

Structural Calculations

for

NEW SINGLE-FAMILY DWELLING

Yusen Residence

3246 72nd PI SE

Mercer Island, WA 98040

PERMIT SUBMISSION

prepared by:

O.G. Engineering, PLLC

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Job No. 25014

Date: 12/22/25



Date: 12/22/2025
 Job # 25014

Vertical Design Loads

Roof	
Roofing	3 psf
Sheathing	2
Framing	3
Batt Insulation	0.4
5/8" Gypsum Board	2.8
Solar-ready Zones	4 *
Sum	15.2 psf
Slope:	6 :12
Slope Correction Factor	1.12
Subtotal	17 psf
M/E/P/misc.	1 psf
DL=	18 psf
SL=	25 psf

Upper Floor	
Flooring	4 psf
1" Gypcrete	10
Subfloor	3.6
Framing	3
5/8" Gypsum Board	2.8
M/E/P/misc.	1.6
DL=	25 psf
LL=	40 psf

Living Areas

Storage Attic	
Flooring	4 psf
Subfloor	3.6
Framing	3
5/8" Gypsum Board	2.8
M/E/P/misc.	1.6
DL=	15 psf
LL=	40 psf

Living Areas

Roof Deck	
Built-up Decking	8 psf
Subfloor	2.4
Framing	3
5/8" Gypsum Board	2.8
M/E/P/misc.	1.8
DL=	18 psf
SL=	25 psf
LL=	60 psf

Decks

Main Floor	
Flooring	4 psf
Subfloor	3.6
Framing	3
5/8" Gypsum Board	2.8
M/E/P/misc.	1.6
DL=	15 psf
LL=	40 psf

Living Areas

Exterior Walls	
Siding	3 psf
Sheathing	1.6
Studs	1.4
Batt Insulation	0.2
1/2" Gypsum Board	2.2
M/E/P/misc.	1.6
DL=	10 psf

Interior Walls	
2 Layers 1/2" Gypsum Board	4.4 psf
Studs	0.9
M/E/P/misc.	1.7
DL=	7 psf

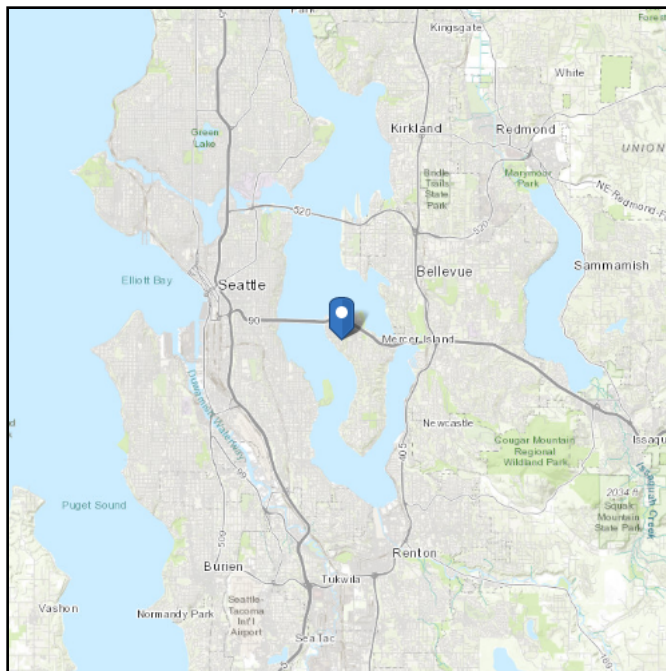
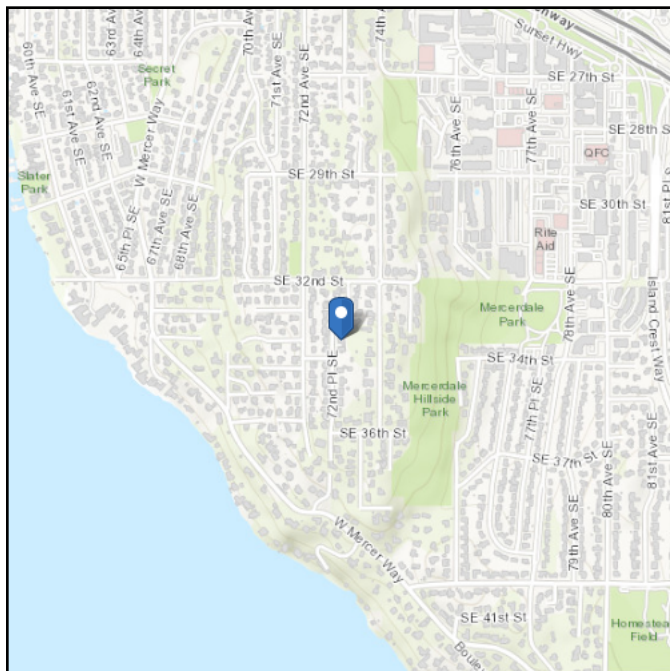


ASCE Hazards Report

Address:
3246 72nd Pl SE
Mercer Island, Washington
98040

Standard: ASCE/SEI 7-16
Risk Category: II
Soil Class: D - Stiff Soil

Latitude: 47.580398
Longitude: -122.241831
Elevation: 314.07384801296126 ft (NAVD 88)



Wind

Results:

Wind Speed	98 Vmph
10-year MRI	67 Vmph
25-year MRI	74 Vmph
50-year MRI	78 Vmph
100-year MRI	83 Vmph

Data Source: ASCE/SEI 7-16, Fig. 26.5-1B and Figs. CC.2-1–CC.2-4, and Section 26.5.2
Date Accessed: Fri Nov 14 2025

Value provided is 3-second gust wind speeds at 33 ft above ground for Exposure C Category, based on linear interpolation between contours. Wind speeds are interpolated in accordance with the 7-16 Standard. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (annual exceedance probability = 0.00143, MRI = 700 years).

Site is not in a hurricane-prone region as defined in ASCE/SEI 7-16 Section 26.2.

Site Soil Class: D - Stiff Soil

Results:

S_s :	1.409	S_{D1} :	N/A
S_1 :	0.49	T_L :	6
F_a :	1	PGA :	0.603
F_v :	N/A	PGA _M :	0.663
S_{MS} :	1.409	F_{PGA} :	1.1
S_{M1} :	N/A	I_e :	1
S_{DS} :	0.94	C_v :	1.382

Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8.

Data Accessed: Fri Nov 14 2025

Date Source: [USGS Seismic Design Maps](#)



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Date: 12/22/2025
Job # 25014

Seismic Design Loads

Seismic Design Parameters (ASCE 7-16 Section 12.8.1)			
Approximate Fundamental Period			
$T = T_a = C_t h_n^x$			
where:	$C_t =$	0.02	
	$h_n =$	36	
	$x =$	0.75	
	$T =$	0.29 s	
Seismic Response Coefficient			
	$S_s =$	1.41	
	$S_1 =$	0.49	
	$S_{ds} =$	0.94	
	$S_{d1} =$	0.49	
	$R =$	6.5	
	$\rho =$	1	
	$\Omega =$	2.5	
	$C_d =$	4	
	$I_e =$	1	
	$C_s = S_{ds}/(R/I_e) =$	0.14	W
	$T_L =$	6 s	> T
$C_{s,max} = S_{d1}/[T(R/I_e)]$	=	0.26	
$C_{s,min} = 0.044S_{ds}I_e$	=	0.041	
$C_{s,min} =$		0.01	
$S_1 <$	0.6		
$C_{s,min} = 0.5S_1/(R/I_e) =$	0.038		Ignore
$C_{s,min,gov} =$	0.041		
$C_{s,gov} =$	0.14	(LRFD)	

Effective Seismic Weight				
Floor	Area (sf)	w_{floor} (psf)	w_{walls} (psf) ¹	W (lbs)
Roof	4180	18	12	125400
Upper	3190	25	24	156310
Main	2050	15	24	79950

Sum: 361660 lbs

¹Includes weight of interior/exterior walls as uniform area load

Base Shear (includes ρ) - LRFD Level			
$\rho V = \rho C_s W =$	0.145	W =	52302 lbs

Vertical Distribution of Base Shear (ASCE 7-16 Section 12.8.3) - LRFD Level						
Floor	W_x (lbs)	h_x (ft)	$w_x h_x^k$	C_{vx}	F_x (lbs)	F_x (psf)
Roof	125400	36	4514400	0.52	26976	6.5
Upper	156310	22	3438820	0.39	20549	6.4
Main	79950	10	799500	0.09	4777	2.3
Sum:			8752720		52302	

Where $k =$

Diaphragm Forces (ASCE 7-16 Section 12.10.1.1, $\rho = 1.0$) - LRFD Level						
Floor	F_i (lbs)	ΣF_i	W_i (lbs)	ΣW_i	$\Sigma F_i / \Sigma W_i$	F_{px} (lbs)
Roof	26976	26976	125400	125400	0.22	26976
Upper	20549	47524	156310	281710	0.17	26369
Main	4777	52302	79950	361660	0.14	11562

Floor	F_{px} Min (lbs)	F_{px} Max (lbs)	F_{px} Gov (lbs)	F_{px} Gov (psf)
Roof	23575	47150	26976	6.5
Upper	29386	58773	29386	9.2
Main	15031	30061	15031	7.3

ASCE 7-16 Wind Forces, Chapter 27, Part 1

Project File: 25014_Yusen.ec6

LIC# : KW-06018000, Build:20.25.11.05

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DESCRIPTION: Yusen Residence

MWFRS

Basic Values

Risk Category	2 per ASCE 7-16 Table 1.5-1	Horizontal Dim. in North-South Direction (B or L)	62.0 ft
V : Basic Wind Speed	98.0 per ASCE 7-16 Fig. 26.5-1 & 26.5-2	Horizontal Dim. in East-West Direction (B or L)	90.0 ft
Kd : Directionality Factor	0.850 per ASCE 7-16 Table 26.6-1	h : Mean Roof height	= 26.0 ft
Exposure Category	per ASCE 7-16 Section 26.7	Topographic Factor per ASCE 7-16 Sec 26.8 & Figure 26.8-1	
North : Exposure C	East : Exposure C	North : K1 = 0.2650 K2 = 1.0 K3 = 1.0	Kzt = 1.600
South : Exposure C	West : Exposure C	South : K1 = 0.2650 K2 = 1.0 K3 = 1.0	Kzt = 1.600
		East : K1 = 0.2650 K2 = 1.0 K3 = 1.0	Kzt = 1.600
		West : K1 = 0.2650 K2 = 1.0 K3 = 1.0	Kzt = 1.600

Building Period & Flexibility Category

User has specified the building frequency is ≥ 1 Hz, therefore considered RIGID for both North-South and East-West directions.

Building Story Data

Level Description	hi ft	Story Ht ft	$E_R : X$ ft	$E_R : X$ ft
Roof	26.00	14.00	0.000	0.000
Upper	12.00	12.00	0.000	0.000

Gust Factor

For wind coming from direction indicated

North =	0.850	South =	0.850
East =	0.850	West =	0.850

ASCE 7-16 Wind Forces, Chapter 27, Part 1

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Enclosure

Check that Building Qualifies as "OPEN"

	North Wall	South Wall	East Wall	West Wall	Roof	Total
Agross	1.0ft^2	1.0ft^2	1.0ft^2	1.0ft^2	1.0ft^2	5.0ft^2
Aopenings	0.0ft^2	0.0ft^2	0.0ft^2	0.0ft^2	0.0ft^2	0.0ft^2
Aopenings >= 0.8 * Agross	No	No	No	No		

Building does NOT qualify as OPEN

North Wall

Continue to check this direction for ENCLOSED

Reference Area = Smaller of 4 sq. ft. or 1% of Agross 0.010 ft^2
 Is Ao < Reference Area ? Yes

Building qualifies as "ENCLOSED" when the North wall receives positive external pressure.

South Wall

Continue to check this direction for ENCLOSED

Reference Area = Smaller of 4 sq. ft. or 1% of Agross 0.010 ft^2
 Is Ao < Reference Area ? Yes

Building qualifies as "ENCLOSED" when the South wall receives positive external pressure.

East Wall

Continue to check this direction for ENCLOSED

Reference Area = Smaller of 4 sq. ft. or 1% of Agross 0.010 ft^2
 Is Ao < Reference Area ? Yes

Building qualifies as "ENCLOSED" when the East wall receives positive external pressure.

West Wall

Continue to check this direction for ENCLOSED

Reference Area = Smaller of 4 sq. ft. or 1% of Agross 0.010 ft^2
 Is Ao < Reference Area ? Yes

Building qualifies as "ENCLOSED" when the West wall receives positive external pressure.

Velocity Pressures

When the following walls experience leeward or sidewall pressures, the value of Kh shall be (per Table 26.10-1) :

North Wall = 0.9531 psf South Wall : 0.9531 psf East Wall = 0.9531psf West Wall = 0.9531 psf

When the following walls experience leeward or sidewall pressures, the value of qh shall be (per Eq 26.10-1) :

North Wall = 31.874 psf South Wall : 31.874 psf East Wall = 31.874psf West Wall = 31.874 psf

qz : Windward Wall Velocity Pressures at various heights per Eq. 27.3-1

Height Above Base (ft)	North Elevation		South Elevation		East Elevation		West Elevation	
	Kz	qz	Kz	qz	Kz	qz	Kz	qz
0.00	0.849	28.39	0.849	28.39	0.849	28.39	0.849	28.39
4.00	0.849	28.39	0.849	28.39	0.849	28.39	0.849	28.39
8.00	0.849	28.39	0.849	28.39	0.849	28.39	0.849	28.39
12.00	0.849	28.39	0.849	28.39	0.849	28.39	0.849	28.39
16.00	0.860	28.78	0.860	28.78	0.860	28.78	0.860	28.78
20.00	0.902	30.16	0.902	30.16	0.902	30.16	0.902	30.16
24.00	0.937	31.34	0.937	31.34	0.937	31.34	0.937	31.34

ASCE 7-16 Wind Forces, Chapter 27, Part 1

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26.00 0.953 31.87 0.953 31.87 0.953 31.87 0.953 31.87

Pressure Coefficients

GCpi Values when elevation receives positive external pressure

GCpi : Internal pressure coefficient, per sec. 26.13 and Table 26.13-1

	North	South	East	West
+/-	0.180	0.180	0.180	0.180

Specify Cp Values from Figure 27.3-1 for Windward, Leeward & Side Walls

Cp Values when elevation receives positive external pressure

	North	South	East	West
Windward Wall	0.80	0.80	0.80	0.80
Leeward Wall	-0.50	-0.50	-0.50	-0.50
Side Walls	-0.70	-0.70	-0.70	-0.70

Wind Pressures

Wind Pressures when NORTH Elevation receives positive external wind pressure

	Positive Internal	Negative Internal
Leeward Wall Pressures	-19.284 psf	-7.809 psf
Side Wall Pressures	-24.702 psf	-13.228 psf
Windward Wall Pressures . .	Positive Internal	Negative Internal
Height Above Base (ft)	Pressure (psf)	Pressure (psf)
0.00	13.57	25.04
4.00	13.57	25.04
8.00	13.57	25.04
12.00	13.57	25.04
16.00	13.83	25.31
20.00	14.77	26.25
24.00	15.57	27.05
26.00	15.94	27.41

Wind Pressures when SOUTH Elevation receives positive external wind pressure

	Positive Internal	Negative Internal
Leeward Wall Pressures	-19.284 psf	-7.809 psf
Side Wall Pressures	-24.702 psf	-13.228 psf
Windward Wall Pressures . .	Positive Internal	Negative Internal
Height Above Base (ft)	Pressure (psf)	Pressure (psf)
0.00	13.57	25.04
4.00	13.57	25.04
8.00	13.57	25.04
12.00	13.57	25.04
16.00	13.83	25.31
20.00	14.77	26.25
24.00	15.57	27.05
26.00	15.94	27.41

Wind Pressures when EAST Elevation receives positive external wind pressure

	Positive Internal	Negative Internal
Leeward Wall Pressures	-19.284 psf	-7.809 psf
Side Wall Pressures	-24.702 psf	-13.228 psf
Windward Wall Pressures . .	Positive Internal	Negative Internal
Height Above Base (ft)	Pressure (psf)	Pressure (psf)
0.00	13.57	25.04

ASCE 7-16 Wind Forces, Chapter 27, Part 1

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4.00	13.57	25.04
8.00	13.57	25.04
12.00	13.57	25.04
16.00	13.83	25.31
20.00	14.77	26.25
24.00	15.57	27.05
26.00	15.94	27.41

Wind Pressures when WEST Elevation receives positive external wind pressure

	<u>Positive Internal</u>	<u>Negative Internal</u>
Leeward Wall Pressures	-19.284 psf	-7.809 psf
Side Wall Pressures	-24.702 psf	-13.228 psf
Windward Wall Pressures		
Height Above Base (ft)	Positive Internal Pressure (psf)	Negative Internal Pressure (psf)
0.00	13.57	25.04
4.00	13.57	25.04
8.00	13.57	25.04
12.00	13.57	25.04
16.00	13.83	25.31
20.00	14.77	26.25
24.00	15.57	27.05
26.00	15.94	27.41

Story Forces for Design Wind Load Cases

Values below are calculated based on a building with dimensions B x L x h as defined on the "Basic Values" tab.

Load Case	Windward Wall	Building level	Ht. Range	Trib. Height	Wind Shear Components (k)		Eccentricity for (ft)		Mt. (ft-k)
					In "Y" Direction	In "X" Direction	"Y" Shear	"X" Shear	
CASE 1	North	Level 2	19.00' -> 26.0	7.00	-21.77	---	---	---	---
CASE 1	North	Level 1	6.00' -> 19.00	13.00	-38.62	---	---	---	---
CASE 1	South	Level 2	19.00' -> 26.0	7.00	21.77	---	---	---	---
CASE 1	South	Level 1	6.00' -> 19.00	13.00	38.62	---	---	---	---
CASE 1	East	Level 2	19.00' -> 26.0	7.00	---	-15.00	---	---	---
CASE 1	East	Level 1	6.00' -> 19.00	13.00	---	-26.60	---	---	---
CASE 1	West	Level 2	19.00' -> 26.0	7.00	---	15.00	---	---	---
CASE 1	West	Level 1	6.00' -> 19.00	13.00	---	26.60	---	---	---
CASE 2	North	Level 2	19.00' -> 26.0	7.00	-16.33	---	---	13.16	214.8
CASE 2	North	Level 1	6.00' -> 19.00	13.00	-28.96	---	---	13.16	381.1
CASE 2	South	Level 2	19.00' -> 26.0	7.00	16.33	---	---	13.16	214.8
CASE 2	South	Level 1	6.00' -> 19.00	13.00	28.96	---	---	13.16	381.1
CASE 2	East	Level 2	19.00' -> 26.0	7.00	---	-11.25	8.99	---	101.1
CASE 2	East	Level 1	6.00' -> 19.00	13.00	---	-19.95	8.99	---	179.3
CASE 2	West	Level 2	19.00' -> 26.0	7.00	---	11.25	8.99	---	101.1
CASE 2	West	Level 1	6.00' -> 19.00	13.00	---	19.95	8.99	---	179.3
CASE 3	North & East	Level 2	19.00' -> 26.0	7.00	-16.33	-11.25	---	---	---
CASE 3	North & East	Level 1	6.00' -> 19.00	13.00	-28.96	-19.95	---	---	---
CASE 3	North & West	Level 2	19.00' -> 26.0	7.00	-16.33	11.25	---	---	---
CASE 3	North & West	Level 1	6.00' -> 19.00	13.00	-28.96	19.95	---	---	---

ASCE 7-16 Wind Forces, Chapter 27, Part 1

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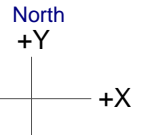
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CASE 3	South & West	Level 2	19.00' -> 26.0	7.00	16.33	11.25	---	---	---
CASE 3	South & West	Level 1	6.00' -> 19.0	13.00	28.96	19.95	---	---	---
CASE 3	South & East	Level 2	19.00' -> 26.0	7.00	16.33	-11.25	---	---	---
CASE 3	South & East	Level 1	6.00' -> 19.0	13.00	28.96	-19.95	---	---	---
CASE 4	North & East	Level 2	19.00' -> 26.0	7.00	-12.26	-8.44	8.99	13.16	237.2
CASE 4	North & East	Level 1	6.00' -> 19.0	13.00	-21.74	-14.98	8.99	13.16	420.7
CASE 4	North & West	Level 2	19.00' -> 26.0	7.00	-12.26	8.44	8.99	13.16	237.2
CASE 4	North & West	Level 1	6.00' -> 19.0	13.00	-21.74	14.98	8.99	13.16	420.7
CASE 4	South & West	Level 2	19.00' -> 26.0	7.00	12.26	8.44	8.99	13.16	237.2
CASE 4	South & West	Level 1	6.00' -> 19.0	13.00	21.74	14.98	8.99	13.16	420.7
CASE 4	South & East	Level 2	19.00' -> 26.0	7.00	12.26	-8.44	8.99	13.16	237.2
CASE 4	South & East	Level 1	6.00' -> 19.0	13.00	21.74	-14.98	8.99	13.16	420.7
Min per ASCE 27.1.	North	Level 2	19.00' -> 26.0	7.00	-10.08	---	---	---	---
Min per ASCE 27.1.	North	Level 1	6.00' -> 19.0	13.00	-18.72	---	---	---	---
Min per ASCE 27.1.	South	Level 2	19.00' -> 26.0	7.00	10.08	---	---	---	---
Min per ASCE 27.1.	South	Level 1	6.00' -> 19.0	13.00	18.72	---	---	---	---
Min per ASCE 27.1.	East	Level 2	19.00' -> 26.0	7.00	---	-6.94	---	---	---
Min per ASCE 27.1.	East	Level 1	6.00' -> 19.0	13.00	---	-12.90	---	---	---
Min per ASCE 27.1.	West	Level 2	19.00' -> 26.0	7.00	---	6.94	---	---	---
Min per ASCE 27.1.	West	Level 1	6.00' -> 19.0	13.00	---	12.90	---	---	---

Base Shear for Design Wind Load Cases

Values below are calculated based on a building with dimensions B x L x h as defined on the "General" tab.

