STATE OF CONNECTICUT

CONNECTICUT SITING COUNCIL

Ten Franklin Square, New Britain, CT 06051
Phone: (860) 827-2935 Fax: (860) 827-2950
E-Mail: siting.council@po.state.ct.us
Web Site: www.state.ct.us/csc/index.htm

March 20, 2001

Sandy M. Carter
Verizon Wireless
20 Alexander Drive
P.O. Box 5029
Wallingford, CT 06492

RE: **TS-VER-023-010216-1** - Cellco Partnership d/b/a Verizon Wireless request for an order to approve tower sharing at an existing telecommunications facility located at 540 Cherrybrook Road, Canton, Connecticut.

Dear Ms. Carter:

At a public meeting held March 15, 2001, the Connecticut Siting Council (Council) ruled that the shared use of this existing tower site is technically, legally, environmentally, and economically feasible and meets public safety concerns, and therefore, in compliance with General Statutes § 16-50aa, the Council has ordered the shared use of this facility to avoid the unnecessary proliferation of tower structures. This facility has also been carefully modeled to ensure that radio frequency emissions are conservatively below State and federal standards applicable to the frequencies now used on this tower.

This decision is under the exclusive jurisdiction of the Council. Any additional change to this facility may require an explicit request to this agency pursuant to General Statutes § 16-50aa or notice pursuant to Regulations of Connecticut State Agencies Section 16-50j-73, as applicable. Such request or notice shall include all relevant information regarding the proposed change with cumulative worst-case modeling of radio frequency exposure at the closest point uncontrolled access to the tower base, consistent with Federal Communications Commission, Office of Engineering and Technology, Bulletin 65. Any deviation from this format may result in the Council implementing enforcement proceedings pursuant to General Statutes § 16-50u including, without limitation, imposition of expenses resulting from such failure and of civil penalties in an amount not less than one thousand dollars per day for each day of construction or operation in material violation.

This decision applies only to this request for tower sharing and is not applicable to any other request or construction.

The proposed shared use is to be implemented as specified in your letter dated February 16, 2001.

Thank you for your attention and cooperation.

Very truly yours,

Mortimer A. Gelston
Chairman

MAG/RKE/laf

c: Honorable Kathleen C. Corkum, First Selectman, Town of Canton
Eric Barz, Town Planner, Town of Canton
Frederick E. Turkington, Jr., Chief Administrative Officer, Town of Canton
Esther McNany, SBA, Inc.

I:\siting\em\bam-ver\canton\dc031501.doc

STATE OF CONNECTICUT

CONNECTICUT SITING COUNCIL

Ten Franklin Square
New Britain, Connecticut 06051
Phone: (860) 827-2935
Fax: (860) 827-2950

February 26, 2001

Honorable Kathleen C. Corkum
First Selectman
Town of Canton
4 Market Street
P. O. Box 168
Collinsville, CT 06022-0168

RE: **TS-VER-023-010216-1** - Cellco Partnership d/b/a Verizon Wireless request for an order to approve tower sharing at an existing telecommunications facility located at 540 Cherrybrook Road, Canton, Connecticut.

Dear Ms. Corkum:

The Connecticut Siting Council (Council) received this request for tower sharing, pursuant to Connecticut General Statutes § 16-50aa.

The Council will consider this item at the next meeting scheduled for March 15, 2001, at 1:30 p.m. in Hearing Room Two, Ten Franklin Square, New Britain, Connecticut.

Please call me or inform the Council if you have any questions or comments regarding this proposal.

Thank you for your cooperation and consideration.

Very truly yours,

Joel M. Rinebold
Executive Director

JMR/RKE/laf

Enclosure: Notice of Tower Sharing

c: Mr. Eric Barz, Town Planner, Town of Canton
Mr. Frederick E. Turkington, Jr., Chief Administrative Officer, Town of Canton

Network Dept.

verizon wireless

Verizon Wireless
20 Alexander Drive
Wallingford, Connecticut 06492

February 16, 2001

HAND DELIVERED

Mr. Mortimer A. Gelston, Chairman
Connecticut Siting Council
10 Franklin Square
New Britain, Connecticut 06051

Re: Request by Cellco Partnership d/b/a Verizon Wireless for an Order to Approve the Shared Use of a Tower Facility located at 540 Cherrybrook Road, Canton, Connecticut.

Dear Chairman Gelston:

Pursuant to Connecticut General Statutes (C.G.S.) Sec. 16-50aa, Cellco Partnership d/b/a Verizon Wireless hereby requests an order from the Connecticut Siting Council ("Council") to approve the proposed shared use by Verizon Wireless of an existing tower located at the North Canton Fire Station at 540 Cherrybrook Road, Canton, Connecticut. The North Canton Volunteer Fire Association owns the property which is leased to SBA Towers, Inc. and SBA Towers, Inc. owns the tower. As shown on the attached drawing and as further described below, Verizon Wireless proposes to install antennas on the existing tower and to locate its equipment building at the base of the tower. Verizon Wireless requests that the Council finds that the proposed shared use of the tower facility satisfy the criteria stated in C.G.S. Sec. 16-50aa, and to issue an order approving the proposed shared use.

Background

Verizon Wireless is licensed by the Federal Communications Commission to provide cellular telephone service in the Hartford County New England County Metropolitan Area (NECMA), which includes the area to be served by the proposed Canton installation.

The facility at 540 Cherrybrook Road, Canton, consists of a 150-foot AGL monopole tower. Verizon Wireless and SBA Towers, Inc. have agreed to the proposed-shared use of this tower pursuant to mutually acceptable terms and conditions. SBA Towers, Inc. has authorized Verizon Wireless to apply for all necessary permits, approvals and authorizations which may be required for the proposed shared use of this facility.

Verizon Wireless proposes to install twelve (12) Swedcom Model ALP9011 antennas, approximately 43 inches in height on a platform with their center of radiation at approximately 140 feet above ground level ("AGL"). Verizon Wireless will also install one (1) GPS antenna on the tower. Equipment associated with these antennas will be located in a new approximately 12-foot x 30-foot equipment building located at the base of the tower. Verizon Wireless will install a diesel generator for emergency use. The generator will be installed following receipt of the required DEP permit

C.G.S. Sec. 16-50aa provides that, upon written request for approval of a proposed shared use, "if the Council finds that the proposed shared use of the facility is technically, legally, environmentally and economically feasible and meets public safety concerns, the Council shall issue an order approving such shared use" (C.G.S. Sec. 16-50aa(c)(1).)

Discussion

A. Technical Feasibility. The existing tower is structurally sound and capable of supporting the proposed Verizon antennas. Enclosed is the structural design and analysis of the tower. Verizon engineers have determined that the proposed antenna installations present minimal potential for interference to or from existing radio transmissions from this location. In addition, the applicant is unaware of any occasion where its operations have caused interference with AM, FM, or television reception. The proposed shared use of this tower therefore is technically feasible.

B Legal Feasibility. Under C.G.S. Sec. 16-50aa, the Council has been authorized to issue an order approving the proposed-shared use of an existing communications tower facility such as the facility at 540 Cherrybrook Road in Canton. (C.G.S. Sec. 16-50aa(c)(1).) This authority complements the Council's prior-existing authority under C.G.S. Sec. 16-50p to issue orders approving the construction of new towers that are subject to the Council's jurisdiction. C.G.S. Section 16-50x(a) directs the Council to "give consideration to other state laws and municipal regulations as it shall deem appropriate" in ruling on requests for the shared use of existing tower facilities. Under the authority vested in the Council by C.G.S. Sec. 16-50aa, an order by the Council approving the shared use would permit the applicant to obtain a building permit for the proposed installations.

C. Environmental Feasibility. The proposed shared use would have a minimal environmental effect, for the following reasons:

1. The proposed installations would have an insignificant incremental visual impact, and would not cause any significant change or alteration in the physical or environmental characteristics of the existing site. The addition of the proposed antennas would not increase the height of the tower, and would not extend the boundaries of the tower site, including the placement of the equipment building near the base of the existing tower.

2. The proposed installation would not increase the noise levels at the existing facility by six decibels or more. The only additional noise will occur during emergency use or periodic exercising of the generator.

3. Operation of the additional antennas will not increase the total radio frequency electromagnetic radiation power density, measured at the tower base to a level at or above the applicable standard. "Worst-case" exposure calculations for a point at the base of the tower in relation to operation of each of Verizon's antenna arrays are as follows:

	Applicable ANSI Stnd.	Calculated "Worst-Case"	Percentage of Stnd.
Verizon	0.583 mW/cm2	0.0348 mW/cm2	5.98%
		Total	5.98%

The collective "worst-case" exposure would be only 5.98% of the ANSI standard, as calculated for mixed frequency sites. Power density levels from shared use of the tower facility would thus be well below applicable ANSI standards.

