NORTHEAST SITE SOLUTIONS
Turnkey Wireless Development

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

February 7, 2017

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

RE: Notice of Exempt Modification
269 Flanders Road, East Lyme CT 06357
Latitude: 41.36210400
Longitude: -72.20698700
T-Mobile Site#: CT11039D_L700

Dear Ms. Bachman:

T-Mobile currently maintains two (2) antennas at the 92-foot level of the existing 85-foot transmission pole located at 269 Flanders Road, East Lyme CT. The electric transmission pole is owned by CL&P d/b/a Eversource. The property which holds the utility easment is owned by Chalet Susse Intntl, Inc. T-Mobile now intends to install three (3) new 700/1900/2100 MHz. The new antennas would be installed at the 92-foot level of the tower. T-Mobile also intends to make the following modifications.

Planned Modifications:

Remove: NONE

Remove and Replace:
(2) APX16DWV-16DWV-SE-A20 (Remove) - (2) Commscope SBNHH-1D65A (Replace)

Install New:
(1) Commscope SBNHH-1D65A
(3) Smart Bias-T
(10) 1-1/4” Coax

Existing to Remain: (8) 1-1/4” Coax

This facility was approved by the CT Siting Council. Petition No. 396 – Dated July 14, 1998. The petition was approved for Omnipoint to install two (2) antenna on the existing CL&P 90-foot monopole structure. Please see attached.

NORTHEAST SITE SOLUTIONS
Turnkey Wireless Development

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

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

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

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

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

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

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

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

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

Sincerely,

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

Attachments
cc: Mark C. Nickerson- First Selectman - as elected official
William Mulholland- Zoning Official
CL&P d/b/a Eversource - as tower owner
Chalet Sussie Intntl, Inc - property owner- **Utility Easement**

Exhibit A

Petition No. 530
AT&T Wireless PCS, LLC
East Lyme, Connecticut
Staff Report
November 28, 2001

On November 5, 2001, Connecticut Siting Council (Council) member Gerald J. Heffernan and Christina Lepage and Robert Mercier of the Council staff met with AT&T Wireless PCS, Inc. (AT&T) representatives Peter Carbone and Karen Couture on Flanders Road, East Lyme, Connecticut for inspection of an electric transmission structure. The property and structure is owned by Connecticut Light and Power Co. (CL&P). AT&T with the agreement of CL&P, proposes to modify the structure by installing antennas and associated equipment 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 the installation of six panel antennas on a pipe extension. The antennas would extend approximately 10-feet above the existing 98-foot transmission line monopole structure (# 6077). The height at the top of the antennas would be about 109-feet above ground level (AGL), with a centerline of 108-feet AGL.

Equipment cabinets will be located on a 12-foot by 20-foot concrete pad within a 16-foot by 33-foot compound with an 8-foot high stockade fence with 1-foot of barbed wire near to the base of the tower. Placement of the proposed equipment compound would be within a vegetated area adjacent to a cleared area. The proposed compound would require the removal of some vegetation. AT&T investigated the possible use of the cleared area as a location of the equipment compound and have determined that they can not use the cleared area because it is owned by the Department of Transportation (DOT). The DOT has refused AT&T request for a lease or easement over their land in similar proposals. An underground conduit from an existing utility pole will provide power and telephone service to the site. A gravel access drive will be constructed for direct access to the site.

The zoning designation of this site is Commercial (CA). AT&T identified that the surrounding landscape is comprised of transmission towers, high voltage lines, right-of-way, the railroad station, Interstate 95 and commercial uses. The nearest residence is 350 feet to the north.

The worst-case power density for the telecommunications operations at the site has been calculated to be 2.77% of the applicable standard for uncontrolled environments.

AT&T contends that the proposed modification of the structure would not cause a substantial adverse environmental impact and would prevent the construction of a new tower in the area. AT&T also states that the proposed facility would not be out of scale with the existing surrounding landscape.

Exhibit B

The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analyses.

1:5460
1"=455'

2/3/2017 12:55:39 PM

269 FLANDERS RD

Location	269 FLANDERS RD	**Mblu**	31.0/ 6-1/ / /
Acct#	008282	**Owner**	CHALET SUSSE INTNTL INC
Assessment	$593,250	**Appraisal**	$847,500
PID	6970	**Building Count**	1

Current Value

Appraisal			
Valuation Year	**Improvements**	**Land**	**Total**
2016	$0	$847,500	$847,500

Assessment			
Valuation Year	**Improvements**	**Land**	**Total**
2016	$0	$593,250	$593,250

Owner of Record

Owner CHALET SUSSE INTNTL INC
Co-Owner
Address PO BOX 657
ONE CHALET DR
WILTON, NH 03086

Sale Price $0
Certificate
Book & Page 306/ 431
Sale Date 07/08/1987

Ownership History

Ownership History
No Data for Ownership History

Building Information

Building 1 : Section 1

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

Building Attributes	
Field	**Description**

Style	Vacant Land
Model	
Grade:	
Stories:	
Occupancy	
Exterior Wall 1	
Exterior Wall 2	
Roof Structure:	
Roof Cover	
Interior Wall 1	
Interior Wall 2	
Interior Flr 1	
Interior Flr 2	
Heat Fuel	
Heat Type:	
AC Type:	
Total Bedrooms:	
Total Bthrms:	
Total Half Baths:	
Total Xtra Fixtrs:	
Total Rooms:	
Bath Style:	
Kitchen Style:	

Building Photo

(http://images.vgsi.com/photos2/EastLymeCTPhotos//\01\01\1

Building Layout

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

Extra Features

Extra Features	Legend
No Data for Extra Features	

Land

Land Use

Use Code 3900
Description DEVEL LAND
Zone CA
Neighborhood 0030
Alt Land Appr No
Category

Land Line Valuation

Size (Acres) 26.64
Frontage 0
Depth 0
Assessed Value $593,250
Appraised Value $847,500

Outbuildings

Outbuildings	Legend

No Data for Outbuildings

Valuation History

Appraisal			
Valuation Year	**Improvements**	**Land**	**Total**
2015	$0	$750,100	$750,100
2014	$0	$750,100	$750,100
2013	$0	$750,100	$750,100

Assessment			
Valuation Year	**Improvements**	**Land**	**Total**
2015	$0	$525,070	$525,070
2014	$0	$525,070	$525,070
2013	$0	$525,070	$525,070

Exhibit C

GENERAL NOTES

1. ALL MATERIALS FURNISHED AND INSTALLED SHALL BE IN STRICT ACCORDANCE WITH ALL APPLICABLE CODES, REGULATIONS, AND ORDINANCES. SUBCONTRACTORS SHALL ISSUE ALL APPROPRIATE NOTICES AND COMPLY WITH ALL LAWS, ORDINANCES, RULES, REGULATIONS, AND LAWFUL ORDERS OF ANY PUBLIC AUTHORITY REGARDING THE PERFORMANCE OF THE WORK.
2. ALL WORK CARRIED OUT SHALL COMPLY WITH ALL APPLICABLE MUNICIPAL AND UTILITY COMPANY SPECIFICATIONS AND LOCAL JURISDICTIONAL CODES, ORDINANCES AND APPLICABLE REGULATIONS.
3. UNLESS NOTED OTHERWISE, THE WORK SHALL INCLUDE FURNISHING MATERIALS, EQUIPMENT, APPURTENANCES, AND LABOR NECESSARY TO COMPLETE ALL INSTALLATIONS AS INDICATED ON THE DRAWINGS.
4. THE SUBCONTRACTOR SHALL INSTALL ALL EQUIPMENT AND MATERIALS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS UNLESS SPECIFICALLY STATED OTHERWISE.
5. IF THE SPECIFIED EQUIPMENT CANNOT BE INSTALLED AS SHOWN ON THESE DRAWINGS, THE SUBCONTRACTOR SHALL PROPOSE AN ALTERNATIVE INSTALLATION SPACE FOR APPROVAL BY THE CONTRACTOR.
6. THE SUBCONTRACTOR SHALL LEGALLY AND PROPERLY DISPOSE OF ALL SCRAP MATERIALS SUCH AS COAXIAL CABLES AND OTHER ITEMS REMOVED FROM THE EXISTING FACILITY. ANTENNAS REMOVED SHALL BE RETURNED TO THE OWNER'S DESIGNATED LOCATION.
7. THE SUBCONTRACTOR SHALL LEAVE PREMISES IN CLEAN CONDITION.
8. SUBCONTRACTOR SHALL VERIFY ALL EXISTING DIMENSIONS AND CONDITIONS PRIOR TO COMMENCING ANY WORK. ALL DIMENSIONS OF EXISTING CONSTRUCTION SHOWN ON THE DRAWING MUST BE VERIFIED. SUBCONTRACTOR SHALL NOTIFY THE CONTRACTOR OF ANY DISCREPANCIES PRIOR TO ORDERING MATERIAL OR PROCEEDING WITH CONSTRUCTION.
9. ALL SAFETY PRECAUTIONS MUCH BE TAKEN WHEN WORKING AROUND HIGH LEVELS OF ELECTROMAGNETIC RADIATION. EQUIPMENT SHOULD BE SHUTDOWN PRIOR TO PERFORMING ANY WORK THAT COULD EXPOSE THE WORKERS TO DANGER. PERSONAL RF EXPOSURE MONITORS ARE ADVISED TO BE WORN TO ALERT OF ANY DANGEROUS EXPOSURE LEVELS.

LOCATION MAP

DIRECTIONS

DIRECTIONS FROM BLOOMFIELD, CT:
GET ON I-91 S IN WINDSOR FROM CT-218 E, TAKE CT-2 E AND CT-11 S TO CT-82 E IN SALEM. TAKE EXIT 4 FROM CT-11 S, TAKE CT-85 S AND CT-161 S TO YOUR DESTINATION IN EAST LYME, TURN LEFT ONTO CT-82 E, AT THE TRAFFIC CIRCLE, TAKE THE 1ST EXIT ONTO CT-85 S, TURN RIGHT ONTO CT-161 S, TURN LEFT ONTO KING ARTHUR DR, TURN LEFT, DESTINATION WILL BE ON THE RIGHT.

T · · Mobile ·

2016 L700

T-MOBILE SITE NUMBER

CT11039D

85' UTILITY TOWER

SITE ADDRESS
269 FLANDERS RD. (EVERSOURCE TOWER #6076)
EAST LYME, CT 06357
RF CONFIG TYPE
1HP_704Bu

SITE SUMMARY

SITE TYPE:	EXISTING SITE OVERLAY
SITE ADDRESS:	269 FLANDERS RD. (EVERSOURCE TOWER #6076) EAST LYME, CT 06357
SITE LATITUDE: SITE LONGITUDE:	41° 21' 43.6" -72° 12' 25.1"
JURISDICTION:	TOWN OF EAST LYME
POWER COMPANY: TELEPHONE COMPANY:	EVERSOURCE LIGHTTOWER
TOWER OWNER/MANAGER:	CONNECTICUT LIGHT AND POWER 107 SELDEN ST BERLIN, CT 06037 1-860-947-2121
WIRELESS CARRIER:	T-MOBILE 35 GRIFFIN RD S BLOOMFIELD, CT 06002 OFFICE: 860-692-7100 FAX: 860-692-7159
ENGINEER:	SMW ENGINEERING GROUP N.C., PLLC 158 BUSINESS CENTER DRIVE BIRMINGHAM, AL 35244 CONTACT: ALVIN A. KRAFT, PE PHONE: 205-252-6985

APPROVALS

DEPARTMENT	NAME/SIGNATURE	DATE
DEVELOPMENT MANAGER		
PROPERTY/TOWER OWNER		
SITE ACQUISITION MANAGER		
CONSTRUCTION MANAGER		
RF ENGINEER		
OPERATIONS MANAGER		

SHEET INDEX

BUILDING CODES

ALL CONSTRUCTION SHALL COMPLY WITH THE LATEST EDITION OF THE (AS ADOPTED BY LOCAL JURISDICTION):

- 2016 CONNECTICUT BUILDING CODE
- 2012 INTERNATIONAL BUILDING CODE W/AMENDMENTS
- 2009 ICC/ANSI A117.1 W/AMENDMENTS
- 2012 INTERNATIONAL EXISTING BUILDING CODE W/AMENDMENTS
- 2012 INTERNATIONAL PLUMBING CODE WITH AMENDMENTS
- 2012 INTERNATIONAL MECHANICAL CODE W/AMENDMENTS
- 2012 INTERNATIONAL ENERGY CONSERVATION CODE W/AMENDMENTS
- 2014 NFPA 70, NATIONAL ELECTRICAL CODE W/AMENDMENTS
- 2012 INTERNATIONAL RESIDENTIAL CODE W/AMENDMENTS

HANDICAP REQUIREMENTS

FACILITY IS UNMANNED AND NOT FOR HUMAN HABITATION. HANDICAP ACCESS IS NOT REQUIRED.

PLUMBING REQUIREMENTS

FACILITY HAS NO SANITARY OR POTABLE WATER

CALL BEFORE YOU DIG

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

CONNECTICUT CALL BEFORE YOU DIG
STATE WIDE
1-800-922-4455 OR 811
HTTP://WWW.CBYD.COM/#

T · · Mobile ·

35 GRIFFIN RD S
BLOOMFIELD, CT 06002
OFFICE: 860-692-7100
FAX: 860-692-7159

PLANS PREPARED BY:

NSS NORTHEAST SITE SOLUTIONS
Turnkey Wireless Development
199 BRICKYARD RD
FARMINGTON, CT 06032

SMW ENGINEERING GROUP, INC.
TOGETHER PLANNING A BETTER TOMORROW

01/23/17

SITE INFORMATION:

CT11039D
269 FLANDERS RD.
(EVERSOURCE TOWER #6076)
EAST LYME, CT 06357

#	DATE	DESCRIPTION:
0	10/11/16	ISSUED FOR CLIENT REV.
1	10/24/16	ISSUED PER CLIENT COMMENT
2	11/15/16	REVISED PER CLIENT COMMENTS
3	01/23/17	REVISION 3

T-MOBILE SITE ID: CT11039D

SHEET NAME: TITLE SHEET

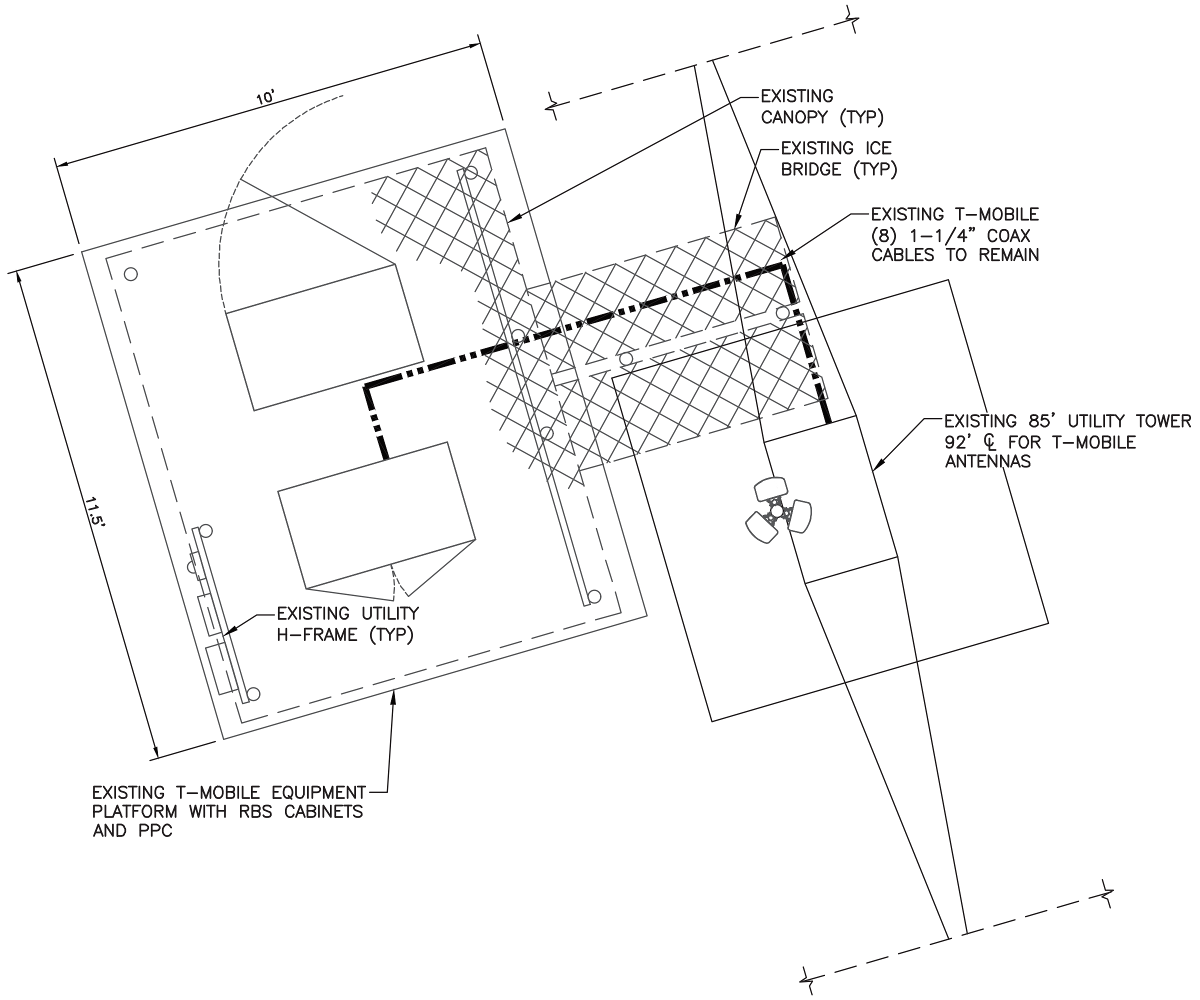
SMW #: 16-2081

DESIGNER:	ACR
CHECKED BY:	RTB
ENGINEER:	VGD

SHEET NUMBER: T-1

SITE NOTES:

1. DIGGING AND/OR TRENCHING INSIDE COMPOUND, MUST BE DONE BY HAND.
2. EXISTING SITE INFORMATION AND LAYOUT SHOWN REPRESENT INFORMATION OBTAINED FROM NSS & T-MOBILE.
3. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO FIELD VERIFY THE EXACT LOCATIONS OF EXISTING UTILITIES WHICH MAY CONFLICT WITH PROPOSED IMPROVEMENTS.
4. LOCATION OF UNDERGROUND UTILITIES WAS NOT PERFORMED.
5. THE ADEQUACY OF EXISTING SITE UTILITIES TO ACCOMMODATE NEW CO-LOCATION LOAD(S) WAS NOT VERIFIED.
6. ALL EXISTING VEGETATION AND IMPROVEMENTS SHOWN ARE TO REMAIN UNLESS OTHERWISE SHOWN IN THESE DRAWINGS.



N

0' 4' 8' 12'

1" = 4' (11"x17")

1 / C-1 EXISTING OVERALL SITE PLAN

T-Mobile

35 GRIFFIN RD S
BLOOMFIELD, CT 06002
OFFICE: 860-692-7100
FAX: 860-692-7159

PLANS PREPARED BY:

NSS NORTHEAST SITE SOLUTIONS
Turnkey Wireless Development
199 BRICKYARD RD
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269 FLANDERS RD.
(EVERSOURCE TOWER #6076)
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2	11/15/16	REVISED PER CLIENT COMMENTS
3	01/23/17	REVISION 3

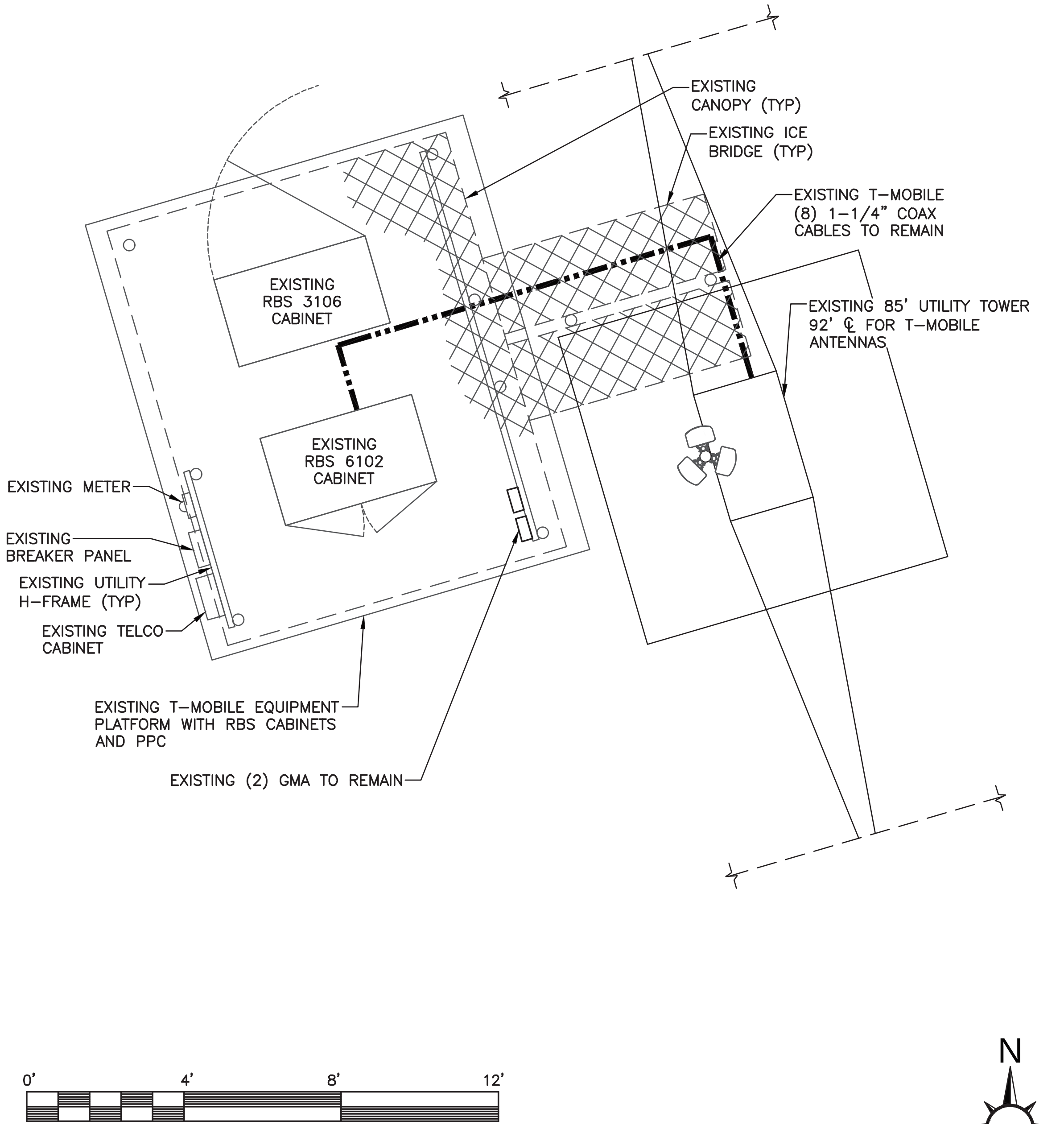
T-MOBILE SITE ID: CT11039D

SHEET NAME: OVERALL SITE PLAN

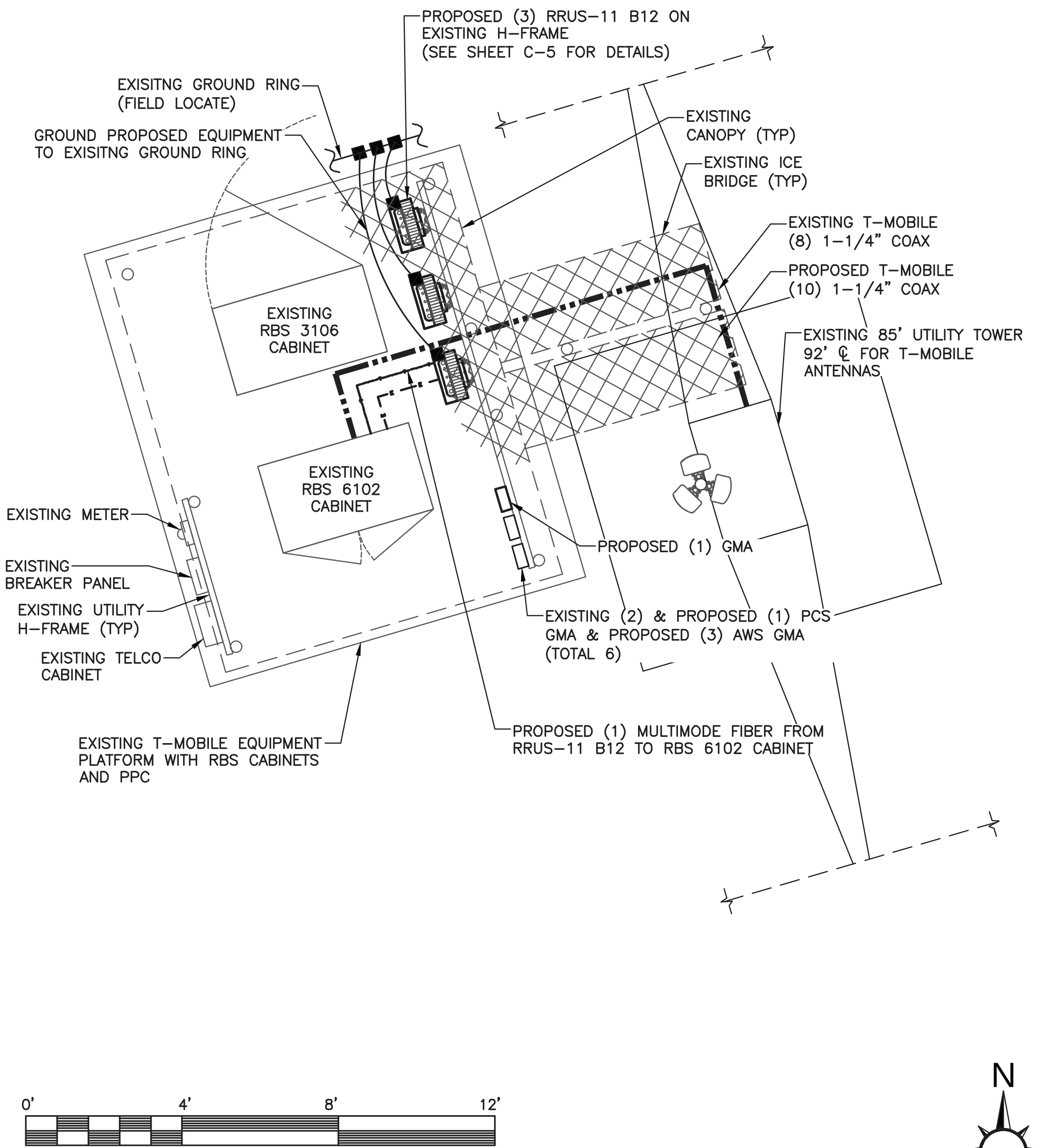
SMW #: 16-2081

SHEET NUMBER: C-1

DESIGNER:	ACR
CHECKED BY:	RTB
ENGINEER:	VGD



1 / C-2 EXISTING EQUIPMENT PLAN



2 / C-2 PROPOSED EQUIPMENT PLAN

T-Mobile
35 GRIFFIN RD S
BLOOMFIELD, CT 06002
OFFICE: 860-692-7100
FAX: 860-692-7159

PLANS PREPARED BY:
NSS NORTHEAST SITE SOLUTIONS
Turnkey Wireless Development
199 BRICKYARD RD
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SMW ENGINEERING GROUP, INC.
TOGETHER PLANNING A BETTER TOMORROW

01/23/17

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3	01/23/17	REVISION 3

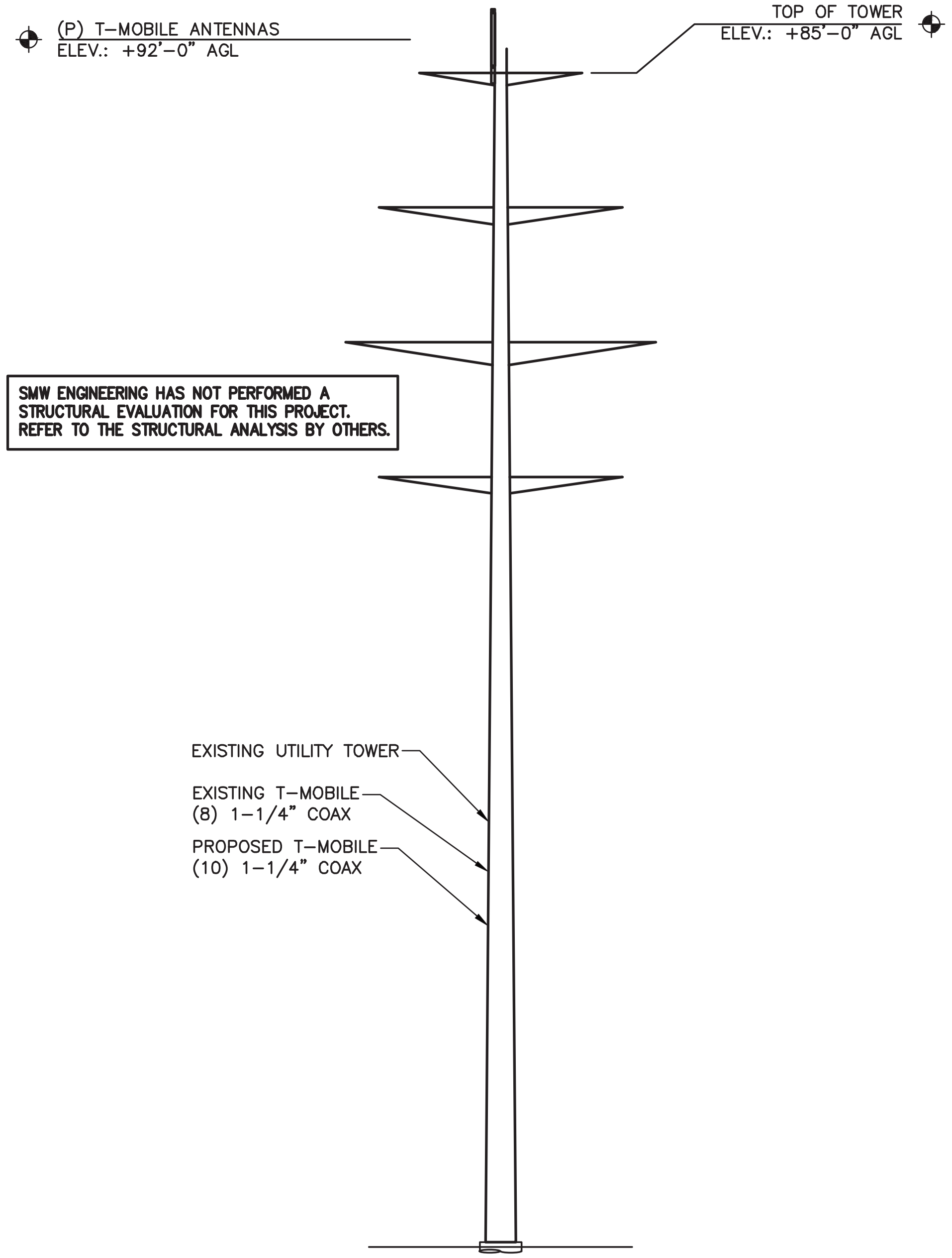
T-MOBILE SITE ID: CT11039D

SHEET NAME:
EQUIPMENT PLAN

SMW #: 16-2081

DESIGNER:	ACR
CHECKED BY:	RTB
ENGINEER:	VGD

SHEET NUMBER: C-2



SMW ENGINEERING HAS NOT PERFORMED A STRUCTURAL EVALUATION FOR THIS PROJECT. REFER TO THE STRUCTURAL ANALYSIS BY OTHERS.

STRUCTURAL NOTES:

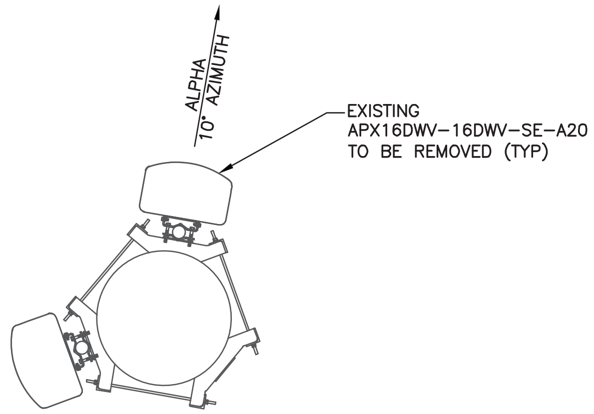
1. SMW HAS NOT PERFORMED A STRUCTURAL ANALYSIS OF THE EXISTING TOWER OR PROPOSED ANTENNA MOUNT. REFER TO STRUCTURAL ANALYSIS OR STRUCTURAL LETTER BY OTHERS FOR ADDITIONAL INFORMATION.
2. IF THE TOWER STRUCTURAL ANALYSIS SHOWS THE NEED FOR TOWER REINFORCEMENT REFER TO TOWER REINFORCEMENT DESIGN PRIOR TO THE INSTALLATION OF ANY PROPOSED EQUIPMENT.
3. REFER TO TOWER STRUCTURAL ANALYSIS FOR PROPOSED CABLE ROUTING AND ATTACHMENT DETAILS.
4. TOWER ELEVATION SHOWN IS NOT DRAWN TO SCALE AND IS INTENDED ONLY FOR REFERENCE PURPOSES. REFER TO ORIGINAL TOWER DESIGN FOR ADDITIONAL INFORMATION.

ANTENNA NOTES:

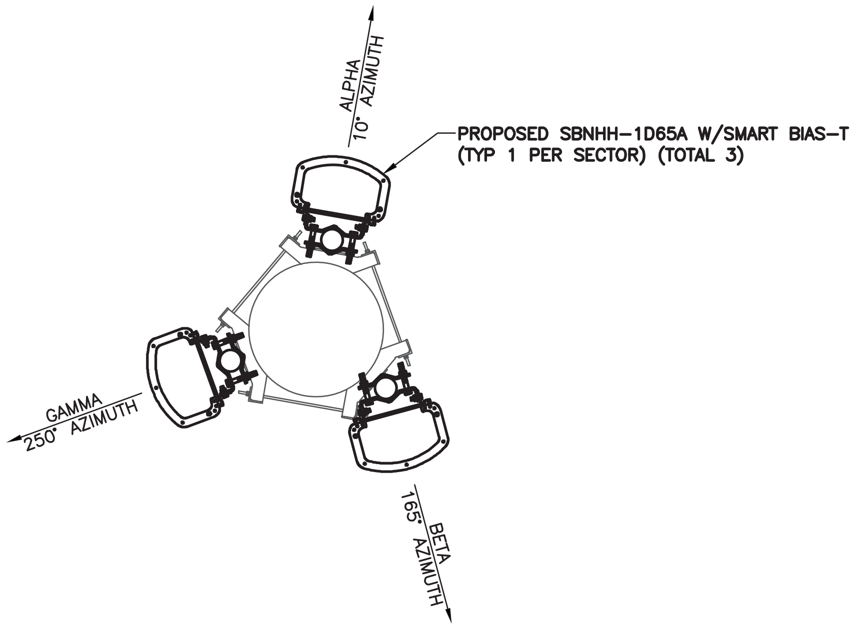
1. THE PRE-APPLICATION & LEASE DIRECTION OF THE ANTENNA SHALL BE ADJUSTED TO MEET SYSTEM REQUIREMENTS.
2. CONTRACTOR SHALL VERIFY HEIGHT OF ANTENNA WITH T-MOBILE PCS PM.
3. CONTRACTOR SHALL VERIFY HEIGHT AND DIRECTION OF MICROWAVE DISHES WITH T-MOBILE PROJECT MANAGER (WHEN APPLICABLE).
4. ALL ANTENNA AZIMUTHS TO BE FROM MAGNETIC NORTH.
5. CONTRACTOR TO USE EXISTING ANTENNA TOP HAT.

1 C-3 TOWER ELEVATION
NOT TO SCALE

N



2 C-3 EXISTING ANTENNA ORIENTATION PLAN
NOT TO SCALE



3 C-3 PROPOSED ANTENNA ORIENTATION PLAN
NOT TO SCALE

T-Mobile
35 GRIFFIN RD S
BLOOMFIELD, CT 06002
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FAX: 860-692-7159

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T-MOBILE SITE ID: CT11039D

SHEET NAME:
TOWER ELEVATION & ANTENNA PLAN

SMW #: 16-2081

DESIGNER:	ACR
CHECKED BY:	RTB
ENGINEER:	VGD

SHEET NUMBER: C-3

TOWER EQUIPMENT SCHEDULE

ANTENNA MARK	SECTOR	ANTENNA MODEL	ANTENNA ORIENTATION	RAD CENTER	RADIO	TMA MODEL	EQUIPMENT	SURGE PROTECTION	COAX/CABLE	TECHNOLOGY
A1	ALPHA	(1) COMMSCOPE – SBNHH–1D65A (P)	10°	92'			(1) ANDREW SMART BIAS T (P)		(4) 1–1/4" COAX (E) (2) 1–1/4" COAX (P)	U1900/G1900/U1200/ L2100/L700
B1	BETA	(1) COMMSCOPE – SBNHH–1D65A (P)	165°	92'			(1) ANDREW SMART BIAS T (P)		(4) 1–1/4" COAX (E) (2) 1–1/4" COAX (P)	U1900/G1900/U1200/ L2100/L700
C1	GAMMA	(1) COMMSCOPE – SBNHH–1D65A (P)	250°	92'			(1) ANDREW SMART BIAS T (P)		(6) 1–1/4" COAX (P)	U1900/G1900/U1200/ L2100/L700

TABLE NOTE:
(P) DENOTES PROPOSED EQUIPMENT
(E) DENOTES EXISTING EQUIPMENT

EQUIPMENT NOTES:
1. THE HYBRID CABLE LENGTH SHOWN IS ONLY AN ESTIMATE & SHOULD NOT BE USED FOR ORDERING MATERIALS. CONFIRM THE REQUIRED HYBRID CABLE LENGTH W/T–MOBILE PRIOR TO ORDERING OR INSTALLATION.
2. THE CONTRACTOR SHALL TEST THE OPTICAL FIBER AFTER INSTALLATION IN ACCORDANCE W/T–MOBILE STANDARDS & SUPPLY THE RESULTS TO T–MOBILE.
3. THE CONTRACTOR SHALL CONFIRM THE TOWER TOP EQUIPMENT LIST ABOVE W/THE FINAL T–MOBILE RFDS PRIOR TO INSTALLATION.
4. ALL EXISTING & PROPOSED ANTENNA CABLES SHALL BE COLOR CODED PER T–MOBILE STANDARDS.
5. REFER TO NOKIA SIEMENS NETWORKS EQUIPMENT INSTALLATION STANDARDS FOR ADDITIONAL INFORMATION.
6. REFER TO EQUIPMENT MANUFACTURER'S SPECIFICATION SHEETS FOR ADDITIONAL INFORMATION NOT LISTED ABOVE.

TOWER LOADING SUMMARY

EXISTING QUANTITY	REMOVE QUANTITY	EQUIPMENT TYPE	ADD QUANTITY	TOTAL QUANTITY
2	2	PANEL ANTENNA	3	3
8	0	COAX CABLE	10	18
0	0	TMA	0	0
0	0	DIPLEXER	0	0
0	0	RRUS–11 B12 GROUND MOUNTED	3	3
0	0	SMART BIAS T	3	3

RFDS REFERENCE:
CT11039D–L700–RFDS 10–3–16

T-Mobile
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BLOOMFIELD, CT 06002
OFFICE: 860–692–7100
FAX: 860–692–7159

PLANS PREPARED BY:
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3	01/23/17	REVISION 3

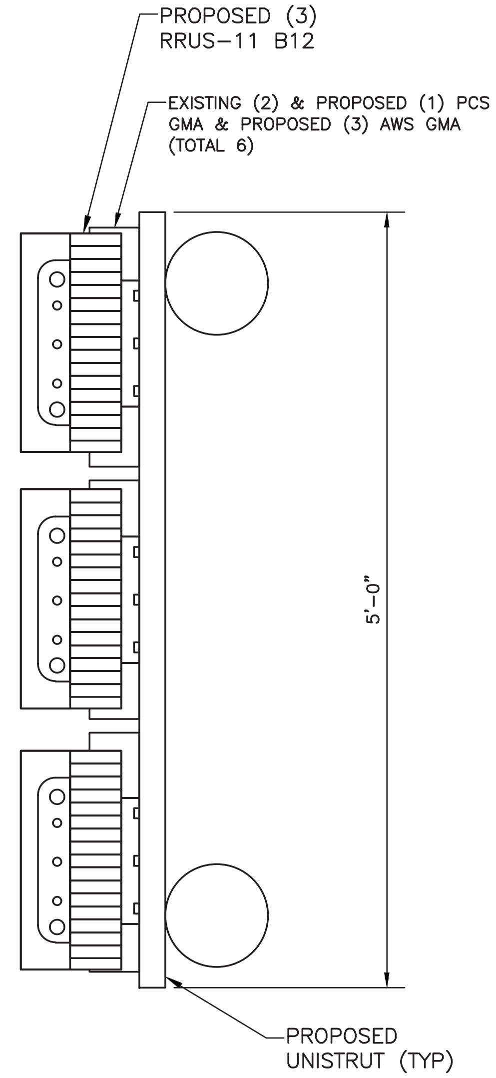
T-MOBILE SITE ID: CT11039D

SHEET NAME: TOWER EQUIPMENT SCHEDULE

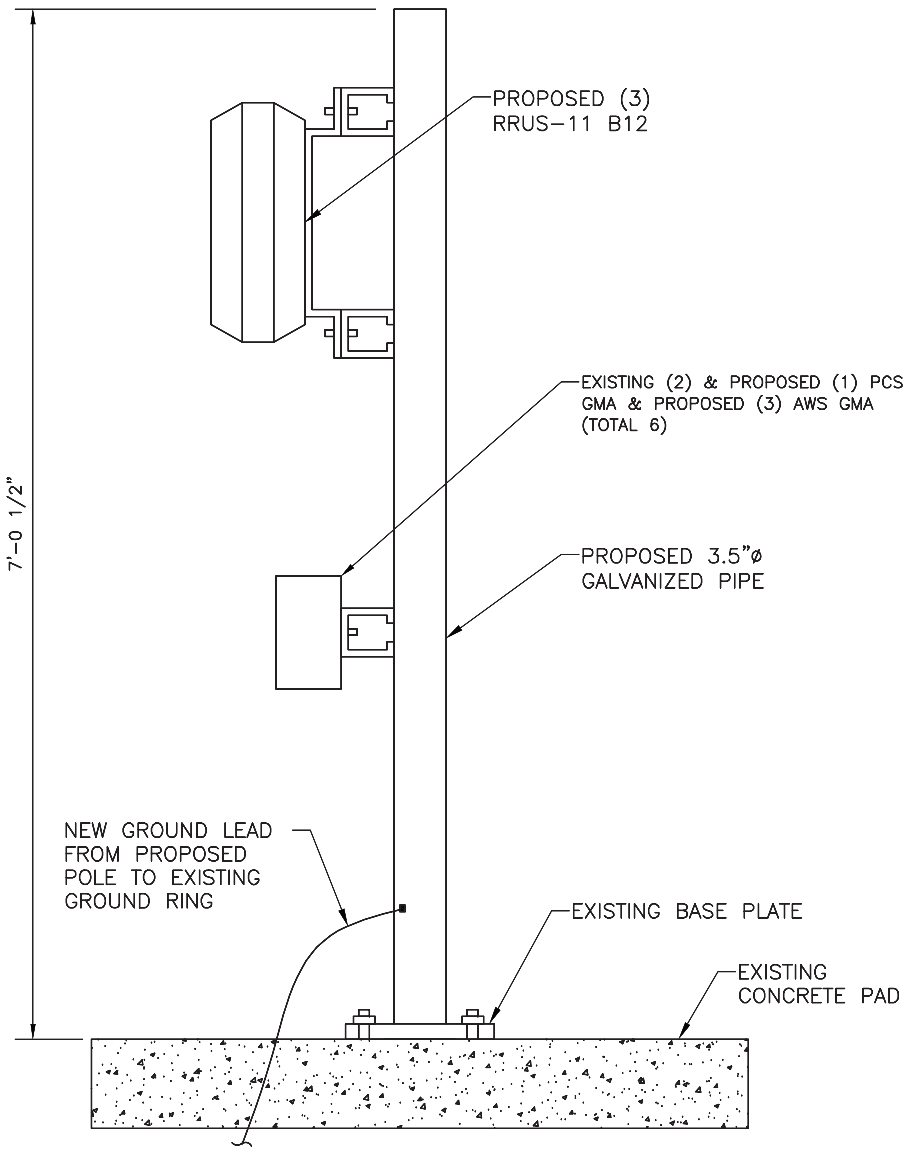
SMW #: 16–2081

DESIGNER:	ACR
CHECKED BY:	RTB
ENGINEER:	VGD

SHEET NUMBER: C-4



TOP VIEW



SIDE VIEW

T-Mobile
35 GRIFFIN RD S
BLOOMFIELD, CT 06002
OFFICE: 860−692−7100
FAX: 860−692−7159

PLANS PREPARED BY:
NSS NORTHEAST SITE SOLUTIONS
Turnkey Wireless Development
199 BRICKYARD RD
FARMINGTON, CT 06032

SMW ENGINEERING GROUP, INC.
TOGETHER PLANNING A BETTER TOMORROW

01/23/17

SITE INFORMATION:
CT11039D
269 FLANDERS RD.
(EVERSOURCE TOWER #6076)
EAST LYME, CT 06357

#	DATE	DESCRIPTION:
0	10/11/16	ISSUED FOR CLIENT REV.
1	10/24/16	ISSUED PER CLIENT COMMENT
2	11/15/16	REVISED PER CLIENT COMMENTS
3	01/23/17	REVISION 3

T-MOBILE SITE ID: CT11039D

SHEET NAME: EQUIPMENT DETAIL

SMW #: 16−2081

DESIGNER:	ACR
CHECKED BY:	RTB
ENGINEER:	VGD

SHEET NUMBER: C-5

GENERAL ELECTRICAL NOTES:

1. ALL WORK IS TO COMPLY WITH THE LATEST EDITION OF THE NATIONAL ELECTRIC CODE (NEC) AND ANY LOCAL ORDINANCES, CODES, AND ALL OTHER ADMINISTRATIVE AUTHORITIES HAVING JURISDICTION. THE CONTRACTOR SHALL FURNISH AND PAY FOR ALL PERMITS AND RELATED FEES.

