

# RB Engineers, Inc.

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JOB: MERLINO  
PROJECT #: 20-7888  
BY: R.B. / MJT  
DATE: 11/23/2020

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## STRUCTURAL COMPUTATIONS FOR

MERLINO RESIDENCE  
MERCER ISLAND, WA

### BASIS FOR DESIGN:

CODE: INTERNATIONAL BUILDING CODE (2015 EDITION)  
WIND: 110 MPH, EXPOSURE "B"  $K_{zt} = 1.2$   
SEISMIC:  $S_s = 1.55$ ,  $S_1 = 0.55$  (SITE CLASS D)  
ROOF SNOW: 25 PSF  
ALLOWABLE SOIL BEARING PRESSURE: 2500 PSF PER SOILS REPORT

### INDEX TO COMPUTATIONS:

GENERAL	_____	G1 – G3
LATERAL	_____	L1 – L24
BEAM	_____	B1 – B49
COLUMN	_____	C1 – C5
FOOTING	_____	F1 – F10

RB ENGINEERS, INC. IS  
NOT RESPONSIBLE FOR THE SITE,  
SOILS, WEATHER PROOFING, TRUSSES  
AND/OR EXISTING CONDITIONS.



EXPIRES: Feb 20 **22**

**RB Engineers, Inc.**

1312 2nd St Kirkland, WA  
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Project: Merlino Residence	By: RB/MJT
Client:	Date: 9/10/2020
Subject: Lateral Calculations	Page: <b>G2/</b>

**LOADING CRITERIA FOR ROOF AND/OR CEILING**

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- Main Roof Area
- Canopy or Mansard Roof
- Ceiling Only
- Other

<b>Item</b>	<b>Material</b>	<b>Load PSF</b>
Roofing	Composition	2.2
Sheathing or Decking	15/32 CDX	1.5
Insulation		2.8
Ceiling	5/8 GWB	2.6
Fixtures		1.0
Framing	Truss	2.3
Misc.		0.6

**TOTAL DEAD LOAD :** 13 PSF

**LIVE LOADS**

- Snow Load - 25 psf - non reducible
- Ceiling Only - 10 psf
- Increase in  $F_b$  and  $F_v$  of 15% allowed for duration of load

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**LOADING CRITERIA FOR FLOOR**

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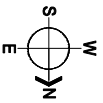
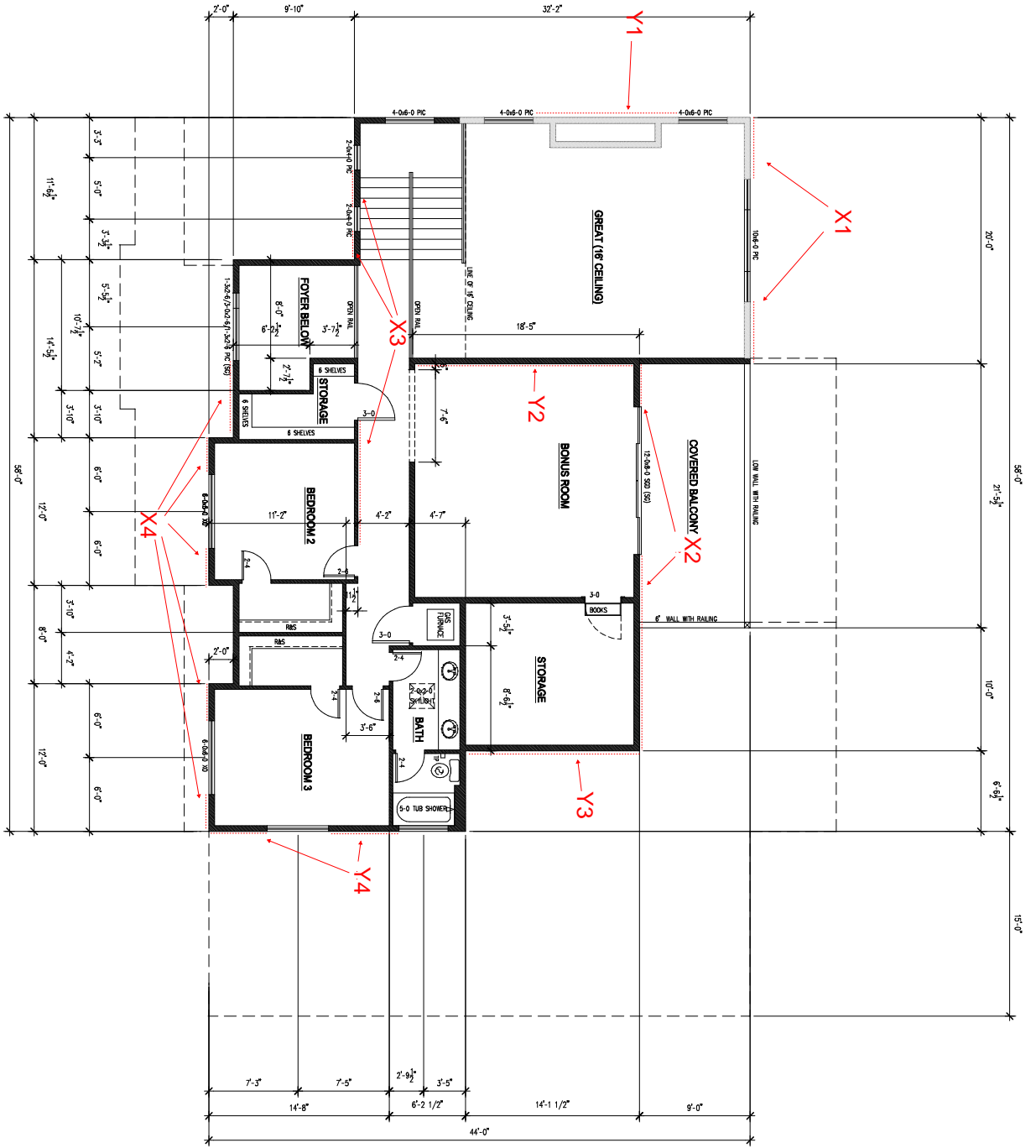
Item	Material	Load PSF
Floor Covering	Carpet and Pad	3.0
Floor Sheathing	3/4" T&G CDX	2.3
Ceiling	1/2" GWB	2.2
Fixtures		1.0
Framing	TJI's	3.0
Misc		1.5

**TOTAL DEAD LOAD :** 13 PSF

**LIVE LOADS**

- Residential - 40 psf (reducible)
- Office - 50 psf (reducible)
- Assembly - 100 psf (non-reducible)
- Corridors and Exits - 100 psf (reducible)
- Storage - 125 psf (non-reducible)

SW Key Plan



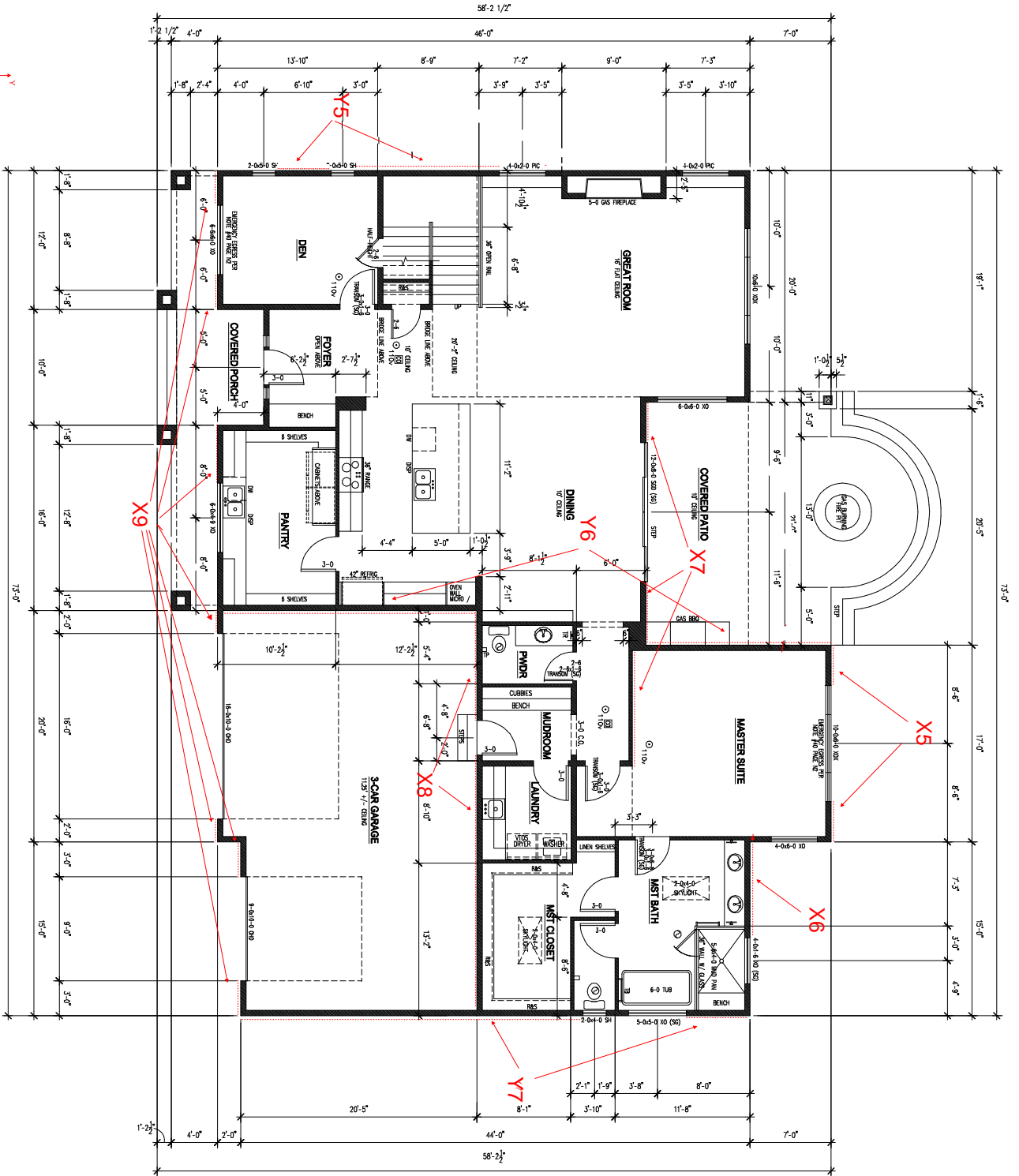
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 SHEET NUMBER: **A4**  
 SCALE: 1/4"=1'-0"  
 DATE: 7.16.2020  
 REVISION: 1/24/2020

**MERLINO RESIDENCE**  
 MERCER ISLAND, WA

UPPER LEVEL FLOOR PLAN

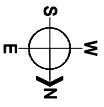
DR. GRESTI  
 ARCHITECTS 3/1/2022  
 206.428.6800

SW Key Plan



ADD 18 S.F. TO MAIN LEVEL

<b>FLOOR AREA:</b>	
UNHEATED FLOOR AREA:	3482 S.F.
HEATED FLOOR AREA:	3744 S.F.
TOTAL HEATED AREA:	3744 S.F.
<b>GARAGE:</b>	
REAR PORCH:	784 S.F.
ENTRY PORCH:	182 S.F.
COVERED BALCONY:	380 S.F.
	208 S.F.
<b>FLOOR AREA RATIO:</b>	
MAXIMUM ALLOWED:	5242 S.F.
	4000 S.F.
TOTAL LIVING:	3744 S.F.
	784 S.F.
<b>GREAT ROOM TALL CEILING:</b>	1460 S.F. x 8'
<b>FOYER TALL CEILING:</b>	70 S.F. x 11'
<b>STAIRWELL CEILING:</b>	103 S.F. x 11'
<b>PROPOSED F.A.R.</b>	4918 S.F.



**A2**

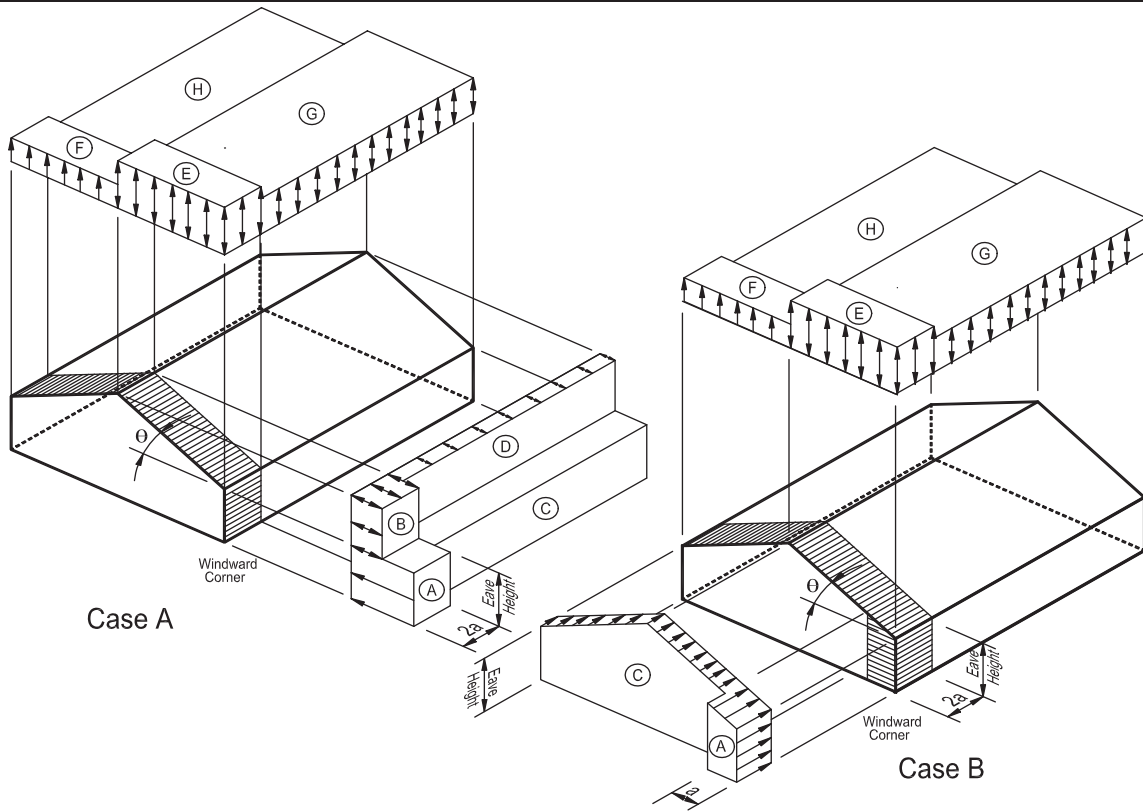
DATE: 7.16.2020  
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 SHEET NUMBER: 204, 002, 000

# MERLINO RESIDENCE

MERCER ISLAND, WA

## MAIN LEVEL FLOOR PLAN

<b>Main Wind Force Resisting System – Method 2</b>		<b><math>h \leq 60</math> ft.</b>
<b>Figure 28.6-1</b>	<b>Design Wind Pressures</b>	<b>Walls &amp; Roofs</b>
<b>Enclosed Buildings</b>		



Notes:

1. Pressures shown are applied to the horizontal and vertical projections, for exposure B, at  $h=30$  ft (9.1m). Adjust to other exposures and heights with adjustment factor  $\lambda$ .
2. The load patterns shown shall be applied to each corner of the building in turn as the reference corner. (See Figure 28.4-1)
3. For Case B use  $\theta = 0^\circ$ .
4. Load cases 1 and 2 must be checked for  $25^\circ < \theta \leq 45^\circ$ . Load case 2 at  $25^\circ$  is provided only for interpolation between  $25^\circ$  and  $30^\circ$ .
5. Plus and minus signs signify pressures acting toward and away from the projected surfaces, respectively.
6. For roof slopes other than those shown, linear interpolation is permitted.
7. The total horizontal load shall not be less than that determined by assuming  $p_s = 0$  in zones B & D.
8. Where zone E or G falls on a roof overhang on the windward side of the building, use  $E_{OH}$  and  $G_{OH}$  for the pressure on the horizontal projection of the overhang. Overhangs on the leeward and side edges shall have the basic zone pressure applied.
9. Notation:
  - $a$ : 10 percent of least horizontal dimension or  $0.4h$ , whichever is smaller, but not less than either 4% of least horizontal dimension or 3 ft (0.9 m).
  - $h$ : Mean roof height, in feet (meters), except that eave height shall be used for roof angles  $< 10^\circ$ .
  - $\theta$ : Angle of plane of roof from horizontal, in degrees.

Main Wind Force Resisting System – Method 2				h ≤ 60 ft.								
Figure 28.6-1 (cont'd)		Design Wind Pressures		Walls & Roofs								
Enclosed Buildings												
Simplified Design Wind Pressure , p <sub>S30</sub> (psf) (Exposure B at h = 30 ft. with I = 1.0)												
Basic Wind Speed (mph)	Roof Angle (degrees)	Load Case	Zones									
			Horizontal Pressures				Vertical Pressures				Overhangs	
			A	B	C	D	E	F	G	H	E <sub>OH</sub>	G <sub>OH</sub>
110	0 to 5°	1	19.2	-10.0	12.7	-5.9	-23.1	-13.1	-16.0	-10.1	-32.3	-25.3
	10°	1	21.6	-9.0	14.4	-5.2	-23.1	-14.1	-16.0	-10.8	-32.3	-25.3
	15°	1	24.1	-8.0	16.0	-4.6	-23.1	-15.1	-16.0	-11.5	-32.3	-25.3
	20°	1	26.6	-7.0	17.7	-3.9	-23.1	-16.0	-16.0	-12.2	-32.3	-25.3
	25°	1	24.1	3.9	17.4	4.0	-10.7	-14.6	-7.7	-11.7	-19.9	-17.0
		2	-----	-----	-----	-----	-4.1	-7.9	-1.1	-5.1	-----	-----
	30 to 45	1	21.6	14.8	17.2	11.8	1.7	-13.1	0.6	-11.3	-7.6	-8.7
	2	21.6	14.8	17.2	11.8	8.3	-6.5	7.2	-4.6	-7.6	-8.7	
115	0 to 5°	1	21.0	-10.9	13.9	-6.5	-25.2	-14.3	-17.5	-11.1	-35.3	-27.6
	10°	1	23.7	-9.8	15.7	-5.7	-25.2	-15.4	-17.5	-11.8	-35.3	-27.6
	15°	1	26.3	-8.7	17.5	-5.0	-25.2	-16.5	-17.5	-12.6	-35.3	-27.6
	20°	1	29.0	-7.7	19.4	-4.2	-25.2	-17.5	-17.5	-13.3	-35.3	-27.6
	25°	1	26.3	4.2	19.1	4.3	-11.7	-15.9	-8.5	-12.8	-21.8	-18.5
		2	-----	-----	-----	-----	-4.4	-8.7	-1.2	-5.5	-----	-----
	30 to 45	1	23.6	16.1	18.8	12.9	1.8	-14.3	0.6	-12.3	-8.3	-9.5
	2	23.6	16.1	18.8	12.9	9.1	-7.1	7.9	-5.0	-8.3	-9.5	
120	0 to 5°	1	22.8	-11.9	15.1	-7.0	-27.4	-15.6	-19.1	-12.1	-38.4	-30.1
	10°	1	25.8	-10.7	17.1	-6.2	-27.4	-16.8	-19.1	-12.9	-38.4	-30.1
	15°	1	28.7	-9.5	19.1	-5.4	-27.4	-17.9	-19.1	-13.7	-38.4	-30.1
	20°	1	31.6	-8.3	21.1	-4.6	-27.4	-19.1	-19.1	-14.5	-38.4	-30.1
	25°	1	28.6	4.6	20.7	4.7	-12.7	-17.3	-9.2	-13.9	-23.7	-20.2
		2	-----	-----	-----	-----	-4.8	-9.4	-1.3	-6.0	-----	-----
	30 to 45	1	25.7	17.6	20.4	14.0	2.0	-15.6	0.7	-13.4	-9.0	-10.3
	2	25.7	17.6	20.4	14.0	9.9	-7.7	8.6	-5.5	-9.0	-10.3	
130	0 to 5°	1	26.8	-13.9	17.8	-8.2	-32.2	-18.3	-22.4	-14.2	-45.1	-35.3
	10°	1	30.2	-12.5	20.1	-7.3	-32.2	-19.7	-22.4	-15.1	-45.1	-35.3
	15°	1	33.7	-11.2	22.4	-6.4	-32.2	-21.0	-22.4	-16.1	-45.1	-35.3
	20°	1	37.1	-9.8	24.7	-5.4	-32.2	-22.4	-22.4	-17.0	-45.1	-35.3
	25°	1	33.6	5.4	24.3	5.5	-14.9	-20.4	-10.8	-16.4	-27.8	-23.7
		2	-----	-----	-----	-----	-5.7	-11.1	-1.5	-7.1	-----	-----
	30 to 45	1	30.1	20.6	24.0	16.5	2.3	-18.3	0.8	-15.7	-10.6	-12.1
	2	30.1	20.6	24.0	16.5	11.6	-9.0	10.0	-6.4	-10.6	-12.1	
140	0 to 5°	1	31.1	-16.1	20.6	-9.6	-37.3	-21.2	-26.0	-16.4	-52.3	-40.9
	10°	1	35.1	-14.5	23.3	-8.5	-37.3	-22.8	-26.0	-17.5	-52.3	-40.9
	15°	1	39.0	-12.9	26.0	-7.4	-37.3	-24.4	-26.0	-18.6	-52.3	-40.9
	20°	1	43.0	-11.4	28.7	-6.3	-37.3	-26.0	-26.0	-19.7	-52.3	-40.9
	25°	1	39.0	6.3	28.2	6.4	-17.3	-23.6	-12.5	-19.0	-32.3	-27.5
		2	-----	-----	-----	-----	-6.6	-12.8	-1.8	-8.2	-----	-----
	30 to 45	1	35.0	23.9	27.8	19.1	2.7	-21.2	0.9	-18.2	-12.3	-14.0
	2	35.0	23.9	27.8	19.1	13.4	-10.5	11.7	-7.5	-12.3	-14.0	
150	0 to 5°	1	35.7	-18.5	23.7	-11.0	-42.9	-24.4	-29.8	-18.9	-60.0	-47.0
	10°	1	40.2	-16.7	26.8	-9.7	-42.9	-26.2	-29.8	-20.1	-60.0	-47.0
	15°	1	44.8	-14.9	29.8	-8.5	-42.9	-28.0	-29.8	-21.4	-60.0	-47.0
	20°	1	49.4	-13.0	32.9	-7.2	-42.9	-29.8	-29.8	-22.6	-60.0	-47.0
	25°	1	44.8	7.2	32.4	7.4	-19.9	-27.1	-14.4	-21.8	-37.0	-31.6
		2	-----	-----	-----	-----	-7.5	-14.7	-2.1	-9.4	-----	-----
	30 to 45	1	40.1	27.4	31.9	22.0	3.1	-24.4	1.0	-20.9	-14.1	-16.1
	2	40.1	27.4	31.9	22.0	15.4	-12.0	13.4	-8.6	-14.1	-16.1	

Unit Conversions – 1.0 ft = 0.3048 m; 1.0 psf = 0.0479 kN/m<sup>2</sup>

<b>Main Wind Force Resisting System – Method 2</b>		<b>h ≤ 60 ft.</b>
<b>Figure 28.6-1 (cont'd)</b>	<b>Design Wind Pressures</b>	<b>Walls &amp; Roofs</b>
<b>Enclosed Buildings</b>		

**Simplified Design Wind Pressure ,  $p_{S30}$  (psf) (Exposure B at h = 30 ft.)**

Basic Wind Speed (mph)	Roof Angle (degrees)	Load Case	Zones									
			Horizontal Pressures				Vertical Pressures				Overhangs	
			A	B	C	D	E	F	G	H	EoH	GoH
<b>160</b>	0 to 5°	1	40.6	-21.1	26.9	-12.5	-48.8	-27.7	-34.0	-21.5	-68.3	-53.5
	10°	1	45.8	-19.0	30.4	-11.1	-48.8	-29.8	-34.0	-22.9	-68.3	-53.5
	15°	1	51.0	-16.9	34.0	-9.6	-48.8	-31.9	-34.0	-24.3	-68.3	-53.5
	20°	1	56.2	-14.8	37.5	-8.2	-48.8	-34.0	-34.0	-25.8	-68.3	-53.5
	25°	1	50.9	8.2	36.9	8.4	-22.6	-30.8	-16.4	-24.8	-42.1	-35.9
		2	-----	-----	-----	-----	-8.6	-16.8	-2.3	-10.7	-----	-----
	30 to 45	1	45.7	31.2	36.3	25.0	3.5	-27.7	1.2	-23.8	-16.0	-18.3
	2	45.7	31.2	36.3	25.0	17.6	-13.7	15.2	-9.8	-16.0	-18.3	
<b>180</b>	0 to 5°	1	51.4	-26.7	34.1	-15.8	-61.7	-35.1	-43.0	-27.2	-86.4	-67.7
	10°	1	58.0	-24.0	38.5	-14.0	-61.7	-37.7	-43.0	-29.0	-86.4	-67.7
	15°	1	64.5	-21.4	43.0	-12.2	-61.7	-40.3	-43.0	-30.8	-86.4	-67.7
	20°	1	71.1	-18.8	47.4	-10.4	-61.7	-43.0	-43.0	-32.6	-86.4	-67.7
	25°	1	64.5	10.4	46.7	10.6	-28.6	-39.0	-20.7	-31.4	-53.3	-45.4
		2	-----	-----	-----	-----	-10.9	-21.2	-3.0	-13.6	-----	-----
	30 to 45	1	57.8	39.5	45.9	31.6	4.4	-35.1	1.5	-30.1	-20.3	-23.2
	2	57.8	39.5	45.9	31.6	22.2	-17.3	19.3	-12.3	-20.3	-23.2	
<b>200</b>	0 to 5°	1	63.4	-32.9	42.1	-19.5	-76.2	-43.3	-53.1	-33.5	-106.7	-83.5
	10°	1	71.5	-29.7	47.6	-17.3	-76.2	-46.5	-53.1	-35.8	-106.7	-83.5
	15°	1	79.7	-26.4	53.1	-15.0	-76.2	-49.8	-53.1	-38.0	-106.7	-83.5
	20°	1	87.8	-23.2	58.5	-12.8	-76.2	-53.1	-53.1	-40.2	-106.7	-83.5
	25°	1	79.6	12.8	57.6	13.1	-35.4	-48.2	-25.6	-38.7	-65.9	-56.1
		2	-----	-----	-----	-----	-13.4	-26.2	-3.7	-16.8	-----	-----
	30 to 45	1	71.3	48.8	56.7	39.0	5.5	-43.3	1.8	-37.2	-25.0	-28.7
	2	71.3	48.8	56.7	39.0	27.4	-21.3	23.8	-15.2	-25.0	-28.7	

**Adjustment Factor  
for Building Height and Exposure,  $\lambda$**

Mean roof height (ft)	Exposure		
	B	C	D
15	1.00	1.21	1.47
20	1.00	1.29	1.55
25	1.00	1.35	1.61
30	1.00	1.40	1.66
35	1.05	1.45	1.70
40	1.09	1.49	1.74
45	1.12	1.53	1.78
50	1.16	1.56	1.81
55	1.19	1.59	1.84
60	1.22	1.62	1.87

Unit Conversions – 1.0 ft = 0.3048 m; 1.0 psf = 0.0479 kN/m<sup>2</sup>



leeward net pressures.  $p_s$  shall be determined by the following equation:

$$p_s = \lambda K_{zt} p_{S30} \quad (28.6-1)$$

where

$\lambda$  = adjustment factor for building height and exposure from Fig. 28.6-1

$K_{zt}$  = topographic factor as defined in Section 26.8 evaluated at mean roof height,  $h$

$p_{S30}$  = simplified design wind pressure for Exposure B, at  $h = 30$  ft (9.1 m) from Fig. 28.6-1

#### 28.6.4 Minimum Design Wind Loads

The load effects of the design wind pressures from Section 28.6.3 shall not be less than a minimum load defined by assuming the pressures,  $p_s$ , for zones A and C equal to +16 psf, Zones B and D equal to +8 psf, while assuming  $p_s$  for Zones E, F, G, and H are equal to 0 psf.

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**LATERAL WIND FORCES  
 ENVELOPE PROCEDURE (ASCE 7-10 Chapter 28)**

		<u>Design Wind Pressures</u>	
Roof Pitch:	3:12 (14°)	Wind Speed:	110 mph
Wind Exposure:	B λ = 1.0 ASCE 7-10 p.305	A:	24.1
Minimum Pressure:	16 psf (wall) 28.6.4	B:	0.0
Minimum Pressure:	8 psf (roof) 28.6.4	C:	16
Kzt:	1.2	D:	0.0

(ASCE 7-10) Using Allowable Stress Design, 2.4.1 Basic Combinations option 7: 0.6 D + 0.6 W

**X – X Direction**

---

$$\Sigma F_w \text{ Roof} = (24.1x((4x2+4x1+9x5)) + 16.0x(32x1.5+12x4)) / 1000 =$$

$$2.91 \times 1.2 \text{ Kzt} \times 0.6 = 2.09 \text{ kip}$$

$$\Sigma F_w \text{ Upper} = (24.1x((11x5x2+4x2+5x3.5)) + 16.0x(28x10+5x4)) / 1000 =$$

$$8.07 \times 1.2 \text{ Kzt} \times 0.6 = \boxed{5.81} \text{ kip}$$

$$\text{Roof Min} = ((16x(57+96)+8x(38+255)) / 1000) \times 1.2 \text{ Kzt} \times 0.6 = \boxed{3.45} \text{ kip}$$

$$\text{Upper Min} = ((16x(135.5+300)+8x(65+18)) / 1000) \times 1.2 \text{ Kzt} \times 0.6 = 5.50 \text{ kip}$$

**Y – Y Direction**

---

$$\Sigma F_w \text{ Roof} = (24.1x((15x5)) + 16.0x(43x5)) / 1000 =$$

$$5.25 \times 1.2 \text{ Kzt} \times 0.6 = 3.78 \text{ kip}$$

$$\Sigma F_w \text{ Upper} = (24.1x((15x5x2+4.5x2.5+5x3.5)) + 16.0x(9x7.5+34x5)) / 1000 =$$

$$8.11 \times 1.2 \text{ Kzt} \times 0.6 = 5.84 \text{ kip}$$

$$\text{Roof Min} = ((16x(75+215)+8x(45+215))) / 1000) \times 1.2 \text{ Kzt} \times 0.6 = \boxed{4.84} \text{ kip}$$

$$\text{Upper Min} = ((16x(178.75+237.5)+8x(96.5+95)) / 1000) \times 1.2 \text{ Kzt} \times 0.6 = \boxed{5.90} \text{ kip}$$

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Client:		Date:	9/10/2020
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**QUAKE FORCES** (ASCE 7-10)

Site Class "D" (Table 11.4.2)

Ss = 1.55 - Critical Values per Latest USG Website      Based on Latitude and Longitude

S1 = 0.55 - Critical Values per Latest USG Website      Based on Latitude and Longitude

Fa = 1.0 per Table 11.4-1

Fv = 1.5 per Table 11.4-2

Sms = Fa \* Ss = 1.0 (1.55) = 1.55      11.4-1

Sm1 = Fv \* S1 = 1.5 (0.55) = .825      11.4-2

Sds = 2/3 \* Sms = 2/3 (1.55) = 1.03      11.4-3

Sd1 = 2/3 \* Sm1 = 2/3 (0.825) = .55      11.4-4

SEISMIC RESPONSE COEFFICIENT: Use Section (12.8.1.1) ASCE 7-10 Except as Noted

To = 0.2 (Sd1/Sds) = 0.11 SEC      11.4.5

Ts = Sd1 /Sds = 0.53 SEC      11.4.5

Tstruc = Ct \* (Hn)<sup>3/4</sup> = 0.020 (25.3)<sup>3/4</sup> = 0.23 SEC

Where To ≤ Tstruc ≤ Ts    Sa = Sds = 1.03 Therefore Seismic Design Category "D"

R = 6.5 for Wood Shear Walls per ASCE 7-10 Table 12.2-1

Cs = Sds /(R/I) = 1.03 / (6.5/1) = 0.158      12.8-2

**Cs = 0.16**



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Subject:	Lateral Calculations	Page:	L10/

**WIND FORCES ON SHEAR WALLS****Shearwalls in X – X Direction**

$$F_w X - X @ \text{Roof:} \quad 3.45 \quad \text{kips} \qquad 3.45 \text{ k} / 44 \text{ ft} = \quad 78.4 \quad \#/\text{Ft}$$

$$V @ X 1 = (3.45/44) \times (9/2) = \frac{0.35}{5'+5'} = 35 \quad \frac{\#}{\text{Ft}}$$

SW-4

$$V @ X 2 = (3.45/44) \times (9/2 + 23/2) = \frac{1.25}{16'+3.5'} = 64 \quad \frac{\#}{\text{Ft}}$$

SW-4

$$V @ X 3 = (3.45/44) \times (23/2 + 10/2) = \frac{1.29}{10'+3'+2.25'} = 85 \quad \frac{\#}{\text{Ft}}$$

SW-X

Restrain to window to reduce h:w ratio (For 2.25' shear walls)

$$V @ X 4 = (3.45/44) \times (10/2 + 2) = \frac{0.55}{6'+3'+3'+3'+3'} = 30 \quad \frac{\#}{\text{Ft}}$$

SW-4

$$F_w X - X @ \text{Upper:} \quad 5.81 \quad \text{kips} \qquad 5.08 \text{ k} / 53 \text{ ft} = \quad 109.6 \quad \#/\text{Ft}$$

$$V @ X 5 = (5.81/53) \times (7/2) = \frac{0.38}{3.5'+3.5'} = 55 \quad \frac{\#}{\text{Ft}}$$

SW-4

$$V @ X 6 = (5.81/53) \times (7/2 + 9/2) + 0.35 = \frac{1.23}{8.25'+5'+5'} = 67 \quad \frac{\#}{\text{Ft}}$$

SW-4

$$V @ X 7 = (5.81/53) \times (9/2 + 1 + 13.5/2) + 1.25 = \frac{2.60}{10'+5.5'+3.5'} = 137 \quad \frac{\#}{\text{Ft}}$$

SW-3

$$V @ X 8 = (5.81/53) \times (13.5/2 + 20.5/2) + 1.29 \times (12/20.5) + 0.55 \times (6/18) \times (1.5/20.5) = \frac{2.63}{22'+9.5'} = 84 \quad \frac{\#}{\text{Ft}}$$

SW-4

$$V @ X 9 = (5.81/53) \times (20.5/2 + 2) + 1.29 \times (8.5/20.5) + 0.55 \times (6/18) \times (19/20.5) + 0.55 \times (12/18) = \frac{2.41}{4 \times (24" \times 10' \text{ LRP})} < 4.5 \text{ k LRP Capacity.}$$

SW-3

4x(24"x10' LRP)=4 x 1.125k = 4.5 k LRP Capacity

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Subject:	Lateral Calculations	Page:	L11/

**WIND FORCES ON SHEAR WALLS****Shearwalls in Y – Y Direction**


---

F <sub>w</sub> Y – Y @ Roof:	4.84 kips		4.84 k / 58 ft =	83.4	#/Ft
V @ Y 1 =	(4.84/58)x(20/2)=	$\frac{0.83}{12'}$	=	70	$\frac{\#}{\text{Ft}}$
<span style="border: 1px solid black; padding: 2px;">SW-4</span>					
V @ Y 2 =	(4.84/58)x(20/2+31.5/2)=	$\frac{2.15}{17.75'}$	=	121	$\frac{\#}{\text{Ft}}$
<span style="border: 1px solid black; padding: 2px;">SW-4</span>					
V @ Y 3 =	(4.84/58)x(31.5/2+6.5/2)=	$\frac{1.59}{14'}$	=	113	$\frac{\#}{\text{Ft}}$
<span style="border: 1px solid black; padding: 2px;">SW-4</span>					
V @ Y 4 =	(4.84/58)x(6.5/2)=	$\frac{0.27}{5.5'+4.75'}$	=	26	$\frac{\#}{\text{Ft}}$
<span style="border: 1px solid black; padding: 2px;">SW-4</span>					

---

F <sub>w</sub> Y – Y @ Upper:	5.90 kips		5.66k / 39 ft =	151.3	#/Ft
V @ Y 5 =	(5.90/73)x(38/2)	$\frac{3.39}{12.5'+4.75'}$	=	196	$\frac{\#}{\text{Ft}}$
<span style="border: 1px solid black; padding: 2px;">SW-3</span>	+0.83				
	+2.15x(18/38)=				
V @ Y 6 =	(5.90/73)x(38/2+3+32/2)	$\frac{5.42}{22'+16'}$	=	143	$\frac{\#}{\text{Ft}}$
<span style="border: 1px solid black; padding: 2px;">SW-4</span>	+2.15x(20/38)				
	+1.59x(22/32)				
	+0.27x(15/32)=				
V @ Y 7 =	(5.90/73)x(32/2)	$\frac{1.93}{29.5'+5.5'}$	=	55	$\frac{\#}{\text{Ft}}$
<span style="border: 1px solid black; padding: 2px;">SW-4</span>	+1.59x(10/32)				
	+0.27x(17/32)=				

---

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Client:		Date:	9/10/2020
Subject:	Lateral Calculations	Page:	L12/

**QUAKE FORCES ON SHEAR WALLS****Shearwalls in X – X Direction**

$$F_w X - X @ \text{Roof:} \quad 12.46 \quad \text{kips} \quad 12.46 \text{ k} / 44 \text{ ft} = \quad 283.2 \quad \#/\text{Ft}$$

$$V @ X 1 = (12.46/44) \times (9/2) = \frac{1.27}{5' + 5'} = 127 \quad \frac{\#}{\text{Ft}}$$

$$V @ X 2 = (12.46/44) \times (9/2 + 23/2) = \frac{4.53}{16' + 3.5'} = 232 \quad \frac{\#}{\text{Ft}}$$

(1.25 - 0.125x(9/3.5))x350 #/Ft = 325 #/Ft capacity per table 4.3.4 ANSI/AF+PA SDPWS

$$V @ X 3 = (12.46/44) \times (23/2 + 10/2) = \frac{4.67}{10' + 3' + 2.25'} = 306 \quad \frac{\#}{\text{Ft}}$$

Restrain to window to reduce h:w ratio (For 2.25' shear walls)

(1.25 - 0.125x(9/3))x350 #/Ft = 306 #/Ft capacity per table 4.3.4 ANSI/AF+PA SDPWS

$$V @ X 4 = (12.46/44) \times (10/2 + 2) = \frac{1.98}{6' + 3' + 3' + 3' + 3'} = 110 \quad \frac{\#}{\text{Ft}}$$

(1.25 - 0.125x(9/3))x350 #/Ft = 306 #/Ft capacity per table 4.3.4 ANSI/AF+PA SDPWS

$$F_w X - X @ \text{Upper:} \quad 9.86 \quad \text{kips} \quad 9.86 \text{ k} / 53 \text{ ft} = \quad 186.0 \quad \#/\text{Ft}$$

$$V @ X 5 = (9.86/53) \times (7/2) = \frac{0.65}{3.5' + 3.5'} = 93 \quad \frac{\#}{\text{Ft}}$$

(1.25 - 0.125x(10/3.5))x350 #/Ft = 313 #/Ft capacity per table 4.3.4 ANSI/AF+PA SDPWS

$$V @ X 6 = (9.86/53) \times (7/2 + 9/2) + 1.27 = \frac{2.76}{8.25'} = 335 \quad \frac{\#}{\text{Ft}}$$

$$V @ X 7 = (9.86/53) \times (9/2 + 1 + 13.5/2) + 4.53 = \frac{6.81}{10' + 5.5' + 3.5'} = 358 \quad \frac{\#}{\text{Ft}}$$

(1.25 - 0.125x(10/3.5))x450 #/Ft = 402 #/Ft capacity per table 4.3.4 ANSI/AF+PA SDPWS

$$V @ X 8 = (9.86/53) \times (13.5/2 + 20.5/2) + 4.67 \times (12/20.5) + 1.98 \times (6/18) \times (1.5/20.5) = \frac{5.95}{22' + 9.5'} = 189 \quad \frac{\#}{\text{Ft}}$$

$$V @ X 9 = (9.86/53) \times (20.5/2 + 2) + 4.67 \times (8.5/20.5) + 1.98 \times (6/18) \times (19/20.5) + 1.98 \times (12/18) - 4.5 = \frac{1.65}{5' + 3' + 3'} = 150 \quad \frac{\#}{\text{Ft}}$$

4x(24"x10' LRP) = 4 x 1.125k = 4.5 k LRP Capacity

(1.25 - 0.125x(10/3))x350 #/Ft = 292 #/Ft capacity per table 4.3.4 ANSI/AF+PA SDPWS

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Subject:	Lateral Calculations	Page:	L13/

**QUAKE FORCES ON SHEAR WALLS****Shearwalls in Y – Y Direction**


---

F <sub>w</sub> Y – Y @ Roof:	12.46 kips		12.46 k / 58 ft =	214.9	#/Ft
V @ Y 1 =	(12.46/58)x(20/2)=	$\frac{2.15}{12'}$	=	179	$\frac{\#}{Ft}$
<b>SW-4</b>					
V @ Y 2 =	(12.46/58)x(20/2+31.5/2)=	$\frac{5.53}{17.75'}$	=	312	$\frac{\#}{Ft}$
<b>SW-4</b>					
V @ Y 3 =	(12.46/58)x(31.5/2+6.5/2)=	$\frac{4.08}{14'}$	=	292	$\frac{\#}{Ft}$
<b>SW-4</b>					
V @ Y 4 =	(12.46/58)x(6.5/2)=	$\frac{0.70}{5.5'+4.75'}$	=	68	$\frac{\#}{Ft}$
<b>SW-4</b>					

---

F <sub>w</sub> Y – Y @ Upper:	9.86 kips		9.86 k / 73 ft =	135.0	#/Ft
V @ Y 5 =	(9.86/73)x(38/2)	$\frac{7.34}{12.5'+4.75'}$	=	425	$\frac{\#}{Ft}$
<b>SW-3</b>	+2.15				
	+5.53x(18/38)=				
V @ Y 6 =	(9.86/73)x(38/2+3+32/2)	$\frac{11.18}{22'+16'}$	=	294	$\frac{\#}{Ft}$
<b>SW-4</b>	+5.53x(20/38)				
	+4.08x(22/32)				
	+0.70x(15/32)=				
V @ Y 7 =	(9.86/73)x(32/2)	$\frac{3.81}{29.5'+5.5'}$	=	109	$\frac{\#}{Ft}$
<b>SW-4</b>	+4.08x(10/32)				
	+0.70x(17/32)=				

---



Project: Merlino Residence	By: RB/MJT
Client:	Date: 9/10/2020
Subject: Lateral Calculations	Page: L14/

**CHECK OVERTURNING FOR:** X 1 (Quake)

L = 5 ft TL<sub>RF</sub> = 5 ft (conservative)

P = 127 lb/ft

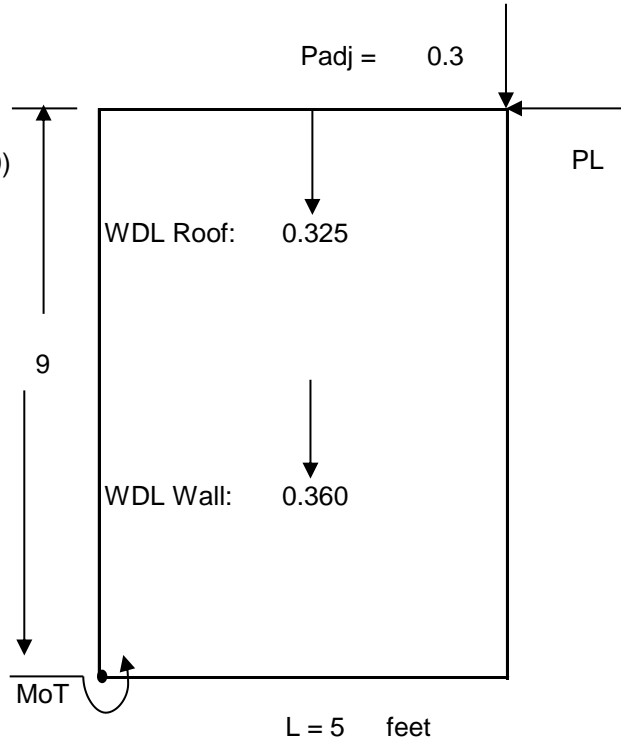
P x L = 5x127 = 0.64 kip

MoT = 0.64\*9 = 5.72 kip - ft

DL<sub>f</sub> = 0.45 (Ref. Sect. 12.4.2.3 ASC. 7-10)

MR = [(0.325+0.360)x0.5x5+0.3x5]x0.45 = 1.45 kip - ft

T = C =  $\frac{MoT - MR}{L}$  = 0.85 kip



Therefore use (1)CS16 hold downs at each end

Project: Merlino Residence	By: RB/MJT
Client:	Date: 9/10/2020
Subject: Lateral Calculations	Page: <b>L15/</b>

**CHECK OVERTURNING FOR:** X 3 (Quake)

L = 2.25 ft TL<sub>RF</sub> = 5 ft (conservative)

P = 306 lb/ft

P x L = 2.25x306 = 0.69 kip

MoT = 0.69\*9 = 6.20 kip - ft

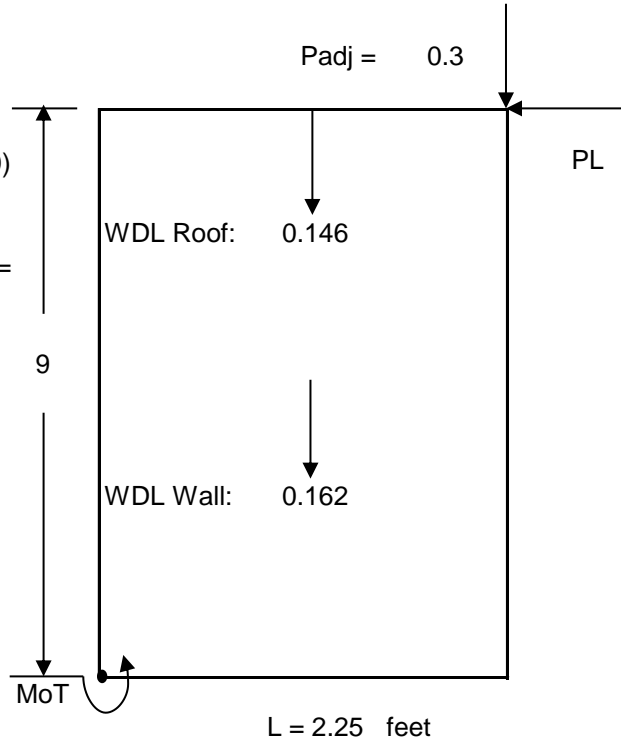
DL<sub>f</sub> = 0.45 (Ref. Sect. 12.4.2.3 ASC. 7-10)

