ROBINSON & COLE LLP

KENNETH C. BALDWIN

280 Trumbull Street
Hartford, CT 06103-3597
Main (860) 275-8200
Fax (860) 275-8299
kbaldwin@rc.com
Direct (860) 275-8345

ORIGINAL

March 30, 2010

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

Re: **EM-VER-044-091112**
60 Commerce Street, East Haven, Connecticut
Completion of Construction Activity

Dear Mr. Phelps:

The purpose of this letter is to notify you and the Connecticut Siting Council that the above-referenced Cellco Partnership d/b/a Verizon Wireless telecommunications facility has now been activated.

If you have any questions or need any additional information regarding this facility please do not hesitate to contact me.

Sincerely,

Kenneth C. Baldwin

KCB/kmd
Copy to:
Sandy M. Carter

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@ct.gov
www.ct.gov/csc

December 14, 2009

Kenneth C. Baldwin, Esq.
Robinson & Cole LLP
280 Trumbull Street
Hartford, CT 06103-3597

RE: **EM-VER-044-091112** - Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 60 Commerce Street, East Haven, Connecticut.

Dear Attorney Baldwin:

The Connecticut Siting Council (Council) hereby acknowledges your notice to modify this existing telecommunications facility, pursuant to Section 16-50j-73 of the Regulations of Connecticut State Agencies.

The proposed modifications are to be implemented as specified here and in your notice dated November 12, 2009, including the placement of all necessary equipment and shelters within the tower compound. The modifications are in compliance with the exception criteria in Section 16-50j-72 (b) of the Regulations of Connecticut State Agencies as changes to an existing facility site that would not increase tower height, extend the boundaries of the tower site, increase noise levels at the tower site boundary by six decibels, and increase the total radio frequencies electromagnetic radiation power density measured at the tower site boundary to or above the standard adopted by the State Department of Environmental Protection pursuant to General Statutes § 22a-162. 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. Please be advised that the validity of this action shall expire one year from the date of this letter. Any additional change to this facility will require explicit notice to this agency pursuant to Regulations of Connecticut State Agencies Section 16-50j-73. Such notice shall include all relevant information regarding the proposed change with cumulative worst-case modeling of radio frequency exposure at the closest point of 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.

Thank you for your attention and cooperation.

Very truly yours,

S. Derek Phelps
Executive Director

SDP/MP/laf

c: The Honorable April Capone Almon, Mayor, Town of East Haven
George Mingione, Zoning Enforcement Officer, Town of East Haven
Thomas J. Regan, Esq., Brown Rudnick LLP

ROBINSON & COL

KENNETH C. BALDWIN

280 Trumbull Street
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kbaldwin@rc.com
Direct (860) 275-8345

EM-VER-044-091112

ORIGINAL

November 12, 2009

Via Hand Delivery

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

Re: **Notice of Exempt Modification**
60 Commerce Street, East Haven, Connecticut

Dear Mr. Phelps:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") intends to install antennas on the existing 70-foot self-supporting monopole tower owned by TowerCo at 60 Commerce Street in East Haven, Connecticut. Please accept this letter as notification pursuant to R.C.S.A. § 16-50j-73, for construction that constitutes an exempt modification pursuant to R.C.S.A. § 16-50j-72(b)(2). In accordance with R.C.S.A. § 16-50j-73, a copy of this letter is being sent to East Haven Mayor, April Capone Almon. A copy of this letter is also being sent to Perrelli Associates, LLC, the owner of the property on which the tower is located.

The existing facility consists of a 70-foot self-supporting monopole tower capable of supporting multiple carriers within a fenced compound at 60 Commerce Street in East Haven. The tower is currently shared by Sprint Nextel with antennas at the 65-foot level on the tower. Cellco intends to install twelve (12) panel-type antennas at the 55-foot level on the tower and place a 12' x 20' equipment shelter and natural gas-fired back-up generator on the ground, near the base of the tower. Attached behind Tab 1 are Project Plans for the proposed Cellco facility.

The planned modifications to the East Haven facility fall squarely within those activities explicitly provided for in R.C.S.A. § 16-50j-72(b)(2).

1. The proposed modification will not increase the overall height of the existing tower. Cellco's antennas will be mounted with their centerline at the 55-foot level on the existing 70-foot tower.

2. The proposed modifications will not require an extension of the site boundary. The installation of a 12' x 20' equipment shelter and back-up generator will require a small extension of the fenced compound. All improvements, however, will remain within TowerCo's leased area.

3. The proposed installation will not increase the noise levels at the facility by six decibels or more.

4. The operation of the antennas will not increase radio frequency (RF) power density levels at the facility to a level at or above the Federal Communications Commission (FCC) adopted safety standard. The worst-case RF power density calculations for existing and Cellco antennas would be 20.73% of the FCC standard. A copy of the Calculated Radio Frequency Emission Report, prepared by C Squared Systems, LLC, is attached behind Tab 2.

Also attached, behind Tab 3, is a Structural Analysis confirming that the tower and foundation can support the existing and Cellco antennas and associated equipment.

For the foregoing reasons, Cellco respectfully submits that the proposed antenna installation at the facility constitutes an exempt modification under R.C.S.A. § 16-50j-72(b)(2).

Sincerely,

Kenneth C. Baldwin

Attachments
Copy to:
April Capone Almon, East Haven Mayor
Perrelli Associates, LLC
Sandy M. Carter
Michelle Kababik

Cellco Partnership

d.b.a. verizon wireless

WIRELESS COMMUNICATIONS FACILITY

EAST HAVEN COSEY BEACH
60 COMMERCE STREET
EAST HAVEN, CT 06512

SITE DIRECTIONS

FROM: 99 EAST RIVER DRIVE, EAST HARTFORD, CONNECTICUT **TO:** 60 COMMERCE STREET, EAST HAVEN, CT 06512

1.	Depart E River Dr	
2.	Take ramp left for I-84 East toward Boston	0.3 mi
3.	At exit 55, take ramp right for SR-2 / Veterans of Foreign Wars Memorial Hwy East toward Norwich / New London	3.4 mi
4.	At exit 5D, take ramp right for SR-3 South toward Glastonbury / Wethersfield	2.7 mi
5.	Take ramp left for I-91 South toward New Haven	33.4 mi
6.	Take ramp left for I-95 North / Governor John Davis Lodge Tpke toward New London	2.2 mi
7.	At exit 51, take ramp right for Frontage Rd / Saltonstall Pkwy toward East Haven	1.1 mi
8.	Turn right onto SR-142 / Hemingway Ave	1.0 mi
9.	Keep straight onto Coe Ave	
10.	Turn right onto SR-337 / Silver Sands Rd	0.3 mi
11.	Turn right onto Commerce St	0.5 mi
12.	Arrive at 60 Commerce St, East Haven, Connecticut 06512	

