Structural Calculations

for

ADDITIONS & ALTERATIONS

Pierce Residence

5635 84th Ave SE

Mercer Island, WA 98040

FIELD REVISION 1

prepared by:
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Job No. 21031

Date: 10/5/22

Date: 10/5/2022
Job # 21031

Vertical Design Loads

Upper Roof		
Roofing	3	psf
Sheathing	2	
Framing	1.5	
5/8" Gypsum Board	2.8	
Insulation	0.4	
Sum	9.3	psf
Slope:	5	:12
Slope Correction Factor	1.08	
Subtotal	10.1	psf
M/E/P/misc.	1.9	psf
DL=	12	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

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*

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: 10/5/2022
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)
Upper Roof	2030	12	10	44660
UF/LR	2710	13	25	102980
			Sum:	**147640 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 =	**34548 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)
Upper Roof	44660	20	893200	0.49	**16955**	**8.4**
UF/LR	102980	9	926820	0.51	**17593**	**6.5**
		Sum:	1820020		34548	

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)
Upper Roof	13042	13042	44660	44660	0.29	13042
UF/LR	13533	26575	102980	147640	0.18	18536

Floor	F_{px} Min (lbs)	F_{px} Max (lbs)	F_{px} Gov (lbs)	F_{px} Gov (psf)
Upper Roof	7315	14631	**13042**	**6.4**
UF/LR	16868	33736	**18536**	**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

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

DESCRIPTION: 5635 84th Ave SE

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

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 "Y" Shear	(ft) "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

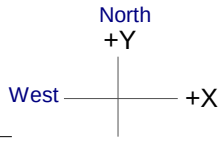
Project File: 21031_Pierce.ec6

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

$V_{SEISMIC} = 0.7 \times 34548 = \underset{EL,ASD}{24184^{\#}}$

WIND BASE SHEAR

$V_{WIND} = 0.6 \times 39080 = \underset{WL,ASD}{23448^{\#}}$

→ $V_{SEISMIC} > V_{WIND}$

∴ SEISMIC GOVERNS MLFRS DESIGN

UPPER FLOOR FRAMING

UFB1 UPPER FLOOR BEAM

SPAN = 29'-8"

USE 8 1/2 x 24 PSL

$w = \left[\frac{(8+20+25)}{DL\ LL\ SL}^{UR} + \frac{(6+20)}{DL\ LL}^{ATTIC}\right]\left(\frac{14'}{2}\right) + \frac{(13+40)}{DL\ LL}^{UF}\left(\frac{12'}{2}\right)$

$+ \frac{(13+20+25)}{DL\ LL\ SL}^{LR}\left(\frac{7'}{2}\right) + \frac{(10)}{DL}^{WALL}(8')$

$= 300^{\#} + 210 + 260 + 380^{\#/LF}$

DL LL SL LL

UFB2 UPPER FLOOR BEAM

SPAN = 10'-0"

USE 8 1/2 x 9 1/4 PSL

$w = 300 + 210 + 260 + 380^{\#/LF}$ (SIM UFB1)

DL LL SL LL

UFB3 UPPER FLOOR BEAM

SPAN = 15'-3"

USE W8x28

$P = (4330 + 3050 + 5370 + 3770)_{UFB1} + (1300 + 1050 + 240 + 130)_{UFB3}$

DL LL LL SL DL LL LL SL

$= 5050 + 4100 + 5370 + 7410^{\#}$ $e_x = 5'3"$

DL LL SL LL

UFB4 UPPER FLOOR BEAM

SPAN = 8'-9"

USE 3 1/2 x 9 1/4 PSL

$w = \frac{13+40}{DL\ LL}^{UF}$ PSF TRIB $= \frac{16'}{2} = 8'$

$P = \left\{\left[\frac{(8+20+25)}{DL\ LL\ SL}^{ROOF} + \frac{(6+20)}{DL\ LL}^{ATTIC}\right]\left(\frac{25'}{2}\right) + \frac{(7)}{DL}^{WALL}(8')\right\}\left(\frac{11'}{2}\right)$

$= 1850 + 2000 + 2500 + 2000^{\#}$ $e_x = 9"$

DL LL SL LL

UFB5 UPPER FLOOR BEAM

SPAN = 9'-3"

USE 4x10

$w = \frac{13+20+25}{DL\ LL\ SL}$ LF TRIB $= \frac{9'}{2} = 4'6"$

LOW ROOF FRAMING

LRR1/2 LOW ROOF RAFTERS

SPAN = 7'-6" W = 13+20+25 PSF DL LIVE SNOW USE 2x8 @ 24" O.C.

LRB3 LOW ROOF BEAM

SPAN = 7'-6" P = (13+20+25 PSF DL LIVE SNOW)(7'-7"/2)(7'-6"/2) = 180+270+340 lbs

USE 4x8

W = 13+20+25 PSF DL LIVE SNOW TRIB = 2' e_x = 4 1/2"

LRR4 LOW ROOF RAFTERS

SPAN = 6'-0" W = 13+20+25 PSF DL LIVE SNOW USE 2x4 @ 24" O.C.

LRH5 LOW ROOF HEADER

SPAN = 6'-0" W = 13+20+25 PSF DL LIVE SNOW TRIB = 8'/2 = 4'-0"

USE 4x6

MAIN FLOOR FRAMING

MFB3 MAIN FLOOR BEAM

SPAN = 21'-9" $P = \underset{OC}{3840} + \underset{MC}{2690} + \underset{SC}{3324} + \underset{U}{4860}$ #@MIDSPAN

VFB3

USE 5 1/4 x 9 1/4 PSL

POST

POST SUPPORTING (UFE1)

H = 8'-0" P = 4350 + 3050 + 3790 + 5571#
DL LL SL W

USE 3½ x 7 PSL

POST SUPPORTING (UFE3)

H = 8'-0" P = 3840 + 2690 + 3320 + 4860#
DL LL SL W

USE 3½ x 5¼ PSL (MAY → LARGER OK)

POST SUPPORTING (UFE4)

