DEI
DIBBLE ENGINEERS INC

SUPPLEMENTAL STRUCTURAL CALCULATIONS

PEYREE REMODEL

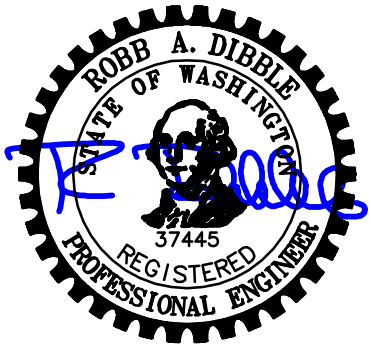
6059 77th Ave SE

Mercer Island, WA

Prepared for Gelotte Hommas

Project # 17-291

February 27, 2019



02/27/2019

DEI
DIBBLE ENGINEERS INC

SUPPLEMENTAL STRUCTURAL CALCULATIONS
TABLE OF CONTENTS

Peyree DEI Job #17-291

- Design Criteria and Loads SD1 – SD2
- Lateral SL1 – SL50
  - Shearwalls
  - Hold-downs
  - Diaphragms
  - Moment Frames
    - Column Pilasters
    - Footings

DEI
DIBBLE ENGINEERS INC

DESIGN CRITERIA AND LOADS

Peyree Remodel #17-291

SD1
Date: 06/2017
By: JCW

DEI
DIBBLE ENGINEERS INC

Design Criteria

Project Name:	**Peyree Remodel**
Project #:	**17-291**
Location:	**6059 77th Ave SE, Mercer Island, WA 98040**
Building Code:	**2015 IBC**
Permitting Authority:	**Mercer Island, WA**

Gravity Design Loads

Roof Dead Load	21	psf
Roof Live Load	20	psf
Exterior Wall Load	17	psf
Floor Dead Load	15	psf
Floor Live Load	40	psf
LL Reducible?	Y	Y/N
Partition Load	5	psf
Composite Floor	N/A	psf

Foundation

Soil Bearing Pressure	3000	psf
Pile Capacity	N/A	tons
Frost Depth	18	inch

Lateral Earth Pressures

Restrained	35	pcf
Unrestrained:	35	pcf
Passive Pressure:	350	pcf
Friction Coefficient	0.5	

Snow

Ground Snow Load p_g	20	psf
Importance Factor I_S	1	
Snow Load p_s	25	psf
Snow Exposure C_e	1.00	
Thermal Factor C_t	1.00	

Concrete

	f'c	fy	
Footing:	3	60	ksi
Slab-on-grade:	3	60	ksi
Concrete Beams :	3	60	ksi
Elevated Slabs:	N/A	60	ksi
Concrete Columns:	N/A	60	ksi
Concrete Walls:	4.5	60	ksi
Piles:	N/A	N/A	ksi

Masonry

	f'm	fy	
Reinforced Masonry	N/A	N/A	ksi

Structural Steel

	Fy	
W-shapes: ASTM A992, Gr. 50	50	ksi
Tube/Pipe: ASTM A500, Gr. B.	46	ksi

Lumber

Item: Species & Grade	Fb	Fv	
2x4 : HF #2	850	150	psi
2x6 & larger 2x 's : HF #2	850	150	psi
4x Beams & Post: HF #2	850	180	psi
6x Beams & Post : DF #1	1300	170	psi

Engineered Wood Products

SWWJ / OWWJ	TJI/TJL	
PSL / LSL / LVL	2900	psi
Glulam: 24F-V4 / 24F-V8	2400	psi
Sheathing (roof)	15/32	inch
Sheathing (floor)	23/32	inch
Sheathing (walls)	15/32	inch

DEI
DIBBLE ENGINEERS INC

Project Name: Peyree Remodel
Project #: 17-291
Subject:Design Weights

Sheet # 2
Date: 08/2018
By: JCW

Roof Dead Loads

Roofing Material - Concrete Tile	12.0 psf
1/2" Ply	1.5 psf
Framing Member - Pre-MFR Trusses at 24" o/c	3 psf
Batt Insulation	1 psf
5/8" Gyp Board	2.8 psf
Misc. Other	0.7 psf
	21.0 psf

Assume Roof DL of 21 psf

Typical Exterior Wall Dead Loads

Stucco Siding	10.0 psf
1/2" Ply/OSB	1.7 psf
Framing Member (2x6 Studs @ 16" oc)	1.4 psf
Batt Insulation	0.5 psf
1/2" Gyp Board	2.2 psf
Misc. Other	1.2 psf
	17.0 psf

Assume Wall DL of 17 psf

Typical Floor Dead Loads

Finish Flooring Material	3.0 psf
-	0 psf
-	0 psf
3/4" Ply	2.3 psf
Framing Member (11-7/8" TJI Joists at 16" o/c	3 psf
Batt Insulation	1 psf
5/8" Gyp Board	2.8 psf
Misc. Other	2.9 psf
	15.0 psf

Assume Floor DL of 15 psf

Deck Dead Loads

Deck Boards - Trex Decking	2.7 psf
- 1/2" Ply	1.7 psf
- 1/2" Concrete Pavers	18 psf
Framing Member (11-7/8" TJI at 16" o/c)	3 psf
- Perimeter Railing	2 psf
Misc. Other	2.6 psf
	30.0 psf

Assume DL of 30 psf

DEI
DIBBLE ENGINEERS INC

LATERAL

Peyree Remodel #17-291

DEI
DIBBLE ENGINEERS INC

PROJECT NAME: PEYREE RESIDENCE
PROJECT #: 17-291
SUBJECT: LATERAL - SEISMIC DESIGN LOAD
SHEET #: SL1
DATE: 2/2019
BY: JCW

SEISMIC DESIGN LOAD

BUILDING WEIGHT BY LEVEL -

- ROOF LEVEL:
  - ROOF = (4236.5 ft² tot area)(25 psf DL) = 105913 #
  - Exterior Walls = (290 ft tot length)($\frac{9ft}{2}$ ht)(20 psf DL) = 26100 #
  - Int. Walls = (307 ft total length)($\frac{9ft}{2}$ ht)(5 psf DL) = 6908 #
  - MOMENT FRAME 1 = (77 plf DL)(9.5 ft ht)(2 cols) + (22 plf)(9.5 ft)(2 cols)
    ASSUMED W16x77 cols — W10x22 cols.
    + (31 plf)(34.5 ft length) = 2951 #
    W16x31 bm's
  - Total = 141872 #
- UPPER FLOOR LEVEL:
  - FLOOR = (3763.75 ft² tot area)(15 psf DL) = 56456 #
  - Ext. Walls = (290 ft)($\frac{9ft}{2}$)(20 psf DL) + (310 ft)($\frac{11ft}{2}$)(20 psf DL) = 60200 #
  - Int. Walls = (307 ft)($\frac{9ft}{2}$)(5 psf DL) + (290 ft)($\frac{11ft}{2}$)(5 psf DL) = 14883 #
  - MOMENT FRAME 2 = (68 plf DL)($\frac{11ft}{2}$)(2 cols) + (40 plf DL)(12 ft) = 1228 #
    ASSUMED W21x68 cols — W18x40 bms
  - Total = 132767 #
- MAIN FLOOR LEVEL:
  - FLOOR = (3753.75 ft²)(15 psf DL) = 56306 #
  - Ext. walls = (310 ft)($\frac{11ft}{2}$)(20 psf DL) + (125 ft)($\frac{10ft}{2}$)(20 psf DL) = 46600 #
  - Int. Walls = (290 ft)($\frac{11ft}{2}$)(5 psf DL) + (240 ft)($\frac{10ft}{2}$)(5 psf DL) = 13975 #
  - MF-1 = (77 plf DL)(14.5 ft)(2 cols) + (22 plf DL)(14.5 ft)(2 cols.) + (31 plf DL)(34.5 ft)
    = 3941 #
  - MF-2 = (68 plf DL)(10.5 ft ht)(2 cols) + (40 plf DL)(42 ft) = 1908 #
  - Total = 122730 #

* SEISMIC BASE @ MAIN FLOOR FOR E-W DIRECTION
- ASSUME 1/2 of main floor load resisted by UPPER FLOOR LATERAL SYSTEM
- W_{roof} = 141.9k, W_{upper} = 132.7k + (0.5)(122.7k) = 194k, W_{main} = 0k (base)

* SEISMIC BASE @ MAIN FLOOR FOR EAST HALF OF BLDG, @ LOWER FLOOR FOR WEST HALF FOR N-S DIRECTION
- W_{roof} = 141.9k, W_{upper} = 132.4k, $W_{main,East}$ = 0k (base), $W_{main,West}$ = (0.5)(122.7k) = 61.4k

DEI
DIBBLE ENGINEERS INC

Project Name: Peyree Remodel
Project #: 17-291
Subject: Seismic Base Shear E-W

SEISMIC BASE SHEAR CALCULATION

References: 2015 IBC (Ch16), ASCE 7-10 (Ch.11,12,& 22),

Method ASD
Loading Longitudinal Direction
Lateral System A. BEARING WALL SYSTEM
[Tab. 12.2-1] 15. Light-framed (wood) walls sheathed with wood structural panels rated for shear resistance

Risk Category	II	[IBC Tab. 1604.5]	Building Height Limit (ft)	65	[Tab. 12.2-1]
Site Class	C	[ASCE Ch.20]			
Design Category	D	[IBC Sec. 1613.3.5; Tab 1613.3.5(1&2)]			

*Recommend USGS Seismic Hazard Data

S_S	1.464	[IBC Fig. 1613.3.1(1) or *]	**Using Metric? Check Table		
S_1	0.562	[IBC Fig. 1613.3.1(2) or *]	C_t**	0.02	[Tab. 12.8-2]
F_a	1.00	[IBC Sec. 1613.3.3(1)]	x**	0.75	[Tab. 12.8-2]
F_v	1.3	[IBC Sec. 1613.3.3(2)]	h_n	31 ft	[Sec. 12.8-2.1]
S_{MS}	1.46	[IBC Eqn. 16-37]	T_a	0.263	[Eqn. 12.8-7]
S_{M1}	0.73	[IBC Eqn. 16-38]	C_u	1.4	[Tab. 12.8-1]
S_{DS}	0.976	[IBC Eqn. 16-39]	T_{MODAL}		[Sec. 12.8.2]
S_{D1}	0.487	[IBC Eqn. 16-40]	T	0.2628	[Sec. 12.8.2]
			T_L	6 sec	[Fig. 22-12]
I	1	[Tab. 1.5-2]			
R	6.5	[Tab. 12.2-1]	S_{DS} / (R/I) = C_s	0.150	[Eqn. 12.8-2]
Ω_0	3	[Tab. 12.2-1]	S_{D1} / [T*(R/I)] = $C_{S,MAX}$	0.285	[Eqn. 12.8-3]
C_d	4	[Tab. 12.2-1]	(S_{D1}*T_L) /[T^2 *(R/I)] = $C_{S,MAX}$	6.512	[Eqn. 12.8-4]
ρ	1.3	[Sec.12.3.4]	0.044*S_{DS}*I ≥ 0.01 = $C_{S,MIN}$	0.043	[Eqn. 12.8-5]
			(0.5*S_1) / (R/I) = $C_{S,MIN}$	0.043	[Eqn. 12.8-6]
			ABS Cs MIN	0.0429	
			ABS Cs MAX	6.5121	
			Cs (Design)	**0.1502**	

	W =	344.6 K	[Sec. 12.8.1]
ASD	V =	47.10 K	[Eqn. 12.8.1]

Vertical Distribution of Forces ASCE 7-10, Sec. 12.8.3

Expontent related to structural period

k = 1.0 [Sec. 12.8.3]

Level	Weight, w_x	Height, h_x	$w_x h_x^k$	[Eqn. 12.8-12] C_{vx}	[Eqn. 12.8-11] $F_x = C_s*C_{vx}*\Sigma w*\rho$	[Eqn. 12.8-13] V_x
Roof	141.9 K	19 ft	2696 K-ft	0.559	26.31 K	26.31 K
Upper	202.7 K	11 ft	2128 K-ft	0.441	20.77 K	47.08 K
Main	0.0 K	0 ft	0 K-ft	0.000	0.00 K	47.08 K
Lower	0.0 K	-10 ft	0 K-ft	0.000	0.00 K	47.08 K
-	0.0 K	0 ft	0 K-ft	0.000	0.00 K	47.08 K
-	0.0 K	0 ft	0 K-ft	0.000	0.00 K	47.08 K
-	0.0 K	0 ft	0 K-ft	0.000	0.00 K	47.08 K
-	0.0 K	0 ft	0 K-ft	0.000	0.00 K	47.08 K
-	0.0 K	0 ft	0 K-ft	0.000	0.00 K	47.08 K
-	0.0 K	0 ft	0 K-ft	0.000	0.00 K	47.08 K
-	0.0 K	0 ft	0 K-ft	0.000	0.00 K	47.08 K
Σ	**344.6 K**		**4824 K-ft**	**1.000**	**47.08 K**	