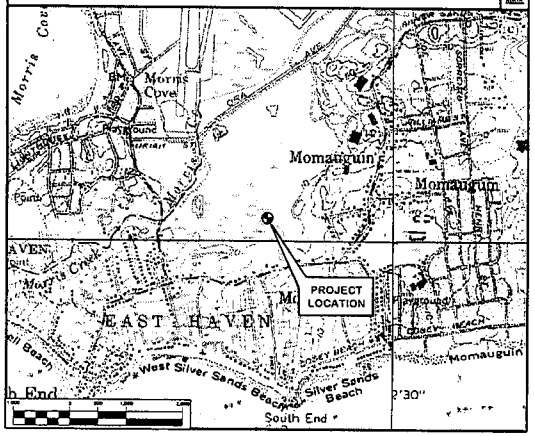
GENERAL NOTES

1. PROPOSED ANTENNA LOCATIONS AND HEIGHTS PROVIDED BY CELLCO PARTNERSHIP.

PROJECT SCOPE

1. THE PROPOSED SCOPE OF WORK GENERALLY INCLUDES THE INSTALLATION OF A 12'x20' PREFABRICATED WIRELESS EQUIPMENT SHELTER ON A CONCRETE FOUNDATION AND A NATURAL GAS FUELED GENERATOR ON A CONCRETE PAD, LOCATED WITHIN A PROPOSED FENCED EXPANSION TO THE EXISTING WIRELESS COMMUNICATIONS LEASE AREA.
2. A TOTAL OF TWELVE (12) DIRECTIONAL PANEL ANTENNAS ARE PROPOSED TO BE MOUNTED ON AN EXISTING ±70' TALL MONOPOLE TOWER AT A CENTERLINE ELEVATION OF ±55' ABOVE THE TOWER BASE.
3. ELECTRIC AND TELCO UTILITIES SHALL BE ROUTED UNDERGROUND TO THE PROPOSED EQUIPMENT SHELTER FROM AN EXISTING UTILITY BACKBOARD LOCATED ADJACENT TO THE FENCED COMPOUND. THE GAS UTILITY LINE WILL BE ROUTED UNDERGROUND FROM A PROPOSED GAS METER (FINAL LOCATION TO BE DETERMINED BY THE LOCAL GAS COMPANY)

VICINITY MAP — SCALE: 1" = 1000'



PROJECT SUMMARY

SITE NAME:	EAST HAVEN COSEY BEACH
SITE ADDRESS:	60 COMMERCE STREET EAST HAVEN, CT 06512
LESSEE/TENANT:	CELLCO PARTNERSHIP d.b.a. VERIZON WIRELESS 99 EAST RIVER DRIVE EAST HARTFORD, CT 06108
CONTACT PERSON:	SANDY CARTER CELLCO PARTNERSHIP (860) 803-8219
TOWER COORDINATES:	LATITUDE 41°-14'-59" LONGITUDE 72°-52'-58" COORDINATES ARE BASED ON CONNECTICUT SITING COUNCIL DATABASE.

SHEET INDEX

SHT. NO.	DESCRIPTION	REV. NO.
T-1	TITLE SHEET	A
C-1	COMPOUND PLAN	A
C-2	COMPOUND ELEVATION	A

REV.	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
A	11/11/09	DEB	DMD	ISSUED FOR CSC-CLIENT REVIEW

DESIGNED BY: CFC
DRAWN BY: DEB
CHK'D BY: DMD

Cellco Partnership d.b.a. verizon wireless

NATCOM

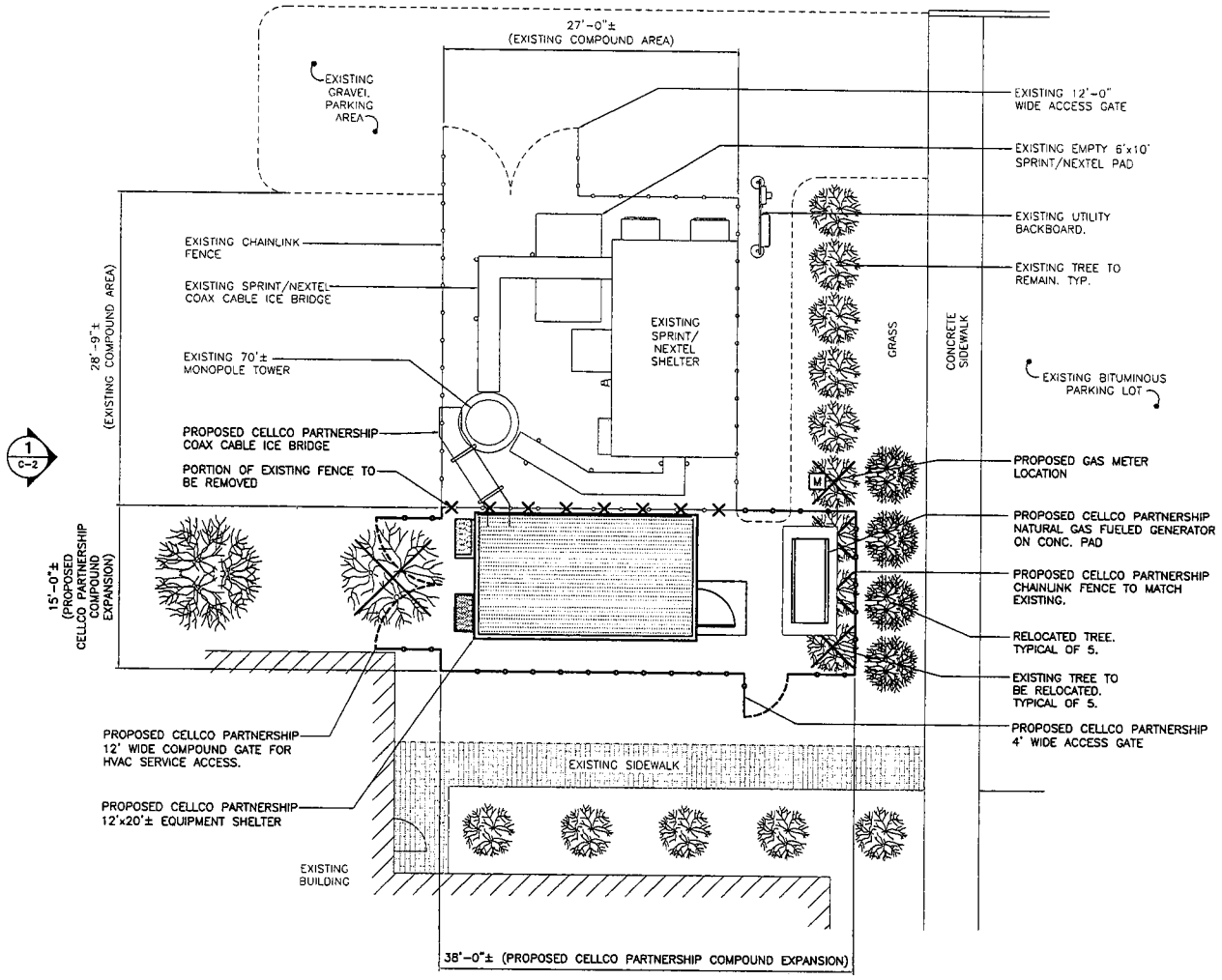
VERIZON WIRELESS
WIRELESS COMMUNICATIONS FACILITY
EAST HAVEN COSEY BEACH
60 COMMERCE STREET
EAST HAVEN, CT 06512

DATE: 11/10/09
SCALE: AS NOTED
JOB NO. 09019

TITLE SHEET

T-1

Sheet No. 1 of 3



DESIGNED BY:	CFC
DRAWN BY:	DEB
CHK'D BY:	DMD

REV	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
A	11/11/09	DEB	DMD	ISSUED FOR CSC-CLIENT REVIEW

Cellco Partnership d.b.a. Verizon wireless

NATCOMM

Ph: 203.488.0580
Fax: 203.488.8587
e: info@natcomm.com
63-2 N. Branford Rd.
Branford, CT 06405

