NORTHEAST SITE SOLUTIONS
Turnkey Wireless Development

May 6, 2015

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

RE: Notice of Exempt Modification
484 Meriden Road, Middlefield, CT 06455
Longitude: -72.7320285
Latitude: 41.53553559
T-Mobile Site#: CTHA244A_VoLte

Members of the Siting Council:

On behalf of T-Mobile, Northeast Site Solutions (NSS) is submitting an exempt modification application to the Connecticut Siting Council for modification of existing equipment at a tower facility located at 484 Meriden Road, Middlefield, CT 06455.

The 484 Meriden Road, Middlefield, CT facility consists of a 150' Monopole Tower owned and operated by Verizon. In order to accommodate technological changes and enhance system performance in the State of Connecticut, T-Mobile plans to modify the equipment configurations at many of its existing cell sites. Please accept this letter and attachments as notification, pursuant to R.C.S.A. Section 16-50j-73, of construction which constitutes an exempt modification pursuant to R.C.S.A. Section 16-50j-72(b)(2). In compliance with R.C.S.A. Section 16-50j-73, a copy of this letter and attachments is being sent to the chief elected official of the municipality in which the affected cell site is located.

As part of T-Mobile's VOLTE Project, T-Mobile desires to upgrade their equipment to meet the new standards of 4G technology. The new equipment will allow customers to download files and browse the internet at a high rate of speed while also allowing their phones to be compatible with the latest 4G technology.

Attached is a summary of the planned modifications, including power density calculations reflecting the change in T-Mobile's operations at the site along with the required fee of $625.

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The changes to the facility do not constitute modifications as defined in Connecticut General Statutes significantly changed or altered. Rather, the planned changes to the facility fall squarely within those activities explicitly provided for in R.C.S.A. Section 16-50j-72(b)(2).

1. The overall height of the structure will be unaffected.

2. The proposed changes will not extend the site boundaries. There will be no effect on the site compound other than the new equipment cabinets.

3. The proposed changes will not increase the noise level at the existing facility by six decibels or more.

4. The changes in radio frequency power density will not increase the calculated "worst case" power density for the combined operations at the site to a level at or above the applicable standard for uncontrolled environments as calculated for a mixed frequency site.

For the foregoing reasons, Northeast Site Solutions (NSS) on behalf of T-Mobile, respectfully submits that the proposed changes at the referenced site constitute exempt modifications under R.C.S.A. Section 16-50j-72(b)(2).

Please feel free to call me at 860.209.4690 with any questions you may have concerning this matter.

Sincerely,

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

cc: Town of Middlefield, Allan Johanson, Zoning
American Tower Corporation
Land Management Inc.

Exhibit A

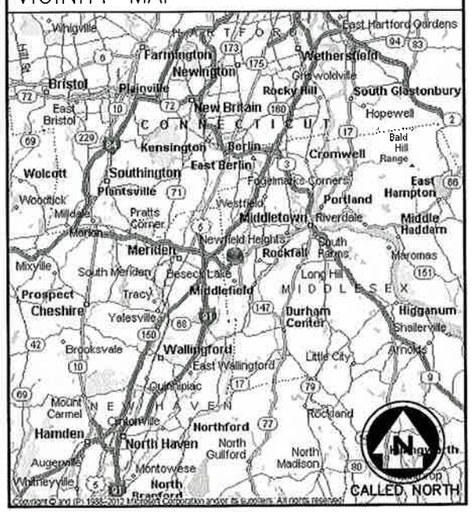
T-MOBILE NORTHEAST LLC

CTHA244A
CTHA244/VERIZONMIDDLEFIELD

484 MERIDEN RD
MIDDLEFIELD, CT

(4E-GU19 CONFIGURATION)

VICINITY MAP



DO NOT SCALE DRAWINGS

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

CALL:
"CALL BEFORE YOU DIG"
CALL 811
www.ct811.com

CALL THREE WORKING DAYS PRIOR TO DIGGING

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

COLOR CODE FOR UTILITY LOCATIONS

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

GENERAL NOTES

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

PROJECT SUMMARY

SITE NUMBER:	CTHA244A	APPLICANT:	T–MOBILE NORTHEAST LLC 35 GRIFFIN RD BLOOMFIELD, CT 06002 (860) 692–7100
SITE NAME:	CTHA244A/VERIZONMIDDLEFIELD		
SITE ADDRESS:	484 MERIDEN RD MIDDLEFIELD, CT		
PROPERTY OWNER:	VERIZON WIRELESS 99 EAST RIVER DR EAST HARTFORD, CT 06108 ATTN: ALEX TYURIN ALEKSEY.TYURIN@VERIZONWIRELESS.COM	PROJECT MANAGER:	NORTHEAST SITE SOLUTIONS 199 BRICKYARD RD FARMINGTON, CT 06032
		CONTACT:	JOE CARBONELL (860) 463–3175
PARCEL:	MAP: 4, LOT: 5		
CURRENT ZONING:	MIDDLEFIELD, CT	ARCHITECT/ENGINEER:	INFINIGY ENGINEERING 1033 WATERVLIET SHAKER ROAD ALBANY, NY 12205
JURISDICTION:	MIDDLESEX COUNTY		
LAT./LONG.:	N 41.53554° / W –72.73203°	CONTACT:	MIKE LANE 518–690–0790
CONSTRUCTION TYPE: USE GROUP:	TBD N/A		

PROJECT DESCRIPTION

☒ EXISTING MONOPOLE	☒ EXISTING CABINET(S)	☒ OUTDOOR
☐ EXISTING LATTICE TOWER	☐ EXISTING RBS 2106	☐ INDOOR
☐ EXISTING TRANSMISSION TOWER	☐ EXISTING RBS 3106	☒ EXISTING CONCRETE PAD
☐ EXISTING WATER TANK	☒ PROPOSED RBS 6201	☐ EXISTING STEEL PLATFORM
☐ EXISTING BUILDING	☐ SITE SUPPORT KIT	☒ EXISTING PPC
☐ EXISTING FLAGPOLE	☐ SITE SUPPORT CABINET	☐ PANELBOARD
☐ EXISTING FORT WORTH	☒ GPS	

T–MOBILE NORTHEAST LLC PROPOSES THE MODIFICATION OF AN UNMANNED WIRELESS BROADBAND FACILITY. REPLACEMENT OF EXISTING PANEL ANTENNAS & TMA'S WITH PROPOSED PANEL ANTENNAS AND ASSOCIATED CABLING. REUSE EXISTING GPS ANTENNA AND REMOVE AND REPLACE EXISTING EQUIPMENT CABINETS.

SHEET INDEX

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T-Mobile
T-MOBILE NORTHEAST LLC
35 GRIFFIN ROAD
SOUTH BLOOMFIELD, CT 06002

NSS NORTHEAST SITE SOLUTIONS
199 BRICKYARD RD
FARMINGTON, CT 06032

INFINIGY
FROM ZERO TO INFINIGY
the solutions are endless
1033 WATERVLIET SHAKER ROAD
ALBANY, NY 12205
OFFICE: (518) 690–0790
FAX: (518) 690–0793

SUBMITTALS

DATE	DESCRIPTION	REVISION
4/1/15	ISSUED FOR REVIEW	A
4/2/15	REVISED PER COMMENTS	B
4/8/15	REVISED PER COMMENTS	C
4/13/15	REVISED PER COMMENTS	D
5/1/15	REVISED PER COMMENTS	E

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

PROJECT NO:	379-000
DRAWN BY:	AHS
CHECKED BY:	AJD

STATE OF CONNECTICUT
JOHN S. STEVENS
No. 24705
LICENSED PROFESSIONAL ENGINEER
PROFESSIONAL SEAL

NOTE: IF DRAWINGS ARE 22"x34", USE GRAPHICAL SCALE AND/OR 1/2 TIMES OF THE NOTED SCALE.

SITE NAME
CTHA244A
484 MERIDEN RD
MIDDLEFIELD, CT

SHEET TITLE
TITLE SHEET

SHEET NUMBER
T-1
SHEET 1 OF 6 SHEETS

ELECTRICAL NOTES:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

GENERAL NOTES:

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

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

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

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

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

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

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

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

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

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

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

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

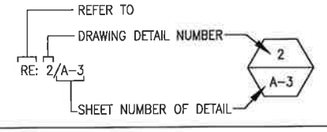
ABBREVIATIONS

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

ARCHITECTURAL SYMBOLS

ROOM
###
X

DETAIL REFERENCE KEY



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SUBMITTALS

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

PROJECT NO: 379-000
DRAWN BY: AHS
CHECKED BY: AJD

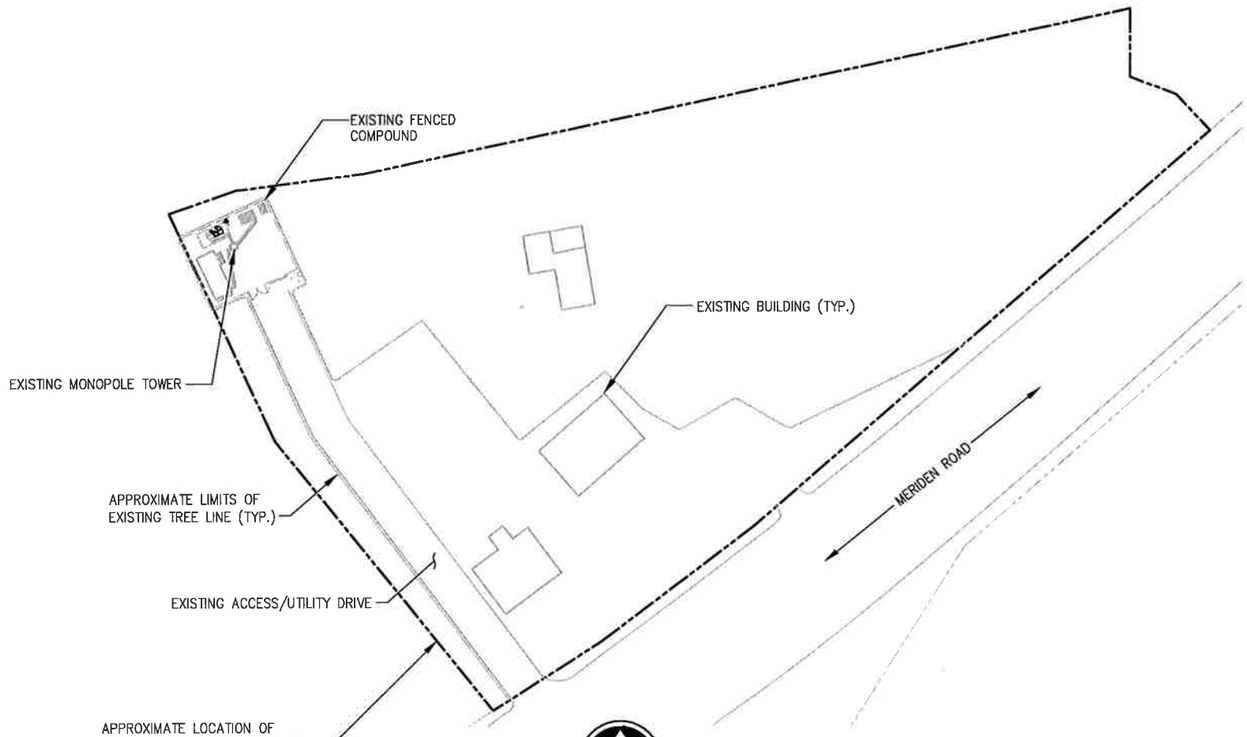
STATE OF CONNECTICUT
JOHN S. STEVENS
No. 24705
LICENSED PROFESSIONAL ENGINEER
PROFESSIONAL SEAL

NOTE: IF DRAWINGS ARE 22"x34", USE GRAPHICAL SCALE AND/OR 1/2 TIMES OF THE NOTED SCALE.

SITE NAME
CTHA244A
484 MERIDEN RD
MIDDLEFIELD, CT

SHEET TITLE
GENERAL NOTES

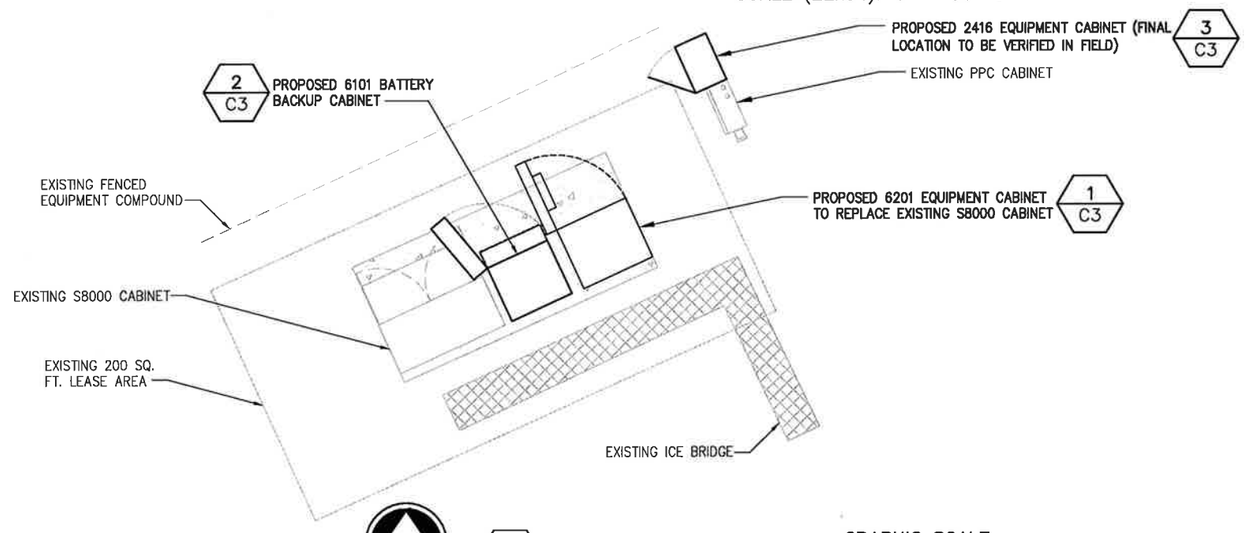
SHEET NUMBER
N-1
SHEET 2 OF 6 SHEETS



CALLED NORTH

1 — SITE PLAN
SCALE: AS NOTED

GRAPHIC SCALE:
100' 50' 0 50' 100'
SCALE (11x17): 1" = 100'-0"
SCALE (22x34): 1" = 50'-0"



CALLED NORTH

2 — COMPOUND PLAN
SCALE: AS NOTED

GRAPHIC SCALE:
6' 3' 0 3' 6'
SCALE (11x17): 1" = 6'-0"
SCALE (22x34): 1" = 3'-0"

BASEMAPPING PREPARED FROM A SITE VISIT PERFORMED BY INFINIGY ON MARCH 3, 2015, AND INFORMATION PROVIDED BY SPRINT, AND DOES NOT REPRESENT AN ACTUAL FIELD SURVEY.

GENERAL SITE NOTES:

1. A COMPLETE BOUNDARY SURVEY OF THE HOST PARCEL HAS NOT BEEN PERFORMED BY INFINIGY ENGINEERING. BOUNDARY INFORMATION WAS OBTAINED FROM INFORMATION PROVIDED BY OTHERS. PROPERTY IS SUBJECT TO ALL EASEMENTS AND RESTRICTIONS OF RECORD.
2. BASEMAPPING INFORMATION BASED ON PROVIDED INFORMATION.
3. CONTRACTOR TO FIELD VERIFY DIMENSIONS AS NECESSARY BEFORE CONSTRUCTION.
4. THE PROPOSED DEVELOPMENT DOES NOT INCLUDE SIGNS OF ADVERTISING.
5. THE PROPOSED DEVELOPMENT IS UNMANNED AND THEREFORE DOES NOT REQUIRE A MEANS OF WATER SUPPLY OR SEWAGE DISPOSAL.
6. NO LANDSCAPING WORK IS PROPOSED IN CONJUNCTION WITH THIS DEVELOPMENT OTHER THAN THAT WHICH IS SHOWN.
7. THE PROPOSED DEVELOPMENT DOES NOT INCLUDE OUTDOOR STORAGE OR ANY SOLID WASTE RECEPTACLES.
8. UTILITIES SHOWN ON PLAN ARE TAKEN FROM OWNERS RECORDS AND FIELD LOCATION OF VISIBLE SURFACE FEATURES. THE EXISTENCE, EXTENT AND EXACT HORIZONTAL AND VERTICAL LOCATIONS OF UTILITIES HAS NOT BEEN VERIFIED. ANY CONTRACTOR PERFORMING WORK ON THIS SITE MUST CONTACT MISS UTILITY AT LEAST 48 HOURS PRIOR TO COMMENCING WORK.
9. ALL OBSOLETE OR UNUSED FACILITIES SHALL BE REMOVED WITHIN 12 MONTHS OF CESSATION OF OPERATIONS.

SITE LEGEND

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

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4/8/15	REVISED PER COMMENTS	C
4/13/15	REVISED PER COMMENTS	D
5/1/15	REVISED PER COMMENTS	E

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

PROJECT NO:	379-000
DRAWN BY:	AHS
CHECKED BY:	AJD

PROFESSIONAL SEAL

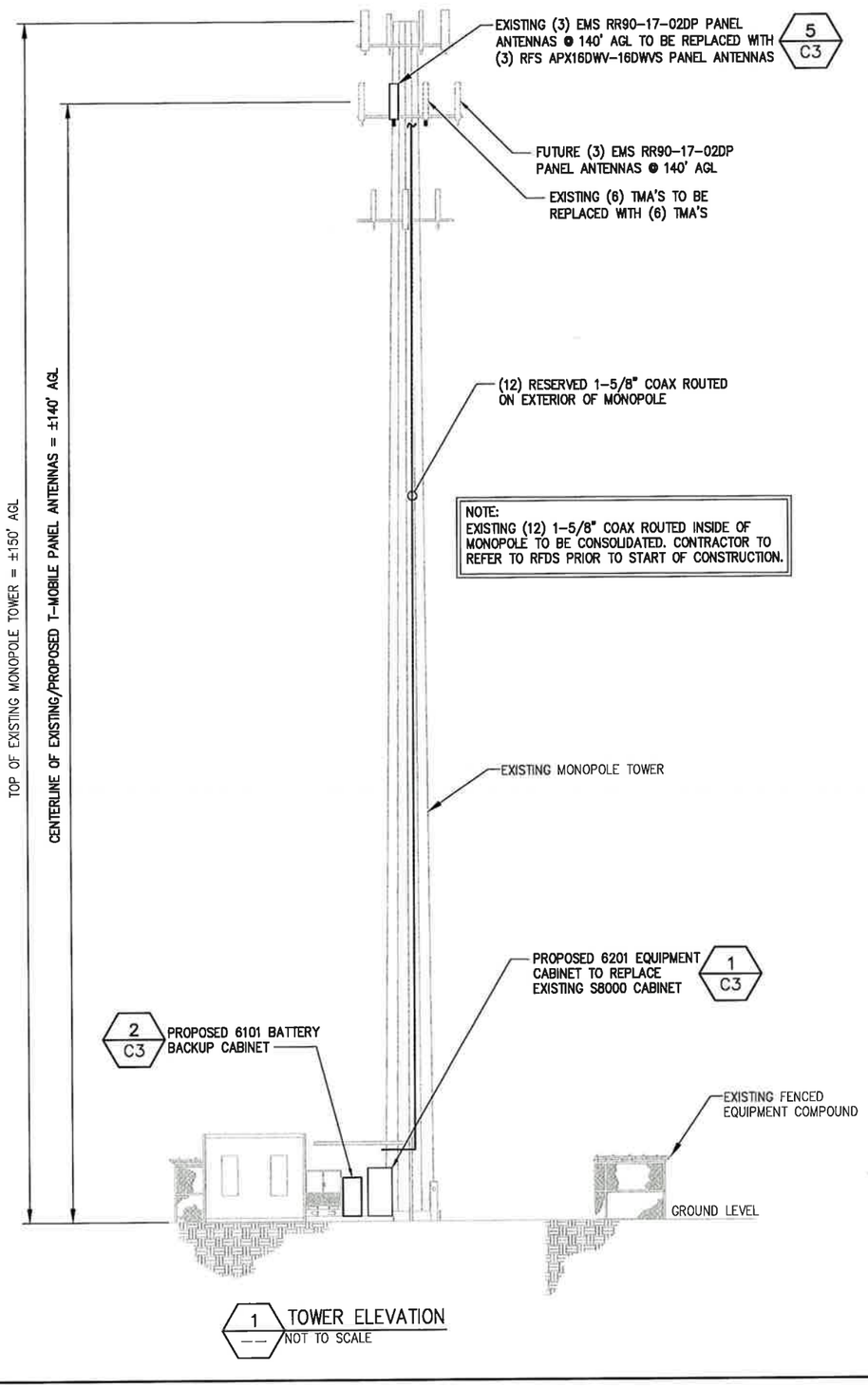
NOTE: IF DRAWINGS ARE 22"x34", USE GRAPHICAL SCALE AND/OR 1/2 TIMES OF THE NOTED SCALE.

