STRUCTURAL ANALYSIS REPORT

For

ME 5045 (LTE 3C)

PORTLAND USM

246 Deering Avenue
Portland, ME 03082

Antennas Mounted on Pipe Masts Secured to Parapet walls and Penthouse Façade; Equipment Platform on the Roof

Prepared for:

EMPIRE telecom

at&t

Dated: March 2, 2016

STATE OF MAINE
DANIEL P. HAMM
No. 10344
LICENSED PROFESSIONAL ENGINEER

Prepared by:

Hudson Design Group LLC

1600 Osgood Street Building 20 North, Suite 3090
North Andover, MA 01845
Phone: (978) 557-5553
www.hudsondesigngroupllc.com

Hudson Design Group LLC

SCOPE OF WORK:

Hudson Design Group LLC (HDG) has been authorized by AT&T to conduct a structural evaluation of the structure that will support the existing AT&T equipment located in the areas depicted in the latest HDG's construction drawings.

This report represents this office's findings, conclusions and recommendations pertaining to the support of AT&T's proposed equipment.

This office performed an on-site visual survey of the above areas on January 27, 2016. Attendees included Rick Greene (HDG – Field Technician).

CONCLUSION SUMMARY:

As-built plans prepared by Donald L. Dimick dated May 1970 were available for our use. A limited visual survey of the structure was completed in or near the areas of the Proposed Work. The following documents were used for our reference:

- Original construction drawings prepared by Aerial Spectrum dated April 26, 2006.
- Previous HDG Structural Analysis Report dated March 8, 2012.

Based on our evaluation, we have determined that the existing structure **IS CAPABLE** of supporting the proposed equipment loading with the following modification:

- **Brace the existing parapets with new steel angle kickers tied back to the roof structure secured with epoxy anchors at both ends (See the latest HDG construction drawings for details).**
- **Reinforce the existing H-Frame supporting the existing Purcell Cabinet with new pipe masts and new angle kickers secured to the roof with epoxy anchors (See the latest HDG construction drawings for details).**

Referenced documents are attached.

Hudson Design Group LLC

APPURTENANCE/EQUIPMENT CONFIGURATION:

(3) 7770 Antennas (55"x11"x5" – Wt. = 35 lbs. /each) (One per sector)

(1) SBNH-1D6565C Antenna (96.4"x11.9"x7.1" – Wt. = 61 lbs. each) (Alpha)

(1) HPA-65R-BUU-H8 Antenna (92.4"x14.8"x7.4" – Wt. = 73 lbs. each) (Alpha)

(1) TPA-65R-LCUUUU-H8 Antenna (96"x14.4"x8.6" – Wt. = 75 lbs. each) (Alpha)

(1) AM-X-CD-14-65-00T-RET Antenna (48"x11.8"x5.9" – Wt. = 37 lbs. each) (Beta)

(1) SBNHH-1D65A Antenna (55"x11.85"x7.1" – Wt. = 41 lbs. each) (Beta)

(2) QS66512-3 Antennas (72"x12"x9.6" – Wt. = 105 lbs. each) (Beta & Gamma)

(1) AM-X-CD-16-65-00T-RET Antenna (72"x11.8"x5.9" – Wt. = 49 lbs. each) (Gamma)

(1) HPA-65R-BUU-H6 Antenna (72"x14.8"x9" – Wt. = 56 lbs. each) (Gamma)

(9) RRUS-11 RRH (19.7"x17"x7.2" – Wt. = 51 lbs. /each) (Three per sector)

(6) A2 Modules (16.4"x15.2"x3.4" – Wt. = 22 lbs. /each) (Two per sector)

(3) RRH (RRUS-32) (26.7"x12.1"x6.7" – Wt. = 60 lbs. /each) (One per sector)

(3) Squid Surge Suppressors (24"x9.7"ø - Wt. = 33 lbs. /each) (One per sector)

(3) 9E Surge Suppressors (11.5"x10.4"x6.3" - Wt. = 43.5 lbs. /each) (One per sector)

Hudson Design Group LLC

DESIGN CRITERIA:

1. International Building Code (IBC) 2009, and ASCE 7-05 (Minimum Design Loads for Buildings and Other Structures).

   Wind Analysis:

Reference Wind Speed:	100 mph	(FIG 6-1C; ASCE 7-05)
Category:	C	(Section 6.5.6.3; ASCE 7-05)

   Roof:

Ground Snow, P_g:	60 psf	(FIG 7-1; ASCE 7-05)
Importance Factor, I:	1.0	(Category II)
Exposure Factor, Ce:	1.0	(Exp. B- Partially Exposed)
Thermal Factor, Ct:	1.0	(Typical Structure)
Flat Roof Snow Load:	**42 psf**	**(P_f=0.7*Ce*Ct*I*P_g)**

2. EIA/TIA -222- G Structural Standards for Steel Antenna Towers and Antenna Supporting Structures

City/Town:	Portland
County:	Cumberland
Wind Load:	100 mph
Nominal Ice Thickness:	1 inch

3. Approximate height above grade to the center of the Antennas:

   92'-5"+/- (Alpha)
   88'-3"+/- (Beta & Gamma)

Hudson Design Group LLC

EXISTING ROOF CONSTRUCTION:

The existing roof construction consists of a roofing membrane over a reinforced concrete slab supported by reinforced concrete columns and bearing walls.

ANTENNA SUPPORT RECOMMENDATIONS:

- The new Alpha sector antenna is proposed to be mounted on a new pipe mast attached to existing angle wall mounts secured to the existing penthouse façade with epoxy anchors.

- The new Beta and Gamma sector antennas are proposed to be mounted on new pipe masts attached to existing steel angles secured to the existing parapet walls with epoxy anchors.

  HDG recommends bracing the existing parapets with new steel angle kickers tied back to the roof structure secured with epoxy anchors at both ends.

RRH SUPPORT RECOMMENDATIONS:

- The new Alpha sector RRH's are proposed to be mounted on new unistrut components secured to the existing penthouse façade with epoxy anchors.

- The new Beta & Gamma sector RRH's are proposed to be mounted on new unistrut components attached to existing steel angles secured to the existing parapets with epoxy anchors.

Limitations and assumptions:

1. Reference the latest HDG construction drawings for all the equipment locations details.

2. Mount all equipment per manufacturer's specifications.

3. All structural members and their connections are assumed to be in good condition and are free from defects with no deterioration to its member capacities.

4. All antennas, coax cables and waveguide cables are assumed to be properly installed and supported as per the manufacturer requirements.

5. HDG is not responsible for any modifications completed prior to and hereafter which HDG was not directly involved.

6. If field conditions differ from what is assumed in this report, then the engineer of record is to be notified as soon as possible.

7. A condition assessment of the roof was not part of the scope of work.

FIELD PHOTOS:

Photo 1: Sample photo illustrating the existing antennas.

Photo 2: Sample photo illustrating the existing antennas.

FIELD PHOTOS (Cont.):

Photo 3: Sample photo illustrating the existing antennas.

Photo 4: Sample photo illustrating the existing Purcell cabinet on existing H-Frame (to be reinforced).

Hudson Design Group LLC

Alpha Sector Calculations

Date: 03-02-2016
Project Name: Portland USM
Project Number: ME5045
Designed By: GH **Checked By:** MSC

Hudson Design Group LLC

ALPHA

2.6.5.2 Velocity Pressure Coeff:

$K_z = 2.01\ (z/z_g)^{2/\alpha}$

z_g= 900 (ft)

K_z= 1.245

α= 9.5

z= 92.42 (ft)

$K_{zmin} \le K_z \le 2.01$

Table 2-4

Exposure	Z_g	α	K_{zmin}	K_e
B	1200 ft	7.0	0.70	0.9
C	900 ft	9.5	0.85	1.0
D	700 ft	11.5	1.03	1.1

2.6.6.4 Topographic Factor:

Table 2-5

Topo. Category	K_t	f
2	0.43	1.25
3	0.53	2.0
4	0.72	1.5

$K_{zt} = [1+(K_e K_t/K_h)]^2$

$K_h = e^{(f*z/H)}$

K_{zt}= #DIV/0!

K_h= #DIV/0!

