PULLMAN & COMLEY, LLC
ATTORNEYS AT LAW

EM-POCKET-005-090122

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ORIGINAL

January 21, 2009

Via Federal Express

S. Derek Phelps, Executive Director
Connecticut Siting Council
Ten Franklin Square
New Britain, CT 06051

Re: Notice of Exempt Modification
Verizon Wireless Telecommunications Facility
5 Old Farms Road, Barkhamsted, Connecticut

Dear Mr. Phelps:

Youghiogheny Communications-Northeast, LLC, doing business as Pocket Communications ("Pocket"), intends to install antennas and appurtenant equipment at the existing 145-foot monopole facility owned by Verizon Wireless and located at 5 Old Farms Road, Barkhamsted, Connecticut ("Facility"). Pocket Communications provides prepaid, flat rate wireless voice and data services to more than a quarter of a million subscribers. Pocket is licensed by the Federal Communications Commission (FCC) to provide PCS wireless telecommunications service in the State of Connecticut, which includes the area to be served by the proposed installation. This installation constitutes an exempt modification pursuant to the Public Utility Environmental Standards Act, Connecticut General Statutes Section 16-50g et. seq. (PUESA), and Section 16-50j-72(b)(2) of the Regulations of the Connecticut State Agencies adopted pursuant to PUESA. In accordance with R.C.S.A. Section 16-50j-73, a copy of this notice has been sent to Donald B. Stein, First Selectman, Town of Barkhamsted.

The existing Facility consists of a 145-foot self-supporting monopole tower capable of supporting multiple carriers within a fenced compound. The coordinates for the Facility are **Lat: 41°-54'-52.3" and Long: 73°–01'-20.4".** The tower is located in the southwestern portion of Barkhamsted, approximately 450 feet northeast of Old North Road, roughly 900 feet north of New Hartford Road (Route 44) and roughly two miles southeast of downtown Winsted (see Site Map, attached as Exhibit A). The tower currently supports T-Mobile antennas at the one hundred twenty four foot (124') level centerline AGL (above ground level), AT&T antennas at the one hundred thirty five foot level (135') AGL, and Verizon antennas at the one hundred forty five foot level (145') AGL. As noted in the footnote on page 3 of the power density calculations (Exhibit D), AT&T has relocated their antennas from the one hundred five foot level (105') centerline AGL to the one hundred thirty five foot level (135') centerline AGL. The power density calculations reflect this change. Pocket proposes to install three RFS APXV18-206517S-

C flush mount antennas on the tower at the one hundred fifteen foot centerline (115') AGL, and a Nortel CDMA Micro BTS 3231 cabinet, mounted on an "H-Frame," contained within a six foot by six foot (6'-0" x 6'-0") lease area. A small GPS antenna will be mounted to an ice bridge which will run from the lease area to the tower. Utilities will be run via a proposed underground conduit from existing utility sources at the Facility (See Design Drawings and Equipment Specifications, attached as Exhibits B and C respectively).

For the following reasons, the proposed modifications to the Old Farms Road Facility meet the exempt modification criteria set forth in R.C.S.A. Section 16-50j-72(b)(2):

1. The proposed modification will not increase the height of the tower as Pocket's antennas will be installed at a center line height of approximately 115 feet.

2. The installation of Pocket's equipment and shelter will not require an extension of the site boundaries.

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

4. The operation of the additional antennas will not increase the total radio frequency (RF) power density, measured at the site boundary, to a level at or above the standard adopted by the Connecticut Department of Environmental Protection as set forth in Section 22a-162 of the Connecticut General Statutes and MPE limits established by the Federal Communications Commission. The worst-case RF power density calculations for the proposed Pocket antennas would be 25.18% of the FCC standard (see general power density calculations table, attached as Exhibit D).

Also attached, Exhibit E, is a structural analysis confirming that the tower can support the existing and proposed antennas and associated equipment.

For the foregoing reasons, Pocket respectfully submits that the proposed antenna installation and equipment at the Barkhamsted Facility constitutes an exempt modification under R.C.S.A. Section 16-50j-72(b)(2).

Respectfully Submitted,

Carrie L. Larson

cc: Donald B. Stein, First Selectman, Town of Barkhamsted
John and Ethel Lavieri, underlying property owners
Verizon Wireless

Exhibit A

Site Map

Pocket Site NHCT0550A

5 Old Farms Road

Barkhamsted, Connecticut

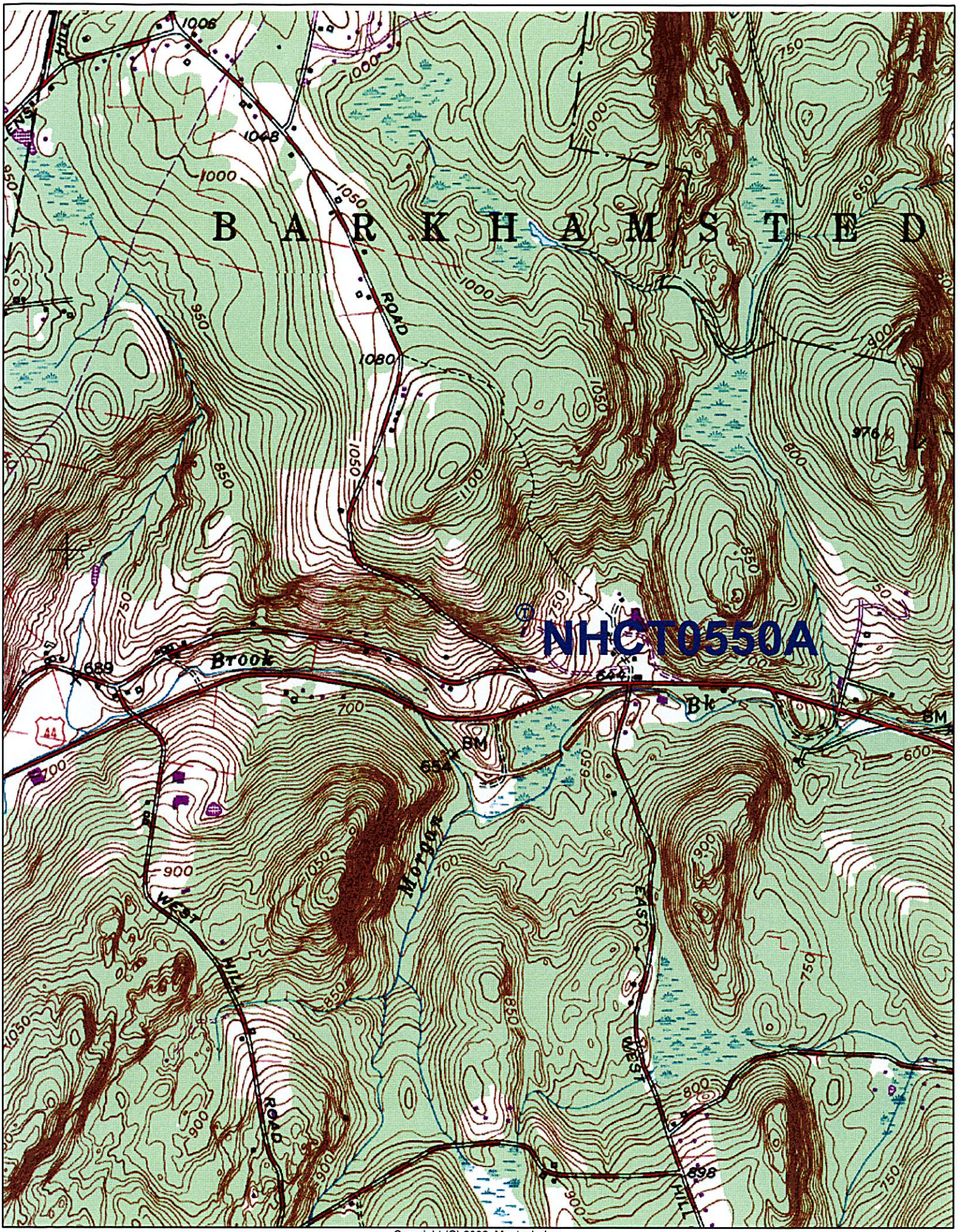


Exhibit B

Design Drawings

Pocket Site NHCT0550A

5 Old Farms Road

Barkhamsted, Connecticut

pocket™
COMMUNICATIONS

WIRELESS COMMUNICATIONS FACILITY

NHCT0550A

5 OLD FARMS ROAD
BARKHAMSTED, CT 06063

GENERAL NOTES

1. ALL WORK SHALL BE IN ACCORDANCE WITH THE 2003 INTERNATIONAL BUILDING CODE AS MODIFIED BY THE 2005 CONNECTICUT SUPPLEMENT, INCLUDING THE TIA/EIA-222 REVISION "F" "STRUCTURAL STANDARDS FOR STEEL ANTENNA TOWERS AND SUPPORTING STRUCTURES."
2. THE COMPOUND, TOWER, PRIMARY GROUND RING, ELECTRICAL SERVICE TO THE METER BANK AND TELEPHONE SERVICE TO THE DEMARCATION POINT ARE PROVIDED BY SITE OWNER. AS BUILT FIELD CONDITIONS REGARDING THESE ITEMS SHALL BE CONFIRMED BY THE CONTRACTOR. SHOULD ANY FIELD CONDITIONS PRECLUDE COMPLIANCE WITH THE DRAWINGS, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER AND SHALL NOT PROCEED WITH ANY AFFECTED WORK.
3. CONTRACTOR SHALL REVIEW ALL DRAWINGS AND SPECIFICATIONS IN THE CONTRACT DOCUMENT SET. CONTRACTOR SHALL COORDINATE ALL WORK SHOWN IN THE SET OF DRAWINGS. THE CONTRACTOR SHALL PROVIDE A COMPLETE SET OF DRAWINGS TO ALL SUBCONTRACTORS AND ALL RELATED PARTIES. THE SUBCONTRACTORS SHALL EXAMINE ALL THE DRAWINGS AND SPECIFICATIONS FOR THE INFORMATION THAT AFFECTS THEIR WORK.
4. CONTRACTOR SHALL PROVIDE A COMPLETE BUILD-OUT WITH ALL FINISHES, STRUCTURAL, MECHANICAL, AND ELECTRICAL COMPONENTS AND PROVIDE ALL ITEMS AS SHOWN OR INDICATED ON THE DRAWINGS OR IN THE WRITTEN SPECIFICATIONS.
5. CONTRACTOR SHALL FURNISH ALL MATERIAL, LABOR AND EQUIPMENT TO COMPLETE THE WORK AND FURNISH A COMPLETED JOB ALL IN ACCORDANCE WITH LOCAL AND STATE GOVERNING AUTHORITIES AND OTHER AUTHORITIES HAVING LAWFUL JURISDICTION OVER THE WORK.
6. CONTRACTOR SHALL SECURE AND PAY FOR ALL PERMITS AND ALL INSPECTIONS REQUIRED AND SHALL ALSO PAY FEES REQUIRED FOR THE GENERAL CONSTRUCTION, PLUMBING, ELECTRICAL AND HVAC. PERMITS SHALL BE PAID FOR BY THE RESPECTIVE SUBCONTRACTORS.
7. CONTRACTOR SHALL MAINTAIN A CURRENT SET OF DRAWINGS AND SPECIFICATIONS ON SITE AT ALL TIMES AND INSURE DISTRIBUTION OF NEW DRAWINGS TO SUBCONTRACTORS AND OTHER RELEVANT PARTIES AS SOON AS THEY ARE MADE AVAILABLE. ALL OLD DRAWINGS SHALL BE MARKED VOID AND REMOVED FROM THE CONTRACT AREA. THE CONTRACTOR SHALL FURNISH AN "AS-BUILT" SET OF DRAWINGS TO OWNER UPON COMPLETION OF PROJECT.
8. LOCATION OF EQUIPMENT, AND WORK SUPPLIED BY OTHERS THAT IS DIAGRAMMATICALLY INDICATED ON THE DRAWINGS SHALL BE DETERMINED BY THE CONTRACTOR. THE CONTRACTOR SHALL DETERMINE LOCATIONS AND DIMENSIONS SUBJECT TO STRUCTURAL CONDITIONS AND WORK OF THE SUBCONTRACTORS.
9. THE CONTRACTOR IS SOLELY RESPONSIBLE TO DETERMINE CONSTRUCTION PROCEDURE AND SEQUENCE, AND TO ENSURE THE SAFETY OF THE EXISTING STRUCTURES AND ITS COMPONENT PARTS DURING CONSTRUCTION. THIS INCLUDES THE ADDITION OF WHATEVER SHORING, BRACING, UNDERPINNING, ETC. THAT MAY BE NECESSARY. MAINTAIN EXISTING BUILDING'S/PROPERTY'S OPERATIONS, COORDINATE WORK WITH BUILDING/PROPERTY OWNER.
10. DRAWINGS INDICATE THE MINIMUM STANDARDS, BUT IF ANY WORK SHOULD BE INDICATED TO BE SUBSTANDARD TO ANY ORDINANCES, LAWS, CODES, RULES, OR REGULATIONS BEARING ON THE WORK, THE CONTRACTOR SHALL INCLUDE IN HIS WORK AND SHALL EXECUTE THE WORK CORRECTLY IN ACCORDANCE WITH SUCH ORDINANCES, LAWS, CODES, RULES OR REGULATIONS WITH NO INCREASE IN COSTS.
11. ALL UTILITY WORK SHALL BE IN ACCORDANCE WITH LOCAL UTILITY COMPANY REQUIREMENTS AND SPECIFICATIONS.
12. ALL EQUIPMENT AND PRODUCTS PURCHASED ARE TO BE REVIEWED BY CONTRACTOR AND ALL APPLICABLE SUBCONTRACTORS FOR ANY CONDITION PER MFR.'S RECOMMENDATIONS. CONTRACTOR TO SUPPLY THESE ITEMS AT NO COST TO OWNER OR CONSTRUCTION MANAGER.
13. ANY AND ALL ERRORS, DISCREPANCIES, AND "MISSED" ITEMS ARE TO BE BROUGHT TO THE ATTENTION OF POCKET COMMUNICATIONS DURING THE BIDDING PROCESS BY THE CONTRACTOR. ALL THESE ITEMS ARE TO BE INCLUDED IN THE BID. NO "EXTRA" WILL BE ALLOWED FOR MISSED ITEMS.
14. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL ON-SITE SAFETY FROM THE TIME THE JOB IS AWARDED UNTIL ALL WORK IS COMPLETE AND ACCEPTED BY THE OWNER.
15. CONTRACTOR TO REVIEW ALL SHOP DRAWINGS AND SUBMIT COPY TO ENGINEER FOR APPROVAL. DRAWINGS MUST BEAR THE CHECKER'S INITIALS BEFORE SUBMITTING TO THE CONSTRUCTION MANAGER FOR REVIEW.
16. THE CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS, ELEVATIONS, ANGLES, AND EXISTING CONDITIONS AT THE SITE, PRIOR TO FABRICATION AND/OR INSTALLATION OF ANY WORK IN THE CONTRACT AREA.
17. COORDINATION, LAYOUT, FURNISHING AND INSTALLATION OF CONDUIT AND ALL APPURTENANCES REQUIRED FOR PROPER INSTALLATION OF ELECTRICAL AND TELECOMMUNICATION SERVICE SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR.
18. ALL DAMAGE CAUSED TO ANY EXISTING STRUCTURE SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR WILL BE HELD LIABLE FOR ALL REPAIRS REQUIRED FOR EXISTING STRUCTURES IF DAMAGED DURING CONSTRUCTION ACTIVITIES.
19. THE CONTRACTOR SHALL CONTACT "CALL BEFORE YOU DIG" AT LEAST 48 HOURS PRIOR TO ANY EXCAVATIONS AT 1-800-922-4455. ALL UTILITIES SHALL BE IDENTIFIED AND CLEARLY MARKED. CONTRACTOR SHALL MAINTAIN AND PROTECT MARKED UTILITIES THROUGHOUT PROJECT COMPLETION.

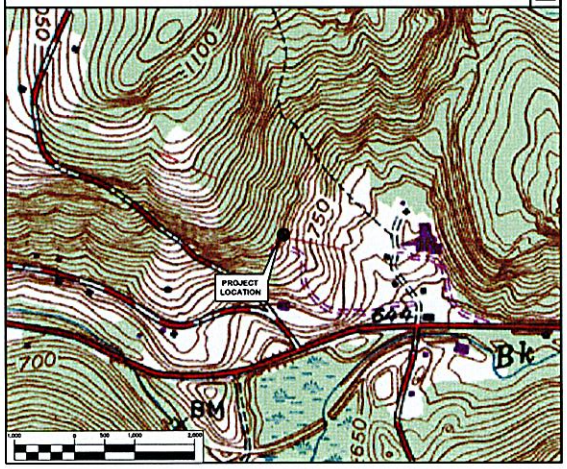
DRIVING DIRECTIONS

FROM HARTFORD, CT:

91 SOUTH TO EXIT 29A TOWARD CAPITOL AREA. MERGE ONTO WHITEHEAD HWY. TAKE THE EXIT, TURN RIGHT ONTO PROSPECT ST. TURN LEFT ONTO ARCH ST. TURN RIGHT ONTO MAIN ST. MAIN ST BECOMES US-44 W. APPROXIMATELY 22.2 MILES, TURN RIGHT ONTO OLD FARMS RD (PORTIONS UNPAVED). SITE IS LOCATED BEHIND FIRST RESIDENCE ON LEFT.

VICINITY MAP

SCALE: 1" = 1000'



PROJECT SUMMARY

SITE NUMBER:	NHCT0550A
SITE NAME:	5 OLD FARMS ROAD
SITE ADDRESS:	5 OLD FARMS ROAD BARKHAMSTED, CT 06063
APPLICANT:	YOUGHIOGHENY COMMUNICATIONS-NORTHEAST LLC 2819 NW LOOP 410 SAN ANTONIO, TX 78230
CONTACT PERSON:	JASON D'AMICO – PROGRAM MANAGER GRAPEVINE SOLUTIONS PRODUCT MANAGEMENT (860) 209-0104
TOWER COORDINATES:	LATITUDE: 41°-54'-52.26" LONGITUDE: 73°-01'-20.39" COORDINATES BASED ON CONNECTICUT SITING COUNCIL DATABASE, LAST UPDATED SEPTEMBER 25, 2008.

SHEET INDEX

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GENERAL NOTES

1. PROPOSED ANTENNA LOCATIONS AND HEIGHTS PROVIDED BY POCKET COMMUNICATIONS.
2. ALL POCKET COMMUNICATIONS SAFETY PROCEDURES MUST BE ADHERED TO.
3. ANTENNA SYSTEM SWEEP TESTING PER LATEST POCKET COMMUNICATIONS DOCUMENT.

PROJECT SCOPE

1. THE PROPOSED SCOPE OF WORK GENERALLY ENTAILS THE INSTALLATION OF CLUSTER MOUNT TELECOMMUNICATIONS ANTENNAS, COAX, ICE BRIDGE AND RADIO CABINET INCLUDING THE NECESSARY UTILITIES.
2. A TOTAL OF THREE (3) DIRECTIONAL PANEL ANTENNAS ARE PROPOSED TO BE CLUSTER MOUNTED TO THE EXISTING ±145' ABOVE GRADE LEVEL (AGL) MONOPOLE TOWER AT A RAD CENTER ±115' AGL.
3. ELECTRIC AND TELCO UTILITIES SHALL BE ROUTED UNDERGROUND TO THE PROPOSED EQUIPMENT FROM AN EXISTING UTILITY BACKBOARD LOCATED ADJACENT TO THE FENCED COMPOUND.

PROJECT INFORMATION

1. THIS SITE IS UNMANNED AND HAS RESTRICTED ACCESS TO OUTDOOR EQUIPMENT. IT WILL BE USED FOR THE TRANSMISSION OF RADIO SIGNALS FOR THE PURPOSE OF PROVIDING PUBLIC CELLULAR SERVICE.
2. POCKET COMMUNICATIONS CERTIFIES THAT THIS TELEPHONE EQUIPMENT FACILITY WILL BE SERVICED ONLY BY POCKET COMMUNICATIONS EMPLOYEES AND THE WORK ASSOCIATED WITH ANY EQUIPMENT CANNOT BE PERFORMED BY HANDICAPPED PERSONS. THIS FACILITY WILL BE FREQUENTED ONLY BY SERVICE PERSONNEL FOR MAINTENANCE AND REPAIR SERVICES ONLY. THIS FACILITY IS EXEMPT FROM THE REQUIREMENTS OF THE AMERICANS WITH DISABILITIES ACT (ADA), APPENDIX B, SECTION 4.11.(5)(b).
3. NO POTABLE WATER SUPPLY IS TO BE PROVIDED AT THIS LOCATION.
4. NO WASTE WATER WILL BE GENERATED AT THIS LOCATION.
5. NO SOLID WASTE WILL BE GENERATED AT THIS LOCATION.
6. POCKET COMMUNICATIONS MAINTENANCE CREW (TYPICALLY ONE PERSON) WILL MAKE AN AVERAGE OF ONE TRIP PER MONTH AT ONE HOUR PER VISIT.

DESIGNED BY:	CFC
DRAWN BY:	CMS
CHK'D BY:	CFC

REV.	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
1	11/05/08	JV	CFC	ISSUED FOR CONSTRUCTION
0	10/10/08	CMS	CFC	ISSUED FOR REVIEW

PROFESSIONAL ENGINEER SEAL

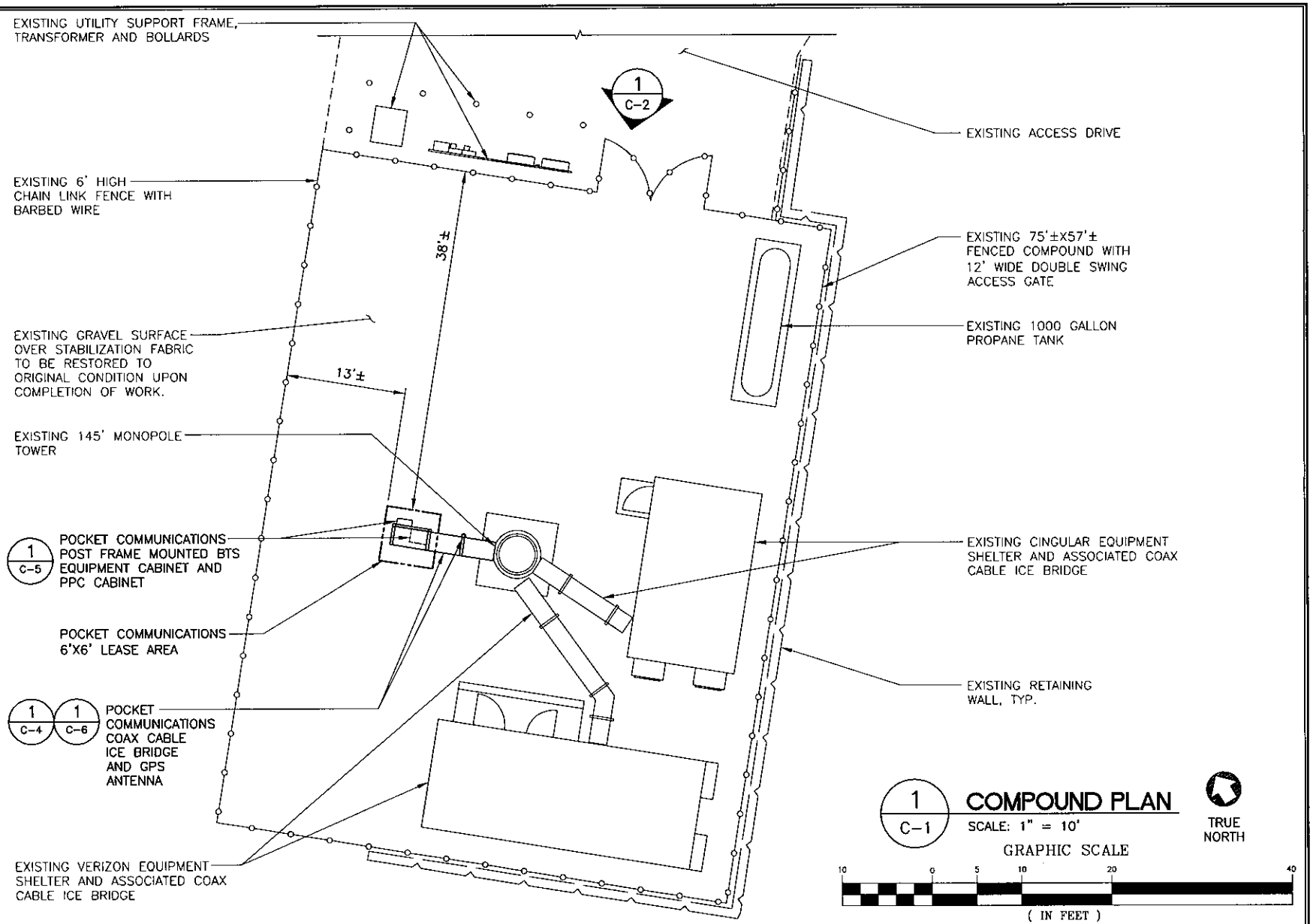
NATE D'AMICO
CONNECTICUT
LICENSED PROFESSIONAL ENGINEER

POCKET COMMUNICATIONS
NHCT0550A
5 OLD FARMS ROAD
BARKHAMSTED, CT 06063

DATE: 10/10/08
SCALE: AS SHOWN
JOB NO. 08117.C013

TITLE SHEET

SHEET NO.
T-1
Sheet No. 1 of 14



DESIGNED BY:	CFC
DRAWN BY:	CMS
CHK'D BY:	CFC

REV.	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
1	11/05/08	JV	CFC	ISSUED FOR CONSTRUCTION
0	10/10/08	CMS	CFC	ISSUED FOR REVIEW

PROFESSIONAL ENGINEER SEAL

pocket COMMUNICATIONS

NATE DIMMI

POCKET COMMUNICATIONS

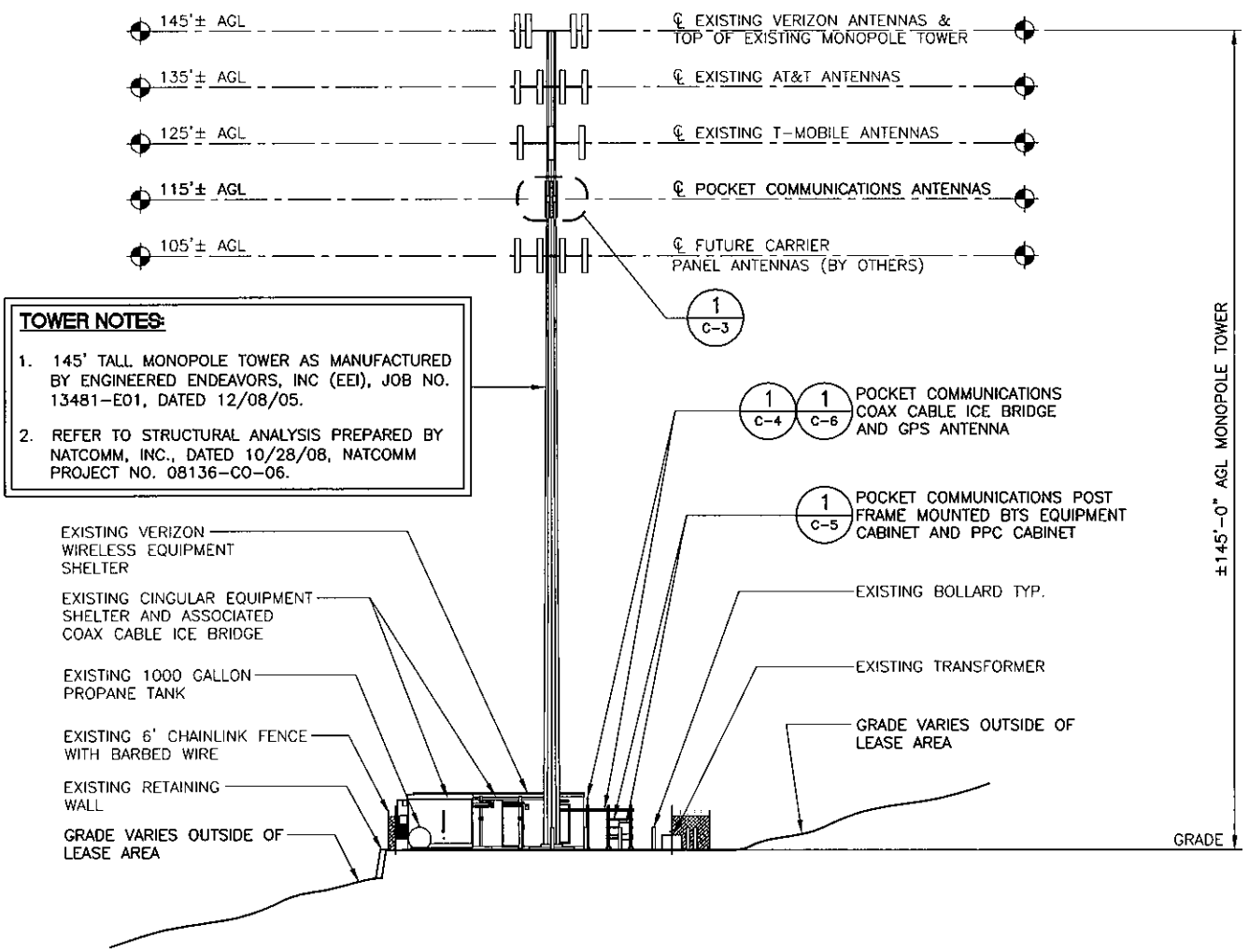
NHCT0550A

5 OLD FARMS ROAD
BARKHAMSTED, CT 06063

DATE:	10/10/08
SCALE:	AS SHOWN
JOB NO.	08117.0013

COMPOUND PLAN

SHEET NO.
C-1
Sheet No. 2 of 14



1 / C-2 **COMPOUND ELEVATION**

SCALE: 1" = 20'

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)

1 inch = 20 ft.

DESIGNED BY: CFC
DRAWN BY: CMS
CHK'D BY: CFC

REV.	DATE	DRAWN BY/CHK'D BY	DESCRIPTION
1	11/05/08	JW	ISSUED FOR CONSTRUCTION
0	10/10/08	CMS	CFC ISSUED FOR REVIEW

POCKET COMMUNICATIONS

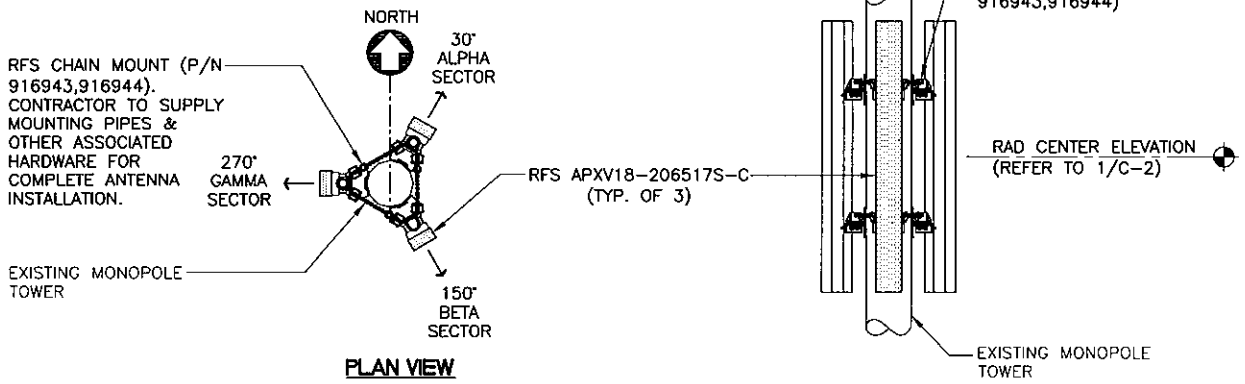
NHCT0550A

5 OLD FARMS ROAD
BARKHAMSTED, CT 06063

DATE: 10/10/08
SCALE: AS SHOWN
JOB NO. 08117.C013

COMPOUND ELEVATION

SHEET NO. C-2



PLAN VIEW

TYPICAL SECTOR ELEVATION

1 / C-3 ANTENNA MOUNTING CONFIGURATION

NOT TO SCALE

ANTENNA KEY

	# ANTENNAS PER SECTOR	ANTENNA NUMBER	COAX COLOR CODE	ANTENNA VENDOR	MODEL NUMBER	AZIMUTH	C/L HEIGHT	MECHANICAL DOWNTILT	ELECTRICAL DOWNTILT	COAX SIZE	# COAX PER ANTENNA	COAX MANUFACTURER	COAX LENGTH
ALPHA FACE	1	A-1	(2)-RED BAND	RFS	APXV18-206517S-C	30°	±115'-0"	0°	REFER TO RFDS ANTENNA SHEET FOR FINAL TILT AND AZIMUTHS	1 5/8"	2	RFS	135'± PER RUN
BETA FACE	1	B-1	(2)-BLUE BAND	RFS	APXV18-206517S-C	150°	±115'-0"	0°	REFER TO RFDS ANTENNA SHEET FOR FINAL TILT AND AZIMUTHS	1 5/8"	2	RFS	
GAMMA FACE	1	C-1	(2)-GREEN BAND	RFS	APXV18-206517S-C	270°	±115'-0"	0°	REFER TO RFDS ANTENNA SHEET FOR FINAL TILT AND AZIMUTHS	1 5/8"	2	RFS	
GPS ANTENNA	-	-	-	PC TEL ANT.	GPS-TMG-26NMS	-	±12'-6"	-	-	1/2"	1	RFS	±10'

TOWER NOTES:

1. FOR DETAILED TOWER INFORMATION, REFER TO TOWER ERECTION DRAWINGS BY OTHERS. THE TOWER ON SHEET C-2 IS SHOWN GENERAL CONFIGURATION PURPOSES ONLY.
2. ANTENNA CONFIGURATION IS SUBJECT TO CHANGE. VERIFY ANTENNA HEIGHT, DOWN-TILT, AND AZIMUTH WITH PROJECT MANAGER PRIOR TO CONSTRUCTION.
3. THE TOWER STRUCTURAL SHALL BE REVISED TO REFLECT ANY REVISION IN ANTENNA OR COAX CONFIGURATION.