DEI
DIBBLE ENGINEERS INC

Project Name: Peyree Remodel
Project #: 17-291
Subject: Seismic Base Shear E-W

SEISMIC BASE SHEAR CALCULATION

References: 2015 IBC (Ch16), ASCE 7-10 (Ch.11,12,& 22),

Diaphragm Design Forces ASCE 7-10 & 12.10.1.1

Level	w_x	F_x	[Eqn. 12.10-1] F_{px}	[Eqn.12.10-3] $F_{px,max}$	[Eqn.12.10-2] $F_{px,min}$	F_{px} (Design)
Roof	141.9 K	20.24 K	20.24 K	55.39 K	27.69 K	19.39 K
Upper	202.7 K	15.98 K	21.31 K	79.13 K	39.57 K	27.70 K
Main	0.0 K	0.00 K	0.00 K	0.00 K	0.00 K	0.00 K
Lower	0.0 K	0.00 K	0.00 K	0.00 K	0.00 K	0.00 K
-	0.0 K	0.00 K	0.00 K	0.00 K	0.00 K	0.00 K
-	0.0 K	0.00 K	0.00 K	0.00 K	0.00 K	0.00 K
-	0.0 K	0.00 K	0.00 K	0.00 K	0.00 K	0.00 K
-	0.0 K	0.00 K	0.00 K	0.00 K	0.00 K	0.00 K
-	0.0 K	0.00 K	0.00 K	0.00 K	0.00 K	0.00 K
-	0.0 K	0.00 K	0.00 K	0.00 K	0.00 K	0.00 K
-	0.0 K	0.00 K	0.00 K	0.00 K	0.00 K	0.00 K
Σ	**344.6 K**	**36.2 K**	**41.5 K**	**134.5 K**	**67.3 K**	**47.1 K**

DEI
DIBBLE ENGINEERS INC

Project Name: Peyree Remodel
Project #: 17-291
Subject: Seimsic Base Shear - N-S (East)

SEISMIC BASE SHEAR CALCULATION

References: 2015 IBC (Ch16), ASCE 7-10 (Ch.11,12,& 22),

Method	ASD	
Loading	Longitudinal Direction	
Lateral System	C. MOMENT RESISTING FRAME SYSTEMS	
[Tab. 12.2-1]	01. Steel special moment frames	
Risk Category	II	[IBC Tab. 1604.5]
Site Class	C	[ASCE Ch.20]
Design Category	D	[IBC Sec. 1613.3.5; Tab 1613.3.5(1&2)]

Building Height Limit (ft): No Limit [Tab. 12.2-1]

*Recommend USGS Seismic Hazard Data

S_S	1.464	[IBC Fig. 1613.3.1(1) or *]
S_1	0.562	[IBC Fig. 1613.3.1(2) or *]
F_a	1.00	[IBC Sec. 1613.3.3(1)]
F_v	1.3	[IBC Sec. 1613.3.3(2)]
S_{MS}	1.46	[IBC Eqn. 16-37]
S_{M1}	0.73	[IBC Eqn. 16-38]
S_{DS}	0.976	[IBC Eqn. 16-39]
S_{D1}	0.487	[IBC Eqn. 16-40]
I	1	[Tab. 1.5-2]
R	8	[Tab. 12.2-1]
Ω_0	3	[Tab. 12.2-1]
C_d	5.5	[Tab. 12.2-1]
ρ	1.3	[Sec.12.3.4]

**Using Metric? Check Table

C_t**	0.028	[Tab. 12.8-2]
x**	0.8	[Tab. 12.8-2]
h_n	31 ft	[Sec. 12.8-2.1]
T_a	0.437	[Eqn. 12.8-7]
C_u	1.4	[Tab. 12.8-1]
T_{MODAL}		[Sec. 12.8.2]
T	0.4368	[Sec. 12.8.2]
T_L	6 sec	[Fig. 22-12]
$S_{DS} / (R/I) = C_s$	0.122	[Eqn. 12.8-2]
$S_{D1} / [T*(R/I)] = C_{S,MAX}$	0.139	[Eqn. 12.8-3]
$(S_{D1}*T_L) /[T^2 *(R/I)] = C_{S,MAX}$	1.915	[Eqn. 12.8-4]
$0.044*S_{DS}*I \geq 0.01 = C_{S,MIN}$	0.043	[Eqn. 12.8-5]
$(0.5*S_1) / (R/I) = C_{S,MIN}$	0.035	[Eqn. 12.8-6]
ABS Cs MIN	0.0351	
ABS Cs MAX	1.9149	
Cs (Design)	**0.1220**	

	W =	274.6 K	[Sec. 12.8.1]
ASD	V =	30.50 K	[Eqn. 12.8.1]

Vertical Distribution of Forces ASCE 7-10, Sec. 12.8.3

Expontent related to structural period

k = 1.0 [Sec. 12.8.3]

Level	Weight, w_x	Height, h_x	$w_x h_x^k$	[Eqn. 12.8-12] C_{vx}	[Eqn. 12.8-11] $F_x = C_s*C_{vx}*\Sigma w*\rho$	[Eqn. 12.8-13] V_x
Roof	141.9 K	19 ft	2696 K-ft	0.659	20.10 K	20.10 K
Upper	132.8 K	11 ft	1394 K-ft	0.341	10.39 K	30.49 K
Main	0.0 K	0 ft	0 K-ft	0.000	0.00 K	30.49 K
Lower	0.0 K	-10 ft	0 K-ft	0.000	0.00 K	30.49 K
-	0.0 K	0 ft	0 K-ft	0.000	0.00 K	30.49 K
-	0.0 K	0 ft	0 K-ft	0.000	0.00 K	30.49 K
-	0.0 K	0 ft	0 K-ft	0.000	0.00 K	30.49 K
-	0.0 K	0 ft	0 K-ft	0.000	0.00 K	30.49 K
-	0.0 K	0 ft	0 K-ft	0.000	0.00 K	30.49 K
-	0.0 K	0 ft	0 K-ft	0.000	0.00 K	30.49 K
-	0.0 K	0 ft	0 K-ft	0.000	0.00 K	30.49 K
Σ	**274.6 K**		**4090 K-ft**	**1.000**	**30.49 K**	

SEISMIC BASE SHEAR CALCULATION

References: 2015 IBC (Ch16), ASCE 7-10 (Ch.11,12,& 22),

Diaphragm Design Forces ASCE 7-10 & 12.10.1.1

Level	w_x	F_x	[Eqn. 12.10-1] F_{px}	[Eqn.12.10-3] $F_{px,max}$	[Eqn.12.10-2] $F_{px,min}$	F_{px} (Design)
Roof	141.9 K	15.46 K	15.46 K	55.39 K	27.69 K	19.39 K
Upper	132.8 K	7.99 K	11.34 K	51.83 K	25.91 K	18.14 K
Main	0.0 K	0.00 K	0.00 K	0.00 K	0.00 K	0.00 K
Lower	0.0 K	0.00 K	0.00 K	0.00 K	0.00 K	0.00 K
-	0.0 K	0.00 K	0.00 K	0.00 K	0.00 K	0.00 K
-	0.0 K	0.00 K	0.00 K	0.00 K	0.00 K	0.00 K
-	0.0 K	0.00 K	0.00 K	0.00 K	0.00 K	0.00 K
-	0.0 K	0.00 K	0.00 K	0.00 K	0.00 K	0.00 K
-	0.0 K	0.00 K	0.00 K	0.00 K	0.00 K	0.00 K
-	0.0 K	0.00 K	0.00 K	0.00 K	0.00 K	0.00 K
-	0.0 K	0.00 K	0.00 K	0.00 K	0.00 K	0.00 K
Σ	**274.6 K**	**23.5 K**	**26.8 K**	**107.2 K**	**53.6 K**	**37.5 K**

DEI DIBBLE ENGINEERS INC

Project Name: Peyree Remodel
Project #: 17-291
Subject: Seimsic Base Shear - N-S (West) (MF)

SEISMIC BASE SHEAR CALCULATION

References: 2015 IBC (Ch16), ASCE 7-10 (Ch.11,12,& 22),

Method	ASD	
Loading	Longitudinal Direction	
Lateral System	C. MOMENT RESISTING FRAME SYSTEMS	
[Tab. 12.2-1]	01. Steel special moment frames	
Risk Category	II	[IBC Tab. 1604.5]
Site Class	C	[ASCE Ch.20]
Design Category	D	[IBC Sec. 1613.3.5; Tab 1613.3.5(1&2)]

*Recommend USGS Seismic Hazard Data

Building Height Limit (ft)			No Limit		[Tab. 12.2-1]
S_S	1.464	[IBC Fig. 1613.3.1(1) or *]	**Using Metric? Check Table		
S_1	0.562	[IBC Fig. 1613.3.1(2) or *]	C_t**	0.028	[Tab. 12.8-2]
F_a	1.00	[IBC Sec. 1613.3.3(1)]	x**	0.8	[Tab. 12.8-2]
F_v	1.3	[IBC Sec. 1613.3.3(2)]	h_n	31 ft	[Sec. 12.8-2.1]
S_{MS}	1.46	[IBC Eqn. 16-37]	T_a	0.437	[Eqn. 12.8-7]
S_{M1}	0.73	[IBC Eqn. 16-38]	C_u	1.4	[Tab. 12.8-1]
S_{DS}	0.976	[IBC Eqn. 16-39]	T_{MODAL}		[Sec. 12.8.2]
S_{D1}	0.487	[IBC Eqn. 16-40]	T	0.4368	[Sec. 12.8.2]
			T_L	6 sec	[Fig. 22-12]
I	1	[Tab. 1.5-2]			
R	8	[Tab. 12.2-1]	S_{DS} / (R/I) = C_s	0.122	[Eqn. 12.8-2]
Ω_0	3	[Tab. 12.2-1]	S_{D1} / [T*(R/I)] = $C_{S,MAX}$	0.139	[Eqn. 12.8-3]
C_d	5.5	[Tab. 12.2-1]	(S_{D1}*T_L) /[T^2 *(R/I)] = $C_{S,MAX}$	1.915	[Eqn. 12.8-4]
ρ	1.3	[Sec.12.3.4]	0.044*S_{DS}*I ≥ 0.01 = $C_{S,MIN}$	0.043	[Eqn. 12.8-5]
			(0.5*S_1) / (R/I) = $C_{S,MIN}$	0.035	[Eqn. 12.8-6]
			ABS Cs MIN	0.0351	
			ABS Cs MAX	1.9149	
			Cs (Design)	**0.1220**	

	W =	336.0 K	[Sec. 12.8.1]
ASD	V =	37.40 K	[Eqn. 12.8.1]

Vertical Distribution of Forces ASCE 7-10, Sec. 12.8.3

Expontent related to structural period

k = 1.0 [Sec. 12.8.3]

Level	Weight, w_x	Height, h_x	$w_x h_x^k$	[Eqn. 12.8-12] C_{vx}	[Eqn. 12.8-11] $F_x = C_s*C_{vx}*\Sigma w*\rho$	[Eqn. 12.8-13] V_x
Roof	141.9 K	29 ft	4114 K-ft	0.552	20.60 K	20.60 K
Upper	132.8 K	21 ft	2722 K-ft	0.365	13.63 K	34.23 K
Main	61.4 K	10 ft	614 K-ft	0.082	3.07 K	37.30 K
Lower	0.0 K	0 ft	0 K-ft	0.000	0.00 K	37.30 K
-	0.0 K	0 ft	0 K-ft	0.000	0.00 K	37.30 K
-	0.0 K	0 ft	0 K-ft	0.000	0.00 K	37.30 K
-	0.0 K	0 ft	0 K-ft	0.000	0.00 K	37.30 K
-	0.0 K	0 ft	0 K-ft	0.000	0.00 K	37.30 K
-	0.0 K	0 ft	0 K-ft	0.000	0.00 K	37.30 K
-	0.0 K	0 ft	0 K-ft	0.000	0.00 K	37.30 K
-	0.0 K	0 ft	0 K-ft	0.000	0.00 K	37.30 K
Σ	**336.0 K**		**7450 K-ft**	**1.000**	**37.30 K**	

DEI
DIBBLE ENGINEERS INC

Project Name: Peyree Remodel
Project #: 17-291
Subject: Seimsic Base Shear - N-S (West)

