STRUCTURAL ANALYSIS REPORT

For

ME 5045 (LTE)

PORTLAND USM

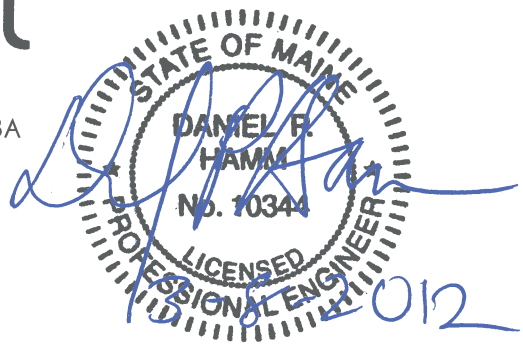
246 Deering Avenue
Portland, ME 03082

Equipment Curb on the Roof; Antennas Mounted on the Building Façade

Prepared for:

at&t

500 Enterprise Drive, Suite 3A
Rock Hill, CT 06067



Dated:

March 8, 2012

Prepared by:
HUDSON DESIGN GROUP, LLC.
1600 Osgood Street Building 20 North, Suite 2-101
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 supporting the proposed 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 LTE Equipment.

This office conducted an on-site visual survey of the above areas on March 6, 2012. Attendees included Sergio Anastacio (HDG-Assistant Project Manager).

CONCLUSION SUMMARY:

As-built plans prepared by Donald L. Dimick were available for our use. The previous stamped drawings and design calculations prepared by Areal Spectrum, were available for our reference.

A limited visual survey of the structure was completed in or near the areas of the Proposed Work. Based on our evaluation, we have determined that, in general, structural designs to support the proposed AT&T Equipment within or near the Proposed Location can be completed and components installed with **NO STRUCTURAL UPGRADES REQUIRED** to the existing structure.

HDG recommends supporting the new LTE Equipment on a curb platform extension. The new extension is recommended to be installed directly over the building columns to adequately support the new loading. Reference the latest HDG's construction drawings for details.

A summary of the proposed support types and attachment locations are as follows:

(1) LTE Antenna (SBNH-1D6565C) (96.4"x11.9"x7.1" – Wt. 61lbs.) (Alpha Sector)... Mounted on a new steel pipe and mounting brackets, secured by the building facade.

(2) LTE Antennas (KMW AM-X-CD-16-65-00T) (72"x11.8"x5.9" - Wt. 48.5lbs.) (Beta and Gamma Sectors).... Mounted on new steel pipes supported by the existing antenna mounts.

(1) Emerson Outdoor Power Cabinet (Wt.=2150 lbs)... Supported by the new equipment curb extension.

(2) Purcell Cabinets (Wt. = 250 lbs/each)..... Supported by the new equipment curb extension.

(3) Surge Arrestor DC2-48-60-0-9E (1 per sector)... Mounted on new unistrut components.

(6) RRH (2 per sector) (Wt. = 50 lbs/each)..... Mounted on new unistrut components.
Referenced documents are attached.

Hudson Design Group LLC

Referenced documents are attached.

DESIGN CRITERIA:

1. International Building Code 2009, ASCE 7-10 Minimum Design Loads for Buildings and Other Structures.

   Wind Analysis:

Reference Wind Speed:	110 MPH	(FIG 26.5-1C; ASCE 7-10)
Category:	C	(26.7.3; ASCE 7 -10)
Gust Effect Factor (G):	0.85	(26.9.1; ASCE 7-10)
Force Coefficient (Cf):	Varies	(FIG 29.5-1 thru 29.5-3; ASCE 7-10)
F = qz * G * Cf * Af:		(Equation 29.5-1; ASCE 7-10)

   Snow Loading:

Ground Snow Load (Pg):	60 psf	(FIG 7-1; ASCE 7-10)
Flat Roof Snow Load (Pf):	37.8 psf	

   Pf = 0.7 * Ce * Ct * I * Pg (Equation 7.3-1; ASCE 7-10)

   Ce=0.9; Ct=1.0; I=1.0

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

County:	Cumberland
Wind Load:	100 mph

3. Approximate height above grade to antennas:

   85'-2"+/- (Beta and Gamma sectors)
   88'-8"+/- (Alpha sector)

Hudson Design Group LLC

EXISTING ROOF CONSTRUCTION:

The roof construction appears to consist of an adhered roofing membrane on top of a reinforced concrete slab supported by reinforced concrete columns and bearing walls.

Antenna SUPPORT RECOMMENDATIONS:

- The new LTE Alpha sector antenna is proposed to be supported by a new steel pipe and mounting brackets, secured to the building facade.
- The new LTE Beta and Gamma sector antennas are proposed to be supported by new steel pipes, secured to the existing antenna support angles.

RRH's / Surge Arrestor SUPPORT RECOMMENDATIONS:

- The new Alpha sector Surge Arrestor and RRH's are proposed to be mounted on new unistrut components, secured to the building using epoxy anchors.
- The new Beta and Gamma sector Surge Arrestors and RRH's proposed to be mounted on new unistrut components, secured to the existing antenna support angles.

EQUIPMENT SUPPORT RECOMMENDATIONS:

HDG recommends that the proposed equipment be supported by the new equipment rooftop curb extension as shown in the latest HDG construction drawings.

OTHER RECOMMENDATIONS:

HDG recommends that the new curb extension be installed directly over the building columns to adequately support the new equipment load. (Contractor to verify the column locations).

Hudson Design Group LLC

Notes:

1. Reference the latest HDG construction drawings for all the equipment locations.
2. All detail requirements will be designed and furnished in the construction drawings.
3. Mount all equipment per manufacturer's specifications.
4. HDG is under the assumption that the equipment curb was located over building columns.
5. 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.

EXISTING ANTENNAS:

Photo 1: Sample photo illustrating the existing Alpha sector antennas.

Photo 2: Sample photo illustrating the existing Beta sector antennas.

Hudson Design Group LLC

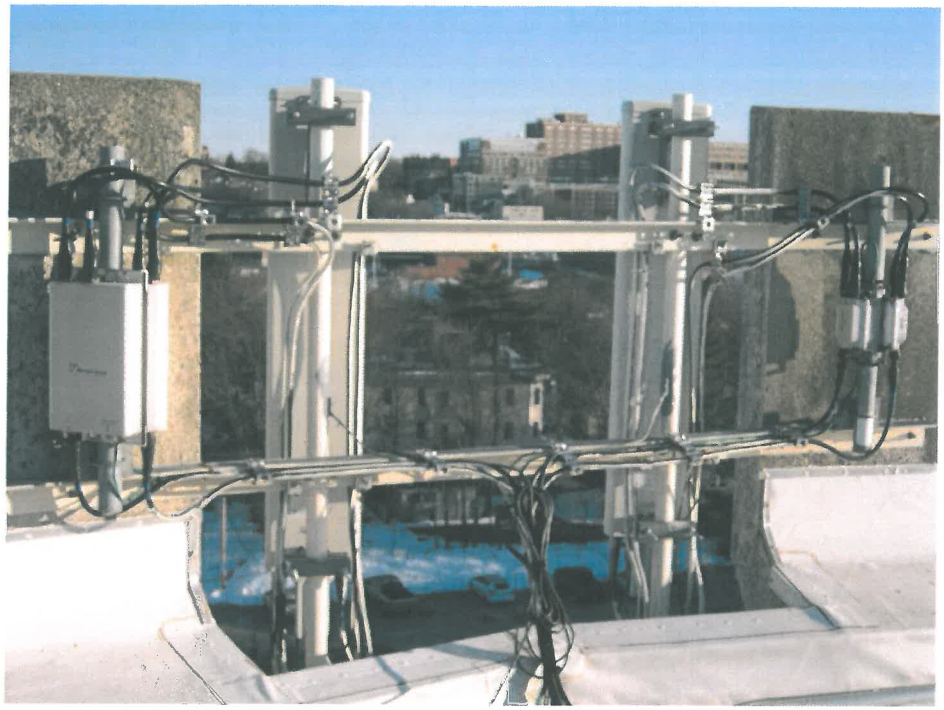


Photo 3: Sample photo illustrating the existing Gamma sector antennas.