VERIZON WIRELESS

WIRELESS COMMUNICATIONS FACILITY

EAST HAVEN COSEY BEACH

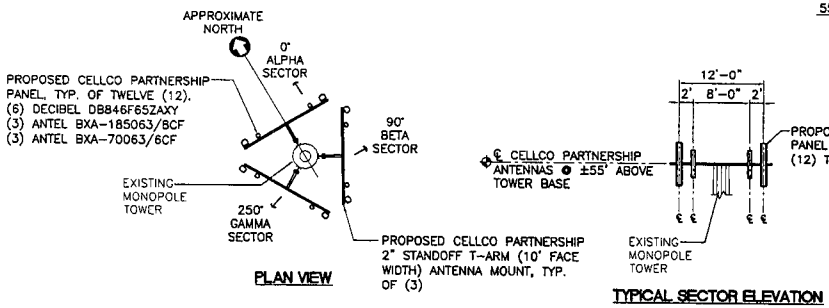
60 COMMERCE STREET
EAST HAVEN, CT 06512

DATE: 11/10/09
SCALE: AS NOTED
JOB NO. 09019

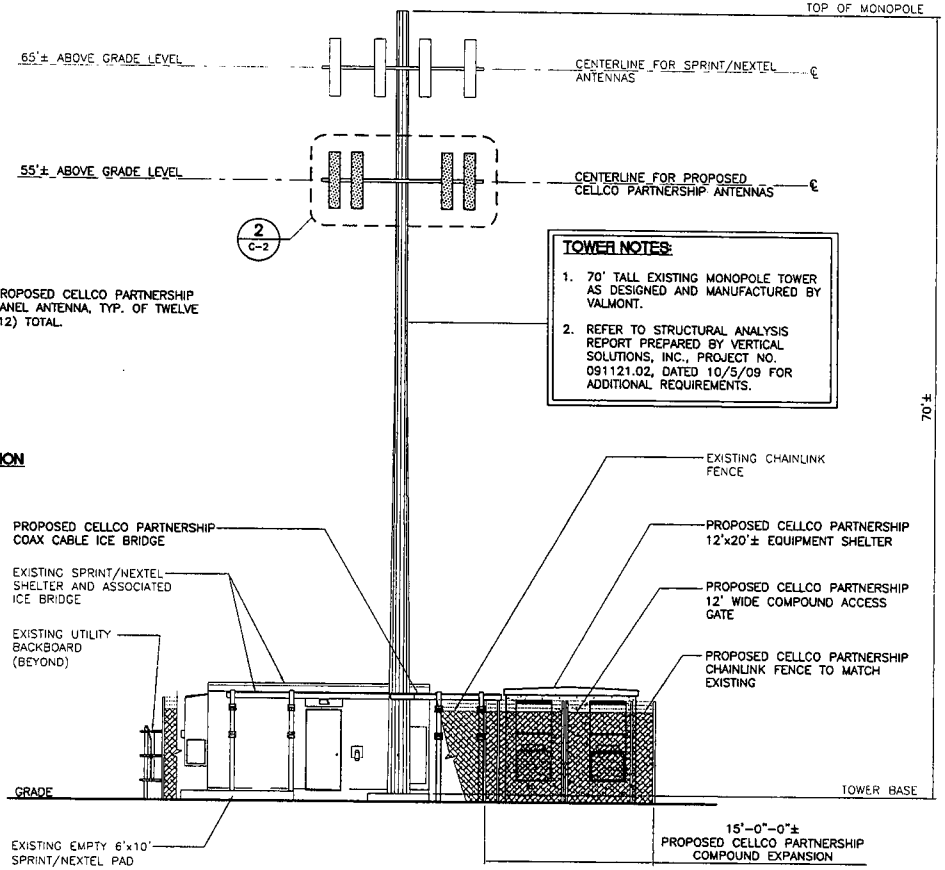
COMPOUND PLAN

C-1

Sheet No. 2 of 3



2 / C-2 **ANTENNA MOUNTING CONFIGURATION**
NOT TO SCALE



TOWER NOTES:

1. 70' TALL EXISTING MONOPOLE TOWER AS DESIGNED AND MANUFACTURED BY VALMONT.
2. REFER TO STRUCTURAL ANALYSIS REPORT PREPARED BY VERTICAL SOLUTIONS, INC., PROJECT NO. 091121.02, DATED 10/5/09 FOR ADDITIONAL REQUIREMENTS.

1 / C-2 **WEST ELEVATION**
SCALE: 1" = 5'

GRAPHIC SCALE
3 0 2.5 5 10 20
(IN FEET)
1 inch = 5 ft.

DESIGNED BY:	CFC
DRAWN BY:	DEB
CHK'D BY:	DMD

REV	DATE	DRAWN BY	CHK'D BY	DESCRIPTION
A	11/11/09	DEB	DMD	ISSUED FOR CSC-CLIENT REVIEW

Cellco Partnership d b a Verizon wireless

NATE DIMMI
203.488.0580
ndimmi@snet.net
63-2 N. Branford Rd.
Branford, CT 06405

VERIZON WIRELESS
WIRELESS COMMUNICATIONS FACILITY
EAST HAVEN COSEY BEACH
60 COMMERCE STREET
EAST HAVEN, CT 06512

DATE: 11/10/09
SCALE: AS NOTED
JOB NO. 09019

COMPOUND ELEVATION

C-2

Sheet No. 3 of 3

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

Calculated Radio Frequency Emissions

verizonwireless
We never stop working for you.®

East Haven – Cosey Beach

60 Commerce Street, East Haven, CT 06512

Table of Contents

List of Tables

1. INTRODUCTION

The purpose of this report is to investigate compliance with applicable FCC regulations for the proposed Verizon Wireless antennas to be installed on the existing monopole at 60 Commerce Street, East Haven, CT 06512.

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

Public exposure to radio frequencies is regulated and enforced in units of milliwatts per square centimeter (mW/cm^2). The general population exposure limits for the various frequency ranges are defined in the attached "FCC Limits for Maximum Permissible Exposure (MPE)" in Attachment B of this report. Because each carrier will be using different frequency bands, and each frequency band has different exposure limits, it is necessary to report percent of MPE rather than power density.

The FCC general population / uncontrolled limits set the maximum exposure to which most people may be subjected. "General population / uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure."[1]

Higher exposure limits are permitted under the occupational / controlled exposure category, but only for persons who are exposed as a consequence of their employment and who have been made fully aware of the potential for exposure (through training), and they must be able to exercise control over their exposure.[2] General population / uncontrolled limits are five times more stringent than the levels that are acceptable for occupational, or radio frequency trained individuals.

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

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

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

---

[1] OET Bulletin 65 – Edition 97-01 – August 1997 Federal Communications Commission Office of Engineering & Technology Note 2 (Attachment B)

[2] OET Bulletin 65 – Note 1

2. FCC Guidelines for Evaluating RF Radiation Exposure Limits

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

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

3. RF Exposure Prediction Methods

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

$$\text{Power Density} = \left(\frac{1.6^2 \times EIRP}{4\pi \times R^2} \right) \times \text{Off Beam Loss}$$

Where:

EIRP = Effective Isotropic Radiated Power

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

H = Horizontal Distance from antenna

V = Vertical Distance from center of radiation of antenna

1.6 = Ground Reflection Factor

Off Beam Loss is determined by the selected antenna patterns

4. Calculation Results

Table 1 below outlines the current power density information for this site as obtained from the Connecticut Siting Council database, except where otherwise noted[3].