2. ALL EQUIPMENT AND MATERIAL FURNISHED AND INSTALLED UNDER THIS CONTRACT SHALL BE UNDERWRITERS LABORATORIES (U.L.) LISTED, NEW, FREE FROM DEFECTS, AND SHALL BE GUARANTEED FOR A PERIOD OF ONE YEAR FROM DATE OF FINAL ACCEPTANCE BY OWNER OR HIS REPRESENTATIVE. SHOULD ANY TROUBLE DEVELOP DURING THIS PERIOD DUE TO FAULTY WORKMANSHIP, MATERIAL, OR EQUIPMENT, THE CONTRACTOR SHALL FURNISH ALL NECESSARY MATERIALS AND LABOR TO CORRECT THE TROUBLE WITHOUT COST TO THE OWNER.

3. ALL WORK SHALL BE EXECUTED IN A WORKMAN LIKE MANNER AND SHALL PRESENT A NEAT MECHANICAL APPEARANCE WHEN COMPLETED. CONTRACTOR SHOULD AVOID DAMAGE TO EXISTING UTILITIES WHEREVER POSSIBLE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL CUTTING AND PATCHING RELATED TO ELECTRICAL WORK, AND SHALL RESTORE ALL EXISTING LANDSCAPING, SPRINKLER SYSTEMS, CONDUITS, WIRING, PIPING, ETC. DAMAGED BY THE ELECTRICAL WORK TO MATCH EXISTING CONDITIONS.

4. ELECTRICAL WORK SHALL INCLUDE, BUT NOT BE LIMITED TO, ALL LABOR, MATERIALS AND EQUIPMENT REQUIRED TO COMPLETE ELECTRICAL POWER AND LIGHTING SYSTEMS, TELEPHONE AND COMMUNICATION SYSTEMS, PANELBOARDS, CONDUIT, CONTROL WIRING, GROUNDING, ETC. AS INDICATED ON ELECTRICAL DRAWINGS AND/OR AS REQUIRED BY GOVERNING CODES.

5. PRIOR TO INSTALLING ANY ELECTRICAL WORK, THE CONTRACTOR SHALL VISIT THE JOB SITE AND VERIFY EXISTING SITE LOCATIONS AND CONDITIONS AND UTILITY SERVICE REQUIREMENTS OF THE JOB, AND BY REFERENCE TO ENGINEERING AND EQUIPMENT SUPPLIERS' DRAWINGS. SHOULD THERE BE ANY QUESTION OR PROBLEM CONCERNING THE NECESSARY PROVISIONS TO BE MADE. PROPER DIRECTIONS SHALL BE OBTAINED BEFORE PROCEEDING WITH ANY WORK.

6. PROVIDE POWER AND TELEPHONE TO SERVICE POINTS PER UTILITY COMPANY REQUIREMENTS. CONTRACTOR SHALL CONTACT UTILITY SERVICE PLANNERS AND OBTAIN ALL SERVICE REQUIREMENTS AND INCLUDE COSTS FOR SUCH IN THEIR BID.

7. SERVICE EQUIPMENT SHALL HAVE A SHORT CIRCUIT WITHSTAND RATING EXCEEDING THE MAXIMUM AVAILABLE FAULT CURRENT AT THE SUPPLY TERMINAL ON THE UTILITY TRANSFORMER SECONDARY, THE INSULATION SHALL BE FREE FROM ANY SHORT CIRCUITS AND GROUNDS. CONTRACTOR TO OBTAIN THE AVAILABLE SHORT CIRCUIT CURRENT FROM THE ELECTRICAL SERVICE PROVIDER.

8. ALL WIRES SHALL BE STRANDED COPPER WITH THHN/THWN AND 600 VOLTS INSULATION. ALL GROUND CONDUCTORS TO BE PROPERLY SIZED COPPER. (STRANDED OR SOLID)

9. IN THE EVENT OF ANY CONFLICT OR INCONSISTENCY BETWEEN ITEMS SHOWN ON THE PLANS AND/OR SPECIFICATIONS, THE NOTE, SPECIFICATION OR CODE WHICH PRESCRIBES AND ESTABLISHES THE HIGHEST STANDARD OF PERFORMANCE SHALL PREVAIL.

10. SERVICE CONDUITS SHALL HAVE NO MORE THAN (4) -50° BENDS IN ANY SINGLE RUN. THE CONTRACTOR SHALL PROVIDE PULL BOXES AS NEEDED WHERE CONDUIT REQUIREMENTS EXCEED THESE CONDITIONS. PULL WIRES AND CAPS SHALL BE PROVIDED AT ALL SPARE CONDUITS FOR FUTURE USE.

11. ALL ELECTRICAL EQUIPMENT SHALL BE ANCHORED TO WITHSTAND LOCAL WIND SPEED REQUIREMENTS AND DESIGNED FOR OUTDOOR EXPOSURE.

12. ALL COAX, POWER AND TELEPHONE SYSTEM CONDUITS SHALL HAVE A MINIMUM 24" SCH. 80 PVC RADIUS SWEEPS TO EQUIPMENT, PULLBOXES, GUY, ETC., UNLESS OTHERWISE NOTED, OR AS REQUIRED BY UTILITY COMPANIES.

13. FUSE TYPE SHALL BE BUSSMAN RKI LOW PEAK FUSE (LPN-RK-140).

14. UPON COMPLETION OF THE JOB, THE CONTRACTOR SHALL FURNISH AS-BUILT DRAWINGS TO THE OWNER.

15. GENERAL GROUNDING CRITERIA
    1ST STEP: GROUND TO EXISTING BUILDING STRUCTURAL STEEL AND TO THE EXISTING COLD WATER METAL PIPE LINE. (WHERE APPLICABLE) THEN TEST GROUNDING RESISTANCE FOR 5 OHMS OR LESS OVERALL GROUND RESISTANCE. WHERE THE EFFECTIVE RESISTANCE DOES NOT MEET THIS CRITERIA, PROVIDE SUPPLEMENTAL GROUNDING AND RE-TEST UNTIL GROUND RESISTANCE FALLS BELOW THIS LEVEL.

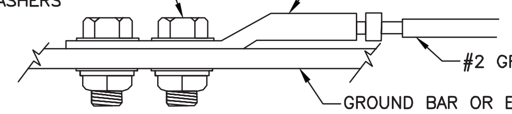
16. SUPPLEMENTAL GROUND MAY CONSIST OF ONE OR MORE OF THE FOLLOWING:
    COUNTERPOISE, USER GROUND, GROUND ROD AND/OR GROUND WELL IN EXTREMELY ADVERSE SOIL CONDITIONS. WHERE THE EXISTING BUILDING STEEL DOES NOT PROVIDE AN EFFECTIVE GROUND RESISTANCE, THEN THE CONTRACTOR SHALL PROVIDE A SEPARATE GROUND CONDUCTOR FROM ROOF MOUNTED BTS EQUIPMENT LOCATIONS EITHER DOWN THROUGH THE INSIDE OF THE BUILDING OR DOWN THE OUTSIDE OF THE BUILDING, DEPENDING UPON OWNER PREFERENCE. WHERE THE GROUND CONDUCTOR FROM THE ROOF MOUNTED EQUIPMENT IS ROUTED IN CONDUIT, THE CONDUIT SHALL BE EFFECTIVELY GROUNDED TO THE GROUND CONDUCTOR AT BOTH ENDS OF THE CONDUIT. (GUY INSTALLATIONS):

    FOR INSTALLATIONS WHERE WOODEN STRUCTURES, TOWERS, CONCRETE SILOS ETC. ARE ENCOUNTERED A PARATE DOWNLEAD SHALL BE PROVIDED FROM THE 3 ANTENNAS SEPARATED BY A MINIMUM OF 12 INCHES FROM THE COAXIAL CABLES. THE GROUND CONDUCTOR SHALL BE SECURELY FASTENED TO THE EXTERIOR OF OUTSIDE STRUCTURES WITH NONMETALLIC GROUND STRAPS EVERY 10 FEET. AGAIN, AS FOR TENANT IMPROVEMENT PROJECTS, TEST THE GROUND RESISTANCE FOR GUY INSTALLATIONS AND PROCEED PER THE ABOVE STEPS.

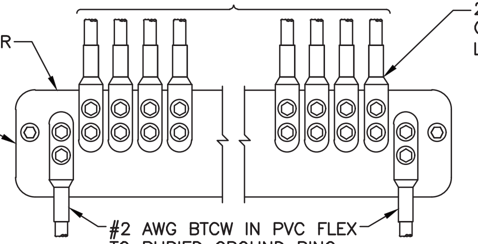
17. CONTRACTOR TO COLOR PHASE CONDUCTORS BLACK (B PHASE), RED (A PHASE), WHITE (NEUTRAL), AND GREEN (GROUND).

18. CONTRACTOR TO PROVIDE GUTTER TAP.

19. THERE SHALL BE A MINIMUM CLEARANCE OF 48" BETWEEN FRONT OF ELECTRICAL EQUIPMENT AND ANY WALL OR OBSTRUCTION.



1 / E-1 TWO HOLE LUG CONNECTION DETAIL
NOT TO SCALE



2 / E-1 GROUND BAR DETAIL
NOT TO SCALE

T-Mobile
35 GRIFFIN RD S
BLOOMFIELD, CT 06002
OFFICE: 860-692-7100
FAX: 860-692-7159

PLANS PREPARED BY:
NSS NORTHEAST SITE SOLUTIONS
Turnkey Wireless Development
199 BRICKYARD RD
FARMINGTON, CT 06032

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T-MOBILE SITE ID: CT11039D

SHEET NAME:
ELECTRICAL & GROUNDING DETAILS

SMW #: 16-2081

DESIGNER:	ACR
CHECKED BY:	RTB
ENGINEER:	VGD

SHEET NUMBER: E-1

Exhibit D

CENTEK engineering

Centered on Solutions℠

Structural Analysis of Antenna Mast and Tower

T-Mobile Site Ref: CT11039D

Eversource Structure No. 6076
85' Electric Transmission Pole (Finney)

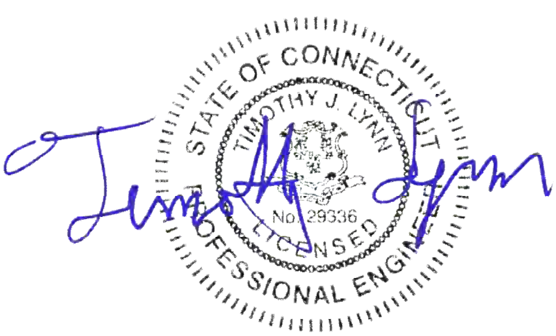
269 Flanders Road
East Lyme, CT

CENTEK Project No. 16162.02

~~Date: October 27, 2016~~

~~Rev 1: January 3, 2017~~

Rev 2: January 17, 2017



Prepared for:
T-Mobile USA
35 Griffin Road
Bloomfield, CT 06002

Table of Contents

Introduction

The purpose of this report is to analyze the existing mast and 85' tower located at 269 Flanders Road in East Lyme, CT for the proposed antenna and equipment upgrade by T-Mobile.

The existing/proposed loads consist of the following:

- T-MOBILE (Existing to be removed):

  Antennas: Two (2) RFS APX16DWV-16DWVS-E-A20 panel antennas mounted on a mast with a RAD center elevation of 92-ft above tower base plate.

- T-MOBILE (Existing to remain):

  Coax Cables: Eight (8) 1-1/4" ∅ coax cables running on the outside of the tower as indicated in section 4 of this report.

- **T-MOBILE (Proposed):**

  Antennas: Three (3) Andrew SBNHH-1D65A panel antennas and three (3) Andrew ATSBT-TOP-FM-4G Smart Bias Tees mounted on a mast with a RAD center elevation of 92-ft above tower base plate.
  Coax Cables: Ten (10) 1-1/4" ∅ coax cables running on the outside of the tower as indicated in section 4 of this report.

Primary assumptions used in the analysis

- Design steel stresses are defined by AISC-LRFD 14th edition for design of the antenna Mast and antenna supporting elements.
- ASCE-48-05 "Design of Steel Transmission Pole Structures", defines steel stresses for evaluation of the utility pole.
- All utility pole members are adequately protected to prevent corrosion of steel members.
- All proposed antenna mounts are modeled as listed above.
- Pipe mast will be properly installed and maintained.
- No residual stresses exist due to incorrect pole erection.
- All bolts are appropriately tightened providing the necessary connection continuity.
- All welds conform to the requirements of AWS D1.1.
- Pipe mast and utility pole will be in plumb condition.
- Utility pole was properly installed and maintained and all members were properly designed, detailed, fabricated, and installed and have been properly maintained since erection.
- Any deviation from the analyzed loading will require a new analysis for verification of structural adequacy.

Analysis

Structural analysis of the existing antenna mast was independently completed using the current version of RISA-3D computer program licensed to CENTEK Engineering, Inc.

The existing mast consisting of a 4" (O.D. =4.5") Sch. 80 x 17' long pipe conforming to ASTM A53 Grade B (Fy = 35ksi) connected at two points to the existing pole was analyzed for its ability to resist loads prescribed by the TIA-222-G standard and found to be structurally inadequate.

A proposed mast consisting of a 6" (O.D. =6.63") Sch. 80 x 16' long pipe conforming to ASTM A53 Grade B (Fy = 35ksi) connected at two points to the existing pole was designed for to resist loads prescribed by the TIA-222-G. Section 5 of this report details these gravity and lateral wind loads. NESC prescribed loads were also applied to the mast in order to obtain reactions needed for analyzing the utility pole structure. These loads are developed in Section 7 of this report. Load cases and combinations used in RISA-3D for TIA/EIA loading and for NESC/NU loading are listed in report Sections 6 and 8, respectively. An envelope solution was first made to determine maximum and minimum forces, stresses, and deflections to confirm the selected section as adequate. Additional analyses were then made to determine the NESC forces to be applied to the pole structure.

The RISA-3D program contains a library of all AISC shapes and corresponding section properties are computed and applied directly within the program. The program's Steel Code Check option was also utilized. The forces calculated in RISA-3D using NESC guidelines were then applied to the pole. Maximum usage for the pole was calculated considering the additional forces from the mast and associated appurtenances.

Design Basis

Our analysis was performed in accordance with TIA-222-G, ASCE-48-05 "Design of Steel Transmission Pole Structures Second Edition", NESC C2-2007 and Northeast Utilities Design Criteria.

- UTILITY POLE ANALYSIS

  The purpose of this analysis is to determine the adequacy of the existing utility pole to support the proposed antenna loads. The loading and design requirements were analyzed in accordance with the NU Design Criteria Table, NESC C2-2007 ~ Construction Grade B, and ASC-48-05.

  Load cases considered:

  Load Case 1: NESC Heavy
  Wind Pressure..……………………………..   4.0 psf
  Radial Ice Thickness……………………….   0.5"
  Vertical Overload Capacity Factor………….   1.50
  Wind Overload Capacity Factor…………….   2.50
  Wire Tension Overload Capacity Factor……   1.65

  Load Case 2: NESC Extreme
  Wind Speed..……………………………….   120 mph (1)
  Radial Ice Thickness………………………..   0"

  Note 1: NESC C2-2007, Section25, Rule 250C: Extreme Wind Loading, 1.25 x Gust Response Factor (wind speed: 3-second gust)

- MAST ASSEMBLY ANALYSIS

  Mast, appurtenances and connections to the utility tower were analyzed and designed in accordance with the NU Design Criteria Table, TIA-222-G and AISC standards.

  Load cases considered:

  Load Case 1:
  Wind Speed………………………………... 105 mph (2016 CSBC Appendix-N)
  Radial Ice Thickness………………………. 0”

  Load Case 2:
  Wind Pressure.……………………………. 50 mph wind pressure
  Radial Ice Thickness……………………….. 0.75”

Results

- MAST ASSEMBLY

  The proposed mast was determined to be structurally **adequate**.

Member	Stress Ratio (% of capacity)	Result
Pipe 6” Sch. 80	43.2%	**PASS**
Bracket Plate	52.0%	**PASS**

- UTILITY TOWER

  This analysis finds that the subject utility structure is adequate to support the existing mast and related appurtenances. The tower stresses meet the requirements set forth by the ASCE-48-05 “Design of Steel Transmission Pole Structures”, for the applied NESC Heavy and Hi-Wind load cases. The detailed analysis results are provided in Section 9 of this report. The analysis results are summarized as follows:

  A maximum usage of **55.0%** occurs in the utility tower under the **NESC Heavy** loading condition.

  TOWER SECTION:

  The utility tower was found to be within allowable limits.

Tower Section	Stress Ratio (% of capacity)	Result
Base	55.0%	**PASS**

- FOUNDATION AND ANCHORS

  The existing foundation consists of a 8-ft square x 8.0-ft long reinforced concrete pier with twelve (12) rock anchors embedded 22-ft into rock. The base of the tower is connected to the foundation by means of twenty (20) 2.25”∅, ASTM A615-75 anchor bolts embedded into the concrete foundation structure. Foundation information was obtained from Northeast Utilities drawing 01087-60000.

BASE REACTIONS:

From analysis of CL&P pole based on NESC/NU prescribed loads.

Load Case	Transverse	Axial	Overturning Moment
NESC Heavy Wind x-direction	64.7 kips	65.9 kips	4022.6 ft-kips
NESC Extreme Wind x-direction	65.2 kips	34.5 kips	3903.5 ft-kips
NESC Heavy Wind y-direction	5.8 kips	65.9 kips	255.7 ft-kips
NESC Extreme Wind y-direction	20.8 kips	34.5 kips	925.1 ft-kips

Note 1 – 10% increase applied to tower base reactions per OTRM 051

ANCHOR BOLTS:

The anchor bolts were found to be within allowable limits.

Pole Component	Design Limit	Stress Ratio (percentage of capacity)	Result
Anchor Bolts	Tension	47.2%	**PASS**

BASE PLATE:

The base plate was found to be within allowable limits.

Pole Component	Design Limit	Stress Ratio (percentage of capacity)	Result
Base Plate	Bending	84.0%	**PASS**

FOUNDATION:

The foundation was found to be within allowable limits.

Foundation	Design Limit	Allowable Limit	Proposed Loading (4)	Result
Reinf. Conc. Pier w/ Rock Anchors	OTM (1)	1.0 FS (2)	1.11 FS (2)	**PASS**
	Bearing Pressure	50 ksf (3)	27.7 ksf	**PASS**

Note 1: OTM denotes overturning moment.
Note 2: FS denotes Factor of Safety
Note 3: Bearing Capacity based on Weak Rock.
Note 4: 10% increase to PLS base reactions used in foundation analysis per OTRM 051.

Conclusion

This analysis shows that the subject utility pole **is adequate** to support the proposed T-Mobile equipment upgrade.

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

Please feel free to call with any questions or comments.

Respectfully Submitted by:

Timothy J. Lynn, PE
Structural Engineer

STANDARD CONDITIONS FOR FURNISHING OF PROFESSIONAL ENGINEERING SERVICES ON EXISTING STRUCTURES

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

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

- Information from the field and/or drawings in the possession of CENTEK engineering, Inc. or generated by field inspections or measurements of the structure.

- It is the responsibility of the client to ensure that the information provided to CENTEK engineering, Inc. and used in the performance of our engineering services is correct and complete. In the absence of information to the contrary, we assume that all structures were constructed in accordance with the drawings and specifications and are in an un-corroded condition and have not deteriorated. It is therefore assumed that its capacity has not significantly changed from the “as new” condition.

- All services will be performed to the codes specified by the client, and we do not imply to meet any other codes or requirements unless explicitly agreed in writing. If wind and ice loads or other relevant parameters are to be different from the minimum values recommended by the codes, the client shall specify the exact requirement. In the absence of information to the contrary, all work will be performed in accordance with the latest revision of ANSI/ASCE10 & ANSI/EIA-222.

- All services are performed, results obtained, and recommendations made in accordance with generally accepted engineering principles and practices. CENTEK engineering, Inc. is not responsible for the conclusions, opinions and recommendations made by others based on the information we supply.

GENERAL DESCRIPTION OF STRUCTURAL ANALYSIS PROGRAM ~ RISA-3D

RISA-3D Structural Analysis Program is an integrated structural analysis and design software package for buildings, bridges, tower structures, etc.

Modeling Features:

- Comprehensive CAD-like graphic drawing/editing capabilities that let you draw, modify and load elements as well as snap, move, rotate, copy, mirror, scale, split, merge, mesh, delete, apply, etc.
- Versatile drawing grids (orthogonal, radial, skewed)
- Universal snaps and object snaps allow drawing without grids
- Versatile general truss generator
- Powerful graphic select/unselect tools including box, line, polygon, invert, criteria, spreadsheet selection, with locking
- Saved selections to quickly recall desired selections
- Modification tools that modify single items or entire selections
- Real spreadsheets with cut, paste, fill, math, sort, find, etc.
- Dynamic synchronization between spreadsheets and views so you can edit or view any data in the plotted views or in the spreadsheets
- Simultaneous view of multiple spreadsheets
- Constant in-stream error checking and data validation
- Unlimited undo/redo capability
- Generation templates for grids, disks, cylinders, cones, arcs, trusses, tanks, hydrostatic loads, etc.
- Support for all units systems & conversions at any time
- Automatic interaction with RISASection libraries
- Import DXF, RISA-2D, STAAD and ProSteel 3D files
- Export DXF, SDNF and ProSteel 3D files

Analysis Features:

- Static analysis and P-Delta effects
- Multiple simultaneous dynamic and response spectra analysis using Gupta, CQC or SRSS mode combinations
- Automatic inclusion of mass offset (5% or user defined) for dynamic analysis
- Physical member modeling that does not require members to be broken up at intermediate joints
- State of the art 3 or 4 node plate/shell elements
- High-end automatic mesh generation — draw a polygon with any number of sides to create a mesh of well-formed quadrilateral (NOT triangular) elements.
- Accurate analysis of tapered wide flanges - web, top and bottom flanges may all taper independently
- Automatic rigid diaphragm modeling
- Area loads with one-way or two-way distributions
- Multiple simultaneous moving loads with standard AASHTO loads and custom moving loads for bridges, cranes, etc.
- Torsional warping calculations for stiffness, stress and design
- Automatic Top of Member offset modeling
- Member end releases & rigid end offsets
- Joint master-slave assignments
- Joints detachable from diaphragms
- Enforced joint displacements
- 1-Way members, for tension only bracing, slipping, etc.

- 1-Way springs, for modeling soils and other effects
- Euler members that take compression up to their buckling load, then turn off.
- Stress calculations on any arbitrary shape
- Inactive members, plates, and diaphragms allows you to quickly remove parts of structures from consideration
- Story drift calculations provide relative drift and ratio to height
- Automatic self-weight calculations for members and plates
- Automatic subgrade soil spring generator

Graphics Features:

- Unlimited simultaneous model view windows
- Extraordinary "true to scale" rendering, even when drawing
- High-speed redraw algorithm for instant refreshing
- Dynamic scrolling stops right where you want
- Plot & print virtually everything with color coding & labeling
- Rotate, zoom, pan, scroll and snap views
- Saved views to quickly restore frequent or desired views
- Full render or wire-frame animations of deflected model and dynamic mode shapes with frame and speed control
- Animation of moving loads with speed control
- High quality customizable graphics printing

Design Features:

- Designs concrete, hot rolled steel, cold formed steel and wood
- ACI 1999/2002, BS 8110-97, CSA A23.3-94, IS456:2000,EC 2-1992 with consistent bar sizes through adjacent spans
- Exact integration of concrete stress distributions using parabolic or rectangular stress blocks
- Concrete beam detailing (Rectangular, T and L)
- Concrete column interaction diagrams
- Steel Design Codes: AISC ASD 9th, LRFD 2nd & 3rd, HSS Specification, CAN/CSA-S16.1-1994 & 2004, BS 5950-1-2000, IS 800-1984, Euro 3-1993 including local shape databases
- AISI 1999 cold formed steel design
- NDS 1991/1997/2001 wood design, including Structural Composite Lumber, multi-ply, full sawn
- Automatic spectra generation for UBC 1997, IBC 2000/2003
- Generation of load combinations: ASCE, UBC, IBC, BOCA, SBC, ACI
- Unbraced lengths for physical members that recognize connecting elements and full lengths of members
- Automatic approximation of K factors
- Tapered wide flange design with either ASD or LRFD codes
- Optimization of member sizes for all materials and all design codes, controlled by standard or user-defined lists of available sizes and criteria such as maximum depths
- Automatic calculation of custom shape properties
- Steel Shapes: AISC, HSS, CAN, ARBED, British, Euro, Indian, Chilean
- Light Gage Shapes: AISI, SSMA, Dale / Incor, Dietrich, Marino\WARE
- Wood Shapes: Complete NDS species/grade database
- Full seamless integration with RISAFoot (Ver 2 or better) for advanced footing design and detailing
- Plate force summation tool

Results Features:

- Graphic presentation of color-coded results and plotted designs
- Color contours of plate stresses and forces with quadratic smoothing, the contours may also be animated
- Spreadsheet results with sorting and filtering of: reactions, member & joint deflections, beam & plate forces/stresses, optimized sizes, code designs, concrete reinforcing, material takeoffs, frequencies and mode shapes
- Standard and user-defined reports
- Graphic member detail reports with force/stress/deflection diagrams and detailed design calculations and expanded diagrams that display magnitudes at any dialed location
- Saved solutions quickly restore analysis and design results.

GENERAL DESCRIPTION OF STRUCTURAL ANALYSIS PROGRAM ~ PLS-TOWER

PLS-TOWER is a Microsoft Windows program for the analysis and design of steel latticed towers used in electric power lines or communication facilities. Both self-supporting and guyed towers can be modeled. The program performs design checks of structures under user specified loads. For electric power structures it can also calculate maximum allowable wind and weight spans and interaction diagrams between different ratios of allowable wind and weight spans.

Modeling Features:

- Powerful graphics module (stress usages shown in different colors)
- Graphical selection of joints and members allows graphical editing and checking
- Towers can be shown as lines, wire frames or can be rendered as 3-d polygon surfaces
- Can extract geometry and connectivity information from a DXF CAD drawing
- CAD design drawings, title blocks, drawing borders or photos can be tied to structure model
- XML based post processor interface
- Steel Detailing Neutral File (SDNF) export to link with detailing packages
- Can link directly to line design program PLS-CADD
- Automatic generation of structure files for PLS-CADD
- Databases of steel angles, rounds, bolts, guys, etc.
- Automatic generation of joints and members by symmetries and interpolations
- Automated mast generation (quickly builds model for towers that have regular repeating sections) via graphical copy/paste
- Steel angles and rounds modeled either as truss, beam or tension-only elements
- Guys are easily handled (can be modeled as exact cable elements)

Analysis Features:

- Automatic handling of tension-only members
- Automatic distribution of loads in 2-part suspension insulators (v-strings, horizontal vees, etc.)
- Automatic calculation of tower dead, ice, and wind loads as well as drag coefficients according to:
    - ASCE 74-1991
    - NESC 2002
    - NESC 2007
    - IEC 60826:2003
    - EN50341-1:2001 (CENELEC)
    - EN50341-3-9:2001 (UK NNA)
    - EN50341-3-17:2001 (Portugal NNA)
    - ESAA C(b)1-2003 (Australia)
    - TPNZ (New Zealand)
    - REE (Spain)
    - EIA/TIA 222-F
    - ANSI/TIA 222-G
    - CSA S37-01
- Automated microwave antenna loading as per EIA/TIA 222-F and ANSI/TIA 222-G
- Minimization of problems caused by unstable joints and mechanisms
- Automatic bandwidth minimization and ability to solve large problems
- Design checks according to (other standards can be added easily):
    - ASCE Standard 10-90

- AS 3995 (Australian Standard 3995)
- BS 8100 (British Standard 8100)
- EN50341-1 (CENELEC, both empirical and analytical methods are available)
- ECCS 1985
- NGT-ECCS
- PN-90/B-03200
- EIA/TIA 222-F
- ANSI/TIA 222-G
- CSA S37-01
- EDF/RTE Resal
- IS 802 (India Standard 802)

Results Features:

- Design summaries printed for each group of members
- Easy to interpret text, spreadsheet and graphics design summaries
- Automatic determination of allowable wind and weight spans
- Automatic determination of interaction diagrams between allowable wind and weight spans
- Capability to batch run multiple tower configurations and consolidate the results
- Automated optimum angle member size selection and bolt quantity determination

Tool for interactive angle member sizing and bolt quantity determination.

Criteria for Design of PCS Facilities On or Extending Above Metal Electric Transmission Towers & Analysis of Transmission Towers Supporting PCS Masts [(1)]

Introduction

This criteria is the result from an evaluation of the methods and loadings specified by the separate standards, which are used in designing telecommunications towers and electric transmission towers. That evaluation is detailed elsewhere, but in summary; the methods and loadings are significantly different. This criteria specifies the manner in which the appropriate standard is used to design PCS facilities including masts and brackets (hereafter referred to as “masts”), and to evaluate the electric transmission towers to support PCS masts. The intent is to achieve an equivalent level of safety and security under the extreme design conditions expected in Connecticut and Massachusetts.

ANSI Standard TIA-222 covering the design of telecommunications structures specifies a working strength/allowable stress design approach. This approach applies the loads from extreme weather loading conditions, and designs the structure so that it does not exceed some defined percentage of failure strength (allowable stress).

ANSI Standard C2-2007 (National Electrical Safety Code) covering the design of electric transmission metal structures is based upon an ultimate strength/yield stress design approach. This approach applies a multiplier (overload capacity factor) to the loads possible from extreme weather loading conditions, and designs the structure so that it does not exceed its ultimate strength (yield stress).

Each standard defines the details of how loads are to be calculated differently. Most of the NU effort in “unifying” both codes was to establish what level of strength each approach would provide, and then increasing the appropriate elements of each to achieve a similar level of security under extreme weather loadings.

Two extreme weather conditions are considered. The first is an extreme wind condition (hurricane) based upon a 50-year recurrence (2% annual probability). The second is a winter condition combining wind and ice loadings.

The following sections describe the design criteria for any PCS mast extending above the top of an electric transmission tower, and the analysis criteria for evaluating the loads on the transmission tower from such a mast from the lower portions of such a mast, and loads on the pre-existing electric lower portions of such a mast, and loads on the pre-existing electric transmission tower and the conductors it supports.

Note 1: *Prepared from documentation provide from Northeast Utilities.*

P C S   M a s t

The PCS facility (mast, external cable/trays, including the 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 222-G:

E L E C T R I C   T R A N S M I S S I O N   T O W E R

The electric transmission tower shall be analyzed using yield stress theory in accordance with the attached table titled "NU Design Criteria". This specifies uniform loadings (different from the TIA loadings) on the each of the following components of the installed facility:

- PCS mast for its total height above ground level, including the initial and planned future support platforms, antennas, etc. above the top of an electric transmission structure.
- Conductors are related devices and hardware.
- Electric transmission structure. The loads from the PCS facility and from the electric conductors shall be applied to the structure at conductor and PCS mast attachment points, where those load transfer to the tower.

The uniform loadings and factors specified for the above components in the table are based upon the National Electrical Safety Code 2007 Edition Extreme Wind (Rule 250C) and Combined Ice and Wind (Rule 250B-Heavy) Loadings. These provide equivalent loadings compared to TIA and its loads and factors with the exceptions noted above. (Note that the NESC does not require the projected wind surfaces of structures and equipment to be increased by the ice covering.)

In the event that the electric transmission tower is not sufficient to support the additional loadings of the PCS mast, reinforcement will be necessary to upgrade the strength of the overstressed members.

Attachment A

NU Design Criteria

Condition	Standard	Item	Basic Wind Speed V (MPH)	Pressure Q (PSF)	Height Factor Kz	Gust Factor Gh	Load or Stress Factor	Force Coef - Shape Factor
Ice Condition	TIA/EIA	Antenna Mount	TIA	TIA (.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	1.00	1.00	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	1.00	1.00	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	Use NESC C2-2007, Section 25, Rule 250C: Extreme Wind Loading 1.25 x Gust Response Factor Height above ground level based on top of Mast/Antenna					1.6 Flat Surfaces 1.3 Round Surfaces
High Wind Condition	NESC Extreme Wind	Tower/Pole Analysis with Antennas below top of Tower/Pole	Use NESC C2-2007, Section 25, Rule 250C: Extreme Wind Loading Height above ground level based on 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 Conditon*		Tower/Pole Analysis with antennas extending above top of Tower/Pole	Use NESC C2-2007, Section 25, Rule 250D: Extreme Ice with Wind Loading 4PSF Wind Load 1.25 x Gust Response Factor Height above ground level based on top of Mast/Antenna					1.6 Flat Surfaces 1.3 Round Surfaces
NESC Extreme Ice with Wind Conditon*		Tower/Pole Analysis with Antennas below top of Tower/Pole	Use NESC C2-2007, Section 25, Rule 250D: Extreme Ice with Wind Loading 4PSF Wind Load Height above ground level based on top of Tower/Pole					1.6 Flat Surfaces 1.3 Round Surfaces
NESC Extreme Ice with Wind Conditon*		Conductors:	Conductor loads provided by NU					

* Only for Structures Installed after 2007

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 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 along side 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.

INPUT DATA

TOWER ID: 6076

Structure Height (ft) : 85

Wind Zone : SE Coastal CT (red)

Wind Speed : 120 mph

Tower Type : ○ Suspension ◉ Strain

Extreme Wind Model : PCS Addition

Shield Wire Properties:

	BACK	AHEAD
NAME =	*3/8 CW*	*3/8 CW*
DESCRIPTION =	3/8	3/8
STRANDING =	7 #8 Cu Weld	7 #8 Cu Weld
DIAMETER =	0.385 in	0.385 in
WEIGHT =	0.324 lb/ft	0.324 lb/ft

Conductor Properties:

	BACK	AHEAD
NAME =	*BITTERN*	*BITTERN*
	1272.000	1272.000
	45/7 ACSR	45/7 ACSR
DIAMETER =	1.345 in	1.345 in
WEIGHT =	1.432 lb/ft	1.432 lb/ft
Number of Conductors per phase	1	1

Insulator Weight = 0 lbs

Broken Wire Side = AHEAD SPAN

Horizontal Line Tensions:

	BACK		AHEAD	
	Shield	Conductor	Shield	Conductor
NESC HEAVY =	4,200	10,000	4,200	10,000
EXTREME WIND =	3,610	9,643	3,743	10,961
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 =	2,408	4,288	1,769	4,478

Line Geometry:

					SUM
LINE ANGLE (deg) =	BACK:	14	AHEAD:	14	**28**
WIND SPAN (ft) =	BACK:	184	AHEAD:	299	**483**
WEIGHT SPAN (ft) =	BACK:	216	AHEAD:	471	**687**

Northeast Utilities System

Job :		Page	of
Description:	Spec. Number	Sheet	of
	Computed by	Date	4/28/10
	Checked by	Date	

WIRE LOADING AT ATTACHMENTS

TOWER ID: 6076

Wind Span =	483 ft
Weight Span =	687 ft
Total Angle =	28 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 =	3,910 lb	0 lb	901 lb	1,889 lb	6,724 lb	283 lb
Conductor =	8,927 lb	0 lb	2,658 lb	4,351 lb	16,010 lb	836 lb

2. NESC RULE 250C Transverse Extreme Wind Loading:

	Horizontal	Longitudinal	Vertical
Shield Wire =	2,687 lb	148 lb	256 lb
Conductor =	7,972 lb	1,471 lb	1,131 lb

3. NESC RULE 250C Longitudinal Extreme Wind Loading:

	Horizontal	Longitudinal	Vertical
Shield Wire =	#VALUE!	#VALUE!	256 lb
Conductor =	#VALUE!	#VALUE!	1,131 lb

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

	Horizontal	Longitudinal	Vertical
Shield Wire =	#VALUE!	#VALUE!	1,406 lb
Conductor =	#VALUE!	#VALUE!	2,987 lb

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

	Horizontal	Longitudinal	Vertical
Shield Wire =	#VALUE!	#VALUE!	601 lb
Conductor =	#VALUE!	#VALUE!	1,772 lb

6. 60 Deg. F, No Wind

	Horizontal	Longitudinal	Vertical
Shield Wire =	1,011 lb	620 lb	223 lb
Conductor =	2,121 lb	184 lb	984 lb

7. Construction

	Horizontal	Longitudinal	Vertical
Shield Wire =	1,516 lb	930 lb	334 lb
Conductor =	3,181 lb	277 lb	1,476 lb

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

ANTENNA MAST DESIGN

STRUCT. NO. 6076
T-MOBILE CT11039D
269 FLANDERS ROAD
EAST LYME, CT 06357

VICINITY MAP

NORTH

PROJECT SUMMARY

SITE ADDRESS:	269 FLANDERS ROAD EAST LYME, CT 06357
PROJECT COORDINATES:	LAT: 41°−21'−43.60N LON: 72°−12'−25.20W ELEV:±123' AMSL
EVERSOURCE STRUCT NO:	6076
EVERSOURCE CONTACT:	ROBERT GRAY 860.728.6125
T−MOBILE SITE REF.:	CT11039D
T−MOBILE CONTACT:	MARK RICHARD 860.692.7143
ANTENNA CL HEIGHT:	92'−0"
ENGINEER OF RECORD:	CENTEK ENGINEERING, INC. 63−2 NORTH BRANFORD ROAD BRANFORD, CT 06405
CENTEK CONTACT:	CARLO F. CENTORE, PE 203.488.0580 ext. 122

SHEET INDEX

REV.	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
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SCALE: AS SHOWN
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TITLE SHEET

SHEET NO.
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DESIGN BASIS

1. GOVERNING CODE: 2012 INTERNATIONAL BUILDING CODE AS MODIFIED BY THE 2016 CT STATE SUPPLEMENT.

2. TIA–222–G, ASCE–48–05 – "DESIGN OF STEEL TRANSMISSION POLE STRUCTURES", NESC C2–2007 AND NORTHEAST UTILITIES DESIGN CRITERIA.

3. DESIGN CRITERIA

   WIND LOAD: (ANTENNA MAST)
   NOMINAL DESIGN WIND SPEED (V) = 105 MPH (2016 CSBC: APPENDIX 'N')

   WIND LOAD: (UTILITY POLE & FOUNDATION)
   BASIC WIND SPEED (V) =120 MPH (3–SECOND GUST) BASED ON NESC C2–2007, SECTION 25 RULE 250C.

GENERAL NOTES

1. REFER TO STRUCTURAL ANALYSIS AND REINFORCEMENT DESIGN PREPARED BY CENTEK ENGINEERING, INC., FOR T–MOBILE DATED 1/17/17.

2. TOWER GEOMETRY AND STRUCTURE MEMBER SIZES WERE OBTAINED FROM THE ORIGINAL TOWER DESIGN DRAWINGS PREPARED BY THE FINNEY STEEL POLE CO., INC. DATED DECEMBER 1, 1971.

3. THE TEMPORARY DETACHMENT AND/OR REPLACEMENT OF TOWER MEMBERS SHALL BE DONE ONE AT A TIME AND SHALL BE CONDUCTED ON DAYS WITH LESS THAN 15 MPH WIND PRESENT. NO MEMBER SHALL BE LEFT DISCONNECTED FOR THE NEXT WORKING DAY.

4. ALL STEEL REINFORCEMENT SHOWN HEREIN APPLIES TO ALL SIDES OF THE TOWER.

5. ALL REPLACEMENT STEEL MEMBERS SHALL BE INSTALLED WITH A325–N BOLTS (SIZE TO MATCH EXISTING). UNLESS OTHERWISE NOTED BELOW.

6. THE TOWER STRUCTURE IS DESIGNED TO BE SELF–SUPPORTING AND STABLE AFTER REINFORCEMENTS ARE COMPLETE. IT IS THE CONTRACTOR'S SOLE RESPONSIBILITY TO DETERMINE ERECTION PROCEDURE & SEQUENCE AND TO INSURE THE SAFETY OF THE TOWER STRUCTURE AND ITS COMPONENT PARTS DURING ERECTION. THIS INCLUDES PROVIDING AND MAINTAINING ADEQUATE SHORING, BRACING, UNDERPINNING, TEMPORARY ANCHORS, GUYING, BARRICADES, ETC. AS MAY BE REQUIRED FOR THE PROTECTION OF EXISTING PROPERTY, CONSTRUCTION WORKERS, AND FOR PUBLIC SAFETY. MAINTAIN EXISTING SITE OPERATIONS AND COORDINATE WORK WITH TOWER OWNER.

7. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE GOVERNING BUILDING CODE.

8. DRAWINGS INDICATE THE MINIMUM STANDARDS, BUT IF ANY WORK SHOULD BE INDICATED TO BE SUBSTANDARD TO ANY ORDINANCES, LAWS, CODES, RULES, OR REGULATIONS BEARING ON THE WORK, THE CONTRACTOR SHALL INCLUDE IN HIS SCOPE OF WORK AND SHALL EXECUTE THE WORK CORRECTLY IN ACCORDANCE WITH SUCH ORDINANCES, LAWS, CODES, RULES OR REGULATIONS WITH NO INCREASE IN COSTS.

9. BEFORE BEGINNING THE WORK, THE CONTRACTOR IS RESPONSIBLE FOR MAKING SUCH INVESTIGATIONS CONCERNING PHYSICAL CONDITIONS (SURFACE AND SUBSURFACE) AT OR CONTIGUOUS TO THE SITE WHICH MAY AFFECT PERFORMANCE AND COST OF THE WORK. THIS INCLUDES VERIFYING ALL DIMENSIONS, ELEVATIONS, ANGLES, AND EXISTING CONDITIONS AT THE SITE, PRIOR TO FABRICATION AND/OR INSTALLATION OF ANY WORK IN THE CONTRACT AREA. CONTRACTOR SHALL TAKE FIELD MEASUREMENTS NECESSARY TO ASSURE PROPER FIT OF ALL FINISHED WORK.

