

STRUCTURAL ANALYSIS REPORT

For

4PB0247A (L600)
PB247 / ROOSEVELT ARMS

226 Stevens Avenue
Portland, ME 04102

**Antennas Mounted within Existing Ballasted Enclosure
and New Enclosures on Roof;
Equipment Room on the First Floor**



Prepared for:



Dated: October 12, 2017

Prepared by:



45 Beechwood Drive
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SCOPE OF WORK:

Hudson Design Group LLC (HDG) has been authorized by T-Mobile to conduct a structural evaluation of the structure supporting the proposed T-Mobile 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 T-Mobile's proposed equipment.

This office conducted an on-site visual survey of the above areas on September 18, 2017. Attendees included Ron Pennimpede (HDG – Senior Project Manager).

CONCLUSION SUMMARY:

Building 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. The following documents were used for our reference:

- Previous HDG Structural Analysis dated March 3, 2016.

Based on our evaluation, we have determined that the existing structure **IS CAPABLE** of supporting the proposed equipment within or near the proposed locations with the proposed modifications:

- **Reinforce the existing roof joists below the new antenna enclosures with (2) 1.75"x9.25" Boise Cascade LVL's (3100 Fb) sistered to each joist. Reference the latest HDG construction drawings for locations and connection details.**

HDG did not perform a condition assessment of the entire roof, but did perform an inspection of the existing roof members and structural columns below the area where the proposed equipment is located.

APPURTENANCE/EQUIPMENT CONFIGURATION:

(3) DBXNH-6565B-A2M Antennas (72.7"x11.9"x7.1" – Wt. = 47 lbs/each)

(3) HBX-9016DS-A2M Antennas (74.7"x6.8"x3.8" - Wt. = 17 lbs/each)

(3) APXVAA24_43-U-A20 Antennas (96"x24"x8.5" - Wt. = 125 lbs/each)

(3) RRUS 4478 B71 RRH's (15"x13.2"x7.4" - Wt. = 60 lbs/each)

(3) ATMA4P4DBP TMA's (11.2"x8"x4.9" – Wt. = 16 lbs/each)



DESIGN CRITERIA:

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

Wind Analysis:

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

Roof:

Ground Snow, P_g :	60 psf	(FIG 7-1; ASCE 7-05)
Importance Factor, I :	1.0	(Category II)
Exposure Factor, C_e :	1.0	(Fully Exposed)
Thermal Factor, C_t :	1.0	(Typical Structure)
Flat Roof Snow Load:	42 psf	($P_i=0.7 \cdot C_e \cdot C_t \cdot I \cdot P_g$)

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

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

3. Approximate height above grade to the top of the enclosure:

43'-0" +/-



EXISTING ROOF CONSTRUCTION:

The existing roof construction consists of a roofing membrane and rigid insulation over wood plank decking supported by a system of built-up knee walls, beams, columns, and brick bearing walls.

ANTENNA/RRH SUPPORT RECOMMENDATIONS:

The new antennas and RRH's are proposed to be mounted on new pipe masts within the new and existing FRP chimneys secured to the existing roof structure with thru bolts.

Limitations and assumptions:

1. Reference the latest HDG construction drawings for all the equipment locations details.
2. Mount all equipment per manufacturer's specifications.
3. All structural members and their connections are assumed to be in good condition and are free from defects with no deterioration to its member capacities.
4. All antennas, coax cables and waveguide cables are assumed to be properly installed and supported as per the manufacturer requirements.
5. HDG is not responsible for any modifications completed prior to and hereafter which HDG was not directly involved.
6. HDG did not perform a condition assessment on the roof. HDG is under the assumption that the roof has been constructed properly and is in good condition.
7. If field conditions differ from what is assumed in this report, then the engineer of record is to be notified as soon as possible.

FIELD PHOTOS:



Photo 1: Sample photo showing the existing ballasted FRP chimney.



Photo 2: Sample photo showing the existing roof construction below the FRP chimney.

FIELD PHOTOS (Cont.):



Photo 3: Sample photo showing the existing roof construction below the FRP chimney.