Carrier	Number of Trans.	Effective Radiated Power (ERP) Per Transmitter (Watts)	Antenna Centerline Height (Feet)	Operating Frequency (MHz)	Total ERP (Watts)	Power Density (mw/cm^2)	Limit	%MPE
Nextel iDEN	19	100	65	851	1,900	0.1627	0.5673	28.68%
Sprint CDMA	11	411	65	1962.5	4,521	0.3871	1.0000	38.71%
Sprint WiMAX	3	562	65	2657	1,686	0.1444	1.0000	14.44%
							Total	81.82%

Table 1: Existing Carrier Information

The values listed in Table 1 assume all antennas are directed at the ground near the base of the tower with 0dB off-beam loss. Because all existing and proposed antennas are directional in nature, most of the power is concentrated on the horizon, with much less power directed towards the ground immediately below the antennas. Table 2 below accounts for this characteristic by including a nominal 10dB attenuation factor due to the directional antenna patterns. (Reference "Off-Beam Loss factor" in Section 3 of this report)[4].

Carrier	Number of Trans.	Effective Radiated Power (ERP) Per Transmitter (Watts)	Antenna Centerline Height (Feet)	Operating Frequency (MHz)	Total ERP (Watts)	Power Density (mw/cm^2)	Limit	%MPE
Nextel iDEN	19	100	65	851	1,900	0.0163	0.5673	2.87%
Sprint CDMA	11	411	65	1962.5	4,521	0.0387	1.0000	3.87%
Sprint WiMAX	3	562	65	2657	1,686	0.0144	1.0000	1.44%
Verizon CDMA	9	447	55	880	4,023	0.0482	0.5867	8.21%
Verizon EVDO	3	554	55	1900	1,662	0.0199	1.0000	1.99%
Verizon LTE	1	981	55	750	981	0.0117	0.5000	2.35%
							Total	20.73%

Table 2: Existing and Proposed Carrier Information

[3] Please note that the antenna height used for the Sprint and Nextel antennas has been updated based upon the structural analysis completed by Vertical Solutions dated October 5, 2009 (see Attachment C).

[4] Recommended updates to the Siting Council database with off-beam loss are shown in Table 2 in gray text.

5. Conclusion

The above analysis verifies that emissions from the proposed site will be below the maximum power density levels as outlined by the FCC in the OET Bulletin 65 Ed. 97-01. When using conservative methods and including the directionality of the existing and proposed antennas, the cumulative power density from the all transmit antennas is well below the limits for the general public. The highest expected percent of Maximum Permissible Exposure at ground level is 20.73% of the FCC limit.

6. Statement of Certification

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

Tony Wells
C Squared Systems

October 22, 2009
Date

Attachment A: References

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

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

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

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

(A) Limits for Occupational/Controlled Exposure

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

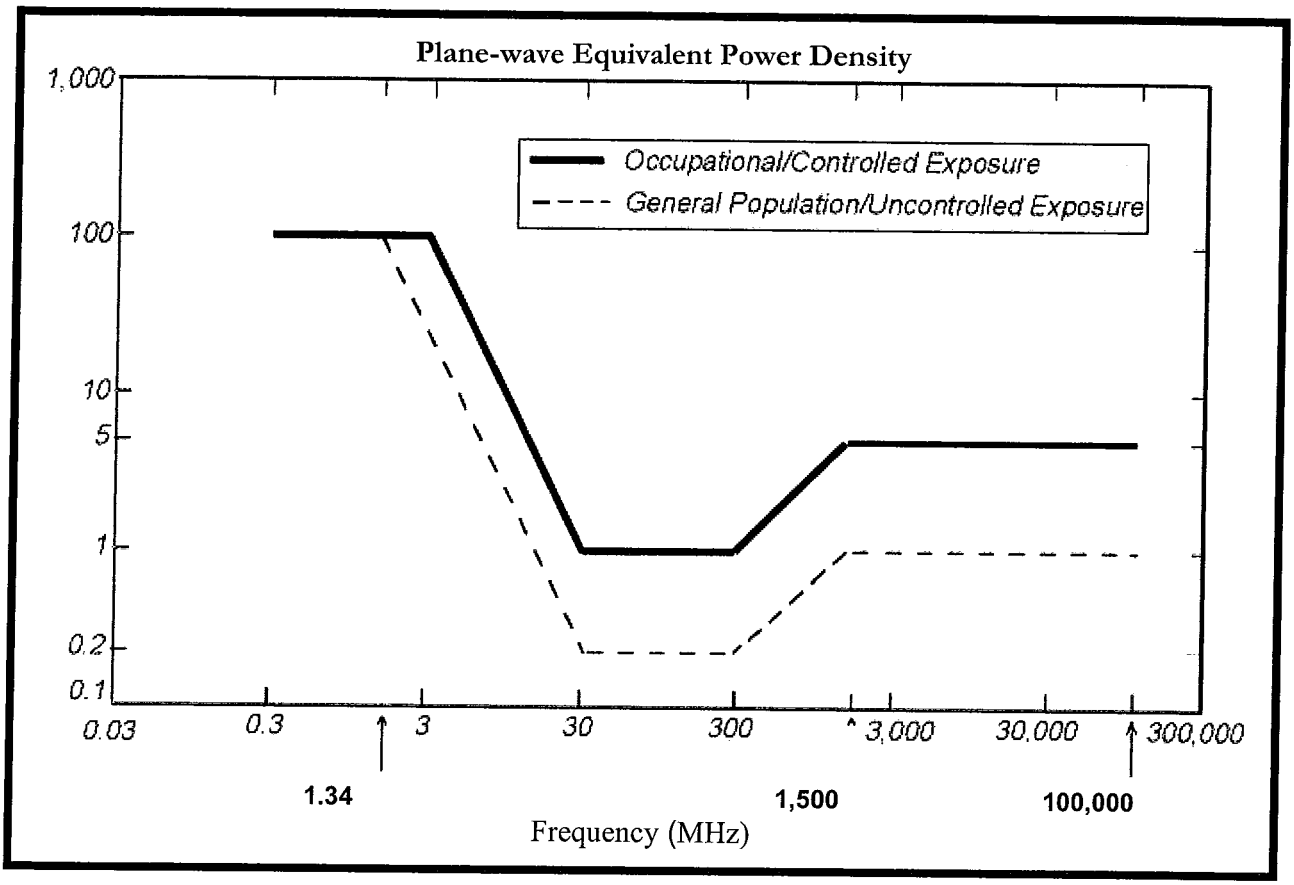
(B) Limits for General Population/Uncontrolled Exposure