H = 8'-0" P = 2150 + 1830 + 2290 + 3230#
DL LL SL W

USE 4x4

FOUNDATIONS

F1 INTERIOR PAD FOOTING

$P_1 = \frac{2010}{DL} + \frac{1410}{LL} + \frac{1750}{SL} + \frac{2550}{U}$ #

$P_2 = \frac{2150}{DL} + \frac{1830}{LL} + \frac{2290}{SL} + \frac{3230}{U}$ #

OFB3

VFB4

3' APART

USE 2'x5' PAD FOOTING

Multiple Simple Beam

Project File: 21031_Pierce.ec6

Description : Upper Floor Framing

Wood Beam Design : UFB1 - Upper Floor Beam

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

BEAM Size : **3.5x24, 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

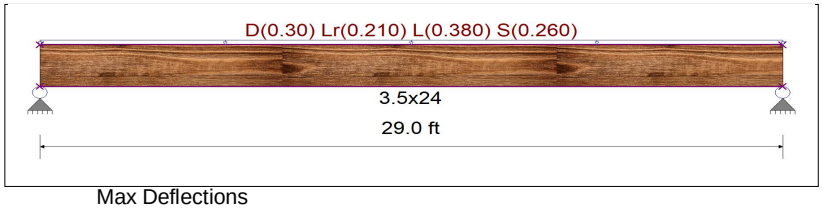
Unif Load: D = 0.30, Lr = 0.210, L = 0.380, S = 0.260 k/ft, Trib= 1.0 ft

Design Summary

Max fb/Fb Ratio = **0.951** : 1
fb : Actual : 2,553.04 psi at 14.500 ft in Span # 1
Fb : Allowable : 2,685.24 psi
Load Comb : +D+L+H

Max fv/FvRatio = **0.526** : 1
fv : Actual : 152.60 psi at 27.067 ft in Span # 1
Fv : Allowable : 290.00 psi
Load Comb : +D+L+H

Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	4.35	3.05	5.51	3.77			
Right Support	4.35	3.05	5.51	3.77			



Max Deflections

Transient Downward	0.685 in	Total Downward	1.226 in
Ratio	507	Ratio	283
	LC: L Only		LC: +D+L+H
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 : **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

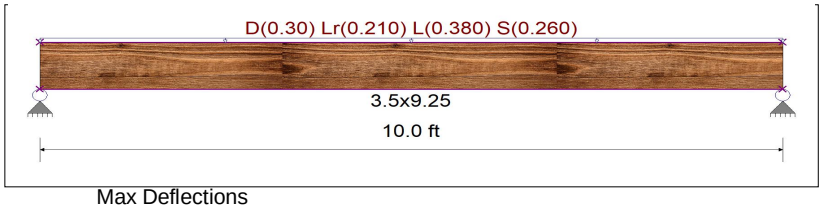
Unif Load: D = 0.30, Lr = 0.210, L = 0.380, S = 0.260 k/ft, Trib= 1.0 ft

Design Summary

Max fb/Fb Ratio = **0.705** : 1
fb : Actual : 2,043.62 psi at 5.000 ft in Span # 1
Fb : Allowable : 2,900.00 psi
Load Comb : +D+L+H

Max fv/FvRatio = **0.460** : 1
fv : Actual : 133.37 psi at 9.233 ft in Span # 1
Fv : Allowable : 290.00 psi
Load Comb : +D+L+H

Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	1.50	1.05	1.90	1.30			
Right Support	1.50	1.05	1.90	1.30			



Max Deflections

Transient Downward	0.169 in	Total Downward	0.303 in
Ratio	708	Ratio	396
	LC: L Only		LC: +D+L+H
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Multiple Simple Beam

Project File: 21031_Pierce.ec6

Steel Beam Design : UFB3 - Upper Floor Beam

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

STEEL Section : **W8x28, Defined Brace Locations, 1st at 5.250 ft, 2nd at ft, 3rd at fi**
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 = 5.850, Lr = 4.10, L = 7.410, S = 5.070 k @ 5.250 ft

Steel Beam Design : UFB3 - Upper Floor Beam

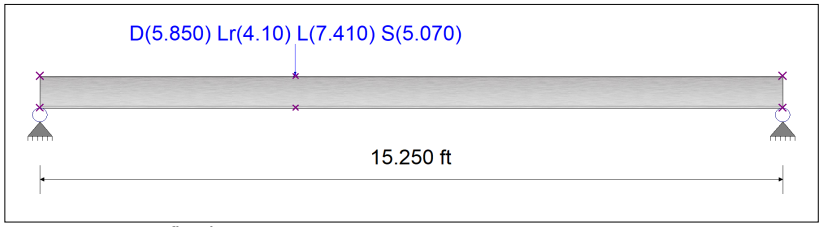
Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16

STEEL Section : **W8x28, Defined Brace Locations, 1st at 5.250 ft, 2nd at ft, 3rd at fi**
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 = **0.769** : 1
Mu : Applied 52.221 k-ft at 5.236 ft in Span # 1
Mn / Omega : Allow 67.864 k-ft
Load Comb : +D+0.750L+0.750S+H

Max fv/FvRatio = **0.217** : 1
Vu : Applied 9.974 k at 0.000 ft in Span # 1
Vn / Omega : Allow 45.942 k
Load Comb : +D+0.750L+0.750S+H



Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	3.84	2.69	4.86	3.32			
Right Support	2.01	1.41	2.55	1.75			

Max Deflections

Transient Downward	0.294 in	Total Downward	0.526 in
Ratio	623		348
	LC: L Only		LC: +D+L+H
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-06018000, Build:20.22.8.17 O.G. ENGINEERING, PLLC

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

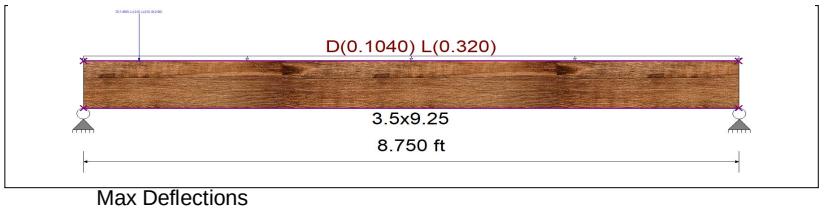
Unif Load: D = 0.0130, L = 0.040 k/ft, Trib= 8.0 ft
1Point: D = 1.850, Lr = 2.0, L = 2.0, S = 2.50 k @ 0.750 ft

Design Summary

Max fb/Fb Ratio = **0.467** : 1
fb : Actual : 1,353.59 psi at 3.588 ft in Span # 1
Fb : Allowable : 2,900.00 psi
Load Comb : +D+L+H

Max fv/FvRatio = **0.873** : 1
fv : Actual : 291.06 psi at 0.000 ft in Span # 1
Fv : Allowable : 333.50 psi
Load Comb : +D+0.750L+0.750S+H

Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	2.15	1.83	3.23	2.29			
Right Support	0.61	0.17	1.57	0.21			