MR = [(0.146+0.162)x0.5x2.25+0.3x2.25]x0.45 = 0.46 kip - ft

H = 9

T = C =  $\frac{MoT - MR}{L}$

2.55 kip ↑ ↓



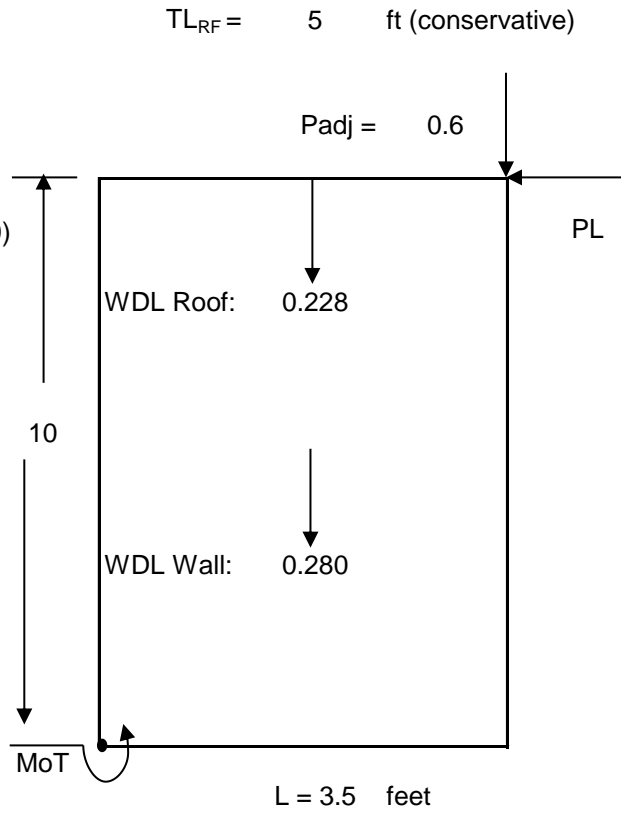
Therefore use (2)CS16 hold downs at each end

Project: Merlino Residence	By: RB/MJT
Client:	Date: 9/10/2020
Subject: Lateral Calculations	Page: <b>L16/</b>

**CHECK OVERTURNING FOR:** X 7 (Quake)

$L = 3.5$  ft  
 $P = 358$  lb/ft  
 $P \times L = 3.5 \times 358 = 1.25$  kip  
 $MoT = 1.25 \times 10 = 12.53$  kip - ft  
 $DL_f = 0.45$  (Ref. Sect. 12.4.2.3 ASC. 7-10)  
 $MR = [(0.228 + 0.280) \times 0.5 \times 3.5 + 0.6 \times 3.5] \times 0.45 = 1.34$  kip - ft

$T = C = \frac{MoT - MR}{L} = \frac{12.53 - 1.34}{3.5} = 3.20$  kip



Therefore use STHD14 hold downs at each end

Project: Merlino Residence	By: RB/MJT
Client:	Date: 9/10/2020
Subject: Lateral Calculations	Page: <b>L17/</b>

**CHECK OVERTURNING FOR:** Y 2 (Quake)

L = 17.75 ft TL<sub>RF</sub> = 5 ft (conservative)

P = 312 lb/ft

P x L = 17.75x312 = 5.54 kip

MoT = 5.54\*9 = 49.84 kip - ft

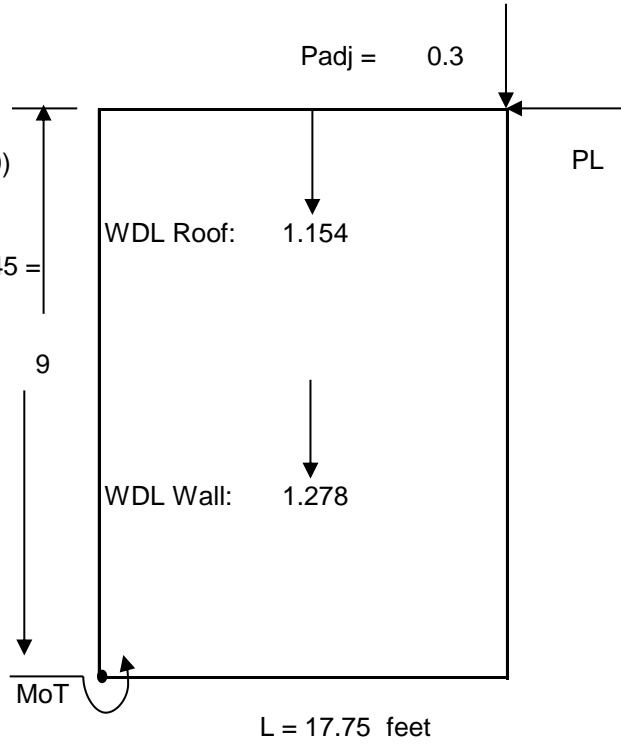
DL<sub>f</sub> = 0.45 (Ref. Sect. 12.4.2.3 ASC. 7-10)

MR = [(1.154+1.278)x0.5x17.75+0.3x17.75]x0.45 = 12.11 kip - ft

T = C =  $\frac{MoT - MR}{L}$

2.13 kip

H = 9



Therefore use (2)CS16 hold downs at each end

Project: Merlino Residence	By: RB/MJT
Client:	Date: 9/10/2020
Subject: Lateral Calculations	Page: <b>L18/</b>

**CHECK OVERTURNING FOR:** Y 1 (Quake)

L = 12 ft TL<sub>RF</sub> = 5 ft (conservative)

P = 179 lb/ft

P x L = 12x179 = 2.15 kip

MoT = 2.15\*9 = 19.33 kip - ft

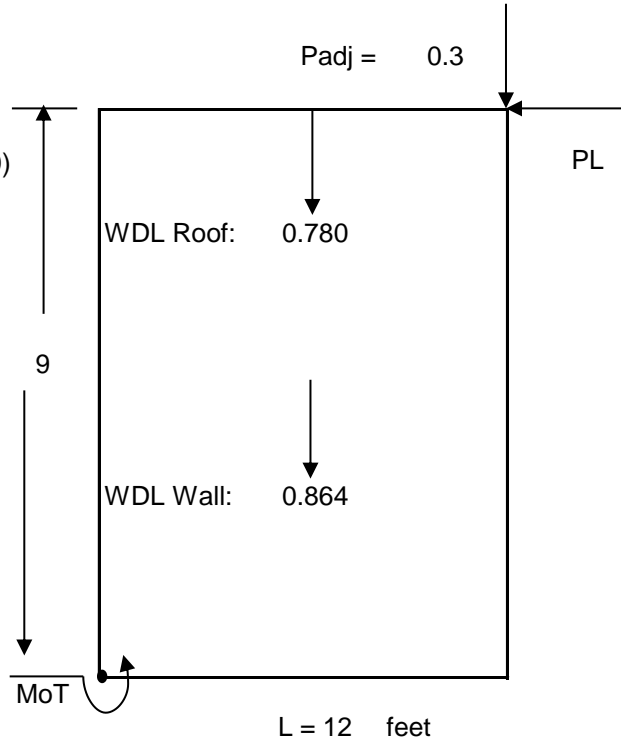
DL<sub>f</sub> = 0.45 (Ref. Sect. 12.4.2.3 ASC. 7-10)

MR = [(0.780+0.864)x0.5x12+0.3x12]x0.45 = 6.06 kip - ft

$T = C = \frac{MoT - MR}{L}$

1.11 kip

H = 9



Therefore use (1)CS16 hold downs at each end

Project: Merlino Residence	By: RB/MJT
Client:	Date: 9/10/2020
Subject: Lateral Calculations	Page: L19/

**CHECK OVERTURNING FOR:** Y 5 (Quake)

L = 4.75 ft TL<sub>RF</sub> = 5 ft (conservative)

P = 425 lb/ft

P x L = 4.75 x 425 = 2.02 kip

MoT = 2.02 x 10 = 20.19 kip - ft

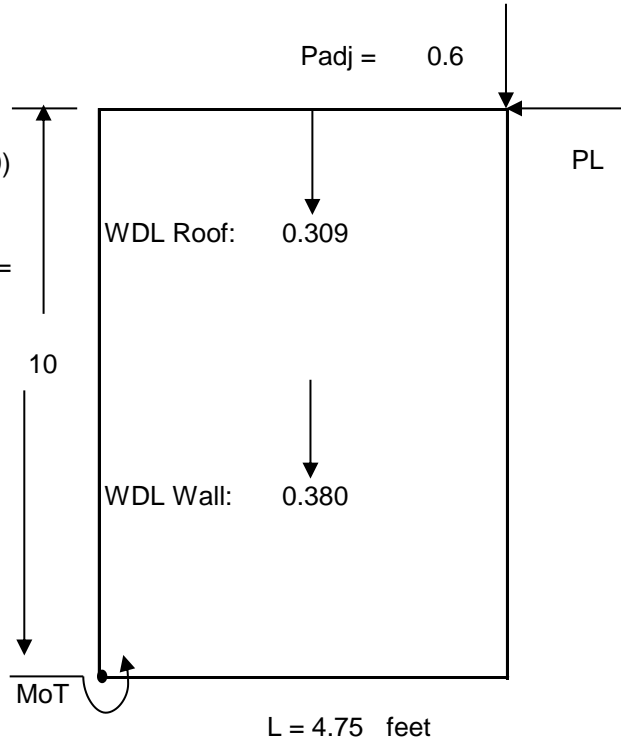
DL<sub>f</sub> = 0.45 (Ref. Sect. 12.4.2.3 ASC. 7-10)

MR = [(0.309 + 0.380) x 0.5 x 4.75 + 0.6 x 4.75] x 0.45 = 2.02 kip - ft

$T = C = \frac{MoT - MR}{L}$

3.83 kip ↑ ↓

H = 10



Therefore use STHD14 hold downs at each end

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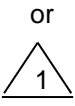
Project: Merlino Residence	By: RB/MJT
Client:	Date: 9/10/2020
Subject: Lateral Calculations	Page: L20/

**SHEARWALL SCHEDULE**

**Typ. Ext. Wall Construction**

SW-6	1) Sheathing: 1/2" Plywood or 7/16" O.S.B Exterior Side, Blocked, Nail w/ 8d @ 6" O.C. All edges and @ 12" O.C. Field 2) Bolt Sill Plate to Concrete w/ 5/8" DIA. X 10" A.B.'s @ 48" O.C. 3) Nail bottom plate to framing below w/ 16d @ 4" O.C. 4) Fasten double plate to joist or blocking above per details on S1 & S2.
------	---

Capacity: 240 lb/ft



**Shearwall Schedule**

--- --

Indicates shearwall w/ Plywood one side

SW-4	1) Sheathing: 1/2" plywood or 7/16" O.S.B. one side, blocked, nail w/ 8d @ 4" O.C. all edges and 12" O.C. field. 2) Bolt sill plate to concrete w/ 5/8" DIA. X 10" A.B.'s @ 32" O.C. 3) Nail bottom plate to framing below w/ 16d @ 3" O.C. 4) Fasten double plate to joist or blocking above per details on S1 & S2.
------	--

Capacity: 350 lb/ft



--- --

Indicates shearwall w/ Plywood two sides

(2)SW-3	1) Sheathing: 1/2" plywood or O.S.B. two sides, blocked, nail w/ 8d @ 3" O.C. all edges and 12" O.C. field 2) Bolt 3x or double sill plate to concrete w/ 5/8" DIA. X 10" exp. Bolts @ 12" O.C. 3) Fasten double bottom plates to double joist or blocking below w/ 2 rows 2 layers 16d @ 6" O.C. or 2 rows A35 clips @ 16" O.C. 4) Fasten double top plates to double joist or blocking above w/ 2 rows A35 clips @ 16" O.C. or per details on S1 & S2 5) Use 3x all framing members receiving en. From abutting panels
---------	--

Capacity: 900 lb/ft



--- --

Indicates shearwall w/ Plywood one side

SW-3	1) Sheathing: 1/2" plywood or 7/16" O.S.B. one side, blocked, nail w/ 8d @ 3" O.C. all edges and 12" O.C. field 2) Bolt 3x or double sill plate to concrete w/ 5/8" DIA x 10" A.B.'s @ 24" O.C. (U.N.O.) 3) Fasten double plate to joist or blocking above per details on S1 & S2. 4) Use (2) 2x studs @ 16" O.C. at detail D / S1 (U.N.O.) 5) Provide 3x stud framing at all members receiving edge nailing from abutting panels (U.N.O.)
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Capacity: 450 lb/ft



--- --

Indicates shearwall w/ Plywood one side

SW-2	1) Sheathing: 1/2" plywood or 7/16" O.S.B. one side, blocked, nail w/ 8d @ 2" O.C. all edges and 12" O.C. field 2) Bolt 3x or double sill plate to concrete w/ 5/8" DIA x 10" A.B.'s @ 16" O.C. 3) Fasten double plate to joist or blocking above per details on S1 & S2. 4) Provide 3x stud framing at all members receiving edge nailing from abutting panels
------	--

Capacity: 585 lb/ft



# SOLE PLATE NAILING

$$16^D \text{ NAIL CAPACITY} = 94 \frac{\#}{\text{NAIL}} \quad \underline{\underline{\text{NER 272}}}$$

$$16^D @ 3'' \text{ o.c.} = 94 \frac{\#}{\text{NAIL}} \times 342 = 323 \frac{\#}{\text{NAIL}}$$

REDUCTION  
(.837)

$$\text{REDUCTION DUE TO PENETRATION} = \frac{1.25}{1.5} \times 323 \frac{\#}{\text{NAIL}} = 269 \frac{\#}{\text{NAIL}}$$

$$\text{NAILING FOR WIND \& QUAKE} = 269 \frac{\#}{\text{NAIL}} \times 1.6 = 430 \frac{\#}{\text{NAIL}}$$

↑  
LATERAL INCREASE

∴ USE 16<sup>D</sup> @ 3 $\frac{1}{2}$ " o.c. SOLE PLATE TO 1 $\frac{3}{4}$  L<sub>2</sub>

Rim.



TB-206

May 2019 (Expires 3/2021)

TABLE 2: STRUCTURAL COMPOSITE LUMBER<sup>[1]</sup>

Nail Size		Nails Into Wide Face (Perpendicular to Strands)		Nails Into Narrow Edge (Parallel to Strands)						Min. End Distance
		Microllam® LVL, Parallam® PSL	TimberStrand® LSL, TJ® Rim Board	Microllam® LVL	Parallam® PSL	TimberStrand® LSL <sup>[2]</sup> , TJ® Rim Board				
						1 1/8"	1 1/4"	1 1/2"	1 3/4" - 3 1/2"	
On-Center Spacing		On-Center Spacing								
6d (2") common & 8d (2 1/2") box	[0.113"]	2"	2"	3"	3"	6"	4"	3"	3"	2 1/2"
8d (2 1/2") common	[0.131"]	2"	2"	4"	4"	6"	4"	3"	3"	2 3/4"
8d (1 1/2") N8 or NA11	[0.131"]	2"	2"	4"	4"	6"	4"	3"	3"	2 3/4"
10d (3") box	[0.128"]	2"	2"	4"	4"	6"	4"	3"	3"	2 3/4"
12d (3 1/4") box	[0.128"]	2"	2"	4"	4"	6"	4"	3"	3"	2 3/4"
10d (3") common	[0.148"]	3"	2 1/2"	5"	4"	6"	4"	3"	3"	3"
12d (3 1/4") common	[0.148"]	3"	2 1/2"	5"	4"	6"	4"	3"	3"	3"
10d (1 1/2") N10 or NA9D	[0.148"]	3"	2 1/2"	5"	4"	6"	4"	3"	3"	3"
16d (3 1/2") box	[0.135"]	3"	2 1/2"	5"	4"	16" <sup>[3]</sup>	4"	3"	3"	2 3/4"
16d (3 1/4") sinker	[0.148"]	3"	2 1/2"	5"	4"	16" <sup>[3]</sup>	4"	3"	3"	3"
16d (3 1/2") common	[0.162"]	4"	3"	8" <sup>[3]</sup>	6"	16" <sup>[3]</sup>	6" <sup>[4]</sup>	6" <sup>[4]</sup>	6" <sup>[5]</sup>	3 1/4"
Proprietary Wood Screws <sup>[6][7]</sup>	[0.250"]	- [11]		- [8]	- [8][9]	N/A	- [8][10]		- [11]	
Framing Angles: A34, A35, LTP4, LTP5, MP34, MPA1, MPA1F, and MP4F		OK		N/A		N/A	N/A			2 3/4"

[1] See **General Notes** on page 3.

[2] Closest on-center edge nailing for StrandGuard® TimberStrand® LSL sill plates is one (1) row at 4" o.c. for 2x<sub>1</sub> (1 1/2" thick).

[3] Can be reduced to 5" o.c. with maximum nail penetration of 1 1/4" into narrow edge (e.g. nails that connect sole plate above to block or rim).

[4] Can be reduced to 4" o.c. with maximum nail penetration of 1 1/4" into narrow edge (e.g. nails that connect sole plate above to block or rim).

[5] Can be reduced to 3 1/2" o.c. with maximum nail penetration of 1 1/4" into narrow edge (e.g. nails that connect sole plate above to block or rim).

[6] Proprietary wood screws are Simpson Strong-Tie® SDS and SDW, USP® WS, and FastenMaster® TrusLok® structural wood screws; nominal fastener shank diameter = 0.25".

[7] 6" long USP® WS structural wood screws are not recommended for TimberStrand® LSL or Parallam® PSL.

[8] Space proprietary wood screws at 6" o.c. minimum, into the narrow edge. For alternative spacing, reference Simpson Strong-Tie® engineering letter *Sole or Top Plate to Rim/Blocking using SDWS and SDWH Screw* (L-F-PLTRMBLK19).

[9] Two (2) staggered rows of proprietary wood screws are permitted in the narrow edge of Parallam® PSL for members 3 1/2" thick. Three (3) staggered rows of proprietary wood screws are permitted in the narrow edge of Parallam® PSL for members greater than or equal to 5 1/2" thick. For multiple rows, edge distance is a minimum of 1" and spacing between staggered rows is a minimum of 1 1/2".

[10] One (1) row of proprietary wood screws is permitted in the narrow edge of TimberStrand® LSL for members 1 1/2", 1 1/2", and 1 3/4" thick. Two (2) staggered rows of proprietary wood screws are permitted in the narrow edge of TimberStrand® LSL for members 3 1/2" thick. For multiple rows, edge distance is a minimum of 1" and spacing between staggered rows is a minimum of 1 1/2".

[11] See screw manufacturer's recommendations for spacing and capacity of connections. End distances, edge distances, and capacity of the screws must be sufficient to minimize splitting.

**Fastener spacing not applicable for shear wall applications. See appropriate code report for grade specific TimberStrand® LSL nailing requirements.**



Technical Support  
888-453-8358  
TechSupport@Weyerhaeuser.com

**TRUS JOIST® PRODUCT TECHNICAL INFORMER**

10/30/2018 (SW-N132)

**Shearwall Sole Plate Fastening Recommendations into Trus Joist Timberstrand® LSL Structural Composite Lumber**

The shear transfer between upper level wood framed shear walls via their sole plate fasteners into the rimboard/blocking below is a critical connection that needs careful specification.

Weyerhaeuser evaluates and promotes Timberstrand LSL as the preferred rimboard/blocking material due to economics, adjacent TJ® joist depth compatibility, width availability, fastening capabilities, and meeting the criteria in IBC 2303.1.13.

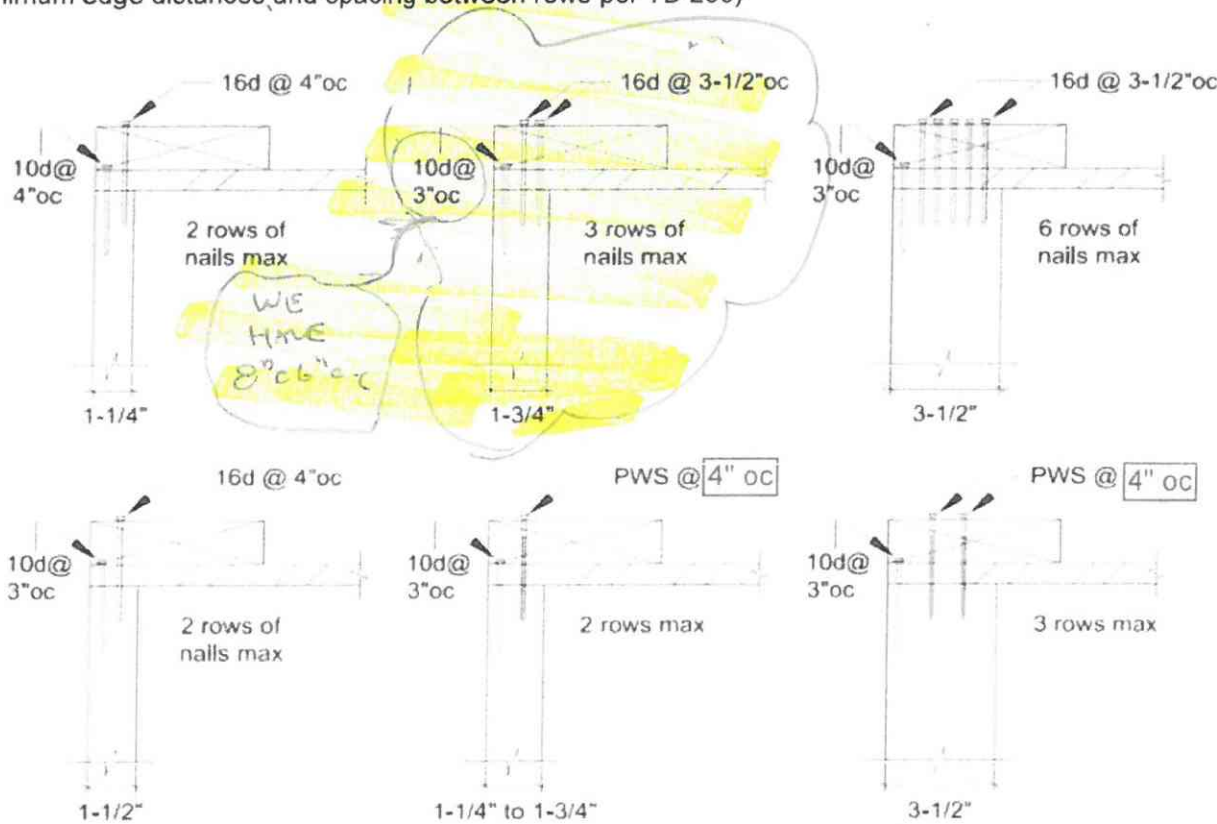
The sole plate's fastener type, number of rows, spacing and the WIDTH of the Timberstrand LSL rimboard/blocking should be properly specified, scheduled and detailed in the construction documents. A clear specification also helps suppliers create an accurate material list and avoids framing issues during construction.

Trus Joist by Weyerhaeuser publishes 2 documents to help an engineer of record to correctly specify Timberstrand LSL to avoid potential splitting and achieve lateral shear transfer.

- ICC ESR 1387
- Technical Bulletin TB-206

Also refer to Simpson Strong-Tie Engineering Letter L-F-PLTRMBLK19

Section details below summarize the fastener minimum spacings, maximum number of rows and width requirements: (Note: PWS = Proprietary Wood Screws; 1.25" & 1.5" widths are 1.3E grade, while 1.75" & 3.5" are 1.55E grade. Minimum edge distances and spacing between rows per TB-206)



CHECK LOW ROOF CONNECTION TO TRANSFER

LATERAL LOAD

ROOF DIAPHRAGM CAPACITY = 240 #/l

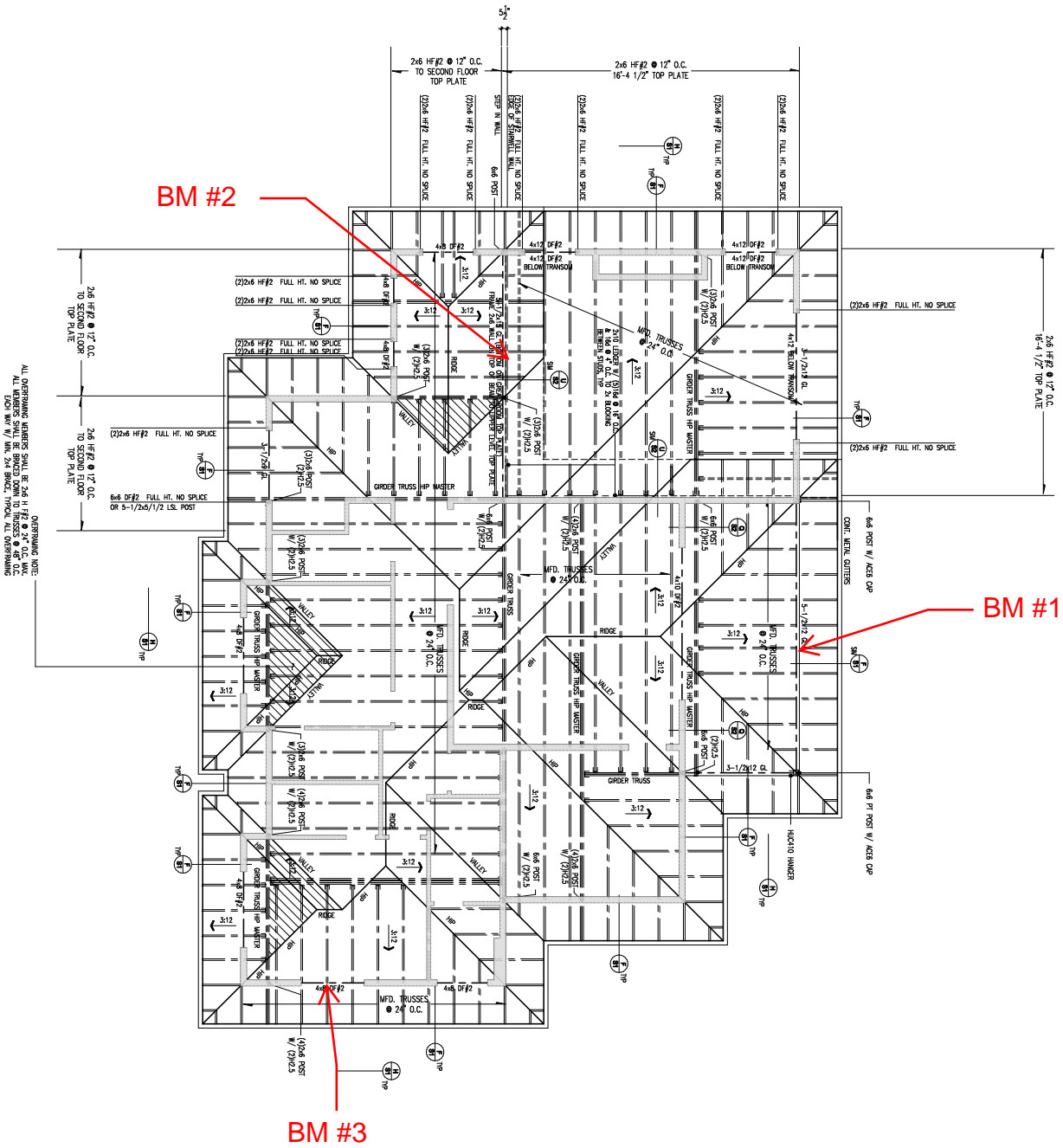
CHECK CAPACITY OF 16" x 4" o.c. =  
(REF. DIR. (U/S2))

$$= 94 \frac{\#}{\text{NAIL}} \times 1.6 \times 3 = 451 \frac{\#}{l}$$

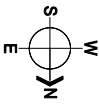
NER. 272  
TABLE 4

LT. NO  
INCREASE

∴ USE 240 #/l OF INTERNAL LOAD  
TRANSFER CAPACITY



OVERDRAWING NOTE:  
 ALL OVERDRAWING DIMENSIONS SHALL BE 2x4 IN. FROM 2x4 O.C. DIM.  
 ALL DIMENSIONS SHOWN SHOULD BE 2x4 IN. FROM 2x4 O.C. DIM.  
 EACH DIM. W/ MIN. 2x4 BRACE. TYPICAL ALL OVERDRAWING.

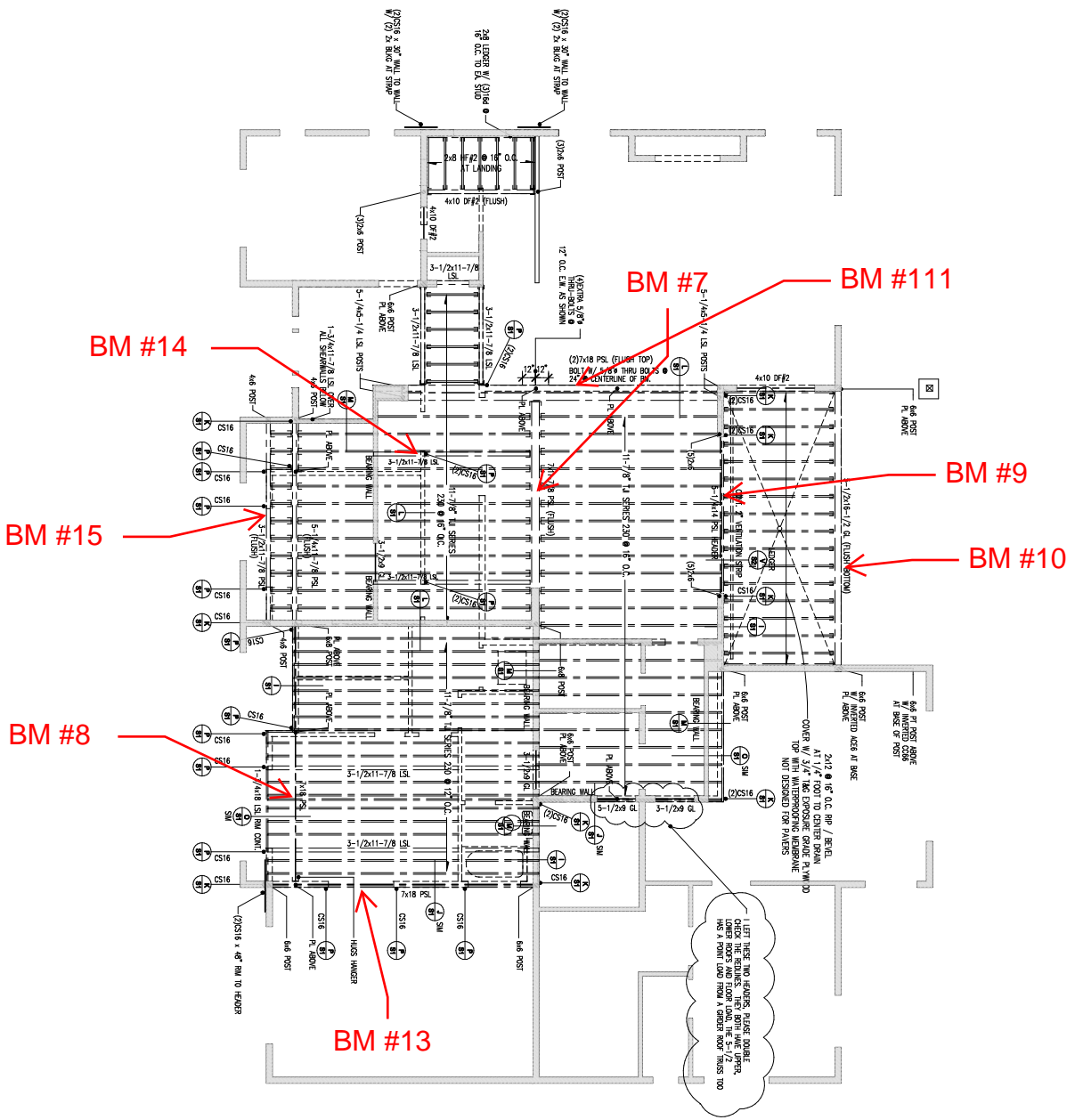


<p>COMPANY FILE NAME <b>A6</b> SHEET NUMBER</p>	<p><b>MERLINO RESIDENCE</b> MERCER ISLAND, WA</p>	<p><b>UPPER ROOF FRAMING PLAN</b></p>	<p>DATE: 7/15, 2020                  SCALE: 1/4"=1'-0"                  DRAWN BY: JKL                  DATE: 7.15.2020</p>
<p>REVISION: 1/24, 2020</p>		<p>DATE: 7/15, 2020</p>	
<p>PROJECT NUMBER</p>		<p>DATE: 7/15, 2020</p>	

DATE: 7/15, 2020

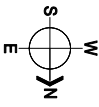


BEAM KEY PLAN

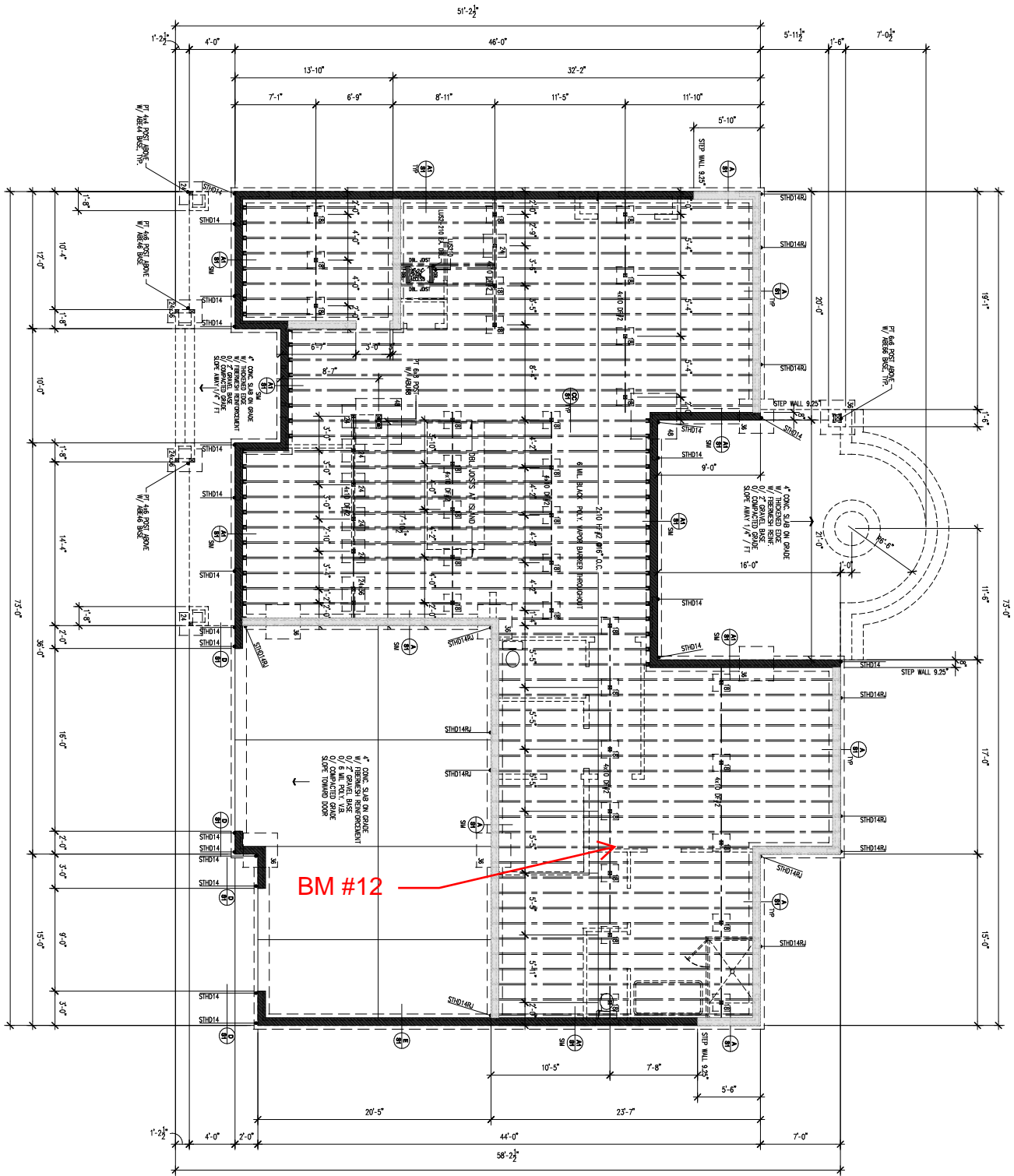


1. LET THESE TWO BEAMS, PLEASE DOUBLE CHECK THE BEAMS, THEY BOTH HAVE UPPER HANS HANGER AND FROM A BEAM TO BEAM

2x12 @ 16\"/>



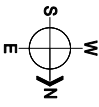
	COMPANER FILE NAME <b>A3</b>	<b>MERLINO RESIDENCE</b> MERCER ISLAND, WA	<b>UPPER LEVEL FLOOR FRAMING</b>		ENGINEER 3/1/2022 206.408.8980 <a href="mailto:dm@drceest.com">dm@drceest.com</a>
	SCALE 1/4"=1'-0"				
SHEET NUMBER		DATE 11.1.2020			



**BM #12**

**FOOTING SCHEDULE:**

1'-6" x 1'-6" x 8" DEEP CONC. FOOTING W/ TR- (9) #4 EACH W/M, TR- TOP AND BOTTOM, TR-	2'-0" x 2'-0" x 8" DEEP CONC. FOOTING W/ TR- (9) #4 EACH W/M, TR- TOP AND BOTTOM, TR-	2'-6" x 2'-6" x 8" DEEP CONC. FOOTING W/ TR- (9) #4 EACH W/M, TR- TOP AND BOTTOM, TR-	3'-0" x 3'-0" x 12" DEEP CONC. FOOTING W/ TR- (9) #4 EACH W/M, TR- TOP AND BOTTOM, TR-	4'-0" x 4'-0" x 14" DEEP CONC. FOOTING W/ TR- (9) #4 EACH W/M, TR- TOP AND BOTTOM, TR-
--	--	--	---	---



**A1**  
 SHEET NUMBER  
 1/4" = 1'-0"  
 SCALE  
 7.16.2020  
 DATE  
 1/24/2020  
 REVISION

**MERLINO RESIDENCE**  
 MERCER ISLAND, WA

**MAIN LEVEL FLOOR FRAMING & FOUNDATION PLAN**

ENGINE 3/1/2022  
**DRGREST**  
 206 408 8880

**Wood Beam**

Lic. #: KW-06010288

File: Merlino Residence.ecb  
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 RB Engineers, Inc.

DESCRIPTION: BM # 1

**CODE REFERENCES**

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10  
 Load Combination Set : IBC 2018

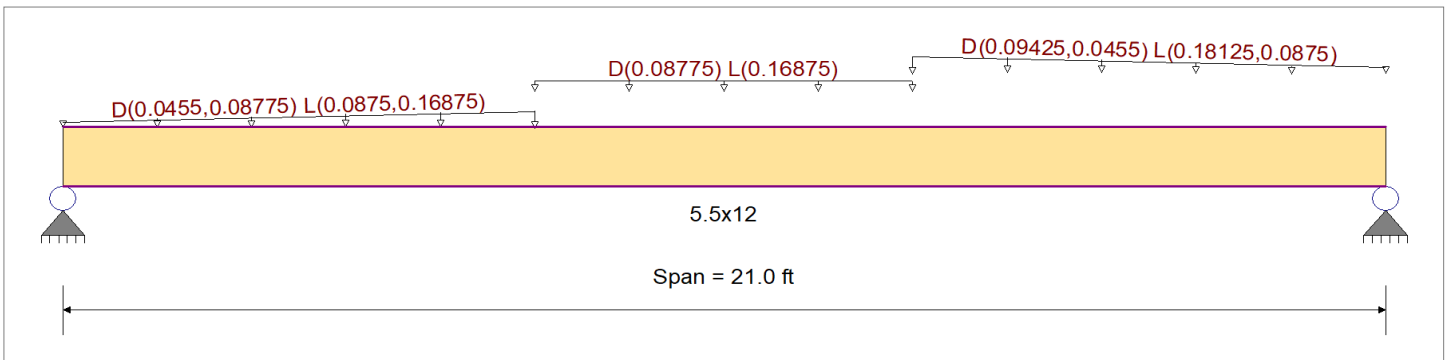
**Material Properties**

Analysis Method : Allowable Stress Design  
 Load Combination IBC 2018

Wood Species : DF/DF  
 Wood Grade : 24F - V4

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

Fb +	2,400.0 psi	E : Modulus of Elasticity	
Fb -	1,850.0 psi	Ebend- xx	1,800.0 ksi
Fc - Prll	1,650.0 psi	Eminbend - xx	950.0 ksi
Fc - Perp	650.0 psi	Ebend- yy	1,600.0 ksi
Fv	265.0 psi	Eminbend - yy	850.0 ksi
Ft	1,100.0 psi	Density	31.210 pcf



**Applied Loads**

Service loads entered. Load Factors will be applied for calculations.