Load Case	Windward Wall	Leeward Wall	Wind Base Shear Components (k)		Mt, (ft-k)
			In "Y" Direction	In "X" Direction	
Case 1	North	South	-60.39	---	---
Case 1	South	North	60.39	---	---
Case 1	East	West	---	-41.60	---
Case 1	West	East	---	41.60	---
Case 2	North	South	-45.29	---	/- 595.9
Case 2	South	North	45.29	---	/- 595.9
Case 2	East	West	---	-31.20	/- 280.5
Case 2	West	East	---	31.20	/- 280.5
Case 3	North & East	South & West	-45.29	-31.20	---
Case 3	North & West	South & East	-45.29	31.20	---
Case 3	South & West	North & East	45.29	31.20	---
Case 3	South & East	North & West	45.29	-31.20	---
Case 4	North & East	South & West	-34.00	-23.42	/- 657.8
Case 4	North & West	South & East	-34.00	23.42	/- 657.8
Case 4	South & West	North & East	34.00	23.42	/- 657.8
Case 4	South & East	North & West	34.00	-23.42	/- 657.8
Min per ASCE 27.1.5	North	South	-28.80	---	---
Min per ASCE 27.1.5	South	North	28.80	---	---
Min per ASCE 27.1.5	East	West	---	-19.84	---



ASCE 7-16 Wind Forces, Chapter 27, Part 1

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Min per ASCE 27.1.5	West	East	---	19.84	---
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ASD-LEVEL SEISMIC BASE SHEAR = $0.7 \times 52302 = 36611$ lbs

ASD-LEVEL WIND BASE SHEAR = $0.6 \times 60390 = 36234$ lbs

SEISMIC BASE SHEAR > WIND

---> SEISMIC GOVERNS MLFRS DESIGN

ROOF FRAMING

(ELEMENTS NOT EXPRESSED ARE BY INTERPOLATION)

RB3 ROOF BEAM

SPAN = 16' 4"

$W = \frac{18 + 25 \text{ psf}}{0.5} \text{ TRSS} = \frac{21}{2} = 10.5'$

Use 5 1/2 x 12 GLB

RB13 ROOF BEAM

SPAN = 24' 0"

$W = \frac{18 + 25 \text{ psf}}{0.5} \text{ TRSS} = \frac{22}{2} = 11'$

Use 5 1/2 x 16 PCL

RB17 ROOF BEAM

SPAN = 15' 6"

$W = \frac{18 + 25 \text{ psf}}{0.5} \text{ TRSS}_1 = \frac{9'}{2} + 1' = 5.5'$
FROM $x=0'$ TO $13'$

Use 6 x 10

$\text{TRSS}_2 = \frac{13'}{2} = 6.5'$ FROM $x=13'$ TO $15.5'$

RB18 ROOF RAFTERS

SPAN = 9' 0"

$W = \frac{18 + 25 \text{ psf}}{0.5}$

Use 2 x 6 x 24" b.c.

UPPER FLOOR FRAMING (ELEMENTS NOT EXPLICITLY
CALC'D BY INVENTION)

(VFJ) UPPER FLOOR JOIST & STORAGE ATTIC

$$SPAN = 22'3" \quad W = \frac{SA}{PL} = \frac{15740 \text{ psf}}{2} \quad \text{USE } 1\frac{7}{8} \text{ TJI } 5610126 \text{ c.}$$

(VFB4) UPPER FLOOR BEAM

$$SPAN = 22'3" \quad P = \left(\frac{SA}{PL} \right) \left(\frac{S}{2} \right) \left(\frac{22'}{2} \right) = \frac{410 + 1100 \text{ \#}}{2} \quad X = 13'3"$$

USE 3" 2x1170 PSL

(VFB5) UPPER FLOOR BEAM

$$SPAN = 19'9" \quad P_1 = \left(\frac{18+25}{PL} \right) \left(\frac{24'}{2} \right) \left(\frac{22'}{2} \right) = \frac{(2313)}{2} = 2380 + 3200 \text{ \#}$$

USE 7x1170 PSL

$$P_2 = \left[\left(\frac{18+25}{PL} \right) \left(\frac{24'}{2} \right) + \left(\frac{W}{PL} \right) (12') + \left(\frac{SA}{PL} \right) \left(\frac{20'}{2} \right) \right] \left(\frac{24'}{2} \right)$$

$$= \frac{790 + 440 + 700 \text{ \#}}{2} \quad CP = 10'6"$$

$$W = \left(\frac{W}{PL} \right) (12') = \frac{120 \text{ \#}}{2} \quad \text{FRAMING } 20' \text{ TO } 10'6"$$

(VFH6) UPPER FLOOR HEADER

$$SPAN = 9'6" \quad W = \left(\frac{18+25}{PL} \right) \left(\frac{13'}{2} \right) + \left(\frac{W}{PL} \right) (8') + \left(\frac{SA}{PL} \right) \left(\frac{22'}{2} \right)$$

USE 5" 4x9 1/4 ISL

$$= \frac{360 + 440 + 160 \text{ \#}}{2} \text{ AT}$$

(VFB9) UPPER FLOOR BEAM

$$W = \left(\frac{18+25}{PL} \right) \left(\frac{22'}{2} \right) + \left(\frac{W}{PL} \right) (9') + \left(\frac{VF}{PL} \right) \left(\frac{17'}{2} \right) = \frac{500 + 280 + 340 \text{ \#}}{2} \text{ AT}$$

USE TRPL 13/4x14 ISL

$$SPAN = 9'9"$$

UF39 UPPER FLOOR BEAM

SPAN = 19'-3"

$W = \frac{25740 \text{ est}}{20 \text{ ft}} \text{ Use } 14" \text{ I } 36 @ 16' \text{ c}$

UF810 UPPER FLOOR BEAM

SPAN = 17'-9"

$W_1 = \left(\frac{18+25}{20 \text{ ft}} \right) \left(\frac{29 \text{ ft}}{2} \right) + \left(\frac{10}{20} \right) (9 \text{ ft}) = \frac{350 + 360 \text{ ft}}{20 \text{ ft}}$

Use 5 1/4 x 14 LSL

$P_1 = \left(\frac{18+25}{20 \text{ ft}} \right) \left(\frac{4 \text{ ft}}{2} \right) \left(\frac{17 \text{ ft}}{2} \right) = \frac{340 + 400 \text{ ft}}{20 \text{ ft}} \text{ exp} = 9 \text{ ft} \times 2 \text{ ft}$

$W_2 = \left(\frac{6+20}{20 \text{ ft}} \right) \left(\frac{4 \text{ ft}}{2} \right) = \frac{10 + 50 \text{ ft}}{20 \text{ ft}}$

UF811 UPPER FLOOR BEAM

SPAN = 18'-3"

$W = \left(\frac{25+40}{20 \text{ ft}} \right) \left(\frac{35 \text{ ft}}{2} \right) = \frac{440 + 710 \text{ ft}}{20 \text{ ft}}$

Use W12x30

$P = (2) \left(\frac{3280 + 3450 \text{ ft}}{20 \text{ ft}} \right) = \frac{6080 + 6900 \text{ ft}}{20 \text{ ft}} \text{ exp} = 15 \text{ ft} \times 6 \text{ ft}$

UF812 UPPER FLOOR BEAM

SPAN = 13'-6"

$W = \frac{25740 \text{ est}}{20 \text{ ft}} \text{ TRBS}_1 = \frac{16 \text{ ft}}{2} = 8 \text{ ft} \text{ from } x = 0' \text{ to } 8 \text{ ft} \times 9 \text{ ft}$

Use 3 1/2 x 14 LSL

$\text{TRBS}_2 = \frac{25 \text{ ft}}{2} = 12 \text{ ft} \text{ from } x = 8 \text{ ft} \times 9 \text{ ft} \text{ to } 13 \text{ ft} \times 9 \text{ ft}$

UF813 UPPER FLOOR BEAM

BACK SPAN = 11'-0"
CANTILEVER = 4'-6"

$W = \frac{25740 \text{ est}}{20 \text{ ft}} \text{ TRBS}_1 = \frac{19 \text{ ft}}{2} = 9 \text{ ft} \text{ from } x = 0' \text{ to } 11 \text{ ft} \times 9 \text{ ft}$

Use 3 1/2 x 14 LSL

$\text{TRBS}_2 = \frac{10 \text{ ft}}{2} = 5 \text{ ft} \text{ from } x = 11 \text{ ft} \times 9 \text{ ft} \text{ to } 15 \text{ ft} \times 9 \text{ ft}$

UF814 UPPER FLOOR BEAM

SPAN = 19'-3"

$P = \left(\frac{25+40}{20 \text{ ft}} \right) \left(\frac{11 \text{ ft}}{2} \right) \left(\frac{19 \text{ ft}}{2} \right) = \frac{1310 + 2080 \text{ ft}}{20 \text{ ft}}$

Use TRPC 13 1/4 x 14 LSL

$\text{exp} = 12 \text{ ft} \times 9 \text{ ft}$

PERMIT

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UFB17 UPPER FLOOR BEAM

SPAN = 15'3"

$$W = \frac{(10)(12')}{2} = 120 \text{ #/ft}$$

USE TRAC 14x14 USC

$$P = 1.4(2.57) \frac{7318 \text{ #/ft}}{21'9"} = \frac{1310 \text{ #}}{EL} \quad \begin{matrix} \text{UTM} \\ \text{EX} = 2'3" \\ \text{EX} = 13' \end{matrix}$$

UFB19 UPPER FLOOR BEAM

SPAN = 13'9"

$$W = \frac{(18+25+60)}{PCSCU} \left(\frac{516'}{2} \right) = \frac{50+70+170 \text{ #/ft}}{20 \text{ USC } 20}$$

USE 6x10

MAIN FLOOR FRAMING (ELEMENTS NOT EXPLICITLY
CALC'D OR BY INSPECTION)

MFB2 MAIN FLOOR BEAM

SPAN = 13'6" $P = \frac{5000}{8L} + \frac{6480}{16} + \frac{1040}{5} \text{ CO} = 9''$

USE TRPC 13/4 x 14 @C

MFB3 MAIN FLOOR BEAM

SPAN = 17'6"

$W_1 = \frac{25700}{8L} \text{ CO}$ $TKIB = \frac{33'}{2} = 16'6''$

UAT = 621 SF

$W_2 = \frac{15740}{8L} \text{ CO}$ $TKIB_1 = \frac{20'}{2} = 10'$
FROM X=0' TO 10'6"

K_{LL} = 2

$\rightarrow U_{LL} = C_0 \left(0.25 + \frac{15}{8K_u U_A} \right) W_3 = \frac{1400}{8L} \text{ CO}$
 $= 0.666$

$TKIB_2 = \frac{33'}{2} = 16'6''$
FROM X=8'6" TO 11'6"

$TKIB = \frac{20'}{2} = 10'$
FROM X=11'6" TO 17'6"

(CONVERT BY THE LL)

USE W12 x 35

$P_1 = \left[\frac{18120}{8L} \left(\frac{33'}{2} \right) + \frac{1040}{8L} \right] \left(\frac{16'}{2} \right)$
 $= \frac{3100}{8L} + \frac{3300}{8L} \text{ CO} = 3'0''$

$P_2 = 1.4 \times 2.5 \times \frac{32932 \text{ #F}}{10'} = 1153 \text{ #F}$ (SW OF C)
WFO R L WFO EL CO = 2'6"

$P_3 = 1.4 \times 2.5 \times \frac{84800 \text{ #F}}{20'} = 29710 \text{ #F}$ (SW MFC)

$P_4 = \frac{4760}{8L} + \frac{6170}{8L} + \frac{1120}{8L} \text{ CO} = 16'6''$
MFB2 (CO) EL CO = 12'6"

MF35 MAIN FLOOR BEAM

SPAN = 18'9" $P = \frac{MF}{OC \cdot u} \left(\frac{6'}{2} \right) \left(\frac{19'}{2} \right) = \frac{430 + 1140}{u} \#$
 MF34
 $ex = 12'6"$

USE 3 1/2 x 14 LSL

MF36 MAIN FLOOR BEAM

SPAN = 8'3"

$P_1 = \frac{UF314}{OC} + \frac{1300}{u} \#$ $ex = 1'6"$

USE 2 1/2 x 14 LSL

$P_2 = \frac{SF310}{OC} + \frac{3400}{u} \#$ $ex = 6'0"$

$W_1 = \frac{MF}{OC \cdot u} 15740 \#$ $TR3B = \frac{19'}{2} = 9'6"$

$W_2 = \frac{UF}{OC \cdot u} 25140 \#$ $TR3B_1 = \frac{25'}{2} = 12'6"$
 FROM 0' TO 1'6"
 $TR3B_2 = \frac{37'}{2} = 18'6"$
 FROM 1'6" TO 8'3"

MF38 MAIN FLOOR BEAM

SPAN = 18'6"

$P_1 = \frac{MF}{OC \cdot u} (15740) \left(\frac{18'}{2} \right) \left(\frac{8'}{2} \right) = \frac{540 + 1440}{u} \#$
 MF37
 $ex = 6'0"$

USE W12x30

$P_2 = \frac{UF313}{OC} + \frac{2040}{u} \#$ $ex = 9'0"$

$P_3 = 1.4 \times 2.5 \times \frac{5364 \# \#}{9'6"} = \frac{19760}{u} \#$ (SW MF. b3)

$P_4 = \left[\frac{UF}{OC \cdot u} (25140) \left(\frac{25'}{2} \right) + \frac{MF}{OC \cdot u} (15740) \left(\frac{35'}{2} \right) + \frac{W}{OC} (7'') \right] \left(\frac{3'6"}{2} \right)$
 MF31
 $= \frac{1170 + 2100}{u} \#$ $ex = 16'3"$

MFOA MAIN FLOOR BEAM

SPAN = 13'6"

$$W = \frac{15400 \text{ (ft)}}{2} \text{ TRSS} = \frac{28'}{2} = 14'$$

Use W12x26

$$P_1 = \frac{2420}{2} + \frac{4720}{2} + \frac{9610}{2} \text{ # MFB 8 } e_c = 13'6"$$

$$P_2 = \frac{1700}{2} + \frac{2720}{2} \text{ # UFB 12 } e_c = 13'6"$$

$$P_3 = \frac{240}{2} + \frac{210}{2} + \frac{50}{2} \text{ # MFB 2 } e_c = 13'6"$$

POST

BASEMENT POST SUPPORTING MFB 3

$H = 9'0"$

$P = \frac{10310}{DL} + \frac{10610}{u} + \frac{1540}{DL} + \frac{2370}{EL} \#$

Use $5\frac{1}{4} \times 5\frac{1}{4}$ PSL

A AREA ALREADY REDUCED FOR MFB 3

BASEMENT POST SUPPORTING MFB 6

$H = 9'0"$

$P_1 = \frac{3250}{DL} + \frac{5360}{u} + \frac{940}{DL} \#$

$A = 219 \text{ sq ft}$

$k_u = 4$

$P_2 = \left[\left(\frac{1540}{DL} \right) \left(\frac{25'}{2} \right) + \left(\frac{1540}{DL} \right) \left(\frac{25'}{2} \right) \right] \left(\frac{9'0"}{2} \right) =$

$= \frac{1620}{DL} + \frac{3410}{u} \#$ (MFB 6 CENTER)

$\rightarrow U_{RES} = L \left(0.25 + \frac{15}{\sqrt{k_u A}} \right) DL$

$= 0.76L$

Use $3\frac{1}{2} \times 5\frac{1}{4}$ PSL

BASEMENT POST SUPPORTING MFB 4

$H = 9'0"$

$P = \frac{5620}{DL} + \frac{10860}{u} + \frac{500}{DL} + \frac{9200}{EL} \#$

Use $3\frac{1}{2} \times 9\frac{1}{4}$ PSL 2.2E

FOUNDATIONS (ELEMENTS NOT EXPECTED IN CASES
OR BY INSPECTION)

(F2) INTERIOR STRIP FOOTING (WORST CASE
(INCLUDES EL) @ G.L. (C))

P FACTOR = 32970 # (SEE POST CALC)

↳ ASSUME 8" SPRESS

$$W_{UNFAIRED} = \frac{(15+40)}{2 \times u} \left(\frac{34'}{2} \right) = \frac{260 + 680}{2 \times u} \text{ #/ft}$$

$$\rightarrow W_{TOTAL} = \frac{32970}{8"} + 1.099 \times 260 + 0.75 \times 680$$

$$= 4920 \text{ #/ft}$$

Use 2" wide STRIP FOOTING

Good for 2' x 2000 ft = 1.33 = 5330 #/ft @

(F1) PERIMETER STRIP FOOTING (WORST CASE @ G.L. (H))

$$W = \left[\frac{(18+25)}{2 \times u} + \frac{(25+40)}{2 \times u} + \frac{(15+40)}{2 \times u} \right] \left(\frac{10'}{2} \right) + \frac{(1)}{2} (20')$$

$$= \frac{750}{2 \times u} + \frac{760 + 240}{u \times u} \text{ #/ft}$$

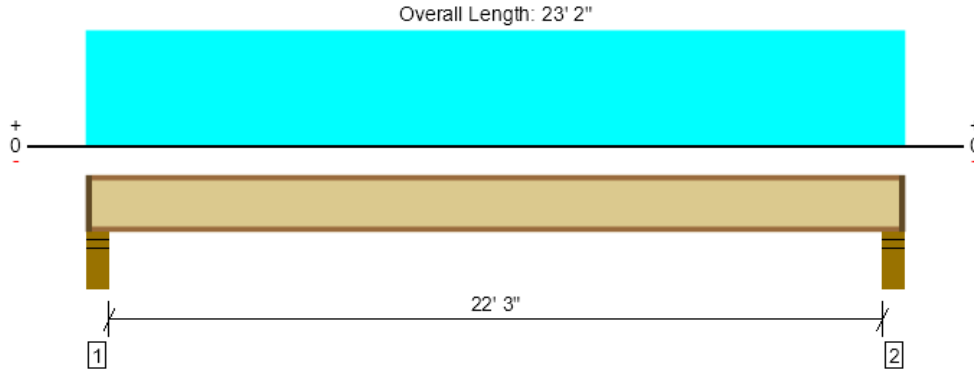
Use 18" STRIP FTG
Good for 3000 #/ft @

(F4) EXTERIOR PAD FOOTING (WORST CASE @ (11/13))

$$P = \frac{(18+25)}{2 \times u} \left(\frac{10'}{2} \right) \left(\frac{20'}{2} \right) = \frac{1600 + 2200}{2 \times u} \text{ #}$$

Use 2" 50. PAD Good for 2' x 2000 = 8000 # @

Upper Floor , UFJ1 - Storage Attic Floor Joists
1 piece(s) 11 7/8" TJI@ 560 @ 12" OC



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	630 @ 4 1/2"	1725 (3.50")	Passed (37%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	612 @ 5 1/2"	2050	Passed (30%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3455 @ 11' 7"	9500	Passed (36%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.362 @ 11' 7"	0.560	Passed (L/744)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.497 @ 11' 7"	1.121	Passed (L/541)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	45	Any	Passed	--	--

Member Length : 22' 11"
 System : Floor
 Member Type : Joist
 Building Use : Residential
 Building Code : IBC 2021
 Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories	Details
	Total	Available	Required	Dead	Floor Live	Factored		
1 - Stud wall - HF	5.50"	4.00"	1.75"	174	463	637	1 1/2" Rim Board	A3
2 - Stud wall - HF	5.50"	4.00"	1.75"	174	463	637	1 1/2" Rim Board	A3

• Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	9' 7" o/c	
Bottom Edge (Lu)	22' 11" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

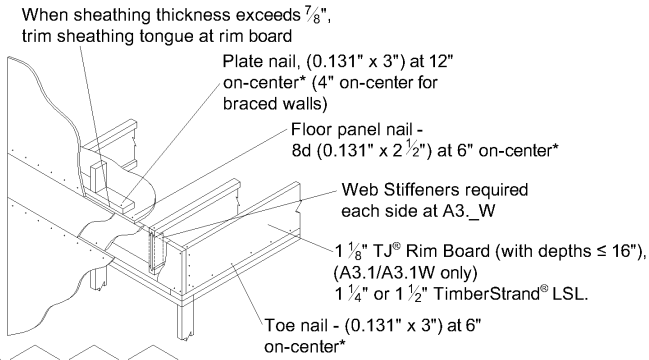
Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 23' 2"	12"	15.0	40.0	Storage Attic

Member Notes
UFJ1 - Storage Attic Floor Joists

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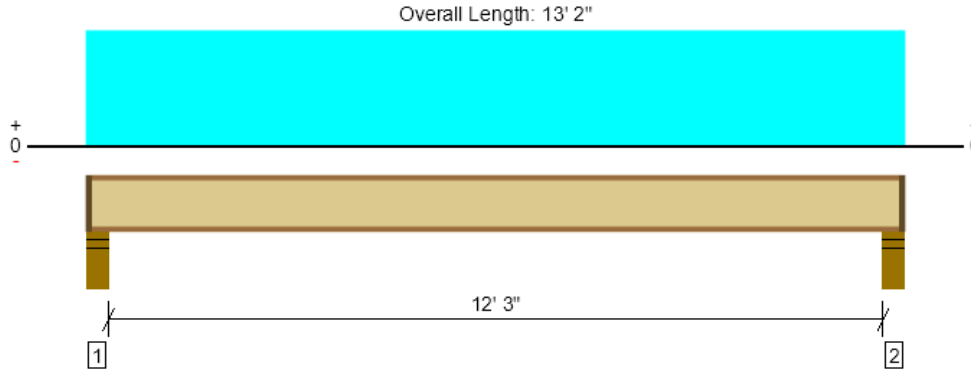


* For A3.1-A3.3 installation specifications see Rim Board Details and Installation in *Weyerhaeuser Installation Guide for Floor and Roof Framing*, TJ-9001.