SITE NAME
CTHA244A
484 MERIDEN RD
MIDDLEFIELD, CT

SHEET TITLE
SITE PLAN

SHEET NUMBER
C-1
SHEET 3 OF 6 SHEETS

NOTE:
INFINIGY ENGINEERING HAS NOT EVALUATED THE TOWER OR LOADING FOR THIS SITE, AND ASSUMES NO RESPONSIBILITY FOR ITS STRUCTURAL INTEGRITY REGARDING ITS EXISTING OR PROPOSED LOADING. FINAL INSTALLATION TO COMPLY WITH RESULTS OF PASSING STRUCTURAL ANALYSIS.



1 TOWER ELEVATION
NOT TO SCALE

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RF MAN.			
ZONING			
OPS			
CONSTR.			
SITE AC.			

PROJECT NO:	379-000
DRAWN BY:	AHS
CHECKED BY:	AJD

STATE OF CONNECTICUT
JOHN S. STEVENS
No. 24705
LICENSED PROFESSIONAL ENGINEER

PROFESSIONAL SEAL

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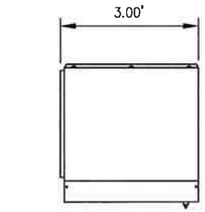
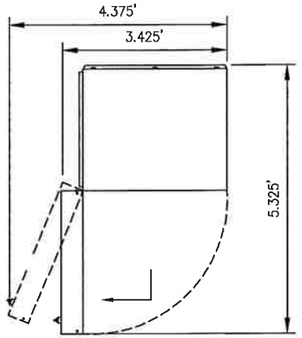
SITE NAME
CTHA244A
484 MERIDEN RD
MIDDLEFIELD, CT

SHEET TITLE
ELEVATION

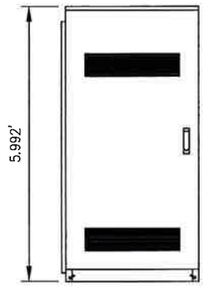
SHEET NUMBER
C-2
SHEET 4 OF 6 SHEETS



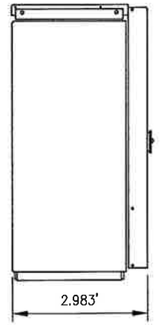
TOP



TOP VIEW

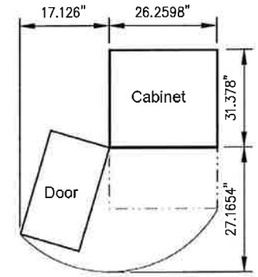


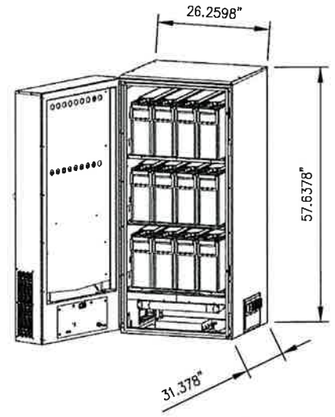
FRONT



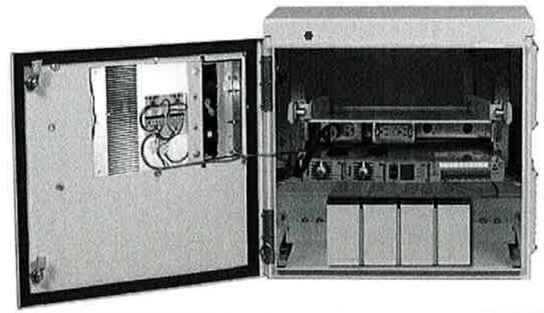
SIDE

1 ERICSSON 6201 EQUIPMENT CABINET
NOT TO SCALE



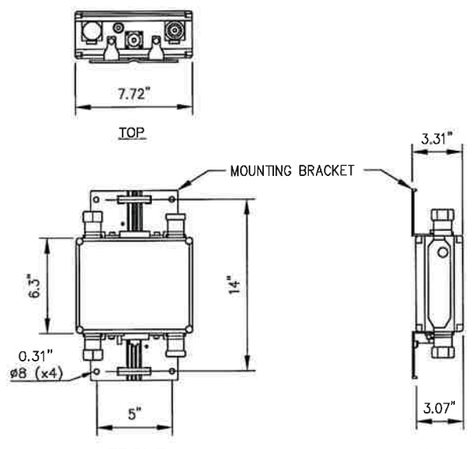


2 BBS 6101 BATTERY BACKUP CABINET
NOT TO SCALE

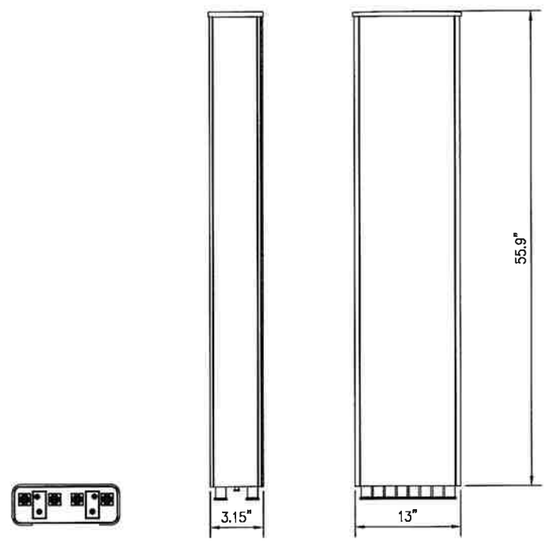


Physical Characteristics	
Framework Type	NetXtend™ Compact Enclosure
Available Space	Up to 14 RU, 19" W
Dimensions (H x W x D)	Enclosure: 24" x 24" x 16" Battery tray: 22" W x 13" D
Mounting	Wall or H-frame, pole mount (wall-mount kit included)
Weight, Equipped	Enclosure: 64 lb., w/out batteries Four (4) batteries: 36 lb. total
Access	Front

3 ERICSSON 2416 EQUIPMENT CABINET
NOT TO SCALE



4 TMA DETAIL
NOT TO SCALE



ANTENNA: APX16DWV 16DWVS

5 ANTENNA DETAIL
NOT TO SCALE

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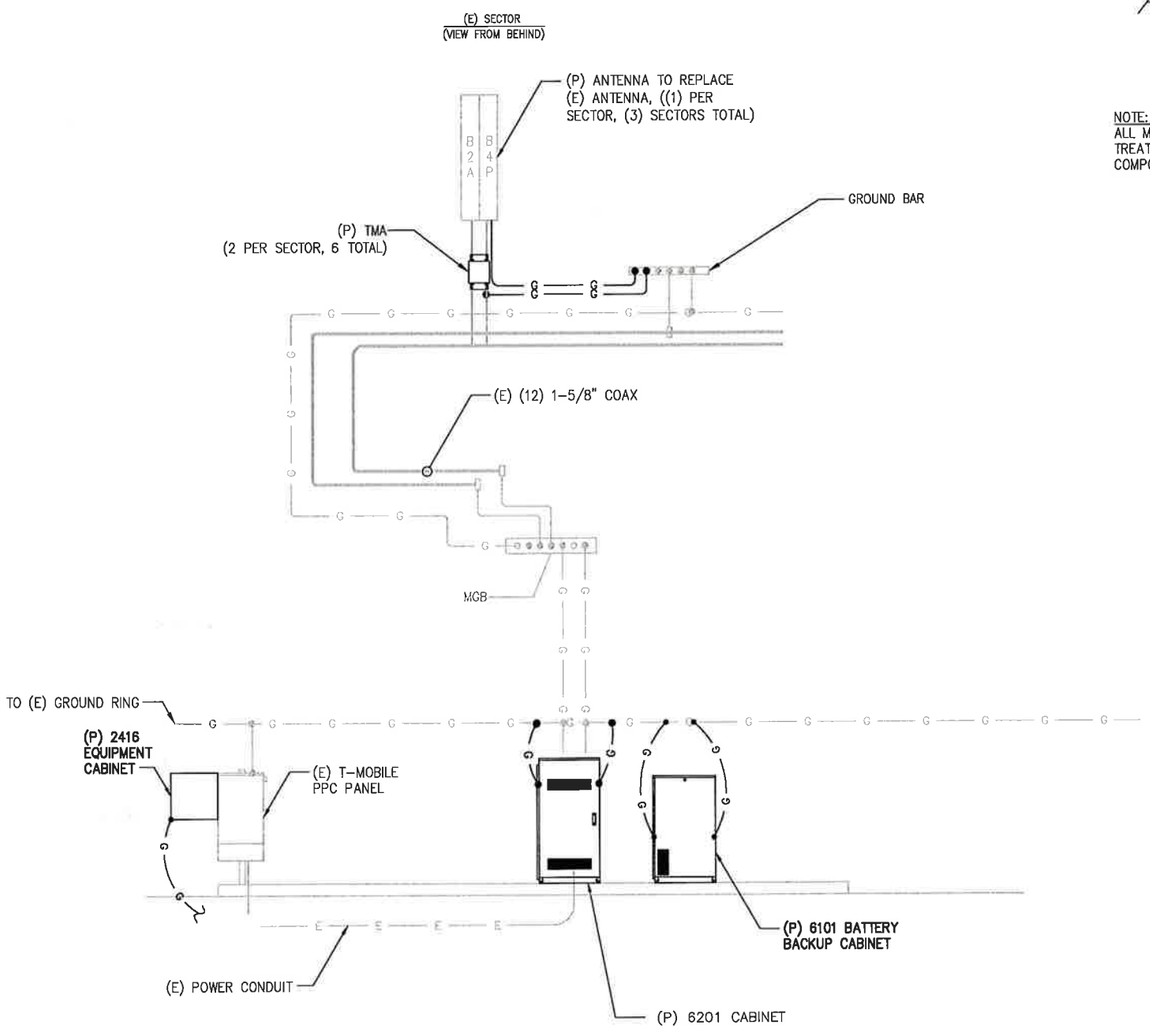
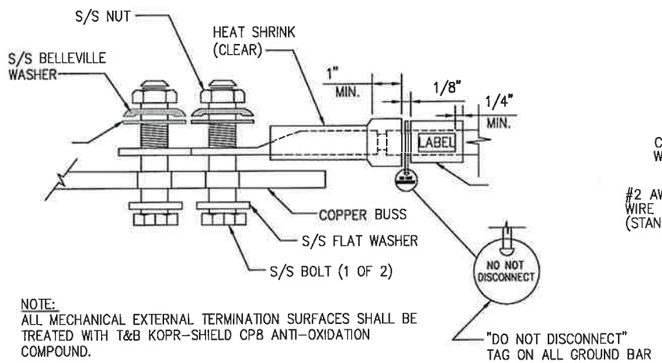
484 MERIDEN RD
MIDDLEFIELD, CT

SHEET TITLE
EQUIPMENT DETAILS

SHEET NUMBER
C-3
SHEET 5 OF **6** SHEETS

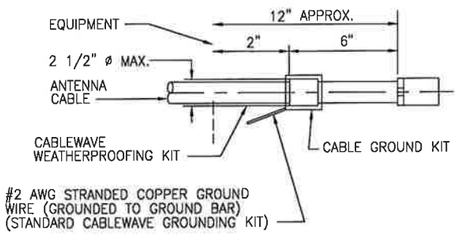


1 GROUDING DIAGRAM
NOT TO SCALE



NOTE:
ALL MECHANICAL EXTERNAL TERMINATION SURFACES SHALL BE TREATED WITH T&B KOPR-SHIELD CP8 ANTI-OXIDATION COMPOUND.

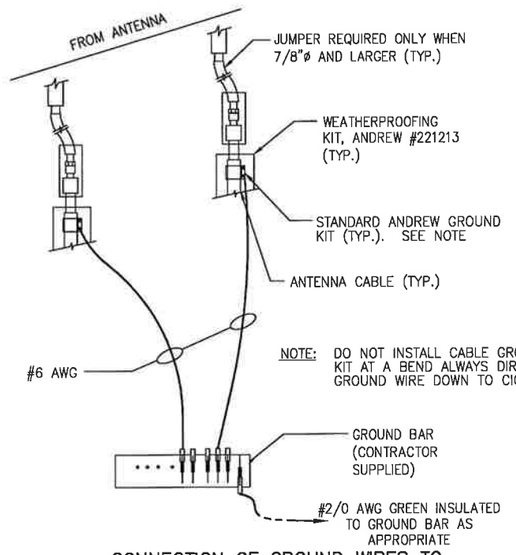
2 EQUIPMENT GROUND CONNECTION
NOT TO SCALE



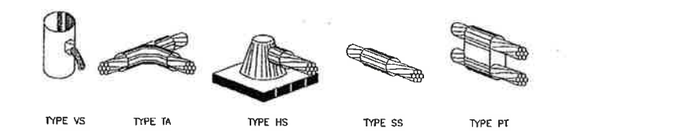
TO ANTENNA CABLE

NOTE:
DO NOT INSTALL CABLE GROUND KIT AT A BEND AND ALWAYS DIRECT GROUND WIRE DOWN TO GROUND BAR.

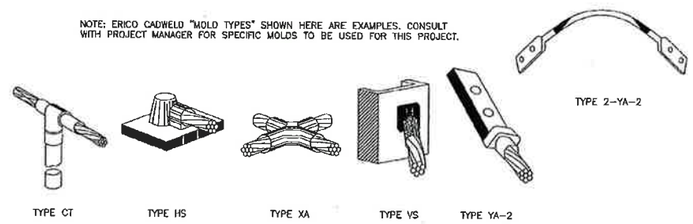
3 CABLE GROUND KIT CONNECTION
NOT TO SCALE



4 CONNECTION OF GROUND WIRES TO GROUNDING BARS @ ANTENNAS
NOT TO SCALE



NOTE: ERICO CADWELD "MOLD TYPES" SHOWN HERE ARE EXAMPLES. CONSULT WITH PROJECT MANAGER FOR SPECIFIC MOLDS TO BE USED FOR THIS PROJECT.



5 EQUIPMENT GROUND CONNECTION
NOT TO SCALE

T-Mobile
T-MOBILE NORTHEAST LLC
35 GRIFFIN ROAD
SOUTH BLOOMFIELD, CT 06002

NSS NORTHEAST SITE SOLUTIONS
199 BUCKYARD RD
FARMINGTON, CT 06032

INFINIGY8
FROM ZERO TO INFINIGY
the solutions are endless
1033 WATERVLIET SHAKER ROAD
ALBANY, NY 12205
OFFICE: (518) 690-0790
FAX: (518) 690-0793

SUBMITTALS		
DATE	DESCRIPTION	REVISION
4/1/15	ISSUED FOR REVIEW	A
4/2/15	REVISED PER COMMENTS	B
4/8/15	REVISED PER COMMENTS	C
4/13/15	REVISED PER COMMENTS	D
5/1/15	REVISED PER COMMENTS	E

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

PROJECT NO:	379-000
DRAWN BY:	AHS
CHECKED BY:	AJD

STATE OF CONNECTICUT
JOHN S. STEVENS
No. 24705
LICENSED PROFESSIONAL ENGINEER
PROFESSIONAL SEAL

NOTE: IF DRAWINGS ARE 22"x34", USE GRAPHICAL SCALE AND/OR 1/2 TIMES OF THE NOTED SCALE.

SITE NAME
CTHA244A
484 MERIDEN RD
MIDDLEFIELD, CT

SHEET TITLE
GROUNDING DIAGRAM & DETAILS

SHEET NUMBER
E-1
SHEET 6 OF 6 SHEETS

Exhibit B

CENTEK engineering

Centered on Solutions℠

Structural Analysis Report

150-ft Existing EEI Monopole

Proposed T-Mobile
Antenna Upgrade

T-Mobile Site Ref: CTHA244A

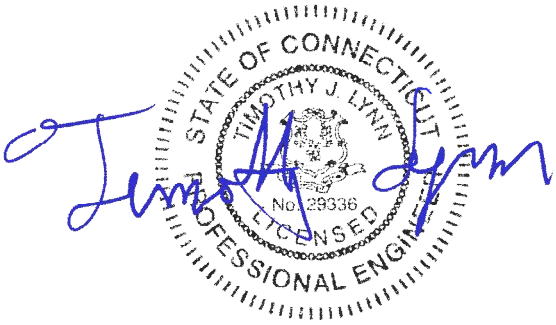
Verizon Site Ref: Middlefield

484 Meriden Road
Middlefield, CT

Centek Project No. 15049.005

~~Date: March 17, 2015~~

Rev 1: April 17, 2015



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

63-2 North Branford Road, Branford, CT 06405 203.488.0580 Fax 203.488.8587 www.CentekEng.com

Table of Contents

Introduction

The purpose of this report is to summarize the results of the non-linear, P-Δ structural analysis of the antenna upgrade proposed by T-Mobile on the existing monopole (tower) owned and operated by Verizon Wireless, located in Middlefield, CT.

The host tower is a 150-ft, four-section, eighteen sided, tapered monopole, originally designed and manufactured by Engineered Endeavors Inc (EEI)—job no: 11121, dated September 17, 2002. The tower geometry, structure member sizes and foundation system information were obtained from the aforementioned EEI design report.

Antenna and appurtenance information were obtained from a previous structural analysis report prepared by Centek project no. 13001.106 dated January 2, 2014 and a T-Mobile RF data sheet.

The tower is made up of four (4) tapered vertical sections consisting of A572-65 pole sections. The vertical tower sections are slip joint connected. The diameter of the pole (flat-flat) is 19.50-in at the top and 56.50-in at the base.

T-Mobile proposes the removal of three (3) panel antennas and six (6) TMA's and the installation of three (3) panel antennas and six (6) TMA's mounted to the existing T-Arms. Refer to the Antenna and Appurtenance Summary below for a detailed description of the proposed antenna and appurtenance configuration.

Antenna and Appurtenance Summary

The existing, proposed and future loads considered in this analysis consist of the following:

- VERIZON WIRELESS (Existing/Reserved):
  Antennas: Six (6) Antel LPA-80063-6CF panel antennas, six (6) Antel BXA-70063-6CF panel antennas, six (6) LPA-171063-12CF panel antennas, six (6) RFS FD9R6004/2C-3L diplexers, six (6) RRH's and one (1) main distribution box mounted on an existing low profile platform with a RAD center elevation of 150-ft above existing grade.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower and six (6) 1-5/8" ∅ coax cables and two (2) 1-5/8" ∅ fiber cables running on the exterior of the existing tower.
- AT&T (Existing):
  Antennas: Three (3) KMW AM-X-CD-16-65-00T panel antennas, six (6) Powerwave 7770 panel antennas, six (6) Powerwave LGP21401 TMA's, six (6) Powerwave LGP21901 Diplexers and three (3) Kathrein Smart Bias-T mounted on one (1) low profile platform at a RAD center elevation of 134-ft above grade level.
  Coax Cables: Twelve (12) 1 5/8" ∅ coax cables running on the inside of monopole.
- AT&T (EXISTING):
  Antennas: Six (6) Ericsson RRUS-11 and one (1) Raycap DC6-48-60-18-8F surge arrestor mounted to one (1) universal ring mount with a RAD center elevation of 136-ft above grade level.
  Coax Cables: One (1) fiber cable and two (2) dc control cables running on the inside of the monopole.