4. The proposed installations would not require any water or sanitary facilities, or generate discharges to water bodies. Operation of the emergency back-up generator will result in limited air emission; pursuant to R.C.S.A. Section 22a-174-3, the generator will require the issuance of a permit from the Department of Environmental Protection Bureau of Air Management. After construction is complete, the proposed installation would not generate any traffic other than periodic maintenance visits. The proposed use of this facility would therefore have a minimal environmental effect, and is environmentally feasible.

D. Economic Feasibility. As previously mentioned, the tower owner and the applicant has entered into a mutual agreement to share use of the existing tower on terms agreeable to the parties, and the proposed tower sharing is thus economically feasible.

E. Public Safety Concerns. As stated above, the existing tower is structurally capable of supporting the proposed Verizon antennas. The Applicant is not aware of any other public safety concerns relative to the proposed tower sharing of the existing tower. In fact, the provision of new or improved cellular phone service in the Town of Canton, especially along Route 179 between Route 44 and North Canton and surrounding area, through shared use of the tower is expected to enhance the safety and welfare of area residents and travelers. The public safety benefits of wireless service are further illustrated by the decision of local authorities elsewhere in Connecticut to provide cellular phones to the residents to improve local public safety and emergency communications. The proposed-shared use of this facility would likewise improve public safety in the Canton area.

Conclusion

For the reasons discussed above, the proposed shared use of the existing telecommunications tower facility at located at 540 Cherrybrook Road in Canton satisfies the criteria stated in C.G.S. Sec. 16-50aa, and advances the General Assembly's and the Council's goal of preventing the proliferation of towers in Connecticut. The Applicant therefore requests that the Council issue an order approving the proposed shared use.

Thank you for your consideration of this matter.

Pursuant to Connecticut General Statutes, Section 16-50v and Section 16-50v-1(a) of the Regulations of Connecticut State Agencies, Verizon Wireless is submitting a check in the amount of $500.00 for the required filing fee.

Respectfully yours,

Sandy M. Carter

Sandy M. Carter
Manager – Regulatory
Verizon Wireless

Attachment
cc: Ms. Kathleen C. Corkum, First Selectman

NATCOMM, LLC

Consulting Engineers

February 8, 2001

Mr. Mark Gauger
Verizon Wireless
20 Alexander Drive
Wallingford, CT 06492

Re.: Verizon ~ SBA North Canton Site
540 Cherrybrook Road, North Canton, Connecticut
Natcomm, LLC Project No. 315C

Dear Mr. Gauger:

We have completed a review of the structural assessment and loading conditions for the existing SBA, Inc. tower at the above referenced site. The review was performed to determine the adequacy of the 150 ft. self supported monopole tower for carrying additional loads from the proposed Verizon Wireless antennas and cables. The analysis is in compliance with local codes and regulations.

The calculations are based on the proposed equipment being installed at 140 ft. above the tower base plate elevation. The dead loads of the proposed equipment, as well as live loads from wind forces and ice build-up on the tower and equipment were considered. Existing and future equipment were considered in the analysis, however, there are no current inventories available for the co-locating carriers to compare against the design parameters.

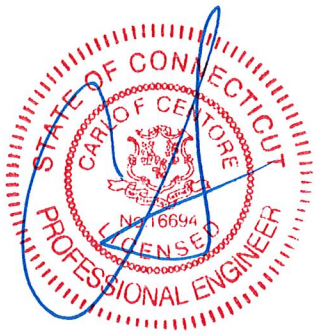
Review of the structural analysis report completed by Fred A. Nudd Corp. dated November 2, 2000 has shown that the tower is adequate to support the proposed equipment loading with the existing and future loading as indicated in the report. The structural report specifies a total of 12 generic antennas (Model No. DB896) at this elevation. The proposed antenna model to be installed is ALP 9011-880.

A comparison of the specifications for the two antenna models has shown that the proposed equipment will impose significantly less wind load on the tower and will ultimately reduce the overturning moment at the base of the structure. This evaluation is based on information provided by the antenna manufacturers.

In conclusion, the existing monopole tower located at 540 Cherrybrook Road, North Canton, CT is suitable for installation of the proposed Verizon Wireless equipment based on the generic antenna model used for existing and future carriers. If there are any questions regarding this matter, please feel free to call.

Sincerely,

Walter E. Pierson, P.E.
Project Engineer



c.c. F. Tomcak, Natcomm, LLC.
C.F. Centore, Natcomm, LLC.

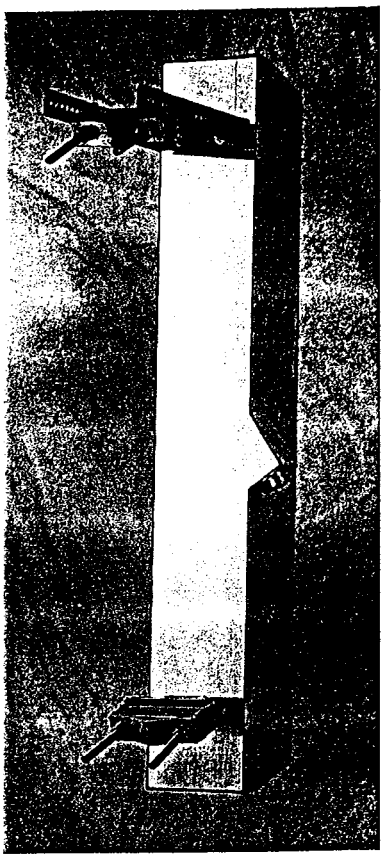
Sweacom

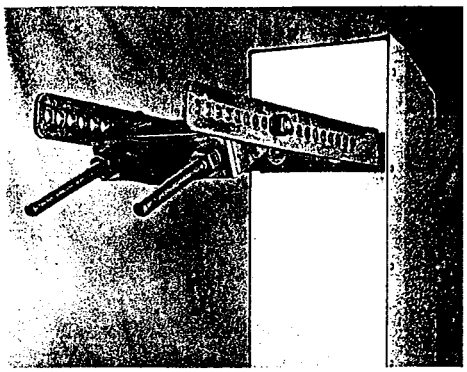
ALP-E 9011-Din

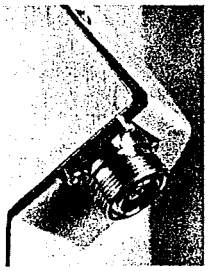
Enhanced Log-Periodic Antenna

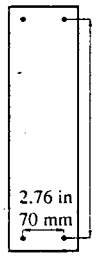
Features:

- ❑ Small Size
- ❑ Aesthetically Pleasing
- ❑ Suitable For TDMA/CDMA
- ❑ High Return Loss
- ❑ Low Intermodulation
- ❑ High FTB
- ❑ Broadbanded
- ❑ Side-lobe Suppression
- ❑ Sturdy Design
- ❑ Down-Tilt Brackets Incl.









The distance between the center of the bolts (on the back of the antenna) are shown in the drawing above.

Bolt diameter is: **3/8-16** [comes with lock nut].

Frequency Range:	**800-900 MHz**
Impedance:	**50 ohm**
Connector Type:	**7/16 Din**
Return Loss:	**20 dB**
Polarization:	**Vertical**
Gain:	**> 11 dBd**
Front To Back Ratio:	**> 30 dB**
Side-Lobe Suppression:	**18 dB**
Intermodulation (2x25W):	**IM3 > 146 dB**
	IM5 > 153 dB
	IM7/9 > 163 dB
Power Rating:	**500 W**
H-Plane (-3 dB point):	**85 - 92°**
V-Plane (-3 dB point):	**16 - 18°**
Lightning Protection:	**DC Grounded**

Overall Height:	**43 in**	**[1092 mm]**
Width:	**6.5 in**	**[165 mm]**
Depth:	**8 in**	**[203 mm]**
Weight Including Tilt-Brackets:	**20 lbs**	**[9.1 Kg]**
Rated Wind Velocity:	**113 mph**	**[180 Km/h]**
Wind Area (CxA/Side):	**2.3 sq. ft.**	**[0.22 sq.m]**
Lateral Thrust At Rated Wind Worst Case:	**112 lbs**	**[500 N]**

Radiating Elements:	**Aluminum**
Extrusion:	**Aluminum**
Radome:	**Grey PVC**
Tilt-Bracket:	**Hot Dip Galvanized Steel**
Antenna Bolts:	**Stainless Steel**

The ALP-E 9011-Din is made in U.S.A.

Network Dept.