Max Deflections

Transient Downward	0.108 in	Total Downward	0.158 in
Ratio	971	Ratio	664
	LC: L Only		LC: +D+L+H
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 : Douglas Fir-Larch Wood Grade : No.2

Fb - Tension	900 psi	Fc - Prll	1350 psi	Fv	180 psi	Ebend- xx	1600 ksi	Density	31.21 pcf
Fb - Compr	900 psi	Fc - Perp	625 psi	Ft	575 psi	Eminbend - xx	580 ksi		

Applied Loads

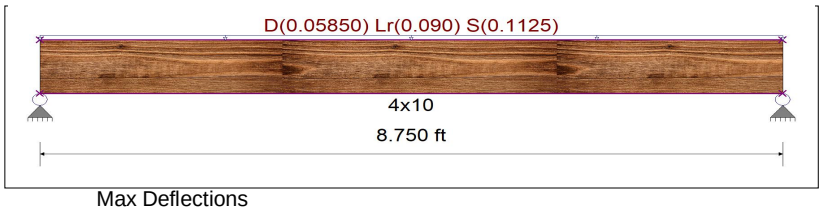
Unif Load: D = 0.0130, Lr = 0.020, S = 0.0250 k/ft, Trib= 4.50 ft

Design Summary

Max fb/Fb Ratio = **0.317** : 1
fb : Actual : 393.46 psi at 4.375 ft in Span # 1
Fb : Allowable : 1,242.00 psi
Load Comb : +D+S+H

Max fv/FvRatio = **0.167** : 1
fv : Actual : 34.66 psi at 0.000 ft in Span # 1
Fv : Allowable : 207.00 psi
Load Comb : +D+S+H

Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	0.26	0.39		0.49			
Right Support	0.26	0.39		0.49			



Max Deflections

Transient Downward	0.040 in	Total Downward	0.061 in
Ratio	2599	Ratio	1710
	LC: S Only		LC: +D+S+H
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-06018000, Build:20.22.8.17 O.G. ENGINEERING, PLLC

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 : 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

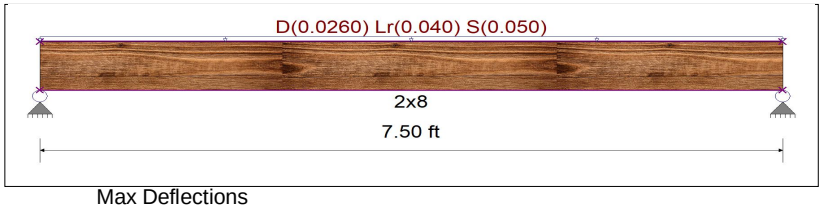
Unif Load: D = 0.0130, Lr = 0.020, S = 0.0250 k/ft, Trib= 2.0 ft

Design Summary

Max fb/Fb Ratio = **0.342** : 1
fb : Actual : 487.99 psi at 3.750 ft in Span # 1
Fb : Allowable : 1,428.30 psi
Load Comb : +D+S+H

Max fv/FvRatio = **0.160** : 1
fv : Actual : 33.02 psi at 0.000 ft in Span # 1
Fv : Allowable : 207.00 psi
Load Comb : +D+S+H

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



Max Deflections

Transient Downward	0.047 in	Total Downward	0.071 in
Ratio	1916	Ratio	1261
	LC: S Only		LC: +D+S+H
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 : 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

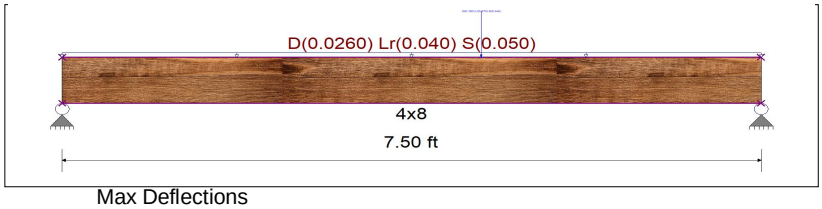
Unif Load: D = 0.0130, Lr = 0.020, S = 0.0250 k/ft, Trib= 2.0 ft
1Point: D = 0.180, Lr = 0.270, S = 0.340 k @ 4.50 ft

Design Summary

Max fb/Fb Ratio = **0.421** : 1
fb : Actual : 567.10 psi at 4.500 ft in Span # 1
Fb : Allowable : 1,345.50 psi
Load Comb : +D+S+H

Max fv/FvRatio = **0.157** : 1
fv : Actual : 32.60 psi at 6.900 ft in Span # 1
Fv : Allowable : 207.00 psi
Load Comb : +D+S+H

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



Max Deflections

Transient Downward	0.048 in	Total Downward	0.073 in
Ratio	1885	Ratio	1235
	LC: S Only		LC: +D+S+H
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Multiple Simple Beam

Project File: 21031_Pierce.ec6

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 :	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

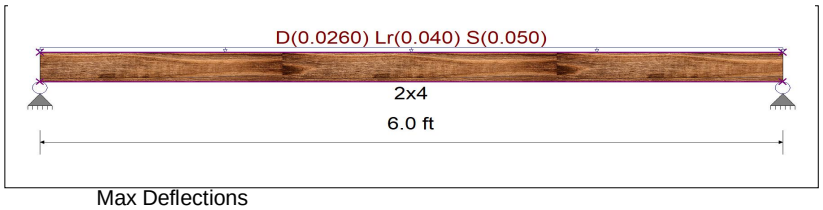
Unif Load: D = 0.0130, Lr = 0.020, S = 0.0250 k/ft, Trib= 2.0 ft

Design Summary

Max fb/Fb Ratio = **0.751** : 1
fb : Actual : 1,340.08 psi at 3.000 ft in Span # 1
Fb : Allowable : 1,785.38 psi
Load Comb : +D+S+H

Max fv/FvRatio = **0.285** : 1
fv : Actual : 59.06 psi at 5.720 ft in Span # 1
Fv : Allowable : 207.00 psi
Load Comb : +D+S+H

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



Max Deflections

Transient Downward	0.171 in	Total Downward	0.260 in
Ratio	421	Ratio	277
	LC: S Only		LC: +D+S+H
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Wood Beam Design : LRH4 - Low Roof Header

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

BEAM Size : **4x6, 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

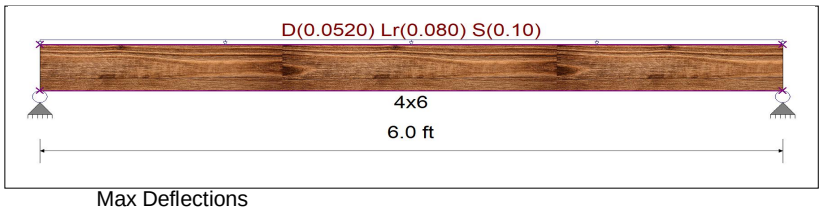
Unif Load: D = 0.0130, Lr = 0.020, S = 0.0250 k/ft, Trib= 4.0 ft

