

# STRUCTURAL ANALYSIS REPORT

For

**ME 5048 (LTE)**  
**PORTLAND HARBOR**  
284 Danforth Street  
Portland, ME 04102

## Equipment on a Rooftop Platform and Antennas Supported on Penthouse Façade and Roof Top Ballast Mounts



Prepared for:



**at&t**

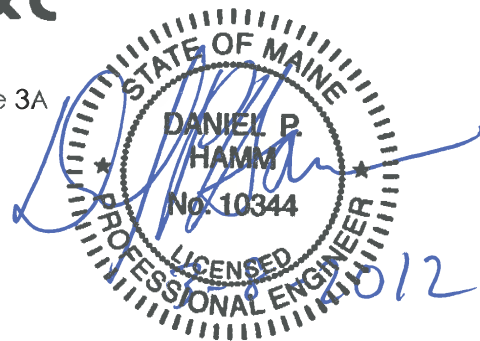
500 Enterprise Drive, Suite 3A  
Rock Hill, CT 06067

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](http://www.hudsondesigngroupllc.com)





## 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 February 29, 2011. Attendees included Sergio Anastacio (HDG-Assistant Project Manager).

## CONCLUSION SUMMARY:

As-built plans were not available and could not be obtained for our use. 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. Reference the attached HDG's drawings for all equipment locations.

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

**(2) LTE Antennas (Commscope SBNH-1D6565C) (96.4"x11.9"x7.1" - Wt. 60.8lbs.) (Alpha and Gamma Sectors)....**Mounted on new steel pipes supported by the existing roof top ballast mount (Gamma) and Penthouse Façade (Alpha).

**(1) LTE Antenna (P65-17-XLH-RR) (96"x12"x6" - Wt. 70 lbs.) (Beta Sector)...**Supported a new steel pipe, secured to the penthouse facade.

**(1) Emerson Outdoor Power Cabinet (Wt.=2150 lbs)...**Supported by the existing steel platform on the roof.

**(2) Purcell Cabinets Stacked on a 14" Plinth (Wt. = 250 lbs/each).....**Supported by the existing steel platform on the roof.

**(3) Surge Arrestor DC2-48-60-0-9E (1 per sector)...**Mounted on unistruts secured to the existing ballast frames and penthouse facade.

**(6) RRH (2 per sector) (Wt. = 50 lbs/each).....**Mounted on unistruts secured to the existing steel ballast frames and penthouse facade.



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: 97'-3" & 86'-7"



### **EXISTING ROOF CONSTRUCTION:**

The roof construction consists of a single-ply EPDM membrane adhered to rigid insulation on a light gauge metal roof deck support by a series of open web steel bar joists, steel beams and steel columns. Stamped construction drawings prepared by Sebago Technics dated 2-17-2006 were used for reference in determining the steel platform framing member.

During the HDG site survey it was confirmed that the existing steel platform supports the following:

(2) Ericsson RBS 3106 Cabinets (no BBU)	Weight= 1391 lbs/each
(1) Ericsson RBS 3106 Cabinet (with BBU)	Weight= 2700 lbs.
(1) Booster Cabinet	Weight= 350 lbs.
(3) RRUs	Weight= 250 lbs.
(1) PBC-02	Weight= 100 lbs.

### **EQUIPMENT SUPPORT RECOMMENDATIONS:**

HDG recommends that the proposed equipment be supported by the existing platform as shown in the latest HDG construction drawings.

### **Antenna SUPPORT RECOMMENDATIONS:**

- The new LTE Alpha sector antenna is proposed to be mounted on the existing ballasted roof top mount.
- The new LTE Beta and Gamma sector antennas are proposed to be mounted on new bracket mount secured to the existing penthouse walls.

### **RRH's / Surge Arrestor SUPPORT RECOMMENDATIONS:**

- The Alpha sector Surge Arrestor and RRH's are proposed to be mounted on new unistruts secured to the existing ballast mounts.
- The Beta and Gamma RRH's and Surge Arrestors are proposed to be mounted on new unistruts secured to the penthouse facade.



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 could not verify the support attachments to the roof structure at the time of our site visit. HDG is under the assumption that the equipment platform was constructed properly and adequately attached to the building structure over building columns.
5. HDG is under the assumption that the ballast mounts were located over structurally adequate roof support (i.e. beam or column). HDG was not able to verify the roof structure and its components at the time of our visit.
6. 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 EQUIPMENT:**



**Photo 1:** Sample photo illustrating the existing equipment platform

**EXISTING ANTENNAS:**



**Photo 2:** Sample photo illustrating the existing antenna mounted to penthouse



**Photo 3:** Sample photo illustrating the existing antenna mounted to the penthouse wall.



**Photo 4:** Sample photo illustrating the existing antenna supported on a ballast mount.





**Proposed Drawings**

**PROJECT INFORMATION**

SCOPE OF WORK: UNMANNED TELECOMMUNICATIONS FACILITY MODIFICATIONS  
 SITE ADDRESS: 284 DANFORTH STREET  
 PORTLAND, ME 04102  
 LATITUDE: 43.646151 N 43° 38' 46.14" N  
 LONGITUDE: 70.266560 W 70° 15' 59.62" W  
 JURISDICTION: NATIONAL, STATE & LOCAL CODES OR ORDINANCES  
 CURRENT USE: TELECOMMUNICATIONS FACILITY  
 PROPOSED USE: TELECOMMUNICATIONS FACILITY



**SITE NUMBER: ME5048**  
**SITE NAME: PORTLAND HARBOR**

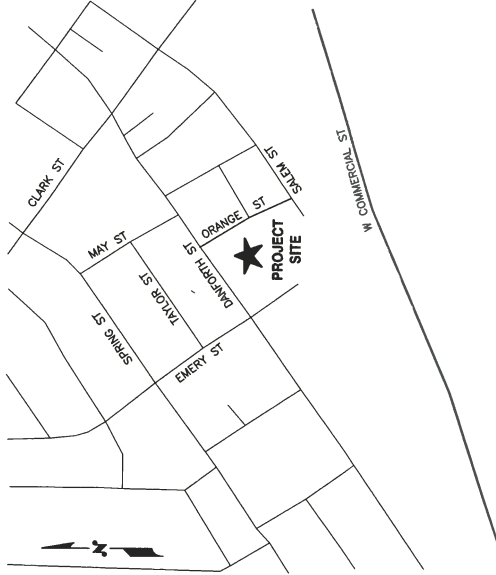
**DRAWING INDEX**

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**VICINITY MAP**

DIRECTIONS:  
 START OUT GOING SOUTHWEST ON COCHITUATE RD / RT-30 W TOWARD BURR ST. MAKE A U-TURN ONTO COCHITUATE RD / RT-30. TAKE THE RAMP TOWARD I-90 / MASSPIKE / SPRINGFIELD / BOSTON. MERGE ONTO I-90 E / MASSACHUSETTS TURNPIKE / MASS PIKE TOWARD I-95 / BOSTON (PORTIONS TOLL). TAKE THE I-95 N / RT-128 N / RT-30 EXIT, EXIT 14, N.H. - PORTLAND (PORTIONS TOLL). MERGE ONTO I-95 N VIA THE EXIT ON THE LEFT TOWARD WALTHAM. PORTLAND (PORTIONS TOLL) (PASSING THROUGH NEW HAMPSHIRE, THEN CROSSING INTO MAINE). MERGE ONTO RT-30 N TOWARD PORTLAND. PORTLAND (PORTIONS TOLL) (PORTIONS TOLL). TAKE EXIT 4 TOWARD PORTLAND. PORTLAND (PORTIONS TOLL) (PORTIONS TOLL). MERGE ONTO I-95 N TOWARD PORTLAND. PORTLAND (PORTIONS TOLL) (PORTIONS TOLL). TAKE EXIT 4 TOWARD PORTLAND. PORTLAND (PORTIONS TOLL) (PORTIONS TOLL). SLIGHT LEFT ONTO VALLEY ST. TURN SLIGHT RIGHT ONTO DANFORTH ST. 284 DANFORTH ST IS ON THE RIGHT.



**GENERAL NOTES**

- THIS DOCUMENT IS THE CREATION, DESIGN, PROPERTY AND COPYRIGHTED WORK OF AT&T. ANY DUPLICATION OR USE WITHOUT EXPRESS WRITTEN CONSENT IS STRICTLY PROHIBITED. THEIR LAWFULLY AUTHORIZED REGULATORY AND ADMINISTRATIVE FUNCTIONS IS SPECIFICALLY ALLOWED.
- THE FACILITY IS AN UNMANNED PRIVATE AND SECURED EQUIPMENT INSTALLATION. IT IS ONLY ACCESSIBLE BY TRAINED PERSONNEL. THE FACILITY IS NOT TO BE OPENED TO THE PUBLIC AND THEREFORE DOES NOT REQUIRE ANY WATER OR SANITARY SEWER SERVICE. THE FACILITY IS NOT COVERED BY REGULATIONS REQUIRING PUBLIC ACCESS PER ADA REQUIREMENTS.
- CONTRACTOR SHALL VERIFY ALL PLANS AND EXISTING DIMENSIONS AND CONDITIONS ON THE JOB SITE AND SHALL IMMEDIATELY NOTIFY THE AT&T REPRESENTATIVE IN WRITING OF DISCREPANCIES BEFORE PROCEEDING WITH THE WORK OR BE RESPONSIBLE FOR SAME.



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**UNDERGROUND SERVICE ALERT**

NO.	DATE	REVISIONS	DESIGNED BY:	DRAWN BY:	SCALE:
2	02/20/13	ISSUED FOR CONSTRUCTION	RP	RP	AS SHOWN
1	02/23/13	ISSUED FOR PERMITTING	RP	RP	AS SHOWN
0	02/20/13	ISSUED FOR REVIEW	RP	RP	AS SHOWN

at&t  
 550 COCHITUATE ROAD  
 FRAMINGHAM, MA 01701

SITE NUMBER: ME5048  
 SITE NAME: PORTLAND HARBOR  
 284 DANFORTH STREET  
 PORTLAND, ME 04102  
 CUMBERLAND COUNTY

**NEXLINK**  
 a LinkTel GLOBAL SERVICES company  
 800 MARSHALL PHELPS ROAD UNIT# 2A  
 WINDSOR, CT 06095

**Hudson Design Group**  
 600 COCHITUATE STREET UNIT 207  
 N. ANDOVER, MA 01854  
 TEL: (978) 334-3338  
 FAX: (978) 334-3338

AT&T  
 TITLE SHEET (LTE)  
 DRAWING NUMBER: ME5048-01  
 1-1  
 REV 2

### GROUNDING NOTES

1. THE SUBCONTRACTOR SHALL REVIEW AND INSPECT THE EXISTING FACILITY GROUNDING SYSTEM AND LIGHTNING PROTECTION SYSTEM (AS DESIGNED AND INSTALLED) FOR STRICT COMPLIANCE WITH THE NEC (AS NOTED BY THE A&T), THE SITE-SPECIFIC (UL, LPI, OR NFPA) LIGHTNING PROTECTION CODE, AND GENERAL COMPLIANCE WITH TELLORDIANE AND TIA GROUNDING STANDARDS. THE SUBCONTRACTOR SHALL REPORT ANY VIOLATIONS OR ADVERSE FINDINGS TO THE CONTRACTOR FOR RESOLUTION.
2. ALL GROUND ELECTRODE SYSTEMS (INCLUDING TELECOMMUNICATION, RAIN, LIGHTNING PROTECTION, AND AC POWER GROUND) SHALL BE BONDED TOGETHER, AT OR BELOW GRADE, BY TWO OR MORE COPPER BONDING CONDUCTORS IN ACCORDANCE WITH THE NEC.
3. THE SUBCONTRACTOR SHALL PERFORM IEEE FALL-OF-POTENTIAL RESISTANCE TO EARTH TESTING (PER IEEE 1100 AND 81) FOR NEW GROUND ELECTRODE SYSTEMS. THE SUBCONTRACTOR SHALL FURNISH AND INSTALL SUPPLEMENTAL GROUND ELECTRODES AS NEEDED TO ACHIEVE A TEST RESULT OF 5 OHMS OR LESS.
4. METAL RACEWAY SHALL NOT BE USED AS THE NEC REQUIRED EQUIPMENT GROUND CONDUCTOR. STRANDED COPPER CONDUCTORS WITH GREEN INSULATION, SIZED IN ACCORDANCE WITH THE NEC, SHALL BE FURNISHED AND INSTALLED WITH THE POWER CIRCUITS TO BTS EQUIPMENT.
5. EACH BTS CABINET FRAME SHALL BE DIRECTLY CONNECTED TO THE MASTER GROUND BAR WITH GREEN INSULATED SUPPLEMENTAL EQUIPMENT WIRES, 6 AWG STRANDED COPPER OR LARGER FOR INDOOR BTS 2 AWG STRANDED COPPER FOR OUTDOOR BTS.
6. EXOTHERMIC WELDS SHALL BE USED FOR ALL GROUNDING CONNECTIONS BELOW GRADE.
7. APPROVED ANTI-OXIDANT COATINGS (I.E., CONDUCTIVE GEL OR PASTE) SHALL BE USED ON ALL COMPRESSION AND BOLTED GROUND CONNECTIONS.
8. ICE BRIDGE BONDING CONDUCTORS SHALL BE EXOTHERMICALLY BONDED OR BOLTED TO THE BRIDGE AND THE TOWER GROUND BAR.
9. ALUMINUM CONDUCTOR OR COPPER CLAD STEEL CONDUCTOR SHALL NOT BE USED FOR GROUNDING CONNECTIONS.
10. MISCELLANEOUS ELECTRICAL AND NON-ELECTRICAL METAL BOXES, FRAMES AND SUPPORTS SHALL BE BONDED TO THE GROUND RING, IN ACCORDANCE WITH THE NEC.
11. METAL CONDUIT SHALL BE MADE ELECTRICALLY CONTINUOUS WITH LISTED BONDING FITTINGS OR BY BONDING ACROSS THE DISCONTINUITY WITH 6 AWG COPPER WIRE UL APPROVED GROUNDING TYPE CONDUIT CLAMPS.
12. ALL NEW STRUCTURES WITH A FOUNDATION AND/OR FOOTING HAVING 20 FT. OR MORE 1/2" OR GREATER ELECTRICALLY CONDUCTIVE REINFORCING STEEL MUST HAVE IT BONDED TO THE GROUND RING USING AN EXOTHERMIC WELD CONNECTION USING #2 AWG SOLID TINNED COPPER GROUND WIRE, PER NEC 250.50

### GENERAL NOTES

1. FOR THE PURPOSE OF CONSTRUCTION DRAWING, THE FOLLOWING DEFINITIONS SHALL APPLY:  
CONTRACTOR - NEXLINK  
SUBCONTRACTOR - GENERAL CONTRACTOR (CONSTRUCTION) OWNER - AT&T MOBILITY
2. PRIOR TO THE SUBMISSION OF BIDS, THE BIDDING SUBCONTRACTOR SHALL VISIT THE CELL SITE TO FAMILIARIZE WITH THE EXISTING CONDITIONS AND TO VERIFY THAT THE WORK CAN BE COMPLETED AS SHOWN ON THE CONSTRUCTION DRAWINGS. ANY DISCREPANCY FOUND SHALL BE BROUGHT TO THE ATTENTION OF CONTRACTOR.
3. ALL MATERIALS FURNISHED AND INSTALLED SHALL BE IN STRICT ACCORDANCE WITH THE NEC, AS NOTED BY THE A&T, AND ALL APPLICABLE LOCAL, STATE, AND FEDERAL LAWS, ORDINANCES, RULES, REGULATIONS, AND LAWFUL ORDERS OF ANY PUBLIC AUTHORITY REGARDING THE PERFORMANCE OF THE WORK. ALL WORK SHALL BE IN STRICT COMPLIANCE WITH ALL APPLICABLE MUNICIPAL AND UTILITY COMPANY SPECIFICATIONS AND LOCAL JURISDICTIONAL CODES, ORDINANCES AND APPLICABLE REGULATIONS.
4. DRAWINGS PROVIDED HERE ARE NOT TO BE SCALED AND ARE INTENDED TO SHOW OUTLINE ONLY.
5. UNLESS NOTED OTHERWISE, THE WORK SHALL INCLUDE FURNISHING MATERIALS, EQUIPMENT, APPURTENANCES, AND LABOR NECESSARY TO COMPLETE ALL INSTALLATIONS AS INDICATED ON THE DRAWINGS.
6. "KITTING LIST" SUPPLIED WITH THE BID PACKAGE IDENTIFIES ITEMS THAT WILL BE SUPPLIED BY CONTRACTOR. ITEMS NOT INCLUDED IN THE BILL OF MATERIALS AND KITTING LIST SHALL BE SUPPLIED BY THE SUBCONTRACTOR.
7. THE SUBCONTRACTOR SHALL INSTALL ALL EQUIPMENT AND MATERIALS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS UNLESS SPECIFICALLY STATED OTHERWISE.
8. IF THE SPECIFIED EQUIPMENT CANNOT BE INSTALLED AS SHOWN ON THESE DRAWINGS, THE SUBCONTRACTOR SHALL PROPOSE AN ALTERNATIVE INSTALLATION PLAN FOR APPROVAL BY THE CONTRACTOR.
9. SUBCONTRACTOR SHALL DETERMINE ACTUAL ROUTING OF CONDUIT, POWER AND TELLORDIANE BONDING SUBCIRCUITS AS SHOWN ON THE POWER, GROUNDING AND TELLORDIANE BONDING DRAWINGS. THE SUBCONTRACTOR SHALL CONFIRM AND/OR PLAN SHALL ADD NEW TRAYS AS NECESSARY. SUBCONTRACTOR SHALL CONFIRM THE ACTUAL ROUTING WITH THE CONTRACTOR.
10. THE SUBCONTRACTOR SHALL PROTECT EXISTING IMPROVEMENTS, PAVEMENTS, CURBS, SIDEWALKS, AND OTHER EXISTING PARTS SHALL BE REPAIRED AT SUBCONTRACTOR'S EXPENSE TO THE SATISFACTION OF OWNER.
11. SUBCONTRACTOR SHALL LEGALLY AND PROPERLY DISPOSE OF ALL SCRAP MATERIALS SUCH AS METALS, WOOD, AND OTHER DEBRIS REMOVED FROM THE EXISTING FACILITY. ANTENNAS REMOVED SHALL BE RETURNED TO THE OWNERS DESIGNATED LOCATION.
12. SUBCONTRACTOR SHALL LEAVE PREMISES IN CLEAN CONDITION.
13. ALL CONCRETE REPAIR WORK SHALL BE DONE IN ACCORDANCE WITH AMERICAN CONCRETE INSTITUTE (ACI) 301.
14. ANY NEW CONCRETE NEEDED FOR THE CONSTRUCTION SHALL BE AIR-ENTRAINED CONCRETE WITH A MINIMUM OF 25% AIR. ALL CONCRETE WORK SHALL BE DONE IN ACCORDANCE WITH ACI 318 CODE REQUIREMENTS.