Photo 4: Sample photo showing the existing T-Mobile equipment.



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Calculations

Date: 10/11/2017

Project Number: 4PB0247A

Project Name: PB247/Roosevelt Arms

Designed By: SO Checked By: MSC



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Wind Analysis → Antenna Enclosure - 3.5 ft. x 4.5 ft. x 12 ft. (Side 1)

Reference Codes:

-International Building Code 2009 (IBC 2009)

-Minimum Design Loads for Buildings and Other Structures (ASCE 7-05)

Structure Classification	II	(ASCE 7-05 Table 1-1)
Basic Wind Speed, V	100 mph	(ASCE 7-05 Figure 6-1)
Importance Factor, I	I	(ASCE 7-05 Table 6-1)
Exposure Category	B	(ASCE 7-05 Section 6.5.6.3)
Height Above Ground Level, z	43 ft	(Top of Enclosure)
Exposure Coefficient, K_z	0.78	(ASCE 7-05 Table 6-3)
Wind Directionality Coef., K_d	0.90	(ASCE 7-05 Table 6-4)
Topographic Factor, K_{zt}	1.00	(ASCE 7-05 Section 6.5.7.2)
Velocity Pressure, q_z	$= 0.00256K_zK_{zt}K_dV^2I$ $= \underline{\underline{17.97 \text{ psf}}}$	(ASCE 7-05 Equation 6-15)
Gust Factor, G	0.85	(ASCE 7-05 Section 6.5.8)
Net Force Coefficient, C_f	1.35	(ASCE 7-05 Figure 6.21)
Projected Area Normal to Wind, A_f	54 ft ²	(4.5 ft. x 12 ft.)
Wind Force, F	$= q_zGC_fA_f$ $= \underline{\underline{1113.59 \text{ lbs}}}$	(ASCE 7-05 Equation 6-28)

Date: 10/11/2017

Project Number: 4PB0247A

Project Name: PB247/Roosevelt Arms

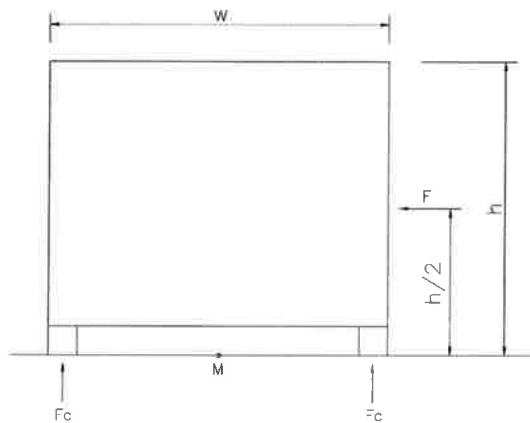
Designed By: SO Checked By: MSC



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Calculate Overturning Moment of Proposed Antenna Enclosure

Dimensions (ft)	Wide, w	Depth, d	Height, h
	4.5	3.5	12



$$\begin{aligned} \text{Moment, } M &= F \times h/2 \\ &= \underline{6681.51} \quad \text{lb-ft} \end{aligned}$$

Calculate Force Couple

$$\begin{aligned} \text{Force Couple } M / d & \\ &= \underline{1909.00} \quad \text{lbs.} \end{aligned}$$

Number of Supports in Tension:

F_c per Suppo 954.50 lbs.

Date: 10/11/2017

Project Number: 4PB0247A

Project Name: PB247/Roosevelt Arms

Designed By: SO Checked By: MSC



Wind Analysis → Antenna Enclosure - 3.5 ft. x 4.5 ft. x 12 ft. (Side 2)

Reference Codes:

-International Building Code 2009 (IBC 2009)

-Minimum Design Loads for Buildings and Other Structures (ASCE 7-05)