Verizon Wireless
20 Alexander Drive
Wallingford, Connecticut 06492

February 16, 2001

Honorable Ms. Kathleen C. Corkum,
First Selectman
Town Hall
4 Market Street
Collinsville, Connecticut 06019

Dear Ms. Corkum:

This letter is to inform you that Cellco Partnership d/b/a Verizon Wireless plans to install antennas and associated equipment at the existing tower facility located at the North Canton Volunteer Fire Department at 540 Cherrybrook Road, Canton Connecticut. I am enclosing a copy of Verizon Wireless's tower sharing application to the Connecticut Siting Council.

The application fully sets forth the Company's proposal. However, if you have any questions or require further information on our plans or the Siting Council's procedures, please contact me at (203) 294-8519 or Mr. Joel Rinebold, Executive Director of the Connecticut Siting Council at (860) 827-2935.

Sincerely,

Sandy M. Carter

Sandy M. Carter
Manager – Regulatory
Verizon Wireless

Enclosure

February 7, 2001

Sandy Carter
Regulatory Manager
Verizon Wireless
20 Alexander Drive
Wallingford, CT 06492

RE: SBA Canton 2 Facility
4275-011 – Volunteer Fire Dept
540 Cherry Brook Road

Dear Sandy:

Please consider this as a Letter of Authorization for Verizon to proceed with any and all necessary permits and approvals to collocate on the above referenced facility.

We acknowledge that Verizon has filed a Collocation Application with SBA and that that application has been approved. As always, we look forward to working with you. If I can be of further assistance, please call.

Sincerely,

Esther K. McNany
Territory Manager

verizon wireless

WIRELESS COMMUNICATIONS FACILITY

NORTH CANTON
540 CHERRYBROOK ROAD
NORTH CANTON, CONNECTICUT

PROJECT SUMMARY

SITE NAME:	NORTH CANTON
SITE ADDRESS:	540 CHERRYBROOK ROAD NORTH CANTON, CONNECTICUT
SITE OWNER:	SBA, INC. 80 EASTERN BLVD. GLASTONBURY, CT 06033 (860) 659-9101
APPLICANT:	CELLCO PARTNERSHIP 20 ALEXANDER DR. WALLINGFORD, CT 06492 (203) 294-7440
CENTER OF TOWER:	LATITUDE: 41° 53' 38.62" LONGITUDE: 72° 53' 37.49"

GENERAL NOTES

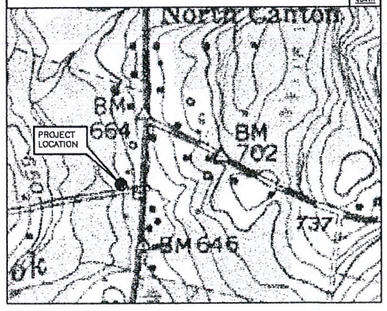
1. PROPOSED ANTENNA AND MOUNTING PLATFORM ELEVATIONS WERE PROVIDED BY CELLCO PARTNERSHIP. EXISTING PLATFORM HEIGHT INFORMATION PROVIDED BY THE SITE OWNER.

SITE DIRECTIONS

FROM : TO :

VICINITY MAP

NOT TO SCALE



SHEET INDEX

SHT. NO.	DESCRIPTION	REV. NO.
T-1	TITLE SHEET	00
C-1	COMPOUNDPLAN&TOWER ELEVATIONS	00

REVISIONS		
00	02/12/01	SITING COUNCIL

Cellco Partnership
d.b.a. verizon wireless

Natcomm, LLC
53-2 North Branford Road
Branford, Connecticut 06405
Tel (203) 488-0580
Fax (203) 488-8587
Consulting Engineers • Project Management
Civil • Structural • Mechanical • Electrical

STATE OF CONNECTICUT
CARL J. PETRE
No. 19004
REGISTERED PROFESSIONAL ENGINEER
PROFESSIONAL ENGINEER

NORTH CANTON

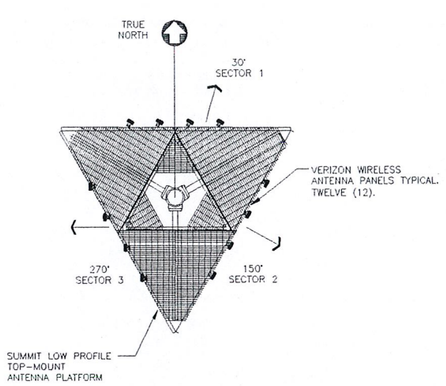
540 CHERRYBROOK ROAD
NORTH CANTON, CONNECTICUT

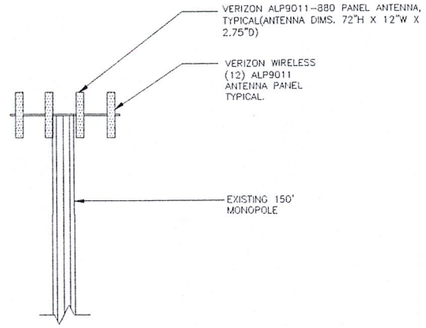
PROJECT NO:	315A
DRAWN BY:	DFB
CHECKED BY:	JJP
SCALE:	AS NOTED
DATE:	02/12/01

TITLE SHEET

T-1

DWG. 1 OF 2

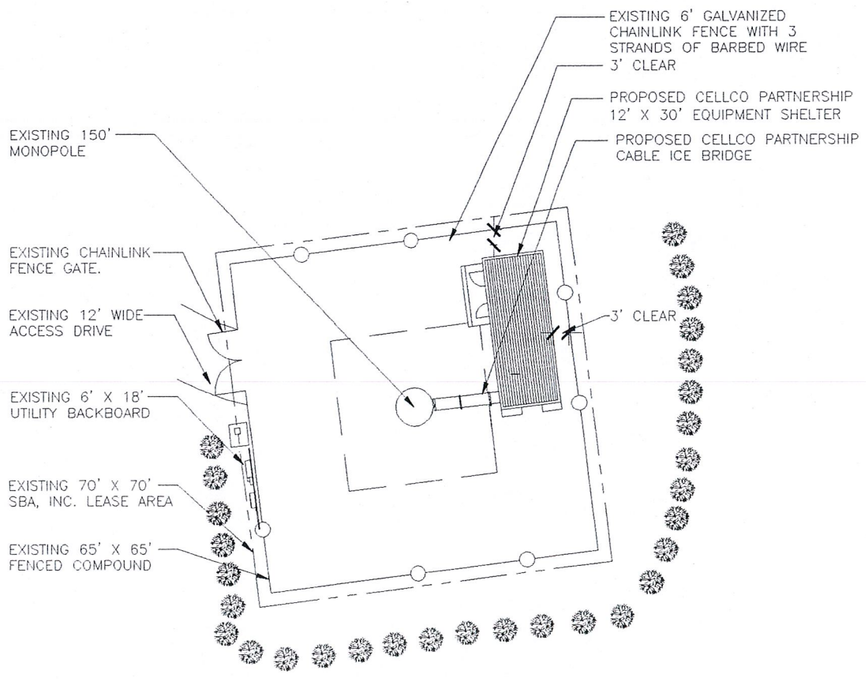




3 / C-1 MONOPOLE ANTENNA MOUNTING CONFIGURATION

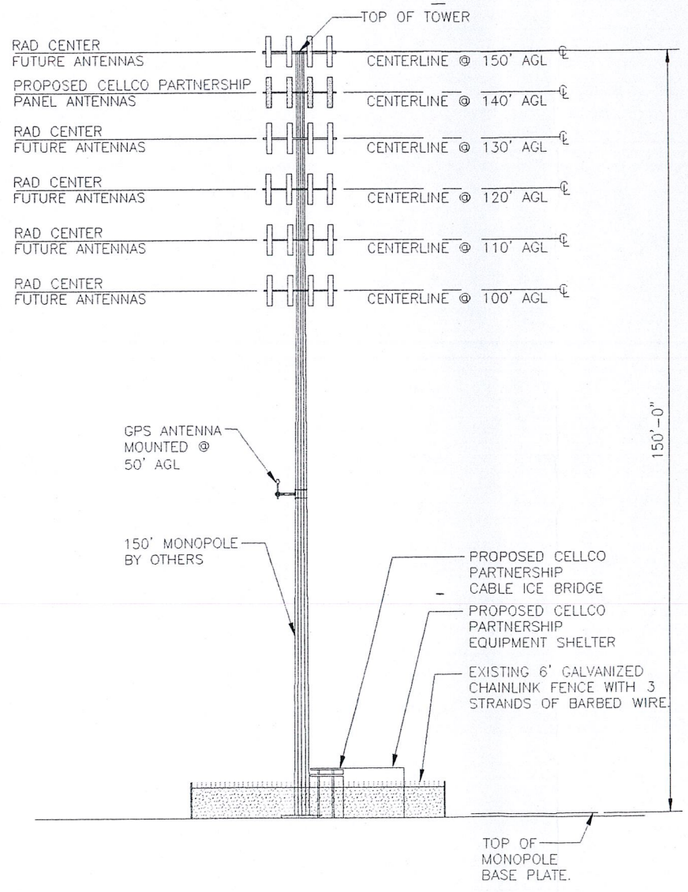
NOT TO SCALE

LAT: 41° 53' 38.62"
LONG.: 72° 53' 37.49"
BASED ON CT SITING COUNCIL



1 / C-1 COMPOUND PLAN

NOT TO SCALE



2 / C-1 ELEVATION

NOT TO SCALE

REVISIONS		
00	02/12/01	SITING COUNCIL

Cellco Partnership
d.b.a. verizon wireless

Natcomm, LLC - Engineering Consultants
NATCOMM
Natcomm, L.L.C.
53-2 North Branford Road
Branford, Connecticut 06405
Tel (203) 488-0580
Fax (203) 488-8587
Consulting Engineering and Management
Civil-Structural-Mechanical-Electrical