K_e= 0 (from Table 2-4)

(If Category 1 then K_{zt}=1.0)

K_t= 0 (from Table 2-5)

f= 0 (from Table 2-5)

Category=	1

z= 92.42

H= 0 (Ht. of the crest above surrounding terrain)

K_{zt}= 1.00

Date: 03-02-2016
Project Name: Portland USM
Project Number: ME5045
Designed By: GH Checked By: MSC

Hudson Design Group LLC

2.6.7 Gust Effect Factor

2.6.7.1 Self Supporting Lattice Structures

Gh = 1.0 Latticed Structures > 600 ft

Gh = 0.85 Latticed Structures 450 ft or less

Gh = 0.85 + 0.15 [h/150 - 3.0] h= ht. of structure

h=	85	Gh=	0.85

2.6.7.2 Guyed Masts Gh= 0.85

2.6.7.3 Pole Structures Gh= 1.1

2.6.9 Appurtenances Gh= 1.0

2.6.7.4 Structures Supported on Other Structures
(Cantilivered tubular or latticed spines, pole, structures on buildings (ht. : width ratio > 5)

Gh=	1.35	**Gh=**	**1.35**

Date: 03-02-2016
Project Name: Portland USM
Project Number: ME5045
Designed By: GH Checked By: MSC

Hudson Design Group LLC

2.6.9.2 Design Wind Force on Appurtenances

$F = qz*Gh*(EPA)_A$

$q_z = 0.00256*K_z*K_{zt}*K_d*V_{max}^2*I$

q_z= 30.27

K_z=	1.245
K_{zt}=	1.0
K_d=	0.95
V_{max}=	100
I=	1.0

Table 2-2

Structure Type	Wind Direction Probability Factor, Kd
Latticed structures with triangular, square or rectangular cross sections	0.85
Tubular pole structures, latticed structures with other cross sections, appurtenances	0.95

Determine Cf:

If lattice Structure See Manual

If Tubular Pole Structure, Use Corrected Value from Table 2.7 Below

C mph.ft	Round	18 Sided	16 Sided	12 Sided	8 Sided
< 32 (Subcritical)	1.2	1.2	1.2	1.2	1.2
32 to 64 (Transitional)	$38.4/C^{1.0}$	$25.8/C^{0.885}$	$12.6/C^{0.678}$	$2.99/C^{0.263}$	1.2
> 64 (Supercritical)	0.6	0.65	0.75	1	1.2

$C = (I*K_{zt}*K_z)^{0.5}*V*D$

D = Outside diameter for rounds: 0.25 feet

C= 27.89 **Cf=** 1.2

Date: 03-02-2016
Project Name: Portland USM
Project Number: ME5045
Designed By: GH Checked By: MSC

Hudson Design Group LLC

Determine Ca:

Table 2-8

Force Coefficients (Ca) for Appurtenances				
Member Type		**Aspect Ratio ≤ 2.5**	**Aspect Ratio = 7**	**Aspect Ratio ≥ 25**
		Ca	**Ca**	**Ca**
Flat		1.2	1.4	2.0
Round	**C < 32** (Subcritical)	0.7	0.8	1.2
	32 ≤ C ≤ 64 (Transitional)	$3.76/(C^{0.485})$	$3.37/(C^{0.415})$	$38.4/(C^{-1.0})$
	C > 64 (Supercritical)	0.5	0.6	0.6

Aspect Ratio is the overall length/width ratio in the plane normal to the wind direction.
(Aspect ratio is independent of the spacing between support points of a linear appurtenance, and the section length considered to have uniform wind load).

Note: Linear interpolation may be used for aspect ratios other than those shown.

Appurtenances	Height	Width	Depth	Flat Area	Aspect Ratio	Ca	Force (lbs)
TPA-65R-LCUUUU-H8	96.0	14.4	8.6	9.60	6.67	1.39	**543**
RRUS-32	26.7	12.1	6.7	2.24	2.21	1.20	**110**

ICE WEIGHT CALCULATIONS

Project: ME5045 - Portland USM

Thickness of ice: 1 in.
Density of ice: 56 pcf

TPA-65R-LCUUUU-H8 Antenna

Weight of ice based on total radial SF area:

Depth (in):	8.6	
height (in):	96	
Width (in):	14.4	
Total weight of ice on object:		167 lbs
Weight of object:	75 lbs	
Combined weight of ice and object:		242 lbs

QS66512-3 Antenna

Weight of ice based on total radial SF area:

Depth (in):	9.6	
height (in):	72	
Width (in):	12	
Total weight of ice on object:		121 lbs
Weight of object:	105 lbs	
Combined weight of ice and object:		226 lbs

HPA-65R-BUU-H6 Antenna

Weight of ice based on total radial SF area:

Depth (in):	9	
height (in):	72	
Width (in):	14.8	
Total weight of ice on object:		132 lbs
Weight of object:	56 lbs	
Combined weight of ice and object:		188 lbs

AM-X-CD-16-65-00T-RET Antenna

Weight of ice based on total radial SF area:

Depth (in):	5.9	
height (in):	72	
Width (in):	11.8	
Total weight of ice on object:		99 lbs
Weight of object:	49 lbs	
Combined weight of ice and object:		148 lbs

9E Surge Suppressor

Weight of ice based on total radial SF area:

Depth (in):	6.3	
height (in):	11.5	
Width (in):	10.4	
Total weight of ice on object:		21 lbs
Weight of object:	43.5 lbs	
Combined weight of ice and object:		64 lbs

2-3/8" Pipe

Per foot weight of ice:

diameter (in):	2.38	
Per foot weight of ice on object:		3 plf

RRUS-11 RRH

Weight of ice based on total radial SF area:

Depth (in):	7.2	
height (in):	19.7	
Width (in):	17	
Total weight of ice on object:		45 lbs
Weight of object:	51 lbs	
Combined weight of ice and object:		96 lbs

RRUS-32 RRH

Weight of ice based on total radial SF area:

Depth (in):	6.7	
height (in):	26.7	
Width (in):	12.1	
Total weight of ice on object:		44 lbs
Weight of object:	60 lbs	
Combined weight of ice and object:		104 lbs

LGP21401 TMA

Weight of ice based on total radial SF area:

Depth (in):	2.7	
height (in):	14.4	
Width (in):	9	
Total weight of ice on object:		16 lbs
Weight of object:	19 lbs	
Combined weight of ice and object:		35 lbs

A2 Module

Weight of ice based on total radial SF area:

Depth (in):	3.4	
height (in):	16.4	
Width (in):	15.2	
Total weight of ice on object:		28 lbs
Weight of object:	22 lbs	
Combined weight of ice and object:		50 lbs

Fiber Box

Weight of ice based on total radial SF area:

Depth (in):	6	
height (in):	13	
Width (in):	13	
Total weight of ice on object:		25 lbs
Weight of object:	20 lbs	
Combined weight of ice and object:		45 lbs

3.5x3.5x0.3125 Angle

Weight of ice based on total radial SF area:

Depth (in):	0.3125	
height (in):	12	
Width (in):	7	
Per foot weight of ice on object:		6 plf

Project:

Location: Alpha sector pipe mast
Multi-Loaded Multi-Span Beam
[2009 International Building Code(AISC 13th Ed ASD)]
Pipe 2 Std. x 9.0 FT (1 + 5.5 + 2.5) / ASTM A53-GR.B
Section Adequate By: 35.4%
Controlling Factor: Deflection

Gregory Haggstrom, EIT
Hudson Design Group LLC
1600 Osgood Street, Bldg 20N, Suite 3090
North Andover, MA 01845

StruCalc Version 8.0.113.0 3/2/2016 10:24:41 AM

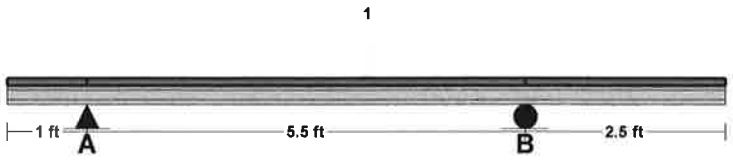
DEFLECTIONS	Left		Center		Right	
Live Load	-0.08	IN 2L/292	0.16	IN L/408	-0.25	IN 2L/244
Dead Load	0.00	in	0.00	in	0.00	in
Total Load	-0.08	IN 2L/288	0.16	IN L/404	-0.25	IN 2L/244

