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Sandy, UT 84070
801-255-7700 fax: 801-255-8071

Structural Calculations

For:
Avrame - USA

Idylwood Office
11490 Julianne Avenue North, Grant, Minnesota, 55082

These calculations have been authorized for use at the property shown above. No provisions have been made for the re-use of these calculations on any other property.

Prepared by: Layton B. Asmus, P.E. (UT)
Supervised by: Cody Palmer, P.E. (MN)

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the state of Minnesota.

Signature: Cody R. Palmer

Type or Printed Name: Cody R Palmer

Date: 08/29/2023 License Number: 59454

IMPORTANT
This copy has been authorized by McNeil Engineering Structural, L.C only if the seal is in **red** or **green** ink and the signature is in **blue** ink.

Date: November 30, 2021
Rev. August 28, 2023 by DFB

21003.050 SA1
L B A

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CIVIL, STRUCTURAL ENGINEERING & LAND SURVEYING
PAVEMENT & ROOF CONSULTING

PROJECT	DATE	SHEET
Avrame - USA **Idylwood Office** 11490 Julianne Avenue North, Grant, Minnesota, 55082	**August, 23**	
	DESIGNED BY **D F B**	PROJECT NO. **21003.050 SA1**

Project Information

Project Name: Avrame - USA , Idylwood Office
Project Location: 11490 Julianne Avenue North, Grant, Minnesota, 55082

Design Criteria

Governing Building Code: 2020 Minnesota Building Code
Type of Construction: Wood Post Beam
Wind Zone (3-sec Gust): **120 mph** Exposure: **C**
Risk Category: **II** Site Class: **D**
Seismic Design Category: **D**
Roof Vertical Loads: Dead Load = 15 psf Live Load = 20 psf
Ground Snow Load = 100 psf
Snow Load = 84 psf flat roof (Dormers); 34 psf sloped roof (A-frame)
Floor Vertical Load: Dead Load = 15 psf Live Load = 50 psf

Construction Materials

Concrete 28-Day Compressive Strength

Footings:	3000 psi	
Foundations:	3500 psi	
Interior Slabs on Grade:	4000 psi	per IBC Table 1904.2
Porches, Garage Slabs, Exterior Steps:	4000 psi	per IBC Table 1904.2

Reinforcing Grade: ASTM A615 Gr. 60

Wood

Sawn Lumber (Walls)	DF-L no. 2 - Fb=825psi, Fv=95psi, E=1600ksi
Sawn Lumber (Beams Rafter):	DF-L no. 2 - Fb=825psi, Fv=95psi, E=1600ksi
FrameWorks Header	Versa-Lam - Fb=2800 psi, Fv=285psi, 2000ksi
Glu-Laminated Beams	24F-V4 (DF/DF) - Fb=2400psi, Fv=265psi, E=1800ksi
Roof Sheathing	5/8” CDX or OSB
Floor Sheathing	3/4" OSB (Tongue and Groove)

Soil Criteria

Geotechnical Consultant: .
Report Number:
Bearing Pressure: 1500 psf (Assumed per Table 1806.2)
Min. Bearing Depth: 40" (Frost Conditions), 15" (Non-Frost Conditions)
Min. Footing Width: 20"
Retaining Wall Pressure: Active: 40 pcf At-Rest: 55 pcf Passive: 250 psf (Assumed per Table 1610.1)

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PROJECT	DATE	SHEET OF
AFRAME	07-29-19	
	DESIGNED BY CRP / CHECKED BY	PROJECT NO. -

DEAD LOAD

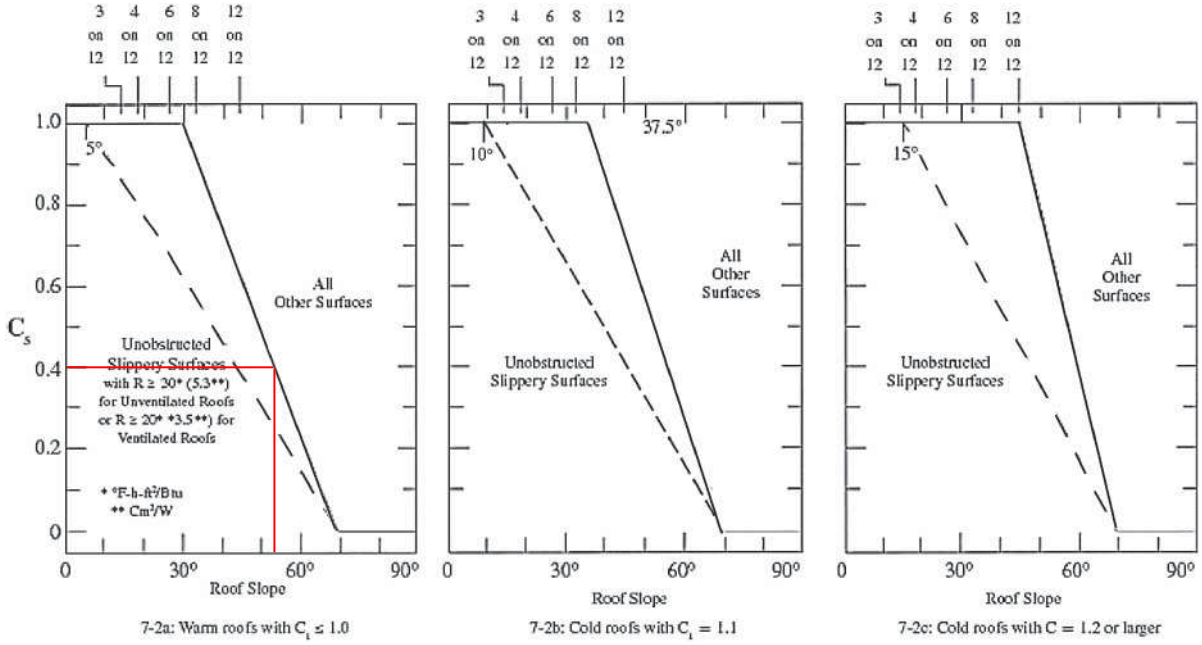
Roof Dead Load				
Standing Seam Roofing	2	psf		
Sheathing	1.5	psf		
Insulation	1	psf		
Electrical/Mech	2	psf		
Beams	2	psf		
Gyp Ceiling	3	psf		
Misc	1	psf		
TOTAL	12.5	psf		
		Use 15 psf in calcs		
Floor Dead Load				
Flooring	3	psf		
Sheathing	2	psf		
Insulation	1	psf		
Electrical/Mech	2	psf		
Beams	3	psf		
Gyp Ceiling (Loft)	3	psf		
Misc	1	psf		
TOTAL	15	psf		
		Use 15 psf in calcs		

FLOOR LIVE LOAD
50 PSF (OFFICE)

SNOW LOAD
SEE THE FOLLOWING CALCULATIONS

SNOW LOAD

pg = 100 PSF GROUND SNOW LOAD
Ce = 1.2 PER TABLE 7.3-1
Ct = 1.0 PER TABLE 7.3-2
Is = 1.0 PER TABLE 1.5-1
pf = 0.7 Ce Ct Is pg PER 7.3-1
pf = 0.7 x 1.2 x 1.0 x 1.0 x 100 PSF = 84 PSF
Cs = 0.4 (FOR A-FRAME, 1.0 FOR DORMERS)
ps = Cs pf PER 7.4-1
ps = 0.4 x 84 PSF = 33.6 PSF (A-FRAME)
ps = 1 x 84 PSF = 84 PSF (DORMER)



7-2a: Warm roofs with $C_t \leq 1.0$ 7-2b: Cold roofs with $C_t = 1.1$ 7-2c: Cold roofs with C = 1.2 or larger

Cs

7.6 UNBALANCED ROOF SNOW LOADS

Balanced and unbalanced loads shall be analyzed separately. Winds from all directions shall be accounted for when establishing unbalanced loads.

7.6.1 Unbalanced Snow Loads for Hip and Gable Roofs. For hip and gable roofs with a slope exceeding 7 on 12 (30.2°) or with a slope less than ½ on 12 (2.38°), unbalanced snow loads are not required to be applied. Roofs with an eave to ridge distance, W, of 20 ft (6.1 m) or less that have simply supported prismatic members spanning from ridge to eave shall be designed to resist an unbalanced uniform snow load on the leeward side equal to Ip_g. For these roofs, the windward side shall be unloaded. For all other gable roofs, the unbalanced load shall consist of $0.3p_s$ on the

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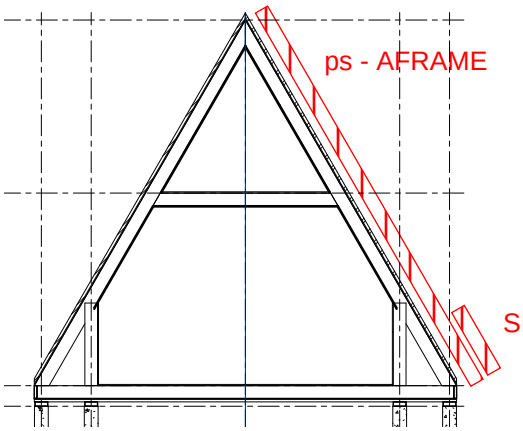
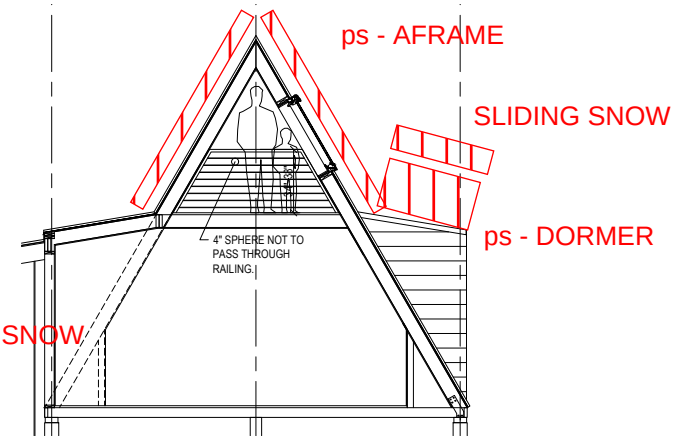
PROJECT	DATE	SHEET OF
AFRAME - DUO	07-29-19	
	DESIGNED BY: CRP / CHECKED BY:	PROJECT NO.: 19003

SNOW LOAD (cont)



SNOW LOADING - TYP AFRAME



SNOW LOADING - AT DORMER

SLIDING SNOW = 0.4 pf W PER SECTION 7.9
W = 5-ft (RIDGE TO "EAVE" OF HIGH ROOF)
IF THE WIDTH OF THE LOWER ROOF IS LESS THAN 15-FT,
THE SLIDING SNOW SHALL BE REDUCED
PROPORTIONALLY.

"LOW" ROOF WITDH = 5-FT

SLIDING SNOW = 0.4 X 84 PSF X 5-FT X 5/15 = 56 PLF

ADDED WEIGHT TO DORMER = 56 PLF/5-FT = 12 PSF

PROJECT	DATE	SHEET OF
AFRAME - DUO	07-29-19	
	DESIGNED BY CRP / CHECKED BY	PROJECT NO. 19003

WIND LOAD

Table 27.2-1 Steps to Determine MWFRS Wind Loads for Enclosed, Partially Enclosed, and Open Buildings of All Heights

Step 1: Determine Risk Category of building; see Table 1.5-1.
Step 2: Determine the basic wind speed, V, for the applicable Risk Category; see Figs. 26.5-1 and 26.5-2.
Step 3: Determine wind load parameters:
- Wind directionality factor, K_d; see Section 26.6 and Table 26.6-1.
- Exposure category; see Section 26.7.
- Topographic factor, K_{zt}; see Section 26.8 and table in Fig. 26.8-1.
- Ground elevation factor, K_e; see Section 26.9
- Gust-effect factor, G or G_f; see Section 26.11.
- Enclosure classification; see Section 26.12.
- Internal pressure coefficient, (GC_{pi}); see Section 26.13 and Table 26.13-1.

Step 4: Determine velocity pressure exposure coefficient, K_z or K_h; see Table 26.10-1.
Step 5: Determine velocity pressure q_z or q_h, Eq. (26.10-1).
Step 6: Determine external pressure coefficient, C_p or C_N:
- Fig. 27.3-1 for walls and flat, gable, hip, monoslope, or mansard roofs.
- Fig. 27.3-2 for domed roofs.
- Fig. 27.3-3 for arched roofs.
- Fig. 27.3-4 for monoslope roof, open building.
- Fig. 27.3-5 for pitched roof, open building.
- Fig. 27.3-6 for troughed roof, open building.
- Fig. 27.3-7 for along-ridge/valley wind load case for monoslope, pitched, or troughed roof, open building.

Step 7: Calculate wind pressure, p, on each building surface:
- Eq. (27.3-1) for rigid and flexible buildings.
- Eq. (27.3-2) for open buildings.

RISK CATEGORY II
BASIC WIND SPEED (V) = 150 MPH
Kd = 0.85
EXPOSURE C
Kzt = 1.0
Ke = 1.0
G = 0.85
ENCLOSED
GCpi = 0.18 or -0.18
Kz = 0.98 (30-ft or less)

h/L = 29-ft / 20-ft (SHORT FRAME) = 1.45
h/L = 29-ft/ 40-ft (LONG FRAME) = 0.725

qz = 0.00256 x 0.98 x 1.0 x 0.85 x 1.0 x 150^2 = 47.9 PSF

p = q GCp - qi (GCpi)

Normal to ridge (angle = approx. 55 degrees)
Cp = -0.6
Parallel to ridge
Cp = -0.7

p = 47.9 psf x -0.18 - 47.9 psf x 0.85 x -0.7 = 37 PSF

PROJECT	DATE		SHEET OF
AFRAME - DUO	07-29-19		
	DESIGNED BY CRP	CHECKED BY	PROJECT NO. 19003

WIND LOAD (cont.)

TRANSVERSE DIRECTION

TRIBUTARY AREA OF WIND LOAD IN TRANSVERSE DIRECTION IS APPLIED TO EACH TRUSS - SEE RISA CALCULATIONS.

LONGITUDINAL DIRECTION:

AREA OF END WALLS = 180 SQ-FT.

PRESSURE - 180 SQ-FT X 37 PSF X 2 (FOR EACH EACH) = 13.4 KIPS

FORCE EACH SIDE = 6.7 KIPS

LENGTH OF WALL = 14-FT (MIN) FOR DUO

UNIT SHEAR = 6.7 KIPS / 14 FT = 480 PLF (ULTIMATE)
UNIT SHEAR (ALLOWABLE) = 0.6 X W PLF = 288 PLF

16d TOENAILS AT 4" O.C. AT RIMBOARD
DURATION FACTOR = 1.6; DIAPHRAGM FACTOR = 1.1, TOE-NAIL FACTOR = 0.83
103 LBS X 1.6 X 1.1 X 0.83 X 12/4 = 451 PLF; THEREFORE, OK.

A35 CLIPS PROVIED AT BLOCKS AS WELL.

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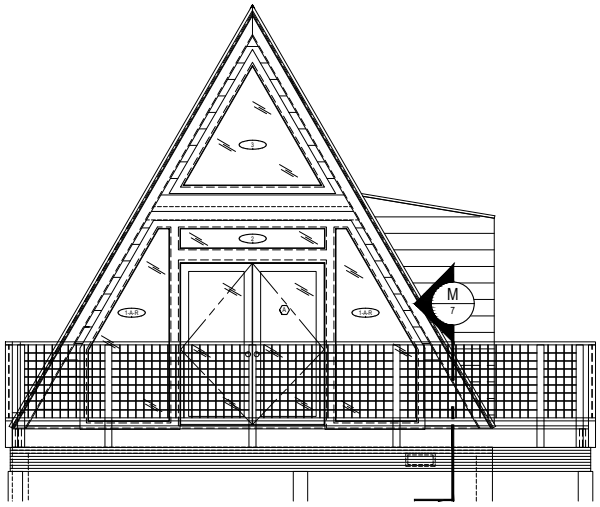
PROJECT	DATE	SHEET OF
AVRAME	02-17-21	- -

DESIGNED BY	CHECKED BY	PROJECT NO.
CRP	-	20003

OUT-OF-PLANE FORCES ON END WALLS



COMPONENT AND CLADDING WIND LOADING

Table 30.4-1 Steps to Determine C&C Wind Loads for Enclosed Low-Rise Buildings (Simplified Method)

Step 1: Determine risk category; see Table 1.5-1.
Step 2: Determine the basic wind speed, V, for applicable risk category; see Figs. 26.5-1 and 26.5-2.
Step 3: Determine wind load parameters:
- Exposure category B, C, or D; see Section 26.7.
- Topographic factor, K_{zt}; see Section 26.8 and Fig. 26.8-1.

Step 4: Enter figure to determine wind pressures at $h = 30$ ft, p_{net30}; see Fig. 30.4-1.
Step 5: Enter figure to determine adjustment for building height and exposure, λ; see Fig. 30.4-1.
Step 6: Determine adjusted wind pressures, p_{net}; see Eq. (30.4-1).

RISK CATEGORY II
BASIC WIND SPEED (V) = 120 MPH
EXPOSURE C
Kzt = 1.0
Ke = 1.0

ADJUSTMENT FACTOR FOR EXPOSURE = 1.4

Net Design Wind Pressure, p_{net30}, in lb/ft^2, for Exposure B at h = 30 ft, V= 95–130 mph

	Zone	Effective Wind Area (ft^2)	Basic Wind Speed (mph)													
			95		100		105		110		115		120		130	
Walls	4	10	16.2	–17.6	18.0	–19.5	19.8	–21.5	21.8	–23.6	23.8	–25.8	25.9	–28.1	30.4	–33.0
	4	20	15.5	–16.9	17.2	–18.7	18.9	–20.6	20.8	–22.6	22.7	–24.7	24.7	–26.9	29.0	–31.6
	4	50	14.5	–15.9	16.1	–17.6	17.8	–19.4	19.5	–21.3	21.3	–23.3	23.2	–25.4	27.2	–29.8
	4	100	13.8	–15.2	15.3	–16.8	16.9	–18.5	18.5	–20.4	20.2	–22.2	22.0	–24.2	25.9	–28.4
	5	10	16.2	–21.7	18.0	–24.1	19.8	–26.6	21.8	–29.1	23.8	–31.9	25.9	–34.7	30.4	–40.7
	5	20	15.5	–20.3	17.2	–22.5	18.9	–24.8	20.8	–27.2	22.7	–29.7	24.7	–32.4	29.0	–38.0
	5	50	14.5	–18.3	16.1	–20.3	17.8	–22.4	19.5	–24.6	21.3	–26.9	23.2	–29.3	27.2	–34.3
	5	100	13.8	–16.9	15.3	–18.7	16.9	–20.6	18.5	–22.6	20.2	–24.7	22.0	–26.9	25.9	–31.6

PRESSURE USED IN CALCS:
28.1 PSF X 1.4 = 39.4 PSF (ULT.)

23.6 PSF (ASD)

SEE CALCS FOR WIND GIRTS

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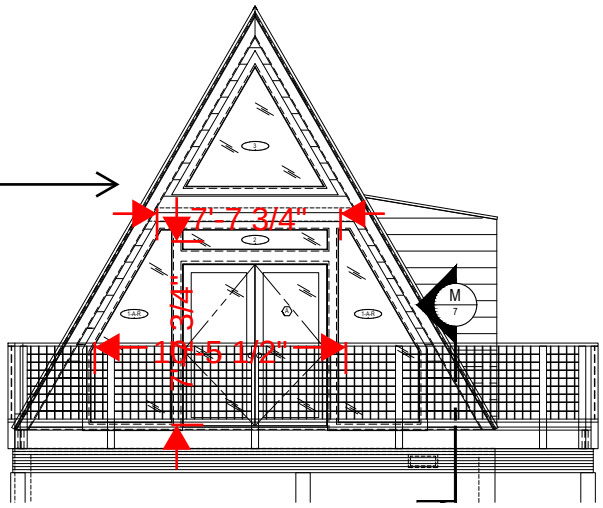
PROJECT	DATE	SHEET	OF
AVRAME	02-17-21	-	-

DESIGNED BY	CHECKED BY	PROJECT NO.
CRP	-	20003



FORCE AT TOP OF JAMB CONNECTION

TRIBUTARY AREA = 10.5-FT/2 X 8-FT/2 = 21 SQ. FT

FORCE FROM WIND = 23.6 PSF X 21 SQ.FT = 496 LBS

PROVIDE A34 CLIP AT JAMBS

SEE CALCULATIONS BELOW FOR JAMB STUD

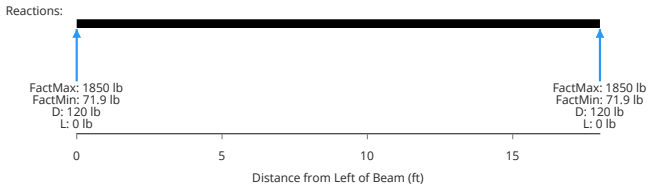
REACTION AT UPPER WIND GIRT (SEE CALCULATIONS BELOW) = 660 LBS

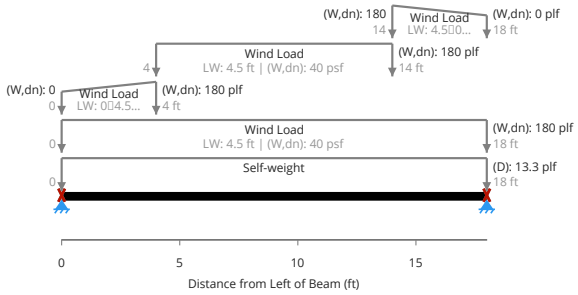
GIRT TO BEAR INTO BLOCK AND BE ATTACHED WITH CS16 X 4-FT LONG (MIN)

Client:		**Date:**	Feb 18, 2021
Author:	Cody Palmer	**Job #:**	21003
Project:	Avrame	**Subject:**	**TRIO Wind Girt (Lower)**
References:	NDS 2018 (ASD)		

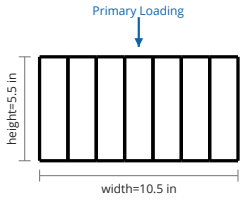
Summary

44%	Allowable Bending Moment	$M' = 20\,400$ lb · ft
11%	Allowable Shear	$V' = 17\,600$ lb
8%	Allowable Bearing Load	$R' = 23\,600$ lb
92%	Governing Live / Short-Term Deflection	$\delta_{ST} = -1.39$ in
	Critical Live / Short-Term Deflection Ratio	$(L/)_{ST} = 156$
4%	Governing Long-Term Deflection	$\delta_{LT} = -0.0635$ in
	Critical Long-Term Deflection Ratio	$(L/)_{LT} = 3400$
8%	Simplified DL+LL Deflection	$\delta_{DL+LL} = -0.127$ in
	Critical Simplified DL+LL Deflection Ratio	$(L/)_{DL+LL} = 1700$





Key Properties



Member		7 plies - 1-1/2x5-1/2 Versa-Lam LVL 1.8E-2650Fb
Beam Plan Length	$L_X =$	18 ft
Continuous Bracing for Lateral Torsional Buckling		No continuous bracing

Loads

Design Conditions

Design Code for Load Combinations	International Building Code (IBC) 2018

Member Properties

Cross-Sectional Area	$A = 57.7$ in^2
Strong Axis Moment of Inertia	$I_{xx} = 146$ in^4
Section Modulus	$S = 52.9$ in^3
Base Allowable Bending Stress	$F_b = 2650$ psi
Base Allowable Shear Stress	$F_v = 285$ psi
Base Perpendicular Compression Allowable Stress	$F_{c\perp} = 750$ psi
Base Modulus of Elasticity	$E = 1\,700\,000$ psi

Elastic Modulus (NDS 2018 2.3)

Adjusted Modulus of Elasticity	$E' = 1\,700\,000$ psi

Section Bending (NDS 2018 2.3)

Governing Duration Factor in Bending	$C_{D,b} = 1.6$
Beam Stability Factor	$C_L = 1$
Volume Factor	$C_V = 1.09$
Adjusted Bending Strength	$F_b' = 4620$ psi

Shear Design (NDS 2018 3.4)

Governing Duration Factor	$C_D = 1.6$
Adjusted Shear Strength	$F_v' = 456$ psi

Bearing (NDS 2018 3.10)

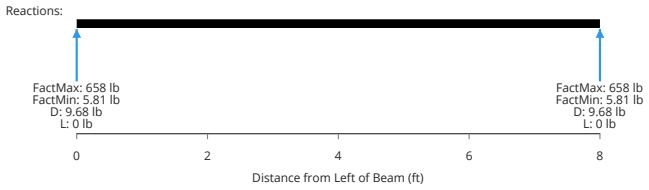
Base Bearing Strength	$F_{c\perp}'/C_b = 750$ psi

Comments

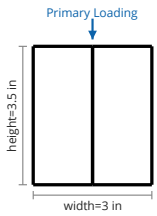
Client:		**Date:**	Feb 18, 2021
Author:	Cody Palmer	**Job #:**	21003
Project:	Avrame	**Subject:**	**TRIO Wind Girt (Upper)**
References:	NDS 2018 (ASD)		

Summary

60%	Allowable Bending Moment	$M' = 2430\ \text{lb} \cdot \text{ft}$
21%	Allowable Shear	$V' = 3190\ \text{lb}$
10%	Allowable Bearing Load	$R' = 6750\ \text{lb}$
78%	Governing Live / Short-Term Deflection	$\delta_{ST} = -0.627\ \text{in}$
	Critical Live / Short-Term Deflection Ratio	$(L/)_{ST} = 153$
1%	Governing Long-Term Deflection	$\delta_{LT} = -0.00612\ \text{in}$
	Critical Long-Term Deflection Ratio	$(L/)_{LT} = 15\,700$
2%	Simplified DL+LL Deflection	$\delta_{DL+LL} = -0.0122\ \text{in}$
	Critical Simplified DL+LL Deflection Ratio	$(L/)_{DL+LL} = 7850$

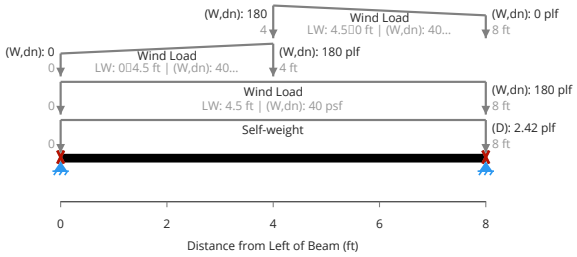


Key Properties



Member		2 plies - 1-1/2x3-1/2 Versa-Lam LVL 1.8E-2650Fb
Beam Plan Length	$L_X =$	8 ft
Continuous Bracing for Lateral Torsional Buckling		No continuous bracing

Loads



Design Conditions

Design Code for Load Combinations	International Building Code (IBC) 2018

Member Properties

Cross-Sectional Area	$A = 10.5\ \text{in}^2$
Strong Axis Moment of Inertia	$I_{xx} = 10.7\ \text{in}^4$
Section Modulus	$S = 6.12\ \text{in}^3$
Base Allowable Bending Stress	$F_b = 2650\ \text{psi}$
Base Allowable Shear Stress	$F_v = 285\ \text{psi}$
Base Perpendicular Compression Allowable Stress	$F_{c\perp} = 750\ \text{psi}$
Base Modulus of Elasticity	$E = 1\,700\,000\ \text{psi}$

Elastic Modulus (NDS 2018 2.3)

Adjusted Modulus of Elasticity	$E' = 1\,700\,000\ \text{psi}$

Section Bending (NDS 2018 2.3)

Volume Factor	$C_V = 1.15$

Positive Bending (NDS 2018 2.3)

Governing Duration Factor - Positive Bending	$C^+_{D,b} = 1.6$
Governing Beam Stability Factor - Positive Bending	$C^+_L = 0.98$
Adjusted Bending Strength - Positive Bending	$F'^+_b = 4770\ \text{psi}$

Negative Bending (NDS 2018 2.3)

Governing Duration Factor - Negative Bending	$C^-_{D,b} = 0.9$
Governing Beam Stability Factor - Negative Bending	$C^-_L = 0.99$
Adjusted Bending Strength - Negative Bending	$F'^-_b = 2710\ \text{psi}$

Shear Design (NDS 2018 3.4)

Governing Duration Factor	$C_D = 1.6$
Adjusted Shear Strength	$F'_v = 456\ \text{psi}$

Bearing (NDS 2018 3.10)

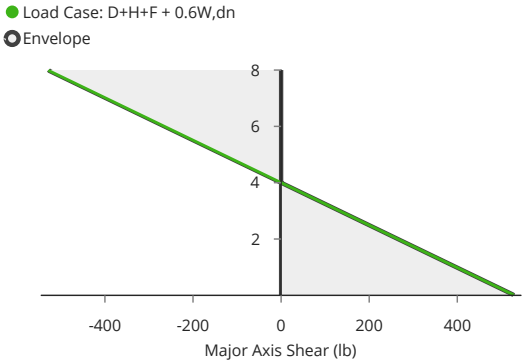
Base Bearing Strength	$F'_{c\perp}/C_b = 750\ \text{psi}$

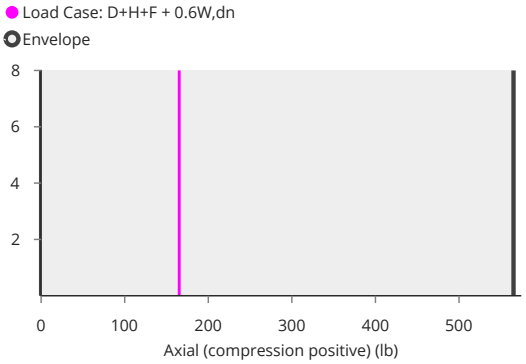
Comments

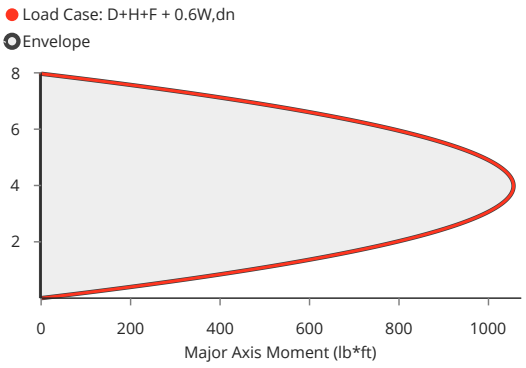
Client:		**Date:**	Feb 18, 2021
Author:	Cody Palmer	**Job #:**	21003
Project:	Avrame	**Subject:**	**End Wall Jamb Stud**
References:	NDS 2018 (ASD)		

Summary

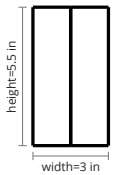
3%	Allowable Compressive Load (X-Axis Buckling)	$P'_x = 17\,400$ lb
14%	Allowable Compressive Load (Y-Axis Buckling)	$P'_y = 4260$ lb
46%	Allowable X-Axis Moment	$M'_x = 2310$ lb · ft
46%	Combined Compression / Bending	Int. $= 0.461$
32%	Governing Live / Short-Term X-Axis Deflection	$\delta_{x,ST} = -0.128$ in
	Critical Live / Short-Term X-Axis Deflection Ratio	$(L/)_{x,ST} = 750$
0%	Governing Long-Term X-Axis Deflection	$\delta_{x,LT} = 0$ in
	Critical Long-Term X-Axis Deflection Ratio	$(L/)_{x,LT} = 0$
	Critical Simplified DL+LL X-Axis Deflection Ratio	$(L/)_{x,DL+LL} = 0$





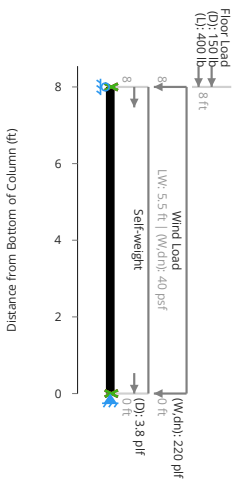


Key Properties

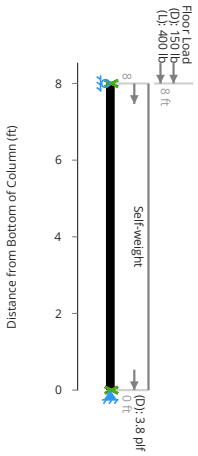


Member	2 plies - 2x6 D.Fir-L No. 2
Connection Between Plies	Nailed
Column Height	$L = 8$ ft
Continuous Bracing for Strong Axis Buckling	No
Continuous Bracing for Weak Axis Buckling	No
Continuous Bracing for Lateral Torsional Buckling	No

Loads



Weak Axis Loads



Design Conditions

Design Code for Load Combinations	International Building Code (IBC) 2018

Member Properties

Cross-Sectional Area	$A = 16.5\ \text{in}^2$
Strong Axis Moment of Inertia	$I_{xx} = 41.6\ \text{in}^4$
Weak Axis Moment of Inertia	$I_{yy} = 12.4\ \text{in}^4$
Base Allowable Compression Stress	$F_c = 1350\ \text{psi}$
Base Allowable Bending Stress (X-axis)	$F_{bx} = 900\ \text{psi}$
Base Allowable Bending Stress (Y-axis)	$F_{by} = 900\ \text{psi}$
Base Minimum Elastic Modulus (X-axis)	$E_{minx} = 580\,000\ \text{psi}$
Base Minimum Elastic Modulus (Y-axis)	$E_{miny} = 580\,000\ \text{psi}$
Base Elastic Modulus (X-axis)	$E_x = 1\,600\,000\ \text{psi}$
Base Elastic Modulus (Y-axis)	$E_y = 1\,600\,000\ \text{psi}$

Elastic Modulus (NDS 2018 2.3)

Adjusted Minimum Elastic Modulus (X-axis)	$E'_{min,x} = 580\,000\ \text{psi}$
Adjusted Minimum Elastic Modulus (Y-axis)	$E'_{min,y} = 580\,000\ \text{psi}$
Adjusted Nominal Elastic Modulus (X-axis)	$E'_x = 1\,600\,000\ \text{psi}$
Adjusted Nominal Elastic Modulus (Y-axis)	$E'_y = 1\,600\,000\ \text{psi}$

Capacity in Pure Axial Loading (NDS 2018 Section 3.7)

Size Factor	$C_{F,c} = 1.1$
Fully Braced Compression Strength - Pure Axial Loading	$F_c^* = 1490\ \text{psi}$
Governing Slenderness - X-axis	$(\ell_e/d) = 17.5$
Governing Slenderness - Y-axis	$(\ell_e/b) = 32$
Adjusted Compression Strength (X-axis)	$F'_{c,x} = 1050\ \text{psi}$
Adjusted Compression Strength (Y-axis)	$F'_{c,y} = 258\ \text{psi}$

Capacity in Pure Bending (NDS 2018 Section 3.3)

Governing Duration Factor - Pure X-Axis Bending	$C_{D,x} = 1.6$
Governing Duration Factor - Pure Y-Axis Bending	$C_{D,y} = 0.9$
Size Factor	$C_{F,b} = 1.3$
Governing Beam Stability Factor - Pure Bending	$C_L = 0.98$
Allowable Bending Stress (X-axis)	$F'_{bx} = 1840\ \text{psi}$
Allowable Bending Stress (Y-Axis)	$F'_{by} = 1210\ \text{psi}$

Combined Bending and Compression (NDS 2018 Section 3.9)

Fully Braced Compression Strength	$F^*_{c,int} = 2380\ \text{psi}$
Adjusted Compression Strength (X-axis)	$F'_{cx,int} = 1270\ \text{psi}$
Adjusted Compression Strength (Y-axis)	$F'_{cy,int} = 267\ \text{psi}$
Adjusted Compression Strength - Interaction	$F'_{c,int} = 267\ \text{psi}$
Governing Beam Stability Factor - Interaction	$C_{L,int} = 0.98$
Allowable Bending Stress (X-axis)	$F'_{bx,int} = 1840\ \text{psi}$
Allowable Bending Stress (Y-Axis)	$F'_{by,int} = 2150\ \text{psi}$

Comments

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CIVIL, STRUCTURAL ENGINEERING & LAND SURVEYING
PAVEMENT & ROOF CONSULTING

PROJECT	DATE	SHEET OF
Aframe - Various	**Feb-20**	
	DESIGNED BY: CRP	PROJECT NO.: **19003**

Lateral Analysis - Seismic

S_S	125	Mapped spectral acceleration for short periods, %, per Fig. 1613.3.1(1) or from NSHMP Prograı
S_1	50	Mapped spectral acceleration for 1-second periods, %, per Fig. 1613.3.1(2) or from NSHMP Prc
SC	D	Site Class as defined per ASCE 7-16 Tbl. 20.3-1
F_a	1.2	Site coeff as a function of Site Class and S_S per IBC 2018 Tbl. 1613.2.3(1)
F_v	1.5	Site coeff as a function of Site Class and S_1 per IBC 2018 Tbl. 1613.2.3(2)
R	6.5	Response modification factor per ASCE 7-16 Tbl. 12.2-1
I_E	1	Occupancy importance factor per ASCE 7-16 Table 1.5-2

LONGITUDINAL DIRECTION
(TIMBER SHEATHED WALLS/ROOF)

S_{MS}	1.500	IBC 2018 Eq. 16-36
S_{M1}	0.750	IBC 2018 Eq. 16-37
S_{DS}	1.000	IBC 2018 Eq. 16-38
S_{D1}	0.500	IBC 2018 Eq. 16-39

C_T	0.02	Building period coeff per ASCE 7-16 Table 12.8-2
h_n	25	Height of building above base level to highest level of structure, ft., per ASCE 7-16 12.8.2.1
x=	0.75	ASCE 7-16 Table 12.8-2

T_a	0.224	Approximate Fundamental period of the building, sec. per ASCE 7-16 12.8.2.1
f	4.472	Frequency of the building, Hz
T_0	0.100	Period corresponding to change in design response spectrum
T_S	0.500	Short period ASCE 7-16 11.3
T_L	8.000	Long-period transition period shown in ASCE 7-16 Fig. 22-14
S_a	1.000	ASCE 7-16 Eq. 11.4-6 For $T_L > T > T_S$

RC	II	Risk Category Per IBC 2018 1604.5, Table 1604.5
SDC	D	Seismic Design Category per IBC 2018 Table 1613.2.5(1) & 1613.2.5(2)

C_S	0.1538	ASCE 7-16 Eq. 12.8-2
C_S	0.3440	ASCE 7-16 Eq. 12.8-3
C_S	0.0440	ASCE 7-16 Eq. 12.8-5

Base Shear Coefficient used in calculations

C_S	0.154 *W	(Ultimate)
C_S	0.110 *W	(Service) = (Ultimate)/1.4 IBC 2018 Sec. 1605.3.2
k=	1	

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CIVIL, STRUCTURAL ENGINEERING & LAND SURVEYING
PAVEMENT & ROOF CONSULTING

PROJECT	DATE	SHEET OF
Aframe - Various	**Aug-20**	
	DESIGNED BY: CRP	PROJECT NO.: **19003**

Lateral Analysis - Seismic

S_S	125	Mapped spectral acceleration for short periods, %, per Fig. 1613.3.1(1) or from NSHMP Program
S_1	50	Mapped spectral acceleration for 1-second periods, %, per Fig. 1613.3.1(2) or from NSHMP Program
SC	D	Site Class as defined per ASCE 7-16 Tbl. 20.3-1
F_a	1.2	Site coeff as a function of Site Class and S_S per IBC 2018 Tbl. 1613.2.3(1)
F_v	1.5	Site coeff as a function of Site Class and S_1 per IBC 2018 Tbl. 1613.2.3(2)
R	2	Response modification factor per ASCE 7-16 Tbl. 12.2-1 TRANSVERSE DIRECTION (TIMBER TRUSS)
I_E	1	Occupancy importance factor per ASCE 7-16 Table 1.5-2
S_{MS}	1.500	IBC 2018 Eq. 16-36
S_{M1}	0.750	IBC 2018 Eq. 16-37
S_{DS}	1.000	IBC 2018 Eq. 16-38
S_{D1}	0.500	IBC 2018 Eq. 16-39
C_T	0.02	Building period coeff per ASCE 7-16 Table 12.8-2
h_n	25	Height of building above base level to highest level of structure, ft., per ASCE 7-16 12.8.2.1
x=	0.75	ASCE 7-16 Table 12.8-2
T_a	0.224	Approximate Fundamental period of the building, sec. per ASCE 7-16 12.8.2.1
f	4.472	Frequency of the building, Hz
T_0	0.100	Period corresponding to change in design response spectrum
T_S	0.500	Short period ASCE 7-16 11.3
T_L	8.000	Long-period transition period shown in ASCE 7-16 Fig. 22-14
S_a	1.000	ASCE 7-16 Eq. 11.4-6 For $T_L > T > T_S$
RC	II	Risk Category Per IBC 2018 1604.5, Table 1604.5
SDC	D	Seismic Design Category per IBC 2018 Table 1613.2.5(1) & 1613.2.5(2)
C_S	0.5000	ASCE 7-16 Eq. 12.8-2
C_S	1.1180	ASCE 7-16 Eq. 12.8-3
C_S	0.0440	ASCE 7-16 Eq. 12.8-5

Base Shear Coefficient used in calculations

C_S	0.500 *W	(Ultimate)
C_S	0.357 *W	(Service) = (Ultimate)/1.4 IBC 2018 Sec. 1605.3.2
k=	1	

AVRAME FRAME SHEATHED W/ OSB IS LIKELY TO BEHAVE LIKE A TIMBER "DRAG" TRUSS COMMON IN LIGHT-FRAMED RESIDENTIAL CONSTRUCTION (WHICH OFTEN USE LIGHT-FRAMED SHEARWALLS FOR THE VERTICAL LATERAL FORCE RESISTING SYSTEM).

