



**Crown Castle**  
3530 Toringdon Way Suite 300  
Charlotte NC 28277

Tel (704) 405-6600

October 17, 2014

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

**RE: T-Mobile-Exempt Modification - Crown Site BU: 822765**  
**T-Mobile Site ID: CT11025B**  
**Located at: 10 Sylvia St, Branford, CT 06405**

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 The Honorable James B. Cosgrove, First Selectman for the City of Branford, and 322 East Main Street LLC, Property Owner.

T-Mobile plans to modify the existing wireless communications facility owned by Crown Castle and located at **10 Sylvia St, Branford, CT 06405**. 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: The Honorable James B. Cosgrove, First Selectman  
Selectman's Office  
Branford Town Hall  
1019 Main Street  
Branford, CT 06405

cc: 322 East Main Street LLC  
375 Fairfield Avenue, Building 1  
Stamford, CT 06911



T-MOBILE NORTHEAST LLC

**T-MOBILE SITE #: CT11057C**  
**CROWN CASTLE BU #: 825983**  
**SITE NAME: MIDDLETOWN 1**  
**90 INDUSTRIAL PARK ROAD**  
**MIDDLETOWN, CT 06457**  
**MIDDLESEX COUNTY**

**SITE CONFIGURATION: 704G**

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



T-MOBILE NORTHEAST LLC

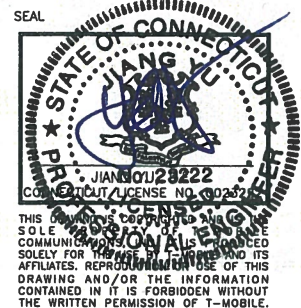
4 SYLVAN WAY  
 PARSIPPANY, NJ 07054  
 PHONE: (973) 397-4800  
 FAX: (973) 292-8893

MIDDLETOWN 1

CT11057C

90 INDUSTRIAL PARK ROAD  
 MIDDLETOWN, CT 06457  
 MIDDLESEX COUNTY

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.



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SCALE: AS SHOWN

REV.	DATE	BY	DESCRIPTION
0	10/07/14	JC	ISSUED AS FINAL
A	08/25/14	JC	ISSUED FOR REVIEW

REVISIONS

DRAWN BY: JC  
 CHECKED BY: BSH  
 APPROVED BY: GHN  
 DATE: 08/21/14  
 TITLE: TITLE SHEET

**TITLE SHEET**

PROJECT NO. 50066258/50066270

T - 1

SHEET NO.

**SITE INFORMATION**



**KEY MAP**

N.T.S.

**DIRECTIONS: (FROM PARSIPPANY):**

TAKE US-202 N TO I-80 E TO I-287 N. KEEP RIGHT AT THE FORK, FOLLOW SIGNS FOR I-87 S/I-287/TAPPAN ZEE BR/NEW YORK CITY/NEW YORK THRUWAY AND MERGE ONTO I-287 E/I-87 S. TAKE EXIT 9N-9S FOR HUTCHINSON PKWY TOWARD WHITESTONE BRIDGE/MERRITT PKWY. MERGE ONTO WESTCHESTER AVE. TAKE THE HUTCHINSON PKWY N RAMP TO MERRITT PKWY. MERGE ONTO HUTCHINSON RIVER PKWY N. CONTINUE ONTO CT-15 N. TAKE EXIT 68 N-E TO MERGE ONTO I-91 N TOWARD CT-66 E/HARTFORD/MIDDLETOWN. TAKE EXIT 20 FOR COUNTRY CLUB RD TOWARD MIDDLE ST. TURN LEFT ONTO COUNTRY CLUB RD. TAKE THE 1ST RIGHT ONTO MIDDLE ST. TURN RIGHT ONTO SMITH ST. TURN LEFT ONTO INDUSTRIAL PARK RD. TURN RIGHT, DESTINATION WILL BE ON THE LEFT.

**PROJECT INFORMATION**

T-MOBILE SITE #: CT11057C  
 CROWN CASTLE BU #: 825983  
 SITE ADDRESS: 90 INDUSTRIAL PARK ROAD  
 MIDDLETOWN, CT 06457  
 MIDDLESEX COUNTY

LATITUDE: N 41° 35' 8.3"  
 LONGITUDE: W 72° 42' 50.49"

TOWER OWNER: CROWN CASTLE  
 1200 MACARTHUR BLVD., SUITE 200  
 MAHWAH, NJ 07430

CONTACT: PETER TISI  
 (201) 236-9224

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

CONTACT: PHONE #: (973) 397-4800  
 FAX #: (973) 292-8893

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

CONTACT: GREG NAWROTZKI  
 (973) 576-9653

SCOPE OF WORK: REMOVE AND REPLACE (3) EXISTING ANTENNAS WITH (3) NEW ANTENNAS, ADD (3) NEW BIAS TEES, ADD (3) NEW RRU'S AT GRADE

**SHEET INDEX**

SHEET NO.	SHEET 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

**APPROVALS**

T-MOBILE	DATE
OWNER/ LANDLORD	DATE
RF ENGINEER	DATE
ZONING	DATE
CONSTRUCTION	DATE

**GENERAL NOTES:**

- 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
- 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.
- 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.
- ALL WORK CARRIED OUT SHALL COMPLY WITH ALL APPLICABLE MUNICIPAL AND UTILITY COMPANY SPECIFICATIONS AND LOCAL JURISDICTIONAL CODES, ORDINANCES AND APPLICABLE REGULATIONS.
- DRAWINGS PROVIDED HERE ARE NOT TO SCALE UNLESS OTHERWISE NOTED AND ARE INTENDED TO SHOW OUTLINE ONLY.
- UNLESS NOTED OTHERWISE, THE WORK SHALL INCLUDE FURNISHING MATERIALS, EQUIPMENT, APPURTENANCES, AND LABOR NECESSARY TO COMPLETE ALL INSTALLATIONS AS INDICATED ON THE DRAWINGS.
- THE CONTRACTOR SHALL INSTALL ALL EQUIPMENT AND MATERIALS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS UNLESS SPECIFICALLY STATED OTHERWISE.
- IF THE SPECIFIED EQUIPMENT CANNOT BE INSTALLED AS SHOWN ON THESE DRAWINGS, THE CONTRACTOR SHALL PROPOSE AN ALTERNATIVE INSTALLATION FOR APPROVAL BY PROJECT MANAGEMENT.
- 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.
- 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.
- 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.
- CONTRACTOR SHALL LEAVE PREMISES IN CLEAN CONDITION.
- 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.
- 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.
- 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.
- 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.
- 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:**

- THE CONTRACTOR SHALL CONTACT UTILITY LOCATING SERVICES PRIOR TO THE START OF CONSTRUCTION.
- 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.
- ALL SITE WORK SHALL BE AS INDICATED ON THE DRAWINGS AND PROJECT SPECIFICATIONS.
- IF NECESSARY, RUBBISH, STUMPS, DEBRIS, STICKS, STONES, TOP SOIL AND OTHER REFUSE SHALL BE REMOVED FROM THE SITE AND DISPOSED OF LEGALLY.
- 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.
- CONTRACTOR SHALL MINIMIZE DISTURBANCE TO EXISTING SITE DURING CONSTRUCTION.
- THE CONTRACTOR SHALL PROVIDE SITE SIGNAGE IN ACCORDANCE WITH THE T-MOBILE SPECIFICATION FOR SITE SIGNAGE.
- THE SITE SHALL BE GRADED TO CAUSE SURFACE WATER TO FLOW AWAY FROM THE TRANSMISSION EQUIPMENT AND TOWER AREAS.
- 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.
- THE SUB GRADE SHALL BE COMPACTED AND BROUGHT TO A SMOOTH UNIFORM GRADE PRIOR TO FINISHED SURFACE APPLICATION, SEE SOIL COMPACTION NOTES.
- 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.
- 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:**

- ALL ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS, NEC AND ALL APPLICABLE LOCAL CODES.
- CONTRACTOR SHALL MODIFY EXISTING CABLE TRAY SYSTEM AS REQUIRED TO SUPPORT RF AND TRANSPORT CABLEING TO THE NEW BTS EQUIPMENT. CONTRACTOR SHALL SUBMIT MODIFICATIONS TO PROJECT MANAGEMENT FOR APPROVAL.
- CONDUIT ROUTINGS ARE SCHEMATIC. CONTRACTOR SHALL INSTALL CONDUITS SO THAT ACCESS TO EQUIPMENT IS NOT BLOCKED.
- WIRING, RACEWAY AND SUPPORT METHODS AND MATERIALS SHALL COMPLY WITH THE REQUIREMENTS OF THE NEC AND TELCORDIA.
- ALL CIRCUITS SHALL BE SEGREGATED AND MAINTAIN MINIMUM CABLE SEPARATION AS REQUIRED BY THE NEC AND TELCORDIA.
- CABLES SHALL NOT BE ROUTED THROUGH LADDER-STYLE CABLE TRAY RUNGS.
- 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.
- 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).
- PANELBOARDS (ID NUMBERS) AND INTERNAL CIRCUIT BREAKERS (CIRCUIT ID NUMBERS) SHALL BE CLEARLY LABELED WITH ENGRAVED LAMACOID PLASTIC LABELS.
- ALL TIE WRAPS SHALL BE CUT FLUSH WITH APPROVED CUTTING TOOL TO REMOVE SHARP EDGES.
- 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.
- 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.
- 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.
- SUPPLEMENTAL EQUIPMENT GROUND WIRING LOCATED OUTDOORS, OR BELOW GRADE, SHALL BE SINGLE CONDUCTOR #2 AWG SOLID TINNED COPPER CABLE, UNLESS OTHERWISE SPECIFIED.
- 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.
- 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).
- RACEWAY AND CABLE TRAY SHALL BE LISTED OR LABELED FOR ELECTRICAL USE IN ACCORDANCE WITH NEMA, UL, ANSI/IEEE, AND NEC.
- NEW RACEWAY OR CABLE TRAY WILL MATCH THE EXISTING INSTALLATION WHERE POSSIBLE.
- 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.
- ELECTRICAL METALLIC TUBING (EMT), ELECTRICAL NONMETALLIC TUBING (ENT), OR RIGID NONMETALLIC CONDUIT (RIGID PVC, SCHEDULE 40) SHALL BE USED FOR CONCEALED INDOOR LOCATIONS.
- GALVANIZED STEEL INTERMEDIATE METALLIC CONDUIT (IMC) SHALL BE USED FOR OUTDOOR LOCATIONS ABOVE GRADE.
- 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.
- LIQUID-TIGHT FLEXIBLE METALLIC CONDUIT (LIQUID-TITE FLEX) SHALL BE USED INDOORS AND OUTDOORS, WHERE VIBRATION OCCURS OR FLEXIBILITY IS NEEDED.
- CONDUIT AND TUBING FITTINGS SHALL BE THREADED OR COMPRESSION-TYPE AND APPROVED FOR THE LOCATION USED. SETSCREW FITTINGS ARE NOT ACCEPTABLE.
- CABINETS, BOXES, AND WIREWAYS SHALL BE LISTED OR LABELED FOR ELECTRICAL USE IN ACCORDANCE WITH NEMA, UL, ANSI/IEEE, AND NEC.
- CABINETS, BOXES, AND WIREWAYS TO MATCH THE EXISTING INSTALLATION WHERE POSSIBLE.
- 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.
- 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.
- 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.
- 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.
- THE CONTRACTOR SHALL NOTIFY AND OBTAIN NECESSARY AUTHORIZATION FROM PROJECT MANAGEMENT BEFORE COMMENCING WORK ON THE AC POWER DISTRIBUTION PANELS.
- 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:**

- 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.
- 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.
- 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.
- 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.
- A CHAMFER 3/4" SHALL BE PROVIDED AT ALL EXPOSED EDGES OF CONCRETE, UNO, IN ACCORDANCE WITH ACI 301 SECTION 4.2.4.
- 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.
- 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.
- 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.
- 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:**

- 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".
- 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.
- BOLTED CONNECTIONS SHALL BE ASTM A325 BEARING TYPE (3/4") CONNECTIONS AND SHALL HAVE MINIMUM OF TWO BOLTS UNLESS NOTED OTHERWISE.
- NON-STRUCTURAL CONNECTIONS FOR STEEL GRATING MAY USE 5/8" DIA. ASTM A 307 BOLTS UNLESS NOTED OTHERWISE.
- 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.
- CONTRACTOR SHALL SUBMIT SHOP DRAWINGS FOR ENGINEER REVIEW & APPROVAL ON PROJECTS REQUIRING STRUCTURAL STEEL.
- ALL STRUCTURAL STEEL WORK SHALL BE DONE IN ACCORDANCE WITH AISC SPECIFICATIONS.

**CONSTRUCTION NOTES:**

- FIELD VERIFICATION:  
CONTRACTOR SHALL FIELD VERIFY SCOPE OF WORK, T-MOBILE ANTENNA PLATFORM LOCATION AND ANTENNAS TO BE REPLACED.
- COORDINATION OF WORK:  
CONTRACTOR SHALL COORDINATE RF WORK AND PROCEDURES WITH PROJECT MANAGEMENT.
- 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.
- 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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MIDDLETOWN 1

CT11057C

90 INDUSTRIAL PARK ROAD  
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MIDDLESEX COUNTY

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SCALE



SCALE

AS SHOWN

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0	10/07/14	JC	ISSUED AS FINAL
A	08/25/14	JC	ISSUED FOR REVIEW

REVISIONS

DRAWN BY JC

CHECKED BY BSH

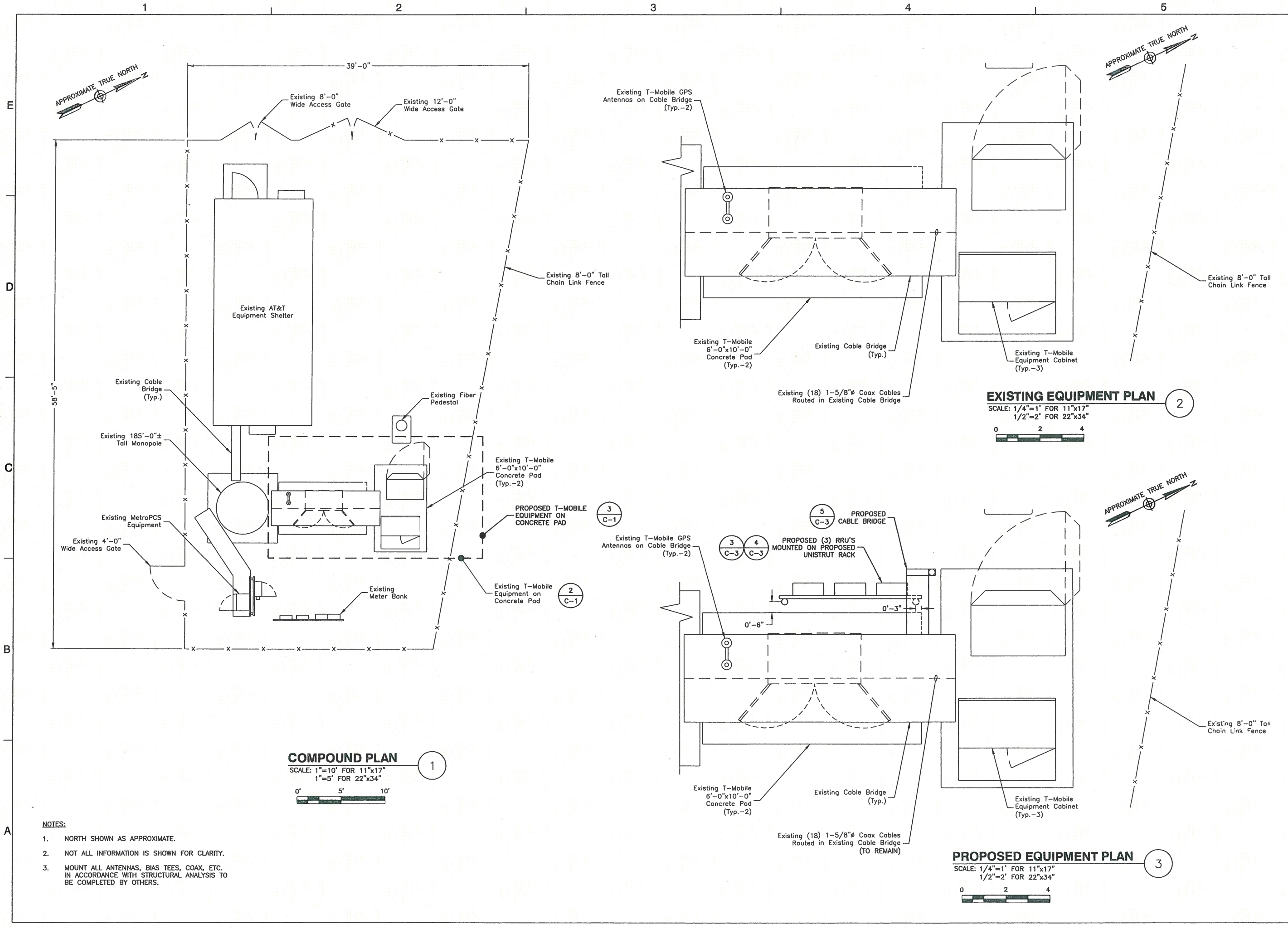
APPROVED BY GHN

DATE 08/21/14

TITLE

**GENERAL NOTES**

PROJECT NO. 50066258/50066270



**COMPOUND PLAN** 1  
 SCALE: 1"=10' FOR 11"x17"  
 1"=5' FOR 22"x34"  
 0' 5' 10'

**EXISTING EQUIPMENT PLAN** 2  
 SCALE: 1/4"=1' FOR 11"x17"  
 1/2"=2' FOR 22"x34"  
 0 2 4

**PROPOSED EQUIPMENT PLAN** 3  
 SCALE: 1/4"=1' FOR 11"x17"  
 1/2"=2' FOR 22"x34"  
 0 2 4

- NOTES:**
1. NORTH SHOWN AS APPROXIMATE.
  2. NOT ALL INFORMATION IS SHOWN FOR CLARITY.
  3. MOUNT ALL ANTENNAS, BIAS TEES, COAX, ETC. IN ACCORDANCE WITH STRUCTURAL ANALYSIS TO BE COMPLETED BY OTHERS.