- Verizon (Existing):
  GPS: One (1) GPS antenna mounted on a 4-ft standoff arm with a RAD center elevation of 83-ft above grade level.
  Coax Cables: One (1) 7/8" ∅ coax cable running on the inside of monopole.
- T-Mobile (Existing/Reserved to Remain):
  Antennas: Six (6) EMS RR90-17-02DP panel antennas (three existing and three reserved) mounted to one (1) 4-Sector T-Arm frame w/ work supports with a RAD center elevation of 140-ft above grade level.
  Coax Cables: Twelve (12) existing 1 5/8" ∅ coax cables running on the inside of the monopole. Twelve (12) reserved 1 5/8" ∅ coax cables running on the exterior of the monopole.
- T-Mobile (Existing/Reserved to Remove):
  Antennas: Three (3) EMS RR90-17-02DP panel antennas and six (6) Remec 10"x8"x5" TMA's mounted to one (1) 4-Sector T-Arm frame w/ work supports with a RAD center elevation of 140-ft above grade level.
- **T-Mobile (Proposed):**
  Antennas: Three (3) RFS APX16DWV-16DWVS panel antennas and six (6) Ericsson KRY 112 71/2 TMA's mounted to one (1) 4-Sector T-Arm frame w/ work supports with a RAD center elevation of 140-ft above grade level.

Primary Assumptions Used in the Analysis

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

Analysis

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

The existing tower was analyzed for the controlling basic wind speed (fastest mile) with no ice and a 75% reduction of wind force with ½ inch accumulative ice to determine stresses in members as per guidelines of TIA/EIA-222-F-96 entitled "Structural Standards for Steel Antenna Towers and Antenna Supporting Structures", the American Institute of Steel Construction (AISC) and the Manual of Steel Construction; Allowable Stress Design (ASD).

The controlling wind speed is determined by evaluating the local available wind speed data as provided in Appendix K of the CSBC[1] and the wind speed data available in the TIA/EIA-222-F-96 Standard. The higher of the two wind speeds is utilized in preparation on the tower analysis.

Tower Loading

Tower loading was determined by the basic wind speed as applied to projected surface areas with modification factors per TIA/EIA-222-F, gravity loads of the tower structure and its components, and the application of ½" radial ice on the tower structure and its components.

Basic Wind Speed:	Middlesex; v = 85 mph (fastest mile)	*[Section 16 of TIA/EIA-222-F-96]*
	Middlefield; v = 105 mph (3 second gust) equivalent to v = 85 mph (fastest mile)	*[Appendix K of the 2005 CT Building Code Supplement]*
	TIA/EIA-222-F and Appendix K wind speeds are equal.	
Load Cases:	Load Case 1; 85 mph wind speed w/ no ice plus gravity load – used in calculation of tower stresses and rotation.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 2; 74 mph wind speed w/ ½" radial ice plus gravity load – used in calculation of tower stresses. The 74 mph wind speed velocity represents 75% of the wind pressure generated by the 85 mph wind speed.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 3; Seismic – not checked	*[Section 1614.5 of State Bldg. Code 2005] does not control in the design of this structure type*

[1] The 2005 Connecticut State Building Code as amended by the 2009 CT State Supplement. (CSBC)

Tower Capacity

Tower stresses were calculated utilizing the structural analysis software tnxTower. Allowable stresses were determined based on Table 5 of the TIA/EIA code with a 1/3 increase per Section 3.1.1.1 of the same code.

- Calculated stresses were found to be within allowable limits. In Load Case 1, per tnxTower "Section Capacity Table", this tower was found to be at **99.0%** of its total capacity.

Tower Section	Elevation	Stress Ratio (percentage of capacity)	Result
Pole Shaft (L2)	86.49'-123.58'	99.0%	**PASS**

Foundation and Anchors

The existing foundation consists of a 7-ft square x 3.0-ft long reinforced concrete pier on a 27.0-ft square x 2.5-ft thick reinforced concrete pad. The sub-grade conditions used in the analysis of the existing foundation were obtained from the aforementioned EEI design report; job no: 11121, dated September 17, 2002. The base of the tower is connected to the foundation by means of (16) 2.25"∅, ASTM A615-75 anchor bolts embedded approximately 5-ft into the concrete foundation structure.

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

Location	Vector	Proposed Reactions
Base	Shear	30 kips
	Compression	37 kips
	Moment	3301 kip-ft

- The foundation was found to be within allowable limits.

Foundation	Design Limit	IBC 2003/2005 CT State Building Code Section 3108.4.2 (FS)[1]	Proposed Loading (FS)[1]	Result
Reinforced Concrete Pad and Pier	OTM[2]	2.0	2.07	**PASS**

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

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

Tower Component	Design Limit	Stress Ratio (percentage of capacity)	Result
Anchor Bolts	Combined Compression and Bending	78.2%	**PASS**
Base Plate	Bending	95.1%	**PASS**

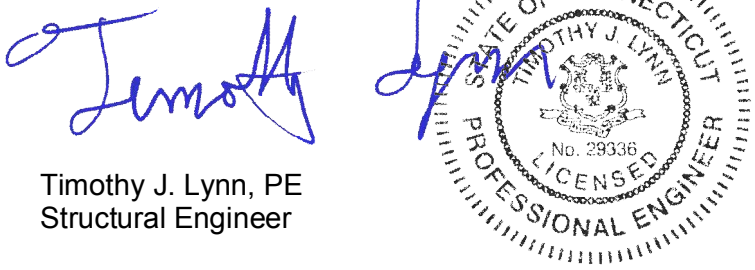
Conclusion

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

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

Please feel free to call with any questions or comments.

Respectfully Submitted by:



Timothy J. Lynn, PE
Structural Engineer

Standard Conditions for Furnishing of Professional Engineering Services on Existing Structures

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

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

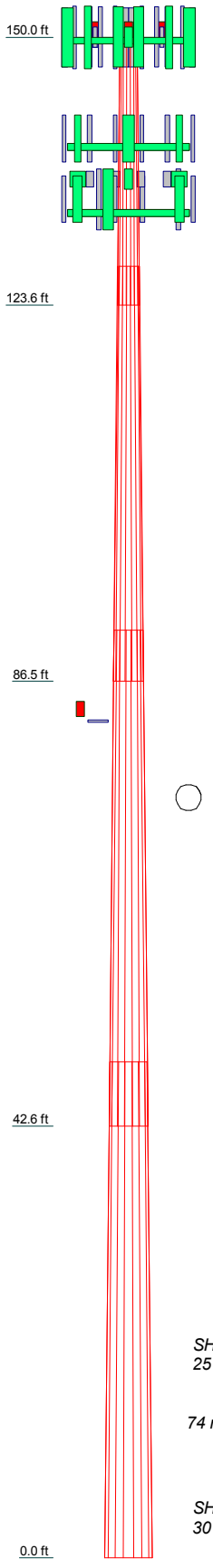
General Description of Structural Analysis Program

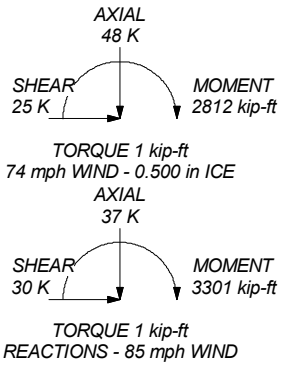
tnxTower, is an integrated structural analysis and design software package for Designed specifically for the telecommunications industry, tnxTower, formerly ERITower, automates much of the tower analysis and design required by the TIA/EIA 222 Standard.

tnxTower Features:

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

Section	1	2	3	4	
Length (ft)	26.420	40.920	48.920	48.906	
Number of Sides	18	18	18	18	
Thickness (in)	0.188	0.250	0.375	0.375	
Socket Length (ft)	3.833	5.000	6.333		
Top Dia (in)	19.500	24.998	33.726	43.922	
Bot Dia (in)	26.370	35.510	46.300	56.500	
Grade	A572-65				
Weight (K)	1.2	3.3	7.9	9.9	22.3





DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
LPA-80063/6CF (Verizon - Reserved)	150	(2) RR90-17-02DP (T-Mobile Existing)	140
LPA-171063-12CF (Verizon - Reserved)	150	APX16DWV-16DWVS-E-A20 (T-Mobile Proposed)	140
BXA-70063/6CF (Verizon - Reserved)	150	APX16DWV-16DWVS-E-A20 (T-Mobile Proposed)	140
BXA-70063/6CF (Verizon - Reserved)	150		
LPA-171063-12CF (Verizon - Reserved)	150	APX16DWV-16DWVS-E-A20 (T-Mobile Proposed)	140
LPA-80063/6CF (Verizon - Reserved)	150	(2) KRY112-71-2 (T-Mobile Proposed)	140
LPA-80063/6CF (Verizon - Reserved)	150	(2) KRY112-71-2 (T-Mobile Proposed)	140
LPA-171063-12CF (Verizon - Reserved)	150	(2) KRY112-71-2 (T-Mobile Proposed)	140
BXA-70063/6CF (Verizon - Reserved)	150	4-Sector T-Arm w/ Work Support (T-Mobile Existing)	139.5
BXA-70063/6CF (Verizon - Reserved)	150	(2) RRUS-11 (ATI - Existing)	136
LPA-171063-12CF (Verizon - Reserved)	150	(2) RRUS-11 (ATI - Existing)	136
		(2) RRUS-11 (ATI - Existing)	136
LPA-80063/6CF (Verizon - Reserved)	150	DC6-48-60-18-8F Surge Arrestor (ATI - Existing)	136
LPA-80063/6CF (Verizon - Reserved)	150		
LPA-171063-12CF (Verizon - Reserved)	150	Valmont Uni-Tri Bracket (ATI - Existing)	136
		(2) 7770.00 (ATI - Existing)	134
BXA-70063/6CF (Verizon - Reserved)	150	AM-X-CD-16-65-00T-RET(72") (ATI - Existing)	134
BXA-70063/6CF (Verizon - Reserved)	150		
LPA-171063-12CF (Verizon - Reserved)	150	(2) 7770.00 (ATI - Existing)	134
		AM-X-CD-16-65-00T-RET(72") (ATI - Existing)	134
LPA-80063/6CF (Verizon - Reserved)	150		
(2) FD9R6004/2C-3L Diplexer (Verizon - Reserved)	150	(2) 7770.00 (ATI - Existing)	134
		AM-X-CD-16-65-00T-RET(72") (ATI - Existing)	134
(2) FD9R6004/2C-3L Diplexer (Verizon - Reserved)	150		
		(2) LGP21401 TMA (ATI - Existing)	134
(2) FD9R6004/2C-3L Diplexer (Verizon - Reserved)	150	(2) LGP21401 TMA (ATI - Existing)	134
		(2) LGP21401 TMA (ATI - Existing)	134
RRH2x40-AWS (Verizon - Reserved)	150	(2) LGP21901 Diplexer (ATI - Existing)	134
RRH2x40-AWS (Verizon - Reserved)	150	(2) LGP21901 Diplexer (ATI - Existing)	134
RRH2x40-AWS (Verizon - Reserved)	150	(2) LGP21901 Diplexer (ATI - Existing)	134
RRH2x40-07-U (Verizon - Reserved)	150	Smart Bias T (ATI - Existing)	134
RRH2x40-07-U (Verizon - Reserved)	150	Smart Bias T (ATI - Existing)	134
RRH2x40-07-U (Verizon - Reserved)	150	Smart Bias T (ATI - Existing)	134
DB-T1-6Z-8AB-0Z (Verizon - Reserved)	150	Valmont 13' Low Profile Platform (ATI - Existing)	133
EEI 14-ft Low Profile Platform (Verizon - Existing)	150	GPS (Verizon - Existing)	83
(2) RR90-17-02DP (T-Mobile Existing)	140	4-ft Standoff (Verizon - Existing)	82.5
(2) RR90-17-02DP (T-Mobile Existing)	140		

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower designed for a 85 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 74 mph basic wind with 0.50 in ice.
3. Deflections are based upon a 50 mph wind.
4. Weld together tower sections have flange connections.
5. Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications.
6. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
7. Welds are fabricated with ER-70S-6 electrodes.
8. TOWER RATING: 99%

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

Job:	***15049.005 - CTHA244A***		
Project:	***150' EEI Monopole - 484 Meriden Rd., Middlefield, CT***		
Client: T-Mobile	Drawn by: TJL		App'd:
Code: TIA/EIA-222-F	Date: 04/17/15		Scale: NTS
Path: J:\Jobs\1504900.WI005 - CTHA244A\04_Structural\Backup Documentation\Calcs\Rev (1)\ER Files\150' Monopole_Middlefield_CT.eri			Dwg No. E-1

Tower Input Data

There is a pole section.
This tower is designed using the TIA/EIA-222-F standard.
The following design criteria apply:

Basic wind speed of 85 mph.
Nominal ice thickness of 0.500 in.
Ice density of 56 pcf.
A wind speed of 74 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 50 mph.
Weld together tower sections have flange connections..
Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications..
Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards..
Welds are fabricated with ER-70S-6 electrodes..
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in pole design is 1.333.
Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

Options

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

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	150.000-123.580	26.420	3.833	18	19.500	26.370	0.188	0.750	A572-65 (65 ksi)
L2	123.580-86.493	40.920	5.000	18	24.998	35.510	0.250	1.000	A572-65 (65 ksi)
L3	86.493-42.573	48.920	6.333	18	33.726	46.300	0.375	1.500	A572-65 (65 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
L4	42.573-0.000	48.906		18	43.922	56.500	0.375	1.500	A572-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
L1	19.801	11.493	541.578	6.856	9.906	54.672	1083.869	5.748	3.102	16.544
	26.777	15.582	1349.519	9.295	13.396	100.741	2700.814	7.792	4.311	22.993
L2	26.384	19.638	1519.570	8.786	12.699	119.659	3041.139	9.821	3.960	15.839
	36.058	27.979	4394.721	12.517	18.039	243.622	8795.225	13.992	5.810	23.239
L3	35.551	39.696	5578.094	11.839	17.133	325.584	11163.527	19.852	5.276	14.069
	47.014	54.662	14565.424	16.303	23.520	619.268	29150.014	27.336	7.489	19.97
L4	46.254	51.832	12418.103	15.459	22.312	556.555	24852.545	25.921	7.070	18.854
	57.372	66.803	26585.492	19.924	28.702	926.259	53205.966	33.408	9.284	24.757

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
L1 150.000-123.580				1	1	1		
L2 123.580-86.493				1	1	1		
L3 86.493-42.573				1	1	1		
L4 42.573-0.000				1	1	1		

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight klf
1 5/8 (Verizon - Existing)	C	No	Inside Pole	150.000 - 1.000	12	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
1 5/8 (T-Mobile - Existing)	C	No	Inside Pole	140.000 - 1.000	12	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
1 5/8 (AT&T - Existing)	C	No	Inside Pole	134.000 - 1.000	12	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
7/8 (Verizon - Existing)	C	No	Inside Pole	83.000 - 1.000	1	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
1 5/8 (Verizon - Existing)	C	No	CaAa (Out Of Face)	150.000 - 1.000	1	No Ice	0.198	0.001
						1/2" Ice	0.298	0.003
1 5/8 (Verizon - Existing)	C	No	CaAa (Out Of Face)	150.000 - 1.000	5	No Ice	0.000	0.001
						1/2" Ice	0.000	0.003
RG6-Fiber (AT&T - Existing)	C	No	Inside Pole	134.000 - 1.000	1	No Ice	0.000	0.001
						1/2" Ice	0.000	0.001
#8 AWG Copper WIre	C	No	Inside Pole	134.000 - 1.000	2	No Ice	0.000	0.000

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight klf
(AT&T - Existing)						1/2" Ice	0.000	0.000
HYBRIFLEX 1-5/8"	C	No	CaAa (Out Of Face)	83.000 - 1.000	2	No Ice	0.000	0.002
(Verizon - Existing)						1/2" Ice	0.000	0.003
1 5/8	C	No	CaAa (Out Of Face)	140.000 - 1.000	2	No Ice	0.198	0.001
(T-Mobile - Reserved)						1/2" Ice	0.298	0.003
1 5/8	C	No	CaAa (Out Of Face)	140.000 - 1.000	10	No Ice	0.000	0.001
(T-Mobile - Reserved)						1/2" Ice	0.000	0.003

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	150.000-123.580	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	11.733	1.046
L2	123.580-86.493	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	22.030	2.124
L3	86.493-42.573	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	26.088	2.690
L4	42.573-0.000	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	24.694	2.561

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	150.000-123.580	A	0.500	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	17.659	1.583
L2	123.580-86.493	A	0.500	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	33.156	3.132
L3	86.493-42.573	A	0.500	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	39.264	4.007
L4	42.573-0.000	A	0.500	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	37.166	3.817

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
LPA-80063/6CF (Verizon - Reserved)	A	From Face	3.000 6.000 0.000	0.000	150.000	No Ice 1/2" Ice	10.308 10.868	9.005 9.554	0.027 0.101
LPA-171063-12CF (Verizon - Reserved)	A	From Face	3.000 4.000 0.000	0.000	150.000	No Ice 1/2" Ice	5.994 6.462	6.054 6.523	0.012 0.055
BXA-70063/6CF (Verizon - Reserved)	A	From Face	3.000 1.000 0.000	0.000	150.000	No Ice 1/2" Ice	7.731 8.268	4.158 4.595	0.012 0.054
BXA-70063/6CF (Verizon - Reserved)	A	From Face	3.000 -1.000 0.000	0.000	150.000	No Ice 1/2" Ice	7.731 8.268	4.158 4.595	0.012 0.054
LPA-171063-12CF (Verizon - Reserved)	A	From Face	3.000 -4.000 0.000	0.000	150.000	No Ice 1/2" Ice	5.994 6.462	6.054 6.523	0.012 0.055
LPA-80063/6CF (Verizon - Reserved)	A	From Face	3.000 -6.000 0.000	0.000	150.000	No Ice 1/2" Ice	10.308 10.868	9.005 9.554	0.027 0.101
LPA-80063/6CF (Verizon - Reserved)	B	From Face	3.000 6.000 0.000	0.000	150.000	No Ice 1/2" Ice	10.308 10.868	9.005 9.554	0.027 0.101
LPA-171063-12CF (Verizon - Reserved)	B	From Face	3.000 4.000 0.000	0.000	150.000	No Ice 1/2" Ice	5.994 6.462	6.054 6.523	0.012 0.055
BXA-70063/6CF (Verizon - Reserved)	B	From Face	3.000 1.000 0.000	0.000	150.000	No Ice 1/2" Ice	7.731 8.268	4.158 4.595	0.012 0.054
BXA-70063/6CF (Verizon - Reserved)	B	From Face	3.000 -1.000 0.000	0.000	150.000	No Ice 1/2" Ice	7.731 8.268	4.158 4.595	0.012 0.054
LPA-171063-12CF (Verizon - Reserved)	B	From Face	3.000 -4.000 0.000	0.000	150.000	No Ice 1/2" Ice	5.994 6.462	6.054 6.523	0.012 0.055
LPA-80063/6CF (Verizon - Reserved)	B	From Face	3.000 -6.000 0.000	0.000	150.000	No Ice 1/2" Ice	10.308 10.868	9.005 9.554	0.027 0.101
LPA-80063/6CF (Verizon - Reserved)	C	From Face	3.000 6.000 0.000	0.000	150.000	No Ice 1/2" Ice	10.308 10.868	9.005 9.554	0.027 0.101
LPA-171063-12CF (Verizon - Reserved)	C	From Face	3.000 4.000 0.000	0.000	150.000	No Ice 1/2" Ice	5.994 6.462	6.054 6.523	0.012 0.055
BXA-70063/6CF (Verizon - Reserved)	C	From Face	3.000 1.000 0.000	0.000	150.000	No Ice 1/2" Ice	7.731 8.268	4.158 4.595	0.012 0.054
BXA-70063/6CF (Verizon - Reserved)	C	From Face	3.000 -1.000 0.000	0.000	150.000	No Ice 1/2" Ice	7.731 8.268	4.158 4.595	0.012 0.054
LPA-171063-12CF (Verizon - Reserved)	C	From Face	3.000 -4.000 0.000	0.000	150.000	No Ice 1/2" Ice	5.994 6.462	6.054 6.523	0.012 0.055
LPA-80063/6CF (Verizon - Reserved)	C	From Face	3.000 -6.000 0.000	0.000	150.000	No Ice 1/2" Ice	10.308 10.868	9.005 9.554	0.027 0.101
(2) FD9R6004/2C-3L Diplexer (Verizon - Reserved)	A	From Face	3.000 0.000 0.000	0.000	150.000	No Ice 1/2" Ice	0.000 0.000	0.085 0.136	0.003 0.005

