Structural Calculations

for

ADDITIONS & ALTERATIONS

Pierce Residence

5635 84th Ave SE

Mercer Island, WA 98040

PERMIT SUBMITTAL

prepared by:

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Job No. 21031

Date: 12/13/21

Date: 12/13/2021
Job # 21031

Vertical Design Loads

Existing Roof		
Roofing	3	psf
Sheathing	2	
2x4 @24"o.c.	0.6	
Insulation	0.2	
Sum	5.8	psf
Slope:	5	:12
Slope Correction Factor	1.08	
Subtotal	6.3	psf
M/E/P/misc.	1.7	psf
DL=	8	psf
SL=	25	psf
RLL=	20	psf

Upper Addition Roof		
Roofing	3	psf
5/8" Plywood	2	
2x6 @24"o.c.	0.9	
Insulation	0.2	
Sum	6.1	psf
Slope:	5	:12
Slope Correction Factor	1.08	
Subtotal	6.6	psf
M/E/P/misc.	1.4	psf
DL=	8	psf
SL=	25	psf
RLL=	20	psf

Lower Addition Roof		
Roofing	3	psf
5/8" Plywood	2	
2x8 @24"o.c.	1.2	
Insulation	0.4	
5/8" Gypsum Board	2.8	
Sum	9.4	psf
Slope:	5	:12
Slope Correction Factor	1.08	
Subtotal	10.2	psf
M/E/P/misc.	2.8	psf
DL=	13	psf
SL=	25	psf
RLL=	20	psf

Outdoor Roof		
Roofing	3	psf
5/8" Plywood	2	
2x8 @24"o.c.	1.2	
Sum	6.2	psf
Slope:	5	:12
Slope Correction Factor	1.08	
Subtotal	6.7	psf
M/E/P/misc.	6.3	psf
DL=	13	psf
SL=	25	psf
RLL=	20	psf

Attic			
2x4 @16"o.c.	0.9		
Insulation	0.2		
5/8" Gypsum Board	2.8		
M/E/P/misc.	2.1		
DL=	6	psf	
LL=	20	psf	*Limited Storage*

Upper Floor			
Flooring	4	psf	
Subfloor	2		
Joists	2.3		
5/8" Gypsum Board	2.8		
M/E/P/misc.	1.9		
DL=	13	psf	
LL=	40	psf	*Living Areas*

Existing Main Floor			
Flooring	4	psf	
2x Car Decking	4		
4x10 @5'-0"o.c.	1.4		
Batt Insulation	0.4		
M/E/P/misc.	2.2		
DL=	12	psf	
LL=	40	psf	*Living Areas*

Addition Main Floor			
Flooring	4	psf	
3/4" Plywood	2.4		
2x8 @16"o.c.	1.8		
Batt Insulation	0.3		
M/E/P/misc.	1.5		
DL=	10	psf	
LL=	40	psf	*Living Areas*

Outdoor Deck		
Tile & Mortar Bed	20	psf
3/4" Plywood	2.4	
2x10 @16"o.c.	2.3	
M/E/P/misc.	5.3	
DL=	30	psf
LL=	60	psf

Decks

Existing Wood Exterior Walls		
Wood Siding	2	psf
Sheathing	2	
2x4 @16"o.c.	0.9	
Batt Insulation	0.2	
1/2" Gypsum Board	2.2	
M/E/P/misc.	2.7	
DL=	10	psf

Existing Brick Exterior Walls		
Brick Siding	39	psf
Sheathing	1.6	
Studs	1.4	
Batt Insulation	0.2	
1/2" Gypsum Board	2.2	
M/E/P/misc.	3.6	
DL=	48	psf

Addition Exterior Walls		
Wood Siding	2	psf
1/2" Plywood	1.6	
2x6 @16"o.c.	1.4	
Batt Insulation	0.2	
1/2" Gypsum Board	2.2	
M/E/P/misc.	2.6	
DL=	10	psf

Interior Walls		
2 Layers 1/2" Gypsum Board	4.4	psf
2x4 @16"o.c.	0.9	
M/E/P/misc.	1.7	
DL=	7	psf

Date: 12/13/2021
Job # 21031

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 =	20	
x =	0.75	
T =	0.19	s

Seismic Response Coefficient

S_s =	1.46	
S_1 =	0.51	
S_{ds} =	1.17	
S_{d1} =	0.51	
R =	6.5	
ρ =	1.3	
Ω =	2.5	
C_d =	4	
I_e =	1	

$C_s = S_{ds}/(R/I_e)$ = 0.18 W

T_L = 6 s > T

$C_{s,max} = S_{d1}/[T(R/I_e)]$ = 0.41

$C_{s,min} = 0.044 S_{ds} I_e$ = 0.051

$C_{s,min}$ = 0.01

S_1 < 0.6

$C_{s,min} = 0.5 S_1/(R/I_e)$ = 0.039 **Ignore**

$C_{s,min,gov}$ = 0.051

$C_{s,gov}$ = 0.18 (LRFD)

Effective Seismic Weight				
Floor	Area (sf)	w_{floor} (psf)	w_{walls} (psf)[1]	W (lbs)
Roof/Attic	2480	14	10	59520
UF/LR	3080	13	25	117040
			Sum:	**176560 lbs**

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

Base Shear (includes ρ) - LRFD Level			
$\rho V = \rho C_s W$ =	0.234	W =	**41315 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/Attic	59520	20	1190400	0.53	**21919**	**8.8**
UF/LR	117040	9	1053360	0.47	**19396**	**6.3**
		Sum:	2243760		41315	

Where k = 1

Diaphragm Forces (ASCE 7-16 Section 12.10.1.1) - LRFD Level						
Floor	F_i (lbs)	$\sum F_i$	W_i (lbs)	$\sum W_i$	$\sum F_i / \sum W_i$	F_{px} (lbs)
Roof/Attic	16861	16861	59520	59520	0.28	16861
UF/LR	14920	31781	117040	176560	0.18	21067

Floor	F_{px} Min (lbs)	F_{px} Max (lbs)	F_{px} Gov (lbs)	F_{px} Gov (psf)
Roof/Attic	9749	19499	**16861**	**6.8**
UF/LR	19171	38342	**21067**	**6.8**

Hazards by Location

Search Information

Address: 5635 84th Ave SE, Mercer Island, WA 98040, USA

Coordinates: 47.5522457, -122.2273405

Elevation: 263 ft

Timestamp: 2021-07-25T19:42:48.994Z

Hazard Type: Seismic

Reference Document: ASCE7-16

Risk Category: II

Site Class: D-default

Basic Parameters

Name	Value	Description
S_S	1.458	MCE_R ground motion (period=0.2s)
S_1	0.506	MCE_R ground motion (period=1.0s)
S_{MS}	1.749	Site-modified spectral acceleration value
S_{M1}	* null	Site-modified spectral acceleration value
S_{DS}	1.166	Numeric seismic design value at 0.2s SA
S_{D1}	* null	Numeric seismic design value at 1.0s SA

* See Section 11.4.8

Additional Information

Name	Value	Description
SDC	* null	Seismic design category
F_a	1.2	Site amplification factor at 0.2s
F_v	* null	Site amplification factor at 1.0s
CR_S	0.902	Coefficient of risk (0.2s)
CR_1	0.898	Coefficient of risk (1.0s)
PGA	0.624	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.749	Site modified peak ground acceleration
T_L	6	Long-period transition period (s)
SsRT	1.458	Probabilistic risk-targeted ground motion (0.2s)
SsUH	1.616	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	4.188	Factored deterministic acceleration value (0.2s)
S1RT	0.506	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.563	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	1.625	Factored deterministic acceleration value (1.0s)
PGAd	1.402	Factored deterministic acceleration value (PGA)

* See Section 11.4.8

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard loads are provided by the U.S. Geological Survey Seismic Design Web Services.

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

Project File: 21031_Pierce.ec6

LIC# : KW-06015519, Build:20.21.10.27 O.G. Engineering, PLLC (c) ENERCALC INC 1983-2021

DESCRIPTION: 5635 84th Ave SE

5635 84th Ave SE

Basic Values

Risk Category	2 per ASCE 7-16 Table 1.5-1	Horizontal Dim. in North-South Direction (B or L)	78.0 ft
V : Basic Wind Speed	98.0	Horizontal Dim. in East-West Direction (B or L)	58.0 ft
Kd : Directionality Factor	0.850 per ASCE 7-16 Table 26.6-1	h : Mean Roof height =	20.0 ft

Exposure Category per ASCE 7-16 Section 26.7

North : Exposure C East : Exposure C
South : Exposure C West : Exposure C

Topographic Factor per ASCE 7-16 Sec 26.8 & Figure 26.8-1

North :	K1 =	0.2650	K2 =	1.0	K3 =	1.0	Kzt =	1.600
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	20.00	11.00	0.000	0.000
Upper	9.00	9.00	0.000	0.000

Gust Factor

For wind coming from direction indicated

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

Enclosure

Check if Building Qualifies as "Ope

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

All four Agross values must be non-zero **Building does NOT qualify as "Open"**

User has specified the Building is to be considered Enclosed when NORTH elevation receives positi

User has specified the Building is to be considered Enclosed when SOUTH elevation receives positi

User has specified the Building is to be considered Enclosed when EAST elevation receives positive

User has specified the Building is to be considered Enclosed when WEST elevation receives positive

Velocity Pressures

When the following walls experience leeward or sidewall pressures, the value of Kh shall be (per Table 2

North Wall = 0.9019 psf South Wall = 0.9019 psf East Wall = 0.9019 psf West Wall = 0.9019 psf

When the following walls experience leeward or sidewall pressures, the value of qh shall be (per Table 2

North Wall = 30.161 psf South Wall = 30.161 psf East Wall = 30.161 psf West Wall = 30.161 psf

qz : Windward Wall Velocity Pressures at various heights per Eq. 26.10

Height Above Base (ft)	North Elevation Kz	North Elevation qz	South Elevation Kz	South Elevation qz	East Elevation Kz	East Elevation qz	West Elevation Kz	West Elevation 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

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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

Pressure Coefficients

GCpi Values when elevation receives positive external press

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

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	-18.247 psf	-7.389 psf
Side Wall Pressures	-23.375 psf	-12.517 psf

Windward Wall Pressures . . Height Above Base (ft)	Positive Internal Pressure (psf)	Negative Internal Pressure (psf)
0.00	13.88	24.73
4.00	13.88	24.73
8.00	13.88	24.73
12.00	13.88	24.73
16.00	14.14	25.00
20.00	15.08	25.94

Wind Pressures when SOUTH Elevation receives positive external wind pressure

	Positive Internal	Negative Internal
Leeward Wall Pressures	-18.247 psf	-7.389 psf
Side Wall Pressures	-23.375 psf	-12.517 psf

Windward Wall Pressures . . Height Above Base (ft)	Positive Internal Pressure (psf)	Negative Internal Pressure (psf)
0.00	13.88	24.73
4.00	13.88	24.73
8.00	13.88	24.73
12.00	13.88	24.73
16.00	14.14	25.00
20.00	15.08	25.94

Wind Pressures when EAST Elevation receives positive external wind pressure

	Positive Internal	Negative Internal
Leeward Wall Pressures	-18.247 psf	-7.389 psf
Side Wall Pressures	-23.375 psf	-12.517 psf

Windward Wall Pressures . . Height Above Base (ft)	Positive Internal Pressure (psf)	Negative Internal Pressure (psf)
0.00	13.88	24.73
4.00	13.88	24.73
8.00	13.88	24.73

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

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DESCRIPTION: 5635 84th Ave SE

12.00	13.88	24.73
16.00	14.14	25.00
20.00	15.08	25.94

Wind Pressures when WEST Elevation receives positive external wind pressure

	Positive Internal	Negative Internal
Leeward Wall Pressures	-18.247 psf	-7.389 psf
Side Wall Pressures	-23.375 psf	-12.517 psf

Windward Wall Pressures . . Height Above Base (ft)	Positive Internal Pressure (psf)	Negative Internal Pressure (psf)
0.00	13.88	24.73
4.00	13.88	24.73
8.00	13.88	24.73
12.00	13.88	24.73
16.00	14.14	25.00
20.00	15.08	25.94

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 Valu

Load Case	Windward Wall	Building level	Ht. Range	Trib. Height	Wind Shear Components (k) In "Y" Direction	In "X" Direction	Eccentricity for (ft) "Y" Shear	"X" Shear	Mt, (ft-k)
CASE 1	North	Level 2	14.50' -> 20.0	5.50	-10.43	---	---	---	---
CASE 1	North	Level 1	4.50' -> 14.5(	10.00	-18.63	---	---	---	---
CASE 1	South	Level 2	14.50' -> 20.0	5.50	10.43	---	---	---	---
CASE 1	South	Level 1	4.50' -> 14.5(	10.00	18.63	---	---	---	---
CASE 1	East	Level 2	14.50' -> 20.0	5.50	---	-14.02	---	---	---
CASE 1	East	Level 1	4.50' -> 14.5(	10.00	---	-25.06	---	---	---
CASE 1	West	Level 2	14.50' -> 20.0	5.50	---	14.02	---	---	---
CASE 1	West	Level 1	4.50' -> 14.5(	10.00	---	25.06	---	---	---
CASE 2	North	Level 2	14.50' -> 20.0	5.50	-7.82	---	---	8.70	- 68.0
CASE 2	North	Level 1	4.50' -> 14.5(	10.00	-13.97	---	---	8.70	121.6
CASE 2	South	Level 2	14.50' -> 20.0	5.50	7.82	---	---	8.70	- 68.0
CASE 2	South	Level 1	4.50' -> 14.5(	10.00	13.97	---	---	8.70	121.6
CASE 2	East	Level 2	14.50' -> 20.0	5.50	---	-10.52	11.70	---	123.1
CASE 2	East	Level 1	4.50' -> 14.5(	10.00	---	-18.79	11.70	---	219.9
CASE 2	West	Level 2	14.50' -> 20.0	5.50	---	10.52	11.70	---	123.1
CASE 2	West	Level 1	4.50' -> 14.5(	10.00	---	18.79	11.70	---	219.9
CASE 3	North & East	Level 2	14.50' -> 20.0	5.50	-7.82	-10.52	---	---	---
CASE 3	North & East	Level 1	4.50' -> 14.5(	10.00	-13.97	-18.79	---	---	---
CASE 3	North & West	Level 2	14.50' -> 20.0	5.50	-7.82	10.52	---	---	---
CASE 3	North & West	Level 1	4.50' -> 14.5(	10.00	-13.97	18.79	---	---	---
CASE 3	South & West	Level 2	14.50' -> 20.0	5.50	7.82	10.52	---	---	---
CASE 3	South & West	Level 1	4.50' -> 14.5(	10.00	13.97	18.79	---	---	---
CASE 3	South & East	Level 2	14.50' -> 20.0	5.50	7.82	-10.52	---	---	---
CASE 3	South & East	Level 1	4.50' -> 14.5(	10.00	13.97	-18.79	---	---	---
CASE 4	North & East	Level 2	14.50' -> 20.0	5.50	-5.87	-7.90	11.70	8.70	143.5

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

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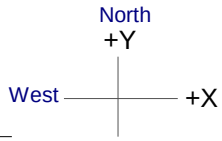
DESCRIPTION: 5635 84th Ave SE

CASE 4	North & East	Level 1	4.50' ->	14.5(	10.00	-10.49	-14.11	11.70	8.70	256.3
CASE 4	North & West	Level 2	14.50' ->	20.0	5.50	-5.87	7.90	11.70	8.70	143.5
CASE 4	North & West	Level 1	4.50' ->	14.5(	10.00	-10.49	14.11	11.70	8.70	256.3
CASE 4	South & West	Level 2	14.50' ->	20.0	5.50	5.87	7.90	11.70	8.70	143.5
CASE 4	South & West	Level 1	4.50' ->	14.5(	10.00	10.49	14.11	11.70	8.70	256.3
CASE 4	South & East	Level 2	14.50' ->	20.0	5.50	5.87	-7.90	11.70	8.70	143.5
CASE 4	South & East	Level 1	4.50' ->	14.5(	10.00	10.49	-14.11	11.70	8.70	256.3
Min per ASCE 27.1.	North	Level 2	14.50' ->	20.0	5.50	-5.10	---	---	---	---
Min per ASCE 27.1.	North	Level 1	4.50' ->	14.5(	10.00	-9.28	---	---	---	---
Min per ASCE 27.1.	South	Level 2	14.50' ->	20.0	5.50	5.10	---	---	---	---
Min per ASCE 27.1.	South	Level 1	4.50' ->	14.5(	10.00	9.28	---	---	---	---
Min per ASCE 27.1.	East	Level 2	14.50' ->	20.0	5.50	---	-6.86	---	---	---
Min per ASCE 27.1.	East	Level 1	4.50' ->	14.5(	10.00	---	-12.48	---	---	---
Min per ASCE 27.1.	West	Level 2	14.50' ->	20.0	5.50	---	6.86	---	---	---
Min per ASCE 27.1.	West	Level 1	4.50' ->	14.5(	10.00	---	12.48	---	---	---

Base Shear for Design Wind Load Cas

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



Load Case	Windward Wall	Leeward Wall	Wind Base Shear Components (k) In "Y" Direction	In "X" Direction		Mt, (ft-k)
Case 1	North	South	-29.06	---		---
Case 1	South	North	29.06	---		---
Case 1	East	West	---	-39.08		---
Case 1	West	East	---	39.08		---
Case 2	North	South	-21.79	---	/-	189.6
Case 2	South	North	21.79	---	/-	189.6
Case 2	East	West	---	-29.31	/-	342.9
Case 2	West	East	---	29.31	/-	342.9
Case 3	North & East	South & West	-21.79	-29.31		---
Case 3	North & West	South & East	-21.79	29.31		---
Case 3	South & West	North & East	21.79	29.31		---
Case 3	South & East	North & West	21.79	-29.31		---
Case 4	North & East	South & West	-16.36	-22.00	/-	399.8
Case 4	North & West	South & East	-16.36	22.00	/-	399.8
Case 4	South & West	North & East	16.36	22.00	/-	399.8
Case 4	South & East	North & West	16.36	-22.00	/-	399.8
Min per ASCE 27.1.5	North	South	-14.38	---		---
Min per ASCE 27.1.5	South	North	14.38	---		---
Min per ASCE 27.1.5	East	West	---	-19.34		---
Min per ASCE 27.1.5	West	East	---	19.34		---

GOVERNING LATERAL LOAD ON MLFRS

SEISMIC BASE SHEAR

$V_{SEISMIC} = 0.7 \times 41315^{\#} = \underset{EL,ASD}{28920^{\#}}$

WIND BASE SHEAR

$V_{WIND} = 0.6 \times 39080 = \underset{WL,ASD}{23450^{\#}}$

→ $V_{SEISMIC} > V_{WIND}$

∴ SEISMIC GOVERNS MLFRS DESIGN

UPPER ROOF FRAMING

(UR1-3) UPPER ROOF RAFTERS

SPAN = 6'-9" W = 8 + 20 + 25 PSF Use 2x6 @ 24" o.c.
DL LL SL

(UR4) UPPER ROOF BEAM

SPAN = 10'-3" W = 8 + 50 + 25 PSF Use 4-10
DL LL SL

TRIB = 14'/2 = 7'

ATTIC FRAMING

AJ1/#3 ATTIC JOIST

SPAN = 10'-3" $w = \frac{6}{DL} + \frac{20}{LL}$ psf USE 2x6 @ 16" o.c.