Structure Classification	II	(ASCE 7-05 Table 1-1)
Basic Wind Speed, V	100 mph	(ASCE 7-05 Figure 6-1)
Importance Factor, I	1	(ASCE 7-05 Table 6-1)
Exposure Category	B	(ASCE 7-05 Section 6.5.6.3)
Height Above Ground Level, z	43 ft	(Top of Enclosure)
Exposure Coefficient, K_z	0.78	(ASCE 7-05 Table 6-3)
Wind Directionality Coef., K_d	0.90	(ASCE 7-05 Table 6-4)
Topographic Factor, K_{zt}	1.00	(ASCE 7-05 Section 6.5.7.2)
Velocity Pressure, q_z	$= 0.00256K_zK_{zt}K_dV^2I$ $= \underline{\underline{17.97 \text{ psf}}}$	(ASCE 7-05 Equation 6-15)
Gust Factor, G	0.85	(ASCE 7-05 Section 6.5.8)
Net Force Coefficient, C_f	1.35	(ASCE 7-05 Figure 6.21)
Projected Area Normal to Wind, A_f	42 ft ²	(3.5 ft. x 12 ft.)
Wind Force, F	$= q_zGC_fA_f$ $= \underline{\underline{866.12 \text{ lbs}}}$	(ASCE 7-05 Equation 6-28)

Date: 10/11/2017

Project Number: 4PB0247A

Project Name: PB247/Roosevelt Arms

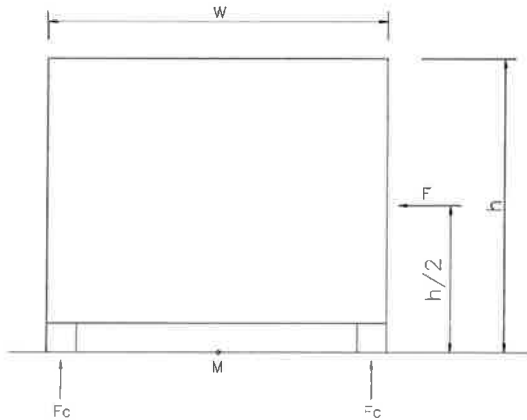
Designed By: SO Checked By: MSC



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Calculate Overturning Moment of Proposed Antenna Enclosure

Dimensions (ft)	Wide, w	Depth, d	Height, h
	3.5	4.5	12



Moment, M $F \times h/2$
= 5196.73 **lb-ft**

Calculate Force Couple

Force Couple M / d
= 1154.83 **lbs.**

Number of Supports in Tension:

F_c per Suppo **577.41 lbs.**



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Roof Check

Date: 10/11/2017

Project Name: PB247/Roosevelt Arms

Project Number: 4PB0247A

Designed By: SO Checked By: MSC



CHECK ROOF JOIST:

Joist Size = 1.5"x9.25"
Joist Spacing = 1.75 ft

Live Loads: Roof

Snow 42 psf

Dead Loads: Roof

Rubber Membrane 1 psf
Rigid Insulation 1.5 psf
Tar & Gravel 8 psf
Planks 3 psf
Ceilings 2 psf
Miscellaneous 3 psf

Total = 18.5 psf

Load Breakdown:

● **Roof Joist**

Live Load

→ Snow 42 psf x 1.8 ft. (Tributary Width)
= **73.5 plf**

Dead Load

→ Dead 18.5 psf x 1.8 ft. (Tributary Width)
32.4 plf

Project: 4PB0247A (L600)

Location: Alpha-Gamma Roof Joist Check (Side 1)

Multi-Loaded Multi-Span Beam

[2009 International Building Code(2005 NDS)]

1.5 IN x 9.25 IN x 11.0 FT

#2 - Spruce-Pine-Fir - Dry Use

Section Inadequate By: 175.7%

Controlling Factor: Moment / Depth Required 15.36 In.



