Crown Castle
3530 Toringdon Way Suite 300
Charlotte NC 28277

Tel (704) 405-6600

March 10, 2015

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

RE: **T-Mobile-Exempt Modification - Crown Site BU: 806383**
T-Mobile Site ID: CT11142A
Located at: 56 Cosgrove Rd, Willington, CT 06279

Dear Ms. Bachman:

This letter and exhibits are submitted on behalf of T-Mobile. T-Mobile is making modifications to certain existing sites in its Connecticut system in order to implement their 700MHz technology. Please accept this letter and exhibits as notification, pursuant to § 16-50j-73 of the Regulations of Connecticut State Agencies ("R.C.S.A."), of construction that constitutes an exempt modification pursuant to R.C.S.A. § 16-50j-72(b)(2). In compliance with R.C.S.A. § 16-50j-73, a copy of this letter is being sent to Mrs. Christina B. Mailhos, First Selectman for the Town of Willington and Martin & Isabella Drobney, Property Owners.

T-Mobile plans to modify the existing wireless communications facility owned by Crown Castle and located at 56 **Cosgrove Rd, Willington, CT 06279**. Attached are a compound plan and elevation depicting the planned changes (Exhibit-1), and documentation of the structural sufficiency of the structure to accommodate the revised antenna configuration (Exhibit-2). Also included is a power density table report reflecting the modification to T-Mobile's operations at the site (Exhibit-3).

The changes to the facility do not constitute a modification as defined in Connecticut General Statutes ("C.G.S.") § 16-50i(d) because the general physical characteristics of the facility will not be significantly changed. Rather, the planned changes to the facility fall squarely within those activities explicitly provided for in the 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 tower. T-Mobile's replacement antennas will be located at the same elevation on the existing tower.

2. There will be no proposed modifications to the ground and no extension of boundaries.

3. The proposed modifications will not increase noise levels at the facility by six decibels or more.

4. The operation of the replacement antennas will not increase radio frequency (RF) emissions at the facility to a level at or above the Federal Communications Commission (FCC) adopted safety standard. A cumulative General Power Density table report for T-Mobile's modified facility is included as Exhibit-3.

5. A Structural Modification Report confirming that the tower and foundation can support T-Mobile's proposed modifications is included as Exhibit-2.

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

Sincerely,

Jerry Feathers
Real Estate Specialist

Enclosure

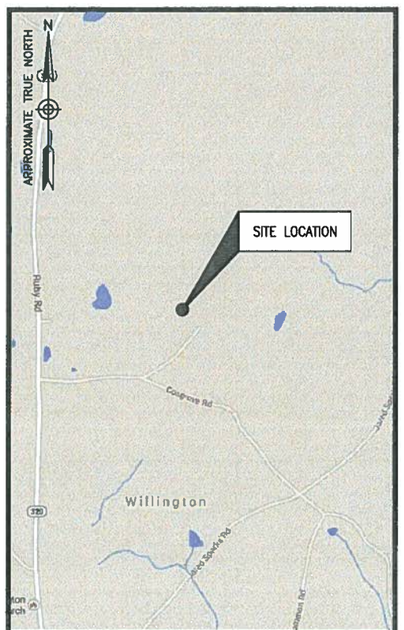
Tab 1: Exhibit-1: Compound plan and elevation depicting the planned changes
Tab 2: Exhibit-2: Structural Modification Report
Tab 3: Exhibit-3: General Power Density Table Report (RF Emissions Analysis Report)

cc: Mrs. Christina B. Mailhos
Town Office Building
40 Old Farms Road
Willington, CT 06279

cc: Martin & Isabella Drobney
56 Cosgrove Rd
Willington, CT 06279

T-MOBILE NORTHEAST LLC

T-MOBILE SITE #: CT11142A
CROWN CASTLE BU #: 806383
SITE NAME: HRT 087 943325
COSGROVE ROAD WHIFFORD HILL
WEST WILLINGTON, CT 06279
TOLLAND COUNTY



VICINITY MAP

FROM PARSIPPANY, NJ:

DEPART SYLVAN WAY AND TAKE I-287 N TO I-287 E. FOLLOW SIGNS FOR WHITE PLAINS/RYE. TAKE EXIT 9N-9S FOR HUTCHINSON PKWY TOWARD WHITESTONE BRIDGE/MERRITT PKWY. MERGE ONTO WESTCHESTER AVE E. TAKE THE HUTCHINSON PKWY N RAMP TO MERRITT PKWY. MERGE ONTO HUTCHINSON RIVER PKWY N. KEEP RIGHT AT THE FORK TO STAY ON HUTCHINSON RIVER PKWY N. CONTINUE ONTO CT-15 N. KEEP LEFT TO STAY ON CT-15 N. TAKE EXIT 68 N-E TO MERGE ONTO I-91 N TOWARD CT-66 E/HARTFORD/MIDDLETOWN. TAKE EXIT 29 TO MERGE ONTO CT-15 N/US-5 N TOWARD I-84E/E HARTFORD/BOSTON. CONTINUE ONTO CT-15 N. TAKE THE EXIT ON THE LEFT ONTO I-84 E TOWARD BOSTON. TAKE EXIT 69 FOR CONNECTICUT 74 TOWARD U.S. 44/WILLINGTON/PUTNAM. TURN RIGHT ONTO CT-74 E. TURN LEFT ONTO CT-320 N. TURN RIGHT ONTO COSGROVE RD. SITE WILL BE ON THE LEFT.

ENGINEER
DEWBERRY ENGINEERS INC.
600 PARSIPPANY ROAD
SUITE 301
PARSIPPANY, NJ 07054

CONTACT: GREG NAWROTZKI
PHONE #: (973) 576-9653

CONSTRUCTION
CROWN CASTLE
500 WEST CUMMINGS PARK, SUITE 3600
WOBURN, MA 01801

CONTACT: WARREN KELLEHER
PHONE #: (781) 970-0055

CONSULTANT TEAM

SITE NAME:
HRT 087 943325

SITE NUMBER:
CT11142A

TOWER OWNER:
CROWN CASTLE
500 WEST CUMMINGS PARK, SUITE 3600
WOBURN, MA 01801

APPLICANT/DEVELOPER:
T-MOBILE NORTHEAST LLC
4 SYLVAN WAY
PARSIPPANY, NJ 07054

COORDINATES:
LATITUDE: 41°-53'-32.92" N (NAD83)
LONGITUDE: 72°-15'-38.15" W (NAD83)
(PER CROWN CASTLE)

CONFIGURATION
704G

PROJECT SUMMARY

SITE ADDRESS:
COSGROVE ROAD WHIFFORD HILL
WEST WILLINGTON, CT 06279
TOLLAND COUNTY

PROJECT DIRECTORY

- REMOVE AND REPLACE (3) EXISTING ANTENNAS WITH (3) NEW ANTENNAS.
- INSTALL (3) NEW BIAS TEES.
- INSTALL (6) NEW LINES OF COAX.
- REMOVE (3) EXISTING TMA'S.
- INSTALL (1) NEW BBU CABINET ON A NEW CONCRETE PAD AT GRADE.

SCOPE OF WORK

THIS DOCUMENT WAS DEVELOPED TO REFLECT A SPECIFIC SITE AND ITS SITE CONDITIONS AND IS NOT TO BE USED FOR ANOTHER SITE OR WHEN OTHER CONDITIONS PERTAIN. REUSE OF THIS DOCUMENT IS AT THE SOLE RISK OF THE USER.

A.D.A. COMPLIANCE:
FACILITY IS UNMANNED AND NOT FOR HUMAN HABITATION.

SHT. NO.	DESCRIPTION
T-1	TITLE SHEET
G-1	GENERAL NOTES
C-1	COMPOUND PLAN & EQUIPMENT PLANS
C-2	ANTENNA LAYOUTS & ELEVATIONS
C-3	CONSTRUCTION DETAILS
E-1	GROUNDING NOTES & DETAILS

SHEET INDEX

T-MOBILE NORTHEAST LLC
4 SYLVAN WAY
PARSIPPANY, NJ 07054

CROWN CASTLE
500 WEST CUMMINGS PARK, SUITE 3600
WOBURN, MA 01801

Dewberry Engineers Inc.
600 PARSIPPANY ROAD
SUITE 301
PARSIPPANY, NJ 07054
PHONE: 973.739.9400
FAX: 973.739.9710

CT11142A
HRT 087 943325

CONSTRUCTION DRAWINGS

0	03/05/15	ISSUED AS FINAL
A	03/01/15	ISSUED FOR REVIEW

STATE OF CONNECTICUT
JIANG YU
No. 23222
PROFESSIONAL ENGINEER
JIANG YU
CONNECTICUT LICENSE NO. 23222

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER TO ALTER THIS DOCUMENT.

DRAWN BY:	JC
REVIEWED BY:	BSH
CHECKED BY:	GHN
PROJECT NUMBER:	50066258
JOB NUMBER:	50071483
SITE ADDRESS:	

COSGROVE ROAD
WHIFFORD HILL, WEST
WILLINGTON, CT 06279
TOLLAND COUNTY

SHEET TITLE

TITLE SHEET

SHEET NUMBER

T-1

GENERAL NOTES:

1. FOR THE PURPOSE OF CONSTRUCTION DRAWING, THE FOLLOWING DEFINITIONS SHALL APPLY:
   PROJECT MANAGEMENT – CROWN CASTLE
   CONTRACTOR – GENERAL CONTRACTOR (CONSTRUCTION)
   OWNER – T–MOBILE
   OEM – ORIGINAL EQUIPMENT MANUFACTURER
2. PRIOR TO THE SUBMISSION OF BIDS, THE BIDDING CONTRACTOR SHALL VISIT THE CELL SITE TO FAMILIARIZE WITH THE EXISTING CONDITIONS AND TO CONFIRM THAT THE WORK CAN BE ACCOMPLISHED AS SHOWN ON THE CONSTRUCTION DRAWINGS. ANY DISCREPANCY FOUND SHALL BE BROUGHT TO THE ATTENTION OF PROJECT MANAGEMENT.
3. ALL MATERIALS FURNISHED AND INSTALLED SHALL BE IN STRICT ACCORDANCE WITH ALL APPLICABLE CODES, REGULATIONS, AND ORDINANCES. CONTRACTOR 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.
4. ALL WORK CARRIED OUT SHALL COMPLY WITH ALL APPLICABLE MUNICIPAL AND UTILITY COMPANY SPECIFICATIONS AND LOCAL JURISDICTIONAL CODES, ORDINANCES AND APPLICABLE REGULATIONS.
5. DRAWINGS PROVIDED HERE ARE NOT TO SCALE UNLESS OTHERWISE NOTED AND ARE INTENDED TO SHOW OUTLINE ONLY.
6. UNLESS NOTED OTHERWISE, THE WORK SHALL INCLUDE FURNISHING MATERIALS, EQUIPMENT, APPURTENANCES, AND LABOR NECESSARY TO COMPLETE ALL INSTALLATIONS AS INDICATED ON THE DRAWINGS.
7. THE CONTRACTOR SHALL INSTALL ALL EQUIPMENT AND MATERIALS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS UNLESS SPECIFICALLY STATED OTHERWISE.
8. IF THE SPECIFIED EQUIPMENT CANNOT BE INSTALLED AS SHOWN ON THESE DRAWINGS, THE CONTRACTOR SHALL PROPOSE AN ALTERNATIVE INSTALLATION FOR APPROVAL BY PROJECT MANAGEMENT.
9. CONTRACTOR SHALL DETERMINE ACTUAL ROUTING OF CONDUIT, POWER AND T1 CABLES, GROUNDING CABLES AS SHOWN ON THE POWER, GROUNDING AND TELCO PLAN DRAWING. CONTRACTOR SHALL UTILIZE EXISTING TRAYS AND/OR SHALL ADD NEW TRAYS AS NECESSARY. CONTRACTOR SHALL CONFIRM THE ACTUAL ROUTING WITH PROJECT MANAGEMENT.
10. THE CONTRACTOR SHALL PROTECT EXISTING IMPROVEMENTS, PAVEMENTS, CURBS, LANDSCAPING AND STRUCTURES. ANY DAMAGED PART SHALL BE REPAIRED AT CONTRACTOR'S EXPENSE TO THE SATISFACTION OF THE OWNER.
11. CONTRACTOR 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.
12. CONTRACTOR SHALL LEAVE PREMISES IN CLEAN CONDITION.
13. THE CONTRACTOR SHALL SUPERVISE AND DIRECT THE PROJECT DESCRIBED HEREIN. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ALL CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES, AND PROCEDURES AND FOR COORDINATING ALL PORTIONS OF THE WORK UNDER THE CONTRACT.
14. CONTRACTOR SHALL NOTIFY DEWBERRY 48 HOURS IN ADVANCE OF POURING CONCRETE, OR BACKFILLING TRENCHES, SEALING ROOF AND WALL PENETRATIONS & POST DOWNS, FINISHING NEW WALLS OR FINAL ELECTRICAL CONNECTIONS FOR ENGINEER REVIEW.
15. CONTRACTOR SHALL VERIFY ALL EXISTING DIMENSIONS AND CONDITIONS PRIOR TO COMMENCING ANY WORK. ALL DIMENSIONS OF EXISTING CONSTRUCTION SHOWN ON THE DRAWINGS MUST BE VERIFIED. CONTRACTOR SHALL NOTIFY PROJECT MANAGEMENT OF ANY DISCREPANCIES PRIOR TO ORDERING MATERIAL OR PROCEEDING WITH CONSTRUCTION.
16. THE EXISTING CELL SITE IS IN FULL COMMERCIAL OPERATION. ANY CONSTRUCTION WORK BY CONTRACTOR SHALL NOT DISRUPT THE EXISTING NORMAL OPERATION. ANY WORK ON EXISTING EQUIPMENT MUST BE COORDINATED WITH CONTRACTOR. ALSO, WORK SHOULD BE SCHEDULED FOR AN APPROPRIATE MAINTENANCE WINDOW USUALLY IN LOW TRAFFIC PERIODS AFTER MIDNIGHT.
17. SINCE THE CELL SITE IS ACTIVE, ALL SAFETY PRECAUTIONS MUST 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.

SITE WORK GENERAL NOTES:

1. THE CONTRACTOR SHALL CONTACT UTILITY LOCATING SERVICES PRIOR TO THE START OF CONSTRUCTION.
2. ALL EXISTING ACTIVE SEWER, WATER, GAS, ELECTRIC, AND OTHER UTILITIES WHERE ENCOUNTERED IN THE WORK, SHALL BE PROTECTED AT ALL TIMES, AND WHERE REQUIRED FOR THE PROPER EXECUTION OF THE WORK, SHALL BE RELOCATED AS DIRECTED BY CONTRACTOR. EXTREME CAUTION SHOULD BE USED BY THE CONTRACTOR WHEN EXCAVATING OR DRILLING PIERS AROUND OR NEAR UTILITIES. CONTRACTOR SHALL PROVIDE SAFETY TRAINING FOR THE WORKING CREW. THIS WILL INCLUDE BUT NOT BE LIMITED TO:
   A) FALL PROTECTION
   B) CONFINED SPACE
   C) ELECTRICAL SAFETY
   D) TRENCHING & EXCAVATION.
3. ALL SITE WORK SHALL BE AS INDICATED ON THE DRAWINGS AND PROJECT SPECIFICATIONS.
4. IF NECESSARY, RUBBISH, STUMPS, DEBRIS, STICKS, STONES, TOP SOIL AND OTHER REFUSE SHALL BE REMOVED FROM THE SITE AND DISPOSED OF LEGALLY.
5. ALL EXISTING INACTIVE SEWER, WATER, GAS, ELECTRIC AND OTHER UTILITIES, WHICH INTERFERE WITH THE EXECUTION OF THE WORK, SHALL BE REMOVED AND/OR CAPPED, PLUGGED OR OTHERWISE DISCONTINUED AT POINTS WHICH WILL NOT INTERFERE WITH THE EXECUTION OF THE WORK, SUBJECT TO THE APPROVAL OF CONTRACTOR, OWNER AND/OR LOCAL UTILITIES.
6. CONTRACTOR SHALL MINIMIZE DISTURBANCE TO EXISTING SITE DURING CONSTRUCTION.
7. THE CONTRACTOR SHALL PROVIDE SITE SIGNAGE IN ACCORDANCE WITH THE T–MOBILE SPECIFICATION FOR SITE SIGNAGE.
8. THE SITE SHALL BE GRADED TO CAUSE SURFACE WATER TO FLOW AWAY FROM THE TRANSMISSION EQUIPMENT AND TOWER AREAS.
9. NO FILL OR EMBANKMENT MATERIAL SHALL BE PLACED ON FROZEN GROUND. FROZEN MATERIALS, SNOW OR ICE SHALL NOT BE PLACED IN ANY FILL OR EMBANKMENT.
10. THE SUB GRADE SHALL BE COMPACTED AND BROUGHT TO A SMOOTH UNIFORM GRADE PRIOR TO FINISHED SURFACE APPLICATION, SEE SOIL COMPACTION NOTES.
11. THE AREAS OF THE OWNER'S PROPERTY DISTURBED BY THE WORK AND NOT COVERED BY THE TOWER, EQUIPMENT OR DRIVEWAY, SHALL BE GRADED TO A UNIFORM SLOPE, AND STABILIZED TO PREVENT EROSION.
12. EROSION CONTROL MEASURES, IF REQUIRED DURING CONSTRUCTION, SHALL BE IN CONFORMANCE WITH THE LOCAL JURISDICTION'S GUIDELINES FOR EROSION AND SEDIMENT CONTROL.

ELECTRICAL INSTALLATION NOTES:

1. ALL ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS, NEC AND ALL APPLICABLE LOCAL CODES.
2. CONTRACTOR SHALL MODIFY EXISTING CABLE TRAY SYSTEM AS REQUIRED TO SUPPORT RF AND TRANSPORT CABLING TO THE NEW BTS EQUIPMENT. CONTRACTOR SHALL SUBMIT MODIFICATIONS TO PROJECT MANAGEMENT FOR APPROVAL.
3. CONDUIT ROUTINGS ARE SCHEMATIC. CONTRACTOR SHALL INSTALL CONDUITS SO THAT ACCESS TO EQUIPMENT IS NOT BLOCKED.
4. WIRING, RACEWAY AND SUPPORT METHODS AND MATERIALS SHALL COMPLY WITH THE REQUIREMENTS OF THE NEC AND TELCORDIA.
5. ALL CIRCUITS SHALL BE SEGREGATED AND MAINTAIN MINIMUM CABLE SEPARATION AS REQUIRED BY THE NEC AND TELCORDIA.
6. CABLES SHALL NOT BE ROUTED THROUGH LADDER–STYLE CABLE TRAY RUNGS.
7. EACH END OF EVERY POWER, POWER PHASE CONDUCTOR (I.E., HOTS), GROUNDING, AND T1 CONDUCTOR AND CABLE SHALL BE LABELED WITH COLOR–CODED INSULATION OR ELECTRICAL TAPE (3M BRAND, 1/2 INCH PLASTIC ELECTRICAL TAPE WITH UV PROTECTION, OR EQUAL). THE IDENTIFICATION METHOD SHALL CONFORM WITH NEC & OSHA, AND MATCH EXISTING INSTALLATION REQUIREMENTS.
8. ALL ELECTRICAL COMPONENTS SHALL BE CLEARLY LABELED WITH ENGRAVED LAMACOID PLASTIC LABELS. ALL EQUIPMENT SHALL BE LABELED WITH THEIR VOLTAGE RATING, PHASE CONFIGURATION, WIRE CONFIGURATION, POWER OR AMPACITY RATING, AND BRANCH CIRCUIT ID NUMBERS (I.E., PANELBOARD AND CIRCUIT ID'S).
9. PANELBOARDS (ID NUMBERS) AND INTERNAL CIRCUIT BREAKERS (CIRCUIT ID NUMBERS) SHALL BE CLEARLY LABELED WITH ENGRAVED LAMACOID PLASTIC LABELS.
10. ALL TIE WRAPS SHALL BE CUT FLUSH WITH APPROVED CUTTING TOOL TO REMOVE SHARP EDGES.
11. POWER, CONTROL, AND EQUIPMENT GROUND WIRING IN TUBING OR CONDUIT SHALL BE SINGLE CONDUCTOR (SIZE 14 AWG OR LARGER), 600V, OIL RESISTANT THHN OR THWN–2, CLASS B STRANDED COPPER CABLE RATED FOR 90 °C (WET AND DRY) OPERATION; LISTED OR LABELED FOR THE LOCATION AND RACEWAY SYSTEM USED, UNLESS OTHERWISE SPECIFIED.
12. POWER PHASE CONDUCTORS (I.E., HOTS) SHALL BE LABELED WITH COLOR–CODED INSULATION OR ELECTRICAL TAPE (3M BRAND, 1/2 INCH PLASTIC ELECTRICAL TAPE WITH UV PROTECTION, OR EQUAL.) PHASE CONDUCTOR COLOR CODES SHALL CONFORM WITH THE NEC & OSHA AND MATCH EXISTING INSTALLATION REQUIREMENTS.
13. SUPPLEMENTAL EQUIPMENT GROUND WIRING LOCATED INDOORS SHALL BE SINGLE CONDUCTOR (SIZE 6 AWG OR LARGER), 600V, OIL RESISTANT THHN OR THWN–2 GREEN INSULATION, CLASS B STRANDED COPPER CABLE RATED FOR 90°C (WET AND DRY) OPERATION; LISTED OR LABELED FOR THE LOCATION AND RACEWAY SYSTEM USED, UNLESS OTHERWISE SPECIFIED.
14. SUPPLEMENTAL EQUIPMENT GROUND WIRING LOCATED OUTDOORS, OR BELOW GRADE, SHALL BE SINGLE CONDUCTOR #2 AWG SOLID TINNED COPPER CABLE, UNLESS OTHERWISE SPECIFIED.
15. POWER AND CONTROL WIRING, NOT IN TUBING OR CONDUIT, SHALL BE MULTI–CONDUCTOR, TYPE TC CABLE (SIZE 14 AWG OR LARGER), 600V, OIL RESISTANT THHN OR THWN–2, CLASS B STRANDED COPPER CABLE RATED FOR 90°C (WET AND DRY) OPERATION; WITH OUTER JACKET; LISTED OR LABELED FOR THE LOCATION USED, UNLESS OTHERWISE SPECIFIED.
16. ALL POWER AND POWER GROUNDING CONNECTIONS SHALL BE CRIMP–STYLE, COMPRESSION WIRE LUGS AND WIRENUTS BY THOMAS AND BETTS (OR EQUAL). LUGS AND WIRENUTS SHALL BE RATED FOR OPERATION AT NO LESS THAN 75°C (90°C IF AVAILABLE).
17. RACEWAY AND CABLE TRAY SHALL BE LISTED OR LABELED FOR ELECTRICAL USE IN ACCORDANCE WITH NEMA, UL, ANSI/IEEE, AND NEC.
18. NEW RACEWAY OR CABLE TRAY WILL MATCH THE EXISTING INSTALLATION WHERE POSSIBLE.
19. ELECTRICAL METALLIC TUBING (EMT) OR RIGID NONMETALLIC CONDUIT (I.E., RIGID PVC SCHEDULE 40, OR RIGID PVC SCHEDULE 80 FOR LOCATIONS SUBJECT TO PHYSICAL DAMAGE) SHALL BE USED FOR EXPOSED INDOOR LOCATIONS.
20. ELECTRICAL METALLIC TUBING (EMT), ELECTRICAL NONMETALLIC TUBING (ENT), OR RIGID NONMETALLIC CONDUIT (RIGID PVC, SCHEDULE 40) SHALL BE USED FOR CONCEALED INDOOR LOCATIONS.
21. GALVANIZED STEEL INTERMEDIATE METALLIC CONDUIT (IMC) SHALL BE USED FOR OUTDOOR LOCATIONS ABOVE GRADE.
22. RIGID NONMETALLIC CONDUIT (I.E., RIGID PVC SCHEDULE 40 OR RIGID PVC SCHEDULE 80) SHALL BE USED UNDERGROUND; DIRECT BURIED, IN AREAS OF OCCASIONAL LIGHT VEHICLE TRAFFIC OR ENCASED IN REINFORCED CONCRETE IN AREAS OF HEAVY VEHICLE TRAFFIC.
23. LIQUID–TIGHT FLEXIBLE METALLIC CONDUIT (LIQUID–TITE FLEX) SHALL BE USED INDOORS AND OUTDOORS, WHERE VIBRATION OCCURS OR FLEXIBILITY IS NEEDED.
24. CONDUIT AND TUBING FITTINGS SHALL BE THREADED OR COMPRESSION–TYPE AND APPROVED FOR THE LOCATION USED. SETSCREW FITTINGS ARE NOT ACCEPTABLE.
25. CABINETS, BOXES, AND WIREWAYS SHALL BE LISTED OR LABELED FOR ELECTRICAL USE IN ACCORDANCE WITH NEMA, UL, ANSI/IEEE, AND NEC.
26. CABINETS, BOXES, AND WIREWAYS TO MATCH THE EXISTING INSTALLATION WHERE POSSIBLE.
27. WIREWAYS SHALL BE EPOXY–COATED (GRAY) AND INCLUDE A HINGED COVER, DESIGNED TO SWING OPEN DOWNWARD; SHALL BE PANDUIT TYPE E (OR EQUAL); AND RATED NEMA 1 (OR BETTER) INDOORS, OR NEMA 3R (OR BETTER) OUTDOORS.
28. EQUIPMENT CABINETS, TERMINAL BOXES, JUNCTION BOXES, AND PULL BOXES SHALL BE GALVANIZED OR EPOXY–COATED SHEET STEEL, SHALL MEET OR EXCEED UL 50, AND RATED NEMA 1 (OR BETTER) INDOORS, OR NEMA 3R (OR BETTER) OUTDOORS.
29. METAL RECEPTACLE, SWITCH, AND DEVICE BOXES SHALL BE GALVANIZED, EPOXY–COATED, OR NON–CORRODING; SHALL MEET OR EXCEED UL 514A AND NEMA OS 1; AND RATED NEMA 1 (OR BETTER) INDOORS, OR WEATHER PROTECTED (WP OR BETTER) OUTDOORS.
30. NONMETALLIC RECEPTACLE, SWITCH, AND DEVICE BOXES SHALL MEET OR EXCEED NEMA OS 2; AND RATED NEMA 1 (OR BETTER) INDOORS, OR WEATHER PROTECTED (WP OR BETTER) OUTDOORS.
31. THE CONTRACTOR SHALL NOTIFY AND OBTAIN NECESSARY AUTHORIZATION FROM PROJECT MANAGEMENT BEFORE COMMENCING WORK ON THE AC POWER DISTRIBUTION PANELS.
32. THE CONTRACTOR SHALL PROVIDE NECESSARY TAGGING ON THE BREAKERS, CABLES AND DISTRIBUTION PANELS IN ACCORDANCE WITH THE APPLICABLE CODES AND STANDARDS TO SAFEGUARD AGAINST LIFE AND PROPERTY.

CONCRETE AND REINFORCING STEEL NOTES:

1. ALL CONCRETE WORK SHALL BE IN ACCORDANCE WITH THE ACI 301, ACI 318, ACI 336, ASTM A184, ASTM A185 AND THE DESIGN AND CONSTRUCTION SPECIFICATION FOR CAST–IN–PLACE CONCRETE.
2. ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4000 PSI AT 28 DAYS, UNLESS NOTED OTHERWISE. A HIGHER STRENGTH (4000 PSI) MAY BE USED. ALL CONCRETING WORK SHALL BE DONE IN ACCORDANCE WITH ACI 318 CODE REQUIREMENTS.
3. REINFORCING STEEL SHALL CONFORM TO ASTM A 615, GRADE 60, DEFORMED UNLESS NOTED OTHERWISE. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A 185 WELDED STEEL WIRE FABRIC UNLESS NOTED OTHERWISE (UNO). SPLICES SHALL BE CLASS "B" AND ALL HOOKS SHALL BE STANDARD, UNO.
4. THE FOLLOWING MINIMUM CONCRETE COVER SHALL BE PROVIDED FOR REINFORCING STEEL UNLESS SHOWN OTHERWISE ON DRAWINGS:

   CONCRETE CAST AGAINST EARTH.....3 IN.
   CONCRETE EXPOSED TO EARTH OR WEATHER:
   #6 AND LARGER .....2 IN.
   #5 AND SMALLER & WWF.....1 1/2 IN.
   CONCRETE NOT EXPOSED TO EARTH OR WEATHER OR NOT CAST AGAINST THE GROUND:
   SLAB AND WALL .....3/4 IN.
   BEAMS AND COLUMNS.....1 1/2 IN.

5. A CHAMFER 3/4" SHALL BE PROVIDED AT ALL EXPOSED EDGES OF CONCRETE, UNO, IN ACCORDANCE WITH ACI 301 SECTION 4.2.4.
6. INSTALLATION OF CONCRETE EXPANSION/WEDGE ANCHOR, SHALL BE PER MANUFACTURER'S WRITTEN RECOMMENDED PROCEDURE. THE ANCHOR BOLT, DOWEL OR ROD SHALL CONFORM TO MANUFACTURER'S RECOMMENDATION FOR EMBEDMENT DEPTH OR AS SHOWN ON THE DRAWINGS. NO REBAR SHALL BE CUT WITHOUT PRIOR CONTRACTOR APPROVAL WHEN DRILLING HOLES IN CONCRETE. SPECIAL INSPECTIONS, REQUIRED BY GOVERNING CODES, SHALL BE PERFORMED IN ORDER TO MAINTAIN MANUFACTURER'S MAXIMUM ALLOWABLE LOADS. ALL EXPANSION/WEDGE ANCHORS SHALL BE STAINLESS STEEL OR HOT DIPPED GALVANIZED. EXPANSION BOLTS SHALL BE PROVIDED BY RAMSET/REDHEAD OR APPROVED EQUAL.
7. CONCRETE CYLINDER TEST IS NOT REQUIRED FOR SLAB ON GRADE WHEN CONCRETE IS LESS THAN 50 CUBIC YARDS (IBC 1905.6.2.3) IN THAT EVENT THE FOLLOWING RECORDS SHALL BE PROVIDED BY THE CONCRETE SUPPLIER;
   (A) RESULTS OF CONCRETE CYLINDER TESTS PERFORMED AT THE SUPPLIER'S PLANT,
   (B) CERTIFICATION OF MINIMUM COMPRESSIVE STRENGTH FOR THE CONCRETE GRADE SUPPLIED.
   FOR GREATER THAN 50 CUBIC YARDS THE GC SHALL PERFORM THE CONCRETE CYLINDER TEST.
8. AS AN ALTERNATIVE TO ITEM 7, TEST CYLINDERS SHALL BE TAKEN INITIALLY AND THEREAFTER FOR EVERY 50 YARDS OF CONCRETE FROM EACH DIFFERENT BATCH PLANT.
9. EQUIPMENT SHALL NOT BE PLACED ON NEW PADS FOR SEVEN DAYS AFTER PAD IS POURED, UNLESS IT IS VERIFIED BY CYLINDER TESTS THAT COMPRESSIVE STRENGTH HAS BEEN ATTAINED.