Design Summary

Max fb/Fb Ratio = **0.346** : 1
fb : Actual : 465.15 psi at 3.000 ft in Span # 1
Fb : Allowable : 1,345.50 psi
Load Comb : +D+S+H

Max fv/FvRatio = **0.146** : 1
fv : Actual : 30.32 psi at 5.560 ft in Span # 1
Fv : Allowable : 207.00 psi
Load Comb : +D+S+H

Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	0.16	0.24		0.30			
Right Support	0.16	0.24		0.30			



Max Deflections

Transient Downward	0.038 in	Total Downward	0.057 in
Ratio	1906	Ratio	1254
	LC: S Only		LC: +D+S+H
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Multiple Simple Beam

Project File: 21031_Pierce.ec6

Description : Main Floor Framing

Wood Beam Design : MFB3 - Main 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 IBC 2018 Load Combinations, Major Axis Bending

Wood Species : iLevel Truss Joist
Wood Grade : Parallam PSL 2.2E

Fb - Tension	2900 psi	Fc - Prll	2900 psi	Fv	290 psi	Ebend- xx	2200 ksi	Density	45.07 pcf
Fb - Compr	2900 psi	Fc - Perp	750 psi	Ft	2025 psi	Eminbend - xx	1118.19 ksi		

Applied Loads

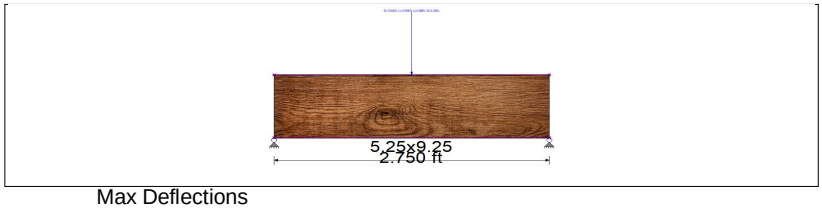
1Point: D = 3.840, Lr = 2.690, L = 4.860, S = 3.320 k @ 1.375 ft

Design Summary

Max fb/Fb Ratio = **0.331** : 1
fb : Actual : 958.70 psi at 1.375 ft in Span # 1
Fb : Allowable : 2,900.00 psi
Load Comb : +D+L+H

Max fv/FvRatio = **0.463** : 1
fv : Actual : 134.36 psi at 0.000 ft in Span # 1
Fv : Allowable : 290.00 psi
Load Comb : +D+L+H

Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	1.92	1.35	2.43	1.66			
Right Support	1.92	1.35	2.43	1.66			



Max Deflections

Transient Downward	0.005 in	Total Downward	0.010 in
Ratio	6874	Ratio	3349
	LC: L Only		.C: +D+0.750L+0.750S+H
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Wood Column

Project File: 21031_Pierce.ec6

DESCRIPTION: Post Supporting UFB1

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	8 ft		
(Used for non-slender calculations)			
Wood Species	iLevel Truss Joist		
Wood Grade	Parallam PSL 1.8E		
Fb +	2,400.0 psi	Fv	190.0 psi
Fb -	2,400.0 psi	Ft	1,755.0 psi
Fc - Prll	2,500.0 psi	Density	45.070 pcf
Fc - Perp	425.0 psi		

E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial
Basic	1,800.0	1,800.0	1,800.0 ksi
Minimum	914.88	914.88	

Wood Section Name	**3.5x7.0**		
Wood Grading/Manuf.	Trus Joist		
Wood Member Type	Parallam PSL		
Exact Width	**3.50** in	Allow Stress Modification Factors	
Exact Depth	**7.0** in	Cf or Cv for Bending	1.0
Area	24.50 in^2	Cf or Cv for Compressio	1.0
Ix	100.042 in^4	Cf or Cv for Tension	1.0
Iy	25.010 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 = 8 ft, K
Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 8 ft, K

Applied Loads

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

Column self weight included : 61.345 lbs * Dead Load Factor
AXIAL LOADS . . .
UFB1: Axial Load at 8.0 ft, D = 4.350, Lr = 3.050, L = 5.510, S = 3.790 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.4880 : 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	11.386 k
Applied Mx	0.0 k-ft
Applied My	0.0 k-ft
Fc : Allowable	952.43 psi

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

Load Combination	+0.60D
Location of max.above base	8.0 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	0.415	0.1929	PASS	0.0 ft	0.0	PASS	8.0 ft
+D+L	1.000	0.377	0.4296	PASS	0.0 ft	0.0	PASS	8.0 ft
+D+Lr	1.250	0.306	0.3181	PASS	0.0 ft	0.0	PASS	8.0 ft
+D+S	1.150	0.331	0.3515	PASS	0.0 ft	0.0	PASS	8.0 ft
+D+0.750Lr+0.750L	1.250	0.306	0.4618	PASS	0.0 ft	0.0	PASS	8.0 ft
+D+0.750L+0.750S	1.150	0.331	0.4880	PASS	0.0 ft	0.0	PASS	8.0 ft
+0.60D	1.600	0.242	0.1115	PASS	0.0 ft	0.0	PASS	8.0 ft