Load for Span Number 1

Varying Uniform Load : D= 0.0130->0.0130, L= 0.0250->0.0250 ksf, Extent = 0.0 -->> 7.50 ft, Trib Width = 3.50->6.750 ft

Uniform Load : D = 0.0130, L = 0.0250 ksf, Extent = 7.50 -->> 13.50 ft, Tributary Width = 6.750 ft

Varying Uniform Load : D= 0.0130->0.0130, L= 0.0250->0.0250 ksf, Extent = 13.50 -->> 21.0 ft, Trib Width = 7.250->3.50 ft

**DESIGN SUMMARY**

**Design OK**

Maximum Bending Stress Ratio	=	<b>0.502</b> 1	Maximum Shear Stress Ratio	=	<b>0.184</b> : 1
Section used for this span	=	<b>5.5x12</b>	Section used for this span	=	<b>5.5x12</b>
fb: Actual	=	1,196.40psi	fv: Actual	=	48.69 psi
Fb: Allowable	=	2,383.11 psi	Fv: Allowable	=	265.00 psi
Load Combination	=	+D+L	Load Combination	=	+D+L
Location of maximum on span	=	10.577ft	Location of maximum on span	=	20.004 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
<b>Maximum Deflection</b>					
Max Downward Transient Deflection		0.479 in	Ratio =		525 >=360
Max Upward Transient Deflection		0.000 in	Ratio =		0 <360
Max Downward Total Deflection		0.729 in	Ratio =		345 >=240
Max Upward Total Deflection		0.000 in	Ratio =		0 <240

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values			
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v
D Only	Length = 21.0 ft	1	0.191	0.070	0.90	0.993	1.00	1.00	1.00	1.00	1.00	4.50	409.30	2144.80	0.73	16.66	238.50
+D+L	Length = 21.0 ft	1	0.502	0.184	1.00	0.993	1.00	1.00	1.00	1.00	1.00	13.16	1,196.40	2383.11	2.14	48.69	265.00
+D+0.750L	Length = 21.0 ft	1	0.336	0.123	1.25	0.993	1.00	1.00	1.00	1.00	1.00	11.00	999.63	2978.89	1.79	40.68	331.25
+0.60D	Length = 21.0 ft	1	0.064	0.024	1.60	0.993	1.00	1.00	1.00	1.00	1.00	2.70	245.58	3812.98	0.44	9.99	424.00



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DESCRIPTION: BM # 1

**Overall Maximum Deflections**

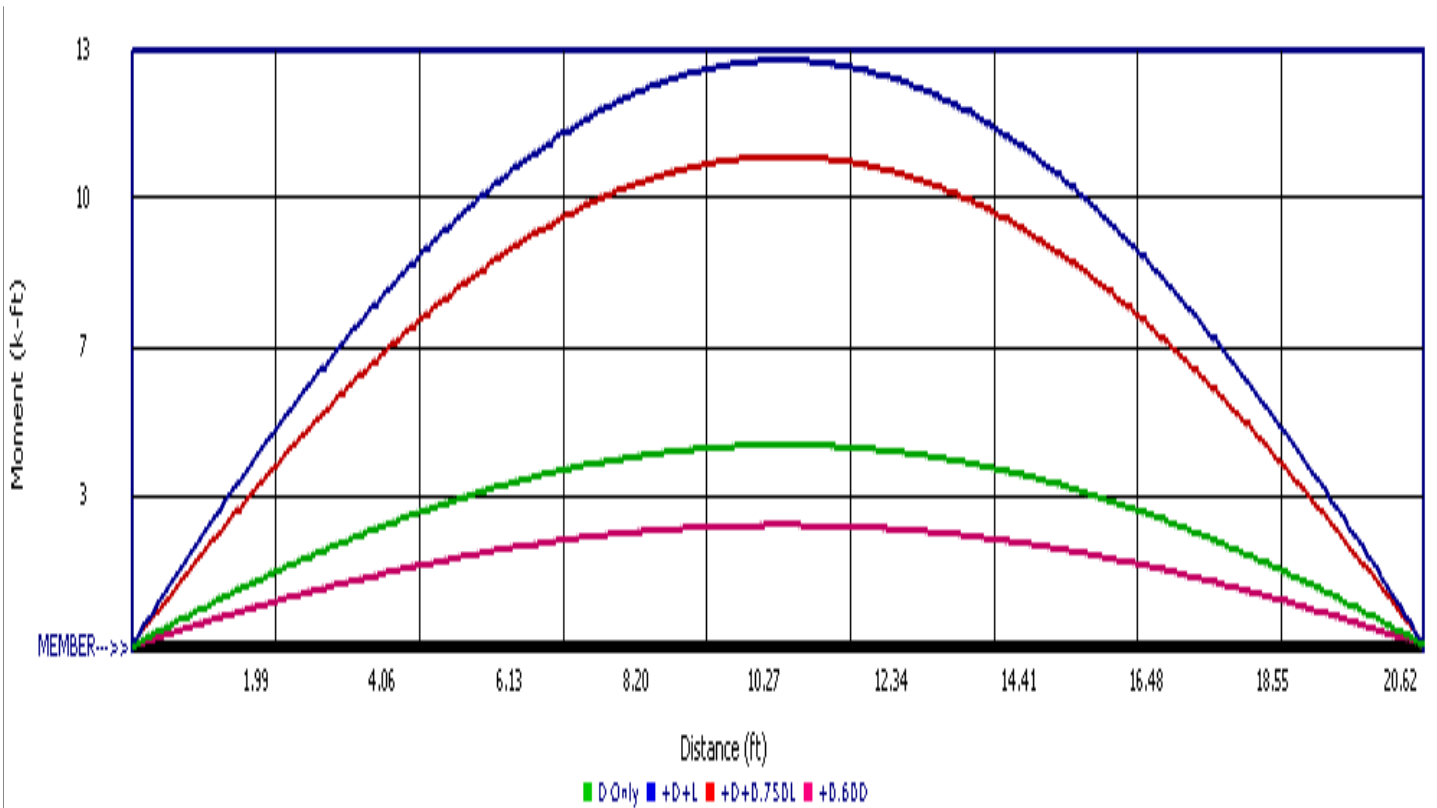
Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.7288	10.577		0.0000	0.000

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	2.247	2.284
Overall MINimum	1.478	1.503
D Only	0.769	0.782
+D+L	2.247	2.284
+D+0.750L	1.878	1.909
+0.60D	0.461	0.469
L Only	1.478	1.503

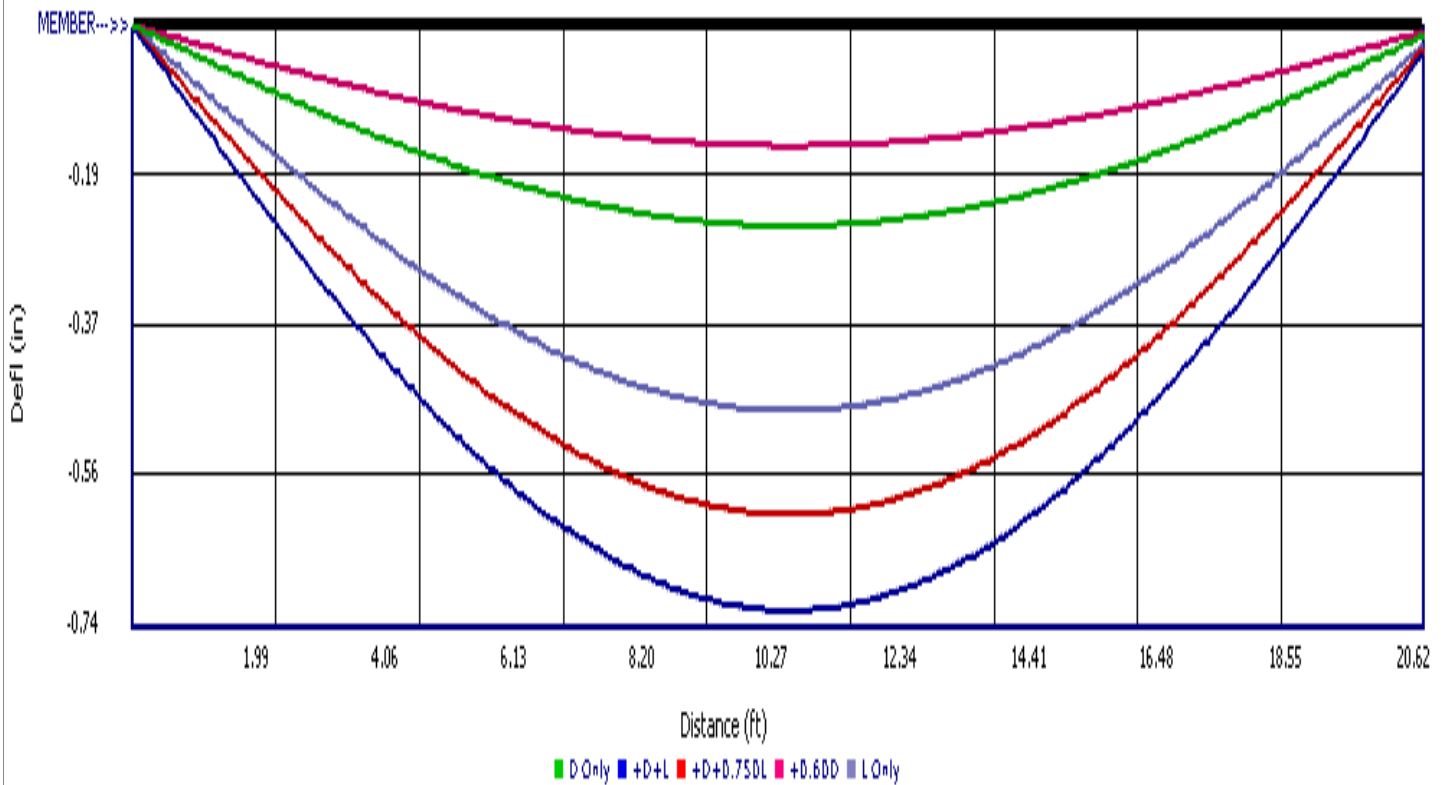
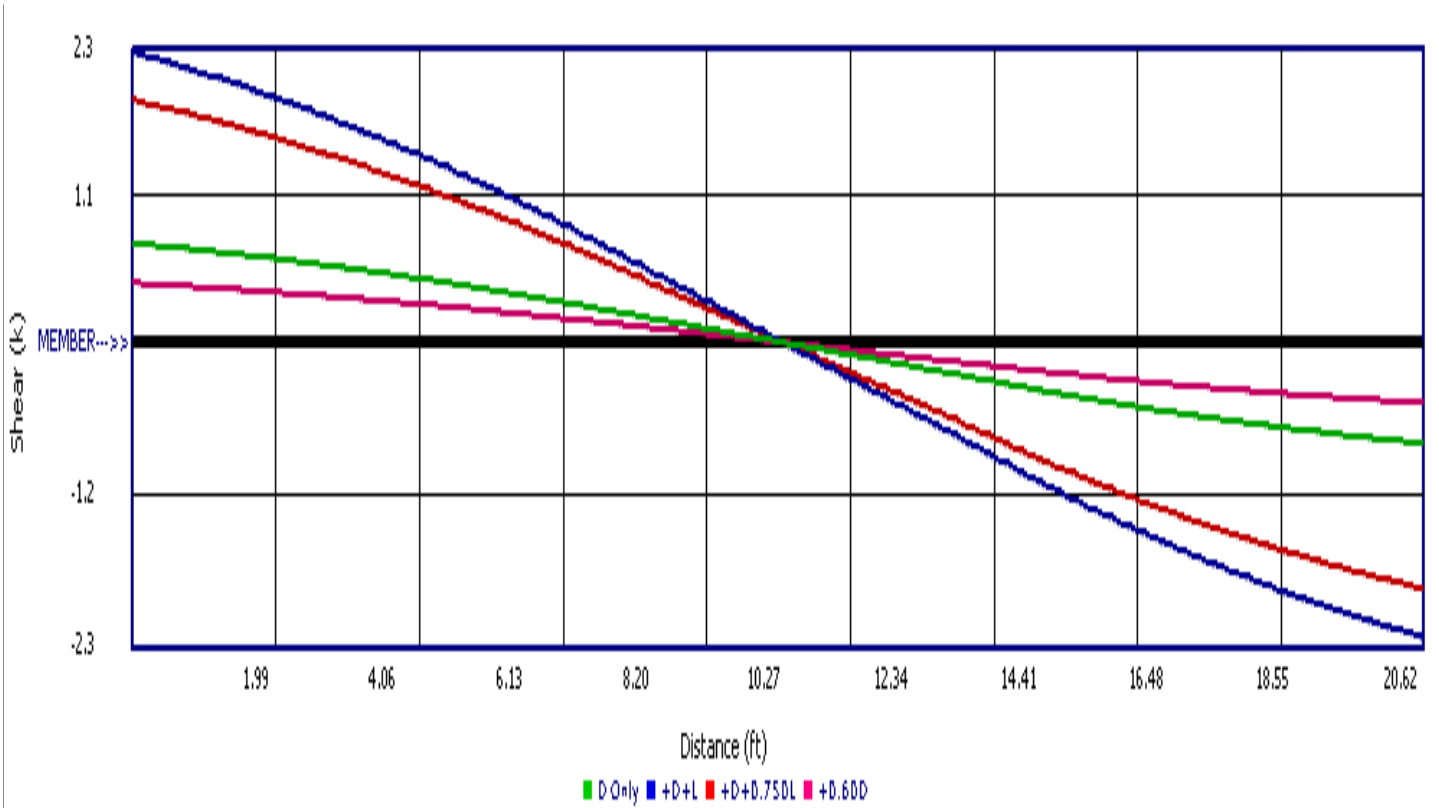


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DESCRIPTION: BM # 1





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DESCRIPTION: BM # 2

Load Combination	Segment Length	Span #	Max Stress Ratios		Moment Values							Shear Values								
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v			
+0.60D	Length = 19.0 ft	1	0.050	0.024	1.60	0.981	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	3.24	188.70	3766.34	0.00	0.00	0.00

**Overall Maximum Deflections**

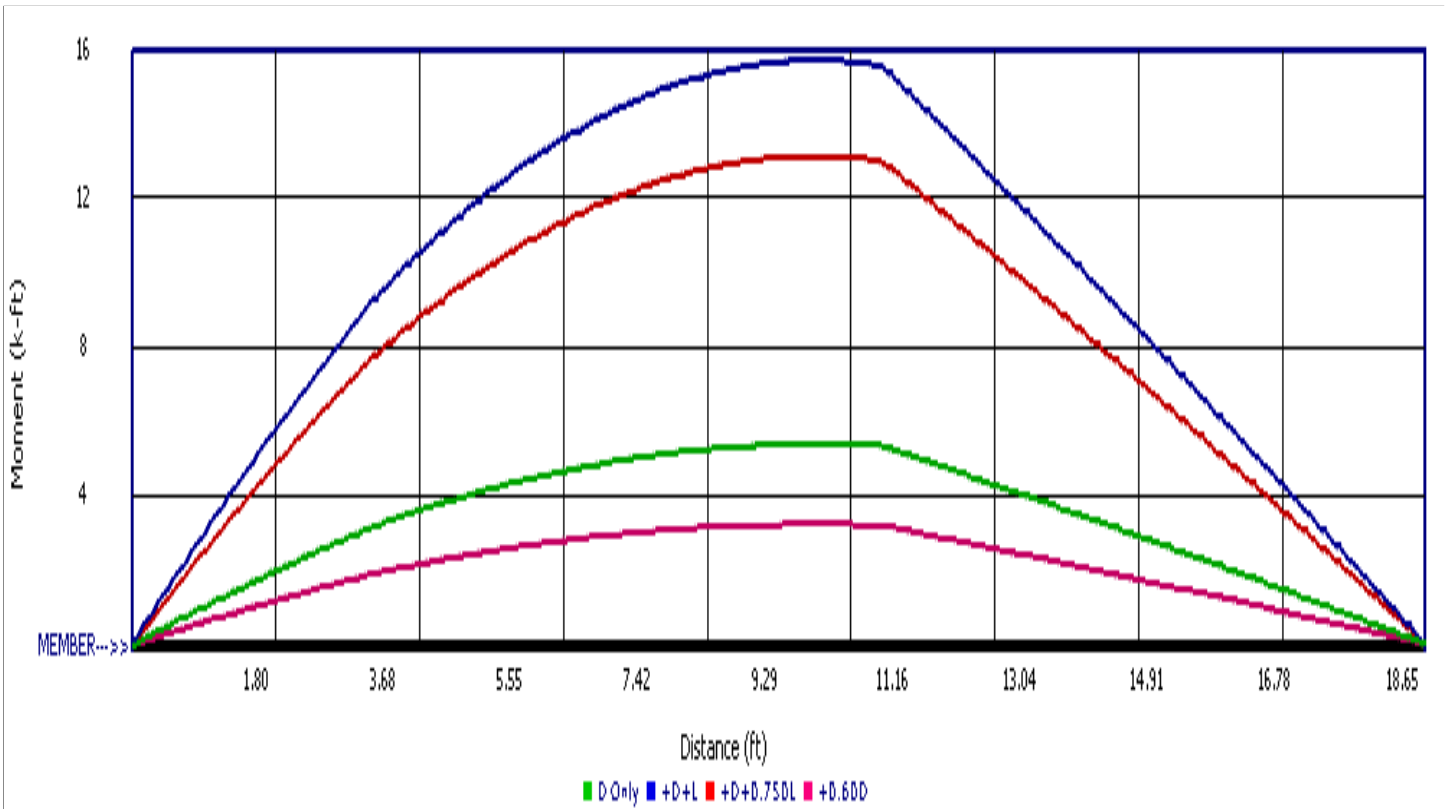
Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.3515	9.431		0.0000	0.000

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	2.921	2.086
Overall MINimum	1.921	1.371
D Only	1.000	0.715
+D+L	2.921	2.086
+D+0.750L	2.440	1.744
+0.60D	0.600	0.429
L Only	1.921	1.371

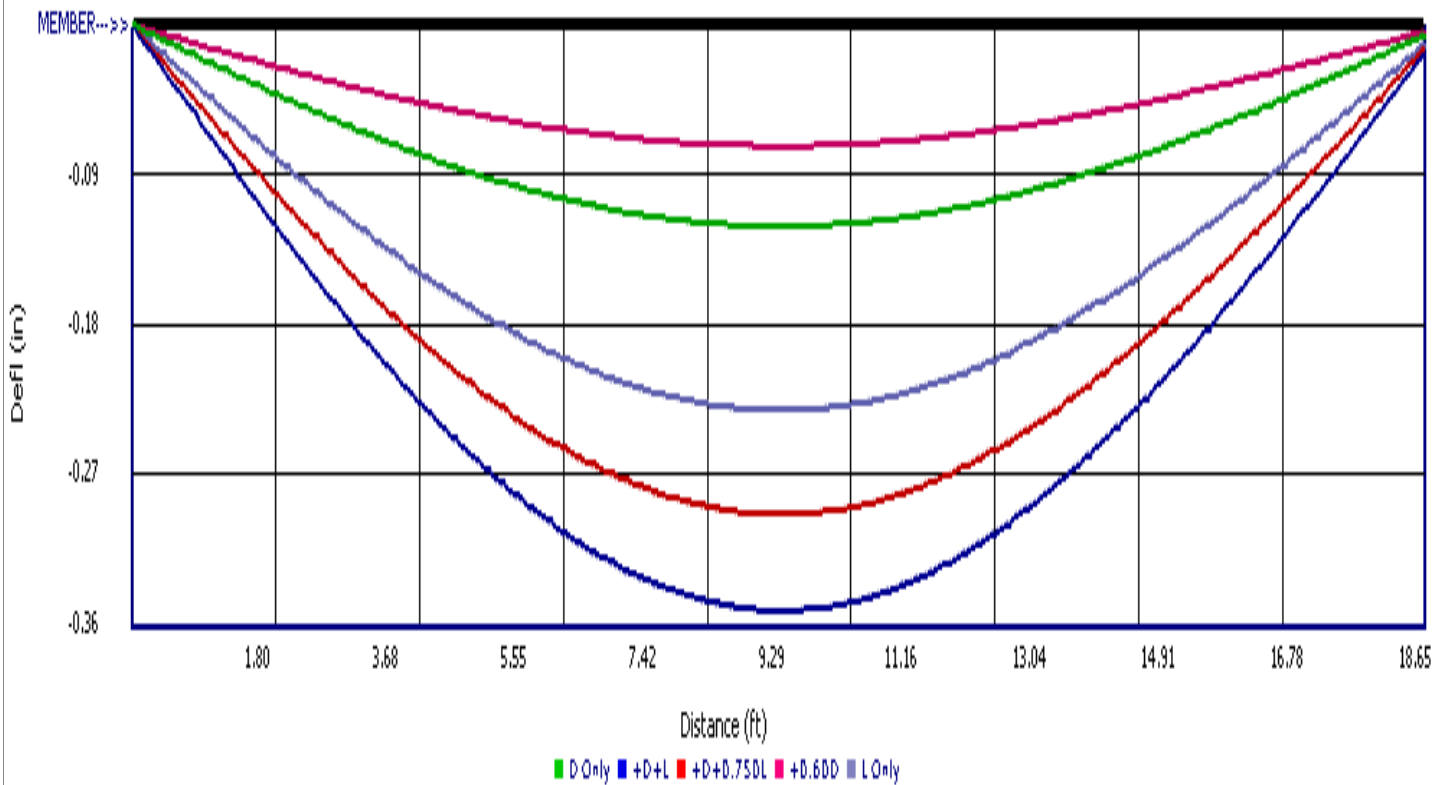
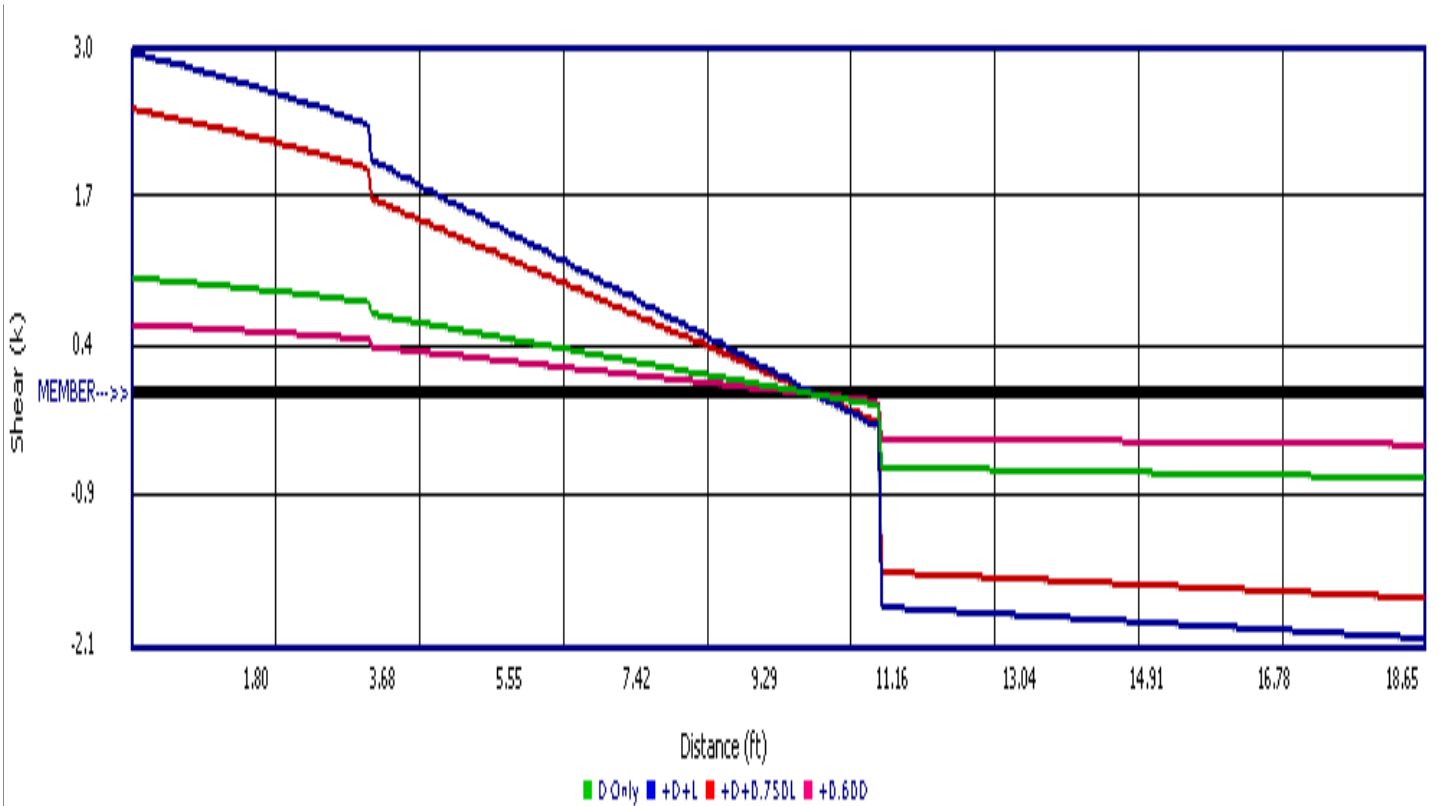


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DESCRIPTION: BM # 2



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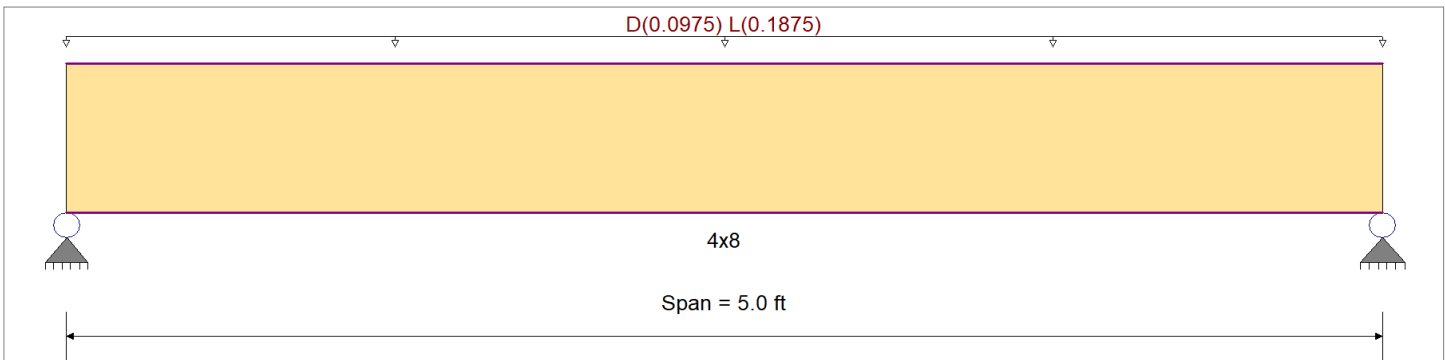
DESCRIPTION: BM # 3

**CODE REFERENCES**

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10  
 Load Combination Set : IBC 2018

**Material Properties**

Analysis Method : Allowable Stress Design	Fb +	900.0 psi	E : Modulus of Elasticity
Load Combination IBC 2018	Fb -	900.0 psi	Ebend- xx
	Fc - Prll	1,350.0 psi	Eminbend - xx
Wood Species : Douglas Fir - Larch	Fc - Perp	625.0 psi	
Wood Grade : No.2	Fv	180.0 psi	Density
	Ft	575.0 psi	31.210pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling			



**Applied Loads**

Service loads entered. Load Factors will be applied for calculations.

Uniform Load : D = 0.0130, L = 0.0250 ksf, Tributary Width = 7.50 ft

**DESIGN SUMMARY**

**Design OK**

Maximum Bending Stress Ratio =	<b>0.298</b> : 1	Maximum Shear Stress Ratio =	<b>0.178</b> : 1
Section used for this span	<b>4x8</b>	Section used for this span	<b>4x8</b>
fb: Actual =	348.56 psi	fv: Actual =	31.97 psi
Fb: Allowable =	1,170.00 psi	Fv: Allowable =	180.00 psi
Load Combination	+D+L	Load Combination	+D+L
Location of maximum on span	2.500ft	Location of maximum on span	0.000ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1
<b>Maximum Deflection</b>			
Max Downward Transient Deflection	0.015 in	Ratio =	4023 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.023 in	Ratio =	2646 >=240
Max Upward Total Deflection	0.000 in	Ratio =	0 <240

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values				
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v	
D Only	Length = 5.0 ft	1	0.113	0.068	0.90	1.300	1.00	1.00	1.00	1.00	1.00	0.30	119.25	1053.00	0.00	0.00	0.00	0.00
+D+L	Length = 5.0 ft	1	0.298	0.178	1.00	1.300	1.00	1.00	1.00	1.00	1.00	0.89	348.56	1170.00	0.00	0.54	31.97	180.00
+D+0.750L	Length = 5.0 ft	1	0.199	0.119	1.25	1.300	1.00	1.00	1.00	1.00	1.00	0.74	291.23	1462.50	0.00	0.45	26.71	225.00
+0.60D	Length = 5.0 ft	1	0.038	0.023	1.60	1.300	1.00	1.00	1.00	1.00	1.00	0.18	71.55	1872.00	0.00	0.11	6.56	288.00

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.0227	2.518		0.0000	0.000

**Wood Beam**

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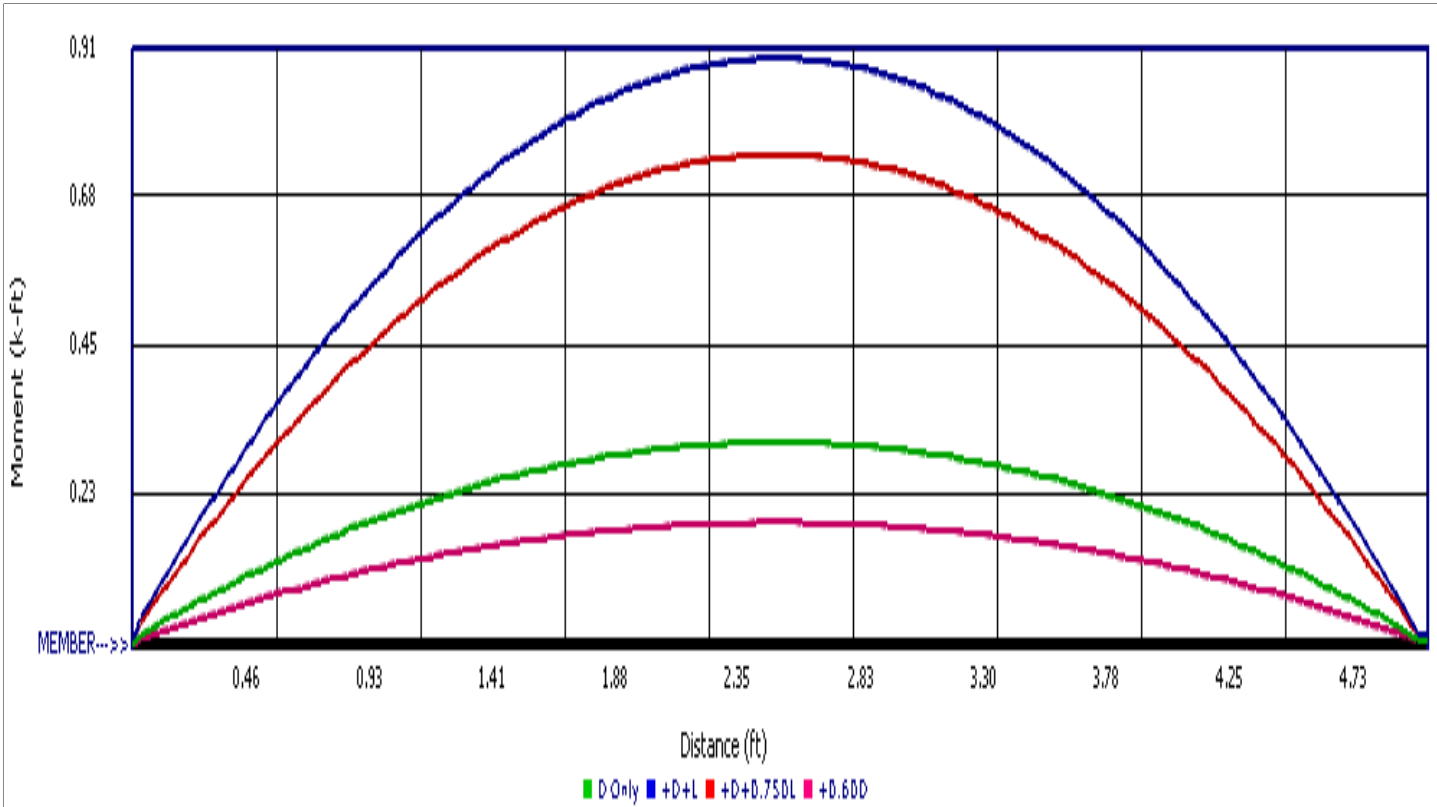
DESCRIPTION: BM # 3

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	0.713	0.713
Overall MINimum	0.469	0.469
D Only	0.244	0.244
+D+L	0.713	0.713
+D+0.750L	0.595	0.595
+0.60D	0.146	0.146
L Only	0.469	0.469

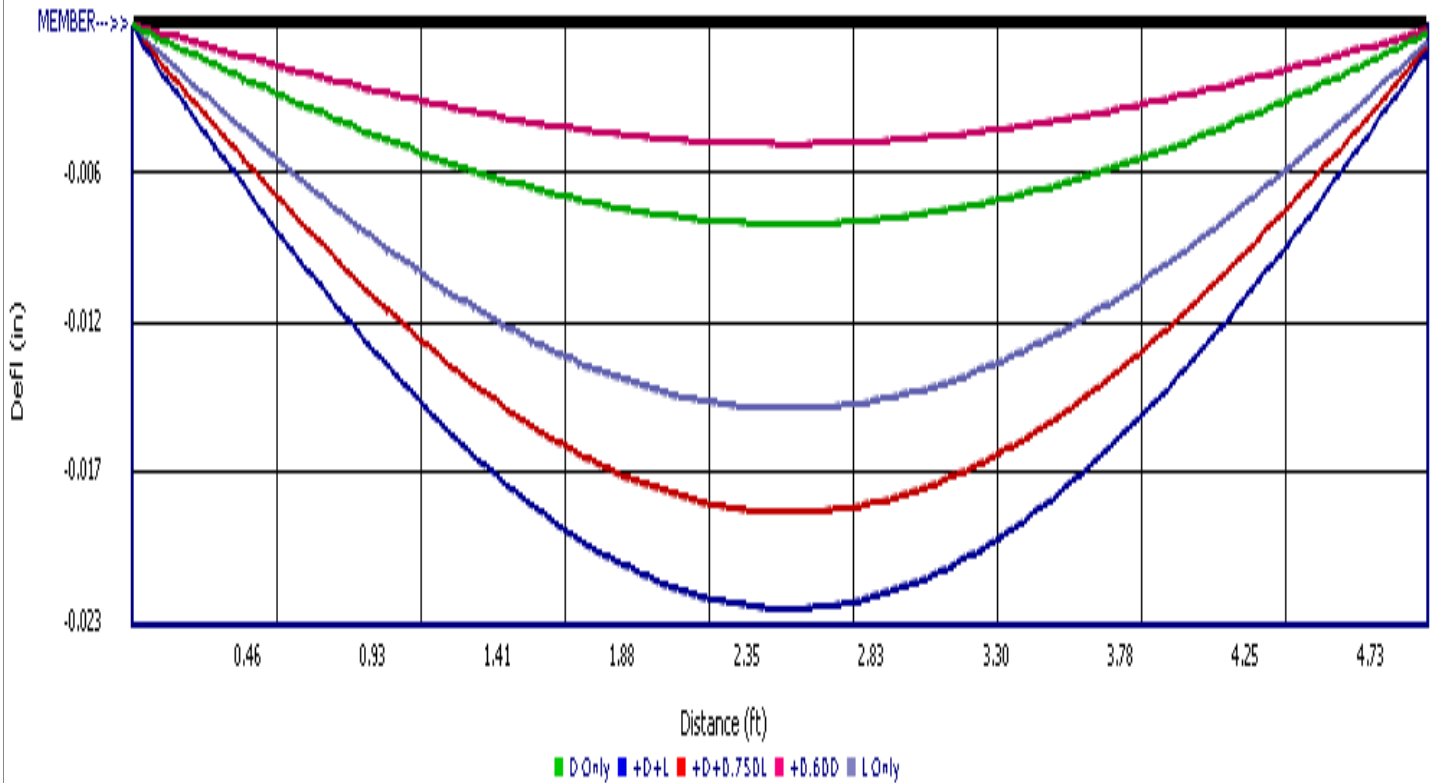
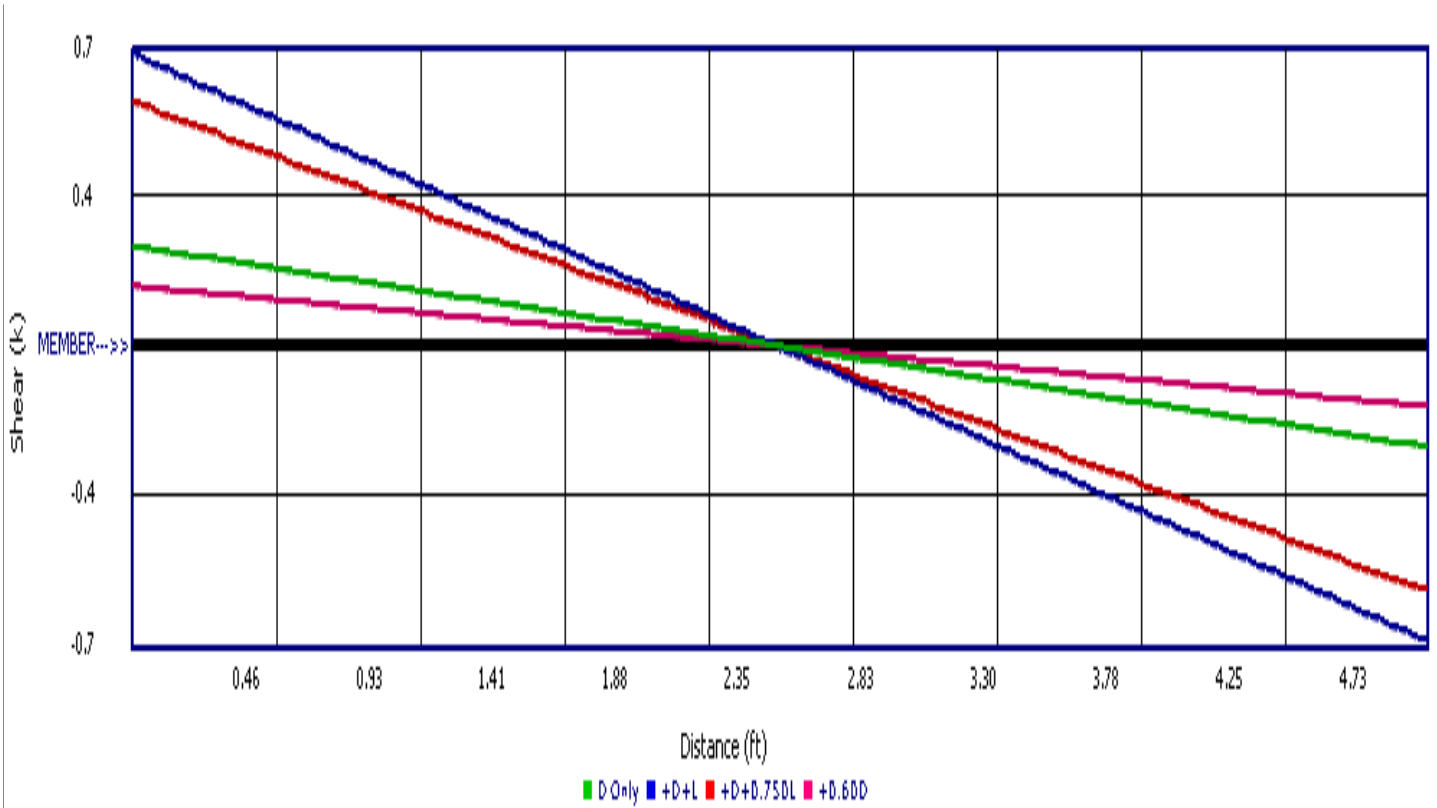


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DESCRIPTION: BM # 3





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DESCRIPTION: BM # 4

**CODE REFERENCES**

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10  
 Load Combination Set : IBC 2018

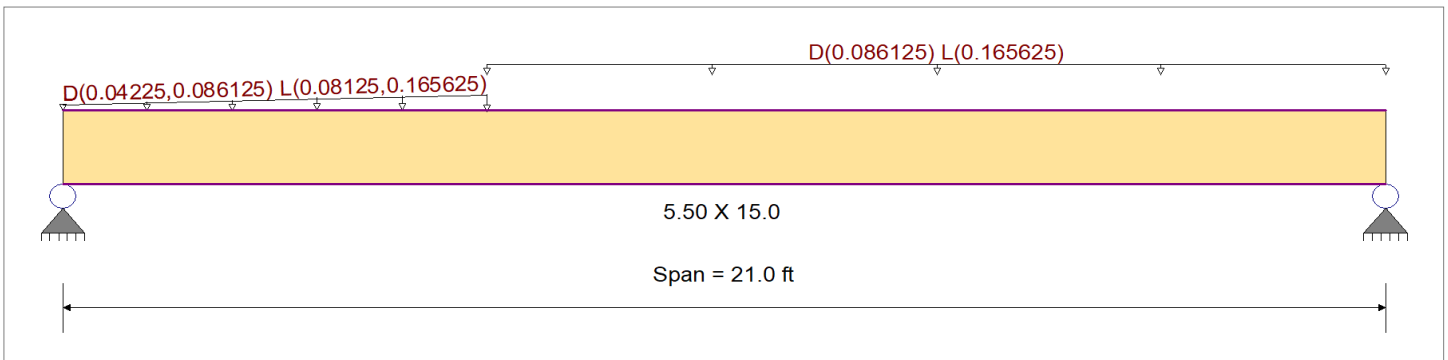
**Material Properties**

Analysis Method : Allowable Stress Design  
 Load Combination IBC 2018

Wood Species : DF/DF  
 Wood Grade : 24F - V4

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

Fb +	2,400.0 psi	E : Modulus of Elasticity	
Fb -	1,850.0 psi	Ebend- xx	1,800.0 ksi
Fc - Prll	1,650.0 psi	Eminbend - xx	950.0 ksi
Fc - Perp	650.0 psi	Ebend- yy	1,600.0 ksi
Fv	265.0 psi	Eminbend - yy	850.0 ksi
Ft	1,100.0 psi	Density	31.210 pcf



**Applied Loads**

Service loads entered. Load Factors will be applied for calculations.

Load for Span Number 1

Varying Uniform Load : D= 0.0130->0.0130, L= 0.0250->0.0250 ksf, Extent = 0.0 -->> 6.750 ft, Trib Width = 3.250->6.625 ft

Uniform Load : D = 0.0130, L = 0.0250 ksf, Extent = 6.750 -->> 21.0 ft, Tributary Width = 6.625 ft

**DESIGN SUMMARY**

**Design OK**

Maximum Bending Stress Ratio	=	<b>0.334</b>	1	Maximum Shear Stress Ratio	=	<b>0.157</b>	: 1
Section used for this span		<b>5.50 X 15.0</b>		Section used for this span		<b>5.50 X 15.0</b>	
fb: Actual	=	779.34	psi	fv: Actual	=	41.61	psi
Fb: Allowable	=	2,330.52	psi	Fv: Allowable	=	265.00	psi
Load Combination		+D+L		Load Combination		+D+L	
Location of maximum on span	=	10.653	ft	Location of maximum on span	=	19.774	ft
Span # where maximum occurs	=	Span # 1		Span # where maximum occurs	=	Span # 1	
<b>Maximum Deflection</b>							
Max Downward Transient Deflection		0.251	in	Ratio =		1003	>=360
Max Upward Transient Deflection		0.000	in	Ratio =		0	<360
Max Downward Total Deflection		0.382	in	Ratio =		659	>=240
Max Upward Total Deflection		0.000	in	Ratio =		0	<240

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values						
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v			
D Only	Length = 21.0 ft	1	0.127	0.060	0.90	0.971	1.00	1.00	1.00	1.00	1.00	4.58	266.62	2097.47	0.00	0.00	0.00	0.78	14.23	238.50
+D+L	Length = 21.0 ft	1	0.334	0.157	1.00	0.971	1.00	1.00	1.00	1.00	1.00	13.39	779.34	2330.52	0.00	0.00	0.00	2.29	41.61	265.00
+D+0.750L	Length = 21.0 ft	1	0.224	0.105	1.25	0.971	1.00	1.00	1.00	1.00	1.00	11.19	651.16	2913.15	0.00	0.00	0.00	1.91	34.76	331.25
+0.60D	Length = 21.0 ft	1	0.043	0.020	1.60	0.971	1.00	1.00	1.00	1.00	1.00	2.75	159.97	3728.84	0.00	0.00	0.00	0.47	8.54	424.00

**Wood Beam**

Lic. #: KW-06010288

File: Merlino Residence.ec6  
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 RB Engineers, Inc.

DESCRIPTION: BM # 4

**Overall Maximum Deflections**

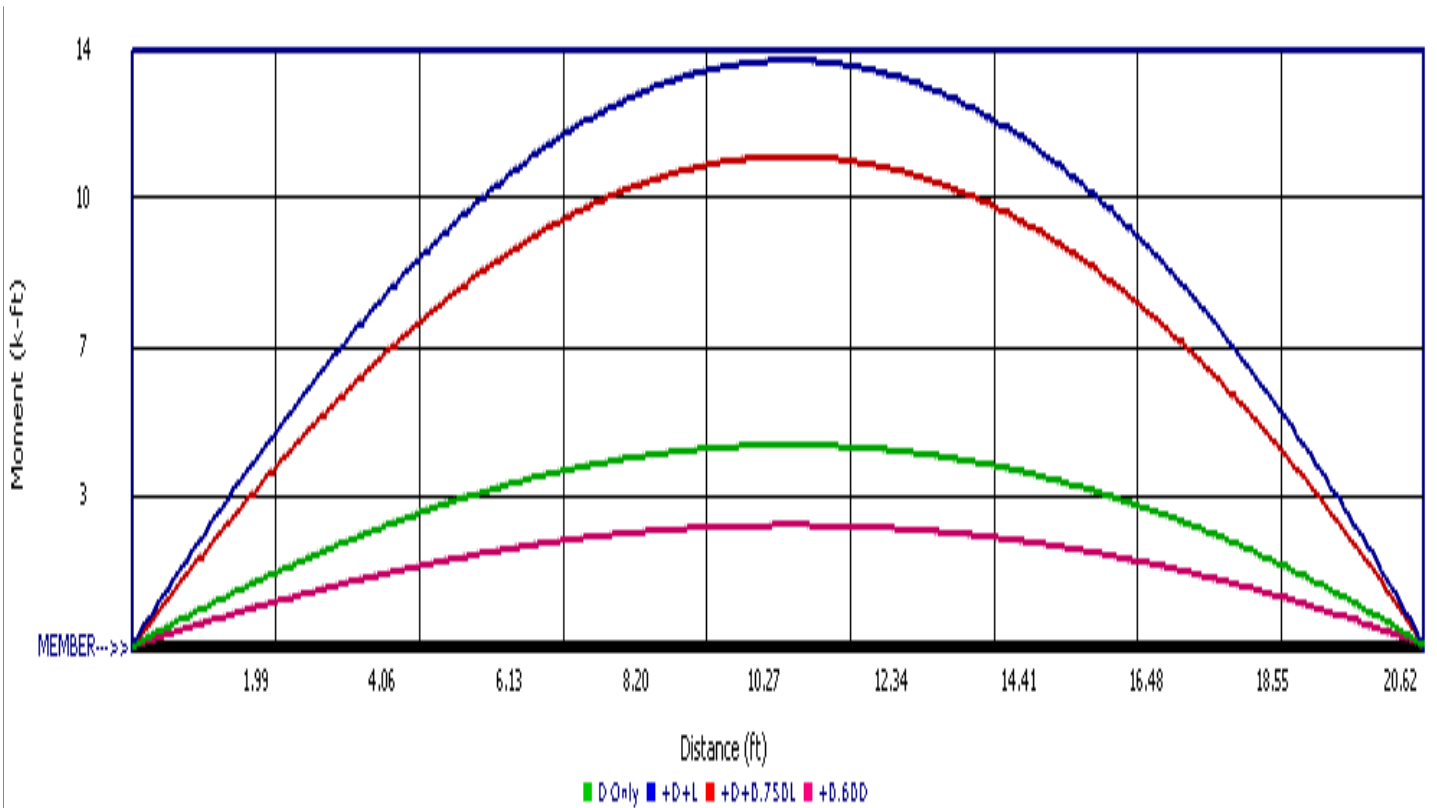
Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.3819	10.577		0.0000	0.000

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	2.257	2.597
Overall MINimum	1.485	1.709
D Only	0.772	0.888
+D+L	2.257	2.597
+D+0.750L	1.886	2.170
+0.60D	0.463	0.533
L Only	1.485	1.709

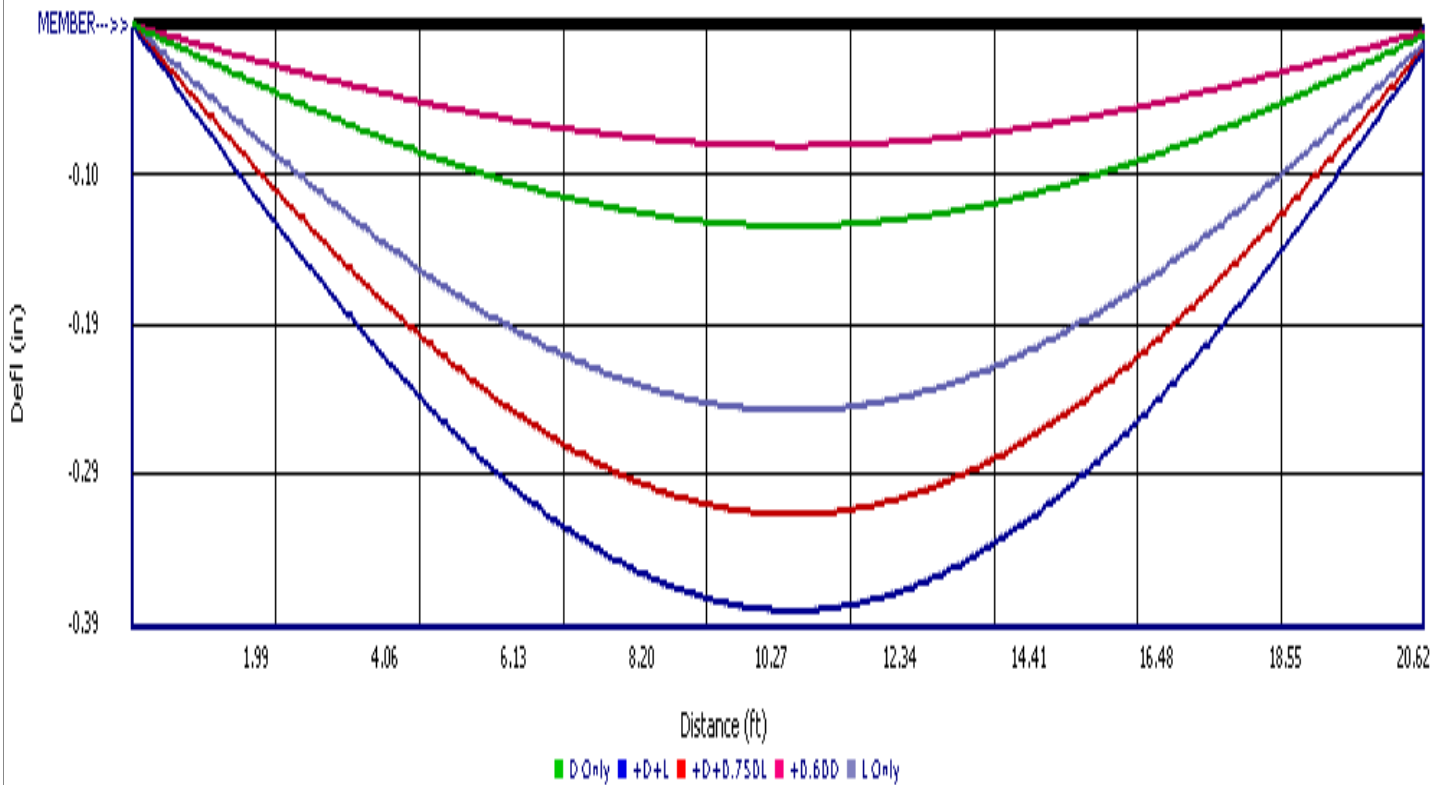
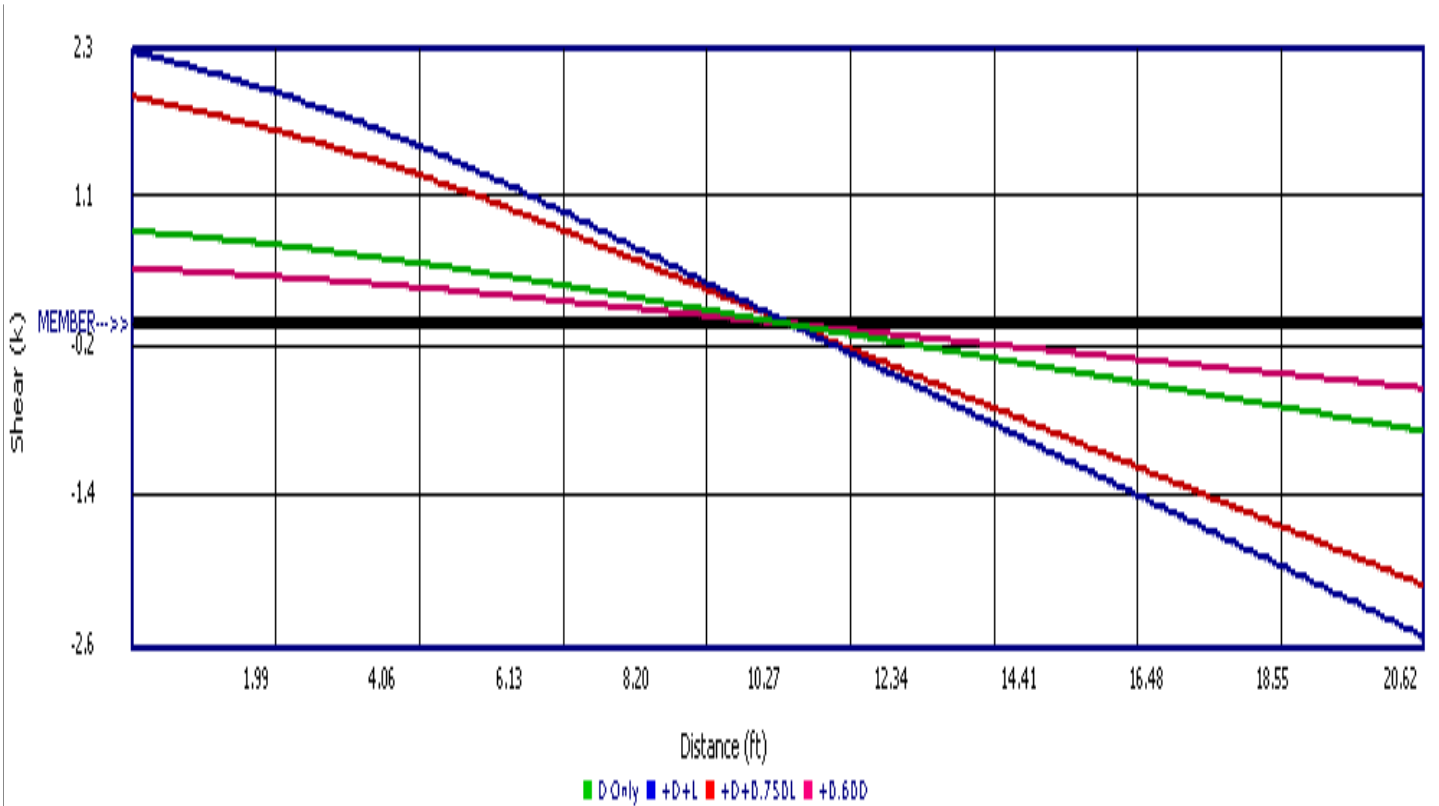


Wood Beam

Lic. #: KW-06010288

File: Merlino Residence.ec6  
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RB Engineers, Inc.