THE AVRAME TRUSSES RESITS LOADS LIKE A TRUSS - PIN-PIN JOINTS - AN R OF 2 WAS ASSIGNED (TO BE ON PAR WITH LIGHT-FRAMED WALLS SHEATHED WITH "OTHER" MATERIALS). AS A COMPARISION CANTILEVER COLUMN TIMBER FRAMES THAT RESIST LOADS VIA MOMENT RESISTING CONFIGURATIONS/CONNECTIONS ARE ASSIGNED AN R = 1.5

SEISMIC LOADING

V = Cs x W - PER 12.8-1

Cs = 0.154 LONGITUDINAL DIRECTION (SHEARWALLS)
Cs = 0.408 TRANSVERS DIRECTION (WOOD TRUSS)

EFFECTIVE SEISMIC WEIGHT
DEAD LOAD ROOF = 15 PSF
DEAD LOAD OF FLOOR = 15 PSF
UNIFORM FLAT SNOW LOAD = 105 PSF
"SEISMIC SNOW" LOAD = 105 X .2 = 21 PSF (APPLIED AT ROOF LEVEL ONLY)

SEISMIC BASE SHEAR (ULTIMATE)

LONGITUDINAL DIRECTION

ROOF = (15 PSF + 21 PSF) X 0.154 = 5.5 PSF
FLOOR = (15 PSF) X 0.154 = 2.3PSF

TRANSVERSE DIRECTION

ROOF = (15 PSF + 21 PSF) X 0.5 = 18 PSF = 36 PLF ALONG MEMBERS
FLOOR = (15 PSF) X 0.5 = 7.5 PSF = 15 PLF ALONG MEMBERS

SEISMIC FORCE IN LONGITUDINAL DIRECTION:

1-FT TRIBUTARY STRIP
ROOF AREA = 40 SQ.FT (20-FT + 20-FT)
40 SQ. FT X (15 PSF + 21 PSF) X 0.154 = 222 LBS
FLOOR AREA = 28 SQ. FT (8-FT + 20-FT)
28 SQ. FT X (15 PSF) X 0.154 = 65 LBS

TOTAL = 287 PLF

UNIT SHEAR EACH SIDE = 287 PLF / 2 = 144 PLF (ULTIMATE)
UNIT SHEAR (ALLOWABLE) = 0.7 X W PLF = 100 PLF

16d TOENAILS AT 4" O.C. AT RIMBOARD
DURATION FACTOR = 1.6; DIAPHRAGM FACTOR = 1.1, TOE-NAIL FACTOR = 0.83
103 LBS X 1.6 X 1.1 X 0.83 X 12/4 = 451 PLF; THEREFORE, OK.

A35 CLIPS PROVIDED AS WELL.

SEISMIC FORCE IN TRANSVERE DIRECTION LONGITUDINAL DIRECTION:

SEE RISA REACTIONS

TABLE 2a

UNIFORM LOADS (psf) ON APA RATED OSB SHEATHING.
MULTI-SPAN, NORMAL DURATION OF LOAD, DRY CONDITIONS, PANELS 24 INCHES OR WIDER

Span Rating[b]	Load Governed By[c]	Strength Axis[a]: Perpendicular to Supports, Span Center-to-Center of Supports (inches)										Parallel to Supports, Span Center-to-Center of Supports (inches)		
		12	16	19.2	24	30	32	36	40	48	60	12	16	24
	L/360	261	98	54	26	13	10					48	18	
	L/240	392	147	81	39	19	16					72	27	
24/0	L/180	522	196	107	52	26	21					96	36	
	Bending	250	141	98	63	40	35					81	45	
	Shear	248	179	147	116	91	85					248	179	
	L/360	339	128	70	34	17	14	12				70	26	
	L/240	509	191	105	51	25	20	18				104	39	
24/16	L/180	679	255	140	68	33	27	24				139	52	
	Bending	321	180	125	80	51	45	29				96	54	
	Shear	286	207	169	133	105	98	83				286	207	
	L/360	500	188	103	50	24	20	18	13			109	41	14
	L/240	750	282	154	75	37	30	26	19			163	61	21
32/16	L/180	1,001	376	206	100	49	40	35	25			218	82	28
	Bending	371	209	145	93	59	52	33	27			138	77	28
	Shear	314	228	186	147	116	108	92	82			314	228	141
	L/360	979	368	201	98	48	39	34	25	16		244	92	31
	L/240	1,468	552	302	146	72	58	51	37	24		365	137	46
40/20	L/180	1,958	736	403	195	96	78	69	49	32		487	183	62
	Bending	625	352	244	156	100	88	56	45	31		225	127	45
	Shear	390	283	232	182	144	134	114	102	88		390	283	175
	L/360	1,740	655	358	174	85	69	61	44	29	14	398	150	51
	L/240	2,610	982	537	260	128	104	91	66	43	21	597	225	76
48/24	L/180	3,480	1,309	716	347	170	139	122	88	57	28	796	300	101
	Bending	833	469	326	208	133	117	74	60	42	27	338	190	68
	Shear	476	345	282	222	175	164	139	125	108	85	476	345	213

(a) The strength axis is the long panel dimension unless otherwise identified.

(b) Nominal thickness may vary within Span Rating. For range of thicknesses, see Table 5 of APA's *Panel Design Specification*, Form D510.

(c) Some capacities may be increased by application of formulas in *Panel Design Specification*, Form D510.

PLEASE NOTE: THE TIMBER DESIGN BASED ON NDS WHICH IS REFERENCED BY BOTH THE 2015 AND 2018 IBC

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Location: FLOOR - 2x4 intermediate wall
Column
[2015 International Building Code(2015 NDS)]
1.5 IN x 3.5 IN x 8.0 FT @ 16 O.C.
Stud - Douglas-Fir-Larch - Dry Use
Section Adequate By: 41.4%

Location: FLOOR - Crawlspace beam - 3-ft
Uniformly Loaded Floor Beam
[2015 International Building Code(2015 NDS)]
(2) 1.5 IN x 5.5 IN x 3.0 FT
#2 - Douglas-Fir-Larch - Dry Use
Section Adequate By: 23.9%
Controlling Factor: Moment

Location: FLOOR - Crawlspace beam - 4-ft
Uniformly Loaded Floor Beam
[2015 International Building Code(2015 NDS)]
(2) 1.5 IN x 7.25 IN x 4.0 FT
#2 - Douglas-Fir-Larch - Dry Use
Section Adequate By: 11.4%
Controlling Factor: Moment

Location: FLOOR - Crawlspace beam - 5-ft
Uniformly Loaded Floor Beam
[2015 International Building Code(2015 NDS)]
(2) 1.5 IN x 9.25 IN x 5.0 FT
#2 - Douglas-Fir-Larch - Dry Use
Section Adequate By: 5.8%
Controlling Factor: Moment

Location: FLOOR - Crawlspace beam - 7-ft
Uniformly Loaded Floor Beam
[2015 International Building Code(2015 NDS)]
(2) 1.75 IN x 7.25 IN x 7.0 FT
2.0E Microllam - iLevel Trus Joist
Section Adequate By: 8.3%
Controlling Factor: Moment

Location: FLOOR - Crawlspace beam - 9-ft
Uniformly Loaded Floor Beam
[2015 International Building Code(2015 NDS)]
(2) 1.75 IN x 9.5 IN x 9.0 FT
2.0E Microllam - iLevel Trus Joist
Section Adequate By: 6.9%
Controlling Factor: Moment

Location: FTG - 20-in crawlspace
Footing
[2015 International Building Code(2015 NDS)]
Footing Size: 20.0 IN Wide x 12.0 IN Deep Continuous Footing With 8.0 IN Thick x 24.0 IN Tall Stemwall
Section Footing Design Adequate

Location: FTG - 24-in end wall
Footing
[2015 International Building Code(2015 NDS)]
Footing Size: 24.0 IN Wide x 12.0 IN Deep Continuous Footing With 8.0 IN Thick
24.0 IN Tall Stemwall
Section Footing Design Adequate

Location: FTG - 36-in continuous footing
Footing
[2015 International Building Code(2015 NDS)]
Footing Size: 36.0 IN Wide x 12.0 IN Deep Continuous Footing With 8.0 IN Thick
24.0 IN Tall Stemwall
Section Footing Design Adequate

Location: FTG - Footing below girder trusses
Footing
[2015 International Building Code(2015 NDS)]
Footing Size: 3.0 FT x 4.5 FT x 12.00 IN
Section Footing Design Adequate

Location: LOFT - Loft Beam at Stair opening
Uniformly Loaded Floor Beam
[2015 International Building Code(2015 NDS)]
(2) 1.75 IN x 11.25 IN x 20.0 FT
1.9E Microllam - iLevel Trus Joist
Section Adequate By: 35.7%
Controlling Factor: Deflection

Location: LOFT - Loft Floor Joists
Floor Joist
[2015 International Building Code(2015 NDS)]
1.75 IN x 5.5 IN x 10.0 FT @ 24 O.C.
1.55E Timberstrand LSL - iLevel Trus Joist
Section Adequate By: 33.6%
Controlling Factor: Moment

Location: LOFT - Stair Stringer
Multi-Loaded Multi-Span Beam
[2015 International Building Code(2015 NDS)]
1.75 IN x 9.5 IN x 12.0 FT (Actual 15 FT)
1.55E Timberstrand LSL - iLevel Trus Joist
Section Adequate By: 66.2%
Controlling Factor: Deflection


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Location: ROOF - Dormer at Loft (10-ft)
Multi-Loaded Multi-Span Beam
[2015 International Building Code(2015 NDS)]
(3) 1.75 IN x 9.5 IN x 10.0 FT
1.55E Timberstrand LSL - iLevel Trus Joist
Section Adequate By: 4.3%
Controlling Factor: Deflection

Location: ROOF - Dormer at Loft (8-ft)
Multi-Loaded Multi-Span Beam
[2015 International Building Code(2015 NDS)]
(2) 1.75 IN x 9.5 IN x 8.0 FT
1.55E Timberstrand LSL - iLevel Trus Joist
Section Adequate By: 38.0%
Controlling Factor: Deflection

Location: ROOF - Dormer Beam
Roof Beam
[2015 International Building Code(2015 NDS)]
(2) 1.75 IN x 9.5 IN x 10.0 FT
1.55E Timberstrand LSL - iLevel Trus Joist
Section Adequate By: 90.9%
Controlling Factor: Moment

Location: ROOF - Dormer Rafters
Roof Rafter
[2015 International Building Code(2015 NDS)]
1.5 IN x 9.25 IN x 5.0 FT @ 24 O.C.
#2 - Douglas-Fir-Larch - Dry Use
Section Adequate By: 3.1%
Controlling Factor: Moment

Location: ROOF - Skylight Header
Roof Beam
[2015 International Building Code(2015 NDS)]
(2) 1.75 IN x 7.25 IN x 4.0 FT
1.9E Microllam - iLevel Trus Joist
Section Adequate By: 195.5%
Controlling Factor: Shear

Location: ROOF - Wind Girt
Multi-Loaded Multi-Span Beam
[2015 International Building Code(2015 NDS)]
(4) 1.5 IN x 5.5 IN x 10.0 FT
#2 - Douglas-Fir-Larch - Dry Use
Section Adequate By: 19.2%
Controlling Factor: Moment

Project: 19003 - Aframe - Duo

Location: FLOOR - 2x4 intermediate wall
Column
[2015 International Building Code(2015 NDS)]
1.5 IN x 3.5 IN x 8.0 FT @ 16 O.C.
Stud - Douglas-Fir-Larch - Dry Use
Section Adequate By: 41.4%

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McNeil Engineering
130 S. Main Street
Logan, UT 84321

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VERTICAL REACTIONS

Live Load:	Vert-LL-Rxn =	800	lb
Dead Load:	Vert-DL-Rxn =	309	lb
Total Load:	Vert-TL-Rxn =	1109	lb

COLUMN DATA

Total Column Length:	8	ft
Unbraced Length (X-Axis) Lx:	8	ft
Unbraced Length (Y-Axis) Ly:	4	ft
Column End Condition-K (e):	1	
Axial Load Duration Factor	1.00	

STUD PROPERTIES

Stud - Douglas-Fir-Larch

	Base Values	Adjusted
Compressive Stress:	Fc = 850 psi	Fc' = 361 psi
	Cd=1.00 Cf=1.05 Cp=0.40	
Bending Stress (X-X Axis):	Fbx = 700 psi	Fbx' = 886 psi
	Cd=1.00 CF=1.10 Cr=1.15	
Bending Stress (Y-Y Axis):	Fby = 700 psi	Fby' = 886 psi
	Cd=1.00 CF=1.10 Cr=1.15	
Modulus of Elasticity:	E = 1400 ksi	E' = 1400 ksi

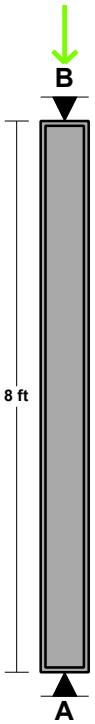
Stud Section (X-X Axis):	dx =	3.5	in
Stud Section (Y-Y Axis):	dy =	1.5	in
Area:	A =	5.25	in2
Section Modulus (X-X Axis):	Sx =	3.06	in3
Section Modulus (Y-Y Axis):	Sy =	1.31	in3
Slenderness Ratio:	Lex/dx =	27.43	
	Ley/dy =	32	

Stud Calculations (Controlling Case Only):

Controlling Load Case: Axial Total Load Only (L + D)

Actual Compressive Stress:	Fc =	211	psi
Allowable Compressive Stress:	Fc' =	361	psi
Eccentricity Moment (X-X Axis):	Mx-ex =	0	ft-lb
Eccentricity Moment (Y-Y Axis):	My-ey =	0	ft-lb
Moment Due to Lateral Loads (X-X Axis):	Mx =	0	ft-lb
Moment Due to Lateral Loads (Y-Y Axis):	My =	0	ft-lb
Bending Stress Lateral Loads Only (X-X Axis):	Fbx =	0	psi
Allowable Bending Stress (X-X Axis):	Fbx' =	886	psi
Bending Stress Lateral Loads Only (Y-Y Axis):	Fby =	0	psi
Allowable Bending Stress (Y-Y Axis):	Fby' =	886	psi
Combined Stress Factor:	**CSF =**	**0.59**	

LOADING DIAGRAM



AXIAL LOADING

Live Load:	PL =	600	plf
Dead Load:	PD =	225	plf
Column Self Weight:	CSW =	9	plf
Total Axial Load:	PT =	834	plf

NOTES

Project: 19003 - Aframe - Duo

Location: FLOOR - Crawlspace beam - 3-ft
Uniformly Loaded Floor Beam
[2015 International Building Code(2015 NDS)]
(2) 1.5 IN x 5.5 IN x 3.0 FT
#2 - Douglas-Fir-Larch - Dry Use
Section Adequate By: 23.9%
Controlling Factor: Moment

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130 S. Main Street
Logan, UT 84321

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DEFLECTIONS Center

Live Load	0.02	IN L/1753
Dead Load	0.01	in
Total Load	0.03	IN L/1248

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

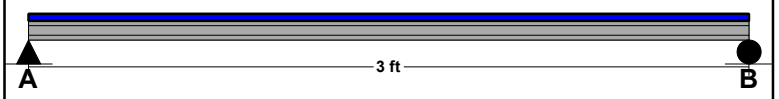
REACTIONS

	A		B	
Live Load	1125	lb	1125	lb
Dead Load	455	lb	455	lb
Total Load	1580	lb	1580	lb
Bearing Length	0.84	in	0.84	in

BEAM DATA Center

Span Length	3	ft
Unbraced Length-Top	3	ft
Floor Duration Factor	1.00	
Notch Depth	0.00	

LOADING DIAGRAM



MATERIAL PROPERTIES
#2 - Douglas-Fir-Larch

	Base Values		Adjusted	
Bending Stress:	Fb = 900	psi	Fb' = 1165	psi
	Cd=1.00 Cl=1.00 CF=1.30			
Shear Stress:	Fv = 180	psi	Fv' = 180	psi
	Cd=1.00			
Modulus of Elasticity:	E = 1600	ksi	E' = 1600	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 625	psi	Fc - ⊥' = 625	psi

Controlling Moment: 1185 ft-lb
1.5 ft from left support
Created by combining all dead and live loads.
Controlling Shear: -1106 lb
At a distance d from support.
Created by combining all dead and live loads.

FLOOR LOADING

		Side 1		Side 2	
Floor Live Load	FLL =	40	psf	10	psf
Floor Dead Load	FDL =	15	psf	5	psf
Floor Tributary Width	FTW =	15	ft	15	ft
Wall Load	WALL =	0	plf		

BEAM LOADING

Beam Total Live Load:	wL =	750	plf
Beam Total Dead Load:	wD =	300	plf
Beam Self Weight:	BSW =	4	plf
Total Maximum Load:	wT =	1054	plf

Comparisons with required sections:

	Req'd		Provided	
Section Modulus:	12.21	in3	15.13	in3
Area (Shear):	9.22	in2	16.5	in2
Moment of Inertia (deflection):	8.54	in4	41.59	in4
Moment:	1185	ft-lb	1469	ft-lb
Shear:	-1106	lb	1980	lb

NOTES

5 psf added for partition loading
Additional 10 psf added for incidental kicker loading.

Project: 19003 - Aframe - Duo

Location: FLOOR - Crawlspace beam - 4-ft
Uniformly Loaded Floor Beam
[2015 International Building Code(2015 NDS)]
(2) 1.5 IN x 7.25 IN x 4.0 FT
#2 - Douglas-Fir-Larch - Dry Use
Section Adequate By: 11.4%
Controlling Factor: Moment

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130 S. Main Street
Logan, UT 84321

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

DEFLECTIONS Center

Live Load	0.03	IN L/1694
Dead Load	0.01	in
Total Load	0.04	IN L/1205

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

REACTIONS

	A		B	
Live Load	1500	lb	1500	lb
Dead Load	609	lb	609	lb
Total Load	2109	lb	2109	lb
Bearing Length	1.13	in	1.13	in

BEAM DATA Center

Span Length	4 ft
Unbraced Length-Top	4 ft
Floor Duration Factor	1.00
Notch Depth	0.00

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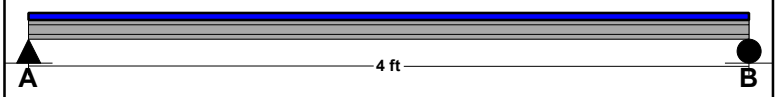

MATERIAL PROPERTIES
#2 - Douglas-Fir-Larch

	Base Values		Adjusted	
Bending Stress:	Fb = 900	psi	Fb' = 1072	psi
	Cd=1.00 Cl=0.99 CF=1.20			
Shear Stress:	Fv = 180	psi	Fv' = 180	psi
	Cd=1.00			
Modulus of Elasticity:	E = 1600	ksi	E' = 1600	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 625	psi	Fc - ⊥' = 625	psi

Controlling Moment: 2109 ft-lb
2.0 ft from left support
Created by combining all dead and live loads.
Controlling Shear: -1477 lb
At a distance d from support.
Created by combining all dead and live loads.

FLOOR LOADING

		Side 1		Side 2	
Floor Live Load	FLL =	40	psf	10	psf
Floor Dead Load	FDL =	15	psf	5	psf
Floor Tributary Width	FTW =	15	ft	15	ft
Wall Load	WALL =	0	plf		

BEAM LOADING

Beam Total Live Load:	wL =	750	plf
Beam Total Dead Load:	wD =	300	plf
Beam Self Weight:	BSW =	5	plf
Total Maximum Load:	wT =	1055	plf

Comparisons with required sections:

	Req'd		Provided	
Section Modulus:	23.6	in3	26.28	in3
Area (Shear):	12.31	in2	21.75	in2
Moment of Inertia (deflection):	20.25	in4	95.27	in4
Moment:	2109	ft-lb	2349	ft-lb
Shear:	-1477	lb	2610	lb

NOTES
5 psf added for partition loading
Additional 10 psf added for incidental kicker loading.

Project: 19003 - Aframe - Duo

Location: FLOOR - Crawlspace beam - 5-ft
Uniformly Loaded Floor Beam
[2015 International Building Code(2015 NDS)]
(2) 1.5 IN x 9.25 IN x 5.0 FT
#2 - Douglas-Fir-Larch - Dry Use
Section Adequate By: 5.8%
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	0.03	IN L/1801
Dead Load	0.01	in
Total Load	0.05	IN L/1279

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

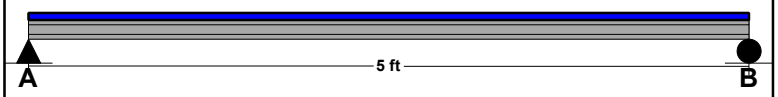
REACTIONS A B

	A		B	
Live Load	1875	lb	1875	lb
Dead Load	765	lb	765	lb
Total Load	2640	lb	2640	lb
Bearing Length	1.41	in	1.41	in

BEAM DATA Center

Span Length	5 ft
Unbraced Length-Top	5 ft
Floor Duration Factor	1.00
Notch Depth	0.00

LOADING DIAGRAM



MATERIAL PROPERTIES
#2 - Douglas-Fir-Larch

	Base Values		Adjusted	
Bending Stress:	Fb = 900	psi	Fb' = 979	psi
	Cd=1.00 Cl=0.99 CF=1.10			
Shear Stress:	Fv = 180	psi	Fv' = 180	psi
	Cd=1.00			
Modulus of Elasticity:	E = 1600	ksi	E' = 1600	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 625	psi	Fc - ⊥' = 625	psi

Controlling Moment: 3300 ft-lb
2.5 ft from left support
Created by combining all dead and live loads.
Controlling Shear: -1848 lb
At a distance d from support.
Created by combining all dead and live loads.

FLOOR LOADING

		Side 1		Side 2	
Floor Live Load	FLL =	40	psf	10	psf
Floor Dead Load	FDL =	15	psf	5	psf
Floor Tributary Width	FTW =	15	ft	15	ft
Wall Load	WALL =	0	plf		

BEAM LOADING

Beam Total Live Load:	wL =	750	plf
Beam Total Dead Load:	wD =	300	plf
Beam Self Weight:	BSW =	6	plf
Total Maximum Load:	wT =	1056	plf

Comparisons with required sections:

	Req'd		Provided	
Section Modulus:	40.44	in3	42.78	in3
Area (Shear):	15.4	in2	27.75	in2
Moment of Inertia (deflection):	39.54	in4	197.86	in4
Moment:	3300	ft-lb	3491	ft-lb
Shear:	-1848	lb	3330	lb

NOTES
5 psf added for partition loading
Additional 10 psf added for incidental kicker loading.

Project: 19003 - Aframe - Duo

Location: FLOOR - Crawlspace beam - 7-ft
Uniformly Loaded Floor Beam
[2015 International Building Code(2015 NDS)]
(2) 1.75 IN x 7.25 IN x 7.0 FT
2.0E Microllam - iLevel Trus Joist
Section Adequate By: 8.3%
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	0.18	IN L/461
Dead Load	0.07	in
Total Load	0.26	IN L/327

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

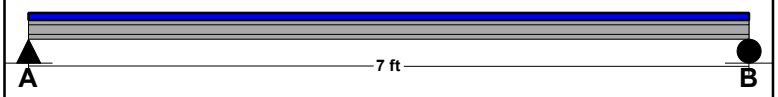
REACTIONS

	A		B	
Live Load	2625	lb	2625	lb
Dead Load	1078	lb	1078	lb
Total Load	3703	lb	3703	lb
Bearing Length	1.41	in	1.41	in

BEAM DATA Center

Span Length	7 ft
Unbraced Length-Top	7 ft
Floor Duration Factor	1.00
Notch Depth	0.00

LOADING DIAGRAM



MATERIAL PROPERTIES
2.0E Microllam - iLevel Trus Joist

	Base Values		Adjusted	
Bending Stress:	Fb = 2600	psi	Fb' = 2748	psi
	Cd=1.00 Cl=0.99 CF=1.07			
Shear Stress:	Fv = 285	psi	Fv' = 285	psi
	Cd=1.00			
Modulus of Elasticity:	E = 2000	ksi	E' = 2000	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 750	psi	Fc - ⊥' = 750	psi

Controlling Moment: 6480 ft-lb
3.5 ft from left support
Created by combining all dead and live loads.
Controlling Shear: -3110 lb
At a distance d from support.
Created by combining all dead and live loads.

FLOOR LOADING

		Side 1		Side 2	
Floor Live Load	FLL =	40	psf	10	psf
Floor Dead Load	FDL =	15	psf	5	psf
Floor Tributary Width	FTW =	15	ft	15	ft
Wall Load	WALL =	0	plf		

BEAM LOADING

Beam Total Live Load:	wL =	750	plf
Beam Total Dead Load:	wD =	300	plf
Beam Self Weight:	BSW =	8	plf
Total Maximum Load:	wT =	1058	plf

Comparisons with required sections:

	Req'd	Provided
Section Modulus:	28.3 in3	30.66 in3
Area (Shear):	16.37 in2	25.38 in2
Moment of Inertia (deflection):	86.81 in4	111.15 in4
Moment:	6480 ft-lb	7021 ft-lb
Shear:	-3110 lb	4821 lb

NOTES
5 psf added for partition loading
Additional 10 psf added for incidental kicker loading.

Project: 19003 - Aframe - Duo

Location: FLOOR - Crawlspace beam - 9-ft
Uniformly Loaded Floor Beam
[2015 International Building Code(2015 NDS)]
(2) 1.75 IN x 9.5 IN x 9.0 FT
2.0E Microllam - iLevel Trus Joist
Section Adequate By: 6.9%
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	0.22	IN L/488
Dead Load	0.09	in
Total Load	0.31	IN L/345

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

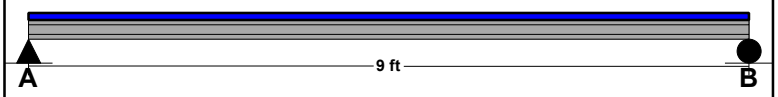
REACTIONS

	A		B	
Live Load	3375	lb	3375	lb
Dead Load	1397	lb	1397	lb
Total Load	4772	lb	4772	lb
Bearing Length	1.82	in	1.82	in

BEAM DATA Center

Span Length	9	ft
Unbraced Length-Top	9	ft
Floor Duration Factor	1.00	
Notch Depth	0.00	

LOADING DIAGRAM



MATERIAL PROPERTIES
2.0E Microllam - iLevel Trus Joist

	Base Values		Adjusted	
Bending Stress:	Fb = 2600	psi	Fb' = 2617	psi
	Cd=1.00 Cl=0.97 CF=1.03			
Shear Stress:	Fv = 285	psi	Fv' = 285	psi
	Cd=1.00			
Modulus of Elasticity:	E = 2000	ksi	E' = 2000	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 750	psi	Fc - ⊥' = 750	psi

Controlling Moment: 10736 ft-lb
4.5 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 4008 lb
At a distance d from support.
Created by combining all dead and live loads.

FLOOR LOADING

		Side 1		Side 2	
Floor Live Load	FLL =	40	psf	10	psf
Floor Dead Load	FDL =	15	psf	5	psf
Floor Tributary Width	FTW =	15	ft	15	ft
Wall Load	WALL =	0	plf		

BEAM LOADING

Beam Total Live Load:	wL =	750	plf
Beam Total Dead Load:	wD =	300	plf
Beam Self Weight:	BSW =	10	plf
Total Maximum Load:	wT =	1060	plf

Comparisons with required sections:

	Req'd	Provided
Section Modulus:	49.24 in3	52.65 in3
Area (Shear):	21.1 in2	33.25 in2
Moment of Inertia (deflection):	184.5 in4	250.07 in4
Moment:	10736 ft-lb	11479 ft-lb
Shear:	4008 lb	6318 lb

NOTES
5 psf added for partition loading
Additional 10 psf added for incidental kicker loading.

Project: 19003 - Aframe - Duo

Location: FTG - 20-in crawlspace
Footing
[2015 International Building Code(2015 NDS)]
Footing Size: 20.0 IN Wide x 12.0 IN Deep Continuous Footing With 8.0 IN Thick x 24.0 IN Tall Stemwall
Section Footing Design Adequate

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CAUTIONS
* Footing has been designed without reinforcement

FOOTING PROPERTIES

Allowable Soil Bearing Pressure:	Qs =	1500	psf
Concrete Compressive Strength:	F'c =	2500	psi
Reinforcing Steel Yield Strength:	Fy =	60000	psi
Concrete Reinforcement Cover:	c =	3	in

FOOTING SIZE

Width:	W =	20	in
Depth:	Depth =	12	in
Effective Depth to Top Layer of Steel:	d =	10	in

STEMWALL SIZE

Stemwall Width:	8	in
Stemwall Height:	24	in
Stemwall Weight:	150	pcf

FOOTING CALCULATIONS

Bearing Calculations:

Ultimate Bearing Pressure:	Qu =	615	psf
Effective Allowable Soil Bearing Pressure:	Qe =	1350	psf
Width Required:	Wreq =	0.76	ft

Beam Shear Calculations (One Way Shear):

Beam Shear:	Vu1 =	0	lb
Allowable Beam Shear:	Vc1 =	4400	lb

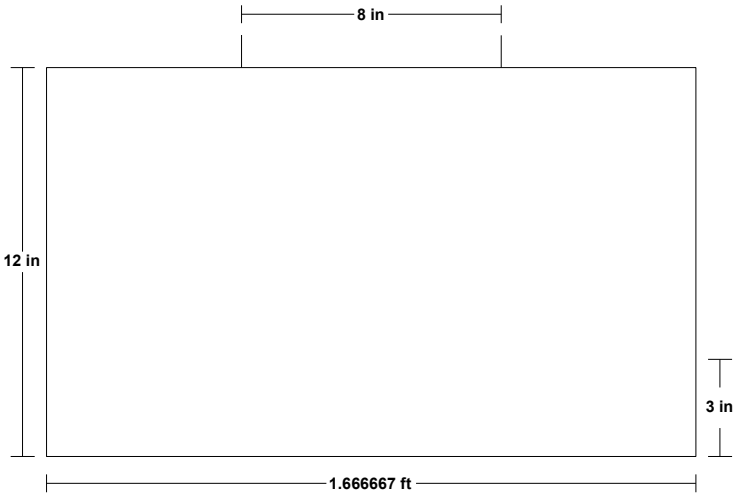
Transverse Direction:

Bending Calculations:

Factored Moment:	Mu =	1323	in-lb
Nominal Moment Strength:	Mn =	27500	in-lb

NOTES

LOADING DIAGRAM



FOOTING LOADING

Live Load:	PL =	600	plf
Dead Load:	PD =	225	plf
Total Load:	PT =	1025	plf
Ultimate Factored Load:	Pu =	1470	plf

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Logan, UT 84321

CAUTIONS
* Footing has been designed without reinforcement

FOOTING PROPERTIES

Allowable Soil Bearing Pressure:	Qs =	1500	psf
Concrete Compressive Strength:	F'c =	2500	psi
Reinforcing Steel Yield Strength:	Fy =	60000	psi
Concrete Reinforcement Cover:	c =	3	in

FOOTING SIZE

Width:	W =	24	in
Depth:	Depth =	12	in
Effective Depth to Top Layer of Steel:	d =	10	in

STEMWALL SIZE

Stemwall Width:	8	in
Stemwall Height:	24	in
Stemwall Weight:	150	pcf

FOOTING CALCULATIONS

Bearing Calculations:

Ultimate Bearing Pressure:	Qu =	550	psf
Effective Allowable Soil Bearing Pressure:	Qe =	1350	psf
Width Required:	Wreq =	0.81	ft

Beam Shear Calculations (One Way Shear):

Beam Shear:	Vu1 =	0	lb
Allowable Beam Shear:	Vc1 =	4400	lb

Transverse Direction:

Bending Calculations:

Factored Moment:	Mu =	2080	in-lb
Nominal Moment Strength:	Mn =	27500	in-lb

NOTES

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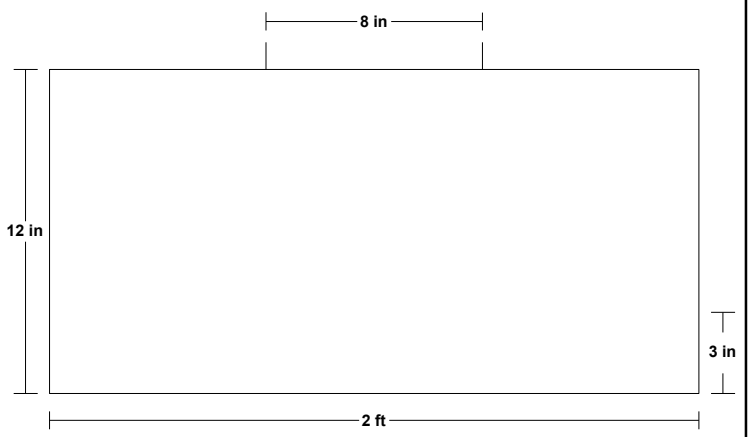

FOOTING LOADING

Live Load:	PL =	600	plf
Dead Load:	PD =	300	plf
Total Load:	PT =	1100	plf
Ultimate Factored Load:	Pu =	1560	plf

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CAUTIONS
* Footing has been designed without reinforcement

FOOTING PROPERTIES

Allowable Soil Bearing Pressure:	Qs =	1500	psf
Concrete Compressive Strength:	F'c =	2500	psi
Reinforcing Steel Yield Strength:	Fy =	60000	psi
Concrete Reinforcement Cover:	c =	3	in

FOOTING SIZE

Width:	W =	36	in
Depth:	Depth =	12	in
Effective Depth to Top Layer of Steel:	d =	10	in

STEMWALL SIZE

Stemwall Width:	8	in
Stemwall Height:	24	in
Stemwall Weight:	150	pcf

FOOTING CALCULATIONS

Bearing Calculations:

Ultimate Bearing Pressure:	Qu =	1267	psf
Effective Allowable Soil Bearing Pressure:	Qe =	1350	psf
Width Required:	Wreq =	2.81	ft

Beam Shear Calculations (One Way Shear):

Beam Shear:	Vu1 =	609	lb
Allowable Beam Shear:	Vc1 =	4400	lb

Transverse Direction:

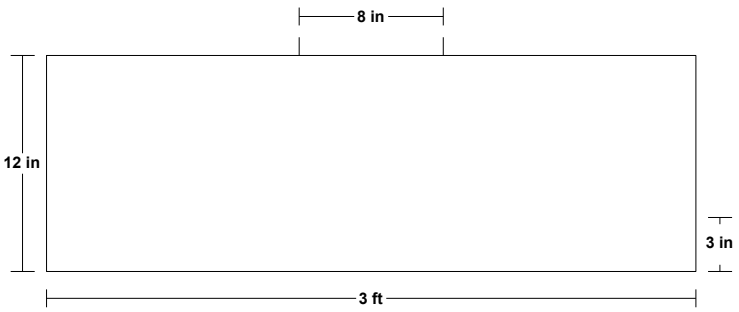
Bending Calculations:

Factored Moment:	Mu =	14918	in-lb
Nominal Moment Strength:	Mn =	27500	in-lb

NOTES

Footings design as unreinforced per ACI 318 chapter 14 (foundation wall on footing and/or light framed residential construction).