AH2 ATTIC HEADER

SPAN = 9'-3" $P = \frac{290}{DL} + \frac{720}{LL} + \frac{900\#}{SL}$ (UKBC4) # @ MIDSPAN

USE 4x8

AB3 ATTIC BEAM

SPAN = 14'-0" $w_1 = \frac{8}{DL} + \frac{20}{LL} + \frac{25}{SL}$ (UR) psf TRIB = $\frac{24'}{4} = 6'$

$w_2 = \frac{6}{DL} + \frac{20}{LL}$ (ATTIC) psf TRIB = $\frac{24'}{2} = 12'$

USE 3½x11 7/8 PSL $P = \frac{290}{DL} + \frac{720}{LL} + \frac{900\#}{SL}$ (URB4) @ 6'-4"

AB4/6 ATTIC BEAM

SPAN = 11'-4" $w_1 = \frac{8}{DL} + \frac{20}{LL} + \frac{25}{SL}$ (UR) psf TRIB = $\frac{24'}{2} = 12'$

USE 3½x 9½ PSL $w_2 = \frac{6}{DL} + \frac{20}{LL}$ (ATTIC) psf TRIB = $\frac{24'}{2} = 12'$

AB5 ATTIC BEAM

SPAN = 8'-0" $w_1 = \frac{8}{DL} + \frac{20}{LL} + \frac{25}{SL}$ (UR) psf TRIB = $\frac{24'}{4} = 6'$

USE 3½x 9½ PSL $w_2 = \frac{6}{DL} + \frac{20}{LL}$ (ATTIC) psf TRIB = $\frac{24'}{4} = 6'$

UPPER FLOOR FRAMING

UFB1 UPPER FLOOR BEAM

SPAN = 9'-0"

$W_1 = \left[\underset{DL}{(8}+\underset{LL}{20}+\underset{SL}{25}) + \underset{DL}{(6}+\underset{LL}{20}\right]\left(\frac{14'}{2}\right)\left(\frac{5'}{12'}\right) = \underset{DL}{70} + \underset{LL}{60} + \underset{SL}{70} + \underset{L}{60}$ #/ft

USE 5 1/4 x 9 1/2 PSL

$W_2 = \underset{DL}{(10)}(8') = \underset{DL}{80}$ #/ft

$W_2 = \underset{DL}{(13}+\underset{LL}{20}+\underset{SL}{25})\left(\frac{8'}{2}\right) + \underset{DL}{(13}+\underset{L}{40})\left(\frac{12'}{2}\right)$

$= \underset{DL}{130} + \underset{LL}{80} + \underset{SL}{100} + \underset{L}{240}$ #/ft

UFB2 UPPER FLOOR BEAM

SPAN = 10'-3"

$W = \underset{DL}{13}+\underset{L}{40}$ psf TRIB $= \frac{16'}{2} = 8'$

USE 5 1/4 x 9 1/4 PSL

$P = \left[\underset{DL}{(8}+\underset{LL}{20}+\underset{SL}{25})\left(\frac{20'}{2}\right) + \underset{DL}{(6}+\underset{L}{20})\left(\frac{20'}{2}\right)\right]\left(\frac{14'}{2}\right)$

$= \underset{DL}{1330} + \underset{LL}{1400} + \underset{SL}{2380} + \underset{L}{1400}$ # @ x = 2'-6"

UFB3 UPPER FLOOR BEAM

SPAN = 15'-3"

$P = \underset{DL}{(13}+\underset{L}{40})\left(\frac{18'}{2}\right)\left(\frac{21'}{2}\right) + \left[\underset{DL}{(8}+\underset{LL}{20}+\underset{SL}{25}) + \underset{DL}{(6}+\underset{L}{20})\right]\left(\frac{20'}{2}\right)\left(\frac{21'}{2}\right)$

USE W8x24

$= \underset{DL}{2700} + \underset{LL}{2100} + \underset{SL}{2630} + \underset{L}{5880}$ # @ x = 10'

UFB4 UPPER FLOOR BEAM

SPAN = 15'-3"

$P = \underset{DL}{1181} + \underset{LL}{1680} + \underset{SL}{2110} + \underset{L}{1680}$ # @ x = 3'-3"

USE 3 1/2 x 9 1/4

UFB5 UPPER FLOOR BEAM

SPAN = 9'-3"

$W = \underset{DL}{13}+\underset{LL}{20}+\underset{SL}{25}$ psf TRIB $= \frac{9'}{2} = 4'-6"$

USE 4x10

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UFB6 UPPER FLOOR BEAM

SPAN = 10'-3"

$w_1 = [(\underset{DL}{8}+\underset{ML}{20}+\underset{SL}{25})_{UR}+(\underset{DL}{6}+\underset{LL}{20})_{ATTIC}](\frac{6'}{2}+2') + (\underset{DL}{10})_{WALL}(8') + (\underset{DL}{13}+\underset{LL}{40})_{UF}(\frac{6'}{2}) = \underset{DL}{190}+\underset{ML}{100}+\underset{SL}{130}+\underset{LL}{220}$ #/FT

USE 5 1/4 x 9 1/4 PSL

UFB7 UPPER FLOOR BEAM

SPAN = 15'-0"

$P_1 = \underset{DL}{1130}+\underset{ML}{630}+\underset{SL}{770}+\underset{LL}{1580}$ # (UFB1) @ x = 7'-6"

USE W8x24

$P_2 = (\underset{DL}{13}+\underset{LL}{40})_{UF}(\frac{18'}{2})(\frac{9'}{2}) = \underset{DL}{530}+\underset{LL}{1620}$ # @ x = 7'-6"

$P_3 = (\pm)(.7 \times \frac{2.5}{1.3} \times \frac{29697 \# \cdot ft}{13'-6"}) = (\pm)\ \underset{EL}{5920}$ # @ x = 1'(+), +14'(−)

(LRFD, e/s, OTM, L WALL)

$P_4 = [(\underset{DL}{8}+\underset{ML}{20}+\underset{SL}{25})_{UR}+(\underset{DL}{6}+\underset{LL}{20})_{ATTIC}](\frac{20'}{2})(\frac{11'}{2})$

$= \underset{DL}{770}+\underset{ML}{1100}+\underset{SL}{1380}+\underset{LL}{1100}$ # @ x = 7'-6"

UFJ8 UPPER FLOOR JOIST

SPAN = 13'-6" $w = \underset{DL}{13}+\underset{LL}{40}$ PSF USE 2x10 @ 16" o.c. OF #2

UFB9 UPPER FLOOR BEAM

SPAN = 12'-4"

$P = \underset{DL}{1030}+\underset{ML}{410}+\underset{SL}{510}+\underset{LL}{440}$ # (UFB11) @ x = 6"

USE 4x10

UFB10 UPPER FLOOR BEAM

SPAN = 13'-6"

$w = [(\underset{DL}{8}+\underset{ML}{20}+\underset{SL}{25})_{UR}+(\underset{DL}{6}+\underset{LL}{20})_{ATTIC}](\frac{10'}{2}) + (\underset{DL}{10})_{WALL}(8') + (\underset{DL}{13}+\underset{ML}{20}+\underset{SL}{25})_{OR}(\frac{8'}{2})$

USE 5 1/2 x 10 1/2 GLB

$= \underset{DL}{200}+\underset{ML}{180}+\underset{SL}{230}+\underset{LL}{100}$ #/FT

UFB11 UPPER FLOOR BEAM

SPAN = 10'-3" $W = \underset{DL}{(8+20+25)}\left(\frac{8'}{2}\right) + \underset{DL}{(13+40)}\left(\frac{14'}{2}\right) + \underset{DL}{(10)}(8')$ (UR, UF, WALL)

USE 5¼ * 9¼ PSL $= \underset{DL}{20\#} + \underset{LL}{80\#} + \underset{SL}{10\#} + \underset{U}{280\#/FT}$

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OUTDOOR ROOF FRAMING

ORR1 OUTDOOR ROOF RAFTERS

SPAN = 8'-3" w = 13 (DL) + 20 (RL) + 25 (SL) psf USE 2x8 @ 24" o.c.

ORB2 OUTDOOR ROOF BEAM

SPAN = 13'-9" w = 13 (DL) + 20 (RL) + 25 (SL) psf TRIB = 17'-0" / 2 = 8'-6"

USE 5 1/2 x 9 GLB

ORB3 OUTDOOR ROOF BEAM

SPAN = 17'-3" P = 760 (DL) + 1170 (RL) + 1460 (SL) # @ ORB2 ex = 8'-6"

USE 5 1/2 x 10 1/2 GLB

ORB4 OUTDOOR ROOF BEAM

SPAN = 13'-9" w = 13 (DL) + 20 (RL) + 25 (SL) psf TRIB = 8' / 2 = 4'

USE 5 1/2 x 10 1/2 GLB

LOW ROOF FRAMING

LRR1/2 LOW ROOF RAFTERS

SPAN = 7'-6" W = 13+20+25 PSF (PL LL SL) USE 2x8 @ 24" O.C.

LRB3 LOW ROOF BEAM

SPAN = 7'-6" P = (13+20+25)(7'-3"/2)(7'-6"/2) = 1800+2700+3400 # (PL LL SL)

USE 4x8

W = 13+20+25 PSF (PL LL SL) TRIB = 2' e_x = 4'-6"

LRR4 LOW ROOF RAFTERS

SPAN = 6'-0" W = 13+20+25 PSF (PL LL SL) USE 2x4 @ 24" O.C. (NEW)

2x6 OK

LRH5 LOW ROOF HEADER

SPAN = 6'-0" UFB 7 P = 1220+1700+1080+5130 = 9130# (PL LL SL EL) + 2180# (W) e_x = 1'

USE 5½x9 GLB

MAIN FLOOR FRAMING

MFJ1 MAIN FLOOR JOISTS

SPAN = 7'-6" W = 10 psf + 10 psf LL 2x10@16" o.c.

MFB2 MAIN FLOOR BEAM

SPAN = 4'-9" P = 250 lb DL + 360 lb LL + 360 lb SL + 450 lb LL @ x = 6"

USE 4x10

OUTDOOR DECK ELEMENTS

ODJ1 OUTDOOR DECK JOIST

SPAN = 6'-6" $w = \frac{30}{DL} + \frac{60}{LL}$ psf USE 2x10 @ 16" o.c.

ODB2 OUTDOOR DECK BEAM

BACKSPAN = 8'-6" $w = \frac{30}{DL} + \frac{60}{LL}$ psf TRIB = 7'
CANTILEVER = 2'-6"

USE 6x10 HF#1 PT

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MAIN FLR POST

Post supporting UFB3 (worst case 3½x5¼ PSL)

ft = 7'-9" P = 1770 + 1380 + 1720 + 3860 # (UFB3)
DL LL SL W

Use 3½x5¼ PSL

Post supporting UFB4 (worst case 4x4)

ft = 7'-9" P = 930 + 1320 + 1650 + 1320 #
DL LL SL W

Use 4x4

Post supporting UFB6 (worst case 4x6)

ft = 7'-9" P = 2(970 + 520 + 6720 + 1130 #) = 1940 + 1040 + 13440 + 2260 #
DL LL SL W
UFB1

Use 4x6

FOUNDATIONS

F1 INTERIOR PAD FOOTING @ G.L. 4 (WORST CASE RECTANGULAR F1)

$P_1 = \frac{930}{DL} + \frac{720}{LL} + \frac{910}{SL} + \frac{20320}{U}$ # (OFB3)

$P_2 = \frac{930}{DL} + \frac{1320}{LL} + \frac{1650}{SL} + \frac{1320}{U}$ # (VFB4)

3' APART

USE 2'x5' PAD FOOTING

F1 INTERIOR PAD FOOTING @ G.L. 3 (WORST CASE SQUARE F1)

$P = \frac{1220}{DL} + \frac{870}{LL} + \frac{7000}{SL} + \frac{2480}{U} + \frac{5130}{EL, UFO}$ #

$P_{FACTORED} = 1.13D + 0.75(SL+LL) + 0.525(EL) = 6570$ #

USE 2' SQ. PAD Good for $1.33 \times 2^2 \times 2000 = 11640$ # ok

F4 Deck PAD FOOTING

$P = \left(\frac{300}{DL} + \frac{60}{U}\right)\left(\frac{12'}{2}\right)\left(\frac{18'}{2}\right) = \frac{1620}{LL} + \frac{3240}{LL}$ #

USE 1'-9" SQ. PAD Good for $1.75^2 \times 2000 = 6125$ # ok

F5 Deck PAS FOOTING

$P = \left(\frac{\text{Deck}}{\frac{300}{DL} + \frac{60}{U}}\right)\left(\frac{21'}{2}\right)\left(\frac{18'}{2}\right) + \left(\frac{\text{Roof}}{\frac{113}{DL} + \frac{20}{LL} + \frac{25}{SL}}\right)\left(\frac{16'}{2}\right)\left(\frac{18'}{2}\right)$

$= \frac{1930}{DL} + \frac{1520}{LL} + \frac{1190}{SL} + \frac{18900}{U}$ # $\rightarrow P_{FACTORED} = 1930 + 0.75(1520 + 18900) = 14770$ #

USE 2'-0" SQ. PAS Good for 8000 # ok

F6 Deck PAD FOOTING

$P = (\underset{DL}{13} + \underset{LL}{20} + \underset{SL}{25})(\tfrac{16'}{2})(\tfrac{12'}{2}) + (\underset{DL}{6} + \underset{LL}{20})(\tfrac{14'}{2})(\tfrac{11'}{2}) + (\underset{DL}{13} + \underset{LL}{4.4})(\tfrac{14'}{2})(\tfrac{4'}{2})$

$+ (\underset{DL}{13} + \underset{LL}{20} + \underset{SL}{25})(\tfrac{16'}{2})(\tfrac{18'}{2}) + (\underset{DL}{20} + \underset{LL}{60})(\tfrac{7'}{2})(\tfrac{9'}{2} + 2\tfrac{1}{6}')$

$= \underset{DL}{2760^{\#}} + \underset{LL}{2484^{\#}} + \underset{SL}{3150^{\#}} + \underset{LL}{2000^{\#}}$ $P_{ALLOWED} = 2760 + 0.75(3150 + 2000) = 7935^{\#}$

USE $2\frac{1}{3}'$ SQ. PAD found for $2.25^2 \times 2000 = 10125^{\#}$ ok

F7 OUTDOOR FIRE PIT FOOTING

$DTM = \underset{EL\ REF}{11153^{\#}\text{-}ft}$ (WSW24 - 0 SW MF.A3 (SEE STEAM MAIN SPREADSHEET)

USE $4\frac{1}{3}' \times 8\frac{1}{9}'$ PAD w/ MIN $27'' \times 93''$ PEDESTAL

DIAPHRAGMS + COLLECTORS
UPPER FLOOR SHEAR WALLS

SW VF.D

$V_{DIA} = V_{SW} = 3706^{\#}$

$v_{DIA} = \frac{V_{DIA}}{L_{DIA}} = \frac{3706}{30\frac{1}{4}''} = \frac{121^{\#}/ft}{ELASD}$

USE "ROOF SHEATHING" (7/16" PLY w/ 10d @ 6", UNBLOCKED)

$v_{allow} = 215^{\#}/ft$ ok (NO COLLECTOR REQ'D)

SW VF-F6 (RST 1)

$V_{DIA} = V_{SW} = 5160^{\#}$ $L_{DIA} = 16\frac{1}{6}'' + 8'-0'' = 24\frac{1}{6}''$ (SW + COLLECTOR)

$v_{DIA} = \frac{5160^{\#}}{24\frac{1}{6}''} = 210^{\#}/ft < 215$ ok

USE (E) ROOF SHEATHING + 8'-0" COLLECTOR

$T_{COLLECTOR} = v_{DIA} \times 8' = 1680^{\#}$ USE L@16'

GOOD FOR $1705^{\#}$ ok

SW VF-F.1/2 (ADU)

$V_{DIA} = V_{SW} = 990 + 804 = 1794^{\#}$ $L_{DIA} = 15\frac{1}{4}'$ (SWS + ABS)

$v_{DIA} = \frac{1794^{\#}}{15\frac{1}{4}''} = 114^{\#}/ft$ ok USE (E) ROOF SHEATHING + COLLECTOR

$T_{STRAP} = v_{DIA} \times \frac{L_{ABS}}{2} = 117 \times \frac{8\frac{1}{6}''}{2} = 480^{\#}$

USE L@18' GOOD FOR $1235^{\#}$ ok

SW VF-3 (RST2)

$V_{DIA} = V_{SW} = 3712^{\#}$ $L_{DIA} = 34'$ (ENTIRE WIDTH OF ROOF)

$v_{DIA} = \frac{3712^{\#}}{34'} = 109^{\#}/FT < 215$ ok

Use (E) ROOF SHEATHING + COLLECTOR

$T_{STRAP} = V_{DIA} \times 13'-3'' = 1440^{\#}$ Use LSTA36

Good for $1640^{\#}$ ok

SW VF-5 (RST4+5)

$V_{DIA} = V_{SW} = 5754^{\#}$ $L_{DIA} = 36'$ (ENTIRE WIDTH OF ROOF)

$v_{DIA} = \frac{5754}{36} = 160^{\#}/FT < 215$ ok

Use (E) ROOF SHEATHING + COLLECTOR

$T_{RST4} = V_{DIA} \times 13' = 2080^{\#}$ Use LSTA36 (RST4)

Good for $2450^{\#}$ ok

$T_{RST5} = V_{DIA} \times 25' = 4000^{\#}$ Use LSTI40 (RST5)

Good for $4735^{\#}$ ok

SW VF-7

$V_{DIA} = V_{SW} = 1858^{\#}$ $L_{DIA} = L_{SW} = 23'$

$v_{DIA} = \frac{1858}{23} = 81^{\#}/FT < 215$ ok

(NO STRAP REQ'D)

DIAPHRAGMS + COLLECTORS
MAIN FLOOR STEEL WALLS

(RATIO OF DIAPHRAGM STORY FORCE TO STORY FORCE)

(STEAL FROM UF STEEL WALLS)

(STEAL FROM UF DIAPHRAGM)

UST 1/2

SW MF. C. 1/2

$V_{DIA} = V_{ABOVE} + V_{COLR} \times \frac{F_{P,UF}}{F_{UF}} =$

$= (2075 + 1631) + (1287 + 1411) \times \frac{6.8}{6.3} = 7180^{\#}$

$L_{DIA} = 54\frac{1}{2}'$ $v_{DIA} = \frac{7180}{54.5} = 132^{\#/FT}$ < 215 plf Vall = ok

USE "FLOOR SHEATHING" (3/4" PLY w/ 10d @ 6 EW, UNBLOCKED)

$T_{UST2} = v_{DIA} \times 14'9'' = 1950^{\#}$ USE 'UST22' Good for 3260# ok

$T_{UST2} = v_{DIA} \times 14' = 1850^{\#}$ USE 'UST3A' Good for 2050# ok

SW MF. A3 (UST 3)

$V_{DIA} = V_{SW} = 970^{\#}$ $L_{DIA} = 16'$ $v_{DIA} = \frac{970}{16} = 61^{\#/FT}$ < 215 ok

$T_{STRAP} = 970^{\#}$ USE 'LS21' Good for 1030# ok

OUTDOOR ROOF (UST 4)

$T_{STRAP} = \frac{V_{ROOF}}{2} = \frac{16' \times 19'}{2} \times 4.4^{PSF} = 670^{\#}$

USE 'LS21' Good for 1030# ok

SW MF. E6 (UST 5/6)

$V_{DIA} = V_{ABOVE} + V_{COLR} \times \frac{F_{P,UF}}{F_{UF}} = 5760 + 3874 \times \frac{6.8}{6.3} = 9350^{\#}$

$L_{DIA} = 50\frac{1}{4}''$ $v_{DIA} = \frac{9350}{50.75} = 184^{\#/FT}$ < 215 ok

$T_{UST5} = v_{DIA} \times 21' = 3864^{\#}$ USE 'UST40' Good for 4735# ok

$T_{UST6} = v_{DIA} \times 51' - 6'' = 1010^{\#}$ USE 'LS21' Good for 1030# ok

SW MF-F.1/2 (VJT 7)