ANTENNA NOTES:

1. ALL COAX SHALL BE COLOR CODED AT (2) PLACES EACH: AT ANTENNA AND AT CABINET.
2. (2) COLOR BANDS DENOTES TRANSMIT. TRANSMITS TO BE CONNECTED TO THE +45 PORTS OF THE ANTENNAS.
3. PRIOR TO ORDERING ANY ANTENNAS OR COAX, CONTRACTOR SHALL CONTACT POCKET COMMUNICATIONS CONSTRUCTION MANAGER AND OBTAIN APPROVAL FOR MATERIALS LISTED. CONTRACTOR IS SOLELY RESPONSIBLE FOR THIS COORDINATION.

DESIGNED BY: CFC
DRAWN BY: CMS
CHK'D BY: CFC

REV.	DATE	DRAWN BY/CHK'D BY	DESCRIPTION
1	11/05/08	JM	ISSUED FOR CONSTRUCTION
0	10/10/08	CMS / CFC	ISSUED FOR REVIEW

PROFESSIONAL ENGINEER SEAL

pocket COMMUNICATIONS

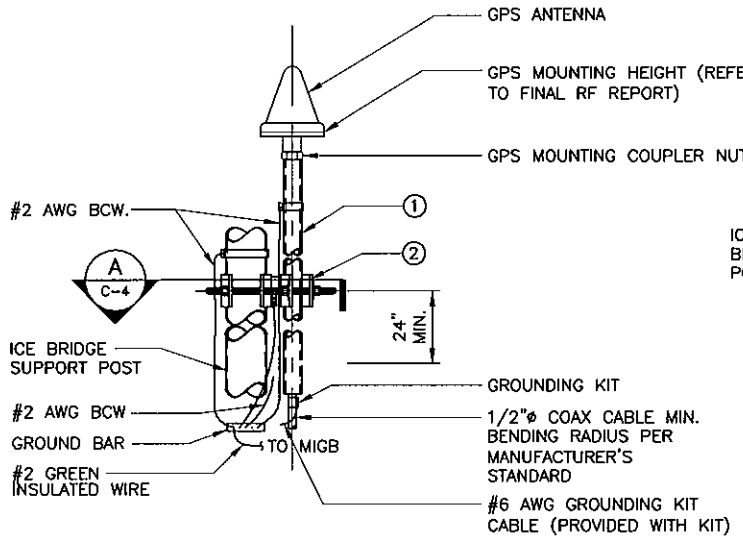
NATEDMMI

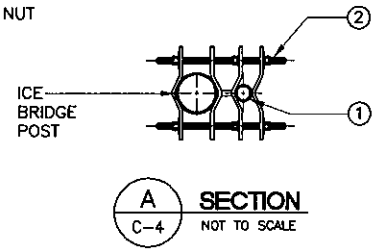
POCKET COMMUNICATIONS
NHCT0550A
5 OLD FARMS ROAD
BARKHAMSTED, CT 06063

DATE: 10/10/08
SCALE: AS SHOWN
JOB NO. 08117.0013

ANTENNA AND COAX DETAILS

SHEET NO.
C-3





GPS ANTENNA MOUNTING BRACKET

BILL OF MATERIALS		
ITEM	DESCRIPTION	QUANTITY
1	1"ø O.D. x 3'-0" LG. ALUMINUM MOUNTING PIPE	1
2	UNIVERSAL CLAMP SET.	1

NOTES:

1. THE ELEVATION AND LOCATION OF THE GPS ANTENNA SHALL BE IN ACCORDANCE WITH THE FINAL RF REPORT.
2. GPS ANTENNA LOCATION MUST BE ABLE TO RECEIVE CLEAR SIGNALS FROM A MINIMUM OF FOUR (4) SATELLITES. CONFIRM WITH HANDHELD GPS PRIOR TO ESTABLISHING FINAL LOCATION OF GPS ANTENNAS.
3. THE GPS ANTENNA MOUNT IS DESIGNED TO FASTEN TO A 1" OUTSIDE DIAMETER ALUMINUM PIPE. THE PIPE MUST NOT BE THREADED AT THE ANTENNA MOUNT END. THE PIPE SHALL BE CUT TO THE REQUIRED LENGTH (MINIMUM OF 24 INCHES) USING A HAND OR ROTARY PIPE CUTTER TO ASSURE A SMOOTH AND PERPENDICULAR CUT. A HACK SAW SHALL NOT BE USED. THE CUT PIPE END SHALL BE DEBURRED AND SMOOTH IN ORDER TO SEAL AGAINST THE NEOPRENE GASKET ATTACHED TO THE ANTENNA MOUNT.

1 / C-4 **GPS GROUNDING/MOUNTING BRACKET DETAIL**

NOT TO SCALE

DESIGNED BY:	CFC
DRAWN BY:	CMS
CHK'D BY:	CFC

REV.	DATE	DRAWN BY/CHK'D BY	DESCRIPTION
1	11/05/08	JV	CFC ISSUED FOR CONSTRUCTION
0	10/10/08	CMS	CFC ISSUED FOR REVIEW

PROFESSIONAL ENGINEER SEAL

pocket COMMUNICATIONS

NATIONWIDE

POCKET COMMUNICATIONS

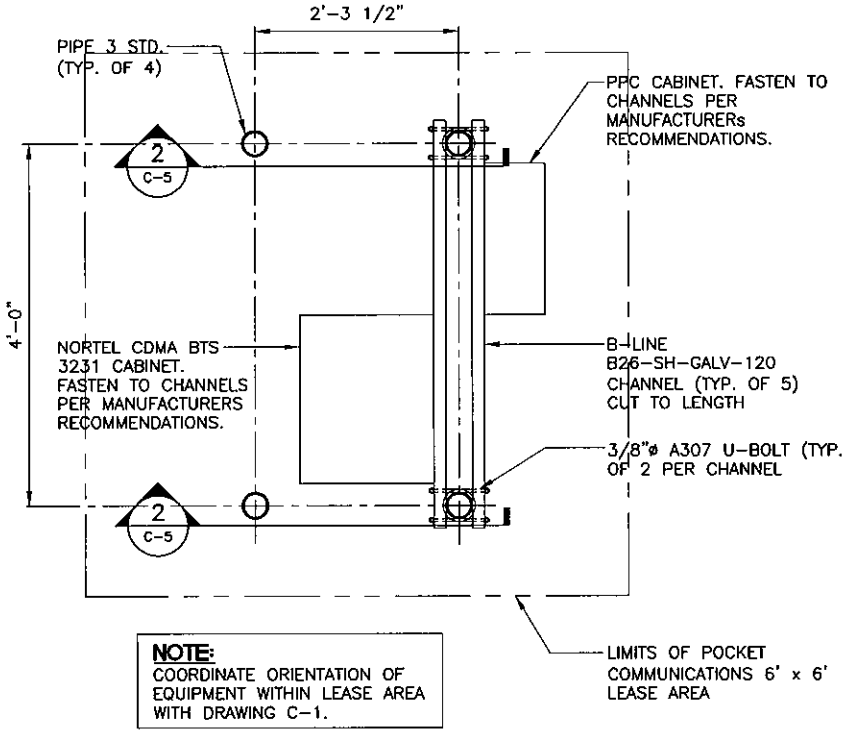
NHCT0550A

5 OLD FARMS ROAD
BARKHAMSTED, CT 06063

DATE:	10/10/08
SCALE:	AS SHOWN
JOB NO.	08117.C013

GPS DETAIL

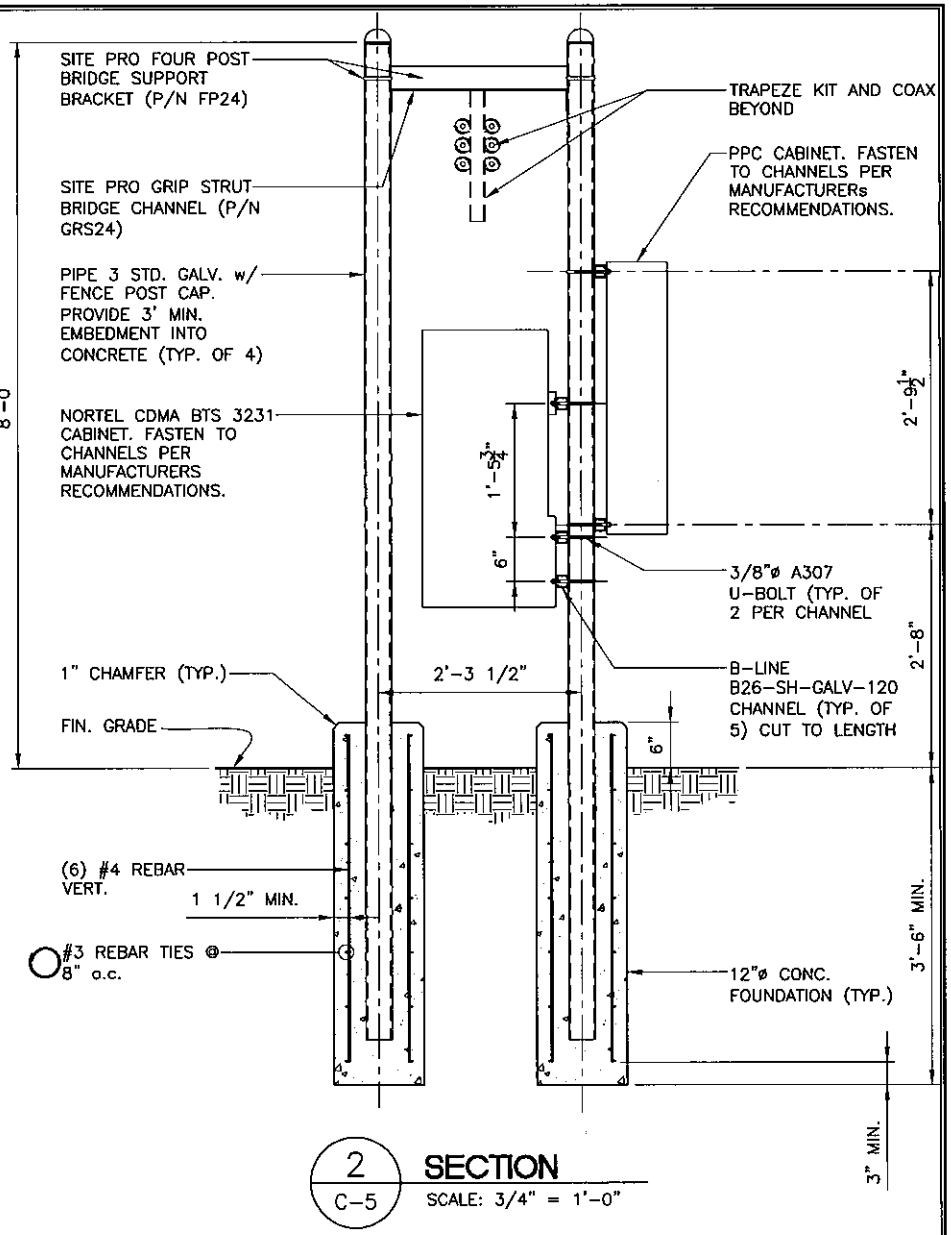
SHEET NO.
C-4



NOTE:
COORDINATE ORIENTATION OF EQUIPMENT WITHIN LEASE AREA WITH DRAWING C-1.

1 / C-5 **EQUIP. CABINET SUPPORT FRAME PLAN**

SCALE: 3/4" = 1'-0"



2 / C-5 **SECTION**

SCALE: 3/4" = 1'-0"

REV.	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
0	10/10/08	CMS	CFC	ISSUED FOR REVIEW
1	11/05/08	JV	CFC	ISSUED FOR CONSTRUCTION

DESIGNED BY: CFC
DRAWN BY: CMS
CHK'D BY: CFC

PROFESSIONAL ENGINEER SEAL

pocket COMMUNICATIONS

NATIONWIDE

POCKET COMMUNICATIONS

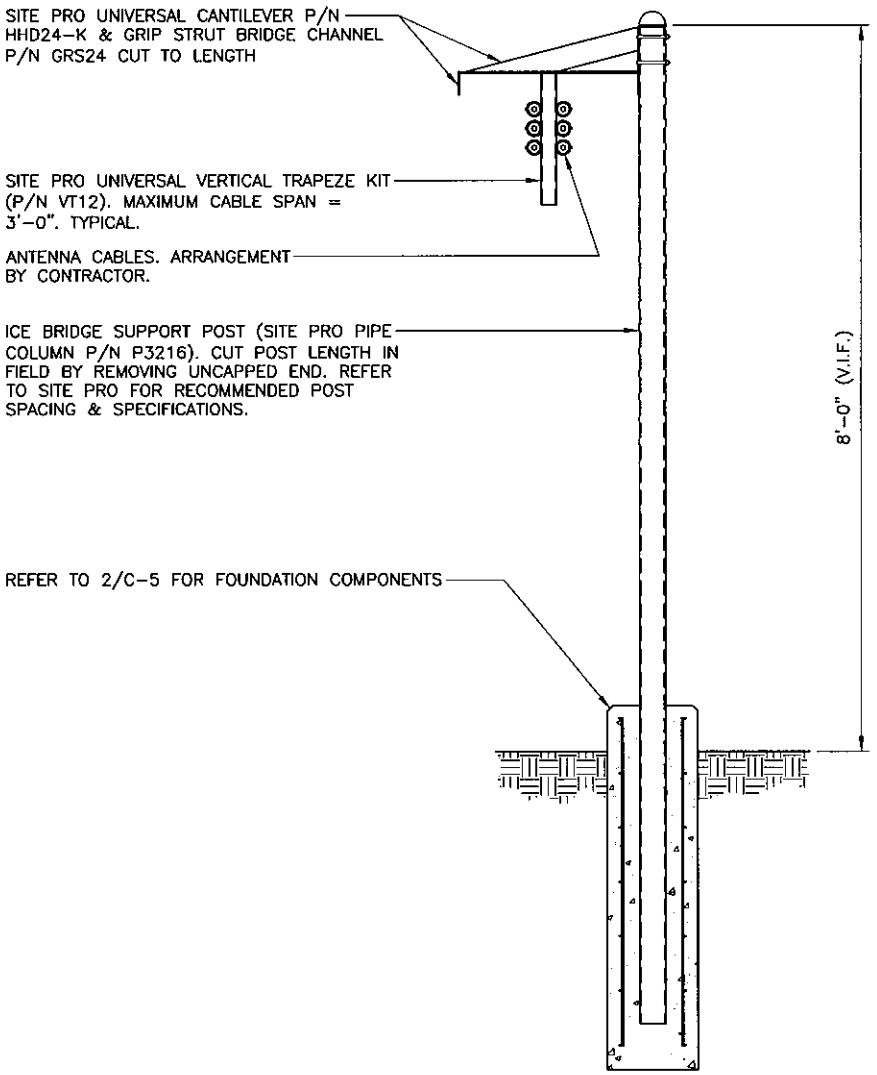
NHCT0550A

5 OLD FARMS ROAD
BARKHAMSTED, CT 06063

DATE: 10/10/08
SCALE: AS SHOWN
JOB NO. 08117.0013

EQUIPMENT CABINET SUPPORT DETAILS

SHEET NO.
C-5



1 / C-6 ICE BRIDGE DETAIL

SCALE: 3/4" = 1'-0"

GENERAL NOTES:

1. THE CONTRACTOR SHALL CALL UTILITIES PRIOR TO THE START OF CONSTRUCTION.
2. ACTIVE EXISTING UTILITIES, WHERE ENCOUNTERED IN THE WORK, SHALL BE PROTECTED AT ALL TIMES. THE ENGINEER SHALL BE NOTIFIED IMMEDIATELY, PRIOR TO PROCEEDING, SHOULD ANY UNCOVERED EXISTING UTILITY PRECLUDE COMPLETION OF THE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
3. ALL RUBBISH, STUMPS, DEBRIS, STICKS, STONES AND OTHER REFUSE SHALL BE REMOVED OFF SITE AND BE LEGALLY DISPOSED, AT NO ADDITIONAL COST.
4. THE SITE SHALL BE GRADED TO CAUSE SURFACE WATER TO FLOW AWAY FROM THE EQUIPMENT AND TOWER AREAS.
5. NO FILL OR EMBANKMENT MATERIAL SHALL BE PLACED ON FROZEN GROUND. FROZEN MATERIALS, SNOW OR ICE SHALL NOT BE PLACED IN ANY FILL OR EMBANKMENT.
6. THE AREAS OF THE COMPOUND DISTURBED BY THE WORK SHALL BE RETURNED TO THEIR ORIGINAL CONDITION.
7. CONTRACTOR SHALL MINIMIZE DISTURBANCE TO EXISTING SITE DURING CONSTRUCTION. EROSION CONTROL MEASURES, SHALL BE IN CONFORMANCE WITH THE LOCAL GUIDELINES FOR EROSION AND SEDIMENT CONTROL.
8. IF ANY FIELD CONDITIONS EXIST WHICH PRECLUDE COMPLIANCE WITH THE DRAWINGS, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER AND SHALL PROCEED WITH AFFECTED WORK AFTER CONFLICT IS SATISFACTORILY RESOLVED.
9. DIMENSIONS AND DETAILS SHALL BE CHECKED AGAINST THE PRE MANUFACTURED EQUIPMENT SHOP DRAWINGS.
10. THE CONTRACTOR SHALL VERIFY AND COORDINATE THE SIZE AND LOCATION OF ALL OPENINGS, SLEEVES AND ANCHOR BOLTS AS REQUIRED BY ALL TRADES.
11. ALL CONCRETE WORK SHALL BE IN ACCORDANCE WITH THE ACI 301, ACI 318.
12. ALL CONCRETE SHALL BE NORMAL WEIGHT, 6% AIR ENTRAINED WITH A MAXIMUM SLUMP OF 4", AND SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3,000 PSI AT 28 DAYS, UNLESS NOTED OTHERWISE ON THE DRAWINGS.
13. REINFORCING STEEL SHALL CONFORM TO ASTM A615, GRADE 60, DEFORMED BARS.
14. PROVIDE 1 1/2 IN. MINIMUM COVER FOR REINFORCING STEEL UNLESS OTHERWISE NOTED ON THE DRAWINGS.
15. ALL STRUCTURAL STEEL IS DESIGNED BY ALLOWABLE STRESS DESIGN (ASD) AND SHALL CONFORM TO ASTM A36, (FY = 36 KSI).
16. ALL STEEL PIPE SHALL CONFORM TO ASTM A53, (FY = 35 KSI).
17. ALL STEEL MATERIAL (EXPOSED TO WEATHER) SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123 "ZINC (HOT DIPPED GALVANIZED) COATINGS" ON IRONS AND STEEL PRODUCTS.
18. ALL BOLTS, ANCHORS AND MISCELLANEOUS HARDWARE SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A153 "ZINC COATING (HOT-DIP) ON IRON AND STEEL HARDWARE".

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CHK'D BY:	CFC		
1	11/25/08	JV	CFC ISSUED FOR CONSTRUCTION
0	10/10/08	CMS	CFC ISSUED FOR REVIEW
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NHCT0550A

5 OLD FARMS ROAD
BARKHAMSTED, CT 06063

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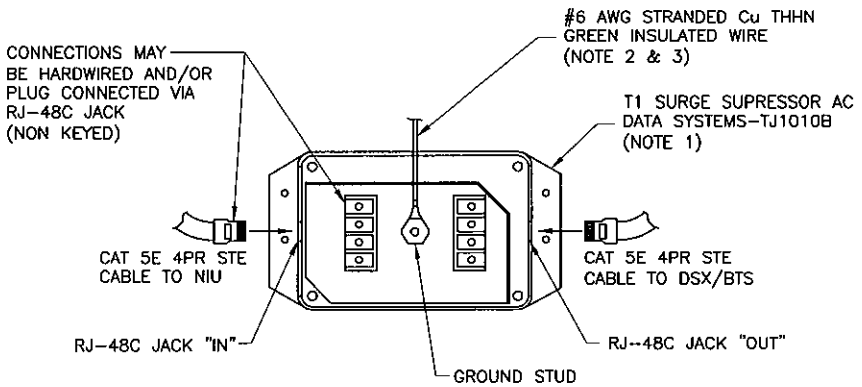
ICE BRIDGE DETAIL AND NOTES

SHEET NO.
C-6
Sheet No. 2 of 13



1 / E-1 **T1 SURGE SUPPRESSOR**

NOT TO SCALE

NOTES:

1. MOUNT T1-TVSS UNIT ON EQUIPMENT FRAME. USE APPROPRIATE STAINLESS STEEL BOLTS WITH FLAT WASHERS AND A LOCK WASHER ON THE NUT SIDE. THE TVSS MAY BE LOCATED ON THE TELCO BACKBOARD. REFER TO MANUFACTURERS INSTRUCTIONS.
2. ATTACH RING TERMINAL FROM SUPPLIED GROUND CONDUCTOR TO TVSS GROUND STUD. SECURELY FASTEN WITH SUPPLIED WASHER AND NUT. REFER TO MANUFACTURERS INSTRUCTIONS. FOR PROPER PERFORMANCE, THE GROUND CONDUCTOR LENGTH SHOULD BE LIMITED WITH NO SHARP BENDS ON COILS.
3. WHEN TVSS IS MOUNTED ON EQUIPMENT FRAME, BOND THE GROUND CONDUCTOR TO THE EQUIPMENT FRAME GROUND. ENSURE PROPER GROUNDING SURFACES. WHEN TVSS IS MOUNTED ON THE TELCO BACKBOARD, BOND THE GROUND CONDUCTOR TO THE TELCO BOARD GROUND BAR OR NEAREST GROUND BAR.

ELECTRICAL NOTES:

1. ALL ELECTRICAL AND GROUNDING WORK TO BE PERFORMED IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS, NEC, AND ALL APPLICABLE LOCAL CODES.
2. CONDUIT ROUTINGS ARE SCHEMATIC. CONTRACTOR SHALL VERIFY ROUTING AND LENGTHS PRIOR TO CONSTRUCTION.
3. WIRING, RACEWAY, AND SUPPORT METHODS AND MATERIALS SHALL COMPLY WITH THE REQUIREMENTS OF THE NEC.
4. THE CONTRACTOR SHALL NOTIFY AND OBTAIN NECESSARY AUTHORIZATION BEFORE COMMENCING WORK ON THE AC POWER DISTRIBUTION PANELS.
5. THE CONTRACTOR SHALL PROVIDE NECESSARY TAGGING ON THE BREAKERS, CABLES AND DISTRIBUTION PANELS IN ACCORDANCE WITH THE APPLICABLE CODES AND STANDARDS TO SAFEGUARD AGAINST LIFE AND PROPERTY.
6. CONTRACTOR SHALL PROVIDE 100 AMP, SINGLE PHASE, 120/240 VAC, 60 HZ SERVICE FOR SITE.
7. CONTRACTOR SHALL COORDINATE WITH UTILITY COMPANY BEFORE THE START OF CONSTRUCTION. POWER AND TELCO CONDUIT SHALL BE PROVIDED AND INSTALLED PER UTILITY REQUIREMENTS.
8. FOR COMPLETE INTERNAL WIRING AND ARRANGEMENT REFER TO DRAWINGS PROVIDED BY AC OR TELCO PANEL MANUFACTURER.
9. ALL SERVICE EQUIPMENT AND INSTALLATIONS SHALL COMPLY WITH THE NEC, UTILITY COMPANY AND LOCAL CODE REQUIREMENTS.
10. CONTRACTOR SHALL INSTALL SUFFICIENT LENGTHS OF LFMC INCLUDING ALL CONDUIT FITTINGS (NUTS, REDUCING BUSHINGS, ELBOWS, COUPLINGS, ETC.) NECESSARY FOR CONNECTION FROM IMC CONDUIT TO THE POWER CABINET.
11. CONTRACTOR SHALL PROVIDE ELECTRICAL SERVICE EQUIPMENT WITH FAULT CURRENT RATINGS GREATER THAN THE AVAILABLE FAULT CURRENT FROM THE POWER UTILITY.
12. CONTRACTOR SHALL VERIFY THAT THE MAIN BONDING JUMPER AND GROUNDING ELECTRODE CONDUCTOR IS INSTALLED PROPERLY IN MAIN DISCONNECT SWITCH.

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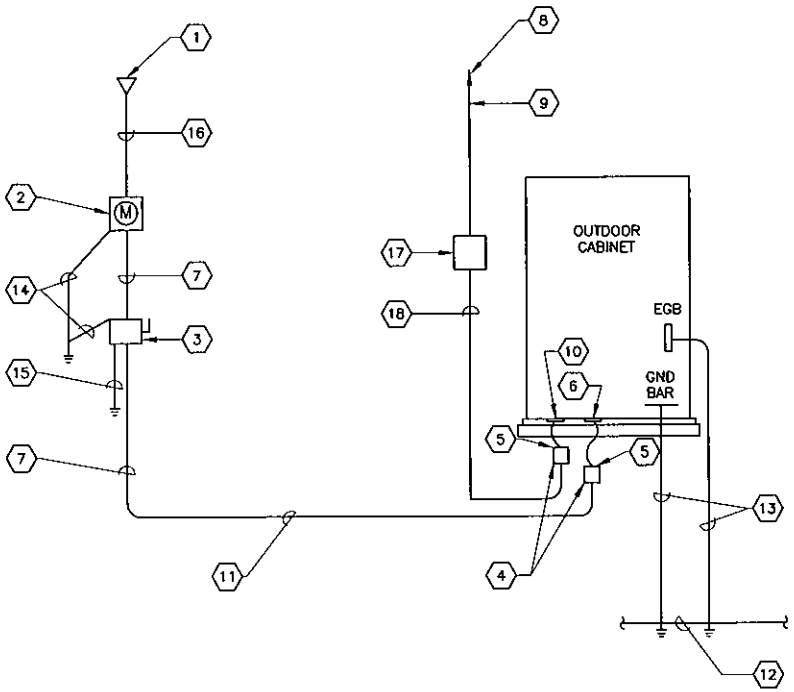
SUPPRESSOR DETAIL AND ELECTRICAL NOTES

SHEET NO.

E-1

Sheet No. 2 of 12



1 / E-2 POWER, TELCO, + GROUND SINGLE LINE DIAGRAM

NOT TO SCALE

REFERENCE NOTES:

1. ELECTRICAL DEMARCATION POINT 120/208V OR 240V, 1ø, 3W. ELECTRICAL CONTRACTOR TO COORDINATE WITH LOCAL POWER FOR SERVICE TO METER.
2. CONTRACTOR TO SUPPLY AND INSTALL A 100A, 120/208/240V 1ø, 3W METER BASE. METER BASE TO BE NEMA 3R RATED AND ACCEPTABLE TO LOCAL UTILITY. PROVIDE WITH MECHANICALLY ATTACHED ENGRAVED IDENTIFICATION LABEL INDICATING "POCKET COMMUNICATIONS METER".
3. MAIN DISCONNECT SWITCH. CONTRACTOR TO SUPPLY AND INSTALL NEMA 3R 100A FUSIBLE DISCONNECT SWITCH WITH LOCKABLE HANDLE. PROVIDE WITH 100A FUSES, AIC RATING TO BE PER LOCAL UTILITY REQUIREMENTS. PROVIDE WITH MECHANICALLY ATTACHED ENGRAVED IDENTIFICATION LABEL INDICATING "POCKET COMMUNICATIONS SERVICE DISCONNECT".
4. WEATHER TIGHT JUNCTION BOX (IF REQUIRED). SIZE TO NEC CODE FOR APPLICATION.
5. LIQUID TIGHT FLEXIBLE METALLIC CONDUIT W/W WEATHER TIGHT FITTINGS AND SUPPORTS. SIZE AND CONTENTS TO MATCH ASSOCIATED USE (POWER OR TELCO).
6. UTILITY POWER ENTRY INTO CABINET. COORDINATE TERMINATION WITH CABINET MANUFACTURER.
7. CONTRACTOR TO SUPPLY AND INSTALL 1 1/2" GRC. AFG AND PVC 36" BFG C/W (3) #1 AWG THHN & (1) #6 GRND FOR UTILITY SERVICE. (INSTALL EXPANSION COUPLINGS AT EACH END OF RUN ABOVE GRADE).
8. TELCO DEMARCATION POINT. ELECTRICAL CONTRACTOR TO COORDINATE WITH LOCAL TELCO FOR SERVICE TO TELCOBOX OR CABINET.
9. CONTRACTOR TO SUPPLY AND INSTALL (1) 2" GRC AFG AND PVC 36" BFG C/W PULL CORDS AND T1 CABLE FOR TELCO SERVICE TO CABINET TERMINATION POINT. VERIFY WITH TELCO REQUIREMENTS (INSTALL EXPANSION COUPLINGS AT EACH END OF RUN ABOVE GRADE).
10. TELCO SERVICE ENTRY INTO CABINET. COORDINATE TERMINATION IN WITH CABINET MANUFACTURER.
11. CONTRACTOR TO ARRANGE AND PAY FOR UNDERGROUND UTILITY LOCATION SURVEYS FOR ALL TRENCHING. REUSE NATIVE BACKFILL AND RETURN TO ORIGINAL CONDITION. INSTALL 6" WIDE METALLIC LINED RED PLASTIC MARKER TAPE 8" ABOVE ALL BURIED CONDUIT.
12. BURIED GROUND RING.
13. (1) #2 SOLID BARE TINNED CU GROUNDING ELECTRODE CONDUCTOR BONDED TO 5/8"X10' COPPER CLAD STEEL GROUNDING ELECTRODES. LOCATE GROUNDING ELECTRODE ADJACENT TO "CABINET". BOND GROUNDING ELECTRODE SYSTEM TO CABINET GROUND RING.
14. #2 AWG GND.
15. #2 AWG SERVICE GROUND.
16. TO UTILITY SOURCE PER UTILITY REQUIREMENTS (COORDINATE WITH ELECTRIC UTILITY).
17. NEMA 3R TELCO BOX.
18. 2" PVC (RGS ABOVE GROUND) W/PULL STRING AND T1 CABLE.

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CHK'D BY:	CFC

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SINGLE LINE DIAGRAM AND NOTES

SHEET NO.
E-2

PANEL "SSC"								
LOAD DESCRIPTION	LOAD (kVA)	BRKR. SIZE	CKT. NO.	PHASE A	PHASE B	CKT. NO.	BRKR. SIZE	LOAD (kVA)	LOAD DESCRIPTION
BTS CABINET	2.5	30/2	1			2	30/2	2.2	TVSS
	2.5		3			4		2.2	
LIGHTING	.9	10/1	5			6	–	–	SPACE
SPACE	–	–	7			8	–	–	SPACE
SPACE	–	–	9			10	–	–	SPACE
SPACE	–	–	11			12	–	–	SPACE
SPACE	–	–	13			14	–	–	SPACE
SPACE	–	–	15			16	–	–	SPACE
SPACE	–	–	17			18	–	–	SPACE
SPACE	–	–	19			20	–	–	SPACE
SPACE	–	–	21			22	–	–	SPACE
SPACE	–	–	23			24	–	–	SPACE
LOAD SUB–TOTAL	5.6	LOAD SUB–TOTAL		10.3 kVA				4.4	LOAD SUB–TOTAL

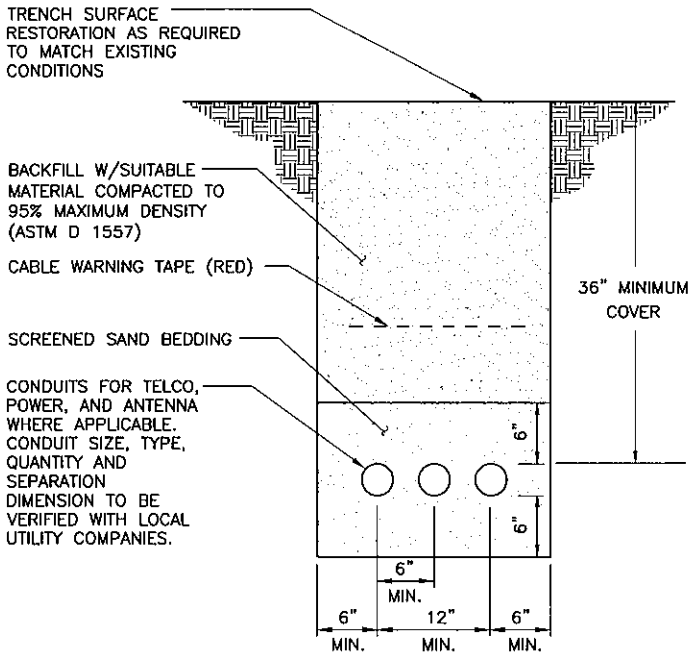
100A MCB, 120/240V, 1ø, 3W (65,000 AIC MIN)		
TOTAL CONNECTED LOAD	10.3 KW	
25% OF LARGEST CONT. LOAD	1250 W	
TOTAL LOADS	11.5 KW	48 AMPS
NOTE: ALL NON–OPTIONAL BREAKERS PROVIDED BY SSC MFR		

NOTE:

CIRCUIT BREAKER SIZES SHOWN ARE TYPICAL. REFER TO EQUIPMENT MANUFACTURING SPECIFICATIONS FOR SITE SPECIFIC CIRCUIT BREAKER REQUIREMENTS.