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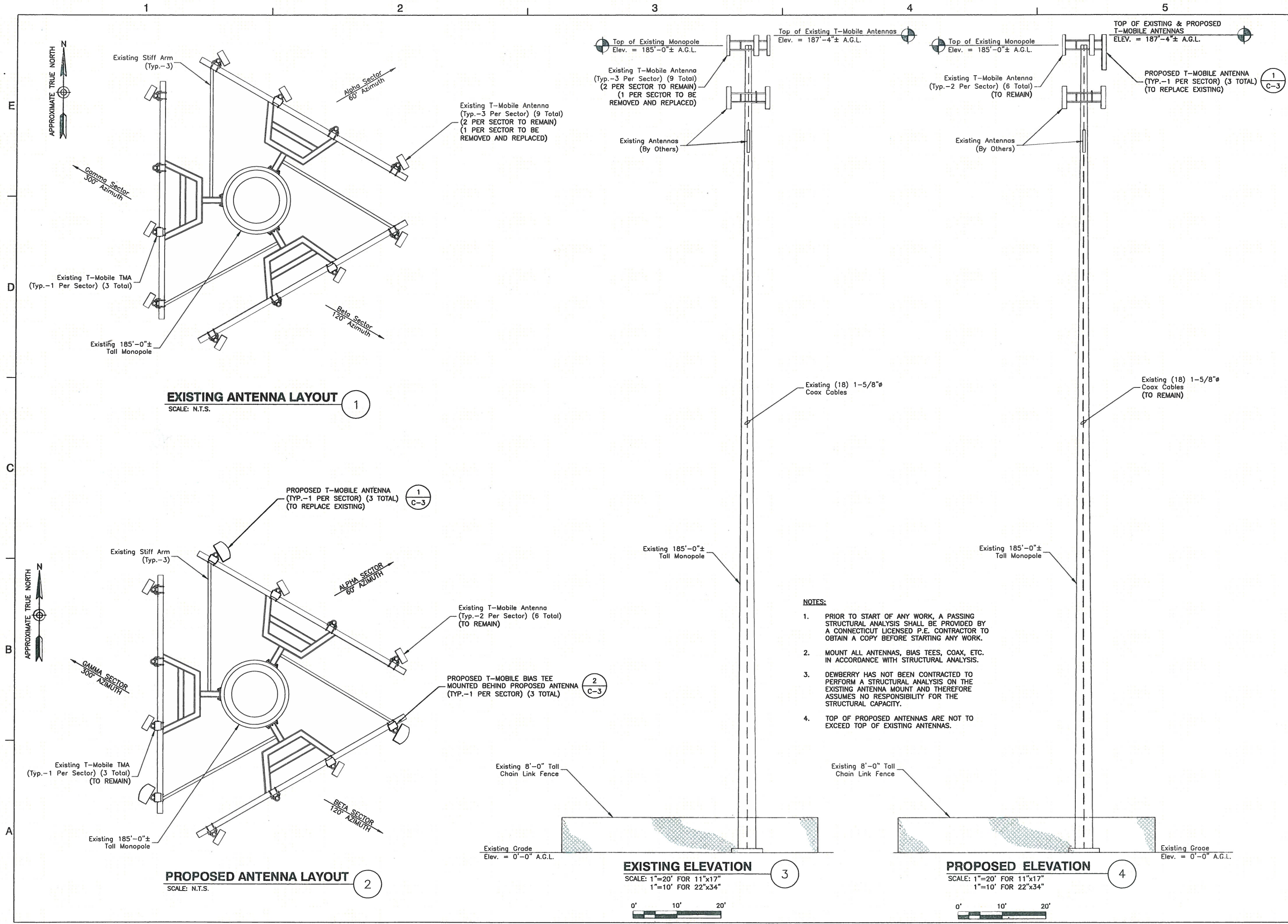
SCALE AS SHOWN

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 APPROVED BY GHN  
 DATE 08/21/14  
 TITLE

**COMPOUND PLAN & EQUIPMENT PLANS**  
 PROJECT NO. 50066258/50066270



**EXISTING ANTENNA LAYOUT**  
SCALE: N.T.S.

**PROPOSED ANTENNA LAYOUT**  
SCALE: N.T.S.

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

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

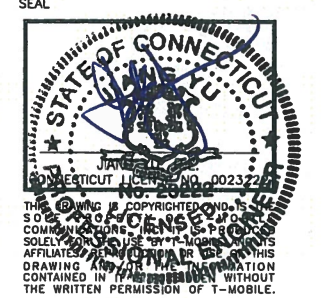
- NOTES:**
1. PRIOR TO START OF ANY WORK, A PASSING STRUCTURAL ANALYSIS SHALL BE PROVIDED BY A CONNECTICUT LICENSED P.E. CONTRACTOR TO OBTAIN A COPY BEFORE STARTING ANY WORK.
  2. MOUNT ALL ANTENNAS, BIAS TEES, COAX, ETC. IN ACCORDANCE WITH STRUCTURAL ANALYSIS.
  3. DEWBERRY HAS NOT BEEN CONTRACTED TO PERFORM A STRUCTURAL ANALYSIS ON THE EXISTING ANTENNA MOUNT AND THEREFORE ASSUMES NO RESPONSIBILITY FOR THE STRUCTURAL CAPACITY.
  4. TOP OF PROPOSED ANTENNAS ARE NOT TO EXCEED TOP OF EXISTING ANTENNAS.

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AS SHOWN

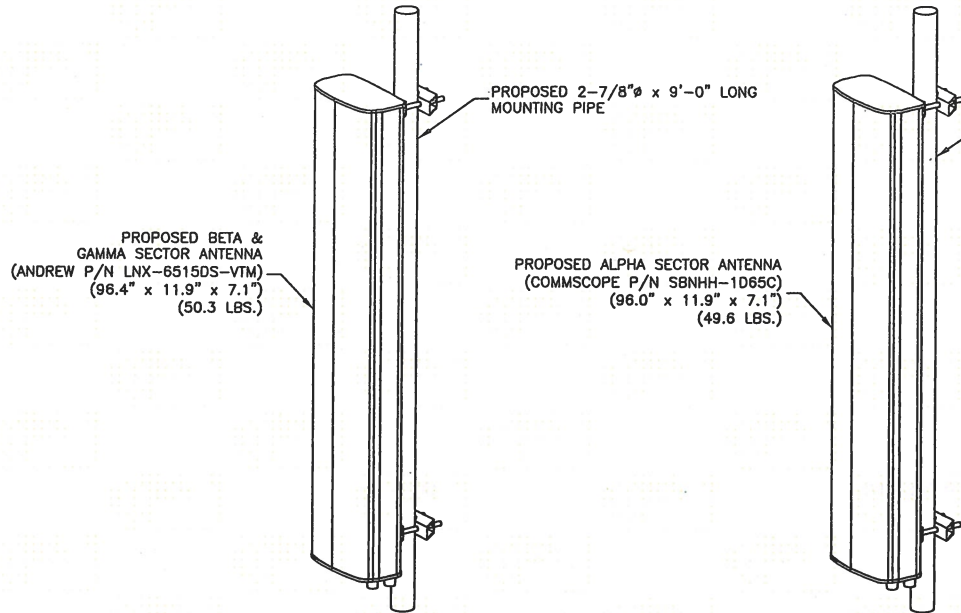
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REVISIONS  
DRAWN BY: JC  
CHECKED BY: BSH  
APPROVED BY: GHN  
DATE: 08/21/14

TITLE  
**ANTENNA LAYOUTS & ELEVATIONS**

PROJECT NO. 50066258/50066270

**C-2**  
SHEET NO.



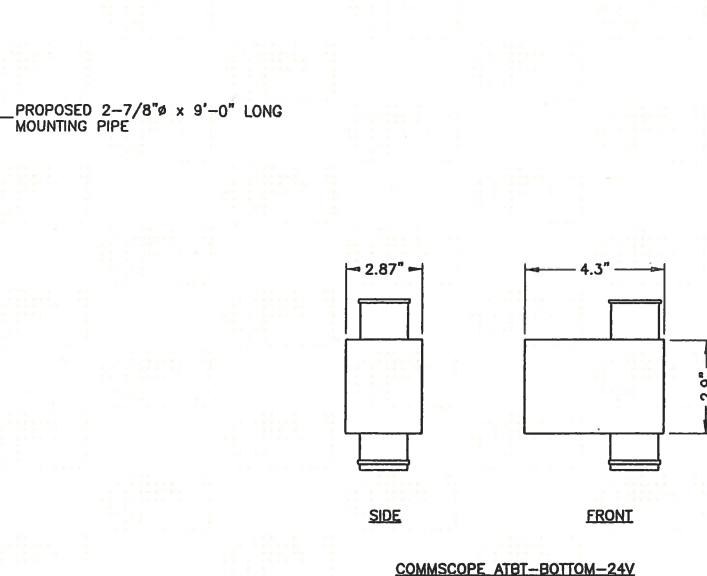
NOTES:

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 DETAILS

SCALE: N.T.S.

1



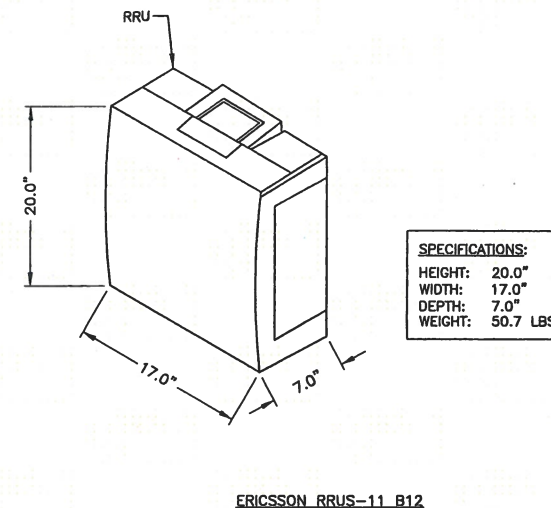
NOTES:

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

SCALE: N.T.S.

2



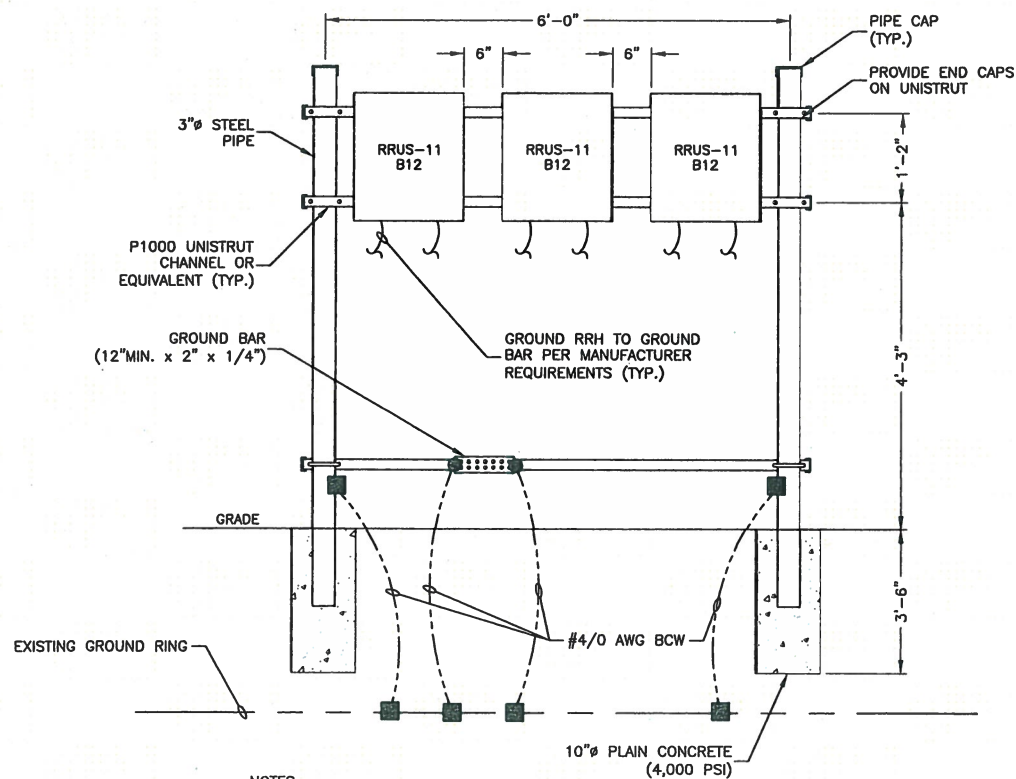
RRU NOTES:

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.

RRUS-11 - REMOTE RADIO UNIT

SCALE: N.T.S.

3



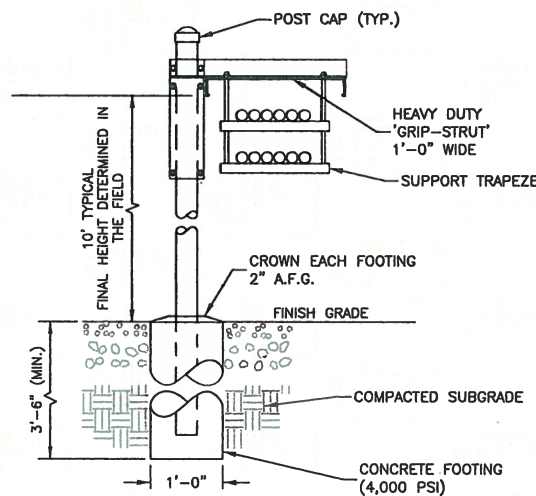
NOTES:

1. CONTRACTOR SHALL SUPPLY AND INSTALL UNISTRUT (OR EQUIVALENT) MOUNTING CHANNELS.
2. CONTRACTOR SHALL SUPPLY (BUT NOT INSTALL) 3/8" UNISTRUT BOLTING HARDWARE AND SPRING NUTS. TYPICAL FOUR PER RRU. CONTRACTOR SHALL BAG THE BOLTING HARDWARE AND HANG FROM INSTALLED UNISTRUT FRAME.
3. SPACING MAY VARY BASED ON SELECTED EQUIPMENT. ADJUSTMENTS TO SPACING WILL BE MADE BY RRU INSTALLER.
4. NO PAINTING OF THE RRU OR SOLAR SHIELD IS ALLOWED.

RRU RACK DETAIL

SCALE: N.T.S.

4



NOTES:

1. CABLE BRIDGE SHALL BE SITE PRO 1 1/2" GRIP-SPAN ICE BRIDGE KITS WITH Z-BRACKET TRAPEZE (P/N: IB12D-216Z) OR APPROVED EQUAL.
2. ALL COMPONENTS SHALL BE INSTALLED ACCORDING TO MANUFACTURER'S SPECIFICATIONS.
3. CONTRACTOR SHALL DETERMINE REQUIRED QUANTITY OF ALL CABLE BRIDGE COMPONENTS.
4. SNAP-IN HANGERS, SPLICE-KITS, HINGE KITS, EXTENSION KITS, STIFFENERS, AND OTHER MISCELLANEOUS HARDWARE SHALL BE PROVIDED BY THE CONTRACTOR AS REQUIRED.
5. CABLE BRIDGE SHALL BE ROUTED TO ACCOMMODATE THE MINIMUM BENDING RADIUS OF THE COAXIAL CABLE.
6. CABLE BRIDGE COMPONENTS SHOWN ARE SCHEMATIC, CONSULT MANUFACTURER FOR EXACT AND CURRENT SPECIFICATIONS.

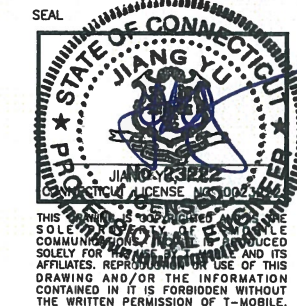
CABLE BRIDGE DETAIL

SCALE: N.T.S.

5

		DESIGN CONFIGURATION			
ANTENNAS		COAX		COAX LENGTH	
EXISTING	PROPOSED	EXISTING	PROPOSED		
ALPHA	EMS RR90-17-02DP	COMMSCOPE SBNHH-1D65C	(6) 1-5/8"	-	235'
	RFS APX16DWV-16DWVS-C	EXISTING TO REMAIN			
BETA	EMS RR90-17-02DP	EXISTING TO REMAIN	(6) 1-5/8"	-	235'
	EMS RR90-17-02DP	COMMSCOPE LNX-6515DS-VTM			
	RFS APX16DWV-16DWVS-C	EXISTING TO REMAIN			
GAMMA	EMS RR90-17-02DP	EXISTING TO REMAIN	(6) 1-5/8"	-	235'
	EMS RR90-17-02DP	COMMSCOPE LNX-6515DS-VTM			
	RFS APX16DWV-16DWVS-C	EXISTING TO REMAIN			
	EMS RR90-17-02DP	EXISTING TO REMAIN			

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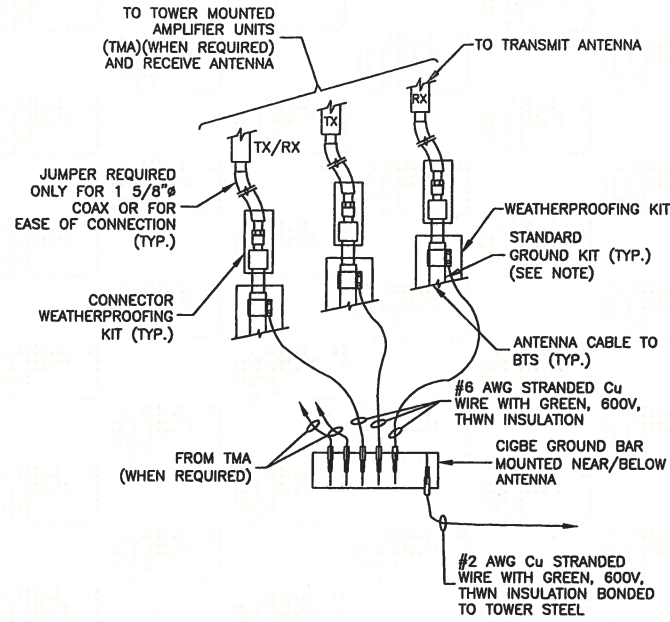
DATE 08/21/14

TITLE

CONSTRUCTION DETAILS

**GROUNDING NOTES:**

- 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.
- 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.
- 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.
- 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.
- 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.
- METAL CONDUIT AND TRAY SHALL BE GROUNDED AND MADE ELECTRICALLY CONTINUOUS WITH LISTED BONDING FITTINGS OR BY BONDING ACROSS THE DISCONTINUITY WITH #6 AWG COPPER WIRE AND UL APPROVED GROUNDING TYPE CONDUIT CLAMPS.
- 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.
- 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.
- ALUMINUM CONDUCTOR OR COPPER CLAD STEEL CONDUCTOR SHALL NOT BE USED FOR GROUNDING CONNECTIONS.
- 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.
- 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.
- ALL EXTERIOR GROUND CONDUCTORS BETWEEN EQUIPMENT/GROUND BARS AND THE GROUND RING, SHALL BE 2 AWG SOLID TIN-PLATED COPPER UNLESS OTHERWISE INDICATED.
- 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.
- EXOTHERMIC WELDS SHALL BE PERMITTED ON TOWERS ONLY WITH THE EXPRESS APPROVAL OF THE TOWER MANUFACTURER OR THE CONTRACTOR'S STRUCTURAL ENGINEER.
- 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.
- ON ROOFTOP SITES WHERE EXOTHERMIC WELDS ARE A FIRE HAZARD COPPER COMPRESSION CAP CONNECTORS MAY BE USED FOR WIRE TO WIRE CONNECTIONS. 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.
- 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.
- APPROVED ANTIOXIDANT COATINGS (I.E., CONDUCTIVE GEL OR PASTE) SHALL BE USED ON ALL COMPRESSION AND BOLTED GROUND CONNECTIONS.
- ALL EXTERIOR GROUND CONNECTIONS SHALL BE COATED WITH A CORROSION RESISTANT MATERIAL.
- MISCELLANEOUS ELECTRICAL AND NON-ELECTRICAL METAL BOXES, FRAMES AND SUPPORTS SHALL BE BONDED TO THE GROUND RING, IN ACCORDANCE WITH THE NEC.
- 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.
- 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.



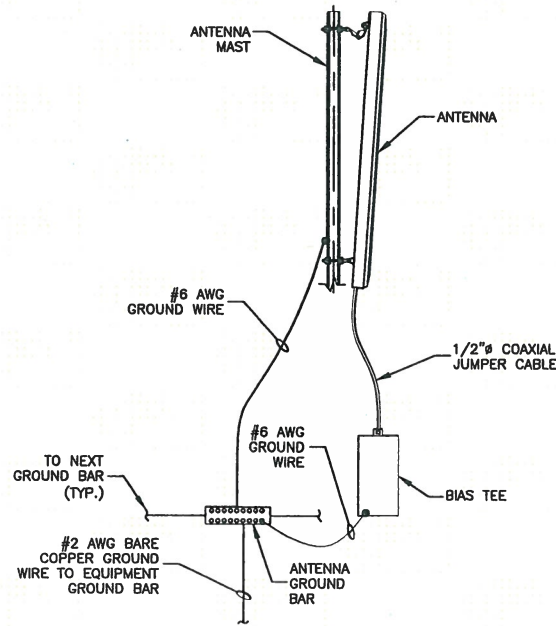
**NOTE:**

- 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)**

SCALE: N.T.S.

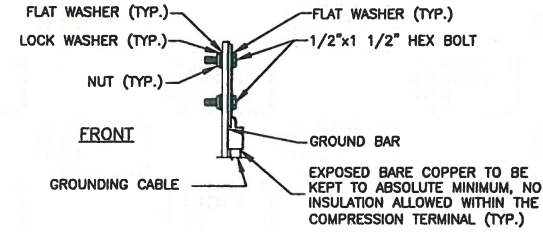
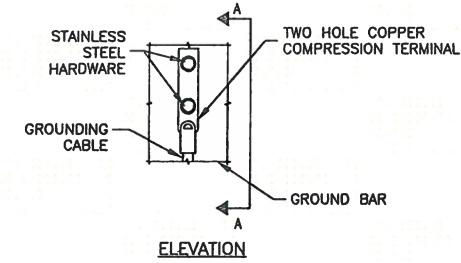
1



**TYPICAL ANTENNA GROUNDING DETAIL**

SCALE: N.T.S.

3



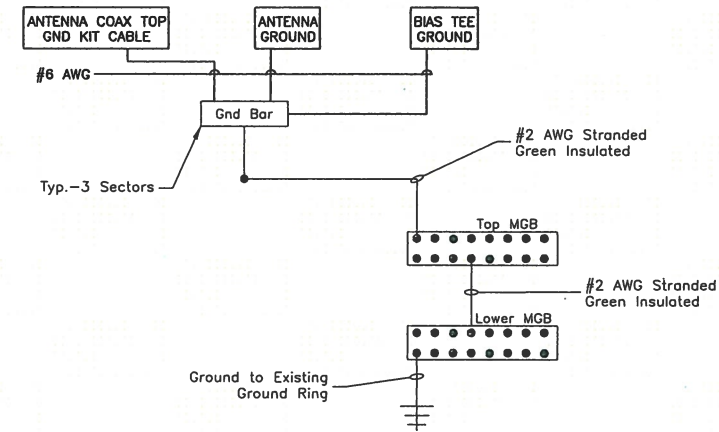
**NOTES:**

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

**TYPICAL GROUND BAR MECHANICAL CONNECTION DETAIL**

SCALE: N.T.S.

