STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL

IN RE:	:	
	:	
APPLICATION OF CELLCO PARTNERSHIP D/B/A VERIZON WIRELESS FOR A CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY AND PUBLIC NEED FOR THE CONSTRUCTION, MAINTENANCE AND OPERATION OF A WIRELESS TELECOMMUNICATIONS FACILITY AT 541 BROADBRIDGE ROAD, BRIDGEPORT, CONNECTICUT	:	DOCKET NO. 472
	:	APRIL 26, 2018

RESPONSES OF CELLCO PARTNERSHIP D/B/A VERIZON WIRELESS TO CONNECTICUT SITING COUNCIL DEVELOPMENT AND MANAGEMENT (D&M) PLAN INTERROGATORIES

Question No. 1

In Cellco Partnership d/b/a Verizon Wireless' (Cellco) Development and Management Plan (D&M Plan) dated April 5, 2018, would the erosion and sedimentation control measures be consistent with the 2002 Connecticut Guidelines for Soil Erosion and Sediment Control per Condition 2(d) of the Decision and Order (D&O)?

Response

Yes. A note referencing the 2002 Connecticut Guidelines for Soil Erosion and Sedimentation Control has been included on Sheet C-1 of the revised D&M Plans included in Attachment 1.

Question No. 2

Provide the construction hours in accordance with Condition No. 2(e) of the D&O. Also, provide the days of the week.

Response

The hours of construction will be 8:00 AM to 4:30 PM Monday through Friday.

Question No. 3

Is the tower designed with a yield point in accordance with Condition No. 2(b) of the D&O?

Response

Yes. The tower has been designed with this yield point, referenced in the EEI cover letter and Tower Design Documents, dated April 18, 2018 and included in Attachment 2.

Question No. 4

On page 2 of the Geotechnical Evaluation, it notes that, "Cobbles and boulders were present from 7.5 feet to 17.5 feet below grade. Bedrock is apparently at 17.5 feet below grade." Would Cellco utilize mechanical means to remove bedrock and boulders, or would blasting be necessary?

Response

The Cobbles and Boulders will be removed as part of excavation by the caisson drillers. No blasting would be required for the installation of the tower foundation.

Question No. 5

Would the color of the tower be white as noted in Finding of Fact #67?

Response

The proposed unipole tower would be painted white.

Question No. 6

Referencing Finding of Fact #99 and Sheet C-2, would the generator exhaust be routed to avoid air handlers on the roof? Specifically, would the exhaust be routed above the roof line, or

would it exit directly out of the top of the generator unit?

Response

The generators exhaust will extend above the roof of the adjacent commercial building and will be clear of all air handlers on the roof as required by the State Building Code. *See* Attachment 1 Sheet A-1.

ATTACHMENT 1

CELLCO PARTNERSHIP

d.b.a. verizon

WIRELESS COMMUNICATIONS FACILITY

BRIDGEPORT NE CT

DEVELOPMENT & MANAGEMENT PLAN - DOCKET No. 472

541 BROADBRIDGE ROAD
BRIDGEPORT, CT 06610

VICINITY MAP — SCALE: N.T.S.

DIRECTIONS TO SITE:

HEAD NORTH ON ALEXANDER DR TOWARD BARNES INDUSTRIAL RD S
TURN RIGHT ONTO BARNES INDUSTRIAL RD S
TURN LEFT AT THE 1ST CROSS STREET ONTO CT-68 W
TURN RIGHT TOWARD US-5 N/N COLONY RD
TURN RIGHT ONTO US-5 N/N COLONY RD
TURN LEFT TO MERGE ONTO CT-15 S TOWARD NEW HAVEN
TAKE EXIT 52 FOR STATE ROUTE 108 S/STATE ROUTE 8 S TOWARD BRIDGEPORT
KEEP RIGHT, FOLLOW SIGNS FOR CT-108/STRATFORD
TURN LEFT ONTO CT-108 W/NICHOLS AVE
TURN RIGHT ONTO PENNY AVE
CONTINUE ONTO HUNTINGTON TURNPIKE
TURN LEFT ONTO BROADBRIDGE RD
DESTINATION WILL BE ON THE LEFT.

CONSULTANT TEAM

PROJECT ENGINEER

HUDSON DESIGN GROUP, LLC
45 BEECHWOOD DRIVE
NORTH ANDOVER, MA 01845
TEL: 1-(978)-557-5553
FAX: 1-(978)-336-5586

MEP ENGINEER

HUDSON DESIGN GROUP, LLC
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NORTH ANDOVER, MA 01845
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SURVEYOR

NORTHEAST SURVEY CONSULTANTS
116 PLEASANT ST. SUITE 302
EASTHAMPTON, MA 01027
TEL: 1-(413)-203-5144

PROJECT SUMMARY

SITE NAME:	BRIDGEPORT NE CT
SITE ADDRESS:	541 BROADBRIDGE ROAD BRIDGEPORT, CT 06610
PROPERTY OWNER:	BEARDSLEY PLAZA LIMITED PARTNERSHIP P.O. BOX 1700 BRIDGEPORT, CT 06601
APPLICANT:	CELLCO PARTNERSHIP d/b/a VERIZON 20 ALEXANDER DRIVE WALLINGFORD, CT 06492
SITE ACQUISITION CONTACT:	ALEKSEY TYURIN CELLCO PARTNERSHIP (806) 803-8213
LEGAL/REGULATORY COUNSEL:	KENNETH C. BALDWIN ESQ. ROBINSON + COLE LLP (860)275-8345
LATITUDE:	N41° 13' 19.494"
LONGITUDE:	W73° 10' 02.504"

SCOPE OF WORK INFO.

VERIZON WIRELESS IS PROPOSING TO INSTALL THE FOLLOWING IMPROVEMENTS ON PROPOSED TELECOMMUNICATION SITE:

- NEW 8'x20' FENCED LEASE AREA ON EXISTING PARCEL OF LAND.
- NEW PANEL ANTENNAS: (2) ANTENNA PER SECTOR WITH (3) SECTORS, FOR A TOTAL OF (6) ANTENNAS.
- (12) NEW QUADPLEXERS.

ITEMS LISTED ABOVE TO BE MOUNTED WITHIN PROPOSED VERIZON FLAGPOLE.

- NEW EQUIPMENT CABINETS: (2) CABINETS WITH GENERATOR ON PROPOSED 7'x13' CONCRETE EQUIPMENT PAD.
- NEW RRHs: (3) RRHs PER SECTOR WITH (3) SECTORS, FOR A TOTAL OF (9) RRHs

ITEMS LISTED ABOVE TO BE INSTALLED WITHIN THE PROPOSED 8'x19' FENCED COMPOUND.

- NEW POWER AND TELCO SERVICES WILL BE ROUTED UNDERGROUND FROM EXISTING UTILITY POLE TO PROPOSED ELECTRICAL METER AND HOFFMAN BOX ON PROPOSED H-FRAME.
- FINAL UTILITY ROUTING TO BE DETERMINED/VERIFIED BY UTILITY COMPANIES.

SHEET INDEX

PREPARED FOR: CELLCO PARTNERSHIP D.B.A.
verizon

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FAX: (978) 336-5586

STATE OF CONNECTICUT
DEREK J CREASER
LICENSED PROFESSIONAL ENGINEER

CHECKED BY: DJR

APPROVED BY: DJC

SUBMITTALS

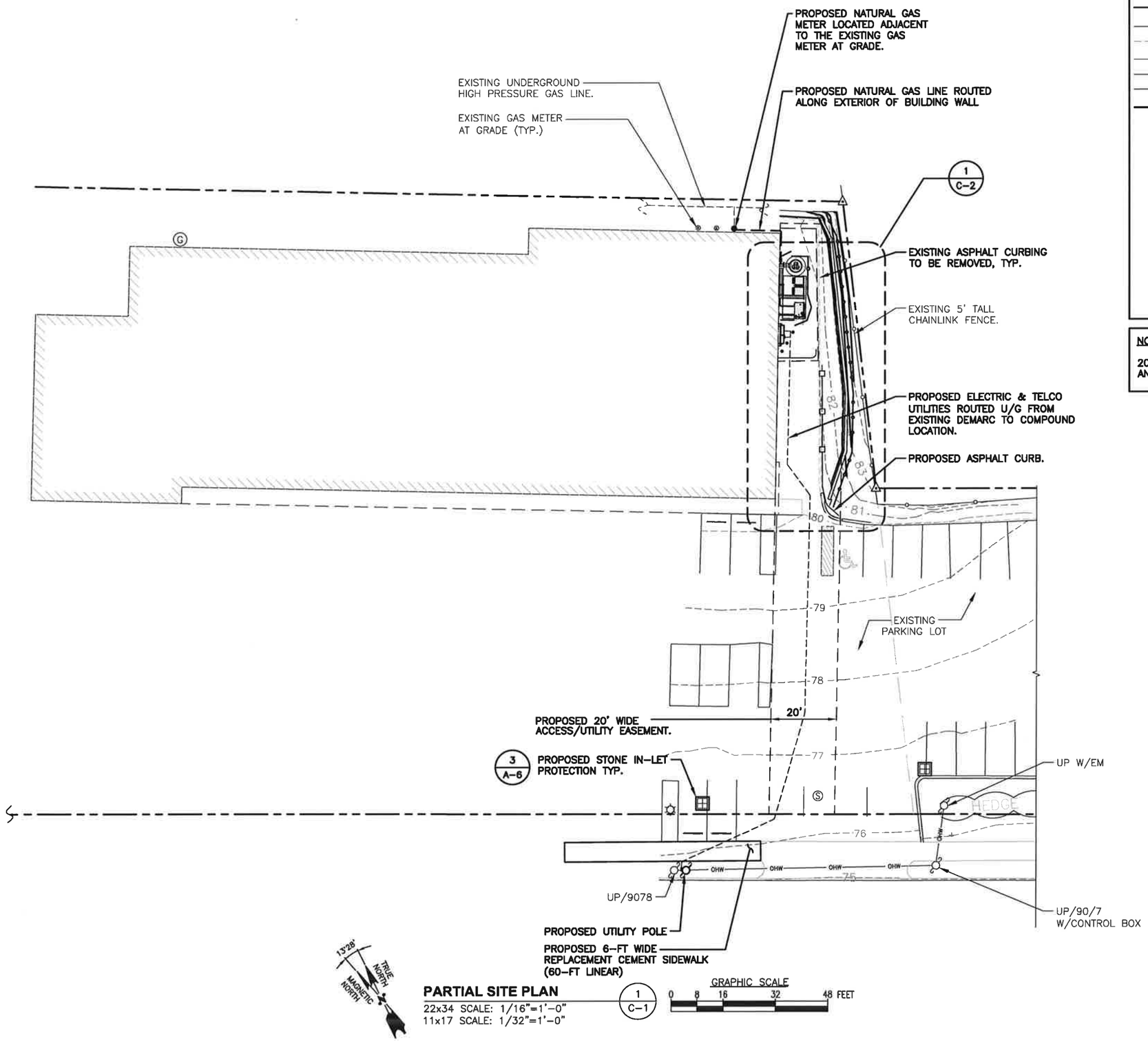
REV.	DATE	DESCRIPTION	BY
2	04/23/18	REVISED PER COMMENTS	KAM
1	03/21/18	REVISED PER COMMENTS	JS
0	03/12/18	ISSUED FOR REVIEW	JS

SITE NAME:
BRIDGEPORT NE CT

SITE ADDRESS:
541 BROADBRIDGE ROAD
BRIDGEPORT, CT 06610

SHEET TITLE
TITLE SHEET

SHEET NUMBER
T-1



PARTIAL SITE PLAN (1 / C-1)

22x34 SCALE: 1/16"=1'-0"

11x17 SCALE: 1/32"=1'-0"

LEGEND

- PROPERTY LINE – SUBJECT PARCEL
- ABUTTERS PROPERTY LINE
- CONTOUR LINE
- OHW — OVERHEAD WIRE
- CHAIN LINK FENCE
- YELLOW PAINTED LINE
- 81 — PROPOSED CONTOUR LINE
- CATCH BASIN
- ROOF DRAIN
- POST
- MANHOLE
- GAS METER (EXISTING/NEW)
- EXISTING UTILITY POLE
- GUY WIRE ANCHOR
- LIGHT POLE
- IRON PIPE FOUND
- CONC. BOUND FOUND
- CALCULATED POINT
- CLR CLEARANCE

NOTE:

2002 CONNECTICUT GUIDELINES FOR SOIL EROSION AND SEDIMENT CONTROL

PREPARED FOR: CELLCO PARTNERSHIP D.B.A.

verizon

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STATE OF CONNECTICUT
DEREK J. CREASER
No. 26551
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APPROVED BY: DJC

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BRIDGEPORT NE CT

SITE ADDRESS:

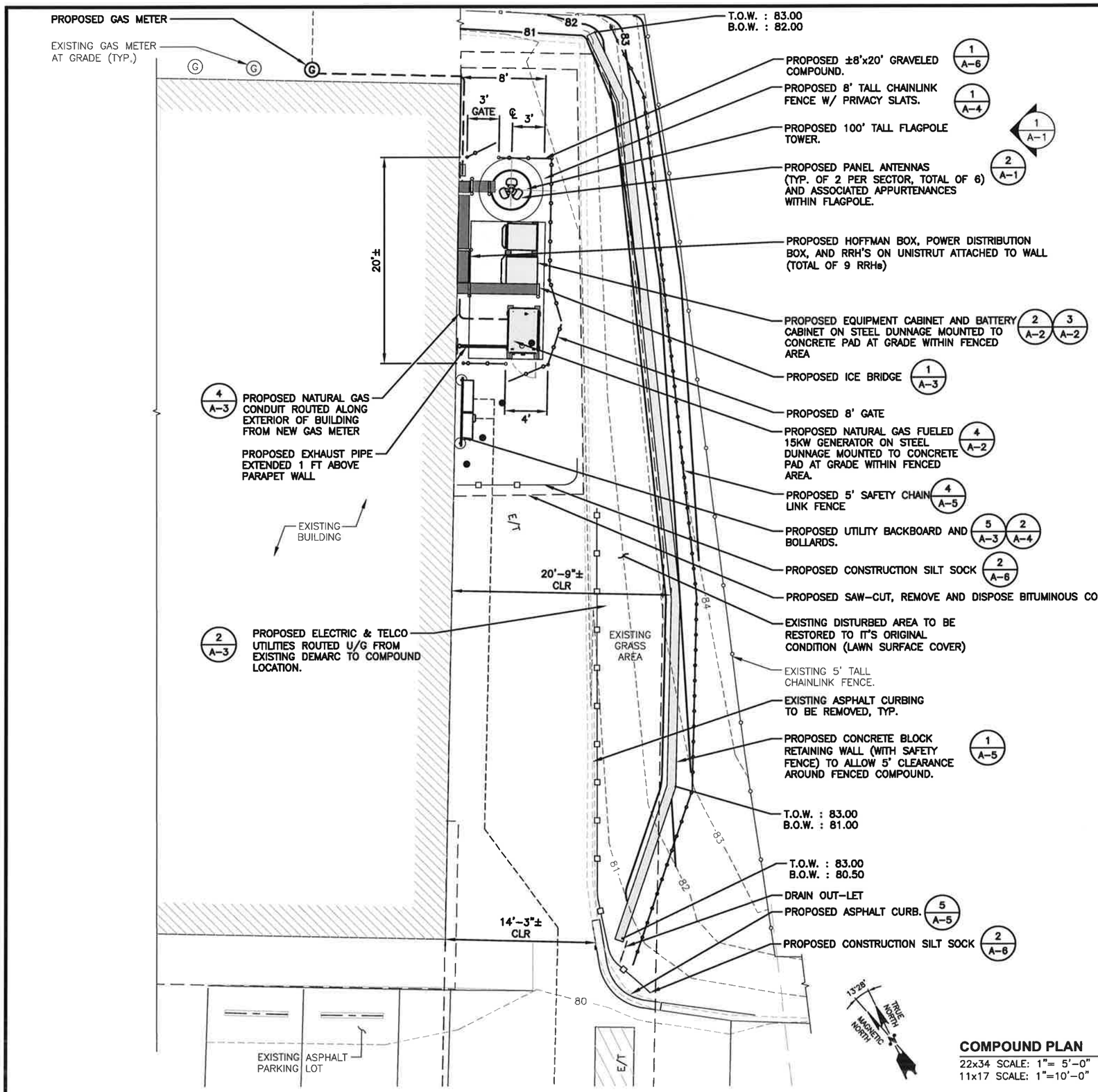
541 BROADBRIDGE ROAD
BRIDGEPORT, CT 06610