STRUCTURAL STEEL NOTES:

1. ALL STEEL WORK SHALL BE PAINTED OR GALVANIZED IN ACCORDANCE WITH THE DRAWINGS UNLESS NOTED OTHERWISE. STRUCTURAL STEEL SHALL BE ASTM–A–36 UNLESS OTHERWISE NOTED ON THE SITE SPECIFIC DRAWINGS. STEEL DESIGN, INSTALLATION AND BOLTING SHALL BE PERFORMED IN ACCORDANCE WITH THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC) "MANUAL OF STEEL CONSTRUCTION".
2. ALL WELDING SHALL BE PERFORMED USING E70XX ELECTRODES AND WELDING SHALL CONFORM TO AISC. WHERE FILLET WELD SIZES ARE NOT SHOWN, PROVIDE THE MINIMUM SIZE PER TABLE J2.4 IN THE AISC "MANUAL OF STEEL CONSTRUCTION". PAINTED SURFACES SHALL BE TOUCHED UP.
3. BOLTED CONNECTIONS SHALL BE ASTM A325 BEARING TYPE (3/4"Ø) CONNECTIONS AND SHALL HAVE MINIMUM OF TWO BOLTS UNLESS NOTED OTHERWISE.
4. NON–STRUCTURAL CONNECTIONS FOR STEEL GRATING MAY USE 5/8" DIA. ASTM A 307 BOLTS UNLESS NOTED OTHERWISE.
5. INSTALLATION OF CONCRETE EXPANSION/WEDGE ANCHOR, SHALL BE PER MANUFACTURER'S WRITTEN RECOMMENDED PROCEDURE. THE ANCHOR BOLT, DOWEL OR ROD SHALL CONFORM TO MANUFACTURER'S RECOMMENDATION FOR EMBEDMENT DEPTH OR AS SHOWN ON THE DRAWINGS. NO REBAR SHALL BE CUT WITHOUT PRIOR CONTRACTOR APPROVAL WHEN DRILLING HOLES IN CONCRETE. SPECIAL INSPECTIONS, REQUIRED BY GOVERNING CODES, SHALL BE PERFORMED IN ORDER TO MAINTAIN MANUFACTURER'S MAXIMUM ALLOWABLE LOADS. ALL EXPANSION/WEDGE ANCHORS SHALL BE STAINLESS STEEL OR HOT DIPPED GALVANIZED. EXPANSION BOLTS SHALL BE PROVIDED BY RAMSET/REDHEAD OR APPROVED EQUAL.
6. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS FOR ENGINEER REVIEW & APPROVAL ON PROJECTS REQUIRING STRUCTURAL STEEL.
7. ALL STRUCTURAL STEEL WORK SHALL BE DONE IN ACCORDANCE WITH AISC SPECIFICATIONS.

CONSTRUCTION NOTES:

1. FIELD VERIFICATION:
   CONTRACTOR SHALL FIELD VERIFY SCOPE OF WORK, T–MOBILE ANTENNA PLATFORM LOCATION AND ANTENNAS TO BE REPLACED.
2. COORDINATION OF WORK:
   CONTRACTOR SHALL COORDINATE RF WORK AND PROCEDURES WITH PROJECT MANAGEMENT.
3. CABLE LADDER RACK:
   CONTRACTOR SHALL FURNISH AND INSTALL CABLE LADDER RACK, CABLE TRAY, AND CONDUIT AS REQUIRED TO SUPPORT CABLES TO THE NEW BTS LOCATION.
4. GROUNDING OF ALL EQUIPMENT AND ANTENNAS IS NOT CONSIDERED PART OF THE SCOPE OF THIS PROJECT AND IS THE RESPONSIBILITY OF THE OWNER AND CONTRACTOR AT THE TIME OF CONSTRUCTION. ALL EQUIPMENT AND ANTENNAS TO BE INSTALLED AND GROUNDED IN ACCORDANCE WITH GOVERNING BUILDING CODE, MANUFACTURER RECOMMENDATIONS AND OWNER SPECIFICATIONS.

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HRT 087 943325

CONSTRUCTION DRAWINGS

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A	03/01/15	ISSUED FOR REVIEW

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STATE OF CONNECTICUT
JIANG YU
No. 25222
REGISTERED PROFESSIONAL ENGINEER
CONNECTICUT LICENSE NO. PE.25222

DRAWN BY:	JC
REVIEWED BY:	BSH
CHECKED BY:	GHN
PROJECT NUMBER:	50066258
JOB NUMBER:	50071483
SITE ADDRESS:	

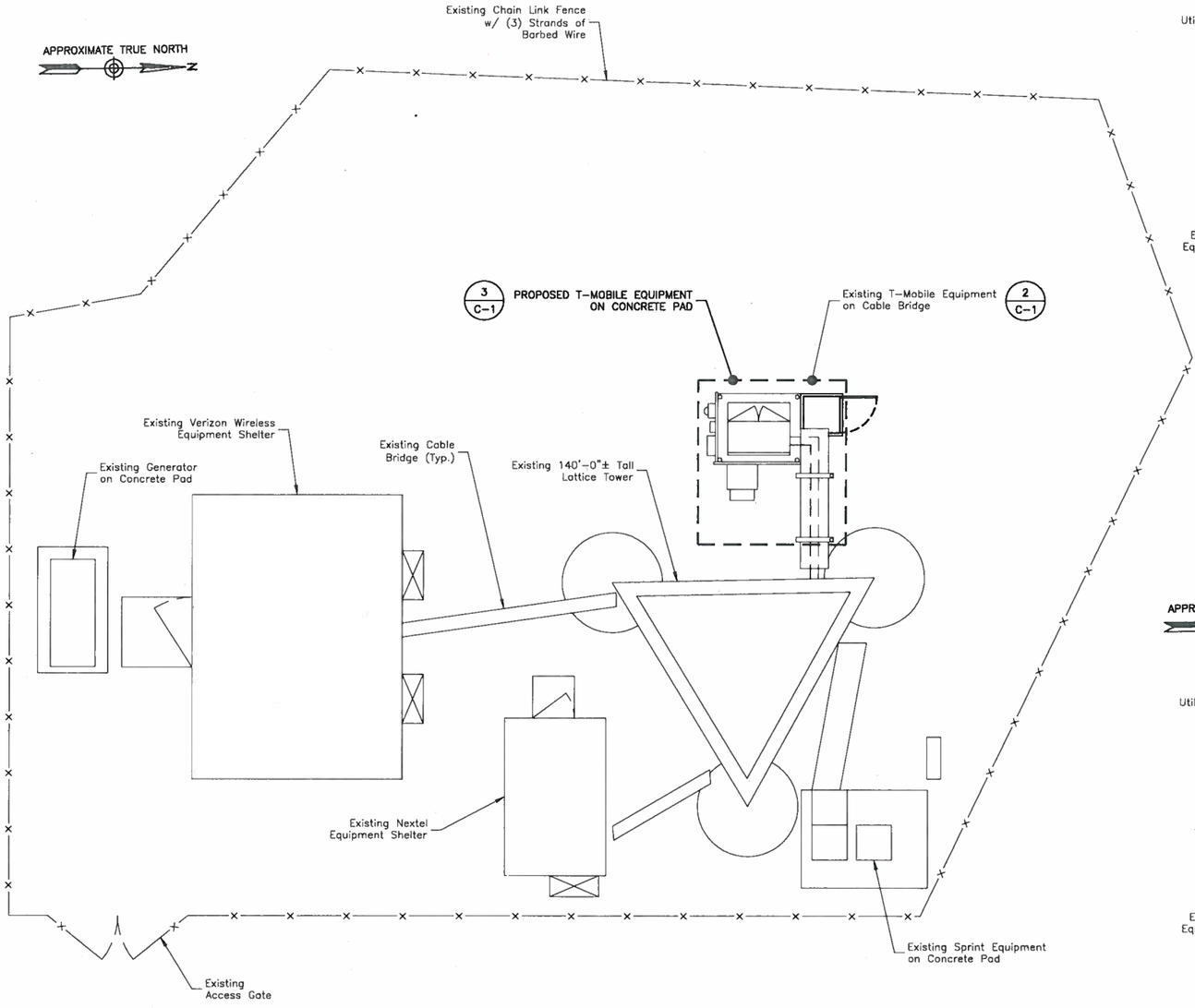
COSGROVE ROAD
WHIFFORD HILL, WEST
WILLINGTON, CT 06279
TOLLAND COUNTY

SHEET TITLE

GENERAL NOTES

SHEET NUMBER

G–1

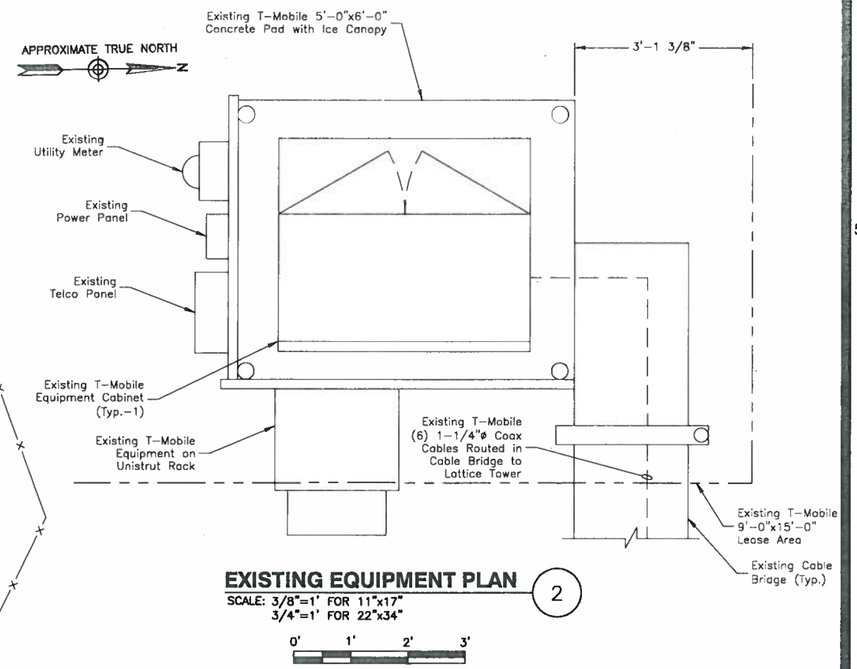


COMPOUND PLAN

1

SCALE: 1"=10' FOR 11"x17"
1"=5' FOR 22"x34"

0' 5' 10'

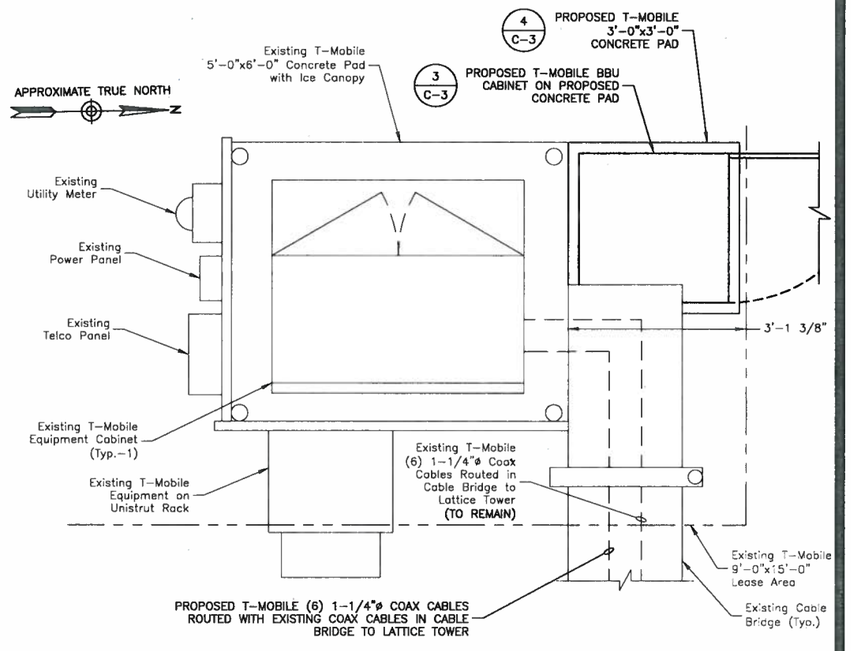


EXISTING EQUIPMENT PLAN

2

SCALE: 3/8"=1' FOR 11"x17"
3/4"=1' FOR 22"x34"

0' 1' 2' 3'



PROPOSED EQUIPMENT PLAN

2

SCALE: 3/8"=1' FOR 11"x17"
3/4"=1' FOR 22"x34"

0' 1' 2' 3'

NOTES:

1. NORTH ARROW SHOWN AS APPROXIMATE.
2. NOT ALL INFORMATION IS SHOWN FOR CLARITY.
3. ALL PROPOSED EQUIPMENT, INCLUDING ANTENNAS, BIAS TEES, COAX, ETC., SHALL BE MOUNTED IN ACCORDANCE WITH THE TOWER STRUCTURAL ANALYSIS BY FDH ENGINEERING, INC. DATED FEBRUARY 12, 2015.

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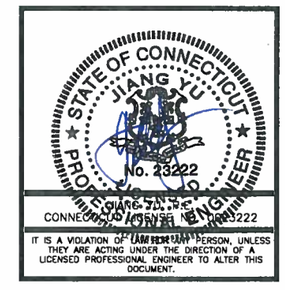


DRAWN BY:	JC
REVIEWED BY:	BSH
CHECKED BY:	GHN
PROJECT NUMBER:	50066258
JOB NUMBER:	50071483
SITE ADDRESS:	

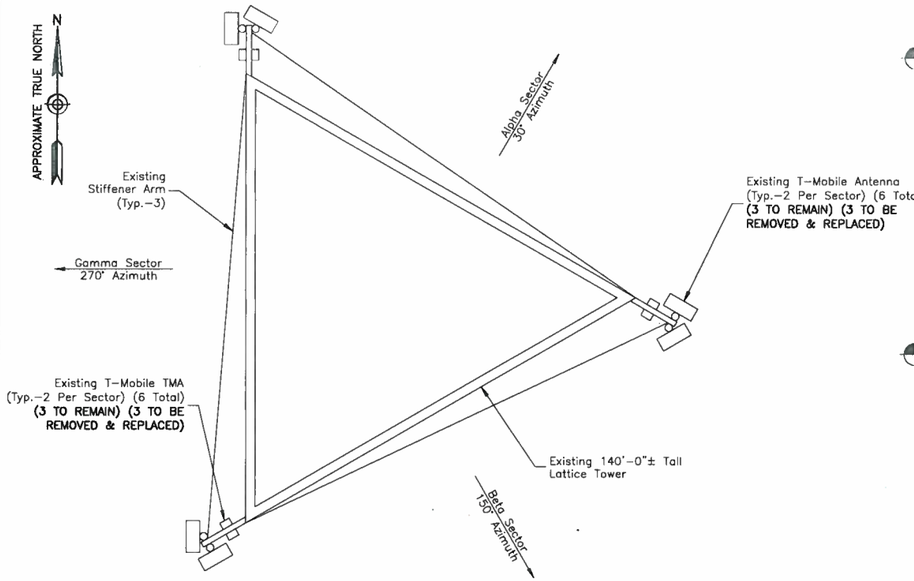
COSGROVE ROAD
WHIFFORD HILL, WEST
WILLINGTON, CT 06279
TOLLAND COUNTY

SHEET TITLE

COMPOUND PLAN & EQUIPMENT PLANS

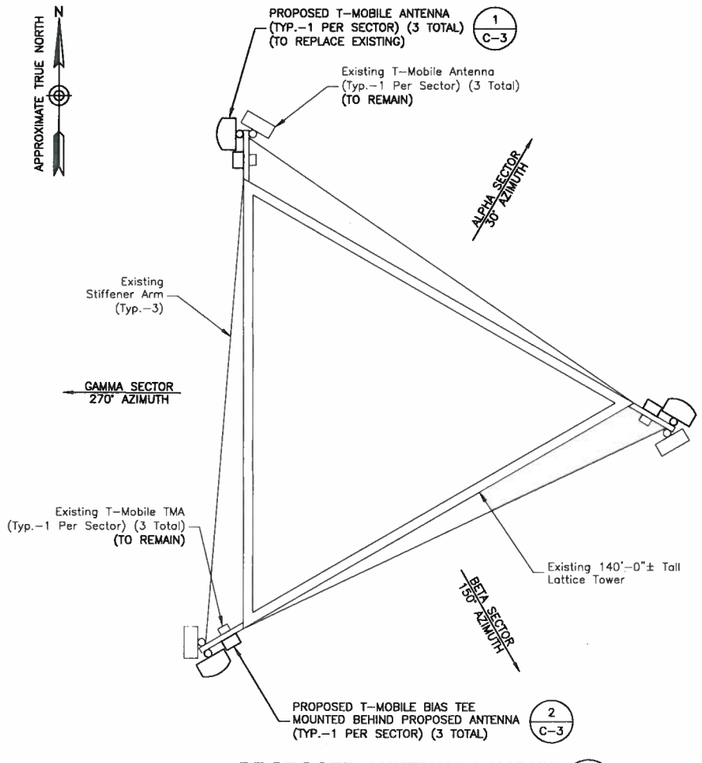
SHEET NUMBER

C-1



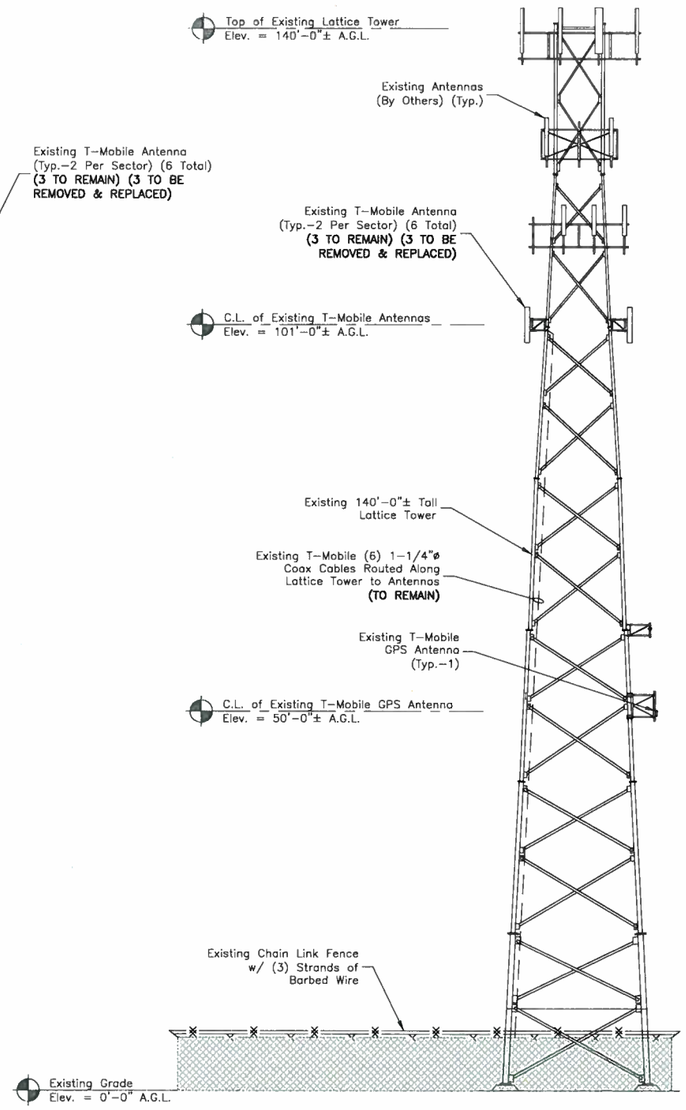
EXISTING ANTENNA LAYOUT (1)

SCALE: N.T.S.



PROPOSED ANTENNA LAYOUT (2)

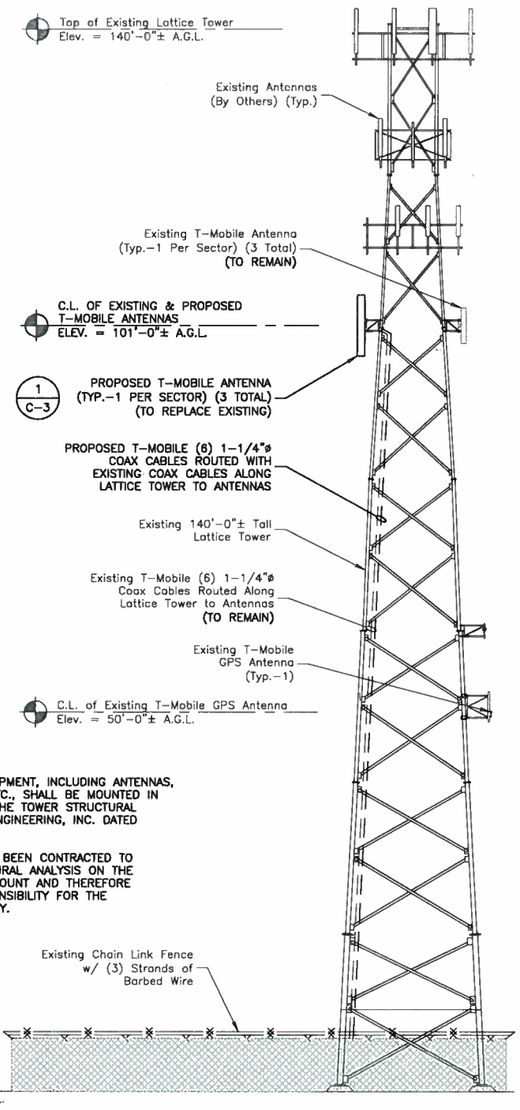
SCALE: N.T.S.



EXISTING ELEVATION (3)

SCALE: 1"=20' FOR 11"x17"
1"=10' FOR 22"x34"

0' 10' 20'



PROPOSED ELEVATION (4)

SCALE: 1"=20' FOR 11"x17"
1"=10' FOR 22"x34"

0' 10' 20'

NOTES:

1. ALL PROPOSED EQUIPMENT, INCLUDING ANTENNAS, BIAS TEES, COAX, ETC., SHALL BE MOUNTED IN ACCORDANCE WITH THE TOWER STRUCTURAL ANALYSIS BY FDH ENGINEERING, INC. DATED FEBRUARY 12, 2015.
2. DEWBERRY HAS NOT BEEN CONTRACTED TO PERFORM A STRUCTURAL ANALYSIS ON THE EXISTING ANTENNA MOUNT AND THEREFORE ASSUMES NO RESPONSIBILITY FOR THE STRUCTURAL CAPACITY.

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STATE OF CONNECTICUT
JIANG YU
23222
REGISTERED
PROFESSIONAL ENGINEER
JIANG YU
CONNECTICUT LICENSE NO. 23222
IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER TO ALTER THIS DOCUMENT.

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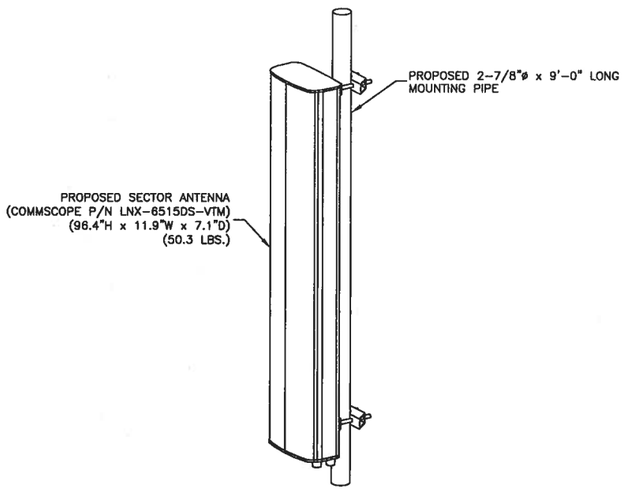
COSGROVE ROAD
WHIFFORD HILL, WEST
WILLINGTON, CT 06279
TOLLAND COUNTY

SHEET TITLE

ANTENNA LAYOUTS & ELEVATIONS

SHEET NUMBER

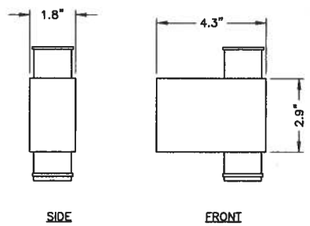
C–2



NOTES:

1. MOUNT ANTENNAS PER MANUFACTURER'S RECOMMENDATIONS.
2. GROUND ANTENNAS AND MOUNTS PER MANUFACTURER'S RECOMMENDATIONS AND T-MOBILE STANDARDS.
3. CONFIRM REQUIRED ANTENNAS WITH THE LATEST RFDS.

ISOMETRIC ANTENNA DETAIL 1
SCALE: N.T.S.

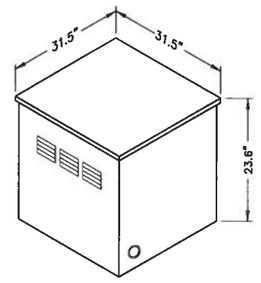


ANDREW ATBT-BOTTOM-24V

NOTES:

1. MOUNT EQUIPMENT PER MANUFACTURER'S RECOMMENDATIONS.
2. GROUND EQUIPMENT AND MOUNTS PER MANUFACTURER'S RECOMMENDATIONS AND T-MOBILE STANDARDS.
3. CONFIRM REQUIRED EQUIPMENT WITH THE LATEST RFDS.

BIAS TEE DETAIL 2
SCALE: N.T.S.



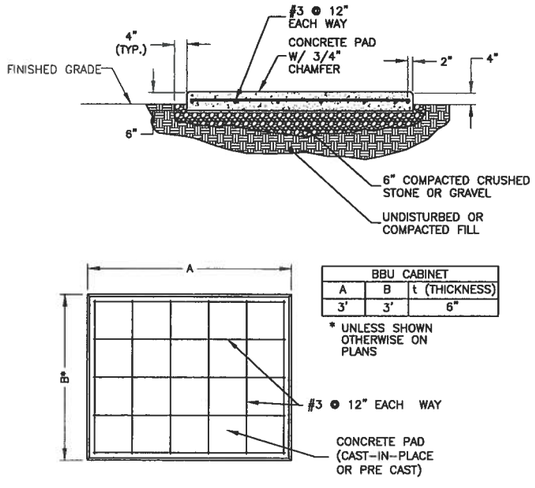
ALCATEL-LUCENT EZBFo BATTERY BACKUP SYSTEM

MATERIAL:	ANCHOR:
CONCRETE	3/8"ø HILTI KWIK BOLT 3 W/2-1/2" MIN. EMBED.
STRUCTURAL STEEL	1/2"ø STRUCTURAL BOLTS

NOTE:

1. CONTRACTOR SHALL ANCHOR CABINET IN ACCORDANCE WITH MANUFACTURER RECOMMENDATIONS.

BBU CABINET DETAIL 3
SCALE: N.T.S.



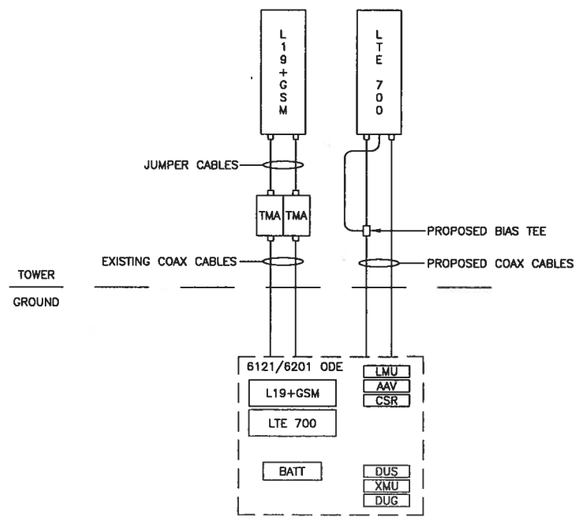
BBU CABINET		
A	B	t (THICKNESS)
3'	3'	6"

* UNLESS SHOWN OTHERWISE ON PLANS

NOTES:

1. USE GALVANIZED HILTI EXPANSION ANCHORS OR, APPROVED EQUAL, FOR EQUIPMENT ANCHORAGE.
2. VERIFY THE SIZE OF THE EMERGENCY GENERATOR WITH THE SUPPLIER.
3. FOR SIZE AND LOCATION OF ANCHORS AND OTHER REQUIREMENT, SEE EQUIPMENT VENDOR DRAWINGS.

OUTDOOR PAD FOR MINOR EQUIPMENT 4
SCALE: N.T.S.



SITE CONFIGURATION 704G 5
SCALE: N.T.S.