STATE OF CONNECTICUT
CARL E. EBELING JR.
LICENSED PROFESSIONAL ENGINEER
15694
PROFESSIONAL ENGINEER SEAL

NORTH CANTON

540 CHERRYBROOK ROAD
NORTH CANTON, CT. 06059

PROJECT NO:	315A
DRAWN BY:	DFB
CHECKED BY:	JJP
SCALE:	AS NOTED
DATE:	02/12/01

COMPOUND PLAN & ELEVATION

C-1

DWG. 2 OF 2

FRED A. NUDD CORPORATION

1743 ROUTE 104, BOX 577
ONTARIO, NY 14519
(315) 524-2531 FAX (315) 524-4249

www.nuddtowers.com

Design of
150 ' Monopole Tower

MODEL #: MJ-140

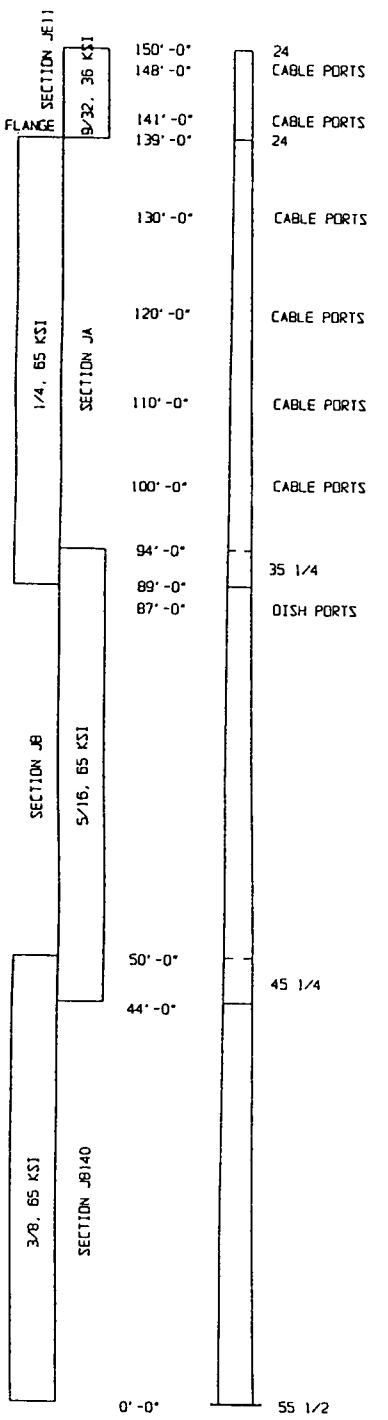
PROJECT #: 7221; #4275-011

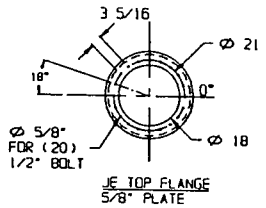
LOCATION: Canton 2, CT

for

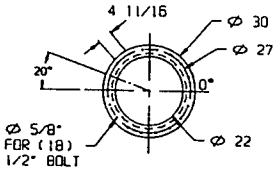
SBA Inc. - CT
80 Eastern Blvd
Glastonbury, CT 06033

November, 2000





JE TOP FLANGE
5/8" PLATE



JA/JE CONNECTION FLANGE
5/8" PLATE
Fy > 50 KSI

ANTENNA (TOP) PORTS
ORIENTATION: 0°,120°,240°

CABLE ENTRY PORT LOCATIONS

HEIGHT	AZIMUTH	SIZE
6'	0°	12x18
4', 8'	90°	12x18
6'	180°	12x18
4', 8'	280°	12x18
2'	0°	18x29

CLIMBING FACE: 130°

TOWER LOADING CONDI

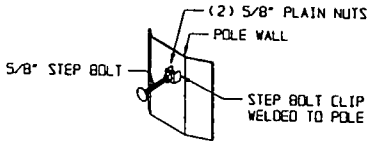
QTY	Antenna	Elevation
12	DB 896	150
1	TD 1142	150
1	PD 220	150
1	14' Low Profile Platform	150
12	DB 896	141
1	14' Low Profile Platform	141
12	DB 896	130
1	14' Low Profile Platform	130
12	DB 896	120
1	14' Low Profile Platform	120
12	DB 896	110
1	14' Low Profile Platform	110
12	DB 896	100
1	14' Low Profile Platform	100
1	MYA 4505	90

NOTE: Any deviation from the proposed design antenna loading will require a tower analysis for verification of structural integrity.

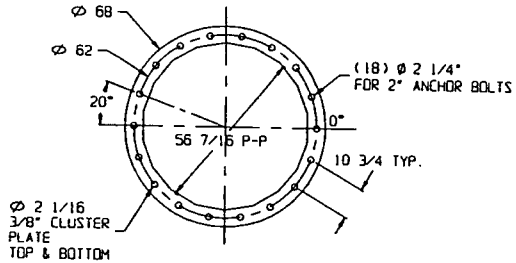
TOWER DESIGN CONDITIONS
This tower was designed to withstand 80 mph wind speed with 1/2" radial ice and the wind/ice reduction, per ANSI/EIA/TIA 222-F recommended standard.
Worst case load condition is wind without ice.
Allowable steel stresses per AISC ASD 9th Edition.
Allowable concrete stresses per ACI 318-95.

MATERIAL SPECIFICATIONS

Monopole Plate:	ASTM A36, A572
Anchor Bolts:	ASTM A687, Fu > 125 ksi
All other steel:	ASTM A36, Fy > 36 ksi
Hardware:	A325 Hot Dipped Galvanized Bolts with Anco Nuts
Galvanizing:	ASTM A123



STEP BOLT INSTALLATION



JB-140 BASE FLANGE
1 1/2" PLATE
Fy > 50 KSI
5/8" WELD

INSTALLATION GENERAL NOTES
1. Installation of tower must be performed by a qualified tower erector.
2. Install sections such that climbing device is aligned.
3. Install safety climb per manufacturer's recommendations.
4. Slip-joint jacking force: Minimum 6000 lb.
5. Tighten all structural and anchor bolts per AISC specifications.
6. Sections are numbered at the bottom, near the climbing face.
7. Installer must grind outside/top and inside/bottom of each section and at the weld locations of the squaring bracing to facilitate slip joint fit. Cover grind area with spray galvanizing.

Pole section weights, lb:

Section JE11:	1100 +/-
Section JA:	4350 +/-
Section JB:	6900 +/-
Section JB140:	11400 +/-

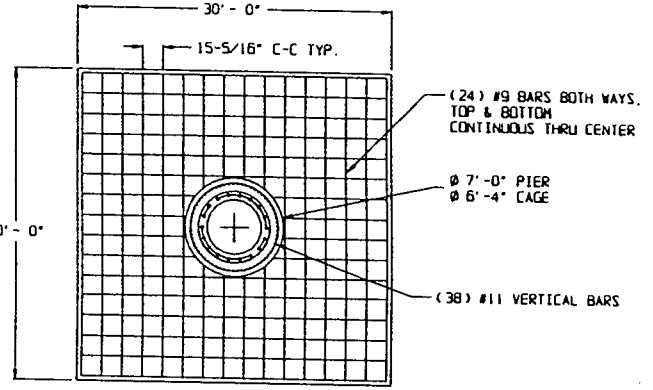
CONCRETE SPECIFICATIONS
1. Concrete shall have a minimum compressive strength of at least 3000 psi at 28 days. It is our recommendation that 4000 psi concrete be installed to account for any unknown installation variables that could degrade the concrete.
2. Concrete installation shall meet ACI 318-95 installation requirements for reinforced concrete.
3. All concrete shall be placed against undisturbed soil free of water and all foreign objects and materials.
4. Minimum concrete cover shall be 3" over all reinforcing bars.
5. Reinforcing bars shall be ASTM A-615 Grade 60 deformed bars.
6. Assemble bars with tie wires or weld. Welded bars must conform to ANSI/AWS D1.1-94 specifications.
7. Champher all sharp corners of exposed concrete.