$V_{DIA} = V_{CVR} \times \frac{F_{p,VF}}{F_{VF}} = (1014+830)\left(\frac{6.8}{6.3}\right) = 2040^{\#}$

$L_{DIA} = 26'$ $v_{DIA} = \frac{2000}{26} = 77^{\#/ft} < 215$ ok

$T_{SPEAR} = V_{DIA} \times \frac{6'}{2} = 310^{\#}$ use 'LSTA/6' good for $1235^{\#}$ ok

SW MF-2

$V_{DIA} = V_{ABV} + V_{CVR} \times \frac{F_{p,VF}}{F_{VF}} = 2475 + 2214\left(\frac{6.8}{6.3}\right) = 4950^{\#}$

$v_{DIA} = \frac{V_{DIA}}{L_{DIA}} = \frac{4950}{36'} = 140^{\#/ft} < 215$ ok

∴ No collector req'd

SW MF-3 (VJT 9)

$V_{DIA} = 2[1058+(1014)\left(\frac{6.8}{6.3}\right)] = 5940^{\#}$ | $L_{DIA} = 36'$

$v_{DIA} = \frac{5940}{36} = 164^{\#/ft} < 215$ ok

$T_{VJT9} = 164 \times 20' = 3280^{\#}$ Use (2) 'CSL1'

good for $2 \times 1705 = 3410^{\#}$ ok

Use (6) 'LTP5' good for $6 \times 730 = 3280^{\#}$ ok

SW MF-37.1/2

$V_{DIA} = (1058+1543)\left(\frac{6.8}{6.3}\right) = 2810^{\#}$ $L_{DIA} = 15'6"$

$v_{DIA} = \frac{2810}{15.5} = 180^{\#/ft} < 215$ ok

∴ NO COLLECTOR REQUIRED

SW MF. J

$V_{DIA} = 3350 \times \frac{6.8}{6.3} = 3620^{\#}$ $L_{DIA} = 31'-9"$

$V_{DIA} = \frac{3620}{31.75} = 114^{\#}/_{FT} < 215$ ok (NO COVERTOR REQ'D)

Multiple Simple Beam

Project File: 21031_Pierce.ec6

LIC# : KW-06015519, Build:20.21.10.27 O.G. Engineering, PLLC (c) ENERCALC INC 1983-2021

Description : Upper Roof Framing

Wood Beam Design : URR1-3_Upper Roof Rafters

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : **2x6, Sawn, Fully Braced**
Using Allowable Stress Design with ASCE 7-16 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

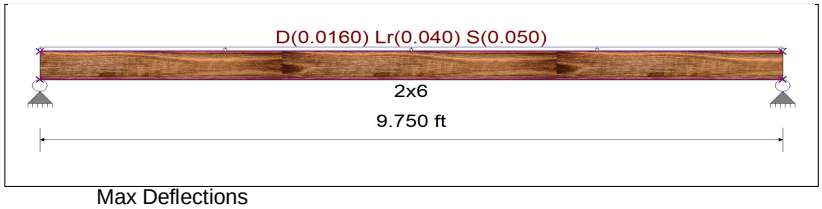
Unif Load: D = 0.0080, Lr = 0.020, S = 0.0250 k/ft, Trib= 2.0 ft

Design Summary

Max fb/Fb Ratio = **0.852** : 1
fb : Actual : 1,244.45 psi at 4.875 ft in Span # 1
Fb : Allowable : 1,461.36 psi
Load Comb : +D+S

Max fv/FvRatio = **0.307** : 1
fv : Actual : 53.04 psi at 9.295 ft in Span # 1
Fv : Allowable : 172.50 psi
Load Comb : +D+S

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	0.08		0.20	0.24			
Right Support	0.08		0.20	0.24			



Max Deflections

Transient Downward	0.378 in	Total Downward	0.499 in
Ratio	309	Ratio	234
	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 : URB3 - Upper Roof Beam

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : **4x10, Sawn, Fully Braced**
Using Allowable Stress Design with ASCE 7-16 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

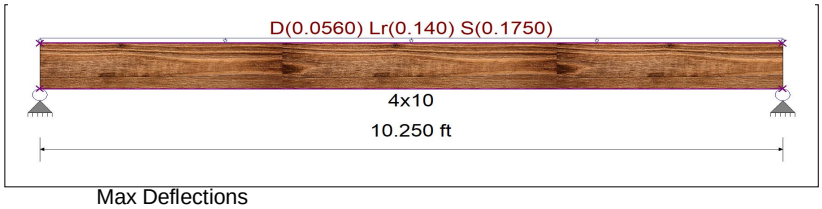
Unif Load: D = 0.0080, Lr = 0.020, S = 0.0250 k/ft, Trib= 7.0 ft

Design Summary

Max fb/Fb Ratio = **0.622** : 1
fb : Actual : 729.37 psi at 5.125 ft in Span # 1
Fb : Allowable : 1,173.00 psi
Load Comb : +D+S

Max fv/FvRatio = **0.271** : 1
fv : Actual : 46.81 psi at 0.000 ft in Span # 1
Fv : Allowable : 172.50 psi
Load Comb : +D+S

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	0.29		0.72	0.90			
Right Support	0.29		0.72	0.90			



Max Deflections

Transient Downward	0.146 in	Total Downward	0.192 in
Ratio	844	Ratio	639
	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: 21031_Pierce.ec6

LIC# : KW-06015519, Build:20.21.11.30 O.G. Engineering, PLLC (c) ENERCALC INC 1983-2021

Description : Upper Floor Framing

Wood Beam Design : UFB1 - Upper Floor Beam

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : **5.25x9.25, Parallam PSL, Fully Braced**
Using Allowable Stress Design with ASCE 7-16 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	750.0 psi	Ft	2,025.0 psi	Eminbend - xx	1,118.19 ksi		

Applied Loads

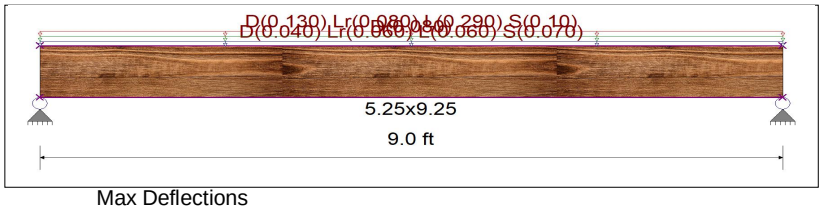
Unif Load: D = 0.040, Lr = 0.060, L = 0.060, S = 0.070 k/ft, Trib= 1.0 ft
Unif Load: D = 0.080 k/ft, Trib= 1.0 ft
Unif Load: D = 0.130, Lr = 0.080, L = 0.290, S = 0.10 k/ft, Trib= 1.0 ft

Design Summary

Max fb/Fb Ratio = **0.336** : 1
fb : Actual : 973.72 psi at 4.500 ft in Span # 1
Fb : Allowable : 2,900.00 psi
Load Comb : +D+L

Max fv/FvRatio = **0.240** : 1
fv : Actual : 69.50 psi at 0.000 ft in Span # 1
Fv : Allowable : 290.00 psi
Load Comb : +D+L

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	1.13	1.58	0.63	0.77			
Right Support	1.13	1.58	0.63	0.77			



Max Deflections

Transient Downward	0.068 in	Total Downward	0.125 in
Ratio	1583	Ratio	866
	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:

Wood Beam Design : UFB2 - Upper Floor Beam

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : **5.25x9.25, Parallam PSL, Fully Braced**
Using Allowable Stress Design with ASCE 7-16 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	750.0 psi	Ft	2,025.0 psi	Eminbend - xx	1,118.19 ksi		

Applied Loads

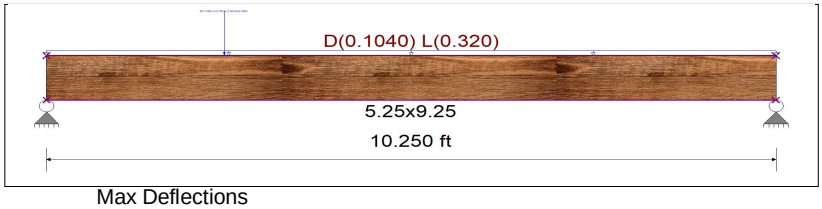
Unif Load: D = 0.0130, L = 0.040 k/ft, Trib= 8.0 ft
1Point: D = 1.330, Lr = 1.90, L = 1.90, S = 2.380 k @ 2.50 ft

Design Summary

Max fb/Fb Ratio = **0.572** : 1
fb : Actual : 1,908.70 psi at 2.528 ft in Span # 1
Fb : Allowable : 3,335.00 psi
Load Comb : +D+0.750L+0.750S

Max fv/FvRatio = **0.492** : 1
fv : Actual : 142.55 psi at 0.000 ft in Span # 1
Fv : Allowable : 290.00 psi
Load Comb : +D+L

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	1.54	3.08	1.44	1.80			
Right Support	0.86	2.10	0.46	0.58			



Max Deflections

Transient Downward	0.171 in	Total Downward	0.251 in
Ratio	719	Ratio	489
	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: 21031_Pierce.ec6

LIC# : KW-06015519, Build:20.21.11.30 O.G. Engineering, PLLC (c) ENERCALC INC 1983-2021

Steel Beam Design : UFB3 - Upper Floor Beam

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16

STEEL Section : **W8x24, Defined Brace Locations, 1st at 10.0 ft, 2nd at ft, 3rd at ft**
Using Allowable Strength Design with ASCE 7-16 Load Combinations, Major Axis Bending Fy = 50.0 ksi E = 29,000.0 ksi

Applied Loads

1Point: D = 2.70, Lr = 2.10, L = 5.880, S = 2.630 k @ 10.0 ft

Steel Beam Design : UFB3 - Upper Floor Beam

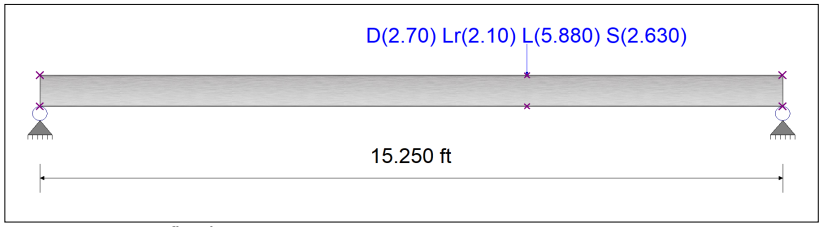
Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16

STEEL Section : **W8x24, Defined Brace Locations, 1st at 10.0 ft, 2nd at ft, 3rd at ft**
Using Allowable Strength Design with ASCE 7-16 Load Combinations, Major Axis Bending Fy = 50.0 ksi E = 29,000.0 ksi

Design Summary

Max fb/Fb Ratio = **0.541** : 1
Mu : Applied 31.183 k-ft at 10.014 ft in Span # 1
Mn / Omega : Allow 57.635 k-ft
Load Comb : +D+0.750L+0.750S

Max fv/FvRatio = **0.153** : 1
Vu : Applied 5.956 k at 10.014 ft in Span # 1
Vn / Omega : Allow 38.857 k
Load Comb : +D+0.750L+0.750S



Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	0.93	2.02	0.72	0.91			
Right Support	1.77	3.86	1.38	1.72			

Max Deflections

Transient Downward	0.276 in	Total Downward	0.403 in
Ratio	663		454
	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: 21031_Pierce.ec6

LIC# : KW-06015519, Build:20.21.11.30 O.G. Engineering, PLLC (c) ENERCALC INC 1983-2021

Wood Beam Design : UFB4 - Upper Floor Beam

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : **3.5x9.25, Parallam PSL, Fully Braced**
Using Allowable Stress Design with ASCE 7-16 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	750.0 psi	Ft	2,025.0 psi	Eminbend - xx	1,118.19 ksi		

Applied Loads

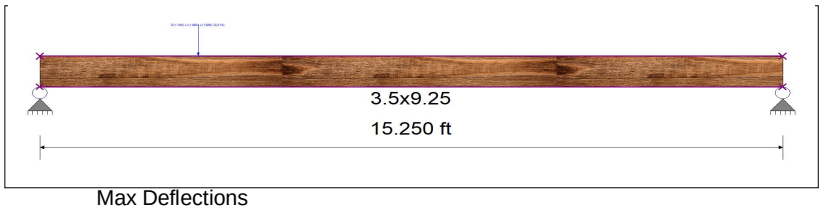
1Point: D = 1.180, Lr = 1.680, L = 1.680, S = 2.10 k @ 3.250 ft

Design Summary

Max fb/Fb Ratio = **0.740** : 1
fb : Actual : 2,467.97 psi at 3.253 ft in Span # 1
Fb : Allowable : 3,335.00 psi
Load Comb : +D+0.750L+0.750S

Max fv/FvRatio = **0.439** : 1
fv : Actual : 146.38 psi at 0.000 ft in Span # 1
Fv : Allowable : 333.50 psi
Load Comb : +D+0.750L+0.750S

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	0.93	1.32	1.32	1.65			
Right Support	0.25	0.36	0.36	0.45			



Max Deflections

Transient Downward	0.325 in	Total Downward	0.508 in
Ratio	562	Ratio	360
	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 : UFB5 - Upper Floor Beam

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : **4x10, Sawn, Fully Braced**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending

Wood Species :	Hem-Fir					Wood Grade :	No.2		
Fb - Tension	850.0 psi	Fc - Prll	1,300.0 psi	Fv	150.0 psi	Ebend- xx	1,300.0 ksi	Density	26.840 pcf
Fb - Compr	850.0 psi	Fc - Perp	405.0 psi	Ft	525.0 psi	Eminbend - xx	470.0 ksi		

Applied Loads

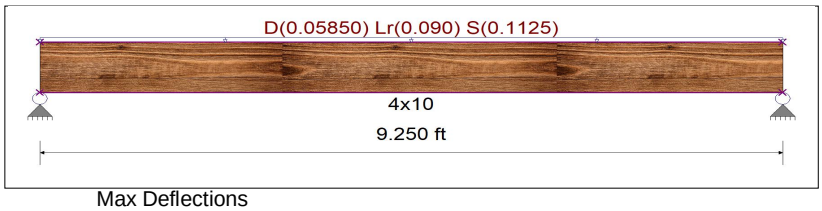
Unif Load: D = 0.0130, Lr = 0.020, S = 0.0250 k/ft, Trib= 4.50 ft

Design Summary

Max fb/Fb Ratio = **0.375** : 1
fb : Actual : 439.71 psi at 4.625 ft in Span # 1
Fb : Allowable : 1,173.00 psi
Load Comb : +D+S

Max fv/FvRatio = **0.212** : 1
fv : Actual : 36.64 psi at 0.000 ft in Span # 1
Fv : Allowable : 172.50 psi
Load Comb : +D+S

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	0.27		0.42	0.52			
Right Support	0.27		0.42	0.52			



Max Deflections

Transient Downward	0.062 in	Total Downward	0.094 in
Ratio	1787	Ratio	1176
	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: 21031_Pierce.ec6

LIC# : KW-06015519, Build:20.21.11.30 O.G. Engineering, PLLC (c) ENERCALC INC 1983-2021

Wood Beam Design : UFB6 - Upper Floor Beam

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : **5.25x9.25, Parallam PSL, Fully Braced**
Using Allowable Stress Design with ASCE 7-16 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	750.0 psi	Ft	2,025.0 psi	Eminbend - xx	1,118.19 ksi		

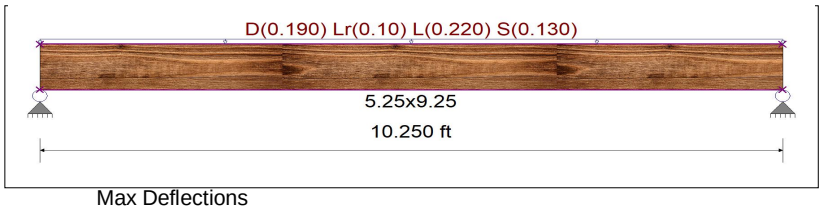
Applied Loads

Unif Load: D = 0.190, Lr = 0.10, L = 0.220, S = 0.130 k/ft, Trib= 1.0 ft

Design Summary

Max fb/Fb Ratio = **0.298** : 1
fb : Actual : 863.04 psi at 5.125 ft in Span # 1
Fb : Allowable : 2,900.00 psi
Load Comb : +D+L

Max fv/FvRatio = **0.224** : 1
fv : Actual : 64.90 psi at 0.000 ft in Span # 1
Fv : Allowable : 290.00 psi
Load Comb : +D+L



Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	0.97	1.13	0.51	0.67			
Right Support	0.97	1.13	0.51	0.67			

Max Deflections

Transient Downward	0.072 in	Total Downward	0.134 in
Ratio	1705	Ratio	915
	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 : UFB7 - Upper Floor Beam

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16

STEEL Section : **W8x24, Defined Brace Locations, 1st at 7.50 ft, 2nd at ft, 3rd at ft**
Using Allowable Strength Design with ASCE 7-16 Load Combinations, Major Axis Bending Fy = 50.0 ksi E = 29,000.0 ksi

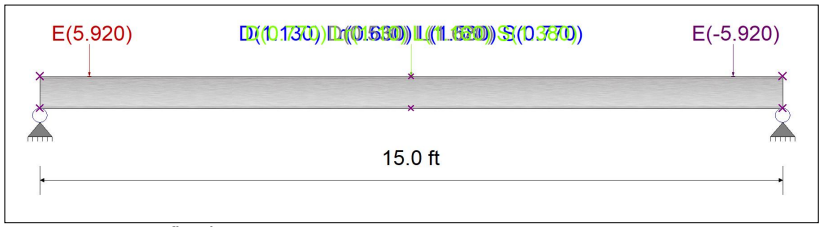
Applied Loads

1Point: D = 1.130, Lr = 0.630, L = 1.580, S = 0.770 k @ 7.50 ft
2Point: D = 0.530, L = 1.620 k @ 7.50 ft
3Point: D = 0.770, Lr = 1.10, L = 1.160, S = 1.380 k @ 7.50 ft
4Point: E = 5.920 k @ 1.0 ft
5Point: E = -5.920 k @ 14.0 ft

Design Summary

Max fb/Fb Ratio = **0.495** : 1
Mu : Applied 28.541 k-ft at 7.500 ft in Span # 1
Mn / Omega : Allow 57.635 k-ft
Load Comb : +1.123D+0.750L+0.750S+0.5250

Max fv/FvRatio = **0.167** : 1
Vu : Applied 6.499 k at 0.000 ft in Span # 1
Vn / Omega : Allow 38.857 k
Load Comb : +1.123D+0.750L+0.750S+0.5250



Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	1.22	2.18	0.87	1.08		5.13	
Right Support	1.22	2.18	0.87	1.08		-5.13	

Max Deflections

Transient Downward	0.222 in	Total Downward	0.346 in
Ratio	810	Ratio	520
	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 : UFJ8 - Upper Floor Joists

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : **2x10, Sawn, Fully Braced**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending
Wood Species : Douglas Fir-Larch Wood Grade : No.2

Fb - Tension	900.0 psi	Fc - Prll	1,350.0 psi	Fv	180.0 psi	Ebend- xx	1,600.0 ksi	Density	31.210 pcf
Fb - Compr	900.0 psi	Fc - Perp	625.0 psi	Ft	575.0 psi	Eminbend - xx	580.0 ksi		

Applied Loads

Unif Load: D = 0.0130, L = 0.040 k/ft, Trib= 1.330 ft

Wood Beam Design : UFJ8 - Upper Floor Joists

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : **2x10, Sawn, Fully Braced**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending
Wood Species : Douglas Fir-Larch Wood Grade : No.2

Fb - Tension	900.0 psi	Fc - Prll	1,350.0 psi	Fv	180.0 psi	Ebend- xx	1,600.0 ksi	Density	31.210 pcf
Fb - Compr	900.0 psi	Fc - Perp	625.0 psi	Ft	575.0 psi	Eminbend - xx	580.0 ksi		