Wood Column

Project File: 21031_Pierce.ec6

DESCRIPTION: Post Supporting UFB1

Maximum Reactions

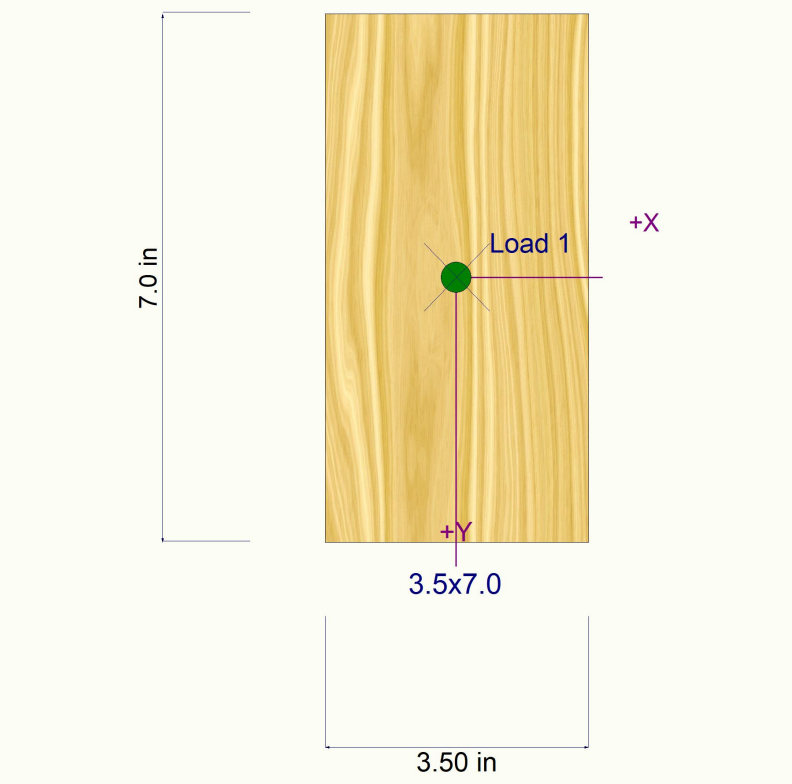
Note: Only non-zero reactions are listed.

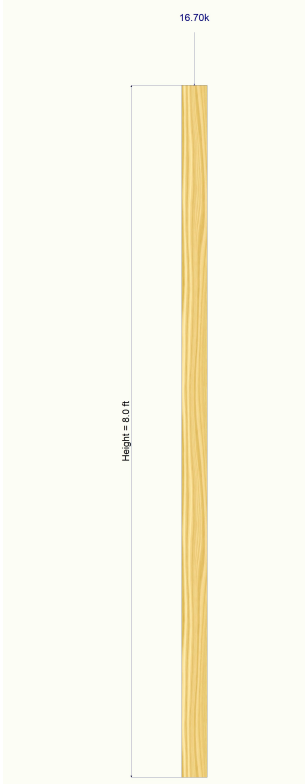
Load Combination	X-X Axis Reaction @ Base	@ Top	k	Y-Y Axis Reaction @ Base	@ Top	Axial Reaction @ Base	My - End Moments @ Base	@ Top	k-ft	Mx - End Moments @ Base	@ Top
D Only						4.411					
+D+L						9.921					
+D+Lr						7.461					
+D+S						8.201					
+D+0.750Lr+0.750L						10.831					
+D+0.750L+0.750S						11.386					
+0.60D						2.647					
Lr Only						3.050					
L Only						5.510					
S Only						3.790					

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

DESCRIPTION: Post Supporting UFB3

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	8 ft		
(Used for non-slender calculations)			
Wood Species	iLevel Truss Joist		
Wood Grade	Parallam PSL 1.8E		
Fb +	2,400.0 psi	Fv	190.0 psi
Fb -	2,400.0 psi	Ft	1,755.0 psi
Fc - Prll	2,500.0 psi	Density	45.070 pcf
Fc - Perp	425.0 psi		

E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial
Basic	1,800.0	1,800.0	1,800.0 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 = 8 ft, K
Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 8 ft, K

Applied Loads

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

Column self weight included : 46.009 lbs * Dead Load Factor
AXIAL LOADS . . .
UFB3: Axial Load at 8.0 ft, D = 3.840, Lr = 2.690, L = 4.860, S = 3.320 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.5726 : 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	10.021 k
Applied Mx	0.0 k-ft
Applied My	0.0 k-ft
Fc : Allowable	952.43 psi

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

Load Combination	+0.60D
Location of max.above base	8.0 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	0.415	0.2266	PASS	0.0 ft	0.0	PASS	8.0 ft
+D+L	1.000	0.377	0.5050	PASS	0.0 ft	0.0	PASS	8.0 ft
+D+Lr	1.250	0.306	0.3738	PASS	0.0 ft	0.0	PASS	8.0 ft
+D+S	1.150	0.331	0.4118	PASS	0.0 ft	0.0	PASS	8.0 ft
+D+0.750Lr+0.750L	1.250	0.306	0.5428	PASS	0.0 ft	0.0	PASS	8.0 ft
+D+0.750L+0.750S	1.150	0.331	0.5726	PASS	0.0 ft	0.0	PASS	8.0 ft
+0.60D	1.600	0.242	0.1310	PASS	0.0 ft	0.0	PASS	8.0 ft

Wood Column

Project File: 21031_Pierce.ec6

LIC# : KW-06018000, Build:20.22.8.17 O.G. ENGINEERING, PLLC (c) ENERCALC INC 1983-2022

DESCRIPTION: Post Supporting UFB3

Maximum Reactions

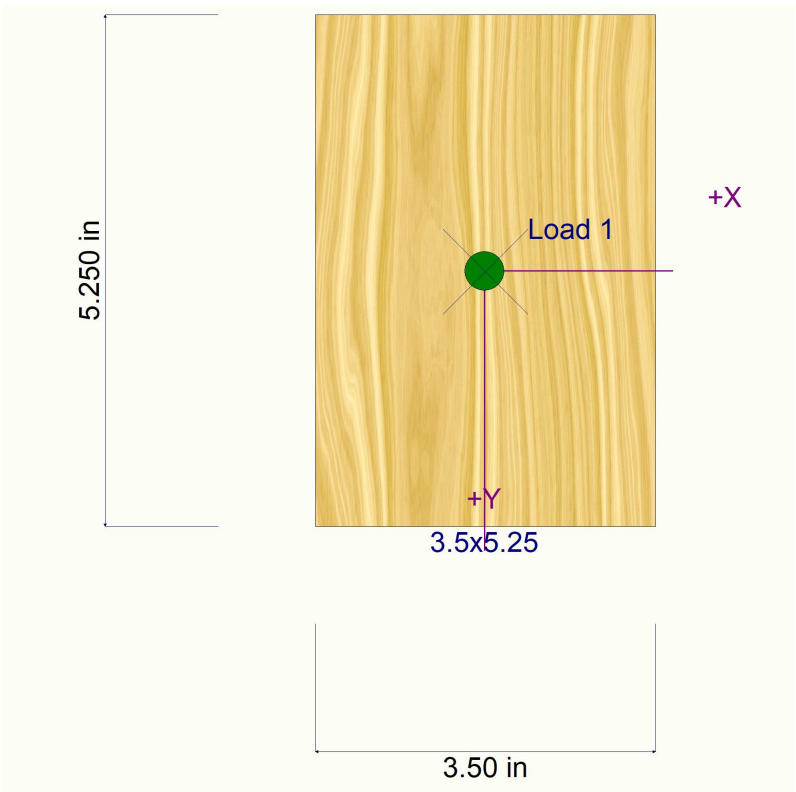
Note: Only non-zero reactions are listed.