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(2) FD9R6004/2C-3L	B	From Face	3.000	0.000	150.000	No Ice	0.000	0.085	0.003
Diplexer			0.000			1/2" Ice	0.000	0.136	0.005
(Verizon - Reserved)			0.000						
(2) FD9R6004/2C-3L	C	From Face	3.000	0.000	150.000	No Ice	0.000	0.085	0.003
Diplexer			0.000			1/2" Ice	0.000	0.136	0.005
(Verizon - Reserved)			0.000						
RRH2x40-AWS	A	From Face	3.000	0.000	150.000	No Ice	2.522	1.589	0.044
(Verizon - Reserved)			0.000			1/2" Ice	2.753	1.795	0.061
			0.000						
RRH2x40-AWS	B	From Face	3.000	0.000	150.000	No Ice	2.522	1.589	0.044
(Verizon - Reserved)			0.000			1/2" Ice	2.753	1.795	0.061
			0.000						
RRH2x40-AWS	C	From Face	3.000	0.000	150.000	No Ice	2.522	1.589	0.044
(Verizon - Reserved)			0.000			1/2" Ice	2.753	1.795	0.061
			0.000						
RRH2x40-07-U	A	From Face	3.000	0.000	150.000	No Ice	0.000	1.228	0.050
(Verizon - Reserved)			0.000			1/2" Ice	0.000	1.385	0.067
			0.000						
RRH2x40-07-U	B	From Face	3.000	0.000	150.000	No Ice	0.000	1.228	0.050
(Verizon - Reserved)			0.000			1/2" Ice	0.000	1.385	0.067
			0.000						
RRH2x40-07-U	C	From Face	3.000	0.000	150.000	No Ice	0.000	1.228	0.050
(Verizon - Reserved)			0.000			1/2" Ice	0.000	1.385	0.067
			0.000						
DB-T1-6Z-8AB-0Z	A	From Face	3.000	0.000	150.000	No Ice	5.600	2.333	0.044
(Verizon - Reserved)			0.000			1/2" Ice	5.915	2.558	0.080
			0.000						
EEI 14-ft Low Profile	C	None		0.000	150.000	No Ice	16.500	16.500	1.550
Platform						1/2" Ice	20.000	20.000	1.800
(Verizon - Existing)									
(2) RR90-17-02DP	A	From Face	3.500	0.000	140.000	No Ice	4.356	1.974	0.018
(T-Mobile Existing)			0.000			1/2" Ice	4.775	2.312	0.040
			0.000						
(2) RR90-17-02DP	B	From Face	3.500	0.000	140.000	No Ice	4.356	1.974	0.018
(T-Mobile Existing)			0.000			1/2" Ice	4.775	2.312	0.040
			0.000						
(2) RR90-17-02DP	C	From Face	3.500	0.000	140.000	No Ice	4.356	1.974	0.018
(T-Mobile Existing)			0.000			1/2" Ice	4.775	2.312	0.040
			0.000						
APX16DWV-16DWVS-E-A	A	From Face	3.500	0.000	140.000	No Ice	7.065	2.150	0.041
20			0.000			1/2" Ice	7.516	2.490	0.074
(T-Mobile Proposed)			0.000						
APX16DWV-16DWVS-E-A	B	From Face	3.500	0.000	140.000	No Ice	7.065	2.150	0.041
20			0.000			1/2" Ice	7.516	2.490	0.074
(T-Mobile Proposed)			0.000						
APX16DWV-16DWVS-E-A	C	From Face	3.500	0.000	140.000	No Ice	7.065	2.150	0.041
20			0.000			1/2" Ice	7.516	2.490	0.074
(T-Mobile Proposed)			0.000						
(2) KRY112-71-2	A	From Face	3.500	0.000	140.000	No Ice	0.000	0.450	0.015
(T-Mobile Proposed)			0.000			1/2" Ice	0.000	0.559	0.020
			0.000						
(2) KRY112-71-2	B	From Face	3.500	0.000	140.000	No Ice	0.000	0.450	0.015
(T-Mobile Proposed)			0.000			1/2" Ice	0.000	0.559	0.020
			0.000						
(2) KRY112-71-2	C	From Face	3.500	0.000	140.000	No Ice	0.000	0.450	0.015
(T-Mobile Proposed)			0.000			1/2" Ice	0.000	0.559	0.020
			0.000						

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
4-Sector T-Arm w/ Work Support	C	None		0.000	139.500	No Ice	40.000	40.000	1.375
						1/2" Ice	46.000	46.000	1.900
(T-Mobile Existing)									
(2) RRUS-11	A	From Face	0.500	0.000	136.000	No Ice	2.994	1.246	0.050
(AT&T - Existing)			0.000			1/2" Ice	3.226	1.412	0.070
			0.000						
(2) RRUS-11	B	From Face	0.500	0.000	136.000	No Ice	2.994	1.246	0.050
(AT&T - Existing)			0.000			1/2" Ice	3.226	1.412	0.070
			0.000						
(2) RRUS-11	C	From Face	0.500	0.000	136.000	No Ice	2.994	1.246	0.050
(AT&T - Existing)			0.000			1/2" Ice	3.226	1.412	0.070
			0.000						
DC6-48-60-18-8F Surge Arrestor	C	From Face	0.500	0.000	136.000	No Ice	2.228	2.228	0.020
			0.000			1/2" Ice	2.447	2.447	0.039
(AT&T - Existing)			0.000						
Valmont Uni-Tri Bracket	C	None		0.000	136.000	No Ice	1.750	1.750	0.290
(AT&T - Existing)						1/2" Ice	1.940	1.940	0.306
(2) 7770.00	A	From Face	3.500	0.000	134.000	No Ice	5.882	2.928	0.035
(AT&T - Existing)			0.000			1/2" Ice	6.314	3.273	0.068
			0.000						
AM-X-CD-16-65-00T-RET(72")	A	From Face	3.500	0.000	134.000	No Ice	8.260	4.642	0.050
			2.000			1/2" Ice	8.807	5.088	0.096
(AT&T - Existing)			0.000						
(2) 7770.00	B	From Face	3.500	0.000	134.000	No Ice	5.882	2.928	0.035
(AT&T - Existing)			0.000			1/2" Ice	6.314	3.273	0.068
			0.000						
AM-X-CD-16-65-00T-RET(72")	B	From Face	3.500	0.000	134.000	No Ice	8.260	4.642	0.050
			2.000			1/2" Ice	8.807	5.088	0.096
(AT&T - Existing)			0.000						
(2) 7770.00	C	From Face	3.500	0.000	134.000	No Ice	5.882	2.928	0.035
(AT&T - Existing)			0.000			1/2" Ice	6.314	3.273	0.068
			0.000						
AM-X-CD-16-65-00T-RET(72")	C	From Face	3.500	0.000	134.000	No Ice	8.260	4.642	0.050
			2.000			1/2" Ice	8.807	5.088	0.096
(AT&T - Existing)			0.000						
(2) LGP21401 TMA	A	From Face	3.500	0.000	134.000	No Ice	0.000	0.367	0.018
(AT&T - Existing)			0.000			1/2" Ice	0.000	0.480	0.023
			0.000						
(2) LGP21401 TMA	B	From Face	3.500	0.000	134.000	No Ice	0.000	0.367	0.018
(AT&T - Existing)			0.000			1/2" Ice	0.000	0.480	0.023
			0.000						
(2) LGP21401 TMA	C	From Face	3.500	0.000	134.000	No Ice	0.000	0.367	0.018
(AT&T - Existing)			0.000			1/2" Ice	0.000	0.480	0.023
			0.000						
(2) LGP21901 Diplexer	A	From Face	3.500	0.000	134.000	No Ice	0.000	0.117	0.006
(AT&T - Existing)			0.000			1/2" Ice	0.000	0.166	0.008
			0.000						
(2) LGP21901 Diplexer	B	From Face	3.500	0.000	134.000	No Ice	0.000	0.117	0.006
(AT&T - Existing)			0.000			1/2" Ice	0.000	0.166	0.008
			0.000						
(2) LGP21901 Diplexer	C	From Face	3.500	0.000	134.000	No Ice	0.000	0.117	0.006
(AT&T - Existing)			0.000			1/2" Ice	0.000	0.166	0.008
			0.000						
Smart Bias T	A	From Face	3.500	0.000	134.000	No Ice	0.000	0.078	0.002
(AT&T - Existing)			0.000			1/2" Ice	0.000	0.121	0.003
			0.000						
Smart Bias T	B	From Face	3.500	0.000	134.000	No Ice	0.000	0.078	0.002

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(AT&T - Existing)			0.000 0.000			1/2" Ice	0.000	0.121	0.003
Smart Bias T	C	From Face	3.500	0.000	134.000	No Ice	0.000	0.078	0.002
(AT&T - Existing)			0.000 0.000			1/2" Ice	0.000	0.121	0.003
Valmont 13' Low Profile Platform (AT&T - Existing)	C	None		0.000	133.000	No Ice 1/2" Ice	15.700 20.100	15.700 20.100	1.300 1.765
GPS	A	From Face	4.000	0.000	83.000	No Ice	1.000	1.000	0.010
(Verizon - Existing)			0.000 0.000			1/2" Ice	1.500	1.500	0.015
4-ft Standoff	A	From Face	2.000	0.000	82.500	No Ice	1.400	0.087	0.030
(Verizon - Existing)			0.000 0.000			1/2" Ice	1.735	0.131	0.041

Tower Pressures - No Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z ksf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1	136.131	1.499	0.028	50.495	A	0.000	50.495	50.495	100.00	0.000	0.000
150.000-123.5					B	0.000	50.495		100.00	0.000	0.000
80					C	0.000	50.495		100.00	0.000	11.733
L2	104.312	1.389	0.026	95.025	A	0.000	95.025	95.025	100.00	0.000	0.000
123.580-86.49					B	0.000	95.025		100.00	0.000	0.000
3					C	0.000	95.025		100.00	0.000	22.030
L3	64.055	1.209	0.022	148.799	A	0.000	148.799	148.799	100.00	0.000	0.000
86.493-42.573					B	0.000	148.799		100.00	0.000	0.000
					C	0.000	148.799		100.00	0.000	26.088
L4	20.525	1	0.018	181.026	A	0.000	181.026	181.026	100.00	0.000	0.000
42.573-0.000					B	0.000	181.026		100.00	0.000	0.000
					C	0.000	181.026		100.00	0.000	24.694

Tower Pressure - With Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z ksf	t_Z in	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1	136.131	1.499	0.021	0.500	52.697	A	0.000	52.697	52.697	100.00	0.000	0.000
150.000-123.580						B	0.000	52.697		100.00	0.000	0.000
						C	0.000	52.697		100.00	0.000	17.659

Section Elevation ft	z ft	K_Z	q_z ksf	t_Z in	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L2	104.312	1.389	0.019	0.500	98.115	A	0.000	98.115	98.115	100.00	0.000	0.000
123.580-86.493						B	0.000	98.115		100.00	0.000	0.000
						C	0.000	98.115		100.00	0.000	33.156
L3	64.055	1.209	0.017	0.500	152.459	A	0.000	152.459	152.459	100.00	0.000	0.000
86.493-42.573						B	0.000	152.459		100.00	0.000	0.000
						C	0.000	152.459		100.00	0.000	39.264
L4 42.573-0.000	20.525	1	0.014	0.500	184.573	A	0.000	184.573	184.573	100.00	0.000	0.000
						B	0.000	184.573		100.00	0.000	0.000
						C	0.000	184.573		100.00	0.000	37.166

Tower Pressure - Service

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z ksf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1	136.131	1.499	0.010	50.495	A	0.000	50.495	50.495	100.00	0.000	0.000
150.000-123.5					B	0.000	50.495		100.00	0.000	0.000
80					C	0.000	50.495		100.00	0.000	11.733
L2	104.312	1.389	0.009	95.025	A	0.000	95.025	95.025	100.00	0.000	0.000
123.580-86.49					B	0.000	95.025		100.00	0.000	0.000
3					C	0.000	95.025		100.00	0.000	22.030
L3	64.055	1.209	0.008	148.799	A	0.000	148.799	148.799	100.00	0.000	0.000
86.493-42.573					B	0.000	148.799		100.00	0.000	0.000
					C	0.000	148.799		100.00	0.000	26.088
L4	20.525	1	0.006	181.026	A	0.000	181.026	181.026	100.00	0.000	0.000
42.573-0.000					B	0.000	181.026		100.00	0.000	0.000
					C	0.000	181.026		100.00	0.000	24.694

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	1.046	1.217	A	1	0.65	1	1	1	50.495	2.088	0.079	C
150.000-123.5			B	1	0.65	1	1	1	50.495			
80			C	1	0.65	1	1	1	50.495			
L2	2.124	3.315	A	1	0.65	1	1	1	95.025	3.634	0.098	C
123.580-86.49			B	1	0.65	1	1	1	95.025			
3			C	1	0.65	1	1	1	95.025			
L3	2.690	7.854	A	1	0.65	1	1	1	148.799	4.615	0.105	C
86.493-42.573			B	1	0.65	1	1	1	148.799			
			C	1	0.65	1	1	1	148.799			
L4	2.561	9.871	A	1	0.65	1	1	1	181.026	4.450	0.105	C
42.573-0.000			B	1	0.65	1	1	1	181.026			
			C	1	0.65	1	1	1	181.026			
Sum Weight:	8.421	22.257						OTM	1050.197 kip-ft	14.786		

Tower Forces - No Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L1	1.046	1.217	A	1	0.65	1	1	1	50.495	2.088	0.079	C
150.000-123.5			B	1	0.65	1	1	1	50.495			
80			C	1	0.65	1	1	1	50.495			
L2	2.124	3.315	A	1	0.65	1	1	1	95.025	3.634	0.098	C
123.580-86.49			B	1	0.65	1	1	1	95.025			
3			C	1	0.65	1	1	1	95.025			
L3	2.690	7.854	A	1	0.65	1	1	1	148.799	4.615	0.105	C
86.493-42.573			B	1	0.65	1	1	1	148.799			
			C	1	0.65	1	1	1	148.799			
L4	2.561	9.871	A	1	0.65	1	1	1	181.026	4.450	0.105	C
42.573-0.000			B	1	0.65	1	1	1	181.026			
			C	1	0.65	1	1	1	181.026			
Sum Weight:	8.421	22.257						OTM	1050.197 kip-ft	14.786		

Tower Forces - No Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L1	1.046	1.217	A	1	0.65	1	1	1	50.495	2.088	0.079	C
150.000-123.5			B	1	0.65	1	1	1	50.495			
80			C	1	0.65	1	1	1	50.495			
L2	2.124	3.315	A	1	0.65	1	1	1	95.025	3.634	0.098	C
123.580-86.49			B	1	0.65	1	1	1	95.025			
3			C	1	0.65	1	1	1	95.025			
L3	2.690	7.854	A	1	0.65	1	1	1	148.799	4.615	0.105	C
86.493-42.573			B	1	0.65	1	1	1	148.799			
			C	1	0.65	1	1	1	148.799			
L4	2.561	9.871	A	1	0.65	1	1	1	181.026	4.450	0.105	C
42.573-0.000			B	1	0.65	1	1	1	181.026			
			C	1	0.65	1	1	1	181.026			
Sum Weight:	8.421	22.257						OTM	1050.197 kip-ft	14.786		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L1	1.046	1.217	A	1	0.65	1	1	1	50.495	2.088	0.079	C
150.000-123.5			B	1	0.65	1	1	1	50.495			
80			C	1	0.65	1	1	1	50.495			
L2	2.124	3.315	A	1	0.65	1	1	1	95.025	3.634	0.098	C

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
123.580-86.49			B	1	0.65	1	1	1	95.025			
3			C	1	0.65	1	1	1	95.025			
L3	2.690	7.854	A	1	0.65	1	1	1	148.799	4.615	0.105	C
86.493-42.573			B	1	0.65	1	1	1	148.799			
			C	1	0.65	1	1	1	148.799			
L4	2.561	9.871	A	1	0.65	1	1	1	181.026	4.450	0.105	C
42.573-0.000			B	1	0.65	1	1	1	181.026			
			C	1	0.65	1	1	1	181.026			
Sum Weight:	8.421	22.257						OTM	1050.197 kip-ft	14.786		

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L1	1.583	1.599	A	1	0.65	1	1	1	52.697	1.824	0.069	C
150.000-123.5			B	1	0.65	1	1	1	52.697			
80			C	1	0.65	1	1	1	52.697			
L2	3.132	4.030	A	1	0.65	1	1	1	98.115	3.153	0.085	C
123.580-86.49			B	1	0.65	1	1	1	98.115			
3			C	1	0.65	1	1	1	98.115			
L3	4.007	8.969	A	1	0.65	1	1	1	152.459	3.899	0.089	C
86.493-42.573			B	1	0.65	1	1	1	152.459			
			C	1	0.65	1	1	1	152.459			
L4	3.817	11.225	A	1	0.65	1	1	1	184.573	3.684	0.087	C
42.573-0.000			B	1	0.65	1	1	1	184.573			
			C	1	0.65	1	1	1	184.573			
Sum Weight:	12.538	25.824						OTM	902.600 kip-ft	12.560		

Tower Forces - With Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L1	1.583	1.599	A	1	0.65	1	1	1	52.697	1.824	0.069	C
150.000-123.5			B	1	0.65	1	1	1	52.697			
80			C	1	0.65	1	1	1	52.697			
L2	3.132	4.030	A	1	0.65	1	1	1	98.115	3.153	0.085	C
123.580-86.49			B	1	0.65	1	1	1	98.115			
3			C	1	0.65	1	1	1	98.115			
L3	4.007	8.969	A	1	0.65	1	1	1	152.459	3.899	0.089	C
86.493-42.573			B	1	0.65	1	1	1	152.459			
			C	1	0.65	1	1	1	152.459			
L4	3.817	11.225	A	1	0.65	1	1	1	184.573	3.684	0.087	C
42.573-0.000			B	1	0.65	1	1	1	184.573			
			C	1	0.65	1	1	1	184.573			
Sum Weight:	12.538	25.824						OTM	902.600	12.560		