Multiple Simple Beam

Project File: 21031_Pierce.ec6

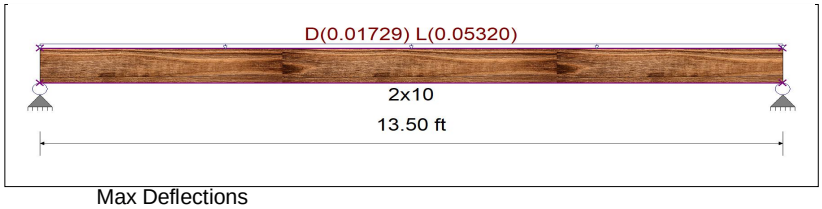
LIC# : KW-06015519, Build:20.21.11.30 O.G. Engineering, PLLC (c) ENERCALC INC 1983-2021

Design Summary

Max fb/Fb Ratio = **0.791** : 1
fb : Actual : 900.87 psi at 6.750 ft in Span # 1
Fb : Allowable : 1,138.50 psi
Load Comb : +D+L

Max fv/FvRatio = **0.286** : 1
fv : Actual : 51.44 psi at 0.000 ft in Span # 1
Fv : Allowable : 180.00 psi
Load Comb : +D+L

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	0.12	0.36					
Right Support	0.12	0.36					



Max Deflections

Transient Downward	0.253 in	Total Downward	0.335 in
Ratio	641	Ratio	484
	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 : UFB10 - Upper Floor Beam

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : **5.5x10.5, GLB, Fully Braced**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending
Wood Species : DF/DF Wood Grade : 24F-V8

Fb - Tension	2400 psi	Fc - Prll	1650 psi	Fv	265 psi	Ebend- xx	1800 ksi	Density	31.21 pcf
Fb - Compr	2400 psi	Fc - Perp	650 psi	Ft	1100 psi	Eminbend - xx	950 ksi		

Applied Loads

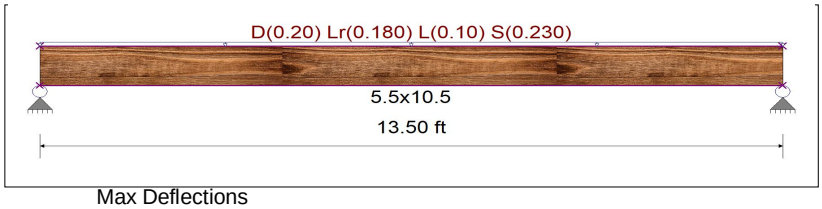
Unif Load: D = 0.20, Lr = 0.180, L = 0.10, S = 0.230 k/ft, Trib= 1.0 ft

Design Summary

Max fb/Fb Ratio = **0.439** : 1
fb : Actual : 1,210.49 psi at 6.750 ft in Span # 1
Fb : Allowable : 2,760.00 psi
Load Comb : +D+0.750L+0.750S

Max fv/FvRatio = **0.257** : 1
fv : Actual : 78.46 psi at 0.000 ft in Span # 1
Fv : Allowable : 304.75 psi
Load Comb : +D+0.750L+0.750S

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	1.35	0.68	1.22	1.55			
Right Support	1.35	0.68	1.22	1.55			



Max Deflections

Transient Downward	0.181 in	Total Downward	0.338 in
Ratio	895	Ratio	478
	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 : UFB11 - Upper Floor Beam

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : **5.25x9.25, Parallam PSL, Fully Braced**
Using Allowable Stress Design with ASCE 7-16 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	750.0 psi	Ft	2,025.0 psi	Eminbend - xx	1,118.19 ksi		

Applied Loads

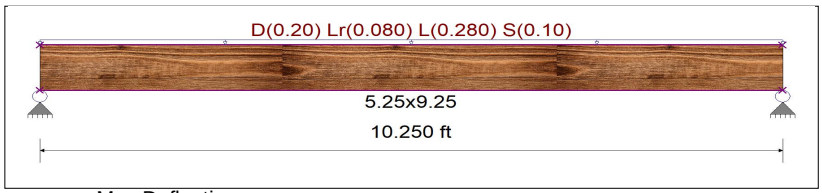
Unif Load: D = 0.20, Lr = 0.080, L = 0.280, S = 0.10 k/ft, Trib= 1.0 ft

Design Summary

Max fb/Fb Ratio = **0.348** : 1
fb : Actual : 1,010.39 psi at 5.125 ft in Span # 1
Fb : Allowable : 2,900.00 psi
Load Comb : +D+L

Max fv/FvRatio = **0.262** : 1
fv : Actual : 75.98 psi at 0.000 ft in Span # 1
Fv : Allowable : 290.00 psi
Load Comb : +D+L

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	1.03	1.44	0.41	0.51			
Right Support	1.03	1.44	0.41	0.51			



Max Deflections

Transient Downward	0.092 in	Total Downward	0.157 in
Ratio	1340	Ratio	781
	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: 21031_Pierce.ec6

LIC# : KW-06015519, Build:20.21.11.30 O.G. Engineering, PLLC (c) ENERCALC INC 1983-2021

Wood Beam Design : UFB9 - Upper Floor Beam

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : **4x10, Sawn, Fully Braced**

Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending

Wood Species : Hem-Fir Wood Grade : No.2

Fb - Tension	850.0 psi	Fc - Prll	1,300.0 psi	Fv	150.0 psi	Ebend- xx	1,300.0 ksi	Density	26.840 pcf
Fb - Compr	850.0 psi	Fc - Perp	405.0 psi	Ft	525.0 psi	Eminbend - xx	470.0 ksi		

Applied Loads

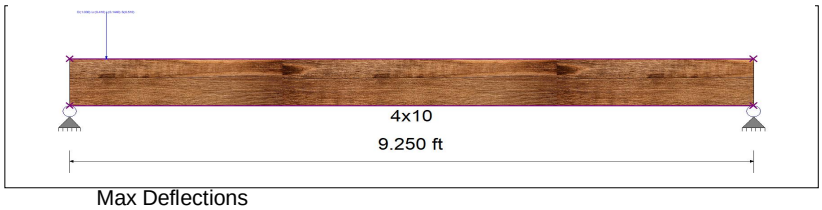
1Point: D = 1.030, Lr = 0.410, L = 0.1440, S = 0.510 k @ 0.50 ft

Design Summary

Max fb/Fb Ratio = **0.149** : 1
fb : Actual : 174.64 psi at 0.524 ft in Span # 1
Fb : Allowable : 1,173.00 psi
Load Comb : +D+S

Max fv/FvRatio = **0.391** : 1
fv : Actual : 67.49 psi at 0.000 ft in Span # 1
Fv : Allowable : 172.50 psi
Load Comb : +D+S

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	0.97	0.14	0.39	0.48			
Right Support	0.06	0.01	0.02	0.03			



Max Deflections

Transient Downward	0.008 in	Total Downward	0.024 in
Ratio	9999	Ratio	4544
	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: 21031_Pierce.ec6

LIC# : KW-06015519, Build:20.21.11.28 O.G. Engineering, PLLC (c) ENERCALC INC 1983-2021

Description : Outdoor Roof Framing

Wood Beam Design : ORR1 - Outdoor Roof Rafters

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : **2x8, Sawn, Fully Braced**
Using Allowable Stress Design with ASCE 7-16 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 = 0.0130, Lr = 0.020, S = 0.0250 k/ft, Trib= 2.0 ft

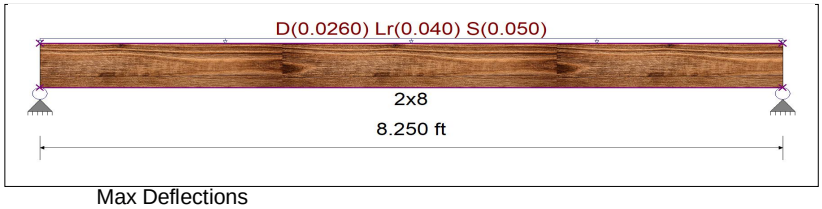
Design Summary

Max fb/Fb Ratio = **0.438** : 1
fb : Actual : 590.47 psi at 4.125 ft in Span # 1
Fb : Allowable : 1,348.95 psi
Load Comb : +D+S

Max fv/FvRatio = **0.251** : 1
fv : Actual : 43.24 psi at 0.000 ft in Span # 1
Fv : Allowable : 172.50 psi
Load Comb : +D+S

Max Reactions (k)

	D	L	Lr	S	W	E	H
Left Support	0.11		0.17	0.21			
Right Support	0.11		0.17	0.21			



Max Deflections

Transient Downward	0.085 in	Total Downward	0.129 in
Ratio	1170	Ratio	769
	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 : ORB2 - Outdoor Roof Beam

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : **5.5x9, GLB, Fully Braced**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending
Wood Species : DF/DF Wood Grade : 24F-V8

Fb - Tension	2400 psi	Fc - Prll	1650 psi	Fv	265 psi	Ebend- xx	1800 ksi	Density	31.21 pcf
Fb - Compr	2400 psi	Fc - Perp	650 psi	Ft	1100 psi	Eminbend - xx	950 ksi		

Applied Loads

Unif Load: D = 0.0130, Lr = 0.020, S = 0.0250 k/ft, Trib= 8.50 ft

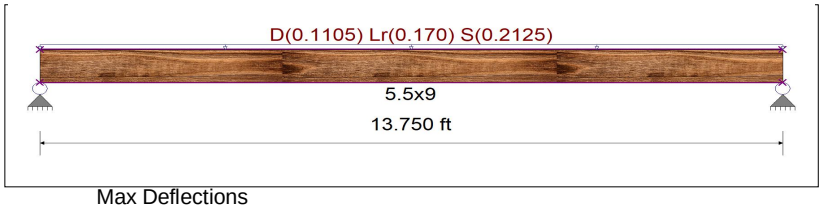
Design Summary

Max fb/Fb Ratio = **0.447** : 1
fb : Actual : 1,233.68 psi at 6.875 ft in Span # 1
Fb : Allowable : 2,760.00 psi
Load Comb : +D+S

Max fv/FvRatio = **0.221** : 1
fv : Actual : 67.29 psi at 0.000 ft in Span # 1
Fv : Allowable : 304.75 psi
Load Comb : +D+S

Max Reactions (k)

	D	L	Lr	S	W	E	H
Left Support	0.76		1.17	1.46			
Right Support	0.76		1.17	1.46			



Max Deflections

Transient Downward	0.286 in	Total Downward	0.434 in
Ratio	577	Ratio	379
	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: 21031_Pierce.ec6

LIC# : KW-06015519, Build:20.21.11.28 O.G. Engineering, PLLC (c) ENERCALC INC 1983-2021

Wood Beam Design : ORB3 - Outdoor Roof Beam

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : **5.5x10.5, GLB, Fully Unbraced**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending

Wood Species :	DF/DF					Wood Grade :	24F-V8		
Fb - Tension	2,400.0 psi	Fc - Prll	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

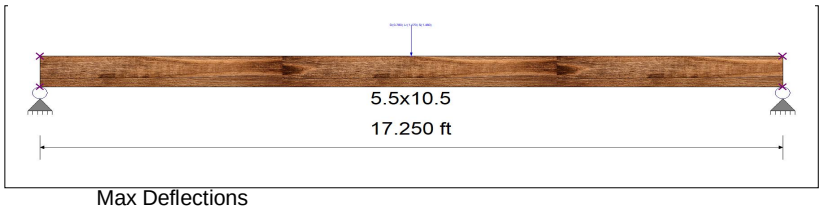
1Point: D = 0.760, Lr = 1.170, S = 1.460 k @ 8.625 ft

Design Summary

Max fb/Fb Ratio = **0.421** : 1
fb : Actual : 1,136.77 psi at 8.625 ft in Span # 1
Fb : Allowable : 2,698.54 psi
Load Comb : +D+S

Max fv/FvRatio = **0.095** : 1
fv : Actual : 28.83 psi at 0.000 ft in Span # 1
Fv : Allowable : 304.75 psi
Load Comb : +D+S

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	0.38		0.59	0.73			
Right Support	0.38		0.59	0.73			



Max Deflections

Transient Downward	0.284 in	Total Downward	0.432 in
Ratio	729	Ratio	479
	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 : ORB4 - Outdoor Roof Beam

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : **5.5x10.5, GLB, Fully Braced**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending

Wood Species :	DF/DF					Wood Grade :	24F-V8		
Fb - Tension	2,400.0 psi	Fc - Prll	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

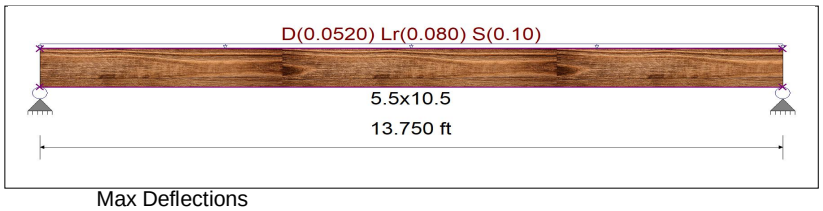
Unif Load: D = 0.0130, Lr = 0.020, S = 0.0250 k/ft, Trib= 4.0 ft

Design Summary

Max fb/Fb Ratio = **0.155** : 1
fb : Actual : 426.53 psi at 6.875 ft in Span # 1
Fb : Allowable : 2,760.00 psi
Load Comb : +D+S

Max fv/FvRatio = **0.089** : 1
fv : Actual : 27.14 psi at 0.000 ft in Span # 1
Fv : Allowable : 304.75 psi
Load Comb : +D+S

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	0.36		0.55	0.69			
Right Support	0.36		0.55	0.69			



Max Deflections

Transient Downward	0.085 in	Total Downward	0.129 in
Ratio	1948	Ratio	1282
	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: 21031_Pierce.ec6

LIC# : KW-06015519, Build:20.21.11.30 O.G. Engineering, PLLC (c) ENERCALC INC 1983-2021

Description : Main Floor Framing

Wood Beam Design : MFJ1 - Main Floor Joists

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : **2x10, Sawn, Fully Braced**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending

Wood Species :	Hem-Fir				Wood Grade :	No.2			
Fb - Tension	850.0 psi	Fc - Prll	1,300.0 psi	Fv	150.0 psi	Ebend- xx	1,300.0 ksi	Density	26.840 pcf
Fb - Compr	850.0 psi	Fc - Perp	405.0 psi	Ft	525.0 psi	Eminbend - xx	470.0 ksi		

Applied Loads

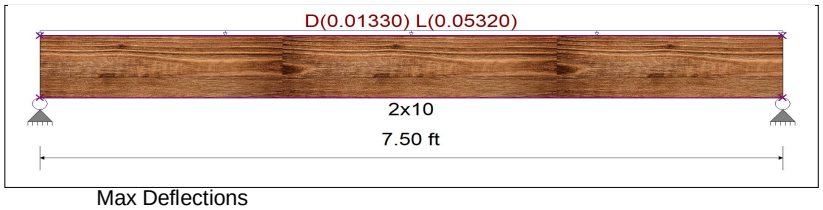
Unif Load: D = 0.010, L = 0.040 k/ft, Trib= 1.330 ft

Design Summary

Max fb/Fb Ratio = **0.244** : 1
fb : Actual : 262.31 psi at 3.750 ft in Span # 1
Fb : Allowable : 1,075.25 psi
Load Comb : +D+L

Max fv/FvRatio = **0.180** : 1
fv : Actual : 26.96 psi at 0.000 ft in Span # 1
Fv : Allowable : 150.00 psi
Load Comb : +D+L

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	0.05	0.20					
Right Support	0.05	0.20					



Max Deflections

Transient Downward	0.030 in	Total Downward	0.037 in
Ratio	3039	Ratio	2431
	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 : MFJ1 - Main Floor Joists

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : **4x10, Sawn, Fully Unbraced**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending

Wood Species :	Hem-Fir				Wood Grade :	No.2			
Fb - Tension	850.0 psi	Fc - Prll	1,300.0 psi	Fv	150.0 psi	Ebend- xx	1,300.0 ksi	Density	26.840 pcf
Fb - Compr	850.0 psi	Fc - Perp	405.0 psi	Ft	525.0 psi	Eminbend - xx	470.0 ksi		

Applied Loads

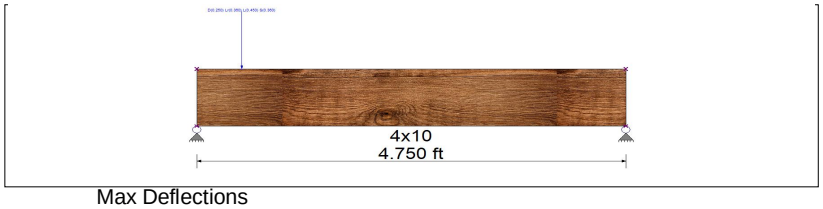
1Point: D = 0.250, Lr = 0.360, L = 0.450, S = 0.360 k @ 0.50 ft

Design Summary

Max fb/Fb Ratio = **0.079** : 1
fb : Actual : 92.09 psi at 0.507 ft in Span # 1
Fb : Allowable : 1,160.06 psi
Load Comb : +D+0.750L+0.750S

Max fv/FvRatio = **0.206** : 1
fv : Actual : 35.55 psi at 0.000 ft in Span # 1
Fv : Allowable : 172.50 psi
Load Comb : +D+0.750L+0.750S

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	0.22	0.40	0.32	0.32			
Right Support	0.03	0.05	0.04	0.04			



Max Deflections

Transient Downward	0.002 in	Total Downward	0.004 in
Ratio	9999	Ratio	9999
	LC: L Only		LC: +D+0.750Lr+0.750L
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Multiple Simple Beam

Project File: 21031_Pierce.ec6

LIC# : KW-06015519, Build:20.21.11.28 O.G. Engineering, PLLC (c) ENERCALC INC 1983-2021

Description : Low Roof Framing

Wood Beam Design : LRR1/2 - Low Roof Rafters

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : **2x8, Sawn, Fully Braced**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending

Wood Species :	Hem-Fir				Wood Grade :	No.2			
Fb - Tension	850.0 psi	Fc - Prll	1,300.0 psi	Fv	150.0 psi	Ebend- xx	1,300.0 ksi	Density	26.840 pcf
Fb - Compr	850.0 psi	Fc - Perp	405.0 psi	Ft	525.0 psi	Eminbend - xx	470.0 ksi		

Applied Loads

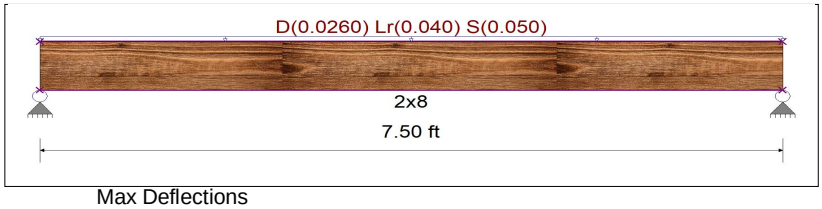
Unif Load: D = 0.0130, Lr = 0.020, S = 0.0250 k/ft, Trib= 2.0 ft

Design Summary

Max fb/Fb Ratio = **0.362** : 1
fb : Actual : 487.99 psi at 3.750 ft in Span # 1
Fb : Allowable : 1,348.95 psi
Load Comb : +D+S

Max fv/FvRatio = **0.191** : 1
fv : Actual : 33.02 psi at 0.000 ft in Span # 1
Fv : Allowable : 172.50 psi
Load Comb : +D+S

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	0.10		0.15	0.19			
Right Support	0.10		0.15	0.19			



Max Deflections

Transient Downward	0.058 in	Total Downward	0.088 in
Ratio	1557	Ratio	1024
	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 : LRB3 - Low Roof Beam