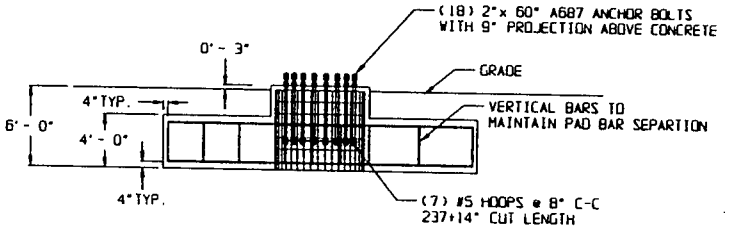
SOIL SPECIFICATIONS
1. Per geotechnical report by Jaworski Geotech, Inc. dated November 3, 1999 (JGI Project No.99336G). Soil is loose to very dense, brown, fine sand with silt and occasional cobbles and boulders. Groundwater was encountered 6' below grade.
2. All foundations shall be free of free standing water as far as possible prior to pouring concrete and shall be kept thus until backfill is in place. If not possible, special pouring procedures must be followed.
3. Rock, non-cohesive, saturated or submerged soils are not to be considered as normal soil. See EIA 7.2.2.
4. Backfill shall be compacted to 100 pcf in 6" lifts using suitable material
5. Backfill shall be placed so as to prevent accumulation of water around foundations or anchors.

TOWER REACTIONS:

Overturning Moment:	3544 kip-ft
Shear:	32 kip

CONCRETE VOLUME:	136.5± cuyd
STEEL WEIGHT:	10656 lb





FRED A. NUDD CORPORATION
Route 104-Ontario, New York 14519-315/524-2531

SCALE: N/S	DRAWN BY: RDP	APPROVED BY:
DATE: 11/2/00		

150' MJ-140 MONOPOLE DESIGN

SBA, INC. #4275-011 / CANTON 2
HARTFORD COUNTY, CT

MONOPOLE CALCULATIONS

SBA
Canton 2, CT
11/00

Design Standards:
ANSI/EIA/TIA 222-F
AISC-ASD 9th Edition

Definition of Monopole characteristics:

Pole Height: $OAH := 150 \cdot ft$

# of sides: $Sides := 18 \quad (8,12,18)$

# of applied Point Loads: $PL := 8$

Definition of Wind and pressure characteristics:

Wind speed: $V := 80 \cdot mph$

Ice: $Ice := 0 \cdot in$

Exposure Coefficient: $K(z) := \left(\frac{z}{33 \cdot ft}\right)^{\frac{2}{7}}$

Gust response factor: $Gh := 1.69$

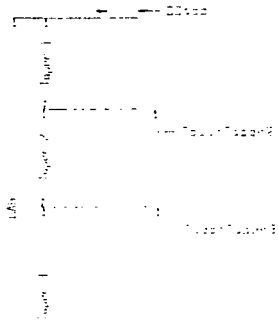
Velocity pressure: $q(z) := .00256 \cdot K(z) \cdot \left(\frac{V}{mph}\right)^2 \cdot Gh \cdot psf$

Define Top diameter of pole: $OD_{top} := 24 \cdot in$

Set the pole face taper: $Taper1 := \frac{0 \cdot in}{10 \cdot ft}$ $Taper2 := \frac{2.25 \cdot in \cdot 1}{10 \cdot ft}$ $Taper3 := \frac{2.25 \cdot in}{10 \cdot ft}$

$TopofTaper2 := 139 \cdot ft$

$TopofTaper3 := 139 \cdot ft$



Equation for pole diameter as a function of elevation:

$$\begin{aligned} \theta(z) := {} & OD_{top} \ldots \\ & + Taper1 \cdot (OAH - if(z > TopofTaper2, z, TopofTaper2)) \ldots \\ & + Taper2 \cdot (TopofTaper2 - z) \cdot (z \geq TopofTaper3) \cdot (z < TopofTaper2) \ldots \\ & + \left[\begin{matrix} Taper2 \cdot (TopofTaper2 - TopofTaper3) \ldots \\ + Taper3 \cdot (TopofTaper3 - z) \end{matrix}\right] \cdot (z < TopofTaper3) \end{aligned}$$

Average diameter:

$\theta(OAH) = 24\,in$

$\theta(TopofTaper2) = 24\,in$

$\theta(TopofTaper3) = 24\,in$

$\theta(0 \cdot ft) = 55.3\,in$

Calculate **force coefficient** for 12/18 sided pole: $Dp := \theta\left(\frac{OAH}{2}\right)$

$$\sqrt{K(OAH)} \cdot \frac{V}{mph} \cdot \frac{Dp}{ft} > 64 = 1$$

$$\sqrt{K(33 \cdot ft)} \cdot \frac{V}{mph} \cdot \frac{Dp}{ft} > 64 = 1$$

If both are 1, then

$Cf := 1.03 \cdot (Sides = 12) \ldots + .72 \cdot (Sides = 18)$

$Cf = 0.72$

Definition of Point Loads: $pl := 1 .. PL$

$T1142 = 78.1\,lbf$ $PD220 = 50.6\,lbf$ $MYA4505 = 64\,lbf$

$DB896 = 158.7\,lbf$ $LoPro14Platform = 188.2\,lbf$

$pl =$	$PLWL_{pl} :=$	$PLElev_{pl} :=$
1	12·DB896 + 1·LoPro14Platform	150·ft
2	T1142 + PD220	150·ft
3	12·DB896 + 1·LoPro14Platform	141·ft
4	12·DB896 + 1·LoPro14Platform	130·ft
5	12·DB896 + 1·LoPro14Platform	120·ft
6	12·DB896 + 1·LoPro14Platform	110·ft
7	12·DB896 + 1·LoPro14Platform	100·ft
8	MYA4505	90·ft

Calculate overturning moment and shears:

Point load forces:

$$PLOTM(z) := \sum_{pl} PLWL_{pl} \cdot (PLElev_{pl} - z) \cdot (PLElev_{pl} > z) \cdot K(PLElev_{pl}) \cdot Gh$$

$$PLShear(z) := \sum_{pl} PLWL_{pl} \cdot (PLElev_{pl} > z) \cdot K(PLElev_{pl}) \cdot Gh$$

Pole Section forces:

$$PoleOTM(z) := \sum_{j} \left[\frac{\theta(j \cdot ft) + \theta[(j-1) \cdot ft]}{2} + 2 \cdot Ice \right] \cdot 1 \cdot ft \cdot q(j \cdot ft) \cdot Cf \cdot (j \cdot ft - z) \cdot [(j \cdot ft) \geq z]$$

$$PoleShear(z) := \sum_{j} \left[\frac{\theta(j \cdot ft) + \theta[(j-1) \cdot ft]}{2} + 2 \cdot Ice \right] \cdot 1 \cdot ft \cdot q(j \cdot ft) \cdot Cf \cdot [(j \cdot ft) \geq z]$$

Total Overturning Moment & Shear functions:

$OTM(z) := PLOTM(z) + PoleOTM(z)$ $OTM(0 \cdot ft) = 3472\,kip \cdot ft$

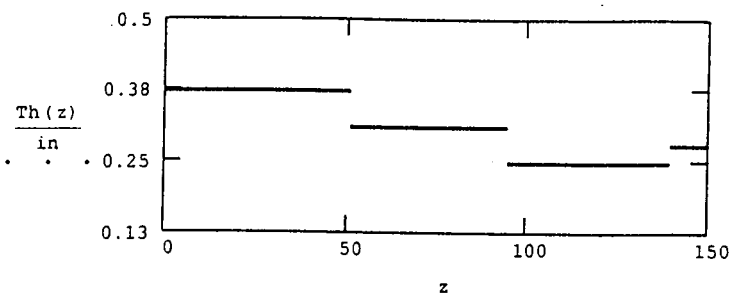
$Shear(z) := PLShear(z) + PoleShear(z)$ $Shear(0 \cdot ft) = 32\,kip$

DEFINITION OF POLE GEOMETRY:

Assign plate thickness for each section.