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

Tower Forces - With Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L1	1.583	1.599	A	1	0.65	1	1	1	52.697	1.824	0.069	C
150.000-123.5			B	1	0.65	1	1	1	52.697			
80			C	1	0.65	1	1	1	52.697			
L2	3.132	4.030	A	1	0.65	1	1	1	98.115	3.153	0.085	C
123.580-86.49			B	1	0.65	1	1	1	98.115			
3			C	1	0.65	1	1	1	98.115			
L3	4.007	8.969	A	1	0.65	1	1	1	152.459	3.899	0.089	C
86.493-42.573			B	1	0.65	1	1	1	152.459			
			C	1	0.65	1	1	1	152.459			
L4	3.817	11.225	A	1	0.65	1	1	1	184.573	3.684	0.087	C
42.573-0.000			B	1	0.65	1	1	1	184.573			
			C	1	0.65	1	1	1	184.573			
Sum Weight:	12.538	25.824						OTM	902.600 kip-ft	12.560		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L1	1.583	1.599	A	1	0.65	1	1	1	52.697	1.824	0.069	C
150.000-123.5			B	1	0.65	1	1	1	52.697			
80			C	1	0.65	1	1	1	52.697			
L2	3.132	4.030	A	1	0.65	1	1	1	98.115	3.153	0.085	C
123.580-86.49			B	1	0.65	1	1	1	98.115			
3			C	1	0.65	1	1	1	98.115			
L3	4.007	8.969	A	1	0.65	1	1	1	152.459	3.899	0.089	C
86.493-42.573			B	1	0.65	1	1	1	152.459			
			C	1	0.65	1	1	1	152.459			
L4	3.817	11.225	A	1	0.65	1	1	1	184.573	3.684	0.087	C
42.573-0.000			B	1	0.65	1	1	1	184.573			
			C	1	0.65	1	1	1	184.573			
Sum Weight:	12.538	25.824						OTM	902.600 kip-ft	12.560		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	1.046	1.217	A	1	0.65	1	1	1	50.495	0.722	0.027	C
150.000-123.5			B	1	0.65	1	1	1	50.495			
80			C	1	0.65	1	1	1	50.495			
L2	2.124	3.315	A	1	0.65	1	1	1	95.025	1.257	0.034	C
123.580-86.49			B	1	0.65	1	1	1	95.025			
3			C	1	0.65	1	1	1	95.025			
L3	2.690	7.854	A	1	0.65	1	1	1	148.799	1.597	0.036	C
86.493-42.573			B	1	0.65	1	1	1	148.799			
			C	1	0.65	1	1	1	148.799			
L4	2.561	9.871	A	1	0.65	1	1	1	181.026	1.540	0.036	C
42.573-0.000			B	1	0.65	1	1	1	181.026			
			C	1	0.65	1	1	1	181.026			
Sum Weight:	8.421	22.257						OTM	363.390 kip-ft	5.116		

Tower Forces - Service - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	1.046	1.217	A	1	0.65	1	1	1	50.495	0.722	0.027	C
150.000-123.5			B	1	0.65	1	1	1	50.495			
80			C	1	0.65	1	1	1	50.495			
L2	2.124	3.315	A	1	0.65	1	1	1	95.025	1.257	0.034	C
123.580-86.49			B	1	0.65	1	1	1	95.025			
3			C	1	0.65	1	1	1	95.025			
L3	2.690	7.854	A	1	0.65	1	1	1	148.799	1.597	0.036	C
86.493-42.573			B	1	0.65	1	1	1	148.799			
			C	1	0.65	1	1	1	148.799			
L4	2.561	9.871	A	1	0.65	1	1	1	181.026	1.540	0.036	C
42.573-0.000			B	1	0.65	1	1	1	181.026			
			C	1	0.65	1	1	1	181.026			
Sum Weight:	8.421	22.257						OTM	363.390 kip-ft	5.116		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
L1	1.046	1.217	A	1	0.65	1	1	1	50.495	0.722	0.027	C
150.000-123.5			B	1	0.65	1	1	1	50.495			
80			C	1	0.65	1	1	1	50.495			
L2	2.124	3.315	A	1	0.65	1	1	1	95.025	1.257	0.034	C
123.580-86.49			B	1	0.65	1	1	1	95.025			
3			C	1	0.65	1	1	1	95.025			
L3	2.690	7.854	A	1	0.65	1	1	1	148.799	1.597	0.036	C
86.493-42.573			B	1	0.65	1	1	1	148.799			
			C	1	0.65	1	1	1	148.799			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L4	2.561	9.871	A	1	0.65	1	1	1	181.026	1.540	0.036	C
42.573-0.000			B	1	0.65	1	1	1	181.026			
			C	1	0.65	1	1	1	181.026			
Sum Weight:	8.421	22.257						OTM	363.390 kip-ft	5.116		

Tower Forces - Service - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w klf	Ctrl. Face
L1	1.046	1.217	A	1	0.65	1	1	1	50.495	0.722	0.027	C
150.000-123.5			B	1	0.65	1	1	1	50.495			
80			C	1	0.65	1	1	1	50.495			
L2	2.124	3.315	A	1	0.65	1	1	1	95.025	1.257	0.034	C
123.580-86.49			B	1	0.65	1	1	1	95.025			
3			C	1	0.65	1	1	1	95.025			
L3	2.690	7.854	A	1	0.65	1	1	1	148.799	1.597	0.036	C
86.493-42.573			B	1	0.65	1	1	1	148.799			
			C	1	0.65	1	1	1	148.799			
L4	2.561	9.871	A	1	0.65	1	1	1	181.026	1.540	0.036	C
42.573-0.000			B	1	0.65	1	1	1	181.026			
			C	1	0.65	1	1	1	181.026			
Sum Weight:	8.421	22.257						OTM	363.390 kip-ft	5.116		

Force Totals

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Leg Weight	22.257					
Bracing Weight	0.000					
Total Member Self-Weight	22.257			-0.135	0.284	
Total Weight	37.034			-0.135	0.284	
Wind 0 deg - No Ice		-0.091	-29.663	-3183.269	12.410	-0.576
Wind 30 deg - No Ice		14.805	-25.643	-2750.746	-1587.783	-0.588
Wind 45 deg - No Ice		20.985	-20.910	-2242.376	-2251.858	-0.534
Wind 60 deg - No Ice		25.734	-14.752	-1581.200	-2762.454	-0.443
Wind 90 deg - No Ice		29.768	0.091	11.992	-3196.853	-0.180
Wind 120 deg - No Ice		25.826	14.910	1601.934	-2774.581	0.132
Wind 135 deg - No Ice		21.114	21.039	2259.256	-2269.008	0.280
Wind 150 deg - No Ice		14.963	25.734	2762.604	-1608.786	0.409
Wind 180 deg - No Ice		0.091	29.663	3183.000	-11.842	0.576
Wind 210 deg - No Ice		-14.805	25.643	2750.477	1588.350	0.588
Wind 225 deg - No Ice		-20.985	20.910	2242.107	2252.426	0.534
Wind 240 deg - No Ice		-25.734	14.752	1580.931	2763.022	0.443
Wind 270 deg - No Ice		-29.768	-0.091	-12.261	3197.420	0.180
Wind 300 deg - No Ice		-25.826	-14.910	-1602.203	2775.148	-0.132

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Wind 315 deg - No Ice		-21.114	-21.039	-2259.525	2269.575	-0.280
Wind 330 deg - No Ice		-14.963	-25.734	-2762.873	1609.354	-0.409
Member Ice	3.567					
Total Weight Ice	47.886			-0.209	0.462	
Wind 0 deg - Ice		-0.074	-24.947	-2676.172	10.087	-0.535
Wind 30 deg - Ice		12.452	-21.568	-2312.849	-1334.742	-0.555
Wind 45 deg - Ice		17.648	-17.588	-1885.595	-1892.783	-0.508
Wind 60 deg - Ice		21.641	-12.409	-1329.855	-2321.803	-0.426
Wind 90 deg - Ice		25.032	0.074	9.416	-2686.616	-0.183
Wind 120 deg - Ice		21.715	12.537	1346.109	-2331.429	0.109
Wind 135 deg - Ice		17.752	17.692	1898.789	-1906.395	0.249
Wind 150 deg - Ice		12.580	21.641	2322.056	-1351.413	0.372
Wind 180 deg - Ice		0.074	24.947	2675.755	-9.164	0.535
Wind 210 deg - Ice		-12.452	21.568	2312.431	1335.665	0.555
Wind 225 deg - Ice		-17.648	17.588	1885.177	1893.706	0.508
Wind 240 deg - Ice		-21.641	12.409	1329.437	2322.727	0.426
Wind 270 deg - Ice		-25.032	-0.074	-9.834	2687.539	0.183
Wind 300 deg - Ice		-21.715	-12.537	-1346.526	2332.352	-0.109
Wind 315 deg - Ice		-17.752	-17.692	-1899.207	1907.318	-0.249
Wind 330 deg - Ice		-12.580	-21.641	-2322.474	1352.336	-0.372
Total Weight	37.034			-0.135	0.284	
Wind 0 deg - Service		-0.032	-10.264	-1101.565	4.480	-0.199
Wind 30 deg - Service		5.123	-8.873	-951.903	-549.220	-0.204
Wind 45 deg - Service		7.261	-7.235	-775.997	-779.004	-0.185
Wind 60 deg - Service		8.905	-5.105	-547.216	-955.681	-0.153
Wind 90 deg - Service		10.300	0.032	4.061	-1105.992	-0.062
Wind 120 deg - Service		8.936	5.159	554.214	-959.877	0.046
Wind 135 deg - Service		7.306	7.280	781.661	-784.938	0.097
Wind 150 deg - Service		5.178	8.905	955.830	-556.488	0.141
Wind 180 deg - Service		0.032	10.264	1101.296	-3.912	0.199
Wind 210 deg - Service		-5.123	8.873	951.634	549.788	0.204
Wind 225 deg - Service		-7.261	7.235	775.727	779.572	0.185
Wind 240 deg - Service		-8.905	5.105	546.947	956.249	0.153
Wind 270 deg - Service		-10.300	-0.032	-4.331	1106.559	0.062
Wind 300 deg - Service		-8.936	-5.159	-554.484	960.445	-0.046
Wind 315 deg - Service		-7.306	-7.280	-781.931	785.506	-0.097
Wind 330 deg - Service		-5.178	-8.905	-956.099	557.055	-0.141

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 45 deg - No Ice
5	Dead+Wind 60 deg - No Ice
6	Dead+Wind 90 deg - No Ice
7	Dead+Wind 120 deg - No Ice
8	Dead+Wind 135 deg - No Ice
9	Dead+Wind 150 deg - No Ice
10	Dead+Wind 180 deg - No Ice
11	Dead+Wind 210 deg - No Ice
12	Dead+Wind 225 deg - No Ice
13	Dead+Wind 240 deg - No Ice
14	Dead+Wind 270 deg - No Ice

Comb. No.	Description
15	Dead+Wind 300 deg - No Ice
16	Dead+Wind 315 deg - No Ice
17	Dead+Wind 330 deg - No Ice
18	Dead+Ice+Temp
19	Dead+Wind 0 deg+Ice+Temp
20	Dead+Wind 30 deg+Ice+Temp
21	Dead+Wind 45 deg+Ice+Temp
22	Dead+Wind 60 deg+Ice+Temp
23	Dead+Wind 90 deg+Ice+Temp
24	Dead+Wind 120 deg+Ice+Temp
25	Dead+Wind 135 deg+Ice+Temp
26	Dead+Wind 150 deg+Ice+Temp
27	Dead+Wind 180 deg+Ice+Temp
28	Dead+Wind 210 deg+Ice+Temp
29	Dead+Wind 225 deg+Ice+Temp
30	Dead+Wind 240 deg+Ice+Temp
31	Dead+Wind 270 deg+Ice+Temp
32	Dead+Wind 300 deg+Ice+Temp
33	Dead+Wind 315 deg+Ice+Temp
34	Dead+Wind 330 deg+Ice+Temp
35	Dead+Wind 0 deg - Service
36	Dead+Wind 30 deg - Service
37	Dead+Wind 45 deg - Service
38	Dead+Wind 60 deg - Service
39	Dead+Wind 90 deg - Service
40	Dead+Wind 120 deg - Service
41	Dead+Wind 135 deg - Service
42	Dead+Wind 150 deg - Service
43	Dead+Wind 180 deg - Service
44	Dead+Wind 210 deg - Service
45	Dead+Wind 225 deg - Service
46	Dead+Wind 240 deg - Service
47	Dead+Wind 270 deg - Service
48	Dead+Wind 300 deg - Service
49	Dead+Wind 315 deg - Service
50	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	150 - 123.58	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-12.158	0.265	0.095
			Max. Mx	14	-6.463	270.976	1.637
			Max. My	2	-6.480	1.710	269.074
			Max. Vy	14	-17.404	270.976	1.637
			Max. Vx	2	-17.322	1.710	269.074
			Max. Torque	11			-0.445
L2	123.58 - 86.493	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-18.813	0.265	0.095
			Max. Mx	14	-11.933	958.017	4.217
			Max. My	2	-11.945	4.308	953.165
			Max. Vy	14	-20.896	958.017	4.217
			Max. Vx	2	-20.814	4.308	953.165
			Max. Torque	2			0.385
L3	86.493 - 42.573	Pole	Max Tension	1	0.000	0.000	0.000

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Compression	18	-30.929	0.462	0.209
			Max. Mx	14	-22.252	1944.743	8.113
			Max. My	2	-22.259	8.267	1935.433
			Max. Vy	14	-25.342	1944.743	8.113
			Max. Vx	2	-25.234	8.267	1935.433
			Max. Torque	11			-0.604
L4	42.573 - 0	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	18	-47.886	0.462	0.209
			Max. Mx	14	-37.013	3293.855	12.661
			Max. My	2	-37.013	12.816	3279.296
			Max. Vy	14	-29.791	3293.855	12.661
			Max. Vx	2	-29.685	12.816	3279.296
			Max. Torque	11			-0.602

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	18	47.886	0.000	0.000
	Max. H_x	14	37.034	29.765	0.091
	Max. H_z	2	37.034	0.091	29.660
	Max. M_x	2	3279.297	0.091	29.660
	Max. M_z	6	3293.261	-29.765	-0.091
	Max. Torsion	3	0.602	-14.805	25.643
	Min. Vert	14	37.034	29.765	0.091
	Min. H_x	6	37.034	-29.765	-0.091
	Min. H_z	10	37.034	-0.091	-29.660
	Min. M_x	10	-3279.015	-0.091	-29.660
	Min. M_z	14	-3293.855	29.765	0.091
	Min. Torsion	11	-0.602	14.805	-25.643

Tower Mast Reaction Summary

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead Only	37.034	-0.000	-0.000	-0.135	0.284	0.000
Dead+Wind 0 deg - No Ice	37.034	-0.091	-29.660	-3279.297	12.816	-0.587
Dead+Wind 30 deg - No Ice	37.034	14.805	-25.643	-2834.058	-1635.868	-0.602
Dead+Wind 45 deg - No Ice	37.034	20.985	-20.910	-2310.276	-2320.065	-0.547
Dead+Wind 60 deg - No Ice	37.034	25.734	-14.752	-1629.060	-2846.120	-0.456
Dead+Wind 90 deg - No Ice	37.034	29.765	0.091	12.380	-3293.261	-0.188
Dead+Wind 120 deg - No Ice	37.034	25.825	14.910	1650.426	-2858.569	0.130
Dead+Wind 135 deg - No Ice	37.034	21.114	21.039	2327.636	-2337.706	0.281
Dead+Wind 150 deg - No Ice	37.034	14.963	25.734	2846.227	-1657.515	0.413
Dead+Wind 180 deg - No Ice	37.034	0.091	29.660	3279.015	-12.225	0.586
Dead+Wind 210 deg - No Ice	37.034	-14.805	25.643	2833.778	1636.459	0.602
Dead+Wind 225 deg - No Ice	37.034	-20.985	20.910	2309.997	2320.657	0.548
Dead+Wind 240 deg - No Ice	37.034	-25.734	14.752	1628.780	2846.713	0.456
Dead+Wind 270 deg - No Ice	37.034	-29.765	-0.091	-12.661	3293.855	0.189
Dead+Wind 300 deg - No Ice	37.034	-25.825	-14.910	-1650.709	2859.163	-0.130
Dead+Wind 315 deg - No Ice	37.034	-21.114	-21.039	-2327.920	2338.298	-0.282

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	K	K	K	kip-ft	kip-ft	kip-ft
Dead+Wind 330 deg - No Ice	37.034	-14.963	-25.734	-2846.510	1658.106	-0.414
Dead+Ice+Temp	47.886	-0.000	-0.000	-0.209	0.462	0.000
Dead+Wind 0 deg+Ice+Temp	47.886	-0.074	-24.946	-2794.296	10.575	-0.558
Dead+Wind 30 deg+Ice+Temp	47.886	12.452	-21.567	-2415.005	-1393.681	-0.582
Dead+Wind 45 deg+Ice+Temp	47.886	17.648	-17.588	-1968.868	-1976.382	-0.534
Dead+Wind 60 deg+Ice+Temp	47.886	21.641	-12.409	-1388.570	-2424.354	-0.450
Dead+Wind 90 deg+Ice+Temp	47.886	25.031	0.074	9.857	-2805.184	-0.198
Dead+Wind 120 deg+Ice+Temp	47.886	21.715	12.537	1405.559	-2434.392	0.108
Dead+Wind 135 deg+Ice+Temp	47.886	17.752	17.692	1982.638	-1990.598	0.254
Dead+Wind 150 deg+Ice+Temp	47.886	12.580	21.641	2424.596	-1411.117	0.384
Dead+Wind 180 deg+Ice+Temp	47.886	0.074	24.946	2793.848	-9.587	0.558
Dead+Wind 210 deg+Ice+Temp	47.886	-12.452	21.567	2414.559	1394.670	0.582
Dead+Wind 225 deg+Ice+Temp	47.886	-17.648	17.588	1968.423	1977.372	0.535
Dead+Wind 240 deg+Ice+Temp	47.886	-21.641	12.409	1388.124	2425.345	0.451
Dead+Wind 270 deg+Ice+Temp	47.886	-25.031	-0.074	-10.305	2806.176	0.198
Dead+Wind 300 deg+Ice+Temp	47.886	-21.715	-12.537	-1406.008	2435.384	-0.108
Dead+Wind 315 deg+Ice+Temp	47.886	-17.752	-17.692	-1983.088	1991.589	-0.255
Dead+Wind 330 deg+Ice+Temp	47.886	-12.580	-21.641	-2425.046	1412.107	-0.384
Dead+Wind 0 deg - Service	37.034	-0.032	-10.263	-1136.489	4.639	-0.205
Dead+Wind 30 deg - Service	37.034	5.123	-8.873	-982.150	-566.664	-0.211
Dead+Wind 45 deg - Service	37.034	7.261	-7.235	-800.651	-803.754	-0.192
Dead+Wind 60 deg - Service	37.034	8.904	-5.104	-564.598	-986.049	-0.160
Dead+Wind 90 deg - Service	37.034	10.299	0.032	4.198	-1141.058	-0.066
Dead+Wind 120 deg - Service	37.034	8.936	5.159	571.831	-990.386	0.046
Dead+Wind 135 deg - Service	37.034	7.305	7.280	806.503	-809.889	0.099
Dead+Wind 150 deg - Service	37.034	5.177	8.904	986.204	-574.180	0.145
Dead+Wind 180 deg - Service	37.034	0.032	10.263	1136.206	-4.041	0.205
Dead+Wind 210 deg - Service	37.034	-5.123	8.873	981.867	567.262	0.211
Dead+Wind 225 deg - Service	37.034	-7.261	7.235	800.368	804.352	0.192
Dead+Wind 240 deg - Service	37.034	-8.904	5.104	564.315	986.647	0.160
Dead+Wind 270 deg - Service	37.034	-10.299	-0.032	-4.481	1141.656	0.066
Dead+Wind 300 deg - Service	37.034	-8.936	-5.159	-572.114	990.984	-0.046
Dead+Wind 315 deg - Service	37.034	-7.305	-7.280	-806.786	810.488	-0.099
Dead+Wind 330 deg - Service	37.034	-5.177	-8.904	-986.488	574.778	-0.145