LOADING DIAGRAM



FOOTING LOADING

Live Load:	PL =	2300	plf
Dead Load:	PD =	1300	plf
Total Load:	PT =	3800	plf
Ultimate Factored Load:	Pu =	5480	plf

Project: 19003 - Aframe - Duo

Location: FTG - Footing below girder trusses
Footing
[2015 International Building Code(2015 NDS)]
Footing Size: 3.0 FT x 4.5 FT x 12.00 IN
Section Footing Design Adequate

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Logan, UT 84321

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CAUTIONS
* Footing has been designed without reinforcement

FOOTING PROPERTIES

Allowable Soil Bearing Pressure:	Qs =	1500	psf
Concrete Compressive Strength:	F'c =	2500	psi
Reinforcing Steel Yield Strength:	Fy =	60000	psi
Concrete Reinforcement Cover:	c =	3	in

FOOTING SIZE

Width:	W =	3	ft
Length:	L =	4.5	ft
Depth:	Depth =	12	in
Effective Depth to Top Layer of Steel:	d =	10	in

COLUMN AND BASEPLATE SIZE

Column Type:	Concrete		
Column Width:	m =	8	in
Column Depth:	n =	24	in

FOOTING CALCULATIONS

Bearing Calculations:

Ultimate Bearing Pressure:	Qu =	1259	psf
Effective Allowable Soil Bearing Pressure:	Qe =	1350	psf
Required Footing Area:	Areq =	12.59	sf
Area Provided:	A =	13.50	sf

Baseplate Bearing:

Bearing Required:	Bear =	25200	lb
Allowable Bearing:	Bear-A =	448800	lb

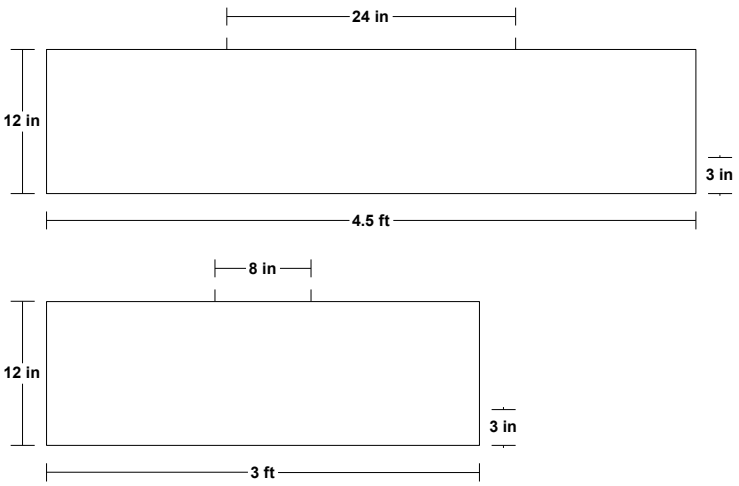
Beam Shear Calculations (One Way Shear):

Beam Shear:	Vu1 =	2333	lb
Allowable Beam Shear:	Vc1 =	13200	lb

Punching Shear Calculations (Two Way Shear):

Critical Perimeter:	Bo =	104	in
Punching Shear:	Vu2 =	17267	lb
Controlling Allowable Punching Shear:	vc2 =	63556	lb

LOADING DIAGRAM



FOOTING LOADING

Live Load:	PL =	12000	lb
Dead Load:	PD =	5000	lb
Total Load:	PT =	17000	lb
Ultimate Factored Load:	Pu =	25200	lb
Footing plus soil above footing weight:	Wt =	1305	lb

Short Direction:
Bending Calculations:

Factored Moment:	Mu =	68600	in-lb
Nominal Moment Strength:	Mn =	123750	in-lb

Long Direction:
Bending Calculations:

Factored Moment:	Mu =	52500	in-lb
Nominal Moment Strength:	Mn =	82500	in-lb

NOTES

Project: 19003 - Aframe - Duo

Location: LOFT - Loft Beam at Stair opening
Uniformly Loaded Floor Beam
[2015 International Building Code(2015 NDS)]
(2) 1.75 IN x 11.25 IN x 20.0 FT
1.9E Microllam - iLevel Trus Joist
Section Adequate By: 35.7%
Controlling Factor: Deflection

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130 S. Main Street
Logan, UT 84321

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

DEFLECTIONS Center

Live Load	0.49	IN L/488
Dead Load	0.24	in
Total Load	0.73	IN L/327

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

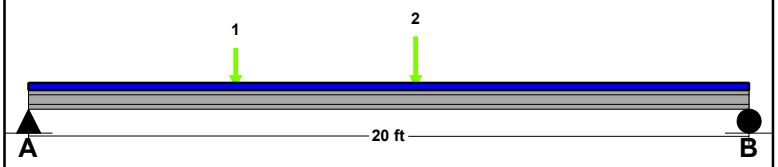
REACTIONS

	A		B	
Live Load	938	lb	807	lb
Dead Load	478	lb	428	lb
Total Load	1416	lb	1235	lb
Bearing Length	0.54	in	0.47	in

BEAM DATA Center

Span Length	20	ft
Unbraced Length-Top	0	ft
Floor Duration Factor	1.00	
Notch Depth	0.00	

LOADING DIAGRAM



MATERIAL PROPERTIES
1.9E Microllam - iLevel Trus Joist

	Base Values		Adjusted	
Bending Stress:	Fb = 2600	psi	Fb' = 2623	psi
	Cd=1.00 CF=1.01			
Shear Stress:	Fv = 285	psi	Fv' = 285	psi
	Cd=1.00			
Modulus of Elasticity:	E = 1900	ksi	E' = 1900	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 750	psi	Fc - ⊥' = 750	psi

Controlling Moment: 8519 ft-lb
10.0 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 1363 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:

	Req'd		Provided	
Section Modulus:	38.97	in3	73.83	in3
Area (Shear):	7.17	in2	39.38	in2
Moment of Inertia (deflection):	306.11	in4	415.28	in4
Moment:	8519	ft-lb	16137	ft-lb
Shear:	1363	lb	7481	lb

FLOOR LOADING

		Side 1		Side 2	
Floor Live Load	FLL =	40	psf	0	psf
Floor Dead Load	FDL =	15	psf	0	psf
Floor Tributary Width	FTW =	1	ft	0	ft
Wall Load	WALL =	0	plf		

BEAM LOADING

Beam Total Live Load:	wL =	40	plf
Beam Total Dead Load:	wD =	15	plf
Beam Self Weight:	BSW =	12	plf
Total Maximum Load:	wT =	67	plf

POINT LOADS - CENTER SPAN

Load Number	One		Two	
Live Load	405	lb	540	lb
Dead Load	155	lb	205	lb
Location	5.75	ft	10.75	ft

NOTES

Project: 19003 - Aframe - Duo

Location: LOFT - Loft Floor Joists
Floor Joist
[2015 International Building Code(2015 NDS)]
1.75 IN x 5.5 IN x 10.0 FT @ 24 O.C.
1.55E Timberstrand LSL - iLevel Trus Joist
Section Adequate By: 33.6%
Controlling Factor: Moment

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DEFLECTIONS Center

Live Load	0.25	IN L/489
Dead Load	0.09	in
Total Load	0.34	IN L/356

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

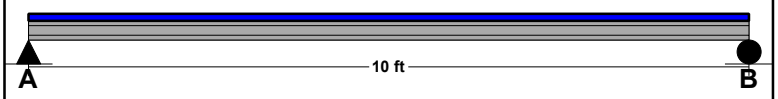
REACTIONS A B

	A		B	
Live Load	400	lb	400	lb
Dead Load	150	lb	150	lb
Total Load	550	lb	550	lb
Bearing Length	0.35	in	0.35	in

SUPPORT LOADS A B

	A		B	
Live Load	200	plf	200	plf
Dead Load	75	plf	75	plf
Total Load	275	plf	275	plf

LOADING DIAGRAM



MATERIAL PROPERTIES

1.55E Timberstrand LSL - iLevel Trus Joist

		Base Values		Adjusted	
Bending Stress:	Fb =	2325	psi	Fb' =	2498 psi
	Cd=1.00 CF=1.07				
Shear Stress:	Fv =	310	psi	Fv' =	310 psi
	Cd=1.00				
Modulus of Elasticity:	E =	1550	ksi	E' =	1550 ksi
Comp. ⊥ to Grain:	Fc - ⊥ =	900	psi	Fc - ⊥' =	900 psi

Controlling Moment: 1375 ft-lb
5.0 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2
Controlling Shear: -506 lb
At a distance d from right 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:	6.61 in3	8.82 in3
Area (Shear):	2.45 in2	9.63 in2
Moment of Inertia (deflection):	34.83 in4	47.31 in4
Moment:	1375 ft-lb	1837 ft-lb
Shear:	-506 lb	1989 lb

Decking Information

Plywood Thickness:	T =	3/4	in
Plywood Is Glued:			
Moment of Inertia Calculations For Glued Floor:			
Joist Area:	A-joist =	9.63	IN2
Plywood Area:	A-ply =	3.13	IN2
Section Centroid:	C =	4	IN ABOVE BASE
Moment of Inertia (deflection):	I-comb =	47	IN4

JOIST DATA Center

Span Length	10	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft

Floor sheathing applied to top of joists-top of joists fully braced.
Floor Duration Factor 1.00

JOIST LOADING

Uniform Floor Loading	Center		
Live Load	LL =	40	psf
Dead Load	DL =	15	psf
Total Load	TL =	55	psf
TL Adj. For Joist Spacing	wT =	110	plf

NOTES

Project: 19003 - Aframe - Duo

Location: LOFT - Stair Stringer
Multi-Loaded Multi-Span Beam
[2015 International Building Code(2015 NDS)]
1.75 IN x 9.5 IN x 12.0 FT (Actual 15 FT)
1.55E Timberstrand LSL - iLevel Trus Joist
Section Adequate By: 66.2%
Controlling Factor: Deflection

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DEFLECTIONS Center

Live Load	0.30	IN L/598
Dead Load	0.14	in
Total Load	0.44	IN L/411

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

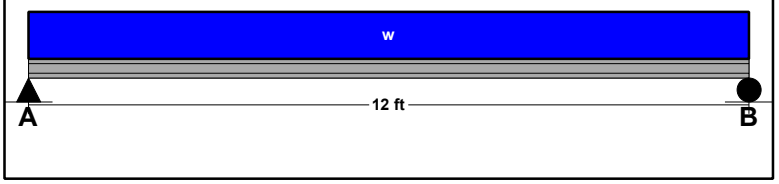
REACTIONS A B

	A		B	
Live Load	480	lb	480	lb
Dead Load	219	lb	219	lb
Total Load	699	lb	699	lb
Bearing Length	0.44	in	0.44	in

BEAM DATA Center

Span Length	12	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	12	ft
Beam End Elevation Difference	9	ft
Live Load Duration Factor	1.00	
Notch Depth	0.00	

LOADING DIAGRAM



UNIFORM LOADS Center

Uniform Live Load	80	plf
Uniform Dead Load	24	plf
Beam Self Weight	5	plf
Total Uniform Load	109	plf

MATERIAL PROPERTIES

1.55E Timberstrand LSL - iLevel Trus Joist

	Base Values		Adjusted	
Bending Stress:	Fb = 2325	psi	Fb' = 2376	psi
	Cd=1.00 CF=1.02			
Shear Stress:	Fv = 310	psi	Fv' = 310	psi
	Cd=1.00			
Modulus of Elasticity:	E = 1550	ksi	E' = 1550	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 900	psi	Fc - ⊥' = 900	psi

Controlling Moment: 2097 ft-lb
6.0 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2
Controlling Shear: -503 lb
At a distance d from right 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:	10.59	in3	26.32	in3
Area (Shear):	2.44	in2	16.63	in2
Moment of Inertia (deflection):	75.24	in4	125.03	in4
Moment:	2097	ft-lb	5211	ft-lb
Shear:	-503	lb	3436	lb

NOTES

Project: 19003 - Aframe - Duo

Location: ROOF - Dormer at Loft (10-ft)
Multi-Loaded Multi-Span Beam
[2015 International Building Code(2015 NDS)]
(3) 1.75 IN x 9.5 IN x 10.0 FT
1.55E Timberstrand LSL - iLevel Trus Joist
Section Adequate By: 4.3%
Controlling Factor: Deflection

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

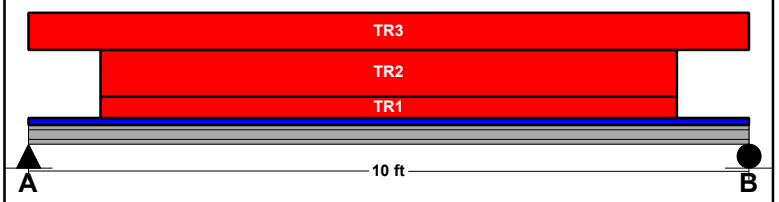
DEFLECTIONS	Center	
Live Load	0.32	IN L/375
Dead Load	0.10	in
Total Load	0.42	IN L/286

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

REACTIONS	A	B
Live Load	3750 lb	3750 lb
Dead Load	1134 lb	1134 lb
Total Load	4884 lb	4884 lb
Bearing Length	1.03 in	1.03 in

BEAM DATA	Center
Span Length	10 ft
Unbraced Length-Top	0 ft
Unbraced Length-Bottom	10 ft
Live Load Duration Factor	1.15
Notch Depth	0.00

LOADING DIAGRAM



UNIFORM LOADS	Center
Uniform Live Load	0 plf
Uniform Dead Load	0 plf
Beam Self Weight	16 plf
Total Uniform Load	16 plf

MATERIAL PROPERTIES
1.55E Timberstrand LSL - iLevel Trus Joist

	Base Values	Adjusted
Bending Stress:	Fb = 2325 psi	Fb' = 2732 psi
	Cd=1.15 CF=1.02	
Shear Stress:	Fv = 310 psi	Fv' = 357 psi
	Cd=1.15	
Modulus of Elasticity:	E = 1550 ksi	E' = 1550 ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 900 psi	Fc - ⊥' = 900 psi

Controlling Moment: 13638 ft-lb
5.0 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2
Controlling Shear: 4600 lb
At a distance d from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

TRAPEZOIDAL LOADS - CENTER SPAN			
Load Number	One	Two	Three
Left Live Load	160 plf	340 plf	350 plf
Left Dead Load	64 plf	150 plf	40 plf
Right Live Load	160 plf	340 plf	350 plf
Right Dead Load	64 plf	150 plf	40 plf
Load Start	1 ft	1 ft	0 ft
Load End	9 ft	9 ft	10 ft
Load Length	8 ft	8 ft	10 ft

Comparisons with required sections:	Req'd	Provided
Section Modulus:	59.91 in3	78.97 in3
Area (Shear):	19.35 in2	49.88 in2
Moment of Inertia (deflection):	359.72 in4	375.1 in4
Moment:	13638 ft-lb	17977 ft-lb
Shear:	4600 lb	11854 lb

NOTES

Project: 19003 - Aframe - Duo

Location: ROOF - Dormer at Loft (8-ft)
Multi-Loaded Multi-Span Beam
[2015 International Building Code(2015 NDS)]
(2) 1.75 IN x 9.5 IN x 8.0 FT
1.55E Timberstrand LSL - iLevel Trus Joist
Section Adequate By: 38.0%
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/497
Dead Load	0.06	in
Total Load	0.25	IN L/380

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

REACTIONS	A		B	
Live Load	2900	lb	2900	lb
Dead Load	844	lb	844	lb
Total Load	3744	lb	3744	lb
Bearing Length	1.19	in	1.19	in

BEAM DATA	Center
Span Length	8 ft
Unbraced Length-Top	0 ft
Unbraced Length-Bottom	8 ft
Live Load Duration Factor	1.15
Notch Depth	0.00

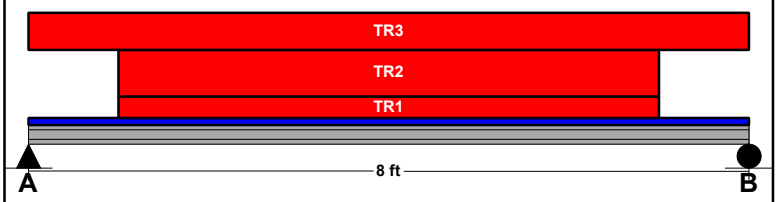
MATERIAL PROPERTIES
1.55E Timberstrand LSL - iLevel Trus Joist

	Base Values		Adjusted	
Bending Stress:	Fb = 2325	psi	Fb' = 2732	psi
	Cd=1.15 CF=1.02			
Shear Stress:	Fv = 310	psi	Fv' = 357	psi
	Cd=1.15			
Modulus of Elasticity:	E = 1550	ksi	E' = 1550	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 900	psi	Fc - ⊥' = 900	psi

Controlling Moment: 8558 ft-lb
4.0 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2
Controlling Shear: -3455 lb
At a distance d from right 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:	37.59 in3	52.65 in3
Area (Shear):	14.54 in2	33.25 in2
Moment of Inertia (deflection):	181.22 in4	250.07 in4
Moment:	8558 ft-lb	11985 ft-lb
Shear:	-3455 lb	7902 lb

LOADING DIAGRAM



UNIFORM LOADS	Center
Uniform Live Load	0 plf
Uniform Dead Load	0 plf
Beam Self Weight	10 plf
Total Uniform Load	10 plf

TRAPEZOIDAL LOADS - CENTER SPAN

Load Number	One	Two	Three
Left Live Load	160 plf	340 plf	350 plf
Left Dead Load	64 plf	150 plf	40 plf
Right Live Load	160 plf	340 plf	350 plf
Right Dead Load	64 plf	150 plf	40 plf
Load Start	1 ft	1 ft	0 ft
Load End	7 ft	7 ft	8 ft
Load Length	6 ft	6 ft	8 ft

NOTES

Project: 19003 - Aframe - Duo

Location: ROOF - Dormer Beam
Roof Beam
[2015 International Building Code(2015 NDS)]
(2) 1.75 IN x 9.5 IN x 10.0 FT
1.55E Timberstrand LSL - iLevel Trus Joist
Section Adequate By: 90.9%
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	0.22	IN L/537
Dead Load	0.03	in
Total Load	0.25	IN L/474

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A		B	
Live Load	1925	lb	1925	lb
Dead Load	258	lb	258	lb
Total Load	2183	lb	2183	lb
Bearing Length	0.69	in	0.69	in

BEAM DATA

Span Length	10	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	0	:12
Roof Duration Factor	1	

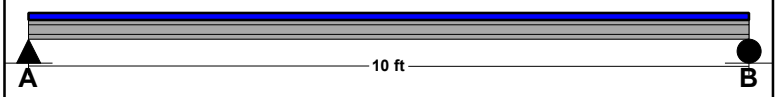
MATERIAL PROPERTIES
1.55E Timberstrand LSL - iLevel Trus Joist

	Base Values		Adjusted	
Bending Stress:	Fb = 2325	psi	Fb' = 2376	psi
	Cd=1.00 CF=1.02			
Shear Stress:	Fv = 310	psi	Fv' = 310	psi
	Cd=1.00			
Modulus of Elasticity:	E = 1550	ksi	E' = 1550	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 900	psi	Fc - ⊥' = 900	psi

Controlling Moment: 5458 ft-lb
5.0 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 1878 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	27.57 in3	52.65 in3
Area (Shear):	9.08 in2	33.25 in2
Moment of Inertia (deflection):	111.76 in4	250.07 in4
Moment:	5458 ft-lb	10422 ft-lb
Shear:	1878 lb	6872 lb

LOADING DIAGRAM



ROOF LOADING
Side One:

Roof Live Load:	LL =	140	psf
Roof Dead Load:	DL =	15	psf
Tributary Width:	TW =	2.8	ft

Side Two:

Roof Live Load:	LL =	0	psf
Roof Dead Load:	DL =	0	psf
Tributary Width:	TW =	0	ft
Wall Load:	WALL =	0	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	10	ft
Beam Self Weight:	BSW =	10	plf
Beam Uniform Live Load:	wL =	385	plf
Beam Uniform Dead Load:	wD_adj =	52	plf
Total Uniform Load:	wT =	437	plf

NOTES

Project: 19003 - Aframe - Duo

Location: ROOF - Dormer Rafters
Roof Rafter
[2015 International Building Code(2015 NDS)]
1.5 IN x 9.25 IN x 5.0 FT @ 24 O.C.
#2 - Douglas-Fir-Larch - Dry Use
Section Adequate By: 3.1%
Controlling Factor: Moment

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DEFLECTIONS Center

Live Load	0.05	IN L/1126
Dead Load	0.00	in
Total Load	0.06	IN L/1072

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A		B	
Live Load	1500	lb	1500	lb
Dead Load	75	lb	75	lb
Total Load	1575	lb	1575	lb
Bearing Length	1.68	in	1.68	in

SUPPORT LOADS

	A		B	
Live Load	750	plf	750	plf
Dead Load	38	plf	38	plf
Total Load	788	plf	788	plf

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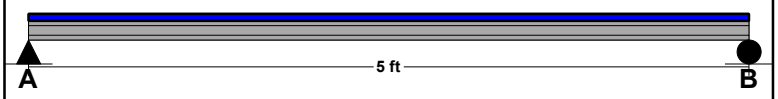

MATERIAL PROPERTIES
#2 - Douglas-Fir-Larch

	Base Values		Adjusted	
Bending Stress:	Fb = 900	psi	Fb' = 1139	psi
	Cd=1.00 CF=1.10 Cr=1.15			
Shear Stress:	Fv = 180	psi	Fv' = 180	psi
	Cd=1.00			
Modulus of Elasticity:	E = 1600	ksi	E' = 1600	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 625	psi	Fc - ⊥' = 625	psi

Controlling Moment: 1969 ft-lb
2.5 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2
Controlling Shear: -1103 lb
At a distance d from right 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:	20.75	in3	21.39	in3
Area (Shear):	9.19	in2	13.88	in2
Moment of Inertia (deflection):	21.09	in4	98.93	in4
Moment:	1969	ft-lb	2029	ft-lb
Shear:	-1103	lb	1665	lb

RAFTER DATA Interior

Span Length	5	ft
Rafter Pitch	0	:12

Roof sheathing applied to top of joists-top of rafters fully braced.

Roof Duration Factor	1.00
Peak Notch Depth	0.00
Base Notch Depth	0.00

RAFTER LOADING
Uniform Roof Loading

Roof Live Load:	LL =	300	psf
Roof Dead Load:	DL =	15	psf

Slope Adjusted Spans And Loads

Interior Span:	L-adj =	5	ft
Eave Span:	L-Eave-adj =	0	ft
Interior Live Load:	wL-adj =	600	plf
Eave Live Load:	wL-Eave-adj =	NaN	plf
Interior Dead Load:	wD-adj =	30	plf
Eave Dead Load:	wD-Eave-adj =	NaN	plf
Interior Total Load:	wT-adj =	630	plf
Eave Total Load:	wT-Eave-adj =	NaN	plf

NOTES

Project: 19003 - Aframe - Duo

Location: ROOF - Skylight Header
Roof Beam
[2015 International Building Code(2015 NDS)]
(2) 1.75 IN x 7.25 IN x 4.0 FT
1.9E Microllam - iLevel Trus Joist
Section Adequate By: 195.5%
Controlling Factor: Shear

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

DEFLECTIONS Center

Live Load	0.03	IN L/1905
Dead Load	0.01	in
Total Load	0.03	IN L/1510

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS

	A		B	
Live Load	1848	lb	1848	lb
Dead Load	483	lb	483	lb
Total Load	2331	lb	2331	lb
Bearing Length	0.89	in	0.89	in

BEAM DATA

Span Length	4	ft
Unbraced Length-Top	2	ft
Unbraced Length-Bottom	0	ft
Roof Pitch	12	:12
Roof Duration Factor	1	

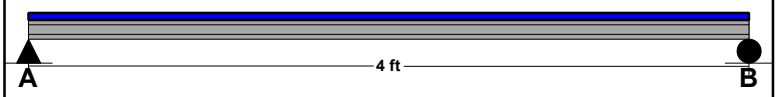
MATERIAL PROPERTIES
1.9E Microllam - iLevel Trus Joist

	Base Values		Adjusted	
Bending Stress:	Fb = 2600	psi	Fb' = 2774	psi
	Cd=1.00 Cl=1.00 CF=1.07			
Shear Stress:	Fv = 285	psi	Fv' = 285	psi
	Cd=1.00			
Modulus of Elasticity:	E = 1900	ksi	E' = 1900	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 750	psi	Fc - ⊥' = 750	psi

Controlling Moment: 2331 ft-lb
2.0 ft from left support
Created by combining all dead and live loads.
Controlling Shear: 1631 lb
At a distance d from support.
Created by combining all dead and live loads.

Comparisons with required sections:	Req'd	Provided
Section Modulus:	10.08 in3	30.66 in3
Area (Shear):	8.59 in2	25.38 in2
Moment of Inertia (deflection):	14 in4	111.15 in4
Moment:	2331 ft-lb	7088 ft-lb
Shear:	1631 lb	4821 lb

LOADING DIAGRAM



ROOF LOADING
Side One:

Roof Live Load:	LL =	84	psf
Roof Dead Load:	DL =	15	psf
Tributary Width:	TW =	10	ft

Side Two:

Roof Live Load:	LL =	84	psf
Roof Dead Load:	DL =	15	psf
Tributary Width:	TW =	1	ft
Wall Load:	WALL =	0	plf

SLOPE/PITCH ADJUSTED LENGTHS AND LOADS

Adjusted Beam Length:	Ladj =	4	ft
Beam Self Weight:	BSW =	8	plf
Beam Uniform Live Load:	wL =	924	plf
Beam Uniform Dead Load:	wD_adj =	241	plf
Total Uniform Load:	wT =	1165	plf

NOTES

Project: 19003 - Aframe - Duo

Location: ROOF - Wind Girt
Multi-Loaded Multi-Span Beam
[2015 International Building Code(2015 NDS)
(2) 1.5 IN x 5.5 IN x 8.5 FT
1.3E Timberstrand LSL - iLevel Trus Joist
Section Adequate By: 9.9%
Controlling Factor: Deflection

Cody Palmer
McNeil Engineering
130 S. Main Street
Logan, UT 84321

StruCalc Version 10.0.1.6 5/21/2020 3:55:05 PM

DEFLECTIONS	Center
Live Load	0.76 IN L/134
Dead Load	0.01 in
Total Load	0.77 IN L/132

Live Load Deflection Criteria: L/120 Total Load Deflection Criteria: L/120

REACTIONS	A	B
Live Load	1356 lb	1356 lb
Dead Load	22 lb	22 lb
Total Load	1378 lb	1378 lb
Bearing Length	0.65 in	0.65 in

BEAM DATA	Center
Span Length	8.5 ft
Unbraced Length-Top	0 ft
Unbraced Length-Bottom	8.5 ft
Live Load Duration Factor	1.60
Notch Depth	0.00

MATERIAL PROPERTIES

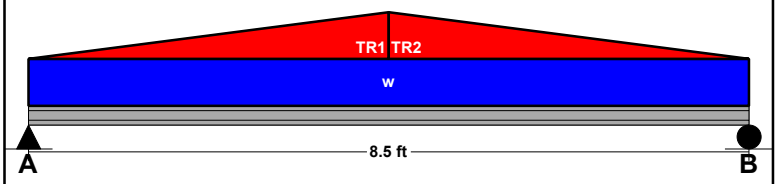
1.3E Timberstrand LSL - iLevel Trus Joist

	Base Values	Adjusted
Bending Stress:	Fb = 1700 psi	Fb' = 2922 psi
	Cd=1.60 CF=1.07	
Shear Stress:	Fv = 425 psi	Fv' = 680 psi
	Cd=1.60	
Modulus of Elasticity:	E = 1300 ksi	E' = 1300 ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 710 psi	Fc - ⊥' = 710 psi

Controlling Moment: 3271 ft-lb
4.25 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2
Controlling Shear: 1284 lb
At a distance d from 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:	13.43 in3	15.13 in3
Area (Shear):	2.83 in2	16.5 in2
Moment of Inertia (deflection):	37.84 in4	41.59 in4
Moment:	3271 ft-lb	3683 ft-lb
Shear:	1284 lb	7480 lb

LOADING DIAGRAM



UNIFORM LOADS	Center
Uniform Live Load	205 plf
Uniform Dead Load	0 plf
Beam Self Weight	5 plf
Total Uniform Load	210 plf

TRAPEZOIDAL LOADS - CENTER SPAN		
Load Number	One	Two
Left Live Load	0 plf	228 plf
Left Dead Load	0 plf	0 plf
Right Live Load	228 plf	0 plf
Right Dead Load	0 plf	0 plf
Load Start	0 ft	4.25 ft
Load End	4.25 ft	8.5 ft
Load Length	4.25 ft	4.25 ft

NOTES

Dowel-type Fasenter Lateral Design Value

Fastener Type		**Wood-to-metal**	
Diameter of Fastener	D	0.5	in
Load Duration Factor	C_D	1	Table 2.3.3
Wet Service Factor	C_M	1	Table 10.3.3
Temperature Factor	C_t	1	Table 10.3.4
Group Action Factor (see below)	C_g	0.98863	
Geometry Factor	C_Δ	0.95	
End Grain Factor	C_{eg}	1	
Diaphragm Factor	C_{di}	1	
Toe-Nail Factor	C_{tn}	1	

Adjustment Factor **0.939198**

Group Action Factor Calculation

	m	0.845808	
	u	1.014055	
Center-to-center spacing between adjacent fasteners in a row	s	4	in
load/slip modulus	y	95459.42	lbs/in
	n	3	
	REA	0.71341	
Modulus of elasticity of side member	Es	29000000	psi
Sum of gross cross-sectional areas of side member	As	1.125	in^2
Modulus of elasticity of main member	Em	1400000	psi
Sum of gross cross-sectional areas of main member	Am	16.625	in^2
	Cg	0.98863	

Dowel-type Fasenter Lateral Design Value

Fastener Type		**Wood-to-metal**	
Diameter of Fastener	D	0.5	in
Load Duration Factor	C_D	1.6	Table 2.3.3
Wet Service Factor	C_M	1	Table 10.3.3
Temperature Factor	C_t	1	Table 10.3.4
Group Action Factor (see below)	C_g	0.98863	
Geometry Factor	C_Δ	0.95	
End Grain Factor	C_{eg}	1	
Diaphragm Factor	C_{di}	1	
Toe-Nail Factor	C_{tn}	1	

Adjustment Factor **1.502717**

Group Action Factor Calculation

	m	0.845808	
	u	1.014055	
Center-to-center spacing between adjacent fasteners in a row	s	4	in
load/slip modulus	y	95459.42	lbs/in
	n	3	
	REA	0.71341	
Modulus of elasticity of side member	Es	29000000	psi
Sum of gross cross-sectional areas of side member	As	1.125	in^2
Modulus of elasticity of main member	Em	1400000	psi
Sum of gross cross-sectional areas of main member	Am	16.625	in^2
	Cg	0.98863	

Reference Design Value for Wood-to-Steel Connections

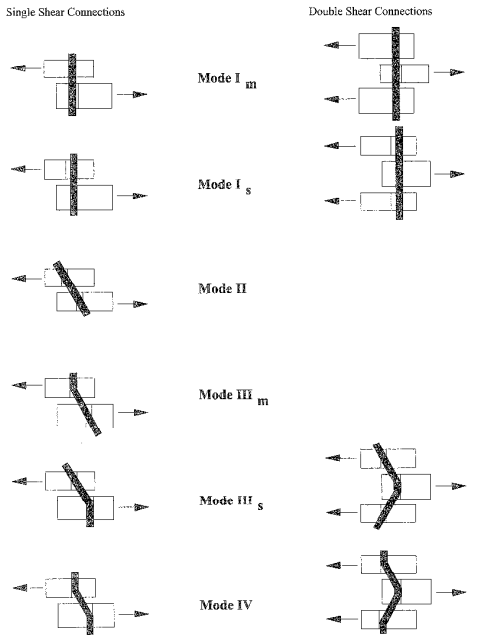
per NDS

Steel Plate to Wood Connection **Double Truss - Top and Collar T**

Aug-19

Dowel Diameter	D	1/2	in	
		Double Shear		
Main Member				
Wood Species Specific Gravity	G_m	0.5		
Dowel Bearing Strength Parallel to Grain	$F_{e\parallel}$	5600	psi	
Dowel Bearing Strength Perpendicular to Grain	$F_{e\perp}$	3158	psi	
Angle Between Direction of Load anc Direction of Grain	Θ_m	30		
Dowel Bearing Strength	F_{em}	4693	psi	
Main Member Dowel Bearing Length	l_m	1.750	in	
Steel Plate				
Dowel Bearing Strength in Steel Plate	F_{es}	87000	psi	
Side Member Dowel Bearing Length	l_s	0.125	in	
Dowel Bending Yield Strength	F_{yb}	45000	psi	
	$K\Theta$	1.08		
$F_{em} / F_{es} =$	R_e	0.05394		
$l_m / l_s =$	R_t	14.00		
	k_1	0.32		
	k_2	0.64		
	k_3	14.79		
Yield Limit Equations				
Reduction Term	R_d	4.33		
Yield Mode I_m	I_m	948	lbs	
Yield Mode I_s	I_s	2510	lbs	
Reduction Term	R_d	3.90		
Yield Mode II	II	N/A	lbs	
Reduction Term	R_d	3.47		
Yield Mode III_m	III_m	N/A	lbs	
Yield Mode III_s	III_s	1218	lbs	
Yield Mode IV	IV	1667	lbs	
Reference Design Value	**Z**	**948**	**lbs**	
Adjustment Factors per NDS		1.5		
Required Capacity (per RISA)		3015	lbs	
# of Bolts each member		2.1	bolts	

Figure 1 Connection Yield Modes



Reference Design Value for Wood-to-Steel Connections

per NDS

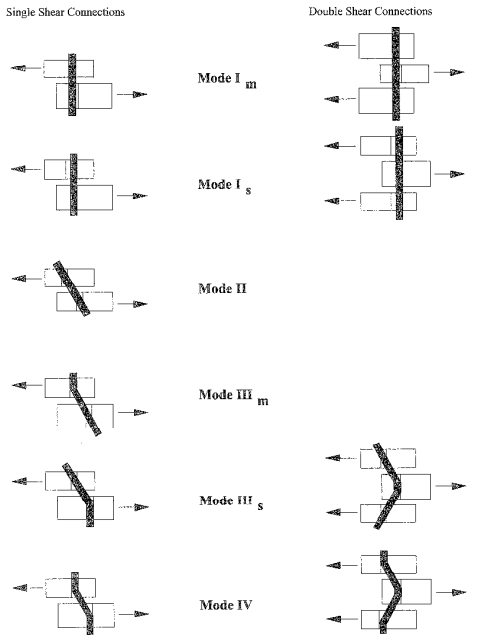
Steel Plate to Wood Connection **Double Truss - Loft**

Aug-19

Dowel Diameter	D	5/8	in	
		Double Shear		
Main Member				
Wood Species Specific Gravity	G_m	0.5		
Dowel Bearing Strength Parallel to Grain	$F_{e\parallel}$	5600	psi	
Dowel Bearing Strength Perpendicular to Grain	$F_{e\perp}$	2824	psi	
Angle Between Direction of Load anc Direction of Grain	Θ_m	90		
Dowel Bearing Strength	F_{em}	2824	psi	
Main Member Dowel Bearing Length	l_m	3.500	in	
Steel Plate				
Dowel Bearing Strength in Steel Plate	F_{es}	87000	psi	
Side Member Dowel Bearing Length	l_s	0.188	in	
Dowel Bending Yield Strength	F_{yb}	45000	psi	
	$K\Theta$	1.25		
$F_{em} / F_{es} =$	R_e	0.03246		
$l_m / l_s =$	R_t	18.67		
	k_1	0.26		
	k_2	0.56		
	k_3	16.42		