DESIGN CONFIGURATION

	ANTENNAS		COAX		COAX LENGTH
	EXISTING	PROPOSED	EXISTING	PROPOSED	
ALPHA	EMS RR90-17-02DP	EXISTING TO REMAIN	(2) 1-1/4"ø	(2) 1-1/4"ø	151'-0"
	EMS RR90-17-02DP	COMMSCOPE LNX-6515DS-VTM			
BETA	EMS RR90-17-02DP	EXISTING TO REMAIN	(2) 1-1/4"ø	(2) 1-1/4"ø	151'-0"
	EMS RR90-17-02DP	COMMSCOPE LNX-6515DS-VTM			
GAMMA	EMS RR90-17-02DP	EXISTING TO REMAIN	(2) 1-1/4"ø	(2) 1-1/4"ø	151'-0"
	EMS RR90-17-02DP	COMMSCOPE LNX-6515DS-VTM			

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STATE OF CONNECTICUT
JIANG XU
No. 23222
LICENSED PROFESSIONAL ENGINEER
CONNECTICUT LICENSE NO. 23222

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REVIEWED BY:	BSH
CHECKED BY:	GHN
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SITE ADDRESS:	

COSGROVE ROAD
WHIFFORD HILL, WEST
WILLINGTON, CT 06279
TOLLAND COUNTY

SHEET TITLE

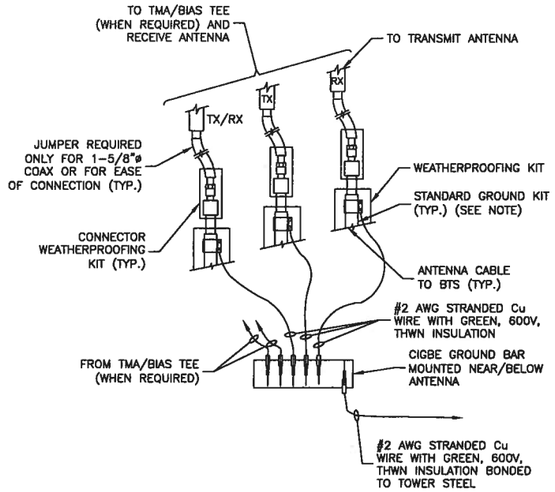
CONSTRUCTION DETAILS

SHEET NUMBER

C-3

GROUNDING NOTES:

1. THE CONTRACTOR SHALL REVIEW AND INSPECT THE EXISTING FACILITY GROUNDING SYSTEM AND LIGHTNING PROTECTION SYSTEM (AS DESIGNED AND INSTALLED) FOR STRICT COMPLIANCE WITH THE NEC (AS ADOPTED BY THE AHJ). THE SITE-SPECIFIC (UL, LPI, OR NFPA) LIGHTING PROTECTION CODE, AND GENERAL COMPLIANCE WITH TELCORDIA AND TIA GROUNDING STANDARDS. THE CONTRACTOR SHALL REPORT ANY VIOLATIONS OR ADVERSE FINDINGS TO THE ENGINEER FOR RESOLUTION.
2. ALL GROUND ELECTRODE SYSTEMS (INCLUDING TELECOMMUNICATION, RADIO, LIGHTNING PROTECTION, AND AC POWER GES'S) SHALL BE BONDED TOGETHER, AT OR BELOW GRADE, BY TWO OR MORE COPPER BONDING CONDUCTORS. ALL AVAILABLE GROUNDING ELECTRODES SHALL BE CONNECTED TOGETHER IN ACCORDANCE WITH THE NEC.
3. THE CONTRACTOR SHALL PERFORM IEEE FALL-OF-POTENTIAL RESISTANCE TO EARTH TESTING (PER IEEE 1100 AND 81) FOR GROUND ELECTRODE SYSTEMS. USE OF OTHER METHODS MUST BE PRE-APPROVED BY THE ENGINEER IN WRITING.
4. THE CONTRACTOR SHALL FURNISH AND INSTALL SUPPLEMENTAL GROUND ELECTRODES AS NEEDED TO ACHIEVE A TEST RESULT OF 5 OHMS OR LESS ON TOWER SITES AND 10 OHMS OR LESS ON ROOFTOP SITES. WHEN ADDING ELECTRODES, CONTRACTOR SHALL MAINTAIN A MINIMUM DISTANCE BETWEEN THE ADDED ELECTRODE AND ANY OTHER EXISTING ELECTRODE EQUAL TO THE BURIED LENGTH OF THE ROD. IDEALLY, CONTRACTOR SHALL STRIVE TO KEEP THE SEPARATION DISTANCE EQUAL TO TWICE THE BURIED LENGTH OF THE RODS.
5. THE CONTRACTOR IS RESPONSIBLE FOR PROPERLY SEQUENCING GROUNDING AND UNDERGROUND CONDUIT INSTALLATION AS TO PREVENT ANY LOSS OF CONTINUITY IN THE GROUNDING SYSTEM OR DAMAGE TO THE CONDUIT.
6. METAL CONDUIT AND TRAY SHALL BE GROUNDED AND MADE ELECTRICALLY CONTINUOUS WITH LISTED BONDING FITTINGS OR BY BONDING ACROSS THE DISCONTINUITY WITH 8 AWG COPPER WIRE AND UL APPROVED GROUNDING TYPE CONDUIT CLAMPS.
7. METAL RACEWAY SHALL NOT BE USED AS THE NEC REQUIRED EQUIPMENT GROUND CONDUCTOR. STRANDED COPPER CONDUCTORS WITH GREEN INSULATION, SIZED IN ACCORDANCE WITH THE NEC, SHALL BE FURNISHED AND INSTALLED WITH THE POWER CIRCUITS TO TRANSMISSION EQUIPMENT.
8. CONNECTIONS TO THE GROUND BUS SHALL NOT BE DOUBLED UP OR STACKED. BACK-TO-BACK CONNECTIONS ON OPPOSITE SIDES OF THE GROUND BUS ARE PERMITTED.
9. ALUMINUM CONDUCTOR OR COPPER CLAD STEEL CONDUCTOR SHALL NOT BE USED FOR GROUNDING CONNECTIONS.
10. USE OF 90° BENDS IN THE PROTECTION GROUNDING CONDUCTORS SHALL BE AVOIDED WHEN 45° BENDS CAN BE ADEQUATELY SUPPORTED. IN ALL CASES, BENDS SHALL BE MADE WITH A MINIMUM BEND RADIUS OF 8 INCHES.
11. EACH INTERIOR TRANSMISSION CABINET FRAME/PLINTH SHALL BE DIRECTLY CONNECTED TO THE MASTER GROUND BAR WITH 6 AWG STRANDED, GREEN INSULATED SUPPLEMENTAL EQUIPMENT GROUND WIRE UNLESS NOTED OTHERWISE IN THE DETAILS. EACH OUTDOOR CABINET FRAME/PLINTH SHALL BE DIRECTLY CONNECTED TO THE BURIED GROUND RING WITH 2 AWG SOLID TIN-PLATED COPPER WIRE UNLESS NOTED OTHERWISE IN THE DETAILS.
12. ALL EXTERIOR GROUND CONDUCTORS BETWEEN EQUIPMENT/GROUND BARS AND THE GROUND RING, SHALL BE 2 AWG SOLID TIN-PLATED COPPER UNLESS OTHERWISE INDICATED.
13. EXOTHERMIC WELDS SHALL BE USED FOR ALL GROUNDING CONNECTIONS BELOW GRADE. CONNECTIONS TO ABOVE GRADE UNITS SHALL BE MADE WITH EXOTHERMIC WELDS WHERE PRACTICAL OR WITH 2 HOLE MECHANICAL TYPE BRASS CONNECTORS WITH STAINLESS STEEL HARDWARE, INCLUDING SET SCREWS. HIGH PRESSURE CRIMP CONNECTORS MAY ONLY BE USED WITH WRITTEN PERMISSION FROM T-MOBILE MARKET REPRESENTATIVE.
14. EXOTHERMIC WELDS SHALL BE PERMITTED ON TOWERS ONLY WITH THE EXPRESS APPROVAL OF THE TOWER MANUFACTURER OR THE CONTRACTORS STRUCTURAL ENGINEER.
15. ALL WIRE TO WIRE GROUND CONNECTIONS TO THE INTERIOR GROUND RING SHALL BE FORMED USING HIGH PRESS CRIMPS OR SPLIT BOLT CONNECTORS WHERE INDICATED IN THE DETAILS.
16. ON ROOFTOP SITES WHERE EXOTHERMIC WELDS ARE A FIRE HAZARD COPPER COMPRESSION CAP CONNECTORS MAY BE USED FOR WIRE TO WIRE CONNECTORS. 2 HOLE MECHANICAL TYPE BRASS CONNECTORS WITH STAINLESS STEEL HARDWARE, INCLUDING SET SCREWS SHALL BE USED FOR CONNECTION TO ALL ROOFTOP TRANSMISSION EQUIPMENT AND STRUCTURAL STEEL.
17. COAX BRIDGE BONDING CONDUCTORS SHALL BE EXOTHERMICALLY BONDED OR BOLTED TO THE BRIDGE AND THE TOWER GROUND BAR USING TWO-HOLE MECHANICAL TYPE BRASS CONNECTORS AND STAINLESS STEEL HARDWARE.
18. APPROVED ANTIOXIDANT COATINGS (I.E., CONDUCTIVE GEL OR PASTE) SHALL BE USED ON ALL COMPRESSION AND BOLTED GROUND CONNECTIONS.
19. ALL EXTERIOR GROUND CONNECTIONS SHALL BE COATED WITH A CORROSION RESISTANT MATERIAL.
20. MISCELLANEOUS ELECTRICAL AND NON-ELECTRICAL METAL BOXES, FRAMES AND SUPPORTS SHALL BE BONDED TO THE GROUND RING, IN ACCORDANCE WITH THE NEC.
21. BOND ALL METALLIC OBJECTS WITHIN 6 FT OF THE BURIED GROUND RING WITH 2 AWG SOLID TIN-PLATED COPPER GROUND CONDUCTOR. DURING EXCAVATION FOR NEW GROUND CONDUCTORS, IF EXISTING GROUND CONDUCTORS ARE ENCOUNTERED, BOND EXISTING GROUND CONDUCTORS TO NEW CONDUCTORS.
22. GROUND CONDUCTORS USED IN THE FACILITY GROUND AND LIGHTNING PROTECTION SYSTEMS SHALL NOT BE ROUTED THROUGH METALLIC OBJECTS THAT FORM A RING AROUND THE CONDUCTOR, SUCH AS METALLIC CONDUITS, METAL SUPPORT CLIPS OR SLEEVES THROUGH WALLS OR FLOORS. WHEN IT IS REQUIRED TO BE HOUSED IN CONDUIT TO MEET CODE REQUIREMENTS OR LOCAL CONDITIONS, NON-METALLIC MATERIAL SUCH AS PVC PLASTIC CONDUIT SHALL BE USED. WHERE USE OF METAL CONDUIT IS UNAVOIDABLE (E.G., NON-METALLIC CONDUIT PROHIBITED BY LOCAL CODE) THE GROUND CONDUCTOR SHALL BE BONDED TO EACH END OF THE METAL CONDUIT WITH LISTED BONDING FITTINGS.

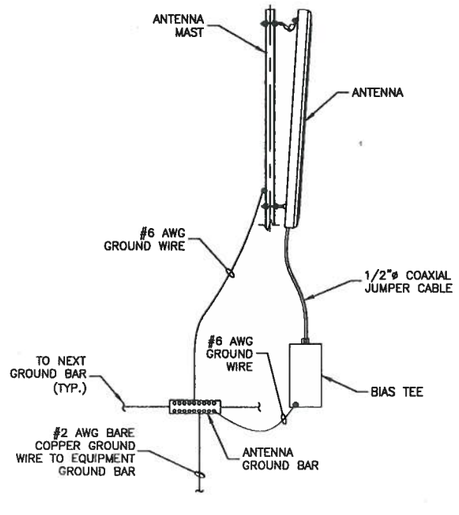


NOTE:

1. DO NOT INSTALL CABLE GROUND KIT AT A BEND AND ALWAYS DIRECT GROUND WIRE DOWN TO CIGBE.

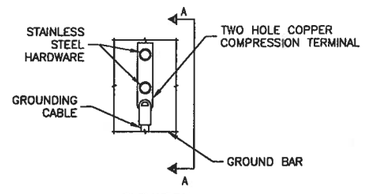
CONNECTION OF GROUND WIRES TO GROUNDING BAR (CIGBE) 1

SCALE: N.T.S.

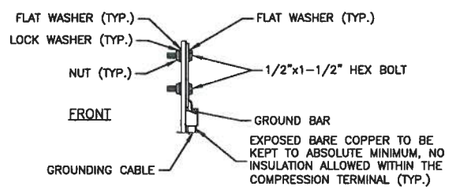


TYPICAL ANTENNA GROUNDING DETAIL 3

SCALE: N.T.S



ELEVATION



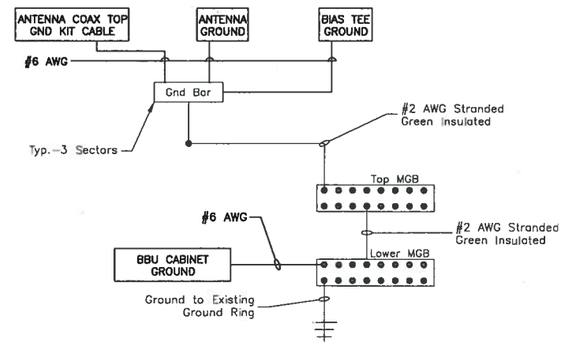
SECTION 'A-A'

NOTES:

1. DOUBLING UP OR STACKING OF CONNECTIONS IS NOT PERMITTED.
2. OXIDE INHIBITING COMPOUND TO BE USED AT ALL LOCATIONS.

TYPICAL GROUND BAR MECHANICAL CONNECTION DETAIL 2

SCALE: N.T.S.



NOTES:

1. BOND ANTENNA GROUNDING KIT CABLE TO TOP CIGBE
2. BOND ANTENNA GROUNDING KIT CABLE TO BOTTOM CIGBE.
3. SCHEMATIC GROUNDING DIAGRAM IS TYPICAL FOR EACH SECTOR.
4. VERIFY EXISTING GROUND SYSTEM IS INSTALLED PER T-MOBILE STANDARDS.

SCHEMATIC GROUNDING DIAGRAM 4

SCALE: N.T.S.

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STATE OF CONNECTICUT
JIANG YU
No. 28923
REGISTERED PROFESSIONAL ENGINEER
JIANG YU, P.E.
CONNECTICUT LICENSE NO. 028923
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DRAWN BY:	JC
REVIEWED BY:	BSH
CHECKED BY:	GHN
PROJECT NUMBER:	50066258
JOB NUMBER:	50071483
SITE ADDRESS:	

COSGROVE ROAD
WHIFFORD HILL, WEST
WILLINGTON, CT 06279
TOLLAND COUNTY

SHEET TITLE

GROUNDING NOTES & DETAILS

SHEET NUMBER

E-1

Date: **February 12, 2015**

Marianne Dunst
Crown Castle
3530 Toringdon Way Suite 300
Charlotte, NC 28277

FDH Engineering, Inc.
6521 Meridien Drive, Suite 107
Raleigh, North Carolina 27616
9197551012

Subject: **Structural Analysis Report**

Carrier Designation:	***T-Mobile* Co-Locate**	
	Carrier Site Number:	CT11142A
	Carrier Site Name:	Willington/ Rt 320/ Cosg 1
Crown Castle Designation:	**Crown Castle BU Number:**	806383
	Crown Castle Site Name:	HRT 087 943325
	Crown Castle JDE Job Number:	322230
	Crown Castle Work Order Number:	1005475
	Crown Castle Application Number:	282537 Rev. 2
Engineering Firm Designation:	**FDH Engineering, Inc. Project Number:**	15BDRT1400(R1)

Site Data: **COSGROVE ROADWHIFFORD HILL, WEST WILLINGTON, Tolland County, CT**
Latitude *41° 53' 32.92"*, Longitude *-72° 15' 38.15"*
140 Foot - Self Support Tower

Dear Marianne Dunst,

FDH Engineering, Inc. is pleased to submit this **"Structural Analysis Report"** to determine the structural integrity of the above mentioned tower. This analysis has been performed in accordance with the Crown Castle Structural 'Statement of Work' and the terms of Crown Castle Purchase Order Number 754360, in accordance with application 282537, revision 2.

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

LC7: Existing + Reserved + Proposed Equipment **Sufficient Capacity**
Note: See Table I and Table II for the proposed and existing/reserved loading, respectively.

The analysis has been performed in accordance with the TIA/EIA-222-F standard and local code requirements based upon a wind speed of 85 mph fastest mile.

All modifications and equipment proposed in this report shall be installed in accordance with the attached drawings for the determined available structural capacity to be effective.

We at *FDH Engineering, Inc.* appreciate the opportunity of providing our continuing professional services to you and Crown Castle. If you have any questions or need further assistance on this or any other projects please give us a call.

Respectfully submitted by:

Colleen Brophy, EI
Project Engineer

Reviewed by:

Dennis D. Abel PE
Director - Structural Engineering
CT PE License No. 23247

STATE OF CONNECTICUT
DENNIS D. ABEL
No. 23247
LICENSED
PROFESSIONAL ENGINEER

02-12-2015

TABLE OF CONTENTS

1) INTRODUCTION

This tower is a 140 ft Self Support tower designed by ROHN in December of 1986. The tower's original design wind speed and code are unknown.

2) ANALYSIS CRITERIA

The structural analysis was performed for this tower in accordance with the requirements of TIA/EIA-222-F Structural Standards for Steel Antenna Towers and Antenna Supporting Structures using a fastest mile wind speed of 85 mph with no ice, 37.6 mph with 1 inch ice thickness and 50 mph under service loads.

Table 1 - Proposed Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
101.0	101.0	3	commscope	ATBT-BOTTOM-24V	(6)	1-1/4	--
		3	commscope	LNX-6515DS-VTM w/ Mount Pipe			

Table 2 - Existing and Reserved Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
137.0	139.0	3	alcatel lucent	RRH2X60-AWS	(2)	1-5/8	2
		3	alcatel lucent	RRH2X60-PCS			
		6	andrew	HBXX-6517DS-VTM w/ Mount Pipe			
		3	andrew	LNX-6514DS-VTM w/ Mount Pipe			
		3	andrew	LNX-8513DS-A1M w/ Mount Pipe			
		2	rfs celwave	DB-T1-6Z-8AB-0Z			
	137.0	1	crown mounts	Sector Mount [SM 506-3]	(12)	1-5/8	1
		6	rfs celwave	FD9R6004/2C-3L			
124.0	125.0	6	decibel	DB980H90E-M w/ Mount Pipe	(6)	1-5/8	1
	124.0	1	tower mounts	Sector Mount [SM 502-3]			
112.0	114.0	9	decibel	DB844H90E-XY w/ Mount Pipe	(9)	7/8	3
		12	swedcom	ALP 9212-N w/ Mount Pipe			
	112.0	1	crown mounts	Sector Mount [SM 201-3]			
101.0	101.0	1	crown mounts	Side Arm Mount [SO 304-3]	(6)	1-1/4	1
		3	ems wireless	RR90-17-00DP w/ Mount Pipe			
		3	ericsson	KRY 112 13/1			
		3	ems wireless	RR90-17-00DP w/ Mount Pipe	--	--	3
		3	ericsson	KRY 112 13/1			

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
60.0	60.0	1	crown mounts	Side Arm Mount [SO 305-1]	(1)	1/2	1
		1	gps	GPS_A			
50.0	50.0	1	crown mounts	Side Arm Mount [SO 201-1]	(1)	1/2	1
		1	unknown	GPS			

Notes:
1) Existing Equipment
2) Reserved Equipment
3) Equipment To Be Removed; Not Considered in this Analysis

Table 3 - Design Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)
140	140	4	--	PD10017 Antennas	--	--
131	131	6	--	PD1132 antennas	--	--
121	121	2	--	6' Std dishes	--	--
100	100	1	--	PD1109 Antenna	--	--

3) ANALYSIS PROCEDURE

Table 4 - Documents Provided

Document	Remarks	Reference	Source
4-GEOTECHNICAL REPORTS	JGI Eastern	1069386	CCISITES
4-TOWER FOUNDATION DRAWINGS/DESIGN/SPECS	Rohn	1069383	CCISITES
4-TOWER MANUFACTURER DRAWINGS	Rohn	1069394	CCISITES

3.1) Analysis Method

tnxTower (version 6.1.4.1), a commercially available analysis software package, was used to create a three-dimensional model of the tower and calculate member stresses for various loading cases. Selected output from the analysis is included in Appendix A.

3.2) Assumptions

1) Tower and structures were built in accordance with the manufacturer's specifications.
2) The tower and structures have been maintained in accordance with the manufacturer's specification.
3) The configuration of antennas, transmission cables, mounts and other appurtenances are as specified in Tables 1 and 2 and the referenced drawings.
4) When applicable, transmission cables are considered as structural components for calculating wind loads as allowed by TIA/EIA-222-F.
5) The loading at the 112' level will be removed before installation or proposed loading.

This analysis may be affected if any assumptions are not valid or have been made in error. FDH Engineering, Inc. should be notified to determine the effect on the structural integrity of the tower.

4) ANALYSIS RESULTS

Table 5 - Section Capacity (Summary)

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
T1	140 - 120	Leg	ROHN 2 STD	2	-19.97	32.30	61.8	Pass
T2	120 - 100	Leg	ROHN 2.5 EH	38	-44.13	65.60	67.3	Pass
T3	100 - 80	Leg	ROHN 3 EH	69	-66.75	83.78	79.7	Pass
T4	80 - 60	Leg	ROHN 3.5 EH	90	-88.78	110.27	80.5	Pass
T5	60 - 40	Leg	ROHN 4 X-STR	111	-109.79	139.07	78.9	Pass
T6	40 - 20	Leg	ROHN 5 EH	132	-128.63	177.46	72.5	Pass
T7	20 - 0	Leg	ROHN 5 X-STR	147	-154.37	177.86	86.8	Pass
T1	140 - 120	Diagonal	L1 3/4x1 3/4x3/16	7	-3.50	7.71	45.3 67.0 (b)	Pass
T2	120 - 100	Diagonal	L1 3/4x1 3/4x3/16	44	-3.09	4.45	69.5	Pass
T3	100 - 80	Diagonal	L2x2x3/16	74	-3.93	4.18	94.0	Pass
T4	80 - 60	Diagonal	L2 1/2x2 1/2x3/16	95	-4.19	6.39	65.6 76.3 (b)	Pass
T5	60 - 40	Diagonal	L3x3x3/16	116	-4.54	8.74	52.0 82.6 (b)	Pass
T6	40 - 20	Diagonal	L3x3x3/16	137	-5.52	5.99	92.1	Pass
T7	20 - 0	Diagonal	L3x3x1/4	152	-5.88	6.57	89.4	Pass
T1	140 - 120	Top Girt	L2x2x1/8	6	-0.50	2.83	17.8	Pass
T2	120 - 100	Top Girt	L2x2x1/8	41	-0.09	2.79	3.2	Pass
							Summary	
						Leg (T7)	86.8	Pass
						Diagonal (T3)	94.0	Pass
						Top Girt (T1)	17.8	Pass
						Bolt Checks	82.6	Pass
						RATING =	94.0	Pass

Table 6 - Tower Component Stresses vs. Capacity – LC7

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Base Foundation	0	44.8	Pass
1	Base Foundation Soil Interaction	0	82.5	Pass

Structure Rating (max from all components) =	94.0%

Notes:
1) See additional documentation in “Appendix C – Additional Calculations” for calculations supporting the % capacity consumed.

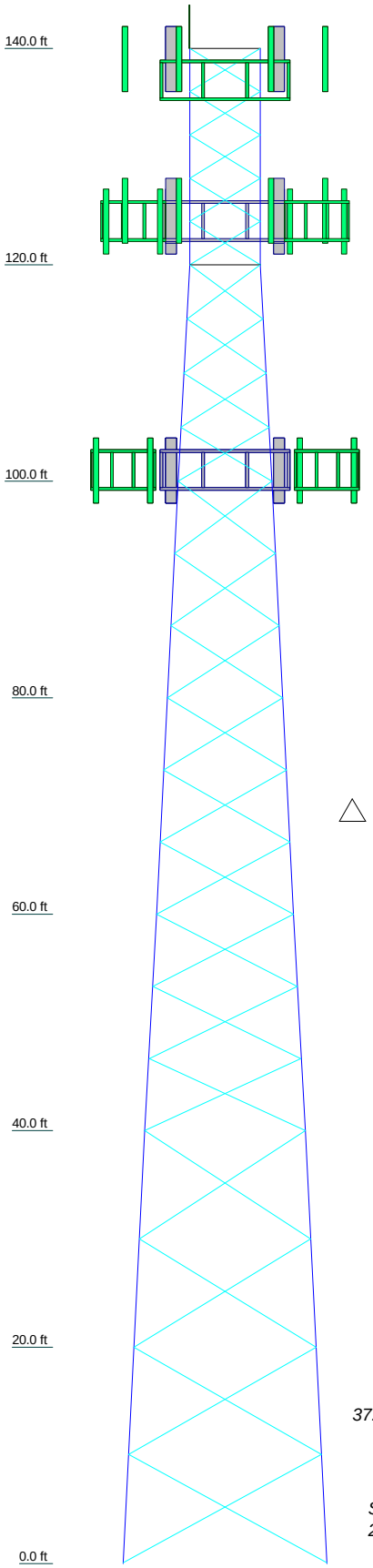
4.1) Recommendations

The tower and its foundation have sufficient capacity to carry the existing, reserved, and proposed loads. No modifications are required at this time.

APPENDIX A

TNXTOWER OUTPUT

Section	T1	T2	T3	T4	T5	T6	T7
Legs	ROHN 2 STD	ROHN 2.5 EH	ROHN 3 EH	ROHN 3.5 EH	ROHN 4 X-STR	ROHN 5 EH	ROHN 5 X-STR
Leg Grade	A618-50						
Diagonals	L1 3/4x1 3/4x3/16		L2x2x3/16	L2 1/2x2 1/2x3/16	L3x3x3/16		L3x3x1/4
Diagonal Grade	A36						A572-50
Top Girts	L2x2x1/8				N.A.		
Face Width (ft)	6.52083	6.5625	8.60417	10.6354	12.6771	14.7708	16.7708
# Panels @ (ft)	5 @ 4	4 @ 5	9 @ 6.66667			2 @ 10	2 @ 9.95833
Weight (K)	0.8	1.0	1.2	1.6	2.0	2.2	2.6



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Lightning Rod	140	(2) DB980H90E-M w/ Mount Pipe	124
(2) FD9R6004/2C-3L	137	(2) DB980H90E-M w/ Mount Pipe	124
(2) FD9R6004/2C-3L	137	Sector Mount [SM 502-3]	124
(2) FD9R6004/2C-3L	137	7'x2" Antenna Mount Pipe	124
Sector Mount [SM 506-3]	137	7'x2" Antenna Mount Pipe	124
(2) HBXX-6517DS-VTM w/ Mount Pipe	137	7'x2" Antenna Mount Pipe	124
(2) HBXX-6517DS-VTM w/ Mount Pipe	137	RR90-17-00DP w/ Mount Pipe	101
(2) HBXX-6517DS-VTM w/ Mount Pipe	137	RR90-17-00DP w/ Mount Pipe	101
LNX-6514DS-VTM w/ Mount Pipe	137	RR90-17-00DP w/ Mount Pipe	101
LNX-6514DS-VTM w/ Mount Pipe	137	KRY 112 13/1	101
LNX-6514DS-VTM w/ Mount Pipe	137	KRY 112 13/1	101
LNX-8513DS-A1M w/ Mount Pipe	137	KRY 112 13/1	101
LNX-8513DS-A1M w/ Mount Pipe	137	LNX-6515DS-VTM w/ Mount Pipe	101
LNX-8513DS-A1M w/ Mount Pipe	137	LNX-6515DS-VTM w/ Mount Pipe	101
RRH2X60-AWS	137	LNX-6515DS-VTM w/ Mount Pipe	101
RRH2X60-AWS	137	ATBT-BOTTOM-24V	101
RRH2X60-AWS	137	ATBT-BOTTOM-24V	101
RRH2X60-PCS	137	ATBT-BOTTOM-24V	101
RRH2X60-PCS	137	Side Arm Mount [SO 304-3]	101
RRH2X60-PCS	137	GPS_A	60
DB-T1-6Z-8AB-0Z	137	Side Arm Mount [SO 305-1]	60
DB-T1-6Z-8AB-0Z	137	GPS	50
(2) DB980H90E-M w/ Mount Pipe	124	Side Arm Mount [SO 201-1]	50

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A618-50	50 ksi	70 ksi	A572-50	50 ksi	65 ksi
A36	36 ksi	58 ksi			

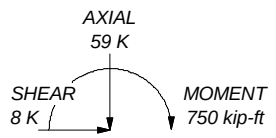
TOWER DESIGN NOTES

1. Tower is located in Tolland County, Connecticut.
2. Tower designed for a 85.00 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 37.60 mph basic wind with 1.00 in ice. Ice is considered to increase in thickness with height.
4. Deflections are based upon a 50.00 mph wind.
5. TOWER RATING: 94%

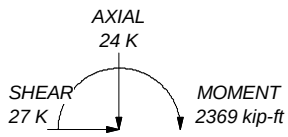
MAX. CORNER REACTIONS AT BASE:

DOWN: 154 K
SHEAR: 17 K

UPLIFT: -131 K
SHEAR: 15 K



TORQUE 3 kip-ft
37.60 mph WIND - 1.00 in ICE



TORQUE 11 kip-ft
REACTIONS - 85.00 mph WIND

FDH Engineering, Inc.
6521 Meridien Drive, Suite 107
Raleigh, North Carolina 27616
Phone: 9197551012
FAX: 9197551031
Tower Analysis

Job: HRT 087 943325, BU 806383			
Project: 15BDRT1400(R1)			
Client: Crown Castle	Drawn by: CBrophy	App'd:	
Code: TIA/EIA-222-F	Date: 02/12/15	Scale: NTS	
Path:		Dwg No. E-1	

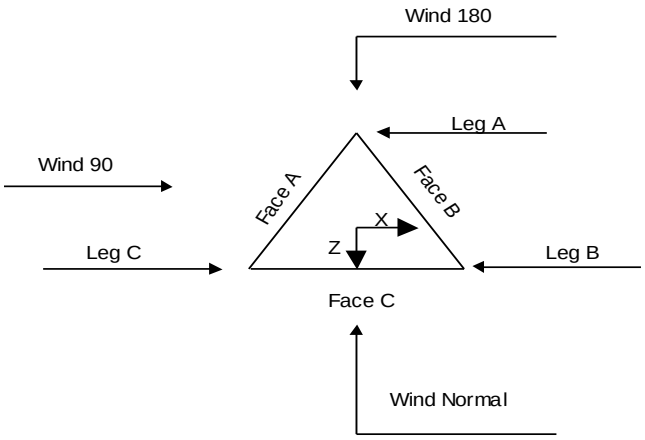
Tower Input Data

The main tower is a 3x free standing tower with an overall height of 140' above the ground line.
The base of the tower is set at an elevation of 0' above the ground line.
The face width of the tower is 6'6-1/4" at the top and 18'9-1/4" at the base.
This tower is designed using the TIA/EIA-222-F standard.
The following design criteria apply:

Tower is located in Tolland County, Connecticut.
Basic wind speed of 85.00 mph.
Nominal ice thickness of 1.00 in.
Ice thickness is considered to increase with height.
Ice density of 56 pcf.
A wind speed of 37.60 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 50.00 mph.
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in tower member design is 1.333.
Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Options

	Consider Moments - Legs		Distribute Leg Loads As Uniform		Treat Feedline Bundles As Cylinder
	Consider Moments - Horizontals		Assume Legs Pinned		Use ASCE 10 X-Brace Ly Rules
	Consider Moments - Diagonals	√	Assume Rigid Index Plate	√	Calculate Redundant Bracing Forces
	Use Moment Magnification	√	Use Clear Spans For Wind Area		Ignore Redundant Members in FEA
√	Use Code Stress Ratios	√	Use Clear Spans For KL/r		SR Leg Bolts Resist Compression
√	Use Code Safety Factors - Guys		Retension Guys To Initial Tension	√	All Leg Panels Have Same Allowable
√	Escalate Ice	√	Bypass Mast Stability Checks	√	Offset Girt At Foundation
	Always Use Max Kz	√	Use Azimuth Dish Coefficients	√	Consider Feedline Torque
	Use Special Wind Profile	√	Project Wind Area of Appurt.	√	Include Angle Block Shear Check
√	Include Bolts In Member Capacity		Autocalc Torque Arm Areas		Poles
	Leg Bolts Are At Top Of Section		SR Members Have Cut Ends		Include Shear-Torsion Interaction
√	Secondary Horizontal Braces Leg	√	Sort Capacity Reports By Component		Always Use Sub-Critical Flow
	Use Diamond Inner Bracing (4 Sided)		Triangulate Diamond Inner Bracing		Use Top Mounted Sockets
	Add IBC .6D+W Combination		Use TIA-222-G Tension Splice Capacity Exemption		



Triangular Tower

Tower Section Geometry

Tower Section	*Tower Elevation*	*Assembly Database*	*Description*	*Section Width*	*Number of Sections*	*Section Length*
	ft			*ft*		*ft*
T1	140'-120'			6'6-1/4"	1	20'
T2	120'-100'		08N087	6'6-23/32"	1	20'
T3	100'-80'		09N006	8'7-3/16"	1	20'
T4	80'-60'		10N007	10'7-11/16"	1	20'
T5	60'-40'		11N007	12'8-5/32"	1	20'
T6	40'-20'		12N004	14'9-1/4"	1	20'
T7	20'-0'		13N003	16'9-1/4"	1	20'

Tower Section Geometry *(cont'd)*

Tower Section	*Tower Elevation*	*Diagonal Spacing*	*Bracing Type*	*Has K Brace End Panels*	*Has Horizontals*	*Top Girt Offset*	*Bottom Girt Offset*
	ft	*ft*				*in*	*in*
T1	140'-120'	4'	X Brace	No	No	0.00	0.00
T2	120'-100'	5'	X Brace	No	No	0.00	0.00
T3	100'-80'	6'8-1/32"	X Brace	No	No	0.00	0.00
T4	80'-60'	6'8-1/32"	X Brace	No	No	0.00	0.00
T5	60'-40'	6'8-1/32"	X Brace	No	No	0.00	0.00
T6	40'-20'	10'	X Brace	No	No	0.00	0.00
T7	20'-0'	9'11-17/32"	X Brace	No	No	0.00	1.00

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Type	Leg Size	Leg Grade	Diagonal Type	Diagonal Size	Diagonal Grade
T1 140'-120'	Pipe	ROHN 2 STD	A618-50 (50 ksi)	Single Angle	L1 3/4x1 3/4x3/16	A36 (36 ksi)
T2 120'-100'	Pipe	ROHN 2.5 EH	A618-50 (50 ksi)	Single Angle	L1 3/4x1 3/4x3/16	A36 (36 ksi)
T3 100'-80'	Pipe	ROHN 3 EH	A618-50 (50 ksi)	Single Angle	L2x2x3/16	A36 (36 ksi)
T4 80'-60'	Pipe	ROHN 3.5 EH	A618-50 (50 ksi)	Single Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T5 60'-40'	Pipe	ROHN 4 X-STR	A618-50 (50 ksi)	Single Angle	L3x3x3/16	A36 (36 ksi)
T6 40'-20'	Pipe	ROHN 5 EH	A618-50 (50 ksi)	Single Angle	L3x3x3/16	A36 (36 ksi)
T7 20'-0'	Pipe	ROHN 5 X-STR	A618-50 (50 ksi)	Single Angle	L3x3x1/4	A572-50 (50 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Top Girt Type	Top Girt Size	Top Girt Grade	Bottom Girt Type	Bottom Girt Size	Bottom Girt Grade
T1 140'-120'	Equal Angle	L2x2x1/8	A36 (36 ksi)	Single Angle		A36 (36 ksi)
T2 120'-100'	Single Angle	L2x2x1/8	A36 (36 ksi)	Single Angle		A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
T1 140'-120'	0.00	0.00	A36 (36 ksi)	1.03	1	1.05	36.00	36.00
T2 120'-100'	0.00	0.00	A36 (36 ksi)	1.03	1	1.05	36.00	36.00
T3 100'-80'	0.00	0.00	A36 (36 ksi)	1.03	1	1.05	36.00	36.00
T4 80'-60'	0.00	0.00	A36 (36 ksi)	1.03	1	1.05	36.00	36.00
T5 60'-40'	0.00	0.00	A36 (36 ksi)	1.03	1	1.05	36.00	36.00
T6 40'-20'	0.00	0.00	A36 (36 ksi)	1.03	1	1.05	36.00	36.00
T7 20'-0'	0.00	0.00	A36 (36 ksi)	1.03	1	1.05	36.00	36.00

