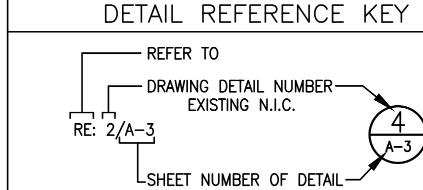
INSURANCE AND BONDS

1. CONTRACTOR, AT THEIR OWN EXPENSE, SHALL CARRY AND MAINTAIN, FOR THE DURATION OF THE PROJECT, ALL INSURANCE, AS REQUIRED AND LISTED, AND SHALL NOT COMMENCE WITH THEIR WORK UNTIL THEY HAVE PRESENTED AN ORIGINAL CERTIFICATE OF INSURANCE STATING ALL COVERAGES TO THE OWNER. REFER TO THE MASTER AGREEMENT FOR REQUIRED INSURANCE LIMITS.
2. THE OWNER SHALL BE NAMED AS AN ADDITIONAL INSURED ON ALL POLICIES.
3. CONTRACTOR MUST PROVIDE PROOF OF INSURANCE.

ARCHITECTURAL SYMBOLS



DETAIL REFERENCE KEY



ABBREVIATIONS

ADJ	ADJUSTABLE
AGL	ABOVE GROUND LINE
&	AND
APPROX	APPROXIMATE
@	AT
BTS	BASE TRANSMISSION STATION
CAB	CABINET
CLG	CEILING
CONC	CONCRETE
CONT	CONTINUOUS
DIA OR ø	DIAMETER
DWG	DRAWING
EA	EACH
ELEC	ELECTRICAL
ELEV	ELEVATION
EQ	EQUAL
EQUIP	EQUIPMENT
EGB	EQUIPMENT GROUND BAR
(E)	EXISTING
EXT	EXTERIOR
FF	FINISHED FLOOR
GA	GAUGE
GALV	GALVANIZED
GC	GENERAL CONTRACTOR
GRND	GROUND
LG	LONG
MAX	MAXIMUM
MECH	MECHANICAL
MW	MICROWAVE DISH
MFR	MANUFACTURER
MGB	MASTER GROUND BAR
MIN	MINIMUM
MTL	METAL
(N)	NEW
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
OC	ON CENTER
OPP	OPPOSITE
(P)	PROPOSED
PCS	PERSONAL COMMUNICATION SYSTEM
PPC	POWER PROTECTION CABINET
SF	SQUARE FOOT
SHT	SHEET
SIM	SIMILAR
SS	STAINLESS STEEL
STL	STEEL
TOC	TOP OF CONCRETE
TOM	TOP OF MASONRY
TYP	TYPICAL
VIF	VERIFY IN FIELD
UON	UNLESS OTHERWISE NOTED
WWF	WELDED WIRE FABRIC
W/	WITH

T-Mobile

T-MOBILE NORTHEAST, LLC
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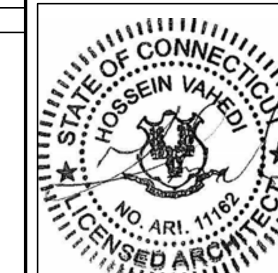
Phone number: 617-852-3611
Fax Number : 781-742-2247

SUBMITTALS

DATE	DESCRIPTION	REVISION
10/13/15	ISSUED FOR REVIEW	A
10/19/15	FINAL CD	0

DEPT.	DATE	APP'D	REVISIONS
RFE			
RF MAN.			
ZONING			
OPS			
CONSTR.			
SITE AC.			

PROJECT NO:	CT11356C
DRAWN BY:	MB
CHECKED BY:	KM



PROFESSIONAL SEAL

SITE NUMBER
CT11356C

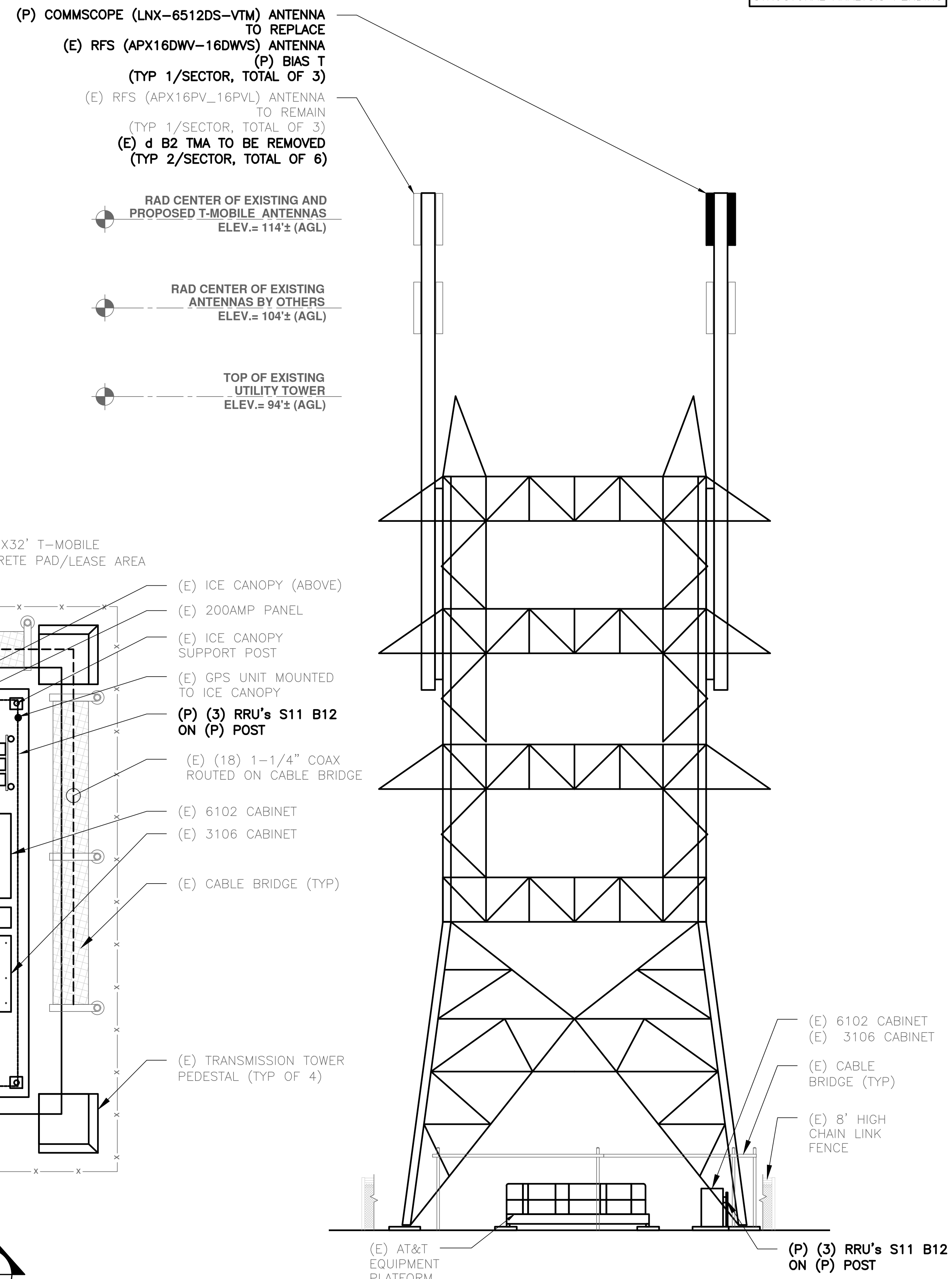
SITE NAME
CT356/CL&P TOWER - RT.123

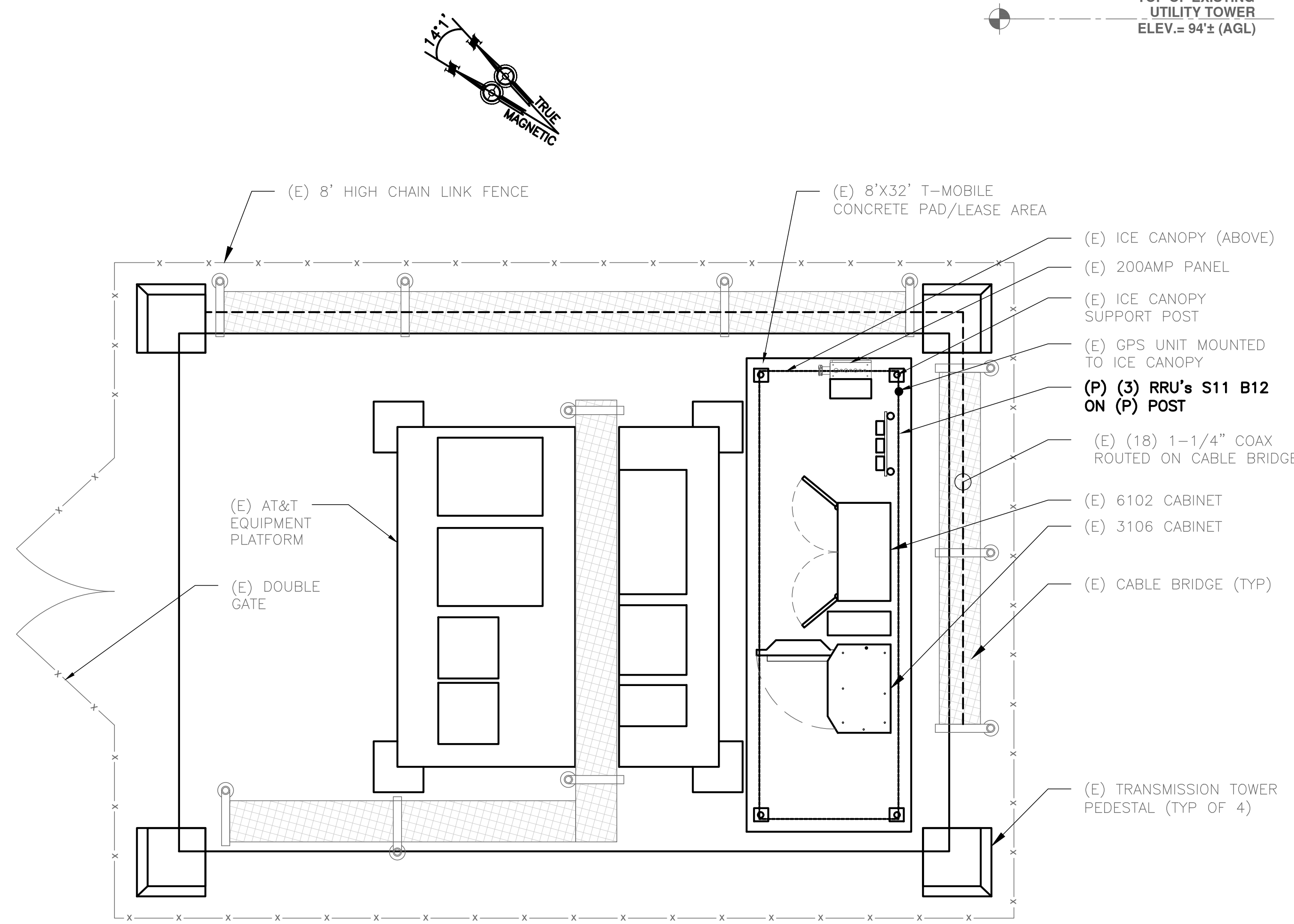
SITE ADDRESS
2 WILLRUSS STREET
POLE #1102 LINE # 1880
NORWALK, CT, 06850

SHEET TITLE
GENERAL AND ELECTRICAL NOTES

SHEET NUMBER
N-1

STRUCTURAL ANALYSIS PENDING





SITE PLAN (1 / A-1)

SCALE: 1/8" = 1'-0" (11x17)
SCALE: 1/4" = 1'-0" (24x36)

0 8 16 24
SCALE 1"=8' (11x17)
1"=4' (24x36)

ELEVATION (2 / A-1)

SCALE: 1/16" = 1'-0" (11x17)
SCALE: 1/8" = 1'-0" (24x36)

0 16 32 48
SCALE 1"=16' (11x17)
1"=8' (24x36)

GENERAL SITE NOTES

1. SITE INFORMATION WAS OBTAINED FROM A FIELD INVESTIGATION PERFORMED BY ATLANTIS DESIGN GROUP, INC. CONTRACTOR TO FIELD VERIFY DIMENSIONS AS NECESSARY BEFORE CONSTRUCTION.

2. THE PROPOSED DEVELOPMENT DOES NOT INCLUDE SIGNS OF ADVERTISING.

3. THE PROPOSED DEVELOPMENT IS UNMANNED AND THEREFORE DOES NOT REQUIRE A MEANS OF WATER SUPPLY OR SEWAGE DISPOSAL.

4. NO LANDSCAPING WORK IS PROPOSED IN CONJUNCTION WITH THIS DEVELOPMENT OTHER THAN THAT WHICH IS SHOWN.

5. THE PROPOSED DEVELOPMENT DOES NOT INCLUDE OUTDOOR STORAGE OR ANY SOLID WASTE RECEPTACLES.

6. UTILITIES SHOWN ON PLAN ARE TAKEN FROM OWNERS RECORDS AND FIELD LOCATION OF VISIBLE SURFACE FEATURES. THE EXISTENCE, EXTENT AND EXACT HORIZONTAL AND VERTICAL LOCATIONS OF UTILITIES HAS NOT BEEN VERIFIED. ANY CONTRACTOR PERFORMING WORK ON THIS SITE MUST CONTACT CALL BEFORE YOU DIG THREE WORKING DAYS PRIOR TO COMMENCING WORK.

7. ALL OBSOLETE OR UNUSED FACILITIES SHALL BE REMOVED WITHIN 12 MONTHS OF CESSATION OF OPERATIONS.

SITE LEGEND

- SITE PROPERTY LINE
- STREET OR ROAD
- CHAIN LINK FENCE
- OPAQUE WOODEN FENCE
- BOARD ON BOARD FENCE
- DECIDUOUS TREES/SHRUBS
- EVERGREEN TREES/SHRUBS
- TREE LINE
- UTILITY POLE
- (E) EXISTING
- (N) NEW
- (P) PROPOSED
- (F) FUTURE
- PROP. LTE ANTENNA
- PROP. UMTS/GSM ANTENNA
- EX. GSM ANTENNA
- EX. UMTS ANTENNA

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ATLANTIS DESIGN GROUP, INC.
286 Old Connecticut Path,
Wayland, MA 01778
Phone number: 617-852-3611
Fax Number : 781-742-2247

SUBMITTALS		
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10/19/15	FINAL CD	0

DEPT.	DATE	APP'D	REVISIONS
RFE			
RF MAN.			
ZONING			
OPS			
CONSTR.			
SITE AC.			

PROJECT NO:	CT11356C
DRAWN BY:	MB
CHECKED BY:	KM

STATE OF CONNECTICUT · HOSSEIN VAHEDI · NO. ARI. 11162 · LICENSED ARCHITECT

PROFESSIONAL SEAL

SITE NUMBER
CT11356C

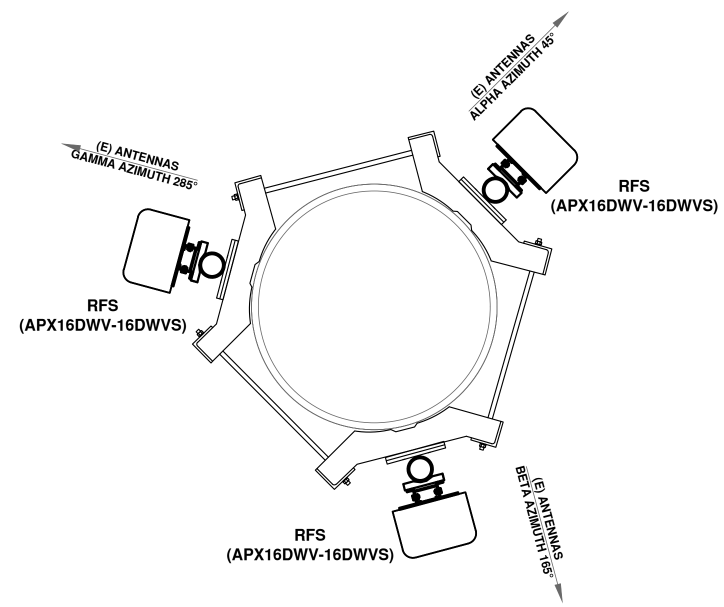
SITE NAME
CT356/CL&P TOWER - RT.123

SITE ADDRESS
2 WILLRUSS STREET
POLE #1102 LINE # 1880
NORWALK, CT, 06850

SHEET TITLE
SITE PLAN AND ELEVATION

SHEET NUMBER
A-1

STRUCTURAL ANALYSIS PENDING



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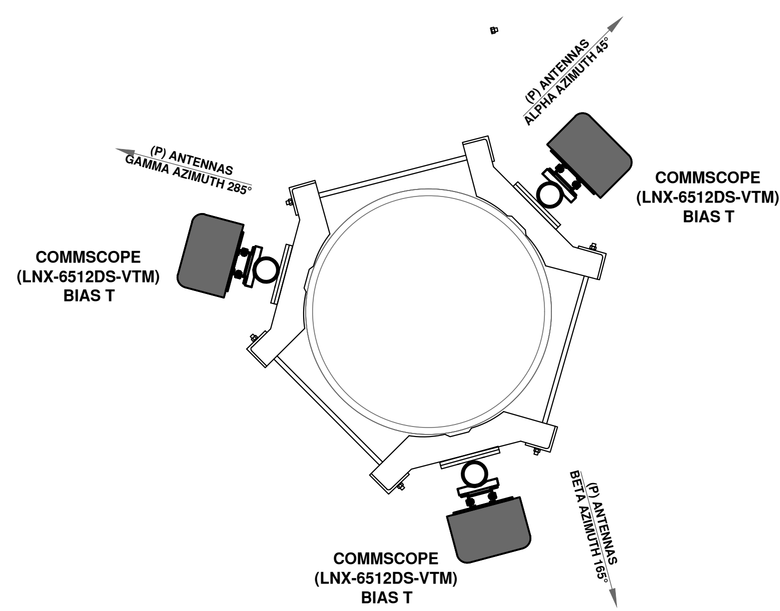
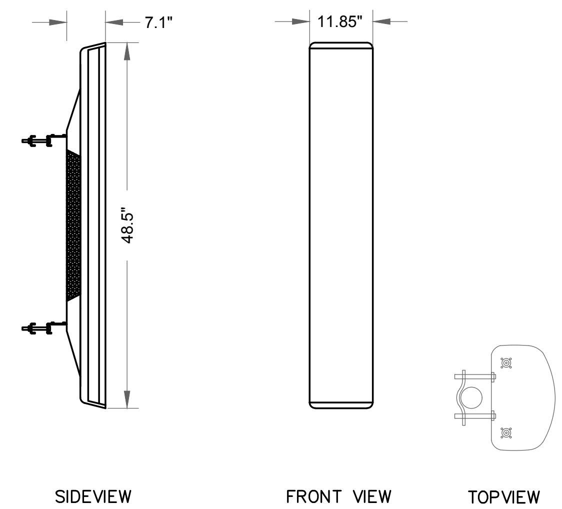


FINAL

ANTENNA PLAN 1 / A-2

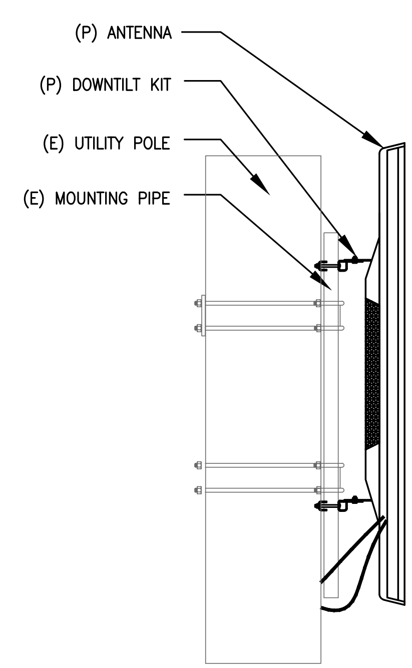
SCALE: N.T.S



MANUFACTURE: COMMSCOPE DUAL POLE
MODEL NO. (LNX-6512DS-VTM)
DIMENSIONS:
DEPTH 181.0 MM | 7.1 IN
LENGTH 1232.0 MM | 48.5 IN
WIDTH 301.0 MM | 11.9 IN
NET WEIGHT 13.0 KG | 28.7 LB

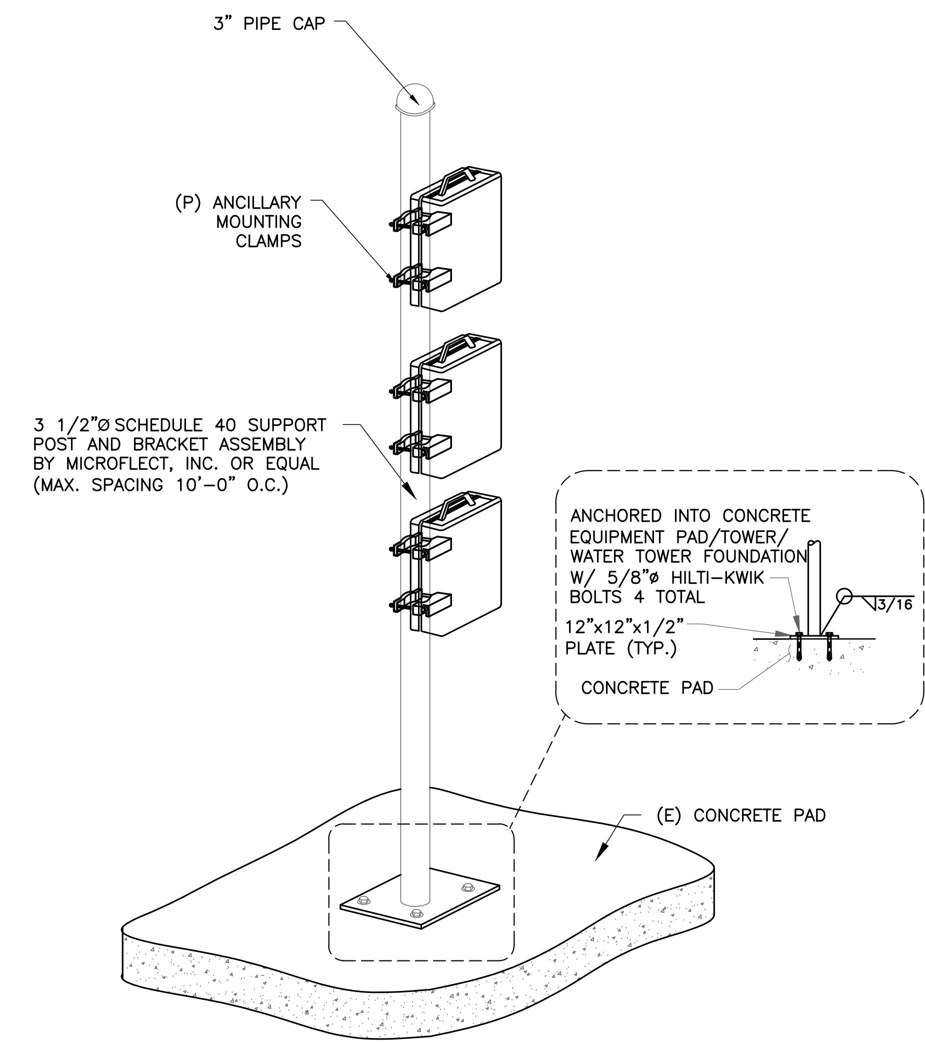
COMMSCOPE ANTENNA DETAIL 2 / A-2

SCALE: N.T.S



ANTENNA MOUNT DETAIL 3 / A-2

SCALE: N.T.S



RRUS MOUNT DETAILS 4 / A-2

SCALE: N.T.S

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SUBMITTALS

DATE	DESCRIPTION	REVISION
10/13/15	ISSUED FOR REVIEW	A
10/19/15	FINAL CD	0

DEPT.	DATE	APP'D	REVISIONS
RFE			
RF MAN.			
ZONING			
OPS			
CONSTR.			
SITE AC.			

PROJECT NO:	CT11356C
DRAWN BY:	MB
CHECKED BY:	KM

PROFESSIONAL SEAL

SITE NUMBER
CT11356C

SITE NAME
CT356/CL&P TOWER - RT.123

SITE ADDRESS
2 WILLRUSS STREET
POLE #1102 LINE # 1880
NORWALK, CT, 06850

SHEET TITLE
DETAILS

SHEET NUMBER
A-2

NOTES:

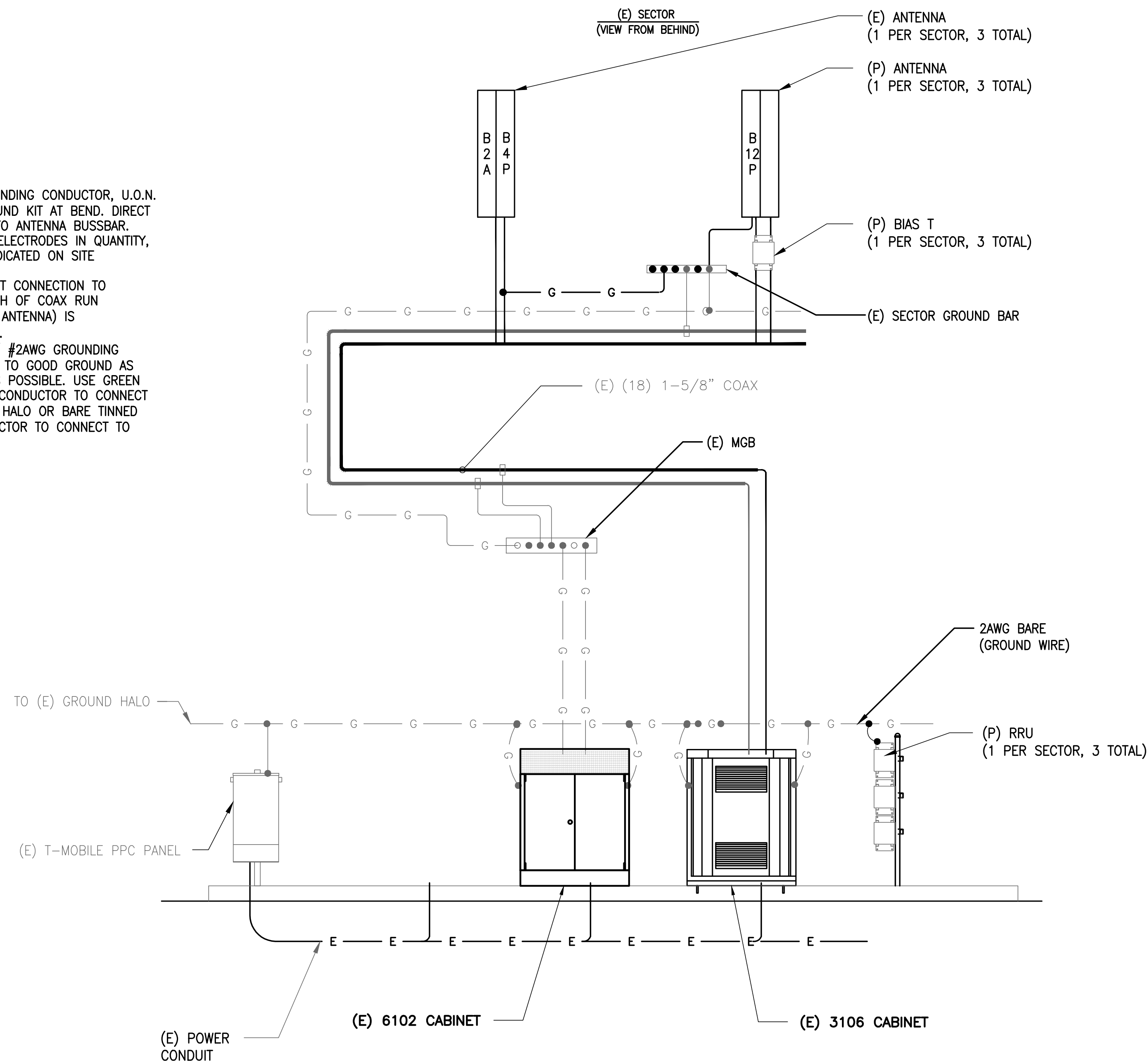
A. PROVIDE #2AWG GROUNDING CONDUCTOR, U.O.N.

B. DO NOT INSTALL GROUND KIT AT BEND. DIRECT GROUND WIRE DOWN TO ANTENNA BUSSBAR.

C. PROVIDE GROUNDING ELECTRODES IN QUANTITY, TYPE AND SIZE AS INDICATED ON SITE GROUNDING PLAN.

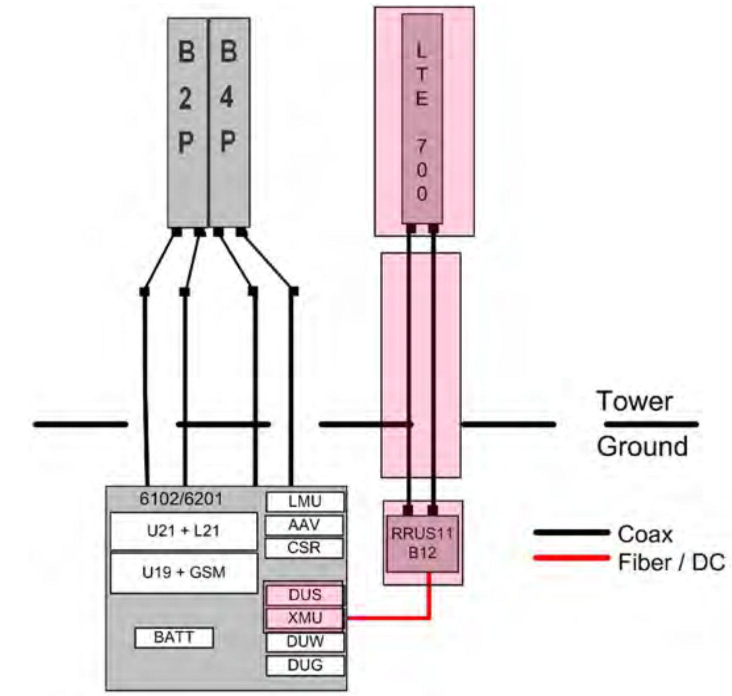
D. ADD COAX GROUND KIT CONNECTION TO BUSSBAR WHEN LENGTH OF COAX RUN (FROM EQUIPMENT TO ANTENNA) IS GREATER THAN 20'-0".

E. GROUND HCS BOX W/ #2AWG GROUNDING CONDUCTOR ATTACHED TO GOOD GROUND AS DIRECT AND SHORT AS POSSIBLE. USE GREEN STRANDED INSULATED CONDUCTOR TO CONNECT TO BUSSBAR/GROUND HALO OR BARE TINNED SOLID COPPER CONDUCTOR TO CONNECT TO GROUND RING.



GROUNDING DIAGRAM 1 / E-1

SCALE: N.T.S



TRUNK FIBER NOTES:

1. IN GENERAL THIS CABLE WILL HANDLE SIMILARLY TO ⅞" COAXIAL CABLE, AND SIMILAR INSTALLATION TECHNIQUES APPLY. ALL CABLES ARE INDIVIDUALLY SERIALIZED, BE SURE TO WRITE DOWN THE CABLE SERIAL NUMBER FOR FUTURE REFERENCE.
2. THE TERMINATED FIBER ENDS (THE BROKEN OUT FIBERS PLUS CONNECTORS) HOWEVER ARE FRAGILE, AND THESE MUST BE PROTECTED DURING THE INSTALLATION PROCESS.
3. LEAVE THE PROTECTIVE TUBE AND SOCK AROUND THE FIBER TAILS AND CONNECTORS IN PLACE DURING HOISTING AND SECURING THE CABLE. REMOVE THIS ONLY JUST PRIOR TO MAKING THE FINAL CONNECTIONS TO THE OVP BOX.
4. DO NOT BEND THE FIBER ENDS (IN THE ORANGE FURCATION TUBES) TIGHTER THAN ¾" (19MM) BEND RADIUS, ELSE THERE IS A RISK OF BREAKING THE GLASS FIBERS.
5. BE SURE THAT THE LACE UP ENDS AND FIBER CONNECTORS ARE NOT DAMAGED BY ATTACHMENT OF A HOISTING GRIP OR DURING THE HOISTING PROCESS. ATTACH A HOISTING GRIP ON THE JACKETED CABLE NO LESS THAN 6 INCHES BELOW THE FIBER BREAKOUT POINT. IF A HOISTING GRIP IS NOT EASILY ATTACHED, USE A SIMPLE LINE ATTACHED BELOW THE FIBER BREAK-OUT POINT (I.E. AT THE CABLE OUTER JACKET). PREVENT THE FIBER TAILS (IN PROTECTIVE TUBE) AT THE CABLE END FROM UNDUE MOVEMENT DURING HOISTING BY SECURING THE PROTECTIVE TUBE (WITH OUTER SOCK) TO THE HOISTING LINE.
6. DURING HOISTING ENSURE THAT THERE IS A FREE PATH AND THAT THE CABLE, AND ESPECIALLY THE FIBER ENDS, WILL NOT BE SNAGGED ON TOWER MEMBERS OR OTHER OBSTACLES.
7. INSTALLATION TEMPERATURE RANGE IS –22F TO 158F (–30C TO +70C).
8. MINIMUM CABLE BEND RADII ARE 22.2" (565MM) LOADED (WITH TENSION ON THE CABLE) AND 11.1" (280MM) UNLOADED.
9. MAXIMUM CABLE TENSILE LOAD IS 3560 N (800 LB) SHORT TERM (DURING INSTALLATION) AND 1070 N (240 LB) LONG TERM.
10. COMMSCOPE NON LACE UP GRIP RECOMMENDED FOR MONOPOLE INSTALLATIONS.
11. MAXIMUM HANGER SPACING 3FT (0.9 M).

HYBRID FIBER/POWER JUMPER NOTES:

1. IN GENERAL THIS CABLE WILL HANDLE SIMILARLY TO A ⅜" COAXIAL CABLE.
2. THE TERMINATED FIBER ENDS HOWEVER ARE FRAGILE AND MUST BE PROTECTED DURING INSTALLATION. LEAVE THE PACKAGING AROUND THE FIBER ENDS IN PLACE UNTIL READY TO CONNECT THE JUMPER BETWEEN OVP AND RRU OR BBU.
3. DO NOT BEND THE FIBER BREAKOUT CABLE (BETWEEN THE MAIN CABLE AND THE FIBER CONNECTOR) TIGHTER THAN ¾" (19MM) RADIUS, ELSE THERE IS A RISK OF BREAKING THE GLASS.
4. ATTACH THE MAIN CABLE SECURELY TO THE STRUCTURE OR EQUIPMENT USING HANGERS AND/OR CABLE TIES TO PREVENT STRAIN ON CONNECTIONS FROM MOVEMENT IN WIND OR SNOW/ICE CONDITIONS.
5. ENSURE THE LC FIBER CONNECTORS ARE SEATED FIRMLY IN PANEL IN OVP OR IN EQUIPMENT.
6. INSTALLATION TEMPERATURE RANGE IS –22F TO 158F (–30C TO 70C).
7. MINIMUM CABLE BEND RADII ARE 10.3 INCH (265MM) LOADED (WITH TENSION ON THE CABLE) AND 5.2 INCH (130MM) UNLOADED.
8. MAXIMUM CABLE TENSILE LOAD IS 350 LB (1560N) SHORT TERM (DURING INSTALLATION) AND 105 LB (470N) LONG TERM.
9. STANDARD LENGTHS AVAILABLE ARE 6 FEET, 15 FEET AND 20 FEET

704BU CONFIGURATION
COAX/FIBER PLUMBING DIAGRAM 2 / E-1

SCALE: N.T.S

T-Mobile

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35 GRIFFIN ROAD SOUTH
BLOOMFIELD, CT 06002
OFFICE: (860) 692-7100
FAX:(860) 692-7159

ATLANTIS DESIGN GROUP, INC.
286 Old Connecticut Path,
Wayland, MA 01778
Phone number: 617-852-3611
Fax Number : 781-742-2247

SUBMITTALS

DATE	DESCRIPTION	REVISION
10/13/15	ISSUED FOR REVIEW	A
10/19/15	FINAL CD	0

DEPT.	DATE	APP'D	REVISIONS
RFE			
RF MAN.			
ZONING			
OPS			
CONSTR.			
SITE AC.			

PROJECT NO:	CT11356C
DRAWN BY:	MB
CHECKED BY:	KM

PROFESSIONAL SEAL

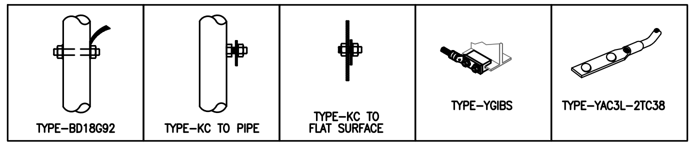
SITE NUMBER
CT11356C

SITE NAME
CT356/CL&P TOWER - RT.123

SITE ADDRESS
2 WILLRUSS STREET
POLE #1102 LINE # 1880
NORWALK, CT, 06850

SHEET TITLE
GROUNDING DIAGRAM AND POWER ONE LINE DIAGRAM

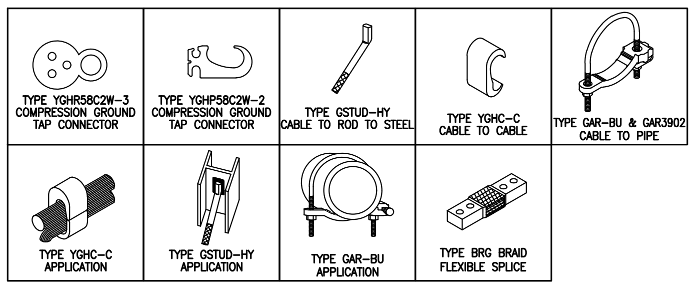
SHEET NUMBER
E-1



BURNDY GROUNDING DETAILS

1 / E-2

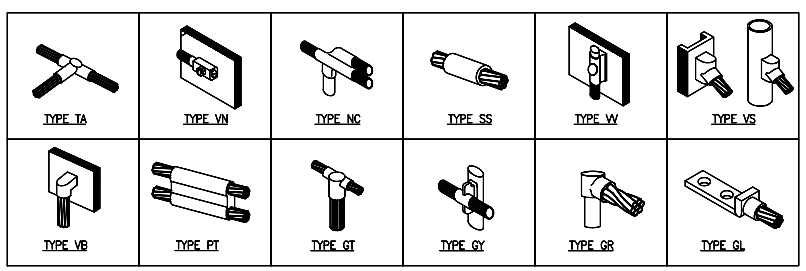
SCALE: N.T.S.



BURNDY GROUNDING PRODUCTS

2 / E-2

SCALE: N.T.S.



CADWELD GROUNDING CONNECTION PRODUCTS

3 / E-2

SCALE: N.T.S.

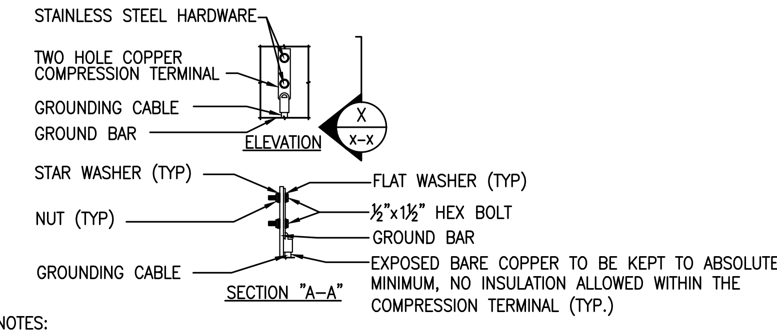
TERMINATION TYPES:
A. MECHANICAL COMPRESSION LUG
B. DOUBLE BARRELL COMPRESSION CONNECTOR
C. EXOTHERMIC TERMINATION
D. BEAM CLAMP

	SOLID #2 TINNED COPPER	#6 GROUND LEAD	#2/O STRANDED MAIN DOWN CONDUCTOR	MASTER GRND BAR	STRUCTURAL OR TOWER STEEL	BLDG SERVICE ENTR OR GRND RING	GROUND ROD
SOLID #2 TINNED COPPER	B OR C	B OR C		C	A, C, OR D		C
#6 GROUND LEAD	B OR C			A	A, C, OR D		
#2/O STRANDED GRNDG ELECTRODE CONDUCTOR				A	A, C, OR D	A	
MASTER GROUND BAR	C	A	A				
STRUCTURAL OR TOWER STEEL	A, C, OR D	A, C, OR D	A, C, OR D				
GROUND RING	C		C				C

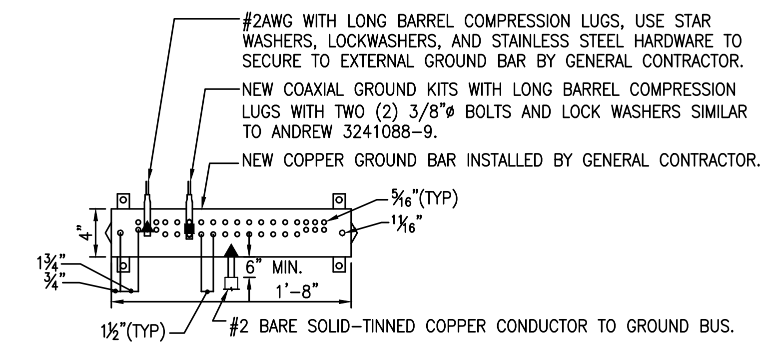
GROUNDING TERMINATION MARTIX

4 / E-2

SCALE: N.T.S.



NOTES:
1. OXIDE INHIBITING COMPOUND TO BE USED AT ALL LOCATIONS.

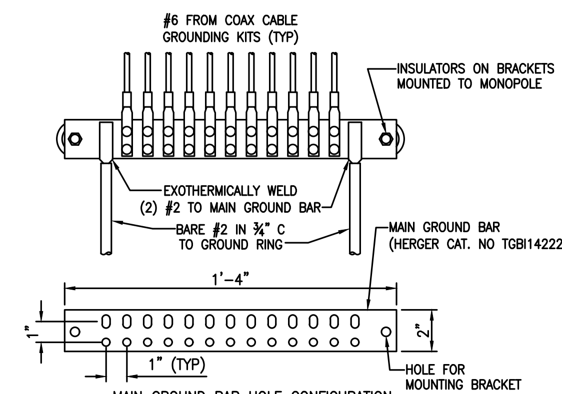


NOTES:
1. ALL HARDWARE STAINLESS STEEL COAT ALL SURFACES WITH KOPR-SHIELD BEFORE MATING.
2. FOR GROUND BOND TO STEEL ONLY: INSERT A TOOTH WASHER BETWEEN LUG AND STEEL. COAT ALL SURFACES WITH KOPR-SHIELD.
3. ALL HOLES ARE COUNTERSUNK 1/16".

TYPICAL GROUND BAR CONNECTIONS DETAIL

5 / E-2

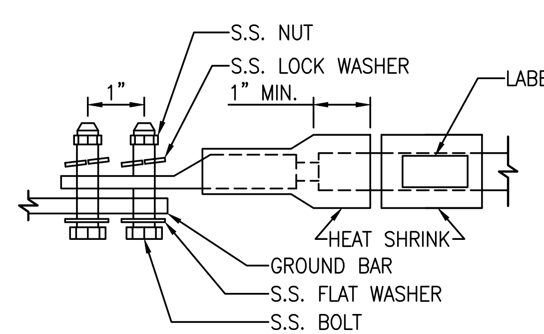
SCALE: N.T.S.



GROUND BAR DETAIL

6 / E-2

SCALE: N.T.S.



LUG NOTES:
1. ALL HARDWARE IS 18-8 STAINLESS STEEL, INCLUDING LOCK WASHERS.
2. ALL HARDWARE SHALL BE S.S. ⅜"ø OR LARGER.
3. FOR GROUND BOND TO STEEL ONLY: INSERT A DRAGON TOOTH WASHER BETWEEN LUG AND STEEL. COAT ALL SURFACES WITH ANTI-OXIDIZATION COMPOUND PRIOR TO MATING.

GROUND BAR DETAIL

7 / E-2

SCALE: N.T.S.

T-Mobile

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RFE			
RF MAN.			
ZONING			
OPS			
CONSTR.			
SITE AC.			

PROJECT NO:	CT11356C
DRAWN BY:	MB
CHECKED BY:	KM

PROFESSIONAL SEAL

SITE NUMBER
CT11356C

SITE NAME
CT356/CL&P TOWER - RT.123

SITE ADDRESS
2 WILLRUSS STREET
POLE #1102 LINE # 1880
NORWALK, CT, 06850

SHEET TITLE
GROUNDING DETAILS

SHEET NUMBER
E-2

Exhibit D

PAUL J. FORD
& COMPANY

T-Mobile
35 Griffin Road South
Bloomfield, CT 06002

STRUCTURAL ANALYSIS OF
EXISTING EVERSOURCE
TRANSMISSION TOWER #1102
TRANSMISSION LINE #1880

94'-0" TYPE "D" STEEL DEAD END TOWER
115KV QUAD CIRCUIT TRANSMISSION LINE

STRUCTURE TO SUPPORT NEW ANTENNAS AND COAX
INSTALLED ON AN EXISTING TOWER DIRECT MOUNT

T-MOBILE
SITE #CT11356C

2 WILLRUSS STREET
NORWALK
CONNECTICUT

PAUL J. FORD #31215-0012.002

~~NOVEMBER 13, 2015~~
REV. 1 - JANUARY 14, 2016

STATE OF CONNECTICUT
DAVID L. SUMMERS
No. 21884
LICENSED
PROFESSIONAL ENGINEER

1/14/2016

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

T-Mobile Existing Facility

Site ID: CT11356C

CT356/ CL&P Tower- Rt. 123
2 Willruss Street
Norwalk, CT 06850

November 18, 2015

EBI Project Number: 6215005783

Site Compliance Summary	
Compliance Status:	**COMPLIANT**
Site total MPE% of FCC general public allowable limit:	**4.81 %**

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

November 18, 2015

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

Emissions Analysis for Site: **CT11356C – CT356/ CL&P Tower- Rt. 123**

EBI Consulting was directed to analyze the proposed T-Mobile facility located at **2 Willruss Street, Norwalk, CT**, 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 (μW/cm2). 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 public 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 public 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 limit for the 700 MHz Band is approximately 467 $\mu W/cm^2$, and the general population exposure limit for the PCS and AWS 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 **2 Willruss Street, Norwalk, CT**, 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 manufactures supplied specifications, minus 10 dB, 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 GSM / UMTS channels (PCS Band - 1900 MHz) were considered for each sector of the proposed installation. These Channels have a transmit power of 30 Watts per Channel

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

3) 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.

4) 1 LTE channel (700 MHz Band) was considered for each sector of the proposed installation. This channel has a transmit power of 30 Watts.

5) Since the radios are ground mounted there are additional cabling losses accounted for. For each RF path the following losses were calculated. 1.12 dB of additional cable loss at 700 MHz, 1.95 dB of additional cable loss at 1900 MHz and 2.06 dB of additional cable loss at 2100 MHz. This is based on manufacturers Specifications for 170 feet of 1-1/4” coax cable on each path.

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 six foot person standing at the base of the tower. The maximum gain of the antenna per the antenna manufactures supplied specifications minus 10 dB 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 **RFS APX16PV-16PVL** for 1900 MHz (PCS) and 2100 MHz (AWS) channels and the **Commscope LNX-6512DS-VTM** for 700 MHz channels. This is based on feedback from the carrier with regards to anticipated antenna selection. The **RFS APX16PV-16PVL** have a maximum gain of **16.3 dBd** at their main lobe at 1900 MHz and 2100 MHz. The **Commscope LNX-6512DS-VTM** has a maximum gain of **12 dBd** at its main lobe at 700 MHz. The maximum gain of the antenna per the antenna manufactures supplied specifications, minus 10 dB, 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 **114 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.

All calculations were done with respect to uncontrolled / general public threshold limits.

T-Mobile Site Inventory and Power Data

Sector:	A	Sector:	B	Sector:	C
Antenna #:	**1**	Antenna #:	**1**	Antenna #:	**1**
Make / Model:	RFS APX16PV-16PVL	Make / Model:	RFS APX16PV-16PVL	Make / Model:	RFS APX16PV-16PVL
Gain:	16.3 dBd	Gain:	16.3 dBd	Gain:	16.3 dBd
Height (AGL):	114	Height (AGL):	114	Height (AGL):	114
Frequency Bands	1900 MHz(PCS) / 2100 MHz (AWS)	Frequency Bands	1900 MHz(PCS) / 2100 MHz (AWS)	Frequency Bands	1900 MHz(PCS) / 2100 MHz (AWS)
Channel Count	6	Channel Count	6	# PCS Channels:	6
Total TX Power:	240	Total TX Power:	240	# AWS Channels:	240
ERP (W):	6,411.91	ERP (W):	6,411.91	ERP (W):	6,411.91
Antenna A1 MPE%	1.98	Antenna B1 MPE%	1.98	Antenna C1 MPE%	1.98
Antenna #:	**2**	Antenna #:	**2**	Antenna #:	**2**
Make / Model:	Commscope LNX-6512DS-VTM	Make / Model:	Commscope LNX-6512DS-VTM	Make / Model:	Commscope LNX-6512DS-VTM
Gain:	12 dBd	Gain:	12 dBd	Gain:	12 dBd
Height (AGL):	114	Height (AGL):	114	Height (AGL):	114
Frequency Bands	700 MHz	Frequency Bands	700 MHz	Frequency Bands	700 MHz
Channel Count	1	Channel Count	1	Channel Count	1
Total TX Power:	30	Total TX Power:	30	Total TX Power:	30
ERP (W):	367.38	ERP (W):	367.38	ERP (W):	367.38
Antenna A2 MPE%	0.24	Antenna B2 MPE%	0.24	Antenna C2 MPE%	0.24

Site Composite MPE%	
Carrier	**MPE%**
T-Mobile (Per Sector Max)	**2.22 %**
AT&T	2.59 %
Site Total MPE %:	**4.81 %**

T-Mobile Sector 1 Total:	2.22 %
T-Mobile Sector 2 Total:	2.22 %
T-Mobile Sector 3 Total:	2.22 %
Site Total:	4.81%

T-Mobile _per sector	# Channels	Watts ERP (Per Channel)	Height (feet)	Total Power Density ($\mu W/cm^2$)	Frequency (MHz)	Allowable MPE ($\mu W/cm^2$)	Calculated % MPE
T-Mobile 2100 MHz (AWS) LTE	**2**	**1592.76**	**114**	**9.82**	**2100**	**1000**	**0.98 %**
T-Mobile 1900 MHz (PCS) GSM/UMTS	**2**	**816.81**	**114**	**5.04**	**1900**	**1000**	**0.50 %**
T-Mobile 2100 MHz (AWS) UMTS	**2**	**796.38**	**114**	**4.91**	**2100**	**1000**	**0.49 %**
T-Mobile 700 MHz LTE	**1**	**367.38**	**114**	**1.13**	**700**	**467**	**0.24 %**
						Total:	**2.22 %**

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Summary

All calculations performed for this analysis yielded results that were **within** the allowable limits for general public 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 public exposure to RF Emissions are shown here:

T-Mobile Sector	Power Density Value (%)
Sector 1:	2.22 %
Sector 2:	2.22 %
Sector 3 :	2.22 %
T-Mobile Per Sector Maximum:	2.22 %
Site Total:	4.81 %
Site Compliance Status:	**COMPLIANT**

The anticipated composite MPE value for this site assuming all carriers present is **4.81%** of the allowable FCC established general public 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.

Scott Heffernan
RF Engineering Director

EBI Consulting
21 B Street
Burlington, MA 01803

Table of Contents

INTRODUCTION

The purpose of this report is to summarize the results of the structural analysis on the existing 94'-0" self-support type “D” 115kV quad circuit steel dead end transmission tower. The analysis sought to determine the effects of adding new antennas and coax installed on an existing Tower Direct Mount at an elevation of 114'-0"±.

The vertical loads, due to the weight of the antennas, antenna mounts and coax, are carried by the transmission tower legs. The shear loads, due to wind on the antennas, antenna mounts and coax are transferred to the existing tower at various elevations along its height.

ANALYSIS

The structural analysis has been performed per the requirements of Eversource (NEU) Overhead Transmission Standard OTRM 059.1. The mount analysis is performed per TIA/EIA-222-F. The electrical transmission tower is analyzed per the C2-2007 National Electrical Safety Code (NESC). The foundation is evaluated based on NESC loads and Eversource provided geotechnical parameters.

The existing transmission tower was analyzed using a comprehensive computer program entitled "TOWER". The program analyzes the tower as a cantilevered truss considering a worst case loading condition. It is assumed that the tower is loaded by concentric forces at its joints and that the members of the truss are subjected to only axial tension or compression. Also, the program assumes that the members are not subjected to any end moments. Local analysis is performed, as necessary, to evaluate the effects of bending on tower members.

The existing mount is analyzed using RISA-3D software.

References:

Type:	Document #:	By:	Dated:
Structure Erection Dwg:	01135-50006 (E5-E6)	Bethlehem Steel	7/11/1958
Structure Detail Dwg:	01135-50006 (17-24,32)	Bethlehem Steel	7/11/1958
Foundation Dwg:	01135-60003 (1)	CL&P	5/16/1958
Construction Dwgs:	CT11356C	Atlantis Group	10/19/15
Previous SA:	08174.CO.05	Natcomm Consulting Engineers	7/9/2009
Previous SA:	11021.CO34	Centek Engineering	6/10/2011
Photos:	N/A	Eversource	N/A

Shield Wire:

(1) 0.438 Comp
Diameter = 0.438“ Weight = 0.408 lbs/ft
(1) OPGW-120 (6-Groove) - 10/9 FOCAS
Diameter =0.738“ Weight = 0.518 lbs/ft

115kV Conductor:

(12) 795.0 kcmil 45/7 ACSR (Tern)
Diameter = 1.063“ Weight = 0.895 lbs/ft
Note: Shield wire, conductor, and corresponding tower loads have been provided by Eversource.

ANALYSIS (Continued)

Proposed T-Mobile Installation @ 114'-0":

Mount Type:

Existing Tower Direct Mount with equipment installed on:
12" Mast Pipe with Tri Sector Mount
Area = 3.0 ft^2 (Estimated) Weight = 101 lbs (Estimated)

Equipment: (see cut sheets for dimensions and weights)

(3) Commscope LNX6512DS-VTM - Proposed

(3) Bias T - Proposed

(3) RFS APX16PV-16PVL - Existing

Coax:

(18) 1-1/4" Coax - existing (see profile sketch for routing)
Weight = 0.66 lbs/ft

Existing AT&T Installation @ 105'-0" & 104'-0":

Mount Type:

Existing Tower Direct Mount with equipment installed on:
12" Mast Pipe with Tri Sector Mount
Area = 3.0 ft^2 (Estimated) Weight = 101 lbs (Estimated)

Equipment: (see cut sheets for dimensions and weights)

(3) KMW AM-X-CD-14-65 – Existing (105'-0")

(3) Powerwave TT19-08BP11-001 – Existing (105'-0")

(3) Powerwave 7770 – Existing (104'-0")

(3) Powerwave TT19-08BP11-001 – Existing (104'-0")

Coax:

(12) 1-1/4" Coax – existing (see profile sketch for routing)

Weight = 0.66 lbs/ft

EVERSOURCE LOADING CONDITIONS

Tower & Foundation Analysis: 2007 National Electrical Safety Code

		Overload Capacity Factors:
Load Case 1	NESC Heavy 39.5 mph Wind Speed 4 psf wind (Structure, Equipment & Wires) ½" Radial Ice (Equipment & Wires)	Vertical = 1.5 Wind = 2.5 Wire Tension = 1.65
Load Case 2	Extreme Wind 110 mph Basic Wind Speed No Radial Ice NEU Gust Response Factor = 1.25 (for any antenna equipment above tower)	Vertical = 1.0 Wind = 1.0 Wire Tension = 1.0
Load Case 3-4	Broken Shield Wire (NESC Heavy) 39.5 mph Wind Speed 4 psf wind (Structure, Equipment & Wires) ½" Radial Ice (Equipment & Wires)	Vertical = 1.5 Wind = 2.5 Wire Tension = 1.65
Load Case 5	Broken Conductor (NESC Heavy) 39.5 mph Wind Speed 4 psf wind (Structure, Equipment & Wires) ½" Radial Ice (Equipment & Wires)	Vertical = 1.5 Wind = 2.5 Wire Tension = 1.65

Tension Angle = 26°

Wind Span = 818' (409' Back & 409' Ahead)

Weight Span = 830' (415' Back & 415' Ahead)

Shape Factors

-Flat surfaces = 1.6

-Round surfaces (bare) = 1.3

-Round surfaces (w/ coax surface banded) = 1.45

-Coax (Mounted on tower legs or poles/pipes on stand-off brackets) = 1.6

Mount Analysis: TIA/EIA-222-F

Load Case 1	Extreme Wind 85 mph Wind Speed (Per Eversource exception, re: OTRM 059.1.E.1) No Radial Ice
Load Case 2	Combined Ice and Wind 74 mph Wind Speed (87% of basic wind speed, Annex A) ½" Radial Ice

RESULTS

The existing 94'-0" self-support type "D" 115kV quad circuit steel dead end transmission tower is sufficient to support the existing and proposed loads as defined in this report.

The existing equipment masts are sufficient to support the existing and proposed loads.

The existing foundation is sufficient to support the existing and proposed loads.