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DEFLECTIONS	Center
Live Load	0.69 IN L/190
Dead Load	0.20 in
Total Load	0.89 IN L/148
Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240	

REACTIONS	A	B
Live Load	1362 lb	1362 lb
Dead Load	404 lb	404 lb
Total Load	1766 lb	1766 lb
Bearing Length	2.77 in	2.77 in

BEAM DATA	Center
Span Length	11 ft
Unbraced Length-Top	0 ft
Unbraced Length-Bottom	11 ft
Live Load Duration Factor	1.00
Notch Depth	0.00

MATERIAL PROPERTIES

#2 - Spruce-Pine-Fir

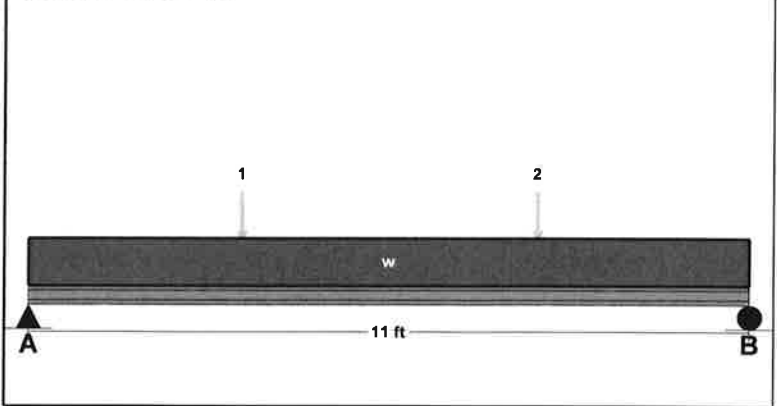
	Base Values	Adjusted
Bending Stress:	Fb = 875 psi	Fb' = 1107 psi
	Cd=1.00 CF=1.10 Cr=1.15	
Shear Stress:	Fv = 135 psi	Fv' = 135 psi
	Cd=1.00	
Modulus of Elasticity:	E = 1400 ksi	E' = 1400 ksi
Min. Mod. of Elasticity:	E_min = 510 ksi	E_min' = 510 ksi
Comp. \perp to Grain:	Fc \perp = 425 psi	Fc \perp ' = 425 psi

Controlling Moment: 5440 ft-lb
 5.5 Ft from left support of span 2 (Center Span)
 Created by combining all dead loads and live loads on span(s) 2

Controlling Shear: 1766 lb
 At left support of span 2 (Center Span)
 Created by combining all dead loads and live loads on span(s) 2

Comparisons with required sections:	Req'd	Provided
Section Modulus:	58.97 in3	21.39 in3
Area (Shear):	19.63 in2	13.88 in2
Moment of Inertia (deflection):	187.09 in4	98.93 in4
Moment:	5440 ft-lb	1973 ft-lb
Shear:	1766 lb	1249 lb

LOADING DIAGRAM



UNIFORM LOADS	Center
Uniform Live Load	74 plf
Uniform Dead Load	33 plf
Beam Self Weight	3 plf
Total Uniform Load	110 plf

POINT LOADS - CENTER SPAN	One	Two
Live Load	955 lb	955 lb
Dead Load	209 lb	209 lb
Location	3.25 ft	7.75 ft

NOTES

Project: 4PB0247A (L600)

Location: Alpha-Gamma Reinforced Roof Joist (Side 1)

Multi-Loaded Multi-Span Beam

[2009 International Building Code(2005 NDS)]