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Calc K Single Angles	Calc K Solid Rounds	K Factors[1] Legs	X Brace Diags X Y	K Brace Diags X Y	Single Diags X Y	Girts X Y	Horiz. X Y	Sec. Horiz. X Y	Inner Brace X Y
T1 140'-120'	Yes	No	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1
T2 120'-100'	Yes	No	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1
T3 100'-80'	Yes	No	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1
T4 80'-60'	Yes	No	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1
T5 60'-40'	Yes	No	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1
T6 40'-20'	Yes	No	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1
T7 20'-0'	Yes	No	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1

[1]*Note: K factors are applied to member segment lengths. K-braces without inner supporting members will have the K factor in the out-of-plane direction applied to the overall length.*

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Net Width Deduct in	Leg U	Diagonal Net Width Deduct in	Diagonal U	Top Girt Net Width Deduct in	Top Girt U	Bottom Girt Net Width Deduct in	Bottom Girt U	Mid Girt Net Width Deduct in	Mid Girt U	Long Horizontal Net Width Deduct in	Long Horizontal U	Short Horizontal Net Width Deduct in	Short Horizontal U
T1 140'-120'	0.00	1	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75
T2 120'-100'	0.00	1	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75
T3 100'-80'	0.00	1	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75
T4 80'-60'	0.00	1	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75
T5 60'-40'	0.00	1	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75
T6 40'-20'	0.00	1	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75
T7 20'-0'	0.00	1	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Connection Type	Leg Bolt Size in	Leg No.	Diagonal Bolt Size in	Diagonal No.	Top Girt Bolt Size in	Top Girt No.	Bottom Girt Bolt Size in	Bottom Girt No.	Mid Girt Bolt Size in	Mid Girt No.	Long Horizontal Bolt Size in	Long Horizontal No.	Short Horizontal Bolt Size in	Short Horizontal No.
T1 140'-120'	Flange	0.63 A325N	4	0.50 A325N	1	0.50 A325N	1	0.50 A325N	0	0.50 A325N	0	0.50 A325N	0	0.50 A325N	0

Tower Elevation ft	Leg Connection Type	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
		Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.
T2 120'-100'	Flange	0.75 A325N	4	0.50 A325N	1	0.50 A325N	1	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0
T3 100'-80'	Flange	0.88 A325N	4	0.50 A325N	1	0.50 A325N	0	0.00 A325N	0	0.50 A325N	0	0.50 A325N	0	0.50 A325N	0
T4 80'-60'	Flange	0.88 A325N	4	0.50 A325N	1	0.50 A325N	0	0.50 A325N	0	0.50 A325N	0	0.50 A325N	0	0.50 A325N	0
T5 60'-40'	Flange	1.00 A325N	4	0.50 A325N	1	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0
T6 40'-20'	Flange	1.00 A325N	4	0.63 A325N	1	0.63 A325N	0	0.00 A325N	0	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0
T7 20'-0'	Flange	1.00 A449	4	0.63 A325N	1	0.63 A325N	0	0.00 A325N	0	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
LDF6-50A(1-1/4") ***	A	Yes	Ar (CfAe)	101' - 8'	0.00	0.3	12	6	1.00	1.55		0.66
LDF4-50A(1/2") ***	C	Yes	Ar (CfAe)	60' - 8'	0.00	0.45	1	1	0.63	0.63		0.15
LDF7-50A(1-5/8")	B	Yes	Ar (CfAe)	124' - 8'	0.00	-0.05	6	6	1.00	1.98		0.82
LDF4-50A(1/2") ***	B	Yes	Ar (CfAe)	50' - 8'	0.00	-0.15	1	1	0.63	0.63		0.15
HB158-1-08U8-S8J18(1-5/8)	C	Yes	Ar (CfAe)	137' - 8'	0.00	0.455	1	1	1.00	1.98		1.30
HB158-1-08U8-S8J18(1-5/8)	C	Yes	Ar (CfAe)	137' - 8'	0.00	0.4	1	1	1.00	1.98		1.30
LDF7-50A(1-5/8") *** ***	C	Yes	Ar (CfAe)	137' - 8'	0.00	0.42	12	6	1.00	1.98		0.82
Feedline Ladder (Af)	A	Yes	Af (CfAe)	101' - 8'	0.00	0.3	1	1	3.00	3.00	12.00	8.40
Feedline Ladder (Af)	A	Yes	Af (CfAe)	60' - 8'	0.00	-0.45	1	1	3.00	3.00	12.00	8.40
Feedline Ladder (Af)	B	Yes	Af (CfAe)	124' - 8'	0.00	-0.15	1	1	3.00	3.00	12.00	8.40
Feedline Ladder (Af)	C	Yes	Af (CfAe)	137' - 8'	0.00	0.42	1	1	3.00	3.00	12.00	8.40
Feedline Ladder (Af) ***	C	Yes	Af (CfAe)	112' - 8'	0.00	-0.4	1	1	3.00	3.00	12.00	8.40
Safety Line 3/8	A	Yes	Ar (CfAe)	140' - 0'	0.00	0	1	1	0.38	0.38		0.22

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
T1	140'-120'	A	0.625	0.000	0.000	0.000	0.00
		B	3.960	1.000	0.000	0.000	0.05
		C	22.440	4.250	0.000	0.000	0.35
T2	120'-100'	A	1.400	0.250	0.000	0.000	0.02
		B	19.800	5.000	0.000	0.000	0.27
		C	26.400	8.000	0.000	0.000	0.52
T3	100'-80'	A	16.125	5.000	0.000	0.000	0.33
		B	19.800	5.000	0.000	0.000	0.27
		C	26.400	10.000	0.000	0.000	0.58
T4	80'-60'	A	16.125	5.000	0.000	0.000	0.33
		B	19.800	5.000	0.000	0.000	0.27
		C	26.400	10.000	0.000	0.000	0.58
T5	60'-40'	A	16.125	10.000	0.000	0.000	0.50
		B	20.325	5.000	0.000	0.000	0.27
		C	27.450	10.000	0.000	0.000	0.59
T6	40'-20'	A	16.125	10.000	0.000	0.000	0.50
		B	20.850	5.000	0.000	0.000	0.27
		C	27.450	10.000	0.000	0.000	0.59
T7	20'-0'	A	9.925	6.000	0.000	0.000	0.30
		B	12.510	3.000	0.000	0.000	0.16
		C	16.470	6.000	0.000	0.000	0.35

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
T1	140'-120'	A	1.179	4.554	0.000	0.000	0.000	0.05
		B		1.446	6.491	0.000	0.000	0.18
		C		18.435	27.585	0.000	0.000	1.30
T2	120'-100'	A	1.155	4.798	1.441	0.000	0.000	0.10
		B		7.151	32.401	0.000	0.000	0.88
		C		21.454	36.942	0.000	0.000	1.70
T3	100'-80'	A	1.128	10.728	28.757	0.000	0.000	1.13
		B		7.060	32.340	0.000	0.000	0.87
		C		21.179	39.846	0.000	0.000	1.80
T4	80'-60'	A	1.094	10.505	28.682	0.000	0.000	1.11
		B		6.948	32.265	0.000	0.000	0.85
		C		20.844	39.697	0.000	0.000	1.77
T5	60'-40'	A	1.051	10.216	35.922	0.000	0.000	1.39
		B		9.081	32.169	0.000	0.000	0.85
		C		24.965	39.505	0.000	0.000	1.78
T6	40'-20'	A	1.000	9.875	35.694	0.000	0.000	1.35
		B		11.017	32.056	0.000	0.000	0.85
		C		24.283	39.278	0.000	0.000	1.73
T7	20'-0'	A	1.000	7.508	21.417	0.000	0.000	0.83
		B		6.610	19.233	0.000	0.000	0.51
		C		14.570	23.567	0.000	0.000	1.04

Feed Line Shielding

Section	Elevation	Face	A_R	A_R Ice	A_F	A_F Ice
	ft		ft^2	ft^2	ft^2	ft^2
T1	140'-120'	A	0.000	0.569	0.059	0.427
		B	0.000	1.025	0.465	0.769
		C	0.000	5.890	2.504	4.421
T2	120'-100'	A	0.000	0.644	0.129	0.494
		B	0.000	4.170	1.943	3.200
		C	0.000	6.172	2.696	4.737
T3	100'-80'	A	0.000	2.799	1.287	2.482
		B	0.000	2.793	1.511	2.476
		C	0.000	4.365	2.217	3.870
T4	80'-60'	A	0.000	2.549	1.522	2.911
		B	0.000	2.551	1.787	2.913
		C	0.000	3.973	2.623	4.537
T5	60'-40'	A	0.000	2.834	2.179	4.044
		B	0.000	2.480	2.113	3.538
		C	0.000	3.905	3.124	5.573
T6	40'-20'	A	0.000	1.887	1.547	2.830
		B	0.000	1.744	1.531	2.617
		C	0.000	2.597	2.218	3.896
T7	20'-0'	A	0.000	1.157	0.913	1.735
		B	0.000	1.013	0.889	1.520
		C	0.000	1.509	1.288	2.263

Feed Line Center of Pressure

Section	Elevation	CP_X	CP_Z	CP_X Ice	CP_Z Ice
	ft	in	in	in	in
T1	140'-120'	-8.15	5.74	-5.47	3.41
T2	120'-100'	-4.67	3.44	-3.99	2.56
T3	100'-80'	-6.03	-1.93	-5.39	-1.06
T4	80'-60'	-6.37	-2.09	-5.89	-1.22
T5	60'-40'	-8.47	-1.06	-8.30	-0.22
T6	40'-20'	-9.87	-1.39	-9.93	-0.73
T7	20'-0'	-7.71	-1.13	-8.01	-0.75

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
Lightning Rod	C	From Leg	0.00 0' 2'	0.000	140'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.25 0.66 0.97 1.49 2.68	0.25 0.66 0.97 1.49 2.68	0.03 0.03 0.04 0.06 0.14
***									
(2) FD9R6004/2C-3L	A	From Leg	4.00	0.000	137'	No Ice	0.37	0.08	0.00

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
			0'			1/2" Ice	0.45	0.14	0.01
			0'			1" Ice	0.54	0.20	0.01
						2" Ice	0.75	0.34	0.02
						4" Ice	1.28	0.74	0.06
(2) FD9R6004/2C-3L	B	From Leg	4.00	0.000	137'	No Ice	0.37	0.08	0.00
			0'			1/2" Ice	0.45	0.14	0.01
			0'			1" Ice	0.54	0.20	0.01
						2" Ice	0.75	0.34	0.02
						4" Ice	1.28	0.74	0.06
(2) FD9R6004/2C-3L	C	From Leg	4.00	0.000	137'	No Ice	0.37	0.08	0.00
			0'			1/2" Ice	0.45	0.14	0.01
			0'			1" Ice	0.54	0.20	0.01
						2" Ice	0.75	0.34	0.02
						4" Ice	1.28	0.74	0.06
Sector Mount [SM 506-3]	C	None		0.000	137'	No Ice	35.47	35.47	1.74
						1/2" Ice	50.60	50.60	2.35
						1" Ice	65.73	65.73	2.95
						2" Ice	95.99	95.99	4.16
						4" Ice	156.51	156.51	6.59
(2) HBXX-6517DS-VTM w/ Mount Pipe	A	From Leg	4.00	0.000	137'	No Ice	8.98	6.96	0.07
			0'			1/2" Ice	9.65	8.18	0.14
			2'			1" Ice	10.29	9.14	0.21
						2" Ice	11.59	11.02	0.40
						4" Ice	14.32	15.03	0.91
(2) HBXX-6517DS-VTM w/ Mount Pipe	B	From Leg	4.00	0.000	137'	No Ice	8.98	6.96	0.07
			0'			1/2" Ice	9.65	8.18	0.14
			2'			1" Ice	10.29	9.14	0.21
						2" Ice	11.59	11.02	0.40
						4" Ice	14.32	15.03	0.91
(2) HBXX-6517DS-VTM w/ Mount Pipe	C	From Leg	4.00	0.000	137'	No Ice	8.98	6.96	0.07
			0'			1/2" Ice	9.65	8.18	0.14
			2'			1" Ice	10.29	9.14	0.21
						2" Ice	11.59	11.02	0.40
						4" Ice	14.32	15.03	0.91
LNX-6514DS-VTM w/ Mount Pipe	A	From Leg	4.00	0.000	137'	No Ice	8.57	7.00	0.06
			0'			1/2" Ice	9.22	8.19	0.13
			2'			1" Ice	9.84	9.08	0.20
						2" Ice	11.10	10.90	0.38
						4" Ice	13.75	14.93	0.89
LNX-6514DS-VTM w/ Mount Pipe	B	From Leg	4.00	0.000	137'	No Ice	8.57	7.00	0.06
			0'			1/2" Ice	9.22	8.19	0.13
			2'			1" Ice	9.84	9.08	0.20
						2" Ice	11.10	10.90	0.38
						4" Ice	13.75	14.93	0.89
LNX-6514DS-VTM w/ Mount Pipe	C	From Leg	4.00	0.000	137'	No Ice	8.57	7.00	0.06
			0'			1/2" Ice	9.22	8.19	0.13
			2'			1" Ice	9.84	9.08	0.20
						2" Ice	11.10	10.90	0.38
						4" Ice	13.75	14.93	0.89
LNX-8513DS-A1M w/ Mount Pipe	A	From Leg	4.00	0.000	137'	No Ice	8.65	7.08	0.06
			0'			1/2" Ice	9.31	8.27	0.13
			2'			1" Ice	9.93	9.18	0.21
						2" Ice	11.20	11.02	0.39
						4" Ice	13.87	15.06	0.90
LNX-8513DS-A1M w/ Mount Pipe	B	From Leg	4.00	0.000	137'	No Ice	8.65	7.08	0.06
			0'			1/2" Ice	9.31	8.27	0.13
			2'			1" Ice	9.93	9.18	0.21

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
						2" Ice	11.20	11.02	0.39
						4" Ice	13.87	15.06	0.90
LNX-8513DS-A1M w/ Mount Pipe	C	From Leg	4.00 0' 2'	0.000	137'	No Ice	8.65	7.08	0.06
						1/2" Ice	9.31	8.27	0.13
						1" Ice	9.93	9.18	0.21
						2" Ice	11.20	11.02	0.39
						4" Ice	13.87	15.06	0.90
RRH2X60-AWS	C	From Leg	4.00 0' 2'	0.000	137'	No Ice	2.19	1.43	0.04
						1/2" Ice	2.40	1.61	0.06
						1" Ice	2.61	1.80	0.08
						2" Ice	3.07	2.21	0.13
						4" Ice	4.09	3.13	0.26
RRH2X60-AWS	B	From Leg	4.00 0' 2'	0.000	137'	No Ice	2.19	1.43	0.04
						1/2" Ice	2.40	1.61	0.06
						1" Ice	2.61	1.80	0.08
						2" Ice	3.07	2.21	0.13
						4" Ice	4.09	3.13	0.26
RRH2X60-AWS	A	From Leg	4.00 0' 2'	0.000	137'	No Ice	2.19	1.43	0.04
						1/2" Ice	2.40	1.61	0.06
						1" Ice	2.61	1.80	0.08
						2" Ice	3.07	2.21	0.13
						4" Ice	4.09	3.13	0.26
RRH2X60-PCS	A	From Leg	4.00 0' 2'	0.000	137'	No Ice	2.57	2.01	0.06
						1/2" Ice	2.79	2.22	0.08
						1" Ice	3.02	2.43	0.10
						2" Ice	3.52	2.89	0.16
						4" Ice	4.61	3.92	0.31
RRH2X60-PCS	B	From Leg	4.00 0' 2'	0.000	137'	No Ice	2.57	2.01	0.06
						1/2" Ice	2.79	2.22	0.08
						1" Ice	3.02	2.43	0.10
						2" Ice	3.52	2.89	0.16
						4" Ice	4.61	3.92	0.31
RRH2X60-PCS	C	From Leg	4.00 0' 2'	0.000	137'	No Ice	2.57	2.01	0.06
						1/2" Ice	2.79	2.22	0.08
						1" Ice	3.02	2.43	0.10
						2" Ice	3.52	2.89	0.16
						4" Ice	4.61	3.92	0.31
DB-T1-6Z-8AB-0Z	A	From Leg	4.00 0' 2'	0.000	137'	No Ice	5.60	2.33	0.04
						1/2" Ice	5.92	2.56	0.08
						1" Ice	6.24	2.79	0.12
						2" Ice	6.91	3.28	0.21
						4" Ice	8.37	4.37	0.45
DB-T1-6Z-8AB-0Z	B	From Leg	4.00 0' 2'	0.000	137'	No Ice	5.60	2.33	0.04
						1/2" Ice	5.92	2.56	0.08
						1" Ice	6.24	2.79	0.12
						2" Ice	6.91	3.28	0.21
						4" Ice	8.37	4.37	0.45
***									
(2) DB980H90E-M w/ Mount Pipe	A	From Leg	4.00 0' 1'	0.000	124'	No Ice	4.04	3.62	0.03
						1/2" Ice	4.50	4.48	0.07
						1" Ice	4.95	5.22	0.11
						2" Ice	5.87	6.74	0.22
						4" Ice	8.05	10.00	0.55
(2) DB980H90E-M w/ Mount Pipe	B	From Leg	4.00 0' 1'	0.000	124'	No Ice	4.04	3.62	0.03
						1/2" Ice	4.50	4.48	0.07
						1" Ice	4.95	5.22	0.11
						2" Ice	5.87	6.74	0.22

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
						4" Ice	8.05	10.00	0.55
(2) DB980H90E-M w/ Mount Pipe	C	From Leg	4.00 0' 1'	0.000	124'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	4.04 4.50 4.95 5.87 8.05	3.62 4.48 5.22 6.74 10.00	0.03 0.07 0.11 0.22 0.55
Sector Mount [SM 502-3]	C	None		0.000	124'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	33.02 47.36 61.70 90.38 147.74	33.02 47.36 61.70 90.38 147.74	1.67 2.22 2.77 3.88 6.08
7'x2" Antenna Mount Pipe	A	From Face	4.00 0' 0'	0.000	124'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	1.66 2.39 2.83 3.71 5.58	1.66 2.39 2.83 3.71 5.58	0.03 0.04 0.06 0.10 0.27
7'x2" Antenna Mount Pipe	B	From Face	4.00 0' 0'	0.000	124'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	1.66 2.39 2.83 3.71 5.58	1.66 2.39 2.83 3.71 5.58	0.03 0.04 0.06 0.10 0.27
7'x2" Antenna Mount Pipe	C	From Face	4.00 0' 0'	0.000	124'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	1.66 2.39 2.83 3.71 5.58	1.66 2.39 2.83 3.71 5.58	0.03 0.04 0.06 0.10 0.27
***									
***									
RR90-17-00DP w/ Mount Pipe	A	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	4.59 5.09 5.58 6.59 8.73	3.32 4.09 4.78 6.23 9.31	0.03 0.07 0.12 0.22 0.56
RR90-17-00DP w/ Mount Pipe	B	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	4.59 5.09 5.58 6.59 8.73	3.32 4.09 4.78 6.23 9.31	0.03 0.07 0.12 0.22 0.56
RR90-17-00DP w/ Mount Pipe	C	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	4.59 5.09 5.58 6.59 8.73	3.32 4.09 4.78 6.23 9.31	0.03 0.07 0.12 0.22 0.56
KRY 112 13/1	A	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.33 0.42 0.51 0.72 1.25	0.24 0.32 0.40 0.60 1.09	0.00 0.01 0.01 0.02 0.07
KRY 112 13/1	B	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.33 0.42 0.51 0.72 1.25	0.24 0.32 0.40 0.60 1.09	0.00 0.01 0.01 0.02 0.07
KRY 112 13/1	C	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice	0.33 0.42 0.51 0.72	0.24 0.32 0.40 0.60	0.00 0.01 0.01 0.02

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
						4" Ice	1.25	1.09	0.07
LNX-6515DS-VTM w/ Mount Pipe	A	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	11.68 12.40 13.14 14.60 17.87	9.84 11.37 12.91 15.27 20.14	0.08 0.17 0.27 0.51 1.15
LNX-6515DS-VTM w/ Mount Pipe	B	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	11.68 12.40 13.14 14.60 17.87	9.84 11.37 12.91 15.27 20.14	0.08 0.17 0.27 0.51 1.15
LNX-6515DS-VTM w/ Mount Pipe	C	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	11.68 12.40 13.14 14.60 17.87	9.84 11.37 12.91 15.27 20.14	0.08 0.17 0.27 0.51 1.15
ATBT-BOTTOM-24V	A	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.12 0.17 0.23 0.38 0.77	0.08 0.12 0.17 0.30 0.67	0.00 0.00 0.01 0.01 0.04
ATBT-BOTTOM-24V	B	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.12 0.17 0.23 0.38 0.77	0.08 0.12 0.17 0.30 0.67	0.00 0.00 0.01 0.01 0.04
ATBT-BOTTOM-24V	C	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.12 0.17 0.23 0.38 0.77	0.08 0.12 0.17 0.30 0.67	0.00 0.00 0.01 0.01 0.04
Side Arm Mount [SO 304-3]	C	None		0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	1.76 2.75 3.74 5.72 9.68	1.76 2.75 3.74 5.72 9.68	0.07 0.10 0.12 0.18 0.28
***									
GPS_A	A	From Leg	2.00 0' 0'	0.000	60'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.30 0.37 0.46 0.65 1.15	0.30 0.37 0.46 0.65 1.15	0.00 0.00 0.01 0.02 0.08
Side Arm Mount [SO 305-1]	A	From Leg	1.00 0' 0'	0.000	60'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.94 1.48 2.02 3.10 5.26	1.41 2.17 2.93 4.45 7.49	0.03 0.04 0.06 0.08 0.14
***									
GPS	A	From Leg	2.00 0' 0'	0.000	50'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.17 0.24 0.31 0.48 0.92	0.17 0.24 0.31 0.48 0.92	0.00 0.00 0.00 0.01 0.05
Side Arm Mount [SO 201-1]	A	From Leg	1.00 0' 0'	0.000	50'	No Ice 1/2" Ice 1" Ice 2" Ice	2.96 4.10 5.24 7.52	2.11 2.93 3.75 5.39	0.10 0.12 0.14 0.18

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
***						4" Ice	12.08	8.67	0.26

Force Totals

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Leg Weight	5.72					
Bracing Weight	5.58					
Total Member Self-Weight	11.30			0.19	10.24	
Total Weight	23.85			0.19	10.24	
Wind 0 deg - No Ice		-0.04	-27.50	-2361.51	16.49	-11.35
Wind 30 deg - No Ice		12.98	-22.58	-1962.79	-1115.73	-9.63
Wind 60 deg - No Ice		22.12	-12.77	-1114.30	-1919.84	-6.04
Wind 90 deg - No Ice		26.03	0.04	6.43	-2252.51	-1.10
Wind 120 deg - No Ice		23.79	13.79	1186.45	-2031.66	4.71
Wind 150 deg - No Ice		13.06	22.62	1969.42	-1126.54	8.53
Wind 180 deg - No Ice		0.04	25.62	2239.97	4.00	10.19
Wind 210 deg - No Ice		-12.98	22.58	1963.17	1136.21	9.63
Wind 240 deg - No Ice		-23.75	13.71	1175.63	2045.91	6.65
Wind 270 deg - No Ice		-26.03	-0.04	-6.05	2272.99	1.10
Wind 300 deg - No Ice		-22.16	-12.85	-1125.11	1946.57	-4.15
Wind 330 deg - No Ice		-13.06	-22.62	-1969.03	1147.02	-8.53
Member Ice	12.75					
Total Weight Ice	58.83			-0.95	38.21	
Wind 0 deg - Ice		-0.01	-8.19	-713.89	39.51	-3.14
Wind 30 deg - Ice		3.83	-6.66	-587.71	-299.01	-2.61
Wind 60 deg - Ice		6.50	-3.75	-333.19	-537.17	-1.62
Wind 90 deg - Ice		7.68	0.01	0.35	-638.49	-0.27
Wind 120 deg - Ice		7.09	4.10	356.65	-578.50	1.34
Wind 150 deg - Ice		3.85	6.66	587.11	-301.27	2.34
Wind 180 deg - Ice		0.01	7.52	665.78	36.91	2.76
Wind 210 deg - Ice		-3.83	6.66	585.81	375.43	2.61
Wind 240 deg - Ice		-7.08	4.09	354.39	653.62	1.80
Wind 270 deg - Ice		-7.68	-0.01	-2.25	714.91	0.27
Wind 300 deg - Ice		-6.51	-3.77	-335.44	614.89	-1.15
Wind 330 deg - Ice		-3.85	-6.66	-589.01	377.69	-2.34
Total Weight	23.85			0.19	10.24	
Wind 0 deg - Service		-0.02	-9.52	-818.41	1.99	-3.93
Wind 30 deg - Service		4.49	-7.81	-680.45	-389.78	-3.33
Wind 60 deg - Service		7.65	-4.42	-386.85	-668.02	-2.09
Wind 90 deg - Service		9.01	0.02	0.95	-783.13	-0.38
Wind 120 deg - Service		8.23	4.77	409.26	-706.71	1.63
Wind 150 deg - Service		4.52	7.83	680.18	-393.52	2.95
Wind 180 deg - Service		0.02	8.87	773.80	-2.33	3.53
Wind 210 deg - Service		-4.49	7.81	678.02	389.44	3.33
Wind 240 deg - Service		-8.22	4.75	405.51	704.21	2.30
Wind 270 deg - Service		-9.01	-0.02	-3.37	782.79	0.38
Wind 300 deg - Service		-7.67	-4.45	-390.59	669.84	-1.44

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Wind 330 deg - Service		-4.52	-7.83	-682.61	393.18	-2.95

Load Combinations

Comb. No.	Description
1	Dead Only
2	Dead+Wind 0 deg - No Ice
3	Dead+Wind 30 deg - No Ice
4	Dead+Wind 60 deg - No Ice
5	Dead+Wind 90 deg - No Ice
6	Dead+Wind 120 deg - No Ice
7	Dead+Wind 150 deg - No Ice
8	Dead+Wind 180 deg - No Ice
9	Dead+Wind 210 deg - No Ice
10	Dead+Wind 240 deg - No Ice
11	Dead+Wind 270 deg - No Ice
12	Dead+Wind 300 deg - No Ice
13	Dead+Wind 330 deg - No Ice
14	Dead+Ice+Temp
15	Dead+Wind 0 deg+Ice+Temp
16	Dead+Wind 30 deg+Ice+Temp
17	Dead+Wind 60 deg+Ice+Temp
18	Dead+Wind 90 deg+Ice+Temp
19	Dead+Wind 120 deg+Ice+Temp
20	Dead+Wind 150 deg+Ice+Temp
21	Dead+Wind 180 deg+Ice+Temp
22	Dead+Wind 210 deg+Ice+Temp
23	Dead+Wind 240 deg+Ice+Temp
24	Dead+Wind 270 deg+Ice+Temp
25	Dead+Wind 300 deg+Ice+Temp
26	Dead+Wind 330 deg+Ice+Temp
27	Dead+Wind 0 deg - Service
28	Dead+Wind 30 deg - Service
29	Dead+Wind 60 deg - Service
30	Dead+Wind 90 deg - Service
31	Dead+Wind 120 deg - Service
32	Dead+Wind 150 deg - Service
33	Dead+Wind 180 deg - Service
34	Dead+Wind 210 deg - Service
35	Dead+Wind 240 deg - Service
36	Dead+Wind 270 deg - Service
37	Dead+Wind 300 deg - Service
38	Dead+Wind 330 deg - Service

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
T1	140 - 120	Leg	Max Tension	8	16.52	0.01	-0.01
			Max. Compression	6	-19.96	0.08	-0.01
			Max. Mx	2	-2.22	-0.80	-0.01

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. My	9	-1.01	0.01	-0.85
			Max. Vy	6	-1.39	0.59	0.01
			Max. Vx	9	-1.36	0.01	0.51
		Diagonal	Max Tension	5	3.40	0.00	0.00
			Max. Compression	11	-3.50	0.00	0.00
			Max. Mx	23	0.79	0.02	-0.00
			Max. My	7	-2.35	0.00	0.01
			Max. Vy	23	-0.02	0.02	-0.00
			Max. Vx	7	-0.00	0.00	0.00
		Top Girt	Max Tension	8	0.53	0.00	0.00
			Max. Compression	6	-0.50	0.00	0.00
			Max. Mx	14	0.01	-0.04	0.00
			Max. My	26	0.01	0.00	0.00
			Max. Vy	14	0.02	0.00	0.00
			Max. Vx	26	-0.00	0.00	0.00
T2	120 - 100	Leg	Max Tension	8	38.17	-0.11	-0.01
			Max. Compression	6	-44.13	0.29	-0.01
			Max. Mx	6	-44.13	0.29	-0.01
			Max. My	7	-2.96	0.00	-0.22
			Max. Vy	4	0.43	-0.29	0.00
			Max. Vx	7	0.40	0.00	-0.22
		Diagonal	Max Tension	5	3.09	0.00	0.00
			Max. Compression	5	-3.09	0.00	0.00
			Max. Mx	23	0.82	0.02	0.00
			Max. My	11	-3.03	-0.00	0.00
			Max. Vy	21	0.02	0.02	0.00
			Max. Vx	15	-0.00	0.00	0.00
		Top Girt	Max Tension	4	0.06	0.00	0.00
			Max. Compression	10	-0.09	0.00	0.00
			Max. Mx	14	-0.01	-0.04	0.00
			Max. My	15	0.00	0.00	0.00
			Max. Vy	14	0.02	0.00	0.00
			Max. Vx	15	-0.00	0.00	0.00
T3	100 - 80	Leg	Max Tension	12	58.40	-0.14	0.00
			Max. Compression	2	-66.75	0.13	0.02
			Max. Mx	6	-50.85	0.29	-0.01
			Max. My	7	-3.06	0.00	-0.22
			Max. Vy	4	-0.07	-0.29	0.00
			Max. Vx	13	-0.06	-0.01	0.21
		Diagonal	Max Tension	5	3.85	0.00	0.00
			Max. Compression	5	-3.94	0.00	0.00
			Max. Mx	25	0.95	0.03	-0.00
			Max. My	26	-0.51	0.03	0.00
			Max. Vy	25	0.03	0.03	-0.00
			Max. Vx	26	0.00	0.00	0.00
T4	80 - 60	Leg	Max Tension	12	77.51	-0.14	0.00
			Max. Compression	2	-88.78	0.24	0.02
			Max. Mx	6	-88.61	0.24	-0.01
			Max. My	13	-4.34	-0.01	0.23
			Max. Vy	19	-0.05	0.22	-0.00
			Max. Vx	13	-0.06	-0.01	0.23
		Diagonal	Max Tension	3	4.10	0.00	0.00
			Max. Compression	3	-4.19	0.00	0.00
			Max. Mx	23	1.00	0.06	0.01
			Max. My	15	-0.17	0.06	0.01
			Max. Vy	25	0.04	0.06	-0.01
			Max. Vx	15	0.00	0.00	0.00
T5	60 - 40	Leg	Max Tension	12	94.98	-0.21	-0.01
			Max. Compression	2	-109.79	0.32	0.02
			Max. Mx	17	13.93	-0.54	0.00
			Max. My	11	-4.98	-0.01	-0.28