Component	Controlling Member	Usage
Lattice Tower Global	Angle 54P in Load Case TCL Broken	90%
Lattice Tower Local	Group 2 Mast Connection (Ext. Wind)	98%
North Mast	M4 HSS 6x6x1/4	77%
South Mast	M4 HSS 6x6x1/4	75%
Mount Connection at Twr.	Clamp Plate Connection	52%
Foundation Uplift	N/A	49%
Foundation Overturning	N/A	65%
Foundation Soil Bearing	N/A	54%

CONCLUSION

The existing 94'-0" tower #1102 is sufficient to support the new antennas and coax as outlined in this report.

We trust this report fulfills your current needs. However, if you should have any other questions or require additional information, please call.

Submitted by:
PAUL J. FORD AND COMPANY

Chad Hines, P.E., S.E.
Engineering Manager
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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 not necessarily limited to:

- Information supplied by the client regarding the structure itself, its foundations, soil conditions, the antenna and feed line load on the structure and its components, or other relevant information.

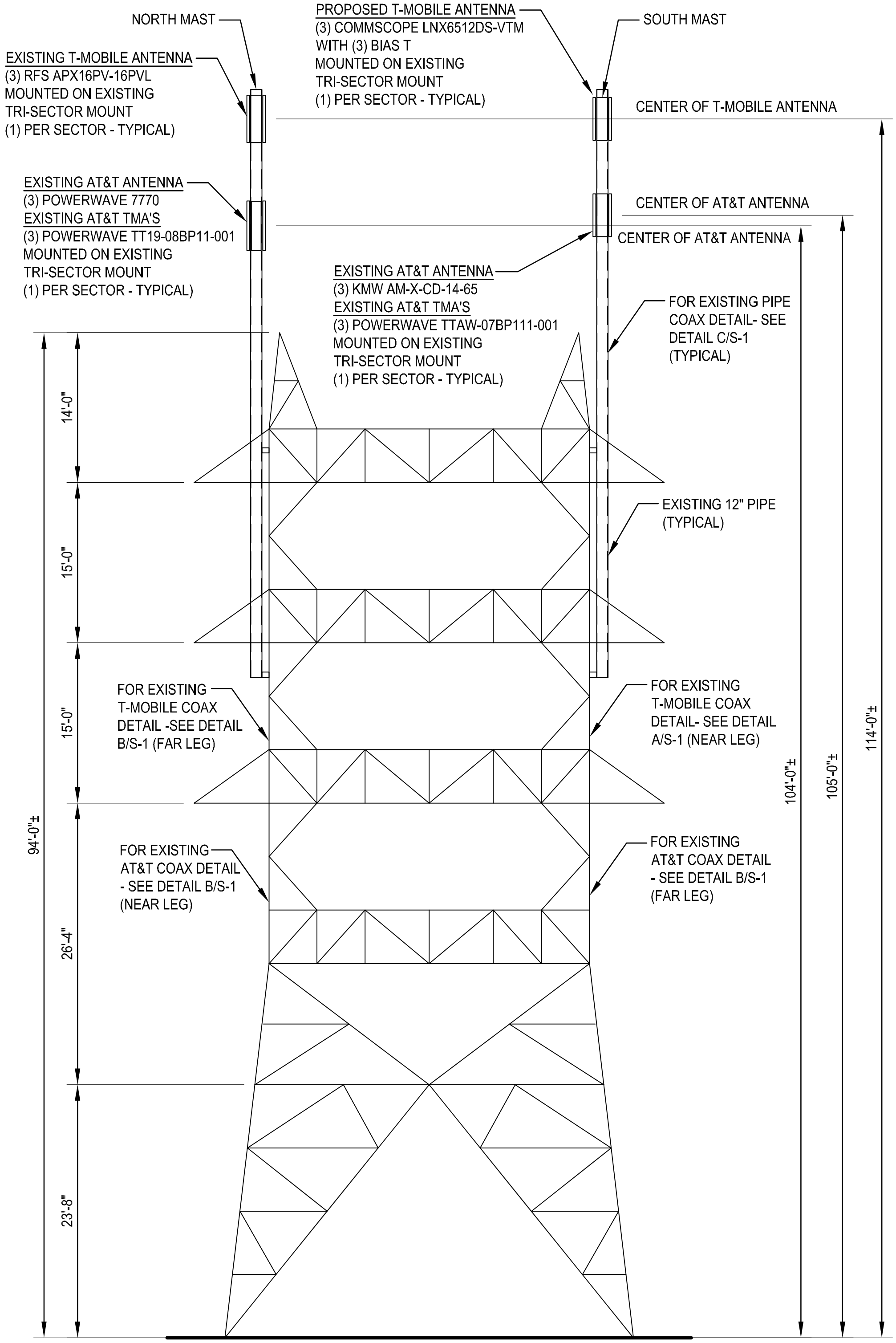
- Information generated by the field inspections or measurements of structure.

- It is the responsibility of the client to ensure that the information provided to PAUL J. FORD AND COMPANY 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 a non-corroded condition and have not deteriorated; and we, therefore, assume that their 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 to the latest revision of the ASCE 10 Standard, ASCE 48 Standard, or TIA-EIA Standard.

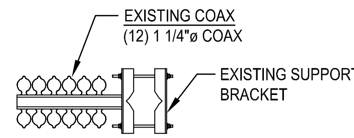
- All Services are performed, results obtained, and recommendations made in accordance with generally accepted engineering principles and practices. PAUL J. FORD AND COMPANY is not responsible for the conclusion, opinions and recommendations made by others based on the information we supply.

STRUCTURE DESIGN PROFILE

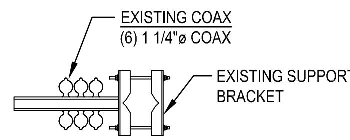


ELEVATION

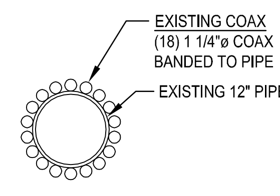
TRANSVERSE FACE
LOOKING NORTHEAST



DETAIL "A"
COAX DETAIL



DETAIL "B"
COAX DETAIL



DETAIL "C"
COAX DETAIL

NOTE:
INFORMATION PROVIDED ON THIS DRAWING IS INTENDED SOLELY FOR THE PURPOSES OF THIS STRUCTURAL ANALYSIS REPORT. PJF WILL NOT BE RESPONSIBLE FOR ITEMS FABRICATED OR PURCHASED BASED ON THIS DRAWING.

PAUL J. FORD & COMPANY
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T-MOBILE
35 GRIFFIN ROAD SOUTH BLOOMFIELD, CONNECTICUT 06002

Description: TRANSMISSION TOWER WITH ANTENNA MOUNT - ELEVATION AND SECTIONS
Utility: EVERSOURCE
Structure Info: TOWER #1102; LINE #1880
Site Info: 2 WILLRUSS STREET NORWALK, CONNECTICUT
SITE #CT11356C

Job No.	31215-0012.002.6000
Drawn by:	FE
Designed by:	CBH
Checked by:	CBH
Date	11-12-2015

S-1

31215-0012.002.6000.dwg

Loads and Load Calculations

Table of Contents

INPUT DATA

TOWER ID: 1102

Structure Height (ft) : 94

Wind Zone : Central CT (green)

Wind Speed : 110 mph

Tower Type : ○ Suspension ◉ Strain

Extreme Wind Model : PCS Addition

Shield Wire Properties:

	BACK	AHEAD
NAME =	*0.438 COMP*	*0.438 COMP*
DESCRIPTION =	0.438	0.438
STRANDING =	9/3 Cu/Cal Brz	9/3 Cu/Cal Brz
DIAMETER =	0.438 in	0.438 in
WEIGHT =	0.408 lb/ft	0.408 lb/ft

Conductor Properties:

		BACK	AHEAD		
	NAME =	*TERN*	*TERN*		
Number of Conductors per phase	1	795.000	795.000	1	Number of Conductors per phase
		45/7 ACSR	45/7 ACSR		
	DIAMETER =	1.063 in	1.063 in		
	WEIGHT =	0.895 lb/ft	0.895 lb/ft		

Insulator Weight = 200 lbs

Broken Wire Side = AHEAD SPAN

Horizontal Line Tensions:

	BACK		AHEAD	
	Shield	Conductor	Shield	Conductor
NESC HEAVY =	3,800	7,000	3,800	7,000
EXTREME WIND =	3,140	7,568	3,140	7,568
LONG. WIND =	na	na	na	na
250D COMBINED =	na	na	na	na
NESC W/O OLF =	na	na	na	na
60 DEG F NO WIND =	1,412	2,734	1,412	2,734

Line Geometry:

					SUM
LINE ANGLE (deg) =	BACK:	13	AHEAD:	13	**26**
WIND SPAN (ft) =	BACK:	409	AHEAD:	409	**818**
WEIGHT SPAN (ft) =	BACK:	415	AHEAD:	415	**830**

Job :	AT&T Norwalk, CT-5046			Page	of
		Spec. Number		Sheet	of
Description:		Computed by		Date	7/21/08
		Checked by		Date	

WIRE LOADING AT ATTACHMENTS

TOWER ID: 1102

Wind Span = 818 ft
Weight Span = 830 ft
Total Angle = 26 degrees

Broken Wire Span = AHEAD SPAN
Type of Insulator Attachment = STRAIN

1. NESC RULE 250B Heavy Loading:

	INTACT CONDITION			BROKEN WIRE CONDITION		
	Horizontal	Longitudinal	Vertical	Horizontal	Longitudinal	Vertical
Shield Wire =	3,810 lb	0 lb	1,234 lb	1,905 lb	6,108 lb	617 lb
Conductor =	6,618 lb	0 lb	2,924 lb	3,309 lb	11,252 lb	1,462 lb

2. NESC RULE 250C Transverse Extreme Wind Loading:

	Horizontal	Longitudinal	Vertical
Shield Wire =	2,270 lb	0 lb	339 lb
Conductor =	5,486 lb	0 lb	1,143 lb

3. NESC RULE 250C Longitudinal Extreme Wind Loading:

	Horizontal	Longitudinal	Vertical
Shield Wire =	#VALUE!	#VALUE!	339 lb
Conductor =	#VALUE!	#VALUE!	1,143 lb

4. NESC RULE 250D Extreme Ice & Wind Loading:

	Horizontal	Longitudinal	Vertical
Shield Wire =	#VALUE!	#VALUE!	1,823 lb
Conductor =	#VALUE!	#VALUE!	3,272 lb

5. NESC RULE 250B w/o OLF's

	Horizontal	Longitudinal	Vertical
Shield Wire =	#VALUE!	#VALUE!	823 lb
Conductor =	#VALUE!	#VALUE!	1,949 lb

6. 60 Deg. F, No Wind

	Horizontal	Longitudinal	Vertical
Shield Wire =	637 lb	0 lb	339 lb
Conductor =	1,234 lb	0 lb	1,143 lb

7. Construction

	Horizontal	Longitudinal	Vertical
Shield Wire =	956 lb	0 lb	508 lb
Conductor =	1,851 lb	0 lb	1,714 lb

NOTE: All loads include required overload factors (OLF's).

Northeast Utilities System

Job :	AT&T Norwalk, CT-5046	Spec. Number		Page	of
Description:		Computed by		Sheet	of
		Checked by		Date	7/21/08
				Date	

INPUT DATA

TOWER ID: 1102

Structure Height (ft) : 94

Wind Zone : Central CT (green)

Wind Speed : 110 mph

Tower Type : ○ Suspension ◉ Strain

Extreme Wind Model : PCS Addition

Shield Wire Properties:

	BACK	AHEAD
NAME =	*OPGW-120*	*OPGW-120*
DESCRIPTION =	6-Groove	6-Groove
STRANDING =	10/9 FOCAS	10/9 FOCAS
DIAMETER =	0.738 in	0.738 in
WEIGHT =	0.518 lb/ft	0.518 lb/ft

Conductor Properties:

		BACK	AHEAD		
	NAME =	*NONE*	*NONE*		
Number of Conductors per phase	1	-	-	1	Number of Conductors per phase
		- -	- -		
	DIAMETER =	0.000 in	0.000 in		
	WEIGHT =	0.000 lb/ft	0.000 lb/ft		

Insulator Weight = 200 lbs

Broken Wire Side = AHEAD SPAN

Horizontal Line Tensions:

	BACK		AHEAD	
	Shield	Conductor	Shield	Conductor
NESC HEAVY =	6,000	na	6,000	na
EXTREME WIND =	7,760	na	7,760	na
LONG. WIND =	na	na	na	na
250D COMBINED =	na	na	na	na
NESC W/O OLF =	na	na	na	na
60 DEG F NO WIND =	2,076	na	2,076	na

Line Geometry:

					SUM
LINE ANGLE (deg) =	BACK:	13	AHEAD:	13	**26**
WIND SPAN (ft) =	BACK:	409	AHEAD:	409	**818**
WEIGHT SPAN (ft) =	BACK:	415	AHEAD:	415	**830**

Job :	AT&T Norwalk, CT-5046			Page	of
Description:		Spec. Number		Sheet	of
		Computed by		Date	7/21/08
		Checked by		Date	

WIRE LOADING AT ATTACHMENTS

TOWER ID: 1102

Wind Span =	818 ft
Weight Span =	830 ft
Total Angle =	26 degrees

Broken Wire Span =	AHEAD SPAN
Type of Insulator Attachment =	STRAIN

1. NESC RULE 250B Heavy Loading:

	INTACT CONDITION			BROKEN WIRE CONDITION		
	Horizontal	Longitudinal	Vertical	Horizontal	Longitudinal	Vertical
Shield Wire =	5,652 lb	0 lb	1,603 lb	2,826 lb	9,645 lb	802 lb
Conductor =	#VALUE!	#VALUE!	987 lb	#VALUE!	#VALUE!	494 lb

2. NESC RULE 250C Transverse Extreme Wind Loading:

	Horizontal	Longitudinal	Vertical
Shield Wire =	4,939 lb	0 lb	430 lb
Conductor =	#VALUE!	#VALUE!	400 lb

3. NESC RULE 250C Longitudinal Extreme Wind Loading:

	Horizontal	Longitudinal	Vertical
Shield Wire =	#VALUE!	#VALUE!	430 lb
Conductor =	#VALUE!	#VALUE!	400 lb

4. NESC RULE 250D Extreme Ice & Wind Loading:

	Horizontal	Longitudinal	Vertical
Shield Wire =	#VALUE!	#VALUE!	2,224 lb
Conductor =	#VALUE!	#VALUE!	1,432 lb

5. NESC RULE 250B w/o OLF's

	Horizontal	Longitudinal	Vertical
Shield Wire =	#VALUE!	#VALUE!	1,069 lb
Conductor =	#VALUE!	#VALUE!	658 lb

6. 60 Deg. F, No Wind

	Horizontal	Longitudinal	Vertical
Shield Wire =	937 lb	0 lb	430 lb
Conductor =	#VALUE!	#VALUE!	400 lb

7. Construction

	Horizontal	Longitudinal	Vertical
Shield Wire =	1,405 lb	0 lb	645 lb
Conductor =	#VALUE!	#VALUE!	600 lb

NOTE: All loads include required overload factors (OLF's).

Equipment Loads (Tubular Pole on Lattice Structure) - TIA/EIA-222-F

Constants

$h_{lattice} := 94 \cdot ft$ height of lattice structure

$V := 85$ Basic Wind Speed

$V_i := 74$ Basic Wind Speed with Ice

$r_{ice} := 0.5 \cdot in$ Radial Ice

$I_d := 56 \cdot pcf$ Ice Density

$G_H = 1.167$ Calculated GRF, Sec. 2.3.4.1

$m_{grf.pole} := 1.25$ GRF Multiplier, Sec. 2.3.4.4

$G'_H := G_H \cdot m_{grf.pole} = 1.458$ Final GRF of pole on lattice, Sec. 2.3.4.4

$$G_H := 0.65 + \left(\frac{0.60}{\left(\frac{h_{lattice}}{33 \cdot ft} \right)^{\frac{1}{7}}} \right)$$

Height Above Grade

$z_{pole} := 94 \cdot ft$ Pole Section Average Height Above Ground for Wind Load

$z_{tmobile} := 114 \cdot ft$ equip height

$z_{att\_south} := 105 \cdot ft$ equip height

$z_{att\_north} := 104 \cdot ft$ equip height

$z_{coax} := 114 \cdot ft$ equip height

Exposure Coefficients:

$$Kz_{pole} := \left(\frac{z_{pole}}{33 \cdot ft} \right)^{\frac{2}{7}} = 1.349$$

$$Kz_{tmobile} := \left(\frac{z_{tmobile}}{33 \cdot ft} \right)^{\frac{2}{7}} = 1.425$$

$$Kz_{coax} := \left(\frac{z_{coax}}{33 \cdot ft} \right)^{\frac{2}{7}} = 1.425$$

$$Kz_{att\_south} := \left(\frac{z_{att\_south}}{33 \cdot ft} \right)^{\frac{2}{7}} = 1.392$$

$$Kz_{att\_north} := \left(\frac{z_{att\_north}}{33 \cdot ft} \right)^{\frac{2}{7}} = 1.388$$

Pipe Extension Loads - TIA/EIA-222-F

Constants

$OD := 12.75 \cdot in$	outer diameter of pipe riser
$L_{pipe} := 55 \cdot ft$	Length of pipe riser
$t_{pipe} := 0.5 \cdot in$	Pipe Thickness
$C := \sqrt{Kz_{pole}} \cdot V \cdot \frac{OD}{ft} = 104.88$	Table 1
$CF_{pole} := 0.59$	Table 1
$SA_{pole} := OD = 1.063\ ft$	Projected Surface Area of Pipe
$SAice_{pole} := OD + (2 \cdot r_{ice}) = 1.146\ ft$	Projected Surface Area of Pipe with Ice

Wind Pressure: Pipe

$$qz_{pole} := 0.00256 \cdot \frac{lb}{ft^2} \cdot V^2 \cdot G'_H \cdot Kz_{pole} \cdot CF_{pole} \cdot SA_{pole} = 22.804\ \frac{lb}{ft}$$

$$qzice_{pole} := 0.00256 \cdot \frac{lb}{ft^2} \cdot V_i^2 \cdot G'_H \cdot Kz_{pole} \cdot CF_{pole} \cdot SAice_{pole} = 18.639\ \frac{lb}{ft}$$

Ice Load (Weight)

$$Aice_{pole} := \frac{\pi}{4} \cdot \left((OD + 2 \cdot r_{ice})^2 - OD^2 \right) = 20.813\ in^2$$

$$Wice_{pole} := I_d \cdot Aice_{pole} = 8.1\ plf$$

Member Loads - TIA/EIA-222-F

Member Size: HSS 6x6x1/4

$L_{eq} := 84 \cdot in$

$H_{eq} := 6 \cdot in$

$W_{eq} := 6 \cdot in$

$$Ar_{eq} := \frac{L_{eq}}{W_{eq}} = 14$$

$$Ca_{eq} := \begin{cases} \text{if } Ar_{eq} \le 7 \\ \quad 1.4 \\ \text{if } 7 < Ar_{eq} < 25 \\ \quad 1.4 + \frac{(Ar_{eq} - 7) \cdot (2.0 - 1.4)}{(25 - 7)} \\ \text{if } Ar_{eq} \ge 25 \\ \quad 2.0 \end{cases} = 1.633$$

TIA/EIA-222-F, Table 3

$A_{eq} := H_{eq} = 0.5\ ft$

$$F_{eq_1} := 0.00256 \cdot \frac{lb}{ft^2} \cdot V^2 \cdot Kz_{pole} \cdot G'_H \cdot Ca_{eq} \cdot A_{eq} = 29.708\ \frac{lb}{ft}$$

$Aice_{eq} := H_{eq} + 2 \cdot r_{ice} = 7\ in$

$$Fice_{eq_1} := 0.00256 \cdot \frac{lb}{ft^2} \cdot V_i^2 \cdot Kz_{pole} \cdot G'_H \cdot Ca_{eq} \cdot Aice_{eq} = 26.269\ \frac{lb}{ft}$$

Gravity Load = self weight of member calculated by RISA 3D

$$A_{ice} := (W_{eq} + 2 \cdot r_{ice}) \cdot (H_{eq} + 2 \cdot r_{ice}) - W_{eq} \cdot H_{eq} = 13\ in^2$$

$$WT_{ice_1} := A_{ice} \cdot I_d = 5.056\ plf$$

Equipment Loads - TIA/EIA-222-F

North Mast

Equipment Model: RFS APX16-PV-16PVL

$L_{eq} := 53 \cdot in$

$W_{eq} := 12.9 \cdot in$

$t_{eq} := 3.1 \cdot in$

$WT_{eq} := 39.6 \cdot lb$

$QTY_{eq} := 3$

$$Ar_{eq} := \frac{L_{eq}}{W_{eq}} = 4.109$$

$$Ca_{eq} := \begin{cases} \text{if } Ar_{eq} \le 7 \\ \quad 1.4 \\ \text{if } 7 < Ar_{eq} < 25 \\ \quad 1.4 + \dfrac{(Ar_{eq} - 7) \cdot (2.0 - 1.4)}{(25 - 7)} \\ \text{if } Ar_{eq} \ge 25 \\ \quad 2.0 \end{cases} = 1.4$$

TIA/EIA-222-F, Table 3

$SA_{eq} := L_{eq} \cdot W_{eq} = 4.75\ ft^2$

$SAice_{eq} := (L_{eq} + 2 \cdot r_{ice}) \cdot (W_{eq} + 2 \cdot r_{ice}) = 5.213\ ft^2$

$A_{eq} := SA_{eq} \cdot QTY_{eq} = 14.244\ ft^2$

$Aice_{eq} := SAice_{eq} \cdot QTY_{eq} = 15.638\ ft^2$

$$F_{eq_1} := 0.00256 \cdot \frac{lb}{ft^2} \cdot V^2 \cdot Kz_{tmobile} \cdot G'_H \cdot Ca_{eq} \cdot A_{eq} = 766.498\ lb$$

$$Fice_{eq_1} := 0.00256 \cdot \frac{lb}{ft^2} \cdot V_i^2 \cdot Kz_{tmobile} \cdot G'_H \cdot Ca_{eq} \cdot Aice_{eq} = 637.793\ lb$$

$$T_{WT_1} := WT_{eq} \cdot QTY_{eq} = 118.8\ lb$$

$$V_{ice} := (L_{eq} + 2 \cdot r_{ice}) \cdot (W_{eq} + 2 \cdot r_{ice}) \cdot (t_{eq} + 2 \cdot r_{ice}) - L_{eq} \cdot W_{eq} \cdot t_{eq} = 957.99\ in^3$$

$$WT_{ice_1} := V_{ice} \cdot I_d \cdot QTY_{eq} = 93.138\ lbf$$

Equipment Loads - TIA/EIA-222-F

Equipment Loads - TIA/EIA-222-F

North Mast

Equipment Model: Powerwave 7770

$L_{eq} := 55 \cdot in$

$W_{eq} := 11 \cdot in$

$t_{eq} := 5 \cdot in$

$WT_{eq} := 35 \cdot lb$

$QTY_{eq} := 3$

$$Ar_{eq} := \frac{L_{eq}}{W_{eq}} = 5$$

$$Ca_{eq} := \begin{cases} 1.4 & \text{if } Ar_{eq} \le 7 \\ 1.4 + \frac{(Ar_{eq} - 7) \cdot (2.0 - 1.4)}{(25 - 7)} & \text{if } 7 < Ar_{eq} < 25 \\ 2.0 & \text{if } Ar_{eq} \ge 25 \end{cases} = 1.4$$

TIA/EIA-222-F, Table 3

$SA_{eq} := L_{eq} \cdot W_{eq} = 4.2\ ft^2$

$SAice_{eq} := (L_{eq} + 2 \cdot r_{ice}) \cdot (W_{eq} + 2 \cdot r_{ice}) = 4.667\ ft^2$

$A_{eq} := SA_{eq} \cdot QTY_{eq} = 12.604\ ft^2$

$Aice_{eq} := SAice_{eq} \cdot QTY_{eq} = 14\ ft^2$

$$F_{eq_6} := 0.00256 \cdot \frac{lb}{ft^2} \cdot V^2 \cdot Kz_{att\_north} \cdot G'_H \cdot Ca_{eq} \cdot A_{eq} = 660.707\ lb$$

$$Fice_{eq_6} := 0.00256 \cdot \frac{lb}{ft^2} \cdot V_i^2 \cdot Kz_{att\_north} \cdot G'_H \cdot Ca_{eq} \cdot Aice_{eq} = 556.223\ lb$$

$$T_{WT_6} := WT_{eq} \cdot QTY_{eq} = 105\ lb$$

$$V_{ice} := (L_{eq} + 2 \cdot r_{ice}) \cdot (W_{eq} + 2 \cdot r_{ice}) \cdot (t_{eq} + 2 \cdot r_{ice}) - L_{eq} \cdot W_{eq} \cdot t_{eq} = 1007\ in^3$$

$$WT_{ice_6} := V_{ice} \cdot I_d \cdot QTY_{eq} = 97.903\ lbf$$

Equipment Loads - TIA/EIA-222-F

North Mast

Equipment Model: Powerwave TT19-08BP111-001

$L_{eq} := 9.9 \cdot in$

$W_{eq} := 6.7 \cdot in$

$t_{eq} := 5.4 \cdot in$

$WT_{eq} := 18 \cdot lb$

$QTY_{eq} := 3$

$Ar_{eq} := \frac{L_{eq}}{W_{eq}} = 1.478$

$$Ca_{eq} := \begin{cases} 1.4 & \text{if } Ar_{eq} \le 7 \\ 1.4 + \frac{(Ar_{eq} - 7) \cdot (2.0 - 1.4)}{(25 - 7)} & \text{if } 7 < Ar_{eq} < 25 \\ 2.0 & \text{if } Ar_{eq} \ge 25 \end{cases} = 1.4$$

TIA/EIA-222-F, Table 3

$SA_{eq} := L_{eq} \cdot W_{eq} = 0.46\ ft^2$

$SAice_{eq} := (L_{eq} + 2 \cdot r_{ice}) \cdot (W_{eq} + 2 \cdot r_{ice}) = 0.583\ ft^2$

$A_{eq} := SA_{eq} \cdot QTY_{eq} = 1.382\ ft^2$

$Aice_{eq} := SAice_{eq} \cdot QTY_{eq} = 1.749\ ft^2$

$$F_{eq_7} := 0.00256 \cdot \frac{lb}{ft^2} \cdot V^2 \cdot Kz_{att\_north} \cdot G'_H \cdot Ca_{eq} \cdot A_{eq} = 72.438\ lb$$

$$Fice_{eq_7} := 0.00256 \cdot \frac{lb}{ft^2} \cdot V_i^2 \cdot Kz_{att\_north} \cdot G'_H \cdot Ca_{eq} \cdot Aice_{eq} = 69.47\ lb$$

$T_{WT_7} := WT_{eq} \cdot QTY_{eq} = 54\ lb$

$$V_{ice} := (L_{eq} + 2 \cdot r_{ice}) \cdot (W_{eq} + 2 \cdot r_{ice}) \cdot (t_{eq} + 2 \cdot r_{ice}) - L_{eq} \cdot W_{eq} \cdot t_{eq} = 178.97\ in^3$$

$WT_{ice_7} := V_{ice} \cdot I_d \cdot QTY_{eq} = 17.4\ lbf$

Equipment Loads - TIA/EIA-222-F

South Mast

Equipment Model: Commscope LNX-6512DS-VTM

$L_{eq} := 48.5 \cdot in$

$W_{eq} := 11.9 \cdot in$

$t_{eq} := 7.1 \cdot in$

$WT_{eq} := 28.7 \cdot lb$

$QTY_{eq} := 3$

$$Ar_{eq} := \frac{L_{eq}}{W_{eq}} = 4.076$$

$$Ca_{eq} := \begin{cases} 1.4 & \text{if } Ar_{eq} \le 7 \\ 1.4 + \frac{(Ar_{eq} - 7) \cdot (2.0 - 1.4)}{(25 - 7)} & \text{if } 7 < Ar_{eq} < 25 \\ 2.0 & \text{if } Ar_{eq} \ge 25 \end{cases} = 1.4$$

TIA/EIA-222-F, Table 3

$SA_{eq} := L_{eq} \cdot W_{eq} = 4.01\ ft^2$

$A_{eq} := SA_{eq} \cdot QTY_{eq} = 12.024\ ft^2$

$SAice_{eq} := (L_{eq} + 2 \cdot r_{ice}) \cdot (W_{eq} + 2 \cdot r_{ice}) = 4.434\ ft^2$

$Aice_{eq} := SAice_{eq} \cdot QTY_{eq} = 13.303\ ft^2$

$$F_{eq_4} := 0.00256 \cdot \frac{lb}{ft^2} \cdot V^2 \cdot Kz_{tmobile} \cdot G'_H \cdot Ca_{eq} \cdot A_{eq} = 647.045\ lb$$

$$Fice_{eq_4} := 0.00256 \cdot \frac{lb}{ft^2} \cdot V_i^2 \cdot Kz_{tmobile} \cdot G'_H \cdot Ca_{eq} \cdot Aice_{eq} = 542.583\ lb$$

$$T_{WT_4} := WT_{eq} \cdot QTY_{eq} = 86.1\ lb$$

$$V_{ice} := (L_{eq} + 2 \cdot r_{ice}) \cdot (W_{eq} + 2 \cdot r_{ice}) \cdot (t_{eq} + 2 \cdot r_{ice}) - L_{eq} \cdot W_{eq} \cdot t_{eq} = 1074.49\ in^3$$

$$WT_{ice_4} := V_{ice} \cdot I_d \cdot QTY_{eq} = 104.464\ lbf$$

Equipment Loads - TIA/EIA-222-F

South Mast

Equipment Model: Bias Tee

$L_{eq} := 3.7 \cdot in$

$W_{eq} := 2.0 \cdot in$

$t_{eq} := 5.63 \cdot in$

$WT_{eq} := 1.8 \cdot lb$

$QTY_{eq} := 3$

$$Ar_{eq} := \frac{L_{eq}}{W_{eq}} = 1.85$$

$$Ca_{eq} := \begin{cases} 1.4 & \text{if } Ar_{eq} \le 7 \\ 1.4 + \frac{(Ar_{eq} - 7) \cdot (2.0 - 1.4)}{(25 - 7)} & \text{if } 7 < Ar_{eq} < 25 \\ 2.0 & \text{if } Ar_{eq} \ge 25 \end{cases} = 1.4$$

TIA/EIA-222-F, Table 3

$SA_{eq} := L_{eq} \cdot W_{eq} = 0.05\ ft^2$

$SAice_{eq} := (L_{eq} + 2 \cdot r_{ice}) \cdot (W_{eq} + 2 \cdot r_{ice}) = 0.098\ ft^2$

$A_{eq} := SA_{eq} \cdot QTY_{eq} = 0.154\ ft^2$

$Aice_{eq} := SAice_{eq} \cdot QTY_{eq} = 0.294\ ft^2$

$$F_{eq_5} := 0.00256 \cdot \frac{lb}{ft^2} \cdot V^2 \cdot Kz_{tmobile} \cdot G'_H \cdot Ca_{eq} \cdot A_{eq} = 8.296\ lb$$

$$Fice_{eq_5} := 0.00256 \cdot \frac{lb}{ft^2} \cdot V_i^2 \cdot Kz_{tmobile} \cdot G'_H \cdot Ca_{eq} \cdot Aice_{eq} = 11.981\ lb$$

$T_{WT_5} := WT_{eq} \cdot QTY_{eq} = 5.4\ lb$

$V_{ice} := (L_{eq} + 2 \cdot r_{ice}) \cdot (W_{eq} + 2 \cdot r_{ice}) \cdot (t_{eq} + 2 \cdot r_{ice}) - L_{eq} \cdot W_{eq} \cdot t_{eq} = 51.821\ in^3$

$WT_{ice_5} := V_{ice} \cdot I_d \cdot QTY_{eq} = 5.038\ lbf$

Equipment Loads - TIA/EIA-222-F

South Mast

Equipment Model: KMW AM-X-CD-14-65

$L_{eq} := 48 \cdot in$

$W_{eq} := 11.8 \cdot in$

$t_{eq} := 5.9 \cdot in$

$WT_{eq} := 36.4 \cdot lb$

$QTY_{eq} := 3$

$$Ar_{eq} := \frac{L_{eq}}{W_{eq}} = 4.068$$

$$Ca_{eq} := \begin{cases} 1.4 & \text{if } Ar_{eq} \le 7 \\ 1.4 + \frac{(Ar_{eq} - 7) \cdot (2.0 - 1.4)}{(25 - 7)} & \text{if } 7 < Ar_{eq} < 25 \\ 2.0 & \text{if } Ar_{eq} \ge 25 \end{cases} = 1.4$$

TIA/EIA-222-F, Table 3

$SA_{eq} := L_{eq} \cdot W_{eq} = 3.93\ ft^2$

$A_{eq} := SA_{eq} \cdot QTY_{eq} = 11.8\ ft^2$

$SAice_{eq} := (L_{eq} + 2 \cdot r_{ice}) \cdot (W_{eq} + 2 \cdot r_{ice}) = 4.356\ ft^2$

$Aice_{eq} := SAice_{eq} \cdot QTY_{eq} = 13.067\ ft^2$

$$F_{eq_2} := 0.00256 \cdot \frac{lb}{ft^2} \cdot V^2 \cdot Kz_{att\_south} \cdot G'_H \cdot Ca_{eq} \cdot A_{eq} = 620.247\ lb$$

$$Fice_{eq_2} := 0.00256 \cdot \frac{lb}{ft^2} \cdot V_i^2 \cdot Kz_{att\_south} \cdot G'_H \cdot Ca_{eq} \cdot Aice_{eq} = 520.562\ lb$$

$$T_{WT_2} := WT_{eq} \cdot QTY_{eq} = 109.2\ lb$$

$$V_{ice} := (L_{eq} + 2 \cdot r_{ice}) \cdot (W_{eq} + 2 \cdot r_{ice}) \cdot (t_{eq} + 2 \cdot r_{ice}) - L_{eq} \cdot W_{eq} \cdot t_{eq} = 985.92\ in^3$$

$$WT_{ice_2} := V_{ice} \cdot I_d \cdot QTY_{eq} = 95.853\ lbf$$

Equipment Loads - TIA/EIA-222-F

Equipment Loads - TIA/EIA-222-F

South Mast

Equipment Model: Powerwave TTAW-07BP111-001

$L_{eq} := 9.9 \cdot in$

$W_{eq} := 6.7 \cdot in$

$t_{eq} := 5.4 \cdot in$

$WT_{eq} := 18 \cdot lb$

$QTY_{eq} := 3$

$Ar_{eq} := \frac{L_{eq}}{W_{eq}} = 1.478$

$$Ca_{eq} := \begin{cases} 1.4 & \text{if } Ar_{eq} \le 7 \\ 1.4 + \frac{(Ar_{eq} - 7) \cdot (2.0 - 1.4)}{(25 - 7)} & \text{if } 7 < Ar_{eq} < 25 \\ 2.0 & \text{if } Ar_{eq} \ge 25 \end{cases} = 1.4$$

TIA/EIA-222-F, Table 3

$SA_{eq} := L_{eq} \cdot W_{eq} = 0.46\ ft^2$

$SAice_{eq} := (L_{eq} + 2 \cdot r_{ice}) \cdot (W_{eq} + 2 \cdot r_{ice}) = 0.583\ ft^2$

$A_{eq} := SA_{eq} \cdot QTY_{eq} = 1.382\ ft^2$

$Aice_{eq} := SAice_{eq} \cdot QTY_{eq} = 1.749\ ft^2$

$F_{eq_3} := 0.00256 \cdot \frac{lb}{ft^2} \cdot V^2 \cdot Kz_{att\_south} \cdot G'_H \cdot Ca_{eq} \cdot A_{eq} = 72.636\ lb$

$Fice_{eq_3} := 0.00256 \cdot \frac{lb}{ft^2} \cdot V_i^2 \cdot Kz_{att\_south} \cdot G'_H \cdot Ca_{eq} \cdot Aice_{eq} = 69.66\ lb$

$T_{WT_3} := WT_{eq} \cdot QTY_{eq} = 54\ lb$

$V_{ice} := (L_{eq} + 2 \cdot r_{ice}) \cdot (W_{eq} + 2 \cdot r_{ice}) \cdot (t_{eq} + 2 \cdot r_{ice}) - L_{eq} \cdot W_{eq} \cdot t_{eq} = 178.97\ in^3$

$WT_{ice_3} := V_{ice} \cdot I_d \cdot QTY_{eq} = 17.4\ lbf$

Equipment Loads - TIA/EIA-222-F

Equipment Model: Microflect Universal Tri-Bracket

$QTY_{pipe} := 3$

$L_{pipe} := 72 \cdot in$

$OD_{pipe} := 2.375 \cdot in$

$Ar_{eq} := \dfrac{L_{pipe}}{OD_{pipe}} = 30.316$

$WT_{bracket} := 101 \cdot lbf$

$WT_{pipe} := 3.66 \cdot plf$

Wind Load (Without ice) and Wind Load (with ice) = 0 (Assumed shielded by Antennas)

$F_{mount_1} := 0$ $\qquad$ $Fice_{mount_1} := 0$

$$T_{mount_1} := WT_{pipe} \cdot L_{pipe} \cdot QTY_{pipe} + WT_{bracket} = 166.88\ lbf$$

$$V_{pipe} := \frac{\pi}{4} \cdot OD_{pipe}^{\ 2} \cdot L_{pipe} = 0.185\ ft^3$$

$$V_{ice} := \frac{\pi}{4} \cdot \left(OD_{pipe} + r_{ice} \cdot 2\right)^2 \cdot \left(L_{pipe} + r_{ice} \cdot 2\right) - V_{pipe} = 0.193\ ft^3$$

$$WT_{ice.mount_1} := V_{ice} \cdot I_d \cdot QTY_{pipe} + 5 \cdot lbf = 37.482\ lbf$$

Coax Loads - TIA/EIA-222-F

Coax Cable Description: 1-1/4" Coax run outside pipe

$OD_{coax} := 1.55 \cdot in$ $L_{coax} := 20 \cdot ft$ $WT_{coax} := 0.66 \cdot plf$ $QTY_{coax} := 18$

$NP_{coax} := 6$ Number of Projected Coax

$Ar_{coax} := \frac{L_{coax}}{OD_{coax}} = 154.839$ Aspect Ratio of Coax

$$Ca_{coax} := \begin{cases} 0.8 & \text{if } Ar_{coax} \le 7 \\ 0.8 + \frac{(Ar_{coax} - 7) \cdot (2.0 - 1.4)}{(25 - 7)} & \text{if } 7 < Ar_{coax} < 25 \\ 1.2 & \text{if } Ar_{coax} \ge 25 \end{cases} = 1.2$$

TIA/EIA-222-F, Table 3

$$SA_{coax} := \frac{NP_{coax} \cdot OD_{coax}}{ft} = 0.775$$

$$SAice_{coax} := \frac{(NP_{coax} \cdot OD_{coax}) + (2 \cdot r_{ice})}{ft} = 0.858$$

$$F_{coax_1} := 0.00256 \cdot V^2 \cdot Kz_{coax} \cdot G'_H \cdot Ca_{coax} \cdot SA_{coax} \cdot plf = 35.747\ plf$$

$$Fice_{coax_1} := 0.00256 \cdot V_i^2 \cdot Kz_{coax} \cdot G'_H \cdot Ca_{coax} \cdot SAice_{coax} \cdot plf = 30.007\ plf$$

$$T_{WT.coax_1} := WT_{coax} \cdot QTY_{coax} = 11.88\ plf$$

$$WTice_{coax_1} := \frac{\pi}{4} \cdot \left((OD_{coax} + 2 \cdot r_{ice})^2 - OD_{coax}^2 \right) \cdot QTY_{coax} \cdot I_d = 22.541\ plf$$

Equipment Loads (Tubular Pole on Lattice Structure) - NESC 2007

T-Mobile Existing Equipment with Existing Coax - North Mast

Constants

$h_{mount} := 117 \cdot ft$	Top of Mast AGL
$V := 110$	250C 3 sec Gust Speed per OTRM 060
$V_i := 39.5$	250B 3 sec Gust Speed with Ice
$r_{ice} := 0.5 \cdot in$	250B Radial Ice
$I_d := 57\ pcf$	Ice Density
$I := 1.0$	NESC Importance Factor

$$E_s := 0.346 \cdot \left(\frac{33}{\left(0.67 \cdot \frac{h_{mount}}{ft}\right)} \right)^{\frac{1}{7}} = 0.306 \qquad B_s := \frac{1}{\left(1 + \frac{0.56 \cdot \left(0.67 \cdot \frac{h_{mount}}{ft}\right)}{220}\right)} = 0.834$$

NESC Factors, Table 250-3

$k_v := 1.43$ — NESC Constant, Table 250-3

$$G_{RF} := \frac{\left(1 + \left(2.7 \cdot E_s \cdot B_s^{\ 0.5}\right)\right)}{k_v^{\ 2}} = 0.858$$

Calculated GRF, Table 250-3

$m_{grf} := 1.25$ — NEU specified multiplier for 250C (OTRM 059.1, Attachment A)

$G'_{RF} := G_{RF} \cdot m_{grf} = 1.072$ — Calculated GRF for 250C

$$k_z := 2.01 \cdot \left(\frac{h_{mount}}{900 \cdot ft} \right)^{\left(\frac{2}{9.5}\right)} = 1.308$$

Calculated kz per Table 250-2

$qz := 0.00256 \cdot k_z \cdot V^2 \cdot I \cdot psf = 40.5\ psf$

$qz_{ice} := 0.00256 \cdot V_i^{\ 2} \cdot I \cdot psf = 4.0\ psf$

Shape Factors:

$Cd_R := 1.3$

$Cd_F := 1.6$

$Cd_{coax} := 1.6$

NESC Overload Factors:

$OLF250B_V := 1.5$	250B Vertical OLF
$OLF250B_T := 2.5$	250B Transverse Wind OLF
$OLF250C_V := 1.0$	250C Vertical OLF
$OLF250C_T := 1.0$	250C Transverse Wind OLF

Pipe Mast Loads - NESC 2007

Pipe Mast Loads - NESC 2007

Constants

$OD_{pipe} := 12.75 \cdot \textbf{in}$ — Outer diameter of pipe riser

$SA_{pipe} := OD_{pipe} = 1.063\ \textbf{ft}$ — Projected Surface Area of Pipe

$SAice_{pipe} := OD_{pipe} + 2 \cdot r_{ice} = 1.146\ \textbf{ft}$ — Projected Surface Area of Pipe with Ice

Wind Pressure: Pipe

$qz_{pipe.Above} := qz \cdot G'_{RF} \cdot Cd_R \cdot SA_{pipe} = 60.0\ \textbf{plf}$ — 250C Wind Pressure Above Top of Tower

$qz_{pipe.Below} := qz \cdot G_{RF} \cdot Cd_R \cdot SA_{pipe} = 48.0\ \textbf{plf}$ — 250C Wind Pressure Below top of tower

$qzice_{pipe} := qz_{ice} \cdot Cd_R \cdot SAice_{pipe} = 5.9\ \textbf{plf}$ — 250B Wind Pressure

Ice Load (Weight)

$$Aice_{pipe} := \frac{\pi}{4} \cdot \left(\left(OD_{pipe} + 2 \cdot r_{ice} \right)^2 - OD_{pipe}^{\ 2} \right) = 20.813\ \textbf{in}^2$$

$$Wice_{pipe} := I_d \cdot Aice_{pipe} = 8.2\ \textbf{plf}$$

Mount Load - NESC 2007

$j := 1..2$

Mount Description:

1. Microflect Tri-Sector Mount:

$A_{mount_1} := 3.0 \cdot ft^2$ $\quad Aice_{mount_1} := 4.22 \cdot ft^2$ $\quad WT_{mount_1} := 101 \cdot lb$ $\quad WTice_{mount_1} := 150 \cdot lb$

2. (3) 2.375" OD Pipe Mounts

$A_{mount_2} := 0 \cdot ft^2$ $\quad Aice_{mount_2} := 0 \cdot ft^2$ $\quad WT_{mount_2} := 66 \cdot lb$ $\quad WTice_{mount_2} := 97 \cdot lb$

3. Mount Description #3

$A_{mount_3} := 0 \cdot ft^2$ $\quad Aice_{mount_3} := 0 \cdot ft^2$ $\quad WT_{mount_3} := 0 \cdot lb$ $\quad WTice_{mount_3} := 0 \cdot lb$

4. Mount Description #4

$A_{mount_4} := 0 \cdot ft^2$ $\quad Aice_{mount_4} := 0 \cdot ft^2$ $\quad WT_{mount_4} := 0 \cdot lb$ $\quad WTice_{mount_4} := 0 \cdot lb$

Calculations

$$F_{mount_j} := qz \cdot G'_{RF} \cdot Cd_F \cdot A_{mount_j}$$

$$Fice_{mount_j} := qz_{ice} \cdot Cd_F \cdot Aice_{mount_j}$$

$$TWT_{mount_j} := WT_{mount_j}$$

$$TWTice_{mount_j} := WTice_{mount_j}$$

	NESC 250B	NESC 250C
Weight	$TWTice_{mount} = \begin{bmatrix} 150 \\ 97 \end{bmatrix} lb$	$TWT_{mount} = \begin{bmatrix} 101 \\ 66 \end{bmatrix} lb$
Wind	$Fice_{mount} = \begin{bmatrix} 27.0 \\ 0.0 \end{bmatrix} lbf$	$F_{mount} = \begin{bmatrix} 208.5 \\ 0.0 \end{bmatrix} lbf$

Equipment Loads - NESC 2007

$i := 1 .. 1$

Equipment Description

1. APX16PV-16PVL	$QTY_{eq_1} := 3$	$L_{eq_1} := 53.0 \cdot in$	$W_{eq_1} := 12.9 \cdot in$	$t_{eq_1} := 3.1 \cdot in$	$WT_{eq_1} := 39.6 \cdot lbf$
2. Not Used	$QTY_{eq_2} := 0$	$L_{eq_2} := 0 \cdot in$	$W_{eq_2} := 0 \cdot in$	$t_{eq_2} := 0 \cdot in$	$WT_{eq_2} := 0 \cdot lbf$
3. Not Used	$QTY_{eq_3} := 0$	$L_{eq_3} := 0 \cdot in$	$W_{eq_3} := 0 \cdot in$	$t_{eq_3} := 0 \cdot in$	$WT_{eq_3} := 0 \cdot lbf$
4. Not Used	$QTY_{eq_4} := 0$	$L_{eq_4} := 0 \cdot in$	$W_{eq_4} := 0 \cdot in$	$t_{eq_4} := 0 \cdot in$	$WT_{eq_4} := 0 \cdot lbf$
5. Not Used	$QTY_{eq_5} := 0$	$L_{eq_5} := 0 \cdot in$	$W_{eq_5} := 0 \cdot in$	$t_{eq_5} := 0 \cdot in$	$WT_{eq_5} := 0 \cdot lbf$
6. Not Used	$QTY_{eq_6} := 0$	$L_{eq_6} := 0 \cdot in$	$W_{eq_6} := 0 \cdot in$	$t_{eq_6} := 0 \cdot in$	$WT_{eq_6} := 0 \cdot lbf$

Calculations

$$V_{ice_i} := \begin{cases} 0 & \text{if } QTY_{eq_i} = 0 \\ \left(\left(L_{eq_i} + 2 \cdot r_{ice}\right) \cdot \left(W_{eq_i} + 2 \cdot r_{ice}\right) \cdot \left(t_{eq_i} + 2 \cdot r_{ice}\right) - L_{eq_i} \cdot W_{eq_i} \cdot t_{eq_i}\right) & \text{else} \end{cases}$$

$$SA_{eq_i} := L_{eq_i} \cdot W_{eq_i} \cdot QTY_{eq_i}$$

$$F_{eq_i} := qz \cdot G'_{RF} \cdot Cd_F \cdot SA_{eq_i}$$

$$SAice_{eq_i} := \left(L_{eq_i} + 2 \cdot r_{ice}\right) \cdot \left(W_{eq_i} + 2 \cdot r_{ice}\right) \cdot QTY_{eq_i}$$

$$Fice_{eq_i} := qz_{ice} \cdot Cd_F \cdot SAice_{eq_i}$$

$$TWT_{eq_i} := WT_{eq_i} \cdot QTY_{eq_i}$$

$$TWT_{ice_i} := TWT_{eq_i} + \left(V_{ice_i} \cdot QTY_{eq_i} \cdot I_d\right)$$

		NESC 250B	NESC 250C
$SA_{eq} = [14.24]\ ft^2$	Weight	$TWT_{ice} = [213.6]\ lbf$	$TWT_{eq} = [118.8]\ lbf$
$SAice_{eq} = [15.64]\ ft^2$ $V_{ice} = [0.55]\ ft^3$	Wind	$Fice_{eq} = [99.9]\ lbf$	$F_{eq} = [990.0]\ lbf$

Coax Loads - NESC 2007

$qz = 40.5\ psf$ $qz_{ice} = 4.0\ psf$ $Cd_{coax} = 1.6$ $k := 1..1$

Coax Cable Description

1. Coax Model #1	$QTY_{coax_1} := 6$	$NP_{coax_1} := 3$	$OD_{coax_1} := 1.55 \cdot in$	$WT_{coax_1} := 0.66 \cdot plf$
2. Coax Model #2	$QTY_{coax_2} := 0$	$NP_{coax_2} := 0$	$OD_{coax_2} := 0 \cdot in$	$WT_{coax_2} := 0 \cdot plf$
3. Coax Model #3	$QTY_{coax_3} := 0$	$NP_{coax_3} := 0$	$OD_{coax_3} := 0 \cdot in$	$WT_{coax_3} := 0 \cdot plf$
4. Coax Model #4	$QTY_{coax_4} := 0$	$NP_{coax_4} := 0$	$OD_{coax_4} := 0 \cdot in$	$WT_{coax_4} := 0 \cdot plf$
5. Coax Model #5	$QTY_{coax_5} := 0$	$NP_{coax_5} := 0$	$OD_{coax_5} := 0 \cdot in$	$WT_{coax_5} := 0 \cdot plf$
6. Coax Model #6	$QTY_{coax_6} := 0$	$NP_{coax_6} := 0$	$OD_{coax_6} := 0 \cdot in$	$WT_{coax_6} := 0 \cdot plf$

Calculations

$$SA_{coax_k} := NP_{coax_k} \cdot OD_{coax_k}$$

$$coaxspan := \begin{bmatrix} 18.5 \\ 13.1 \\ 14 \\ 15 \\ 15 \end{bmatrix} \cdot ft$$

Input coax vertical span between attachment joints

$$SAice_{coax_k} := \begin{cases} 0 & \text{if } NP_{coax_k} = 0 \\ \left(NP_{coax_k} \cdot OD_{coax_k} + 2 \cdot r_{ice}\right) & \text{else} \end{cases}$$

$SA_{coax} = [0.388]\ ft$ $SAice_{coax} = [0.471]\ ft$

$$F_{coax.pipe.Above} := qz \cdot G'_{RF} \cdot Cd_{coax} \cdot \left(\sum SA_{coax}\right) = 26.933\ plf$$

$$F_{coax.pipe.Below} := qz \cdot G_{RF} \cdot Cd_{coax} \cdot \left(\sum SA_{coax}\right) = 21.547\ plf$$

$$Fice_{coax.pipe} := qz_{ice} \cdot Cd_{coax} \cdot \left(\sum SAice_{coax}\right) = 3.009\ plf$$

$$F_{coax.twr} := qz \cdot G_{RF} \cdot Cd_{coax} \cdot \left(\sum SA_{coax} \right) \cdot coaxspan$$

$$Fice_{coax.twr} := qz_{ice} \cdot Cd_{coax} \cdot \left(\sum SAice_{coax} \right) \cdot coaxspan$$

$$TWT_{coax_k} := WT_{coax_k} \cdot QTY_{coax_k}$$ $$TWT_{coax} = [3.96]\ plf$$

$$TWTice_{coax_k} := \begin{cases} TWT_{coax_k} & \text{if } NP_{coax_k} = 0 \\ \left(\frac{\pi}{4} \cdot \left(\left(OD_{coax_k} + 2 \cdot r_{ice} \right)^2 - \left(OD_{coax_k} \right)^2 \right) \cdot QTY_{coax_k} \cdot I_d \right) + TWT_{coax_k} & \text{else} \end{cases}$$

$$Coax_{wt} := \left(\sum TWT_{coax} \right) \cdot coaxspan$$

$$Coax_{icewt} := \left(\sum TWTice_{coax} \right) \cdot coaxspan$$ $$TWTice_{coax} = [11.608]\ plf$$

NESC 250B

NESC 250C

$$Fice_{coax.twr} = \begin{bmatrix} 56 \\ 39 \\ 42 \\ 45 \\ 45 \end{bmatrix} lbf \qquad Coax_{icewt} = \begin{bmatrix} 215 \\ 152 \\ 163 \\ 174 \\ 174 \end{bmatrix} lbf \qquad F_{coax.twr} = \begin{bmatrix} 399 \\ 282 \\ 302 \\ 323 \\ 323 \end{bmatrix} lbf \qquad Coax_{wt} = \begin{bmatrix} 73 \\ 52 \\ 55 \\ 59 \\ 59 \end{bmatrix} lbf$$

Summary of Loads - NESC 2007

NESC 250B

$OLF250B_T = 2.5$

$OLF250B_V = 1.5$

NESC 250C

$OLF250C_T = 1.0$

$OLF250C_V = 1.0$

<u>Pipe Mast</u>

NESC 250B:

$qzice_{pipe} \cdot OLF250B_T = 15\ plf$

$Wice_{pipe} \cdot OLF250B_V = 12\ plf$

NESC 250C:

$qz_{pipe.Above} \cdot OLF250C_T = 60\ plf$

$qz_{pipe.Below} \cdot OLF250C_T = 48\ plf$

<u>Mount</u>

NESC 250B:

$\left(\sum Fice_{mount}\right) \cdot OLF250B_T = 67\ lbf$

$\left(\sum TWTice_{mount}\right) \cdot OLF250B_V = 371\ lb$

NESC 250C:

$\left(\sum F_{mount}\right) \cdot OLF250C_T = 209\ lbf$

$\left(\sum TWT_{mount}\right) \cdot OLF250C_V = 167\ lb$

<u>Equipment</u>

NESC 250B:

$\left(\sum Fice_{eq}\right) \cdot OLF250B_T = 250\ lbf$

$\left(\sum TWT_{ice}\right) \cdot OLF250B_V = 320\ lbf$

NESC 250C:

$\left(\sum F_{eq}\right) \cdot OLF250C_T = 990\ lbf$

$\left(\sum TWT_{eq}\right) \cdot OLF250C_V = 119\ lbf$

<u>Coax</u>

NESC 250B:

$Fice_{coax.pipe} \cdot OLF250B_T = 8\ plf$

$\left(\sum TWTice_{coax}\right) \cdot OLF250B_V = 17\ plf$

NESC 250C:

$F_{coax.pipe.Above} \cdot OLF250C_T = 27\ plf$

$F_{coax.pipe.Below} \cdot OLF250C_T = 22\ plf$

$\left(\sum TWT_{coax}\right) \cdot OLF250C_V = 4\ plf$

$$Fice_{coax.twr} \cdot OLF250B_T = \begin{bmatrix} 139 \\ 99 \\ 105 \\ 113 \\ 113 \end{bmatrix} lbf \qquad F_{coax.twr} \cdot OLF250C_T = \begin{bmatrix} 399 \\ 282 \\ 302 \\ 323 \\ 323 \end{bmatrix} lbf$$

$$Coax_{icewt} \cdot OLF250B_V = \begin{bmatrix} 322 \\ 228 \\ 244 \\ 261 \\ 261 \end{bmatrix} lbf \qquad Coax_{wt} \cdot OLF250C_V = \begin{bmatrix} 73 \\ 52 \\ 55 \\ 59 \\ 59 \end{bmatrix} lbf$$

Equipment Loads (Tubular Pole on Lattice Structure) - NESC 2007

AT&T Existing Equipment with Existing Coax - North Mast

Constants

$h_{mount} := 104 \cdot ft$	Centerline of Equipment, AGL
$V := 110$	250C 3 sec Gust Speed per OTRM 060
$V_i := 39.5$	250B 3 sec Gust Speed with Ice
$r_{ice} := 0.5 \cdot in$	250B Radial Ice
$I_d := 57\ pcf$	Ice Density
$I := 1.0$	NESC Importance Factor

$$E_s := 0.346 \cdot \left(\frac{33}{\left(0.67 \cdot \frac{h_{mount}}{ft}\right)} \right)^{\frac{1}{7}} = 0.311 \qquad B_s := \frac{1}{\left(1 + \frac{0.56 \cdot \left(0.67 \cdot \frac{h_{mount}}{ft}\right)}{220}\right)} = 0.849$$

NESC Factors, Table 250-3

$k_v := 1.43$ NESC Constant, Table 250-3

$$G_{RF} := \frac{\left(1 + \left(2.7 \cdot E_s \cdot B_s^{\ 0.5}\right)\right)}{k_v^{\ 2}} = 0.867$$

Calculated GRF, Table 250-3

$m_{grf} := 1.25$ NEU specified multiplier for 250C (OTRM 059.1, Attachment A)

$G'_{RF} := G_{RF} \cdot m_{grf} = 1.084$ Calculated GRF for 250C

$$k_z := 2.01 \cdot \left(\frac{h_{mount}}{900 \cdot ft}\right)^{\left(\frac{2}{9.5}\right)} = 1.276$$

Calculated kz per Table 250-2

$qz := 0.00256 \cdot k_z \cdot V^2 \cdot I \cdot psf = 39.5\ psf$ $\qquad qz_{ice} := 0.00256 \cdot V_i^{\ 2} \cdot I \cdot psf = 4.0\ psf$

Shape Factors:

$Cd_R := 1.3$

$Cd_F := 1.6$

$Cd_{coax} := 1.6$

NESC Overload Factors:

$OLF250B_V := 1.5$	250B Vertical OLF
$OLF250B_T := 2.5$	250B Transverse Wind OLF
$OLF250C_V := 1.0$	250C Vertical OLF
$OLF250C_T := 1.0$	250C Transverse Wind OLF

Pipe Mast Loads - NESC 2007

See T-Mobile load calculations for Pipe Mast Loads

Mount Load - NESC 2007

$j := 1..2$

Mount Description:

1. Microflect Tri-Sector Mount:

$A_{mount_1} := 3.0 \cdot ft^2$ $\quad Aice_{mount_1} := 4.22 \cdot ft^2$ $\quad WT_{mount_1} := 101 \cdot lb$ $\quad WTice_{mount_1} := 150 \cdot lb$

2. (3) 2.375" OD Pipe Mounts

$A_{mount_2} := 0 \cdot ft^2$ $\quad Aice_{mount_2} := 0 \cdot ft^2$ $\quad WT_{mount_2} := 66 \cdot lb$ $\quad WTice_{mount_2} := 97 \cdot lb$

3. Mount Description #3

$A_{mount_3} := 0 \cdot ft^2$ $\quad Aice_{mount_3} := 0 \cdot ft^2$ $\quad WT_{mount_3} := 0 \cdot lb$ $\quad WTice_{mount_3} := 0 \cdot lb$

4. Mount Description #4

$A_{mount_4} := 0 \cdot ft^2$ $\quad Aice_{mount_4} := 0 \cdot ft^2$ $\quad WT_{mount_4} := 0 \cdot lb$ $\quad WTice_{mount_4} := 0 \cdot lb$

Calculations

$$F_{mount_j} := qz \cdot G'_{RF} \cdot Cd_F \cdot A_{mount_j}$$

$$Fice_{mount_j} := qz_{ice} \cdot Cd_F \cdot Aice_{mount_j}$$

$$TWT_{mount_j} := WT_{mount_j}$$

$$TWTice_{mount_j} := WTice_{mount_j}$$

	NESC 250B	NESC 250C
Weight	$TWTice_{mount} = \begin{bmatrix} 150 \\ 97 \end{bmatrix} lb$	$TWT_{mount} = \begin{bmatrix} 101 \\ 66 \end{bmatrix} lb$
Wind	$Fice_{mount} = \begin{bmatrix} 27.0 \\ 0.0 \end{bmatrix} lbf$	$F_{mount} = \begin{bmatrix} 205.7 \\ 0.0 \end{bmatrix} lbf$

Equipment Load - NESC 2007

Equipment Loads - NESC 2007

$i := 1..2$

Equipment Description

1. Powerwave 7770	$QTY_{eq_1} := 3$	$L_{eq_1} := 55.4 \cdot in$	$W_{eq_1} := 11.0 \cdot in$	$t_{eq_1} := 4.9 \cdot in$	$WT_{eq_1} := 39.0 \cdot lbf$
2. Powerwave TT19-08BP11-001	$QTY_{eq_2} := 3$	$L_{eq_2} := 9.9 \cdot in$	$W_{eq_2} := 6.7 \cdot in$	$t_{eq_2} := 5.4 \cdot in$	$WT_{eq_2} := 18.0 \cdot lbf$
3. Not Used	$QTY_{eq_3} := 0$	$L_{eq_3} := 0 \cdot in$	$W_{eq_3} := 0 \cdot in$	$t_{eq_3} := 0 \cdot in$	$WT_{eq_3} := 0 \cdot lbf$
4. Not Used	$QTY_{eq_4} := 0$	$L_{eq_4} := 0 \cdot in$	$W_{eq_4} := 0 \cdot in$	$t_{eq_4} := 0 \cdot in$	$WT_{eq_4} := 0 \cdot lbf$
5. Not Used	$QTY_{eq_5} := 0$	$L_{eq_5} := 0 \cdot in$	$W_{eq_5} := 0 \cdot in$	$t_{eq_5} := 0 \cdot in$	$WT_{eq_5} := 0 \cdot lbf$
6. Not Used	$QTY_{eq_6} := 0$	$L_{eq_6} := 0 \cdot in$	$W_{eq_6} := 0 \cdot in$	$t_{eq_6} := 0 \cdot in$	$WT_{eq_6} := 0 \cdot lbf$

Calculations

$$V_{ice_i} := \begin{cases} 0 & \text{if } QTY_{eq_i} = 0 \\ \left(\left(L_{eq_i} + 2 \cdot r_{ice}\right) \cdot \left(W_{eq_i} + 2 \cdot r_{ice}\right) \cdot \left(t_{eq_i} + 2 \cdot r_{ice}\right) - L_{eq_i} \cdot W_{eq_i} \cdot t_{eq_i}\right) & \text{else} \end{cases}$$

$$SA_{eq_i} := L_{eq_i} \cdot W_{eq_i} \cdot QTY_{eq_i} \qquad F_{eq_i} := qz \cdot G'_{RF} \cdot Cd_F \cdot SA_{eq_i}$$

$$SAice_{eq_i} := \left(L_{eq_i} + 2 \cdot r_{ice}\right) \cdot \left(W_{eq_i} + 2 \cdot r_{ice}\right) \cdot QTY_{eq_i} \qquad Fice_{eq_i} := qz_{ice} \cdot Cd_F \cdot SAice_{eq_i}$$

$$TWT_{eq_i} := WT_{eq_i} \cdot QTY_{eq_i}$$

$$TWT_{ice_i} := TWT_{eq_i} + \left(V_{ice_i} \cdot QTY_{eq_i} \cdot I_d\right)$$

NESC 250B | NESC 250C

$$SA_{eq} = \begin{bmatrix} 12.70 \\ 1.38 \end{bmatrix} ft^2$$

Weight $\quad TWT_{ice} = \begin{bmatrix} 216.7 \\ 71.7 \end{bmatrix} lbf \quad TWT_{eq} = \begin{bmatrix} 117.0 \\ 54.0 \end{bmatrix} lbf$

$$SAice_{eq} = \begin{bmatrix} 14.10 \\ 1.75 \end{bmatrix} ft^2 \qquad V_{ice} = \begin{bmatrix} 0.58 \\ 0.10 \end{bmatrix} ft^3$$

Wind $\quad Fice_{eq} = \begin{bmatrix} 90.1 \\ 11.2 \end{bmatrix} lbf \quad F_{eq} = \begin{bmatrix} 870.6 \\ 94.8 \end{bmatrix} lbf$

Coax Loads - NESC 2007

$qz = 39.5\ psf$ $qz_{ice} = 4.0\ psf$ $Cd_{coax} = 1.6$ $k := 1..1$

Coax Cable Description

1. Coax Model #1	$QTY_{coax_1} := 6$	$NP_{coax_1} := 3$	$OD_{coax_1} := 1.55 \cdot in$	$WT_{coax_1} := 0.66 \cdot plf$
2. Coax Model #2	$QTY_{coax_2} := 0$	$NP_{coax_2} := 0$	$OD_{coax_2} := 0 \cdot in$	$WT_{coax_2} := 0 \cdot plf$
3. Coax Model #3	$QTY_{coax_3} := 0$	$NP_{coax_3} := 0$	$OD_{coax_3} := 0 \cdot in$	$WT_{coax_3} := 0 \cdot plf$
4. Coax Model #4	$QTY_{coax_4} := 0$	$NP_{coax_4} := 0$	$OD_{coax_4} := 0 \cdot in$	$WT_{coax_4} := 0 \cdot plf$
5. Coax Model #5	$QTY_{coax_5} := 0$	$NP_{coax_5} := 0$	$OD_{coax_5} := 0 \cdot in$	$WT_{coax_5} := 0 \cdot plf$
6. Coax Model #6	$QTY_{coax_6} := 0$	$NP_{coax_6} := 0$	$OD_{coax_6} := 0 \cdot in$	$WT_{coax_6} := 0 \cdot plf$

Calculations

$$SA_{coax_k} := NP_{coax_k} \cdot OD_{coax_k}$$

$$coaxspan := \begin{bmatrix} 18.5 \\ 13.1 \\ 14 \\ 15 \\ 15 \end{bmatrix} \cdot ft$$

Input coax vertical span between attachment joints

$$SAice_{coax_k} := \begin{cases} 0 & \text{if } NP_{coax_k} = 0 \\ \left(NP_{coax_k} \cdot OD_{coax_k} + 2 \cdot r_{ice}\right) & \text{else} \end{cases}$$

$SA_{coax} = [0.388]\ ft$ $SAice_{coax} = [0.471]\ ft$

$$F_{coax.pipe.Above} := qz \cdot G'_{RF} \cdot Cd_{coax} \cdot \left(\sum SA_{coax}\right) = 26.573\ plf$$

$$F_{coax.pipe.Below} := qz \cdot G_{RF} \cdot Cd_{coax} \cdot \left(\sum SA_{coax}\right) = 21.258\ plf$$

$$Fice_{coax.pipe} := qz_{ice} \cdot Cd_{coax} \cdot \left(\sum SAice_{coax}\right) = 3.009\ plf$$

$$F_{coax.twr} := qz \cdot G_{RF} \cdot Cd_{coax} \cdot \left(\sum SA_{coax}\right) \cdot coaxspan$$

$$Fice_{coax.twr} := qz_{ice} \cdot Cd_{coax} \cdot \left(\sum SAice_{coax}\right) \cdot coaxspan$$

$$TWT_{coax_k} := WT_{coax_k} \cdot QTY_{coax_k}$$

$$TWT_{coax} = [3.96]\ plf$$

$$TWTice_{coax_k} := \begin{cases} TWT_{coax_k} & \text{if } NP_{coax_k} = 0 \\ \left(\frac{\pi}{4} \cdot \left(\left(OD_{coax_k} + 2 \cdot r_{ice}\right)^2 - \left(OD_{coax_k}\right)^2\right) \cdot QTY_{coax_k} \cdot I_d\right) + TWT_{coax_k} & \text{else} \end{cases}$$

$$Coax_{wt} := \left(\sum TWT_{coax}\right) \cdot coaxspan$$

$$TWTice_{coax} = [11.608]\ plf$$

$$Coax_{icewt} := \left(\sum TWTice_{coax}\right) \cdot coaxspan$$

NESC 250B

NESC 250C

$$Fice_{coax.twr} = \begin{bmatrix} 56 \\ 39 \\ 42 \\ 45 \\ 45 \end{bmatrix} lbf \qquad Coax_{icewt} = \begin{bmatrix} 215 \\ 152 \\ 163 \\ 174 \\ 174 \end{bmatrix} lbf \qquad F_{coax.twr} = \begin{bmatrix} 393 \\ 278 \\ 298 \\ 319 \\ 319 \end{bmatrix} lbf \qquad Coax_{wt} = \begin{bmatrix} 73 \\ 52 \\ 55 \\ 59 \\ 59 \end{bmatrix} lbf$$

Summary of Loads - NESC 2007

	NESC 250B	NESC 250C
	$OLF250B_T = 2.5$	$OLF250C_T = 1.0$
	$OLF250B_V = 1.5$	$OLF250C_V = 1.0$
Pipe Mast	See T-Mobile Calcs	
Mount	$\left(\sum Fice_{mount}\right) \cdot OLF250B_T = 67$ **lbf**	$\left(\sum F_{mount}\right) \cdot OLF250C_T = 206$ **lbf**
	$\left(\sum TWTice_{mount}\right) \cdot OLF250B_V = 371$ **lb**	$\left(\sum TWT_{mount}\right) \cdot OLF250C_V = 167$ **lb**
Equipment	$\left(\sum Fice_{eq}\right) \cdot OLF250B_T = 253$ **lbf**	$\left(\sum F_{eq}\right) \cdot OLF250C_T = 965$ **lbf**
	$\left(\sum TWT_{ice}\right) \cdot OLF250B_V = 433$ **lbf**	$\left(\sum TWT_{eq}\right) \cdot OLF250C_V = 171$ **lbf**
Coax	$Fice_{coax.pipe} \cdot OLF250B_T = 8$ **plf**	$F_{coax.pipe.Above} \cdot OLF250C_T = 27$ **plf**
	$\left(\sum TWTice_{coax}\right) \cdot OLF250B_V = 17$ **plf**	$F_{coax.pipe.Below} \cdot OLF250C_T = 21$ **plf**
		$\left(\sum TWT_{coax}\right) \cdot OLF250C_V = 4$ **plf**

$$Fice_{coax.twr} \cdot OLF250B_T = \begin{bmatrix} 139 \\ 99 \\ 105 \\ 113 \\ 113 \end{bmatrix} \textbf{lbf} \qquad F_{coax.twr} \cdot OLF250C_T = \begin{bmatrix} 393 \\ 278 \\ 298 \\ 319 \\ 319 \end{bmatrix} \textbf{lbf}$$

$$Coax_{icewt} \cdot OLF250B_V = \begin{bmatrix} 322 \\ 228 \\ 244 \\ 261 \\ 261 \end{bmatrix} \textbf{lbf} \qquad Coax_{wt} \cdot OLF250C_V = \begin{bmatrix} 73 \\ 52 \\ 55 \\ 59 \\ 59 \end{bmatrix} \textbf{lbf}$$

Equipment Loads (Tubular Pole on Lattice Structure) - NESC 2007

T-Mobile Proposed Equipment with Existing Coax - South Mast

Constants

$h_{mount} := 117 \cdot ft$ Top of Mast AGL

$V := 110$ 250C 3 sec Gust Speed per OTRM 060

$V_i := 39.5$ 250B 3 sec Gust Speed with Ice

$r_{ice} := 0.5 \cdot in$ 250B Radial Ice

$I_d := 57\ pcf$ Ice Density

$I := 1.0$ NESC Importance Factor

$$E_s := 0.346 \cdot \left(\frac{33}{\left(0.67 \cdot \frac{h_{mount}}{ft}\right)} \right)^{\frac{1}{7}} = 0.306 \qquad B_s := \frac{1}{\left(1 + \frac{0.56 \cdot \left(0.67 \cdot \frac{h_{mount}}{ft}\right)}{220}\right)} = 0.834$$

NESC Factors, Table 250-3

$k_v := 1.43$ NESC Constant, Table 250-3

$$G_{RF} := \frac{\left(1 + \left(2.7 \cdot E_s \cdot B_s^{\ 0.5}\right)\right)}{k_v^{\ 2}} = 0.858$$

Calculated GRF, Table 250-3

$m_{grf} := 1.25$ NEU specified multiplier for 250C (OTRM 059.1, Attachment A)

$G'_{RF} := G_{RF} \cdot m_{grf} = 1.072$ Calculated GRF for 250C

$$k_z := 2.01 \cdot \left(\frac{h_{mount}}{900 \cdot ft} \right)^{\left(\frac{2}{9.5}\right)} = 1.308$$

Calculated kz per Table 250-2

$qz := 0.00256 \cdot k_z \cdot V^2 \cdot I \cdot psf = 40.5\ psf$

$qz_{ice} := 0.00256 \cdot V_i^{\ 2} \cdot I \cdot psf = 4.0\ psf$

Shape Factors:

$Cd_R := 1.3$

$Cd_F := 1.6$

$Cd_{coax} := 1.6$

NESC Overload Factors:

$OLF250B_V := 1.5$ 250B Vertical OLF

$OLF250B_T := 2.5$ 250B Transverse Wind OLF

$OLF250C_V := 1.0$ 250C Vertical OLF

$OLF250C_T := 1.0$ 250C Transverse Wind OLF

Pipe Mast Loads - NESC 2007

Pipe Mast Loads - NESC 2007

Constants

$OD_{pipe} := 12.75 \cdot \mathbf{in}$ — Outer diameter of pipe riser

$SA_{pipe} := OD_{pipe} = 1.063\ \mathbf{ft}$ — Projected Surface Area of Pipe

$SAice_{pipe} := OD_{pipe} + 2 \cdot r_{ice} = 1.146\ \mathbf{ft}$ — Projected Surface Area of Pipe with Ice

Wind Pressure: Pipe

$qz_{pipe.Above} := qz \cdot G'_{RF} \cdot Cd_R \cdot SA_{pipe} = 60.0\ \mathbf{plf}$ — 250C Wind Pressure Above Top of Tower

$qz_{pipe.Below} := qz \cdot G_{RF} \cdot Cd_R \cdot SA_{pipe} = 48.0\ \mathbf{plf}$ — 250C Wind Pressure Below top of tower

$qzice_{pipe} := qz_{ice} \cdot Cd_R \cdot SAice_{pipe} = 5.9\ \mathbf{plf}$ — 250B Wind Pressure

Ice Load (Weight)

$$Aice_{pipe} := \frac{\pi}{4} \cdot \left(\left(OD_{pipe} + 2 \cdot r_{ice} \right)^2 - {OD_{pipe}}^2 \right) = 20.813\ \mathbf{in}^2$$

$$Wice_{pipe} := I_d \cdot Aice_{pipe} = 8.2\ \mathbf{plf}$$

Mount Load - NESC 2007

$j := 1..2$

Mount Description:

1. Microflect Tri-Sector Mount:

$A_{mount_1} := 3.0 \cdot ft^2$ $\quad Aice_{mount_1} := 4.22 \cdot ft^2$ $\quad WT_{mount_1} := 101 \cdot lb$ $\quad WTice_{mount_1} := 150 \cdot lb$

2. (3) 2.375" OD Pipe Mounts

$A_{mount_2} := 0 \cdot ft^2$ $\quad Aice_{mount_2} := 0 \cdot ft^2$ $\quad WT_{mount_2} := 66 \cdot lb$ $\quad WTice_{mount_2} := 97 \cdot lb$

3. Mount Description #3

$A_{mount_3} := 0 \cdot ft^2$ $\quad Aice_{mount_3} := 0 \cdot ft^2$ $\quad WT_{mount_3} := 0 \cdot lb$ $\quad WTice_{mount_3} := 0 \cdot lb$

4. Mount Description #4

$A_{mount_4} := 0 \cdot ft^2$ $\quad Aice_{mount_4} := 0 \cdot ft^2$ $\quad WT_{mount_4} := 0 \cdot lb$ $\quad WTice_{mount_4} := 0 \cdot lb$

Calculations

$$F_{mount_j} := qz \cdot G'_{RF} \cdot Cd_F \cdot A_{mount_j}$$

$$Fice_{mount_j} := qz_{ice} \cdot Cd_F \cdot Aice_{mount_j}$$

$$TWT_{mount_j} := WT_{mount_j}$$

$$TWTice_{mount_j} := WTice_{mount_j}$$

	NESC 250B	NESC 250C
Weight	$TWTice_{mount} = \begin{bmatrix} 150 \\ 97 \end{bmatrix} lb$	$TWT_{mount} = \begin{bmatrix} 101 \\ 66 \end{bmatrix} lb$
Wind	$Fice_{mount} = \begin{bmatrix} 27.0 \\ 0.0 \end{bmatrix} lbf$	$F_{mount} = \begin{bmatrix} 208.5 \\ 0.0 \end{bmatrix} lbf$

Equipment Loads - NESC 2007

$i := 1..2$

Equipment Description

1. LNX-6512DS-VTM	$QTY_{eq_1} := 3$	$L_{eq_1} := 48.5 \cdot in$	$W_{eq_1} := 11.9 \cdot in$	$t_{eq_1} := 7.1 \cdot in$	$WT_{eq_1} := 28.7 \cdot lbf$
2. Bias T	$QTY_{eq_2} := 3$	$L_{eq_2} := 5.63 \cdot in$	$W_{eq_2} := 3.7 \cdot in$	$t_{eq_2} := 2.0 \cdot in$	$WT_{eq_2} := 1.8 \cdot lbf$
3. Not Used	$QTY_{eq_3} := 0$	$L_{eq_3} := 0 \cdot in$	$W_{eq_3} := 0 \cdot in$	$t_{eq_3} := 0 \cdot in$	$WT_{eq_3} := 0 \cdot lbf$
4. Not Used	$QTY_{eq_4} := 0$	$L_{eq_4} := 0 \cdot in$	$W_{eq_4} := 0 \cdot in$	$t_{eq_4} := 0 \cdot in$	$WT_{eq_4} := 0 \cdot lbf$
5. Not Used	$QTY_{eq_5} := 0$	$L_{eq_5} := 0 \cdot in$	$W_{eq_5} := 0 \cdot in$	$t_{eq_5} := 0 \cdot in$	$WT_{eq_5} := 0 \cdot lbf$
6. Not Used	$QTY_{eq_6} := 0$	$L_{eq_6} := 0 \cdot in$	$W_{eq_6} := 0 \cdot in$	$t_{eq_6} := 0 \cdot in$	$WT_{eq_6} := 0 \cdot lbf$

Calculations

$$V_{ice_i} := \begin{cases} 0 & \text{if } QTY_{eq_i} = 0 \\ \left(\left(L_{eq_i} + 2 \cdot r_{ice}\right) \cdot \left(W_{eq_i} + 2 \cdot r_{ice}\right) \cdot \left(t_{eq_i} + 2 \cdot r_{ice}\right) - L_{eq_i} \cdot W_{eq_i} \cdot t_{eq_i}\right) & \text{else} \end{cases}$$

$$SA_{eq_i} := L_{eq_i} \cdot W_{eq_i} \cdot QTY_{eq_i}$$

$$F_{eq_i} := qz \cdot G'_{RF} \cdot Cd_F \cdot SA_{eq_i}$$

$$SAice_{eq_i} := \left(L_{eq_i} + 2 \cdot r_{ice}\right) \cdot \left(W_{eq_i} + 2 \cdot r_{ice}\right) \cdot QTY_{eq_i}$$

$$Fice_{eq_i} := qz_{ice} \cdot Cd_F \cdot SAice_{eq_i}$$

$$TWT_{eq_i} := WT_{eq_i} \cdot QTY_{eq_i}$$

$$TWT_{ice_i} := TWT_{eq_i} + \left(V_{ice_i} \cdot QTY_{eq_i} \cdot I_d\right)$$

NESC 250B — NESC 250C

$$SA_{eq} = \begin{bmatrix} 12.02 \\ 0.43 \end{bmatrix} ft^2$$

Weight $TWT_{ice} = \begin{bmatrix} 192.4 \\ 10.5 \end{bmatrix} lbf$ $TWT_{eq} = \begin{bmatrix} 86.1 \\ 5.4 \end{bmatrix} lbf$

$$SAice_{eq} = \begin{bmatrix} 13.30 \\ 0.65 \end{bmatrix} ft^2 \quad V_{ice} = \begin{bmatrix} 0.62 \\ 0.03 \end{bmatrix} ft^3$$

Wind $Fice_{eq} = \begin{bmatrix} 85.0 \\ 4.1 \end{bmatrix} lbf$ $F_{eq} = \begin{bmatrix} 835.7 \\ 30.2 \end{bmatrix} lbf$

Coax Loads - NESC 2007

$qz = 40.5\ psf$ $qz_{ice} = 4.0\ psf$ $Cd_{coax} = 1.6$ $k := 1..1$

Coax Cable Description

1. Coax Model #1	$QTY_{coax_1} := 12$	$NP_{coax_1} := 6$	$OD_{coax_1} := 1.55 \cdot in$	$WT_{coax_1} := 0.66 \cdot plf$
2. Coax Model #2	$QTY_{coax_2} := 0$	$NP_{coax_2} := 0$	$OD_{coax_2} := 0 \cdot in$	$WT_{coax_2} := 0 \cdot plf$
3. Coax Model #3	$QTY_{coax_3} := 0$	$NP_{coax_3} := 0$	$OD_{coax_3} := 0 \cdot in$	$WT_{coax_3} := 0 \cdot plf$
4. Coax Model #4	$QTY_{coax_4} := 0$	$NP_{coax_4} := 0$	$OD_{coax_4} := 0 \cdot in$	$WT_{coax_4} := 0 \cdot plf$
5. Coax Model #5	$QTY_{coax_5} := 0$	$NP_{coax_5} := 0$	$OD_{coax_5} := 0 \cdot in$	$WT_{coax_5} := 0 \cdot plf$
6. Coax Model #6	$QTY_{coax_6} := 0$	$NP_{coax_6} := 0$	$OD_{coax_6} := 0 \cdot in$	$WT_{coax_6} := 0 \cdot plf$

Calculations

$$SA_{coax_k} := NP_{coax_k} \cdot OD_{coax_k}$$

$$coaxspan := \begin{bmatrix} 18.5 \\ 13.1 \\ 14 \\ 15 \\ 15 \end{bmatrix} \cdot ft$$

Input coax vertical span between attachment joints

$$SAice_{coax_k} := \begin{cases} 0 & \text{if } NP_{coax_k} = 0 \\ \left(NP_{coax_k} \cdot OD_{coax_k} + 2 \cdot r_{ice}\right) & \text{else} \end{cases}$$

$SA_{coax} = [0.775]\ ft$ $SAice_{coax} = [0.858]\ ft$

$$F_{coax.pipe.Above} := qz \cdot G'_{RF} \cdot Cd_{coax} \cdot \left(\sum SA_{coax}\right) = 53.867\ plf$$

$$F_{coax.pipe.Below} := qz \cdot G_{RF} \cdot Cd_{coax} \cdot \left(\sum SA_{coax}\right) = 43.094\ plf$$

$$Fice_{coax.pipe} := qz_{ice} \cdot Cd_{coax} \cdot \left(\sum SAice_{coax}\right) = 5.485\ plf$$

$$F_{coax.twr} := qz \cdot G_{RF} \cdot Cd_{coax} \cdot \left(\sum SA_{coax}\right) \cdot coaxspan$$

$$Fice_{coax.twr} := qz_{ice} \cdot Cd_{coax} \cdot \left(\sum SAice_{coax}\right) \cdot coaxspan$$

$$TWT_{coax_k} := WT_{coax_k} \cdot QTY_{coax_k} \qquad TWT_{coax} = [7.92]\ plf$$

$$TWTice_{coax_k} := \begin{cases} \text{if } NP_{coax_k} = 0 \\ \quad TWT_{coax_k} \\ \text{else} \\ \quad \left(\frac{\pi}{4} \cdot \left(\left(OD_{coax_k} + 2 \cdot r_{ice}\right)^2 - \left(OD_{coax_k}\right)^2\right) \cdot QTY_{coax_k} \cdot I_d\right) + TWT_{coax_k} \end{cases}$$

$$Coax_{wt} := \left(\sum TWT_{coax}\right) \cdot coaxspan$$

$$TWTice_{coax} = [23.216]\ plf$$

$$Coax_{icewt} := \left(\sum TWTice_{coax}\right) \cdot coaxspan$$

NESC 250B

NESC 250C

$$Fice_{coax.twr} = \begin{bmatrix} 101 \\ 72 \\ 77 \\ 82 \\ 82 \end{bmatrix} lbf \qquad Coax_{icewt} = \begin{bmatrix} 429 \\ 304 \\ 325 \\ 348 \\ 348 \end{bmatrix} lbf \qquad F_{coax.twr} = \begin{bmatrix} 797 \\ 565 \\ 603 \\ 646 \\ 646 \end{bmatrix} lbf \qquad Coax_{wt} = \begin{bmatrix} 147 \\ 104 \\ 111 \\ 119 \\ 119 \end{bmatrix} lbf$$

Summary of Loads - NESC 2007

	NESC 250B	**NESC 250C**
	$OLF250B_T = 2.5$	$OLF250C_T = 1.0$
	$OLF250B_V = 1.5$	$OLF250C_V = 1.0$
Pipe Mast	$qzice_{pipe} \cdot OLF250B_T = 15\ plf$	$qz_{pipe.Above} \cdot OLF250C_T = 60\ plf$
	$Wice_{pipe} \cdot OLF250B_V = 12\ plf$	$qz_{pipe.Below} \cdot OLF250C_T = 48\ plf$
Mount	$\left(\sum Fice_{mount}\right) \cdot OLF250B_T = 67\ lbf$	$\left(\sum F_{mount}\right) \cdot OLF250C_T = 209\ lbf$
	$\left(\sum TWTice_{mount}\right) \cdot OLF250B_V = 371\ lb$	$\left(\sum TWT_{mount}\right) \cdot OLF250C_V = 167\ lb$
Equipment	$\left(\sum Fice_{eq}\right) \cdot OLF250B_T = 223\ lbf$	$\left(\sum F_{eq}\right) \cdot OLF250C_T = 866\ lbf$
	$\left(\sum TWT_{ice}\right) \cdot OLF250B_V = 304\ lbf$	$\left(\sum TWT_{eq}\right) \cdot OLF250C_V = 92\ lbf$
Coax	$Fice_{coax.pipe} \cdot OLF250B_T = 14\ plf$	$F_{coax.pipe.Above} \cdot OLF250C_T = 54\ plf$
	$\left(\sum TWTice_{coax}\right) \cdot OLF250B_V = 35\ plf$	$F_{coax.pipe.Below} \cdot OLF250C_T = 43\ plf$
		$\left(\sum TWT_{coax}\right) \cdot OLF250C_V = 8\ plf$

$$Fice_{coax.twr} \cdot OLF250B_T = \begin{bmatrix} 254 \\ 180 \\ 192 \\ 206 \\ 206 \end{bmatrix} lbf \qquad F_{coax.twr} \cdot OLF250C_T = \begin{bmatrix} 797 \\ 565 \\ 603 \\ 646 \\ 646 \end{bmatrix} lbf$$

$$Coax_{icewt} \cdot OLF250B_V = \begin{bmatrix} 644 \\ 456 \\ 488 \\ 522 \\ 522 \end{bmatrix} lbf \qquad Coax_{wt} \cdot OLF250C_V = \begin{bmatrix} 147 \\ 104 \\ 111 \\ 119 \\ 119 \end{bmatrix} lbf$$

Equipment Loads (Tubular Pole on Lattice Structure) - NESC 2007

AT&T Existing Equipment with Existing Coax - South Mast

Constants

$h_{mount} := 105 \cdot ft$	Centerline of Equipment, AGL
$V := 110$	250C 3 sec Gust Speed per OTRM 060
$V_i := 39.5$	250B 3 sec Gust Speed with Ice
$r_{ice} := 0.5 \cdot in$	250B Radial Ice
$I_d := 57\ pcf$	Ice Density
$I := 1.0$	NESC Importance Factor

$$E_s := 0.346 \cdot \left(\frac{33}{\left(0.67 \cdot \frac{h_{mount}}{ft}\right)} \right)^{\frac{1}{7}} = 0.311 \qquad B_s := \frac{1}{\left(1 + \frac{0.56 \cdot \left(0.67 \cdot \frac{h_{mount}}{ft}\right)}{220}\right)} = 0.848$$

NESC Factors, Table 250-3

$k_v := 1.43$ — NESC Constant, Table 250-3

$$G_{RF} := \frac{\left(1 + \left(2.7 \cdot E_s \cdot B_s^{\,0.5}\right)\right)}{k_v^{\,2}} = 0.867$$

Calculated GRF, Table 250-3

$m_{grf} := 1.25$ — NEU specified multiplier for 250C (OTRM 059.1, Attachment A)

$G'_{RF} := G_{RF} \cdot m_{grf} = 1.083$ — Calculated GRF for 250C

$$k_z := 2.01 \cdot \left(\frac{h_{mount}}{900 \cdot ft}\right)^{\left(\frac{2}{9.5}\right)} = 1.279$$

Calculated kz per Table 250-2

$qz := 0.00256 \cdot k_z \cdot V^2 \cdot I \cdot psf = 39.6\ psf$ $\qquad qz_{ice} := 0.00256 \cdot V_i^{\,2} \cdot I \cdot psf = 4.0\ psf$

Shape Factors:

$Cd_R := 1.3$

$Cd_F := 1.6$

$Cd_{coax} := 1.6$

NESC Overload Factors:

$OLF250B_V := 1.5$	250B Vertical OLF
$OLF250B_T := 2.5$	250B Transverse Wind OLF
$OLF250C_V := 1.0$	250C Vertical OLF
$OLF250C_T := 1.0$	250C Transverse Wind OLF

Pipe Mast Loads - NESC 2007

Pipe Mast Loads - NESC 2007

See T-Mobile load calculations for Pipe Mast Loads

Mount Load - NESC 2007

$j := 1..2$

Mount Description:

1. Microflect Tri-Sector Mount:

$A_{mount_1} := 3.0 \cdot ft^2$ $\quad Aice_{mount_1} := 4.22 \cdot ft^2$ $\quad WT_{mount_1} := 101 \cdot lb$ $\quad WTice_{mount_1} := 150 \cdot lb$

2. (3) 2.375" OD Pipe Mounts

$A_{mount_2} := 0 \cdot ft^2$ $\quad Aice_{mount_2} := 0 \cdot ft^2$ $\quad WT_{mount_2} := 66 \cdot lb$ $\quad WTice_{mount_2} := 97 \cdot lb$

3. Mount Description #3

$A_{mount_3} := 0 \cdot ft^2$ $\quad Aice_{mount_3} := 0 \cdot ft^2$ $\quad WT_{mount_3} := 0 \cdot lb$ $\quad WTice_{mount_3} := 0 \cdot lb$

4. Mount Description #4

$A_{mount_4} := 0 \cdot ft^2$ $\quad Aice_{mount_4} := 0 \cdot ft^2$ $\quad WT_{mount_4} := 0 \cdot lb$ $\quad WTice_{mount_4} := 0 \cdot lb$

Calculations

$$F_{mount_j} := qz \cdot G'_{RF} \cdot Cd_F \cdot A_{mount_j}$$

$$Fice_{mount_j} := qz_{ice} \cdot Cd_F \cdot Aice_{mount_j}$$

$$TWT_{mount_j} := WT_{mount_j}$$

$$TWTice_{mount_j} := WTice_{mount_j}$$

	NESC 250B	NESC 250C
Weight	$TWTice_{mount} = \begin{bmatrix} 150 \\ 97 \end{bmatrix} lb$	$TWT_{mount} = \begin{bmatrix} 101 \\ 66 \end{bmatrix} lb$
Wind	$Fice_{mount} = \begin{bmatrix} 27.0 \\ 0.0 \end{bmatrix} lbf$	$F_{mount} = \begin{bmatrix} 206.0 \\ 0.0 \end{bmatrix} lbf$

Equipment Loads - NESC 2007

Equipment Loads - NESC 2007

$i := 1..2$

Equipment Description

1. KMW AM-X-CD-14-65 $QTY_{eq_1} := 3$ $L_{eq_1} := 48.0 \cdot in$ $W_{eq_1} := 11.8 \cdot in$ $t_{eq_1} := 5.9 \cdot in$ $WT_{eq_1} := 36.4 \cdot lbf$

2. Powerwave TT19-08BP11-001 $QTY_{eq_2} := 3$ $L_{eq_2} := 9.9 \cdot in$ $W_{eq_2} := 6.7 \cdot in$ $t_{eq_2} := 5.4 \cdot in$ $WT_{eq_2} := 18 \cdot lbf$

3. Not Used $QTY_{eq_3} := 0$ $L_{eq_3} := 0 \cdot in$ $W_{eq_3} := 0 \cdot in$ $t_{eq_3} := 0 \cdot in$ $WT_{eq_3} := 0 \cdot lbf$

4. Not Used $QTY_{eq_4} := 0$ $L_{eq_4} := 0 \cdot in$ $W_{eq_4} := 0 \cdot in$ $t_{eq_4} := 0 \cdot in$ $WT_{eq_4} := 0 \cdot lbf$

5. Not Used $QTY_{eq_5} := 0$ $L_{eq_5} := 0 \cdot in$ $W_{eq_5} := 0 \cdot in$ $t_{eq_5} := 0 \cdot in$ $WT_{eq_5} := 0 \cdot lbf$

6. Not Used $QTY_{eq_6} := 0$ $L_{eq_6} := 0 \cdot in$ $W_{eq_6} := 0 \cdot in$ $t_{eq_6} := 0 \cdot in$ $WT_{eq_6} := 0 \cdot lbf$

Calculations

$$V_{ice_i} := \begin{cases} \text{if } QTY_{eq_i} = 0 \\ \quad 0 \\ \text{else} \\ \quad \left(\left(L_{eq_i} + 2 \cdot r_{ice}\right) \cdot \left(W_{eq_i} + 2 \cdot r_{ice}\right) \cdot \left(t_{eq_i} + 2 \cdot r_{ice}\right) - L_{eq_i} \cdot W_{eq_i} \cdot t_{eq_i}\right) \end{cases}$$

$$SA_{eq_i} := L_{eq_i} \cdot W_{eq_i} \cdot QTY_{eq_i}$$

$$F_{eq_i} := qz \cdot G'_{RF} \cdot Cd_F \cdot SA_{eq_i}$$

$$SAice_{eq_i} := \left(L_{eq_i} + 2 \cdot r_{ice}\right) \cdot \left(W_{eq_i} + 2 \cdot r_{ice}\right) \cdot QTY_{eq_i}$$

$$Fice_{eq_i} := qz_{ice} \cdot Cd_F \cdot SAice_{eq_i}$$

$$TWT_{eq_i} := WT_{eq_i} \cdot QTY_{eq_i}$$

$$TWT_{ice_i} := TWT_{eq_i} + \left(V_{ice_i} \cdot QTY_{eq_i} \cdot I_d\right)$$

NESC 250B NESC 250C

$SA_{eq} = \begin{bmatrix} 11.80 \\ 1.38 \end{bmatrix} ft^2$

Weight $TWT_{ice} = \begin{bmatrix} 206.8 \\ 71.7 \end{bmatrix} lbf$ $TWT_{eq} = \begin{bmatrix} 109.2 \\ 54.0 \end{bmatrix} lbf$

$SAice_{eq} = \begin{bmatrix} 13.07 \\ 1.75 \end{bmatrix} ft^2$ $V_{ice} = \begin{bmatrix} 0.57 \\ 0.10 \end{bmatrix} ft^3$

Wind $Fice_{eq} = \begin{bmatrix} 83.5 \\ 11.2 \end{bmatrix} lbf$ $F_{eq} = \begin{bmatrix} 810.1 \\ 94.9 \end{bmatrix} lbf$

Coax Loads - NESC 2007

$qz = 39.6\ psf$ $\quad qz_{ice} = 4.0\ psf$ $\quad Cd_{coax} = 1.6$ $\quad k := 1..1$

Coax Cable Description

1. Coax Model #1	$QTY_{coax_1} := 6$	$NP_{coax_1} := 3$	$OD_{coax_1} := 1.55 \cdot in$	$WT_{coax_1} := 0.66 \cdot plf$
2. Coax Model #2	$QTY_{coax_2} := 0$	$NP_{coax_2} := 0$	$OD_{coax_2} := 0 \cdot in$	$WT_{coax_2} := 0 \cdot plf$
3. Coax Model #3	$QTY_{coax_3} := 0$	$NP_{coax_3} := 0$	$OD_{coax_3} := 0 \cdot in$	$WT_{coax_3} := 0 \cdot plf$
4. Coax Model #4	$QTY_{coax_4} := 0$	$NP_{coax_4} := 0$	$OD_{coax_4} := 0 \cdot in$	$WT_{coax_4} := 0 \cdot plf$
5. Coax Model #5	$QTY_{coax_5} := 0$	$NP_{coax_5} := 0$	$OD_{coax_5} := 0 \cdot in$	$WT_{coax_5} := 0 \cdot plf$
6. Coax Model #6	$QTY_{coax_6} := 0$	$NP_{coax_6} := 0$	$OD_{coax_6} := 0 \cdot in$	$WT_{coax_6} := 0 \cdot plf$

Calculations

$$SA_{coax_k} := NP_{coax_k} \cdot OD_{coax_k}$$

$$coaxspan := \begin{bmatrix} 18.5 \\ 13.1 \\ 14 \\ 15 \\ 15 \end{bmatrix} \cdot ft$$

Input coax vertical span between attachment joints

$$SAice_{coax_k} := \begin{cases} 0 & \text{if } NP_{coax_k} = 0 \\ \left(NP_{coax_k} \cdot OD_{coax_k} + 2 \cdot r_{ice}\right) & \text{else} \end{cases}$$

$SA_{coax} = [0.388]\ ft$ $\quad SAice_{coax} = [0.471]\ ft$

$$F_{coax.pipe.Above} := qz \cdot G'_{RF} \cdot Cd_{coax} \cdot \left(\sum SA_{coax}\right) \cdot 0 = 0\ plf$$

See T-Mobile calcs for projected coax wind

$$F_{coax.pipe.Below} := qz \cdot G_{RF} \cdot Cd_{coax} \cdot \left(\sum SA_{coax}\right) \cdot 0 = 0\ plf$$

See T-Mobile calcs for projected coax wind

$$Fice_{coax.pipe} := qz_{ice} \cdot Cd_{coax} \cdot \left(\sum SAice_{coax}\right) = 3.009\ plf$$

$$F_{coax.twr} := qz \cdot G_{RF} \cdot Cd_{coax} \cdot \left(\sum SA_{coax} \right) \cdot coaxspan$$

$$Fice_{coax.twr} := qz_{ice} \cdot Cd_{coax} \cdot \left(\sum SAice_{coax} \right) \cdot coaxspan$$

$$TWT_{coax_k} := WT_{coax_k} \cdot QTY_{coax_k} \qquad TWT_{coax} = [3.96]\ plf$$

$$TWTice_{coax_k} := \begin{cases} TWT_{coax_k} & \text{if } NP_{coax_k} = 0 \\ \left(\frac{\pi}{4} \cdot \left(\left(OD_{coax_k} + 2 \cdot r_{ice} \right)^2 - \left(OD_{coax_k} \right)^2 \right) \cdot QTY_{coax_k} \cdot I_d \right) + TWT_{coax_k} & \text{else} \end{cases}$$

$$Coax_{wt} := \left(\sum TWT_{coax} \right) \cdot coaxspan$$

$$TWTice_{coax} = [11.608]\ plf$$

$$Coax_{icewt} := \left(\sum TWTice_{coax} \right) \cdot coaxspan$$

NESC 250B

NESC 250C

$$Fice_{coax.twr} = \begin{bmatrix} 56 \\ 39 \\ 42 \\ 45 \\ 45 \end{bmatrix} lbf \qquad Coax_{icewt} = \begin{bmatrix} 215 \\ 152 \\ 163 \\ 174 \\ 174 \end{bmatrix} lbf \qquad F_{coax.twr} = \begin{bmatrix} 394 \\ 279 \\ 298 \\ 319 \\ 319 \end{bmatrix} lbf \qquad Coax_{wt} = \begin{bmatrix} 73 \\ 52 \\ 55 \\ 59 \\ 59 \end{bmatrix} lbf$$

Summary of Loads - NESC 2007

Summary of Loads - NESC 2007

	NESC 250B	NESC 250C
	$OLF250B_T = 2.5$	$OLF250C_T = 1.0$
	$OLF250B_V = 1.5$	$OLF250C_V = 1.0$
Pipe Mast	See T-Mobile Calcs	
Mount	$\left(\sum Fice_{mount}\right) \cdot OLF250B_T = 67$ **lbf**	$\left(\sum F_{mount}\right) \cdot OLF250C_T = 206$ **lbf**
	$\left(\sum TWTice_{mount}\right) \cdot OLF250B_V = 371$ **lb**	$\left(\sum TWT_{mount}\right) \cdot OLF250C_V = 167$ **lb**
Equipment	$\left(\sum Fice_{eq}\right) \cdot OLF250B_T = 237$ **lbf**	$\left(\sum F_{eq}\right) \cdot OLF250C_T = 905$ **lbf**
	$\left(\sum TWT_{ice}\right) \cdot OLF250B_V = 418$ **lbf**	$\left(\sum TWT_{eq}\right) \cdot OLF250C_V = 163$ **lbf**
Coax	$Fice_{coax.pipe} \cdot OLF250B_T = 8$ **plf**	$F_{coax.pipe.Above} \cdot OLF250C_T = 0$ **plf**
	$\left(\sum TWTice_{coax}\right) \cdot OLF250B_V = 17$ **plf**	$F_{coax.pipe.Below} \cdot OLF250C_T = 0$ **plf**
		$\left(\sum TWT_{coax}\right) \cdot OLF250C_V = 4$ **plf**

$$Fice_{coax.twr} \cdot OLF250B_T = \begin{bmatrix} 139 \\ 99 \\ 105 \\ 113 \\ 113 \end{bmatrix} \textbf{lbf} \qquad F_{coax.twr} \cdot OLF250C_T = \begin{bmatrix} 394 \\ 279 \\ 298 \\ 319 \\ 319 \end{bmatrix} \textbf{lbf}$$

$$Coax_{icewt} \cdot OLF250B_V = \begin{bmatrix} 322 \\ 228 \\ 244 \\ 261 \\ 261 \end{bmatrix} \textbf{lbf} \qquad Coax_{wt} \cdot OLF250C_V = \begin{bmatrix} 73 \\ 52 \\ 55 \\ 59 \\ 59 \end{bmatrix} \textbf{lbf}$$

MOUNT ANALYSIS

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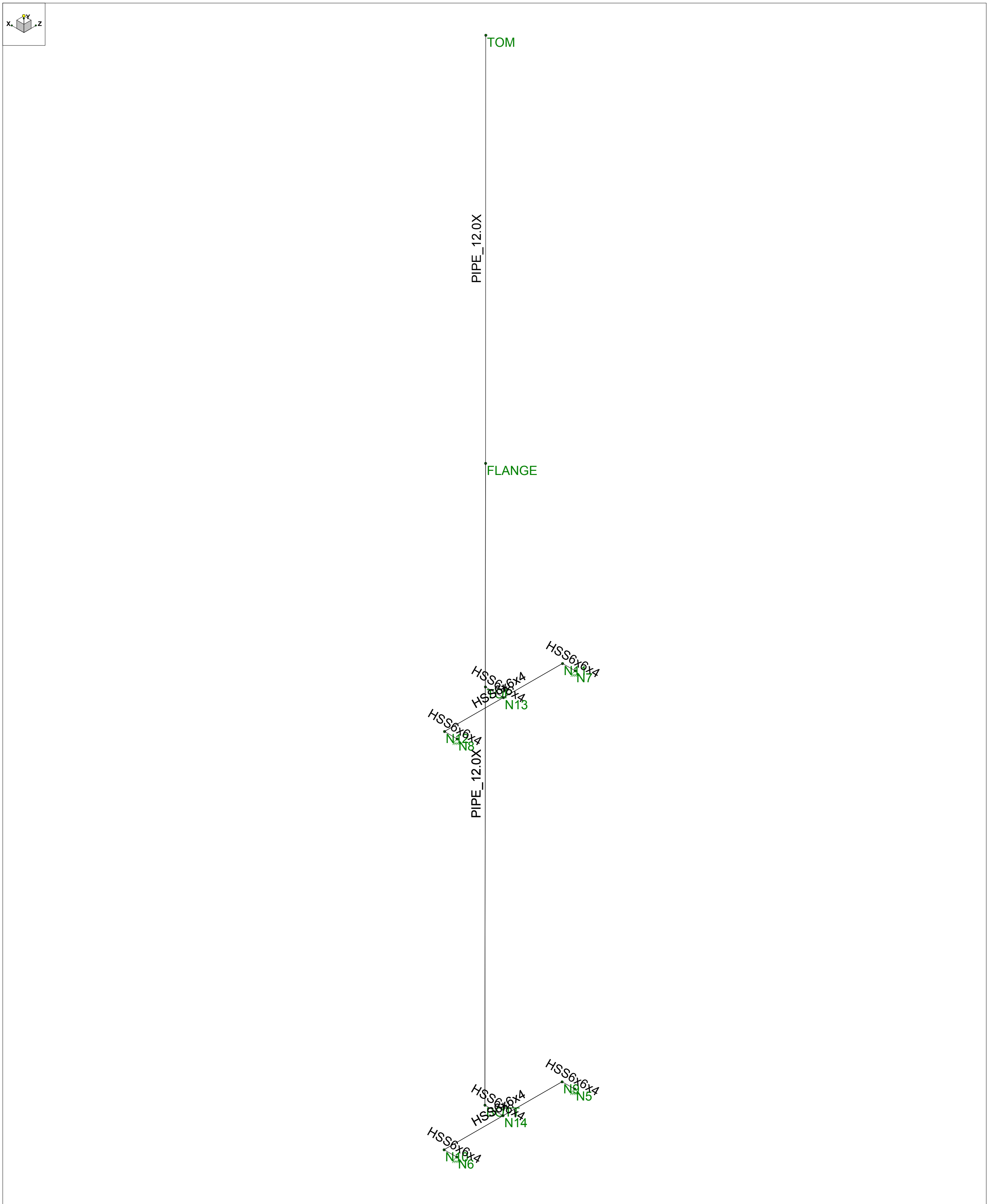
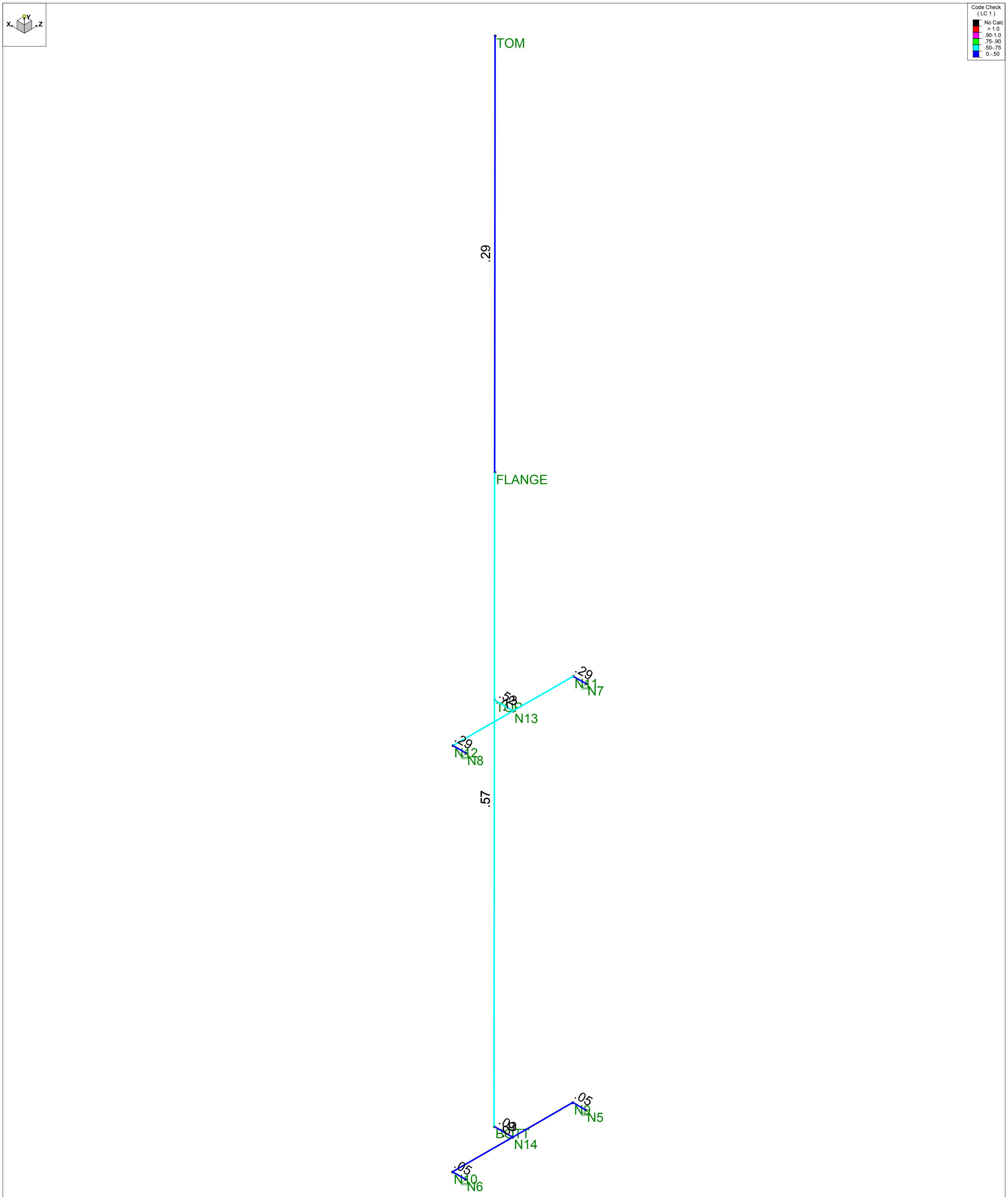


Paul J Ford and Company	North Mast on Eversource Tower # 1102	SK - 1
KAT		Jan 13, 2016 at 5:18 PM
31215-0012.002.6090		31215-0012.002.6090 - North Mast...



Member Code Checks Displayed
Results for LC 1, (x) TIA/EIA Wind + Ice on PCS Structure

Paul J Ford and Company	North Mast on Eversource Tower # 1102	SK - 2
KAT		Jan 13, 2016 at 5:19 PM
31215-0012.002.6090		31215-0012.002.6090 - North Mast...