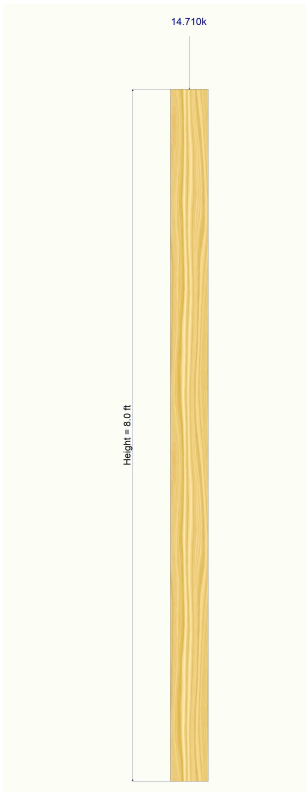
Load Combination	X-X Axis Reaction @ Base	@ Top	k	Y-Y Axis Reaction @ Base	@ Top	Axial Reaction @ Base	My - End Moments @ Base	@ Top	k-ft	Mx - End Moments @ Base	@ Top
D Only						3.886					
+D+L						8.746					
+D+Lr						6.576					
+D+S						7.206					
+D+0.750Lr+0.750L						9.549					
+D+0.750L+0.750S						10.021					
+0.60D						2.332					
Lr Only						2.690					
L Only						4.860					
S Only						3.320					

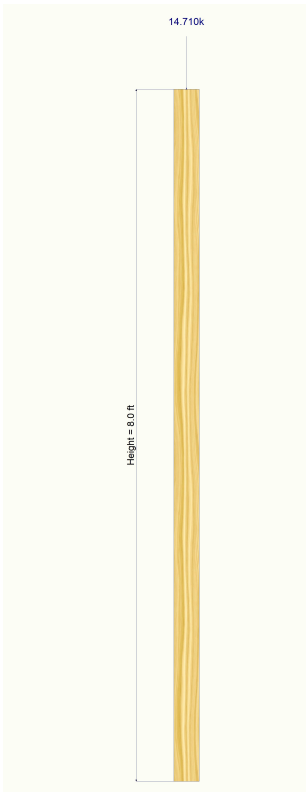
Maximum Deflections for Load Combinations

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

DESCRIPTION: Post Supporting UFB4

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	8 ft		
(Used for non-slender calculations)			
Wood Species	Douglas Fir-Larch		
Wood Grade	No.2		
Fb +	900.0 psi	Fv	180.0 psi
Fb -	900.0 psi	Ft	575.0 psi
Fc - Prll	1,350.0 psi	Density	31.210 pcf
Fc - Perp	625.0 psi		

E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial
Basic	1,600.0	1,600.0	1,600.0 ksi
Minimum	580.0	580.0	

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 = 8 ft, K
Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 8 ft, K

Applied Loads

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

Column self weight included : 21.240 lbs * Dead Load Factor
AXIAL LOADS . . .
UFB4: Axial Load at 8.0 ft, D = 2.150, Lr = 1.830, L = 3.230, S = 2.290 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.8909 : 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	6.311 k
Applied Mx	0.0 k-ft
Applied My	0.0 k-ft
Fc : Allowable	578.30 psi

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

Load Combination	+0.60D
Location of max.above base	8.0 ft
Applied Design Shear	0.0 psi
Allowable Shear	288.0 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	0.400	0.3170	PASS	0.0 ft	0.0	PASS	8.0 ft
+D+L	1.000	0.366	0.7761	PASS	0.0 ft	0.0	PASS	8.0 ft
+D+Lr	1.250	0.301	0.5598	PASS	0.0 ft	0.0	PASS	8.0 ft
+D+S	1.150	0.324	0.6297	PASS	0.0 ft	0.0	PASS	8.0 ft
+D+0.750Lr+0.750L	1.250	0.301	0.8346	PASS	0.0 ft	0.0	PASS	8.0 ft
+D+0.750L+0.750S	1.150	0.324	0.8909	PASS	0.0 ft	0.0	PASS	8.0 ft
+0.60D	1.600	0.240	0.1784	PASS	0.0 ft	0.0	PASS	8.0 ft

Wood Column

Project File: 21031_Pierce.ec6

DESCRIPTION: Post Supporting UFB4

Maximum Reactions

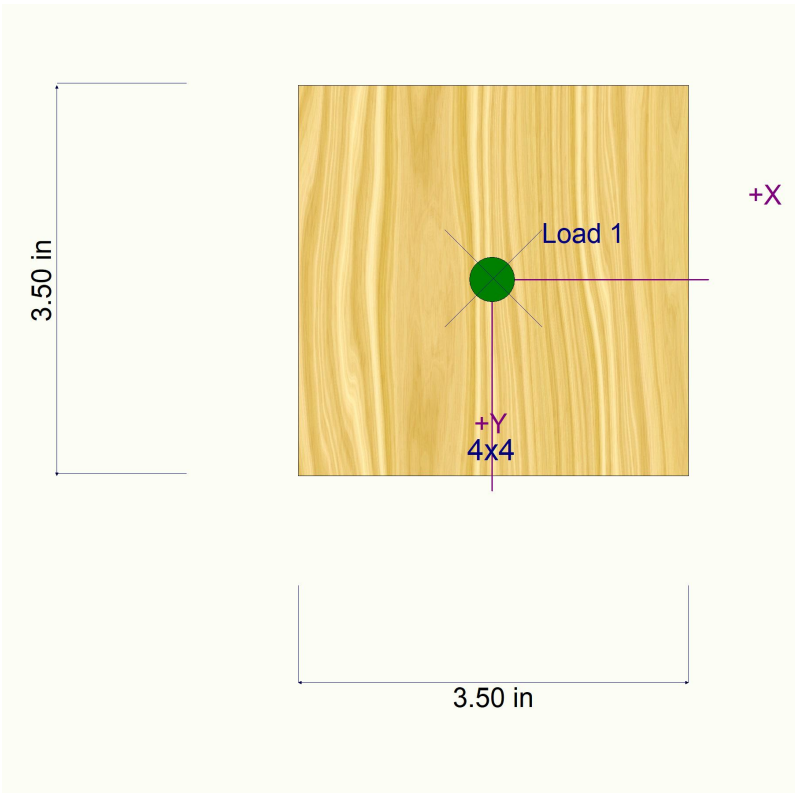
Note: Only non-zero reactions are listed.