Hudson Design Group LLC

EXISTING EQUIPMENT:

Photo 4: Sample photo illustrating the existing equipment.

Photo 5: Sample photo illustrating the existing equipment.

Hudson Design Group LLC

Calculations

Date: 03-20-12
Project Name: Portland USM
Project Number: ME5045
Designed By: AA **Checked By**: MSC

Hudson Design Group LLC

2.6.5.2 Velocity Pressure Coeff:

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

z=	88.67	(ft)
z_g=	900	(ft)
α=	9.5	

K_z= 1.234

Kzmin ≤ Kz ≤ 2.01

Table 2-4

Exposure	Z_g	α	K_{zmin}	K_e
B	1200 ft	7	0.70	0.90
C	900 ft	9.5	0.85	1
D	700 ft	11.5	1.03	1.10

2.6.6.4 Topographic Factor:

Table 2-5

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

$K_{zt} = [1+(K_e K_t/K_h)]^2$ $K_h = e^{(t*z/H)}$

K_{zt}= #DIV/0!

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

Category=	1

K_h=	#DIV/0!	
K_e=	0	(from Table 2-4)
K_t=	0	(from Table 2-5)
f=	0	(from Table 2-5)
z=	88.67	
H=	0	(Ht. of the crest above surrounding terrain)
K_{zt}=	1.00	

Date: 03-20-12
Project Name: Portland USM
Project Number: ME5045
Designed By: AA **Checked By**: MSC

Hudson Design Group LLC

2.6.7 Gust Effect Factors

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= 88.67 Gh= 0.48867

2.6.7.2 Guyed Masts Gh= 0.85

2.6.7.3 Pole Structures Gh= 1.1

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: 03-20-12
Project Name: Portland USM
Project Number: ME5045
Designed By: AA **Checked By:** MSC

Hudson Design Group LLC

2.6.8 Design Ice Thickness:

$t_{iz} = 2.0*t_i*I*K_{iz}*(K_{zt})^{0.35}$

t_i=	1
I=	1
K_{iz}=	1.10
K_{zt}=	1

t_{iz}= 2.21

$K_{iz} = [z/33]^{0.10} \leq 1.4$

K_{iz}= 1.10

Calculating the weight of ice, the cross-sectional area of ice shall be determined by:

$A_{iz} = \pi*t_{iz}*(D_c + t_{iz})$

Dc= 96.4 (in) Largest Dim of Member

A_{iz} = 683.94

2.6.9 Design Wind Load:

F= qz*Gh*(EPA's)

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

K_z=	1.234
K_{zt}=	1
K_d=	0.95
V_{max}=	100

q_z= 30.01

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**

Date: 03-20-12
Project Name: Portland USM
Project Number: ME5045
Designed By: AA **Checked By**: MSC

Hudson Design Group LLC

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

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

Dp = Outside Diameter or Out to Out: 0.2 feet

C= **22.22** **Cf=** 1.2

Appurtenances	Height	Width	Depth	Flat Area	Force Per Appurtenance
Item No.1	96.4	11.9	7.1	7.97	**387.30** (lbs)
Item No.2	72	11.8	5.9	5.90	**286.84** (lbs)
Item No.3	55	11	5	4.20	**204.26** (lbs)
Item No.4	0	0	0	0.00	**0.00** (lbs)
Item No.5	0	0	0	0.00	**0.00** (lbs)

TOTAL FORCE (ΣF_A) = **878.40** (lbs)

ICE WEIGHT CALCULATIONS

Project: ME5045

Thickness of ice: 0.75

PROPOSED

Weight of ice based on total radial SF area: **Antenna**

Depth (in):	7.1	
height (in):	96.4	
Width (in):	11.8	
Total weight of ice on object:		89 pounds ice
Weight of object:	61	pounds
Combined weight of ice and object:		150 pounds

Per foot weight of ice: **Pipe**

pipe weight per foot:	3.65	
pipe length (ft):	8.5	
diameter (in):	2.375	
Per foot weight of ice on object:		2 pounds ice /ft
Total weight of ice on object:		19 pounds
Total weight of pipe:		31.025 pounds
Combined weight of pipe and ice:		50 pounds

* Density of ice used = 56 PCF

Total Weight: 199 pounds

ICE WEIGHT CALCULATIONS

Project: ME5045

Thickness of ice: 0.75

EXISTING
Antenna

Weight of ice based on total radial SF area:

Depth (in):	5	
height (in):	55	
Width (in):	11	
Total weight of ice on object:		43 pounds ice
Weight of object:	30	pounds
Combined weight of ice and object:		73 pounds

Pipe

Per foot weight of ice:

pipe weight per foot:	3.65	
pipe length (ft):	6	
diameter (in):	2.375	
Per foot weight of ice on object:		2 pounds ice /ft
Total weight of ice on object:		13 pounds
Total weight of pipe:		21.9 pounds
Combined weight of pipe and ice:		35 pounds

* Density of ice used = 56 PCF

Total Weight:	108 pounds

Project: ME5045 (LTE)

Location: ANTENNA SUPPORT ANGLE (WORSE CASE)
Multi-Loaded Multi-Span Beam
[2009 International Building Code(AISC 13th Ed ASD)]
A36 L4x4x1/4 x 5.0 FT Leg Up
Section Adequate By: 410.4%
Controlling Factor: Shear

Andres Agudelo
Hudson Design Grroup LLC
1600 Osgood Steet, Suite 2-101, Bldg. 20N
North Andover, MA 01845

StruCalc Version 8.0.111.0 3/20/2012 2:23:54 PM

DEFLECTIONS	Center	
Live Load	0.02	IN L/3163
Horizontal Component	0.01	
Dead Load	0.00	in
Horizontal Component	0.00	in
Total Load	0.02	IN L/2908
Horizontal Component	0.01	

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A	B
Live Load	167 lb	130 lb
Dead Load	17 lb	17 lb
Total Load	183 lb	146 lb
Bearing Length	0.63 in	0.63 in

BEAM DATA	Center
Span Length	5 ft
Unbraced Length-Top	1.5 ft
Unbraced Length-Bottom	5 ft

STEEL ANGLE PROPERTIES
L4x4x1/4 - A36

Properties:

Yield Stress:	Fy =	36 ksi
Modulus of Elasticity:	E =	29000 ksi
Depth (Leg Length):	d =	4 in
Leg Thickness:	tw =	0.25 in
Distance to Angle Toe of Fillet:	k =	0.63 in
Moment of Inertia About X-X Axis:	Ix =	3 in4
Section Modulus About X-X Axis:	Sx =	1.03 in3

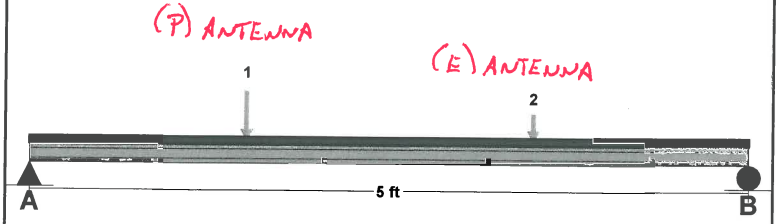
Design Properties per 13th Edition AISC Steel Manual:

Angle Tip is in Compression		
Flange Buckling Ratio:	FBR =	16
Allowable Flange Buckling Ratio for Compact:	AFBR =	15.33
Allowable Flange Buckling Ratio for Non-Compact:	AFBR_NC =	25.83
Elastic Lateral-Torsional Buckling Moment:	Me =	114.89 ft-lb
Nominal Flexural Strength w/ Safety Factor:	Mn =	1962.04 ft-lb
Controlling Equation:	F10-3	
Controlling Cv Factor:	Cv =	1
Nominal Shear Strength w/ Safety Factor:	Vn =	12934 lb