Yield Limit Equations				
Reduction Term	R_d	5.00		
Yield Mode I_m	I_m	1236	lbs	
Yield Mode I_s	I_s	4078	lbs	
Reduction Term	R_d	4.50		
Yield Mode II	II	N/A	lbs	
Reduction Term	R_d	4.00		
Yield Mode III_m	III_m	N/A	lbs	
Yield Mode III_s	III_s	1337	lbs	
Yield Mode IV	IV	1769	lbs	
Reference Design Value	**Z**	**1236**	**lbs**	
Adjustment Factors per NDS		0.93		
Required Capacity (per RISA)		3100	lbs	
# of Bolts each member		2.7	bolts	

Figure 1 Connection Yield Modes



Reference Design Value for Wood-to-Steel Connections

per NDS

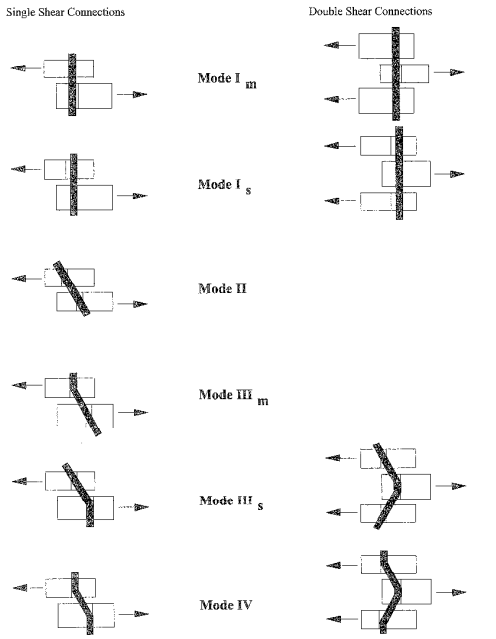
Steel Plate to Wood Connection **Double Truss - Mid-Floor**

Aug-19

Dowel Diameter	D	1/2	in	
		Double Shear		
Main Member				
Wood Species Specific Gravity	G_m	0.5		
Dowel Bearing Strength Parallel to Grain	$F_{e\parallel}$	5600	psi	
Dowel Bearing Strength Perpendicular to Grain	$F_{e\perp}$	3158	psi	
Angle Between Direction of Load anc Direction of Grain	Θ_m	0		
Dowel Bearing Strength	F_{em}	5600	psi	
Main Member Dowel Bearing Length	l_m	3.500	in	
Steel Plate				
Dowel Bearing Strength in Steel Plate	F_{es}	87000	psi	
Side Member Dowel Bearing Length	l_s	0.188	in	
Dowel Bending Yield Strength	F_{yb}	45000	psi	
	$K\Theta$	1.00		
$F_{em} / F_{es} =$	R_e	0.06437		
$l_m / l_s =$	R_t	18.67		
	k_1	0.49		
	k_2	0.50		
	k_3	9.57		

Yield Limit Equations			
Reduction Term	R_d	4.00	
Yield Mode I_m	I_m	2450	lbs
Yield Mode I_s	I_s	4078	lbs
Reduction Term	R_d	3.60	
Yield Mode II	II	N/A	lbs
Reduction Term	R_d	3.20	
Yield Mode III_m	III_m	N/A	lbs
Yield Mode III_s	III_s	1521	lbs
Yield Mode IV	IV	1963	lbs
Reference Design Value	**Z**	**1521**	**lbs**
Adjustment Factors per NDS		0.93	
Required Capacity (per RISA)		3100	lbs
# of Bolts each member		2.2	bolts

Figure 1 Connection Yield Modes



Reference Design Value for Wood-to-Steel Connections

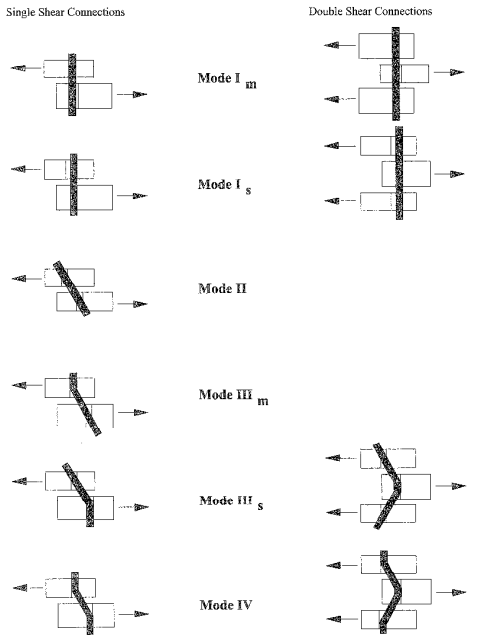
per NDS

Steel Plate to Wood Connection **Double Truss - Base Corner**

Aug-19

	Dowel Diameter	D	5/8	in
			Double Shear	
Main Member	Wood Species Specific Gravity	G_m	0.5	
	Dowel Bearing Strength Parallel to Grain	$F_{e\parallel}$	5600	psi
	Dowel Bearing Strength Perpendicular to Grain	$F_{e\perp}$	2824	psi
	Angle Between Direction of Load anc Direction of Grain	Θ_m	60	
	Dowel Bearing Strength	F_{em}	3224	psi
	Main Member Dowel Bearing Length	l_m	5.250	in
Steel Plate	Dowel Bearing Strength in Steel Plate	F_{es}	87000	psi
	Side Member Dowel Bearing Length	l_s	0.188	in
	Dowel Bending Yield Strength	F_{yb}	45000	psi
		$K\Theta$	1.17	
	$F_{em} / F_{es} =$	R_e	0.03705	
	$l_m / l_s =$	R_t	28.00	
		k_1	0.43	
		k_2	0.49	
		k_3	15.33	
Yield Limit Equations	Reduction Term	R_d	4.67	
	Yield Mode I_m	I_m	2267	lbs
	Yield Mode I_s	I_s	4369	lbs
	Reduction Term	R_d	4.20	
	Yield Mode II	II	N/A	lbs
	Reduction Term	R_d	3.73	
	Yield Mode III_m	III_m	N/A	lbs
	Yield Mode III_s	III_s	1523	lbs
	Yield Mode IV	IV	2021	lbs
	Reference Design Value	**Z**	**1523**	**lbs**
	Adjustment Factors per NDS		0.94	
	Required Capacity (per RISA)		3100	lbs
	# of Bolts each member		2.2	bolts

Figure 1 Connection Yield Modes



Reference Design Value for Wood-to-Steel Connections

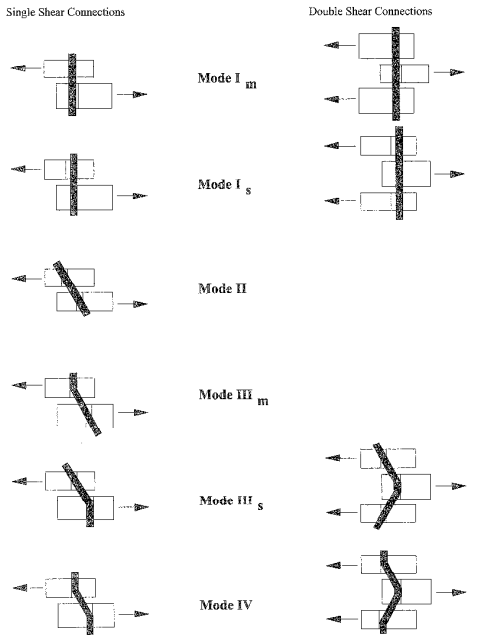
per NDS

Steel Plate to Wood Connection **Single Truss - Top and Collar**

Aug-19

	Dowel Diameter	D	1/2	in
			Double Shear	
Main Member	Wood Species Specific Gravity	G_m	0.5	
	Dowel Bearing Strength Parallel to Grain	$F_{e\parallel}$	5600	psi
	Dowel Bearing Strength Perpendicular to Grain	$F_{e\perp}$	3158	psi
	Angle Between Direction of Load anc Direction of Grain	Θ_m	30	
	Dowel Bearing Strength	F_{em}	4693	psi
	Main Member Dowel Bearing Length	l_m	1.750	in
Steel Plate	Dowel Bearing Strength in Steel Plate	F_{es}	87000	psi
	Side Member Dowel Bearing Length	l_s	0.125	in
	Dowel Bending Yield Strength	F_{yb}	45000	psi
		$K\Theta$	1.08	
	$F_{em} / F_{es} =$	R_e	0.05394	
	$l_m / l_s =$	R_t	14.00	
		k_1	0.32	
		k_2	0.64	
		k_3	14.79	
Yield Limit Equations	Reduction Term	R_d	4.33	
	Yield Mode I_m	I_m	948	lbs
	Yield Mode I_s	I_s	2510	lbs
	Reduction Term	R_d	3.90	
	Yield Mode II	II	N/A	lbs
	Reduction Term	R_d	3.47	
	Yield Mode III_m	III_m	N/A	lbs
	Yield Mode III_s	III_s	1218	lbs
	Yield Mode IV	IV	1667	lbs
	Reference Design Value	**Z**	**948**	**lbs**
	Adjustment Factors per NDS		1.5	
	Required Capacity (per RISA)		2900	lbs
	# of Bolts each member		2.0	bolts

Figure 1 Connection Yield Modes



Reference Design Value for Wood-to-Steel Connections

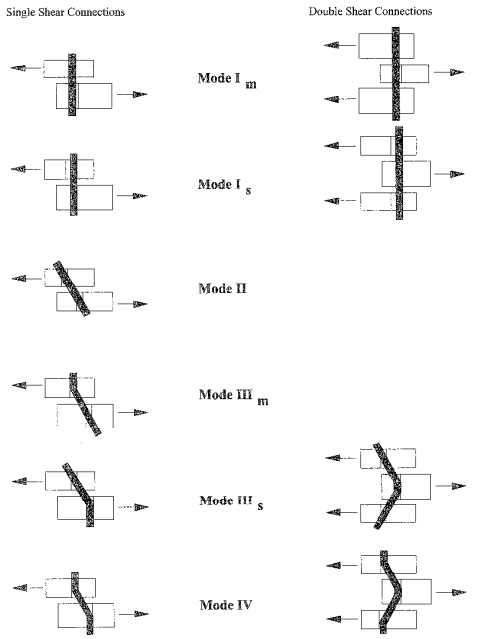
per NDS

Steel Plate to Wood Connection **Single Truss - Mid-Floor**

Aug-19

Dowel Diameter	D	1/2	in	
		Double Shear		
Main Member				
Wood Species Specific Gravity	G_m	0.5		
Dowel Bearing Strength Parallel to Grain	$F_{e\parallel}$	5600	psi	
Dowel Bearing Strength Perpendicular to Grain	$F_{e\perp}$	3158	psi	
Angle Between Direction of Load anc Direction of Grain	Θ_m	0		
Dowel Bearing Strength	F_{em}	5600	psi	
Main Member Dowel Bearing Length	l_m	1.750	in	
Steel Plate				
Dowel Bearing Strength in Steel Plate	F_{es}	87000	psi	
Side Member Dowel Bearing Length	l_s	0.125	in	
Dowel Bending Yield Strength	F_{yb}	45000	psi	
	$K\Theta$	1.00		
$F_{em} / F_{es} =$	R_e	0.06437		
$l_m / l_s =$	R_t	14.00		
	k_1	0.38		
	k_2	0.62		
	k_3	13.49		
Yield Limit Equations				
Reduction Term	R_d	4.00		
Yield Mode I_m	I_m	1225	lbs	
Yield Mode I_s	I_s	2719	lbs	
Reduction Term	R_d	3.60		
Yield Mode II	II	N/A	lbs	
Reduction Term	R_d	3.20		
Yield Mode III_m	III_m	N/A	lbs	
Yield Mode III_s	III_s	1430	lbs	
Yield Mode IV	IV	1963	lbs	
Reference Design Value	**Z**	**1225**	**lbs**	
Adjustment Factors per NDS		0.93		
Required Capacity (per RISA)		2600	lbs	
# of Bolts each member		2.3	bolts	

Figure 1 Connection Yield Modes



Reference Design Value for Wood-to-Steel Connections

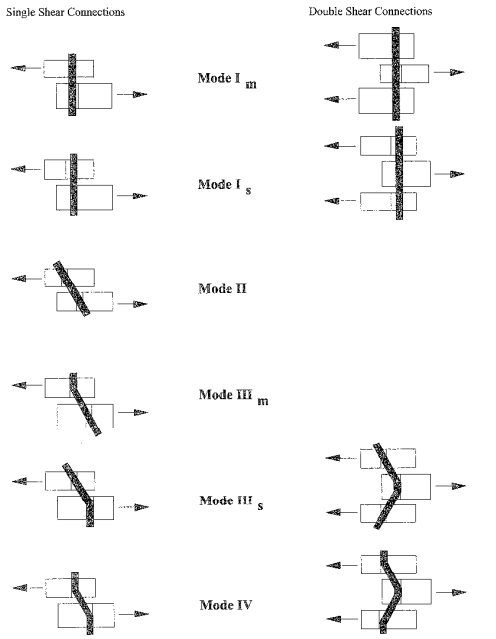
per NDS

Steel Plate to Wood Connection **Single Truss - Loft**

Aug-19

Dowel Diameter	D	1/2	in	
		Double Shear		
Main Member				
Wood Species Specific Gravity	G_m	0.5		
Dowel Bearing Strength Parallel to Grain	$F_{e\parallel}$	5600	psi	
Dowel Bearing Strength Perpendicular to Grain	$F_{e\perp}$	3158	psi	
Angle Between Direction of Load anc Direction of Grain	Θ_m	0		
Dowel Bearing Strength	F_{em}	5600	psi	
Main Member Dowel Bearing Length	l_m	1.750	in	
Steel Plate				
Dowel Bearing Strength in Steel Plate	F_{es}	87000	psi	
Side Member Dowel Bearing Length	l_s	0.188	in	
Dowel Bending Yield Strength	F_{yb}	45000	psi	
	$K\Theta$	1.00		
$F_{em} / F_{es} =$	R_e	0.06437		
$l_m / l_s =$	R_t	9.33		
	k_1	0.26		
	k_2	0.62		
	k_3	9.57		
Yield Limit Equations				
Reduction Term	R_d	4.00		
Yield Mode I_m	I_m	1225	lbs	
Yield Mode I_s	I_s	4078	lbs	
Reduction Term	R_d	3.60		
Yield Mode II	II	N/A	lbs	
Reduction Term	R_d	3.20		
Yield Mode III_m	III_m	N/A	lbs	
Yield Mode III_s	III_s	1521	lbs	
Yield Mode IV	IV	1963	lbs	
Reference Design Value	**Z**	**1225**	**lbs**	
Adjustment Factors per NDS		0.93		
Required Capacity (per RISA)		1600	lbs	
# of Bolts each member		1.4	bolts	

Figure 1 Connection Yield Modes



Reference Design Value for Wood-to-Steel Connections

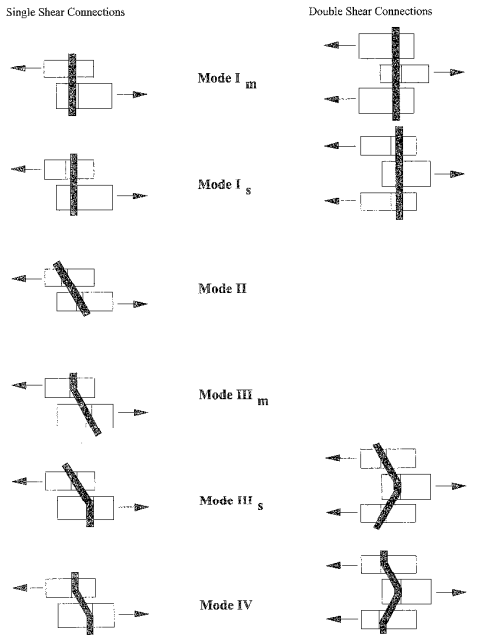
per NDS

Steel Plate to Wood Connection **Single Truss - Base Corner**

Aug-19

	Dowel Diameter	D	1/2	in
			Double Shear	
Main Member	Wood Species Specific Gravity	G_m	0.5	
	Dowel Bearing Strength Parallel to Grain	$F_{e\parallel}$	5600	psi
	Dowel Bearing Strength Perpendicular to Grain	$F_{e\perp}$	3158	psi
	Angle Between Direction of Load anc Direction of Grain	Θ_m	60	
	Dowel Bearing Strength	F_{em}	3544	psi
	Main Member Dowel Bearing Length	l_m	1.750	in
Steel Plate	Dowel Bearing Strength in Steel Plate	F_{es}	87000	psi
	Side Member Dowel Bearing Length	l_s	0.125	in
	Dowel Bending Yield Strength	F_{yb}	45000	psi
		$K\Theta$	1.17	
	$F_{em} / F_{es} =$	R_e	0.04074	
	$l_m / l_s =$	R_t	14.00	
		k_1	0.25	
		k_2	0.68	
		k_3	17.10	
Yield Limit Equations	Reduction Term	R_d	4.67	
	Yield Mode I_m	I_m	664	lbs
	Yield Mode I_s	I_s	2330	lbs
	Reduction Term	R_d	4.20	
	Yield Mode II	II	N/A	lbs
	Reduction Term	R_d	3.73	
	Yield Mode III_m	III_m	N/A	lbs
	Yield Mode III_s	III_s	994	lbs
	Yield Mode IV	IV	1354	lbs
	Reference Design Value	**Z**	**664**	**lbs**
	Adjustment Factors per NDS		1.5	
	Required Capacity (per RISA)		2600	lbs
	# of Bolts each member		2.6	bolts

Figure 1 Connection Yield Modes



Reference Design Value for Wood-to-Steel Connections

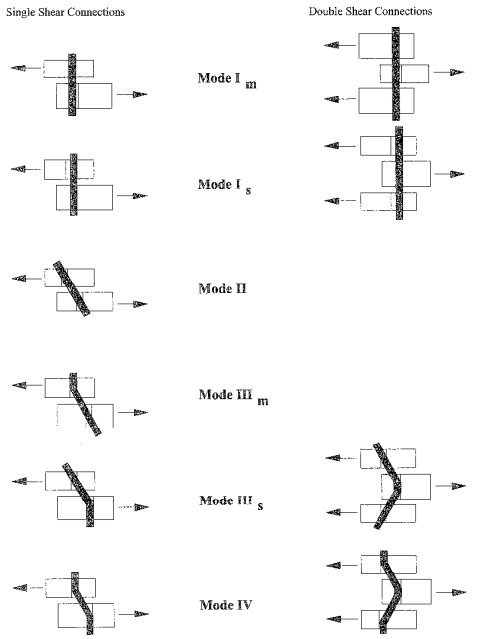
per NDS

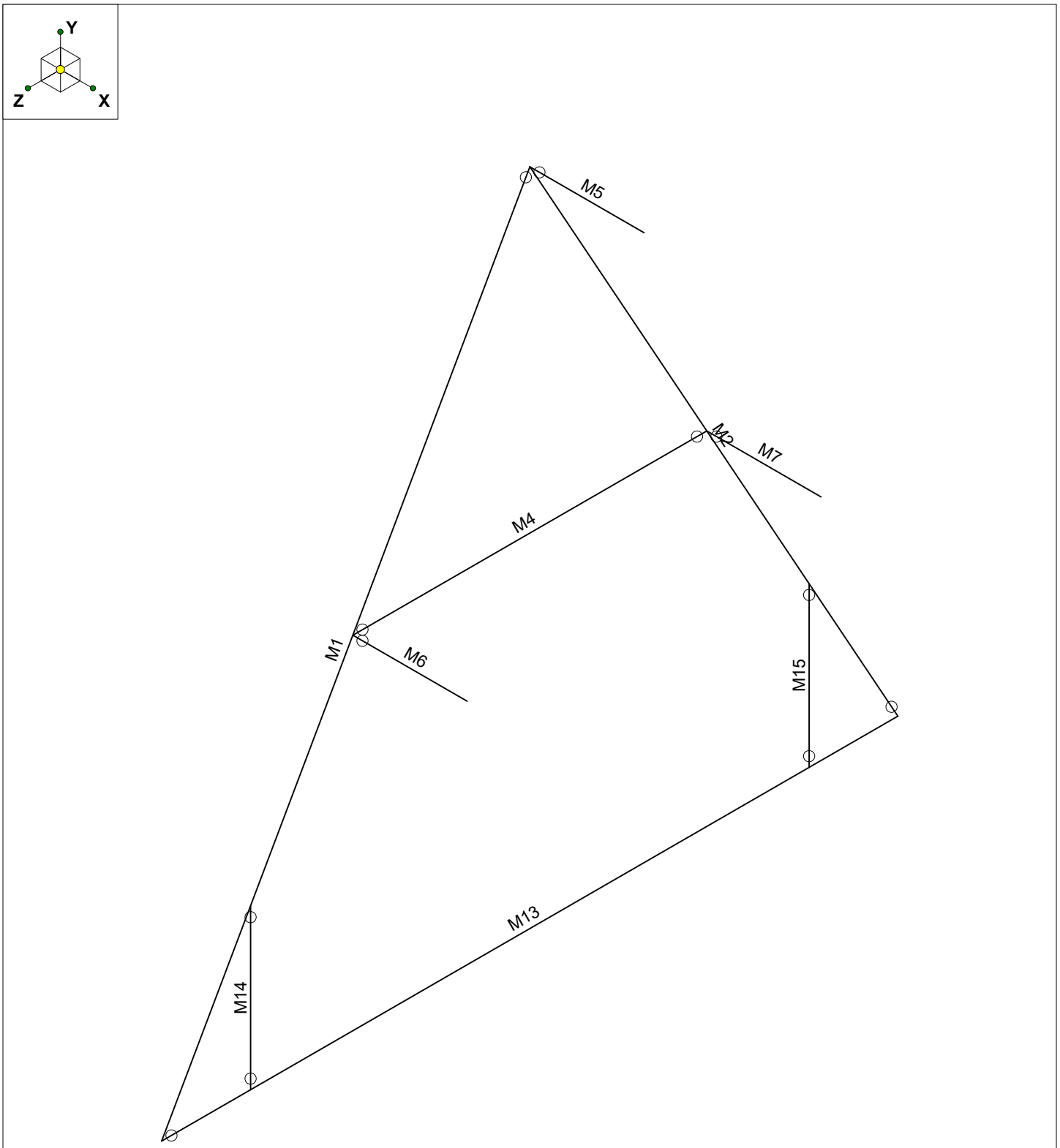
Steel Plate to Wood Connection **Single Truss - Base - No loft**

Aug-19

Dowel Diameter	D	1/2	in	
		Double Shear		
Main Member				
Wood Species Specific Gravity	G_m	0.5		
Dowel Bearing Strength Parallel to Grain	$F_{e\parallel}$	5600	psi	
Dowel Bearing Strength Perpendicular to Grain	$F_{e\perp}$	3158	psi	
Angle Between Direction of Load anc Direction of Grain	Θ_m	0		
Dowel Bearing Strength	F_{em}	5600	psi	
Main Member Dowel Bearing Length	l_m	1.750	in	
Steel Plate				
Dowel Bearing Strength in Steel Plate	F_{es}	87000	psi	
Side Member Dowel Bearing Length	l_s	0.125	in	
Dowel Bending Yield Strength	F_{yb}	45000	psi	
	$K\Theta$	1.00		
$F_{em} / F_{es} =$	R_e	0.06437		
$l_m / l_s =$	R_t	14.00		
	k_1	0.38		
	k_2	0.62		
	k_3	13.49		
Yield Limit Equations				
Reduction Term	R_d	4.00		
Yield Mode I_m	I_m	1225	lbs	
Yield Mode I_s	I_s	2719	lbs	
Reduction Term	R_d	3.60		
Yield Mode II	II	N/A	lbs	
Reduction Term	R_d	3.20		
Yield Mode III_m	III_m	N/A	lbs	
Yield Mode III_s	III_s	1430	lbs	
Yield Mode IV	IV	1963	lbs	
Reference Design Value	**Z**	**1225**	**lbs**	
Adjustment Factors per NDS		1.5		
Required Capacity (per RISA)		4600	lbs	
# of Bolts each member		2.5	bolts	

Figure 1 Connection Yield Modes





McNeil Engineering	DUO - TRUSS 1	SK - 2
CRP		Aug 24, 2020 at 2:55 PM
20003		DUO - TRUSS 1.r3d

Wood Properties

	Label	Type	Database	Species	Grade	Cm	Ci	Emod	Nu	Therm. Coeff. [1e⁵°F⁻¹]	Density [k/ft³]
1	LSL	SCL	TrusJoist	1.7E TimberStrand LSL	na			1	0.3	0.3	0.035

Wood Section Sets

	Label	Shape	Type	Design List	Material	Design Rule	Area [in²]	Iyy [in⁴]	Izz [in⁴]	J [in⁴]
1	Collar Tie	1.75X5.5FS	Beam	None	LSL	Typical	9.625	2.456	24.263	7.858
2	Main Lower Trusses	1.75X9.5FS	Beam	None	LSL	Typical	16.625	4.243	125.034	15.002
3	Floor Beam	1.75X9.5FS	Beam	None	LSL	Typical	16.625	4.243	125.034	15.002
4	Vert. Kicker	1.75X5.5FS	Column	None	LSL	Typical	9.625	2.456	24.263	7.858

Node Coordinates

	Label	X [ft]	Y [ft]	Z [ft]	Detach From Diaphragm
1	N1	0	0	0	
2	N2	0	0	19.333	
3	N3	0	17.333	9.667	
4	N6	0	9	14.314019	
5	N7	0	9	5.0195	
6	N8	3	17.333	9.667	
7	N10	3	9	14.314019	
8	N11	3	9	5.0195	
9	N14	0	0	2.333	
10	N15	0	0	17	
11	N18	0	4.183518	17	
12	N19	0	4.183086	2.333	

Node Boundary Conditions

	Node Label	X [k/in]	Y [k/in]	Z [k/in]
1	N2	Reaction	Reaction	
2	N1	Reaction	Reaction	Reaction
3	N8	Reaction	Reaction	Reaction
4	N10	Reaction	Reaction	Reaction
5	N11	Reaction	Reaction	Reaction

Member Primary Data

	Label	I Node	J Node	Section/Shape	Type	Design List	Material	Design Rule
1	M1	N2	N3	Main Lower Trusses	Beam	None	LSL	Typical
2	M2	N1	N3	Main Lower Trusses	Beam	None	LSL	Typical
3	M4	N6	N7	Collar Tie	Beam	None	LSL	Typical
4	M5	N3	N8	RIGID	None	None	RIGID	Typical
5	M6	N6	N10	RIGID	None	None	RIGID	Typical
6	M7	N7	N11	RIGID	None	None	RIGID	Typical
7	M13	N2	N1	Floor Beam	Beam	None	LSL	Typical
8	M14	N15	N18	Vert. Kicker	Column	None	LSL	Typical
9	M15	N14	N19	Vert. Kicker	Column	None	LSL	Typical

Wood Design Parameters

	Label	Shape	Length [ft]	le2 [ft]	le-bend top [ft]	le-bend bot [ft]	Cr	y sway	z sway
1	M1	Main Lower Trusses	19.846	1	1	1			
2	M2	Main Lower Trusses	19.847	1	1	1			

Wood Design Parameters (Continued)

	Label	Shape	Length [ft]	le2 [ft]	le-bend top [ft]	le-bend bot [ft]	Cr	y sway	z sway
3	M4	Collar Tie	9.295	1	1	Lbyy			
4	M13	Floor Beam	19.333	1	1	Lbyy			
5	M14	Vert. Kicker	4.184		Lbyy				
6	M15	Vert. Kicker	4.183		Lbyy				

Member Distributed Loads (BLC 1 : Dead Load)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M2	Y	-32	-32	0	%100
2	M1	Y	-32	-32	0	%100
3	M4	Y	-32	-32	0	%100
4	M13	Y	-32	-32	0	%100

1

Member Distributed Loads (BLC 2 : Live Load)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M4	Y	-100	-100	0	%100
2	M13	Y	-100	-100	0	%100

Member Distributed Loads (BLC 3 : Wind Load)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M1	y	-74	-74	0	%100
2	M2	y	74	74	0	%100

Member Distributed Loads (BLC 4 : Snow Load)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M1	Y	-70	-70	0	%100
2	M2	Y	-70	-70	0	%100
3	M1	Y	-224	-224	0	5
4	M2	Y	-224	-224	0	5

Member Distributed Loads (BLC 5 : Seismic Load)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M1	Z	-36	-36	0	%100
2	M2	Z	-36	-36	0	%100
3	M13	Z	-15	-15	0	%100
4	M4	Z	-15	-15	0	%100

Basic Load Cases

	BLC Description	Category	Y Gravity	Distributed
1	Dead Load	DL	-1	4
2	Live Load	LL		2
3	Wind Load	WL		2
4	Snow Load	SL		4
5	Seismic Load	EL		4

Load Combinations

	Description	Solve	P-Delta	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
1	Deflection 1	Yes	Y	DL	1										
2	Deflection 2	Yes	Y	LL	1										
3	Deflection 3	Yes	Y	DL	1	LL	1								
4	IBC 16-8	Yes	Y	DL	1										
5	IBC 16-9	Yes	Y	DL	1	LL	1	LLS	1						
6	IBC 16-10 (b)	Yes	Y	DL	1	SL	1	SLN	1						
7	IBC 16-11 (b)	Yes	Y	DL	1	LL	0.75	LLS	0.75	SL	0.75	SLN	0.75		
8	IBC 16-12 (a)	Yes	Y	DL	1	WL	0.6								
9	IBC 16-13 (a)	Yes	Y	DL	1	WL	0.45	LL	0.75	LLS	0.75				
10	IBC 16-13 (b)	Yes	Y	DL	1	WL	0.45	LL	0.75	LLS	0.75	SL	0.75	SLN	0.75
11	IBC 16-15	Yes	Y	DL	0.6	WL	0.6								
12	IBC 16-12 (b)	Yes	Y	DL	1	EL	0.7								
13	IBC 16-14 (a)	Yes	Y	DL	1	EL	0.525	LL	0.75	LLS	0.75				
14	IBC 16-14 (b)	Yes	Y	DL	1	EL	0.525	LL	0.75	LLS	0.75	SL	0.75	SLN	0.75
15	IBC 16-16	Yes	Y	DL	0.6	EL	0.7								

Envelope Node Reactions

	Node Label		X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb-ft]	LC	MZ [lb-ft]	LC
1	N2	max	0	15	4188.55	7	0	15	0	15	0	15	0	15
2		min	0	1	245.57	15	0	1	0	1	0	1	0	1
3	N1	max	0	15	4560.48	14	1539.17	11	0	15	0	15	0	15
4		min	0	1	1215.97	11	0	7	0	1	0	1	0	1
5	N8	max	0	15	0	11	0	7	0	15	0	15	0	15
6		min	0	1	0	7	0	11	0	1	0	1	0	1
7	N10	max	0	15	0	4	0	6	0	15	0	15	0	15
8		min	0	1	0	8	0	8	0	1	0	1	0	1
9	N11	max	0	15	0	11	0	7	0	15	0	15	0	15
10		min	0	1	0	7	0	8	0	1	0	1	0	1
11	Totals:	max	0	15	8376.99	7	1539.17	11						
12		min	0	1	1479.6	11	0	2						

Envelope Node Displacements

	Node Label		X [in]	LC	Y [in]	LC	Z [in]	LC	X Rotation [rad]	LC	Y Rotation [rad]	LC	Z Rotation [rad]	LC
1	N1	max	0	15	0	11	0	7	3.18e-3	7	0	15	0	15
2		min	0	1	0	14	0	11	-2.78e-3	11	0	1	0	1
3	N2	max	0	15	0	15	0.01	7	-1.2e-3	4	0	15	0	15
4		min	0	1	0	7	0	11	-6.94e-3	10	0	1	0	1
5	N3	max	0	15	0	11	0.01	7	5.09e-3	8	0	15	0	15
6		min	0	1	-0.02	7	-0.02	11	-1.19e-4	6	0	1	0	1
7	N6	max	0	15	-0.01	4	0	6	2.05e-3	7	0	15	0	15
8		min	0	1	-0.16	8	-0.29	8	-4.05e-4	11	0	1	0	1
9	N7	max	0	15	0.15	11	0.01	7	-5.22e-4	4	0	15	0	15
10		min	0	1	-0.02	7	-0.29	11	-2.62e-3	10	0	1	0	1
11	N8	max	0	15	0	7	0	11	5.09e-3	8	1.89e-4	7	5.96e-4	7
12		min	0	1	0	11	0	7	-1.19e-4	6	-4.3e-4	11	7.54e-5	11
13	N10	max	0	15	0	8	0	8	2.05e-3	7	3.61e-5	6	4.53e-3	8
14		min	0	1	0	1	0	6	-4.05e-4	11	-8.15e-3	8	2.13e-4	1
15	N11	max	0	15	0	7	0	11	-5.22e-4	4	3.36e-4	7	6.27e-4	7
16		min	0	1	0	11	0	7	-2.62e-3	10	-8.08e-3	11	-4.28e-3	11
17	N14	max	0	15	0.07	11	0	7	4.03e-3	7	0	15	0	15
18		min	0	1	-0.1	7	0	11	-1.25e-3	11	0	1	0	1
19	N15	max	0	15	-0.03	4	0.01	7	-1.18e-3	4	0	15	0	15

Envelope Node Displacements (Continued)

	Node Label		X [in]	LC	Y [in]	LC	Z [in]	LC	X Rotation [rad]	LC	Y Rotation [rad]	LC	Z Rotation [rad]	LC
20		min	0	1	-0.16	10	0	11	-5.46e-3	10	0	1	0	1
21	N18	max	0	15	-0.03	4	-0.03	4	8.53e-5	6	0	15	0	15
22		min	0	1	-0.15	10	-0.25	10	-3.08e-3	8	0	1	0	1
23	N19	max	0	15	0.07	11	0.14	7	1.5e-4	5	0	15	0	15
24		min	0	1	-0.09	7	-0.13	11	-3.07e-3	11	0	1	0	1

Envelope Beam Deflections

	Member Label	Span		Location [ft]	y' [in]	(n) L'/y' Ratio	LC
1	M1	1	max	4.34	0	NC	11
2		1	min	2.69	-0.03	1686	10
3		2	max	4.96	0	NC	15
4		2	min	19.85	1.24	292	10
5	M2	1	max	0.41	0	NC	15
6		1	min	2.69	-0.03	1698	14
7		2	max	10.34	0	NC	11
8		2	min	19.85	0.69	523	7
9	M4	1	max	0.1	0	NC	15
10		1	min	4.65	-0.55	204	3
11	M13	1	max	0.6	0	NC	4
12		1	min	2.22	0.01	3617	10
13		2	max	14.1	0	NC	15
14		2	min	9.67	-0.3	582	3
15		3	max	17.12	0	NC	2
16		3	min	17.92	0.01	3967	8

Envelope Maximum Member Section Forces

	Member		Axial[lb]	Loc[ft]	LC	y Shear[lb]	Loc[ft]	LC	z Shear[lb]	Loc[ft]	LC	Torque[lb-ft]	Loc[ft]	LC	y-y Moment[lb-ft]	Loc[ft]	LC	z-z Moment[lb-ft]	Loc[ft]	LC
1	M1	max	4791.81	0	7	845.27	0	10	0	19.85	15	0	19.85	15	0	19.85	15	1404.51	10.34	7
2		min	-636.06	4.75	11	-786.98	10.13	7	0	0	1	0	0	1	0	0	1	-2301.92	4.75	7
3	M2	max	5873.69	0	10	781.01	0	7	0	19.85	15	0	19.85	15	0	19.85	15	2267.71	10.34	10
4		min	-37.09	10.34	2	-870.8	10.13	10	0	0	1	0	0	1	0	0	1	-2374.55	4.75	10
5	M4	max	1630.53	9.29	14	624.31	0	5	0	9.29	15	0	9.29	15	0	9.29	15	0	9.29	15
6		min	261.28	0	15	-624.31	9.29	3	0	0	1	0	0	1	0	0	1	-1450.67	4.65	3
7	M5	max	0	3	15	0	3	15	0	3	15	0	3	15	0	3	15	0	3	15
8		min	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	3	6
9	M6	max	0	3	15	0	3	15	0	3	15	0	3	15	0	3	11	0	3	6
10		min	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	3	8
11	M7	max	0	3	15	0	3	15	0	3	15	0	3	15	0	3	11	0	3	11
12		min	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	3	7
13	M13	max	437.14	19.33	11	1246.72	17.12	9	0	19.33	15	0	19.33	15	0	19.33	15	2554.91	16.92	9
14		min	-1662.6	0	7	-986.22	16.92	3	0	0	1	0	0	1	0	0	1	-1992.68	9.67	3
15	M14	max	668.68	0	11	0	4.18	15	0	4.18	15	0	4.18	15	0	4.18	15	0	4.18	15
16		min	-1876.57	4.18	3	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
17	M15	max	-380.77	0	6	0	4.18	15	0	4.18	15	0	4.18	15	0	4.18	15	0	4.18	15
18		min	-2258.82	4.18	9	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1

