T-Mobile

15 Commerce Way
Suite B
Norton, MA 02766

STRUCTURAL ANALYSIS
4PB1259A

Address:
638 CONGRESS STREET
PORTLAND, ME 04101

Date:
JULY 11, 2017

CHAPPELL ENGINEERING ASSOCIATES, LLC
Civil • Structural • Land Surveying

R.K. Executive Centre ■ 201 Boston Post Road West ■ Suite 101 ■ Marlborough, MA 01752
t. 508.481.7400 ■ www.chappellengineering.com ■ f. 508.481.7406

July 11, 2017

T-Mobile
15 Commerce Way
Suite B
Norton, MA 02766

Structural Analysis of Antenna Loads

RE:

Site Number	4PB1259A
Site Name	PB259 / Comfac - Lafayette
Site Address	638 Congress Street, Portland, ME 04101

To whom it may concern:

Chappell Engineering Associates, LLC has reviewed the existing antenna installation at the above referenced location. Based upon the site visit completed on 06-05-2017, the *alpha*, *beta* and *gamma* sector antennas are located on the face of the existing rooftop penthouse. The existing antenna mounts consist of cantilevered antenna pipe masts secured to the face of the penthouse.

The existing T-Mobile sectors currently consist of two (2) existing panel antennas per sector. T-Mobile currently proposes to re-configure the existing antenna configuration by removing and replacing one existing antenna in its place and installing a proposed antenna on the existing antenna mount. Additionally, three (3) Remote Radio Units and three (3) style 3CX TMA's will be located on the exiting antenna mounts. Also, two (2) hybrid DC/Fiber cables will be run to service the proposed antennas

The current antenna configuration consists of:

Sectors	Status	Antenna/Appurtenance	Dimensions (in)	Location
Alpha, Beta , Gamma	Existing	(1) RFS APX16DWV-S-E-A20	56H x 13W x 3.2D	Face of Penthouse
	Existing	(1) Andrew LNX-6515DS-A1M	96.6H x 11.9W x 7.1D	Face of Penthouse
	Existing	(1) RFS Twin TMA's	12H x 10W x 4D	Face of Penthouse
	Existing	(2) TMA's	14H x 6W x 4D	Face of Penthouse

T-Mobile currently proposes to re-configure the existing antennas as shown (final total configuration):

Sectors	Status	Antenna/Appurtenance	Dimensions (in)	Location
Alpha, Beta , Gamma	Proposed	(1) Commscope FF-65C-R2 Panel	96H x 25.2Wx 9.3D	Face of Penthouse
	Proposed	(1) Ericsson 4478 B71 RRU	15H x 13.2Wx 7.4D	Face of Penthouse
	Existing	(1) RFS APX16DWV-S-E-A20 Panel	56H x 13W x 3.2D	Face of Penthouse
	Proposed	(1) RFS Style 3CX TMA	11.2H x 8.0Wx 4.9D	Face of Penthouse
	Proposed	(2) RFS ACU-A20-S	4H x 1.6Wx 3.5D	Face of Penthouse

The proposed antennas will be installed on the existing pipe currently supporting the existing AIR antennas.

Based upon our review of the loads, our stability analysis of the existing antenna mounting pipes, Chappell Engineering Associates, LLC has determined that the existing antenna support structures **have adequate capacity** to support the proposed L600MHz modernization upgrade configuration as shown above. Photos of the existing antenna mounts are enclosed for your convenience. A copy of the proposed L600MHz antenna upgrade mounting plan being proposed by Chappell Engineering is also enclosed.

If you have any questions regarding this matter, please do not hesitate to call.