15. ALL STRUCTURAL STEEL WORK SHALL BE DETAILED, FABRICATED AND ERECTED IN ACCORDANCE WITH AISC SPECIFICATIONS. ALL STRUCTURAL STEEL SHALL BE ASTM A36 (F<sub>y</sub> = 36 ksi) UNLESS OTHERWISE NOTED. PIPES SHALL BE ASTM A53 TYPE E (F<sub>y</sub> = 36 ksi). ALL STEEL EXPOSED TO WEATHER SHALL BE HOT DIPPED GALVANIZED. TOUCH-UP ALL SCRATCHES AND CORROSION IN THE FIELD AFTER STEEL IS ERECTED USING A COMPATIBLE ZINC RICH PAINT.
  16. CONSTRUCTION SHALL COMPLY WITH UNITS SPECIFICATIONS AND "GENERAL CONSTRUCTION SPECIFICATIONS FOR AT&T MOBILITY SITES."
  17. SUBCONTRACTOR SHALL VERIFY ALL EXISTING DIMENSIONS AND CONDITIONS PRIOR TO COMMENCING ANY WORK. ALL DIMENSIONS OF EXISTING CONSTRUCTION SHOWN ON THE DRAWINGS MUST BE VERIFIED. PRIOR TO ORDERING MATERIAL OR PROCEEDING WITH CONSTRUCTION, THE SUBCONTRACTOR SHALL NOTIFY THE CONTRACTOR OF ANY DISCREPANCIES PRIOR TO ORDERING MATERIAL OR PROCEEDING WITH CONSTRUCTION.
  18. THE EXISTING CELL SITE IS IN FULL COMMERCIAL OPERATION. ANY CONSTRUCTION WORK BY SUBCONTRACTOR SHALL NOT DISRUPT THE EXISTING COMMERCIAL OPERATION. ALL CONSTRUCTION SHALL BE COORDINATED WITH CONTRACTOR. ALSO, WORK SHOULD BE SCHEDULED FOR AN APPROPRIATE MAINTENANCE WINDOW USUALLY IN LOW TRAFFIC PERIODS AFTER MIDNIGHT.
  19. SINCE THE CELL SITE IS ACTIVE, ALL SAFETY PRECAUTIONS MUST BE TAKEN WHEN WORKING AROUND HIGH LEVELS OF ELECTROMAGNETIC RADIATION. EQUIPMENT SHOULD BE SHUTDOWN PRIOR TO PERFORMING ANY WORK THAT COULD EXPOSE THE WORKERS TO DANGER. PERSONAL RF EXPOSURE MONITORS SHOULD BE USED TO BE WORN TO ALERT OF ANY DANGEROUS EXPOSURE LEVELS.
  20. APPLICABLE BUILDING CODES:  
SUBCONTRACTOR'S WORK SHALL COMPLY WITH ALL APPLICABLE NATIONAL, STATE AND LOCAL BUILDING CODES AS ADOPTED BY THE LOCAL AUTHORITY HAVING JURISDICTION (A&T) FOR THE LOCATION. THE LATEST ADOPTED CODES AND STANDARDS IN EFFECT ON THE DATE OF CONTRACT AWARD SHALL GOVERN THE DESIGN.  
BUILDING CODE: IBC 2009  
ELECTRICAL DRAWINGS LIGHTNING CODE: REFER TO ELECTRICAL DRAWINGS
- SUBCONTRACTOR'S WORK SHALL COMPLY WITH THE LATEST EDITION OF THE FOLLOWING STANDARDS:
- AMERICAN CONCRETE INSTITUTE (ACI) 318; BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE;
  - AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)
  - MANUAL OF STEEL CONSTRUCTION, ASD, NINTH EDITION;
  - TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA) 222-G, STRUCTURAL STANDARDS FOR STEEL
  - ANTENNA TOWER AND ANTENNA SUPPORTING STRUCTURES, REFER TO ELECTRICAL DRAWINGS FOR SPECIFIC ELECTRICAL STANDARDS.
- FOR ANY CONFLICTS BETWEEN SECTIONS OF LISTED CODES AND STANDARDS REQUIREMENTS, THE MORE STRINGENT REQUIREMENT SHALL GOVERN. WHERE THERE IS CONFLICT BETWEEN A GENERAL REQUIREMENT AND A SPECIFIC REQUIREMENT, THE SPECIFIC REQUIREMENT SHALL GOVERN.

### ABBREVIATIONS

ACL	ABOVE GRADE LEVEL	G.C.	GENERAL CONTRACTOR	RF	RADIO FREQUENCY
AWG	AMERICAN WIRE GAUGE <td>MGB</td> <td>MASTER</td> <td>GROUND BUS</td> <td>TO BE DETERMINED</td>	MGB	MASTER	GROUND BUS	TO BE DETERMINED
BCW	BARE COPPER WIRE <td>MIN</td> <td>MINIMUM</td> <td>TBD</td> <td>TO BE REMOVED</td>	MIN	MINIMUM	TBD	TO BE REMOVED
BTS	BASE TRANSMICER STATION <td>PROPOSED</td> <td>NEW</td> <td>TBR</td> <td>TO BE REMOVED</td>	PROPOSED	NEW	TBR	TO BE REMOVED
EG	EQUIPMENT GROUND <td>N.T.S.</td> <td>NOT TO SCALE</td> <td>TBR</td> <td>AND REPLACED</td>	N.T.S.	NOT TO SCALE	TBR	AND REPLACED
EGR	EQUIPMENT GROUND RINGS <td>REF</td> <td>REFERENCE</td> <td>TYP</td> <td>TYPICAL</td>	REF	REFERENCE	TYP	TYPICAL
		REQ	REQUIRED		



550 COCHITUATE ROAD  
FRAMINGHAM, MA 01701

SITE NUMBER: ME8048  
SITE NAME: PORTLAND HARBOR  
284 DANFORTH STREET  
PORTLAND, ME 04102  
CUMBERLAND COUNTY



800 MARSHALL PHELPS ROAD, UNIT#F-2A  
WINDSOR, CT 06095



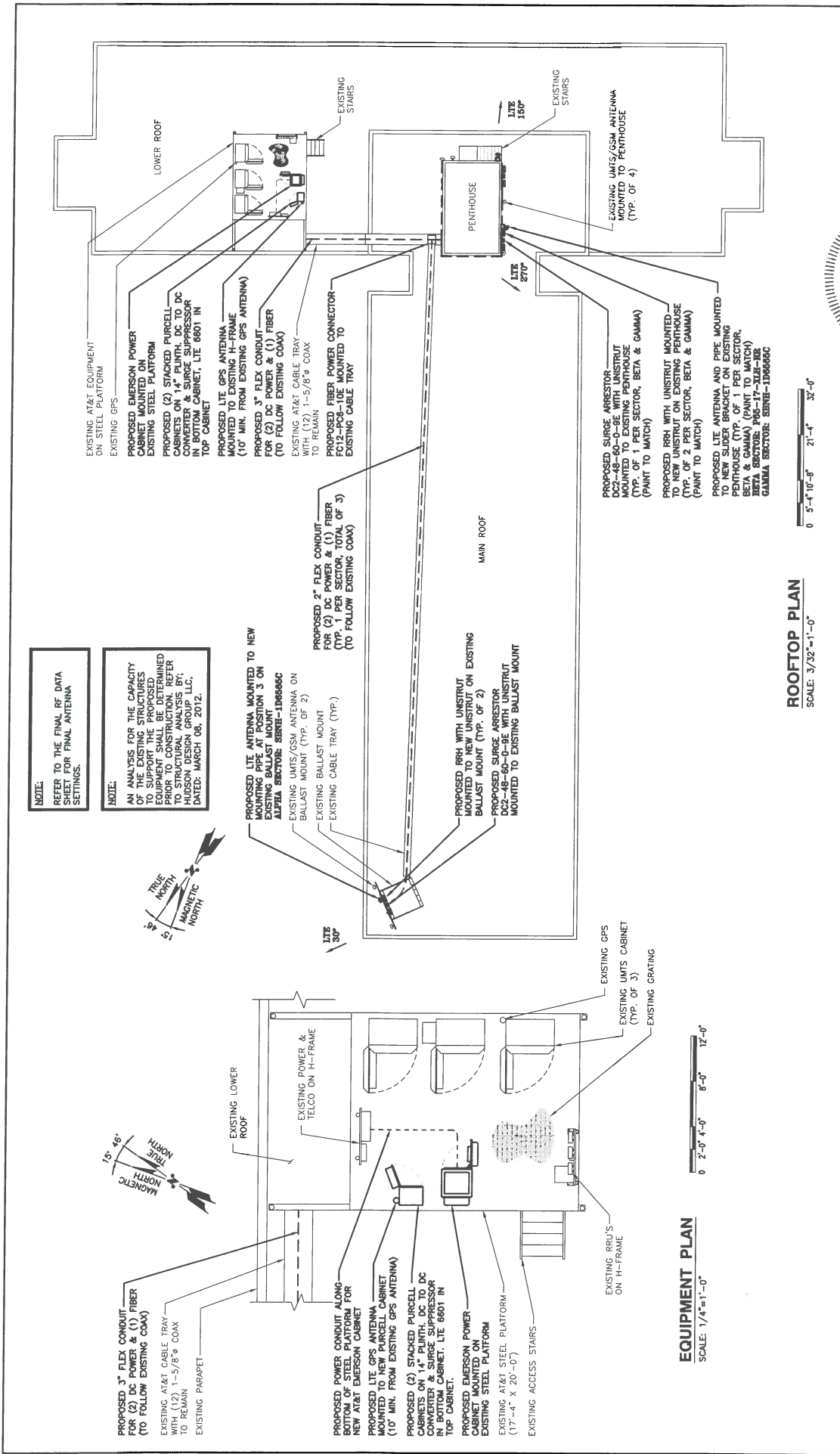
480 GAZDZ STREET  
BRIDGEWATER, MA 01921  
TEL: (978) 327-5550  
FAX: (978) 327-5558

NO. DATE REVISIONS  
2 10/09/12 ISSUED FOR CONSTRUCTION  
1 02/23/12 ISSUED FOR PERMITTING  
0 02/09/12 ISSUED FOR REVIEW

DESIGNED BY: RP  
SCALE: AS SHOWN  
DRAWN BY: RP

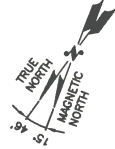
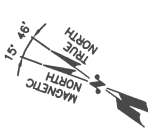
AT&T  
GENERAL NOTES  
(LTE)  
DRAWING NUMBER: CN-1

REV 2



**NOTE:**  
REFER TO THE FINAL RF DATA SHEET FOR FINAL ANTENNA SETTINGS.

**NOTE:**  
AN ANALYSIS FOR THE CAPACITY TO SUPPORT THE PROPOSED EQUIPMENT SHALL BE DETERMINED BY THE ENGINEER. REFER TO STRUCTURAL ANALYSIS BY HUDSON DESIGN GROUP LLC, DATED: MARCH 08, 2012.



**EQUIPMENT PLAN**  
SCALE: 1/4"=1'-0"

**ROOFTOP PLAN**  
SCALE: 3/32"=1'-0"

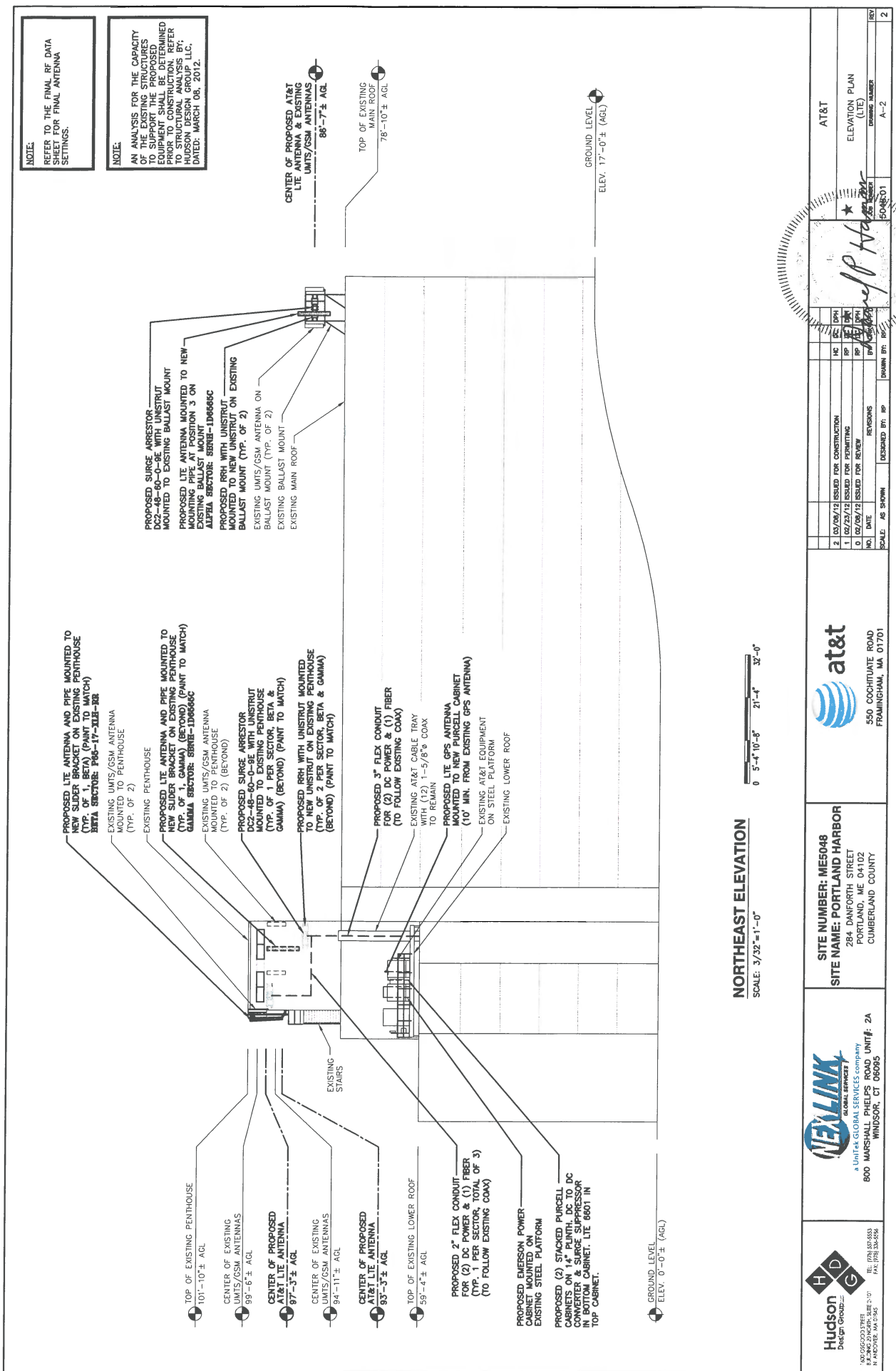
<p>HUDSON DESIGN GROUP INC. 0262003 STREET N. ANDOVER, MA 01861 TEL: 978.557.6550 FAX: 978.557.6550</p>		<p>a Uniflex GLOBAL SERVICES company 800 MARSHALL BELLS ROAD, UNIT# 2A HUDSON, CT 06035</p>		<p><b>SITE NUMBER: ME5048</b> <b>SITE NAME: PORTLAND HARBOR</b> 284 DANFORTH STREET PORTLAND, ME 04102 CUMBERLAND COUNTY</p>		<p>550 COCHITUATE ROAD FRAMINGHAM, MA 01701</p>	
<p>DATE: 02/09/12 ISSUED FOR REVIEW</p>		<p>DATE: 02/09/12 ISSUED FOR REVIEW</p>		<p>DATE: 02/23/12 ISSUED FOR PERMITTING</p>		<p>DATE: 03/09/12 ISSUED FOR CONSTRUCTION</p>	
<p>DESIGNED BY: RP</p>		<p>DESIGNED BY: RP</p>		<p>DESIGNED BY: RP</p>		<p>DESIGNED BY: RP</p>	
<p>SCALE: AS SHOWN</p>		<p>SCALE: AS SHOWN</p>		<p>SCALE: AS SHOWN</p>		<p>SCALE: AS SHOWN</p>	
<p>PROJECT: 5048-01</p>		<p>PROJECT: 5048-01</p>		<p>PROJECT: 5048-01</p>		<p>PROJECT: 5048-01</p>	
<p>DRAWING NUMBER: A-1</p>		<p>DRAWING NUMBER: A-1</p>		<p>DRAWING NUMBER: A-1</p>		<p>DRAWING NUMBER: A-1</p>	
<p>PROJECT: EQUIPMENT &amp; ROOFTOP PLAN (LTE)</p>		<p>PROJECT: EQUIPMENT &amp; ROOFTOP PLAN (LTE)</p>		<p>PROJECT: EQUIPMENT &amp; ROOFTOP PLAN (LTE)</p>		<p>PROJECT: EQUIPMENT &amp; ROOFTOP PLAN (LTE)</p>	
<p>DATE: 02/09/12</p>		<p>DATE: 02/09/12</p>		<p>DATE: 02/09/12</p>		<p>DATE: 02/09/12</p>	
<p>SCALE: 1/4"=1'-0"</p>		<p>SCALE: 1/4"=1'-0"</p>		<p>SCALE: 1/4"=1'-0"</p>		<p>SCALE: 1/4"=1'-0"</p>	
<p>PROJECT: 5048-01</p>		<p>PROJECT: 5048-01</p>		<p>PROJECT: 5048-01</p>		<p>PROJECT: 5048-01</p>	
<p>DATE: 02/09/12</p>		<p>DATE: 02/09/12</p>		<p>DATE: 02/09/12</p>		<p>DATE: 02/09/12</p>	
<p>SCALE: AS SHOWN</p>		<p>SCALE: AS SHOWN</p>		<p>SCALE: AS SHOWN</p>		<p>SCALE: AS SHOWN</p>	
<p>DESIGNED BY: RP</p>		<p>DESIGNED BY: RP</p>		<p>DESIGNED BY: RP</p>		<p>DESIGNED BY: RP</p>	
<p>DATE: 02/09/12</p>		<p>DATE: 02/09/12</p>		<p>DATE: 02/09/12</p>		<p>DATE: 02/09/12</p>	
<p>ISSUED FOR REVIEW</p>		<p>ISSUED FOR REVIEW</p>		<p>ISSUED FOR REVIEW</p>		<p>ISSUED FOR REVIEW</p>	
<p>ISSUED FOR CONSTRUCTION</p>		<p>ISSUED FOR CONSTRUCTION</p>		<p>ISSUED FOR CONSTRUCTION</p>		<p>ISSUED FOR CONSTRUCTION</p>	
<p>DATE: 03/09/12</p>		<p>DATE: 03/09/12</p>		<p>DATE: 03/09/12</p>		<p>DATE: 03/09/12</p>	
<p>ISSUED FOR PERMITTING</p>		<p>ISSUED FOR PERMITTING</p>		<p>ISSUED FOR PERMITTING</p>		<p>ISSUED FOR PERMITTING</p>	
<p>DATE: 02/23/12</p>		<p>DATE: 02/23/12</p>		<p>DATE: 02/23/12</p>		<p>DATE: 02/23/12</p>	
<p>ISSUED FOR CONSTRUCTION</p>		<p>ISSUED FOR CONSTRUCTION</p>		<p>ISSUED FOR CONSTRUCTION</p>		<p>ISSUED FOR CONSTRUCTION</p>	
<p>DATE: 02/09/12</p>		<p>DATE: 02/09/12</p>		<p>DATE: 02/09/12</p>		<p>DATE: 02/09/12</p>	



AT&T  
EQUIPMENT & ROOFTOP PLAN  
(LTE)

**NOTE:**  
REFER TO THE FINAL RF DATA SHEET FOR FINAL ANTENNA SETTINGS.

**NOTE:**  
AN ANALYSIS FOR THE CAPACITY OF THE EXISTING STRUCTURES TO SUPPORT THE PROPOSED EQUIPMENT SHALL BE DETERMINED BY A STRUCTURAL ANALYSIS BY HUDSON DESIGN GROUP, LLC. DATED: MARCH 06, 2012.