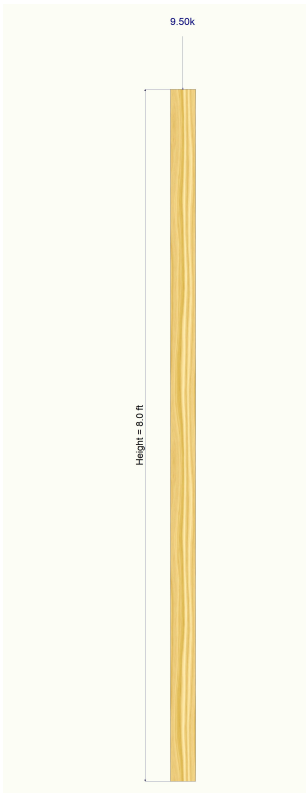
Load Combination	X-X Axis Reaction @ Base	@ Top	k	Y-Y Axis Reaction @ Base	@ Top	Axial Reaction @ Base	My - End Moments @ Base	@ Top	k-ft	Mx - End Moments @ Base	@ Top
D Only						2.171					
+D+L						5.401					
+D+Lr						4.001					
+D+S						4.461					
+D+0.750Lr+0.750L						5.966					
+D+0.750L+0.750S						6.311					
+0.60D						1.303					
Lr Only						1.830					
L Only						3.230					
S Only						2.290					

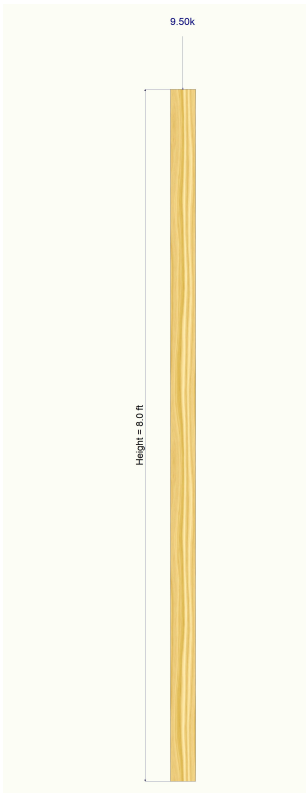
Maximum Deflections for Load Combinations

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







Combined Footing

Project File: 21031_Pierce.ec6

LIC# : KW-06018000, Build:20.22.8.17 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 tha	ft
Maximum Allowed Bearing Pressure	10.0 ksf
(A value of zero implies no limit)	
Adjusted Allowable Soil Bearing	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

Pedestal dimensions...

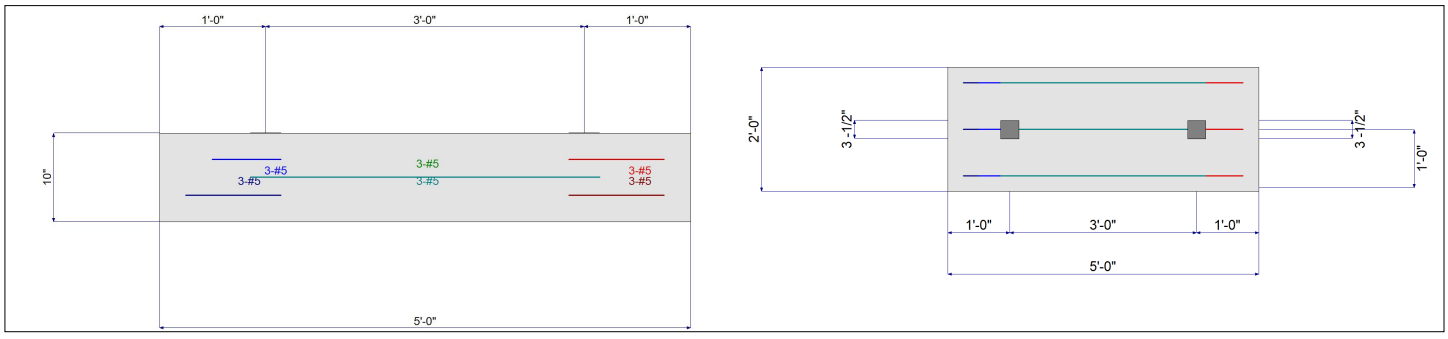
	Col #1	Col #2	
Sq. Dim. =	3.50	3.50	in
Height =			in

Rebar Center to Concrete Edge @ Top	=	3.0	in	
Rebar Center to Concrete Edge @ Bottom	=	3.0	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

		D	Lr	L	S	W	E	H	
Applied @ Left Column									
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	=								