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Owen Gould O.G. Engineering, PLLC (206) 290-4608 owen@ogengineer.com	



Upper Floor , UFJ2 - Storage Attic Floor Joists
1 piece(s) 11 7/8" TJI@ 210 @ 16" OC



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	474 @ 4 1/2"	1460 (3.50")	Passed (32%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	449 @ 5 1/2"	1655	Passed (27%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1413 @ 6' 7"	3795	Passed (37%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.092 @ 6' 7"	0.310	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.127 @ 6' 7"	0.621	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	60	Any	Passed	--	--

Member Length : 12' 11"
 System : Floor
 Member Type : Joist
 Building Use : Residential
 Building Code : IBC 2021
 Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories	Details
	Total	Available	Required	Dead	Floor Live	Factored		
1 - Stud wall - HF	5.50"	4.00"	1.75"	132	351	483	1 1/2" Rim Board	A3
2 - Stud wall - HF	5.50"	4.00"	1.75"	132	351	483	1 1/2" Rim Board	A3

• Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' 3" o/c	
Bottom Edge (Lu)	12' 11" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

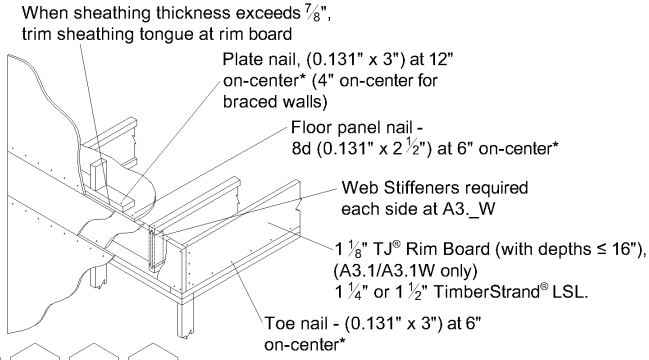
Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 13' 2"	16"	15.0	40.0	Storage Attic

Member Notes
UFJ2 - Storage Attic Floor Joists

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ForteWEB Software Operator	Job Notes
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* For A3.1-A3.3 installation specifications see Rim Board Details and Installation in *Weyerhaeuser Installation Guide for Floor and Roof Framing*, TJ-9001.

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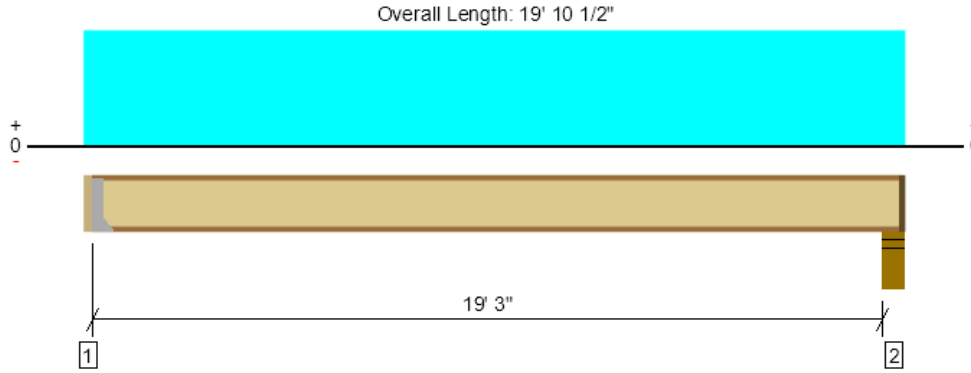


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ForteWEB v3.9

File Name: 25014 Yusen

Upper Floor , UFJ8 - Upper Floor Joists
1 piece(s) 14" TJI® 360 @ 16" OC



Drawing is Conceptual. All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal (typ.).

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	838 @ 2"	1080 (1.75")	Passed (78%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	838 @ 2"	1955	Passed (43%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	4049 @ 9' 10"	7335	Passed (55%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.271 @ 9' 10"	0.483	Passed (L/856)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.440 @ 9' 10"	0.967	Passed (L/527)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	50	Any	Passed	--	--

Member Length : 19' 7"
 System : Floor
 Member Type : Joist
 Building Use : Residential
 Building Code : IBC 2021
 Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories	Details
	Total	Available	Required	Dead	Floor Live	Factored		
1 - Hanger on 14" PSL beam	2.00"	Hanger ¹	1.75" / - ²	328	524	852	See note ¹	--
2 - Stud wall - HF	5.50"	4.00"	1.75"	335	536	870	1 1/2" Rim Board	A3

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- ¹ See Connector grid below for additional information and/or requirements.
- ² Required Bearing Length / Required Bearing Length with Web Stiffeners

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	5' 1" o/c	
Bottom Edge (Lu)	19' 7" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie

Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	IUS2.37/14	2.00"	N/A	12-10dx1.5	2-Strong-Grip	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 19' 10 1/2"	16"	25.0	40.0	Upper Floor

Member Notes

UFJ8 - Upper Floor Joists

ForteWEB Software Operator	Job Notes
Owen Gould O.G. Engineering, PLLC (206) 290-4608 owen@ogengineer.com	



Weyerhaeuser Notes

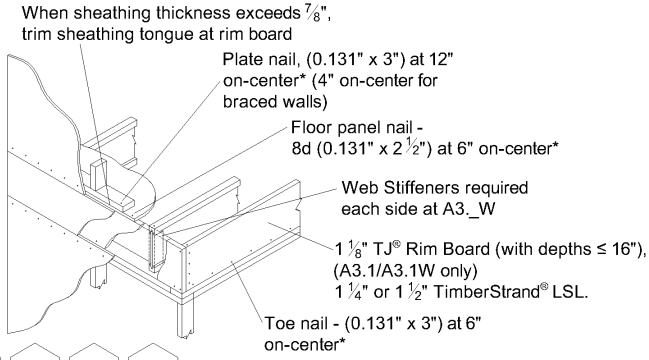
Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

29 of 81

ForteWEB Software Operator	Job Notes
Owen Gould O.G. Engineering, PLLC (206) 290-4608 owen@ogengineer.com	





* For A3.1-A3.3 installation specifications see Rim Board Details and Installation in *Weyerhaeuser Installation Guide for Floor and Roof Framing*, TJ-9001.

ForteWEB Software Operator	Job Notes
Owen Gould O.G. Engineering, PLLC (206) 290-4608 owen@ogengineer.com	



Multiple Simple Beam

Project File: 25014_Yusen.ec6

LIC#: KW-06018000, Build:20.25.07.31

O.G. ENGINEERING, PLLC

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Description : Roof Framing

Wood Beam Design : RB3 - Roof Beam

Code References

Governing Code : IBC 2018, CBC 2019
 Referenced Design Standard(s) : NDS 2018
 Load Combination Set : IBC 2021

BEAM Size : 5.5x12, GLB, Fully Braced

Using Allowable Stress Design with IBC 2021 Load Combinations, Major Axis Bending

Wood Species :	DF/DF				Wood Grade :	24F-V8			
Fb - Tension	2,400.0 psi	Fc - Pll	1,650.0 psi	Fv	265.0 psi	Ebend- xx	1,800.0 ksi	Density	31.210 pcf
Fb - Compr	2,400.0 psi	Fc - Perp	650.0 psi	Ft	1,100.0 psi	Eminbend - xx	950.0 ksi		

Applied Loads

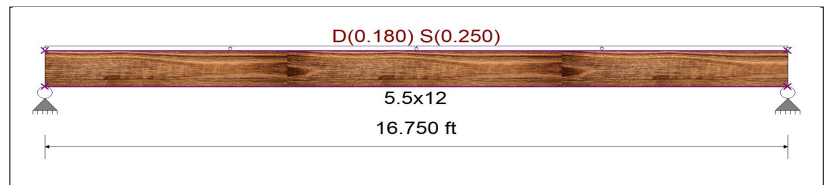
Unif Load: D = 0.0180, S = 0.0250 k/ft, Trib= 10.0 ft

Design Summary

Max fb/Fb Ratio = **0.497** : 1
 fb : Actual : 1,370.93 psi at 8.375 ft in Span # 1
 Fb : Allowable : 2,760.00 psi
 Load Comb : +D+S

Max fv/FvRatio = **0.269** : 1
 fv : Actual : 81.85 psi at 0.000 ft in Span # 1
 Fv : Allowable : 304.75 psi
 Load Comb : +D+S

Max Reactions (k)	<u>D</u>	<u>Lr</u>	<u>L</u>	<u>S</u>	<u>W</u>	<u>E</u>	<u>H</u>
Left Support	1.51			2.09			
Right Support	1.51			2.09			



Max Deflections

Transient Downward	0.312 in	Total Downward	0.537 in
Ratio	643	Ratio	374
LC: S Only		LC: +D+S	
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
LC:		LC:	

Wood Beam Design : RB13 - Roof Beam

Code References

Governing Code : IBC 2018, CBC 2019
 Referenced Design Standard(s) : NDS 2018
 Load Combination Set : IBC 2021

BEAM Size : 5.25x16.0, Parallam PSL, Fully Braced

Using Allowable Stress Design with IBC 2021 Load Combinations, Major Axis Bending

Wood Species :	iLevel Truss Joist				Wood Grade :	Parallam PSL 2.2E			
Fb - Tension	2,900.0 psi	Fc - Pll	2,900.0 psi	Fv	290.0 psi	Ebend- xx	2,200.0 ksi	Density	45.070 pcf
Fb - Compr	2,900.0 psi	Fc - Perp	625.0 psi	Ft	2,025.0 psi	Eminbend - xx	1,118.19 ksi		

Applied Loads

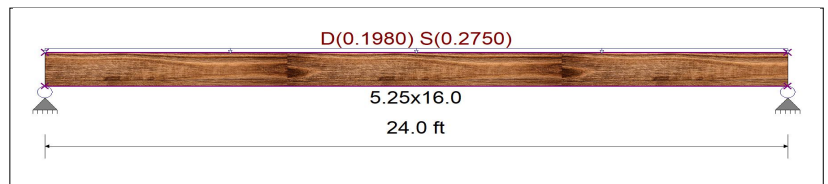
Unif Load: D = 0.0180, S = 0.0250 k/ft, Trib= 11.0 ft

Design Summary

Max fb/Fb Ratio = **0.565** : 1
 fb : Actual : 1,824.43 psi at 12.000 ft in Span # 1
 Fb : Allowable : 3,230.19 psi
 Load Comb : +D+S

Max fv/FvRatio = **0.304** : 1
 fv : Actual : 101.36 psi at 0.000 ft in Span # 1
 Fv : Allowable : 333.50 psi
 Load Comb : +D+S

Max Reactions (k)	<u>D</u>	<u>Lr</u>	<u>L</u>	<u>S</u>	<u>W</u>	<u>E</u>	<u>H</u>
Left Support	2.38			3.30			
Right Support	2.38			3.30			



Max Deflections

Transient Downward	0.523 in	Total Downward	0.770 in
Ratio	550	Ratio	374
LC: S Only		LC: +D+0.750S	
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
LC:		LC:	

Multiple Simple Beam

Project File: 25014_Yusen.ec6

LIC#: KW-06018000, Build:20.25.07.31

O.G. ENGINEERING, PLLC

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Wood Beam Design : RB17 - Roof Beam

Code References

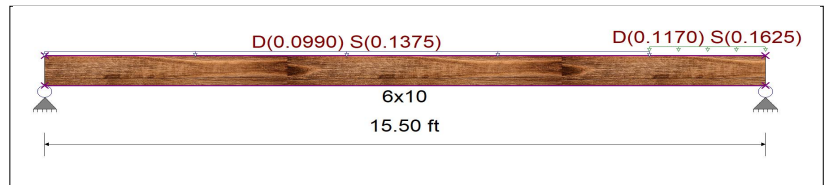
Governing Code : IBC 2018, CBC 2019
 Referenced Design Standard(s) : NDS 2018
 Load Combination Set : IBC 2021

BEAM Size : **6x10, Sawn, Fully Braced**
 Using Allowable Stress Design with IBC 2021 Load Combinations, Major Axis Bending
 Wood Species : Douglas Fir-Larch Wood Grade : No.1
 Fb - Tension 1,350.0 psi Fc - Prll 925.0 psi Fv 170.0 psi Ebend- xx 1,600.0 ksi Density 31.210 pcf
 Fb - Compr 1,350.0 psi Fc - Perp 625.0 psi Ft 675.0 psi Eminbend - xx 580.0 ksi

Applied Loads
 Unif Load: D = 0.0180, S = 0.0250 k/ft, 0.0 ft to 13.0 ft, Trib= 5.50 ft
 Unif Load: D = 0.0180, S = 0.0250 k/ft, 13.0 to 15.50 ft, Trib= 6.50 ft

Design Summary

Max fb/Fb Ratio = **0.670** : 1
 fb : Actual : 1,039.98 psi at 7.802 ft in Span # 1
 Fb : Allowable : 1,552.50 psi
 Load Comb : +D+S
 Max fv/FvRatio = **0.284** : 1
 fv : Actual : 55.46 psi at 15.500 ft in Span # 1
 Fv : Allowable : 195.50 psi
 Load Comb : +D+S
 Max Reactions (k) D Lr L S W E H
 Left Support 0.77 1.07
 Right Support 0.81 1.12



Max Deflections

Transient Downward	0.289 in	Total Downward	0.497 in
Ratio	644	Ratio	374
LC: S Only		LC: +D+S	
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
LC:		LC:	

Wood Beam Design : RR18 - Roof Rafters

Code References

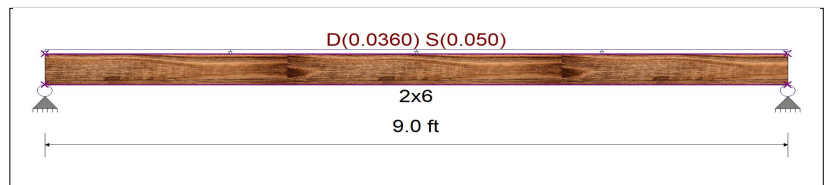
Governing Code : IBC 2018, CBC 2019
 Referenced Design Standard(s) : NDS 2018
 Load Combination Set : IBC 2021

BEAM Size : **2x6, Sawn, Fully Braced**
 Using Allowable Stress Design with IBC 2021 Load Combinations, Major Axis Bending
 Wood Species : Hem-Fir Wood Grade : No.2
 Fb - Tension 850 psi Fc - Prll 1300 psi Fv 150 psi Ebend- xx 1300 ksi Density 26.84 pcf
 Fb - Compr 850 psi Fc - Perp 405 psi Ft 525 psi Eminbend - xx 470 ksi

Applied Loads
 Unif Load: D = 0.0180, S = 0.0250 k/ft, Trib= 2.0 ft

Design Summary

Max fb/Fb Ratio = **0.945** : 1
 fb : Actual : 1,381.69 psi at 4.500 ft in Span # 1
 Fb : Allowable : 1,461.36 psi
 Load Comb : +D+S
 Max fv/FvRatio = **0.408** : 1
 fv : Actual : 70.36 psi at 0.000 ft in Span # 1
 Fv : Allowable : 172.50 psi
 Load Comb : +D+S
 Max Reactions (k) D Lr L S W E H
 Left Support 0.16 0.23
 Right Support 0.16 0.23



Max Deflections

Transient Downward	0.274 in	Total Downward	0.472 in
Ratio	393	Ratio	228
LC: S Only		LC: +D+S	
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
LC:		LC:	

Multiple Simple Beam

Project File: 25014_Yusen.ec6

LIC# : KW-06018000, Build:20.25.07.31

O.G. ENGINEERING, PLLC

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Description : Upper Floor Framing

Wood Beam Design : UFB4 - Upper Floor Beam

Code References

Governing Code : IBC 2018, CBC 2019
 Referenced Design Standard(s) : NDS 2018
 Load Combination Set : IBC 2021

BEAM Size : 3.5x11.875, Parallam PSL, Fully Braced

Using Allowable Stress Design with IBC 2021 Load Combinations, Major Axis Bending

Wood Species : iLevel Truss Joist Wood Grade : Parallam PSL 2.2E
 Fb - Tension 2900 psi Fc - Prll 2900 psi Fv 290 psi Ebend- xx 2200 ksi Density 45.07 pcf
 Fb - Compr 2900 psi Fc - Perp 750 psi Ft 2025 psi Eminbend - xx 1118.19 ksi

Applied Loads

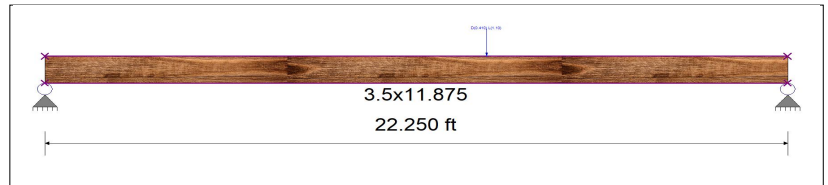
1Point: D = 0.410, L = 1.10 k @ 13.250 ft

Design Summary

Max fb/Fb Ratio = 0.405 : 1
 fb : Actual : 1,177.21 psi at 13.276 ft in Span # 1
 Fb : Allowable : 2,903.37 psi
 Load Comb : +D+L

Max fv/FvRatio = 0.112 : 1
 fv : Actual : 32.45 psi at 13.276 ft in Span # 1
 Fv : Allowable : 290.00 psi
 Load Comb : +D+L

Max Reactions (k) D Lr L S W E H
 Left Support 0.17 0.44
 Right Support 0.24 0.66



Max Deflections

Transient Downward	0.389 in	Total Downward	0.533 in
Ratio	687	Ratio	500
LC: L Only		LC: +D+L	
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
LC:		LC:	

Wood Beam Design : UFB5 - Upper Floor Beam

Code References

Governing Code : IBC 2018, CBC 2019
 Referenced Design Standard(s) : NDS 2018
 Load Combination Set : IBC 2021

BEAM Size : 7x11.875, Parallam PSL, Fully Braced

Using Allowable Stress Design with IBC 2021 Load Combinations, Major Axis Bending

Wood Species : iLevel Truss Joist Wood Grade : Parallam PSL 2.2E
 Fb - Tension 2,900.0 psi Fc - Prll 2,900.0 psi Fv 290.0 psi Ebend- xx 2,200.0 ksi Density 45.070 pcf
 Fb - Compr 2,900.0 psi Fc - Perp 625.0 psi Ft 2,025.0 psi Eminbend - xx 1,118.19 ksi

Applied Loads

Unif Load: D = 0.120 k/ft, 0.0 ft to 10.50 ft, Trib= 1.0 ft

1Point: D = 2.380, S = 3.30 k @ 8.50 ft

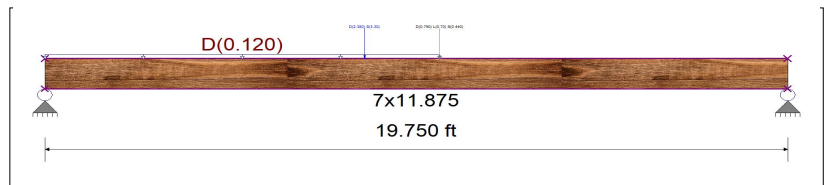
2Point: D = 0.790, L = 0.70, S = 0.440 k @ 10.50 ft

Design Summary

Max fb/Fb Ratio = 0.784 : 1
 fb : Actual : 2,618.41 psi at 8.493 ft in Span # 1
 Fb : Allowable : 3,338.88 psi
 Load Comb : +D+S

Max fv/FvRatio = 0.256 : 1
 fv : Actual : 85.47 psi at 0.000 ft in Span # 1
 Fv : Allowable : 333.50 psi
 Load Comb : +D+S

Max Reactions (k) D Lr L S W E H
 Left Support 2.65 0.33 2.09
 Right Support 1.78 0.37 1.65



Max Deflections

Transient Downward	0.474 in	Total Downward	0.982 in
Ratio	500	Ratio	241
LC: S Only		LC: +D+S	
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
LC:		LC:	

Multiple Simple Beam

Project File: 25014_Yusen.ec6

LIC#: KW-06018000, Build:20.25.07.31

O.G. ENGINEERING, PLLC

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Wood Beam Design : UFH6 - Upper Floor Header

Code References

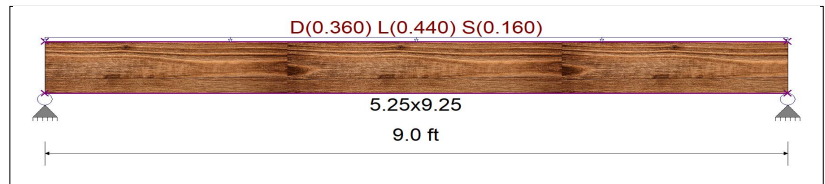
Governing Code : IBC 2018, CBC 2019
 Referenced Design Standard(s) : NDS 2018
 Load Combination Set : IBC 2021

BEAM Size : 5.25x9.25, Parallam PSL, Fully Braced
 Using Allowable Stress Design with IBC 2021 Load Combinations, Major Axis Bending
 Wood Species : iLevel Truss Joist Wood Grade : Parallam PSL 2.2E
 Fb - Tension 2,900.0 psi Fc - Prll 2,900.0 psi Fv 290.0 psi Ebend- xx 2,200.0 ksi Density 45.070 pcf
 Fb - Compr 2,900.0 psi Fc - Perp 625.0 psi Ft 2,025.0 psi Eminbend - xx 1,118.19 ksi