Envelope Member End Reactions

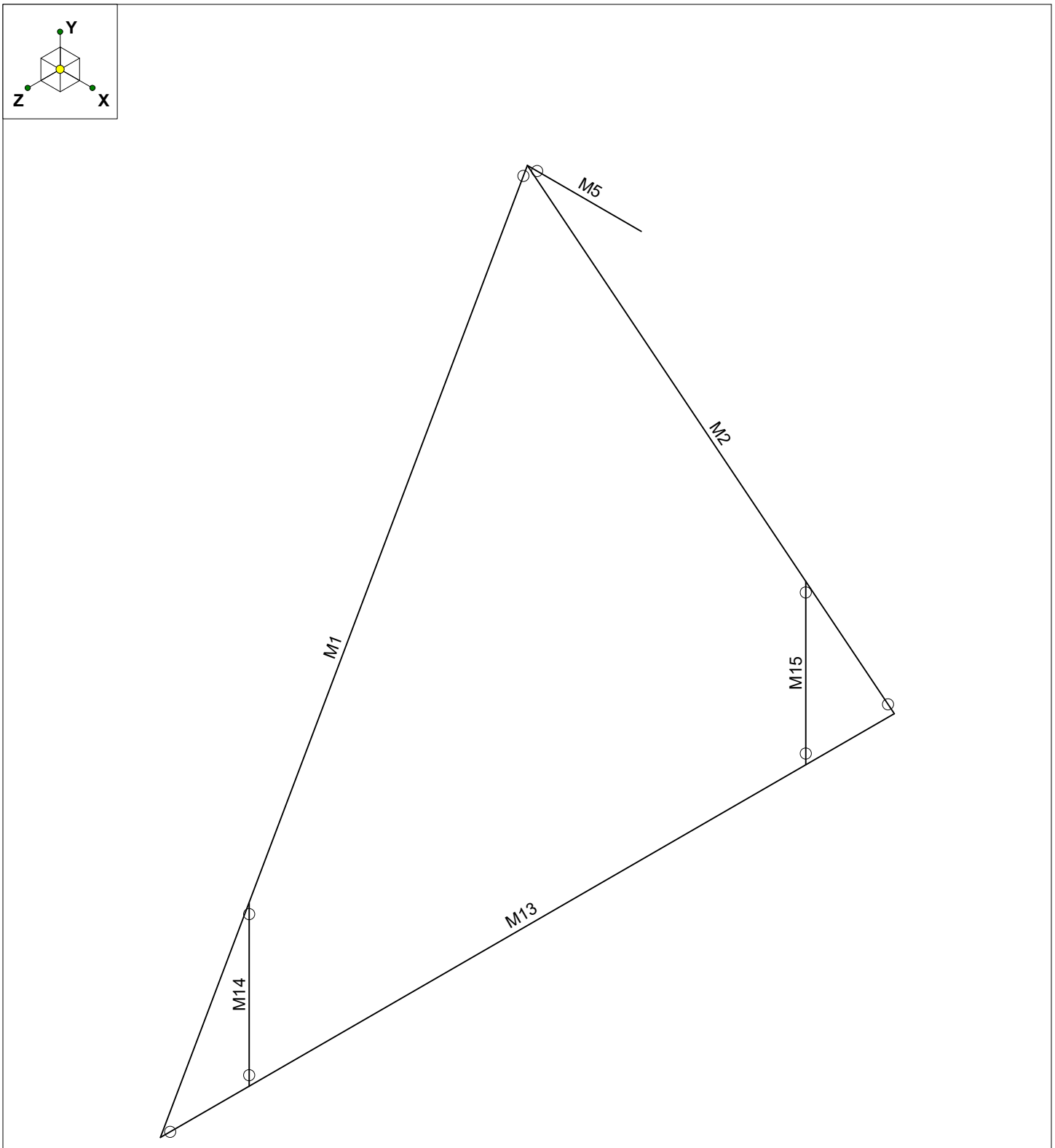
	Member	Member End		Axial[lb]	LC	y Shear[lb]	LC	z Shear[lb]	LC	Torque[lb-ft]	LC	y-y Moment[lb-ft]	LC	z-z Moment[lb-ft]	LC
1	M1	I	max	4791.81	7	845.27	10	0	15	0	15	0	15	0	15
2			min	-546.26	11	143.59	15	0	1	0	1	0	1	0	1
3		J	max	72.9	6	66.54	2	0	15	0	15	0	15	0	15
4			min	-575.69	11	-366.64	8	0	1	0	1	0	1	0	1

Envelope Member End Reactions (Continued)

	Member	Member End		Axial[lb]	LC	y Shear[lb]	LC	z Shear[lb]	LC	Torque[lb-ft]	LC	y-y Moment[lb-ft]	LC	z-z Moment[lb-ft]	LC
5	M2	I	max	5873.69	10	781.01	7	0	15	0	15	0	15	0	15
6			min	1465.81	1	19.24	11	0	1	0	1	0	1	0	1
7		J	max	611.19	8	306.57	11	0	15	0	15	0	15	0	15
8			min	-37.09	2	-130.76	6	0	1	0	1	0	1	0	1
9	M4	I	max	1593.2	10	624.31	5	0	15	0	15	0	15	0	15
10			min	261.28	15	95.75	11	0	1	0	1	0	1	0	1
11		J	max	1630.53	14	-95.75	15	0	15	0	15	0	15	0	15
12			min	308.53	11	-624.31	3	0	1	0	1	0	1	0	1
13	M5	I	max	0	15	0	15	0	15	0	15	0	15	0	15
14			min	0	1	0	1	0	1	0	1	0	1	0	1
15		J	max	0	15	0	15	0	15	0	15	0	15	0	15
16			min	0	1	0	1	0	1	0	1	0	1	0	6
17	M6	I	max	0	15	0	15	0	15	0	15	0	15	0	15
18			min	0	1	0	1	0	1	0	1	0	1	0	1
19		J	max	0	15	0	15	0	15	0	15	0	11	0	6
20			min	0	1	0	1	0	1	0	1	0	1	0	8
21	M7	I	max	0	15	0	15	0	15	0	15	0	15	0	15
22			min	0	1	0	1	0	1	0	1	0	1	0	1
23		J	max	0	15	0	15	0	15	0	15	0	11	0	11
24			min	0	1	0	1	0	1	0	1	0	1	0	7
25	M13	I	max	436.15	11	647.36	11	0	15	0	15	0	15	0	15
26			min	-1662.6	7	-555.37	3	0	1	0	1	0	1	0	1
27		J	max	437.14	11	1000.74	9	0	15	0	15	0	15	0	15
28			min	-1662.6	7	35.44	6	0	1	0	1	0	1	0	1
29	M14	I	max	668.68	11	0	15	0	15	0	15	0	15	0	15
30			min	-1866.78	3	0	1	0	1	0	1	0	1	0	1
31		J	max	662.81	11	0	15	0	15	0	15	0	15	0	15
32			min	-1876.57	3	0	1	0	1	0	1	0	1	0	1
33	M15	I	max	-380.77	6	0	15	0	15	0	15	0	15	0	15
34			min	-2249.03	9	0	1	0	1	0	1	0	1	0	1
35		J	max	-390.56	6	0	15	0	15	0	15	0	15	0	15
36			min	-2258.82	9	0	1	0	1	0	1	0	1	0	1

Envelope AWC NDS-15: ASD Member Wood Code Checks

	Member	Shape	Code Check	Loc[ft]	LC	Shear Check	Loc[ft]	Dir	LC	Fc' [ksi]	Ft' [ksi]	Fb1' [ksi]	Fb2' [ksi]	Fv' [ksi]	RB	CL	CP	Eqn
1	M1	1.75X9.5FS	0.48	4.75	7	0.11	10.13	y	7	1.1	2.1	2.97	2.99	0.67	6.1	0.99	0.4	3.9-3
2	M2	1.75X9.5FS	0.48	4.75	7	0.11	10.13	y	7	1.1	2.1	2.97	2.99	0.67	6.1	0.99	0.4	3.9-3
3	M4	1.75X5.5FS	0.83	4.65	5	0.17	9.29	y	5	1.52	1.82	2.59	2.6	0.59	4.64	1	0.64	3.9-3
4	M13	1.75X9.5FS	0.39	9.67	5	0.15	2.42	y	5	1.13	1.82	2.59	2.6	0.59	6.1	1	0.48	3.9-1
5	M14	1.75X5.5FS	0.11	4.18	5	0	4.18	z	15	0.85	1.82	2.56	2.6	0.94	9.5	0.99	0.36	3.9-1
6	M15	1.75X5.5FS	0.11	4.18	5	0	4.18	z	15	0.85	1.82	2.56	2.6	0.94	9.49	0.99	0.36	3.9-1



McNeil Engineering	DUO - TRUSS 3	SK - 1
CRP		Aug 24, 2020 at 3:08 PM
19003		DUO - TRUSS 3.r3d

Wood Properties

	Label	Type	Database	Species	Grade	Cm	Ci	Emod	Nu	Therm. Coeff. [1e⁵°F⁻¹]	Density [k/ft³]
1	LSL	SCL	TrusJoist	1.7E TimberStrand LSL	na			1	0.3	0.3	0.035

Wood Section Sets

	Label	Shape	Type	Design List	Material	Design Rule	Area [in²]	Iyy [in⁴]	Izz [in⁴]	J [in⁴]
1	Collar Tie	1.75X5.5FS	Beam	None	LSL	Typical	9.625	2.456	24.263	7.858
2	Main Lower Trusses	1.75X9.5FS	Beam	None	LSL	Typical	16.625	4.243	125.034	15.002
3	Floor Beam	1.75X9.5FS	Beam	None	LSL	Typical	16.625	4.243	125.034	15.002
4	Vert. Kicker	1.75X5.5FS	Column	None	LSL	Typical	9.625	2.456	24.263	7.858

Node Coordinates

	Label	X [ft]	Y [ft]	Z [ft]	Detach From Diaphragm
1	N1	0	0	0	
2	N2	0	0	19.333	
3	N3	0	17.333	9.667	
4	N6	0	9	14.314019	
5	N7	0	9	5.0195	
6	N8	3	17.333	9.667	
7	N14	0	0	2.333	
8	N15	0	0	17	
9	N18	0	4.183518	17	
10	N19	0	4.183086	2.333	

Node Boundary Conditions

	Node Label	X [k/in]	Y [k/in]	Z [k/in]
1	N2	Reaction	Reaction	
2	N1	Reaction	Reaction	Reaction
3	N8	Reaction	Reaction	Reaction

Member Primary Data

	Label	I Node	J Node	Section/Shape	Type	Design List	Material	Design Rule
1	M1	N2	N3	Main Lower Trusses	Beam	None	LSL	Typical
2	M2	N1	N3	Main Lower Trusses	Beam	None	LSL	Typical
3	M5	N3	N8	RIGID	None	None	RIGID	Typical
4	M13	N2	N1	Floor Beam	Beam	None	LSL	Typical
5	M14	N15	N18	Vert. Kicker	Column	None	LSL	Typical
6	M15	N14	N19	Vert. Kicker	Column	None	LSL	Typical

Wood Design Parameters

	Label	Shape	Length [ft]	le2 [ft]	le-bend top [ft]	le-bend bot [ft]	Cr	y sway	z sway
1	M1	Main Lower Trusses	19.846	1	1	1			
2	M2	Main Lower Trusses	19.847	1	1	1			
3	M13	Floor Beam	19.333	1	1	Lbyy			
4	M14	Vert. Kicker	4.184		Lbyy				
5	M15	Vert. Kicker	4.183		Lbyy				

Member Distributed Loads (BLC 1 : Dead Load)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M2	Y	-32	-32	0	%100
2	M1	Y	-32	-32	0	%100
3	M13	Y	-32	-32	0	%100

1

Member Distributed Loads (BLC 2 : Live Load)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M13	Y	-100	-100	0	%100

Member Distributed Loads (BLC 3 : Wind Load)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M1	y	-74	-74	0	%100
2	M2	y	74	74	0	%100

Member Distributed Loads (BLC 4 : Snow Load)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M1	Y	-70	-70	0	%100
2	M2	Y	-70	-70	0	%100
3	M1	Y	-224	-224	0	5
4	M2	Y	-224	-224	0	5

Member Distributed Loads (BLC 5 : Seismic Load)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M1	Z	-36	-36	0	%100
2	M2	Z	-36	-36	0	%100
3	M13	Z	-15	-15	0	%100

Basic Load Cases

	BLC Description	Category	Y Gravity	Distributed
1	Dead Load	DL	-1	3
2	Live Load	LL		1
3	Wind Load	WL		2
4	Snow Load	SL		4
5	Seismic Load	EL		3

Load Combinations

	Description	Solve	P-Delta	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
1	Deflection 1	Yes	Y	DL	1										
2	Deflection 2	Yes	Y	LL	1										
3	Deflection 3	Yes	Y	DL	1	LL	1								
4	IBC 16-8	Yes	Y	DL	1										
5	IBC 16-9	Yes	Y	DL	1	LL	1	LLS	1						
6	IBC 16-10 (b)	Yes	Y	DL	1	SL	1	SLN	1						
7	IBC 16-11 (b)	Yes	Y	DL	1	LL	0.75	LLS	0.75	SL	0.75	SLN	0.75		
8	IBC 16-12 (a)	Yes	Y	DL	1	WL	0.6								
9	IBC 16-13 (a)	Yes	Y	DL	1	WL	0.45	LL	0.75	LLS	0.75				
10	IBC 16-13 (b)	Yes	Y	DL	1	WL	0.45	LL	0.75	LLS	0.75	SL	0.75	SLN	0.75

Load Combinations (Continued)

	Description	Solve	P-Delta	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
11	IBC 16-15	Yes	Y	DL	0.6	WL	0.6								
12	IBC 16-12 (b)	Yes	Y	DL	1	EL	0.7								
13	IBC 16-14 (a)	Yes	Y	DL	1	EL	0.525	LL	0.75	LLS	0.75				
14	IBC 16-14 (b)	Yes	Y	DL	1	EL	0.525	LL	0.75	LLS	0.75	SL	0.75	SLN	0.75
15	IBC 16-16	Yes	Y	DL	0.6	EL	0.7								

Envelope Node Reactions

	Node Label		X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb-ft]	LC	MZ [lb-ft]	LC
1	N2	max	0	15	3680.4	7	0	15	0	15	0	15	0	15
2		min	0	1	168.1	11	0	1	0	1	0	1	0	1
3	N1	max	0	15	4038.98	10	1539.17	11	0	15	0	15	0	15
4		min	0	1	966.65	2	0	7	0	1	0	1	0	1
5	N8	max	0	15	0	11	0	7	0	15	0	15	0	15
6		min	0	1	0	7	0	11	0	1	0	1	0	1
7	Totals:	max	0	15	7360.73	7	1539.17	8						
8		min	0	1	1288.1	11	0	2						

Envelope Node Displacements

	Node Label		X [in]	LC	Y [in]	LC	Z [in]	LC	X Rotation [rad]	LC	Y Rotation [rad]	LC	Z Rotation [rad]	LC
1	N1	max	0	15	0	2	0	7	1.56e-2	7	0	15	0	15
2		min	0	1	0	10	0	11	-3.72e-4	11	0	1	0	1
3	N2	max	0	15	0	11	0.01	7	-4.73e-3	15	0	15	0	15
4		min	0	1	0	7	-0.01	11	-1.96e-2	10	0	1	0	1
5	N3	max	0	15	0	11	0	7	2.14e-3	11	0	15	0	15
6		min	0	1	-0.01	7	-0.02	11	-1.47e-2	7	0	1	0	1
7	N6	max	0	15	-0.19	4	-0.33	4	1.9e-3	7	0	15	0	15
8		min	0	1	-0.69	10	-1.23	10	-4.33e-4	11	0	1	0	1
9	N7	max	0	15	0.05	11	1.02	7	-4.68e-4	4	0	15	0	15
10		min	0	1	-0.58	7	-0.1	11	-2.47e-3	10	0	1	0	1
11	N8	max	0	15	0	7	0	11	2.14e-3	11	7.16e-5	7	3.82e-4	7
12		min	0	1	0	11	0	7	-1.47e-2	7	-4.52e-4	11	3.45e-5	11
13	N14	max	0	15	0	11	0	7	1.48e-2	7	0	15	0	15
14		min	0	1	-0.43	7	0	11	8.23e-4	11	0	1	0	1
15	N15	max	0	15	-0.12	15	0	7	-3.7e-3	15	0	15	0	15
16		min	0	1	-0.49	10	0	11	-1.62e-2	10	0	1	0	1
17	N18	max	0	15	-0.12	15	-0.22	15	-3.58e-3	4	0	15	0	15
18		min	0	1	-0.49	10	-0.87	10	-1.33e-2	10	0	1	0	1
19	N19	max	0	15	0	11	0.76	7	1.1e-2	7	0	15	0	15
20		min	0	1	-0.43	7	-0.02	11	-9.35e-4	11	0	1	0	1

Envelope Beam Deflections

	Member Label	Span		Location [ft]	y' [in]	(n) L'/y' Ratio	LC
1	M1	1	max	4.55	0	NC	4
2		1	min	2.69	-0.04	1302	10
3		2	max	4.96	0	NC	15
4		2	min	19.85	4.14	87	10
5	M2	1	max	4.55	0	NC	4
6		1	min	2.69	-0.04	1318	7
7		2	max	4.96	0	NC	11
8		2	min	19.85	3.6	100	7
9	M13	1	max	0.2	0	NC	14
10		1	min	2.22	0.02	1209	10

Envelope Beam Deflections (Continued)

	Member Label	Span		Location [ft]	y' [in]	(n) L'/y' Ratio	LC
11		2	max	16.71	0	NC	11
12		2	min	9.26	-0.76	231	10
13		3	max	19.13	0	NC	10
14		3	min	17.12	-0.01	1883	7

Envelope Maximum Member Section Forces

	Member		Axial[lb]	Loc[ft]	LC	y Shear[lb]	Loc[ft]	LC	z Shear[lb]	Loc[ft]	LC	Torque[lb-ft]	Loc[ft]	LC	y-y Moment[lb-ft]	Loc[ft]	LC	z-z Moment[lb-ft]	Loc[ft]	LC
1	M1	max	3035.06	0	7	1071.3	0	10	0	19.85	15	0	19.85	15	0	19.85	15	0	19.85	15
2		min	-968.19	4.75	11	-798.61	19.85	10	0	0	1	0	0	1	0	0	1	-4165.77	9.51	10
3	M2	max	4110.68	0	10	1004.22	0	7	0	19.85	15	0	19.85	15	0	19.85	15	652.39	13.64	11
4		min	68.16	4.96	2	-553.67	19.85	7	0	0	1	0	0	1	0	0	1	-3514.23	7.24	7
5	M5	max	0	3	15	0	3	15	0	3	15	0	3	15	0	3	15	0	3	15
6		min	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
7	M13	max	638.28	2.22	11	1088.7	0	10	0	19.33	15	0	19.33	15	0	19.33	15	1499.16	16.92	11
8		min	-634.01	0	7	-986.22	16.92	3	0	0	1	0	0	1	0	0	1	-4099.06	8.06	10
9	M14	max	839.37	0	11	0	4.18	15	0	4.18	15	0	4.18	15	0	4.18	15	0	4.18	15
10		min	-1226.52	4.18	3	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
11	M15	max	403.53	0	6	0	4.18	15	0	4.18	15	0	4.18	15	0	4.18	15	0	4.18	15
12		min	-1684.79	4.18	9	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1

Envelope Member End Reactions

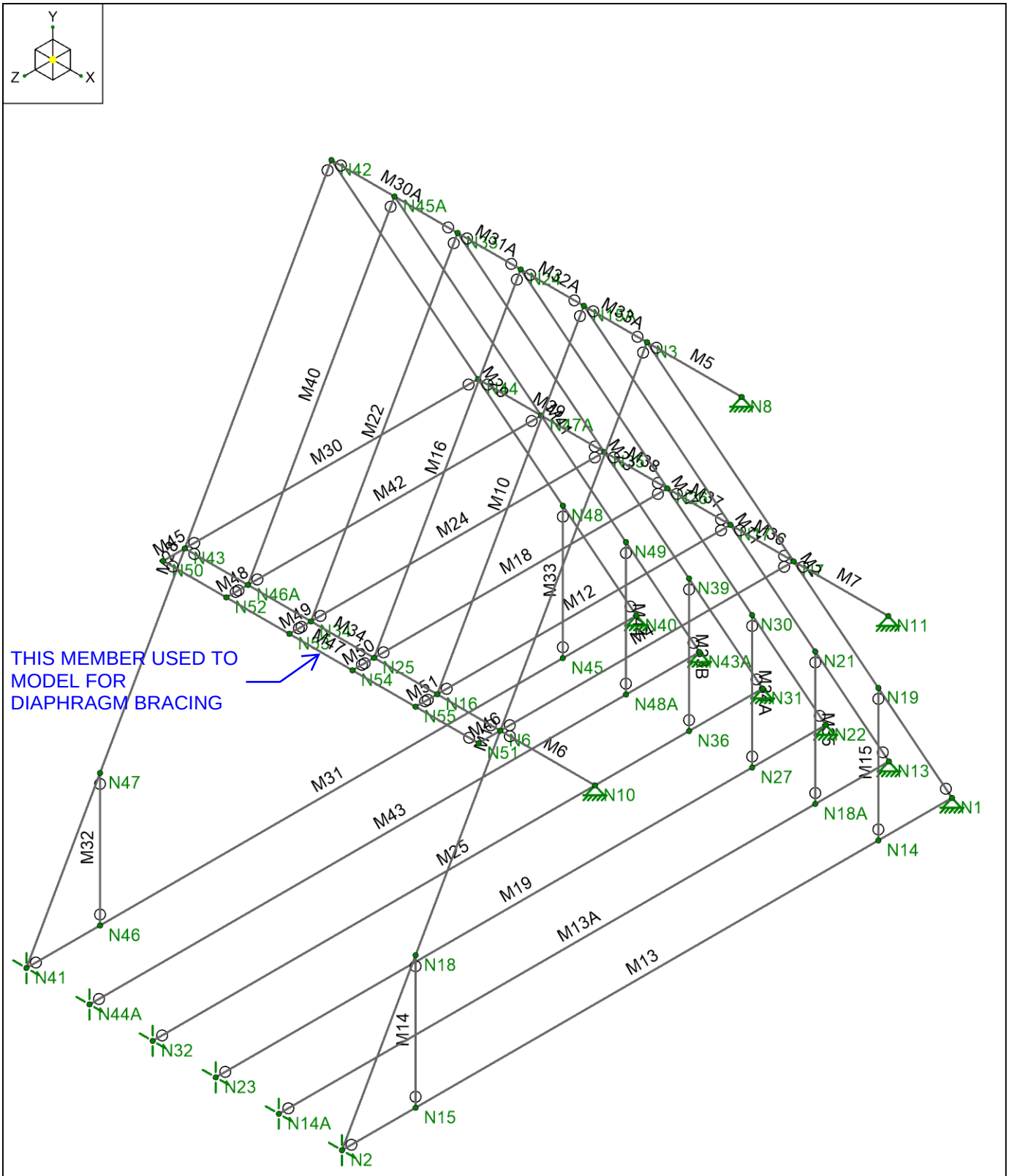
	Member	Member End		Axial[lb]	LC	y Shear[lb]	LC	z Shear[lb]	LC	Torque[lb-ft]	LC	y-y Moment[lb-ft]	LC	z-z Moment[lb-ft]	LC
1	M1	I	max	3035.06	7	1071.3	10	0	15	0	15	0	15	0	15
2			min	-878.39	11	192.04	15	0	1	0	1	0	1	0	1
3		J	max	304.93	7	-122.43	2	0	15	0	15	0	15	0	15
4			min	-522.84	11	-798.61	10	0	1	0	1	0	1	0	1
5	M2	I	max	4110.68	10	1004.22	7	0	15	0	15	0	15	0	15
6			min	903.69	1	61.64	11	0	1	0	1	0	1	0	1
7		J	max	750.21	10	210.22	11	0	15	0	15	0	15	0	15
8			min	68.16	2	-553.67	7	0	1	0	1	0	1	0	1
9	M5	I	max	0	15	0	15	0	15	0	15	0	15	0	15
10			min	0	1	0	1	0	1	0	1	0	1	0	1
11		J	max	0	15	0	15	0	15	0	15	0	15	0	15
12			min	0	1	0	1	0	1	0	1	0	1	0	1
13	M13	I	max	638.28	11	1088.7	10	0	15	0	15	0	15	0	15
14			min	-634.01	7	-73.39	2	0	1	0	1	0	1	0	1
15		J	max	633.68	11	631.27	11	0	15	0	15	0	15	0	15
16			min	-633.99	7	-744.26	6	0	1	0	1	0	1	0	1
17	M14	I	max	839.37	11	0	15	0	15	0	15	0	15	0	15
18			min	-1216.73	3	0	1	0	1	0	1	0	1	0	1
19		J	max	833.5	11	0	15	0	15	0	15	0	15	0	15
20			min	-1226.52	3	0	1	0	1	0	1	0	1	0	1
21	M15	I	max	403.53	6	0	15	0	15	0	15	0	15	0	15
22			min	-1675.01	9	0	1	0	1	0	1	0	1	0	1
23		J	max	393.75	6	0	15	0	15	0	15	0	15	0	15
24			min	-1684.79	9	0	1	0	1	0	1	0	1	0	1

Envelope AWC NDS-15: ASD Member Wood Code Checks

	Member	Shape	Code Check	Loc[ft]	LC	Shear Check	Loc[ft]	Dir	LC	Fc' [ksi]	Ft' [ksi]	Fb1' [ksi]	Fb2' [ksi]	Fv' [ksi]	RB	CL	CP	Eqn
1	M1	1.75X9.5FS	0.59	4.75	7	0.13	0	y	7	1.1	2.1	2.97	2.99	0.67	6.1	0.99	0.4	3.9-3
2	M2	1.75X9.5FS	0.58	4.75	7	0.13	0	y	7	1.1	2.1	2.97	2.99	0.67	6.1	0.99	0.4	3.9-3
3	M13	1.75X9.5FS	0.63	9.67	5	0.15	2.42	y	5	1.13	1.82	2.59	2.6	0.59	6.1	1	0.48	3.9-1

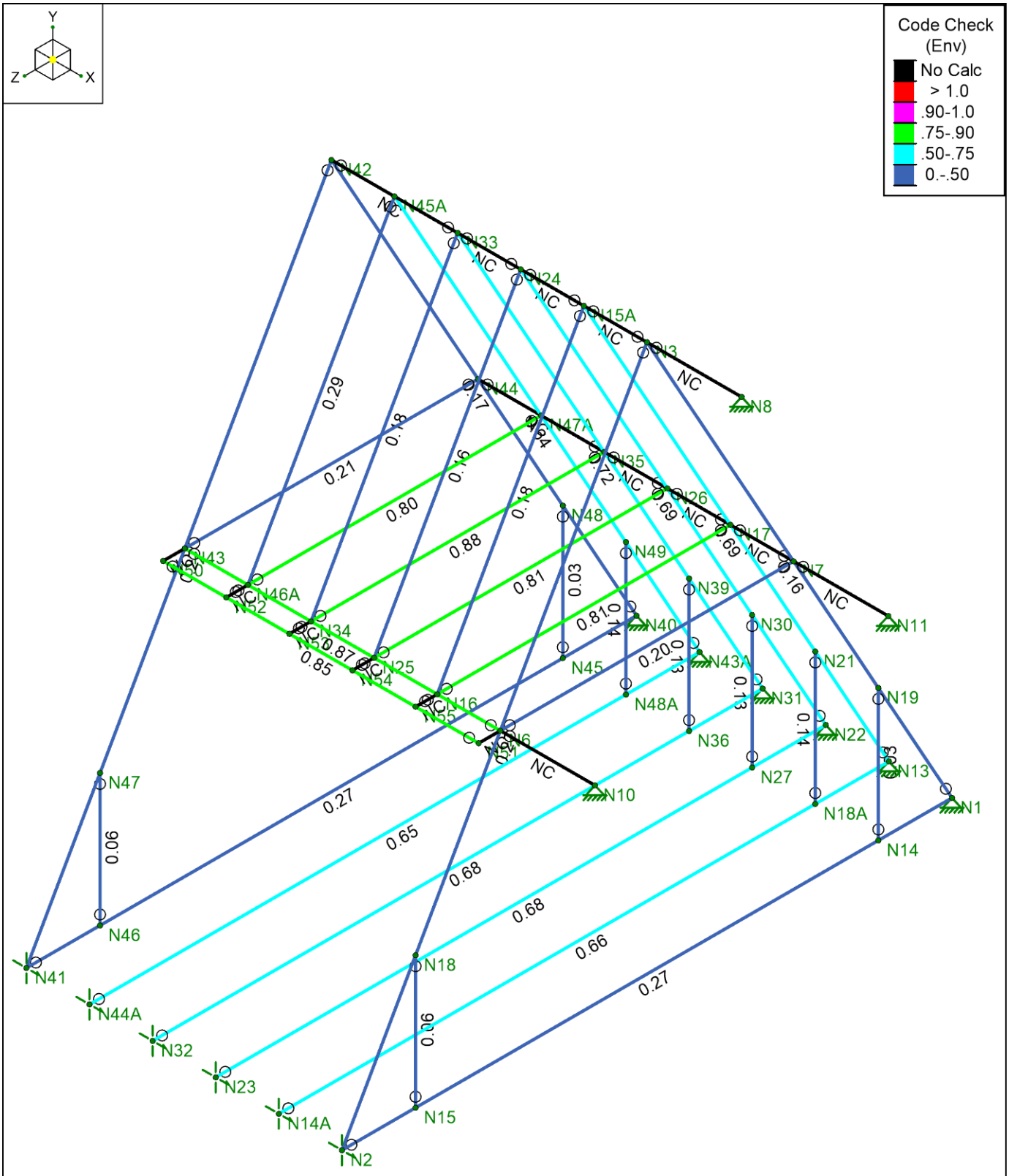
Envelope AWC NDS-15: ASD Member Wood Code Checks (Continued)

	Member	Shape	Code Check	Loc[ft]	LC	Shear Check	Loc[ft]	Dir	LC	Fc' [ksi]	Ft' [ksi]	Fb1' [ksi]	Fb2' [ksi]	Fv' [ksi]	RB	CL	CP	Eqn
4	M14	1.75X5.5FS	0.1	0	11	0	4.18	z	15	0.87	2.92	4.06	4.16	0.94	9.5	0.97	0.23	3.6.3
5	M15	1.75X5.5FS	0.07	4.18	5	0	4.18	z	15	0.85	1.82	2.56	2.6	0.94	9.49	0.99	0.36	3.9-1



Envelope Only Solution

McNeil Engineering	DUO - TRUSS 6	SK-2
DFB		Aug 28, 2023
21003.050		DUO - TRUSS 6_10-ft rev.r3d



Member Code Checks Displayed (Enveloped)
Envelope Only Solution

McNeil Engineering	DUO - TRUSS 6	SK-3
DFB		Aug 28, 2023
21003.050		DUO - TRUSS 6_10-ft rev.r3d

Wood Properties

	Label	Type	Database	Species	Grade	Cm	Ci	Emod	Nu	Therm. Coeff. [1e⁵°F⁻¹]	Density [k/ft³]
1	LSL	SCL	TrusJoist	2.0E_DF/LP/WH Microllam LVL	na			1	0.3	0.3	0.035

Wood Section Sets

	Label	Shape	Type	Design List	Material	Design Rule	Area [in²]	Iyy [in⁴]	Izz [in⁴]	J [in⁴]
1	Girder Collar Tie	2-1.75X5.5FS	Beam	None	LSL	Typical	19.25	19.651	48.526	47.522
2	Girder Truss	2-1.75X9.5FS	Beam	None	LSL	Typical	33.25	33.943	250.068	104.306
3	Girder Floor Beam	2-1.75X9.5FS	Beam	None	LSL	Typical	33.25	33.943	250.068	104.306
4	Girder Vert. Kicker	2-1.75X5.5FS	Column	None	LSL	Typical	19.25	19.651	48.526	47.522
5	Collar Tie	1.75X5.5FS	Beam	None	LSL	Typical	9.625	2.456	24.263	7.858
6	Truss	1.75X9.5FS	Beam	None	LSL	Typical	16.625	4.243	125.034	15.002
7	Floor Beam	1.75X9.5FS	Beam	None	LSL	Typical	16.625	4.243	125.034	15.002
8	Vert. Kicker	1.75X5.5FS	Column	None	LSL	Typical	9.625	2.456	24.263	7.858
9	Dormer Header	2-1.75X11.875FS	Beam	None	LSL	Typical	41.562	42.428	488.413	138.22
10	Diaphragm "Brace"	2-1.75X9.5FS	Beam	None	LSL	Typical	33.25	33.943	250.068	104.306

Node Coordinates

	Label	X [ft]	Y [ft]	Z [ft]	Detach From Diaphragm
1	N1	0	0	0	
2	N2	0	0	19.333	
3	N3	0	17.333	9.667	
4	N6	0	9	14.314019	
5	N7	0	9	5.0195	
6	N8	3	17.333	9.667	
7	N10	3	9	14.314019	
8	N11	3	9	5.0195	
9	N14	0	0	2.333	
10	N15	0	0	17	
11	N18	0	4.183518	17	
12	N19	0	4.183086	2.333	
13	N13	-2	0	0	
14	N14A	-2	0	19.333	
15	N15A	-2	17.333	9.667	
16	N16	-2	9	14.314019	
17	N17	-2	9	5.0195	
18	N18A	-2	0	2.333	
19	N21	-2	4.183086	2.333	
20	N22	-4	0	0	
21	N23	-4	0	19.333	
22	N24	-4	17.333	9.667	
23	N25	-4	9	14.314019	
24	N26	-4	9	5.0195	
25	N27	-4	0	2.333	
26	N30	-4	4.183086	2.333	
27	N31	-6	0	0	
28	N32	-6	0	19.333	
29	N33	-6	17.333	9.667	
30	N34	-6	9	14.314019	
31	N35	-6	9	5.0195	
32	N36	-6	0	2.333	
33	N39	-6	4.183086	2.333	
34	N40	-10	0	0	
35	N41	-10	0	19.333	

Node Coordinates (Continued)

	Label	X [ft]	Y [ft]	Z [ft]	Detach From Diaphragm
36	N42	-10	17.333	9.667	
37	N43	-10	9	14.314019	
38	N44	-10	9	5.0195	
39	N45	-10	0	2.333	
40	N46	-10	0	17	
41	N47	-10	4.183518	17	
42	N48	-10	4.183086	2.333	
43	N43A	-8	0	0	
44	N44A	-8	0	19.333	
45	N45A	-8	17.333	9.667	
46	N46A	-8	9	14.314019	
47	N47A	-8	9	5.0195	
48	N48A	-8	0	2.333	
49	N49	-8	4.183086	2.333	
50	N50	-10	9	15	
51	N51	0	9	15	
52	N52	-8	9	15	
53	N53	-6	9	15	
54	N54	-4	9	15	
55	N55	-2	9	15	

Node Boundary Conditions

	Node Label	X [k/in]	Y [k/in]	Z [k/in]
1	N2	Reaction	Reaction	
2	N1	Reaction	Reaction	Reaction
3	N8	Reaction	Reaction	Reaction
4	N10	Reaction	Reaction	Reaction
5	N11	Reaction	Reaction	Reaction
6	N13	Reaction	Reaction	Reaction
7	N14A	Reaction	Reaction	
8	N22	Reaction	Reaction	Reaction
9	N23	Reaction	Reaction	
10	N31	Reaction	Reaction	Reaction
11	N32	Reaction	Reaction	
12	N40	Reaction	Reaction	Reaction
13	N41	Reaction	Reaction	
14	N25			
15	N43A	Reaction	Reaction	Reaction
16	N44A	Reaction	Reaction	
17	N34			
18	N16			
19	N46A			

Member Primary Data

	Label	I Node	J Node	Rotate(deg)	Section/Shape	Type	Design List	Material	Design Rule
1	M1	N2	N3		Girder Truss	Beam	None	LSL	Typical
2	M2	N1	N3		Girder Truss	Beam	None	LSL	Typical
3	M4	N6	N7		Girder Collar Tie	Beam	None	LSL	Typical
4	M5	N3	N8		RIGID	None	None	RIGID	Typical
5	M6	N6	N10		RIGID	None	None	RIGID	Typical
6	M7	N7	N11		RIGID	None	None	RIGID	Typical
7	M13	N2	N1		Girder Floor Beam	Beam	None	LSL	Typical
8	M14	N15	N18		Girder Vert. Kicker	Column	None	LSL	Typical

Member Primary Data (Continued)

	Label	I Node	J Node	Rotate(deg)	Section/Shape	Type	Design List	Material	Design Rule
9	M15	N14	N19		Girder Vert. Kicker	Column	None	LSL	Typical
10	M10	N16	N15A		Truss	Beam	None	LSL	Typical
11	M11	N13	N15A		Truss	Beam	None	LSL	Typical
12	M12	N16	N17		Collar Tie	Beam	None	LSL	Typical
13	M13A	N14A	N13		Floor Beam	Beam	None	LSL	Typical
14	M16	N25	N24		Truss	Beam	None	LSL	Typical
15	M17	N22	N24		Truss	Beam	None	LSL	Typical
16	M18	N25	N26		Collar Tie	Beam	None	LSL	Typical
17	M19	N23	N22		Floor Beam	Beam	None	LSL	Typical
18	M22	N34	N33		Truss	Beam	None	LSL	Typical
19	M23	N31	N33		Truss	Beam	None	LSL	Typical
20	M24	N34	N35		Collar Tie	Beam	None	LSL	Typical
21	M25	N32	N31		Floor Beam	Beam	None	LSL	Typical
22	M28	N41	N42		Girder Truss	Beam	None	LSL	Typical
23	M29	N40	N42		Girder Truss	Beam	None	LSL	Typical
24	M30	N43	N44		Girder Collar Tie	Beam	None	LSL	Typical
25	M31	N41	N40		Girder Floor Beam	Beam	None	LSL	Typical
26	M32	N46	N47		Girder Vert. Kicker	Column	None	LSL	Typical
27	M33	N45	N48		Girder Vert. Kicker	Column	None	LSL	Typical
28	M34	N43	N6		Dormer Header	Beam	None	LSL	Typical
29	M30A	N42	N33		RIGID	None	None	RIGID	Typical
30	M31A	N33	N24		RIGID	None	None	RIGID	Typical
31	M32A	N24	N15A		RIGID	None	None	RIGID	Typical
32	M33A	N15A	N3		RIGID	None	None	RIGID	Typical
33	M33B	N39	N36		Vert. Kicker	Column	None	LSL	Typical
34	M34A	N30	N27		Vert. Kicker	Column	None	LSL	Typical
35	M35	N21	N18A		Vert. Kicker	Column	None	LSL	Typical
36	M36	N7	N17		RIGID	None	None	RIGID	Typical
37	M37	N17	N26		RIGID	None	None	RIGID	Typical
38	M38	N26	N35		RIGID	None	None	RIGID	Typical
39	M39	N35	N44		RIGID	None	None	RIGID	Typical
40	M40	N46A	N45A		Truss	Beam	None	LSL	Typical
41	M41	N43A	N45A		Truss	Beam	None	LSL	Typical
42	M42	N46A	N47A		Collar Tie	Beam	None	LSL	Typical
43	M43	N44A	N43A		Floor Beam	Beam	None	LSL	Typical
44	M44	N49	N48A		Vert. Kicker	Column	None	LSL	Typical
45	M45	N43	N50		RIGID	None	None	RIGID	Typical
46	M46	N6	N51		RIGID	None	None	RIGID	Typical
47	M47	N50	N51	90	Diaphragm "Brace"	Beam	None	LSL	Typical
48	M48	N46A	N52		RIGID	None	None	RIGID	Typical
49	M49	N53	N34		RIGID	None	None	RIGID	Typical
50	M50	N54	N25		RIGID	None	None	RIGID	Typical
51	M51	N55	N16		RIGID	None	None	RIGID	Typical