Global

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?	No
Max Iterations for Wall Stiffness	3
Gravity Acceleration (ft/sec^2)	32.2
Wall Mesh Size (in)	12
Eigensolution Convergence Tol. (1.E-)	4
Vertical Axis	Y
Global Member Orientation Plane	XZ
Static Solver	Sparse Accelerated
Dynamic Solver	Standard Solver

Hot Rolled Steel Code	AISC 9th: ASD
RISAConnection Code	None
Cold Formed Steel Code	None
Wood Code	None
Wood Temperature	< 100F
Concrete Code	None
Masonry Code	None
Aluminum Code	None - Building

Number of Shear Regions	4
Region Spacing Increment (in)	4
Biaxial Column Method	PCA Load Contour
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, Continued

Seismic Code	UBC 1997
Seismic Base Elevation (ft)	Not Entered
Add Base Weight?	No
Ct X	.035
Ct Z	.035
T X (sec)	Not Entered
T Z (sec)	Not Entered
R X	8.5
R Z	8.5
Ca	.36
Cv	.54
Nv	1
Occupancy Category	4
Seismic Zone	3
Om Z	1
Om X	1
Rho Z	1
Rho X	1

Hot Rolled Steel Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (\1E...	Density[k/ft...	Yield[ksi]	Ry	Fu[ksi]	Rt
1	A572 Gr.50	29000	11154	.3	.65	.49	50	1.1	65	1.2
2	A992	29000	11154	.3	.65	.49	50	1.1	65	1.2
3	A500 Gr.B (42)	29000	11154	.3	.65	.49	42	1.3	58	1.1
4	A500 Gr. B (46)	29000	11154	.3	.65	.49	46	1.5	58	1.2
5	A500 Gr. C (46)	29000	11154	.3	.65	.49	46	1.5	62	1.2
6	A500 Gr. C (50)	29000	11154	.3	.65	.49	50	1.5	62	1.2
7	A53 Gr. B	29000	11154	.3	.65	.49	35	1.5	60	1.2
8	A36	29000	11154	.3	.65	.49	36	1.5	58	1.2

Hot Rolled Steel Section Sets

	Label	Shape	Type	Design List	Material	Design R...	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	MAST	PIPE_12.0X	Beam	Pipe	A53 Gr. B	Typical	17.5	339	339	678
2	Brace	HSS6x6x4	Beam	Tube	A500 Gr. B (46)	Typical	5.24	28.6	28.6	45.6

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diaphragm
1	BOTT	1.833	0	0	0	
2	TOP	1.833	21.5	0	0	
3	FLANGE	1.833	33	0	0	
4	TOM	1.833	55	0	0	
5	N5	0	0	3.5	0	
6	N6	0	0	-3.5	0	
7	N7	0	21.5	3.5	0	
8	N8	0	21.5	-3.5	0	
9	N9	.75	0	3.5	0	
10	N10	.75	0	-3.5	0	
11	N11	.75	21.5	3.5	0	
12	N12	.75	21.5	-3.5	0	
13	N13	.75	21.5	0	0	
14	N14	.75	0	0	0	

Member Primary Data

	Label	I Joint	J Joint	K Joint	Rotate...	Section/Shape	Type	Design List	Material	Design Rules
1	M1	BOTT	FLAN...			MAST	Beam	Pipe	A53 Gr. B	Typical
2	M2	FLAN...	TOM			MAST	Beam	Pipe	A53 Gr. B	Typical
3	M3	N8	N12			Brace	Beam	Tube	A500 Gr. B (46)	Typical
4	M4	N12	N11			Brace	Beam	Tube	A500 Gr. B (46)	Typical
5	M5	N11	N7			Brace	Beam	Tube	A500 Gr. B (46)	Typical
6	M6	N6	N10			Brace	Beam	Tube	A500 Gr. B (46)	Typical
7	M7	N10	N9			Brace	Beam	Tube	A500 Gr. B (46)	Typical
8	M8	N9	N5			Brace	Beam	Tube	A500 Gr. B (46)	Typical
9	M9	N13	TOP			Brace	Beam	Tube	A500 Gr. B (46)	Typical
10	M10	N14	BOTT			Brace	Beam	Tube	A500 Gr. B (46)	Typical

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]	Footing
1	BOTT							
2	TOP							
3	FLANGE							
4	TOM							
5	N5	Reaction	Reaction	Reaction				
6	N6	Reaction	Reaction	Reaction				
7	N7	Reaction	Reaction	Reaction				
8	N8	Reaction	Reaction	Reaction				
9	N9							
10	N10							
11	N11							
12	N12							

Basic Load Cases

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distribut...	Area(M...	Surface...
1	Self Weight	None		-1						
2	Equipment Weight	None					5	2		
3	Ice Weight	None					5	10		
4	(x) TIA/EIA Wind_Combined Ice/Wi	None					3	10		
5	(x) TIA/EIA Wind_Extreme Wind	None					3	10		
6	(z) TIA/EIA Wind_Combined Ice/Wi	None					3	10		
7	(z) TIA/EIA Wind_Extreme Wind	None					3	10		

Load Combinations

	Description	S...	PDelta	SRSS	B...	F...	B...	F...	B...	F...	B...	F...	B...	F...	B...	F...	B...	F...	B...	F...	B...	F...	B...	F...
1	(x) TIA/EIA Wind + Ice on PC...	Y...			1	1	2	1	3	1	4	1												
2	(x) TIA/EIA Wind on PCS Stru...	Y...			1	1	2	1	5	1														
3	(z) TIA/EIA Wind + Ice on PC...	Y...			1	1	2	1	3	1	6	1												
4	(z)TIA/EIA Wind on PCS Struc...	Y...			1	1	2	1	7	1														
5	Self Weight	Y...			1	1																		

Member Point Loads (BLC 2 : Equipment Weight)

	Member Label	Direction	Magnitude[lb,k-ft]	Location[ft,%]
1	M2	Y	-166.9	19
2	M2	Y	-118.8	19
3	M2	Y	-105	10
4	M2	Y	-54	10

Member Point Loads (BLC 2 : Equipment Weight) (Continued)

	Member Label	Direction	Magnitude[lb,k-ft]	Location[ft,%]
5	M2	Y	-166.9	10

Member Point Loads (BLC 3 : Ice Weight)

	Member Label	Direction	Magnitude[lb,k-ft]	Location[ft,%]
1	M2	Y	-37.482	19
2	M2	Y	-93.138	19
3	M2	Y	-97.903	10
4	M2	Y	-17.4	10
5	M2	Y	-37.482	10

Member Point Loads (BLC 4 : (x) TIA/EIA Wind Combined Ice/Wi)

	Member Label	Direction	Magnitude[lb,k-ft]	Location[ft,%]
1	M2	X	-637.793	19
2	M2	X	-556.223	10
3	M2	X	-69.47	10

Member Point Loads (BLC 5 : (x) TIA/EIA Wind Extreme Wind)

	Member Label	Direction	Magnitude[lb,k-ft]	Location[ft,%]
1	M2	X	-766.498	19
2	M2	X	-660.707	10
3	M2	X	-72.438	10

Member Point Loads (BLC 6 : (z) TIA/EIA Wind Combined Ice/Wi)

	Member Label	Direction	Magnitude[lb,k-ft]	Location[ft,%]
1	M2	Z	-637.793	19
2	M2	Z	-556.223	10
3	M2	Z	-69.47	10

Member Point Loads (BLC 7 : (z) TIA/EIA Wind Extreme Wind)

	Member Label	Direction	Magnitude[lb,k-ft]	Location[ft,%]
1	M2	Z	-766.498	19
2	M2	Z	-660.707	10
3	M2	Z	-72.438	10

Member Distributed Loads (BLC 2 : Equipment Weight)

	Member Label	Direction	Start Magnitude[lb/ft..	End Magnitude[lb/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	-11.88	-11.88	0	0
2	M2	Y	-11.88	-11.88	0	19

Member Distributed Loads (BLC 3 : Ice Weight)

	Member Label	Direction	Start Magnitude[lb/ft..	End Magnitude[lb/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M2	Y	-8.1	-8.1	0	0
2	M1	Y	-8.1	-8.1	0	0
3	M5	Y	-5.056	-5.056	0	0
4	M4	Y	-5.056	-5.056	0	0
5	M3	Y	-5.056	-5.056	0	0
6	M6	Y	-5.056	-5.056	0	0
7	M7	Y	-5.056	-5.056	0	0
8	M8	Y	-5.056	-5.056	0	0
9	M2	Y	-22.541	-22.541	0	19
10	M1	Y	-22.541	-22.541	0	0

Member Distributed Loads (BLC 4 : (x) TIA/EIA Wind Combined Ice/Wi)

	Member Label	Direction	Start Magnitude[lb/ft...	End Magnitude[lb/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M2	X	-18.639	-18.639	0	0
2	M1	X	-18.639	-18.639	0	0
3	M4	PX	-26.269	-26.269	0	0
4	M3	PX	-26.269	-26.269	0	0
5	M5	PX	-26.269	-26.269	0	0
6	M8	PX	-26.269	-26.269	0	0
7	M7	PX	-26.269	-26.269	0	0
8	M6	PX	-26.269	-26.269	0	0
9	M1	X	-30.007	-30.007	0	0
10	M2	X	-30.007	-30.007	0	19

Member Distributed Loads (BLC 5 : (x) TIA/EIA Wind Extreme Wind)

	Member Label	Direction	Start Magnitude[lb/ft...	End Magnitude[lb/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M2	X	-22.804	-22.804	0	0
2	M1	X	-22.804	-22.804	0	0
3	M4	PX	-29.708	-29.708	0	0
4	M5	PX	-29.708	-29.708	0	0
5	M3	PX	-29.708	-29.708	0	0
6	M8	PX	-29.708	-29.708	0	0
7	M7	PX	-29.708	-29.708	0	0
8	M6	PX	-29.708	-29.708	0	0
9	M1	X	-35.747	-35.747	0	0
10	M2	X	-35.747	-35.747	0	19

Member Distributed Loads (BLC 6 : (z) TIA/EIA Wind Combined Ice/Wi)

	Member Label	Direction	Start Magnitude[lb/ft...	End Magnitude[lb/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M2	Z	-18.639	-18.639	0	0
2	M1	Z	-18.639	-18.639	0	0
3	M5	PZ	-26.269	-26.269	0	0
4	M4	PZ	-26.269	-26.269	0	0
5	M3	PZ	-26.269	-26.269	0	0
6	M8	PZ	-26.269	-26.269	0	0
7	M7	PZ	-26.269	-26.269	0	0
8	M6	PZ	-26.269	-26.269	0	0
9	M1	Z	-30.007	-30.007	0	0
10	M2	Z	-30.007	-30.007	0	19

Member Distributed Loads (BLC 7 : (z) TIA/EIA Wind Extreme Wind)

	Member Label	Direction	Start Magnitude[lb/ft...	End Magnitude[lb/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M2	Z	-22.804	-22.804	0	0
2	M1	Z	-22.804	-22.804	0	0
3	M5	PZ	-29.708	-29.708	0	0
4	M4	PZ	-29.708	-29.708	0	0
5	M3	PZ	-29.708	-29.708	0	0
6	M8	PZ	-29.708	-29.708	0	0
7	M7	PZ	-29.708	-29.708	0	0
8	M6	PZ	-29.708	-29.708	0	0
9	M2	Z	-35.747	-35.747	0	19
10	M1	Z	-35.747	-35.747	0	0

Member Section Forces

	LC	Member Label	Sec	Axial[lb]	y Shear[lb]	z Shear[lb]	Torque[k-ft]	y-y Mo...	z-z Mo...
1	1	M1	1	133.235	1582.337	0	0	0	-.402
2			2	-708.84	1983.667	0	0	0	-15.112
3			3	-1550.914	2384.996	0	0	0	-33.133
4			4	3879.348	-2645.006	0	0	0	-48.468
5			5	3037.273	-2243.677	0	0	0	-28.302
6	1	M2	1	3037.273	-2243.677	0	0	0	-28.302
7			2	2475.891	-1976.124	0	0	0	-16.697
8			3	1435.823	-1082.878	0	0	0	-7.19
9			4	874.44	-815.325	0	0	0	-1.97
10			5	0	0	0	0	0	0
11	1	M3	1	2807.608	3243.091	5308.928	0	0	0
12			2	2807.608	3238.8	5308.928	0	.995	-.608
13			3	2807.608	3234.509	5308.928	0	1.991	-1.215
14			4	2807.608	3230.217	5308.928	0	2.986	-1.821
15			5	2807.608	3225.926	5308.928	0	3.982	-2.426
16	1	M4	1	5308.928	3225.926	-2807.608	-2.426	3.982	0
17			2	5308.928	3185.875	-2761.637	-2.426	-.891	-5.61
18			3	5308.928	3145.823	-2715.666	-2.426	-5.684	-11.151
19			4	5308.928	-3185.875	2761.637	2.426	-.891	-5.61
20			5	5308.928	-3225.926	2807.608	2.426	3.982	0
21	1	M5	1	2807.608	-3225.926	-5308.928	0	3.982	-2.426
22			2	2807.608	-3230.217	-5308.928	0	2.986	-1.821
23			3	2807.608	-3234.509	-5308.928	0	1.991	-1.215
24			4	2807.608	-3238.8	-5308.928	0	.995	-.608
25			5	2807.608	-3243.091	-5308.928	0	0	0
26	1	M6	1	-699.227	173.54	-1395.356	0	0	0
27			2	-699.227	169.249	-1395.356	0	-.262	-.032
28			3	-699.227	164.958	-1395.356	0	-.523	-.063
29			4	-699.227	160.667	-1395.356	0	-.785	-.094
30			5	-699.227	156.376	-1395.356	0	-1.047	-.124
31	1	M7	1	-1395.356	156.376	699.227	-.124	-1.047	0
32			2	-1395.356	116.324	745.198	-.124	.217	-.239
33			3	-1395.356	76.273	791.169	-.124	1.562	-.407
34			4	-1395.356	-116.324	-745.198	.124	.217	-.239
35			5	-1395.356	-156.376	-699.227	.124	-1.047	0
36	1	M8	1	-699.227	-156.376	1395.356	0	-1.047	-.124
37			2	-699.227	-160.667	1395.356	0	-.785	-.094
38			3	-699.227	-164.958	1395.356	0	-.523	-.063
39			4	-699.227	-169.249	1395.356	0	-.262	-.032
40			5	-699.227	-173.54	1395.356	0	0	0
41	1	M9	1	5431.332	6291.646	0	0	0	-4.852
42			2	5431.332	6286.819	0	0	0	-6.555
43			3	5431.332	6281.991	0	0	0	-8.256
44			4	5431.332	6277.163	0	0	0	-9.956
45			5	5431.332	6272.336	0	0	0	-11.655
46	1	M10	1	-1582.337	152.545	0	0	0	-.247
47			2	-1582.337	147.718	0	0	0	-.288
48			3	-1582.337	142.89	0	0	0	-.327
49			4	-1582.337	138.062	0	0	0	-.365
50			5	-1582.337	133.235	0	0	0	-.402
51	2	M1	1	-1409.086	2163.579	0	0	0	2.454
52			2	-1998.372	2646.625	0	0	0	-17.388
53			3	-2587.658	3129.671	0	0	0	-41.215
54			4	2736.675	-3163.57	0	0	0	-57.973
55			5	2147.389	-2680.524	0	0	0	-33.866
56	2	M2	1	2147.389	-2680.524	0	0	0	-33.866
57			2	1754.532	-2358.493	0	0	0	-20.009

Member Section Forces (Continued)

	LC	Member Label	Sec	Axial[lb]	y Shear[lb]	z Shear[lb]	Torque[k-ft]	y-y Mo...	z-z Mo...
58			3	1035.775	-1303.318	0	0	0	-8.656
59			4	642.917	-981.287	0	0	0	-2.373
60			5	0	0	0	0	0	0
61	2	M3	1	3492.121	3042.245	6609.895	0	0	0
62			2	3492.121	3038.902	6609.895	0	1.239	-.57
63			3	3492.121	3035.558	6609.895	0	2.479	-1.14
64			4	3492.121	3032.215	6609.895	0	3.718	-1.708
65			5	3492.121	3028.872	6609.895	0	4.957	-2.277
66	2	M4	1	6609.895	3028.872	-3492.121	-2.277	4.957	0
67			2	6609.895	2997.668	-3440.132	-2.277	-1.108	-5.273
68			3	6609.895	2966.465	-3388.143	-2.277	-7.083	-10.492
69			4	6609.895	-2997.668	3440.132	2.277	-1.108	-5.273
70			5	6609.895	-3028.872	3492.121	2.277	4.957	0
71	2	M5	1	3492.121	-3028.872	-6609.895	0	4.957	-2.277
72			2	3492.121	-3032.215	-6609.895	0	3.718	-1.708
73			3	3492.121	-3035.558	-6609.895	0	2.479	-1.14
74			4	3492.121	-3038.902	-6609.895	0	1.239	-.57
75			5	3492.121	-3042.245	-6609.895	0	0	0
76	2	M6	1	-977.812	-619.108	-1935.618	0	0	0
77			2	-977.812	-622.451	-1935.618	0	-.363	.116
78			3	-977.812	-625.794	-1935.618	0	-.726	.233
79			4	-977.812	-629.137	-1935.618	0	-1.089	.351
80			5	-977.812	-632.481	-1935.618	0	-1.452	.469
81	2	M7	1	-1935.618	-632.481	977.812	.469	-1.452	0
82			2	-1935.618	-663.684	1029.801	.469	.305	1.134
83			3	-1935.618	694.888	-1081.79	-.469	2.153	2.323
84			4	-1935.618	663.684	-1029.801	-.469	.305	1.134
85			5	-1935.618	632.481	-977.812	-.469	-1.452	0
86	2	M8	1	-977.812	632.481	1935.618	0	-1.452	.469
87			2	-977.812	629.137	1935.618	0	-1.089	.351
88			3	-977.812	625.794	1935.618	0	-.726	.233
89			4	-977.812	622.451	1935.618	0	-.363	.116
90			5	-977.812	619.108	1935.618	0	0	0
91	2	M9	1	6776.286	5932.93	0	0	0	-4.553
92			2	6776.286	5928.102	0	0	0	-6.159
93			3	6776.286	5923.275	0	0	0	-7.763
94			4	6776.286	5918.447	0	0	0	-9.366
95			5	6776.286	5913.619	0	0	0	-10.968
96	2	M10	1	-2163.579	-1389.775	0	0	0	.939
97			2	-2163.579	-1394.603	0	0	0	1.316
98			3	-2163.579	-1399.431	0	0	0	1.694
99			4	-2163.579	-1404.258	0	0	0	2.073
100			5	-2163.579	-1409.086	0	0	0	2.454
101	3	M1	1	3185.179	-560.807	-1840.567	-1.384	3.829	-5.996
102			2	2343.105	-560.807	-2241.896	-1.384	-13.011	-1.37
103			3	1501.031	-560.807	-2643.226	-1.384	-33.162	3.257
104			4	3879.348	0	2645.007	0	-48.468	0
105			5	3037.273	0	2243.677	0	-28.302	0
106	3	M2	1	3037.273	0	2243.677	0	-28.302	0
107			2	2475.891	0	1976.124	0	-16.697	0
108			3	1435.823	0	1082.878	0	-7.19	0
109			4	874.44	0	815.325	0	-1.97	0
110			5	0	0	0	0	0	0
111	3	M3	1	1013.823	3193.523	2328.414	0	0	0
112			2	1013.823	3189.232	2323.489	0	.436	-.598
113			3	1013.823	3184.941	2318.563	0	.871	-1.196
114			4	1013.823	3180.649	2313.638	0	1.306	-1.793

Member Section Forces (Continued)

	LC	Member Label	Sec	Axial[lb]	y Shear[lb]	z Shear[lb]	Torque[k-ft]	y-y Mo...	z-z Mo...
115			5	1013.823	3176.358	2308.712	0	1.739	-2.389
116	3	M4	1	2308.712	3176.358	-1013.823	-2.389	1.739	0
117			2	2308.712	3136.307	-1013.823	-2.389	-.035	-5.524
118			3	-3380.85	3096.255	-1013.823	-2.389	2.968	-10.977
119			4	-3380.85	-183.498	-1574.629	.174	.213	-.356
120			5	-3380.85	-223.549	-1574.629	.174	-2.543	0
121	3	M5	1	-1574.629	-223.549	3380.85	0	-2.543	-.174
122			2	-1574.629	-227.841	3385.775	0	-1.909	-.132
123			3	-1574.629	-232.132	3390.701	0	-1.273	-.089
124			4	-1574.629	-236.423	3395.626	0	-.637	-.045
125			5	-1574.629	-240.714	3400.551	0	0	0
126	3	M6	1	-1.714	1152.452	-364.513	0	0	0
127			2	-1.714	1148.16	-369.439	0	-.069	-.216
128			3	-1.714	1143.869	-374.364	0	-.139	-.431
129			4	-1.714	1139.578	-379.289	0	-.209	-.645
130			5	-1.714	1135.287	-384.215	0	-.281	-.858
131	3	M7	1	-384.215	1135.287	1.714	-.858	-.281	0
132			2	-384.215	1095.235	1.714	-.858	-.278	-1.952
133			3	1456.352	-2149.306	562.521	1.678	-.884	-7.663
134			4	1456.352	-2189.357	562.521	1.678	.1	-3.866
135			5	1456.352	-2229.409	562.521	1.678	1.085	0
136	3	M8	1	562.521	-2229.409	-1456.352	0	1.085	-1.678
137			2	562.521	-2233.7	-1451.427	0	.812	-1.26
138			3	562.521	-2237.991	-1446.501	0	.541	-.841
139			4	562.521	-2242.283	-1441.576	0	.27	-.421
140			5	562.521	-2246.574	-1436.65	0	0	0
141	3	M9	1	-560.807	3239.702	5689.562	10.335	-4.778	-2.563
142			2	-560.807	3234.874	5689.562	10.335	-3.237	-3.439
143			3	-560.807	3230.046	5689.562	10.335	-1.697	-4.314
144			4	-560.807	3225.219	5689.562	10.335	-.156	-5.188
145			5	-560.807	3220.391	5689.562	10.335	1.384	-6.061
146	3	M10	1	560.807	3204.49	-1840.567	-3.829	.609	-2.536
147			2	560.807	3199.662	-1840.567	-3.829	.111	-3.403
148			3	560.807	3194.835	-1840.567	-3.829	-.387	-4.269
149			4	560.807	3190.007	-1840.567	-3.829	-.886	-5.133
150			5	560.807	3185.179	-1840.567	-3.829	-1.384	-5.996
151	4	M1	1	2239.855	-395.999	-2197.653	-1.656	4.577	-4.234
152			2	1650.569	-395.999	-2680.699	-1.656	-15.547	-.967
153			3	1061.282	-395.999	-3163.745	-1.656	-39.655	2.3
154			4	2736.675	0	3163.57	0	-57.973	0
155			5	2147.389	0	2680.524	0	-33.866	0
156	4	M2	1	2147.389	0	2680.524	0	-33.866	0
157			2	1754.532	0	2358.493	0	-20.009	0
158			3	1035.775	0	1303.318	0	-8.656	0
159			4	642.917	0	981.287	0	-2.373	0
160			5	0	0	0	0	0	0
161	4	M3	1	1351.184	2983.227	3048.931	0	0	0
162			2	1351.184	2979.883	3043.361	0	.571	-.559
163			3	1351.184	2976.54	3037.79	0	1.141	-1.117
164			4	1351.184	2973.197	3032.22	0	1.71	-1.675
165			5	1351.184	2969.854	3026.65	0	2.278	-2.232
166	4	M4	1	3026.65	2969.854	-1351.184	-2.232	2.278	0
167			2	3026.65	2938.65	-1351.184	-2.232	-.086	-5.17
168			3	-3783.711	2907.447	-1351.184	-2.232	3.269	-10.285
169			4	-3783.711	592.254	-1747.182	-.416	.211	1.009
170			5	-3783.711	561.05	-1747.182	-.416	-2.846	0
171	4	M5	1	-1747.182	561.05	3783.711	0	-2.846	.416

Member Section Forces (Continued)

	LC	Member Label	Sec	Axial[lb]	y Shear[lb]	z Shear[lb]	Torque[k-ft]	y-y Mo...	z-z Mo...
172			2	-1747.182	557.707	3789.281	0	-2.136	.311
173			3	-1747.182	554.364	3794.851	0	-1.425	.207
174			4	-1747.182	551.021	3800.421	0	-.713	.103
175			5	-1747.182	547.677	3805.992	0	0	0
176	4	M6	1	-138.539	551.536	-698.015	0	0	0
177			2	-138.539	548.192	-703.586	0	-.131	-.103
178			3	-138.539	544.849	-709.156	0	-.264	-.206
179			4	-138.539	541.506	-714.726	0	-.397	-.307
180			5	-138.539	538.163	-720.296	0	-.532	-.409
181	4	M7	1	-720.296	538.163	138.539	-.409	-.532	0
182			2	-720.296	506.959	138.539	-.409	-.289	-.914
183			3	1477.357	-1783.409	534.537	1.389	-.771	-6.351
184			4	1477.357	-1814.613	534.537	1.389	.164	-3.203
185			5	1477.357	-1845.816	534.537	1.389	1.1	0
186	4	M8	1	534.537	-1845.816	-1477.357	0	1.1	-1.389
187			2	534.537	-1849.16	-1471.787	0	.823	-1.043
188			3	534.537	-1852.503	-1466.217	0	.548	-.696
189			4	534.537	-1855.846	-1460.646	0	.273	-.348
190			5	534.537	-1859.189	-1455.076	0	0	0
191	4	M9	1	-395.999	2283.99	6810.36	12.358	-5.72	-1.817
192			2	-395.999	2279.162	6810.36	12.358	-3.876	-2.434
193			3	-395.999	2274.334	6810.36	12.358	-2.032	-3.051
194			4	-395.999	2269.507	6810.36	12.358	-.188	-3.666
195			5	-395.999	2264.679	6810.36	12.358	1.656	-4.28
196	4	M10	1	395.999	2259.165	-2197.653	-4.577	.724	-1.798
197			2	395.999	2254.337	-2197.653	-4.577	.129	-2.409
198			3	395.999	2249.51	-2197.653	-4.577	-.466	-3.019
199			4	395.999	2244.682	-2197.653	-4.577	-1.061	-3.627
200			5	395.999	2239.855	-2197.653	-4.577	-1.656	-4.234
201	5	M1	1	1629.246	-291.188	0	0	0	-3.115
202			2	1137.97	-291.188	0	0	0	-.713
203			3	646.694	-291.188	0	0	0	1.69
204			4	1801.345	0	0	0	0	0
205			5	1310.069	0	0	0	0	0
206	5	M2	1	1310.069	0	0	0	0	0
207			2	982.552	0	0	0	0	0
208			3	655.035	0	0	0	0	0
209			4	327.517	0	0	0	0	0
210			5	0	0	0	0	0	0
211	5	M3	1	-145.594	908.399	-278.344	0	0	0
212			2	-145.594	905.055	-278.344	0	-.052	-.17
213			3	-145.594	901.712	-278.344	0	-.104	-.339
214			4	-145.594	898.369	-278.344	0	-.157	-.508
215			5	-145.594	895.026	-278.344	0	-.209	-.676
216	5	M4	1	-278.344	895.026	145.594	-.676	-.209	0
217			2	-278.344	863.822	145.594	-.676	.046	-1.539
218			3	-278.344	832.619	145.594	.676	.301	-3.023
219			4	-278.344	-863.822	-145.594	.676	.046	-1.539
220			5	-278.344	-895.026	-145.594	.676	-.209	0
221	5	M5	1	-145.594	-895.026	278.344	0	-.209	-.676
222			2	-145.594	-898.369	278.344	0	-.157	-.508
223			3	-145.594	-901.712	278.344	0	-.104	-.339
224			4	-145.594	-905.055	278.344	0	-.052	-.17
225			5	-145.594	-908.399	278.344	0	0	0
226	5	M6	1	145.594	900.058	278.344	0	0	0
227			2	145.594	896.715	278.344	0	.052	-.168
228			3	145.594	893.372	278.344	0	.104	-.336

Member Section Forces (Continued)

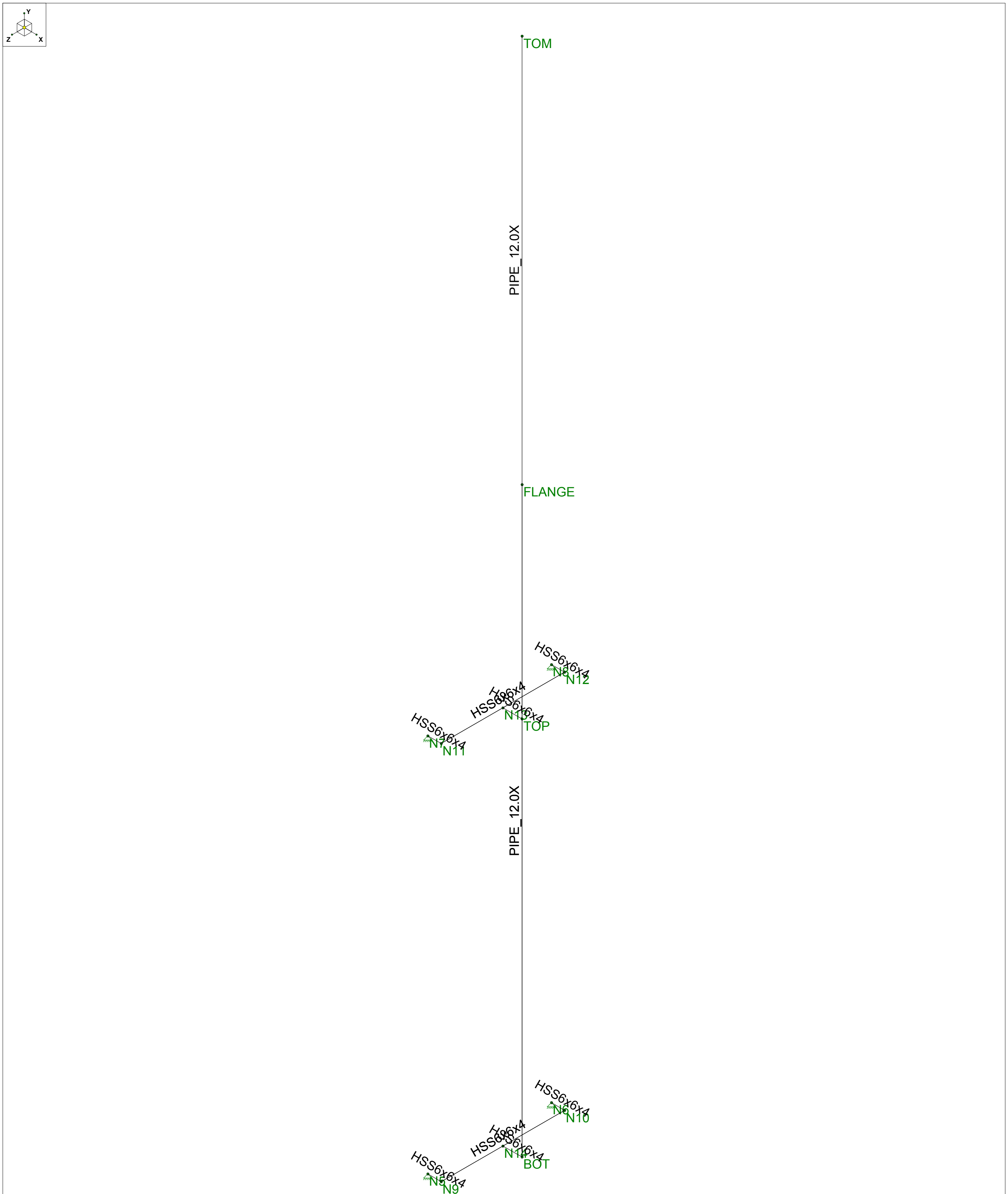
	LC	Member Label	Sec	Axial[lb]	y Shear[lb]	z Shear[lb]	Torque[k-ft]	y-y Mo...	z-z Mo...
229			4	145.594	890.029	278.344	0	.157	-.503
230			5	145.594	886.685	278.344	0	.209	-.67
231	5	M7	1	278.344	886.685	-145.594	-.67	.209	0
232			2	278.344	855.482	-145.594	-.67	-.046	-1.524
233			3	278.344	824.278	-145.594	-.67	-.301	-2.994
234			4	278.344	-855.482	145.594	.67	-.046	-1.524
235			5	278.344	-886.685	145.594	.67	.209	0
236	5	M8	1	145.594	-886.685	-278.344	0	.209	-.67
237			2	145.594	-890.029	-278.344	0	.157	-.503
238			3	145.594	-893.372	-278.344	0	.104	-.336
239			4	145.594	-896.715	-278.344	0	.052	-.168
240			5	145.594	-900.058	-278.344	0	0	0
241	5	M9	1	-291.188	1665.238	0	0	0	-1.353
242			2	-291.188	1660.41	0	0	0	-1.803
243			3	-291.188	1655.582	0	0	0	-2.252
244			4	-291.188	1650.755	0	0	0	-2.699
245			5	-291.188	1645.927	0	0	0	-3.146
246	5	M10	1	291.188	1648.557	0	0	0	-1.34
247			2	291.188	1643.729	0	0	0	-1.786
248			3	291.188	1638.902	0	0	0	-2.23
249			4	291.188	1634.074	0	0	0	-2.673
250			5	291.188	1629.246	0	0	0	-3.115

Joint Reactions

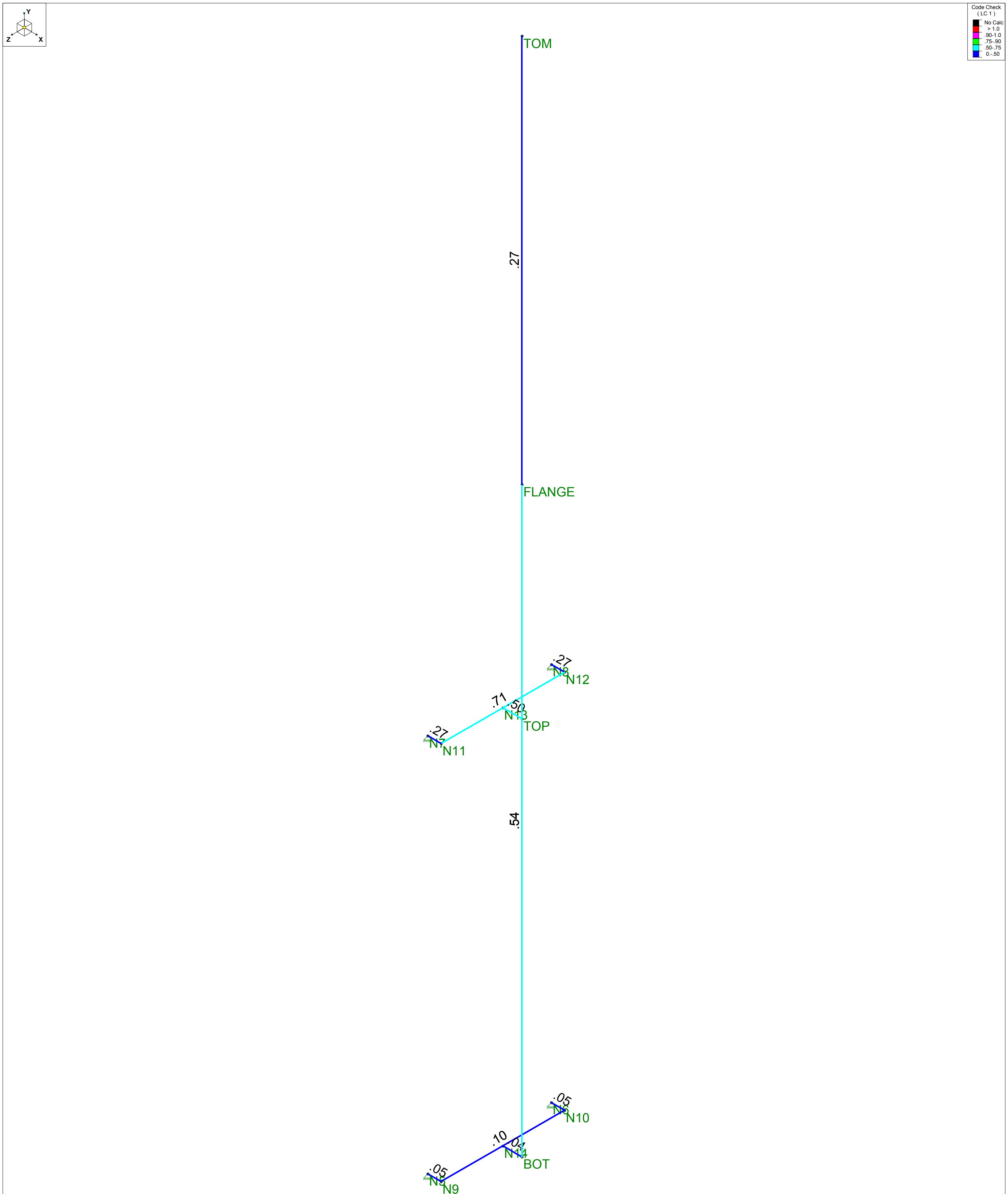
	LC	Joint Label	X [lb]	Y [lb]	Z [lb]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	1	N5	-699.227	173.54	1395.356	0	0	0
2	1	N6	-699.227	173.54	-1395.356	0	0	0
3	1	N7	2807.608	3243.091	-5308.928	0	0	0
4	1	N8	2807.608	3243.091	5308.928	0	0	0
5	1	Totals:	4216.761	6833.263	0			
6	1	COG (ft):	X: 1.765	Y: 28.637	Z: 0			
7	2	N5	-977.812	-619.108	1935.618	0	0	0
8	2	N6	-977.812	-619.108	-1935.618	0	0	0
9	2	N7	3492.121	3042.245	-6609.895	0	0	0
10	2	N8	3492.121	3042.245	6609.895	0	0	0
11	2	Totals:	5028.619	4846.274	0			
12	2	COG (ft):	X: 1.757	Y: 28.614	Z: 0			
13	3	N5	562.521	2246.574	-1436.65	0	0	0
14	3	N6	-1.714	1152.452	-364.513	0	0	0
15	3	N7	-1574.629	240.714	3400.551	0	0	0
16	3	N8	1013.823	3193.523	2328.414	0	0	0
17	3	Totals:	0	6833.263	3927.802			
18	3	COG (ft):	X: 1.765	Y: 28.637	Z: 0			
19	4	N5	534.537	1859.189	-1455.076	0	0	0
20	4	N6	-138.539	551.536	-698.015	0	0	0
21	4	N7	-1747.182	-547.677	3805.992	0	0	0
22	4	N8	1351.184	2983.227	3048.931	0	0	0
23	4	Totals:	0	4846.274	4701.831			
24	4	COG (ft):	X: 1.757	Y: 28.614	Z: 0			
25	5	N5	145.594	900.058	-278.344	0	0	0
26	5	N6	145.594	900.058	278.344	0	0	0
27	5	N7	-145.594	908.399	278.344	0	0	0
28	5	N8	-145.594	908.399	-278.344	0	0	0
29	5	Totals:	0	3616.914	0			
30	5	COG (ft):	X: 1.731	Y: 25.917	Z: 0			

Member AISC ASD Steel Code Checks

	L...	Member	Shape	UC ...	Loc...	Shea...	Loc...		Fa[ksi]	Ft[ksi]	Fby[ksi]	Fbz[...	Cb	Cmy	Cmz	Eqn
1	1	M1	PIPE_...	.569	21....	.023	21....		13.958	21	23.1	23.1	1	.6	.85	H1-2
2	1	M2	PIPE_...	.286	0	.018	0		17.025	21	23.1	23.1	1.75	.6	.85	H1-2
3	1	M3	HSS6x...	.285	.75	.103	0	z	27.371	27.6	30.36	30.36	1.75	.6	.85	H1-2
4	1	M4	HSS6x...	.735	3.5	.165	0	y	24.454	27.6	30.36	30.36	1	.85	.85	H1-2
5	1	M5	HSS6x...	.285	0	.103	0	z	27.371	27.6	30.36	30.36	1.75	.6	.85	H1-2
6	1	M6	HSS6x...	.053	.75	.027	0	z	27.371	27.6	30.36	30.36	1.75	.6	.85	H2-1
7	1	M7	HSS6x...	.091	3.5	.021	3.5	z	24.454	27.6	30.36	30.36	1	.85	.85	H2-1
8	1	M8	HSS6x...	.053	0	.027	0	z	27.371	27.6	30.36	30.36	1.75	.6	.85	H2-1
9	1	M9	HSS6x...	.521	1.083	.122	0	y	27.26	27.6	30.36	30.36	1....	.6	.85	H1-2
10	1	M10	HSS6x...	.028	1.083	.003	0	y	27.26	27.6	30.36	30.36	1....	.6	.85	H2-1
11	2	M1	PIPE_...	.675	21....	.028	21....		13.958	21	23.1	23.1	1	.6	.85	H1-2
12	2	M2	PIPE_...	.338	0	.022	0		17.025	21	23.1	23.1	1.75	.6	.85	H1-2
13	2	M3	HSS6x...	.324	.75	.128	0	z	27.371	27.6	30.36	30.36	1.75	.6	.85	H1-2
14	2	M4	HSS6x...	.774	3.5	.164	0	z	24.454	27.6	30.36	30.36	1	.85	.85	H1-2
15	2	M5	HSS6x...	.324	0	.128	0	z	27.371	27.6	30.36	30.36	1.75	.6	.85	H1-2
16	2	M6	HSS6x...	.086	.75	.038	0	z	27.371	27.6	30.36	30.36	1.75	.6	.85	H2-1
17	2	M7	HSS6x...	.199	3.5	.041	3.5	z	24.454	27.6	30.36	30.36	1	.85	.85	H2-1
18	2	M8	HSS6x...	.086	0	.038	0	z	27.371	27.6	30.36	30.36	1.75	.6	.85	H2-1
19	2	M9	HSS6x...	.502	1.083	.115	0	y	27.26	27.6	30.36	30.36	1....	.6	.85	H1-2
20	2	M10	HSS6x...	.117	1.083	.027	1.083	y	27.26	27.6	30.36	30.36	1....	.6	.85	H2-1
21	3	M1	PIPE_...	.569	21....	.035	21....		13.958	21	23.1	23.1	1.75	.85	.6	H1-2
22	3	M2	PIPE_...	.286	0	.018	0		17.025	21	23.1	23.1	1.75	.85	.6	H1-2
23	3	M3	HSS6x...	.178	.75	.062	0	y	27.371	27.6	30.36	30.36	1.75	.85	.85	H1-2
24	3	M4	HSS6x...	.602	3.5	.162	0	y	24.454	27.6	30.36	30.36	1	.326	.85	H2-1
25	3	M5	HSS6x...	.124	0	.066	.75	z	27.371	27.6	30.36	30.36	1.75	.85	.85	H2-1
26	3	M6	HSS6x...	.047	.75	.022	0	y	27.371	27.6	30.36	30.36	1.75	.85	.85	H2-1
27	3	M7	HSS6x...	.364	3.5	.114	7	y	24.454	27.6	30.36	30.36	1	.496	.85	H1-2
28	3	M8	HSS6x...	.118	0	.044	.75	y	27.371	27.6	30.36	30.36	1.75	.85	.85	H1-2
29	3	M9	HSS6x...	.313	1.083	.545	0	z	27.26	27.6	30.36	30.36	1.36	.484	.85	H2-1
30	3	M10	HSS6x...	.310	1.083	.223	0	y	27.26	27.6	30.36	30.36	1.36	.424	.85	H1-2
31	4	M1	PIPE_...	.675	21....	.042	21....		13.958	21	23.1	23.1	1.75	.85	.6	H1-2
32	4	M2	PIPE_...	.338	0	.022	0		17.025	21	23.1	23.1	1.75	.85	.6	H1-2
33	4	M3	HSS6x...	.196	.75	.059	0	z	27.371	27.6	30.36	30.36	1.75	.85	.85	H1-2
34	4	M4	HSS6x...	.588	3.5	.152	0	y	24.454	27.6	30.36	30.36	1	.28	.85	H2-1
35	4	M5	HSS6x...	.147	0	.074	.75	z	27.371	27.6	30.36	30.36	1.75	.85	.85	H2-1
36	4	M6	HSS6x...	.040	.75	.014	.75	z	27.371	27.6	30.36	30.36	1.75	.85	.85	H2-1
37	4	M7	HSS6x...	.306	3.5	.094	7	y	24.454	27.6	30.36	30.36	1	.407	.85	H1-2
38	4	M8	HSS6x...	.107	0	.036	.75	y	27.371	27.6	30.36	30.36	1.75	.85	.85	H1-2
39	4	M9	HSS6x...	.315	0	.652	0	z	27.26	27.6	30.36	30.36	1....	.484	.85	H2-1
40	4	M10	HSS6x...	.247	1.083	.237	0	y	27.26	27.6	30.36	30.36	1....	.425	.85	H1-2
41	5	M1	PIPE_...	.035	0	.002	0		13.958	21	23.1	23.1	1.75	.6	.6	H1-2
42	5	M2	PIPE_...	.004	0	.000	0		17.025	21	23.1	23.1	1.75	.6	.6	H1-1
43	5	M3	HSS6x...	.038	.75	.018	0	y	27.371	27.6	30.36	30.36	1.75	.6	.85	H2-1
44	5	M4	HSS6x...	.140	3.5	.046	7	y	24.454	27.6	30.36	30.36	1	1	.85	H2-1
45	5	M5	HSS6x...	.038	0	.018	.75	y	27.371	27.6	30.36	30.36	1.75	.6	.85	H2-1
46	5	M6	HSS6x...	.037	.75	.017	0	y	27.371	27.6	30.36	30.36	1.75	.6	.85	H1-2
47	5	M7	HSS6x...	.139	3.5	.045	0	y	24.454	27.6	30.36	30.36	1	1	.85	H1-2
48	5	M8	HSS6x...	.037	0	.017	.75	y	27.371	27.6	30.36	30.36	1.75	.6	.85	H1-2
49	5	M9	HSS6x...	.132	1.083	.032	0	y	27.26	27.6	30.36	30.36	1....	.6	.85	H2-1
50	5	M10	HSS6x...	.131	1.083	.032	0	y	27.26	27.6	30.36	30.36	1....	.6	.85	H1-2



Paul J Ford and Company	South Mast on Eversource Tower # 1102	SK - 1
KAT		Jan 14, 2016 at 8:17 AM
31215-0012.002.6090		31215-0012.002.6090 - South Mas...



Member Code Checks Displayed
Results for LC 1, (x) TIA/EIA Wind_Combined Ice/Wind

Paul J Ford and Company	South Mast on Eversource Tower # 1102	SK - 2
KAT		Jan 14, 2016 at 8:18 AM
31215-0012.002.6090		31215-0012.002.6090 - South Mas...

Global

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?	No
Max Iterations for Wall Stiffness	3
Gravity Acceleration (ft/sec^2)	32.2
Wall Mesh Size (in)	12
Eigensolution Convergence Tol. (1.E-)	4
Vertical Axis	Y
Global Member Orientation Plane	XZ
Static Solver	Sparse Accelerated
Dynamic Solver	Standard Solver

Hot Rolled Steel Code	AISC 9th: ASD
RISAConnection Code	None
Cold Formed Steel Code	None
Wood Code	None
Wood Temperature	< 100F
Concrete Code	None
Masonry Code	None
Aluminum Code	None - Building

Number of Shear Regions	4
Region Spacing Increment (in)	4
Biaxial Column Method	PCA Load Contour
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, Continued

Seismic Code	UBC 1997
Seismic Base Elevation (ft)	Not Entered
Add Base Weight?	No
Ct X	.035
Ct Z	.035
T X (sec)	Not Entered
T Z (sec)	Not Entered
R X	8.5
R Z	8.5
Ca	.36
Cv	.54
Nv	1
Occupancy Category	4
Seismic Zone	3
Om Z	1
Om X	1
Rho Z	1
Rho X	1

Hot Rolled Steel Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (\1E...	Density[k/ft...	Yield[ksi]	Ry	Fu[ksi]	Rt
1	A572 Gr.50	29000	11154	.3	.65	.49	50	1.1	65	1.2
2	A992	29000	11154	.3	.65	.49	50	1.1	65	1.2
3	A500 Gr.B (42)	29000	11154	.3	.65	.49	42	1.3	58	1.1
4	A500 Gr. B (46)	29000	11154	.3	.65	.49	46	1.5	58	1.2
5	A500 Gr. C (46)	29000	11154	.3	.65	.49	46	1.5	62	1.2
6	A500 Gr. C (50)	29000	11154	.3	.65	.49	50	1.5	62	1.2
7	A53 Gr. B	29000	11154	.3	.65	.49	35	1.5	60	1.2
8	A36	29000	11154	.3	.65	.49	36	1.5	58	1.2

Hot Rolled Steel Section Sets

	Label	Shape	Type	Design List	Material	Design R...	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	MAST	PIPE_12.0X	Beam	Pipe	A53 Gr. B	Typical	17.5	339	339	678
2	Brace	HSS6x6x4	Beam	Tube	A500 Gr. B (46)	Typical	5.24	28.6	28.6	45.6

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diaphragm
1	BOT	1.833	0	0	0	
2	TOP	1.833	21.5	0	0	
3	FLANGE	1.833	33	0	0	
4	TOM	1.833	55	0	0	
5	N5	0	0	3.5	0	
6	N6	0	0	-3.5	0	
7	N7	0	21.5	3.5	0	
8	N8	0	21.5	-3.5	0	
9	N9	.75	0	3.5	0	
10	N10	.75	0	-3.5	0	
11	N11	.75	21.5	3.5	0	
12	N12	.75	21.5	-3.5	0	
13	N13	.75	21.5	0	0	
14	N14	.75	0	0	0	

Member Primary Data

	Label	I Joint	J Joint	K Joint	Rotate...	Section/Shape	Type	Design List	Material	Design Rules
1	M1	BOT	FLAN...			MAST	Beam	Pipe	A53 Gr. B	Typical
2	M2	FLAN...	TOM			MAST	Beam	Pipe	A53 Gr. B	Typical
3	M3	N8	N12			Brace	Beam	Tube	A500 Gr. B (46)	Typical
4	M4	N12	N11			Brace	Beam	Tube	A500 Gr. B (46)	Typical
5	M5	N11	N7			Brace	Beam	Tube	A500 Gr. B (46)	Typical
6	M6	N6	N10			Brace	Beam	Tube	A500 Gr. B (46)	Typical
7	M7	N10	N9			Brace	Beam	Tube	A500 Gr. B (46)	Typical
8	M8	N9	N5			Brace	Beam	Tube	A500 Gr. B (46)	Typical
9	M9	N13	TOP			Brace	Beam	Tube	A500 Gr. B (46)	Typical
10	M10	N14	BOT			Brace	Beam	Tube	A500 Gr. B (46)	Typical

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]	Footing
1	BOT							
2	TOP							
3	FLANGE							
4	TOM							
5	N5	Reaction	Reaction	Reaction				
6	N6	Reaction	Reaction	Reaction				
7	N7	Reaction	Reaction	Reaction				
8	N8	Reaction	Reaction	Reaction				
9	N9							
10	N10							
11	N11							
12	N12							

Basic Load Cases

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distribut...	Area(M...	Surface...
1	Self Weight	None		-1						
2	Equipment Weight	None					6	2		
3	Ice Weight	None					6	10		
4	(x) TIA/EIA Wind_Combined Ice/Wi	None					4	10		
5	(x) TIA/EIA Wind_Extreme Wind	None					4	10		
6	(z) TIA/EIA Wind_Combined Ice/Wi	None					4	10		
7	(z) TIA/EIA Wind_Extreme Wind	None					4	10		

Load Combinations

	Description	S...	PDelta	SRSS	B...	F...	B...	F...	B...	F...	B...	F...	B...	F...	B...	F...	B...	F...	B...	F...	B...	F...	B...	F...
1	(x) TIA/EIA Wind_Combined Ic...	Y...	Y		1	1	2	1	3	1	4	1												
2	(x) TIA/EIA Wind_Extreme Wind	Y...	Y		1	1	2	1	5	1														
3	(z) TIA/EIA Wind_Combined Ic...	Y...	Y		1	1	2	1	3	1	6	1												
4	(z) TIA/EIA Wind_Extreme Wind	Y...	Y		1	1	2	1	7	1														
5	Self Weight	Y...	Y		1	1																		

Member Point Loads (BLC 2 : Equipment Weight)

	Member Label	Direction	Magnitude[lb,k-ft]	Location[ft,%]
1	M2	Y	-166.9	19
2	M2	Y	-86.1	19
3	M2	Y	-5.4	19
4	M2	Y	-166.9	9

Member Point Loads (BLC 2 : Equipment Weight) (Continued)

	Member Label	Direction	Magnitude[lb,k-ft]	Location[ft,%]
5	M2	Y	-109.2	9
6	M2	Y	-54	9

Member Point Loads (BLC 3 : Ice Weight)

	Member Label	Direction	Magnitude[lb,k-ft]	Location[ft,%]
1	M2	Y	-37.482	19
2	M2	Y	-104.464	19
3	M2	Y	-5.038	19
4	M2	Y	-37.482	9
5	M2	Y	-98.853	9
6	M2	Y	-17.4	9

Member Point Loads (BLC 4 : (x) TIA/EIA Wind Combined Ice/Wi)

	Member Label	Direction	Magnitude[lb,k-ft]	Location[ft,%]
1	M2	X	-542.6	19
2	M2	X	-11.981	19
3	M2	X	-520.562	9
4	M2	X	-69.66	9

Member Point Loads (BLC 5 : (x) TIA/EIA Wind Extreme Wind)

	Member Label	Direction	Magnitude[lb,k-ft]	Location[ft,%]
1	M2	X	-647	19
2	M2	X	-8.296	19
3	M2	X	-620.247	9
4	M2	X	-72.636	9

Member Point Loads (BLC 6 : (z) TIA/EIA Wind Combined Ice/Wi)

	Member Label	Direction	Magnitude[lb,k-ft]	Location[ft,%]
1	M2	Z	-542.6	19
2	M2	Z	-11.981	19
3	M2	Z	-520.562	9
4	M2	Z	-69.66	9

Member Point Loads (BLC 7 : (z) TIA/EIA Wind Extreme Wind)

	Member Label	Direction	Magnitude[lb,k-ft]	Location[ft,%]
1	M2	Z	-647	19
2	M2	Z	-8.296	19
3	M2	Z	-620.247	9
4	M2	Z	-72.636	9

Member Distributed Loads (BLC 2 : Equipment Weight)

	Member Label	Direction	Start Magnitude[lb/ft..	End Magnitude[lb/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	-11.88	-11.88	0	0
2	M2	Y	-11.88	-11.88	0	19

Member Distributed Loads (BLC 3 : Ice Weight)

	Member Label	Direction	Start Magnitude[lb/ft..	End Magnitude[lb/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M2	Y	-8.1	-8.1	0	0
2	M1	Y	-8.1	-8.1	0	0
3	M5	Y	-5.056	-5.056	0	0
4	M4	Y	-5.056	-5.056	0	0
5	M3	Y	-5.056	-5.056	0	0

Member Distributed Loads (BLC 3 : Ice Weight) (Continued)

	Member Label	Direction	Start Magnitude[lb/ft..	End Magnitude[lb/ft,F]	Start Location[ft,%]	End Location[ft,%]
6	M6	Y	-5.056	-5.056	0	0
7	M7	Y	-5.056	-5.056	0	0
8	M8	Y	-5.056	-5.056	0	0
9	M2	Y	-22.541	-22.541	0	19
10	M1	Y	-22.541	-22.541	0	0

Member Distributed Loads (BLC 4 : (x) TIA/EIA Wind Combined Ice/Wi)

	Member Label	Direction	Start Magnitude[lb/ft..	End Magnitude[lb/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M2	X	-18.639	-18.639	0	0
2	M1	X	-18.639	-18.639	0	0
3	M4	PX	-26.269	-26.269	0	0
4	M3	PX	-26.269	-26.269	0	0
5	M5	PX	-26.269	-26.269	0	0
6	M8	PX	-26.269	-26.269	0	0
7	M7	PX	-26.269	-26.269	0	0
8	M6	PX	-26.269	-26.269	0	0
9	M1	X	-30.007	-30.007	0	0
10	M2	X	-30.007	-30.007	0	19

Member Distributed Loads (BLC 5 : (x) TIA/EIA Wind Extreme Wind)

	Member Label	Direction	Start Magnitude[lb/ft..	End Magnitude[lb/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M2	X	-22.804	-22.804	0	0
2	M1	X	-22.804	-22.804	0	0
3	M4	PX	-29.708	-29.708	0	0
4	M5	PX	-29.708	-29.708	0	0
5	M3	PX	-29.708	-29.708	0	0
6	M8	PX	-29.708	-29.708	0	0
7	M7	PX	-29.708	-29.708	0	0
8	M6	PX	-29.708	-29.708	0	0
9	M1	X	-35.747	-35.747	0	0
10	M2	X	-35.747	-35.747	0	19

Member Distributed Loads (BLC 6 : (z) TIA/EIA Wind Combined Ice/Wi)

	Member Label	Direction	Start Magnitude[lb/ft..	End Magnitude[lb/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M2	Z	-18.639	-18.639	0	0
2	M1	Z	-18.639	-18.639	0	0
3	M5	PZ	-26.269	-26.269	0	0
4	M4	PZ	-26.269	-26.269	0	0
5	M3	PZ	-26.269	-26.269	0	0
6	M8	PZ	-26.269	-26.269	0	0
7	M7	PZ	-26.269	-26.269	0	0
8	M6	PZ	-26.269	-26.269	0	0
9	M1	Z	-30.007	-30.007	0	0
10	M2	Z	-30.007	-30.007	0	19

Member Distributed Loads (BLC 7 : (z) TIA/EIA Wind Extreme Wind)

	Member Label	Direction	Start Magnitude[lb/ft..	End Magnitude[lb/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M2	Z	-22.804	-22.804	0	0
2	M1	Z	-22.804	-22.804	0	0
3	M5	PZ	-29.708	-29.708	0	0
4	M4	PZ	-29.708	-29.708	0	0
5	M3	PZ	-29.708	-29.708	0	0
6	M8	PZ	-29.708	-29.708	0	0
7	M7	PZ	-29.708	-29.708	0	0
8	M6	PZ	-29.708	-29.708	0	0

Member Distributed Loads (BLC 7 : (z) TIA/EIA Wind Extreme Wind) (Continued)

	Member Label	Direction	Start Magnitude[lb/ft...	End Magnitude[lb/ft,F]	Start Location[ft,%]	End Location[ft,%]
9	M2	Z	-35.747	-35.747	0	19
10	M1	Z	-35.747	-35.747	0	0

Member Section Forces

	LC	Member Label	Sec	Axial[lb]	y Shear[lb]	z Shear[lb]	Torque[k-ft]	y-y Mo...	z-z Mo...
1	1	M1	1	312.186	1439.495	0	0	0	-.725
2			2	-529.888	1840.825	0	0	0	-14.257
3			3	-1371.963	2242.154	0	0	0	-31.099
4			4	3873.562	-2555.971	0	0	0	-45.65
5			5	3031.487	-2154.642	0	0	0	-26.219
6	1	M2	1	3031.487	-2145.124	0	0	0	-26.219
7			2	2470.105	-1877.571	0	0	0	-15.156
8			3	1424.887	-1019.796	0	0	0	-6.746
9			4	863.504	-752.243	0	0	0	-1.873
10			5	0	-20.13	0	0	0	0
11	1	M3	1	2676.778	3149.713	5066.727	0	0	0
12			2	2676.778	3145.421	5066.727	0	.95	-.59
13			3	2676.778	3141.13	5066.727	0	1.9	-1.18
14			4	2676.778	3136.839	5066.727	0	2.85	-1.768
15			5	2676.778	3132.548	5066.727	0	3.8	-2.356
16	1	M4	1	5067.144	3145.331	-2680.931	-2.356	3.8	0
17			2	5067.144	3105.279	-2634.96	-2.356	-.851	-5.469
18			3	5067.144	-3065.228	2588.989	-2.356	-5.422	-10.868
19			4	5067.144	-3105.279	2634.96	2.356	-.851	-5.469
20			5	5067.144	-3145.331	2680.931	2.356	3.8	0
21	1	M5	1	2676.778	-3132.548	-5066.727	0	3.8	-2.356
22			2	2676.778	-3136.839	-5066.727	0	2.85	-1.768
23			3	2676.778	-3141.13	-5066.727	0	1.9	-1.18
24			4	2676.778	-3145.421	-5066.727	0	.95	-.59
25			5	2676.778	-3149.713	-5066.727	0	0	0
26	1	M6	1	-627.739	261.664	-1258.19	0	0	0
27			2	-627.739	257.373	-1258.19	0	-.236	-.049
28			3	-627.739	253.082	-1258.19	0	-.472	-.097
29			4	-627.739	248.791	-1258.19	0	-.708	-.144
30			5	-627.739	244.499	-1258.19	0	-.944	-.19
31	1	M7	1	-1258.166	245.649	627.478	-.19	-.944	0
32			2	-1258.166	205.598	673.449	-.19	.195	-.395
33			3	-1258.166	165.546	719.42	-.19	1.413	-.72
34			4	-1258.166	-205.598	-673.449	.19	.195	-.395
35			5	-1258.166	-245.649	-627.478	.19	-.944	0
36	1	M8	1	-627.739	-244.499	1258.19	0	-.944	-.19
37			2	-627.739	-248.791	1258.19	0	-.708	-.144
38			3	-627.739	-253.082	1258.19	0	-.472	-.097
39			4	-627.739	-257.373	1258.19	0	-.236	-.049
40			5	-627.739	-261.664	1258.19	0	0	0
41	1	M9	1	5169.674	6089.572	0	0	0	-4.712
42			2	5169.674	6084.745	0	0	0	-6.36
43			3	5169.674	6079.917	0	0	0	-8.007
44			4	5169.674	6075.09	0	0	0	-9.652
45			5	5169.674	6070.262	0	0	0	-11.296
46	1	M10	1	-1439.362	328.743	0	0	0	-.38
47			2	-1439.362	323.916	0	0	0	-.468
48			3	-1439.362	319.088	0	0	0	-.555
49			4	-1439.362	314.26	0	0	0	-.641
50			5	-1439.362	309.433	0	0	0	-.725

Member Section Forces (Continued)