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : **4x8, Sawn, Fully Braced**
Using Allowable Stress Design with ASCE 7-16 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

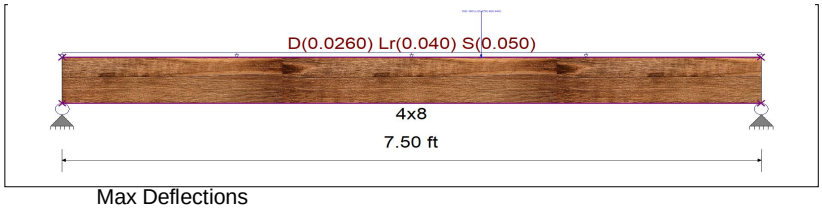
Unif Load: D = 0.0130, Lr = 0.020, S = 0.0250 k/ft, Trib= 2.0 ft
1Point: D = 0.180, Lr = 0.270, S = 0.340 k @ 4.50 ft

Design Summary

Max fb/Fb Ratio = **0.446** : 1
fb : Actual : 567.10 psi at 4.500 ft in Span # 1
Fb : Allowable : 1,270.75 psi
Load Comb : +D+S

Max fv/FvRatio = **0.189** : 1
fv : Actual : 32.60 psi at 6.900 ft in Span # 1
Fv : Allowable : 172.50 psi
Load Comb : +D+S

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	0.17		0.26	0.32			
Right Support	0.21		0.31	0.39			



Max Deflections

Transient Downward	0.059 in	Total Downward	0.090 in
Ratio	1531	Ratio	1004
	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: 21031_Pierce.ec6

LIC# : KW-06015519, Build:20.21.11.28 O.G. Engineering, PLLC (c) ENERCALC INC 1983-2021

Wood Beam Design : LRR4 - Low Roof Rafters

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : **2x4, Sawn, Fully Braced**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending

Wood Species :	Hem-Fir				Wood Grade :	No.2			
Fb - Tension	850.0 psi	Fc - Prll	1,300.0 psi	Fv	150.0 psi	Ebend- xx	1,300.0 ksi	Density	26.840 pcf
Fb - Compr	850.0 psi	Fc - Perp	405.0 psi	Ft	525.0 psi	Eminbend - xx	470.0 ksi		

Applied Loads

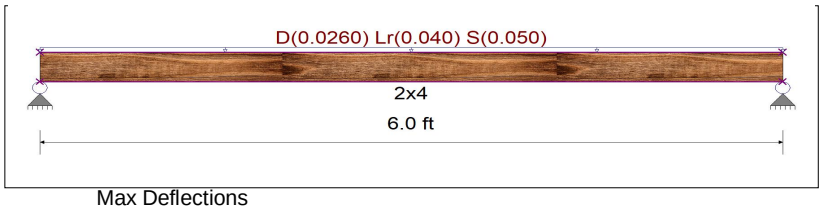
Unif Load: D = 0.0130, Lr = 0.020, S = 0.0250 k/ft, Trib= 2.0 ft

Design Summary

Max fb/Fb Ratio = **0.795** : 1
fb : Actual : 1,340.08 psi at 3.000 ft in Span # 1
Fb : Allowable : 1,686.19 psi
Load Comb : +D+S

Max fv/FvRatio = **0.342** : 1
fv : Actual : 59.06 psi at 5.720 ft in Span # 1
Fv : Allowable : 172.50 psi
Load Comb : +D+S

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	0.08		0.12	0.15			
Right Support	0.08		0.12	0.15			



Max Deflections

Transient Downward	0.210 in	Total Downward	0.320 in
Ratio	342	Ratio	225
	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 : LRH5 - Low Roof Header

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : **5.5x9, GLB, Fully Braced**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending

Wood Species :	DF/DF				Wood Grade :	24F-V8			
Fb - Tension	2,400.0 psi	Fc - Prll	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

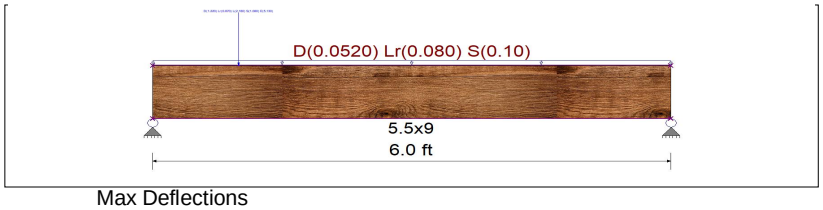
Unif Load: D = 0.0130, Lr = 0.020, S = 0.0250 k/ft, Trib= 4.0 ft
1Point: D = 1.220, Lr = 0.870, L = 2.180, S = 1.080, E = 5.130 k @ 1.0 ft

Design Summary

Max fb/Fb Ratio = **0.242** : 1
fb : Actual : 930.41 psi at 1.000 ft in Span # 1
Fb : Allowable : 3,840.00 psi
Load Comb : +1.123D+0.750L+0.750S+0.5250

Max fv/FvRatio = **0.416** : 1
fv : Actual : 176.47 psi at 0.000 ft in Span # 1
Fv : Allowable : 424.00 psi
Load Comb : +1.123D+0.750L+0.750S+0.5250

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	1.17	1.82	0.97	1.20		4.28	
Right Support	0.36	0.36	0.39	0.48		0.86	



Max Deflections

Transient Downward	0.033 in	Total Downward	0.047 in
Ratio	2191	Ratio	1538
	LC: E Only		+0.750L+0.750S+0.5250E
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Multiple Simple Beam

Project File: 21031_Pierce.ec6

LIC# : KW-06015519, Build:20.21.11.30 O.G. Engineering, PLLC (c) ENERCALC INC 1983-2021

Description : Outdoor Deck Framing

Wood Beam Design : ODJ1 - Outdoor Deck Joists

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : **2x10, Sawn, Fully Braced**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending

Wood Species :	Hem-Fir					Wood Grade :	No.2		
Fb - Tension	850.0 psi	Fc - Prll	1,300.0 psi	Fv	150.0 psi	Ebend- xx	1,300.0 ksi	Density	26.840 pcf
Fb - Compr	850.0 psi	Fc - Perp	405.0 psi	Ft	525.0 psi	Eminbend - xx	470.0 ksi		

Applied Loads

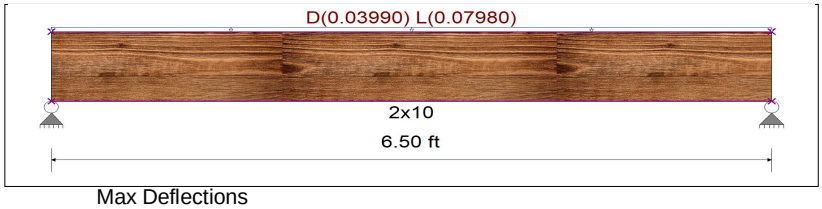
Unif Load: D = 0.030, L = 0.060 k/ft, Trib= 1.330 ft

Design Summary

Max fb/Fb Ratio = **0.412** : 1
fb : Actual : 354.64 psi at 3.250 ft in Span # 1
Fb : Allowable : 860.20 psi
Load Comb : +D+L

Max fv/FvRatio = **0.277** : 1
fv : Actual : 32.24 psi at 0.000 ft in Span # 1
Fv : Allowable : 116.40 psi
Load Comb : +D+L

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	0.13	0.26					
Right Support	0.13	0.26					



Max Deflections

Transient Downward	0.028 in	Total Downward	0.042 in
Ratio	2802	Ratio	1868
	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 : ODB2 - Outdoor Deck Beam

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16

BEAM Size : **6x10, Sawn, Fully Braced**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending

Wood Species :	Hem-Fir					Wood Grade :	No.1		
Fb - Tension	1,050.0 psi	Fc - Prll	750.0 psi	Fv	140.0 psi	Ebend- xx	1,300.0 ksi	Density	26.840 pcf
Fb - Compr	1,050.0 psi	Fc - Perp	405.0 psi	Ft	525.0 psi	Eminbend - xx	470.0 ksi		

Applied Loads

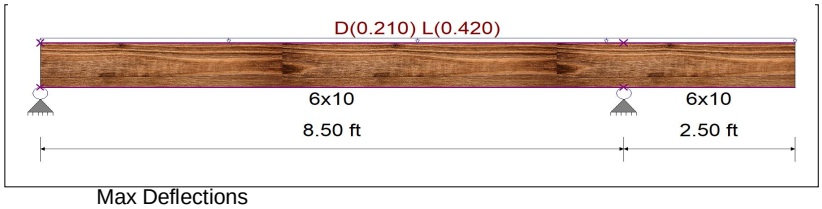
Unif Load: D = 0.030, L = 0.060 k/ft, Trib= 7.0 ft

Design Summary

Max fb/Fb Ratio = **0.927** : 1
fb : Actual : 778.39 psi at 4.123 ft in Span # 1
Fb : Allowable : 840.00 psi
Load Comb : +D+L+H, LL Comb Run (L*)

Max fv/FvRatio = **0.746** : 1
fv : Actual : 83.52 psi at 8.500 ft in Span # 1
Fv : Allowable : 112.00 psi
Load Comb : +D+L+H, LL Comb Run (LL)

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	0.82	1.79					
Right Support	1.49	2.99					



Max Deflections

Transient Downward	0.097 in	Total Downward	0.136 in
Ratio	1047	Ratio	750
	L Only, LL Comb Run (L*)		)+L+H, LL Comb Run (L*)
Transient Upward	-0.091 in	Total Upward	-0.117 in
Ratio	660	Ratio	512
	L Only, LL Comb Run (L*)		)+L+H, LL Comb Run (L*)

Wood Column

Project File: 21031_Pierce.ec6

LIC# : KW-06015519, Build:20.21.11.30 O.G. Engineering, PLLC (c) ENERCALC INC 1983-2021

DESCRIPTION: Post Supporting UFB3 (worst case 3-1/2x5-1/4 PSL)

Code References

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

Analysis Method	Allowable Stress Design		
End Fixities	Top & Bottom Pinned		
Overall Column Height	7.75 ft		
(Used for non-slender calculations)			
Wood Species	iLevel Truss Joist		
Wood Grade	Parallam PSL 1.8E		
Fb +	2400 psi	Fv	190 psi
Fb -	2400 psi	Ft	1755 psi
Fc - Prll	2500 psi	Density	45.07 pcf
Fc - Perp	425 psi		

E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial
Basic	1800	1800	1800 ksi
Minimum	914.88	914.88	

Wood Section Name	**3.5x5.25**		
Wood Grading/Manuf.	Trus Joist		
Wood Member Type	Parallam PSL		
Exact Width	**3.50** in	Allow Stress Modification Factors	
Exact Depth	**5.250** in	Cf or Cv for Bending	1.0
Area	18.375 in^2	Cf or Cv for Compressio	1.0
Ix	42.205 in^4	Cf or Cv for Tension	1.0
Iy	18.758 in^4	Cm : Wet Use Factor	1.0
		Ct : Temperature Fact	1.0
		Cfu : Flat Use Factor	1.0
		Kf : Built-up columns	1.0 *NDS 15.3.2*
		Use Cr : Repetitive ?	No

Brace condition for deflection (buckling) along columns :
X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 7.
Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 7.

Applied Loads

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

Column self weight included : 44.571 lbs * Dead Load Factor
AXIAL LOADS . . .
UFB3: Axial Load at 7.750 ft, D = 1.770, Lr = 1.380, L = 3.860, S = 1.720 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.3232 : 1**

Load Combination	+D+0.750L+0.750S
Governing NDS Forumla	Comp Only, fc/Fc'
Location of max.above base	0.0 ft
At maximum location values are .	
Applied Axial	6.0 k
Applied Mx	0.0 k-ft
Applied My	0.0 k-ft
Fc : Allowable	1,010.39 psi

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

Load Combination	+0.60D
Location of max.above base	7.750 ft
Applied Design Shear	0.0 psi
Allowable Shear	304.0 psi

Maximum SERVICE Lateral Load Reactions . .

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

Maximum SERVICE Load Lateral Deflections . . .

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

Other Factors used to calculate allowable stresses . . .

	Bending	Compression	Tension

Load Combination Results

Load Combination	C_D	C_P	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Maximum Shear Ratios: Stress Ratio	Status	Location
D Only	0.900	0.439	0.09997	PASS	0.0 ft	0.0	PASS	7.750 ft
+D+L	1.000	0.399	0.3092	PASS	0.0 ft	0.0	PASS	7.750 ft
+D+Lr	1.250	0.325	0.1711	PASS	0.0 ft	0.0	PASS	7.750 ft
+D+S	1.150	0.351	0.1904	PASS	0.0 ft	0.0	PASS	7.750 ft
+D+0.750Lr+0.750L	1.250	0.325	0.3077	PASS	0.0 ft	0.0	PASS	7.750 ft
+D+0.750L+0.750S	1.150	0.351	0.3232	PASS	0.0 ft	0.0	PASS	7.750 ft
+0.60D	1.600	0.257	0.05756	PASS	0.0 ft	0.0	PASS	7.750 ft

Wood Column

Project File: 21031_Pierce.ec6

LIC# : KW-06015519, Build:20.21.11.30 O.G. Engineering, PLLC (c) ENERCALC INC 1983-2021

DESCRIPTION: Post Supporting UFB3 (worst case 3-1/2x5-1/4 PSL)

Maximum Reactions

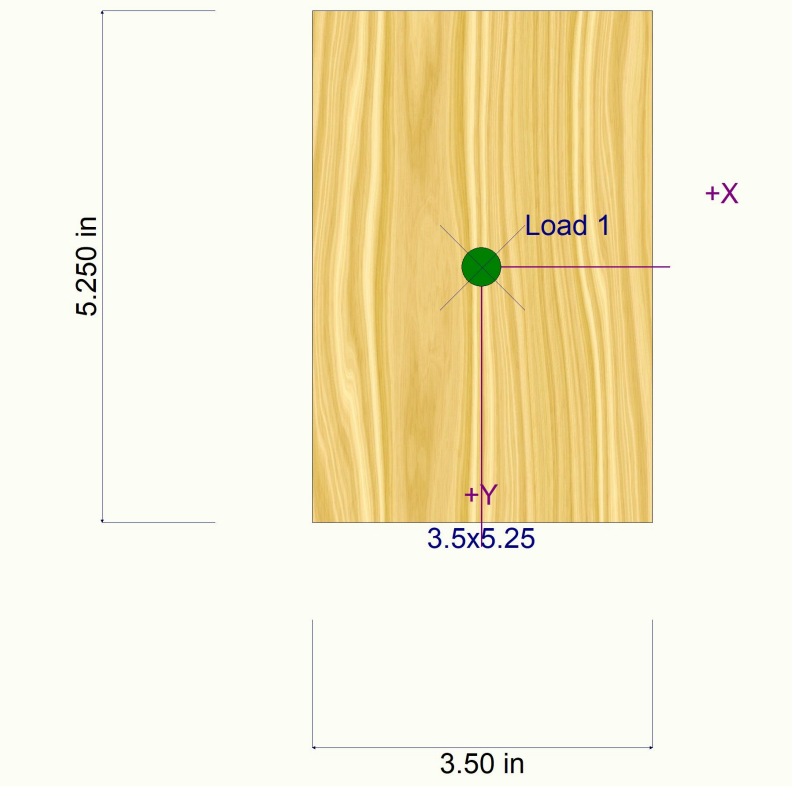
Note: Only non-zero reactions are listed.

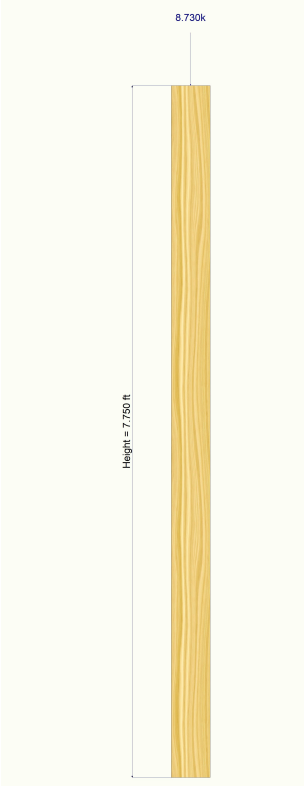
Load Combination	X-X Axis Reaction @ Base	@ Top	k	Y-Y Axis Reaction @ Base	@ Top	Axial Reaction @ Base	My - End Moments @ Base	@ Top	k-ft	Mx - End Moments @ Base	@ Top
D Only						1.815					
+D+L						5.675					
+D+Lr						3.195					
+D+S						3.535					
+D+0.750Lr+0.750L						5.745					
+D+0.750L+0.750S						6.000					
+0.60D						1.089					
Lr Only						1.380					
L Only						3.860					
S Only						1.720					

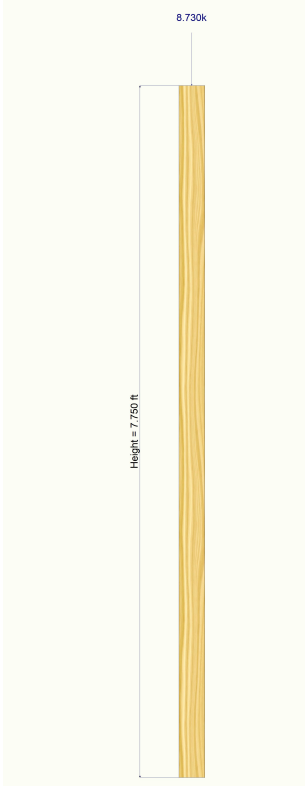
Maximum Deflections for Load Combinations

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

Sketches







Wood Column

Project File: 21031_Pierce.ec6

LIC# : KW-06015519, Build:20.21.11.30 O.G. Engineering, PLLC (c) ENERCALC INC 1983-2021

DESCRIPTION: Post Supporting UFB4 (worst case 4x4)

Code References

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

Analysis Method	Allowable Stress Design		
End Fixities	Top & Bottom Pinned		
Overall Column Height	7.75 ft		
(Used for non-slender calculations)			
Wood Species	Hem-Fir		
Wood Grade	No.2		
Fb +	850 psi	Fv	150 psi
Fb -	850 psi	Ft	525 psi
Fc - Prll	1300 psi	Density	26.84 pcf
Fc - Perp	405 psi		

E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial
Basic	1300	1300	1300 ksi
Minimum	470	470	

Wood Section Name	**4x4**		
Wood Grading/Manuf.	Graded Lumber		
Wood Member Type	Sawn		
Exact Width	**3.50** in	Allow Stress Modification Factors	
Exact Depth	**3.50** in	Cf or Cv for Bending	1.50
Area	12.250 in^2	Cf or Cv for Compressio	1.150
Ix	12.505 in^4	Cf or Cv for Tension	1.50
Iy	12.505 in^4	Cm : Wet Use Factor	1.0
		Ct : Temperature Fact	1.0
		Cfu : Flat Use Factor	1.0
		Kf : Built-up columns	1.0 *NDS 15.3.2*
		Use Cr : Repetitive ?	No

Brace condition for deflection (buckling) along columns :
X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 7.
Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 7.

Applied Loads

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

Column self weight included : 17.695 lbs * Dead Load Factor
AXIAL LOADS . . .
UFB4: Axial Load at 7.750 ft, D = 0.930, Lr = 0.510, L = 1.130, S = 0.670 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.3713 : 1**

Load Combination	+D+0.750L+0.750S
Governing NDS Forumla	Comp Only, fc/Fc'
Location of max.above base	0.0 ft
At maximum location values are .	
Applied Axial	2.298 k
Applied Mx	0.0 k-ft
Applied My	0.0 k-ft
Fc : Allowable	505.16 psi

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

Load Combination	+0.60D
Location of max.above base	7.750 ft
Applied Design Shear	0.0 psi
Allowable Shear	240.0 psi

Maximum SERVICE Lateral Load Reactions . .

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

Maximum SERVICE Load Lateral Deflections . . .