(2) 1.75 IN x 9.25 IN x 11.0 FT

Versa-Lam 3100 Fb - Boise Cascade

Section Adequate By: 76.3%

Controlling Factor: Deflection



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CAUTIONS

* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS

Center

Live Load 0.21 IN L/635

Dead Load 0.06 in

Total Load 0.27 IN L/485

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

REACTIONS

A B

Live Load 1362 lb 1362 lb

Dead Load 442 lb 442 lb

Total Load 1804 lb 1804 lb

Bearing Length 0.69 in 0.69 in

BEAM DATA

Center

Span Length 11 ft

Unbraced Length-Top 0 ft

Unbraced Length-Bottom 11 ft

Live Load Duration Factor 1.00

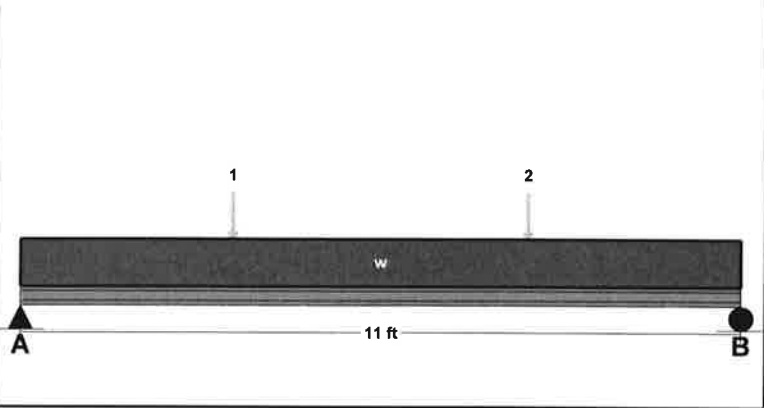
Notch Depth 0.00

MATERIAL PROPERTIES

Versa-Lam 3100 Fb - Boise Cascade

	<u>Base Values</u>	<u>Adjusted</u>
Bending Stress:	Fb = 3100 psi Cd=1.00 CF=1.03	Fb' = 3191 psi
Shear Stress:	Fv = 285 psi Cd=1.00	Fv' = 285 psi
Modulus of Elasticity:	E = 2000 ksi	E' = 2000 ksi
Comp. \perp to Grain:	Fc \perp = 750 psi	Fc \perp ' = 750 psi

LOADING DIAGRAM



UNIFORM LOADS

Center

Uniform Live Load 74 plf

Uniform Dead Load 33 plf

Beam Self Weight 9 plf

Total Uniform Load 116 plf

POINT LOADS - CENTER SPAN

Load Number	<u>One</u>	<u>Two</u>
Live Load	955 lb	955 lb
Dead Load	209 lb	209 lb
Location	3.25 ft	7.75 ft

Controlling Moment: 5544 ft-lb
 5.5 Ft from left support of span 2 (Center Span)
 Created by combining all dead loads and live loads on span(s) 2

Controlling Shear: -1804 lb
 At right support of span 2 (Center Span)
 Created by combining all dead loads and live loads on span(s) 2

Comparisons with required sections:	<u>Req'd</u>	<u>Provided</u>
Section Modulus:	20.85 in3	49.91 in3
Area (Shear):	9.5 in2	32.38 in2
Moment of Inertia (deflection):	130.96 in4	230.84 in4
Moment:	5544 ft-lb	13272 ft-lb
Shear:	-1804 lb	6151 lb

NOTES

Project: 4PB0247A (L600)

Location: Alpha-Gamma Roof Joist Check (Side 2)

Multi-Loaded Multi-Span Beam

[2009 International Building Code(2005 NDS)]

1.5 IN x 9.25 IN x 11.0 FT

#2 - Spruce-Pine-Fir - Dry Use

Section Inadequate By: 43.0%

Controlling Factor: Moment / Depth Required 11.06 In.



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DEFLECTIONS	Center	
Live Load	0.18	IN L/724
Dead Load	0.20	in
Total Load	0.38	IN L/350
Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240		

REACTIONS	A	B
Live Load	643 lb	171 lb
Dead Load	404 lb	404 lb
Total Load	1048 lb	575 lb
Bearing Length	1.64 in	0.90 in

BEAM DATA	Center
Span Length	11 ft
Unbraced Length-Top	0 ft
Unbraced Length-Bottom	11 ft
Live Load Duration Factor	1.00
Notch Depth	0.00