2



**NOTES:**

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

**SCHEMATIC GROUNDING DIAGRAM**

SCALE: N.T.S.

4



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REVISIONS

DRAWN BY JC

CHECKED BY BSH

APPROVED BY GHN

DATE 08/21/14

TITLE

**GROUNDING NOTES & DETAILS**

PROJECT NO. 50066258/50066270

E - 1

SHEET NO.





**PAUL J. FORD AND COMPANY**  
**STRUCTURAL ENGINEERS**  
 250 East Broad Street • Suite 600 • Columbus, Ohio 43215-3708

Date: **September 09, 2014**

Debra Elliott  
 Crown Castle  
 3530 Toringdon Way Suite 300  
 Charlotte, NC 28277

Paul J Ford and Company  
 250 E. Broad Street, Suite 600  
 Columbus, OH 43215  
 614.221.6679  
 jwoolley@pjfweb.com

**Subject: Structural Analysis Report**

**Carrier Designation:** *T-Mobile Co-Locate*  
**Carrier Site Number:** CT11057C  
**Carrier Site Name:** N/A

**Crown Castle Designation:**  
**Crown Castle BU Number:** 825983  
**Crown Castle Site Name:** MIDDLETOWN\_1  
**Crown Castle JDE Job Number:** 302375  
**Crown Castle Work Order Number:** 907744  
**Crown Castle Application Number:** 261508 Rev. 1

**Engineering Firm Designation:** Paul J Ford and Company Project Number: 37513-1570.002.7805

**Site Data:**  
 90 Industrial Park Road, Middletown, Middlesex County, CT  
 Latitude 41° 35' 8.3", Longitude -72° 42' 50.49"  
 185 Foot - Monopole Tower

Dear Debra Elliott,

Paul J Ford and Company 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 685783, in accordance with application 261508, revision 1.

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:

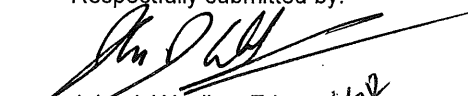
LC4.7: Existing + Reserved + Proposed Equipment w/ Proposed Modifications **Sufficient Capacity**  
 Note: See Table I and Table II for the proposed and existing/reserved loading, respectively.

The structural analysis was performed for this tower in accordance with the requirements the 2005 Connecticut State Building Code 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 0.75 inch ice thickness and 50 mph under service loads.

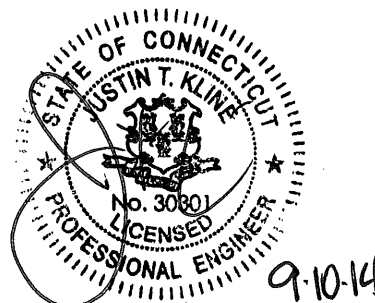
All modifications and equipment proposed in this report shall be installed in accordance with the referenced drawings, dated 8/14/13 and 9/17/13, for the determined available structural capacity to be effective.

We at Paul J Ford and Company 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:

  
 John J. Woolley, E.I. *1612*  
 Structural Designer

tnxTower Report - version 6.1.4.1





PAUL J. FORD AND COMPANY  
STRUCTURAL ENGINEERS  
250 East Broad Street • Suite 600 • Columbus, Ohio 43215-3708

Date: **September 09, 2014**

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Charlotte, NC 28277

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Columbus, OH 43215  
614.221.6679  
jwoolley@pjfweb.com

**Subject: Structural Analysis Report**

**Carrier Designation:**

**T-Mobile Co-Locate**

**Carrier Site Number:**

CT11057C

**Carrier Site Name:**

N/A

**Crown Castle Designation:**

**Crown Castle BU Number:**

825983

**Crown Castle Site Name:**

MIDDLETOWN\_1

**Crown Castle JDE Job Number:**

302375

**Crown Castle Work Order Number:**

907744

**Crown Castle Application Number:**

261508 Rev. 1

**Engineering Firm Designation:**

**Paul J Ford and Company Project Number:** 37513-1570.002.7805

**Site Data:**

**90 Industrial Park Road, Middletown, Middlesex County, CT**

**Latitude 41° 35' 8.3", Longitude -72° 42' 50.49"**

**185 Foot - Monopole Tower**

Dear Debra Elliott,

*Paul J Ford and Company* 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 685783, in accordance with application 261508, revision 1.

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:

LC4.7: Existing + Reserved + Proposed Equipment w/ Proposed Modifications

**Sufficient Capacity**

Note: See Table I and Table II for the proposed and existing/reserved loading, respectively.

The structural analysis was performed for this tower in accordance with the requirements the 2005 Connecticut State Building Code 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 0.75 inch ice thickness and 50 mph under service loads.

All modifications and equipment proposed in this report shall be installed in accordance with the referenced drawings, dated 8/14/13 and 9/17/13, for the determined available structural capacity to be effective.

We at *Paul J Ford and Company* 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:

John J. Woolley, E.I.  
Structural Designer

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**1) INTRODUCTION**

This tower is a 185 ft Monopole tower designed by FRED A. NUDD CORPORATION in May of 1998. The tower was originally designed for a wind speed of 85 mph per TIA/EIA-222-E.

**2) ANALYSIS CRITERIA**

The structural analysis was performed for this tower in accordance with the requirements the 2005 Connecticut State Building Code 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 0.75 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
185.0	185.0	3	commscope	ATBT-BOTTOM-24V	-	-	-
		2	commscope	LNx-6515DS-VTM w/ Mount Pipe			
		1	commscope	SBNHH-1D65C 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
185.0	185.0	3	andrew	ETW190VS12UB	18	1-5/8	1
		3	ems wireless	RR90-17-02DP w/ Mount Pipe			
		3	rfs celwave	APX16DWV-16DWVS-C w/ Mount Pipe			
		1	tower mounts	Sector Mount [SM 802-3]			
		9	ericsson	AIR 21 w/ Mount Pipe	3	1-5/8	
		3	ericsson	AIR 33 w/ Mount Pipe			
		1	raycap	DC6-48-60-18-8F			
175.0	175.0	6	communication components inc.	DTMABP7819VG12A	1 2	3/8 3/4	2
		6	ericsson	RRUS-11			
		3	kmw communications	AM-X-CD-16-65-00T-RET w/ Mount Pipe			
		6	powerwave technologies	LGP13519	12	1-1/4	
		1	raycap	DC6-48-60-18-8F			
		1	tower mounts	Sector Mount [SM 802-3]			
		6	powerwave technologies	7770.00 w/ Mount Pipe			
165.0	165.0	3	rfs celwave	APXV18-206517S-C w/ Mount Pipe	6	1-5/8	1
		1	tower mounts	Pipe Mount [PM 601-3]			
155.0	155.0	3	alcatel lucent	RRH2X40-07-U	2	1-5/8	2
		3	alcatel lucent	RRH2X40-AWS			
		6	antel	BXA-171063-12CF-EDIN-2 w/ Mount Pipe			
		6	antel	BXA-70063-6CF-EDIN-2 w/ Mount Pipe			
		1	rfs celwave	DB-T1-6Z-8AB-OZ			
		1	tower mounts	Platform Mount [LP 301-1]			

- Notes:  
 1) Existing Equipment  
 2) Reserved Equipment  
 3) Equipment To Be Removed

### 3) ANALYSIS PROCEDURE

**Table 3 - Documents Provided**

Document	Remarks	Reference	Source
4-GEOTECHNICAL REPORTS	Clarence Welty, 3/27/1998	3473514	CCISITES
4-TOWER FOUNDATION DRAWINGS/DESIGN/SPECS	Nudd, 98-5980, 5/1/1998	3880469	CCISITES
4-TOWER MANUFACTURER DRAWINGS	Nudd, 98-5980, 5/1/1998	3473517	CCISITES
4-TOWER REINFORCEMENT DESIGN/DRAWINGS/DATA	All-Points Tech, CT107572, 4/26/2005	3879955	CCISITES
4-TOWER PROPOSED REINFORCEMENT DESIGN/DRAWINGS/DATA	PJF, 37513-1570 BP, 8/14/2013	3954032	CCISITES
4-TOWER PROPOSED REINFORCEMENT DESIGN/DRAWINGS/DATA	PJF, 37513-1570 BP A, 9/17/13	3990532	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) The Nudd manufacturer's drawings specify an anchor rod that does not exist. From experience with Nudd monopoles, the anchors are likely A36 standard anchors and have been assumed as such.
- 5) Monopole will be reinforced in conformance with the referenced modification drawings dated 8/14/2013.
- 6) Monopole will be reinforced in conformance with the referenced proposed modification drawings dated 9/17/13.

This analysis may be affected if any assumptions are not valid or have been made in error. Paul J Ford and Company should be notified to determine the effect on the structural integrity of the tower.

**4) ANALYSIS RESULTS**

**Table 4 - Section Capacity (Summary)**

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
L1	185 - 180	Pole	TP18x18x0.1875	1	-1.377	361.254	18.7	Pass
L2	180 - 153	Pole	TP26.8088x18x0.25	2	-7.522	718.182	88.0	Pass
L3	153 - 151.833	Pole	TP27.1894x26.8088x0.3625	3	-7.692	1051.792	63.8	Pass
L4	151.833 - 151	Pole	TP27.4613x27.1894x0.5246	4	-7.851	1527.325	46.0	Pass
L5	151 - 130	Pole	TP34.3125x27.4613x0.3802	5	-10.448	1328.220	83.9	Pass
L6	130 - 120.667	Pole	TP36.844x31.9209x0.4447	6	-14.042	1750.722	83.5	Pass
L7	120.667 - 115	Pole	TP38.6875x36.844x0.4776	7	-15.372	1934.076	81.9	Pass
L8	115 - 114	Pole	TP39.0125x38.6875x0.5402	8	-15.639	2248.011	71.6	Pass
L9	114 - 95	Pole	TP45.1875x39.0125x0.4463	9	-18.774	2065.883	90.1	Pass
L10	95 - 91	Pole	TP45.8125x42.3448x0.5294	10	-22.956	2592.778	80.7	Pass
L11	91 - 90	Pole	TP46.1391x45.8125x0.465	11	-23.230	2297.212	91.6	Pass
L12	90 - 61.5	Pole	TP55.4461x46.1391x0.5299	12	-32.774	3147.320	83.5	Pass
L13	61.5 - 58	Pole	TP56.5891x55.4461x0.5263	13	-34.052	3165.902	84.9	Pass
L14	58 - 40	Pole	TP61.6875x56.5891x0.5788	14	-41.536	3628.093	83.9	Pass
L15	40 - 33	Pole	TP63.9583x61.6875x0.5704	15	-44.580	3910.529	80.9	Pass
L16	33 - 28	Pole	TP65.5804x63.9583x0.595	16	-46.900	4047.974	80.3	Pass
L17	28 - 0	Pole	TP73.8125x65.5804x0.5758	17	-60.428	4154.028	90.6	Pass
							Summary	
						Pole (L11)	91.6	Pass
						<b>RATING =</b>	<b>91.6</b>	<b>Pass</b>

**Table 5 - Tower Component Stresses vs. Capacity**

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1	Anchor Rods	0	84.0	Pass
1	Base Plate	0	50.2	Pass
1	Base Foundation (Combined)	0	84.0	Pass

<b>Structure Rating (max from all components) =</b>	<b>91.6%</b>
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Notes:

- 1) See additional documentation in "Appendix C – Additional Calculations" for calculations supporting the % capacity consumed.

**4.1) Recommendations**

Reinforce the pole as shown in PJF drawings 37513-1570 BP and 37513-1570 BP A, dated 8/14/13 and 9/17/13, respectively.

**APPENDIX A**  
**TNXTOWER OUTPUT**



## Tower Input Data

There is a pole section.

This tower is designed using the TIA/EIA-222-F standard.

The following design criteria apply:

- 1) Tower is located in Middlesex County, Connecticut.
- 2) Basic wind speed of 85 mph.
- 3) Nominal ice thickness of 0.7500 in.
- 4) Ice density of 56.000 pcf.
- 5) A wind speed of 38 mph is used in combination with ice.
- 6) Temperature drop of 50.000 °F.
- 7) Deflections calculated using a wind speed of 50 mph.
- 8) A non-linear (P-delta) analysis was used.
- 9) Pressures are calculated at each section.
- 10) Stress ratio used in pole design is 1.333.
- 11) Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

## Options

Consider Moments - Legs Consider Moments - Horizontals Consider Moments - Diagonals Use Moment Magnification ✓ Use Code Stress Ratios ✓ Use Code Safety Factors - Guys Escalate Ice Always Use Max Kz Use Special Wind Profile Include Bolts In Member Capacity Leg Bolts Are At Top Of Section Secondary Horizontal Braces Leg Use Diamond Inner Bracing (4 Sided) Add IBC .6D+W Combination	Distribute Leg Loads As Uniform Assume Legs Pinned ✓ Assume Rigid Index Plate ✓ Use Clear Spans For Wind Area Use Clear Spans For KL/r Retension Guys To Initial Tension ✓ Bypass Mast Stability Checks ✓ Use Azimuth Dish Coefficients ✓ Project Wind Area of Appurt. ✓ Autocalc Torque Arm Areas SR Members Have Cut Ends Sort Capacity Reports By Component Triangulate Diamond Inner Bracing Use TIA-222-G Tension Splice Capacity Exemption	Treat Feedline Bundles As Cylinder Use ASCE 10 X-Brace Ly Rules Calculate Redundant Bracing Forces Ignore Redundant Members in FEA SR Leg Bolts Resist Compression All Leg Panels Have Same Allowable Offset Girt At Foundation ✓ Consider Feedline Torque Include Angle Block Shear Check <div style="text-align: center; background-color: #e0e0e0; padding: 2px;">Poles</div> ✓ Include Shear-Torsion Interaction Always Use Sub-Critical Flow Use Top Mounted Sockets
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## Tapered Pole Section Geometry

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L1	185.000- 180.000	5.000	0.000	12	18.0000	18.0000	0.1875	0.7500	A36M-42 (42 ksi)
L2	180.000- 153.000	27.000	0.000	12	18.0000	26.8088	0.2500	1.0000	A36M-42 (42 ksi)
L3	153.000- 151.833	1.167	0.000	12	26.8088	27.1894	0.3625	1.4499	Reinf 42.00 ksi (42 ksi)
L4	151.833- 151.000	0.833	0.000	12	27.1894	27.4613	0.5246	2.0983	Reinf 41.97 ksi (42 ksi)
L5	151.000- 130.000	21.000	5.000	12	27.4613	34.3125	0.3802	1.5206	Reinf 42.00 ksi (42 ksi)
L6	130.000- 120.667	14.333	0.000	12	31.9209	36.8440	0.4447	1.7787	Reinf 42.00 ksi (42 ksi)
L7	120.667- 115.000	5.667	0.000	12	36.8440	38.6875	0.4776	1.9105	Reinf 41.15 ksi (41 ksi)
L8	115.000- 114.000	1.000	0.000	12	38.6875	39.0125	0.5402	2.1608	Reinf 42.00 ksi (42 ksi)
L9	114.000- 95.000	19.000	6.000	12	39.0125	45.1875	0.4463	1.7854	Reinf 42.00 ksi (42 ksi)

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L10	95.000-91.000	10.000	0.000	12	42.3448	45.8125	0.5293	2.1174	Reinf 42.00 ksi (42 ksi)
L11	91.000-90.000	1.000	0.000	12	45.8125	46.1391	0.4650	1.8600	Reinf 42.00 ksi (42 ksi)
L12	90.000-61.500	28.500	0.000	12	46.1391	55.4461	0.5299	2.1194	Reinf 42.00 ksi (42 ksi)
L13	61.500-58.000	3.500	0.000	12	55.4461	56.5891	0.5263	2.1054	Reinf 41.66 ksi (42 ksi)
L14	58.000-40.000	18.000	0.000	12	56.5891	61.6875	0.5788	2.3152	Reinf 39.83 ksi (40 ksi)
L15	40.000-33.000	7.000	0.000	12	61.6875	63.9583	0.5704	2.2814	Reinf 42.00 ksi (42 ksi)
L16	33.000-28.000	5.000	0.000	12	63.9583	65.5804	0.5950	2.3800	Reinf 40.65 ksi (41 ksi)
L17	28.000-0.000	28.000		12	65.5804	73.8125	0.5758	2.3032	Reinf 38.25 ksi (38 ksi)

### Tapered Pole Properties

Section	Tip Dia. in	Area in <sup>2</sup>	I in <sup>4</sup>	r in	C in	I/C in <sup>3</sup>	J in <sup>4</sup>	It/Q in <sup>2</sup>	w in	w/t
L1	18.6350	10.7543	435.5296	6.3769	9.3240	46.7106	882.5011	5.2929	4.3215	23.048
	18.6350	10.7543	435.5296	6.3769	9.3240	46.7106	882.5011	5.2929	4.3215	23.048
L2	18.6350	14.2888	574.6149	6.3545	9.3240	61.6275	1164.3256	7.0325	4.1540	16.616
	27.7545	21.3798	1924.8847	9.5080	13.8869	138.6112	3900.3383	10.5225	6.5147	26.059
L3	27.7545	30.8669	2755.5460	9.4678	13.8869	198.4273	5583.4833	15.1917	6.2133	17.142
	28.1485	31.3111	2876.2480	9.6040	14.0841	204.2195	5828.0583	15.4104	6.3153	17.423
L4	28.1485	45.0408	4087.6060	9.5460	14.0841	290.2283	8282.5980	22.1677	5.8809	11.211
	28.4300	45.5000	4213.9101	9.6433	14.2249	296.2342	8538.5243	22.3937	5.9537	11.35
L5	28.4300	33.1504	3103.1778	9.6950	14.2249	218.1507	6287.8796	16.3156	6.3408	16.679
	35.5229	41.5371	6104.4940	12.1478	17.7739	343.4532	12369.359	20.4433	8.1769	21.509
L6	34.8249	45.0689	5699.3931	11.2685	16.5350	344.6858	11548.515	22.1815	7.3631	16.559
	38.1438	52.1180	8813.7607	13.0310	19.0852	461.8110	17859.068	25.6509	8.6825	19.526
L7	38.1438	55.9304	9441.3633	13.0192	19.0852	494.6952	19130.761	27.5272	8.5942	17.993
	40.0522	58.7656	10951.159	13.6791	20.0401	546.4616	22190.017	28.9226	9.0882	19.028
L8	40.0522	66.3563	12325.243	13.6567	20.0401	615.0283	24974.285	32.6586	8.9205	16.513
	40.3887	66.9216	12642.953	13.7731	20.2085	625.6263	25618.052	32.9368	9.0076	16.674
L9	40.3887	55.4279	10522.691	13.8067	20.2085	520.7068	21321.825	27.2799	9.2592	20.745
	46.7815	64.3027	16429.689	16.0173	23.4071	701.9098	33291.004	31.6478	10.9141	24.452
L10	45.9926	71.2747	15907.259	14.9699	21.9346	725.2127	32232.421	35.0793	9.9298	18.758
	47.4286	77.1854	20202.012	16.2114	23.7309	851.2966	40934.753	37.9883	10.8591	20.514
L11	47.4286	67.8974	17821.562	16.2344	23.7309	750.9863	36111.316	33.4170	11.0316	23.724
	47.7667	68.3863	18209.355	16.3513	23.9000	761.8967	36897.091	33.6577	11.1191	23.913
L12	47.7667	77.8146	20661.051	16.3281	23.9000	864.4779	41864.890	38.2980	10.9453	20.657
	57.4020	93.6935	36065.930	19.6600	28.7211	1255.7305	73079.353	46.1131	13.4396	25.365
L13	57.4020	93.0788	35833.881	19.6613	28.7211	1247.6511	72609.158	45.8106	13.4490	25.552
	58.5853	95.0159	38118.051	20.0705	29.3131	1300.3745	77237.506	46.7639	13.7553	26.134
L14	58.5853	104.3883	41799.694	20.0517	29.3131	1425.9716	84697.514	51.3768	13.6147	23.522

Section	Tip Dia. in	Area in <sup>2</sup>	I in <sup>4</sup>	r in	C in	I/C in <sup>3</sup>	J in <sup>4</sup>	I/Q in <sup>2</sup>	w in	w/t
			8				0			
	63.8636	113.8905	54284.954	21.8769	31.9541	1698.8403	109996.03	56.0534	14.9811	25.883
L15	63.8636	112.2433	53514.632	21.8799	31.9541	1674.7332	108435.15	55.2427	15.0037	26.306
			8				47			
	66.2145	116.4137	59704.079	22.6929	33.1304	1802.0927	120976.65	57.2953	15.6123	27.373
L16	66.2145	121.3998	62212.816	22.6841	33.1304	1877.8158	126060.03	59.7493	15.5462	26.128
			2				10			
	67.8938	124.5075	67113.899	23.2648	33.9706	1975.6450	135990.95	61.2788	15.9809	26.858
L17	67.8938	120.5234	65004.728	23.2716	33.9706	1913.5570	131717.20	59.3179	16.0324	27.844
			1				21			
	76.4163	135.7864	92960.785	26.2187	38.2349	2431.3087	188363.75	66.8299	18.2386	31.675
			9				60			
			2				44			
			2				38			