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

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

Other Factors used to calculate allowable stresses . . .

	Bending	Compression	Tension

Load Combination Results

Load Combination	C_D	C_P	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Maximum Shear Ratios: Stress Ratio	Status	Location
D Only	0.900	0.365	0.1576	PASS	0.0 ft	0.0	PASS	7.750 ft
+D+L	1.000	0.333	0.3409	PASS	0.0 ft	0.0	PASS	7.750 ft
+D+Lr	1.250	0.272	0.2338	PASS	0.0 ft	0.0	PASS	7.750 ft
+D+S	1.150	0.294	0.2614	PASS	0.0 ft	0.0	PASS	7.750 ft
+D+0.750Lr+0.750L	1.250	0.272	0.3492	PASS	0.0 ft	0.0	PASS	7.750 ft
+D+0.750L+0.750S	1.150	0.294	0.3713	PASS	0.0 ft	0.0	PASS	7.750 ft
+0.60D	1.600	0.217	0.08952	PASS	0.0 ft	0.0	PASS	7.750 ft

Wood Column

Project File: 21031_Pierce.ec6

LIC# : KW-06015519, Build:20.21.11.30 O.G. Engineering, PLLC (c) ENERCALC INC 1983-2021

DESCRIPTION: Post Supporting UFB4 (worst case 4x4)

Maximum Reactions

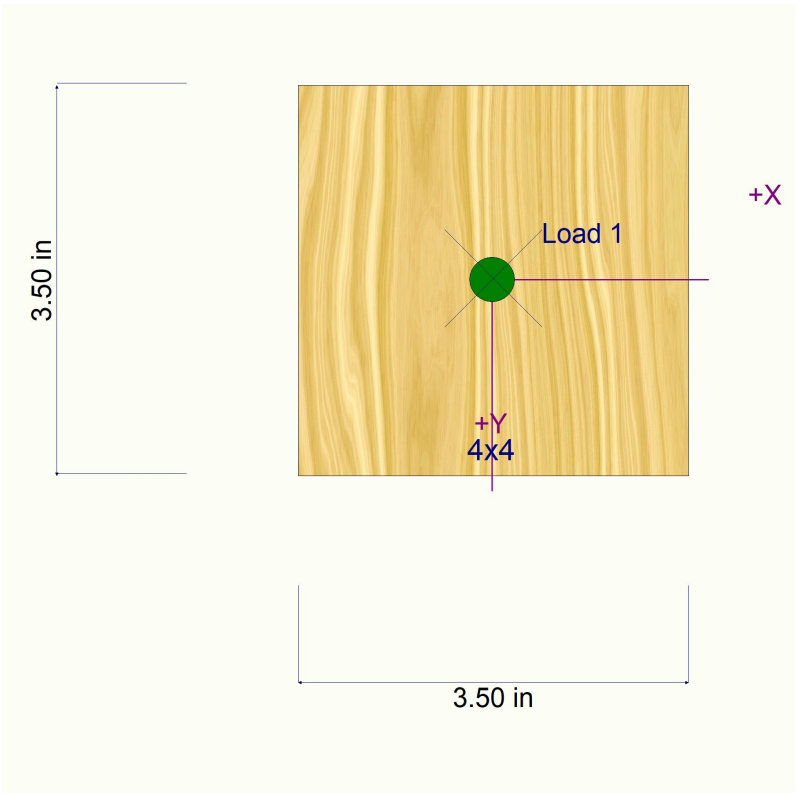
Note: Only non-zero reactions are listed.

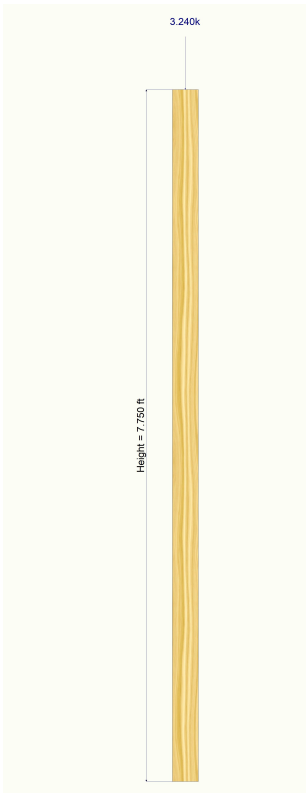
Load Combination	X-X Axis Reaction @ Base	@ Top	k	Y-Y Axis Reaction @ Base	@ Top	Axial Reaction @ Base	My - End Moments @ Base	@ Top	k-ft	Mx - End Moments @ Base	@ Top
D Only						0.948					
+D+L						2.078					
+D+Lr						1.458					
+D+S						1.618					
+D+0.750Lr+0.750L						2.178					
+D+0.750L+0.750S						2.298					
+0.60D						0.569					
Lr Only						0.510					
L Only						1.130					
S Only						0.670					

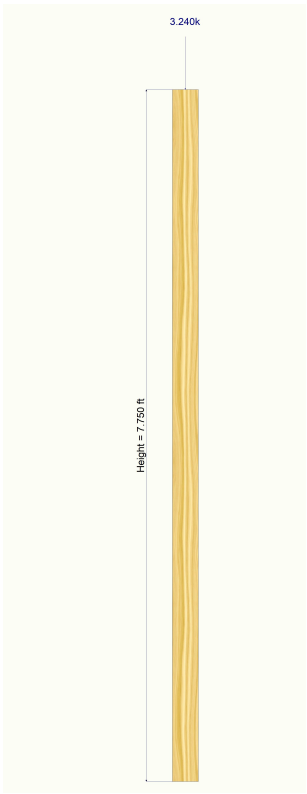
Maximum Deflections for Load Combinations

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

Sketches







Wood Column

Project File: 21031_Pierce.ec6

LIC# : KW-06015519, Build:20.21.11.30 O.G. Engineering, PLLC (c) ENERCALC INC 1983-2021

DESCRIPTION: Post Supporting UFB6 (worst case 4x6)

Code References

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

Analysis Method	Allowable Stress Design		
End Fixities	Top & Bottom Pinned		
Overall Column Height	7.75 ft		
(Used for non-slender calculations)			
Wood Species	Hem-Fir		
Wood Grade	No.2		
Fb +	850.0 psi	Fv	150.0 psi
Fb -	850.0 psi	Ft	525.0 psi
Fc - Prll	1,300.0 psi	Density	26.840 pcf
Fc - Perp	405.0 psi		

E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial
Basic	1,300.0	1,300.0	1,300.0 ksi
Minimum	470.0	470.0	

Wood Section Name	**4x6**		
Wood Grading/Manuf.	Graded Lumber		
Wood Member Type	Sawn		
Exact Width	**3.50** in	Allow Stress Modification Factors	
Exact Depth	**5.50** in	Cf or Cv for Bending	1.30
Area	19.250 in^2	Cf or Cv for Compressio	1.10
Ix	48.526 in^4	Cf or Cv for Tension	1.30
Iy	19.651 in^4	Cm : Wet Use Factor	1.0
		Ct : Temperature Fact	1.0
		Cfu : Flat Use Factor	1.0
		Kf : Built-up columns	1.0 *NDS 15.3.2*
		Use Cr : Repetitive ?	No

Brace condition for deflection (buckling) along columns :
X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 7.
Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 7.

Applied Loads

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

Column self weight included : 27.807 lbs * Dead Load Factor
AXIAL LOADS . . .
UFB6: Axial Load at 7.750 ft, D = 1.940, Lr = 1.020, L = 2.260, S = 1.340 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.4822 : 1**

Load Combination	+D+0.750L+0.750S
Governing NDS Forumla	Comp Only, fc/Fc'
Location of max.above base	0.0 ft
At maximum location values are .	
Applied Axial	4.668 k
Applied Mx	0.0 k-ft
Applied My	0.0 k-ft
Fc : Allowable	502.89 psi

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

Load Combination	+0.60D
Location of max.above base	7.750 ft
Applied Design Shear	0.0 psi
Allowable Shear	240.0 psi

Maximum SERVICE Lateral Load Reactions . .

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

Maximum SERVICE Load Lateral Deflections . . .

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

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

Other Factors used to calculate allowable stresses . . .

	Bending	Compression	Tension

Load Combination Results

Load Combination	C_D	C_P	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Maximum Shear Ratios: Stress Ratio	Status	Location
D Only	0.900	0.379	0.2096	PASS	0.0 ft	0.0	PASS	7.750 ft
+D+L	1.000	0.346	0.4438	PASS	0.0 ft	0.0	PASS	7.750 ft
+D+Lr	1.250	0.284	0.3061	PASS	0.0 ft	0.0	PASS	7.750 ft
+D+S	1.150	0.306	0.3417	PASS	0.0 ft	0.0	PASS	7.750 ft
+D+0.750Lr+0.750L	1.250	0.284	0.4536	PASS	0.0 ft	0.0	PASS	7.750 ft
+D+0.750L+0.750S	1.150	0.306	0.4822	PASS	0.0 ft	0.0	PASS	7.750 ft
+0.60D	1.600	0.226	0.1186	PASS	0.0 ft	0.0	PASS	7.750 ft

Wood Column

Project File: 21031_Pierce.ec6

LIC# : KW-06015519, Build:20.21.11.30 O.G. Engineering, PLLC (c) ENERCALC INC 1983-2021

DESCRIPTION: Post Supporting UFB6 (worst case 4x6)

Maximum Reactions

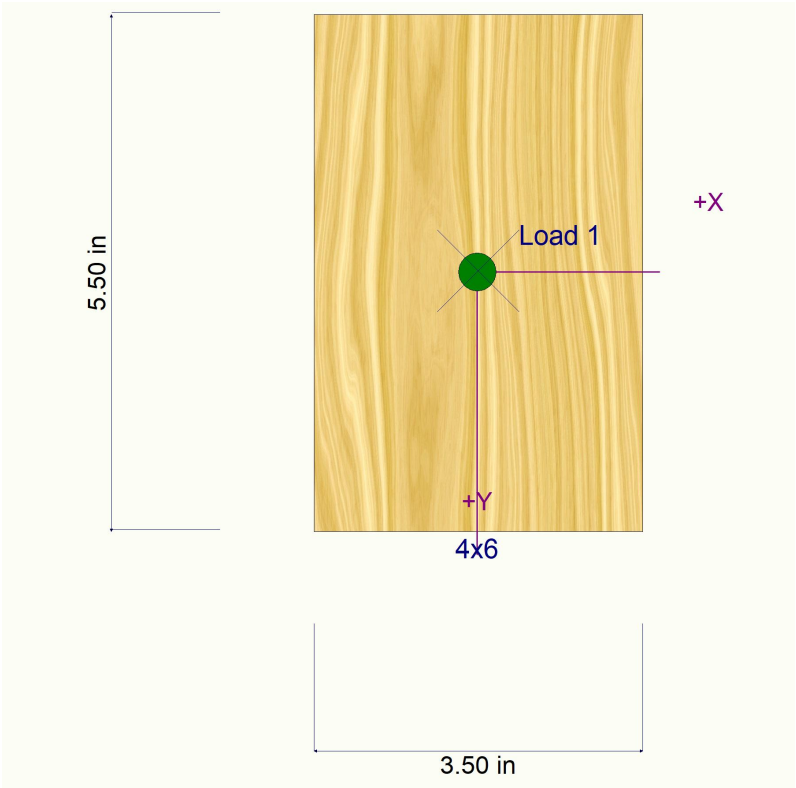
Note: Only non-zero reactions are listed.

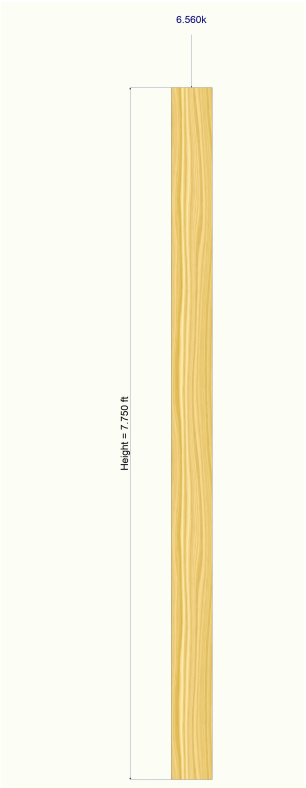
Load Combination	X-X Axis Reaction @ Base	@ Top	k	Y-Y Axis Reaction @ Base	@ Top	Axial Reaction @ Base	My - End Moments @ Base	@ Top	k-ft	Mx - End Moments @ Base	@ Top
D Only						1.968					
+D+L						4.228					
+D+Lr						2.988					
+D+S						3.308					
+D+0.750Lr+0.750L						4.428					
+D+0.750L+0.750S						4.668					
+0.60D						1.181					
Lr Only						1.020					
L Only						2.260					
S Only						1.340					

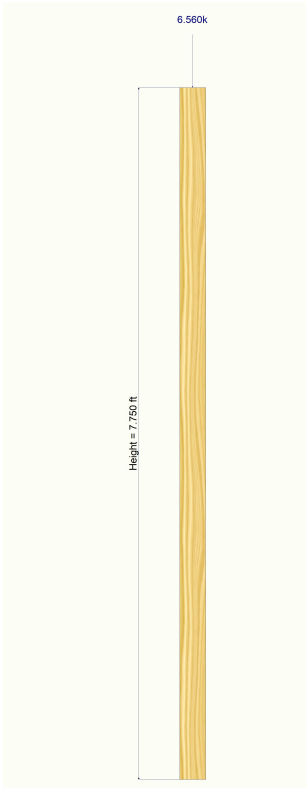
Maximum Deflections for Load Combinations

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

Sketches







O.G. Engineering, PLLC
8645 22nd Ave SW
Seattle, WA 98106

Project Title:
Engineer:
Project ID:
Project Descr:

Printed: 27 JUL 2021, 5:52PM

Combined Footing

File: 21031_Pierce.ec6

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Lic. # : KW-06011183 — O.G. Engineering, PLLC

DESCRIPTION: F1 - Interior Pad Footing

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

Material Properties

f'c : Concrete 28 day strength		2.50 ksi
fy : Rebar Yield		60.0 ksi
Ec : Concrete Elastic Modulus		3,122.0 ksi
Concrete Density		145.0 pcf
ϕ : Phi Values	Flexure :	0.90
	Shear :	0.750

Analysis/Design Settings

Calculate footing weight as dead load ?	Yes
Calculate Pedestal weight as dead load ?	No
Min Steel % Bending Reinf (based on 'd')	
Min Allow % Temp Reinf (based on thick)	0.00180
Min. Overturning Safety Factor	1.0: 1
Min. Sliding Safety Factor	1.0: 1

Soil Information

Allowable Soil Bearing	2.0 ksf
Increase Bearing By Footing Weight	No
Soil Passive Sliding Resistance	250.0 pcf
(Uses entry for "Footing base depth below soil surface" for force)	
Coefficient of Soil/Concrete Friction	0.30

Soil Bearing Increase

Footing base depth below soil surface	ft
Increases based on footing Depth	
Allowable pressure increase per foot	ksf
when base of footing is below	ft
Increases based on footing Width . . .	
Allowable pressure increase per foot	ksf
when maximum length or width is greater than	ft
Maximum Allowed Bearing Pressure	10.0 ksf
(A value of zero implies no limit)	
Adjusted Allowable Soil Bearing	2.0 ksf
(Allowable Soil Bearing adjusted for footing weight and depth & width increases as specified by user.)	

Dimensions & Reinforcing

Distance Left of Column #1	=	1.0 ft
Between Columns	=	3.0 ft
Distance Right of Column #2	=	1.0 ft
Total Footing Length	=	5.0 ft
Footing Width	=	2.0 ft
Footing Thickness	=	10.0 in
Rebar Center to Concrete Edge @ Top	=	3.0 in
Rebar Center to Concrete Edge @ Bottom	=	3.0 in

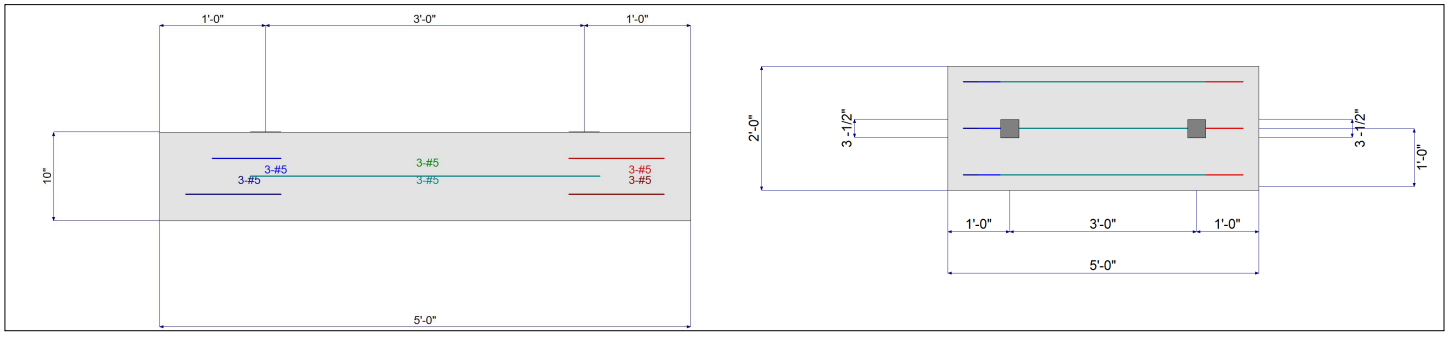
Pedestal dimensions...