$$Elev := \begin{pmatrix} 0\cdot ft \\ 50\cdot ft \\ 94\cdot ft \\ 139\cdot ft \end{pmatrix}$$

$$Th(z) := \begin{cases} .3750\cdot in & \text{if } 0\cdot ft \le z \le Elev_1 \\ .3750\cdot in & \text{if } Elev_1 < z \le Elev_2 \\ .3125\cdot in & \text{if } Elev_2 < z \le Elev_3 \\ .2500\cdot in & \text{if } Elev_3 < z \le Elev_4 \\ .281\cdot in & \text{otherwise} \end{cases}$$



$$Fy(z) := \begin{cases} 65000\cdot psi & \text{if } 0\cdot ft \le z < 139\cdot ft \\ 36000\cdot psi & \text{if } 139\cdot ft \le z < OAH \end{cases}$$

Set equation coefficients for # of sides of pole:

	12	18 sides
Coeff :=	240	215
	365	365
	.870	.852
	.00129	.00137

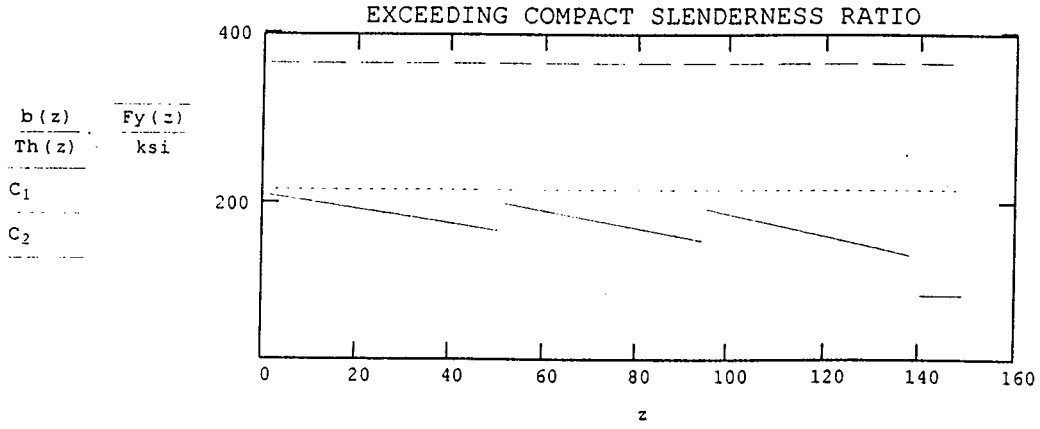
$$Set := 1\cdot(Sides = 12) \ldots + 2\cdot(Sides = 18)$$

$$C := Coeff^{\langle Set \rangle}$$

Check **limiting slenderness ratio** by the limiting width-thickness ratios.
Calculate dimension of flat on outside:

$$\phi := \frac{\pi}{Sides} \qquad b(z) := \theta(z)\cdot\tan(\phi)$$

Limits for compact & non-compact sections:



Calculate the deadload/axial stresses.

$$XArea(z) := Sides\cdot b(z)\cdot Th(z)$$

$$PoleWt := \left(\sum_z XArea(z)\cdot 1\cdot ft\right)\cdot .283\cdot\frac{lbf}{in^3}$$

$$DL = 33529\,lbf$$

$$PoleWt = 20246.6\,lbf$$

$$\frac{DL + PoleWt}{XArea(0\cdot ft)} = 817.4\,psi$$

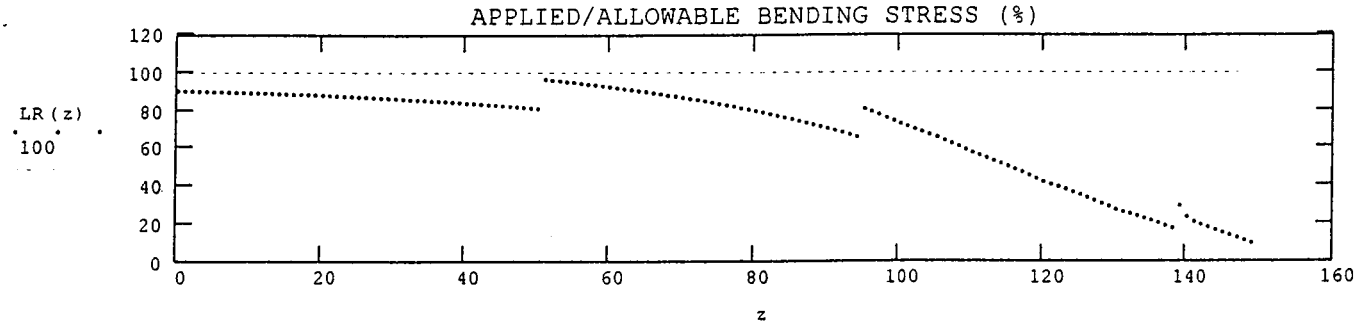
Calculate **allowable compression stresses** per EIA 3.1.1.1:

$$Fa'(z) := \frac{4}{3}\cdot\left[\begin{array}{l}(.60\cdot Fy(z))\cdot\left(\frac{b(z)}{Th(z)}\cdot\sqrt{\frac{Fy(z)}{ksi}} < C_1\right)\ \ldots \\ +\ C_3\cdot Fy(z)\cdot\left(1 - C_4\cdot\sqrt{\frac{Fy(z)}{ksi}}\cdot\frac{b(z)}{Th(z)}\right)\cdot\left(C_1 \le \frac{b(z)}{Th(z)}\cdot\sqrt{\frac{Fy(z)}{ksi}} \le C_2\right)\end{array}\right]$$

$$fb(z) := \frac{OTM(z)\cdot\theta(z)}{2\cdot I(z)\cdot\cos\left(\frac{\phi}{2}\right)} \qquad fax(z) := \frac{DL + PoleWt}{XArea(z)}$$

Calculate Moment of Inertia for polygon section:
Calculate bending & axial compressive stress: $fa(z) := fb(z) + fax(z)$
Load Ratio:

$$LR(z) := \frac{fa(z)}{Fa'(z)}\cdot 100$$



$LR(Elev_1 + 1\cdot ft) =$

90.9
97
81.2
24
83.9
90.9

$Elev_1 + 1\cdot ft =$

1	ft
51	
95	
140	
42	
0	

Anchor bolt calculations: Flange plate is rigid allowing a linear stress distribution.

Select Pole Type $PType := 11$

Anchor bolt size:

$BoltQTY := BoltData_{PType,1}$

$Bolt\phi := BoltData_{PType,2}\cdot in$ $\qquad BoltArea := \frac{\pi}{4}\cdot Bolt\phi^2$

$Fy := 125000\cdot psi$

Pole Type/Anchor Bolts

1	B60	(12)	1-1/2"
2	B80	(12)	1-3/4"
3	B100	(18)	1-3/4"
4	B120	(18)	1-3/4"
5	B140	(18)	2"
6	B160	(18)	2"
7	B180	(18)	2"
8	B200	(18)	2"
9	HB160	(18)	2"
10	JB120	(18)	2"
11	JB140	(18)	2"
12	JB180	(24)	2"

Minimum Bolt Circle: $\theta(0\cdot ft) + 1.5\cdot in + 3\cdot Bolt\phi = 62.8\,in$

Set bolt circle: $BC := BoltData_{PType,4}\cdot in$

$BC = 62\,in$

Central angle between bolts: $\alpha := \frac{2\cdot\pi}{BoltQTY}$

Distance to neutral axis: $Distance_i := \frac{BC}{2} \cdot \sin(i \cdot \alpha)$

se are summed to calculate the largest bolt load:

$$BoltLoad := \frac{OTM(0 \cdot ft)}{2 \cdot \sum_i \frac{(Distance_i)^2}{\max(Distance)}} - \left(\frac{DL + PoleWt}{BoltQTY}\right) \qquad BoltLoad = 144076\,lbf$$

$$f_t := \frac{BoltLoad}{BoltArea} \qquad f_v := \frac{Shear(0 \cdot ft)}{BoltQTY \cdot BoltArea} \qquad f_v = 566.5\,psi \qquad f_t = 45860.8\,psi$$

$$Ft := if\left(.43 \cdot \frac{4}{3} \cdot Fu - 1.8 \cdot f_v \le .33 \cdot \frac{4}{3} \cdot Fu, .43 \cdot \frac{4}{3} \cdot Fu - 1.8 \cdot f_v, .33 \cdot \frac{4}{3} \cdot Fu\right) \qquad \frac{f_t}{Ft} = 83.4\,\%$$

Flange bolt calculations for JE section:

$Bolt\phi 2 := .5 \cdot in$
$BC2 := 27 \cdot in$
$EBolts := 18$

$Ft := 44000 \cdot psi \cdot \frac{4}{3}$

$E\alpha := \frac{2 \cdot \pi}{EBolts}$ $\qquad Distance2_k := \frac{BC2}{2} \cdot \sin(k \cdot E\alpha)$

$$BoltLoad2 := \frac{OTM(TopofTaper2)}{2 \cdot \sum_k \frac{(Distance2_k)^2}{\max(Distance2)}} \qquad \frac{BoltLoad2}{Ft \cdot \frac{\pi}{4} \cdot Bolt\phi 2^2} = 45.5\,\%$$

Flange Plate Design:
For simplicity, calculate the maximum bending stress on the pole, assume it to be acting uniformly and calculate the bending stress of the plate.