Wood Design Parameters

	Label	Shape	Length [ft]	le2 [ft]	le-bend top [ft]	le-bend bot [ft]	Cr	y sway	z sway
1	M1	Girder Truss	19.846	1	1	1			
2	M2	Girder Truss	19.847	1	1	1			
3	M4	Girder Collar Tie	9.295	1	1	Lbyy			
4	M13	Girder Floor Beam	19.333	1	1	Lbyy			
5	M14	Girder Vert. Kicker	4.184		Lbyy				
6	M15	Girder Vert. Kicker	4.183		Lbyy				
7	M10	Truss	9.541	1	1	1			
8	M11	Truss	19.847	1	1	1			
9	M12	Collar Tie	9.295	1	1	Lbyy			

Wood Design Parameters (Continued)

	Label	Shape	Length [ft]	le2 [ft]	le-bend top [ft]	le-bend bot [ft]	Cr	y sway	z sway
10	M13A	Floor Beam	19.333	1	1	Lbyy			
11	M16	Truss	9.541	1	1	1			
12	M17	Truss	19.847	1	1	1			
13	M18	Collar Tie	9.295	1	1	Lbyy			
14	M19	Floor Beam	19.333	1	1	Lbyy			
15	M22	Truss	9.541	1	1	1			
16	M23	Truss	19.847	1	1	1			
17	M24	Collar Tie	9.295	1	1	Lbyy			
18	M25	Floor Beam	19.333	1	1	Lbyy			
19	M28	Girder Truss	19.846	1	1	1			
20	M29	Girder Truss	19.847	1	1	1			
21	M30	Girder Collar Tie	9.295	1	1	Lbyy			
22	M31	Girder Floor Beam	19.333	1	1	Lbyy			
23	M32	Girder Vert. Kicker	4.184		Lbyy				
24	M33	Girder Vert. Kicker	4.183		Lbyy				
25	M34	Dormer Header	10		Lbyy				
26	M33B	Vert. Kicker	4.183		Lbyy				
27	M34A	Vert. Kicker	4.183		Lbyy				
28	M35	Vert. Kicker	4.183		Lbyy				
29	M40	Truss	9.541	1	1	1			
30	M41	Truss	19.847	1	1	1			
31	M42	Collar Tie	9.295	1	1	Lbyy			
32	M43	Floor Beam	19.333	1	1	Lbyy			
33	M44	Vert. Kicker	4.183		Lbyy				
34	M47	Diaphragm "Brace"	10						

Member Distributed Loads (BLC 1 : Dead Load)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M2	Y	-30	-30	0	%100
2	M1	Y	-30	-30	0	%100
3	M10	Y	-30	-30	0	%100
4	M11	Y	-30	-30	0	%100
5	M16	Y	-30	-30	0	%100
6	M17	Y	-30	-30	0	%100
7	M22	Y	-30	-30	0	%100
8	M23	Y	-30	-30	0	%100
9	M28	Y	-30	-30	0	%100
10	M29	Y	-30	-30	0	%100
11	M34	Y	-40	-40	0	%100
12	M40	Y	-30	-30	0	%100
13	M41	Y	-30	-30	0	%100

Member Distributed Loads (BLC 3 : Wind Load)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M1	y	-74	-74	0	%100
2	M2	y	74	74	0	%100
3	M10	y	-74	-74	0	%100
4	M11	y	74	74	0	%100
5	M16	y	-74	-74	0	%100
6	M17	y	74	74	0	%100
7	M22	y	-74	-74	0	%100
8	M23	y	74	74	0	%100
9	M28	y	-74	-74	0	%100

Member Distributed Loads (BLC 3 : Wind Load) (Continued)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
10	M29	y	74	74	0	%100
11	M34	Z	-74	-74	0	%100
12	M40	y	-74	-74	0	%100
13	M41	y	74	74	0	%100

Member Distributed Loads (BLC 4 : Snow Load)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M1	Y	-70	-70	0	%100
2	M2	Y	-70	-70	0	%100
3	M1	Y	-224	-224	0	5
4	M2	Y	-224	-224	0	5
5	M10	Y	-70	-70	0	%100
6	M10	Y	-120	-120	0	5
7	M11	Y	-70	-70	0	%100
8	M11	Y	-224	-224	0	5
9	M16	Y	-70	-70	0	%100
10	M16	Y	-120	-120	0	5
11	M17	Y	-70	-70	0	%100
12	M17	Y	-224	-224	0	5
13	M22	Y	-70	-70	0	%100
14	M22	Y	-120	-120	0	5
15	M23	Y	-70	-70	0	%100
16	M23	Y	-224	-224	0	5
17	M28	Y	-70	-70	0	%100
18	M28	Y	-224	-224	0	5
19	M29	Y	-70	-70	0	%100
20	M29	Y	-224	-224	0	5
21	M34	Y	-260	-260	0	%100
22	M40	Y	-70	-70	0	%100
23	M40	Y	-120	-120	0	5
24	M41	Y	-70	-70	0	%100
25	M41	Y	-224	-224	0	5

Member Distributed Loads (BLC 5 : Seismic Load)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M1	Z	-36	-36	0	%100
2	M2	Z	-36	-36	0	%100
3	M13	Z	-16	-16	0	%100
4	M4	Z	-16	-16	0	%100
5	M10	Z	-36	-36	0	%100
6	M11	Z	-36	-36	0	%100
7	M12	Z	-16	-16	0	%100
8	M13A	Z	-16	-16	0	%100
9	M16	Z	-36	-36	0	%100
10	M17	Z	-36	-36	0	%100
11	M18	Z	-16	-16	0	%100
12	M19	Z	-16	-16	0	%100
13	M22	Z	-36	-36	0	%100
14	M23	Z	-36	-36	0	%100
15	M24	Z	-16	-16	0	%100
16	M25	Z	-16	-16	0	%100
17	M28	Z	-36	-36	0	%100
18	M29	Z	-36	-36	0	%100

Member Distributed Loads (BLC 5 : Seismic Load) (Continued)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
19	M30	Z	-16	-16	0	%100
20	M31	Z	-16	-16	0	%100
21	M34	Z	-36	-36	0	%100
22	M40	Z	-36	-36	0	%100
23	M41	Z	-36	-36	0	%100
24	M42	Z	-16	-16	0	%100
25	M43	Z	-16	-16	0	%100

Member Distributed Loads (BLC 6 : BLC 1 Transient Area Loads)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M4	Y	-15	-15	4.718e-15	9.295
2	M12	Y	-30	-30	4.94e-15	9.295
3	M18	Y	-30	-30	4.829e-15	9.295
4	M24	Y	-30	-30	2.442e-15	9.295
5	M30	Y	-15	-15	0	9.295
6	M42	Y	-30	-30	4.94e-15	9.295
7	M13	Y	-15	-15	3.053e-15	19.333
8	M13A	Y	-30	-30	2.831e-15	19.333
9	M19	Y	-30	-30	2.665e-15	19.333
10	M25	Y	-30	-30	2.609e-15	19.333
11	M31	Y	-15	-15	2.665e-15	19.333
12	M43	Y	-30	-30	3.275e-15	19.333

1

Member Distributed Loads (BLC 7 : BLC 2 Transient Area Loads)

	Member Label	Direction	Start Magnitude [lb/ft, F, psf, lb-ft/ft]	End Magnitude [lb/ft, F, psf, lb-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M4	Y	-50	-50	4.718e-15	9.295
2	M12	Y	-100	-100	4.94e-15	9.295
3	M18	Y	-100	-100	4.829e-15	9.295
4	M24	Y	-100	-100	2.442e-15	9.295
5	M30	Y	-50	-50	0	9.295
6	M42	Y	-100	-100	4.94e-15	9.295
7	M13	Y	-50	-50	3.053e-15	19.333
8	M13A	Y	-100	-100	2.831e-15	19.333
9	M19	Y	-100	-100	2.665e-15	19.333
10	M25	Y	-100	-100	2.609e-15	19.333
11	M31	Y	-50	-50	2.665e-15	19.333
12	M43	Y	-100	-100	3.275e-15	19.333

Basic Load Cases

	BLC Description	Category	Y Gravity	Distributed	Area(Member)
1	Dead Load	DL	-1	13	2
2	Live Load	LL			2
3	Wind Load	WL		13	
4	Snow Load	SL		25	
5	Seismic Load	EL		25	
6	BLC 1 Transient Area Loads	None		12	
7	BLC 2 Transient Area Loads	None		12	

Load Combinations

	Description	Solve	P-Delta	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
1	Deflection 1	Yes	Y	DL	1										
2	Deflection 2	Yes	Y	LL	1										
3	Deflection 3	Yes	Y	DL	1	LL	1								
4	IBC 16-8	Yes	Y	DL	1										
5	IBC 16-9	Yes	Y	DL	1	LL	1	LLS	1						
6	IBC 16-10 (b)	Yes	Y	DL	1	SL	1	SLN	1						
7	IBC 16-11 (b)	Yes	Y	DL	1	LL	0.75	LLS	0.75	SL	0.75	SLN	0.75		
8	IBC 16-12 (a)	Yes	Y	DL	1	WL	0.6								
9	IBC 16-13 (a)	Yes	Y	DL	1	WL	0.45	LL	0.75	LLS	0.75				
10	IBC 16-13 (b)	Yes	Y	DL	1	WL	0.45	LL	0.75	LLS	0.75	SL	0.75	SLN	0.75
11	IBC 16-15	Yes	Y	DL	0.6	WL	0.6								
12	IBC 16-12 (b)	Yes	Y	DL	1	EL	0.7								
13	IBC 16-14 (a)	Yes	Y	DL	1	EL	0.525	LL	0.75	LLS	0.75				
14	IBC 16-14 (b)	Yes	Y	DL	1	EL	0.525	LL	0.75	LLS	0.75	SL	0.75	SLN	0.75
15	IBC 16-16	Yes	Y	DL	0.6	EL	0.7								

Envelope Node Reactions

	Node Label		X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb-ft]	LC	MZ [lb-ft]	LC
1	N2	max	0	7	8472.36	7	0	15	0	15	0	15	0	15
2		min	0	11	-115.87	11	0	1	0	1	0	1	0	1
3	N1	max	0	11	3803.68	10	2208.01	11	0	15	0	15	0	15
4		min	0	7	400.17	2	-3405.9	7	0	1	0	1	0	1
5	N8	max	0.36	11	0	11	0	7	0	15	0	15	0	15
6		min	-3.02	7	0	7	0	12	0	1	0	1	0	1
7	N10	max	1.31	7	0	10	0	10	0	15	0	15	0	15
8		min	-0.15	11	0	3	0	7	0	1	0	1	0	1
9	N11	max	2.09	5	0	5	0	10	0	15	0	15	0	15
10		min	-0.17	11	0	10	-0.01	3	0	1	0	1	0	1
11	N13	max	0.01	11	4656.89	14	2234.29	14	0	15	0	15	0	15
12		min	-0.37	6	958.58	11	531.98	1	0	1	0	1	0	1
13	N14A	max	0.09	11	999.12	5	0	15	LOCKED		LOCKED		0	15
14		min	-0.57	7	95.81	11	0	1	LOCKED		LOCKED		0	1
15	N22	max	0	11	4712.37	14	2184.18	14	0	15	0	15	0	15
16		min	-0.13	6	972.1	11	506.66	1	0	1	0	1	0	1
17	N23	max	0.03	11	1014.85	5	0	15	LOCKED		LOCKED		0	15
18		min	-0.19	7	91.91	11	0	1	LOCKED		LOCKED		0	1
19	N31	max	0.17	6	5109.29	14	2408.69	14	0	15	0	15	0	15
20		min	-0.02	14	1004.46	11	574.98	1	0	1	0	1	0	1
21	N32	max	0.27	7	1015.08	5	0	15	LOCKED		LOCKED		0	15
22		min	-0.04	11	91.96	11	0	1	LOCKED		LOCKED		0	1
23	N40	max	0	7	4172.2	10	2230.21	11	0	15	0	15	0	15
24		min	0	11	656.95	2	-3208.91	7	0	1	0	1	0	1
25	N41	max	0	11	8485.99	7	0	15	0	15	0	15	0	15
26		min	0	7	-116.85	11	0	1	0	1	0	1	0	1
27	N43A	max	0.1	11	3868.35	14	1828.56	14	0	15	0	15	0	15
28		min	-0.66	7	894.44	11	410.31	1	0	1	0	1	0	1
29	N44A	max	1.21	7	991.75	5	0	15	LOCKED		LOCKED		0	15
30		min	-0.23	11	97.13	11	0	1	LOCKED		LOCKED		0	1
31	Totals:	max	0	7	44361.39	7	8080.63	8						
32		min	0	11	6798.53	11	0	1						

Envelope Node Displacements

	Node Label		X [in]	LC	Y [in]	LC	Z [in]	LC	X Rotation [rad]	LC	Y Rotation [rad]	LC	Z Rotation [rad]	LC
1	N1	max	0	7	0	2	0	7	2.26e-3	5	0	6	1.76e-7	7
2		min	0	11	0	10	0	11	-1.95e-3	11	0	11	-1.53e-8	11
3	N2	max	0	11	0	11	0.02	7	3.5e-4	2	4.72e-8	11	3.46e-7	7
4		min	0	7	0	7	0	11	-2.32e-3	10	-5.28e-7	7	-3.02e-8	11
5	N3	max	0	7	0	11	0.02	7	3.52e-3	11	3.67e-8	11	0	11
6		min	0	11	-0.02	7	-0.01	11	-1.77e-3	3	-4.23e-7	7	-6.79e-8	7
7	N6	max	0	11	0.06	5	0.14	5	5.42e-4	5	7.45e-8	11	2.97e-7	7
8		min	0	7	-0.11	11	-0.2	11	-2.52e-4	11	-8.48e-7	7	-2.65e-8	11
9	N7	max	0	11	0.11	11	0.14	5	-5.75e-5	6	0	11	0	11
10		min	0	3	-0.08	3	-0.2	11	-1.03e-3	9	-9.12e-8	7	-6.98e-8	7
11	N8	max	0	7	0	7	0	12	3.52e-3	11	5.7e-4	7	4.45e-4	7
12		min	0	11	0	11	0	7	-1.77e-3	3	-2.68e-4	11	1.59e-5	11
13	N10	max	0	11	0	5	0	7	5.42e-4	5	3.81e-3	5	2.97e-3	11
14		min	0	7	0	10	0	10	-2.52e-4	11	-5.51e-3	11	-1.68e-3	3
15	N11	max	0	11	0	10	0	5	-5.75e-5	6	3.83e-3	5	2.17e-3	5
16		min	0	3	0	3	0	10	-1.03e-3	9	-5.46e-3	11	-2.93e-3	11
17	N14	max	0	7	0.05	11	0	7	1.92e-3	5	4.01e-8	7	1.96e-7	7
18		min	0	11	-0.06	3	0	11	-1.03e-3	11	0	11	-1.71e-8	11
19	N15	max	0	7	0.01	2	0.01	7	-4.13e-5	2	1.38e-8	11	3.25e-7	7
20		min	0	11	-0.06	8	0	11	-1.81e-3	10	-1.39e-7	7	-2.84e-8	11
21	N18	max	0	11	0.01	5	0.05	5	1.39e-3	5	4.83e-8	11	3.61e-7	7
22		min	0	7	-0.06	11	-0.11	11	-2.1e-3	11	-5.43e-7	7	-3.2e-8	11
23	N19	max	0	11	0.05	11	0.11	5	1.62e-3	5	0	6	0	6
24		min	0	7	-0.06	3	-0.09	11	-2.09e-3	11	0	11	0	11
25	N13	max	0	6	0	11	0	4	5.94e-3	7	7.82e-4	7	3.25e-3	7
26		min	0	11	0	14	0	14	-2.48e-3	11	-1.26e-4	11	-5.35e-4	11
27	N14A	max	0	7	0	11	0	5	0	15	0	15	3.25e-3	7
28		min	0	11	0	3	0	15	0	1	0	1	-5.35e-4	11
29	N15A	max	0	7	0.01	11	0.22	7	3.52e-3	11	3.27e-3	7	1.24e-3	7
30		min	0	11	-0.14	7	-0.03	11	-1.77e-3	3	-7.15e-4	11	-2.27e-4	11
31	N16	max	0	11	0.01	2	0.27	7	5.32e-4	11	6.2e-3	7	4.57e-3	6
32		min	0	7	-0.18	10	-0.23	11	-1.12e-3	7	-1.16e-3	11	-4.41e-5	11
33	N17	max	0	11	0.12	11	0.28	7	-5.75e-5	6	2.36e-3	7	1.85e-3	7
34		min	0	3	-0.17	7	-0.23	11	-1.03e-3	9	-4.11e-4	11	-2.57e-4	11
35	N18A	max	0.02	7	0.06	11	0	5	7.2e-3	5	8.2e-4	7	3.25e-3	7
36		min	0	11	-0.17	7	0	15	-1.6e-3	11	-1.32e-4	11	-5.35e-4	11
37	N21	max	0.02	7	0.06	11	0.29	7	2.82e-3	5	1.97e-3	7	1.11e-3	7
38		min	0	11	-0.17	7	-0.12	11	-2.42e-3	11	-3.2e-4	11	-1.88e-4	11
39	N22	max	0	6	0	11	0	4	7.19e-3	7	2.61e-4	7	1.08e-3	7
40		min	0	11	0	14	0	14	-2.71e-3	11	-4.25e-5	11	-1.82e-4	11
41	N23	max	0	7	0	11	0	5	0	15	0	15	1.08e-3	7
42		min	0	11	0	3	0	15	0	1	0	1	-1.82e-4	11
43	N24	max	0	7	0.01	11	0.34	7	3.52e-3	11	1.07e-3	7	4.11e-4	7
44		min	0	11	-0.21	7	-0.04	11	-1.77e-3	3	-2.45e-4	11	-7.7e-5	11
45	N25	max	0	11	0	2	0.37	7	7.95e-4	11	2.05e-3	7	1.57e-3	6
46		min	0	7	-0.25	10	-0.25	11	-1.51e-3	7	-3.96e-4	11	-5.17e-6	11
47	N26	max	0	11	0.13	11	0.38	7	-5.75e-5	6	7.81e-4	7	6.17e-4	7
48		min	0	3	-0.23	7	-0.25	11	-1.03e-3	9	-1.39e-4	11	-8.65e-5	11
49	N27	max	0.01	7	0.07	11	0	5	7.95e-3	5	2.73e-4	7	1.08e-3	7
50		min	0	11	-0.21	7	0	15	-1.79e-3	11	-4.47e-5	11	-1.82e-4	11
51	N30	max	0.01	7	0.07	11	0.35	7	3.83e-3	7	6.56e-4	7	3.68e-4	7
52		min	0	11	-0.2	7	-0.13	11	-2.63e-3	11	-1.08e-4	11	-6.37e-5	11
53	N31	max	0	14	0	11	0	4	7.18e-3	7	5.85e-5	11	2.48e-4	11
54		min	0	6	0	14	0	14	-2.71e-3	11	-3.77e-4	7	-1.55e-3	7
55	N32	max	0	11	0	11	0	5	0	15	0	15	2.48e-4	11

Envelope Node Displacements (Continued)

	Node Label		X [in]	LC	Y [in]	LC	Z [in]	LC	X Rotation [rad]	LC	Y Rotation [rad]	LC	Z Rotation [rad]	LC
56		min	0	7	0	3	0	15	0	1	0	1	-1.55e-3	7
57	N33	max	0	7	0.01	11	0.34	7	3.52e-3	11	3.26e-4	11	1.05e-4	11
58		min	0	11	-0.21	7	-0.04	11	-1.77e-3	3	-1.61e-3	7	-5.96e-4	7
59	N34	max	0	11	0	2	0.36	7	7.92e-4	11	5.34e-4	11	4.3e-5	11
60		min	0	7	-0.24	10	-0.25	11	-1.51e-3	7	-3.01e-3	7	-2.02e-3	7
61	N35	max	0	11	0.13	11	0.38	7	-5.75e-5	6	1.9e-4	11	1.2e-4	11
62		min	0	3	-0.23	7	-0.25	11	-1.03e-3	9	-1.13e-3	7	-8.85e-4	7
63	N36	max	0	11	0.07	11	0	5	7.96e-3	5	6.14e-5	11	2.48e-4	11
64		min	-0.01	7	-0.21	7	0	15	-1.79e-3	11	-3.94e-4	7	-1.55e-3	7
65	N39	max	0	11	0.07	11	0.34	7	3.8e-3	7	1.49e-4	11	8.7e-5	11
66		min	-0.01	7	-0.2	7	-0.13	11	-2.63e-3	11	-9.46e-4	7	-5.34e-4	7
67	N40	max	0	11	0	2	0	7	2.33e-3	5	0	11	0	11
68		min	0	7	0	10	0	11	-1.96e-3	11	-2.72e-8	7	-4.89e-8	7
69	N41	max	0	7	0	11	0.02	7	3.53e-4	2	5.93e-7	7	1.63e-8	11
70		min	0	11	0	7	0	11	-2.32e-3	10	-5.27e-8	11	-1.8e-7	7
71	N42	max	0	7	0	11	0.02	7	3.52e-3	11	4.25e-7	7	7.67e-8	7
72		min	0	11	-0.02	7	-0.01	11	-1.77e-3	3	-3.72e-8	11	0	11
73	N43	max	0	11	0.06	5	0.14	5	5.39e-4	5	8.23e-7	7	2.63e-8	11
74		min	0	7	-0.11	11	-0.2	11	-2.54e-4	11	-7.29e-8	11	-2.97e-7	7
75	N44	max	0	6	0.11	11	0.14	5	-5.75e-5	6	1.07e-7	7	7.56e-8	7
76		min	0	3	-0.08	3	-0.2	11	-1.03e-3	9	0	11	0	11
77	N45	max	0	11	0.05	11	0	7	1.96e-3	5	0	11	0	11
78		min	0	7	-0.06	3	0	11	-1.04e-3	11	-5.07e-8	7	-6.47e-8	7
79	N46	max	0	11	0.01	2	0.01	7	-4.27e-5	2	1.57e-7	7	1.49e-8	11
80		min	0	7	-0.06	8	0	11	-1.81e-3	10	-1.49e-8	11	-1.64e-7	7
81	N47	max	0	11	0.01	5	0.05	5	1.41e-3	5	5.83e-7	7	2.05e-8	11
82		min	0	7	-0.06	11	-0.11	11	-2.11e-3	11	-5.2e-8	11	-2.3e-7	7
83	N48	max	0	7	0.05	11	0.11	5	1.67e-3	5	1.61e-8	7	0	7
84		min	0	11	-0.06	3	-0.09	11	-2.1e-3	11	0	11	0	11
85	N43A	max	0	7	0	11	0	4	5.38e-3	7	3.12e-4	11	1.37e-3	11
86		min	0	11	0	14	0	14	-2.4e-3	11	-1.63e-3	7	-7.62e-3	7
87	N44A	max	0	11	0	11	0	5	0	15	0	15	1.37e-3	11
88		min	0	7	0	3	0	15	0	1	0	1	-7.62e-3	7
89	N45A	max	0	7	0.01	11	0.18	7	3.52e-3	11	6.19e-4	11	3.02e-4	11
90		min	0	11	-0.11	7	-0.02	11	-1.77e-3	3	-6.5e-3	7	-3.89e-3	7
91	N46A	max	0	11	0.02	2	0.25	5	5.33e-4	11	1.12e-3	11	3.95e-5	11
92		min	0	7	-0.17	10	-0.23	11	-1.14e-3	7	-5.97e-3	7	-4.46e-3	6
93	N47A	max	0	6	0.12	11	0.25	5	-5.75e-5	6	1.08e-3	11	5.76e-4	11
94		min	0	3	-0.15	3	-0.22	11	-1.03e-3	9	-5.79e-3	7	-3.46e-3	7
95	N48A	max	0.01	11	0.06	11	0	5	6.85e-3	5	3.29e-4	11	1.37e-3	11
96		min	-0.05	7	-0.16	3	0	15	-1.54e-3	11	-1.75e-3	7	-7.62e-3	7
97	N49	max	0	11	0.06	11	0.26	5	2.47e-3	5	8.03e-4	11	4.88e-4	11
98		min	-0.01	7	-0.15	7	-0.12	11	-2.35e-3	11	-4.41e-3	7	-2.64e-3	7
99	N50	max	0	11	0.06	5	0.14	5	5.39e-4	5	8.23e-7	7	2.63e-8	11
100		min	0	7	-0.11	11	-0.2	11	-2.54e-4	11	-7.29e-8	11	-2.97e-7	7
101	N51	max	0	11	0.06	5	0.14	5	5.42e-4	5	7.45e-8	11	2.97e-7	7
102		min	0	7	-0.1	11	-0.2	11	-2.52e-4	11	-8.48e-7	7	-2.65e-8	11
103	N52	max	0	11	0.02	2	0.25	5	5.4e-4	5	1.11e-3	11	3.95e-5	11
104		min	0	7	-0.16	10	-0.23	11	-2.53e-4	11	-5.89e-3	7	-4.46e-3	6
105	N53	max	0	11	0	2	0.36	7	5.4e-4	5	5.2e-4	11	4.3e-5	11
106		min	0	7	-0.22	10	-0.25	11	-2.53e-4	11	-2.93e-3	7	-2.02e-3	7
107	N54	max	0	11	0	2	0.37	7	5.41e-4	5	2.01e-3	7	1.57e-3	6
108		min	0	7	-0.23	10	-0.25	11	-2.53e-4	11	-3.88e-4	11	-5.17e-6	11
109	N55	max	0	11	0.02	2	0.27	7	5.41e-4	5	6.15e-3	7	4.57e-3	6
110		min	0	7	-0.16	10	-0.23	11	-2.53e-4	11	-1.15e-3	11	-4.41e-5	11

Envelope Beam Deflections

	Member Label	Span		Location [ft]	y' [in]	(n) L'/y' Ratio	LC
1	M1	1	max	2.69	0	NC	11
2		1	min	2.69	-0.01	4948	7
3		2	max	5.17	0	NC	15
4		2	min	19.85	0.52	697	11
5	M2	1	max	0.83	0	NC	15
6		1	min	2.69	-0.01	5289	10
7		2	max	5.17	0	NC	8
8		2	min	19.85	0.49	731	3
9	M4	1	max	0.1	0	NC	12
10		1	min	4.65	-0.12	925	3
11	M13	1	max	1.81	0	NC	6
12		1	min	0	0	NC	1
13		2	max	2.62	0	NC	2
14		2	min	8.46	-0.08	2093	10
15		3	max	18.73	0	NC	10
16		3	min	17.92	0	6512	11
17	M10	1	max	0.1	0	NC	12
18		1	min	4.77	-0.06	1781	10
19	M11	1	max	4.75	0	NC	11
20		1	min	2.69	-0.03	1685	7
21		2	max	6.62	0	NC	11
22		2	min	19.85	1.19	304	3
23	M12	1	max	9.2	0	NC	15
24		1	min	4.65	-0.46	243	3
25	M13A	1	max	0.4	0	NC	11
26		1	min	8.06	-0.71	286	3
27		2	max	17.72	0	NC	5
28		2	min	18.12	0	5784	9
29	M16	1	max	0.1	0	NC	12
30		1	min	4.67	-0.07	1590	10
31	M17	1	max	4.75	0	NC	2
32		1	min	2.69	-0.03	1659	7
33		2	max	10.75	0	NC	15
34		2	min	19.85	1.32	274	3
35	M18	1	max	0.1	0	NC	15
36		1	min	4.65	-0.46	243	3
37	M19	1	max	0.6	0	NC	11
38		1	min	8.06	-0.74	274	3
39		2	max	18.73	0	NC	14
40		2	min	17.12	-0.01	4565	7
41	M22	1	max	0.99	0	NC	5
42		1	min	4.67	-0.07	1582	10
43	M23	1	max	4.75	0	NC	2
44		1	min	2.69	-0.03	1659	7
45		2	max	15.71	0	NC	12
46		2	min	19.85	1.32	274	3
47	M24	1	max	0.1	0	NC	15
48		1	min	4.65	-0.46	243	3
49	M25	1	max	5.03	0	NC	11
50		1	min	8.06	-0.75	273	3
51		2	max	18.73	0	NC	14
52		2	min	17.12	-0.01	4572	7
53	M28	1	max	2.69	0	NC	11
54		1	min	2.69	-0.01	4925	7
55		2	max	5.17	0	NC	15

Envelope Beam Deflections (Continued)

	Member Label	Span		Location [ft]	y' [in]	(n) L'/y' Ratio	LC
56		2	min	19.85	0.52	697	11
57	M29	1	max	0.83	0	NC	15
58		1	min	2.69	-0.01	5302	10
59		2	max	5.17	0	NC	8
60		2	min	19.85	0.5	717	3
61	M30	1	max	0.1	0	NC	12
62		1	min	4.65	-0.12	925	3
63	M31	1	max	1.41	0	NC	9
64		1	min	0	0	NC	1
65		2	max	12.08	0	NC	15
66		2	min	8.66	-0.08	2077	10
67		3	max	18.73	0	NC	2
68		3	min	17.92	0	6479	11
69	M34	1	max	8.75	0	NC	11
70		1	min	5.1	-0.22	544	6
71	M40	1	max	0.1	0	NC	12
72		1	min	4.77	-0.06	1795	10
73	M41	1	max	0.21	0	NC	4
74		1	min	2.69	-0.03	1698	7
75		2	max	6.82	0	NC	11
76		2	min	19.85	1.13	320	3
77	M42	1	max	0.1	0	NC	15
78		1	min	4.65	-0.46	243	3
79	M43	1	max	14.1	0	NC	15
80		1	min	8.06	-0.7	292	3
81		2	max	18.33	0	NC	6
82		2	min	18.12	0.01	5479	9
83	M47	1	max	9.79	0	NC	12
84		1	min	5.21	0.29	414	7

Envelope Maximum Member Section Forces

	Member		Axial[lb]	Loc[ft]	LC	y Shear[lb]	Loc[ft]	LC	z Shear[lb]	Loc[ft]	LC	Torque[lb-ft]	Loc[ft]	LC	y-y Moment[lb-ft]	Loc[ft]	LC	z-z Moment[lb-ft]	Loc[ft]	LC
1	M1	max	10017.74	0	7	694.83	0	10	0	19.85	7	0.02	10.13	7	0.02	10.13	7	2528.51	10.13	5
2		min	-1546.03	4.75	11	-865.18	10.13	7	0	10.34	11	-0.03	10.34	7	-0.02	10.34	7	-1964.26	10.13	11
3	M2	max	4736.36	0	10	622.27	0	6	0	19.85	7	0.02	19.85	7	0.03	19.85	7	2185.42	10.13	11
4		min	-206.2	19.85	3	-610.06	10.13	10	0	10.34	11	0	10.34	11	-0.01	10.34	7	-1821.33	10.13	3
5	M4	max	1087.31	9.29	10	323.82	0	5	0	9.29	15	0	9.29	11	0	9.29	15	0	9.29	15
6		min	-54.72	0	2	-323.82	9.29	3	0	0	1	-0.01	0	7	0	0	1	-752.43	4.65	3
7	M5	max	3.02	3	7	0	3	15	0	3	15	0	3	15	0	3	15	0	3	15
8		min	-0.36	0	11	0	0	1	0	0	1	0	0	1	0	3	6	0	0	1
9	M6	max	0.15	3	11	0	3	15	0	3	15	0	3	15	0	3	11	0	3	5
10		min	-1.31	0	7	0	0	1	0	0	1	0	0	1	0	3	3	0	3	8
11	M7	max	0.17	3	11	0	3	15	0	3	15	0	3	15	0	3	11	0	3	8
12		min	-2.09	0	3	0	0	1	0	0	1	0	0	1	0	3	3	0	3	3
13	M13	max	835.18	19.33	11	1198.76	17.12	11	0	2.22	7	0	19.33	11	0.01	19.33	7	2724.49	16.92	11
14		min	-4304.15	17.12	7	-1184.05	2.22	3	0	2.42	11	0	0	7	-0.02	2.42	7	-2464.61	2.42	11
15	M14	max	1303.54	0	11	0	4.18	15	0	4.18	15	0.02	4.18	7	0	4.18	15	0	4.18	15
16		min	-1992.69	4.18	3	0	0	1	0	0	1	0	0	11	0	0	1	0	0	1
17	M15	max	67.11	4.18	2	0	4.18	15	0	4.18	15	0	4.18	7	0	4.18	15	0	4.18	15
18		min	-1694.37	4.18	8	0	0	1	0	0	1	0	0	11	0	0	1	0	0	1
19	M10	max	1385.2	0	6	547.23	0	10	1.17	9.54	11	9.45	9.54	5	129.54	0	7	458.76	0	7
20		min	-516.5	9.54	11	-391.82	9.54	10	-13.58	0	7	-4.02	0	11	-11.19	0	11	-1011.46	4.57	10
21	M11	max	5809.27	0	10	907.27	0	7	2.14	4.75	7	2.11	19.85	11	10.19	4.75	7	1636.96	10.13	10
22		min	-55.85	10.34	2	-851.05	10.13	14	-0.75	10.34	3	-10.11	4.96	7	-8.04	19.85	3	-2939.99	4.75	3
23	M12	max	1521.83	9.29	7	615.02	0	5	0	9.29	15	-0.85	9.29	15	0	9.29	15	0	9.29	15

Envelope Maximum Member Section Forces (Continued)