Tower Elevation	Gusset Area (per face)	Gusset Thickness	Gusset Grade	Adjust. Factor A <sub>r</sub>	Adjust. Factor A <sub>r</sub>	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals	Double Angle Stitch Bolt Spacing Horizontals
ft	ft <sup>2</sup>	in					in	in
L1 185.000-180.000				1	1	1		
L2 180.000-153.000				1	1	1		
L3 153.000-151.833				1	1	1		
L4 151.833-151.000				1	1	1		
L5 151.000-130.000				1	1	1		
L6 130.000-120.667				1	1	1		
L7 120.667-115.000				1	1	1		
L8 115.000-114.000				1	1	1		
L9 114.000-95.000				1	1	1		
L10 95.000-91.000				1	1	1		
L11 91.000-90.000				1	1	1		
L12 90.000-61.500				1	1	1		
L13 61.500-58.000				1	1	1		
L14 58.000-40.000				1	1	1		
L15 40.000-33.000				1	1	1		
L16 33.000-28.000				1	1	1		
L17 28.000-0.000				1	1	1		

### Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C <sub>A</sub> A <sub>A</sub> ft <sup>2</sup> /ft	Weight klf
LDF7-50A(1-5/8")	C	No	CaAa (Out Of Face)	185.000 - 0.000	1	No Ice	0.198	0.001
						1/2" Ice	0.298	0.002
						1" Ice	0.398	0.004
LDF7-50A(1-5/8")	C	No	CaAa (Out Of Face)	185.000 - 0.000	5	No Ice	0.000	0.001
						1/2" Ice	0.000	0.002

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number	C <sub>A</sub> A <sub>A</sub>		Weight
						ft <sup>2</sup> /ft	klf	
LDF7-50A(1-5/8")	C	No	Inside Pole	185.000 - 0.000	15	1" Ice	0.000	0.004
						No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
LDF6-50A(1-1/4")	C	No	Inside Pole	175.000 - 0.000	12	1" Ice	0.000	0.001
						No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
FB-L98-002-XXX( 3/8)	C	No	Inside Pole	175.000 - 0.000	1	1" Ice	0.000	0.001
						No Ice	0.000	0.000
						1/2" Ice	0.000	0.000
WR-VG86ST-BRD( 3/4)	C	No	Inside Pole	175.000 - 0.000	2	1" Ice	0.000	0.000
						No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
LDF7-50A(1-5/8")	C	No	Inside Pole	165.000 - 0.000	6	1" Ice	0.000	0.001
						No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
HB158-1-08U8-S8J18( 1-5/8)	C	No	Inside Pole	155.000 - 0.000	2	1" Ice	0.000	0.001
						No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
Aero MP3-04	C	No	CaAa (Out Of Face)	53.330 - 38.330	1	1" Ice	0.000	0.001
						No Ice	0.269	0.000
						1/2" Ice	0.380	0.000
Aero MP3-05	C	No	CaAa (Out Of Face)	123.330 - 88.330	1	1" Ice	0.491	0.000
						No Ice	0.348	0.000
						1/2" Ice	0.400	0.000
Aero MP3-04	C	No	CaAa (Out Of Face)	153.750 - 123.330	1	1" Ice	0.657	0.000
						No Ice	0.269	0.000
						1/2" Ice	0.380	0.000
Aero MP3-08	C	No	CaAa (Out Of Face)	37.000 - 0.000	1	1" Ice	0.491	0.000
						No Ice	0.467	0.000
						1/2" Ice	0.578	0.000
Aero MP3-06	C	No	CaAa (Out Of Face)	93.250 - 37.000	1	1" Ice	0.689	0.000
						No Ice	0.434	0.000
						1/2" Ice	0.545	0.000
Aero MP3-04	C	No	CaAa (Out Of Face)	98.250 - 93.250	1	1" Ice	0.657	0.000
						No Ice	0.269	0.000
						1/2" Ice	0.380	0.000
Aero MP3-03	C	No	CaAa (Out Of Face)	132.500 - 112.500	1	1" Ice	0.491	0.000
						No Ice	0.262	0.000
						1/2" Ice	0.374	0.000
Aero MP3-03	C	No	CaAa (Out Of Face)	154.500 - 149.500	1	1" Ice	0.485	0.000
						No Ice	0.262	0.000
						1/2" Ice	0.374	0.000
						1" Ice	0.485	0.000

### Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A <sub>R</sub> ft <sup>2</sup>	A <sub>F</sub> ft <sup>2</sup>	C <sub>A</sub> A <sub>A</sub> In Face ft <sup>2</sup>	C <sub>A</sub> A <sub>A</sub> Out Face ft <sup>2</sup>	Weight K
L1	185.000-180.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.990	0.086
L2	180.000-153.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	5.941	0.731
L3	153.000-151.833	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.851	0.040
L4	151.833-151.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.608	0.028
L5	151.000-130.000	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	10.857	0.712
L6	130.000-120.667	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000

Tower Section n	Tower Elevation ft	Face	$A_R$ $ft^2$	$A_F$ $ft^2$	$C_A A_A$ In Face $ft^2$	$C_A A_A$ Out Face $ft^2$	Weight K
L7	120.667-115.000	C	0.000	0.000	0.000	7.018	0.316
		A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
L8	115.000-114.000	C	0.000	0.000	0.000	4.580	0.192
		A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
L9	114.000-95.000	C	0.000	0.000	0.000	0.808	0.034
		A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
L10	95.000-91.000	C	0.000	0.000	0.000	11.638	0.644
		A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
L11	91.000-90.000	C	0.000	0.000	0.000	3.631	0.136
		A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
L12	90.000-61.500	C	0.000	0.000	0.000	0.980	0.034
		A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
L13	61.500-58.000	C	0.000	0.000	0.000	18.602	0.966
		A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
L14	58.000-40.000	C	0.000	0.000	0.000	2.213	0.119
		A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
L15	40.000-33.000	C	0.000	0.000	0.000	14.968	0.610
		A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
L16	33.000-28.000	C	0.000	0.000	0.000	5.005	0.237
		A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
L17	28.000-0.000	C	0.000	0.000	0.000	3.323	0.170
		A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	18.611	0.949

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

Tower Section n	Tower Elevation ft	Face or Leg	Ice Thickness in	$A_R$ $ft^2$	$A_F$ $ft^2$	$C_A A_A$ In Face $ft^2$	$C_A A_A$ Out Face $ft^2$	Weight K
L1	185.000-180.000	A	0.750	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	1.740	0.163
L2	180.000-153.000	A	0.750	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	10.366	1.148
L3	153.000-151.833	A	0.750	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	1.415	0.058
L4	151.833-151.000	A	0.750	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	1.011	0.041
L5	151.000-130.000	A	0.750	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	18.174	1.037
L6	130.000-120.667	A	0.750	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	11.566	0.461
L7	120.667-115.000	A	0.750	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	7.398	0.280
L8	115.000-114.000	A	0.750	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	1.305	0.049
L9	114.000-95.000	A	0.750	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	$A_R$ ft <sup>2</sup>	$A_F$ ft <sup>2</sup>	$C_{AA}$ In Face ft <sup>2</sup>	$C_{AA}$ Out Face ft <sup>2</sup>	Weight K
L10	95.000-91.000	C	0.750	0.000	0.000	0.000	18.710	0.938
		A		0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
L11	91.000-90.000	C	0.750	0.000	0.000	0.000	5.620	0.197
		A		0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
L12	90.000-61.500	C	0.750	0.000	0.000	0.000	1.477	0.049
		A		0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
L13	61.500-58.000	C	0.750	0.000	0.000	0.000	27.929	1.407
		A		0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
L14	58.000-40.000	C	0.750	0.000	0.000	0.000	3.322	0.173
		A		0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
L15	40.000-33.000	C	0.750	0.000	0.000	0.000	22.890	0.889
		A		0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
L16	33.000-28.000	C	0.750	0.000	0.000	0.000	7.500	0.346
		A		0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
L17	28.000-0.000	C	0.750	0.000	0.000	0.000	4.907	0.247
		A		0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000
		C		0.000	0.000	0.000	27.477	1.382

### Feed Line Center of Pressure

Section	Elevation ft	$CP_x$ in	$CP_z$ in	$CP_x$ Ice in	$CP_z$ Ice in
L1	185.000-180.000	-0.2272	0.1312	-0.3437	0.1984
L2	180.000-153.000	-0.2605	0.1504	-0.3988	0.2302
L3	153.000-151.833	-0.7156	0.4132	-0.9880	0.5704
L4	151.833-151.000	-0.7177	0.4144	-0.9924	0.5730
L5	151.000-130.000	-0.5605	0.3236	-0.8136	0.4697
L6	130.000-120.667	-0.7785	0.4494	-1.1000	0.6351
L7	120.667-115.000	-0.8354	0.4823	-1.1659	0.6731
L8	115.000-114.000	-0.8402	0.4851	-1.1762	0.6791
L9	114.000-95.000	-0.6790	0.3920	-0.9740	0.5623
L10	95.000-91.000	-0.9506	0.5488	-1.2978	0.7493
L11	91.000-90.000	-1.0139	0.5853	-1.3532	0.7813
L12	90.000-61.500	-0.7326	0.4230	-1.0067	0.5812
L13	61.500-58.000	-0.7234	0.4177	-1.0022	0.5786
L14	58.000-40.000	-0.9267	0.5351	-1.2908	0.7452
L15	40.000-33.000	-0.8163	0.4713	-1.1315	0.6533
L16	33.000-28.000	-0.7688	0.4438	-1.0579	0.6108
L17	28.000-0.000	-0.7748	0.4473	-1.0708	0.6182

### Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment t	Placement ft	$C_{AA}$ Front ft <sup>2</sup>	$C_{AA}$ Side ft <sup>2</sup>	Weight K	
***									
ETW190VS12UB	A	From Leg	4.000 0.000	0.000	185.000	No Ice 1/2"	0.664 0.778	0.367 0.461	0.015 0.020

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C <sub>A</sub> A <sub>A</sub> Front ft <sup>2</sup>	C <sub>A</sub> A <sub>A</sub> Side ft <sup>2</sup>	Weight K
			0.000						
ETW190VS12UB	B	From Leg	4.000 0.000 0.000	0.000	185.000	Ice 1" Ice No Ice	0.901 0.664 0.778	0.564 0.367 0.461	0.026 0.015 0.020
ETW190VS12UB	C	From Leg	4.000 0.000 0.000	0.000	185.000	Ice 1" Ice No Ice	0.901 0.664 0.778	0.564 0.367 0.461	0.026 0.015 0.020
Sector Mount [SM 802-3]	C	None		0.000	185.000	Ice 1" Ice No Ice	0.901 0.664 0.778	0.564 0.367 0.461	0.026 0.015 0.020
RR90-17-02DP w/ Mount Pipe	A	From Leg	4.000 0.000 0.000	0.000	185.000	Ice 1" Ice No Ice	0.901 0.664 0.778	0.564 0.367 0.461	0.026 0.015 0.020
RR90-17-02DP w/ Mount Pipe	B	From Leg	4.000 0.000 0.000	0.000	185.000	Ice 1" Ice No Ice	0.901 0.664 0.778	0.564 0.367 0.461	0.026 0.015 0.020
RR90-17-02DP w/ Mount Pipe	C	From Leg	4.000 0.000 0.000	0.000	185.000	Ice 1" Ice No Ice	0.901 0.664 0.778	0.564 0.367 0.461	0.026 0.015 0.020
APX16DWV-16DWVS-C w/ Mount Pipe	A	From Leg	4.000 0.000 0.000	0.000	185.000	Ice 1" Ice No Ice	0.901 0.664 0.778	0.564 0.367 0.461	0.026 0.015 0.020
APX16DWV-16DWVS-C w/ Mount Pipe	B	From Leg	4.000 0.000 0.000	0.000	185.000	Ice 1" Ice No Ice	0.901 0.664 0.778	0.564 0.367 0.461	0.026 0.015 0.020
APX16DWV-16DWVS-C w/ Mount Pipe	C	From Leg	4.000 0.000 0.000	0.000	185.000	Ice 1" Ice No Ice	0.901 0.664 0.778	0.564 0.367 0.461	0.026 0.015 0.020
ATBT-BOTTOM-24V	A	From Leg	4.000 0.000 0.000	0.000	185.000	Ice 1" Ice No Ice	0.901 0.664 0.778	0.564 0.367 0.461	0.026 0.015 0.020
SBNHH-1D65C w/ Mount Pipe	A	From Leg	4.000 0.000 0.000	0.000	185.000	Ice 1" Ice No Ice	0.901 0.664 0.778	0.564 0.367 0.461	0.026 0.015 0.020
ATBT-BOTTOM-24V	B	From Leg	4.000 0.000 0.000	0.000	185.000	Ice 1" Ice No Ice	0.901 0.664 0.778	0.564 0.367 0.461	0.026 0.015 0.020
LNX-6515DS-VTM w/ Mount Pipe	B	From Leg	4.000 0.000 0.000	0.000	185.000	Ice 1" Ice No Ice	0.901 0.664 0.778	0.564 0.367 0.461	0.026 0.015 0.020
ATBT-BOTTOM-24V	C	From Leg	4.000 0.000 0.000	0.000	185.000	Ice 1" Ice No Ice	0.901 0.664 0.778	0.564 0.367 0.461	0.026 0.015 0.020
LNX-6515DS-VTM w/ Mount Pipe	C	From Leg	4.000 0.000 0.000	0.000	185.000	Ice 1" Ice No Ice	0.901 0.664 0.778	0.564 0.367 0.461	0.026 0.015 0.020
****									
(2) 7770.00 w/ Mount Pipe	A	From Leg	4.000 0.000	10.000	175.000	No Ice 1/2"	6.119 6.626	4.254 5.014	0.055 0.103

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft	C <sub>A</sub> A <sub>A</sub> Front ft <sup>2</sup>	C <sub>A</sub> A <sub>A</sub> Side ft <sup>2</sup>	Weight K	
			0.000						
						Ice	7.128	5.711	0.157
						1" Ice			
(2) 7770.00 w/ Mount Pipe	B	From Leg	4.000	10.000	175.000	No Ice	6.119	4.254	0.055
			0.000			1/2"	6.626	5.014	0.103
			0.000			Ice	7.128	5.711	0.157
						1" Ice			
(2) 7770.00 w/ Mount Pipe	C	From Leg	4.000	10.000	175.000	No Ice	6.119	4.254	0.055
			0.000			1/2"	6.626	5.014	0.103
			0.000			Ice	7.128	5.711	0.157
						1" Ice			
AM-X-CD-16-65-00T-RET w/ Mount Pipe	A	From Leg	4.000	23.000	175.000	No Ice	8.498	6.304	0.074
			0.000			1/2"	9.149	7.479	0.139
			0.000			Ice	9.767	8.368	0.212
						1" Ice			
AM-X-CD-16-65-00T-RET w/ Mount Pipe	B	From Leg	4.000	22.000	175.000	No Ice	8.498	6.304	0.074
			0.000			1/2"	9.149	7.479	0.139
			0.000			Ice	9.767	8.368	0.212
						1" Ice			
AM-X-CD-16-65-00T-RET w/ Mount Pipe	C	From Leg	4.000	14.000	175.000	No Ice	8.498	6.304	0.074
			0.000			1/2"	9.149	7.479	0.139
			0.000			Ice	9.767	8.368	0.212
						1" Ice			
(2) RRUS-11	A	From Leg	4.000	23.000	175.000	No Ice	3.249	1.373	0.048
			0.000			1/2"	3.491	1.551	0.068
			0.000			Ice	3.741	1.738	0.092
						1" Ice			
(2) RRUS-11	B	From Leg	4.000	22.000	175.000	No Ice	3.249	1.373	0.048
			0.000			1/2"	3.491	1.551	0.068
			0.000			Ice	3.741	1.738	0.092
						1" Ice			
(2) RRUS-11	C	From Leg	4.000	14.000	175.000	No Ice	3.249	1.373	0.048
			0.000			1/2"	3.491	1.551	0.068
			0.000			Ice	3.741	1.738	0.092
						1" Ice			
(2) LGP13519	A	From Leg	4.000	23.000	175.000	No Ice	0.338	0.207	0.005
			0.000			1/2"	0.422	0.280	0.008
			0.000			Ice	0.515	0.362	0.012
						1" Ice			
(2) LGP13519	B	From Leg	4.000	22.000	175.000	No Ice	0.338	0.207	0.005
			0.000			1/2"	0.422	0.280	0.008
			0.000			Ice	0.515	0.362	0.012
						1" Ice			
(2) LGP13519	C	From Leg	4.000	14.000	175.000	No Ice	0.338	0.207	0.005
			0.000			1/2"	0.422	0.280	0.008
			0.000			Ice	0.515	0.362	0.012
						1" Ice			
(2) DTMABP7819VG12A	A	From Leg	4.000	23.000	175.000	No Ice	1.139	0.391	0.019
			0.000			1/2"	1.284	0.488	0.026
			0.000			Ice	1.437	0.595	0.036
						1" Ice			
(2) DTMABP7819VG12A	B	From Leg	4.000	22.000	175.000	No Ice	1.139	0.391	0.019
			0.000			1/2"	1.284	0.488	0.026
			0.000			Ice	1.437	0.595	0.036
						1" Ice			
(2) DTMABP7819VG12A	C	From Leg	4.000	14.000	175.000	No Ice	1.139	0.391	0.019
			0.000			1/2"	1.284	0.488	0.026
			0.000			Ice	1.437	0.595	0.036
						1" Ice			
DC6-48-60-18-8F	B	From Leg	4.000	22.000	175.000	No Ice	2.216	2.216	0.020
			0.000			1/2"	2.436	2.436	0.039
			0.000			Ice	2.664	2.664	0.061
						1" Ice			
Sector Mount [SM 802-3]	C	None		0.000	175.000	No Ice	24.410	24.410	0.930
						1/2"	31.390	31.390	1.362
						Ice	38.370	38.370	1.794



Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft	C <sub>A</sub> A <sub>A</sub> Front ft <sup>2</sup>	C <sub>A</sub> A <sub>A</sub> Side ft <sup>2</sup>	Weight K	
						1" Ice			
****									
APXV18-206517S-C w/ Mount Pipe	A	From Leg	4.000 0.000 0.000	0.000	165.000	No Ice 1/2" Ice	5.404 5.960 6.481	4.700 5.860 6.734	0.052 0.097 0.150
APXV18-206517S-C w/ Mount Pipe	B	From Leg	4.000 0.000 0.000	0.000	165.000	1" Ice No Ice 1/2" Ice	5.404 5.960 6.481	4.700 5.860 6.734	0.052 0.097 0.150
APXV18-206517S-C w/ Mount Pipe	C	From Leg	4.000 0.000 0.000	0.000	165.000	1" Ice No Ice 1/2" Ice	5.404 5.960 6.481	4.700 5.860 6.734	0.052 0.097 0.150
Pipe Mount [PM 601-3]	C	None		0.000	165.000	1" Ice No Ice 1/2" Ice	4.390 5.480 6.570	4.390 5.480 6.570	0.195 0.237 0.280
****									
(2) BXA-70063-6CF-EDIN-2 w/ Mount Pipe	A	From Leg	4.000 0.000 0.000	0.000	155.000	1" Ice No Ice 1/2" Ice	7.969 8.609 9.216	5.801 6.953 7.819	0.042 0.103 0.171
(2) BXA-70063-6CF-EDIN-2 w/ Mount Pipe	B	From Leg	4.000 0.000 0.000	0.000	155.000	1" Ice No Ice 1/2" Ice	7.969 8.609 9.216	5.801 6.953 7.819	0.042 0.103 0.171
(2) BXA-70063-6CF-EDIN-2 w/ Mount Pipe	C	From Leg	4.000 0.000 0.000	0.000	155.000	1" Ice No Ice 1/2" Ice	7.969 8.609 9.216	5.801 6.953 7.819	0.042 0.103 0.171
(2) BXA-171063-12CF-EDIN-2 w/ Mount Pipe	A	From Leg	4.000 0.000 0.000	0.000	155.000	1" Ice No Ice 1/2" Ice	5.029 5.583 6.103	5.289 6.459 7.348	0.041 0.087 0.140
(2) BXA-171063-12CF-EDIN-2 w/ Mount Pipe	B	From Leg	4.000 0.000 0.000	0.000	155.000	1" Ice No Ice 1/2" Ice	5.029 5.583 6.103	5.289 6.459 7.348	0.041 0.087 0.140
(2) BXA-171063-12CF-EDIN-2 w/ Mount Pipe	C	From Leg	4.000 0.000 0.000	0.000	155.000	1" Ice No Ice 1/2" Ice	5.029 5.583 6.103	5.289 6.459 7.348	0.041 0.087 0.140
RRH2X40-AWS	A	From Leg	4.000 0.000 0.000	0.000	155.000	1" Ice No Ice 1/2" Ice	2.522 2.753 2.993	1.589 1.795 2.010	0.044 0.061 0.082
RRH2X40-AWS	B	From Leg	4.000 0.000 0.000	0.000	155.000	1" Ice No Ice 1/2" Ice	2.522 2.753 2.993	1.589 1.795 2.010	0.044 0.061 0.082
RRH2X40-AWS	C	From Leg	4.000 0.000 0.000	0.000	155.000	1" Ice No Ice 1/2" Ice	2.522 2.753 2.993	1.589 1.795 2.010	0.044 0.061 0.082
RRH2X40-07-U	A	From Leg	4.000 0.000 0.000	0.000	155.000	1" Ice No Ice 1/2" Ice	2.246 2.447 2.657	1.228 1.385 1.551	0.050 0.067 0.086
RRH2X40-07-U	B	From Leg	4.000 0.000 0.000	0.000	155.000	1" Ice No Ice 1/2" Ice	2.246 2.447 2.657	1.228 1.385 1.551	0.050 0.067 0.086
RRH2X40-07-U	C	From Leg	4.000 0.000 0.000	0.000	155.000	1" Ice No Ice 1/2"	2.246 2.447	1.228 1.385	0.050 0.067