SHEET TITLE

PARTIAL SITE PLAN

SHEET NUMBER

C-1



COMPOUND PLAN 1 C-2
22x34 SCALE: 1"= 5'-0"
11x17 SCALE: 1"=10'-0"

GRAPHIC SCALE
0 2.5 5 10 15 FEET

LEGEND

- PROPERTY LINE – SUBJECT PARCEL
- ABUTTERS PROPERTY LINE
- CONTOUR LINE
- OHW — OVERHEAD WIRE
- CHAIN LINK FENCE
- YELLOW PAINTED LINE
- 81 — PROPOSED CONTOUR LINE
- CATCH BASIN
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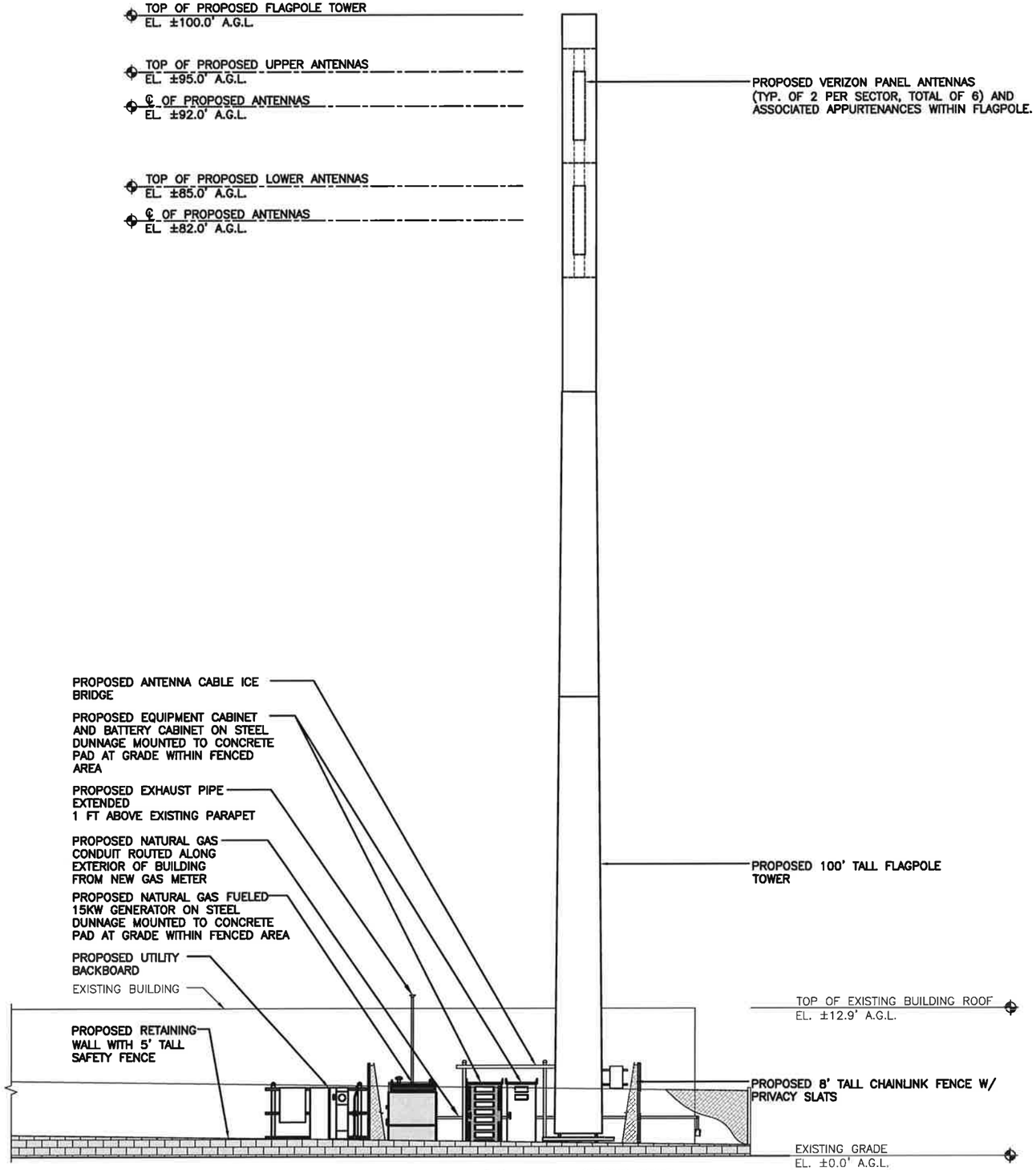
BRIDGEPORT, CT 06610

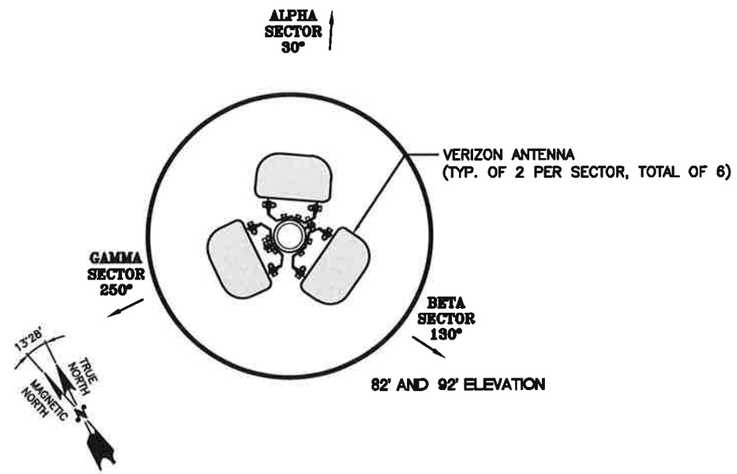
SHEET TITLE
COMPOUND PLAN

SHEET NUMBER
C-2



EAST ELEVATION (1 / A-1)
22x34 SCALE: 1/16"=1'-0"
11x17 SCALE: 1/32"=1'-0"

GRAPHIC SCALE
0 8 16 32 48 FEET



82' AND 92' ELEVATION

ANTENNA MOUNTING CONFIGURATION (2 / A-1)
22x34 SCALE: 1"=1'-0"
11x17 SCALE: 1/2"=1'-0"

GRAPHIC SCALE
0 8 16 32 48 FEET

NOTE:

1. PROPOSED NEW TOWER AND FOUNDATION DESIGN BY OTHERS
2. VERIFY AZIMUTHS W/ RF ENGINEER.

TOWER NOTES:

1.) TOWER ELEVATION IS SHOWN FOR REFERENCE ONLY. CONTRACTOR SHALL REFER TO TOWER MANUFACTURER DRAWINGS FOR COMPLETE INSTALLATION AND BILL OF MATERIAL INFORMATION.
2.) TOWER MINIMUM DESIGN SPECIFICATIONS SHALL BE IN ACCORDANCE WITH ANSI/TIA/EIA 222-G "STRUCTURAL STANDARDS FOR SUPPORTING STRUCTURES AND ANTENNAS, REVISION G" AND GOVERNING FEDERAL, STATE, AND LOCAL CODE REQUIREMENTS
3.) TOWER MANUFACTURER SHALL BE RESPONSIBLE FOR DESIGN AND STRUCTURAL COMPONENTS OF THE TOWER.
4.) FINAL UTILITY CONNECTIONS SHALL BE COORDINATED WITH THE LOCAL UTILITIES.
5.) PROVIDE RIGID FOAM INSULATION ALONG EXISTING BUILDING FOUNDATION AT TOWER LOCATION.

PREPARED FOR: CELLCO PARTNERSHIP D.B.A.
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STATE OF CONNECTICUT
DEREK J. CREASER
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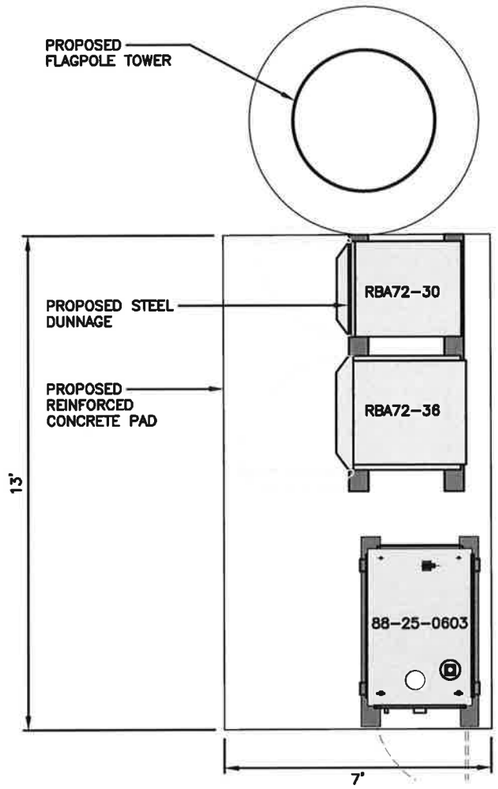
541 BROADBRIDGE ROAD
BRIDGEPORT, CT 06610

SHEET TITLE
ELEVATION AND ANTENNA PLAN

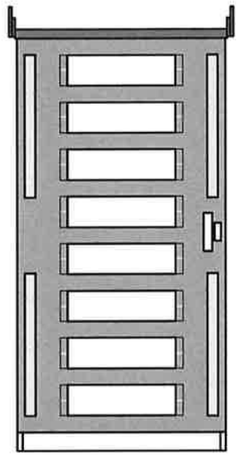
SHEET NUMBER
A-1



EQUIPMENT PLAN (1 / A-2)

22x34 SCALE: 1/2"=1'-0"
11x17 SCALE: 1/4"=1'-0"

GRAPHIC SCALE
0 1 2 4 6 FEET

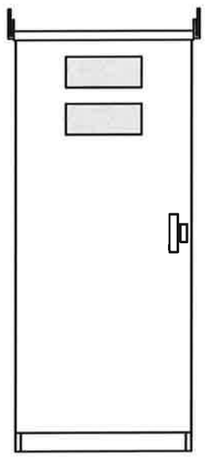


SPECIFICATIONS:
MANUFACTURER: COMMSCOPE
PART NO.: RBA72-36
SIZE: 72"x36"40"
WEIGHT: 2,500 LBS

NOTE:
ANCHOR CABINET TO STEEL DUNNAGE PER MANUFACTURERS RECOMMENDATIONS

BATTERY CABINET DETAIL (2 / A-2)

SCALE: N.T.S

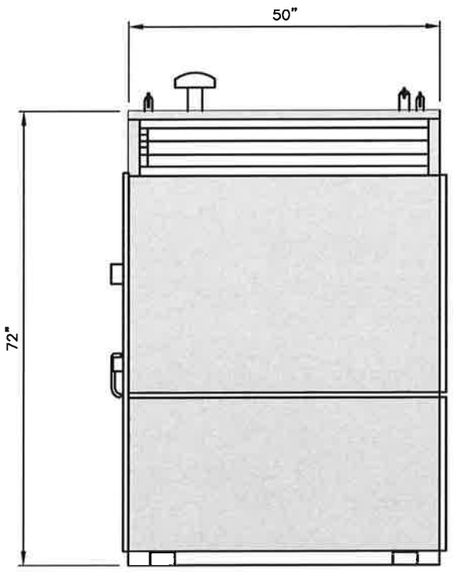


SPECIFICATIONS:
MANUFACTURER: COMMSCOPE
PART NO.: RBA72-30
SIZE: 72"x30"42"
WEIGHT: 740 LBS

NOTE:
ANCHOR CABINET TO STEEL DUNNAGE PER MANUFACTURERS RECOMMENDATIONS

EQUIPMENT CABINET DETAIL (3 / A-2)

SCALE: N.T.S



SPECIFICATIONS:
MANUFACTURER: POLAR POWER INC.
PART NO.: 88-25-0603
SIZE: 72"x50"32"
WEIGHT: 943 LB.

NOTE:
ANCHOR CABINET TO STEEL PLATFORM PER MANUFACTURERS RECOMMENDATIONS

GENERATOR DETAIL (4 / A-2)

SCALE: N.T.S

PREPARED FOR: CELLCO PARTNERSHIP D.B.A.
verizon

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STATE OF CONNECTICUT
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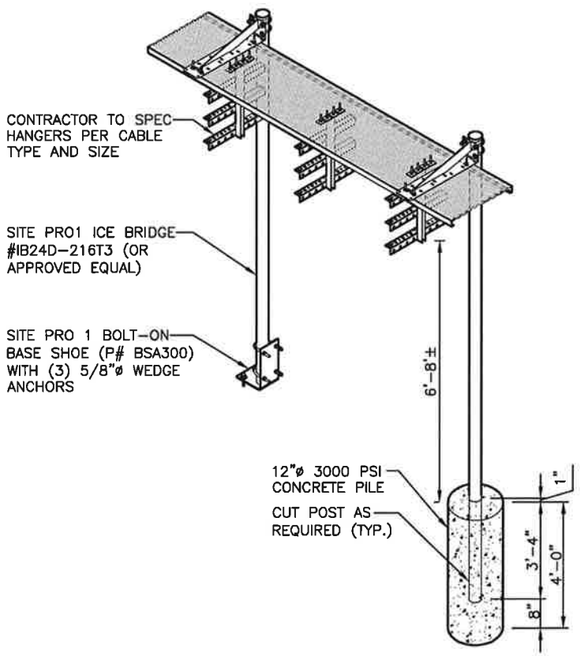
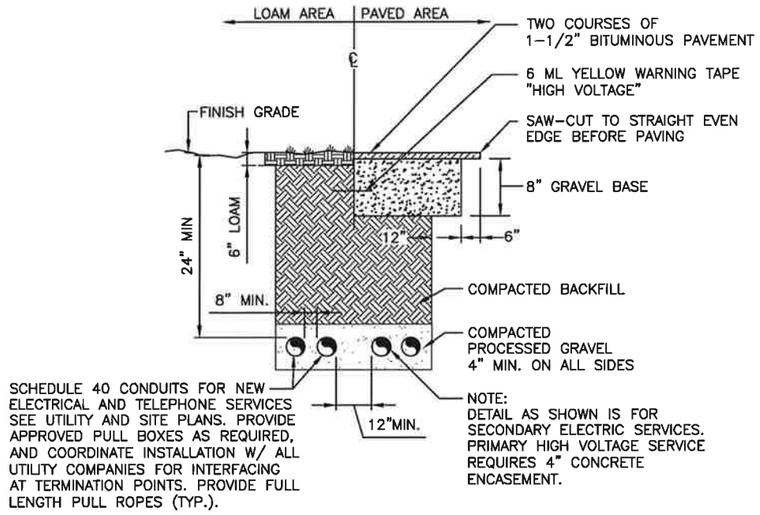
SHEET TITLE
EQUIPMENT DETAILS