1 / E–3 **PANEL SCHEDULE**

NOT TO SCALE



NOTES:

1. THE CLEAN FILL SHALL PASS THROUGH A 3/8" MESH SCREEN AND SHALL NOT CONTAIN SHARP STONES. OTHER BACKFILL SHALL NOT CONTAIN ASHES, CINDERS, SHELLS, FROZEN MATERIAL, LOOSE DEBRIS OR STONES LARGER THAN 2" IN MAXIMUM DIMENSION.
2. WHERE EXISTING UTILITIES ARE LIKELY TO BE ENCOUNTERED, CONTRACTOR SHALL HAND DIG AND PROTECT EXISTING UTILITIES.

2 / E–3 **BURIED CONDUIT DETAIL**

NOT TO SCALE

DESIGNED BY: CFC
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CHK'D BY: CFC

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1	11/05/08	JV	CMS	CFC ISSUED FOR CONSTRUCTION
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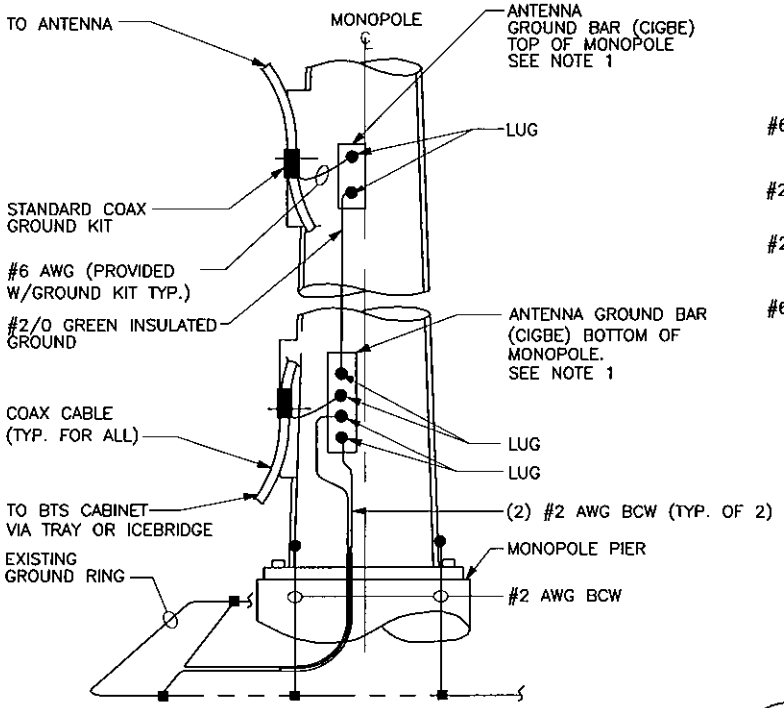
PANEL AND BURIED CONDUIT DETAIL

SHEET NO.
E-3

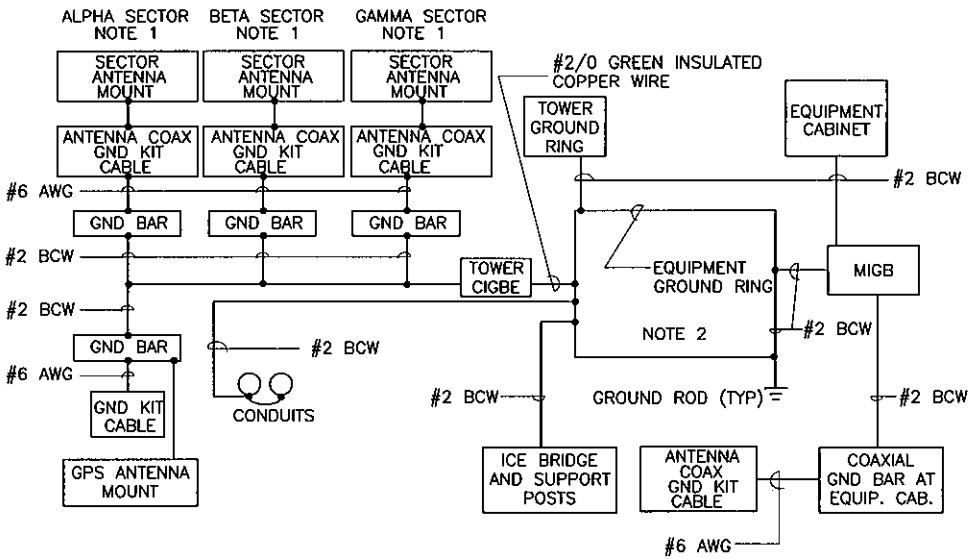


NOTES:

1. NUMBER OF GROUND BARS MAY VARY DEPENDING ON THE TYPE OF TOWER, LOCATION AND CONNECTION ORIENTATION. PROVIDE AS REQUIRED.
2. A SEPARATE GROUND BAR TO BE USED FOR GPS ANTENNA IF REQUIRED.

1 E-4 ANTENNA CABLE GROUNDING DETAIL

NOT TO SCALE



NOTES:

1. BOND ANTENNA GROUNDING KIT CABLE AND ANY OTHER ELEMENTS REQUIRING A GROUND CONNECTION (TMA'S, ETC.) TO GROUND BAR.
2. FOR GROUNDING CONNECTION & DETAILS, SEE LAYOUT DRAWINGS.

2 E-4 SCHEMATIC DIAGRAM - GROUNDING SYSTEM

NOT TO SCALE

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1	11/05/08	JV	CMS	CFC ISSUED FOR CONSTRUCTION
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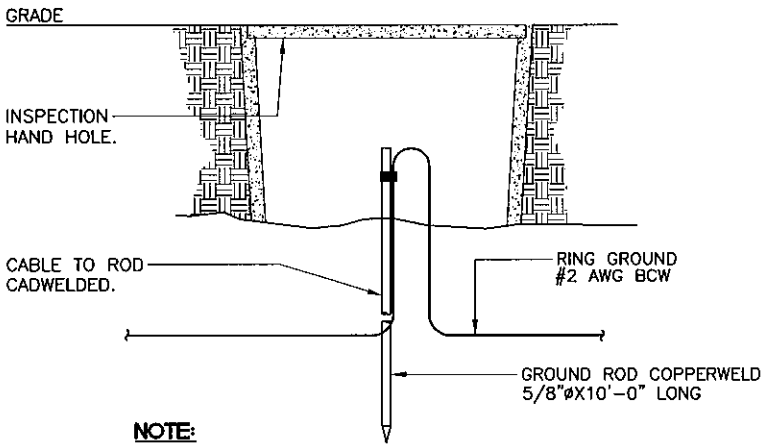
ANTENNA CABLE GROUNDING DETAIL

SHEET NO. E-4

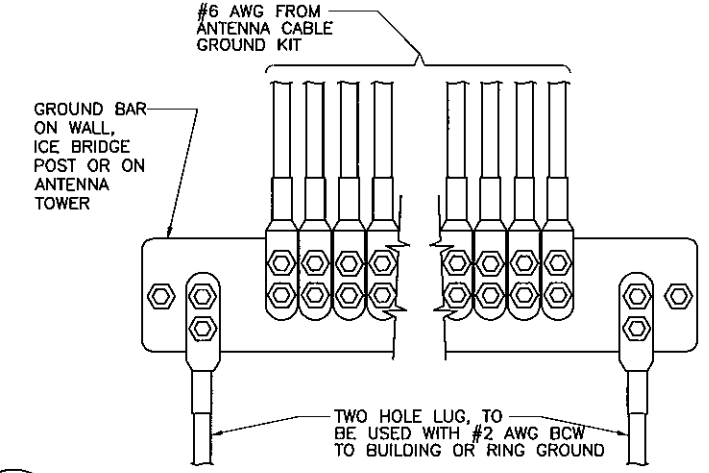


NOTE:

1. INSPECTION HAND HOLE MAY BE CONCRETE OR PVC AND SHALL BE A MINIMUM OF 12" DIA X 18" DEEP.

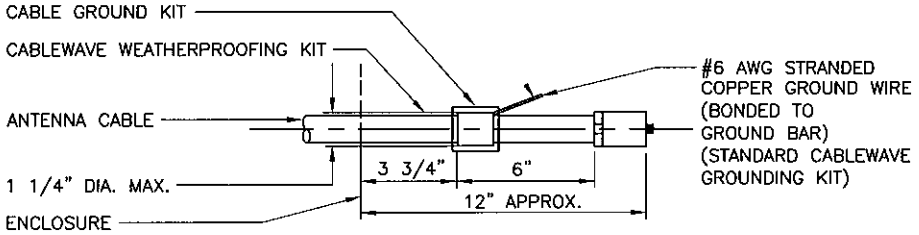
1 / E-5 GROUND ROD WITH ACCESS DETAIL

NOT TO SCALE



2 / E-5 INSTALLATION OF GROUND WIRE TO GROUND BAR

NOT TO SCALE

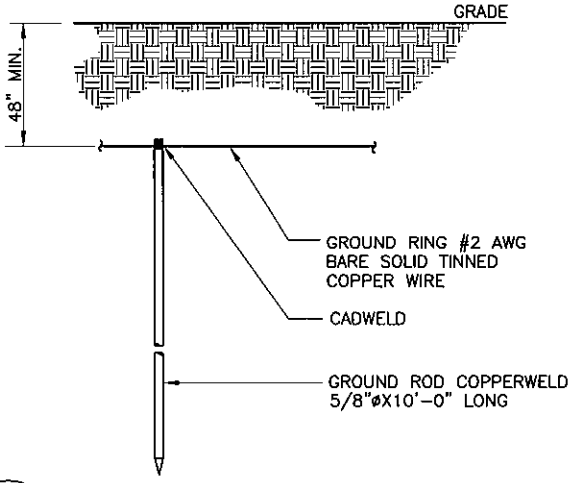


NOTES:

1. DO NOT INSTALL CABLE GROUND KIT AT A BEND AND ALWAYS DIRECT GROUND WIRE DOWN TO GROUND BAR.
2. GROUNDING KIT SHALL BE TYPE AND PART NUMBER AS SUPPLIED OR RECOMMENDED BY CABLE MANUFACTURER.
3. WEATHER PROOFING SHALL BE TYPE AND PART NUMBER AS SUPPLIED OR RECOMMENDED BY CABLE MANUFACTURER.

3 / E-5 CABLE GROUNDING ANTENNA DETAIL

NOT TO SCALE



4 / E-5 GROUND ROD DETAIL

NOT TO SCALE

DESIGNED BY:	CPC
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3	11/26/08	JM	CPC	ISSUED FOR CONSTRUCTION
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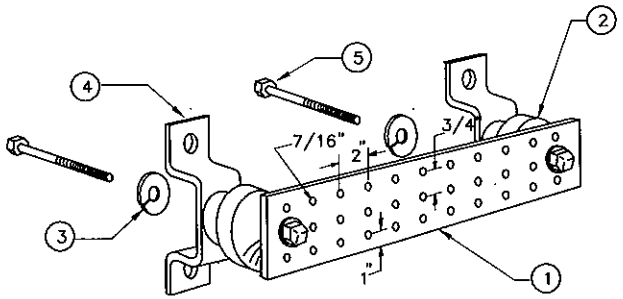
GROUNDING DETAILS

SHEET NO.
E-5

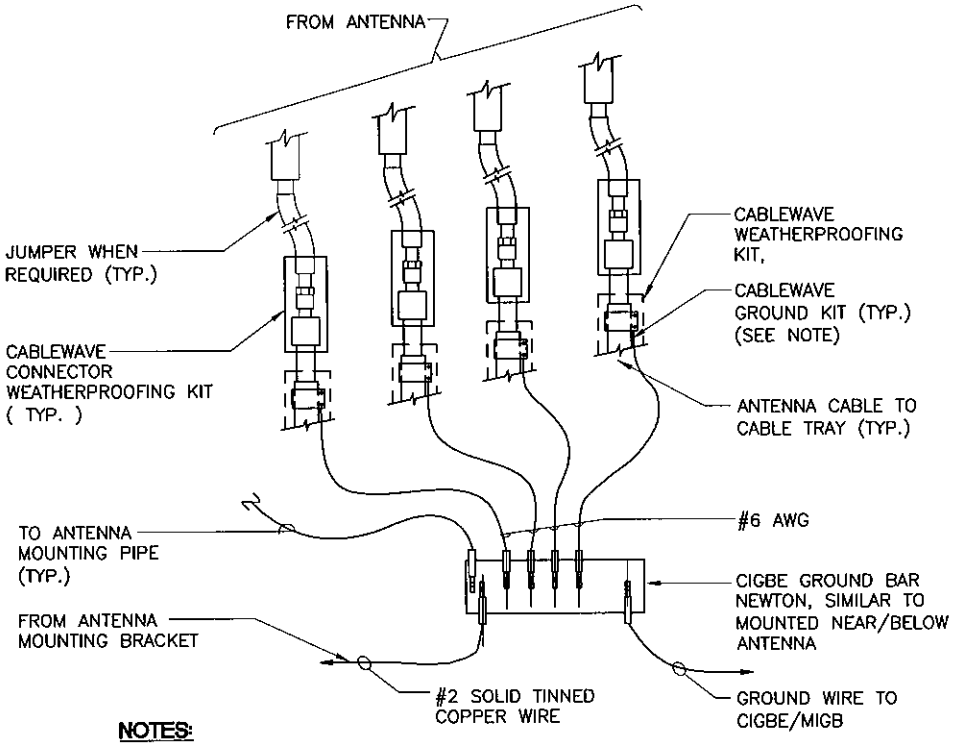


NOTES:

1. TINNED COPPER GROUND BAR, 1/4"X 4"X 20", NEWTON INSTRUMENT CO. HOLE CENTERS TO MATCH NEMA DOUBLE LUG CONFIGURATION
2. INSULATORS, NEWTON INSTRUMENT CAT. NO. 3061-4
3. 5/8" LOCK WASHERS, NEWTON INSTRUMENT CO. CAT. NO. 3015-8
4. WALL MOUNTING BRACKET, NEWTON INSTRUMENT CO. CAT NO. A-6056
5. 5/8-11 X 1" H.H.C.S.BOLTS, NEWTON INSTRUMENT CO. CAT NO. 3012-1
6. LABEL "DO NOT DISCONNECT".
7. SECTOR CIGBE GROUND BAR TO BE SIZED FOR (4) ANTENNAS AND (4) BRACKETS OR MASTS. ALL OTHER GROUND BARS SHALL BE SIZED TO ACCOMMODATE ALL GROUNDING CONNECTIONS REQUIRED PLUS PROVIDE 50% SPARE CAPACITY.

1 / E-6 **GROUND BAR DETAIL**

NOT TO SCALE



NOTES:

1. DO NOT INSTALL CABLE GROUND KIT AT A BEND AND ALWAYS DIRECT GROUND WIRE DOWN TO CIGBE.
2. QTY OF CABLES FROM ANTENNA AS REQUIRED BY OWNER.

2 / E-6 **CONNECTION OF GROUND WIRES TO GROUND BAR**

NOT TO SCALE

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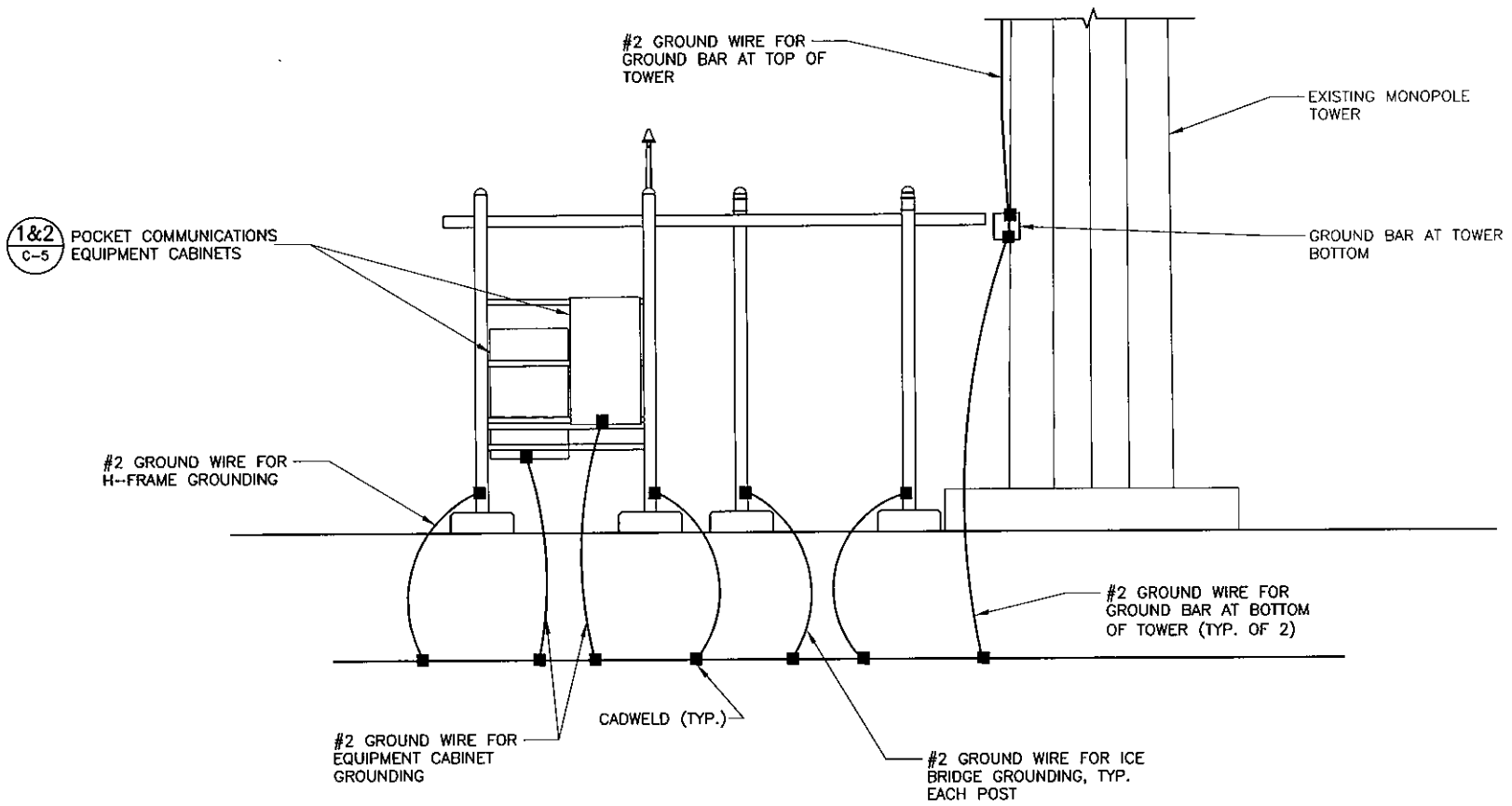
GROUNDING DETAILS

SHEET NO.
E-6
Sheet No. 12 of 15



1 / E-7 **GROUNDING RISER**

NOT TO SCALE

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GROUNDING RISER

SHEET NO.
E-7
Sheet No. 13 of 14

Exhibit C

Equipment Specifications

Pocket Site NHCT0550A

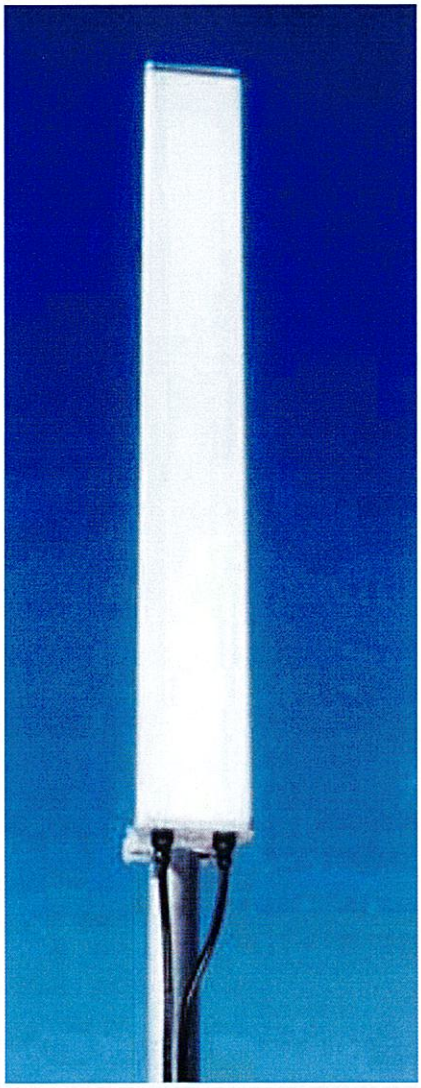
5 Old Farms Road

Barkhamsted, Connecticut

Technical Data Sheet APXV18-206517S-C

Product Description

This variable tilt antenna provides exceptional suppression of all upper sidelobes at all downtilt angles. It also features null fill and a wide downtilt range with optional remote tilt.



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).
- Optional remote tilt - can be retrofitted.
- Broadband design.
- Dual polarization.
- Low profile for low visual impact.

Technical Features

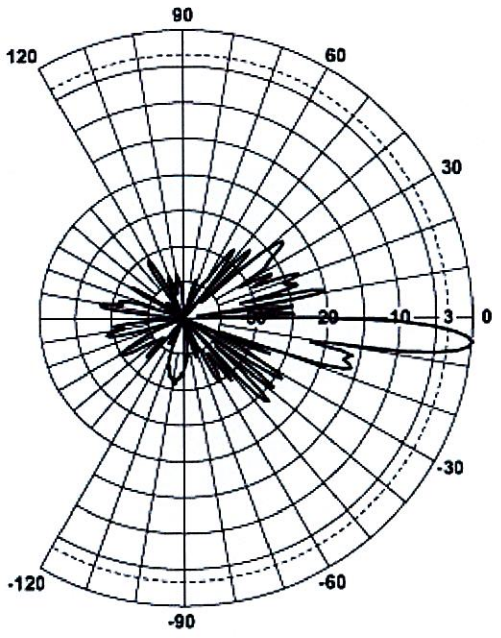
Frequency Band	3G/UMTS (Single, Broad, Dual and Triple-Band)
Horizontal Pattern	Directional
Antenna Type	Panel Dual Polarized
Electrical Down Tilt Option	Variable

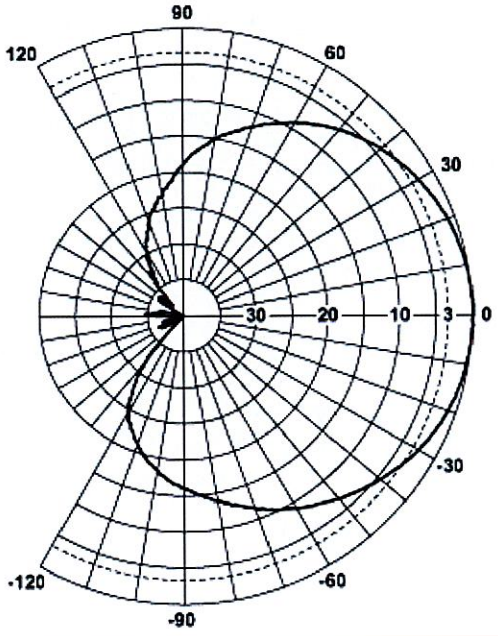
Technical Data Sheet | APXV18-206517S-C

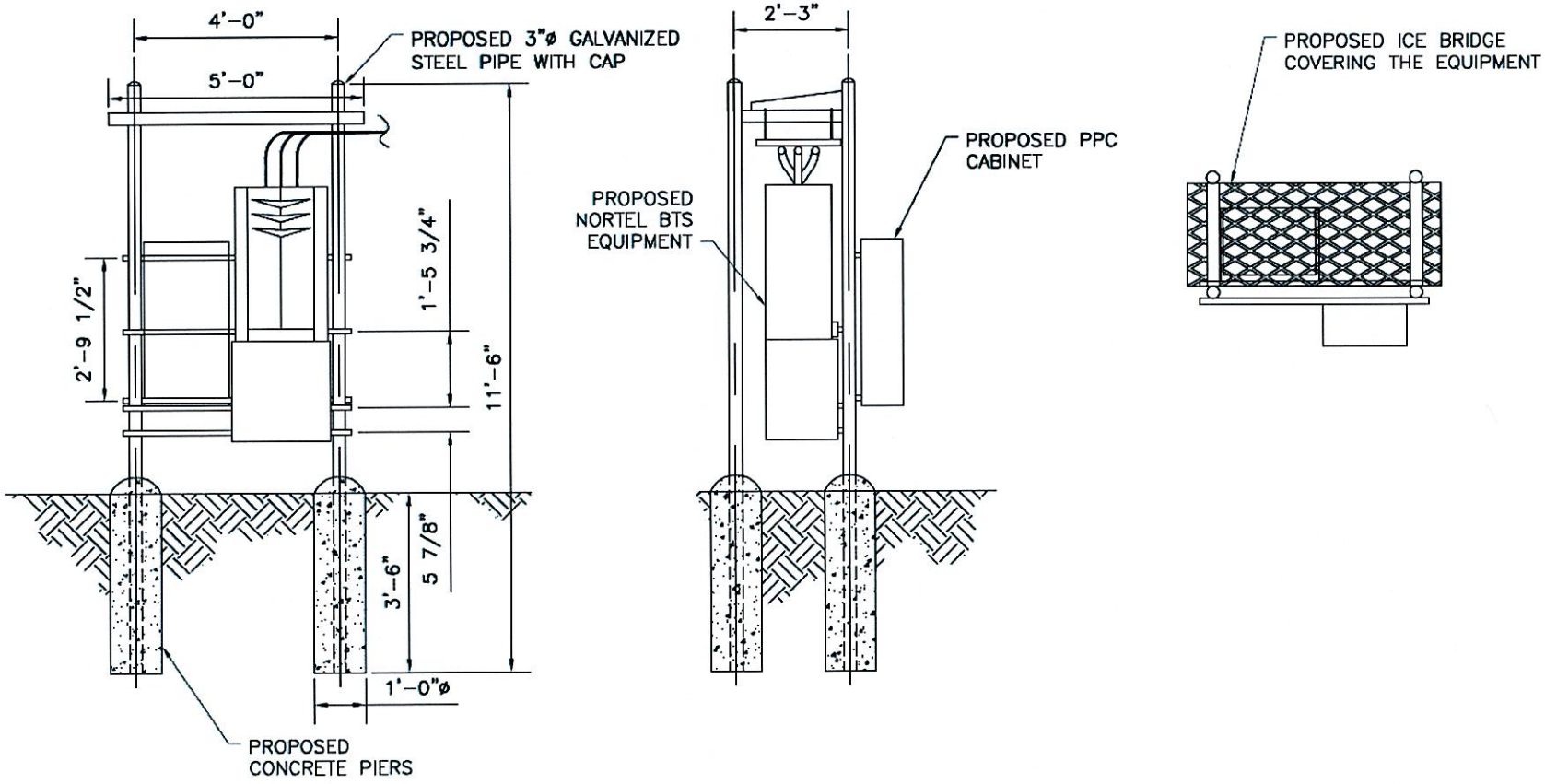
Gain, dBi (dBd)	18.8 (16.7) , 19.0 (16.9)
Frequency Range, MHz	1710-1900, 1900-2170
Connector Type	(2) 7-16 DIN Female
Connector Location	Bottom
Mount Type	Downtilt
Electrical Downtilt, deg	0-10
Horizontal Beamwidth, deg	67 , 63
Mounting Hardware	APM40-2
Rated Wind Speed, km/h (mph)	160 (100)
VSWR	< 1.5:1
Vertical Beamwidth, deg	5.0 , 4.6
Upper Sidelobe Suppression, dB	>17 , >18 all (Typically >20)
Polarization	Dual pol +/-45°
Front-To-Back Ratio, dB	>30
Maximum Power Input, W	300
Isolation between Ports, dB	>30
Lightning Protection	Direct Ground
3rd Order IMP @ 2 x 43 dBm, dBc	>150
7th Order IMP @ 2x46 dBm, dBc	>170
Impedance, Ohms	50
Overall Length, m (ft)	1.85 (6.06)
Mounting Hardware Weight, kg (lb)	3.4 (7.5)
Dimensions - HxWxD, mm (in)	1850 x 175 x 80 (72.0 x 6.8 x 3.15)
Weight w/o Mtg Hardware, kg (lb)	12 (26.4)
Weight w/ Mtg Hardware, kg (lb)	14.8 (32.5)
Radiating Element Material	Brass
Radome Color	Light Grey RAL7035
Radome Material	Fiberglass
Mounting Hardware Material	Diecasted Aluminum
Reflector Material	Aluminum
Max Wind Loading Area, m^2 (ft^2)	0.31 (3.3)
Survival Wind Speed, km/h (mph)	200 (125)
Maximum Thrust @ Rated Wind, N (lbf)	558 (125)
Front Thrust @ Rated Wind, N (lbf)	558 (125)
Shipping Weight, kg (lb)	18.3 (39.8)
Packing Dimensions, HxWxD, mm (in)	2021 x 260 x 200 (79.5 x 10.2 x 7.8)
Packing Dimensions - HxWxD, m (ft)	2.0 x 0.26 x 0.2 (6.6 x 0.85 x 0.65)

Notes

For additional mounting information please click "External Document Link" below.







Pocket/Youghiogheny Communications – Northeast, LLC

Rack Detail

>BUSINESS MADE **SIMPLE**

NORTEL

CDMA BTS 3231 AWS 1.7/2.1 GHz (Outdoor/Indoor)

CDMA BTS 3231

Industry's Highest Capacity AWS Micro BTS

The CDMA BTS 3231 is the latest extension to Nortel Networks BTS (Base Transceiver Station) portfolio providing the ideal solution for urban, sub-urban and rural deployments. The CDMA BTS 3231 is a 3-carrier, 3-sector outdoor/indoor BTS operating at the AWS band of 1.7/2.1 GHz supporting IS-95, 1XRTT and 1xEV-DO simultaneously. BTS 3231 provides flexible deployments solutions including floor, rack, and wall mount options. The power consumption of BTS3231 is industry leading consuming only 630W for 3C3S. The BTS 3231 is also very light at 240lbs making it easy to transport to hard to reach locations such as the top of a high rise building.

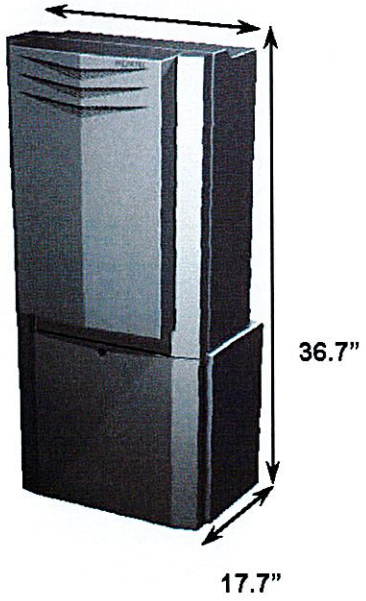


Exhibit D

Power Density Calculations

Pocket Site NHCT0550A

5 Old Farms Road

Barkhamsted, Connecticut

C Squared Systems, LLC
920 Candia Road
Manchester, NH 03109
Phone: (603) 657 9702
E-mail:
support@csquaredsystems.com

Calculated Radio Frequency Emissions

NHCT0550

5 Old Farms Rd, Barkhamsted, CT

Table of Contents

List of Tables

1. Introduction

The purpose of this report is to investigate compliance with applicable FCC regulations for the proposed Pocket antennas to be installed on the existing monopole at 5 Old Farms Rd, Barkhamsted, CT.

These calculations assume that the antennas are operating at 100 percent capacity, that all antenna channels are transmitting simultaneously, and that the radio transmitters are operating at full power. Obstructions (trees, buildings etc.) that would normally attenuate the signal are not taken into account. As a result, the predicted signal levels are much more conservative (higher) than the actual signal levels will be from the finished installation.