Live Load Deflection Criteria: L/180 Total Load Deflection Criteria: L/180

REACTIONS	A		B	
Live Load	197	lb	346	lb
Dead Load	12	lb	21	lb
Total Load	209	lb	367	lb
Bearing Length	0.29	in	0.29	in

BEAM DATA	Left		Center		Right	
Span Length	1	ft	5.5	ft	2.5	ft
Unbraced Length-Top	1	ft	5.5	ft	2.5	ft
Unbraced Length-Bottom	1	ft	5.5	ft	2.5	ft

LOADING DIAGRAM



UNIFORM LOADS	Left		Center		Right	
Uniform Live Load	0	plf	0	plf	0	plf
Uniform Dead Load	0	plf	0	plf	0	plf
Beam Self Weight	4	plf	4	plf	4	plf
Total Uniform Load	4	plf	4	plf	4	plf

POINT LOADS - CENTER SPAN

Load Number	One
Live Load	543 lb
Dead Load	0 lb
Location	3.5 ft

STEEL PROPERTIES
Pipe 2 Std. - A53-GR.B

Properties:

Steel Yield Strength:	Fy =	35	ksi
Modulus of Elasticity:	E =	29000	ksi
Tube Steel Section (X Axis):	dx =	2.38	in
Tube Steel Section (Y Axis):	dy =	2.38	in
Tube Steel Wall Thickness:	t =	0.143	in
Area:	A =	1	in2
Moment of Inertia (X Axis):	Ix =	0.63	in4
Section Modulus (X Axis):	Sx =	0.53	in3
Plastic Section Modulus:	Z =	0.71	in3

Design Properties per AISC 13th Edition Steel Manual:

Flange Buckling Ratio:	FBR =	16.61	
Allowable Flange Buckling Ratio:	AFBR =	58	
Allowable Flange Buckling Ratio non-compact:	AFBR_NC =	256.86	
Nominal Flexural Strength w/ Safety Factor:	Mn =	1245	ft-lb
Controlling Equation:	F8-1		
Shear Buckling Stress Coefficient Eqn. G6-2a:	Fcr =	21	ksi
Nominal Shear Strength w/ Safety Factor:	Vn =	6287	lb

Controlling Moment: 689 ft-lb
3.47 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 1, 2, 3
Controlling Shear: -357 lb
6.0 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s

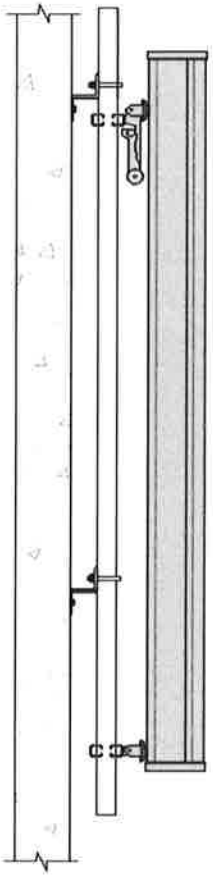
Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	0.46 in4	0.63 in4
Moment:	689 ft-lb	1245 ft-lb
Shear:	-357 lb	6287 lb

NOTES

Site Name: Portland USM
Site No. ME5045
Done by: GH **Checked by:** MSC
Date: 3/2/2016

Hudson Design Group LLC

CHECK CONNECTION CAPACITY (ALPHA)



Reference: Original CD's by Aerial Spectrum

Epoxy Type =	HIT-HY20	
Anchor Diameter =	1/2	in.
Min. Embedment Depth =	2	in.

Allowable Tensile Load =

F_{Tall} = 525 lbs.

Allowable Shear Load =

F_{Vall}= 1230 lbs.

TENSILE FORCES

Reaction **F =** 346 lbs.
(See StruCalc Results)

GRAVITY LOADS

Weight + Ice 310 lbs.

No. of Supports = 2
No. of Anchors / Support = 2

Tension Design Load / Anchor =

f_t= 173.00 lbs. < 525 lbs. **Therefore, OK !**

Shear Design Load / Anchor=

f_v= 77.50 lbs. < 1230 lbs. **Therefore, OK !**

CHECK COMBINED TENSION AND SHEAR

f_t / F_T	+	f_v / F_V	≤	1.0			
0.330	+	0.063	=	0.393	<	1.0	**Therefore, OK !**

Hudson Design Group LLC

Beta & Gamma Sector Calculations

Date: 03-02-2016
Project Name: Portland USM
Project Number: ME5045
Designed By: GH **Checked By:** MSC

Hudson Design Group LLC

BETA & GAMMA

2.6.5.2 Velocity Pressure Coeff:

$K_z = 2.01\ (z/z_g)^{2/\alpha}$

z= 88.25 (ft)

z_g= 900 (ft)

α= 9.5

K_z= 1.233

$K_{zmin} \le K_z \le 2.01$

Table 2-4

Exposure	Z_g	α	K_{zmin}	K_e
B	1200 ft	7.0	0.70	0.9
C	900 ft	9.5	0.85	1.0
D	700 ft	11.5	1.03	1.1

2.6.6.4 Topographic Factor:

Table 2-5

Topo. Category	K_t	f
2	0.43	1.25
3	0.53	2.0
4	0.72	1.5

$K_{zt} = [1+(K_e K_t/K_h)]^2$

$K_h = e^{(f*z/H)}$

K_{zt}= #DIV/0!

K_h= #DIV/0!

K_e= 0 (from Table 2-4)

(If Category 1 then K_{zt} =1.0)

K_t= 0 (from Table 2-5)

f= 0 (from Table 2-5)

Category=	1

z= 88.25

H= 0 (Ht. of the crest above surrounding terrain)

K_{zt}= 1.00

Date: 03-02-2016
Project Name: Portland USM
Project Number: ME5045
Designed By: GH Checked By: MSC

Hudson Design Group LLC

2.6.7 Gust Effect Factor

2.6.7.1 Self Supporting Lattice Structures

Gh = 1.0 Latticed Structures > 600 ft

Gh = 0.85 Latticed Structures 450 ft or less

Gh = 0.85 + 0.15 [h/150 - 3.0] h= ht. of structure

h= 280 Gh= 0.85

2.6.7.2 Guyed Masts Gh= 0.85

2.6.7.3 Pole Structures Gh= 1.1

2.6.9 Appurtenances Gh= 1.0

2.6.7.4 Structures Supported on Other Structures
(Cantilivered tubular or latticed spines, pole, structures on buildings (ht. : width ratio > 5)

Gh= 1.35 **Gh= 1.35**

Date: 03-02-2016
Project Name: Portland USM
Project Number: ME5045
Designed By: GH Checked By: MSC

Hudson Design Group LLC

2.6.9.2 Design Wind Force on Appurtenances

$F = qz*Gh*(EPA)_A$

$q_z = 0.00256*K_z*K_{zt}*K_d*V_{max}^2*I$

q_z= 29.98

K_z= 1.233
K_{zt}= 1.0
K_d= 0.95
V_{max}= 100
I= 1.0

Table 2-2

Structure Type	Wind Direction Probability Factor, Kd
Latticed structures with triangular, square or rectangular cross sections	0.85
Tubular pole structures, latticed structures with other cross sections, appurtenances	0.95

Determine Cf:

If lattice Structure See Manual

If Tubular Pole Structure, Use Corrected Value from Table 2.7 Below

C mph.ft	Round	18 Sided	16 Sided	12 Sided	8 Sided
< 32 (Subcritical)	1.2	1.2	1.2	1.2	1.2
32 to 64 (Transitional)	$38.4/C^{1.0}$	$25.8/C^{0.885}$	$12.6/C^{0.678}$	$2.99/C^{0.263}$	1.2
> 64 (Supercritical)	0.6	0.65	0.75	1	1.2

$C = (I*K_{zt}*K_z)^{0.5}*V*D$

D = Outside diameter for rounds: 0.25 feet

C= 27.76 **Cf=** 1.2

Date: 03-02-2016
Project Name: Portland USM
Project Number: ME5045
Designed By: GH Checked By: MSC

Hudson Design Group LLC

Determine Ca:

Table 2-8

Force Coefficients (Ca) for Appurtenances				
Member Type		Aspect Ratio ≤ 2.5	Aspect Ratio = 7	Aspect Ratio ≥ 25
		Ca	Ca	Ca
Flat		1.2	1.4	2.0
Round	C < 32 (Subcritical)	0.7	0.8	1.2
	32 ≤ C ≤ 64 (Transitional)	$3.76/(C^{0.485})$	$3.37/(C^{0.415})$	$38.4/(C^{1.0})$
	C > 64 (Supercritical)	0.5	0.6	0.6

Aspect Ratio is the overall length/width ratio in the plane normal to the wind direction.
(Aspect ratio is independent of the spacing between support points of a linear appurtenance, and the section length considered to have uniform wind load).