SEISMIC BASE SHEAR CALCULATION

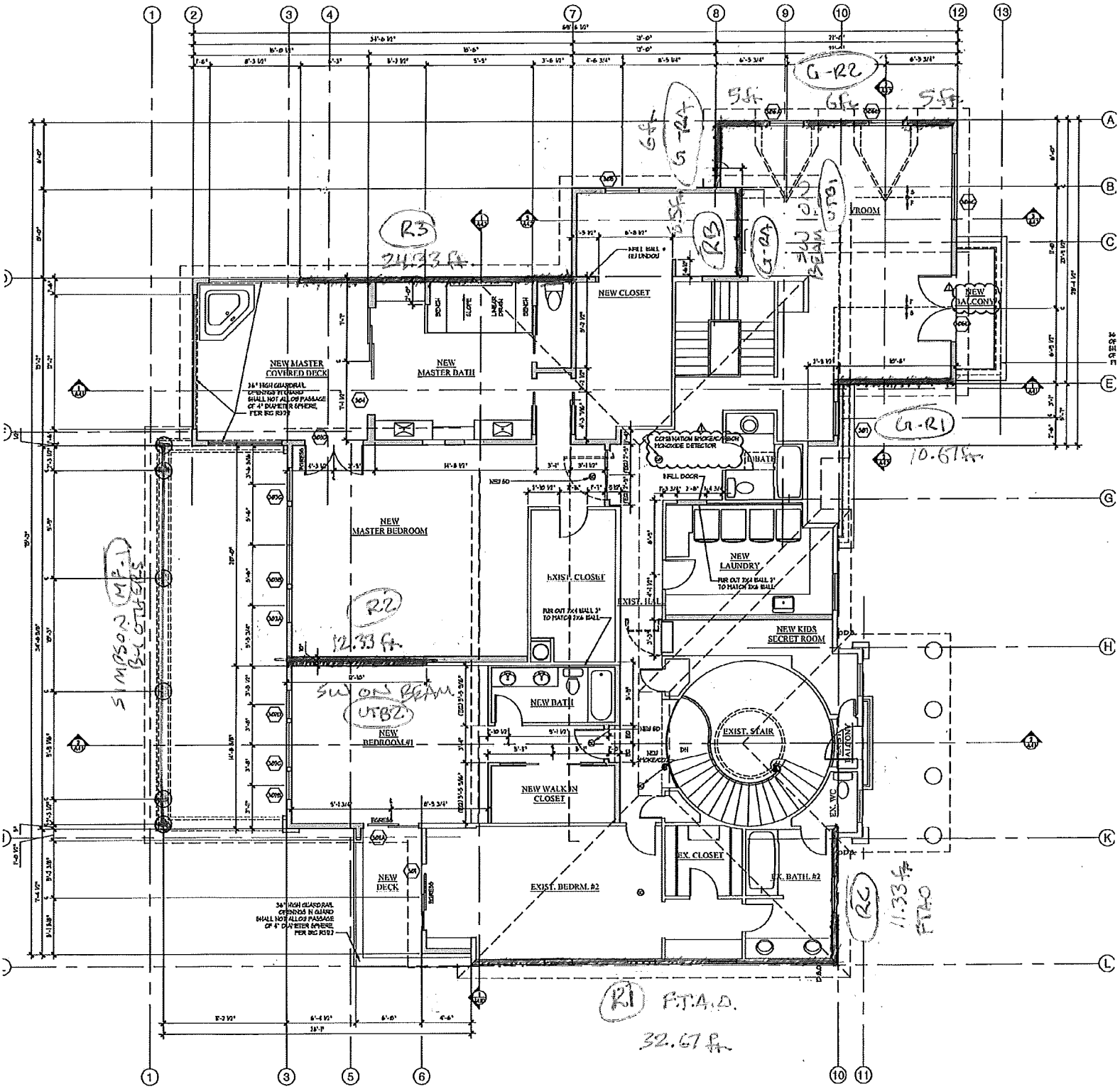
References: 2015 IBC (Ch16), ASCE 7-10 (Ch.11,12,& 22),

Diaphragm Design Forces ASCE 7-10 & 12.10.1.1

Level	w_x	F_x	[Eqn. 12.10-1] F_{px}	[Eqn.12.10-3] $F_{px,max}$	[Eqn.12.10-2] $F_{px,min}$	F_{px} (Design)
Roof	141.9 K	15.85 K	15.85 K	55.39 K	27.69 K	19.39 K
Upper	132.8 K	10.48 K	12.73 K	51.83 K	25.91 K	18.14 K
Main	61.4 K	2.36 K	5.24 K	23.96 K	11.98 K	8.39 K
Lower	0.0 K	0.00 K	0.00 K	0.00 K	0.00 K	0.00 K
-	0.0 K	0.00 K	0.00 K	0.00 K	0.00 K	0.00 K
-	0.0 K	0.00 K	0.00 K	0.00 K	0.00 K	0.00 K
-	0.0 K	0.00 K	0.00 K	0.00 K	0.00 K	0.00 K
-	0.0 K	0.00 K	0.00 K	0.00 K	0.00 K	0.00 K
-	0.0 K	0.00 K	0.00 K	0.00 K	0.00 K	0.00 K
-	0.0 K	0.00 K	0.00 K	0.00 K	0.00 K	0.00 K
-	0.0 K	0.00 K	0.00 K	0.00 K	0.00 K	0.00 K
Σ	**336.0 K**	**28.7 K**	**33.8 K**	**131.2 K**	**65.6 K**	**45.9 K**

LATERAL KEY PLAN

ROOF LEVEL
UPPER FLOOR WALLS



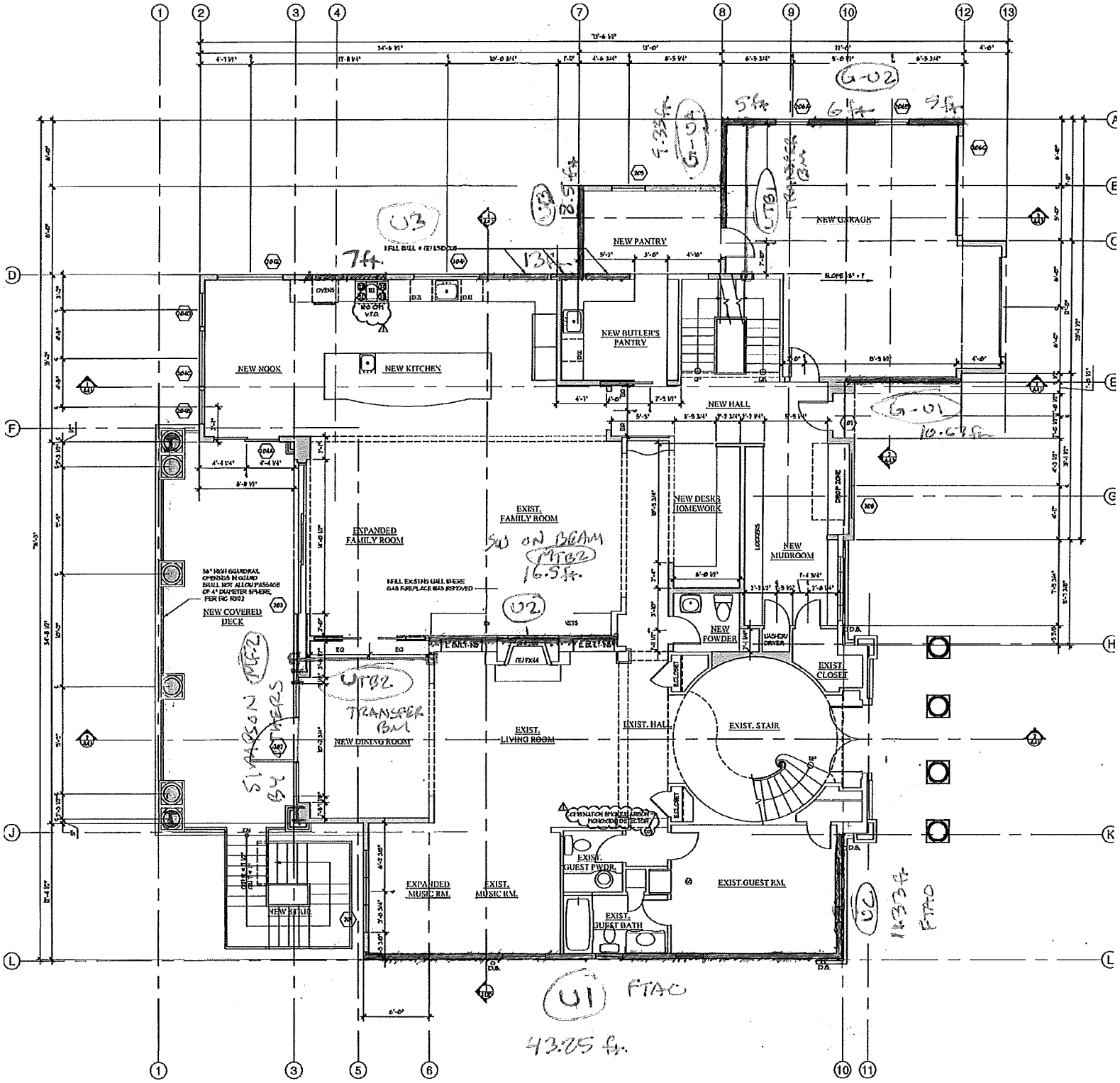
1 PROPOSED UPPER FLOOR PLAN
SCALE: 1/4" = 1'-0"

0 1 2 4 8 12 FT.

NORTH

LATERAL KEY PLAN

UPPER LEVEL
MAIN FLOOR WALLS



1 PROPOSED MAIN FLOOR PLAN
SCALE: 1/4" = 1'-0"

0 1 2 4 8 12 FT.

NORTH

DEI
DIBBLE ENGINEERS INC

Project	Peyree Remodel	*Sheet #*	
Project #	17-291	*Date*	2/2019
Subject	Lateral - Shear Wall Design	*By*	JCW

Shear Wall Design
North-South Direction

Lateral Shear Load (ASD)

North-South Direction

Roof	20.1	kips	
Upper	30.49	kips	
Main	0	kips	[seismic base]

Main Buildling

Area	3960	ft^2	
Area Ratio	0.898		
Proportional Shear Load			
Roof	18.049	kips	
Upper	27.379	kips	
Main	0.000	kips	[seismic base]

0

North-South: Roof Diaphragm - Upper Walls

Wall Height 8.5 ft
Bldg Width 72.33 ft

Wall ID	Pier Length 1	Pier Length 2	Pier Length 3	Pier Length 4	A/R Length 1	A/R Length 2	A/R Length 3	A/R Length 4	Total Length	Trib Area	Shear	Unit Shear	SW-Nailing	SW Capacity	
MF1	0	0	0	0	0	0	0	0	34.25	26.333	6.571	0.192	SMF	-	
RB	8.5	0	0	0	8.5	0	0	0	8.5	32	9.187	1.081	2SW-3	1116	Discont
RC	11.333	0	0	0	11.333	0	0	0	11.333	14	3.494	-	-	-	FTAO → SEE AOA SPREADSHEET
									Total Area	72.333					

North-South: Upper Diaphragm - Main Walls

Wall Height 9.5 ft
Bldg Width 60 ft

Wall ID	Pier Length 1	Pier Length 2	Pier Length 3	Pier Length 4	A/R Length 1	A/R Length 2	A/R Length 3	A/R Length 4	Total Length	Trib Area	Shear	Unit Shear	SW-Nailing	SW Capacity	
MF2	0	0	0	0	0	0	0	0	11.4167	21.75	9.925	0.869	SMF	-	
UB	8.5	0	0	0	8.5	0	0	0	8.5	25.625	11.693	1.376	2SW-2	1.432	
UC	11.333	0	0	0	11.333	0	0	0	11.333	12.625	5.761	-	-	-	FTAO → SEE AOA SPREADSHEET
									Total Area	60					

North-South: Main Diaphragm - Lower Walls

Wall Height 11.33 ft
Bldg Width 65 ft

Wall ID	Pier Length 1	Pier Length 2	Pier Length 3	Pier Length 4	A/R Length 1	A/R Length 2	A/R Length 3	A/R Length 4	Total Length	Trib Area	Shear	Unit Shear	SW-Nailing	SW Capacity
MF1	0	0	0	0	0	0	0	0	34.25	6.25	0.000	0.000	SMF	-
MF2	0	0	0	0	0	0	0	0	11.4167	21.25	0.000	0.000	SMF	-
MB	28.333	0	0	0	28.333	0	0	0	28.333	26.25	0.000	0.000	-	-
MC	17.333	0	0	0	17.333	0	0	0	17.333	11.25	0.000	0.000	-	-
									Total Area	65				

North-East Garage/Playroom

Area	450	ft^2
Area Ratio	0.102	
Proportional Shear Load		
Roof	2.051	kips
Upper	3.111	kips