DESCRIPTION: BM # 4



**Wood Beam**

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 RB Engineers, Inc.

DESCRIPTION: BM # 5

**CODE REFERENCES**

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10  
 Load Combination Set : IBC 2018

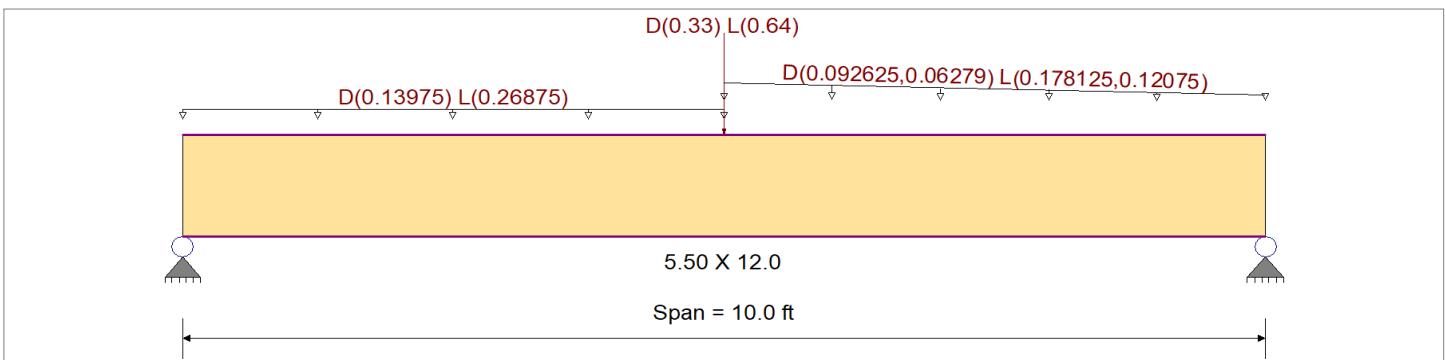
**Material Properties**

Analysis Method : Allowable Stress Design  
 Load Combination IBC 2018

Wood Species : DF/DF  
 Wood Grade : 24F - V4

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

Fb +	2,400.0 psi	E : Modulus of Elasticity	
Fb -	1,850.0 psi	Ebend- xx	1,800.0 ksi
Fc - Prll	1,650.0 psi	Eminbend - xx	950.0 ksi
Fc - Perp	650.0 psi	Ebend- yy	1,600.0 ksi
Fv	265.0 psi	Eminbend - yy	850.0 ksi
Ft	1,100.0 psi	Density	31.210 pcf



**Applied Loads**

Service loads entered. Load Factors will be applied for calculations.

Load for Span Number 1

Uniform Load : D = 0.0130, L = 0.0250 ksf, Extent = 0.0 --> 5.0 ft, Tributary Width = 10.750 ft  
 Varying Uniform Load : D= 0.0130->0.0130, L= 0.0250->0.0250 ksf, Extent = 5.0 --> 10.0 ft, Trib Width = 7.125->4.830 ft

Point Load : D = 0.330, L = 0.640 k @ 5.0 ft

**DESIGN SUMMARY**

**Design OK**

Maximum Bending Stress Ratio	=	<b>0.246</b>	1	Maximum Shear Stress Ratio	=	<b>0.164</b>	: 1
Section used for this span	=	<b>5.50 X 12.0</b>		Section used for this span	=	<b>5.50 X 12.0</b>	
fb: Actual	=	589.88	psi	fv: Actual	=	43.56	psi
Fb: Allowable	=	2,400.00	psi	Fv: Allowable	=	265.00	psi
Load Combination	=	+D+L		Load Combination	=	+D+L	
Location of maximum on span	=	5.000ft		Location of maximum on span	=	0.000ft	
Span # where maximum occurs	=	Span # 1		Span # where maximum occurs	=	Span # 1	
<b>Maximum Deflection</b>							
Max Downward Transient Deflection		0.050	in	Ratio =		2395	>=360
Max Upward Transient Deflection		0.000	in	Ratio =		0	<360
Max Downward Total Deflection		0.076	in	Ratio =		1577	>=240
Max Upward Total Deflection		0.000	in	Ratio =		0	<240

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values						
			M	V	C <sub>d</sub>	C <sub>FV</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v			
D Only	Length = 10.0 ft	1	0.093	0.062	0.90	1.000	1.00	1.00	1.00	1.00	1.00	2.22	201.38	2160.00	0.00	0.00	0.00	0.65	14.88	238.50
+D+L	Length = 10.0 ft	1	0.246	0.164	1.00	1.000	1.00	1.00	1.00	1.00	1.00	6.49	589.88	2400.00	0.00	0.00	0.00	0.00	0.00	0.00
+D+0.750L	Length = 10.0 ft	1	0.164	0.110	1.25	1.000	1.00	1.00	1.00	1.00	1.00	5.42	492.75	3000.00	0.00	0.00	0.00	0.00	0.00	0.00
+0.60D	Length = 10.0 ft	1	0.031	0.021	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.33	120.83	3840.00	0.00	0.00	0.00	0.39	8.93	424.00

**Wood Beam**

Lic. #: KW-06010288

File: Merlino Residence.ec6  
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 RB Engineers, Inc.

DESCRIPTION: BM # 5

**Overall Maximum Deflections**

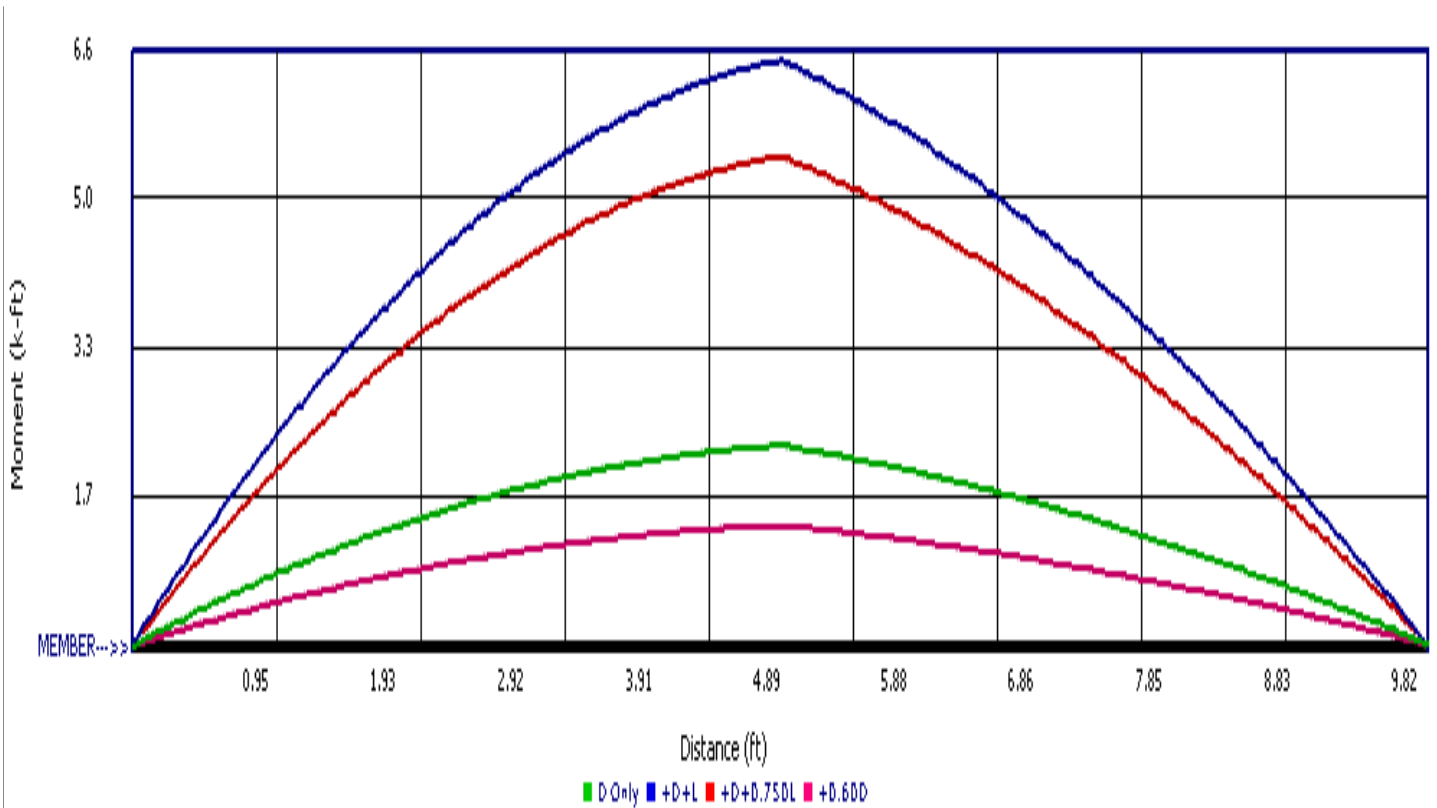
Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.0761	4.964		0.0000	0.000

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	2.319	1.829
Overall MINimum	1.527	1.204
D Only	0.792	0.625
+D+L	2.319	1.829
+D+0.750L	1.937	1.528
+0.60D	0.475	0.375
L Only	1.527	1.204

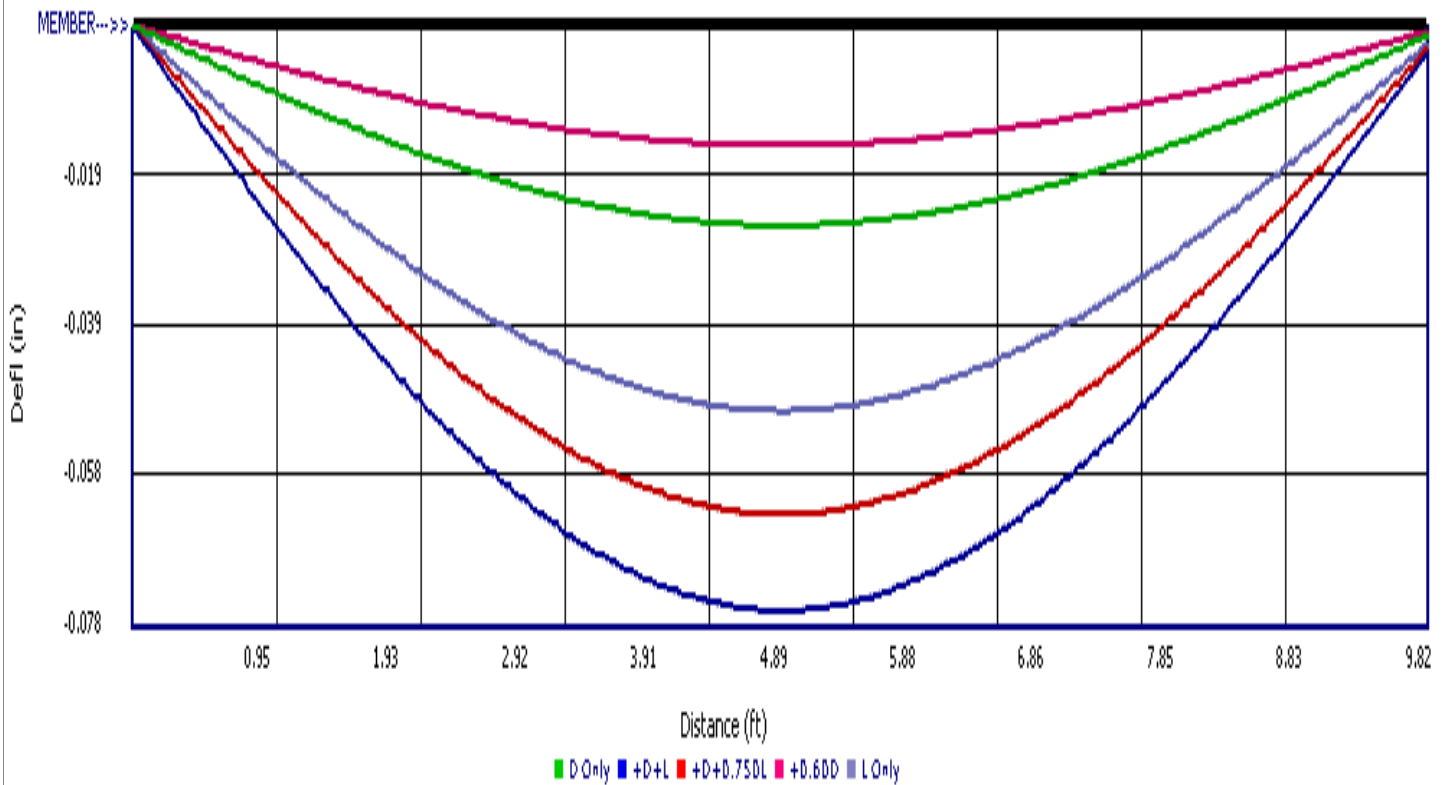
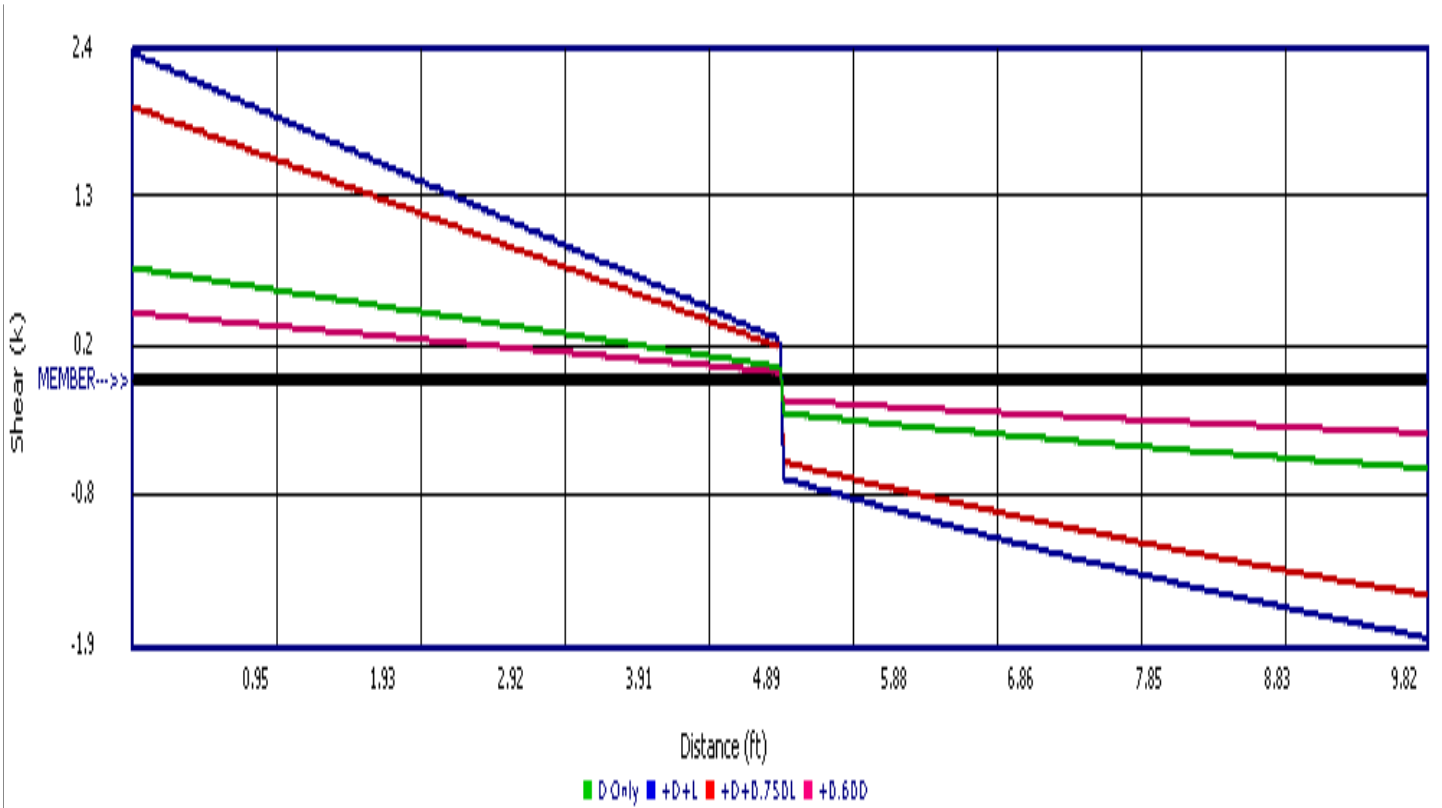


**Wood Beam**

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DESCRIPTION: BM # 5



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 RB Engineers, Inc.

DESCRIPTION: BM # 6

**CODE REFERENCES**

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10  
 Load Combination Set : IBC 2018

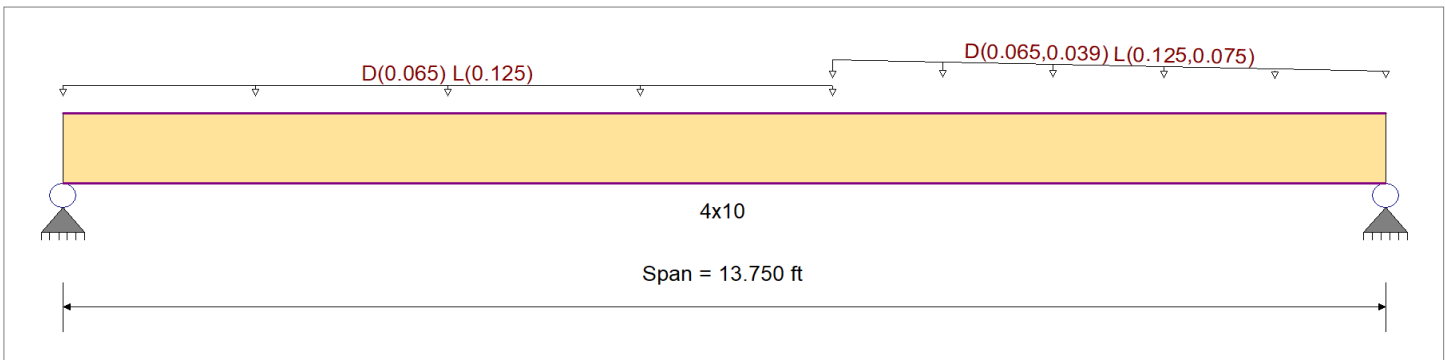
**Material Properties**

Analysis Method : Allowable Stress Design  
 Load Combination IBC 2018

Wood Species : Douglas Fir - Larch  
 Wood Grade : No.2

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

Fb +	900.0 psi	E : Modulus of Elasticity	
Fb -	900.0 psi	Ebend- xx	1,600.0ksi
Fc - Prll	1,350.0 psi	Eminbend - xx	580.0ksi
Fc - Perp	625.0 psi		
Fv	180.0 psi		
Ft	575.0 psi	Density	31.210pcf



**Applied Loads**

Service loads entered. Load Factors will be applied for calculations.

Load for Span Number 1

Uniform Load : D = 0.0130, L = 0.0250 ksf, Extent = 0.0 ---> 8.0 ft, Tributary Width = 5.0 ft  
 Varying Uniform Load : D= 0.0130->0.0130, L= 0.0250->0.0250 ksf, Extent = 8.0 -->> 13.750 ft, Trib Width = 5.0->3.0 ft

**DESIGN SUMMARY**

**Design OK**

Maximum Bending Stress Ratio	=	<b>0.954</b>	1	Maximum Shear Stress Ratio	=	<b>0.292</b>	: 1
Section used for this span		<b>4x10</b>		Section used for this span		<b>4x10</b>	
fb: Actual	=	1,029.81	psi	fv: Actual	=	52.48	psi
Fb: Allowable	=	1,080.00	psi	Fv: Allowable	=	180.00	psi
Load Combination		+D+L		Load Combination		+D+L	
Location of maximum on span	=	6.724	ft	Location of maximum on span	=	0.000	ft
Span # where maximum occurs	=	Span # 1		Span # where maximum occurs	=	Span # 1	
<b>Maximum Deflection</b>							
Max Downward Transient Deflection		0.260	in	Ratio =		635	>=360
Max Upward Transient Deflection		0.000	in	Ratio =		0	<360
Max Downward Total Deflection		0.395	in	Ratio =		418	>=240
Max Upward Total Deflection		0.000	in	Ratio =		0	<240

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values						
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v			
D Only	Length = 13.750 ft	1	0.362	0.111	0.90	1.200	1.00	1.00	1.00	1.00	1.00	1.47	352.30	972.00	0.00	0.00	0.00	0.39	17.95	162.00
+D+L	Length = 13.750 ft	1	0.954	0.292	1.00	1.200	1.00	1.00	1.00	1.00	1.00	4.28	1,029.81	1080.00	0.00	0.00	0.00	1.13	52.48	180.00
+D+0.750L	Length = 13.750 ft	1	0.637	0.195	1.25	1.200	1.00	1.00	1.00	1.00	1.00	3.58	860.43	1350.00	0.00	0.00	0.00	0.95	43.85	225.00
+0.60D	Length = 13.750 ft	1	0.122	0.037	1.60	1.200	1.00	1.00	1.00	1.00	1.00	0.88	211.38	1728.00	0.00	0.00	0.00	0.23	10.77	288.00

**Wood Beam**

Lic. #: KW-06010288

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 RB Engineers, Inc.

DESCRIPTION: BM # 6

**Overall Maximum Deflections**

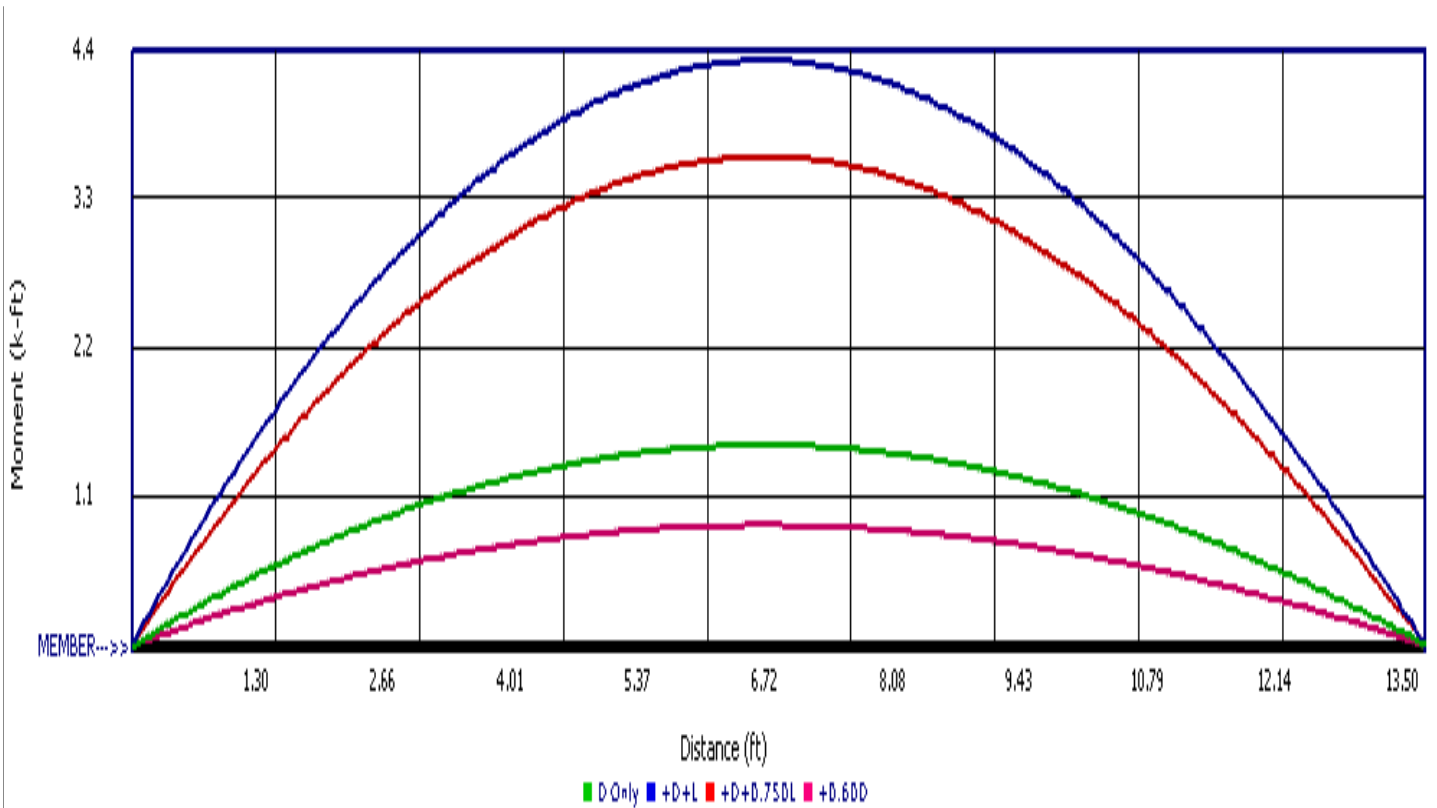
Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.3945	6.875		0.0000	0.000

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	1.276	1.118
Overall MINimum	0.839	0.736
D Only	0.436	0.383
+D+L	1.276	1.118
+D+0.750L	1.066	0.934
+0.60D	0.262	0.230
L Only	0.839	0.736



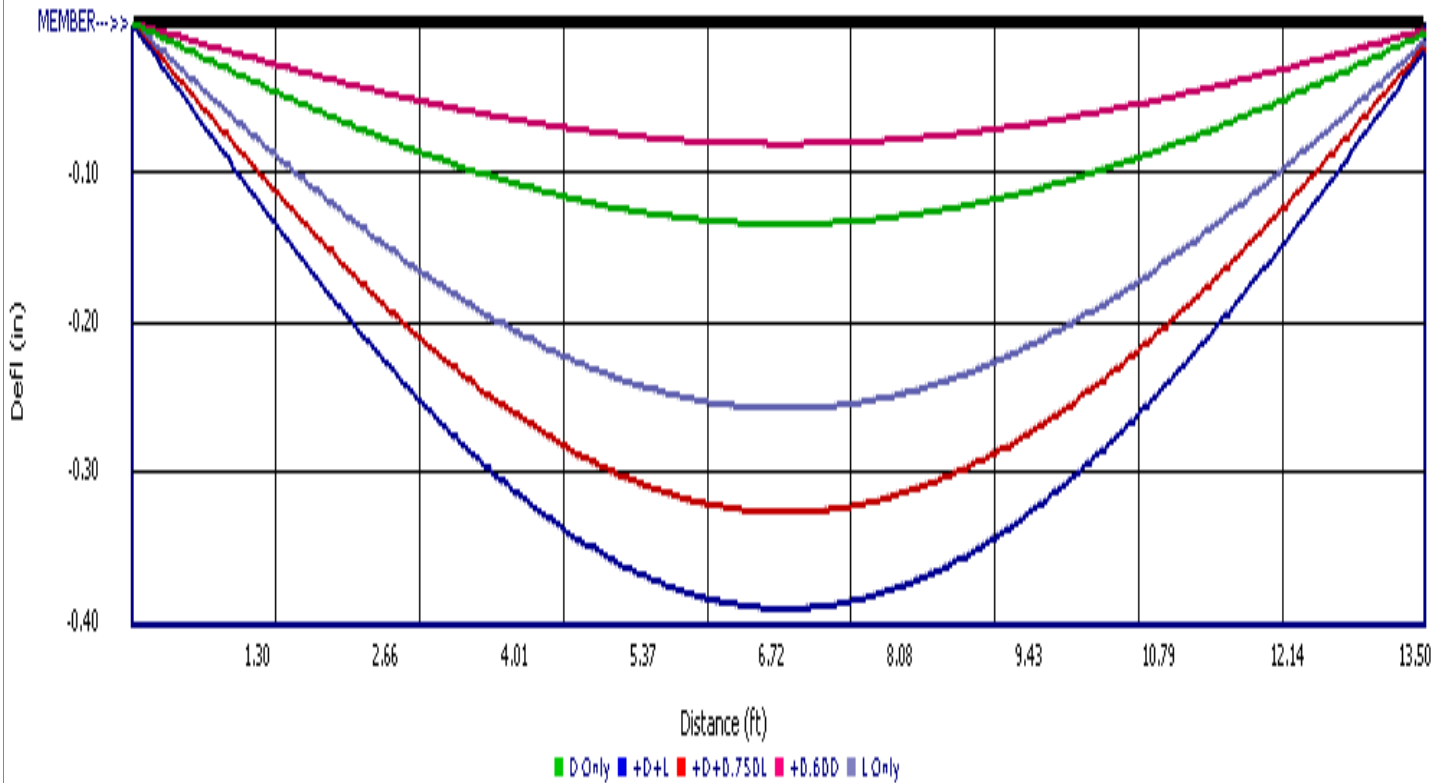
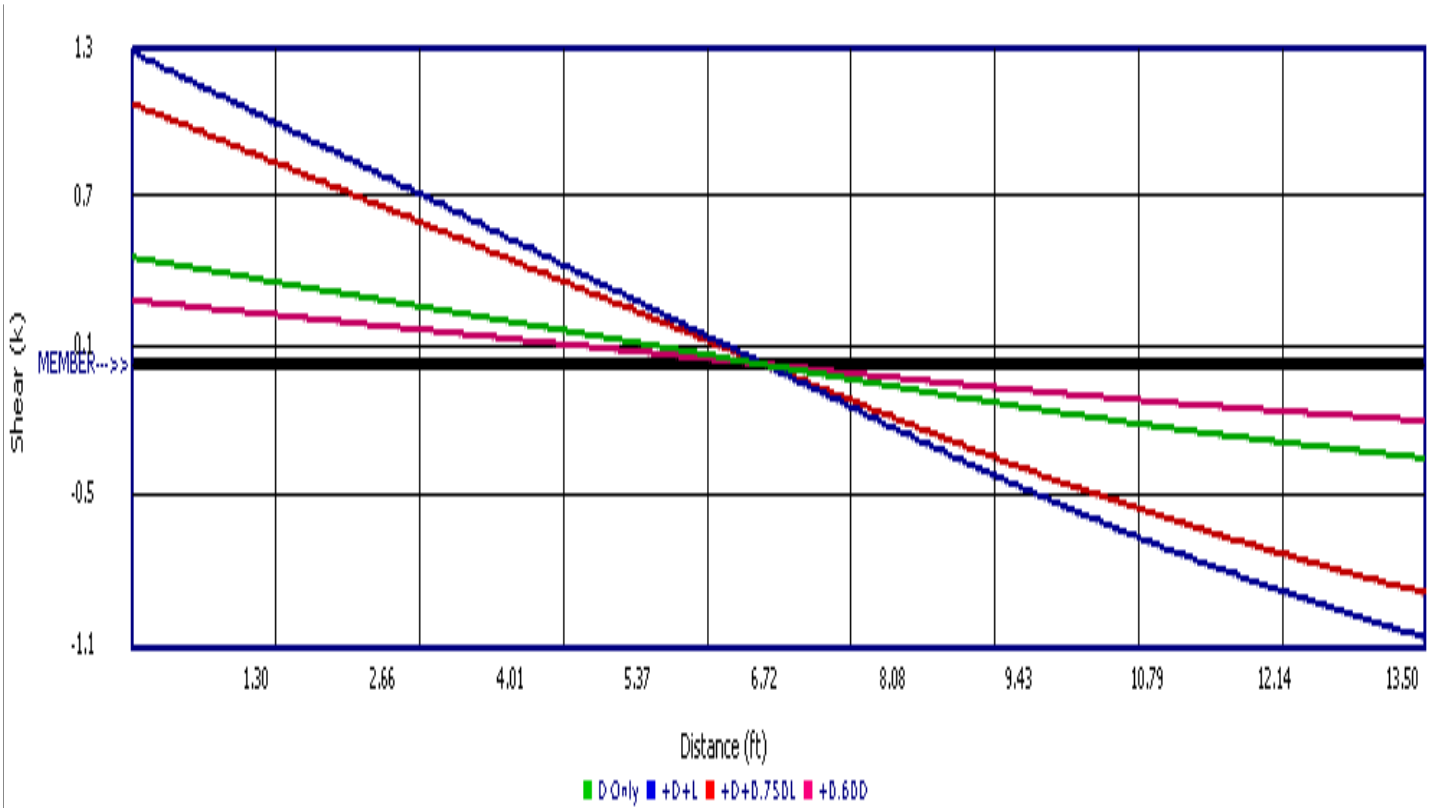


**Wood Beam**

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DESCRIPTION: BM # 6



**Wood Beam**

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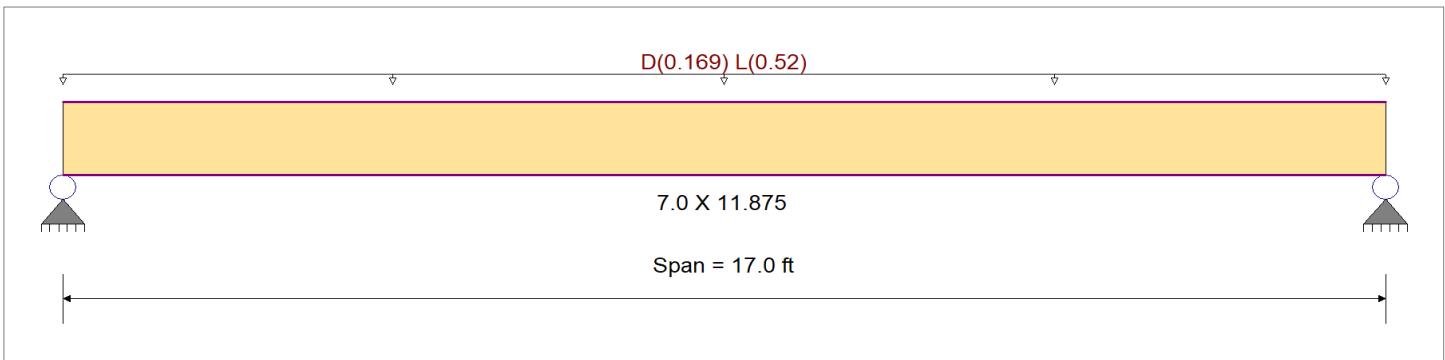
DESCRIPTION: BM # 7

**CODE REFERENCES**

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10  
 Load Combination Set : IBC 2018

**Material Properties**

Analysis Method : Allowable Stress Design	Fb +	2,900.0 psi	E : Modulus of Elasticity
Load Combination IBC 2018	Fb -	2,900.0 psi	Ebend- xx
	Fc - Prll	2,900.0 psi	Eminbend - xx
Wood Species : Trus Joist	Fc - Perp	625.0 psi	
Wood Grade : Parallam PSL 2.0E	Fv	290.0 psi	
	Ft	2,025.0 psi	Density
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling			45.070pcf



**Applied Loads**

Service loads entered. Load Factors will be applied for calculations.

Uniform Load : D = 0.0130, L = 0.040 ksf, Tributary Width = 13.0 ft

**DESIGN SUMMARY**

**Design OK**

Maximum Bending Stress Ratio =	<b>0.632</b>	1	Maximum Shear Stress Ratio =	<b>0.325</b>	: 1
Section used for this span	<b>7.0 X 11.875</b>		Section used for this span	<b>7.0 X 11.875</b>	
fb: Actual =	1,815.49psi		fv: Actual =	94.11 psi	
Fb: Allowable =	2,874.02psi		Fv: Allowable =	290.00 psi	
Load Combination =	+D+L		Load Combination =	+D+L	
Location of maximum on span =	8.500ft		Location of maximum on span =	0.000ft	
Span # where maximum occurs =	Span # 1		Span # where maximum occurs =	Span # 1	
<b>Maximum Deflection</b>					
Max Downward Transient Deflection	0.503 in	Ratio =	405	>=360	
Max Upward Transient Deflection	0.000 in	Ratio =	0	<360	
Max Downward Total Deflection	0.667 in	Ratio =	306	>=240	
Max Upward Total Deflection	0.000 in	Ratio =	0	<240	

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values				
			M	V	C <sub>d</sub>	C <sub>FV</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	Fv	
D Only	Length = 17.0 ft	1	0.172	0.088	0.90	0.991	1.00	1.00	1.00	1.00	1.00	6.11	445.31	2586.62	0.00	0.00	0.00	0.00
+D+L	Length = 17.0 ft	1	0.632	0.325	1.00	0.991	1.00	1.00	1.00	1.00	1.00	24.89	1,815.49	2874.02	0.00	0.00	0.00	0.00
+D+0.750L	Length = 17.0 ft	1	0.410	0.211	1.25	0.991	1.00	1.00	1.00	1.00	1.00	20.19	1,472.95	3592.52	0.00	0.00	0.00	0.00
+0.60D	Length = 17.0 ft	1	0.058	0.030	1.60	0.991	1.00	1.00	1.00	1.00	1.00	3.66	267.19	4598.43	0.00	0.00	0.00	0.00

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.6666	8.562		0.0000	0.000

**Wood Beam**

Lic. #: KW-06010288

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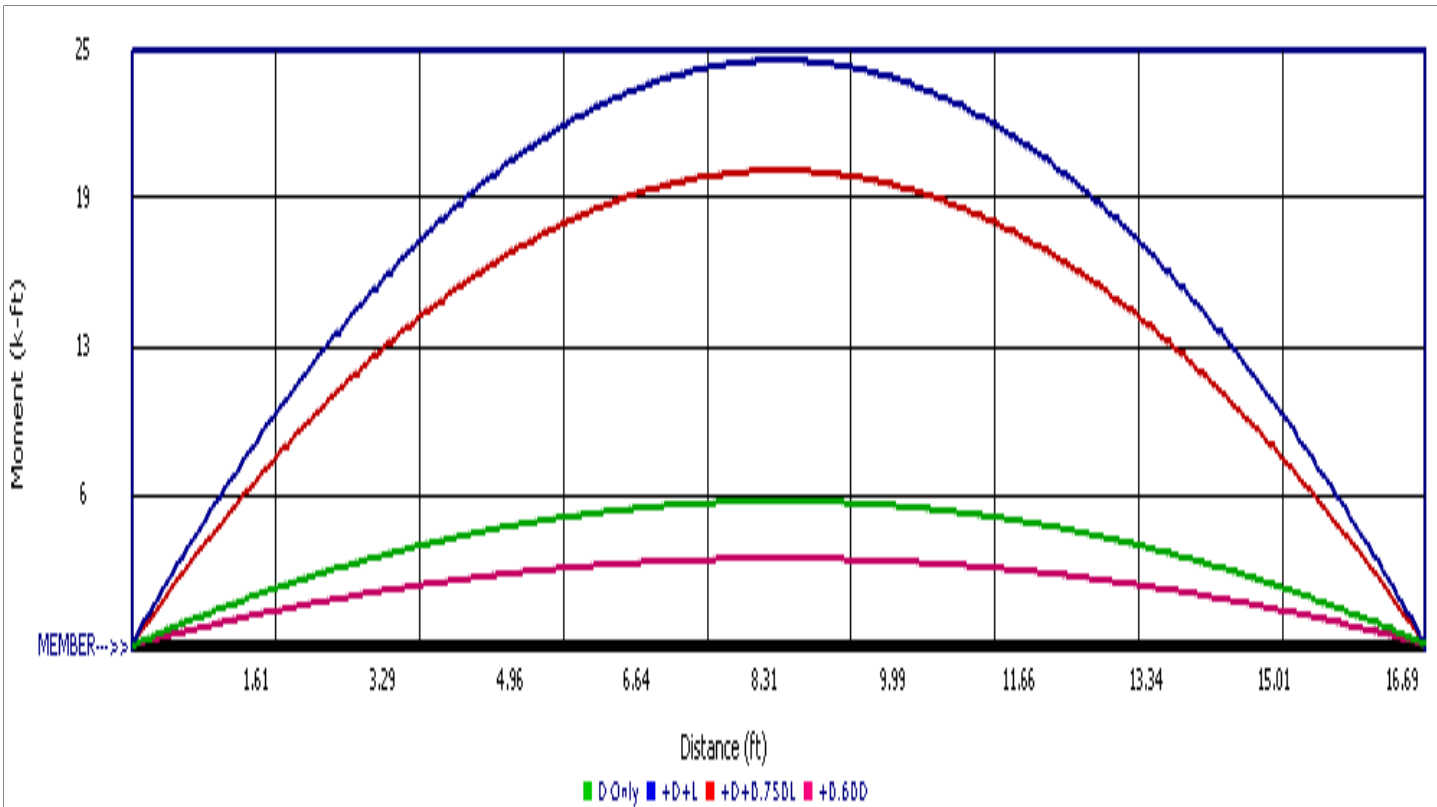
DESCRIPTION: BM # 7

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	5.857	5.857
Overall MINimum	4.420	4.420
D Only	1.437	1.437
+D+L	5.857	5.857
+D+0.750L	4.752	4.752
+0.60D	0.862	0.862
L Only	4.420	4.420

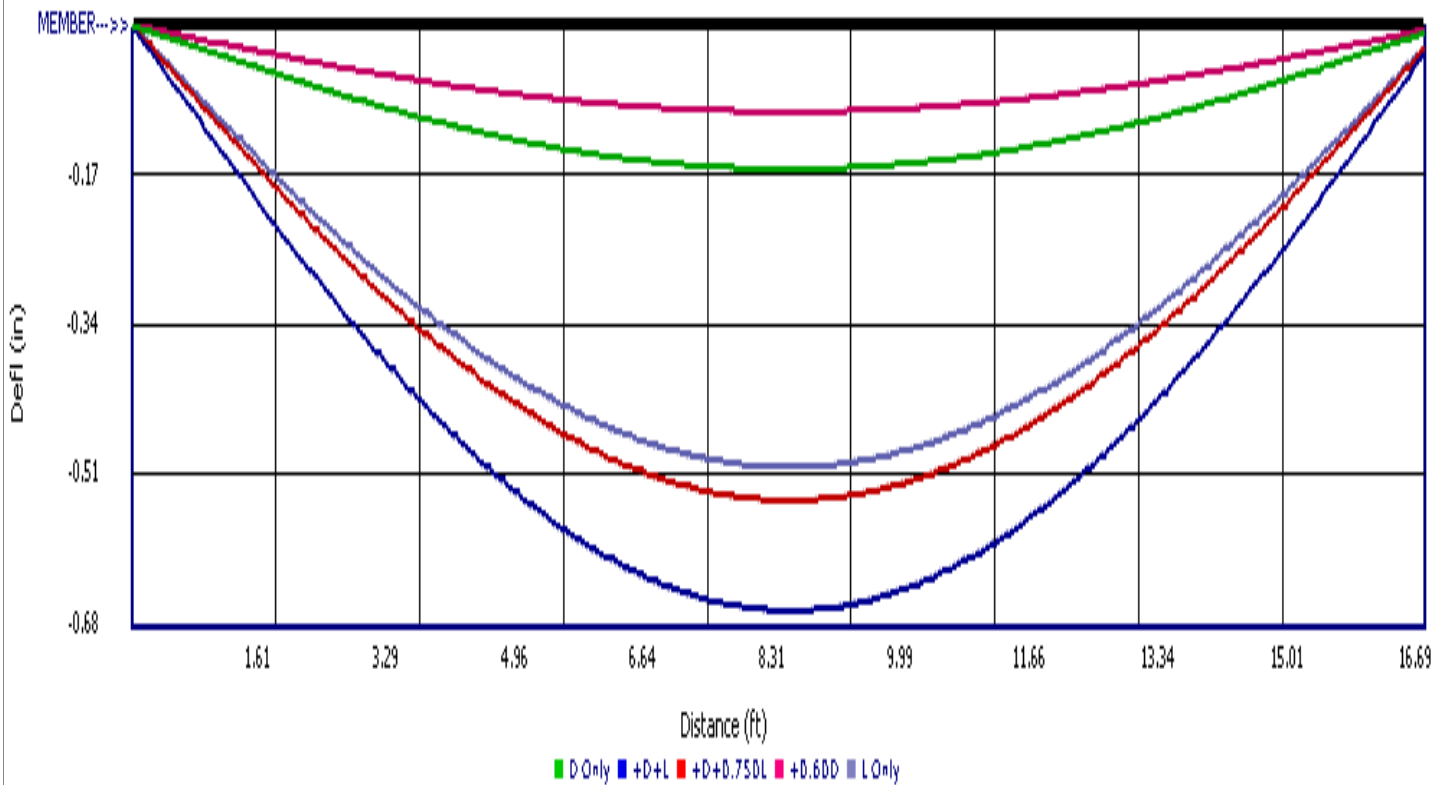
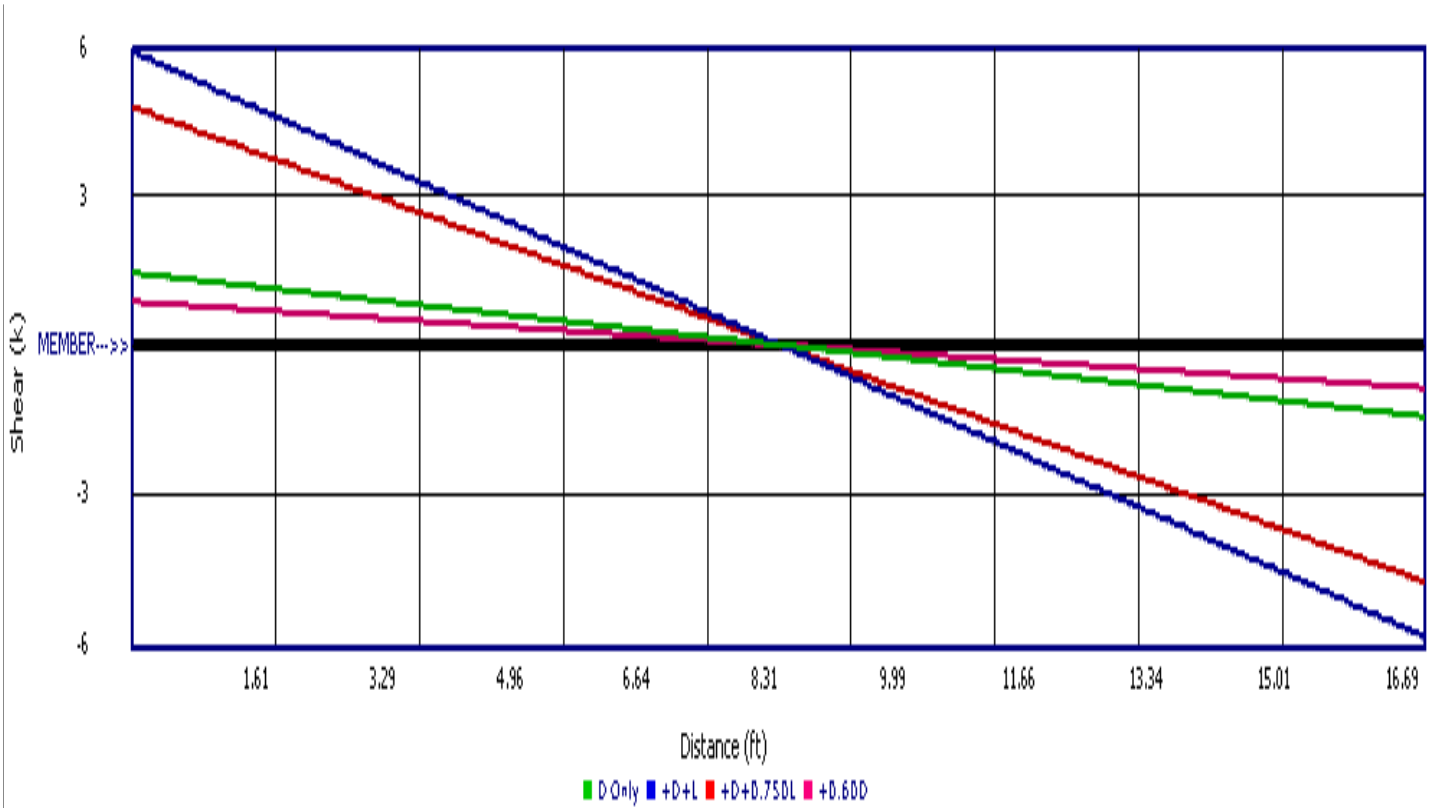


**Wood Beam**

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DESCRIPTION: BM # 7



**Wood Beam**

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File: Merlino Residence.ecb  
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 RB Engineers, Inc.