		Col #1	Col #2	
Sq. Dim.	=	3.50	3.50	in
Height	=			in

Bars left of Col #1	Count	Size #	As Provided	As Req'd
Bottom Bars	3.0	5	0.930	0.4320 in^2
Top Bars	3.0	5	0.930	0.0 in^2
Bars Btwn Cols				
Bottom Bars	3.0	5	0.930	0.4320 in^2
Top Bars	3.0	5	0.930	0.4320 in^2
Bars Right of Col #2				
Bottom Bars	3.0	5	0.930	0.4320 in^2
Top Bars	3.0	5	0.930	0.0 in^2

Applied Loads

Applied @ Left Column		D	Lr	L	S	W	E	H	
Axial Load Downward	=	2.010	1.410	2.550	1.750				k
Moment (+CW)	=								k-ft
Shear (+X)	=								k
Applied @ Right Column									
Axial Load Downward	=	2.150	1.830	3.230	2.290				k
Moment (+CW)	=								k-ft
Shear (+X)	=								k
Overburden	=								



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Combined Footing

Lic. # : KW-06011183 — O.G. Engineering, PLLC

DESCRIPTION: F1 - Interior Pad Footing

DESIGN SUMMARY

Design OK

Factor of Safety	Item	Applied	Capacity	Governing Load Combination
PASS No OTM	Overturning	0.0 k-ft	0.0 k-ft	No OTM
PASS No Sliding	Sliding	0.0 k	1.611 k	No Sliding
PASS No Uplift	Uplift	0.0 k	0.0 k	No Uplift

Utilization Ratio	Item	Applied	Capacity	Governing Load Combination
PASS 0.7314	Soil Bearing	1.463 ksf	2.0 ksf	+D+0.750L+0.750S
PASS 0.1995	1-way Shear - Col #1	14.959 psi	75.0 psi	+1.20D+L+1.60S
PASS 0.2248	1-way Shear - Col #2	16.860 psi	75.0 psi	+1.20D+L+1.60S
PASS 0.1489	2-way Punching - Col #1	22.341 psi	150.0 psi	+1.20D+L+1.60S
PASS 0.1424	2-way Punching - Col #2	21.366 psi	150.0 psi	+1.20D+L+1.60S
PASS No Bending	Flexure - Left of Col #1 - Top	0.0 k-ft	0.0 k-ft	N/A
PASS 0.03880	Flexure - Left of Col #1 - Bottom	1.048 k-ft	27.006 k-ft	+1.20D+L+1.60S
PASS 0.07982	Flexure - Between Cols - Top	-2.156 k-ft	27.006 k-ft	+1.20D+L+1.60S
PASS 0.04456	Flexure - Between Cols - Bottom	1.203 k-ft	27.006 k-ft	+1.20D+L+1.60S
PASS No Bending	Flexure - Right of Col #2 - Top	0.0 k-ft	0.0 k-ft	N/A
PASS 0.05342	Flexure - Right of Col #2 - Bottom	1.443 k-ft	27.006 k-ft	+1.20D+L+1.60S

Soil Bearing

Load Combination...	Total Bearing	Eccentricity from Ftg CL	Actual Soil Bearing Stress @ Left Edge	@ Right Edge	Allowable	Actual / Allow Ratio
D Only	5.37 k	0.039 ft	0.51 ksf	0.56 ksf	2.00 ksf	0.281
+D+L	11.15 k	0.110 ft	0.97 ksf	1.26 ksf	2.00 ksf	0.631
+D+Lr	8.61 k	0.098 ft	0.76 ksf	0.96 ksf	2.00 ksf	0.481
+D+S	9.41 k	0.108 ft	0.82 ksf	1.06 ksf	2.00 ksf	0.531
+D+0.750Lr+0.750L	12.13 k	0.119 ft	1.04 ksf	1.39 ksf	2.00 ksf	0.693
+D+0.750L+0.750S	12.73 k	0.124 ft	1.08 ksf	1.46 ksf	2.00 ksf	0.731
+0.60D	3.22 k	0.039 ft	0.31 ksf	0.34 ksf	2.00 ksf	0.169

Overturning Stability

Load Combination...	Moments about Left Edge k-ft Overturning	Resisting	Ratio	Moments about Right Edge k-ft Overturning	Resisting	Ratio
D Only	0.00	0.00	999.000	0.00	0.00	999.000
+D+L	0.00	0.00	999.000	0.00	0.00	999.000
+D+Lr	0.00	0.00	999.000	0.00	0.00	999.000
+D+S	0.00	0.00	999.000	0.00	0.00	999.000
+D+0.750Lr+0.750L	0.00	0.00	999.000	0.00	0.00	999.000
+D+0.750L+0.750S	0.00	0.00	999.000	0.00	0.00	999.000
+0.60D	0.00	0.00	999.000	0.00	0.00	999.000

Sliding Stability

Load Combination...	Sliding Force	Resisting Force	Sliding SafetyRatio
D Only	0.00 k	1.61 k	999
+D+L	0.00 k	3.34 k	999
+D+Lr	0.00 k	2.58 k	999
+D+S	0.00 k	2.82 k	999
+D+0.750Lr+0.750L	0.00 k	3.64 k	999
+D+0.750L+0.750S	0.00 k	3.82 k	999
+0.60D	0.00 k	0.97 k	999

General Footing

Project File: 21031_Pierce.ec6

LIC# : KW-06015519, Build:20.21.11.30 O.G. Engineering, PLLC (c) ENERCALC INC 1983-2021

DESCRIPTION: F7 - Outdoor Fireplace Pedestal & Footing

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

Material Properties

f'c : Concrete 28 day strength	=	2.50	ksi
fy : Rebar Yield	=	60.0	ksi
Ec : Concrete Elastic Modulus	=	2,850.0	ksi
Concrete Density	=	145.0	pcf
φ Values Flexure	=	0.90	
Shear	=	0.750	

Analysis Settings

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

Soil Design Values

Allowable Soil Bearing	=	2.670	ksf
Soil Density	=	110.0	pcf
Increase Bearing By Footing Weight	=	Yes	
Soil Passive Resistance (for Sliding)	=	250.0	pcf
Soil/Concrete Friction Coeff.	=	0.30	

Increases based on footing Depth

Footing base depth below soil surface	=	1.50	ft
Allow press. increase per foot of depth	=		ksf
when footing base is below	=		ft

Increases based on footing plan dimension

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

Dimensions

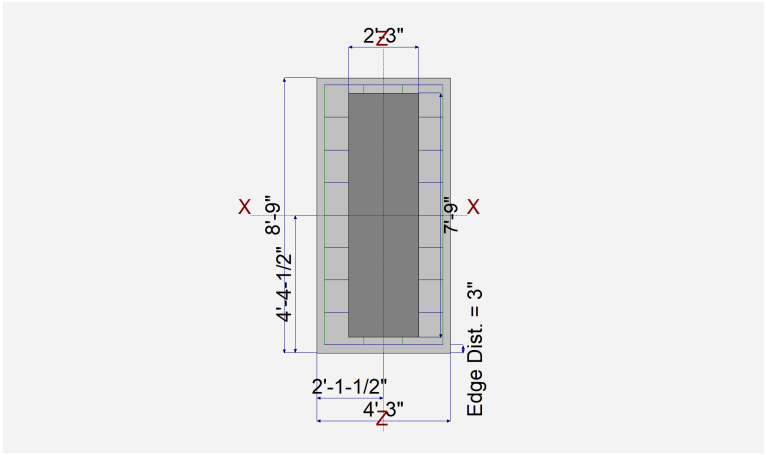
Width parallel to X-X Axis	=	4.250 ft
Length parallel to Z-Z Axis	=	8.750 ft
Footing Thickness	=	12.0 in

Pedestal dimensions...

px : parallel to X-X Axis	=	27.0 in
pz : parallel to Z-Z Axis	=	93.0 in
Height	=	22.0 in

Rebar Centerline to Edge of Concrete...

at Bottom of footing	=	3.250 in



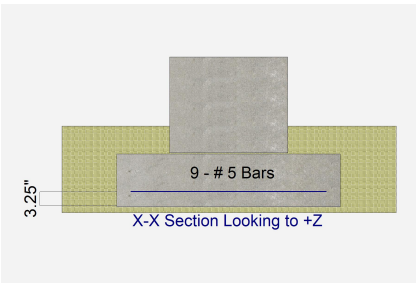
Reinforcing

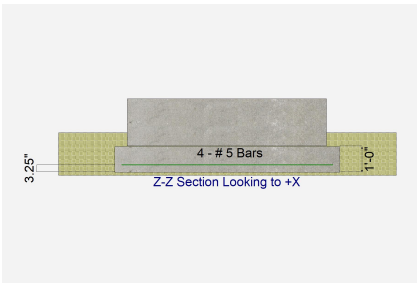
Bars parallel to X-X Axis			
Number of Bars	=		9.0
Reinforcing Bar Size	=	#	5
Bars parallel to Z-Z Axis			
Number of Bars	=		4.0
Reinforcing Bar Size	=	#	5

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation

	Bars along X-X Axis
# Bars required within zone	65.4 %
# Bars required on each side of zone	34.6 %





Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=								k
OB : Overburden	=								ksf
M-xx	=								k-ft
M-zz	=						11.153		k-ft
V-x	=								k
V-z	=								k

General Footing

Project File: 21031_Pierce.ec6

LIC# : KW-06015519, Build:20.21.11.30 O.G. Engineering, PLLC (c) ENERCALC INC 1983-2021

DESCRIPTION: F7 - Outdoor Fireplace Pedestal & Footing

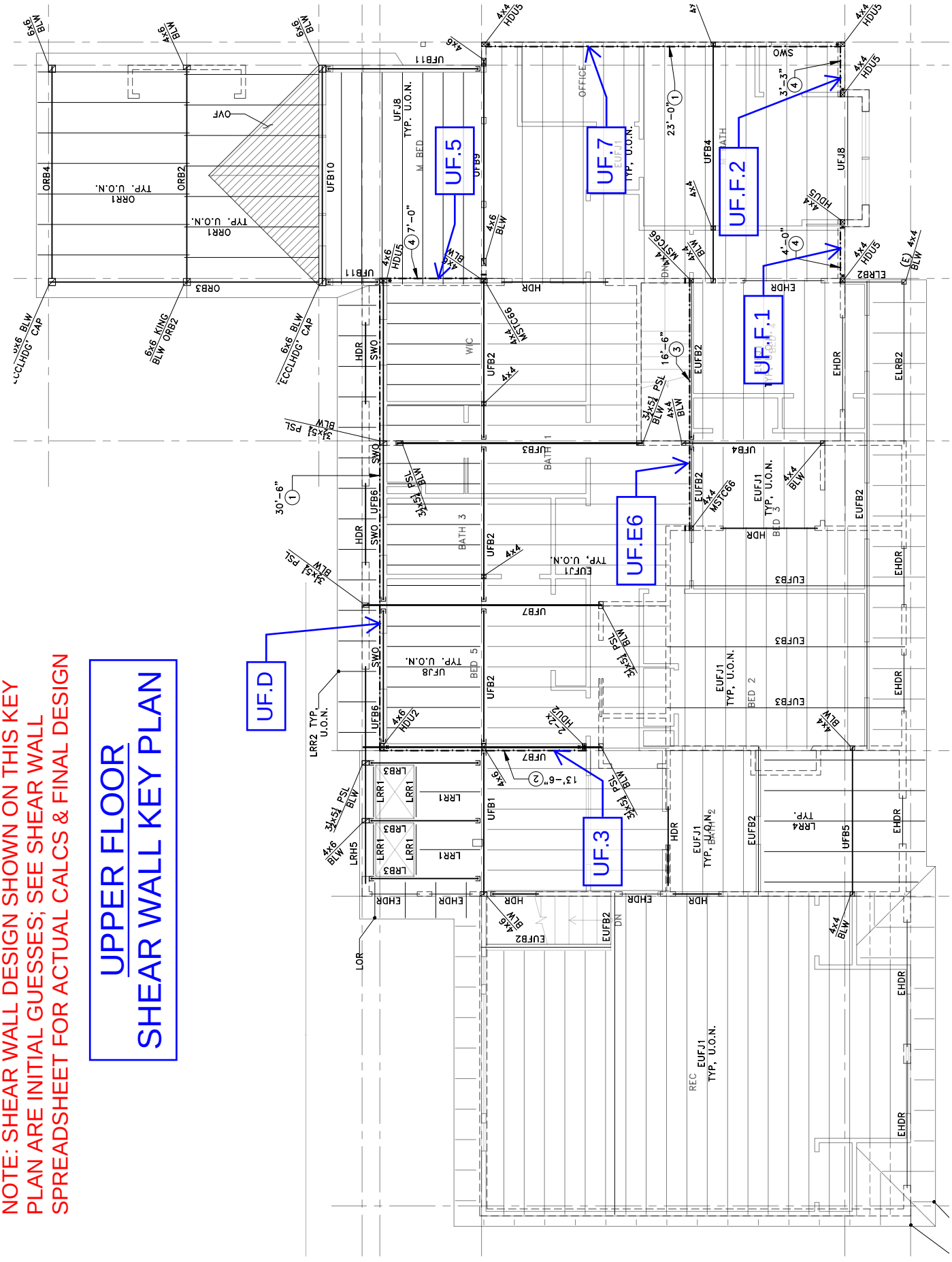
DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.8480	Soil Bearing	2.387 ksf	2.815 ksf	+0.60D+0.70E about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	1.411	Overturning - Z-Z	5.855 k-ft	8.260 k-ft	+0.60D+0.70E
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.03618	Z Flexure (+X)	0.4347 k-ft/ft	12.017 k-ft/ft	+0.90D+E
PASS	0.009693	Z Flexure (-X)	0.120 k-ft/ft	12.375 k-ft/ft	+1.20D+E
PASS	0.000396	X Flexure (+Z)	0.004502 k-ft/ft	11.366 k-ft/ft	+1.40D
PASS	0.000396	X Flexure (-Z)	0.004502 k-ft/ft	11.366 k-ft/ft	+1.40D
PASS	0.04839	1-way Shear (+X)	3.629 psi	75.0 psi	+0.90D+E
PASS	0.007771	1-way Shear (-X)	0.5829 psi	75.0 psi	+1.20D+E
PASS	n/a	1-way Shear (+Z)	0.0 psi	75.0 psi	n/a
PASS	n/a	1-way Shear (-Z)	0.0 psi	75.0 psi	n/a
PASS	0.002002	2-way Punching	0.2373 psi	118.548 psi	+0.90D+E

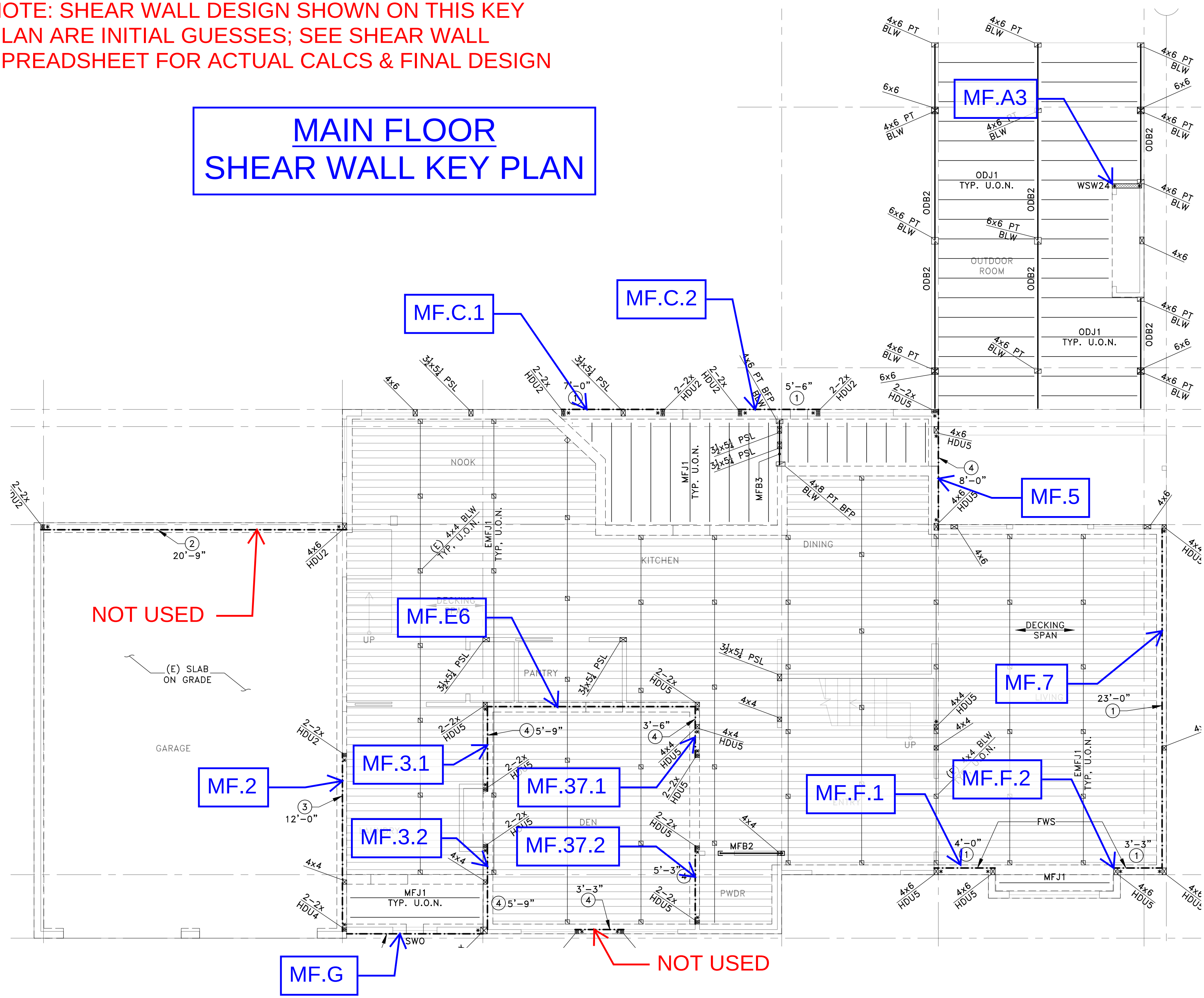
NOTE: SHEAR WALL DESIGN SHOWN ON THIS KEY PLAN ARE INITIAL GUESSES; SEE SHEAR WALL SPREADSHEET FOR ACTUAL CALCS & FINAL DESIGN

UPPER FLOOR
SHEAR WALL KEY PLAN



NOTE: SHEAR WALL DESIGN SHOWN ON THIS KEY PLAN ARE INITIAL GUESSES; SEE SHEAR WALL SPREADSHEET FOR ACTUAL CALCS & FINAL DESIGN

MAIN FLOOR SHEAR WALL KEY PLAN



Plywood Shear Wall Design

Refer to Shear Wall Key Plans

Story Forces - ASD Level	
Floor	F_x (psf)
Roof/Attic	6.2
Upper	4.4

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} = 0.44

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
MSTC28	1540
MSTC40	3080
MSTC52	4620

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} & $P_{DL,END}$, mulitplied 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}

Upper 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.D*	30.5	8	599	none	0	3706	3706	324	2	no	1	460
UF.E6	16.5	8	834	none	0	5160	5160	313	2	no	1	460
UF.F.1	4	8	160	none	0	990	990	247	1	no	1	310
UF.F.2	3.25	8	130	none	0	804	804	247	1	yes	0.81	252

Holdowns for Walls in North-South Direction									
Wall	OTM[7] (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.D*	29647	130	520	33294	-120		-120	NONE	#N/A
UF.E6	41279	180	720	15870	1540		1540	MSTC40	3080
UF.F.1	7919	180	720	1884	1509		1509	HDU2	3075
UF.F.2	6434	180	720	1435	1538		1538	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)
UF.3	13.5	8	600	none	0	3712	3712	275	1	no	1	310
UF.5	7	8	930	none	0	5754	5754	822	DBL 2	no	1	920
UF.7	23	8	300	none	0	1856	1856	81	1	no	1	310

Holdowns for Walls in East-West Direction									
Wall	OTM[7] (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.3	29697	80	320	5064	1825		1825	HDU2	3075
UF.5	46030	80	320	1832	6314		6314	MST72	6730
UF.7	14848	120	480	18661	-166		-166	NONE	#N/A

Upper Floor/ Low 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)
MF.A3	WSW24	11.5	220	none	0	970	970	N/A	WSW24	N/A	N/A	2920lbs
MF.C.1	7	8	410	UF.D	2075	1807	3883	555	3	no	1	600
MF.C.2	5.5	8	320	UF.D	1631	1411	3041	553	3	no	1	600
MF.E6	14	8	880	UF.E6	5160	3879	9039	646	4	no	1	770
MF.F.1	4	8	230	UF.F.1	990	1014	2004	501	3	no	1	600
MF.F.2	3.25	8	190	UF.F.2	804	838	1642	505	3	yes	0.81	488
MF.G*	9.25	8	480	NONE	0	2116	2116	457	2	no	1	460

Holdowns for Walls in North-South Direction									
Wall	OTM[7] (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.A3	11153	N/A	N/A	N/A	7239		7239	SB1x30	8315
MF.C.1	31061	80	320	1832	4176		4176	HDU4	4565
MF.C.2	24330	80	320	1296	4188		4188	HDU4	4565
MF.E6	72312	160	640	10748	4397		4397	HDU4	4565
MF.F.1	16030	80	320	838	3798	1509	5307	HDU5	5645
MF.F.2	13135	80	320	638	3845	1538	5383	HDU5	5645
MF.G*	16927	180	720	6264	1153		1153	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.2	12	8	520	YES	2475	2292	4767	397	2	no	1	460
MF.3.1	5.75	8	230	UF.3	1856	1014	2870	499	3	no	1	600
MF.3.2	5.75	8	230	UF.3	1856	1014	2870	499	3	no	1	600
MF.37.1	3.5	8	240	none	0	1058	1058	302	2	yes	0.88	403
MF.37.2	5.25	8	350	none	0	1543	1543	294	2	no	1	460
MF.5	8	8	760	UF.5	5754	3350	9104	1138	DBL 3	no	1	1200
MF.7	23	8	390	UF.7	1856	1719	3575	155	1	no	1	310

Holdowns for Walls in East-West Direction									
Wall	OTM[7] (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	38136	60	240	3141	2916		2916	HDU2	3075
MF.3.1	22959	60	240	1035	3813		3813	HDU4	4565
MF.3.2	22959	60	240	1035	3813		3813	HDU4	4565
MF.37.1	8464	60	240	527	2268		2268	HDU2	3075
MF.37.2	12343	60	240	910	2178		2178	HDU2	3075
MF.5	72832	170	2090	9666	7896	6314	14210	(2) HDU8	15740
MF.7	28602	190	720	29145	-24		-24	NONE	#N/A

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

Standard and Balloon Framing on Concrete Foundations

Strong-Wall® Wood Shearwall Standard Application on Concrete Foundation (cont.)