10. TOWER REINFORCEMENTS SHALL BE CONDUCTED BY FIELD CREWS EXPERIENCED IN THE ASSEMBLY AND ERECTION OF TRANSMISSION STRUCTURES. ALL SAFETY PROCEDURES, RIGGING AND ERECTION METHODS SHALL BE STANDARD TO THE INDUSTRY AND IN COMPLIANCE WITH OSHA.

11. EXISTING COAXIAL CABLES AND ALL ACCESSORIES SHALL BE RELOCATED AS NECESSARY AND REINSTALLED BY THE CONTRACTOR WITHOUT INTERRUPTION IN SERVICE WHERE THEY ARE IN CONFLICT WITH THE TOWER REINFORCEMENT WORK.

12. IF ANY FIELD CONDITIONS EXIST WHICH PRECLUDE COMPLIANCE WITH THE DRAWINGS, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER AND SHALL PROCEED WITH AFFECTED WORK AFTER CONFLICT IS SATISFACTORILY RESOLVED.

13. ALL DAMAGE CAUSED TO ANY EXISTING STRUCTURE SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR WILL BE HELD LIABLE FOR ALL REPAIRS REQUIRED FOR EXISTING STRUCTURES IF DAMAGED DURING CONSTRUCTION ACTIVITIES.

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DESIGN BASIS AND GENERAL NOTES

SHEET NO.
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STRUCTURAL STEEL

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

2. MATERIAL SPECIFICATIONS

   A. STRUCTURAL STEEL (W SHAPES)---ASTM A992 (FY = 50 KSI)
   B. STRUCTURAL STEEL (OTHER SHAPES)---ASTM A36 (FY = 36 KSI).
   C. STRUCTURAL HSS (RECTANGULAR SHAPES)---ASTM A500 GRADE B, (FY = 46 KSI)
   D. STRUCTURAL HSS (ROUND SHAPES)---ASTM A500 GRADE B, (FY = 42 KSI)
   E. PIPE---ASTM A53 GRADE B (FY = 35 KSI)

3. FASTENER SPECIFICATIONS

   A. CONNECTION BOLTS---ASTM A325-N, UNLESS OTHERWISE SCHEDULED.
   B. U-BOLTS---ASTM A307
   C. ANCHOR RODS---ASTM F1554
   D. WELDING ELECTRODES---ASTM E70XX FOR A36 & A572_GR50 STEELS, ASTM E80XX FOR A572_GR65 STEEL.

4. CONTRACTOR TO REVIEW ALL SHOP DRAWINGS AND SUBMIT COPY TO ENGINEER FOR APPROVAL. DRAWINGS MUST BEAR THE CHECKER'S INITIALS BEFORE SUBMITTING TO THE ENGINEER FOR REVIEW. SHOP DRAWINGS SHALL INCLUDE THE FOLLOWING: SECTION PROFILES, SIZES, CONNECTION ATTACHMENTS, REINFORCING, ANCHORAGE, SIZE AND TYPE OF FASTENERS AND ACCESSORIES. INCLUDE ERECTION DRAWINGS, ELEVATIONS AND DETAILS.

5. STRUCTURAL STEEL SHALL BE DETAILED, FABRICATED AND ERECTED IN ACCORDANCE WITH THE LATEST PROVISIONS OF AISC MANUAL OF STEEL CONSTRUCTION.

6. PROVIDE ALL PLATES, CLIP ANGLES, CLOSURE PIECES, STRAP ANCHORS, MISCELLANEOUS PIECES AND HOLES REQUIRED TO COMPLETE THE STRUCTURE.

7. FIT AND SHOP ASSEMBLE FABRICATIONS IN THE LARGEST PRACTICAL SECTIONS FOR DELIVERY TO SITE.

8. INSTALL FABRICATIONS PLUMB AND LEVEL, ACCURATELY FITTED, AND FREE FROM DISTORTIONS OR DEFECTS.

9. AFTER ERECTION OF STRUCTURES, TOUCHUP ALL WELDS, ABRASIONS AND NON-GALVANIZED SURFACES WITH A 95% ORGANIC ZINC RICH PAINT IN ACCORDANCE WITH ASTM 780.

10. ALL STEEL MATERIAL (EXPOSED TO WEATHER) SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123 "ZINC (HOT DIPPED GALVANIZED) COATINGS" ON IRONS AND STEEL PRODUCTS.

11. ALL BOLTS, ANCHORS AND MISCELLANEOUS HARDWARE SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A153 "ZINC COATING (HOT-DIP) ON IRON AND STEEL HARDWARE".

12. CONTRACTOR SHALL COMPLY WITH AWS CODE FOR PROCEDURES APPEARANCE AND QUALITY OF WELDS, AND WELDING PROCESSES SHALL BE QUALIFIED IN ACCORDANCE WITH AWS "STANDARD QUALIFICATION PROCEDURES". ALL WELDING SHALL BE DONE USING THE SCHEDULED ELECTRODES AND WELDING SHALL CONFORM TO AISC AND D1.1 WHERE FILLET WELD SIZES ARE NOT SHOWN, PROVIDE THE MINIMUM SIZE PER TABLET J2.4 IN THE AISC "MANUAL OF STEEL CONSTRUCTION" 9TH EDITION. AT THE COMPLETION OF WELDING, ALL DAMAGE TO GALVANIZED COATING SHALL BE REPAIRED.

13. THE ENGINEER SHALL BE NOTIFIED OF ANY INCORRECTLY FABRICATED, DAMAGED OR OTHERWISE MISFITTING OR NON CONFORMING MATERIALS OR CONDITIONS TO REMEDIAL OR CORRECTIVE ACTION. ANY SUCH ACTION SHALL REQUIRE ENGINEER REVIEW.

14. CONNECTION ANGLES SHALL HAVE A MINIMUM THICKNESS OF 1/4 INCHES.

15. STRUCTURAL CONNECTION BOLTS SHALL CONFORM TO ASTM A325. ALL BOLTS SHALL BE 3/4" DIAMETER MINIMUM AND SHALL HAVE A MINIMUM OF TWO BOLTS, UNLESS OTHERWISE ON THE DRAWINGS.

16. LOCK WASHER ARE NOT PERMITTED FOR A325 BOLTED STEEL ASSEMBLIES.

17. SHOP CONNECTIONS SHALL BE WELDED OR HIGH STRENGTH BOLTED.

18. MILL BEARING ENDS OF COLUMNS, STIFFENERS, AND OTHER BEARING SURFACES TO TRANSFER LOAD OVER ENTIRE CROSS SECTION.

19. FABRICATE BEAMS WITH MILL CAMBER UP.

20. LEVEL AND PLUMB INDIVIDUAL MEMBERS OF THE STRUCTURE TO AN ACCURACY OF 1:500, BUT NOT TO EXCEED 1/4" IN THE FULL HEIGHT OF THE COLUMN.

21. COMMENCEMENT OF STRUCTURAL STEEL WORK WITHOUT NOTIFYING THE ENGINEER OF ANY DISCREPANCIES WILL BE CONSIDERED ACCEPTANCE OF PRECEDING WORK.

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STRUCTURAL NOTES

SHEET NO.
N-4

MODIFICATION INSPECTION REPORT REQUIREMENTS

PRE-CONSTUCTION		DURING CONSTRUCTION		POST-CONSTRUCTION	
SCHEDULED ITEM	REPORT ITEM	SCHEDULED ITEM	REPORT ITEM	SCHEDULED ITEM	REPORT ITEM
X	EOR MODIFICATION INSPECTION DRAWING	–	FOUNDATIONS	X	MODIFICATION INSPECTOR RECORD REDLINE DRAWING
X	EOR APPROVED SHOP DRAWINGS	–	EARTHWORK: BACKFILL MATERIAL & COMPACTION	–	POST–INSTALLED ANCHOR ROD PULL–OUT TEST
–	EOR APPROVED POST–INSTALLED ANCHOR MPII	–	REBAR & FORMWORK GEOMETRY VERIFICATION	X	PHOTOGRAPHS
–	FABRICATION INSPECTION	–	CONCRETE TESTING		
–	FABRICATOR CERTIFIED WELDER INSPECTION	X	STEEL INSPECTION		
X	MATERIAL CERTIFICATIONS	–	POST INSTALLED ANCHOR ROD VERIFICATION		
		–	BASE PLATE GROUT VERIFICATION		
		–	CONTRACTOR'S CERTIFIED WELD INSPECTION		
		–	ON–SITE COLD GALVANIZING VERIFICATION		
		X	CONTRACTOR AS–BUILT REDLINE DRAWINGS		

NOTES:
1. REFER TO MODIFICATION INSPECTION NOTES FOR ADDITIONAL REQUIREMENTS
2. "X" DENOTES DOCUMENT REQUIRED FOR INCLUSION IN MODIFICATION INSPECTION FINAL REPORT.
3. "–" DENOTES DOCUMENT NOT REQUIRED FOR INCLUSION IN MODIFICATION INSPECTION FINAL REPORT.
4. EOR – ENGINEER OF RECORD
4. MPII – "MANUFACTURER'S PRINTED INSTALLATION GUIDELINES"

GENERAL

1. THE MODIFICATION INSPECTION IS A VISUAL INSPECTION OF STRUCTURAL MODIFICATIONS, TO INCLUDE A REVIEW AND COMPILATION OF SPECIFIED SUBMITTALS AND CONSTRUCTION INSPECTIONS, AS AN ASSURANCE OF COMPLIANCE WITH THE CONSTRUCTION DOCUMENTS PREPARED UNDER THE DIRECTION OF THE ENGINEER OF RECORD (EOR).

2. THE MODIFICATION INSPECTION IS TO CONFIRM INSTALLATION CONFIGURATION AND GENERAL WORKMANSHIP AND IS NOT A REVIEW OF THE MODIFICATION DESIGN. OWNERSHIP OF THE MODIFICATION DESIGN EFFECTIVENESS AND INTENT RESIDES WITH THE ENGINEER OF RECORD.

3. TO ENSURE COMPLIANCE WITH THE MODIFICATION INSPECTION REQUIREMENTS THE GENERAL CONTRACTOR (GC) AND THE MODIFICATION INSPECTOR (MI) COMMENCE COMMUNICATION UPON AUTHORIZATION TO PROCEED BY THE CLIENT. EACH PARTY SHALL BE PROACTIVE IN CONTACTING THE OTHER. THE EOR SHALL BE CONTACTED IF SPECIFIC GC/MI CONTACT INFORMATION IS NOT MADE AVAILABLE.

4. THE GC SHALL PROVIDE THE MI WITH A MINIMUM OF 5 BUSINESS DAYS NOTICE OF IMPENDING INSPECTIONS.

5. WHEN POSSIBLE, THE GC AND MI SHALL BE ON SITE DURING THE MODIFICATION INSPECTION TO HAVE ANY NOTED DEFICIENCIES ADDRESSED DURING THE INITIAL MODIFICATION INSPECTION.

MODIFICATION INSPECTOR (MI)

1. THE MI SHALL CONTACT THE GC UPON AUTHORIZATION BY THE CLIENT TO:

   – REVIEW THE MODIFICATION INSPECTION REPORT REQUIREMENTS.
   – WORK WITH THE GC IN DEVELOPMENT OF A SCHEDULE FOR ON–SITE INSPECTIONS.
   – DISCUSS CRITICAL INSPECTIONS AND PROJECT CONCERNS.

2. THE MI IS RESPONSIBLE FOR COLLECTION OF ALL INSPECTION AND TEST REPORTS, REVIEWING REPORTS FOR ADHERENCE TO THE CONTRACT DOCUMENTS, CONDUCTING ON–SITE INSPECTIONS AND COMPILATION & SUBMISSION OF THE MODIFICATION INSPECTION REPORT TO THE CLIENT AND THE EOR.

GENERAL CONTRACTOR (GC)

1. THE GC IS REQUIRED TO CONTACT THE GC UPON AUTHORIZATION TO PROCEED WITH CONSTRUCTION BY THE CLIENT TO:

   – REVIEW THE MODIFICATION INSPECTION REPORT REQUIREMENTS.
   – WORK WITH THE MI IN DEVELOPMENT OF A SCHEDULE FOR ON–SITE INSPECTIONS.
   – DISCUSS CRITICAL INSPECTIONS AND PROJECT CONCERNS.

2. THE GC IS RESPONSIBLE FOR COORDINATING AND SCHEDULING IN ADVANCE ALL REQUIRED INSPECTIONS AND TESTS WITH THE MI.

CORRECTION OF FAILING MODIFICATION INSPECTION

1. SHOULD THE STRUCTURAL MODIFICATION NOT COMPLY WITH THE REQUIREMENTS OF THE CONSTRUCTION DOCUMENTS, THE GC SHALL WORK WITH THE MODIFICATION INSPECTOR IN A VIABLE REMEDIATION PLAN AS FOLLOWS:

   – CORRECT ALL DEFICIENCIES TO COMPLY WITH THE CONTRACT DOCUMENTS AND COORDINATE WITH THE MI FOR A FOLLOW UP INSPECTION.
   – WITH CLIENT AUTHORIZATION, THE GC MAY WORK WITH THE EOR TO REANALYZE THE MODIFICATION USING THE AS–BUILT CONDITION.

REQUIRED PHOTOGRAPHS

1. THE GC AND MI SHALL AT MINIMUM PHOTO DOCUMENT THE FOLLOWING FOR INCLUSION IN THE MODIFICATION INSPECTION REPORT:

   – PRE–CONSTRUCTION: GENERAL CONDITION OF THE SITE.
   – DURING CONSTRUCTION: RAW MATERIALS, CRITICAL DETAILS, WELD PREPARATION, BOLT INSTALLATION & TORQUE, FINAL INSTALLED CONDITION & SURFACE COATING REPAIRS.
   – POST–CONSTRUCTION: FINAL CONDITION OF THE SITE

REV.	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
1	01/17/17	TJL	CFC	ISSUED FOR CONSTRUCTION
0	01/03/17	TJL	CFC	ISSUED FOR CONSTRUCTION

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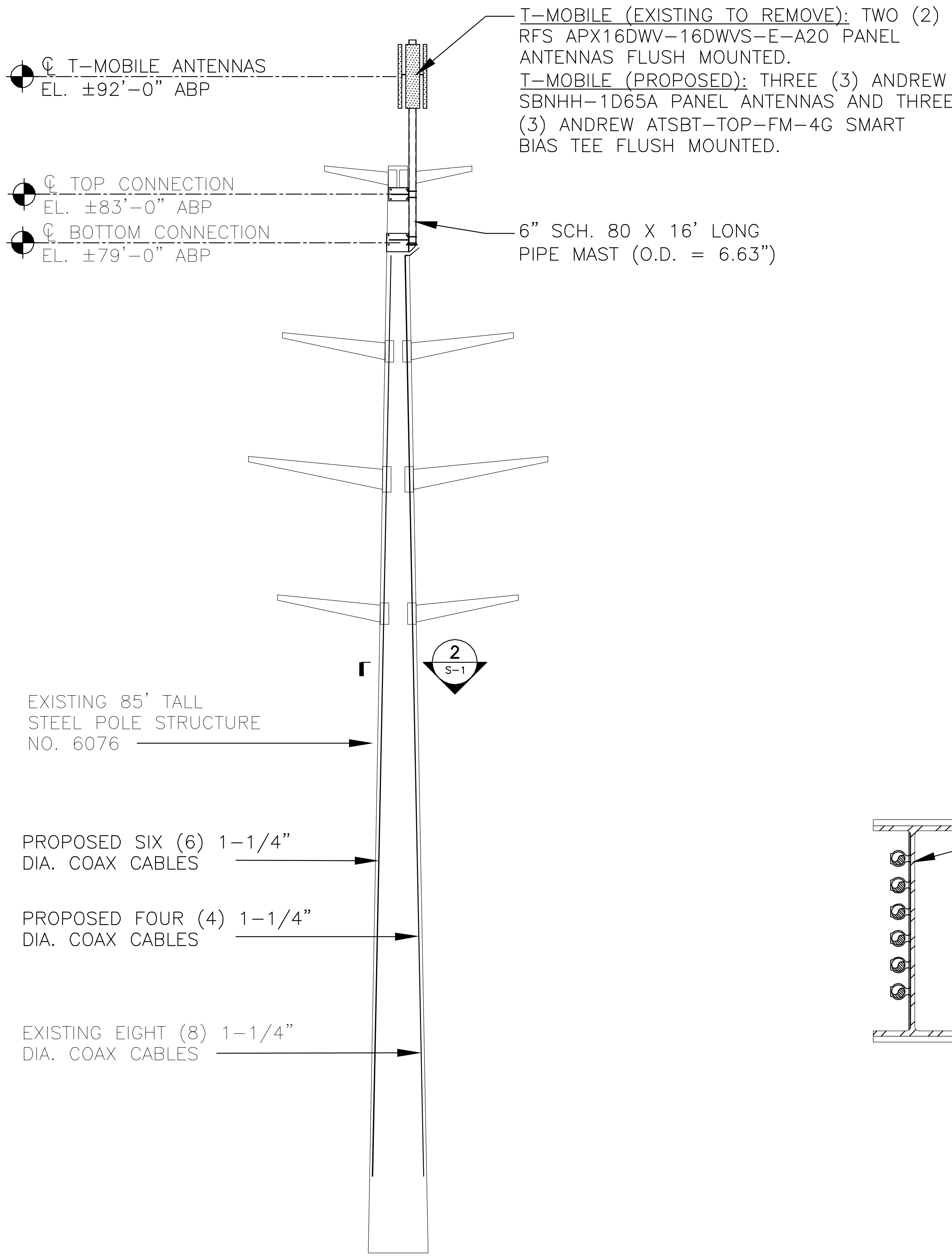
T-MOBILE
ANTENNA MAST DESIGN
CT11039D
EVERSOURCE STRUCTURE 6076
269 FLANDERS ROAD
EAST LYME, CT 06357

DATE: 01/03/17
SCALE: AS SHOWN
JOB NO. 16162.02

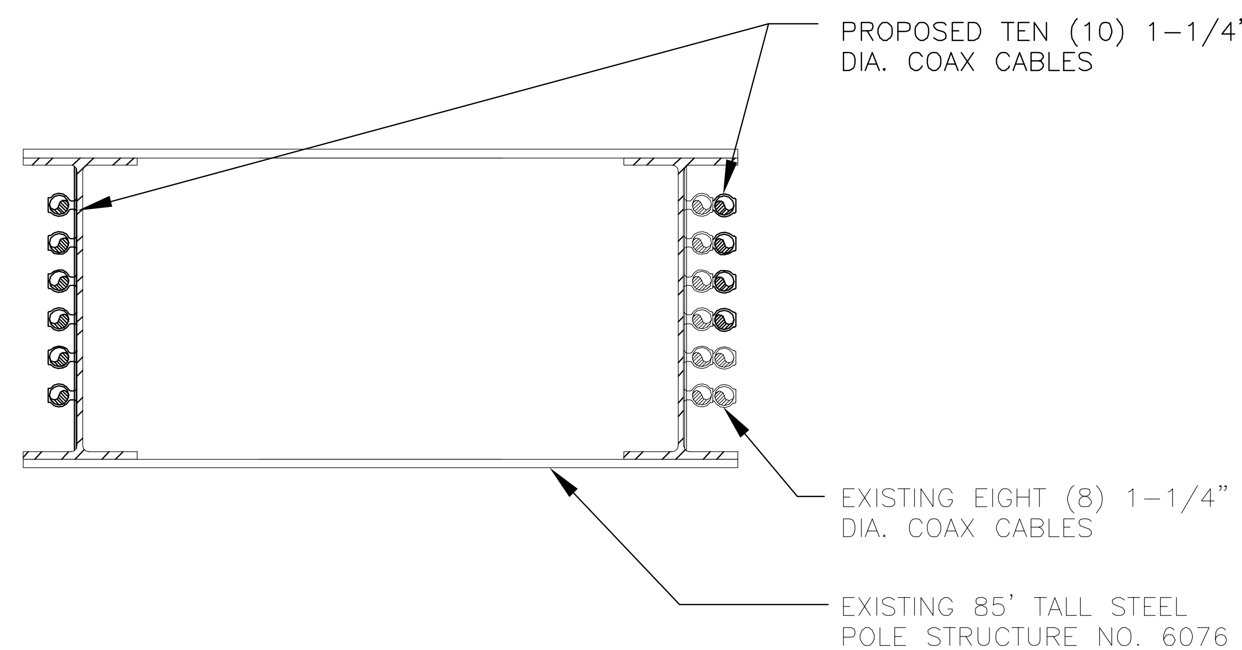
MODIFICATION INSPECTION REQUIREMENTS

SHEET NO.
MI–1



1 / S–1 **TOWER & ANTENNA MAST ELEVATION**

SCALE: NOT TO SCALE



2 / S–1 **FEEDLINE PLAN**

SCALE: NOT TO SCALE

REV.	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
1	01/17/17	TJL	CFC	ISSUED FOR CONSTRUCTION
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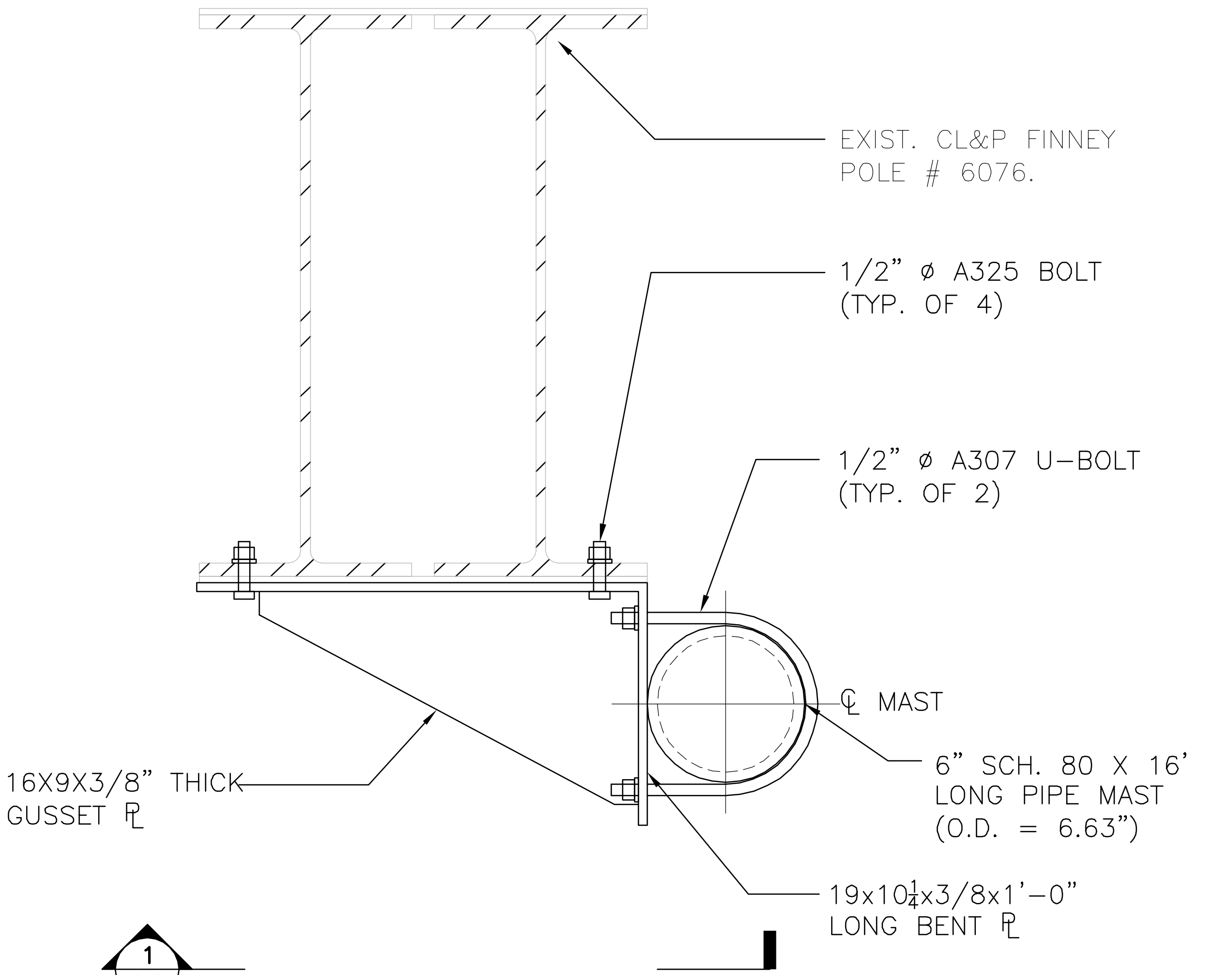
269 FLANDERS ROAD
EAST LYME, CT 06357

DATE:	01/03/17
SCALE:	AS SHOWN
JOB NO.	16162.02

TOWER ELEVATION AND FEEDLINE PLAN

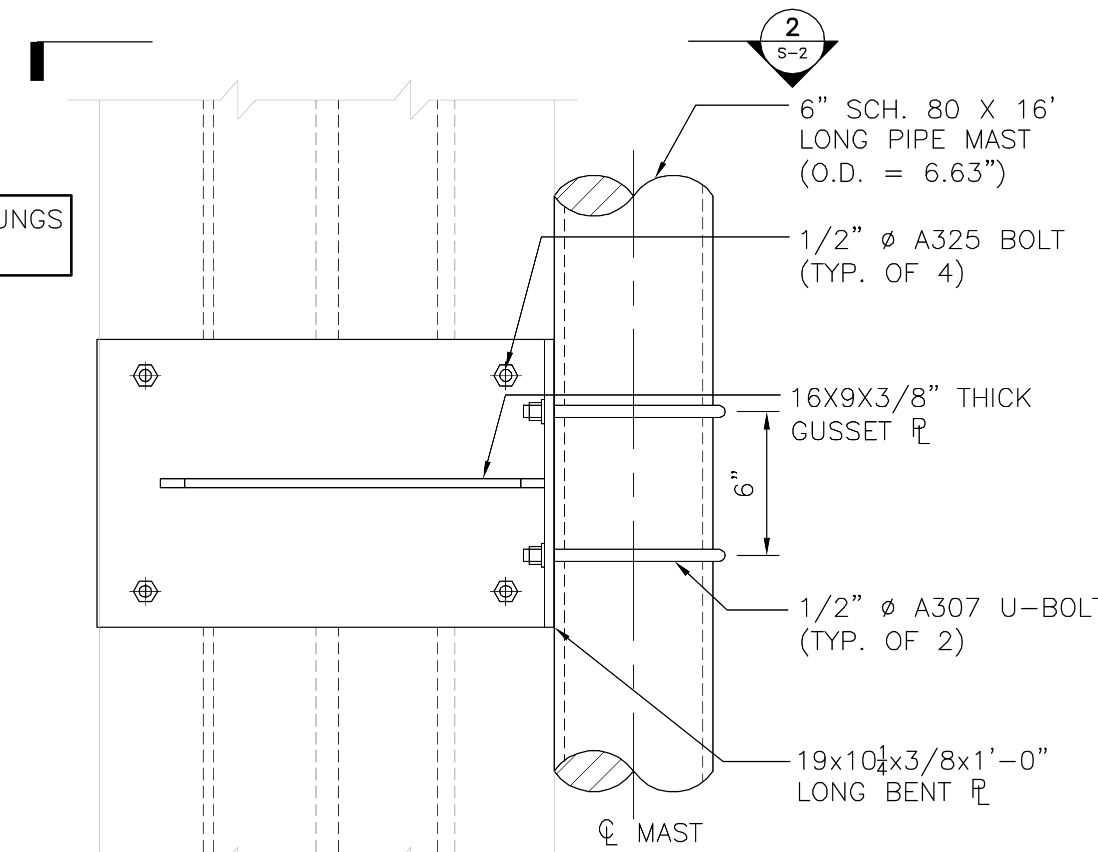
SHEET NO.

S-1



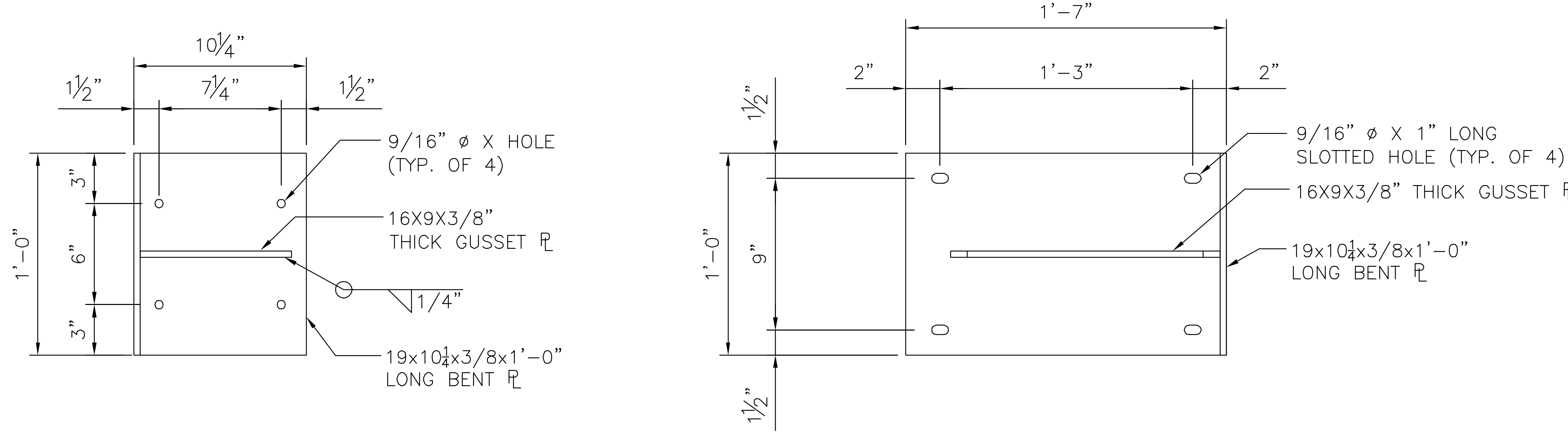
2 S-2 MAST CONNECTION PLAN

SCALE: 1-1/2" = 1'-0"



1 S-2 MAST CONNECTION SECTION

SCALE: 1-1/2" = 1'-0"



3 S-2 CONNECTION BRACKET DETAILS

SCALE: 1-1/2" = 1'-0"

REV.	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
1	01/17/17	TJL	CFC	ISSUED FOR CONSTRUCTION
0	01/03/17	TJL	CFC	ISSUED FOR CONSTRUCTION

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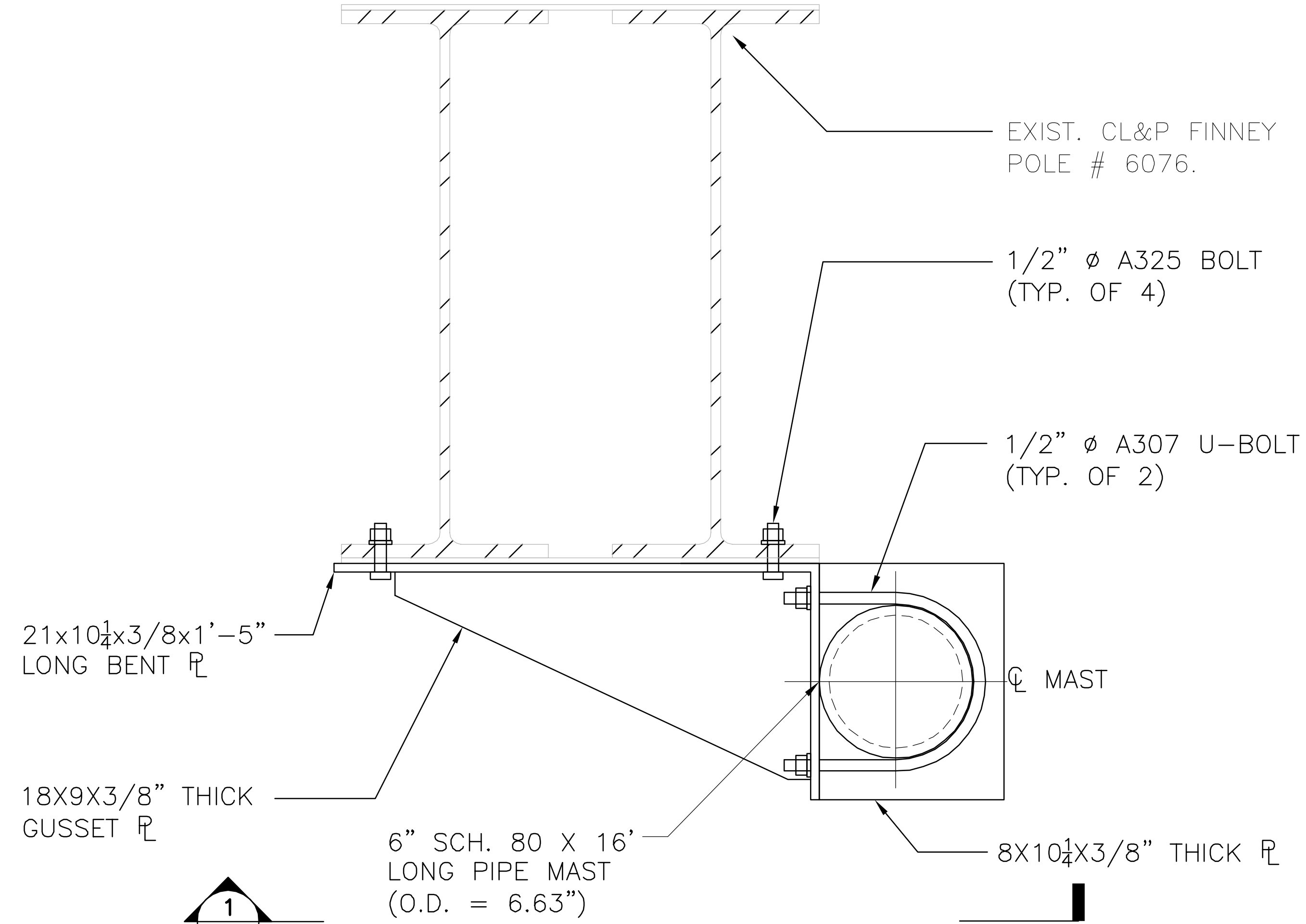
DATE: 01/03/17
SCALE: AS SHOWN
JOB NO. 16162.02

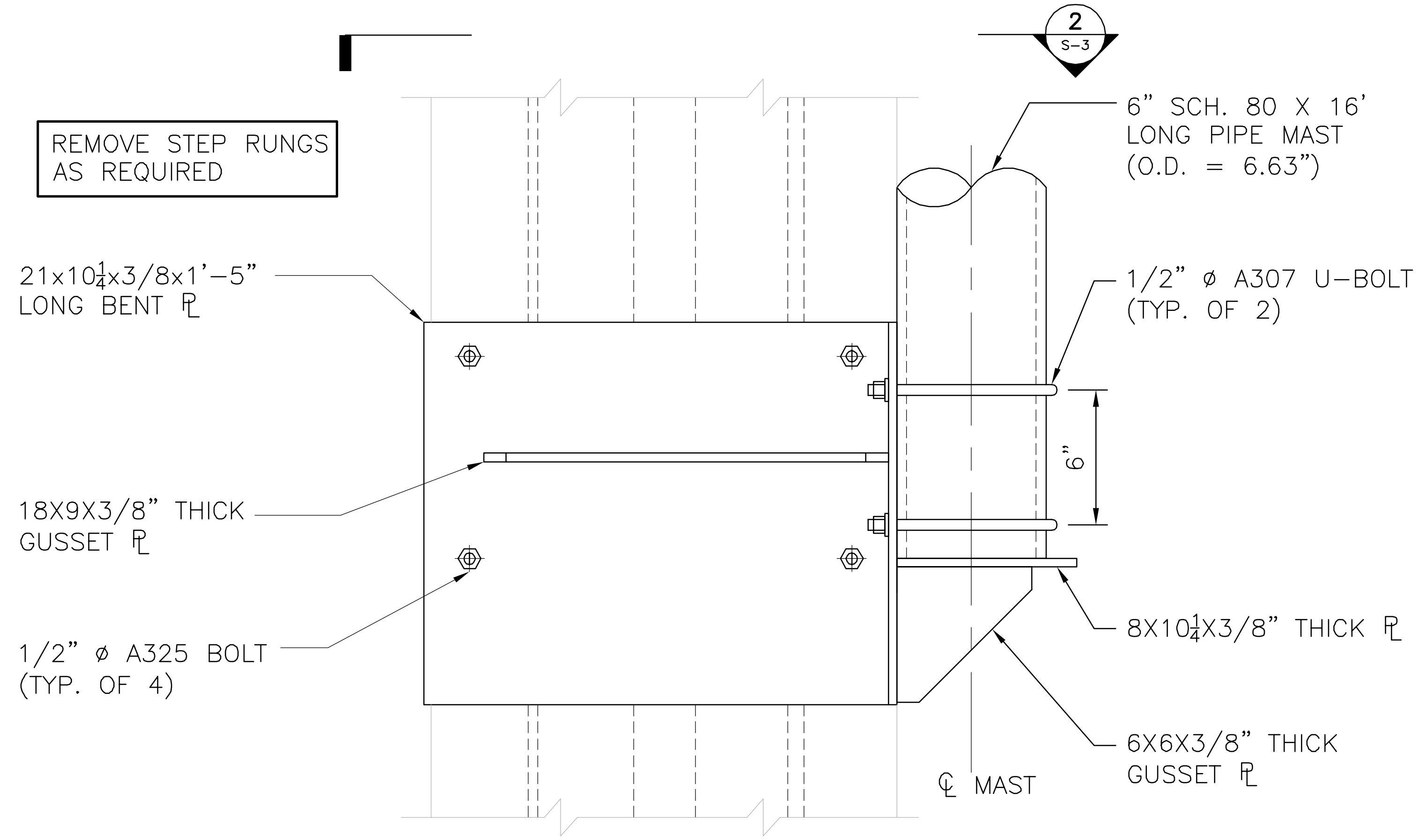
TOP BRACKET DETAILS

SHEET NO.
S-2
Sheet No. 6 of 7



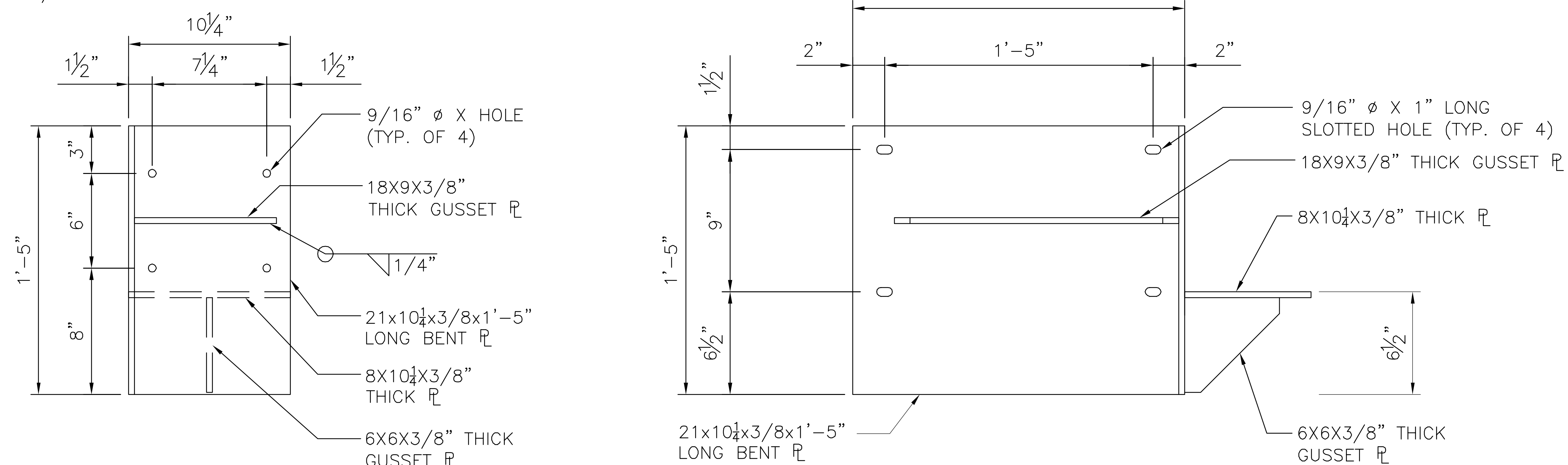
2 S-3 MAST CONNECTION PLAN

SCALE: 1-1/2" = 1'-0"



1 S-3 MAST CONNECTION SECTION

SCALE: 1-1/2" = 1'-0"



3 S-3 CONNECTION BRACKET DETAILS

SCALE: 1-1/2" = 1'-0"

REV.	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
1	01/17/17	TJL	CFC	ISSUED FOR CONSTRUCTION
0	01/03/17	TJL	CFC	ISSUED FOR CONSTRUCTION

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DATE: 01/03/17
SCALE: AS SHOWN
JOB NO. 16162.02

BOTTOM BRACKET DETAILS

SHEET NO.
S-3
Sheet No. 7 of 7

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

Wind Speeds

Basic Wind Speed $V := 105$ mph (User Input - 2016 CSBC Appendix N)

Basic Wind Speed with Ice $V_i := 50$ mph (User Input per Annex B of TIA-222-G)

Input

Structure Type = Structure_Type := Pole (User Input)

Structure Category = SC := III (User Input)

Exposure Category = Exp := C (User Input)

Structure Height = $h := 85$ ft (User Input)

Height to Center of Antennas = $z_{AT\&T} := 92$ ft (User Input)

Radial Ice Thickness = $t_i := 0.75$ in (User Input per Annex B of TIA-222-G)

Radial Ice Density = $Id := 56.00$ pcf (User Input)

Topograpic Factor = $K_{zt} := 1.0$ (User Input)

$K_a := 1.0$ (User Input)

Gust Response Factor = $G_H := 1.35$ (User Input)

Output

Wind Direction Probability Factor = $K_d := \begin{cases} 0.95 & \text{if Structure\_Type} = \text{Pole} \\ 0.85 & \text{if Structure\_Type} = \text{Lattice} \end{cases} = 0.95$ (Per Table 2-2 of TIA-222-G)

Importance Factors = $I_{Wind} := \begin{cases} 0.87 & \text{if } SC = 1 \\ 1.00 & \text{if } SC = 2 \\ 1.15 & \text{if } SC = 3 \end{cases} = 1.15$ (Per Table 2-3 of TIA-222-G)

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

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

$K_{iz} := \left(\frac{z_{AT\&T}}{33}\right)^{0.1} = 1.108$

$t_{iz} := 2.0 \cdot t_i \cdot I_{ice} \cdot K_{iz} \cdot K_{zt}^{0.35} = 2.077$

Velocity Pressure Coefficient = $Kz_{AT\&T} := 2.01\left(\left(\frac{z_{AT\&T}}{zg}\right)\right)^{\frac{2}{\alpha}} = 1.244$

Velocity Pressure w/o Ice = $qz_{AT\&T} := 0.00256 \cdot K_d \cdot Kz_{AT\&T} \cdot K_{zt} \cdot V^2 \cdot I_{Wind} = 38.346$

Velocity Pressure with Ice = $qz_{ice.AT\&T} := 0.00256 \cdot K_d \cdot Kz_{AT\&T} \cdot K_{zt} \cdot V_i^2 \cdot I_{Wind\_w\_Ice} = 7.561$

Development of Wind & Ice Load on Mast

Mast Data: (Pipe 6" Sch. 80) (User Input)

Mast Shape = Round (User Input)

Mast Diameter = $D_{mast} := 6.63$ in (User Input)

Mast Length = $L_{mast} := 17$ ft (User Input)

Mast Thickness = $t_{mast} := 0.432$ in (User Input)