MATERIAL PROPERTIES

#2 - Spruce-Pine-Fir

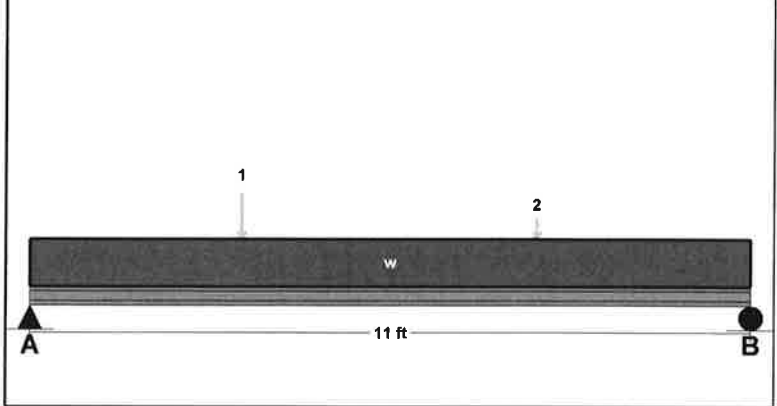
	Base Values	Adjusted
Bending Stress:	Fb = 875 psi	Fb' = 1107 psi
	Cd=1.00 CF=1.10 Cr=1.15	
Shear Stress:	Fv = 135 psi	Fv' = 135 psi
	Cd=1.00	
Modulus of Elasticity:	E = 1400 ksi	E' = 1400 ksi
Min. Mod. of Elasticity:	E_min = 510 ksi	E_min' = 510 ksi
Comp. ⊥ to Grain:	Fc ⊥ = 425 psi	Fc ⊥' = 425 psi

Controlling Moment: 2822 ft-lb
 3.3 Ft from left support of span 2 (Center Span)
 Created by combining all dead loads and live loads on span(s) 2

Controlling Shear: 1048 lb
 At left support of span 2 (Center Span)
 Created by combining all dead loads and live loads on span(s) 2

Comparisons with required sections:	Req'd	Provided
Section Modulus:	30.6 in3	21.39 in3
Area (Shear):	11.64 in2	13.88 in2
Moment of Inertia (deflection):	67.81 in4	98.93 in4
Moment:	2822 ft-lb	1973 ft-lb
Shear:	1048 lb	1249 lb

LOADING DIAGRAM



UNIFORM LOADS	Center
Uniform Live Load	74 plf
Uniform Dead Load	33 plf
Beam Self Weight	3 plf
Total Uniform Load	110 plf

POINT LOADS - CENTER SPAN		
Load Number	One	Two
Live Load	578 lb	-578 lb
Dead Load	209 lb	209 lb
Location	3.25 ft	7.75 ft

NOTES

Project: 4PB0247A (L600)

Location: Alpha-Gamma Reinforced Roof Joist Check (Side 2)

Multi-Loaded Multi-Span Beam

[2009 International Building Code(2005 NDS)]

(2) 1.75 IN x 9.25 IN x 11.0 FT

Versa-Lam 3100 Fb - Boise Cascade

Section Adequate By: 356.1%

Controlling Factor: Moment



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CAUTIONS

* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS

Center

Live Load 0.05 IN L/2412

Dead Load 0.06 in

Total Load 0.12 IN L/1119

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

REACTIONS

A

B

Live Load 643 lb 171 lb

Dead Load 442 lb 442 lb

Total Load 1086 lb 613 lb

Bearing Length 0.41 in 0.23 in

BEAM DATA

Center

Span Length 11 ft

Unbraced Length-Top 0 ft

Unbraced Length-Bottom 11 ft

Live Load Duration Factor 1.00

Notch Depth 0.00

MATERIAL PROPERTIES

Versa-Lam 3100 Fb - Boise Cascade

Base Values

Adjusted

Bending Stress: Fb = 3100 psi Fb' = 3191 psi

Cd=1.00 CF=1.03

Shear Stress: Fv = 285 psi Fv' = 285 psi

Cd=1.00

Modulus of Elasticity: E = 2000 ksi E' = 2000 ksi

Comp. \perp to Grain: Fc - \perp = 750 psi Fc - \perp ' = 750 psi

Controlling Moment: 2910 ft-lb

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

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

Controlling Shear: 1086 lb

At left support of span 2 (Center Span)

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

Comparisons with required sections:

Req'd

Provided

Section Modulus: 10.94 in³ 49.91 in³

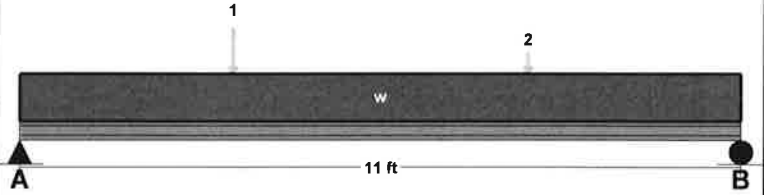
Area (Shear): 5.72 in² 32.38 in²

Moment of Inertia (deflection): 49.52 in⁴ 230.84 in⁴

Moment: 2910 ft-lb 13272 ft-lb

Shear: 1086 lb 6151 lb

LOADING DIAGRAM



UNIFORM LOADS

Center

Uniform Live Load 74 plf

Uniform Dead Load 33 plf

Beam Self Weight 9 plf

Total Uniform Load 116 plf

POINT LOADS - CENTER SPAN

Load Number One Two

Live Load 578 lb -578 lb

Dead Load 209 lb 209 lb

Location 3.25 ft 7.75 ft

NOTES

Project: 4PB0247A (L600)

Location: Beta Roof Joist Check (Worst Case)

Multi-Loaded Multi-Span Beam

[2009 International Building Code(2005 NDS)]

1.5 IN x 9.25 IN x 11.0 FT

#2 - Spruce-Pine-Fir - Dry Use

Section Inadequate By: 189.4%

Controlling Factor: Moment / Depth Required 15.76 In.



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DEFLECTIONS	Center	
Live Load	0.65	IN L/203
Dead Load	0.19	in
Total Load	0.84	IN L/158
Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240		

REACTIONS	A	B
Live Load	1658 lb	1066 lb
Dead Load	469 lb	340 lb
Total Load	2127 lb	1406 lb
Bearing Length	3.34 in	2.20 in

BEAM DATA	Center	
Span Length	11	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	11	ft
Live Load Duration Factor	1.00	
Notch Depth	0.00	

MATERIAL PROPERTIES

#2 - Spruce-Pine-Fir

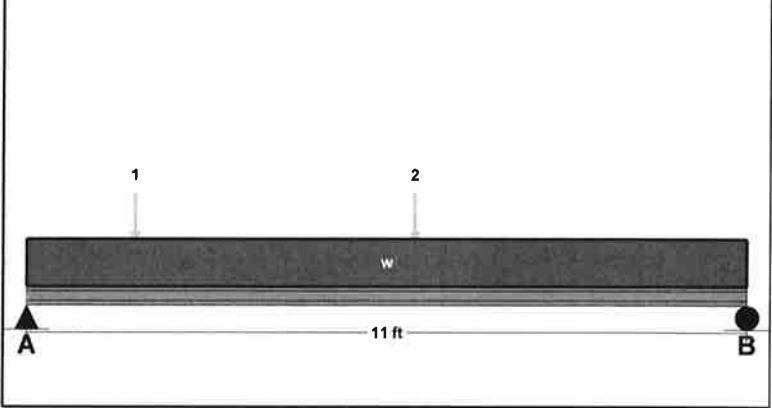
	Base Values	Adjusted
Bending Stress:	Fb = 875 psi Cd=1.00 CF=1.10 Cr=1.15	Fb' = 1107 psi
Shear Stress:	Fv = 135 psi Cd=1.00	Fv' = 135 psi
Modulus of Elasticity:	E = 1400 ksi	E' = 1400 ksi
Min. Mod. of Elasticity:	E_min = 510 ksi	E_min' = 510 ksi
Comp. ⊥ to Grain:	Fc ⊥ = 425 psi	Fc ⊥' = 425 psi

Controlling Moment: 5710 ft-lb
5.94 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

Controlling Shear: 2127 lb
At left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

Comparisons with required sections:	Req'd	Provided
Section Modulus:	61.9 in3	21.39 in3
Area (Shear):	23.64 in2	13.88 in2
Moment of Inertia (deflection):	175.23 in4	98.93 in4
Moment:	5710 ft-lb	1973 ft-lb
Shear:	2127 lb	1249 lb