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Vy	17	0.14	-0.54	0.00
			Max. Vx	2	0.07	-0.12	0.26
		Diagonal	Max Tension	3	4.48	0.00	0.00
			Max. Compression	3	-4.54	0.00	0.00
			Max. Mx	23	0.96	0.09	0.01
			Max. My	21	-0.68	0.05	-0.01
			Max. Vy	25	0.05	0.09	-0.01
			Max. Vx	21	-0.00	0.00	0.00
T6	40 - 20	Leg	Max Tension	12	110.55	-0.33	0.01
			Max. Compression	2	-128.63	0.54	0.03
			Max. Mx	17	15.59	-0.96	0.00
			Max. My	13	-6.54	-0.05	0.66
			Max. Vy	17	0.18	-0.96	0.00
			Max. Vx	13	0.13	-0.05	0.66
		Diagonal	Max Tension	3	5.35	0.00	0.00
			Max. Compression	3	-5.52	0.00	0.00
			Max. Mx	25	0.62	0.11	0.01
			Max. My	21	-1.67	0.09	-0.01
			Max. Vy	25	0.05	0.09	-0.01
			Max. Vx	21	0.00	0.00	0.00
T7	20 - 0	Leg	Max Tension	12	131.41	0.58	-0.01
			Max. Compression	2	-154.37	0.00	-0.00
			Max. Mx	17	18.70	-0.96	0.00
			Max. My	13	-7.77	-0.05	0.94
			Max. Vy	6	-8.14	0.00	0.00
			Max. Vx	7	2.22	0.00	0.00
		Diagonal	Max Tension	3	5.68	0.00	0.00
			Max. Compression	3	-5.88	0.00	0.00
			Max. Mx	25	0.27	0.16	0.02
			Max. My	21	-2.23	0.15	-0.02
			Max. Vy	25	0.07	0.16	0.02
			Max. Vx	21	0.00	0.00	0.00

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Leg C	Max. Vert	10	153.55	14.43	-8.57
	Max. H_x	10	153.55	14.43	-8.57
	Max. H_z	3	-112.22	-10.41	7.47
	Min. Vert	4	-129.01	-12.49	7.42
	Min. H_x	4	-129.01	-12.49	7.42
	Min. H_z	10	153.55	14.43	-8.57
Leg B	Max. Vert	6	153.12	-14.63	-8.28
	Max. H_x	12	-130.78	12.71	7.19
	Max. H_z	12	-130.78	12.71	7.19
	Min. Vert	12	-130.78	12.71	7.19
	Min. H_x	6	153.12	-14.63	-8.28
	Min. H_z	6	153.12	-14.63	-8.28
Leg A	Max. Vert	2	153.66	-0.36	16.82
	Max. H_x	10	-64.59	1.99	-7.54
	Max. H_z	2	153.66	-0.36	16.82
	Min. Vert	8	-130.26	0.31	-14.59
	Min. H_x	5	7.55	-1.99	0.53
	Min. H_z	8	-130.26	0.31	-14.59

Tower Mast Reaction Summary

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	K	K	K	kip-ft	kip-ft	kip-ft
Dead Only	23.85	-0.00	-0.00	0.19	10.24	-0.00
Dead+Wind 0 deg - No Ice	23.85	-0.04	-27.50	-2368.72	16.56	-11.40
Dead+Wind 30 deg - No Ice	23.85	12.97	-22.57	-1968.81	-1119.06	-9.66
Dead+Wind 60 deg - No Ice	23.85	22.11	-12.77	-1117.67	-1925.65	-6.06
Dead+Wind 90 deg - No Ice	23.85	26.03	0.05	6.52	-2259.37	-1.09
Dead+Wind 120 deg - No Ice	23.85	23.79	13.79	1190.09	-2037.86	4.74
Dead+Wind 150 deg - No Ice	23.85	13.05	22.61	1975.41	-1130.01	8.57
Dead+Wind 180 deg - No Ice	23.85	0.04	25.61	2246.77	4.03	10.23
Dead+Wind 210 deg - No Ice	23.85	-12.98	22.57	1969.12	1139.73	9.66
Dead+Wind 240 deg - No Ice	23.85	-23.74	13.71	1179.22	2052.15	6.67
Dead+Wind 270 deg - No Ice	23.85	-26.03	-0.04	-6.01	2279.91	1.10
Dead+Wind 300 deg - No Ice	23.85	-22.15	-12.85	-1128.51	1952.47	-4.17
Dead+Wind 330 deg - No Ice	23.85	-13.05	-22.62	-1975.06	1150.48	-8.57
Dead+Ice+Temp	58.83	0.00	-0.00	-0.93	38.42	-0.00
Dead+Wind 0 deg+Ice+Temp	58.83	-0.01	-8.19	-719.73	39.83	-3.19
Dead+Wind 30 deg+Ice+Temp	58.83	3.83	-6.65	-592.54	-301.51	-2.65
Dead+Wind 60 deg+Ice+Temp	58.83	6.50	-3.75	-335.91	-541.65	-1.63
Dead+Wind 90 deg+Ice+Temp	58.83	7.68	0.01	0.40	-643.80	-0.26
Dead+Wind 120 deg+Ice+Temp	58.83	7.09	4.10	359.63	-583.27	1.38
Dead+Wind 150 deg+Ice+Temp	58.83	3.85	6.66	592.03	-303.79	2.39
Dead+Wind 180 deg+Ice+Temp	58.83	0.01	7.52	671.35	37.20	2.81
Dead+Wind 210 deg+Ice+Temp	58.83	-3.83	6.65	590.71	378.53	2.65
Dead+Wind 240 deg+Ice+Temp	58.83	-7.08	4.09	357.35	658.98	1.82
Dead+Wind 270 deg+Ice+Temp	58.83	-7.68	-0.01	-2.23	720.82	0.26
Dead+Wind 300 deg+Ice+Temp	58.83	-6.51	-3.77	-338.18	619.98	-1.18
Dead+Wind 330 deg+Ice+Temp	58.83	-3.85	-6.66	-593.86	380.80	-2.39
Dead+Wind 0 deg - Service	23.85	-0.02	-9.51	-819.50	12.44	-3.94
Dead+Wind 30 deg - Service	23.85	4.49	-7.81	-681.12	-380.52	-3.34
Dead+Wind 60 deg - Service	23.85	7.65	-4.42	-386.62	-659.62	-2.10
Dead+Wind 90 deg - Service	23.85	9.01	0.02	2.37	-775.08	-0.38
Dead+Wind 120 deg - Service	23.85	8.23	4.77	411.92	-698.43	1.64
Dead+Wind 150 deg - Service	23.85	4.52	7.82	683.67	-384.29	2.97
Dead+Wind 180 deg - Service	23.85	0.02	8.86	777.58	8.11	3.54
Dead+Wind 210 deg - Service	23.85	-4.49	7.81	681.50	401.08	3.34
Dead+Wind 240 deg - Service	23.85	-8.21	4.74	408.16	716.80	2.31
Dead+Wind 270 deg - Service	23.85	-9.01	-0.02	-1.97	795.63	0.38
Dead+Wind 300 deg - Service	23.85	-7.67	-4.45	-390.37	682.33	-1.44
Dead+Wind 330 deg - Service	23.85	-4.52	-7.83	-683.29	404.82	-2.97

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX	PY	PZ	PX	PY	PZ	% Error
	K	K	K	K	K	K	
1	0.00	-23.85	0.00	0.00	23.85	0.00	0.000%
2	-0.04	-23.85	-27.50	0.04	23.85	27.50	0.014%
3	12.98	-23.85	-22.58	-12.97	23.85	22.57	0.022%
4	22.12	-23.85	-12.77	-22.11	23.85	12.77	0.028%
5	26.03	-23.85	0.04	-26.03	23.85	-0.05	0.022%
6	23.79	-23.85	13.79	-23.79	23.85	-13.79	0.013%
7	13.06	-23.85	22.62	-13.05	23.85	-22.61	0.022%
8	0.04	-23.85	25.62	-0.04	23.85	-25.61	0.028%

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
9	-12.98	-23.85	22.58	12.98	23.85	-22.57	0.022%
10	-23.75	-23.85	13.71	23.74	23.85	-13.71	0.014%
11	-26.03	-23.85	-0.04	26.03	23.85	0.04	0.022%
12	-22.16	-23.85	-12.85	22.15	23.85	12.85	0.028%
13	-13.06	-23.85	-22.62	13.05	23.85	22.62	0.022%
14	0.00	-58.83	0.00	-0.00	58.83	0.00	0.001%
15	-0.01	-58.83	-8.19	0.01	58.83	8.19	0.002%
16	3.83	-58.83	-6.66	-3.83	58.83	6.65	0.002%
17	6.50	-58.83	-3.75	-6.50	58.83	3.75	0.002%
18	7.68	-58.83	0.01	-7.68	58.83	-0.01	0.002%
19	7.09	-58.83	4.10	-7.09	58.83	-4.10	0.002%
20	3.85	-58.83	6.66	-3.85	58.83	-6.66	0.002%
21	0.01	-58.83	7.52	-0.01	58.83	-7.52	0.002%
22	-3.83	-58.83	6.66	3.83	58.83	-6.65	0.002%
23	-7.08	-58.83	4.09	7.08	58.83	-4.09	0.002%
24	-7.68	-58.83	-0.01	7.68	58.83	0.01	0.002%
25	-6.51	-58.83	-3.77	6.51	58.83	3.77	0.002%
26	-3.85	-58.83	-6.66	3.85	58.83	6.66	0.002%
27	-0.02	-23.85	-9.52	0.02	23.85	9.51	0.009%
28	4.49	-23.85	-7.81	-4.49	23.85	7.81	0.010%
29	7.65	-23.85	-4.42	-7.65	23.85	4.42	0.011%
30	9.01	-23.85	0.02	-9.01	23.85	-0.02	0.010%
31	8.23	-23.85	4.77	-8.23	23.85	-4.77	0.009%
32	4.52	-23.85	7.83	-4.52	23.85	-7.82	0.010%
33	0.02	-23.85	8.87	-0.02	23.85	-8.86	0.011%
34	-4.49	-23.85	7.81	4.49	23.85	-7.81	0.010%
35	-8.22	-23.85	4.75	8.21	23.85	-4.74	0.009%
36	-9.01	-23.85	-0.02	9.01	23.85	0.02	0.010%
37	-7.67	-23.85	-4.45	7.67	23.85	4.45	0.011%
38	-4.52	-23.85	-7.83	4.52	23.85	7.83	0.010%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	6	0.00000001	0.00000001
2	Yes	7	0.00026286	0.00059939
3	Yes	7	0.00028596	0.00065160
4	Yes	7	0.00030685	0.00069856
5	Yes	7	0.00028608	0.00065205
6	Yes	7	0.00026288	0.00059969
7	Yes	7	0.00028730	0.00065393
8	Yes	7	0.00030735	0.00069994
9	Yes	7	0.00028659	0.00065306
10	Yes	7	0.00026288	0.00059925
11	Yes	7	0.00028665	0.00065304
12	Yes	7	0.00030726	0.00069946
13	Yes	7	0.00028722	0.00065346
14	Yes	6	0.00000001	0.00023792
15	Yes	8	0.00000001	0.00060329
16	Yes	8	0.00000001	0.00059689
17	Yes	8	0.00000001	0.00059665
18	Yes	8	0.00000001	0.00059448
19	Yes	8	0.00000001	0.00059959
20	Yes	8	0.00000001	0.00060611
21	Yes	8	0.00000001	0.00061425

22	Yes	8	0.00000001	0.00061395
23	Yes	8	0.00000001	0.00061486
24	Yes	8	0.00000001	0.00061595
25	Yes	8	0.00000001	0.00061764
26	Yes	8	0.00000001	0.00061028
27	Yes	7	0.00000001	0.00061955
28	Yes	7	0.00000001	0.00063662
29	Yes	7	0.00000001	0.00065317
30	Yes	7	0.00000001	0.00063733
31	Yes	7	0.00000001	0.00062037
32	Yes	7	0.00000001	0.00063959
33	Yes	7	0.00000001	0.00065553
34	Yes	7	0.00000001	0.00063849
35	Yes	7	0.00000001	0.00061998
36	Yes	7	0.00000001	0.00063814
37	Yes	7	0.00000001	0.00065456
38	Yes	7	0.00000001	0.00063854

Maximum Tower Deflections - Service Wind

Section No.	*Elevation* *ft*	*Horz. Deflection* *in*	*Gov. Load Comb.*	*Tilt* °	*Twist* °
T1	140 - 120	3.80	35	0.255	0.016
T2	120 - 100	2.75	35	0.225	0.015
T3	100 - 80	1.86	35	0.181	0.012
T4	80 - 60	1.16	35	0.137	0.009
T5	60 - 40	0.65	35	0.095	0.006
T6	40 - 20	0.30	35	0.057	0.004
T7	20 - 0	0.09	35	0.029	0.002

Critical Deflections and Radius of Curvature - Service Wind

Elevation *ft*	*Appurtenance*	*Gov. Load Comb.*	*Deflection* *in*	*Tilt* °	*Twist* °	*Radius of Curvature* *ft*
140'	Lightning Rod	35	3.80	0.255	0.016	94302
137'	(2) FD9R6004/2C-3L	35	3.64	0.251	0.016	94302
124'	(2) DB980H90E-M w/ Mount Pipe	35	2.95	0.232	0.015	29483
101'	RR90-17-00DP w/ Mount Pipe	35	1.90	0.184	0.012	26494
60'	GPS_A	35	0.65	0.095	0.006	28249
50'	GPS	35	0.45	0.075	0.005	32594

Maximum Tower Deflections - Design Wind

Section No.	*Elevation* *ft*	*Horz. Deflection* *in*	*Gov. Load Comb.*	*Tilt* °	*Twist* °
T1	140 - 120	10.93	2	0.731	0.046
T2	120 - 100	7.91	2	0.647	0.043
T3	100 - 80	5.36	2	0.521	0.034

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T4	80 - 60	3.34	2	0.394	0.026
T5	60 - 40	1.86	2	0.273	0.018
T6	40 - 20	0.85	2	0.165	0.012
T7	20 - 0	0.25	2	0.084	0.005

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
140'	Lightning Rod	2	10.93	0.731	0.046	33069
137'	(2) FD9R6004/2C-3L	2	10.46	0.720	0.046	33069
124'	(2) DB980H90E-M w/ Mount Pipe	2	8.49	0.667	0.044	10339
101'	RR90-17-00DP w/ Mount Pipe	2	5.47	0.527	0.035	9245
60'	GPS_A	2	1.86	0.273	0.018	9811
50'	GPS	2	1.30	0.216	0.015	11332

Bolt Design Data

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt K	Allowable Load K	Ratio Load / Allowable	Allowable Ratio	Criteria
T1	140	Leg	A325N	0.63	4	4.00	13.50	0.297 ✔	1.333	Bolt Tension
		Diagonal	A325N	0.50	1	3.40	3.81	0.893 ✔	1.333	Member Block Shear
		Top Girt	A325N	0.50	1	0.53	2.72	0.196 ✔	1.333	Member Bearing
T2	120	Leg	A325N	0.75	4	9.54	19.44	0.491 ✔	1.333	Bolt Tension
		Diagonal	A325N	0.50	1	3.09	3.81	0.812 ✔	1.333	Member Block Shear
		Top Girt	A325N	0.50	1	0.06	2.72	0.023 ✔	1.333	Member Bearing
T3	100	Leg	A325N	0.88	4	14.60	26.46	0.552 ✔	1.333	Bolt Tension
		Diagonal	A325N	0.50	1	3.94	4.12	0.954 ✔	1.333	Bolt Shear
T4	80	Leg	A325N	0.88	4	19.38	26.46	0.732 ✔	1.333	Bolt Tension
		Diagonal	A325N	0.50	1	4.19	4.12	1.017 ✔	1.333	Bolt Shear
T5	60	Leg	A325N	1.00	4	23.74	34.56	0.687 ✔	1.333	Bolt Tension
		Diagonal	A325N	0.50	1	4.54	4.12	1.102 ✔	1.333	Bolt Shear
T6	40	Leg	A325N	1.00	4	27.64	34.56	0.800 ✔	1.333	Bolt Tension
		Diagonal	A325N	0.63	1	5.35	5.10	1.050 ✔	1.333	Member Bearing
T7	20	Leg	A449	1.00	4	32.85	31.10	1.056 ✔	1.333	Bolt Tension
		Diagonal	A325N	0.63	1	5.88	6.44	0.912 ✔	1.333	Bolt Shear

Compression Checks

Leg Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
T1	140 - 120	ROHN 2 STD	20'	4'	61.0 K=1.00	22.55	1.07	-19.97	24.23	0.824 ✔
T2	120 - 100	ROHN 2.5 EH	20'3/8"	5'1/8"	65.0 K=1.00	21.84	2.25	-44.13	49.21	0.897 ✔
T3	100 - 80	ROHN 3 EH	20'3/8"	6'8-5/32"	70.5 K=1.00	20.84	3.02	-66.75	62.85	1.062 ✔
T4	80 - 60	ROHN 3.5 EH	20'3/8"	6'8-5/32"	61.3 K=1.00	22.49	3.68	-88.78	82.72	1.073 ✔
T5	60 - 40	ROHN 4 X-STR	20'15/32"	6'8-5/32"	54.3 K=1.00	23.67	4.41	-109.79	104.33	1.052 ✔
T6	40 - 20	ROHN 5 EH	20'3/8"	10'1/4"	65.4 K=1.00	21.78	6.11	-128.63	133.13	0.966 ✔
T7	20 - 0	ROHN 5 X-STR	20'3/8"	9'11-5/8"	65.1 K=1.00	21.83	6.11	-154.37	133.43	1.157 ✔

Diagonal Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
T1	140 - 120	L1 3/4x1 3/4x3/16	7'8-5/32"	3'7-7/16"	126.6 K=1.00	9.32	0.62	-3.50	5.79	0.604 ✔
T2	120 - 100	L1 3/4x1 3/4x3/16	9'8-3/4"	4'9-1/4"	166.7 K=1.00	5.37	0.62	-3.09	3.34	0.927 ✔
T3	100 - 80	L2x2x3/16	12'3-1/4"	6'23/32"	184.5 K=1.00	4.39	0.71	-3.93	3.14	1.253 ✔
T4	80 - 60	L2 1/2x2 1/2x3/16	14'1/4"	6'10-29/32"	167.6 K=1.00	5.32	0.90	-4.19	4.80	0.874 ✔
T5	60 - 40	L3x3x3/16	15'10-11/16"	7'9-31/32"	157.6 K=1.00	6.01	1.09	-4.54	6.56	0.693 ✔
T6	40 - 20	L3x3x3/16	19'1-3/16"	9'5-13/32"	190.3 K=1.00	4.12	1.09	-5.52	4.49	1.228 ✔
T7	20 - 0	L3x3x1/4	20'9-19/32"	10'3-19/32"	208.8 K=1.00	3.42	1.44	-5.88	4.93	1.192 ✔
		KL/R > 200 (C) - 152								

Top Girt Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
T1	140 - 120	L2x2x1/8	6'6-1/4"	6'1-5/16"	184.6 K=1.00	4.38	0.48	-0.50	2.12	0.237 ✔
T2	120 - 100	L2x2x1/8	6'6-23/32"	6'1-29/32"	185.8 K=1.00	4.32	0.48	-0.09	2.09	0.042 ✔

Tension Checks

Leg Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
T1	140 - 120	ROHN 2 STD	20'	4'	61.0	30.00	1.07	16.01	32.24	0.497 ✔
T2	120 - 100	ROHN 2.5 EH	20'3/8"	5'1/8"	65.0	30.00	2.25	38.17	67.61	0.565 ✔
T3	100 - 80	ROHN 3 EH	20'3/8"	6'8-5/32"	70.5	30.00	3.02	58.40	90.48	0.645 ✔
T4	80 - 60	ROHN 3.5 EH	20'3/8"	6'8-5/32"	61.3	30.00	3.68	77.51	110.35	0.702 ✔
T5	60 - 40	ROHN 4 X-STR	20'15/32"	6'8-5/32"	54.3	30.00	4.41	94.98	132.22	0.718 ✔
T6	40 - 20	ROHN 5 EH	20'3/8"	10'1/4"	65.4	30.00	6.11	110.55	183.36	0.603 ✔
T7	20 - 0	ROHN 5 X-STR	20'3/8"	9'11-5/8"	65.1	30.00	6.11	131.41	183.36	0.717 ✔

Diagonal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
T1	140 - 120	L1 3/4x1 3/4x3/16	7'8-5/32"	3'7-7/16"	83.3	29.00	0.38	3.40	10.96	0.310 ✔
T2	120 - 100	L1 3/4x1 3/4x3/16	9'8-3/4"	4'9-1/4"	109.0	29.00	0.38	3.09	10.96	0.282 ✔
T3	100 - 80	L2x2x3/16	11'1-29/32"	5'6-1/8"	109.2	29.00	0.45	3.85	13.00	0.296 ✔
T4	80 - 60	L2 1/2x2 1/2x3/16	14'1/4"	6'10-29/32"	108.2	29.00	0.59	4.10	17.07	0.240 ✔
T5	60 - 40	L3x3x3/16	15'10-11/16"	7'9-31/32"	101.3	29.00	0.73	4.48	21.16	0.212 ✔
T6	40 - 20	L3x3x3/16	19'1-3/16"	9'5-13/32"	122.3	29.00	0.71	5.35	20.65	0.259 ✔
T7	20 - 0	L3x3x1/4	20'9-19/32"	10'3-19/32"	134.5	32.50	0.94	5.68	30.53	0.186

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
										✔

Top Girt Design Data (Tension)

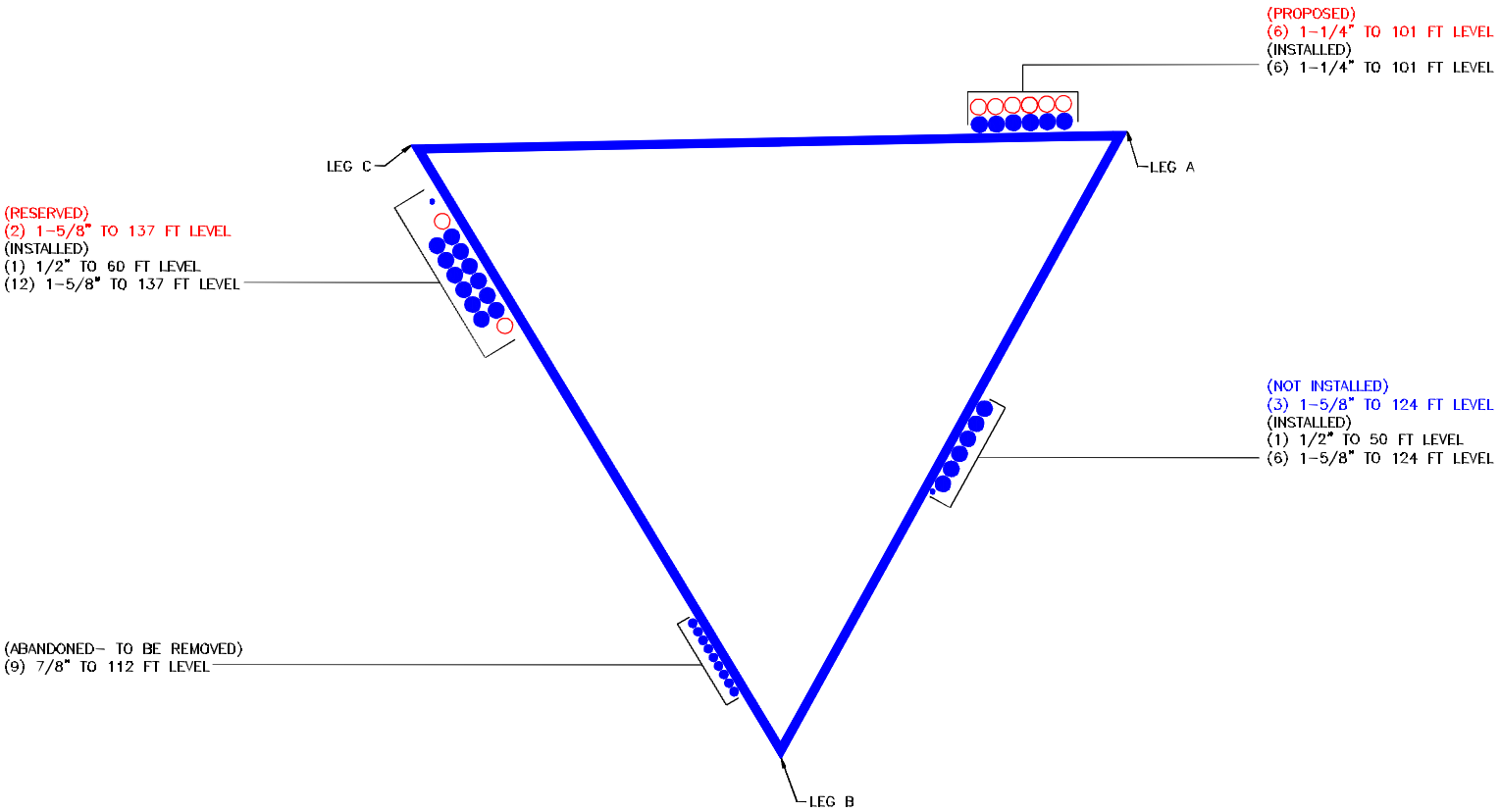
Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
T1	140 - 120	L2x2x1/8	6'6-1/4"	6'1-5/16"	121.2	29.00	0.30	0.53	8.84	0.060 ✔
T2	120 - 100	L2x2x1/8	6'6-23/32"	6'1-29/32"	122.0	29.00	0.30	0.06	8.84	0.007 ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
T1	140 - 120	Leg	ROHN 2 STD	2	-19.97	32.30	61.8	Pass
T2	120 - 100	Leg	ROHN 2.5 EH	38	-44.13	65.60	67.3	Pass
T3	100 - 80	Leg	ROHN 3 EH	69	-66.75	83.78	79.7	Pass
T4	80 - 60	Leg	ROHN 3.5 EH	90	-88.78	110.27	80.5	Pass
T5	60 - 40	Leg	ROHN 4 X-STR	111	-109.79	139.07	78.9	Pass
T6	40 - 20	Leg	ROHN 5 EH	132	-128.63	177.46	72.5	Pass
T7	20 - 0	Leg	ROHN 5 X-STR	147	-154.37	177.86	86.8	Pass
T1	140 - 120	Diagonal	L1 3/4x1 3/4x3/16	7	-3.50	7.71	45.3 67.0 (b)	Pass
T2	120 - 100	Diagonal	L1 3/4x1 3/4x3/16	44	-3.09	4.45	69.5	Pass
T3	100 - 80	Diagonal	L2x2x3/16	74	-3.93	4.18	94.0	Pass
T4	80 - 60	Diagonal	L2 1/2x2 1/2x3/16	95	-4.19	6.39	65.6 76.3 (b)	Pass
T5	60 - 40	Diagonal	L3x3x3/16	116	-4.54	8.74	52.0 82.6 (b)	Pass
T6	40 - 20	Diagonal	L3x3x3/16	137	-5.52	5.99	92.1	Pass
T7	20 - 0	Diagonal	L3x3x1/4	152	-5.88	6.57	89.4	Pass
T1	140 - 120	Top Girt	L2x2x1/8	6	-0.50	2.83	17.8	Pass
T2	120 - 100	Top Girt	L2x2x1/8	41	-0.09	2.79	3.2	Pass
							Summary	
						Leg (T7)	86.8	Pass
						Diagonal (T3)	94.0	Pass
						Top Girt (T1)	17.8	Pass
						Bolt Checks	82.6	Pass
						RATING =	**94.0**	**Pass**

APPENDIX B

BASE LEVEL DRAWING


(PROPOSED)
(6) 1-1/4" TO 101 FT LEVEL
(INSTALLED)
(6) 1-1/4" TO 101 FT LEVEL
LEG C
LEG A
(RESERVED)
(2) 1-5/8" TO 137 FT LEVEL
(INSTALLED)
(1) 1/2" TO 60 FT LEVEL
(12) 1-5/8" TO 137 FT LEVEL
(NOT INSTALLED)
(3) 1-5/8" TO 124 FT LEVEL
(INSTALLED)
(1) 1/2" TO 50 FT LEVEL
(6) 1-5/8" TO 124 FT LEVEL
(ABANDONED- TO BE REMOVED)
(9) 7/8" TO 112 FT LEVEL
LEG B

APPENDIX C

ADDITIONAL CALCULATIONS

SST(PAD-PIER) FOUNDATION CALCULATOR (VERSION 1)

Updated:	2/14/2013

FDH ENGINEERING INNOVATION

PROJECT INFORMATION

FDH Project No:	146GCJ1400
Client Project Name:	HRT 087 943325
Client Project No:	806383
Date:	11/7/2014
Code (F or G):	F

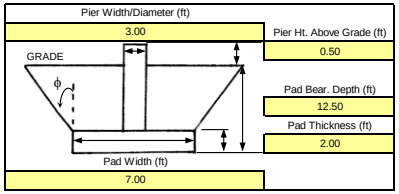
FOUNDATION INFORMATION

Density Concrete (pcf):**	150
Pier Type (S or R):	R
Pier Width/Diameter (ft):	3.00
Pier Cross. Sect. Area (ft^2):	7.069
Pier Height Above Grade (ft):	0.50
Pad Width (ft):	7.00
Pad Thickness (ft):	2.00
Pad Bearing Depth (ft):	12.50
Frost Depth (ft):	3.00
Water Table Depth (ft):	50.00

SOIL INFORMATION

# of Layers Above Pad:	3	Must Be Int. >=1,<=5
# of Layers Adjacent Pad:	1	Must Be Int. >=1,<=5
Total # of Layers:	4	Must Be Int. >=2,<=6
# of Layers Check	OK	If "OK" then cont.
Frost Depth Check	OK	If "OK" then cont.
Water Table Check	OK	If "OK" then cont.
Pad Check	OK	If "OK" then cont.

Checks if # of Layers is within appropriate range
Checks if the frost depth is between layers
Checks if the water table is between layers
Checks if the top of the pad is between soil layers



LEGEND

Input	
Output	
Notes	
Factors & N/A	
Pass/Fail	PASS/FAIL

BEARING CAPACITY INFORMATION

Gross/Net (G/N):	G
Gross Ws (kip):	261.95
Gross Wc (kip):	26.36
Net Wc (kip):	N/A

FACTORS

FACTORS	Rev-F	Rev-G
Weight Resist.	N/A	0.9
Weight Acting	N/A	1.2
Bearing Resist.	0.5	0.75
Up. Resist. Conc.	0.8	N/A
Up. Resist. Soil	0.50	N/A
Up. Resist. Comb.	0.67	0.75

UPLIFT CHECK

Resistance Forces	(Ultimate)	(Allowable)	Acting Forces		Working %
Wt. Concrete (kip):	26.36	21.09	Tower Uplift (kip):	131	82.45%
Wt. Soil (kip):	261.95	130.97			Pass/Fail
Friction (kip):	13.62	6.81			PASS

COMPRESSION CHECK

Resistance Forces	(Ultimate)	(Allowable)	Acting Forces		Working %
Bear. Cap. (ksf):	40.00	20.00	Tower Comp. (kip):	154	44.82%
Friction (kip):	13.62	6.81	Wt. Conc. (kip):	26.36	Pass/Fail
			Wt. Soil (kip):	261.95	PASS

HELPFUL TIPS

*Enter all resistance forces as ultimate values.

**Enter "# of Layers" prior to entering indiv. layer info.

***The frost depth, water table depth, and top of anchor must fall between two soil layers. If any fall within a soil layer, be sure to split the layer into two layers.

****Do not reduce a soil layer's unit weight to account for bouyancy. This will be calculated and accounted for automatically.

*****Do not enter soil data beyond the depth of the bottom of the pad. Only the soil data from the layers above and adjacent to the pad are required.