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX	PY	PZ	PX	PY	PZ	% Error
	K	K	K	K	K	K	
1	0.000	-37.034	0.000	0.000	37.034	0.000	0.000%
2	-0.091	-37.034	-29.663	0.091	37.034	29.660	0.006%
3	14.805	-37.034	-25.643	-14.805	37.034	25.643	0.000%
4	20.985	-37.034	-20.910	-20.985	37.034	20.910	0.000%
5	25.734	-37.034	-14.752	-25.734	37.034	14.752	0.000%
6	29.768	-37.034	0.091	-29.765	37.034	-0.091	0.006%
7	25.826	-37.034	14.910	-25.825	37.034	-14.910	0.000%
8	21.114	-37.034	21.039	-21.114	37.034	-21.039	0.000%
9	14.963	-37.034	25.734	-14.963	37.034	-25.734	0.000%
10	0.091	-37.034	29.663	-0.091	37.034	-29.660	0.006%
11	-14.805	-37.034	25.643	14.805	37.034	-25.643	0.000%
12	-20.985	-37.034	20.910	20.985	37.034	-20.910	0.000%
13	-25.734	-37.034	14.752	25.734	37.034	-14.752	0.000%
14	-29.768	-37.034	-0.091	29.765	37.034	0.091	0.006%
15	-25.826	-37.034	-14.910	25.825	37.034	14.910	0.000%
16	-21.114	-37.034	-21.039	21.114	37.034	21.039	0.000%
17	-14.963	-37.034	-25.734	14.963	37.034	25.734	0.000%
18	0.000	-47.886	0.000	0.000	47.886	0.000	0.000%

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
19	-0.074	-47.886	-24.947	0.074	47.886	24.946	0.001%
20	12.452	-47.886	-21.568	-12.452	47.886	21.567	0.000%
21	17.648	-47.886	-17.588	-17.648	47.886	17.588	0.000%
22	21.641	-47.886	-12.409	-21.641	47.886	12.409	0.000%
23	25.032	-47.886	0.074	-25.031	47.886	-0.074	0.001%
24	21.715	-47.886	12.537	-21.715	47.886	-12.537	0.000%
25	17.752	-47.886	17.692	-17.752	47.886	-17.692	0.000%
26	12.580	-47.886	21.641	-12.580	47.886	-21.641	0.000%
27	0.074	-47.886	24.947	-0.074	47.886	-24.946	0.001%
28	-12.452	-47.886	21.568	12.452	47.886	-21.567	0.000%
29	-17.648	-47.886	17.588	17.648	47.886	-17.588	0.000%
30	-21.641	-47.886	12.409	21.641	47.886	-12.409	0.000%
31	-25.032	-47.886	-0.074	25.031	47.886	0.074	0.001%
32	-21.715	-47.886	-12.537	21.715	47.886	12.537	0.000%
33	-17.752	-47.886	-17.692	17.752	47.886	17.692	0.000%
34	-12.580	-47.886	-21.641	12.580	47.886	21.641	0.000%
35	-0.032	-37.034	-10.264	0.032	37.034	10.263	0.003%
36	5.123	-37.034	-8.873	-5.123	37.034	8.873	0.001%
37	7.261	-37.034	-7.235	-7.261	37.034	7.235	0.001%
38	8.905	-37.034	-5.105	-8.904	37.034	5.104	0.001%
39	10.300	-37.034	0.032	-10.299	37.034	-0.032	0.003%
40	8.936	-37.034	5.159	-8.936	37.034	-5.159	0.001%
41	7.306	-37.034	7.280	-7.305	37.034	-7.280	0.001%
42	5.178	-37.034	8.905	-5.177	37.034	-8.904	0.001%
43	0.032	-37.034	10.264	-0.032	37.034	-10.263	0.003%
44	-5.123	-37.034	8.873	5.123	37.034	-8.873	0.001%
45	-7.261	-37.034	7.235	7.261	37.034	-7.235	0.001%
46	-8.905	-37.034	5.105	8.904	37.034	-5.104	0.001%
47	-10.300	-37.034	-0.032	10.299	37.034	0.032	0.003%
48	-8.936	-37.034	-5.159	8.936	37.034	5.159	0.001%
49	-7.306	-37.034	-7.280	7.305	37.034	7.280	0.001%
50	-5.178	-37.034	-8.905	5.177	37.034	8.904	0.001%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	6	0.00000001	0.00000001
2	Yes	14	0.00006730	0.00012979
3	Yes	18	0.00000001	0.00010972
4	Yes	18	0.00000001	0.00012617
5	Yes	18	0.00000001	0.00011150
6	Yes	14	0.00006724	0.00010516
7	Yes	18	0.00000001	0.00011338
8	Yes	18	0.00000001	0.00012856
9	Yes	18	0.00000001	0.00011230
10	Yes	14	0.00006730	0.00010551
11	Yes	18	0.00000001	0.00011166
12	Yes	18	0.00000001	0.00012621
13	Yes	18	0.00000001	0.00011015
14	Yes	14	0.00006724	0.00011242
15	Yes	18	0.00000001	0.00011301
16	Yes	18	0.00000001	0.00012870
17	Yes	18	0.00000001	0.00011381
18	Yes	6	0.00000001	0.00000001
19	Yes	16	0.00000001	0.00007927

20	Yes	18	0.00000001	0.00012101
21	Yes	18	0.00000001	0.00013986
22	Yes	18	0.00000001	0.00012293
23	Yes	16	0.00000001	0.00007761
24	Yes	18	0.00000001	0.00012487
25	Yes	18	0.00000001	0.00014242
26	Yes	18	0.00000001	0.00012375
27	Yes	16	0.00000001	0.00007765
28	Yes	18	0.00000001	0.00012315
29	Yes	18	0.00000001	0.00013997
30	Yes	18	0.00000001	0.00012152
31	Yes	16	0.00000001	0.00007814
32	Yes	18	0.00000001	0.00012466
33	Yes	18	0.00000001	0.00014273
34	Yes	18	0.00000001	0.00012547
35	Yes	14	0.00007245	0.00005304
36	Yes	15	0.00000001	0.00007825
37	Yes	15	0.00000001	0.00009197
38	Yes	15	0.00000001	0.00008222
39	Yes	14	0.00007245	0.00005219
40	Yes	15	0.00000001	0.00008326
41	Yes	15	0.00000001	0.00009426
42	Yes	15	0.00000001	0.00008090
43	Yes	14	0.00007245	0.00005243
44	Yes	15	0.00000001	0.00008267
45	Yes	15	0.00000001	0.00009207
46	Yes	15	0.00000001	0.00007914
47	Yes	14	0.00007245	0.00005241
48	Yes	15	0.00000001	0.00008243
49	Yes	15	0.00000001	0.00009460
50	Yes	15	0.00000001	0.00008433

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	150 - 123.58	35.100	48	2.322	0.003
L2	127.413 - 86.493	24.562	48	2.053	0.001
L3	91.493 - 42.573	11.819	48	1.272	0.001
L4	48.906 - 0	3.291	48	0.626	0.000

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
150.000	LPA-80063/6CF	48	35.100	2.322	0.003	12010
140.000	(2) RR90-17-02DP	48	30.297	2.222	0.002	6004
139.500	4-Sector T-Arm w/ Work Support	48	30.061	2.217	0.002	5718
136.000	(2) RRUS-11	48	28.421	2.176	0.002	4288
134.000	(2) 7770.00	48	27.499	2.151	0.002	3752
133.000	Valmont 13' Low Profile Platform	48	27.043	2.137	0.001	3531
83.000	GPS	48	9.577	1.110	0.000	3130
82.500	4-ft Standoff	48	9.454	1.101	0.000	3134

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	150 - 123.58	100.927	15	6.682	0.008
L2	127.413 - 86.493	70.691	15	5.912	0.004
L3	91.493 - 42.573	34.058	15	3.667	0.001
L4	48.906 - 0	9.490	15	1.804	0.001

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
150.000	LPA-80063/6CF	15	100.927	6.682	0.008	4289
140.000	(2) RR90-17-02DP	15	87.151	6.396	0.006	2143
139.500	4-Sector T-Arm w/ Work Support	15	86.472	6.380	0.006	2041
136.000	(2) RRUS-11	15	81.768	6.264	0.005	1530
134.000	(2) 7770.00	15	79.122	6.191	0.005	1338
133.000	Valmont 13' Low Profile Platform	15	77.813	6.153	0.004	1259
83.000	GPS	15	27.603	3.199	0.001	1095
82.500	4-ft Standoff	15	27.248	3.173	0.001	1097

Compression Checks

Pole Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
L1	150 - 123.58 (1)	TP26.37x19.5x0.188	26.420	0.000	0.0	39.000	14.989	-6.454	584.559	0.011
L2	123.58 - 86.493 (2)	TP35.51x24.998x0.25	40.920	0.000	0.0	39.000	26.960	-11.927	1051.430	0.011
L3	86.493 - 42.573 (3)	TP46.3x33.726x0.375	48.920	0.000	0.0	39.000	52.725	-22.249	2056.260	0.011
L4	42.573 - 0 (4)	TP56.5x43.922x0.375	48.906	0.000	0.0	39.000	64.059	-34.357	2498.310	0.014

Pole Bending Design Data

Section No.	Elevation ft	Size	Actual M_x kip-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y kip-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
L1	150 - 123.58	TP26.37x19.5x0.188	271.913	35.014	39.000	0.898	0.000	0.000	39.000	0.000

Section No.	Elevation ft	Size	Actual M_x kip-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y kip-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
L2	123.58 - 86.493 (1) (2)	TP35.51x24.998x0.25	960.508	50.970	39.000	1.307	0.000	0.000	39.000	0.000
L3	86.493 - 42.573 (3)	TP46.3x33.726x0.375	1949.575	40.618	39.000	1.041	0.000	0.000	39.000	0.000
L4	42.573 - 0 (4)	TP56.5x43.922x0.375	3037.883	42.812	39.000	1.098	0.000	0.000	39.000	0.000

Pole Shear Design Data

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 $\frac{f_{vt}}{F_{vt}}$
L1	150 - 123.58 (1)	TP26.37x19.5x0.188	17.450	1.164	26.000	0.090	0.131	0.008	26.000	0.000
L2	123.58 - 86.493 (2)	TP35.51x24.998x0.25	20.941	0.777	26.000	0.060	0.131	0.003	26.000	0.000
L3	86.493 - 42.573 (3)	TP46.3x33.726x0.375	25.400	0.482	26.000	0.037	0.130	0.001	26.000	0.000
L4	42.573 - 0 (4)	TP56.5x43.922x0.375	29.227	0.456	26.000	0.035	0.130	0.001	26.000	0.000

Pole Interaction Design Data

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
L1	150 - 123.58 (1)	0.011	0.898	0.000	0.090	0.000	0.911 ✔	1.333	H1-3+VT ✔
L2	123.58 - 86.493 (2)	0.011	1.307	0.000	0.060	0.000	1.319 ✔	1.333	H1-3+VT ✔
L3	86.493 - 42.573 (3)	0.011	1.041	0.000	0.037	0.000	1.053 ✔	1.333	H1-3+VT ✔
L4	42.573 - 0 (4)	0.014	1.098	0.000	0.035	0.000	1.112 ✔	1.333	H1-3+VT ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
L1	150 - 123.58	Pole	TP26.37x19.5x0.188	1	-6.454	779.217	68.3	Pass
L2	123.58 - 86.493	Pole	TP35.51x24.998x0.25	2	-11.927	1401.556	99.0	Pass
L3	86.493 - 42.573	Pole	TP46.3x33.726x0.375	3	-22.249	2740.994	79.0	Pass
L4	42.573 - 0	Pole	TP56.5x43.922x0.375	4	-34.357	3330.247	83.4	Pass
							Summary	

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
						Pole (L2)	99.0	Pass
						RATING =	**99.0**	**Pass**

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Subject:	Anchor Bolt and Base Plate Anlaysis
Location:	150-ft EEI Monopole Middlefield, CT
Rev. 1: 4/17/15	Prepared by: T.J.L. Checked by: C.F.C. Job No. 15049.005

Anchor Bolt and Base Plate Analysis:

Input Data:

Tower Reactions:

Overturning Moment =	$OM := 3301 \cdot ft \cdot kips$	(Input From tnxTower)
Shear Force =	$Shear := 30 \cdot kips$	(Input From tnxTower)
Axial Force =	$Axial := 37 \cdot kips$	(Input From tnxTower)

Anchor Bolt Data:

Use ASTM A615 Grade 75

Number of Anchor Bolts =	$N := 16$	(User Input)
Diameter of Bolt Circle =	$D_{bc} := 66 \cdot in$	(User Input)
Bolt "Column" Distance =	$l := 3.0 \cdot in$	(User Input)
Bolt Ultimate Strength =	$F_u := 100 \cdot ksi$	(User Input)
Bolt Yield Strength =	$F_y := 75 \cdot ksi$	(User Input)
Bolt Modulus =	$E := 29000 \cdot ksi$	(User Input)
Diameter of Anchor Bolts =	$D := 2.25 \cdot in$	(User Input)
Threads per Inch =	$n := 4.5$	(User Input)

Base Plate Data:

Use ASTM A572 60

Plate Yield Strength =	$Fy_{bp} := 60 \cdot ksi$	(User Input)
Base Plate Thickness =	$t_{bp} := 2 \cdot in$	(User Input)
Base Plate Diameter =	$D_{bp} := 72 \cdot in$	(User Input)
Outer Pole Diameter =	$D_{pole} := 56.5 \cdot in$	(User Input)

Geometric Layout Data:

Distance from Bolts to Centroid of Pole:

Radius of Bolt Circle =: $R_{bc} := \frac{D_{bc}}{2} = 33 \cdot in$

Distance to Bolts = $i := 1 .. N$

$$d_i := \left| \begin{array}{l} \theta \leftarrow 2 \cdot \pi \cdot \left(\frac{i}{N} \right) \\ d \leftarrow R_{bc} \cdot \sin(\theta) \end{array} \right.$$

$d_1 = 12.63 \cdot in$ $d_7 = 12.63 \cdot in$

$d_2 = 23.33 \cdot in$ $d_8 = 0.00 \cdot in$

$d_3 = 30.49 \cdot in$ $d_9 = -12.63 \cdot in$

$d_4 = 33.00 \cdot in$ $d_{10} = -23.33 \cdot in$

$d_5 = 30.49 \cdot in$ $d_{11} = -30.49 \cdot in$

$d_6 = 23.33 \cdot in$ etc.

Critical Distances For Bending in Plate:

Outer Pole Radius = $R_{pole} := \frac{D_{pole}}{2} = 28.3 \cdot in$

Moment Arms of Bolts about Neutral Axis = $MA_i := if\left(d_i \geq R_{pole}, d_i - R_{pole}, 0in\right)$

$MA_1 = 0.00 \cdot in$ $MA_7 = 0.00 \cdot in$

$MA_2 = 0.00 \cdot in$ $MA_8 = 0.00 \cdot in$

$MA_3 = 2.24 \cdot in$ $MA_9 = 0.00 \cdot in$

$MA_4 = 4.75 \cdot in$ $MA_{10} = 0.00 \cdot in$

$MA_5 = 2.24 \cdot in$ $MA_{11} = 0.00 \cdot in$

$MA_6 = 0.00 \cdot in$ etc

Effective Width of Baseplate for Bending = $B_{eff} := .8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 35.7 \cdot in$

Anchor Bolt Analysis:

Calculated Anchor Bolt Properties:

Polar Moment of Inertia = $I_p := \sum_i \left(d_i\right)^2 = 8.712 \times 10^3 \cdot in^2$

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

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

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

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

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

Check Anchor Bolt Tension Force:

Maximum Tensile Force = $T_{Max} := OM \cdot \frac{R_{bc}}{I_p} - \frac{Axial}{N} = 147.7 \cdot kips$

Allowable Tensile Force = $T_{ALL.Gross} := 1.333 \cdot \left(0.33 \cdot A_g \cdot F_u\right) = 174.9 \cdot kips$ (1.333 increase allowed per TIA/EIA)

$T_{ALL.Net} := 1.333 \cdot \left(0.60 \cdot A_n \cdot F_y\right) = 194.812 \cdot kips$ (1.333 increase allowed per TIA/EIA)

Bolt Tension % of Capacity = $\frac{T_{Max}}{T_{ALL.Net}} \cdot 100 = 76$ Bolts are "upset bolts". Use net area per AISC

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

Condition1 = "OK"

Check Anchor Bolt Bending Stress:

Maximum Bending Moment = $M_x := \left(\frac{Shear}{N}\right) \cdot l = 0.469 \cdot ft \cdot kips$

Maximum Bending Stress = $f_{bx} := \frac{M_x}{S_x} = 6.8 \cdot ksi$

Allowable Bending Stress = $F_{bx} := 1.333 \cdot 0.6 \cdot F_y = 60 \cdot ksi$ (1.333 increase allowed per TIA/EIA)

Check Combined Stress Requirement:

Per ASCE Manual 72: "If the clearance between the base plate and concrete does not exceed two times the bolt diameter a bending stress analysis of the bolts is NOT normally required.

$$l := \begin{cases} l & \text{if } l > 2 \cdot D_n \\ 0 & \text{otherwise} \end{cases} = 0 \cdot in$$

$$f_{bx} := \begin{cases} f_{bx} & \text{if } l > 2 \cdot D_n \\ 0 & \text{otherwise} \end{cases} = 0 \cdot ksi$$

Check Anchor Bolt Compression/Combined Stress:

Maximum Compressive Force =

$$C_{Max} := OM \cdot \frac{R_{bc}}{l_p} + \frac{Axial}{N} = 152.4 \cdot kips$$

Maximum Compressive Stress =

$$f_a := \frac{C_{Max}}{A_n} = 46.9 \cdot ksi$$

$$K := 0.65$$

$$C_c := \sqrt{\frac{2 \cdot \pi^2 \cdot E}{F_y}} = 87.364$$

$$F_a := \begin{cases} \dfrac{\left[1 - \dfrac{\left(\frac{K \cdot l}{r}\right)^2}{2 \cdot C_c^{\,2}}\right] \cdot F_y}{\dfrac{5}{3} + \dfrac{3 \cdot \left(\frac{K \cdot l}{r}\right)}{8 \cdot C_c} - \dfrac{\left(\frac{K \cdot l}{r}\right)^3}{8 \cdot C_c^{\,3}}} & \text{if } \dfrac{K \cdot l}{r} \le C_c \\ \dfrac{12 \cdot \pi^2 \cdot E}{23 \cdot \left(\frac{K \cdot l}{r}\right)^2} & \text{if } \dfrac{K \cdot l}{r} > C_c \end{cases} = 45 \cdot ksi$$

Allowable Compressive Stress =

$$F_a := 1.333 \cdot F_a = 60 \cdot ksi$$

(1.333 increase allowed per TIA/EIA)

Combined Stress % of Capacity =

$$\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}}\right) \cdot 100 = 78.2$$

Condition 2 =

$$Condition2 := if\left(\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}} \le 1.00, \text{"OK"}, \text{"Overstressed"}\right)$$

Condition2 = "OK"

Base Plate Analysis:

Force from Bolts = $C_i := \frac{OM \cdot d_i}{I_p} + \frac{Axial}{N}$

$C_1 = 59.7 \cdot kips$ $C_7 = 59.7 \cdot kips$

$C_2 = 108.4 \cdot kips$ $C_8 = 2.3 \cdot kips$

$C_3 = 140.9 \cdot kips$ $C_9 = -55.1 \cdot kips$

$C_4 = 152.4 \cdot kips$ $C_{10} = -103.8 \cdot kips$

$C_5 = 140.9 \cdot kips$ $C_{11} = -136.3 \cdot kips$

$C_6 = 108.4 \cdot kips$ etc.