Public exposure to radio frequencies is regulated and enforced in units of microwatts per square centimeter (mW/ cm^2). The number of mW/cm^2 emitted is called the power density. The general population exposure limit for the cellular band is 0.567-0.593 mW/ cm^2, and the general population exposure limit for the PCS/AWS band is 1.0 mW/ 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.

The FCC general population / uncontrolled limits set the maximum exposure to which most people may be subjected. General population / uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

Higher exposure limits are permitted under the occupational / controlled exposure category, but only for persons who are exposed as a consequence of their employment and who have been made fully aware of the potential for exposure (through training), and they must be able to exercise control over their exposure. General population / uncontrolled limits are five times more stringent than the levels that are acceptable for occupational, or radio frequency trained individuals."

The FCC describes exposure to radio frequency (RF) energy in terms of percentage of maximum permissible exposure (MPE) with 100% being the maximum allowed. Rather than the FCC presenting the user specification in terms of complex power density figures over a specified surface area, this MPE measure is particularly useful, and even more so when considering that power density limits actually vary by frequency because of the different absorptive properties of the human body at different frequencies.

MPE limits are specified as time-averaged exposure limits. This means that exposure can be averaged over 30 minutes for general population / uncontrolled exposure (or 6 minutes for occupational / controlled exposure). However, for the case of exposure of the general public, time averaging is usually not applied because of uncertainties over exact exposure conditions and difficulty in controlling time of exposure. Therefore, the typical conservative approach is to assume that any RF exposure to the general public will be continuous.

Finally, it should be noted that the MPE limits adopted by the FCC for both general population / uncontrolled exposure and for occupational / controlled exposure incorporate a substantial margin of safety and have been established to be well below levels generally accepted as having the potential to cause adverse health effects.

2. FCC Guidelines for Evaluating RF Radiation Exposure Limits

In 1985, the FCC established rules to regulate radio frequency (RF) exposure from FCC licensed antenna facilities. In 1996, the FCC updated these rules, which were further amended in August 1997 by OET Bulletin 65 Edition 97-01. These new rules include limits for Maximum Permissible Exposure (MPE) for transmitters operating between 300 kHz and 100 GHz. The FCC MPE limits are based on exposure limits recommended by the National Council on Radiation Protection and Measurements (NCRP), the exposure limits developed by the Institute of Electrical and Electronics Engineers, Inc., (IEEE) and adopted by the American National Standards Institute (ANSI).

Attachment B contains excerpts from OET Bulletin 65 and defines the Maximum Exposure Limit. As shown in these excerpts, each frequency band has different exposure limits, requiring power density to be reported as a percent of Maximum Permissible Exposure (MPE) when dealing with carriers transmitting in different frequency bands.

3. RF Exposure Prediction Methods

The emission field calculation results displayed in the following figures were generated using the following formula as outlined in FCC bulletin OET 65:

$$\text{Power Density} = \left(\frac{EIRP}{\pi \times R^2}\right) \times \text{Off Beam Loss}$$

Where:

EIRP = Effective Isotropic Radiated Power

R = Radial Distance = $\sqrt{(H^2 + V^2)}$

H = Horizontal Distance from antenna

V = Vertical Distance from bottom of antenna

Off Beam Loss is determined by the selected antenna patterns

4. Calculation Results

Table 1 below outlines the power density information for the site. All information for carriers other than Pocket was obtained from current CSC database, except where otherwise noted.[1]

Carrier	Number of Trans.	Effective Radiated Power (ERP) Per Transmitter (Watts)	Antenna Height (Feet)	Operating Frequency (MHz)	Total ERP (Watts)	Power Density (mw/cm^2)	Limit	%MPE
Verizon	9	485	145	1970	4365	0.0746	1.0000	7.46%
Verizon	9	200	145	875	1800	0.0308	0.5833	5.28%
AT&T	2	296	135	880	592	0.0117	0.5867	1.99%
AT&T	2	427	135	1930	854	0.0168	1.0000	1.68%
T-Mobile	8	162	124	1945	1296	0.0303	1.0000	3.03%
Pocket	3	631	115	2130-2133.75	1893	0.0573	1.0000	5.73%
							Total	25.18%

Table 1: Proposed Carrier Information

5. Conclusion

The above analysis verifies that emissions from the proposed site will be well below the maximum power density levels as outlined by the FCC in the OET Bulletin 65 Ed. 97-01. Even when using conservative methods, the cumulative power density from the proposed transmit antennas at the existing facility is well below the limits for the general public. The highest expected percent of Maximum Permissible Exposure at the base of the tower is 25.18% of the FCC limit.

As noted in the introduction, obstructions (trees, buildings etc.) that would normally attenuate the signal are not taken into account. As a result, the predicted signal levels are more conservative (higher) than the actual signal levels will be from the finished installation.

[1] Based on the Structural Analysis Report submitted by Natcomm on 10/28/08 (Attachment C), AT&T has relocated their antennas from 105' centerline to 135' centerline. The associated %MPE values have been updated based on the new height. The calculated total %MPE value incorporates this update. (Gray type in Table 1 above denotes recommended updates for CSC database.)

6. Statement of Certification

I certify to the best of my knowledge that the statements in this report are true and accurate. The calculations follow guidelines set forth in ANSI/IEEE Std. C95.3, ANSI/IEE Std. C95.1 and FCC OET Bulletin 65 Edition 97-01.

December 19, 2008
Date

Daniel l. Goulet
C Squared Systems, LLC

Attachment A: References

OET Bulletin 65 - Edition 97-01 - August 1997 Federal Communications Commission Office of Engineering & Technology

ANSI C95.1-1982, American National Standard Safety Levels With Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 300 kHz to 100 GHz. IEEE-SA Standards Board

IEEE Std C95.3-1991 (Reaff 1997), IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave. IEEE-SA Standards Board

Attachment B: FCC Limits For Maximum Permissible Exposure (MPE)

(A) Limits for Occupational/Controlled Exposure

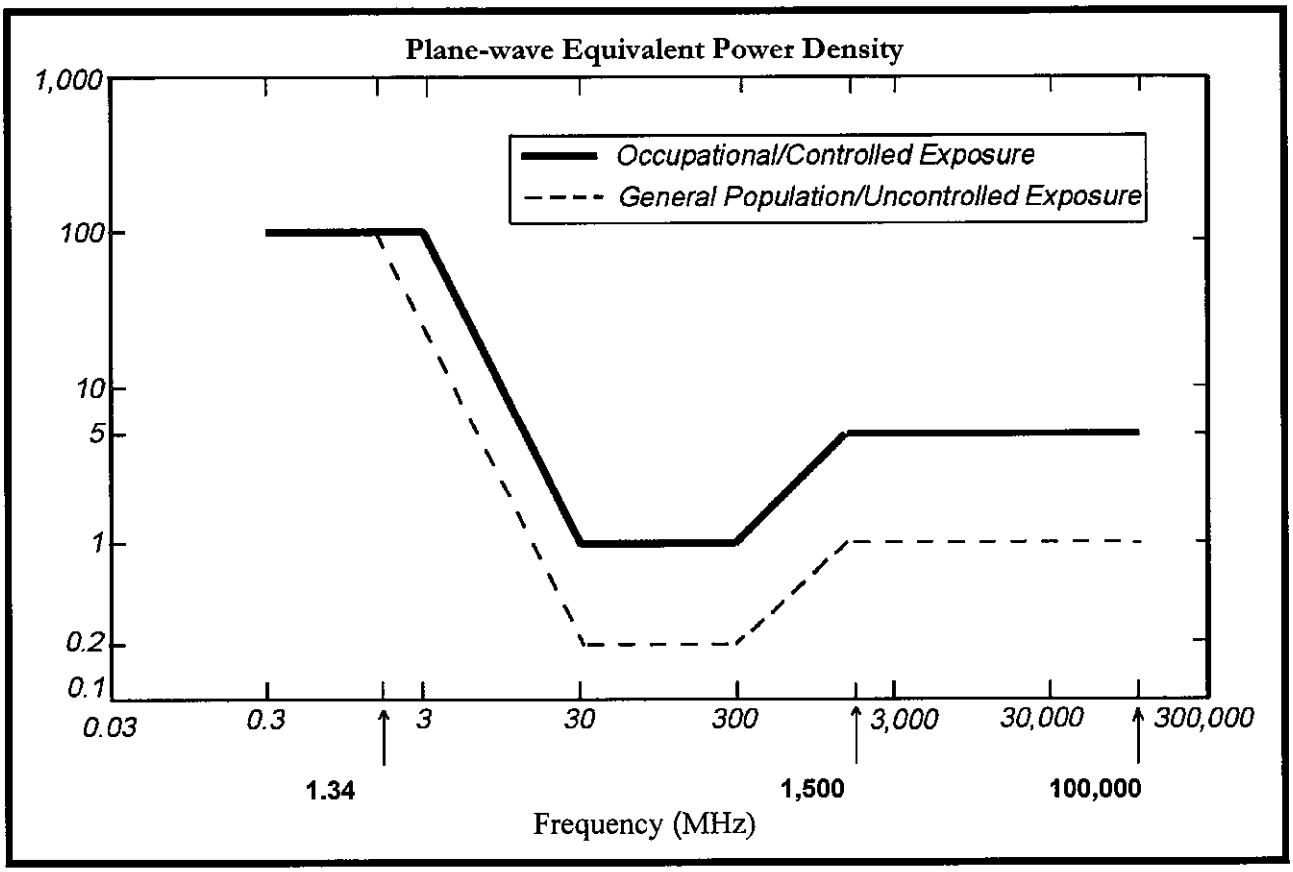
Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (E) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	($900/f^2$)*	6
30-300	61.4	0.163	1.0	6
300-1500	-	-	f/300	6
1500-100,000	-	-	5	6

(B) Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (E) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	($180/f^2$)*	30
30-300	27.5	0.073	0.2	30
300-1500	-	-	f/1500	30
1500-100,000	-	-	1.0	30

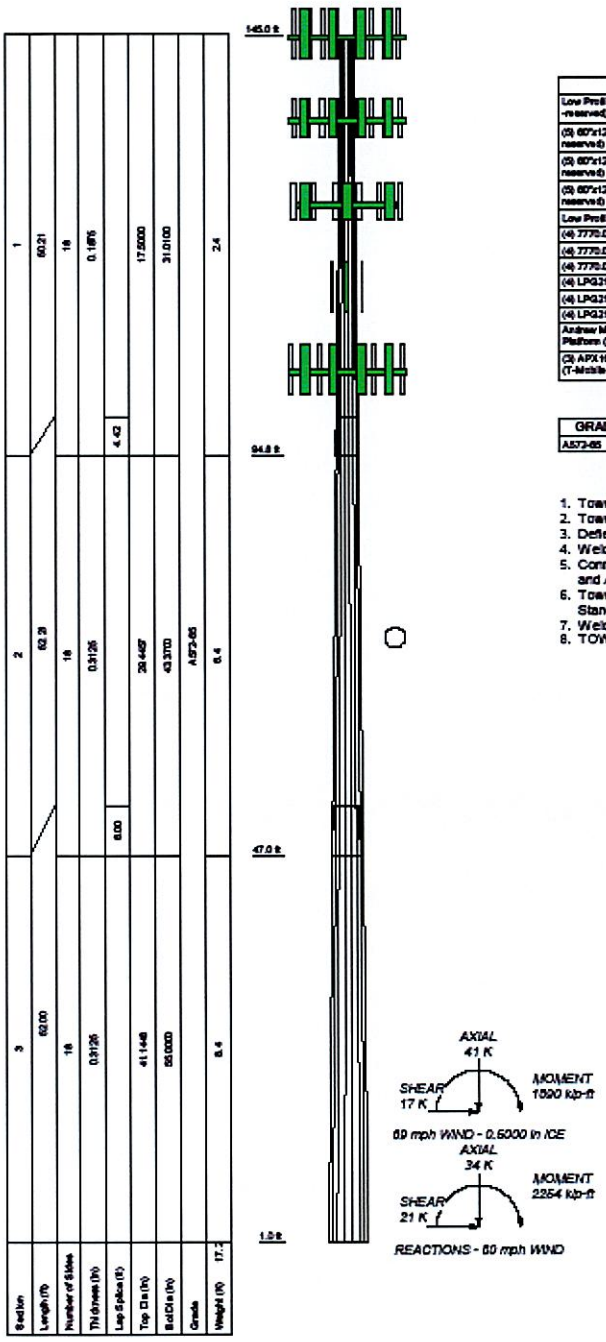
f = frequency in MHz * Plane-wave equivalent power density

NOTE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.
NOTE 2: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.



• FCC Limits for Maximum Permissible Exposure (MPE)

Attachment C: NATCOMM Structural Analysis



Section	1	2	3
Length (ft)	50.21	52.29	52.00
Number of Sides	18	18	18
Thickness (in)	0.1875	0.3125	0.3125
Lap Splice (ft)	4.42	8.00	
Top Dia (in)	17.5000	29.4457	41.1449
Bot Dia (in)	31.0100	43.3700	55.0000
Grade	A572-65		
Weight (K)	17.2	24	64

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Low Profile Platform (Verizon -reserved)	145	(3) APX16DWV-16DWV-S-E-ACU (T-Mobile - reserved)	125
(3) 60"x12"x4" Panel (Verizon - reserved)	145	(3) APX16DWV-16DWV-S-E-ACU (T-Mobile - reserved)	125
(3) 60"x12"x4" Panel (Verizon - reserved)	145	(2) DTMA-1819-DD-12 (T-Mobile - reserved)	125
(3) 60"x12"x4" Panel (Verizon - reserved)	145	(2) DTMA-1819-DD-12 (T-Mobile - reserved)	125
Low Profile Platform (AT&T)	135	(2) DTMA-1819-DD-12 (T-Mobile - reserved)	125
(4) 7770.00 (AT&T)	135	APXV18-206517S-C (Pocket)	115
(4) 7770.00 (AT&T)	135	APXV18-206517S-C (Pocket)	115
(4) 7770.00 (AT&T)	135	APXV18-206517S-C (Pocket)	115
(4) LPG21401 TMA (AT&T)	135	Uni-Tilt Bracket (Pocket)	115
(4) LPG21401 TMA (AT&T)	135	(4) 4'x1' Panel (Future)	105
Andrew MC-PK12S-8-72 Low Profile Platform (T-Mobile - reserved)	125	Low Profile Platform (Future)	105
(3) APX16DWV-16DWV-S-E-ACU (T-Mobile - reserved)	125	(4) 4'x1' Panel (Future)	105
		(4) 4'x1' Panel (Future)	105

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower designed for a 80 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 69 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: 91.2%

NATTCOM INC 63-3 N Branford Rd Branford, CT 06405 Phone: (203) 488-0580 FAX: (203) 488-8587	Job: 145' EEI Monopole		
	Project: 5 Old Farms Road, Barkhamsted, CT		
	Client: Verizon Wireless - Pocket	Drawn by: Staff	Appd:
	Code: TIA/EIA-222-F	Date: 10/28/08	Scale: NTS
	Path:		Dwg No. E-1

Exhibit E

Structural Analysis

Pocket Site NHCT0550A

5 Old Farms Road

Barkhamsted, Connecticut

NATCOMM INC.
CONSULTING ENGINEERS

Structural Analysis Report

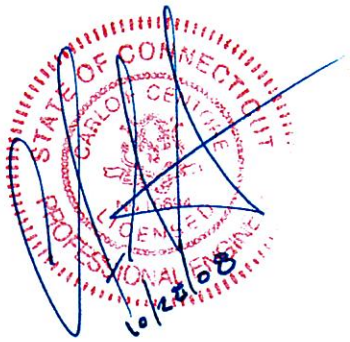
145' Existing Monopole

Pocket Wireless NHCT-0550

Verizon Site Ref: Barkhamsted West
5 Old Farms Road
Barkhamsted, CT

Natcomm Project No. 08136-CO-06

Date: October 28, 2008



Prepared for:

Verizon Wireless
99 East River Road, 9th Floor
East Hartford, CT 06108

p: 203.488.0580
f: 203.488.8587
w: nat-eng.com
63-2 N. Branford Rd.
Branford, CT 06405

Table of Contents

Natcomm, Inc.
Structural Monopole Analysis
145' Existing EEI Monopole
Barkhamsted, CT
October 28, 2008

Introduction

The purpose of this report is to summarize the results of the non-linear, P-Δ structural analysis of the antenna installation proposed by Pocket Wireless on behalf of Verizon Wireless on the existing monopole (tower) located in Barkhamsted, Connecticut.

The host tower is a 145-ft, three-section, eighteen sided, tapered monopole originally designed and manufactured by Engineered Endeavors Inc (EEI)—job no: 13481-E01, dated December 8, 2005 (Revision 0). The tower geometry, structure member sizes and foundation system information were taken from EEI's design report. Antenna and appurtenance information were taken from a previous structural analysis prepared by Natcomm- project no. 07132.CO2, signed and sealed December 12, 2007.

The tower is made up of three (3) 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 17.5-in at the top and 55.00-in at the base.

The aforementioned design report prepared by EEI is available for reference in Section 4 of this report.

Pocket Wireless is proposing the installation of three (3) Cellular panel antennas flush mounted to the existing monopole (tower) on a universal tri-bracket assembly. 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 tower was designed to support several communication antennas. The existing, proposed and future loads considered in this analysis consist of the following:

- VERIZON WIRELESS (Reserved): [1]
  Antennas: Fifteen (15) 60"x12" panel antennas on an existing 14' Low Profile Platform with a RAD center elevation of 144-ft above the existing tower base plate.
  Coax Cables: Fifteen (15) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- AT&T (Existing):
  Antennas: Twelve (12) Powerwave 7770 panel antennas and twelve (12) Powerwave LGP 21401 TMA's on a 14' Low Profile Platform with a RAD center elevation of 134-ft above the existing tower base plate.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- T-MOBILE (Reserved):
  Antennas: Nine (9) RFS APX16DWV-16WV-S-E-ACU panel antennas and Six (6) CCI DTMA-1819-DD-12 TMA's on (1) 12'-6" Low Profile Platform (Andrew Part No. MC-PK12S-9-72 with a RAD center elevation of 124-ft above the existing tower base plate.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.

- FUTURE CARRIER (Future):
  Antennas: Twelve (12) 48"x12" panel antennas on a 14' Low Profile Platform with a RAD center elevation of 104-ft above the existing tower base plate.
  Coax Cables: Twelve (12) 1-5/8" ∅ coax cables running on the inside of the existing tower.
- **POCKET WIRELESS (Proposed):**
  Antennas: Three (3) RFS APXV18-206517S –C panel antennas flush mounted on a universal tri-bracket assembly at a RAD center elevation of 114-ft above the existing tower base plate.
  Coax Cables: Six (6) 1-5/8" ∅ coax cables running on the inside of the existing tower.

Note: [1] Reserved Verizon Wireless antenna loading is conservative to allow for future antenna growth. Existing antenna configuration consists of (6) Antel LPA80063/4CF and (6) Antel LPA1850063/12CF panel antennas.

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 coax cables to be installed within tower.
- A new porthole will not be required.

Analysis

The existing tower was analyzed using a comprehensive computer program entitled RISATower. 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 80 mph basic wind speed (fastest mile) with no ice and 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).

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 tower structure and its components.

Basic Wind Speed:	Litchfield; v = 80 mph (fastest mile)	*[Section 16 of TIA/EIA-222-F-96]*
	Barkhamsted; v = 90 mph (3 second gust) equivalent to v = 75 mph (fastest mile)	*[Appendix K of the 2005 CT Building Code Supplement]*
	TIA/EIA wind speed controls	
Load Cases:	Load Case 1; 80 mph wind speed w/ no ice plus gravity load – used in calculation of tower stresses and rotation. This load case typically controls the design of monopole towers.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 2; 69 mph wind speed w/ ½" radial ice plus gravity load – used in calculation of tower stresses. The 69 mph wind speed velocity represents 75% of the wind pressure generated by the 85 mph wind speed. This load case typically controls the design of lattice towers.	*[Section 2.3.16 of TIA/EIA-222-F-96]*
	Load Case 3; Seismic – not checked	*[Section 1610.1.3 of State Bldg. Code 2005] does not control in the design of this structure type*

Natcomm, Inc.
Structural Monopole Analysis
145' Existing EEI Monopole
Barkhamsted, CT
October 28, 2008

Tower Capacity

Tower stresses were calculated utilizing the structural analysis software RISATower. 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 RISATower "Section Capacity Table", this tower was found to be at **91.2%** of its total capacity.

Foundation and Anchors

The existing foundation consists of a 7-ft square reinforced concrete pedestal with a 21.5-ft square reinforced concrete pad bearing directly on existing sub grade. The sub-grade conditions used in the analysis of the existing foundation were obtained from Jaworski Geotech, Inc's (JGI) geotechnical report JGI project no. 05704G, dated November 30, 2005 available in Section 4 of this report. The monopole tower is connected to the pedestal by means of twelve (14) 2-1/4" diameter, A615-GR75 anchor bolts embedded approximately 7-ft into the concrete foundation structure.

Review of the foundation and anchor design consisted of verification of applied loads obtained from the tower design calculations and code checks of allowable stresses:

- The tower base reactions developed from the governing Load Case 1 were used in the verification of the foundation and its anchors:
  - Shear Force @ top of pedestal = **21** kips
  - Moment @ top of pedestal = **2254** ft-kips
  - Axial Force @ top of pedestal = **34** kips
- The base plate, anchor bolts and the foundation are within allowable limits.
- Foundation resists two times the calculated wind load per the requirements of Section 3108.4.2 of the 2005 CT State Building Code Supplement to the 2003 International Building Code (IBC).

Conclusion

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

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

Please feel free to call with any questions or comments.

Respectfully Submitted by:

10/29/08

Carlo F. Centore, PE
Principal ~ 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 Natcomm, 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 Natcomm, 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. Natcomm, 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

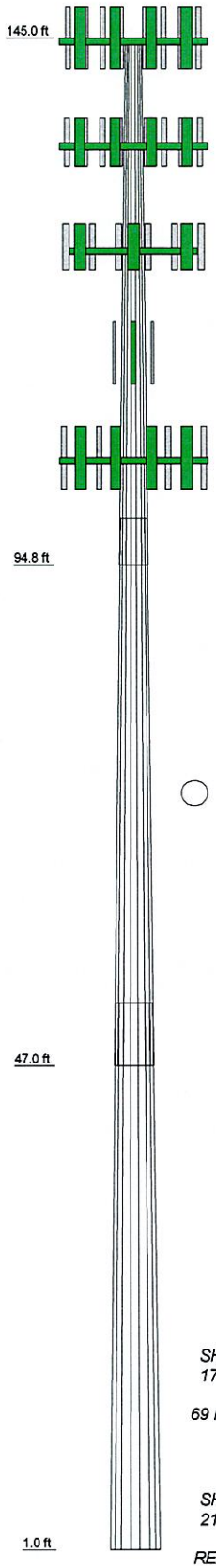
RISATower, is an integrated structural analysis and design software package for Designed specifically for the telecommunications industry, RISATower, formerly ERITower, automates much of the tower analysis and design required by the TIA/EIA 222 Standard.

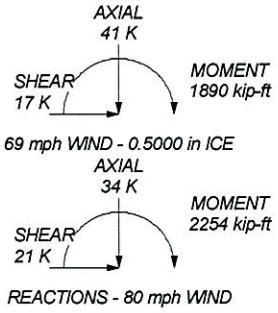
RISATower Features:

- RISATower 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.
- RISATower contains unique features such as True Cable behavior, hog rod take-up, foundation stiffness and much more.

Section	1	2	3
Length (ft)	50.21	52.21	52.00
Number of Sides	18	18	18
Thickness (in)	0.1875	0.3125	0.3125
Lap Splice (ft)	4.42	6.00	
Top Dia (in)	17.5000	29.4457	41.1448
Bot Dia (in)	31.0100	43.3700	55.0000
Grade		A572-65	
Weight (K)	2.4	6.4	8.4

17.2





DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Low Profile Platform (Verizon -reserved)	145	(3) APX16DWV-16DWV-S-E-ACU (T-Mobile - reserved)	125
(5) 60"x12"x4" Panel (Verizon - reserved)	145	(3) APX16DWV-16DWV-S-E-ACU (T-Mobile - reserved)	125
(5) 60"x12"x4" Panel (Verizon - reserved)	145	(2) DTMA-1819-DD-12 (T-Mobile - reserved)	125
(5) 60"x12"x4" Panel (Verizon - reserved)	145	(2) DTMA-1819-DD-12 (T-Mobile - reserved)	125
Low Profile Platform (ATI)	135	(2) DTMA-1819-DD-12 (T-Mobile - reserved)	125
(4) 7770.00 (ATI)	135	APXV18-206517S-C (Pocket)	115
(4) 7770.00 (ATI)	135	APXV18-206517S-C (Pocket)	115
(4) 7770.00 (ATI)	135	APXV18-206517S-C (Pocket)	115
(4) LPG21401 TMA (ATI)	135	Uni-Tri Bracket (Pocket)	115
(4) LPG21401 TMA (ATI)	135	(4) 4'x1' Panel (Future)	105
(4) LPG21401 TMA (ATI)	135	Low Profile Platform (Future)	105
Andrew MC-PK12S-9-72 Low Profile Platform (T-Mobile - reserved)	125	(4) 4'x1' Panel (Future)	105
(3) APX16DWV-16DWV-S-E-ACU (T-Mobile - reserved)	125	(4) 4'x1' Panel (Future)	105

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

1. Tower designed for a 80 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 69 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: 91.2%

NATTCOM INC
63-3 N Branford Rd
Branford, CT 06405
Phone: (203) 488-0580
FAX: (203) 488-8587

Job:	145' EEI Monopole
Project:	5 Old Farms Road, Barkhamsted, CT
Client: Verizon Wireless - Pocket	Drawn by: Staff / App'd:
Code: TIA/EIA-222-F	Date: 10/28/08 / Scale: NTS
Path:	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 80 mph.
Nominal ice thickness of 0.5000 in.
Ice density of 56 pcf.
A wind speed of 69 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	145.00-94.79	50.21	4.42	18	17.5000	31.0100	0.1875	0.7500	A572-65 (65 ksi)
L2	94.79-47.00	52.21	6.00	18	29.4457	43.3700	0.3125	1.2500	A572-65 (65 ksi)
L3	47.00-1.00	52.00		18	41.1448	55.0000	0.3125	1.2500	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	17.7700	10.3031	390.1441	6.1459	8.8900	43.8857	780.8015	5.1525	2.7500	14.667
	31.4884	18.3432	2201.6548	10.9420	15.7531	139.7603	4406.2066	9.1734	5.1278	27.348
L2	31.0969	28.8965	3098.5568	10.3423	14.9584	207.1446	6201.1907	14.4510	4.6324	14.824
	44.0391	42.7077	10003.2431	15.2854	22.0320	454.0333	20019.6488	21.3579	7.0831	22.666
L3	43.4029	40.5006	8531.1263	14.4955	20.9016	408.1573	17073.4781	20.2541	6.6915	21.413
	55.8485	54.2432	20495.5041	19.4141	27.9400	733.5542	41017.9768	27.1267	9.1300	29.216

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 145.00-94.79				1	1	1		
L2 94.79-47.00				1	1	1		
L3 47.00-1.00				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 plf
1 5/8 (Verizon - reserved)	A	No	Inside Pole	145.00 - 1.00	15	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (AT&T)	B	No	Inside Pole	135.00 - 1.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (T-Mobile - reserved)	C	No	Inside Pole	125.00 - 1.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Future)	B	No	Inside Pole	105.00 - 1.00	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
LCF158-50JA (Pocket)	C	No	Inside Pole	115.00 - 1.00	6	No Ice	0.00	0.80
						1/2" Ice	0.00	0.80

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	145.00-94.79	A	0.000	0.000	0.000	0.000	0.78
		B	0.000	0.000	0.000	0.000	0.63
		C	0.000	0.000	0.000	0.000	0.47
L2	94.79-47.00	A	0.000	0.000	0.000	0.000	0.75
		B	0.000	0.000	0.000	0.000	1.19
		C	0.000	0.000	0.000	0.000	0.83
L3	47.00-1.00	A	0.000	0.000	0.000	0.000	0.72
		B	0.000	0.000	0.000	0.000	1.15
		C	0.000	0.000	0.000	0.000	0.79

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	145.00-94.79	A	0.500	0.000	0.000	0.000	0.000	0.78
		B		0.000	0.000	0.000	0.000	0.63
		C		0.000	0.000	0.000	0.000	0.47
L2	94.79-47.00	A	0.500	0.000	0.000	0.000	0.000	0.75
		B		0.000	0.000	0.000	0.000	1.19
		C		0.000	0.000	0.000	0.000	0.83
L3	47.00-1.00	A	0.500	0.000	0.000	0.000	0.000	0.72
		B		0.000	0.000	0.000	0.000	1.15
		C		0.000	0.000	0.000	0.000	0.79

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	145.00-94.79	0.0000	0.0000	0.0000	0.0000
L2	94.79-47.00	0.0000	0.0000	0.0000	0.0000
L3	47.00-1.00	0.0000	0.0000	0.0000	0.0000

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
Low Profile Platform (Verizon -reserved)	C	None		0.0000	145.00	No Ice	18.00	18.00	1.80
						1/2" Ice	23.00	23.00	2.20
(5) 60"x12"x4" Panel (Verizon - reserved)	A	From Face	3.50 0.00 0.00	0.0000	145.00	No Ice	7.00	2.78	0.05
						1/2" Ice	7.47	3.15	0.09
(5) 60"x12"x4" Panel (Verizon - reserved)	B	From Face	3.50 0.00 0.00	0.0000	145.00	No Ice	7.00	2.78	0.05
						1/2" Ice	7.47	3.15	0.09
(5) 60"x12"x4" Panel (Verizon - reserved)	C	From Face	3.50 0.00 0.00	0.0000	145.00	No Ice	7.00	2.78	0.05
						1/2" Ice	7.47	3.15	0.09
Low Profile Platform (AT&T)	C	None		0.0000	135.00	No Ice	18.00	18.00	1.80
						1/2" Ice	23.00	23.00	2.20
(4) 7770.00 (AT&T)	A	From Face	3.50 0.00 0.00	0.0000	135.00	No Ice	5.88	2.93	0.04
						1/2" Ice	6.31	3.27	0.07
(4) 7770.00 (AT&T)	B	From Face	3.50 0.00 0.00	0.0000	135.00	No Ice	5.88	2.93	0.04
						1/2" Ice	6.31	3.27	0.07

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) 7770.00 (AT&T)	C	From Face	3.50 0.00 0.00	0.0000	135.00	No Ice 1/2" Ice	5.88 6.31	2.93 3.27	0.04 0.07
(4) LPG21401 TMA (AT&T)	A	From Face	3.50 0.00 0.00	0.0000	135.00	No Ice 1/2" Ice	0.95 1.09	0.37 0.48	0.02 0.02
(4) LPG21401 TMA (AT&T)	B	From Face	3.50 0.00 0.00	0.0000	135.00	No Ice 1/2" Ice	0.95 1.09	0.37 0.48	0.02 0.02
(4) LPG21401 TMA (AT&T)	C	From Face	3.50 0.00 0.00	0.0000	135.00	No Ice 1/2" Ice	0.95 1.09	0.37 0.48	0.02 0.02
Low Profile Platform (Future)	C	None		0.0000	105.00	No Ice 1/2" Ice	18.00 23.00	18.00 23.00	1.80 2.20
(4) 4'x1' Panel (Future)	A	From Face	3.50 0.00 0.00	0.0000	105.00	No Ice 1/2" Ice	5.60 5.99	1.70 1.99	0.04 0.06
(4) 4'x1' Panel (Future)	B	From Face	3.50 0.00 0.00	0.0000	105.00	No Ice 1/2" Ice	5.60 5.99	1.70 1.99	0.04 0.06
(4) 4'x1' Panel (Future)	C	From Face	3.50 0.00 0.00	0.0000	105.00	No Ice 1/2" Ice	5.60 5.99	1.70 1.99	0.04 0.06
Andrew MC-PK12S-9-72 Low Profile Platform (T-Mobile - reserved)	C	None		0.0000	125.00	No Ice 1/2" Ice	8.80 11.30	8.80 11.30	1.42 1.99
(3) APX16DWV-16DWV-S-E-ACU (T-Mobile - reserved)	A	From Face	3.50 0.00 0.00	0.0000	125.00	No Ice 1/2" Ice	6.70 7.13	2.00 2.33	0.04 0.07
(3) APX16DWV-16DWV-S-E-ACU (T-Mobile - reserved)	B	From Face	3.50 0.00 0.00	0.0000	125.00	No Ice 1/2" Ice	6.70 7.13	2.00 2.33	0.04 0.07
(3) APX16DWV-16DWV-S-E-ACU (T-Mobile - reserved)	C	From Face	3.50 0.00 0.00	0.0000	125.00	No Ice 1/2" Ice	6.70 7.13	2.00 2.33	0.04 0.07
(2) DTMA-1819-DD-12 (T-Mobile - reserved)	A	From Face	3.00 0.00 0.00	0.0000	125.00	No Ice 1/2" Ice	0.71 0.83	0.41 0.52	0.01 0.02
(2) DTMA-1819-DD-12 (T-Mobile - reserved)	B	From Face	3.00 0.00 0.00	0.0000	125.00	No Ice 1/2" Ice	0.71 0.83	0.41 0.52	0.01 0.02
(2) DTMA-1819-DD-12 (T-Mobile - reserved)	C	From Face	3.00 0.00 0.00	0.0000	125.00	No Ice 1/2" Ice	0.71 0.83	0.41 0.52	0.01 0.02
APXV18-206517S-C (Pocket)	A	From Face	1.00 0.00 0.00	0.0000	115.00	No Ice 1/2" Ice	5.17 5.62	3.04 3.47	0.03 0.06
APXV18-206517S-C (Pocket)	B	From Face	1.00 0.00 0.00	0.0000	115.00	No Ice 1/2" Ice	5.17 5.62	3.04 3.47	0.03 0.06
APXV18-206517S-C (Pocket)	C	From Face	1.00 0.00 0.00	0.0000	115.00	No Ice 1/2" Ice	5.17 5.62	3.04 3.47	0.03 0.06
Uni-Tri Bracket (Pocket)	C	None		0.0000	115.00	No Ice 1/2" Ice	1.75 1.94	1.75 1.94	0.29 0.31