Soil Profile							Frustum Calculations						Friction Calculations	
Layer	Depth at Bot. (ft)	Soil Type (C/S)	Unit Wt. (pcf)	Thickness (ft)	Frict. Angle (°)	Cohesion (psf)	Bot. Area (ft^2)	Top Area (ft^2)	Vol. of Soil (ft^3)	Net Vol. of Soil (ft^3)	Net Soil Wt. (kip)	Net Conc. Wt. (kip)	Total Up. (kip)	Total Comp. (kip)
1	3.00	S	115	3.00	35	0	306.36	471.08	1157.33	1136.13	130.65	0.74	0.00	0.00
2	7.80	S	115	4.80	35	0	116.23	306.36	978.07	944.14	108.58	1.19	0.00	0.00
3	10.50	S	115	2.70	35	0	49.00	116.23	216.63	197.55	22.72	0.67	0.00	0.00
4	12.50	S	115	2.00	35	0	N/A	N/A	N/A	N/A	N/A	3.43	13.62	13.62
5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Notes	Cals depth at bot. of soil layer given layer thicknesses	Soil Profile Data Input					Calcs area of bottom of frustum	Calcs area of top of frustum	Calcs volume of soil above pad	Calcs net volume of soil above pad	Calcs net weight of soil above pad	Calcs wt. conc. - wt. soil within foundation volume	Sum of all frictional uplift forces for each soil layer	Sum of all frictional compression forces for each soil layer
Equation	Depth above + Layer Thickness						W*L Anch. or TA(bel.)	TW*TL	(1/3)*t*((TA+BA) +sqrt(TA+BA))	Vs-Apier*t	Vs*γs	If Pier:Apier*t*(γc*γs) If Pad:4*W*t*(γc*γs)	Sum(S to S & S to P)	S to P

Pad Locator		Friction Calculations				Universal Calculations							
Layer	Pad? (Y/N)	Soil to Soil (kip)	Soil to Pad (kip)	Adhesion (psf)	Friction Coeff.	Frost Depth? (Y/ N)	Water Table? (Y/ N)	Bouy. Unit Wt. (pcf)	Bouy. Wt. Soil (kip)	Ko	Vert. Press. (ksf)	Rest Press. (ksf)	Rest Resist. (kip)
1	N	0.00	0.00	N/A	0.43	Y	N	115.00	130.65	0.43	0.35	0.07	1.54
2	N	0.00	0.00	N/A	0.43	N	N	115.00	108.58	0.43	0.90	0.26	8.90
3	N	0.00	0.00	N/A	0.43	N	N	115.00	22.72	0.43	1.21	0.45	8.48
4	Y	N/A	13.62	N/A	0.43	N	N	115.00	N/A	0.43	1.44	0.56	7.90
5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Notes	Determines location of anchor in soil profile	Calcs soil plug cohesional resistance	Calcs frict. on pad sides	Calcs adhesion based on cohesion	Calcs friction coefficient	Determines if soil layer is within the frost depth	Determines if soil layer is beneath the water table	Calculates bouyant unit weight	Calculates net bouyant weight of soil above pad	Calcs resting earth pressure coefficient	Calcs vertical pressure at bottom of each soil layer	Calcs average resting pressure on each soil layer	Calcs resting force acting on sides of each soil layer
Equation	N/A	0.5*Cu*4*W*t	Adh*(4*SAas) or 4*RPF*FC	(0.31+(0.34/Cu))*Cu	tan((2/3)*φ)	N/A	N/A	γs-γw	(γs-γw)*Vs	1-sin(φ)	Ptop+γs*t	(PVtop+PVbot)*0.5* Ko	RPavg*t*L

SERIES IDENTIFIER & SERIES DEPENDENT CALCULATIONS

Tot., # Adj. Anchor	True/False	Water Table Count.	% Pad Bel. WT	Water Table Count.	% Pier Bel. WT	% Total Bel. WT	Pad Check
6,1	FALSE	0	0.00%	0	0.00%	0.00%	0
6,2	FALSE	0	0.00%	0	0.00%	0.00%	0
6,3	FALSE	0	0.00%	0	0.00%	0.00%	0
6,4	FALSE	0	0.00%	0	0.00%	0.00%	0
6,5	FALSE	0	0.00%	0	0.00%	0.00%	0
5,1	FALSE	0	0.00%	0	0.00%	0.00%	0
5,2	FALSE	0	0.00%	0	0.00%	0.00%	0
5,3	FALSE	0	0.00%	0	0.00%	0.00%	0
5,4	FALSE	0	0.00%	0	0.00%	0.00%	0
4,1	TRUE	0	0.00%	0	0.00%	0.00%	1
4,2	FALSE	0	0.00%	0	0.00%	0.00%	0
4,3	FALSE	0	0.00%	0	0.00%	0.00%	0
3,1	FALSE	0	0.00%	0	0.00%	0.00%	0
3,2	FALSE	0	0.00%	0	0.00%	0.00%	0
2,1	FALSE	0	0.00%	0	0.00%	0.00%	0

SYMBOL KEY

Name	Symbol	Name	Symbol
Pad Width	W	Avg. Rest. Press.	RPavg
Anchor Width	L	Vert. Press. at Top	PVtop
Volume of Soil	Vs	Vert. Press. at Bot.	PVbot
Unit Weight Soil	γs	Side Area Anchor	SAas
Unit Weight Water	γw	Weight of Soil	Ws
Unit Weight Conc.	γc	Weight of Concrete	Wc
Friction Angle	φ	Friction Coefficient	FC
Layer Thickness	t	Rest. Press. Force	RPF
Soil to Soil	S to S	Cohesion	Cu
Soil to Pad	S to P	Adhesion	Adh
Area of Pier	Apier		

Date: **February 12, 2015**

Marianne Dunst
Crown Castle
3530 Toringdon Way Suite 300
Charlotte, NC 28277

FDH Engineering, Inc.
6521 Meridien Drive, Suite 107
Raleigh, North Carolina 27616
9197551012

Subject: **Structural Analysis Report**

Carrier Designation:	***T-Mobile* Co-Locate**	
	Carrier Site Number:	CT11142A
	Carrier Site Name:	Willington/ Rt 320/ Cosg 1
Crown Castle Designation:	**Crown Castle BU Number:**	806383
	Crown Castle Site Name:	HRT 087 943325
	Crown Castle JDE Job Number:	322230
	Crown Castle Work Order Number:	1005475
	Crown Castle Application Number:	282537 Rev. 2
Engineering Firm Designation:	**FDH Engineering, Inc. Project Number:**	15BDRT1400(R1)

Site Data: **COSGROVE ROADWHIFFORD HILL, WEST WILLINGTON, Tolland County, CT**
Latitude *41° 53' 32.92"*, Longitude *-72° 15' 38.15"*
140 Foot - Self Support Tower

Dear Marianne Dunst,

FDH Engineering, Inc. is pleased to submit this **"Structural Analysis Report"** to determine the structural integrity of the above mentioned tower. This analysis has been performed in accordance with the Crown Castle Structural 'Statement of Work' and the terms of Crown Castle Purchase Order Number 754360, in accordance with application 282537, revision 2.

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

LC7: Existing + Reserved + Proposed Equipment **Sufficient Capacity**
Note: See Table I and Table II for the proposed and existing/reserved loading, respectively.

The analysis has been performed in accordance with the TIA/EIA-222-F standard and local code requirements based upon a wind speed of 85 mph fastest mile.

All modifications and equipment proposed in this report shall be installed in accordance with the attached drawings for the determined available structural capacity to be effective.

We at *FDH Engineering, Inc.* appreciate the opportunity of providing our continuing professional services to you and Crown Castle. If you have any questions or need further assistance on this or any other projects please give us a call.

Respectfully submitted by:

Colleen Brophy, EI
Project Engineer

Reviewed by:

Dennis D. Abel PE
Director - Structural Engineering
CT PE License No. 23247

STATE OF CONNECTICUT
DENNIS D. ABEL
No. 23247
LICENSED
PROFESSIONAL ENGINEER

02-12-2015

TABLE OF CONTENTS

1) INTRODUCTION

This tower is a 140 ft Self Support tower designed by ROHN in December of 1986. The tower's original design wind speed and code are unknown.

2) ANALYSIS CRITERIA

The structural analysis was performed for this tower in accordance with the requirements of TIA/EIA-222-F Structural Standards for Steel Antenna Towers and Antenna Supporting Structures using a fastest mile wind speed of 85 mph with no ice, 37.6 mph with 1 inch ice thickness and 50 mph under service loads.

Table 1 - Proposed Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
101.0	101.0	3	commscope	ATBT-BOTTOM-24V	(6)	1-1/4	--
		3	commscope	LNX-6515DS-VTM w/ Mount Pipe			

Table 2 - Existing and Reserved Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
137.0	139.0	3	alcatel lucent	RRH2X60-AWS	(2)	1-5/8	2
		3	alcatel lucent	RRH2X60-PCS			
		6	andrew	HBXX-6517DS-VTM w/ Mount Pipe			
		3	andrew	LNX-6514DS-VTM w/ Mount Pipe			
		3	andrew	LNX-8513DS-A1M w/ Mount Pipe			
		2	rfs celwave	DB-T1-6Z-8AB-0Z			
	137.0	1	crown mounts	Sector Mount [SM 506-3]	(12)	1-5/8	1
		6	rfs celwave	FD9R6004/2C-3L			
124.0	125.0	6	decibel	DB980H90E-M w/ Mount Pipe	(6)	1-5/8	1
	124.0	1	tower mounts	Sector Mount [SM 502-3]			
112.0	114.0	9	decibel	DB844H90E-XY w/ Mount Pipe	(9)	7/8	3
		12	swedcom	ALP 9212-N w/ Mount Pipe			
	112.0	1	crown mounts	Sector Mount [SM 201-3]			
101.0	101.0	1	crown mounts	Side Arm Mount [SO 304-3]	(6)	1-1/4	1
		3	ems wireless	RR90-17-00DP w/ Mount Pipe			
		3	ericsson	KRY 112 13/1			
		3	ems wireless	RR90-17-00DP w/ Mount Pipe	--	--	3
		3	ericsson	KRY 112 13/1			

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
60.0	60.0	1	crown mounts	Side Arm Mount [SO 305-1]	(1)	1/2	1
		1	gps	GPS_A			
50.0	50.0	1	crown mounts	Side Arm Mount [SO 201-1]	(1)	1/2	1
		1	unknown	GPS			

Notes:
1) Existing Equipment
2) Reserved Equipment
3) Equipment To Be Removed; Not Considered in this Analysis

Table 3 - Design Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)
140	140	4	--	PD10017 Antennas	--	--
131	131	6	--	PD1132 antennas	--	--
121	121	2	--	6' Std dishes	--	--
100	100	1	--	PD1109 Antenna	--	--

3) ANALYSIS PROCEDURE

Table 4 - Documents Provided

Document	Remarks	Reference	Source
4-GEOTECHNICAL REPORTS	JGI Eastern	1069386	CCISITES
4-TOWER FOUNDATION DRAWINGS/DESIGN/SPECS	Rohn	1069383	CCISITES
4-TOWER MANUFACTURER DRAWINGS	Rohn	1069394	CCISITES

3.1) Analysis Method

tnxTower (version 6.1.4.1), a commercially available analysis software package, was used to create a three-dimensional model of the tower and calculate member stresses for various loading cases. Selected output from the analysis is included in Appendix A.

3.2) Assumptions

1) Tower and structures were built in accordance with the manufacturer's specifications.
2) The tower and structures have been maintained in accordance with the manufacturer's specification.
3) The configuration of antennas, transmission cables, mounts and other appurtenances are as specified in Tables 1 and 2 and the referenced drawings.
4) When applicable, transmission cables are considered as structural components for calculating wind loads as allowed by TIA/EIA-222-F.
5) The loading at the 112' level will be removed before installation or proposed loading.

This analysis may be affected if any assumptions are not valid or have been made in error. FDH Engineering, Inc. should be notified to determine the effect on the structural integrity of the tower.

4) ANALYSIS RESULTS

Table 5 - Section Capacity (Summary)

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
T1	140 - 120	Leg	ROHN 2 STD	2	-19.97	32.30	61.8	Pass
T2	120 - 100	Leg	ROHN 2.5 EH	38	-44.13	65.60	67.3	Pass
T3	100 - 80	Leg	ROHN 3 EH	69	-66.75	83.78	79.7	Pass
T4	80 - 60	Leg	ROHN 3.5 EH	90	-88.78	110.27	80.5	Pass
T5	60 - 40	Leg	ROHN 4 X-STR	111	-109.79	139.07	78.9	Pass
T6	40 - 20	Leg	ROHN 5 EH	132	-128.63	177.46	72.5	Pass
T7	20 - 0	Leg	ROHN 5 X-STR	147	-154.37	177.86	86.8	Pass
T1	140 - 120	Diagonal	L1 3/4x1 3/4x3/16	7	-3.50	7.71	45.3 67.0 (b)	Pass
T2	120 - 100	Diagonal	L1 3/4x1 3/4x3/16	44	-3.09	4.45	69.5	Pass
T3	100 - 80	Diagonal	L2x2x3/16	74	-3.93	4.18	94.0	Pass
T4	80 - 60	Diagonal	L2 1/2x2 1/2x3/16	95	-4.19	6.39	65.6 76.3 (b)	Pass
T5	60 - 40	Diagonal	L3x3x3/16	116	-4.54	8.74	52.0 82.6 (b)	Pass
T6	40 - 20	Diagonal	L3x3x3/16	137	-5.52	5.99	92.1	Pass
T7	20 - 0	Diagonal	L3x3x1/4	152	-5.88	6.57	89.4	Pass
T1	140 - 120	Top Girt	L2x2x1/8	6	-0.50	2.83	17.8	Pass
T2	120 - 100	Top Girt	L2x2x1/8	41	-0.09	2.79	3.2	Pass
							Summary	
						Leg (T7)	86.8	Pass
						Diagonal (T3)	94.0	Pass
						Top Girt (T1)	17.8	Pass
						Bolt Checks	82.6	Pass
						RATING =	94.0	Pass

Table 6 - Tower Component Stresses vs. Capacity – LC7

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Base Foundation	0	44.8	Pass
1	Base Foundation Soil Interaction	0	82.5	Pass

Structure Rating (max from all components) =	94.0%

Notes:
1) See additional documentation in “Appendix C – Additional Calculations” for calculations supporting the % capacity consumed.

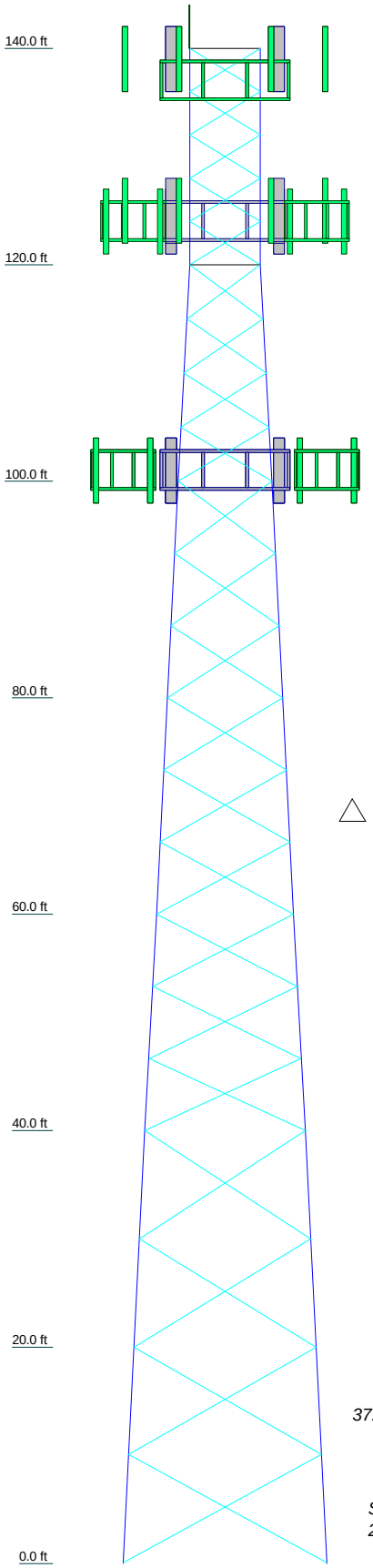
4.1) Recommendations

The tower and its foundation have sufficient capacity to carry the existing, reserved, and proposed loads. No modifications are required at this time.

APPENDIX A

TNXTOWER OUTPUT

Section	T1	T2	T3	T4	T5	T6	T7
Legs	ROHN 2 STD	ROHN 2.5 EH	ROHN 3 EH	ROHN 3.5 EH	ROHN 4 X-STR	ROHN 5 EH	ROHN 5 X-STR
Leg Grade	A618-50						
Diagonals	L1 3/4x1 3/4x3/16		L2x2x3/16	L2 1/2x2 1/2x3/16	L3x3x3/16		L3x3x1/4
Diagonal Grade	A36						A572-50
Top Girts	L2x2x1/8				N.A.		
Face Width (ft)	6.52083	6.5625	8.60417	10.6354	12.6771	14.7708	16.7708
# Panels @ (ft)	5 @ 4	4 @ 5	9 @ 6.66667			2 @ 10	2 @ 9.95833
Weight (K)	0.8	1.0	1.2	1.6	2.0	2.2	2.6



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Lightning Rod	140	(2) DB980H90E-M w/ Mount Pipe	124
(2) FD9R6004/2C-3L	137	(2) DB980H90E-M w/ Mount Pipe	124
(2) FD9R6004/2C-3L	137	Sector Mount [SM 502-3]	124
(2) FD9R6004/2C-3L	137	7'x2" Antenna Mount Pipe	124
Sector Mount [SM 506-3]	137	7'x2" Antenna Mount Pipe	124
(2) HBXX-6517DS-VTM w/ Mount Pipe	137	7'x2" Antenna Mount Pipe	124
(2) HBXX-6517DS-VTM w/ Mount Pipe	137	RR90-17-00DP w/ Mount Pipe	101
(2) HBXX-6517DS-VTM w/ Mount Pipe	137	RR90-17-00DP w/ Mount Pipe	101
LNX-6514DS-VTM w/ Mount Pipe	137	RR90-17-00DP w/ Mount Pipe	101
LNX-6514DS-VTM w/ Mount Pipe	137	KRY 112 13/1	101
LNX-6514DS-VTM w/ Mount Pipe	137	KRY 112 13/1	101
LNX-8513DS-A1M w/ Mount Pipe	137	KRY 112 13/1	101
LNX-8513DS-A1M w/ Mount Pipe	137	LNX-6515DS-VTM w/ Mount Pipe	101
LNX-8513DS-A1M w/ Mount Pipe	137	LNX-6515DS-VTM w/ Mount Pipe	101
RRH2X60-AWS	137	LNX-6515DS-VTM w/ Mount Pipe	101
RRH2X60-AWS	137	ATBT-BOTTOM-24V	101
RRH2X60-AWS	137	ATBT-BOTTOM-24V	101
RRH2X60-PCS	137	ATBT-BOTTOM-24V	101
RRH2X60-PCS	137	Side Arm Mount [SO 304-3]	101
RRH2X60-PCS	137	GPS_A	60
DB-T1-6Z-8AB-0Z	137	Side Arm Mount [SO 305-1]	60
DB-T1-6Z-8AB-0Z	137	GPS	50
(2) DB980H90E-M w/ Mount Pipe	124	Side Arm Mount [SO 201-1]	50

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A618-50	50 ksi	70 ksi	A572-50	50 ksi	65 ksi
A36	36 ksi	58 ksi			

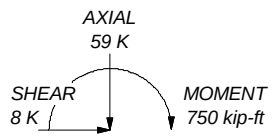
TOWER DESIGN NOTES

1. Tower is located in Tolland County, Connecticut.
2. Tower designed for a 85.00 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 37.60 mph basic wind with 1.00 in ice. Ice is considered to increase in thickness with height.
4. Deflections are based upon a 50.00 mph wind.
5. TOWER RATING: 94%

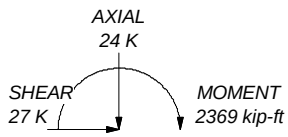
MAX. CORNER REACTIONS AT BASE:

DOWN: 154 K
SHEAR: 17 K

UPLIFT: -131 K
SHEAR: 15 K



TORQUE 3 kip-ft
37.60 mph WIND - 1.00 in ICE



TORQUE 11 kip-ft
REACTIONS - 85.00 mph WIND

FDH Engineering, Inc.
6521 Meridien Drive, Suite 107
Raleigh, North Carolina 27616
Phone: 9197551012
FAX: 9197551031
Tower Analysis

Job: HRT 087 943325, BU 806383			
Project: 15BDRT1400(R1)			
Client: Crown Castle	Drawn by: CBrophy	App'd:	
Code: TIA/EIA-222-F	Date: 02/12/15	Scale: NTS	
Path:		Dwg No. E-1	

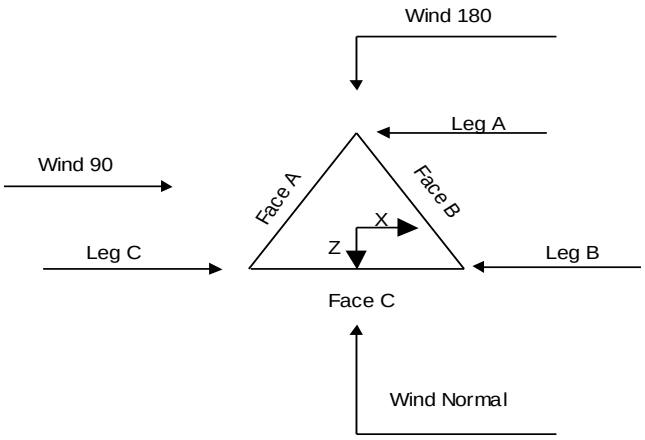
Tower Input Data

The main tower is a 3x free standing tower with an overall height of 140' above the ground line.
The base of the tower is set at an elevation of 0' above the ground line.
The face width of the tower is 6'6-1/4" at the top and 18'9-1/4" at the base.
This tower is designed using the TIA/EIA-222-F standard.
The following design criteria apply:

Tower is located in Tolland County, Connecticut.
Basic wind speed of 85.00 mph.
Nominal ice thickness of 1.00 in.
Ice thickness is considered to increase with height.
Ice density of 56 pcf.
A wind speed of 37.60 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 50.00 mph.
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in tower member design is 1.333.
Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Options

	Consider Moments - Legs		Distribute Leg Loads As Uniform		Treat Feedline Bundles As Cylinder
	Consider Moments - Horizontals		Assume Legs Pinned		Use ASCE 10 X-Brace Ly Rules
	Consider Moments - Diagonals	√	Assume Rigid Index Plate	√	Calculate Redundant Bracing Forces
	Use Moment Magnification	√	Use Clear Spans For Wind Area		Ignore Redundant Members in FEA
√	Use Code Stress Ratios	√	Use Clear Spans For KL/r		SR Leg Bolts Resist Compression
√	Use Code Safety Factors - Guys		Retension Guys To Initial Tension	√	All Leg Panels Have Same Allowable
√	Escalate Ice	√	Bypass Mast Stability Checks	√	Offset Girt At Foundation
	Always Use Max Kz	√	Use Azimuth Dish Coefficients	√	Consider Feedline Torque
	Use Special Wind Profile	√	Project Wind Area of Appurt.	√	Include Angle Block Shear Check
√	Include Bolts In Member Capacity		Autocalc Torque Arm Areas		Poles
	Leg Bolts Are At Top Of Section		SR Members Have Cut Ends		Include Shear-Torsion Interaction
√	Secondary Horizontal Braces Leg	√	Sort Capacity Reports By Component		Always Use Sub-Critical Flow
	Use Diamond Inner Bracing (4 Sided)		Triangulate Diamond Inner Bracing		Use Top Mounted Sockets
	Add IBC .6D+W Combination		Use TIA-222-G Tension Splice Capacity Exemption		



Triangular Tower

Tower Section Geometry

Tower Section	*Tower Elevation*	*Assembly Database*	*Description*	*Section Width*	*Number of Sections*	*Section Length*
	ft			*ft*		*ft*
T1	140'-120'			6'6-1/4"	1	20'
T2	120'-100'		08N087	6'6-23/32"	1	20'
T3	100'-80'		09N006	8'7-3/16"	1	20'
T4	80'-60'		10N007	10'7-11/16"	1	20'
T5	60'-40'		11N007	12'8-5/32"	1	20'
T6	40'-20'		12N004	14'9-1/4"	1	20'
T7	20'-0'		13N003	16'9-1/4"	1	20'

Tower Section Geometry *(cont'd)*

Tower Section	*Tower Elevation*	*Diagonal Spacing*	*Bracing Type*	*Has K Brace End Panels*	*Has Horizontals*	*Top Girt Offset*	*Bottom Girt Offset*
	ft	*ft*				*in*	*in*
T1	140'-120'	4'	X Brace	No	No	0.00	0.00
T2	120'-100'	5'	X Brace	No	No	0.00	0.00
T3	100'-80'	6'8-1/32"	X Brace	No	No	0.00	0.00
T4	80'-60'	6'8-1/32"	X Brace	No	No	0.00	0.00
T5	60'-40'	6'8-1/32"	X Brace	No	No	0.00	0.00
T6	40'-20'	10'	X Brace	No	No	0.00	0.00
T7	20'-0'	9'11-17/32"	X Brace	No	No	0.00	1.00

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Type	Leg Size	Leg Grade	Diagonal Type	Diagonal Size	Diagonal Grade
T1 140'-120'	Pipe	ROHN 2 STD	A618-50 (50 ksi)	Single Angle	L1 3/4x1 3/4x3/16	A36 (36 ksi)
T2 120'-100'	Pipe	ROHN 2.5 EH	A618-50 (50 ksi)	Single Angle	L1 3/4x1 3/4x3/16	A36 (36 ksi)
T3 100'-80'	Pipe	ROHN 3 EH	A618-50 (50 ksi)	Single Angle	L2x2x3/16	A36 (36 ksi)
T4 80'-60'	Pipe	ROHN 3.5 EH	A618-50 (50 ksi)	Single Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T5 60'-40'	Pipe	ROHN 4 X-STR	A618-50 (50 ksi)	Single Angle	L3x3x3/16	A36 (36 ksi)
T6 40'-20'	Pipe	ROHN 5 EH	A618-50 (50 ksi)	Single Angle	L3x3x3/16	A36 (36 ksi)
T7 20'-0'	Pipe	ROHN 5 X-STR	A618-50 (50 ksi)	Single Angle	L3x3x1/4	A572-50 (50 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Top Girt Type	Top Girt Size	Top Girt Grade	Bottom Girt Type	Bottom Girt Size	Bottom Girt Grade
T1 140'-120'	Equal Angle	L2x2x1/8	A36 (36 ksi)	Single Angle		A36 (36 ksi)
T2 120'-100'	Single Angle	L2x2x1/8	A36 (36 ksi)	Single Angle		A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
T1 140'-120'	0.00	0.00	A36 (36 ksi)	1.03	1	1.05	36.00	36.00
T2 120'-100'	0.00	0.00	A36 (36 ksi)	1.03	1	1.05	36.00	36.00
T3 100'-80'	0.00	0.00	A36 (36 ksi)	1.03	1	1.05	36.00	36.00
T4 80'-60'	0.00	0.00	A36 (36 ksi)	1.03	1	1.05	36.00	36.00
T5 60'-40'	0.00	0.00	A36 (36 ksi)	1.03	1	1.05	36.00	36.00
T6 40'-20'	0.00	0.00	A36 (36 ksi)	1.03	1	1.05	36.00	36.00
T7 20'-0'	0.00	0.00	A36 (36 ksi)	1.03	1	1.05	36.00	36.00

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Calc K Single Angles	Calc K Solid Rounds	K Factors[1] Legs	X Brace Diags X Y	K Brace Diags X Y	Single Diags X Y	Girts X Y	Horiz. X Y	Sec. Horiz. X Y	Inner Brace X Y
T1 140'-120'	Yes	No	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1
T2 120'-100'	Yes	No	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1
T3 100'-80'	Yes	No	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1
T4 80'-60'	Yes	No	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1
T5 60'-40'	Yes	No	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1
T6 40'-20'	Yes	No	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1
T7 20'-0'	Yes	No	1	1	1	1	1	1	1	1
				1	1	1	1	1	1	1

[1]*Note: K factors are applied to member segment lengths. K-braces without inner supporting members will have the K factor in the out-of-plane direction applied to the overall length.*

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Net Width Deduct in	Leg U	Diagonal Net Width Deduct in	Diagonal U	Top Girt Net Width Deduct in	Top Girt U	Bottom Girt Net Width Deduct in	Bottom Girt U	Mid Girt Net Width Deduct in	Mid Girt U	Long Horizontal Net Width Deduct in	Long Horizontal U	Short Horizontal Net Width Deduct in	Short Horizontal U
T1 140'-120'	0.00	1	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75
T2 120'-100'	0.00	1	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75
T3 100'-80'	0.00	1	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75
T4 80'-60'	0.00	1	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75
T5 60'-40'	0.00	1	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75
T6 40'-20'	0.00	1	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75
T7 20'-0'	0.00	1	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Connection Type	Leg Bolt Size in	Leg No.	Diagonal Bolt Size in	Diagonal No.	Top Girt Bolt Size in	Top Girt No.	Bottom Girt Bolt Size in	Bottom Girt No.	Mid Girt Bolt Size in	Mid Girt No.	Long Horizontal Bolt Size in	Long Horizontal No.	Short Horizontal Bolt Size in	Short Horizontal No.
T1 140'-120'	Flange	0.63 A325N	4	0.50 A325N	1	0.50 A325N	1	0.50 A325N	0	0.50 A325N	0	0.50 A325N	0	0.50 A325N	0

Tower Elevation ft	Leg Connection Type	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
		Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.
T2 120'-100'	Flange	0.75 A325N	4	0.50 A325N	1	0.50 A325N	1	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0
T3 100'-80'	Flange	0.88 A325N	4	0.50 A325N	1	0.50 A325N	0	0.00 A325N	0	0.50 A325N	0	0.50 A325N	0	0.50 A325N	0
T4 80'-60'	Flange	0.88 A325N	4	0.50 A325N	1	0.50 A325N	0	0.50 A325N	0	0.50 A325N	0	0.50 A325N	0	0.50 A325N	0
T5 60'-40'	Flange	1.00 A325N	4	0.50 A325N	1	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0
T6 40'-20'	Flange	1.00 A325N	4	0.63 A325N	1	0.63 A325N	0	0.00 A325N	0	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0
T7 20'-0'	Flange	1.00 A449	4	0.63 A325N	1	0.63 A325N	0	0.00 A325N	0	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
LDF6-50A(1-1/4") ***	A	Yes	Ar (CfAe)	101' - 8'	0.00	0.3	12	6	1.00	1.55		0.66
LDF4-50A(1/2") ***	C	Yes	Ar (CfAe)	60' - 8'	0.00	0.45	1	1	0.63	0.63		0.15
LDF7-50A(1-5/8")	B	Yes	Ar (CfAe)	124' - 8'	0.00	-0.05	6	6	1.00	1.98		0.82
LDF4-50A(1/2") ***	B	Yes	Ar (CfAe)	50' - 8'	0.00	-0.15	1	1	0.63	0.63		0.15
HB158-1-08U8-S8J18(1-5/8)	C	Yes	Ar (CfAe)	137' - 8'	0.00	0.455	1	1	1.00	1.98		1.30
HB158-1-08U8-S8J18(1-5/8)	C	Yes	Ar (CfAe)	137' - 8'	0.00	0.4	1	1	1.00	1.98		1.30
LDF7-50A(1-5/8") *** ***	C	Yes	Ar (CfAe)	137' - 8'	0.00	0.42	12	6	1.00	1.98		0.82
Feedline Ladder (Af)	A	Yes	Af (CfAe)	101' - 8'	0.00	0.3	1	1	3.00	3.00	12.00	8.40
Feedline Ladder (Af)	A	Yes	Af (CfAe)	60' - 8'	0.00	-0.45	1	1	3.00	3.00	12.00	8.40
Feedline Ladder (Af)	B	Yes	Af (CfAe)	124' - 8'	0.00	-0.15	1	1	3.00	3.00	12.00	8.40
Feedline Ladder (Af)	C	Yes	Af (CfAe)	137' - 8'	0.00	0.42	1	1	3.00	3.00	12.00	8.40
Feedline Ladder (Af) ***	C	Yes	Af (CfAe)	112' - 8'	0.00	-0.4	1	1	3.00	3.00	12.00	8.40
Safety Line 3/8	A	Yes	Ar (CfAe)	140' - 0'	0.00	0	1	1	0.38	0.38		0.22