SHEET NUMBER
A-2

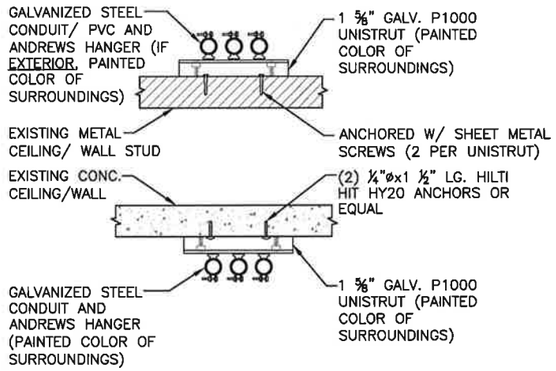


CABLE BRIDGE DETAIL 1 / A-3
22x34 SCALE: N.T.S

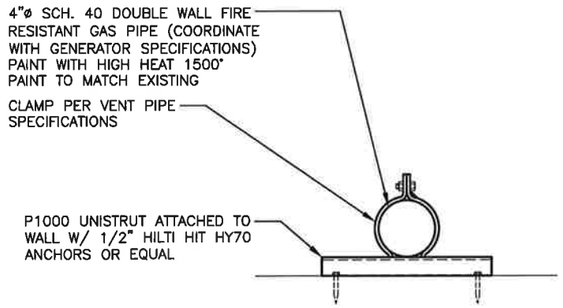
INSTALL (2) PULL STRINGS AND CAP THE TELCO CONDUITS INSIDE THE VAULT AND MESA CABINET TO AVOID WATER/ICE FILL UP



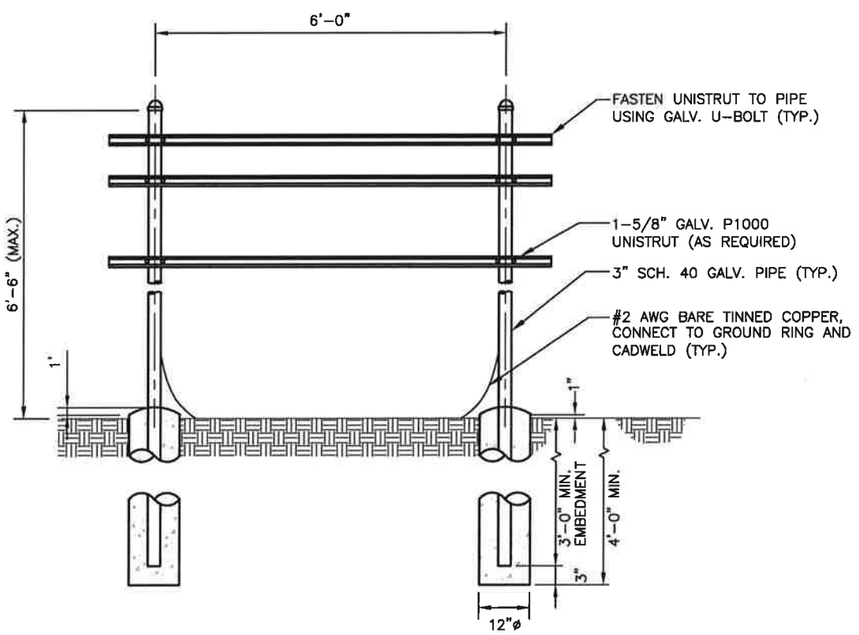
BURIED CONDUIT DETAIL 2 / A-3
SCALE: N.T.S



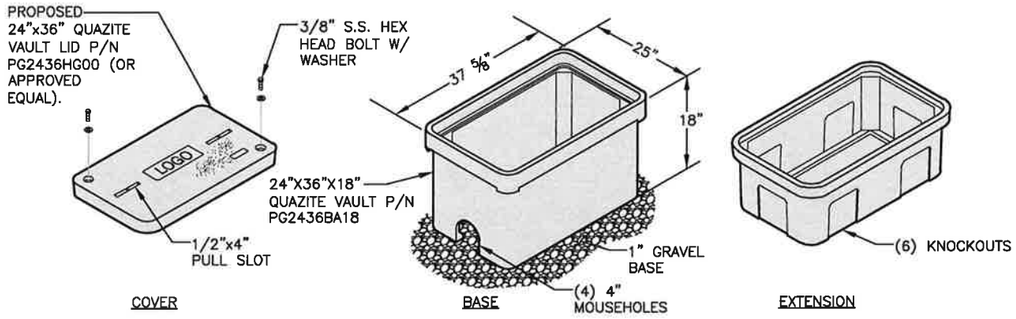
CONDUIT RUN DETAIL 3 / A-3
SCALE: N.T.S



GAS PIPE SUPPORT DETAIL 4 / A-3
SCALE: N.T.S



H-FRAME DETAIL 5 / A-3
SCALE: N.T.S



NOTE:
1. THIS INFORMATION MAY NOT CONTAIN ALL DETAILS REQUIRED FOR CONSTRUCTION. APPROPRIATE MODIFICATION MAY BE REQUIRED TO ENSURE SUITABILITY OF THESE DRAWINGS FOR THE SPECIFIC APPLICATION. SEE SPECIFICATION PROVIDED BY ELECTRICAL DESIGNER FOR FURTHER DETAIL AND INSTALLATION.
2. PROVIDE STANDARD HANDHOLE. COVER COLOR SHALL BE AS SPECIFIED BY THE NIH.
3. PROVIDE 25mm (1") X 10mm (3/8") BELL PULL SLOT FOR EACH HANDHOLE.
4. COVER, RING AND BOX SHALL BE MADE OF SAME MATERIAL.
5. PROVIDE IMPRINTED LOGO TO MATCH.

FOR TELCO AND POWER

HANDHOLE DETAIL 6 / A-3
SCALE: N.T.S

PREPARED FOR: CELLCO PARTNERSHIP D.B.A.
verizon

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No. 28554
LICENSED PROFESSIONAL ENGINEER

CHECKED BY: DJR

APPROVED BY: DJC

SUBMITTALS

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541 BROADBRIDGE ROAD
BRIDGEPORT, CT 06610

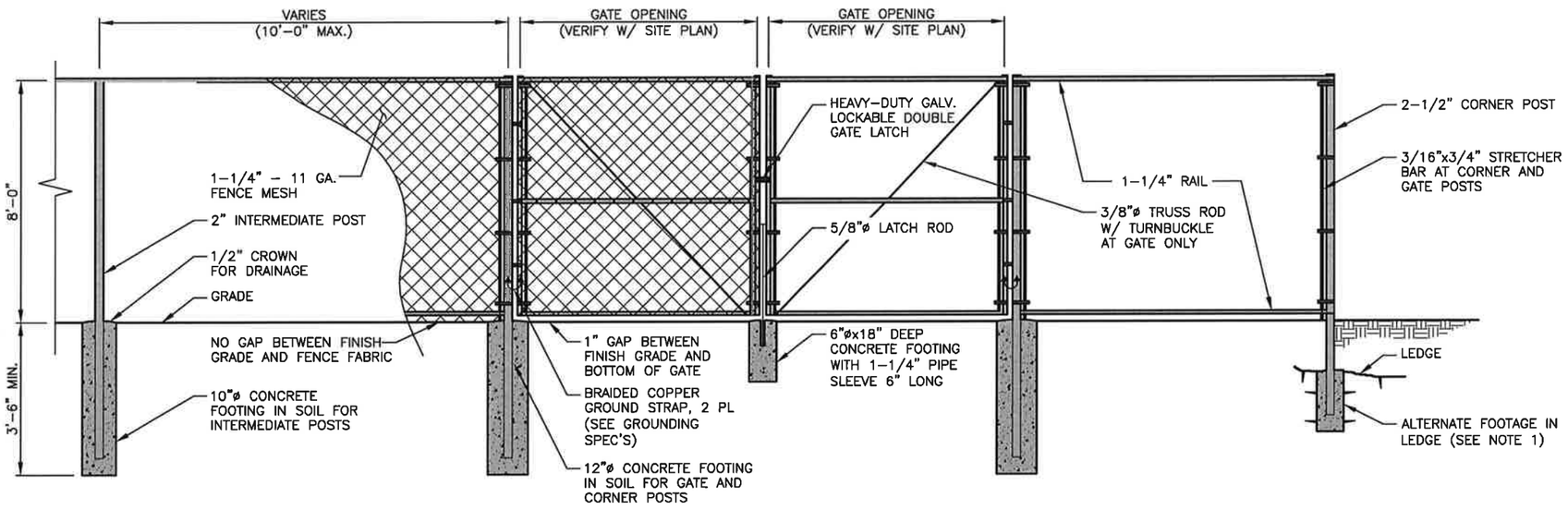
SHEET TITLE
CABLE SUPPORT DETAILS

SHEET NUMBER
A-3

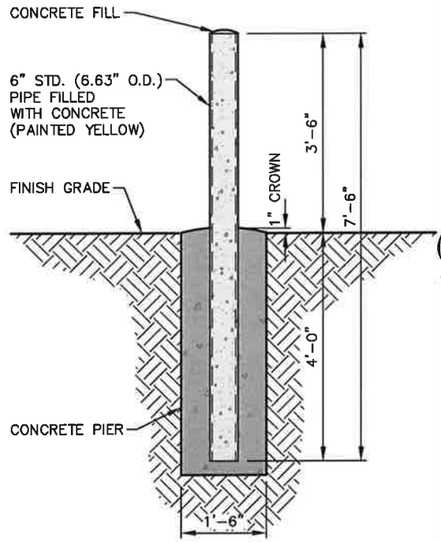
FENCE NOTES

1. ALTERNATE FOOTINGS FOR ALL FENCE POSTS IN LEDGE: IF LEDGE IS ENCOUNTERED AT GRADE, OR AT A DEPTH SHALLOWER THAN 3'–6", CORE DRILL AN 8" DIA HOLE 18" INTO THE LEDGE. CENTER POST IN THE HOLE AND FILL WITH CONCRETE OR GROUT. IF LEDGE IS BELOW FINISH GRADE, COAT BACKFILLED SECTION OF POST WITH COAL TAR, AND BACKFILL WITH WELL–DRAINING GRAVEL.

2. ATTACH EACH GATE WITH 1–1/2 PAIR OF NON–LIFT–OFF TYPE, MALLEABLE IRON OR FORGING, PIN–TYPE HINGES. ASSEMBLIES SHALL ALLOW FOR 180° OF GATE TRAVEL.



CHAINLINK FENCE DETAIL 1 / A–4
SCALE: N.T.S



CONCRETE FILLED BOLLARD 2 / A–4
22x34 SCALE: N.T.S

PREPARED FOR: CELLCO PARTNERSHIP D.B.A.

verizon

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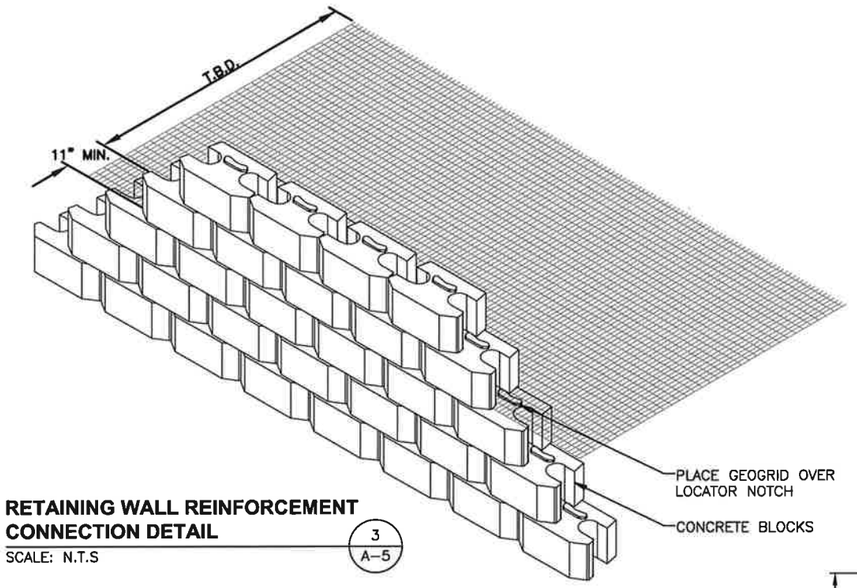
BRIDGEPORT, CT 06610

SHEET TITLE
FENCE DETAILS

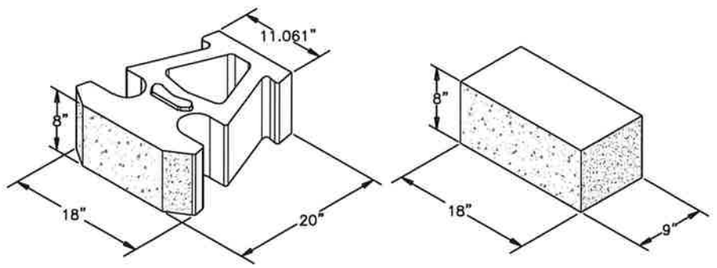
SHEET NUMBER
A-4

RETAINING WALL NOTES:

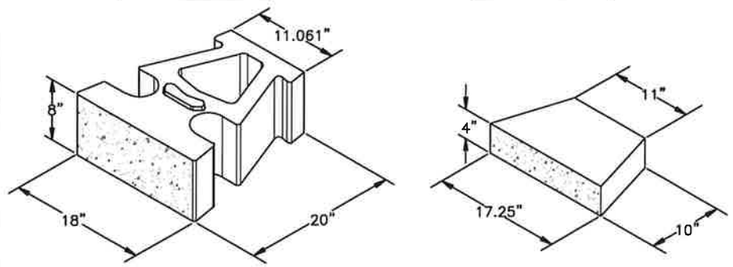
1. CONCRETE UNITS TO BE VERTICA PRO BLOCKS AS MANUFACTURED BY ANCHOR WALL SYSTEMS OR APPROVED EQUAL
2. DRAWINGS FOR SCHEMATIC & BIDDING PURPOSES ONLY. FINAL DESIGN BY VERTICA PRO (OR EQUAL).
3. WALL HEIGHT GREATER THAN 6 FEET WILL REQURE THE USE OF GEOSYNTHETIC REINFORCEMENT. CONSULT MANUFACTURER FOR PLACEMENT REQUIREMENTS.