Tower Pressures - No Ice

$G_H = 1.690$

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 145.00-94.79	117.93	1.439	0	101.487	A	0.000	101.487	101.487	100.00	0.000	0.000
					B	0.000	101.487		100.00	0.000	0.000
					C	0.000	101.487		100.00	0.000	0.000
L2 94.79-47.00	70.10	1.24	0	147.342	A	0.000	147.342	147.342	100.00	0.000	0.000
					B	0.000	147.342		100.00	0.000	0.000
					C	0.000	147.342		100.00	0.000	0.000
L3 47.00-1.00	23.15	1	0	187.342	A	0.000	187.342	187.342	100.00	0.000	0.000
					B	0.000	187.342		100.00	0.000	0.000
					C	0.000	187.342		100.00	0.000	0.000

Tower Pressure - With Ice

$G_H = 1.690$

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
L1 145.00-94.79	117.93	1.439	0	0.5000	105.671	A	0.000	105.671	105.671	100.00	0.000	0.000
						B	0.000	105.671		100.00	0.000	0.000
						C	0.000	105.671		100.00	0.000	0.000
L2 94.79-47.00	70.10	1.24	0	0.5000	151.324	A	0.000	151.324	151.324	100.00	0.000	0.000
						B	0.000	151.324		100.00	0.000	0.000
						C	0.000	151.324		100.00	0.000	0.000
L3 47.00-1.00	23.15	1	0	0.5000	191.175	A	0.000	191.175	191.175	100.00	0.000	0.000
						B	0.000	191.175		100.00	0.000	0.000
						C	0.000	191.175		100.00	0.000	0.000

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 145.00-94.79	117.93	1.439	0	101.487	A	0.000	101.487	101.487	100.00	0.000	0.000
					B	0.000	101.487		100.00	0.000	0.000
					C	0.000	101.487		100.00	0.000	0.000
L2 94.79-47.00	70.10	1.24	0	147.342	A	0.000	147.342	147.342	100.00	0.000	0.000
					B	0.000	147.342		100.00	0.000	0.000
					C	0.000	147.342		100.00	0.000	0.000

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
L3 47.00-1.00	23.15	1	0	187.342	A	0.000	187.342	187.342	100.00	0.000	0.000
					B	0.000	187.342		100.00	0.000	0.000
					C	0.000	187.342		100.00	0.000	0.000

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 plf	Ctrl. Face
L1 145.00-94.79	1.89	2.45	A	1	0.65	1	1	1	101.487	2.62	52.24	C
			B	1	0.65	1	1	1	101.487			
			C	1	0.65	1	1	1	101.487			
L2 94.79-47.00	2.76	6.36	A	1	0.65	1	1	1	147.342	3.27	68.45	C
			B	1	0.65	1	1	1	147.342			
			C	1	0.65	1	1	1	147.342			
L3 47.00-1.00	2.66	8.38	A	1	0.65	1	1	1	187.342	3.40	73.95	C
			B	1	0.65	1	1	1	187.342			
			C	1	0.65	1	1	1	187.342			
Sum Weight:	7.31	17.19						OTM	608.10 kip-ft	9.30		

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 ft²	F K	w plf	Ctrl. Face
L1 145.00-94.79	1.89	2.45	A	1	0.65	1	1	1	101.487	2.62	52.24	C
			B	1	0.65	1	1	1	101.487			
			C	1	0.65	1	1	1	101.487			
L2 94.79-47.00	2.76	6.36	A	1	0.65	1	1	1	147.342	3.27	68.45	C
			B	1	0.65	1	1	1	147.342			
			C	1	0.65	1	1	1	147.342			
L3 47.00-1.00	2.66	8.38	A	1	0.65	1	1	1	187.342	3.40	73.95	C
			B	1	0.65	1	1	1	187.342			
			C	1	0.65	1	1	1	187.342			
Sum Weight:	7.31	17.19						OTM	608.10 kip-ft	9.30		

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 ft²	F K	w plf	Ctrl. Face
L1 145.00-94.79	1.89	2.45	A	1	0.65	1	1	1	101.487	2.62	52.24	C
			B	1	0.65	1	1	1	101.487			
			C	1	0.65	1	1	1	101.487			

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 plf	Ctrl. Face
L2 94.79-47.00	2.76	6.36	A	1	0.65	1	1	1	147.342	3.27	68.45	C
			B	1	0.65	1	1	1	147.342			
			C	1	0.65	1	1	1	147.342			
L3 47.00-1.00	2.66	8.38	A	1	0.65	1	1	1	187.342	3.40	73.95	C
			B	1	0.65	1	1	1	187.342			
			C	1	0.65	1	1	1	187.342			
Sum Weight:	7.31	17.19						OTM	608.10 kip-ft	9.30		

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 ft²	F K	w plf	Ctrl. Face
L1 145.00-94.79	1.89	3.21	A	1	0.65	1	1	1	105.671	2.05	40.80	C
			B	1	0.65	1	1	1	105.671			
			C	1	0.65	1	1	1	105.671			
L2 94.79-47.00	2.76	7.47	A	1	0.65	1	1	1	151.324	2.52	52.73	C
			B	1	0.65	1	1	1	151.324			
			C	1	0.65	1	1	1	151.324			
L3 47.00-1.00	2.66	9.78	A	1	0.65	1	1	1	191.175	2.60	56.60	C
			B	1	0.65	1	1	1	191.175			
			C	1	0.65	1	1	1	191.175			
Sum Weight:	7.31	20.46						OTM	471.29 kip-ft	7.17		

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 ft²	F K	w plf	Ctrl. Face
L1 145.00-94.79	1.89	3.21	A	1	0.65	1	1	1	105.671	2.05	40.80	C
			B	1	0.65	1	1	1	105.671			
			C	1	0.65	1	1	1	105.671			
L2 94.79-47.00	2.76	7.47	A	1	0.65	1	1	1	151.324	2.52	52.73	C
			B	1	0.65	1	1	1	151.324			
			C	1	0.65	1	1	1	151.324			
L3 47.00-1.00	2.66	9.78	A	1	0.65	1	1	1	191.175	2.60	56.60	C
			B	1	0.65	1	1	1	191.175			
			C	1	0.65	1	1	1	191.175			
Sum Weight:	7.31	20.46						OTM	471.29 kip-ft	7.17		

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 ft²	F K	w plf	Ctrl. Face
L1 145.00-94.79	1.89	3.21	A	1	0.65	1	1	1	105.671	2.05	40.80	C
			B	1	0.65	1	1	1	105.671			
			C	1	0.65	1	1	1	105.671			
L2 94.79-47.00	2.76	7.47	A	1	0.65	1	1	1	151.324	2.52	52.73	C
			B	1	0.65	1	1	1	151.324			
			C	1	0.65	1	1	1	151.324			
L3 47.00-1.00	2.66	9.78	A	1	0.65	1	1	1	191.175	2.60	56.60	C
			B	1	0.65	1	1	1	191.175			
			C	1	0.65	1	1	1	191.175			
Sum Weight:	7.31	20.46						OTM	471.29 kip-ft	7.17		

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 plf	Ctrl. Face
L1 145.00-94.79	1.89	2.45	A	1	0.65	1	1	1	101.487	1.02	20.41	C
			B	1	0.65	1	1	1	101.487			
			C	1	0.65	1	1	1	101.487			
L2 94.79-47.00	2.76	6.36	A	1	0.65	1	1	1	147.342	1.28	26.74	C
			B	1	0.65	1	1	1	147.342			
			C	1	0.65	1	1	1	147.342			
L3 47.00-1.00	2.66	8.38	A	1	0.65	1	1	1	187.342	1.33	28.89	C
			B	1	0.65	1	1	1	187.342			
			C	1	0.65	1	1	1	187.342			
Sum Weight:	7.31	17.19						OTM	237.54 kip-ft	3.63		

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 plf	Ctrl. Face
L1 145.00-94.79	1.89	2.45	A	1	0.65	1	1	1	101.487	1.02	20.41	C
			B	1	0.65	1	1	1	101.487			
			C	1	0.65	1	1	1	101.487			
L2 94.79-47.00	2.76	6.36	A	1	0.65	1	1	1	147.342	1.28	26.74	C
			B	1	0.65	1	1	1	147.342			
			C	1	0.65	1	1	1	147.342			
L3 47.00-1.00	2.66	8.38	A	1	0.65	1	1	1	187.342	1.33	28.89	C
			B	1	0.65	1	1	1	187.342			
			C	1	0.65	1	1	1	187.342			
Sum Weight:	7.31	17.19						OTM	237.54 kip-ft	3.63		

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 plf	Ctrl. Face
L1 145.00-94.79	1.89	2.45	A	1	0.65	1	1	1	101.487	1.02	20.41	C
			B	1	0.65	1	1	1	101.487			
			C	1	0.65	1	1	1	101.487			
L2 94.79-47.00	2.76	6.36	A	1	0.65	1	1	1	147.342	1.28	26.74	C
			B	1	0.65	1	1	1	147.342			
			C	1	0.65	1	1	1	147.342			
L3 47.00-1.00	2.66	8.38	A	1	0.65	1	1	1	187.342	1.33	28.89	C
			B	1	0.65	1	1	1	187.342			
			C	1	0.65	1	1	1	187.342			
Sum Weight:	7.31	17.19						OTM	237.54 kip-ft	3.63		

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	17.19					
Bracing Weight	0.00					
Total Member Self-Weight	17.19			0.00	0.00	
Total Weight	34.01			0.00	0.00	
Wind 0 deg - No Ice		0.00	-21.43	-2169.95	0.00	0.00
Wind 30 deg - No Ice		10.72	-18.56	-1879.23	-1084.98	0.00
Wind 60 deg - No Ice		18.56	-10.72	-1084.98	-1879.23	0.00
Wind 90 deg - No Ice		21.43	0.00	0.00	-2169.95	0.00
Wind 120 deg - No Ice		18.56	10.72	1084.98	-1879.23	0.00
Wind 150 deg - No Ice		10.72	18.56	1879.23	-1084.98	0.00
Wind 180 deg - No Ice		0.00	21.43	2169.95	0.00	0.00
Wind 210 deg - No Ice		-10.72	18.56	1879.23	1084.98	0.00
Wind 240 deg - No Ice		-18.56	10.72	1084.98	1879.23	0.00
Wind 270 deg - No Ice		-21.43	0.00	0.00	2169.95	0.00
Wind 300 deg - No Ice		-18.56	-10.72	-1084.98	1879.23	0.00
Wind 330 deg - No Ice		-10.72	-18.56	-1879.23	1084.98	0.00
Member Ice	3.27					
Total Weight Ice	40.71			0.00	0.00	
Wind 0 deg - Ice		0.00	-17.49	-1798.20	0.00	0.00
Wind 30 deg - Ice		8.75	-15.15	-1557.29	-899.10	0.00
Wind 60 deg - Ice		15.15	-8.75	-899.10	-1557.29	0.00
Wind 90 deg - Ice		17.49	0.00	0.00	-1798.20	0.00
Wind 120 deg - Ice		15.15	8.75	899.10	-1557.29	0.00
Wind 150 deg - Ice		8.75	15.15	1557.29	-899.10	0.00
Wind 180 deg - Ice		0.00	17.49	1798.20	0.00	0.00
Wind 210 deg - Ice		-8.75	15.15	1557.29	899.10	0.00
Wind 240 deg - Ice		-15.15	8.75	899.10	1557.29	0.00
Wind 270 deg - Ice		-17.49	0.00	0.00	1798.20	0.00
Wind 300 deg - Ice		-15.15	-8.75	-899.10	1557.29	0.00
Wind 330 deg - Ice		-8.75	-15.15	-1557.29	899.10	0.00
Total Weight	34.01			0.00	0.00	
Wind 0 deg - Service		0.00	-8.37	-847.64	0.00	0.00
Wind 30 deg - Service		4.19	-7.25	-734.08	-423.82	0.00
Wind 60 deg - Service		7.25	-4.19	-423.82	-734.08	0.00
Wind 90 deg - Service		8.37	0.00	0.00	-847.64	0.00

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 120 deg - Service		7.25	4.19	423.82	-734.08	0.00
Wind 150 deg - Service		4.19	7.25	734.08	-423.82	0.00
Wind 180 deg - Service		0.00	8.37	847.64	0.00	0.00
Wind 210 deg - Service		-4.19	7.25	734.08	423.82	0.00
Wind 240 deg - Service		-7.25	4.19	423.82	734.08	0.00
Wind 270 deg - Service		-8.37	0.00	0.00	847.64	0.00
Wind 300 deg - Service		-7.25	-4.19	-423.82	734.08	0.00
Wind 330 deg - Service		-4.19	-7.25	-734.08	423.82	0.00

Load Combinations

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

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	145 - 94.79	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-17.51	0.00	0.00
			Max. Mx	5	-12.45	-446.43	0.00
			Max. My	8	-12.45	0.00	-446.43
			Max. Vy	5	15.31	-446.43	0.00
			Max. Vx	8	15.31	0.00	-446.43
			Max. Torque	16			-0.00
L2	94.79 - 47	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-26.90	0.00	0.00
			Max. Mx	5	-21.21	-1221.26	0.00
			Max. My	8	-21.21	0.00	-1221.26
			Max. Vy	5	18.26	-1221.26	0.00
			Max. Vx	8	18.26	0.00	-1221.26
			Max. Torque	16			-0.00
L3	47 - 1	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-40.71	0.00	0.00
			Max. Mx	5	-34.00	-2253.74	0.00
			Max. My	8	-34.00	0.00	-2253.74
			Max. Vy	5	21.46	-2253.74	0.00
			Max. Vx	8	21.46	0.00	-2253.74
			Max. Torque	26			0.00

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	21	40.71	0.00	-17.49
	Max. H_x	11	34.01	21.43	0.00
	Max. H_z	2	34.01	0.00	21.43
	Max. M_x	2	2253.74	0.00	21.43
	Max. M_z	5	2253.74	-21.43	0.00
	Max. Torsion	26	0.00	8.75	15.15
	Min. Vert	1	34.01	0.00	0.00
	Min. H_x	5	34.01	-21.43	0.00
	Min. H_z	8	34.01	0.00	-21.43
	Min. M_x	8	-2253.74	0.00	-21.43
	Min. M_z	11	-2253.74	21.43	0.00
	Min. Torsion	16	-0.00	-8.75	15.15

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	34.01	0.00	0.00	0.00	0.00	0.00
Dead+Wind 0 deg - No Ice	34.01	0.00	-21.43	-2253.74	0.00	0.00
Dead+Wind 30 deg - No Ice	34.01	10.72	-18.56	-1951.81	-1126.88	0.00
Dead+Wind 60 deg - No Ice	34.01	18.56	-10.72	-1126.88	-1951.81	-0.00
Dead+Wind 90 deg - No Ice	34.01	21.43	0.00	0.00	-2253.74	0.00
Dead+Wind 120 deg - No Ice	34.01	18.56	10.72	1126.88	-1951.81	0.00
Dead+Wind 150 deg - No Ice	34.01	10.72	18.56	1951.81	-1126.88	-0.00

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 180 deg - No Ice	34.01	0.00	21.43	2253.74	0.00	0.00
Dead+Wind 210 deg - No Ice	34.01	-10.72	18.56	1951.81	1126.88	0.00
Dead+Wind 240 deg - No Ice	34.01	-18.56	10.72	1126.88	1951.81	-0.00
Dead+Wind 270 deg - No Ice	34.01	-21.43	0.00	0.00	2253.74	0.00
Dead+Wind 300 deg - No Ice	34.01	-18.56	-10.72	-1126.88	1951.81	0.00
Dead+Wind 330 deg - No Ice	34.01	-10.72	-18.56	-1951.81	1126.88	-0.00
Dead+Ice+Temp	40.71	0.00	0.00	0.00	0.00	0.00
Dead+Wind 0 deg+Ice+Temp	40.71	0.00	-17.49	-1889.55	0.00	0.00
Dead+Wind 30 deg+Ice+Temp	40.71	8.75	-15.15	-1636.40	-944.78	0.00
Dead+Wind 60 deg+Ice+Temp	40.71	15.15	-8.75	-944.78	-1636.40	-0.00
Dead+Wind 90 deg+Ice+Temp	40.71	17.49	0.00	0.00	-1889.55	0.00
Dead+Wind 120 deg+Ice+Temp	40.71	15.15	8.75	944.78	-1636.40	0.00
Dead+Wind 150 deg+Ice+Temp	40.71	8.75	15.15	1636.40	-944.78	-0.00
Dead+Wind 180 deg+Ice+Temp	40.71	0.00	17.49	1889.55	0.00	0.00
Dead+Wind 210 deg+Ice+Temp	40.71	-8.75	15.15	1636.40	944.78	0.00
Dead+Wind 240 deg+Ice+Temp	40.71	-15.15	8.75	944.78	1636.40	-0.00
Dead+Wind 270 deg+Ice+Temp	40.71	-17.49	0.00	0.00	1889.55	0.00
Dead+Wind 300 deg+Ice+Temp	40.71	-15.15	-8.75	-944.78	1636.40	0.00
Dead+Wind 330 deg+Ice+Temp	40.71	-8.75	-15.15	-1636.40	944.78	-0.00
Dead+Wind 0 deg - Service	34.01	0.00	-8.37	-881.21	0.00	0.00
Dead+Wind 30 deg - Service	34.01	4.19	-7.25	-763.15	-440.61	0.00
Dead+Wind 60 deg - Service	34.01	7.25	-4.19	-440.61	-763.15	-0.00
Dead+Wind 90 deg - Service	34.01	8.37	0.00	0.00	-881.21	0.00
Dead+Wind 120 deg - Service	34.01	7.25	4.19	440.61	-763.15	0.00
Dead+Wind 150 deg - Service	34.01	4.19	7.25	763.15	-440.61	-0.00
Dead+Wind 180 deg - Service	34.01	0.00	8.37	881.21	0.00	0.00
Dead+Wind 210 deg - Service	34.01	-4.19	7.25	763.15	440.61	0.00
Dead+Wind 240 deg - Service	34.01	-7.25	4.19	440.61	763.15	-0.00
Dead+Wind 270 deg - Service	34.01	-8.37	0.00	0.00	881.21	0.00
Dead+Wind 300 deg - Service	34.01	-7.25	-4.19	-440.61	763.15	0.00
Dead+Wind 330 deg - Service	34.01	-4.19	-7.25	-763.15	440.61	-0.00

Solution Summary

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
1	0.00	-34.01	0.00	0.00	34.01	0.00	0.000%
2	0.00	-34.01	-21.43	0.00	34.01	21.43	0.000%
3	10.72	-34.01	-18.56	-10.72	34.01	18.56	0.000%
4	18.56	-34.01	-10.72	-18.56	34.01	10.72	0.000%
5	21.43	-34.01	0.00	-21.43	34.01	0.00	0.000%
6	18.56	-34.01	10.72	-18.56	34.01	-10.72	0.000%
7	10.72	-34.01	18.56	-10.72	34.01	-18.56	0.000%
8	0.00	-34.01	21.43	0.00	34.01	-21.43	0.000%
9	-10.72	-34.01	18.56	10.72	34.01	-18.56	0.000%
10	-18.56	-34.01	10.72	18.56	34.01	-10.72	0.000%
11	-21.43	-34.01	0.00	21.43	34.01	0.00	0.000%
12	-18.56	-34.01	-10.72	18.56	34.01	10.72	0.000%
13	-10.72	-34.01	-18.56	10.72	34.01	18.56	0.000%
14	0.00	-40.71	0.00	0.00	40.71	0.00	0.000%
15	0.00	-40.71	-17.49	0.00	40.71	17.49	0.000%
16	8.75	-40.71	-15.15	-8.75	40.71	15.15	0.000%
17	15.15	-40.71	-8.75	-15.15	40.71	8.75	0.000%
18	17.49	-40.71	0.00	-17.49	40.71	0.00	0.000%
19	15.15	-40.71	8.75	-15.15	40.71	-8.75	0.000%
20	8.75	-40.71	15.15	-8.75	40.71	-15.15	0.000%
21	0.00	-40.71	17.49	0.00	40.71	-17.49	0.000%

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
22	-8.75	-40.71	15.15	8.75	40.71	-15.15	0.000%
23	-15.15	-40.71	8.75	15.15	40.71	-8.75	0.000%
24	-17.49	-40.71	0.00	17.49	40.71	0.00	0.000%
25	-15.15	-40.71	-8.75	15.15	40.71	8.75	0.000%
26	-8.75	-40.71	-15.15	8.75	40.71	15.15	0.000%
27	0.00	-34.01	-8.37	0.00	34.01	8.37	0.000%
28	4.19	-34.01	-7.25	-4.19	34.01	7.25	0.000%
29	7.25	-34.01	-4.19	-7.25	34.01	4.19	0.000%
30	8.37	-34.01	0.00	-8.37	34.01	0.00	0.000%
31	7.25	-34.01	4.19	-7.25	34.01	-4.19	0.000%
32	4.19	-34.01	7.25	-4.19	34.01	-7.25	0.000%
33	0.00	-34.01	8.37	0.00	34.01	-8.37	0.000%
34	-4.19	-34.01	7.25	4.19	34.01	-7.25	0.000%
35	-7.25	-34.01	4.19	7.25	34.01	-4.19	0.000%
36	-8.37	-34.01	0.00	8.37	34.01	0.00	0.000%
37	-7.25	-34.01	-4.19	7.25	34.01	4.19	0.000%
38	-4.19	-34.01	-7.25	4.19	34.01	7.25	0.000%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	4	0.00000001	0.00000001
2	Yes	4	0.00000001	0.00020761
3	Yes	5	0.00000001	0.00033857
4	Yes	5	0.00000001	0.00033857
5	Yes	4	0.00000001	0.00020761
6	Yes	5	0.00000001	0.00033857
7	Yes	5	0.00000001	0.00033857
8	Yes	4	0.00000001	0.00020761
9	Yes	5	0.00000001	0.00033857
10	Yes	5	0.00000001	0.00033857
11	Yes	4	0.00000001	0.00020761
12	Yes	5	0.00000001	0.00033857
13	Yes	5	0.00000001	0.00033857
14	Yes	4	0.00000001	0.00000001
15	Yes	5	0.00000001	0.00018356
16	Yes	5	0.00000001	0.00056919
17	Yes	5	0.00000001	0.00056919
18	Yes	5	0.00000001	0.00018356
19	Yes	5	0.00000001	0.00056919
20	Yes	5	0.00000001	0.00056919
21	Yes	5	0.00000001	0.00018356
22	Yes	5	0.00000001	0.00056919
23	Yes	5	0.00000001	0.00056919
24	Yes	5	0.00000001	0.00018356
25	Yes	5	0.00000001	0.00056919
26	Yes	5	0.00000001	0.00056919
27	Yes	4	0.00000001	0.00005652
28	Yes	4	0.00000001	0.00059474
29	Yes	4	0.00000001	0.00059474
30	Yes	4	0.00000001	0.00005652
31	Yes	4	0.00000001	0.00059474
32	Yes	4	0.00000001	0.00059474
33	Yes	4	0.00000001	0.00005652
34	Yes	4	0.00000001	0.00059474

35	Yes	4	0.00000001	0.00059474
36	Yes	4	0.00000001	0.00005652
37	Yes	4	0.00000001	0.00059474
38	Yes	4	0.00000001	0.00059474

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	145 - 94.79	31.857	30	2.1398	0.0000
L2	99.21 - 47	13.935	30	1.4037	0.0000
L3	53 - 1	3.767	30	0.6812	0.0000

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
145.00	Low Profile Platform	30	31.857	2.1398	0.0000	23253
135.00	Low Profile Platform	30	27.599	1.9872	0.0000	11626
125.00	Andrew MC-PK12S-9-72 Low Profile Platform	30	23.444	1.8322	0.0000	5812
115.00	APXV18-206517S-C	30	19.496	1.6722	0.0000	3874
105.00	Low Profile Platform	30	15.859	1.5049	0.0000	2905

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	145 - 94.79	81.351	8	5.4654	0.0000
L2	99.21 - 47	35.614	8	3.5874	0.0000
L3	53 - 1	9.632	8	1.7416	0.0000

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
145.00	Low Profile Platform	8	81.351	5.4654	0.0000	9227
135.00	Low Profile Platform	8	70.487	5.0642	0.0000	4612
125.00	Andrew MC-PK12S-9-72 Low Profile Platform	8	59.885	4.6603	0.0000	2304
115.00	APXV18-206517S-C	8	49.810	4.2510	0.0000	1534
105.00	Low Profile Platform	8	40.525	3.8337	0.0000	1149

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	145 - 94.79 (1)	TP31.01x17.5x0.1875	50.21	144.00	164.3	5.534	17.6355	-12.45	97.60	0.128
L2	94.79 - 47 (2)	TP43.37x29.4457x0.3125	52.21	144.00	117.4	10.832	41.1205	-21.21	445.43	0.048
L3	47 - 1 (3)	TP55x41.1448x0.3125	52.00	144.00	89.0	18.669	54.2432	-34.00	1012.66	0.034

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	145 - 94.79 (1)	TP31.01x17.5x0.1875	446.43	-41.480	38.108	1.088	0.00	0.000	38.108	0.000
L2	94.79 - 47 (2)	TP43.37x29.4457x0.3125	1221.28	-34.828	39.000	0.893	0.00	0.000	39.000	0.000
L3	47 - 1 (3)	TP55x41.1448x0.3125	2253.75	-36.868	36.209	1.018	0.00	0.000	36.209	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Size	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	145 - 94.79 (1)	TP31.01x17.5x0.1875	0.128	1.088	0.000	1.216 ✔	1.333	H1-3 ✔
L2	94.79 - 47 (2)	TP43.37x29.4457x0.3125	0.048	0.893	0.000	0.941 ✔	1.333	H1-3 ✔
L3	47 - 1 (3)	TP55x41.1448x0.3125	0.034	1.018	0.000	1.052 ✔	1.333	H1-3 ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
L1	145 - 94.79	Pole	TP31.01x17.5x0.1875	1	-12.45	130.11	91.2	Pass
L2	94.79 - 47	Pole	TP43.37x29.4457x0.3125	2	-21.21	593.76	70.6	Pass
L3	47 - 1	Pole	TP55x41.1448x0.3125	3	-34.00	1349.88	78.9	Pass
							Summary	
						Pole (L1)	91.2	Pass
						RATING =	**91.2**	**Pass**

Program Version 5.2.0.1 - 6/16/2008 File:J:/Jobs/0813600.WI/CO-06 - 5 Old Farms Rd., Barkhamsted CT (Pocket Wireless)/Rev 2_with_ultra_light_platform/ERI Files/145' EEI Monopole_Barkhamsted_CT.eri

ANCHOR BOLT AND BASE PLATE ANALYSIS

Input Data

Tower Reactions:

Overturning Moment:	$OM := 2254 \cdot ft \cdot kips$	*user input*
Shear Force:	$Shear := 21 \cdot kips$	*user input*
Axial Force:	$Axial := 34 \cdot kips$	*user input*

Anchor Bolt Data:

Use ASTM A615 Grade 75		*user input*
Number of Anchor Bolts = N	$N := 14$	*user input*
Diameter of Bolt Circle:	$D_{bc} := 64in$	*user input*
Bolt "Column" Distance:	$l := 3.0in$	*user input*
Bolt Ultimate Strength:	$F_u := 100 \cdot ksi$	*user input*
Bolt Yield Strength:	$Fy := 75 \cdot ksi$	*user input*
Bolt Modulus:	$E := 29000 \cdot ksi$	*user input*
Anchor Bolt Diameter	$D := 2.25in$	*user input*
Threads per Inch:	$n := 4.5$	*user input*

Base Plate Data:

Use ASTM A572 (60 ksi)		*user input*
Plate Yield Strength:	$Fy_{bp} := 60 \cdot ksi$	*user input*
Base Plate Thickness:	$PlateThickness := 1.75 \cdot in$	*user input*
Base Plate Diameter:	$D_{bp} := 70 \cdot in$	*user input*
Outer Pole Diameter:	$D_{pole} := 55in$	*user input*

Geometric Layout Data:

Distance from the center of gravity of the group to bolt in question = d(i)

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

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

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

$d_1 = 13.88 \cdot in$ $d_7 = 0.00 \cdot in$

$d_2 = 25.02 \cdot in$ $d_8 = -13.88 \cdot in$

$d_3 = 31.20 \cdot in$ $d_9 = -25.02 \cdot in$

$d_4 = 31.20 \cdot in$ $d_{10} = -31.20 \cdot in$

$d_5 = 25.02 \cdot in$ $d_{11} = -31.20 \cdot in$

$d_6 = 13.88 \cdot in$ etc.

Critical Distances For Bending in Plate:

Outer Pole Radius: $R_{pole} := \frac{D_{pole}}{2}$ $R_{pole} = 27.50 \cdot in$

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

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

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

$MA_3 = 3.70 \cdot in$ $MA_9 = 0.00 \cdot in$

$MA_4 = 3.70 \cdot in$ $MA_{10} = 0.00 \cdot in$

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

$MA_6 = 0.00 \cdot in$ etc.

Effective Width of Baseplate for Bending: $EffectiveWidth := .8 \cdot 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2}$ $EffectiveWidth = 34.64 \cdot in$

Anchor Bolt Analysis:

Polar Moment of Inertia I_p:

$$I_p := \sum_i \left(d_i\right)^2 \qquad I_p = 7.168 \times 10^3 \cdot in^2$$

Gross Area of Bolt:

$$A_g := \frac{\pi}{4} \cdot D^2 \qquad A_g = 3.976 \cdot in^2$$

Net Area of Bolt:

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

Net Diameter:

$$D_n := \frac{2 \cdot \sqrt{A_n}}{\sqrt{\pi}} \qquad D_n = 2.03 \cdot in$$

Radius of Gyration of Bolt:

$$r := \frac{D_n}{4} \qquad r = 0.51 \cdot in$$

Section Modulus of Bolt:

$$S_x := \frac{\pi \cdot D_n^{\,3}}{32} \qquad S_x = 0.826 \cdot in^3$$

Anchor Bolt Bending Stress:

Maximum Applied Bending:

$$M_x := \left(\frac{Shear}{N}\right) \cdot l \qquad M_x = 0.375 \cdot ft \cdot kips$$

$$f_{bx} := \frac{M_x}{S_x} \qquad f_{bx} = 5.5 \cdot ksi$$

Allowable Bending

$$F_{bx} := 1.333 \cdot 0.60 \cdot Fy \qquad F_{bx} = 60.0 \cdot ksi$$

Note: 1.333 increase allowed per TIA/EIA

Check Tensile Forces:

Maximum Tensile Force (Gross Area):

$AllowableTension := 1.333 \cdot (0.33 \cdot A_g \cdot F_u)$ $AllowableTension = 174.9 \cdot kips$

Note: 1.333 increase allowed per TIA/EIA

Maximum Tensile Force (Net Area):

$F_{net.area} := 1.333 \cdot (0.60 \cdot A_n \cdot Fy)$ $F_{net.area} = 194.8 \cdot kips$

Note: 1.333 increase allowed per TIA/EIA

Applied Tension:

$$MaxTension := \frac{OM \cdot R_{bc}}{I_p} - \frac{Axial}{N} \qquad MaxTension = 118.3 \cdot kips$$

Check Stresses:

Note: Bolts supplied are "upset bolts." Use net area for checking per AISC.

$$\frac{MaxTension}{F_{net.area}} = 0.61$$

$$Condition := if\left(\frac{MaxTension}{F_{net.area}} \le 1.00, "OK", "Overstressed"\right)$$

Condition = "OK"

Check Compression & Combined Stresses (if required):

Check to see if a complete combined stress analysis is required:

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."