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
T1	140'-120'	A	0.625	0.000	0.000	0.000	0.00
		B	3.960	1.000	0.000	0.000	0.05
		C	22.440	4.250	0.000	0.000	0.35
T2	120'-100'	A	1.400	0.250	0.000	0.000	0.02
		B	19.800	5.000	0.000	0.000	0.27
		C	26.400	8.000	0.000	0.000	0.52
T3	100'-80'	A	16.125	5.000	0.000	0.000	0.33
		B	19.800	5.000	0.000	0.000	0.27
		C	26.400	10.000	0.000	0.000	0.58
T4	80'-60'	A	16.125	5.000	0.000	0.000	0.33
		B	19.800	5.000	0.000	0.000	0.27
		C	26.400	10.000	0.000	0.000	0.58
T5	60'-40'	A	16.125	10.000	0.000	0.000	0.50
		B	20.325	5.000	0.000	0.000	0.27
		C	27.450	10.000	0.000	0.000	0.59
T6	40'-20'	A	16.125	10.000	0.000	0.000	0.50
		B	20.850	5.000	0.000	0.000	0.27
		C	27.450	10.000	0.000	0.000	0.59
T7	20'-0'	A	9.925	6.000	0.000	0.000	0.30
		B	12.510	3.000	0.000	0.000	0.16
		C	16.470	6.000	0.000	0.000	0.35

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
T1	140'-120'	A	1.179	4.554	0.000	0.000	0.000	0.05
		B		1.446	6.491	0.000	0.000	0.18
		C		18.435	27.585	0.000	0.000	1.30
T2	120'-100'	A	1.155	4.798	1.441	0.000	0.000	0.10
		B		7.151	32.401	0.000	0.000	0.88
		C		21.454	36.942	0.000	0.000	1.70
T3	100'-80'	A	1.128	10.728	28.757	0.000	0.000	1.13
		B		7.060	32.340	0.000	0.000	0.87
		C		21.179	39.846	0.000	0.000	1.80
T4	80'-60'	A	1.094	10.505	28.682	0.000	0.000	1.11
		B		6.948	32.265	0.000	0.000	0.85
		C		20.844	39.697	0.000	0.000	1.77
T5	60'-40'	A	1.051	10.216	35.922	0.000	0.000	1.39
		B		9.081	32.169	0.000	0.000	0.85
		C		24.965	39.505	0.000	0.000	1.78
T6	40'-20'	A	1.000	9.875	35.694	0.000	0.000	1.35
		B		11.017	32.056	0.000	0.000	0.85
		C		24.283	39.278	0.000	0.000	1.73
T7	20'-0'	A	1.000	7.508	21.417	0.000	0.000	0.83
		B		6.610	19.233	0.000	0.000	0.51
		C		14.570	23.567	0.000	0.000	1.04

Feed Line Shielding

Section	Elevation	Face	A_R	A_R Ice	A_F	A_F Ice
	ft		ft^2	ft^2	ft^2	ft^2
T1	140'-120'	A	0.000	0.569	0.059	0.427
		B	0.000	1.025	0.465	0.769
		C	0.000	5.890	2.504	4.421
T2	120'-100'	A	0.000	0.644	0.129	0.494
		B	0.000	4.170	1.943	3.200
		C	0.000	6.172	2.696	4.737
T3	100'-80'	A	0.000	2.799	1.287	2.482
		B	0.000	2.793	1.511	2.476
		C	0.000	4.365	2.217	3.870
T4	80'-60'	A	0.000	2.549	1.522	2.911
		B	0.000	2.551	1.787	2.913
		C	0.000	3.973	2.623	4.537
T5	60'-40'	A	0.000	2.834	2.179	4.044
		B	0.000	2.480	2.113	3.538
		C	0.000	3.905	3.124	5.573
T6	40'-20'	A	0.000	1.887	1.547	2.830
		B	0.000	1.744	1.531	2.617
		C	0.000	2.597	2.218	3.896
T7	20'-0'	A	0.000	1.157	0.913	1.735
		B	0.000	1.013	0.889	1.520
		C	0.000	1.509	1.288	2.263

Feed Line Center of Pressure

Section	Elevation	CP_X	CP_Z	CP_X Ice	CP_Z Ice
	ft	in	in	in	in
T1	140'-120'	-8.15	5.74	-5.47	3.41
T2	120'-100'	-4.67	3.44	-3.99	2.56
T3	100'-80'	-6.03	-1.93	-5.39	-1.06
T4	80'-60'	-6.37	-2.09	-5.89	-1.22
T5	60'-40'	-8.47	-1.06	-8.30	-0.22
T6	40'-20'	-9.87	-1.39	-9.93	-0.73
T7	20'-0'	-7.71	-1.13	-8.01	-0.75

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
Lightning Rod	C	From Leg	0.00 0' 2'	0.000	140'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.25 0.66 0.97 1.49 2.68	0.25 0.66 0.97 1.49 2.68	0.03 0.03 0.04 0.06 0.14
***									
(2) FD9R6004/2C-3L	A	From Leg	4.00	0.000	137'	No Ice	0.37	0.08	0.00

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
			0'			1/2" Ice	0.45	0.14	0.01
			0'			1" Ice	0.54	0.20	0.01
						2" Ice	0.75	0.34	0.02
						4" Ice	1.28	0.74	0.06
(2) FD9R6004/2C-3L	B	From Leg	4.00	0.000	137'	No Ice	0.37	0.08	0.00
			0'			1/2" Ice	0.45	0.14	0.01
			0'			1" Ice	0.54	0.20	0.01
						2" Ice	0.75	0.34	0.02
						4" Ice	1.28	0.74	0.06
(2) FD9R6004/2C-3L	C	From Leg	4.00	0.000	137'	No Ice	0.37	0.08	0.00
			0'			1/2" Ice	0.45	0.14	0.01
			0'			1" Ice	0.54	0.20	0.01
						2" Ice	0.75	0.34	0.02
						4" Ice	1.28	0.74	0.06
Sector Mount [SM 506-3]	C	None		0.000	137'	No Ice	35.47	35.47	1.74
						1/2" Ice	50.60	50.60	2.35
						1" Ice	65.73	65.73	2.95
						2" Ice	95.99	95.99	4.16
						4" Ice	156.51	156.51	6.59
(2) HBXX-6517DS-VTM w/ Mount Pipe	A	From Leg	4.00	0.000	137'	No Ice	8.98	6.96	0.07
			0'			1/2" Ice	9.65	8.18	0.14
			2'			1" Ice	10.29	9.14	0.21
						2" Ice	11.59	11.02	0.40
						4" Ice	14.32	15.03	0.91
(2) HBXX-6517DS-VTM w/ Mount Pipe	B	From Leg	4.00	0.000	137'	No Ice	8.98	6.96	0.07
			0'			1/2" Ice	9.65	8.18	0.14
			2'			1" Ice	10.29	9.14	0.21
						2" Ice	11.59	11.02	0.40
						4" Ice	14.32	15.03	0.91
(2) HBXX-6517DS-VTM w/ Mount Pipe	C	From Leg	4.00	0.000	137'	No Ice	8.98	6.96	0.07
			0'			1/2" Ice	9.65	8.18	0.14
			2'			1" Ice	10.29	9.14	0.21
						2" Ice	11.59	11.02	0.40
						4" Ice	14.32	15.03	0.91
LNX-6514DS-VTM w/ Mount Pipe	A	From Leg	4.00	0.000	137'	No Ice	8.57	7.00	0.06
			0'			1/2" Ice	9.22	8.19	0.13
			2'			1" Ice	9.84	9.08	0.20
						2" Ice	11.10	10.90	0.38
						4" Ice	13.75	14.93	0.89
LNX-6514DS-VTM w/ Mount Pipe	B	From Leg	4.00	0.000	137'	No Ice	8.57	7.00	0.06
			0'			1/2" Ice	9.22	8.19	0.13
			2'			1" Ice	9.84	9.08	0.20
						2" Ice	11.10	10.90	0.38
						4" Ice	13.75	14.93	0.89
LNX-6514DS-VTM w/ Mount Pipe	C	From Leg	4.00	0.000	137'	No Ice	8.57	7.00	0.06
			0'			1/2" Ice	9.22	8.19	0.13
			2'			1" Ice	9.84	9.08	0.20
						2" Ice	11.10	10.90	0.38
						4" Ice	13.75	14.93	0.89
LNX-8513DS-A1M w/ Mount Pipe	A	From Leg	4.00	0.000	137'	No Ice	8.65	7.08	0.06
			0'			1/2" Ice	9.31	8.27	0.13
			2'			1" Ice	9.93	9.18	0.21
						2" Ice	11.20	11.02	0.39
						4" Ice	13.87	15.06	0.90
LNX-8513DS-A1M w/ Mount Pipe	B	From Leg	4.00	0.000	137'	No Ice	8.65	7.08	0.06
			0'			1/2" Ice	9.31	8.27	0.13
			2'			1" Ice	9.93	9.18	0.21

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
						2" Ice	11.20	11.02	0.39
						4" Ice	13.87	15.06	0.90
LNX-8513DS-A1M w/ Mount Pipe	C	From Leg	4.00 0' 2'	0.000	137'	No Ice	8.65	7.08	0.06
						1/2" Ice	9.31	8.27	0.13
						1" Ice	9.93	9.18	0.21
						2" Ice	11.20	11.02	0.39
						4" Ice	13.87	15.06	0.90
RRH2X60-AWS	C	From Leg	4.00 0' 2'	0.000	137'	No Ice	2.19	1.43	0.04
						1/2" Ice	2.40	1.61	0.06
						1" Ice	2.61	1.80	0.08
						2" Ice	3.07	2.21	0.13
						4" Ice	4.09	3.13	0.26
RRH2X60-AWS	B	From Leg	4.00 0' 2'	0.000	137'	No Ice	2.19	1.43	0.04
						1/2" Ice	2.40	1.61	0.06
						1" Ice	2.61	1.80	0.08
						2" Ice	3.07	2.21	0.13
						4" Ice	4.09	3.13	0.26
RRH2X60-AWS	A	From Leg	4.00 0' 2'	0.000	137'	No Ice	2.19	1.43	0.04
						1/2" Ice	2.40	1.61	0.06
						1" Ice	2.61	1.80	0.08
						2" Ice	3.07	2.21	0.13
						4" Ice	4.09	3.13	0.26
RRH2X60-PCS	A	From Leg	4.00 0' 2'	0.000	137'	No Ice	2.57	2.01	0.06
						1/2" Ice	2.79	2.22	0.08
						1" Ice	3.02	2.43	0.10
						2" Ice	3.52	2.89	0.16
						4" Ice	4.61	3.92	0.31
RRH2X60-PCS	B	From Leg	4.00 0' 2'	0.000	137'	No Ice	2.57	2.01	0.06
						1/2" Ice	2.79	2.22	0.08
						1" Ice	3.02	2.43	0.10
						2" Ice	3.52	2.89	0.16
						4" Ice	4.61	3.92	0.31
RRH2X60-PCS	C	From Leg	4.00 0' 2'	0.000	137'	No Ice	2.57	2.01	0.06
						1/2" Ice	2.79	2.22	0.08
						1" Ice	3.02	2.43	0.10
						2" Ice	3.52	2.89	0.16
						4" Ice	4.61	3.92	0.31
DB-T1-6Z-8AB-0Z	A	From Leg	4.00 0' 2'	0.000	137'	No Ice	5.60	2.33	0.04
						1/2" Ice	5.92	2.56	0.08
						1" Ice	6.24	2.79	0.12
						2" Ice	6.91	3.28	0.21
						4" Ice	8.37	4.37	0.45
DB-T1-6Z-8AB-0Z	B	From Leg	4.00 0' 2'	0.000	137'	No Ice	5.60	2.33	0.04
						1/2" Ice	5.92	2.56	0.08
						1" Ice	6.24	2.79	0.12
						2" Ice	6.91	3.28	0.21
						4" Ice	8.37	4.37	0.45
***									
(2) DB980H90E-M w/ Mount Pipe	A	From Leg	4.00 0' 1'	0.000	124'	No Ice	4.04	3.62	0.03
						1/2" Ice	4.50	4.48	0.07
						1" Ice	4.95	5.22	0.11
						2" Ice	5.87	6.74	0.22
						4" Ice	8.05	10.00	0.55
(2) DB980H90E-M w/ Mount Pipe	B	From Leg	4.00 0' 1'	0.000	124'	No Ice	4.04	3.62	0.03
						1/2" Ice	4.50	4.48	0.07
						1" Ice	4.95	5.22	0.11
						2" Ice	5.87	6.74	0.22

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
						4" Ice	8.05	10.00	0.55
(2) DB980H90E-M w/ Mount Pipe	C	From Leg	4.00 0' 1'	0.000	124'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	4.04 4.50 4.95 5.87 8.05	3.62 4.48 5.22 6.74 10.00	0.03 0.07 0.11 0.22 0.55
Sector Mount [SM 502-3]	C	None		0.000	124'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	33.02 47.36 61.70 90.38 147.74	33.02 47.36 61.70 90.38 147.74	1.67 2.22 2.77 3.88 6.08
7'x2" Antenna Mount Pipe	A	From Face	4.00 0' 0'	0.000	124'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	1.66 2.39 2.83 3.71 5.58	1.66 2.39 2.83 3.71 5.58	0.03 0.04 0.06 0.10 0.27
7'x2" Antenna Mount Pipe	B	From Face	4.00 0' 0'	0.000	124'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	1.66 2.39 2.83 3.71 5.58	1.66 2.39 2.83 3.71 5.58	0.03 0.04 0.06 0.10 0.27
7'x2" Antenna Mount Pipe	C	From Face	4.00 0' 0'	0.000	124'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	1.66 2.39 2.83 3.71 5.58	1.66 2.39 2.83 3.71 5.58	0.03 0.04 0.06 0.10 0.27
***									
***									
RR90-17-00DP w/ Mount Pipe	A	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	4.59 5.09 5.58 6.59 8.73	3.32 4.09 4.78 6.23 9.31	0.03 0.07 0.12 0.22 0.56
RR90-17-00DP w/ Mount Pipe	B	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	4.59 5.09 5.58 6.59 8.73	3.32 4.09 4.78 6.23 9.31	0.03 0.07 0.12 0.22 0.56
RR90-17-00DP w/ Mount Pipe	C	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	4.59 5.09 5.58 6.59 8.73	3.32 4.09 4.78 6.23 9.31	0.03 0.07 0.12 0.22 0.56
KRY 112 13/1	A	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.33 0.42 0.51 0.72 1.25	0.24 0.32 0.40 0.60 1.09	0.00 0.01 0.01 0.02 0.07
KRY 112 13/1	B	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.33 0.42 0.51 0.72 1.25	0.24 0.32 0.40 0.60 1.09	0.00 0.01 0.01 0.02 0.07
KRY 112 13/1	C	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice	0.33 0.42 0.51 0.72	0.24 0.32 0.40 0.60	0.00 0.01 0.01 0.02

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
						4" Ice	1.25	1.09	0.07
LNX-6515DS-VTM w/ Mount Pipe	A	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	11.68 12.40 13.14 14.60 17.87	9.84 11.37 12.91 15.27 20.14	0.08 0.17 0.27 0.51 1.15
LNX-6515DS-VTM w/ Mount Pipe	B	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	11.68 12.40 13.14 14.60 17.87	9.84 11.37 12.91 15.27 20.14	0.08 0.17 0.27 0.51 1.15
LNX-6515DS-VTM w/ Mount Pipe	C	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	11.68 12.40 13.14 14.60 17.87	9.84 11.37 12.91 15.27 20.14	0.08 0.17 0.27 0.51 1.15
ATBT-BOTTOM-24V	A	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.12 0.17 0.23 0.38 0.77	0.08 0.12 0.17 0.30 0.67	0.00 0.00 0.01 0.01 0.04
ATBT-BOTTOM-24V	B	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.12 0.17 0.23 0.38 0.77	0.08 0.12 0.17 0.30 0.67	0.00 0.00 0.01 0.01 0.04
ATBT-BOTTOM-24V	C	From Leg	4.00 0' 0'	0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.12 0.17 0.23 0.38 0.77	0.08 0.12 0.17 0.30 0.67	0.00 0.00 0.01 0.01 0.04
Side Arm Mount [SO 304-3]	C	None		0.000	101'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	1.76 2.75 3.74 5.72 9.68	1.76 2.75 3.74 5.72 9.68	0.07 0.10 0.12 0.18 0.28
***									
GPS_A	A	From Leg	2.00 0' 0'	0.000	60'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.30 0.37 0.46 0.65 1.15	0.30 0.37 0.46 0.65 1.15	0.00 0.00 0.01 0.02 0.08
Side Arm Mount [SO 305-1]	A	From Leg	1.00 0' 0'	0.000	60'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.94 1.48 2.02 3.10 5.26	1.41 2.17 2.93 4.45 7.49	0.03 0.04 0.06 0.08 0.14
***									
GPS	A	From Leg	2.00 0' 0'	0.000	50'	No Ice 1/2" Ice 1" Ice 2" Ice 4" Ice	0.17 0.24 0.31 0.48 0.92	0.17 0.24 0.31 0.48 0.92	0.00 0.00 0.00 0.01 0.05
Side Arm Mount [SO 201-1]	A	From Leg	1.00 0' 0'	0.000	50'	No Ice 1/2" Ice 1" Ice 2" Ice	2.96 4.10 5.24 7.52	2.11 2.93 3.75 5.39	0.10 0.12 0.14 0.18

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
***						4" Ice	12.08	8.67	0.26

Force Totals

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Leg Weight	5.72					
Bracing Weight	5.58					
Total Member Self-Weight	11.30			0.19	10.24	
Total Weight	23.85			0.19	10.24	
Wind 0 deg - No Ice		-0.04	-27.50	-2361.51	16.49	-11.35
Wind 30 deg - No Ice		12.98	-22.58	-1962.79	-1115.73	-9.63
Wind 60 deg - No Ice		22.12	-12.77	-1114.30	-1919.84	-6.04
Wind 90 deg - No Ice		26.03	0.04	6.43	-2252.51	-1.10
Wind 120 deg - No Ice		23.79	13.79	1186.45	-2031.66	4.71
Wind 150 deg - No Ice		13.06	22.62	1969.42	-1126.54	8.53
Wind 180 deg - No Ice		0.04	25.62	2239.97	4.00	10.19
Wind 210 deg - No Ice		-12.98	22.58	1963.17	1136.21	9.63
Wind 240 deg - No Ice		-23.75	13.71	1175.63	2045.91	6.65
Wind 270 deg - No Ice		-26.03	-0.04	-6.05	2272.99	1.10
Wind 300 deg - No Ice		-22.16	-12.85	-1125.11	1946.57	-4.15
Wind 330 deg - No Ice		-13.06	-22.62	-1969.03	1147.02	-8.53
Member Ice	12.75					
Total Weight Ice	58.83			-0.95	38.21	
Wind 0 deg - Ice		-0.01	-8.19	-713.89	39.51	-3.14
Wind 30 deg - Ice		3.83	-6.66	-587.71	-299.01	-2.61
Wind 60 deg - Ice		6.50	-3.75	-333.19	-537.17	-1.62
Wind 90 deg - Ice		7.68	0.01	0.35	-638.49	-0.27
Wind 120 deg - Ice		7.09	4.10	356.65	-578.50	1.34
Wind 150 deg - Ice		3.85	6.66	587.11	-301.27	2.34
Wind 180 deg - Ice		0.01	7.52	665.78	36.91	2.76
Wind 210 deg - Ice		-3.83	6.66	585.81	375.43	2.61
Wind 240 deg - Ice		-7.08	4.09	354.39	653.62	1.80
Wind 270 deg - Ice		-7.68	-0.01	-2.25	714.91	0.27
Wind 300 deg - Ice		-6.51	-3.77	-335.44	614.89	-1.15
Wind 330 deg - Ice		-3.85	-6.66	-589.01	377.69	-2.34
Total Weight	23.85			0.19	10.24	
Wind 0 deg - Service		-0.02	-9.52	-818.41	1.99	-3.93
Wind 30 deg - Service		4.49	-7.81	-680.45	-389.78	-3.33
Wind 60 deg - Service		7.65	-4.42	-386.85	-668.02	-2.09
Wind 90 deg - Service		9.01	0.02	0.95	-783.13	-0.38
Wind 120 deg - Service		8.23	4.77	409.26	-706.71	1.63
Wind 150 deg - Service		4.52	7.83	680.18	-393.52	2.95
Wind 180 deg - Service		0.02	8.87	773.80	-2.33	3.53
Wind 210 deg - Service		-4.49	7.81	678.02	389.44	3.33
Wind 240 deg - Service		-8.22	4.75	405.51	704.21	2.30
Wind 270 deg - Service		-9.01	-0.02	-3.37	782.79	0.38
Wind 300 deg - Service		-7.67	-4.45	-390.59	669.84	-1.44

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Wind 330 deg - Service		-4.52	-7.83	-682.61	393.18	-2.95

Load Combinations

Comb. No.	Description
1	Dead Only
2	Dead+Wind 0 deg - No Ice
3	Dead+Wind 30 deg - No Ice
4	Dead+Wind 60 deg - No Ice
5	Dead+Wind 90 deg - No Ice
6	Dead+Wind 120 deg - No Ice
7	Dead+Wind 150 deg - No Ice
8	Dead+Wind 180 deg - No Ice
9	Dead+Wind 210 deg - No Ice
10	Dead+Wind 240 deg - No Ice
11	Dead+Wind 270 deg - No Ice
12	Dead+Wind 300 deg - No Ice
13	Dead+Wind 330 deg - No Ice
14	Dead+Ice+Temp
15	Dead+Wind 0 deg+Ice+Temp
16	Dead+Wind 30 deg+Ice+Temp
17	Dead+Wind 60 deg+Ice+Temp
18	Dead+Wind 90 deg+Ice+Temp
19	Dead+Wind 120 deg+Ice+Temp
20	Dead+Wind 150 deg+Ice+Temp
21	Dead+Wind 180 deg+Ice+Temp
22	Dead+Wind 210 deg+Ice+Temp
23	Dead+Wind 240 deg+Ice+Temp
24	Dead+Wind 270 deg+Ice+Temp
25	Dead+Wind 300 deg+Ice+Temp
26	Dead+Wind 330 deg+Ice+Temp
27	Dead+Wind 0 deg - Service
28	Dead+Wind 30 deg - Service
29	Dead+Wind 60 deg - Service
30	Dead+Wind 90 deg - Service
31	Dead+Wind 120 deg - Service
32	Dead+Wind 150 deg - Service
33	Dead+Wind 180 deg - Service
34	Dead+Wind 210 deg - Service
35	Dead+Wind 240 deg - Service
36	Dead+Wind 270 deg - Service
37	Dead+Wind 300 deg - Service
38	Dead+Wind 330 deg - Service

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
T1	140 - 120	Leg	Max Tension	8	16.52	0.01	-0.01
			Max. Compression	6	-19.96	0.08	-0.01
			Max. Mx	2	-2.22	-0.80	-0.01

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. My	9	-1.01	0.01	-0.85
			Max. Vy	6	-1.39	0.59	0.01
			Max. Vx	9	-1.36	0.01	0.51
		Diagonal	Max Tension	5	3.40	0.00	0.00
			Max. Compression	11	-3.50	0.00	0.00
			Max. Mx	23	0.79	0.02	-0.00
			Max. My	7	-2.35	0.00	0.01
			Max. Vy	23	-0.02	0.02	-0.00
			Max. Vx	7	-0.00	0.00	0.00
		Top Girt	Max Tension	8	0.53	0.00	0.00
			Max. Compression	6	-0.50	0.00	0.00
			Max. Mx	14	0.01	-0.04	0.00
			Max. My	26	0.01	0.00	0.00
			Max. Vy	14	0.02	0.00	0.00
			Max. Vx	26	-0.00	0.00	0.00
T2	120 - 100	Leg	Max Tension	8	38.17	-0.11	-0.01
			Max. Compression	6	-44.13	0.29	-0.01
			Max. Mx	6	-44.13	0.29	-0.01
			Max. My	7	-2.96	0.00	-0.22
			Max. Vy	4	0.43	-0.29	0.00
			Max. Vx	7	0.40	0.00	-0.22
		Diagonal	Max Tension	5	3.09	0.00	0.00
			Max. Compression	5	-3.09	0.00	0.00
			Max. Mx	23	0.82	0.02	0.00
			Max. My	11	-3.03	-0.00	0.00
			Max. Vy	21	0.02	0.02	0.00
			Max. Vx	15	-0.00	0.00	0.00
		Top Girt	Max Tension	4	0.06	0.00	0.00
			Max. Compression	10	-0.09	0.00	0.00
			Max. Mx	14	-0.01	-0.04	0.00
			Max. My	15	0.00	0.00	0.00
			Max. Vy	14	0.02	0.00	0.00
			Max. Vx	15	-0.00	0.00	0.00
T3	100 - 80	Leg	Max Tension	12	58.40	-0.14	0.00
			Max. Compression	2	-66.75	0.13	0.02
			Max. Mx	6	-50.85	0.29	-0.01
			Max. My	7	-3.06	0.00	-0.22
			Max. Vy	4	-0.07	-0.29	0.00
			Max. Vx	13	-0.06	-0.01	0.21
		Diagonal	Max Tension	5	3.85	0.00	0.00
			Max. Compression	5	-3.94	0.00	0.00
			Max. Mx	25	0.95	0.03	-0.00
			Max. My	26	-0.51	0.03	0.00
			Max. Vy	25	0.03	0.03	-0.00
			Max. Vx	26	0.00	0.00	0.00
T4	80 - 60	Leg	Max Tension	12	77.51	-0.14	0.00
			Max. Compression	2	-88.78	0.24	0.02
			Max. Mx	6	-88.61	0.24	-0.01
			Max. My	13	-4.34	-0.01	0.23
			Max. Vy	19	-0.05	0.22	-0.00
			Max. Vx	13	-0.06	-0.01	0.23
		Diagonal	Max Tension	3	4.10	0.00	0.00
			Max. Compression	3	-4.19	0.00	0.00
			Max. Mx	23	1.00	0.06	0.01
			Max. My	15	-0.17	0.06	0.01
			Max. Vy	25	0.04	0.06	-0.01
			Max. Vx	15	0.00	0.00	0.00
T5	60 - 40	Leg	Max Tension	12	94.98	-0.21	-0.01
			Max. Compression	2	-109.79	0.32	0.02
			Max. Mx	17	13.93	-0.54	0.00
			Max. My	11	-4.98	-0.01	-0.28

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Vy	17	0.14	-0.54	0.00
			Max. Vx	2	0.07	-0.12	0.26
		Diagonal	Max Tension	3	4.48	0.00	0.00
			Max. Compression	3	-4.54	0.00	0.00
			Max. Mx	23	0.96	0.09	0.01
			Max. My	21	-0.68	0.05	-0.01
			Max. Vy	25	0.05	0.09	-0.01
			Max. Vx	21	-0.00	0.00	0.00
T6	40 - 20	Leg	Max Tension	12	110.55	-0.33	0.01
			Max. Compression	2	-128.63	0.54	0.03
			Max. Mx	17	15.59	-0.96	0.00
			Max. My	13	-6.54	-0.05	0.66
			Max. Vy	17	0.18	-0.96	0.00
			Max. Vx	13	0.13	-0.05	0.66
		Diagonal	Max Tension	3	5.35	0.00	0.00
			Max. Compression	3	-5.52	0.00	0.00
			Max. Mx	25	0.62	0.11	0.01
			Max. My	21	-1.67	0.09	-0.01
			Max. Vy	25	0.05	0.09	-0.01
			Max. Vx	21	0.00	0.00	0.00
T7	20 - 0	Leg	Max Tension	12	131.41	0.58	-0.01
			Max. Compression	2	-154.37	0.00	-0.00
			Max. Mx	17	18.70	-0.96	0.00
			Max. My	13	-7.77	-0.05	0.94
			Max. Vy	6	-8.14	0.00	0.00
			Max. Vx	7	2.22	0.00	0.00
		Diagonal	Max Tension	3	5.68	0.00	0.00
			Max. Compression	3	-5.88	0.00	0.00
			Max. Mx	25	0.27	0.16	0.02
			Max. My	21	-2.23	0.15	-0.02
			Max. Vy	25	0.07	0.16	0.02
			Max. Vx	21	0.00	0.00	0.00

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Leg C	Max. Vert	10	153.55	14.43	-8.57
	Max. H_x	10	153.55	14.43	-8.57
	Max. H_z	3	-112.22	-10.41	7.47
	Min. Vert	4	-129.01	-12.49	7.42
	Min. H_x	4	-129.01	-12.49	7.42
	Min. H_z	10	153.55	14.43	-8.57
Leg B	Max. Vert	6	153.12	-14.63	-8.28
	Max. H_x	12	-130.78	12.71	7.19
	Max. H_z	12	-130.78	12.71	7.19
	Min. Vert	12	-130.78	12.71	7.19
	Min. H_x	6	153.12	-14.63	-8.28
	Min. H_z	6	153.12	-14.63	-8.28
Leg A	Max. Vert	2	153.66	-0.36	16.82
	Max. H_x	10	-64.59	1.99	-7.54
	Max. H_z	2	153.66	-0.36	16.82
	Min. Vert	8	-130.26	0.31	-14.59
	Min. H_x	5	7.55	-1.99	0.53
	Min. H_z	8	-130.26	0.31	-14.59

Tower Mast Reaction Summary

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	K	K	K	kip-ft	kip-ft	kip-ft
Dead Only	23.85	-0.00	-0.00	0.19	10.24	-0.00
Dead+Wind 0 deg - No Ice	23.85	-0.04	-27.50	-2368.72	16.56	-11.40
Dead+Wind 30 deg - No Ice	23.85	12.97	-22.57	-1968.81	-1119.06	-9.66
Dead+Wind 60 deg - No Ice	23.85	22.11	-12.77	-1117.67	-1925.65	-6.06
Dead+Wind 90 deg - No Ice	23.85	26.03	0.05	6.52	-2259.37	-1.09
Dead+Wind 120 deg - No Ice	23.85	23.79	13.79	1190.09	-2037.86	4.74
Dead+Wind 150 deg - No Ice	23.85	13.05	22.61	1975.41	-1130.01	8.57
Dead+Wind 180 deg - No Ice	23.85	0.04	25.61	2246.77	4.03	10.23
Dead+Wind 210 deg - No Ice	23.85	-12.98	22.57	1969.12	1139.73	9.66
Dead+Wind 240 deg - No Ice	23.85	-23.74	13.71	1179.22	2052.15	6.67
Dead+Wind 270 deg - No Ice	23.85	-26.03	-0.04	-6.01	2279.91	1.10
Dead+Wind 300 deg - No Ice	23.85	-22.15	-12.85	-1128.51	1952.47	-4.17
Dead+Wind 330 deg - No Ice	23.85	-13.05	-22.62	-1975.06	1150.48	-8.57
Dead+Ice+Temp	58.83	0.00	-0.00	-0.93	38.42	-0.00
Dead+Wind 0 deg+Ice+Temp	58.83	-0.01	-8.19	-719.73	39.83	-3.19
Dead+Wind 30 deg+Ice+Temp	58.83	3.83	-6.65	-592.54	-301.51	-2.65
Dead+Wind 60 deg+Ice+Temp	58.83	6.50	-3.75	-335.91	-541.65	-1.63
Dead+Wind 90 deg+Ice+Temp	58.83	7.68	0.01	0.40	-643.80	-0.26
Dead+Wind 120 deg+Ice+Temp	58.83	7.09	4.10	359.63	-583.27	1.38
Dead+Wind 150 deg+Ice+Temp	58.83	3.85	6.66	592.03	-303.79	2.39
Dead+Wind 180 deg+Ice+Temp	58.83	0.01	7.52	671.35	37.20	2.81
Dead+Wind 210 deg+Ice+Temp	58.83	-3.83	6.65	590.71	378.53	2.65
Dead+Wind 240 deg+Ice+Temp	58.83	-7.08	4.09	357.35	658.98	1.82
Dead+Wind 270 deg+Ice+Temp	58.83	-7.68	-0.01	-2.23	720.82	0.26
Dead+Wind 300 deg+Ice+Temp	58.83	-6.51	-3.77	-338.18	619.98	-1.18
Dead+Wind 330 deg+Ice+Temp	58.83	-3.85	-6.66	-593.86	380.80	-2.39
Dead+Wind 0 deg - Service	23.85	-0.02	-9.51	-819.50	12.44	-3.94
Dead+Wind 30 deg - Service	23.85	4.49	-7.81	-681.12	-380.52	-3.34
Dead+Wind 60 deg - Service	23.85	7.65	-4.42	-386.62	-659.62	-2.10
Dead+Wind 90 deg - Service	23.85	9.01	0.02	2.37	-775.08	-0.38
Dead+Wind 120 deg - Service	23.85	8.23	4.77	411.92	-698.43	1.64
Dead+Wind 150 deg - Service	23.85	4.52	7.82	683.67	-384.29	2.97
Dead+Wind 180 deg - Service	23.85	0.02	8.86	777.58	8.11	3.54
Dead+Wind 210 deg - Service	23.85	-4.49	7.81	681.50	401.08	3.34
Dead+Wind 240 deg - Service	23.85	-8.21	4.74	408.16	716.80	2.31
Dead+Wind 270 deg - Service	23.85	-9.01	-0.02	-1.97	795.63	0.38
Dead+Wind 300 deg - Service	23.85	-7.67	-4.45	-390.37	682.33	-1.44
Dead+Wind 330 deg - Service	23.85	-4.52	-7.83	-683.29	404.82	-2.97