Applied Loads
 Unif Load: D = 0.360, L = 0.440, S = 0.160 k/ft, Trib= 1.0 ft

Design Summary
 Max fb/Fb Ratio = **0.435** : 1
 fb : Actual : 1,298.30 psi at 4.500 ft in Span # 1
 Fb : Allowable : 2,985.01 psi
 Load Comb : +D+L
 Max fv/FvRatio = **0.383** : 1
 fv : Actual : 111.20 psi at 0.000 ft in Span # 1
 Fv : Allowable : 290.00 psi
 Load Comb : +D+L
 Max Reactions (k)

	D	Lr	L	S	W	E
Left Support	1.62		1.98	0.72		
Right Support	1.62		1.98	0.72		



Max Deflections

Transient Downward	0.086 in	Total Downward	0.156 in
Ratio	1259	Ratio	692
LC: L Only		LC: +D+L	
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
LC:		LC:	

Wood Beam Design : UFB9 - Upper Floor Beam

Code References

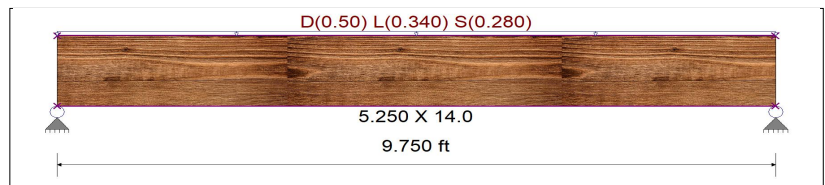
Governing Code : IBC 2018, CBC 2019
 Referenced Design Standard(s) : NDS 2018
 Load Combination Set : IBC 2021

BEAM Size : 5.250 X 14.0, TimberStrand LSL, Fully Braced
 Using Allowable Stress Design with IBC 2021 Load Combinations, Major Axis Bending
 Wood Species : iLevel Truss Joist Wood Grade : TimberStrand LSL 1.55E
 Fb - Tension 2,325.0 psi Fc - Prll 2,050.0 psi Fv 310.0 psi Ebend- xx 1,550.0 ksi Density 45.010 pcf
 Fb - Compr 2,325.0 psi Fc - Perp 800.0 psi Ft 1,070.0 psi Eminbend - xx 787.82 ksi

Applied Loads
 Unif Load: D = 0.50, L = 0.340, S = 0.280 k/ft, Trib= 1.0 ft

Design Summary
 Max fb/Fb Ratio = **0.305** : 1
 fb : Actual : 698.42 psi at 4.875 ft in Span # 1
 Fb : Allowable : 2,292.26 psi
 Load Comb : +D+L
 Max fv/FvRatio = **0.270** : 1
 fv : Actual : 83.57 psi at 0.000 ft in Span # 1
 Fv : Allowable : 310.00 psi
 Load Comb : +D+L
 Max Reactions (k)

	D	Lr	L	S	W	E
Left Support	2.44		1.66	1.37		
Right Support	2.44		1.66	1.37		



Max Deflections

Transient Downward	0.037 in	Total Downward	0.092 in
Ratio	3132	Ratio	1267
LC: L Only		LC: +D+L	
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
LC:		LC:	

Multiple Simple Beam

Project File: 25014_Yusen.ec6

LIC#: KW-06018000, Build:20.25.07.31

O.G. ENGINEERING, PLLC

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Wood Beam Design : UFB10 - Upper Floor Beam

Code References

Governing Code : IBC 2018, CBC 2019
 Referenced Design Standard(s) : NDS 2018
 Load Combination Set : IBC 2021

BEAM Size : 5.25x14.0, Parallam PSL, Fully Braced

Using Allowable Stress Design with IBC 2021 Load Combinations, Major Axis Bending

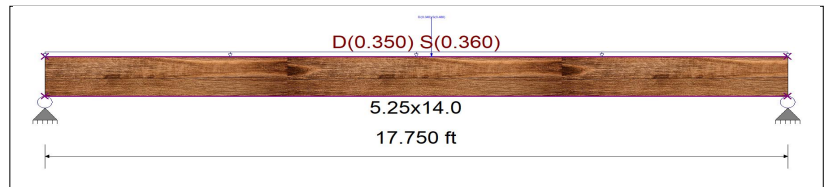
Wood Species : iLevel Truss Joist Wood Grade : Parallam PSL 2.2E
 Fb - Tension 2,900.0 psi Fc - Pll 2,900.0 psi Fv 290.0 psi Ebend- xx 2,200.0 ksi Density 45.070 pcf
 Fb - Compr 2,900.0 psi Fc - Perp 625.0 psi Ft 2,025.0 psi Eminbend - xx 1,118.19 ksi

Applied Loads

Unif Load: D = 0.350, S = 0.360 k/ft, Trib= 1.0 ft
 1Point: D = 0.340, S = 0.480 k @ 9.250 ft

Design Summary

Max fb/Fb Ratio = **0.673** : 1
 fb : Actual : 2,206.98 psi at 9.230 ft in Span # 1
 Fb : Allowable : 3,278.42 psi
 Load Comb : +D+S
 Max fv/FvRatio = **0.412** : 1
 fv : Actual : 137.32 psi at 17.750 ft in Span # 1
 Fv : Allowable : 333.50 psi
 Load Comb : +D+S



Max Reactions (k) D Lr L S W E H
 Left Support 3.27 3.42
 Right Support 3.28 3.45

Max Deflections			
Transient Downward	0.343 in	Total Downward	0.666 in
Ratio	621	Ratio	319
	LC: S Only		LC: +D+S
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Steel Beam Design : UFB11 - Upper Floor Beam

Code References

Governing Code : IBC 2018, CBC 2019
 Referenced Design Standard(s) : AISC 360-16
 Load Combination Set : IBC 2021

STEEL Section : W12x30, Fully Braced

Using Allowable Strength Design with IBC 2021 Load Combinations, Major Axis Bending

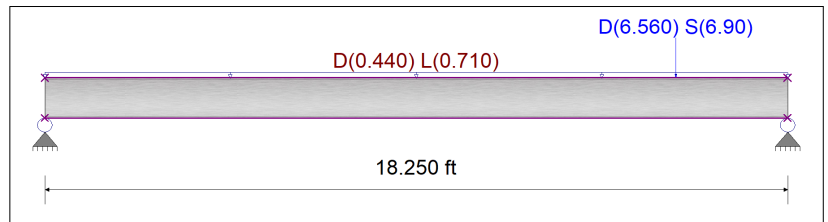
Fy = 50.0 ksi E = 29,000.0ksi

Applied Loads

Unif Load: D = 0.440, L = 0.710 k/ft, Trib= 1.0 ft
 1Point: D = 6.560, S = 6.90 k @ 15.50 ft

Design Summary

Max fb/Fb Ratio = **0.542** : 1
 Mu : Applied 58.231 k-ft at 10.950 ft in Span # 1
 Mn / Omega : Allow 107.535 k-ft
 Load Comb : +D+0.750L+0.750S
 Max fv/FvRatio = **0.295** : 1
 Vu : Applied 18.841 k at 18.250 ft in Span # 1
 Vn / Omega : Allow 63.960 k
 Load Comb : +D+0.750L+0.750S



Max Reactions (k) D Lr L S W E H
 Left Support 5.00 6.48 1.04
 Right Support 9.59 6.48 5.86

Max Deflections			
Transient Downward	0.258 in	Total Downward	0.510 in
Ratio	848	Ratio	429
	LC: L Only		LC: +D+L
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Multiple Simple Beam

Project File: 25014_Yusen.ec6

LIC#: KW-06018000, Build:20.25.07.31

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Wood Beam Design : UFB12 - Upper Floor Beam

Code References

Governing Code : IBC 2018, CBC 2019
 Referenced Design Standard(s) : NDS 2018
 Load Combination Set : IBC 2021

BEAM Size : 3.5x14, TimberStrand LSL, Fully Braced

Using Allowable Stress Design with IBC 2021 Load Combinations, Major Axis Bending

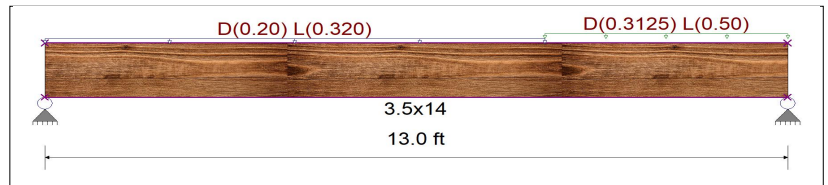
Wood Species : iLevel Truss Joist Wood Grade : TimberStrand LSL 1.55E
 Fb - Tension 2,325.0 psi Fc - Pll 2,050.0 psi Fv 310.0 psi Ebend- xx 1,550.0 ksi Density 45.010 pcf
 Fb - Compr 2,325.0 psi Fc - Perp 800.0 psi Ft 1,070.0 psi Eminbend - xx 787.82 ksi

Applied Loads

Unif Load: D = 0.0250, L = 0.040 k/ft, 0.0 ft to 8.750 ft, Trib= 8.0 ft
 Unif Load: D = 0.0250, L = 0.040 k/ft, 8.750 to 13.0 ft, Trib= 12.50 ft

Design Summary

Max fb/Fb Ratio = **0.565** : 1
 fb : Actual : 1,295.74 psi at 6.890 ft in Span # 1
 Fb : Allowable : 2,292.26 psi
 Load Comb : +D+L
 Max fv/FvRatio = **0.436** : 1
 fv : Actual : 135.30 psi at 13.000 ft in Span # 1
 Fv : Allowable : 310.00 psi
 Load Comb : +D+L
 Max Reactions (k) D Lr L S W E H
 Left Support 1.38 2.21
 Right Support 1.70 2.72



Max Deflections

Transient Downward	0.189 in	Total Downward	0.307 in
Ratio	825	Ratio	507
LC: L Only		LC: +D+L	
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
LC:		LC:	

Wood Beam Design : UFB13 - Upper Floor Beam

Code References

Governing Code : IBC 2018, CBC 2019
 Referenced Design Standard(s) : NDS 2018
 Load Combination Set : IBC 2021

BEAM Size : 3.5x14, TimberStrand LSL, Fully Braced

Using Allowable Stress Design with IBC 2021 Load Combinations, Major Axis Bending

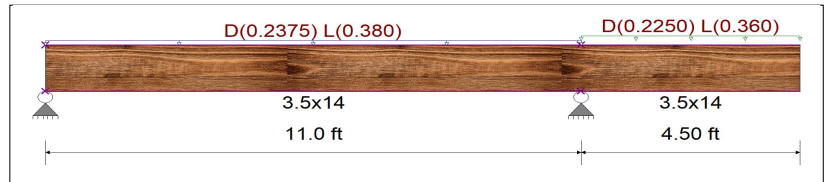
Wood Species : iLevel Truss Joist Wood Grade : TimberStrand LSL 1.55E
 Fb - Tension 2,325.0 psi Fc - Pll 2,050.0 psi Fv 310.0 psi Ebend- xx 1,550.0 ksi Density 45.010 pcf
 Fb - Compr 2,325.0 psi Fc - Perp 800.0 psi Ft 1,070.0 psi Eminbend - xx 787.82 ksi

Applied Loads

Unif Load: D = 0.0250, L = 0.040 k/ft, 0.0 ft to 11.0 ft, Trib= 9.50 ft
 Unif Load: D = 0.0250, L = 0.040 k/ft, 11.0 to 15.50 ft, Trib= 9.0 ft

Design Summary

Max fb/Fb Ratio = **0.377** : 1
 fb : Actual : 864.35 psi at 5.170 ft in Span # 1
 Fb : Allowable : 2,292.26 psi
 Load Comb : +D+L+H, LL Comb Run (L*)
 Max fv/FvRatio = **0.389** : 1
 fv : Actual : 120.45 psi at 11.000 ft in Span # 1
 Fv : Allowable : 310.00 psi
 Load Comb : +D+L+H, LL Comb Run (LL)
 Max Reactions (k) D Lr L S W E H
 Left Support 1.10 2.09
 Right Support 2.53 4.04



Max Deflections

Transient Downward	0.109 in	Total Downward	0.141 in
Ratio	986	Ratio	934
L Only, LL Comb Run (L*)		+L+H, LL Comb Run (L*)	
Transient Upward	-0.132 in	Total Upward	-0.146 in
Ratio	816	Ratio	738
L Only, LL Comb Run (L*)		+L+H, LL Comb Run (L*)	

Multiple Simple Beam

Project File: 25014_Yusen.ec6

LIC#: KW-06018000, Build:20.25.07.31

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Wood Beam Design : UFB14 - Upper Floor Beam

Code References

Governing Code : IBC 2018, CBC 2019
 Referenced Design Standard(s) : NDS 2018
 Load Combination Set : IBC 2021

BEAM Size : **5.250 X 14.0, TimberStrand LSL, Fully Braced**
 Using Allowable Stress Design with IBC 2021 Load Combinations, Major Axis Bending
 Wood Species : iLevel Truss Joist Wood Grade : TimberStrand LSL 1.55E
 Fb - Tension 2,325.0 psi Fc - Prll 2,050.0 psi Fv 310.0 psi Ebend- xx 1,550.0 ksi Density 45.010 pcf
 Fb - Compr 2,325.0 psi Fc - Perp 800.0 psi Ft 1,070.0 psi Eminbend - xx 787.82 ksi

Applied Loads

1Point: D = 1.310, L = 2.090 k @ 12.0 ft

Design Summary

Max fb/Fb Ratio = **0.469** : 1
 fb : Actual : 1,075.11 psi at 11.999 ft in Span # 1
 Fb : Allowable : 2,292.26 psi
 Load Comb : +D+L
 Max fv/FvRatio = **0.140** : 1
 fv : Actual : 43.25 psi at 12.063 ft in Span # 1
 Fv : Allowable : 310.00 psi
 Load Comb : +D+L
 Max Reactions (k) D Lr L S W E H
 Left Support 0.49 0.79
 Right Support 0.82 1.30



Max Deflections

Transient Downward	0.267 in	Total Downward	0.435 in
Ratio	864	Ratio	531
LC: L Only		LC: +D+L	
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
LC:		LC:	

Wood Beam Design : UFB17 - Upper Floor Beam

Code References

Governing Code : IBC 2018, CBC 2019
 Referenced Design Standard(s) : NDS 2018
 Load Combination Set : IBC 2021

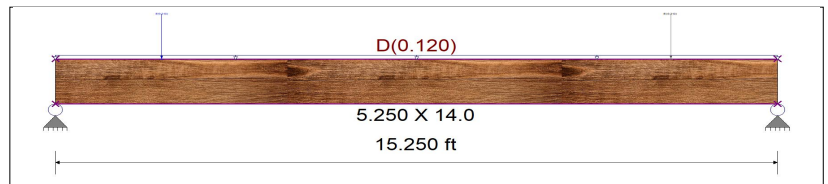
BEAM Size : **5.250 X 14.0, TimberStrand LSL, Fully Braced**
 Using Allowable Stress Design with IBC 2021 Load Combinations, Major Axis Bending
 Wood Species : iLevel Truss Joist Wood Grade : TimberStrand LSL 1.55E
 Fb - Tension 2,325.0 psi Fc - Prll 2,050.0 psi Fv 310.0 psi Ebend- xx 1,550.0 ksi Density 45.010 pcf
 Fb - Compr 2,325.0 psi Fc - Perp 800.0 psi Ft 1,070.0 psi Eminbend - xx 787.82 ksi

Applied Loads

Unif Load: D = 0.120 k/ft, Trib= 1.0 ft
 1Point: E = 9.310 k @ 2.250 ft
 2Point: E = -9.310 k @ 13.0 ft

Design Summary

Max fb/Fb Ratio = **0.234** : 1
 fb : Actual : 859.07 psi at 2.288 ft in Span # 1
 Fb : Allowable : 3,667.62 psi
 Load Comb : +1.132D+0.70E
 Max fv/FvRatio = **0.232** : 1
 fv : Actual : 114.88 psi at 0.000 ft in Span # 1
 Fv : Allowable : 496.00 psi
 Load Comb : +1.132D+0.70E
 Max Reactions (k) D Lr L S W E H
 Left Support 0.92 6.56
 Right Support 0.92 -6.56



Max Deflections

Transient Downward	0.000 in	Total Downward	0.079 in
Ratio	9999	Ratio	2319
LC:		LC: D Only	
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	0 <0	Ratio	9999
LC:		LC:	

Multiple Simple Beam

Project File: 25014_Yusen.ec6

LIC# : KW-06018000, Build:20.25.07.31

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Wood Beam Design : UFB19 - Upper Floor Beam

Code References

Governing Code : IBC 2018, CBC 2019
 Referenced Design Standard(s) : NDS 2018
 Load Combination Set : IBC 2021

BEAM Size : 6x10, Sawn, Fully Braced

Using Allowable Stress Design with IBC 2021 Load Combinations, Major Axis Bending

Wood Species : Douglas Fir-Larch

Wood Grade : No.1

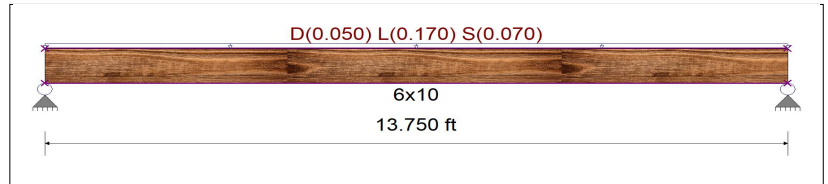
Fb - Tension	1,350.0 psi	Fc - Prll	925.0 psi	Fv	170.0 psi	Ebend- xx	1,600.0 ksi	Density	31.210 pcf
Fb - Compr	1,350.0 psi	Fc - Perp	625.0 psi	Ft	675.0 psi	Eminbend - xx	580.0 ksi		

Applied Loads

Unif Load: D = 0.050, L = 0.170, S = 0.070 k/ft, Trib= 1.0 ft

Design Summary

Max fb/Fb Ratio = **0.559** : 1
 fb : Actual : 754.16 psi at 6.875 ft in Span # 1
 Fb : Allowable : 1,350.00 psi
 Load Comb : +D+L
 Max fv/FvRatio = **0.255** : 1
 fv : Actual : 43.42 psi at 0.000 ft in Span # 1
 Fv : Allowable : 170.00 psi
 Load Comb : +D+L



Max Reactions (k)	<u>D</u>	<u>Lr</u>	<u>L</u>	<u>S</u>	<u>W</u>	<u>E</u>	<u>H</u>
Left Support	0.34		1.17	0.48			
Right Support	0.34		1.17	0.48			

Max Deflections

Transient Downward	0.219 in	Total Downward	0.283 in
Ratio	754	Ratio	583
LC: L Only			
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
LC: LC:			

Multiple Simple Beam

Project File: 25014_Yusen.ec6

LIC#: KW-06018000, Build:20.25.07.31

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Description : Main Floor Framing

Wood Beam Design : MFB2 - Main Floor Beam

Code References

Governing Code : IBC 2018, CBC 2019
 Referenced Design Standard(s) : NDS 2018
 Load Combination Set : IBC 2018

BEAM Size : 5.250 X 14.0, TimberStrand LSL, Fully Braced

Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending

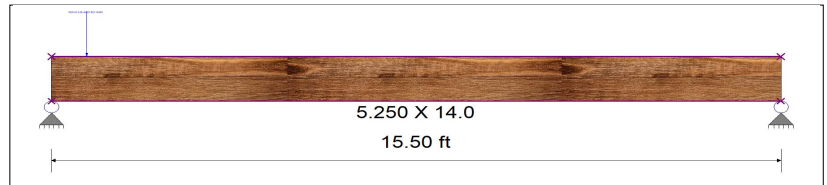
Wood Species : iLevel Truss Joist
 Wood Grade : TimberStrand LSL 1.55E
 Fb - Tension 2,325.0 psi Fc - Prll 2,050.0 psi Fv 310.0 psi Ebend- xx 1,550.0 ksi Density 45.010 pcf
 Fb - Compr 2,325.0 psi Fc - Perp 800.0 psi Ft 1,070.0 psi Eminbend - xx 787.82 ksi

Applied Loads

1Point: D = 5.0, L = 6.480, S = 1.040 k @ 0.750 ft

Design Summary

Max fb/Fb Ratio = 0.250 : 1
 fb : Actual : 572.33 psi at 0.775 ft in Span # 1
 Fb : Allowable : 2,292.26 psi
 Load Comb : +D+L
 Max fv/FvRatio = 0.719 : 1
 fv : Actual : 222.95 psi at 0.000 ft in Span # 1
 Fv : Allowable : 310.00 psi
 Load Comb : +D+L



Max Reactions (k) D Lr L S W E H
 Left Support 4.76 6.17 0.99
 Right Support 0.24 0.31 0.05

Max Deflections

Transient Downward	0.070 in	Total Downward	0.124 in
Ratio	2661	Ratio	1502
LC: L Only		LC: +D+L	
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
LC:		LC:	

Steel Beam Design : MFB3 - Main Floor Beam

Code References

Governing Code : IBC 2018, CBC 2019
 Referenced Design Standard(s) : AISC 360-16
 Load Combination Set : IBC 2021

STEEL Section : W12x35, Fully Braced

Using Allowable Strength Design with IBC 2021 Load Combinations, Major Axis Bending