Mast Aspect Ratio = $Ar_{mast} := \frac{12 L_{mast}}{D_{mast}} = 30.8$

Mast Force Coefficient = $Ca_{mast} = 1.2$

Wind Load (without ice)

Mast Projected Surface Area = $A_{mast} := \frac{D_{mast}}{12} = 0.553$ sf/ft

Total Mast Wind Force = $qz_{AT\&T} \cdot G_H \cdot Ca_{mast} \cdot A_{mast} = 34$ plf **BLC 5**

Wind Load (with ice)

Mast Projected Surface Area w/ Ice = $AICE_{mast} := \frac{(D_{mast} + 2 \cdot t_{iz})}{12} = 0.899$ sf/ft

Total Mast Wind Force w/ Ice = $qz_{ice.AT\&T} \cdot G_H \cdot Ca_{mast} \cdot AICE_{mast} = 11$ plf **BLC 4**

Gravity Loads (without ice)

Weight of the mast = Self Weight **(Computed internally by Risa-3D)** plf **BLC 1**

Gravity Loads (ice only)

Ice Area per Linear Foot = $Ai_{mast} := \frac{\pi}{4}\left[(D_{mast} + t_{iz} \cdot 2)^2 - D_{mast}^2\right] = 56.8$ sq in

Weight of Ice on Mast = $W_{ICEmast} := Id \cdot \frac{Ai_{mast}}{144} = 22$ plf **BLC 3**

Development of Wind & Ice Load on Antennas

Antenna Data:

Antenna Model =	Andrew SBNHH-1D65A		
Antenna Shape =	Flat		(User Input)
Antenna Height =	$L_{ant} := 55.5$	in	(User Input)
Antenna Width =	$W_{ant} := 11.9$	in	(User Input)
Antenna Thickness =	$T_{ant} := 7.1$	in	(User Input)
Antenna Weight =	$WT_{ant} := 33.5$	lbs	(User Input)
Number of Antennas =	$N_{ant} := 3$		(User Input)
Antenna Aspect Ratio =	$Ar_{ant} := \frac{L_{ant}}{W_{ant}} = 4.7$		
Antenna Force Coefficient =	$Ca_{ant} = 1.3$		

Wind Load (without ice)

Surface Area for One Antenna =	$SA_{ant} := \frac{L_{ant} \cdot W_{ant}}{144} = 4.6$	sf	
Antenna Projected Surface Area =	$A_{ant} := SA_{ant} \cdot N_{ant} = 13.8$	sf	
Total Antenna Wind Force =	$F_{ant} := qz_{AT\&T} \cdot G_H \cdot Ca_{ant} \cdot K_a \cdot A_{ant} = 923$	lbs	**BLC 5**

Wind Load (with ice)

Surface Area for One Antenna w/ Ice =	$SA_{ICEant} := \frac{(L_{ant} + 2 \cdot t_{iz}) \cdot (W_{ant} + 2 \cdot t_{iz})}{144} = 6.7$	sf	
Antenna Projected Surface Area w/ Ice =	$A_{ICEant} := SA_{ICEant} \cdot N_{ant} = 20$	sf	
Total Antenna Wind Force w/ Ice =	$Fi_{ant} := qz_{ice.AT\&T} \cdot G_H \cdot Ca_{ant} \cdot K_a \cdot A_{ICEant} = 264$	lbs	**BLC 4**

Gravity Load (without ice)

Weight of All Antennas =	$WT_{ant} \cdot N_{ant} = 101$	lbs	**BLC 2**

Gravity Loads (ice only)

Volume of Each Antenna =	$V_{ant} := L_{ant} \cdot W_{ant} \cdot T_{ant} = 4689$	cu in	
Volume of Ice on Each Antenna =	$V_{ice} := (L_{ant} + 2 \cdot t_{iz})(W_{ant} + 2 \cdot t_{iz}) \cdot (T_{ant} + 2 \cdot t_{iz}) - V_{ant} = 6090$	cu in	
Weight of Ice on Each Antenna =	$W_{ICEant} := \frac{V_{ice}}{1728} \cdot Id = 197$	lbs	
Weight of Ice on All Antennas =	$W_{ICEant} \cdot N_{ant} = 592$	lbs	**BLC 3**

Development of Wind & Ice Load on Antennas

Antenna Data:

Antenna Model =	Andrew ATSBT-TOP-FM-4G		
Antenna Shape =	Flat		(User Input)
Antenna Height =	$L_{ant} := 5.63$	in	(User Input)
Antenna Width =	$W_{ant} := 3.7$	in	(User Input)
Antenna Thickness =	$T_{ant} := 2.0$	in	(User Input)
Antenna Weight =	$WT_{ant} := 2$	lbs	(User Input)
Number of Antennas =	$N_{ant} := 3$		(User Input)
Antenna Aspect Ratio =	$Ar_{ant} := \frac{L_{ant}}{W_{ant}} = 1.5$		
Antenna Force Coefficient =	$Ca_{ant} = 1.2$		

Wind Load (without ice)

Surface Area for One Antenna =	$SA_{ant} := \frac{L_{ant} \cdot W_{ant}}{144} = 0.1$	sf	
Antenna Projected Surface Area =	$A_{ant} := SA_{ant} \cdot N_{ant} = 0.4$	sf	
Total Antenna Wind Force =	$F_{ant} := qz_{AT\&T} \cdot G_H \cdot Ca_{ant} \cdot K_a \cdot A_{ant} = 27$	lbs	**BLC 5**

Wind Load (with ice)

Surface Area for One Antenna w/ Ice =	$SA_{ICEant} := \frac{(L_{ant} + 2 \cdot t_{iz}) \cdot (W_{ant} + 2 \cdot t_{iz})}{144} = 0.5$	sf	
Antenna Projected Surface Area w/ Ice =	$A_{ICEant} := SA_{ICEant} \cdot N_{ant} = 1.6$	sf	
Total Antenna Wind Force w/ Ice =	$Fi_{ant} := qz_{ice.AT\&T} \cdot G_H \cdot Ca_{ant} \cdot K_a \cdot A_{ICEant} = 20$	lbs	**BLC 4**

Gravity Load (without ice)

Weight of All Antennas =	$WT_{ant} \cdot N_{ant} = 6$	lbs	**BLC 2**

Gravity Loads (ice only)

Volume of Each Antenna =	$V_{ant} := L_{ant} \cdot W_{ant} \cdot T_{ant} = 42$	cu in	
Volume of Ice on Each Antenna =	$V_{ice} := (L_{ant} + 2 \cdot t_{iz})(W_{ant} + 2 \cdot t_{iz}) \cdot (T_{ant} + 2 \cdot t_{iz}) - V_{ant} = 431$	cu in	
Weight of Ice on Each Antenna =	$W_{ICEant} := \frac{V_{ice}}{1728} \cdot Id = 14$	lbs	
Weight of Ice on All Antennas =	$W_{ICEant} \cdot N_{ant} = 42$	lbs	**BLC 3**

CENTEK engineering Centered on Solutions www.centekeng.com 63-2 North Branford Road P: (203) 488-0580 Branford, CT 06405 F: (203) 488-8587	Subject:	Loads on T-Mobile Equipmnet Structure # 6076
	Location:	East Lyme, CT
	Rev. 1: 12/22/16	Prepared by: T.J.L. Checked by: C.F.C. Job No. 16162.02

Development of Wind & Ice Load on Coax Cables

Coax Cable Data:

Coax Type = HELIAX 1-1/4"

Shape = Round (User Input)

Coax Outside Diameter = $D_{coax} := 1.55$ in (User Input)

Coax Cable Length = $L_{coax} := 11$ ft (User Input)

Weight of Coax per foot = $Wt_{coax} := 0.66$ plf (User Input)

Total Number of Coax = $N_{coax} := 18$ (User Input)

No. of Coax Projecting Outside Face of Mast = $NP_{coax} := 4$ (User Input)

Coax aspect ratio, $Ar_{coax} := \frac{(L_{coax} \cdot 12)}{D_{coax}} = 85.2$

Coax Cable Force Factor Coefficient = $Ca_{coax} = 1.2$

Wind Load (without ice)

Coax projected surface area = $A_{coax} := \frac{(NP_{coax} D_{coax})}{12} = 0.5$ sf/ft

Total Coax Wind Force = $F_{coax} := Ca_{coax} \cdot qz_{AT\&T} \cdot G_H \cdot A_{coax} = 32$ plf **BLC 5**

Wind Load (with ice)

Coax projected surface area w/ Ice = $AICE_{coax} := \frac{(NP_{coax} \cdot D_{coax} + 2 \cdot t_{iz})}{12} = 0.9$ sf/ft

Total Coax Wind Force w/ Ice = $Fi_{coax} := Ca_{coax} \cdot qz_{ice.AT\&T} \cdot G_H \cdot AICE_{coax} = 11$ plf **BLC 4**

Gravity Loads (without ice)

Weight of all cables w/o ice $WT_{coax} := Wt_{coax} \cdot N_{coax} = 12$ plf **BLC 2**

Gravity Loads (ice only)

Ice Area per Linear Foot = $Ai_{coax} := \frac{\pi}{4}\left[(D_{coax} + 2 \cdot t_{iz})^2 - D_{coax}{}^2\right] = 23.7$ sq in

Ice Weight All Coax per foot = $WTi_{coax} := N_{coax} \cdot Id \cdot \frac{Ai_{coax}}{144} = 166$ plf **BLC 3**

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Consulting Engineers
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Branford, CT 06405
Ph. 203-488-0580 / Fax. 203-488-8587

Subject: **Analysis of TIA/EIA Wind and Ice Loads for Analysis of Mast Only**
Tabulated Load Cases
Location: **East Lyme, CT**
Date: 10/25/16 Prepared by: T.J.L. Checked by: C.F.C. Job No. 16162.02

Load Case	Description
1	Self Weight (Mast)
2	Weight of Appurtenances
3	Weight of Ice Only
4	TIA Wind with Ice
5	TIA Wind

Footnotes:

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Consulting Engineers
63-2 North Branford Road
Branford, CT 06405
Ph. 203-488-0580 / Fax. 203-488-8587

Subject: **Analysis of TIA/EIA Wind and Ice Loads for Analysis of Mast Only**
Load Combinations Table

Location: **East Lyme, CT**

Date: 10/25/16 Prepared by: T.J.L. Checked by: C.F.C. Job No. 16162.02

Load Combination	Description	Envelope Soultion	Wind Factor	P-Delta	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
1	1.2D + 1.6W		1	Y	1	1.2	2	1.2	5	1.6				
2	0.9D + 1.6W		1	Y	1	0.9	2	0.9	5	1.6				
3	1.2D + 1.0Di + 1.0Wi		1	Y	1	1.2	2	1.2	3	1.0	4	1.0		

Footnotes:
BLC = Basic Load Case
D = Dead Load
Di = Dead Load of Ice
W = Wind Load
W = Wind Load w/ Ice

Global

Display Sections for Member Calcs	5
Max Internal Sections for Member Calcs	97
Include Shear Deformation?	Yes
Include Warping?	Yes
Trans Load Btwn Intersecting Wood Wall?	Yes
Increase Nailing Capacity for Wind?	Yes
Area Load Mesh (in^2)	144
Merge Tolerance (in)	.12
P-Delta Analysis Tolerance	0.50%
Include P-Delta for Walls?	Yes
Automaticly Iterate Stiffness for Walls?	No
Maximum Iteration Number 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	Accelerated Solver

Hot Rolled Steel Code	AISC 14th(360-10): LRFD
Adjust Stiffness?	Yes(Iterative)
RISAConnection Code	AISC 14th(360-10): ASD
Cold Formed Steel Code	AISI 1999: ASD
Wood Code	AF&PA NDS-97: ASD
Wood Temperature	< 100F
Concrete Code	ACI 318-02
Masonry Code	ACI 530-05: ASD
Aluminum Code	AA ADM1-05: ASD - 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 Z	.035
Ct X	.035
T Z (sec)	Not Entered
T X (sec)	Not Entered
R Z	8.5
R X	8.5
Ca	.36
Cv	.54
Nv	1
Occupancy Category	4
Seismic Zone	3
Seismic Detailing Code	ASCE 7-05
Om Z	1
Om X	1
Rho Z	1
Rho X	1

Footing Overturning Safety Factor	1.5
Check Concrete Bearing	No
Footing Concrete Weight (k/ft^3)	0
Footing Concrete f'c (ksi)	3
Footing Concrete Ec (ksi)	4000
Lamda	1
Footing Steel fy (ksi)	60
Minimum Steel	0.0018
Maximum Steel	0.0075
Footing Top Bar	#3
Footing Top Bar Cover (in)	3.5
Footing Bottom Bar	#3
Footing Bottom Bar Cover (in)	3.5
Pedestal Bar	#3
Pedestal Bar Cover (in)	1.5
Pedestal Ties	#3

Hot Rolled Steel Properties

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

Hot Rolled Steel Design Parameters

	Label	Shape	Lengt...	Lbyy[ft]	Lbzz[ft]	Lcomp t...	Lcomp b...	L-torqu...	Kyy	Kzz	Cb	Function
1	M1	Mast	16									Lateral

Hot Rolled Steel Section Sets

	Label	Shape	Type	Design List	Material	Design ...	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	Mast	PIPE_6.0X	Beam	Pipe	A53 Gr. B	Typical	7.83	38.3	38.3	76.6

Member Primary Data

	Label	I Joint	J Joint	K Joint	Rotate(d...	Section/Shape	Type	Design List	Material	Design R...
1	M1	BOTCO...	TOPMA...			Mast	Beam	Pipe	A53 Gr. B	Typical

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From ...
1	BOTCONNECTION	0	1	0	0	
2	TOPCONNECTION	0	5	0	0	
3	TOPMAST	0	17	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	BOTCONNECTION	Reaction	Reaction	Reaction				
2	TOPCONNECTION	Reaction		Reaction		Reaction		

Member Point Loads (BLC 2 : Weight of Appurtenances)

	Member Label	Direction	Magnitude[k,k-ft]	Location[ft,%]
1	M1	Y	-.101	14
2	M1	Y	-.006	14

Member Point Loads (BLC 3 : Weight of Ice Only)

	Member Label	Direction	Magnitude[k,k-ft]	Location[ft,%]
1	M1	Y	-.592	14
2	M1	Y	-.042	14

Member Point Loads (BLC 4 : TIA Wind with Ice)

	Member Label	Direction	Magnitude[k,k-ft]	Location[ft,%]
1	M1	X	.264	14
2	M1	X	.02	14

Member Point Loads (BLC 5 : TIA Wind)

	Member Label	Direction	Magnitude[k,k-ft]	Location[ft,%]
1	M1	X	.923	14
2	M1	X	.027	14

Joint Loads and Enforced Displacements

Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft, k*s^2*ft)]
No Data to Print ...			

Member Distributed Loads (BLC 2 : Weight of Appurtenances)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	-.012	-.012	7	11

Member Distributed Loads (BLC 3 : Weight of Ice Only)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	-.022	-.022	0	0
2	M1	Y	-.166	-.166	7	11

Member Distributed Loads (BLC 4 : TIA Wind with Ice)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M1	X	.011	.011	0	11
2	M1	X	.011	.011	7	11

Member Distributed Loads (BLC 5 : TIA Wind)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M1	X	.034	.034	0	11
2	M1	X	.032	.032	7	11

Basic Load Cases

	BLC Description	Category	X Gra...	Y Gravity	Z Gra...	Joint	Point	Distrib..	Area(...	Surfa...
1	Self Weight	None		-1						
2	Weight of Appurtenances	None					2	1		
3	Weight of Ice Only	None					2	2		
4	TIA Wind with Ice	None					2	2		
5	TIA Wind	None					2	2		

Load Combinations

	Description	Sol...	PDelta	SR..	BLC	Fact..	BLC	Fact..	BLC	Fact..	BLC	Fact..	BLC	Fact..	BLC	Fact..	BLC	Fact..	BLC	Fact...
1	1.2D + 1.6W	Yes	Y		1	1.2	2	1.2	5	1.6										
2	0.9D + 1.6W	Yes	Y		1	.9	2	.9	5	1.6										
3	1.2D + 1.0Di + 1.0Wi	Yes	Y		1	1.2	2	1.2	3	1	4	1								

Envelope Member Section Forces

	Member	Sec		Axial[k]	LC	y Shear[k]	LC	z Shear[k]	LC	Torqu...	LC	y-y Mo...	LC	z-z Mo...	LC
1	M1	1	max	2.348	3	-.819	3	0	1	0	1	0	1	0	1
2			min	.523	2	-4.292	1	0	1	0	1	0	1	0	1
3		2	max	2.132	3	-.863	3	0	1	0	1	0	1	17.603	1
4			min	.427	2	-4.51	1	0	1	0	1	0	1	3.363	3
5		3	max	1.735	3	1.841	1	0	1	0	1	0	1	9.626	1
6			min	.321	2	.353	3	0	1	0	1	0	1	1.825	3

Envelope Member Section Forces (Continued)

	Member	Sec		Axial[k]	LC	y Shear[k]	LC	z Shear[k]	LC	Torqu...	LC	y-y Mo...	LC	z-z Mo...	LC
7		4	max	.978	3	1.524	1	0	1	0	1	0	1	3.055	1
8			min	.192	2	.287	3	0	1	0	1	0	1	.579	3
9		5	max	0	1	.004	1	0	1	0	1	0	1	0	1
10			min	0	1	.003	3	0	1	0	1	0	1	0	1

Envelope Member Section Stresses

	Member	Sec		Axial[ksi]	LC	y Shear[...	LC	z Shear[...	LC	y-Top[ksi]	LC	y-Bot[ksi]	LC	z-Top[ksi]	LC	z-Bot[ksi]	LC
1	M1	1	max	.3	3	-.209	3	0	1	0	1	0	1	0	1	0	1
2			min	.067	2	-1.096	1	0	1	0	1	0	1	0	1	0	1
3		2	max	.272	3	-.22	3	0	1	-3.493	3	18.283	1	0	1	0	1
4			min	.055	2	-1.152	1	0	1	-18.283	1	3.493	3	0	1	0	1
5		3	max	.222	3	.47	1	0	1	-1.896	3	9.998	1	0	1	0	1
6			min	.041	2	.09	3	0	1	-9.998	1	1.896	3	0	1	0	1
7		4	max	.125	3	.389	1	0	1	-.601	3	3.174	1	0	1	0	1
8			min	.025	2	.073	3	0	1	-3.174	1	.601	3	0	1	0	1
9		5	max	0	1	0	1	0	1	0	1	0	1	0	1	0	1
10			min	0	1	0	3	0	1	0	1	0	1	0	1	0	1

Envelope Joint Reactions

	Joint		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC
1	BOTCONNE...	max	4.292	1	2.348	3	0	1	0	1	0	1	0	1
2		min	.819	3	.523	2	0	1	0	1	0	1	0	1
3	TOPCONNE...	max	-1.268	3	0	1	0	1	0	1	0	1	0	1
4		min	-6.615	1	0	1	0	1	0	1	0	1	0	1
5	Totals:	max	-.449	3	2.348	3	0	1						
6		min	-2.323	1	.523	2	0	1						

Envelope Joint Displacements

	Joint		X [in]	LC	Y [in]	LC	Z [in]	LC	X Rotatio...	LC	Y Rotatio...	LC	Z Rotation...	LC
1	BOTCONNE...	max	0	3	0	2	0	1	0	1	0	1	1.784e-3	1
2		min	0	1	0	3	0	1	0	1	0	1	3.405e-4	3
3	TOPCONNE...	max	0	1	0	2	0	1	0	1	0	1	-7.399e-4	3
4		min	0	3	0	3	0	1	0	1	0	1	-3.875e-3	1
5	TOPMAST	max	1.963	1	0	2	0	1	0	1	0	1	-3.269e-3	3
6		min	.374	3	-.001	3	0	1	0	1	0	1	-1.718e-2	1

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

	Member	Shape	Code Check	Loc...	LC	Sh...	Loc[ft]	Dir	LC	phi*Pn...	phi*...	phi*...	phi*...	...	Eqn
1	M1	PIPE_6.0X	.432	4	1	.061	4		1	167.707	246...	40.95	40.95	...	H1...

Joint Reactions

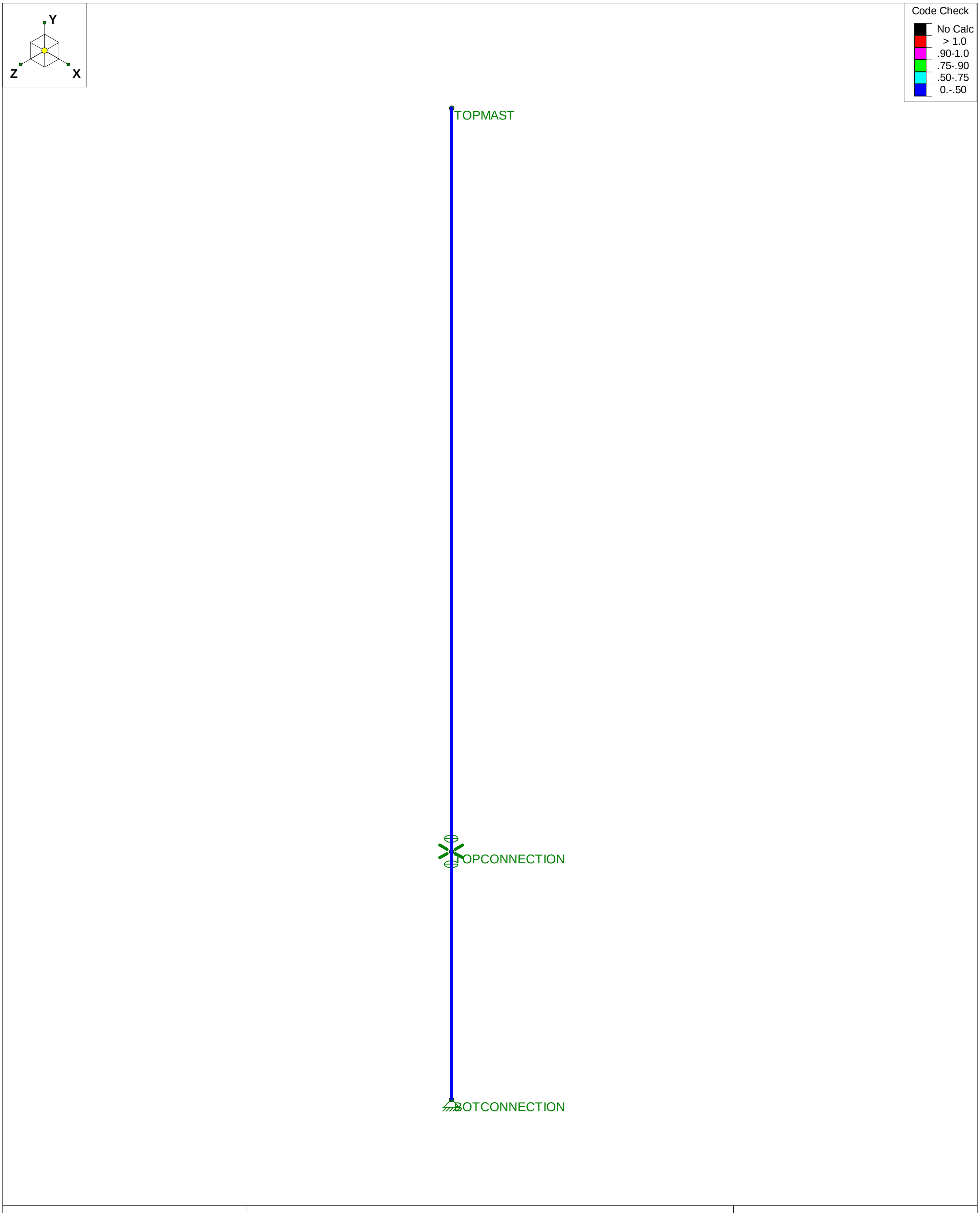
	LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	1	BOTCONNECTION	4.292	.698	0	0	0	0
2	1	TOPCONNECTION	-6.615	0	0	0	0	0
3	1	Totals:	-2.323	.698	0			
4	1	COG (ft):	X: 0	Y: 10.187	Z: 0			

Joint Reactions

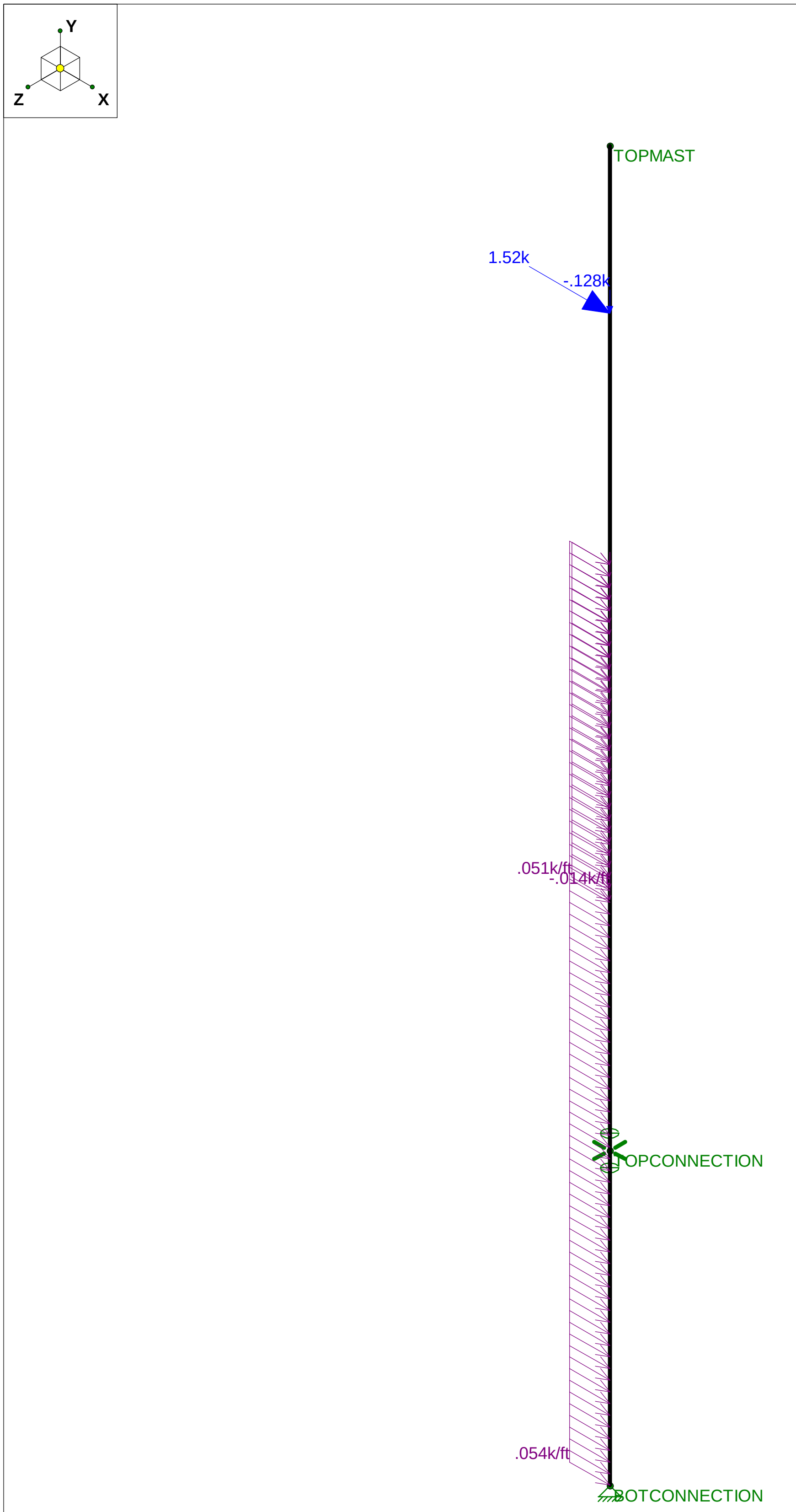
	LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	2	BOTCONNECTION	4.289	.523	0	0	0	0
2	2	TOPCONNECTION	-6.612	0	0	0	0	0
3	2	Totals:	-2.323	.523	0			
4	2	COG (ft):	X: 0	Y: 10.187	Z: 0			

Joint Reactions

	LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	3	BOTCONNECTION	.819	2.348	0	0	0	0
2	3	TOPCONNECTION	-1.268	0	0	0	0	0
3	3	Totals:	-.449	2.348	0			
4	3	COG (ft):	X: 0	Y: 11.256	Z: 0			

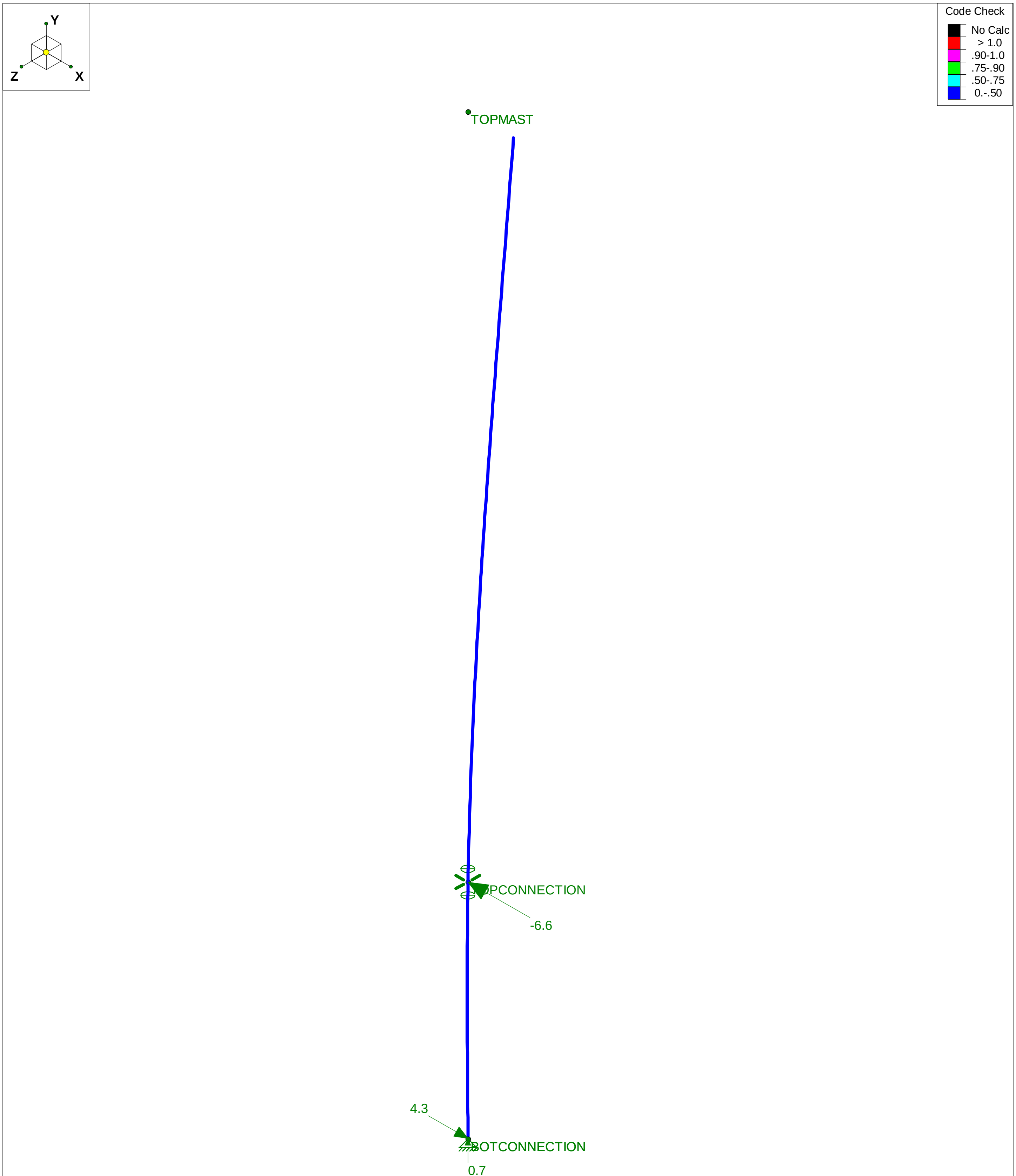


CENTEK Engineering, INC.		
tjl, cfc	Structure # 6076 Mast	Dec 22, 2016 at 11:15 AM
16162.02 /T-Mobile CT110...	Unity Check	TIA.r3d

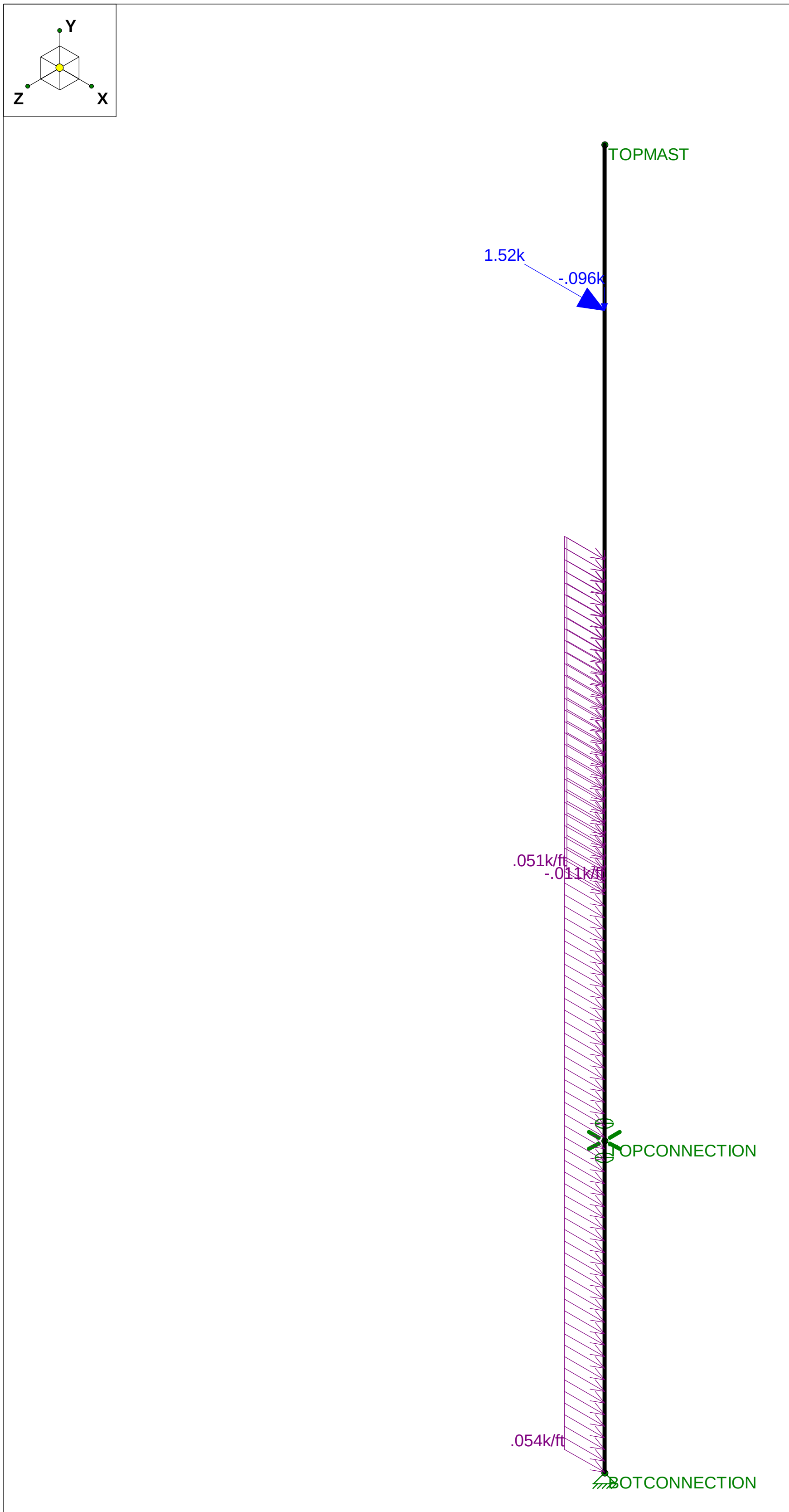


Loads: LC 1, 1.2D + 1.6W

CENTEK Engineering, INC.	Structure # 6076 Mast LC #1 Loads	
tjl, cfc		Dec 22, 2016 at 11:15 AM
16162.02 /T-Mobile CT110...		TIA.r3d

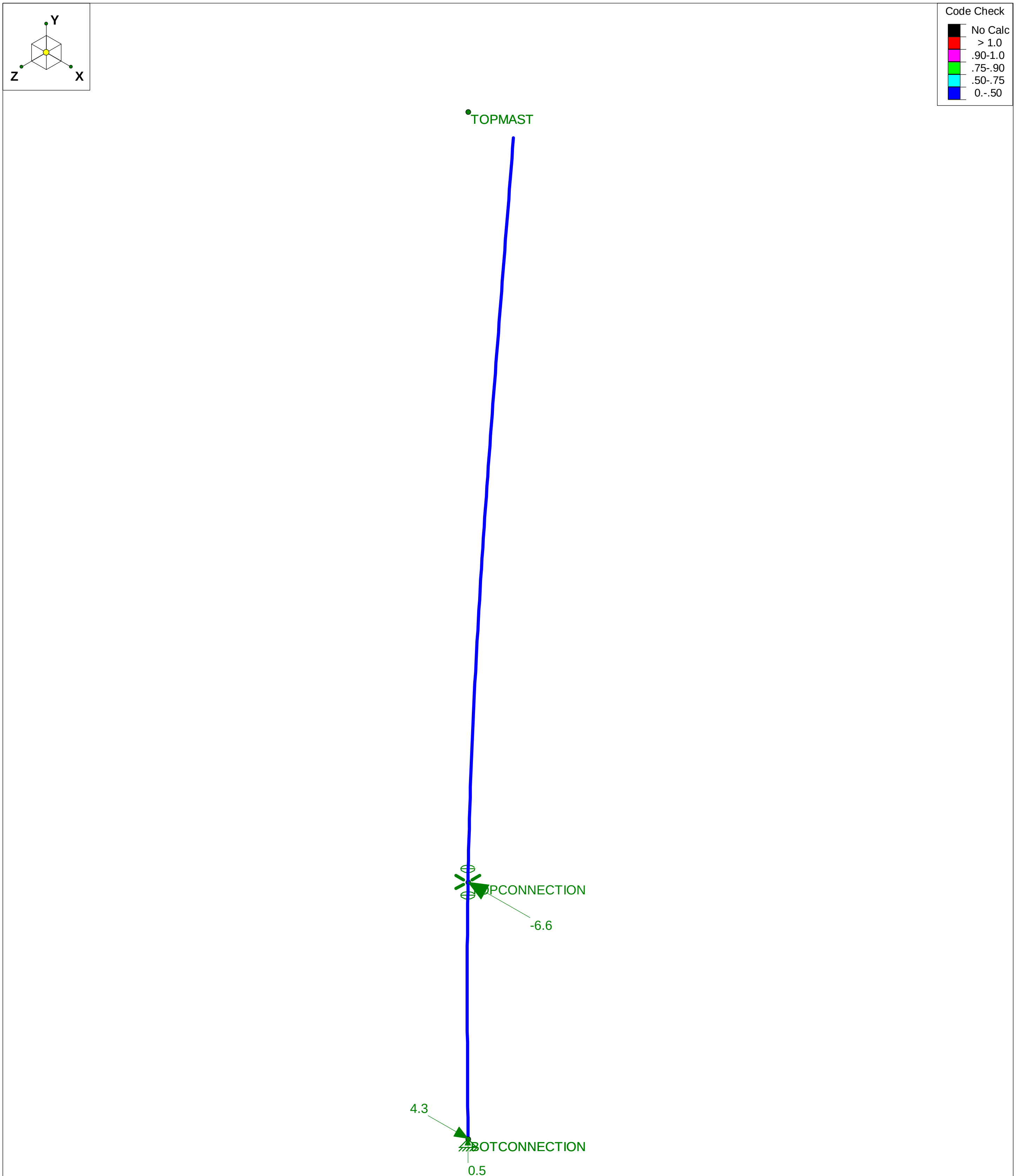


CENTEK Engineering, INC.		
tjl, cfc	Structure # 6076 Mast	Dec 22, 2016 at 11:16 AM
16162.02 /T-Mobile CT110...	LC #1 Reactions and Deflected Shape	TIA.r3d

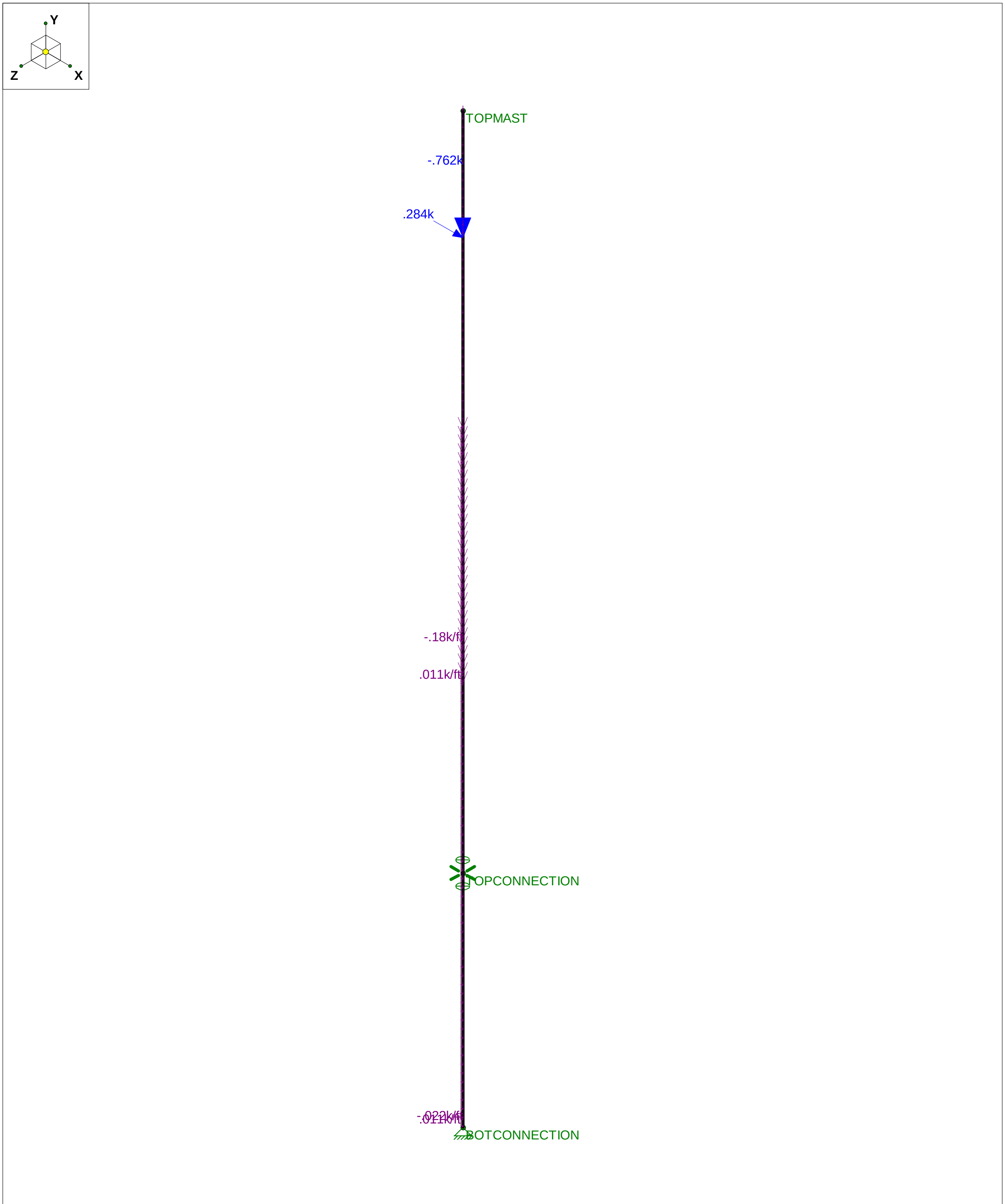


Loads: LC 2, 0.9D + 1.6W

CENTEK Engineering, INC.		
tjl, cfc	Structure # 6076 Mast	Dec 22, 2016 at 11:15 AM
16162.02 /T-Mobile CT110...	LC #2 Loads	TIA.r3d