Set the clear space between the plate and bolt to zero and remove bending stresses if a combined stress analysis is not required:

$$l := \begin{cases} l & \text{if } l > 2 \cdot D_n \\ 0.00\,in & \text{otherwise} \end{cases} \qquad l = 0.00 \cdot in$$

$$f_{bx} := \begin{cases} f_{bx} & \text{if } l > 2 \cdot D_n \\ 0.0\,ksi & \text{otherwise} \end{cases} \qquad f_{bx} = 0.0 \cdot ksi$$

Allowable Compressive Force:

$$K := 0.65$$

$$C_c := \sqrt{\frac{2 \cdot \pi^2 \cdot E}{Fy}} \qquad C_c = 87.36$$

$$F_a := \begin{cases} \dfrac{\left[1 - \dfrac{\left(\frac{K \cdot l}{r}\right)^2}{2 \cdot C_c^{\,2}}\right] \cdot Fy}{\dfrac{5}{3} + \dfrac{3 \cdot \left(\frac{K \cdot l}{r}\right)}{8 \cdot C_c} - \dfrac{\left(\frac{K \cdot l}{r}\right)^3}{8 \cdot C_c^{\,3}}} & \text{if } \dfrac{K \cdot l}{r} \le C_c \\ \dfrac{12 \cdot \pi^2 \cdot E}{23 \cdot \left(\frac{K \cdot l}{r}\right)^2} & \text{if } \dfrac{K \cdot l}{r} > C_c \end{cases} \qquad F_a = 45.0 \cdot ksi$$

$$F_a := 1.333 \cdot F_a \quad \text{Note: 1.333 increase allowed per TIA/EIA} \qquad F_a = 60.0 \cdot ksi$$

Applied Compressive Force:

$$MaxCompression := \frac{OM \cdot R_{bc}}{I_p} + \frac{Axial}{N} \qquad MaxCompression = 123.2 \cdot kips$$

$$f_a := \frac{MaxCompression}{A_n} \qquad f_a = 37.9 \cdot ksi$$

Check Combined Stresses:

$$\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}} = 0.63$$

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

Base Plate Analysis:

Force from Bolt(s):

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

$C_1 = 54.8 \cdot kips$ $C_7 = 2.4 \cdot kips$

$C_2 = 96.8 \cdot kips$ $C_8 = -50.0 \cdot kips$

$C_3 = 120.2 \cdot kips$ $C_9 = -92.0 \cdot kips$

$C_4 = 120.2 \cdot kips$ $C_{10} = -115.3 \cdot kips$

$C_5 = 96.8 \cdot kips$ $C_{11} = -115.3 \cdot kips$

$C_6 = 54.8 \cdot kips$ etc.

Bending Stress in Plate:

$$f_{bp} := \sum_i \frac{6 \cdot C_i \cdot MA_i}{EffectiveWidth \cdot PlateThickness^2} \qquad f_{bp} = 50.3 \cdot ksi$$

Check Stresses:

$$\frac{f_{bp}}{1.333 \cdot 0.75 Fy_{bp}} = 0.84$$

$$Condition := if\left(\frac{f_{bp}}{1.333 \cdot 0.75 Fy_{bp}} < 1.00, "OK", "Overstressed"\right)$$

Condition = "OK"

NATCOMM

Job	145' EEI Monopole - Barkhamsted, CT	Project No.	08136.CO6	Page	of
Description	Foundation Analysis	Computed by	Staff	Sheet 1	of 9
		Checked by		Date 10/28/08	Date

MONOPOLE FOUNDATION ANALYSIS

TOWER FORCES:

Moment Caused by Tower	$M_t := 2254 \cdot ft \cdot kips$
Shear at Base of Tower	$S_t := 21kip$
Max Compressive Force	$C_t := 34 \cdot kip$
Height of Tower	$H_t := 145 \cdot ft$
Base Plate Bolt Circle	$MP := 64.0in$

FOOTING DIMENSIONS:

Overall Depth of Footing	$D_f := 8.0ft$
Length of Pier	$L_p := 5.5 \cdot ft$
Extension of Pier Above Grade	$L_{pag} := 1.0 \cdot ft$
Diameter of Pier	$d_p := 7.0 \cdot ft$
Thickness of Footing	$T_f := 3.5 \cdot ft$
Width of Footing:	$W_f := 21.5ft$
Length of Anchor Bolts:	$L_{st} := 96.0in$
Projection of anchor bolts above pier	$A_{BP} := 12.0 \cdot in$
Anchor Bolt Diameter	$d_{anchor} := 2.25in$
Anchor bolt area	$A_{anchor} := 3.98 \cdot in^2$

PROPERTIES:

Compressive Strength of Concrete	$fc := 4000psi$
Yield Strength of Steel Reinforcement	$fy := 60000 \cdot psi$
Yield Strength of Anchor Bolt	$fya := 75000 \cdot psi$
Internal Friction Angle of Soil	$\phi_s := 30 \cdot deg$
Allowable Bearing Capacity	$q_s := 8000 \cdot psf$
Unit Weight of Soil	$\gamma_{soil} := 120pcf$
Unit Weight of Concrete	$\gamma_{conc} := 150 \cdot pcf$
Is foundation subject to bouyancy (Yes=1/N=0):	$Bouyancy := 0$
Depth to Neglect	$n := 1.0ft$
Cohesion of Clay Type Soil Note: Use 0 for Sandy Soil	$c := 0 \cdot ksf$
Seismic Zone Factor:	$Z := 2$
IBC Fig 23-2	
Coefficient of Friction between Concrete:	$\mu := 0.45$
Clear Cover of Reinforcement Pier:	$Cvr_{pier} := 3 \cdot in$
Clear Cover of Reinforcement Pad:	$Cvr_{pad} := 3 \cdot in$

PIER REINFORCEMENT:

Bar Size	$BSpier := 8$	Bar Diameter	$d_{bpier} := 1.000 \cdot in$
Number of Bars	$NBpier := 46$	Bar Area	$A_{bpier} := 0.790 \cdot in^2$

PAD REINFORCEMENT:

TOP:	Bar Size	$BS_{top} := 8$	Bar Diameter	$d_{btop} := 1.000 \cdot in$
	Number of Bars	$NB_{top} := 22$	Bar Area	$A_{btop} := 0.790 \cdot in^2$
BOTTOM:	Bar Size	$BS_{bot} := 8$	Bar Diameter	$d_{bbot} := 1.000 \cdot in$
	Number of Bars	$NB_{bot} := 22$	Bar Area	$A_{bot} := 0.790 \cdot in^2$

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

Load Factor (EIA 3.1.1): $LF := if\left[H_t \le 700 \cdot ft, 1.333, if\left[H_t \ge 1200, 1.7, 1.333 + \left(\frac{H_t - 700}{1200 - 700}\right) \cdot 0.4\right]\right]$ $LF = 1.333$

STABILITY OF FOOTING

Adjusted Unit Weights:

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

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

Passive Pressure:

$P_{pn} := K_p \cdot \gamma_s \cdot n + c \cdot 2 \cdot \sqrt{K_p}$ $\quad P_{pn} = 0.36 \cdot \text{ksf}$

$P_{pt} := K_p \cdot \gamma_s \cdot (D_f - T_f) + c \cdot 2 \cdot \sqrt{K_p}$ $\quad P_{pt} = 1.62 \cdot \text{ksf}$

$P_{top} := \text{if}[n < (D_f - T_f), P_{pt}, P_{pn}]$ $\quad P_{top} = 1.62 \cdot \text{ksf}$

$P_{bot} := K_p \cdot \gamma_s \cdot D_f + c \cdot 2 \cdot \sqrt{K_p}$ $\quad P_{bot} = 2.88 \cdot \text{ksf}$

$P_{ave} := \frac{P_{top} + P_{bot}}{2}$ $\quad P_{ave} = 2.25 \cdot \text{ksf}$

$T_p := \text{if}[n < (D_f - T_f), T_f, (D_f - n)]$ $\quad T_p = 3.5 \cdot \text{ft}$

$A_p := W_f \cdot T_p$ $\quad A_p = 75.25 \cdot \text{ft}^2$

Ultimate Shear:

$S_u := P_{ave} \cdot A_p$ $\quad S_u = 169.3125 \cdot \text{kip}$

Weight of Concrete Pad:

$WT_c := \left[\left(W_f^2 \cdot T_f \right) + \frac{d_p^2 \cdot \pi}{4} L_p \right] \cdot \gamma_c$ $\quad WT_c = 274.431 \cdot \text{kip}$

Weight of Soil: above Footing:

$WT_{s1} := \left[W_f^2 \cdot \left(\left| L_p - L_{pag} - n \right| \right) - \frac{d_p^2 \cdot \pi}{4} \cdot \left(\left| L_p - L_{pag} - n \right| \right) \right] \cdot \gamma_s$ $\quad WT_{s1} = 177.9815 \cdot \text{kip}$

Weight of Soil Wedge at back face:

$WT_{s2} := \left(\frac{D_f^2 \cdot \tan(\phi_s)}{2} \cdot W_f \right) \cdot \gamma_s$ $\quad WT_{s2} = 47.666 \cdot \text{kip}$

Total Weight:

$WT_{tot} := WT_c + WT_{s1} + C_t$ $\quad WT_{tot} = 486.4125 \cdot \text{kip}$

Resisting Moment:

$M_r := (WT_{tot}) \cdot \frac{W_f}{2} + S_u \cdot \frac{T_f}{3} + WT_{s2} \cdot \left(W_f + \frac{D_f \cdot \tan(\phi_s)}{3} \right)$ $\quad M_r = 6524.6719 \cdot \text{kip} \cdot \text{ft}$

Overturning Moment:

$M_{ot} := M_t + S_t \cdot (L_p + T_f)$ $\quad M_{ot} = 2443 \cdot \text{kip} \cdot \text{ft}$

Factor of Safety:

$FS := \frac{M_r}{M_{ot}}$ $\quad FS_{req} := 2$ $\quad FS = 2.67$

$\text{SafetyCheck} := \text{if}(FS > FS_{req}, \text{"Okay"}, \text{"No Good"})$ $\quad \text{SafetyCheck} = \text{"Okay"}$

SHEAR CAPACITY IN PIER

$$S_p := \frac{P_{ave} \cdot A_p + \mu \cdot WT_{tot}}{FS_{req}} \qquad S_p = 194.0991 \cdot kips$$

$$ShearCheck := if(S_p > S_t, "Okay", "No Good") \qquad ShearCheck = "Okay"$$

BEARING PRESSURE CAUSED BY FOOTING

$$A_{mat} := W_f^2 \qquad A_{mat} = 462.25 \cdot ft^2$$

$$S := \frac{W_f^3}{6} \qquad S = 1656.3958 \cdot ft^3$$

$$P_{max} := \frac{WT_{tot}}{A_{mat}} + \frac{M_{ot}}{S} \qquad P_{max} = 2.5272 \cdot ksf$$

$$P_{min} := \frac{WT_{tot}}{A_{mat}} - \frac{M_{ot}}{S} \qquad P_{min} = -0.4226 \cdot ksf$$

$$MaxPressure := if(P_{max} < q_s, "Okay", "No Good") \qquad MaxPressure = "Okay"$$

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

Distance to Resultant of Pressure Distribution:

$$X_p := \frac{P_{max}}{\frac{P_{max} - P_{min}}{W_f}} \cdot \frac{1}{3} \qquad X_p = 6.1399 \cdot ft$$

Distance to Kern:

$$X_k := \frac{W_f}{6} \qquad X_k = 3.5833 \cdot ft$$

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

Eccentricity:

$$e := \frac{M_{ot}}{WT_{tot}} \qquad e = 5.0225$$

Adjusted Soil Pressure:

$$P_a := \frac{2 \cdot WT_{tot}}{3 \cdot W_f \left(\frac{W_f}{2} - e \right)} \qquad P_a = 2.6334 \cdot ksf$$

$$q_{adj} := if\left(P_{min} < 0, P_a, \frac{P_{max}}{ft^2} \right) \qquad q_{adj} = 2.6334 \cdot ksf$$

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

CONCRETE BEARING CAPACITY (ACI 10.17)

(ACI 9.3.2.2) $\phi_c := 0.75$

$P_b := \phi_c \cdot 0.85 \cdot f'c \cdot \frac{d_p^2 \cdot \pi}{4}$ $P_b = 14131.5121 \cdot kip$

$BearingCheck := if(P_b > LF \cdot C_t, "Okay", "No Good")$ BearingCheck = "Okay"

SHEAR STRENGTH OF CONCRETE

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

(ACI 9.3.2.3) $\phi_{vc} := .85$

$d := T_f - Cvr_{pad} - 1in - d_{bbot}$ $d = 37 \cdot in$

$d_1 := \frac{W_f}{2} - \frac{d_p}{2}$ $d_1 = 7.25 \cdot ft$

$d_2 := d_1 - d$ $d_2 = 4.1667 \cdot ft$

$L := \left(\frac{W_f}{2} - e\right) \cdot 3$ $L = 17.1825 \cdot ft$

$Slope := if\left(L > W_f, \frac{P_{max} - P_{min}}{W_f}, \frac{q_{adj}}{L}\right)$ $Slope = 0.1533 \cdot kcf$

$V_{req} := LF \cdot \left[\left(q_{adj} - Slope \cdot d_1\right) + \left(\frac{Slope \cdot d_1}{2}\right)\right] \cdot W_f \cdot d_1$ $V_{req} = 431.7268 \cdot kip$

ACI 11.3.1.1 $V_{Avail} := \phi_c \cdot 2 \cdot \sqrt{f'c \cdot psi} \cdot W_f \cdot d$ $V_{Avail} = 1026.3615 \cdot kip$

$BeamShearCheck := if(V_{req} < V_{Avail}, "Okay", "No Good")$ BeamShearCheck = "Okay"

Punching Shear: (Critical Section Located at a distance of d/2 from the face of pier) (ACI 11.12.2.1)

$b_o := \left(d_p + d\right) \cdot \pi$ $b_o = 31.6777 \cdot ft$

Area included inside bo: $A_{bo} := \frac{\pi \cdot \left(d_p + d\right)^2}{4}$ $A_{bo} = 79.8543 \cdot ft^2$

Area outside of bo: $A_{out} := A_{mat} - A_{bo}$ $A_{out} = 382.3957 \cdot ft^2$

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

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

$v_u := \text{Find}(v_u)$ $v_u = 4.98 \cdot ksf$

$V_u := v_u \cdot d \cdot W_f$ $V_u = 330.1332 \cdot kips$

$V_{req} := LF \cdot V_u$ $V_{req} = 440.0675 \cdot kips$

$V_{Avail} := \phi_c \cdot 4 \cdot \sqrt{f'c \cdot psi} \cdot b_o \cdot d$ $V_{Avail} = 3024.4463 \cdot kips$

$PunchingShearCheck := \text{if}(V_{req} < V_{Avail}, \text{"Okay"}, \text{"No Good"})$ PunchingShearCheck = "Okay"

STEEL REINFORCEMENT IN THE PAD

ACI 9.3.2.2 $\phi_m := .90$

Take Maximum Bending at face of Pier:

$q_b := q_{adj} - d_1 \cdot Slope$ $q_b = 1.5222 \cdot ksf$

$M_n := \frac{1}{LF \cdot \phi_m} \cdot \left[(q_{adj} - q_b) \cdot \frac{d_1^2}{3} + q_b \cdot \frac{d_1^2}{2} \right] \cdot W_f$ $M_n = 1065.8411 \cdot kip \cdot ft$

ACI 10.2.7.3 $\beta := \text{if}\left[f'c \le 4000 \cdot psi, .85, \text{if}\left[f'c \ge 8000 \cdot psi, .65, .85 - \left(\frac{\frac{f'c}{psi} - 4000}{1000} \right) \cdot .05 \right] \right]$ $\beta = 0.85$

$R_u := \frac{M_n}{\phi_m \cdot W_f \cdot d^2}$ $R_u = 5793.9\ lbf$

$\rho := \frac{0.85 \cdot f'c}{fy} \left(1 - \sqrt{1 - \frac{2 \cdot R_u}{0.85 \cdot f'c}} \right)$ $\rho = 0.0007$

$\rho_{min} := 1.333 \cdot \rho$ $\rho_{min} = 0.0009$

TEMPERATURE AND SHRINKAGE

$\rho_{sh} := if(fy \geq 60000 \cdot psi, 0.0018, 0.0020)$ $\rho_{sh} = 0.0018$

(ACI 7.12.2.1b)

FOR BOTTOM BARS: $As := \max(\rho\rho_{min}, \rho_{sh}) \cdot W_f \cdot d$ $As = 17.1828 \cdot in^2$

$As_{prov} := A_{bot} \cdot NB_{bot}$ $As_{prov} = 17.38 \cdot in^2$

$PadReinforcement := if(As_{prov} > As, "Okay", "No Good")$ $PadReinforcement = "Okay"$

FOR TOP BARS: $As := \rho_{sh} \cdot (W_f \cdot d)$ $As = 17.1828 \cdot in^2$

$As_{prov} := A_{btop} \cdot NB_{top}$ $As_{prov} = 17.38 \cdot in^2$

$PadReinforcement := if(As_{prov} > As, "Okay", "No Good")$ $PadReinforcement = "Okay"$

DEVELOPMENT LENGTH OF PAD REINFORCEMENT

TENSION (ACI 12.2.3)

Bar Spacing: $B_{sPad} := \frac{W_f - 2 \cdot Cvr_{pad} - NB_{bot} \cdot d_{bbot}}{NB_{bot} - 1}$ $B_{sPad} = 10.9524 \cdot in$

Development Length Factors:

Reinforcement Location Factor	$\alpha := 1.0$	
Coating Factor	$\beta := 1.0$	
Concrete strength Factor	$\lambda := 1.0$	
Reinforcement Size Factor	$\gamma := 1.0$	

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

Transverse Reinforcement Index:

As allowed by ACI 12.2.4 $k_{tr} := 0$

$L_{dbt} := \frac{3}{40} \cdot \frac{fy}{\sqrt{f'c \cdot psi}} \cdot \frac{\alpha\beta\cdot\gamma\cdot\lambda}{\frac{c+k_{tr}}{d_{bbot}}} \cdot d_{bbot}$ $L_{dbt} = 23.7171 \cdot in$

$L_{dbmin} := 12 \cdot in$

Minimum Development Length: (ACI 12.2.1) $L_{dbtCheck} := if(L_{dbt} \geq L_{dbmin}, "Use L.dbt", "Use L.dbmin")$ $L_{dbtCheck} = "Use L.dbt"$

Available Length in Pad: $L_{Pad} := \frac{W_f}{2} - \frac{d_p}{2} - Cvr_{pad}$ $L_{Pad} = 84 \cdot in$

$LpadTension := if(L_{Pad} > L_{dbt}, "Okay", "No Good")$ $LpadTension = "Okay"$

REINFORCEMENT IN PIER

Pier Area:

$$A_{pv} := \frac{\pi \cdot d_p^{\,2}}{4} \qquad A_p = 5541.7694 \cdot in^2$$

(ACI 10.8.4 and 10.9.1)

$$A_{smin} := 0.01 \cdot 0.05 \cdot A_p \qquad A_{smin} = 2.7709 \cdot in^2$$

$$A_{sprov} := NBpier \cdot A_{bpier} \qquad A_{sprov} = 36.34 \cdot in^2$$

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

NOTE: Anchor Bolts are not accounted for in reinforcement calculation and will provide additional reinforcement to satisfy minimum requirement of steel.

Bar Spacing In Pier:

$$B_{sPier} := \frac{d_p \cdot \pi}{NBpier} - d_{bpier} \qquad B_{sPier} = 4.7368 \cdot in$$

Diameter of Reinforcement Cage:

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

Maximum Moment in Pier:

$$M_p := \left[M_t + S_t \cdot \left(L_p + \frac{A_{BP}}{2}\right)\right] \cdot LF \qquad M_p = 38070.48 \cdot in \cdot kips$$

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

(defined variables)

$$\left(f'_c \;\; f_y \;\; cl \;\; Spiral\right) = (3 \;\; 60 \;\; 3 \;\; 0)$$

The required input is column diameter in inches, number of reinforcing bars, bar size number, factored axial load in kips and moment in kip inches:

$$\left(D \;\; N \;\; n \;\; P_u \;\; M_{xu}\right) := (84 \;\; 46 \;\; 8 \;\; 45.3 \;\; 38055)$$

Clears any previous output:

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

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

The Output is given as useable axial load in kips, moment capacity in kip inches, splicing stress in ksi, and reinforcement ratio:

$$\left(\phi P_n \;\; \phi M_{xn} \;\; f_{sp} \;\; \rho\right) = (83.4495 \;\; 70103.1448 \;\; -60 \;\; 0.0066)$$

Column size and reinforcement may be changed to match capacity to the applied load.

$$AxialLoadCheck := if\left(\phi P_n \geq P_u, "Okay", "No Good"\right) \qquad AxialLoadCheck = "Okay"$$

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

DEVELOPMENT LENGTH OF PIER REINFORCEMENT

TENSION (ACI 12.2.3)

Factors for development:

Reinforcement Location Factor $\alpha := 1.0$

Coating Factor $\beta := 1.0$

Concrete strength Factor $\lambda := 1.0$

Reinforcement Size Factor $\gamma := 1.0$

Spacing or Cover Dimension: $c := if\left(Cvr_{pier} < \frac{B_{sPier}}{2}, Cvr_{pier}, \frac{B_{sPier}}{2}\right)$ $c = 2.3684 \cdot in$

Transverse Reinforcement:

As allowed by ACI 12.2.4 $k_{tr} := 0$

$$L_{dbt} := \frac{3}{40} \cdot \frac{fy}{\sqrt{f'c \cdot psi}} \cdot \frac{\alpha \cdot \beta \cdot \gamma \cdot \lambda}{\frac{c + k_{tr}}{d_{bpier}}} \cdot d_{bpier} \qquad L_{dbt} = 30.0418 \cdot in$$

$L_{dbmin} := 12 \cdot in$

Minimum Development Length: (ACI 12.2.1)

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

$$L_{dh} := \frac{1200 \cdot d_{bpier}}{\sqrt{\frac{f'c}{psi}}} \cdot .7 \qquad L_{dh} = 13.2816 \cdot in$$

$L_{db} := \max\left(L_{dbt}, L_{dbmin}\right)$ $L_{db} = 30.0418 \cdot in$

COMPRESSION: (ACI 12.3.2)

$$L_{dbc1} := \frac{.02 \cdot d_{bpier} \cdot fy}{\sqrt{f'c \cdot psi}} \qquad L_{dbc1} = 18.9737 \cdot in$$

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

$L_{dbc} := if\left(L_{dbc1} \geq L_{dbmin}, L_{dbc1}, L_{dbmin}\right)$ $L_{dbc} = 18.9737 \cdot in$

Available Length in Foundation:

$L_{pier} := L_p - Cvr_{pier}$ $L_{pier} = 63 \cdot in$

$L_{pad} := T_f - Cvr_{pad}$ $L_{pad} = 39 \cdot in$

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

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

NOTE: Anchor bolts and plate provided

TIE SIZE AND SPACING IN COLUMN

Minimum Tie Size:

$Tie_{min} := if(BSpier \le 10, 3, 4)$ $\quad Tie_{min} = 3$

Used #4 Ties

$d_{Tie} := 4$

Seismic factor:
(ACI 21.10.5)

$z := if(Z \le 2, 1, 0.5)$ $\quad z = 1$

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

$s_{lim2} := \frac{48 \cdot d_{Tie} \cdot in}{8} \cdot z$ $\quad s_{lim2} = 24 \cdot in$

$s_{lim3} := D_f \cdot z$ $\quad s_{lim3} = 96 \cdot in$

$s_{lim4} := 18in$ $\quad s_{lim4} = 18 \cdot in$

Maximum Spacing:

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

Number of Ties Required:

$$n_{tie} := \frac{L_{pier} - 3 \cdot in}{s_{tie}} + 1 \quad n_{tie} = 4.75$$

CHECK ANCHOR STEEL EMBEDMENT

Depth:

$D_{ab} := L_{st} - A_{BP}$ $\quad D_{ab} = 7 \cdot ft$ $\quad L_{anchor} := \frac{(0.11 \cdot fya) \cdot in}{\sqrt{f'c \cdot psi}}$ $\quad L_{anchor} = 10.8703 \cdot ft$

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

$DepthCheck = "No Good"$

Note: Anchor plate is provided

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ENGINEERED
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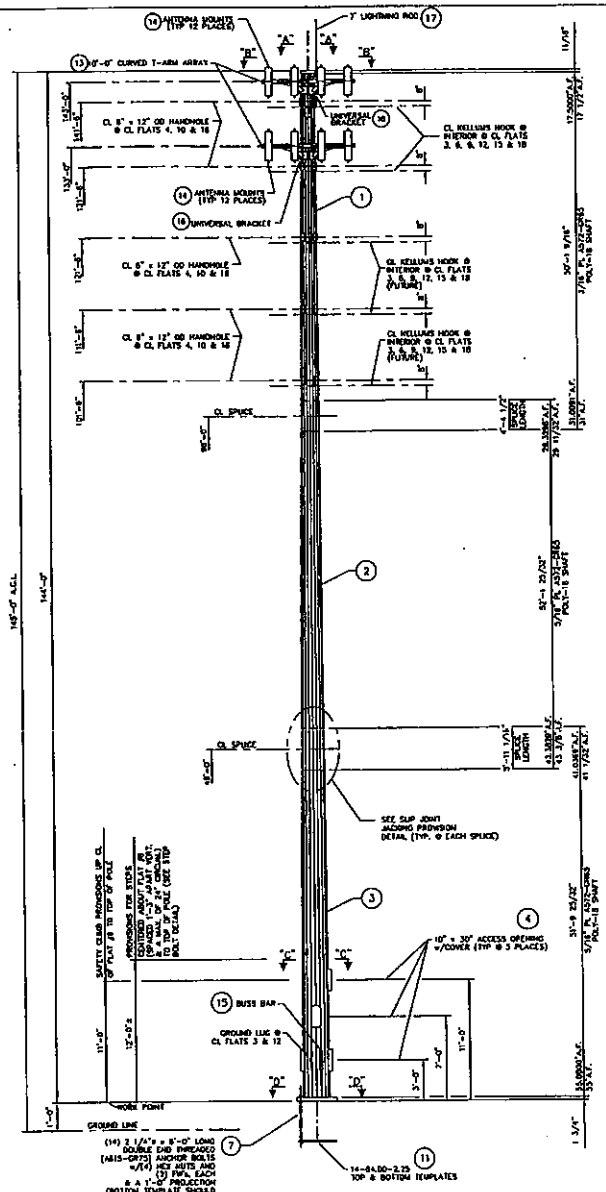
The Experienced Point of View

NatComm
Structure & Foundation
Design Calculations
145' Monopole
Site: Barkhamsted West
EEI Job #: 13841-E01

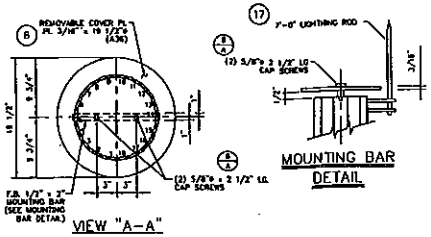
ENGINEERED ENDEAVORS INCORPORATED

7610 Jenther Drive ■ Mentor, Ohio 44060
Telephone: (440) 918-1101 ■ Telefax: (440) 918-1108

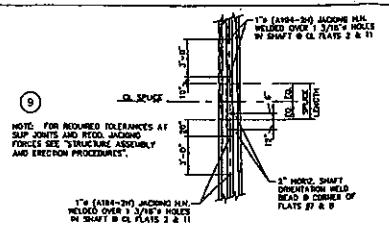


ERECTION VIEW
SCALE ——— NONE

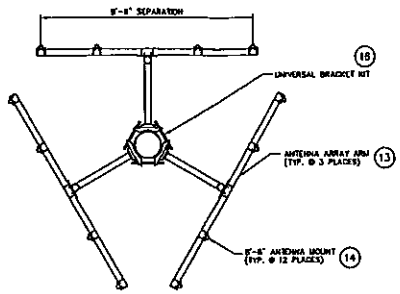
NOTE: ALL ELEVATIONS SHOWN FROM BOTTOM OF BASE PLATE UNLESS OTHERWISE NOTED.



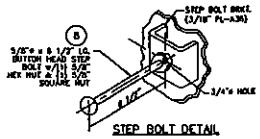
VIEW "A-A"



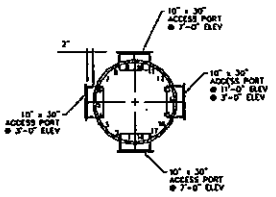
SLIP JOINT JACKING PROVISION DETAIL



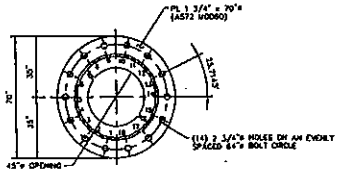
SECTION "B-B"



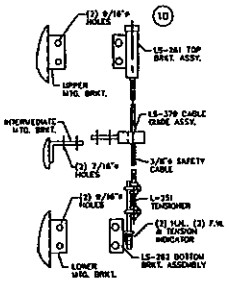
STEP BOLT DETAIL



SECTION "C-C"



SECTION "D-D"



SAFETY CLIMB ATTACHMENT DETAILS
(LOCATED ALONG CL OF FLAT #8)

MATERIAL REQ'D. PER ASSEMBLY

	GALV. WT.	QTY.	ITEM	MK. NO.	DESCRIPTION
*	--	1	1	---	SHAFT ASSY. (TOP) 50.17' LG.
*	--	1	2	---	SHAFT ASSY. (MIDDLE) 52.15' LG.
*	--	1	3	---	SHAFT ASSY. (BOTTOM) 51.95' LG.
*	31.41	5	4	K11497	10" x 30" ACCESS PORT COVER PL
			5		HARDWARE AS FOLLOWS:
*	6.87	15	5 a/c	K11097	6" x 12" HANDHOLE COVER PL
*	15.85	1	6	GS14893	REMOVABLE COVER PLATE
*		2	6 a/c		5/8"ø x 2 1/2" LG. CAP SCREW
	129.50	14	7	225-AB8DE-4	2 1/4"ø x 8'-0" LG. [A615-GR75] ANCHOR BOLTS w/(4) HEX NUTS [A36-GR2H] & (2) FWL. EACH
	1.08	---	8	S10006	5/8"ø x 8 1/2" LG. BUTTON HEAD STEP BOLT w/(1) HEX & (1) SQUARE NUT EACH
		1	9		STRUCTURE ASSEMBLY AND ERECTION PROCEDURES
		1	10	DBI-140	140'-0" SAFETY CLIMB KIT
		1	10 a/c	L2010	SAFETY CLIMB HARNESS
	121.70	2	11	14-64.00-2.25	SETTING TEMPLATE
	1.50	12	12	GS13625	5/8"ø KELLUMS HOOK ASSY.
	302.09	6	13	K11397	CURVED ANTENNA ARRAY ARM (10'-0" SEPARATION)
	40.91	24	14	K11014	8'-6" ANTENNA MOUNT
	7.50	1	15	K10062	20" BUSS BAR KIT
	231.03	2	16	K10461	UNIVERSAL BRACKET (10" - 25")
	28.60	1	17	K10333	7' LIGHTNING ROD

TOTAL GALV. STR. & ACCES. WT. ____#
TOTAL ANCHOR BOLT & TEMPLATE WT. 2056.42#

GENERAL NOTES

1) MONOPOLE IS DESIGNED IN ACCORDANCE WITH TIA/EIA-222F FOR 80 MPH FASTEST MILE WIND SPEED AND 1/2" RADIAL ICE (NON-CONCURRENTLY). MEETS THE REQUIREMENTS OF SECTIONS 1608 & 3108 OF THE 2000 & 2003 IBC FOR 100 MPH 3-SECOND GUST WIND SPEED.
2) ALL WELDS SHALL BE IN ACCORDANCE WITH AWS D1.1, (LATEST EDITION). LONGITUDINAL SEAM WELDS WITHIN SLIP-JOINT AREA IN TENPLE SECTION SHALL BE 100% PENETRATION.
3) MONOPOLE SHALL BE HOT DIP GALVANIZED PER ASTM A123.
4) CONTRACTOR SHALL THOROUGHLY REVIEW EEI'S ASSEMBLY & ERECTION PROCEDURE PRIOR TO RETAINING THE ERECTION OF THE MONOPOLE
5) THE ORIENTATION OF THE MONOPOLE SHALL BE VERIFIED PRIOR TO ERECTION OF THE POLE.
6) SECTIONS OF THE MONOPOLE SHALL BE JACKED TOGETHER WITH A MINIMUM JACKING FORCE OF 10,000 lbf APPLIED TO EACH SIDE. FOR A MAXIMUM RECOMMENDED JACKING FORCE, SPLICE LENGTH TOLERANCE, AND AIR GAP BETWEEN SECTIONS REFER TO EEI ASSEMBLY & ERECTION PROCEDURE.
7) FOR PROPER SHAFT ALIGNMENT A 2" HORIZONTAL WELD BEAD AND A MARK ARE POSITIONED ON EACH SHAFT AT EACH SPLICE. THE 2" HORIZONTAL WELD BEADS ARE ON THE MATCHING CORNERS. THE MARK NUMBER IS ON THE ADJACENT FLAT. THE CORNERS WITH WELD BEADS SHALL BE AUGNED FROM TOP TO BOTTOM OF THE POLE. MARK NUMBERS SHALL BE MATCHED FOR EACH SIDE & THE DISTANCE BETWEEN TWO WELD BEADS SHOULD BE 16" (±4").
8) FIELD ASSEMBLY NUTS (1"ø) FOR JACKING SECTIONS TOGETHER ARE LOCATED ON OPPOSING SECTION FLATS ABOVE AND BELOW SPLICES.
9) GAP BETWEEN TOP OF THE FOUNDATION AND BOTTOM OF THE BASE PLATE MAY BE FILLED WITH A NON-SHRINK GROUT WITH A MINIMUM COMPRESSIVE STRENGTH OF 7,000 psi. WATER DRAINAGE MUST BE PROVIDED UNDERNEATH THE BASE PLATE TO ENSURE THAT MOISTURE DOES NOT COLLECT INSIDE THE MONOPOLE.
10) ALL BOLTED CONNECTIONS WITH A325 HIGH-STRENGTH BOLTS SHALL BE ASSEMBLED IN ACCORDANCE WITH SPECIFICATIONS FOR STRUCTURAL JOINTS USING A325 OR A490 BOLTS. BOLTS SHALL BE BROUGHT TO SNUG-TIGHT CONDITIONS AS RECOMMENDED BY THE FLANGE SPECIFICATIONS IN FLANGE-TYPE JOINTS AND SHOULD BE SHIMMED IF NECESSARY. THE SHIMS WILL BE SUPPLIED BY EEI.
11) ANCHOR BOLTS SHALL BE TIGHTENED AFTER THE STRUCTURE IS PLUMB. BOTH TOP & BOTTOM NUT SHALL BE TIGHTEN TO 400 ft-lbs MOMENT. FOR DETAIL ANCHOR BOLT INSTALLATION REFER TO EEI ASSEMBLY AND ERECTION PROCEDURE.
12) POLE TAPER = 0.2895in/ft.