	Member		Axial[lb]	Loc[ft]	LC	y Shear[lb]	Loc[ft]	LC	z Shear[lb]	Loc[ft]	LC	Torque[lb-ft]	Loc[ft]	LC	y-y Moment[lb-ft]	Loc[ft]	LC	z-z Moment[lb-ft]	Loc[ft]	LC
24		min	140.53	0	11	-615.02	9.29	3	0	0	1	-13.64	0	6	0	0	1	-1429.07	4.65	3
25	M13A	max	217.22	19.33	15	1264.97	17.12	9	0.14	19.33	11	0	19.33	15	1.82	17.12	7	2594.48	16.92	9
26		min	-13.75	17.12	3	-1268.36	16.92	3	-0.82	17.12	7	0	0	1	-9.62	16.92	7	-3723.53	7.45	3
27	M16	max	1292.72	0	6	526.66	0	10	0.38	9.54	11	3.11	9.54	5	43.58	0	7	169.49	0	5
28		min	-533.11	9.54	11	-412.39	9.54	10	-4.57	0	7	-1.4	0	11	-3.65	0	11	-1115.04	4.37	10
29	M17	max	5745.68	0	10	924.15	0	7	0.71	4.75	7	0.74	19.85	11	3.37	4.75	7	1504.37	10.34	10
30		min	-47.17	10.34	2	-770.47	10.13	14	-0.24	10.34	3	-3.35	4.96	7	-2.64	19.85	3	-2998.63	4.75	3
31	M18	max	1473.72	9.29	14	615.02	0	5	0	9.29	15	-0.31	9.29	15	0	9.29	15	0	9.29	15
32		min	174.61	0	15	-615.02	9.29	3	0	0	1	-4.76	0	6	0	0	1	-1429.07	4.65	3
33	M19	max	217.29	19.33	15	1209.8	17.12	9	0.05	19.33	11	0	19.33	15	0.59	17.12	7	2466.4	16.92	9
34		min	-15.13	17.12	3	-1252.63	16.92	3	-0.27	17.12	7	0	0	1	-3.2	16.92	7	-3841.03	7.65	3
35	M22	max	3576.06	0	6	525.7	0	10	6.28	9.54	7	1.78	9.54	11	5.51	0	11	162.79	0	5
36		min	-710.21	9.54	11	-413.35	9.54	10	-0.58	0	11	-4.67	0	3	-59.89	0	7	-1120.04	4.37	10
37	M23	max	6176.36	0	10	924.05	0	7	0.38	19.85	5	4.83	10.13	7	3.98	19.85	5	1506.34	10.34	10
38		min	-45.23	10.34	2	-773.51	10.13	14	-1.06	0	7	-0.93	10.34	11	-5.02	4.75	7	-2999.39	4.75	3
39	M24	max	2720.38	9.29	7	615.02	0	5	0	9.29	15	5.74	9.29	6	0	9.29	15	0	9.29	15
40		min	-91.59	0	11	-615.02	9.29	3	0	0	1	0.33	0	15	0	0	1	-1429.07	4.65	3
41	M25	max	217.29	19.33	15	1208.39	17.12	9	0.38	19.33	7	0	19.33	15	4.62	16.92	7	2463.13	16.92	9
42		min	-15.08	17.12	3	-1252.41	16.92	3	-0.06	17.12	11	0	0	1	-0.84	17.12	7	-3842.74	7.65	3
43	M28	max	10049.95	0	7	696.19	0	10	0	4.75	7	0.03	19.85	7	0.04	10.34	7	2557.42	10.13	5
44		min	-1551.02	4.75	11	-873.89	10.13	7	0	10.34	7	-0.02	4.96	7	-0.01	4.96	7	-1971.38	10.13	11
45	M29	max	5137.49	0	10	621.68	0	6	0	4.75	7	0	19.85	11	0.01	10.34	7	2202.16	10.13	11
46		min	-184.52	19.85	3	-606.76	4.96	11	0	10.34	7	-0.02	10.34	7	-0.03	19.85	7	-1886.46	10.13	3
47	M30	max	2023.54	9.29	7	323.82	0	5	0	9.29	15	0.01	9.29	7	0	9.29	15	0	9.29	15
48		min	251.57	0	15	-323.82	9.29	3	0	0	1	0	0	11	0	0	1	-752.43	4.65	3
49	M31	max	837.11	19.33	11	1204.03	17.12	11	0	16.92	11	0	2.22	7	0.02	2.42	7	2736.67	16.92	11
50		min	-4317.84	17.12	7	-1198.21	2.22	3	0	0	7	0	2.42	11	-0.01	19.33	7	-2473.06	2.42	11
51	M32	max	1308.63	0	11	0	4.18	15	0	4.18	15	0	4.18	11	0	4.18	15	0	4.18	15
52		min	-2012.91	4.18	3	0	0	1	0	0	1	-0.03	0	7	0	0	1	0	0	1
53	M33	max	86.47	4.18	2	0	4.18	15	0	4.18	15	0	4.18	11	0	4.18	15	0	4.18	15
54		min	-1696.86	4.18	8	0	0	1	0	0	1	0	0	7	0	0	1	0	0	1
55	M34	max	1.7	5.94	11	4518.45	2.08	7	517.42	10	7	609.75	1.98	7	281.53	4.9	11	191.96	3.96	11
56		min	-19.35	4.06	7	-4626.14	10	6	-677.26	2.08	7	-604.24	8.02	7	-1522.54	3.96	7	-12232.95	3.96	7
57	M30A	max	14.88	4	7	2167.1	2	7	1152.79	4	7	235.96	2	5	203.09	2	11	251.34	2	11
58		min	-0.89	2	11	-2163.24	2.04	7	-1156.44	0	7	-398.72	0	6	-2312.88	2	7	-4334.2	2	7
59	M31A	max	20.99	2	7	0	2	15	0	2	15	2.3	2	2	0	2	15	0	2	15
60		min	-1.26	0	11	0	0	1	0	0	1	-14.55	0	6	0	0	1	0	0	1
61	M32A	max	16.45	2	7	0	2	15	0	2	15	353.82	2	6	0	2	7	0	2	7
62		min	-1.05	0	11	0	0	1	0	0	1	-156.51	0	3	0	0	1	0	0	1
63	M33A	max	3.02	2	7	0	2	15	0	2	15	409.74	2	6	0	2	7	0	2	7
64		min	-0.36	0	11	0	0	1	0	0	1	-286.85	0	3	0	0	1	0	0	1
65	M33B	max	-209.31	4.18	6	0	4.18	15	0	4.18	15	5.53	4.18	7	0	4.18	15	0	4.18	15
66		min	-2335.19	0	3	0	0	1	0	0	1	-0.87	0	11	0	0	1	0	0	1
67	M34A	max	-205.51	4.18	6	0	4.18	15	0	4.18	15	0.64	4.18	11	0	4.18	15	0	4.18	15
68		min	-2337.05	0	3	0	0	1	0	0	1	-3.84	0	7	0	0	1	0	0	1
69	M35	max	-343.5	4.18	6	0	4.18	15	0	4.18	15	1.88	4.18	11	0	4.18	15	0	4.18	15
70		min	-2467.4	0	3	0	0	1	0	0	1	-11.58	0	7	0	0	1	0	0	1
71	M36	max	0.17	2	11	0	2	15	0	2	15	809.6	2	6	0	2	7	0	2	15
72		min	-2.1	0	3	0	0	1	0	0	1	-1673.95	0	3	0	2	11	0	2	7
73	M37	max	0.1	2	6	0	2	15	0	2	15	758.77	2	6	0	2	7	0	2	15
74		min	-1.23	0	10	0	0	1	0	0	1	-654.15	0	2	0	0	1	0	2	7
75	M38	max	0.23	2	6	0	2	15	0	2	15	10.91	2	11	0	2	15	0	2	15
76		min	-1.21	0	10	0	0	1	0	0	1	-110.17	0	7	0	0	1	0	0	1
77	M39	max	0	4	11	358.4	1.96	5	1061.62	1.96	7	1690.45	4	5	2132.95	2	7	0	4	6
78		min	-1.37	0	14	-368.4	2	3	-1066.48	2	7	-956.57	0	6	-564.06	2	11	-736.79	2	3

Envelope Maximum Member Section Forces (Continued)

	Member		Axial[lb]	Loc[ft]	LC	y Shear[lb]	Loc[ft]	LC	z Shear[lb]	Loc[ft]	LC	Torque[lb-ft]	Loc[ft]	LC	y-y Moment[lb-ft]	Loc[ft]	LC	z-z Moment[lb-ft]	Loc[ft]	LC
79	M40	max	8.03	0	11	548.58	0	10	13.18	9.54	7	13.31	9.54	6	10.75	0	11	474.65	0	7
80		min	-4792.16	9.54	7	-390.47	9.54	10	-1.13	0	11	-5.32	0	2	-125.71	0	7	-1004.79	4.57	10
81	M41	max	5019.54	0	10	899.78	0	7	0.28	4.75	11	23.3	10.13	7	7.89	10.34	14	1823.28	10.13	10
82		min	-69.7	19.85	3	-884.22	10.13	14	-2.63	0	7	-5.29	10.34	2	-12.51	4.75	7	-2913.3	4.75	3
83	M42	max	685.52	9.29	11	615.02	0	5	0	9.29	15	8.14	9.29	6	0	9.29	15	0	9.29	15
84		min	-959.38	0	7	-615.02	9.29	3	0	0	1	-2.43	0	2	0	0	1	-1429.07	4.65	3
85	M43	max	217.2	19.33	15	1293.64	17.12	9	2.59	19.33	7	0	19.33	15	20.52	16.92	7	2661.05	16.92	9
86		min	-13.17	17.12	3	-1275.73	16.92	3	-0.37	17.12	11	0	0	1	-5.74	17.12	7	-3668.6	7.45	3
87	M44	max	-403.4	4.18	6	0	4.18	15	0	4.18	15	26.67	4.18	7	0	4.18	15	0	4.18	15
88		min	-2528.49	0	3	0	0	1	0	0	1	-4.75	0	11	0	0	1	0	0	1
89	M45	max	237.88	0.69	11	39.1	0.69	8	0.1	0.69	7	0	0.69	15	0.01	0	11	26.94	0	8
90		min	-859.9	0	7	-11.13	0	2	-0.01	0	11	0	0	1	-0.07	0	7	-7.63	0	2
91	M46	max	538.17	0.69	11	68.09	0.69	7	0.01	0.69	11	0	0.69	15	0.07	0	7	46.22	0	7
92		min	-2888.49	0	7	9.63	0	2	-0.1	0	7	0	0	1	-0.01	0	11	-0.61	0.69	6
93	M47	max	0.01	1.98	11	2888.49	10	7	69.58	10	7	-0.01	10	2	21.7	1.98	2	8600.96	5.94	7
94		min	-0.1	8.02	7	-3421.91	2.08	7	-39.13	0	8	-0.61	8.02	6	-873.93	4.06	7	-1580.85	5.94	11
95	M48	max	311.44	0.69	11	0	0.69	15	0	0.69	15	57.35	0.69	11	0	0.69	7	0	0.69	6
96		min	-2562	0	7	0	0	6	0	0	1	-609.37	0	6	0	0	1	0	0	1
97	M49	max	3402.65	0.69	7	0	0.69	6	0	0.69	15	27.28	0.69	11	0	0.69	7	0	0.69	15
98		min	-546.01	0	11	0	0	1	0	0	1	-336.11	0	7	0	0	1	0	0.69	6
99	M50	max	1431.85	0.69	7	0	0.69	6	0	0.69	15	56.46	0.69	6	0	0.69	15	0	0.69	15
100		min	-255.68	0	11	0	0	1	0	0	1	-6.51	0	11	0	0	1	0	0.69	6
101	M51	max	1475.9	0.69	7	0	0.69	6	0	0.69	15	537.65	0.69	6	0	0.69	15	0	0.69	15
102		min	-285.8	0	11	0	0	1	0	0	1	-51.25	0	11	0	0.69	7	0	0.69	6

Envelope Member End Reactions

	Member	Member End		Axial[lb]	LC	y Shear[lb]	LC	z Shear[lb]	LC	Torque[lb-ft]	LC	y-y Moment[lb-ft]	LC	z-z Moment[lb-ft]	LC
1	M1	I	max	10017.74	7	694.83	10	0	7	0	7	0	11	0	15
2			min	-1451.14	11	109.39	15	0	11	0	11	0	7	0	1
3		J	max	221.54	7	145.58	2	0	7	0	11	0	15	0	15
4			min	-686.43	11	-447.34	8	0	11	-0.03	7	0	1	0	1
5	M2	I	max	4736.36	10	622.27	6	0	15	0.01	7	0	15	0	15
6			min	-45.95	2	44.33	11	0	7	0	11	0	1	0	1
7		J	max	738.29	11	352.35	11	0	7	0.02	7	0.03	7	409.74	6
8			min	-206.2	3	-244.29	6	0	11	0	11	0	11	-286.85	3
9	M4	I	max	1087.31	10	323.82	5	0	15	0	11	0	15	0	15
10			min	-54.72	2	54.87	15	0	1	-0.01	7	0	1	0	1
11		J	max	1087.31	10	-54.87	11	0	15	0	11	0	15	0	15
12			min	-54.72	2	-323.82	3	0	1	-0.01	7	0	1	0	1
13	M5	I	max	3.02	7	0	15	0	15	0	15	0	15	0	15
14			min	-0.36	11	0	1	0	1	0	1	0	1	0	1
15		J	max	3.02	7	0	15	0	15	0	15	0	15	0	15
16			min	-0.36	11	0	1	0	1	0	1	0	6	0	1
17	M6	I	max	0.15	11	0	15	0	15	0	15	0	15	0	15
18			min	-1.31	7	0	1	0	1	0	1	0	1	0	1
19		J	max	0.15	11	0	15	0	15	0	15	0	11	0	5
20			min	-1.31	7	0	1	0	1	0	1	0	3	0	8
21	M7	I	max	0.17	11	0	15	0	15	0	15	0	15	0	15
22			min	-2.09	3	0	1	0	1	0	1	0	1	0	1
23		J	max	0.17	11	0	15	0	15	0	15	0	11	0	8
24			min	-2.09	3	0	1	0	1	0	1	0	3	0	3
25	M13	I	max	834.95	11	1081.79	11	0	7	0	11	0	15	0	15
26			min	-4303.88	7	-1022.16	3	0	11	0	7	0	1	0	1
27		J	max	835.18	11	1168.08	11	0	7	0	11	0.01	7	0	15
28			min	-4304.15	7	-501.11	3	0	11	0	7	0	11	0	1

Envelope Member End Reactions (Continued)

	Member	Member End		Axial[lb]	LC	y Shear[lb]	LC	z Shear[lb]	LC	Torque[lb-ft]	LC	y-y Moment[lb-ft]	LC	z-z Moment[lb-ft]	LC
29	M14	I	max	1303.54	11	0	15	0	15	0.02	7	0	15	0	15
30			min	-1973.11	3	0	1	0	1	0	11	0	1	0	1
31		J	max	1291.8	11	0	15	0	15	0.02	7	0	15	0	15
32			min	-1992.69	3	0	1	0	1	0	11	0	1	0	1
33	M15	I	max	67.11	2	0	15	0	15	0	7	0	15	0	15
34			min	-1674.8	8	0	1	0	1	0	11	0	1	0	1
35		J	max	67.11	2	0	15	0	15	0	7	0	15	0	15
36			min	-1694.37	8	0	1	0	1	0	11	0	1	0	1
37	M10	I	max	1385.2	6	547.23	10	1.17	11	9.45	5	129.54	7	458.76	7
38			min	-346.3	11	26.14	2	-13.58	7	-4.02	11	-11.19	11	-192.57	11
39		J	max	115.68	5	26.14	2	1.17	11	9.45	5	0	15	0	15
40			min	-516.5	11	-391.82	10	-13.58	7	-4.02	11	0	1	0	1
41	M11	I	max	5809.27	10	907.27	7	2.14	7	0	15	0	15	0	15
42			min	1472.97	1	-59.87	11	-0.17	11	0	1	0	1	0	1
43		J	max	520.82	8	293.3	11	0.49	11	2.11	11	3.42	11	130.34	5
44			min	-55.85	2	-159.45	7	-0.75	3	-4.97	3	-8.04	3	-121.47	11
45	M12	I	max	1521.83	7	615.02	5	0	15	-0.85	15	0	15	0	15
46			min	140.53	11	90.17	11	0	1	-13.64	6	0	1	0	1
47		J	max	1521.83	7	-90.17	15	0	15	-0.85	15	0	15	0	15
48			min	140.53	11	-615.02	3	0	1	-13.64	6	0	1	0	1
49	M13A	I	max	0	15	999.12	5	0.09	11	0	15	0	15	0	15
50			min	0	1	95.81	11	-0.57	7	0	1	0	1	0	1
51		J	max	217.22	15	1023.42	9	0.14	11	0	15	0	15	0	15
52			min	-13.75	3	-27.01	6	-0.82	7	0	1	0	1	0	1
53	M16	I	max	1292.72	6	526.66	10	0.38	11	3.11	5	43.58	7	169.49	5
54			min	-362.91	11	12.07	2	-4.57	7	-1.4	11	-3.65	11	-98.18	11
55		J	max	107.47	5	12.07	2	0.38	11	3.11	5	0	15	0	15
56			min	-533.11	11	-412.39	10	-4.57	7	-1.4	11	0	1	0	1
57	M17	I	max	5745.68	10	924.15	7	0.71	7	0	15	0	15	0	15
58			min	1429.43	1	-62.96	11	-0.06	11	0	1	0	1	0	1
59		J	max	576.07	10	312.65	11	0.17	11	0.74	11	1.19	11	157.98	2
60			min	-47.17	2	-124.01	3	-0.24	3	-1.63	3	-2.64	3	-368.37	6
61	M18	I	max	1456.25	7	615.02	5	0	15	-0.31	15	0	15	0	15
62			min	174.61	15	90.17	15	0	1	-4.76	6	0	1	0	1
63		J	max	1473.72	14	-90.17	11	0	15	-0.31	15	0	15	0	15
64			min	183.81	11	-615.02	3	0	1	-4.76	6	0	1	0	1
65	M19	I	max	0	15	1014.85	5	0.03	11	0	15	0	15	0	15
66			min	0	1	91.91	11	-0.19	7	0	1	0	1	0	1
67		J	max	217.29	15	968.25	9	0.05	11	0	15	0	15	0	15
68			min	-15.13	3	-148.35	6	-0.27	7	0	1	0	1	0	1
69	M22	I	max	3576.06	6	525.7	10	6.28	7	1.78	11	5.51	11	162.79	5
70			min	-540.02	11	11.77	2	-0.58	11	-4.67	3	-59.89	7	-94.57	11
71		J	max	2409.7	7	11.77	2	6.28	7	1.78	11	0	15	0	15
72			min	-710.21	11	-413.35	10	-0.58	11	-4.67	3	0	1	0	1
73	M23	I	max	6176.36	10	924.05	7	0.08	11	0	15	0	15	0	15
74			min	1568.77	1	-63	11	-1.06	7	0	1	0	1	0	1
75		J	max	649.89	10	313.51	11	0.38	5	2.46	5	3.98	5	177.68	5
76			min	-45.23	2	-128.3	3	-0.21	11	-0.93	11	-1.51	11	-384.16	6
77	M24	I	max	2720.38	7	615.02	5	0	15	5.74	6	0	15	0	15
78			min	-91.59	11	90.17	15	0	1	0.33	15	0	1	0	1
79		J	max	2720.38	7	-90.17	11	0	15	5.74	6	0	15	0	15
80			min	-91.59	11	-615.02	3	0	1	0.33	15	0	1	0	1
81	M25	I	max	0	15	1015.08	5	0.27	7	0	15	0	15	0	15
82			min	0	1	91.96	11	-0.04	11	0	1	0	1	0	1
83		J	max	217.29	15	966.84	9	0.38	7	0	15	0	15	0	15

Envelope Member End Reactions (Continued)

	Member	Member End		Axial[lb]	LC	y Shear[lb]	LC	z Shear[lb]	LC	Torque[lb-ft]	LC	y-y Moment[lb-ft]	LC	z-z Moment[lb-ft]	LC
84			min	-15.08	3	-145	6	-0.06	11	0	1	0	1	0	1
85	M28	I	max	10049.95	7	696.19	10	0	7	0	11	0	7	0	15
86			min	-1456.13	11	109.19	15	0	11	0	7	0	11	0	1
87		J	max	2653.32	7	146.24	2	0	11	0.03	7	0	15	0	15
88			min	-863.12	11	-447.76	8	0	7	0	11	0	1	0	1
89	M29	I	max	5137.49	10	621.68	6	0	7	0	11	0	15	0	15
90			min	230.98	2	44.39	11	0	11	-0.01	7	0	1	0	1
91		J	max	769.98	11	356.01	11	0	11	0	11	0	11	398.72	6
92			min	-184.52	3	-241.98	6	0	7	-0.02	7	-0.03	7	-235.96	3
93	M30	I	max	2023.54	7	323.82	5	0	15	0.01	7	0	15	0	15
94			min	251.57	15	54.87	15	0	1	0	11	0	1	0	1
95		J	max	2023.54	7	-54.87	11	0	15	0.01	7	0	15	0	15
96			min	279.08	11	-323.82	3	0	1	0	11	0	1	0	1
97	M31	I	max	836.87	11	1085.47	11	0	11	0	7	0	15	0	15
98			min	-4317.6	7	-1036.32	3	0	7	0	11	0	1	0	1
99		J	max	837.11	11	1173.35	11	0	11	0	7	0	11	0	15
100			min	-4317.84	7	-524.73	3	0	7	0	11	-0.01	7	0	1
101	M32	I	max	1308.63	11	0	15	0	15	0	11	0	15	0	15
102			min	-1993.33	3	0	1	0	1	-0.03	7	0	1	0	1
103		J	max	1296.88	11	0	15	0	15	0	11	0	15	0	15
104			min	-2012.91	3	0	1	0	1	-0.03	7	0	1	0	1
105	M33	I	max	86.47	2	0	15	0	15	0	11	0	15	0	15
106			min	-1677.29	8	0	1	0	1	0	7	0	1	0	1
107		J	max	86.47	2	0	15	0	15	0	11	0	15	0	15
108			min	-1696.86	8	0	1	0	1	0	7	0	1	0	1
109	M34	I	max	0.1	7	2696.23	6	73.33	11	609.75	7	0	15	0	15
110			min	-0.01	11	101.65	11	-126.09	7	-290.27	11	0	1	0	1
111		J	max	0.14	11	48.59	11	517.42	7	289.62	11	0	15	0	15
112			min	-1.2	7	-4626.14	6	-130.66	11	-604.24	7	0	1	0	1
113	M30A	I	max	0	7	2167.1	7	97.79	11	235.96	5	0	15	0	15
114			min	0	1	-125.2	11	-1156.44	7	-398.72	6	0	1	0	1
115		J	max	14.88	7	125.67	11	1152.79	7	178.39	5	0	15	0	6
116			min	-0.89	11	-2163.24	7	-101.54	11	-398.71	6	0	6	0	10
117	M31A	I	max	20.99	7	0	15	0	15	2.3	2	0	15	0	15
118			min	-1.26	11	0	1	0	1	-14.55	6	0	1	0	1
119		J	max	20.99	7	0	15	0	15	2.3	2	0	15	0	15
120			min	-1.26	11	0	1	0	1	-14.55	6	0	1	0	1
121	M32A	I	max	16.45	7	0	15	0	15	353.82	6	0	15	0	15
122			min	-1.05	11	0	1	0	1	-156.51	3	0	1	0	1
123		J	max	16.45	7	0	15	0	15	353.82	6	0	7	0	7
124			min	-1.05	11	0	1	0	1	-156.51	3	0	8	0	1
125	M33A	I	max	3.02	7	0	15	0	15	409.74	6	0	15	0	15
126			min	-0.36	11	0	1	0	1	-286.85	3	0	1	0	1
127		J	max	3.02	7	0	15	0	15	409.74	6	0	7	0	7
128			min	-0.36	11	0	1	0	1	-286.85	3	0	8	0	8
129	M33B	I	max	-219.09	6	0	15	0	15	5.53	7	0	15	0	15
130			min	-2335.19	3	0	1	0	1	-0.87	11	0	1	0	1
131		J	max	-209.31	6	0	15	0	15	5.53	7	0	15	0	15
132			min	-2325.41	3	0	1	0	1	-0.87	11	0	1	0	1
133	M34A	I	max	-215.29	6	0	15	0	15	0.64	11	0	15	0	15
134			min	-2337.05	3	0	1	0	1	-3.84	7	0	1	0	1
135		J	max	-205.51	6	0	15	0	15	0.64	11	0	15	0	15
136			min	-2327.26	3	0	1	0	1	-3.84	7	0	1	0	1
137	M35	I	max	-353.28	6	0	15	0	15	1.88	11	0	15	0	15
138			min	-2467.4	3	0	1	0	1	-11.58	7	0	1	0	1

Envelope Member End Reactions (Continued)

	Member	Member End		Axial[lb]	LC	y Shear[lb]	LC	z Shear[lb]	LC	Torque[lb-ft]	LC	y-y Moment[lb-ft]	LC	z-z Moment[lb-ft]	LC
139		J	max	-343.5	6	0	15	0	15	1.88	11	0	15	0	15
140			min	-2457.61	3	0	1	0	1	-11.58	7	0	1	0	1
141	M36	I	max	0.17	11	0	15	0	15	809.6	6	0	15	0	15
142			min	-2.1	3	0	1	0	1	-1673.95	3	0	1	0	1
143		J	max	0.17	11	0	15	0	15	809.6	6	0	7	0	15
144			min	-2.1	3	0	1	0	1	-1673.95	3	0	11	0	7
145	M37	I	max	0.1	6	0	15	0	15	758.77	6	0	15	0	15
146			min	-1.23	10	0	1	0	1	-654.15	2	0	1	0	1
147		J	max	0.1	6	0	15	0	15	758.77	6	0	7	0	15
148			min	-1.23	10	0	1	0	1	-654.15	2	0	8	0	7
149	M38	I	max	0.23	6	0	15	0	15	10.91	11	0	15	0	15
150			min	-1.21	10	0	1	0	1	-110.17	7	0	1	0	1
151		J	max	0.23	6	0	15	0	15	10.91	11	0	15	0	15
152			min	-1.21	10	0	1	0	1	-110.17	7	0	1	0	1
153	M39	I	max	-0.08	4	358.4	5	1061.62	7	602.5	2	0	15	0	15
154			min	-1.37	14	2.81	11	-277.93	11	-956.57	6	0	1	0	1
155		J	max	0	11	-0.06	11	282.03	11	1690.45	5	0	15	0	6
156			min	0	7	-368.4	3	-1066.48	7	-749.28	6	0	14	0	11
157	M40	I	max	8.03	11	548.58	10	13.18	7	13.31	6	10.75	11	474.65	7
158			min	-3678	7	25.95	2	-1.13	11	-5.32	2	-125.71	7	-194.56	11
159		J	max	-162.16	11	25.95	2	13.18	7	13.31	6	0	15	0	15
160			min	-4792.16	7	-390.47	10	-1.13	11	-5.32	2	0	1	0	1
161	M41	I	max	5019.54	10	899.78	7	0.28	11	0	15	0	15	0	15
162			min	1220.92	1	-58.7	11	-2.63	7	0	1	0	1	0	1
163		J	max	445.29	11	288.26	11	-0.24	11	14.39	6	-1.21	11	57.57	5
164			min	-69.7	3	-157.73	7	-1.71	14	-5.29	2	-8.41	14	-97.38	11
165	M42	I	max	685.52	11	615.02	5	0	15	8.14	6	0	15	0	15
166			min	-959.38	7	90.17	11	0	1	-2.43	2	0	1	0	1
167		J	max	685.52	11	-90.17	15	0	15	8.14	6	0	15	0	15
168			min	-959.38	7	-615.02	3	0	1	-2.43	2	0	1	0	1
169	M43	I	max	0	15	991.75	5	1.21	7	0	15	0	15	0	15
170			min	0	1	97.13	11	-0.23	11	0	1	0	1	0	1
171		J	max	217.2	15	1052.09	9	2.59	7	0	15	0	15	0	15
172			min	-13.17	3	25.66	6	-0.37	11	0	1	0	1	0	1
173	M44	I	max	-413.18	6	0	15	0	15	26.67	7	0	15	0	15
174			min	-2528.49	3	0	1	0	1	-4.75	11	0	1	0	1
175		J	max	-403.4	6	0	15	0	15	26.67	7	0	15	0	15
176			min	-2518.71	3	0	1	0	1	-4.75	11	0	1	0	1
177	M45	I	max	237.88	11	39.1	8	0.1	7	0	15	0.01	11	26.94	8
178			min	-859.9	7	-11.13	2	-0.01	11	0	1	-0.07	7	-7.63	2
179		J	max	237.88	11	39.1	8	0.1	7	0	15	0	15	0.61	6
180			min	-859.9	7	-11.13	2	-0.01	11	0	1	0	1	0.01	2
181	M46	I	max	538.17	11	68.09	7	0.01	11	0	15	0.07	7	46.22	7
182			min	-2888.49	7	9.63	2	-0.1	7	0	1	-0.01	11	6.59	2
183		J	max	538.17	11	68.09	7	0.01	11	0	15	0	15	-0.01	2
184			min	-2888.49	7	9.63	2	-0.1	7	0	1	0	1	-0.61	6
185	M47	I	max	0.01	11	237.88	11	10.97	2	-0.01	2	0	15	0	15
186			min	-0.1	7	-859.9	7	-39.13	8	-0.61	6	0	1	0	1
187		J	max	0.01	11	2888.49	7	69.58	7	-0.01	2	0	15	0	15
188			min	-0.1	7	-538.17	11	10.12	2	-0.61	6	0	1	0	1
189	M48	I	max	311.44	11	0	15	0	15	57.35	11	0	15	0	15
190			min	-2562	7	0	6	0	1	-609.37	6	0	1	0	1
191		J	max	311.44	11	0	15	0	15	57.35	11	0	7	0	6
192			min	-2562	7	0	6	0	1	-609.37	6	0	1	0	1
193	M49	I	max	3402.65	7	0	6	0	15	27.28	11	0	15	0	15

Envelope Member End Reactions (Continued)

	Member	Member End		Axial[lb]	LC	y Shear[lb]	LC	z Shear[lb]	LC	Torque[lb-ft]	LC	y-y Moment[lb-ft]	LC	z-z Moment[lb-ft]	LC
194			min	-546.01	11	0	1	0	1	-336.11	7	0	1	0	1
195		J	max	3402.65	7	0	6	0	15	27.28	11	0	7	0	15
196			min	-546.01	11	0	1	0	1	-336.11	7	0	1	0	6
197	M50	I	max	1431.85	7	0	6	0	15	56.46	6	0	15	0	15
198			min	-255.68	11	0	1	0	1	-6.51	11	0	1	0	1
199		J	max	1431.85	7	0	6	0	15	56.46	6	0	15	0	15
200			min	-255.68	11	0	1	0	1	-6.51	11	0	1	0	6
201	M51	I	max	1475.9	7	0	6	0	15	537.65	6	0	15	0	15
202			min	-285.8	11	0	1	0	1	-51.25	11	0	1	0	1
203		J	max	1475.9	7	0	6	0	15	537.65	6	0	15	0	15
204			min	-285.8	11	0	1	0	1	-51.25	11	0	7	0	6

Envelope AWC NDS-15: ASD Member Wood Code Checks

	Member	Shape	Code Check	Loc[ft]	LC	Shear Check	Loc[ft]	Dir	LC	Fc' [ksi]	Ft' [ksi]	Fb1' [ksi]	Fb2' [ksi]	Fv' [ksi]	RB	CL	CP	Eqn
1	M1	2-1.75X9.5FS	0.24	10.13	5	0.13	10.13	y	5	1.27	1.66	2.75	2.75	0.29	3.05	1	0.48	3.9-3
2	M2	2-1.75X9.5FS	0.15	10.13	5	0.09	0	y	6	1.27	1.66	2.75	2.75	0.33	3.05	1	0.48	3.9-3
3	M4	2-1.75X5.5FS	0.19	4.65	5	0.09	9.29	y	5	1.58	1.66	2.75	2.75	0.29	2.32	1	0.6	3.9-3
4	M13	2-1.75X9.5FS	0.26	2.42	5	0.19	2.22	y	5	1.32	1.66	2.75	2.75	0.29	3.05	1	0.5	3.9-1
5	M14	2-1.75X5.5FS	0.06	4.18	5	0	4.18	z	7	1.41	1.66	2.74	2.75	0.33	4.75	1	0.53	3.9-1
6	M15	2-1.75X5.5FS	0.03	4.18	8	0	4.18	z	7	1.92	2.66	4.38	4.4	0.33	4.75	1	0.46	3.9-1
7	M10	1.75X9.5FS	0.17	0	7	0.15	0	y	6	2.79	1.91	3.15	3.16	0.33	6.1	0.99	0.92	3.9-3
8	M11	1.75X9.5FS	0.62	4.75	5	0.27	10.13	y	7	1.27	1.66	2.74	2.75	0.33	6.1	1	0.48	3.9-3
9	M12	1.75X5.5FS	0.76	4.65	5	0.38	9.29	y	5	1.76	1.66	2.74	2.75	0.29	4.64	1	0.67	3.9-3
10	M13A	1.75X9.5FS	0.62	7.45	5	0.4	16.92	y	5	1.32	1.66	2.74	2.75	0.29	6.1	1	0.5	3.9-3
11	M16	1.75X9.5FS	0.15	3.98	6	0.13	0	y	6	2.79	1.91	3.15	3.16	0.33	6.1	0.99	0.92	3.9-3
12	M17	1.75X9.5FS	0.62	4.75	5	0.25	0	y	7	1.27	1.66	2.74	2.75	0.33	6.1	1	0.48	3.9-3
13	M18	1.75X5.5FS	0.75	4.65	5	0.35	9.29	y	5	1.76	1.66	2.74	2.75	0.29	4.64	1	0.67	3.9-3
14	M19	1.75X9.5FS	0.64	7.65	5	0.4	16.92	y	5	1.32	1.66	2.74	2.75	0.29	6.1	1	0.5	3.9-3
15	M22	1.75X9.5FS	0.17	3.88	6	0.14	0	y	6	2.79	1.91	3.15	3.16	0.33	6.1	0.99	0.92	3.9-3
16	M23	1.75X9.5FS	0.64	4.75	5	0.25	0	y	7	1.27	1.66	2.74	2.75	0.33	6.1	1	0.48	3.9-3
17	M24	1.75X5.5FS	0.81	4.65	5	0.36	9.29	y	5	1.76	1.66	2.74	2.75	0.29	4.64	1	0.67	3.9-3
18	M25	1.75X9.5FS	0.64	7.65	5	0.4	16.92	y	5	1.32	1.66	2.74	2.75	0.29	6.1	1	0.5	3.9-3
19	M28	2-1.75X9.5FS	0.24	10.13	5	0.13	10.13	y	5	1.27	1.66	2.75	2.75	0.29	3.05	1	0.48	3.9-3
20	M29	2-1.75X9.5FS	0.16	10.13	5	0.09	0	y	6	1.27	1.66	2.75	2.75	0.33	3.05	1	0.48	3.9-3
21	M30	2-1.75X5.5FS	0.19	4.65	5	0.09	9.29	y	5	1.58	1.66	2.75	2.75	0.29	2.32	1	0.6	3.9-3
22	M31	2-1.75X9.5FS	0.26	2.42	5	0.19	2.22	y	5	1.32	1.66	2.75	2.75	0.29	3.05	1	0.5	3.9-1
23	M32	2-1.75X5.5FS	0.06	4.18	5	0	4.18	z	7	1.41	1.66	2.74	2.75	0.33	4.75	1	0.53	3.9-1
24	M33	2-1.75X5.5FS	0.03	4.18	8	0	4.18	z	7	1.92	2.66	4.38	4.4	0.33	4.75	1	0.46	3.9-1
25	M34	2-1.75X11.875FS	0.82	3.96	7	1.06	10	y	7	0.43	1.91	3.1	3.16	0.33	10.79	0.98	0.14	3.9-3
26	M33B	1.75X5.5FS	0.15	0	5	0.04	4.18	z	7	1	1.66	2.72	2.75	0.33	9.49	0.99	0.38	3.9-1
27	M34A	1.75X5.5FS	0.15	0	5	0.03	4.18	z	7	1	1.66	2.72	2.75	0.33	9.49	0.99	0.38	3.9-1
28	M35	1.75X5.5FS	0.15	0	5	0.09	4.18	z	7	1	1.66	2.72	2.75	0.33	9.49	0.99	0.38	3.9-1
29	M40	1.75X9.5FS	0.29	4.27	6	0.19	0	y	6	2.79	1.91	3.15	3.16	0.33	6.1	0.99	0.92	3.9-1
30	M41	1.75X9.5FS	0.58	4.75	5	0.34	10.13	y	7	1.27	1.66	2.74	2.75	0.33	6.1	1	0.48	3.9-3
31	M42	1.75X5.5FS	0.76	4.65	5	0.35	9.29	y	5	1.76	1.66	2.74	2.75	0.29	4.64	1	0.67	3.9-1
32	M43	1.75X9.5FS	0.62	7.45	5	0.4	16.92	y	5	1.32	1.66	2.74	2.75	0.29	6.1	1	0.5	3.9-3
33	M44	1.75X5.5FS	0.16	0	5	0.21	4.18	z	7	1	1.66	2.72	2.75	0.33	9.49	0.99	0.38	3.9-1
34	M47	2-1.75X9.5FS	0.8	4.06	7	0.47	3.96	y	7	0.43	1.91	3.12	3.16	0.33	9.65	0.99	0.14	3.9-3

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PROJECT	DATE	SHEET OF
AFRAME	07-29-19	
	DESIGNED BY CRP / CHECKED BY	PROJECT NO. 19003

TRUSS ANCHORAGE TO FND (120 MPH) 3.5-FT WALLS (CRAWLSPACE)

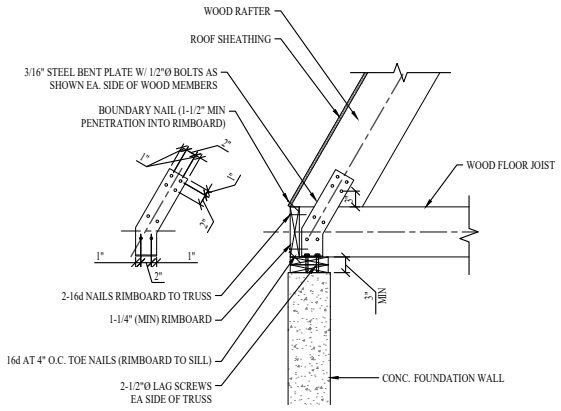
LOAD COMBINATION 11 (0.6D + 0.7E)
COMBINATION FOR HIGHEST SHEAR LOAD WITH MIN RESISTING DEAD LOAD

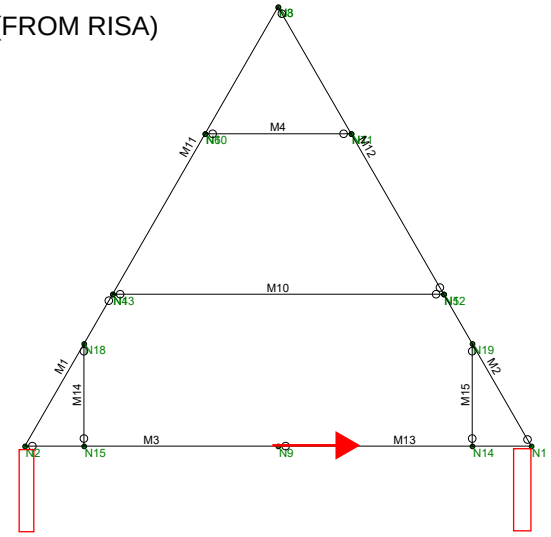
FROM RISA
SHEAR = 2125 LBS PER TRUSS (65% RESISTED BY WALL BEARING INTO SOIL, 35% RESISTED BY OPPOSITE WALL)

PLEASE NOTE: DISREGARDS POSSIBLY FLOOR DIAPHRAGM CAPACITY (CONSERVATIVE)

VERTICAL LOAD = 0.6D = 1963 LBS PER TRUSS (FROM RISA)

(4) LAGS PROVIDED





RESISTED BY CANTILEVER WALL ON THIS SIDE

RESISTED BY BEARING INTO SOIL THIS SIDE

REQ'D CAPACITY THIS SIDE
372 LBS/FT (745 LBS PER TRUSS)

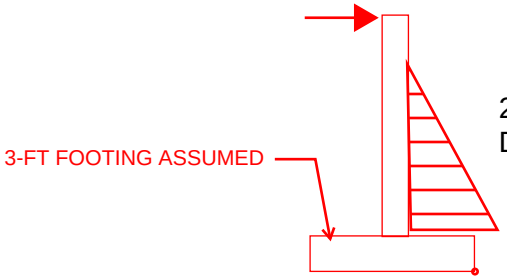
REQ'D CAPACITY THIS SIDE
585 LBS/FT (1170 LBS PER TRUSS)

CONVERT TO A UNIFORM LOAD ON THIS WALL (IN WHICH CASE RESULTANT MOMENTS ARE EQUAL)

372 LBS X 3.5-FT = W X 3.5-ft^2 / 2
W = 213 PLF

THIS LOAD IS IN ADDITION TO THE RETAINED SOIL

SEE RETAINPRO CALCULATION



OTM = 585 LBS X 4-FT = 2340 FT-LBS
RM = PASSIVE SOIL (NEGLECT TOP 1-FT) + 0.6 DL OF TRUSS AND FOOTING AND SOIL)
RM = (1/2 X (250 PSF X 2.5-FT) X 2.5-FT) X 1/3 X 2.5-FT + 1640 LBS/2 X 1.5-FT + 0.6 X (1-FT X 3-FT + 8/12 X 4-FT) X 150 PCF X 1.5-FT + 0.6 X (3-FT X 120 PSF X 1-FT) = 2862 FT-LBS
RM > OTM; THEREFORE OK (W/ WIND)

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RetainPro (c) 1987-2018, Build 11.18.12.04
License : KW-06057891
License To : MCNEIL ENGINEERING

Cantilevered Retaining Wall

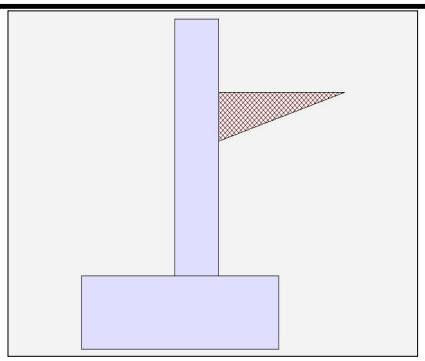
Code: IBC 2018,ACI 318-14,TMS 402-16

Criteria

Retained Height	=	2.50 ft
Wall height above soil	=	1.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	0.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	213.0 #/ft
...Height to Top	=	3.50 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Seismic (E) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	1,300.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Design Summary

Wall Stability Ratios

Overturning	=	1.85	OK
Sliding	=	1.12	Ratio < 1.5!
Total Bearing Load	=	2,375 lbs	
...resultant ecc.	=	8.09 in	
Soil Pressure @ Toe	=	1,916 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	2,000 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	2,683 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	12.5 psi	OK
Footing Shear @ Heel	=	3.4 psi	OK
Allowable	=	82.2 psi	

Sliding Calcs

Lateral Sliding Force	=	959.9 lbs	
less 100% Passive Force	= -	125.0 lbs	
less 100% Friction Force	= -	950.1 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	364.7 lbs	NG

Vertical component of active lateral soil pressure IS considered in the calculation of soil bearing pressures.