**NORTHEAST ELEVATION**  
SCALE: 3/32" = 1'-0"

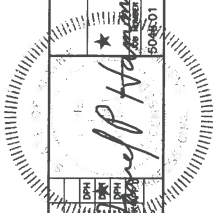
0 5'-4" 10'-8" 21'-4" 32'-0"

**Hudson Design Group, LLC**  
100 GOSWOLD STREET  
FRAMINGHAM, MA 01701  
TEL: (978) 557-5533  
FAX: (978) 557-5535

**NEXLINK**  
a Unitel Global Services Company  
800 MARSHALL PHELPS ROAD UNIT# 2A  
WINDSOR, CT 06095

**at&t**  
SITE NUMBER: ME5048  
SITE NAME: PORTLAND HARBOR  
284 DANFORTH STREET  
PORTLAND, ME 04102  
CUMBERLAND COUNTY

**at&t**  
550 COCHITUATE ROAD  
FRAMINGHAM, MA 01701

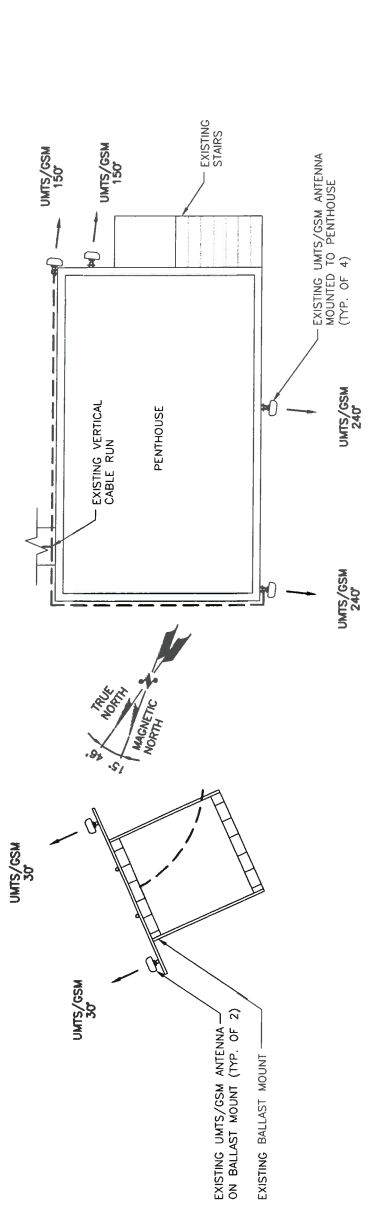


NO.	DATE	REVISIONS	DESIGNED BY:	DRAWN BY:	SCALE
2	03/09/12	ISSUED FOR CONSTRUCTION	RP	RP	AS SHOWN
1	02/23/12	ISSUED FOR PERMITTING	RP	RP	AS SHOWN
0	02/09/12	ISSUED FOR REVIEW	RP	RP	AS SHOWN

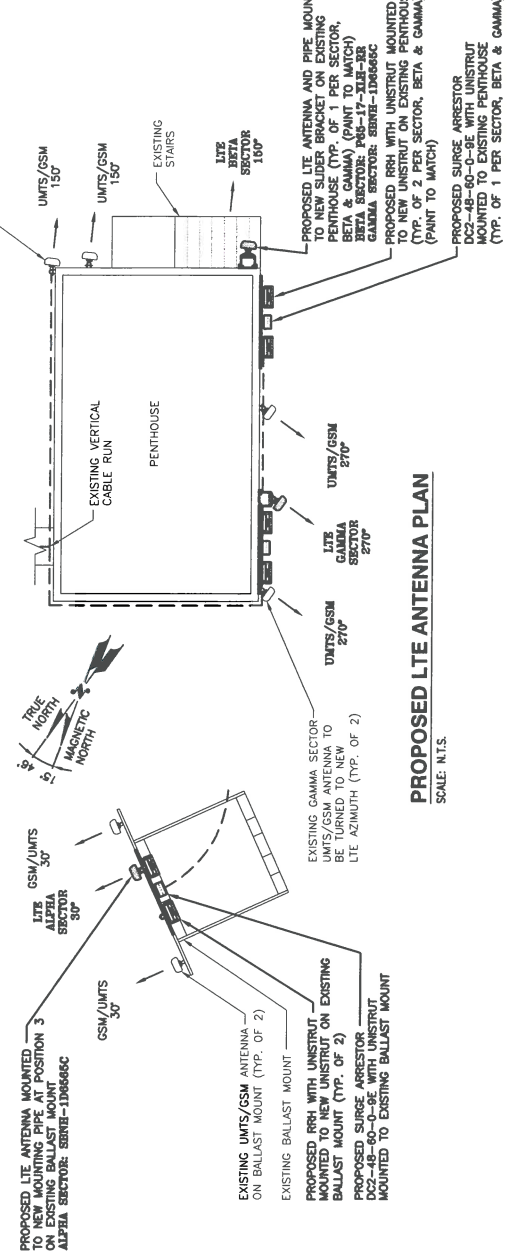
PROJECT: AT&T  
ELEVATION PLAN (LIE)  
DRAWING NUMBER: A-2  
SCALE: 1/8" = 1'-0"  
DATE: 03/01/12

**NOTE:**  
REFER TO THE FINAL RF DATA SHEET FOR FINAL ANTENNA SETTINGS.

**NOTE:**  
AN ANALYSIS FOR THE CAPACITY OF THE EXISTING STRUCTURES TO SUPPORT THE ANTENNA EQUIPMENT SHALL BE DETERMINED PRIOR TO CONSTRUCTION. REFER TO THE FINAL ANALYSIS BY: HUSTON CONSULTING GROUP, LLC, DATED: MARCH 08, 2012.



**EXISTING UMTS/GSM ANTENNA PLAN**  
SCALE: N.T.S.

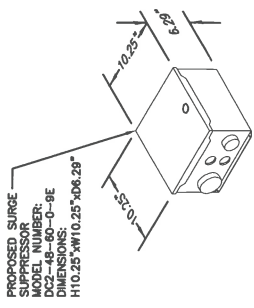


**PROPOSED LTE ANTENNA PLAN**  
SCALE: N.T.S.

800 WASHINGTON STREET, SUITE 200 WINDSOR, CT 06095 TEL: (878) 557-5553 FAX: (878) 557-5556		800 WASHINGTON STREET, SUITE 200 WINDSOR, CT 06095		550 COCHITUATE ROAD FRAMINGHAM, MA 01701	
UNIT# 2A		SITE NAME: PORTLAND HARBOR 284 DANFORTH STREET PORTLAND, ME 04102 CUMBERLAND COUNTY		SITE NUMBER: ME5048	
REVISIONS NO. DATE 0 02/09/12 ISSUED FOR REVIEW 1 02/23/12 ISSUED FOR PERMITTING 2 03/09/12 ISSUED FOR CONSTRUCTION		REVISIONS NO. DATE 0 02/09/12 ISSUED FOR REVIEW 1 02/23/12 ISSUED FOR PERMITTING 2 03/09/12 ISSUED FOR CONSTRUCTION		DECORATED BY: RP DRAWN BY: RP CHECKED BY: RP DESIGNED BY: RP	
PROJECT NUMBER: 5048-01		PROJECT NUMBER: 5048-01		PROJECT NUMBER: 5048-01	
SHEET NUMBER: A-3		SHEET NUMBER: A-3		SHEET NUMBER: A-3	
ANTENNA PLAN (LIE)		ANTENNA PLAN (LIE)		ANTENNA PLAN (LIE)	
AT&T		AT&T		AT&T	

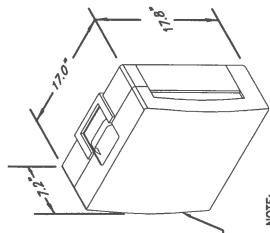
**NOTE:**  
REFER TO THE FINAL RF DATA SHEET FOR FINAL ANTENNA SETTINGS.

**NOTE:**  
AN ANALYSIS FOR THE CAPACITY OF THE EXISTING STRUCTURES TO SUPPORT THE PROPOSED EQUIPMENT SHALL BE DETERMINED PRIOR TO CONSTRUCTION. REFER TO THE STRUCTURAL ANALYSIS BY HUDSON DESIGN GROUP, LLC, DATED: MARCH 08, 2012.



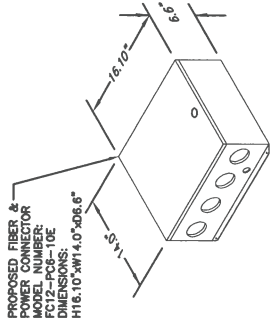
PROPOSED SURGE SUPPRESSOR  
MODEL NUMBER: DC8-48-60-0-9E  
DIMENSIONS:  
H10.25" x W10.25" x D6.28"

**NOTE:**  
MOUNT PER MANUFACTURER'S SPECIFICATIONS.  
**DC SURGE SUPPRESSOR DETAIL**  
SCALE: N.T.S.



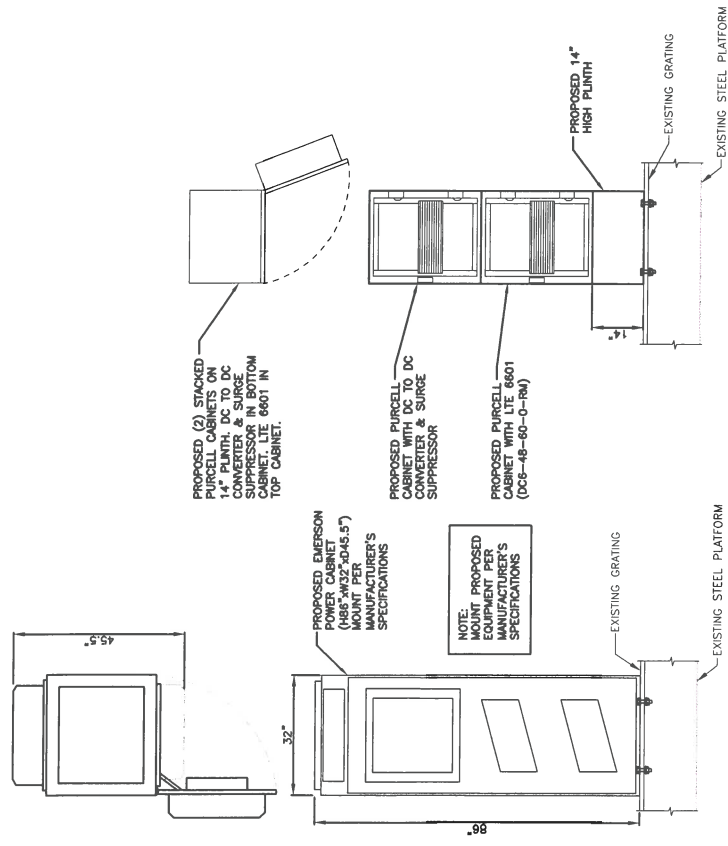
PROPOSED RRH  
DIMENSIONS:  
H17.0" x W17.0" x D7.2"

**NOTE:**  
MOUNT PER MANUFACTURER'S SPECIFICATIONS.  
**RRH DETAIL**  
SCALE: N.T.S.



PROPOSED FIBER & POWER CONNECTOR  
MODEL NUMBER: FC12-PC8-10E  
DIMENSIONS:  
H16.10" x W14.0" x D6.6"

**NOTE:**  
MOUNT PER MANUFACTURER'S SPECIFICATIONS.  
**FIBER & POWER CONNECTOR DETAIL**  
SCALE: N.T.S.



**PROPOSED EQUIPMENT MOUNTING DETAIL**  
SCALE: N.T.S.

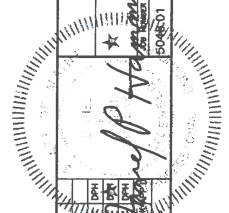


550 COCHITUATE ROAD  
FRAMINGHAM, MA 01701

**SITE NUMBER: ME5048**  
**SITE NAME: PORTLAND HARBOR**  
284 DANFORTH STREET  
PORTLAND, ME 04102  
CUMBERLAND COUNTY

**SMALLINK GLOBAL SERVICES**  
A Unitek GLOBAL SERVICES company  
800 WASHINGTON STATE ROAD UNIT# 2A  
WINDSOR, CT 06095

**Hudson Design Group**  
TEL: (781) 507-5533  
FAX: (781) 507-5535  
142 GOSWORTHY STREET  
MILFORD, MA 01860



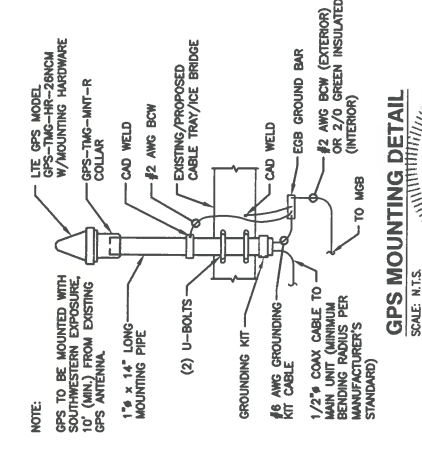
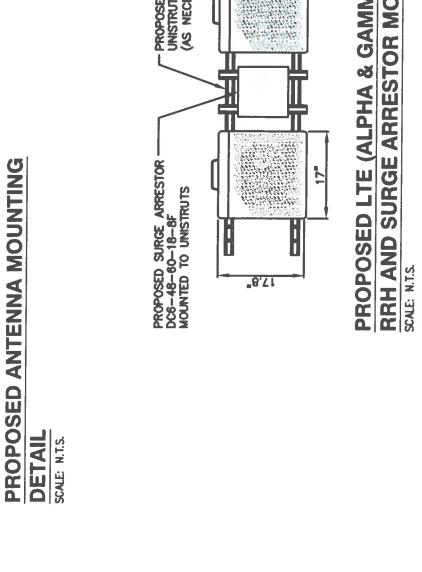
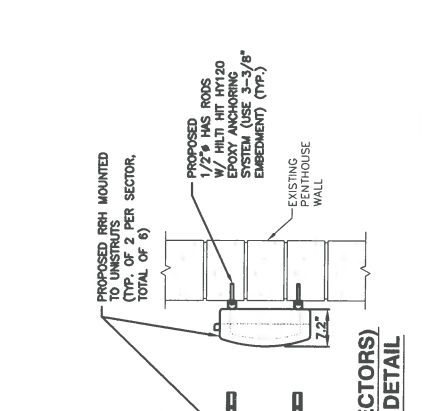
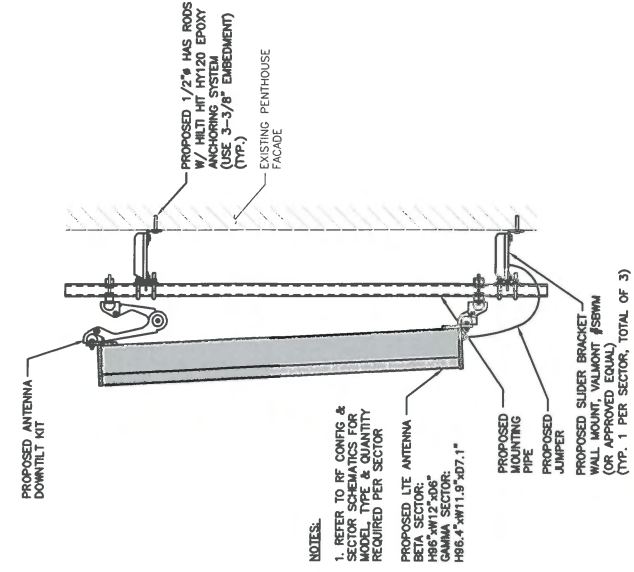
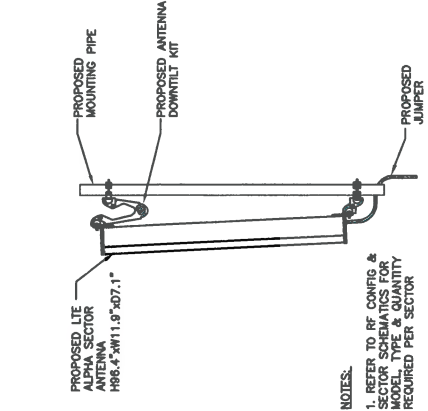
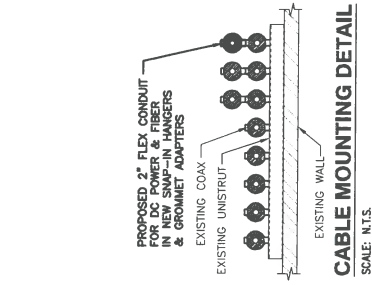
NO.	DATE	DESCRIPTION
1	02/23/12	ISSUED FOR PERMITTING
2	03/09/12	ISSUED FOR CONSTRUCTION
3	02/23/12	ISSUED FOR REVIEW
4	02/09/12	ISSUED FOR REVIEW
5	02/09/12	ISSUED FOR REVIEW
6	02/09/12	ISSUED FOR REVIEW
7	02/09/12	ISSUED FOR REVIEW
8	02/09/12	ISSUED FOR REVIEW
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98	02/09/12	ISSUED FOR REVIEW
99	02/09/12	ISSUED FOR REVIEW
100	02/09/12	ISSUED FOR REVIEW

AT&T  
DETAILS  
(LITE)  
DRAWING NUMBER  
A-4

SCALE: AS SHOWN  
DESIGNED BY: RP  
DRAWN BY: RP

**NOTE:**  
REFER TO THE FINAL RF DATA SHEET FOR FINAL ANTENNA SETTINGS.

**NOTE:**  
AN ANALYSIS FOR THE CAPACITY OF THE EXISTING STRUCTURES TO SUPPORT THE PROPOSED EQUIPMENT SHALL BE DETERMINED BY A STRUCTURAL ENGINEER. REFER TO STRUCTURAL DRAWING S-1, HUDSON DESIGN GROUP LLC, DATED: MARCH 08, 2012.