Maximum Bending Stress in Plate = $f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{\left(B_{eff} \cdot t_{bp}^2\right)} = 56.9 \cdot ksi$

Allowable Bending Stress in Plate = $F_{bp} := 1.33 \cdot 0.75 \cdot Fy_{bp} = 59.9 \cdot ksi$

Plate Bending Stress % of Capacity = $\frac{f_{bp}}{F_{bp}} \cdot 100 = 95.1$

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

Condition3 = "Ok"

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Subject:	Foundation Analysis
Location:	150-ft Monopole Middlefield, CT
Rev. 1: 4/17/15	Prepared by: T.J.L. Checked by: C.F.C. Job No. 15049.005

Standard Monopole Foundation:

Input Data:

Tower Data

Overturning Moment =	$OM := 3301 \cdot ft \cdot kips$	(User Input from tnxTower)	
Shear Force =	$Shear := 30 \cdot kip$	(User Input from tnxTower)	
Axial Force =	$Axial := 37 \cdot kip$	(User Input from tnxTower)	
Tower Height =	$H_t := 150 \cdot ft$	(User Input)	

Footing Data:

Overall Depth of Footing =	$D_f := 4.5 \cdot ft$	(User Input)	
Length of Pier =	$L_p := 3.0 \cdot ft$	(User Input)	
Extension of Pier Above Grade =	$L_{pag} := 1.0 \cdot ft$	(User Input)	
Diameter of Pier =	$d_p := 7.0 \cdot ft$	(User Input)	
Thickness of Footing =	$T_f := 2.5 \cdot ft$	(User Input)	
Width of Footing =	$W_f := 27.0 \cdot ft$	(User Input)	

Anchor Bolt Data:

Length of Anchor Bolts =	$L_{st} := 72 \cdot in$	(User Input)	
Projection of Anchor Bolts Above Pier =	$A_{BP} := 12.0 \cdot in$	(User Input)	
Anchor Bolt Diameter =	$d_{anchor} := 2.25 \cdot in$	(User Input)	
Base Plate Bolt Circle =	$MP := 66.0 \cdot in$	(User Input)	

Material Properties:

Concrete Compressive Strength =	$f_c := 4000 \cdot psi$	(User Input)	
Steel Reinforcment Yield Strength =	$f_y := 60000 \cdot psi$	(User Input)	
Anchor Bolt Yield Strength =	$f_{ya} := 75000 \cdot psi$	(User Input)	
Internal Friction Angle of Soil =	$\Phi_s := 30 \cdot deg$	(User Input)	
Allowable Soil Bearing Capacity =	$q_s := 3000 \cdot psf$	(User Input)	
Unit Weight of Soil =	$\gamma_{soil} := 110 \cdot pcf$	(User Input)	
Unit Weight of Concrete =	$\gamma_{conc} := 150 \cdot pcf$	(User Input)	
Foundation Bouyancy =	$Bouyancy := 0$	(User Input)	(Yes=1 / No=0)
Depth to Neglect =	$n := 0 \cdot ft$	(User Input)	
Cohesion of Clay Type Soil =	$c := 0 \cdot ksf$	(User Input)	(Use 0 for Sandy Soil)
Seismic Zone Factor =	$Z := 2$	(User Input)	(UBC-1997 Fig 23-2)
Coefficient of Friction Between Concrete =	$\mu := 0.45$	(User Input)	

Pier Reinforcement:

Bar Size =	$BS_{pier} := 8$	(User Input)	
Bar Diameter =	$d_{bpier} := 1.0 \cdot in$	(User Input)	
Number of Bars =	$NB_{pier} := 40$	(User Input)	
Clear Cover of Reinforcement =	$Cvr_{pier} := 3 \cdot in$	(User Input)	
Reinforcement Location Factor =	$\alpha_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Coating Factor =	$\beta_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Concrete Strength Factor =	$\lambda_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Reinforcement Size Factor =	$\gamma_{pier} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Diameter of Tie =	$d_{Tie} := 0.5 \cdot in$	(User Input)	

Pad Reinforcement:

Bar Size =	$BS_{top} := 8$	(User Input)	(Top of Pad)
Bar Diameter =	$d_{btop} := 1.0 \cdot in$	(User Input)	(Top of Pad)
Number of Bars =	$NB_{top} := 24$	(User Input)	(Top of Pad)
Bar Size =	$BS_{bot} := 8$	(User Input)	(Bottom of Pad)
Bar Diameter =	$d_{bbot} := 1.0 \cdot in$	(User Input)	(Bottom of Pad)
Number of Bars =	$NB_{bot} := 44$	(User Input)	(Bottom of Pad)
Clear Cover of Reinforcement =	$Cvr_{pad} := 3.0 \cdot in$	(User Input)	
Reinforcement Location Factor =	$\alpha_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Coating Factor =	$\beta_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Concrete Strength Factor =	$\lambda_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)
Reinforcement Size Factor =	$\gamma_{pad} := 1.0$	(User Input)	(ACI-2008 12.2.4)

Calculated Factors:

Pier Reinforcement Bar Area =

$$A_{bpier} := \frac{\pi \cdot d_{bpier}^2}{4} = 0.785 \cdot in^2$$

Pad Top Reinforcement Bar Area =

$$A_{btop} := \frac{\pi \cdot d_{btop}^2}{4} = 0.785 \cdot in^2$$

Pad Bottom Reinforcement Bar Area =

$$A_{bbot} := \frac{\pi \cdot d_{bbot}^2}{4} = 0.785 \cdot in^2$$

Coefficient of Lateral Soil Pressure =

$$K_p := \frac{1 + \sin(\Phi_s)}{1 - \sin(\Phi_s)} = 3$$

Load Factor =

$$LF := \begin{cases} 1.333 & \text{if } H_t \le 700 \cdot ft \\ 1.7 & \text{if } H_t \ge 1200 \cdot ft \\ 1.333 + \left(\frac{H_t - 700ft}{1200ft - 700ft} \right) \cdot 0.4 & \text{otherwise} \end{cases} = 1.333$$

Stability of Footing:

Adjusted Concrete Unit Weight =

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

Adjusted Soil Unit Weight =

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

Passive Pressure =

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

$$P_{pt} := K_p\cdot\gamma_s\cdot\left(D_f - T_f\right) + c\cdot 2\cdot\sqrt{K_p} = 0.66\cdot\text{ksf}$$

$$P_{top} := \text{if}\left[n < \left(D_f - T_f\right), P_{pt}, P_{pn}\right] = 0.66\cdot\text{ksf}$$

$$P_{bot} := K_p\cdot\gamma_s\cdot D_f + c\cdot 2\cdot\sqrt{K_p} = 1.485\cdot\text{ksf}$$

$$P_{ave} := \frac{P_{top} + P_{bot}}{2} = 1.073\cdot\text{ksf}$$

$$T_p := \text{if}\left[n < \left(D_f - T_f\right), T_f, \left(D_f - n\right)\right] = 2.5$$

$$A_p := W_f\cdot T_p = 67.5$$

Ultimate Shear =

$$S_u := P_{ave}\cdot A_p = 72.394\cdot\text{kip}$$

Weight of Concrete Pad =

$$WT_c := \left[\left(W_f^{\,2}\cdot T_f\right) + d_p^{\,2}\cdot L_p\right]\cdot\gamma_c = 295.425\cdot\text{kip}$$

Weight of Soil Above Footing =

$$WT_{s1} := \left[\left(W_f^{\,2} - d_p^{\,2}\right)\cdot\begin{cases}\left(L_p - L_{pag} - n\right) & \text{if } \left(L_p - L_{pag} - n\right) \geq 0 \\ 0 & \text{if } \left(L_p - L_{pag} - n\right) \leq 0\end{cases}\right]\cdot\gamma_s = 149.6\cdot\text{kip}$$

Weight of Soil Wedge at Back Face =

$$WT_{s2} := \left(\frac{D_f^{\,2}\cdot\tan\left(\Phi_s\right)}{2}\cdot W_f\right)\cdot\gamma_s = 17.362\cdot\text{kip}$$

Weight of Soil Wedge at back face Corners =

$$WT_{s3} := 2\cdot\left[\left(D_f\right)^3\cdot\frac{\tan\left(\Phi_s\right)}{3}\right]\cdot\gamma_s = 3.858\cdot\text{kips}$$

Total Weight =

$$WT_{tot} := WT_c + WT_{s1} + \text{Axial} = 482.025\cdot\text{kip}$$

Resisting Moment =

$$M_r := \left(WT_{tot}\right)\cdot\frac{W_f}{2} + S_u\cdot\frac{T_f}{3} + \left[\left(WT_{s2} + WT_{s3}\right)\cdot\left(W_f + \frac{D_f\cdot\tan\left(\Phi_s\right)}{3}\right)\right] = 7159\cdot\text{kip}\cdot\text{ft}$$

Overturning Moment =

$$M_{ot} := \text{OM} + \text{Shear}\cdot\left(L_p + T_f\right) = 3466\cdot\text{kip}\cdot\text{ft}$$

Factor of Safety Actual =

$$FS := \frac{M_r}{M_{ot}} = 2.07$$

Factor of Safety Required =

$$FS_{req} := 2$$

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

$$\text{OverTurning\_Moment\_Check} = \text{"Okay"}$$

Shear Capacity in Pier:

Shear Resistance of Pier = $S_p := \frac{\mu \cdot WT_{tot}}{FS_{req}} = 108.456 \cdot kips$

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

$Shear\_Check = "Okay"$

Bearing Pressure Caused by Footing:

Area of the Mat = $A_{mat} := W_f^2 = 729$

Section Modulus of Mat = $S := \frac{W_f^3}{6} = 3280.5 \cdot ft^3$

Maximum Pressure in Mat = $P_{max} := \frac{WT_{tot}}{A_{mat}} + \frac{M_{ot}}{S} = 1.718 \cdot ksf$

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

$Max\_Pressure\_Check = "Okay"$

Minimum Pressure in Mat = $P_{min} := \frac{WT_{tot}}{A_{mat}} - \frac{M_{ot}}{S} = -0.395 \cdot ksf$

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

$Min\_Pressure\_Check = "No Good"$

Distance to Resultant of Pressure Distribution = $X_p := \frac{P_{max}}{\frac{P_{max} - P_{min}}{W_f}} \cdot \frac{1}{3} = 7.316$

Distance to Kern = $X_k := \frac{W_f}{6} = 4.5$

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

Eccentricity = $e := \frac{M_{ot}}{WT_{tot}} = 7.19$

Adjusted Soil Pressure = $P_a := \frac{2 \cdot WT_{tot}}{3 \cdot W_f \cdot \left(\frac{W_f}{2} - e\right)} = 1.886 \cdot ksf$

$q_{adj} := if(P_{min} < 0, P_a, P_{max}) = 1.886 \cdot ksf$

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

$Pressure\_Check = "Okay"$

Concrete Bearing Capacity:

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

Bearing Strength Between Pier and Pad = $P_b := \Phi_c \cdot 0.85 \cdot f_c \cdot \frac{\pi \cdot d_p^2}{4} = 1.225 \times 10^4 \cdot kips$ (ACI-2008 10.14)

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

$Bearing\_Check = "Okay"$

Shear Strength of Concrete:

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

$\phi_c := 0.85$ (ACI 9.3.2.5)

$d := T_f - Cvr_{pad} - d_{bbot} = 26 \cdot in$

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

$d_2 := d_1 - d$

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

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

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

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

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

$Beam\_Shear\_Check = "Okay"$

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

Critical Perimeter of Punching Shear = $b_o := \left(d_p + d\right) \cdot \pi = 28.8$

Area Included Inside Perimeter = $A_{bo} := \frac{\pi \cdot \left(d_p + d\right)^2}{4} = 66$

Area Outside of Perimeter = $A_{out} := A_{mat} - A_{bo} = 663$

Guess Value = $v_u := 1ksf$ (From "Foundation Analysis and design", By Joseph Bowles, Eq. 8-9)

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

$v_u := Find(v_u) = 7.7 \cdot ksf$

$V_u := v_u \cdot d \cdot W_f = 451.9 \cdot kips$

Required Shear Strength = $V_{req} := LF \cdot V_u = 602.4 \cdot kips$

Available Shear Strength = $V_{Avail} := \phi_c \cdot 4 \cdot \sqrt{f_c \cdot psi} \cdot b_o \cdot d = 1932.1 \cdot kip$ (ACI-2008 11.11.2.1)

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

$Punching\_Shear\_Check = "Okay"$

Steel Reinforcement in Pad:

Required Reinforcement for Bending:

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

$q_b := q_{adj} - d_1 \cdot Slope = 0.89 \cdot ksf$

Maximum Bending at Face of Pier = $M_u := LF \cdot \left[\left(q_{adj} - q_b \right) \cdot \frac{d_1^2}{3} + q_b \cdot \frac{d_1^2}{2} \right] \cdot W_f = 2796.8 \cdot kip \cdot ft$

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

(ACI-200810.2.7.3)

$R_n := \frac{M_u}{\phi_m \cdot W_f \cdot d^2} = 170.3 \cdot psi$

$\rho := \frac{0.85 \cdot f_c}{f_y} \left(1 - \sqrt{1 - \frac{2 \cdot R_n}{0.85 \cdot f_c}} \right) = 0.0029$

$\rho_{min} := \rho = 0.00291$

Required Reinforcement for Temperature and Shrinkage:

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

Check Bottom Bars:

$$As := \begin{cases} \rho_{min} \cdot W_f \cdot d & \text{if } \rho_{min} > \frac{\rho_{sh}}{2} \\ \rho_{sh} \cdot W_f \cdot \frac{d}{2} & \text{otherwise} \end{cases} = 24.535 \cdot in^2$$

$$As_{prov} := A_{bbot} \cdot NB_{bot} = 34.6 \cdot in^2$$

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

Pad_Reinforcement_Bot = "Okay"

Check top Bars:

$$As := \rho_{sh} \cdot \left(W_f \cdot \frac{d}{2}\right) = 7.6 \cdot in^2$$

$$As_{prov} := A_{btop} \cdot NB_{top} = 18.8 \cdot in^2$$

$$Pad\_Reinforcement\_Top := if\left(As_{prov} > As, "Okay", "No Good"\right)$$

Pad_Reinforcement_Top = "Okay"

Developement Length Pad Reinforcement:

Bar Spacing =

$$B_{sPad} := \frac{W_f - 2 \cdot Cvr_{pad} - NB_{bot} \cdot d_{bbot}}{NB_{bot} - 1} = 6.37 \cdot in$$

Spacing or Cover Dimension =

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

Transverse Reinforcement Index =

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

$$L_{dbt} := \frac{3 \cdot f_y \alpha_{pad} \cdot \beta_{pad} \cdot \gamma_{pad} \cdot \lambda_{pad}}{40 \cdot \sqrt{f_c \cdot psi} \cdot \frac{c + k_{tr}}{d_{bbot}}} \cdot d_{bbot} = 23.7 \cdot in$$

Minimum Development Length =

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

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

Available Length in Pad =

$$L_{Pad} := \frac{W_f}{2} - \frac{d_p}{2} - Cvr_{pad} = 117 \cdot in$$

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

Lpad_Check = "Okay"

Steel Reinforcement in Pier:

Area of Pier =

$$A_p := \frac{\pi \cdot d_p^{\,2}}{4} = 5541.77 \cdot in^2$$

$$A_{smin} := 0.01 \cdot 0.5 \cdot A_p = 27.71 \cdot in^2$$ (ACI-2008 10.8.4 & 10.9.1)

$$A_{sprov} := NB_{pier} \cdot A_{bpier} = 31.42 \cdot in^2$$

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

Steel_Area_Check = "Okay"

Bar Spacing In Pier =

$$B_{sPier} := \frac{d_p \cdot \pi}{NB_{pier}} - d_{bpier} = 5.597 \cdot in$$

Diameter of Reinforcement Cage =

$$Diam_{cage} := d_p - 2 \cdot Cvr_{pier} = 78 \cdot in$$

Maximum Moment in Pier =

$$M_p := \left[OM + Shear \cdot \left(L_p + \frac{A_{BP}}{2}\right)\right] \cdot LF = 54482.4 \cdot in \cdot kips$$

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

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

$$\left(D \;\; N \;\; n \;\; P_u \;\; M_{xu}\right) = \left(84 \;\; 40 \;\; 8 \;\; 49.321 \;\; 5.448 \times 10^4\right)$$

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

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

$$\left(\phi P_n \;\; \phi M_{xn} \;\; f_{sp} \;\; \rho\right) = \left(55.554 \;\; 6.137 \times 10^4 \;\; -60 \;\; 5.702 \times 10^{-3}\right)$$

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

Axial_Load_Check = "Okay"

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

Bending_Check = "Okay"

Development Length Pier Reinforcement:

Available Length in Foundation:

$L_{pier} := L_p - Cvr_{pier} = 33 \cdot in$

$L_{pad} := T_f - Cvr_{pad} = 27 \cdot in$

Tension: (ACI-2008 12.2.3)

Spacing or Cover Dimension =

$c := if\left(Cvr_{pier} < \frac{B_{sPier}}{2}, Cvr_{pier}, \frac{B_{sPier}}{2}\right) = 2.799 \cdot in$

Transverse Reinforcement =

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

$L_{dbt} := \frac{3 \cdot f_y \cdot \alpha_{pier} \cdot \beta_{pier} \cdot \gamma_{pier} \cdot \lambda_{pier}}{40 \cdot \sqrt{f_c \cdot psi} \cdot \left(\frac{c + k_{tr}}{d_{bpier}}\right)} \cdot d_{bpier} = 25.42 \cdot in$

Minimum Development Length =

$L_{dh} := \frac{1200 \cdot d_{bpier}}{\sqrt{\frac{f_c}{psi}}} \cdot .7 = 13.282 \cdot in$ (ACI 12.2.1)

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

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

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

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

Compression: (ACI-2008 12.3.2)

$L_{dbc1} := \frac{.02 \cdot d_{bpier} \cdot f_y}{\sqrt{f_c \cdot psi}} = 18.974 \cdot in$

$L_{dbmin} := 0.0003 \cdot \frac{in^2}{lb} \cdot \left(d_{bpier} \cdot f_y\right) = 18 \cdot in$

$L_{dbc} := if\left(L_{dbc1} \geq L_{dbmin}, L_{dbc1}, L_{dbmin}\right) = 18.974 \cdot in$

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

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

Tie Size and Spacing in Column:

Minimum Tie Size = $Tie_{min} := if(BS_{pier} \le 10, 3, 4) = 3$

Used #4 Ties

Seismic Factor = $z := if(Z \le 2, 1, 0.5) = 1$ (ACI-2008 21.10.5)

$s_{lim1} := 16 \cdot d_{bpier} \cdot z = 16 \cdot in$

$s_{lim2} := 48 \cdot d_{Tie} \cdot z = 24 \cdot in$

$s_{lim3} := D_f \cdot z = 54 \cdot in$

$s_{lim4} := 18in$

Maximum Spacing = $s_{tie} := \min\left(\begin{pmatrix} s_{lim1} \\ s_{lim2} \\ s_{lim3} \\ s_{lim4} \end{pmatrix}\right) = 16 \cdot in$

Number of Ties Required = $n_{tie} := \frac{L_{pier} - 3 \cdot in}{s_{tie}} + 1 = 2.875$

Check Anchor Steel Embedment:

Depth Available = $D_{ab} := L_{st} - A_{BP} = 5 \cdot ft$

Length of Anchor Bolt = $L_{anchor} := \frac{(0.11 \cdot f_{ya}) \cdot in}{\sqrt{f_c \cdot psi}} = 10.87 \cdot ft$

$Depth\_Check := if(D_{ab} \ge L_{anchor}, "Okay", "No Good")$

Depth_Check = "No Good"

Note: Anchor plate is provided

Network Modernization RFDS v3.0

T-Mobile

Site ID	**CTHA244A**	**Latitude**	41.53554
		Longitude	-72.73203
Site Name	CTHA244/VerizonMiddlefiel	**Site Type**	Structure (Non-Building)
Address	484 Meriden Road,Middlefield	**Site Class**	Monopole
Market	CONNECTICUT	**Landlord**	Verizon

Configuration
4E-GU19

Approvals	
Market RF	
Market Development	

RFDS Revision		**Date**	07/29/2014
RFDS Final			
Work Order #		**NOC#**	877-611-5868

Site Information

Existing Configuration					Proposed Configuration			
1	2	3	4	Cabinet #	1	2	3	4
GSM	GSM			Technology	GSM/UMTS/LTE	GSM		
S8000	S18000			Cabinet type	6201 ODE	S8000		
				CBU				
				DUW30	1			
				DUL20				
				DUG20	1			
				DUS41	1			
				RBS6601				
6				dTRU/TRX				
				RU22 B4				
				RUS01 B2	3			
				RUS01 B4	6			

	Relocate cabinet
	Add cabinet
x	Swap cabinet
	Remove cabinet
	Make cabinet dark

Scope of Work

Swap existing Nortel cabinet for E/// 6201 cabinet. Add DUG,DUW&DUS41

ALPHA - Scope of Work

	Add new mount		Add RRU
	Relocate antenna		Swap existing RRU
	Add antenna		Remove RRU
x	Swap antenna	x	Consolidate coax cables
	Remove antenna		Add coax cables
x	Add TMA		Add fiber cables
x	Swap TMA		Add hybrid combiner
	Remove TMA		Add filter combiner

Swap existing dualpole with quadpole.Swap existing single TMA's with twin TMA's on GSM/UMTS and Add AWS TMA on LTE.Consolidate coax .Daisy chain all Rets and add homerun cable.