RETAINING WALL REINFORCEMENT CONNECTION DETAIL (3 / A-5)
SCALE: N.T.S

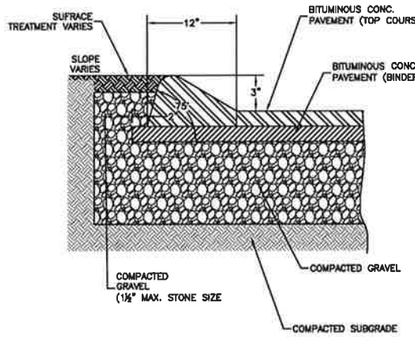


BEVELED UNIT | **CORNER UNIT**

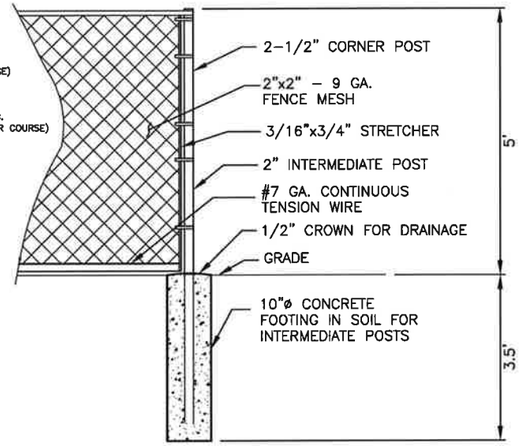


STRAIGHT UNIT | **CAP UNIT**

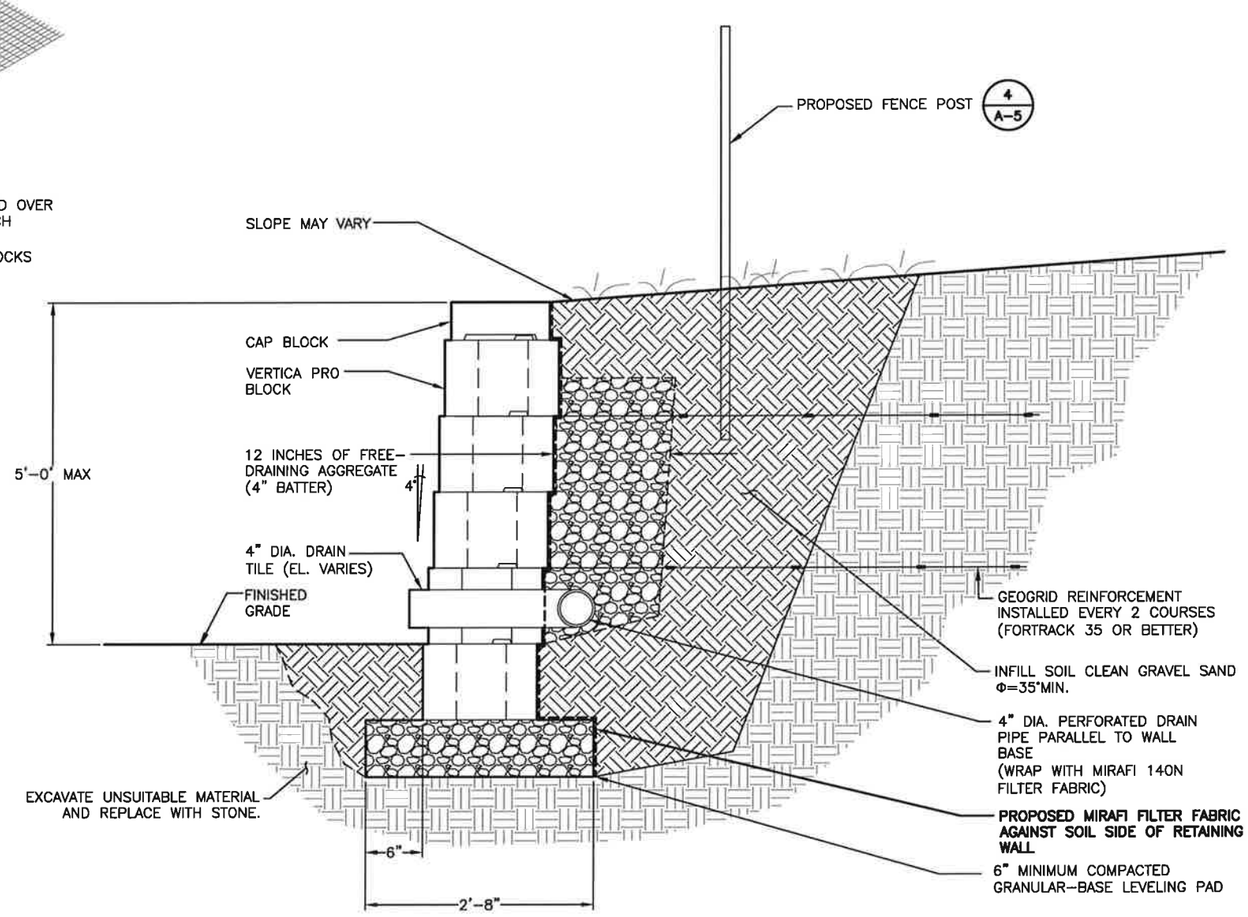
TYPICAL RETAINING WALL BLOCK DETAIL (2 / A-5)
SCALE: N.T.S



BITUMINOUS CURB DETAIL (5 / A-5)
SCALE: N.T.S



SAFETY FENCE DETAILS (4 / A-5)
SCALE: N.T.S



TYPICAL RETAINING WALL SECTION DETAIL (1 / A-5)
SCALE: N.T.S

PREPARED FOR: CELLCO PARTNERSHIP D.B.A.

verizon

HUDSON Design Group LLC
45 BEECHWOOD DRIVE
N. ANDOVER, MA 01845
TEL: (978) 557-5553
FAX: (978) 336-5586

STATE OF CONNECTICUT
DEREK J. CREASER
No. 28553
LICENSED PROFESSIONAL ENGINEER

CHECKED BY: DJR

APPROVED BY: DJC

SUBMITTALS

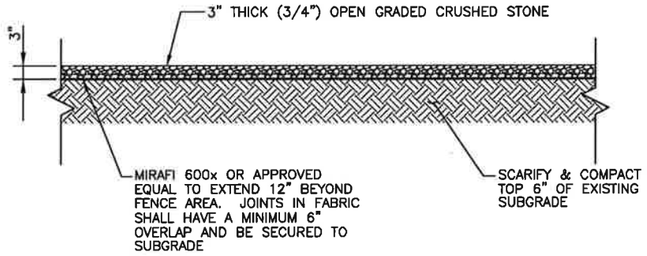
REV.	DATE	DESCRIPTION	BY
2	04/23/18	REVISED PER COMMENTS	KAM
1	03/21/18	REVISED PER COMMENTS	JS
0	03/12/18	ISSUED FOR REVIEW	JS

SITE NAME:
BRIDGEPORT NE CT

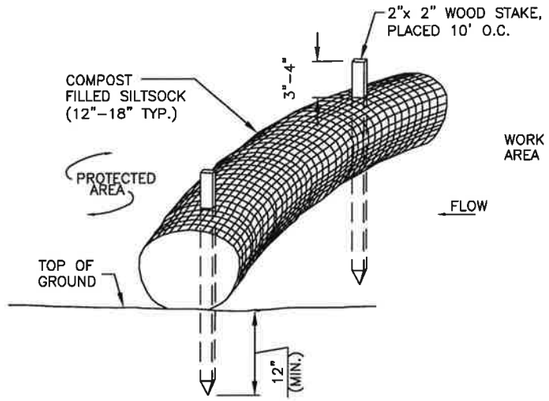
SITE ADDRESS:
541 BROADBRIDGE ROAD
BRIDGEPORT, CT 06610

SHEET TITLE
RETAINING WALL DETAIL

SHEET NUMBER
A-5



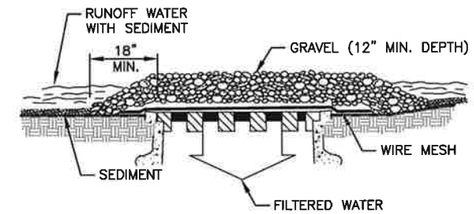
COMPOUND SURFACE DETAIL (1 / A-6)
22x34 SCALE: 1"=1'-0"
11x17 SCALE: 1/2"=1'-0"



NOTES:

1. SILTSOCK SHALL BE FILTREXX SILTSOXX, OR APPROVED EQUAL.
2. COMPOST MATERIAL SHALL BE DISPERSED ON SITE, AS DETERMINED BY THE ENGINEER.
3. SILTSOCK SHALL BE INSPECTED PERIODICALLY AND AFTER ALL STORM EVENTS, AND REPAIR OR REPLACEMENT SHALL BE PERFORMED PROMPTLY AS NEEDED.
4. SEE SPECIFICATIONS FOR SOCK SIZE, AND COMPOST FILL, REQUIREMENTS.

SILT SOCK DETAIL (WHERE APPLICABLE) (2 / A-6)
SCALE: N.T.S



CONSTRUCTION SEQUENCE:

1. A WIRE MESH SHOULD BE PLACED OVER THE DROP INLET OR CURB OPENING SO THAT THE ENTIRE OPENING AND A MINIMUM OF 12 INCHES AROUND THE OPENING ARE COVERED BY THE MESH. THE MESH MAY BE ORDINARY HARDWARE CLOTH OR WIRE MESH WITH OPENINGS UP TO 1/2 INCH.

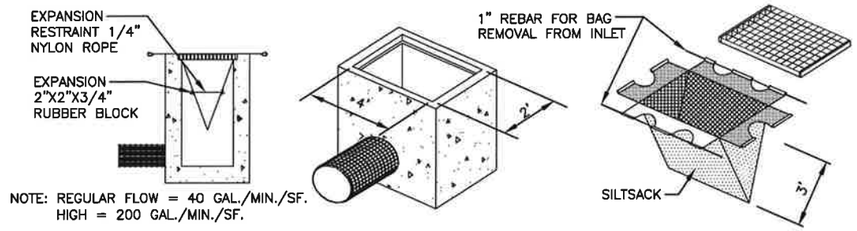
2. THE WIRE MESH SHOULD BE COVERED WITH CLEAN COARSE AGGREGATE SUCH AS SEWER STONE FOR A MINIMUM DEPTH OF 12 INCHES.

3) THE COARSE AGGREGATE SHOULD EXTEND AT LEAST 18 INCHES ON ALL SIDES OF THE DRAIN OPENING.

MAINTENANCE:

ALL STRUCTURES SHOULD BE INSPECTED AFTER EVERY RAIN STORM AND REPAIRS MADE AS NECESSARY. SEDIMENT SHOULD BE REMOVED FROM THE TRAPPING DEVICES AFTER THE SEDIMENT HAS REACHED A MAXIMUM OF ONE HALF THE DEPTH OF THE TRAP. THE SEDIMENT SHOULD BE DISPOSED OF IN A SUITABLE AREA AND PROTECTED FROM EROSION BY EITHER STRUCTURAL OR VEGETATIVE MEANS. THE TEMPORARY TRAPS SHOULD BE REMOVED AND THE AREA REPAIRED AS SOON AS THE CONTRIBUTING DRAINAGE AREA TO THE INLET HAS BEEN COMPLETELY STABILIZED.

STONE INLET PROTECTION DETAIL-ON SITE



NOTE: REGULAR FLOW = 40 GAL./MIN./SF.
HIGH = 200 GAL./MIN./SF.

SILKSACK DETAIL - ON OR OFF SITE

STONE INLET PROTECTION DETAIL (3 / A-6)
SCALE: N.T.S

PREPARED FOR: CELLCO PARTNERSHIP D.B.A.

verizon

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STATE OF CONNECTICUT
DEREK J. CREASER
No. 28551
LICENSED PROFESSIONAL ENGINEER

CHECKED BY: DJR

APPROVED BY: DJC

SUBMITTALS

REV.	DATE	DESCRIPTION	BY
2	04/23/18	REVISED PER COMMENTS	KAM
1	03/21/18	REVISED PER COMMENTS	JS
0	03/12/18	ISSUED FOR REVIEW	JS

SITE NAME:
BRIDGEPORT NE CT

SITE ADDRESS:
541 BROADBRIDGE ROAD
BRIDGEPORT, CT 06610

SHEET TITLE
SITE SURFACE AND EROSION CONTROL DETAILS

SHEET NUMBER
A-6

ATTACHMENT 2

ENGINEERED ENDEAVORS

April 18, 2018

Reference: Design and Reliability of a 100 *ft* Monopole
Quality of Steel and Fabrication of a Monopole Structure
Verizon Wireless Site *Bridgeport NE*
Site Location: Bridgeport, CT
EE Job Number: 18280-D01

To Whom it May Concern:

In response to the design and anticipated reliability and theoretical initial collapse point of a 100*ft* monopole, Engineered Endeavors (EE) offers the following comments:

1. The monopole structure is designed to meet the requirements of the ANSI TIA-222-G titled *Structural Standards for Antenna Supporting Structures and Antennas*. It also meets or exceeds the requirements of *The 2015 International Building Code, Connecticut Building Code,* and the *Steel Construction Manual 15th Edition* by the American Institute of Steel Construction (AISC). Furthermore, the foundation and anchor bolts meet the requirements of the American Concrete Institute's *Building Code Requirements for Structural Concrete* (ACI 318-15).

2. Based on the location of this structure, the maximum TIA-222-G wind speed required is 110 *mph,* nominal (ASCE 7-05) and ASCE 7-10, 2015 IBC 124 mph ultimate 3-second gust. The wind exceeds the 50-year maximum anticipated wind velocity at 33 *ft* above ground level. Additional factors are applied to increase the wind loading, *e.g.*, a gust response factor is imposed in order to account for sudden changes in wind speed, a height coefficient to account for increasing wind speed with height, and an exposure coefficient. Based on these conservative coefficients, the structure could in fact survive even greater wind loads than the basic design wind speed without any failures.

3. The monopole structure design is controlled by wind induced loads, however, earthquake induced loads are also evaluated with all building code requirements being satisfied. Vertical loads (*i.e.*, gravity loads) are minimal on these types of structures, approximately 10% of the maximum capacity.

4. The design and loading assumptions which are used for the analysis of these structures are very conservative in nature when compared to other building codes; as a result, **structural failure is highly improbable**.

5. Failure of a **steel monopole structure** is defined as being that point at which the induced stresses exceed the yield strength of the material. At this point, deflections will be induced in the structure, which will no longer be recoverable once the load has been removed. Hence, a

permanent deflection in the monopole would exist. The induced loads must be sustained for a long enough period in order that the structure has time to respond to the load without its removal. Monopoles are flexible, ductile structures, which are not generally susceptible to damage by impact loads such as wind gust or earthquake shocks.

6. As the structure leans over from the induced loads, it presents a reduced exposure area for the development of wind-induced forces. This would result in the lowering of the applied forces and, therefore, the reduction of stresses and a halting of the structural deflection.

7. Hypothetically, let's assume that a pole becomes overloaded. The typical consequence of this overloading is "local buckling" where a relatively small portion of the shaft distorts and "kinks" the steel. Upon the removal of the applied load, the structure will not return to a plumb position. This does not cause a free falling pole. Even though the buckle exists, the cross section of the pole is capable of carrying the entire vertical load. Thus, in the result, wind induced loads could not conceivably bring this type of structure to the ground due to the excellent ductile properties, design criteria, and failure mode.

8. **In regards of this particular 100-ft monopole, the structure is designed with the highest design stresses at the approximately 20 feet below the top of the radome spool mast, i.e. at 80-ft elevation. In the event of the theoretical "collapse", the upper 20 feet of the monopole under the wind velocity pressure will bend and lean over the lower standing section, thus no debris will reach the outside of the perimeter of the lease property.**

9. EEI has never experienced a structural failure due to weather induced overloading. EE personnel have over 30 years combined experience in design and fabrication of these types of structures.

In response to your inquiry regarding the quality of steel and fabrication of a monopole structure:

1) The monopole is fabricated from ASTM A572 material with a controlled silicon content of 0.06% maximum to promote a uniform galvanized coating. The base plate material is also fabricated from ASTM A572 material. All plate material meets a Charpy V-Notch toughness requirement of 15 *ft-lbs* @ -20° Fahrenheit. By meeting the strict toughness requirement, the monopole is best suited to resist the cyclic/fatigue type loading (*i.e.*, wind induced loading) these structures exhibit. The toughness specification is based on 35 years of taper tubular poles being designed and manufactured for the electrical transmission and communication industries.