	LC	Member Label	Sec	Axial[lb]	y Shear[lb]	z Shear[lb]	Torque[k-ft]	y-y Mo...	z-z Mo...
51	2	M1	1	-1173.177	1968.073	0	0	0	2.028
52			2	-1762.463	2451.119	0	0	0	-16.202
53			3	-2351.749	2934.165	0	0	0	-38.416
54			4	2713.575	-3037.155	0	0	0	-54.093
55			5	2124.289	-2554.109	0	0	0	-31.029
56	2	M2	1	2124.289	-2545.95	0	0	0	-31.029
57			2	1731.432	-2223.919	0	0	0	-17.912
58			3	1008.475	-1209.006	0	0	0	-7.952
59			4	615.617	-886.975	0	0	0	-2.188
60			5	0	-16.89	0	0	0	0
61	2	M3	1	3318.426	2907.171	6290.034	0	0	0
62			2	3318.426	2903.828	6290.034	0	1.179	-.545
63			3	3318.426	2900.485	6290.034	0	2.359	-1.089
64			4	3318.426	2897.142	6290.034	0	3.538	-1.632
65			5	3318.426	2893.799	6290.034	0	4.718	-2.175
66	2	M4	1	6290.675	2912.925	-3324.829	-2.175	4.718	0
67			2	6290.675	2881.722	-3272.84	-2.175	-1.055	-5.07
68			3	6290.675	2850.519	-3220.851	-2.175	-6.737	-10.086
69			4	6290.675	-2881.722	3272.84	2.175	-1.055	-5.07
70			5	6290.675	-2912.925	3324.829	2.175	4.718	0
71	2	M5	1	3318.426	-2893.799	-6290.034	0	4.718	-2.175
72			2	3318.426	-2897.142	-6290.034	0	3.538	-1.632
73			3	3318.426	-2900.485	-6290.034	0	2.359	-1.089
74			4	3318.426	-2903.828	-6290.034	0	1.179	-.545
75			5	3318.426	-2907.171	-6290.034	0	0	0
76	2	M6	1	-879.849	-502.332	-1747.378	0	0	0
77			2	-879.849	-505.675	-1747.378	0	-.328	.095
78			3	-879.849	-509.018	-1747.378	0	-.655	.19
79			4	-879.849	-512.361	-1747.378	0	-.983	.285
80			5	-879.849	-515.705	-1747.378	0	-1.311	.382
81	2	M7	1	-1747.331	-513.826	879.347	.382	-1.311	0
82			2	-1747.331	-545.029	931.336	.382	.274	.926
83			3	-1747.331	-576.232	983.325	-.382	1.949	1.908
84			4	-1747.331	545.029	-931.336	-.382	.274	.926
85			5	-1747.331	513.826	-879.347	-.382	-1.311	0
86	2	M8	1	-879.849	515.705	1747.378	0	-1.311	.382
87			2	-879.849	512.361	1747.378	0	-.983	.285
88			3	-879.849	509.018	1747.378	0	-.655	.19
89			4	-879.849	505.675	1747.378	0	-.328	.095
90			5	-879.849	502.332	1747.378	0	0	0
91	2	M9	1	6428.897	5645.462	0	0	0	-4.351
92			2	6428.897	5640.635	0	0	0	-5.879
93			3	6428.897	5635.807	0	0	0	-7.405
94			4	6428.897	5630.979	0	0	0	-8.93
95			5	6428.897	5626.152	0	0	0	-10.454
96	2	M10	1	-1967.654	-1157.448	0	0	0	.764
97			2	-1967.654	-1162.276	0	0	0	1.078
98			3	-1967.654	-1167.104	0	0	0	1.393
99			4	-1967.654	-1171.931	0	0	0	1.71
100			5	-1967.654	-1176.759	0	0	0	2.028
101	3	M1	1	3182.727	-561.677	-1711.869	-1.315	3.593	-5.994
102			2	2340.653	-561.677	-2113.199	-1.315	-12.185	-1.36
103			3	1498.578	-561.677	-2514.528	-1.315	-31.275	3.274
104			4	3873.562	1.303	2555.363	0	-45.639	.023
105			5	3031.487	1.303	2154.033	0	-26.213	.012
106	3	M2	1	3031.487	.55	2144.867	0	-26.213	.012
107			2	2470.105	.55	1877.314	0	-15.152	.009

Member Section Forces (Continued)

	LC	Member Label	Sec	Axial[lb]	y Shear[lb]	z Shear[lb]	Torque[k-ft]	y-y Mo...	z-z Mo...
108			3	1424.887	.55	1019.539	0	-6.743	.006
109			4	863.504	.55	751.986	0	-1.871	.003
110			5	0	.55	19.873	0	0	0
111	3	M3	1	958.645	3107.793	2203.914	0	0	0
112			2	958.645	3103.501	2198.988	0	.413	-.582
113			3	958.645	3099.21	2194.063	0	.825	-1.164
114			4	958.645	3094.919	2189.137	0	1.236	-1.745
115			5	958.645	3090.628	2184.212	0	1.646	-2.324
116	3	M4	1	2183.792	3089.279	-958.45	-2.324	1.646	0
117			2	2183.792	3049.227	-958.45	-2.324	-.032	-5.371
118			3	-3258.525	3009.176	-958.45	-2.324	2.87	-10.672
119			4	-3258.525	-264.589	-1520.103	.237	.209	-.498
120			5	-3258.525	-304.64	-1520.103	.237	-2.451	0
121	3	M5	1	-1520.382	-307.314	3257.91	0	-2.451	-.237
122			2	-1520.382	-311.605	3262.835	0	-1.84	-.179
123			3	-1520.382	-315.896	3267.76	0	-1.227	-.12
124			4	-1520.382	-320.188	3272.686	0	-.614	-.06
125			5	-1520.382	-324.479	3277.611	0	0	0
126	3	M6	1	22.596	1185.986	-299.295	0	0	0
127			2	22.596	1181.695	-304.221	0	-.057	-.222
128			3	22.596	1177.404	-309.146	0	-.114	-.443
129			4	22.596	1173.113	-314.072	0	-.173	-.663
130			5	22.596	1168.821	-318.997	0	-.232	-.883
131	3	M7	1	-318.993	1168.352	-22.568	-.883	-.232	0
132			2	-318.993	1128.301	-22.568	-.883	-.271	-2.01
133			3	1393.012	-2114.958	539.262	1.653	-.85	-7.543
134			4	1393.012	-2155.01	539.262	1.653	.094	-3.806
135			5	1393.012	-2195.061	539.262	1.653	1.037	0
136	3	M8	1	539.141	-2195.053	-1393.095	0	1.037	-1.653
137			2	539.141	-2199.344	-1388.17	0	.777	-1.241
138			3	539.141	-2203.636	-1383.244	0	.517	-.828
139			4	539.141	-2207.927	-1378.319	0	.258	-.414
140			5	539.141	-2212.218	-1373.394	0	0	0
141	3	M9	1	-561.737	3235.841	5441.895	9.746	-4.579	-2.561
142			2	-561.737	3231.014	5441.895	9.746	-3.105	-3.437
143			3	-561.737	3226.186	5441.895	9.746	-1.632	-4.311
144			4	-561.737	3221.358	5441.895	9.746	-.158	-5.184
145			5	-561.737	3216.531	5441.895	9.746	1.315	-6.055
146	3	M10	1	561.737	3202.553	-1712.037	-3.593	.539	-2.536
147			2	561.737	3197.726	-1712.037	-3.593	.076	-3.402
148			3	561.737	3192.898	-1712.037	-3.593	-.388	-4.267
149			4	561.737	3188.07	-1712.037	-3.593	-.851	-5.131
150			5	561.737	3183.243	-1712.037	-3.593	-1.315	-5.994
151	4	M1	1	2228.654	-394.795	-2019.825	-1.563	4.251	-4.215
152			2	1639.368	-394.795	-2502.871	-1.563	-14.406	-.958
153			3	1050.082	-394.795	-2985.917	-1.563	-37.047	2.299
154			4	2713.575	.64	3036.211	0	-54.077	.011
155			5	2124.289	.64	2553.165	0	-31.02	.006
156	4	M2	1	2124.289	.269	2545.552	0	-31.02	.006
157			2	1731.432	.269	2223.521	0	-17.905	.004
158			3	1008.475	.269	1208.608	0	-7.947	.003
159			4	615.617	.269	886.577	0	-2.186	.001
160			5	0	.269	16.492	0	0	0
161	4	M3	1	1279.019	2862.195	2885.454	0	0	0
162			2	1279.019	2858.852	2879.884	0	.541	-.536
163			3	1279.019	2855.508	2874.313	0	1.08	-1.072
164			4	1279.019	2852.165	2868.743	0	1.618	-1.607

Member Section Forces (Continued)

	LC	Member Label	Sec	Axial[lb]	y Shear[lb]	z Shear[lb]	Torque[k-ft]	y-y Mo...	z-z Mo...
165			5	1279.019	2848.822	2863.173	0	2.156	-2.142
166	4	M4	1	2862.516	2846.485	-1278.837	-2.142	2.156	0
167			2	2862.516	2815.282	-1278.837	-2.142	-.082	-4.954
168			3	-3618.665	2784.078	-1278.837	-2.142	3.136	-9.853
169			4	-3618.665	483.309	-1673.629	-.331	.207	.818
170			5	-3618.665	452.105	-1673.629	-.331	-2.722	0
171	4	M5	1	-1673.843	448.673	3617.845	0	-2.722	.331
172			2	-1673.843	445.33	3623.415	0	-2.043	.248
173			3	-1673.843	441.987	3628.985	0	-1.363	.164
174			4	-1673.843	438.643	3634.556	0	-.682	.082
175			5	-1673.843	435.3	3640.126	0	0	0
176	4	M6	1	-105.86	593.243	-610.27	0	0	0
177			2	-105.86	589.9	-615.84	0	-.115	-.111
178			3	-105.86	586.556	-621.41	0	-.231	-.221
179			4	-105.86	583.213	-626.98	0	-.348	-.331
180			5	-105.86	579.87	-632.551	0	-.466	-.44
181	4	M7	1	-632.573	579.39	105.899	-.44	-.466	0
182			2	-632.573	548.187	105.899	-.44	-.281	-.987
183			3	1387.365	-1731.423	500.769	1.35	-.72	-6.169
184			4	1387.365	-1762.626	500.769	1.35	.156	-3.112
185			5	1387.365	-1793.83	500.769	1.35	1.032	0
186	4	M8	1	500.685	-1793.91	-1387.46	0	1.032	-1.35
187			2	500.685	-1797.253	-1381.89	0	.773	-1.014
188			3	500.685	-1800.596	-1376.32	0	.514	-.676
189			4	500.685	-1803.939	-1370.75	0	.256	-.339
190			5	500.685	-1807.283	-1365.179	0	0	0
191	4	M9	1	-394.825	2271.829	6480.827	11.545	-5.456	-1.81
192			2	-394.825	2267.002	6480.827	11.545	-3.701	-2.425
193			3	-394.825	2262.174	6480.827	11.545	-1.947	-3.038
194			4	-394.825	2257.346	6480.827	11.545	-.192	-3.65
195			5	-394.825	2252.519	6480.827	11.545	1.563	-4.26
196	4	M10	1	394.825	2248.22	-2019.964	-4.251	.625	-1.79
197			2	394.825	2243.392	-2019.964	-4.251	.078	-2.398
198			3	394.825	2238.565	-2019.964	-4.251	-.469	-3.005
199			4	394.825	2233.737	-2019.964	-4.251	-1.016	-3.611
200			5	394.825	2228.909	-2019.964	-4.251	-1.563	-4.215
201	5	M1	1	1629.278	-291.477	0	0	0	-3.115
202			2	1138.002	-291.477	0	0	0	-.711
203			3	646.726	-291.477	0	0	0	1.694
204			4	1801.345	.307	0	0	0	.005
205			5	1310.069	.307	0	0	0	.003
206	5	M2	1	1310.069	.122	0	0	0	.003
207			2	982.552	.122	0	0	0	.002
208			3	655.035	.122	0	0	0	.001
209			4	327.517	.122	0	0	0	0
210			5	0	.122	0	0	0	0
211	5	M3	1	-145.746	908.187	-278.609	0	0	0
212			2	-145.746	904.844	-278.609	0	-.052	-.17
213			3	-145.746	901.501	-278.609	0	-.104	-.339
214			4	-145.746	898.158	-278.609	0	-.157	-.508
215			5	-145.746	894.814	-278.609	0	-.209	-.676
216	5	M4	1	-278.608	894.829	145.733	-.676	-.209	0
217			2	-278.608	863.625	145.733	-.676	.046	-1.539
218			3	-278.608	832.422	145.733	.676	.301	-3.023
219			4	-278.608	-863.625	-145.733	.676	.046	-1.539
220			5	-278.608	-894.829	-145.733	.676	-.209	0
221	5	M5	1	-145.746	-894.814	278.609	0	-.209	-.676

Member Section Forces (Continued)

	LC	Member Label	Sec	Axial[lb]	y Shear[lb]	z Shear[lb]	Torque[k-ft]	y-y Mo...	z-z Mo...
222			2	-145.746	-898.158	278.609	0	-.157	-.508
223			3	-145.746	-901.501	278.609	0	-.104	-.339
224			4	-145.746	-904.844	278.609	0	-.052	-.17
225			5	-145.746	-908.187	278.609	0	0	0
226	5	M6	1	145.746	900.267	278.658	0	0	0
227			2	145.746	896.924	278.658	0	.052	-.168
228			3	145.746	893.581	278.658	0	.104	-.336
229			4	145.746	890.238	278.658	0	.157	-.504
230			5	145.746	886.895	278.658	0	.209	-.67
231	5	M7	1	278.659	886.881	-145.758	-.67	.209	0
232			2	278.659	855.677	-145.758	-.67	-.046	-1.525
233			3	278.659	824.474	-145.758	-.67	-.301	-2.995
234			4	278.659	-855.677	145.758	.67	-.046	-1.525
235			5	278.659	-886.881	145.758	.67	.209	0
236	5	M8	1	145.746	-886.895	-278.658	0	.209	-.67
237			2	145.746	-890.238	-278.658	0	.157	-.504
238			3	145.746	-893.581	-278.658	0	.104	-.336
239			4	145.746	-896.924	-278.658	0	.052	-.168
240			5	145.746	-900.267	-278.658	0	0	0
241	5	M9	1	-291.492	1665.064	0	0	0	-1.352
242			2	-291.492	1660.236	0	0	0	-1.802
243			3	-291.492	1655.409	0	0	0	-2.251
244			4	-291.492	1650.581	0	0	0	-2.699
245			5	-291.492	1645.753	0	0	0	-3.145
246	5	M10	1	291.492	1648.728	0	0	0	-1.34
247			2	291.492	1643.901	0	0	0	-1.786
248			3	291.492	1639.073	0	0	0	-2.231
249			4	291.492	1634.245	0	0	0	-2.674
250			5	291.492	1629.418	0	0	0	-3.115

Joint Reactions

	LC	Joint Label	X [lb]	Y [lb]	Z [lb]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	1	N5	-627.739	263.016	1258.166	0	0	0
2	1	N6	-627.739	263.016	-1258.166	0	0	0
3	1	N7	2676.778	3150.722	-5067.144	0	0	0
4	1	N8	2676.778	3150.722	5067.144	0	0	0
5	1	Totals:	4098.078	6827.477	0			
6	1	COG (ft):	X: 1.764	Y: 28.54	Z: 0			
7	2	N5	-879.849	-501.153	1747.331	0	0	0
8	2	N6	-879.849	-501.153	-1747.331	0	0	0
9	2	N7	3318.426	2912.74	-6290.675	0	0	0
10	2	N8	3318.426	2912.74	6290.675	0	0	0
11	2	Totals:	4877.155	4823.174	0			
12	2	COG (ft):	X: 1.756	Y: 28.426	Z: 0			
13	3	N5	539.141	2210.635	-1373.311	0	0	0
14	3	N6	22.596	1185.939	-299.291	0	0	0
15	3	N7	-1520.382	326.646	3278.227	0	0	0
16	3	N8	958.645	3104.258	2203.494	0	0	0
17	3	Totals:	0	6827.477	3809.119			
18	3	COG (ft):	X: 1.764	Y: 28.54	Z: 0			
19	4	N5	500.685	1806.146	-1365.084	0	0	0
20	4	N6	-105.86	593.379	-610.292	0	0	0
21	4	N7	-1673.843	-434.525	3640.946	0	0	0
22	4	N8	1279.019	2858.174	2884.797	0	0	0
23	4	Totals:	0	4823.174	4550.367			

Joint Reactions (Continued)

	LC	Joint Label	X [lb]	Y [lb]	Z [lb]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
24	4	COG (ft):	X: 1.756	Y: 28.426	Z: 0			
25	5	N5	145.746	900.074	-278.659	0	0	0
26	5	N6	145.746	900.074	278.659	0	0	0
27	5	N7	-145.746	908.383	278.608	0	0	0
28	5	N8	-145.746	908.383	-278.608	0	0	0
29	5	Totals:	0	3616.914	0			
30	5	COG (ft):	X: 1.731	Y: 25.917	Z: 0			

Member AISC ASD Steel Code Checks

	L...	Member	Shape	UC ...	Loc...	Shea...	Loc......		Fa[ksi]	Ft[ksi]	Fby[ksi]	Fbz[...	Cb	Cmy	Cmz	Eqn
1	1	M1	PIPE_...	.539	21....	.022	21....		13.958	21	23.1	23.1	1	.6	.85	H1-2
2	1	M2	PIPE_...	.265	0	.018	0		17.025	21	23.1	23.1	1.75	.6	.85	H1-2
3	1	M3	HSS6x...	.274	.75	.098	0	z	27.371	27.6	30.36	30.36	1.75	.6	.85	H1-2
4	1	M4	HSS6x...	.710	3.5	.160	0	y	24.454	27.6	30.36	30.36	1	.85	.85	H1-2
5	1	M5	HSS6x...	.274	0	.098	0	z	27.371	27.6	30.36	30.36	1.75	.6	.85	H1-2
6	1	M6	HSS6x...	.051	.75	.024	0	z	27.371	27.6	30.36	30.36	1.75	.6	.85	H2-1
7	1	M7	HSS6x...	.097	3.5	.022	3.5	z	24.454	27.6	30.36	30.36	1	.85	.85	H2-1
8	1	M8	HSS6x...	.051	0	.024	0	z	27.371	27.6	30.36	30.36	1.75	.6	.85	H2-1
9	1	M9	HSS6x...	.504	1.083	.118	0	y	27.26	27.6	30.36	30.36	1....	.6	.85	H1-2
10	1	M10	HSS6x...	.040	1.083	.006	0	y	27.26	27.6	30.36	30.36	1....	.6	.85	H2-1
11	2	M1	PIPE_...	.633	21....	.026	21....		13.958	21	23.1	23.1	1	.6	.85	H1-2
12	2	M2	PIPE_...	.310	0	.021	0		17.025	21	23.1	23.1	1.75	.6	.85	H1-2
13	2	M3	HSS6x...	.309	.75	.122	0	z	27.371	27.6	30.36	30.36	1.75	.6	.85	H1-2
14	2	M4	HSS6x...	.741	3.5	.156	0	z	24.454	27.6	30.36	30.36	1	.85	.85	H1-2
15	2	M5	HSS6x...	.309	0	.122	0	z	27.371	27.6	30.36	30.36	1.75	.6	.85	H1-2
16	2	M6	HSS6x...	.076	.75	.034	0	z	27.371	27.6	30.36	30.36	1.75	.6	.85	H2-1
17	2	M7	HSS6x...	.172	3.5	.035	3.5	z	24.454	27.6	30.36	30.36	1	.85	.85	H2-1
18	2	M8	HSS6x...	.076	0	.034	0	z	27.371	27.6	30.36	30.36	1.75	.6	.85	H2-1
19	2	M9	HSS6x...	.478	1.083	.110	0	y	27.26	27.6	30.36	30.36	1....	.6	.85	H1-2
20	2	M10	HSS6x...	.098	1.083	.023	1.083	y	27.26	27.6	30.36	30.36	1....	.6	.85	H2-1
21	3	M1	PIPE_...	.539	21....	.033	21....		13.958	21	23.1	23.1	1....	.85	.599	H1-2
22	3	M2	PIPE_...	.265	0	.018	0		17.025	21	23.1	23.1	1.75	.85	.6	H1-2
23	3	M3	HSS6x...	.171	.75	.060	0	y	27.371	27.6	30.36	30.36	1.75	.85	.85	H1-2
24	3	M4	HSS6x...	.584	3.5	.158	0	y	24.454	27.6	30.36	30.36	1	.331	.85	H2-1
25	3	M5	HSS6x...	.122	0	.064	.75	z	27.371	27.6	30.36	30.36	1.75	.85	.85	H2-1
26	3	M6	HSS6x...	.046	.75	.023	0	y	27.371	27.6	30.36	30.36	1.75	.85	.85	H1-2
27	3	M7	HSS6x...	.358	3.5	.112	7	y	24.454	27.6	30.36	30.36	1	.511	.85	H1-2
28	3	M8	HSS6x...	.115	0	.043	.75	y	27.371	27.6	30.36	30.36	1.75	.85	.85	H1-2
29	3	M9	HSS6x...	.309	1.083	.516	0	z	27.26	27.6	30.36	30.36	1.36	.485	.85	H2-1
30	3	M10	HSS6x...	.307	1.083	.213	0	y	27.26	27.6	30.36	30.36	1....	.436	.85	H1-2
31	4	M1	PIPE_...	.633	21....	.039	21....		13.958	21	23.1	23.1	1....	.85	.599	H1-2
32	4	M2	PIPE_...	.310	0	.021	0		17.025	21	23.1	23.1	1.75	.85	.6	H1-2
33	4	M3	HSS6x...	.187	.75	.056	0	z	27.371	27.6	30.36	30.36	1.75	.85	.85	H1-2
34	4	M4	HSS6x...	.564	3.5	.145	0	y	24.454	27.6	30.36	30.36	1	.283	.85	H2-1
35	4	M5	HSS6x...	.138	0	.071	.75	z	27.371	27.6	30.36	30.36	1.75	.85	.85	H2-1
36	4	M6	HSS6x...	.038	.75	.012	.75	z	27.371	27.6	30.36	30.36	1.75	.85	.85	H2-1
37	4	M7	HSS6x...	.295	3.5	.092	7	y	24.454	27.6	30.36	30.36	1	.419	.85	H1-2
38	4	M8	HSS6x...	.102	0	.035	.75	y	27.371	27.6	30.36	30.36	1.75	.85	.85	H1-2
39	4	M9	HSS6x...	.304	0	.612	0	z	27.26	27.6	30.36	30.36	1....	.485	.85	H2-1
40	4	M10	HSS6x...	.242	1.083	.223	0	y	27.26	27.6	30.36	30.36	1....	.44	.85	H1-2
41	5	M1	PIPE_...	.035	0	.002	0		13.958	21	23.1	23.1	1....	.6	.6	H1-2
42	5	M2	PIPE_...	.004	0	.000	0		17.025	21	23.1	23.1	1.75	.6	.6	H1-1
43	5	M3	HSS6x...	.038	.75	.018	0	y	27.371	27.6	30.36	30.36	1.75	.6	.85	H2-1
44	5	M4	HSS6x...	.140	3.5	.046	7	y	24.454	27.6	30.36	30.36	1	1	.85	H2-1
45	5	M5	HSS6x...	.038	0	.018	.75	y	27.371	27.6	30.36	30.36	1.75	.6	.85	H2-1

Member AISC ASD Steel Code Checks (Continued)

	L...	Member	Shape	UC ...	Loc...	Shea...	Loc...	...	Fa[ksi]	Ft[ksi]	Fby[ksi]	Fbz[...	Cb	Cmy	Cmz	Eqn
46	5	M6	HSS6x...	.037	.75	.017	0	y	27.371	27.6	30.36	30.36	1.75	.6	.85	H1-2
47	5	M7	HSS6x...	.139	3.5	.045	0	y	24.454	27.6	30.36	30.36	1	1	.85	H1-2
48	5	M8	HSS6x...	.037	0	.017	.75	y	27.371	27.6	30.36	30.36	1.75	.6	.85	H1-2
49	5	M9	HSS6x...	.132	1.083	.032	0	y	27.26	27.6	30.36	30.36	1....	.6	.85	H2-1
50	5	M10	HSS6x...	.131	1.083	.032	0	y	27.26	27.6	30.36	30.36	1....	.6	.85	H1-2

Flange Bolt and Flange Plate Analysis

RISA Reactions Input: (LC 4)

$OM := 33.9 \cdot ft \cdot kip$ North Mast, LC2

$V := 2.7 \cdot kip$ North Mast, LC2

$A := 2.2 \cdot kip$ North Mast, LC2

Flange Bolt Input:

Assumes ASTM A325 bolts

$N := 8$ Number of Bolts

$BC := 17 \cdot in$

$Fu_{bolt} := 105 \cdot ksi$

$Fy_{bolt} := 81\ ksi$

$E := 29000 \cdot ksi$

$D_{bolt} := 1.125 \cdot in$

$n := 7$ Threads per inch

Flange Plate Input:

Assumes ASTM A36

$Fy_{plate} := 36 \cdot ksi$

$t_{Plate} := 1.5 \cdot in$

$D_{Plate} := 20 \cdot in$

$D_{Pole} := 12.75 \cdot in$

Distance from Bolts to Centroid of Pole:

$R_{BC} := \frac{BC}{2} = 8.5\ in$

$i := 1..N$

$$d_i := \begin{Vmatrix} \Theta \leftarrow 2 \cdot \pi \cdot \frac{i}{N} \\ d \leftarrow R_{BC} \cdot \sin(\Theta) \end{Vmatrix}$$

$$d = \begin{bmatrix} 6.01 \\ 8.5 \\ 6.01 \\ 0 \\ -6.01 \\ -8.5 \\ -6.01 \\ 0 \end{bmatrix} in$$

Determine Distances For Bending in Plate:

$$R_{Pole} := \frac{D_{Pole}}{2} = 6.375\ in$$

$$MA_i := \begin{array}{l} \text{if } d_i \geq R_{Pole} \\ \quad \| \ d_i - R_{Pole} \\ \text{else} \\ \quad \| \ 0 \cdot in \end{array}$$

$$MA_i = \begin{bmatrix} 0 \\ 2.125 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} in$$

$$B_{eff} := 0.8 \cdot 2 \cdot \sqrt{\left(\frac{D_{Plate}}{2}\right)^2 - \left(\frac{D_{Pole}}{2}\right)^2} = 12.327\ in$$

Flange Bolt Properties and Check:

$$I_p := \sum_i d_i^{\,2} = 289\ in^2$$

$$A_g := \frac{\pi \cdot D_{bolt}^{\,2}}{4} = 0.994\ in^2$$

$$A_n := \frac{\pi}{4} \cdot \left(D_{bolt} - \frac{0.9743\ in}{n}\right)^2 = 0.763\ in^2$$

$$D_n := \frac{2 \cdot \sqrt{A_n}}{\sqrt{\pi}} = 0.986\ in$$

$$r_{bolt} := \frac{D_n}{4} = 0.246\ in$$

$$S_{bolt} := \pi \cdot \frac{D_n^{\,3}}{32} = 0.094\ in^3$$

$$T_{max} := OM \cdot \frac{R_{BC}}{I_p} - \frac{A}{N} = 11.69\ kip$$

$$T_{allow} := 1.33 \cdot (0.33 \cdot A_g \cdot Fu_{bolt}) = 45.809\ kip$$

$$Bolt_{usage} := \frac{T_{max}}{T_{allow}} = 0.255$$

$$Status_{bolt} := \begin{array}{l} \text{if } Bolt_{usage} \leq 1 \\ \quad \| \ \text{"OK"} \\ \text{else} \\ \quad \| \ \text{"NG"} \end{array} = \text{"OK"}$$

Flange Plate Check:

$$C_i := \frac{OM \cdot d_i}{I_p} + \frac{A}{N}$$

$$C = \begin{bmatrix} 8.735 \\ 12.24 \\ 8.735 \\ 0.275 \\ -8.185 \\ -11.69 \\ -8.185 \\ 0.275 \end{bmatrix} \; kip$$

Bolt Forces

$$f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{B_{eff} \cdot t_{Plate}^{\;2}} = 5.626 \; ksi$$

$$F_{bp} := 1.33 \cdot 0.75 \cdot Fy_{plate} = 35.91 \; ksi$$

$$Plate_{usage} := \frac{f_{bp}}{F_{bp}} = 0.157$$

$$Status_{plate} := \begin{array}{l} \text{if } Plate_{usage} \le 1 \\ \quad \text{"OK"} \\ \text{else} \\ \quad \text{"NG"} \end{array} = \text{"OK"}$$

Mast Connection at Tower

RISA Reactions

$Vert := 3.3 \cdot kip$ Worst Case (Envelope) of North Mast & South Mast

$H_x := 3.5\ kip$ Worst Case (Envelope) of North Mast & South Mast

$H_z := 6.6\ kip$ Worst Case (Envelope) of North Mast & South Mast

Bolt Input:

Assumes ASTM A325 type N

$N := 4$ Number of Bolts at Connection

$D_{bolt} := 0.75 \cdot in$ Diameter of Bolts

$F_{t.bolt} := 19.4\ kip$ Allowable Tensile Strength, ASD 9th Table I-A

$F_{v.bolt} := 9.3\ kip$ Allowable Shear Strength, ASD 9th Table I-D

$\mu := 0.4$ Coefficient of Friction - Steel on Steel

Calculations:

$$f_v := \frac{\sqrt{{H_x}^2 + {Vert}^2}}{N} = 1.203\ kip$$

$$Usage_{shear} := \frac{f_v}{F_{v.bolt}} = 0.129$$

$$Status_{shear} := \begin{array}{l} \text{if } Usage_{shear} \le 1 \\ \quad \text{“OK”} \\ \text{else} \\ \quad \text{“NG”} \end{array} = \text{“OK”}$$

$T_{bolt} := 0.3 \cdot F_{t.bolt} = 5.82\ kip$ Assumed installed bolt tension

$F_{slip} := T_{bolt} \cdot N \cdot \mu = 9.312\ kip$ Assumed friction connection slip capacity

$$Usage_{slip} := \frac{\sqrt{{H_x}^2 + {Vert}^2}}{F_{slip}} = 0.517$$

$$Status_{slip} := \begin{array}{l} \text{if } Usage_{slip} \le 1 \\ \quad \text{“OK”} \\ \text{else} \\ \quad \text{“NG”} \end{array} = \text{“OK”}$$

NESC Mount Loading

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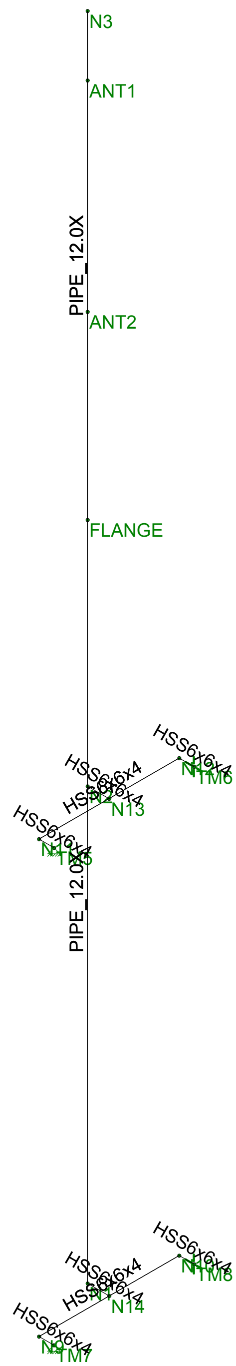
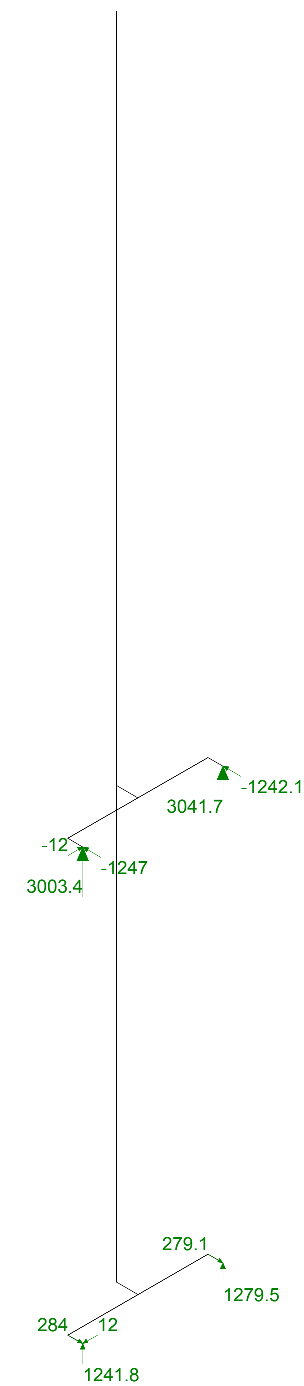
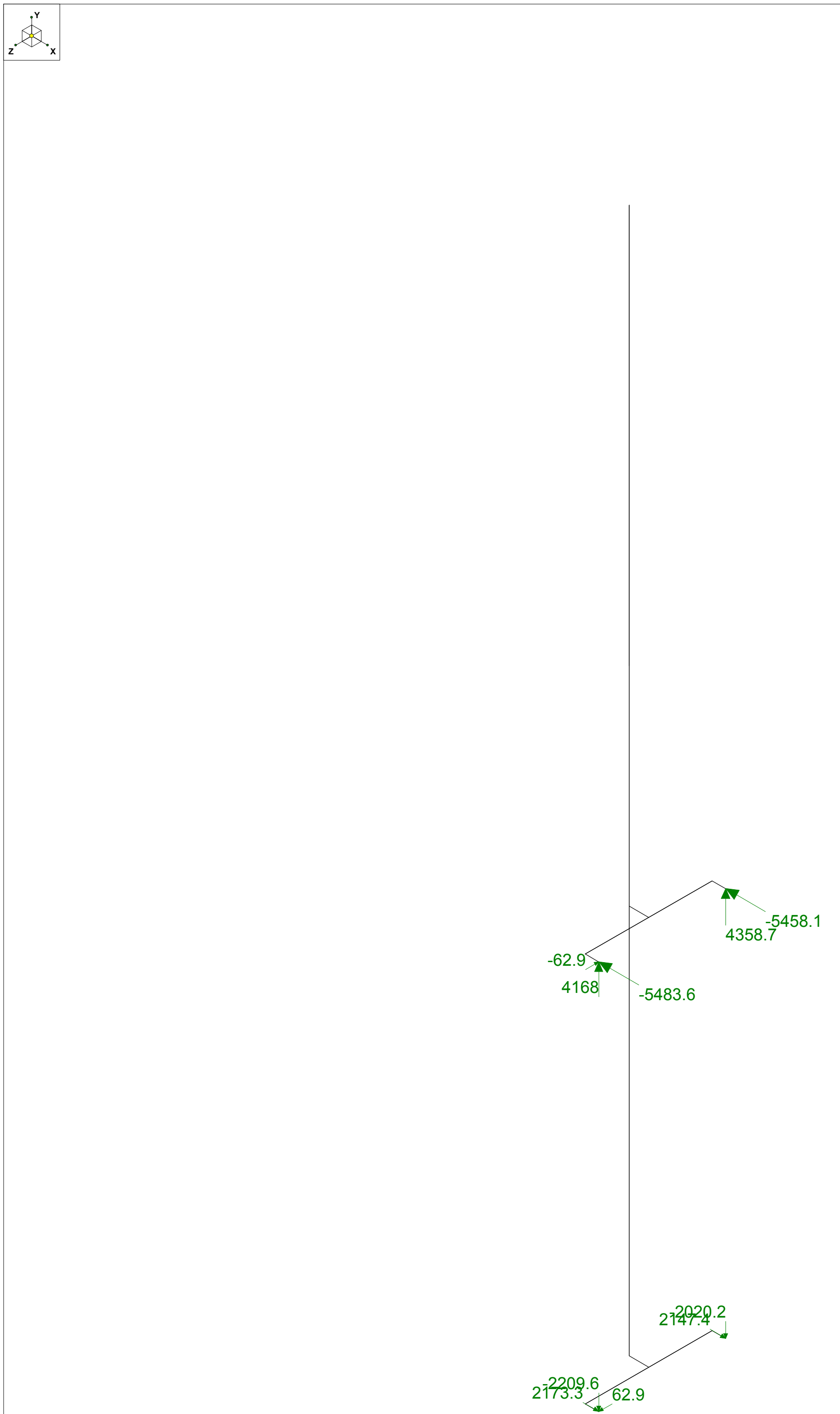


Paul J. Ford & Co.	North Mast on Eversource Tower #1102	SK - 1
CBH		Nov 11, 2015 at 1:49 PM
31215-0012.002.6000		North Mast - NESC Loads.r3d



Results for LC 1, 250B: NESC Heavy
Z-direction Reaction Units are lb and k-ft

Paul J. Ford & Co.	North Mast on Eversource Tower #1102	SK - 2
CBH		Nov 11, 2015 at 1:51 PM
31215-0012.002.6000		North Mast - NESC Loads.r3d



Results for LC 2, 250C: Extreme Wind (Trans.)
Z-direction Reaction Units are lb and k-ft

Paul J. Ford & Co.	North Mast on Eversource Tower #1102	SK - 3
CBH		Nov 11, 2015 at 1:52 PM
31215-0012.002.6000		North Mast - NESC Loads.r3d

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diaphragm
1	N1	-1.833	62	0	0	
2	N2	-1.833	83.5	0	0	
3	FLANGE	-1.833	95	0	0	
4	N3	-1.833	117	0	0	
5	TM7	0	62	3.5	0	
6	TM8	0	62	-3.5	0	
7	TM5	0	83.5	3.5	0	
8	TM6	0	83.5	-3.5	0	
9	N9	-.75	62	3.5	0	
10	N10	-.75	62	-3.5	0	
11	N11	-.75	83.5	3.5	0	
12	N12	-.75	83.5	-3.5	0	
13	N13	-.75	83.5	0	0	
14	N14	-.75	62	0	0	
15	ANT1	-1.833	114	0	0	
16	ANT2	-1.833	104	0	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]	Footing
1	TM6	Reaction	Reaction					
2	TM5	Reaction	Reaction	Reaction				
3	TM7	Reaction	Reaction	Reaction				
4	TM8	Reaction	Reaction					

Member Primary Data

	Label	I Joint	J Joint	K Joint	Rotate(deg)	Section/Shape	Type	Design List	Material	Design Rules
1	M1	N1	FLAN...			Pipe Mast	Beam	Pipe	A53 Gr. B	Typical
2	M2	FLAN...	N3			Pipe Mast	Beam	Pipe	A53 Gr. B	Typical
3	M3	TM5	N11			HSS Frame	Beam	SquareTube	A500 Gr.46	Typical
4	M4	N11	N12			HSS Frame	Beam	SquareTube	A500 Gr.46	Typical
5	M5	N12	TM6			HSS Frame	Beam	SquareTube	A500 Gr.46	Typical
6	M6	TM7	N9			HSS Frame	Beam	SquareTube	A500 Gr.46	Typical
7	M7	N9	N10			HSS Frame	Beam	SquareTube	A500 Gr.46	Typical
8	M8	N10	TM8			HSS Frame	Beam	SquareTube	A500 Gr.46	Typical
9	M9	N14	N1			HSS Stub	Beam	SquareTube	A500 Gr.46	Typical
10	M10	N13	N2			HSS Stub	Beam	SquareTube	A500 Gr.46	Typical

Basic Load Cases

	BLC Description	Category	X Gra...	Y Gra...	Z Gra...	Joint	Point	Distributed	Area(Mem...	Surface...
1	250B: NESC Heavy	None		-1.5		8		12		
2	250C: Extreme Wind (Trans.)	None		-1		8		11		

Load Combinations

	Description	S...	PDe..	SR..	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...
1	250B: NESC Heavy	Yes	Y		1	1																		
2	250C: Extreme Wind (Trans.)	Yes	Y		2	1																		

Joint Loads and Enforced Displacements (BLC 1 : 250B: NESC Heavy)

	Joint Label	L,D,M	Direction	Magnitude[(lb,k-ft), (in,rad), (lb*s^2/ft, lb*s^2...
1	ANT1	L	Y	-371
2	ANT1	L	X	67
3	ANT1	L	Y	-320
4	ANT1	L	X	250
5	ANT2	L	Y	-371
6	ANT2	L	X	67
7	ANT2	L	Y	-433
8	ANT2	L	X	253

Joint Loads and Enforced Displacements (BLC 2 : 250C: Extreme Wind (Trans.))

	Joint Label	L,D,M	Direction	Magnitude[(lb,k-ft), (in,rad), (lb*s^2/ft, lb*s^2...
1	ANT1	L	Y	-167
2	ANT1	L	X	209
3	ANT1	L	Y	-119
4	ANT1	L	X	990
5	ANT2	L	Y	-167
6	ANT2	L	X	206
7	ANT2	L	Y	-171
8	ANT2	L	X	965

Member Distributed Loads (BLC 1 : 250B: NESC Heavy)

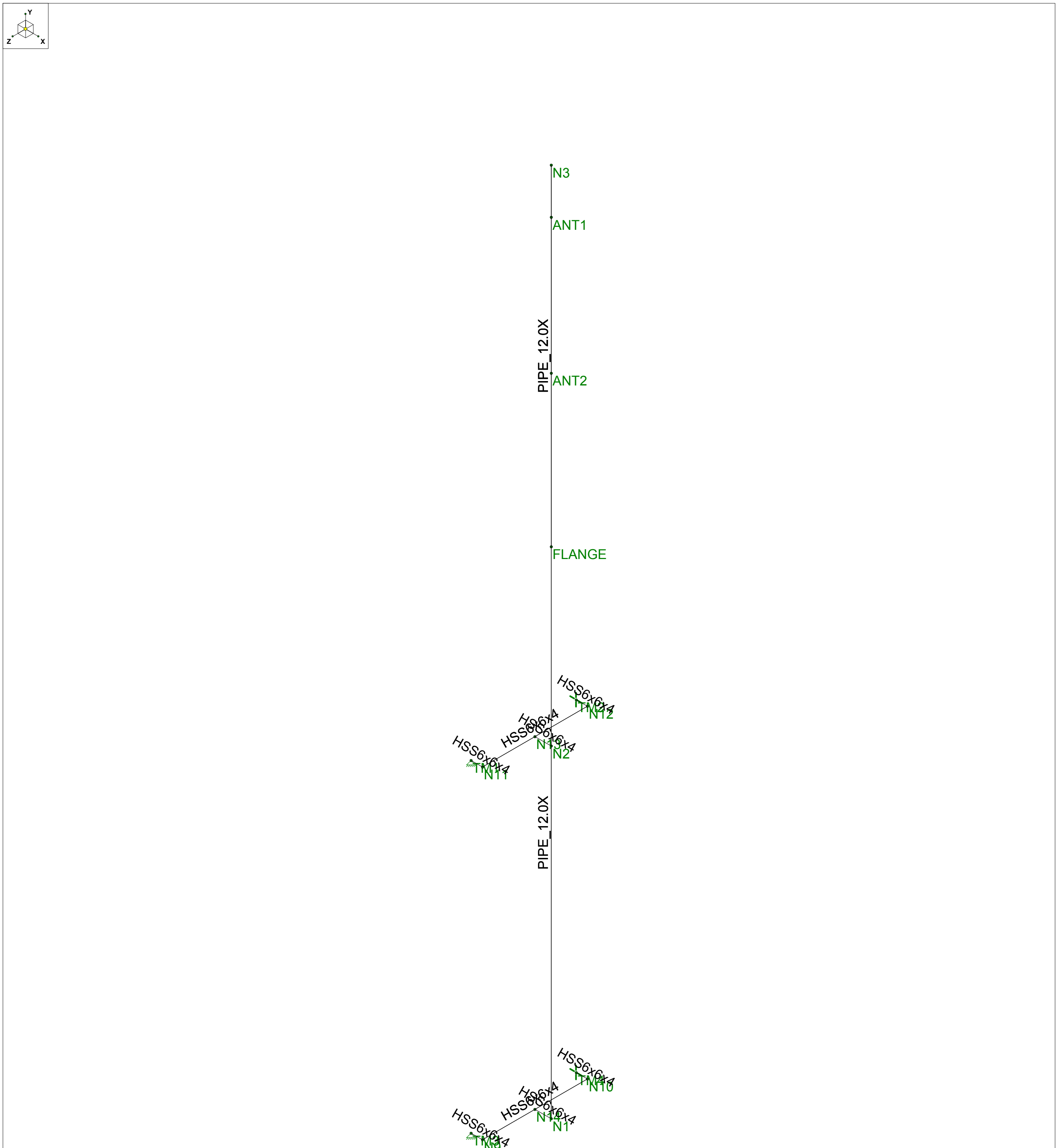
	Member Label	Direction	Start Magnitude[lb/ft,F]	End Magnitude[lb/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	-12	-12	0	0
2	M2	Y	-12	-12	0	0
3	M1	X	15	15	0	0
4	M2	X	15	15	0	0
5	M1	X	8	8	18	33
6	M1	Y	-17	-17	18	33
7	M2	X	8	8	0	19
8	M2	Y	-17	-17	0	19
9	M1	X	8	8	18	33
10	M1	Y	-17	-17	18	33
11	M2	X	8	8	0	9
12	M2	Y	-17	-17	0	9

Member Distributed Loads (BLC 2 : 250C: Extreme Wind (Trans.))

	Member Label	Direction	Start Magnitude[lb/ft,F]	End Magnitude[lb/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M1	X	48	48	0	32
2	M1	X	60	60	32	33
3	M2	X	60	60	0	0
4	M1	X	21	21	18	32
5	M1	X	27	27	32	33
6	M2	X	27	27	0	19
7	M1	X	21	21	18	32
8	M1	Y	-4	-4	18	32
9	M2	X	27	27	32	33
10	M2	X	27	27	0	9
11	M2	X	-4	-4	0	9

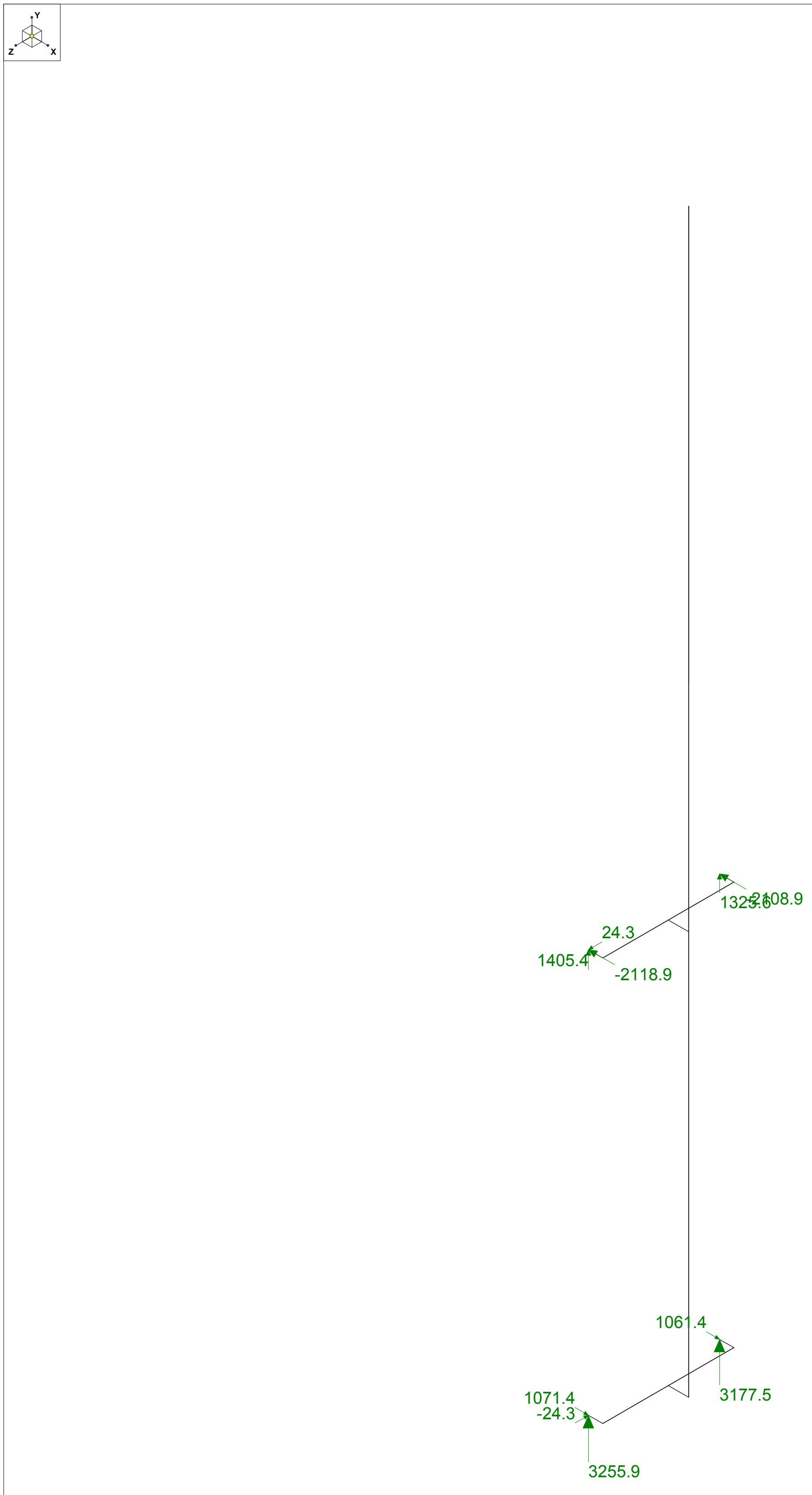
Joint Reactions

	LC	Joint Label	X [lb]	Y [lb]	Z [lb]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	1	TM6	-1242.117	3041.729	0	0	0	0
2	1	TM5	-1247.019	3003.419	-11.982	0	0	0
3	1	TM7	284.028	1241.762	11.982	0	0	0
4	1	TM8	279.109	1279.461	0	0	0	0
5	1	Totals:	-1926	8566.371	0			
6	1	COG (ft):	X: -1.768	Y: 92.46	Z: 0			
7	2	TM6	-5458.142	4358.742	0	0	0	0
8	2	TM5	-5483.62	4168	-62.88	0	0	0
9	2	TM7	2173.34	-2209.598	62.88	0	0	0
10	2	TM8	2147.421	-2020.229	0	0	0	0
11	2	Totals:	-6621	4296.914	0			
12	2	COG (ft):	X: -1.747	Y: 90.907	Z: 0			



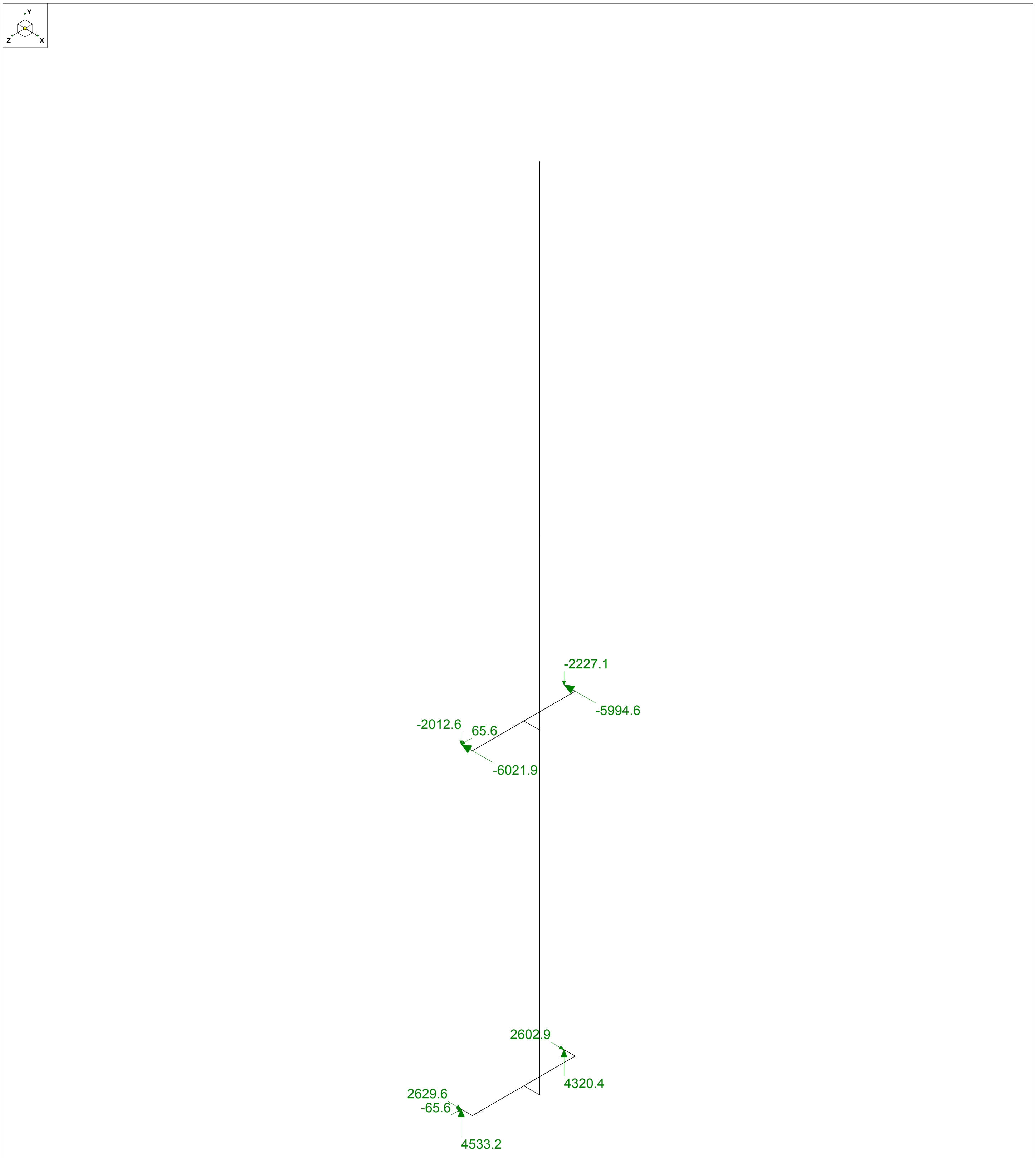
Envelope Only Solution

Paul J. Ford & Co.	South Mast on Eversource Tower #1102	SK - 1
CBH		Nov 11, 2015 at 1:58 PM
31215-0012.002.6000		South Mast - NESC Loads.r3d



Results for LC 1, 250B: NESC Heavy
Z-direction Reaction Units are lb and k-ft

Paul J. Ford & Co.	South Mast on Eversource Tower #1102	SK - 2
CBH		Nov 11, 2015 at 1:59 PM
31215-0012.002.6000		South Mast - NESC Loads.r3d



Results for LC 2, 250C: Extreme Wind (Trans.)
Z-direction Reaction Units are lb and k-ft

Paul J. Ford & Co.	South Mast on Eversource Tower #1102	SK - 3
CBH		Nov 11, 2015 at 1:59 PM
31215-0012.002.6000		South Mast - NESC Loads.r3d

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diaphragm
1	N1	1.833	62	0	0	
2	N2	1.833	83.5	0	0	
3	FLANGE	1.833	95	0	0	
4	N3	1.833	117	0	0	
5	TM3	0	62	3.5	0	
6	TM4	0	62	-3.5	0	
7	TM1	0	83.5	3.5	0	
8	TM2	0	83.5	-3.5	0	
9	N9	.75	62	3.5	0	
10	N10	.75	62	-3.5	0	
11	N11	.75	83.5	3.5	0	
12	N12	.75	83.5	-3.5	0	
13	N13	.75	83.5	0	0	
14	N14	.75	62	0	0	
15	ANT1	1.833	114	0	0	
16	ANT2	1.833	105	0	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]	Footing
1	TM2	Reaction	Reaction					
2	TM1	Reaction	Reaction	Reaction				
3	TM3	Reaction	Reaction	Reaction				
4	TM4	Reaction	Reaction					

Member Primary Data

	Label	I Joint	J Joint	K Joint	Rotate(deg)	Section/Shape	Type	Design List	Material	Design Rules
1	M1	N1	FLAN...			Pipe Mast	Beam	Pipe	A53 Gr. B	Typical
2	M2	FLAN...	N3			Pipe Mast	Beam	Pipe	A53 Gr. B	Typical
3	M3	TM1	N11			HSS Frame	Beam	SquareTube	A500 Gr.46	Typical
4	M4	N11	N12			HSS Frame	Beam	SquareTube	A500 Gr.46	Typical
5	M5	N12	TM2			HSS Frame	Beam	SquareTube	A500 Gr.46	Typical
6	M6	TM3	N9			HSS Frame	Beam	SquareTube	A500 Gr.46	Typical
7	M7	N9	N10			HSS Frame	Beam	SquareTube	A500 Gr.46	Typical
8	M8	N10	TM4			HSS Frame	Beam	SquareTube	A500 Gr.46	Typical
9	M9	N14	N1			HSS Stub	Beam	SquareTube	A500 Gr.46	Typical
10	M10	N13	N2			HSS Stub	Beam	SquareTube	A500 Gr.46	Typical

Basic Load Cases

	BLC Description	Category	X Gra...	Y Gra...	Z Gra...	Joint	Point	Distributed	Area(Mem...	Surface...
1	250B: NESC Heavy	None		-1.5		8		12		
2	250C: Extreme Wind (Trans.)	None		-1		8		10		

Load Combinations

	Description	S...	PDe...	SR...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...
1	250B: NESC Heavy	Yes	Y		1	1																		
2	250C: Extreme Wind (Trans.)	Yes	Y		2	1																		

Joint Loads and Enforced Displacements (BLC 1 : 250B: NESC Heavy)

	Joint Label	L,D,M	Direction	Magnitude[(lb,k-ft), (in,rad), (lb*s^2/ft, lb*s^2...
1	ANT1	L	Y	-371
2	ANT1	L	X	67
3	ANT1	L	Y	-304
4	ANT1	L	X	223
5	ANT2	L	Y	-371
6	ANT2	L	X	67
7	ANT2	L	Y	-418
8	ANT2	L	X	237

Joint Loads and Enforced Displacements (BLC 2 : 250C: Extreme Wind (Trans.))