North-South: Roof

Wall Height 8.5 ft
Bldg Width 22 ft

Wall ID	Pier Length 1	Pier Length 2	Pier Length 3	Pier Length 4	A/R Length 1	A/R Length 2	A/R Length 3	A/R Length 4	Total Length	Trib Area	Shear	Unit Shear	SW-Nailing	SW Capacity
G-RA	8.5	6	0	0	8.5	6	0	0	14.5	22	2.051	0.141	SW-6	0.288
									Total Area	22				

North-South: Upper

Wall Height 9.5 ft
Bldg Width 22 ft

Wall ID	Pier Length 1	Pier Length 2	Pier Length 3	Pier Length 4	A/R Length 1	A/R Length 2	A/R Length 3	A/R Length 4	Total Length	Trib Area	Shear	Unit Shear	SW-Nailing	SW Capacity
G-UA	9.333	0	0	0	9.333	0	0	0	9.333	22	3.111	0.333	SW-4	0.428
									Total Area	22				

DEI
DIBBLE ENGINEERS INC

Project	Peyree Remodel	*Sheet #*	
Project #	17-291	*Date*	2/2019
Subject	Lateral - Shear Wall Design	*By*	JCW

Shear Wall Overturning
North-South Direction

Main Building

Lateral Shear Load (ASD)

Roof	18.049 kips	
Upper	27.379 kips	
Main	0.000 kips	[seismic base]

DLmin = (0.6-0.14SDS)DL = 0.46336 DL
DLmax = (1.0+14SDS)DL = 1.13664 DL

$$T = \frac{vh - DL_{min}\frac{b}{2}}{b - 0.5ft} \qquad C = \frac{vh + DL_{max}\frac{b}{2}}{b - 0.5ft}$$

North-South: Roof

Wall ID	Height	Length	Shear	DL_{min}	DL_{max}	Tension	T_{abv}	T_{tot}	Compr	C_{abv}	C_{tot}	Holdown	Capacity		
RB	8.5	8.5	9.187	1.490	3.656	8.970	0.000	8.970	11.704	0.000	11.704	(F)CMST14	9.215	Discont SW: ΩT/0.7 =	32.035
RC	8.5	11.333	3.494	0.604	1.481	2.425	0.000	2.425	3.516	0.000	3.516	(B)CMST14	2.556		

North-South: Upper

Wall ID	Height	Length	Shear	DL_{min}	DL_{max}	Tension	T_{abv}	T_{tot}	Compr	C_{abv}	C_{tot}	Holdown	Capacity
UB	9.5	8.5	11.693	0.748	1.836	14.387	0.000	14.387	15.851	0.000	15.851	(2) HDU8	15.740
UC	9.5	11.333	5.761	1.260	3.092	4.605	2.425	7.031	6.992	3.516	10.508	HDU8 (DF)	7.315

North-South: Main

Wall ID	Height	Length	Shear	DL_{min}	DL_{max}	Tension	T_{abv}	T_{tot}	Compr	C_{abv}	C_{tot}	Holdown	Capacity
MB	3.5	28.333	0.000	2.183	5.354	-1.111	0.000	-1.111	2.725	0.000	2.725	HDU2	2.215
MC - conc	11.33	28.333	14.403	3.142	7.706	4.264	7.031	11.295	9.785	10.508	20.293	-	-

North-East Garage/Playroom

Lateral Shear Load (ASD)

Roof	2.051 kips	
Upper	3.111 kips	

North-South: Roof

Wall ID	Height	Length	Shear	DL_{min}	DL_{max}	Tension	T_{abv}	T_{tot}	Compr	C_{abv}	C_{tot}	Holdown	Capacity
G-RA.1	8.5	8.5	1.202322	1.490	3.656	0.486	8.970	9.456	3.220	11.704	14.924	(2) (D)CMST14	11.588
G-RA.2	8.5	6	0.848698	1.357	3.329	0.571	0	0.571	3.128	0	3.128	LSTHD8	1.95

North-South: Upper

Wall ID	Height	Length	Shear	DL_{min}	DL_{max}	Tension	T_{abv}	T_{tot}	Compr	C_{abv}	C_{tot}	Holdown	Capacity
G-UA	9.5	9.333	3.111224	0.519	1.273	3.072	0.571	3.643	4.019	3.128	7.146	HDU8	4.870

DEI
DIBBLE ENGINEERS INC

Project	Peyree Remodel	*Sheet #*	
Project #	17-291	*Date*	2/2019
Subject	Lateral - Shear Wall Design	*By*	JCW

Shear Wall Design - Moment Frame Loading
North-South Direction

Lateral Shear Load (ASD)

North-South Direction

Roof	20.6 kips	
Upper	34.23 kips	
Main	37.3 kips	
Lower	0 kips	[seismic base]

Main Building

Area	3960 ft^2	
Area Ratio	1.000	
Proportional Shear Load		
Roof	20.600 kips	
Upper	34.230 kips	
Main	37.300 kips	
Lower	0 kips	[seismic base]

North-South: Roof Diaphragm - Upper Walls

Wall Height 8.5 ft
Bldg Width 72.33 ft

Wall ID	Pier Length 1	Pier Length 2	Pier Length 3	Pier Length 4	A/R Length 1	A/R Length 2	A/R Length 3	A/R Length 4	Total Length	Trib Area	Shear	Unit Shear	SW-Nailing	SW Capacity
MF1	0	0	0	0	0	0	0	0	34.25	26.333	7.500	0.219	SMF	-
RB	8.5	0	0	0	8.5	0	0	0	8.5	32	9.414	1.072		
RC	11.333	0	0	0	11.333	0	0	0	11.333	14	3.987	0.350		
									Total Area	72.333				

North-South: Upper Diaphragm - Main Walls

Wall Height 9.5 ft
Bldg Width 60 ft

Wall ID	Pier Length 1	Pier Length 2	Pier Length 3	Pier Length 4	A/R Length 1	A/R Length 2	A/R Length 3	A/R Length 4	Total Length	Trib Area	Shear	Unit Shear	SW-Nailing	SW Capacity
MF2	0	0	0	0	0	0	0	0	11.4167	21.75	12.408	1.087	SMF	-
UB	8.5	0	0	0	8.5	0	0	0	8.5	25.625	14.619	1.720		
UC	11.333	0	0	0	11.333	0	0	0	11.333	12.625	7.203	0.636		
									Total Area	60				

North-South: Main Diaphragm - Lower Walls

Wall Height 11.33 ft
Bldg Width 65 ft

Wall ID	Pier Length 1	Pier Length 2	Pier Length 3	Pier Length 4	A/R Length 1	A/R Length 2	A/R Length 3	A/R Length 4	Total Length	Trib Area	Shear	Unit Shear	SW-Nailing	SW Capacity
MF1	0	0	0	0	0	0	0	0	34.25	6.25	3.587	0.105	SMF	-
MF2	0	0	0	0	0	0	0	0	11.4167	21.25	12.194	1.068	SMF	-
MB	28.333	0	0	0	28.333	0	0	0	28.333	26.25	15.063	0.532		
MC	17.333	0	0	0	17.333	0	0	0	17.333	11.25	6.456	0.372		
									Total Area	65				

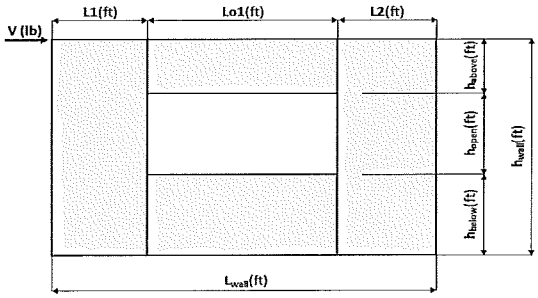
Force Transfer Around Openings Calculator

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:	IBC 2015	**Date:**	2/22/2019
Designer:	JCW		
Client:	Gelotte Hommas		
Project:	Peyree Residence		
Wall Line:	RC		



Shear Wall Calculation Variables

			Opening 1
V	3494 lbf		
L1	4.50 ft	ha1	1.58 ft
L2	3.50 ft	ho1	4.25 ft
h_{wall}	8.50 ft	hb1	2.67 ft
L_{wall}	11.33 ft	Lo1	3.33 ft

Wall Pier Aspect Ratio		Adj. Factor
P1=ho1/L1=	0.94	N/A
P2=ho1/L2=	1.21	N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 2621 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(ha1+hb1) = 617 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) = 2054 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) = 1155 lbf

F2 = O1(L2)/(L1+L2) = 899 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) = 1.87 ft

T2 = (L2*Lo1)/(L1+L2) = 1.46 ft

6. Unit shear beside opening

V1 = (V/L)(L1+T1)/L1 = 437 plf

V2 = (V/L)(T2+L2)/L2 = 437 plf

Check V1*L1+V2*L2=V? 3494 lbf **OK**

7. Resistance to corner forces

R1 = V1*L1 = 1965 lbf

R2 = V2*L2 = 1529 lbf

8. Difference corner force + resistance

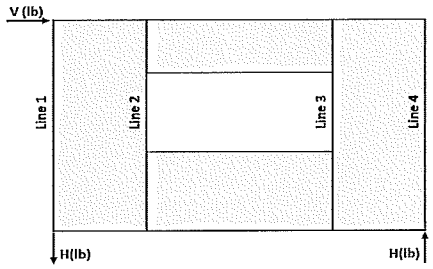
R1-F1 = 810 lbf

R2-F2 = 630 lbf

9. Unit shear in corner zones

vc1 = (R1-F1)/L1 = 180 plf

vc2 = (R2-F2)/L2 = 180 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(ha1+hb1)+V1(ho1)=H?		765	1856	2621 lbf
Line 2: va1(ha1+hb1)-vc1(ha1+hb1)-V1(ho1)=0?	2621	765	1856	0
Line 3: vc2(ha1+hb1)+V2(ho1)=H?		765	1856	2621 lbf

Design Summary

Req. Sheathing Capacity	617 plf	**4-Term Deflection**	0.197 in.	**3-Term Deflection**	0.218 in.
Req. Strap Force	1155 lbf	**4-Term Story Drift %**	0.008 %	**3-Term Story Drift %**	0.009 %
Req. HD Force (H)	2621 lbf		See Page 2		See Page 3

APA Disclaimer

The information contained herein is intended for use as a resource to aid in the shear wall design based on APA – The Engineered Wood Association's testing and knowledge of wood-framed shear wall system design utilizing the force transfer around openings (FTAO) methodology. Neither APA, nor its member manufacturers, make any warranty, expressed or implied, or assume any legal liability or responsibility for the accuracy, use, application of, and/or reference to opinions, findings, conclusions, or recommendations included in this calculator. Consult your local jurisdiction or design professional to assure compliance with code, construction, and performance requirements. Because APA has no control over quality of workmanship or the conditions under which engineered wood products are used, it cannot accept responsibility of product performance or designs as actually constructed. ©2018 APA – THE ENGINEERED WOOD ASSOCIATION · ALL RIGHTS RESERVED · ANY COPYING, MODIFICATION, DISTRIBUTION, OR OTHER USE OF THIS PUBLICATION OTHER THAN AS EXPRESSLY AUTHORIZED BY APA IS PROHIBITED BY THE U.S. COPYRIGHT LAWS.

Project Information

Code:	IBC 2015	**Date:**	2/22/2019
Designer:	JCW		
Client:	Gelotte Hommas		
Project:	Peyree Residence		
Wall Line:	RC		

Shear Wall Deflection Calculation Variables

Sheathing:

Plywood	Sheathing Material
15/32	Performance Category
APA Rated Sheathing	Grade
	Gt Override
	Ga Overide

Wood End Post Values:

Species:	Hem-Fir	
E:	1.30E+06	(psi)
	Qty	Stud Size
Dimensions:	2	2x6
A:	16.5	(in.^{2})
A Override:		(in.^{2})

Nail Type: 10d common (penny weight)

	Pier 1	Pier 2	
Nail Spacing:	2	2	(in.)
HD Capacity:	1573	1573	(lbf)
HD Deflection:		0	(in.)

Four-Term Equation Deflection Check

$$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_a + d_a\frac{h}{b} \qquad \text{(Equation 23-2)}$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
Sheathing:	15/32	15/32	15/32	15/32	
Nail:	10d common	10d common	10d common	10d common	
v_{asd}:	437	437	437	437	(plf)
$v_{strength}$:	624	624	624	624	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	8.50	5.83	5.83	8.50	(ft)
A:	16.5	16.5	16.5	16.5	(in.^{2})
Gt:	27,000	27,000	27,000	27,000	(lbf/in.)
Nail Spacing:	2	2	2	2	(in.)
Vn:	104	104	104	104	(plf)
e:	0.0014	0.0014	0.0014	0.0014	(in.)
b:	4.50	4.50	3.50	3.50	(ft)
HD Capacity:	1573	1573	1573	1573	(lbf)
HD Defl:	0	0	0	0	(in.)