HUDSON DESIGN GROUP  
1307 GOSWOLD STREET  
MILFORD, MA 01860  
TEL: (978) 537-5533  
FAX: (978) 537-5535

NEXLINK GLOBAL SERVICES COMPANY  
800 WASHINGTON STREET  
WINDSOR, CT 06095

550 COCHITUATE ROAD  
FRAMINGHAM, MA 01701

SITE NUMBER: ME5048  
SITE NAME: PORTLAND HARBOR  
284 DANFORTH STREET  
PORTLAND, ME 04102  
CUMBERLAND COUNTY

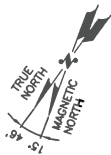
AT&T  
DETAILS  
(LIE)  
DRAWING NUMBER  
A-5

NO.	DATE	REVISIONS	DESIGNED BY:	DRAWN BY:	SCALE:
2	03/09/12	ISSUED FOR CONSTRUCTION	RF	DPH	
1	02/23/12	ISSUED FOR PERMITTING	RF	DPH	
0	02/09/12	ISSUED FOR REVIEW	RF	DPH	

SCALE: AS SHOWN  
DESIGNED BY: RF  
DRAWN BY: DPH

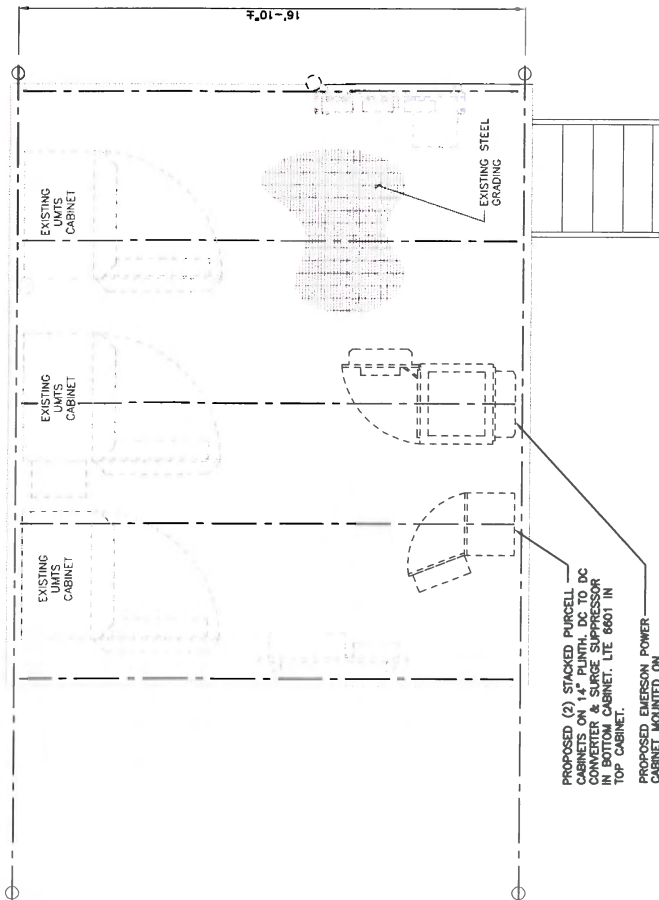
2
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**NOTE:**  
AN ANALYSIS FOR THE CAPACITY OF THE EXISTING STRUCTURES TO SUPPORT THE PROPOSED EQUIPMENT SHALL BE DETERMINED PRIOR TO CONSTRUCTION.

**NOTE:**  
AN ANALYSIS FOR THE CAPACITY OF THE EXISTING STRUCTURES TO SUPPORT THE PROPOSED EQUIPMENT SHALL BE DETERMINED PRIOR TO CONSTRUCTION. REFER TO STRUCTURAL ANALYSIS BY HUDSON DESIGN GROUP LLC, DATED: MARCH 08, 2012.

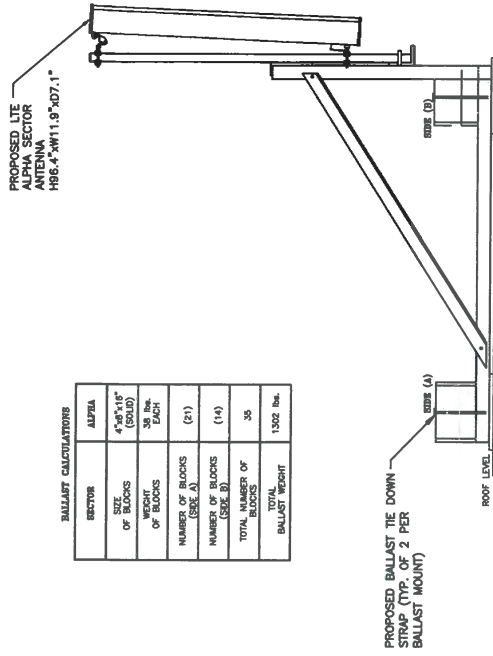


**EXISTING PLATFORM FRAMING PLAN**  
SCALE: 1/2"=1'-0"



**BALLAST CALCULATIONS**

SECTOR	ALPHA
SIZE OF BLOCKS	4"x6"x18" (SOLID)
WEIGHT OF BLOCKS	36 lbs.
NUMBER OF BLOCKS (SEE A)	(21)
NUMBER OF BLOCKS (SEE B)	(14)
TOTAL NUMBER OF BLOCKS	35
BALLAST WEIGHT	1260 lbs.



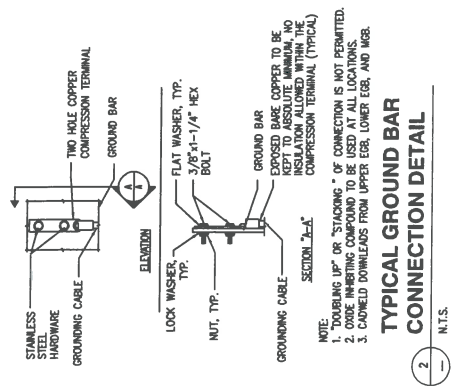
**PROPOSED LTE ANTENNA DETAIL (ALPHA SECTOR)**  
SCALE: N.T.S.



**SITE NUMBER: ME5048**  
**SITE NAME: PORTLAND HARBOR**  
284 DANFORTH STREET  
PORTLAND, ME 04102  
CUMBERLAND COUNTY

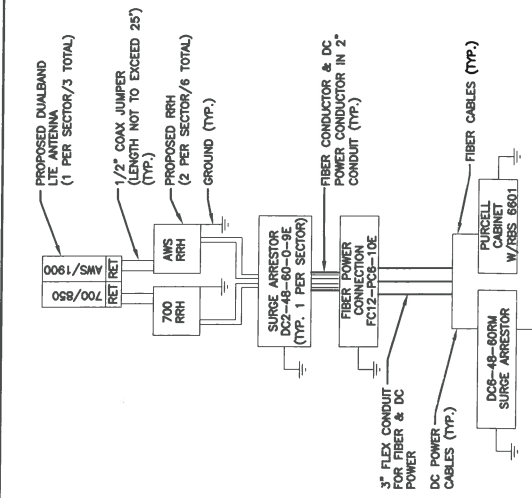


NO.	DATE	REVISIONS	DESIGNED BY: RP	DRAWN BY: RP	DRAWING NUMBER
2	10/09/12	ISSUED FOR CONSTRUCTION			AT&T
1	02/23/12	ISSUED FOR PERMITTING			PLATFORM PLAN (LTE)
0	02/09/12	ISSUED FOR REVIEW			S-1
					5048-01
					2



NOTE:  
 1. "DOWELING UP" OR "STACKING" OF CONNECTION IS NOT PERMITTED.  
 2. WIRING CABLES SHOULD BE USED FOR ALL APPLICATIONS.  
 3. CABLED DOWNLEADS FROM UPPER EBB, LOWER EBB, AND MBB.

TYPICAL GROUND BAR CONNECTION DETAIL  
 2 N.T.S.



NOTES:  
 1. CONTRACTOR TO CONFIRM ALL PARTS.  
 2. INSTALL ALL EQUIPMENT TO MANUFACTURER'S RECOMMENDATIONS.

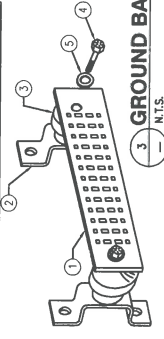
PLUMBING DIAGRAM  
 4 N.T.S.

EACH GROUND CONDUCTOR TERMINATING ON ANY GROUND BAR SHALL HAVE AN IDENTIFICATION TAG ATTACHED AT EACH END THAT WILL IDENTIFY ITS ORIGIN AND DESTINATION.

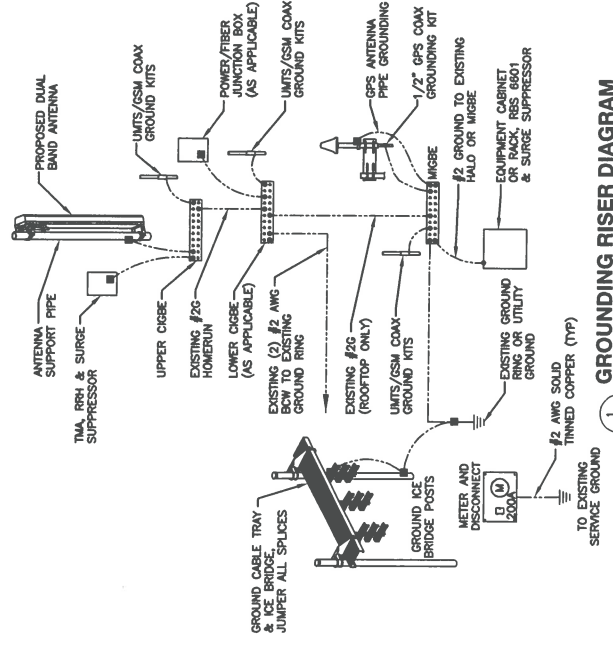
- SECTION "P" - SURGE PRODUCERS
- CABLE ENTRY POINTS (MATCH PLATES) (#2)
  - GENERATOR FRAMEWORK (IF AVAILABLE) (#2)
  - TELECO GROUND BAR
  - COMMERCIAL POWER COMMON NEUTRAL/GROUND BOND (#2)
  - +24V POWER SUPPLY RETURN BAR (#2)
  - 48V POWER SUPPLY RETURN BAR (#2)
  - RECTIFIER FRAMES.

- SECTION "A" - SURGE ABSORBERS
- INTERIOR GROUND RING (#2)
  - EXTERNAL EARTH GROUND FIELD (BURIED GROUND RING) (#2)
  - METALLIC COLD WATER PIPE (IF AVAILABLE) (#2)
  - BUILDING STEEL (IF AVAILABLE) (#2)

WIRELESS SOLUTIONS INC.	
NO.	DESCRIPTION
1	HUB-0420-IS SOLID GND. BAR (20"x4"x1/4")
2	WALL MTG. BRKT.
3	INSULATORS
4	5/8"-11"x1" H.C.S.
5	5/8" LOCKWASHER



GROUND BAR - DETAIL  
 3 N.T.S.



GROUNDING RISER DIAGRAM  
 1 N.T.S.

800 MARSHALL PIKE CT WINDSOR, CT 06095 TEL: 860.336.5555 FAX: 860.336.5555		SITE NUMBER: ME5048 SITE NAME: PORTLAND HARBOR 284 DANFORTH STREET PORTLAND, ME 04102 CUMBERLAND COUNTY	
UNIT # 2A 800 MARSHALL PIKE CT WINDSOR, CT 06095		SCALE: AS SHOWN DESIGNED BY: RP DRAWN BY: RP	
800 MARSHALL PIKE CT WINDSOR, CT 06095 TEL: 860.336.5555 FAX: 860.336.5555		REVISIONS NO. DATE BY REVISIONS 1 02/23/12 ISSUED FOR PERMITTING 2 03/09/12 ISSUED FOR CONSTRUCTION 3 04/26/12 ISSUED FOR REVIEW	
PROJECT NO.: 5048-01 DRAWING NO.: G-1 SHEET NO.: 2		AT&T PLUMBING DIAGRAM & GROUNDING DETAILS (LITE)	



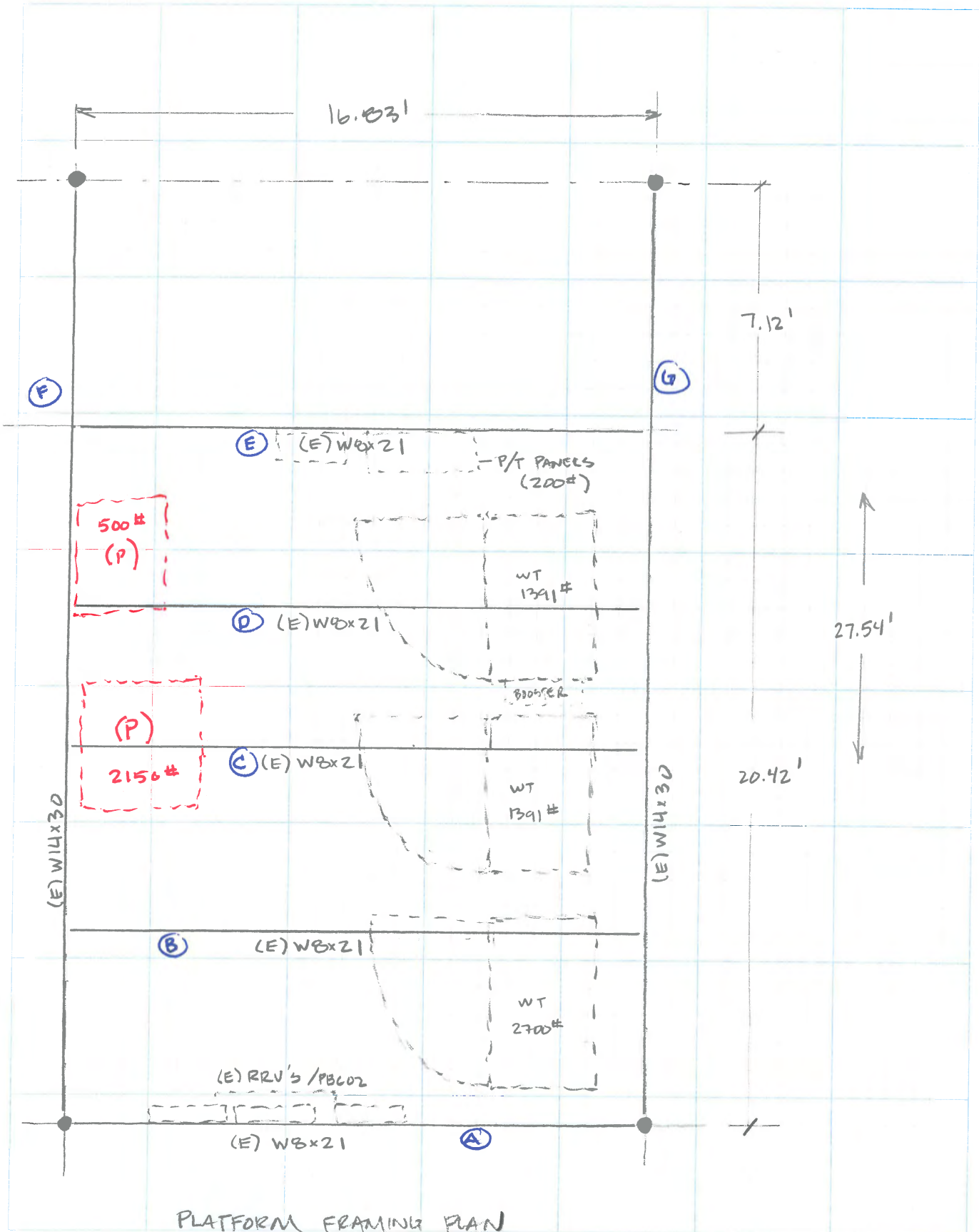
## Calculations

DATE: 2-29-12

Project Name: PORTLAND HARBOR

Project No.: ME5048

Design By: MSC Chk'd By: \_\_\_\_\_ Page \_\_\_\_\_ of \_\_\_\_\_



157132

Project: ME5048 Portland Harbor (LTE) AT&T - Nexlink

Location: Beam A

Multi-Loaded Multi-Span Beam

[2009 International Building Code(AISC 13th Ed ASD)]