	Joint Label	L,D,M	Direction	Magnitude[(lb,k-ft), (in,rad), (lb*s^2/ft, lb*s^2...
1	ANT1	L	Y	-167
2	ANT1	L	X	209
3	ANT1	L	Y	-92
4	ANT1	L	X	866
5	ANT2	L	Y	-167
6	ANT2	L	X	206
7	ANT2	L	Y	-163
8	ANT2	L	X	905

Member Distributed Loads (BLC 1 : 250B: NESC Heavy)

	Member Label	Direction	Start Magnitude[lb/ft,F]	End Magnitude[lb/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	-12	-12	0	0
2	M2	Y	-12	-12	0	0
3	M1	X	15	15	0	0
4	M2	X	15	15	0	0
5	M1	X	14	14	18	33
6	M1	Y	-35	-35	18	33
7	M2	X	14	14	0	19
8	M2	Y	-35	-35	0	19
9	M1	X	8	8	18	33
10	M1	Y	-17	-17	18	33
11	M2	X	8	8	0	10
12	M2	Y	-17	-17	0	10

Member Distributed Loads (BLC 2 : 250C: Extreme Wind (Trans.))

	Member Label	Direction	Start Magnitude[lb/ft,F]	End Magnitude[lb/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M1	X	48	48	0	32
2	M1	X	60	60	32	33
3	M2	X	60	60	0	0
4	M1	X	43	43	18	32
5	M1	X	54	54	32	33
6	M2	X	54	54	0	19
7	M1	Y	-8	-8	18	33
8	M2	Y	-8	-8	0	19
9	M1	Y	-4	-4	18	33
10	M2	Y	-4	-4	0	19

Joint Reactions

	LC	Joint Label	X [lb]	Y [lb]	Z [lb]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	1	TM2	-2108.897	1325.589	0	0	0	0
2	1	TM1	-2118.927	1405.379	24.328	0	0	0
3	1	TM3	1071.391	3255.902	-24.328	0	0	0
4	1	TM4	1061.433	3177.501	0	0	0	0
5	1	Totals:	-2095	9164.371	0			
6	1	COG (ft):	X: 1.773	Y: 92.815	Z: 0			
7	2	TM2	-5994.619	-2227.142	0	0	0	0
8	2	TM1	-6021.889	-2012.573	65.571	0	0	0
9	2	TM3	2629.629	4533.193	-65.571	0	0	0
10	2	TM4	2602.879	4320.437	0	0	0	0
11	2	Totals:	-6784	4613.914	0			
12	2	COG (ft):	X: 1.753	Y: 91.406	Z: 0			

COMPUTER OUTPUT

TABLE OF CONTENTS

COMMENTARY

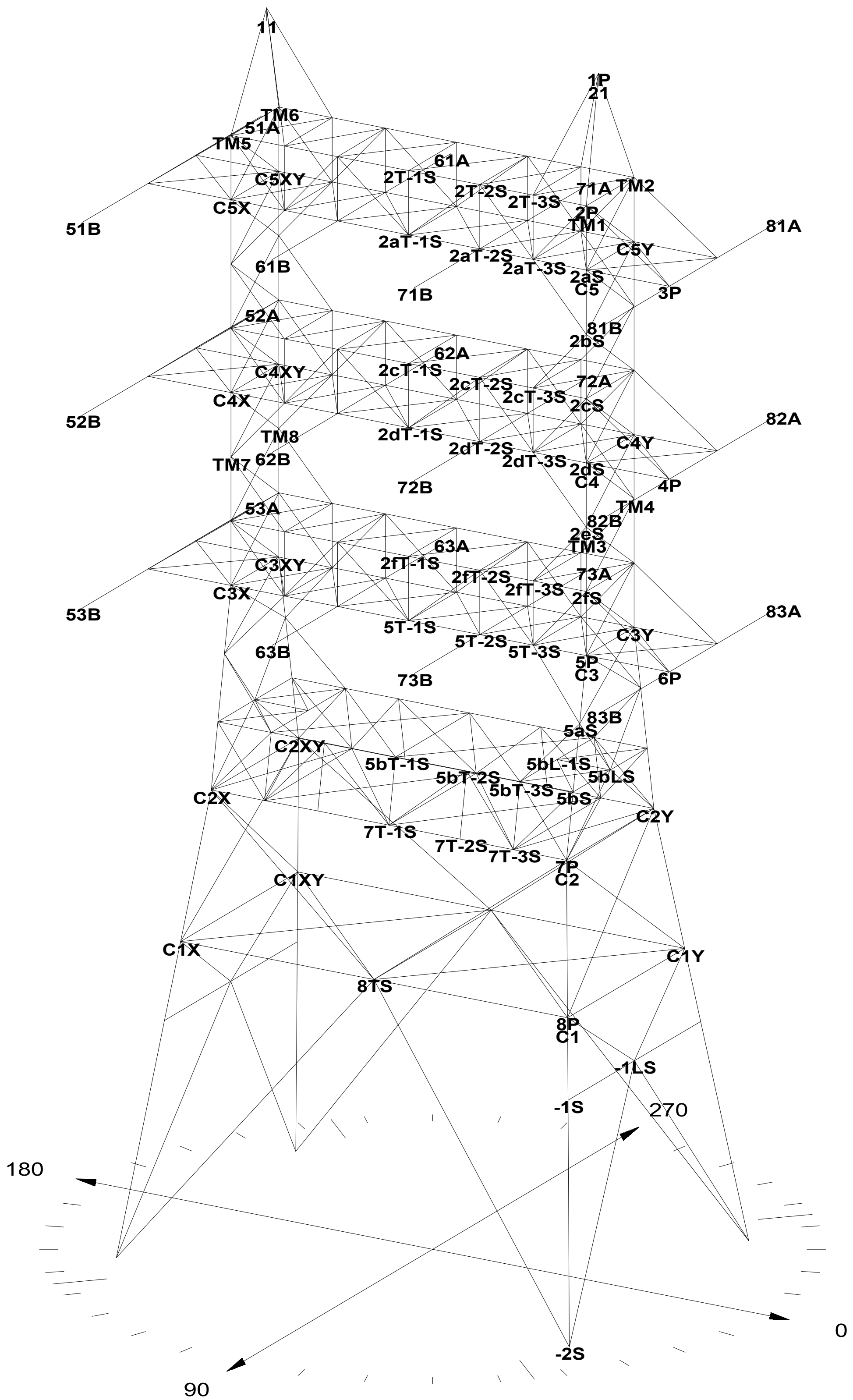
The following section provides the results of the computer run of the transmission tower with all of the specified loading conditions including the effects of the additional loads. This commentary is an attempt to clarify the large amounts of data that results from the computer output of the "Tower" program to make it easier for those not familiar with this program to interpret the results of the analysis.

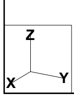
The stress summary pages can be found on the last several pages of the computer output and are arranged in two tables. The first table is called the "Group Summary (Compression Portion)" which summarizes the stress usages on all members which are under a compression load. The second table is the "Group Summary (Tension Portion)" which summarizes the stress usages on all members which are under a tension load. The stress summary pages are fairly self-explanatory except for a few columns. Both tables list all of the member groups in the tower model regardless of whether the members see a tension or compression load. Both tables also list the description, type, size, steel strength and maximum usage of all member groups. Note that the maximum usage is listed on both tables and is the same value. Following the maximum usage column on both tables is the maximum usage in either compression or tension (depending on the table), followed by the member designation of the most heavily loaded member, the largest load and the controlling load case in which it occurs. On the compression table, the L/R Curve Number (1-6) refers to which equation is used to calculate the KL/r values for compression capacity. These curve numbers correspond to the equations 5.7-5 through 5.7-10 in the ANSI/ASCE 10, Design of Latticed Steel Transmission Structures. Several columns on both the compression and tension tables begin with "Conn." which refers to the connection capacities. RLX, RLY & RLZ refer the "ratio" length each member's actual length is multiplied by to calculate its design capacity in the designated direction.

When a member is designated as a tension-only member, the program will first run the tower analysis as if all members take compression, then if any of the tension-only members show failure in compression, it will rerun the analysis with those failing tension-only members having no compression capacity. The output indicates which tension-only members were assigned zero compression capacity with a note before the member forces section. (Example: "Note: Fuse #206 is buckled and its AE is reduced to 1 N for load case 1").

Dummy members are sometimes used in the analysis to add mathematical stability to the structure. They are used to stabilize planar joints and other forms of instability. These members though, do not significantly change the resulting stresses in the existing members because they are assigned very small cross-sectional areas.

Paul J. Ford and Company, Project: "31215-0012.002.6000_Bethlehem Steel - Type D+23LE"
Tower Version 14.00, 2:44:07 PM Wednesday, November 11, 2015
Undeformed geometry displayed





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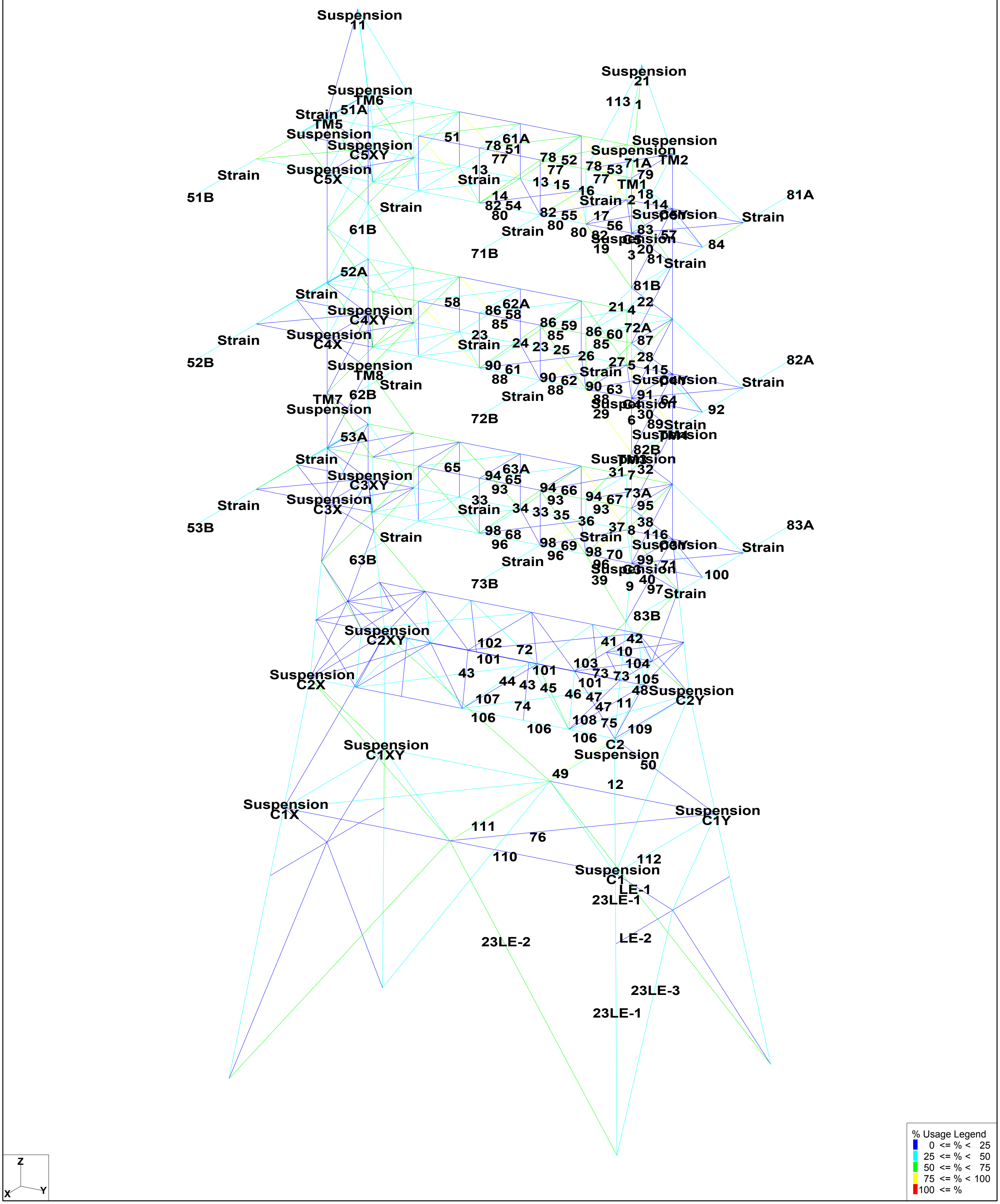

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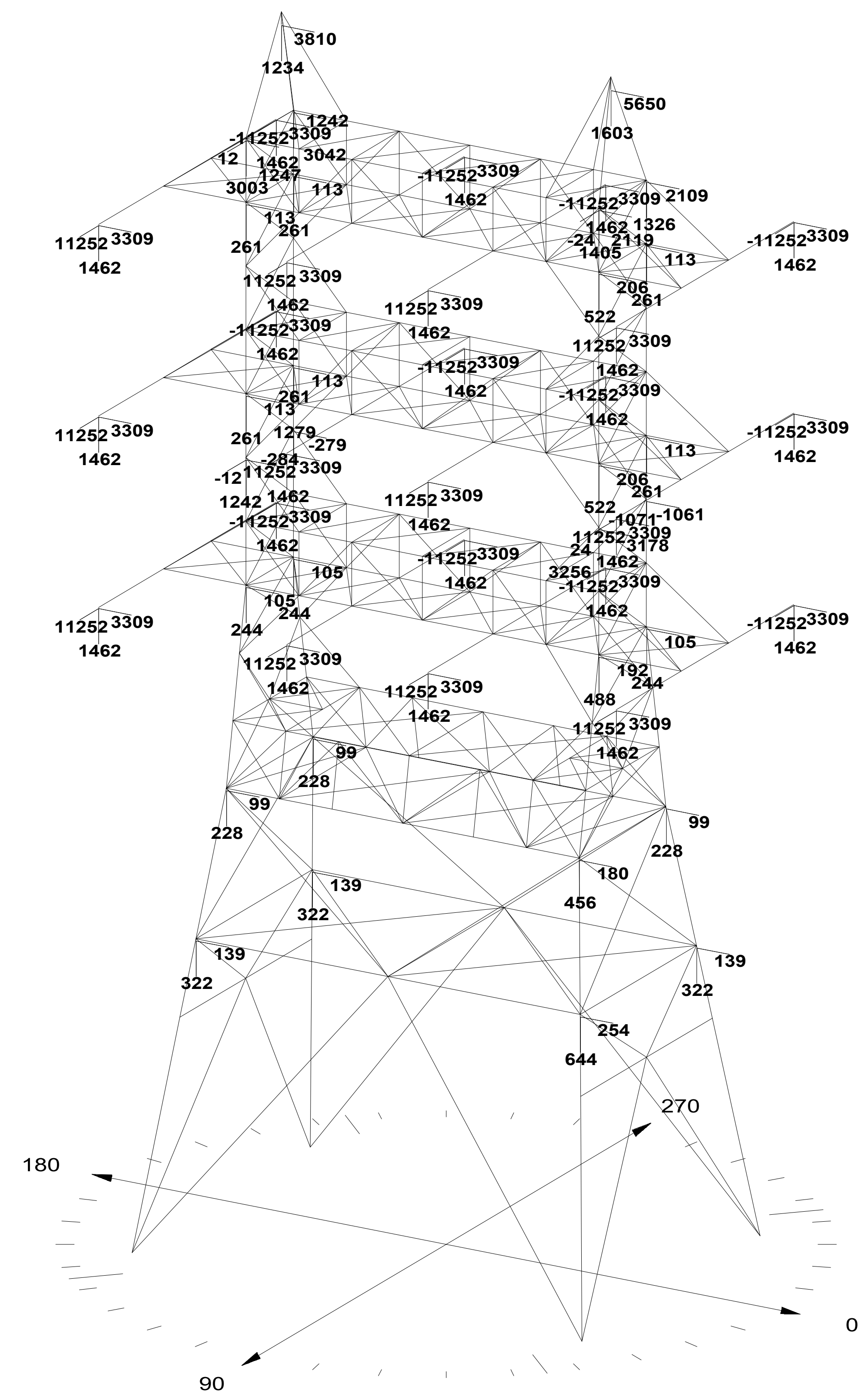
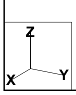
Tower Version 14.00, 2:48:42 PM Wednesday, November 11, 2015
Undeformed geometry displayed
Displaying load vectors for load case: 1 250B: NESC Heavy





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Tower Version 14.00, 2:49:03 PM Wednesday, November 11, 2015
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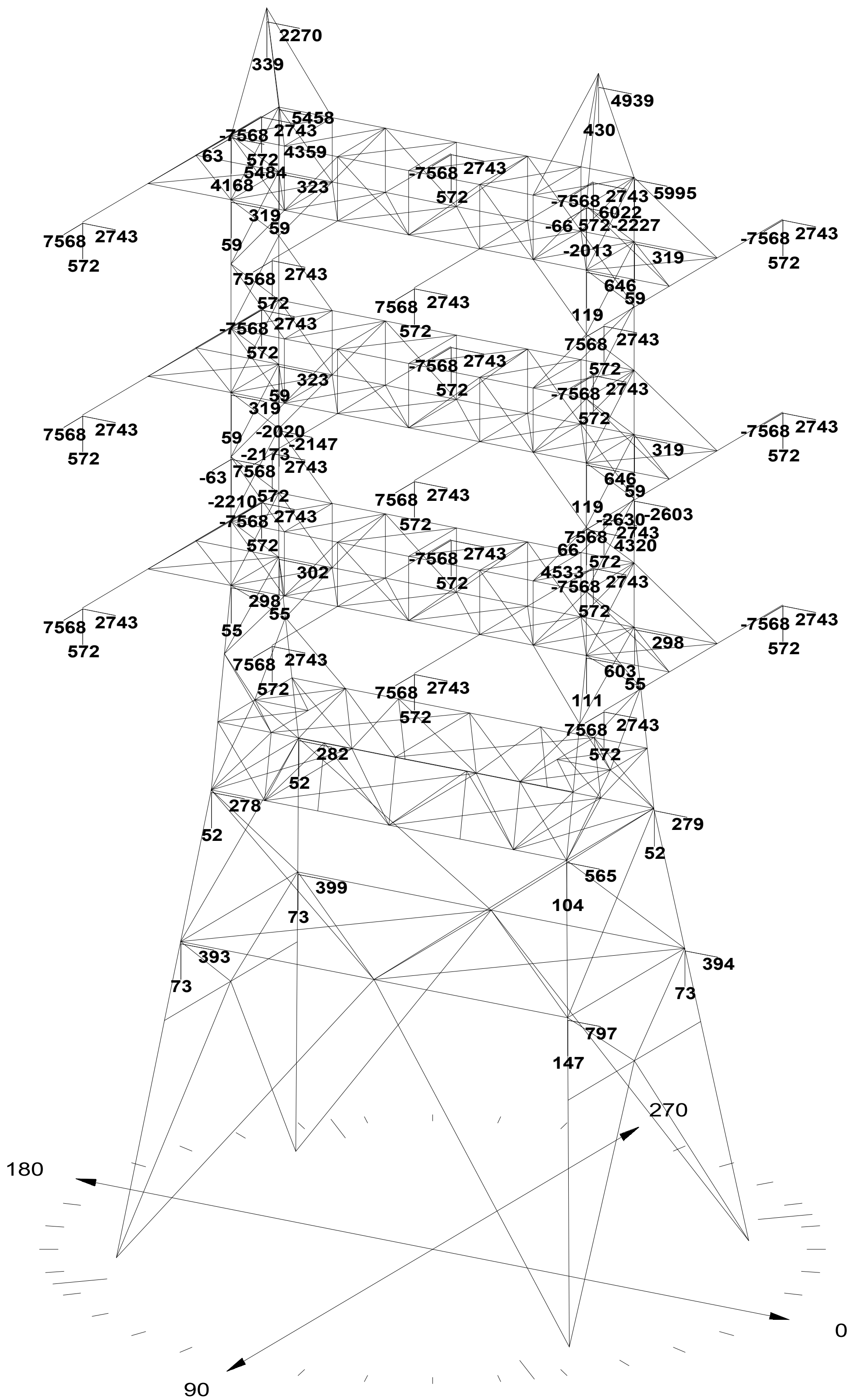

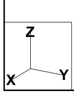

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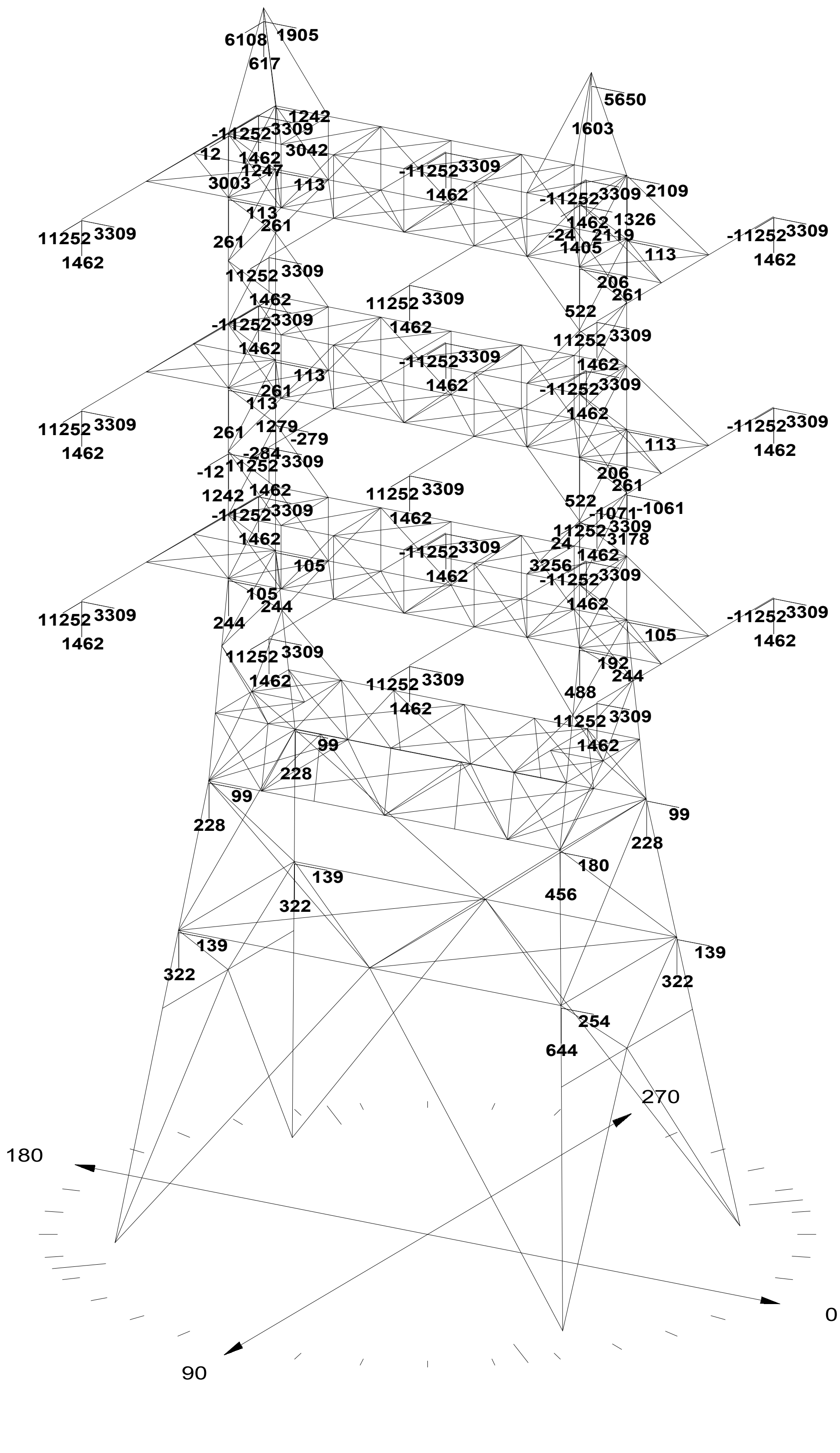
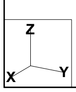
Tower Version 14.00, 2:49:22 PM Wednesday, November 11, 2015
Undeformed geometry displayed
Displaying load vectors for load case: 3 SWL Broken: 250B





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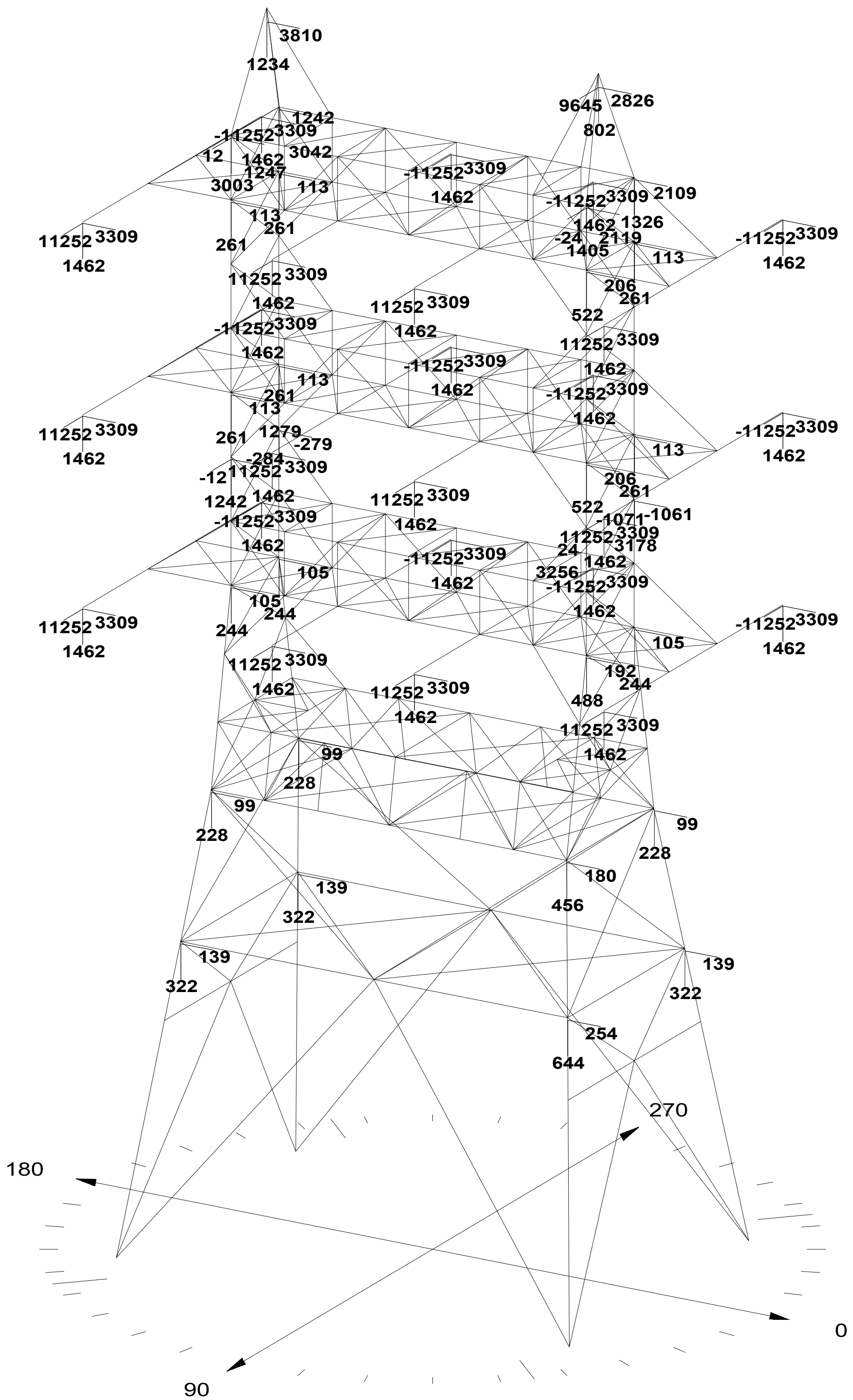

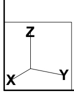

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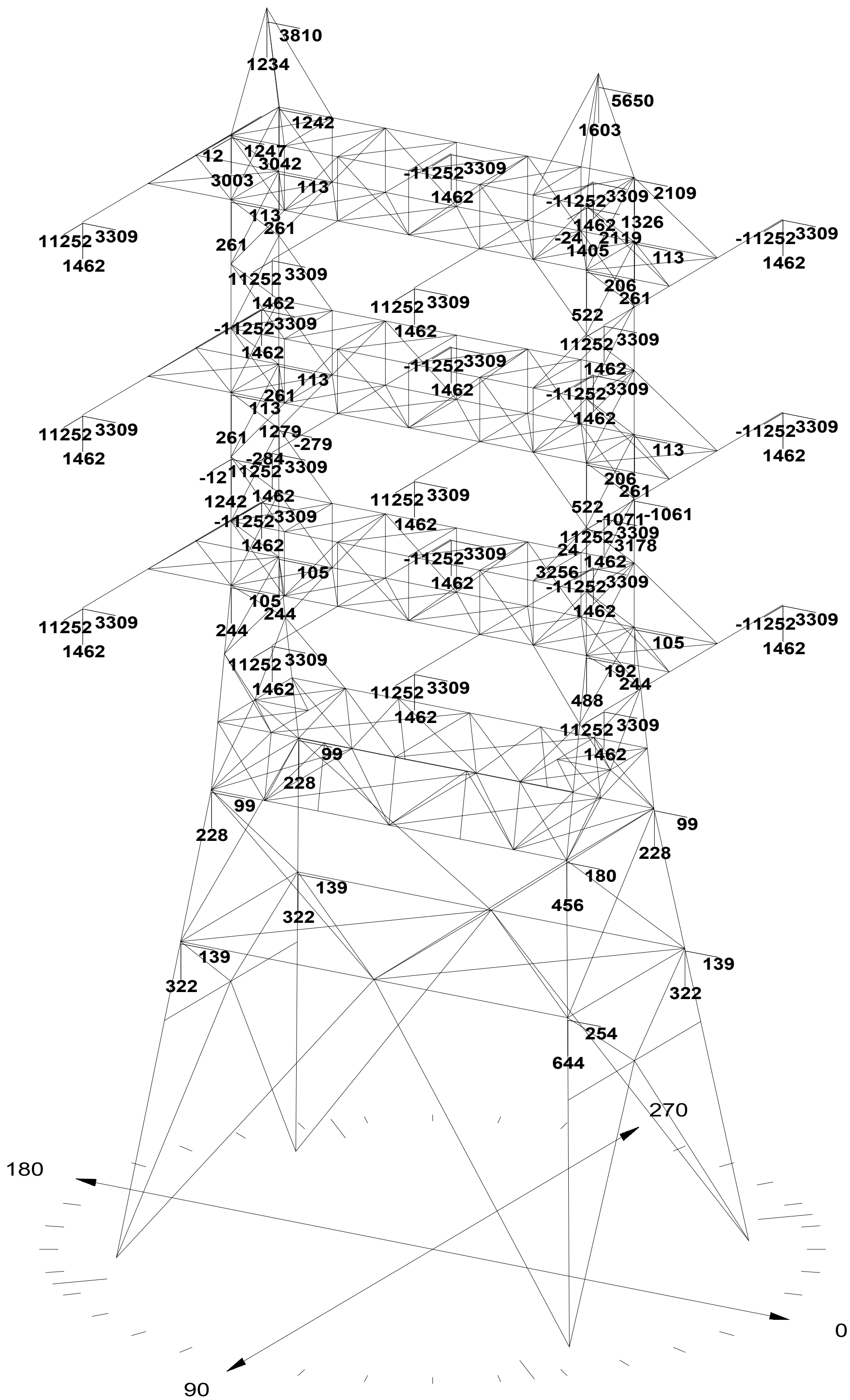

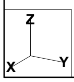

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Project Name : Eversource; 104'-0" Bethlehem Steel - Type D+33LE
Project Notes: Based on erection drawing CE 4324-C, Sheets E5 & E6
Project File : G:\Transmission\Eversource\2015\312-T-Mobile\31215-0012 Tower 1102 - TMobile CT11356C\31215-0012.002.6000 - Tower Analysis\31215-0012.002.6000_Bethlehem Steel - Type D+23LE.tow
Date run     : 2:41:09 PM Wednesday, November 11, 2015
by           : Tower Version 14.00
Licensed to  : Paul J. Ford and Company

Successfully performed nonlinear analysis

Member check option: ASCE 10
Connection rupture check: Not Checked
Crossing diagonal check: ASCE 10  [Alternate Unsupported RLOUT = 1]
Included angle check: None
Climbing load check: None
Redundant members checked with: Actual Force

Loads from file: \\pjf-data1\vol1\transmission\eversource\2015\312-t-mobile\31215-0012 tower 1102 - tmobile ct11356c\31215-0012.002.6000 - tower analysis\31215-0012.002.6000-broken.lca