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.032	0.196	0.009	0.000	0.010	0.135	0.006	0.000
		Sum	0.237			Sum	0.151
Pier 2 (left)				**Pier 2 (right)**			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.013	0.135	0.006	0.000	0.041	0.196	0.009	0.000
		Sum	0.154			Sum	0.246

Total Defl.	
0.197	(in.)
0.0077	%drift

APA Disclaimer

The information contained herein is intended for use as a resource to aid in the shear wall design based on APA – The Engineered Wood Association's testing and knowledge of wood-framed shear wall system design utilizing the force transfer around openings (FTAO) methodology. Neither APA, nor its member manufacturers, make any warranty, expressed or implied, or assume any legal liability or responsibility for the accuracy, use, application of, and/or reference to opinions, findings, conclusions, or recommendations included in this calculator. Consult your local jurisdiction or design professional to assure compliance with code, construction, and performance requirements. Because APA has no control over quality of workmanship or the conditions under which engineered wood products are used, it cannot accept responsibility of product performance or designs as actually constructed. ©2018 APA – THE ENGINEERED WOOD ASSOCIATION · ALL RIGHTS RESERVED · ANY COPYING, MODIFICATION, DISTRIBUTION, OR OTHER USE OF THIS PUBLICATION OTHER THAN AS EXPRESSLY AUTHORIZED BY APA IS PROHIBITED BY THE U.S. COPYRIGHT LAWS.

Project Information

Code:	IBC 2015	**Date:**	2/22/2019
Designer:	JCW		
Client:	Gelotte Hommas		
Project:	Peyree Residence		
Wall Line:	RC		

Three-Term Equation Deflection Check

$$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \qquad (4.3\text{-}1)$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
Sheathing:	15/32	15/32	15/32	15/32	
Nail:	10d common	10d common	10d common	10d common	
v_{asd}:	437	437	437	437	(plf)
$v_{strength}$:	624	624	624	624	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	8.50	5.83	5.83	8.50	(ft)
A:	16.5	16.5	16.5	16.5	(in.^{2})
Ga:	23.0	23.0	23.0	23.0	(kips/in.)
b:	4.50	4.50	3.50	3.50	(ft)
HD Capacity:	1573	1573	1573	1573	(lbf)
HD Defl:	0	0	0	0	(in.)

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.032	0.231	0.000	0.010	0.158	0.000
	Sum	0.262		Sum	0.169
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.013	0.158	0.000	0.041	0.231	0.000
	Sum	0.171		Sum	0.271

Total Defl.	
0.218	(in.)
0.0086	%drift

Comment: The 3-term equation is calibrated to be approximately equal to 4-term equation at 1.4*ASD capacity.

APA Disclaimer

The information contained herein is intended for use as a resource to aid in the shear wall design based on APA – The Engineered Wood Association's testing and knowledge of wood-framed shear wall system design utilizing the force transfer around openings (FTAO) methodology. Neither APA, nor its member manufacturers, make any warranty, expressed or implied, or assume any legal liability or responsibility for the accuracy, use, application of, and/or reference to opinions, findings, conclusions, or recommendations included in this calculator. Consult your local jurisdiction or design professional to assure compliance with code, construction, and performance requirements. Because APA has no control over quality of workmanship or the conditions under which engineered wood products are used, it cannot accept responsibility of product performance or designs as actually constructed. ©2018 APA – THE ENGINEERED WOOD ASSOCIATION · ALL RIGHTS RESERVED · ANY COPYING, MODIFICATION, DISTRIBUTION, OR OTHER USE OF THIS PUBLICATION OTHER THAN AS EXPRESSLY AUTHORIZED BY APA IS PROHIBITED BY THE U.S. COPYRIGHT LAWS.

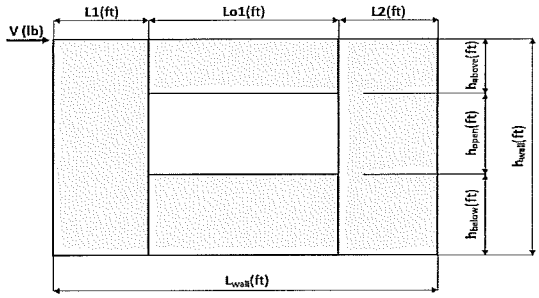
Force Transfer Around Openings Calculator

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:	IBC 2015	**Date:**	2/22/2019
Designer:	JCW		
Client:	Gelotte Hommas		
Project:	Peyree Residence		
Wall Line:	UC		



Shear Wall Calculation Variables

V	5761 lbf		Opening 1	Wall Pier Aspect Ratio		Adj. Factor
L1	2.33 ft	ha1	1.67 ft	P1=ho1/L1=	2.25	0.9687
L2	3.33 ft	ho1	5.25 ft	P2=ho1/L2=	1.58	N/A
h_{wall}	9.50 ft	hb1	2.58 ft			
L_{wall}	11.50 ft	Lo1	5.83 ft			

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ — 4761 lbf

2. Unit shear above + below opening
First opening: va1 = vb1 = H/(ha1+hb1) = 1120 plf

3. Total boundary force above + below openings
First opening: O1 = va1 x (Lo1) = 6534 lbf

4. Corner forces
F1 = O1(L1)/(L1+L2) = 2692 lbf
F2 = O1(L2)/(L1+L2) = 3842 lbf

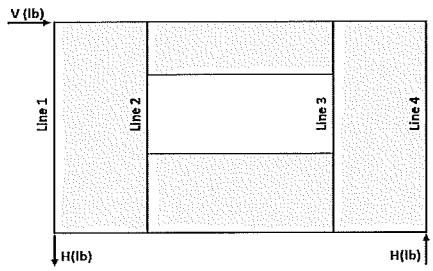
5. Tributary length of openings
T1 = (L1*Lo1)/(L1+L2) = 2.40 ft
T2 = (L2*Lo1)/(L1+L2) = 3.43 ft

6. Unit shear beside opening
V1 = (V/L)(L1+T1)/L1 = 1017 plf
V2 = (V/L)(T2+L2)/L2 = 1017 plf
Check V1*L1+V2*L2=V? 5761 lbf **OK**

7. Resistance to corner forces
R1 = V1*L1 = 2373 lbf
R2 = V2*L2 = 3388 lbf

8. Difference corner force + resistance
R1-F1 = -318 lbf
R2-F2 = -455 lbf

9. Unit shear in corner zones
vc1 = (R1-F1)/L1 = -136 plf
vc2 = (R2-F2)/L2 = -136 plf



Check Summary of Shear Values for One Opening

Line 1: vc1(ha1+hb1)+V1(ho1)=H?		-580	5341	4761 lbf
Line 2: va1(ha1+hb1)-vc1(ha1+hb1)-V1(ho1)=0?	4761	-580	5341	0
Line 3: vc2(ha1+hb1)+V2(ho1)=H?		-580	5341	4761 lbf

Design Summary

Req. Sheathing Capacity	1120 plf	**4-Term Deflection**	0.699 in.	**3-Term Deflection**	0.636 in.
Req. Strap Force	3842 lbf	**4-Term Story Drift %**	0.025 %	**3-Term Story Drift %**	0.022 %
Req. HD Force (H)	4761 lbf		See Page 2		See Page 3

APA Disclaimer

The information contained herein is intended for use as a resource to aid in the shear wall design based on APA – The Engineered Wood Association's testing and knowledge of wood-framed shear wall system design utilizing the force transfer around openings (FTAO) methodology. Neither APA, nor its member manufacturers, make any warranty, expressed or implied, or assume any legal liability or responsibility for the accuracy, use, application of, and/or reference to opinions, findings, conclusions, or recommendations included in this calculator. Consult your local jurisdiction or design professional to assure compliance with code, construction, and performance requirements. Because APA has no control over quality of workmanship or the conditions under which engineered wood products are used, it cannot accept responsibility of product performance or designs as actually constructed. ©2018 APA – THE ENGINEERED WOOD ASSOCIATION · ALL RIGHTS RESERVED · ANY COPYING, MODIFICATION, DISTRIBUTION, OR OTHER USE OF THIS PUBLICATION OTHER THAN AS EXPRESSLY AUTHORIZED BY APA IS PROHIBITED BY THE U.S. COPYRIGHT LAWS.

Project Information

Code:	IBC 2015	**Date:**	2/22/2019
Designer:	JCW		
Client:	Gelotte Hommas		
Project:	Peyree Residence		
Wall Line:	UC		

Shear Wall Deflection Calculation Variables

Sheathing:

Plywood	Sheathing Material
15/32	Performance Category
APA Rated Sheathing	Grade
	Gt Override
	Ga Overide

Wood End Post Values:

Species:	Hem-Fir		
E:	1.30E+06	(psi)	
	Qty	Stud Size	
Dimensions:	2	2x6	
A:	16.5	(in.^{2})	
A Override:		(in.^{2})	

Nail Type: 10d common (penny weight)

2-SIDED

	Pier 1	Pier 2	
Nail Spacing:	2 - 2	2 - 2	(in.)
HD Capacity:	4870	4870	(lbf)
HD Deflection:		0	(in.)

Four-Term Equation Deflection Check

$$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_a + d_a\frac{h}{b} \qquad \text{(Equation 23-2)}$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
Sheathing:	15/32	15/32	15/32	15/32	
Nail:	10d common	10d common	10d common	10d common	
v_{asd}:	1017	1017	1017	1017	(plf)
$v_{strength}$:	1453	1453	1453	1453	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.50	6.92	6.92	9.50	(ft)
A:	16.5	16.5	16.5	16.5	(in.^{2})
Gt:	27,000	27,000	27,000	27,000	(lbf/in.)
Nail Spacing:	2	2	2	2	(in.)
Vn:	242	242	242	242	(plf)
e:	0.0227	0.0227	0.0227	0.0227	(in.)
b:	2.33	2.33	3.33	3.33	(ft)
HD Capacity:	4870	4870	4870	4870	(lbf)
HD Defl:	0	0	0	0	(in.)

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.199	0.511	0.162	0.000	0.077	0.372	0.118	0.000
		Sum	0.872			Sum	0.567
Pier 2 (left)				**Pier 2 (right)**			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.054	0.372	0.118	0.000	0.140	0.511	0.162	0.000
		Sum	0.544			Sum	0.813

Total Defl.	
0.699	(in.)
0.0245	%drift

APA Disclaimer

The information contained herein is intended for use as a resource to aid in the shear wall design based on APA – The Engineered Wood Association's testing and knowledge of wood-framed shear wall system design utilizing the force transfer around openings (FTAO) methodology. Neither APA, nor its member manufacturers, make any warranty, expressed or implied, or assume any legal liability or responsibility for the accuracy, use, application of, and/or reference to opinions, findings, conclusions, or recommendations included in this calculator. Consult your local jurisdiction or design professional to assure compliance with code, construction, and performance requirements. Because APA has no control over quality of workmanship or the conditions under which engineered wood products are used, it cannot accept responsibility of product performance or designs as actually constructed. ©2018 APA – THE ENGINEERED WOOD ASSOCIATION · ALL RIGHTS RESERVED · ANY COPYING, MODIFICATION, DISTRIBUTION, OR OTHER USE OF THIS PUBLICATION OTHER THAN AS EXPRESSLY AUTHORIZED BY APA IS PROHIBITED BY THE U.S. COPYRIGHT LAWS.

Project Information

Code:	IBC 2015	**Date:**	2/22/2019
Designer:	JCW		
Client:	Gelotte Hommas		
Project:	Peyree Residence		
Wall Line:	UC		

Three-Term Equation Deflection Check

$$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \qquad (4.3\text{-}1)$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
Sheathing:	15/32	15/32	15/32	15/32	
Nail:	10d common	10d common	10d common	10d common	
v_{asd}:	1017	1017	1017	1017	(plf)
$v_{strength}$:	1453	1453	1453	1453	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.50	6.92	6.92	9.50	(ft)
A:	16.5	16.5	16.5	16.5	(in.^{2})
Ga:	23.0	23.0	23.0	23.0	(kips/in.)
b:	2.33	2.33	3.33	3.33	(ft)
HD Capacity:	4870	4870	4870	4870	(lbf)
HD Defl:	0	0	0	0	(in.)

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.199	0.600	0.000	0.077	0.437	0.000
	Sum	0.799		Sum	0.514
Pier 2 (left)			**Pier 2 (right)**		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.054	0.437	0.000	0.140	0.600	0.000
	Sum	0.491		Sum	0.740

Total Defl.	
0.636	(in.)
0.0223	%drift

Comment: The 3-term equation is calibrated to be approximately equal to 4-term equation at 1.4*ASD capacity.