A992-50 W8x21 x 16.83 FT

Section Adequate By: 206.0%

Controlling Factor: Deflection

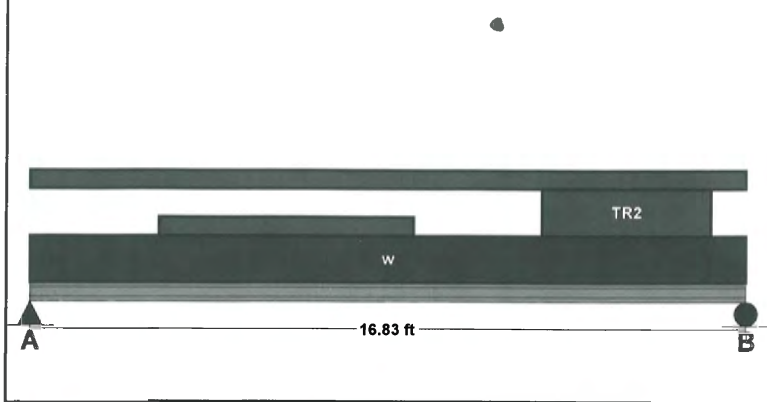
Michael Cabral - Structural Dept. Head  
Hudson Design Group LLC (p) 978.557.5553  
1600 Osgood Street Bldg 20N Suite 2-101  
North Andover, MA 01845

page  
of

StruCalc Version 8.0.111.0

3/1/2012 11:27:50 AM

**LOADING DIAGRAM**



**DEFLECTIONS**

Center

Live Load 0.05 IN L/3910

Dead Load 0.22 in

Total Load 0.27 IN L/734

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

**REACTIONS**

A

B

Live Load 526 lb 526 lb

Dead Load 1974 lb 2772 lb

Total Load 2500 lb 3298 lb

Bearing Length 0.70 in 0.70 in

**BEAM DATA**

Center

Span Length 16.83 ft

Unbraced Length-Top 0 ft

Unbraced Length-Bottom 16.83 ft

**STEEL PROPERTIES**

W8x21 - A992-50

**Properties:**

Yield Stress: Fy = 50 ksi  
Modulus of Elasticity: E = 29000 ksi  
Depth: d = 8.28 in  
Web Thickness: tw = 0.25 in  
Flange Width: bf = 5.27 in  
Flange Thickness: tf = 0.4 in  
Distance to Web Toe of Fillet: k = 0.7 in  
Moment of Inertia About X-X Axis: Ix = 75.3 in4  
Section Modulus About X-X Axis: Sx = 18.2 in3  
Plastic Section Modulus About X-X Axis: Zx = 20.4 in3

**Design Properties per AISC 13th Edition Steel Manual:**

Flange Buckling Ratio: FBR = 6.59  
Allowable Flange Buckling Ratio: AFBR = 9.15  
Web Buckling Ratio: WBR = 27.52  
Allowable Web Buckling Ratio: AWBR = 90.55  
Controlling Unbraced Length: Lb = 0 ft  
Limiting Unbraced Length -  
for lateral-torsional buckling: Lp = 4.45 ft  
Nominal Flexural Strength w/ safety factor: Mn = 50898 ft-lb  
Controlling Equation: F2-1  
Web height to thickness ratio: h/tw = 27.52  
Limiting height to thickness ratio for eqn. G2-2: h/tw-limit = 53.95  
Cv Factor: Cv = 1  
Controlling Equation: G2-2  
Nominal Shear Strength w/ safety factor: Vn = 41400 lb

**Controlling Moment:**

11599 ft-lb

8.92 Ft from left support of span 2 (Center Span)

Created by combining all dead loads and live loads on span(s) 2

**Controlling Shear:**

-3298 lb

17.0 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): 24.6 in4 75.3 in4

Moment: 11599 ft-lb 50898 ft-lb

Shear: -3298 lb 41400 lb

**UNIFORM LOADS**

Center

Uniform Live Load 63 plf

Uniform Dead Load 80 plf

Beam Self Weight 21 plf

Total Uniform Load 164 plf

**TRAPEZOIDAL LOADS - CENTER SPAN**

Load Number	One	Two	Three
Left Live Load	0 plf	0 plf	0 plf
Left Dead Load	58 plf	338 plf	80 plf
Right Live Load	0 plf	0 plf	0 plf
Right Dead Load	58 plf	338 plf	80 plf
Load Start	3 ft	12 ft	0 ft
Load End	9 ft	16 ft	16.83 ft
Load Length	6 ft	4 ft	16.83 ft

Project: ME5048 Portland Harbor (LTE) AT&T - Nexlink

Location: Beam A  
Multi-Loaded Multi-Span Beam  
[2009 International Building Code(AISC 13th Ed ASD)]  
A992-50 W8x21 x 16.83 FT  
Section Adequate By: 206.0%  
Controlling Factor: Deflection

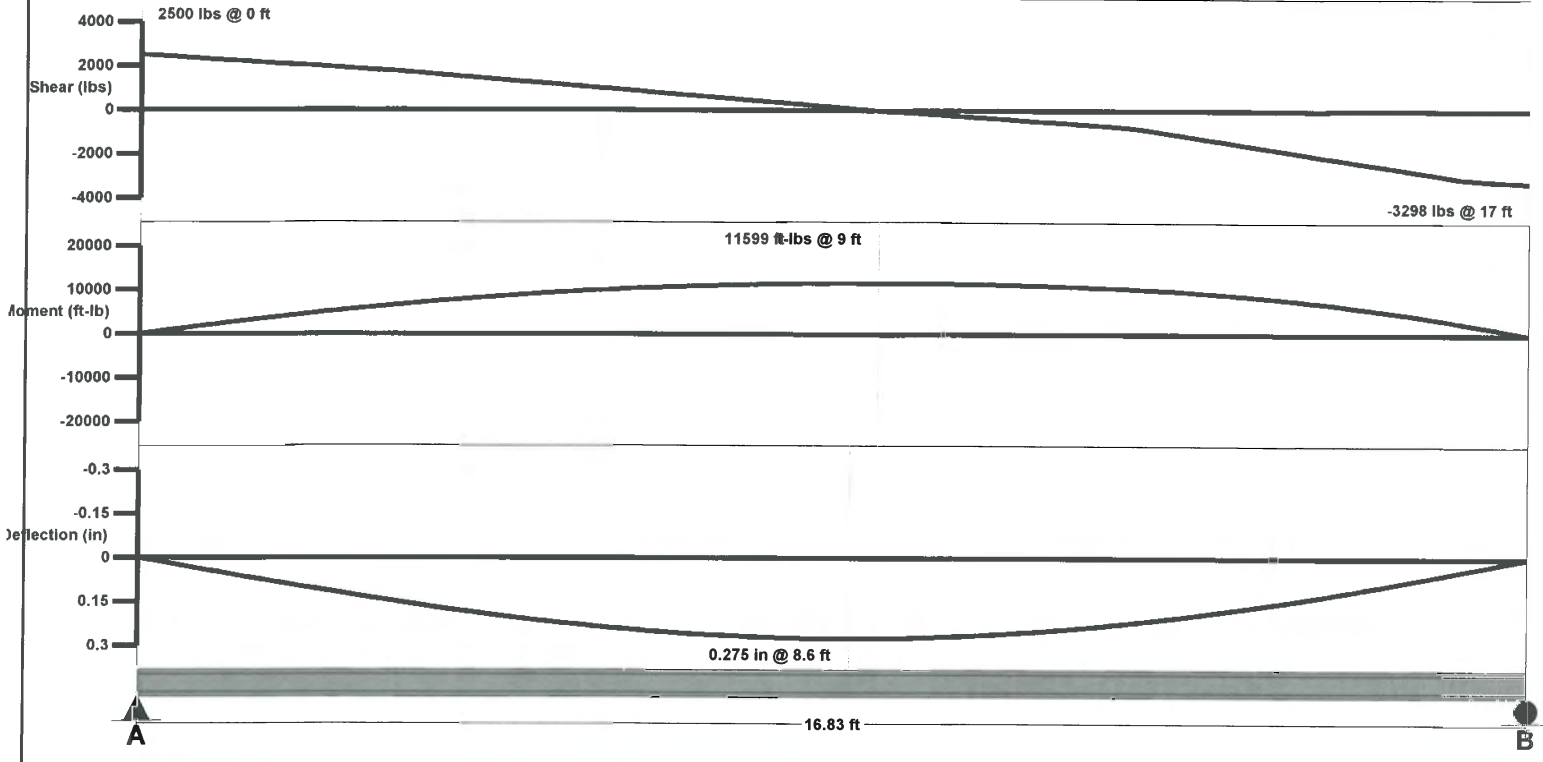
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**VMD DIAGRAM**



Project: ME5048 Portland Harbor (LTE) AT&T - Nexlink

Location: Beam B  
Multi-Loaded Multi-Span Beam  
[2009 International Building Code(AISC 13th Ed ASD)]  
A992-50 W8x21 x 16.83 FT  
Section Adequate By: 254.3%  
Controlling Factor: Deflection

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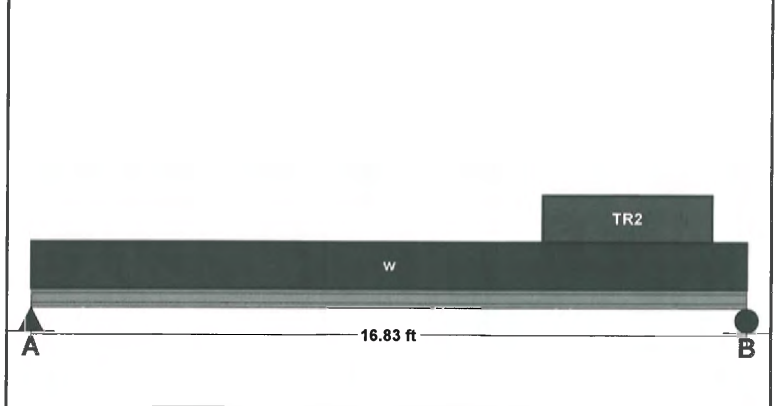
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**LOADING DIAGRAM**



<b>DEFLECTIONS</b>		Center
Live Load	0.10	IN L/1955
Dead Load	0.13	in
Total Load	0.24	IN L/850
Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240		

<b>REACTIONS</b>		A	B
Live Load	1052 lb	1052 lb	
Dead Load	1077 lb	1975 lb	
Total Load	2129 lb	3026 lb	
Bearing Length	0.70 in	0.70 in	

<b>BEAM DATA</b>		Center
Span Length	16.83	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	16.83	ft

**STEEL PROPERTIES**  
W8x21 - A992-50

**Properties:**

Yield Stress:	Fy =	50 ksi
Modulus of Elasticity:	E =	29000 ksi
Depth:	d =	8.28 in
Web Thickness:	tw =	0.25 in
Flange Width:	bf =	5.27 in
Flange Thickness:	tf =	0.4 in
Distance to Web Toe of Fillet:	k =	0.7 in
Moment of Inertia About X-X Axis:	Ix =	75.3 in4
Section Modulus About X-X Axis:	Sx =	18.2 in3
Plastic Section Modulus About X-X Axis:	Zx =	20.4 in3

**Design Properties per AISC 13th Edition Steel Manual:**

Flange Buckling Ratio:	FBR =	6.59
Allowable Flange Buckling Ratio:	AFBR =	9.15
Web Buckling Ratio:	WBR =	27.52
Allowable Web Buckling Ratio:	AWBR =	90.55
Controlling Unbraced Length:	Lb =	0 ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	4.45 ft
Nominal Flexural Strength w/ safety factor:	Mn =	50898 ft-lb
Controlling Equation:	F2-1	
Web height to thickness ratio:	h/tw =	27.52
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95
Cv Factor:	Cv =	1
Controlling Equation:	G2-2	
Nominal Shear Strength w/ safety factor:	Vn =	41400 lb

<b>UNIFORM LOADS</b>		Center
Uniform Live Load	125	plf
Uniform Dead Load	80	plf
Beam Self Weight	21	plf
Total Uniform Load	226	plf

<b>TRAPEZOIDAL LOADS - CENTER SPAN</b>		
Load Number	Two	
Left Live Load	0	plf
Left Dead Load	338	plf
Right Live Load	0	plf
Right Dead Load	338	plf
Load Start	12	ft
Load End	16	ft
Load Length	4	ft

**Controlling Moment:** 10029 ft-lb  
9.42 Ft from left support of span 2 (Center Span)  
Created by combining all dead loads and live loads on span(s) 2

**Controlling Shear:** -3026 lb  
17.0 Ft from left support of span 2 (Center Span)  
Created by combining all dead loads and live loads on span(s)

<b>Comparisons with required sections:</b>	Req'd	Provided
Moment of Inertia (deflection):	21.26 in4	75.3 in4
Moment:	10029 ft-lb	50898 ft-lb
Shear:	-3026 lb	41400 lb

Project: ME5048 Portland Harbor (LTE) AT&T - Nexlink

Location: Beam B  
Multi-Loaded Multi-Span Beam  
[2009 International Building Code(AISC 13th Ed ASD)]  
A992-50 W8x21 x 16.83 FT  
Section Adequate By: 254.3%  
Controlling Factor: Deflection

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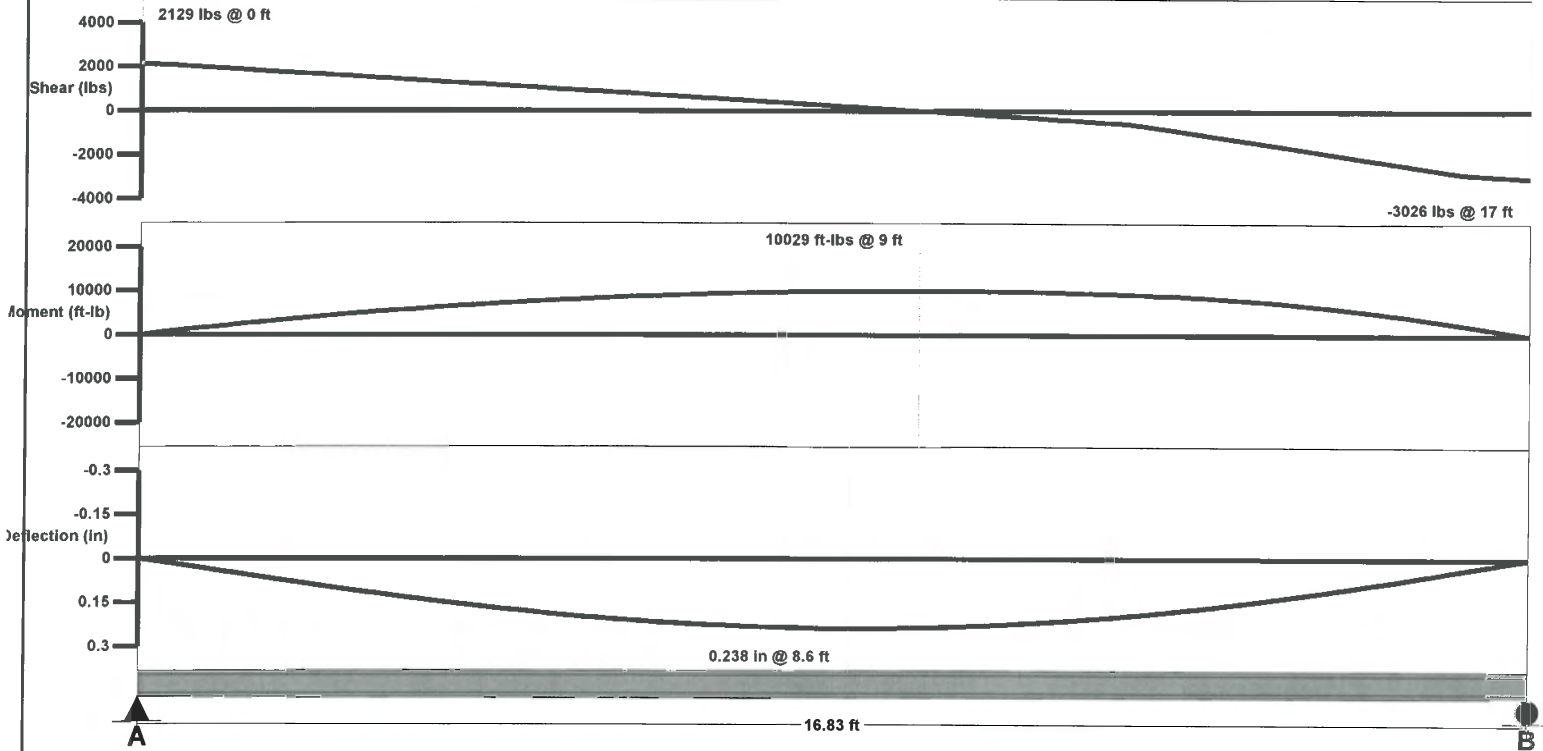
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### VMD DIAGRAM





Project: ME5048 Portland Harbor (LTE) AT&T - Nexlink

Location: Beam C  
 Multi-Loaded Multi-Span Beam  
 [2009 International Building Code(AISC 13th Ed ASD)]  
 A992-50 W8x21 x 16.83 FT  
 Section Adequate By: 155.3%  
 Controlling Factor: Deflection

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DEFLECTIONS		Center
Live Load	0.10	IN L/1955
Dead Load	0.23	in
Total Load	0.33	IN L/613
Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240		

REACTIONS	A	B
Live Load	1052 lb	1052 lb
Dead Load	3144 lb	2097 lb
Total Load	4195 lb	3149 lb
Bearing Length	0.70 in	0.70 in

BEAM DATA	Center
Span Length	16.83 ft
Unbraced Length-Top	0 ft
Unbraced Length-Bottom	16.83 ft

**STEEL PROPERTIES**

W8x21 - A992-50

**Properties:**

Yield Stress:	Fy =	50 ksi
Modulus of Elasticity:	E =	29000 ksi
Depth:	d =	8.28 in
Web Thickness:	tw =	0.25 in
Flange Width:	bf =	5.27 in
Flange Thickness:	ff =	0.4 in
Distance to Web Toe of Fillet:	k =	0.7 in
Moment of Inertia About X-X Axis:	Ix =	75.3 in4
Section Modulus About X-X Axis:	Sx =	18.2 in3
Plastic Section Modulus About X-X Axis:	Zx =	20.4 in3