*** Analysis Results:

Maximum element usage is 89.70% for Angle "54P" in load case "TCL Broken: 250B"
Maximum insulator usage is 39.40% for Strain "51A" in load case "250B: NESC Heavy"
```

Summary of Joint Support Reactions For All Load Cases:

Load Case	Joint Label	Long. Force (kips)	Tran. Force (kips)	Vert. Force (kips)	Shear Force (kips)	Tran. Moment (ft-k)	Long. Moment (ft-k)	Bending Moment (ft-k)	Vert. Moment (ft-k)	Found. Usage %
250B: NESC Heavy	-2S	-23.43	-32.30	-120.18	39.90	0.00	0.00	0.00	0.00	0.00
250B: NESC Heavy	-2X	14.00	-20.66	64.44	24.96	0.00	0.00	0.00	0.00	0.00
250B: NESC Heavy	-2XY	-12.92	-19.06	61.31	23.03	0.00	0.00	0.00	0.00	0.00
250B: NESC Heavy	-2Y	22.35	-30.57	-116.54	37.87	0.00	0.00	0.00	0.00	0.00
250C: Extreme Wind (Trans.)	-2S	-21.87	-31.90	-114.08	38.68	0.00	0.00	0.00	0.00	0.00
250C: Extreme Wind (Trans.)	-2X	18.00	-25.76	85.31	31.43	0.00	0.00	0.00	0.00	0.00
250C: Extreme Wind (Trans.)	-2XY	-18.52	-26.20	86.53	32.09	0.00	0.00	0.00	0.00	0.00
250C: Extreme Wind (Trans.)	-2Y	22.38	-32.32	-115.16	39.31	0.00	0.00	0.00	0.00	0.00
SWL Broken: 250B	-2S	-23.87	-35.47	-126.40	42.75	0.00	0.00	0.00	0.00	0.00
SWL Broken: 250B	-2X	11.69	-18.78	49.05	22.12	0.00	0.00	0.00	0.00	0.00
SWL Broken: 250B	-2XY	-14.38	-20.02	72.54	24.64	0.00	0.00	0.00	0.00	0.00
SWL Broken: 250B	-2Y	20.44	-26.42	-105.55	33.40	0.00	0.00	0.00	0.00	0.00
SWR Broken: 250B	-2S	-26.47	-36.01	-141.95	44.69	0.00	0.00	0.00	0.00	0.00
SWR Broken: 250B	-2X	12.83	-16.30	52.02	20.74	0.00	0.00	0.00	0.00	0.00
SWR Broken: 250B	-2XY	-12.59	-21.95	66.88	25.31	0.00	0.00	0.00	0.00	0.00
SWR Broken: 250B	-2Y	16.58	-25.50	-87.13	30.42	0.00	0.00	0.00	0.00	0.00
TCL Broken: 250B	-2S	-14.37	-11.40	-99.25	18.34	0.00	0.00	0.00	0.00	0.00
TCL Broken: 250B	-2X	1.73	-24.65	9.68	24.71	0.00	0.00	0.00	0.00	0.00
TCL Broken: 250B	-2XY	-23.50	-29.69	110.74	37.86	0.00	0.00	0.00	0.00	0.00
TCL Broken: 250B	-2Y	24.89	-33.54	-130.67	41.76	0.00	0.00	0.00	0.00	0.00

Summary of Joint Support Reactions For All Load Cases in Direction of Leg:

Load Case	Support Joint	Origin Joint	Leg Member	Force In Leg Dir. (kips)	Residual Shear Perpendicular To Leg (kips)	Residual Shear Horizontal To Leg - Res. (kips)	Residual Shear Horizontal To Leg - Long. (kips)	Residual Shear Horizontal To Leg - Tran. (kips)	Total Long. Force (kips)	Total Tran. Force (kips)	Total Vert. Force (kips)
250B: NESC Heavy	-2S	-1S	157P	125.343	18.039	18.166	0.320	18.164	-23.43	-32.30	-120.18
250B: NESC Heavy	-2X	-1X	157X	-67.859	13.056	13.180	-1.613	13.081	14.00	-20.66	64.44
250B: NESC Heavy	-2XY	-1XY	157XY	-64.420	11.795	11.900	1.135	11.845	-12.92	-19.06	61.31
250B: NESC Heavy	-2Y	-1Y	157Y	121.388	16.750	16.860	0.060	16.860	22.35	-30.57	-116.54

250C: Extreme Wind (Trans.)	-2S	-1S	157P	119.045	18.363	18.483	-0.067	18.483	-21.87	-31.90	-114.08
250C: Extreme Wind (Trans.)	-2X	-1X	157X	-89.558	15.664	15.804	-1.601	15.723	18.00	-25.76	85.31
250C: Extreme Wind (Trans.)	-2XY	-1XY	157XY	-90.891	15.983	16.132	1.885	16.022	-18.52	-26.20	86.53
250C: Extreme Wind (Trans.)	-2Y	-1Y	157Y	120.249	18.646	18.775	-0.243	18.774	22.38	-32.32	-115.16
SWL Broken: 250B	-2S	-1S	157P	131.855	20.480	20.607	-0.436	20.602	-23.87	-35.47	-126.40
SWL Broken: 250B	-2X	-1X	157X	-52.197	13.064	13.204	-2.263	13.009	11.69	-18.78	49.05
SWL Broken: 250B	-2XY	-1XY	157XY	-75.759	11.406	11.492	0.430	11.484	-14.38	-20.02	72.54
SWL Broken: 250B	-2Y	-1Y	157Y	109.829	13.907	14.003	-0.150	14.002	20.44	-26.42	-105.55
SWR Broken: 250B	-2S	-1S	157P	147.571	19.220	19.330	-0.822	19.313	-26.47	-36.01	-141.95
SWR Broken: 250B	-2X	-1X	157X	-55.019	10.429	10.566	-2.832	10.180	12.83	-16.30	52.02
SWR Broken: 250B	-2XY	-1XY	157XY	-70.128	13.999	14.087	-0.270	14.084	-12.59	-21.95	66.88
SWR Broken: 250B	-2Y	-1Y	157Y	91.030	15.159	15.256	0.169	15.255	16.58	-25.50	-87.13
TCL Broken: 250B	-2S	-1S	157P	100.827	4.633	4.722	-4.714	-0.277	-14.37	-11.40	-99.25
TCL Broken: 250B	-2X	-1X	157X	-12.591	23.364	23.517	0.133	23.516	1.73	-24.65	9.68
TCL Broken: 250B	-2XY	-1XY	157XY	-115.843	16.646	16.808	2.208	16.662	-23.50	-29.69	110.74
TCL Broken: 250B	-2Y	-1Y	157Y	135.993	18.053	18.168	0.235	18.166	24.89	-33.54	-130.67

Overturning Moment Summary For All Load Cases:

Load Case	Transverse Moment (ft-k)	Longitudinal Moment (ft-k)	Resultant Moment (ft-k)
250B: NESC Heavy	6929.297	6.740	6929.301
250C: Extreme Wind (Trans.)	7667.289	1.703	7667.289
SWL Broken: 250B	6758.496	581.583	6783.473
SWR Broken: 250B	6652.131	913.971	6714.625
TCL Broken: 250B	6697.391	913.325	6759.380

Sections Information:

Section Label	Top Z (ft)	Bottom Z (ft)	Joint Count	Member Count	Tran. Face Top Width (ft)	Tran. Face Bot Width (ft)	Tran. Face Gross Area (ft^2)	Long. Face Top Width (ft)	Long. Face Bot Width (ft)	Long. Face Gross Area (ft^2)	
SWpeak	70.333	61.333	10	8	0.00	7.00	31.500	28.00	30.00	261.000	
TBridge	61.333	56.333	28	86	7.00	7.00	35.000	30.00	30.00	150.000	
MBridge	46.333	41.333	28	86	7.00	7.00	35.000	30.00	30.00	150.000	
LBridge	31.333	26.333	28	86	7.00	7.00	35.000	30.00	30.00	150.000	
Tarm	61.333	56.333	12	14	7.00	7.00	35.000	30.00	44.00	185.000	
Marm	46.333	41.333	12	14	7.00	7.00	35.000	30.00	44.00	185.000	
Barm	31.333	26.333	12	14	7.00	7.00	35.000	30.00	44.00	185.000	
U Std Body	56.333	46.333	20	24	7.00	7.00	70.000	30.00	30.00	300.000	
M Std Body	41.333	31.333	20	24	7.00	7.00	70.000	30.00	30.00	300.000	
L Std Body	26.333	11.333	44	118	7.00	12.77	148.275	30.00	30.00	450.000	
L2 Std Body	11.333	-5.917	16	31	12.77	19.40	277.495	30.00	34.06	552.500	
13LE	**0.000**	**0.000**	**0**	**0**	**0.00**	**0.00**	**0.000**	**0.00**	**0.00**	**0.000**	**Section "13LE" has a longitudinal face gross area of 0.0, wind loads will not be calculated correctly for this section ??**
23LE	0.000	-23.667	16	16	17.13	26.23	513.064	32.67	38.23	838.989	
33LE	**0.000**	**0.000**	**0**	**0**	**0.00**	**0.00**	**0.000**	**0.00**	**0.00**	**0.000**	**Section "33LE" has a longitudinal face gross area of 0.0, wind loads will not be calculated correctly for this section ??**
TM	**0.000**	**0.000**	**0**	**0**	**0.00**	**0.00**	**0.000**	**0.00**	**0.00**	**0.000**	**Section "TM" has a longitudinal face gross area of 0.0, wind loads will not be calculated correctly for this section ??**
PM	**0.000**	**0.000**	**0**	**0**	**0.00**	**0.00**	**0.000**	**0.00**	**0.00**	**0.000**	**Section "PM" has a longitudinal face gross area of 0.0, wind loads will not be calculated correctly for this section ??**

*** Overall summary for all load cases - Usage = Maximum Stress / Allowable Stress
Printed capacities do not include the strength factor entered for each load case.
The Group Summary reports on the member and load case that resulted in maximum usage
which may not necessarily be the same as that which produces maximum force.

Group Summary (Compression Portion):

Group Label	Group Desc.	Angle Type	Angle Size	Steel Strength (ksi)	Max Usage %	Usage Cont-rol	Max Use In Comp. %	Comp. Control Member	Comp. Force (kips)	Comp. Control Load Case	L/r Capacity (kips)	Comp. Connect. Shear Capacity (kips)	Comp. Connect. Bearing Capacity (kips)	RLX	RLY	RLZ	L/r	KL/r	Length Comp. Member (ft)	Curve No.	No. Of Bolts Comp.
1	LEG-D331	SAE	2.5X2.5X0.1875	33.0	72.15	Comp	72.15	1P	-12.734	SWR Brok	17.649	27.200	25.312	0.500	0.500	0.500	117.68	118.84	9.708	3	2
2	LEG-D251	SAE	5X5X0.375	33.0	19.73	Comp	19.73	2X	-21.011	SWL Brok	106.517	0.000	0.000	1.000	1.000	1.000	60.61	60.61	5.000	1	0
3	LEG-D251	SAE	5X5X0.375	33.0	24.63	Tens	23.48	3X	-25.011	SWL Brok	106.517	0.000	0.000	1.000	1.000	1.000	60.61	60.61	5.000	1	0
4	LEG-D251	SAE	5X5X0.375	33.0	41.44	Comp	41.44	4P	-44.143	SWR Brok	106.517	0.000	0.000	1.000	1.000	1.000	60.61	60.61	5.000	1	0
5	LEG-D251	SAE	5X5X0.375	33.0	33.52	Comp	33.52	5P	-35.705	SWR Brok	106.517	136.000	253.125	1.000	1.000	1.000	60.61	60.61	5.000	1	10
6	LEG-D222	SAE	8X8X0.5	33.0	17.28	Comp	17.28	6P	-42.376	SWR Brok	245.252	0.000	0.000	1.000	1.000	1.000	37.74	37.74	5.000	1	0
7	LEG-D222	SAE	8X8X0.5	33.0	34.11	Comp	34.11	7P	-83.660	SWR Brok	245.252	0.000	0.000	1.000	1.000	1.000	37.74	37.74	5.000	1	0
8	LEG-D222	SAE	8X8X0.5	33.0	28.50	Comp	28.50	8P	-69.895	SWR Brok	245.252	272.000	337.499	1.000	1.000	1.000	37.74	37.74	5.000	1	10
9	LEG-D220	SAE	8X8X0.5	33.0	30.08	Comp	30.08	9P	-73.660	SWR Brok	244.864	0.000	0.000	1.000	1.000	1.000	38.43	38.43	5.092	1	0
10	LEG-D220	SAE	8X8X0.5	33.0	47.36	Comp	47.36	10P	-115.966	SWR Brok	244.864	380.800	944.999	1.000	1.000	1.000	38.43	38.43	5.092	1	28
11	LEG-D125	SAE	8X8X0.5	33.0	44.53	Tens	43.53	11P	-106.579	SWR Brok	244.864	0.000	0.000	1.000	1.000	1.000	38.43	38.43	5.092	1	0
12	LEG-D125	SAE	8X8X0.5	33.0	48.09	Comp	48.09	12P	-116.173	SWR Brok	241.582	380.800	944.999	0.500	0.500	0.500	43.84	43.84	11.617	1	28
13	VBR-D324	SAE	2X2X0.1875	33.0	9.91	Tens	1.34	13Y	-0.117	TCL Brok	8.763	27.200	25.312	1.000	1.000	1.000	152.28	152.28	5.000	4	2
14	VBR-D320	SAE	3X3X0.1875	33.0	87.99	Comp	87.99	15XY	-13.440	SWR Brok	15.275	27.200	25.312	1.000	1.000	1.000	157.25	142.91	7.810	6	2
15	VBR-D322	SAE	3X3X0.1875	33.0	82.51	Comp	82.51	16Y	-14.033	SWR Brok	17.007	27.200	25.312	1.000	1.000	1.000	135.44	135.44	6.727	4	2
16	VBR-D271	SAE	2X2X0.1875	33.0	49.37	Comp	49.37	17XY	-4.326	SWR Brok	8.763	27.200	25.312	1.000	1.000	1.000	152.28	152.28	5.000	4	2
17	VBR-D259	SAE	3X3X0.1875	33.0	78.84	Comp	78.84	18Y	-14.159	250C: Ex	17.958	40.800	37.969	1.000	1.000	1.000	135.44	131.80	6.727	5	3
18	VBR-D267	SAE	2X2X0.1875	33.0	33.20	Comp	33.20	19Y	-4.081	SWR Brok	12.292	27.200	25.312	0.500	0.500	0.500	131.00	128.42	8.602	5	2
19	VBR-D257	SAE	3X3X0.3125	33.0	71.49	Comp	71.49	20P	-20.579	250C: Ex	28.788	40.800	63.281	1.000	1.000	1.000	137.05	133.03	6.727	5	3
20	VBR-D265	SAE	2.5X2.5X0.25	33.0	32.70	Comp	32.70	21XY	-8.457	TCL Brok	25.861	27.200	33.750	0.500	0.500	0.500	105.12	108.84	8.602	2	2
21	VBR-D255	SAE	3X3X0.3125	33.0	72.77	Comp	72.77	22XY	-20.950	250C: Ex	28.788	40.800	63.281	1.000	1.000	1.000	137.05	133.03	6.727	5	3
22	VBR-D263	SAE	2.5X2.5X0.25	33.0	31.51	Tens	28.07	23XY	-7.260	TCL Brok	25.861	27.200	33.750	0.500	0.500	0.500	105.12	108.84	8.602	2	2
23	VBR-D310	SAE	2X2X0.1875	33.0	10.12	Tens	1.41	24Y	-0.124	TCL Brok	8.763	27.200	25.312	1.000	1.000	1.000	152.28	152.28	5.000	4	2
24	VBR-D306	SAU	4X3.5X0.25	33.0	80.80	Comp	80.80	26X	-25.582	250C: Ex	31.660	40.800	50.625	1.000	1.000	1.000	127.69	127.69	7.810	4	3
25	VBR-D308	SAE	3.5X3.5X0.25	33.0	72.45	Comp	72.45	27P	-24.146	TCL Brok	33.327	40.800	50.625	1.000	1.000	1.000	116.31	118.16	6.727	3	3
26	VBR-D269	SAU	3X2.5X0.25	33.0	58.13	Comp	58.13	28XY	-15.245	250C: Ex	26.226	27.200	33.750	1.000	1.000	1.000	113.64	116.82	5.000	3	2
27	VBR-D253	SAE	4X4X0.25	33.0	65.53	Comp	65.53	29P	-27.114	250C: Ex	41.379	54.400	67.500	1.000	1.000	1.000	101.54	110.77	6.727	3	4
28	VBR-D261	SAE	2.5X2.5X0.25	33.0	29.89	Comp	29.89	30XY	-7.731	TCL Brok	25.861	27.200	33.750	0.500	0.500	0.500	105.12	108.84	8.602	2	2
29	VBR-D230	SAE	4X4X0.25	33.0	75.62	Comp	75.62	31Y	-31.288	250C: Ex	41.379	54.400	67.500	1.000	1.000	1.000	101.54	110.77	6.727	3	4
30	VBR-D238	SAE	3X3X0.3125	33.0	21.38	Comp	21.38	32XY	-8.722	TCL Brok	43.226	40.800	63.281	0.500	0.500	0.500	87.63	95.72	8.602	2	3
31	VBR-D228	SAE	4X4X0.25	33.0	60.83	Comp	60.83	33XY	-25.172	SWR Brok	41.379	54.400	67.500	1.000	1.000	1.000	101.54	110.77	6.727	3	4
32	VBR-D236	SAE	3X3X0.3125	33.0	21.88	Tens	18.71	34XY	-7.636	TCL Brok	43.226	40.800	63.281	0.500	0.500	0.500	87.63	95.72	8.602	2	3
33	VBR-D295	SAE	2X2X0.1875	33.0	10.48	Tens	1.52	35P	-0.134	TCL Brok	8.763	27.200	25.312	1.000	1.000	1.000	152.28	152.28	5.000	4	2
34	VBR-D291	SAE	4X4X0.3125	33.0	71.60	Comp	71.60	37XY	-33.467	SWR Brok	46.740	54.400	84.375	1.000	1.000	1.000	118.49	119.24	7.810	3	4
35	VBR-D293	SAE	4X4X0.25	33.0	75.10	Comp	75.10	38Y	-31.074	SWR Brok	41.379	54.400	67.500	1.000	1.000	1.000	101.54	110.77	6.727	3	4
36	VBR-D244	SAE	3.5X3.5X0.25	33.0	47.50	Comp	47.50	39XY	-18.354	SWR Brok	38.640	40.800	50.625	1.000	1.000	1.000	86.46	103.23	5.000	3	3
37	VBR-D226	SAE	4X4X0.375	33.0	51.33	Comp	51.33	40P	-31.171	250C: Ex	60.729	68.000	126.562	1.000	1.000	1.000	102.44	111.22	6.727	3	5
38	VBR-D234	SAE	3X3X0.3125	33.0	19.15	Comp	19.15	41XY	-7.812	TCL Brok	43.226	40.800	63.281	0.500	0.500	0.500	87.63	95.72	8.602	2	3
39	VBR-D224	SAE	4X4X0.375	33.0	67.51	Comp	67.51	42Y	-36.727	SWR Brok	60.413	54.400	101.250	1.000	1.000	1.000	103.48	111.74	6.795	3	4
40	VBR-D232	SAE	2.5X2.5X0.25	33.0	18.58	Comp	18.58	43X	-3.924	SWR Brok	21.114	27.200	33.750	0.560	0.560	0.560	128.67	126.65	9.401	5	2
41	VBR-D138	SAE	4X4X0.375	33.0	67.01	Comp	67.01	44X	-40.486	TCL Brok	60.413	68.000	126.562	1.000	1.000	1.000	103.48	111.74	6.795	3	5
42	VBR-D145	SAE	3X3X0.1875	33.0	38.73	Comp	38.73	45P	-6.997	SWR Brok	18.065	27.200	25.312	1.000	1.000	1.000	134.92	131.41	6.701	5	2
43	VBR-D155	SAE	2X2X0.1875	33.0	4.88	Comp	4.88	46P	-0.495	SWR Brok	10.139	27.200	25.312	1.000	1.000	1.000	155.08	141.57	5.092	6	2
44	VBR-D137	SAE	4X4X0.375	33.0	48.87	Comp	48.87	48XY	-27.003	SWR Brok	55.259	68.000	126.562	1.000	1.000	1.000	119.84	119.92	7.869	3	5
45	VBR-D135	SAE	4X4X0.375	33.0	37.98	Comp	37.98	49Y	-22.945	SWR Brok	60.413	68.000	126.562	1.000	1.000	1.000	103.48	111.74	6.795	3	5
46	VBR-D153	SAE	4X4X0.3125	33.0	45.56	Tens	40.45	50X	-22.004	250C: Ex	56.996	54.400	84.375	1.000	1.000	1.000	77.24	98.62	5.092	3	4
47	VBR-D151	SAU	7X4X0.4375	33.0	15.49	Cross	15.49	51X	-17.286	TCL Brok	111.619	149.600	324.843	0.500	1.000	0.500	72.81	96.40	6.795	3	11
48	VBR-D143	SAE	3X3X0.1875	33.0	52.76	Comp	52.76	53Y	-7.030	SWR Brok	13.323	27.200	25.312	1.000	1.000	1.000	163.28	153.02	8.110	5	2
49	VBR-D127	DAS	3.5X3X0.25	33.0	89.70	Tens	64.74	54X	-32.551	SWL Brok	50.279	54.400	67.500	0.500	1.000	0.500	137.64	133.48	18.926	5	2
50	VBR-D141	SAU	2.5X2X0.1875	33.0	54.58	Comp	54.58	55X	-1.643	SWR Brok	3.010	27.200	25.312	0.573	1.000	0.573	376.13	277.52	18.807	6	2
51	HBR-D197	SAE	2.5X2.5X0.1875	33.0	71.90	Comp	71.90	56P	-3.716	SWR Brok	5.168	13.600	12.656	1.000	1.000	1.000	223.50	223.50	9.220	4	1
52	HBR-D198	SAE	2.5X2.5X0.1875	33.0	52.97	Comp	52.97	58AR	-3.360	SWR Brok	6.344	13.600	12.656	1.000	1.000	1.000	201.74	201.74	8.322	4	1
53	HBR-D199	SAE	2.5X2.5X0.1875	33.0	46.74	Comp	46.74	59AR	-2.965	SWR Brok	6.344	13.600	12.656	1.000	1.000	1.000	201.74	201.74	8.322	4	1
54	HBR-D201	SAE	2X2X0.1875	33.0	36.02	Tens	13.96	60P	-1.439	TCL Brok	10.309	13.600	12.656	0.500	0.500	0.500	140.40	140.40	9.220	4	1
55	HBR-D203	SAE	2X2X0.25	33.0	40.67	Tens	0.00	61Y	0.000		16.440	13.600	16.875	0.500	0.500	0.500	127.70	127.70	8.322	4	1
56	HBR-D205	SAE	2X2X0.25	33.0	20.84	Cross	20.84	62X	-2.085	SWR Brok	10.006	13.600	16.875	0.500	1.000	0.500	163.97	163.97	8.322	4	1
57	HBR-D189	SAE	2X2X0.25	33.0	63.86	Comp	63.86	63X	-7.446	TCL Brok	11.659	13.600	16.875	0.500	0.500	0.500	151.91	151.91	9.899	4	1
58	HBR-D197	SAE	2.5X2.5X0.1875	33.0	40.70	Comp	40.70	64P	-2.104	SWR Brok	5.168	13.600	12.656	1.000	1.000	1.000	223.50	223.50	9.220	4	1

59	HBR-D198	SAE	2.5X2.5X0.1875	33.0	30.15	Comp	30.15	66AR	-1.912	SWR Brok	6.344	13.600	12.656	1.000	1.000	1.000	201.74	201.74	8.322	4	1	
60	HBR-D199	SAE	2.5X2.5X0.1875	33.0	28.88	Comp	28.88	67AR	-1.832	SWR Brok	6.344	13.600	12.656	1.000	1.000	1.000	201.74	201.74	8.322	4	1	
61	HBR-D201	SAE	2X2X0.1875	33.0	34.17	Tens	17.26	68P	-1.091	250C: Ex	6.320	13.600	12.656	0.500	1.000	0.500	179.31	179.31	9.220	4	1	
62	HBR-D203	SAE	2X2X0.25	33.0	37.23	Tens	0.00	69Y	0.000		16.440	13.600	16.875	0.500	0.500	0.500	127.70	127.70	8.322	4	1	
63	HBR-D205	SAE	2X2X0.25	33.0	23.21	Cross	23.21	70XY	-2.323	TCL Brok	10.006	13.600	16.875	0.500	1.000	0.500	163.97	163.97	8.322	4	1	
64	HBR-D189	SAE	2X2X0.25	33.0	11.48	Tens	0.00	71Y	0.000		11.659	13.600	16.875	0.500	0.500	0.500	151.91	151.91	9.899	4	1	
65	HBR-D197	SAE	2.5X2.5X0.1875	33.0	32.10	Comp	32.10	72P	-1.659	SWR Brok	5.168	13.600	12.656	1.000	1.000	1.000	223.50	223.50	9.220	4	1	
66	HBR-D198	SAE	2.5X2.5X0.1875	33.0	23.61	Comp	23.61	74AR	-1.498	SWR Brok	6.344	13.600	12.656	1.000	1.000	1.000	201.74	201.74	8.322	4	1	
67	HBR-D199	SAE	2.5X2.5X0.1875	33.0	22.49	Comp	22.49	75AR	-1.427	SWR Brok	6.344	13.600	12.656	1.000	1.000	1.000	201.74	201.74	8.322	4	1	
68	HBR-D201	SAE	2X2X0.1875	33.0	33.52	Tens	15.37	76P	-0.972	250C: Ex	6.320	13.600	12.656	0.500	1.000	0.500	179.31	179.31	9.220	4	1	
69	HBR-D203	SAE	2X2X0.25	33.0	43.28	Tens	5.34	77P	-0.534	250C: Ex	10.006	13.600	16.875	0.500	1.000	0.500	163.97	163.97	8.322	4	1	
70	HBR-D205	SAE	2X2X0.25	33.0	31.17	Cross	31.17	78P	-3.119	TCL Brok	10.006	13.600	16.875	0.500	1.000	0.500	163.97	163.97	8.322	4	1	
71	HBR-D189	SAE	2X2X0.25	33.0	9.96	Tens	0.00	79Y	0.000		11.659	13.600	16.875	0.500	0.500	0.500	151.91	151.91	9.899	4	1	
72	HBR-D179	SAE	2X2X0.1875	33.0	37.86	Comp	37.86	80XY	-1.853	TCL Brok	4.894	27.200	25.312	0.500	0.500	0.500	229.89	203.78	15.096	5	2	
73	HBR-D180	SAU	2.5X1.5X0.25	33.0	8.08	Comp	8.08	81XY	-0.930	TCL Brok	11.519	40.800	50.625	0.500	0.750	0.500	152.83	152.83	7.047	4	3	
74	HBR-D177	SAE	2X2X0.1875	33.0	54.92	Comp	54.92	83Y	-1.079	SWL Brok	1.966	13.600	12.656	1.000	0.500	0.500	321.54	321.54	16.532	4	1	
75	HBR-D178	SAE	2X2X0.1875	33.0	49.15	Cross	49.15	84P	-1.440	TCL Brok	2.931	13.600	12.656	0.500	1.000	0.500	263.33	263.33	13.540	4	1	
76	HBR-D30	SAE	2X2X0.1875	33.0	32.35	Tens	27.56	85XY	-0.264	SWL Brok	0.959	13.600	12.656	1.000	0.500	0.500	460.30	460.30	23.667	4	1	
77	HRZ-D314	SAE	3X3X0.25	33.0	58.13	Tens	43.92	87X	-15.866	250C: Ex	36.123	0.000	0.000	1.000	1.000	1.000	91.22	91.22	4.500	1	0	
78	HRZ-D207	SAE	2X2X0.1875	33.0	83.44	Comp	83.44	91P	-3.730	TCL Brok	4.471	13.600	12.656	1.000	1.000	1.000	213.20	213.20	7.000	4	1	
79	HRZ-D278	SAE	2.5X2.5X0.1875	33.0	11.92	Comp	11.92	92X	-1.358	TCL Brok	11.388	27.200	25.312	1.000	1.000	1.000	169.70	150.56	7.000	6	2	
80	HRZ-D317	SAE	3X3X0.25	33.0	47.50	Tens	45.43	93P	-12.385	TCL Brok	27.259	54.400	67.500	1.000	1.000	1.000	121.62	121.62	6.000	4	4	
81	HRZ-D186	SAE	4X4X0.25	33.0	41.42	Comp	41.42	96X	-11.266	TCL Brok	40.528	27.200	33.750	1.000	1.000	1.000	105.66	112.83	7.000	3	2	
82	HRZ-D208	SAE	2X2X0.1875	33.0	74.20	Tens	52.02	97P	-2.326	TCL Brok	4.471	13.600	12.656	1.000	1.000	1.000	213.20	213.20	7.000	4	1	
83	HRZ-D277	SAE	2.5X2.5X0.1875	33.0	13.47	Comp	13.47	100P	-1.534	250C: Ex	11.388	27.200	25.312	1.000	1.000	1.000	169.70	150.56	7.000	6	2	
84	HRZ-D188	SAU	3.5X2.5X0.25	33.0	75.44	Tens	0.00	101X	0.000		17.286	27.200	33.750	1.000	1.000	1.000	154.41	154.41	7.000	4	2	
85	HRZ-D300	SAE	4X4X0.25	33.0	69.11	Tens	61.85	103XY	-34.330	250C: Ex	55.506	0.000	0.000	1.000	1.000	1.000	67.92	67.92	4.500	1	0	
86	HRZ-D207	SAE	2X2X0.1875	33.0	33.82	Comp	33.82	106X	-1.512	TCL Brok	4.471	13.600	12.656	1.000	1.000	1.000	213.20	213.20	7.000	4	1	
87	HRZ-D276	SAE	2X2X0.1875	33.0	13.17	Comp	13.17	108X	-0.589	250C: Ex	4.471	13.600	12.656	1.000	1.000	1.000	213.20	213.20	7.000	4	1	
88	HRZ-D303	SAE	4X4X0.25	33.0	42.42	Tens	40.84	110Y	-22.669	250C: Ex	55.506	0.000	0.000	1.000	1.000	1.000	67.92	67.92	4.500	1	0	
89	HRZ-D184	SAE	4X4X0.25	33.0	22.04	Comp	22.04	112XY	-5.995	TCL Brok	40.528	27.200	33.750	1.000	1.000	1.000	105.66	112.83	7.000	3	2	
90	HRZ-D208	SAE	2X2X0.1875	33.0	79.36	Tens	50.15	115X	-2.242	250B: NE	4.471	13.600	12.656	1.000	1.000	1.000	213.20	213.20	7.000	4	1	
91	HRZ-D250	SAE	2.5X2.5X0.1875	33.0	8.21	Comp	8.21	116P	-0.935	250C: Ex	11.388	27.200	25.312	1.000	1.000	1.000	169.70	150.56	7.000	6	2	
92	HRZ-D188	SAU	3.5X2.5X0.25	33.0	49.69	Tens	0.00	117X	0.000		17.286	27.200	33.750	1.000	1.000	1.000	154.41	154.41	7.000	4	2	
93	HRZ-D285	SAE	4X4X0.3125	33.0	72.40	Tens	62.67	120X	-25.569	250C: Ex	64.147	40.800	63.281	1.000	1.000	1.000	68.27	81.20	4.500	2	3	
94	HRZ-D207	SAE	2X2X0.1875	33.0	25.43	Comp	25.43	123P	-1.137	TCL Brok	4.471	13.600	12.656	1.000	1.000	1.000	213.20	213.20	7.000	4	1	
95	HRZ-D249	SAE	2X2X0.1875	33.0	20.45	Comp	20.45	124X	-0.914	250C: Ex	4.471	13.600	12.656	1.000	1.000	1.000	213.20	213.20	7.000	4	1	
96	HRZ-D288	SAE	4X4X0.3125	33.0	45.40	Tens	45.23	125Y	-24.606	SWR Brok	60.285	54.400	84.375	1.000	1.000	1.000	91.02	91.02	6.000	1	4	
97	HRZ-D184	SAE	4X4X0.25	33.0	21.41	Comp	21.41	128XY	-5.823	TCL Brok	40.528	27.200	33.750	1.000	1.000	1.000	105.66	112.83	7.000	3	2	
98	HRZ-D208	SAE	2X2X0.1875	33.0	86.88	Tens	77.40	131P	-3.460	250B: NE	4.471	13.600	12.656	1.000	1.000	1.000	213.20	213.20	7.000	4	1	
99	HRZ-D248	SAE	3.5X3.5X0.3125	33.0	8.83	Comp	8.83	132P	-3.516	250B: NE	39.830	40.800	63.281	1.000	1.000	1.000	121.74	121.07	7.000	6	3	
100	HRZ-D188	SAU	3.5X2.5X0.25	33.0	50.53	Tens	0.00	133X	0.000		17.286	27.200	33.750	1.000	1.000	1.000	154.41	154.41	7.000	4	2	
101	HRZ-D166	SAE	8X8X0.5	33.0	18.67	Tens	15.19	135X	-37.546	TCL Brok	247.247	0.000	0.000	1.000	1.000	1.000	33.96	33.96	4.500	1	0	
102	HRZ-D174	SAE	3.5X3.5X0.25	33.0	0.30	Tens	0.14	137P	-0.026	SWR Brok	18.536	27.200	33.750	1.000	1.000	1.000	187.55	161.54	10.847	6	2	
103	HRZ-D170	SAU	3X2.5X0.25	33.0	5.09	Comp	5.09	138P	-1.114	TCL Brok	21.876	40.800	50.625	2.000	1.000	1.000	137.74	130.91	5.423	6	3	
104	HRZ-D176	SAE	2X2X0.25	33.0	1.44	Comp	1.44	139P	-0.203	TCL Brok	14.106	27.200	33.750	1.000	1.000	1.000	138.11	138.11	4.500	4	2	
105	HRZ-D168	SAU	3.5X3X0.25	33.0	4.26	Tens	3.30	140XY	-1.089	TCL Brok	33.009	40.800	50.625	1.000	1.000	1.000	103.14	111.57	5.423	3	3	
106	HRZ-D165	SAE	6X6X0.5	33.0	40.64	Comp	40.64	143P	-49.748	TCL Brok	167.121	122.400	303.750	1.000	1.000	1.000	45.76	64.32	4.500	2	9	
107	HRZ-D173	SAE	3X3X0.1875	33.0	18.91	Comp	18.91	144P	-1.413	SWR Brok	7.473	27.200	25.312	1.000	1.000	1.000	257.11	204.33	12.770	6	2	
108	HRZ-D169	SAE	3X3X0.25	33.0	3.21	Comp	3.21	145X	-0.608	250B: NE	18.935	27.200	33.750	1.000	0.500	0.500	164.77	147.54	12.770	6	2	
109	HRZ-D167	SAU	3.5X3X0.25	33.0	9.88	Comp	9.88	146X	-2.566	250C: Ex	25.975	27.200	33.750	1.000	0.500	0.500	138.05	131.10	12.770	6	2	
110	HRZ-D24	SAE	3X3X0.1875	33.0	31.90	Comp	31.90	147XY	-4.202	TCL Brok	13.173	40.800	37.969	0.500	0.500	0.500	164.43	153.89	16.333	5	3	
111	HRZ-D28	SAE	3X3X0.1875	33.0	49.51	Comp	49.51	148P	-3.224	TCL Brok	6.511	13.600	12.656	1.000	0.500	0.500	218.89	218.89	17.128	4	1	
112	HRZ-D26	SAE	3.5X3.5X0.25	33.0	39.20	Comp	39.20	149P	-10.062	TCL Brok	25.671	40.800	50.625	0.500	0.500	0.500	148.08	137.27	17.128	6	3	
113	HRZ-D329	SAE	2.5X2.5X0.1875	33.0	43.65	Tens	30.62	150XY	-5.042	SWR Brok	16.467	27.200	25.312	0.500	0.500	0.500	124.50	124.50	10.271	4	2	
114	STR-D194	BAR	2X0.1875X0.1875	33.0	39.69	Tens	0.00	151Y	0.000		0.049	27.200	25.312	1.000	1.000	1.000	1908.09	1482.57	8.602	5	2	
115	STR-D195	BAR	2X0.1875X0.1875	33.0	40.18	Tens	0.00	152Y	0.000		0.049	27.200	25.312	1.000	1.000	1.000	1908.09	1482.57	8.602	5	2	
116	STR-D196	BAR	2X0.1875X0.1875	33.0	39.00	Tens	0.00	153Y	0.000		0.049	27.200	25.312	1.000	1.000	1.000	1908.09	1482.57	8.602	5	2	
LE-1	VBR-D14	SAU	3X2X0.25	33.0	42.64	Tens	29.84	154Y	-1.654	250B: NE	5.542	40.800	50.625	1.000	1.000	1.000	287.79	247.90	10.433	5	3	
LE-2	**HRZ-D18**	**SAE**	**3X3X0.1875**	**33.0**	**14.75**	**Comp**	**14.75**	**155Y**	**-1.165**	**TCL Brok**	**7.902**	**27.200**	**25.312**	**2.000**	**1.000**	**1.000**	**247.97**	**198.70**	**9.702**	**6**	**2**	**A**

potentially damaging moment exists in the following members (make sure your system is well triangulated to minimize moments): 155P 155X 155XY 155Y ??

13LE-1	LEG-D4	SAE	8X8X0.5	33.0	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.000	0	0
13LE-2	VBR-D6	DAS	4X3X0.25	33.0	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.000	0	0
13LE-3	VBR-D12	SAU	2.5X2X0.1875	33.0	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.000	0	0

23LE-1	LEG-D35	SAE	8X8X0.5	33.0	51.86	Tens	48.50	157P	-116.561	SWR Brok	240.335	380.800	944.999	0.333	0.333	0.333	45.73	45.73	18.195	1	28
23LE-2	VBR-D37	DAS	4X3X0.4375	33.0	71.26	Comp	71.26	158P	-39.184	SWL Brok	54.989	81.600	177.187	0.250	1.000	0.250	189.30	172.85	30.762	5	3
23LE-3	VBR-D48	SAE	3X3X0.1875	33.0	37.89	Tens	20.11	159P	-1.050	250B: NE	5.220	40.800	37.969	1.000	0.333	0.333	283.29	244.47	22.168	5	3
33LE-1	LEG-D75	SAE	8X8X0.5	33.0	0.00		0.00		0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.000	0	0
33LE-2	VBR-D77	DAS	5X3.5X0.25	33.0	0.00		0.00		0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.000	0	0
33LE-3	VBR-D91	SAE	3X3X0.1875	33.0	0.00		0.00		0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.000	0	0

Group Summary (Tension Portion):

Group Label	Group Desc.	Angle Type	Angle Size	Steel Strength (ksi)	Max Usage %	Usage Cont-rol	Max Use In Tens. %	Tension Control Member	Tension Force (kips)	Tension Control Load Case	Net Section Capacity (kips)	Tension Connect. Shear Capacity (kips)	Tension Connect. Bearing Capacity (kips)	Tension Connect. Rupture Capacity (kips)	Length Tens. Member (ft)	No. Of Bolts Tens.	No. Of Holes	Hole Diameter (in)
1	LEG-D331	SAE	2.5X2.5X0.1875	33.0	72.15	Comp	45.44	1XY	7.744	SWL Brok	17.044	27.200	25.312	0.000	9.708	2	2.000	0.875
2	LEG-D251	SAE	5X5X0.375	33.0	19.73	Comp	18.53	2Y	14.046	SWR Brok	75.817	0.000	0.000	0.000	5.000	0	4.000	0.875
3	LEG-D251	SAE	5X5X0.375	33.0	24.63	Tens	24.63	3Y	18.672	SWR Brok	75.817	0.000	0.000	0.000	5.000	0	4.000	0.875
4	LEG-D251	SAE	5X5X0.375	33.0	41.44	Comp	26.67	4XY	23.104	SWL Brok	86.645	0.000	0.000	0.000	5.000	0	3.000	0.875
5	LEG-D251	SAE	5X5X0.375	33.0	33.52	Comp	23.08	5Y	17.499	SWR Brok	75.817	136.000	253.125	0.000	5.000	10	4.000	0.875
6	LEG-D222	SAE	8X8X0.5	33.0	17.28	Comp	11.02	6Y	21.822	SWR Brok	198.000	0.000	0.000	0.000	5.000	0	4.000	0.875
7	LEG-D222	SAE	8X8X0.5	33.0	34.11	Comp	27.23	7XY	53.920	TCL Brok	198.000	0.000	0.000	0.000	5.000	0	4.000	0.875
8	LEG-D222	SAE	8X8X0.5	33.0	28.50	Comp	20.88	8XY	38.319	TCL Brok	183.562	272.000	337.499	0.000	5.000	10	5.000	0.875
9	LEG-D220	SAE	8X8X0.5	33.0	30.08	Comp	23.37	9XY	41.707	TCL Brok	178.466	0.000	0.000	0.000	5.092	0	5.353	0.875
10	LEG-D220	SAE	8X8X0.5	33.0	47.36	Comp	42.86	10XY	84.857	TCL Brok	198.000	380.800	944.999	0.000	5.092	28	4.000	0.875
11	LEG-D125	SAE	8X8X0.5	33.0	44.53	Tens	44.53	11XY	75.319	TCL Brok	169.125	0.000	0.000	0.000	5.092	0	6.000	0.875
12	LEG-D125	SAE	8X8X0.5	33.0	48.09	Comp	44.78	12XY	88.716	TCL Brok	198.130	380.800	944.999	0.000	11.617	28	3.991	0.875
13	VBR-D324	SAE	2X2X0.1875	33.0	9.91	Tens	9.91	14XY	1.607	SWR Brok	16.214	27.200	25.312	0.000	5.000	2	1.000	0.875
14	VBR-D320	SAE	3X3X0.1875	33.0	87.99	Comp	54.81	15Y	13.874	SWR Brok	27.500	27.200	25.312	0.000	7.810	2	1.000	0.875
15	VBR-D322	SAE	3X3X0.1875	33.0	82.51	Comp	39.94	16X	10.109	250C: Ex	27.500	27.200	25.312	0.000	6.727	2	1.000	0.875
16	VBR-D271	SAE	2X2X0.1875	33.0	49.37	Comp	37.68	17Y	6.109	SWR Brok	16.214	27.200	25.312	0.000	5.000	2	1.000	0.875
17	VBR-D259	SAE	3X3X0.1875	33.0	78.84	Comp	63.47	18X	17.453	TCL Brok	27.500	40.800	37.969	0.000	6.727	3	1.000	0.875
18	VBR-D267	SAE	2X2X0.1875	33.0	33.20	Comp	25.91	19P	4.201	SWR Brok	16.214	27.200	25.312	0.000	8.602	2	1.000	0.875
19	VBR-D257	SAE	3X3X0.3125	33.0	71.49	Comp	51.89	20XY	21.173	250C: Ex	44.745	40.800	63.281	0.000	6.727	3	1.000	0.875
20	VBR-D265	SAE	2.5X2.5X0.25	33.0	32.70	Comp	26.31	21X	7.155	TCL Brok	28.846	27.200	33.750	0.000	8.602	2	1.000	0.875
21	VBR-D255	SAE	3X3X0.3125	33.0	72.77	Comp	49.92	22P	20.369	250C: Ex	44.745	40.800	63.281	0.000	6.727	3	1.000	0.875
22	VBR-D263	SAE	2.5X2.5X0.25	33.0	31.51	Tens	31.51	23X	8.569	TCL Brok	28.846	27.200	33.750	0.000	8.602	2	1.000	0.875
23	VBR-D310	SAE	2X2X0.1875	33.0	10.12	Tens	10.12	25XY	1.641	SWR Brok	16.214	27.200	25.312	0.000	5.000	2	1.000	0.875
24	VBR-D306	SAU	4X3.5X0.25	33.0	80.80	Comp	63.53	26P	25.920	250C: Ex	44.284	40.800	50.625	0.000	7.810	3	1.458	0.875
25	VBR-D308	SAE	3.5X3.5X0.25	33.0	72.45	Comp	51.05	27X	20.542	250C: Ex	40.240	40.800	50.625	0.000	6.727	3	1.532	0.875
26	VBR-D269	SAU	3X2.5X0.25	33.0	58.13	Comp	52.41	28P	14.256	250C: Ex	32.410	27.200	33.750	0.000	5.000	2	1.000	0.875
27	VBR-D253	SAE	4X4X0.25	33.0	65.53	Comp	62.00	29XY	28.989	250C: Ex	46.755	54.400	67.500	0.000	6.727	4	1.672	0.875
28	VBR-D261	SAE	2.5X2.5X0.25	33.0	29.89	Comp	22.45	30X	6.106	TCL Brok	28.846	27.200	33.750	0.000	8.602	2	1.000	0.875
29	VBR-D230	SAE	4X4X0.25	33.0	75.62	Comp	61.81	31X	29.304	250C: Ex	47.411	54.400	67.500	0.000	6.727	4	1.571	0.875
30	VBR-D238	SAE	3X3X0.3125	33.0	21.38	Comp	18.78	32X	7.662	TCL Brok	44.745	40.800	63.281	0.000	8.602	3	1.000	0.875
31	VBR-D228	SAE	4X4X0.25	33.0	60.83	Comp	56.79	33P	26.554	TCL Brok	46.755	54.400	67.500	0.000	6.727	4	1.672	0.875
32	VBR-D236	SAE	3X3X0.3125	33.0	21.88	Tens	21.88	34X	8.926	TCL Brok	44.745	40.800	63.281	0.000	8.602	3	1.000	0.875
33	VBR-D295	SAE	2X2X0.1875	33.0	10.48	Tens	10.48	36XY	1.700	SWR Brok	16.214	27.200	25.312	0.000	5.000	2	1.000	0.875
34	VBR-D291	SAE	4X4X0.3125	33.0	71.60	Comp	62.76	37Y	34.140	SWR Brok	59.439	54.400	84.375	0.000	7.810	4	1.458	0.875
35	VBR-D293	SAE	4X4X0.25	33.0	75.10	Comp	54.05	38X	26.021	250C: Ex	48.145	54.400	67.500	0.000	6.727	4	1.458	0.875
36	VBR-D244	SAE	3.5X3.5X0.25	33.0	47.50	Comp	46.01	39P	18.770	TCL Brok	43.696	40.800	50.625	0.000	5.000	3	1.000	0.875
37	VBR-D226	SAE	4X4X0.375	33.0	51.33	Comp	49.23	40XY	33.474	SWR Brok	68.648	68.000	126.562	0.000	6.727	5	1.672	0.875
38	VBR-D234	SAE	3X3X0.3125	33.0	19.15	Comp	15.78	41X	6.440	TCL Brok	44.745	40.800	63.281	0.000	8.602	3	1.000	0.875
39	VBR-D224	SAE	4X4X0.375	33.0	67.51	Comp	64.97	42XY	35.342	SWR Brok	68.833	54.400	101.250	0.000	6.795	4	1.653	0.875
40	VBR-D232	SAE	2.5X2.5X0.25	33.0	18.58	Comp	17.60	43Y	4.788	SWR Brok	28.846	27.200	33.750	0.000	9.401	2	1.000	0.875
41	VBR-D138	SAE	4X4X0.375	33.0	67.01	Comp	58.39	44Y	39.706	SWR Brok	68.355	68.000	126.562	0.000	6.795	5	1.702	0.875
42	VBR-D145	SAE	3X3X0.1875	33.0	38.73	Comp	17.35	45XY	4.391	SWL Brok	27.500	27.200	25.312	0.000	6.701	2	1.000	0.875
43	VBR-D155	SAE	2X2X0.1875	33.0	4.88	Comp	2.85	47X	0.463	TCL Brok	16.214	27.200	25.312	0.000	5.092	2	1.000	0.875
44	VBR-D137	SAE	4X4X0.375	33.0	48.87	Comp	43.15	48Y	28.241	SWR Brok	65.451	68.000	126.562	0.000	7.869	5	2.000	0.875
45	VBR-D135	SAE	4X4X0.375	33.0	37.98	Comp	31.63	49X	20.703	250C: Ex	65.451	68.000	126.562	0.000	6.795	5	2.000	0.875
46	VBR-D153	SAE	4X4X0.3125	33.0	45.56	Tens	45.56	50P	24.783	TCL Brok	59.407	54.400	84.375	0.000	5.092	4	1.462	0.875
47	VBR-D151	SAU	7X4X0.4375	33.0	15.49	Cross	10.16	52XY	10.475	TCL Brok	103.105	149.600	324.843	0.000	6.795	11	3.000	0.875
48	VBR-D143	SAE	3X3X0.1875	33.0	52.76	Comp	16.32	53X	4.131	SWL Brok	27.500	27.200	25.312	0.000	8.110	2	1.000	0.875

49	VBR-D127	DAS	3.5X3X0.25	33.0	89.70	Tens	89.70	54P	48.798TCL Brok	72.542	54.400	67.500	0.000	18.926	2	2.000	0.875
50	VBR-D141	SAU	2.5X2X0.1875	33.0	54.58	Comp	25.71	55Y	4.933TCL Brok	19.184	27.200	25.312	0.000	18.807	2	1.000	0.875
51	HBR-D197	SAE	2.5X2.5X0.1875	33.0	71.90	Comp	17.09	57P	2.163SWL Brok	21.917	13.600	12.656	0.000	9.220	1	1.000	0.875
52	HBR-D198	SAE	2.5X2.5X0.1875	33.0	52.97	Comp	15.38	58P	1.947SWL Brok	21.917	13.600	12.656	0.000	8.322	1	1.000	0.875
53	HBR-D199	SAE	2.5X2.5X0.1875	33.0	46.74	Comp	16.21	59P	2.051TCL Brok	21.917	13.600	12.656	0.000	8.322	1	1.000	0.875
54	HBR-D201	SAE	2X2X0.1875	33.0	36.02	Tens	36.02	60X	4.559TCL Brok	16.214	13.600	12.656	0.000	9.220	1	1.000	0.875
55	HBR-D203	SAE	2X2X0.25	33.0	40.67	Tens	40.67	61X	5.531TCL Brok	21.421	13.600	16.875	0.000	8.322	1	1.000	0.875
56	HBR-D205	SAE	2X2X0.25	33.0	20.84	Cross	8.73	62Y	1.187TCL Brok	21.421	13.600	16.875	0.000	8.322	1	1.000	0.875
57	HBR-D189	SAE	2X2X0.25	33.0	63.86	Comp	61.83	63XY	8.408TCL Brok	21.421	13.600	16.875	0.000	9.899	1	1.000	0.875
58	HBR-D197	SAE	2.5X2.5X0.1875	33.0	40.70	Comp	15.90	65P	2.013TCL Brok	21.917	13.600	12.656	0.000	9.220	1	1.000	0.875
59	HBR-D198	SAE	2.5X2.5X0.1875	33.0	30.15	Comp	14.46	66P	1.830TCL Brok	21.917	13.600	12.656	0.000	8.322	1	1.000	0.875
60	HBR-D199	SAE	2.5X2.5X0.1875	33.0	28.88	Comp	14.42	67AR	1.825TCL Brok	21.917	13.600	12.656	0.000	8.322	1	1.000	0.875
61	HBR-D201	SAE	2X2X0.1875	33.0	34.17	Tens	34.17	68X	4.325TCL Brok	16.214	13.600	12.656	0.000	9.220	1	1.000	0.875
62	HBR-D203	SAE	2X2X0.25	33.0	37.23	Tens	37.23	69X	5.063TCL Brok	21.421	13.600	16.875	0.000	8.322	1	1.000	0.875
63	HBR-D205	SAE	2X2X0.25	33.0	23.21	Cross	5.71	70Y	0.777TCL Brok	21.421	13.600	16.875	0.000	8.322	1	1.000	0.875
64	HBR-D189	SAE	2X2X0.25	33.0	11.48	Tens	11.48	71Y	1.561TCL Brok	21.421	13.600	16.875	0.000	9.899	1	1.000	0.875
65	HBR-D197	SAE	2.5X2.5X0.1875	33.0	32.10	Comp	11.43	73P	1.446TCL Brok	21.917	13.600	12.656	0.000	9.220	1	1.000	0.875
66	HBR-D198	SAE	2.5X2.5X0.1875	33.0	23.61	Comp	10.44	74P	1.321TCL Brok	21.917	13.600	12.656	0.000	8.322	1	1.000	0.875
67	HBR-D199	SAE	2.5X2.5X0.1875	33.0	22.49	Comp	10.18	75P	1.289TCL Brok	21.917	13.600	12.656	0.000	8.322	1	1.000	0.875
68	HBR-D201	SAE	2X2X0.1875	33.0	33.52	Tens	33.52	76X	4.242TCL Brok	16.214	13.600	12.656	0.000	9.220	1	1.000	0.875
69	HBR-D203	SAE	2X2X0.25	33.0	43.28	Tens	43.28	77X	5.885TCL Brok	21.421	13.600	16.875	0.000	8.322	1	1.000	0.875
70	HBR-D205	SAE	2X2X0.25	33.0	31.17	Cross	8.68	78X	1.181TCL Brok	21.421	13.600	16.875	0.000	8.322	1	1.000	0.875
71	HBR-D189	SAE	2X2X0.25	33.0	9.96	Tens	9.96	79Y	1.354TCL Brok	21.421	13.600	16.875	0.000	9.899	1	1.000	0.875
72	HBR-D179	SAE	2X2X0.1875	33.0	37.86	Comp	9.47	80Y	1.536TCL Brok	16.214	27.200	25.312	0.000	15.096	2	1.000	0.875
73	HBR-D180	SAU	2.5X1.5X0.25	33.0	8.08	Comp	4.51	81Y	0.966TCL Brok	21.421	40.800	50.625	0.000	7.047	3	1.000	0.875
74	HBR-D177	SAE	2X2X0.1875	33.0	54.92	Comp	14.61	83Y	1.849TCL Brok	16.214	13.600	12.656	0.000	16.532	1	1.000	0.875
75	HBR-D178	SAE	2X2X0.1875	33.0	49.15	Cross	5.47	84X	0.693TCL Brok	16.214	13.600	12.656	0.000	13.540	1	1.000	0.875
76	HBR-D30	SAE	2X2X0.1875	33.0	32.35	Tens	32.35	85Y	4.094TCL Brok	16.214	13.600	12.656	0.000	23.667	1	1.000	0.875
77	HRZ-D314	SAE	3X3X0.25	33.0	58.13	Tens	58.13	87Y	19.231250C: Ex	33.082	0.000	0.000	0.000	4.500	0	2.000	0.875
78	HRZ-D207	SAE	2X2X0.1875	33.0	83.44	Comp	33.25	91X	4.209SWR Brok	16.214	13.600	12.656	0.000	7.000	1	1.000	0.875
79	HRZ-D278	SAE	2.5X2.5X0.1875	33.0	11.92	Comp	9.82	92P	2.152250B: NE	21.917	27.200	25.312	0.000	7.000	2	1.000	0.875
80	HRZ-D317	SAE	3X3X0.25	33.0	47.50	Tens	47.50	94XY	15.715TCL Brok	33.082	0.000	0.000	0.000	4.500	0	2.000	0.875
81	HRZ-D186	SAE	4X4X0.25	33.0	41.42	Comp	18.66	96XY	5.076TCL Brok	43.624	27.200	33.750	0.000	7.000	2	2.154	0.875
82	HRZ-D208	SAE	2X2X0.1875	33.0	74.20	Tens	74.20	98P	9.392250B: NE	16.214	13.600	12.656	0.000	7.000	1	1.000	0.875
83	HRZ-D277	SAE	2.5X2.5X0.1875	33.0	13.47	Comp	7.44	100X	1.631250B: NE	21.917	27.200	25.312	0.000	7.000	2	1.000	0.875
84	HRZ-D188	SAU	3.5X2.5X0.25	33.0	75.44	Tens	75.44	101X	10.753SWR Brok	14.254	27.200	33.750	0.000	7.000	2	3.246	0.875
85	HRZ-D300	SAE	4X4X0.25	33.0	69.11	Tens	69.11	103P	34.268250C: Ex	49.582	0.000	0.000	0.000	4.500	0	2.000	0.875
86	HRZ-D207	SAE	2X2X0.1875	33.0	33.82	Comp	12.44	106X	1.574SWR Brok	16.214	13.600	12.656	0.000	7.000	1	1.000	0.875
87	HRZ-D276	SAE	2X2X0.1875	33.0	13.17	Comp	12.43	108P	1.574SWR Brok	16.214	13.600	12.656	0.000	7.000	1	1.000	0.875
88	HRZ-D303	SAE	4X4X0.25	33.0	42.42	Tens	42.42	110X	21.032250C: Ex	49.582	0.000	0.000	0.000	4.500	0	2.000	0.875
89	HRZ-D184	SAE	4X4X0.25	33.0	22.04	Comp	3.95	112Y	1.074250C: Ex	43.624	27.200	33.750	0.000	7.000	2	2.154	0.875
90	HRZ-D208	SAE	2X2X0.1875	33.0	79.36	Tens	79.36	114P	10.044250B: NE	16.214	13.600	12.656	0.000	7.000	1	1.000	0.875
91	HRZ-D250	SAE	2.5X2.5X0.1875	33.0	8.21	Comp	6.20	116X	1.359SWL Brok	21.917	27.200	25.312	0.000	7.000	2	1.000	0.875
92	HRZ-D188	SAU	3.5X2.5X0.25	33.0	49.69	Tens	49.69	117X	10.773SWR Brok	21.679	27.200	33.750	0.000	7.000	2	3.246	0.875
93	HRZ-D285	SAE	4X4X0.3125	33.0	72.40	Tens	72.40	119Y	44.278SWR Brok	61.153	0.000	0.000	0.000	4.500	0	2.000	0.875
94	HRZ-D207	SAE	2X2X0.1875	33.0	25.43	Comp	10.18	123X	1.288SWR Brok	16.214	13.600	12.656	0.000	7.000	1	1.000	0.875
95	HRZ-D249	SAE	2X2X0.1875	33.0	20.45	Comp	14.59	124P	1.846SWR Brok	16.214	13.600	12.656	0.000	7.000	1	1.000	0.875
96	HRZ-D288	SAE	4X4X0.3125	33.0	45.40	Tens	45.40	125X	24.696TCL Brok	61.153	54.400	84.375	0.000	6.000	4	2.000	0.875
97	HRZ-D184	SAE	4X4X0.25	33.0	21.41	Comp	4.34	128Y	1.179250C: Ex	43.624	27.200	33.750	0.000	7.000	2	2.154	0.875
98	HRZ-D208	SAE	2X2X0.1875	33.0	86.88	Tens	86.88	130P	10.995250B: NE	16.214	13.600	12.656	0.000	7.000	1	1.000	0.875
99	HRZ-D248	SAE	3.5X3.5X0.3125	33.0	8.83	Comp	3.10	132X	1.263250C: Ex	53.952	40.800	63.281	0.000	7.000	3	1.000	0.875
100	HRZ-D188	SAU	3.5X2.5X0.25	33.0	50.53	Tens	50.53	133X	10.955SWR Brok	21.679	27.200	33.750	0.000	7.000	2	3.246	0.875
101	HRZ-D166	SAE	8X8X0.5	33.0	18.67	Tens	18.67	135Y	34.272SWR Brok	183.562	0.000	0.000	0.000	4.500	0	5.000	0.875
102	HRZ-D174	SAE	3.5X3.5X0.25	33.0	0.30	Tens	0.30	137P	0.082TCL Brok	43.696	27.200	33.750	0.000	10.847	2	1.000	0.875
103	HRZ-D170	SAU	3X2.5X0.25	33.0	5.09	Comp	3.27	138X	0.937TCL Brok	28.698	40.800	50.625	0.000	5.423	3	1.000	0.875
104	HRZ-D176	SAE	2X2X0.25	33.0	1.44	Comp	0.69	139X	0.148250C: Ex	21.421	27.200	33.750	0.000	4.500	2	1.000	0.875
105	HRZ-D168	SAU	3.5X3X0.25	33.0	4.26	Tens	4.26	140Y	1.695TCL Brok	39.835	40.800	50.625	0.000	5.423	3	1.000	0.875
106	HRZ-D165	SAE	6X6X0.5	33.0	40.64	Comp	29.90	143X	35.518SWL Brok	118.800	122.400	303.750	0.000	4.500	9	4.000	0.875
107	HRZ-D173	SAE	3X3X0.1875	33.0	18.91	Comp	0.00	144P	0.000	27.500	27.200	25.312	0.000	12.770	2	1.000	0.875
108	HRZ-D169	SAE	3X3X0.25	33.0	3.21	Comp	1.70	145P	0.463SWL Brok	36.271	27.200	33.750	0.000	12.770	2	1.000	0.875
109	HRZ-D167	SAU	3.5X3X0.25	33.0	9.88	Comp	7.22	146P	1.963250C: Ex	33.338	27.200	33.750	0.000	12.770	2	2.000	0.875
110	HRZ-D24	SAE	3X3X0.1875	33.0	31.90	Comp	7.81	147Y	1.768250C: Ex	22.628	40.800	37.969	0.000	16.333	3	2.000	0.875
111	HRZ-D28	SAE	3X3X0.1875	33.0	49.51	Comp	0.00	148P	0.000	27.500	13.600	12.656	0.000	17.128	1	1.000	0.875
112	HRZ-D26	SAE	3.5X3.5X0.25	33.0	39.20	Comp	1.62	149P	0.602250B: NE	37.199	40.800	50.625	0.000	17.128	3	2.000	0.875

113	HRZ-D329	SAE	2.5X2.5X0.1875	33.0	43.65	Tens	43.65	150Y	7.439SWR Brok	17.044	27.200	25.312	0.000	10.271	2	2.000	0.875
114	STR-D194	BAR	2X0.1875X0.1875	33.0	39.69	Tens	39.69	151Y	2.763SWR Brok	6.961	27.200	25.312	0.000	8.602	2	1.000	0.875
115	STR-D195	BAR	2X0.1875X0.1875	33.0	40.18	Tens	40.18	152Y	2.797SWR Brok	6.961	27.200	25.312	0.000	8.602	2	1.000	0.875
116	STR-D196	BAR	2X0.1875X0.1875	33.0	39.00	Tens	39.00	153Y	2.715SWR Brok	6.961	27.200	25.312	0.000	8.602	2	1.000	0.875
LE-1	VBR-D14	SAU	3X2X0.25	33.0	42.64	Tens	42.64	154Y	12.299TCL Brok	28.846	40.800	50.625	0.000	10.433	3	1.000	0.875
LE-2	**HRZ-D18**	**SAE**	**3X3X0.1875**	**33.0**	**14.75**	**Comp**	**1.76**	**155P**	**0.446TCL Brok**	**27.500**	**27.200**	**25.312**	**0.000**	**9.702**	**2**	**1.000**	**0.875**

A potentially damaging moment exists in the following members (make sure your system is well triangulated to minimize moments): 155P 155X 155XY 155Y ??

13LE-1	LEG-D4	SAE	8X8X0.5	33.0	0.00		0.00		0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0
13LE-2	VBR-D6	DAS	4X3X0.25	33.0	0.00		0.00		0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0
13LE-3	VBR-D12	SAU	2.5X2X0.1875	33.0	0.00		0.00		0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0
23LE-1	LEG-D35	SAE	8X8X0.5	33.0	51.86	Tens	51.86	156XY	87.701TCL Brok	169.125	0.000	0.000	0.000	6.065	0	6.000	0.875
23LE-2	VBR-D37	DAS	4X3X0.4375	33.0	71.26	Comp	52.90	158X	43.164TCL Brok	121.751	81.600	177.187	0.000	30.762	3	2.000	0.875
23LE-3	VBR-D48	SAE	3X3X0.1875	33.0	37.89	Tens	37.89	159P	10.419TCL Brok	27.500	40.800	37.969	0.000	22.168	3	1.000	0.875
33LE-1	LEG-D75	SAE	8X8X0.5	33.0	0.00		0.00		0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0
33LE-2	VBR-D77	DAS	5X3.5X0.25	33.0	0.00		0.00		0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0
33LE-3	VBR-D91	SAE	3X3X0.1875	33.0	0.00		0.00		0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0

*** Maximum Stress Summary for Each Load Case

Summary of Maximum Usages by Load Case:

Load Case	Maximum Usage %	Element Label	Element Type
250B: NESC Heavy	86.88	130P	Angle
250C: Extreme Wind (Trans.)	85.41	15X	Angle
SWL Broken: 250B	86.33	130P	Angle
SWR Broken: 250B	87.99	15XY	Angle
TCL Broken: 250B	89.70	54P	Angle

Summary of Insulator Usages:

Insulator Label	Insulator Type	Maximum Usage %	Load Case	Weight (lbs)
51A	Strain	39.40	250B: NESC Heavy	40.0
51B	Strain	39.40	250B: NESC Heavy	40.0
52A	Strain	39.40	250B: NESC Heavy	40.0
52B	Strain	39.40	250B: NESC Heavy	40.0
53A	Strain	39.40	250B: NESC Heavy	40.0
53B	Strain	39.40	250B: NESC Heavy	40.0
61A	Strain	39.40	250B: NESC Heavy	40.0
61B	Strain	39.40	250B: NESC Heavy	40.0
62A	Strain	39.40	250B: NESC Heavy	40.0
62B	Strain	39.40	250B: NESC Heavy	40.0
63A	Strain	39.40	250B: NESC Heavy	40.0
63B	Strain	39.40	250B: NESC Heavy	40.0
71A	Strain	39.40	250B: NESC Heavy	40.0
71B	Strain	39.40	250B: NESC Heavy	40.0
72A	Strain	39.40	250B: NESC Heavy	40.0
72B	Strain	39.40	250B: NESC Heavy	40.0
73A	Strain	39.40	250B: NESC Heavy	40.0
73B	Strain	39.40	250B: NESC Heavy	40.0
81A	Strain	39.40	250B: NESC Heavy	40.0
81B	Strain	39.40	250B: NESC Heavy	40.0
82A	Strain	39.40	250B: NESC Heavy	40.0
82B	Strain	39.40	250B: NESC Heavy	40.0
83A	Strain	39.40	250B: NESC Heavy	40.0
83B	Strain	39.40	250B: NESC Heavy	40.0

```
       11 Suspension   12.86           SWL Broken: 250B   10.0
       21 Suspension   20.16           SWR Broken: 250B   10.0
      TM1 Suspension   12.70 250C: Extreme Wind (Trans.)    0.0
      TM2 Suspension   12.79 250C: Extreme Wind (Trans.)    0.0
      TM3 Suspension   10.48 250C: Extreme Wind (Trans.)    0.0
      TM4 Suspension   10.09 250C: Extreme Wind (Trans.)    0.0
      TM5 Suspension   13.78 250C: Extreme Wind (Trans.)    0.0
      TM6 Suspension   13.97 250C: Extreme Wind (Trans.)    0.0
      TM7 Suspension    6.20 250C: Extreme Wind (Trans.)    0.0
      TM8 Suspension    5.90 250C: Extreme Wind (Trans.)    0.0
       C1 Suspension    1.62 250C: Extreme Wind (Trans.)    0.0
       C2 Suspension    1.15 250C: Extreme Wind (Trans.)    0.0
       C3 Suspension    1.23 250C: Extreme Wind (Trans.)    0.0
       C4 Suspension    1.31 250C: Extreme Wind (Trans.)    0.0
       C5 Suspension    1.31 250C: Extreme Wind (Trans.)    0.0
      C1Y Suspension    0.80 250C: Extreme Wind (Trans.)    0.0
      C2Y Suspension    0.57 250C: Extreme Wind (Trans.)    0.0
      C3Y Suspension    0.61 250C: Extreme Wind (Trans.)    0.0
      C4Y Suspension    0.65 250C: Extreme Wind (Trans.)    0.0
      C5Y Suspension    0.65 250C: Extreme Wind (Trans.)    0.0
      C1X Suspension    0.80 250C: Extreme Wind (Trans.)    0.0
      C2X Suspension    0.57 250C: Extreme Wind (Trans.)    0.0
      C3X Suspension    0.61 250C: Extreme Wind (Trans.)    0.0
      C4X Suspension    0.65 250C: Extreme Wind (Trans.)    0.0
      C5X Suspension    0.65 250C: Extreme Wind (Trans.)    0.0
     C1XY Suspension    0.81 250C: Extreme Wind (Trans.)    0.0
     C2XY Suspension    0.57 250C: Extreme Wind (Trans.)    0.0
     C3XY Suspension    0.61 250C: Extreme Wind (Trans.)    0.0
     C4XY Suspension    0.66 250C: Extreme Wind (Trans.)    0.0
     C5XY Suspension    0.66 250C: Extreme Wind (Trans.)    0.0

*** Weight of structure (lbs):
    Weight of Angles*Section DLF:     32492.8
    Weight of Strains:                  960.0
    Weight of Suspensions:               20.0
    Total:                            33472.8