Note: Linear interpolation may be used for aspect ratios other than those shown.

Appurtenances	Height	Width	Depth	Flat Area	Aspect Ratio	Ca	Force (lbs)
QS66512-3	72.0	12.0	9.6	6.00	6.00	1.36	**329**
HPA-65R-BUU-H6	72.0	14.8	9.0	7.40	4.86	1.31	**391**
AM-X-CD-16-65-00T-RET	72.0	11.8	5.9	5.90	6.10	1.36	**325**
RRUS-11 (Shielded)	19.7	5.0	7.2	0.68	3.94	1.26	**35**
RRUS-32	26.7	12.1	6.7	2.24	2.21	1.20	**109**
9E Surge	11.5	10.4	6.3	0.83	1.11	1.20	**40**
Fiber Box	13.0	13.0	6.0	1.17	1.00	1.20	**57**

ICE WEIGHT CALCULATIONS

Project: ME5045 - Portland USM

Thickness of ice: 1 in.
Density of ice: 56 pcf

TPA-65R-LCUUUU-H8 Antenna

Weight of ice based on total radial SF area:

Depth (in):	8.6	
height (in):	96	
Width (in):	14.4	
Total weight of ice on object:		167 lbs
Weight of object:	75 lbs	
Combined weight of ice and object:		242 lbs

RRUS-11 RRH

Weight of ice based on total radial SF area:

Depth (in):	7.2	
height (in):	19.7	
Width (in):	17	
Total weight of ice on object:		45 lbs
Weight of object:	51 lbs	
Combined weight of ice and object:		96 lbs

QS66512-3 Antenna

Weight of ice based on total radial SF area:

Depth (in):	9.6	
height (in):	72	
Width (in):	12	
Total weight of ice on object:		121 lbs
Weight of object:	105 lbs	
Combined weight of ice and object:		226 lbs

RRUS-32 RRH

Weight of ice based on total radial SF area:

Depth (in):	6.7	
height (in):	26.7	
Width (in):	12.1	
Total weight of ice on object:		44 lbs
Weight of object:	60 lbs	
Combined weight of ice and object:		104 lbs

HPA-65R-BUU-H6 Antenna

Weight of ice based on total radial SF area:

Depth (in):	9	
height (in):	72	
Width (in):	14.8	
Total weight of ice on object:		132 lbs
Weight of object:	56 lbs	
Combined weight of ice and object:		188 lbs

LGP21401 TMA

Weight of ice based on total radial SF area:

Depth (in):	2.7	
height (in):	14.4	
Width (in):	9	
Total weight of ice on object:		16 lbs
Weight of object:	19 lbs	
Combined weight of ice and object:		35 lbs

AM-X-CD-16-65-00T-RET Antenna

Weight of ice based on total radial SF area:

Depth (in):	5.9	
height (in):	72	
Width (in):	11.8	
Total weight of ice on object:		99 lbs
Weight of object:	49 lbs	
Combined weight of ice and object:		148 lbs

A2 Module

Weight of ice based on total radial SF area:

Depth (in):	3.4	
height (in):	16.4	
Width (in):	15.2	
Total weight of ice on object:		28 lbs
Weight of object:	22 lbs	
Combined weight of ice and object:		50 lbs

9E Surge Suppressor

Weight of ice based on total radial SF area:

Depth (in):	6.3	
height (in):	11.5	
Width (in):	10.4	
Total weight of ice on object:		21 lbs
Weight of object:	43.5 lbs	
Combined weight of ice and object:		64 lbs

Fiber Box

Weight of ice based on total radial SF area:

Depth (in):	6	
height (in):	13	
Width (in):	13	
Total weight of ice on object:		25 lbs
Weight of object:	20 lbs	
Combined weight of ice and object:		45 lbs

2-3/8" Pipe

Per foot weight of ice:

diameter (in):	2.38	
Per foot weight of ice on object:		3 plf

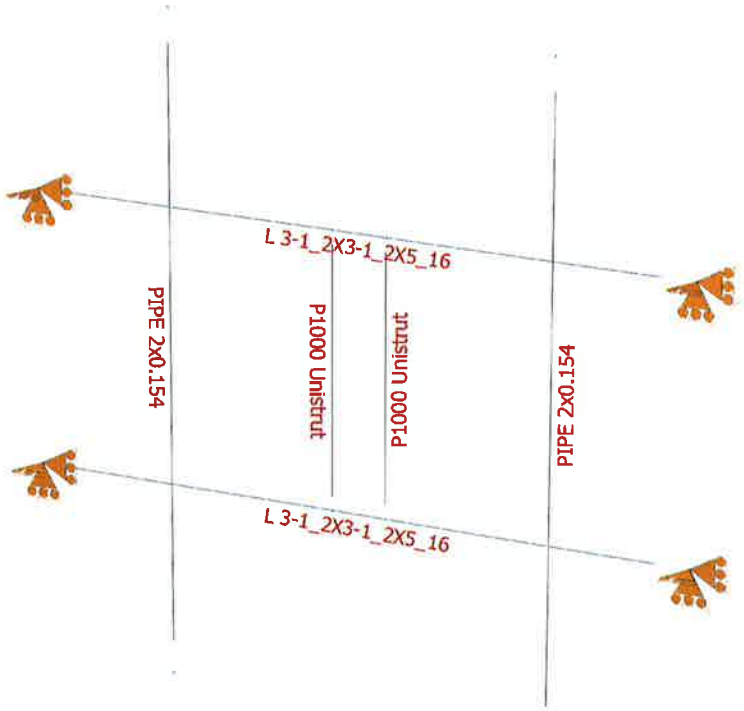
3.5x3.5x0.3125 Angle

Weight of ice based on total radial SF area:

Depth (in):	0.3125	
height (in):	12	
Width (in):	7	
Per foot weight of ice on object:		6 plf

Bentley

Current Date: 3/2/2016 10:04 AM
Units system: English
File name: W:\STRUCTURAL DEPARTMENT\ANALYSIS SOFTWARE\RAM Elements\RAM Projects\ME5045.etz\


L 3-1_2X3-1_2X5_16
PIPE 2x0.154
P1000 Unistrut
P1000 Unistrut
PIPE 2x0.154
L 3-1_2X3-1_2X5_16

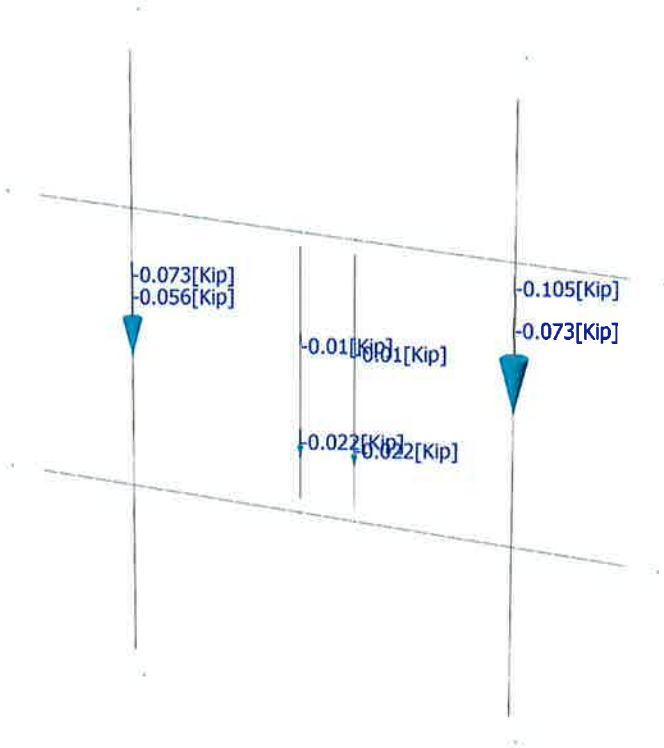

Y
Z
X

Bentley

Current Date: 3/2/2016 10:04 AM
Units system: English
File name: W:\STRUCTURAL DEPARTMENT\ANALYSIS SOFTWARE\RAM Elements\RAM Projects\ME5045.etz\
Load condition: DL=Dead Load