BETA - Scope of Work

	Add new mount		Add RRU
	Relocate antenna		Swap existing RRU
	Add antenna		Remove RRU
x	Swap antenna	x	Consolidate coax cables
	Remove antenna		Add coax cables
x	Add TMA		Add fiber cables
x	Swap TMA		Add hybrid combiner
	Remove TMA		Add filter combiner

Swap existing dualpole with quadpole.Swap existing single TMA's with twin TMA's on GSM/UMTS and Add AWS TMA on LTE.Consolidate coax .Daisy chain all Rets and add homerun cable.

GAMMA - Scope of Work

	Add new mount		Add RRU
	Relocate antenna		Swap existing RRU
	Add antenna		Remove RRU
x	Swap antenna	x	Consolidate coax cables
	Remove antenna		Add coax cables
x	Add TMA		Add fiber cables
x	Swap TMA		Add hybrid combiner
	Remove TMA		Add filter combiner

Swap existing dualpole with quadpole.Swap existing single TMA's with twin TMA's on GSM/UMTS and Add AWS TMA on LTE.Consolidate coax .Daisy chain all Rets and add homerun cable.

DELTA - Scope of Work

	Add new mount		Add RRU
	Relocate antenna		Swap existing RRU
	Add antenna		Remove RRU
	Swap antenna		Consolidate coax cables
	Remove antenna		Add coax cables
	Add TMA		Add fiber cables
	Swap TMA		Add hybrid combiner
	Remove TMA		Add filter combiner

Network Modernization RFDS v3.0

T-Mobile

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Configuration
4E-GU19

Approvals	
Market RF	
Market Development	

RFDS Revision	
RFDS Final	

Date 07/29/2014

ALPHA (view from behind)

Existing Configuration					Proposed Configuration			
x	x			**Mount**	x	x		
GSM	GSM			Technology	GSM/UMTS	LTE		
B2	B2			Band	B2	B4		
P	P			Active/Passive	P	P		
Dual pole	Dual pole			Ant. Type	Quad pole		Dual pole	
RR90_17_02DP	RR90_17_02DP			Ant. Model	APX16DWV_16DWVS		RR90_17_02DP	
EMS	EMS			Ant. Vendor	RFS		EMS	
140	140			Ant. Height	140			
60	60			Azimuth	60			
No				RET deployed	Yes	Yes		
2				E-Tilt	2	2		
0				M-Tilt	0	0		
1	1			TMA #	1	1		
d B2	d B2			TMA Type	dd B2	dd B4		
				RRU #				
				RRU Type				
2	2			Used Coax #	2	2		
1-5/8"	1-5/8"			Coax Type	1-5/8"	1-5/8"		
170	170			Coax Length (ft)	165			
				Fiber (CPRI) #				
				Splitter #				
				Combiner #				
				Combiner Type				

	Add new mount		Add RRU
	Relocate antenna		Swap existing RRU
	Add antenna		Remove RRU
x	Swap antenna	x	Consolidate coax cables
	Remove antenna		Add coax cables
x	Add TMA		Add fiber cables
x	Swap TMA		Add hybrid combiner
	Remove TMA		Add filter combiner

Scope of work

Swap existing dualpole with quadpole.Swap existing single TMA's with twin TMA's on GSM/UMTS and Add AWS TMA on LTE.Consolidate coax .Daisy chain all Rets and add homerun cable.

BETA (view from behind)

Existing Configuration					Proposed Configuration			
x	x			**Mount**	x	x		
GSM	GSM			Technology	GSM/UMTS	LTE		
B2	B2			Band	B2	B4		
P	P			Active/Passive	P	P		
Dual pole	Dual pole			Ant. Type	Quad pole		Dual pole	
RR90_17_02DP	RR90_17_02DP			Ant. Model	APX16DWV_16DWVS		RR90_17_02DP	
EMS	EMS			Ant. Vendor	RFS		EMS	
140	140			Ant. Height	140			
150	150			Azimuth	150			
No				RET deployed	Yes	Yes		
2				E-Tilt	2	2		
0				M-Tilt	0	0		
1	1			TMA #	1	1		
d B2	d B2			TMA Type	dd B2	dd B4		
				RRU #				
				RRU Type				
2	2			Used Coax #	2	2		
1-5/8"	1-5/8"			Coax Type	1-5/8"	1-5/8"		
170	170			Coax Length (ft)	170			
				Fiber (CPRI) #				
				Splitter #				
				Combiner #				
				Combiner Type				

	Add new mount		Add RRU
	Relocate antenna		Swap existing RRU
	Add antenna		Remove RRU
x	Swap antenna	x	Consolidate coax cables
	Remove antenna		Add coax cables
x	Add TMA		Add fiber cables
x	Swap TMA		Add hybrid combiner
	Remove TMA		Add filter combiner

Scope of work

Swap existing dualpole with quadpole.Swap existing single TMA's with twin TMA's on GSM/UMTS and Add AWS TMA on LTE.Consolidate coax .Daisy chain all Rets and add homerun cable.

Network Modernization RFDS v3.0

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4E-GU19

Approvals	
Market RF	
Market Development	

RFDS Revision	
RFDS Final	

Date 07/29/2014

GAMMA (view from behind)

Existing Configuration					Proposed Configuration			
x	x				x	x		
GSM	GSM			Technology	GSM/UMTS	LTE		
B2	B2			Band	B2	B4		
P	P			Active/Passive	P	P		
Dual pole	Dual pole			Ant. Type	Quad pole		Dual pole	
RR90_17_02DP	RR90_17_02DP			Ant. Model	APX16DWV_16DWVS		RR90_17_02DP	
EMS	EMS			Ant. Vendor	RFS		EMS	
140	140			Ant. Height	140			
230	230			Azimuth	230			
No				RET deployed	Yes	Yes		
2				E-Tilt	2	2		
0				M-Tilt	0	0		
1	1			TMA #	1	1		
d B2	d B2			TMA Type	dd B2	dd B4		
				RRU #				
				RRU Type				
2	2			Used Coax #	2	2		
1-5/8"	1-5/8"			Coax Type	1-5/8"	1-5/8"		
170	170			Coax Length (ft)	170			
				Fiber (CPRI) #				
				Splitter #				
				Combiner #				
				Combiner Type				

	Add new mount		Add RRU
	Relocate antenna		Swap existing RRU
	Add antenna		Remove RRU
x	Swap antenna	x	Consolidate coax cables
	Remove antenna		Add coax cables
x	Add TMA		Add fiber cables
x	Swap TMA		Add hybrid combiner
	Remove TMA		Add filter combiner

Scope of work

Swap existing dualpole with quadpole.Swap existing single TMA's with twin TMA's on GSM/UMTS and Add AWS TMA on LTE.Consolidate coax .Daisy chain all Rets and add homerun cable.

DELTA (view from behind)

Existing Configuration					Proposed Configuration			
				Technology				
				Band				
				Active/Passive				
				Ant. Type				
				Ant. Model				
				Ant. Vendor				
				Ant. Height				
				Azimuth				
				RET deployed				
				E-Tilt				
				M-Tilt				
				TMA #				
				TMA Type				
				RRU #				
				RRU Type				
				Used Coax #				
				Coax Type				
				Coax Length (ft)				
				Fiber (CPRI) #				
				Splitter #				
				Combiner #				
				Combiner Type				

	Add new mount		Add RRU
	Relocate antenna		Swap existing RRU
	Add antenna		Remove RRU
	Swap antenna		Consolidate coax cables
	Remove antenna		Add coax cables
	Add TMA		Add fiber cables
	Swap TMA		Add hybrid combiner
	Remove TMA		Add filter combiner

Scope of work

Product Data Sheet **APX16DWV-16DWVS-E-A20**

Optimizer® Side-by-Side Dual Polarized Antenna, 1710-2200, 65deg, 18.4dBi, 1.4m, VET, 0-10deg RET

Product Description

A combination of two X-Polarized antennas in a single radome, this pair of variable tilt antennas provides exceptional suppression of all upper sidelobes at all downtilt angles. It also features a wide downtilt range. This antenna is optimized for performance across the entire frequency band (1710-2200 MHz). The antenna comes pre-connected with two antenna control units (ACU).

Features/Benefits

- **Variable electrical downtilt - provides enhanced precision in controlling intercell interference. The tilt is infield adjustable 0-10 deg.**
- **High Suppression of all Upper Sidelobes (Typically <-20dB).**
- **Gain tracking – difference between AWS UL (1710-1755 MHz) and DL (2110-2155 MHz) <1dB.**
- **Two X-Polarised panels in a single radome.**
- **Azimuth horizontal beamwidth difference <4deg between AWS UL (1710-1755 MHz) and DL (2110-2155 MHz).**
- **Low profile for low visual impact.**
- **Dual polarization; Broadband design.**
- **Includes (2) AISG 2.0 Compatible ACU-A20-N antenna control units.**

Technical Specifications

Electrical Specifications

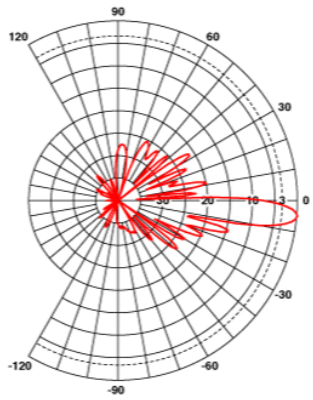
Frequency Range, MHz	1710-2200
Horizontal Beamwidth, deg	65
Vertical Beamwidth, deg	5.9 to 7.7
Electrical Downtilt, deg	0-10
Gain, dBi (dBd)	18.4 (16.3)
1st Upper Sidelobe Suppression, dB	> 18 (typically > 20)
Upper Sidelobe Suppression, dB	> 18 all (typically > 20)
Front-To-Back Ratio, dB	>26 (typically 28)
Polarization	Dual pol +/-45°
VSWR	< 1.5:1
Isolation between Ports, dB	> 30
3rd Order IMP @ 2 x 43 dBm, dBc	> 150 (155 Typical)
Impedance, Ohms	50
Maximum Power Input, W	300
Lightning Protection	Direct Ground
Connector Type	(4) 7-16 Long Neck Female

Mechanical Specifications

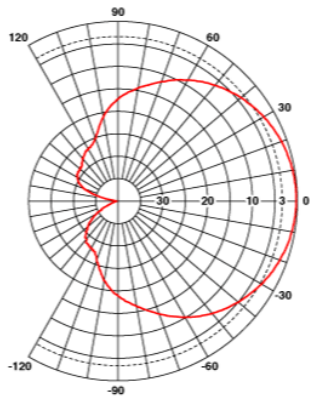
Dimensions - HxWxD, mm (in)	1420 x 331 x 80 (55.9 x 13 x 3.15)
Weight w/o Mtg Hardware, kg (lb)	18.5 (40.7)
Survival Wind Speed, km/h (mph)	200 (125)
Rated Wind Speed, km/h (mph)	160 (100)
Max Wind Loading Area, m² (ft²)	0.47 (5.03)
Front Thrust @ Rated Wind, N (lbf)	756 (170)
Maximum Thrust @ Rated Wind, N (lbf)	756 (170)
Wind Load - Side @ Rated Wind, N (lbf)	231 (52)
Wind Load - Rear @ Rated Wind, N (lbf)	408 (92)
Radome Material	Fiberglass
Radome Color	Light Grey RAL7035
Mounting Hardware Material	Diecasted Aluminum
Shipping Weight, kg (lb)	24.5 (53.9)
Packing Dimensions, HxWxD, mm (in)	1520 x 408 x 198 (59.8 x 16 x 7.8)

Ordering Information

Mounting Hardware	APM40-2 + APM40-E2



Vertical Pattern



Horizontal Pattern

Dual Duplex Tower Mounted Amplifier Fullband

for 1900 MHz

*When installed close to the antenna, this **Tower Mounted Amplifier (TMA)** enhances the overall network performance and coverage. This is due to reduced system noise figure and improved uplink sensitivity.*

Improved operator business – futureproof

Operators are now facing a familiar syndrome, where they are forced to merge or share network frequencies. This Ericsson dual duplex TMA eliminates any problems this could cause, by covering the entire GSM 1900 band.

When building new networks

Fast deployment is crucial in a new network rollout. This is where the Ericsson dual duplex TMAs can provide a cost-effective solution that gives a faster rollout with a reduction of the initial investments.

When improving existing network

Continuous improvement to the quality of the network and sufficient coverage is vital for operators. With the installation of TMAs the extra traffic generated provides a typical payback time of 2–12 months and increases the net revenue.

Key features

- The only approved dual duplex fullband TMA for Ericsson GSM 1900 MHz RBSs.
- Full 60 MHz bandwidth – futureproof and logistically simple
- Optimized for Ericsson's RBS 2102 / 2202 and RBS 2106 / 2206
- Compact casing

ERICSSON

Convincing results from the field

Actual test from the field in existing networks have shown significant improvements:
20–50% reduction of dropped calls and up to 5% increase in total talk time.

Excellent reliability

The durable Ericsson dual duplex TMAs have lightning protection, dual amplifiers and alarm functionality, providing continuous, dependable performance, even when mounted in hazardous weather environments.

Technical Specifications for Dual Duplex TMA Fullband for GSM 1900

Dual Duplex Tower Mounted Amplifier	**KRY 112 71**
Electrical specifications	
Bandwidth:	60 MHz
Receiver pass band:	1850 – 1910 MHz
Transmitting pass band:	1930 – 1990 MHz
Gain:	12 dB
Input IP3, better than:	12 dBm
Tx loss, typical:	0.5 dB
Tx/Rx Return Loss, typical:	20 dB
ANT Return Loss, typical:	20 dB
Noise figure, typical:	1.7 dB
Maximum power handling, continuous:	54 dBm (250 W)
All IM*/ in receiving band (2 x 43 dBm CW):	< –121 dBm
DC powering / Alarm handling:	Superimposed on the RF feeder. Dual alarm levels.
Impedance:	50 Ohm
Type approval:	Ericsson TMA + BTS fulfils ETSI requirements
Mechanical specifications	
Dimensions (H x W x D)	12.5 x 5.6 x 3.7 in (316 x 141 x 95 mm)
Weight:	13.2 lb (6.0 kg)
RF connectors:	7-16 female
Ground connector:	M8 bolt & nut
Mounting:	Pole or wall mounting
Environmental specifications	
Temperature range, full performance:	-27 °F to +130 °F (-33 °C to +55 °C)
MTBF:	1 000 000 hours
Sealing:	IP 65
Lightning protection:	IEC 1024
Safety:	UL1950, ETL marking, EN 60950
Ordering numbers	
ddTMA 1900 FB with LNA by-pass:	KRY 112 71/2
Available ordering guides:	EN/LZT 123 7019 and EN/LZT 123 7020

*/ Referring to IM5 and IM7 measured at the Antenna port.
IM3 considered subject to frequency planning.

Ericsson AB
www.ericsson.com

AE/LZT 123 6836 R4

Exhibit C

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

T-Mobile Existing Facility

Site ID: CTHA244A

CTHA244/Verizon Middlefield
484 Meriden Road
Middlefield, CT 06455

March 26, 2015

Site Compliance Summary	
Compliance Status:	**COMPLIANT**
Site total MPE% of FCC general public allowable limit:	**47.09 %**

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March 26, 2015

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

Emissions Analysis for Site: **CTHA244A – CTHA244/Verizon Middlefield**

EBI Consulting was directed to analyze the proposed T-Mobile facility located at **484 Meriden Road, Middlefield, CT**, for the purpose of determining whether the emissions from the Proposed T-Mobile Antenna Installation located on this property are within specified federal limits.

All information used in this report was analyzed as a percentage of current Maximum Permissible Exposure (% MPE) as listed in the FCC OET Bulletin 65 Edition 97-01and ANSI/IEEE Std C95.1. The FCC regulates Maximum Permissible Exposure in units of microwatts per square centimeter (μW/cm2). The number of $\mu W/cm^2$ calculated at each sample point is called the power density. The exposure limit for power density varies depending upon the frequencies being utilized. Wireless Carriers and Paging Services use different frequency bands each with different exposure limits, therefore it is necessary to report results and limits in terms of percent MPE rather than power density.

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

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

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

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

Additional details can be found in FCC OET 65.

CALCULATIONS

Calculations were done for the proposed T-Mobile Wireless antenna facility located at **484 Meriden Road, Middlefield, 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) 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.

5) 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.

6) The antennas used in this modeling are the **RFS APX16DWV-16DWVS-E-A20** for 1900 MHz (PCS) and 2100 MHz (AWS) 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 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. There are also three (1 per sector) EMS RR90-10-02DP remaining on the tower. These antennas will remain installed but not utilized.

7) The antenna mounting height centerline of the proposed antennas is **140 feet** above ground level (AGL).

8) 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):	140	Height (AGL):	140	Height (AGL):	140
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):	10,237.91	ERP (W):	10,237.91	ERP (W):	10,237.91
Antenna A1 MPE%	2.05	Antenna B1 MPE%	2.05	Antenna C1 MPE%	2.05
Antenna #:	**2 (Dormant)**	Antenna #:	**2 (Dormant)**	Antenna #:	**2 (Dormant)**
Make / Model:	EMS RR90-17-02DP	Make / Model:	EMS RR90-17-02DP	Make / Model:	EMS RR90-17-02DP
Gain:	14.4 dBd	Gain:	14.4 dBd	Gain:	14.4 dBd
Height (AGL):	140	Height (AGL):	140	Height (AGL):	140
Frequency Bands	1900 MHz(PCS)	Frequency Bands	1900 MHz(PCS)	Frequency Bands	1900 MHz(PCS)
Channel Count	0	Channel Count	0	Channel Count	0
Total TX Power:	0	Total TX Power:	0	Total TX Power:	0
ERP (W):	0.00	ERP (W):	0.00	ERP (W):	0.00
Antenna A2 MPE%	0.00	Antenna B2 MPE%	0.00	Antenna C2 MPE%	0.00

Site Composite MPE%	
Carrier	**MPE%**
T-Mobile	**6.15**
Verizon Wireless	23.04 %
AT&T	17.90 %
Site Total MPE %:	**47.09 %**

T-Mobile Sector 1 Total:	2.05 %
T-Mobile Sector 2 Total:	2.05 %
T-Mobile Sector 3 Total:	2.05 %
Site Total:	47.09 %

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Summary

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

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

T-Mobile Sector	Power Density Value (%)
Sector 1:	2.05 %
Sector 2:	2.05 %
Sector 3 :	2.05 %
T-Mobile Total:	6.15 %
Site Total:	47.09 %
Site Compliance Status:	**COMPLIANT**

The anticipated composite MPE value for this site assuming all carriers present is **47.09%** 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

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