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment t °	Placement ft	C <sub>A</sub> A <sub>A</sub> Front ft <sup>2</sup>	C <sub>A</sub> A <sub>A</sub> Side ft <sup>2</sup>	Weight K
			0.000					
DB-T1-6Z-8AB-0Z	C	From Leg	4.000 0.000 0.000	0.000	155.000	Ice 1" Ice No Ice 1/2" Ice 6.240	2.657 1.551 2.333 2.558 2.791	0.086 0.044 0.080 0.120
Platform Mount [LP 301-1]	C	None		0.000	155.000	1" Ice No Ice 1/2" Ice 51.500 1" Ice	30.100 30.100 40.800 40.800 51.500	1.589 2.029 2.470
***								

### Tower Pressures - No Ice

$G_H = 1.690$

Section Elevation ft	z ft	K <sub>Z</sub>	q <sub>Z</sub> ksf	A <sub>G</sub> ft <sup>2</sup>	F a c e	A <sub>F</sub> ft <sup>2</sup>	A <sub>R</sub> ft <sup>2</sup>	A <sub>leg</sub> ft <sup>2</sup>	Leg %	C <sub>A</sub> A <sub>A</sub> In Face ft <sup>2</sup>	C <sub>A</sub> A <sub>A</sub> Out Face ft <sup>2</sup>
L1 185.000-180.000	182.500	1.63	0.030	7.500	A	0.000	7.500	7.500	100.00	0.000	0.000
					B	0.000	7.500		100.00	0.000	0.000
					C	0.000	7.500		100.00	0.000	0.990
L2 180.000-153.000	165.615	1.586	0.029	50.410	A	0.000	50.410	50.410	100.00	0.000	0.000
					B	0.000	50.410		100.00	0.000	0.000
					C	0.000	50.410		100.00	0.000	5.941
L3 153.000-151.833	152.415	1.548	0.029	2.625	A	0.000	2.625	2.625	100.00	0.000	0.000
					B	0.000	2.625		100.00	0.000	0.000
					C	0.000	2.625		100.00	0.000	0.851
L4 151.833-151.000	151.416	1.545	0.029	1.898	A	0.000	1.898	1.898	100.00	0.000	0.000
					B	0.000	1.898		100.00	0.000	0.000
					C	0.000	1.898		100.00	0.000	0.608
L5 151.000-130.000	140.112	1.512	0.028	54.052	A	0.000	54.052	54.052	100.00	0.000	0.000
					B	0.000	54.052		100.00	0.000	0.000
					C	0.000	54.052		100.00	0.000	10.857
L6 130.000-120.667	125.263	1.464	0.027	27.410	A	0.000	27.410	27.410	100.00	0.000	0.000
					B	0.000	27.410		100.00	0.000	0.000
					C	0.000	27.410		100.00	0.000	7.018
L7 120.667-115.000	117.810	1.438	0.027	17.834	A	0.000	17.834	17.834	100.00	0.000	0.000
					B	0.000	17.834		100.00	0.000	0.000
					C	0.000	17.834		100.00	0.000	4.580
L8 115.000-114.000	114.499	1.427	0.026	3.237	A	0.000	3.237	3.237	100.00	0.000	0.000
					B	0.000	3.237		100.00	0.000	0.000
					C	0.000	3.237		100.00	0.000	0.808
L9 114.000-95.000	104.268	1.389	0.026	66.658	A	0.000	66.658	66.658	100.00	0.000	0.000
					B	0.000	66.658		100.00	0.000	0.000
					C	0.000	66.658		100.00	0.000	11.638
L10 95.000-91.000	92.990	1.344	0.025	15.040	A	0.000	15.040	15.040	100.00	0.000	0.000
					B	0.000	15.040		100.00	0.000	0.000
					C	0.000	15.040		100.00	0.000	3.631
L11 91.000-90.000	90.499	1.334	0.025	3.831	A	0.000	3.831	3.831	100.00	0.000	0.000
					B	0.000	3.831		100.00	0.000	0.000
					C	0.000	3.831		100.00	0.000	0.980
L12 90.000-61.500	75.315	1.266	0.023	120.632	A	0.000	120.632	120.632	100.00	0.000	0.000
				2	B	0.000	120.632		100.00	0.000	0.000
					C	0.000	120.632		100.00	0.000	18.602
L13 61.500-58.000	59.744	1.185	0.022	16.338	A	0.000	16.338	16.338	100.00	0.000	0.000
					B	0.000	16.338		100.00	0.000	0.000
					C	0.000	16.338		100.00	0.000	2.213

Section Elevation	z	K <sub>Z</sub>	q <sub>z</sub>	A <sub>G</sub>	F a c e	A <sub>F</sub>	A <sub>R</sub>	A <sub>leg</sub>	Leg %	C <sub>A</sub> A <sub>A</sub> In Face ft <sup>2</sup>	C <sub>A</sub> A <sub>A</sub> Out Face ft <sup>2</sup>
ft	ft		ksf	ft <sup>2</sup>		ft <sup>2</sup>	ft <sup>2</sup>	ft <sup>2</sup>			
L14 58.000-40.000	48.871	1.119	0.021	88.707	A	0.000	88.707	88.707	100.00	0.000	0.000
					B	0.000	88.707		100.00	0.000	0.000
					C	0.000	88.707		100.00	0.000	14.968
L15 40.000-33.000	36.479	1.029	0.019	36.647	A	0.000	36.647	36.647	100.00	0.000	0.000
					B	0.000	36.647		100.00	0.000	0.000
					C	0.000	36.647		100.00	0.000	5.005
L16 33.000-28.000	30.490	1	0.018	26.987	A	0.000	26.987	26.987	100.00	0.000	0.000
					B	0.000	26.987		100.00	0.000	0.000
					C	0.000	26.987		100.00	0.000	3.323
L17 28.000-0.000	13.724	1	0.018	162.62 5	A	0.000	162.625	162.625	100.00	0.000	0.000
					B	0.000	162.625		100.00	0.000	0.000
					C	0.000	162.625		100.00	0.000	18.611

### Tower Pressure - With Ice

**G<sub>H</sub> = 1.690**

Section Elevation	z	K <sub>Z</sub>	q <sub>z</sub>	t <sub>z</sub>	A <sub>G</sub>	F a c e	A <sub>F</sub>	A <sub>R</sub>	A <sub>leg</sub>	Leg %	C <sub>A</sub> A <sub>A</sub> In Face ft <sup>2</sup>	C <sub>A</sub> A <sub>A</sub> Out Face ft <sup>2</sup>
ft	ft		ksf	in	ft <sup>2</sup>		ft <sup>2</sup>	ft <sup>2</sup>	ft <sup>2</sup>			
L1 185.000-180.000	182.500	1.63	0.006	0.7500	8.125	A	0.000	8.125	8.125	100.00	0.000	0.000
						B	0.000	8.125		100.00	0.000	0.000
						C	0.000	8.125		100.00	0.000	1.740
L2 180.000-153.000	165.615	1.586	0.006	0.7500	53.785	A	0.000	53.785	53.785	100.00	0.000	0.000
						B	0.000	53.785		100.00	0.000	0.000
						C	0.000	53.785		100.00	0.000	10.366
L3 153.000-151.833	152.415	1.548	0.006	0.7500	2.771	A	0.000	2.771	2.771	100.00	0.000	0.000
						B	0.000	2.771		100.00	0.000	0.000
						C	0.000	2.771		100.00	0.000	1.415
L4 151.833-151.000	151.416	1.545	0.006	0.7500	2.002	A	0.000	2.002	2.002	100.00	0.000	0.000
						B	0.000	2.002		100.00	0.000	0.000
						C	0.000	2.002		100.00	0.000	1.011
L5 151.000-130.000	140.112	1.512	0.005	0.7500	56.677	A	0.000	56.677	56.677	100.00	0.000	0.000
						B	0.000	56.677		100.00	0.000	0.000
						C	0.000	56.677		100.00	0.000	18.174
L6 130.000-120.667	125.263	1.464	0.005	0.7500	28.576	A	0.000	28.576	28.576	100.00	0.000	0.000
						B	0.000	28.576		100.00	0.000	0.000
						C	0.000	28.576		100.00	0.000	11.566
L7 120.667-115.000	117.810	1.438	0.005	0.7500	18.542	A	0.000	18.542	18.542	100.00	0.000	0.000
						B	0.000	18.542		100.00	0.000	0.000
						C	0.000	18.542		100.00	0.000	7.398
L8 115.000-114.000	114.499	1.427	0.005	0.7500	3.362	A	0.000	3.362	3.362	100.00	0.000	0.000
						B	0.000	3.362		100.00	0.000	0.000
						C	0.000	3.362		100.00	0.000	1.305
L9 114.000-95.000	104.268	1.389	0.005	0.7500	69.033	A	0.000	69.033	69.033	100.00	0.000	0.000
						B	0.000	69.033		100.00	0.000	0.000
						C	0.000	69.033		100.00	0.000	18.710
L10 95.000-91.000	92.990	1.344	0.005	0.7500	15.540	A	0.000	15.540	15.540	100.00	0.000	0.000
						B	0.000	15.540		100.00	0.000	0.000
						C	0.000	15.540		100.00	0.000	5.620
L11 91.000-90.000	90.499	1.334	0.005	0.7500	3.956	A	0.000	3.956	3.956	100.00	0.000	0.000
						B	0.000	3.956		100.00	0.000	0.000
						C	0.000	3.956		100.00	0.000	1.477
L12 90.000-61.500	75.315	1.266	0.005	0.7500	124.195	A	0.000	124.195	124.195	100.00	0.000	0.000
						B	0.000	124.195		100.00	0.000	0.000
						C	0.000	124.195		100.00	0.000	27.929
L13 61.500-58.000	59.744	1.185	0.004	0.7500	16.776	A	0.000	16.776	16.776	100.00	0.000	0.000
						B	0.000	16.776		100.00	0.000	0.000
						C	0.000	16.776		100.00	0.000	3.322
L14 58.000-40.000	48.871	1.119	0.004	0.7500	90.957	A	0.000	90.957	90.957	100.00	0.000	0.000
						B	0.000	90.957		100.00	0.000	0.000
						C	0.000	90.957		100.00	0.000	22.890
L15 40.000-33.000	36.479	1.029	0.004	0.7500	37.522	A	0.000	37.522	37.522	100.00	0.000	0.000
						B	0.000	37.522		100.00	0.000	0.000

Section Elevation ft	z ft	K <sub>Z</sub>	q <sub>z</sub> ksf	t <sub>z</sub> in	A <sub>G</sub> ft <sup>2</sup>	F a c e	A <sub>F</sub> ft <sup>2</sup>	A <sub>R</sub> ft <sup>2</sup>	A <sub>leg</sub> ft <sup>2</sup>	Leg %	C <sub>A</sub> A <sub>A</sub> In Face ft <sup>2</sup>	C <sub>A</sub> A <sub>A</sub> Out Face ft <sup>2</sup>
L16 33.000-28.000	30.490	1	0.004	0.7500	27.612	C	0.000	37.522	27.612	100.00	0.000	7.500
						A	0.000	27.612		100.00	0.000	0.000
						B	0.000	27.612		100.00	0.000	0.000
L17 28.000-0.000	13.724	1	0.004	0.7500	166.125	C	0.000	166.125	166.125	100.00	0.000	0.000
						A	0.000	166.125		100.00	0.000	0.000
						B	0.000	166.125		100.00	0.000	0.000
						C	0.000	166.125		100.00	0.000	27.477

**Tower Pressure - Service**

$G_H = 1.690$

Section Elevation ft	z ft	K <sub>Z</sub>	q <sub>z</sub> ksf	A <sub>G</sub> ft <sup>2</sup>	F a c e	A <sub>F</sub> ft <sup>2</sup>	A <sub>R</sub> ft <sup>2</sup>	A <sub>leg</sub> ft <sup>2</sup>	Leg %	C <sub>A</sub> A <sub>A</sub> In Face ft <sup>2</sup>	C <sub>A</sub> A <sub>A</sub> Out Face ft <sup>2</sup>
L1 185.000-180.000	182.500	1.63	0.010	7.500	A	0.000	7.500	7.500	100.00	0.000	0.000
					B	0.000	7.500		100.00	0.000	0.000
					C	0.000	7.500		100.00	0.000	0.990
L2 180.000-153.000	165.615	1.586	0.010	50.410	A	0.000	50.410	50.410	100.00	0.000	0.000
					B	0.000	50.410		100.00	0.000	0.000
					C	0.000	50.410		100.00	0.000	5.941
L3 153.000-151.833	152.415	1.548	0.010	2.625	A	0.000	2.625	2.625	100.00	0.000	0.000
					B	0.000	2.625		100.00	0.000	0.000
					C	0.000	2.625		100.00	0.000	0.851
L4 151.833-151.000	151.416	1.545	0.010	1.898	A	0.000	1.898	1.898	100.00	0.000	0.000
					B	0.000	1.898		100.00	0.000	0.000
					C	0.000	1.898		100.00	0.000	0.608
L5 151.000-130.000	140.112	1.512	0.010	54.052	A	0.000	54.052	54.052	100.00	0.000	0.000
					B	0.000	54.052		100.00	0.000	0.000
					C	0.000	54.052		100.00	0.000	10.857
L6 130.000-120.667	125.263	1.464	0.009	27.410	A	0.000	27.410	27.410	100.00	0.000	0.000
					B	0.000	27.410		100.00	0.000	0.000
					C	0.000	27.410		100.00	0.000	7.018
L7 120.667-115.000	117.810	1.438	0.009	17.834	A	0.000	17.834	17.834	100.00	0.000	0.000
					B	0.000	17.834		100.00	0.000	0.000
					C	0.000	17.834		100.00	0.000	4.580
L8 115.000-114.000	114.499	1.427	0.009	3.237	A	0.000	3.237	3.237	100.00	0.000	0.000
					B	0.000	3.237		100.00	0.000	0.000
					C	0.000	3.237		100.00	0.000	0.808
L9 114.000-95.000	104.268	1.389	0.009	66.658	A	0.000	66.658	66.658	100.00	0.000	0.000
					B	0.000	66.658		100.00	0.000	0.000
					C	0.000	66.658		100.00	0.000	11.638
L10 95.000-91.000	92.990	1.344	0.009	15.040	A	0.000	15.040	15.040	100.00	0.000	0.000
					B	0.000	15.040		100.00	0.000	0.000
					C	0.000	15.040		100.00	0.000	3.631
L11 91.000-90.000	90.499	1.334	0.009	3.831	A	0.000	3.831	3.831	100.00	0.000	0.000
					B	0.000	3.831		100.00	0.000	0.000
					C	0.000	3.831		100.00	0.000	0.980
L12 90.000-61.500	75.315	1.266	0.008	120.632	A	0.000	120.632	120.632	100.00	0.000	0.000
					B	0.000	120.632		100.00	0.000	0.000
					C	0.000	120.632		100.00	0.000	18.602
L13 61.500-58.000	59.744	1.185	0.008	16.338	A	0.000	16.338	16.338	100.00	0.000	0.000
					B	0.000	16.338		100.00	0.000	0.000
					C	0.000	16.338		100.00	0.000	2.213
L14 58.000-40.000	48.871	1.119	0.007	88.707	A	0.000	88.707	88.707	100.00	0.000	0.000
					B	0.000	88.707		100.00	0.000	0.000
					C	0.000	88.707		100.00	0.000	14.968
L15 40.000-33.000	36.479	1.029	0.007	36.647	A	0.000	36.647	36.647	100.00	0.000	0.000
					B	0.000	36.647		100.00	0.000	0.000
					C	0.000	36.647		100.00	0.000	5.005
L16 33.000-28.000	30.490	1	0.006	26.987	A	0.000	26.987	26.987	100.00	0.000	0.000
					B	0.000	26.987		100.00	0.000	0.000

Section Elevation ft	z ft	$K_z$	$q_z$ ksf	$A_G$ ft <sup>2</sup>	F a c e	$A_F$ ft <sup>2</sup>	$A_R$ ft <sup>2</sup>	$A_{leg}$ ft <sup>2</sup>	Leg %	$C_A A_A$ In Face ft <sup>2</sup>	$C_A A_A$ Out Face ft <sup>2</sup>
L17 28.000-0.000	13.724	1	0.006	162.625	C	0.000	26.987	162.625	100.00	0.000	3.323
					A	0.000	162.625		100.00	0.000	0.000
					B	0.000	162.625		100.00	0.000	0.000
					C	0.000	162.625		100.00	0.000	18.611

### 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
L1	185 - 180	Pole	Max Tension	14	0.000	-0.000	0.000
			Max. Compression	14	-3.455	0.068	-0.046
			Max. Mx	11	-1.379	23.926	-0.017
			Max. My	8	-1.379	0.018	-23.922
			Max. Vy	11	-5.014	23.926	-0.017
			Max. Vx	8	5.013	0.018	-23.922
			Max. Torque	6			
L2	180 - 153	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	14	-15.417	0.765	-0.696

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L3	153 - 151.833	Pole	Max. Mx	11	-7.532	334.536	-1.600
			Max. My	8	-7.536	1.611	-335.116
			Max. Vy	11	-20.048	334.536	-1.600
			Max. Vx	8	20.002	1.611	-335.116
			Max. Torque	2			-0.448
			Max Tension	1	0.000	0.000	0.000
			Max. Compression	14	-15.629	0.790	-0.711
			Max. Mx	11	-7.701	358.029	-1.751
			Max. My	8	-7.706	1.764	-358.553
			Max. Vy	11	-20.224	358.029	-1.751
L4	151.833 - 151	Pole	Max. Vx	8	20.178	1.764	-358.553
			Max. Torque	12			0.338
			Max Tension	1	0.000	0.000	0.000
			Max. Compression	14	-15.820	0.808	-0.721
			Max. Mx	11	-7.860	374.938	-1.860
			Max. My	8	-7.865	1.875	-375.421
			Max. Vy	11	-20.354	374.938	-1.860
			Max. Vx	8	20.308	1.875	-375.421
			Max. Torque	12			0.346
			Max Tension	1	0.000	0.000	0.000
L5	151 - 130	Pole	Max. Compression	14	-19.052	1.176	-0.934
			Max. Mx	11	-10.458	719.221	-3.925
			Max. My	8	-10.462	3.976	-718.932
			Max. Vy	11	-22.738	719.221	-3.925
			Max. Vx	8	22.692	3.976	-718.932
			Max. Torque	12			0.454
			Max Tension	1	0.000	0.000	0.000
			Max. Compression	14	-23.296	1.529	-1.137
			Max. Mx	11	-14.051	1063.072	-5.785
			Max. My	8	-14.055	5.870	-1062.084
L6	130 - 120.667	Pole	Max. Vy	11	-25.252	1063.072	-5.785
			Max. Vx	8	25.206	5.870	-1062.084
			Max. Torque	12			0.596
			Max Tension	1	0.000	0.000	0.000
			Max. Compression	14	-24.886	1.684	-1.227
			Max. Mx	11	-15.381	1209.107	-6.522
			Max. My	8	-15.384	6.623	-1207.840
			Max. Vy	11	-26.296	1209.107	-6.522
			Max. Vx	8	26.250	6.623	-1207.840
			Max. Torque	12			0.668
L7	120.667 - 115	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	14	-25.200	1.713	-1.243
			Max. Mx	11	-15.648	1235.498	-6.653
			Max. My	8	-15.651	6.757	-1234.182
			Max. Vy	11	-26.484	1235.498	-6.653
			Max. Vx	8	26.438	6.757	-1234.182
			Max. Torque	12			0.680
			Max Tension	1	0.000	0.000	0.000
			Max. Compression	14	-28.939	2.112	-1.472
			Max. Mx	11	-18.781	1594.679	-8.350
L8	115 - 114	Pole	Max. My	8	-18.784	8.494	-1592.720
			Max. Vy	11	-28.808	1594.679	-8.350
			Max. Vx	8	28.762	8.494	-1592.720
			Max. Torque	12			0.812
			Max Tension	1	0.000	0.000	0.000
			Max. Compression	14	-33.669	2.427	-1.654
			Max. Mx	11	-22.963	1892.952	-9.658
			Max. My	8	-22.966	9.835	-1890.496
			Max. Vy	11	-30.840	1892.952	-9.658
			Max. Vx	8	30.794	9.835	-1890.496
L9	114 - 95	Pole	Max. Torque	7			-0.953
			Max Tension	1	0.000	0.000	0.000
			Max. Compression	14	-33.994	2.461	-1.673
			Max. Mx	11	-23.237	1923.893	-9.789
			Max. My	8	-23.240	9.969	-1921.387