**Design Properties per AISC 13th Edition Steel Manual:**

Flange Buckling Ratio:	FBR =	6.59
Allowable Flange Buckling Ratio:	AFBR =	9.15
Web Buckling Ratio:	WBR =	27.52
Allowable Web Buckling Ratio:	AWBR =	90.55
Controlling Unbraced Length:	Lb =	0 ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	4.45 ft
Nominal Flexural Strength w/ safety factor:	Mn =	50898 ft-lb
Controlling Equation:	F2-1	
Web height to thickness ratio:	h/tw =	27.52
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95
Cv Factor:	Cv =	1
Controlling Equation:	G2-2	
Nominal Shear Strength w/ safety factor:	Vn =	41400 lb

**Controlling Moment:** 13557 ft-lb

9.09 Ft from left support of span 2 (Center Span)

Created by combining all dead loads and live loads on span(s) 2

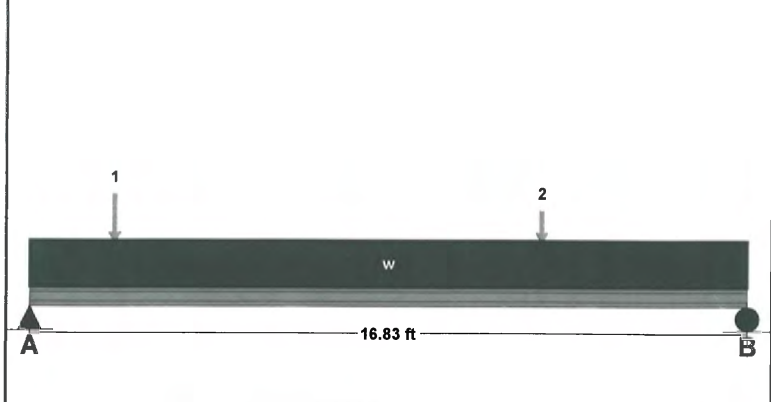
**Controlling Shear:** 4195 lb

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):	29.5 in4	75.3 in4
Moment:	13557 ft-lb	50898 ft-lb
Shear:	4195 lb	41400 lb

**LOADING DIAGRAM**



**UNIFORM LOADS**

	Center
Uniform Live Load	125 plf
Uniform Dead Load	80 plf
Beam Self Weight	21 plf
Total Uniform Load	226 plf

**POINT LOADS - CENTER SPAN**

Load Number	One	Two
Live Load	0 lb	0 lb
Dead Load	2150 lb	1391 lb
Location	2 ft	12 ft

Project: ME5048 Portland Harbor (LTE) AT&T - Nexlink

Location: Beam C  
Multi-Loaded Multi-Span Beam  
[2009 International Building Code(AISC 13th Ed ASD)]  
A992-50 W8x21 x 16.83 FT  
Section Adequate By: 155.3%  
Controlling Factor: Deflection

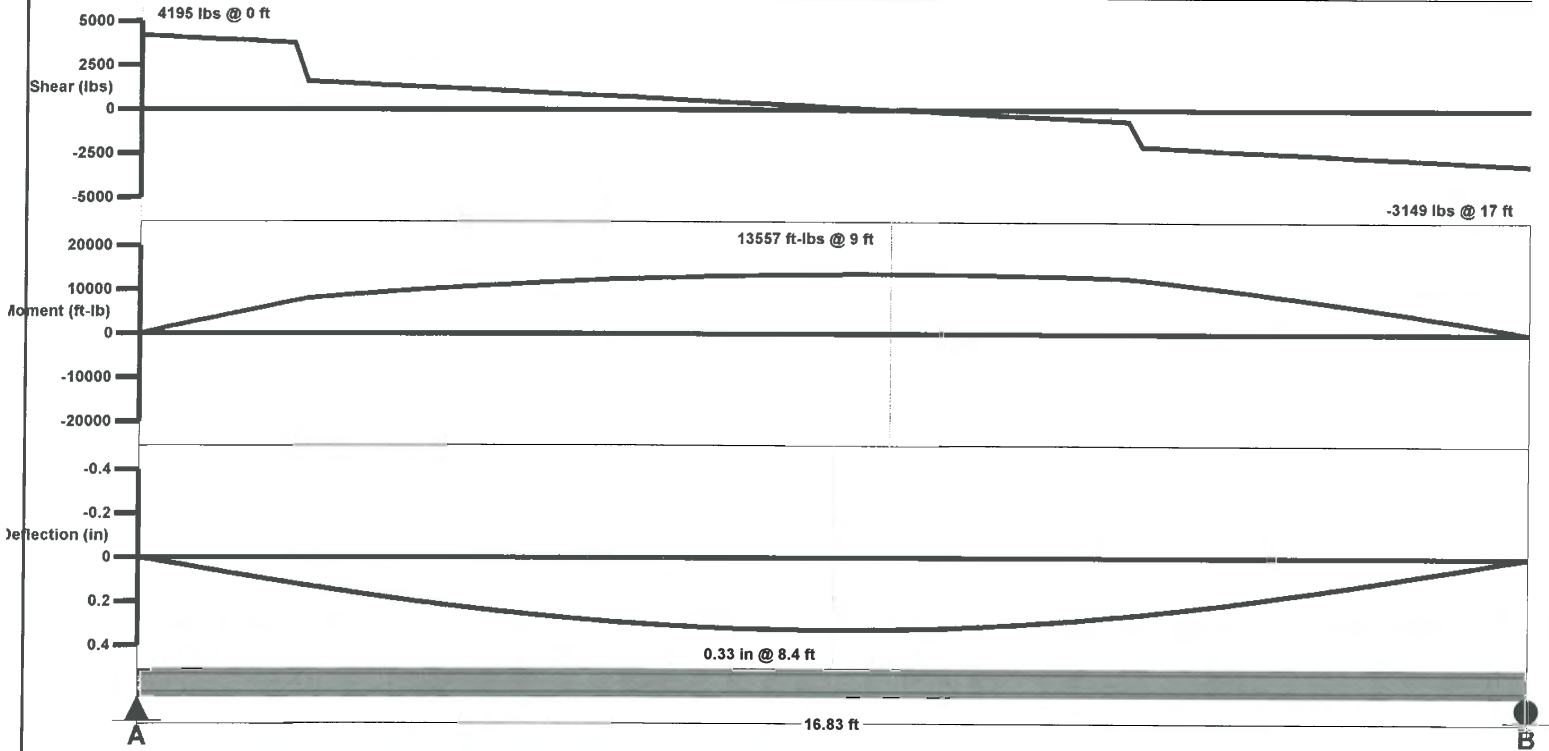
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**VMD DIAGRAM**



Project: ME5048 Portland Harbor (LTE) AT&T - Nexlink

Location: Beam D

Multi-Loaded Multi-Span Beam

[2009 International Building Code(AISC 13th Ed ASD)]

A992-50 W8x21 x 16.83 FT

Section Adequate By: 195.8%

Controlling Factor: Deflection

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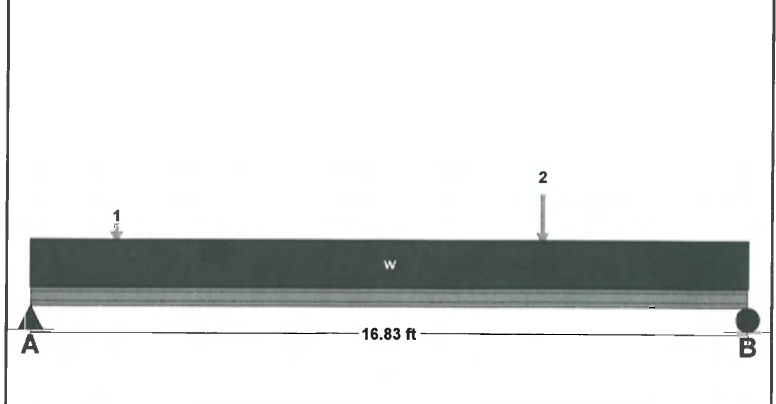
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**LOADING DIAGRAM**



**DEFLECTIONS** Center

Live Load 0.10 IN L/1955

Dead Load 0.18 in

Total Load 0.28 IN L/710

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

**REACTIONS**

Live Load 1052 lb 1052 lb

Dead Load 1690 lb 1901 lb

Total Load 2742 lb 2953 lb

Bearing Length 0.70 in 0.70 in

**BEAM DATA**

Span Length 16.83 ft

Unbraced Length-Top 0 ft

Unbraced Length-Bottom 16.83 ft

**STEEL PROPERTIES**

W8x21 - A992-50

**Properties:**

Yield Stress:	Fy =	50 ksi
Modulus of Elasticity:	E =	29000 ksi
Depth:	d =	8.28 in
Web Thickness:	tw =	0.25 in
Flange Width:	bf =	5.27 in
Flange Thickness:	tf =	0.4 in
Distance to Web Toe of Fillet:	k =	0.7 in
Moment of Inertia About X-X Axis:	Ix =	75.3 in4
Section Modulus About X-X Axis:	Sx =	18.2 in3
Plastic Section Modulus About X-X Axis:	Zx =	20.4 in3

**Design Properties per AISC 13th Edition Steel Manual:**

Flange Buckling Ratio:	FBR =	6.59
Allowable Flange Buckling Ratio:	AFBR =	9.15
Web Buckling Ratio:	WBR =	27.52
Allowable Web Buckling Ratio:	AWBR =	90.55
Controlling Unbraced Length:	Lb =	0 ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	4.45 ft
Nominal Flexural Strength w/ safety factor:	Mn =	50898 ft-lb
Controlling Equation:	F2-1	
Web height to thickness ratio:	h/tw =	27.52
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95
Cv Factor:	Cv =	1
Controlling Equation:	G2-2	
Nominal Shear Strength w/ safety factor:	Vn =	41400 lb

**Controlling Moment:** 12116 ft-lb

9.93 Ft from left support of span 2 (Center Span)

Created by combining all dead loads and live loads on span(s) 2

**Controlling Shear:** -2953 lb

17.0 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:**

	<u>Req'd</u>	<u>Provided</u>
Moment of Inertia (deflection):	25.46 in4	75.3 in4
Moment:	12116 ft-lb	50898 ft-lb
Shear:	-2953 lb	41400 lb

**UNIFORM LOADS** Center

Uniform Live Load 125 plf

Uniform Dead Load 80 plf

Beam Self Weight 21 plf

Total Uniform Load 226 plf

**POINT LOADS - CENTER SPAN**

Load Number One Two

Live Load 0 lb 0 lb

Dead Load 500 lb 1391 lb

Location 2 ft 12 ft

Project: ME5048 Portland Harbor (LTE) AT&T - Nexlink

Location: Beam D  
Multi-Loaded Multi-Span Beam  
[2009 International Building Code(AISC 13th Ed ASD)]  
A992-50 W8x21 x 16.83 FT  
Section Adequate By: 195.8%  
Controlling Factor: Deflection

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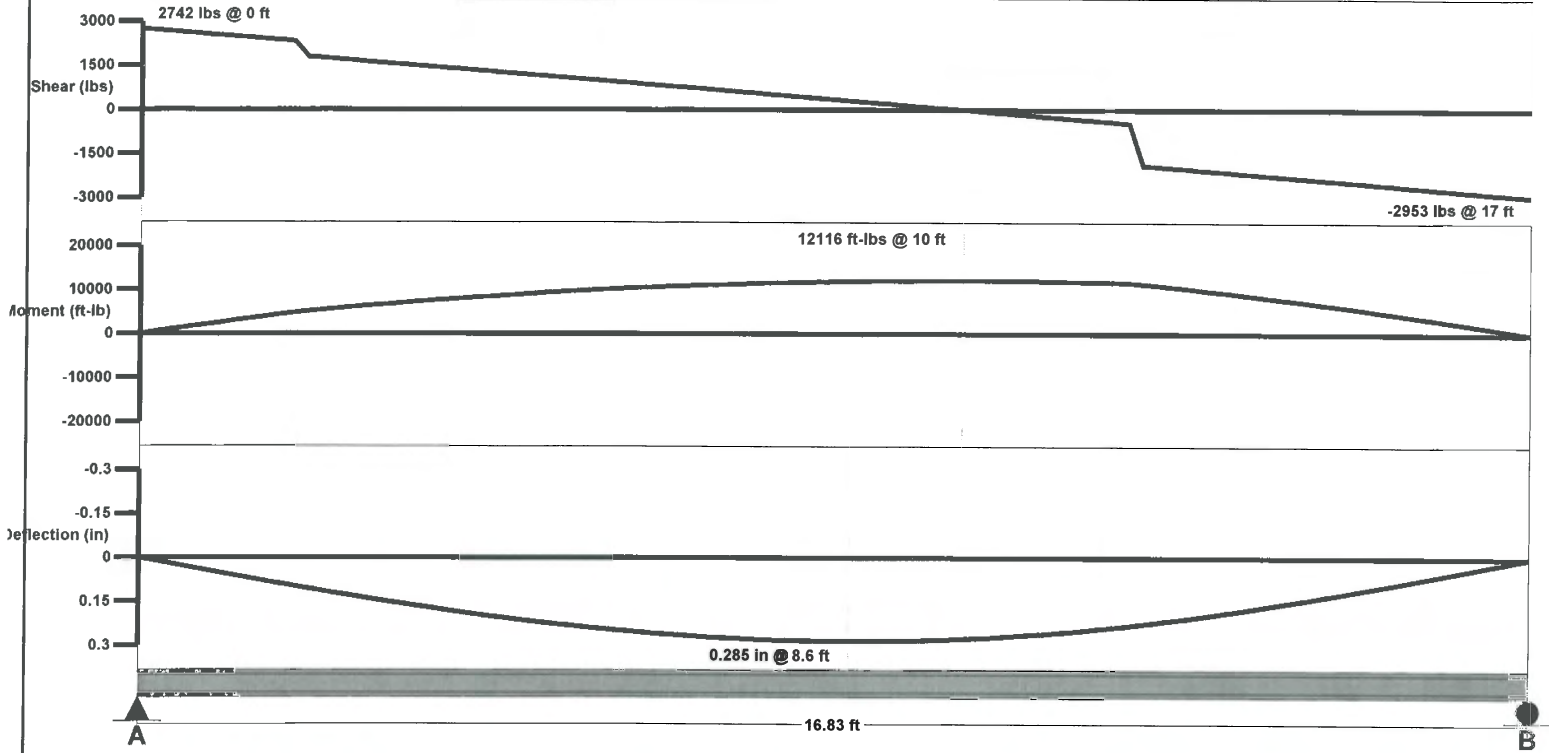
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**VMD DIAGRAM**



Project: ME5048 Portland Harbor (LTE) AT&T - Nexlink

Location: Beam E

Multi-Loaded Multi-Span Beam

[2009 International Building Code(AISC 13th Ed ASD)]

A992-50 W8x21 x 16.83 FT

Section Adequate By: 360.1%

Controlling Factor: Deflection

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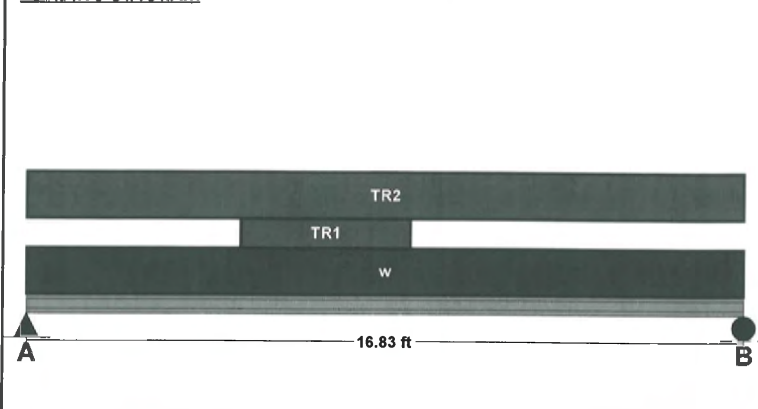
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**LOADING DIAGRAM**



**DEFLECTIONS** Center

Live Load 0.05 IN L/3910

Dead Load 0.13 in

Total Load 0.18 IN L/1104

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

**REACTIONS**

Live Load 526 lb 526 lb

Dead Load 1303 lb 1270 lb

Total Load 1829 lb 1796 lb

Bearing Length 0.70 in 0.70 in

**BEAM DATA**

Span Length 16.83 ft

Unbraced Length-Top 0 ft

Unbraced Length-Bottom 16.83 ft

**STEEL PROPERTIES**

W8x21 - A992-50

**Properties:**

Yield Stress:	Fy =	50 ksi
Modulus of Elasticity:	E =	29000 ksi
Depth:	d =	8.28 in
Web Thickness:	tw =	0.25 in
Flange Width:	bf =	5.27 in
Flange Thickness:	tf =	0.4 in
Distance to Web Toe of Fillet:	k =	0.7 in
Moment of Inertia About X-X Axis:	Ix =	75.3 in4
Section Modulus About X-X Axis:	Sx =	18.2 in3
Plastic Section Modulus About X-X Axis:	Zx =	20.4 in3

**Design Properties per AISC 13th Edition Steel Manual:**

Flange Buckling Ratio:	FBR =	6.59
Allowable Flange Buckling Ratio:	AFBR =	9.15
Web Buckling Ratio:	WBR =	27.52
Allowable Web Buckling Ratio:	AWBR =	90.55
Controlling Unbraced Length:	Lb =	0 ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	4.45 ft
Nominal Flexural Strength w/ safety factor: Controlling Equation:	Mn =	50898 ft-lb
Web height to thickness ratio:	h/tw =	27.52
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95
Cv Factor:	Cv =	1
Controlling Equation:	G2-2	
Nominal Shear Strength w/ safety factor:	Vn =	41400 lb

**Controlling Moment:** 7902 ft-lb

8.25 Ft from left support of span 2 (Center Span)

Created by combining all dead loads and live loads on span(s) 2

**Controlling Shear:** 1829 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):	16.37 in4	75.3 in4
Moment:	7902 ft-lb	50898 ft-lb
Shear:	1829 lb	41400 lb