DESCRIPTION: BM # 8

**CODE REFERENCES**

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10  
 Load Combination Set : IBC 2018

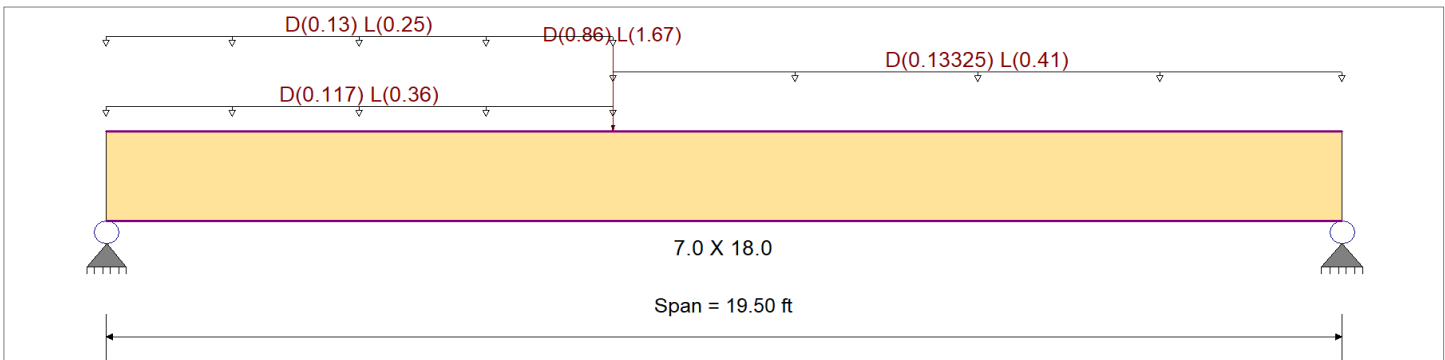
**Material Properties**

Analysis Method : Allowable Stress Design  
 Load Combination IBC 2018

Wood Species : Trus Joist  
 Wood Grade : Parallam PSL 2.0E

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

Fb +	2,900.0 psi	E : Modulus of Elasticity	
Fb -	2,900.0 psi	Ebend- xx	2,000.0ksi
Fc - Prll	2,900.0 psi	Eminbend - xx	1,016.54ksi
Fc - Perp	625.0 psi		
Fv	290.0 psi		
Ft	2,025.0 psi	Density	45.070pcf



**Applied Loads**

Service loads entered. Load Factors will be applied for calculations.

Load for Span Number 1

- Uniform Load : D = 0.0130, L = 0.040 ksf, Extent = 0.0 --> 8.0 ft, Tributary Width = 9.0 ft
- Uniform Load : D = 0.0130, L = 0.040 ksf, Extent = 8.0 --> 19.50 ft, Tributary Width = 10.250 ft
- Point Load : D = 0.860, L = 1.670 k @ 8.0 ft
- Uniform Load : D = 0.0130, L = 0.0250 ksf, Extent = 0.0 --> 8.0 ft, Tributary Width = 10.0 ft

**DESIGN SUMMARY**

**Design OK**

Maximum Bending Stress Ratio	=	<b>0.500</b>	1	Maximum Shear Stress Ratio	=	<b>0.308</b>	: 1
Section used for this span		<b>7.0 X 18.0</b>		Section used for this span		<b>7.0 X 18.0</b>	
fb: Actual	=	1,359.40psi		fv: Actual	=	89.32 psi	
Fb: Allowable	=	2,719.36psi		Fv: Allowable	=	290.00 psi	
Load Combination		+D+L		Load Combination		+D+L	
Location of maximum on span	=	8.042ft		Location of maximum on span	=	0.000ft	
Span # where maximum occurs	=	Span # 1		Span # where maximum occurs	=	Span # 1	
<b>Maximum Deflection</b>							
Max Downward Transient Deflection		0.295 in	Ratio =	793	>=	480	
Max Upward Transient Deflection		0.000 in	Ratio =	0	<	480	
Max Downward Total Deflection		0.411 in	Ratio =	569	>=	240	
Max Upward Total Deflection		0.000 in	Ratio =	0	<	240	

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values						
			M	V	C <sub>d</sub>	C <sub>FV</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v			
D Only	Length = 19.50 ft	1	0.160	0.099	0.90	0.938	1.00	1.00	1.00	1.00	1.00	12.32	391.13	2447.43	0.00	0.00	0.00	2.16	25.72	261.00
+D+L	Length = 19.50 ft	1	0.500	0.308	1.00	0.938	1.00	1.00	1.00	1.00	1.00	42.82	1,359.40	2719.36	0.00	0.00	0.00	7.50	89.32	290.00
+D+0.750L	Length = 19.50 ft	1	0.329	0.203	1.25	0.938	1.00	1.00	1.00	1.00	1.00	35.20	1,117.33	3399.20	0.00	0.00	0.00	6.17	73.42	362.50
+0.60D	Length = 19.50 ft	1	0.054	0.033	1.60	0.938	1.00	1.00	1.00	1.00	1.00	7.39	234.68	4350.98	0.00	0.00	0.00	1.30	15.43	464.00

**Wood Beam**

Lic. #: KW-06010288

File: Merlino Residence.ec6  
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 RB Engineers, Inc.

DESCRIPTION: BM # 8

**Overall Maximum Deflections**

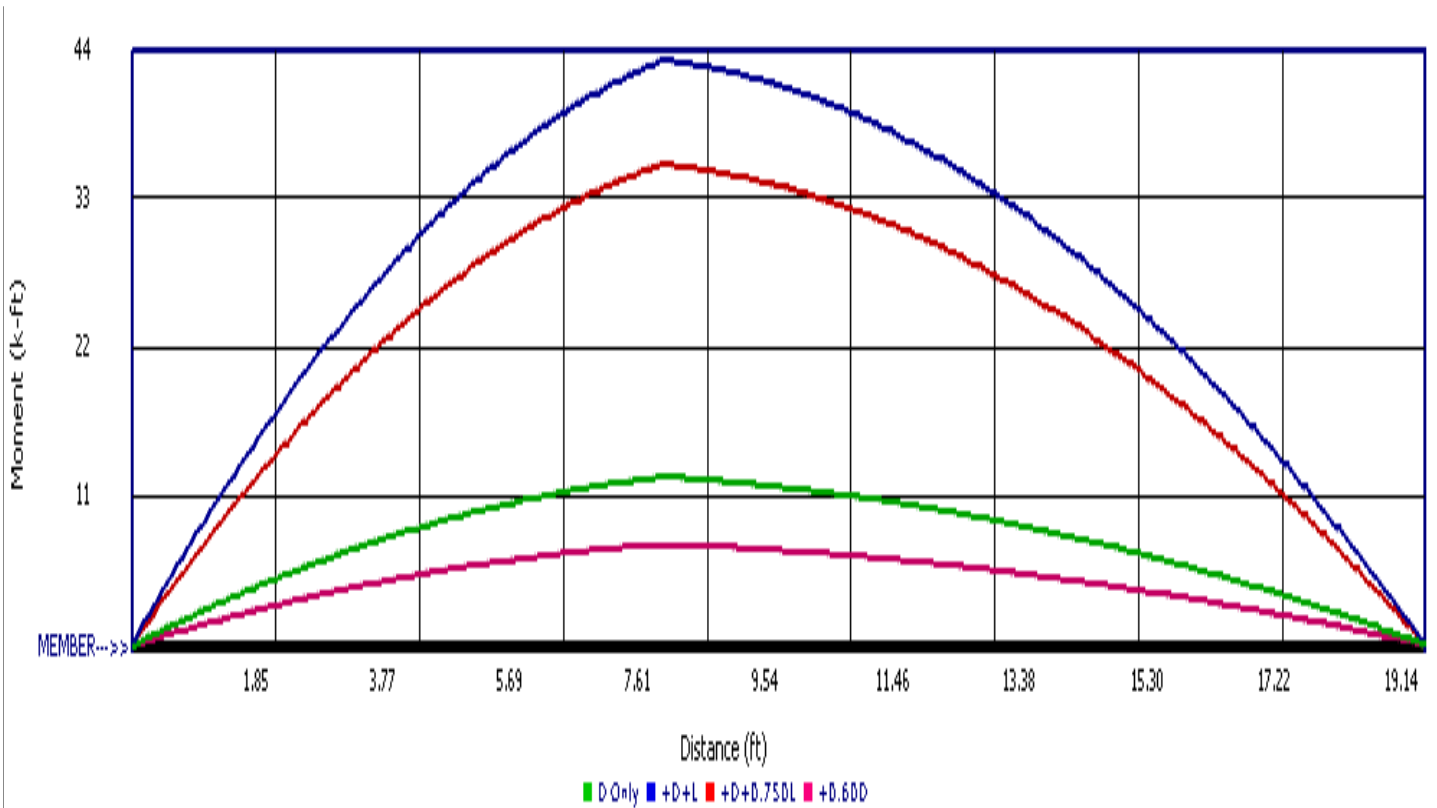
Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.4111	9.536		0.0000	0.000

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	8.784	6.850
Overall MINimum	6.254	5.011
D Only	2.530	1.839
+D+L	8.784	6.850
+D+0.750L	7.220	5.597
+0.60D	1.518	1.103
L Only	6.254	5.011

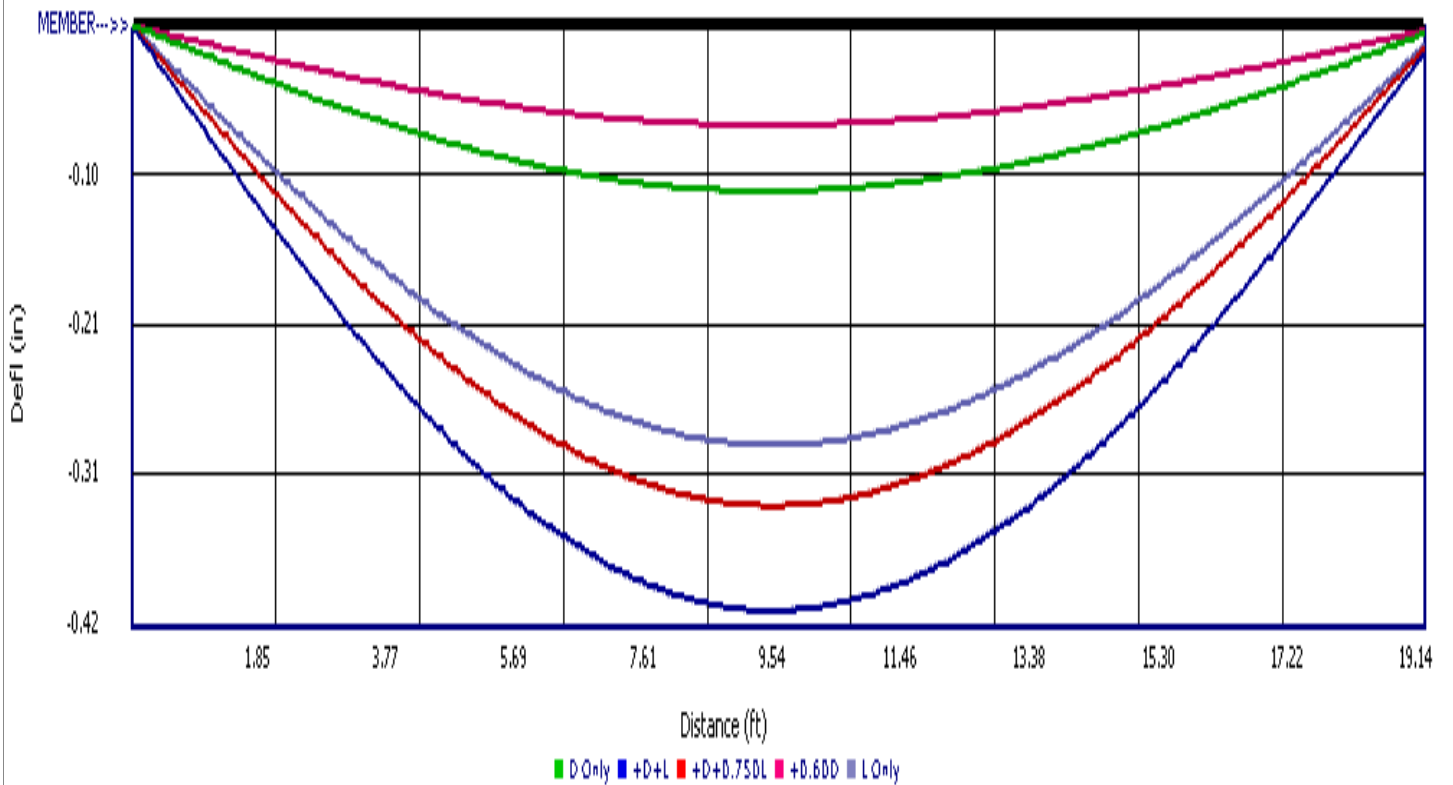
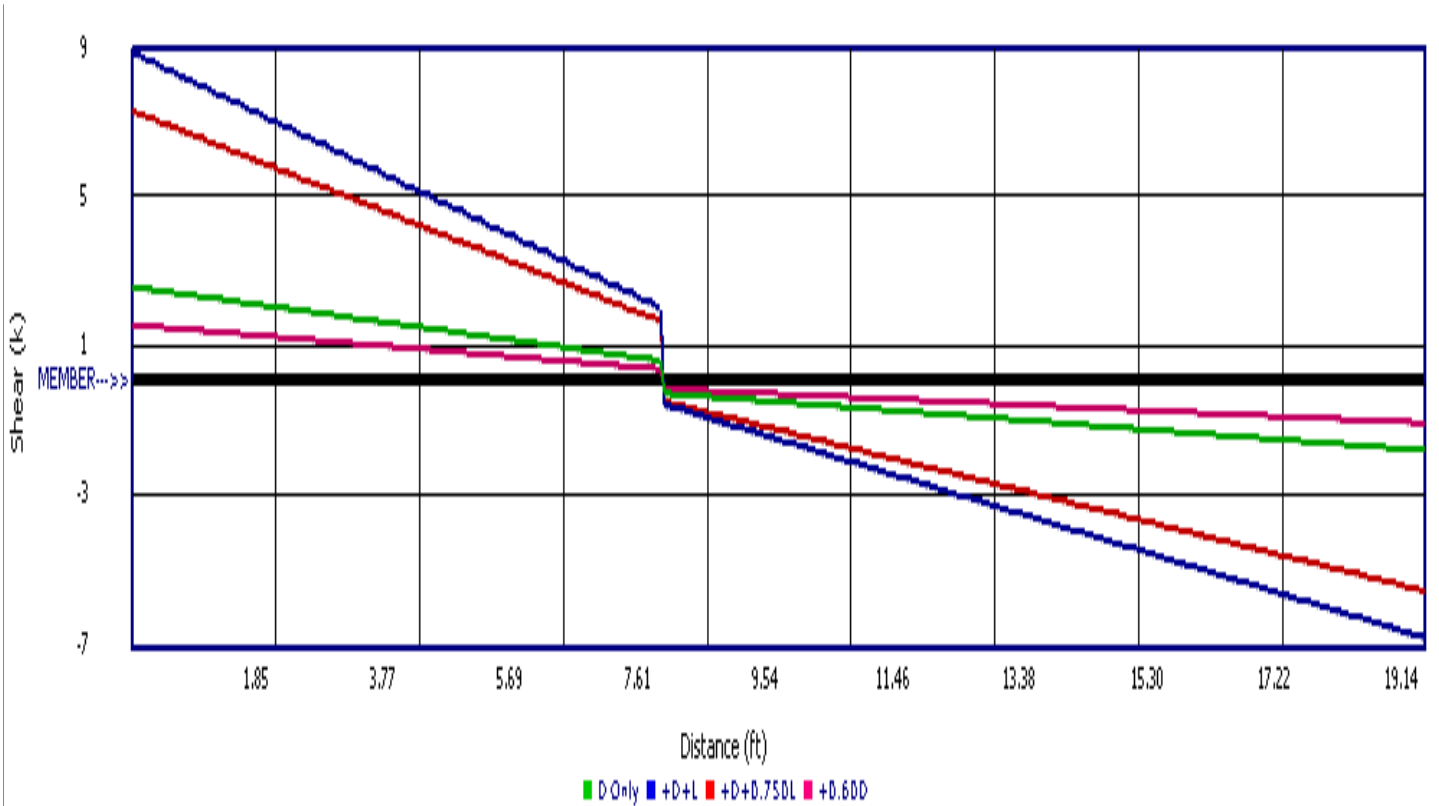


**Wood Beam**

Lic. #: KW-06010288

File: Merlino Residence.ec6  
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RB Engineers, Inc.

DESCRIPTION: BM # 8



**Wood Beam**

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File: Merlino Residence.ec6  
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 RB Engineers, Inc.

DESCRIPTION: BM # 9

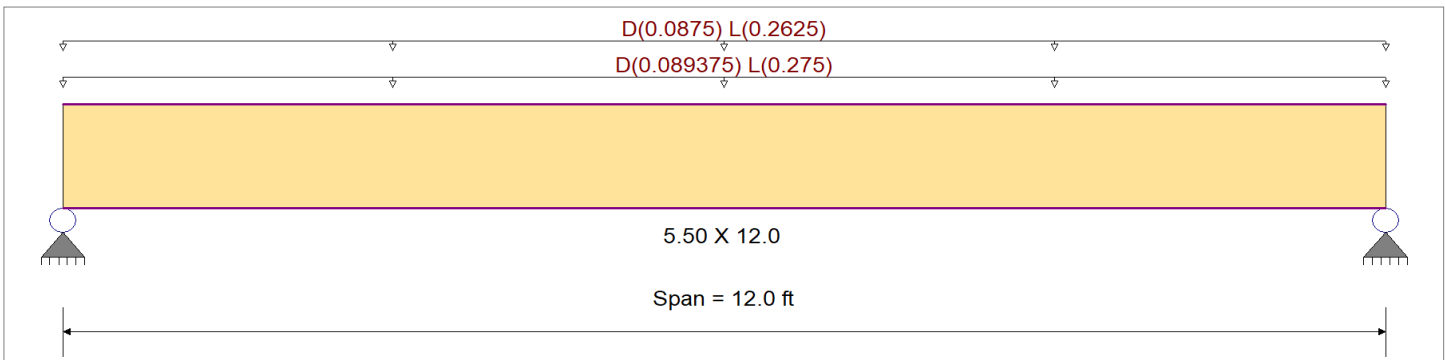
**CODE REFERENCES**

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10  
 Load Combination Set : IBC 2018

**Material Properties**

Analysis Method : Allowable Stress Design	Fb +	2,400.0 psi	E : Modulus of Elasticity
Load Combination IBC 2018	Fb -	1,850.0 psi	Ebend- xx
	Fc - Prll	1,650.0 psi	Eminbend - xx
Wood Species : DF/DF	Fc - Perp	650.0 psi	Ebend- yy
Wood Grade : 24F - V4	Fv	265.0 psi	Eminbend - yy
	Ft	1,100.0 psi	Density
			31.210pcf

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling



**Applied Loads**

Service loads entered. Load Factors will be applied for calculations.

Uniform Load : D = 0.0130, L = 0.040 ksf, Tributary Width = 6.875 ft  
 Uniform Load : D = 0.020, L = 0.060 ksf, Tributary Width = 4.375 ft

**DESIGN SUMMARY**

**Design OK**

Maximum Bending Stress Ratio =	<b>0.487</b> : 1	Maximum Shear Stress Ratio =	<b>0.309</b> : 1
Section used for this span	<b>5.50 X 12.0</b>	Section used for this span	<b>5.50 X 12.0</b>
fb: Actual =	1,168.98psi	fv: Actual =	81.77 psi
Fb: Allowable =	2,400.00psi	Fv: Allowable =	265.00 psi
Load Combination =	+D+L	Load Combination =	+D+L
Location of maximum on span =	6.000ft	Location of maximum on span =	0.000ft
Span # where maximum occurs =	Span # 1	Span # where maximum occurs =	Span # 1
<b>Maximum Deflection</b>			
Max Downward Transient Deflection	0.177 in	Ratio =	813 >=480
Max Upward Transient Deflection	0.000 in	Ratio =	0 <480
Max Downward Total Deflection	0.235 in	Ratio =	612 >=240
Max Upward Total Deflection	0.000 in	Ratio =	0 <240

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values						
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v				
D Only	Length = 12.0 ft	1	0.134	0.085	0.90	1.000	1.00	1.00	1.00	1.00	1.00	1.00	3.18	289.43	2160.00	0.00	0.00	0.00	0.89	20.25	238.50
+D+L	Length = 12.0 ft	1	0.487	0.309	1.00	1.000	1.00	1.00	1.00	1.00	1.00	1.00	12.86	1,168.98	2400.00	0.00	0.00	0.00	3.60	81.77	265.00
+D+0.750L	Length = 12.0 ft	1	0.316	0.200	1.25	1.000	1.00	1.00	1.00	1.00	1.00	1.00	10.44	949.09	3000.00	0.00	0.00	0.00	2.92	66.39	331.25
+0.60D	Length = 12.0 ft	1	0.045	0.029	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.91	173.66	3840.00	0.00	0.00	0.00	0.53	12.15	424.00

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.2352	6.044		0.0000	0.000



**Wood Beam**

Lic. #: KW-06010288

File: Merlino Residence.ec6  
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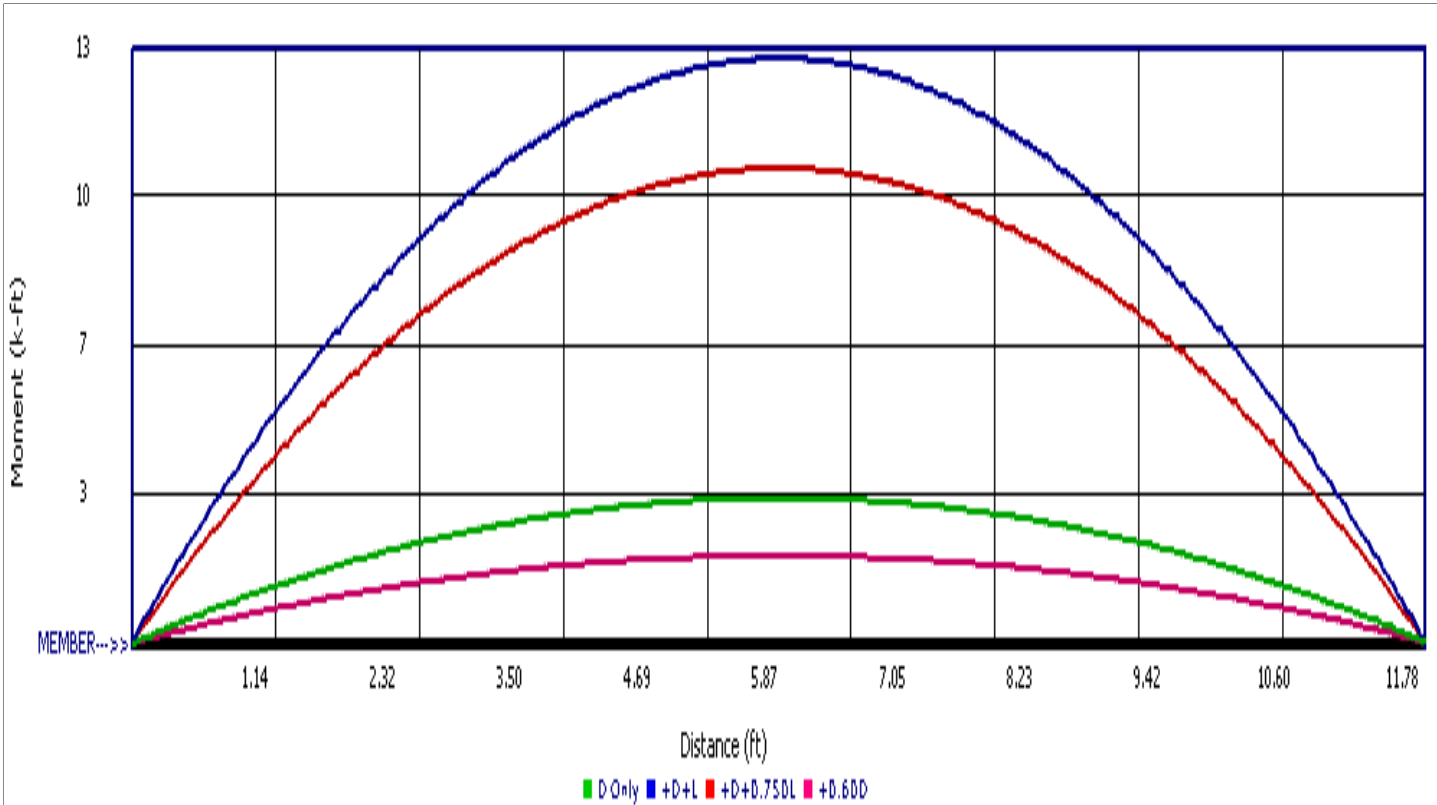
DESCRIPTION: BM # 9

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	4.286	4.286
Overall MINimum	3.225	3.225
D Only	1.061	1.061
+D+L	4.286	4.286
+D+0.750L	3.480	3.480
+0.60D	0.637	0.637
L Only	3.225	3.225

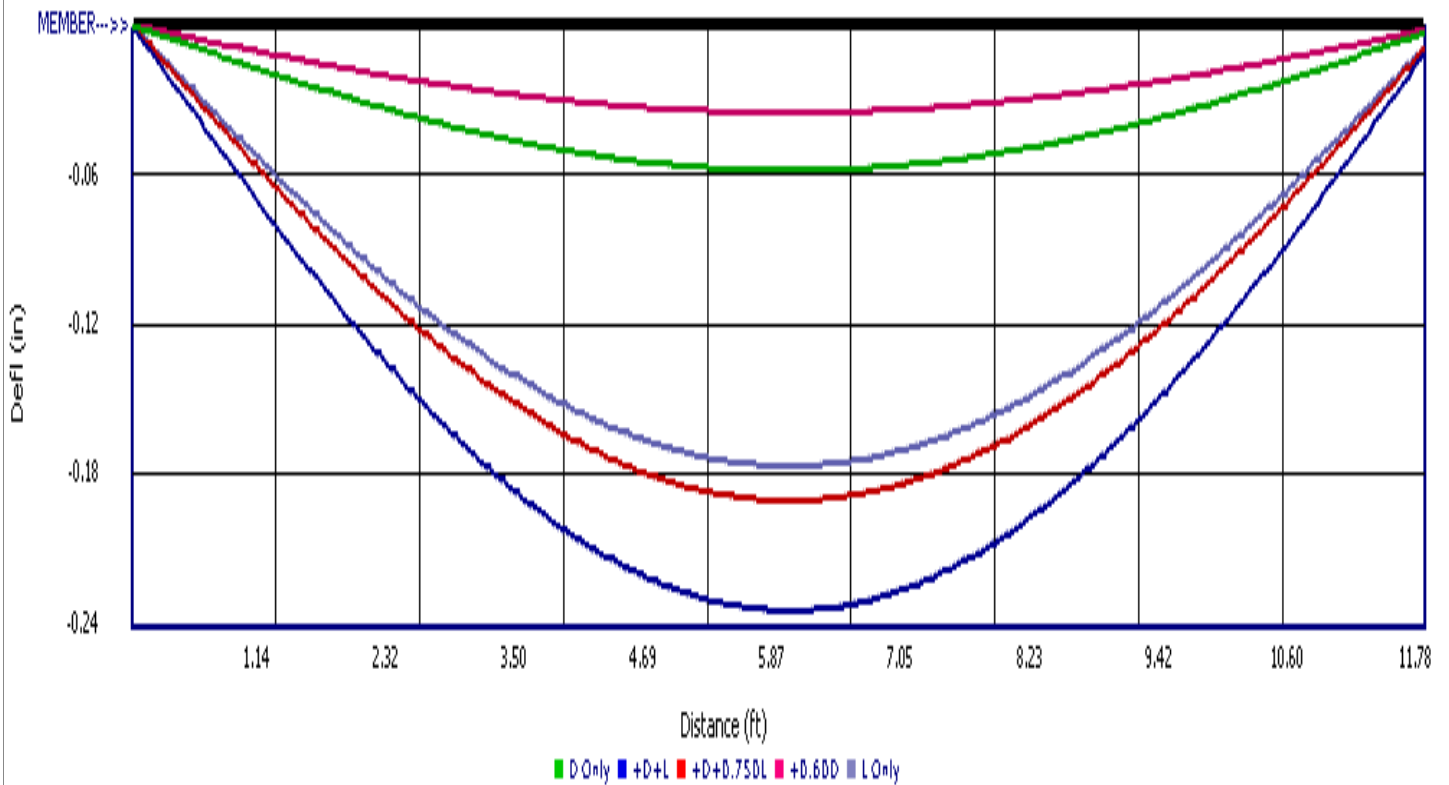
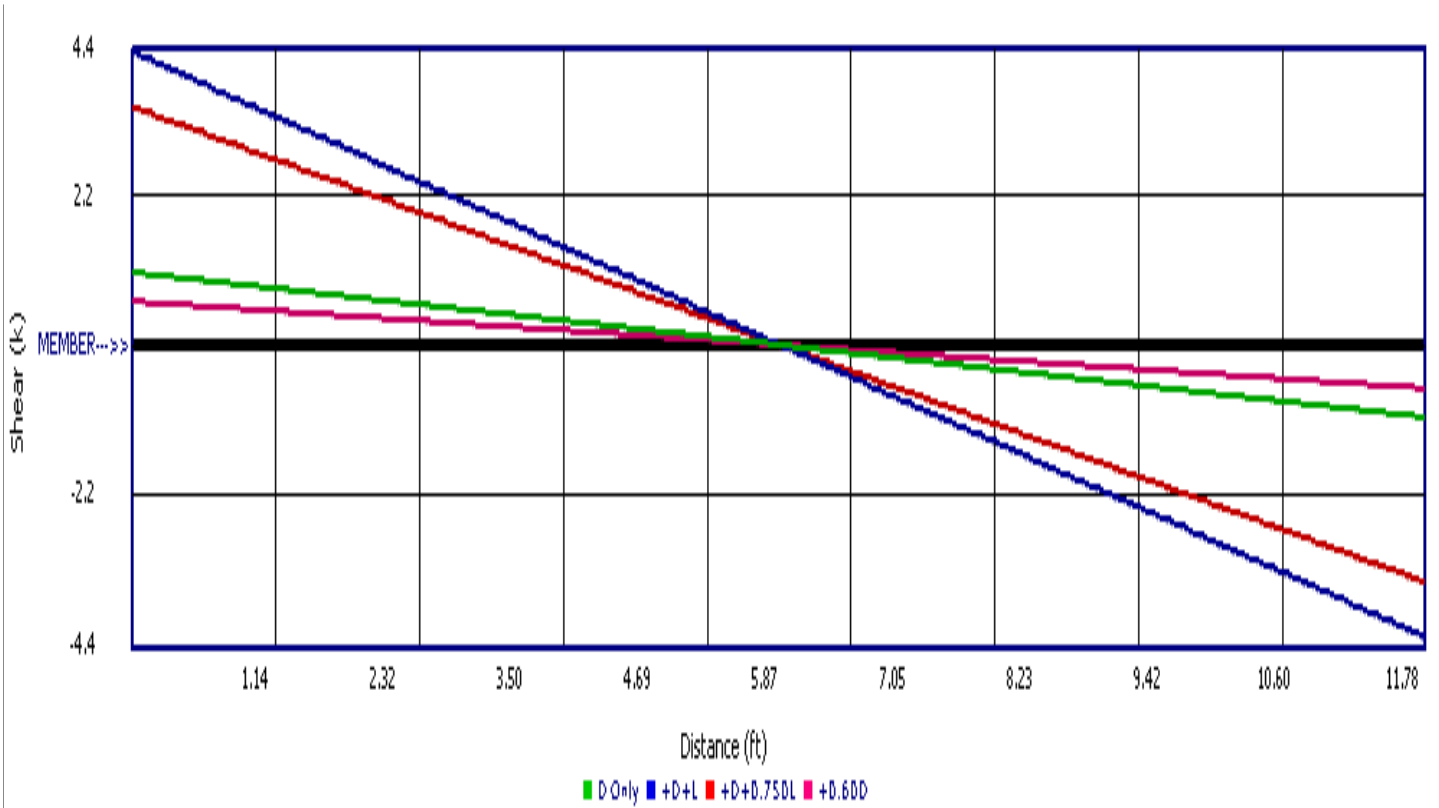


Wood Beam

Lic. #: KW-06010288

File: Merlino Residence.ec6  
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RB Engineers, Inc.

DESCRIPTION: BM # 9



**Wood Beam**

Lic. #: KW-06010288

File: Merlino Residence.ecb  
 Software copyright ENERCALC, INC. 1983-2020, Build:12.20.8.17  
 RB Engineers, Inc.

DESCRIPTION: BM # 10

**CODE REFERENCES**

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10  
 Load Combination Set : IBC 2018

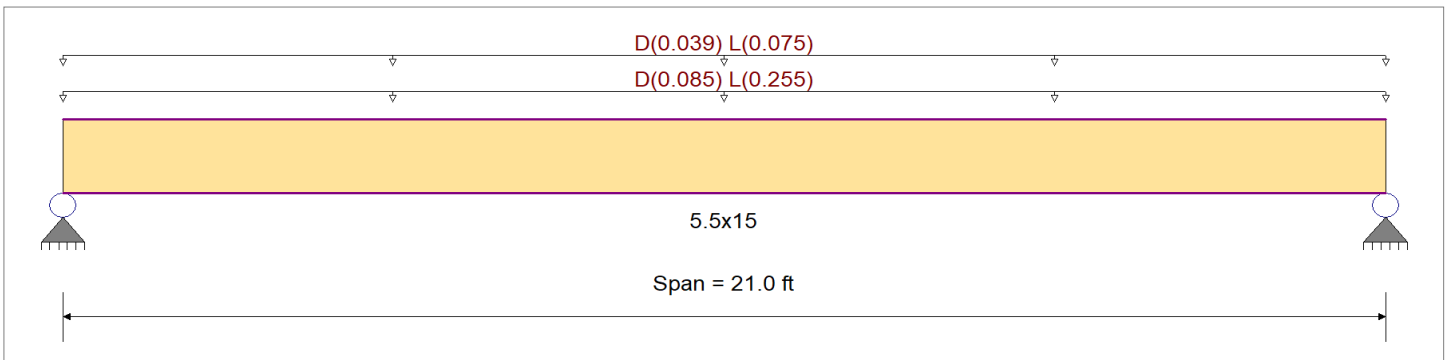
**Material Properties**

Analysis Method : Allowable Stress Design  
 Load Combination IBC 2018

Wood Species : DF/DF  
 Wood Grade : 24F - V4

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

Fb +	2,400.0 psi	E : Modulus of Elasticity	
Fb -	1,850.0 psi	Ebend- xx	1,800.0 ksi
Fc - Prll	1,650.0 psi	Eminbend - xx	950.0 ksi
Fc - Perp	650.0 psi	Ebend- yy	1,600.0 ksi
Fv	265.0 psi	Eminbend - yy	850.0 ksi
Ft	1,100.0 psi	Density	31.210 pcf



**Applied Loads**

Service loads entered. Load Factors will be applied for calculations.

Uniform Load : D = 0.020, L = 0.060 ksf, Tributary Width = 4.250 ft  
 Uniform Load : D = 0.0130, L = 0.0250 ksf, Tributary Width = 3.0 ft

**DESIGN SUMMARY**

**Design OK**

Maximum Bending Stress Ratio	=	<b>0.625</b> : 1	Maximum Shear Stress Ratio	=	<b>0.289</b> : 1
Section used for this span		<b>5.5x15</b>	Section used for this span		<b>5.5x15</b>
fb: Actual	=	1,456.10 psi	fv: Actual	=	76.55 psi
Fb: Allowable	=	2,330.52 psi	Fv: Allowable	=	265.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	10.500ft	Location of maximum on span	=	0.000ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
<b>Maximum Deflection</b>					
Max Downward Transient Deflection		0.522 in	Ratio =		483 >=480
Max Upward Transient Deflection		0.000 in	Ratio =		0 <480
Max Downward Total Deflection		0.718 in	Ratio =		351 >=240
Max Upward Total Deflection		0.000 in	Ratio =		0 <240

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values							
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v					
D Only	Length = 21.0 ft	1	0.190	0.088	0.90	0.971	1.00	1.00	1.00	1.00	1.00	1.00	1.00	6.84	397.70	2097.47	0.00	0.00	0.00	0.00	20.91	238.50
+D+L	Length = 21.0 ft	1	0.625	0.289	1.00	0.971	1.00	1.00	1.00	1.00	1.00	1.00	1.00	25.03	1,456.10	2330.52	0.00	0.00	0.00	0.00	76.55	265.00
+D+0.750L	Length = 21.0 ft	1	0.409	0.189	1.25	0.971	1.00	1.00	1.00	1.00	1.00	1.00	1.00	20.48	1,191.50	2913.15	0.00	0.00	0.00	0.00	62.64	331.25
+0.60D	Length = 21.0 ft	1	0.064	0.030	1.60	0.971	1.00	1.00	1.00	1.00	1.00	1.00	1.00	4.10	238.62	3728.84	0.00	0.00	0.00	0.00	12.54	424.00

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.7177	10.577		0.0000	0.000

**Wood Beam**

Lic. #: KW-06010288

File: Merlino Residence.ec6  
 Software copyright ENERCALC, INC. 1983-2020, Build:12.20.8.17  
 RB Engineers, Inc.