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L12	90 - 61.5	Pole	Max. Vy	11	-31.043	1923.893	-9.789
			Max. Vx	8	30.997	9.969	-1921.387
			Max. Torque	7			-0.973
			Max Tension	1	0.000	0.000	0.000
			Max. Compression	14	-45.097	3.516	-2.281
			Max. Mx	11	-32.778	2885.605	-13.531
			Max. My	8	-32.780	13.820	-2881.667
L13	61.5 - 58	Pole	Max. Vy	11	-36.598	2885.605	-13.531
			Max. Vx	8	36.551	13.820	-2881.667
			Max. Torque	7			-1.370
			Max Tension	1	0.000	0.000	0.000
			Max. Compression	14	-46.576	3.660	-2.363
			Max. Mx	11	-34.056	3014.885	-13.991
			Max. My	8	-34.058	14.296	-3010.770
L14	58 - 40	Pole	Max. Vy	11	-37.280	3014.885	-13.991
			Max. Vx	8	37.234	14.296	-3010.770
			Max. Torque	7			-1.419
			Max Tension	1	0.000	0.000	0.000
			Max. Compression	14	-55.162	4.437	-2.811
			Max. Mx	11	-41.539	3717.907	-16.356
			Max. My	8	-41.540	16.740	-3712.879
L15	40 - 33	Pole	Max. Vy	11	-40.875	3717.907	-16.356
			Max. Vx	8	40.829	16.740	-3712.879
			Max. Torque	7			-1.751
			Max Tension	1	0.000	0.000	0.000
			Max. Compression	14	-58.649	4.758	-2.996
			Max. Mx	11	-44.582	4008.586	-17.275
			Max. My	8	-44.583	17.692	-4003.203
L16	33 - 28	Pole	Max. Vy	11	-42.182	4008.586	-17.275
			Max. Vx	8	42.136	17.692	-4003.203
			Max. Torque	7			-1.858
			Max Tension	1	0.000	0.000	0.000
			Max. Compression	14	-61.295	4.994	-3.132
			Max. Mx	11	-46.902	4221.796	-17.931
			Max. My	8	-46.903	18.373	-4216.158
L17	28 - 0	Pole	Max. Vy	11	-43.103	4221.796	-17.931
			Max. Vx	8	43.057	18.373	-4216.158
			Max. Torque	7			-1.930
			Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-76.741	-1291.483	0.011
			Max. Mx	11	-60.428	5503.323	-21.593
			Max. My	8	-60.428	22.181	-5496.257
			Max. Vy	11	-48.517	5503.323	-21.593
			Max. Vx	8	48.472	22.181	-5496.257
			Max. Torque	7			-2.364

### Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	18	76.741	-10.998	0.053
	Max. H <sub>x</sub>	11	60.438	48.505	-0.123
	Max. H <sub>z</sub>	2	60.438	-0.123	48.459
	Max. M <sub>x</sub>	2	5494.158	-0.123	48.459
	Max. M <sub>z</sub>	5	5500.051	-48.505	0.123
	Max. Torsion	13	2.363	24.148	41.909
	Min. Vert	11	60.438	48.505	-0.123
	Min. H <sub>x</sub>	5	60.438	-48.505	0.123
	Min. H <sub>z</sub>	8	60.438	0.123	-48.459
	Min. M <sub>x</sub>	8	-5496.257	0.123	-48.459
	Min. M <sub>z</sub>	11	-5503.323	48.505	-0.123
	Min. Torsion	7	-2.364	-24.148	-41.909

### Tower Mast Reaction Summary

Load Combination	Vertical	Shear <sub>x</sub>	Shear <sub>z</sub>	Overturning Moment, M <sub>x</sub>	Overturning Moment, M <sub>z</sub>	Torque
	K	K	K	kip-ft	kip-ft	kip-ft
Dead Only	60.438	-0.000	0.000	1.029	1.607	0.000
Dead+Wind 0 deg - No Ice	60.438	0.123	-48.459	-5494.158	-18.907	-1.931
Dead+Wind 30 deg - No Ice	60.438	24.361	-42.032	-4768.779	-2767.331	-0.982
Dead+Wind 60 deg - No Ice	60.438	42.072	-24.338	-2764.674	-4773.806	0.230
Dead+Wind 90 deg - No Ice	60.438	48.505	-0.123	-19.494	-5500.051	1.381
Dead+Wind 120 deg - No Ice	60.438	41.949	24.125	2731.210	-4753.304	2.162
Dead+Wind 150 deg - No Ice	60.438	24.148	41.909	4750.375	-2731.769	2.364
Dead+Wind 180 deg - No Ice	60.438	-0.123	48.459	5496.257	22.181	1.932
Dead+Wind 210 deg - No Ice	60.438	-24.361	42.032	4770.878	2770.604	0.982
Dead+Wind 240 deg - No Ice	60.438	-42.072	24.338	2766.772	4777.079	-0.231
Dead+Wind 270 deg - No Ice	60.438	-48.505	0.123	21.593	5503.323	-1.382
Dead+Wind 300 deg - No Ice	60.438	-41.949	-24.125	-2729.111	4756.576	-2.162
Dead+Wind 330 deg - No Ice	60.438	-24.148	-41.909	-4748.276	2735.041	-2.363
Dead+Ice+Temp	76.741	0.000	-0.000	3.953	6.420	0.000
Dead+Wind 0 deg+Ice+Temp	76.741	0.024	-10.988	-1292.574	2.541	-0.582
Dead+Wind 30 deg+Ice+Temp	76.741	5.520	-9.528	-1120.895	-645.955	-0.301
Dead+Wind 60 deg+Ice+Temp	76.741	9.536	-5.515	-647.777	-1119.593	0.061
Dead+Wind 90 deg+Ice+Temp	76.741	10.998	-0.053	-0.011	-1291.483	0.406
Dead+Wind 120 deg+Ice+Temp	76.741	9.512	5.473	648.890	-1115.511	0.642
Dead+Wind 150 deg+Ice+Temp	76.741	5.478	9.504	1124.997	-638.884	0.707
Dead+Wind 180 deg+Ice+Temp	76.741	-0.024	10.988	1300.758	10.706	0.582
Dead+Wind 210 deg+Ice+Temp	76.741	-5.520	9.528	1129.078	659.202	0.301
Dead+Wind 240 deg+Ice+Temp	76.741	-9.536	5.515	655.960	1132.840	-0.061
Dead+Wind 270 deg+Ice+Temp	76.741	-10.997	0.024	8.174	1304.710	-0.406
Dead+Wind 300 deg+Ice+Temp	76.741	-9.512	-5.473	-640.706	1128.758	-0.642
Dead+Wind 330 deg+Ice+Temp	76.741	-5.478	-9.504	-1116.813	652.132	-0.707
Dead+Wind 0 deg - Service	60.438	0.043	-16.768	-1901.394	-5.474	-0.669
Dead+Wind 30 deg - Service	60.438	8.429	-14.543	-1650.071	-956.866	-0.340
Dead+Wind 60 deg - Service	60.438	14.556	-8.421	-956.331	-1651.427	0.080
Dead+Wind 90 deg - Service	60.438	16.784	-0.043	-6.061	-1903.052	0.479
Dead+Wind 120 deg - Service	60.438	14.514	8.347	946.116	-1644.316	0.750
Dead+Wind 150 deg - Service	60.438	8.355	14.500	1645.063	-944.547	0.819
Dead+Wind 180 deg - Service	60.438	-0.043	16.768	1903.498	8.752	0.669
Dead+Wind 210 deg - Service	60.438	-8.429	14.543	1652.175	960.145	0.340
Dead+Wind 240 deg - Service	60.438	-14.556	8.421	958.435	1654.706	-0.080
Dead+Wind 270 deg - Service	60.438	-16.784	0.043	8.165	1906.330	-0.479
Dead+Wind 300 deg - Service	60.438	-14.514	-8.347	-944.012	1647.594	-0.750
Dead+Wind 330 deg - Service	60.438	-8.355	-14.500	-1642.959	947.825	-0.819

### Solution Summary



Load Comb.	Sum of Applied Forces			Sum of Reactions			% Error
	PX K	PY K	PZ K	PX K	PY K	PZ K	
1	0.000	-60.438	0.000	0.000	60.438	-0.000	0.000%
2	0.123	-60.438	-48.464	-0.123	60.438	48.459	0.006%
3	24.361	-60.438	-42.032	-24.361	60.438	42.032	0.000%
4	42.072	-60.438	-24.338	-42.072	60.438	24.338	0.000%
5	48.509	-60.438	-0.123	-48.505	60.438	0.123	0.006%
6	41.949	-60.438	24.125	-41.949	60.438	-24.125	0.000%
7	24.148	-60.438	41.909	-24.148	60.438	-41.909	0.000%
8	-0.123	-60.438	48.464	0.123	60.438	-48.459	0.006%
9	-24.361	-60.438	42.032	24.361	60.438	-42.032	0.000%
10	-42.072	-60.438	24.338	42.072	60.438	-24.338	0.000%
11	-48.509	-60.438	0.123	48.505	60.438	-0.123	0.006%
12	-41.949	-60.438	-24.125	41.949	60.438	24.125	0.000%
13	-24.148	-60.438	-41.909	24.148	60.438	41.909	0.000%
14	0.000	-76.741	0.000	-0.000	76.741	0.000	0.001%
15	0.024	-76.741	-10.988	-0.024	76.741	10.988	0.000%
16	5.520	-76.741	-9.528	-5.520	76.741	9.528	0.000%
17	9.536	-76.741	-5.515	-9.536	76.741	5.515	0.000%
18	10.998	-76.741	-0.024	-10.998	76.741	0.053	0.038%
19	9.512	-76.741	5.473	-9.512	76.741	-5.473	0.000%
20	5.478	-76.741	9.504	-5.478	76.741	-9.504	0.000%
21	-0.024	-76.741	10.988	0.024	76.741	-10.988	0.000%
22	-5.520	-76.741	9.528	5.520	76.741	-9.528	0.000%
23	-9.536	-76.741	5.515	9.536	76.741	-5.515	0.000%
24	-10.998	-76.741	0.024	10.997	76.741	-0.024	0.000%
25	-9.512	-76.741	-5.473	9.512	76.741	5.473	0.000%
26	-5.478	-76.741	-9.504	5.478	76.741	9.504	0.000%
27	0.043	-60.438	-16.769	-0.043	60.438	16.768	0.003%
28	8.429	-60.438	-14.544	-8.429	60.438	14.543	0.003%
29	14.558	-60.438	-8.422	-14.556	60.438	8.421	0.003%
30	16.785	-60.438	-0.043	-16.784	60.438	0.043	0.003%
31	14.515	-60.438	8.348	-14.514	60.438	-8.347	0.003%
32	8.356	-60.438	14.502	-8.355	60.438	-14.500	0.003%
33	-0.043	-60.438	16.769	0.043	60.438	-16.768	0.003%
34	-8.429	-60.438	14.544	8.429	60.438	-14.543	0.003%
35	-14.558	-60.438	8.422	14.556	60.438	-8.421	0.003%
36	-16.785	-60.438	0.043	16.784	60.438	-0.043	0.003%
37	-14.515	-60.438	-8.348	14.514	60.438	8.347	0.003%
38	-8.356	-60.438	-14.502	8.355	60.438	14.500	0.003%

### Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	6	0.00000001	0.00000001
2	Yes	13	0.00007944	0.00008744
3	Yes	17	0.00000001	0.00010066
4	Yes	17	0.00000001	0.00010078
5	Yes	13	0.00007943	0.00008281
6	Yes	17	0.00000001	0.00010049
7	Yes	17	0.00000001	0.00009725
8	Yes	13	0.00007943	0.00012052
9	Yes	17	0.00000001	0.00010187
10	Yes	17	0.00000001	0.00010177
11	Yes	13	0.00007943	0.00011523
12	Yes	17	0.00000001	0.00009732
13	Yes	17	0.00000001	0.00010055
14	Yes	6	0.00000001	0.00002462
15	Yes	16	0.00000001	0.00006648
16	Yes	16	0.00000001	0.00007039
17	Yes	16	0.00000001	0.00007040
18	Yes	23	0.00000001	0.00000000
19	Yes	16	0.00000001	0.00007030
20	Yes	16	0.00000001	0.00007034
21	Yes	16	0.00000001	0.00006700
22	Yes	16	0.00000001	0.00007142

23	Yes	16	0.00000001	0.00007147
24	Yes	16	0.00000001	0.00006716
25	Yes	16	0.00000001	0.00007055
26	Yes	16	0.00000001	0.00007045
27	Yes	13	0.00008229	0.00003673
28	Yes	13	0.00008212	0.00013961
29	Yes	13	0.00008212	0.00014016
30	Yes	13	0.00008228	0.00003640
31	Yes	13	0.00008212	0.00014647
32	Yes	13	0.00008213	0.00013112
33	Yes	13	0.00008229	0.00003767
34	Yes	13	0.00008212	0.00014533
35	Yes	13	0.00008212	0.00014486
36	Yes	13	0.00008228	0.00003731
37	Yes	13	0.00008212	0.00013142
38	Yes	13	0.00008212	0.00014672

### Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	185 - 180	28.555	35	1.653	0.001
L2	180 - 153	26.829	35	1.640	0.001
L3	153 - 151.833	18.288	35	1.321	0.001
L4	151.833 - 151	17.967	35	1.307	0.001
L5	151 - 130	17.739	35	1.300	0.001
L6	135 - 120.667	13.727	35	1.091	0.001
L7	120.667 - 115	10.642	35	0.945	0.001
L8	115 - 114	9.558	35	0.882	0.001
L9	114 - 95	9.374	35	0.873	0.001
L10	101 - 91	7.200	35	0.726	0.000
L11	91 - 90	5.741	35	0.657	0.000
L12	90 - 61.5	5.604	35	0.647	0.000
L13	61.5 - 58	2.488	35	0.403	0.000
L14	58 - 40	2.202	35	0.376	0.000
L15	40 - 33	1.024	35	0.250	0.000
L16	33 - 28	0.692	35	0.203	0.000
L17	28 - 0	0.496	35	0.172	0.000

### Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
185.000	ETW190VS12UB	35	28.555	1.653	0.001	12073
175.000	(2) 7770.00 w/ Mount Pipe	35	25.128	1.606	0.001	7512
165.000	APXV18-206517S-C w/ Mount Pipe	35	21.858	1.489	0.001	4594
155.000	(2) BXA-70063-6CF-EDIN-2 w/ Mount Pipe	35	18.849	1.348	0.001	3532

### Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	185 - 180	82.290	10	4.765	0.003
L2	180 - 153	77.323	10	4.727	0.002
L3	153 - 151.833	52.734	10	3.809	0.003

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L4	151.833 - 151	51.809	10	3.769	0.003
L5	151 - 130	51.154	10	3.748	0.002
L6	135 - 120.667	39.592	10	3.148	0.002
L7	120.667 - 115	30.702	10	2.727	0.002
L8	115 - 114	27.576	10	2.546	0.002
L9	114 - 95	27.046	10	2.518	0.002
L10	101 - 91	20.775	10	2.094	0.001
L11	91 - 90	16.565	10	1.897	0.001
L12	90 - 61.5	16.171	10	1.867	0.001
L13	61.5 - 58	7.180	10	1.164	0.001
L14	58 - 40	6.357	10	1.084	0.001
L15	40 - 33	2.956	10	0.723	0.000
L16	33 - 28	1.997	10	0.586	0.000
L17	28 - 0	1.431	10	0.496	0.000

### Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
185.000	ETW190VS12UB	10	82.290	4.765	0.003	4249
175.000	(2) 7770.00 w/ Mount Pipe	10	72.427	4.631	0.002	2642
165.000	APXV18-206517S-C w/ Mount Pipe	10	63.015	4.294	0.002	1614
155.000	(2) BXA-70063-6CF-EDIN-2 w/ Mount Pipe	10	54.351	3.886	0.003	1239

### Compression Checks

### Pole Design Data

Section No.	Elevation ft	Size	L ft	L <sub>u</sub> ft	Kl/r	F <sub>a</sub> ksi	A in <sup>2</sup>	Actual P K	Allow. P <sub>a</sub> K	Ratio P P <sub>a</sub>
L1	185 - 180 (1)	TP18x18x0.1875	5.000	0.000	0.0	25.200	10.7543	-1.377	271.008	0.005
L2	180 - 153 (2)	TP26.8088x18x0.25	27.000	0.000	0.0	25.200	21.3798	-7.522	538.771	0.014
L3	153 - 151.833 (3)	TP27.1894x26.8088x0.3625	1.167	0.000	0.0	25.200	31.3111	-7.692	789.041	0.010
L4	151.833 - 151 (4)	TP27.4613x27.1894x0.5246	0.833	0.000	0.0	25.182	45.5000	-7.851	1145.780	0.007
L5	151 - 130 (5)	TP34.3125x27.4613x0.3802	21.000	0.000	0.0	25.200	39.5403	-10.448	996.414	0.010
L6	130 - 120.667 (6)	TP36.844x31.9209x0.4447	14.333	0.000	0.0	25.200	52.1180	-14.042	1313.370	0.011
L7	120.667 - 115 (7)	TP38.6875x36.844x0.4776	5.667	0.000	0.0	24.690	58.7656	-15.372	1450.920	0.011
L8	115 - 114 (8)	TP39.0125x38.6875x0.5402	1.000	0.000	0.0	25.200	66.9216	-15.639	1686.430	0.009
L9	114 - 95 (9)	TP45.1875x39.0125x0.4463	19.000	0.000	0.0	25.200	61.5001	-18.774	1549.800	0.012
L10	95 - 91 (10)	TP45.8125x42.3448x0.5294	10.000	0.000	0.0	25.200	77.1854	-22.956	1945.070	0.012
L11	91 - 90 (11)	TP46.1391x45.8125x0.4659	1.000	0.000	0.0	25.200	68.3863	-23.230	1723.340	0.013
L12	90 - 61.5 (12)	TP55.4461x46.1391x0.5299	28.500	0.000	0.0	25.200	93.6935	-32.774	2361.080	0.014
L13	61.5 - 58 (13)	TP56.5891x55.4461x0.5263	3.500	0.000	0.0	24.996	95.0159	-34.052	2375.020	0.014
L14	58 - 40 (14)	TP61.6875x56.5891x0.578	18.000	0.000	0.0	23.898	113.890	-41.536	2721.750	0.015

Section No.	Elevation ft	Size	L ft	L <sub>u</sub> ft	Kl/r	F <sub>a</sub> ksi	A in <sup>2</sup>	Actual P K	Allow. P <sub>a</sub> K	Ratio $\frac{P}{P_a}$
L15	40 - 33 (15)	TP63.9583x61.6875x0.570 8	7.000	0.000	0.0	25.200	116.414	-44.580	2933.630	0.015
L16	33 - 28 (16)	TP65.5804x63.9583x0.595 4	5.000	0.000	0.0	24.390	124.508	-46.900	3036.740	0.015
L17	28 - 0 (17)	TP73.8125x65.5804x0.575 8	28.000	0.000	0.0	22.950	135.786	-60.428	3116.300	0.019