Controlling Moment: 267 ft-lb
1.5 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2
Controlling Flexural Shear: 183 lb
Controlling Torsional Shear (C-G4-2): 2351 lb
Controlling Shear: 2534 lb
At 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):	0.34 in4	3 in4
Moment:	267 ft-lb	1962 ft-lb
Shear:	2534 lb	12934 lb

LOADING DIAGRAM



UNIFORM LOADS	Center
Uniform Live Load	0 plf
Uniform Dead Load	0 plf
Beam Self Weight	7 plf
Total Uniform Load	7 plf

POINT LOADS - CENTER SPAN

Load Number	One	Two
Live Load	194 lb	102.5 lb
Dead Load	0 lb	0 lb
Location	1.5 ft	3.5 ft

$F_{WIND} = \frac{388\#}{2} = 194\#$

$F_{WIND} = \frac{205\#}{2} = 102.5\#$

DATE: 03-20-12
Project Name: PORTLAND USM
Project No.: ME 5045 (LTE)
Design By: AA Chk'd By: MSC Page ____ of ____

Hudson Design Group LLC

* CHECK ANTENNA SUPPORT ANCHORING SYSTEM: (WORSE CASE)

OVERVIEW: THE ANTENNA SUPPORT ANGLES ARE ATTACHED TO THE PARAPET AT EACH END WITH (2) 1/2 HILTI HY 20 (REFERENCE: ORIGINAL DESIGN DRAWING PREPARED BY AERIAL SPECTRUM)

$F_T = 525\#$
$F_V = 1230\#$
> HIT-HY20 (2" EMBEDMENT) (ASSUMED)

- TENSION

$$f_T = \frac{183\#}{2 \text{ ANCHORS}} = 91.5\#/\text{ANCHOR} < 525\#/\text{ANCHOR} \therefore \text{O.K!}$$

- SHEAR:

$$f = \frac{199\# + 108\# + 40\#}{2} = 173.5\#$$

$$f_V = \frac{173.5\#}{2 \text{ ANCHORS}} = 86.75\#/\text{ANCHOR} < 1230\#/\text{ANCHOR} \therefore \text{O.K!}$$

- CHECK COMBINED TENSION/SHEAR:

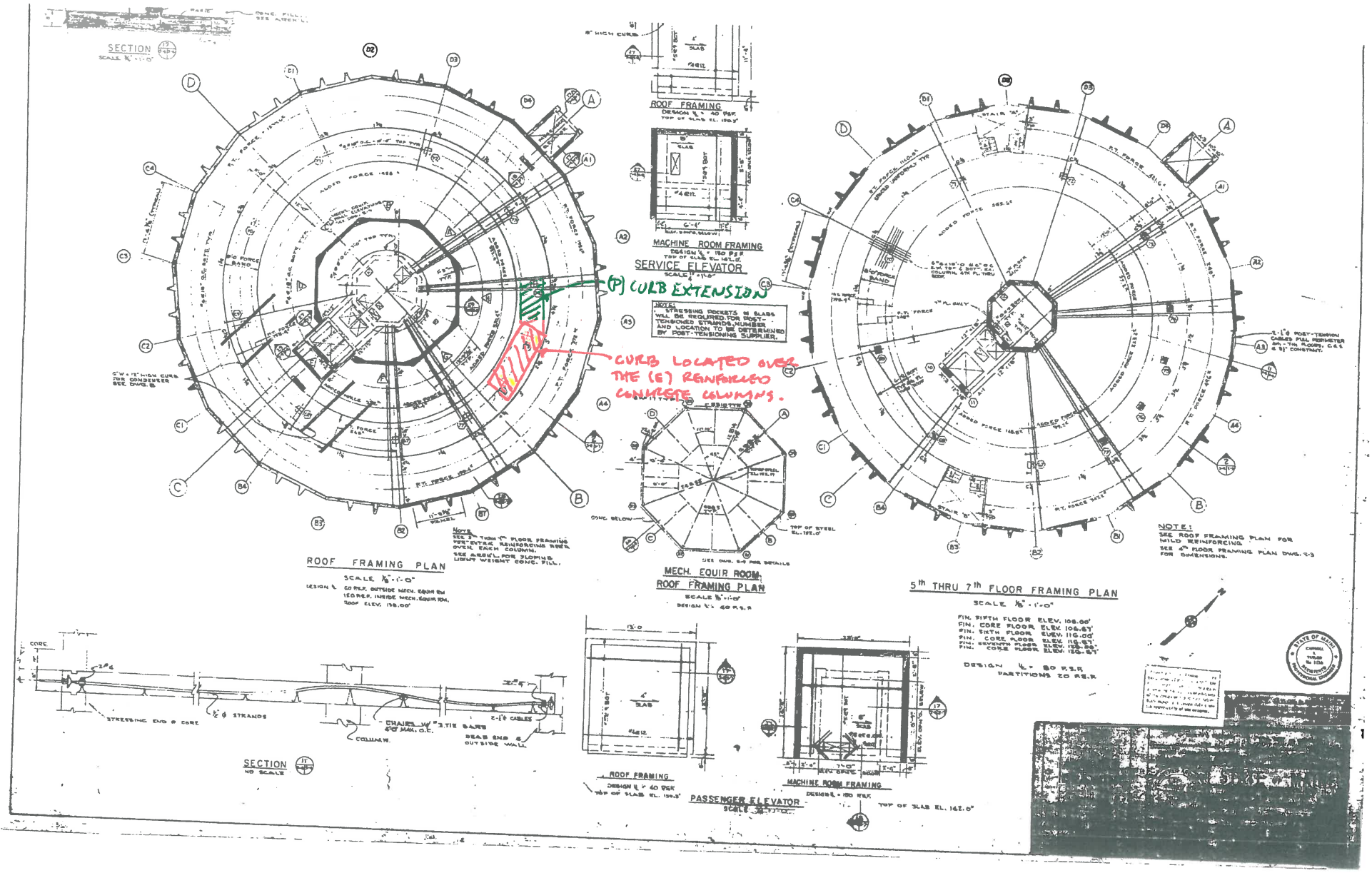
$$\frac{f_T}{F_T} + \frac{f_V}{F_V} \leq 1.0$$