APA Disclaimer

The information contained herein is intended for use as a resource to aid in the shear wall design based on APA – The Engineered Wood Association's testing and knowledge of wood-framed shear wall system design utilizing the force transfer around openings (FTAO) methodology. Neither APA, nor its member manufacturers, make any warranty, expressed or implied, or assume any legal liability or responsibility for the accuracy, use, application of, and/or reference to opinions, findings, conclusions, or recommendations included in this calculator. Consult your local jurisdiction or design professional to assure compliance with code, construction, and performance requirements. Because APA has no control over quality of workmanship or the conditions under which engineered wood products are used, it cannot accept responsibility of product performance or designs as actually constructed. ©2018 APA – THE ENGINEERED WOOD ASSOCIATION · ALL RIGHTS RESERVED · ANY COPYING, MODIFICATION, DISTRIBUTION, OR OTHER USE OF THIS PUBLICATION OTHER THAN AS EXPRESSLY AUTHORIZED BY APA IS PROHIBITED BY THE U.S. COPYRIGHT LAWS.

DEI
DIBBLE ENGINEERS INC

Project	Peyree Remodel	*Sheet #*	
Project #	17-291	*Date*	2/2019
Subject	Lateral - Shear Wall Design	*By*	JCW

Shear Wall Design
East-West Direction

Lateral Shear Load (ASD)

East-West Direction

Roof	26.31 kips	
Upper	47.08 kips	
Main	0 kips	[seismic base]

Main Building

Area	3960 ft^2	
Area Ratio	0.898	
Proportional Shear Load		
Roof	23.625 kips	
Upper	42.276 kips	
Main	0.000 kips	[seismic base]

East-West: Roof Diaphragm - Upper Walls

Wall Height 8.5 ft
Bldg Width 69 ft

Wall ID	Pier Length 1	Pier Length 2	Pier Length 3	Pier Length 4	A/R Length 1	A/R Length 2	A/R Length 3	A/R Length 4	Total Length	Trib Area	Shear	Unit Shear	SW-Nailing	SW Capacity	
R1	32.667	0	0	0	32.667	0	0	0	32.667	13.5	4.622	-	-	-	FTAO → SEE APA
R3	12.333	0	0	0	12.333	0	0	0	12.333	30.5	10.443	0.847	2SW-4	0.856	Discont SPREADSHEET
R4	24.333	0	0	0	24.333	0	0	0	24.333	25	8.560	0.352	SW-4	0.428	
									Total Area	69					

East-West: Upper Diaphragm - Main Walls

Wall Height 9.5 ft
Bldg Width 69 ft

Wall ID	Pier Length 1	Pier Length 2	Pier Length 3	Pier Length 4	A/R Length 1	A/R Length 2	A/R Length 3	A/R Length 4	Total Length	Trib Area	Shear	Unit Shear	SW-Nailing	SW Capacity	
U1	43.25	0	0	0	43.25	0	0	0	43.25	14.5	8.884	-	-	-	FTAO → SEE APA
U2	16.5	0	0	0	16.5	0	0	0	16.5	30.5	18.687	1.133	2SW-2	1.432	Discont SPREADSHEET
U3	7	13	0	0	7	13	0	0	20	24	14.705	0.735	2SW-4	0.856	
									Total Area	69					

0

East-West: Main Diaphragm - Lower Walls

Wall Height 11.33 ft
Bldg Width 62.333 ft

Wall ID	Pier Length 1	Pier Length 2	Pier Length 3	Pier Length 4	A/R Length 1	A/R Length 2	A/R Length 3	A/R Length 4	Total Length	Trib Area	Shear	Unit Shear	SW-Nailing	SW Capacity
M1	14	6.5	6.667	6	14	6.5	6.667	6	33.167	5.333	0.000	0.000	-	-
M2	17.333	0	0	0	17.333	0	0	0	17.333	16.25	0.000	0.000	-	-
M3	18.333	0	0	0	18.333	0	0	0	18.333	14.417	0.000	0.000	-	-
M4	14.667	0	0	0	14.667	0	0	0	14.667	14.917	0.000	0.000	-	-
M5	7.25	7.25	6.667	0	7.25	7.25	6.667	0	21.167	11.417	0.000	0.000	-	-
									Total Area	62.334				

North-East Garage/Playroom

Area	450 ft^2	
Area Ratio	0.102	
Proportional Shear Load		
Roof	2.685 kips	
Upper	4.804 kips	

East-West: Roof Diaphragm - Upper Walls

Wall Height 8.5 ft
Bldg Width 23.75 ft

Wall ID	Pier Length 1	Pier Length 2	Pier Length 3	Pier Length 4	A/R Length 1	A/R Length 2	A/R Length 3	A/R Length 4	Total Length	Trib Area	Shear	Unit Shear	SW-Nailing	SW Capacity
G-R1	10.667	0	0	0	10.667	0	0	0	10.667	11.875	1.342	0.126	SW-6	0.288
G-R2	5	6	5	0	5	6	5	0	16	11.875	1.342	0.084	SW-6	0.288
									Total Area	23.75				

0

East-West: Upper Diaphragm - Main Walls

Wall Height 9.5 ft
Bldg Width 23.72 ft

Wall ID	Pier Length 1	Pier Length 2	Pier Length 3	Pier Length 4	A/R Length 1	A/R Length 2	A/R Length 3	A/R Length 4	Total Length	Trib Area	Shear	Unit Shear	SW-Nailing	SW Capacity
G-U1	10.667	0	0	0	10.667	0	0	0	10.667	11.875	2.405	0.225	SW-6	0.288
G-U2	5	6	5	0	5	6	5	0	16	11.875	2.405	0.150	SW-6	0.288
									Total Area	23.75				

DEI
DIBBLE ENGINEERS INC

Project	Peyree Remodel	*Sheet #*	
Project #	17-291	*Date*	2/2019
Subject	Lateral - Shear Wall Design	*By*	JCW

Shear Wall Overturning
North-South Direction

Main Building

Lateral Shear Load (ASD)

Roof	23.625	kips	
Upper	42.276	kips	
Main	0.000	kips	[seismic base]

DLmin = (0.6-0.14SDS)DL = 0.46336 DL
DLmax = (1.0+14SDS)DL = 1.13664 DL

$$T = \frac{vh - DL_{min}\frac{b}{2}}{b - 0.5ft} \qquad C = \frac{vh + DL_{max}\frac{b}{2}}{b - 0.5ft}$$

East-West: Roof Diaphragm - Upper Walls

Wall ID	Height	Length	Shear	DL_{min}	DL_{max}	Tension	T_{abv}	T_{tot}	Compr	C_{abv}	C_{tot}	Holdown	Capacity		
R1	8.5	32.667	4.622	1.741	4.270	0.338	0.000	0.338	3.390	0.000	3.390	(A)CMST14	1.573		
R2	8.5	12.333	10.44307	0.657	1.612	7.159	0.000	7.159	8.342	0.000	8.342	2 (C)CMST14	7.866	Discont SW: ΩT/0.7 =	30.682
R3	8.5	24.333	8.559894	1.969	4.830	2.048	0.000	2.048	5.518	0.000	5.518	(B)CMST14	2.556		

East-West: Upper Diaphragm - Main Walls

Wall ID	Height	Length	Shear	DL_{min}	DL_{max}	Tension	T_{abv}	T_{tot}	Compr	C_{abv}	C_{tot}	Holdown	Capacity		
U1	9.5	43.25	8.884	2.104	6.145	0.910	0.338	1.247	5.083	3.390	8.472	(C)CMST14	3.933		
U2	9.5	16.5	18.68718	1.844	4.525	10.144	0.000	10.144	13.428	8.342	21.770	HDU11	11.175	Discont SW: ΩT/0.7 =	43.476
U3.1	9.5	7	5.146634	1.314	3.222	6.815	2.048	8.862	9.257	5.518	14.776	(F)CMST14	9.215	HDU11	
U3.2	9.5	13	9.558034	1.145	2.808	6.669	2.048	8.717	8.724	5.518	14.243	(F)CMST14	9.215	HDU11	

East-West: Main Diaphragm - Lower Walls

Wall ID	Height	Length	Shear	DL_{min}	DL_{max}	Tension	T_{abv}	T_{tot}	Compr	C_{abv}	C_{tot}	Holdown	Capacity
M1	11.333	14	0.000	1.968	4.827	-1.020	1.247	0.227	2.503	8.472	10.975	HDU2	2.215
M2	11.333	17.333	0	0.991	2.430	-0.510	0.000	-0.510	1.251	0.000	1.251	HDU2	2.215
M3	11.333	18.333	0	1.048	2.570	-0.539	0.000	-0.539	1.321	0.000	1.321	HDU2	2.215
M4	11.333	14.667	0	2.044	5.015	-1.058	0.000	-1.058	2.596	0.000	2.596	HDU2	2.215
M5	11.333	7.25	0	1.019	2.500	-0.547	8.862	8.315	1.342	5.518	6.861	(2)HDU8	14.630

North-East Garage/Playroom

Lateral Shear Load (ASD)

Roof	2.051	kips
Upper	3.111	kips

East-West: Roof

Wall ID	Height	Length	Shear	DL_{min}	DL_{max}	Tension	T_{abv}	T_{tot}	Compr	C_{abv}	C_{tot}	Holdown	Capacity
G-R1.1	8.5	10.667	1.342347	0.939	2.304	0.630	0.000	0.630	2.331	0.000	2.331	(A)CMST14	1.573
G-R2.1	8.5	5	0.419483	0.440	1.080	0.548	0.000	0.548	1.392	0.000	1.392	(A)CMST14	1.573
G-R2.2	8.5	6	0.50338	0.528	1.296	0.490	0.000	0.490	1.485	0.000	1.485	(A)CMST14	1.573
G-R2.3	8.5	5	0.419483	0.440	1.080	0.548	0.000	0.548	1.392	0.000	1.392	(A)CMST14	1.573

North-South: Upper

Wall ID	Height	Length	Shear	DL_{min}	DL_{max}	Tension	T_{abv}	T_{tot}	Compr	C_{abv}	C_{tot}	Holdown	Capacity
G-U1.1	9.5	10.667	2.405079	1.779	4.365	1.314	0.630	1.943	4.537	2.331	6.868	HDU2	2.215
G-U2.1	9.5	5	0.751587	0.834	2.046	1.123	0.548	1.671	2.723	1.392	4.116	HDU2	2.215
G-U2.2	9.5	6	0.901905	1.001	2.455	1.012	0.490	1.502	2.897	1.485	4.382	HDU2	2.215
G-U2.3	9.5	5	0.751587	0.834	2.046	1.123	0.548	1.671	2.723	1.392	4.116	HDU2	2.215

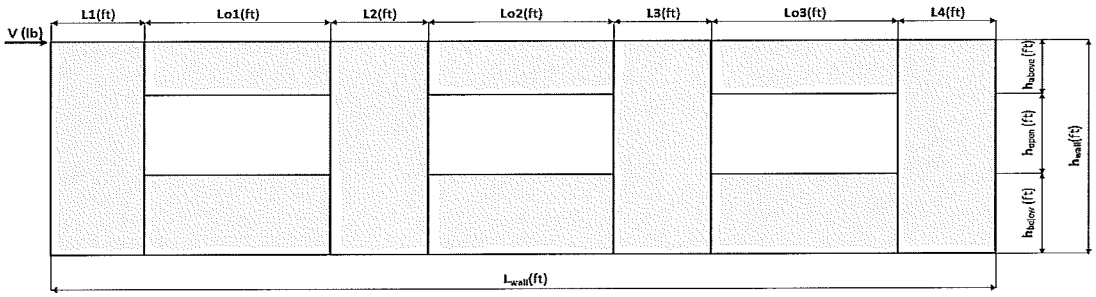
Force Transfer Around Openings Calculator

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:	IBC 2015	**Date:**	2/22/2019
Designer:	JCW		
Client:	Gelotte Hommas		
Project:	Peyree Residence		
Wall Line:	R1		



Shear Wall Calculation Variables

V	4622 lbf		Opening 1		Opening 2		Opening 3	Wall Pier Aspect Ratio		Adj. Factor
L1	6.67 ft	ha1	1.75 ft	ha2	1.75 ft	ha3	1.75 ft	P1=ho1/L1=	0.60	N/A
L2	5.00 ft	ho1	4.00 ft	ho2	4.00 ft	ho3	4.00 ft	P2=ho2/L2=	0.80	N/A
L3	4.83 ft	hb1	2.75 ft	hb2	2.75 ft	hb3	2.75 ft	P3=ho3/L3=	0.83	N/A
L4	9.00 ft	Lo1	2.50 ft	Lo2	2.50 ft	Lo3	2.50 ft	P4=ho3/L4=	0.44	N/A
h_{wall}	8.50 ft									
L_{wall}	33.00 ft									