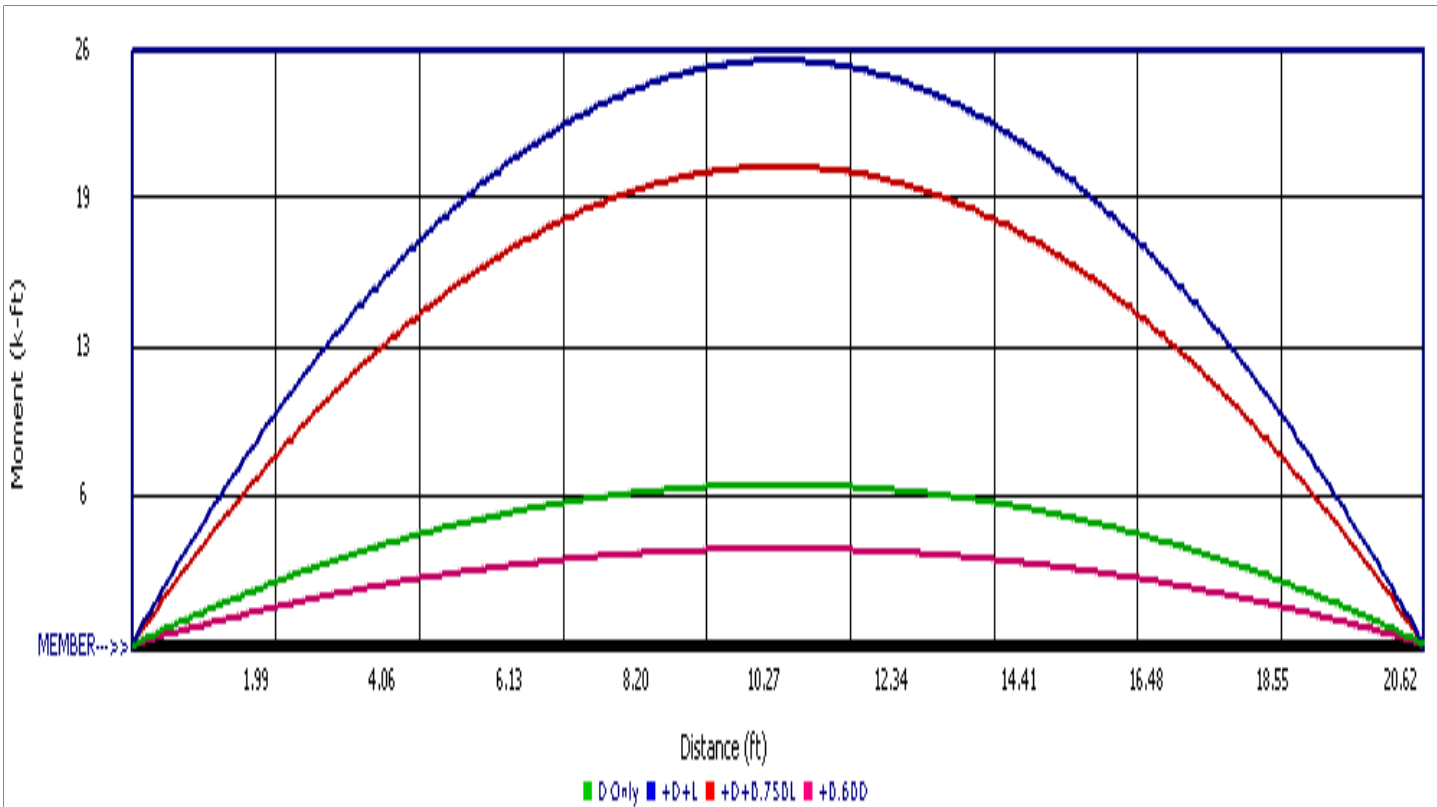
DESCRIPTION: BM # 10

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	4.767	4.767
Overall MINimum	3.465	3.465
D Only	1.302	1.302
+D+L	4.767	4.767
+D+0.750L	3.901	3.901
+0.60D	0.781	0.781
L Only	3.465	3.465

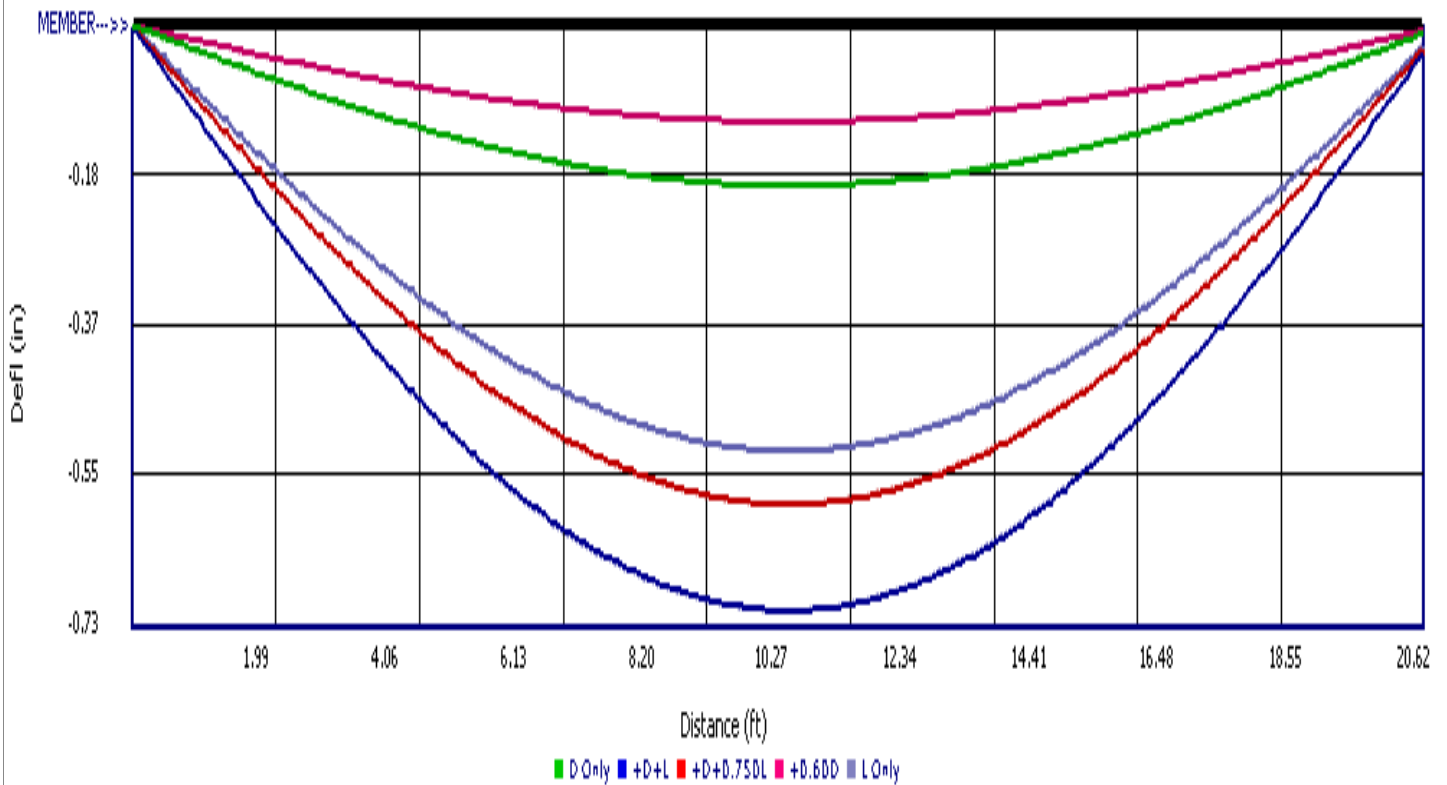
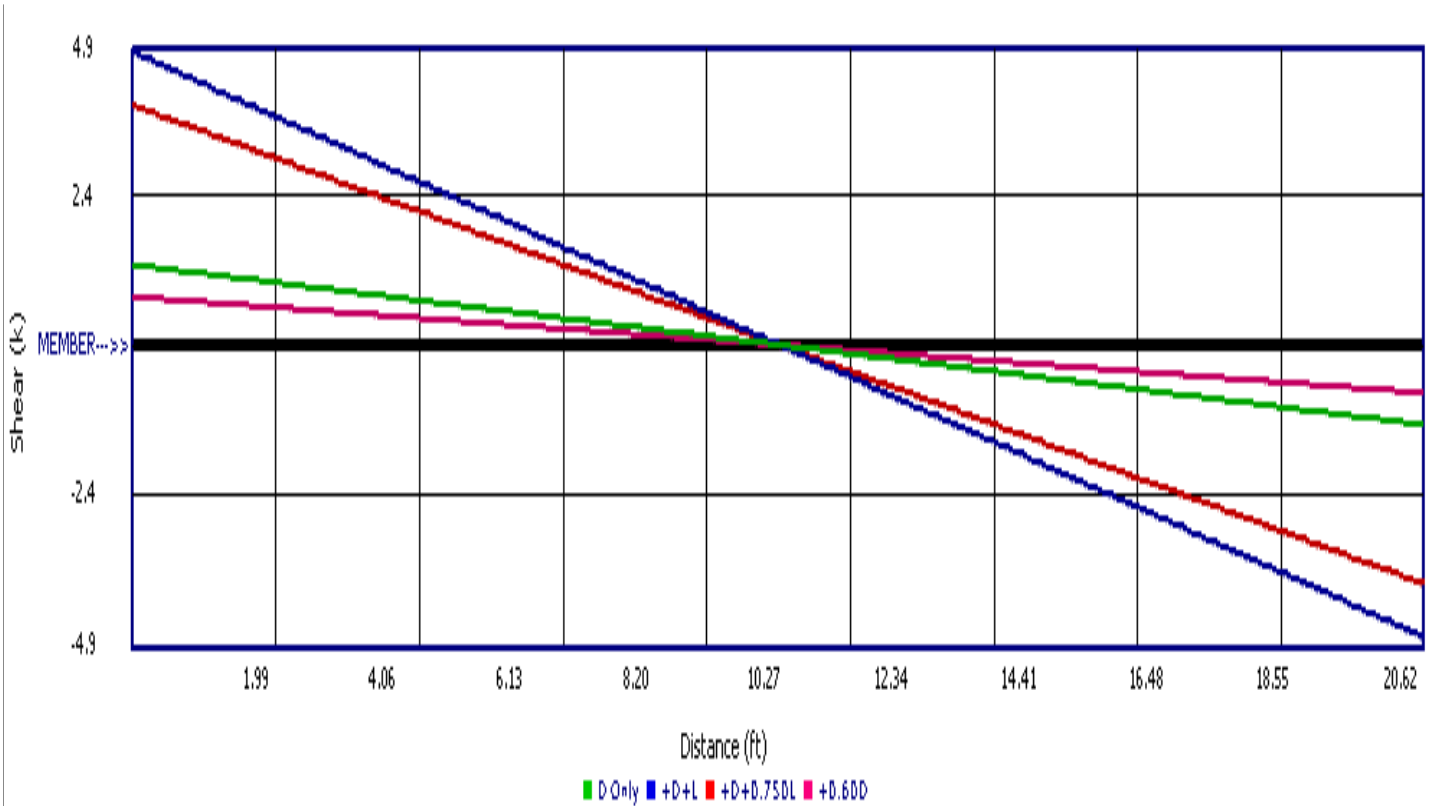


Wood Beam

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RB Engineers, Inc.

DESCRIPTION: BM # 10



**Wood Beam**

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File: Merlino Residence.ecb  
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 RB Engineers, Inc.

DESCRIPTION: BM # 11

**CODE REFERENCES**

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10  
 Load Combination Set : IBC 2018

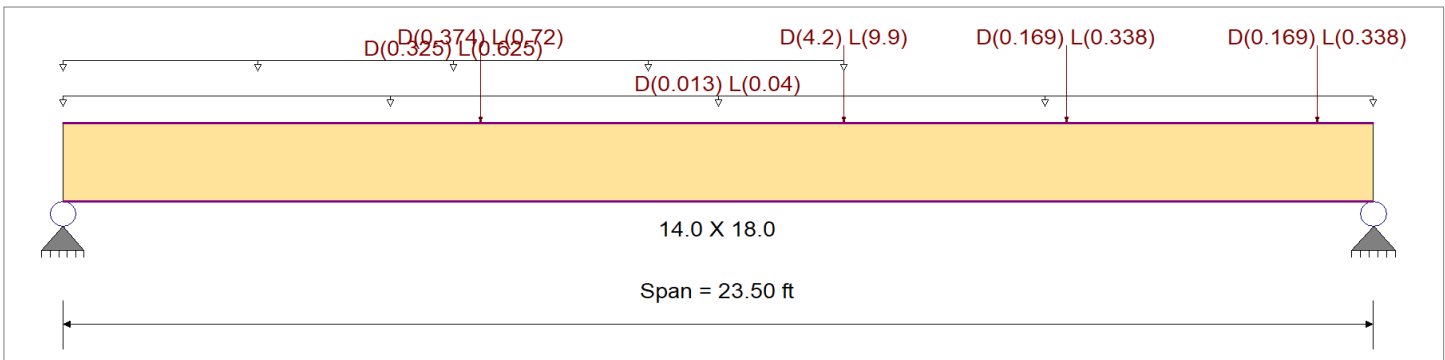
**Material Properties**

Analysis Method : Allowable Stress Design  
 Load Combination IBC 2018

Wood Species : Trus Joist  
 Wood Grade : Parallam PSL 2.0E

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

Fb +	2,900.0 psi	E : Modulus of Elasticity	
Fb -	2,900.0 psi	Ebend- xx	2,000.0ksi
Fc - Prll	2,900.0 psi	Eminbend - xx	1,016.54ksi
Fc - Perp	625.0 psi		
Fv	290.0 psi		
Ft	2,025.0 psi	Density	45.070pcf



**Applied Loads**

Service loads entered. Load Factors will be applied for calculations.

- Uniform Load : D = 0.0130, L = 0.040, Tributary Width = 1.0 ft
- Point Load : D = 0.3740, L = 0.720 k @ 7.50 ft
- Point Load : D = 4.20, L = 9.90 k @ 14.0 ft
- Point Load : D = 0.1690, L = 0.3380 k @ 18.0 ft
- Point Load : D = 0.1690, L = 0.3380 k @ 22.50 ft
- Uniform Load : D = 0.0130, L = 0.0250 ksf, Extent = 0.0 ---> 14.0 ft, Tributary Width = 25.0 ft

**DESIGN SUMMARY**

**Design OK**

Maximum Bending Stress Ratio	=	<b>0.746</b> : 1	Maximum Shear Stress Ratio	=	<b>0.310</b> : 1
Section used for this span	=	<b>14.0 X 18.0</b>	Section used for this span	=	<b>14.0 X 18.0</b>
fb: Actual	=	2,003.37 psi	fv: Actual	=	89.78 psi
Fb: Allowable	=	2,685.24 psi	Fv: Allowable	=	290.00 psi
Load Combination	=	+D+L	Load Combination	=	+D+L
Location of maximum on span	=	13.980ft	Location of maximum on span	=	0.000ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
<b>Maximum Deflection</b>					
Max Downward Transient Deflection		0.580 in	Ratio =		485 >=480
Max Upward Transient Deflection		0.000 in	Ratio =		0 <480
Max Downward Total Deflection		0.847 in	Ratio =		332 >=240
Max Upward Total Deflection		0.000 in	Ratio =		0 <240

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values			
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v
D Only	Length = 23.50 ft	1	0.258	0.111	0.90	0.926	1.00	1.00	1.00	1.00	1.00	39.29	623.71	2416.72	4.85	28.89	261.00
+D+L	Length = 23.50 ft	1	0.746	0.310	1.00	0.926	1.00	1.00	1.00	1.00	1.00	126.21	2,003.37	2685.24	15.08	89.78	290.00
+D+0.750L	Length = 23.50 ft	1	0.494	0.206	1.25	0.926	1.00	1.00	1.00	1.00	1.00	104.48	1,658.46	3356.55	12.53	74.56	362.50
+0.60D	Length = 23.50 ft	1	0.087	0.037	1.60	0.926	1.00	1.00	1.00	1.00	1.00	23.58	374.23	4296.39	2.91	17.34	464.00

**Wood Beam**

Lic. #: KW-06010288

File: Merlino Residence.ec6  
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 RB Engineers, Inc.

DESCRIPTION: BM # 11

**Overall Maximum Deflections**

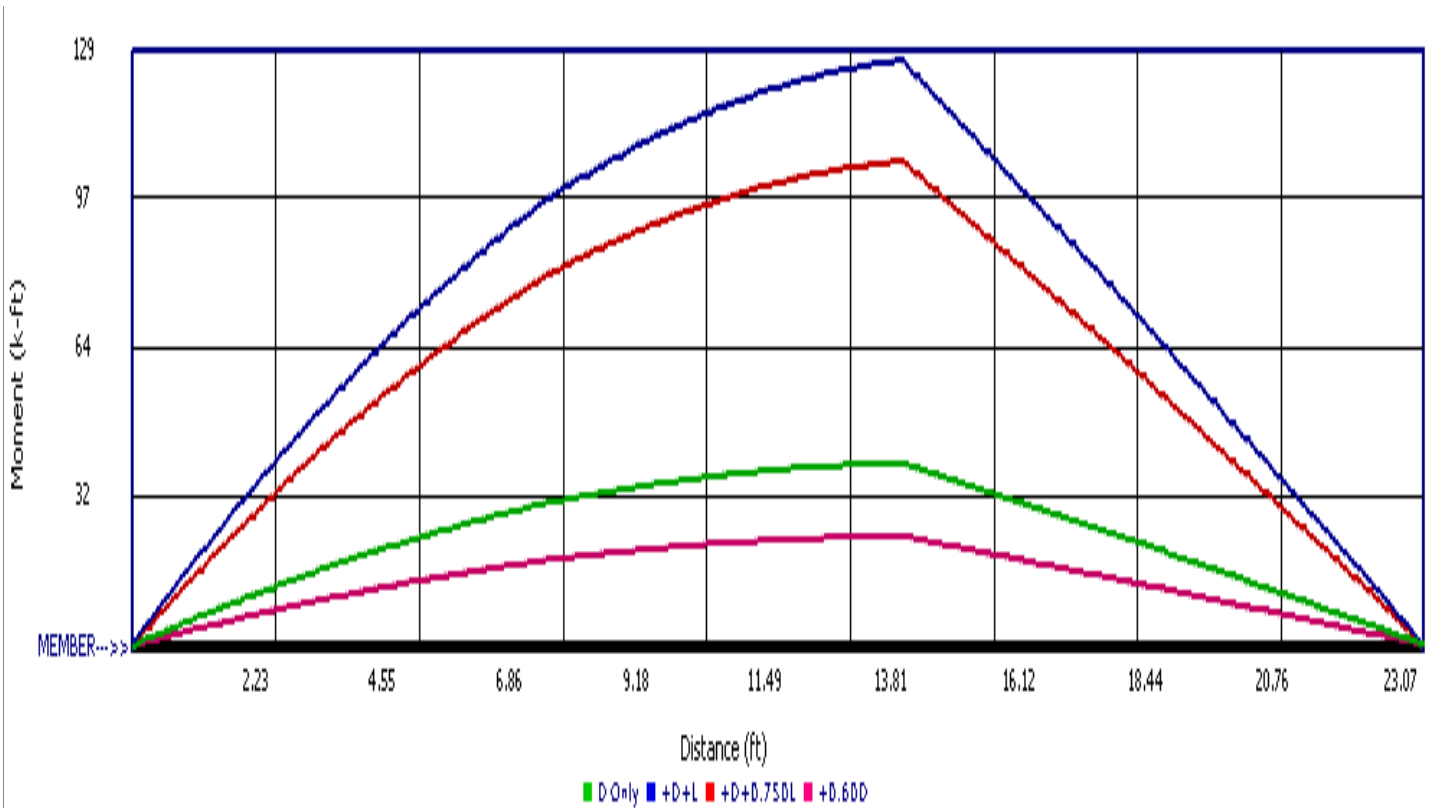
Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.8471	11.922		0.0000	0.000

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	16.546	14.207
Overall MINimum	11.199	9.787
D Only	5.347	4.421
+D+L	16.546	14.207
+D+0.750L	13.746	11.761
+0.60D	3.208	2.652
L Only	11.199	9.787

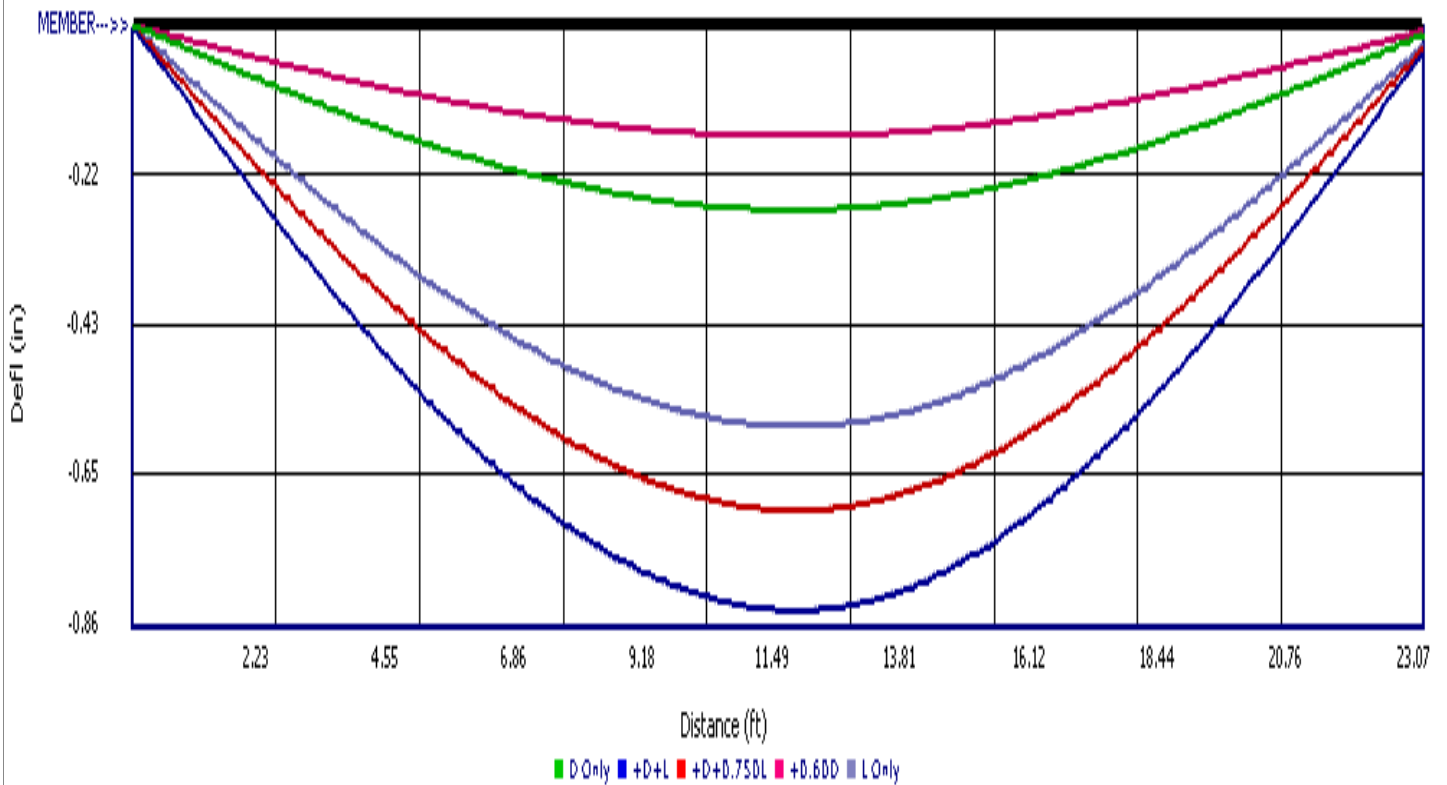
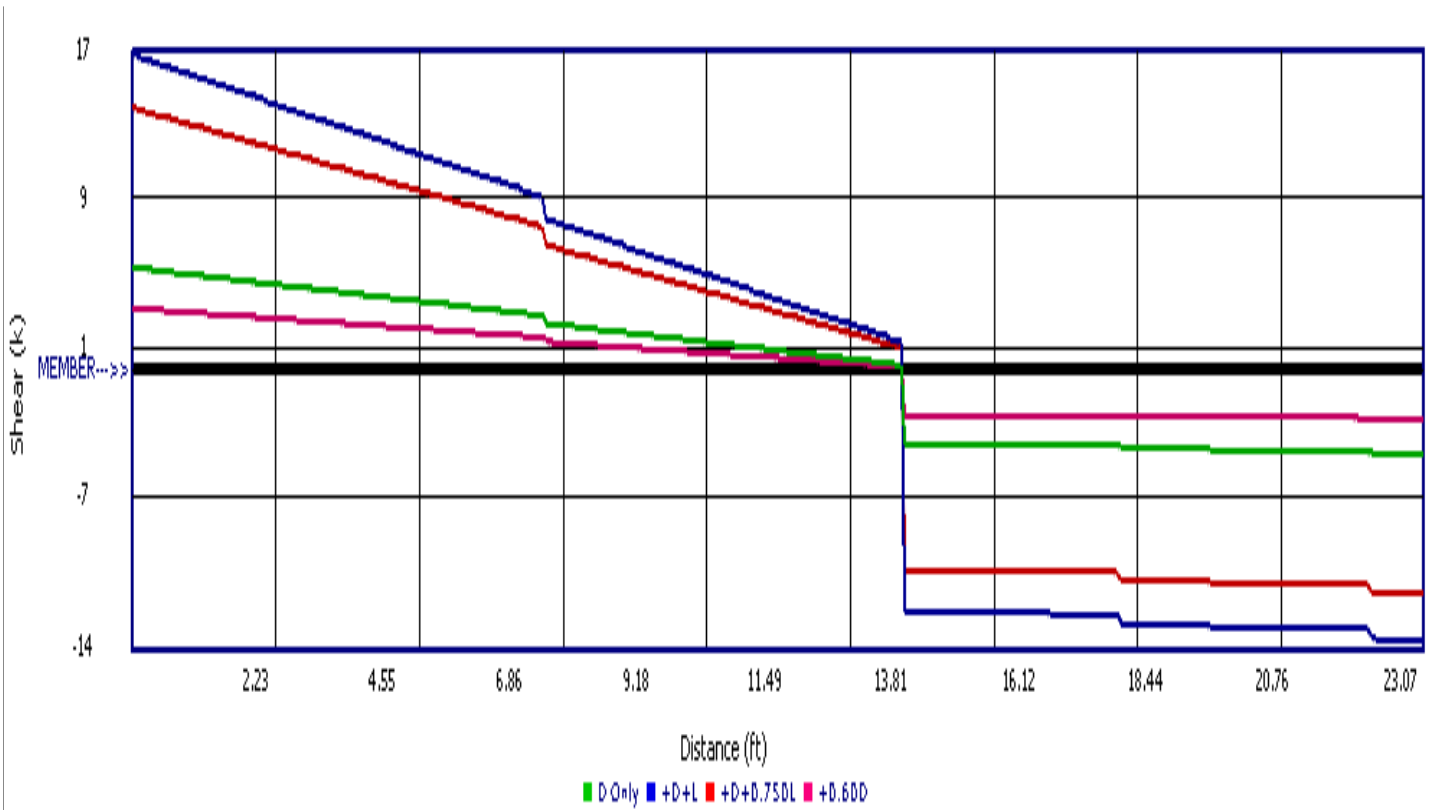


Wood Beam

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DESCRIPTION: BM # 11





**Wood Beam**

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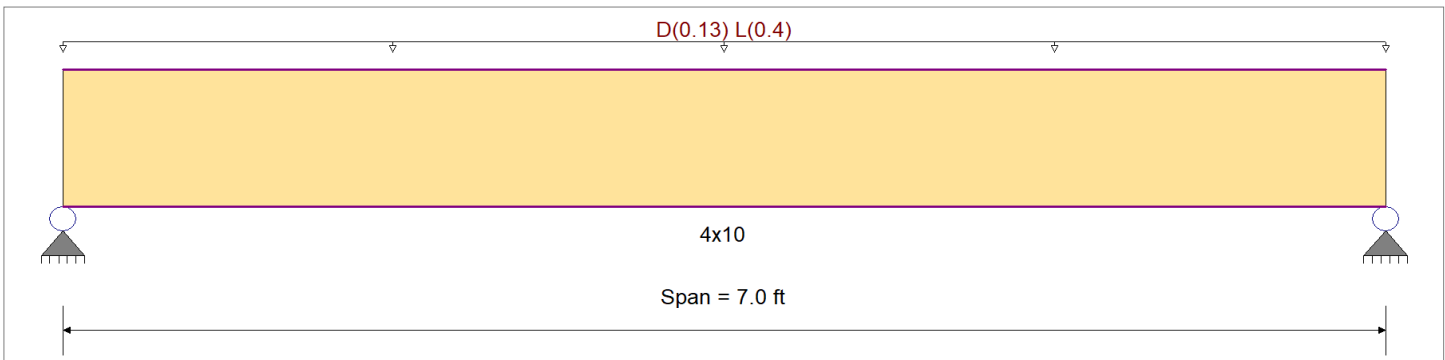
DESCRIPTION: BM # 12

**CODE REFERENCES**

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10  
 Load Combination Set : IBC 2018

**Material Properties**

Analysis Method : Allowable Stress Design	Fb +	900.0 psi	E : Modulus of Elasticity
Load Combination IBC 2018	Fb -	900.0 psi	Ebend- xx
	Fc - Prll	1,350.0 psi	Eminbend - xx
Wood Species : Douglas Fir - Larch	Fc - Perp	625.0 psi	
Wood Grade : No.2	Fv	180.0 psi	Density
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling	Ft	575.0 psi	31.210pcf



**Applied Loads**

Service loads entered. Load Factors will be applied for calculations.

Uniform Load : D = 0.0130, L = 0.040 ksf, Tributary Width = 10.0 ft

**DESIGN SUMMARY**

**Design OK**

Maximum Bending Stress Ratio =	<b>0.723</b> : 1	Maximum Shear Stress Ratio =	<b>0.373</b> : 1
Section used for this span	<b>4x10</b>	Section used for this span	<b>4x10</b>
fb: Actual =	780.48psi	fv: Actual =	67.13 psi
Fb: Allowable =	1,080.00psi	Fv: Allowable =	180.00 psi
Load Combination	+D+L	Load Combination	+D+L
Location of maximum on span	3.500ft	Location of maximum on span	6.234 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1
<b>Maximum Deflection</b>			
Max Downward Transient Deflection	0.059 in	Ratio =	1427 >=480
Max Upward Transient Deflection	0.000 in	Ratio =	0 <480
Max Downward Total Deflection	0.078 in	Ratio =	1077 >=240
Max Upward Total Deflection	0.000 in	Ratio =	0 <240

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values					
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	Fv		
D Only	Length = 7.0 ft	1	0.197	0.102	0.90	1.200	1.00	1.00	1.00	1.00	1.00	0.80	191.44	972.00	0.00	0.00	0.00	0.00	162.00
+D+L	Length = 7.0 ft	1	0.723	0.373	1.00	1.200	1.00	1.00	1.00	1.00	1.00	3.25	780.48	1080.00	0.00	1.45	67.13	180.00	0.00
+D+0.750L	Length = 7.0 ft	1	0.469	0.242	1.25	1.200	1.00	1.00	1.00	1.00	1.00	2.63	633.22	1350.00	0.00	1.18	54.46	225.00	0.00
+0.60D	Length = 7.0 ft	1	0.066	0.034	1.60	1.200	1.00	1.00	1.00	1.00	1.00	0.48	114.86	1728.00	0.00	0.00	0.00	0.00	288.00

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.0780	3.526		0.0000	0.000

**Wood Beam**

Lic. #: KW-06010288

File: Merlino Residence.ec6  
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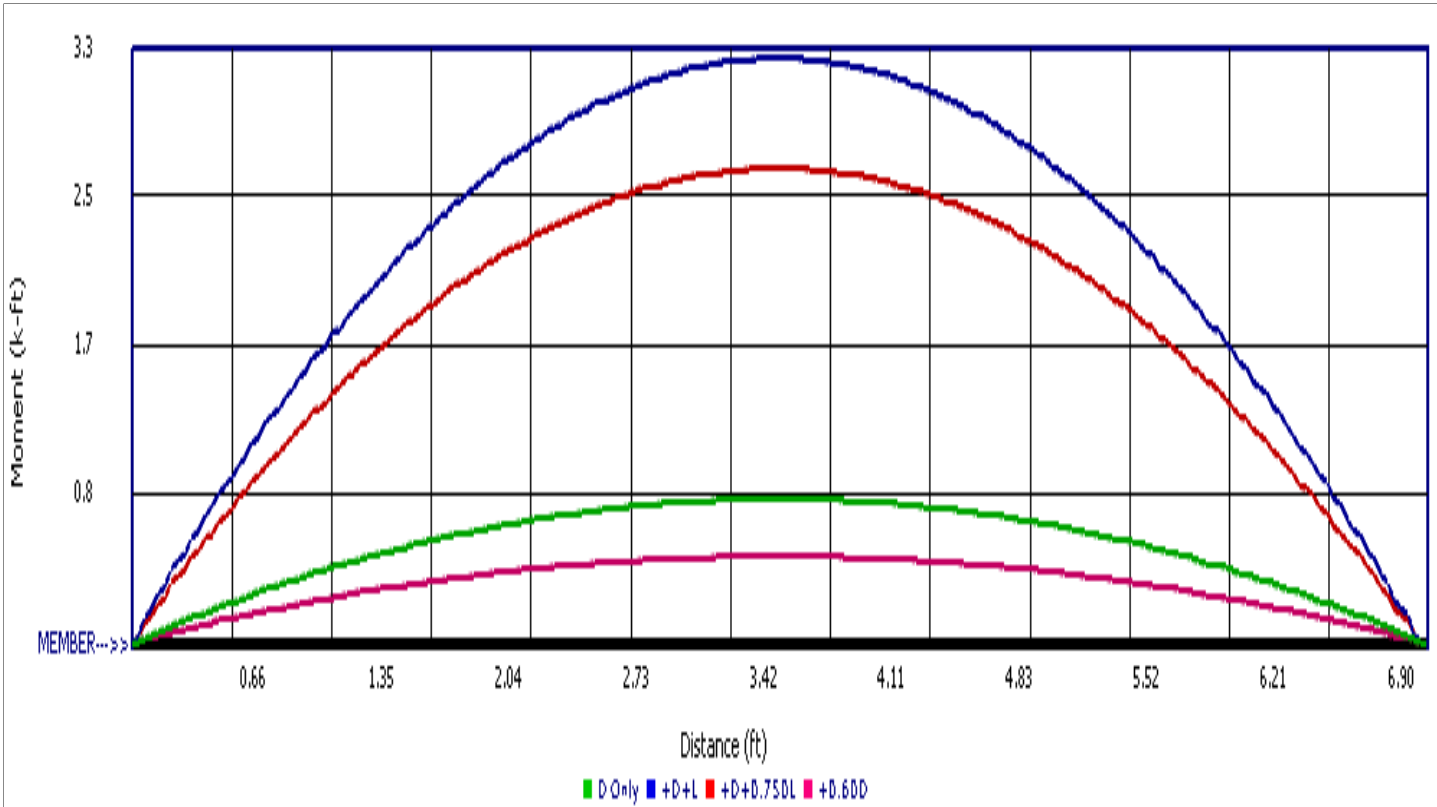
DESCRIPTION: BM # 12

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	1.855	1.855
Overall MINimum	1.400	1.400
D Only	0.455	0.455
+D+L	1.855	1.855
+D+0.750L	1.505	1.505
+0.60D	0.273	0.273
L Only	1.400	1.400

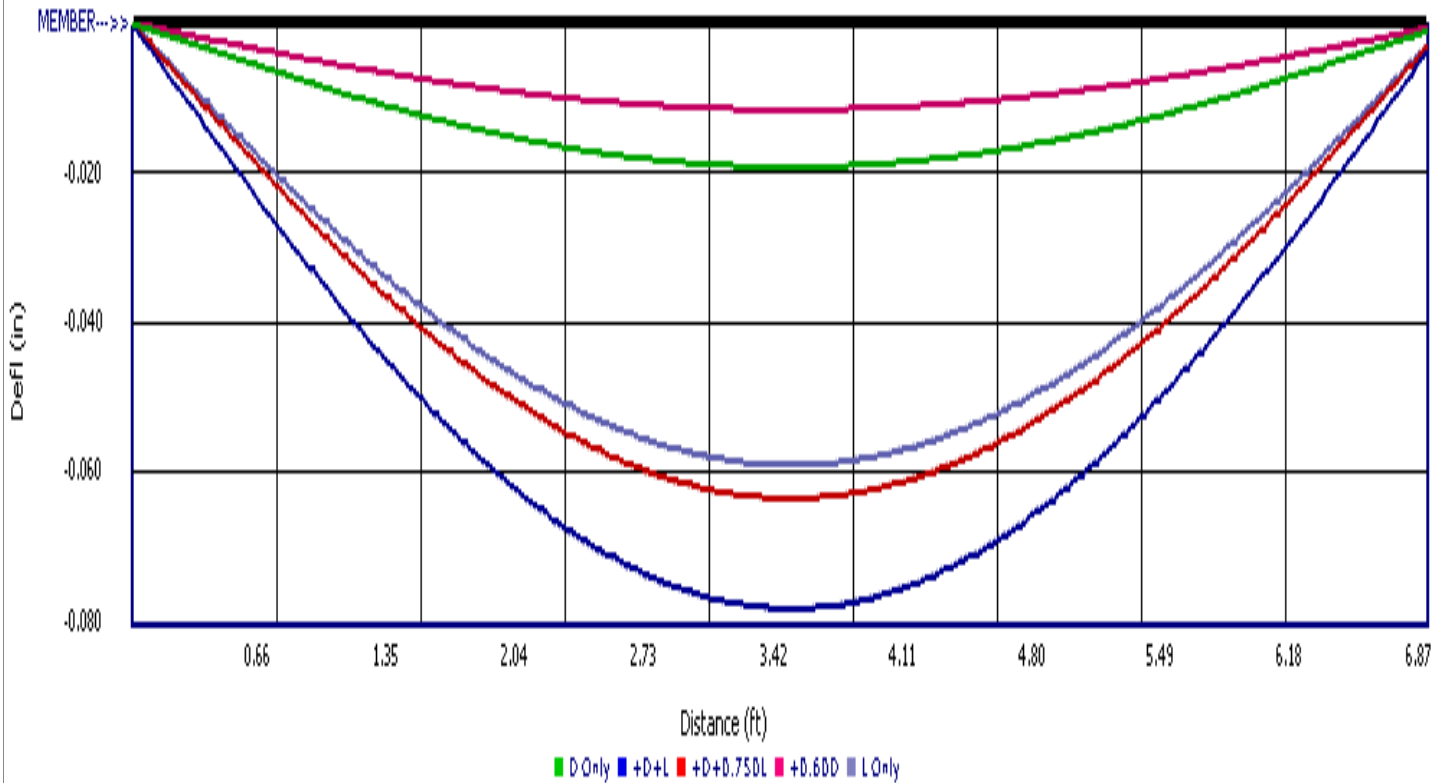
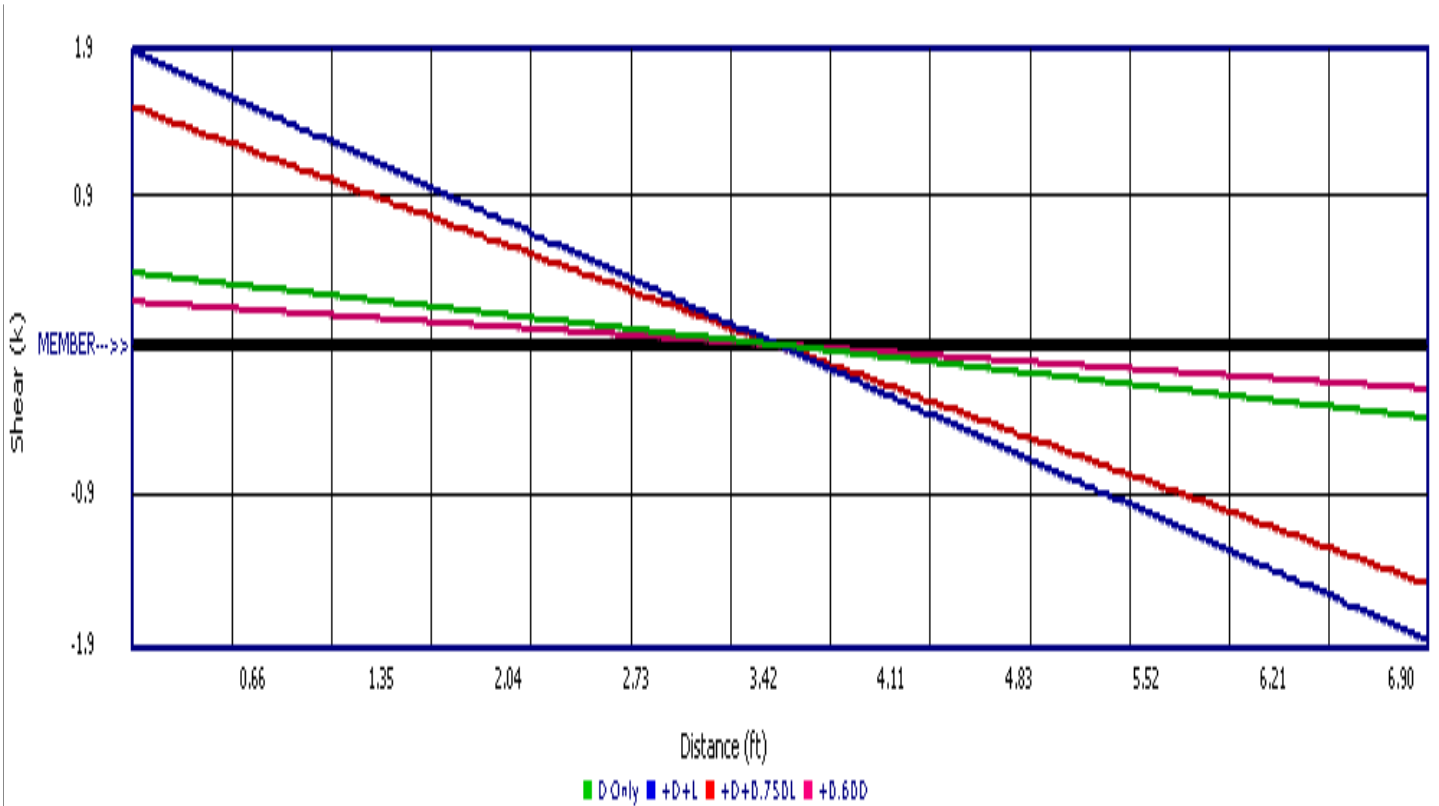


Wood Beam

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DESCRIPTION: BM # 12



**Wood Beam**

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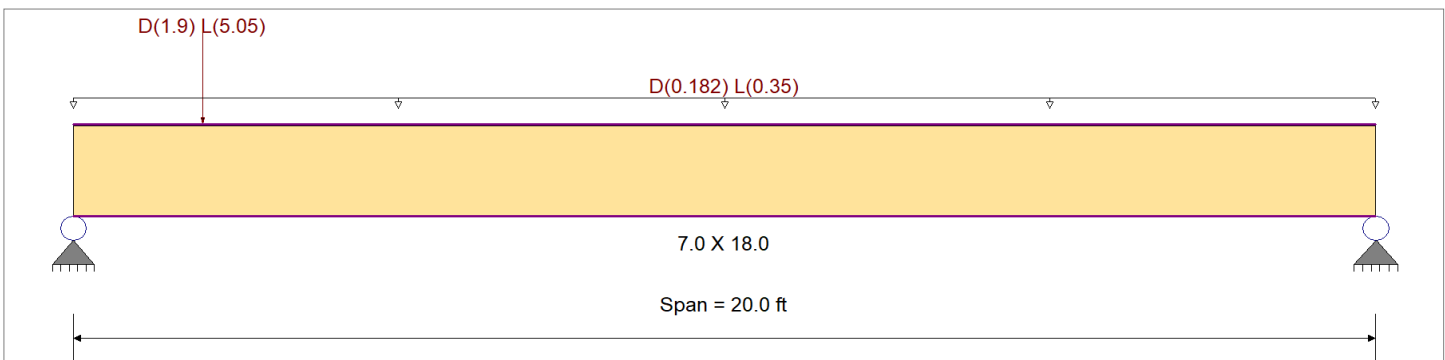
DESCRIPTION: BM # 13

**CODE REFERENCES**

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10  
 Load Combination Set : IBC 2018

**Material Properties**

Analysis Method : Allowable Stress Design	Fb +	2,900.0 psi	E : Modulus of Elasticity
Load Combination IBC 2018	Fb -	2,900.0 psi	Ebend- xx
	Fc - Prll	2,900.0 psi	Eminbend - xx
Wood Species : Trus Joist	Fc - Perp	625.0 psi	
Wood Grade : Parallam PSL 2.0E	Fv	290.0 psi	
	Ft	2,025.0 psi	Density
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling			45.070pcf



**Applied Loads**

Service loads entered. Load Factors will be applied for calculations.