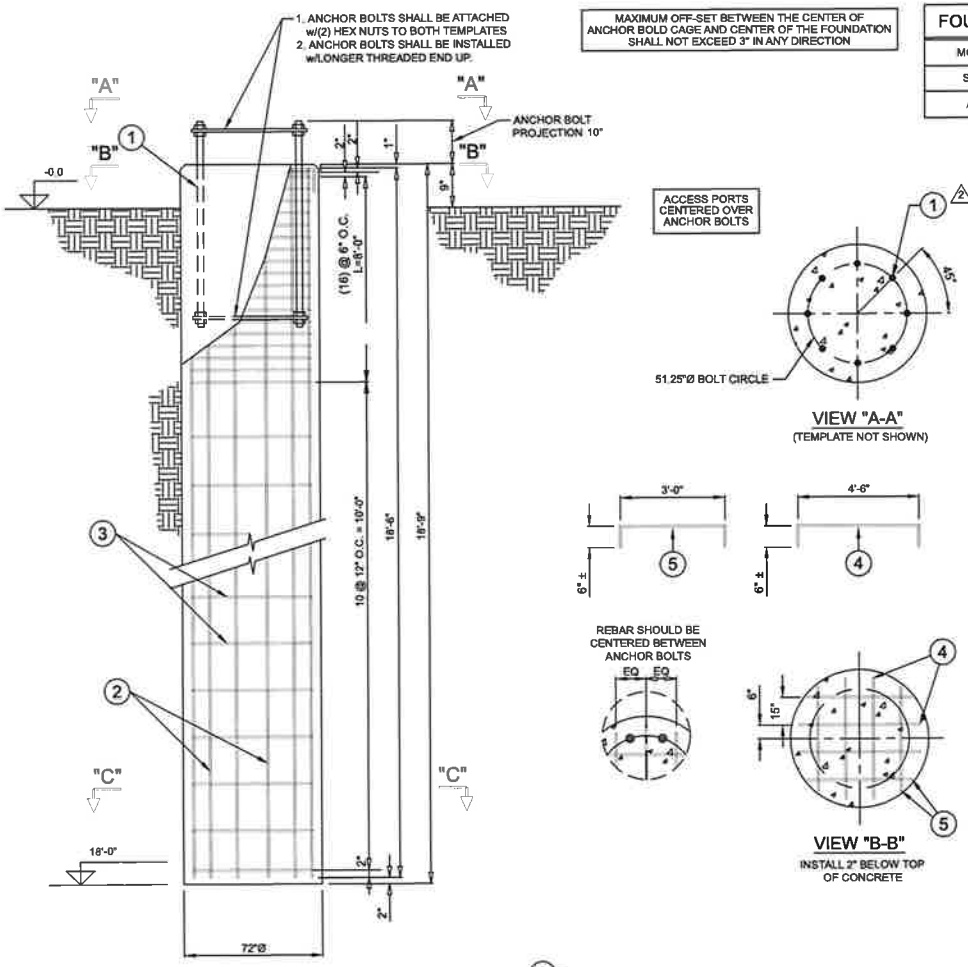
2) Anchor bolts are fabricated from A615 Grade 75 material. The bolts are 2 ¼ *in* diameter, made from #18J bar stock. All threads are rolled. Anchor bolts come complete with two (2) A194 Grade 2H hex nuts. The anchor bolt material must also meet a Charpy V-Notch toughness of 15 *ft-lbs* @ -20° Fahrenheit, to resist the cyclic/fatigue type loading (*i.e.*, wind induced loading) these structures exhibit.

EEI guarantees the quality of steel used on the entire monopole. Material Certifications (Mill Test Reports) are available on all material at the time of fabrication. The toughness requirement should be taken very seriously, for over the lifetime of the structure not having this toughness requirement, "toe" cracks may occur at the base of the structure and the structure could ultimately fail. Fabrication of the monopole is performed in accordance with the provisions of the AISC *Steel Construction Manual* and ASTM/TIA-222G *Structural Standards for Antenna Supporting Structures and Antennas*. All welding and inspection is in accordance with the American Welding Society's Specification D1.1 - latest revision. Testing and inspection reports are available upon request at the time of fabrication.

In conclusion, due to the aforementioned items, EE's monopole structures have never experienced a "free fall" type failure due to wind or seismic induced loads. I hope that these comments address the issues, which you might encounter relative to the anticipated performance of monopole structures and quality of steel and fabrication. However, I will be most happy to answer any specific questions, which you might have.

Sincerely,
Engineered Endeavors

Boris Fayman, PE
Senior Engineer



MAXIMUM OFF-SET BETWEEN THE CENTER OF ANCHOR BOLD CAGE AND CENTER OF THE FOUNDATION SHALL NOT EXCEED 3" IN ANY DIRECTION

FOUNDATION LOADING	
MOMENT	615.0 kip-ft
SHEAR	11.9 kips
AXIAL	15.8 kips

MATERIAL LIST		
ITEM	QTY.	DESCRIPTION
1	8	1 3/4"Ø x 6'-0" (A615-GR.75) ANCHOR BOLTS
2	26	#8 REBAR x 18'-6" (ASTM A615-GR.60)
3	29	#5 REBAR x 18'-0" (ASTM A615-GR.60)
4	4	#4 REBAR x 5'-6" (ASTM A615-GR.60)
5	4	#4 REBAR x 4'-0" (ASTM A615-GR.60)

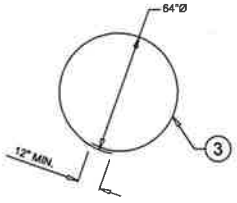
VOL. CONCRETE @ 4000 psi (TYPE II CEMENT)	20.0 yd^3
STEEL (ASTM A615-GR.60)	1900.0 lbs

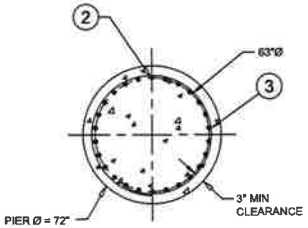
ACCESS PORTS CENTERED OVER ANCHOR BOLTS

VIEW "A-A"
(TEMPLATE NOT SHOWN)

REBAR SHOULD BE CENTERED BETWEEN ANCHOR BOLTS

VIEW "B-B"
INSTALL 2" BELOW TOP OF CONCRETE





SECTION "C-C"

GENERAL NOTES:

1. FOUNDATION DESIGN IS BASED ON THE FOLLOWING: EEI JOB# 18280-D01, SOIL REPORT BY HUDSON DESIGN GROUP, LLC, DATE - 10/02/17.
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.
   IT IS RECOMMENDED TO USE A STEEL CAISSON PIPE TO PREVENT SOIL DISTURBANCE AND REDUCE THE EFFECT OF DRILLING ON THE ADJACENT BUILDING.
   FOUNDATION INSTALLER SHALL VERIFY IF THERE ARE NO ANY UNDERGROUND UTILITIES AT THE LOCATION OF DRILLING.
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.
4. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR ALL CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES,AND PROCEDURES.
5. SPECIAL INSPECTION IS REQUIRED IN ACCORDANCE WITH 2016 IBC and CT BC.
   5.1. SOIL.
      5.1.a. FOUNDATION EXCAVATION SHALL BE INSPECTED PRIOR TO INSTALLATION OF REINFORCEMENT.
      5.1.b. VERIFY DEPTH AND DIAMETER OF THE EXCAVATION.
      5.1.c. VERIFY ACTUAL SOIL CONDITIONS AGAINST THE GEOTECHNICAL REPORT.
   5.2. REINFORCING STEEL.
      5.2.a. VERIFY GRADE, LENGTH, DIAMETER, AND QUANTITY OF REBARS AND COMPLIANCE WITH THE DRAWINGS.
      5.2.b. VERIFY GRADE, LENGTH, DIAMETER, AND QUANTITY OF ANCHOR BOLTS AND BOLT PATTERN ON THE TEMPLATES.
   5.3. CONCRETE.
      5.3.a. VERIFY STRENGTH, SLUMP, AIR, TEMPERATURE OF CONCRETE, AND DESIGN MIX.
6. REINFORCING STEEL.
   6.1. REINFORCING STEEL SHALL CONFORM TO ASTM A615-97, Fy=60 ksi.
   6.2. ALL REINFORCEMENT SHALL BE ASSEMBLED USING STEEL WIRE. WELDING IS NOT PERMITTED.
   6.3. MINIMUM SPLICE LENGTH FOR LONGITUDINAL BARS: No. 6 BARS AND SMALLER - 44 x Ø bar; No. 7 BARS AND LARGER 55 x Ø bar.
   6.4. HORIZONTAL STIRRUPS SHALL BE STAGGERED ALONG THE REBAR CAGE WITH NO MORE THAN 50% OF SPLICES IN ONE PLACE.
7. CONCRETE.
   7.1. MIX DESIGN AND CONSTRUCTION PROCEDURE SHALL BE IN COMPLIANCE WITH ACI 318, ACI 336.3R,AND ALL APPLICABLE STATE AND LOCAL CODES.
   7.2. MINIMUM COMPRESSIVE STRENGTH - 4000 psi AT 28 DAYS AND TYPE II CEMENT SHALL BE USED UNLESS STATED OTHERWISE.
   7.3. SLUMP: DRILLED PIER - 7" (±1"), MAT FOUNDATION - 3" (±1").
   7.4. CONCRETE SHALL BE DEPOSITED AS NEARLY AS PRACTICAL IN ITS FINAL POSITION TO AVOID SEGREGATION DUE TO REHANDLING OR FLOWING.
   7.5. CONCRETE SHALL BE THOROUGHLY CONSOLIDATED BY ALL SUITABLE MEANS DURING PLACEMENT AND SHALL BE THOROUGHLY WORKED AROUND REINFORCEMENT AND EMBEDDED FIXTURES AND INTO CORNERS OF FORMS.
8. ANCHOR BOLT INSTALLATION: ANCHOR BOLT ORIENTATION SHALL BE VERIFIED WITH THE SITE PLANS AND MONOPOLE DRAWING FOR PROPER ACCESS PORT ORIENTATION AND ANCHOR BOLT ALIGNMENT PRIOR TO CONCRETE PLACEMENT.

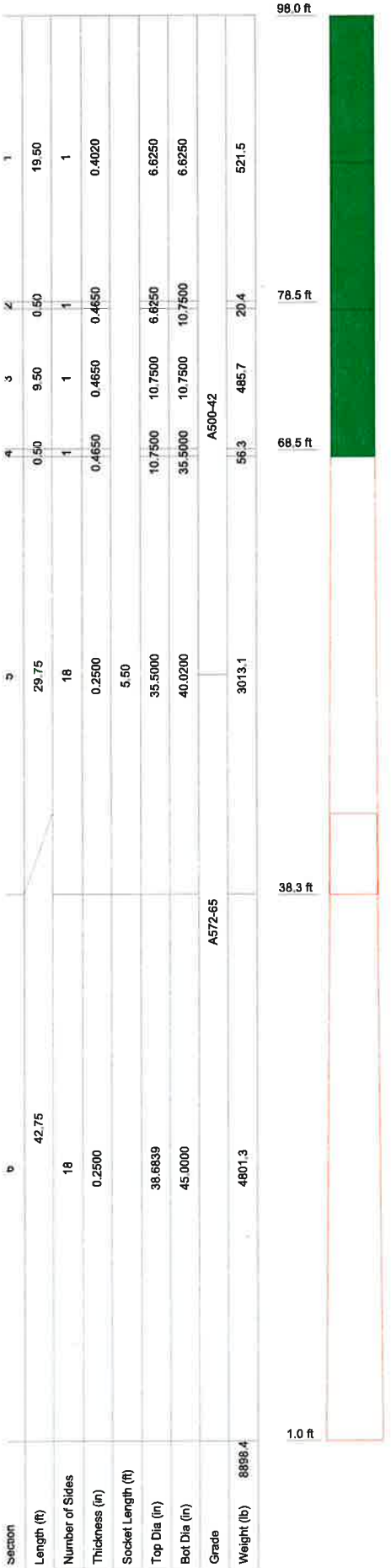
04-18-2018

ENGINEERED ENDEAVORS
The Experienced Point of View
15175 Kinsman Road * Burton, OH 44062
Ph. 440.970.5004 * www.engend.com*

REV	DESCRIPTION	DATE	DWN	CHK
2	REVISED w/FALL ZONE	04/18/2018	BF	BF
1	REVISED TOWER DESIGN	03/15/2018	BF	BF
0	COMPLETED DRAWING	02/20/2018	BF	BF

Verizon Wireless
100-ft Monopole
Bridgeport NE
Bridgeport, CT

SCALE: N.T.S. | PROJECT NO. 18280-D01
SHEET 1 of 1 | DRAWING NO. 18280D-100.0



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
36" X 10' AMS	98 - 88	36" X 10' AMS	78 - 68
36" X 10' AMS	88 - 78		

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A500-42	42000 psi	58000 psi	A572-65	65000 psi	80000 psi

TOWER DESIGN NOTES

1. Tower is located in Fairfield County, Connecticut.
2. Tower designed for Exposure C to the TIA-222-G Standard.
3. Tower designed for a 110 mph basic wind in accordance with the TIA-222-G Standard.
4. Tower is also designed for a 50 mph basic wind with 0.75 in ice. Ice is considered to increase in thickness with height.
5. Deflections are based upon a 60 mph wind.
6. Tower Structure Class II.
7. Topographic Category 1 with Crest Height of 0.00 ft
8. Fall Zone not to exceed 17'
9. TOWER RATING: 57.2%

ALL REACTIONS ARE FACTORED

AXIAL
24676 lb

SHEAR
2832 lb

MOMENT
141 kip-ft

50 mph WIND - 0.7500 in ICE

AXIAL
15794 lb

SHEAR
11867 lb

MOMENT
615 kip-ft

REACTIONS - 110 mph WIND

STATE OF CONNECTICUT
BORIS FAYMAN
No. 29864
LICENSED
PROFESSIONAL ENGINEER

04-18-2018

Engineered Endeavors
15175 Kinsman Road
Burton, OH
Consulting Engineers
Phone: 440.970.5004
FAX: www.engend.com

Job: *18280-D01. R2*
Project: *100' Monopole. Bridgeport NE CT*
Client: Verizon Wireless | Drawn by: bfayman | App'd:
Code: TIA-222-G | Date: 04/18/18 | Scale: N
Path: | Dwg No.

tnxTower	Job	Page
	18280-D01. R2	1 of 13
Engineered Endeavors 15175 Kinsman Road Burton, OH Phone: 440.970.5004 FAX: www.engend.com	**Project** 100' Monopole. Bridgeport NE CT	**Date** 10:07:18 04/18/18
	Client Verizon Wireless	**Designed by** bfayman

Tower Input Data

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

Tower is located in Fairfield County, Connecticut.
Basic wind speed of 110 mph.
Structure Class II.
Exposure Category C.
Topographic Category 1.
Crest Height 0.00 ft.
Nominal ice thickness of 0.7500 in.
Ice thickness is considered to increase with height.
Ice density of 56.00 pcf.
A wind speed of 50 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 60 mph.
Fall Zone not to exceed 17'.
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in pole design is 1.
Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Options

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

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

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	98.00-78.50	19.50	0.00	Round	6.6250	6.6250	0.4020		A500-42 (42000 psi)
L2	78.50-78.00	0.50	0.00	Round	6.6250	10.7500	0.4650		A500-42 (42000 psi)
L3	78.00-68.50	9.50	0.00	Round	10.7500	10.7500	0.4650		A500-42 (42000 psi)
L4	68.50-68.00	0.50	0.00	Round	10.7500	35.5000	0.4650		A500-42 (42000 psi)
L5	68.00-38.25	29.75	5.50	18	35.5000	40.0200	0.2500	1.0000	A572-65 (65000 psi)
L6	38.25-1.00	42.75		18	38.6839	45.0000	0.2500	1.0000	A572-65 (65000 psi)