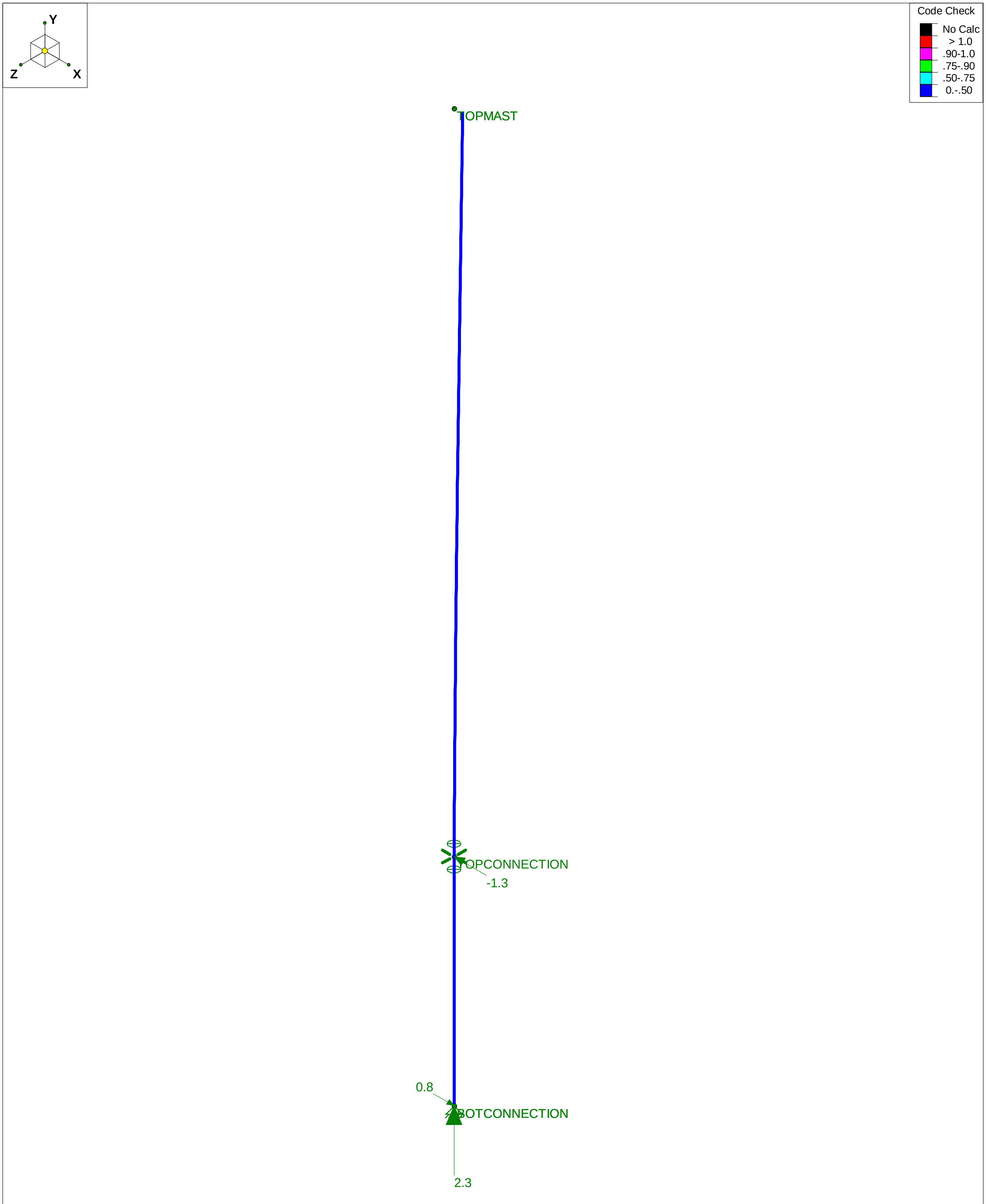


CENTEK Engineering, INC.		
tjl, cfc	Structure # 6076 Mast	Dec 22, 2016 at 11:17 AM
16162.02 /T-Mobile CT110...	LC #2 Reactions and Deflected Shape	TIA.r3d



Loads: LC 3, 1.2D + 1.0Di + 1.0Wi

CENTEK Engineering, INC.	Structure # 6076 Mast LC #3 Loads	
tjl, cfc		Dec 22, 2016 at 11:15 AM
16162.02 /T-Mobile CT110...		TIA.r3d



CENTEK Engineering, INC.		
tjl, cfc	Structure # 6076 Mast	Dec 22, 2016 at 11:17 AM
16162.02 /T-Mobile CT110...	LC #3 Reactions and Deflected Shape	TIA.r3d

Mast Connection:

Reactions at Top Connection:

Horizontal = $Horizontal := 6.7 \cdot kips$ (User Input from Risa 3D)

Vertical = $Vertical := 0 \cdot kips$ (User Input from Risa 3D)

Moment = $Moment := 0 \cdot kips \cdot ft$ (User Input from Risa 3D)

Mast Diameter = $Mast_d := 6.625 \cdot in$ (User Input)

Check Pipe to Bracket U-Bolts:

Bolt Data:

Bolt Grade = A307 (User Input)

Number of Bolts = $n_b := 4$ (User Input) (2 U-Bolts)

Bolt Diameter = $d_b := 0.5in$ (User Input)

Bolt Area = $a_b := \frac{1}{4} \cdot \pi \cdot d_b^2 = 0.196 \cdot in^2$ (User Input)

Desing Tensile Stress = $F_t := 33.8 \cdot ksi$ (User Input)

Design Shear Stress = $F_v := 20.3 \cdot ksi$ (User Input)

Check Bolt Stresses:

Wind Acting Parallel to Bolts:

Shear Force per Bolt = $F_{v.conn} := \frac{Vertical}{n_b} = 0 \cdot kips$

Shear Stress per Bolt = $F_{v.act} := \frac{F_{v.conn}}{a_b} = 0 \cdot ksi$

$Condition1 := if(F_{v.act} < F_v, \text{"OK"}, \text{"Overstressed"})$

$Condition1 = \text{"OK"}$

Allowable Tensile Stress Adjusted for Shear = $F_{t.adj} := \sqrt{F_t^2 - 4.39 \cdot F_{v.act}^2} = 33.8 \cdot ksi$

Tension Force Each Bolt = $F_{tension.bolt} := \frac{Horizontal}{n_b} = 1.675 \cdot kips$

Tension Stress Each Bolt = $F_{t.act} := \frac{F_{tension.bolt}}{a_b} = 8.5 \cdot ksi$

$Condition2 := if(F_{t.act} < F_{t.adj}, \text{"OK"}, \text{"Overstressed"})$

$Condition2 = \text{"OK"}$

Wind Acting Perpendicular to Bolts:

Shear Force per Bolt = $F_{v.conn} := \frac{Horizontal}{n_b} = 1.68 \cdot kips$

Shear Stress per Bolt = $F_{v.act} := \frac{F_{v.conn}}{a_b} = 8.53 \cdot ksi$

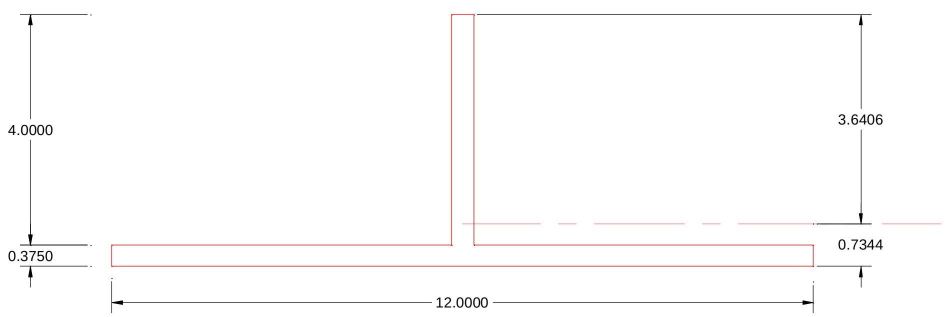
$Condition3 := if(F_{v.act} < F_v, "OK", "Overstressed")$

$Condition3 = "OK"$

Check Bracket:

Bracket Plate Data:

Plate Yield Strength =	$Fy_{bp} := 36 \cdot ksi$	(User Input)
Base Plate Thickness =	$t_{bp} := 0.375 \cdot in$	(User Input)
Distance from Center of Mast to Face of Tower =	$d := 5.125 \cdot in$	(User Input)
Bracket Plate Section Modulus =	$S_{bp} := 2.04 \cdot in^3$	(User Input)



Check Bracket Plate Bending Stress:

Maximum Bending Plate = $M_{bp} := Horizontal \cdot d = 34.34 \cdot in \cdot kips$

Maximum Bending Stress in Plate = $f_{bp} := \frac{M_{bp}}{S_{bp}} = 17 \cdot ksi$

Allowable Bending Stress in Plate = $F_{bp} := 0.9 \cdot Fy_{bp} = 32.4 \cdot ksi$

Plate Bending Stress % of Capacity = $\frac{f_{bp}}{F_{bp}} \cdot 100 = 52$

Condition3 = $Condition1 := if\left(\frac{f_{bp}}{F_{bp}} < 1.00, "Ok", "Overstressed"\right)$

$Condition1 = "Ok"$

Check Bracket to Tower Connection:

Bolt Data:

Bolt Grade =	A325	(User Input)
Number of Bolts =	$n_b := 4$	(User Input)
Bolt Diameter =	$d_b := 0.5\text{in}$	(User Input)
Bolt Spacing Horizontal =	$S_{bH} := 15\text{in}$	(User Input)
Bolt Spacing Vertical =	$S_{bV} := 9\text{in}$	(User Input)
Bolt Area =	$a_b := \frac{1}{4}\cdot\pi\cdot d_b^{\,2} = 0.196\cdot\text{in}^2$	(User Input)
Desing Tensile Stress =	$F_t := 67.5\cdot\text{ksi}$	(User Input)
Design Shear Stress =	$F_v := 40.5\cdot\text{ksi}$	(User Input)

Check Bolt Stresses:

Wind Acting Parallel to Bolts:

Shear Force per Bolt = $$F_{v.conn} := \frac{\text{Vertical}}{n_b} + \frac{\text{Vertical}\cdot\frac{\text{Mast}_d}{2}}{S_{bV}\cdot\frac{n_b}{2}} = 0\cdot\text{kips}$$

Shear Stress per Bolt = $$F_{v.act} := \frac{F_{v.conn}}{a_b} = 0\cdot\text{ksi}$$

$$\text{Condition1} := \text{if}\left(F_{v.act} < F_v, \text{"OK"}, \text{"Overstressed"}\right)$$

Condition1 = "OK"

Allowable Tensile Stress Adjusted for Shear = $$F_{t.adj} := \sqrt{F_t^{\,2} - 4.39\cdot F_{v.act}^{\,2}} = 67.5\cdot\text{ksi}$$

Tension Force Each Bolt = $$F_{tension.bolt} := \frac{\text{Horizontal}}{n_b} + \frac{\text{Horizontal}\cdot\frac{\text{Mast}_d}{2}}{S_{bH}\cdot\frac{n_b}{2}} = 2.415\cdot\text{kips}$$

Tension Stress Each Bolt = $$F_{t.act} := \frac{F_{tension.bolt}}{a_b} = 12.3\cdot\text{ksi}$$

$$\text{Condition2} := \text{if}\left(F_{t.act} < F_{t.adj}, \text{"OK"}, \text{"Overstressed"}\right)$$

Condition2 = "OK"

Wind Acting Perpendicular to Bolts:

Shear Force per Bolt = $F_{v.conn} := \frac{Vertical + Horizontal}{n_b} + \frac{Vertical \cdot \frac{Mast_d}{2}}{S_{bV} \cdot \frac{n_b}{2}} = 1.68 \cdot kips$

Shear Stress per Bolt = $F_{v.act} := \frac{F_{v.conn}}{a_b} = 8.53 \cdot ksi$

Condition3 := if$\left(F_{v.act} < F_v, \text{"OK"}, \text{"Overstressed"}\right)$

Condition3 = "OK"

Allowable Tensile Stress Adjusted for Shear = $F_{t.adj} := \sqrt{F_t^2 - 4.39 \cdot F_{v.act}^2} = 65.09 \cdot ksi$

Tension Force Each Bolt = $F_{tension.bolt} := \frac{Horizontal \cdot d}{S_{bH} \cdot \frac{n_b}{2}} = 1.145 \cdot kips$

Tension Stress Each Bolt = $F_{t.act} := \frac{F_{tension.bolt}}{a_b} = 5.8 \cdot ksi$

Condition4 := if$\left(F_{t.act} < F_{t.adj}, \text{"OK"}, \text{"Overstressed"}\right)$

Condition4 = "OK"

Reactions at Bottom Connection:

Horizontal =	$Horizontal := 4.3 \cdot kips$	(User Input from Risa 3D)
Vertical =	$Vertical := 0.7 \cdot kips$	(User Input from Risa 3D)
Moment =	$Moment := 0 \cdot kips \cdot ft$	(User Input from Risa 3D)
Mast Diameter =	$Mast_d := 6.625 \cdot in$	(User Input)

Check Pipe to Bracket U-Bolts:

Bolt Data:

Bolt Grade =	A307	(User Input)	
Number of Bolts =	$n_b := 4$	(User Input)	(2 U-Bolts)
Bolt Diameter =	$d_b := 0.5in$	(User Input)	
Bolt Area =	$a_b := \frac{1}{4} \cdot \pi \cdot d_b^2 = 0.196 \cdot in^2$	(User Input)	
Desing Tensile Stress =	$F_t := 33.8 \cdot ksi$	(User Input)	
Design Shear Stress =	$F_v := 20.3 \cdot ksi$	(User Input)	

Check Bolt Stresses:

Wind Acting Parallel to Bolts:

Shear Force per Bolt = $F_{v.conn} := \frac{Vertical}{n_b} = 0.175 \cdot kips$

Shear Stress per Bolt = $F_{v.act} := \frac{F_{v.conn}}{a_b} = 0.89 \cdot ksi$

Condition1 := if($F_{v.act} < F_v$, "OK" , "Overstressed")

Condition1 = "OK"

Allowable Tensile Stress Adjusted for Shear = $F_{t.adj} := \sqrt{F_t^2 - 4.39 \cdot F_{v.act}^2} = 33.75 \cdot ksi$

Tension Force Each Bolt = $F_{tension.bolt} := \frac{Horizontal}{n_b} = 1.075 \cdot kips$

Tension Stress Each Bolt = $F_{t.act} := \frac{F_{tension.bolt}}{a_b} = 5.5 \cdot ksi$

Condition2 := if($F_{t.act} < F_{t.adj}$, "OK" , "Overstressed")

Condition2 = "OK"

Wind Acting Perpendicular to Bolts:

Shear Force per Bolt = $F_{v.conn} := \frac{Horizontal}{n_b} = 1.08 \cdot kips$

Shear Stress per Bolt = $F_{v.act} := \frac{F_{v.conn}}{a_b} = 5.47 \cdot ksi$

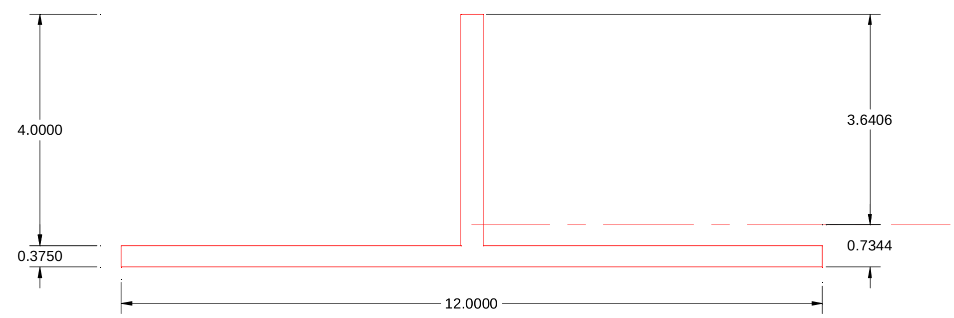
$Condition3 := if\left(F_{v.act} < F_v, \text{"OK"}, \text{"Overstressed"}\right)$

$Condition3 = \text{"OK"}$

Check Bracket:

Bracket Plate Data:

Plate Yield Strength =	$Fy_{bp} := 36 \cdot ksi$	(User Input)
Base Plate Thickness =	$t_{bp} := 0.375 \cdot in$	(User Input)
Distance from Center of Mast to Face of Tower =	$d := 5.125 \cdot in$	(User Input)
Bracket Plate Section Modulus =	$S_{bp} := 2.04 \cdot in^3$	(User Input)



Check Bracket Plate Bending Stress:

Maximum Bending Plate = $M_{bp} := Horizontal \cdot d = 22.04 \cdot in \cdot kips$

Maximum Bending Stress in Plate = $f_{bp} := \frac{M_{bp}}{S_{bp}} = 11 \cdot ksi$

Allowable Bending Stress in Plate = $F_{bp} := 0.9 \cdot Fy_{bp} = 32.4 \cdot ksi$

Plate Bending Stress % of Capacity = $\frac{f_{bp}}{F_{bp}} \cdot 100 = 33.3$

Condition3 = $Condition1 := if\left(\frac{f_{bp}}{F_{bp}} < 1.00, \text{"Ok"}, \text{"Overstressed"}\right)$

$Condition1 = \text{"Ok"}$

Check Bracket to Tower Connection:

Bolt Data:

Bolt Grade =	A325	(User Input)
Number of Bolts =	$n_b := 4$	(User Input)
Bolt Diameter =	$d_b := 0.5in$	(User Input)
Bolt Spacing Horizontal =	$S_{bH} := 17in$	(User Input)
Bolt Spacing Vertical =	$S_{bV} := 9in$	(User Input)
Bolt Area =	$a_b := \frac{1}{4} \cdot \pi \cdot d_b^{\,2} = 0.196 \cdot in^2$	(User Input)
Desing Tensile Stress =	$F_t := 67.5 \cdot ksi$	(User Input)
Design Shear Stress =	$F_v := 40.5 \cdot ksi$	(User Input)

Check Bolt Stresses:

Wind Acting Parallel to Bolts:

Shear Force per Bolt = $$F_{v.conn} := \frac{Vertical}{n_b} + \frac{Vertical \cdot \frac{Mast_d}{2}}{S_{bV} \cdot \frac{n_b}{2}} = 0.304 \cdot kips$$

Shear Stress per Bolt = $$F_{v.act} := \frac{F_{v.conn}}{a_b} = 1.55 \cdot ksi$$

$$Condition1 := if\left(F_{v.act} < F_v, \text{"OK"}, \text{"Overstressed"}\right)$$

$$Condition1 = \text{"OK"}$$

Allowable Tensile Stress Adjusted for Shear = $$F_{t.adj} := \sqrt{F_t^{\,2} - 4.39 \cdot F_{v.act}^{\,2}} = 67.42 \cdot ksi$$

Tension Force Each Bolt = $$F_{tension.bolt} := \frac{Horizontal}{n_b} + \frac{Horizontal \cdot \frac{Mast_d}{2}}{S_{bH} \cdot \frac{n_b}{2}} = 1.494 \cdot kips$$

Tension Stress Each Bolt = $$F_{t.act} := \frac{F_{tension.bolt}}{a_b} = 7.6 \cdot ksi$$

$$Condition2 := if\left(F_{t.act} < F_{t.adj}, \text{"OK"}, \text{"Overstressed"}\right)$$

$$Condition2 = \text{"OK"}$$

Wind Acting Perpendicular to Bolts:

Shear Force per Bolt = $F_{v.conn} := \frac{Vertical + Horizontal}{n_b} + \frac{Vertical \cdot \frac{Mast_d}{2}}{S_{bV} \cdot \frac{n_b}{2}} = 1.38 \cdot kips$

Shear Stress per Bolt = $F_{v.act} := \frac{F_{v.conn}}{a_b} = 7.02 \cdot ksi$

Condition3 := if$\left(F_{v.act} < F_v, \text{"OK"}, \text{"Overstressed"}\right)$

Condition3 = "OK"

Allowable Tensile Stress Adjusted for Shear = $F_{t.adj} := \sqrt{F_t^{\,2} - 4.39 \cdot F_{v.act}^{\,2}} = 65.88 \cdot ksi$

Tension Force Each Bolt = $F_{tension.bolt} := \frac{Horizontal \cdot d}{S_{bH} \cdot \frac{n_b}{2}} = 0.648 \cdot kips$

Tension Stress Each Bolt = $F_{t.act} := \frac{F_{tension.bolt}}{a_b} = 3.3 \cdot ksi$

Condition4 := if$\left(F_{t.act} < F_{t.adj}, \text{"OK"}, \text{"Overstressed"}\right)$

Condition4 = "OK"

Basic Components

Heavy Wind Pressure =	$p := 4.00$	psf	(User Input NESC 2007 Figure 250-1 & Table 250-1)
Basic Windspeed =	$V := 120$	mph	(User Input NESC 2007 Figure 250-2(e))
Radial Ice Thickness =	$Ir := 0.50$	in	(User Input)
Radial Ice Density =	$Id := 56.0$	pcf	(User Input)

Factors for Extreme Wind Calculation

Elevation of Top of Mast Above Grade =	$TME := 95$	ft	(User Input)
Multiplier Gust Response Factor =	$m := 1.25$		(User Input - Only for NESC Extreme wind case)
NESC Factor =	$kv := 1.43$		(User Input from NESC 2007 Table 250-3 equation)
Importance Factor =	$I := 1.0$		(User Input from NESC 2007 Section 250.C.2)

Velocity Pressure Coefficient = $Kz := 2.01 \cdot \left(\frac{TME}{900}\right)^{\frac{2}{9.5}} = 1.252$ (NESC 2007 Table 250-2)

Exposure Factor = $Es := 0.346 \left[\frac{33}{(0.67 \cdot TME)}\right]^{\frac{1}{7}} = 0.315$ (NESC 2007 Table 250-3)

Response Term = $Bs := \frac{1}{\left(1 + 0.375 \cdot \frac{TME}{220}\right)} = 0.861$ (NESC 2007 Table 250-3)

Gust Response Factor = $Grf := \frac{\left[1 + \left(2.7 \cdot Es \cdot Bs^{\frac{1}{2}}\right)\right]}{kv^2} = 0.875$ (NESC 2007 Table 250-3)

Wind Pressure = $qz := 0.00256 \cdot Kz \cdot V^2 \cdot Grf \cdot I = 40.4$ psf (NESC 2007 Section 250.C.2)

Shape Factors NUS Design Criteria Issued April 12, 2007

Shape Factor for Round Members =	$Cd_R := 1.3$	(User Input)
Shape Factor for Flat Members =	$Cd_F := 1.6$	(User Input)
Shape Factor for Coax Cables Attached to Outside of Pole =	$Cd_{coax} := 1.45$	(User Input)

Overload Factors NU Design Criteria Table

Overload Factors for Wind Loads:

NESC Heavy Loading =	**2.5**	(User Input)	Apply in Risa-3D Analysis
NESC Extreme Loading =	**1.0**	(User Input)	Apply in Risa-3D Analysis

Overload Factors for Vertical Loads:

NESC Heavy Loading =	**1.5**	(User Input)	Apply in Risa-3D Analysis
NESC Extreme Loading =	**1.0**	(User Input)	Apply in Risa-3D Analysis

Development of Wind & Ice Load on Mast

Mast Data: (Pipe 6" Sch. 80)

Mast Shape =	Round		(User Input)
Mast Diameter =	$D_{mast} := 6.63$	in	(User Input)
Mast Length =	$L_{mast} := 17$	ft	(User Input)
Mast Thickness =	$t_{mast} := 0.432$	in	(User Input)

Wind Load (NESC Extreme)

Mast Projected Surface Area =	$A_{mast} := \frac{D_{mast}}{12} = 0.553$	sf/ft	
Total Mast Wind Force (Above NU Structure) =	$qz \cdot Cd_R \cdot A_{mast} \cdot m = 36$	plf	**BLC 5**
Total Mast Wind Force (Below NU Structure) =	$qz \cdot Cd_R \cdot A_{mast} = 29$	plf	**BLC 5**

Wind Load (NESE Heavy)

Mast Projected Surface Area w/ Ice =	$AICE_{mast} := \frac{(D_{mast} + 2 \cdot Ir)}{12} = 0.636$	sf/ft	
Total Mast Wind Force w/ Ice =	$p \cdot Cd_R \cdot AICE_{mast} = 3$	plf	**BLC 4**

Gravity Loads (without ice)

Weight of the mast =	Self Weight	**(Computed internally by Risa-3D)**	plf	**BLC 1**

Gravity Loads (ice only)

Ice Area per Linear Foot =	$Ai_{mast} := \frac{\pi}{4}\left[(D_{mast} + Ir \cdot 2)^2 - D_{mast}^2\right] = 11.2$	sq in	
Weight of Ice on Mast =	$W_{ICEmast} := Id \cdot \frac{Ai_{mast}}{144} = 4$	plf	**BLC 3**

Development of Wind & Ice Load on Antennas

Antenna Data:

Antenna Model = Andrew SBNHH-1D65A

Antenna Shape = Flat (User Input)

Antenna Height = $L_{ant} := 55.5$ in (User Input)

Antenna Width = $W_{ant} := 11.9$ in (User Input)

Antenna Thickness = $T_{ant} := 7.1$ in (User Input)

Antenna Weight = $WT_{ant} := 33.5$ lbs (User Input)

Number of Antennas = $N_{ant} := 3$ (User Input)

Wind Load (NESC Extreme)

Assumes Maximum Possible Wind Pressure Applied to all Antennas Simultaneously

Surface Area for One Antenna = $SA_{ant} := \frac{L_{ant} \cdot W_{ant}}{144} = 4.6$ sf

Antenna Projected Surface Area = $A_{ant} := SA_{ant} \cdot N_{ant} = 13.8$ sf

Total Antenna Wind Force = $F_{ant} := qz \cdot Cd_F \cdot A_{ant} \cdot m = 1111$ lbs **BLC 5**

Wind Load (NESC Heavy)

Assumes Maximum Possible Wind Pressure Applied to all Antennas Simultaneously

Surface Area for One Antenna w/ Ice = $SA_{ICEant} := \frac{(L_{ant} + 1) \cdot (W_{ant} + 1)}{144} = 5.1$ sf

Antenna Projected Surface Area w/ Ice = $A_{ICEant} := SA_{ICEant} \cdot N_{ant} = 15.2$ sf

Total Antenna Wind Force w/ Ice = $Fi_{ant} := p \cdot Cd_F \cdot A_{ICEant} = 97$ lbs **BLC 4**

Gravity Load (without ice)

Weight of All Antennas = $WT_{ant} \cdot N_{ant} = 101$ lbs **BLC 2**

Gravity Load (ice only)

Volume of Each Antenna = $V_{ant} := L_{ant} \cdot W_{ant} \cdot T_{ant} = 4689$ cu in

Volume of Ice on Each Antenna = $V_{ice} := (L_{ant} + 1)(W_{ant} + 1) \cdot (T_{ant} + 1) - V_{ant} = 1214$ cu in

Weight of Ice on Each Antenna = $W_{ICEant} := \frac{V_{ice}}{1728} \cdot Id = 39$ lbs

Weight of Ice on All Antennas = $W_{ICEant} \cdot N_{ant} = 118$ lbs **BLC 3**

Development of Wind & Ice Load on Antennas

Antenna Data:

Antenna Model =	Andrew ATSBT-TOP-FM-4G		
Antenna Shape =	Flat		(User Input)
Antenna Height =	$L_{ant} := 5.63$	in	(User Input)
Antenna Width =	$W_{ant} := 3.7$	in	(User Input)
Antenna Thickness =	$T_{ant} := 2.0$	in	(User Input)
Antenna Weight =	$WT_{ant} := 2$	lbs	(User Input)
Number of Antennas =	$N_{ant} := 3$		(User Input)

Wind Load (NESC Extreme)

Assumes Maximum Possible Wind Pressure Applied to all Antennas Simultaneously

Surface Area for One Antenna = $SA_{ant} := \frac{L_{ant} \cdot W_{ant}}{144} = 0.1$ sf

Antenna Projected Surface Area = $A_{ant} := SA_{ant} \cdot N_{ant} = 0.4$ sf

Total Antenna Wind Force = $F_{ant} := qz \cdot Cd_F \cdot A_{ant} \cdot m = 35$ lbs **BLC 5**

Wind Load (NESC Heavy)

Assumes Maximum Possible Wind Pressure Applied to all Antennas Simultaneously

Surface Area for One Antenna w/ Ice = $SA_{ICEant} := \frac{(L_{ant} + 1) \cdot (W_{ant} + 1)}{144} = 0.2$ sf

Antenna Projected Surface Area w/ Ice = $A_{ICEant} := SA_{ICEant} \cdot N_{ant} = 0.6$ sf

Total Antenna Wind Force w/ Ice = $Fi_{ant} := p \cdot Cd_F \cdot A_{ICEant} = 4$ lbs **BLC 4**

Gravity Load (without ice)

Weight of All Antennas = $WT_{ant} \cdot N_{ant} = 6$ lbs **BLC 2**

Gravity Load (ice only)

Volume of Each Antenna = $V_{ant} := L_{ant} \cdot W_{ant} \cdot T_{ant} = 42$ cu in

Volume of Ice on Each Antenna = $V_{ice} := (L_{ant} + 1)(W_{ant} + 1) \cdot (T_{ant} + 1) - V_{ant} = 52$ cu in

Weight of Ice on Each Antenna = $W_{ICEant} := \frac{V_{ice}}{1728} \cdot Id = 2$ lbs

Weight of Ice on All Antennas = $W_{ICEant} \cdot N_{ant} = 5$ lbs **BLC 3**

CENTEK engineering Centered on Solutions™ www.centekeng.com 63-2 North Branford Road P: (203) 488-0580 Branford, CT 06405 F: (203) 488-8587	Subject: Location: Rev. 1: 12/22/16	Load Analysis of T-Mobile Equipment on Structure #6076 East Lyme, CT Prepared by: T.J.L Checked by: C.F.C. Job No. 16162.02

Development of Wind & Ice Load on Coax Cables

Existing Coax Cable Data:

Coax Type = HELIAX 1-1/4"

Shape = Round (User Input)

Coax Outside Diameter = $D_{coax} := 1.55$ in (User Input)

Coax Cable Length = $L_{coax} := 11$ ft (User Input)

Weight of Coax per foot = $Wt_{coax} := 0.66$ plf (User Input)

Total Number of Coax = $N_{coax} := 18$ (User Input)

No. of Coax Projecting Outside Face of Mast = $NP_{coax} := 4$ (User Input)

Wind Load (NESC Extreme)

Coax projected surface area = $A_{coax} := \frac{(NP_{coax} D_{coax})}{12} = 0.5$ ft

Total Coax Wind Force (Above NU Structure) = $F_{coax} := qz \cdot Cd_{coax} \cdot A_{coax} \cdot m = 38$ plf **BLC 5**

Wind Load (NESC Heavy)

Coax projected surface area w/ Ice = $AICE_{coax} := \frac{(NP_{coax} \cdot D_{coax} + 2 \cdot Ir)}{12} = 0.6$ ft

Total Coax Wind Force w/ Ice = $Fi_{coax} := p \cdot Cd_{coax} \cdot AICE_{coax} = 3$ plf **BLC 4**

Gravity Loads (without ice)

Weight of all cables w/o ice $WT_{coax} := Wt_{coax} \cdot N_{coax} = 12$ plf **BLC 2**

Gravity Load (ice only)

Ice Area per Linear Foot = $Ai_{coax} := \frac{\pi}{4}\left[(D_{coax} + 2 \cdot Ir)^2 - D_{coax}^{\ 2}\right] = 3.2$ sq in

Ice Weight All Coax per foot = $WTi_{coax} := N_{coax} \cdot Id \cdot \frac{Ai_{coax}}{144} = 23$ plf **BLC 3**

CENTEK engineering, INC.
Consulting Engineers
63-2 North Branford Road
Branford, CT 06405
Ph. 203-488-0580 / Fax. 203-488-8587

Subject: **Analysis of NESC Heavy Wind and NESC Extreme Wind for Obtaining Reactions Applied to Utility Pole**
Tabulated Load Cases

Location: **East Lyme, CT**

Date: 10/25/16 Prepared by: T.J.L. Checked by: C.F.C. Job No. 16162.02

Load Case	Description
1	Self Weight (Mast)
2	Weight of Appurtenances
3	Weight of Ice Only
4	NESC Heavy Wind
5	NESC Extreme Wind

Footnotes:

CENTEK engineering, INC.
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63-2 North Branford Road
Branford, CT 06405
Ph. 203-488-0580 / Fax. 203-488-8587

Subject: **Analysis of NESC Heavy Wind and NESC Extreme Wind for Obtaining Reactions Applied to Utility Pole**
Load Combinations Table

Location: **East Lyme, CT**

Date: 10/25/16 Prepared by: T.J.L. Checked by: C.F.C. Job No. 16162.02

Load Combination	Description	Envelope Soultion	Wind Factor	P-Delta	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
1	NESC Heavy Wind		1		1	1.5	2	1.5	3	1.5	4	2.5		
2	NESC Extreme Wind		1		1	1	2	1	5	1				

Footnotes:
(1) BLC = Basic Load Case

Global

Display Sections for Member Calcs	5
Max Internal Sections for Member Calcs	97
Include Shear Deformation?	Yes
Include Warping?	Yes
Trans Load Btwn Intersecting Wood Wall?	Yes
Increase Nailing Capacity for Wind?	Yes
Area Load Mesh (in^2)	144
Merge Tolerance (in)	.12
P-Delta Analysis Tolerance	0.50%
Include P-Delta for Walls?	Yes
Automaticly Iterate Stiffness for Walls?	No
Maximum Iteration Number 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	Accelerated Solver

Hot Rolled Steel Code	AISC 14th(360-10): LRFD
Adjust Stiffness?	Yes(Iterative)
RISAConnection Code	AISC 14th(360-10): ASD
Cold Formed Steel Code	AISI 1999: ASD
Wood Code	AF&PA NDS-97: ASD
Wood Temperature	< 100F
Concrete Code	ACI 318-02
Masonry Code	ACI 530-05: ASD
Aluminum Code	AA ADM1-05: ASD - 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 Z	.035
Ct X	.035
T Z (sec)	Not Entered
T X (sec)	Not Entered
R Z	8.5
R X	8.5
Ca	.36
Cv	.54
Nv	1
Occupancy Category	4
Seismic Zone	3
Seismic Detailing Code	ASCE 7-05
Om Z	1
Om X	1
Rho Z	1
Rho X	1

Footing Overturning Safety Factor	1.5
Check Concrete Bearing	No
Footing Concrete Weight (k/ft^3)	0
Footing Concrete f'c (ksi)	3
Footing Concrete Ec (ksi)	4000
Lamda	1
Footing Steel fy (ksi)	60
Minimum Steel	0.0018
Maximum Steel	0.0075
Footing Top Bar	#3
Footing Top Bar Cover (in)	3.5
Footing Bottom Bar	#3
Footing Bottom Bar Cover (in)	3.5
Pedestal Bar	#3
Pedestal Bar Cover (in)	1.5
Pedestal Ties	#3

Hot Rolled Steel Properties

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

Hot Rolled Steel Design Parameters

	Label	Shape	Lengt...	Lbyy[ft]	Lbzz[ft]	Lcomp t...	Lcomp b...	L-torqu...	Kyy	Kzz	Cb	Function
1	M1	Existing Mast	16									Lateral

Hot Rolled Steel Section Sets

	Label	Shape	Type	Design List	Material	Design ...	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	Existing Mast	PIPE_6.0X	Column	Pipe	A53 Gr. B	Typical	7.83	38.3	38.3	76.6

Member Primary Data

	Label	I Joint	J Joint	K Joint	Rotate(d...	Section/Shape	Type	Design List	Material	Design R...
1	M1	BOTCO...	TOPMA...			Existing Mast	Column	Pipe	A53 Gr. B	Typical

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From ...
1	BOTCONNECTION	0	1	0	0	
2	TOPCONNECTION	0	5	0	0	
3	TOPMAST	0	17	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	BOTCONNECTION	Reaction	Reaction	Reaction				
2	TOPCONNECTION	Reaction		Reaction		Reaction		

Member Point Loads (BLC 2 : Weight of Appurtenances)

	Member Label	Direction	Magnitude[k,k-ft]	Location[ft,%]
1	M1	Y	-.101	14
2	M1	Y	-.006	14

Member Point Loads (BLC 3 : Weight of Ice Only)

	Member Label	Direction	Magnitude[k,k-ft]	Location[ft,%]
1	M1	Y	-.118	14
2	M1	Y	-.005	14

Member Point Loads (BLC 4 : NESC Heavy Wind)

	Member Label	Direction	Magnitude[k,k-ft]	Location[ft,%]
1	M1	X	.097	14
2	M1	X	.004	14

Member Point Loads (BLC 5 : NESC Extreme Wind)

	Member Label	Direction	Magnitude[k,k-ft]	Location[ft,%]
1	M1	X	1.111	14
2	M1	X	.035	14

Joint Loads and Enforced Displacements

Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft, k*s^2*ft)]
No Data to Print ...			

Member Distributed Loads (BLC 2 : Weight of Appurtenances)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	-.012	-.012	7	11

Member Distributed Loads (BLC 3 : Weight of Ice Only)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	-.004	-.004	0	11
2	M1	Y	-.023	-.023	7	11

Member Distributed Loads (BLC 4 : NESC Heavy Wind)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M1	X	.003	.003	0	11
2	M1	X	.003	.003	7	11

Member Distributed Loads (BLC 5 : NESC Extreme Wind)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M1	X	.029	.029	0	7
2	M1	X	.036	.036	7	11
3	M1	X	.038	.038	7	11

Basic Load Cases

	BLC Description	Category	X Gra...	Y Gravity	Z Gra...	Joint	Point	Distrib..	Area(...	Surfa...
1	Self Weight	None		-1						
2	Weight of Appurtenances	None					2	1		
3	Weight of Ice Only	None					2	2		
4	NESC Heavy Wind	None					2	2		
5	NESC Extreme Wind	None					2	3		

Load Combinations

	Description	Sol...	PDelta	SR..	BLC	Fact..	BLC	Fact..	BLC	Fact..	BLC	Fact..	BLC	Fact..	BLC	Fact..	BLC	Fact..	BLC	Fact...
1	NESC Heavy Wind on PC...	Yes	Y		1	1.5	2	1.5	3	1.5	4	2.5								
2	NESC Extreme Wind on P...	Yes	Y		1	1	2	1	5	1										
3	Self Weight				1	1														

Envelope Joint Reactions

	Joint		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC
1	BOTCONNE...	max	3.217	2	1.26	1	0	1	0	1	0	1	0	1
2		min	.703	1	.581	2	0	1	0	1	0	1	0	1
3	TOPCONNE...	max	-1.068	1	0	1	0	1	0	1	0	1	0	1
4		min	-4.862	2	0	1	0	1	0	1	0	1	0	1
5	Totals:	max	-.365	1	1.26	1	0	1						

Envelope Joint Reactions (Continued)

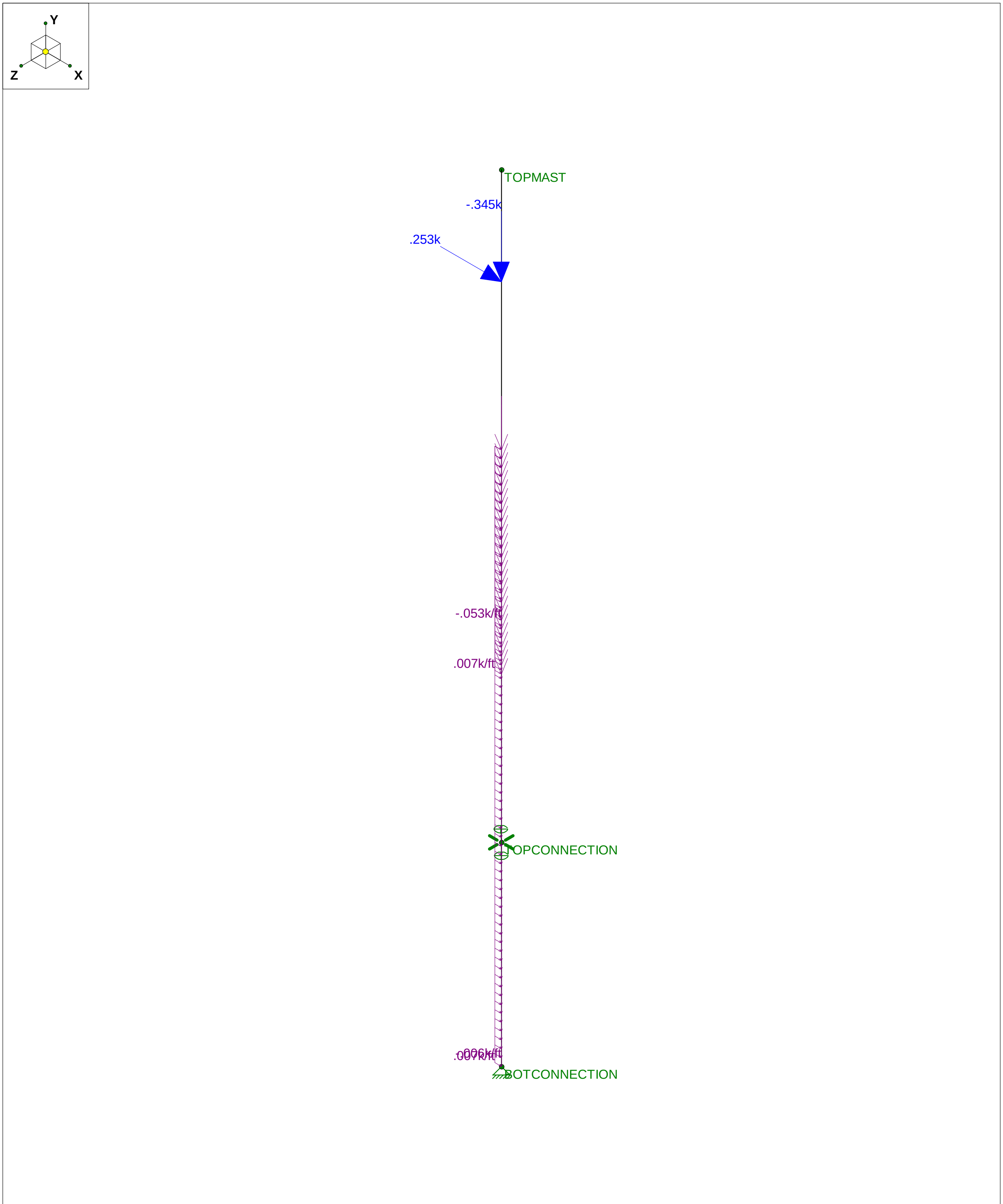
Joint			X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC
6		min	-1.645	2	.581	2	0	1						

Joint Reactions

	LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	1	BOTCONNECTION	.703	1.26	0	0	0	0
2	1	TOPCONNECTION	-1.068	0	0	0	0	0
3	1	Totals:	-.365	1.26	0			
4	1	COG (ft):	X: 0	Y: 10.678	Z: 0			