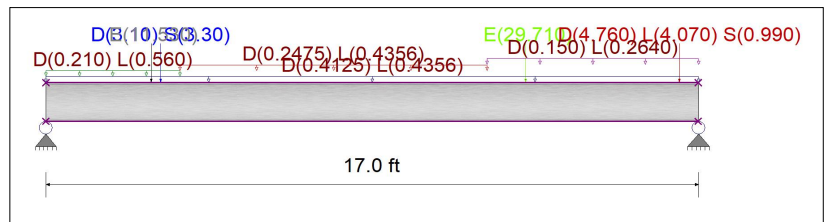
Fy = 50.0 ksi E = 29,000.0ksi

Applied Loads

Unif Load: D = 0.0250, L = 0.02640 k/ft, Trib= 16.50 ft
 Unif Load: D = 0.0150, L = 0.040 k/ft, 0.0 to 3.50 ft, Trib= 14.0 ft
 Unif Load: D = 0.0150, L = 0.02640 k/ft, 3.50 to 11.50 ft, Trib= 16.50 ft
 Unif Load: D = 0.0150, L = 0.02640 k/ft, 11.50 to 17.0 ft, Trib= 10.0 ft
 1Point: D = 3.10, S = 3.30 k @ 3.0 ft
 2Point: E = 11.530 k @ 2.750 ft
 3Point: E = 29.710 k @ 12.50 ft
 4Point: D = 4.760, L = 4.070, S = 0.990 k @ 16.50 ft

Design Summary

Max fb/Fb Ratio = 0.817 : 1
 Mu : Applied 104.346 k-ft at 10.087 ft in Span # 1
 Mn / Omega : Allow 127.745 k-ft
 Load Comb : +1.099D+0.750L+0.750S+0.5250
 Max fv/FvRatio = 0.439 : 1
 Vu : Applied 32.894 k at 17.000 ft in Span # 1
 Vn / Omega : Allow 75.0 k
 Load Comb : +1.099D+0.750L+0.750S+0.5250



Max Reactions (k) D Lr L S W E H
 Left Support 8.10 7.76 2.75 17.53
 Right Support 10.31 10.61 1.54 23.71

Max Deflections

Transient Downward	0.201 in	Total Downward	0.388 in
Ratio	1017	Ratio	525
LC: L Only		LC: +D+L	
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
LC:		LC:	

Multiple Simple Beam

Project File: 25014_Yusen.ec6

LIC#: KW-06018000, Build:20.25.07.31

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Wood Beam Design : MFB5 - Main Floor Beam

Code References

Governing Code : IBC 2018, CBC 2019
 Referenced Design Standard(s) : NDS 2018
 Load Combination Set : IBC 2018

BEAM Size : 3.5x14, TimberStrand LSL, Fully Braced
 Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending
 Wood Species : iLevel Truss Joist Wood Grade : TimberStrand LSL 1.55E
 Fb - Tension 2,325.0 psi Fc - Prll 2,050.0 psi Fv 310.0 psi Ebend- xx 1,550.0 ksi Density 45.010 pcf
 Fb - Compr 2,325.0 psi Fc - Perp 800.0 psi Ft 1,070.0 psi Eminbend - xx 787.82 ksi

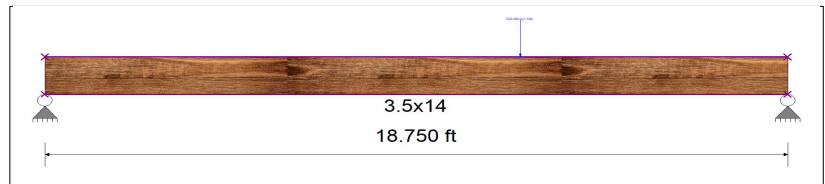
Applied Loads

1Point: D = 0.430, L = 1.140 k @ 12.0 ft

Design Summary

Max fb/Fb Ratio = **0.311** : 1
 fb : Actual : 711.86 psi at 12.000 ft in Span # 1
 Fb : Allowable : 2,292.26 psi
 Load Comb : +D+L
 Max fv/FvRatio = **0.099** : 1
 fv : Actual : 30.76 psi at 12.000 ft in Span # 1
 Fv : Allowable : 310.00 psi
 Load Comb : +D+L
 Max Reactions (k) $\frac{D}{L_r}$ $\frac{L}{S}$ $\frac{W}{E}$ $\frac{H}{H}$

Left Support	0.15	0.41		
Right Support	0.28	0.73		



Max Deflections

Transient Downward	0.197 in	Total Downward	0.272 in
Ratio	1140	Ratio	828
LC: L Only		LC: +D+L	
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
LC:		LC:	

Wood Beam Design : MFB6 - Main Floor Beam

Code References

Governing Code : IBC 2018, CBC 2019
 Referenced Design Standard(s) : NDS 2018
 Load Combination Set : IBC 2018

BEAM Size : 3.5x14, TimberStrand LSL, Fully Braced
 Using Allowable Stress Design with IBC 2018 Load Combinations, Major Axis Bending
 Wood Species : iLevel Truss Joist Wood Grade : TimberStrand LSL 1.55E
 Fb - Tension 2,325.0 psi Fc - Prll 2,050.0 psi Fv 310.0 psi Ebend- xx 1,550.0 ksi Density 45.010 pcf
 Fb - Compr 2,325.0 psi Fc - Perp 800.0 psi Ft 1,070.0 psi Eminbend - xx 787.82 ksi

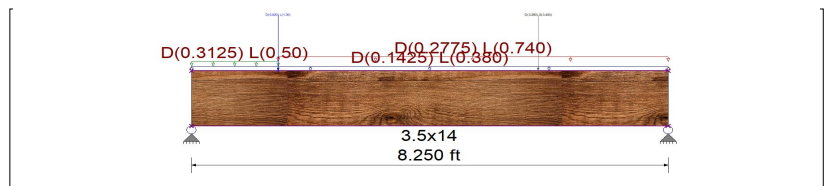
Applied Loads

Unif Load: D = 0.0150, L = 0.040 k/ft, Trib= 9.50 ft
 Unif Load: D = 0.0250, L = 0.040 k/ft, 0.0 to 1.50 ft, Trib= 12.50 ft
 Unif Load: D = 0.0150, L = 0.040 k/ft, 1.50 to 8.250 ft, Trib= 18.50 ft
 1Point: D = 0.820, L = 1.30 k @ 1.50 ft
 2Point: D = 3.280, S = 3.450 k @ 6.0 ft

Design Summary

Max fb/Fb Ratio = **0.841** : 1
 fb : Actual : 1,927.03 psi at 4.483 ft in Span # 1
 Fb : Allowable : 2,292.26 psi
 Load Comb : +D+L
 Max fv/FvRatio = **0.898** : 1
 fv : Actual : 278.43 psi at 8.250 ft in Span # 1
 Fv : Allowable : 310.00 psi
 Load Comb : +D+L
 Max Reactions (k) $\frac{D}{L_r}$ $\frac{L}{S}$ $\frac{W}{E}$ $\frac{H}{H}$

Left Support	3.35	5.36	0.94	
Right Support	4.27	4.82	2.51	



Max Deflections

Transient Downward	0.104 in	Total Downward	0.192 in
Ratio	950	Ratio	516
LC: L Only		LC: +D+0.750L+0.750S	
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
LC:		LC:	

Multiple Simple Beam

Project File: 25014_Yusen.ec6

LIC#: KW-06018000, Build:20.25.07.31

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Steel Beam Design : MFB8 - Main Floor Beam

Code References

Governing Code : IBC 2018, CBC 2019
 Referenced Design Standard(s) : AISC 360-16
 Load Combination Set : IBC 2018

STEEL Section : W12x30, Fully Braced

Using Allowable Strength Design with IBC 2018 Load Combinations, Major Axis Bending

Fy = 50.0 ksi E = 29,000.0ksi

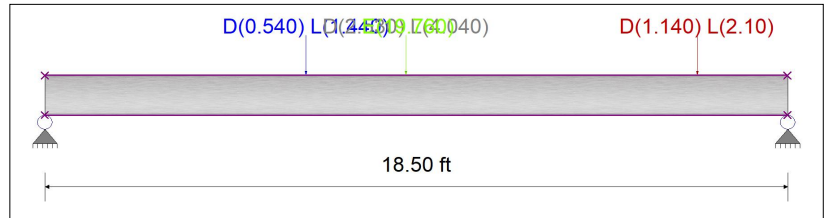
Applied Loads

- 1Point: D = 0.540, L = 1.440 k @ 6.50 ft
- 2Point: D = 2.530, L = 4.040 k @ 9.0 ft
- 3Point: E = 19.760 k @ 9.0 ft
- 4Point: D = 1.140, L = 2.10 k @ 16.250 ft

Design Summary

Max fb/Fb Ratio = **0.762** : 1
 Mu : Applied 81.993 k-ft at 9.003 ft in Span # 1
 Mn / Omega : Allow 107.535 k-ft
 Load Comb : +D+0.750L+0.5250E

Max fv/FvRatio = **0.167** : 1
 Vu : Applied 10.706 k at 16.280 ft in Span # 1
 Vn / Omega : Allow 63.960 k
 Load Comb : +D+0.750L+0.5250E



Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	1.79		3.26			10.15	
Right Support	2.42		4.32			9.61	

Max Deflections			
Transient Downward	0.201 in	Total Downward	0.314 in
Ratio	1104		706
	LC: L Only	Total Upward	0.000 in
Transient Upward	0.000 in	Ratio	9999
Ratio	9999	LC:	LC:

Steel Beam Design : MFB9 - Main Floor Beam

Code References

Governing Code : IBC 2018, CBC 2019
 Referenced Design Standard(s) : AISC 360-16
 Load Combination Set : IBC 2018

STEEL Section : W12x26, Fully Braced

Using Allowable Strength Design with IBC 2018 Load Combinations, Major Axis Bending

Fy = 50.0 ksi E = 29,000.0ksi

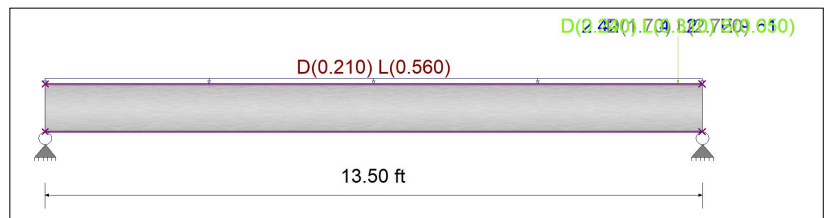
Applied Loads

- Unif Load: D = 0.0150, L = 0.040 k/ft, Trib= 14.0 ft
- 1Point: D = 2.420, L = 4.320, E = 9.610 k @ 13.0 ft
- 2Point: D = 1.70, L = 2.720 k @ 13.0 ft
- 3Point: D = 0.240, L = 0.310, S = 0.050 k @ 13.0 ft

Design Summary

Max fb/Fb Ratio = **0.222** : 1
 Mu : Applied 20.591 k-ft at 7.335 ft in Span # 1
 Mn / Omega : Allow 92.814 k-ft
 Load Comb : +D+L

Max fv/FvRatio = **0.332** : 1
 Vu : Applied 18.654 k at 13.500 ft in Span # 1
 Vn / Omega : Allow 56.120 k
 Load Comb : +D+0.750L+0.750S+0.5250E



Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	1.58		4.05	0.00		0.36	
Right Support	5.62		10.86	0.05		9.25	

Max Deflections			
Transient Downward	0.083 in	Total Downward	0.117 in
Ratio	1941		1379
	LC: L Only	Total Upward	0.000 in
Transient Upward	0.000 in	Ratio	9999
Ratio	9999	LC:	LC:

Wood Column

Project File: 25014_Yusen.ec6

LIC#: KW-06018000, Build:20.25.07.31

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DESCRIPTION: Basement post supporting MFB3

Code References

Governing Code : IBC 2018, CBC 2019
 Referenced Design Standard(s) : NDS 2018
 Load Combinations Used : IBC 2018

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	iLevel Truss Joist	Exact Width	5.250 in Allow Stress Modification Factors
Wood Grade	Parallam PSL 1.8E	Exact Depth	5.250 in Cf or Cv for Bending 1.096
Fb +	2,400.0 psi	Area	27.563 in ² Cf or Cv for Compression 1.0
Fb -	2,400.0 psi	Ix	63.308 in ⁴ Cf or Cv for Tension 1.0
Fc - Prll	2,500.0 psi	Iy	63.308 in ⁴ Cm : Wet Use Factor 1.0
Fc - Perp	425.0 psi		Ct : Temperature Fact 1.0
E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial
	Basic	1,800.0	1,800.0
	Minimum	914.88	914.88
			1,800.0 ksi
			Column Buckling Condition:
			ABOUT X-X Axis: Lux = 9 ft, Kx = 1.0
			ABOUT Y-Y Axis: Luy = 9 ft, Ky = 1.0

Applied Loads

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

Column self weight included : 77.642 lbs * Dead Load Factor

AXIAL LOADS . . .

Axial Load at 9.0 ft, D = 10.310, L = 10.610, S = 1.540, E = 23.710 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.7209 : 1**
 Load Combination +1.099D+0.750L+0.750S+0.5250E
 Governing NDS Forumla Comp Only, fc/Fc'
 Location of max.above base 0.0 ft
 At maximum location values are .
 Applied Axial 32.973 k
 Applied Mx 0.0 k-ft
 Applied My 0.0 k-ft
 Fc : Allowable 1,659.43 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

PASS Maximum Shear Stress Ratio = **0.0 : 1**
 Load Combination +0.4684D+0.70E
 Location of max.above base 9.0 ft
 Applied Design Shear 0.0 psi
 Allowable Shear 304.0 psi

Bending Compression Shear

Load Combination Results

Load Combination	C _D	C _P	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
D Only	0.900	0.661	0.2534	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+L	1.000	0.613	0.4967	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+S	1.150	0.551	0.2734	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+0.750L	1.250	0.514	0.4142	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+0.750L+0.750S	1.150	0.551	0.4469	PASS	0.0 ft	0.0	PASS	9.0 ft
+1.132D+0.70E	1.600	0.415	0.6199	PASS	0.0 ft	0.0	PASS	9.0 ft
+1.099D+0.750L+0.750S+0.525C	1.600	0.415	0.7209	PASS	0.0 ft	0.0	PASS	9.0 ft
+0.60D	1.600	0.415	0.1363	PASS	0.0 ft	0.0	PASS	9.0 ft
+0.4684D+0.70E	1.600	0.415	0.4693	PASS	0.0 ft	0.0	PASS	9.0 ft

Wood Column

Project File: 25014_Yusen.ec6

LIC# : KW-06018000, Build:20.25.07.31

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DESCRIPTION: Basement post supporting MFB3

Maximum Reactions

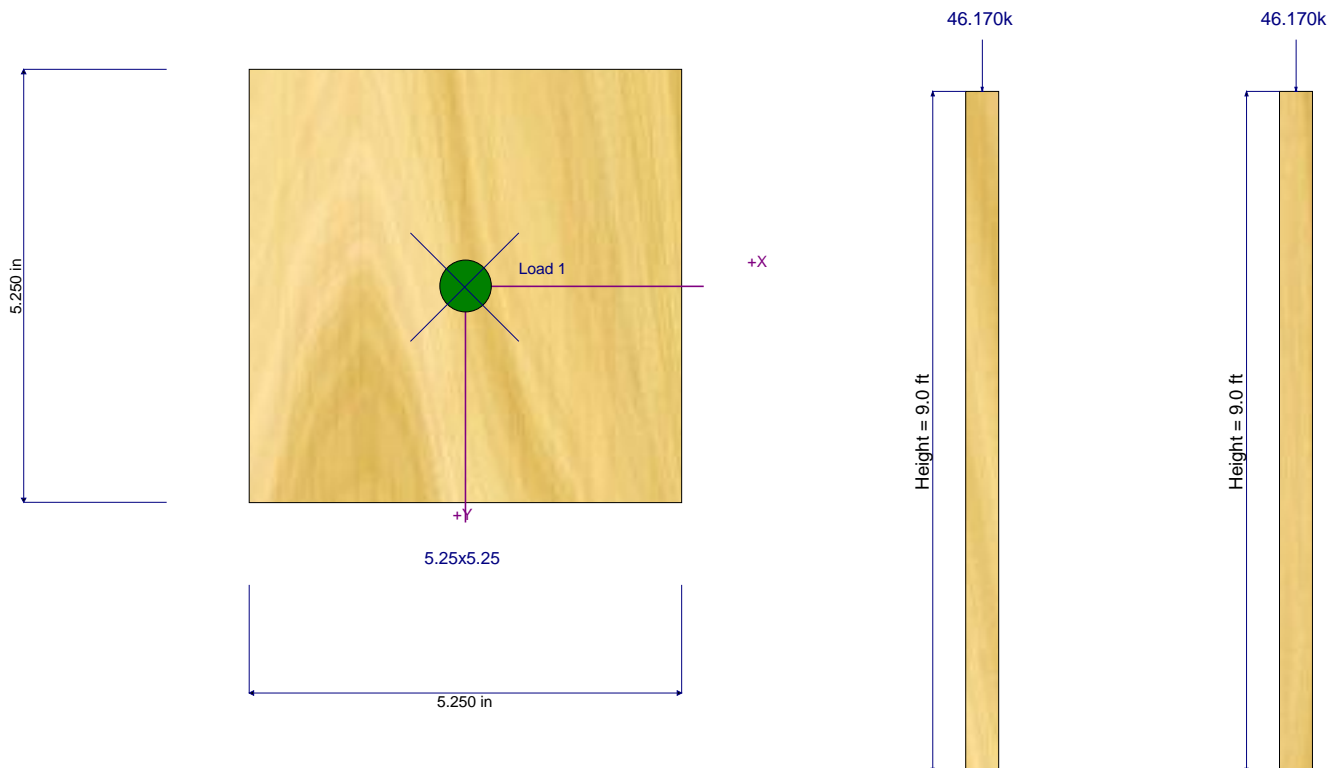
Note: Only non-zero reactions are listed.

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	@ Base	@ Top	@ Base	@ Top
D Only					10.388				
+D+L					20.998				
+D+S					11.928				
+D+0.750L					18.345				
+D+0.750L+0.750S					19.500				
+D+0.70E					26.985				
+D+0.750L+0.750S+0.5250E					31.948				
+0.60D					6.233				
+0.60D+0.70E					22.830				
L Only					10.610				
S Only					1.540				
E Only					23.710				

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
D Only	0.0000 in	0.000ft	0.000 in	0.000ft
+D+L	0.0000 in	0.000ft	0.000 in	0.000ft
+D+S	0.0000 in	0.000ft	0.000 in	0.000ft
+D+0.750L	0.0000 in	0.000ft	0.000 in	0.000ft
+D+0.750L+0.750S	0.0000 in	0.000ft	0.000 in	0.000ft
+D+0.70E	0.0000 in	0.000ft	0.000 in	0.000ft
+D+0.750L+0.750S+0.5250E	0.0000 in	0.000ft	0.000 in	0.000ft
+0.60D	0.0000 in	0.000ft	0.000 in	0.000ft
+0.60D+0.70E	0.0000 in	0.000ft	0.000 in	0.000ft
L Only	0.0000 in	0.000ft	0.000 in	0.000ft
S Only	0.0000 in	0.000ft	0.000 in	0.000ft
E Only	0.0000 in	0.000ft	0.000 in	0.000ft

Sketches



Wood Column

Project File: 25014_Yusen.ec6

LIC#: KW-06018000, Build:20.25.07.31

O.G. ENGINEERING, PLLC

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: Basement post supporting MFB6

Code References

Governing Code : IBC 2018, CBC 2019
 Referenced Design Standard(s) : NDS 2018
 Load Combinations Used : IBC 2018

General Information

Analysis Method	Allowable Stress Design	Wood Section Name	3.5x5.25
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	iLevel Truss Joist	Exact Width	3.50 in Allow Stress Modification Factors
Wood Grade	Parallam PSL 1.8E	Exact Depth	5.250 in Cf or Cv for Bending 1.096
Fb +	2,400.0 psi	Area	18.375 in^2 Cf or Cv for Compression 1.0
Fb -	2,400.0 psi	Ix	42.205 in^4 Cf or Cv for Tension 1.0
Fc - Prll	2,500.0 psi	Iy	18.758 in^4 Cm : Wet Use Factor 1.0
Fc - Perp	425.0 psi		Ct : Temperature Fact 1.0
E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial
	Basic	1,800.0	1,800.0
	Minimum	914.88	914.88
			1,800.0 ksi
			Column Buckling Condition:
			ABOUT X-X Axis: Lux = 9 ft, Kx = 1.0
			ABOUT Y-Y Axis: Luy = 9 ft, Ky = 1.0

Applied Loads

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

Column self weight included : 51.760 lbs * Dead Load Factor

AXIAL LOADS . . .