Strong-Wall Wood Shearwall Model[9]	Allowable Vertical Load, P (lb.)[4]	2,500 psi Concrete						3,000 psi Concrete					
		Seismic[3]			Wind			Seismic[3]			Wind		
		Allowable ASD Shear Load, V (lb.)	Drift at Allowable Shear, Δ (in.)[10]	Anchor Tension at Allowable Shear, T (lb.)[11]	Allowable ASD Shear Load, V (lb.)	Drift at Allowable Shear, Δ (in.)[10]	Anchor Tension at Allowable Shear, T (lb.)[11]	Allowable ASD Shear Load, V (lb.)	Drift at Allowable Shear, Δ (in.)[10]	Anchor Tension at Allowable Shear, T (lb.)[11]	Allowable ASD Shear Load, V (lb.)	Drift at Allowable Shear, Δ (in.)[10]	Anchor Tension at Allowable Shear, T (lb.)[11]
WSW12x12	1,000	485	0.62	8,540	625	0.80	10,915	485	0.62	8,540	625	0.80	10,915
	4,000	485	0.62	8,540	625	0.80	10,915	485	0.62	8,540	625	0.80	10,915
	7,500	485	0.62	8,540	625	0.80	10,915	485	0.62	8,540	625	0.80	10,915
WSW18x12	1,000	1,340	0.58	13,580	1,645	0.75	16,675	1,340	0.58	13,580	1,755	0.80	17,770
	4,000	1,340	0.58	13,580	1,495	0.68	15,160	1,340	0.58	13,580	1,755	0.80	17,770
	7,500	1,340	0.58	13,580	1,320	0.60	13,395	1,340	0.58	13,580	1,605	0.73	16,280
WSW24x12	1,000	2,920	0.58	21,795	3,195	0.66	23,830	2,920	0.58	21,795	3,750	0.77	27,985
	4,000	2,920	0.58	21,795	2,980	0.61	22,240	2,920	0.58	21,795	3,540	0.73	26,395
	7,500	2,920	0.58	21,795	2,735	0.56	20,390	2,920	0.58	21,795	3,290	0.68	24,540
WSW18x13	1,000	1,190	0.63	13,065	1,515	0.85	16,675	1,190	0.63	13,065	1,555	0.87	17,100
	4,000	1,190	0.63	13,065	1,380	0.77	15,160	1,190	0.63	13,065	1,555	0.87	17,100
	7,500	1,190	0.63	13,065	1,220	0.68	13,395	1,190	0.63	13,065	1,480	0.83	16,280
WSW24x13	1,000	2,590	0.64	20,970	2,945	0.74	23,830	2,590	0.64	20,970	3,445	0.87	27,865
	4,000	2,590	0.64	20,970	2,750	0.69	22,240	2,590	0.64	20,970	3,260	0.82	26,395
	7,500	2,590	0.64	20,970	2,520	0.63	20,390	2,590	0.64	20,970	3,035	0.76	24,540
WSW18x14[9]	1,000	960	0.69	11,580	1,245	0.93	14,995	960	0.69	11,580	1,245	0.93	14,995
	4,000	960	0.69	11,580	1,245	0.93	14,995	960	0.69	11,580	1,245	0.93	14,995
WSW24x14	1,000	2,175	0.69	19,300	2,685	0.89	23,830	2,175	0.69	19,300	2,815	0.93	24,970
	4,000	2,175	0.69	19,300	2,505	0.83	22,240	2,175	0.69	19,300	2,815	0.93	24,970
WSW18x16[9]	1,000	830	0.79	11,420	1,085	1.07	14,945	830	0.79	11,420	1,085	1.07	14,945
	4,000	830	0.79	11,420	1,085	1.07	14,945	830	0.79	11,420	1,085	1.07	14,945
WSW24x16	1,000	1,810	0.80	18,330	2,350	1.04	23,830	1,810	0.80	18,330	2,400	1.07	24,355
	4,000	1,810	0.80	18,330	2,195	0.97	22,240	1,810	0.80	18,330	2,400	1.07	24,355
WSW18x18[9]	1,000	650	0.90	10,105	855	1.20	13,225	650	0.90	10,105	855	1.20	13,225
	4,000	650	0.90	10,105	855	1.20	13,225	650	0.90	10,105	855	1.20	13,225
WSW24x18[9]	1,000	1,420	0.92	16,220	1,890	1.20	21,555	1,420	0.92	16,220	1,890	1.20	21,555
	4,000	1,420	0.92	16,220	1,890	1.20	21,555	1,420	0.92	16,220	1,890	1.20	21,555
WSW18x20	1,000	545	1.03	9,385	700	1.33	12,020	545	1.03	9,385	700	1.33	12,020
	4,000	545	1.03	9,385	700	1.33	12,020	545	1.03	9,385	700	1.33	12,020
WSW24x20	1,000	1,180	1.02	14,940	1,510	1.33	19,140	1,180	1.02	14,940	1,510	1.33	19,140
	4,000	1,180	1.02	14,940	1,510	1.33	19,140	1,180	1.02	14,940	1,510	1.33	19,140

1. Allowable shear loads are applicable to installations on concrete with specified compressive strengths as listed using the ASD basic (IBC Section 1605.3.1) or the alternative basic (IBC Section 1605.3.2) load combinations.
2. Load values include evaluation of bearing stresses on concrete foundations and do not require further evaluation by the Designer. For installations on masonry foundations, bearing capacity shall be evaluated by the Designer.
3. Seismic design based on 2015 IBC using R = 6.5. For other codes, use the seismic coefficients corresponding to light-frame bearing walls with wood structural panels or sheet-steel panels.
4. Allowable vertical load denotes the total maximum concentric vertical load permitted on the panel acting in combination with the allowable shear loads.
5. Allowable shear, drift and anchor tension values may be interpolated for intermediate height or vertical loads. For panels 74½"–78" tall, use the values for a 78"-tall panel.
6. High-strength anchor bolts are required for anchor tension forces exceeding the allowable load for standard-strength bolts tabulated on pages 23–24. See pages 22–29 for WSW-AB anchor bolt information and anchorage solutions.
7. All panels taller than 18' require a 2x6 minimum full-height stud attached to each side. Attach using 10d common nails at 16" o.c.
8. See page 14 for allowable out-of-plane and axial capacities.
9. WSW24x7 must be trimmed from a WSW24x8 shearwall. WSW18x14, 16, and 18, and WSW24x18 shearwalls are trimmed from a 20 ft.-tall panel.
10. Drifts at lower design shear may be linearly reduced.
11. Tabulated anchor tension values assume no resisting vertical load. Anchor tension loads at design shear values and including the effect of vertical load may be determined using the following equation:
    T = [(V x H) / B] – P/2, where:
    T = Anchor tension load (lb.)
    V = Design shear load (lb.)
    P = Applied vertical load (lb.)
    H = Panel height (in.)
    B = Moment arm (in.); 8.06" for WSW12, 13.94" for WSW18, 18.94" for WSW24.

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Anchorage Solutions

Strong-Wall® Wood Shearwall Tension Anchorage Solutions – 2,500 psi Concrete[1,5,6]

Design Criteria	Concrete Condition	Anchor Strength[2]	WSW-AB7/8 Anchor Bolt			WSW-AB1 Anchor Bolt		
			ASD Allowable Tension (lb.)	W (in.)	d_e (in.)	ASD Allowable Tension (lb.)	W (in.)	d_e (in.)
Seismic[3]	Cracked	Standard	11,900	27	9	16,100	33	11
			13,100	29	10	17,100	35	12
		High Strength	24,900	43	15	33,000	51	17
			27,100	46	16	35,300	54	18
	Uncracked	Standard	12,500	24	8	15,700	28	10
			13,100	25	9	17,100	30	10
		High Strength	25,300	38	13	32,300	44	15
			27,100	40	14	35,300	47	16
Wind[4]	Cracked	Standard	5,100	14	6	6,200	16	6
			8,700	20	7	11,400	24	8
			13,100	27	9	17,100	32	11
		High Strength	15,900	30	10	21,100	36	12
			18,400	33	11	27,300	42	14
			23,100	38	13	31,800	46	16
			27,100	42	14	35,300	50	17
	Uncracked	Standard	5,000	12	6	6,400	14	6
			9,300	18	6	12,500	22	8
			13,100	23	8	17,100	28	10
		High Strength	15,200	25	9	21,900	32	11
			19,900	30	10	26,400	36	12
			24,000	34	12	31,500	40	14
			27,100	37	13	35,300	43	15

Strong-Wall® Wood Shearwall Tension Anchorage Solutions – 3,000 psi Concrete[1,5,6]

Design Criteria	Concrete Condition	Anchor Strength[2]	WSW-AB7/8 Anchor Bolt			WSW-AB1 Anchor Bolt		
			ASD Allowable Tension (lb.)	W (in.)	d_e (in.)	ASD Allowable Tension (lb.)	W (in.)	d_e (in.)
Seismic[3]	Cracked	Standard	12,300	26	9	16,000	31	11
			13,100	28	10	17,100	33	11
		High Strength	25,200	41	14	32,700	48	16
			27,100	43	15	35,300	51	17
	Uncracked	Standard	12,000	22	8	16,300	27	9
			13,100	24	8	17,100	28	10
		High Strength	25,300	36	12	32,700	42	14
			27,100	38	13	35,300	44	15
Wind[4]	Cracked	Standard	5,000	13	6	5,600	14	6
			8,800	19	7	10,200	21	7
			13,100	25	9	17,100	30	10
		High Strength	15,700	28	10	20,100	33	11
			19,200	32	11	25,300	38	13
			23,200	36	12	32,300	44	15
			27,100	40	14	35,300	47	16
	Uncracked	Standard	5,500	12	6	6,200	13	6
			8,500	16	6	12,800	21	7
			13,100	22	8	17,100	26	9
		High Strength	16,600	25	9	21,800	30	10
			19,700	28	10	25,200	33	11
			24,000	32	11	31,700	38	13
			27,100	35	12	35,300	41	14

See footnotes on page 24.

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Force Transfer Around Openings Calculator

THREE 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

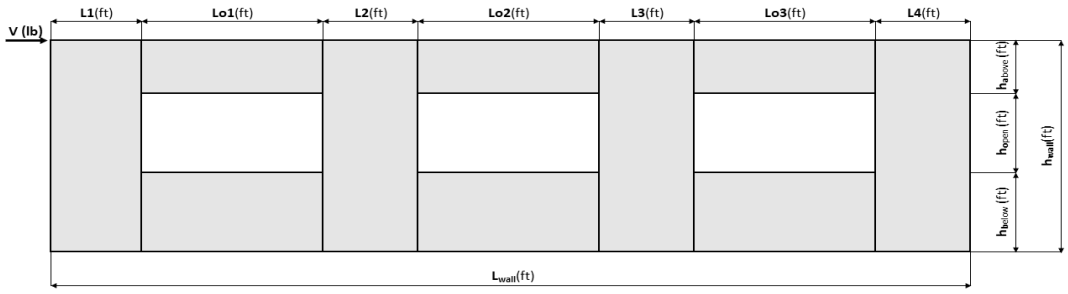
Code: **Date:**

Designer:

Client:

Project:

Wall Line: UF.D



Shear Wall Calculation Variables

V	3706 lbf		Opening 1		Opening 2		Opening 3	Adj. Factor Method =	2bs/h
L1	2.25 ft	ha1	1.25 ft	ha2	1.25 ft	ha3	1.25 ft	Wall Pier Aspect Ratio	Adj. Factor
L2	4.00 ft	ho1	5.00 ft	ho2	5.00 ft	ho3	5.00 ft	P1=ho1/L1= 2.22	0.900
L3	5.00 ft	hb1	1.75 ft	hb2	1.75 ft	hb3	1.75 ft	P2=ho2/L2= 1.25	N/A
L4	4.00 ft	Lo1	3.00 ft	Lo2	8.50 ft	Lo3	3.75 ft	P3=ho3/L3= 1.00	N/A
h_{wall}	8.00 ft							P4=ho3/L4= 1.25	N/A
L_{wall}	30.50 ft								

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 972 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(ha1+hb1) =	324 plf
Second opening: va2 = vb2 = H/(ha2+hb2) =	324 plf
Third opening: va3 = vb3 = H/(ha3+hb3) =	324 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	972 lbf
Second opening: O2 = va2 x (Lo2) =	2754 lbf
Third opening: O3 = va3 x (Lo3) =	1215 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	350 lbf
F2 = O1(L2)/(L1+L2) =	622 lbf
F3 = O2(L2)/(L2+L3) =	1224 lbf
F4 = O2(L3)/(L2+L3) =	1530 lbf
F5 = O3(L3)/(L3+L4) =	675 lbf
F6 = O3(L4)/(L3+L4) =	540 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) =	1.08 ft
T2 = (L2*Lo1)/(L1+L2) =	1.92 ft
T3 = (L2*Lo2)/(L2+L3) =	3.78 ft
T4 = (L3*Lo2)/(L2+L3) =	4.72 ft
T5 = (L3*Lo3)/(L3+L4) =	2.08 ft
T6 = (L4*Lo3)/(L3+L4) =	1.67 ft

6. Unit shear beside opening

V1 = (V/L)(L1+T1)/L1 =	180 plf
V2 = (V/L)(T2+L2+T3)/L2 =	295 plf
V3 = (V/L)(T4+L3+T5)/L3 =	287 plf
V4 = (V/L)(T6+L4)/L4 =	172 plf
Check V1*L1+V2*L2+V3*L3+V4*L4=V?	3706 lbf **OK**

7. Resistance to corner forces

R1 = V1*L1 =	405 lbf
R2 = V2*L2 =	1178 lbf
R3 = V3*L3 =	1434 lbf
R4 = V4*L4 =	689 lbf

8. Difference corner force + resistance

R1-F1 =	55 lbf
R2-F2-F3 =	-668 lbf
R3-F4-F5 =	-771 lbf
R4-F6 =	149 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 =	24 plf
vc2 = (R2-F2-F3)/L2 =	-167 plf
vc3 = (R3-F4-F5)/L3 =	-154 plf
vc4 = (R4-F6)/L4 =	37 plf

Project Information

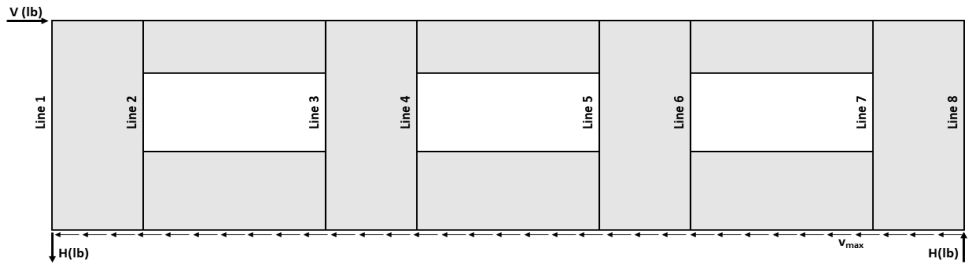
Code: **Date:**

Designer:

Client:

Project:

Wall Line: UF.D



Check Summary of Shear Values for Three Openings

Line 1: vc1(ha1+hb1)+V1(ho1)=H?		73	899	972 lbf
Line 2: va1(ha1+hb1)-vc1(ha1+hb1)-V1(ho1)=0?	972	73	899	0
Line 3: vc2(ha1+hb1)+V2(ho1)-va1(ha1+hb1)=0?	-501	1473	972	0
Line 4: va2(ha2+hb2)-V2(ho2)-vc2(ha2+hb2)=0?	972	1473	-501	0
Line 5: va2(ha2+hb2)-vc3(ha2+hb2)-V3(ho2)=0?	972	-462	1434	0
Line 6: va3(ha3+hb3)-V3(ho3)-vc3(ha3+hb3)=0?	972	1434	-462	0
Line 7: va3(ha3+hb3)-vc4(ha3+hb3)-V4(ho3)=0?	972	111	861	0
Line 8: vc4(ha3+hb3)+V4(ho3)=H?		111	861	972 lbf

Design Summary*

Req. Sheathing Capacity	324 plf
Req. Strap Force	1530 lbf
Req. HD Force (H)	972 lbf
Req. Shear Wall Anchorage Force (v_{max})	122 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

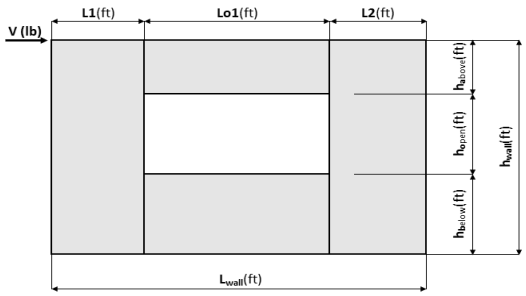
Code: **Date:**

Designer:

Client:

Project:

Wall Line: MF.G



Shear Wall Calculation Variables

V	2116 lbf	Opening 1	
L1	3.00 ft	ha1	1.25 ft
L2	3.25 ft	ho1	4.00 ft
h_{wall}	8.00 ft	hb1	2.75 ft
L_{wall}	9.25 ft	Lo1	3.00 ft

Adj. Factor Method =		2bs/h
Wall Pier Aspect Ratio		Adj. Factor
P1=ho1/L1=	1.33	N/A
P2=ho2/L2=	1.23	N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1830 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(ha1+hb1) = 457 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 1372 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 659 lbf

F2 = O1(L2)/(L1+L2) = 714 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 1.44 ft

T2 = (L2*Lo1)/(L1+L2) = 1.56 ft

6. Unit shear beside opening

V1 = (V/L)(L1+T1)/L1 = 339 plf

V2 = (V/L)(T2+L2)/L2 = 339 plf

Check V1*L1+V2*L2=V? 2116 lbf **OK**

7. Resistance to corner forces

R1 = V1*L1 = 1016 lbf

R2 = V2*L2 = 1100 lbf

8. Difference corner force + resistance

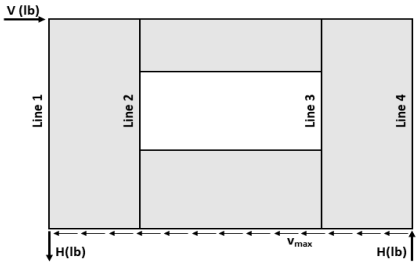
R1-F1 = 357 lbf

R2-F2 = 387 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 119 plf

vc2 = (R2-F2)/L2 = 119 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(ha1+hb1)+V1(ho1)=H?		476	1354	1830 lbf
Line 2: va1(ha1+hb1)-vc1(ha1+hb1)-V1(ho1)=0?	1830	476	1354	0
Line 3: va1(ha1+hb1)-vc2(ha1+hb1)-V1(ho1)=0?	1830	476	1354	0
Line 4: vc2(ha1+hb1)+V2(ho1)=H?		476	1354	1830 lbf

Design Summary*

Req. Sheathing Capacity	457 plf
Req. Strap Force	714 lbf
Req. HD Force (H)	1830 lbf
Req. Shear Wall Anchorage Force (v_{max})	229 plf

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