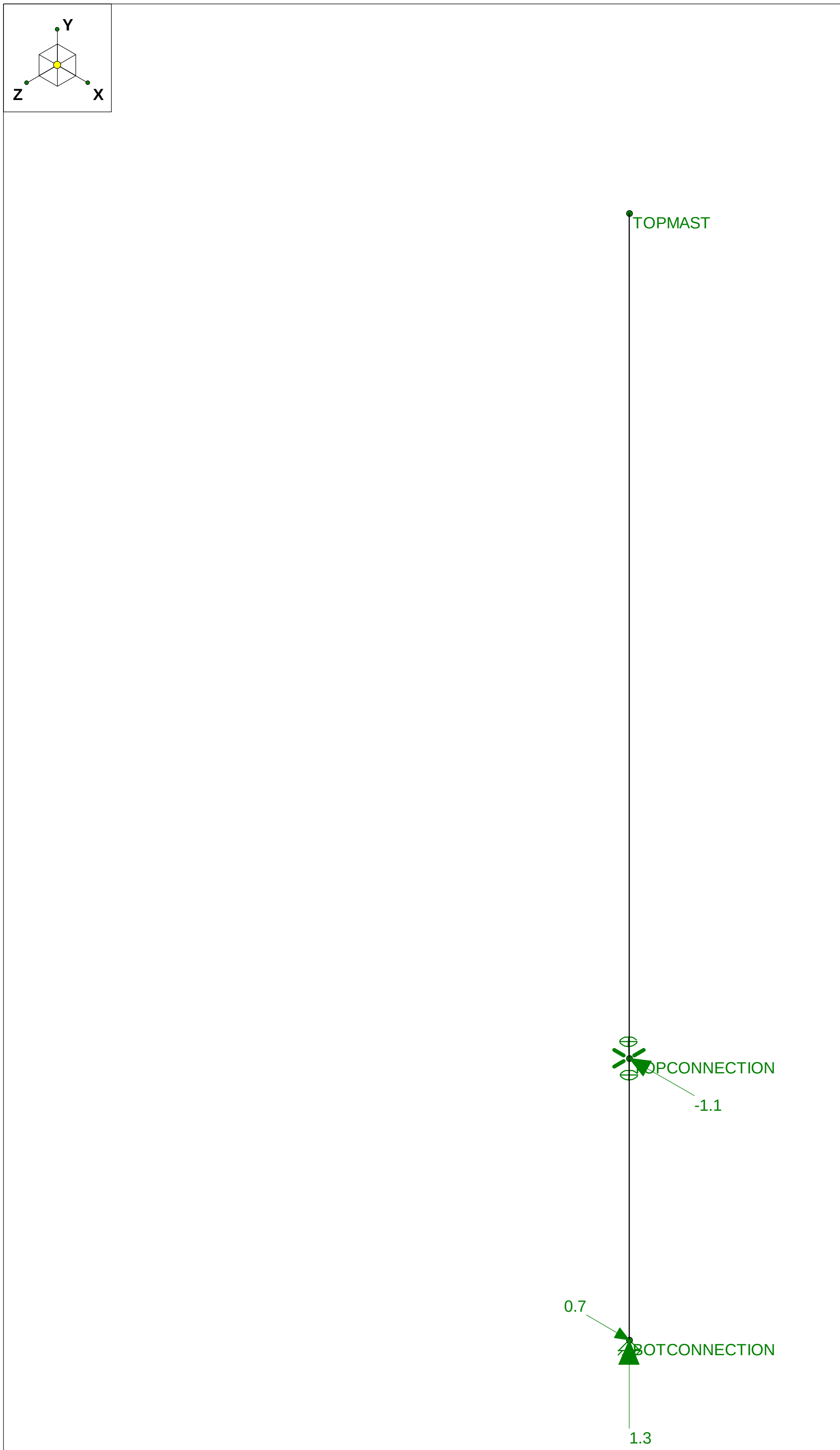
Joint Reactions

	LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	2	BOTCONNECTION	3.217	.581	0	0	0	0
2	2	TOPCONNECTION	-4.862	0	0	0	0	0
3	2	Totals:	-1.645	.581	0			
4	2	COG (ft):	X: 0	Y: 10.187	Z: 0			



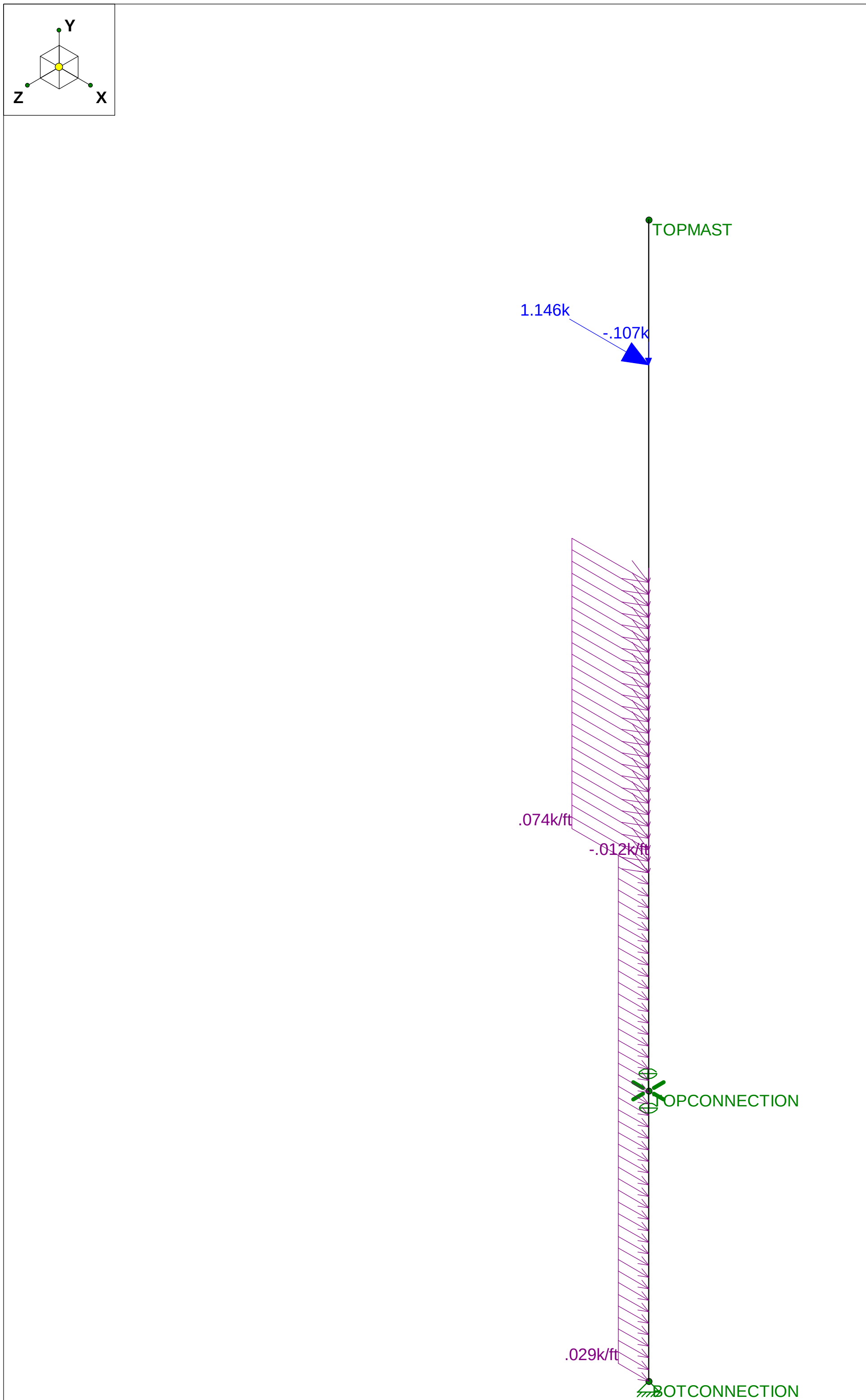
Loads: LC 1, NESC Heavy Wind on PCS Structure

Centek Engineering		
tjl, cfc	Structure # 6076 Mast	Dec 22, 2016 at 11:19 AM
16162.02 / T-Mobile CT110...	LC #1 Loads	NESC.r3d



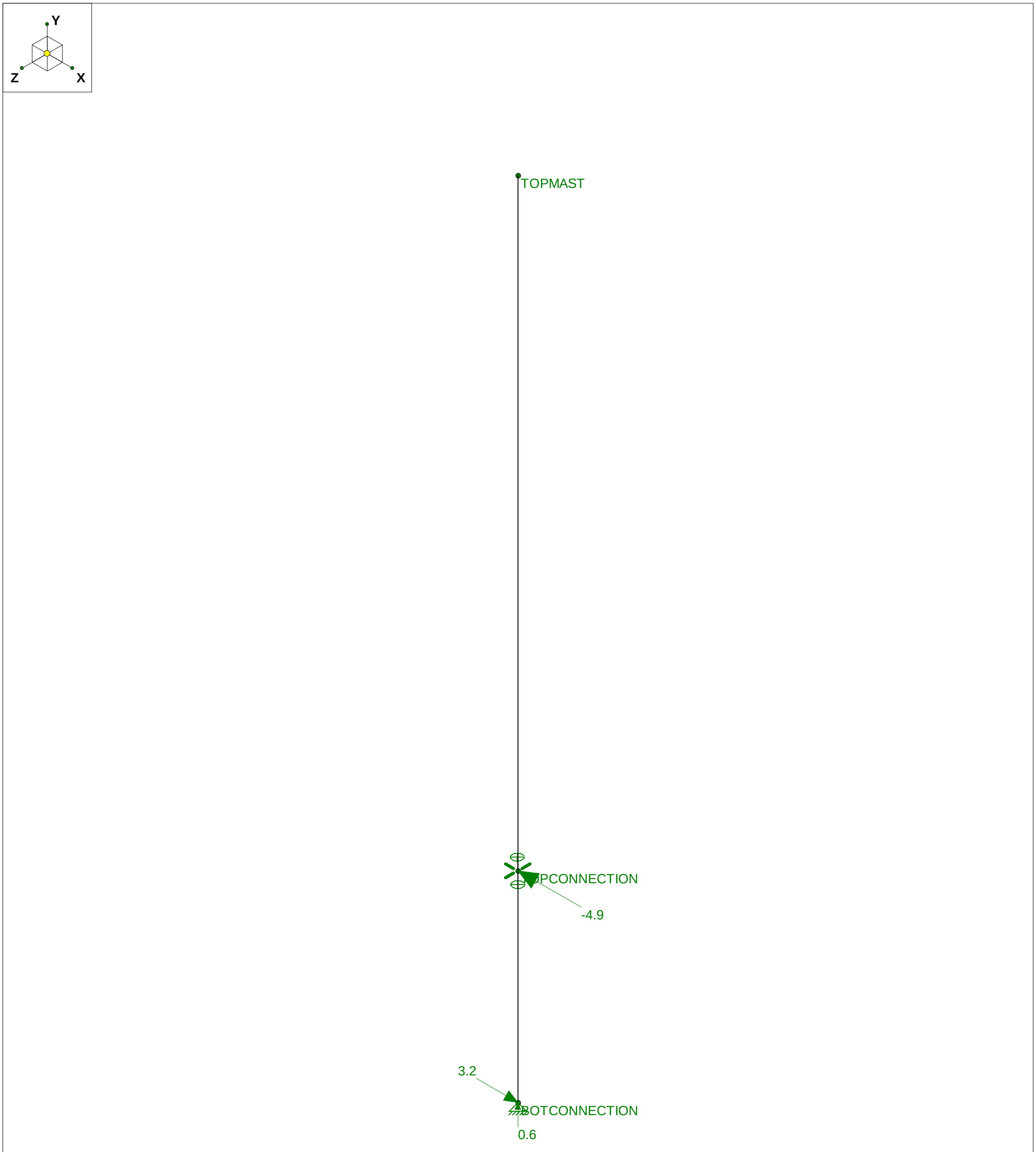
Results for LC 1, NESC Heavy Wind on PCS Structure
Z-direction Reaction Units are k and k-ft

Centek Engineering		
tjl, cfc	Structure # 6076 Mast	Dec 22, 2016 at 11:19 AM
16162.02 / T-Mobile CT110...	LC #1 Reactions	NESC.r3d



Loads: LC 2, NESC Extreme Wind on PCS Structure

Centek Engineering		
tjl, cfc	Structure # 6076 Mast	Dec 22, 2016 at 11:19 AM
16162.02 / T-Mobile CT110...	LC #2 Loads	NESC.r3d



Results for LC 2, NESC Extreme Wind on PCS Structure
Z-direction Reaction Units are k and k-ft

Centek Engineering		
tjl, cfc	Structure # 6076 Mast	Dec 22, 2016 at 11:21 AM
16162.02 / T-Mobile CT110...	LC #2 Reactions	NESC.r3d

Basic Components

Heavy Wind Pressure = $p := 4.00$ psf (User Input NESC 2007 Figure 250-1 & Table 250-1)

Basic Windspeed = $V := 120$ mph (User Input NESC 2007 Figure 250-2(e))

Radial Ice Thickness = $Ir := 0.50$ in (User Input)

Radial Ice Density = $Id := 56.0$ pcf (User Input)

Factors for Extreme Wind Calculation

Top of Structure Above Grade = $TME := 85$ ft (User Input)

Multiplier Gust Response Factor = $m := 1.25$ (User Input - Only for NESC Extreme wind case)

NESC Factor = $kv := 1.43$ (User Input from NESC 2007 Table 250-3 equation)

Importance Factor = $I := 1.0$ (User Input from NESC 2007 Section 250.C.2)

Velocity Pressure Coefficient = $Kz := 2.01 \cdot \left(\frac{0.67TME}{900}\right)^{\frac{2}{9.5}} = 1.124$ (NESC 2007 Table 250-2)

Exposure Factor = $Es := 0.346\left[\frac{33}{(0.67 \cdot TME)}\right]^{\frac{1}{7}} = 0.32$ (NESC 2007 Table 250-3)

Response Term = $Bs := \frac{1}{\left(1 + 0.375 \cdot \frac{TME}{220}\right)} = 0.873$ (NESC 2007 Table 250-3)

Gust Response Factor = $Grf := \frac{\left[1 + \left(2.7 \cdot Es \cdot Bs^{\frac{1}{2}}\right)\right]}{kv^2} = 0.884$ (NESC 2007 Table 250-3)

Wind Pressure = $qz := 0.00256 \cdot Kz \cdot V^2 \cdot Grf \cdot I = 36.6$ psf (NESC 2007 Section 250.C.2)

Shape Factors

NUS Design Criteria Issued April 12, 2007

Shape Factor for Round Members = $Cd_R := 1.3$ (User Input)

Shape Factor for Flat Members = $Cd_F := 1.6$ (User Input)

Shape Factor for Coax Cables Attached to Outside of Pole = $Cd_{coax} := 1.45$ (User Input)

Overload Factors

NU Design Criteria Table

Overload Factors for Wind Loads:

NESC Heavy Loading = **2.5** (User Input) Apply in Risa-3D Analysis

NESC Extreme Loading = **1.0** (User Input) Apply in Risa-3D Analysis

Overload Factors for Vertical Loads:

NESC Heavy Loading = **1.5** (User Input) Apply in Risa-3D Analysis

NESC Extreme Loading = **1.0** (User Input) Apply in Risa-3D Analysis

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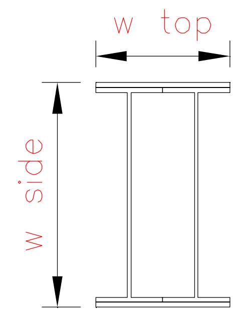
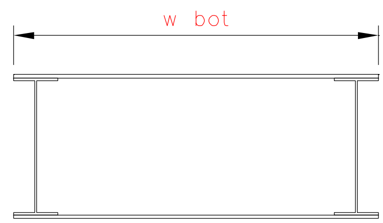
Development of Wind & Ice Load on CL&P Pole

Pole Data:

Shape =	Flat	
Width Side =	$W_{side} := 25$	in
Width Top =	$W_{top} := 18$	in
Width Bottom =	$W_{bot} := 56.25$	in
Length =	$L := 85$	ft
Area Top =	$A_{top} := 49.2$	sq in
Area Bottom =	$A_{bot} := 110.5$	sq in
Weight of Steel =	$W_{steel} := 490$	pcf
Area Top Ice =	$Ai_{top} := 40$	sq in
Area Bottom Ice =	$Ai_{bot} := 80$	sq in





Gravity Loads (without ice)

Weight Pole Top =	$Wt_{top} := \frac{A_{top}}{144} \cdot W_{steel} = 167$	plf	**BLC 2**
Weight Pole Bottom =	$Wt_{bot} := \frac{A_{bot}}{144} \cdot W_{steel} = 376$	plf	**BLC 2**

Gravity Loads (ice only)

Weight of Ice on Pole Top =	$W_{ICE.top} := Id \cdot \frac{Ai_{top}}{144} = 16$	plf	**BLC 3**
Weight of Ice on Pole Bottom =	$W_{ICE.bot} := Id \cdot \frac{Ai_{bot}}{144} = 31$	plf	**BLC 3**

Wind Load (NESC Extreme)

Pole Projected Surface Area Top = $A_{top} := \frac{W_{top}}{12} = 1.5$ sq ft/ft

Pole Projected Surface Area Bottom = $A_{bot} := \frac{W_{bot}}{12} = 4.688$ sq ft/ft

Pole Projected Surface Area Side = $A_{side} := \frac{W_{side}}{12} = 2.083$ sq ft/ft

Total Pole Wind Force Top = $qz \cdot Cd_F \cdot A_{top} = 88$ plf **BLC 7**

Total Pole Wind Force Bottom = $qz \cdot Cd_F \cdot A_{bot} = 275$ plf **BLC 7**

Total Pole Wind Force Side = $qz \cdot Cd_F \cdot A_{side} = 122$ plf **BLC 5**

Wind Load (NESE Heavy)

Pole Projected Surface Area w/ Ice Top = $AICE_{top} := \frac{\left(W_{top} + 2 \cdot Ir\right)}{12} = 1.583$ sq ft/ft

Pole Projected Surface Area w/ Ice Bottom = $AICE_{bot} := \frac{\left(W_{bot} + 2 \cdot Ir\right)}{12} = 4.771$ sq ft/ft

Pole Projected Surface Area w/ Ice Side = $AICE_{side} := \frac{\left(W_{side} + 2 \cdot Ir\right)}{12} = 2.167$ sq ft/ft

Total Pole Wind Force w/ Ice Top = $p \cdot Cd_F \cdot AICE_{top} = 10$ plf **BLC 6**

Total Pole Wind Force w/ Ice Bottom = $p \cdot Cd_F \cdot AICE_{bot} = 31$ plf **BLC 6**

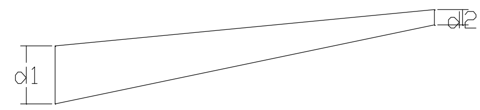
Total Pole Wind Force w/ Ice Side = $p \cdot Cd_F \cdot AICE_{side} = 14$ plf **BLC 4**

Development of Wind & Ice Load on CL&P Pole Arms

ARM Data:

Shape = Flat

Depth of Arm at Top = $ARM_{d1} := 19$



Depth of Arm at Bottom = $ARM_{d2} := 5$

Width of Arm at Top = $ARM_{W1} := 19$

Width of Arm at Bottom = $ARM_{W2} := 5$

Thickness of Arm Wall = $ARM_t := 0.25$

Gravity Loads (without ice)

Arm Area Top = $A_{armtop} := (ARM_{d1} \cdot ARM_{W1}) - [(ARM_{W1} - 2ARM_t) \cdot (ARM_{d1} - 2ARM_t)]$

Arm Area Bottom = $A_{armbot} := (ARM_{d2} \cdot ARM_{W2}) - [(ARM_{W2} - 2ARM_t) \cdot (ARM_{d2} - 2ARM_t)]$

Weight Arm Top = $Wt_{top} := \frac{A_{armtop}}{144} \cdot W_{steel} = 64$ plf **BLC 2**

Weight Arm Bottom = $Wt_{bot} := \frac{A_{armbot}}{144} \cdot W_{steel} = 16$ plf **BLC 2**

Gravity Loads (ice only)

Arm Area w/ Ice Top = $Ai_{armtop} := (ARM_{d1} + 2 \cdot Ir) \cdot (ARM_{W1} + 2 \cdot Ir) - ARM_{d1} \cdot ARM_{W1} = 39$

Arm Area w/ Ice Bottom = $Ai_{armbot} := (ARM_{d2} + 2 \cdot Ir) \cdot (ARM_{W2} + 2 \cdot Ir) - ARM_{d2} \cdot ARM_{W2} = 11$

Weight of Ice on Arm Top = $W_{ICE.top} := Id \cdot \frac{Ai_{armtop}}{144} = 15$ plf **BLC 3**

Weight of Ice on Arm Bottom = $W_{ICE.bot} := Id \cdot \frac{Ai_{armbot}}{144} = 4$ plf **BLC 3**

Wind Load (NESC Extreme)

Arm Projected Surface Area Top = $A_{top} := \frac{ARM_{d1}}{12} = 1.583$ sq ft/ft

Arm Projected Surface Area Bottom = $A_{bot} := \frac{ARM_{d2}}{12} = 0.417$ sq ft/ft

Total Arm Wind Force Top = $qz \cdot Cd_F \cdot A_{top} = 93$ plf **BLC 7**

Total Arm Wind Force Bottom = $qz \cdot Cd_F \cdot A_{bot} = 24$ plf **BLC 7**

Wind Load (NESE Heavy)

Arm Projected Surface Area w/ Ice Top = $AICE_{top} := \frac{(ARM_{d1} + 2 \cdot Ir)}{12} = 1.667$ sq ft/ft

Arm Projected Surface Area w/ Ice Bottom = $AICE_{bot} := \frac{(ARM_{d2} + 2 \cdot Ir)}{12} = 0.5$ sq ft/ft

Total Arm Wind Force w/ Ice Top = $p \cdot Cd_F \cdot AICE_{top} = 11$ plf **BLC 6**

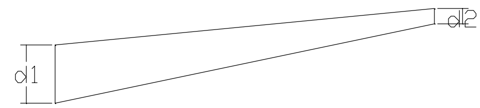
Total Arm Wind Force w/ Ice Bottom = $p \cdot Cd_F \cdot AICE_{bot} = 3$ plf **BLC 6**

Development of Wind & Ice Load on CL&P Pole Arms

ARM Data:

Shape = Flat

Depth of Arm at Top = $ARM_{d1} := 16$



Depth of Arm at Bottom = $ARM_{d2} := 5$

Width of Arm at Top = $ARM_{W1} := 16$

Width of Arm at Bottom = $ARM_{W2} := 5$

Thickness of Arm Wall = $ARM_t := 0.25$

Gravity Loads (without ice)

Arm Area Top = $A_{armtop} := \left(ARM_{d1} \cdot ARM_{W1}\right) - \left[\left(ARM_{W1} - 2ARM_t\right) \cdot \left(ARM_{d1} - 2ARM_t\right)\right]$

Arm Area Bottom = $A_{armbot} := \left(ARM_{d2} \cdot ARM_{W2}\right) - \left[\left(ARM_{W2} - 2ARM_t\right) \cdot \left(ARM_{d2} - 2ARM_t\right)\right]$

Weight Arm Top = $Wt_{top} := \frac{A_{armtop}}{144} \cdot W_{steel} = 54$ plf **BLC 2**

Weight Arm Bottom = $Wt_{bot} := \frac{A_{armbot}}{144} \cdot W_{steel} = 16$ plf **BLC 2**

Gravity Loads (ice only)

Arm Area w/ Ice Top = $Ai_{armtop} := \left(ARM_{d1} + 2 \cdot Ir\right) \cdot \left(ARM_{W1} + 2 \cdot Ir\right) - ARM_{d1} \cdot ARM_{W1} = 33$

Arm Area w/ Ice Bottom = $Ai_{armbot} := \left(ARM_{d2} + 2 \cdot Ir\right) \cdot \left(ARM_{W2} + 2 \cdot Ir\right) - ARM_{d2} \cdot ARM_{W2} = 11$

Weight of Ice on Arm Top = $W_{ICE.top} := Id \cdot \frac{Ai_{armtop}}{144} = 13$ plf **BLC 3**

Weight of Ice on Arm Bottom = $W_{ICE.bot} := Id \cdot \frac{Ai_{armbot}}{144} = 4$ plf **BLC 3**

Wind Load (NESC Extreme)

Arm Projected Surface Area Top =	$A_{top} := \frac{ARM_{d1}}{12} = 1.333$	sq ft/ft	
Arm Projected Surface Area Bottom =	$A_{bot} := \frac{ARM_{d2}}{12} = 0.417$	sq ft/ft	
Total Arm Wind Force Top =	$qz \cdot Cd_F \cdot A_{top} = 78$	plf	**BLC 7**
Total Arm Wind Force Bottom =	$qz \cdot Cd_F \cdot A_{bot} = 24$	plf	**BLC 7**

Wind Load (NESE Heavy)

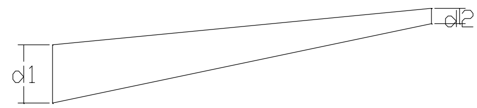
Arm Projected Surface Area w/ Ice Top =	$AICE_{top} := \frac{(ARM_{d1} + 2 \cdot Ir)}{12} = 1.417$	sq ft/ft	
Arm Projected Surface Area w/ Ice Bottom =	$AICE_{bot} := \frac{(ARM_{d2} + 2 \cdot Ir)}{12} = 0.5$	sq ft/ft	
Total Arm Wind Force w/ Ice Top =	$p \cdot Cd_F \cdot AICE_{top} = 9$	plf	**BLC 6**
Total Arm Wind Force w/ Ice Bottom =	$p \cdot Cd_F \cdot AICE_{bot} = 3$	plf	**BLC 6**

Development of Wind & Ice Load on CL&P Pole Arms

ARM Data:

Shape = Flat

Depth of Arm at Top = $ARM_{d1} := 12$



Depth of Arm at Bottom = $ARM_{d2} := 5$

Width of Arm at Top = $ARM_{W1} := 12$

Width of Arm at Bottom = $ARM_{W2} := 5$

Thickness of Arm Wall = $ARM_t := 0.25$

Gravity Loads (without ice)

Arm Area Top = $A_{armtop} := \left(ARM_{d1} \cdot ARM_{W1}\right) - \left[\left(ARM_{W1} - 2ARM_t\right) \cdot \left(ARM_{d1} - 2ARM_t\right)\right]$

Arm Area Bottom = $A_{armbot} := \left(ARM_{d2} \cdot ARM_{W2}\right) - \left[\left(ARM_{W2} - 2ARM_t\right) \cdot \left(ARM_{d2} - 2ARM_t\right)\right]$

Weight Arm Top = $Wt_{top} := \frac{A_{armtop}}{144} \cdot W_{steel} = 40$ plf **BLC 2**

Weight Arm Bottom = $Wt_{bot} := \frac{A_{armbot}}{144} \cdot W_{steel} = 16$ plf **BLC 2**

Gravity Loads (ice only)

Arm Area w/ Ice Top = $Ai_{armtop} := \left(ARM_{d1} + 2 \cdot Ir\right) \cdot \left(ARM_{W1} + 2 \cdot Ir\right) - ARM_{d1} \cdot ARM_{W1} = 25$

Arm Area w/ Ice Bottom = $Ai_{armbot} := \left(ARM_{d2} + 2 \cdot Ir\right) \cdot \left(ARM_{W2} + 2 \cdot Ir\right) - ARM_{d2} \cdot ARM_{W2} = 11$

Weight of Ice on Arm Top = $W_{ICE.top} := Id \cdot \frac{Ai_{armtop}}{144} = 10$ plf **BLC 3**

Weight of Ice on Arm Bottom = $W_{ICE.bot} := Id \cdot \frac{Ai_{armbot}}{144} = 4$ plf **BLC 3**

Wind Load (NESC Extreme)

Arm Projected Surface Area Top =	$A_{top} := \frac{ARM_{d1}}{12} = 1$	sq ft/ft	
Arm Projected Surface Area Bottom =	$A_{bot} := \frac{ARM_{d2}}{12} = 0.417$	sq ft/ft	
Total Arm Wind Force Top =	$qz \cdot Cd_F \cdot A_{top} = 59$	plf	**BLC 7**
Total Arm Wind Force Bottom =	$qz \cdot Cd_F \cdot A_{bot} = 24$	plf	**BLC 7**

Wind Load (NESE Heavy)

Arm Projected Surface Area w/ Ice Top =	$AICE_{top} := \frac{(ARM_{d1} + 2 \cdot Ir)}{12} = 1.083$	sq ft/ft	
Arm Projected Surface Area w/ Ice Bottom =	$AICE_{bot} := \frac{(ARM_{d2} + 2 \cdot Ir)}{12} = 0.5$	sq ft/ft	
Total Arm Wind Force w/ Ice Top =	$p \cdot Cd_F \cdot AICE_{top} = 7$	plf	**BLC 6**
Total Arm Wind Force w/ Ice Bottom =	$p \cdot Cd_F \cdot AICE_{bot} = 3$	plf	**BLC 6**

Development of Wind & Ice Load on Coax Cables

Coax Cable Data:

Coax Type =	HELIAX 1-1/4"		
Shape =	Round		(User Input)
Coax Outside Diameter =	$D_{coax} := 1.55$	in	(User Input)
Coax Cable Length =	$L_{coax} := 85$	ft	(User Input)
Weight of Coax per foot =	$Wt_{coax} := 0.66$	plf	(User Input)
Total Number of Coax =	$N_{coax} := 18$		(User Input)
No. of Coax Projecting Outside Face of Pole =	$NP_{coax} := 0$		(User Input)

Wind Load (NESC Extreme)

Coax projected surface area = $A_{coax} := \frac{(NP_{coax} D_{coax})}{12} = 0$ ft

Total Coax Wind Force (Below NU Structure) = $F_{coax} := qz \cdot Cd_{coax} \cdot A_{coax} = 0$ plf **BLC 19 & 21**

Wind Load (NESC Heavy)

Coax projected surface area w/ Ice = $AICE_{coax} := \frac{(NP_{coax} \cdot D_{coax} + 2 \cdot Ir)}{12} = 0.1$ ft

Total Coax Wind Force w/ Ice = $Fi_{coax} := p \cdot Cd_{coax} \cdot AICE_{coax} = 0$ plf **BLC 18 & 20**

Gravity Loads (without ice)

Weight of all cables w/o ice $WT_{coax} := Wt_{coax} \cdot N_{coax} = 12$ plf **BLC 16**

Gravity Load (ice only)

Ice Area per Linear Foot = $Ai_{coax} := \frac{\pi}{4}\left[(D_{coax} + 2 \cdot Ir)^2 - D_{coax}^{\,2}\right] = 3.2$ sq in

Ice Weight All Coax per foot = $WTi_{coax} := N_{coax} \cdot Id \cdot \frac{Ai_{coax}}{144} = 23$ plf **BLC 17**

Global

Display Sections for Member Calcs	5
Max Internal Sections for Member Calcs	97
Include Shear Deformation?	Yes
Include Warping?	Yes
Trans Load Btwn Intersecting Wood Wall?	Yes
Increase Nailing Capacity for Wind?	Yes
Area Load Mesh (in^2)	144
Merge Tolerance (in)	.12
P-Delta Analysis Tolerance	0.50%
Include P-Delta for Walls?	Yes
Automaticly Iterate Stiffness for Walls?	No
Maximum Iteration Number 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	Accelerated Solver

Hot Rolled Steel Code	AISC 9th: ASD
RISAConnection Code	AISC 14th(360-10): ASD
Cold Formed Steel Code	AISI 1999: ASD
Wood Code	AF&PA NDS-97: ASD
Wood Temperature	< 100F
Concrete Code	ACI 318-02
Masonry Code	ACI 530-05: ASD
Aluminum Code	AA ADM1-05: ASD - 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 Z	.035
Ct X	.035
T Z (sec)	Not Entered
T X (sec)	Not Entered
R Z	8.5
R X	8.5
Ca	.36
Cv	.54
Nv	1
Occupancy Category	4
Seismic Zone	3
Seismic Detailing Code	ASCE 7-05
Om Z	1
Om X	1
Rho Z	1
Rho X	1

Footing Overturning Safety Factor	1.5
Check Concrete Bearing	No
Footing Concrete Weight (k/ft^3)	0
Footing Concrete f'c (ksi)	3
Footing Concrete Ec (ksi)	4000
Lamda	1
Footing Steel fy (ksi)	60
Minimum Steel	0.0018
Maximum Steel	0.0075
Footing Top Bar	#3
Footing Top Bar Cover (in)	3.5
Footing Bottom Bar	#3
Footing Bottom Bar Cover (in)	3.5
Pedestal Bar	#3
Pedestal Bar Cover (in)	1.5
Pedestal Ties	#3

Hot Rolled Steel Properties

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

Hot Rolled Steel Design Parameters

	Label	Shape	Leng...	Lbyy[ft]	Lbzz[ft]	Lcomp ...	Lcomp ...	Kyy	Kzz	Cm...	Cm...	Cb	y s...	z s...	Functi...
1	M1	CL&P Pole # 844	85												Lateral
2	M2	arm	9.413												Lateral
3	M3	arm	9.413												Lateral
4	M4	arm	11.76												Lateral
5	M5	arm	11.76												Lateral
6	M6	arm	9.086												Lateral
7	M7	arm	9.086												Lateral
8	M8	arm	5.799												Lateral
9	M9	arm	5.799												Lateral

Hot Rolled Steel Section Sets

	Label	Shape	Type	Design List	Material	Design ...	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	CL&P Pole # 844	W21x44	Column	Wide Flange	A992	Typical	13	20.7	843	.77
2	arm	W8x28	Beam	Wide Flange	A992	Typical	8.25	21.7	98	.537

Member Primary Data

	Label	I Joint	J Joint	K Joint	Rotate(d...	Section/Shape	Type	Design List	Material	Design R...
1	M1	BOTTO...	TOP-PO...			CL&P Pole # 844	Column	Wide Flange	A992	Typical
2	M2	ARM1-L...	ARM1			arm	Beam	Wide Flange	A992	Typical
3	M3	ARM1-R...	ARM1			arm	Beam	Wide Flange	A992	Typical
4	M4	ARM2-L...	ARM2			arm	Beam	Wide Flange	A992	Typical
5	M5	ARM2-R...	ARM2			arm	Beam	Wide Flange	A992	Typical
6	M6	ARM3-L...	ARM3			arm	Beam	Wide Flange	A992	Typical
7	M7	ARM3-R...	ARM3			arm	Beam	Wide Flange	A992	Typical
8	M8	ARM4-R...	ARM4			arm	Beam	Wide Flange	A992	Typical
9	M9	ARM4-L...	ARM4			arm	Beam	Wide Flange	A992	Typical

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From ...
1	BOTTOM-POLE	0	0	0	0	
2	ARM1-LEFT	-9.33	47.75	0	0	
3	ARM2-LEFT	-11.67	59.75	0	0	
4	ARM3-LEFT	-9	71.75	0	0	
5	ARM4-LEFT	-5.75	84.75	0	0	
6	TOP-POLE	0	85	0	0	
7	ARM1-RIGHT	9.33	47.75	0	0	
8	ARM2-RIGHT	11.67	59.75	0	0	
9	ARM3-RIGHT	9	71.75	0	0	
10	ARM4-RIGHT	5.75	84.75	0	0	
11	ARM1	0	46.5	0	0	
12	ARM2	0	58.3	0	0	
13	ARM3	0	70.5	0	0	
14	ARM4	0	84	0	0	
15	BOTTOM-BRACE	0	79	0	0	
16	TOP-BRACE	0	83	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	BOTTOM-POLE	Reaction	Reaction	Reaction	Reaction	Reaction	Reaction	
2	ARM2-LEFT							
3	ARM1-LEFT							

Member Point Loads

Member Label	Direction	Magnitude[k,k-ft]	Location[ft,%]
No Data to Print ...			

Joint Loads and Enforced Displacements (BLC 8 : x-direction NESC Heavy Wire Load)

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft, k*s^2*ft)]
1	ARM4-LEFT	L	Y	-.901
2	ARM4-RIGHT	L	Y	-.901
3	ARM3-LEFT	L	Y	-2.658
4	ARM3-RIGHT	L	Y	-2.658
5	ARM2-RIGHT	L	Y	-2.658
6	ARM2-LEFT	L	Y	-2.658
7	ARM1-LEFT	L	Y	-2.658
8	ARM1-RIGHT	L	Y	-2.658
9	ARM4-LEFT	L	X	3.91
10	ARM4-RIGHT	L	X	3.91
11	ARM3-LEFT	L	X	8.927
12	ARM3-RIGHT	L	X	8.927
13	ARM2-LEFT	L	X	8.927
14	ARM2-RIGHT	L	X	8.927
15	ARM1-LEFT	L	X	8.927
16	ARM1-RIGHT	L	X	8.927

Joint Loads and Enforced Displacements (BLC 9 : x-driection NESC Extreme Wire Lo)

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft, k*s^2*ft)]
1	ARM4-LEFT	L	Y	-.256
2	ARM4-RIGHT	L	Y	-.256
3	ARM3-LEFT	L	Y	-1.131
4	ARM3-RIGHT	L	Y	-1.131
5	ARM2-LEFT	L	Y	-1.131
6	ARM2-RIGHT	L	Y	-1.131
7	ARM1-RIGHT	L	Y	-1.131
8	ARM1-LEFT	L	Y	-1.131
9	ARM4-LEFT	L	X	2.687
10	ARM4-RIGHT	L	X	2.687
11	ARM3-LEFT	L	X	7.972
12	ARM3-RIGHT	L	X	7.972
13	ARM2-RIGHT	L	X	7.972
14	ARM2-LEFT	L	X	7.972
15	ARM1-LEFT	L	X	7.972
16	ARM1-RIGHT	L	X	7.972

Joint Loads and Enforced Displacements (BLC 10 : z-direction NESC Heavy Wire Lo)

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft, k*s^2*ft)]
1	ARM4-LEFT	L	Y	-.901
2	ARM4-RIGHT	L	Y	-.901
3	ARM3-LEFT	L	Y	-2.658
4	ARM3-RIGHT	L	Y	-2.658
5	ARM2-LEFT	L	Y	-2.658
6	ARM2-RIGHT	L	Y	-2.658
7	ARM1-LEFT	L	Y	-2.658
8	ARM1-RIGHT	L	Y	-2.658

Joint Loads and Enforced Displacements (BLC 11 : z-direction NESC Extreme Wire Lo)

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft, k*s^2*ft)]
1	ARM4-LEFT	L	Y	-.256
2	ARM4-RIGHT	L	Y	-.256
3	ARM3-LEFT	L	Y	-1.131
4	ARM3-RIGHT	L	Y	-1.131
5	ARM2-LEFT	L	Y	-1.131
6	ARM2-RIGHT	L	Y	-1.131
7	ARM1-LEFT	L	Y	-1.131
8	ARM1-RIGHT	L	Y	-1.131

Joint Loads and Enforced Displacements (BLC 12 : x-direction NESC Heavy Mast Reac)

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft, k*s^2*ft)]
1	TOP-BRACE	L	X	1.068
2	BOTTOM-BRACE	L	X	-.703
3	TOP-BRACE	L	Y	-1.26

Joint Loads and Enforced Displacements (BLC 13 : x-direction NESC Extreme Mast Re)

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft, k*s^2*ft)]
1	TOP-BRACE	L	X	4.862
2	BOTTOM-BRACE	L	X	-3.217
3	TOP-BRACE	L	Y	-.581

Joint Loads and Enforced Displacements (BLC 14 : z-direction NESC Heavy Mast Reac)

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft, k*s^2*ft)]
1	TOP-BRACE	L	Z	1.068
2	BOTTOM-BRACE	L	Z	-.703
3	TOP-BRACE	L	Y	-1.26

Joint Loads and Enforced Displacements (BLC 15 : z-direction NESC Extreme Mast Re)

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft, k*s^2*ft)]
1	TOP-BRACE	L	Z	4.862
2	BOTTOM-BRACE	L	Z	-3.217
3	TOP-BRACE	L	Y	-.581

Member Distributed Loads (BLC 2 : Weight Pole and Arms)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	-.376	-.167	0	0
2	M9	Y	-.016	-.04	0	0

Member Distributed Loads (BLC 2 : Weight Pole and Arms) (Continued)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
3	M8	Y	-.016	-.04	0	0
4	M6	Y	-.016	-.054	0	0
5	M7	Y	-.016	-.054	0	0
6	M3	Y	-.016	-.054	0	0
7	M2	Y	-.016	-.054	0	0
8	M4	Y	-.016	-.064	0	0
9	M5	Y	-.016	-.064	0	0

Member Distributed Loads (BLC 3 : Weight of Ice Only on Pole and A)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	-.031	-.016	0	0
2	M9	Y	-.004	-.01	0	0
3	M8	Y	-.004	-.01	0	0
4	M6	Y	-.004	-.013	0	0
5	M7	Y	-.004	-.013	0	0
6	M3	Y	-.004	-.013	0	0
7	M2	Y	-.004	-.013	0	0
8	M4	Y	-.004	-.015	0	0
9	M5	Y	-.004	-.015	0	0

Member Distributed Loads (BLC 4 : x-direction NESC Heavy Wind on P)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M1	X	.014	.014	0	0

Member Distributed Loads (BLC 5 : x-direction NESC Extreme Wind on)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M1	X	.122	.122	0	0

Member Distributed Loads (BLC 6 : z-direction NESC Heavy Wind)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M1	Z	.031	.01	0	0
2	M8	Z	.003	.007	0	0
3	M9	Z	.003	.007	0	0
4	M7	Z	.003	.009	0	0
5	M6	Z	.003	.009	0	0
6	M3	Z	.003	.009	0	0
7	M2	Z	.003	.009	0	0
8	M5	Z	.003	.011	0	0
9	M4	Z	.003	.011	0	0

Member Distributed Loads (BLC 7 : z-direction NESC Extreme Wind)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M1	Z	.275	.088	0	0
2	M8	Z	.024	.059	0	0
3	M9	Z	.024	.059	0	0
4	M7	Z	.024	.078	0	0
5	M6	Z	.024	.078	0	0
6	M2	Z	.024	.078	0	0
7	M3	Z	.024	.078	0	0

Member Distributed Loads (BLC 7 : z-direction NESC Extreme Wind) (Continued)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
8	M5	Z	.024	.093	0	0
9	M4	Z	.024	.093	0	0

Member Distributed Loads (BLC 16 : Weight of Coax Cables)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	-.012	-.012	0	0

Member Distributed Loads (BLC 17 : Weight of Ice on Coax Cables)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M1	Y	-.023	-.023	0	0

Member Distributed Loads (BLC 18 : x-direction NESC Heavy Coax)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M1	X	0	0	0	0

Member Distributed Loads (BLC 19 : x-direction NESC Extreme Coax)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M1	X	0	0	0	0

Member Distributed Loads (BLC 20 : z-direction NESC Heavy Coax)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M1	Z	0	0	0	0

Member Distributed Loads (BLC 21 : z-direction NESC Extreme Coax)

	Member Label	Direction	Start Magnitude[k/ft,F]	End Magnitude[k/ft,F]	Start Location[ft,%]	End Location[ft,%]
1	M1	Z	0	0	0	0

Basic Load Cases

	BLC Description	Category	X Gra...	Y Gravity	Z Gra...	Joint	Point	Distrib..	Area(...	Surfa...
1	Self Weight (Not Used)	None								
2	Weight Pole and Arms	None						9		
3	Weight of Ice Only on Pole and A	None						9		
4	x-direction NESC Heavy Wind on P	None						1		
5	x-direction NESC Extreme Wind on	None						1		
6	z-direction NESC Heavy Wind	None						9		
7	z-direction NESC Extreme Wind	None						9		
8	x-direction NESC Heavy Wire Load	None				16				
9	x-driection NESC Extreme Wire Lo	None				16				
10	z-direction NESC Heavy Wire Lo	None				8				
11	z-direction NESC Extreme Wire Lo	None				8				
12	x-direction NESC Heavy Mast Reac	None				3				
13	x-direction NESC Extreme Mast Re	None				3				
14	z-direction NESC Heavy Mast Reac	None				3				
15	z-direction NESC Extreme Mast Re	None				3				
16	Weight of Coax Cables	None						1		
17	Weight of Ice on Coax Cables	None						1		
18	x-direction NESC Heavy Coax	None						1		

Basic Load Cases (Continued)