MFB6 East: Axial Load at 9.0 ft, D = 3.350, L = 4.070, S = 0.940 k

MFB6 West: Axial Load at 9.0 ft, D = 1.620, L = 2.590 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio =	0.8399 : 1	Maximum SERVICE Lateral Load Reactions . .	
Load Combination	+D+L	Top along Y-Y	0.0 k Bottom along Y-Y 0.0 k
Governing NDS Formula	Comp Only, fc/Fc'	Top along X-X	0.0 k Bottom along X-X 0.0 k
Location of max.above base	0.0 ft	Maximum SERVICE Load Lateral Deflections . . .	
At maximum location values are .		Along Y-Y	0.0 in at 0.0 ft above base
Applied Axial	11.682 k	for load combination : n/a	
Applied Mx	0.0 k-ft	Along X-X	0.0 in at 0.0 ft above base
Applied My	0.0 k-ft	for load combination : n/a	
Fc : Allowable	756.94 psi	Other Factors	
PASS Maximum Shear Stress Ratio =	0.0 : 1		<u>Bending</u> <u>Compression</u> <u>Shear</u>
Load Combination	+0.4684D		
Location of max.above base	9.0 ft		
Applied Design Shear	0.0 psi		
Allowable Shear	304.0 psi		

Load Combination Results

Load Combination	C _D	C _P	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
D Only	0.900	0.334	0.3634	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+L	1.000	0.303	0.8399	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+S	1.150	0.265	0.4256	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+0.750L	1.250	0.245	0.7126	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+0.750L+0.750S	1.150	0.265	0.7654	PASS	0.0 ft	0.0	PASS	9.0 ft
+1.132D	1.600	0.193	0.4009	PASS	0.0 ft	0.0	PASS	9.0 ft
+1.099D+0.750L+0.750S	1.600	0.193	0.7914	PASS	0.0 ft	0.0	PASS	9.0 ft
+0.60D	1.600	0.193	0.2126	PASS	0.0 ft	0.0	PASS	9.0 ft
+0.4684D	1.600	0.193	0.1659	PASS	0.0 ft	0.0	PASS	9.0 ft

Wood Column

Project File: 25014_Yusen.ec6

LIC# : KW-06018000, Build:20.25.07.31

O.G. ENGINEERING, PLLC

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: Basement post supporting MFB6

Maximum Reactions

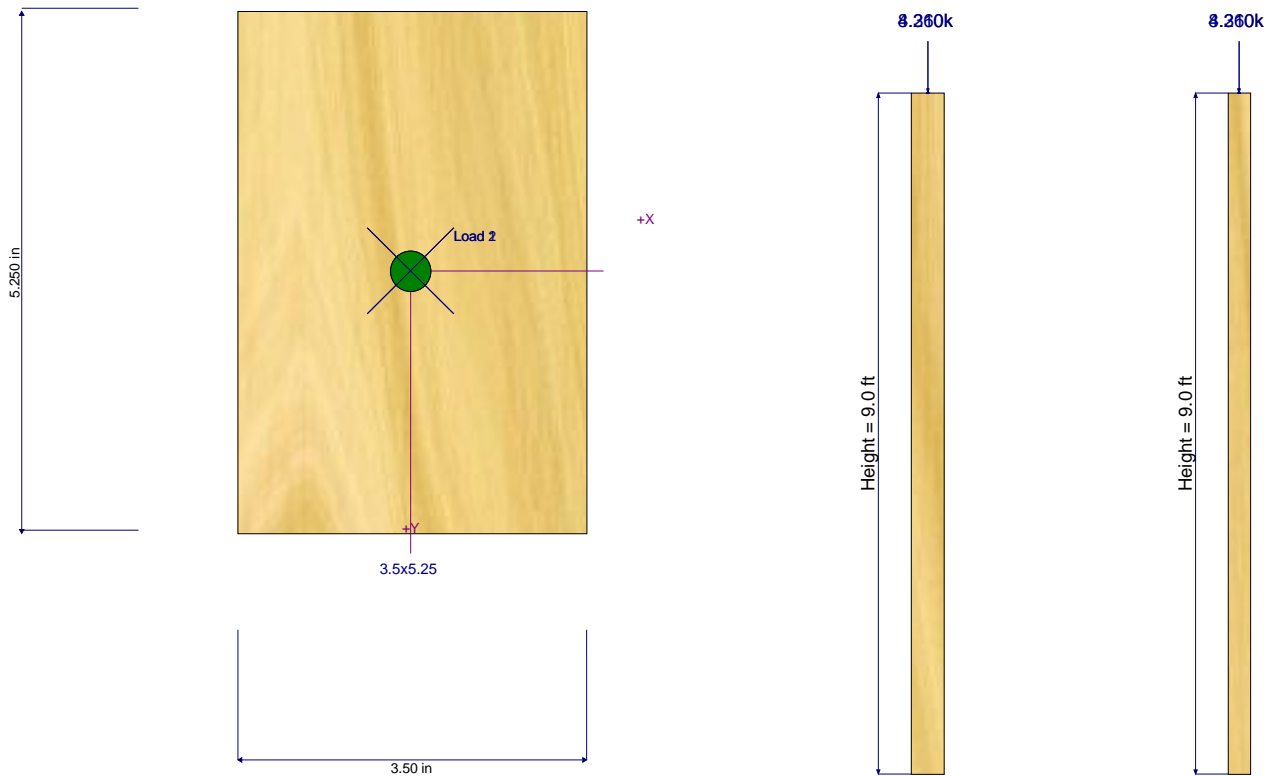
Note: Only non-zero reactions are listed.

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	@ Base	@ Top	@ Base	@ Top	
D Only						5.022						
+D+L						11.682						
+D+S						5.962						
+D+0.750L						10.017						
+D+0.750L+0.750S						10.722						
+0.60D						3.013						
L Only						6.660						
S Only						0.940						

Maximum Deflections for Load Combinations

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

Sketches



Wood Column

Project File: 25014_Yusen.ec6

LIC# : KW-06018000, Build:20.25.07.31

O.G. ENGINEERING, PLLC

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DESCRIPTION: Basement post supporting MFB9

Code References

Governing Code : IBC 2018, CBC 2019
 Referenced Design Standard(s) : NDS 2018
 Load Combinations Used : IBC 2018

General Information

Analysis Method	Allowable Stress Design	Wood Section Name	3.5x9.25
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	iLevel Truss Joist	Exact Width	3.50 in Allow Stress Modification Factors
Wood Grade	Parallam PSL 2.2E	Exact Depth	9.250 in Cf or Cv for Bending 1.029
Fb +	2900 psi	Area	32.375 in^2 Cf or Cv for Compression 1.0
Fb -	2900 psi	Ix	230.840 in^4 Cf or Cv for Tension 1.0
Fc - Prll	2900 psi	Iy	33.049 in^4 Cm : Wet Use Factor 1.0
Fc - Perp	750 psi	Density	45.07 pcf Ct : Temperature Fact 1.0
E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial
	Basic	2200	2200
	Minimum	1118.19	1118.19
			2200 ksi
			Column Buckling Condition:
			ABOUT X-X Axis: Lux = 9 ft, Kx = 1.0
			ABOUT Y-Y Axis: Luy = 9 ft, Ky = 1.0

Applied Loads

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

Column self weight included : 91.196 lbs * Dead Load Factor

AXIAL LOADS . . .

MFB9: Axial Load at 9.0 ft, D = 5.620, L = 10.860, S = 0.050, E = 9.250 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.6337 : 1**
 Load Combination +1.099D+0.750L+0.750S+0.5250E
 Governing NDS Forumla Comp Only, fc/Fc'
 Location of max.above base 0.0 ft
 At maximum location values are .
 Applied Axial 19.314 k
 Applied Mx 0.0 k-ft
 Applied My 0.0 k-ft
 Fc : Allowable 941.37 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

PASS Maximum Shear Stress Ratio = **0.0 : 1**
 Load Combination +0.4684D+0.70E
 Location of max.above base 9.0 ft
 Applied Design Shear 0.0 psi
 Allowable Shear 464.0 psi

Bending Compression Shear

Load Combination Results

Load Combination	C _D	C _P	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
D Only	0.900	0.351	0.1926	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+L	1.000	0.318	0.5550	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+S	1.150	0.279	0.1915	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+0.750L	1.250	0.257	0.4587	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+0.750L+0.750S	1.150	0.279	0.4617	PASS	0.0 ft	0.0	PASS	9.0 ft
+1.132D+0.70E	1.600	0.203	0.4245	PASS	0.0 ft	0.0	PASS	9.0 ft
+1.099D+0.750L+0.750S+0.525C	1.600	0.203	0.6337	PASS	0.0 ft	0.0	PASS	9.0 ft
+0.60D	1.600	0.203	0.1124	PASS	0.0 ft	0.0	PASS	9.0 ft
+0.4684D+0.70E	1.600	0.203	0.3002	PASS	0.0 ft	0.0	PASS	9.0 ft

Wood Column

Project File: 25014_Yusen.ec6

LIC# : KW-06018000, Build:20.25.07.31

O.G. ENGINEERING, PLLC

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DESCRIPTION: Basement post supporting MFB9

Maximum Reactions

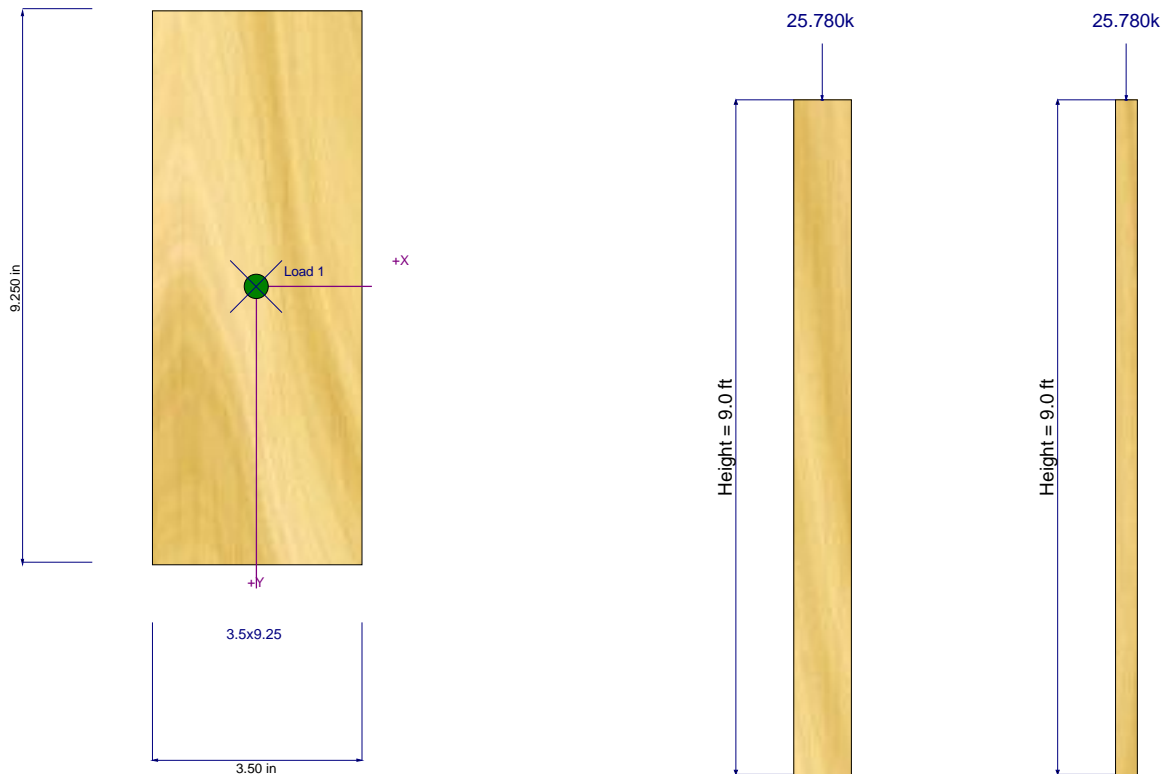
Note: Only non-zero reactions are listed.

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						5.711				
+D+L						16.571				
+D+S						5.761				
+D+0.750L						13.856				
+D+0.750L+0.750S						13.894				
+D+0.70E						12.186				
+D+0.750L+0.750S+0.5250E						18.750				
+0.60D						3.427				
+0.60D+0.70E						9.902				
L Only						10.860				
S Only						0.050				
E Only						9.250				

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection		Max. Y-Y Deflection	
	Distance		Distance	
D Only	0.0000 in	0.000ft	0.000 in	0.000ft
+D+L	0.0000 in	0.000ft	0.000 in	0.000ft
+D+S	0.0000 in	0.000ft	0.000 in	0.000ft
+D+0.750L	0.0000 in	0.000ft	0.000 in	0.000ft
+D+0.750L+0.750S	0.0000 in	0.000ft	0.000 in	0.000ft
+D+0.70E	0.0000 in	0.000ft	0.000 in	0.000ft
+D+0.750L+0.750S+0.5250E	0.0000 in	0.000ft	0.000 in	0.000ft
+0.60D	0.0000 in	0.000ft	0.000 in	0.000ft
+0.60D+0.70E	0.0000 in	0.000ft	0.000 in	0.000ft
L Only	0.0000 in	0.000ft	0.000 in	0.000ft
S Only	0.0000 in	0.000ft	0.000 in	0.000ft
E Only	0.0000 in	0.000ft	0.000 in	0.000ft

Sketches



Plywood Shear Wall Design

Refer to Shear Wall Key Plans

Story Forces - ASD Level	
Floor	F _x (psf)
Roof	4.5
2nd	4.5
1st	1.6

Plywood Grade	
CD-X	Struct 1 or CD-X

15/32" Plywood, w/ 10d nails, min. 1-1/2" penetration into framing members

R_d (Dead Load Resistance Factor) = 0.6-0.14S_{ds} = 0.47

Wall Mark Capacity (Grade Struct 1)		
Wall Mark	Edge Nailing	Capacity (plf)
1	6" o.c.	340
2	4" o.c.	510
3	3" o.c.	665
4	2" o.c.	870
Dbl 2	4" o.c. Both Sides	1020
Dbl 3	3" o.c. Both Sides	1330
Dbl 4	2" o.c. Both Sides	1740

Wall Mark Capacity (Grade CD-X)		
Wall Mark	Edge Nailing	Capacity (plf)
1	6" o.c.	310
2	4" o.c.	460
3	3" o.c.	600
4	2" o.c.	770
Dbl 2	4" o.c. Both Sides	920
Dbl 3	3" o.c. Both Sides	1200
Dbl 4	2" o.c. Both Sides	1540

Holdown Schedule	
Holdown	Capacity (lb)
HDU2	3075
HDU4	4565
HDU5	5645
HDU8	7870
MSTC40	1920
MSTC52	3455
MSTC66	4775

Notes

- 1) Wall_{abv} = Shear wall on story above that adds shear to subject wall
- 2) V_{abv} = Shear demand from wall on story above
- 3) V_{cur} = Shear demand from current story = A_T x F_x
- 4) V = Total shear demand in wall = V_{abv} + V_{cur}
- 5) v = unit shear demand = V / L
- 6) Allowable shear reduction multiplier of 2xL/h for walls w/ h>2L (=1 if h<2L)
- 7) OTM = Wall overturning moment = V x h
- 8) w_{DL} = Distributed resisting dead load on top of wall
- 9) P_{DL,END} = Minimum resisting point dead load on end of wall
- 10) RM = Resisting Moment from w_{DL} & P_{DL,END}, multiplied by R_d above
- 11) T_{end} = Tension at end of wall from current story shear = (OTM - RM) / L
- 12) T_{abv} = Tension from wall holdown on story above
- 13) T = T_{end} + T_{abv}

Roof Diaphragm

Walls in North-South Direction												
Wall	L (ft)	h (ft)	A _T (sf)	Wall _{abv} ¹	V _{abv} ² (lbs)	V _{cur} ³ (lbs)	V ⁴ (lb)	v ⁵ (plf)	Wall Mark	h>2L?	2xL/h ⁶	Capacity (plf)
UF.2	23	6	620	none	0	2801	2801	122	1	no	1	310
UF.3	13.5	9	470	none	0	2123	2123	157	1	no	1	310
UF.4	14.5	6	100	none	0	452	452	31	1	no	1	310
UF.5*	16	9	1080	none	0	4879	4879	610	4	no	1	770
UF.6	9.25	9	330	none	0	1491	1491	161	1	no	1	310
UF.7*	35.75	9	1220	none	0	5511	5511	347	2	no	1	460
UF.9.1	2.75	9	180	none	0	813	813	296	3	yes	0.61	367
UF.9.2	2.75	9	180	none	0	813	813	296	3	yes	0.61	367

Holdowns for Walls in North-South Direction										
Wall	OTM' (lb-ft)	w _{DL} ⁸ (plf)	P _{DL,END} ⁹ (lb)	RM ¹⁰ (lb-ft)	T _{end} ¹¹ (lb)	T _{abv} ¹² (lb)	T ¹³ (lb)	Holdown	Capacity	
UF.2	16805	60	240	10019	295		295	NONE	#N/A	Close enough
UF.3	19109	120	480	8157	811		811	HDU2	3075	
UF.4	2710	60	240	4584	-129		-129	NONE	#N/A	
UF.5*	43910	430	1720	38671	327		327	NONE	#N/A	Close enough
UF.6	13417	290	870	9581	415		415	NONE	#N/A	Close enough
UF.7*	49602	400	800	133125	-2336		-2336	NONE	#N/A	Close enough
UF.9.1	7318	120	480	831	2359		2359	MSTC52	3455	
UF.9.2	7318	120	480	831	2359		2359	MSTC52	3455	

Walls in East-West Direction												
Wall	L (ft)	h (ft)	A _T (sf)	Wall _{abv} ¹	V _{abv} ² (lbs)	V _{cur} ³ (lbs)	V ⁴ (lb)	v ⁵ (plf)	Wall Mark	h>2L?	2xL/h ⁶	Capacity (plf)
UF.B*	27.5	9	460	none	0	2078	2078	164	1	no	1	310
UF.C*	10	9	810	none	0	3659	3659	732	4	no	1	770
UF.D8	9	9	880	none	0	3975	3975	442	2	no	1	460
UF.F	7	9	70	none	0	316	316	45	1	no	1	310
UF.H*	15.25	9	500	none	0	2259	2259	258	1	no	1	310

Holdowns for Walls in East-West Direction										
Wall	OTM' (lb-ft)	w _{DL} ⁸ (plf)	P _{DL,END} ⁹ (lb)	RM ¹⁰ (lb-ft)	T _{end} ¹¹ (lb)	T _{abv} ¹² (lb)	T ¹³ (lb)	Holdown	Capacity	
UF.B*	18702	120	480	27437	-318		-318	NONE	#N/A	Close enough
UF.C*	32932	270	540	8853	2408		2408	HDU2	3075	
UF.D8	35778	60	0	1138	3849		3849	MSTC66B3	3820	
UF.F	2846	250	500	4508	-237		-237	NONE	#N/A	
UF.H*	20329	120	480	9965	680		680	HDU2	3075	

Upper Floor Diaphragm

Walls in North-South Direction												
Wall	L (ft)	h (ft)	A _T (sf)	Wall _{abv} ¹	V _{abv} ² (lbs)	V _{cur} ³ (lbs)	V ⁴ (lb)	v ⁵ (plf)	Wall Mark	h>2L?	2xL/h ⁶	Capacity (plf)
MF.2	11.25	8.5	330	UF.2	2801	1488	4289	381	2	no	1	460
MF.3	8.75	11	370	UF.3	2123	1668	3792	433	2	no	1	460
MF.4*	14.5	12	80	UF.4	452	361	812	134	1	no	1	310
MF.45*	16	11	490	UF.5	3795	2209	6004	901	DBL 2	no	1	920
MF.6	9.25	11	230	UF.6	1491	1037	2528	273	1	no	1	310
MF.63	9.5	11	550	UF.5&7	2396	2480	4876	513	3	no	1	600
MF.8.1	7.5	11	420	UF.7&9	2251	1894	4145	553	3	no	1	600
MF.8.2	8.75	11	490	UF.7&9	2626	2209	4835	553	3	no	1	600
MF.10.1	3.25	11	115	UF.9	474	519	993	306	3	yes	0.59	355
MF.10.2	3.25	11	115	UF.9	474	519	993	306	3	yes	0.59	355

Holdowns for Walls in North-South Direction										
Wall	OTM' (lb-ft)	w _{DL} ⁸ (plf)	P _{DL,END} ⁹ (lb)	RM ¹⁰ (lb-ft)	T _{end} ¹¹ (lb)	T _{abv} ¹² (lb)	T ¹³ (lb)	Holdown	Capacity	
MF.2	36455	110	440	5579	2745	811	2745	HDU2	3075	Close enough
MF.3	41707	110	440	3776	4335		5146	HDU2	3075	
MF.4*	9750	120	480	9169	40		40	NONE	#N/A	
MF.45*	66045	110	440	9893	3510		3510	HDU4	4565	
MF.6	27806	110	440	4111	2562		2562	HDU2	3075	
MF.63	53640	80	360	3293	5300		5300	HDU5	5645	
MF.8.1	45591	80	360	2319	5770		5770	HDU5	5645	Close enough
MF.8.2	53189	80	360	2910	5746		5746	HDU5	5645	Close enough
MF.10.1	10922	200	800	1713	2834		2834	HDU2	3075	
MF.10.2	10922	200	800	1713	2834		2834	HDU2	3075	

Walls in East-West Direction												
Wall	L (ft)	h (ft)	A _T (sf)	Wall _{abv} ¹	V _{abv} ² (lbs)	V _{cur} ³ (lbs)	V ⁴ (lb)	v ⁵ (plf)	Wall Mark	h>2L?	2xL/h ⁶	Capacity (plf)
MF.A	28.5	8.5	510	Roof	2304	2300	4604	162	1	no	1	310
MF.B*	29.75	11	620	UF.B	2078	2796	4874	400	2	no	1	460
MF.C*	20	11	900	UF.C	3659	4058	7717	707	4	no	1	770
MF.D.1	2.5	8	230	Roof	1039	1037	2076	830	DBL 4	yes	0.63	963
MF.D.2	2.5	8	230	Roof	1039	1037	2076	830	DBL 4	yes	0.63	963
MF.E	18	11	670	UF.D8	3975	3021	6996	389	2	no	1	460
MF.F	12	11	140	UF.F	316	631	947	79	1	no	1	310
MF.G	6.75	12	90	Roof	407	406	812	120	1	no	1	310
MF.H*	17	11	440	UF.H	2259	1984	4243	1029	DBL 3	no	1	1200
MF.I	11.75	12	110	Roof	497	496	993	85	1	no	1	310