**UNIFORM LOADS** Center

Uniform Live Load 63 plf

Uniform Dead Load 40 plf

Beam Self Weight 21 plf

Total Uniform Load 124 plf

**TRAPEZOIDAL LOADS - CENTER SPAN**

Load Number	One	Two
Left Live Load	0 plf	0 plf
Left Dead Load	50 plf	80 plf
Right Live Load	0 plf	0 plf
Right Dead Load	50 plf	80 plf
Load Start	5 ft	0 ft
Load End	9 ft	16.83 ft
Load Length	4 ft	16.83 ft

Project: ME5048 Portland Harbor (LTE) AT&T - Nexlink

Location: Beam E  
Multi-Loaded Multi-Span Beam  
[2009 International Building Code(AISC 13th Ed ASD)]  
A992-50 W8x21 x 16.83 FT  
Section Adequate By: 360.1%  
Controlling Factor: Deflection

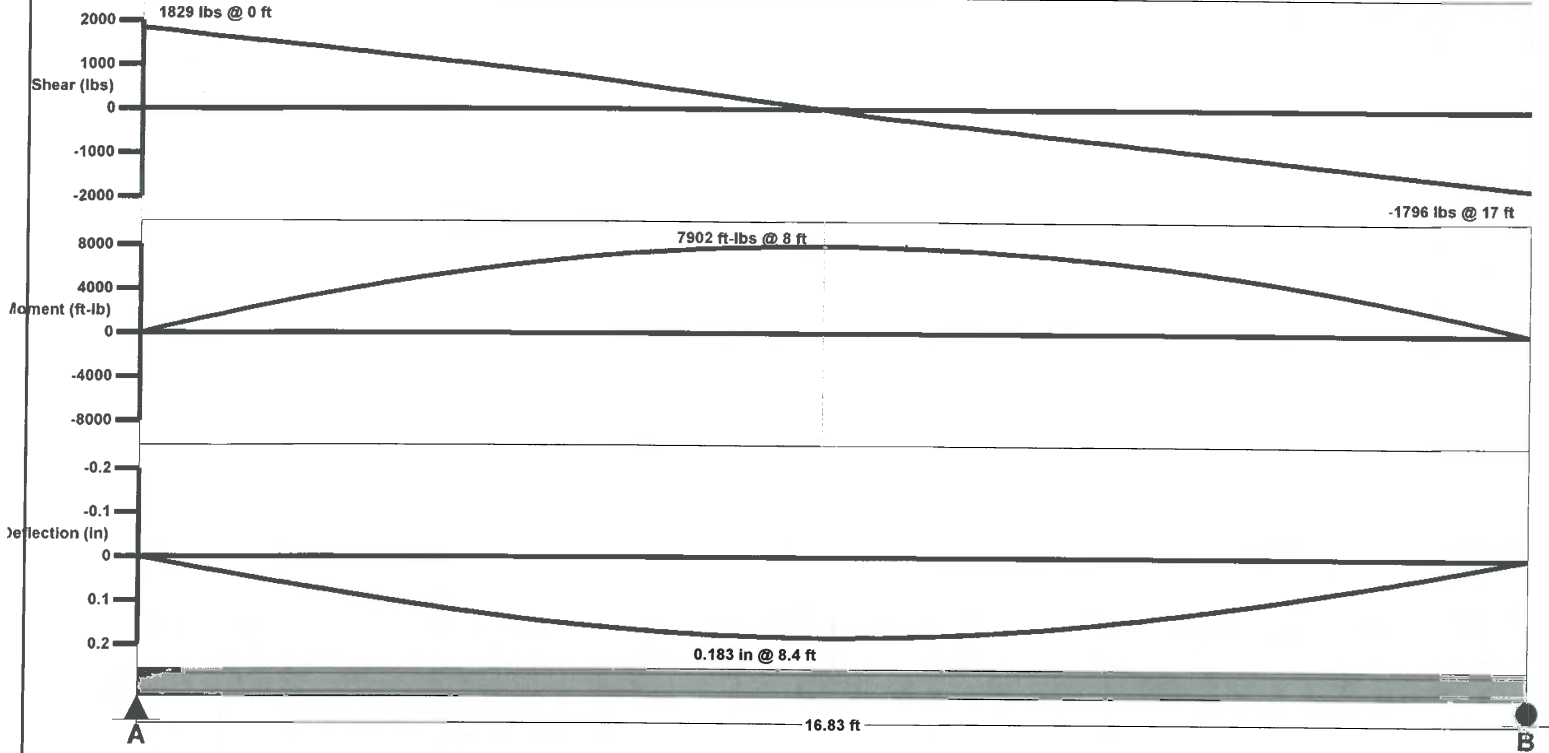
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**VMD DIAGRAM**



Project: ME5048 Portland Harbor (LTE) AT&T - Nexlink

Location: Beam F  
 Multi-Loaded Multi-Span Beam  
 [2009 International Building Code(AISC 13th Ed ASD)]  
 A992-50 W14x30 x 27.54 FT  
 Section Adequate By: 45.8%  
 Controlling Factor: Deflection

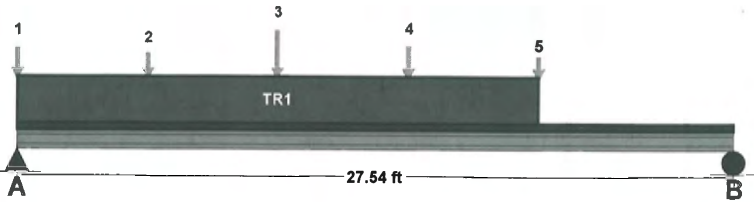
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**LOADING DIAGRAM**



**DEFLECTIONS** Center

Live Load 0.26 IN L/1269  
 Dead Load 0.68 in  
 Total Load 0.94 IN L/350

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

**REACTIONS**

	A	B
Live Load	2680 lb	1528 lb
Dead Load	7416 lb	4198 lb
Total Load	10096 lb	5726 lb
Bearing Length	0.79 in	0.79 in

**BEAM DATA**

Center  
 Span Length 27.54 ft  
 Unbraced Length-Top 0 ft  
 Unbraced Length-Bottom 27.54 ft

**STEEL PROPERTIES**

W14x30 - A992-50

**Properties:**

Yield Stress:	Fy =	50 ksi
Modulus of Elasticity:	E =	29000 ksi
Depth:	d =	13.8 in
Web Thickness:	tw =	0.27 in
Flange Width:	bf =	6.73 in
Flange Thickness:	tf =	0.39 in
Distance to Web Toe of Fillet:	k =	0.79 in
Moment of Inertia About X-X Axis:	Ix =	291 in4
Section Modulus About X-X Axis:	Sx =	42 in3
Plastic Section Modulus About X-X Axis:	Zx =	47.3 in3

**Design Properties per AISC 13th Edition Steel Manual:**

Flange Buckling Ratio:	FBR =	8.74
Allowable Flange Buckling Ratio:	AFBR =	9.15
Web Buckling Ratio:	WBR =	45.3
Allowable Web Buckling Ratio:	AWBR =	90.55
Controlling Unbraced Length:	Lb =	0 ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	5.26 ft
Nominal Flexural Strength w/ safety factor:	Mn =	118014 ft-lb
Controlling Equation:	F2-1	
Web height to thickness ratio:	h/tw =	45.3
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95
Cv Factor:	Cv =	1
Controlling Equation:	G2-2	
Nominal Shear Strength w/ safety factor:	Vn =	74520 lb

**Controlling Moment:** 59951 ft-lb

11.57 Ft from left support of span 2 (Center Span)

Created by combining all dead loads and live loads on span(s) 2

**Controlling Shear:** 7596 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):	199.61 in4	291 in4
Moment:	59951 ft-lb	118014 ft-lb
Shear:	7596 lb	74520 lb

**UNIFORM LOADS** Center

Uniform Live Load 0 plf  
 Uniform Dead Load 0 plf  
 Beam Self Weight 30 plf  
 Total Uniform Load 30 plf

**POINT LOADS - CENTER SPAN**

Load Number	One	Two	Three	Four	Five
Live Load	526 lb	1052 lb	1052 lb	1052 lb	526 lb
Dead Load	1974 lb	1077 lb	3144 lb	1690 lb	1303 lb
Location	0 ft	5 ft	10 ft	15 ft	20 ft

**TRAPEZOIDAL LOADS - CENTER SPAN**

Load Number	One
Left Live Load	0 plf
Left Dead Load	80 plf
Right Live Load	0 plf
Right Dead Load	80 plf
Load Start	0 ft
Load End	20 ft
Load Length	20 ft

Project: ME5048 Portland Harbor (LTE) AT&T - Nexlink

Location: Beam F  
Multi-Loaded Multi-Span Beam  
[2009 International Building Code(AISC 13th Ed ASD)]  
A992-50 W14x30 x 27.54 FT  
Section Adequate By: 45.8%  
Controlling Factor: Deflection

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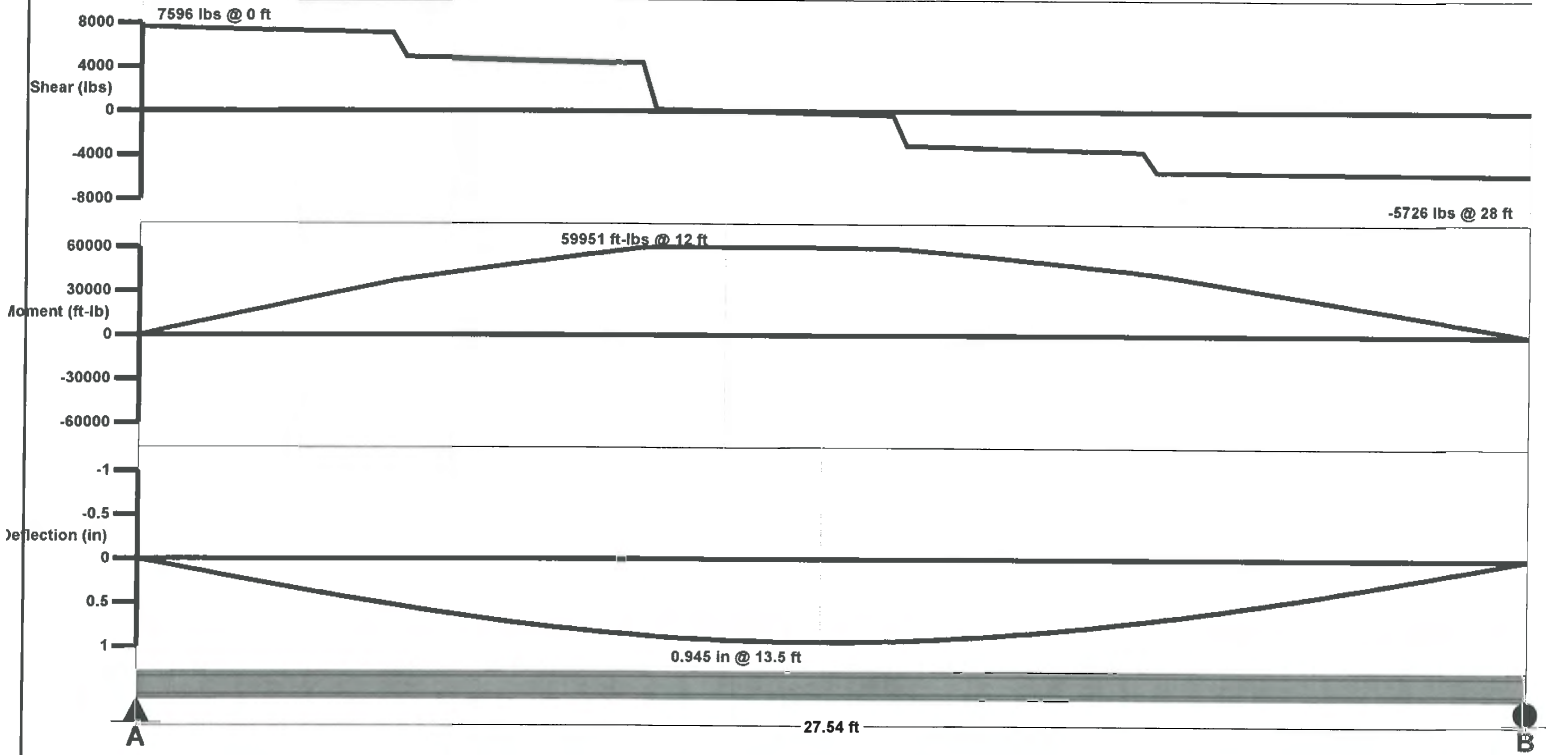
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**VMD DIAGRAM**





Project: ME5048 Portland Harbor (LTE) AT&T - Nexlink

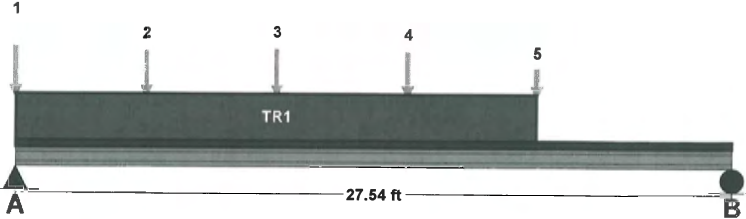
Location: Beam G  
 Multi-Loaded Multi-Span Beam  
 [2009 International Building Code(AISC 13th Ed ASD)]  
 A992-50 W14x30 x 27.54 FT  
 Section Adequate By: 49.9%  
 Controlling Factor: Deflection

Michael Cabral - Structural Dept. Head  
 Hudson Design Group LLC (p) 978.557.5553  
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 North Andover, MA 01845

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**LOADING DIAGRAM**



**DEFLECTIONS** Center

Live Load 0.26 IN L/1269  
 Dead Load 0.66 in  
 Total Load 0.92 IN L/360  
 Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

**REACTIONS**

	A	B
Live Load	2680 lb	1528 lb
Dead Load	8369 lb	4072 lb
Total Load	11049 lb	5600 lb
Bearing Length	0.79 in	0.79 in

**BEAM DATA**

Center  
 Span Length 27.54 ft  
 Unbraced Length-Top 0 ft  
 Unbraced Length-Bottom 27.54 ft

**STEEL PROPERTIES**

W14x30 - A992-50

**Properties:**

Yield Stress:	Fy =	50 ksi
Modulus of Elasticity:	E =	29000 ksi
Depth:	d =	13.8 in
Web Thickness:	tw =	0.27 in
Flange Width:	bf =	6.73 in
Flange Thickness:	tf =	0.39 in
Distance to Web Toe of Fillet:	k =	0.79 in
Moment of Inertia About X-X Axis:	Ix =	291 in4
Section Modulus About X-X Axis:	Sx =	42 in3
Plastic Section Modulus About X-X Axis:	Zx =	47.3 in3

**Design Properties per AISC 13th Edition Steel Manual:**

Flange Buckling Ratio:	FBR =	8.74
Allowable Flange Buckling Ratio:	AFBR =	9.15
Web Buckling Ratio:	WBR =	45.3
Allowable Web Buckling Ratio:	AWBR =	90.55
Controlling Unbraced Length:	Lb =	0 ft
Limiting Unbraced Length - for lateral-torsional buckling:	Lp =	5.26 ft
Nominal Flexural Strength w/ safety factor:	Mn =	118014 ft-lb
Controlling Equation:	F2-1	
Web height to thickness ratio:	h/tw =	45.3
Limiting height to thickness ratio for eqn. G2-2:	h/tw-limit =	53.95
Cv Factor:	Cv =	1
Controlling Equation:	G2-2	
Nominal Shear Strength w/ safety factor:	Vn =	74520 lb

**Controlling Moment:**

57907 ft-lb

14.32 Ft from left support of span 2 (Center Span)

Created by combining all dead loads and live loads on span(s) 2

**Controlling Shear:**

7751 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):	194.17 in4	291 in4
Moment:	57907 ft-lb	118014 ft-lb
Shear:	7751 lb	74520 lb

**UNIFORM LOADS** Center

Uniform Live Load 0 plf  
 Uniform Dead Load 0 plf  
 Beam Self Weight 30 plf  
 Total Uniform Load 30 plf

**POINT LOADS - CENTER SPAN**

Load Number	One	Two	Three	Four	Five
Live Load	526 lb	1052 lb	1052 lb	1052 lb	526 lb
Dead Load	2772 lb	1975 lb	2097 lb	1901 lb	1270 lb
Location	0 ft	5 ft	10 ft	15 ft	20 ft

**TRAPEZOIDAL LOADS - CENTER SPAN**

Load Number	One
Left Live Load	0 plf
Left Dead Load	80 plf
Right Live Load	0 plf
Right Dead Load	80 plf
Load Start	0 ft
Load End	20 ft
Load Length	20 ft

Project: ME5048 Portland Harbor (LTE) AT&T - Nexlink

Location: Beam G  
Multi-Loaded Multi-Span Beam  
[2009 International Building Code(AISC 13th Ed ASD)]  
A992-50 W14x30 x 27.54 FT  
Section Adequate By: 49.9%  
Controlling Factor: Deflection