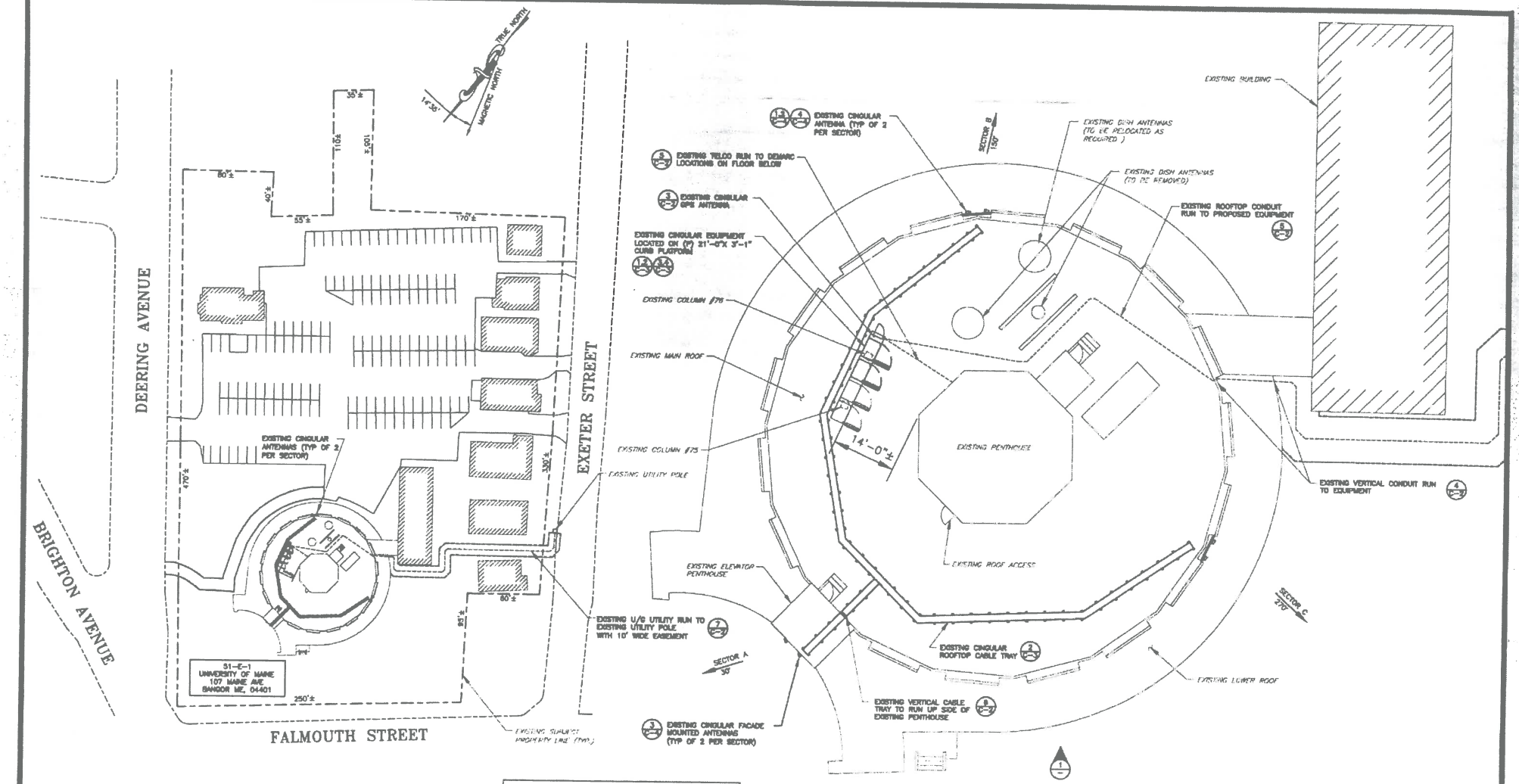
$$\frac{91.5}{525} + \frac{86.75}{1230} = 0.24 < 1.0 \therefore \text{O.K!}$$

157132

Hudson Design Group LLC

Referenced Drawings


SECTION
ROOF FRAMING
MACHINE ROOM FRAMING
SERVICE ELEVATOR
(P) CURB EXTENSION
CURB LOCATED OVER THE (E) REINFORCED CONCRETE COLUMNS.
ROOF FRAMING PLAN
MECH. EQUIP. ROOM ROOF FRAMING PLAN
5th THRU 7th FLOOR FRAMING PLAN
NOTE: SEE ROOF FRAMING PLAN FOR WILD REINFORCING. SEE 4th FLOOR FRAMING PLAN DWG. S-3 FOR DIMENSIONS.
SECTION
ROOF FRAMING
MACHINE ROOM FRAMING
PASSENGER ELEVATOR



PLOT PLAN (1/—)
APPX. SCALE: 1"=40'-0"

40 0 20 40 80 160

NOTES:
- PLOT PLAN IS NOT THE RESULT OF A SURVEY. IT IS BASED ON FIELD MEASUREMENTS AND SCALED ASSESSORS MAPS AVAILABLE. ALL INFORMATION SHOWN IS APPROXIMATE ONLY AND SUBJECT TO ANY CONDITION THAT A SURVEY MAY REVEAL.

ROOF PLAN (2/—)
SCALE: 1/8"=1'-0"

8 0 4 8 16 32

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 WIRELESS
CONSTRUCTION DEPARTMENT
580 MAIN STREET
BOLTON, MA 01740
PHONE: (781) 890-7422
FAX: (781) 890-7474

NO.	DATE	REVISIONS	BY	CHK	APP'D
0	11-20-06	AS BUILTS	PRC	PLM	ETK

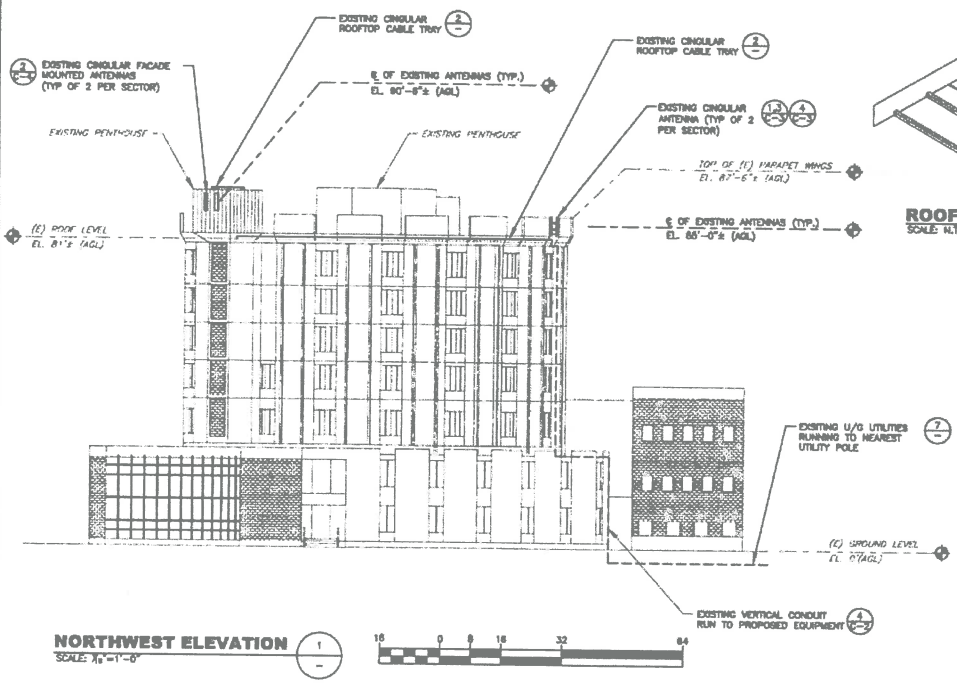
SCALE: AS SHOWN | DESIGNED: PRC ETK | DRAWN: PRC PR

PROFESSIONAL STAMP

CINGULAR WIRELESS

SITE PLAN & ROOF PLAN

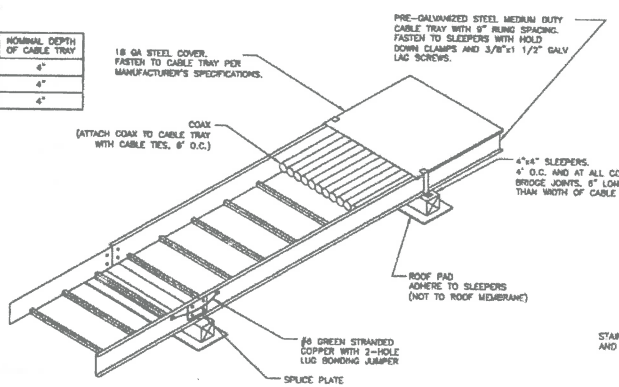
DRAWING NUMBER	REV
C-1	0



NORTHWEST ELEVATION

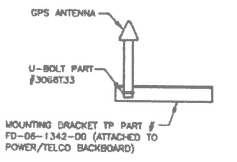
SCALE: 1/16"=1'-0"

NUMBER OF COAXIAL CABLES	WIDTH OF CABLE TRAY	NOMINAL DEPTH OF CABLE TRAY
12	24"	4"
8	18"	4"
4	12"	4"



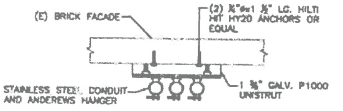
ROOF MOUNTED COAX TRAY

SCALE: N.T.S.



GPS SUPPORT

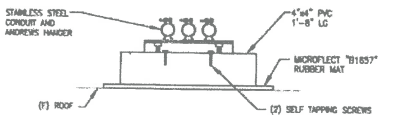
SCALE: N.T.S.