Holdowns for Walls in East-West Direction										
Wall	OTM' (lb-ft)	w _{DL} ⁸ (plf)	P _{DL,END} ⁹ (lb)	RM ¹⁰ (lb-ft)	T _{end} ¹¹ (lb)	T _{abv} ¹² (lb)	T ¹³ (lb)	Holdown	Capacity	
MF.A	39130	390	780	84602	-1596		-1596	NONE	#N/A	
MF.B*	53610	320	640	75248	-727	2408	-727	NONE	#N/A	
MF.C*	84890	320	640	35973	2446		4854	HDU5	5645	Close enough
MF.D.1	16609	390	1560	2398	5684		5684	HDU5	5645	Close enough
MF.D.2	16609	390	1560	2398	5684		5684	HDU5	5645	
MF.E	76961	340	680	31533	2524		2524	HDU2	3075	
MF.F	10422	300	600	13490	-256		-256	NONE	#N/A	
MF.G	9749	260	520	4418	790		790	HDU2	3075	
MF.H*	46670	290	580	24247	1319		1319	HDU2	3075	
MF.I	11915	260	520	11269	55		55	NONE	#N/A	Close enough

Main Floor Diaphragm

Walls in North-South Direction												
Wall	L (ft)	h (ft)	A _T (sf)	Wall _{abv} ¹ (lb-ft)	V _{abv} ² (lbs)	V _{cur} ³ (lbs)	V ⁴ (lb)	v ⁵ (plf)	Wall Mark	h>2L?	2xL/h ⁶	Capacity (plf)
B.63	12.75	9	1020	MF.63	4876	1664	6540	513	3	no	1	600

Holdowns for Walls in North-South Direction									
Wall	OTM' (lb-ft)	w _{DL} ⁸ (plf)	P _{DL,END} ⁹ (lb)	RM ¹⁰ (lb-ft)	T _{end} ¹¹ (lb)	T _{abv} ¹² (lb)	T ¹³ (lb)	Holdown	Capacity
B.63	58863	60	240	3718	4325		4325	HDU4	4565

Walls in East-West Direction												
Wall	L (ft)	h (ft)	A _T (sf)	Wall _{abv} ¹ (lb-ft)	V _{abv} ² (lbs)	V _{cur} ³ (lbs)	V ⁴ (lb)	v ⁵ (plf)	Wall Mark	h>2L?	2xL/h ⁶	Capacity (plf)
B.C	17	9	720	MF.C	7717	1175	8892	523	3	no	1	600
B.E	8.25	9	660	MF.E	6996	1077	8073	979	DBL 3	no	1	1200

Holdowns for Walls in East-West Direction										
Wall	OTM' (lb-ft)	w _{DL} ⁸ (plf)	P _{DL,END} ⁹ (lb)	RM ¹⁰ (lb-ft)	T _{end} ¹¹ (lb)	T _{abv} ¹² (lb)	T ¹³ (lb)	Holdown	Capacity	
B.C	80027	340	680	28427	3035		3035	HDU2	3075	
B.E	72658	340	680	8047	7832		7832	HDU8	7870	

*Shear wall with force-transfer around openings (see additional spreadsheet to follow)



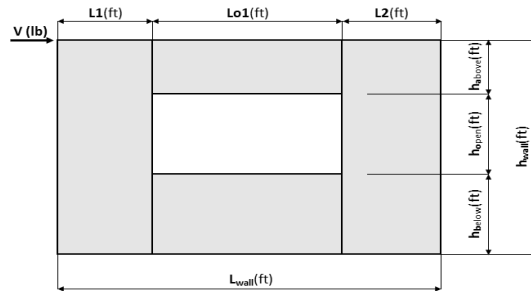
Force Transfer Around Openings Calculator

ONE OPENING

The force transfer around openings (FTAO) method of shear wall analysis is an approach that aims to reinforce the wall such that it performs as if there was no opening. This approach lends certain advantages over segmented shear walls: more versatility, because it allows for narrower wall segments while still meeting the height-to-width ratios and, often, fewer required hold-downs.

Project Information

Code: _____ Date: _____
 Designer: _____
 Client: _____
 Project: _____
 Wall Line: UF.5

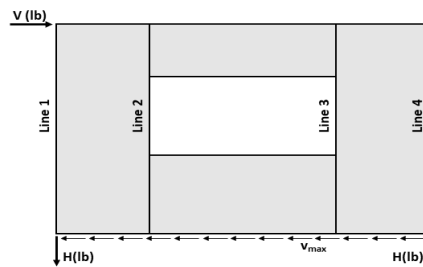


Shear Wall Calculation Variables

V	4879 lbf	Opening 1	Adj. Factor Method =	1.25-0.125h/bs
L1	5.75 ft	ha	Wall Pier Aspect Ratio	Adj. Factor
L2	5.00 ft	ho	P1=ho/L1=	0.78
hwall	9.00 ft	hb	P2=hb/L2=	0.90
Lwall	16.00 ft	Lo1		

- 1. Hold-down forces:** $H = Vh_{wall}/L_{wall} = 2744$ lbf
- 2. Unit shear above + below opening**
 First opening: $va1 = vb1 = H/(h_a+h_b) = 610$ plf
- 3. Total boundary force above + below openings**
 First opening: $O1 = va1 \times (L_{o1}) = 3202$ lbf
- 4. Corner forces**
 $F1 = O1(L1)/(L1+L2) = 1713$ lbf
 $F2 = O1(L2)/(L1+L2) = 1489$ lbf
- 5. Tributary length of openings**
 $T1 = (L1 \times Lo1)/(L1+L2) = 2.81$ ft
 $T2 = (L2 \times Lo1)/(L1+L2) = 2.44$ ft

- 6. Unit shear beside opening**
 $v1 = (V/L)(L1+T1)/L1 = 454$ plf
 $v2 = (V/L)(T2+L2)/L2 = 454$ plf
 Check $v1 \times L1 + v2 \times L2 = V?$ 4879 lbf **OK**
- 7. Resistance to corner forces**
 $R1 = v1 \times L1 = 2610$ lbf
 $R2 = v2 \times L2 = 2269$ lbf
- 8. Difference corner force + resistance**
 $R1-F1 = 897$ lbf
 $R2-F2 = 780$ lbf
- 9. Unit shear in corner zones**
 $vc1 = (R1-F1)/L1 = 156$ plf
 $vc2 = (R2-F2)/L2 = 156$ plf



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H?$		702	2042	2744 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?$	2744	702	2042	0
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?$	2744	702	2042	0
Line 4: $vc2(h_a+h_b)+v2(h_o)=H?$		702	2042	2744 lbf

Design Summary*

Req. Sheathing Capacity	610 plf
Req. Strap Force	1713 lbf
Req. HD Force (H)	2744 lbf
Req. Shear Wall Anchorage Force (v_{max})	305 plf

*The Design Summary assumes that the shear wall is designed as blocked.



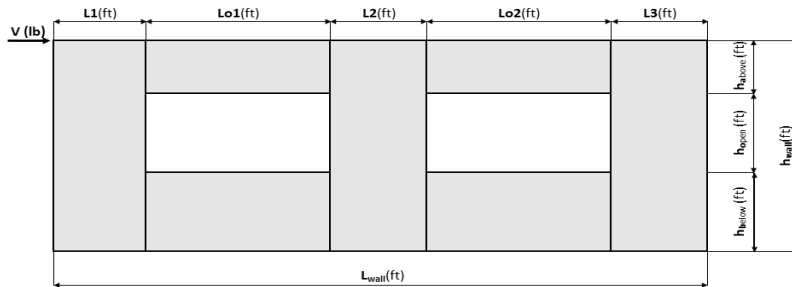
Force Transfer Around Openings Calculator

TWO OPENINGS

The force transfer around openings (FTAO) method of shear wall analysis is an approach that aims to reinforce the wall such that it performs as if there was no opening. This approach lends certain advantages over segmented shear walls: more versatility, because it allows for narrower wall segments while still meeting the height-to-width ratios and, often, fewer required hold-downs.

Project Information

Code: _____ Date: _____
 Designer: _____
 Client: _____
 Project: _____
 Wall Line: UF.7



Shear Wall Calculation Variables

V	5511 lbf	Opening 1		Opening 2		Adj. Factor Method = 1.25-0.125h/bs	
L1	3.25 ft	h _{a1}	1.00 ft	h _{a2}	1.00 ft	Wall Pier Aspect Ratio	Adj. Factor
L2	3.25 ft	h _{o1}	5.00 ft	h _{o2}	5.00 ft	P1=h _o /L1=	1.54
L3	20.50 ft	h _{b1}	3.00 ft	h _{b2}	3.00 ft	P2=h _o /L2=	1.54
h _{wall}	9.00 ft	Lo1	5.25 ft	Lo2	3.50 ft	P3=h _o /L3=	0.24
L _{wall}	35.75 ft						N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ = 1387 lbf

2. Unit shear above + below opening
 First opening: $va1 = vb1 = H/(h_{a1}+h_{b1}) = 347$ plf
 Second opening: $va2 = vb2 = H/(h_{a2}+h_{b2}) = 347$ plf

3. Total boundary force above + below openings
 First opening: $O1 = va1 \times (Lo1) = 1821$ lbf
 Second opening: $O2 = va2 \times (Lo2) = 1214$ lbf

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 911$ lbf
 $F2 = O1(L2)/(L1+L2) = 911$ lbf
 $F3 = O2(L2)/(L2+L3) = 166$ lbf
 $F4 = O2(L3)/(L2+L3) = 1048$ lbf

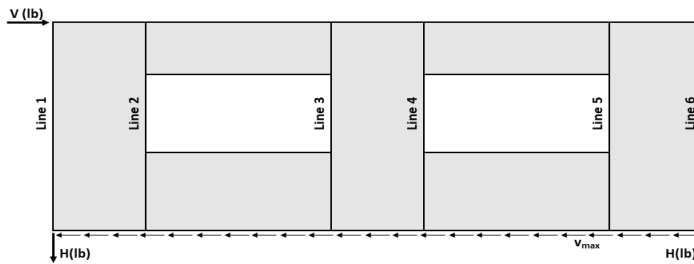
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 2.63$ ft
 $T2 = (L2 \times Lo1)/(L1+L2) = 2.63$ ft
 $T3 = (L2 \times Lo2)/(L2+L3) = 0.48$ ft
 $T4 = (L3 \times Lo2)/(L2+L3) = 3.02$ ft

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 279$ plf
 $v2 = (V/L)(T2+L2+T3)/L2 = 301$ plf
 $v3 = (V/L)(T4+L3)/L3 = 177$ plf
 Check $v1 \times L1 + v2 \times L2 + v3 \times L3 = V?$ = 5511 lbf **OK**

7. Resistance to corner forces
 $R1 = v1 \times L1 = 906$ lbf
 $R2 = v2 \times L2 = 980$ lbf
 $R3 = v3 \times L3 = 3626$ lbf

8. Difference corner force + resistance
 $R1-F1 = -5$ lbf
 $R2-F2-F3 = -97$ lbf
 $R3-F4 = 2578$ lbf

9. Unit shear in corner zones
 $vc1 = (R1-F1)/L1 = -1$ plf
 $vc2 = (R2-F2-F3)/L2 = -30$ plf
 $vc3 = (R3-F4)/L3 = 126$ plf



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_{a1}+h_{b1})+v1(h_{o1})=H?$	-6	1393	1387 lbf
Line 2: $va1(h_{a1}+h_{b1})-vc1(h_{a1}+h_{b1})-v1(h_{o1})=0?$	1387	-6	1393
Line 3: $vc2(h_{a2}+h_{b2})+v2(h_{o2})-va1(h_{a1}+h_{b1})=0?$	-120	1507	1387
Line 4: $va2(h_{a2}+h_{b2})-v2(h_{o2})-vc2(h_{a2}+h_{b2})=0?$	1387	1507	-120
Line 5: $va2(h_{a2}+h_{b2})-vc3(h_{a2}+h_{b2})-v3(h_{o2})=0?$	1387	503	884
Line 6: $vc3(h_{a2}+h_{b2})+v3(h_{o2})=H?$	503	884	1387 lbf

Design Summary*

Req. Sheathing Capacity	347 plf
Req. Strap Force	1048 lbf
Req. HD Force	1387 lbf
Req. Shear Wall Anchorage Force	154 plf

*The Design Summary assumes that the shear wall is designed as blocked.



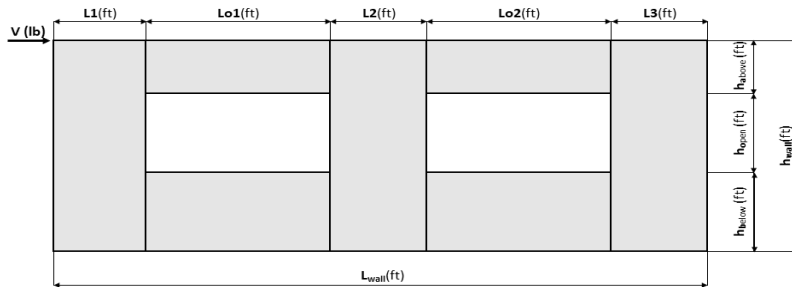
Force Transfer Around Openings Calculator

TWO OPENINGS

The force transfer around openings (FTAO) method of shear wall analysis is an approach that aims to reinforce the wall such that it performs as if there was no opening. This approach lends certain advantages over segmented shear walls: more versatility, because it allows for narrower wall segments while still meeting the height-to-width ratios and, often, fewer required hold-downs.

Project Information

Code: _____ Date: _____
 Designer: _____
 Client: _____
 Project: _____
 Wall Line: UF.B



Shear Wall Calculation Variables

V	2078 lbf	Opening 1		Opening 2		Adj. Factor Method = 1.25-0.125h/bs	
L1	2.50 ft	h _{a1}	2.75 ft	h _{a2}	2.75 ft	Wall Pier Aspect Ratio	Adj. Factor
L2	7.25 ft	h _{o1}	5.00 ft	h _{o2}	5.00 ft	P1=h _o /L1=	2.00
L3	5.75 ft	h _{b1}	3.00 ft	h _{b2}	3.00 ft	P2=h _o /L2=	0.69
h _{wall}	10.75 ft	Lo1	9.50 ft	Lo2	2.50 ft	P3=h _o /L3=	0.87
L _{wall}	27.50 ft						N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ = 812 lbf

2. Unit shear above + below opening
 First opening: $va1 = vb1 = H/(h_{a1}+h_{b1})$ = 141 plf
 Second opening: $va2 = vb2 = H/(h_{a2}+h_{b2})$ = 141 plf

3. Total boundary force above + below openings
 First opening: $O1 = va1 \times (Lo1)$ = 1342 lbf
 Second opening: $O2 = va2 \times (Lo2)$ = 353 lbf

4. Corner forces
 $F1 = O1(L1)/(L1+L2)$ = 344 lbf
 $F2 = O1(L2)/(L1+L2)$ = 998 lbf
 $F3 = O2(L2)/(L2+L3)$ = 197 lbf
 $F4 = O2(L3)/(L2+L3)$ = 156 lbf

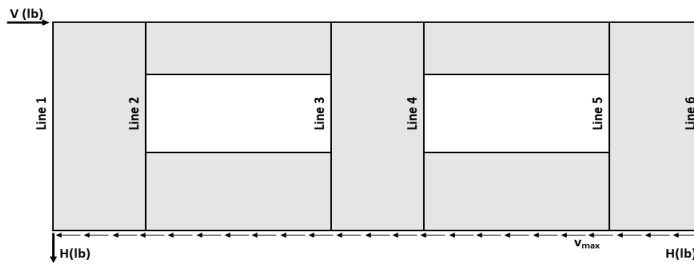
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2)$ = 2.44 ft
 $T2 = (L2 \times Lo1)/(L1+L2)$ = 7.06 ft
 $T3 = (L2 \times Lo2)/(L2+L3)$ = 1.39 ft
 $T4 = (L3 \times Lo2)/(L2+L3)$ = 1.11 ft

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1$ = 149 plf
 $v2 = (V/L)(T2+L2+T3)/L2$ = 164 plf
 $v3 = (V/L)(T4+L3)/L3$ = 90 plf
 Check $v1 \times L1 + v2 \times L2 + v3 \times L3 = V?$ = 2078 lbf **OK**

7. Resistance to corner forces
 $R1 = v1 \times L1$ = 373 lbf
 $R2 = v2 \times L2$ = 1187 lbf
 $R3 = v3 \times L3$ = 518 lbf

8. Difference corner force + resistance
 $R1 - F1$ = 29 lbf
 $R2 - F2 - F3$ = -8 lbf
 $R3 - F4$ = 362 lbf

9. Unit shear in corner zones
 $vc1 = (R1 - F1)/L1$ = 12 plf
 $vc2 = (R2 - F2 - F3)/L2$ = -1 plf
 $vc3 = (R3 - F4)/L3$ = 63 plf



Check Summary of Shear Values for Two Openings

Line 1: $vc1(h_{a1}+h_{b1})+v1(h_{o1})=H?$	66	746	812 lbf
Line 2: $va1(h_{a1}+h_{b1})-vc1(h_{a1}+h_{b1})-v1(h_{o1})=0?$	812	66	0
Line 3: $vc2(h_{a2}+h_{b2})+v2(h_{o2})-va1(h_{a1}+h_{b1})=0?$	-6	819	0
Line 4: $va2(h_{a2}+h_{b2})-v2(h_{o2})-vc2(h_{a2}+h_{b2})=0?$	812	819	0
Line 5: $va2(h_{a2}+h_{b2})-vc3(h_{a2}+h_{b2})-v3(h_{o2})=0?$	812	362	0
Line 6: $vc3(h_{a2}+h_{b2})+v3(h_{o2})=H?$	362	450	812 lbf

Design Summary*

Req. Sheathing Capacity	164 plf
Req. Strap Force	998 lbf
Req. HD Force	812 lbf
Req. Shear Wall Anchorage Force	76 plf

*The Design Summary assumes that the shear wall is designed as blocked.



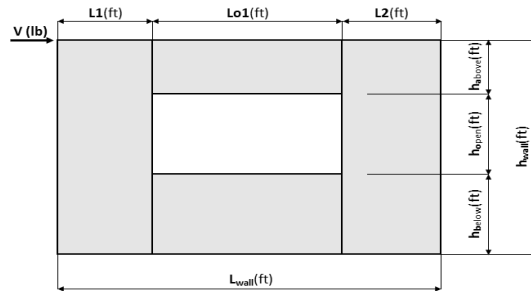
Force Transfer Around Openings Calculator

ONE OPENING

The force transfer around openings (FTAO) method of shear wall analysis is an approach that aims to reinforce the wall such that it performs as if there was no opening. This approach lends certain advantages over segmented shear walls: more versatility, because it allows for narrower wall segments while still meeting the height-to-width ratios and, often, fewer required hold-downs.

Project Information

Code: _____ Date: _____
 Designer: _____
 Client: _____
 Project: _____
 Wall Line: U.F.C

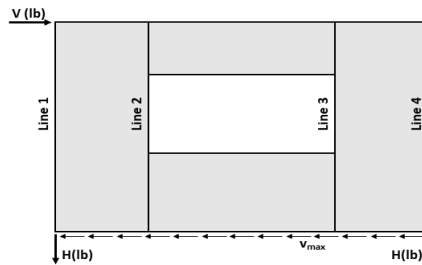


Shear Wall Calculation Variables

V	3659 lbf	Opening 1	Adj. Factor Method =	1.25-0.125h/bs
L1	2.00 ft	ha	Wall Pier Aspect Ratio	Adj. Factor
L2	4.50 ft	ho	P1=ha/L1=	2.25
hwall	9.00 ft	hb	P2=hb/L2=	1.00
Lwall	10.00 ft	Lo1		N/A

- 1. Hold-down forces: $H = Vh_{wall}/L_{wall}$** 3293 lbf
- 2. Unit shear above + below opening**
 First opening: $va1 = vb1 = H/(h_a+h_b) =$ 732 plf
- 3. Total boundary force above + below openings**
 First opening: $O1 = va1 \times (Lo1) =$ 2561 lbf
- 4. Corner forces**
 $F1 = O1(L1)/(L1+L2) =$ 788 lbf
 $F2 = O1(L2)/(L1+L2) =$ 1773 lbf
- 5. Tributary length of openings**
 $T1 = (L1*Lo1)/(L1+L2) =$ 1.08 ft
 $T2 = (L2*Lo1)/(L1+L2) =$ 2.42 ft

- 6. Unit shear beside opening**
 $v1 = (V/L)(L1+T1)/L1 =$ 563 plf
 $v2 = (V/L)(T2+L2)/L2 =$ 563 plf
 Check $v1*L1+v2*L2=V?$ 3659 lbf **OK**
- 7. Resistance to corner forces**
 $R1 = v1*L1 =$ 1126 lbf
 $R2 = v2*L2 =$ 2533 lbf
- 8. Difference corner force + resistance**
 $R1-F1 =$ 338 lbf
 $R2-F2 =$ 760 lbf
- 9. Unit shear in corner zones**
 $vc1 = (R1-F1)/L1 =$ 169 plf
 $vc2 = (R2-F2)/L2 =$ 169 plf



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H?$		760	2533	3293 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?$	3293	760	2533	0
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?$	3293	760	2533	0
Line 4: $vc2(h_a+h_b)+v2(h_o)=H?$		760	2533	3293 lbf

Design Summary*

Req. Sheathing Capacity	732 plf
Req. Strap Force	1773 lbf
Req. HD Force (H)	3293 lbf
Req. Shear Wall Anchorage Force (v_{max})	366 plf

*The Design Summary assumes that the shear wall is designed as blocked.