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	6.6250	7.8592	38.2027	2.2047	3.3125	11.5329	76.4054	3.9272	0.0000	0
	6.6250	7.8592	38.2027	2.2047	3.3125	11.5329	76.4054	3.9272	0.0000	0
L2	6.6250	8.9988	42.9262	2.1841	3.3125	12.9589	85.8524	4.4967	0.0000	0
	10.7500	15.0247	199.0731	3.6400	5.3750	37.0369	398.1462	7.5079	0.0000	0
L3	10.7500	15.0247	199.0731	3.6400	5.3750	37.0369	398.1462	7.5079	0.0000	0
	10.7500	15.0247	199.0731	3.6400	5.3750	37.0369	398.1462	7.5079	0.0000	0
L4	10.7500	15.0247	199.0731	3.6400	5.3750	37.0369	398.1462	7.5079	0.0000	0
	35.5000	51.1805	7854.0869	12.3878	17.7500	442.4838	15708.1738	25.5750	0.0000	0
L5	36.0476	27.9709	4390.9829	12.5138	18.0340	243.4836	8787.7436	13.9881	5.8080	23.232
	40.6374	31.5575	6305.9592	14.1184	20.3302	310.1775	12620.2159	15.7817	6.6035	26.414
L6	40.1062	30.4973	5691.5194	13.6440	19.6514	289.6237	11390.5279	15.2516	6.3684	25.473
	45.6942	35.5091	8983.8709	15.8863	22.8600	392.9952	17979.5629	17.7579	7.4800	29.92

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	Double Angle Stitch Bolt Spacing Redundants in
L1 98.00-78.50				0	1	1			
L2 78.50-78.00				0	1	1			
L3 78.00-68.50				0	1	1			
L4 68.50-68.00				0	1	1			
L5 68.00-38.25				1	1	1			
L6 38.25-1.00				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 ft²/ft	Weight plf
AVA5-50 (7/8 LOW DENSI.FOAM)	C	No	Inside Pole	92.00 - 4.00	18	No Ice	0.00	0.30
						1/2" Ice	0.00	0.30
						1" Ice	0.00	0.30
AVA5-50 (7/8 LOW DENSI.FOAM)	C	No	Inside Pole	82.00 - 4.00	18	No Ice	0.00	0.30
						1/2" Ice	0.00	0.30
						1" Ice	0.00	0.30
AVA5-50 (7/8 LOW DENSI.FOAM)	C	No	Inside Pole	72.00 - 4.00	18	No Ice	0.00	0.30
						1/2" Ice	0.00	0.30
						1" Ice	0.00	0.30

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft²	A_F ft²	C_AA_A In Face ft²	C_AA_A Out Face ft²	Weight lb
L1	98.00-78.50	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	91.80
L2	78.50-78.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	5.40
L3	78.00-68.50	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	121.50
L4	68.50-68.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	8.10
L5	68.00-38.25	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	481.95
L6	38.25-1.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	554.85

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft²	A_F ft²	C_AA_A In Face ft²	C_AA_A Out Face ft²	Weight lb
L1	98.00-78.50	A	1.655	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	91.80
L2	78.50-78.00	A	1.635	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	5.40
L3	78.00-68.50	A	1.625	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	121.50

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft²	A_F ft²	C_AA_A In Face ft²	C_AA_A Out Face ft²	Weight lb
L4	68.50-68.00	A	1.613	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	8.10
L5	68.00-38.25	A	1.572	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	481.95
L6	38.25-1.00	A	1.426	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	554.85

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	98.00-78.50	0.0000	0.0000	0.0000	0.0000
L2	78.50-78.00	0.0000	0.0000	0.0000	0.0000
L3	78.00-68.50	0.0000	0.0000	0.0000	0.0000
L4	68.50-68.00	0.0000	0.0000	0.0000	0.0000
L5	68.00-38.25	0.0000	0.0000	0.0000	0.0000
L6	38.25-1.00	0.0000	0.0000	0.0000	0.0000

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft Vert ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft²	C_AA_A Side ft²	Weight lb
36" X 10' AMS	C	None		0.00	98.00 - 88.00	No Ice	18.38	18.38	1000.00
						1/2" Ice	22.68	22.68	1263.82
						1" Ice	23.42	23.42	1537.64
36" X 10' AMS	C	None		0.00	88.00 - 78.00	No Ice	18.38	18.38	1000.00
						1/2" Ice	22.68	22.68	1263.82
						1" Ice	23.42	23.42	1537.64
36" X 10' AMS	C	None		0.00	78.00 - 68.00	No Ice	18.38	18.38	1000.00
							22.68	22.68	1263.82

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 lb
						1/2" Ice 1" Ice	23.42	23.42	1537.64

Load Combinations

Comb. No.	Description
1	Dead Only
2	1.2 Dead+1.6 Wind 0 deg - No Ice
3	0.9 Dead+1.6 Wind 0 deg - No Ice
4	1.2 Dead+1.6 Wind 30 deg - No Ice
5	0.9 Dead+1.6 Wind 30 deg - No Ice
6	1.2 Dead+1.6 Wind 60 deg - No Ice
7	0.9 Dead+1.6 Wind 60 deg - No Ice
8	1.2 Dead+1.6 Wind 90 deg - No Ice
9	0.9 Dead+1.6 Wind 90 deg - No Ice
10	1.2 Dead+1.6 Wind 120 deg - No Ice
11	0.9 Dead+1.6 Wind 120 deg - No Ice
12	1.2 Dead+1.6 Wind 150 deg - No Ice
13	0.9 Dead+1.6 Wind 150 deg - No Ice
14	1.2 Dead+1.6 Wind 180 deg - No Ice
15	0.9 Dead+1.6 Wind 180 deg - No Ice
16	1.2 Dead+1.6 Wind 210 deg - No Ice
17	0.9 Dead+1.6 Wind 210 deg - No Ice
18	1.2 Dead+1.6 Wind 240 deg - No Ice
19	0.9 Dead+1.6 Wind 240 deg - No Ice
20	1.2 Dead+1.6 Wind 270 deg - No Ice
21	0.9 Dead+1.6 Wind 270 deg - No Ice
22	1.2 Dead+1.6 Wind 300 deg - No Ice
23	0.9 Dead+1.6 Wind 300 deg - No Ice
24	1.2 Dead+1.6 Wind 330 deg - No Ice
25	0.9 Dead+1.6 Wind 330 deg - No Ice
26	1.2 Dead+1.0 Ice+1.0 Temp
27	1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp
28	1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp
29	1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp
30	1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp
31	1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp
32	1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp
33	1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp
34	1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp
35	1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp
36	1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp
37	1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp
38	1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp
39	Dead+Wind 0 deg - Service
40	Dead+Wind 30 deg - Service
41	Dead+Wind 60 deg - Service
42	Dead+Wind 90 deg - Service

Comb. No.	Description
43	Dead+Wind 120 deg - Service
44	Dead+Wind 150 deg - Service
45	Dead+Wind 180 deg - Service
46	Dead+Wind 210 deg - Service
47	Dead+Wind 240 deg - Service
48	Dead+Wind 270 deg - Service
49	Dead+Wind 300 deg - Service
50	Dead+Wind 330 deg - Service

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial lb	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	98 - 78.5	Pole	Max Tension	27	0.00	0.00	-0.00
			Max. Compression	26	-5188.94	0.00	0.00
			Max. Mx	8	-3003.63	-27.59	0.00
			Max. My	2	-3003.63	0.00	27.59
			Max. Vy	8	2779.09	-27.59	0.00
			Max. Vx	2	-2779.09	0.00	27.59
			Max. Torque	6			0.00
L2	78.5 - 78	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-5335.79	0.00	0.00
			Max. Mx	8	-3098.28	-28.99	0.00
			Max. My	2	-3098.28	0.00	28.99
			Max. Vy	8	2846.85	-28.99	0.00
			Max. Vx	2	-2846.85	0.00	28.99
			Max. Torque	6			0.00
L3	78 - 68.5	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-8291.27	0.00	0.00
			Max. Mx	8	-4974.90	-62.63	0.00
			Max. My	2	-4974.90	0.00	62.63
			Max. Vy	8	4227.09	-62.63	0.00
			Max. Vx	2	-4227.09	0.00	62.63
			Max. Torque	6			0.00
L4	68.5 - 68	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-8497.87	0.00	0.00
			Max. Mx	8	-5114.39	-64.76	0.00
			Max. My	2	-5114.39	0.00	64.76
			Max. Vy	8	4316.25	-64.76	0.00
			Max. Vx	2	-4316.25	0.00	64.76
			Max. Torque	6			0.00
L5	68 - 38.25	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-13734.14	0.00	0.00
			Max. Mx	8	-8481.10	-203.77	0.00
			Max. My	2	-8481.10	0.00	203.77
			Max. Vy	8	7192.03	-203.77	0.00
			Max. Vx	2	-7192.03	0.00	203.77
			Max. Torque	6			0.00
L6	38.25 - 1	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	26	-24676.07	0.00	0.00
			Max. Mx	8	-15790.41	-614.70	0.00
			Max. My	2	-15790.41	0.00	614.70
			Max. Vy	8	11871.85	-614.70	0.00
			Max. Vx	2	-11871.85	0.00	614.70
			Max. Torque	6			0.00

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical lb	Horizontal, X lb	Horizontal, Z lb
Pole	Max. Vert	26	24676.07	0.00	0.00
	Max. H_x	21	11845.76	11866.61	0.00
	Max. H_z	2	15794.35	0.00	11866.61
	Max. M_x	2	614.70	0.00	11866.61
	Max. M_z	8	614.70	-11866.61	0.00
	Max. Torsion	6	0.00	-10276.78	5933.30
	Min. Vert	7	11845.76	-10276.78	5933.30
	Min. H_x	8	15794.35	-11866.61	0.00
	Min. H_z	14	15794.35	0.00	-11866.61
	Min. M_x	14	-614.70	0.00	-11866.61
	Min. M_z	20	-614.70	11866.61	0.00
	Min. Torsion	10	-0.00	-10276.78	-5933.30

Tower Mast Reaction Summary

Load Combination	Vertical lb	$Shear_x$ lb	$Shear_z$ lb	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead Only	13161.96	0.00	0.00	0.00	0.00	0.00
1.2 Dead+1.6 Wind 0 deg - No Ice	15794.35	0.00	-11866.61	-614.70	0.00	0.00
0.9 Dead+1.6 Wind 0 deg - No Ice	11845.76	0.00	-11866.61	-612.92	0.00	0.00
1.2 Dead+1.6 Wind 30 deg - No Ice	15794.35	5933.30	-10276.78	-532.34	-307.35	0.00
0.9 Dead+1.6 Wind 30 deg - No Ice	11845.76	5933.30	-10276.78	-530.80	-306.46	0.00
1.2 Dead+1.6 Wind 60 deg - No Ice	15794.35	10276.78	-5933.30	-307.35	-532.34	-0.00
0.9 Dead+1.6 Wind 60 deg - No Ice	11845.76	10276.78	-5933.30	-306.46	-530.80	-0.00
1.2 Dead+1.6 Wind 90 deg - No Ice	15794.35	11866.61	0.00	0.00	-614.70	0.00
0.9 Dead+1.6 Wind 90 deg - No Ice	11845.76	11866.61	0.00	0.00	-612.92	0.00
1.2 Dead+1.6 Wind 120 deg - No Ice	15794.35	10276.78	5933.30	307.35	-532.34	0.00
0.9 Dead+1.6 Wind 120 deg - No Ice	11845.76	10276.78	5933.30	306.46	-530.80	0.00
1.2 Dead+1.6 Wind 150 deg - No Ice	15794.35	5933.30	10276.78	532.34	-307.35	-0.00
0.9 Dead+1.6 Wind 150 deg - No Ice	11845.76	5933.30	10276.78	530.80	-306.46	-0.00
1.2 Dead+1.6 Wind 180 deg - No Ice	15794.35	0.00	11866.61	614.70	0.00	0.00
0.9 Dead+1.6 Wind 180 deg - No Ice	11845.76	0.00	11866.61	612.92	0.00	0.00
1.2 Dead+1.6 Wind 210 deg - No Ice	15794.35	-5933.30	10276.78	532.34	307.35	0.00
0.9 Dead+1.6 Wind 210 deg - No Ice	11845.76	-5933.30	10276.78	530.80	306.46	0.00
1.2 Dead+1.6 Wind 240 deg - No Ice	15794.35	-10276.78	5933.30	307.35	532.34	-0.00

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	lb	lb	lb	kip-ft	kip-ft	kip-ft
0.9 Dead+1.6 Wind 240 deg - No Ice	11845.76	-10276.78	5933.30	306.46	530.80	-0.00
1.2 Dead+1.6 Wind 270 deg - No Ice	15794.35	-11866.61	0.00	0.00	614.70	0.00
0.9 Dead+1.6 Wind 270 deg - No Ice	11845.76	-11866.61	0.00	0.00	612.92	0.00
1.2 Dead+1.6 Wind 300 deg - No Ice	15794.35	-10276.78	-5933.30	-307.35	532.34	0.00
0.9 Dead+1.6 Wind 300 deg - No Ice	11845.76	-10276.78	-5933.30	-306.46	530.80	0.00
1.2 Dead+1.6 Wind 330 deg - No Ice	15794.35	-5933.30	-10276.78	-532.34	307.35	-0.00
0.9 Dead+1.6 Wind 330 deg - No Ice	11845.76	-5933.30	-10276.78	-530.80	306.46	-0.00
1.2 Dead+1.0 Ice+1.0 Temp	24676.07	0.00	0.00	0.00	0.00	0.00
1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp	24676.07	0.00	-2832.30	-141.05	0.00	0.00
1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp	24676.07	1416.15	-2452.84	-122.15	-70.53	0.00
1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp	24676.07	2452.84	-1416.15	-70.53	-122.15	0.00
1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp	24676.07	2832.30	0.00	0.00	-141.05	0.00
1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp	24676.07	2452.84	1416.15	70.53	-122.15	0.00
1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp	24676.07	1416.15	2452.84	122.15	-70.53	0.00
1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp	24676.07	0.00	2832.30	141.05	0.00	0.00
1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp	24676.07	-1416.15	2452.84	122.15	70.53	0.00
1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp	24676.07	-2452.84	1416.15	70.53	122.15	0.00
1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp	24676.07	-2832.30	0.00	0.00	141.05	0.00
1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp	24676.07	-2452.84	-1416.15	-70.53	122.15	0.00
1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp	24676.07	-1416.15	-2452.84	-122.15	70.53	0.00
Dead+Wind 0 deg - Service	13161.96	0.00	-2030.77	-106.99	0.00	0.00
Dead+Wind 30 deg - Service	13161.96	1015.39	-1758.70	-92.65	-53.49	0.00
Dead+Wind 60 deg - Service	13161.96	1758.70	-1015.39	-53.49	-92.65	0.00
Dead+Wind 90 deg - Service	13161.96	2030.77	0.00	0.00	-106.99	0.00
Dead+Wind 120 deg - Service	13161.96	1758.70	1015.39	53.49	-92.65	0.00
Dead+Wind 150 deg - Service	13161.96	1015.39	1758.70	92.65	-53.49	0.00
Dead+Wind 180 deg - Service	13161.96	0.00	2030.77	106.99	0.00	0.00
Dead+Wind 210 deg - Service	13161.96	-1015.39	1758.70	92.65	53.49	0.00
Dead+Wind 240 deg - Service	13161.96	-1758.70	1015.39	53.49	92.65	0.00
Dead+Wind 270 deg - Service	13161.96	-2030.77	0.00	0.00	106.99	0.00
Dead+Wind 300 deg - Service	13161.96	-1758.70	-1015.39	-53.49	92.65	0.00
Dead+Wind 330 deg - Service	13161.96	-1015.39	-1758.70	-92.65	53.49	0.00