Combined Footing

Project File: 21031_Pierce.ec6

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

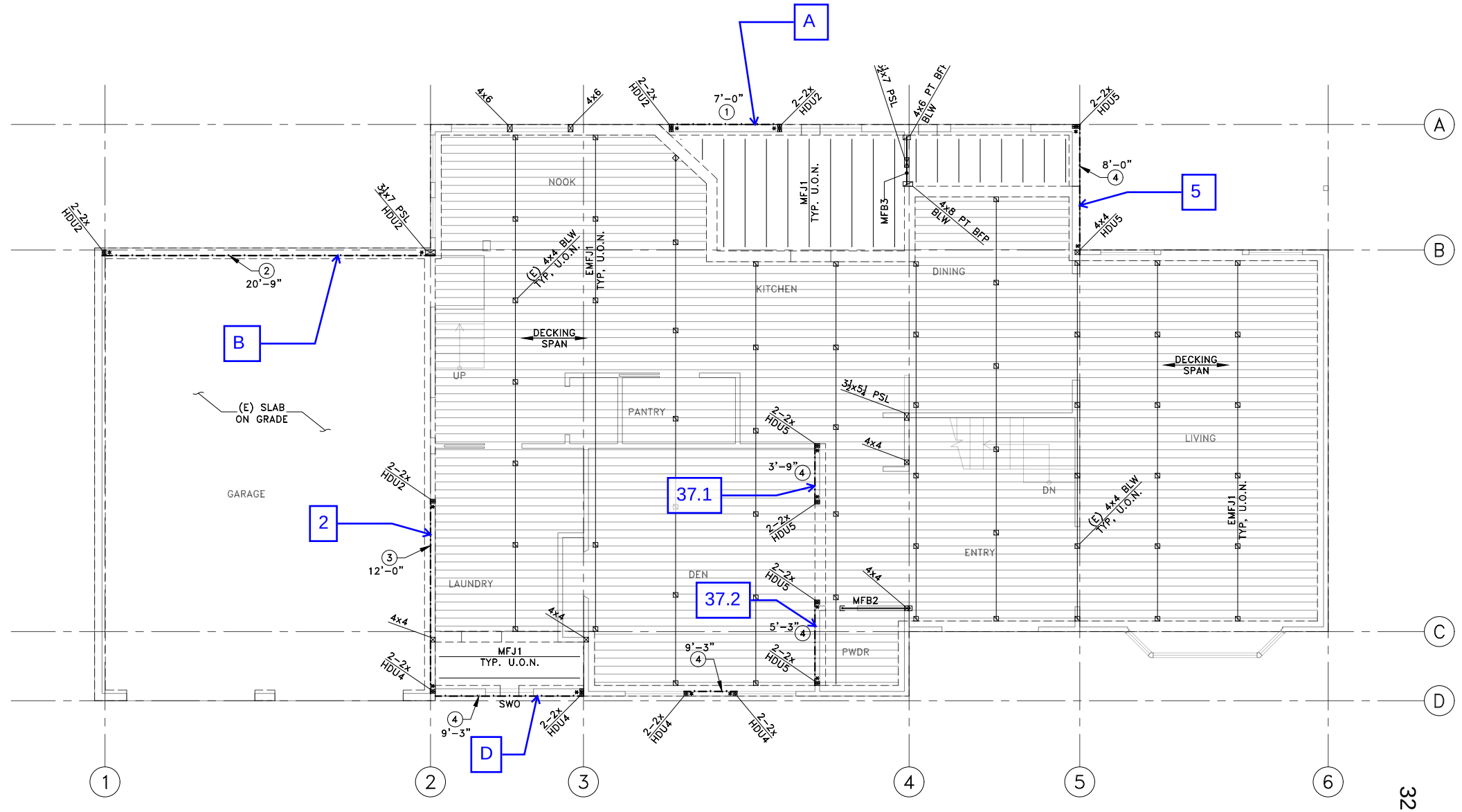
Load Combination...	Moments about Left Edge k-ft Overturning	Resisting	Ratio	Moments about Right Edg k-ft Overturning	Resisting	Ratio
D Only	0.00	0.00	999.000	0.00	0.00	999.000
+D+L	0.00	0.00	999.000	0.00	0.00	999.000
+D+Lr	0.00	0.00	999.000	0.00	0.00	999.000
+D+S	0.00	0.00	999.000	0.00	0.00	999.000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

Z-Axis Footing Flexure - Maximum Values for Load Combination

Load Combination...	Mu (ft-k)	Distance from left (ft)	Tension Side	As Req'd (in^2)	Governed by	Actual As (in^2)	Phi*Mn (ft-k)	Mu / PhiMn
+0.60D	0.000	0.000	0	0.000	0	0.000	0.000	0.000
+0.60D	0.000	0.013	0	0.000	0	0.000	0.000	0.000
+0.60D	0.000	0.025	0	0.000	0	0.000	0.000	0.000
+0.60D	0.000	0.038	0	0.000	0	0.000	0.000	0.000
+0.60D	0.000	0.050	0	0.000	0	0.000	0.000	0.000
+0.60D	0.000	0.063	0	0.000	0	0.000	0.000	0.000



MAIN FLOOR SHEAR WALL KEY PLAN

Plywood Shear Wall Design

Refer to Shear Wall Key Plans

Story Forces - ASD Level	
Floor	F_x (psf)
Upper Roof	5.8
Upper	4.5

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 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)
A	7	8	230	NONE	0	1045	1045	149	1	no	1	310
B	20.75	8	1150	YES	5036	5226	10262	495	3	no	1	600
D*	9.25	8	200	NONE	0	909	909	197	1	no	1	310

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
A	8362	145	290	2435	847		847	HDU2	3075
B	82099	200	400	22402	2877		2877	HDU2	3075
D*	7271	180	720	6264	109		109	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)
2	12	8	730	YES	3197	3317	6514	543	3	no	1	600
37.1	3.75	8	300	YES	1314	1363	2677	714	4	yes	0.94	722
37.2	5.25	8	420	YES	1839	1909	3748	714	4	no	1	770
5	8	8	440	YES	1927	1999	3926	491	3	no	1	600

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
2	52115	380	0	11934	3348		3348	HDU4	4565
37.1	21417	190	0	583	5556		5556	HDU5	5645
37.2	29984	190	0	1142	5494		5494	HDU5	5645
5	31412	80	0	1117	3787		3787	HDU4	4565

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

Project Information

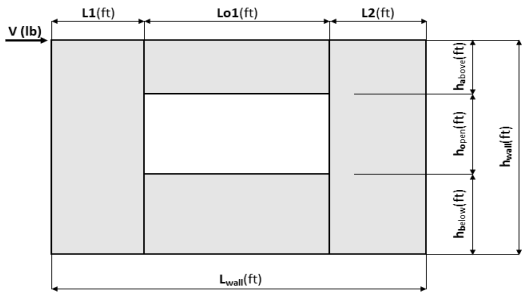
Code: **Date:**

Designer:

Client:

Project:

Wall Line: D



Shear Wall Calculation Variables

			Opening 1
V	909 lbf		
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} 786 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(ha1+hb1) = 197 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 590 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 283 lbf

F2 = O1(L2)/(L1+L2) = 307 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 = 145 plf

V2 = (V/L)(T2+L2)/L2 = 145 plf

Check V1*L1+V2*L2=V? 909 lbf **OK**

7. Resistance to corner forces

R1 = V1*L1 = 436 lbf

R2 = V2*L2 = 473 lbf

8. Difference corner force + resistance

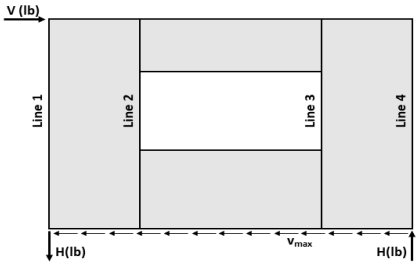
R1-F1 = 153 lbf

R2-F2 = 166 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 51 plf

vc2 = (R2-F2)/L2 = 51 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(ha1+hb1)+V1(ho1)=H?		204	582	786 lbf
Line 2: va1(ha1+hb1)-vc1(ha1+hb1)-V1(ho1)=0?	786	204	582	0
Line 3: va1(ha1+hb1)-vc2(ha1+hb1)-V1(ho1)=0?	786	204	582	0
Line 4: vc2(ha1+hb1)+V2(ho1)=H?		204	582	786 lbf

Design Summary*

Req. Sheathing Capacity	197 plf
Req. Strap Force	307 lbf
Req. HD Force (H)	786 lbf
Req. Shear Wall Anchorage Force (v_{max})	98 plf

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