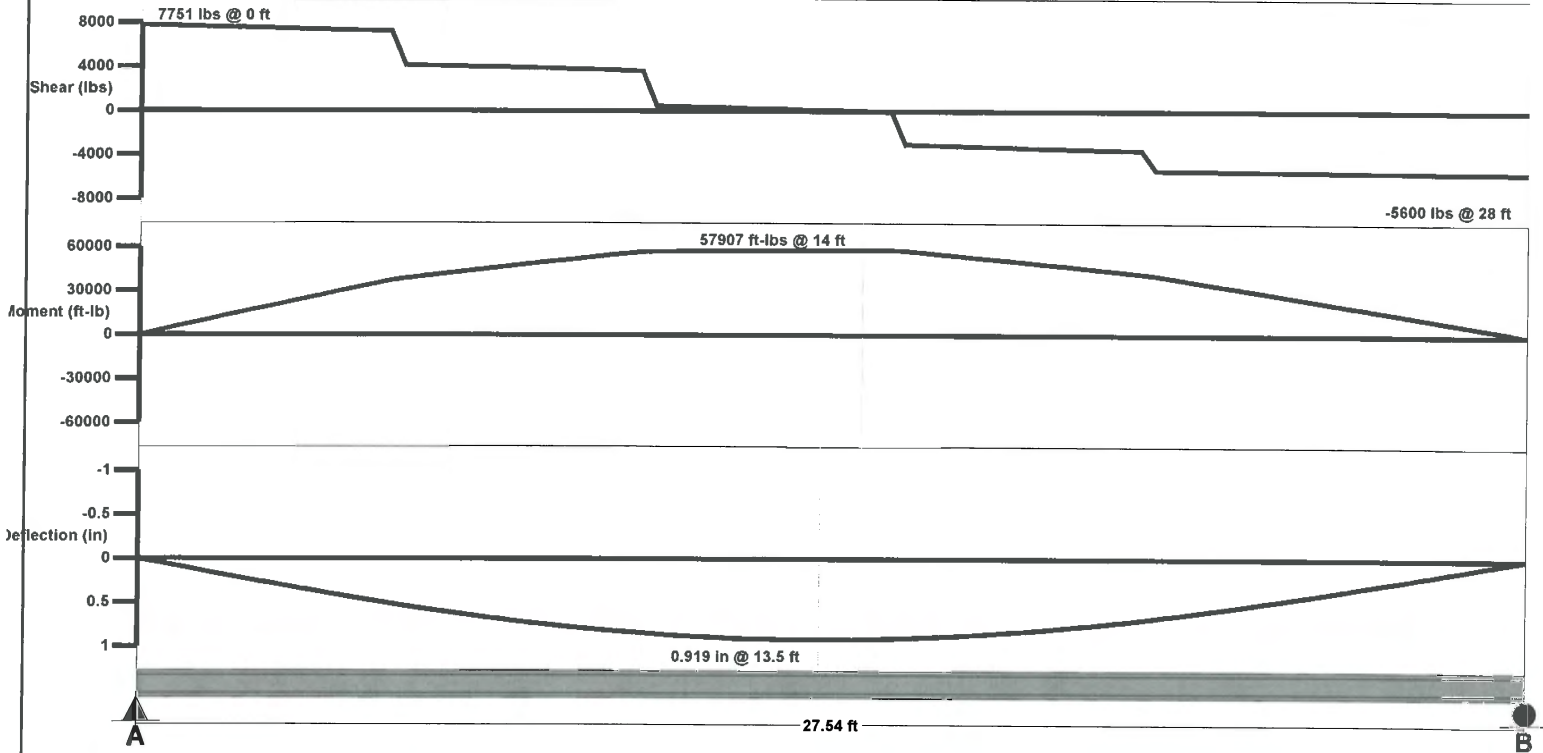
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**VMD DIAGRAM**



Date: 03-01-12  
 Project Name: PORTLAND HARBOR  
 Project Number: ME5048  
 Designed By: AA      Checked By: MSC



**2.6.5.2 Velocity Pressure Coeff:**

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

z = 86.67 (ft) → ANTENNAS (ALPHA SECTOR)  
 z<sub>g</sub> = 900 (ft)  
 α = 9.5

**K<sub>z</sub> = 1.228**

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

Table 2-4

Exposure	Z <sub>g</sub>	α	K <sub>zmin</sub>	K <sub>e</sub>
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 <sub>t</sub>	f
2	0.43	1.25
3	0.53	2
4	0.72	1.5

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

$$K_h = e^{(fz/H)}$$

**K<sub>zt</sub> = #DIV/0!**

K<sub>h</sub> = #DIV/0!

K<sub>e</sub> = 0 (from Table 2-4)

K<sub>t</sub> = 0 (from Table 2-5)

f = 0 (from Table 2-5)

z = 86.67

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

K<sub>zt</sub> = 1.00

*(If Category 1 then K<sub>zt</sub> = 1.0)*

**Category = 1**

Date: 03-01-12  
Project Name: PORTLAND HARBOR  
Project Number: ME5048  
Designed By: AA      Checked By: MSC



**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= 86.67

Gh= 0.48667

**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**

*(Cantilevered tubular or latticed spines, pole, structures on buildings (ht. : width ratio > 5)*

Gh= 1.35

Gh= 1.35

Date: 03-01-12  
 Project Name: PORTLAND HARBOR  
 Project Number: ME5048  
 Designed By: AA      Checked By: MSC



**2.6.8 Design Ice Thickness:**

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

$$t_{iz} = 2.20$$

$$t_i = 1$$

$$I = 1$$

$$K_{iz} = 1.10$$

$$K_{zt} = 1$$

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

$$K_{iz} = 1.10$$

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

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

$$D_c = 96.4 \text{ (in) Largest Dim of Member}$$

$$A_{iz} = 682.35$$

**2.6.9 Design Wind Load:**

$$F = q_z * G * h * (EPA's)$$

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

$$q_z = 29.87$$

$$K_z = 1.228$$

$$K_{zt} = 1$$

$$K_d = 0.95$$

$$V_{max} = 100$$

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: 03-01-12  
 Project Name: PORTLAND HARBOR  
 Project Number: ME5048  
 Designed By: AA      Checked By: MSC



**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 = 22.16

Cf = 1.2

Appurtenances	Height	Width	Depth	Flat Area	Force Per Appurtenance
Item No.1	96.4	11.9	7.1	7.97	385.45 (lbs) → (P) ANTENNA
Item No.2	55	11	5	4.20	203.28 (lbs) → (E) ANTENNA
Item No.3	55	11	5	4.20	203.28 (lbs) → (E) ANTENNA
Item No.4	0	0	0	0.00	0.00 (lbs)
Item No.5	0	0	0	0.00	0.00 (lbs)

TOTAL FORCE ( $\Sigma F_A$ ) =	792.00 (lbs)
--------------------------------	--------------

Date: 03-01-12

Project Name: PORTLAND HARBOR

Project Number: ME5048

Designed By: AA      Checked By: MSC



**2.6.5.2 Velocity Pressure Coeff:**

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

**$K_z = 1.211$**

$z = 81$  (ft) → *RAN + SURGE ARRESTOR*  
 $z_g = 900$  (ft)  
 $\alpha = 9.5$

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

**Table 2-4**

Exposure	$Z_g$	$\alpha$	$K_{zmin}$	$K_e$
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

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

$$K_h = e^{(fz/H)}$$

**$K_{zt} = \text{\#DIV/0!}$**

$K_h = \text{\#DIV/0!}$

$K_e = 0$  (from Table 2-4)

$K_t = 0$  (from Table 2-5)

$f = 0$  (from Table 2-5)

$z = 81$

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

$K_{zt} = 1.00$

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

**Category = 1**

Date: 03-01-12  
Project Name: PORTLAND HARBOR  
Project Number: ME5048  
Designed By: AA      Checked By: MSC



**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= 81

Gh= 0.481

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

(Cantilevered tubular or latticed spines, pole, structures on buildings (ht. : width ratio > 5)

Gh= 1.35

Gh= 1.35



Date: 03-01-12  
 Project Name: PORTLAND HARBOR  
 Project Number: ME5048  
 Designed By: AA      Checked By: MSC



**2.6.8 Design Ice Thickness:**

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

$t_{iz} = 2.19$

$t_i = 1$

$I = 1$

$K_{iz} = 1.09$

$K_{zt} = 1$

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

$K_{iz} = 1.09$

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

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

$D_c = 17.8$  (in) Largest Dim of Member

$A_{iz} = 137.39$

**2.6.9 Design Wind Load:**

$$F = q_z * G * h * (EPA's)$$

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

$q_z = 29.44$

$K_z = 1.211$

$K_{zt} = 1$

$K_d = 0.95$

$V_{max} = 100$

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: 03-01-12  
 Project Name: PORTLAND HARBOR  
 Project Number: ME5048  
 Designed By: AA      Checked By: MSC



**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= 22.01

Cf= 1.2

Appurtenances	Height	Width	Depth	Flat Area	Force Per Appurtenance
Item No.1	17.8	17	7.2	2.10	100.24 (lbs) → RRH
Item No.2	17.8	17	7.2	2.10	100.24 (lbs) → RRH
Item No.3	10.25	10.25	6.29	0.73	34.80 (lbs) → SURGE ARRESTOR
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 <sub>A</sub> ) =	235.27 (lbs)
----------------------------------	--------------

**Site Name:** PORTLAND HARBOR  
**Site No.** ME5048  
**Done by:** AA                      **Checked by:** MSC  
**Date:** 3/1/2012



**Calculate Total Ballast Required for Ballast Mount** → ALPHA SECTOR

**WIND FORCES**

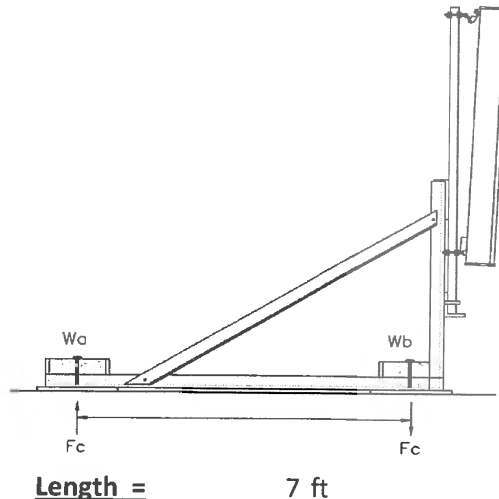
**F antenna =** 792 lbs.

**F rrh =** 201 lbs.

**F surge =** 35 lbs.

**Antenna Height =** 6 ft

**RRH & Surge Height =** 2 ft



**Overturning at Ballast**

**Moment =** 6268.8 lbs.-ft

S.F.

1.2

**Hold Down Force =** 895.54 lbs. Per Side

**Wa Ballast**

Equipment

Frame = 100 lbs.

**Total Ballast Required Wa=** 795.54 lbs.

**Blocks Required Wa =** 21 Assumed 38lbs Block (4"x8"x16" Solid)

**Wb Ballast**

Equipment

Frame 150 lbs.

Antennas 120 lbs.

RRH's 100 lbs.

Surge Arrestor 20 lbs.

**Total =** 390 lbs.

**Total Ballast Required Wb =** 505.54 lbs.

**Blocks Required Wb=** 14 Assumed 38lbs Block (4"x8"x16" Solid)

ROOF EXCESS CAPACITY ANALYSIS

ROOF DEAD LOAD:

	(PSF)
- SINGLE-PLY EPDM MEMBRANE	1.5
- RIGID INSULATION	1.5
- METAL ROOF DECK	3
- MISC	5

DESIGN DEAD LOAD = 11 PSF

LIVE LOAD:

$P_g = 60 \text{ PSF}$  (ASCE 7-10 FIG 7-1)

FLAT ROOF SNOW ( $P_f$ ) =  $0.7 \times C_e \times C_t \times I \times P_g$  (EQUATION 7.3-1; ASCE-10)  
 $= 0.7 \times 0.9 \times 1.0 \times 1.0 \times 60 \text{ PSF}$

$P_f = \underline{37.8 \text{ PSF}}$

BALLAST LOADING:

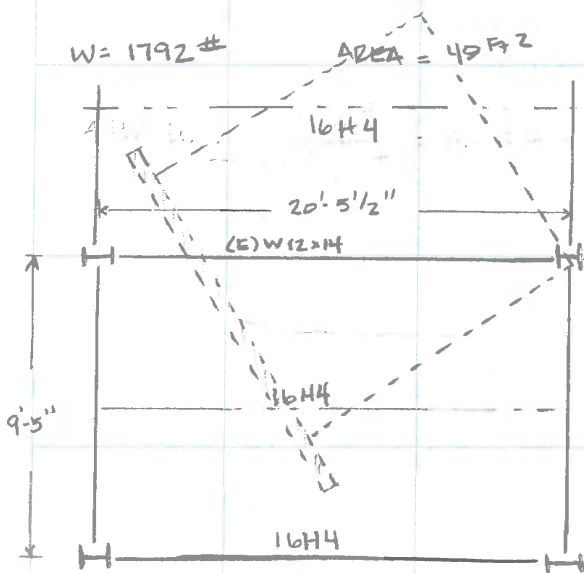
$W = 1792 \#$  AREA =  $49 \text{ FT}^2 = 7 \underline{36.57 \text{ PSF}}$

LOADING:

BALLAST LOAD = 36.57 PSF  
 (INCLUDING FRAME)

DEAD = 11 PSF

LIVE = 37.8 PSF



16H4 (SJI-MANUAL LT-39)  
 BAR JOIST SPACING = 5'-0" O.C.  
 ALLOW. TOTAL LOAD =  $438 \text{ PLF} / 5'-0" = 87.6 \text{ PSF}$

- BALLAST WEIGHT IS SUPPORTED OVER (3) FRAMING MEMBERS.

$W_{\text{EACH MEMBER}} = 1792 \# / 3 = 598 \# / \text{EA FRAMING MEMBER ON ROOF}$

PARTIAL FRAMING



CALCULATE NET LOAD IN ROOF FRAMING:

16H4 BAR JOIST @ 5'-0" O.C.

TOTAL ALLOW LOAD = 87.6 psf (T.L.)

$$\text{NET LOAD} = 87.6 \text{ psf} - 11 \text{ psf} - 37.8 \text{ psf} = 38.8 \text{ psf}$$

$$= 38.8 \text{ psf} > \text{BALLAST LOADING (FULL) } 36.57 \text{ psf (O.K.)}$$

(REFERENCE STRUCAL RUN FOR (E) W12X14 STEEL ROOF BEAM CARRYING BALLAST LOADING. SECTION ADEQUATE BY 84.7%)

ANALYSIS CONCLUDES THE EXISTING ROOF FRAMING IS CAPABLE OF SUPPORT THE ROOF TOP BALLAST MOUNT.

Project: ME5048 Portland Harbor (LTE) AT&T - Nexlink

Location: Existing Roof Beam Below Ballast  
Multi-Loaded Multi-Span Beam  
[2009 International Building Code(AISC 13th Ed ASD)]  
A36 W12x14 x 20.5 FT

Section Adequate By: 84.7%  
Controlling Factor: Moment

Michael Cabral - Structural Dept. Head  
Hudson Design Group LLC (p) 978.557.5553  
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**DEFLECTIONS** Center

Live Load 0.29 IN L/842  
Dead Load 0.20 in  
Total Load 0.49 IN L/497  
Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

**REACTIONS** A B

Live Load 1937 lb 1937 lb  
Dead Load 1220 lb 1205 lb  
Total Load 3157 lb 3142 lb  
Bearing Length 0.53 in 0.53 in

**BEAM DATA** Center

Span Length 20.5 ft  
Unbraced Length-Top 0 ft  
Unbraced Length-Bottom 20.5 ft

**STEEL PROPERTIES**

W12x14 - A36

**Properties:**

Yield Stress:  $F_y = 36$  ksi  
Modulus of Elasticity:  $E = 29000$  ksi  
Depth:  $d = 11.9$  in  
Web Thickness:  $t_w = 0.2$  in  
Flange Width:  $b_f = 3.97$  in  
Flange Thickness:  $t_f = 0.23$  in  
Distance to Web Toe of Fillet:  $k = 0.53$  in  
Moment of Inertia About X-X Axis:  $I_x = 88.6$  in<sup>4</sup>  
Section Modulus About X-X Axis:  $S_x = 14.9$  in<sup>3</sup>  
Plastic Section Modulus About X-X Axis:  $Z_x = 17.4$  in<sup>3</sup>

**Design Properties per AISC 13th Edition Steel Manual:**

Flange Buckling Ratio:  $FBR = 8.82$   
Allowable Flange Buckling Ratio:  $AFBR = 10.79$   
Web Buckling Ratio:  $WBR = 54.25$   
Allowable Web Buckling Ratio:  $AWBR = 106.72$   
Controlling Unbraced Length:  $L_b = 0$  ft  
Limiting Unbraced Length -  
for lateral-torsional buckling:  $L_p = 3.13$  ft  
Nominal Flexural Strength w/ safety factor:  $M_n = 31257$  ft-lb  
Controlling Equation: F2-1  
Web height to thickness ratio:  $h/t_w = 54.25$   
Limiting height to thickness ratio for eqn. G2-2:  $h/t_w\text{-limit} = 63.58$   
Cv Factor:  $C_v = 1$   
Controlling Equation: G2-2  
Nominal Shear Strength w/ safety factor:  $V_n = 34272$  lb

**Controlling Moment:**

16927 ft-lb

10.25 Ft from left support of span 2 (Center Span)

Created by combining all dead loads and live loads on span(s) 2

**Controlling Shear:**

3157 lb

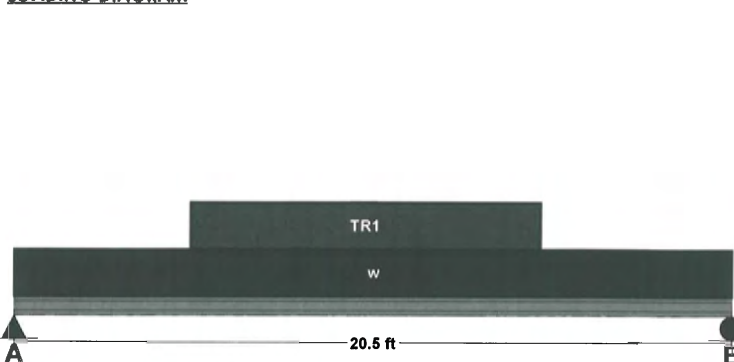
At left support of span 2 (Center Span)

Created by combining all dead loads and live loads on span(s)

**Comparisons with required sections:**

	Req'd	Provided
Moment of Inertia (deflection):	42.76 in <sup>4</sup>	88.6 in <sup>4</sup>
Moment:	16927 ft-lb	31257 ft-lb
Shear:	3157 lb	34272 lb

**LOADING DIAGRAM**



**UNIFORM LOADS** Center

Uniform Live Load 189 plf  
Uniform Dead Load 75 plf  
Beam Self Weight 14 plf  
Total Uniform Load 278 plf

**TRAPEZOIDAL LOADS - CENTER SPAN**

Load Number One  
Left Live Load 0 plf  
Left Dead Load 60 plf  
Right Live Load 0 plf  
Right Dead Load 60 plf  
Load Start 5 ft  
Load End 15 ft  
Load Length 10 ft

Project: ME5048 Portland Harbor (LTE) AT&T - Nexlink

Location: Existing Roof Beam Below Ballast  
Multi-Loaded Multi-Span Beam  
[2009 International Building Code(AISC 13th Ed ASD)]  
A36 W12x14 x 20.5 FT  
Section Adequate By: 84.7%  
Controlling Factor: Moment

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**VMD DIAGRAM**