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

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

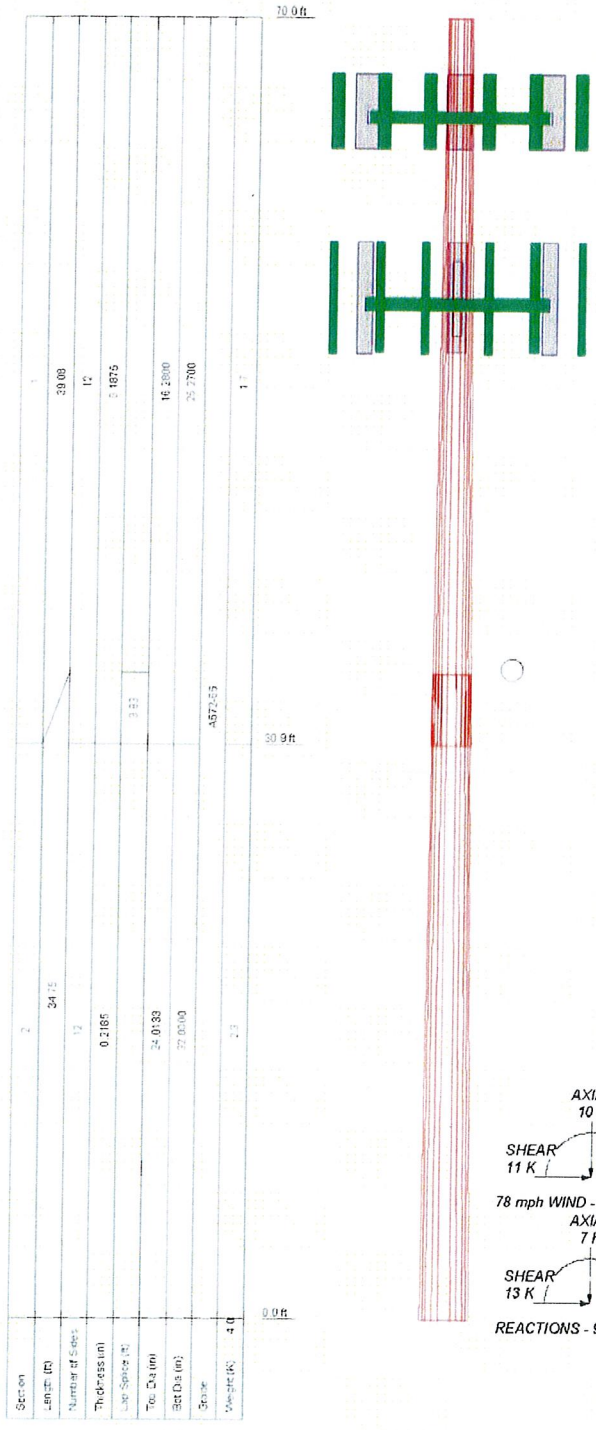
NOTE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.



• FCC Limits for Maximum Permissible Exposure (MPE)

Attachment C: Excerpt from Structural Analysis (Vertical Solutions Project: 091121.02 Rev. 0)



DESIGNED APPURTENANCE LOADING

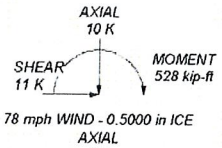
TYPE	ELEVATION	TYPE	ELEVATION
2' Standoff T-Arm (10' face width)	65	2' Standoff T-Arm (10' face width)	65
2' Standoff T-Arm (10' face width)	65	(2) DB846F65ZAXY w/Mount Pipe	55
2' Standoff T-Arm (10' face width)	65	(2) DB846F65ZAXY w/Mount Pipe	55
(3) DB844045ZAXY w/Mount Pipe	65	(2) DB846F65ZAXY w/Mount Pipe	55
(3) DB844045ZAXY w/Mount Pipe	65	BXA-70063/8CF with MP	55
(3) DB844045ZAXY w/Mount Pipe	65	BXA-70063/8CF with MP	55
RR65-18-VDPL2	65	BXA-70063/8CF with MP	55
RR65-18-VDPL2	65	BXA-185063/8CF with MP	55
RR65-18-VDPL2	65	BXA-185063/8CF with MP	55
2' Standoff T-Arm (10' face width)	55	BXA-185063/8CF with MP	55
2' Standoff T-Arm (10' face width)	55		

MATERIAL STRENGTH

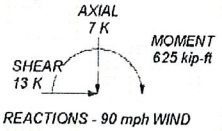
GRADE	Fy	Fu	GRADE	Fy	Fu
A572-65	65 ksi	80 ksi			

TOWER DESIGN NOTES

1. Tower is located in New Haven County, Connecticut.
2. Tower designed for a 90 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 78 mph basic wind with 0.50 in ice.
4. Deflections are based upon a 60 mph wind.
5. TOWER RATING: 93%



78 mph WIND - 0.5000 in ICE



REACTIONS - 90 mph WIND

Vertical Solutions, Inc. 2002 Production Drive Apex, NC 27539 Phone: 888-321-6167 FAX: 919-321-1768	Job: *New Haven Tweed CT2024*		
	Project: *091121.01*		
	Client: TowerCo	Drawn by: hsanford	Appd:
	Code: TIA/EIA-222-F	Date: 10/05/09	Scale: NTS
	Path:		Dwg No: E-1

TowerCo

PASS
(Foundation, 98% capacity)

vertical solutions

October 5, 2009

Mr. Stephen Rambeau
TowerCo, LLC
5000 Valleystone Drive
Cary, NC 27519
(919) 653-5722

Vertical Solutions, Inc.
PO Box 579
Holly Springs, NC 27540
(888) 321-6167
operations@verticalsolutions-inc.com

Subject:	**Rigorous Structural Analysis**
Carrier Designation	**Verizon Wireless, Co-location** **Site Number: N/A** **Site Name: East Haven Cosey Beach**
TowerCo Designation	**Site Number: CT2024** **Site Name: New Haven Tweed**
Engineering Firm Designation	**Vertical Solutions Project: 091121.02 Rev. 0**
Site Data	**60 Commerce St., East Haven, New Haven County, CT 06512** **Latitude: N41° 15' 4.44"±; Longitude: W72° 52' 55.54"±** **Elevation: 10-ft, Topography Category: 1;** **Exposure Category: "C"; Structure Class II;** **70-ft Self Supporting Pole Structure (Monopole)**

Dear Mr. Rambeau,

To your request, we present our structural analysis.

Our work indicates that with the proposed appurtenance configuration, the tower and foundation **will** satisfy the structural strength requirements of EIA/TIA-222-F-1996, *Structural Standards for Steel Antenna Towers and Antenna Supporting Structures* (industry standard) and the *2003 International Building Code* (local building code) for:

- 90-mph fastest mile basic wind speed
- 78-mph fastest mile basic wind speed with 1/2" radial ice

We trust you find our work satisfactory. Please do not hesitate to call should you have any questions.

Sincerely,

Holly Sanford

Holly R. Sanford, E.I.
Structural Engineer In Training

STATE OF CONNECTICUT
MICHAEL L. LASSITER
No. 20064
LICENSED
PROFESSIONAL ENGINEER

Michael L. Lassiter

Michael L. Lassiter, S.E., P.E., C.W.I.
Structural Engineer, Civil Engineer, Certified Weld Inspector
and President

OCT 0 6 2009

Table 1: Existing, Proposed and Reserved Appurtenance Configuration

Elevation (AGL, ft)	Carrier	Mount	Equipment	Coax	Location
65[1]	Sprint Nextel	(3) T-Arms	(9) Andrew DB844G45ZAXY (3) EMS RR65-18-VDPL2	(15) 1 5/8	Inside
55	***Verizon Wireless***	***(3) T-Arms***	***(6) Decibel DB846F65ZAXY*** ***(3) Antel BXA-185063/8CF*** ***(3) Antel BXA-70063/6CF***	***(12) 1 5/8***	***Inside[2]***

1 – Design loading [EPA=56.2 sq ft]. Existing equipment [EPA=70.0 sq ft].; Maximum Reserved load [EPA=92.4 sq.ft.]. Existing loading listed above and used in analysis.
2 – Hand hole rims currently available at 59 ft.

Table 2: Tower Structure Results – Percent Capacity Utilized:

Elevation (ft)	Shaft	Result	Connections	Result
70 to 30.917	65	O. K.	--	--
30.917 to 0	93	O. K.	50	O. K.

1 –Utilization of 105% or less considered acceptable.

Table 3: Foundation Results, Percent Capacity Utilized

Component[1]	Design Foundation	Analysis Requirements	Percent Utilized	Result
Horizontal	*13 k*	*12.8 k*	**98**	**O. K.**
Moment	*729 k-ft*	*625 k-ft*	86	O. K.

1 – Reactions obtained from the analysis were compared with the design reactions.