Uniform Load : D = 0.0130, L = 0.0250 ksf, Tributary Width = 14.0 ft  
 Point Load : D = 1.90, L = 5.050 k @ 2.0 ft

**DESIGN SUMMARY**

**Design OK**

Maximum Bending Stress Ratio =	<b>0.398</b> < 1	Maximum Shear Stress Ratio =	<b>0.443</b> < 1
Section used for this span	<b>7.0 X 18.0</b>	Section used for this span	<b>7.0 X 18.0</b>
fb: Actual =	1,079.49psi	fv: Actual =	128.55 psi
Fb: Allowable =	2,712.49psi	Fv: Allowable =	290.00 psi
Load Combination	+D+L	Load Combination	+D+L
Location of maximum on span	8.686ft	Location of maximum on span	0.000ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1
<b>Maximum Deflection</b>			
Max Downward Transient Deflection	0.250 in	Ratio =	958 >=480
Max Upward Transient Deflection	0.000 in	Ratio =	0 <480
Max Downward Total Deflection	0.371 in	Ratio =	646 >=240
Max Upward Total Deflection	0.000 in	Ratio =	0 <240

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values								
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v						
D Only	Length = 20.0 ft	1	0.144	0.149	0.90	0.935	1.00	1.00	1.00	1.00	1.00	1.00	1.00	11.10	352.35	2441.24	0.00	0.00	0.00	0.00	0.00	261.00	
+D+L	Length = 20.0 ft	1	0.398	0.443	1.00	0.935	1.00	1.00	1.00	1.00	1.00	1.00	1.00	34.00	1,079.49	2712.49	0.00	0.00	0.00	0.00	0.00	0.00	290.00
+D+0.750L	Length = 20.0 ft	1	0.265	0.293	1.25	0.935	1.00	1.00	1.00	1.00	1.00	1.00	1.00	28.28	897.65	3390.61	0.00	0.00	0.00	0.00	0.00	0.00	362.50
+0.60D	Length = 20.0 ft	1	0.049	0.050	1.60	0.935	1.00	1.00	1.00	1.00	1.00	1.00	1.00	6.66	211.41	4339.98	0.00	0.00	0.00	0.00	0.00	0.00	464.00

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.3714	9.708		0.0000	0.000

**Wood Beam**

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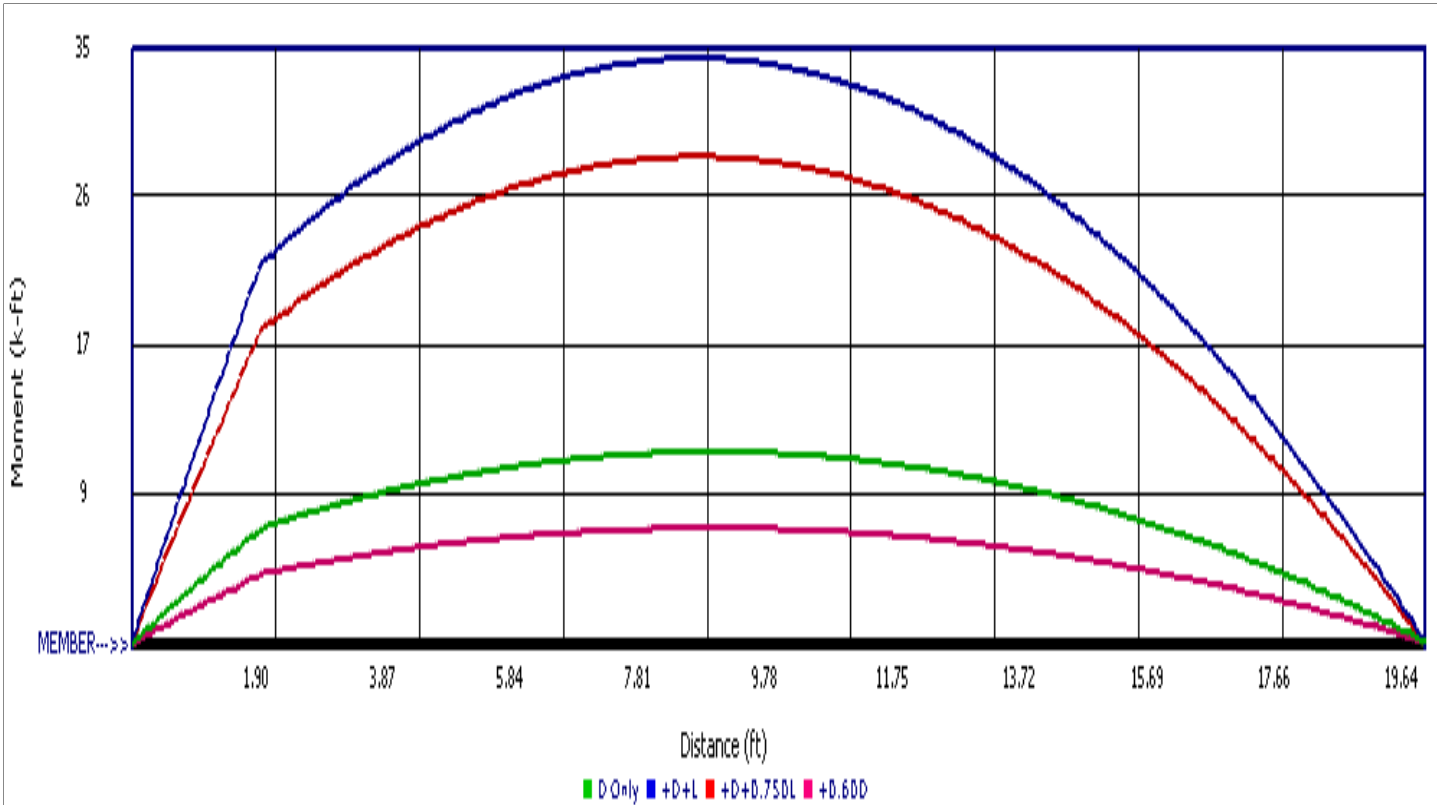
DESCRIPTION: BM # 13

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	11.575	6.015
Overall MINimum	8.045	4.005
D Only	3.530	2.010
+D+L	11.575	6.015
+D+0.750L	9.564	5.014
+0.60D	2.118	1.206
L Only	8.045	4.005

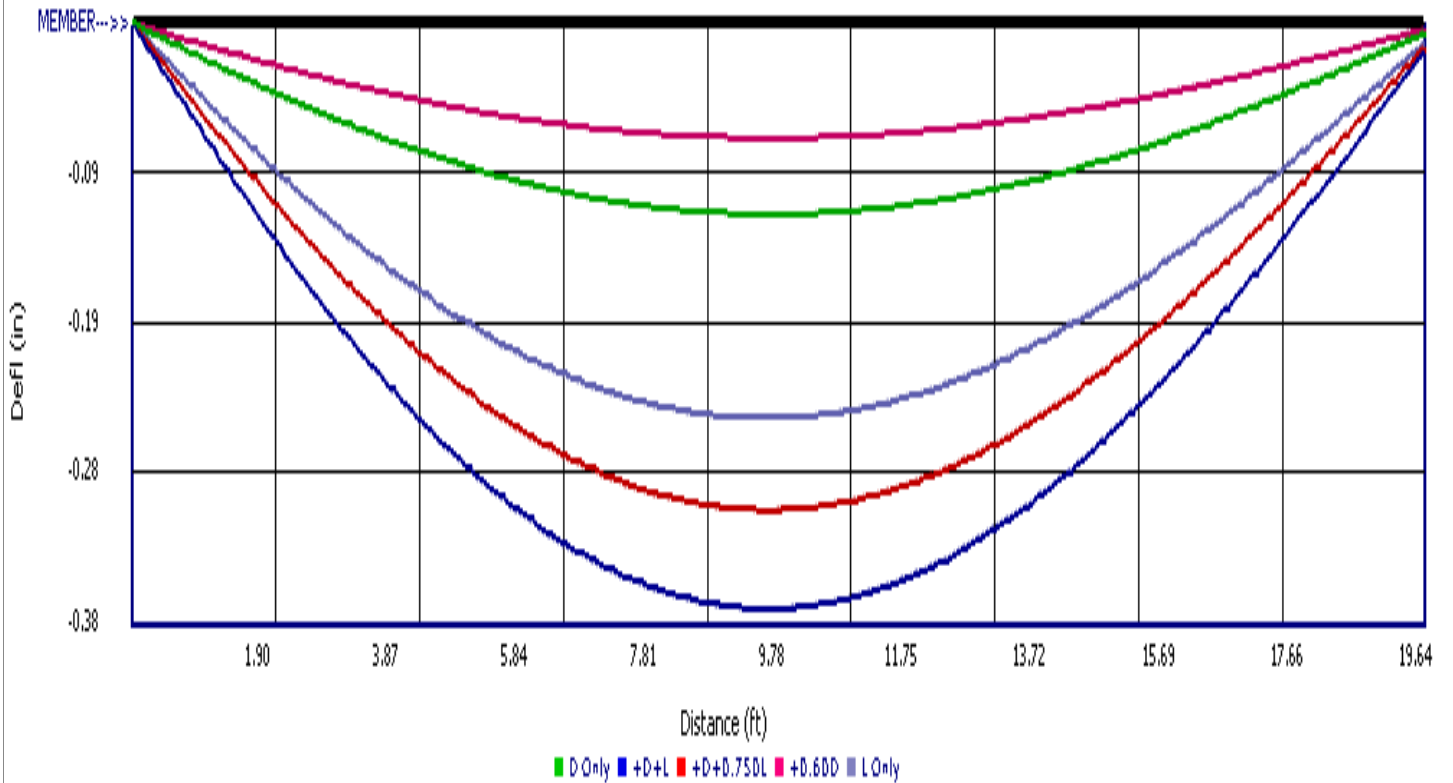
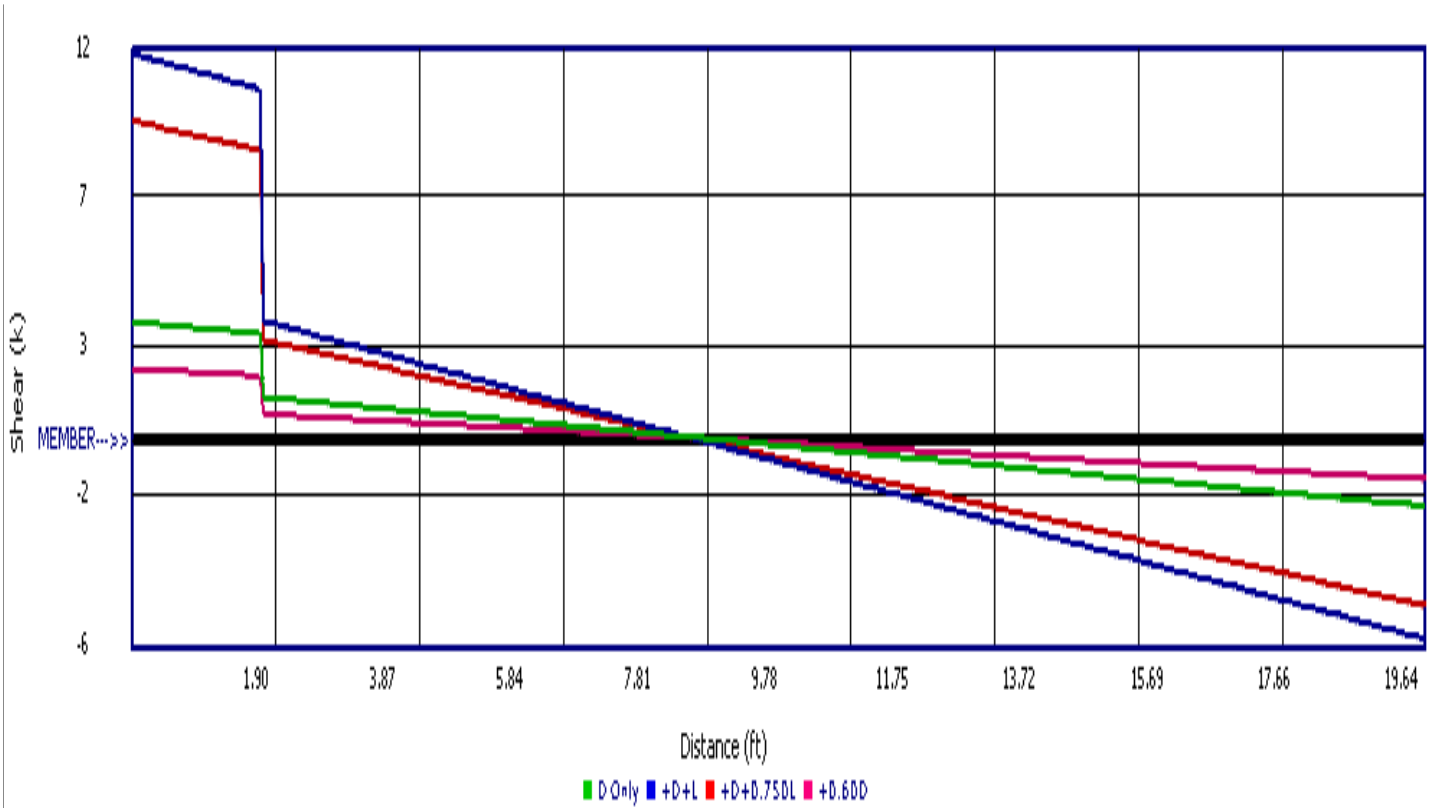


Wood Beam

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DESCRIPTION: BM # 13



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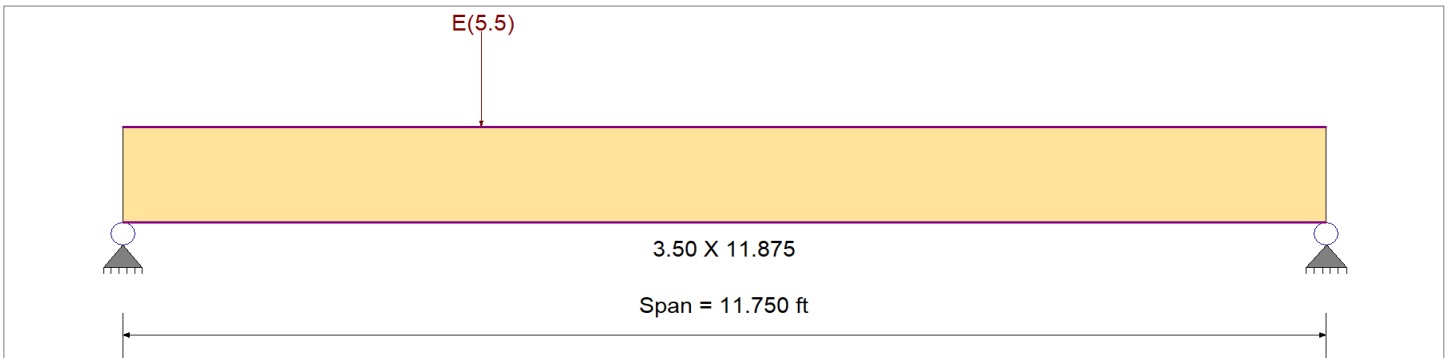
Description : BM # 14

**CODE REFERENCES**

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10  
 Load Combination Set : IBC 2018

**Material Properties**

Analysis Method : Allowable Stress Design	Fb +	1700 psi	E : Modulus of Elasticity	
Load Combination IBC 2018	Fb -	1700 psi	Ebend- xx	1300 ksi
	Fc - Prll	1835 psi	Eminbend - xx	660.75 ksi
Wood Species : Trus Joist	Fc - Perp	710 psi		
Wood Grade : TimberStrand LSL 1.3E - Beam/Col	Fv	425 psi		
	Ft	1075 psi	Density	45.01 pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling				



**Applied Loads**

Service loads entered. Load Factors will be applied for calculations.

Point Load : E = 5.50 k @ 3.50 ft (SEISMIC DISCONTINUITY  $\Omega=2.5$  IS INCLUDED)

**DESIGN SUMMARY**

**Design OK**

Maximum Bending Stress Ratio =	<b>0.506</b> : 1	Maximum Shear Stress Ratio =	<b>0.143</b> : 1
Section used for this span	<b>3.50 X 11.875</b>	Section used for this span	<b>3.50 X 11.875</b>
fb : Actual =	1,377.45 psi	fv : Actual =	97.56 psi
FB : Allowable =	2,720.00 psi	Fv : Allowable =	680.00 psi
Load Combination =	E Only * 0.70	Load Combination =	E Only * 0.70
Location of maximum on span =	3.516 ft	Location of maximum on span =	0.000 ft
Span # where maximum occurs =	Span # 1	Span # where maximum occurs =	Span # 1
<b>Maximum Deflection</b>			
Max Downward Transient Deflection	0.406 in	Ratio =	347 >=240
Max Upward Transient Deflection	0.000 in	Ratio =	0 <240
Max Downward Total Deflection	0.284 in	Ratio =	495 >=180
Max Upward Total Deflection	0.000 in	Ratio =	0 <180

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values					
			M	V	C <sub>d</sub>	C <sub>FV</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v			
Length = 11.750 ft	1				0.90	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	382.50
E Only * 0.70						1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Length = 11.750 ft	1		0.506	0.143	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	9.44	1,377.45	2720.00	2.70	97.56	680.00	680.00
E Only * 0.5250						1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Length = 11.750 ft	1		0.380	0.108	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	7.08	1,033.09	2720.00	2.03	73.17	680.00	680.00

**Overall Maximum Deflections**

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
E Only	1	0.4063	5.275		0.0000	0.000

**Wood Beam**

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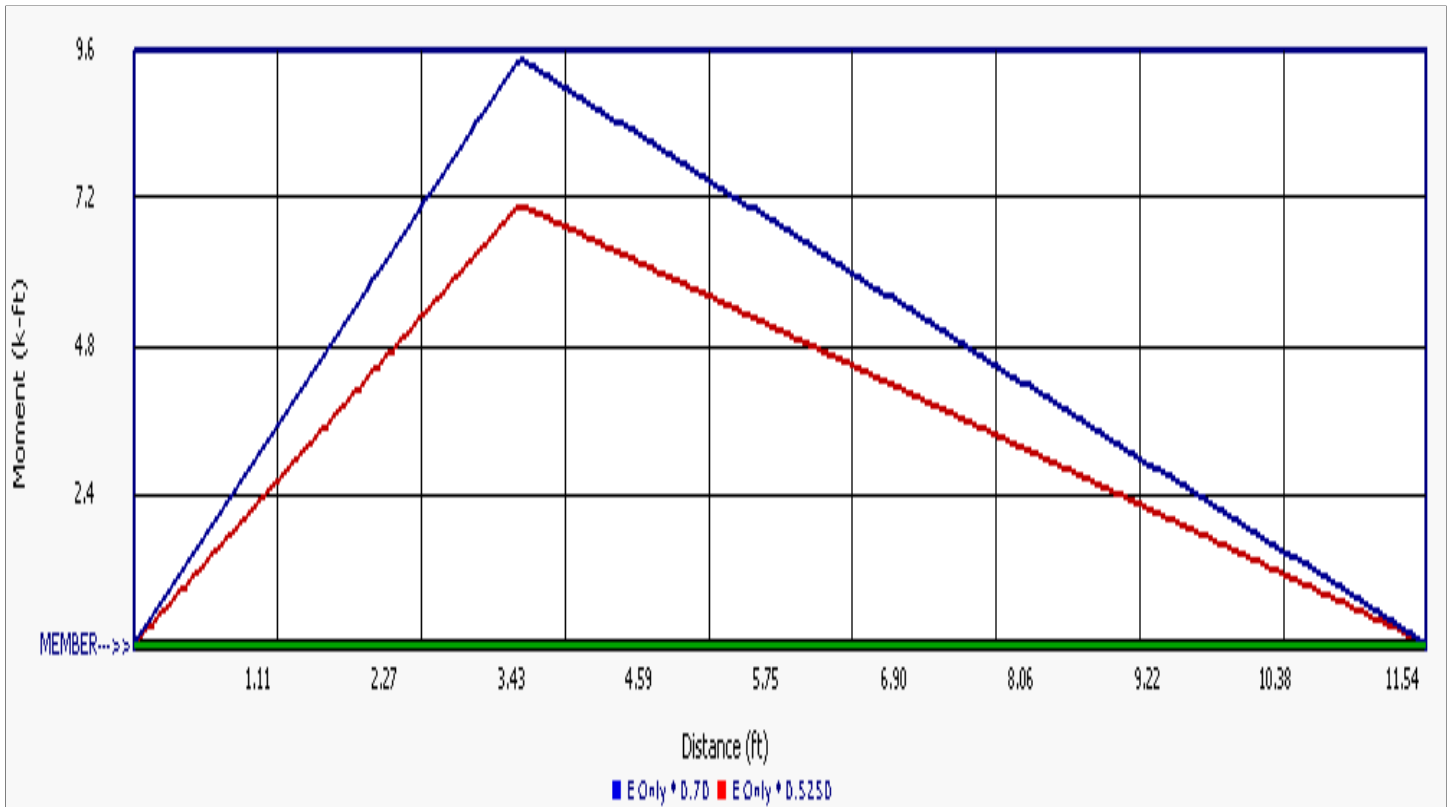
Description : BM # 14

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	3.862	1.638
Overall MINimum	3.862	1.638
E Only * 0.70	2.703	1.147
E Only * 0.5250	2.027	0.860
E Only	3.862	1.638



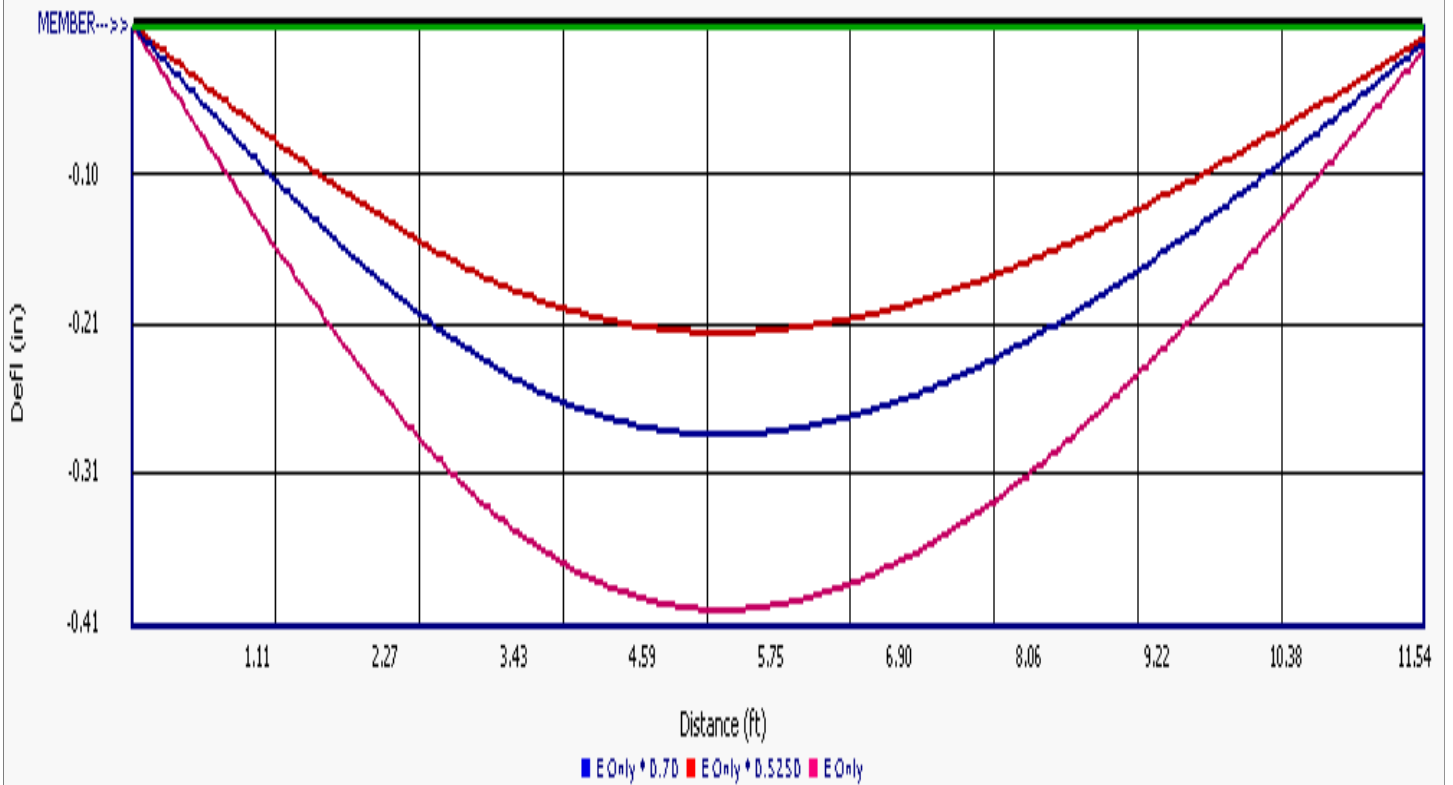
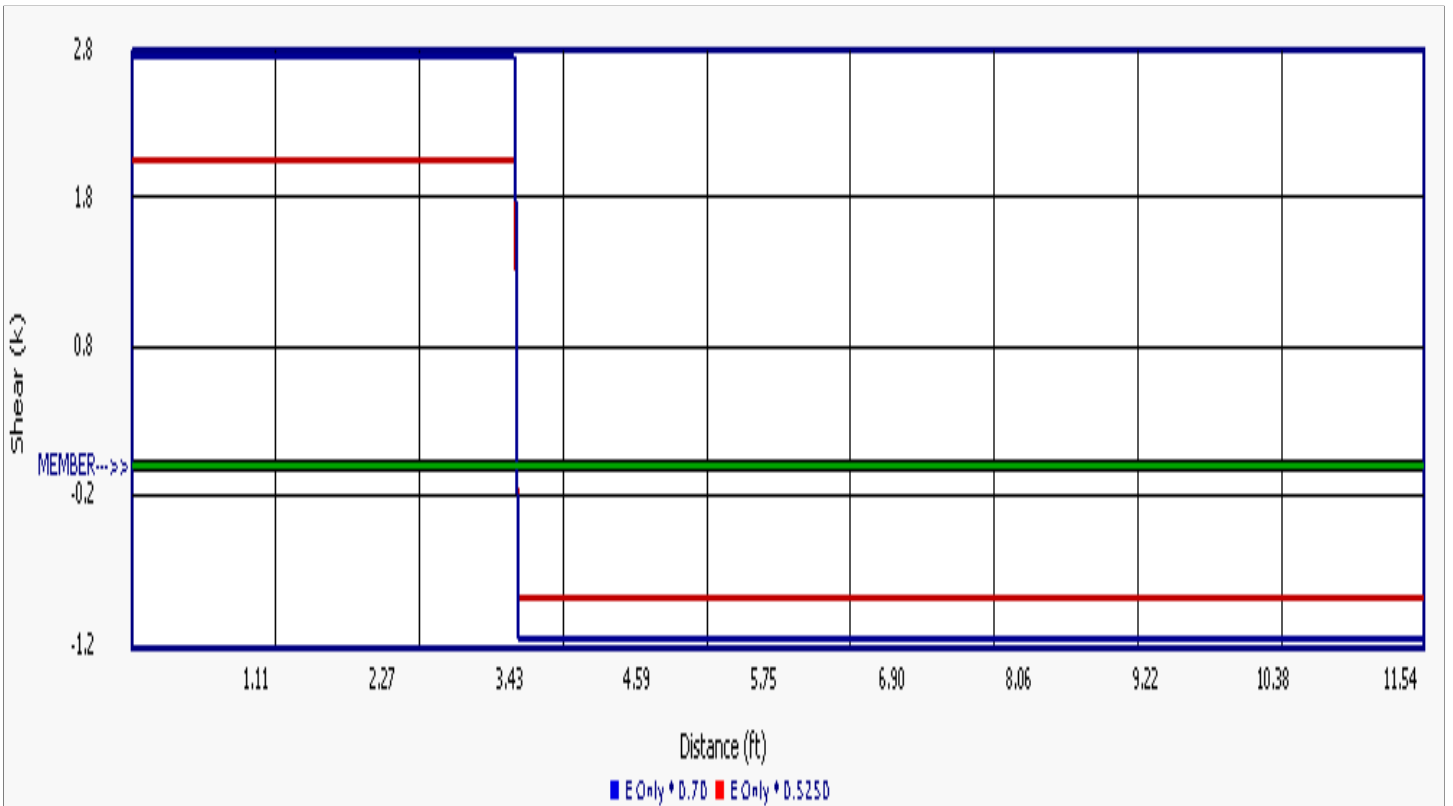


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Description : BM # 14



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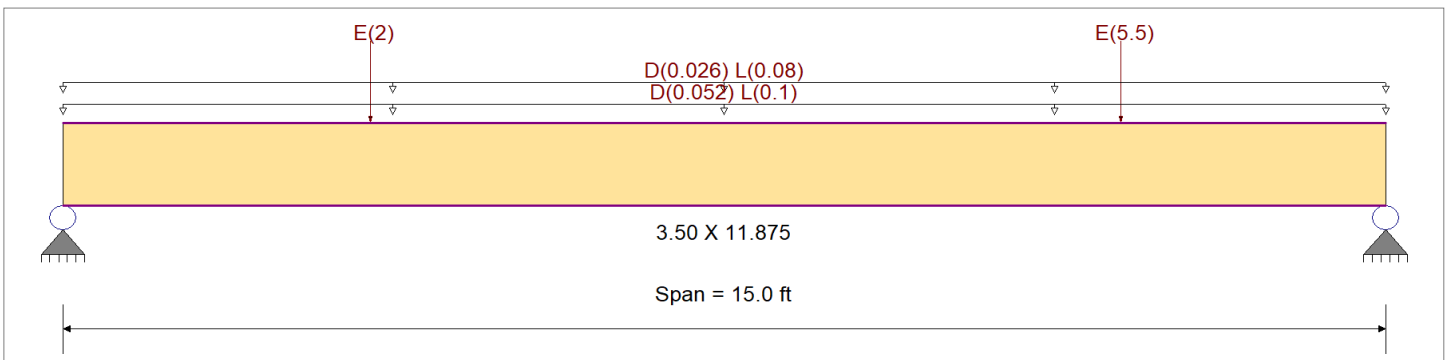
Description : BM # 15

**CODE REFERENCES**

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10  
 Load Combination Set : IBC 2018

**Material Properties**

Analysis Method : Allowable Stress Design	Fb +	2900 psi	E : Modulus of Elasticity
Load Combination IBC 2018	Fb -	2900 psi	Ebend- xx
	Fc - Prll	2900 psi	Eminbend - xx
Wood Species : Trus Joist	Fc - Perp	625 psi	
Wood Grade : Parallam PSL 2.0E	Fv	290 psi	
	Ft	2025 psi	Density
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling			45.07pcf



**Applied Loads**

Service loads entered. Load Factors will be applied for calculations.

- Point Load : E = 2.0 k @ 3.50 ft (SEISMIC DISCONTINUITY  $\Omega=2.5$  IS INCLUDED)
- Point Load : E = 5.50 k @ 12.0 ft (SEISMIC DISCONTINUITY  $\Omega=2.5$  IS INCLUDED)
- Uniform Load : D = 0.0130, L = 0.0250 ksf, Tributary Width = 4.0 ft
- Uniform Load : D = 0.0130, L = 0.040 ksf, Tributary Width = 2.0 ft

**DESIGN SUMMARY**

**Design OK**

Maximum Bending Stress Ratio =	<b>0.390</b> : 1	Maximum Shear Stress Ratio =	<b>0.307</b> : 1
Section used for this span	<b>3.50 X 11.875</b>	Section used for this span	<b>3.50 X 11.875</b>
fb : Actual =	1,811.66psi	fv : Actual =	142.29 psi
FB : Allowable =	4,640.00psi	Fv : Allowable =	464.00 psi
Load Combination	+D+0.750L+0.5250E	Load Combination	+D+0.750L+0.5250E
Location of maximum on span =	9.088ft	Location of maximum on span =	14.015 ft
Span # where maximum occurs =	Span # 1	Span # where maximum occurs =	Span # 1
<b>Maximum Deflection</b>			
Max Downward Transient Deflection	0.555 in	Ratio =	324 >=240
Max Upward Transient Deflection	0.000 in	Ratio =	0 <240
Max Downward Total Deflection	0.541 in	Ratio =	332 >=180
Max Upward Total Deflection	0.000 in	Ratio =	0 <180

**Maximum Forces & Stresses for Load Combinations**

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values						
			M	V	C <sub>d</sub>	C <sub>FV</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v			
D Only	Length = 15.0 ft	1	0.123	0.070	0.90	1.000	1.00	1.00	1.00	1.00	1.00	2.19	320.03	2610.00	0.00	0.00	0.00	0.51	18.34	261.00
+D+L	Length = 15.0 ft	1	0.365	0.209	1.00	1.000	1.00	1.00	1.00	1.00	1.00	7.26	1,058.55	2900.00	0.00	0.00	0.00	1.68	60.66	290.00
+D+0.750L	Length = 15.0 ft	1	0.241	0.138	1.25	1.000	1.00	1.00	1.00	1.00	1.00	5.99	873.92	3625.00	0.00	0.00	0.00	1.39	50.08	362.50
+D+0.70E	Length = 15.0 ft	1	0.365	0.304	1.60	1.000	1.00	1.00	1.00	1.00	1.00	11.62	1,695.57	4640.00	0.00	0.00	0.00	3.91	141.29	464.00

**Wood Beam**

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Description : BM # 15

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values						
			M	V	C <sub>d</sub>	C <sub>F/V</sub>	C <sub>i</sub>	C <sub>r</sub>	C <sub>m</sub>	C <sub>t</sub>	C <sub>L</sub>	M	fb	F'b	V	fv	F'v			
+D+0.750L+0.5250E	Length = 15.0 ft	1	0.390	0.307	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	12.42	1,811.66	4640.00	0.00	0.00	0.00
+0.60D	Length = 15.0 ft	1	0.041	0.024	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.32	192.02	4640.00	0.00	0.00	0.00	
+0.60D+0.70E	Length = 15.0 ft	1	0.348	0.289	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	11.06	1,613.42	4640.00	0.00	0.00	0.00	

**Overall Maximum Deflections**

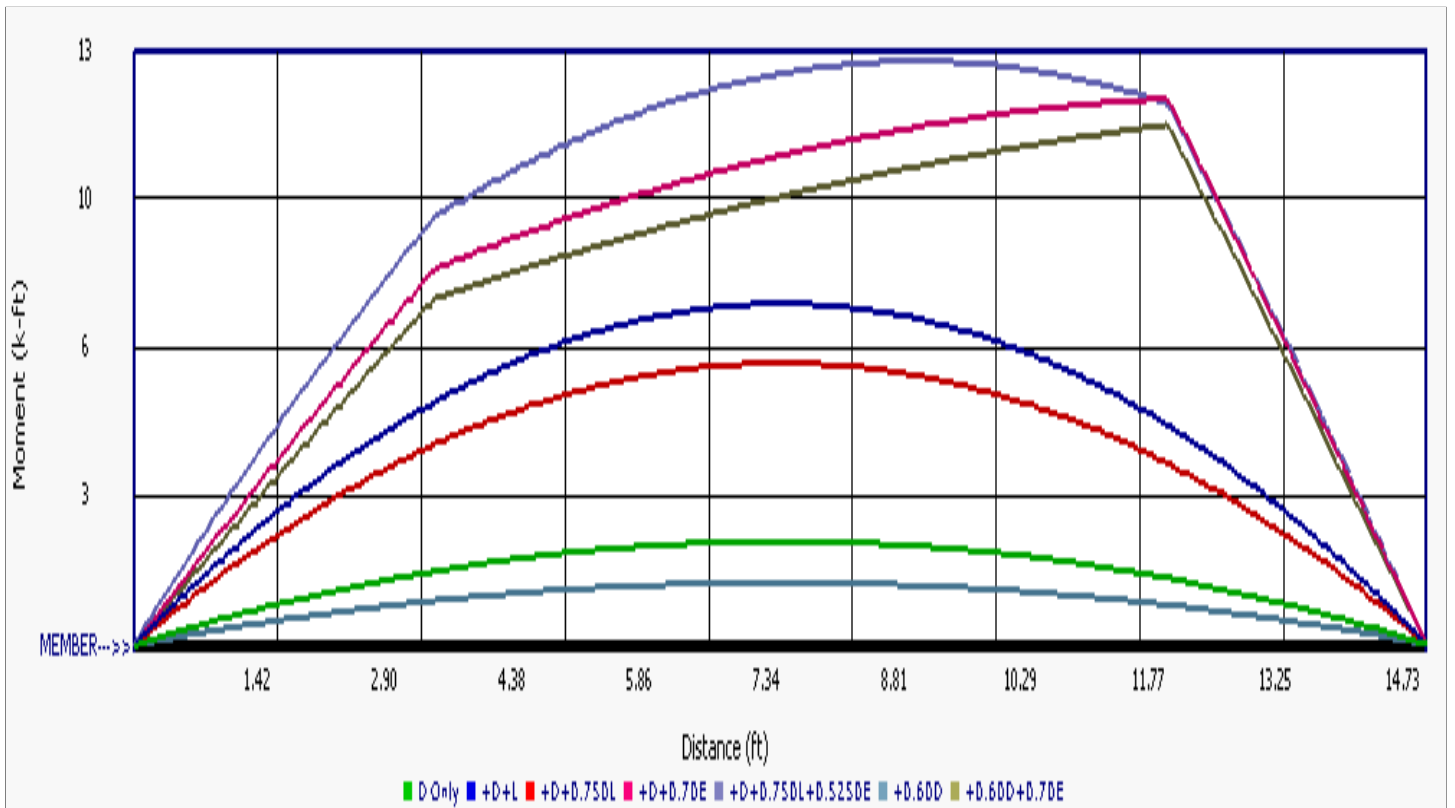
Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
E Only	1	0.5552	7.993		0.0000	0.000

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	2.980	4.867
Overall MINimum	2.633	4.867
D Only	0.585	0.585
+D+L	1.935	1.935
+D+0.750L	1.598	1.598
+D+0.70E	2.428	3.992
+D+0.750L+0.5250E	2.980	4.153
+0.60D	0.351	0.351
+0.60D+0.70E	2.194	3.758
L Only	1.350	1.350
E Only	2.633	4.867

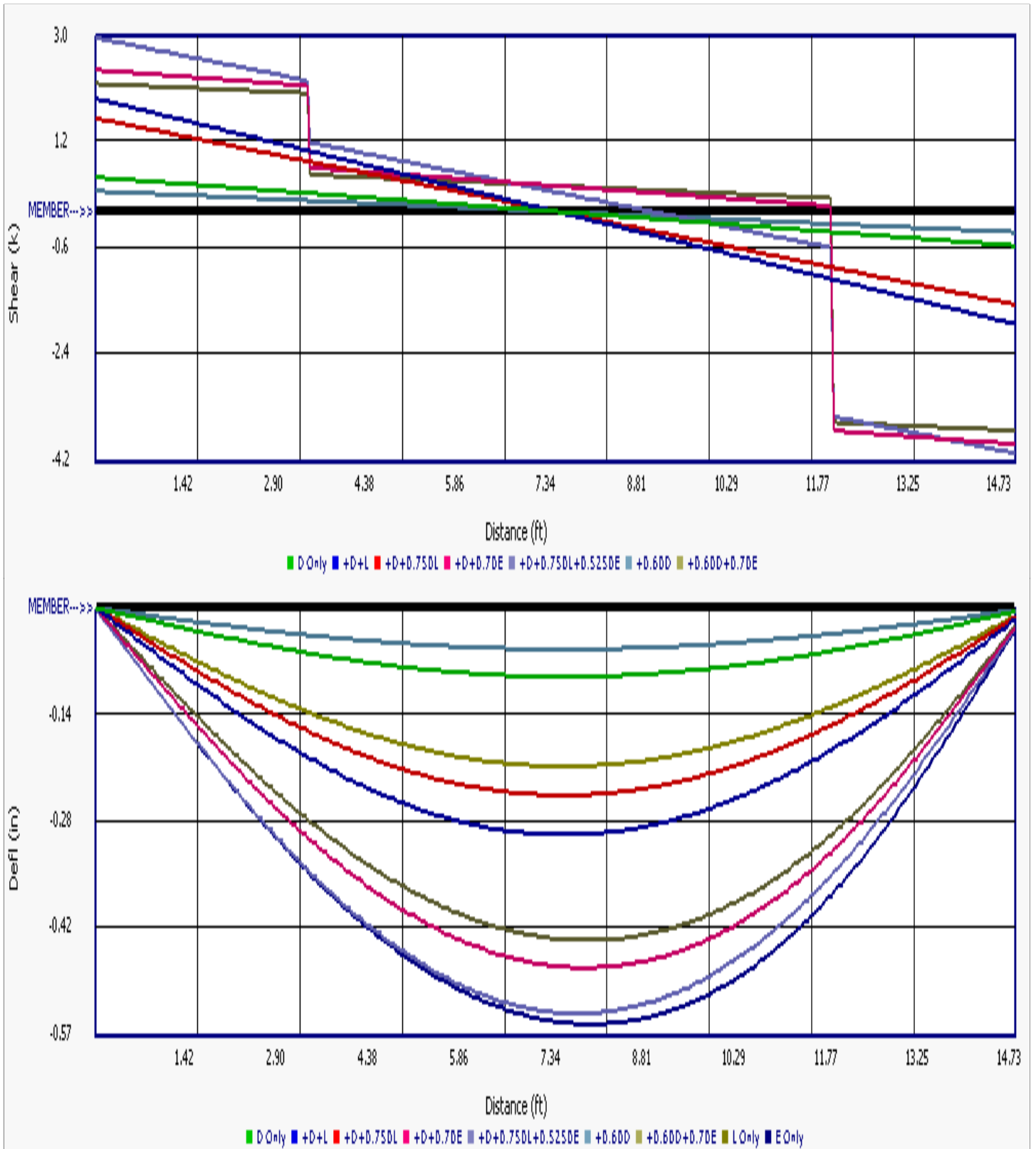


### Wood Beam

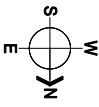
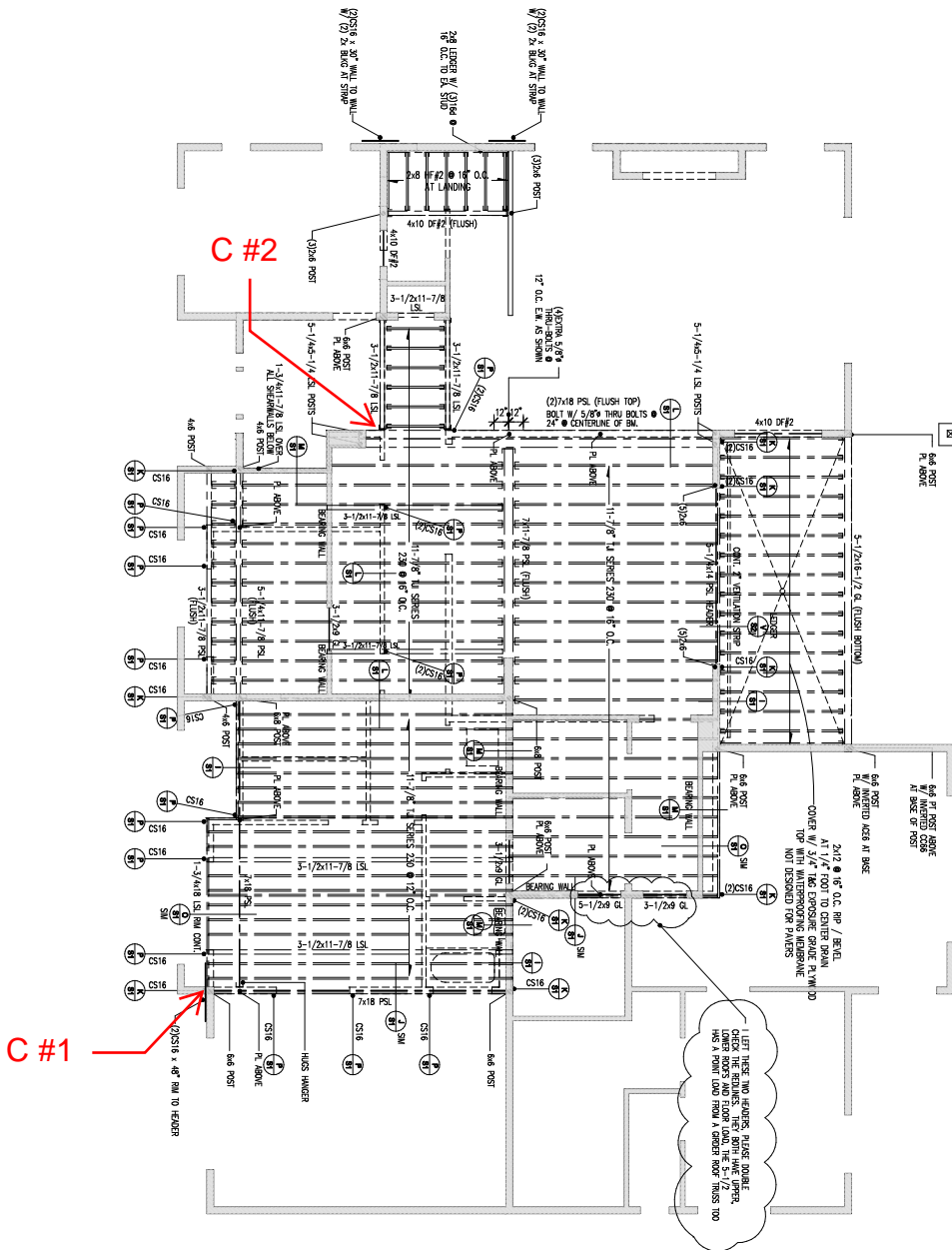
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Lic. # : KW-06010288

Description : BM # 15



# Column Key Plan



 <b>A3</b> SHEET NUMBER	<b>MERLINO RESIDENCE</b> MERCER ISLAND, WA	<b>UPPER LEVEL FLOOR FRAMING</b>	 DREEST ENGINEERS 3/1/2022 206 408 8980 <a href="mailto:dreest@dreestengineers.com">dreest@dreestengineers.com</a>
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## Wood Column

Lic. #: KW-06010288

File: Merlino Residence.ec6

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RB Engineers, Inc.

DESCRIPTION: C #1

### Code References

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

Load Combinations Used : ASCE 7-16

### General Information

Analysis Method :	Allowable Stress Design			Wood Section Name	6x6
End Fixities	Top & Bottom Pinned			Wood Grading/Manuf.	Graded Lumber
Overall Column Height	9 ft			Wood Member Type	Sawn
<i>( Used for non-slender calculations )</i>					
Wood Species	Hem Fir			Exact Width	5.50 in
Wood Grade	No.2			Exact Depth	5.50 in
Fb +	575 psi	Fv	140 psi	Area	30.250 in <sup>2</sup>
Fb -	575 psi	Ft	375 psi	Ix	76.255 in <sup>4</sup>
Fc - Prll	575 psi	Density	26.84 pcf	Iy	76.255 in <sup>4</sup>
Fc - Perp	405 psi				
E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial	Allow Stress Modification Factors	
Basic	1100	1100	1100 ksi	Cf or Cv for Bending	1.0
Minimum	400	400		Cf or Cv for Compression	1.0
				Cf or Cv for Tension	1.0
				Cm : Wet Use Factor	1.0
				Ct : Temperature Factor	1.0
				Cfu : Flat Use Factor	1.0
				Kf : Built-up columns	1.0 NDS 15.3.2
				Use Cr : Repetitive ?	No

Brace condition for deflection (buckling) along columns :

X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 9 ft, K = 1.0

Y-Y (depth) axis : Fully braced against buckling ABOUT X-X Axis

### Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 50.744 lbs \* Dead Load Factor

AXIAL LOADS . . .

Axial Load at 9.0 ft, D = 3.50, L = 8.0 k

### DESIGN SUMMARY

#### Bending & Shear Check Results

**PASS** Max. Axial+Bending Stress Ratio = **0.8227 : 1**

Load Combination +D+L

Governing NDS Formula **Comp Only,  $f_c/F_c'$**

Location of max. above base 0.0 ft

At maximum location values are . . .

Applied Axial 11.551 k

Applied Mx 0.0 k-ft

Applied My 0.0 k-ft

Fc : Allowable 464.131 psi

**Maximum SERVICE Lateral Load Reactions . .**

Top along Y-Y	0.0 k	Bottom along Y-Y	0.0 k
Top along X-X	0.0 k	Bottom along X-X	0.0 k

**Maximum SERVICE Load Lateral Deflections . . .**

Along Y-Y	0.0 in	at	0.0 ft	above base
for load combination : n/a				
Along X-X	0.0 in	at	0.0 ft	above base
for load combination : n/a				

Other Factors used to calculate allowable stresses . . .

<b>Bending</b>	<b>Compression</b>	<b>Tension</b>
----------------	--------------------	----------------

**PASS** Maximum Shear Stress Ratio = **0.0 : 1**

Load Combination +0.60D

Location of max. above base 9.0 ft

Applied Design Shear 0.0 psi

Allowable Shear 224.0 psi

### Load Combination Results

Load Combination	C <sub>D</sub>	C <sub>P</sub>	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
D Only	0.900	0.831	0.2730	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+L	1.000	0.807	0.8227	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+0.750L	1.250	0.747	0.5884	PASS	0.0 ft	0.0	PASS	9.0 ft
+0.60D	1.600	0.664	0.1153	PASS	0.0 ft	0.0	PASS	9.0 ft

### Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction		k	Y-Y Axis Reaction		Axial Reaction	My - End Moments		Mx - End Moments	
	@ Base	@ Top		@ Base	@ Top		@ Base	@ Top	@ Base	@ Top
D Only						3.551				
+D+L						11.551				
+D+0.750L						9.551				

**Wood Column**

Lic. # : KW-06010288

File: Merlino Residence.ec6  
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 RB Engineers, Inc.

DESCRIPTION: C #1

**Maximum Reactions**

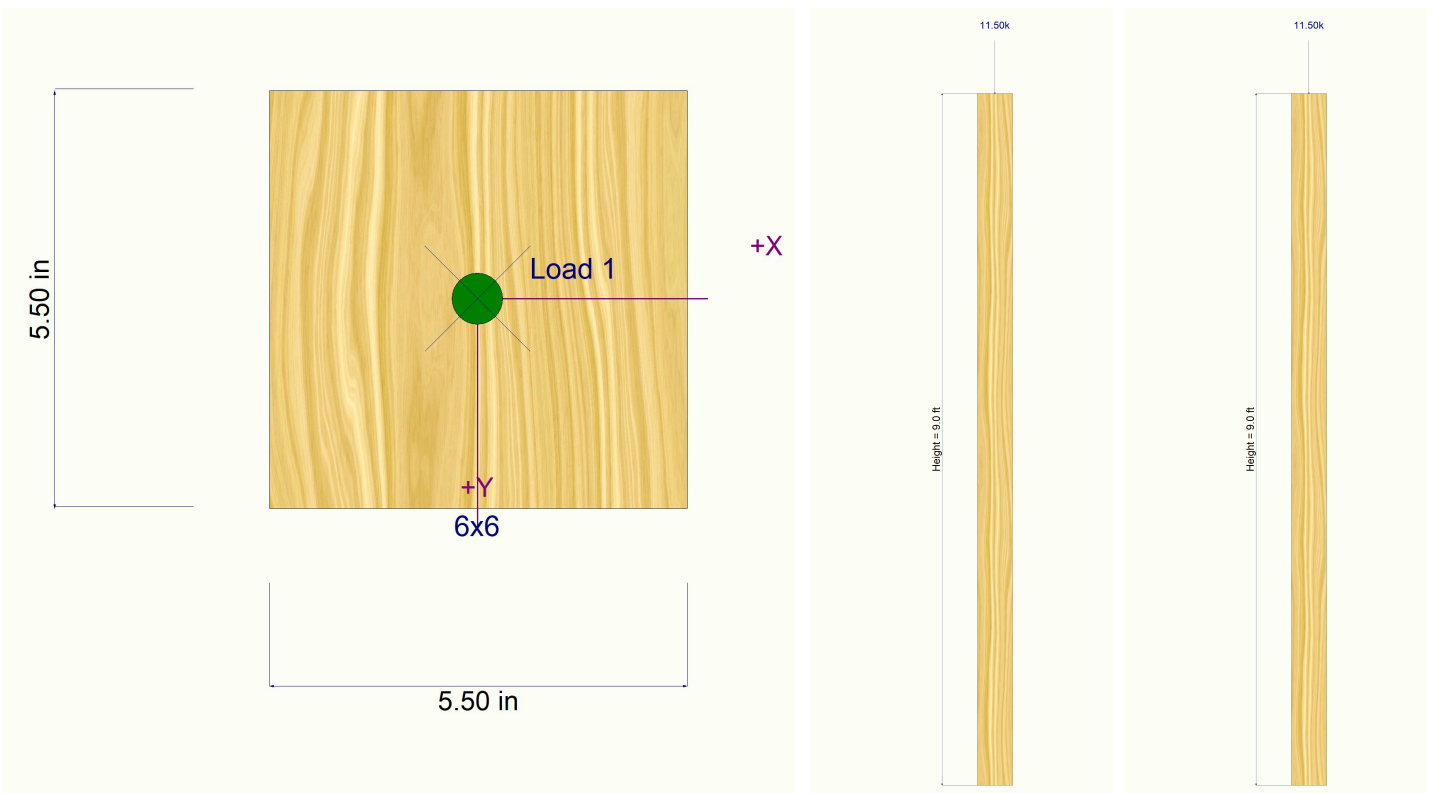
Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction		k	Y-Y Axis Reaction		Axial Reaction	My - End Moments		k-ft	Mx - End Moments	
	@ Base	@ Top		@ Base	@ Top		@ Base	@ Top		@ Base	@ Top
+0.60D						2.130					
L Only						8.000					

**Maximum Deflections for Load Combinations**

Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
D Only	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+L	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.750L	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+0.60D	0.0000 in	0.000 ft	0.0000 in	0.000 ft
L Only	0.0000 in	0.000 ft	0.0000 in	0.000 ft

**Sketches**



**Wood Column**

Lic. # : KW-06010288

File: Merlino Residence.ec6  
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 RB Engineers, Inc.