Loads

Concentrated - Members

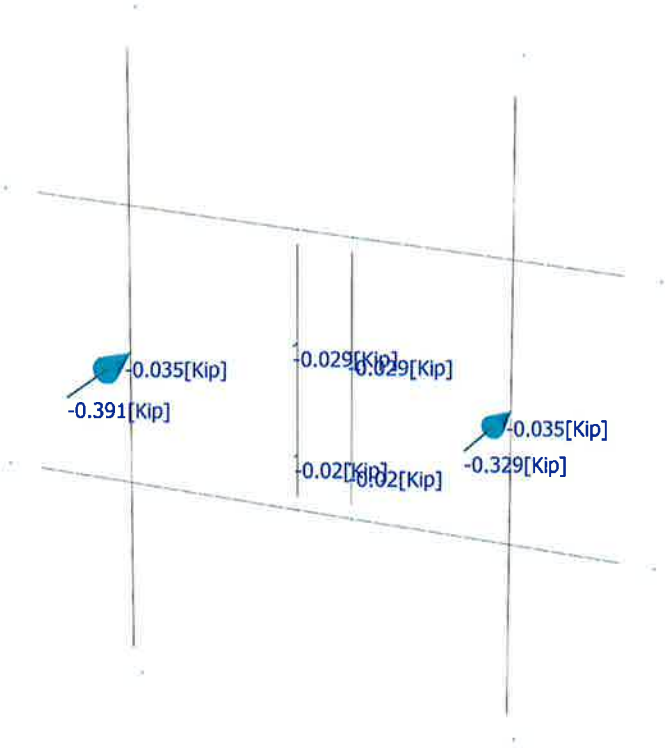


Bentley

Current Date: 3/2/2016 10:04 AM
Units system: English
File name: W:\STRUCTURAL DEPARTMENT\ANALYSIS SOFTWARE\RAM Elements\RAM Projects\ME5045.etz\
Load condition: W=Wind Load

Loads

Concentrated - Members

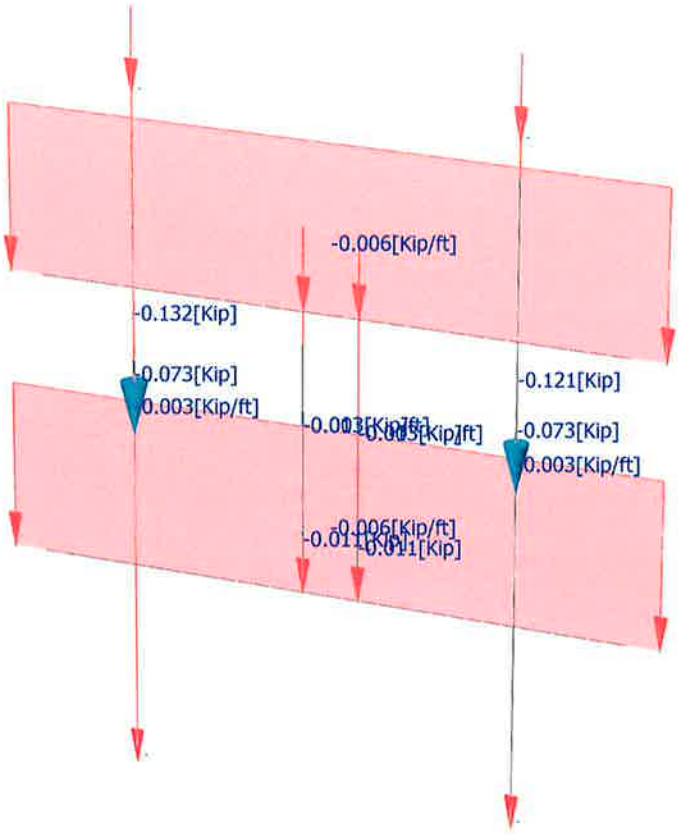


Bentley

Current Date: 3/2/2016 10:04 AM
Units system: English
File name: W:\STRUCTURAL DEPARTMENT\ANALYSIS SOFTWARE\RAM Elements\RAM Projects\ME5045.etz\
Load condition: I=Ice Load

Loads

Global distributed - Members
Local distributed - Members
Concentrated - Members

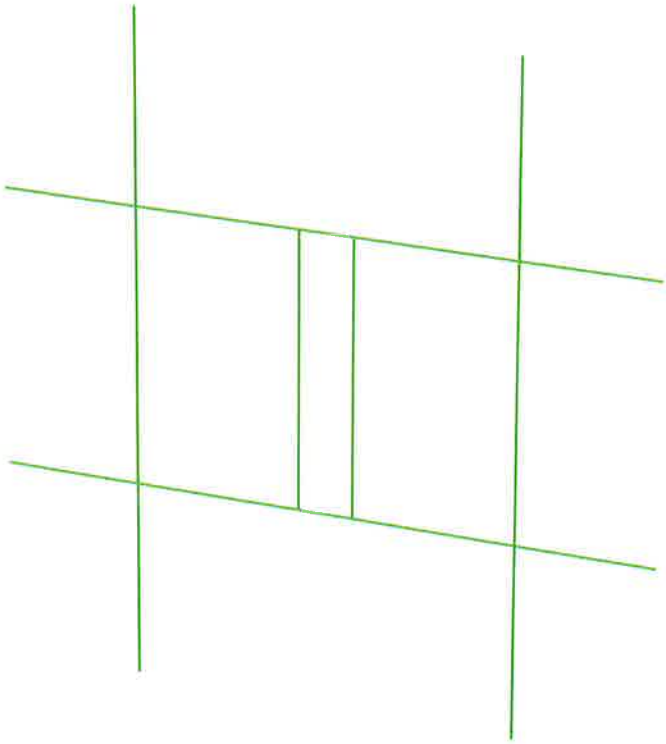


Bentley

Current Date: 3/2/2016 10:04 AM
Units system: English
File name: W:\STRUCTURAL DEPARTMENT\ANALYSIS SOFTWARE\RAM Elements\RAM Projects\ME5045.etz\

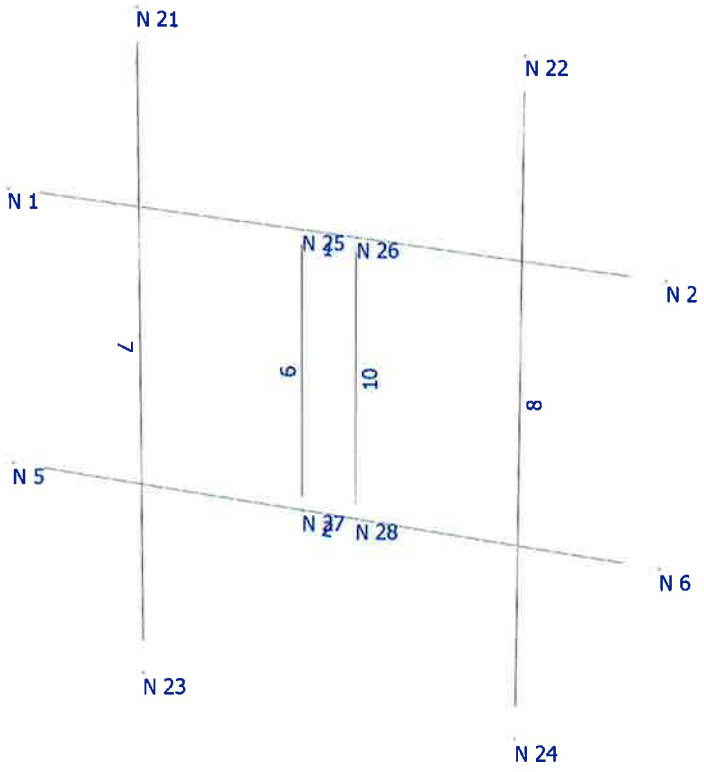
Design status

- Not designed
- Error on design
- Design O.K.
- With warnings



Bentley

Current Date: 3/2/2016 10:04 AM
Units system: English
File name: W:\STRUCTURAL DEPARTMENT\ANALYSIS SOFTWARE\RAM Elements\RAM Projects\ME5045.etz\