EXTERIOR CONDUIT RUN

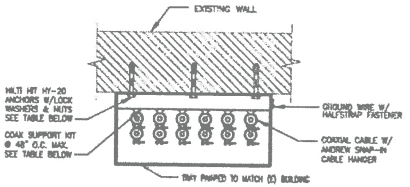
SCALE: N.T.S.

NOTE:
PAINT EXPOSED CONDUIT AND HARDWARE TO MATCH THE COLOR OF THE EXISTING SURROUNDINGS.



CONDUIT RUN ON ROOF

SCALE: N.T.S.

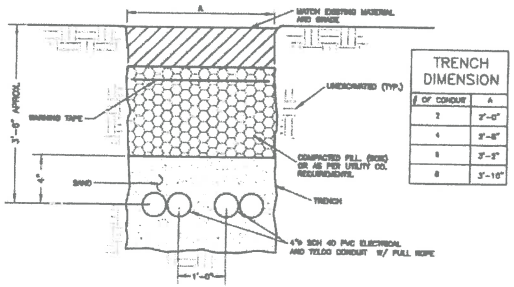


No. CABLES	MICROFLECT CORK SUPPORT KIT	No. OF ANCHORS	A
1 TO 4	B1580	2	11 1/2"
5 TO 8	B1580	3	21 1/2"
8 TO 12	B1581	3	30 1/2"

NOTE:
1. USE STAINLESS STEEL ANCHORS INTO CONCRETE. USE CARBON STEEL ANCHORS INTO BRICK OR MASONRY USE TOGGLE BOLTS INTO STUD WALLS.
2. ANCHOR TO BE INSTALLED IN 1/2"ø HOLES DRILLED W/ HILTI CARBIDE TIPPED DRILL BITS. ANCHORS SHALL BE INSTALLED PER MANUFACT./HERF'S RECOMMENDATIONS.
3. DETAIL BASED ON THE USE OF MICROFLECT AND HILTI. CONTRACTOR MAY SUBSTITUTE EQUAL MATERIALS APPROVED BY LESSEE/LICENSEE.
4. PAINT ALL MOUNTING BRACKETS TO MATCH COLOR OF EXISTING BUILDING

VERTICAL COAX CABLE TRAY

SCALE: N.T.S.



TRENCH DIMENSION	
# OF CONDUIT	A
2	2'-0"
4	2'-8"
6	3'-2"
8	3'-10"

TRENCH DETAIL- ELEC/TELCO

SCALE: N.T.S.

NOTE:
1. IF FREE OF ORGANIC OR OTHER DELETERIOUS MATERIAL, EXCAVATED MATERIAL MAY BE USED FOR BACKFILL. IF NOT, PROVIDE CLEAN, COMPACTIBLE MATERIAL. COMPACT IN 8" LIFTS. REMOVE ANY LARGE ROCKS PRIOR TO BACKFILLING
2. CONDUITS SHOWN DO NOT NEED TO BE IN SAME TRENCH HOWEVER, ALL DIMENSIONS SHOWN ARE FOR ALL CONDUIT TRENCHING REGARDLESS OF THE NUMBER OF CONDUITS PER TRENCH.
3. CARE TO BE TAKEN TO AVOID EXISTING UNDERGROUND UTILITIES

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

NO.	DATE	REVISIONS	BY	CHK	APP'D
0	11-29-06	AS BUILTS	PRC	PLM	ETK

SCALE: AS SHOWN DESIGNED: PRC ETK DRAWN: PRC HP

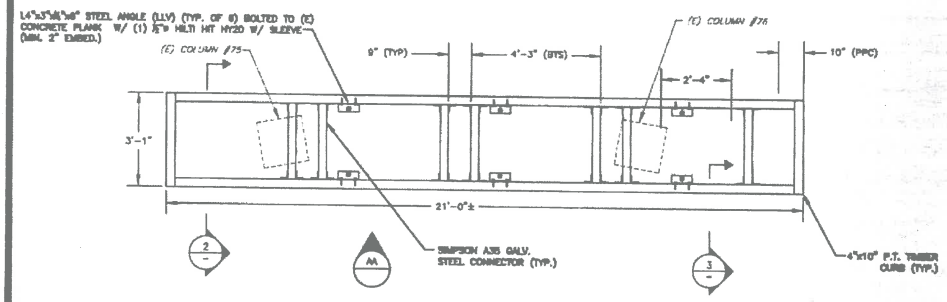
PROFESSIONAL STAMP

STATE OF MAINE — REGISTERED PROFESSIONAL ENGINEER

CINGULAR WIRELESS

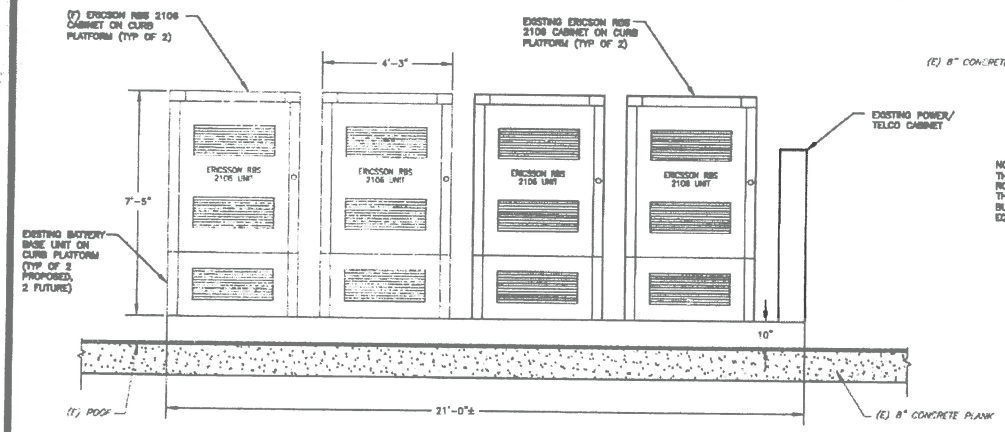
ELEVATION AND CONSTRUCTION DETAILS

DRAWING NUMBER	REV
C-2	0



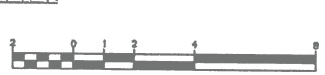
PLAN

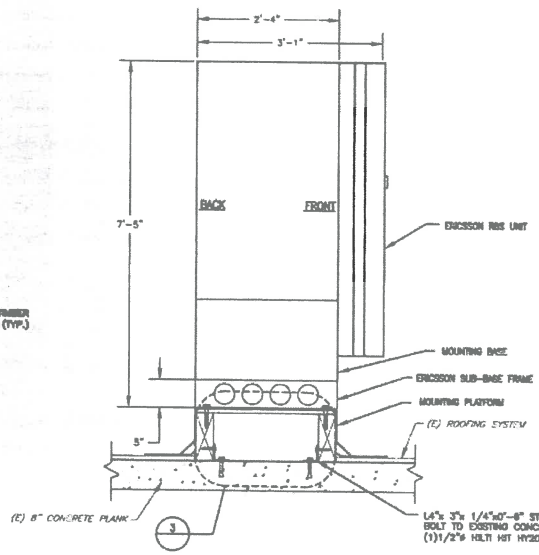
NOTE:
LOCATION OF PROPOSED CURB PLATFROM DESIGNED FROM EXISTING BUILDING PLANS OBTAINED FROM USM PORTLAND MAINTENANCE DEPARTMENT. THE CONTRACTOR SHALL VERIFY THE LOCATIONS OF EXISTING SUPPORT COLUMNS PRIOR TO CONSTRUCTION.