### Pole Bending Design Data

Section No.	Elevation ft	Size	Actual M <sub>x</sub> kip-ft	Actual f <sub>bx</sub> ksi	Allow. F <sub>bx</sub> ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M <sub>y</sub> kip-ft	Actual f <sub>by</sub> ksi	Allow. F <sub>by</sub> ksi	Ratio $\frac{f_{by}}{F_{by}}$
L1	185 - 180 (1)	TP18x18x0.1875	23.935	6.149	25.200	0.244	0.000	0.000	25.200	0.000
L2	180 - 153 (2)	TP26.8088x18x0.25	336.27	29.113	25.200	1.155	0.000	0.000	25.200	0.000
L3	153 - 151.833 (3)	TP27.1894x26.8088x0.36	359.86	21.146	25.200	0.839	0.000	0.000	25.200	0.000
L4	151.833 - 151 (4)	TP27.4613x27.1894x0.52	376.83	15.265	25.182	0.606	0.000	0.000	25.182	0.000
L5	151 - 130 (5)	TP34.3125x27.4613x0.38	722.48	27.873	25.200	1.106	0.000	0.000	25.200	0.000
L6	130 - 120.667 (6)	TP36.844x31.9209x0.444	1067.7	27.746	25.200	1.101	0.000	0.000	25.200	0.000
L7	120.667 - 115 (7)	TP38.6875x36.844x0.477	1214.4	26.668	24.690	1.080	0.000	0.000	24.690	0.000
L8	115 - 114 (8)	TP39.0125x38.6875x0.54	1240.9	23.802	25.200	0.945	0.000	0.000	25.200	0.000
L9	114 - 95 (9)	TP45.1875x39.0125x0.44	1601.4	29.944	25.200	1.188	0.000	0.000	25.200	0.000
L10	95 - 91 (10)	TP45.8125x42.3448x0.52	1900.7	26.793	25.200	1.063	0.000	0.000	25.200	0.000
L11	91 - 90 (11)	TP46.1391x45.8125x0.46	1931.7	30.426	25.200	1.207	0.000	0.000	25.200	0.000
L12	90 - 61.5 (12)	TP55.4461x46.1391x0.52	2896.4	27.679	25.200	1.098	0.000	0.000	25.200	0.000
L13	61.5 - 58 (13)	TP56.5891x55.4461x0.52	3026.0	27.925	24.996	1.117	0.000	0.000	24.996	0.000
L14	58 - 40 (14)	TP61.6875x56.5891x0.57	3730.9	26.354	23.898	1.103	0.000	0.000	23.898	0.000
L15	40 - 33 (15)	TP63.9583x61.6875x0.57	4022.3	26.785	25.200	1.063	0.000	0.000	25.200	0.000
L16	33 - 28 (16)	TP65.5804x63.9583x0.59	4236.0	25.730	24.390	1.055	0.000	0.000	24.390	0.000
L17	28 - 0 (17)	TP73.8125x65.5804x0.57	5520.4	27.247	22.950	1.187	0.000	0.000	22.950	0.000

### Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V K	Actual f <sub>v</sub> ksi	Allow. F <sub>v</sub> ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f <sub>vt</sub> ksi	Allow. F <sub>vt</sub> ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L1	185 - 180 (1)	TP18x18x0.1875	5.016	0.466	16.800	0.056	0.011	0.001	16.800	0.000
L2	180 - 153 (2)	TP26.8088x18x0.25	20.126	0.941	16.800	0.114	0.080	0.003	16.800	0.000
L3	153 - 151.833 (3)	TP27.1894x26.8088x0.36	20.302	0.648	16.800	0.078	0.078	0.002	16.800	0.000
L4	151.833 - 151 (4)	TP27.4613x27.1894x0.52	20.437	0.449	16.788	0.054	0.072	0.001	16.788	0.000
L5	151 - 130 (5)	TP34.3125x27.4613x0.38	22.842	0.578	16.800	0.070	0.232	0.004	16.800	0.000
L6	130 - 120.667	TP36.844x31.9209x0.444	25.356	0.487	16.800	0.059	0.232	0.003	16.800	0.000

Section No.	Elevation ft	Size	Actual V K	Actual $f_v$ ksi	Allow. $F_v$ ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual $f_{vt}$ ksi	Allow. $F_{vt}$ ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L7	(6) 120.667 - 115	7 TP38.6875x36.844x0.477	26.400	0.449	16.460	0.055	0.232	0.002	16.460	0.000
L8	(7) 115 - 114 (8)	6 TP39.0125x38.6875x0.54	26.589	0.397	16.800	0.048	0.232	0.002	16.800	0.000
L9	(9) 114 - 95 (9)	02 TP45.1875x39.0125x0.44	28.911	0.470	16.800	0.057	0.231	0.002	16.800	0.000
L10	(10) 95 - 91 (10)	63 TP45.8125x42.3448x0.52	30.943	0.401	16.800	0.048	0.231	0.002	16.800	0.000
L11	(11) 91 - 90 (11)	94 TP46.1391x45.8125x0.46	31.145	0.455	16.800	0.055	0.231	0.002	16.800	0.000
L12	(12) 90 - 61.5 (12)	5 TP55.4461x46.1391x0.52	36.699	0.392	16.800	0.047	0.231	0.001	16.800	0.000
L13	(13) 61.5 - 58 (13)	99 TP56.5891x55.4461x0.52	37.380	0.393	16.664	0.048	0.231	0.001	16.664	0.000
L14	(14) 58 - 40 (14)	63 TP61.6875x56.5891x0.57	40.974	0.360	15.932	0.046	0.231	0.001	15.932	0.000
L15	(15) 40 - 33 (15)	88 TP63.9583x61.6875x0.57	42.280	0.363	16.800	0.044	0.231	0.001	16.800	0.000
L16	(16) 33 - 28 (16)	04 TP65.5804x63.9583x0.59	43.202	0.347	16.260	0.043	0.231	0.001	16.260	0.000
L17	(17) 28 - 0 (17)	5 TP73.8125x65.5804x0.57	48.617	0.358	15.300	0.048	0.231	0.001	15.300	0.000
		58								

### Pole Interaction Design Data

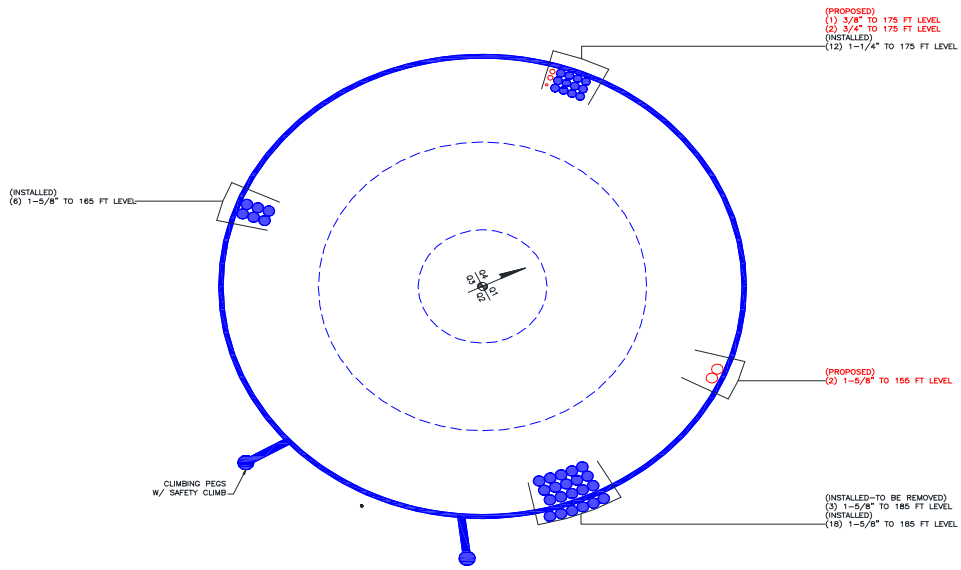
Section No.	Elevation ft	Ratio P	Ratio $f_{bx}$	Ratio $f_{by}$	Ratio $f_v$	Ratio $f_{vt}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
		$P_a$	$F_{bx}$	$F_{by}$	$F_v$	$F_{vt}$			
L1	185 - 180 (1)	0.005	0.244	0.000	0.056	0.000	0.250	1.333	H1-3+VT ✓
L2	180 - 153 (2)	0.014	1.155	0.000	0.114	0.000	1.172	1.333	H1-3+VT ✓
L3	153 - 151.833 (3)	0.010	0.839	0.000	0.078	0.000	0.850	1.333	H1-3+VT ✓
L4	151.833 - 151 (4)	0.007	0.606	0.000	0.054	0.000	0.614	1.333	H1-3+VT ✓
L5	151 - 130 (5)	0.010	1.106	0.000	0.070	0.000	1.118	1.333	H1-3+VT ✓
L6	130 - 120.667 (6)	0.011	1.101	0.000	0.059	0.000	1.113	1.333	H1-3+VT ✓
L7	120.667 - 115 (7)	0.011	1.080	0.000	0.055	0.000	1.091	1.333	H1-3+VT ✓
L8	115 - 114 (8)	0.009	0.945	0.000	0.048	0.000	0.954	1.333	H1-3+VT ✓
L9	114 - 95 (9)	0.012	1.188	0.000	0.057	0.000	1.201	1.333	H1-3+VT ✓
L10	95 - 91 (10)	0.012	1.063	0.000	0.048	0.000	1.076	1.333	H1-3+VT ✓
L11	91 - 90 (11)	0.013	1.207	0.000	0.055	0.000	1.222	1.333	H1-3+VT ✓
L12	90 - 61.5 (12)	0.014	1.098	0.000	0.047	0.000	1.113	1.333	H1-3+VT ✓
L13	61.5 - 58 (13)	0.014	1.117	0.000	0.048	0.000	1.132	1.333	H1-3+VT ✓
L14	58 - 40 (14)	0.015	1.103	0.000	0.046	0.000	1.119	1.333	H1-3+VT ✓
L15	40 - 33 (15)	0.015	1.063	0.000	0.044	0.000	1.079	1.333	H1-3+VT ✓

Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L16	33 - 28 (16)	0.015	1.055	0.000	0.043	0.000	1.071	1.333	H1-3+VT ✓
L17	28 - 0 (17)	0.019	1.187	0.000	0.048	0.000	1.207	1.333	H1-3+VT ✓

### Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	SF*P <sub>allow</sub> K	% Capacity	Pass Fail	
L1	185 - 180	Pole	TP18x18x0.1875	1	-1.377	361.254	18.7	Pass	
L2	180 - 153	Pole	TP26.8088x18x0.25	2	-7.522	718.182	88.0	Pass	
L3	153 - 151.833	Pole	TP27.1894x26.8088x0.3625	3	-7.692	1051.792	63.8	Pass	
L4	151.833 - 151	Pole	TP27.4613x27.1894x0.5246	4	-7.851	1527.325	46.0	Pass	
L5	151 - 130	Pole	TP34.3125x27.4613x0.3802	5	-10.448	1328.220	83.9	Pass	
L6	130 - 120.667	Pole	TP36.844x31.9209x0.4447	6	-14.042	1750.722	83.5	Pass	
L7	120.667 - 115	Pole	TP38.6875x36.844x0.4776	7	-15.372	1934.076	81.9	Pass	
L8	115 - 114	Pole	TP39.0125x38.6875x0.5402	8	-15.639	2248.011	71.6	Pass	
L9	114 - 95	Pole	TP45.1875x39.0125x0.4463	9	-18.774	2065.883	90.1	Pass	
L10	95 - 91	Pole	TP45.8125x42.3448x0.5294	10	-22.956	2592.778	80.7	Pass	
L11	91 - 90	Pole	TP46.1391x45.8125x0.465	11	-23.230	2297.212	91.6	Pass	
L12	90 - 61.5	Pole	TP55.4461x46.1391x0.5299	12	-32.774	3147.320	83.5	Pass	
L13	61.5 - 58	Pole	TP56.5891x55.4461x0.5263	13	-34.052	3165.902	84.9	Pass	
L14	58 - 40	Pole	TP61.6875x56.5891x0.5788	14	-41.536	3628.093	83.9	Pass	
L15	40 - 33	Pole	TP63.9583x61.6875x0.5704	15	-44.580	3910.529	80.9	Pass	
L16	33 - 28	Pole	TP65.5804x63.9583x0.595	16	-46.900	4047.974	80.3	Pass	
L17	28 - 0	Pole	TP73.8125x65.5804x0.5758	17	-60.428	4154.028	90.6	Pass	
							Summary		
							Pole (L11)	91.6	Pass
							<b>RATING =</b>	<b>91.6</b>	<b>Pass</b>

**APPENDIX B**  
**BASE LEVEL DRAWING**



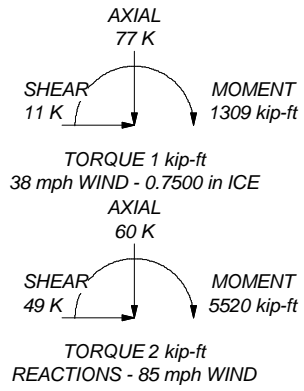
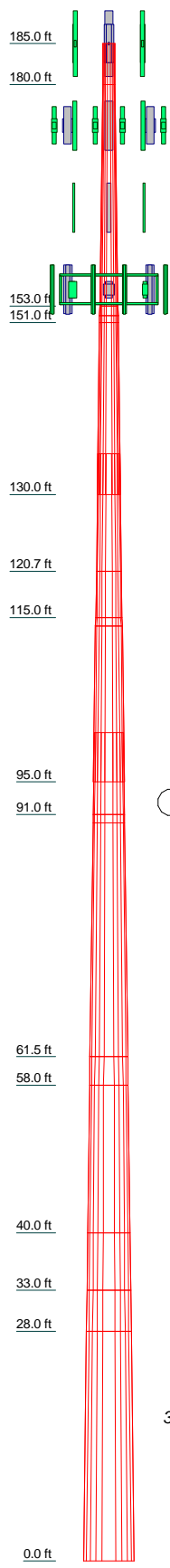


**APPENDIX C**  
**ADDITIONAL CALCULATIONS**

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Program Version 6.1.4.1 - 12/17/2013 File:G:/TOWER/375\_Crown\_Castle/2013/37513-1570 BU 825983/37513-1570.002.7805 WO  
907744 BU 825983 - 002 SA/37513-1570.002.7805 (2 mods incl).eri

Section	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Length (ft)	5.000	27.000	0.1387	21.000	14.333	1.006667	19.000	10.006	1.000	10.000	28.500	3.500	18.000	7.000	5.000	28.000	0.5758	65.5804	73.8125	Reinf 38.25 ksi	
Number of Sides	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	Reinf 40.65 ksi
Thickness (in)	0.1875	0.2500	0.1875	0.3802	0.4447	0.4463	0.5402	0.5299	0.4656	0.4656	0.5299	0.5263	0.5788	0.5704	0.5950	0.5758	0.5758	0.5758	0.5758	0.5758	Reinf 42.00 ksi
Socket Length (ft)	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	Reinf 41.66 ksi
Top Dia (in)	22.8808	22.8808	22.8808	27.4613	31.9209	38.5765	45.1875	51.7981	58.4087	65.0193	71.6299	78.2405	84.8511	91.4617	98.0723	104.6829	111.2935	117.9041	124.5147	131.1253	Reinf 41.66 ksi
Bot Dia (in)	26.8088	26.8088	26.8088	34.3125	36.8440	39.3755	41.9070	44.4385	46.9700	49.5015	52.0330	54.5645	57.0960	59.6275	62.1590	64.6905	67.2220	69.7535	72.2850	74.8165	Reinf 39.83 ksi
Grade	A36M-42	A36M-42	A36M-42	Reinf 42.00 ksi	Reinf 42.00 ksi	Reinf 42.00 ksi	Reinf 42.00 ksi	Reinf 42.00 ksi	Reinf 42.00 ksi	Reinf 42.00 ksi	Reinf 42.00 ksi	Reinf 42.00 ksi	Reinf 42.00 ksi	Reinf 42.00 ksi	Reinf 42.00 ksi	Reinf 42.00 ksi	Reinf 42.00 ksi	Reinf 42.00 ksi	Reinf 42.00 ksi	Reinf 42.00 ksi	Reinf 42.00 ksi
Weight (K)	0.2	1.6	0.1	2.7	2.4	1.1	3.9	2.5	8.3	1.1	6.7	2.7	2.1	12.2	48.2	12.2	12.2	12.2	12.2	12.2	12.2



### DESIGNED APPURTENANCE LOADING


TYPE	ELEVATION	TYPE	ELEVATION
ETW190VS12UB	185	(2) LGP13519	175
ETW190VS12UB	185	(2) LGP13519	175
ETW190VS12UB	185	(2) DTMAPB7819VG12A	175
Sector Mount [SM 802-3]	185	(2) DTMAPB7819VG12A	175
RR90-17-02DP w/ Mount Pipe	185	(2) DTMAPB7819VG12A	175
RR90-17-02DP w/ Mount Pipe	185	DC6-48-60-18-8F	175
RR90-17-02DP w/ Mount Pipe	185	Sector Mount [SM 802-3]	175
APX16DWV-16DWVS-C w/ Mount Pipe	185	APXV18-206517S-C w/ Mount Pipe	165
APX16DWV-16DWVS-C w/ Mount Pipe	185	APXV18-206517S-C w/ Mount Pipe	165
APX16DWV-16DWVS-C w/ Mount Pipe	185	APXV18-206517S-C w/ Mount Pipe	165
ATBT-BOTTOM-24V	185	Pipe Mount [PM 601-3]	165
SBNHH-1D65C w/ Mount Pipe	185	(2) BXA-70063-6CF-EDIN-2 w/ Mount Pipe	155
ATBT-BOTTOM-24V	185	(2) BXA-70063-6CF-EDIN-2 w/ Mount Pipe	155
LNX-6515DS-VTM w/ Mount Pipe	185	(2) BXA-70063-6CF-EDIN-2 w/ Mount Pipe	155
ATBT-BOTTOM-24V	185	(2) BXA-171063-12CF-EDIN-2 w/ Mount Pipe	155
LNX-6515DS-VTM w/ Mount Pipe	185	(2) BXA-171063-12CF-EDIN-2 w/ Mount Pipe	155
(2) 7770.00 w/ Mount Pipe	175	(2) BXA-171063-12CF-EDIN-2 w/ Mount Pipe	155
(2) 7770.00 w/ Mount Pipe	175	(2) BXA-171063-12CF-EDIN-2 w/ Mount Pipe	155
(2) 7770.00 w/ Mount Pipe	175	(2) BXA-171063-12CF-EDIN-2 w/ Mount Pipe	155
AM-X-CD-16-65-00T-RET w/ Mount Pipe	175	RRH2X40-AWS	155
AM-X-CD-16-65-00T-RET w/ Mount Pipe	175	RRH2X40-AWS	155
AM-X-CD-16-65-00T-RET w/ Mount Pipe	175	RRH2X40-AWS	155
(2) RRUS-11	175	RRH2X40-07-U	155
(2) RRUS-11	175	RRH2X40-07-U	155
(2) RRUS-11	175	RRH2X40-07-U	155
(2) LGP13519	175	DB-T1-6Z-8AB-0Z	155
		Platform Mount [LP 301-1]	155

### MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A36M-42	42 ksi	60 ksi	Reinf 41.66 ksi	42 ksi	53 ksi
Reinf 42.00 ksi	42 ksi	53 ksi	Reinf 39.83 ksi	40 ksi	50 ksi
Reinf 41.97 ksi	42 ksi	53 ksi	Reinf 40.65 ksi	41 ksi	51 ksi
Reinf 41.15 ksi	41 ksi	52 ksi	Reinf 38.25 ksi	38 ksi	48 ksi

### TOWER DESIGN NOTES

1. Tower is located in Middlesex County, Connecticut.
2. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 38 mph basic wind with 0.75 in ice.
4. Deflections are based upon a 50 mph wind.
5. TOWER RATING: 91.6%



**Paul J Ford and Company**  
250 E. Broad Street, Suite 600  
Columbus, OH 43215  
Phone: 614.221.6679  
FAX: 614.448.4105

Job: **185' Monopole / Middletown\_1**  
Project: **PJF 37513-1570 / BU 825983**  
Client: CCI  
Code: TIA/EIA-222-F  
Path:

Drawn by: John J Woolley  
Date: 09/10/14  
Scale: NTS  
Dwg No. E-1



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Date: 9/10/2014  
 PJF Project: 37513-1570.002.7805  
 Client Ref. # 825983  
 Site Name: Middletown\_1  
 Description: Micropile  
 Owner: CCI  
 Engineer: JJW

v4.2 - Effective 4-3-13

**Micropile Analysis**

Moment = 5520 k-ft  
 Axial = 60.0 kips  
 Shear = 49.0 kips  
 Item Qty = 30

TIA Ref. = F  
 ASIF = 1.3333  
 Max Ratio = 100.0%

Location = Micropile  
 η = N/A for BP, Rev. G Sect. 4.9.9  
 Threads = N/A for FP, Rev. G  
 Soil = Soft Clay / Silty Clay (Lean) for Micropile

**\*\* For Post Installed Anchors: Check anchors for embedment, epoxy/grout bond, and capacity based on proof load. \*\***