*** End of Report
```

SUPPLEMENTAL CALCULATIONS

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Antenna Support Moment Frame Bolted To Lattice Structure - NESC 2007 Local Analysis Check (OTRM 059.1 Section E.2.e) Top Support Reactions

Maximum Reactions

Compression Force =	$P_c := 13.2\ kip$	Input from PLS-TOWER (Load Case 250C)
Vertical Force =	$P_v := 0 \cdot kip$	Vertical Reaction Input from Risa (Reaction is Tension so used 0, Conservative)
Horizontal Force, x =	$H_x := 6.0\ kip$	Horizontal Reaction Input from RISA Rx (250C)
Horizontal Force, y =	$H_y := .066\ kip$	Horizontal Reaction Input from RISA Rz (250C)

Member Properties (Equal Leg Angle)

Member Type =	L 5x5x3/8	User Input
Width of Member =	$w := 5\ in$	User Input
Member Thickness =	$t := 0.375\ in$	User Input
k(heel to toe of fillet) =	$k_{des} := 0.875\ in$	User Input
Member Area =	$A := 3.61\ in^2$	User Input
Unbraced Length =	$L := 5\ ft$	User Input
Distance to Load along member =	$a := 1.25 \cdot ft$	User Input
Effective Length Factor =	$K := 1$	User Input
Radius of Gyration =	$r_x := 1.56\ in$	User Input
Radius of Gyration =	$r_y := 1.56\ in$	User Input
Radius of Gyration =	$r_z := 0.99\ in$	User Input
Section Modulus =	$S_x := 2.42\ in^3$	User Input
Section Modulus =	$S_y := 2.42\ in^3$	User Input
Moment of Inertia =	$I_x := 8.74\ in^4$	User Input
Moment of Inertia =	$I_y := 8.74\ in^4$	User Input
Yield Stress =	$F_y := 33\ ksi$	User Input
Modulus of Elasticity =	$E := 29000\ ksi$	User Input

Calculate the Compression Capacity Per ASCE 10-97 Section 3.6 and 3.7)

Width to Thickness Ratio = $w_t := \frac{(w - k_{des})}{t} = 11$ (3.7-1)

Limits

$\frac{80}{\sqrt{\frac{F_y}{ksi}}} = 13.926$

$\frac{144}{\sqrt{\frac{F_y}{ksi}}} = 25.0672$

$$Fcr := \begin{cases} \text{if } w_t < \frac{80}{\sqrt{\frac{F_y}{ksi}}} \\ \quad \text{return } F_y \\ \text{else if } \frac{80}{\sqrt{\frac{F_y}{ksi}}} \le w_t \le \frac{144}{\sqrt{\frac{F_y}{ksi}}} \\ \quad \text{return } \left(1.677 - 0.677 \cdot \frac{w_t}{\left(\frac{80}{\sqrt{\frac{F_y}{ksi}}}\right)}\right) \cdot F_y \quad (3.7\text{-}2) \\ \text{else if } w_t > \frac{144}{\sqrt{\frac{F_y}{ksi}}} \\ \quad \text{return } \frac{0.0332 \cdot \pi^2 \cdot E}{w_t^2} \quad (3.7\text{-}3) \end{cases} = 33\ ksi$$

$Fcr = 33\ ksi$

$r := min(r_x, r_y, r_z)$

$C_c := \pi \cdot \sqrt{\frac{2 \cdot E}{F_y}} = 131.706$ (3.6-3)

Determine Compression Capacity, Fa =

$$F_a := \begin{cases} \text{if } \left(\frac{K \cdot L}{r}\right) \le C_c \\ \quad \left(1 - \frac{1}{2} \cdot \left(\frac{\left(\frac{K \cdot L}{r}\right)}{C_c}\right)^2\right) \cdot Fcr \quad (3.6\text{-}1) \\ \text{else} \\ \quad \frac{\pi^2 \cdot E}{\left(\frac{K \cdot L}{r}\right)^2} \quad (3.6\text{-}2) \end{cases} = 29.506\ ksi$$

$\frac{K \cdot L}{r} = 60.606$

$F_a = 29.506\ ksi$

Determine the Bending capacity (per ASCE 10-97 Section 3.14.8)

$b := w - \frac{t}{2} = 4.813\ in$

$M_{yx} := F_y \cdot S_x = 79.86\ kip \cdot in$ (Yield Moment X direction)

$M_{yy} := F_y \cdot S_y = 79.86\ kip \cdot in$ (Yield Moment Y direction)

$M_{yc} := min\left(M_{yx}, M_{yy}\right) = 79.86\ kip \cdot in$ (Compressive Yield Moment, 3.14.8)

$$M_{e.pos} := \frac{\left(0.66 \cdot E \cdot b^4 \cdot t\right)}{(K \cdot L)^2} \cdot \left(\sqrt{1 + \frac{0.81 \cdot (K \cdot L)^2 \cdot t^2}{b^4}} + 1\right) = 2490.002\ kip \cdot in$$

(Elastic Critical Moment + direction, 3.14-7)

$$M_{e.neg} := \frac{\left(0.66 \cdot E \cdot b^4 \cdot t\right)}{(K \cdot L)^2} \cdot \left(\sqrt{1 + \frac{0.81 \cdot (K \cdot L)^2 \cdot t^2}{b^4}} - 1\right) = 351.136\ kip \cdot in$$

(Elastic Critical Moment - direction, 3.14-7)

$M_e := min\left(M_{e.pos}, M_{e.neg}\right) = 351.136\ kip \cdot in$

$$M_b := \begin{cases} M_e & \text{if } M_e \le 0.5 \cdot M_{yc} \\ M_{yc} \cdot \left(1 - \frac{M_{yc}}{4 \cdot M_e}\right) & \text{else if } M_e > 0.5 \cdot M_{yc} \end{cases} = 75.319\ kip \cdot in$$

$M_a := min\left(M_b, M_{yc}\right) = 75.319\ kip \cdot in$ (Allowable Bending Moment, 3.14.8)

$M_{ax} := M_a \qquad M_{ay} := M_a$

Check Combined Axial and Bending

$C_m := 0.85$ (Restrained Ends)

$L_x := 4\ ft + 5.625\ in$ (Bending Length)

$L_y := 4\ ft + 2.875\ in$ (Bending Length)

(Re: Tower Dwgs. sht. 23)

$P := P_c + P_v = 13.2\ kip$ (Total Axial Load)

$P_a := F_a \cdot A = 106.517\ kip$ (Design Axial Load)

$P_y := F_y \cdot A = 119.13\ kip$ (Axial Compression at Yield)

$$P_{ex} := \frac{\pi^2 \cdot E \cdot I_x}{(K \cdot L_x)^2} = 869.91\ kip$$

$$P_{ey} := \frac{\pi^2 \cdot E \cdot I_y}{(K \cdot L_y)^2} = 966.497\ kip$$

$$M_x := \frac{H_x \cdot a \cdot (L_x - a)}{L_x} = 64.825\ kip \cdot in$$

$$M_y := \frac{H_y \cdot a \cdot (L_y - a)}{L_y} = 0.698\ kip \cdot in$$

$$Check_1 := \frac{P}{P_a} + \frac{C_m \cdot M_x}{M_{ax}} \cdot \left(\frac{1}{1 - \frac{P}{P_{ex}}}\right) + \frac{C_m \cdot M_y}{M_{ay}} \cdot \left(\frac{1}{1 - \frac{P}{P_{ey}}}\right) = 0.875 \qquad (3.12\text{-}1)$$

$$Check_2 := \frac{P}{P_y} + \frac{M_x}{M_{ax}} + \frac{M_y}{M_{ay}} = 0.981 \qquad (3.12\text{-}2)$$

$Status_1 :=$ if $Check_1 \le 1$ → "OK", else → "NG" $=$ "OK"

$Status_2 :=$ if $Check_2 \le 1$ → "OK", else → "NG" $=$ "OK"

Antenna Support Moment Frame Bolted To Lattice Structure - NESC 2007 Local Analysis Check (OTRM 059.1 Section E.2.e) Bottom Support Reactions

Maximum Reactions

Compression Force =	$P_c := 5.4\ kip$	Input from PLS-TOWER, 250C
Vertical Force =	$P_v := 4.5 \cdot kip$	Vertical Reaction Input from Risa 3D
Horizontal Force, x =	$H_x := 2.6\ kip$	Horizontal Reaction Input from Risa 3D
Horizontal Force, y =	$H_y := .066\ kip$	Horizontal Reaction Input from Risa 3D

Member Properties (Equal Leg Angle)

Member Type=	L 8x8x1/2	User Input
Width of Member =	$w := 8\ in$	User Input
Member Thickness =	$t := 0.5\ in$	User Input
k(heel to toe of fillet) =	$k_{des} := 1.125\ in$	User Input
Member Area =	$A := 7.75\ in^2$	User Input
Unbraced Length =	$L := 5\ ft$	User Input
Distance to Load along member =	$a := 1.25 \cdot ft$	User Input
Effective Length Factor =	$K := 1$	User Input
Radius of Gyration =	$r_x := 2.5\ in$	User Input
Radius of Gyration =	$r_y := 2.5\ in$	User Input
Radius of Gyration =	$r_z := 1.59\ in$	User Input
Section Modulus =	$S_x := 8.36\ in^3$	User Input
Section Modulus =	$S_y := 8.36\ in^3$	User Input
Moment of Inertia =	$I_x := 48.6\ in^4$	User Input
Moment of Inertia =	$I_y := 48.6\ in^4$	User Input
Yield Stress =	$F_y := 33\ ksi$	User Input
Modulus of Elasticity =	$E := 29000\ ksi$	User Input

Calculate the Compression Capacity Per ASCE 10-97 Section 3.6 and 3.7)

Width to Thickness Ratio = $w_t := \frac{(w - k_{des})}{t} = 13.75$ (3.7-1)

Limits

$\frac{80}{\sqrt{\frac{F_y}{ksi}}} = 13.926$

$\frac{144}{\sqrt{\frac{F_y}{ksi}}} = 25.0672$

$$Fcr := \left\| \begin{array}{l} \text{if } w_t < \frac{80}{\sqrt{\frac{F_y}{ksi}}} \\ \quad \| \text{return } F_y \\ \text{else if } \frac{80}{\sqrt{\frac{F_y}{ksi}}} \le w_t \le \frac{144}{\sqrt{\frac{F_y}{ksi}}} \\ \quad \| \text{return } \left(1.677 - 0.677 \cdot \frac{w_t}{\left(\frac{80}{\sqrt{\frac{F_y}{ksi}}}\right)}\right) \cdot F_y \quad (3.7\text{-}2) \\ \text{else if } w_t > \frac{144}{\sqrt{\frac{F_y}{ksi}}} \\ \quad \| \text{return } \frac{0.0332 \cdot \pi^2 \cdot E}{w_t^2} \quad (3.7\text{-}3) \end{array} \right| = 33 \ ksi$$

$Fcr = 33 \ ksi$

$r := min(r_x, r_y, r_z)$

$C_c := \pi \cdot \sqrt{\frac{2 \cdot E}{F_y}} = 131.706$ (3.6-3)

Determine Compression Capacity, Fa =

$\frac{K \cdot L}{r} = 37.736$

$$F_a := \left\| \begin{array}{l} \text{if } \left(\frac{K \cdot L}{r}\right) \le C_c \\ \quad \left\| \left(1 - \frac{1}{2} \cdot \left(\frac{\left(\frac{K \cdot L}{r}\right)}{C_c}\right)^2\right) \cdot Fcr \right. \quad (3.6\text{-}1) \\ \text{else} \\ \quad \left\| \frac{\pi^2 \cdot E}{\left(\frac{K \cdot L}{r}\right)^2} \right. \quad (3.6\text{-}2) \end{array} \right| = 31.646 \ ksi$$

$F_a = 31.646 \ ksi$

Determine the Bending capacity (per ASCE 10-97 Section 3.14.8)

$$b := w - \frac{t}{2} = 7.75\ \textit{in}$$

$$M_{yx} := F_y \cdot S_x = 275.88\ \textit{kip} \cdot \textit{in}$$ (Yield Moment)

$$M_{yy} := F_y \cdot S_y = 275.88\ \textit{kip} \cdot \textit{in}$$ (Yield Moment)

$$M_{yc} := min\left(M_{yx}, M_{yy}\right) = 275.88\ \textit{kip} \cdot \textit{in}$$ (Compressive Yield Moment, 3.14.8)

$$M_{e.pos} := \frac{\left(0.66 \cdot E \cdot b^4 \cdot t\right)}{(K \cdot L)^2} \cdot \left(\sqrt{1 + \frac{0.81 \cdot (K \cdot L)^2 \cdot t^2}{b^4}} + 1\right) = 20104.305\ \textit{kip} \cdot \textit{in}$$ (Elastic Critical Moment + direction, 3.14-7)

$$M_{e.neg} := \frac{\left(0.66 \cdot E \cdot b^4 \cdot t\right)}{(K \cdot L)^2} \cdot \left(\sqrt{1 + \frac{0.81 \cdot (K \cdot L)^2 \cdot t^2}{b^4}} - 1\right) = 924.409\ \textit{kip} \cdot \textit{in}$$ (Elastic Critical Moment - direction, 3.14-7)

$$M_e := min\left(M_{e.pos}, M_{e.neg}\right) = 924.409\ \textit{kip} \cdot \textit{in}$$

$$M_b := \begin{cases} M_e & \text{if } M_e \le 0.5 \cdot M_{yc} \\ M_{yc} \cdot \left(1 - \frac{M_{yc}}{4 \cdot M_e}\right) & \text{else if } M_e > 0.5 \cdot M_{yc} \end{cases} = 255.297\ \textit{kip} \cdot \textit{in}$$

$$M_a := min\left(M_b, M_{yc}\right) = 255.297\ \textit{kip} \cdot \textit{in}$$ (Allowable Bending Moment, 3.14.8)

$$M_{ax} := M_a \qquad M_{ay} := M_a$$

Check Combined Axial and Bending

$C_m := 0.85$ (Restrained Ends) $L_x := L$

$P := P_c + P_v = 9.9\ kip$ (Total Axial Load) $L_y := L$

$P_a := F_a \cdot A = 245.253\ kip$ (Design Axial Load)

$P_y := F_y \cdot A = 255.75\ kip$ (Axial Compression at Yield)

$$P_{ex} := \frac{\pi^2 \cdot E \cdot I_x}{(K \cdot L_x)^2} = 3863.95\ kip$$

$$P_{ey} := \frac{\pi^2 \cdot E \cdot I_y}{(K \cdot L_y)^2} = 3863.95\ kip$$

$$M_x := \frac{H_x \cdot a \cdot (L_x - a)}{L_x} = 29.25\ kip \cdot in$$

$$M_y := \frac{H_y \cdot a \cdot (L_y - a)}{L_y} = 0.743\ kip \cdot in$$

$$Check_1 := \frac{P}{P_a} + \frac{C_m \cdot M_x}{M_{ax}} \cdot \left(\frac{1}{1 - \frac{P}{P_{ex}}}\right) + \frac{C_m \cdot M_y}{M_{ay}} \cdot \left(\frac{1}{1 - \frac{P}{P_{ey}}}\right) = 0.14 \qquad (3.12\text{-}1)$$

$$Check_2 := \frac{P}{P_y} + \frac{M_x}{M_{ax}} + \frac{M_y}{M_{ay}} = 0.156 \qquad (3.12\text{-}2)$$

$Status_1 :=$ if $Check_1 \le 1$ "OK" else "NG" $=$ "OK"

$Status_2 :=$ if $Check_2 \le 1$ "OK" else "NG" $=$ "OK"

Foundation Analysis (OTRM 059.1)

Reactions

$H_{shear} := 44.7\ kip \cdot 1.1 = 49.17\ kip$ Maximum Shear Force

$P_{comp} := 141.9\ kip \cdot 1.1 = 156.09\ kip$ Maximum Compression Force

$P_{tens} := 110.7\ kip \cdot 1.1 = 121.77\ kip$ Maximum Tension Force

Foundation Properties

$Pier_{height} := 9.5\ ft$

$Pier_{width.top} := 3\ ft$

$Pier_{width.bot} := 6\ ft$

$Pier_{projection} := 0.5\ ft$

$Ftg_{width} := 11\ ft$

$Ftg_{thick} := 3\ ft$

Geotechnical Properties

$\gamma_{conc} := 150\ pcf$

$\gamma_{water} := 62.4\ pcf$

$\gamma_{soil} := 100\ pcf$

$\phi_{soil} := 30\ deg$

$q_{soil} := 9\ ksf$

Calculations

$V_{ftg} := Ftg_{width}^{2} \cdot Ftg_{thick} = 363\ ft^3$

$$V_{pier} := \frac{Pier_{height}}{3} \cdot \left(Pier_{width.top}^{2} + Pier_{width.bot}^{2} + \sqrt{Pier_{width.top}^{2} \cdot Pier_{width.bot}^{2}}\right) = 199.5\ ft^3$$

$Base_1 := Pier_{width.bot}^{2} = 36\ ft^2$ Resisting Pyramid Base 1

$Base_2 := \left(2 \cdot \tan\left(\phi_{soil}\right) \cdot \left(Pier_{height} - Pier_{projection}\right) + Ftg_{width}\right)^{2} = 457.631\ ft^2$ Resisting Pyramid Base 2

$$V_{soil} := \left(\left(\frac{Pier_{height} - Pier_{projection}}{3}\right) \cdot \left(Base_1 + Base_2 + \sqrt{Base_1 \cdot Base_2}\right)\right) - V_{pier} = 1666.454\ ft^3$$

$V_{conc} := V_{ftg} + V_{pier} = 562.5\ ft^3$

$W_{conc} := V_{conc} \cdot \gamma_{conc} = 84.375\ kip$

$W_{soil} := V_{soil} \cdot \gamma_{soil} = 166.645\ kip$

$W_{tot} := W_{conc} + W_{soil} = 251.02\ kip$

Uplift Check

$$Usage_{uplift} := \frac{P_{tens}}{W_{tot}} = 0.485$$

$$Status_{uplift} := \begin{Vmatrix} \text{if } Usage_{uplift} \le 1 \\ \quad \Vert \text{"OK"} \\ \text{else} \\ \quad \Vert \text{"NG"} \end{Vmatrix} = \text{"OK"}$$

Overturning Check

$$M_{ot} := H_{shear} \cdot \left(Pier_{height} + Pier_{projection} + Ftg_{thick}\right) = 639.21 \ \mathbf{kip \cdot ft}$$

$$M_{res} := \left(W_{conc} + \left(\gamma_{soil} \cdot \left(\left(Ftg_{width}^{\ 2} \cdot Pier_{height}\right) - V_{pier}\right)\right)\right) \cdot \frac{Ftg_{width}}{2} = 986.563 \ \mathbf{kip \cdot ft}$$

$$Usage_{OT} := \frac{M_{ot}}{M_{res}} = 0.648$$

$$Status_{ot} := \begin{Vmatrix} \text{if } Usage_{OT} \le 1 \\ \quad \Vert \text{"OK"} \\ \text{else} \\ \quad \Vert \text{"NG"} \end{Vmatrix} = \text{"OK"}$$

Soil Bearing Check

$$A_{ftg} := Ftg_{width}^{\ 2} = 121 \ \mathbf{ft}^2$$

$$S_{ftg} := \frac{Ftg_{width}^{\ 3}}{6} = 221.833 \ \mathbf{ft}^3$$

$$q_{brg} := \frac{P_{comp} + W_{conc}}{A_{ftg}} + \frac{H_{shear} \cdot \left(Pier_{height} + Pier_{projection} + Ftg_{thick}\right)}{S_{ftg}} = 4.869 \ \mathbf{ksf}$$

$$Usage_{bearing} := \frac{q_{brg}}{q_{soil}} = 0.541$$

$$Status_{bearing} := \begin{Vmatrix} \text{if } Usage_{bearing} \le 1 \\ \quad \Vert \text{"OK"} \\ \text{else} \\ \quad \Vert \text{"NG"} \end{Vmatrix} = \text{"OK"}$$

APPENDIX

TABLE OF CONTENTS

1. Scope

This standard provides the required design criteria for wireless communication antennas on or extending above existing electric transmission towers and poles, and the analysis of transmission towers/poles supporting wireless communication antenna support system. This standard also describes the required submittal information.

This standard is applicable to Connecticut Light & Power (CL&P) only.

2. Regulations and Related Codes and Standards

A. ANSI Standard – TIA/EIA-222-F.

B. ANSI Standard – C2-2007 – National Electrical Safety Code.

C. Northeast Utilities (NU) Overhead Transmission Line Standards

1) OTRM 051 – Transmission Line and Substation Terminal Structure & Lightning Mast Foundations.

2) OTRM 060 – Extreme Wind & Ice Loading on Transmission Line Structures.

3) OTRM 063.1 – General Parameters and Guying for 115-kV & 345-kV Wood Pole Construction

4) OTRM 063.2 – Transmission Line Re-conductor Evaluation for Natural Wood Pole Structures

5) OTRM 160 –Technical Requirements for Steel Pole Structures

6) OTRM 162 – Laminated Wood Pole Structures

7) OTRM 163 – Natural Wood Pole Transmission Structures

D. NU Standard Drawings

1) Drawing # 09000-60000 – Grounding Details for Transmission Line Foundations.

E. NU Transmission Group Administrative Guidelines

1) M7-EN-3008 – Telecommunications Attachment Process

2) M7-EN-3016 – Transmission Line & Civil Engineering Calculations

3. Use of Consulting Engineering Firms for Wireless Communication Installations

A. Wireless Communication Carriers shall contact the NU Transmission Line and Civil Engineering Group (TL&CE) for a list of engineering consultants that have been approved to design the wireless communication addition, analyze, and reinforce the transmission structure.

1) Consulting engineering firms may be added to the list per request of the wireless communication carrier’s contingent upon Northeast Utilities review of the consultants’ qualifications and demonstration on the firm's expertise and proficiency in the use of the required software.

2) All engineering consultants shall be approved by Northeast Utilities.

B. Laminated Wood Systems, Inc. (1327 285th Road, PO Box 386, Seward NE 68434) shall be employed to analyze and design all engineered wood projects.

1) Analysis shall follow our current guidelines and procedures. Refer to OTRM 063.

2) Design and Procurement of Laminated pole structures shall be per OTRM 162 and OTRM 163.

4. Analysis Requirements for New Wireless Communication Facilities

A. All structural analyses shall be submitted to NU for review and acceptance. The submitted analysis package shall conform to all the requirements of this standard and must demonstrate that the proposed new addition is structurally adequate and will not compromise the structural adequacy of transmission structure.

B. Analysis packages that conclude the structure is failing shall also be submitted to NU.

C. Field Investigation

1) The Engineering Consultants shall conduct a field investigation to assess structural condition to determine if a structural strength reduction factor is necessary to justify all calculation assumptions made in structural analysis. The field investigation shall include anchor bolts, stub angle, and footing. The written justifications forming the basis for the assumptions shall be included in the calculations.

D. Approved Analysis Programs

1) It is preferred that the latest version of the below referenced programs be utilized. If a vendor utilizes an earlier version, the vendor is required to verify that the earlier version is compatible with the latest release version.
2) “PLS Caisson”, “M-FAD”, or “L-Pile” shall be used to analyze caisson foundations.
3) "PLS Tower" is required to analyze all transmission line lattice structures.
4) "PLS Pole" is required to analyze all transmission line steel poles, with the exception of "Finney" style poles.
5) "STAAD-3D" or "RISA-3D" is required to analyze all transmission line “Finney” (built-up box sections from rolled I beams or Channels and steel plates) poles.
6) "RISA Tower", "STAAD-3D", or "RISA-3D" analysis software is permitted for use in wireless communication mast design and analysis.
7) "MathCAD" worksheet calculations are required for preparation of calculations used in lieu of or to supplement the analysis results of the software above.

E. Analysis and Design

The analysis and design of the wireless communication mast and electric transmission structure shall be performed utilizing a three (3) step approach:

1) STEP 1 - The wireless communication mast and mount design shall be analyzed and designed to comply with TIA/EIA-222-F. This analysis and design does not consider the electric transmission structure.

The Wireless Communication Facility (Mast, antennas, trays, coax supports, including initial and any planned future support platforms, antennas, etc extending the full height above the top level of the electric transmission structure shall be designed in accordance with the provisions of TIA/EIA-222-F Standard with two exceptions:

a) An 85 MPH extreme wind speed shall be used for locations in all counties throughout the State of Connecticut.

b) The allowable stress increase of TIA Section 3.1.1.1allowed for mast section, but is disallowed for the mast to structure connection design.

To clarify, the combined wind and ice condition shall consider ½” radial ice in combination with the wind load (0.75 Wi) as specified in TIA Section 2.3.16.

Shape Factor Criteria shall be per TIA Shape Factors.

2) STEP 2 - The electric transmission structure analysis and evaluation shall be performed in accordance with NESC requirements and shall include the mast and antenna loads determined from NESC applied loading conditions (not TIA/EIA Loads) on the structure and mount as specified below, and shall include the wireless communication mast and antenna loads per NESC criteria)

The strength reduction factor obtained from the field investigation shall be applied to the members or connections that are showing signs of deterioration from their original condition

Existing structures are to be analyzed initially using the current NESC code, then it is permitted to use the original design code with the original conductor load should the existing tower fail the current NESC code.

The structure shall be analyzed using yield stress theory in accordance with Attachment A, “NU Design Criteria.” This specifies uniform loadings (different from the TIA loadings) on each of the following components of the installed facility:

a) Wireless communication mast for its total height above ground level, including the initial and any planned future equipment (Support Platforms, Antennas, TMA’s etc.) above the top of an electric transmission structure.

b) Conductors and related devices and hardware (wire loads will be provided by NU).

c) Electric Transmission Structure

i) The loads from the wireless communication equipment components based on NESC and NU Criteria in Attachment A, and from the electric conductors shall be applied to the structure at conductor and wireless communication mast attachment points, where those loads transfer to the tower.

ii) Shape Factor Multiplier:

NESC Structure Shape	Cd
Polyround (for polygonal steel poles)	1.3
Flat	1.6
Open Lattice	3.2

iii) When Coaxial Cables are mounted alongside the pole structure, the shape multiplier shall be:

Mount Type	Cable Cd	Pole Cd
Coaxial Cables on outside periphery (One layer)	1.45	1.45
Coaxial Cables mounted on stand offs	1.6	1.3

d) The uniform loadings and factors specified for the above components in Attachment A, “NU Design Criteria” are based upon the National Electric Safety Code 2007 Edition Extreme Wind (Rule 250C) and Combined Ice and Wind (Rule 250B-Heavy) Loadings. These provide equivalent loadings compared to the TIA and its loads and factors with the exceptions noted above.

Note: The NESC does not require ice load be included in the supporting structure. (Ice on conductors and shield wire only, and NU will provide these loads).

e) Mast reaction loads shall be evaluated for local effects on the transmission structure members at the attachment points.

If the electric transmission structure is not sufficient to support the additional loadings of the wireless communication mast, reinforcement will be required to upgrade the strength of the overstressed members. Any reinforcement design will be reviewed by NU TL&CE to determine the feasibility of construction and its impact on the use of the structure as a transmission structure.

3) STEP 3 -The Foundation analysis and evaluation shall be performed in accordance with NU requirements (OTRM 051 and this standard).
   a) The Foundation supporting the wireless communication antennas shall be evaluated for stability analysis per OTRM 051.
   b) Existing foundations are exempt from evaluation if both of the following conditions are met:
      i) Original foundations reactions are available, and the new imposed reactions are equal or less than original design reaction; and
      ii) The foundation is observed to be structurally sound.
      iii) Foundation reactions shall be tabulated showing original design foundation reactions (if available) and new imposed foundation reaction loads. Additionally, present differential reaction loads need to be provided.
   c) Foundation calculations shall be performed in a "MathCAD" worksheet unless otherwise approved by NU.
   d) Direct embedded steel poles:
      i) Embedment depths should be provided in existing design drawings. If embedment depth is not indicated on design drawings, contact TL&CE.
   e) Soil Boring
      i) Soil boring information will be provided by NU if available.
      ii) If soil boring report is unavailable:
         (i) The Wireless Communication Carrier's consulting engineer shall coordinate with NU for Soil Boring exploration.
         (ii) Soil properties may be assumed (with NU acceptance) where soil boring or soil report information is not available. Typically assumed values are:
            - Soil unit weight (dry) - 100 pcf
            - Rock unit weight (dry) - 160 pcf
            - Soil angle of internal friction - 30 degrees
            - Rock shear failure angle - 30 degrees (to vertical plane)
            - Ultimate soil bearing capacity – 9,000 psf
            - Ultimate bond stress for grout bonded to rock - 120 psi to 150 psi
            - Water table - must be determined if not available
            - Ultimate rock bearing capacity – 80,000 psf
            - Ultimate rock subgrade modulus – 8,800,000 pcf

F. Weather Conditions

1) Extreme Weather Conditions are considered:

a) An extreme wind (hurricane) based upon a 50-year recurrence (2% annual probability). Refer to OTRM 060 for NESC Extreme Wind Design Zones (NESC Rule 250C)

b) Winter conditions combining wind and ice loadings (NESC Heavy Rule 250B).

c) For structures installed 2007 or later, Combined Extreme Ice and Wind Loadings (NESC Rule 250D).

5. Analysis Requirements for Modifications of Existing Wireless Communication Facilities

A. If a telecommunication carrier proposes changes to the carrier's aerial equipment installed on NU transmission structures, no re-analysis of the structure is required if all of the following condition are met:

1) The loads imposed by the proposed installation (i.e. wind and dead load and number of antennas and their center locations) are equal to or less than the loads imposed by the existing installation, as specified in the original report and construction documents.

2) The number and size of coaxial cables in the proposed installation are equal or less than the number and size of cables in the existing installation, and the arrangement of the cables in the proposed installation produces loads which are equal to or less than the loads from the existing installation, as specified in original report and construction documents.

3) Existing mast and mast mount brackets were installed as specified in the original report and construction documents and the proposed installation will not modify the existing mast and mast mount brackets.

4) Should the structural analysis with the antenna loads demonstrate that the existing tower fails to meet the applicable code, and then a recommendation should be submitted for strengthening the tower.

5) Should the structural analysis with no antenna load reveal a significant structural performance issue which degrades the transmission structure function, then Transmission Line & Civil Engineering Group (TL&CE) shall be informed.

B. The telecommunication carrier's engineer shall provide a letter to NU signed and sealed by a P.E. registered in the state where the project resides, along with documentation demonstrating that the above criteria has been met. (See Section 5.C if the above conditions are not met.)

C. If the above conditions are not met, the modification shall be treated as a new installation and a new analysis and/or design which meets the requirements specified in Section 4, utilizing wire loads provided by NU, will be required.

6. Submittal Requirements

A. All submittals shall comply with M7-EN-3016.

B. All Structural Reports, Calculations, Modification, and Construction Drawings shall be signed and sealed by a Professional Engineer. The engineer must be licensed in the state the project is located.

C. All submittals shall reference ownership as "Connecticut Light & Power" (CL&P). All references to standards, specifications, and requirements shall reference the Northeast Utilities Service Company (NUSCO).

1) Examples:
   a) CL&P Structure #XXXX
   b) NUSCO Drawing #XXXXX-XXXXX

D. The entire package, including the field information, photos, and equipment data sheets utilized for the preparation of the report shall be submitted at one time and must consist of all Reports, Drawings, Calculations, and Supporting Documentation. The package shall include:

1) Hard copies
   a) Original stamped documents as described in section 4.A.
      i) Modification and Construction drawings shall be bound and in 11" x 17" format, non-construction sketches used in the report may be 8.5" x 11" format.
      ii) All Structural Reports and Calculations must be submitted as a bound report.
   b) Calculations
      i) "PLS", "RISA Tower", "STAAD-3D", "RISA-3D", "L-Pile, or "M-FAD" input and output.
      ii) All calculations not included in one of the approved programs listed in Section 5.A must be supplied with formulae in a "MathCAD" worksheet(s).
         (i) No hand calculations are permitted.
         (ii) All formulas shall reference the code & article number.
         (iii) Calculations performed in a spreadsheet shall not be used without prior NU approval.
            1. The formula for each cell must be shown.
            2. The formula used must be associated with the applicable code name and list the code section/reference number
      iii) Foundation Calculations and Evaluations.
   c) Supporting Documentation
      i) Reduced size of existing drawings provided for the analysis as well as any field information that was obtained, including photographs.
      ii) All equipment cut sheets
2) Electronic copy on CD
   a) The CD shall include all files in the original format used to conduct the analysis.
      i) "RISA Tower", "STAAD-3D" or "RISA-3D" input and output files, "MathCAD", "L-Pile","M-FAD", "PLS", and "AutoCAD" files must be included.
      ii) Backup (.bak) or executable files are also required where applicable.
   b) The CD shall include a PDF version of all submitted documents listed above, excluding photographs, which shall be in JPG format.

E. The analysis, design & construction documents then shall be submitted to NU TL&CE for review and approval. Incomplete packages will be returned.

7. <u>Deviations</u>

This standard sets forth the current NU 'best practices' for most applications of this subject matter. Therefore, deviation from this standard is generally not permitted. However, in unique instances a user may submit a written deviation request including justification to the listed Subject Matter Expert (SME). The SME must approve or deny the request in writing prior to the user commencing any non-standard activities. The SME may consult with his/her supervisor, co-SME if any and co-SME supervisor, and subsequently must copy any approval to them.

8. Cognizant Engineering Group

Manager Transmission Line & Civil Engineering - (CT/WMA)

Refer to Master Standards List (MSL) for the names of the current approving manager(s) and SME(s).

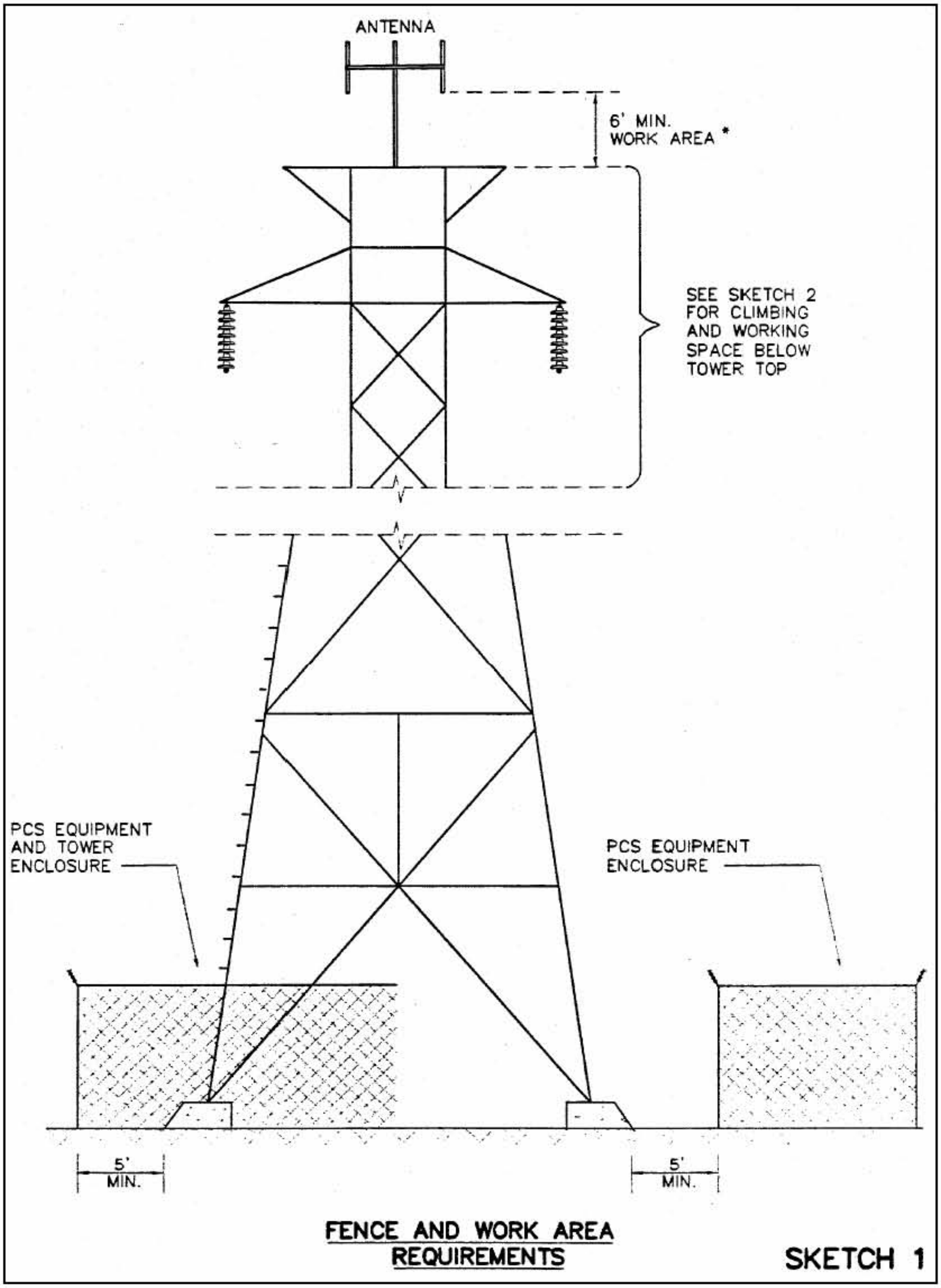
Revision History

Rev. 0 – Original Issue as OTRM 059 on 11/17/09) Split into OTRM 059.1 (CT Only) and OTRM 059.2 (WMA Only). Revised original Attachment A . Updated Section 4.C, 4.E.2, and 5.C. 04/16/2013
Rev. 1 – Updated Section 4.E. assumed soil property values. 03/12/2014

Attachment A

Condition		Attachment A NU Design Criteria	Basic Wind Speed	Pressure	Height factor	Gust Factor	Load or Stress Factor	Force Coef. - Shape Factor
			V (MPH)	Q (PSF)	Kz	Gh		
Ice Condition	TIA/EIA	Antenna Mount	TIA	TIA (0.75Wi)	TIA	TIA	TIA, Section 3.1.1.1 disallowed for connection design	TIA
Ice Condition	NESC Heavy	Tower/Pole Analysis with antennas extending above top of Tower/Pole (Yield Stress)	___	4	1	1	2.50	1.6 Flat Surfaces 1.3 Round Surfaces
Ice Condition	NESC Heavy	Tower/Pole Analysis with antennas below top of Tower/Pole (on two faces)	___	4	1	1	2.50	1.6 Flat Surfaces 1.3 Round Surfaces
Ice Condition	NESC Heavy	Conductors:	Conductor Loads Provided by NU					
High Wind Condition	TIA/EIA	Antenna Mount	85	TIA	TIA	TIA	TIA, Section 3.1.1.1 disallowed for connection design	TIA
High Wind Condition	NESC Extreme Wind	Tower/Pole Analysis with antennas extending above top of Tower/Pole	For wind speed use OTRM 060 Map 1, Rule 250C: Extreme Wind Loading Apply a 1.25 X Gust Response Factor to all telecommunication equipment projected above top of tower/pole and apply a 1.0 x Gust Response Factor to the tower/pole structure					1.6 Flat Surfaces 1.3 Round Surfaces
High Wind Condition	NESC Extreme Wind	Tower/Pole Analysis with antennas below top of Tower/Pole	For wind speed use OTRM 060 Map 1, Rule 250C: Extreme Wind Loading Height above ground is based on overall height to top of tower/pole					1.6 Flat Surfaces 1.3 Round Surfaces
High Wind Condition	NESC Extreme Wind	Conductors:	Conductor Loads Provided by NU					
NESC Extreme Ice with Wind Condition *		Tower/Pole Analysis with antennas extending above top of Tower/Pole	For wind speed use OTRM 060 Map 1, Rule 250D: Extreme Ice with Wind Loading 4 PSF Wind Load 1.25 X Gust Response Factor Apply a 1.25 X Gust Response Factor to all telecommunication equipment projected above top of tower/pole and apply a 1.0 x Gust Response Factor to the tower/pole structure					1.6 Flat Surfaces 1.3 Round Surfaces
NESC Extreme Ice with Wind Condition *		Tower/Pole Analysis with antennas below top of Tower/Pole	For wind speed use OTRM 060 Map 1, Rule 250D: Extreme Ice with Wind Loading 4 PSF Wind Load Height above ground is based on overall height to top of tower/pole					1.6 Flat Surfaces 1.3 Round Surfaces
NESC Extreme Ice with Wind Condition *		Conductors:	Conductor Loads Provided by NU					
		* Only for structures installed after 2007						

Attachment B
Fence and Work Area Requirements

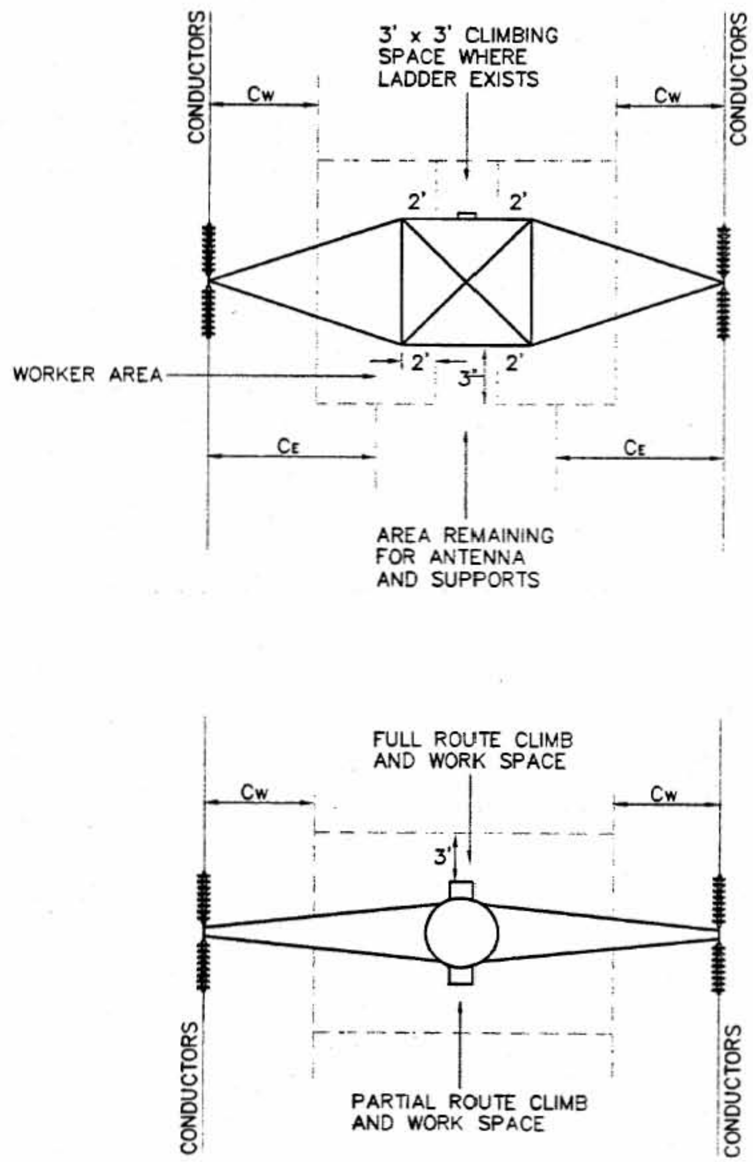


Attachment C
Climbing and Working Spaces

NOMINAL VOLTAGE

	115kV	345kV
WORK Cw *	6.0'	8.5'
ELECTRIC CE	8.0'	12.0'

* QUALIFIED WORKER



CLIMBING AND WORKING SPACES
STEEL LATTICE TOWERS
STEEL AND WOOD POLES

SKETCH 2

Network Modernization RFDS v3.0

T-Mobile

Site ID	**CT11356C**	**Latitude**	41.12576
		Longitude	-73.43270
Site Name	CT356/CL&P Tower - Rt.123	**Site Type**	Structure (Non-Building)
Address	2 Willruss Street Pole #1102 Line # 1880, Norwalk, CT, 06850	**Site Class**	Monopole
Market	Connecticut	**Landlord**	CLNP

Configuration

704Bu

Approvals	
Market RF	
Market Development	

RFDS Revision	
RFDS Final	

Date

Work Order #	

NOC# (888) 218-6664

Site Information

Existing 1	Existing 2	Existing 3	Existing 4	Cabinet #	Proposed 1	Proposed 2	Proposed 3	Proposed 4
UMTS	GSM/UMTS/LTE			Technology	UMTS	GSM/UMTS/LTE		
3106	6102			Cabinet type	3106	6102		
				CBU				
	2			DUW30		2		
	1			DUL20				
	1			DUG20		1		
				DUS31/41		1		
				RBS6601				
				dTRU/TRX				
				RU22 B4				
	6			RUS01 B2		6		
	6			RUS01 B4		6		
				RUS02 B2				

- [ ] Relocate cabinet
- [ ] Add cabinet
- [ ] Swap cabinet
- [ ] Remove cabinet
- [ ] Make cabinet dark

Scope of Work

Swap DUL20 with DUS41 and Add XMU.

ALPHA - Scope of Work

- [ ] Add new mount
- [ ] Relocate antenna
- [ ] Add antenna
- [x] Swap antenna
- [ ] Remove antenna
- [ ] Add TMA
- [ ] Swap TMA
- [x] Remove TMA
- [x] Add RRU
- [ ] Swap existing RRU
- [ ] Remove RRU
- [x] Consolidate coax cables
- [ ] Add coax cables
- [ ] Add fiber cables
- [ ] Add hybrid combiner
- [ ] Add filter combiner

Swap existing B4 quad with a 4ft passive B12 antenna and move B4.Add RRUS on ground.Consolidate coax.Add smart Bias-T.remove existing TMA's.daisy chain RETS and add homerun cable.

BETA - Scope of Work

- [ ] Add new mount
- [ ] Relocate antenna
- [ ] Add antenna
- [x] Swap antenna
- [ ] Remove antenna
- [ ] Add TMA
- [ ] Swap TMA
- [x] Remove TMA
- [x] Add RRU
- [ ] Swap existing RRU
- [ ] Remove RRU
- [x] Consolidate coax cables
- [ ] Add coax cables
- [ ] Add fiber cables
- [ ] Add hybrid combiner
- [ ] Add filter combiner

Swap existing B4 quad with a 4ft passive B12 antenna and move B4.Add RRUS on ground.Consolidate coax.Add smart Bias-T.remove existing TMA's.daisy chain RETS and add homerun cable.

GAMMA - Scope of Work

- [ ] Add new mount
- [ ] Relocate antenna
- [ ] Add antenna
- [x] Swap antenna
- [ ] Remove antenna
- [ ] Add TMA
- [ ] Swap TMA
- [x] Remove TMA
- [x] Add RRU
- [ ] Swap existing RRU
- [ ] Remove RRU
- [x] Consolidate coax cables
- [ ] Add coax cables
- [ ] Add fiber cables
- [ ] Add hybrid combiner
- [ ] Add filter combiner

Swap existing B4 quad with a 4ft passive B12 antenna and move B4.Add RRUS on ground.Consolidate coax.Add smart Bias-T.remove existing TMA's.daisy chain RETS and add homerun cable.

DELTA - Scope of Work

- [ ] Add new mount
- [ ] Relocate antenna
- [ ] Add antenna
- [ ] Swap antenna
- [ ] Remove antenna
- [ ] Add TMA
- [ ] Swap TMA
- [ ] Remove TMA
- [ ] Add RRU
- [ ] Swap existing RRU
- [ ] Remove RRU
- [ ] Consolidate coax cables
- [ ] Add coax cables
- [ ] Add fiber cables
- [ ] Add hybrid combiner
- [ ] Add filter combiner

Network Modernization RFDS v3.0

Site ID	**CT11356C**	**Latitude**	41.12576
		Longitude	-73.43270
Site Name	CT356/CL&P Tower - Rt.123	**Site Type**	Structure (Non-Building)
Address	2 Willruss Street Pole #1102 Line # 1880, Norwalk, CT, 06850	**Site Class**	Monopole
Market	Connecticut	**Landlord**	CLNP

Configuration
704Bu

Approvals	
Market RF	
Market Development	

RFDS Revision	
RFDS Final	

Date

ALPHA (view from behind)

	Existing 1		Existing 2		Existing 3	Existing 4	Proposed 1		Proposed 2		Proposed 3	Proposed 4
Mount	X		X				X		X			
Technology	GSM/UMTS		UMTS/LTE				GSM/UMTS	UMTS/LT	LTE			
Band	B2		B4				B2	B4	B12			
Active/Passive	P		P				P	P	P			
Ant. Type	Quad pole		Quad pole				Quad pole		Dualpole			
Ant. Model	APX16PV_16PVL		APX16DWV-16DWVS				APX16PV_16PVL		LNX-6512DS-VTM			
Ant. Vendor	RFS		RFS				RFS		Commscope			
Ant. Height	114		114				114		114			
Azimuth	45		45				45		45			
RET deployed	Yes		Yes				Yes	Yes	Yes			
E-Tilt	3		3				3	3	2			
M-Tilt	0		0				0	0	0			
TMA #	2											
TMA Type	d B2											
RRU #									1			
RRU Type									S11 B12			
Used Coax #	2	2	2				2	2	2			
Coax Type	1-1/4"	1-1/4"	1-1/4"				1-1/4"	1-1/4"	1-1/4"			
Coax Length (ft)	170		170				170		170			
Fiber (CPRI) #												
Splitter #												
Combiner #												
Combiner Type												

	Add new mount	x	Add RRU
	Relocate antenna		Swap existing RRU
	Add antenna		Remove RRU
x	Swap antenna	x	Consolidate coax cables
	Remove antenna		Add coax cables
	Add TMA		Add fiber cables
	Swap TMA		Add hybrid combiner
x	Remove TMA		Add filter combiner

Scope of work

Swap existing B4 quad with a 4ft passive B12 antenna and move B4.Add RRUS on ground.Consolidate coax.Add smart Bias-T.remove existing TMA's.daisy chain RETS and add homerun cable.

BETA (view from behind)

	Existing 1		Existing 2		Existing 3	Existing 4	Proposed 1		Proposed 2		Proposed 3	Proposed 4
Mount	X		X				X		X			
Technology	GSM/UMTS		UMTS/LTE				GSM/UMTS	UMTS/LT	LTE			
Band	B2		B4				B2	B4	B12			
Active/Passive	P		P				P	P	P			
Ant. Type	Quad pole		Quad pole				Quad pole		Dualpole			
Ant. Model	APX16PV_16PVL		APX16DWV-16DWVS				APX16PV_16PVL		LNX-6512DS-VTM			
Ant. Vendor	RFS		RFS				RFS		Commscope			
Ant. Height	114		114				114		114			
Azimuth	165		165				165		165			
RET deployed	Yes		Yes				Yes	Yes	Yes			
E-Tilt	4		4				4	4	2			
M-Tilt	0		0				0	0	0			
TMA #	2											
TMA Type	d B2											
RRU #									1			
RRU Type									S11 B12			
Used Coax #	2	2	2				2	2	2			
Coax Type	1-1/4"	1-1/4"	1-1/4"				1-1/4"	1-1/4"	1-1/4"			
Coax Length (ft)	170		170				170		170			
Fiber (CPRI) #												
Splitter #												
Combiner #												
Combiner Type												

	Add new mount	x	Add RRU
	Relocate antenna		Swap existing RRU
	Add antenna		Remove RRU
x	Swap antenna	x	Consolidate coax cables
	Remove antenna		Add coax cables
	Add TMA		Add fiber cables
	Swap TMA		Add hybrid combiner
x	Remove TMA		Add filter combiner

Scope of work

Swap existing B4 quad with a 4ft passive B12 antenna and move B4.Add RRUS on ground.Consolidate coax.Add smart Bias-T.remove existing TMA's.daisy chain RETS and add homerun cable.

Network Modernization RFDS v3.0

T-Mobile

Site ID	CT11356C	**Latitude**	41.12576
		Longitude	-73.43270
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Address	2 Willruss Street Pole #1102 Line # 1880, Norwalk, CT, 06850	**Site Class**	Monopole
Market	Connecticut	**Landlord**	CLNP

Configuration

704Bu

Approvals	
Market RF	
Market Development	

RFDS Revision	
RFDS Final	

Date

GAMMA (view from behind)

Existing Configuration / Proposed Configuration

	Existing 1	Existing 2	Existing 3	Existing 4		Proposed 1	Proposed 2	Proposed 3	Proposed 4
	X	X				X	X		
	GSM/UMTS	UMTS/LTE			Technology	GSM/UMTS / UMTS/LT	LTE		
	B2	B4			Band	B2 / B4	B12		
	P	P			Active/Passive	P / P	P		
	Quad pole	Quad pole			Ant. Type	Quad pole	Dualpole		
	APX16PV_16PVL	APX16DWV-16DWVS			Ant. Model	APX16PV_16PVL	LNX-6512DS-VTM		
	RFS	RFS			Ant. Vendor	RFS	Commscope		
	114	114			Ant. Height	114	114		
	285	285			Azimuth	285	285		
	Yes	Yes			RET deployed	Yes / Yes	Yes		
	1	1			E-Tilt	1 / 1	2		
	0	0			M-Tilt	0 / 0	0		
	2				TMA #				
	d B2				TMA Type				
					RRU #		1		
					RRU Type		S11 B12		
	2 / 2	2			Used Coax #	2 / 2	2		
	1-1/4" / 1-1/4"	1-1/4"			Coax Type	1-1/4" / 1-1/4"	1-1/4"		
	170	170			Coax Length (ft)	170	170		
					Fiber (CPRI) #				
					Splitter #				
					Combiner #				
					Combiner Type				

[ ]	Add new mount	[x]	Add RRU
[ ]	Relocate antenna	[ ]	Swap existing RRU
[ ]	Add antenna	[ ]	Remove RRU
[x]	Swap antenna	[x]	Consolidate coax cables
[ ]	Remove antenna	[ ]	Add coax cables
[ ]	Add TMA	[ ]	Add fiber cables
[ ]	Swap TMA	[ ]	Add hybrid combiner
[x]	Remove TMA	[ ]	Add filter combiner

Scope of work

Swap existing B4 quad with a 4ft passive B12 antenna and move B4.Add RRUS on ground.Consolidate coax.Add smart Bias-T.remove existing TMA's.daisy chain RETS and add homerun cable.

DELTA (view from behind)

Existing Configuration / Proposed Configuration

	Existing 1	Existing 2	Existing 3	Existing 4		Proposed 1	Proposed 2	Proposed 3	Proposed 4
					Technology				
					Band				
					Active/Passive				
					Ant. Type				
					Ant. Model				
					Ant. Vendor				
					Ant. Height				
					Azimuth				
					RET deployed				
					E-Tilt				
					M-Tilt				
					TMA #				
					TMA Type				
					RRU #				
					RRU Type				
					Used Coax #				
					Coax Type				
					Coax Length (ft)				
					Fiber (CPRI) #				
					Splitter #				
					Combiner #				
					Combiner Type				

[ ]	Add new mount	[ ]	Add RRU
[ ]	Relocate antenna	[ ]	Swap existing RRU
[ ]	Add antenna	[ ]	Remove RRU
[ ]	Swap antenna	[ ]	Consolidate coax cables
[ ]	Remove antenna	[ ]	Add coax cables
[ ]	Add TMA	[ ]	Add fiber cables
[ ]	Swap TMA	[ ]	Add hybrid combiner
[ ]	Remove TMA	[ ]	Add filter combiner

Scope of work

TT19-08BP111-001 TMA Twin 1900 with 850 Bypass 12 dB AISG 1.1

ELECTRICAL SPECIFICATIONS	
UL Frequency Range (MHz)	1850-1910 with 824-894 bypass
UL Rejection	>77 dB
UL Gain(dB)	12
UL Return Loss	>18
UL Noise Figure	<1.7 dB, Typical
UL Output 3rd Order Intercept Point(dBm)	>+23
UL Bypass Loss(dB)	2.5, Typical
UL Max Input Power (dBm)	+14 dBm
DL Frequency Range (MHz)	1930-1990 with 824-894 bypass
DL Return Loss	>18
DL Insertion Loss (dB)	850 MHz, <0.3; 1900 MHz, <0.5
Intermodulation	@ 2 x +43 dBm TX carriers, in receive band, <160 dBc, reffered to antenna port
Input Voltage (V)	AISG Mode: 10-30; Current alarm mode: 8 -17
Alarm Functionality	AISG compatible or in case of no AISG command received, current alarm mode 170-190 mA
Power Consumption	<1.1W @12V
Power Handling, RMS	850: >57 dBm; 1900: >55 dBm
AISG Compatibility	AISG 1.1 fully upgreadable to AISG 2.0 (AISG version only dependent on loaded SW version) TT19-08BP112-001 has AISG 2.0 loaded from factory

MECHANICAL SPECIFICATIONS	
Dimension HxWxD mm(ft)	250x169x137 mm (9.9”x6.7”x5.4”)
Weight(lbs)	<16
Colors	Off white (NCS 1502-R)
RF Connectors	DIN 7/16 female, long neck
Mounting Kit	Mounting kit for pole and wall is included

ENVIRONMENTAL SPECIFICATIONS	
Temperature Range	-40° C to +65° C (-40° F to +149° F)
Operational	ETS 300 019-1-4
Transportation	ETS 300 019-1-2
Storage	ETS 300 019-1-1
Lightning Protection	3 kA 10/350 μs; 20 kA (Shield)
Housing	Aluminum
MTBF	>1 million hours per TMA
Ingress Protection	IP65 and IP68

APPROVAL AND TESTS	
Safety	EN60950
EMC	3GPP: TS 25.113

*All specifications subject to change without notice. Contact your Powerwave representative for complete performance data.

TTAW-07BP111-001 TMA Twin Dual Band AWS with 700 Bypass 13 dB AISG

ELECTRICAL SPECIFICATIONS*	
UL Frequency Range (MHz)	1710-1770 with 698-746 bypass
UL Rejection	>80 dB TX rejection, >25 dB rejection at 1700 and 1800 MHz
UL Gain (dB)	13
UL Return Loss	>18 dB
UL Noise Figure	<1.6 dB
UL Output 3rd Order Intercept Point (dBm)	>+23 (Input IP3 >+11)
UL Bypass Loss (dB)	<1.9
UL Max Input Power (dBm)	+14 dBm
DL Frequency Range (MHz)	2110-2170 with 698-746 bypass
DL Return Loss	>18 dB
DL Insertion Loss (dB)	<0.4
Intermodulation	<-155 dBc (2x43 dBm TX)
Input Voltage (V)	8.0-30V (AISG Mode 10-30V; Current Alarm Mode 8-17)
Alarm Functionality	AISG compatible or in case of no AISG command received, current alarm mode 170-190 mA
Power Consumption	<1.5 W
Power Handling, RMS	700: 500 W; AWS 300W
AISG Compatibility	AISG 1.1 fully upgreadable to AISG 2.0 (AISG version only depended on loaded SW version) TTAW-07BP112-001 has AISG 2.0 loaded from factory

MECHANICAL SPECIFICATIONS*	
Dimensions HxWxD mm(ft)	250x169x139 (9.9”x6.7”x5.4”)
Weight (lbs)	<18 (<8 kg)
Colors	Off white (NCS 1502-R)
RF Connectors	Female 7/16 DIN, long neck
Mounting Kit	Mounting kit for pole and wall is included

ENVIRONMENTAL SPECIFICATIONS*	
Temperature Range	-40 to +65°C
Operational	ETS 300 019-1-4
Transportation	ETS 300 019-1-2
Storage	ETS 300 019-1-1
Lightning Protection	IEC 61312-1: 2 kA 8/20 µs, 3 kA 10/350 µs
Housing	Aluminium
MTBF	>1 million hours
Ingress Protection	IP67 minimum

APPROVALS AND TESTS*	
Safety	UL 60950; UL 1950, TUV
EMC	FCC part 15

*All specifications subject to change without notice. Please contact your Powerwave representative for complete performance data.

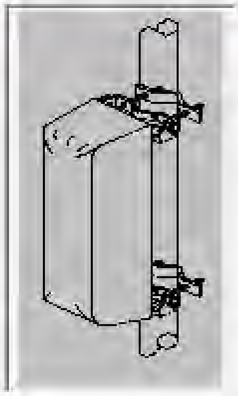
Appurtenance Section

US Name

APX16PV-16PVL

SI Name

APX16PV-16PVL



OK

Cancel

Help

Type

- Generic
- Flat Panel
- Triagonal (LPD)
- Cylindrical (Omni)

Height 53 in

Width 12.9 in

Depth 3.1 in

Weight 0.0396 K

Mount

- 2" Pipe
- 2 1/2" Pipe
- 3" Pipe
- 3 1/2" Pipe

Length 0 in

		No Ice	1/2" Ice	1" Ice	2" Ice	4" Ice
Weight	K	0.04	0.070646	0.106359	0.192562	0.429523
CaAa (Front)	ft^2	6.647083	7.078534	7.518627	8.424738	10.340664
CaAa (Side)	ft^2	1.981366	2.304437	2.634915	3.318094	4.782793

KMW Communications

Base Station Antennas

For Mobile Communications

AM-X-CD-14-65-00T-RET (4' 65˚ Dual Broadband Antenna)

Dual Band Electrical DownTilt Antenna

698 ~ 894MHz, X-pol., H65˚ / V17.0˚

1710 ~ 2170MHz, X-pol., H65˚ / V8.5˚

Electrical Specification

Frequency Range		698~894MHz	1710~2170MHz
Impedance		50Ω	
Polarization		Dual, Slant ±45˚	
Gain		14.0dBi / 11.85dBd @ 698-806MHz 14.8dBi / 12.65dBd @ 824-894MHz	16.1dBi / 13.95dBd @1710-1755MHz 16.3dBi / 14.15dBd @1850-1900MHz 16.0dBi / 13.85dBd @2110-2155MHz
Beamwidth	Horizontal	67˚ @ 698-806MHz 65˚ @ 824-894MHz	60˚ @ 1710-1755MHz 61˚ @ 1850-1900MHz 64˚ @ 2110-2155MHz
	Vertical	17.5 @ 698-806MHz 16.5˚ @ 824-894MHz	8.8˚ @ 1710-1755MHz 8.5˚ @ 1850-1900MHz 8.0˚ @ 2110-2155MHz
VSWR		≤1.5:1	
Front-to-Back Ratio		≥28 dB	
Electrical Downtilt Range		2˚ ~ 16˚	0˚ ~ 10˚
Isolation Between Ports		≥30 dB	
Isolation Between Ports of Different Frequency Elements		≥35 dB	
Cross Pole Discrimination		10.0 dB @ ±60˚ 15.0 dBi @ 0˚	
First Upper Side Lobe Suppression		16dB	
Side Lobe Suppression		> 16 dB @ 0-6˚ Tilt > 18 dB @ 7-12˚ Tilt (Up to 15˚ from Boresight)	> 16 dB @ 0-6˚ Tilt > 18 dB @ 7-10˚ Tilt (Up to 15˚ from Boresight)
Passive Intermodulation		≤ -150 dBc @ 2x20w	
Input Maximum CW Power		500 W	300 W
Environmental Compliance		IP65 for Radome IP67 for Connectors	
RET Motor Configuration		Field Replaceable RET Electronic Control Module / RET Motor is internal to antenna & not field replaceable	
Compliant with AISG 1.1 and 2.0		AISG 1.1 and 2.0	

Mechanical Specification

Dimension (W×D×H)	11.8×5.9×48 inches (300×150×1219mm)
Weight (Without clamp)	36.4 lbs (16.5 kg)
Connector	4 x 7/16 DIN(F), Long Neck
Max Wind Speed	150 mph
Wind Load (@150 mph)	1260 N

Smart Bias Tee Specs

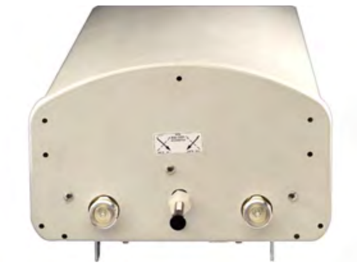
Dimensions

Width	94.0 mm | 3.7 in
Depth	50.0 mm | 2.0 in
Height	143.00 mm | 5.63 in
Net Weight	0.8 kg | 1.8 lb

* This is not the exact Bias tee but the dimensions can be used fro scoping.

T · · Mobile ·

Product Specifications



LNX-6512DS-VTM

Andrew® Antenna, 698–896 MHz, 65° horizontal beamwidth, RET compatible

- Excellent choice to maximize both coverage and capacity in suburban and rural applications
- Ideal choice for site collocations and tough zoning restrictions
- Extended elevation tilt for maximum flexibility in urban core areas
- Remote beam tilt management is an optional feature using Andrew's Teletilt® system
- The RF connectors are designed for IP67 rating and the radome for IP56 rating

Electrical Specifications

Frequency Band, MHz	698–806	806–896
Gain, dBi	14.1	15.0
Beamwidth, Horizontal, degrees	65	65
Beamwidth, Vertical, degrees	19.0	17.0
Beam Tilt, degrees	0–15	0–15
USLS, typical, dB	17	18
Front-to-Back Ratio at 180°, dB	28	28
CPR at Boresight, dB	12	12
CPR at Sector, dB	10	10
Isolation, dB	30	30
VSWR | Return Loss, dB	1.4 | 15.6	1.4 | 15.6
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153
Input Power per Port, maximum, watts	400	400
Polarization	±45°	±45°
Impedance	50 ohm	50 ohm

Electrical Specifications, BASTA*

Frequency Band, MHz	698–806	806–896
Beamwidth, Horizontal Tolerance, degrees	±3	±3

* CommScope® supports NGMN recommendations on Base Station Antenna Standards (BASTA). To learn more about the benefits of BASTA, download the whitepaper Time to Raise the Bar on BSAs.

General Specifications

Antenna Brand	Andrew®
Antenna Type	DualPol®
Band	Single band
Brand	DualPol® | Teletilt®
Operating Frequency Band	698 – 896 MHz
Performance Note	Outdoor usage

Mechanical Specifications

Color	Light gray
Lightning Protection	dc Ground
Radiator Material	Aluminum
Radome Material	Fiberglass, UV resistant
RF Connector Interface	7-16 DIN Female
RF Connector Location	Bottom

Product Specifications

LNX-6512DS-VTM

RF Connector Quantity, total	2
Wind Loading, maximum	379.8 N @ 150 km/h 85.4 lbf @ 150 km/h
Wind Speed, maximum	241 km/h | 150 mph

Dimensions

Depth	181.0 mm | 7.1 in
Length	1232.0 mm | 48.5 in
Width	301.0 mm | 11.9 in
Net Weight	13.0 kg | 28.7 lb

Remote Electrical Tilt (RET) Information

RET System	Teletilt®

Packed Dimensions

Depth	284.0 mm | 11.2 in
Length	1548.0 mm | 60.9 in
Width	411.0 mm | 16.2 in
Shipping Weight	29.5 kg | 65.0 lb

Regulatory Compliance/Certifications

Agency	Classification
RoHS 2011/65/EU	Compliant by Exemption
China RoHS SJ/T 11364-2006	Above Maximum Concentration Value (MCV)
ISO 9001:2008	Designed, manufactured and/or distributed under this quality management system

Included Products

DB380 — Pipe Mounting Kit for 2.4"-4.5" (60-115mm) OD round members on wide panel antennas. Includes 2 clamp sets and double nuts.

DB5083 — Downtilt Mounting Kit for 2.4"-4.5" (60 - 115 mm) OD round members. Includes a heavy-duty, galvanized steel downtilt mounting bracket assembly and associated hardware. This kit is compatible with the DB380 pipe mount kit for panel antennas that are equipped with two mounting brackets.

* Footnotes

Performance Note	Severe environmental conditions may degrade optimum performance

Dual Broadband Antenna

90° 1.4 m MET Antenna

806-960/1710-2170 MHz

Part Number: 7770.00	Horizontal Beamwidth: 90° Gain: 13.5/16 dBi	Electrical Downtilt: Adjustable Connector Type: 7/16 female

The Powerwave dual band dual polarized broadband antenna has individual adjustable electrical downtilt per band (upgradeable to Remote Electrical Tilt (RET). Four connector ports allow separate tilts on each frequency band and ensure the use of diversity concepts. The phase shifter technology, based on a patented sliding dielectric, minimizes intermodulation distortion and maximizes efficiency. The slant +/- 45° dual polarization system provides the independent fading signals needed for achieving top-quality coverage via diversity concepts. The Powerwave Broadband antenna design is based on a patented stacked aperture-coupled patch technology, which provides high isolation performance and a wide VSWR bandwidth. The antennas have superior radiation patterns due to a unique reflector design which provides a very small variation of the –3dB horizontal beam width over the frequency band as well as a high front-to-back ratio.

Key Benefits

- Excellent broad- and multi-band capabilities
- Polarization purity makes good diversity gain
- Excellent pattern performance and high gain over frequency
- High passive intermodulation performance
- Light, slim and robust design

Preliminary

Dual Broadband Antenna

806-960/1710-2170 MHz

Electrical Specifications (Preliminary)

Frequency band (MHz)	806-960		1710-2170
Gain, ± 0.5dB (dBi)	13.5		16.0
Polarization		Dual linear ±45°	
Nominal Impedance (Ohm)		50	
VSWR	1.5:1		
VSWR			1.5:1
Isolation between inputs (dB)	30		
Isolation between inputs (dB)			30
Inter band isolation (dB)		40	
Horizontal -3 dB beamwidth	85 ± 5°		85 ± 5°
Tracking, Horizontal plane, ±60° (dB)	<2.0		
Tracking, Horizontal plane, ±60° (dB)			<2.0
Electrical downtilt range (adjustable)	0° to 10°		0° to 8°
Vertical -3 dB beamwidth	14.3 ± 2.0°		6.6 ± 1°
Sidelobe suppression, Vertical 1 st upper (dB)	>17,16,15 x=0, 5, 10° MET		> 17, 16,15 x=0, 4, 8° MET
Vertical beam squint	<0.8°		<0.5°
First null-fill (dB)	<-25		<-25
Front-to-back ratio (dB)	>25		>27
Front-to-back ratio, total power (dB)	>20		>23
IM3, 2Tx@43dBm (dBc)	<-153		
IM3, 2Tx@43dBm (dBc)			<-153
IM7, 2Tx@43dBm (dBc)			<-160
Power Handling, Average per input (W)	400		250
Power Handling, Average total (W)	800		500

All specifications are subject to change without notice.
Contact your Powerwave representative for complete performance data.

Mechanical Specifications

Connector Type	4 x 7/16 DIN female
Connector Position	Bottom
Dimensions, HxWxD	1408mm x 280mm x 125mm (55”x11”x5”)
Weight Including Brackets	15.8 kg (35 lbs)
Wind Load, Frontal, 42m/s Cd=1	435N (98 lbf)
Survival Wind Speed (m/s)	70 (156mph)
Lightning Protection	DC grounded
Radome Material	GRP
Radome Color	Light Gray
Mounting	Pre-mounted Standard Brackets
Packing Size	1550mm x 355mm x 255mm (61”x14”x10”)

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Powerwave technologies

COVERAGE AND CAPACITY | TECHNOLOGY LEADERSHIP | GLOBAL PARTNER | INTEGRATED SOLUTIONS | QUALITY AND RELIABILITY

D031-08208 Rev A

Exhibit E