Calculate section modulus at base:

Bending stress: $\sigma_{pole} := \frac{OTM(0 \cdot ft) \cdot \theta(0 \cdot ft)}{2 \cdot I(0 \cdot ft)}$ $\qquad \sigma_{pole} = 46292.3\,psi$

Calculate the line load on the welded edge of the plate:

$$Load := \frac{\frac{\pi}{4} \cdot \left[\theta(0 \cdot ft)^2 - \left(\theta(0 \cdot ft) - 2 \cdot Th(0 \cdot ft)\right)^2\right] \cdot \sigma_{pole}}{\pi \cdot \theta(0 \cdot ft)} \qquad Load = 17241.9\,\frac{lbf}{in}$$

Apply this line load to the edge of the plate using AISC beam diagram #23, Beam fixed at one end, free to deflect vertically but not rotate at the other - concentrated load at deflected end. The section calculated as the width of the beam will be mid-way between pole and anchor bolts.

$\theta(0 \cdot ft) = 55.3\,in$

$l := \frac{|BC - \theta(0 \cdot ft)| - NutOD}{2}$ $\qquad l = 1.8\,in$

$bx := \alpha \cdot \frac{l + \theta(0 \cdot ft)}{2}$ $\qquad bx = 10\,in$

$Moment := Load \cdot bx \cdot \frac{l}{2}$ $\qquad Moment = 154.6\,in \cdot kip$

Assume a plate thickness for calculating plate bending stress: $FlangeTh := 1.5 \cdot in$

$FlangeWt = 524\,lbf$ $Fy_{flange} := 50000 \cdot psi$

$$\sigma_{flange} := \frac{Moment \cdot 6}{bx \cdot FlangeTh^2} \qquad \text{AISC F2-1:} \quad Fb_{flange} := .75 \cdot Fy_{flange} \cdot \frac{4}{3} \qquad \frac{\sigma_{flange}}{Fb_{flange}} = 82.8\%$$

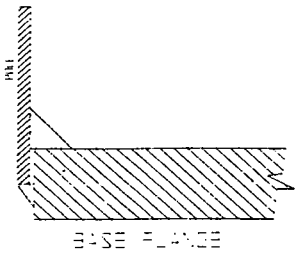
Check base flange weld: Note that the pole will be welded to the base flange with fillet welds inside and outside. Inside will be limited by the plate thickness.

$FilletWeld := .625 \cdot in$

Tension stress of base metal:

$TensionArea := FilletWeld + Th(0 \cdot ft)$

$$\frac{Load}{\frac{TensionArea}{\sqrt{2}} \cdot .3 \cdot \frac{4}{3} \cdot 70 \cdot ksi} = 87.1\%$$



$$TensionStress := \frac{Load}{TensionArea} \qquad \frac{TensionStress}{.6 \cdot \frac{4}{3} \cdot Fy_{flange}} = 43.1\%$$

Shear Stress on base metal: $$\frac{TensionStress}{.3 \cdot \frac{4}{3} \cdot 58000 \cdot psi} = 74.3\%$$

p Flange calculations: $ToT := TopofTaper2$

$$\sigma 2_{pole} := \frac{OTM(ToT) \cdot \theta(ToT)}{2 \cdot I(ToT)} \qquad Load2 := \frac{\frac{\pi}{4} \cdot \left[\theta(ToT)^2 - \left(\theta(ToT) - 2 \cdot Th(ToT)\right)^2\right] \cdot \sigma 2_{pole}}{\pi \cdot \theta(ToT)}$$

$$l2 := \frac{BC2 - \theta(ToT) - 1 \cdot in}{2} \qquad bx := E\alpha \cdot \frac{l2 + \theta(ToT)}{2} \qquad Moment2 := Load2 \cdot bx \cdot \frac{l2}{2}$$

$Flange2Th := .625 \cdot in$ $$\sigma 2_{flange} := \frac{Moment2 \cdot 6}{bx \cdot Flange2Th^2} \qquad \frac{\sigma 2_{flange}}{Fb_{flange}} = 22\%$$

Calculate deflection and rotation at the top at operational windspeed: $E := 29 \cdot 10^6 \cdot psi$

$$\delta := \frac{ft}{E} \cdot \left[\sum_z \frac{OTM(z)}{I(z)} \cdot (OAH - z)\right] \cdot \frac{(50 \cdot mph)^2}{V^2} \qquad \delta = 41.4\,in$$

$$\gamma := \frac{ft}{E} \cdot \left(\sum_z \frac{OTM(z)}{I(z)}\right) \cdot \frac{(50 \cdot mph)^2}{V^2} \qquad \gamma = 2.37\,deg$$

$$Angle := atan\left(\frac{\delta}{OAH}\right) \qquad Angle = 1.32\,deg$$

Monopole Pad & Pier Calculations

Client: SBA, Inc.
Project: Canton 2, CT
11/02/00 11:06

Applied Loads:

OTM:	3472 kip-ft				
Shear:	32 kip	Allowable Soil Bearing	4000	psf	
Deadload:	33.5 kip	Specific Gravity:	2.65		
		Soil Unit Weight:	100	lb/ft^3	
Pad Dimensions:		Submerged Unit Wt	62.26	lb/ft^3	
Width:	30 ft	Soil Ang	30	°	
Thickness:	4 ft	Concrete Unit Wt:	150	lb/ft^3	
OADepth:	6 ft	Concrete f`c:	3000	psi	
Abolt Circle	62 in	Rebar Fy	60000	psi	
Pier Diam:	7 ft 6.50 ft min				
Pier Height:	0.25 ft above Grade	Concrete Volume:	136.5	cuyd	
Pier Depth:	2 ft	Depth to Water:	6	ft	
Total Moment:	3544 kip-ft				

Soil Resistance:

Soil1:	2700.0 kip-ft	8100.0 kip-ft	
Soil2:	209.2 kip-ft	**OTM Capacity:**	
Soil3:	5.3 kip-ft	7937.3 kip-ft	44.7 % Loaded

Concrete Resistance:

Bearing Pressures:

fb(max):	1624.8 psf	
fb(mid):	1021.0 psf	
fb(min):	49.7 psf	OK 96.9% Loaded

Pad Reinforcement:

Pad Moment:	2624.3 kip-ft	Pad Cover	4 in	rho ACI:	0.00333
Pad Bars:	18				
Pad Bar #:	9	17.9 inch²			
Bending Cap:	2688.9 kip-ft	97.6%			
rho min:	0.00113				
rho act:	0.00151 =>	Required Steel:	23.9 inch²	=>	**(24) #9 Bars**
					15.304347826087 inch

Pier Reinforcement:

Pier Cover:	4 in		C-C Spacing:	6.07 inch	
Bar QTY:	38		Clear Spacing:	4.69 inch	
Pier Bar #:	11	56.4 inch²	Hoop #:	5	
Bar Load:	60802 lbf		Cageϕ:	73.375 inch	230"+Lap CutLngth
Capacity:	61680 lbf	98.6%	ϕ=.9(1.3)		