ASSEMBLY MARKING PROCEDURE

EACH INDIVIDUAL ASSEMBLY SHALL HAVE A METAL TAG WELDED TO IT WHICH WILL BE ENGRAVED WITH THE ASSEMBLY MARK NO. AS SHOWN IN THE MATERIAL BILLOC. [MINIMUM OF 3/32" HIGH LETTERS]

STATE OF CONNECTICUT
MICHAEL R. MOREL
No. 21220
LICENSED PROFESSIONAL ENGINEER
7-18-05

NO.	DESCRIPTION	DATE	DWN	APP.
0	COMPLETED APPROVAL DWG	09/08/05	J.A.M.	

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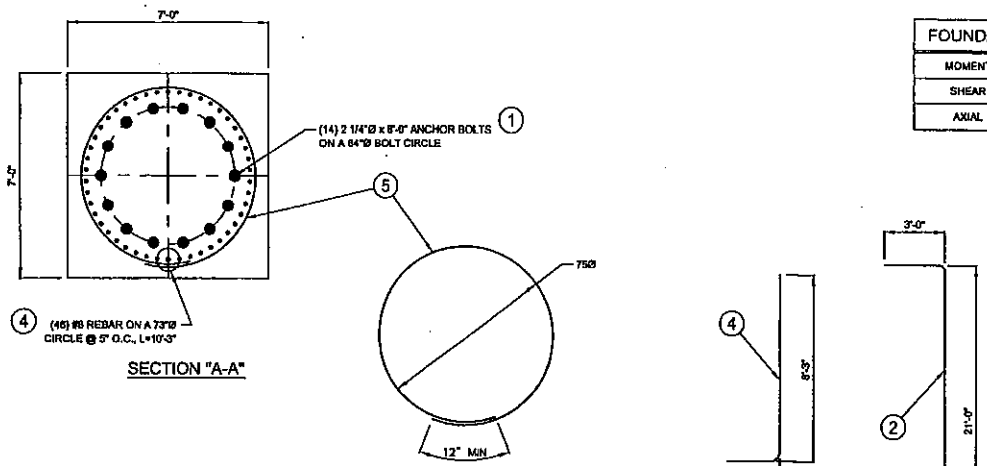
145'-0" MONOPOLE
NATCOMM
BARKHAMSTED WEST
LITCHFIELD COUNTY, CT

SCALE	NONE	PROJECT NO.	13841
SHT.	1 of 1	DRAWING NO.	GS56072

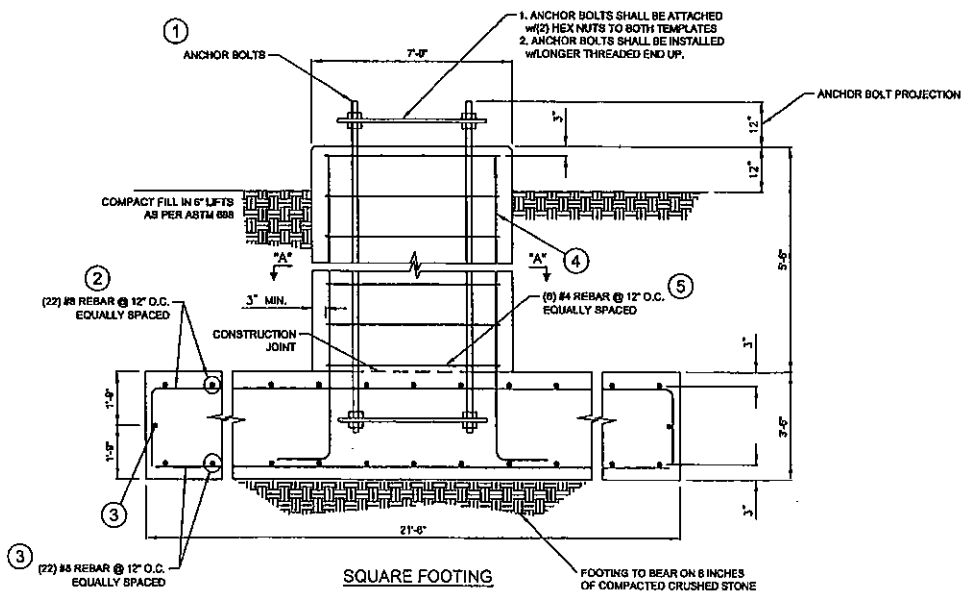


SECTION "A-A"

FOUNDATION LOADING	
MOMENT	2530.5 kip-ft
SHEAR	24.2 kips
AXIAL	21.4 kips

MATERIAL LIST		
ITEM	QTY.	DESCRIPTION
1	14	2 1/4"Ø x 8'-0" (A615-GR.75) ANCHOR BOLTS
2	44	#8 REBAR x 27'-0" (ASTM A615-GR.60)
3	48	#8 REBAR x 21'-0" (ASTM A615-GR.60)
4	46	#5 REBAR x 10'-3" (ASTM A615-GR.60)
5	6	#4 REBAR x 21'-0" (ASTM A615-GR.60)

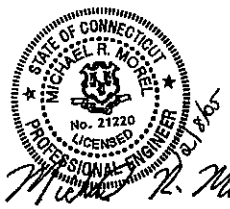
VOL. CONCRETE @ 4000 psi (TYPE II CEMENT)	89.9 yd^3
STEEL (ASTM A615-GR.60)	8780.8 lbs



SQUARE FOOTING

GENERAL NOTES:

1. FOUNDATION DESIGN IS BASED ON THE FOLLOWING: EEI JOB# 13841, DRAWING# GS56072
   SOIL REPORT BY JGI EASTERN, INC., REPORT NO. 05704G - 11/30/05
2. FOUNDATION EMBEDMENT IS SHOWN FROM THE GROUND LEVEL AT THE TIME OF SOIL INVESTIGATION AS DEPICTED IN THE SOIL REPORT. SHOULD THE ACTUAL SOIL CONDITIONS DIFFER FROM THOSE IN THE REPORT, THE GEOTECHNICAL ENGINEER AND FOUNDATION DESIGNER SHOULD BE NOTIFIED IN ORDER TO RE-EVALUATE THE FOUNDATION DESIGN.
3. SOIL REPORT SHOULD BE CONSULTED PRIOR TO CONSTRUCTION. STEEL CASING OR SLURRY METHOD MAY BE REQUIRED TO PREVENT SOIL FROM CAVING DURING CONSTRUCTION. THE CASING SHOULD BE REMOVED AFTER COMPLETION OF CONCRETING OR, IF LEFT IN THE GROUND, ALL VOIDS AROUND THE CASING SHALL BE FILLED WITH PRESSURIZED GROUT. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR ALL CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES, AND PROCEDURES.
4. FOUNDATION EXCAVATION SHALL BE INSPECTED PRIOR TO PLACEMENT OF REINFORCEMENT AND ANCHOR BOLTS.
5. SPECIAL INSPECTION OF REINFORCEMENT, ANCHOR BOLT INSTALLATION, AND CONCRETE IS REQUIRED PER 2003 IBC. FOUNDATION REINFORCEMENT AND ANCHOR BOLTS SHALL BE INSPECTED PRIOR TO PLACEMENT.
6. REINFORCING STEEL SHALL CONFORM TO ASTM A615-97, Fy=60 ksi. REINFORCEMENT SHALL BE ASSEMBLED USING STEEL WIRE. WELDING IS NOT PERMITTED. MINIMUM SPLICE LENGTH: FOR No. 6 BARS AND SMALLER - 44 x Øbar; FOR No. 7 BARS AND LARGER - 55 x Øbar. HORIZONTAL TIES SHALL BE STAGGERED WITH NO MORE THAN 50% OF SPLICES IN ONE PLACE.
7. CONCRETE MIX DESIGN AND CONSTRUCTION PROCEDURE SHALL BE IN COMPLIANCE WITH ACI 318-02, ACI 336.3R-93, AND ALL APPLICABLE STATE AND LOCAL CODES.
   a. MINIMUM COMPRESSIVE STRENGTH - 4000 psi AT 28 DAYS. USE TYPE II CEMENT UNLESS STATED OTHERWISE.
   b. CONCRETE MIX SHOULD HAVE A SLUMP OF 7" (±1") FOR DRILLED PIER AND 3" (±1") FOR MAT FOUNDATIONS.
   c. FOR DRILLED PIERS ONLY THE CONCRETE OVER THE ENTIRE LENGTH OF ANCHOR BOLTS SHALL BE VIBRATED. FOR MAT FOUNDATIONS ALL CONCRETE SHALL BE VIBRATED.
8. ANCHOR BOLT ORIENTATION REQUIRED PRIOR TO CONCRETE PLACEMENT. THE CONTRACTOR SHOULD CONSULT THE SITE PLAN AND MONOPOLE DRAWING FOR PROPER ACCESS PORT ORIENTATION.
9. THE FOUNDATION DEPTH IS BASED, IN PART, ON THE ASSUMED RETAINING WALL HEIGHT. IF THE FOUNDATION DEPTH IS NOT DEEPER THAN THE RETAINING WALL, AS REQUIRED IN THE GEOTECHNICAL REPORT, EEI MUST BE CONTACTED TO RE-EVALUATE THE DESIGN.



REV	DESCRIPTION	DATE	DRN	CHK
0	COMPLETED DRAWING	12/8/2005	J.P.	

ENGINEERED ENDEAVORS INCORPORATED
The Experienced Point of View
7610 Jenther Drive * Mentor, OH 44060-4872
Ph: (440) 918-1101 * Ph: (888) 270-3855
Fx: (440) 918-1108 * www.engend.com

NATCOMM
145'-0" MONOPOLE
BARKHAMSTED WEST
LITCHFIELD COUNTY, CT

SCALE: N.T.S.	PROJECT NO.	13841
SHEET 1 of 1	DRAWING NO.	S13841-145.0

ENGINEERED ENDEAVORS INCORPORATED
The Experienced Point of View

Customer: NATCOMM
Description: 145' MONOPOLE
EEI Job Number: 13841

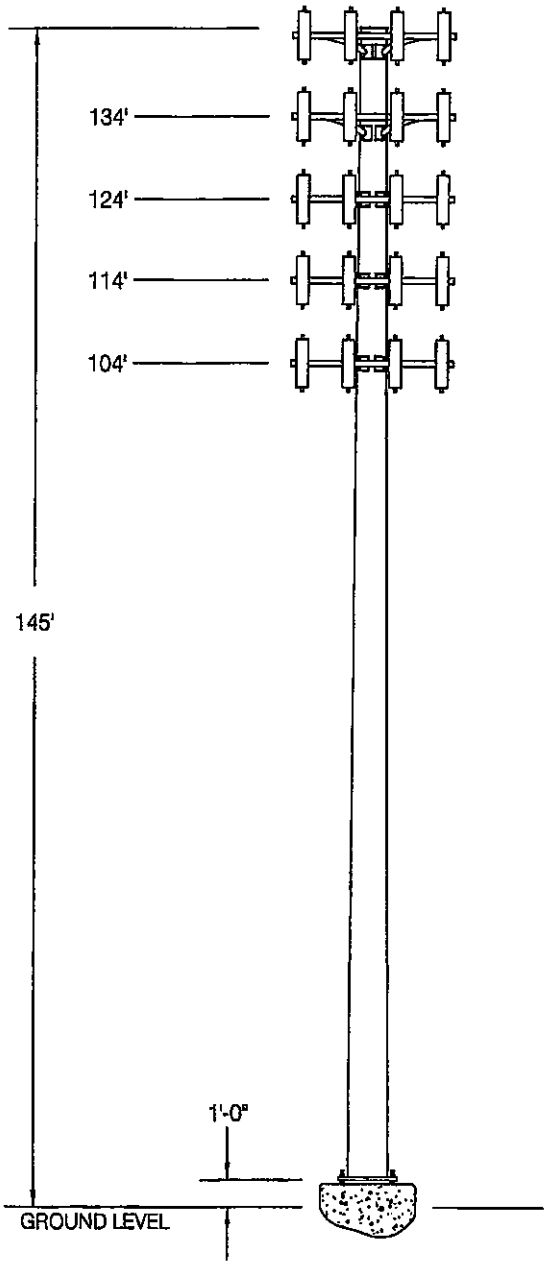
EMERSON™ Network Power

SITE INFORMATION

Location: LITCHFIELD COUNTY, CT
Site Name: BARKHAMSTED WEST
Site Number: N/A

DESIGN INFORMATION

Designed By: JAY PARR
Design Date: 12/6/2005
Status: RELEASE



ANTENNA LOADING

(12) LPA-185063/12CF PANEL ANTENNAS MOUNTED ON (3) 12 ft UNIVERSAL CURVED T-ARMS AT 144'
(12) 7770.00 PANEL ANTENNAS MOUNTED ON (3) 12 ft UNIVERSAL CURVED T-ARMS AT 134'
(12) 4 ft PANEL ANTENNAS MOUNTED ON (3) 12 ft UNIVERSAL T-ARMS AT 124'
(12) 4 ft PANEL ANTENNAS MOUNTED ON (3) 12 ft UNIVERSAL T-ARMS AT 114'
(12) 4 ft PANEL ANTENNAS MOUNTED ON (3) 12 ft UNIVERSAL T-ARMS AT 104'

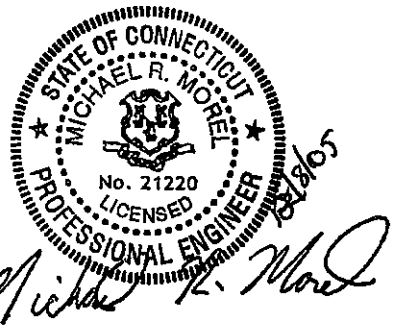
NOTES

DESIGNED WITH AN INITIAL FAILURE POINT AT 97' AGL (48' FALL RADIUS)

DESIGN CRITERIA

DESIGNED IN ACCORDANCE WITH THE TIA/EIA 222-F FOR 80 MPH FASTEST MILE WIND SPEED AND 1/2" RADIAL ICE (NON-SIMULTANEOUS)

DESIGN MEETS THE REQUIREMENTS OF SECTIONS 1609 AND 3108 OF THE 2000 AND 2003 INTERNATIONAL BUILDING CODES FOR 100 MPH 3-SECOND GUST WIND SPEED



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Engineered Endeavors Inc.

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Communications Structure Nonlinear Analysis and Design Program

16:38:28 12-06-2005
Revision 1.3 - 1/22/01
Engineer: PARR

Customer **Natcomm**
Job Name **13841**
Structure **145' Monopole**
Location **Litchfield County, CT**
Site **Barkhamsted West**

OD BOT	OD TOP	NUM. SIDES	THICK INCH	TAPER IN/FT	LENGTH FT	JOINT INCH	JOINT TYPE	YIELD KSI	WEIGHT LBS	JOINT HEIGHT
31.01	17.50	18	0.1875	0.269	50.21	53.00	SLIP	65.0	2417.	96.00
43.37	29.32	18	0.3125	0.269	52.21	72.00	SLIP	65.0	6272.	49.00
55.00	41.01	18	0.3125	0.269	52.00	0.00	BASEPL	65.0	8268.	0.00
			TOTAL TUBE WEIGHT				16958.	POUNDS		
			POLE SHAFT LENGTH				144.00	FEET		

E = 29600.0 KSI
UNIT WGT = 0.283 LBS/CU IN
AISC constants are used for stress reductions.
TUBE SECTIONS HAVE 18 SIDES AND ARE TREATED AS ROUND
Internal bend radius = 3 X T
Tube diameters are measured flat to flat.
Tube diameters are increased by 1.020 for wind across points.
Drag coefficients are increase by 1.300 for steps on the pole.
AISC Tube Shape Coefficient of 1.000 is applied.
REVISED DATA FILE NAME T:\ENG3\JOBS\13841145

APPURTENANCES

DESCRIPTION	NUM.	ELEV.	Kz	AREA	WGT	Ca	AREA	WGT	Ca	FACTOR
				< WITHOUT ICE >			< WITH ICE >			
LPA-185063/12CF	12	144.	1.523	3.26	14.	1.5300	3.81	46.	1.4800	1.17
12' UNIVERSAL T-ARMS	1	144.	1.523	4.95	550.	2.0000	6.20	710.	2.0000	1.00
7770.00	12	133.	1.489	4.20	35.	1.4000	4.67	68.	1.4000	0.93
12' UNIVERSAL T-ARMS	1	133.	1.489	4.95	550.	2.0000	6.20	710.	2.0000	1.00
4' PANELS	12	123.	1.456	4.00	25.	1.4000	4.50	50.	1.4000	1.00
12' UNIVERSAL T-ARMS	1	123.	1.456	4.95	550.	2.0000	6.20	710.	2.0000	1.00
4' PANELS	12	113.	1.421	4.00	25.	1.4000	4.50	50.	1.4000	1.00
12' UNIVERSAL T-ARMS	1	113.	1.421	4.95	550.	2.0000	6.20	710.	2.0000	1.00
4' PANELS	12	103.	1.384	4.00	25.	1.4000	4.50	50.	1.4000	1.00
12' UNIVERSAL T-ARMS	1	103.	1.384	4.95	550.	2.0000	6.20	710.	2.0000	1.00

LOAD CASE 1

BASIC LOADING

DEAD LOAD FACTOR 1.00 WIND PSF REDUCTION 1.00 RADIAL ICE 0.00 IN.

WIND VELOCITY 80 BOTTOM 16.52 PSF TOP 24.89 PSF
MAX BASE ROTATION 0.00 DEG

	APPLIED APPURTENANCE FORCES ELEVATION FT	WEIGHT KIPS	WIND KIPS
LPA-185063/12CF	144.00	0.162	2.954
12' UNIVERSAL T-ARMS	144.00	0.550	0.418
7770.00	133.00	0.420	2.706
12' UNIVERSAL T-ARMS	133.00	0.550	0.408
4' PANELS	123.00	0.300	2.710
12' UNIVERSAL T-ARMS	123.00	0.550	0.399
4' PANELS	113.00	0.300	2.645
12' UNIVERSAL T-ARMS	113.00	0.550	0.390
4' PANELS	103.00	0.300	2.576
12' UNIVERSAL T-ARMS	103.00	0.550	0.379

TUBE PROPERTIES ELEV FT	DIAM IN	WALL IN	MEMBER FORCES SHEAR K	BENDING K-FT	AXIAL K	STRESSES AXIAL KSI	BEND. KSI	ALLOW KSI	STRESS RATIOS	TOTAL DEFL IN	TILT DEG
144.00	17.50	0.1875	3.66	0.00	0.55	0.05	0.00	51.82	0.00	91.2	5.87
133.00	20.46	0.1875	3.66	40.08	0.55	0.05	8.02	49.58	0.16	77.9	5.75
123.00	23.15	0.1875	7.33	113.03	1.61	0.12	17.61	48.05	0.37	66.2	5.47
113.00	25.84	0.1875	11.00	222.55	2.63	0.17	27.75	46.84	0.60	55.3	5.04
103.00	28.53	0.1875	14.62	368.21	3.79	0.23	37.59	45.85	0.82	45.3	4.49
96.00	30.42	0.1875	18.09	494.44	4.99	0.28	44.36	45.27	0.99	39.1	4.04
TYPE OF JOINT: SLIP JOINT											
96.00	29.92	0.3125	18.73	494.44	6.50	0.22	27.87	51.43	0.55	39.1	4.04
82.00	33.68	0.3125	19.49	756.09	8.02	0.24	33.50	49.75	0.68	28.1	3.42
71.00	36.64	0.3125	19.49	970.13	8.02	0.22	36.24	48.67	0.75	20.8	2.91
60.00	39.60	0.3125	20.17	1191.71	9.51	0.25	38.04	47.75	0.80	14.7	2.42
49.00	42.56	0.3125	20.85	1420.93	11.10	0.27	39.20	46.96	0.84	9.7	1.94
TYPE OF JOINT: SLIP JOINT											
49.00	41.81	0.3125	21.61	1420.93	14.41	0.35	40.64	47.15	0.87	9.7	1.94
36.00	45.31	0.3125	21.61	1701.75	14.41	0.33	41.37	46.32	0.90	5.1	1.38
24.00	48.54	0.3125	22.32	1969.57	16.29	0.34	41.67	45.66	0.92	2.2	0.89
12.00	51.77	0.3125	23.01	2245.69	18.23	0.36	41.72	45.08	0.93	0.6	0.43
0.00	55.00	0.3125	24.17	2530.48	21.37	0.40	41.60	44.57	0.94	0.0	0.00

REACTION COMPONENTS (KIPS AND FT-KIPS)

TRANSVERSE SHEAR	VERTICAL FORCE	WIND SHEAR	MOMENT ABOUT TRANSVERSE	MOMENT ABOUT VERTICAL	MOMENT ABOUT WIND AXIS
0.000	21.370	-24.174	2530.483	0.000	0.000

LOAD CASE 2

BASIC LOADING PLUS ICE

DEAD LOAD FACTOR 1.00 WIND PSF REDUCTION 0.75 RADIAL ICE 0.50 IN.

WIND VELOCITY 80 BOTTOM 12.39 PSF TOP 18.67 PSF
MAX BASE ROTATION 0.00 DEG

APPLIED APPURTENANCE FORCES

	ELEVATION FT	WEIGHT KIPS	WIND KIPS
LPA-185063/12CF	144.00	0.553	2.505
12' UNIVERSAL T-ARMS	144.00	0.710	0.392
7770.00	133.00	0.816	2.256
12' UNIVERSAL T-ARMS	133.00	0.710	0.383
4' PANELS	123.00	0.600	2.286
12' UNIVERSAL T-ARMS	123.00	0.710	0.375
4' PANELS	113.00	0.600	2.232
12' UNIVERSAL T-ARMS	113.00	0.710	0.366
4' PANELS	103.00	0.600	2.173
12' UNIVERSAL T-ARMS	103.00	0.710	0.356

TUBE PROPERTIES			MEMBER FORCES			STRESSES			STRESS	TOTAL	
ELEV FT	DIAM IN	WALL IN	SHEAR K	BENDING K-FT	AXIAL K	AXIAL KSI	BEND. KSI	ALLOW KSI	RATIOS	DEFL IN	TILT DEG
144.00	17.50	0.1875	3.18	0.00	1.20	0.12	0.00	51.82	0.00	77.8	5.02
133.00	20.46	0.1875	3.18	34.89	1.20	0.10	6.98	49.58	0.14	66.4	4.92
123.00	23.15	0.1875	6.32	97.83	2.91	0.21	15.24	48.05	0.32	56.4	4.68
113.00	25.84	0.1875	9.46	192.09	4.47	0.30	23.96	46.84	0.52	47.0	4.30
103.00	28.53	0.1875	12.54	317.14	6.15	0.37	32.38	45.85	0.71	38.5	3.82
96.00	30.42	0.1875	15.48	425.29	7.85	0.44	38.16	45.27	0.85	33.2	3.44
			TYPE OF JOINT: SLIP JOINT								
96.00	29.92	0.3125	15.96	425.28	9.32	0.32	23.97	51.43	0.47	33.2	3.44
82.00	33.68	0.3125	15.96	648.37	9.32	0.28	28.73	49.75	0.58	23.9	2.91
71.00	36.64	0.3125	16.52	829.89	10.81	0.30	31.00	48.67	0.64	17.7	2.48
60.00	39.60	0.3125	17.02	1017.00	12.26	0.32	32.46	47.75	0.69	12.4	2.05
49.00	42.56	0.3125	17.53	1209.69	13.82	0.33	33.37	46.96	0.72	8.2	1.65
			TYPE OF JOINT: SLIP JOINT								
49.00	41.81	0.3125	18.09	1209.69	16.90	0.41	34.60	47.15	0.74	8.2	1.65
36.00	45.31	0.3125	18.09	1444.72	16.90	0.38	35.12	46.32	0.77	4.3	1.17
24.00	48.54	0.3125	18.60	1667.91	18.78	0.40	35.28	45.66	0.78	1.9	0.75
12.00	51.77	0.3125	19.10	1897.14	20.72	0.41	35.24	45.08	0.79	0.5	0.36
0.00	55.00	0.3125	19.96	2132.67	23.86	0.44	35.06	44.57	0.79	0.0	0.00

REACTION COMPONENTS (KIPS AND FT-KIPS)

TRANSVERSE SHEAR	VERTICAL FORCE	WIND SHEAR	MOMENT ABOUT TRANSVERSE	MOMENT ABOUT VERTICAL	MOMENT ABOUT WIND AXIS
0.000	23.858	-19.965	2132.671	0.000	0.000

SUMMARY TABLE

ELEV	STRESS RATIO	AXIAL	BENDING	LOADING
144.00	0.01	0.55	0.0	1 BASIC LOADING
133.00	0.16	0.55	40.1	1 BASIC LOADING
123.00	0.37	1.61	113.0	1 BASIC LOADING
113.00	0.60	2.63	222.6	1 BASIC LOADING
103.00	0.82	3.79	368.2	1 BASIC LOADING
96.00	0.99	4.99	494.4	1 BASIC LOADING
82.00	0.68	8.02	756.1	1 BASIC LOADING
71.00	0.75	8.02	970.1	1 BASIC LOADING
60.00	0.80	9.51	1191.7	1 BASIC LOADING
49.00	0.87	14.41	1420.9	1 BASIC LOADING
36.00	0.90	14.41	1701.8	1 BASIC LOADING
24.00	0.92	16.29	1969.6	1 BASIC LOADING
12.00	0.93	18.23	2245.7	1 BASIC LOADING
0.00	0.94	21.37	2530.5	1 BASIC LOADING

MAXIMUM SUPPORT MOMENT K-FT	2530.48
CORRESPONDING AXIAL FORCE KIPS	21.37
CORRESPONDING SHEAR FORCE KIPS	24.17

BASE PLATE AT ELEVATION	0.00	FEET
TUBE DIAMETER	55.00	INCHES
DESIGN MOMENT	2530.5	KIP FT
DESIGN MOMENT IS	0.	DEGREES FROM THE WIND DIRECTION
BOLTS ARE ON THE KNUCKLES OF THE TUBE		
APPLIED AXIAL FORCE	21.4	KIPS
APPLIED SHEAR	24.17	KIPS

BOLT DATA

BOLT TYPE	A615 GR75	
BOLTS ARE EVENLY SPACED		
DIAMETER	2.250	INCHES
EFFECTIVE AREA	3.250	SQ IN
TOTAL LENGTH	8.0	FEET
End plates are required.		
MINIMUM EMBEDMENT	7.1	FEET
NUMBER OF BOLTS	14	
BOLT CIRCLE DIAMETER	64.00	INCHES
ALLOWABLE STRESS	60.0	KSI
APPLIED AXIAL STRESS	42.2	KSI
MAX BOLT FORCE	137.1	KIPS
BOLT BENDING STRESS	2.5	KSI
COMBINED BOLT STRESS	44.7	KSI
CLEARANCE UNDER PLATE	3.25	INCHES
BOLT WEIGHT	1579.2	POUNDS

PLATE DATA

DIAMETER OF PLATE	70.00	INCHES
MATERIAL	A572 MOD60	
PROVIDED THICKNESS	1.750	INCHES
REQUIRED THICKNESS	1.478	INCHES
BOLT HOLE DIAMETER	2.625	INCHES
CENTER HOLE SIZE	45.00	INCHES
NET WEIGHT	1080.8	POUNDS
RAW STOCK WEIGHT	2426.7	POUNDS
SURFACE AREA	30.31	SQ FT
ALLOWABLE STRESS	60.00	KSI
MAX APPLIED STRESS	42.79	KSI
CONCRETE STRENGTH	3000.	PSI

Base Plate - use 70.00 inch ROUND x 1.750 inch A572 MOD60 with (14) 2.250 diameter x 8.00 foot caged A615 GR75 bolts on a 64.00 inch bolt circle. End plates are required.