Item	Nominal Anchor Dia, in	Description	Fy, ksi	Fu, ksi	Location, degrees	Anchor Circle, in	Area Override, in <sup>2</sup>	Area, in <sup>2</sup>	Max Net Compression, kips	Max Net Tension, kips	Load for Capacity Calc, kips	Capacity Override, kips	Capacity, kips	Capacity Ratio	Required Bond Length, ft	
1	2.000	A36	36	58	0.0	68.00	0.00	3.14	55.81	52.02	52.02	0.00	80.17	64.9%		
2	2.000	A36	36	58	15.0	68.00	0.00	3.14	57.16	53.37	53.37	0.00	80.17	66.6%		
3	2.000	A36	36	58	30.0	68.00	0.00	3.14	58.46	54.68	54.68	0.00	80.17	68.2%		
4	2.000	A36	36	58	45.0	68.00	0.00	3.14	59.37	55.58	55.58	0.00	80.17	69.3%		
5	2.000	A36	36	58	60.0	68.00	0.00	3.14	59.61	55.82	55.82	0.00	80.17	69.6%		
6	2.000	A36	36	58	75.0	68.00	0.00	3.14	59.08	55.29	55.29	0.00	80.17	69.0%		
7	2.000	A36	36	58	90.0	68.00	0.00	3.14	57.86	54.07	54.07	0.00	80.17	67.4%		
8	2.000	A36	36	58	105.0	68.00	0.00	3.14	56.17	52.38	52.38	0.00	80.17	65.3%		
9	2.000	A36	36	58	120.0	68.00	0.00	3.14	54.39	50.61	50.61	0.00	80.17	63.1%		
10	2.000	A36	36	58	135.0	68.00	0.00	3.14	52.97	49.18	49.18	0.00	80.17	61.3%		
11	2.000	A36	36	58	150.0	68.00	0.00	3.14	52.27	48.48	48.48	0.00	80.17	60.5%		
12	2.000	A36	36	58	165.0	68.00	0.00	3.14	52.48	48.69	48.69	0.00	80.17	60.7%		
13	2.000	A36	36	58	180.0	68.00	0.00	3.14	53.53	49.74	49.74	0.00	80.17	62.0%		
14	2.000	A36	36	58	195.0	68.00	0.00	3.14	55.09	51.30	51.30	0.00	80.17	64.0%		
15	2.000	A36	36	58	210.0	68.00	0.00	3.14	56.73	52.95	52.95	0.00	80.17	66.0%		
16	2.000	A36	36	58	225.0	68.00	0.00	3.14	58.07	54.28	54.28	0.00	80.17	67.7%		
17	2.000	A36	36	58	240.0	68.00	0.00	3.14	58.80	55.01	55.01	0.00	80.17	68.6%		
18	2.000	A36	36	58	255.0	68.00	0.00	3.14	58.80	55.02	55.02	0.00	80.17	68.6%		
19	2.000	A36	36	58	270.0	68.00	0.00	3.14	58.14	54.35	54.35	0.00	80.17	67.8%		
20	2.000	A36	36	58	285.0	68.00	0.00	3.14	57.02	53.23	53.23	0.00	80.17	66.4%		
21	2.000	A36	36	58	300.0	68.00	0.00	3.14	55.79	52.00	52.00	0.00	80.17	64.9%		
22	2.000	A36	36	58	315.0	68.00	0.00	3.14	54.82	51.03	51.03	0.00	80.17	63.7%		
23	2.000	A36	36	58	330.0	68.00	0.00	3.14	54.45	50.66	50.66	0.00	80.17	63.2%		
24	2.000	A36	36	58	345.0	68.00	0.00	3.14	54.81	51.02	51.02	0.00	80.17	63.6%		
25	0.000	Other			45.0	169.81	4.02	4.02	184.81	179.96	184.81	219.90	219.90	84.0%	55.00	
26	0.000	Other			165.0	169.81	4.02	4.02	166.30	161.45	166.30	219.90	219.90	75.6%	55.00	
27	0.000	Other			285.0	169.81	4.02	4.02	177.73	172.88	177.73	219.90	219.90	80.8%	55.00	
28	0.000	Other			105.0	169.81	4.02	4.02	176.64	171.79	176.64	219.90	219.90	80.3%	55.00	
29	0.000	Other			210.0	169.81	4.02	4.02	179.30	174.46	179.30	219.90	219.90	81.5%	55.00	
30	0.000	Other			335.0	169.81	4.02	4.02	168.32	163.47	168.32	219.90	219.90	76.5%	55.00	
								99.52								

## Stiffened or Unstiffened, Interior Flange Plate - Any Bolt Material TIA Rev F

Site Data	
BU#:	
Site Name:	
App #:	
Manufacturer:	Other

Reactions		
Moment:	1962.25	ft-kips
Axial:	45.46	kips
Shear:	37.1	kips
Exterior Flange Run, T+Q:	0	kips

Reactions adjusted to account for micropiles

Elevation: 0 feet

Bolt Data				
Qty:	24			
Diam:	2			
Bolt Material:	Other	Bolt Fu:	58	
Strength (Fu):	58	ksi	Bolt Fy:	36
Yield (Fy):	36	ksi	Bolt Fty:	19.14
Circle:	68	in		

### Interior Flange Bolt Results

Maximum Bolt Tension: 55.8 Kips, Ext. T=Interior T  
 Allowable Tension: 80.2 Kips  
 Bolt Stress Ratio: 69.6% Pass

Plate Data		
Plate Outer Diam:	72.9375	in
Plate Inner Diam:	62	in (Hole @ Ctr)
Thick:	2	in
Grade:	36	ksi
<b>Effective Width:</b>	9.77	in

### Interior Flange Plate Results

Controlling Bolt Axial Force: 59.6 Kips, Ext. C= Interior C  
 Plate Stress: 18.1 ksi  
 Allowable Plate Stress: 36.0 ksi  
 Plate Stress Ratio: 50.2% Pass

### Flexural Check

Stiffener Data (Welding at Both Sides)		
Config:	1	*
Weld Type:	Fillet	
Groove Depth:		<-- Disregard
Groove Angle:		<-- Disregard
Fillet H. Weld:	0.75	in
Fillet V. Weld:	0.375	in
Width:	5	in
Height:	18	in
Thick:	1	in
Notch:	1	in
Grade:	50	ksi
Weld str.:	70	ksi

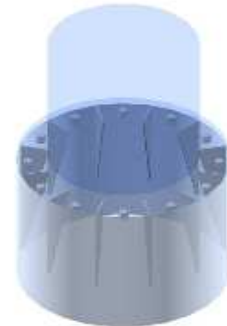
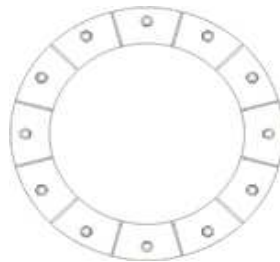
### Stiffener Results

Horizontal Weld : 22.7% Pass  
 Vertical Weld: 11.5% Pass  
 Plate Flex+Shear, fb/Fb+(fv/Fv)^2: 2.1% Pass  
 Plate Tension+Shear, ft/Ft+(fv/Fv)^2: 16.7% Pass  
 Plate Comp. (AISC Bracket): 15.0% Pass

### Pole Results

Pole Punching Shear Check: 3.7% Pass

Pole Data		
Pole OuterDiam:	73.8125	in
Thick:	0.4375	in
Pole Inner Diam:	72.9375	in
Grade:	42	ksi
# of Sides:	12	"0" IF Round
Fu	60	ksi



Stress Increase Factor	
ASIF:	1.333

\* 0 = none, 1 = every bolt, 2 = every 2 bolts, 3 = 2 per bolt

\*\* Note: for complete joint penetration groove welds the groove depth must be exactly 1/2 the stiffener thickness for calculation purposes

**Foundation Loads:**

Pole weight or tower leg compression = 45.5 (kips)  
 Horizontal load at top of pier = 37.1 (kips)  
 Overturning moment at top of pier = 1962 (ft-kips)

**Design criteria:**

Safety factor against overturning = 1.5

**Soil Properties:**

Soil density = 120 (pcf)  
 Allowable soil bearing = 3 (ksf)  
 Depth to water table = 16 (ft)

**Dimensions:**

Pier shape (round or square) R ("R" or "S")  
 Pier width = 7.5 (ft)  
 Pier height above grade = 0.25 (ft)  
 depth to bottom of footing = 10.5 (ft)  
 Footing thickness = 3 (ft)  
 Footing width = 25 (ft)  
 Footing length = 25 (ft)

**Concrete:**

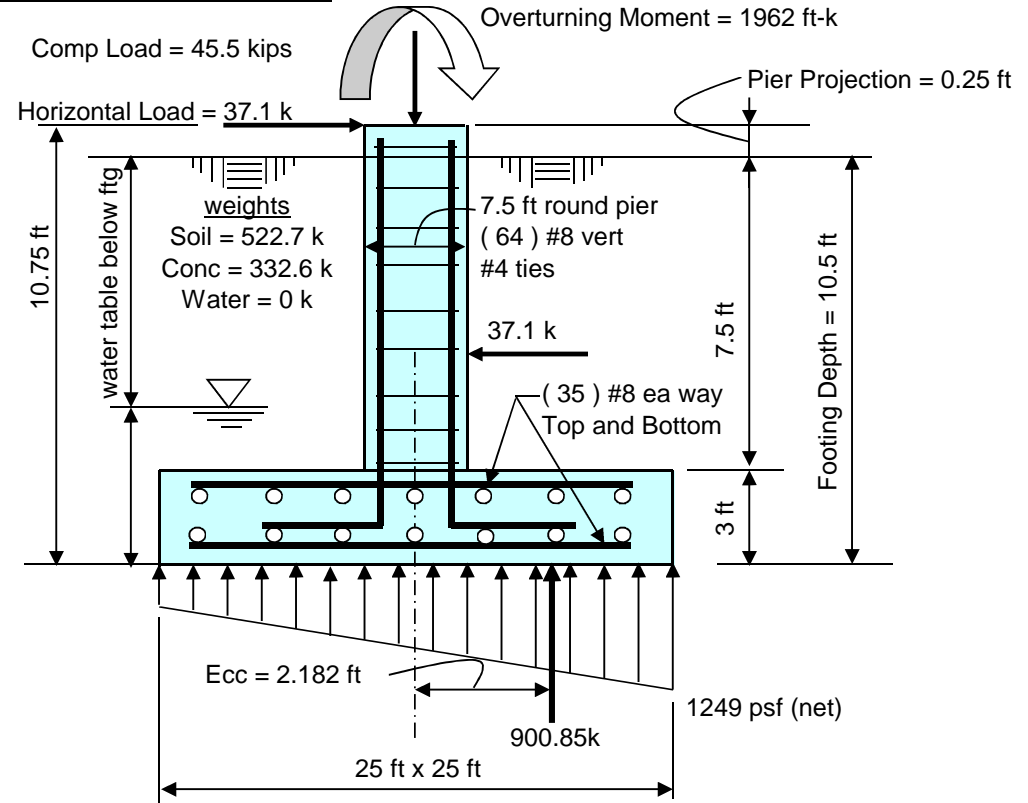
Concrete strength = 4 (ksi)  
 Rebar strength = 60 (ksi)  
 ultimate load factor = 1.3

**Reinforcing Steel:**

Pad  
 minimum cover over rebar = 3 inches  
 size of pad rebar = #8 bar  
 quantity of pad rebar = 35 (ea direction)

**Reinforcing Steel:**

Pier  
 size of vert rebar in pier = #8 bar  
 vertical rebar quantity = 64  
 size of pier ties = #4 bar  
 minimum cover over rebar = 3 inches  
 Total volume of concrete = 82.1 cu yd



Summary of analysis results	
Maximum Net Soil Bearing = 1.249 ksf Allowable Net Soil Bearing = 3 ksf <b>Soil Bearing Stress Ratio = 0.42 Okay</b>	Ult Bending Shear Capacity = 126 psi Ult Bending Shear Stress = 19 psi <b>Bending Shear Stress Ratio = 0.15 Okay</b>
Ftg Overturning Resistance = 11261 ft-kips Overturning Moment = 1962 ft-kips Required Overturning Safety Factor = 1.5 Overturning Safety Factor = 5.728 <b>Ratio = 0.26 Okay</b>	Pad Bending Moment Capacity = 3818 ft-k Pad Bending Moment = 834 ft-k <b>Bending Moment Stress Ratio = 0.22 OK</b>

```

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oo   oo   oo   oo   oo   oo   oo   oo   oo   oo   oo   oo   oo   oo (TM)

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                        spColumn v4.80 (TM)
Computer program for the Strength Design of Reinforced Concrete Sections
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General Information:

=====  
 File Name: g:\tower\375\_crown\_castle\2013\37513-1570 bu 825983\37513-1570.002... \37513-1570 bp a.col  
 Project:  
 Column: Engineer:  
 Code: ACI 318-11 Units: English  
 Run Option: Investigation Slenderness: Not considered  
 Run Axis: X-axis Column Type: Architectural

Material Properties:

=====  
 f'c = 4 ksi fy = 60 ksi  
 Ec = 3605 ksi Es = 29000 ksi  
 Ultimate strain = 0.003 in/in  
 Beta1 = 0.85

Section:

=====  
 Circular: Diameter = 90 in  
 Gross section area, Ag = 6361.73 in^2  
 Ix = 3.22062e+006 in^4 Iy = 3.22062e+006 in^4  
 rx = 22.5 in ry = 22.5 in  
 Xo = 0 in Yo = 0 in

Reinforcement:

=====  
 Bar Set: ASTM A615

Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)	Size	Diam (in)	Area (in^2)
# 3	0.38	0.11	# 4	0.50	0.20	# 5	0.63	0.31
# 6	0.75	0.44	# 7	0.88	0.60	# 8	1.00	0.79
# 9	1.13	1.00	# 10	1.27	1.27	# 11	1.41	1.56
# 14	1.69	2.25	# 18	2.26	4.00			

Confinement: Tied; #3 ties with #10 bars, #4 with larger bars.  
 phi(a) = 0.8, phi(b) = 0.9, phi(c) = 0.65

Layout: Circular  
 Pattern: All Sides Equal (Cover to transverse reinforcement)  
 Total steel area: As = 51.35 in^2 at rho = 0.81% (Note: rho < 1.0%)  
 Minimum clear spacing = 2.97 in

65 #8 Cover = 3 in

Factored Loads and Moments with Corresponding Capacities:

=====  

No.	Pu kip	Mux k-ft	PhiMnx k-ft	PhiMn/Mu NA	depth in	Dt in	depth in	eps_t	Phi
1	45.50	2924.40	8590.39	2.937	16.07	86.08	0.01307	0.900	

\*\*\* End of output \*\*\*

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

T-Mobile Existing Facility

Site ID: CT11057C

Middletown 1  
90 Industrial Park Road  
Middletown, CT 06457

**October 16, 2014**

**EBI Project Number: 62145549**

Site Compliance Summary	
Compliance Status:	<b>COMPLIANT</b>
Site total MPE% of FCC general public allowable limit:	<b>38.63 %</b>



October 16, 2014

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

Emissions Analysis for Site: **CT11057C – Middletown 1**

EBI Consulting was directed to analyze the proposed T-Mobile facility located at **90 Industrial Park Road, Middletown, CT**, for the purpose of determining whether the emissions from the Proposed T-Mobile Antenna Installation located on this property are within specified federal limits.

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

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

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

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

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

Additional details can be found in FCC OET 65.

## **CALCULATIONS**

Calculations were done for the proposed T-Mobile Wireless antenna facility located at **90 Industrial Park Road, Middletown, CT**, using the equipment information listed below. All calculations were performed per the specifications under FCC OET 65. Since T-Mobile is proposing highly focused directional panel antennas, which project most of the emitted energy out toward the horizon, all calculations were performed assuming a lobe representing the maximum gain of the antenna per the antenna manufactures supplied specifications, minus 10 dB, was focused at the base of the tower. For this report the sample point is the top of a 6 foot person standing at the base of the tower.

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

- 1) 2 GSM channels (PCS Band - 1900 MHz) were considered for each sector of the proposed installation. These Channels have a transmit power of 30 Watts per Channel
- 2) 2 UMTS channels (AWS Band – 2100 MHz) were considered for each sector of the proposed installation. These Channels have a transmit power of 30 Watts per Channel.
- 3) 2 LTE channels (AWS Band – 2100 MHz) were considered for each sector of the proposed installation. These Channels have a transmit power of 60 Watts per Channel.
- 4) 1 LTE channel (700 MHz Band) was considered for each sector of the proposed installation. This channel has a transmit power of 30 Watts.
- 5) All radios at the proposed installation were considered to be running at full power and were uncombined in their RF transmissions paths per carrier prescribed configuration. Per FCC OET Bulletin No. 65 - Edition 97-01 recommendations to achieve the maximum anticipated value at each sample point, all power levels emitting from the proposed antenna installation are increased by a factor of 2.56 to account for possible in-phase reflections from the surrounding environment. This is rarely the case, and if so, is never continuous.

- 6) For the following calculations the sample point was the top of a six foot person standing at the base of the tower. The maximum gain of the antenna per the antenna manufactures supplied specifications minus 10 dB was used in this direction. This value is a very conservative estimate as gain reductions for these particular antennas are typically much higher in this direction.
- 7) The antennas used in this modeling are the **RFS APX16DWV-16DWVS-E-A20** for 1900 MHz (PCS) and 2100 MHz (AWS) channels and the **Commscope LNX-6515DS-VTM** for 700 MHz channels. This is based on feedback from the carrier with regards to anticipated antenna selection. The **RFS APX16DWV-16DWVS-E-A20** has a maximum gain of **16.3 dBd** at its main lobe. The **Commscope LNX-6515DS-VTM** has a maximum gain of **14.6 dBd** at its main lobe. The maximum gain of the antenna per the antenna manufactures supplied specifications, minus 10 dB, was used for all calculations. This value is a very conservative estimate as gain reductions for these particular antennas are typically much higher in this direction.
- 8) The antenna mounting height centerline of the proposed antennas is **185 feet** above ground level (AGL).
- 9) Emissions values for additional carriers were taken from the Connecticut Siting Council active database. Values in this database are provided by the individual carriers themselves.

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

**T-Mobile Site Inventory and Power Data**

Sector:	A	Sector:	B	Sector:	C
Antenna #:	1	Antenna #:	1	Antenna #:	1
Make / Model:	RFS APX16DWV-16DWVS-E-A20	Make / Model:	RFS APX16DWV-16DWVS-E-A20	Make / Model:	RFS APX16DWV-16DWVS-E-A20
Gain:	16.3 dBd	Gain:	16.3 dBd	Gain:	16.3 dBd
Height (AGL):	185	Height (AGL):	185	Height (AGL):	185
Frequency Bands	1900 MHz(PCS) / 2100 MHz (AWS)	Frequency Bands	1900 MHz(PCS) / 2100 MHz (AWS)	Frequency Bands	1900 MHz(PCS) / 2100 MHz (AWS)
Channel Count	6	Channel Count	6	# PCS Channels:	6
Total TX Power:	240	Total TX Power:	240	# AWS Channels:	240
ERP (W):	3,833.82	ERP (W):	3,833.82	ERP (W):	3,833.82
Antenna A1 MPE%	1.15	Antenna B1 MPE%	1.15	Antenna C1 MPE%	1.15
Antenna #:	2	Antenna #:	2	Antenna #:	2
Make / Model:	Commscope LNX-6515DS-VTM	Make / Model:	Commscope LNX-6515DS-VTM	Make / Model:	Commscope LNX-6515DS-VTM
Gain:	14.6 dBd	Gain:	14.6 dBd	Gain:	14.6 dBd
Height (AGL):	185	Height (AGL):	185	Height (AGL):	185
Frequency Bands	700 Mhz	Frequency Bands	700 Mhz	Frequency Bands	700 Mhz
Channel Count	1	Channel Count	1	Channel Count	1
Total TX Power:	30	Total TX Power:	30	Total TX Power:	30
ERP (W):	445.37	ERP (W):	445.37	ERP (W):	445.37
Antenna A2 MPE%	0.21	Antenna B2 MPE%	0.21	Antenna C2 MPE%	0.21

Site Composite MPE %	
Carrier	MPE %
T-Mobile	4.07
AT&T	10.50 %
Verizon Wireless	24.06 %
<b>Site Total MPE %:</b>	<b>38.63 %</b>

T-Mobile Sector 1 Total:	1.36 %
T-Mobile Sector 2 Total:	1.36 %
T-Mobile Sector 3 Total:	1.36 %
<b>Site Total:</b>	<b>38.63 %</b>

## Summary

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

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

T-Mobile Sector	Power Density Value (%)
Sector 1:	1.36 %
Sector 2:	1.36 %
Sector 3 :	1.36 %
T-Mobile Total:	4.07 %
Site Total:	38.63 %
Site Compliance Status:	<b>COMPLIANT</b>

The anticipated composite MPE value for this site assuming all carriers present is **38.63%** of the allowable FCC established general public limit sampled at the ground level. This is based upon values listed in the Connecticut Siting Council database for existing carrier emissions.

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



**Scott Heffernan**  
RF Engineering Director

**EBI Consulting**  
21 B Street  
Burlington, MA 01803`