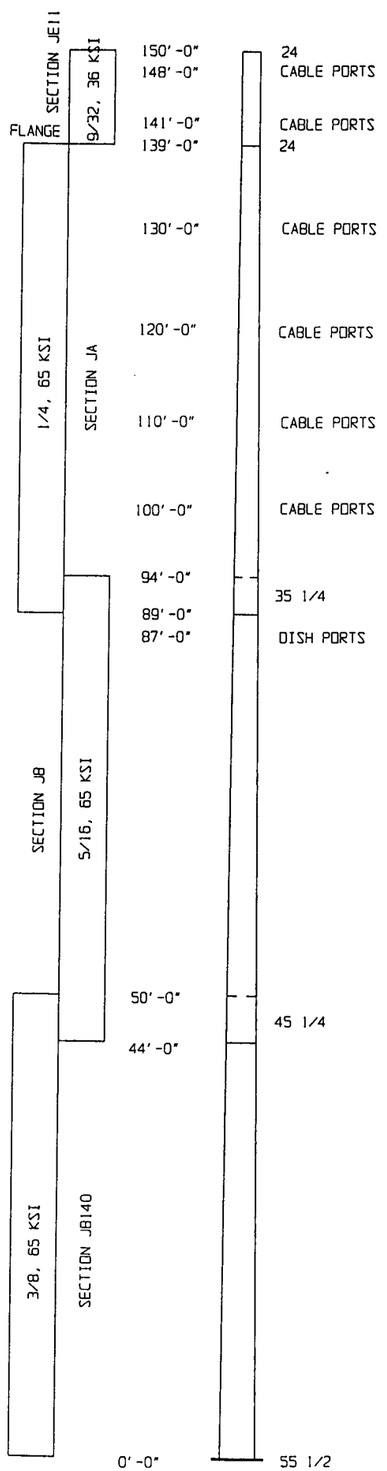
Development Length: ACI 12.2.3

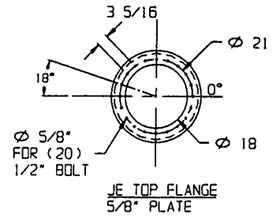
Ktr:	1.53 inch
c:	3.03 inch
ldb:	30.12 inch

Cage Wt:	1150 lbf
Pad Bars:	9506 lbf
	10656 lbf Total Steel Wt

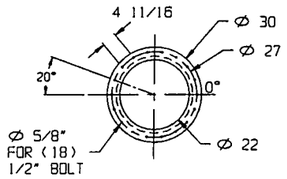
Min. Anchor Bolt Length: 43.12 inch

Foundation Design per ACI 318-95 AISC ASD 9th Edition, EIA 222-F





JE TOP FLANGE
5/8" PLATE



JA/JE CONNECTION FLANGE
5/8" PLATE
Fy > 50 KSI

ANTENNA (TOP) PORTS
ORIENTATION: 0°,120°,240°

CABLE ENTRY PORT LOCATIONS

HEIGHT	AZIMUTH	SIZE
6'	0°	12x18
4', 8'	90°	12x18
6'	180°	12x18
4', 8'	280°	12x18
2'	0°	18x29

CLIMBING FACE: 130°

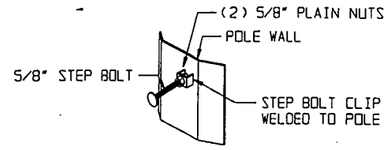
TOWER LOADING CONDITIONS

QTY	Antenna	Elevation
12	DB 896	150
1	TD 1142	150
1	PD 220	150
1	14' Low Profile Platform	150
12	DB 896	141
1	14' Low Profile Platform	141
12	DB 896	130
1	14' Low Profile Platform	130
12	DB 896	120
1	14' Low Profile Platform	120
12	DB 896	110
1	14' Low Profile Platform	110
12	DB 896	100
1	14' Low Profile Platform	100
1	MYA 4505	90

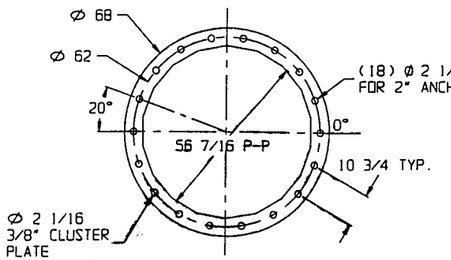
NOTE: Any deviation from the proposed design antenna loading will require a tower analysis for verification of structural integrity.

TOWER DESIGN CONDITIONS
This tower was designed to withstand 80 mph wind speed with 1/2" radial ice and the wind/ice reduction, per ANSI/EIA/TIA 222-F recommended standard.
Worst case load condition is wind without ice.
Allowable steel stresses per AISC ASD 9th Edition.
Allowable concrete stresses per ACI 318-95.

MATERIAL SPECIFICATIONS
Monopole Plate: ASTM A36, A572
Anchor Bolts: ASTM A687, Fu > 125 ksi
All other steel: ASTM A36, Fy > 36 ksi
Hardware: A325 Hot Dipped Galvanized Bolts with Anco Nuts
Galvanizing: ASTM A123



STEP BOLT INSTALLATION



JB-140 BASE FLANGE
1 1/2" PLATE
Fy > 50 KSI
5/8" WELD

INSTALLATION GENERAL NOTES
1. Installation of tower must be performed by a qualified tower erector.
2. Install sections such that climbing device is aligned.
3. Install safety climb per manufacturer's recommendations.
4. Slip-joint jacking force: Minimum 6000 lb.
5. Tighten all structural and anchor bolts per AISC specifications.
6. Sections are numbered at the bottom, near the climbing face.
7. Installer must grind outside/top and inside/bottom of each section and at the weld locations of the squaring bracing to facilitate slip joint fit. Cover grind area with spray galvanizing.

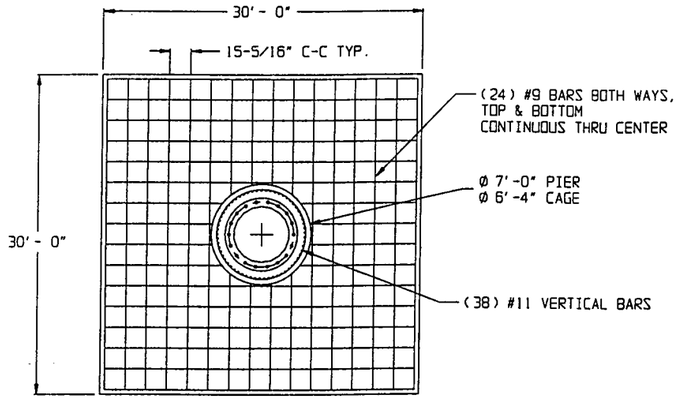
Pole section weights, lb:
Section JE11: 1100 +/-
Section JA: 4350 +/-
Section JB: 6900 +/-
Section JB140: 11400 +/-

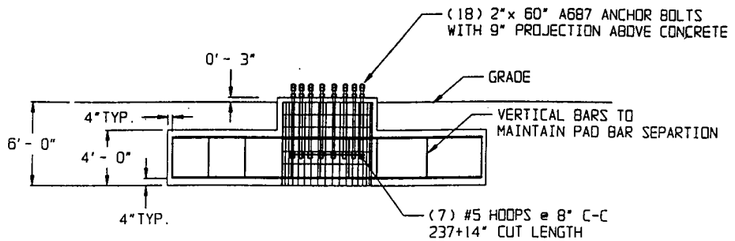
CONCRETE SPECIFICATIONS
1. Concrete shall have a minimum compressive strength of at least 3000 psi at 28 days. It is our recommendation that 4000 psi concrete be installed to account for any unknown installation variables that could degrade the concrete.
2. Concrete installation shall meet ACI 318-95 installation requirements for reinforced concrete.
3. All concrete shall be placed against undisturbed soil free of water and all foreign objects and materials.
4. Minimum concrete cover shall be 3" over all reinforcing bars.
5. Reinforcing bars shall be ASTM A-615 Grade 60 deformed bars.
6. Assemble bars with tie wires or weld. Welded bars must conform to ANSI/AWS D1.1-94 specifications.
7. Champher all sharp corners of exposed concrete.

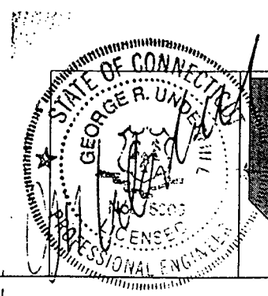
SOIL SPECIFICATIONS
1. Per geotechnical report by Jaworski Geotech, Inc. dated November 3, 1999 (JGI Project No.99336G). Soil is loose to very dense, brown, fine sand with silt and occasional cobbles and boulders. Groundwater was encountered 6' below grade.
2. All foundations shall be free of free standing water as far as possible prior to pouring concrete and shall be kept thus until backfill is in place. If not possible, special pouring procedures must be followed.
3. Rock, non-cohesive, saturated or submerged soils are not to be considered as normal soil. See EIA 7.2.2.
4. Backfill shall be compacted to 100 pcf in 6" lifts using suitable material.
5. Backfill shall be placed so as to prevent accumulation of water around foundations or anchors.

TOWER REACTIONS:
Overturning Moment: 3544 kip*ft
Shear: 32 kip

CONCRETE VOLUME: 136.5± cuyd
STEEL WEIGHT: 10656 lb







FRED A. NUDD CORPORATION
Route 104•Ontario, New York 14519•315/524-2531

SCALE: N/S	DRAWN BY: RDP	APPROVED BY:
DATE: 11/2/00		

150' MJ-140 MONOPOLE DESIGN

SBA, INC. #4275-011 / CANTON 2
HARTFORD COUNTY, CT

DRAWING NUMBER: 00-7221-1