Attachments:

- Project History
- Coax Configuration
- Program input and output
- Base plate and anchor rod calculations

Project History, 091121.02 New Haven Tweed CT2024

TowerCo File No.	VSi File ID	By: / For:	Description
353178	20051011_TFD_ CT2024.pdf	Valmont / Nextel	Tower and Foundation Design Drawings
714962	20081101_TEP_ CT2024.pdf	SiteMaster / TowerCo	Tower Elevation Profile
719745	20081101_SIR_ CT2024.pdf	SiteMaster / TowerCo	Site Inspection Report
--	20090901_CTA_ CT2024.doc	Verizon Wireless / TowerCo	Co-location Application
--	20090929_CTA_CT2024.doc	Verizon Wireless / TowerCo	Co-location Application

Table Note:

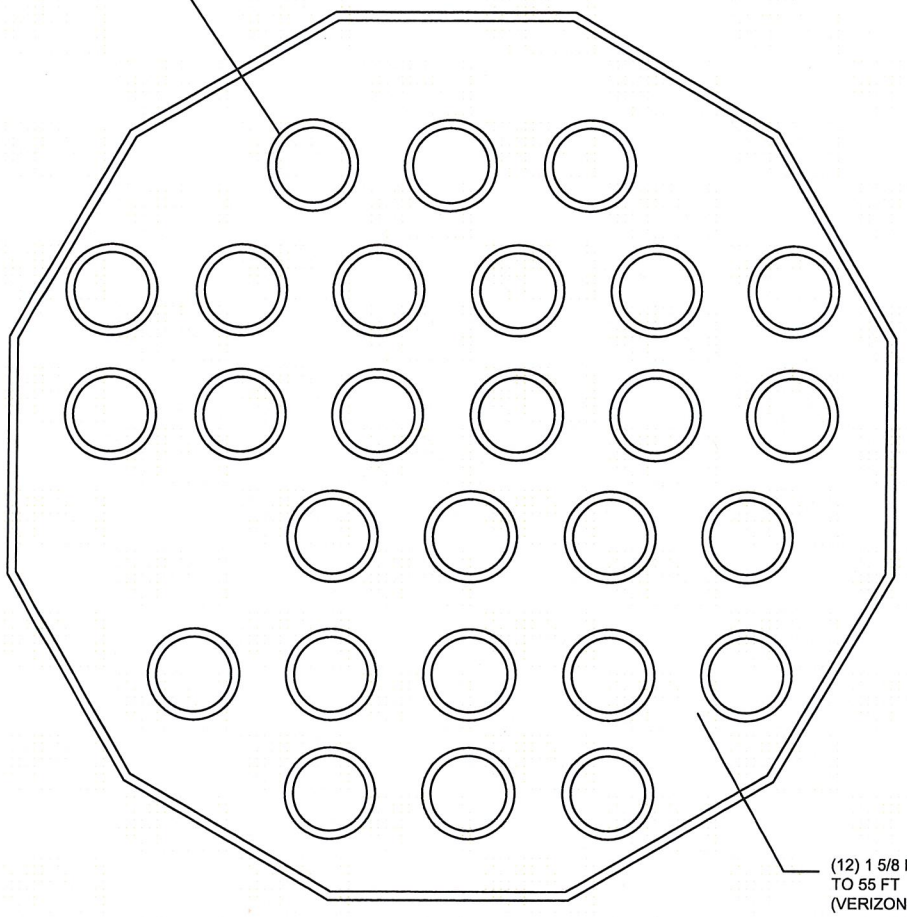
Files name format YYYYMMDD-XXX-ZZZZZZ.pdf

Where:

YYYY=year
MM=month
DD=day published/issued
XXX=file describer
ZZZZZZ=TowerCo Site ID

(15) 1 5/8 EXISTING
TO 65 FT
(SPRINT NEXTEL)

A(INSIDE) = 286.8 SQ IN
A (COAX) = 83.13 SQ IN
FILL RATIO = 30%



(12) 1 5/8 PROPOSED
TO 55 FT
(VERIZON WIRELESS)

COAX CONFIGURATION PLAN - 55 FT

SCALE: 1–1/2" = 1'–0"

PREPARED BY:
vertical solutions
2002 Production Drive
Apex, NC 27539
Office: (888) 321-6167
Fax: (919) 321-1768
www.verticalsolutions-inc.com

PROJECT NAME:
NEW HAVEN TWEED

TOWERCO JOB #:
CT2024

PREPARED FOR:
TowerCo
5000 Valley Stone Drive
Cary, NC 27519
Office: (919) 469-5559
Fax: (919) 469-5530
www.towerco.com