Solution Summary

Load Comb.	Sum of Applied Forces PX lb	PY lb	PZ lb	Sum of Reactions PX lb	PY lb	PZ lb	% Error
1	0.00	-13161.96	0.00	0.00	13161.96	0.00	0.000%
2	0.00	-15794.35	-11866.61	0.00	15794.35	11866.61	0.000%
3	0.00	-11845.76	-11866.61	0.00	11845.76	11866.61	0.000%
4	5933.30	-15794.35	-10276.78	-5933.30	15794.35	10276.78	0.000%
5	5933.30	-11845.76	-10276.78	-5933.30	11845.76	10276.78	0.000%
6	10276.78	-15794.35	-5933.30	-10276.78	15794.35	5933.30	0.000%
7	10276.78	-11845.76	-5933.30	-10276.78	11845.76	5933.30	0.000%
8	11866.61	-15794.35	0.00	-11866.61	15794.35	0.00	0.000%
9	11866.61	-11845.76	0.00	-11866.61	11845.76	0.00	0.000%
10	10276.78	-15794.35	5933.30	-10276.78	15794.35	-5933.30	0.000%
11	10276.78	-11845.76	5933.30	-10276.78	11845.76	-5933.30	0.000%
12	5933.30	-15794.35	10276.78	-5933.30	15794.35	-10276.78	0.000%
13	5933.30	-11845.76	10276.78	-5933.30	11845.76	-10276.78	0.000%
14	0.00	-15794.35	11866.61	0.00	15794.35	-11866.61	0.000%
15	0.00	-11845.76	11866.61	0.00	11845.76	-11866.61	0.000%
16	-5933.30	-15794.35	10276.78	5933.30	15794.35	-10276.78	0.000%
17	-5933.30	-11845.76	10276.78	5933.30	11845.76	-10276.78	0.000%
18	-10276.78	-15794.35	5933.30	10276.78	15794.35	-5933.30	0.000%
19	-10276.78	-11845.76	5933.30	10276.78	11845.76	-5933.30	0.000%
20	-11866.61	-15794.35	0.00	11866.61	15794.35	0.00	0.000%
21	-11866.61	-11845.76	0.00	11866.61	11845.76	0.00	0.000%
22	-10276.78	-15794.35	-5933.30	10276.78	15794.35	5933.30	0.000%
23	-10276.78	-11845.76	-5933.30	10276.78	11845.76	5933.30	0.000%
24	-5933.30	-15794.35	-10276.78	5933.30	15794.35	10276.78	0.000%
25	-5933.30	-11845.76	-10276.78	5933.30	11845.76	10276.78	0.000%
26	0.00	-24676.07	0.00	0.00	24676.07	0.00	0.000%
27	0.00	-24676.07	-2832.30	0.00	24676.07	2832.30	0.000%
28	1416.15	-24676.07	-2452.84	-1416.15	24676.07	2452.84	0.000%
29	2452.84	-24676.07	-1416.15	-2452.84	24676.07	1416.15	0.000%
30	2832.30	-24676.07	0.00	-2832.30	24676.07	0.00	0.000%
31	2452.84	-24676.07	1416.15	-2452.84	24676.07	-1416.15	0.000%
32	1416.15	-24676.07	2452.84	-1416.15	24676.07	-2452.84	0.000%
33	0.00	-24676.07	2832.30	0.00	24676.07	-2832.30	0.000%
34	-1416.15	-24676.07	2452.84	1416.15	24676.07	-2452.84	0.000%
35	-2452.84	-24676.07	1416.15	2452.84	24676.07	-1416.15	0.000%
36	-2832.30	-24676.07	0.00	2832.30	24676.07	0.00	0.000%
37	-2452.84	-24676.07	-1416.15	2452.84	24676.07	1416.15	0.000%
38	-1416.15	-24676.07	-2452.84	1416.15	24676.07	2452.84	0.000%
39	0.00	-13161.96	-2030.77	0.00	13161.96	2030.77	0.000%
40	1015.39	-13161.96	-1758.70	-1015.39	13161.96	1758.70	0.000%
41	1758.70	-13161.96	-1015.39	-1758.70	13161.96	1015.39	0.000%
42	2030.77	-13161.96	0.00	-2030.77	13161.96	0.00	0.000%
43	1758.70	-13161.96	1015.39	-1758.70	13161.96	-1015.39	0.000%
44	1015.39	-13161.96	1758.70	-1015.39	13161.96	-1758.70	0.000%
45	0.00	-13161.96	2030.77	0.00	13161.96	-2030.77	0.000%
46	-1015.39	-13161.96	1758.70	1015.39	13161.96	-1758.70	0.000%
47	-1758.70	-13161.96	1015.39	1758.70	13161.96	-1015.39	0.000%
48	-2030.77	-13161.96	0.00	2030.77	13161.96	0.00	0.000%
49	-1758.70	-13161.96	-1015.39	1758.70	13161.96	1015.39	0.000%
50	-1015.39	-13161.96	-1758.70	1015.39	13161.96	1758.70	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	0.00001980
3	Yes	4	0.00000001	0.00000001
4	Yes	4	0.00000001	0.00039836
5	Yes	4	0.00000001	0.00025640
6	Yes	4	0.00000001	0.00039836
7	Yes	4	0.00000001	0.00025640
8	Yes	4	0.00000001	0.00001980
9	Yes	4	0.00000001	0.00000001
10	Yes	4	0.00000001	0.00039836
11	Yes	4	0.00000001	0.00025640
12	Yes	4	0.00000001	0.00039836
13	Yes	4	0.00000001	0.00025640
14	Yes	4	0.00000001	0.00001980
15	Yes	4	0.00000001	0.00000001
16	Yes	4	0.00000001	0.00039836
17	Yes	4	0.00000001	0.00025640
18	Yes	4	0.00000001	0.00039836
19	Yes	4	0.00000001	0.00025640
20	Yes	4	0.00000001	0.00001980
21	Yes	4	0.00000001	0.00000001
22	Yes	4	0.00000001	0.00039836
23	Yes	4	0.00000001	0.00025640
24	Yes	4	0.00000001	0.00039836
25	Yes	4	0.00000001	0.00025640
26	Yes	4	0.00000001	0.00000001
27	Yes	4	0.00000001	0.00065930
28	Yes	4	0.00000001	0.00066620
29	Yes	4	0.00000001	0.00066620
30	Yes	4	0.00000001	0.00065930
31	Yes	4	0.00000001	0.00066620
32	Yes	4	0.00000001	0.00066620
33	Yes	4	0.00000001	0.00065930
34	Yes	4	0.00000001	0.00066620
35	Yes	4	0.00000001	0.00066620
36	Yes	4	0.00000001	0.00065930
37	Yes	4	0.00000001	0.00066620
38	Yes	4	0.00000001	0.00066620
39	Yes	4	0.00000001	0.00000001
40	Yes	4	0.00000001	0.00000001
41	Yes	4	0.00000001	0.00000001
42	Yes	4	0.00000001	0.00000001
43	Yes	4	0.00000001	0.00000001
44	Yes	4	0.00000001	0.00000001
45	Yes	4	0.00000001	0.00000001
46	Yes	4	0.00000001	0.00000001
47	Yes	4	0.00000001	0.00000001
48	Yes	4	0.00000001	0.00000001
49	Yes	4	0.00000001	0.00000001
50	Yes	4	0.00000001	0.00000001

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	98 - 78.5	3.42	42	0.50	0.00

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L2	78.5 - 78	1.63	42	0.25	0.00
L3	78 - 68.5	1.60	42	0.25	0.00
L4	68.5 - 68	1.20	42	0.14	0.00
L5	68 - 38.25	1.19	42	0.14	0.00
L6	43.753 - 1	0.55	42	0.11	0.00

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
98.00	36" X 10' AMS	42	3.42	0.50	0.00	7997
93.00	36" X 10' AMS	42	2.87	0.42	0.00	7997
88.00	36" X 10' AMS	42	2.36	0.35	0.00	3998
83.00	36" X 10' AMS	42	1.92	0.29	0.00	2670
78.00	36" X 10' AMS	42	1.60	0.25	0.00	3493
73.00	36" X 10' AMS	42	1.36	0.18	0.00	4998
68.00	36" X 10' AMS	42	1.19	0.14	0.00	8732

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	98 - 78.5	19.10	2	2.76	0.00
L2	78.5 - 78	9.23	2	1.41	0.00
L3	78 - 68.5	9.08	2	1.39	0.00
L4	68.5 - 68	6.84	2	0.78	0.00
L5	68 - 38.25	6.76	2	0.78	0.00
L6	43.753 - 1	3.16	2	0.61	0.00

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
98.00	36" X 10' AMS	2	19.10	2.76	0.00	1474
93.00	36" X 10' AMS	2	16.09	2.34	0.00	1474
88.00	36" X 10' AMS	2	13.28	1.96	0.00	737
83.00	36" X 10' AMS	2	10.87	1.63	0.00	491
78.00	36" X 10' AMS	2	9.08	1.39	0.00	643
73.00	36" X 10' AMS	2	7.76	1.02	0.00	916
68.00	36" X 10' AMS	2	6.76	0.78	0.00	1600

Compression Checks

Pole Design Data

Section No.	Elevation	Size	L	L_u	Kl/r	A	P_u	ϕP_n	Ratio $\frac{P_u}{\phi P_n}$
	ft		ft	ft		in^2	lb	lb	
L1	98 - 78.5 (1)	TP6.625x6.625x0.402	19.50	0.00	0.0	7.8591	-3003.63	297076.00	0.010
L2	78.5 - 78 (2)	TP10.75x6.625x0.465	0.50	0.00	0.0	8.9988	-3053.66	340154.00	0.009
L3	78 - 68.5 (3)	TP10.75x10.75x0.465	9.50	0.00	0.0	15.024 7	-4974.90	567935.00	0.009
L4	68.5 - 68 (4)	TP35.5x10.75x0.465	0.50	0.00	0.0	15.024 7	-5046.36	567935.00	0.009
L5	68 - 38.25 (5)	TP40.02x35.5x0.25	29.75	0.00	0.0	30.894 1	-8481.10	1974840.00	0.004
L6	38.25 - 1 (6)	TP45x38.6839x0.25	42.75	0.00	0.0	35.509 1	-15790.40	2115940.00	0.007

Pole Bending Design Data

Section No.	Elevation	Size	M_{ux}	ϕM_{nx}	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M_{uy}	ϕM_{ny}	Ratio $\frac{M_{uy}}{\phi M_{ny}}$
	ft		kip-ft	kip-ft		kip-ft	kip-ft	
L1	98 - 78.5 (1)	TP6.625x6.625x0.402	27.59	49.11	0.562	0.00	49.11	0.000
L2	78.5 - 78 (2)	TP10.75x6.625x0.465	27.59	55.69	0.495	0.00	55.69	0.000
L3	78 - 68.5 (3)	TP10.75x10.75x0.465	62.63	155.05	0.404	0.00	155.05	0.000
L4	68.5 - 68 (4)	TP35.5x10.75x0.465	62.63	155.05	0.404	0.00	155.05	0.000
L5	68 - 38.25 (5)	TP40.02x35.5x0.25	203.77	1583.33	0.129	0.00	1583.33	0.000
L6	38.25 - 1 (6)	TP45x38.6839x0.25	614.70	1951.51	0.315	0.00	1951.51	0.000

Pole Shear Design Data

Section No.	Elevation	Size	Actual V_u	ϕV_n	Ratio $\frac{V_u}{\phi V_n}$	Actual T_u	ϕT_n	Ratio $\frac{T_u}{\phi T_n}$
	ft		lb	lb		kip-ft	kip-ft	
L1	98 - 78.5 (1)	TP6.625x6.625x0.402	2779.10	148538.00	0.019	0.00	72.66	0.000
L2	78.5 - 78 (2)	TP10.75x6.625x0.465	2846.85	283968.00	0.010	0.00	81.64	0.000
L3	78 - 68.5 (3)	TP10.75x10.75x0.465	4227.10	283968.00	0.015	0.00	233.33	0.000
L4	68.5 - 68 (4)	TP35.5x10.75x0.465	4316.25	967312.00	0.004	0.00	233.33	0.000
L5	68 - 38.25 (5)	TP40.02x35.5x0.25	7192.06	987419.00	0.007	0.00	3170.54	0.000
L6	38.25 - 1 (6)	TP45x38.6839x0.25	11871.90	1057970.00	0.011	0.00	3907.78	0.000

Pole Interaction Design Data

Section No.	Elevation	Ratio $\frac{P_u}{\phi P_n}$	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	Ratio $\frac{M_{uy}}{\phi M_{ny}}$	Ratio $\frac{V_u}{\phi V_n}$	Ratio $\frac{T_u}{\phi T_n}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
	ft								
L1	98 - 78.5 (1)	0.010	0.562	0.000	0.019	0.000	0.572	1.000	4.8.2 ✔

Section No.	Elevation ft	Ratio $\frac{P_u}{\phi P_n}$	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	Ratio $\frac{M_{uy}}{\phi M_{ny}}$	Ratio $\frac{V_u}{\phi V_n}$	Ratio $\frac{T_u}{\phi T_n}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L2	78.5 - 78 (2)	0.009	0.495	0.000	0.010	0.000	0.504 ✔	1.000	4.8.2 ✔
L3	78 - 68.5 (3)	0.009	0.404	0.000	0.015	0.000	0.413 ✔	1.000	4.8.2 ✔
L4	68.5 - 68 (4)	0.009	0.404	0.000	0.004	0.000	0.413 ✔	1.000	4.8.2 ✔
L5	68 - 38.25 (5)	0.004	0.129	0.000	0.007	0.000	0.133 ✔	1.000	4.8.2 ✔
L6	38.25 - 1 (6)	0.007	0.315	0.000	0.011	0.000	0.323 ✔	1.000	4.8.2 ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
L1	98 - 78.5	Pole	TP6.625x6.625x0.402	1	-3003.63	297076.00	57.2	Pass
L2	78.5 - 78	Pole	TP10.75x6.625x0.465	2	-3053.66	340154.00	50.4	Pass
L3	78 - 68.5	Pole	TP10.75x10.75x0.465	3	-4974.90	567935.00	41.3	Pass
L4	68.5 - 68	Pole	TP35.5x10.75x0.465	4	-5046.36	567935.00	41.3	Pass
L5	68 - 38.25	Pole	TP40.02x35.5x0.25	5	-8481.10	1974840.00	13.3	Pass
L6	38.25 - 1	Pole	TP45x38.6839x0.25	6	-15790.40	2115940.00	32.3	Pass
							Summary	
						Pole (L1)	57.2	Pass
						RATING =	**57.2**	**Pass**

Anchor Rod and Base Plate Design

Designed per:TIA-222-G

EEI Job #:	18280-D01. R2
Site Name:	Bridgeport NE
Structure:	100-ft Flag Monopole

Client:	Verizon Wireless
Site #:	
Location:	Bridgeport, CT

Base Reactions	
Moment, M_u =	615 ft-kip
Shear, V_u =	11.9 kip
Vertical, P_u =	15.8 kip

Base Plate Properties	
Base Plate Material =	A572GR50
Outside Diameter =	56.25 in
Inside Diameter =	35 in
Weight =	777 lbf

Pole Properties at Base	
Pole Diameter =	45 in
Pole Thickness =	0.25 in
Yield Strength =	65 ksi
Monopole Shape =	18-Sided

Effective Base Plate Bend Line	
Desantis' Bend Line =	33.75 in
% Reduction =	60 %
Reduced Bend Line =	20.25 in
Brinker's Bend Line =	21.49 in
Effective Bend Line =	20.25 in