Very truly yours,
CHAPPELL ENGINEERING ASSOCIATES, LLC

STATE OF MAINE
CLEMENT J. SALEK
No. 11793
LICENSED
PROFESSIONAL ENGINEER

Clement J Salek, P.E.
CJS/cjs

Alpha Sector Antennas

Beta Sector Antennas

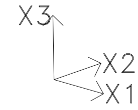
Gamma Sector Antennas

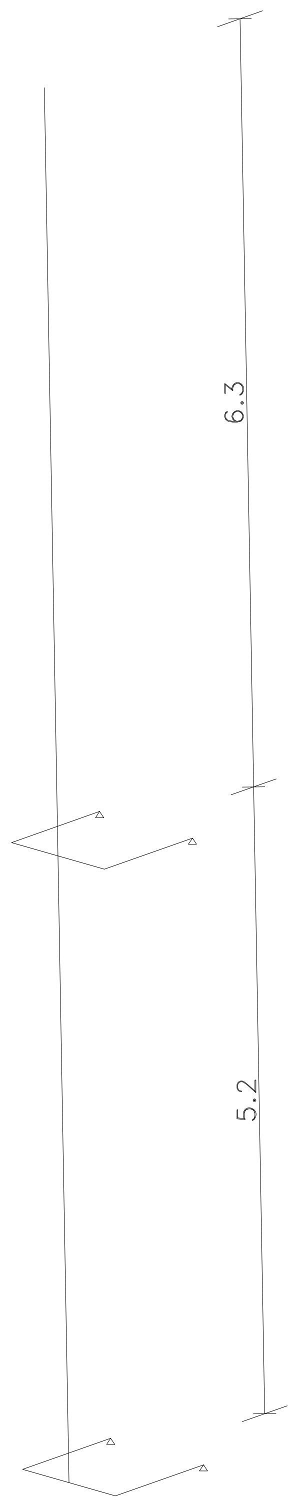
Rear of Antennas

638 Congress St Portland T-Mobile

SCALE = 1:18

DATE: 7/11/17





638 Congress St Portland T-Mobile

Prepared by: *Date:* 7/11/17

Load no. 1: Selfweight (units - kips ft.)

/ BEAM LOADS
SELF X3 -1. B 1 TO 11
/ END

F O R C E S U M M A T I O N

FX1=0. kip
FX2=0. kip
FX3=-0.0996 kip

Load no. 2: Antenna X2 (units - kips ft.)

/ BEAM LOADS
DIST GL FX2 0. B 3 2
/ BEAM LOADS
DIST GL FX2 0.075 B 3 2
/ END

F O R C E S U M M A T I O N

FX1=0. kip
FX2=0.6 kip
FX3=0. kip

Load no. 3: Antenna X1 (units - kips ft.)

/ BEAM LOADS
DIST GL FX1 0.03 B 3 2
/ END

F O R C E S U M M A T I O N

FX1=0.24 kip
FX2=0. kip
FX3=0. kip

Load no. 4: Antenna Dead Load (units - kips ft.)

/ JOINT LOADS
/ JOINT LOADS
FX3 -0.055 N 4 2
/ END STATIC

Load no. 4: Antenna Dead Load (units - kips ft.)

F O R C E S U M M A T I O N

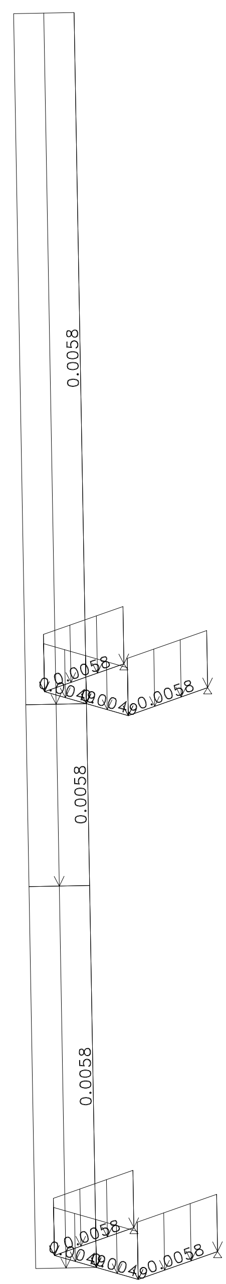
FX1=0. kip
FX2=0. kip
FX3=-0.11 kip

638 Congress St Portland T-Mobile

Load 1: Selfweight

X3 X2 X1

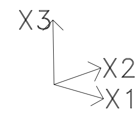
SCALE = 1:20	UNITS: kip ft	DATE: 7/11/17