	BLC Description	Category	X Gra...	Y Gravity	Z Gra...	Joint	Point	Distrib...	Area(...	Surfa...
19	x-direction NESC Extreme Coax	None						1		
20	z-direction NESC Heavy Coax	None						1		
21	z-direction NESC Extreme Coax	None						1		

Load Combinations

	Description	Sol...	PDelta	SR...	BLC	Fact...	BLC	Fact...	BLC	Fact...	BLC	Fact...	BLC	Fact...	BLC	Fact...	BLC	Fact...	BLC	Fact...
1	x-direction NESC Heavy W...	Yes			2	1.5	3	1.5	4	2.5	8	1	12	1	16	1.5	17	1.5	18	2.5
2	x-direction NESC Extreme ...	Yes			2	1	5	1	9	1	13	1	16	1	19	1				
3	z-direction NESC Heavy W...	Yes			2	1.5	3	1.5	6	2.5	10	1	14	1	16	1.5	17	1.5	20	2.5
4	z-direction NESC Extreme ...	Yes			2	1	7	1	11	1	15	1	16	1	21	1				

Envelope Joint Reactions

	Joint		X [k]	LC	Y [k]	LC	Z [k]	LC	MX [k-ft]	LC	MY [k-ft]	LC	MZ [k-ft]	LC
1	BOTTOM-PO...	max	0	3	65.854	1	0	1	0	1	0	1	4022.619	1
2		min	-65.221	2	34.537	2	-20.817	4	-925.041	4	0	1	0	3
3	Totals:	max	0	3	65.854	1	0	1						
4		min	-65.221	2	34.537	2	-20.817	4						

Joint Reactions

	LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	1	BOTTOM-POLE	-64.722	65.854	0	0	0	4022.619
2	1	Totals:	-64.722	65.854	0			
3	1	COG (ft):	X: 0	Y: 46.955	Z: 0			

Joint Reactions

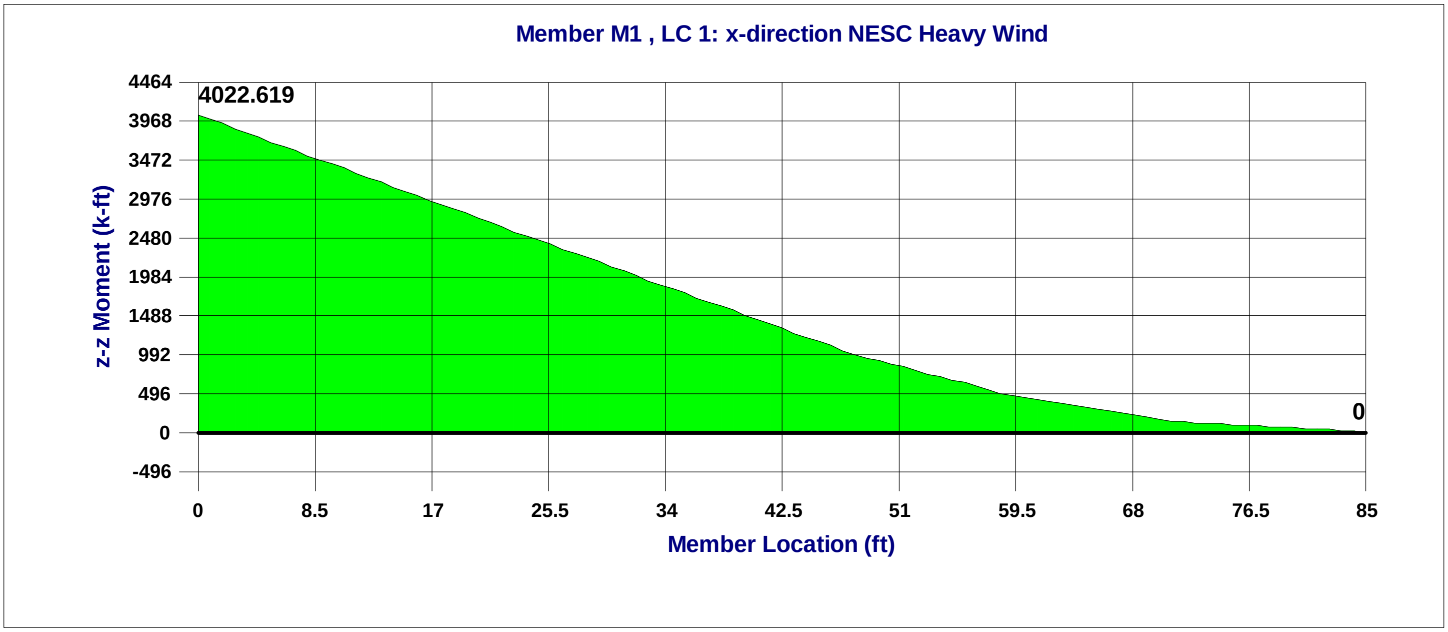
	LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	2	BOTTOM-POLE	-65.221	34.537	0	0	0	3903.536
2	2	Totals:	-65.221	34.537	0			
3	2	COG (ft):	X: 0	Y: 45.004	Z: 0			

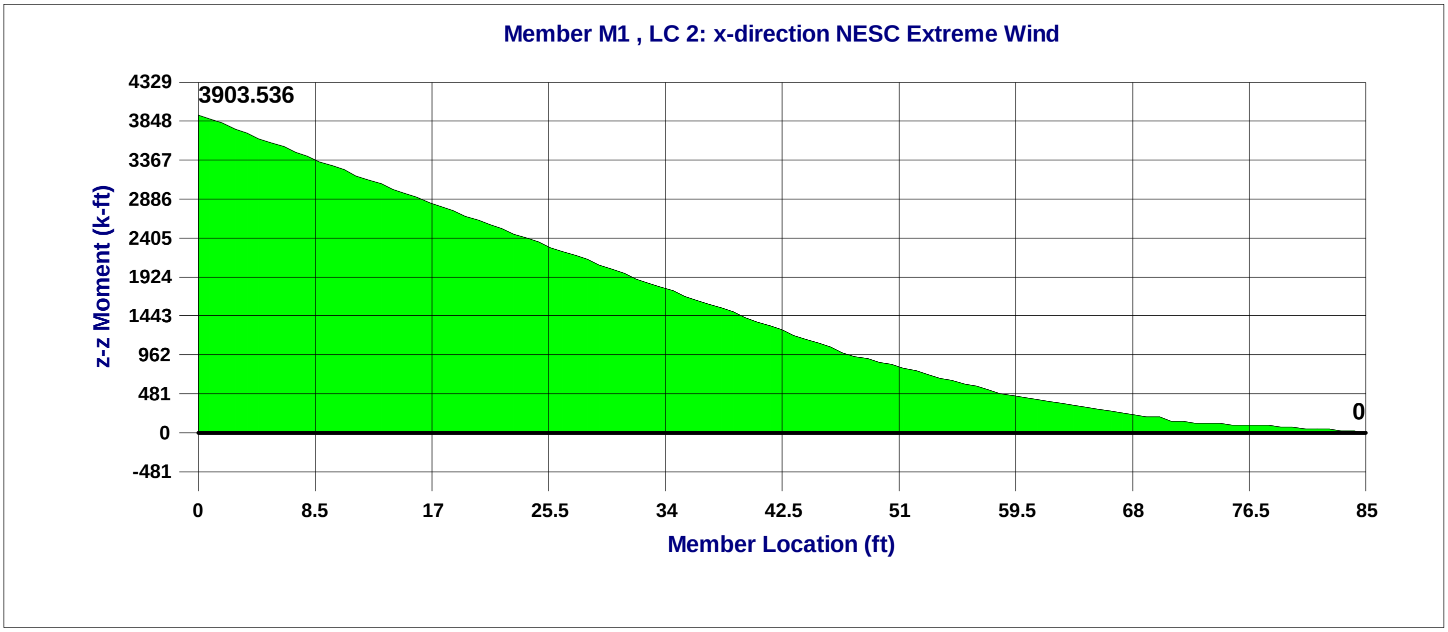
Joint Reactions

	LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	3	BOTTOM-POLE	0	65.854	-5.833	-255.738	0	0
2	3	Totals:	0	65.854	-5.833			
3	3	COG (ft):	X: 0	Y: 46.955	Z: 0			

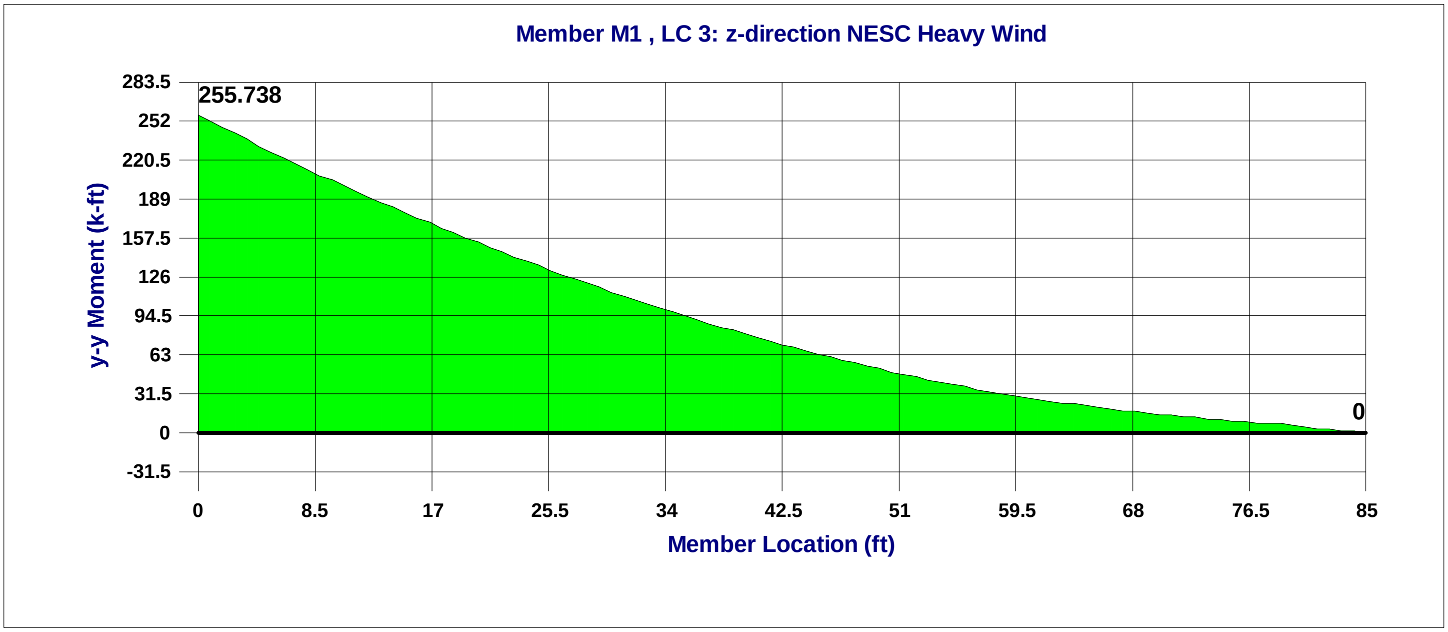
Joint Reactions

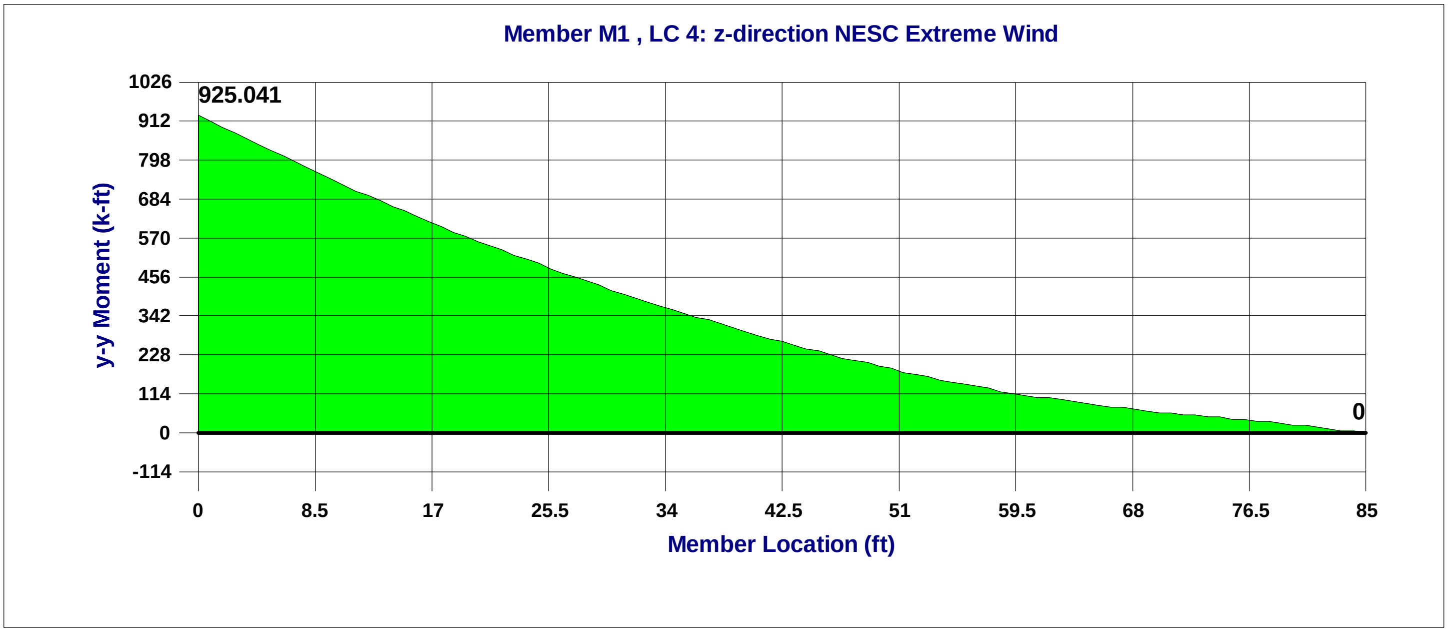
	LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	4	BOTTOM-POLE	0	34.537	-20.817	-925.041	0	0
2	4	Totals:	0	34.537	-20.817			
3	4	COG (ft):	X: 0	Y: 45.004	Z: 0			


Member M1 , LC 1: x-direction NESC Heavy Wind
z-z Moment (k-ft)
4464
3968
3472
2976
2480
1984
1488
992
496
0
-496
4022.619
0
0
8.5
17
25.5
34
42.5
51
59.5
68
76.5
85
Member Location (ft)

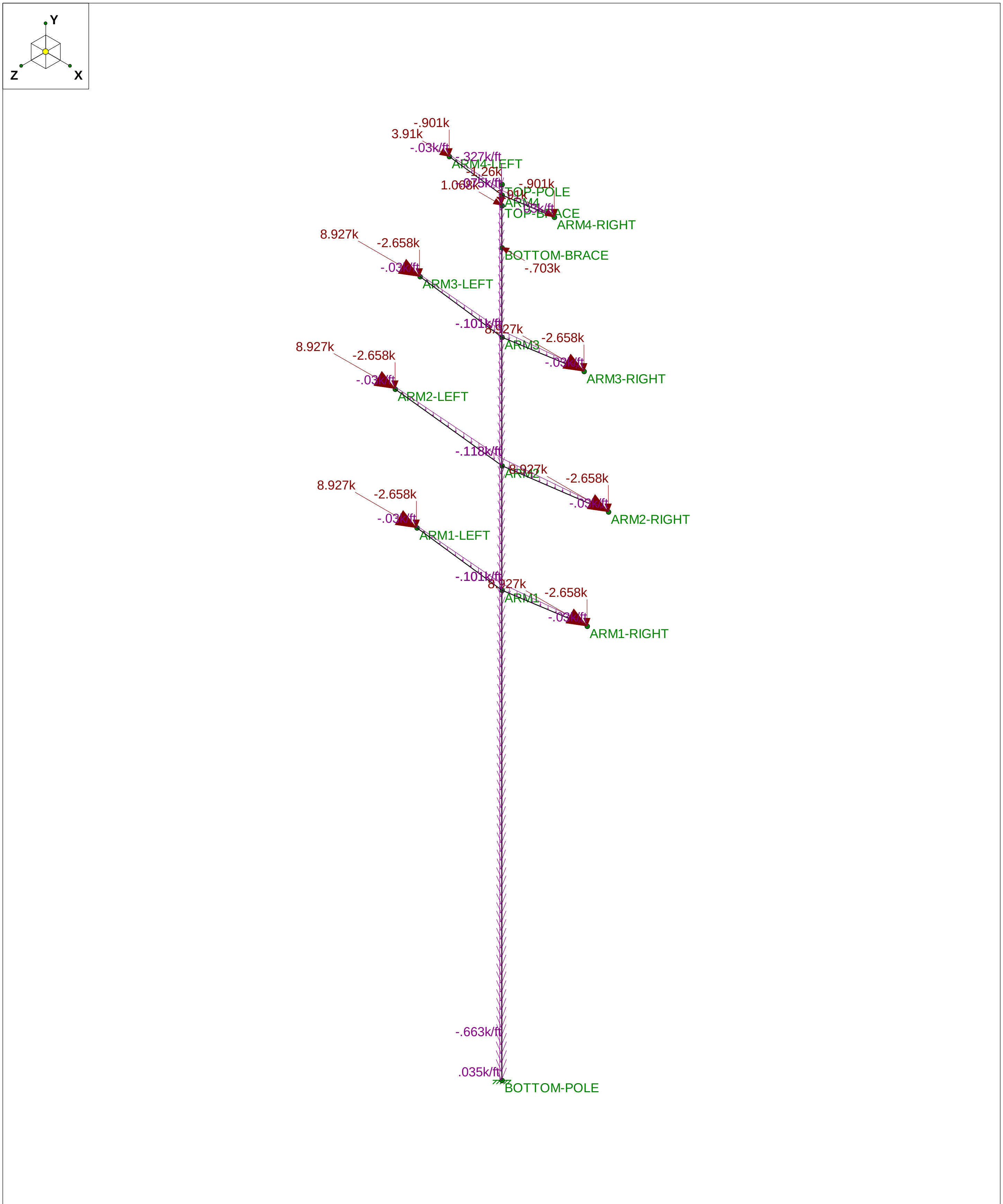


Member M1 , LC 2: x-direction NESC Extreme Wind
3903.536
0
4329
3848
3367
2886
2405
1924
1443
962
481
0
-481
z-z Moment (k-ft)
0
8.5
17
25.5
34
42.5
51
59.5
68
76.5
85
Member Location (ft)


Member M1 , LC 3: z-direction NESC Heavy Wind
283.5
252
220.5
189
157.5
126
94.5
63
31.5
0
-31.5
y-y Moment (k-ft)
255.738
0
0
8.5
17
25.5
34
42.5
51
59.5
68
76.5
85
Member Location (ft)

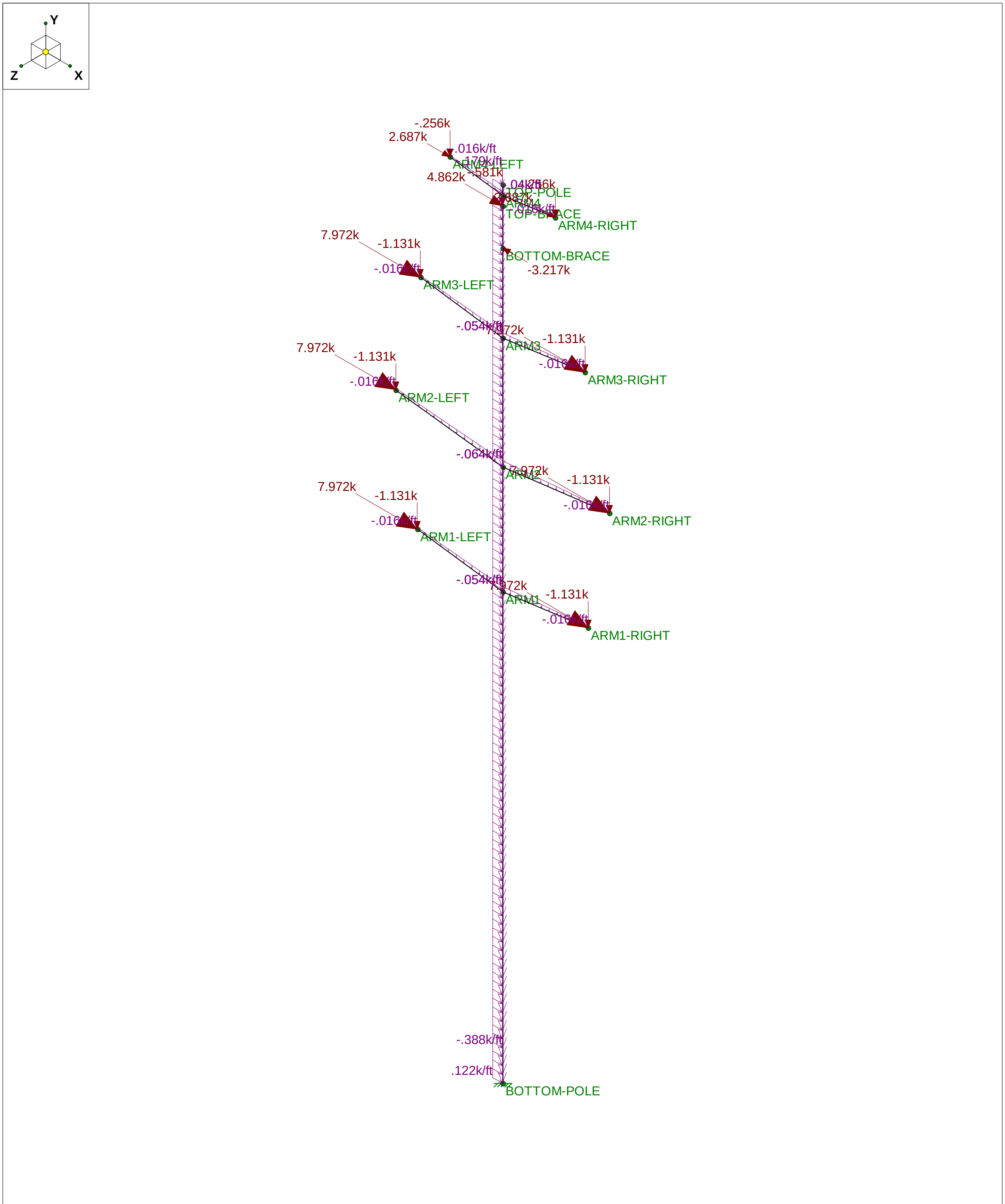


Member M1 , LC 4: z-direction NESC Extreme Wind
925.041
0
1026
912
798
684
570
456
342
228
114
0
-114
y-y Moment (k-ft)
0
8.5
17
25.5
34
42.5
51
59.5
68
76.5
85
Member Location (ft)



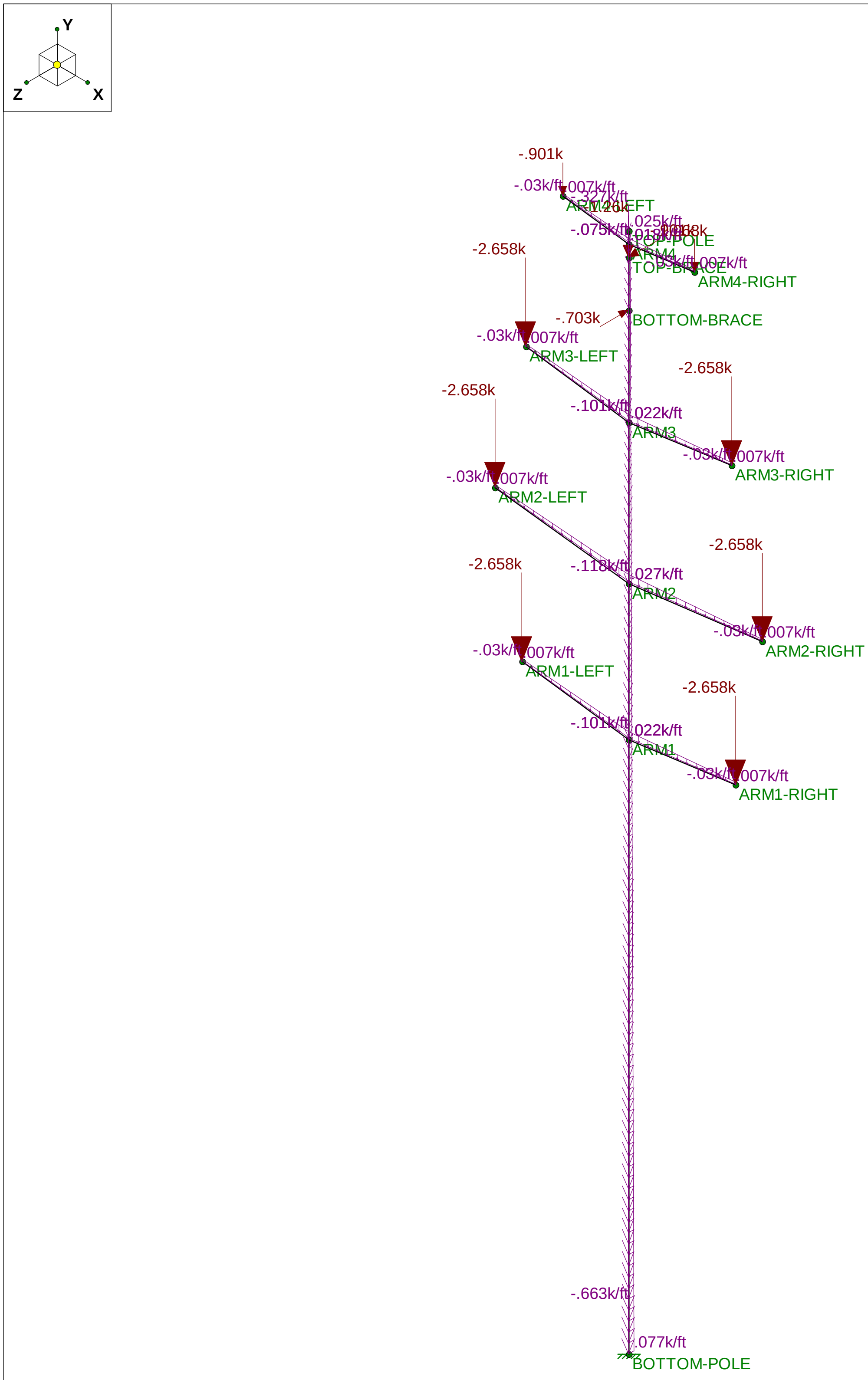
Loads: LC 1, x-direction NESC Heavy Wind

Centek Engineering		
tjl, cfc	Pole #6076	Dec 22, 2016 at 11:24 AM
16162.02 /T-Mobile CT110...	LC #1 Loads	Pole Loading.r3d



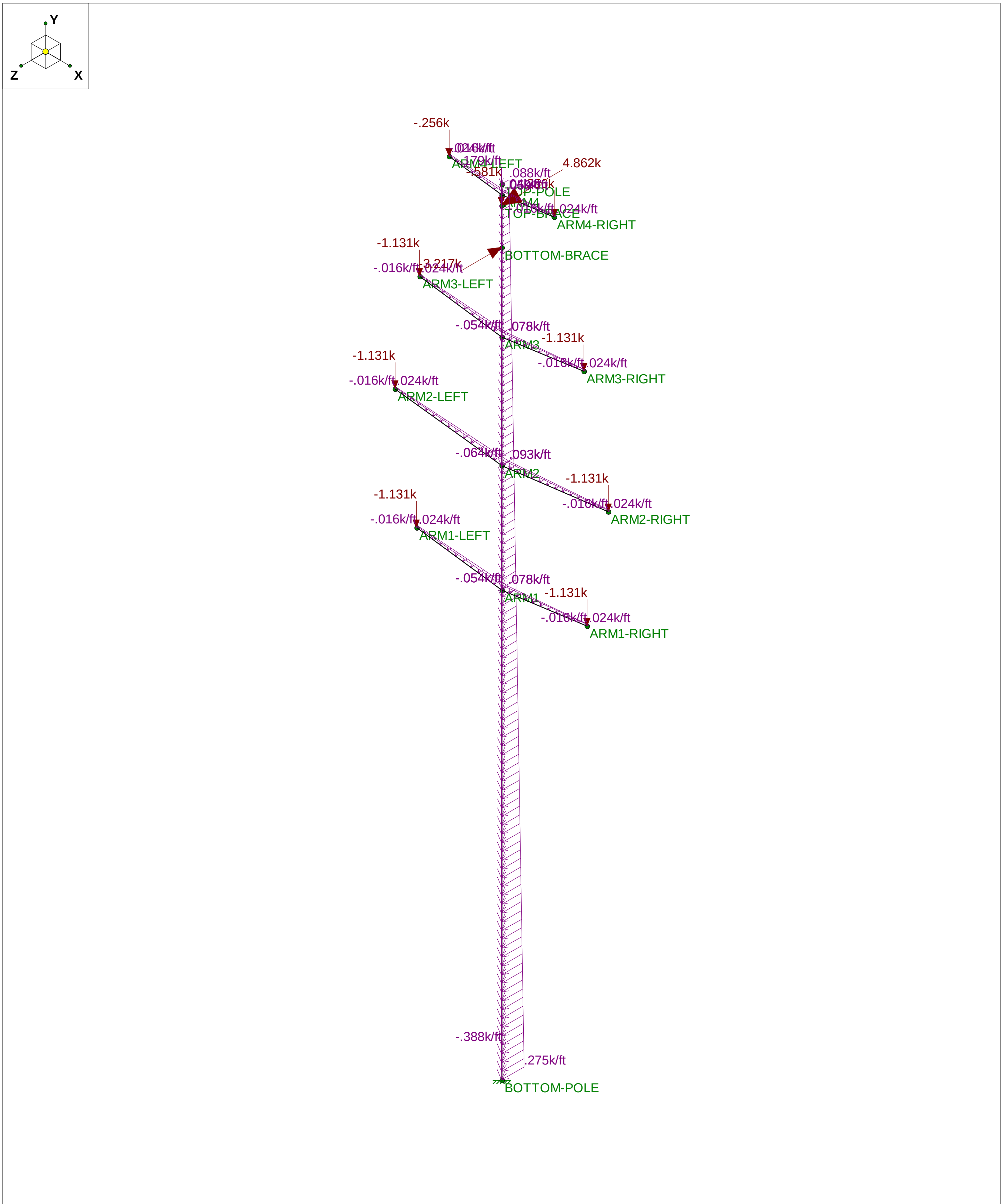
Loads: LC 2, x-direction NESC Extreme Wind

Centek Engineering		
tjl, cfc	Pole #6076	Dec 22, 2016 at 11:24 AM
16162.02 /T-Mobile CT110...	LC #2 Loads	Pole Loading.r3d



Loads: LC 3, z-direction NESC Heavy Wind

Centek Engineering		
tjl, cfc	Pole #6076	Dec 22, 2016 at 11:24 AM
16162.02 /T-Mobile CT110...	LC #3 Loads	Pole Loading.r3d



Loads: LC 4, z-direction NESC Extreme Wind

Centek Engineering		
tjl, cfc	Pole #6076	Dec 22, 2016 at 11:24 AM
16162.02 /T-Mobile CT110...	LC #4 Loads	Pole Loading.r3d

Pole Analysis:

Pole Properties:

Wide Flange Moment of Inertia Iy =	$I_{yy} := 70.4 \cdot in^4$	(User Input)
Wide Flange Moment of Inertia Ix =	$I_{xx} := 1830 \cdot in^4$	(User Input)
Wide Flange Area =	$A_{wf} := 20.1 \cdot in^2$	(User Input)
Flange Wdith =	$b_f := 8.97 \cdot in$	(User Input)
Wide Flange Depth =	$d_{wf} := 23.73 \cdot in$	(User Input)
Tower Width Top =	$W_{TTop} := 18 \cdot in$	(User Input)
Tower Width Base =	$W_{TBase} := 56.25 \cdot in$	(User Input)
Plate Thickness Top =	$Plt_{tTop} := 0.25 \cdot in$	(User Input)
Plate Thickness Base =	$Plt_{tBase} := 0.625 \cdot in$	(User Input)
Length of Pole =	$L_{pole} := 85 \cdot ft$	(User Input)
Nominal Bending Stress =	$F_b := 60 \cdot ksi$	(User Input)
Modulus of Elasticity =	$E := 29000 \cdot ksi$	(User Input)

Member Forces:

Bending Moment x-direction Top =	$M_{xtop} := 0 \cdot kip \cdot ft$	(User Input from RISA-3D)
Bending Moment x-direction Midspan =	$M_{xmid} := 1304 \cdot kip \cdot ft$	(User Input from RISA-3D)
Bending Moment x-direction Bottom =	$M_{xbot} := 4023 \cdot kip \cdot ft$	(User Input from RISA-3D)
Bending Moment y-direction Top =	$M_{ytop} := 0 \cdot kip \cdot ft$	(User Input from RISA-3D)
Bending Moment y-direction Midspan =	$M_{ymid} := 259 \cdot kip \cdot ft$	(User Input from RISA-3D)
Bending Moment y-direction Bottom =	$M_{ybot} := 924 kip \cdot ft$	(User Input from RISA-3D)
Axial Force Top =	$P_{top} := 0 \cdot kip$	(User Input from RISA-3D)
Axial Force Bottom =	$P_{bot} := 62 \cdot kip$	(User Input from RISA-3D)

Increment Length =	$lc := 5 \cdot ft$	(User Input)
Number of Increments =	$N := \frac{L_{pole}}{lc}$	(User Input)

$i := 0..N$

$$d_i := \begin{array}{|l} x \leftarrow (lc \cdot i) \\ d \leftarrow (L_{pole} - x) \end{array}$$

Distance Above Ground Level = $d_i = \begin{pmatrix} 85 \\ 80 \\ 75 \\ 70 \\ 65 \\ 60 \\ 55 \\ 50 \\ 45 \\ 40 \\ 35 \\ 30 \\ 25 \\ 20 \\ 15 \\ 10 \\ 5 \\ 0 \end{pmatrix} ft$

Bending Moment x-direction @ 5' Increments =

$$M_{x_i} := \begin{array}{|l} \Delta M_x \leftarrow \frac{(M_{xmid} - M_{xtop})}{0.5 \cdot L_{pole}} \cdot \left(d_i - \frac{L_{pole}}{2}\right) \text{ if } d_i > \frac{L_{pole}}{2} \\ \Delta M_x \leftarrow \frac{(M_{xbot} - M_{xmid})}{0.5 \cdot L_{pole}} \cdot d_i \text{ if } d_i \le \frac{L_{pole}}{2} \\ M_x \leftarrow M_{xmid} - \Delta M_x \text{ if } d_i > \frac{L_{pole}}{2} \\ M_x \leftarrow M_{xbot} - \Delta M_x \text{ if } d_i \le \frac{L_{pole}}{2} \end{array}$$

Bending Moment y-direction @ 5' Increments =

$$M_{y_i} := \begin{array}{|l} \Delta M_y \leftarrow \frac{(M_{ymid} - M_{ytop})}{0.5 \cdot L_{pole}} \cdot \left(d_i - \frac{L_{pole}}{2}\right) \text{ if } d_i > \frac{L_{pole}}{2} \\ \Delta M_y \leftarrow \frac{(M_{ybot} - M_{ymid})}{0.5 \cdot L_{pole}} \cdot d_i \text{ if } d_i \le \frac{L_{pole}}{2} \\ M_y \leftarrow M_{ymid} - \Delta M_y \text{ if } d_i > \frac{L_{pole}}{2} \\ M_y \leftarrow M_{ybot} - \Delta M_y \text{ if } d_i \le \frac{L_{pole}}{2} \end{array}$$

$$M_{x_i} = \begin{pmatrix} 2 \times 10^{-13} \\ 153 \\ 307 \\ 460 \\ 614 \\ 767 \\ 920 \\ 1074 \\ 1227 \\ 1464 \\ 1784 \\ 2104 \\ 2424 \\ 2743 \\ 3063 \\ 3383 \\ 3703 \\ 4023 \end{pmatrix} \cdot kip \cdot ft \qquad M_{y_i} = \begin{pmatrix} 0 \\ 30 \\ 61 \\ 91 \\ 122 \\ 152 \\ 183 \\ 213 \\ 244 \\ 298 \\ 376 \\ 455 \\ 533 \\ 611 \\ 689 \\ 768 \\ 846 \\ 924 \end{pmatrix} \cdot kip \cdot ft$$

Tower Width =

$$W_{Tx._i} := \left| \begin{array}{l} \Delta W_{T.x} \leftarrow \frac{(W_{TBase} - W_{TTop})}{L_{pole}} \cdot d_i \\ W_{Tx} \leftarrow W_{TBase} - \Delta W_{T.x} \end{array} \right.$$

$$W_{Tx.} = \begin{pmatrix} 1.5 \\ 1.688 \\ 1.875 \\ 2.063 \\ 2.25 \\ 2.438 \\ 2.625 \\ 2.813 \\ 3 \\ 3.188 \\ 3.375 \\ 3.562 \\ 3.75 \\ 3.938 \\ 4.125 \\ 4.312 \\ 4.5 \\ 4.688 \end{pmatrix} ft$$

Plate Thickness =

$$Plt_t := \begin{pmatrix} 0.25 \\ 0.25 \\ 0.25 \\ 0.25 \\ 0.25 \\ 0.25 \\ 0.25 \\ 0.4375 \\ 0.4375 \\ 0.4375 \\ 0.4375 \\ 0.4375 \\ 0.4375 \\ 0.625 \\ 0.625 \\ 0.625 \\ 0.625 \\ 0.625 \end{pmatrix} \cdot in$$

Plate Area =

$$Plt_{A_i} := W_{Tx._i} \cdot (Plt_{t_i})$$

$$Plt_{A_i} = \begin{pmatrix} 4.5 \\ 5.063 \\ 5.625 \\ 6.188 \\ 6.75 \\ 7.313 \\ 7.875 \\ 14.766 \\ 15.75 \\ 16.734 \\ 17.719 \\ 18.703 \\ 19.688 \\ 29.531 \\ 30.938 \\ 32.344 \\ 33.75 \\ 35.156 \end{pmatrix} in^2$$

Distance from Wide Flange Centroid to Built-up Section Centroid =

$$d_{x_i} := \frac{W_{Tx_i}}{2} - \frac{b_f}{2}$$

Distance from Plate Centroid to Built-up Section Centroid =

$$d_{y_i} := \frac{Plt_{t_i}}{2} + \frac{d_{wf}}{2}$$

Total Bult-up Section Area =

$$A_{Tot_i} := 2 \cdot \left(Plt_{A_i} + A_{wf}\right)$$

$$d_x = \begin{pmatrix} 4.52 \\ 5.64 \\ 6.77 \\ 7.89 \\ 9.02 \\ 10.14 \\ 11.27 \\ 12.39 \\ 13.52 \\ 14.64 \\ 15.77 \\ 16.89 \\ 18.02 \\ 19.14 \\ 20.26 \\ 21.39 \\ 22.52 \\ 23.64 \end{pmatrix} \cdot in$$

$$d_y = \begin{pmatrix} 11.99 \\ 11.99 \\ 11.99 \\ 11.99 \\ 11.99 \\ 11.99 \\ 11.99 \\ 12.08 \\ 12.08 \\ 12.08 \\ 12.08 \\ 12.08 \\ 12.08 \\ 12.18 \\ 12.18 \\ 12.18 \\ 12.18 \\ 12.18 \end{pmatrix} \cdot in$$

$$A_{Tot} = \begin{pmatrix} 49.2 \\ 50.3 \\ 51.5 \\ 52.6 \\ 53.7 \\ 54.8 \\ 56 \\ 69.7 \\ 71.7 \\ 73.7 \\ 75.6 \\ 77.6 \\ 79.6 \\ 99.3 \\ 102.1 \\ 104.9 \\ 107.7 \\ 110.5 \end{pmatrix} \cdot in^2$$

Built of Section Moment of Inertia Ix =

$$I_{x_i} := 2\cdot\left[I_{yy} + A_{wf}\cdot\left(d_{x_i}\right)^2 + \frac{1}{12}\cdot Plt_{t_i}\cdot\left(W_{Tx_i}\right)^3\right]$$

Built of Section Moment of Inertia Iy =

$$I_{y_i} := 2\cdot\left[I_{xx} + \frac{1}{12}\cdot W_{Tx_i}\cdot\left(Plt_{t_i}\right)^3 + Plt_{A_i}\cdot\left(d_{y_i}\right)^2\right]$$

$$I_{x_i} = \begin{pmatrix} 1203 \\ 1766 \\ 2455 \\ 3275 \\ 4228 \\ 5317 \\ 6545 \\ 9115 \\ 10886 \\ 12837 \\ 14976 \\ 17306 \\ 19832 \\ 25856 \\ 29284 \\ 32970 \\ 36922 \\ 41146 \end{pmatrix}\cdot in^4$$

$$I_{y_i} = \begin{pmatrix} 4954 \\ 5116 \\ 5277 \\ 5439 \\ 5601 \\ 5763 \\ 5924 \\ 7973 \\ 8260 \\ 8548 \\ 8835 \\ 9123 \\ 9410 \\ 12420 \\ 12838 \\ 13255 \\ 13672 \\ 14089 \end{pmatrix}\cdot in^4$$

Built of Section Modulus Sx = $S_{x_i} := \dfrac{I_{x_i}}{\dfrac{W_{Tx_i}}{2}}$

Built of Section Modulus Sy = $S_{y_i} := \dfrac{I_{y_i}}{Plt_{t_i} + \dfrac{d_{wf}}{2}}$

$$S_{x_i} = \begin{pmatrix} 134 \\ 174 \\ 218 \\ 265 \\ 313 \\ 364 \\ 416 \\ 540 \\ 605 \\ 671 \\ 740 \\ 810 \\ 881 \\ 1094 \\ 1183 \\ 1274 \\ 1367 \\ 1463 \end{pmatrix} \cdot in^3$$

$$S_{y_i} = \begin{pmatrix} 409 \\ 422 \\ 436 \\ 449 \\ 462 \\ 476 \\ 489 \\ 648 \\ 671 \\ 695 \\ 718 \\ 742 \\ 765 \\ 994 \\ 1028 \\ 1061 \\ 1095 \\ 1128 \end{pmatrix} \cdot in^3$$

Bending Stress x-direction @ 5' Increments = $fb_{x_i} := \frac{M_{x_i}}{S_{x_i}}$

Bending Stress y-direction @ 5' Increments = $fb_{y_i} := \frac{M_{y_i}}{S_{y_i}}$

$$fb_{x_i} = \begin{pmatrix} 1.5 \times 10^{-14} \\ 10.6 \\ 16.9 \\ 20.9 \\ 23.5 \\ 25.3 \\ 26.6 \\ 23.9 \\ 24.4 \\ 26.2 \\ 28.9 \\ 31.2 \\ 33 \\ 30.1 \\ 31.1 \\ 31.9 \\ 32.5 \\ 33 \end{pmatrix} \cdot ksi$$

$$fb_{y_i} = \begin{pmatrix} 0 \\ 0.9 \\ 1.7 \\ 2.4 \\ 3.2 \\ 3.8 \\ 4.5 \\ 3.9 \\ 4.4 \\ 5.1 \\ 6.3 \\ 7.4 \\ 8.4 \\ 7.4 \\ 8 \\ 8.7 \\ 9.3 \\ 9.8 \end{pmatrix} \cdot ksi$$

Maximum Bending Stress x-direction = $f_{bxmax} := 33 \cdot ksi$

Percent Stressed = $\frac{f_{bxmax}}{F_b} = 55 \cdot \%$

$Bending\_Check\_x := if\left(f_{bxmax} < F_b, "OK", "NG"\right)$

$Bending\_Check\_x = "OK"$

Maximum Bending Stress y-direction = $f_{bymax} := 9.8 \cdot ksi$

Percent Stressed = $\frac{f_{bymax}}{F_b} = 16.3 \cdot \%$

$Bending\_Check\_y := if\left(f_{bymax} < F_b, "OK", "NG"\right)$

$Bending\_Check\_y = "OK"$

Anchor Bolt and Base Plate Analysis:

Input Data:

Tower Reactions:

Overturning Moment =	$OM := 4023 \cdot ft \cdot kips$	(Input From Risa3D)
Shear Force =	$Shear := 64.7 \cdot kips$	(Input From Risa3D)
Axial Force =	$Axial := 65.9 \cdot kips$	(Input From Risa3D)

Anchor Bolt Data:

Use ASTM A615 Grade 60

Number of Anchor Bolts =	$N := 20$	(User Input)
Bolt "Column" Distance =	$l := 3.0 \cdot in$	(User Input)
Bolt Ultimate Strength =	$F_u := 90 \cdot ksi$	(User Input)
Bolt Yield Strength =	$F_y := 60 \cdot ksi$	(User Input)
Bolt Modulus =	$E := 29000 \cdot ksi$	(User Input)
Diameter of Anchor Bolts =	$D := 2.25 \cdot in$	(User Input)
Threads per Inch =	$n := 4.5$	(User Input)

Base Plate Data:

Use ASTM A36

Plate Yield Strength =	$Fy_{bp} := 36 \cdot ksi$	(User Input)
Base Plate Thickness =	$t_{bp} := 2.5 \cdot in$	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

$d_1 := 19.375in$ (User Input)

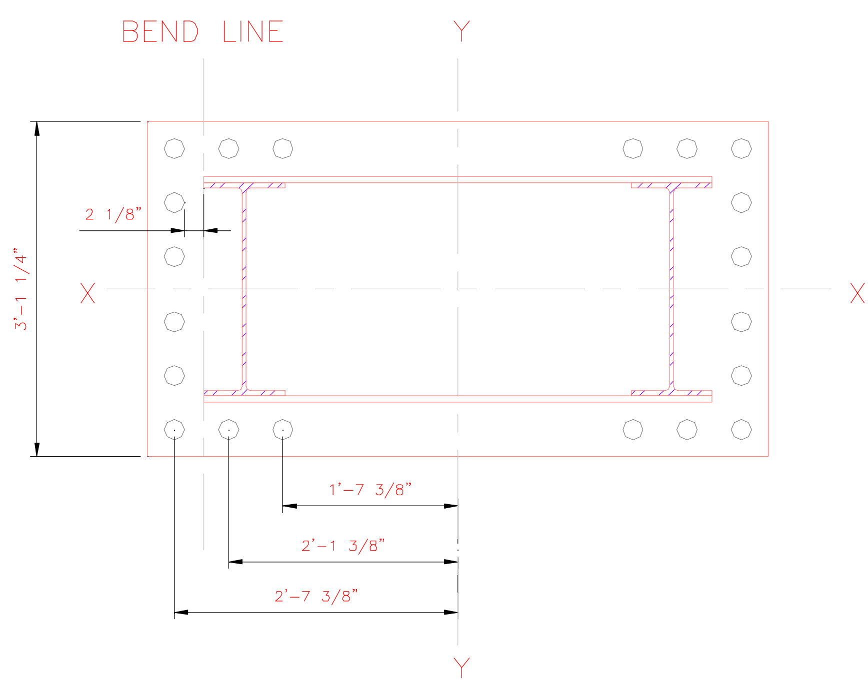
$d_2 := 25.375in$ (User Input)

$d_3 := 31.375in$ (User Input)

Critical Distances For Bending in Plate:

$ma_1 := 2.125in$ (User Input)

Effective Width of Baseplate for Bending = $B_{eff} := 37.25in$ (User Input)



ANCHOR BOLT AND PLATE GEOMETRY

Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Polar Moment of Inertia = $I_p := \left[(d_1)^2 \cdot 4 + (d_2)^2 \cdot 4 + (d_3)^2 \cdot 12\right] = 15890 \cdot in^2$

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

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

Net Diameter = $D_n := \frac{2 \cdot \sqrt{A_n}}{\sqrt{\pi}} = 2.033 \cdot in$

Radius of Gyration of Bolt = $r := \frac{D_n}{4} = 0.508 \cdot in$

Section Modulus of Bolt = $S_x := \frac{\pi \cdot D_n^{\ 3}}{32} = 0.826 \cdot in^3$

Check Anchor Bolt Tension Force:

Maximum Tensile Force = $T_{Max} := OM \cdot \frac{d_3}{I_p} - \frac{Axial}{N} = 92 \cdot kips$

Allowable Tensile Force (Gross Area) = $T_{ALL} := (A_n \cdot F_y) = 194.9 \cdot kips$

Bolt Tension % of Capacity = $\frac{T_{Max}}{T_{ALL}} \cdot 100 = 47.2$

Condition1 = $Condition1 := if\left(\frac{T_{Max}}{T_{ALL}} \le 1.00, \text{"OK"}, \text{"Overstressed"}\right)$

Condition1 = "OK"

Note Shear stress is negligible

Base Plate Analysis:

Force from Bolts = $T_1 := \frac{OM \cdot d_3}{I_p} - \frac{Axial}{N} = 92 \cdot kips$

Applied Bending Stress in Plate = $f_{bp} := \frac{6 \cdot (6T_1 \cdot ma_1)}{B_{eff} t_{bp}^2} = 30.24 \cdot ksi$

Allowable Bending Stress in Plate = $F_{bp} := Fy_{bp} = 36 \cdot ksi$

Plate Bending Stress % of Capacity = $\frac{f_{bp}}{F_{bp}} \cdot 100 = 84$

Condition3 = $Condition2 := if\left(\frac{f_{bp}}{F_{bp}} < 1.00, "Ok", "Overstressed"\right)$

$Condition2 = "Ok"$

Anchor Bolt and Base Plate Analysis:

Input Data:

Tower Reactions:

Overturning Moment =	$OM := 924 \cdot ft \cdot kips$	(Input From RISA-3D)
Shear Force =	$Shear := 20.8 \cdot kips$	(Input From Risa-3D)
Axial Force =	$Axial := 34.6 \cdot kips$	(Input From Risa-3D)

Anchor Bolt Data:

Use ASTM A615 Grade 60

Number of Anchor Bolts =	$N := 20$	(User Input)
Bolt "Column" Distance =	$l := 3.0 \cdot in$	(User Input)
Bolt Ultimate Strength =	$F_u := 90 \cdot ksi$	(User Input)
Bolt Yield Strength =	$F_y := 60 \cdot ksi$	(User Input)
Bolt Modulus =	$E := 29000 \cdot ksi$	(User Input)
Diameter of Anchor Bolts =	$D := 2.25 \cdot in$	(User Input)
Threads per Inch =	$n := 4.5$	(User Input)

Base Plate Data:

Use ASTM A36

Plate Yield Strength =	$Fy_{bp} := 36 \cdot ksi$	(User Input)
Base Plate Thickness =	$t_{bp} := 2.5 \cdot in$	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

$d_1 := 3.625in$ (User Input)

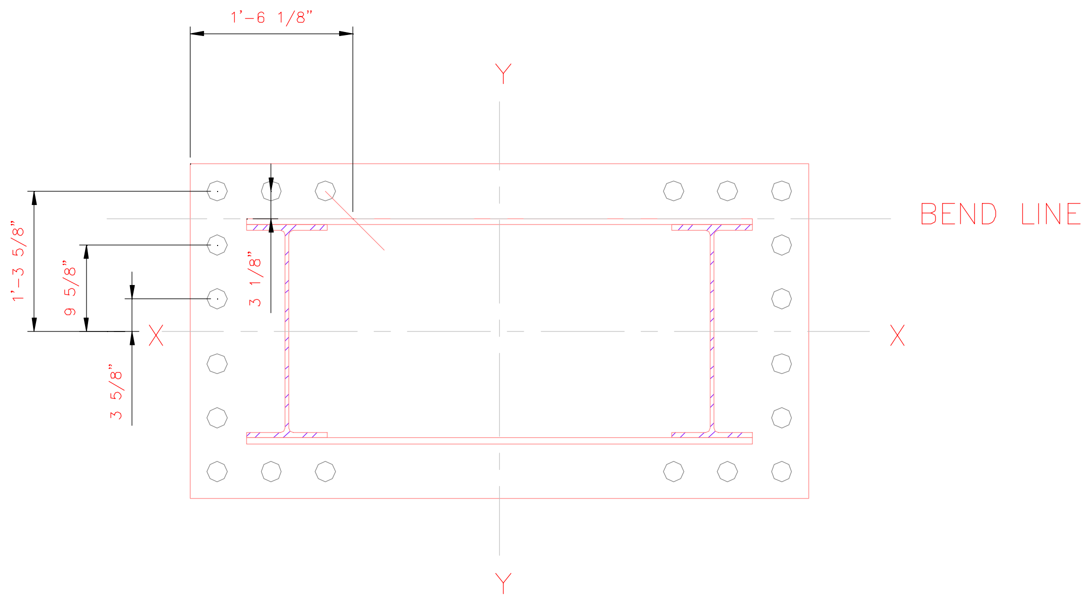
$d_2 := 9.625in$ (User Input)

$d_3 := 15.625in$ (User Input)

Critical Distances For Bending in Plate:

$ma_1 := 3.125in$ (User Input)

Effective Width of Baseplate for Bending = $B_{eff} := 18.125in$ (User Input)



ANCHOR BOLT AND PLATE GEOMETRY

Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Polar Moment of Inertia = $I_p := \left[(d_1)^2 \cdot 4 + (d_2)^2 \cdot 4 + (d_3)^2 \cdot 12\right] = 3353 \cdot in^2$

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

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

Net Diameter = $D_n := \frac{2 \cdot \sqrt{A_n}}{\sqrt{\pi}} = 2.033 \cdot in$

Radius of Gyration of Bolt = $r := \frac{D_n}{4} = 0.508 \cdot in$

Section Modulus of Bolt = $S_x := \frac{\pi \cdot D_n^{\,3}}{32} = 0.826 \cdot in^3$

Check Anchor Bolt Tension Force:

Maximum Tensile Force = $T_{Max} := OM \cdot \frac{d_3}{I_p} - \frac{Axial}{N} = 49.9 \cdot kips$

Allowable Tensile Force (Gross Area) = $T_{ALL} := (A_n \cdot F_y) = 194.9 \cdot kips$

Bolt Tension % of Capacity = $\frac{T_{Max}}{T_{ALL}} \cdot 100 = 25.6$

Condition1 = $Condition1 := if\left(\frac{T_{Max}}{T_{ALL}} \le 1.00, \text{"OK"}, \text{"Overstressed"}\right)$

Condition1 = "OK"

Note Shear stress is negligible

Base Plate Analysis:

Force from Bolts = $C_1 := \frac{OM \cdot d_3}{I_p} + \frac{Axial}{N} = 53.403 \cdot kips$

Applied Bending Stress in Plate = $f_{bp} := \frac{6 \cdot (3C_1 \cdot ma_1)}{B_{eff} \cdot t_{bp}^2} = 26.52 \cdot ksi$

Allowable Bending Stress in Plate = $F_{bp} := Fy_{bp} = 36 \cdot ksi$

Plate Bending Stress % of Capacity = $\frac{f_{bp}}{F_{bp}} \cdot 100 = 73.7$

Condition3 = $Condition3 := if\left(\frac{f_{bp}}{F_{bp}} < 1.00, "Ok", "Overstressed"\right)$

Condition3 = "Ok"

Foundation:

Input Data:

Tower Data

Overturning Moment =	$OM := 4023 \cdot 1.1 \cdot ft \cdot kips = 4425 \cdot ft \cdot kips$	(User Input from PLS-Pole)
Shear Force =	$Shear := 65 \cdot kip \cdot 1.1 = 71.5 \cdot kips$	(User Input from PLS-Pole)
Axial Force =	$Axial := 65.9 \cdot kip \cdot 1.1 = 72.49 \cdot kips$	(User Input from PLS-Pole)
Tower Height =	$H_t := 85 \cdot ft$	(User Input)

Footing Data:

Depth to Bottom of Footing =	$D_f := 7.5 \cdot ft$	(User Input)
Length of Pier =	$L_p := 8 \cdot ft$	(User Input)
Extension of Pier Above Grade =	$L_{pag} := 0.5 \cdot ft$	(User Input)
Width of Pier =	$W_p := 8 \cdot ft$	(User Input)
Depth of Soil =	$D_{soil} := 7.5 \cdot ft$	(User Input)
Depth of Rock =	$D_{rock} := 22 \cdot ft$	(User Input)

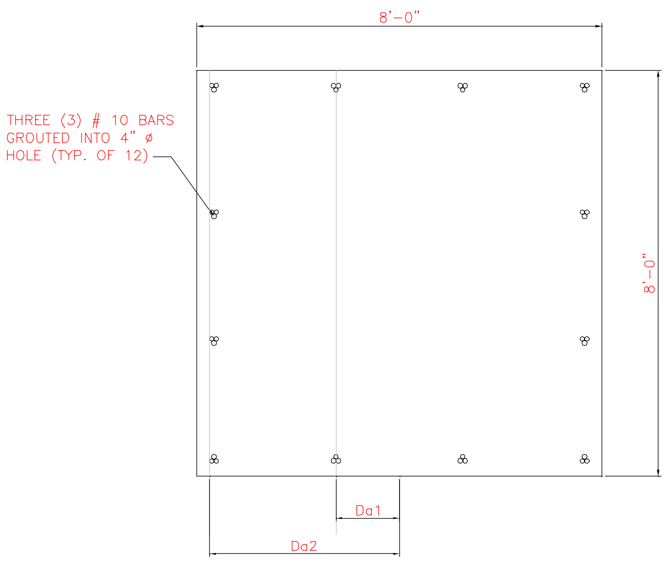
Material Properties:

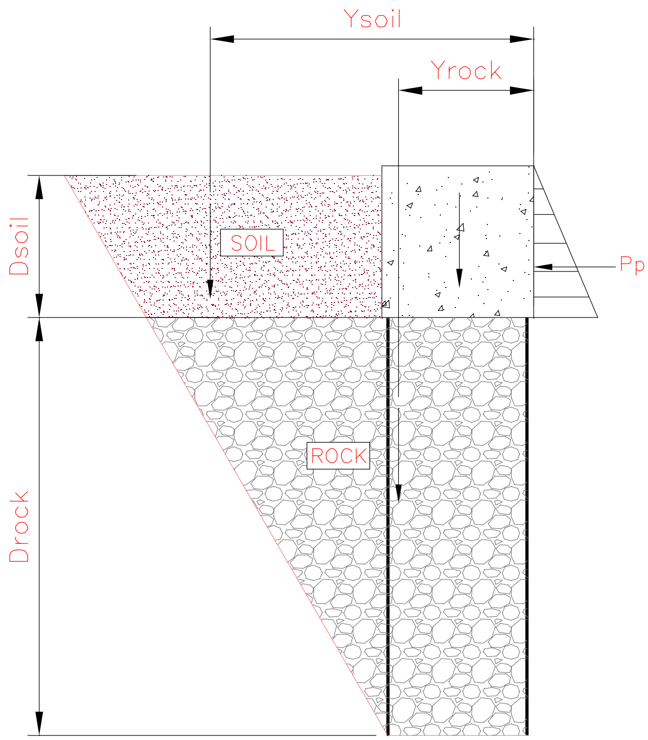
Concrete Compressive Strength =	$f_c := 3000 \cdot psi$	(User Input)	
Steel Reinforcment Yield Strength =	$f_y := 60000 \cdot psi$	(User Input)	
Anchor Bolt Yield Strength =	$f_{ya} := 75000 \cdot psi$	(User Input)	
Internal Friction Angle of Soil =	$\Phi_s := 30 \cdot deg$	(User Input)	
Allowable Soil Bearing Capacity =	$q_s := 4000 \cdot psf$	(User Input)	
Allowable Rock Bearing Capacity =	$q_{rock} := 50000 \cdot psf$	(User Input)	
Unit Weight of Soil =	$\gamma_{soil} := 120 \cdot pcf$	(User Input)	
Unit Weight of Concrete =	$\gamma_{conc} := 150 \cdot pcf$	(User Input)	
Unit Weight of Rock =	$\gamma_{rock} := 160 \cdot pcf$	(User Input)	
Foundation Bouyancy =	$Bouyancy := 0$	(User Input)	(Yes=1 / No=0)
Depth to Neglect =	$n := 1.0 \cdot ft$	(User Input)	
Cohesion of Clay Type Soil =	$c := 0 \cdot ksf$	(User Input)	(Use 0 for Sandy Soil)
Seismic Zone Factor =	$Z := 2$	(User Input)	(UBC-1997 Fig 23-2)
Coefficient of Friction Between Concrete =	$\mu := 0.45$	(User Input)	

Rock Anchor Properties:

ASTM A615 Grade 60

Bolt Ultimate Strength =	$F_u := 90 \cdot ksi$	(User Input)	
Bolt Yield Strength =	$F_y := 60 \cdot ksi$	(User Input)	
Anchor Diameter =	$d_{ra} := 3.81 \cdot in$	(User Input)	(3 # 10 Bars)
Hole Diameter =	$d_{Hole} := 4 \cdot in$	(User Input)	
Grout Strength =	$\tau := 120 \cdot psi$	(User Input)	(Assumed Conservative Value)
Distance to Rock Anchor Group 1 =	$D_{a1} := 15 \cdot in$	(User Input)	
Distance to Rock Anchor Group 2 =	$D_{a2} := 45 \cdot in$	(User Input)	
Number of Rock Anchors in Group 1 =	$N_{a1} := 4$	(User Input)	
Number of Rock Anchors in Group 2 =	$N_{a2} := 8$	(User Input)	
Total Number of Rock Anchors =	$N_{atot} := 12$	(User Input)	





Area 1 = $A1_s := \frac{1}{2} \cdot \tan(\Phi_s) \cdot D_{soil}^2 = 16.238\,ft^2$

Area 2 = $A2_s := \tan(\Phi_s) \cdot D_{rock} \cdot D_{soil} = 95.263\,ft^2$ sf

Distance to Centroid 1 = $Y1 := \tan(\Phi_s) \cdot D_{rock} + \frac{1}{3} \cdot \tan(\Phi_s) \cdot D_{soil} = 14.145\,ft$ ft

Distance to Centroid 2 = $Y2 := \frac{1}{2} \cdot \tan(\Phi_s) \cdot D_{rock} = 6.351\,ft$ ft

Distance from Toe to Centroid of Soil = $Y_{soil} := \frac{(A1_s \cdot Y1 + A2_s \cdot Y2)}{(A1_s + A2_s)} + W_p = 15.49\,ft$ ft

Area 1 = $A1_r := \frac{1}{2} \cdot \tan(\Phi_s) \cdot D_{rock}^2 = 139.719\,ft^2$ sf

Area 2 = $A2_r := W_p \cdot D_{rock} = 176\,ft^2$ sf

Distance to Centroid 1 = $Y1 := W_p + \frac{1}{3} \cdot \tan(\Phi_s) \cdot D_{rock} = 12.234\,ft$ ft

Distance to Centroid 2 = $Y2 := \frac{W_p}{2} = 4\,ft$ ft

Distance from Toe to Centroid of Rock = $Y_{rock} := \frac{(A1_r \cdot Y1 + A2_r \cdot Y2)}{(A1_r + A2_r)} = 7.64\,ft$ ft

Stability of Footing:

Adjusted Concrete Unit Weight = $\gamma_c := \text{if}(\text{Bouyancy} = 1, \gamma_{conc} - 62.4\text{pcf}, \gamma_{conc}) = 150 \cdot \text{pcf}$

Adjusted Soil Unit Weight = $\gamma_s := \text{if}(\text{Bouyancy} = 1, \gamma_{soil} - 62.4\text{pcf}, \gamma_{soil}) = 120 \cdot \text{pcf}$

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

Passive Pressure = $P_{top} := 0 = 0 \cdot \text{ksf}$

$P_{bot} := K_p \cdot \gamma_s \cdot D_{soil} + c \cdot 2 \cdot \sqrt{K_p} = 2.7 \cdot \text{ksf}$

$P_{ave} := \dfrac{P_{top} + P_{bot}}{2} = 1.35 \cdot \text{ksf}$

$A_p := W_p \cdot (L_p - L_{pag}) = 60 \text{ft}^2$

Ultimate Shear = $S_u := P_{ave} \cdot A_p = 81 \cdot \text{kip}$

Weight of Concrete Pad = $WT_c := (W_p{}^2 \cdot L_p) \cdot \gamma_c = 76.8 \cdot \text{kip}$

Total Weight of Soil = $WT_{Stot} := (A1_s + A2_s) \cdot W_p \cdot \gamma_s = 107 \cdot \text{kips}$

Total Weight of Rock = $WT_{Rtot} := (A1_r + A2_r) \cdot W_p \cdot \gamma_{rock} = 404.1 \cdot \text{kips}$

Resisting Moment = $M_r := (WT_c + \text{Axial}) \cdot \dfrac{W_p}{2} + S_u \cdot \dfrac{(L_p - L_{pag})}{3} + WT_{Stot} \cdot Y_{soil} + WT_{Rtot} \cdot Y_{rock} = 5546 \cdot \text{kip} \cdot \text{ft}$

Overturning Moment = $M_{ot} := OM + \text{Shear} \cdot L_p = 4997 \cdot \text{kip} \cdot \text{ft}$

Factor of Safety Actual = $FS := \dfrac{M_r}{M_{ot}} = 1.11$

Factor of Safety Required = $FS_{req} := 1.0$

OverTurning_Moment_Check := if$(FS \geq FS_{req}$, "Okay", "No Good")

OverTurning_Moment_Check = "Okay"

Rock Anchor Check:

Polar Moment of Inertia = $I_p := \left(D_{a1}^2 \cdot N_{a1} + D_{a2}^2 \cdot N_{a2}\right) = 17100 \cdot in^2$

Maximum Tension Force = $T_{Max} := \frac{OM \cdot D_{a2}}{I_p} - \frac{Axial + WT_c}{N_{atot}} = 127.3 \cdot kips$

Gross Area of Bolt Group = $A_g := \frac{\pi}{4} \cdot d_{ra}^2 = 11.401 \cdot in^2$

Allowable Tension = $T_{all} := A_g \cdot F_y = 684.1 \cdot kips$

$\frac{T_{Max}}{T_{all}} = 18.6 \cdot \%$

Condition1 := if$\left(T_{Max} < T_{all}, \text{"OK"}, \text{"NG"}\right)$

Condition1 = "OK"

Check Bond Strength:

Bond Strength = Bond_Strength := $d_{Hole} \cdot \pi \cdot D_{rock} \cdot \tau = 398 \cdot kips$

$\frac{T_{Max}}{Bond\_Strength} = 32 \cdot \%$

Condition2 := if$\left(T_{Max} < Bond_Strength, \text{"OK"}, \text{"NG"}\right)$

Condition2 = "OK"

Bearing Pressure Caused by Footing:

$P_2 := \frac{M_{ot} \cdot D_{a2}}{I_p} = 157.8 \cdot kips$

$P_1 := \frac{M_{ot} \cdot D_{a1}}{I_p} = 52.6 \cdot kips$

Area of the Mat = $A_{mat} := \left(W_p \cdot \frac{W_p}{2}\right) = 32\,ft^2$

Maximum Pressure in Mat = $P_{max} := \frac{WT_c + Axial + P_1 \cdot \frac{N_{a1}}{2} + P_2 \cdot \frac{N_{a2}}{2}}{A_{mat}} = 27.679 \cdot ksf$

Max_Pressure_Check := if$\left(P_{max} < q_{rock}, \text{"Okay"}, \text{"No Good"}\right)$

Max_Pressure_Check = "Okay"

Section 1 - Site Information

Site ID: CT11039D
Status: Draft
Version: 2.2
Project Type: L700
Approved: Not Approved
Approved By: Not Approved
Last Modified: 10/3/2016 6:06:23 AM
Last Modified By: GSM1900\SCLEMONS

Site Name: EastLyme/ I-95/ X72/ At_1
Site Class: Utility Lattice Tower
Site Type: Structure Non Building
Solution Type:
Plan Year:
Market: CONNECTICUT
Vendor: Ericsson
Landlord: CL&P

Latitude: 41.36210400
Longitude: -72.20698700
Address: 269 Flanders Rd.(CL&P tower #1605)
City, State: East Lyme, CT
Region: NORTHEAST

RAN Template: 704Bu Outdoor	AL Template: 1HP_704Bu

Sector Count: 3	Antenna Count: 3	Coax Line Count: 12	TMA Count: 6	RRU Count: 3

Section 2 - Existing Template Images

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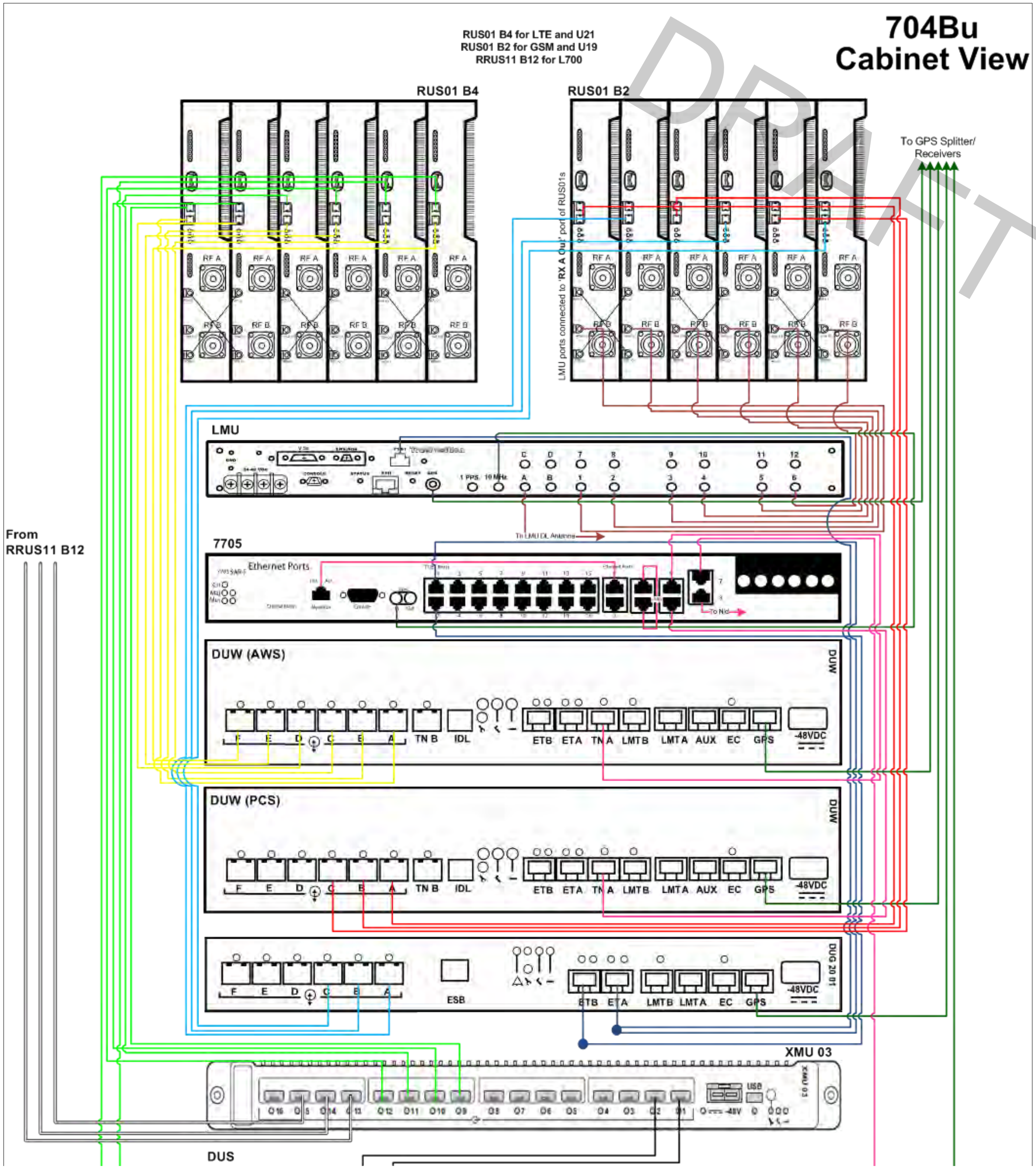
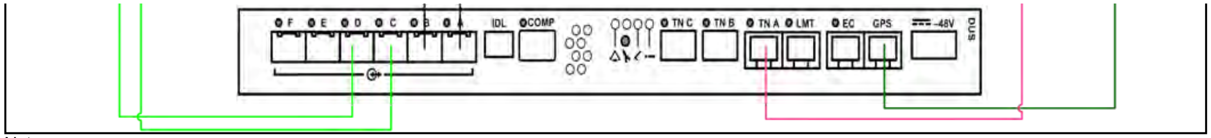
704Bu.png


704Bu
Cabinet View
DRAFT
RUS01 B4 for LTE and U21
RUS01 B2 for GSM and U19
RRUS11 B12 for L700
RUS01 B4
RUS01 B2
To GPS Splitter/
Receivers
LMU ports connected to 'RX A Out' port of RUS01s
LMU
7705
Ethernet Ports
To LMU DL Antenna
DUW (AWS)
DUW (PCS)
From
RRUS11 B12
ETB
ETA
TN A
LMTB
LMTA
AUX
EC
GPS
TN B
IDL
-48VDC
ESB
XMU 03
DUS



Notes:

Section 4 - Siteplan Images

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

Section 5 - RAN Equipment

Existing RAN Equipment		
Template: 4B		
Enclosure	1	2
Enclosure Type	RBS 6102	RBS 3106
Baseband	DUL20, DUW30 **(x2)**, DUG20	
Radio	RUS01 B2 **(x4)**, RUS01 B4 **(x4)**	

Proposed RAN Equipment		
Template: 704Bu Outdoor		
Enclosure	1	2
Enclosure Type	RBS 6102	Ground Mount
Baseband	DUG20 (G1900), DUW30 (U1900), DUS41 (L2100, L700)	
Multiplexer	XMU (L2100, L700)	
Radio	RUS01 B2 **(x3)** (G1900), RUS01 B2 **(x2)** (U1900), RUS01 B4 (U1900), RUS01 B4 **(x3)** (L2100)	RRUS11 B12 **(x3)** (L700)

RAN Scope of Work:

RAN Template:	A&L Template:
704Bu Outdoor	1HP_704Bu

Section 6 - A&L Equipment

Existing Template: 4B
Proposed Template: 1HP_704Bu

Sector 1 (Existing) view from behind		
Coverage Type	A - Outdoor Macro	
Antenna	1	
Antenna Model	APX16DWV-16DWV-S-E-A20 (Quad)	
Azimuth	10	
M. Tilt	0	
Height	97	
Ports	P1	P2
Active Tech.	U1900 G1900	U2100 L2100
Dark Tech.		
Restricted Tech.		
Decomm. Tech.		
E. Tilt	2	3
Cables	1-1/4" Coax - 115 ft. 1-1/4" Coax - 115 ft.	1-1/4" Coax - 115 ft. 1-1/4" Coax - 115 ft.
TMAs	Generic Style 1A - Twin PCS	Generic Style 1B - Twin AWS
Diplexers / Combiners		
Radio		
Sector Equipment		

Unconnected Equipment:

Scope of Work:

RAN Template:	A&L Template:
704Bu Outdoor	1HP_704Bu

CT11039D_2.2_L700

Sector 1 (Proposed) view from behind			
Coverage Type	A - Outdoor Macro		
Antenna	1		
Antenna Model	SBNHH-1D65A (Hex)		
Azimuth	10		
M. Tilt	0		
Height	97		
Ports	P1	P2	P3
Active Tech.	U1900 G1900	U2100 L2100	L700
Dark Tech.			
Restricted Tech.			
Decomm. Tech.			
E. Tilt	2	3	
Cables	1-1/4" Coax - 115 ft. 1-1/4" Coax - 115 ft.	1-1/4" Coax - 115 ft. 1-1/4" Coax - 115 ft.	1-1/4" Coax - 115 ft. 1-1/4" Coax - 115 ft.
TMAs	Generic Style 1A - Twin PCS	Generic Style 1B - Twin AWS	
Diplexers / Combiners			
Radio			
Sector Equipment			Andrew Smart Bias T

Unconnected Equipment:

Scope of Work:

TMA's located on Ground

RAN Template: 704Bu Outdoor	A&L Template: 1HP_704Bu

CT11039D_2.2_L700

Sector 2 (Existing) view from behind		
Coverage Type	A - Outdoor Macro	
Antenna	1	
Antenna Model	APX16DWV-16DWV-S-E-A20 (Quad)	
Azimuth	250	
M. Tilt	0	
Height	97	
Ports	P1	P2
Active Tech.	U1900 G1900	U2100 L2100
Dark Tech.		
Restricted Tech.		
Decomm. Tech.		
E. Tilt	2	3
Cables	1-1/4" Coax - 115 ft. 1-1/4" Coax - 115 ft.	1-1/4" Coax - 115 ft. 1-1/4" Coax - 115 ft.
TMAs	Generic Style 1A - Twin PCS	Generic Style 1B - Twin AWS
Diplexers / Combiners		
Radio		
Sector Equipment		

Unconnected Equipment:

Scope of Work:

RAN Template:	A&L Template:
704Bu Outdoor	1HP_704Bu

CT11039D_2.2_L700

Sector 2 (Proposed) view from behind			
Coverage Type	A - Outdoor Macro		
Antenna	1		
Antenna Model	SBNHH-1D65A (Hex)		
Azimuth	165		
M. Tilt	0		
Height	97		
Ports	P1	P2	P3
Active Tech.	U1900 G1900	U2100 L2100	L700
Dark Tech.			
Restricted Tech.			
Decomm. Tech.			
E. Tilt	2	3	
Cables	1-1/4" Coax - 115 ft. 1-1/4" Coax - 115 ft.	1-1/4" Coax - 115 ft. 1-1/4" Coax - 115 ft.	1-1/4" Coax - 115 ft. 1-1/4" Coax - 115 ft.
TMAs	Generic Style 1A - Twin PCS	Generic Style 1B - Twin AWS	
Diplexers / Combiners			
Radio			
Sector Equipment			Andrew Smart Bias T

Unconnected Equipment:

Scope of Work:

TMA's located on Ground

RAN Template:	A&L Template:
704Bu Outdoor	1HP_704Bu

Sector 3 (Proposed) view from behind

Coverage Type	A - Outdoor Macro		
Antenna	1		
Antenna Model	SBNHH-1D65A (Hex)		
Azimuth	250		
M. Tilt	0		
Height	97		
Ports	P1	P2	P3
Active Tech.	U1900 G1900	U2100 L2100	L700
Dark Tech.			
Restricted Tech.			
Decomm. Tech.			
E. Tilt	2	3	
Cables	1-1/4" Coax - 115 ft. 1-1/4" Coax - 115 ft.	1-1/4" Coax - 115 ft. 1-1/4" Coax - 115 ft.	1-1/4" Coax - 115 ft. 1-1/4" Coax - 115 ft.
TMAs	Generic Style 1A - Twin PCS	Generic Style 1B - Twin AWS	
Diplexers / Combiners			
Radio			
Sector Equipment			Andrew Smart Bias T

Unconnected Equipment:

Scope of Work:

TMA's located on Ground

Product Specifications

POWERED BY ANDREW

SBNHH-1D65A

Andrew® Tri-band Antenna, 698–896 and 2x 1695–2360 MHz, 65° horizontal beamwidth, internal RET. Both high bands share the same electrical tilt.

- Interleaved dipole technology providing for attractive, low wind load mechanical package

Electrical Specifications

Frequency Band, MHz	**698–806**	**806–896**	**1695–1880**	**1850–1990**	**1920–2180**	**2300–2360**
Gain, dBi	13.6	13.7	16.5	16.9	17.1	17.6
Beamwidth, Horizontal, degrees	66	61	70	65	62	61
Beamwidth, Vertical, degrees	17.6	15.9	7.1	6.6	6.2	5.5
Beam Tilt, degrees	0–18	0–18	0–10	0–10	0–10	0–10
USLS, dB	16	13	13	13	12	12
Front-to-Back Ratio at 180°, dB	25	27	28	28	27	29
CPR at Boresight, dB	20	16	20	23	17	20
CPR at Sector, dB	10	5	11	6	1	4
Isolation, dB	25	25	25	25	25	25
Isolation, Intersystem, dB	30	30	30	30	30	30
VSWR | Return Loss, dB	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0	1.5 | 14.0
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153	-153	-153	-153	-153
Input Power per Port, maximum, watts	350	350	350	350	350	300
Polarization	±45°	±45°	±45°	±45°	±45°	±45°
Impedance	50 ohm	50 ohm	50 ohm	50 ohm	50 ohm	50 ohm

Electrical Specifications, BASTA*

Frequency Band, MHz	**698–806**	**806–896**	**1695–1880**	**1850–1990**	**1920–2180**	**2300–2360**
Gain by all Beam Tilts, average, dBi	13.1	13.1	16.1	16.5	16.7	17.2
Gain by all Beam Tilts Tolerance, dB	±0.5	±0.5	±0.5	±0.3	±0.5	±0.4
Gain by Beam Tilt, average, dBi	0 ° | 13.4 9 ° | 13.1 18 ° | 12.7	0 ° | 13.4 9 ° | 13.1 18 ° | 12.7	0 ° | 16.0 5 ° | 16.2 10 ° | 16.1	0 ° | 16.3 5 ° | 16.5 10 ° | 16.5	0 ° | 16.5 5 ° | 16.8 10 ° | 16.6	0 ° | 17.0 5 ° | 17.3 10 ° | 16.9
Beamwidth, Horizontal Tolerance, degrees	±3.1	±5.4	±2.8	±4	±6.6	±4.6
Beamwidth, Vertical Tolerance, degrees	±1.8	±1.4	±0.3	±0.4	±0.5	±0.3
USLS, dB	15	14	15	15	15	14
Front-to-Back Total Power at 180° ± 30°, dB	22	21	26	26	24	25
CPR at Boresight, dB	22	16	22	25	21	22
CPR at Sector, dB	10	6	12	8	5	4

* 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® multiband with internal RET
Band	Multiband
Brand	DualPol® | Teletilt®
Operating Frequency Band	1695 – 2360 MHz | 698 – 896 MHz

Product Specifications

SBNHH-1D65A

POWERED BY ANDREW

Mechanical Specifications

Color	Light gray
Lightning Protection	dc Ground
Radiator Material	Aluminum | Low loss circuit board
Radome Material	Fiberglass, UV resistant
RF Connector Interface	7-16 DIN Female
RF Connector Location	Bottom
RF Connector Quantity, total	6
Wind Loading, maximum	445.0 N @ 150 km/h 100.0 lbf @ 150 km/h
Wind Speed, maximum	241.4 km/h | 150.0 mph

Dimensions

Depth	180.0 mm | 7.1 in
Length	1409.0 mm | 55.5 in
Width	301.0 mm | 11.9 in
Net Weight	15.2 kg | 33.5 lb

Remote Electrical Tilt (RET) Information

Input Voltage	10–30 Vdc
Power Consumption, idle state, maximum	2.0 W
Power Consumption, normal conditions, maximum	13.0 W
Protocol	3GPP/AISG 2.0 (Multi-RET)
RET Interface	8-pin DIN Female | 8-pin DIN Male
RET Interface, quantity	1 female | 1 male
RET System	Teletilt®

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

BSAMNT-1 — Wide Profile Antenna Downtilt Mounting Kit for 2.4 - 4.5 in (60 - 115 mm) OD round members. Kit contains one scissor top bracket set and one bottom bracket set.

Exhibit E

EBI Consulting
environmental | engineering | due diligence

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

T-Mobile Existing Facility

Site ID: CT11039D

90' Utility Tower
269 Flanders Road (CL&P Tower
East Lyme, CT 06357

January 22, 2017

EBI Project Number: 6217000226

Site Compliance Summary	
Compliance Status:	**COMPLIANT**
Site total MPE% of FCC general public allowable limit:	**3.40 %**

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

January 22, 2017

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

Emissions Analysis for Site: **CT11039D – 90' Utility Tower**

EBI Consulting was directed to analyze the proposed T-Mobile facility located at **269 Flanders Road (CL&P Tower, East Lyme, 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.

<u>General population/uncontrolled exposure</u> 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 1900 MHz (PCS) and 2100 MHz (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 **269 Flanders Road (CL&P Tower, East Lyme, 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 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 (PCS Band - 1900 MHz) were considered for each sector of the proposed installation. These Channels have a transmit power of 30 Watts per Channel.

3) 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.

4) 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

5) 1 LTE channel (700 MHz Band) was considered for each sector of the proposed installation. This channel has a transmit power of 30 Watts.

6) Since all radios are ground mounted there are additional cabling losses accounted for. For each ground mounted RF path the following losses were calculated. 0.80 dB of additional cable loss for all ground mounted 700 MHz Channels, 1.40 dB of additional cable loss for all ground mounted 1900 MHz channels and 1.48 dB of additional cable loss for all ground mounted 2100 MHz channels. This is based on manufacturers Specifications for 115 feet of 1-1/4" coax cable on each path.

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

8) For the following calculations the sample point was the top of a 6-foot person standing at the base of the tower. The maximum gain of the antenna per the antenna 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.

9) The antennas used in this modeling are the **Commscope SBNHH-1D65A** for 700 MHz, 1900 MHz (PCS) and 2100 MHz (AWS) channels. This is based on feedback from the carrier with regards to anticipated antenna selection. The **Commscope SBNHH-1D65A** has a maximum gain of **14.7 dBd** at its main lobe at 1900 MHz and 2100 MHz and a maximum gain of **10.9 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.

10) The antenna mounting height centerline of the proposed antennas is **92 feet** above ground level (AGL).

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

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

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T-Mobile Site Inventory and Power Data

Sector:	A	Sector:	B	Sector:	C
Antenna #:	**1**	Antenna #:	**1**	Antenna #:	**1**
Make / Model:	Commscope SBNHH-1D65A	Make / Model:	Commscope SBNHH-1D65A	Make / Model:	Commscope SBNHH-1D65A
Gain:	14.7 dBd / 10.9 dBd	Gain:	14.7 dBd / 10.9 dBd	Gain:	14.7 dBd / 10.9 dBd
Height (AGL):	92	Height (AGL):	92	Height (AGL):	92
Frequency Bands	1900 MHz (PCS) / 2100 MHz (AWS) / 700 MHz	Frequency Bands	1900 MHz (PCS) / 2100 MHz (AWS) / 700 MHz	Frequency Bands	1900 MHz (PCS) / 2100 MHz (AWS) / 700 MHz
Channel Count	9	Channel Count	9	Channel Count	9
Total TX Power(W):	330	Total TX Power(W):	330	Total TX Power(W):	330
ERP (W):	6,650.63	ERP (W):	6,650.63	ERP (W):	6,650.63
Antenna A1 MPE%	3.40	Antenna B1 MPE%	3.40	Antenna C1 MPE%	3.40

Site Composite MPE%	
Carrier	**MPE%**
T-Mobile (Per Sector Max)	**3.40 %**
No Additional Carriers Located At This Facility	NA
Site Total MPE %:	**3.40 %**

T-Mobile Sector A Total:	3.40 %
T-Mobile Sector B Total:	3.40 %
T-Mobile Sector C Total:	3.40 %
Site Total:	3.40 %

T-Mobile _Max Values 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 AWS - 2100 MHz LTE	2	1,259.36	92	12.24	AWS - 2100 MHz	1000	1.22%
T-Mobile AWS - 2100 MHz UMTS	2	629.68	92	6.12	AWS - 2100 MHz	1000	0.61%
T-Mobile PCS - 1950 MHz UMTS	2	641.39	92	6.24	PCS - 1950 MHz	1000	0.62%
T-Mobile PCS - 1950 MHz GSM	2	641.39	92	6.24	PCS - 1950 MHz	1000	0.62%
T-Mobile 700 MHz LTE	1	306.99	92	1.49	700 MHz	467	0.32%
						Total:*	**3.40%**

*NOTE: Totals may vary by 0.01% due to summing of remainders

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 A:	3.40 %
Sector B:	3.40 %
Sector C:	3.40 %
T-Mobile Per Sector Maximum:	3.40 %
Site Total:	3.40 %
Site Compliance Status:	**COMPLIANT**

The anticipated composite MPE value for this site assuming all carriers present is **3.40%** 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.