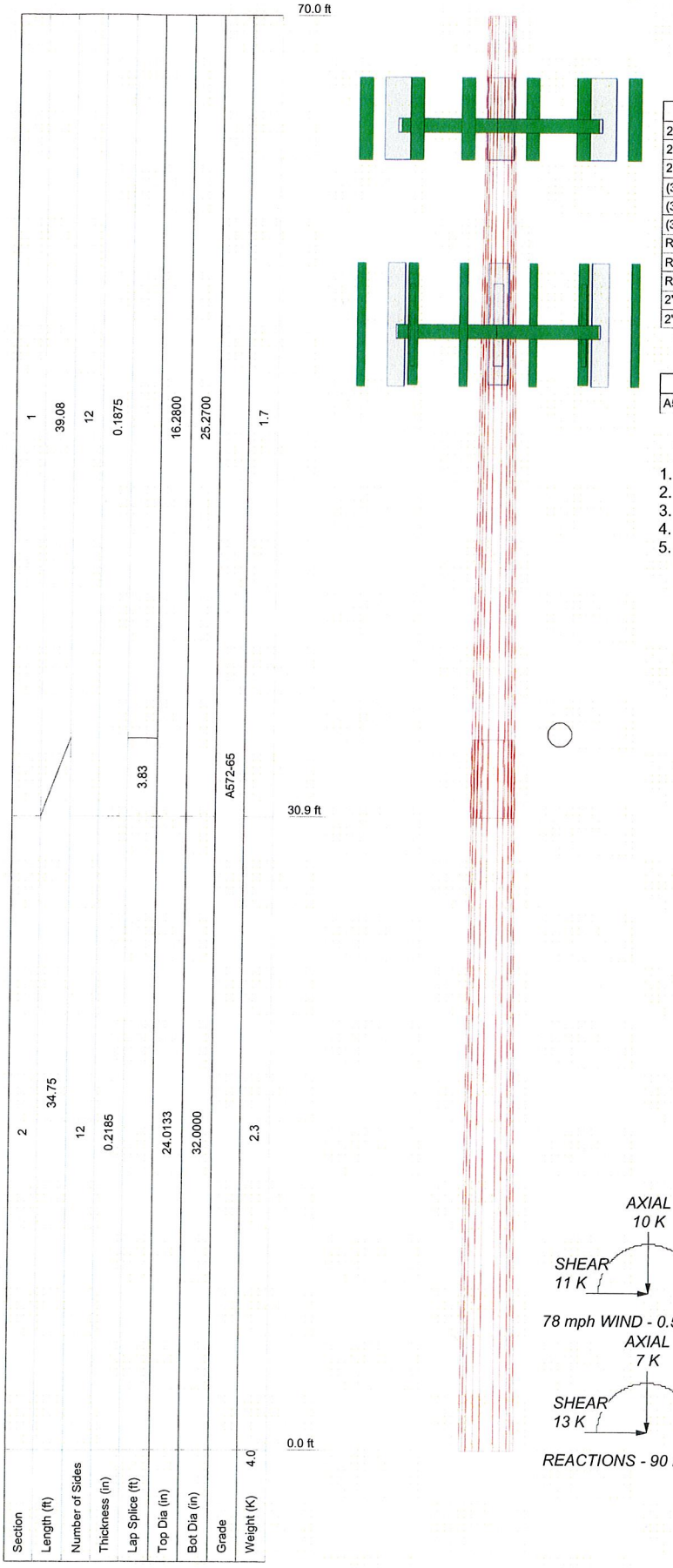
REV	DATE
1	10/05/2009
0	09/02/2009

DRAWN BY: HRS | CHECKED BY: MLL

SHEET NUMBER: **QP-P**

REVISION: 1

VSI #: 091121.02



DESIGNED APPURTENANCE LOADING

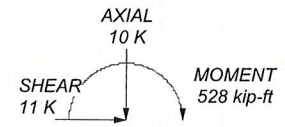
TYPE	ELEVATION	TYPE	ELEVATION
2' Standoff T-Arm (10' face width)	65	2' Standoff T-Arm (10' face width)	55
2' Standoff T-Arm (10' face width)	65	(2) DB846F65ZAXY w/Mount Pipe	55
2' Standoff T-Arm (10' face width)	65	(2) DB846F65ZAXY w/Mount Pipe	55
(3) DB844G45ZAXY w/Mount Pipe	65	(2) DB846F65ZAXY w/Mount Pipe	55
(3) DB844G45ZAXY w/Mount Pipe	65	BXA-70063/6CF with MP	55
(3) DB844G45ZAXY w/Mount Pipe	65	BXA-70063/6CF with MP	55
RR65-18-VDPL2	65	BXA-70063/6CF with MP	55
RR65-18-VDPL2	65	BXA-185063/8CF with MP	55
RR65-18-VDPL2	65	BXA-185063/8CF with MP	55
2' Standoff T-Arm (10' face width)	55	BXA-185063/8CF with MP	55
2' Standoff T-Arm (10' face width)	55		

MATERIAL STRENGTH

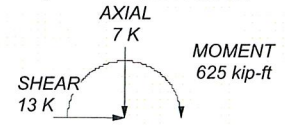
GRADE	Fy	Fu	GRADE	Fy	Fu
A572-65	65 ksi	80 ksi			

TOWER DESIGN NOTES

1. Tower is located in New Haven County, Connecticut.
2. Tower designed for a 90 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 78 mph basic wind with 0.50 in ice.
4. Deflections are based upon a 60 mph wind.
5. TOWER RATING: 93%



78 mph WIND - 0.5000 in ICE



REACTIONS - 90 mph WIND

Vertical Solutions, Inc.
2002 Production Drive
Apex, NC 27539
Phone: 888-321-6167
FAX: 919-321-1768

Job: *New Haven Tweed CT2024*			
Project: *091121.01*			
Client: TowerCo	Drawn by: hsanford		App'd:
Code: TIA/EIA-222-F	Date: 10/05/09		Scale: NTS
Path: C:\Documents and Settings\Vsteps\Desktop\2009\091121 New Haven Tweed, CT\Feb 2\Vsteps\091121.02.tnx			Dwg No. E-1

Tower Input Data

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

Tower is located in New Haven County, Connecticut.
Basic wind speed of 90 mph.
Nominal ice thickness of 0.5000 in.
Ice density of 56 pcf.
A wind speed of 78 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 60 mph.
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in pole design is 1.333.
Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

Options

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

Tapered Pole Section Geometry

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L1	70.00-30.92	39.08	3.83	12	16.2800	25.2700	0.1875	0.7500	A572-65 (65 ksi)
L2	30.92-0.00	34.75		12	24.0133	32.0000	0.2185	0.8740	A572-65 (65 ksi)

Tapered Pole Properties

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
L1	16.8543	9.7158	321.1542	5.7611	8.4330	38.0829	650.7455	4.7818	3.8605	20.59
	26.1614	15.1436	1216.0615	8.9795	13.0899	92.9010	2464.0704	7.4532	6.2699	33.439
L2	25.7724	16.7413	1209.8752	8.5185	12.4389	97.2655	2451.5353	8.2396	5.8500	26.773
	33.1288	22.3605	2882.8128	11.3778	16.5760	173.9149	5841.3602	11.0052	7.9904	36.569

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
L1 70.00-30.92				1	1	1		
L2 30.92-0.00				1	1	1		

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight klf
LDF7-50A (1-5/8 FOAM)	C	No	Inside Pole	65.00 - 0.00	15	No Ice	0.00	0.00
						1/2" Ice	0.00	0.00
LDF7-50A (1-5/8 FOAM)	C	No	Inside Pole	55.00 - 0.00	12	No Ice	0.00	0.00
						1/2" Ice	0.00	0.00

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	70.00-30.92	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	0.66
L2	30.92-0.00	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	0.68

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	70.00-30.92	A	0.500	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	0.66
L2	30.92-0.00	A	0.500	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	0.68

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
2' Standoff T-Arm (10' face width)	A	From Leg	2.00 0.00 0.00	0.0000	65.00	No Ice 1/2" Ice	5.50 6.90	5.50 6.90	0.13 0.17
2' Standoff T-Arm (10' face width)	B	From Leg	2.00 0.00 0.00	0.0000	65.00	No Ice 1/2" Ice	5.50 6.90	5.50 6.90	0.13 0.17
2' Standoff T-Arm (10' face width)	C	From Leg	2.00 0.00 0.00	0.0000	65.00	No Ice 1/2" Ice	5.50 6.90	5.50 6.90	0.13 0.17
2' Standoff T-Arm (10' face width)	A	From Leg	2.00 0.00 0.00	0.0000	55.00	No Ice 1/2" Ice	5.50 6.90	5.50 6.90	0.13 0.17
2' Standoff T-Arm (10' face width)	B	From Leg	2.00 0.00 0.00	0.0000	55.00	No Ice 1/2" Ice	5.50 6.90	5.50 6.90	0.13 0.17
2' Standoff T-Arm (10' face width)	C	From Leg	2.00 0.00 0.00	0.0000	55.00	No Ice 1/2" Ice	5.50 6.90	5.50 6.90	0.13 0.17
(3) DB844G45ZAXY w/Mount Pipe	A	From Leg	4.00 0.00 0.00	0.0000	65.00	No Ice 1/2" Ice	7.71 8.44	5.63 6.73	0.05 0.11
(3) DB844G45ZAXY w/Mount Pipe	B	From Leg	4.00 0.00 0.00	0.0000	65.00	No Ice 1/2" Ice	7.71 8.44	5.63 6.73	0.05 0.11
(3) DB844G45ZAXY w/Mount Pipe	C	From Leg	4.00 0.00 0.00	0.0000	65.00	No Ice 1/2" Ice	7.71 8.44	5.63 6.73	0.05 0.11
RR65-18-VDPL2	A	From Leg	4.00 0.00 0.00	0.0000	65.00	No Ice 1/2" Ice	4.36 4.77	1.97 2.31	0.02 0.04
RR65-18-VDPL2	B	From Leg	4.00 0.00 0.00	0.0000	65.00	No Ice 1/2" Ice	4.36 4.77	1.97 2.31	0.02 0.04
RR65-18-VDPL2	C	From Leg	4.00 0.00 0.00	0.0000	65.00	No Ice 1/2" Ice	4.36 4.77	1.97 2.31	0.02 0.04
(2) DB846F65ZAXY w/Mount Pipe	A	From Leg	4.00 0.00 0.00	0.0000	55.00	No Ice 1/2" Ice	7.27 7.88	7.82 9.01	0.05 0.11
(2) DB846F65ZAXY w/Mount Pipe	B	From Leg	4.00 0.00 0.00	0.0000	55.00	No Ice 1/2" Ice	7.27 7.88	7.82 9.01	0.05 0.11
(2) DB846F65ZAXY w/Mount Pipe	C	From Leg	4.00 0.00 0.00	0.0000	55.00	No Ice 1/2" Ice	7.27 7.88	7.82 9.01	0.05 0.11
BXA-70063/6CF with MP	A	From Leg	4.00 0.00 0.00	0.0000	55.00	No Ice 1/2" Ice	7.75 8.29	6.10 7.04	0.04 0.10
BXA-70063/6CF with MP	B	From Leg	4.00 0.00 0.00	0.0000	55.00	No Ice 1/2" Ice	7.75 8.29	6.10 7.04	0.04 0.10
BXA-70063/6CF with MP	C	From Leg	4.00 0.00 0.00	0.0000	55.00	No Ice 1/2" Ice	7.75 8.29	6.10 7.04	0.04 0.10
BXA-185063/8CF witih MP	A	From Leg	4.00 0.00	0.0000	55.00	No Ice 1/2" Ice	3.18 3.56	3.44 4.05	0.03 0.06