ELEVATION A–A

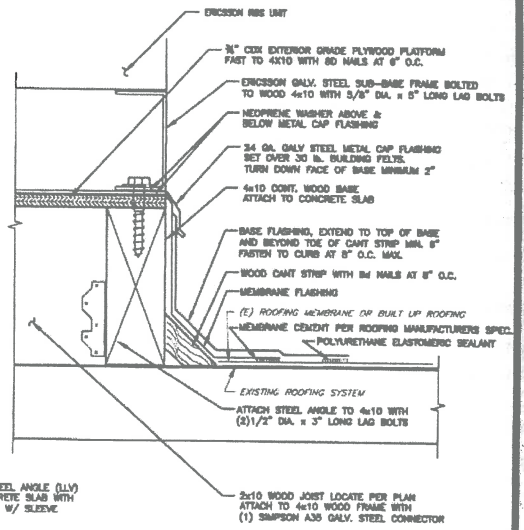
EXISTING CURB PLATFORM
SCALE: 1/2" = 1'-0"



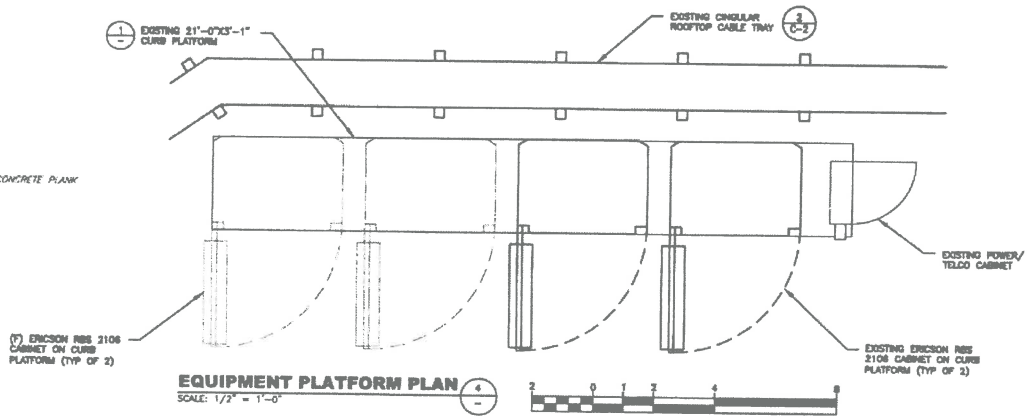


SECTION AT RBS UNIT (2)
SCALE: N.T.S.

NOTE:
THE CONTRACTOR SHALL COORDINATE ALL WORK WITH BUILDING OWNER'S ROOFING CONTRACTOR WHO WILL COMPLETE ALL WORK ASSOCIATED WITH THE ROOF. THE CONTRACTOR SHALL OBTAIN WRITTEN APPROVAL FROM THE BUILDING OWNER'S ROOFING CONTRACTOR BEFORE INSTALLATION OF EQUIPMENT CURB PLATFORM.



DETAIL AT PLATFORM CURB (3)
SCALE: N.T.S



EQUIPMENT PLATFORM PLAN (4)
SCALE: 1/2" = 1'-0"

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 WIRELESS
CONSTRUCTION DEPARTMENT
580 MAIN STREET
BOLTON, MA 01740
PHONE: (781) 890-7422
FAX: (781) 890-7474

NO.	DATE	REVISIONS	BY	CHK	APP'D
0	11-29-06	AS BUILTS	PRC	PLM	ETK

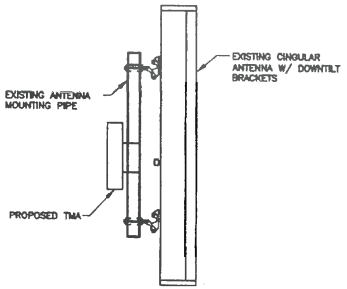
SCALE: AS SHOWN | DESIGNED: PRC | DRAWN: PRC

PROFESSIONAL STAMP

CINGULAR WIRELESS

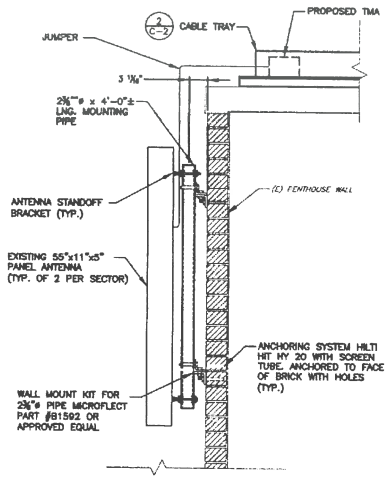
CONSTRUCTION DETAILS

DRAWING NUMBER	REV
C-3	0



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

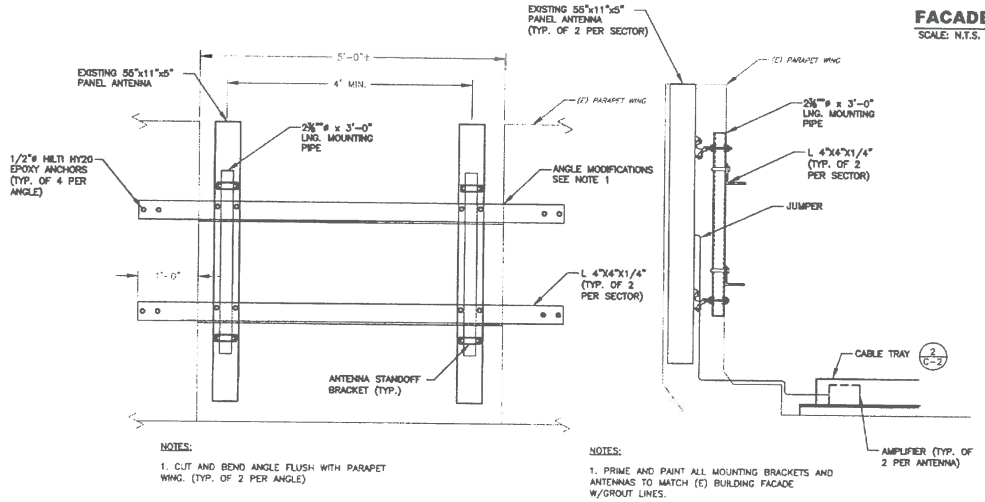
ANTENNA DETAIL
SCALE: N.T.S. — 1/–



NOTES:

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

FACADE ANTENNA MOUNTING DETAIL
SCALE: N.T.S. — 2/–



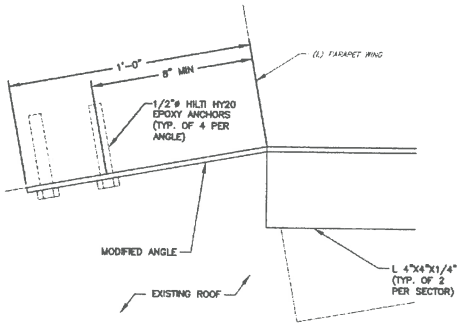
NOTES:

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
SCALE: N.T.S. — 2/–



ANGLE MOUNTING DETAIL
SCALE: N.T.S. — 4/–

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

NO.	DATE	REVISIONS	BY	CHK	APP'D
0	11-29-06	AS BUILTS	PRC	PLM	ETK

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

PROFESSIONAL STAMP

CINGULAR WIRELESS

CONSTRUCTION DETAILS

DRAWING NUMBER	REV
C-4	0

PTLDME5045

ONE GENERAL WAY PO BOX 373 READING, MA 01867 P: (781) 942-0024 F: (781) 942-0551	CLIENT NAME: STATE OF MAINE LAW SCHOOL	DATE: 4/12/06	PAGE: 1/7
		BY: M. MARTEL	
		SITE NAME: USM PORTLAND	

NEW LOCATION FOR CARRELS

CHECK COLUMNS 76 & 75

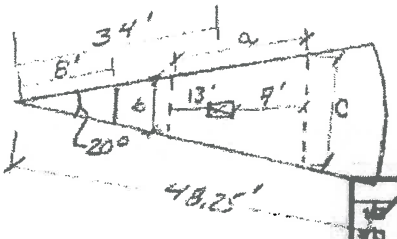
LOADS:

FROM DESIGN DRAWINGS

ROOF 60 #/ft²
7th FLOOR 160 #/ft²
6th FLOOR 100 #/ft²
5th FLOOR 100 #/ft²
4th FLOOR 100 #/ft² (BEAM LOAD ONLY)