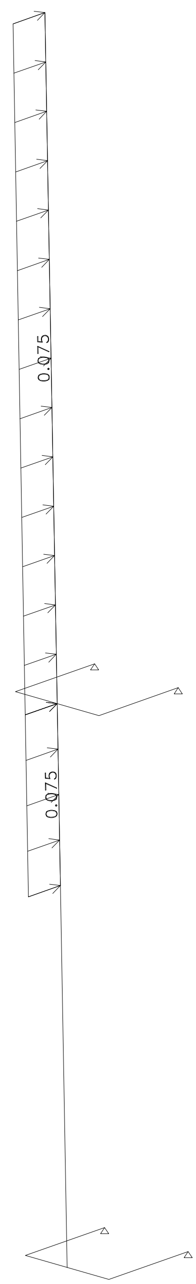


638 Congress St Portland T-Mobile

Load 2: Antenna X2

SCALE = 1:20	UNITS: kip ft	DATE: 7/11/17

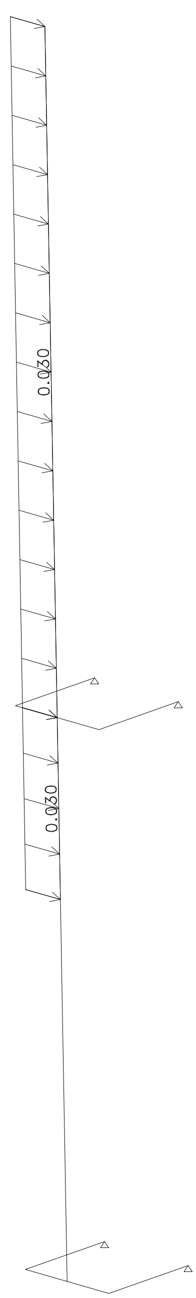




638 Congress St Portland T-Mobile

Load 3: Antenna X1

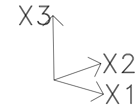
SCALE = 1:20	UNITS: kip ft	DATE: 7/11/17

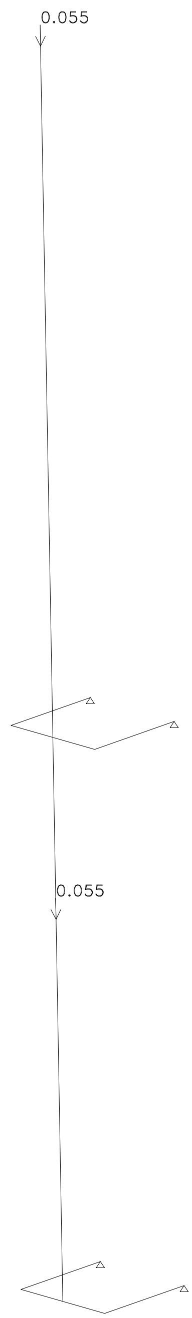


638 Congress St Portland T-Mobile

Load 4: Antenna Dead Load

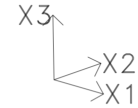
SCALE = 1:20	UNITS: kip ft	DATE: 7/11/17