Load Factors

Building Code	IBC 2018,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.600

Stem Construction

		Bottom
		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	LRFD
Thickness	=	8.00
Rebar Size	=	# 4
Rebar Spacing	=	12.00
Rebar Placed at	=	Center
Design Data		
fb/FB + fa/Fa	=	**0.658**
Total Force @ Section		
Service Level	lbs =	
Strength Level	lbs =	1,367.8
Moment....Actual		
Service Level	ft-# =	
Strength Level	ft-# =	2,233.2
Moment.....Allowable	=	3,387.6
Shear.....Actual		
Service Level	psi =	
Strength Level	psi =	28.5
Shear.....Allowable	psi =	75.0
Anet (Masonry)	in2 =	
Rebar Depth 'd'	in =	4.00
Masonry Data		
f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Wall Weight	psf =	100.0
Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Medium Weight
Masonry Design Method	=	ASD
Concrete Data		
f'c	psi =	2,500.0
Fy	psi =	60,000.0

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Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1348 in2/ft		
(4/3) * As :	0.1797 in2/ft	Min Stem T&S Reinf Area 0.672 in2	
200bd/fy : 200(12)(4)/60000 :	0.16 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.16 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	0.5419 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Dimensions & Strengths

Toe Width	=	1.42 ft
Heel Width	=	1.58
Total Footing Width	=	3.00
Footing Thickness	=	12.00 in
Key Width	=	12.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	2.00 ft

f'c = 3,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	2,683	0 psf
Mu' : Upward	=	2,180	11 ft-#
Mu' : Downward	=	181	227 ft-#
Mu: Design	=	2,000	216 ft-#
Actual 1-Way Shear	=	12.52	3.42 psi
Allow 1-Way Shear	=	43.82	43.82 psi
Toe Reinforcing	=	None Spec'd	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	

Other Acceptable Sizes & Spacings

Toe: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Heel: Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: No key defined

Min footing T&S reinf Area 0.78 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Summary of Overturning & Resisting Forces & Moments

	.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure =	214.4	1.17	250.1	Soil Over Heel =	275.2	2.54	699.7
Surcharge over Heel =				Sloped Soil Over Hee =			
Surcharge Over Toe =				Surcharge Over Heel =			
Adjacent Footing Load =				Adjacent Footing Load =			
Added Lateral Load =	745.5	2.75	2,050.1	Axial Dead Load on Stem =	1,300.0	1.75	2,275.4
Load @ Stem Above Soil =				* Axial Live Load on Stem =			
=				Soil Over Toe =			
				Surcharge Over Toe =			
Total	959.9	**O.T.M.**	2,300.2	Stem Weight(s) =	350.0	1.75	612.6
=		=		Earth @ Stem Transitions =			
				Footing Weight =	450.2	1.50	675.5
				Key Weight =		2.50	
				Vert. Component =		3.00	
				Total =	2,375.4 lbs	**R.M.=**	4,263.2

Resisting/Overturning Ratio = 1.85
Vertical Loads used for Soil Pressure = 2,375.4 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.062	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

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PROJECT	DATE	SHEET OF
AFRAME	07-29-19	
	DESIGNED BY CRP / CHECKED BY	PROJECT NO. 19003

ANCHORAGE OF TRUSS TO SILL PLATE AND SILL PLATE TO FND WALL

REQUIRED CAPACITY AT MAX LOADED SIDE = 585 LBS/FT (1170 LBS PER TRUSS)

LAG SCREWS:

LAG SCREWS

Table 11K LAG SCREWS: Reference Lateral Design Values (Z) for Single Shear (two member) Connections[1,2,3]

with 1/4" ASTM A 36 steel side plate, or ASTM A 653, Grade 33 steel side plate (for $t_s < 1/4$")

Side Member Thickness	Lag Screw Diameter	G=0.67 Red Oak		G=0.55 Mixed Maple Southern Pine		G=0.5 Douglas Fir-Larch		G=0.49 Douglas Fir-Larch (N)		G=0.46 Douglas Fir(S) Hem-Fir(N)		G=0.43 Hem-Fir		G=0.42 Spruce-Pine-Fir		G=0.37 Redwood (open grain)		G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods		G=0.35 Northern Species	
t_s	D	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$
in.	in.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
0.075 (14 gage)	1/4	170	130	160	120	150	110	150	110	150	100	140	100	140	100	130	90	130	90	130	90
	5/16	220	160	200	140	190	130	190	130	190	130	180	120	180	120	170	110	170	110	160	100
	3/8	220	160	200	140	200	130	190	130	190	120	180	120	180	120	170	110	170	100	170	100
0.105 (12 gage)	1/4	180	140	170	130	160	120	160	120	160	110	150	110	150	110	140	100	140	100	140	90
	5/16	230	170	210	150	200	140	200	140	190	130	190	130	190	120	180	110	170	110	170	110
	3/8	230	160	210	140	200	140	200	130	200	130	190	120	190	120	180	110	180	110	170	110
0.120 (11 gage)	1/4	190	150	180	130	170	120	170	120	160	120	160	110	160	110	150	100	150	100	140	100
	5/16	230	170	210	150	210	140	200	140	200	140	190	130	190	130	180	120	180	120	180	110
	3/8	240	170	220	150	210	140	210	140	200	130	200	130	190	120	180	110	180	110	180	110
0.134 (10 gage)	1/4	200	150	180	140	180	130	170	130	170	120	160	120	160	110	150	110	150	100	150	100
	5/16	240	180	220	160	210	150	210	140	200	140	200	130	200	130	190	120	180	120	180	120
	3/8	240	170	220	150	220	140	210	140	210	140	200	130	200	130	190	120	190	120	180	110
0.179 (7 gage)	1/4	220	170	210	150	200	150	200	140	190	140	190	130	190	130	180	120	170	120	170	120
	5/16	260	190	240	170	230	160	230	160	230	150	220	150	220	150	210	130	200	130	200	130
	3/8	270	190	250	170	240	160	240	160	230	150	220	140	220	140	210	130	210	130	200	130
0.239 (3 gage)	1/4	240	180	220	160	210	150	210	150	200	140	190	140	190	130	180	120	180	120	180	120
	5/16	300	220	280	190	270	180	260	180	260	170	250	160	250	160	230	150	230	150	230	140
	3/8	310	220	280	190	270	180	270	180	260	170	250	160	250	160	240	140	230	140	230	140
	7/16	420	290	390	260	380	240	370	240	360	230	350	220	350	220	330	200	330	200	320	190
	1/2	510	340	470	300	460	290	450	280	440	270	430	260	420	260	400	240	400	230	390	230
	5/8	770	490	710	430	680	400	680	400	660	380	640	370	630	360	600	330	590	330	580	320
	3/4	1110	670	1020	590	980	560	970	550	950	530	920	500	910	500	860	450	850	450	840	440
	7/8	1510	880	1390	780	1330	730	1320	710	1280	690	1250	650	1230	650	1170	590	1160	590	1140	570
	1	1940	1100	1780	960	1710	910	1700	890	1650	860	1600	820	1590	810	1500	740	1480	730	1460	710
1/4	1/4	240	180	220	160	210	150	210	150	200	140	200	140	190	130	180	120	180	120	180	120
	5/16	310	220	280	200	270	180	270	180	260	170	250	170	250	160	230	150	230	150	230	140
	3/8	320	220	290	190	280	180	270	180	270	170	260	160	250	160	240	150	240	140	230	140
	7/16	480	320	440	280	420	270	420	260	410	250	390	240	390	230	370	220	360	210	360	210
	1/2	580	390	540	340	520	320	510	320	500	310	480	290	480	290	460	270	450	260	440	260
	5/8	850	530	780	470	750	440	740	440	720	420	700	400	690	400	660	370	650	360	640	350
	3/4	1200	730	1100	640	1060	600	1050	590	1020	570	990	540	980	530	930	490	920	480	900	470
	7/8	1600	930	1470	820	1410	770	1400	750	1360	720	1320	690	1310	680	1240	630	1220	620	1200	600
	1	2040	1150	1870	1000	1800	950	1780	930	1730	900	1680	850	1660	840	1570	770	1550	760	1530	740

1. Tabulated lateral design values (Z) shall be multiplied by all applicable adjustment factors (see Table 10.3.1).
2. Tabulated lateral design values (Z) are for "reduced body diameter" lag screws (see Appendix L) inserted in side grain with screw axis perpendicular to wood fibers; minimum screw penetration, p, into the main member equal to 8D; dowel bearing strengths (F_e) of 61,850 psi for ASTM A 653, Grade 33 steel and 87,000 psi for ASTM A 36 steel and screw bending yield strengths (F_{yb}): F_{yb} = 70,000 psi for D = 1/4"; F_{yb} = 60,000 psi for D = 5/16"; F_{yb} = 45,000 psi for D ≥ 3/8"
3. When 4D ≤ p < 8D, tabulated lateral design values (Z) shall be multiplied by p/8D.

(4) 1/2" LAG BOLTS
DURATION FACTOR = 1.6
REDUCED EMBED

4 LAGS X 320 LBS X 1.6 X 3"/ (8 X 0.5") = 1536 LBS

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PROJECT	DATE	SHEET OF
AFRAME	07-29-19	
	DESIGNED BY: CRP / CHECKED BY:	PROJECT NO.: 19003

ANCHORAGE OF TRUSS TO SILL PLATE AND SILL PLATE TO FND WALL

REQUIRED CAPACITY AT MAX LOADED SIDE = 585 LBS/FT (1170 LBS PER TRUSS)

ANCHOR BOLTS:

Table 11E BOLTS: Reference Lateral Design Values (Z) for Single Shear (two member) Connections[1,2,3,4]

for sawn lumber or SCL to concrete

BOLTS

Embedment Depth in Concrete t_m in.	Side Member t_s in.	Bolt Diameter D in.	G=0.67 Red Oak $Z_{\parallel}$ lbs.	G=0.67 Red Oak $Z_{\perp}$ lbs.	G=0.55 Mixed Maple Southern Pine $Z_{\parallel}$ lbs.	G=0.55 Mixed Maple Southern Pine $Z_{\perp}$ lbs.	G=0.50 Douglas Fir-Larch $Z_{\parallel}$ lbs.	G=0.50 Douglas Fir-Larch $Z_{\perp}$ lbs.	G=0.49 Douglas Fir-Larch(N) $Z_{\parallel}$ lbs.	G=0.49 Douglas Fir-Larch(N) $Z_{\perp}$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_{\parallel}$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_{\perp}$ lbs.
6.0 and greater	1-1/2	1/2	770	480	680	410	650	380	640	380	620	360
		5/8	1070	660	970	580	930	530	920	520	890	470
		3/4	1450	890	1330	660	1270	590	1260	560	1230	520
		7/8	1890	960	1750	720	1690	630	1680	600	1640	550
		1	2410	1020	2250	770	2100	680	2060	650	1930	600
	1-3/4	1/2	830	510	740	430	700	400	690	390	670	370
		5/8	1160	680	1030	600	980	550	970	550	940	530
		3/4	1530	900	1390	770	1330	680	1310	660	1270	600
		7/8	1970	1120	1800	840	1730	740	1720	700	1680	640
		1	2480	1190	2290	890	2210	790	2200	750	2150	700
	2-1/2	1/2	830	590	790	520	770	470	760	460	750	440
		5/8	1290	800	1230	670	1180	610	1170	610	1120	570
		3/4	1840	1000	1630	850	1540	800	1520	780	1460	750
		7/8	2290	1240	2050	1080	1940	1020	1920	1000	1860	920
		1	2800	1520	2530	1280	2410	1130	2390	1080	2310	1000
	3-1/2	1/2	830	590	790	540	770	510	760	500	750	490
		5/8	1290	880	1230	810	1200	730	1190	720	1170	670
		3/4	1860	1190	1770	980	1720	900	1720	880	1680	830
		7/8	2540	1410	2410	1190	2320	1100	2290	1070	2200	1020
		1	3310	1670	2970	1420	2800	1330	2770	1300	2660	1260

3/4" BOLT OR 1" BOLT OPTION
DURATION FACTOR = 1.6

3/4" BOLT
850 LBS X 1.6 = 1360 LBS - SPACED AT 24" O.C. (SAME AS TRUSS SPACING)

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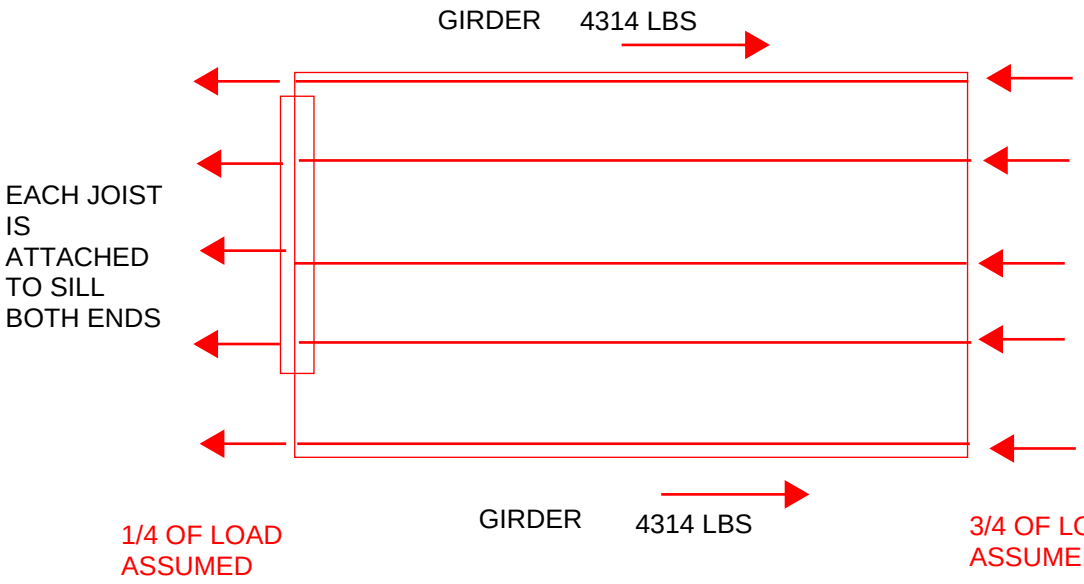
PROJECT	DATE	SHEET OF
AFRAME	07-29-19	
	DESIGNED BY CRP / CHECKED BY	PROJECT NO. 19003

GIRDER LATERAL ATTACHMENT

AT GIRDER TRUSS - DIAPHRAGM ACTION WITH THE FLOOR SYSTEM RESISTS THE LATERAL THRUST OF THE GIRDER (NOT INCLUDING ANY CAPACITY OF THE STHD STRAP EMBEDDED ON THE ENDS)

8-FT DORMER EXAMPLE



LOAD TO BE RESISTED = 5209 LBS X 2 X 0.25 = 2605 LBS

LOAD TO BE RESISTED = 4313 LBS X 2 X 0.75 = 6471 LBS

CAPACITY = 1392 LBS X 2 (TRUSS ANCHOR IN PREVIOUS CALC) + (650 X 6) FOR (6) A35 CLIPS + (2 X 141 X 0.83 X 1.6 X 3) FOR (2) 16D TOE NAILS EACH JOIST

= 7807 LBS

REQUIRED CAPACITY OF DIAPHRAGM
"REACTION" ON DIAPHRAM ENDS (GIRDER TRUSS MINUS ANCHORAGE OF GIRDER TO WALL)

4314 LBS - (1170 LBS + 390 LBS) (PREVIOUS CALC FOR FND WALL CAPACITY) =

2754 LBS

WIDTH OF DIAPHRAGM = (30-FT - 5-FT UNSHEATHED EACH END) = 20-FT
UNIT SHEAR = 2754 LBS / 20-FT = 138 PLF

ALLOWABLE CAPACITY OF UNBLOCKED DIAPHRAGM PER SDPWS TABLE 4.2C (UNBLOCKED DIAPHRAGMS 8d W/ 15/32 PANEL 2" NOMINAL WIDTH - CASE 2 - WIND) = 505 PLF / 2 = 253 PLF; OK

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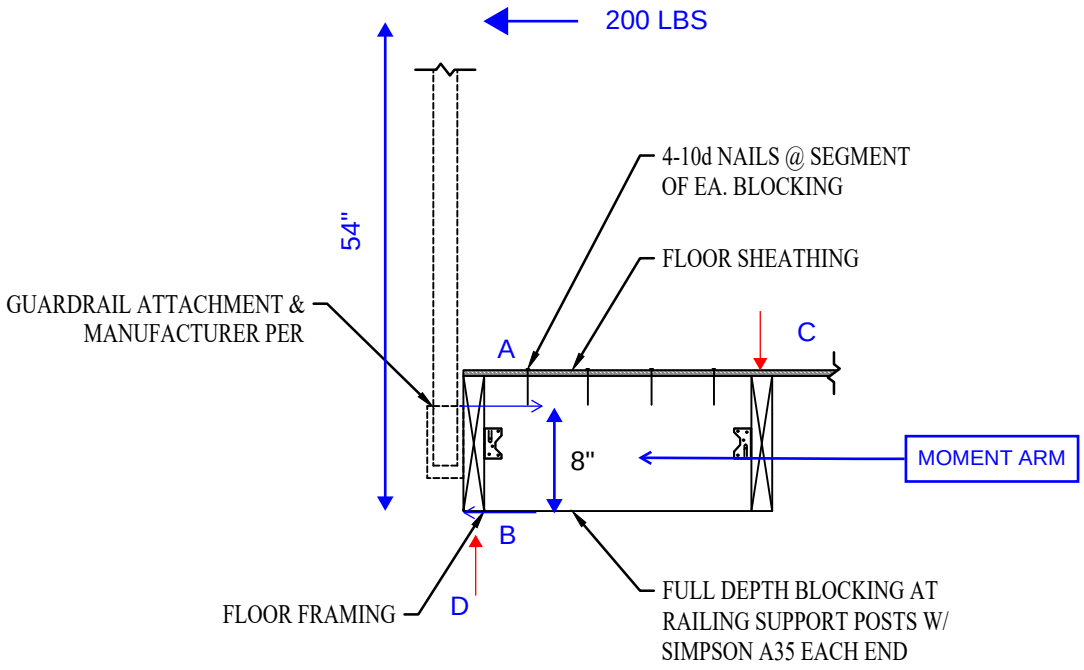
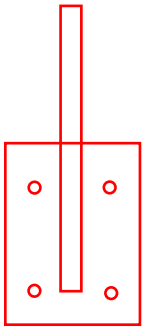
PROJECT	DATE	SHEET OF
AVRAME	03-21-20	
	DESIGNED BY CRP / CHECKED BY	PROJECT NO. 20003

GUARDRAIL DESIGN

HEIGHT OF RAIL = 42-IN (+ 6" TO ATTACHMENT)
FORCE AT TOP RAIL = 200 LBS PER CRC 2019 R301.5 (ACTING IN EITHER DIRECTION)



FORCE AT A = 200 LBS X 54" / 8" = 1350 LBS
FORCE AT B = 880 LBS
SEE CALC BELOW FOR STEEL PIPE



(4) 3/8" LAGS (TOP 2 LAGS IN TENSION)

FORCE AT D (AND C) = 200 LBS (CONCENTRATED LOAD ACTING VERTICALLY DIRECT SHEAR) OR FROM 200 LBS ACTING HORIZ. (CAUSING A MOMENT ON THE RAIL AND THEN THE BLOCK) 200 LBS X 54" / 24" = 450 LBS. A35 (CAPACITY = 590 LBS) PROVIDED EACH END OF BLOCK

CAPACITY OF 3/8" LAG IN WITHDRAWAL
DF-L = 305 lbs/in PER NDS TABLE 12.2A

DURATION FACTOR (LOAD IS NOT CONSTANT - I.E. IT HAS A DURATION OF SECONDS OR MINUTES - NOT YEARS) = 1.6 FOR 10 MINUTES; CONSERVATIVELY USE 1.25 (7-DAYS)

END GRAIN FACTOR = 0.75 PER NDS 12.5.2

MIN LENGTH OF PENETRATION = 1350 LBS / [(2 LAGS) X 305 lbs/in X 1.25 X 0.75) = 2.4 - IN
PROVIDE 2-1/2" MIN EMBED INTO BACKER BLOCK (DISREGARD PENETRATION IN JOIST)

Project: Residential Guardrail

Location: Guardrail post
Multi-Loaded Multi-Span Beam

Pipe 1-1/2 Std. x 4.333 FT (0.8 + 3.5) / ASTM A500-GR.B-42
Section Adequate By: 23.1%
Controlling Factor: Moment

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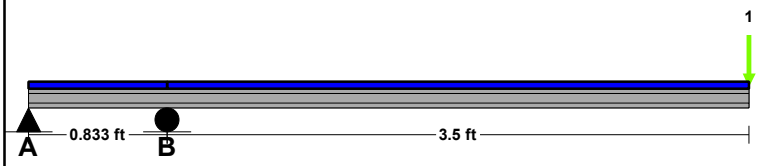
DEFLECTIONS	Center		Right	
Live Load	-0.01	IN L/1578	0.72	IN 2L/116
Dead Load	0.00	in	0.01	in
Total Load	-0.01	IN L/1541	0.73	IN 2L/114

Live Load Deflection Criteria: L/80 Total Load Deflection Criteria: L/80

REACTIONS	A		B	
Live Load	0	lb	1040	lb
Dead Load	-19	lb	31	lb
Total Load	-19	lb	1071	lb
Uplift (1.5 F.S)	**-859**	**lb**	0	**lb**
Bearing Length	0.00	in	0.29	in

BEAM DATA	Center		Right	
Span Length	0.83	ft	3.5	ft
Unbraced Length-Top	0	ft	0	ft
Unbraced Length-Bottom	0.83	ft	3.5	ft

LOADING DIAGRAM



UNIFORM LOADS	Center		Right	
Uniform Live Load	0	plf	0	plf
Uniform Dead Load	0	plf	0	plf
Beam Self Weight	3	plf	3	plf
Total Uniform Load	3	plf	3	plf

POINT LOADS - RIGHT SPAN	
Load Number	One
Live Load	200 lb
Dead Load	0 lb
Location	3.5 ft

STEEL PROPERTIES
Pipe 1-1/2 Std. - A500-GR.B-42

Properties:

Steel Yield Strength:	Fy =	42	ksi
Modulus of Elasticity:	E =	29000	ksi
Tube Steel Section (X Axis):	dx =	1.9	in
Tube Steel Section (Y Axis):	dy =	1.9	in
Tube Steel Wall Thickness:	t =	0.135	in
Area:	A =	0.75	in2
Moment of Inertia (X Axis):	Ix =	0.29	in4
Section Modulus (X Axis):	Sx =	0.31	in3
Plastic Section Modulus:	Z =	0.42	in3

Design Properties per AISC 14th Edition Steel Manual:

Flange Buckling Ratio:	FBR =	14.07	
Allowable Flange Buckling Ratio:	AFBR =	48.33	
Allowable Flange Buckling Ratio non-compact:	AFBR_NC =	214.05	
Nominal Flexural Strength w/ Safety Factor:	Mn =	882	ft-lb
Controlling Equation:	F8-1		
Shear Buckling Stress Coefficient Eqn. G6-2a:	Fcr =	25	ksi
Nominal Shear Strength w/ Safety Factor:	Vn =	5659	lb

Controlling Moment: -717 ft-lb
0.83 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2, 3
Controlling Shear: -862 lb
1.0 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s

Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	0.2 in4	0.29 in4
Moment:	-717 ft-lb	882 ft-lb
Shear:	-862 lb	5659 lb

NOTES

Project: Residential Guardrail

Location: Guardrail Railing
Multi-Loaded Multi-Span Beam

Pipe 1-1/4 Std. x 5.0 FT / ASTM A500-GR.B-42
Section Adequate By: 43.2%
Controlling Factor: Deflection

Cody Palmer
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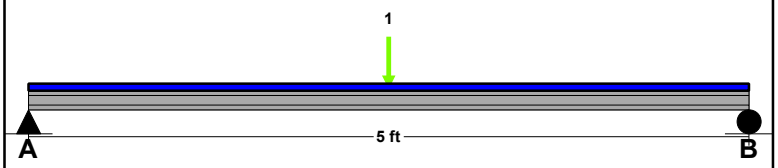
DEFLECTIONS	Center	
Live Load	0.17	IN L/356
Dead Load	0.01	in
Total Load	0.17	IN L/344

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

REACTIONS	A		B	
Live Load	100	lb	100	lb
Dead Load	6	lb	6	lb
Total Load	106	lb	106	lb
Bearing Length	0.26	in	0.26	in

BEAM DATA	Center	
Span Length	5	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	5	ft

LOADING DIAGRAM



UNIFORM LOADS	Center	
Uniform Live Load	0	plf
Uniform Dead Load	0	plf
Beam Self Weight	2	plf
Total Uniform Load	2	plf

POINT LOADS - CENTER SPAN	
Load Number	One
Live Load	200 lb
Dead Load	0 lb
Location	2.5 ft

STEEL PROPERTIES

Pipe 1-1/4 Std. - A500-GR.B-42

Properties:

Steel Yield Strength:	Fy =	42	ksi
Modulus of Elasticity:	E =	29000	ksi
Tube Steel Section (X Axis):	dx =	1.66	in
Tube Steel Section (Y Axis):	dy =	1.66	in
Tube Steel Wall Thickness:	t =	0.13	in
Area:	A =	0.62	in2
Moment of Inertia (X Axis):	Ix =	0.18	in4
Section Modulus (X Axis):	Sx =	0.22	in3
Plastic Section Modulus:	Z =	0.31	in3

Design Properties per AISC 14th Edition Steel Manual:

Flange Buckling Ratio:	FBR =	12.77	
Allowable Flange Buckling Ratio:	AFBR =	48.33	
Allowable Flange Buckling Ratio non-compact:	AFBR_NC =	214.05	
Nominal Flexural Strength w/ Safety Factor:	Mn =	639	ft-lb
Controlling Equation:	F8-1		
Shear Buckling Stress Coefficient Eqn. G6-2b:	Fcr =	25	ksi
Nominal Shear Strength w/ Safety Factor:	Vn =	4678	lb

Controlling Moment: 257 ft-lb
2.5 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2
Controlling Shear: -106 lb
At right support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s

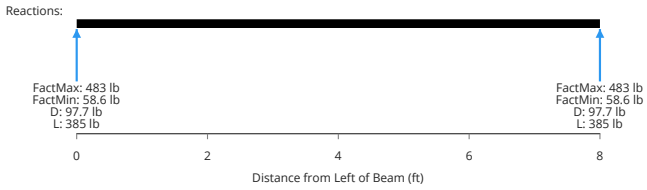
Comparisons with required sections:	Req'd	Provided
Moment of Inertia (deflection):	0.13 in4	0.18 in4
Moment:	257 ft-lb	639 ft-lb
Shear:	-106 lb	4678 lb

NOTES

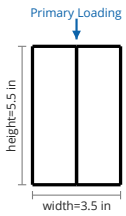
Client:		**Date:**	Feb 18, 2021
Author:	Cody Palmer	**Job #:**	21003
Project:	Avrame	**Subject:**	**DUO Force of Railing on Beam**
References:	NDS 2018 (ASD)		

Summary

33%	Allowable Bending Moment	$M' = 4250\ \text{lb} \cdot \text{ft}$
13%	Allowable Shear	$V' = 3660\ \text{lb}$
6%	Allowable Bearing Load	$R' = 7870\ \text{lb}$
46%	Governing Live / Short-Term Deflection	$\delta_{ST} = -0.123\ \text{in}$
	Critical Live / Short-Term Deflection Ratio	$(L/)_{ST} = 778$
34%	Governing Long-Term Deflection	$\delta_{LT} = -0.135\ \text{in}$
	Critical Long-Term Deflection Ratio	$(L/)_{LT} = 711$
27%	Simplified DL+LL Deflection	$\delta_{DL+LL} = -0.147\ \text{in}$
	Critical Simplified DL+LL Deflection Ratio	$(L/)_{DL+LL} = 655$

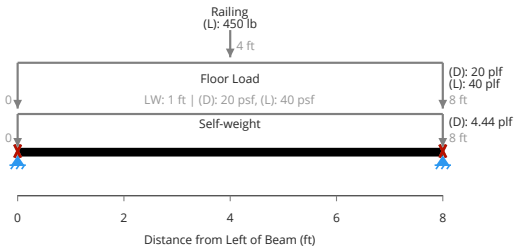


Key Properties



Member		2 plies - 1-3/4x5-1/2 Microllam LVL 2.0E-2600Fb
Beam Plan Length	$L_X =$	8 ft
Continuous Bracing for Lateral Torsional Buckling		Top braced

Loads



Design Conditions

Design Code for Load Combinations	International Building Code (IBC) 2018

Member Properties

Cross-Sectional Area	$A = 19.2\ \text{in}^2$
Strong Axis Moment of Inertia	$I_{xx} = 48.5\ \text{in}^4$
Section Modulus	$S = 17.6\ \text{in}^3$
Base Allowable Bending Stress	$F_b = 2600\ \text{psi}$
Base Allowable Shear Stress	$F_v = 285\ \text{psi}$
Base Perpendicular Compression Allowable Stress	$F_{c\perp} = 750\ \text{psi}$
Base Modulus of Elasticity	$E = 2\,000\,000\ \text{psi}$

Elastic Modulus (NDS 2018 2.3)

Adjusted Modulus of Elasticity	$E' = 2\,000\,000\ \text{psi}$

Section Bending (NDS 2018 2.3)

Volume Factor	$C_V = 1.11$

Positive Bending (NDS 2018 2.3)

Governing Duration Factor - Positive Bending	$C^+_{D,b} = 1$
Governing Beam Stability Factor - Positive Bending	$C^+_L = 1$
Adjusted Bending Strength - Positive Bending	$F'^+_b = 2890\ \text{psi}$

Negative Bending (NDS 2018 2.3)

Governing Duration Factor - Negative Bending	$C^-_{D,b} = 0.9$
Governing Beam Stability Factor - Negative Bending	$C^-_L = 0.99$
Adjusted Bending Strength - Negative Bending	$F'^-_b = 2580\ \text{psi}$

Shear Design (NDS 2018 3.4)

Governing Duration Factor	$C_D = 1$
Adjusted Shear Strength	$F'_v = 285\ \text{psi}$

Bearing (NDS 2018 3.10)

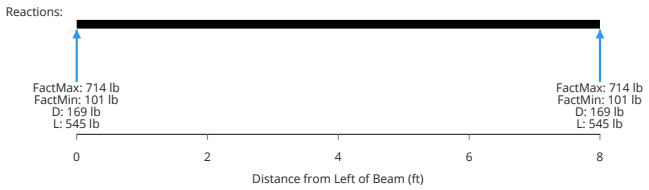
Base Bearing Strength	$F'_{c\perp}/C_b = 750\ \text{psi}$

Comments

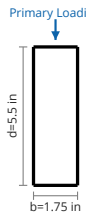
Client:		**Date:**	Feb 18, 2021
Author:	Cody Palmer	**Job #:**	21003
Project:	Avrame	**Subject:**	**DUO Force of Railing on Interior Beam**
References:	NDS 2018 (ASD)		

Summary

88%	Allowable Bending Moment	$M' = 2130\ \text{lb} \cdot \text{ft}$
39%	Allowable Shear	$V' = 1830\ \text{lb}$
18%	Allowable Bearing Load	$R' = 3940\ \text{lb}$
81%	Governing Live / Short-Term Deflection	$\delta_{ST} = -0.323\ \text{in}$
	Critical Live / Short-Term Deflection Ratio	$(L/)_{ST} = 297$
91%	Governing Long-Term Deflection	$\delta_{LT} = -0.363\ \text{in}$
	Critical Long-Term Deflection Ratio	$(L/)_{LT} = 265$
76%	Simplified DL+LL Deflection	$\delta_{DL+LL} = -0.403\ \text{in}$
	Critical Simplified DL+LL Deflection Ratio	$(L/)_{DL+LL} = 238$

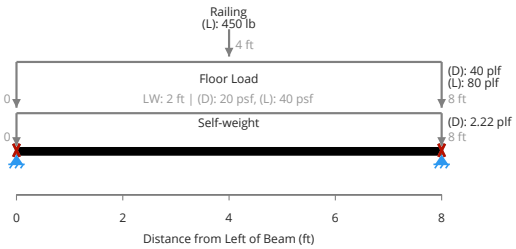


Key Properties



Member		1-3/4x5-1/2 Microllam LVL 2.0E-2600Fb
Beam Plan Length	$L_X =$	8 ft
Continuous Bracing for Lateral Torsional Buckling		Top braced

Loads



Design Conditions

Design Code for Load Combinations	International Building Code (IBC) 2018

Member Properties

Cross-Sectional Area	$A = 9.62\ \text{in}^2$
Strong Axis Moment of Inertia	$I_{xx} = 24.3\ \text{in}^4$
Section Modulus	$S = 8.82\ \text{in}^3$
Base Allowable Bending Stress	$F_b = 2600\ \text{psi}$
Base Allowable Shear Stress	$F_v = 285\ \text{psi}$
Base Perpendicular Compression Allowable Stress	$F_{c\perp} = 750\ \text{psi}$
Base Modulus of Elasticity	$E = 2\,000\,000\ \text{psi}$

Elastic Modulus (NDS 2018 2.3)

Adjusted Modulus of Elasticity	$E' = 2\,000\,000\ \text{psi}$

Section Bending (NDS 2018 2.3)

Volume Factor	$C_V = 1.11$

Positive Bending (NDS 2018 2.3)

Governing Duration Factor - Positive Bending	$C^+_{D,b} = 1$
Governing Beam Stability Factor - Positive Bending	$C^+_L = 1$
Adjusted Bending Strength - Positive Bending	$F'^+_b = 2890\ \text{psi}$

Negative Bending (NDS 2018 2.3)

Governing Duration Factor - Negative Bending	$C^-_{D,b} = 0.9$
Governing Beam Stability Factor - Negative Bending	$C^-_L = 0.923$
Adjusted Bending Strength - Negative Bending	$F'^-_b = 2400\ \text{psi}$

Shear Design (NDS 2018 3.4)

Governing Duration Factor	$C_D = 1$
Adjusted Shear Strength	$F'_v = 285\ \text{psi}$

Bearing (NDS 2018 3.10)

Base Bearing Strength	$F'_{c\perp}/C_b = 750\ \text{psi}$

Comments