Bentley

Current Date: 3/2/2016 10:05 AM
Units system: English
File name: W:\STRUCTURAL DEPARTMENT\ANALYSIS SOFTWARE\RAM Elements\RAM Projects\ME5045.etz\

Steel Code Check

Report: Summary - For all selected load conditions

Load conditions to be included in design :

LC1=1.2DL+1.6W
LC2=0.9DL+1.6W
LC3=1.2DL+W+I
LC4=1.2DL
LC5=0.9DL

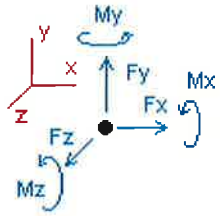
Description	Section	Member	Ctrl Eq.	Ratio	Status	Reference
	L 3-1_2X3-1_2X5_16	**1**	LC1 at 21.25%	0.36	OK	Eq. H1-1b
			LC2 at 21.25%	**0.37**	**OK**	Eq. H1-1b
			LC3 at 80.00%	0.23	OK	Eq. H1-1b
			LC4 at 80.00%	0.10	OK	Eq. H1-1b
			LC5 at 80.00%	0.08	OK	Eq. H1-1b
		2	LC1 at 20.00%	**0.37**	**OK**	Eq. H1-1b
			LC2 at 20.00%	0.35	OK	Eq. H1-1b
			LC3 at 20.00%	0.35	OK	Eq. H1-1b
			LC4 at 80.00%	0.10	OK	Eq. H1-1b
			LC5 at 80.00%	0.07	OK	Eq. H1-1b
	P1000 Unistrut	**9**	LC1 at 37.50%	**0.13**	**OK**	Eq. H1-1b
			LC2 at 37.50%	0.13	OK	Eq. H1-1b
			LC3 at 37.50%	0.09	OK	Eq. H1-1b
			LC4 at 100.00%	0.02	OK	Eq. H1-1b
			LC5 at 100.00%	0.01	OK	Eq. H1-1b
		10	LC1 at 37.50%	**0.13**	**OK**	Eq. H1-1b
			LC2 at 37.50%	0.13	OK	Eq. H1-1b
			LC3 at 37.50%	0.08	OK	Eq. H1-1b
			LC4 at 100.00%	0.01	OK	Eq. H1-1b
			LC5 at 100.00%	0.01	OK	Eq. H1-1b
	PIPE 2x0.154	**7**	LC1 at 50.00%	**0.32**	**OK**	Eq. H1-1b
			LC2 at 50.00%	0.32	OK	Eq. H1-1b
			LC3 at 68.75%	0.29	OK	Eq. H1-1b
			LC4 at 29.17%	0.12	OK	Eq. H1-1b
			LC5 at 29.17%	0.09	OK	Eq. H1-1b
		8	LC1 at 50.00%	0.27	OK	Eq. H1-1b
			LC2 at 50.00%	0.27	OK	Eq. H1-1b
			LC3 at 68.75%	**0.29**	**OK**	Eq. H1-1b
			LC4 at 29.17%	0.12	OK	Eq. H1-1b
			LC5 at 29.17%	0.09	OK	Eq. H1-1b

Bentley

Current Date: 3/2/2016 10:05 AM
Units system: English
File name: W:\STRUCTURAL DEPARTMENT\ANALYSIS SOFTWARE\RAM Elements\RAM Projects\ME5045.etz\

Analysis result

Reactions

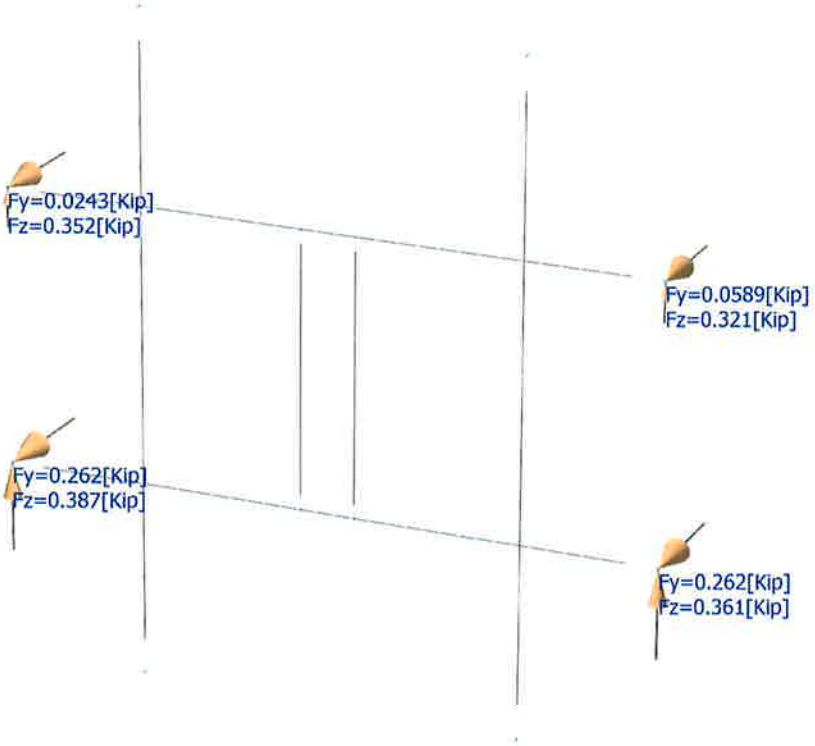


Direction of positive forces and moments

	Forces [Kip]			Moments [Kip*ft]		
Node	**FX**	**FY**	**FZ**	**MX**	**MY**	**MZ**
Condition **LC1=1.2DL+1.6W**						
1	-0.14232	0.02430	0.35193	0.00000	0.00000	0.00000
2	0.14231	0.05886	0.32074	0.00000	0.00000	0.00000
5	0.14232	0.26178	0.38740	0.00000	0.00000	0.00000
6	-0.14231	0.26151	0.36073	0.00000	0.00000	0.00000
SUM	0.00000	0.60644	1.42080	0.00000	0.00000	0.00000
Condition **LC2=0.9DL+1.6W**						
1	-0.12701	-0.01227	0.35511	0.00000	0.00000	0.00000
2	0.12735	0.01788	0.32451	0.00000	0.00000	0.00000
5	0.12701	0.22669	0.38422	0.00000	0.00000	0.00000
6	-0.12735	0.22254	0.35696	0.00000	0.00000	0.00000
SUM	0.00000	0.45483	1.42080	0.00000	0.00000	0.00000
Condition **LC3=1.2DL+W+I**						
1	-0.16192	0.20511	0.20167	0.00000	0.00000	0.00000
2	0.16165	0.23003	0.18173	0.00000	0.00000	0.00000
5	0.16192	0.34378	0.26042	0.00000	0.00000	0.00000
6	-0.16165	0.34652	0.24419	0.00000	0.00000	0.00000
SUM	0.00000	1.12544	0.88800	0.00000	0.00000	0.00000
Condition **LC4=1.2DL**						
1	-0.06124	0.14628	-0.01272	0.00000	0.00000	0.00000
2	0.05984	0.16392	-0.01508	0.00000	0.00000	0.00000
5	0.06124	0.14037	0.01272	0.00000	0.00000	0.00000
6	-0.05984	0.15587	0.01508	0.00000	0.00000	0.00000
SUM	0.00000	0.60644	0.00000	0.00000	0.00000	0.00000

Condition **LC5=0.9DL**

1	-0.04593	0.10971	-0.00954	0.00000	0.00000	0.00000
2	0.04488	0.12294	-0.01131	0.00000	0.00000	0.00000
5	0.04593	0.10528	0.00954	0.00000	0.00000	0.00000
6	-0.04488	0.11690	0.01131	0.00000	0.00000	0.00000
SUM	0.00000	0.45483	0.00000	0.00000	0.00000	0.00000


Fy=0.0243[Kip]
Fz=0.352[Kip]
Fy=0.0589[Kip]
Fz=0.321[Kip]
Fy=0.262[Kip]
Fz=0.387[Kip]
Fy=0.262[Kip]
Fz=0.361[Kip]
Y
Z
X

Site Name: Portland USM
Site No. ME5045
Done by: GH **Checked by:** MSC
Date: 3/2/2016

Hudson Design Group LLC

CHECK CONNECTION CAPACITY (BETA & GAMMA)

Reference: Original CD's by Aerial Spectrum

Epoxy Type = HIT-HY20
Anchor Diameter = 1/2 in.
Min. Embedment Depth = 2 in.