DESCRIPTION: C #2

Code References

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10  
 Load Combinations Used : ASCE 7-16

General Information

Analysis Method :	Allowable Stress Design			Wood Section Name	5.25x5.25
End Fixities	Top & Bottom Pinned			Wood Grading/Manuf.	Trus-Joist
Overall Column Height	9 ft			Wood Member Type	Parallam PSL
<i>( Used for non-slender calculations )</i>					
Wood Species	Trus Joist			Exact Width	5.250 in
Wood Grade	TimberStrand LSL 1.3E - Bear			Exact Depth	5.250 in
Fb +	1700 psi	Fv	425 psi	Area	27.563 in^2
Fb -	1700 psi	Ft	1075 psi	Ix	63.308 in^4
Fc - Prll	1835 psi	Density	45.01 pcf	Iy	63.308 in^4
Fc - Perp	710 psi				
E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial	Allow Stress Modification Factors	
Basic	1300	1300	1300 ksi	Cf or Cv for Bending	1.096
Minimum	660.75	660.75		Cf or Cv for Compression	1.0
				Cf or Cv for Tension	1.0
				Cm : Wet Use Factor	1.0
				Ct : Temperature Factor	1.0
				Cfu : Flat Use Factor	1.0
				Kf : Built-up columns	1.0 NDS 15.3.2
				Use Cr : Repetitive ?	No
Brace condition for deflection (buckling) along columns :					
X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 9 ft, K = 1.0					
Y-Y (depth) axis : Fully braced against buckling ABOUT X-X Axis					

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 77.538 lbs \* Dead Load Factor

AXIAL LOADS . . .

Axial Load at 9.0 ft, D = 5.50, L = 12.0 k

DESIGN SUMMARY

Bending & Shear Check Results

<b>PASS</b> Max. Axial+Bending Stress Ratio =	<b>0.5734 : 1</b>	<b>Maximum SERVICE Lateral Load Reactions . .</b>	
Load Combination	+D+L	Top along Y-Y	0.0 k
Governing NDS Formula	Comp Only, fc/Fc'	Bottom along Y-Y	0.0 k
Location of max.above base	0.0 ft	Top along X-X	0.0 k
Bottom along X-X			0.0 k
At maximum location values are . . .		Maximum SERVICE Load Lateral Deflections . . .	
Applied Axial	17.578 k	Along Y-Y	0.0 in at 0.0 ft above base
Applied Mx	0.0 k-ft	for load combination :	n/a
Applied My	0.0 k-ft	Along X-X	0.0 in at 0.0 ft above base
Fc : Allowable	1,112.27 psi	for load combination :	n/a
<b>PASS</b> Maximum Shear Stress Ratio =	<b>0.0 : 1</b>	Other Factors used to calculate allowable stresses . . .	
Load Combination	+0.60D	Bending	Compression
Location of max.above base	9.0 ft	Tension	
Applied Design Shear	0.0 psi		
Allowable Shear	680.0 psi		

Load Combination Results

Load Combination	C <sub>D</sub>	C <sub>P</sub>	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
D Only	0.900	0.654	0.1874	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+L	1.000	0.606	0.5734	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+0.750L	1.250	0.507	0.4545	PASS	0.0 ft	0.0	PASS	9.0 ft
+0.60D	1.600	0.409	0.1011	PASS	0.0 ft	0.0	PASS	9.0 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction		Y-Y Axis Reaction		Axial Reaction	My - End Moments		Mx - End Moments	
	@ Base	@ Top	@ Base	@ Top		@ Base	@ Top	@ Base	@ Top
D Only					5.578				
+D+L					17.578				
+D+0.750L					14.578				



**Wood Column**

Lic. # : KW-06010288

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 RB Engineers, Inc.

DESCRIPTION: C #2

**Maximum Reactions**

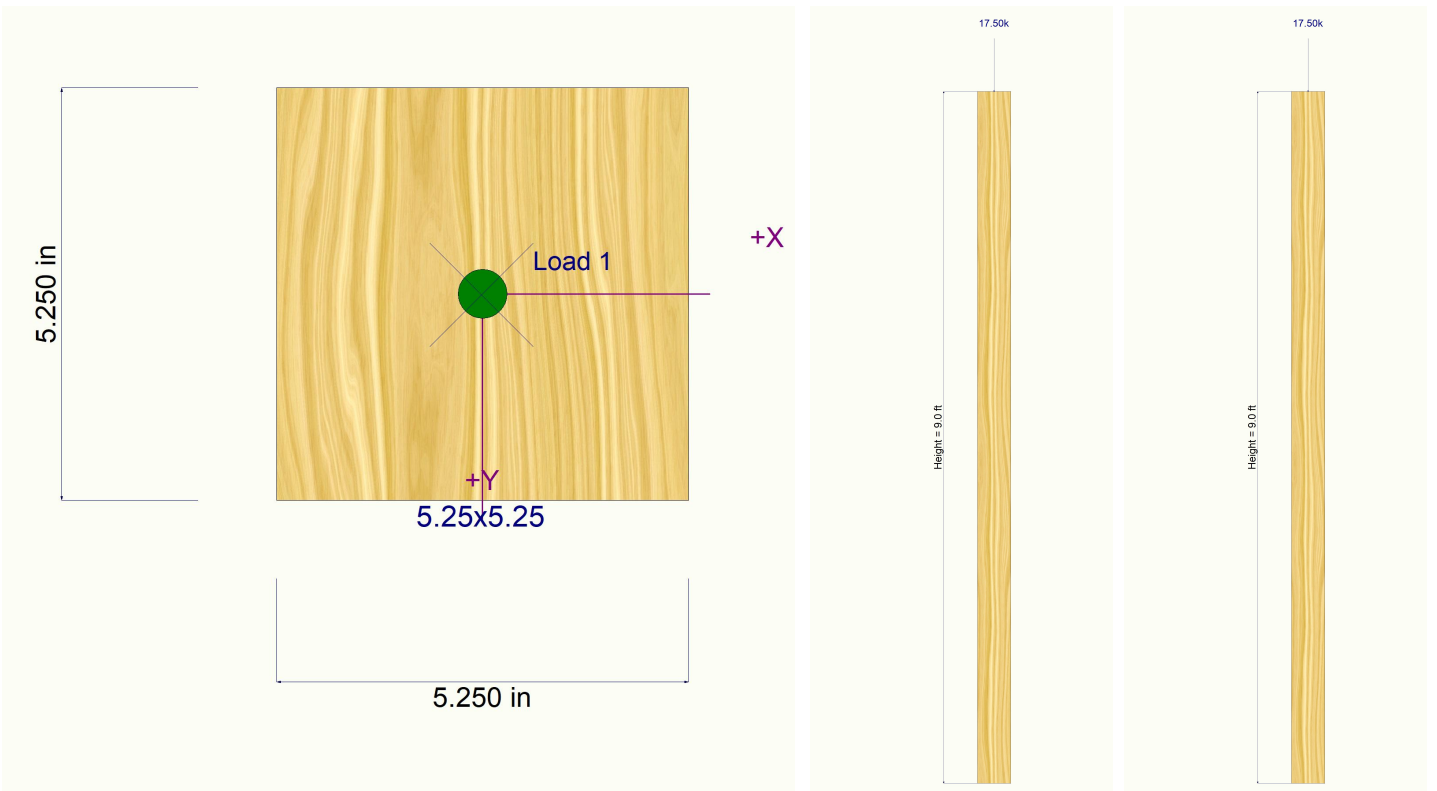
Note: Only non-zero reactions are listed.

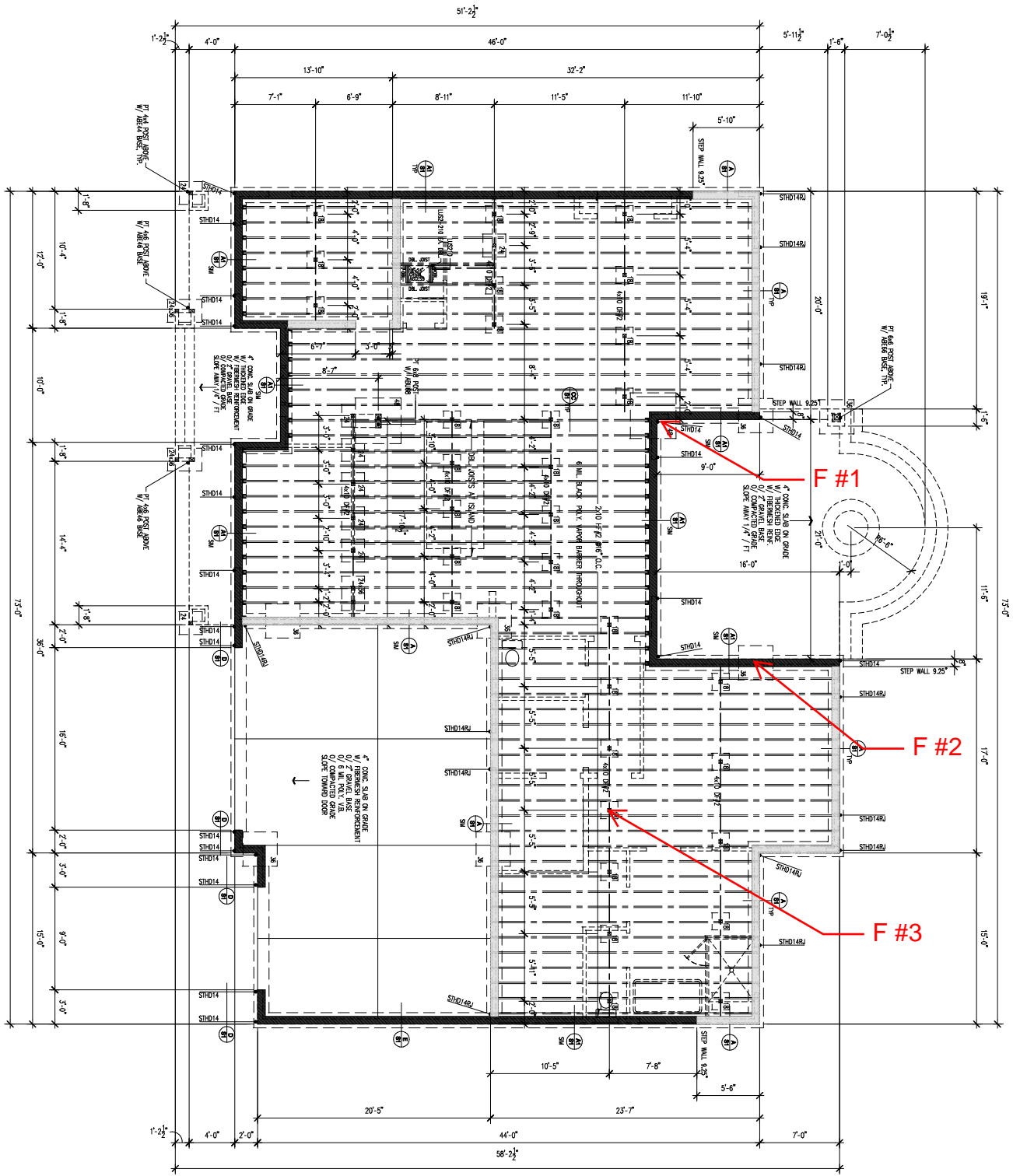
Load Combination	X-X Axis Reaction		k	Y-Y Axis Reaction		Axial Reaction	My - End Moments		k-ft	Mx - End Moments	
	@ Base	@ Top		@ Base	@ Top		@ Base	@ Top		@ Base	@ Top
+0.60D						3.347					
L Only						12.000					

**Maximum Deflections for Load Combinations**

Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
D Only	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+L	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.750L	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+0.60D	0.0000 in	0.000 ft	0.0000 in	0.000 ft
L Only	0.0000 in	0.000 ft	0.0000 in	0.000 ft

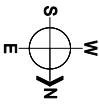
**Sketches**





**FOOTING SCHEDULE:**

1'-6" x 1'-6" x 8" DEEP CONC. FOOTING W/ TR- (9) #4 EACH WAY, TR-
2'-0" x 2'-0" x 8" DEEP CONC. FOOTING W/ TR- (9) #4 EACH WAY, TR-
2'-6" x 2'-6" x 8" DEEP CONC. FOOTING W/ TR- (9) #4 EACH WAY, TR-
3'-0" x 3'-0" x 12" DEEP CONC. FOOTING W/ TR- (9) #4 EACH WAY, TR-
4'-0" x 4'-0" x 14" DEEP CONC. FOOTING W/ TR- (9) #4 EACH WAY, TR-



**A1**  
 SHEET NUMBER  
 1/4" = 1'-0"  
 SCALE  
 7.16.2020  
 DATE  
 1/24/2020  
 REVISION

**MERLINO RESIDENCE**  
 MERCER ISLAND, WA

**MAIN LEVEL FLOOR FRAMING & FOUNDATION PLAN**

08/15/2022  
 204.408.8880

**General Footing**

Lic. # : KW-06010288

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 RB Engineers, Inc.

DESCRIPTION: F 1

Code References

Calculations per ACI 318-14, IBC 2015, CBC 2016, ASCE 7-10  
 Load Combinations Used : IBC 2018

**General Information**

**Material Properties**

fc : Concrete 28 day strength	=	2.50	ksi
fy : Rebar Yield	=	40.0	ksi
Ec : Concrete Elastic Modulus	=	3,122.0	ksi
Concrete Density	=	145.0	pcf
φ Values Flexure	=	0.90	
Shear	=	0.750	

**Soil Design Values**

Allowable Soil Bearing	=	1.50	ksf
Increase Bearing By Footing Weight	=	No	
Soil Passive Resistance (for Sliding)	=	250.0	pcf
Soil/Concrete Friction Coeff.	=	0.30	

**Analysis Settings**

Min Steel % Bending Reinf.	=		
Min Allow % Temp Reinf.	=	0.00180	
Min. Overturning Safety Factor	=	1.0	: 1
Min. Sliding Safety Factor	=	1.0	: 1
Add Ftg Wt for Soil Pressure	:	Yes	
Use ftg wt for stability, moments & shears	:	Yes	
Add Pedestal Wt for Soil Pressure	:	No	
Use Pedestal wt for stability, mom & shear	:	No	

Increases based on footing Depth

Footing base depth below soil surface	=		ft
Allow press. increase per foot of depth when footing base is below	=		ksf
	=		ft

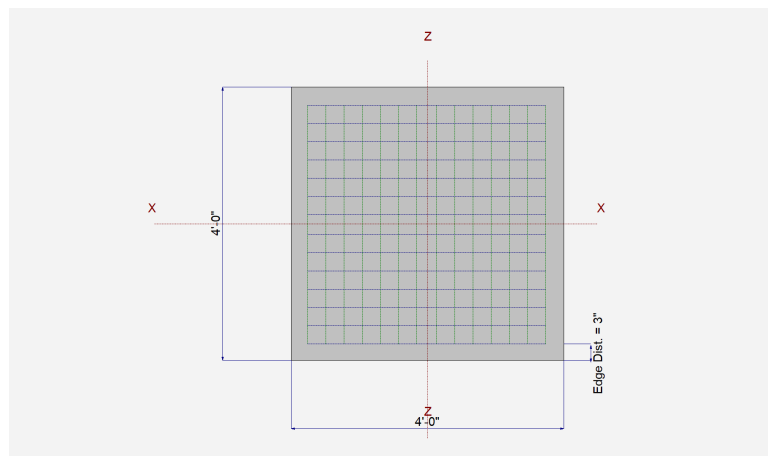
Increases based on footing plan dimension

Allowable pressure increase per foot of depth when max. length or width is greater than	=		ksf
	=		ft

**Dimensions**

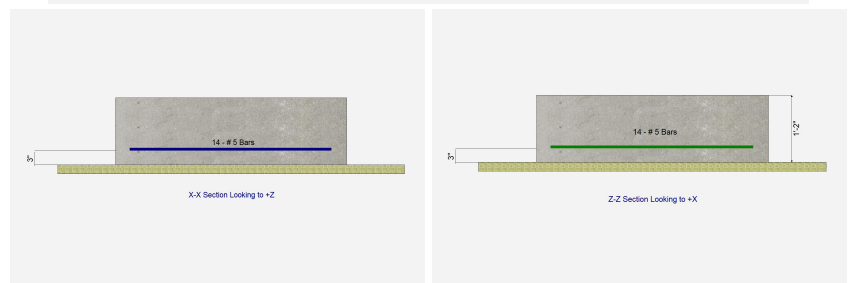
Width parallel to X-X Axis	=	4.0	ft
Length parallel to Z-Z Axis	=	4.0	ft
Footing Thickness	=	14.0	in

Pedestal dimensions...			
px : parallel to X-X Axis	=		in
pz : parallel to Z-Z Axis	=		in
Height	=		in
Rebar Centerline to Edge of Concrete... at Bottom of footing	=	3.0	in



**Reinforcing**

Bars parallel to X-X Axis	=		
Number of Bars	=	14.0	
Reinforcing Bar Size	=	# 5	
Bars parallel to Z-Z Axis	=		
Number of Bars	=	14.0	
Reinforcing Bar Size	=	# 5	
Bandwidth Distribution Check (ACI 15.4.4.2)			
Direction Requiring Closer Separation			n/a
# Bars required within zone			n/a
# Bars required on each side of zone			n/a



**Applied Loads**

	D	Lr	L	S	W	E	H	
P : Column Load	=	5.4		11.30				k
OB : Overburden	=							ksf
M-xx	=							k-ft
M-zz	=							k-ft
V-x	=							k
V-z	=							k

**General Footing**

DESCRIPTION: F 1

DESIGN SUMMARY

Design OK

Min. Ratio	Item	Applied	Capacity	Governing Load Combination	
PASS	0.8087	Soil Bearing	1.213 ksf	1.50 ksf	+D+L about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.09293	Z Flexure (+X)	3.070 k-ft/ft	33.035 k-ft/ft	+1.20D+1.60L
PASS	0.09293	Z Flexure (-X)	3.070 k-ft/ft	33.035 k-ft/ft	+1.20D+1.60L
PASS	0.09293	X Flexure (+Z)	3.070 k-ft/ft	33.035 k-ft/ft	+1.20D+1.60L
PASS	0.09293	X Flexure (-Z)	3.070 k-ft/ft	33.035 k-ft/ft	+1.20D+1.60L
PASS	0.1675	1-way Shear (+X)	12.559 psi	75.0 psi	+1.20D+1.60L
PASS	0.1675	1-way Shear (-X)	12.559 psi	75.0 psi	+1.20D+1.60L
PASS	0.1675	1-way Shear (+Z)	12.559 psi	75.0 psi	+1.20D+1.60L
PASS	0.1675	1-way Shear (-Z)	12.559 psi	75.0 psi	+1.20D+1.60L
PASS	0.3219	2-way Punching	48.288 psi	150.0 psi	+1.20D+1.60L

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xeccc	Zeccc (in)	Actual Soil Bearing Stress @ Location				Actual / Allow Ratio
				Bottom, -Z	Top, +Z	Left, -X	Right, +X	
X-X, D Only	1.50	n/a	0.0	0.5067	0.5067	n/a	n/a	0.338
X-X, +D+L	1.50	n/a	0.0	1.213	1.213	n/a	n/a	0.809
X-X, +D+0.750L	1.50	n/a	0.0	1.036	1.036	n/a	n/a	0.691
X-X, +0.60D	1.50	n/a	0.0	0.3040	0.3040	n/a	n/a	0.203
Z-Z, D Only	1.50	0.0	n/a	n/a	n/a	0.5067	0.5067	0.338
Z-Z, +D+L	1.50	0.0	n/a	n/a	n/a	1.213	1.213	0.809
Z-Z, +D+0.750L	1.50	0.0	n/a	n/a	n/a	1.036	1.036	0.691
Z-Z, +0.60D	1.50	0.0	n/a	n/a	n/a	0.3040	0.3040	0.203

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
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Footing Has NO Overturning

All units k

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
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Footing Has NO Sliding

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	0.9450	+Z	Bottom	0.3024	Min Temp %	1.085	33.035	OK
X-X, +1.40D	0.9450	-Z	Bottom	0.3024	Min Temp %	1.085	33.035	OK
X-X, +1.20D+1.60L	3.070	+Z	Bottom	0.3024	Min Temp %	1.085	33.035	OK
X-X, +1.20D+1.60L	3.070	-Z	Bottom	0.3024	Min Temp %	1.085	33.035	OK
X-X, +1.20D+0.50L	1.516	+Z	Bottom	0.3024	Min Temp %	1.085	33.035	OK
X-X, +1.20D+0.50L	1.516	-Z	Bottom	0.3024	Min Temp %	1.085	33.035	OK
X-X, +1.20D	0.810	+Z	Bottom	0.3024	Min Temp %	1.085	33.035	OK
X-X, +1.20D	0.810	-Z	Bottom	0.3024	Min Temp %	1.085	33.035	OK
X-X, +0.90D	0.6075	+Z	Bottom	0.3024	Min Temp %	1.085	33.035	OK
X-X, +0.90D	0.6075	-Z	Bottom	0.3024	Min Temp %	1.085	33.035	OK
Z-Z, +1.40D	0.9450	-X	Bottom	0.3024	Min Temp %	1.085	33.035	OK
Z-Z, +1.40D	0.9450	+X	Bottom	0.3024	Min Temp %	1.085	33.035	OK
Z-Z, +1.20D+1.60L	3.070	-X	Bottom	0.3024	Min Temp %	1.085	33.035	OK
Z-Z, +1.20D+1.60L	3.070	+X	Bottom	0.3024	Min Temp %	1.085	33.035	OK
Z-Z, +1.20D+0.50L	1.516	-X	Bottom	0.3024	Min Temp %	1.085	33.035	OK
Z-Z, +1.20D+0.50L	1.516	+X	Bottom	0.3024	Min Temp %	1.085	33.035	OK

**General Footing**

Lic. # : KW-06010288

DESCRIPTION: F 1

**Footing Flexure**

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
Z-Z, +1.20D	0.810	-X	Bottom	0.3024	Min Temp %	1.085	33.035	OK
Z-Z, +1.20D	0.810	+X	Bottom	0.3024	Min Temp %	1.085	33.035	OK
Z-Z, +0.90D	0.6075	-X	Bottom	0.3024	Min Temp %	1.085	33.035	OK
Z-Z, +0.90D	0.6075	+X	Bottom	0.3024	Min Temp %	1.085	33.035	OK

**One Way Shear**

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	3.87 psi	3.87 psi	3.87 psi	3.87 psi	3.87 psi	75.00 psi	0.05	OK
+1.20D+1.60L	12.56 psi	12.56 psi	12.56 psi	12.56 psi	12.56 psi	75.00 psi	0.17	OK
+1.20D+0.50L	6.20 psi	6.20 psi	6.20 psi	6.20 psi	6.20 psi	75.00 psi	0.08	OK
+1.20D	3.31 psi	3.31 psi	3.31 psi	3.31 psi	3.31 psi	75.00 psi	0.04	OK
+0.90D	2.49 psi	2.49 psi	2.49 psi	2.49 psi	2.49 psi	75.00 psi	0.03	OK

**Two-Way "Punching" Shear**

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	14.86 psi	150.00psi	0.09909	OK
+1.20D+1.60L	48.29 psi	150.00psi	0.3219	OK
+1.20D+0.50L	23.85 psi	150.00psi	0.159	OK
+1.20D	12.74 psi	150.00psi	0.08494	OK
+0.90D	9.56 psi	150.00psi	0.0637	OK

All units k

**General Footing**

Lic. # : KW-06010288

File: Merlino Residence.ec6  
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 RB Engineers, Inc.

DESCRIPTION: F 2

Code References

Calculations per ACI 318-14, IBC 2015, CBC 2016, ASCE 7-10  
 Load Combinations Used : IBC 2018

**General Information**

**Material Properties**

fc : Concrete 28 day strength	=	2.50	ksi
fy : Rebar Yield	=	40.0	ksi
Ec : Concrete Elastic Modulus	=	3,122.0	ksi
Concrete Density	=	145.0	pcf
φ Values Flexure	=	0.90	
Shear	=	0.750	

**Soil Design Values**

Allowable Soil Bearing	=	1.50	ksf
Increase Bearing By Footing Weight	=	No	
Soil Passive Resistance (for Sliding)	=	250.0	pcf
Soil/Concrete Friction Coeff.	=	0.30	

**Analysis Settings**

Min Steel % Bending Reinf.	=		
Min Allow % Temp Reinf.	=	0.00180	
Min. Overturning Safety Factor	=	1.0	: 1
Min. Sliding Safety Factor	=	1.0	: 1
Add Ftg Wt for Soil Pressure	:	Yes	
Use ftg wt for stability, moments & shears	:	Yes	
Add Pedestal Wt for Soil Pressure	:	No	
Use Pedestal wt for stability, mom & shear	:	No	

Increases based on footing Depth

Footing base depth below soil surface	=		ft
Allow press. increase per foot of depth when footing base is below	=		ksf ft

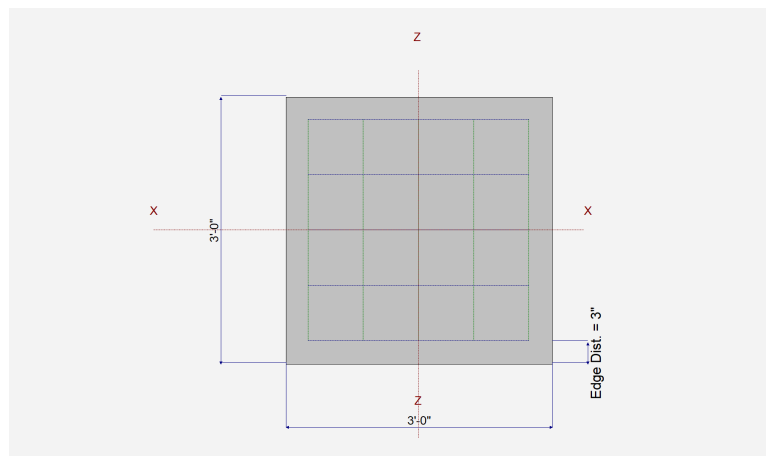
Increases based on footing plan dimension

Allowable pressure increase per foot of depth when max. length or width is greater than	=		ksf ft
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**Dimensions**

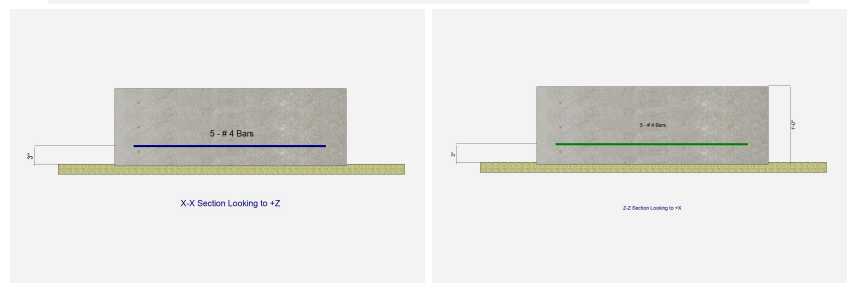
Width parallel to X-X Axis	=	3	ft
Length parallel to Z-Z Axis	=	3.0	ft
Footing Thickness	=	12.0	in

Pedestal dimensions...	=		in
px : parallel to X-X Axis	=		in
pz : parallel to Z-Z Axis	=		in
Height	=		in
Rebar Centerline to Edge of Concrete... at Bottom of footing	=	3.0	in



**Reinforcing**

Bars parallel to X-X Axis	=		
Number of Bars	=	5	
Reinforcing Bar Size	=	# 4	
Bars parallel to Z-Z Axis	=		
Number of Bars	=	5	
Reinforcing Bar Size	=	# 4	
Bandwidth Distribution Check (ACI 15.4.4.2)	=		
Direction Requiring Closer Separation	=	n/a	
# Bars required within zone	=	n/a	
# Bars required on each side of zone	=	n/a	



**Applied Loads**

	D	Lr	L	S	W	E	H	
P : Column Load	=	2.10		5.030				k
OB : Overburden	=							ksf
M-xx	=							k-ft
M-zz	=							k-ft
V-x	=							k
V-z	=							k

**General Footing**

DESCRIPTION: F 2

DESIGN SUMMARY

Design OK

Min. Ratio	Item	Applied	Capacity	Governing Load Combination	
PASS	0.6248	Soil Bearing	0.9372 ksf	1.50 ksf	+D+L about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.1512	Z Flexure (+X)	1.321 k-ft/ft	8.739 k-ft/ft	+1.20D+1.60L
PASS	0.1512	Z Flexure (-X)	1.321 k-ft/ft	8.739 k-ft/ft	+1.20D+1.60L
PASS	0.1512	X Flexure (+Z)	1.321 k-ft/ft	8.739 k-ft/ft	+1.20D+1.60L
PASS	0.1512	X Flexure (-Z)	1.321 k-ft/ft	8.739 k-ft/ft	+1.20D+1.60L
PASS	0.1087	1-way Shear (+X)	8.154 psi	75.0 psi	+1.20D+1.60L
PASS	0.1087	1-way Shear (-X)	8.154 psi	75.0 psi	+1.20D+1.60L
PASS	0.1087	1-way Shear (+Z)	8.154 psi	75.0 psi	+1.20D+1.60L
PASS	0.1087	1-way Shear (-Z)	8.154 psi	75.0 psi	+1.20D+1.60L
PASS	0.2039	2-way Punching	30.579 psi	150.0 psi	+1.20D+1.60L

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Zecc (in)	Actual Soil Bearing Stress @ Location				Actual / Allow Ratio
				Bottom, -Z	Top, +Z	Left, -X	Right, +X	
X-X, D Only	1.50	n/a	0.0	0.3783	0.3783	n/a	n/a	0.252
X-X, +D+L	1.50	n/a	0.0	0.9372	0.9372	n/a	n/a	0.625
X-X, +D+0.750L	1.50	n/a	0.0	0.7975	0.7975	n/a	n/a	0.532
X-X, +0.60D	1.50	n/a	0.0	0.2270	0.2270	n/a	n/a	0.151
Z-Z, D Only	1.50	0.0	n/a	n/a	n/a	0.3783	0.3783	0.252
Z-Z, +D+L	1.50	0.0	n/a	n/a	n/a	0.9372	0.9372	0.625
Z-Z, +D+0.750L	1.50	0.0	n/a	n/a	n/a	0.7975	0.7975	0.532
Z-Z, +0.60D	1.50	0.0	n/a	n/a	n/a	0.2270	0.2270	0.151

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
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Footing Has NO Overturning

All units k

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
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Footing Has NO Sliding

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	0.3675	+Z	Bottom	0.2592	Min Temp %	0.3333	8.739	OK
X-X, +1.40D	0.3675	-Z	Bottom	0.2592	Min Temp %	0.3333	8.739	OK
X-X, +1.20D+1.60L	1.321	+Z	Bottom	0.2592	Min Temp %	0.3333	8.739	OK
X-X, +1.20D+1.60L	1.321	-Z	Bottom	0.2592	Min Temp %	0.3333	8.739	OK
X-X, +1.20D+0.50L	0.6294	+Z	Bottom	0.2592	Min Temp %	0.3333	8.739	OK
X-X, +1.20D+0.50L	0.6294	-Z	Bottom	0.2592	Min Temp %	0.3333	8.739	OK
X-X, +1.20D	0.3150	+Z	Bottom	0.2592	Min Temp %	0.3333	8.739	OK
X-X, +1.20D	0.3150	-Z	Bottom	0.2592	Min Temp %	0.3333	8.739	OK
X-X, +0.90D	0.2363	+Z	Bottom	0.2592	Min Temp %	0.3333	8.739	OK
X-X, +0.90D	0.2363	-Z	Bottom	0.2592	Min Temp %	0.3333	8.739	OK
Z-Z, +1.40D	0.3675	-X	Bottom	0.2592	Min Temp %	0.3333	8.739	OK
Z-Z, +1.40D	0.3675	+X	Bottom	0.2592	Min Temp %	0.3333	8.739	OK
Z-Z, +1.20D+1.60L	1.321	-X	Bottom	0.2592	Min Temp %	0.3333	8.739	OK
Z-Z, +1.20D+1.60L	1.321	+X	Bottom	0.2592	Min Temp %	0.3333	8.739	OK
Z-Z, +1.20D+0.50L	0.6294	-X	Bottom	0.2592	Min Temp %	0.3333	8.739	OK
Z-Z, +1.20D+0.50L	0.6294	+X	Bottom	0.2592	Min Temp %	0.3333	8.739	OK

**General Footing**

Lic. # : KW-06010288

DESCRIPTION: F 2

**Footing Flexure**

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in <sup>2</sup>	Gvrn. As in <sup>2</sup>	Actual As in <sup>2</sup>	Phi*Mn k-ft	Status
Z-Z, +1.20D	0.3150	-X	Bottom	0.2592	Min Temp %	0.3333	8.739	OK
Z-Z, +1.20D	0.3150	+X	Bottom	0.2592	Min Temp %	0.3333	8.739	OK
Z-Z, +0.90D	0.2363	-X	Bottom	0.2592	Min Temp %	0.3333	8.739	OK
Z-Z, +0.90D	0.2363	+X	Bottom	0.2592	Min Temp %	0.3333	8.739	OK

**One Way Shear**

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	2.27 psi	2.27 psi	2.27 psi	2.27 psi	2.27 psi	75.00 psi	0.03	OK
+1.20D+1.60L	8.15 psi	8.15 psi	8.15 psi	8.15 psi	8.15 psi	75.00 psi	0.11	OK
+1.20D+0.50L	3.89 psi	3.89 psi	3.89 psi	3.89 psi	3.89 psi	75.00 psi	0.05	OK
+1.20D	1.94 psi	1.94 psi	1.94 psi	1.94 psi	1.94 psi	75.00 psi	0.03	OK
+0.90D	1.46 psi	1.46 psi	1.46 psi	1.46 psi	1.46 psi	75.00 psi	0.02	OK

**Two-Way "Punching" Shear**

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	8.51 psi	150.00psi	0.05671	OK
+1.20D+1.60L	30.58 psi	150.00psi	0.2039	OK
+1.20D+0.50L	14.57 psi	150.00psi	0.09713	OK
+1.20D	7.29 psi	150.00psi	0.04861	OK
+0.90D	5.47 psi	150.00psi	0.03646	OK

All units k



**General Footing**

Lic. # : KW-06010288

File: Merlino Residence.ec6  
 Software copyright ENERCALC, INC. 1983-2020, Build:12.20.8.17  
 RB Engineers, Inc.

DESCRIPTION: F 3

*Code References*

Calculations per ACI 318-14, IBC 2015, CBC 2016, ASCE 7-10  
 Load Combinations Used : IBC 2018

**General Information**

**Material Properties**

fc : Concrete 28 day strength	=	2.50	ksi
fy : Rebar Yield	=	40.0	ksi
Ec : Concrete Elastic Modulus	=	3,122.0	ksi
Concrete Density	=	145.0	pcf
φ Values Flexure	=	0.90	
Shear	=	0.750	

**Soil Design Values**

Allowable Soil Bearing	=	1.50	ksf
Increase Bearing By Footing Weight	=	No	
Soil Passive Resistance (for Sliding)	=	250.0	pcf
Soil/Concrete Friction Coeff.	=	0.30	

**Analysis Settings**

Min Steel % Bending Reinf.	=		
Min Allow % Temp Reinf.	=	0.00180	
Min. Overturning Safety Factor	=	1.0	: 1
Min. Sliding Safety Factor	=	1.0	: 1
Add Ftg Wt for Soil Pressure	:	Yes	
Use ftg wt for stability, moments & shears	:	Yes	
Add Pedestal Wt for Soil Pressure	:	No	
Use Pedestal wt for stability, mom & shear	:	No	

Increases based on footing Depth

Footing base depth below soil surface	=		ft
Allow press. increase per foot of depth when footing base is below	=		ksf
	=		ft

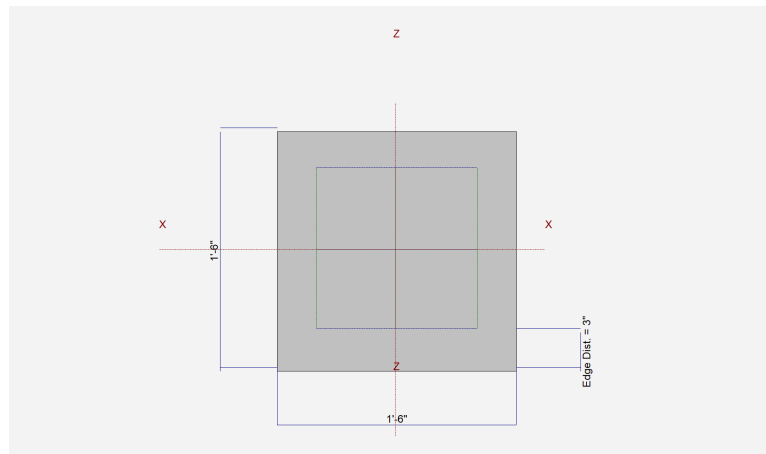
Increases based on footing plan dimension

Allowable pressure increase per foot of depth when max. length or width is greater than	=		ksf
	=		ft

**Dimensions**

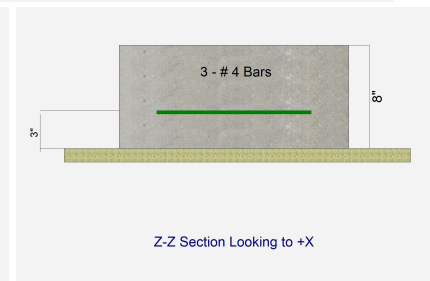
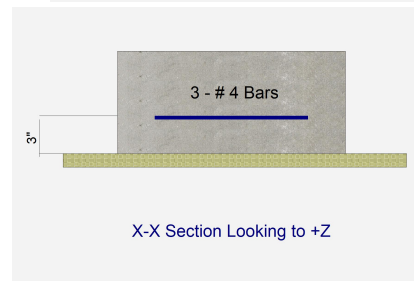
Width parallel to X-X Axis	=	1.50	ft
Length parallel to Z-Z Axis	=	1.50	ft
Footing Thickness	=	8.0	in

Pedestal dimensions...	=		in
px : parallel to X-X Axis	=		in
pz : parallel to Z-Z Axis	=		in
Height	=		in
Rebar Centerline to Edge of Concrete... at Bottom of footing	=	3.0	in



**Reinforcing**

Bars parallel to X-X Axis	=		
Number of Bars	=	3.0	
Reinforcing Bar Size	=	# 4	
Bars parallel to Z-Z Axis	=		
Number of Bars	=	3.0	
Reinforcing Bar Size	=	# 4	
Bandwidth Distribution Check (ACI 15.4.4.2)			
Direction Requiring Closer Separation			
		n/a	
# Bars required within zone		n/a	
# Bars required on each side of zone		n/a	



**Applied Loads**

	D	Lr	L	S	W	E	H	
P : Column Load	=	0.760		2.350				k
OB : Overburden	=							ksf
M-xx	=							k-ft
M-zz	=							k-ft
V-x	=							k
V-z	=							k

**General Footing**

DESCRIPTION: F 3

DESIGN SUMMARY

Design OK

Min. Ratio	Item	Applied	Capacity	Governing Load Combination	
PASS	0.9860	Soil Bearing	1.479 ksf	1.50 ksf	+D+L about Z-Z axis
PASS	n/a	Overturing - X-X	0.0 k-ft	0.0 k-ft	No Overturing
PASS	n/a	Overturing - Z-Z	0.0 k-ft	0.0 k-ft	No Overturing
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.1038	Z Flexure (+X)	0.5840 k-ft/ft	5.624 k-ft/ft	+1.20D+1.60L
PASS	0.1038	Z Flexure (-X)	0.5840 k-ft/ft	5.624 k-ft/ft	+1.20D+1.60L
PASS	0.1038	X Flexure (+Z)	0.5840 k-ft/ft	5.624 k-ft/ft	+1.20D+1.60L
PASS	0.1038	X Flexure (-Z)	0.5840 k-ft/ft	5.624 k-ft/ft	+1.20D+1.60L
PASS	0.1523	1-way Shear (+X)	11.420 psi	75.0 psi	+1.20D+1.60L
PASS	0.1523	1-way Shear (-X)	11.420 psi	75.0 psi	+1.20D+1.60L
PASS	0.1523	1-way Shear (+Z)	11.420 psi	75.0 psi	+1.20D+1.60L
PASS	0.1523	1-way Shear (-Z)	11.420 psi	75.0 psi	+1.20D+1.60L
PASS	0.2870	2-way Punching	43.057 psi	150.0 psi	+1.20D+1.60L

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xeccc	Zeccc (in)	Actual Soil Bearing Stress @ Location				Actual / Allow Ratio
				Bottom, -Z	Top, +Z	Left, -X	Right, +X	
X-X, D Only	1.50	n/a	0.0	0.4344	0.4344	n/a	n/a	0.290
X-X, +D+L	1.50	n/a	0.0	1.479	1.479	n/a	n/a	0.986
X-X, +D+0.750L	1.50	n/a	0.0	1.218	1.218	n/a	n/a	0.812
X-X, +0.60D	1.50	n/a	0.0	0.2607	0.2607	n/a	n/a	0.174
Z-Z, D Only	1.50	0.0	n/a	n/a	n/a	0.4344	0.4344	0.290
Z-Z, +D+L	1.50	0.0	n/a	n/a	n/a	1.479	1.479	0.986
Z-Z, +D+0.750L	1.50	0.0	n/a	n/a	n/a	1.218	1.218	0.812
Z-Z, +0.60D	1.50	0.0	n/a	n/a	n/a	0.2607	0.2607	0.174

Overturing Stability

Rotation Axis & Load Combination...	Overturing Moment	Resisting Moment	Stability Ratio	Status
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Footing Has NO Overturing

All units k

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
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Footing Has NO Sliding

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	0.1330	+Z	Bottom	0.1728	Min Temp %	0.40	5.624	OK
X-X, +1.40D	0.1330	-Z	Bottom	0.1728	Min Temp %	0.40	5.624	OK
X-X, +1.20D+1.60L	0.5840	+Z	Bottom	0.1728	Min Temp %	0.40	5.624	OK
X-X, +1.20D+1.60L	0.5840	-Z	Bottom	0.1728	Min Temp %	0.40	5.624	OK
X-X, +1.20D+0.50L	0.2609	+Z	Bottom	0.1728	Min Temp %	0.40	5.624	OK
X-X, +1.20D+0.50L	0.2609	-Z	Bottom	0.1728	Min Temp %	0.40	5.624	OK
X-X, +1.20D	0.1140	+Z	Bottom	0.1728	Min Temp %	0.40	5.624	OK
X-X, +1.20D	0.1140	-Z	Bottom	0.1728	Min Temp %	0.40	5.624	OK
X-X, +0.90D	0.08550	+Z	Bottom	0.1728	Min Temp %	0.40	5.624	OK
X-X, +0.90D	0.08550	-Z	Bottom	0.1728	Min Temp %	0.40	5.624	OK
Z-Z, +1.40D	0.1330	-X	Bottom	0.1728	Min Temp %	0.40	5.624	OK
Z-Z, +1.40D	0.1330	+X	Bottom	0.1728	Min Temp %	0.40	5.624	OK
Z-Z, +1.20D+1.60L	0.5840	-X	Bottom	0.1728	Min Temp %	0.40	5.624	OK
Z-Z, +1.20D+1.60L	0.5840	+X	Bottom	0.1728	Min Temp %	0.40	5.624	OK
Z-Z, +1.20D+0.50L	0.2609	-X	Bottom	0.1728	Min Temp %	0.40	5.624	OK
Z-Z, +1.20D+0.50L	0.2609	+X	Bottom	0.1728	Min Temp %	0.40	5.624	OK

**General Footing**

Lic. # : KW-06010288

DESCRIPTION: F 3

**Footing Flexure**

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in <sup>2</sup>	Gvrn. As in <sup>2</sup>	Actual As in <sup>2</sup>	Phi*Mn k-ft	Status
Z-Z, +1.20D	0.1140	-X	Bottom	0.1728	Min Temp %	0.40	5.624	OK
Z-Z, +1.20D	0.1140	+X	Bottom	0.1728	Min Temp %	0.40	5.624	OK
Z-Z, +0.90D	0.08550	-X	Bottom	0.1728	Min Temp %	0.40	5.624	OK
Z-Z, +0.90D	0.08550	+X	Bottom	0.1728	Min Temp %	0.40	5.624	OK

**One Way Shear**

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	2.60 psi	2.60 psi	2.60 psi	2.60 psi	2.60 psi	75.00 psi	0.03	OK
+1.20D+1.60L	11.42 psi	11.42 psi	11.42 psi	11.42 psi	11.42 psi	75.00 psi	0.15	OK
+1.20D+0.50L	5.10 psi	5.10 psi	5.10 psi	5.10 psi	5.10 psi	75.00 psi	0.07	OK
+1.20D	2.23 psi	2.23 psi	2.23 psi	2.23 psi	2.23 psi	75.00 psi	0.03	OK
+0.90D	1.67 psi	1.67 psi	1.67 psi	1.67 psi	1.67 psi	75.00 psi	0.02	OK

**Two-Way "Punching" Shear**

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	9.81 psi	150.00psi	0.06537	OK
+1.20D+1.60L	43.06 psi	150.00psi	0.287	OK
+1.20D+0.50L	19.23 psi	150.00psi	0.1282	OK
+1.20D	8.41 psi	150.00psi	0.05603	OK
+0.90D	6.30 psi	150.00psi	0.04203	OK

All units k