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1191 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(ha1+hb1) =	265 plf
Second opening: va2 = vb2 = H/(ha2+hb2) =	265 plf
Third opening: va3 = vb3 = H/(ha3+hb3) =	265 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	661 lbf
Second opening: O2 = va2 x (Lo2) =	661 lbf
Third opening: O3 = va3 x (Lo3) =	661 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	378 lbf
F2 = O1(L2)/(L1+L2) =	283 lbf
F3 = O2(L2)/(L2+L3) =	336 lbf
F4 = O2(L3)/(L2+L3) =	325 lbf
F5 = O3(L3)/(L3+L4) =	231 lbf
F6 = O3(L4)/(L3+L4) =	430 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) =	1.43 ft
T2 = (L2*Lo1)/(L1+L2) =	1.07 ft
T3 = (L2*Lo2)/(L2+L3) =	1.27 ft
T4 = (L3*Lo2)/(L2+L3) =	1.23 ft
T5 = (L3*Lo3)/(L3+L4) =	0.87 ft
T6 = (L4*Lo3)/(L3+L4) =	1.63 ft

6. Unit shear beside opening

V1 = (V/L)(L1+T1)/L1 =	170 plf
V2 = (V/L)(T2+L2+T3)/L2 =	206 plf
V3 = (V/L)(T4+L3+T5)/L3 =	201 plf
V4 = (V/L)(T6+L4)/L4 =	165 plf
Check V1*L1+V2*L2+V3*L3+V4*L4=V?	4622 lbf **OK**

7. Resistance to corner forces

R1 = V1*L1 =	1134 lbf
R2 = V2*L2 =	1028 lbf
R3 = V3*L3 =	971 lbf
R4 = V4*L4 =	1488 lbf

8. Difference corner force + resistance

R1-F1 =	756 lbf
R2-F2-F3 =	409 lbf
R3-F4-F5 =	415 lbf
R4-F6 =	1058 lbf

9. Unit shear in corner zones

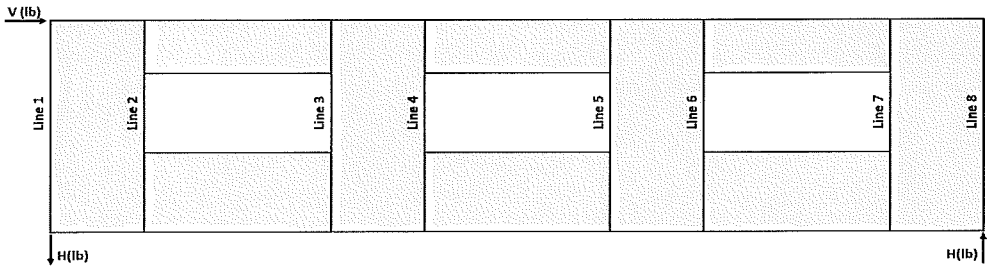
vc1 = (R1-F1)/L1 =	113 plf
vc2 = (R2-F2-F3)/L2 =	82 plf
vc3 = (R3-F4-F5)/L3 =	86 plf
vc4 = (R4-F6)/L4 =	118 plf

APA Disclaimer

The information contained herein is intended for use as a resource to aid in the shear wall design based on APA – The Engineered Wood Association's testing and knowledge of wood-framed shear wall system design utilizing the force transfer around openings (FTAO) methodology. Neither APA, nor its member manufacturers, make any warranty, expressed or implied, or assume any legal liability or responsibility for the accuracy, use, application of, and/or reference to opinions, findings, conclusions, or recommendations included in this calculator. Consult your local jurisdiction or design professional to assure compliance with code, construction, and performance requirements. Because APA has no control over quality of workmanship or the conditions under which engineered wood products are used, it cannot accept responsibility of product performance or designs as actually constructed. ©2018 APA – THE ENGINEERED WOOD ASSOCIATION · ALL RIGHTS RESERVED · ANY COPYING, MODIFICATION, DISTRIBUTION, OR OTHER USE OF THIS PUBLICATION OTHER THAN AS EXPRESSLY AUTHORIZED BY APA IS PROHIBITED BY THE U.S. COPYRIGHT LAWS.

Project Information

Code:	IBC 2015	**Date:**	2/22/2019
Designer:	JCW		
Client:	Gelotte Hommas		
Project:	Peyree Residence		
Wall Line:	R1		



Check Summary of Shear Values for Three Openings

Line 1: vc1(ha1+hb1)+V1(ho1)=H?		510	680	1191 lbf
Line 2: va1(ha1+hb1)-vc1(ha1+hb1)-V1(ho1)=0?	1191	510	680	0
Line 3: vc2(ha1+hb1)+V2(ho1)-va1(ha1+hb1)=0?	368	823	1191	0
Line 4: va2(ha2+hb2)-V2(ho2)-vc2(ha2+hb2)=0?	1191	823	368	0
Line 5: va2(ha2+hb2)-vc3(ha2+hb2)-V3(ho2)=0?	1191	387	804	0
Line 6: va3(ha3+hb3)-V3(ho3)-vc3(ha3+hb3)=0?	1191	804	387	0
Line 7: va3(ha3+hb3)-vc4(ha3+hb3)-V4(ho3)=0?	1191	529	661	0
Line 8: vc4(ha3+hb3)+V4(ho3)=H?		529	661	1191 lbf

Design Summary

Req. Sheathing Capacity	265 plf	**4-Term Deflection**	0.089 in.	**3-Term Deflection**	0.136 in.
Req. Strap Force	430 lbf	**4-Term Story Drift %**	0.003 %	**3-Term Story Drift %**	0.005 %
Req. HD Force (H)	1191 lbf		See Page 3		See Page 4

APA Disclaimer

The information contained herein is intended for use as a resource to aid in the shear wall design based on APA – The Engineered Wood Association's testing and knowledge of wood-framed shear wall system design utilizing the force transfer around openings (FTAO) methodology. Neither APA, nor its member manufacturers, make any warranty, expressed or implied, or assume any legal liability or responsibility for the accuracy, use, application of, and/or reference to opinions, findings, conclusions, or recommendations included in this calculator. Consult your local jurisdiction or design professional to assure compliance with code, construction, and performance requirements. Because APA has no control over quality of workmanship or the conditions under which engineered wood products are used, it cannot accept responsibility of product performance or designs as actually constructed. ©2018 APA – THE ENGINEERED WOOD ASSOCIATION · ALL RIGHTS RESERVED · ANY COPYING, MODIFICATION, DISTRIBUTION, OR OTHER USE OF THIS PUBLICATION OTHER THAN AS EXPRESSLY AUTHORIZED BY APA IS PROHIBITED BY THE U.S. COPYRIGHT LAWS.

Project Information

Code:	IBC 2015	**Date:**	2/22/2019
Designer:	JCW		
Client:	Gelotte Hommas		
Project:	Peyree Residence		
Wall Line:	R1		

Shear Wall Deflection Calculation Variables

Sheathing:

Plywood	Sheathing Material
15/32	Performance Category
APA Rated Sheathing	Grade
	Gt Override
	Ga Overide

Wood End Post Values:

Species:	Hem-Fir	
E:	1.30E+06	(psi)
Qty:	2	
Stud Size:	2x6	
A:	16.5	(in.^{2})
A Override:		(in.^{2})

Nail Type: 10d common (penny weight)

	Pier 1	Pier 4	
Nail Spacing:	6	6	(in.)
HD Capacity:	1573	1573	(lbf)
HD Deflection:		0	(in.)

Four-Term Equation Deflection Check

$$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_a + d_a\frac{h}{b} \qquad \text{(Equation 23-2)}$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	Pier 4-L	Pier 4-R	
Sheathing:	15/32	15/32	15/32	15/32	15/32	15/32	15/32	15/32	
Nail:	10d common	10d common	10d common	10d common	10d common	10d common	10d common	10d common	
v_{asd}:	170	170	206	206	201	201	165	165	(plf)
$v_{strength}$:	243	243	294	294	287	287	236	236	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	8.50	5.75	5.75	5.75	5.75	5.75	5.75	8.50	(ft)
A:	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	(in.^{2})
Gt:	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	(lbf/in.)
Nail Spacing:	6	6	3	3	6	6	6	6	(in.)
Vn:	121	121	73	73	144	144	118	118	(plf)
e:	0.0024	0.0024	0.0005	0.0005	0.0041	0.0041	0.0022	0.0022	(in.)
b:	6.67	6.67	5.00	5.00	4.83	4.83	9.00	9.00	(ft)
HD Capacity:	1573	1573	5715	5715	5715	5715	1573	1573	(lbf)
HD Defl:	0	0	0.064	0.064	0.064	0.064	0	0	(in.)

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.008	0.076	0.015	0.000	0.003	0.052	0.010	0.000
		Sum	0.100			Sum	0.065
Pier 2 (left)				**Pier 2 (right)**			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.004	0.063	0.002	0.022	0.004	0.063	0.002	0.022
		Sum	0.090			Sum	0.090
Pier 3 (left)				**Pier 3 (right)**			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.004	0.061	0.018	0.022	0.004	0.061	0.018	0.022
		Sum	0.105			Sum	0.105
Pier 4 (left)				**Pier 4 (right)**			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.002	0.050	0.009	0.000	0.006	0.074	0.014	0.000
		Sum	0.061			Sum	0.094

Total Defl.	
0.089	(in.)
0.0035	%drift

APA Disclaimer

The information contained herein is intended for use as a resource to aid in the shear wall design based on APA – The Engineered Wood Association's testing and knowledge of wood-framed shear wall system design utilizing the force transfer around openings (FTAO) methodology. Neither APA, nor its member manufacturers, make any warranty, expressed or implied, or assume any legal liability or responsibility for the accuracy, use, application of, and/or reference to opinions, findings, conclusions, or recommendations included in this calculator. Consult your local jurisdiction or design professional to assure compliance with code, construction, and performance requirements. Because APA has no control over quality of workmanship or the conditions under which engineered wood products are used, it cannot accept responsibility of product performance or designs as actually constructed. ©2018 APA – THE ENGINEERED WOOD ASSOCIATION · ALL RIGHTS RESERVED · ANY COPYING, MODIFICATION, DISTRIBUTION, OR OTHER USE OF THIS PUBLICATION OTHER THAN AS EXPRESSLY AUTHORIZED BY APA IS PROHIBITED BY THE U.S. COPYRIGHT LAWS.

Project Information

Code:	IBC 2015	**Date:** 2/22/2019
Designer:	JCW	
Client:	Gelotte Hommas	
Project:	Peyree Residence	
Wall Line:	R1	

Three-Term Equation Deflection Check

$$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \qquad (4.3\text{-}1)$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	Pier 4-L	Pier 4-R	
Sheathing:	15/32	15/32	15/32	15/32	15/32	15/32	15/32	15/32	
Nail:	10d common	10d common	10d common	10d common	10d common	10d common	10d common	10d common	
v_{asd}:	170	170	206	206	201	201	165	165	(plf)
$v_{strength}$:	243	243	294	294	287	287	236	236	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	8.50	5.75	5.75	5.75	5.75	5.75	5.75	8.50	(ft)
A:	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	($in.^2$)
Ga:	14	14	14	14	14	14	14	14	(kips/in.)
b:	6.67	6.67	5.00	5.00	4.83	4.83	9.00	9.00	(ft)
HD Capacity:	1573	1573	5715	5715	5715	5715	1573	1573	(lbf)
HD Defl:	0	0	0.064	0.064	0.064	0.064	0	0	(in.)

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.008	0.148	0.000	0.003	0.100	0.000
	Sum	0.156		Sum	0.102
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.004	0.121	0.022	0.004	0.121	0.022
	Sum	0.147		Sum	0.147
Pier 3 (left)			Pier 3 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.004	0.118	0.022	0.004	0.118	0.022
	Sum	0.144		Sum	0.144
Pier 4 (left)			Pier 4 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.002	0.097	0.000	0.006	0.143	0.000
	Sum	0.099		Sum	0.149

Total Defl.	
0.136	(in.)
0.0053	%drift

Comment: The 3-term equation is calibrated to be approximately equal to 4-term equation at 1.4*ASD capacity.