Allowable Tensile Load =

F_{Tall} = 525 lbs.

Allowable Shear Load =

F_{Vall}= 1230 lbs.

TENSILE FORCES

Reaction **F =** 387 lbs.
(See Ram Output)

SHEAR FORCES

Reaction 347 lbs.

No. of Supports = 4
No. of Anchors / Support = 2

Tension Design Load / Anchor =

f_t= 193.50 lbs. < 525 lbs. **Therefore, OK !**

Shear Design Load / Anchor=

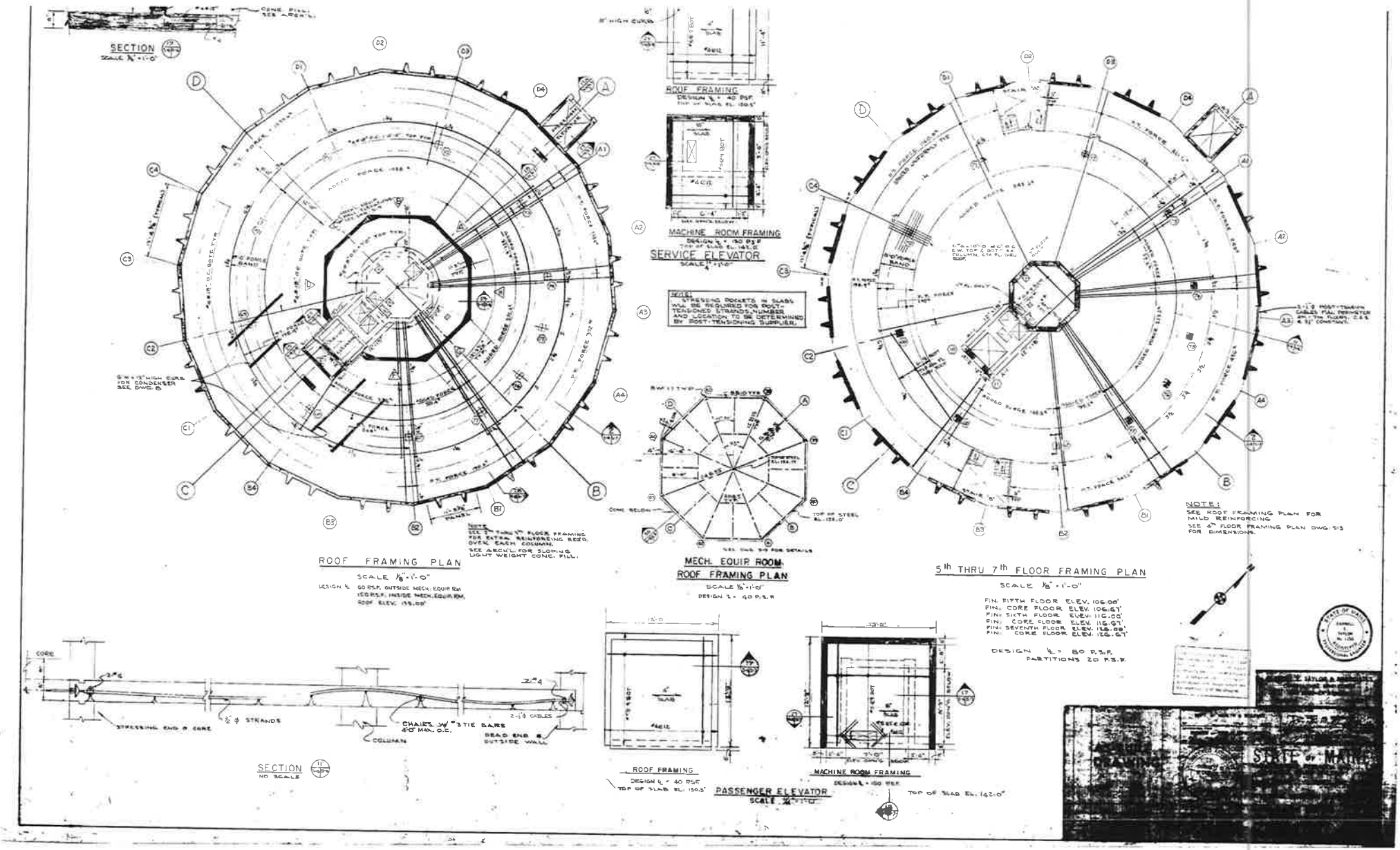
f_v= 173.50 lbs. < 1230 lbs. **Therefore, OK !**