LIGHT WT CONCRETE ON ALL FLOORS
115 #/ft³

CALCULATE TRIBUTARY AREA FOR COLUMN



C = 2(TAN 10 (41')) = 14.4
b = 2(TAN 10 (8')) = 2.8
a = 20'

AREA = (C+b)/2 (a) = 172

AE DESIGN PACKAGE REVIEW STATUS			
☑ ACCEPTED—NO COMMENTS, PROCEED			
☐ COMMENTS			
A ☐ SAC info missing/incomplete	F ☐ Design deviation from standard		
B ☐ AE did not follow directions provided	G ☐ Omissions		
C ☐ Site owner requested changes	H ☐ AE generated changes in design		
D ☐ Design input changes, i.e., RF, zoning required	I ☐ AHJ changed site design		
E ☐ Revised site design	J ☐ OTHER		
Permission to proceed does not constitute acceptance or approval of design details, calculations, analysis, test methods, or materials developed or selected by the supplier and does not relieve the supplier from full compliance with contractual obligations.			
Reviewed by: (RE/PE) Steve Ely		Date: 2-12-07	
RF ENGINEER	QA	MARKET LEAD	CONSTRUCTION
☐			

SLAB THICKNESS = 8" => 8/12 (172) = 114.7 ft³
COLUMN WT = (15")(18")/144 (10') = 22.5 ft³

LOAD TOTALS:

	LL	DL SLAB	COLUMN
ROOF	10.3 K	13.2 K	2.6 K
7th	17.2 K	13.2 K	2.6 K
6th	17.2 K	13.2 K	2.6 K
5th	17.2 K	13.2 K	2.6 K

ONE GENERAL WAY
PO BOX 373
READING, MA 01867
P: (781) 942-0024
F: (781) 942-0551
AERIAL SPECTRUM

CLIENT NAME: STATE OF MAINE LAW SCHOOL

DATE: 4/12/06 PAGE: 2/7

BY: K. MARTEL

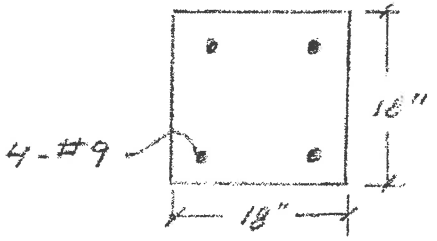
SITE NAME: USM PORTLAND

COLUMN LOAD

MAX COLUMN LOAD ON TOP OF 4TH FLOOR

$P = 10.3 + (17.2)(3) + (13.2)(4) + (2.6)(4) = 125^{K}$

CHECK COLUMN



$K = 0.5$

$l = 10'$

TOTAL LOAD W/ CABINETS $10/2 = 5$

$125^{K} + 5^{K} = 130^{K}$

SEE ATTACHED SPREADSHEET

(MATHCADD)

Input Column Properties

$f'c := 3000psi$ $As := 2in^2$ $d' := 2.564in$ $b := 18in$

$fy := 60000psi$ $A's := 2in^2$ $h := 18in$

$Ag := b \cdot h$ $Ag = 324\,in^2$ $y_{bar} := \frac{h}{2}$ $y_{bar} = 9\,in$

Maximum Vertical Loading

$Po := [0.85f'c \cdot (Ag - As - A's) + (As + A's) \cdot fy]$

$\boxed{Po = 1056\,kip}$ $\phi Po := 0.7 \cdot Po$ $\phi Po = 739.2\,kip$

$P_{nmax} := 0.8[0.85f'c \cdot (Ag - As - A's) + (As + A's) \cdot fy]$ $\phi P_{nmax} := 0.7 \cdot P_{nmax}$

$\boxed{P_{nmax} = 844.8\,kip}$ $\boxed{\phi P_{nmax} = 591.36\,kip}$ $\phi M_0 := 0$

Balance Condition

$d := h - d'$ $d = 15.44\,in$

$c_b := \frac{87000}{87000 + \frac{fy}{psi}} \cdot d$ $c_b = 9.14\,in$

$\varepsilon's := 0.003\left(\frac{c_b - d'}{c_b}\right)$ $\varepsilon's = 0.00216\,\frac{in}{in}$

$f's := 29000000psi \cdot \varepsilon's$ $f's = 62582.534\,psi$

$\beta_1 := 0.85 - \frac{0.05\left(\frac{f'c}{psi} - 4000\right)}{1000}$ $\beta_1 = 0.9$

$a_b := \beta_1 \cdot c_b$ $a_b = 8.22\,in$

$P_{nb} := 0.85 \cdot f'c \cdot b \cdot a_b + A's \cdot f's - As \cdot fy$ $\phi P_{nb} := 0.7 \cdot P_{nb}$

$\boxed{P_{nb} = 382.556\,kip}$ $\boxed{\phi P_{nb} = 267.789\,kip}$

$M_{nb} := 0.85 \cdot f'c \cdot b \cdot a_b \cdot \left(y_{bar} - \frac{a_b}{2}\right) + A's \cdot f's \cdot \left(y_{bar} - d'\right) + As \cdot fy \cdot \left(d - y_{bar}\right)$ $\phi M_{nb} := 0.7 \cdot M_{nb}$

$\boxed{M_{nb} = 3422.942\,in \cdot kip}$ $\boxed{\phi M_{nb} = 199.7\,ft \cdot kip}$

$e_b := \frac{M_{nb}}{P_{nb}}$ $e_b = 8.95\,in$

Pure Bending Mno

$a := \frac{As \cdot fy}{0.85 \cdot f'c \cdot b}$ $a = 2.61\,in$

$c := \frac{a}{\beta_1}$ $c = 2.9\,in$

$\varepsilon's_m := 0.003 \cdot \left(\frac{c - d'}{c}\right)$ $\varepsilon's_m = 0.00035\,\frac{in}{in}$

$f's_m := 29000000psi \cdot \varepsilon's_m$ $f's_m = 10208.841\,psi$

$M_{no} := As \cdot fy \cdot \left(d - \frac{a}{2}\right)$ $\phi M_{no} := 0.9 \cdot M_{no}$

$M_{no} = 1695.5\,in\cdot kip$ $\phi M_{no} = 127.2\,ft\cdot kip$ $\phi P_0 := 0kip$

Compression Controls

$c_1 := \frac{c_b + h}{2}$ $c_1 = 13.57\,in$

$\varepsilon's_1 := 0.003 \cdot \left(\frac{c_1 - d'}{c_1}\right)$ $\varepsilon_{y1} := \frac{\frac{fy}{psi}}{29000000}$ $\varepsilon_{s1} := 0.003 \cdot \frac{d - c_1}{c_1}$

$\varepsilon's_1 = 0.00243\,\frac{in}{in}$ $\varepsilon_{y1} = 0.00207\,\frac{in}{in}$ $\varepsilon_{s1} = 0.00041\,\frac{in}{in}$ $\varepsilon's_{a1} := \min\left(\varepsilon's_1, \varepsilon_{y1}\right)$

$fs_1 := \varepsilon_{s1} \cdot 29000000psi$ $f's_1 := \varepsilon's_{a1} \cdot 29000000psi$

$fs_1 = 11979.378\,psi$ $f's_1 = 60000\,psi$

$a_1 := \beta_1 \cdot c_1$ $a_1 = 12.21\,in$

$C_{c1} := 0.85 \cdot f'c \cdot b \cdot a_1$ $C_{s1} := A's \cdot fy$ $T_{s1} := As \cdot fs_1$

$C_{c1} = 560.49\,kip$ $C_{s1} = 120\,kip$ $T_{s1} = 23.96\,kip$

$P_{n1} := C_{c1} + C_{s1} - T_{s1}$ $\phi P_{n1} := 0.7 \cdot P_{n1}$

$P_{n1} = 656.53\,kip$ $\phi P_{n1} = 459.57\,kip$

$M_{n1} := C_{c1} \cdot \left(y_{bar} - \frac{a_1}{2}\right) + C_{s1} \cdot \left(y_{bar} - d'\right) + T_{s1} \cdot \left(d - y_{bar}\right)$ $\phi M_{n1} := 0.7 \cdot M_{n1}$