LOADING DIAGRAM



UNIFORM LOADS	Center	
Uniform Live Load	74	plf
Uniform Dead Load	33	plf
Beam Self Weight	3	plf
Total Uniform Load	110	plf

POINT LOADS - CENTER SPAN	One	Two
Live Load	955 lb	955 lb
Dead Load	209 lb	209 lb
Location	1.67 ft	5.92 ft

NOTES

Project: 4PB0247A (L600)

Location: Beta Reinforced Roof Joist Check (Worst Case)

Multi-Loaded Multi-Span Beam

[2009 International Building Code(2005 NDS)]

(2) 1.75 IN x 9.25 IN x 11.0 FT

Versa-Lam 3100 Fb - Boise Cascade

Section Adequate By: 88.2%

Controlling Factor: Deflection



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CAUTIONS

* Laminations are to be fully connected to provide uniform transfer of loads to all members

DEFLECTIONS

Center

Live Load 0.19 IN L/677

Dead Load 0.06 in

Total Load 0.26 IN L/515

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

REACTIONS

A

B

Live Load 1658 lb 1066 lb

Dead Load 507 lb 378 lb

Total Load 2165 lb 1444 lb

Bearing Length 0.82 in 0.55 in

BEAM DATA

Center

Span Length 11 ft

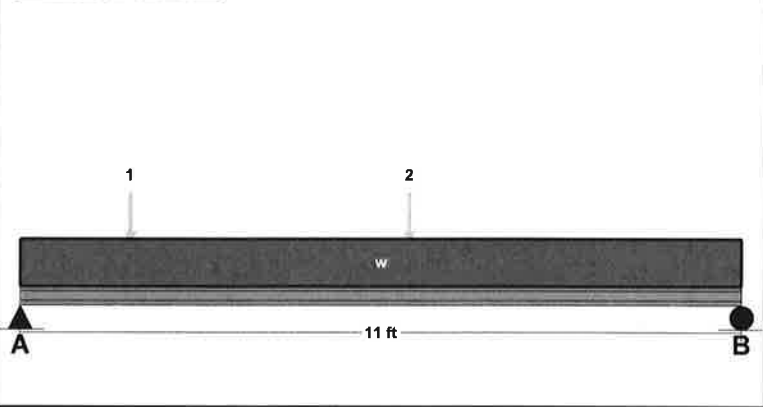
Unbraced Length-Top 0 ft

Unbraced Length-Bottom 11 ft

Live Load Duration Factor 1.00

Notch Depth 0.00

LOADING DIAGRAM



MATERIAL PROPERTIES

Versa-Lam 3100 Fb - Boise Cascade

Base Values

Adjusted

Bending Stress: Fb = 3100 psi Fb' = 3191 psi
Cd=1.00 CF=1.03

Shear Stress: Fv = 285 psi Fv' = 285 psi
Cd=1.00

Modulus of Elasticity: E = 2000 ksi E' = 2000 ksi

Comp. \perp to Grain: Fc \perp = 750 psi Fc \perp ' = 750 psi

UNIFORM LOADS

Center

Uniform Live Load 74 plf

Uniform Dead Load 33 plf

Beam Self Weight 9 plf

Total Uniform Load 116 plf

POINT LOADS - CENTER SPAN

Load Number One Two

Live Load 955 lb 955 lb

Dead Load 209 lb 209 lb

Location 1.67 ft 5.92 ft

Controlling Moment: 5814 ft-lb

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

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

Controlling Shear: 2165 lb

At left support of span 2 (Center Span)

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

Comparisons with required sections:

Req'd

Provided

Section Modulus: 21.86 in3 49.91 in3

Area (Shear): 11.4 in2 32.38 in2

Moment of Inertia (deflection): 122.66 in4 230.84 in4

Moment: 5814 ft-lb 13272 ft-lb

Shear: 2165 lb 6151 lb

NOTES