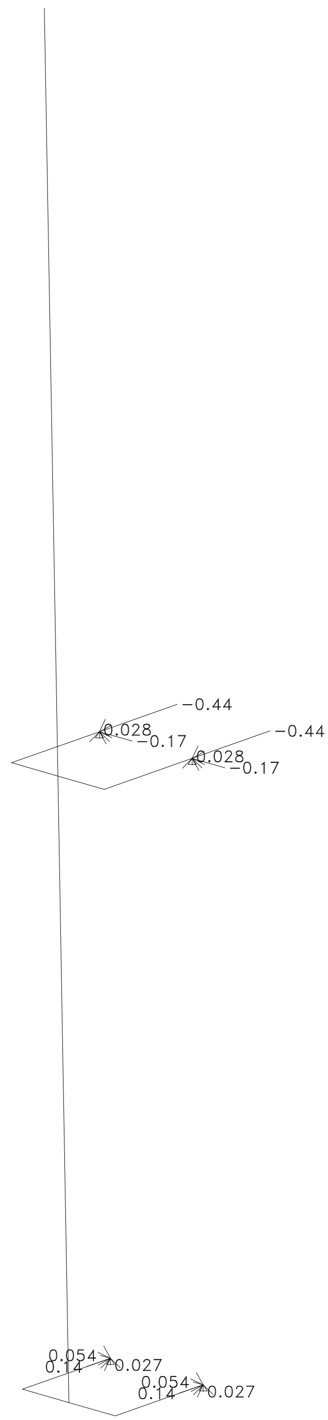




638 Congress St Portland T-Mobile

SCALE = 1:18	UNITS: kip	DATE: 7/11/17





REACTIONS LOADS ENVELOPE

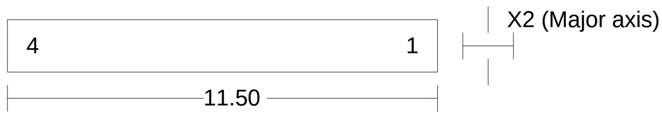
638 Congress St Portland T-Mobile — ***Code:*** AISC-ASD

Prepared by: — ***Date:*** 7/11/17

Detailed Results Table

*Moments: kips*foot , Forces: kips , Stresses: ksi , Section prop.: inch*

Beam:
3, 2, 1



CONSTRAINTS

- Sections : Check
- Steel Grade: A53

DESIGN DATA

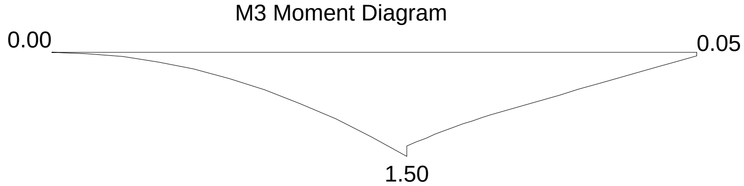
- Kx = 1.00 - Ky = 1.00
- Allow. Slend. : 200 (compr.) 300 (tens.)
- Allowable Deflection : 1/240
- Tension Area Reduction Factor : 1.00
- Building type : Unbraced

Section: PIPE 2-1/2

Ix = 1.53 Iy = 1.53in4 Sx = 1.06 Sy = 1.06in3 Area = 1.70
D = 2.87 t = 0.20in
J = 3.06 Cw = 0.00in6

DESIGN COMBINATION = 2

M3 Moment Diagram



Max. AXIAL Force = 0.05 (tens.), -0.09 (compr.) Max. SHEAR Force = 0.47

DESIGN	EQUATION	FACTORS	VALUES	RESULT
V2 Shear (F4-1)	V/(Av*Fv) <1.00 Fv=0.4*Fy	Av = 1.02	V = 0.47 Fv = 14.00	0.03
M3 Moment (F3-1)	M / S*Fb < 1.00	S = 1.06 Fb =0.660 *Fy	M = 1.50 S*Fb = 2.05	0.73
Deflection	defl. / L / 240 < 1.00		defl = 0.51412	0.89
Combined Stresses (Local) (H1-2) (H2-1)	fa / 0.6Fy (Ft) + fbx / Fbx + fby / Fby < 1.00	fbx = 0.00 Fbx= 0.00 fby = 16.94 Fby= 23.10	P = 0.09 A = 1.70 Fu = 60.00 fb = M/S	0.74
Axial Force (E2-1/2)	fa / Fa < 1.00	(kL/r)x =115 (kL/r)y =115 Cc = 128.10	P = 0.09 Ag = 1.70 Fa = 10.92	0.00
Combined Stresses (tension) (H2-1)	fa / Ft + fbx / Fbx + fby / Fby < 1.00	Fbx = 23.10 Fby = 23.10	fbx = 0.00 fby = 16.94	0.73