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DESIGN CALCULATIONS FOR A SPREAD FOOTER FOUNDATION

Natcomm
145 ft Monopole

Barkhamsted West
Litchfield County, CT

EEI Project Number 13841
December 8, 2005

FOUNDATION DESIGN CALCULATIONS FOR A SPREAD FOOTER FOUNDATION

ENGINEERED ENDEAVORS INCORPORATED
*7610 Jenther Drive * Mentor, Ohio 44060*
*Tel:(440)918-1101 * Fax:(440)918-1108*

CUSTOMER: NATCOMM
STRUCTURE: 145' MONOPOLE
JOB NUMBER: 13841
LOCATION: LITCHFIELD COUNTY, CT
SITE NAME: BARKHAMSTED WEST

SERVICE LOADS AT BASE OF THE MONOPOLE

DESIGN LOADING	
MOMENT	2530.5 ft-kips
SHEAR	24.2 kips
AXIAL	21.4 kips

ANCHOR BOLTS

QUANTITY	14.0
LENGTH	8.0 ft
BOLT CIRCLE	64.0 in
PROJECTION	12.0 in

FOUNDATION PARAMETERS

MINIMUM PEDESTAL WIDTH	84.0 in
PEDESTAL PROJECTION	12.0 in
MINIMUM FOUNDATION HEIGHT	7.5 ft

	HEIGHT	WIDTH		
FOOTING	3.50 ft	21.50 ft	SOIL UNIT WEIGHT	100 pcf
PEDESTAL	5.50 ft	7.00 ft	CONCRETE WEIGHT	150 pcf
			ANGLE OF FRICTION	30 degrees

FOUNDATION WEIGHT	283.11 kips	
CONCRETE VOLUME	69.90 yds^3	
SOIL WEIGHT	240.29 kips	H= 4.50
TOTAL VERTICAL LOAD	544.79 kips	B= 26.70
KERN OF ECCENTRICITY	3.58 ft	
ACTUAL ECCENTRICITY	5.04 ft	
OVERTURNING MOMENT	2748.3 ft-kips	
RESISTING MOMENT	5856.5 ft-kips	
ALLOWABLE GROSS SOIL PRESSURE	0.0 ksf	
ALLOWABLE NET SOIL PRESSURE	8.0 ksf	

		GROSS	NET
SOIL PRESSURE	MAXIMUM q=	2.96 ksf	1.83 ksf
	MINIMUM q=	0.00 ksf	

SAFETY FACTOR **Sf = 2.13**

ULTIMATE STRENGTH DESIGN OF FOOTING

CONCRETE, psi	3000
STEEL, KSI	60

SHEAR IN FOOTING

1. CASE I -DEAD LOAD, TWO-WAY SHEAR — U= 1.4*D

Ultimate Vertical Load, kips		762.71	
Ultimate Pressure, ksf		1.65	
Ultimate shear V, kips		**597.71**	
Design shear Vn, kips		**3217.98**	**O.K.**

2. CASE II - WIND LOAD, ONE-WAY SHEAR — U=0.9*D+1.6*W

Ultimate Moment, kip-ft		4397.28	
Ultimate Vertical Load, kips		490.31	
Eccentricity, ft		8.97	
Ultimate Pressure, ksf	qult=	8.53	
Dist. from edge to critical sect., ft		4.25	
Pressure distance ft	c=	5.35	
Pressure @ critical section, ksf		1.75	
Ultimate Shear, kips		**469.73**	
Design Shear, kips		**864.83**	**O.K.**

FLEXURE STRENGTH DESIGN

Ultimate Moment, kip-ft		Case I	932.32		
		Case II	2681.19	q1=	0.00
Coefficient of Resistance		Rn=	106.9		
Reinforcement Ratio		r=	0.00182		
Min. Reinforcement Ratio		r min	0.00180		
Min. Steel Area, sq.in.		A1	16.91		
Type of Bars		#	8		
		Ab,in^2=	0.79		
BOTTOM	Min. Number of Bars		21.41		
	Actual Number of Bars		22.00		
	Actual Steel Area, sq.in.		17.38		
	Steel Ratio Actual	ra=	0.00187		
	Revised Coef. of Resist	Rn=	112.27		
	Design Moment, kip-ft		**2815.40**		
	Horizontal Spacing, in	shor=	12.00		
TOP	Min. Steel Area, sq.in		16.72		
	Min. Number of Bars		21.16		
	Actual Number of Bars		22.00		
	Top Steel Area, sq.in		17.38		
	Horizontal Spacing, in	shor=	12.00		

PEDESTAL DESIGN

Pedestal Width, in		84	Ultim. Moment	4261.8	
Concrete, ksi		3			
Reinforcement, ksi		60			
Rebars , #8	Q-ty	46	Area, sq.in	0.79	
Design Rebars	Q-ty	12	Area, sq.in	3.03	
Minimum reinforcement ratio		0.0050	Rebar space, in	5.05	
Actual reinforcement ratio		0.0052			
Concrete cover , in		4.5			
Rebar layout radius, in		37.00			

Bending about the major axis

No.	Angle, deg	Coord., in	Edge Dist., in	No.	Angle, deg	Coord., in	Edge Dist., in
1	0	37.00	5.00	7	180	-37.00	79.00
2	30	32.04	9.96	8	210	-32.04	74.04
3	60	18.50	23.50	9	240	-18.50	60.50
4	90	0.00	42.00	10	270	0.00	42.00
5	120	-18.50	60.50	11	300	18.50	23.50
6	150	-32.04	74.04	12	330	32.04	9.96

Location of neutral axis c=, in **8.786**
Compression zone, a= **7.47**

No.	e	Force kips
1	0.0013	105.81

eu= 0.003

Concrete, kips 1599.67

Total compression **1705.48**

Tension zone ey= 0.00207

No.	e	Force kips
2	0.0004	35.12
3	0.0050	181.70
4	0.0113	181.70
5	0.0177	181.70
6	0.0223	181.70
7	0.0240	181.70
8	0.0223	181.70
9	0.0177	181.70
10	0.0113	181.70
11	0.0050	181.70
12	0.0004	35.12

Total tension, kips **1705.53**

Moment due to compression

Rebars	Force kips	Mom. Arm. in	Moment k-ft
1	105.81	37.00	326.24
Concrete	1599.67	38.27	5101.06

Total in compressior **5427.31**

Moment due to tension

Rebars	Force kips	Mom. Arm. in	Moment k-ft
2	35.12	32.04	-93.77
3	181.70	18.50	-280.12
4	181.70	0.00	0.00
5	181.70	-18.50	280.12
6	181.70	-32.04	485.18
7	181.70	-37.00	560.24
8	181.70	-32.04	485.18
9	181.70	-18.50	280.12
10	181.70	0.00	0.00
11	181.70	18.50	-280.12
12	35.12	32.04	-93.77

Total in tension **1343.07**

Design moment about the major axis, kip-i 6093.34

Bending about the diagonal

No.	Angle, deg phi	Coord., in c1	Edge Dist., in di
1	0	37.00	22.40
2	30	32.04	27.35
3	60	18.50	40.90
4	90	0.00	59.40
5	120	-18.50	77.90
6	150	-32.04	91.44
7	180	-37.00	96.40
8	210	-32.04	91.44
9	240	-18.50	77.90
10	270	0.00	59.40
11	300	18.50	40.90
12	330	32.04	27.35

Location of neutral axis c=, in 28.08

Compression zone, a= 23.87

eu= 0.003

No.	e	Force kips
1	0.000607161	45.60
2	7.75609E-05	6.81
12	7.75609E-05	6.81

Concrete, kips 1452.69

Total compression **1511.91**

Moment due to compression

Rebars	Force kips	Mom. Arm. in	Moment k-ft
1	45.60	37.00	140.60
2	6.81	32.04	18.19
12	6.81	32.04	18.19
Concrete	1452.69	51.44	6227.31

Total in compressior **6404.28**

Design Moment, kip-ft **6623.13**

Pedestal Design Moment, kip-ft **6093.34**

Tension zone

ey= 0.00207

No.	e	Force kips
2		
3	0.0014	120
4	0.0033	181
5	0.0053	181
6	0.0068	181
7	0.0073	181
8	0.0068	181
9	0.0053	181
10	0.0033	181
11	0.0014	120
12		

Total tension, kips **1512.41**

Moment due to tension

Rebars	Force kips	Mom. Arm. in	Moment k-ft
3	120.26	18.50	-185.40
4	181.70	18.50	-280.12
5	181.70	0.00	0.00
6	181.70	-18.50	280.12
7	181.70	-37.00	560.24
8	181.70	-32.04	485.18
9	181.70	-18.50	280.12
10	181.70	0.00	0.00
11	120.26	18.50	-185.40

Total in tension **954.75**

JGI EASTERN, Inc.

SERVICES
- Geotechnical
- Environmental
- Construction Monitoring
- Materials Testing

November 30, 2005

Mr. Doug Drost
Natcomm, LLC
63-2 North Branford Road
Branford, CT 06405

Advance Copy by Email

Re: Geotechnical Evaluation
Verizon Wireless Tower – Barkhamsted West
5 Old Farm Road
Barkhamsted, Connecticut

JGI Project No. 05704G

Dear Mr. Drost:

This report, prepared by JGI EASTERN, Inc. (JGI), presents a geotechnical engineering evaluation of subsurface conditions as they relate to foundation design and earthwork construction for the above-referenced communications tower development. Our services were conducted in general accordance with our April 4, 2003 proposal, and are subject to the limitations contained in this report.

SITE AND PROJECT DESCRIPTION

The tower site is approximately 150 feet north of the house at 5 Old Farm Road, in the town of Barkhamsted, Connecticut. Currently, the lease site is undeveloped and moderately wooded. The site slopes down toward the southeast, from approximate Elevation (El) 822 to 804 feet, as shown on plans provided by Natcomm, LLC of Branford, Connecticut.

The project involves constructing a 145-foot high steel monopole communications tower within a 75-foot by 60-foot lease area. A permanent cut slope and a retaining structure will be required on the northwest and southeast sides of the site, respectively, in order to level the lease area. We understand that several equipment cabinets and prefabricated shelters will be constructed as part of the development. A gravel access road, extending from an existing paved driveway that connects to Old Farm Road, will provide access to the tower lease area. The proposed tower development, existing conditions, and test boring and auger probe locations are shown on Figure 1, Subsurface Exploration Location Plan.

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Berlin, CT 06037-1535
(860) 829-1725 Fax 829-1745

☐ 15 Holly Street, Unit 105
Scarborough, ME 04070
(207) 396-5374 Fax 396-5394

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SUBSURFACE EXPLORATIONS AND CONDITIONS

JGI monitored the advancement of one test boring (JB-1) and three auger probes (JP-1, JP-2, and JP-3), by New England Boring Contractors Inc. of Glastonbury, Connecticut on November 18, 2005. The test boring was advanced to a depth of 10 feet using 4-inch diameter solid stem augers. Three-inch inside diameter flush wall casing (FWC) was then set and the test boring extended to a depth of 32 feet below the existing ground surface using a roller bit. Soil samples were obtained semi-continuously from the ground surface to 10 feet and at 5-foot interval thereafter with a standard 2-inch outside diameter split-barrel sampler. Standard Penetration Tests (SPTs) were performed in general accordance with American Society for Testing and Materials (ASTM) D1586.

The auger probes were advanced with 4-inch diameter solid stem augers and were terminated at a depth of 10 feet below the existing ground surface. The auger probes, completed to further evaluate the subsurface conditions within the lease area, encountered conditions similar to JB-1. The approximate exploration locations are shown on Figure 1. The exploration logs are attached. The ground surface elevations at the exploration locations, as indicated on the logs, were estimated from the contours shown on plans provided by Natcomm.

The subsurface profile at the boring location consists of forest mat over subsoil, underlain by glacial till, in which the test boring was terminated. The forest mat consists of dark brown, medium to fine sand and silt, trace gravel with root matter. The subsoil extends to depth of about 1 foot and consists of loose, dark brown, medium to fine sand, little silt. The glacial till, medium dense to very dense, brown, coarse to fine sand, little to some silt, trace to little gravel, extends beyond the depth of the exploration.

Groundwater was not encountered during the exploration program. However, groundwater levels vary depending upon season, precipitation, and other conditions that may differ from those at the time of drilling. Groundwater may temporarily perch above silty layers within the glacial till.

Following drilling, *in situ* soil resistivity testing was completed. Resistivity testing was performed in accordance with ASTM G57 by the Wenner Four Probe Method using a 16gl Earth Resistivity Meter. Two resistivity lines were completed with electrodes spaced at 5, 10, 20, 30, and 40 feet. At the time of resistivity testing, surficial soil was relatively dry. The location and orientation of resistivity lines are shown on Figure 1. The resistivity test results are summarized below:

	Resisti□it□(ohm-cm)	
Electrode Spacing (ft)	**Line 1**	**Line 2**
5	564,255	685,955
10	770,790	1,065,315
20	695,530	848,345
30	546,350	594,605
40	441,220	402,150

FOUNDATION TYPE AND DESIGN RECOMMENDATIONS

To□er

The tower may be supported on either a monolithic mat or a pier and pad foundation bearing directly on the glacial till or on compacted structural fill or minus □-inch crushed stone placed on the glacial till. The tower foundation may be designed on the basis of a net allowable bearing pressure of 8.0 kips per square foot (ksf). The allowable bearing pressure may be increased by one third for transient loadings, such as wind and seismic. Bearing pressure is unlikely to govern the design, with overturning determining the size of the foundation. We estimate that settlement of the tower foundation will be less than 1 inch, and depending on the actual size of the footing, the settlement may be less than □ inch.

An ultimate friction factor (tan δ) of 0.5 may be used for calculation of the sliding resistance between the bearing materials and concrete surfaces. A factor of safety of at least 1.5 should be applied to the sliding resistance. A total unit weight (γ) of 120 pounds per cubic foot and an ultimate passive earth pressure coefficient, K_p, of 3.0 should be used for the calculation of passive resistance provided by compacted backfill adjacent to the tower foundation. The passive pressure calculated with these parameters should be reduced by at least a factor of safety of 3, to reflect the amount of movement required to mobilize the passive resistance.

The underside of the tower foundation should be located at least 3.5 feet below adjacent final grade to reduce the likelihood of frost heave. The 3.5 feet refers to the shortest distance to the ground surface, not necessarily the vertical distance. The underside of the tower foundation should also be located below the base of the adjacent retaining wall that will be constructed at the site, so that the loading from the tower foundation will not impact the retaining wall.

To increase the overturning resistance of the footing, the mat or pad could be located deeper and extended to the surface with a pier. This would reduce the size of the foundation footprint and utilize the mass of the fill placed above the footing to increase overturning resistance. The excavation around and above the foundation should be backfilled with compacted fill.

Control of backfill compaction above and around the foundation will be required to provide uplift and lateral resistance. Care should be exercised during excavation for the tower foundation to minimize disturbance to the soil surrounding the excavation; disturbance to the adjacent soils will influence resistance to lateral loads.

Equipment Cabinets

The equipment cabinet pads may be supported on either concrete pier foundations or slabs-on-grade. For heavily loaded equipment cabinets, we recommend that the foundations, comprising footings or piers, bear on the glacial till. Footings may be designed using a maximum net allowable bearing pressure of 4.0 ksf. Settlements will be small, likely less than □ inch, most of which will occur as load in applied. Strip footings should have a minimum width of 12 inches. Piers should have a

minimum side dimension/diameter of 12 inches. The existing forest mat and subsoil are not suitable for foundation support and should be removed within the foundation bearing zone, defined as the volume beneath 1H:1V lines extending downward and outward from the lower edges of the foundations.

Slabs-on-grade should be underlain by a minimum 12-inch thick layer of compacted structural fill or crushed stone placed on the glacial till. The existing forest mat and subsoil are not suitable for foundation support and should be removed within the foundation bearing zone of the slabs. A modulus of subgrade reaction (k_s) of 250 pounds per cubic inch may be used for design of slabs constructed in this way. Consideration should be given to using dense insulation boards (Dow Styrofoam Highload, or similar) under and adjacent to lightly loaded slabs-on-grade, to provide the equivalent of 3.5 feet of earth cover, thus reducing frost penetration. Settlements of the slabs-on-grade should be less than about □ inch.

Air entraining admixtures should be used for concrete exposed to freezing. To reduce the likelihood of frost heave, the underside of foundation elements should be at least 3.5 feet from the nearest surface exposed to freezing temperatures, unless adequately protected by insulation boards. In the case of the equipment cabinets located along the eastern side of the lease area, the nearest surface exposed to freezing temperatures could be the vertical face of a retaining wall.

Seismic Criteria

The subsurface conditions were reviewed in accordance with the *Connecticut State Building Code*, which includes the *BOCA National Building Code – 13th Edition.* For calculation of the lateral seismic forces on the structure, the soil profile is considered to be Type S_1. Accordingly, the recommended site coefficient (S) for seismic design is 1.0. The site is not susceptible to liquefaction in the event of an earthquake.

Permanent Slopes

A permanent cut slope will be required on the northwest side of the site. The cut slope in the glacial till should be constructed no steeper than 2H:1V. If steeper slopes are planned, they should be designed by a licensed engineer.

Permanent cut slope surfaces should be vegetated, or covered with an erosion mat, to protect against erosion. In addition, because of the large watershed area behind the slope to the west, a drainage swale should be constructed at the top of the cut slope to further control surface water flow and erosion. Temporary sedimentation and erosion control methods should be implemented during construction and left in place until the slope surface has been permanently stabilized.

Lateral Earth Pressures

A proposed concrete masonry unit (CMU) retaining wall up to about 6 feet in height is indicated on the Natcomm plans along the southeast side and part of the southwest side of the lease area. The

retaining wall should be designed to resist combined lateral forces resulting from static soil pressures, surcharges, and additional pressures under seismic events. Surcharge due to water pressure may be neglected, if foundation drains are installed behind the base of the wall and at least an 18-inch width of free draining fill is placed behind the wall. CMU retaining walls are generally free to rotate, unless the top of the wall is fixed or braced, and therefore may be designed on the basis of the □yielding□parameters. Other surcharge loads should be considered where they are located within a horizontal distance equal to 1.5 times the height of the wall. The following design criteria is recommended:

	Yielding
Static Lateral Earth Pressure (Compacted structural fill as an equivalent fluid unit weight)	38 pounds per cubic foot (pcf)
Traffic Surcharge (Distributed uniformly over the height of the wall)	70 psf
Seismic Forces	11H psf/foot (distributed as an inverse triangle)

Note: H is equal to the exposed height of the wall, i.e. above the permanent ground level in front of the wall. Surcharge stresses due to point loads, line loads, and those of limited extent, such as from compaction equipment, should be evaluated using elastic theory.

Retaining structures should be backfilled evenly to the extent practical. Temporary bracing should be specified if walls that are designed to be supported by other structural elements are permitted to be backfilled before the permanent support is in place. An ultimate friction factor (tan δ) of 0.5 may be used to evaluate the factor of safety against sliding at the soil-concrete interface:

Lateral pressures based on the above parameters are cumulative for computing overall factors of safety. To account for effect on the wall of compaction equipment during construction, the lateral pressure should, in any event, not be less than 200 psf, distributed uniformly over the height of the wall.

EARTHWORK AND CONSTRUCTION RECOMMENDATIONS

Compacted Structural Fill

Excavated glacial till may be reused as fill adjacent to and over the tower foundation, provided it can be adequately compacted. However, the glacial till has an elevated silt content and will therefore be difficult to compact when wet. Because of the high silt content, the glacial till will also be sensitive to moisture and lose strength quickly when wet. Consequently, the recommendation for reusing this soil is only applicable during periods when the climate and moisture are favorable for reusing silty soil as compacted fill.

Structural fill originating from an off-site source should conform to the gradation requirements for Bank or Crushed Gravel (M.02.06, Grading B) as defined by the *State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction (Form 816) 2004*. Crushed stone, where used, should have a maximum particle size of □ inch. Structural fill and backfill should be placed in loose lifts not exceeding 12 inches in thickness. Structural fill placed below, and backfill adjacent to and over the foundation should be compacted to at least 95 percent of the maximum dry density, as determined by ASTM D1557.

Mat and Equipment Foundation Subgrades

The foundation bearing subgrades should be prepared by the contractor as outlined herein and observed by the geotechnical engineer, prior to foundation construction. Neither fill nor concrete should be placed on frozen subgrades. Frozen materials should not be used as fill. The existing forest mat and subsoil are not suitable for foundation support and should be removed within the foundation bearing zone. Upon completion of foundation excavation for footings and slabs-on-grade, which will be supported on the glacial till, the subgrade (undisturbed glacial till) should be proofrolled with a least six passes of a vibratory roller or plate compactor. Unstable subgrades should be removed and replaced with compacted structural fill or crushed stone, as necessary.

Boulder Considerations

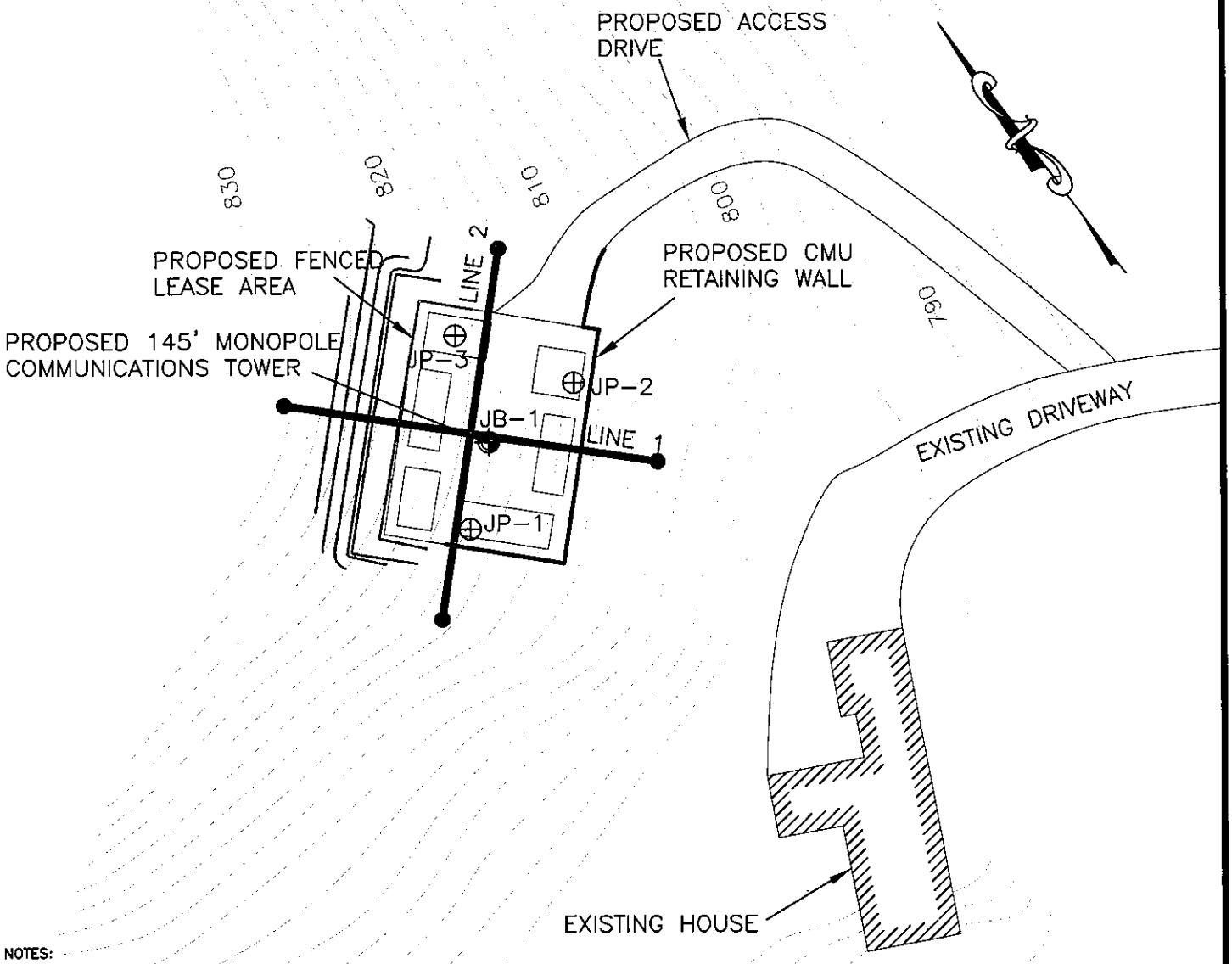
Excavation for the tower foundation may require removing large diameter boulders, which were observed at the ground surface. Where boulders are greater than 2 cubic yards, specifications typically allow their removal to be classified as bedrock excavation. Boulder removal may require blasting, mechanical methods, such as a backhoe-mounted ram, or the use of expansive agents. We recommend that the contractor familiarize him/herself with the anticipated boulder conditions prior to construction.

Temporar□E□ca□ation and De□atering

Excavations greater than 4 feet deep may be required for construction of the tower foundation. Temporary construction slopes in the glacial till should be designed in compliance with the most recent governing regulations. Construction slopes should be cut to a stable incline or braced, depending upon the excavation depth and encountered subsurface conditions.

Construction slopes should be reviewed for signs of mass movement. If mass movement and/or potential stability problems are observed, work should cease; the geotechnical engineer should be immediately contacted. The responsibility for excavation safety and the stability of temporary construction slopes should lie solely with the contractor.

We do not anticipate significant construction dewatering. The contractor should prevent groundwater, if encountered, and surface water runoff from collecting in excavations. Subgrade soils for equipment cabinet pad foundations that become unstable because of such water and/or reworking by construction activity should be replaced with compacted granular structural fill or crushed stone, as necessary.



NOTES:

1. THIS PLAN WAS PREPARED FROM NATCOMM, LLC. OF BRANFORD, CONNECTICUT PROJECT NUMBER: 04063 SHEET: C-1 TITLED: "SITE PLAN" DATED: 11/8/04.

2. THE EXPLORATIONS SHOWN AS JB-1 AND JP-1 THROUGH JP-3 WERE ADVANCED ON NOVEMBER 19, 2005 UNDER THE DIRECTION OF JGI WITH EQUIPMENT OWNED AND OPERATED BY NEW ENGLAND BORING CONTRACTORS, INC. OF GLASTONBURY, CONNECTICUT.

3. RESISTIVITY TESTING WAS PERFORMED ON NOVEMBER 19, 2005 BY A JGI FIELD ENGINEER.

4. THE APPROXIMATE LOCATIONS OF THE SUBSURFACE EXPLORATIONS AND RESISTIVITY TESTS WERE TAPED FROM A STAKED TOWER CENTER PLACED BY OTHERS. THE LOCATIONS SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.

5. USE OF THIS PLAN IS LIMITED TO THE ILLUSTRATION OF THE APPROXIMATE LOCATIONS OF THE SUBSURFACE EXPLORATIONS, RESISTIVITY TESTS, AND OTHER PERTINENT SITE FEATURES. ANY OTHER USE OF THIS PLAN WITHOUT PERMISSION FROM JGI EASTERN INC. IS PROHIBITED.

LEGEND

JB-1	TEST BORING LOCATION
JP-1	TEST PROBE LOCATION (TYP)
LINE 1	RESISTIVITY TEST LOCATION (TYP)
—820—	EXISTING CONTOURS (FEET)
	PROPOSED CONTOURS (FEET)

GRAPHIC SCALE

25 0 25 50 100

(IN FEET)

VERIZON WIRELESS – BARKHAMSTED WEST

BARKHAMSTED, CONNECTICUT

PREPARED FOR:

NATCOMM, LLC
63-2 NORTH BRANFORD ROAD
BRANFORD, CT 06405

DATE: NOVEMBER, 2005
SCALE: 1" = 50'
PROJECT NO: 05704

FIGURE 1

SUBSURFACE EXPLORATION LOCATION PLAN

JGI EASTERN, Inc.
114 Woodlawn Road
Berlin, Connecticut 06037

05704

TEST BORING LOG

PROJ. NAME:	Verizon Barkhamsted West	HAMMER		SAMPLER	CASING	SHEET 1 OF 2
LOCATION:	Barkhamsted, Connecticut	TYPE:	Safety	SS	SSA / FWC	BORING: JB-1
PROJECT NO.:	05704	SIZE:	140 lbs.	2" OD	4" dia. / 3" ID	LOCATION: See Plan
DATE START:	November 18, 2005	FALL:	30"	Drop Method:	Winch/Cable	
DATE END:	November 18, 2005					SURF. EL: 814' ±
BORING CO.:	New England Boring Contractors	GROUNDWATER OBSERVATIONS				
CO. LOCATION:	Glastonbury, Connecticut	DATE	DEPTH	CASING AT	DURATION AFTER DRILLING	
FOREMAN:	Tim Carpenter	11/18/2005		Not Encountered		
JGI REP:	James Mularadelis					

Depth (ft)	SAMPLING No.	Depth (ft.)	Blo□s/ 6"	Penet./ Rec. (in)	Sample Description	Strata Change Depth (ft)	Notes
					Forest Mat	0.2	
	SS-1	0-2	1-0	24/6	SS-1: Loose, dark brown, medium to fine SAND, little Silt (Subsoil)	1.0	
			1-2				
	SS-2	2-4	3-2	24/6	SS-2: Medium dense, brown, coarse to fine SAND, little Gravel and Silt		
			9-15				
5							
	SS-3	5-7	10-13	24/10	SS-3: Similar to SS-2, except dense.		
			17-19				
	SS-4	7-9	17-20	24/10			
			20-23		SS-4: Dense, brown, coarse to fine SAND, some Silt, little Gravel, occasional Cobbles		
10							
	SS-5	10-12	15-20	24/24	SS-5: Similar to SS-4.		
			30-31				
15							
	SS-6	15-17	19-32	24/16	SS-6: Similar to SS-4, except very dense		
			51-63				
20							
	SS-7	20-20.8	59-50/4"	10/8	SS-7: Very dense, brown, coarse to fine SAND, some Silt, trace Gravel, frequent Cobble		
25							
	SS-8	25-25.5	72-50/0"	6/5	SS-8: Similar to SS-7.		
30							

EASTERN, Inc.

Notes:

Proportions Used: trace (1-10%), little (10-20%), some (20-35%), and (35-50%).

Cohesive Consistency (Blows/ft.)		Cohesionless Relative Density (Blows/ft)	
very soft	0-2	very loose	0-4
soft	2-4	loose	4-10
medium stiff	4-8	medium dense	10-30
stiff	8-15	dense	30-50
very stiff	15-30	very dense	50+
hard	30+		

Boring No. JB-1

TEST BORING LOG

PROJ. NAME:	Verizon Barkhamsted West	**HAMMER**	**SAMPLER**	**CASING**	**SHEET 2 OF 2**
LOCATION:	Barkhamsted, Connecticut	TYPE: Safety	SS	SSA / FWC	**BORING:** JB-1
PROJECT NO.:	05704	SIZE: 140 lbs.	2" OD	4" dia. / 3" ID	**LOCATION:** **See Plan**
DATE START:	November 18, 2005	FALL: 30"	Drop Method:	Winch/Cable	
DATE END:	November 18, 2005				**SURF. EL:** 814 +/-
BORING CO.:	New England Boring Contractors	**GROUNDWATER OBSERVATIONS**			
CO. LOCATION:	Glastonbury, Connecticut	**DATE**	**DEPTH**	**CASING AT**	**DURATION AFTER DRILLING**
FOREMAN:	Tim Carpenter	11/18/2005		Not Encountered	
JGI REP.:	James Mularadelis				

Depth (ft)	SAMPLING No.	Depth (ft.)	Blo□s/ 6"	Penet./ Rec. (in)	Sample Description	Strata Change Depth (ft)	Notes
	SS-9	30-30.8	60-50/3"	9/6	SS-9: Very dense, brown, coarse to fine SAND, some Silt, trace Gravel, frequent Cobbles (Glacial Till)		
					Exploration Terminated at 30.8		
35							
40							
45							
50							
55							
60							

EASTERN, Inc.

Notes:

Proportions Used: trace (1-10%), little (10-20%), some (20-35%), and (35-50%).

Cohesive Consistency (Blows/ft.)		Cohesionless Relative Density (Blows/ft)	
very soft	0-2	very loose	0-4
soft	2-4	loose	4-10
medium stiff	4-8	medium dense	10-30
stiff	8-15	dense	30-50
very stiff	15-30	very dense	50+
hard	30+		

Boring No. JB-1

TEST PROBE LOG

PROJECT NAME:	Verizon Barkhamsted West	**EQUIPMENT**		**SHEET 1 OF 1**	
LOCATION:	Barkhamsted, Connecticut	TYPE:	SSA	**PROBE NO.:**	JP-1
PROJECT NO.:	05704	SIZE:	4" dia	**LOCATION:**	See Plan
DATE START:	November 18, 2005				
DATE END:	November 18, 2005			**SURFACE EL:**	814' ±
BORING CO:	New England Boring Contractors	**GROUNDWATER OBSERVATIONS**			
CO. LOCATION:	Glastonbury, Connecticut	**DATE**	**DEPTH**	**CASING AT**	**STABILIZATION PERIOD**
FOREMAN:	Tim Carpenter	11/18/2005		Not Encountered	
JGI INSPECTOR:	James Mularadelis				

Depth (ft.)	SOIL DESCRIPTION	Strata Change Depth (ft)	Notes
	Forest Mat	0.2	
1	Subsoil	1.0	
2			
3			
4			
5	Brown, coarse to fine SAND, some Silt, little Gravel.		
6			
7			
8			
9			
10	(Glacial Till)		
11	Exploration Terminated at 10.0'		
12			
13			
14			
15			
16			
17			
18			
19			
20			

NOTES:

REMARKS: The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test probes at times under conditions stated on the log. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.
Proportions Used: trace (0-10%), little (10-20%), some (20-35%), and (35-50%)

JGI EASTERN, Inc.

TEST PROBE LOG

PROJECT NAME:	Verizon Barkhamsted West	**EQUIPMENT**		**SHEET 1 OF 1**	
LOCATION:	Barkhamsted, Connecticut	TYPE:	SSA	**PROBE NO.:**	JP-2
PROJECT NO.:	05704	SIZE:	4" dia	**LOCATION:**	See Plan
DATE START:	November 18, 2005				
DATE END:	November 18, 2005			**SURFACE EL:**	809' ±
BORING CO:	New England Boring Contractors	**GROUNDWATER OBSERVATIONS**			
CO. LOCATION:	Glastonbury, Connecticut	**DATE**	**DEPTH**	**CASING AT**	**STABILIZATION PERIOD**
FOREMAN:	Tim Carpenter	11/18/2005		Not Encountered	
JGI INSPECTOR:	James Mularadelis				

Depth (ft.)	SOIL DESCRIPTION	Strata Change Depth (ft)	Notes
1	Forest Mat	0.2	
	Subsoil	1.0	
2			
3			
4			
5	Brown, coarse to fine SAND, some Silt, little Gravel.		
6			
7			
8			
9			
10	(Glacial Till)		
11	Exploration Terminated at 10.0'		
12			
13			
14			
15			
16			
17			
18			
19			
20			

NOTES:

REMARKS: The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test probes at times under conditions stated on the log. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.
Proportions Used: trace (0-10%), little (10-20%), some (20-35%), and (35-50%)

JGI EASTERN, Inc.

TEST PROBE LOG

PROJECT NAME:	Verizon Barkhamsted West	**EQUIPMENT**	**SHEET 1 OF 1**
LOCATION:	Barkhamsted, Connecticut	TYPE: SSA	**PROBE NO.:** JP-3
PROJECT NO.:	05704	SIZE: 4" dia	**LOCATION:** See Plan
DATE START:	November 18, 2005		
DATE END:	November 18, 2005		**SURFACE EL.:** 817' ±
BORING CO:	New England Boring Contractors	**GROUNDWATER OBSERVATIONS**	
CO. LOCATION:	Glastonbury, Connecticut	**DATE** / **DEPTH** / **CASING AT** / **STABILIZATION PERIOD**	
FOREMAN:	Tim Carpenter	11/18/2005 — Not Encountered	
JGI INSPECTOR:	James Mularadelis		

Depth (ft.)	SOIL DESCRIPTION	Strata Change Depth (ft)	Notes
1	Forest Mat	0.2	
	Subsoil	1.0	
2			
3			
4			
5	Brown, coarse to fine SAND, some Silt, little Gravel.		
6			
7			
8			
9			
10	(Glacial Till)		
11	Exploration Terminated at 10.0'		
12			
13			
14			
15			
16			
17			
18			
19			
20			

NOTES:

REMARKS: The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test probes at times under conditions stated on the log. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.

Proportions Used: trace (0-10%), little (10-20%), some (20-35%), and (35-50%)

JGI EASTERN, Inc.