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX	PY	PZ	PX	PY	PZ	% Error
	K	K	K	K	K	K	
1	0.00	-23.85	0.00	0.00	23.85	0.00	0.000%
2	-0.04	-23.85	-27.50	0.04	23.85	27.50	0.014%
3	12.98	-23.85	-22.58	-12.97	23.85	22.57	0.022%
4	22.12	-23.85	-12.77	-22.11	23.85	12.77	0.028%
5	26.03	-23.85	0.04	-26.03	23.85	-0.05	0.022%
6	23.79	-23.85	13.79	-23.79	23.85	-13.79	0.013%
7	13.06	-23.85	22.62	-13.05	23.85	-22.61	0.022%
8	0.04	-23.85	25.62	-0.04	23.85	-25.61	0.028%

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
9	-12.98	-23.85	22.58	12.98	23.85	-22.57	0.022%
10	-23.75	-23.85	13.71	23.74	23.85	-13.71	0.014%
11	-26.03	-23.85	-0.04	26.03	23.85	0.04	0.022%
12	-22.16	-23.85	-12.85	22.15	23.85	12.85	0.028%
13	-13.06	-23.85	-22.62	13.05	23.85	22.62	0.022%
14	0.00	-58.83	0.00	-0.00	58.83	0.00	0.001%
15	-0.01	-58.83	-8.19	0.01	58.83	8.19	0.002%
16	3.83	-58.83	-6.66	-3.83	58.83	6.65	0.002%
17	6.50	-58.83	-3.75	-6.50	58.83	3.75	0.002%
18	7.68	-58.83	0.01	-7.68	58.83	-0.01	0.002%
19	7.09	-58.83	4.10	-7.09	58.83	-4.10	0.002%
20	3.85	-58.83	6.66	-3.85	58.83	-6.66	0.002%
21	0.01	-58.83	7.52	-0.01	58.83	-7.52	0.002%
22	-3.83	-58.83	6.66	3.83	58.83	-6.65	0.002%
23	-7.08	-58.83	4.09	7.08	58.83	-4.09	0.002%
24	-7.68	-58.83	-0.01	7.68	58.83	0.01	0.002%
25	-6.51	-58.83	-3.77	6.51	58.83	3.77	0.002%
26	-3.85	-58.83	-6.66	3.85	58.83	6.66	0.002%
27	-0.02	-23.85	-9.52	0.02	23.85	9.51	0.009%
28	4.49	-23.85	-7.81	-4.49	23.85	7.81	0.010%
29	7.65	-23.85	-4.42	-7.65	23.85	4.42	0.011%
30	9.01	-23.85	0.02	-9.01	23.85	-0.02	0.010%
31	8.23	-23.85	4.77	-8.23	23.85	-4.77	0.009%
32	4.52	-23.85	7.83	-4.52	23.85	-7.82	0.010%
33	0.02	-23.85	8.87	-0.02	23.85	-8.86	0.011%
34	-4.49	-23.85	7.81	4.49	23.85	-7.81	0.010%
35	-8.22	-23.85	4.75	8.21	23.85	-4.74	0.009%
36	-9.01	-23.85	-0.02	9.01	23.85	0.02	0.010%
37	-7.67	-23.85	-4.45	7.67	23.85	4.45	0.011%
38	-4.52	-23.85	-7.83	4.52	23.85	7.83	0.010%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	6	0.00000001	0.00000001
2	Yes	7	0.00026286	0.00059939
3	Yes	7	0.00028596	0.00065160
4	Yes	7	0.00030685	0.00069856
5	Yes	7	0.00028608	0.00065205
6	Yes	7	0.00026288	0.00059969
7	Yes	7	0.00028730	0.00065393
8	Yes	7	0.00030735	0.00069994
9	Yes	7	0.00028659	0.00065306
10	Yes	7	0.00026288	0.00059925
11	Yes	7	0.00028665	0.00065304
12	Yes	7	0.00030726	0.00069946
13	Yes	7	0.00028722	0.00065346
14	Yes	6	0.00000001	0.00023792
15	Yes	8	0.00000001	0.00060329
16	Yes	8	0.00000001	0.00059689
17	Yes	8	0.00000001	0.00059665
18	Yes	8	0.00000001	0.00059448
19	Yes	8	0.00000001	0.00059959
20	Yes	8	0.00000001	0.00060611
21	Yes	8	0.00000001	0.00061425

22	Yes	8	0.00000001	0.00061395
23	Yes	8	0.00000001	0.00061486
24	Yes	8	0.00000001	0.00061595
25	Yes	8	0.00000001	0.00061764
26	Yes	8	0.00000001	0.00061028
27	Yes	7	0.00000001	0.00061955
28	Yes	7	0.00000001	0.00063662
29	Yes	7	0.00000001	0.00065317
30	Yes	7	0.00000001	0.00063733
31	Yes	7	0.00000001	0.00062037
32	Yes	7	0.00000001	0.00063959
33	Yes	7	0.00000001	0.00065553
34	Yes	7	0.00000001	0.00063849
35	Yes	7	0.00000001	0.00061998
36	Yes	7	0.00000001	0.00063814
37	Yes	7	0.00000001	0.00065456
38	Yes	7	0.00000001	0.00063854

Maximum Tower Deflections - Service Wind

Section No.	*Elevation* *ft*	*Horz. Deflection* *in*	*Gov. Load Comb.*	*Tilt* °	*Twist* °
T1	140 - 120	3.80	35	0.255	0.016
T2	120 - 100	2.75	35	0.225	0.015
T3	100 - 80	1.86	35	0.181	0.012
T4	80 - 60	1.16	35	0.137	0.009
T5	60 - 40	0.65	35	0.095	0.006
T6	40 - 20	0.30	35	0.057	0.004
T7	20 - 0	0.09	35	0.029	0.002

Critical Deflections and Radius of Curvature - Service Wind

Elevation *ft*	*Appurtenance*	*Gov. Load Comb.*	*Deflection* *in*	*Tilt* °	*Twist* °	*Radius of Curvature* *ft*
140'	Lightning Rod	35	3.80	0.255	0.016	94302
137'	(2) FD9R6004/2C-3L	35	3.64	0.251	0.016	94302
124'	(2) DB980H90E-M w/ Mount Pipe	35	2.95	0.232	0.015	29483
101'	RR90-17-00DP w/ Mount Pipe	35	1.90	0.184	0.012	26494
60'	GPS_A	35	0.65	0.095	0.006	28249
50'	GPS	35	0.45	0.075	0.005	32594

Maximum Tower Deflections - Design Wind

Section No.	*Elevation* *ft*	*Horz. Deflection* *in*	*Gov. Load Comb.*	*Tilt* °	*Twist* °
T1	140 - 120	10.93	2	0.731	0.046
T2	120 - 100	7.91	2	0.647	0.043
T3	100 - 80	5.36	2	0.521	0.034

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T4	80 - 60	3.34	2	0.394	0.026
T5	60 - 40	1.86	2	0.273	0.018
T6	40 - 20	0.85	2	0.165	0.012
T7	20 - 0	0.25	2	0.084	0.005

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
140'	Lightning Rod	2	10.93	0.731	0.046	33069
137'	(2) FD9R6004/2C-3L	2	10.46	0.720	0.046	33069
124'	(2) DB980H90E-M w/ Mount Pipe	2	8.49	0.667	0.044	10339
101'	RR90-17-00DP w/ Mount Pipe	2	5.47	0.527	0.035	9245
60'	GPS_A	2	1.86	0.273	0.018	9811
50'	GPS	2	1.30	0.216	0.015	11332

Bolt Design Data

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt K	Allowable Load K	Ratio Load / Allowable	Allowable Ratio	Criteria
T1	140	Leg	A325N	0.63	4	4.00	13.50	0.297 ✔	1.333	Bolt Tension
		Diagonal	A325N	0.50	1	3.40	3.81	0.893 ✔	1.333	Member Block Shear
		Top Girt	A325N	0.50	1	0.53	2.72	0.196 ✔	1.333	Member Bearing
T2	120	Leg	A325N	0.75	4	9.54	19.44	0.491 ✔	1.333	Bolt Tension
		Diagonal	A325N	0.50	1	3.09	3.81	0.812 ✔	1.333	Member Block Shear
		Top Girt	A325N	0.50	1	0.06	2.72	0.023 ✔	1.333	Member Bearing
T3	100	Leg	A325N	0.88	4	14.60	26.46	0.552 ✔	1.333	Bolt Tension
		Diagonal	A325N	0.50	1	3.94	4.12	0.954 ✔	1.333	Bolt Shear
T4	80	Leg	A325N	0.88	4	19.38	26.46	0.732 ✔	1.333	Bolt Tension
		Diagonal	A325N	0.50	1	4.19	4.12	1.017 ✔	1.333	Bolt Shear
T5	60	Leg	A325N	1.00	4	23.74	34.56	0.687 ✔	1.333	Bolt Tension
		Diagonal	A325N	0.50	1	4.54	4.12	1.102 ✔	1.333	Bolt Shear
T6	40	Leg	A325N	1.00	4	27.64	34.56	0.800 ✔	1.333	Bolt Tension
		Diagonal	A325N	0.63	1	5.35	5.10	1.050 ✔	1.333	Member Bearing
T7	20	Leg	A449	1.00	4	32.85	31.10	1.056 ✔	1.333	Bolt Tension
		Diagonal	A325N	0.63	1	5.88	6.44	0.912 ✔	1.333	Bolt Shear

Compression Checks

Leg Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
T1	140 - 120	ROHN 2 STD	20'	4'	61.0 K=1.00	22.55	1.07	-19.97	24.23	0.824 ✔
T2	120 - 100	ROHN 2.5 EH	20'3/8"	5'1/8"	65.0 K=1.00	21.84	2.25	-44.13	49.21	0.897 ✔
T3	100 - 80	ROHN 3 EH	20'3/8"	6'8-5/32"	70.5 K=1.00	20.84	3.02	-66.75	62.85	1.062 ✔
T4	80 - 60	ROHN 3.5 EH	20'3/8"	6'8-5/32"	61.3 K=1.00	22.49	3.68	-88.78	82.72	1.073 ✔
T5	60 - 40	ROHN 4 X-STR	20'15/32"	6'8-5/32"	54.3 K=1.00	23.67	4.41	-109.79	104.33	1.052 ✔
T6	40 - 20	ROHN 5 EH	20'3/8"	10'1/4"	65.4 K=1.00	21.78	6.11	-128.63	133.13	0.966 ✔
T7	20 - 0	ROHN 5 X-STR	20'3/8"	9'11-5/8"	65.1 K=1.00	21.83	6.11	-154.37	133.43	1.157 ✔

Diagonal Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
T1	140 - 120	L1 3/4x1 3/4x3/16	7'8-5/32"	3'7-7/16"	126.6 K=1.00	9.32	0.62	-3.50	5.79	0.604 ✔
T2	120 - 100	L1 3/4x1 3/4x3/16	9'8-3/4"	4'9-1/4"	166.7 K=1.00	5.37	0.62	-3.09	3.34	0.927 ✔
T3	100 - 80	L2x2x3/16	12'3-1/4"	6'23/32"	184.5 K=1.00	4.39	0.71	-3.93	3.14	1.253 ✔
T4	80 - 60	L2 1/2x2 1/2x3/16	14'1/4"	6'10-29/32"	167.6 K=1.00	5.32	0.90	-4.19	4.80	0.874 ✔
T5	60 - 40	L3x3x3/16	15'10-11/16"	7'9-31/32"	157.6 K=1.00	6.01	1.09	-4.54	6.56	0.693 ✔
T6	40 - 20	L3x3x3/16	19'1-3/16"	9'5-13/32"	190.3 K=1.00	4.12	1.09	-5.52	4.49	1.228 ✔
T7	20 - 0	L3x3x1/4	20'9-19/32"	10'3-19/32"	208.8 K=1.00	3.42	1.44	-5.88	4.93	1.192 ✔
		KL/R > 200 (C) - 152								

Top Girt Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
T1	140 - 120	L2x2x1/8	6'6-1/4"	6'1-5/16"	184.6 K=1.00	4.38	0.48	-0.50	2.12	0.237 ✔
T2	120 - 100	L2x2x1/8	6'6-23/32"	6'1-29/32"	185.8 K=1.00	4.32	0.48	-0.09	2.09	0.042 ✔

Tension Checks

Leg Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
T1	140 - 120	ROHN 2 STD	20'	4'	61.0	30.00	1.07	16.01	32.24	0.497 ✔
T2	120 - 100	ROHN 2.5 EH	20'3/8"	5'1/8"	65.0	30.00	2.25	38.17	67.61	0.565 ✔
T3	100 - 80	ROHN 3 EH	20'3/8"	6'8-5/32"	70.5	30.00	3.02	58.40	90.48	0.645 ✔
T4	80 - 60	ROHN 3.5 EH	20'3/8"	6'8-5/32"	61.3	30.00	3.68	77.51	110.35	0.702 ✔
T5	60 - 40	ROHN 4 X-STR	20'15/32"	6'8-5/32"	54.3	30.00	4.41	94.98	132.22	0.718 ✔
T6	40 - 20	ROHN 5 EH	20'3/8"	10'1/4"	65.4	30.00	6.11	110.55	183.36	0.603 ✔
T7	20 - 0	ROHN 5 X-STR	20'3/8"	9'11-5/8"	65.1	30.00	6.11	131.41	183.36	0.717 ✔

Diagonal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
T1	140 - 120	L1 3/4x1 3/4x3/16	7'8-5/32"	3'7-7/16"	83.3	29.00	0.38	3.40	10.96	0.310 ✔
T2	120 - 100	L1 3/4x1 3/4x3/16	9'8-3/4"	4'9-1/4"	109.0	29.00	0.38	3.09	10.96	0.282 ✔
T3	100 - 80	L2x2x3/16	11'1-29/32"	5'6-1/8"	109.2	29.00	0.45	3.85	13.00	0.296 ✔
T4	80 - 60	L2 1/2x2 1/2x3/16	14'1/4"	6'10-29/32"	108.2	29.00	0.59	4.10	17.07	0.240 ✔
T5	60 - 40	L3x3x3/16	15'10-11/16"	7'9-31/32"	101.3	29.00	0.73	4.48	21.16	0.212 ✔
T6	40 - 20	L3x3x3/16	19'1-3/16"	9'5-13/32"	122.3	29.00	0.71	5.35	20.65	0.259 ✔
T7	20 - 0	L3x3x1/4	20'9-19/32"	10'3-19/32"	134.5	32.50	0.94	5.68	30.53	0.186

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
										✔

Top Girt Design Data (Tension)

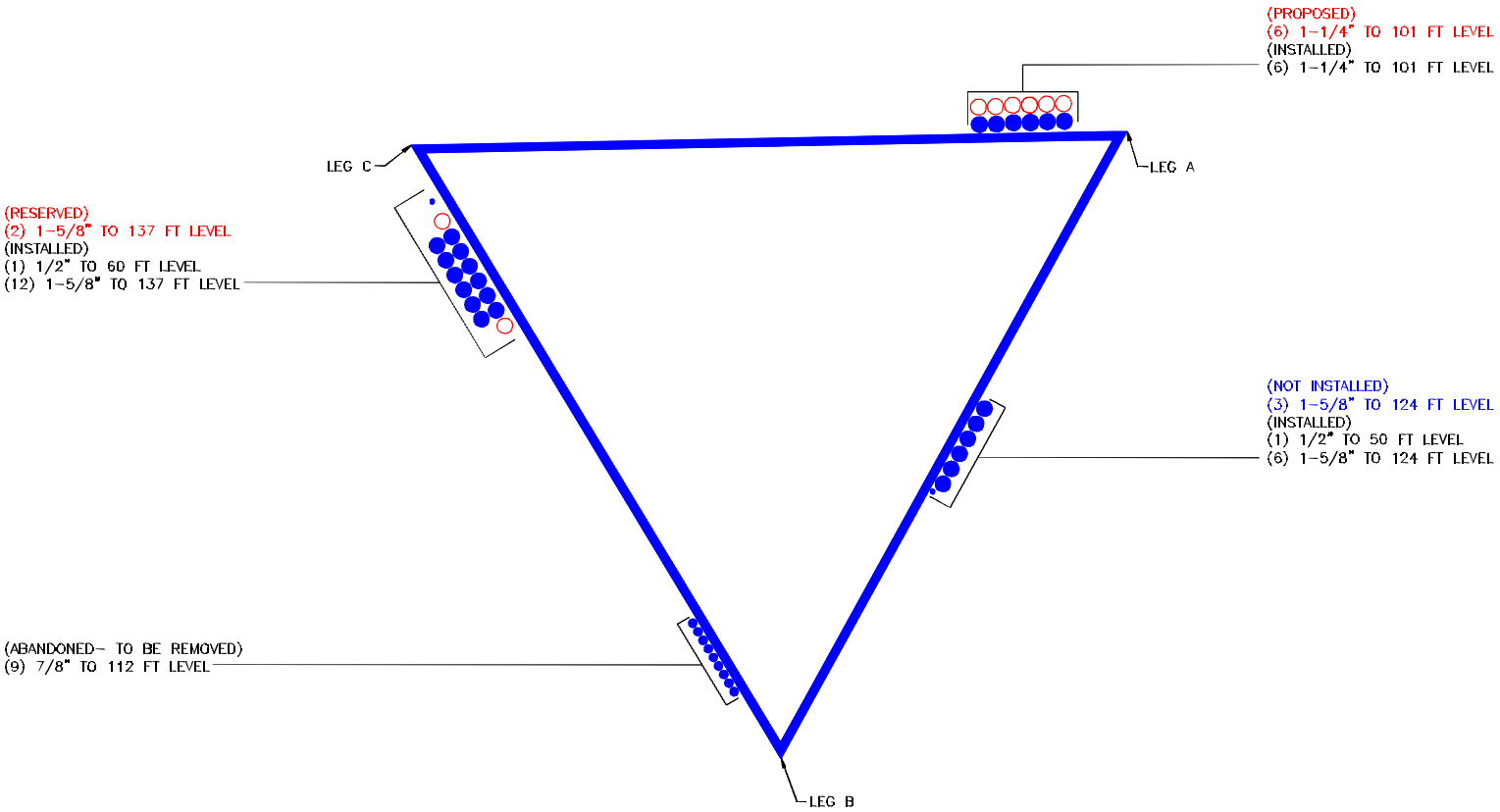
Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
T1	140 - 120	L2x2x1/8	6'6-1/4"	6'1-5/16"	121.2	29.00	0.30	0.53	8.84	0.060 ✔
T2	120 - 100	L2x2x1/8	6'6-23/32"	6'1-29/32"	122.0	29.00	0.30	0.06	8.84	0.007 ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
T1	140 - 120	Leg	ROHN 2 STD	2	-19.97	32.30	61.8	Pass
T2	120 - 100	Leg	ROHN 2.5 EH	38	-44.13	65.60	67.3	Pass
T3	100 - 80	Leg	ROHN 3 EH	69	-66.75	83.78	79.7	Pass
T4	80 - 60	Leg	ROHN 3.5 EH	90	-88.78	110.27	80.5	Pass
T5	60 - 40	Leg	ROHN 4 X-STR	111	-109.79	139.07	78.9	Pass
T6	40 - 20	Leg	ROHN 5 EH	132	-128.63	177.46	72.5	Pass
T7	20 - 0	Leg	ROHN 5 X-STR	147	-154.37	177.86	86.8	Pass
T1	140 - 120	Diagonal	L1 3/4x1 3/4x3/16	7	-3.50	7.71	45.3 67.0 (b)	Pass
T2	120 - 100	Diagonal	L1 3/4x1 3/4x3/16	44	-3.09	4.45	69.5	Pass
T3	100 - 80	Diagonal	L2x2x3/16	74	-3.93	4.18	94.0	Pass
T4	80 - 60	Diagonal	L2 1/2x2 1/2x3/16	95	-4.19	6.39	65.6 76.3 (b)	Pass
T5	60 - 40	Diagonal	L3x3x3/16	116	-4.54	8.74	52.0 82.6 (b)	Pass
T6	40 - 20	Diagonal	L3x3x3/16	137	-5.52	5.99	92.1	Pass
T7	20 - 0	Diagonal	L3x3x1/4	152	-5.88	6.57	89.4	Pass
T1	140 - 120	Top Girt	L2x2x1/8	6	-0.50	2.83	17.8	Pass
T2	120 - 100	Top Girt	L2x2x1/8	41	-0.09	2.79	3.2	Pass
							Summary	
						Leg (T7)	86.8	Pass
						Diagonal (T3)	94.0	Pass
						Top Girt (T1)	17.8	Pass
						Bolt Checks	82.6	Pass
						RATING =	**94.0**	**Pass**

APPENDIX B

BASE LEVEL DRAWING


(PROPOSED)
(6) 1-1/4" TO 101 FT LEVEL
(INSTALLED)
(6) 1-1/4" TO 101 FT LEVEL
LEG C
LEG A
(RESERVED)
(2) 1-5/8" TO 137 FT LEVEL
(INSTALLED)
(1) 1/2" TO 60 FT LEVEL
(12) 1-5/8" TO 137 FT LEVEL
(NOT INSTALLED)
(3) 1-5/8" TO 124 FT LEVEL
(INSTALLED)
(1) 1/2" TO 50 FT LEVEL
(6) 1-5/8" TO 124 FT LEVEL
(ABANDONED- TO BE REMOVED)
(9) 7/8" TO 112 FT LEVEL
LEG B

APPENDIX C

ADDITIONAL CALCULATIONS

SST(PAD-PIER) FOUNDATION CALCULATOR (VERSION 1)

Updated:	2/14/2013

FDH ENGINEERING INNOVATION

PROJECT INFORMATION

FDH Project No:	146GCJ1400
Client Project Name:	HRT 087 943325
Client Project No:	806383
Date:	11/7/2014
Code (F or G):	F

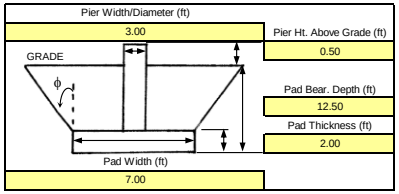
FOUNDATION INFORMATION

Density Concrete (pcf):**	150
Pier Type (S or R):	R
Pier Width/Diameter (ft):	3.00
Pier Cross. Sect. Area (ft^2):	7.069
Pier Height Above Grade (ft):	0.50
Pad Width (ft):	7.00
Pad Thickness (ft):	2.00
Pad Bearing Depth (ft):	12.50
Frost Depth (ft):	3.00
Water Table Depth (ft):	50.00

SOIL INFORMATION

# of Layers Above Pad:	3	Must Be Int. >=1,<=5
# of Layers Adjacent Pad:	1	Must Be Int. >=1,<=5
Total # of Layers:	4	Must Be Int. >=2,<=6
# of Layers Check	OK	If "OK" then cont.
Frost Depth Check	OK	If "OK" then cont.
Water Table Check	OK	If "OK" then cont.
Pad Check	OK	If "OK" then cont.

Checks if # of Layers is within appropriate range
Checks if the frost depth is between layers
Checks if the water table is between layers
Checks if the top of the pad is between soil layers



LEGEND

Input	
Output	
Notes	
Factors & N/A	
Pass/Fail	PASS/FAIL

BEARING CAPACITY INFORMATION

Gross/Net (G/N):	G
Gross Ws (kip):	261.95
Gross Wc (kip):	26.36
Net Wc (kip):	N/A

FACTORS

FACTORS	Rev-F	Rev-G
Weight Resist.	N/A	0.9
Weight Acting	N/A	1.2
Bearing Resist.	0.5	0.75
Up. Resist. Conc.	0.8	N/A
Up. Resist. Soil	0.50	N/A
Up. Resist. Comb.	0.67	0.75

UPLIFT CHECK

Resistance Forces	(Ultimate)	(Allowable)	Acting Forces		Working %
Wt. Concrete (kip):	26.36	21.09	Tower Uplift (kip):	131	82.45%
Wt. Soil (kip):	261.95	130.97			Pass/Fail
Friction (kip):	13.62	6.81			PASS

COMPRESSION CHECK

Resistance Forces	(Ultimate)	(Allowable)	Acting Forces		Working %
Bear. Cap. (ksf):	40.00	20.00	Tower Comp. (kip):	154	44.82%
Friction (kip):	13.62	6.81	Wt. Conc. (kip):	26.36	Pass/Fail
			Wt. Soil (kip):	261.95	PASS

HELPFUL TIPS

*Enter all resistance forces as ultimate values.

**Enter "# of Layers" prior to entering indiv. layer info.

***The frost depth, water table depth, and top of anchor must fall between two soil layers. If any fall within a soil layer, be sure to split the layer into two layers.

****Do not reduce a soil layer's unit weight to account for bouyancy. This will be calculated and accounted for automatically.

*****Do not enter soil data beyond the depth of the bottom of the pad. Only the soil data from the layers above and adjacent to the pad are required.

Soil Profile							Frustum Calculations						Friction Calculations	
Layer	Depth at Bot. (ft)	Soil Type (C/S)	Unit Wt. (pcf)	Thickness (ft)	Frict. Angle (°)	Cohesion (psf)	Bot. Area (ft^2)	Top Area (ft^2)	Vol. of Soil (ft^3)	Net Vol. of Soil (ft^3)	Net Soil Wt. (kip)	Net Conc. Wt. (kip)	Total Up. (kip)	Total Comp. (kip)
1	3.00	S	115	3.00	35	0	306.36	471.08	1157.33	1136.13	130.65	0.74	0.00	0.00
2	7.80	S	115	4.80	35	0	116.23	306.36	978.07	944.14	108.58	1.19	0.00	0.00
3	10.50	S	115	2.70	35	0	49.00	116.23	216.63	197.55	22.72	0.67	0.00	0.00
4	12.50	S	115	2.00	35	0	N/A	N/A	N/A	N/A	N/A	3.43	13.62	13.62
5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Notes	Cals depth at bot. of soil layer given layer thicknesses	Soil Profile Data Input					Calcs area of bottom of frustum	Calcs area of top of frustum	Calcs volume of soil above pad	Calcs net volume of soil above pad	Calcs net weight of soil above pad	Calcs wt. conc. - wt. soil within foundation volume	Sum of all frictional uplift forces for each soil layer	Sum of all frictional compression forces for each soil layer
Equation	Depth above + Layer Thickness						W*L Anch. or TA(bel.)	TW*TL	(1/3)*t*((TA+BA) +sqrt(TA+BA))	Vs-Apier*t	Vs*γs	If Pier:Apier*t*(γc*γs) If Pad:4*W*t*(γc*γs)	Sum(S to S & S to P)	S to P

Pad Locator		Friction Calculations				Universal Calculations							
Layer	Pad? (Y/N)	Soil to Soil (kip)	Soil to Pad (kip)	Adhesion (psf)	Friction Coeff.	Frost Depth? (Y/ N)	Water Table? (Y/ N)	Bouy. Unit Wt. (pcf)	Bouy. Wt. Soil (kip)	Ko	Vert. Press. (ksf)	Rest Press. (ksf)	Rest Resist. (kip)
1	N	0.00	0.00	N/A	0.43	Y	N	115.00	130.65	0.43	0.35	0.07	1.54
2	N	0.00	0.00	N/A	0.43	N	N	115.00	108.58	0.43	0.90	0.26	8.90
3	N	0.00	0.00	N/A	0.43	N	N	115.00	22.72	0.43	1.21	0.45	8.48
4	Y	N/A	13.62	N/A	0.43	N	N	115.00	N/A	0.43	1.44	0.56	7.90
5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Notes	Determines location of anchor in soil profile	Calcs soil plug cohesional resistance	Calcs frict. on pad sides	Calcs adhesion based on cohesion	Calcs friction coefficient	Determines if soil layer is within the frost depth	Determines if soil layer is beneath the water table	Calculates bouyant unit weight	Calculates net bouyant weight of soil above pad	Calcs resting earth pressure coefficient	Calcs vertical pressure at bottom of each soil layer	Calcs average resting pressure on each soil layer	Calcs resting force acting on sides of each soil layer
Equation	N/A	0.5*Cu*4*W*t	Adh*(4*SAas) or 4*RPF*FC	(0.31+(0.34/Cu))*Cu	tan((2/3)*φ)	N/A	N/A	γs-γw	(γs-γw)*Vs	1-sin(φ)	Ptop+γs*t	(PVtop+PVbot)*0.5* Ko	RPavg*t*L

SERIES IDENTIFIER & SERIES DEPENDENT CALCULATIONS

Tot., # Adj. Anchor	True/False	Water Table Count.	% Pad Bel. WT	Water Table Count.	% Pier Bel. WT	% Total Bel. WT	Pad Check
6,1	FALSE	0	0.00%	0	0.00%	0.00%	0
6,2	FALSE	0	0.00%	0	0.00%	0.00%	0
6,3	FALSE	0	0.00%	0	0.00%	0.00%	0
6,4	FALSE	0	0.00%	0	0.00%	0.00%	0
6,5	FALSE	0	0.00%	0	0.00%	0.00%	0
5,1	FALSE	0	0.00%	0	0.00%	0.00%	0
5,2	FALSE	0	0.00%	0	0.00%	0.00%	0
5,3	FALSE	0	0.00%	0	0.00%	0.00%	0
5,4	FALSE	0	0.00%	0	0.00%	0.00%	0
4,1	TRUE	0	0.00%	0	0.00%	0.00%	1
4,2	FALSE	0	0.00%	0	0.00%	0.00%	0
4,3	FALSE	0	0.00%	0	0.00%	0.00%	0
3,1	FALSE	0	0.00%	0	0.00%	0.00%	0
3,2	FALSE	0	0.00%	0	0.00%	0.00%	0
2,1	FALSE	0	0.00%	0	0.00%	0.00%	0

SYMBOL KEY

Name	Symbol	Name	Symbol
Pad Width	W	Avg. Rest. Press.	RPavg
Anchor Width	L	Vert. Press. at Top	PVtop
Volume of Soil	Vs	Vert. Press. at Bot.	PVbot
Unit Weight Soil	γs	Side Area Anchor	SAas
Unit Weight Water	γw	Weight of Soil	Ws
Unit Weight Conc.	γc	Weight of Concrete	Wc
Friction Angle	φ	Friction Coefficient	FC
Layer Thickness	t	Rest. Press. Force	RPF
Soil to Soil	S to S	Cohesion	Cu
Soil to Pad	S to P	Adhesion	Adh
Area of Pier	Apier		