Anchor Rod Properties & Bolt Circle Diam	
Anchor Material =	A615GR75
Anchor Diameter =	1.75 in
Minimum Bolt Circle Ø =	51.19 in
Actual Bolt Circle Ø =	51.25 in
Spacing =	20.13 in
Anchor Length =	6 ft
No. of Anchors =	8
Weight =	432 lbs

Base Plate Thickness	
Section Modulus:	Plastic
Φ_b =	0.9
Minimum Thickness =	1.01 in
Actual Thickness =	1.75 in
M_{ub} =	231 in-k
ΦM_n =	698 in-kip
Usage ratio, % =	33.1%

Anchor Rod Inter. Eq. 1 (4.9.9)	
P_{ub} =	74 kip
V_{ub} =	1.49 kip
η =	0.5
Φ_t =	0.80
$\Phi_t R_{nt}$ =	152 kip
Inter. Eq. 1 =	0.51

Setting Template Properties	
Outside Diameter =	55.25 in
Inside Diameter =	47.25 in
Thickness =	0.375 in
Template Hole Ø =	1.875 in
Template Weight =	66.1 lbs
Bottom Template Must Be Bolted	

Anchor Rod Inter. Eq. 2 (4.9.9)	
L_{ar} =	2.25 in
V_{ub} =	1.49 kip
P_{ub} =	74 kip
M_{ub} =	2.18 kip-in
$\Phi_v R_{nv}$ =	81 kip
$\Phi_t R_{nt}$ =	152 kip
$\Phi_f R_{nm}$ =	42 kip-in
Inter. Eq. 2 =	0.51

Summary Table	
Anchor Material =	A615GR75
Anchor Diameter =	1.75 in
No. of Anchors =	8
Actual Bolt Circle Ø =	51.25 in
Anchor Length =	6 ft
Base Plate Material =	A572GR50
Actual Thickness =	1.75 in
Outside Diameter =	56.25 in
Inside Diameter =	35 in

10975 Kinsman Road
Newbury, OH 44065

Telephone: (440) 564-5484
Email: sales@engend.com

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

Site Data

BU#: *18280-D01*
Site Name: *Bridgeport NE*
App #:

Manufacturer:	Other

Reactions		
Moment:	62.6	ft-kips
Axial:	5.1	kips
Shear:	4.3	kips
Exterior Flange Run, T+q:	20	kips

Bolt Threads:
X-Excluded
φVn=φ(0.55*Ab*Fu)
φ=0.75, φ*Vn (kips):
38.88

Elevation: 68 feet

Bolt Data			
Qty:	12		
Diam:	1	Bolt Fu:	120
Bolt Material:	A325	Bolt Fy:	92
N/A:	100	<-- Disregard	
N/A:	75	<-- Disregard	
Circle:	32	in	

Interior Flange Bolt Results

Maximum Bolt Tension, Tu:	20.0 Kips, Ext. Flange Tu+q
Adjusted φ*Tn (due to Vu=Vu/Qty), I	54.5 Kips
Bolt Stress Ratio:	36.7% **Pass**

Plate Data		
Plate Outer Diam:	35	in
Plate Inner Diam:	12	in (Hole @ Ctr)
Thick:	1.25	in
Grade:	50	ksi
Effective Width:	7.00	in

Interior Flange Plate Results Flexural Check

Controlling Bolt Axial Force:	20.0 Kips, Ext. Flange Tu+q
Plate Stress:	11.0 ksi
Allowable Plate Stress, φ*Fy:	45.0 ksi
Plate Stress Ratio:	24.4% **Pass**

Stiffener Data (Welding at Both Sides)		
Config:	0	*
Weld Type:	Fillet	
Groove Depth:	0.375	<-- Disregard
Groove Angle:	45	<-- Disregard
Fillet H. Weld:	0.3125	in
Fillet V. Weld:	0.3125	in
Width:	3	in
Height:	18	in
Thick:	0.75	in
Notch:	0.5	in
Grade:	36	ksi
Weld str.:	70	ksi

n/a

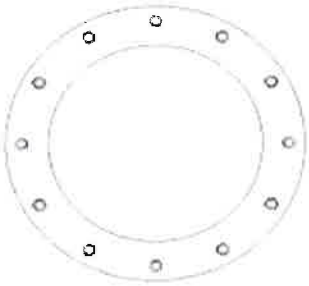
Stiffener Results

Horizontal Weld :	n/a
Vertical Weld:	n/a
Plate Flex+Shear, fb/Fb+(fv/Fv)^2:	n/a
Plate Tension+Shear, ft/Ft+(fv/Fv)^2:	n/a
Plate Comp. (AISC Bracket):	n/a

Pole Results

Pole Punching Shear Check: n/a

Pole Data		
Pole OuterDiam:	35.5	in
Thick:	0.25	in
Pole Inner Diam:	35	in
Grade:	65	ksi
# of Sides:	0	"0" IF Round
Fu	80	ksi



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

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

Stiffened or Unstiffened, Exterior Flange Plate - Any Bolt Material TIA Rev G

Site Data

BU#: *18260-D02*
Site Name: *Bridgeport NE*
App #:

Reactions		
Mu	62.6	ft-kips
Axial, Pu:	5.1	kips
Shear, Vu:	4.3	kips
Elevation:	68	feet

Bolt Threads:
X-Excluded
φVn=φ(0.55*Ab*Fu)
φ=0.75, φ*Vn (kips):
38.88

Pole Manufacturer:	Other

If No stiffeners, Criteria:	TIA G	<-Only Applcable to Unstiffened Cases

Bolt Data			
Qty:	12		
Diameter (in.):	1	Bolt Fu:	120
Bolt Material:	A325	Bolt Fy:	92
N/A:	75	<-- Disregard	
N/A:	55	<-- Disregard	
Circle (in.):	32		

Plate Data		
Diam:	35.5	in
Thick, t:	1.25	in
Grade (Fy):	50	ksi
Strength, Fu:	65	ksi
Single-Rod B-eff:	2.81	in

Stiffener Data (Welding at Both Sides)		
Config:	0	*
Weld Type:	Fillet	
Groove Depth:	0.25	<-- Disregard
Groove Angle:	45	<-- Disregard
Fillet H. Weld:	0.3125	in
Fillet V. Weld:	0.3125	in
Width:	3	in
Height:	18	in
Thick:	0.75	in
Notch:	0.5	in
Grade:	36	ksi
Weld str.:	70	ksi

Pole Data		
Diam:	10.75	in
Thick:	0.5	in
Grade:	42	ksi
# of Sides:	0	"0" IF Round
Fu	60	ksi
Reinf. Fillet Weld	0	"0" if None

Flange Bolt Results

			Non-Rigid
Bolt Tension Capacity, φ*Tn,**B1**:	54.54	kips	φ*Tn
Adjusted φ*Tn (due to Vu=Vu/Qty), **B**:	54.54	kips	φTn[(1-(Vu/φVn)^2]^0.5
Max Bolt directly applied Tu:	7.40	Kips	
Min. PL "tc" for **B** cap. **w/o** Pry:	3.661	in	
Min PL "treq" for actual **T w/ Pry**:	1.059	in	
Min PL "t1" for actual **T w/o Pry**:	1.349	in	
T allowable with Prying:	10.32	kips	α'>1 case
Prying Force, q:	4.69	kips	
Total Bolt Tension=Tu+q:	12.09	kips	
Prying Bolt Stress Ratio=(Tu+q)/(B):	22.2%	**Pass**	

Exterior Flange Plate Results Flexural Check

			Non-Rigid
Compression Side Plate Stress:	19.8	ksi	TIA G
Allowable Plate Stress:	45.0	ksi	φ*Fy
Compression Plate Stress Ratio:	43.9%	**Pass**	Comp. Y.L. Length:
Prying Occurs, PL Check:			30.14
Tension Side Stress Ratio, (treq/t)^2:	71.7%	**Pass**	

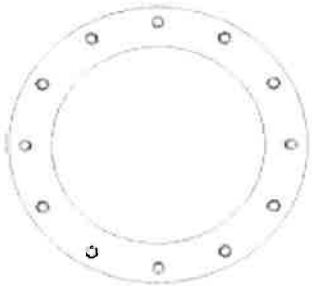
n/a

Stiffener Results

Horizontal Weld :	n/a
Vertical Weld:	n/a
Plate Flex+Shear, fb/Fb+(fv/Fv)^2:	n/a
Plate Tension+Shear, ft/Ft+(fv/Fv)^2:	n/a
Plate Comp. (AISC Bracket):	n/a

Pole Results

Pole Punching Shear Check: n/a



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

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

ENGINEERED
ENDEAVORS
INCORPORATED
The Experienced Point of View

DESIGN CALCULATIONS
FOR A
DRILLED PIER FOUNDATION

Verizon Wireless

100' Monopole

Bridgeport NE

Bridgeport, CT

EEI Project Number 18280-D01, Rev.2

April 18, 2018

15175 Kinsman Road * Burton, OH 44062
Phone: (440) 970-5004
www.engend.com

FOUNDATION DESIGN CALCULATIONS FOR A DRILLED PIER FOUNDATION

CUSTOMER: Verizon Wireless
DATE: 04/18/18
LOCATION: Bridgeport, CT
STRUCTURE: 100' Monopole
SITE NAME: Bridgeport NE
JOB NUMBER: 18280-D01
SITE NUMBER:
STATUS: Rev.2

FOUNDATION DESIGN LOADS

	MOMENT	SHEAR	AXIAL LOAD
UNITS	*ft-kips* *in-lbs*	*kips* *lbs*	*kips* *lbs*
DESIGN LOADING	615.0 7380000.0	11.9 11900.0	15.8 15800.0

PIER PROPERTIES

ANCHOR BOLT CIRCLE 51.3 in
ANCHOR BOLT DESCRIPTION: (8) 1 3/4" BOLTS AT6 ft 0 in
MINIMUM DIAMETER 71.3 in
ACTUAL DIAMETER 72.0 in
PIER AREA 4071.5 in^2
MOMENT OF INERTIA 1319167.3 in^4

SOIL INFORMATION

SOIL DESCRIPTION	DEPTH *ft*	DEPTH *in*	K_H VALUE *pci*	ϕ *degrees*	γ *pcf/pci*	COHESION *psf/psi*	E_{50} *in/in*
SAND/BOULDERS	1.0 17.5	12 210		32	125 0.072		
BEDROCK	17.5 20.0	210 240		40	140 0.081		

GROUNDWATER NOT ENCOUNTERED
DISREGARD UPPER 36in OF SOIL

ACTUAL EMBEDMENT La = 18.0 ft
TOTAL LENGTH L = 18.8 ft

CONCRETE VOLUME **V = 19.6 yds^3**

CONCRETE REINFORCEMENT

	BAR SIZE	BAR WEIGHT	QUANTITY	LENGTH	WEIGHT
VERTICAL BARS	# 8	2.670 lbs/ft	26	18.5 ft	1284.3 lbs
HORIZONTAL TIES	# 5	1.043 lbs/ft	29	18.50 ft	554.7 lbs
TOTAL					**1839.0 lbs**

PIER STRUCTURAL DESIGN

MAXIMUM BENDING MOMENT **798.0 ft-kips**

PIER DIAMETER			72 in
CONCRETE			3 ksi
REINFORCEMENT			60 ksi
REBAR	# 8	QUANTITY	26
DESIGN REBAR		QUANTITY	12
MINIMUM REINFORCEMENT RATIO:			0.0050
ACTUAL REINFORCEMENT RATIO:			0.0050
CONCRETE COVER			4 in
REBAR LAYOUT RADIUS			30.6875 in

BAR AREA	0.79 in^2
BAR AREA	1.71 in^2
REBAR SPACING	7.42 in
HORIZONTAL TIES	19.75

NUMBER	ANGLE	COORDINATE	EDGE DISTANCE
	degrees	*in*	*in*
1		30.69	5.31
2	30	26.58	9.42
3	60	15.34	20.66
4	90		36.00
5	120	-15.34	51.34
6	150	-26.58	62.58
7	180	-30.69	66.69
8	210	-26.58	62.58
9	240	-15.34	51.34
10	270		36.00
11	300	15.34	20.66
12	330	26.58	9.42

LOCATION OF NEUTRAL AXIS **c = 11.200 in**
COMPRESSION ZONE **a = 9.520 in**

COMPRESSION ZONE

REBAR	e	FORCE
		kips
1	0.0016	73.92
2	0.0005	19.25
12	0.0005	19.25
CONCRETE		812.97
COMPRESSION		**925.39 kips**

TENSION ZONE

REBAR	e	FORCE
		kips
3	0.0025	102.70
4	0.0066	102.70
5	0.0108	102.70
6	0.0138	102.70
7	0.0149	102.70
8	0.0138	102.70
9	0.0108	102.70
10	0.0066	102.70
11	0.0025	102.70
TENSION		**924.30 kips**

MAXIMUM MOMENT CAPACITY

MOMENT DUE TO COMPRESSION

REBAR	FORCE	ARM	MOMENT
	kips	*in*	*ft-kips*
1	73.92	30.69	189.02
2	19.25	26.58	42.63
12	19.25	26.58	42.63
CONCRETE	812.97	29.65	2008.94
			2283.24

MOMENT DUE TO TENSION

REBAR	FORCE	ARM	MOMENT
	kips	*in*	*ft-kips*
3	102.70	15.34	-131.32
4	102.70		
5	102.70	-15.34	131.32
6	102.70	-26.58	227.45
7	102.70	-30.69	262.63
8	102.70	-26.58	227.45
9	102.70	-15.34	131.32
10	102.70		
11	102.70	15.34	-131.32
			717.53

DESIGN MOMENT **2700.69 ft-kips**

EEI Project No. 18280. R2

Date 04.18.2017

Base Moment, kip-ft	615.0	Pier Diameter, ft	6.0
Shear Force, kips	11.9	Groundwater, ft	N/A
Vertical Force, kips	15.8	Pier Embedment. ft	18.0
		Disregard, ft	3.0

Soil Properties Information

Soil Layer	Depth, ft	γ	ϕ	C, psf	Kp
SAND	17.5	125.0	32.0		3.25
BEDROCK	20.0	140.0	40.0		4.60

Zero Line, ft	13.3	Force Imbalance	2.226%
Resisting Moment, k-ft	2,632.22	Overturning Moment, k-ft	785.17

Safety Factor 3.35

⚠ This is a beta release of the new ATC Hazards by Location website. Please contact us with feedback.

ATC Hazards by Location

Search Information

Address: Bridgeport, CT, USA

Coordinates: 41.17922579999999, -73.18943839999997

Timestamp: 2018-04-18T14:45:41.183Z

Hazard Type: Wind

Map Results

Text Results

ASCE 7-16

MRI 10-Year	75 mph
MRI 25-Year	84 mph
MRI 50-Year	91 mph
MRI 100-Year	98 mph
Risk Category I	109 mph
Risk Category II	120 mph
Risk Category III	129 mph
Risk Category IV	⚠ 133 mph

You are in a wind-borne debris region if you are also within 1 mile of the coastal mean high water line.

ASCE 7-10

MRI 10-Year	77 mph
MRI 25-Year	87 mph
MRI 50-Year	94 mph
MRI 100-Year	101 mph
Risk Category I	113 mph
Risk Category II	124 mph
Risk Category III-IV	⚠ 133 mph

If the structure under consideration is a healthcare facility, you are in a wind-borne debris region. If other occupancy, use the Risk Category II basic wind speed contours to determine if you are in a wind-borne debris region.

ASCE 7-05

ASCE 7-05 Wind Speed	⚠ 112 mph