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft Vert ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
BXA-185063/8CF witih MP	B	From Leg	0.00 4.00 0.00 0.00	0.0000	55.00	No Ice 1/2" Ice	3.18 3.56	3.44 4.05	0.03 0.06
BXA-185063/8CF witih MP	C	From Leg	0.00 4.00 0.00 0.00	0.0000	55.00	No Ice 1/2" Ice	3.18 3.56	3.44 4.05	0.03 0.06

Load Combinations

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

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	70 - 30.917	12.375	30	1.3498	0.0000
L2	34.75 - 0	3.434	30	0.8867	0.0000

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
65.00	2' Standoff T-Arm (10' face width)	30	10.916	1.2679	0.0000	12759
55.00	2' Standoff T-Arm (10' face width)	30	8.091	1.1121	0.0000	4253

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	70 - 30.917	27.819	2	3.0348	0.0000
L2	34.75 - 0	7.721	2	1.9940	0.0000

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
65.00	2' Standoff T-Arm (10' face width)	2	24.539	2.8900	0.0000	5698
55.00	2' Standoff T-Arm (10' face width)	2	18.190	2.5991	0.0000	1898

Compression Checks

Pole Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
L1	70 - 30.917 (1)	TP25.27x16.28x0.1875	39.08	0.00	0.0	37.624	14.6112	-3.49	549.74	0.006
L2	30.917 - 0 (2)	TP32x24.0133x0.2185	34.75	0.00	0.0	35.042	22.3605	-7.09	783.56	0.009

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$

Pole Bending Design Data

Section No.	Elevation ft	Size	Actual M_x kip-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y kip-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
L1	70 - 30.917 (1)	TP25.27x16.28x0.1875	231.00	32.060	37.624	0.852	0.00	0.000	37.624	0.000
L2	30.917 - 0 (2)	TP32x24.0133x0.2185	624.89	43.117	35.042	1.230	0.00	0.000	35.042	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L1	70 - 30.917 (1)	TP25.27x16.28x0.1875	9.97	0.682	26.000	0.053	0.00	0.000	26.000	0.000
L2	30.917 - 0 (2)	TP32x24.0133x0.2185	12.79	0.572	26.000	0.045	0.00	0.000	26.000	0.000

Pole Interaction Design Data

Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	70 - 30.917 (1)	0.006	0.852	0.000	0.053	0.000	0.859 ✔	1.333	H1-3+VT ✔
L2	30.917 - 0 (2)	0.009	1.230	0.000	0.045	0.000	1.240 ✔	1.333	H1-3+VT ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
L1	70 - 30.917	Pole	TP25.27x16.28x0.1875	1	-3.49	732.80	64.5	Pass
L2	30.917 - 0	Pole	TP32x24.0133x0.2185	2	-7.09	1044.49	93.0	Pass
							Summary	
						Pole (L2)	93.0	Pass
						RATING =	**93.0**	**Pass**

vertical solutions

VSi Job No.: 091121.02
Date: 10/05/2009
Calculated by: HRS

FLANGE PLATE DESIGN, DEFORMATION METHOD, TIA-222-G

Input -

$M_u := 625kip \cdot ft$ = factored moment reaction at top of base plate

$V_{ut} := 12.79kip$ = factored shear reaction at top of base plate

$\eta := 0.50$ = coefficient per Figure 4.4

$F_{ub} := 100 \cdot ksi$ = specified minimum tensile strength of bolt

$\phi := 0.75$

$b_{eff} := 12.56 \cdot in$ = effective width of base plate in flexure

$t := 2.0 \cdot in$ = thickness of base plate

$F_y := 60 \cdot ksi$ = yield stress of base plate

$d_b := 2.25 \cdot in$

$n := 4.5$

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

$\phi R_{nt} := \phi \cdot F_{ub} \cdot A_n$

$\phi R_{nt} = 243.576 \cdot kip$

CONSTANTS:

$psi \equiv \frac{lb}{in^2}$

$ksi \equiv 1000 \cdot psi$

$kip \equiv 1000 \cdot lb$

$$Q := \begin{pmatrix} 2 \\ 4 \\ 2 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} \quad d := \begin{pmatrix} 1 \cdot 12 + 7 + \frac{9}{16} \\ 1 \cdot 12 + 1 + \frac{13}{16} \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} \cdot in \quad A := \begin{pmatrix} 3.25 \\ 3.25 \\ 3.25 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} in^2 \quad \phi R_{nt} := \begin{pmatrix} 243.5 \\ 243.5 \\ 243.5 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} kip$$

$V_{utn} := V_{ut}$

$V_{un} := \frac{V_{utn}}{\sum \overrightarrow{(Q)}}$

$$V_u := \begin{pmatrix} V_{un} \\ V_{un} \\ V_{un} \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}$$

ϕR_{nt} = nominal tension strength

d = distance from center

A = area of fastener

Q = quantity of fasteners

$\sum \overrightarrow{(Q)} = 8$

$sumQAd := \sum \overrightarrow{\left(Q \cdot d^2 \cdot A \right)}$

$sumQAd = 4968 \cdot in^4$

$P_u := \frac{M_u \cdot \overrightarrow{(d \cdot A)}}{sumQAd}$

$r := \left(\frac{P_u + \frac{V_u}{\eta}}{\phi R_{nt}} \right)$

[section 4.9.9]

$$P_u = \begin{pmatrix} 95.987 \\ 67.774 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} \cdot kip \quad V_u = \begin{pmatrix} 1.599 \\ 1.599 \\ 1.599 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} \cdot kip \quad r = \begin{pmatrix} 40.733 \\ 29.146 \\ 1.313 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} \cdot \%$$

$$m := \begin{pmatrix} 3 + \frac{9}{16} \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} \cdot in \qquad M_{PL} := \overrightarrow{\left[\left(\frac{Q}{2}\right) \cdot P_u \cdot m\right]}$$

$$M_{PL} = \begin{pmatrix} 28.496 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix} \cdot kip \cdot ft \qquad \sum M_{PL} = 342.0 \cdot kip \cdot in$$

$$S_{PL} := \frac{b_{eff} \cdot t^2}{6}$$

$$Z_{PL} := 1.5 \cdot S_{PL}$$

$$\phi M_n := 0.9 \cdot F_y \cdot Z_{PL}$$

$$r_b := \frac{\sum M_{PL}}{\phi M_n}$$

$r_b = 50 \cdot \%$

without Stiffeners