$M_{n1} = 2548.84\,in\cdot kip$ $\phi M_{n1} = 148.682\,ft\cdot kip$

$e_1 := \frac{M_{n1}}{P_{n1}}$ $c_1 = 3.88\,in$

Tension Controls

$$c_2 := \frac{c_b}{2} \qquad c_2 = 4.57\,in$$

$$a_2 := \beta_1 \cdot c_2$$

$$\varepsilon's_2 := 0.003 \cdot \left(\frac{c_2 - d'}{c_2} \right) \qquad a_2 = 4.11\,in$$

$$\varepsilon's_2 = 0.00132$$

$$f's_2 := \min\left(\varepsilon's_2 \cdot 29000000psi, 60000psi\right)$$

$$f's_2 = 38165.069\ psi$$

$$fs_2 := fy$$

$$fs_2 = 60000\ psi$$

$$C_{c2} := 0.85 \cdot f'c \cdot b \cdot a_2 \qquad C_{c2} = 188.7\,kip$$

$$C_{s2} := A's \cdot f's_2 \qquad C_{s2} = 76.33\,kip$$

$$T_{s2} := As \cdot fs_2 \qquad T_{s2} = 120\,kip$$

$$P_{n2} := C_{c2} + C_{s2} - T_{s2} \qquad \phi P_{n2} := 0.7 \cdot P_{n2}$$

$$\boxed{P_{n2} = 145.03\,kip} \qquad \boxed{\phi P_{n2} = 101.52\,kip}$$

$$M_{n2} := C_{c2} \cdot \left(y_{bar} - \frac{a_2}{2} \right) + C_{s2} \cdot \left(y_{bar} - d' \right) + T_{s2} \cdot \left(d - y_{bar} \right) \qquad \phi M_{n2} := 0.7 \cdot M_{n2}$$

$$\boxed{M_{n2} = 2573.976\,in \cdot kip} \qquad \boxed{\phi M_{n2} = 150.15\,ft \cdot kip}$$

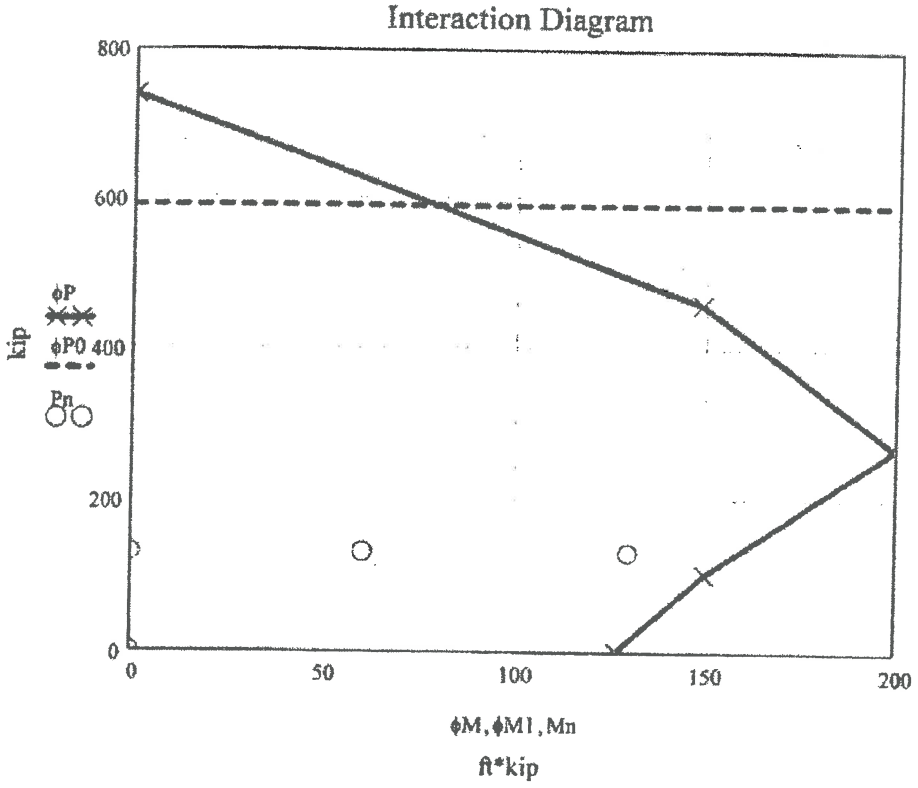
$$e_2 := \frac{M_{n2}}{P_{n2}} \qquad e_2 = 17.75\,in$$

Interaction Diagram Loads and Moments

$$\phi M := \begin{pmatrix} \frac{\phi M_0}{ft \cdot kip} \\ \frac{\phi M_{n1}}{ft \cdot kip} \\ \frac{\phi M_{nb}}{ft \cdot kip} \\ \frac{\phi M_{n2}}{ft \cdot kip} \\ \frac{\phi M_{no}}{ft \cdot kip} \end{pmatrix} \qquad \phi P := \begin{pmatrix} \frac{\phi Po}{kip} \\ \frac{\phi P_{n1}}{kip} \\ \frac{\phi P_{nb}}{kip} \\ \frac{\phi P_{n2}}{kip} \\ \frac{\phi P_0}{kip} \end{pmatrix} \qquad \phi M1 := \begin{pmatrix} \frac{0}{ft \cdot kip} \\ \frac{\phi M_{nb}}{ft \cdot kip} \end{pmatrix} \qquad \phi P0 := \begin{pmatrix} \frac{\phi P_{nmax}}{kip} \\ \frac{\phi P_{nmax}}{kip} \end{pmatrix}$$

Loads and Moments from Structure (kip and ft-kip)

$$Pn := \begin{pmatrix} 130 \\ 130 \\ 130 \\ 0 \end{pmatrix} \qquad Mn := \begin{pmatrix} 0 \\ 60 \\ 130 \\ 0 \end{pmatrix}$$



ONE GENERAL WAY
PO BOX 373
READING, MA 01867
P: (781) 942-0024
F: (781) 942-0551
AERIAL SPECTRUM

CLIENT NAME: STATE OF MAINE LAW SCHOOL

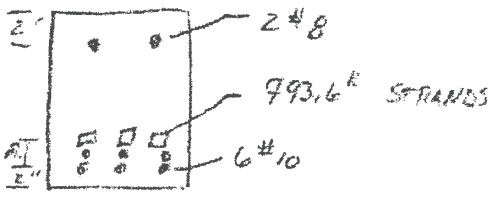
DATE: 4/12/06 PAGE: 7/7

BY: M. MARTIN

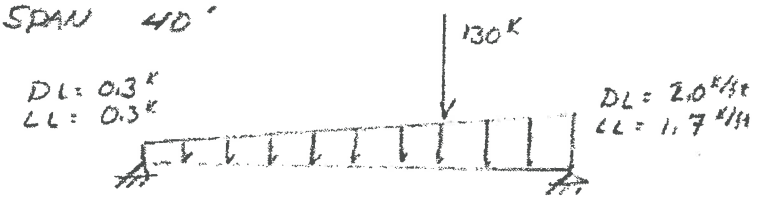
SITE NAME: USM PORTLAND

CHECK BEAM ON 4th FLOOR

BEAM B-2 & B-2A



SPAN 40'



$M = 1831.11 \text{ KIPS} = 21972 \text{ IN KIPS}$

$$f^t = -\frac{P_e}{AC}\left(1 + \frac{eC_T}{r^2}\right) + \frac{21972}{S_c}$$

$$= -\frac{793.6}{1240}\left(1 + \frac{17(21)}{12.12^2}\right) + \frac{21972}{8820} =$$

$$-0.63^{KSI}(1 + 2.43) + 2.49 = 0.329 \text{ KSI}$$ OK

$$f^b = -0.63(1 - 2.43) - 2.49 = 7.59^{KSI}$$ OK