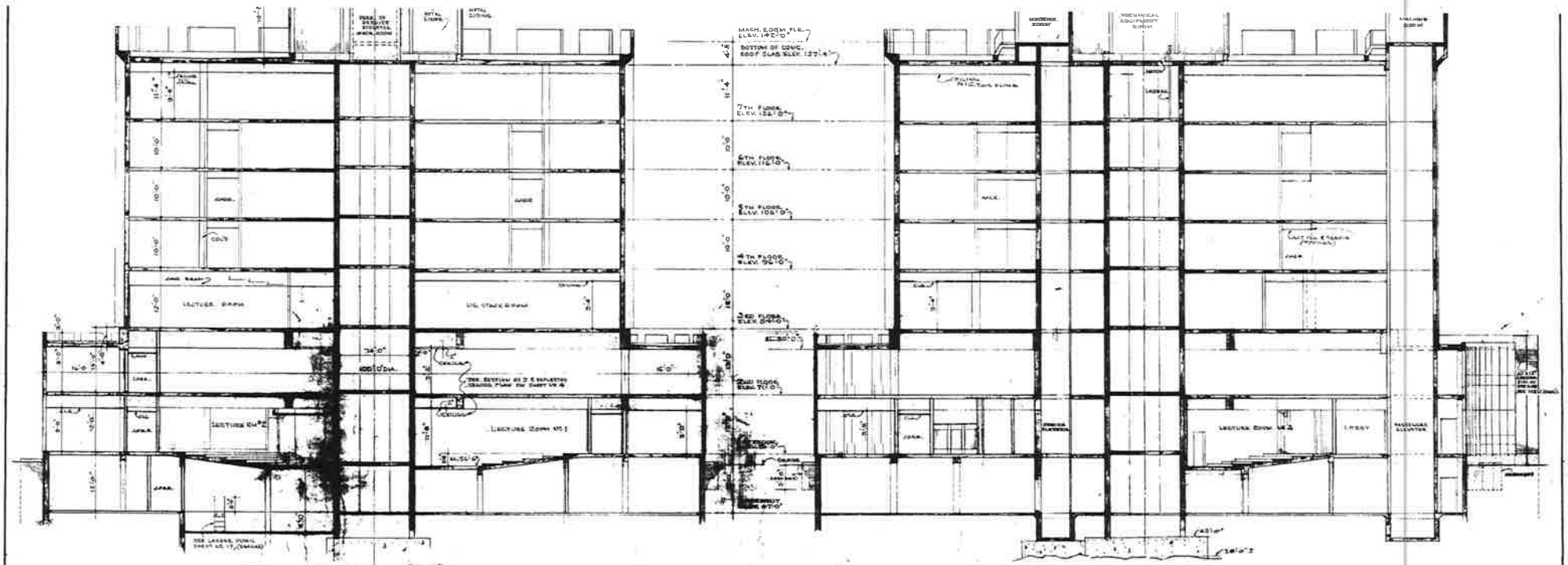
CHECK COMBINED TENSION AND SHEAR

f_t / F_T	+	f_v / F_V	≤	1.0			
0.369	+	0.141	=	0.510	<	1.0	**Therefore, OK !**

Hudson Design Group LLC

Referenced Documents


SECTION
SCALE ½"=1'-0"
ROOF FRAMING PLAN
SCALE ⅛"=1'-0"
DESIGN L = 50 P.S.F. OUTSIDE MECH. EQUIP RM
150 P.S.F. INSIDE MECH. EQUIP RM.
ROOF ELEV. 155.00'
NOTE:
SEE 5th THRU 7th FLOOR FRAMING FOR EXTRA REINFORCING REQ'D. OVER EACH COLUMN.
SEE ARCH'L FOR SLOPING LIGHT WEIGHT CONC. FILL.
ROOF FRAMING
DESIGN L = 40 P.S.F.
TOP OF SLAB EL. 150.5'
MACHINE ROOM FRAMING
DESIGN L = 150 P.S.F.
TOP OF SLAB EL. 141.5'
SERVICE ELEVATOR
SCALE ¼"=1'-0"
NOTE:
STRESSING POCKETS IN SLABS WILL BE REQUIRED FOR POST-TENSIONED STRANDS. NUMBER AND LOCATION TO BE DETERMINED BY POST-TENSIONING SUPPLIER.
MECH. EQUIP ROOM
ROOF FRAMING PLAN
SCALE ⅛"=1'-0"
DESIGN L = 40 P.S.F.
5th THRU 7th FLOOR FRAMING PLAN
SCALE ⅛"=1'-0"
FIN. FIFTH FLOOR ELEV. 106.00'
FIN. CORE FLOOR ELEV. 106.67'
FIN. SIXTH FLOOR ELEV. 116.00'
FIN. CORE FLOOR ELEV. 116.67'
FIN. SEVENTH FLOOR ELEV. 126.00'
FIN. CORE FLOOR ELEV. 126.67'
DESIGN L = 80 P.S.F.
PARTITIONS 20 P.S.F.
NOTE:
SEE ROOF FRAMING PLAN FOR MILD REINFORCING
SEE 4th FLOOR FRAMING PLAN DWG. S13 FOR DIMENSIONS.
CORE
STRESSING END @ CORE
½" ϕ STRANDS
CHAIRS @ 4'-0" MAX. O.C.
3"x3" TIE BARS
2-1⅜ CABLES
COLUMN
DEAD END @ OUTSIDE WALL
SECTION
NO SCALE
ROOF FRAMING
DESIGN L = 40 PSF
TOP OF SLAB EL. 150.5'
PASSENGER ELEVATOR
SCALE ¼"=1'-0"
MACHINE ROOM FRAMING
DESIGN L = 150 PSF
TOP OF SLAB EL. 142.0'



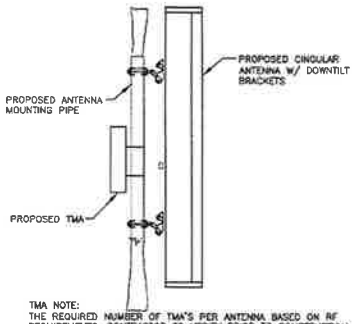
CROSS SECTION ON (B)-(D) LINE TOWARDS SOUTH

CROSS SECTION ON (C)-(A) LINE TOWARDS WEST

AS-BUILT DRAWING

STATE OF MAINE

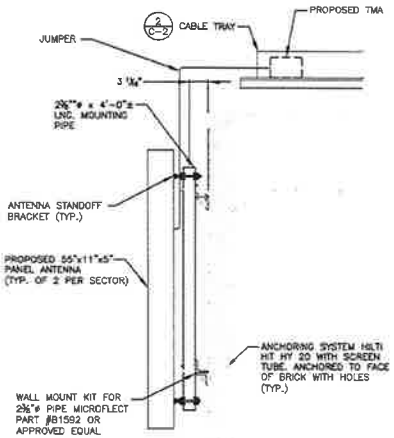
REVISIONS



TMA NOTE:
THE REQUIRED NUMBER OF TMA'S PER ANTENNA BASED ON RF REQUIREMENTS. CONTRACTOR TO VERIFY PRIOR TO CONSTRUCTION

ANTENNA DETAIL 1

SCALE: N.T.S.

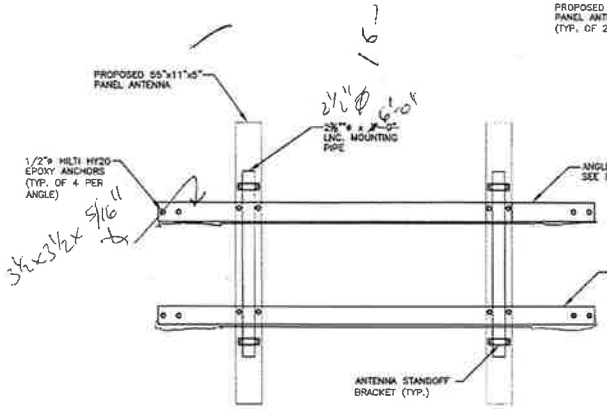


NOTES:

1. PRIME AND PAINT ALL MOUNTING BRACKETS AND ANTENNAS TO MATCH (E) BUILDING FACADE W/GROUT LINES.

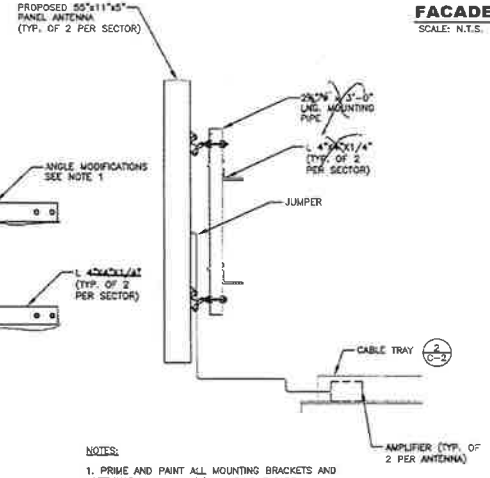
FACADE ANTENNA MOUNTING DETAIL 2

SCALE: N.T.S.



NOTES:

1. CUT AND BEND ANGLE FLUSH WITH PARAPET WING. (TYP. OF 2 PER ANGLE)

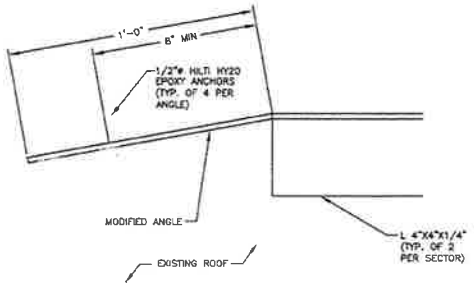


NOTES:

1. PRIME AND PAINT ALL MOUNTING BRACKETS AND ANTENNAS TO MATCH (E) BUILDING FACADE W/GROUT LINES.

ANTENNA MOUNTING DETAILS 2

SCALE: N.T.S.



ANGLE MOUNTING DETAIL 4

SCALE: N.T.S.

AERIAL SPECTRUM

One General Way
PO Box 373
Reading, MA 01880
tel. (781) 942 0024
fax (781) 942 0551
e-mail eamon@aerialspectrum.com

ME5045
USM PORTLAND
DEERING AVENUE
PORTLAND, ME 03082

cingular SM WIRELESS
CONSTRUCTION DEPARTMENT
580 MAIN STREET
BOLTON, MA 01740
PHONE: (781) 690-7422
FAX: (781) 690-7474

NO.	DATE	REVISIONS	BY	CHK	APP'D
D	04-26-05	FOR COMMENT	PRC	PLM	ETK
C	04-13-05	FOR COMMENT	PRC	PLM	ETK
B	02-14-05	FOR COMMENT	PRC	PLM	ETK
A	11-01-05	FOR COMMENT	PRC	PLM	ETK

SCALE: AS SHOWN | DESIGNED: PRC ETK | DRAWN: PRC PM

PROFESSIONAL STAMP

CINGULAR WIRELESS

CONSTRUCTION DETAILS

DRAWING NUMBER	REV
C-4	D