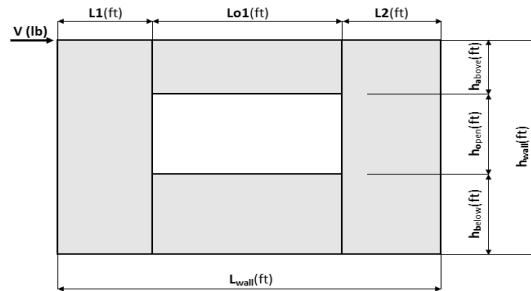
Force Transfer Around Openings Calculator

ONE OPENING

The force transfer around openings (FTAO) method of shear wall analysis is an approach that aims to reinforce the wall such that it performs as if there was no opening. This approach lends certain advantages over segmented shear walls: more versatility, because it allows for narrower wall segments while still meeting the height-to-width ratios and, often, fewer required hold-downs.

Project Information

Code: _____ Date: _____
 Designer: _____
 Client: _____
 Project: _____
 Wall Line: UF.H

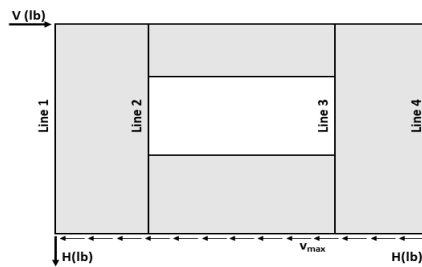


Shear Wall Calculation Variables

V	2259 lbf	Opening 1	Adj. Factor Method = 1.25-0.125h/bs
L1	2.50 ft	h _a	Wall Pier Aspect Ratio
L2	6.25 ft	h _o	Adj. Factor
h _{wall}	12.25 ft	h _b	P1=h _o /L1= 0.80
L _{wall}	15.25 ft	L _{o1}	P2=h _o /L2= 0.32

- Hold-down forces:** $H = Vh_{wall}/L_{wall} = 1814$ lbf
- Unit shear above + below opening**
 First opening: $va1 = vb1 = H/(h_a+h_b) = 177$ plf
- Total boundary force above + below openings**
 First opening: $O1 = va1 \times (L_{o1}) = 1151$ lbf
- Corner forces**
 $F1 = O1(L1)/(L1+L2) = 329$ lbf
 $F2 = O1(L2)/(L1+L2) = 822$ lbf
- Tributary length of openings**
 $T1 = (L1 \times L_{o1})/(L1+L2) = 1.86$ ft
 $T2 = (L2 \times L_{o1})/(L1+L2) = 4.64$ ft

- Unit shear beside opening**
 $v1 = (V/L)(L1+T1)/L1 = 258$ plf
 $v2 = (V/L)(T2+L2)/L2 = 258$ plf
 Check $v1 \times L1 + v2 \times L2 = V?$ 2259 lbf **OK**
- Resistance to corner forces**
 $R1 = v1 \times L1 = 645$ lbf
 $R2 = v2 \times L2 = 1613$ lbf
- Difference corner force + resistance**
 $R1-F1 = 317$ lbf
 $R2-F2 = 792$ lbf
- Unit shear in corner zones**
 $vc1 = (R1-F1)/L1 = 127$ plf
 $vc2 = (R2-F2)/L2 = 127$ plf



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H?$		1298	516	1814 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?$	1814	1298	516	0
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?$	1814	1298	516	0
Line 4: $vc2(h_a+h_b)+v2(h_o)=H?$		1298	516	1814 lbf

Design Summary*

Req. Sheathing Capacity	258 plf
Req. Strap Force	822 lbf
Req. HD Force (H)	1814 lbf
Req. Shear Wall Anchorage Force (v _{max})	148 plf

*The Design Summary assumes that the shear wall is designed as blocked.



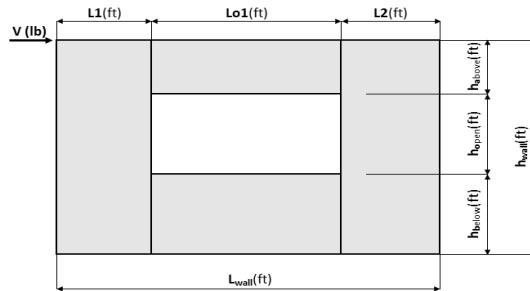
Force Transfer Around Openings Calculator

ONE OPENING

The force transfer around openings (FTAO) method of shear wall analysis is an approach that aims to reinforce the wall such that it performs as if there was no opening. This approach lends certain advantages over segmented shear walls: more versatility, because it allows for narrower wall segments while still meeting the height-to-width ratios and, often, fewer required hold-downs.

Project Information

Code: _____ Date: _____
 Designer: _____
 Client: _____
 Project: _____
 Wall Line: MF.4



Shear Wall Calculation Variables

V	812 lbf	Opening 1	Adj. Factor Method = 1.25-0.125h/bs
L1	3.50 ft	h _a	2.00 ft
L2	3.50 ft	h _o	7.00 ft
h _{wall}	12.00 ft	h _b	3.00 ft
L _{wall}	14.50 ft	Lo1	7.50 ft
			Wall Pier Aspect Ratio
			Adj. Factor
			P1=h _o /L1= 2.00
			N/A
			P2=h _o /L2= 2.00
			N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall} = 672 \text{ lbf}$

2. Unit shear above + below opening
 First opening: $va1 = vb1 = H/(h_a+h_b) = 134 \text{ plf}$

3. Total boundary force above + below openings
 First opening: $O1 = va1 \times (Lo1) = 1009 \text{ lbf}$

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 504 \text{ lbf}$
 $F2 = O1(L2)/(L1+L2) = 504 \text{ lbf}$

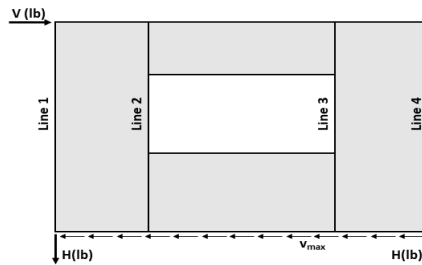
5. Tributary length of openings
 $T1 = (L1*Lo1)/(L1+L2) = 3.75 \text{ ft}$
 $T2 = (L2*Lo1)/(L1+L2) = 3.75 \text{ ft}$

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 116 \text{ plf}$
 $v2 = (V/L)(T2+L2)/L2 = 116 \text{ plf}$
 Check $v1*L1+v2*L2=V?$ **812 lbf OK**

7. Resistance to corner forces
 $R1 = v1*L1 = 406 \text{ lbf}$
 $R2 = v2*L2 = 406 \text{ lbf}$

8. Difference corner force + resistance
 $R1-F1 = -98 \text{ lbf}$
 $R2-F2 = -98 \text{ lbf}$

9. Unit shear in corner zones
 $vc1 = (R1-F1)/L1 = -28 \text{ plf}$
 $vc2 = (R2-F2)/L2 = -28 \text{ plf}$



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H?$		-140	812	672 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?$	672	-140	812	0
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?$	672	-140	812	0
Line 4: $vc2(h_a+h_b)+v2(h_o)=H?$		-140	812	672 lbf

Design Summary*

Req. Sheathing Capacity	134 plf
Req. Strap Force	504 lbf
Req. HD Force (H)	672 lbf
Req. Shear Wall Anchorage Force (v _{max})	56 plf

*The Design Summary assumes that the shear wall is designed as blocked.



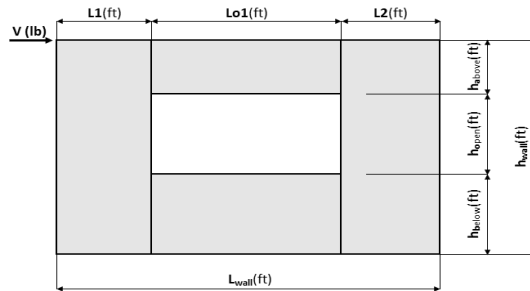
Force Transfer Around Openings Calculator

ONE OPENING

The force transfer around openings (FTAO) method of shear wall analysis is an approach that aims to reinforce the wall such that it performs as if there was no opening. This approach lends certain advantages over segmented shear walls: more versatility, because it allows for narrower wall segments while still meeting the height-to-width ratios and, often, fewer required hold-downs.

Project Information

Code: _____ Date: _____
 Designer: _____
 Client: _____
 Project: _____
 Wall Line: MF.45



Shear Wall Calculation Variables

V	6004 lbf	Opening 1	Adj. Factor Method = 1.25-0.125h/bs
L1	4.25 ft	ha	Wall Pier Aspect Ratio
L2	4.25 ft	ho	P1=ha/L1= 1.65
hwall	12.00 ft	hb	P2=hb/L2= 1.65
Lwall	16.00 ft	Lo1	Adj. Factor
			N/A
			N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ = 4503 lbf

2. Unit shear above + below opening
 First opening: $va1 = vb1 = H/(h_a+h_b) = 901$ plf

3. Total boundary force above + below openings
 First opening: $O1 = va1 \times (Lo1) = 6755$ lbf

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 3377$ lbf
 $F2 = O1(L2)/(L1+L2) = 3377$ lbf

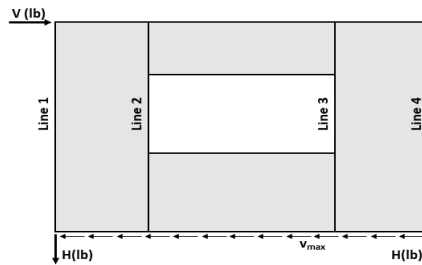
5. Tributary length of openings
 $T1 = (L1*Lo1)/(L1+L2) = 3.75$ ft
 $T2 = (L2*Lo1)/(L1+L2) = 3.75$ ft

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 706$ plf
 $v2 = (V/L)(T2+L2)/L2 = 706$ plf
 Check $v1*L1+v2*L2=V?$ = 6004 lbf **OK**

7. Resistance to corner forces
 $R1 = v1*L1 = 3002$ lbf
 $R2 = v2*L2 = 3002$ lbf

8. Difference corner force + resistance
 $R1-F1 = -375$ lbf
 $R2-F2 = -375$ lbf

9. Unit shear in corner zones
 $vc1 = (R1-F1)/L1 = -88$ plf
 $vc2 = (R2-F2)/L2 = -88$ plf



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H?$		-441	4945	4503 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?$	4503	-441	4945	0
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?$	4503	-441	4945	0
Line 4: $vc2(h_a+h_b)+v2(h_o)=H?$		-441	4945	4503 lbf

Design Summary*

Req. Sheathing Capacity	901 plf
Req. Strap Force	3377 lbf
Req. HD Force (H)	4503 lbf
Req. Shear Wall Anchorage Force (v_{max})	375 plf

*The Design Summary assumes that the shear wall is designed as blocked.



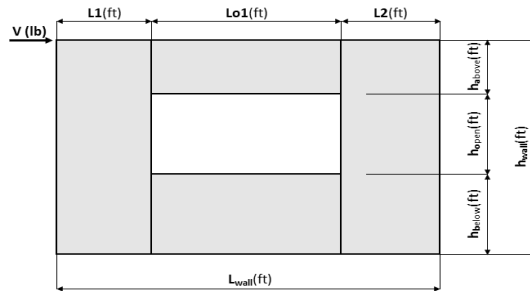
Force Transfer Around Openings Calculator

ONE OPENING

The force transfer around openings (FTAO) method of shear wall analysis is an approach that aims to reinforce the wall such that it performs as if there was no opening. This approach lends certain advantages over segmented shear walls: more versatility, because it allows for narrower wall segments while still meeting the height-to-width ratios and, often, fewer required hold-downs.

Project Information

Code: _____ Date: _____
 Designer: _____
 Client: _____
 Project: _____
 Wall Line: MF.B

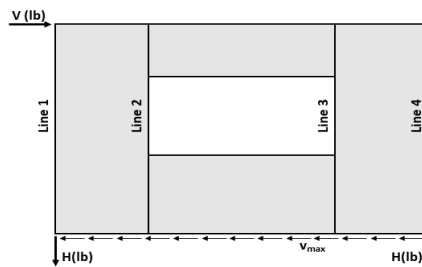


Shear Wall Calculation Variables

V	4874 lbf	Opening 1	Adj. Factor Method =	1.25-0.125h/bs	
L1	19.25 ft	ha	Wall Pier Aspect Ratio	Adj. Factor	
L2	8.00 ft	ho	P1=ha/L1=	0.34	N/A
hwall	11.00 ft	hb	P2=hb/L2=	0.81	N/A
Lwall	29.75 ft	Lo1			

- 1. Hold-down forces:** $H = Vh_{wall}/L_{wall}$ = 1802 lbf
- 2. Unit shear above + below opening**
 First opening: $va1 = vb1 = H/(h_a+h_b) = 400$ plf
- 3. Total boundary force above + below openings**
 First opening: $O1 = va1 \times (L_{o1}) = 1001$ lbf
- 4. Corner forces**
 $F1 = O1(L1)/(L1+L2) = 707$ lbf
 $F2 = O1(L2)/(L1+L2) = 294$ lbf
- 5. Tributary length of openings**
 $T1 = (L1*Lo1)/(L1+L2) = 1.77$ ft
 $T2 = (L2*Lo1)/(L1+L2) = 0.73$ ft

- 6. Unit shear beside opening**
 $v1 = (V/L)(L1+T1)/L1 = 179$ plf
 $v2 = (V/L)(T2+L2)/L2 = 179$ plf
 Check $v1*L1+v2*L2=V?$ = 4874 lbf **OK**
- 7. Resistance to corner forces**
 $R1 = v1*L1 = 3443$ lbf
 $R2 = v2*L2 = 1431$ lbf
- 8. Difference corner force + resistance**
 $R1-F1 = 2736$ lbf
 $R2-F2 = 1137$ lbf
- 9. Unit shear in corner zones**
 $vc1 = (R1-F1)/L1 = 142$ plf
 $vc2 = (R2-F2)/L2 = 142$ plf



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H?$	640	1163	1802 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?$	1802	640	1163
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?$	1802	640	1163
Line 4: $vc2(h_a+h_b)+v2(h_o)=H?$	640	1163	1802 lbf

Design Summary*

Req. Sheathing Capacity	400 plf
Req. Strap Force	707 lbf
Req. HD Force (H)	1802 lbf
Req. Shear Wall Anchorage Force (v_{max})	164 plf

*The Design Summary assumes that the shear wall is designed as blocked.



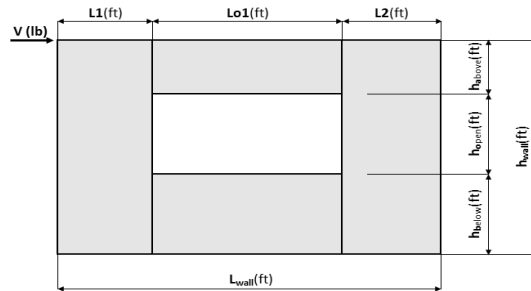
Force Transfer Around Openings Calculator

ONE OPENING

The force transfer around openings (FTAO) method of shear wall analysis is an approach that aims to reinforce the wall such that it performs as if there was no opening. This approach lends certain advantages over segmented shear walls: more versatility, because it allows for narrower wall segments while still meeting the height-to-width ratios and, often, fewer required hold-downs.

Project Information

Code: _____ Date: _____
 Designer: _____
 Client: _____
 Project: _____
 Wall Line: M.F.C

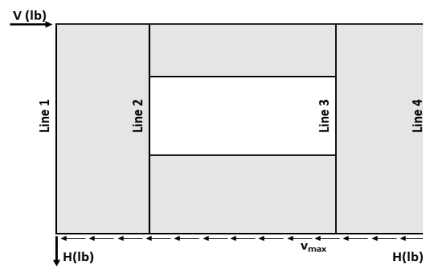


Shear Wall Calculation Variables

V	7717 lbf	Opening 1	Adj. Factor Method =	1.25-0.125h/bs
L1	14.50 ft	ha	Wall Pier Aspect Ratio	Adj. Factor
L2	2.00 ft	ho	P1=ha/L1=	0.34
hwall	11.00 ft	hb	P2=hb/L2=	2.50
Lwall	20.00 ft	Lo1		0.938

- Hold-down forces:** $H = Vh_{wall}/L_{wall} = 4245$ lbf
- Unit shear above + below opening**
 First opening: $va1 = vb1 = H/(h_a+h_b) = 707$ plf
- Total boundary force above + below openings**
 First opening: $O1 = va1 \times (L_{o1}) = 2476$ lbf
- Corner forces**
 $F1 = O1(L1)/(L1+L2) = 2176$ lbf
 $F2 = O1(L2)/(L1+L2) = 300$ lbf
- Tributary length of openings**
 $T1 = (L1*Lo1)/(L1+L2) = 3.08$ ft
 $T2 = (L2*Lo1)/(L1+L2) = 0.42$ ft

- Unit shear beside opening**
 $v1 = (V/L)(L1+T1)/L1 = 468$ plf
 $v2 = (V/L)(T2+L2)/L2 = 468$ plf
 Check $v1*L1+v2*L2=V?$ 7717 lbf **OK**
- Resistance to corner forces**
 $R1 = v1*L1 = 6782$ lbf
 $R2 = v2*L2 = 935$ lbf
- Difference corner force + resistance**
 $R1-F1 = 4606$ lbf
 $R2-F2 = 635$ lbf
- Unit shear in corner zones**
 $vc1 = (R1-F1)/L1 = 318$ plf
 $vc2 = (R2-F2)/L2 = 318$ plf



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H?$		1906	2339	4245 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?$	4245	1906	2339	0
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?$	4245	1906	2339	0
Line 4: $vc2(h_a+h_b)+v2(h_o)=H?$		1906	2339	4245 lbf

Design Summary*

Req. Sheathing Capacity	707 plf
Req. Strap Force	2176 lbf
Req. HD Force (H)	4245 lbf
Req. Shear Wall Anchorage Force (v_{max})	386 plf

*The Design Summary assumes that the shear wall is designed as blocked.



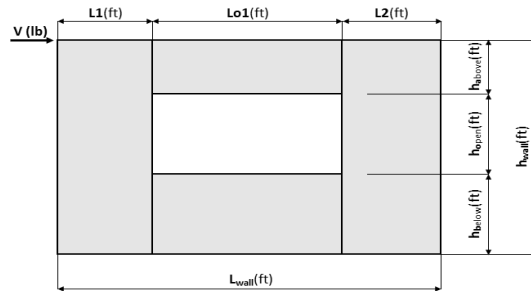
Force Transfer Around Openings Calculator

ONE OPENING

The force transfer around openings (FTAO) method of shear wall analysis is an approach that aims to reinforce the wall such that it performs as if there was no opening. This approach lends certain advantages over segmented shear walls: more versatility, because it allows for narrower wall segments while still meeting the height-to-width ratios and, often, fewer required hold-downs.

Project Information

Code: _____ Date: _____
 Designer: _____
 Client: _____
 Project: _____
 Wall Line: MF.H

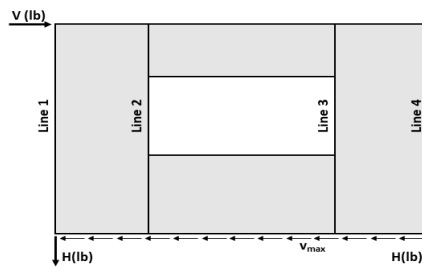


Shear Wall Calculation Variables

V	7717 lbf	Opening 1	Adj. Factor Method =	1.25-0.125h/bs
L1	4.00 ft	ha	Wall Pier Aspect Ratio	Adj. Factor
L2	3.50 ft	ho	P1=ha/L1=	1.13
hwall	11.00 ft	hb	P2=hb/L2=	1.29
Lwall	15.50 ft	Lo1		

- Hold-down forces:** $H = Vh_{wall}/L_{wall} = 5477$ lbf
- Unit shear above + below opening**
 First opening: $va1 = vb1 = H/(h_a+h_b) = 843$ plf
- Total boundary force above + below openings**
 First opening: $O1 = va1 \times (L_{o1}) = 6741$ lbf
- Corner forces**
 $F1 = O1(L1)/(L1+L2) = 3595$ lbf
 $F2 = O1(L2)/(L1+L2) = 3146$ lbf
- Tributary length of openings**
 $T1 = (L1*Lo1)/(L1+L2) = 4.27$ ft
 $T2 = (L2*Lo1)/(L1+L2) = 3.73$ ft

- Unit shear beside opening**
 $v1 = (V/L)(L1+T1)/L1 = 1029$ plf
 $v2 = (V/L)(T2+L2)/L2 = 1029$ plf
 Check $v1*L1+v2*L2=V?$ 7717 lbf **OK**
- Resistance to corner forces**
 $R1 = v1*L1 = 4116$ lbf
 $R2 = v2*L2 = 3601$ lbf
- Difference corner force + resistance**
 $R1-F1 = 521$ lbf
 $R2-F2 = 456$ lbf
- Unit shear in corner zones**
 $vc1 = (R1-F1)/L1 = 130$ plf
 $vc2 = (R2-F2)/L2 = 130$ plf



Check Summary of Shear Values for One Opening

Line 1: $vc1(h_a+h_b)+v1(h_o)=H?$		846	4630	5477 lbf
Line 2: $va1(h_a+h_b)-vc1(h_a+h_b)-v1(h_o)=0?$	5477	846	4630	0
Line 3: $va1(h_a+h_b)-vc2(h_a+h_b)-v1(h_o)=0?$	5477	846	4630	0
Line 4: $vc2(h_a+h_b)+v2(h_o)=H?$		846	4630	5477 lbf

Design Summary*

Req. Sheathing Capacity	1029 plf
Req. Strap Force	3595 lbf
Req. HD Force (H)	5477 lbf
Req. Shear Wall Anchorage Force (v_{max})	498 plf

*The Design Summary assumes that the shear wall is designed as blocked.