APA Disclaimer

The information contained herein is intended for use as a resource to aid in the shear wall design based on APA – The Engineered Wood Association's testing and knowledge of wood-framed shear wall system design utilizing the force transfer around openings (FTAO) methodology. Neither APA, nor its member manufacturers, make any warranty, expressed or implied, or assume any legal liability or responsibility for the accuracy, use, application of, and/or reference to opinions, findings, conclusions, or recommendations included in this calculator. Consult your local jurisdiction or design professional to assure compliance with code, construction, and performance requirements. Because APA has no control over quality of workmanship or the conditions under which engineered wood products are used, it cannot accept responsibility of product performance or designs as actually constructed. ©2018 APA – THE ENGINEERED WOOD ASSOCIATION · ALL RIGHTS RESERVED · ANY COPYING, MODIFICATION, DISTRIBUTION, OR OTHER USE OF THIS PUBLICATION OTHER THAN AS EXPRESSLY AUTHORIZED BY APA IS PROHIBITED BY THE U.S. COPYRIGHT LAWS.

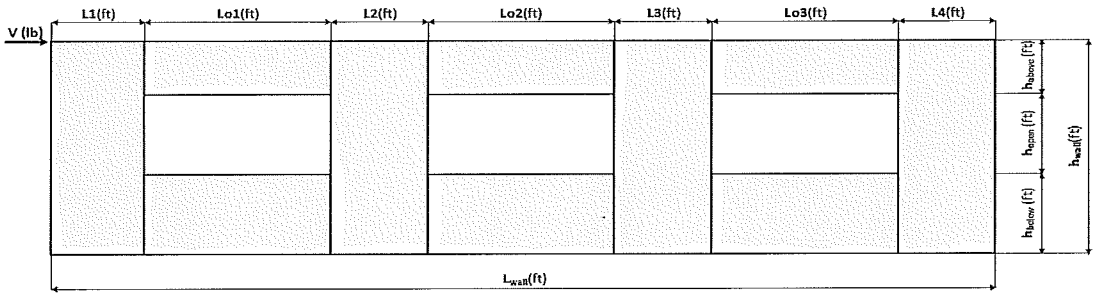
Force Transfer Around Openings Calculator

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:	IBC 2015	**Date:**	2/22/2019
Designer:	JCW		
Client:	Gelotte Hommas		
Project:	Peyree Residence		
Wall Line:	U1		



Shear Wall Calculation Variables

V	8884 lbf		Opening 1		Opening 2		Opening 3	Wall Pier Aspect Ratio		Adj. Factor
L1	12.50 ft	ha1	1.17 ft	ha2	1.17 ft	ha3	1.17 ft	P1=ho1/L1=	0.48	N/A
L2	4.50 ft	ho1	6.00 ft	ho2	6.00 ft	ho3	6.00 ft	P2=ho2/L2=	1.33	N/A
L3	4.75 ft	hb1	2.33 ft	hb2	2.33 ft	hb3	2.33 ft	P3=ho3/L3=	1.26	N/A
L4	12.50 ft	Lo1	4.00 ft	Lo2	2.50 ft	Lo3	2.50 ft	P4=ho3/L4=	0.48	N/A
h_{wall}	9.50 ft									
L_{wall}	43.25 ft									

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ 1951 lbf

2. Unit shear above + below opening

First opening: va1 = vb1 = H/(ha1+hb1) =	558 plf
Second opening: va2 = vb2 = H/(ha2+hb2) =	558 plf
Third opening: va3 = vb3 = H/(ha3+hb3) =	558 plf

3. Total boundary force above + below openings

First opening: O1 = va1 x (Lo1) =	2230 lbf
Second opening: O2 = va2 x (Lo2) =	1394 lbf
Third opening: O3 = va3 x (Lo3) =	1394 lbf

4. Corner forces

F1 = O1(L1)/(L1+L2) =	1640 lbf
F2 = O1(L2)/(L1+L2) =	590 lbf
F3 = O2(L2)/(L2+L3) =	678 lbf
F4 = O2(L3)/(L2+L3) =	716 lbf
F5 = O3(L3)/(L3+L4) =	384 lbf
F6 = O3(L4)/(L3+L4) =	1010 lbf

5. Tributary length of openings

T1 = (L1*Lo1)/(L1+L2) =	2.94 ft
T2 = (L2*Lo1)/(L1+L2) =	1.06 ft
T3 = (L2*Lo2)/(L2+L3) =	1.22 ft
T4 = (L3*Lo2)/(L2+L3) =	1.28 ft
T5 = (L3*Lo3)/(L3+L4) =	0.69 ft
T6 = (L4*Lo3)/(L3+L4) =	1.81 ft

6. Unit shear beside opening

V1 = (V/L)(L1+T1)/L1 =	254 plf
V2 = (V/L)(T2+L2+T3)/L2 =	309 plf
V3 = (V/L)(T4+L3+T5)/L3 =	291 plf
V4 = (V/L)(T6+L4)/L4 =	235 plf
Check V1*L1+V2*L2+V3*L3+V4*L4=V?	8884 lbf **OK**

7. Resistance to corner forces

R1 = V1*L1 =	3172 lbf
R2 = V2*L2 =	1392 lbf
R3 = V3*L3 =	1381 lbf
R4 = V4*L4 =	2940 lbf

8. Difference corner force + resistance

R1-F1 =	1532 lbf
R2-F2-F3 =	123 lbf
R3-F4-F5 =	281 lbf
R4-F6 =	1930 lbf

9. Unit shear in corner zones

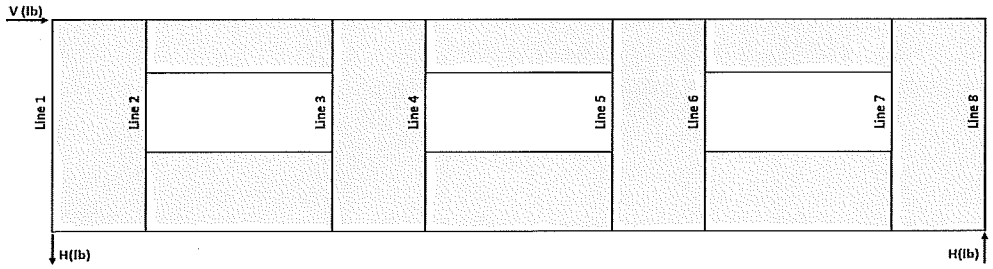
vc1 = (R1-F1)/L1 =	123 plf
vc2 = (R2-F2-F3)/L2 =	27 plf
vc3 = (R3-F4-F5)/L3 =	59 plf
vc4 = (R4-F6)/L4 =	154 plf

APA Disclaimer

The information contained herein is intended for use as a resource to aid in the shear wall design based on APA – The Engineered Wood Association's testing and knowledge of wood-framed shear wall system design utilizing the force transfer around openings (FTAO) methodology. Neither APA, nor its member manufacturers, make any warranty, expressed or implied, or assume any legal liability or responsibility for the accuracy, use, application of, and/or reference to opinions, findings, conclusions, or recommendations included in this calculator. Consult your local jurisdiction or design professional to assure compliance with code, construction, and performance requirements. Because APA has no control over quality of workmanship or the conditions under which engineered wood products are used, it cannot accept responsibility of product performance or designs as actually constructed. ©2018 APA – THE ENGINEERED WOOD ASSOCIATION · ALL RIGHTS RESERVED · ANY COPYING, MODIFICATION, DISTRIBUTION, OR OTHER USE OF THIS PUBLICATION OTHER THAN AS EXPRESSLY AUTHORIZED BY APA IS PROHIBITED BY THE U.S. COPYRIGHT LAWS.

Project Information

Code:	IBC 2015	**Date:**	2/22/2019
Designer:	JCW		
Client:	Gelotte Hommas		
Project:	Peyree Residence		
Wall Line:	U1		



Check Summary of Shear Values for Three Openings

Line 1: vc1(ha1+hb1)+V1(ho1)=H?		429	1522	1951 lbf
Line 2: va1(ha1+hb1)-vc1(ha1+hb1)-V1(ho1)=0?	1951	429	1522	0
Line 3: vc2(ha1+hb1)+V2(ho1)-va1(ha1+hb1)=0?	96	1856	1951	0
Line 4: va2(ha2+hb2)-V2(ho2)-vc2(ha2+hb2)=0?	1951	1856	96	0
Line 5: va2(ha2+hb2)-vc3(ha2+hb2)-V3(ho2)=0?	1951	207	1744	0
Line 6: va3(ha3+hb3)-V3(ho3)-vc3(ha3+hb3)=0?	1951	1744	207	0
Line 7: va3(ha3+hb3)-vc4(ha3+hb3)-V4(ho3)=0?	1951	540	1411	0
Line 8: vc4(ha3+hb3)+V4(ho3)=H?		540	1411	1951 lbf

Design Summary

Req. Sheathing Capacity	558 plf	**4-Term Deflection**	0.154 in.	**3-Term Deflection**	0.194 in.
Req. Strap Force	1640 lbf	**4-Term Story Drift %**	0.005 %	**3-Term Story Drift %**	0.007 %
Req. HD Force (H)	1951 lbf		See Page 3		See Page 4

APA Disclaimer

The information contained herein is intended for use as a resource to aid in the shear wall design based on APA – The Engineered Wood Association's testing and knowledge of wood-framed shear wall system design utilizing the force transfer around openings (FTAO) methodology. Neither APA, nor its member manufacturers, make any warranty, expressed or implied, or assume any legal liability or responsibility for the accuracy, use, application of, and/or reference to opinions, findings, conclusions, or recommendations included in this calculator. Consult your local jurisdiction or design professional to assure compliance with code, construction, and performance requirements. Because APA has no control over quality of workmanship or the conditions under which engineered wood products are used, it cannot accept responsibility of product performance or designs as actually constructed. ©2018 APA – THE ENGINEERED WOOD ASSOCIATION · ALL RIGHTS RESERVED · ANY COPYING, MODIFICATION, DISTRIBUTION, OR OTHER USE OF THIS PUBLICATION OTHER THAN AS EXPRESSLY AUTHORIZED BY APA IS PROHIBITED BY THE U.S. COPYRIGHT LAWS.

Project Information

Code:	IBC 2015		**Date:** 2/22/2019
Designer:	JCW		
Client:	Gelotte Hommas		
Project:	Peyree Residence		
Wall Line:	U1		

Shear Wall Deflection Calculation Variables

Sheathing:		Wood End Post Values:			Nail Type:	10d common	(penny weight)
Plywood	Sheathing Material	Species:	Hem-Fir				
15/32	Performance Category	E:	1.30E+06	(psi)		Pier 1	Pier 4
APA Rated Sheathing	Grade	Qty:	2		Nail Spacing:	3	3 (in.)
		Stud Size:	2x6		HD Capacity:	2556	2556 (lbf)
	Gt Override	A:	16.5	(in.^{2})	HD Deflection:		0 (in.)
	Ga Overide	A Override:		(in.^{2})			

Four-Term Equation Deflection Check

$$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_a + d_a\frac{h}{b} \qquad \text{(Equation 23-2)}$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	Pier 4-L	Pier 4-R	
Sheathing:	15/32	15/32	15/32	15/32	15/32	15/32	15/32	15/32	
Nail:	10d common	10d common	10d common	10d common	10d common	10d common	10d common	10d common	
v_{asd}:	254	254	309	309	291	291	235	235	(plf)
$v_{strength}$:	362	362	442	442	415	415	336	336	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.50	7.17	7.17	7.17	7.17	7.17	7.17	9.50	(ft)
A:	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	(in.^{2})
Gt:	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000	(lbf/in.)
Nail Spacing:	3	3	3	3	3	3	3	3	(in.)
Vn:	91	91	110	110	104	104	84	84	(plf)
e:	0.0009	0.0009	0.0017	0.0017	0.0014	0.0014	0.0007	0.0007	(in.)
b:	12.50	12.50	4.50	4.50	4.75	4.75	12.50	12.50	(ft)
HD Capacity:	2556	2556	5715	5715	5715	5715	2556	2556	(lbf)
HD Defl:	0	0	0.064	0.064	0.064	0.064	0	0	(in.)

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.009	0.128	0.006	0.000	0.004	0.096	0.005	0.000
		Sum	0.143			Sum	0.105
Pier 2 (left)				**Pier 2 (right)**			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.013	0.117	0.009	0.056	0.013	0.117	0.009	0.056
		Sum	0.197			Sum	0.197
Pier 3 (left)				**Pier 3 (right)**			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.012	0.110	0.008	0.050	0.012	0.110	0.008	0.050
		Sum	0.180			Sum	0.180
Pier 4 (left)				**Pier 4 (right)**			
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-1	Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 4 HD-2
0.004	0.089	0.004	0.000	0.009	0.118	0.005	0.000
		Sum	0.097			Sum	0.132

Total Defl.	
0.154	(in.)
0.0054	%drift

APA Disclaimer

The information contained herein is intended for use as a resource to aid in the shear wall design based on APA – The Engineered Wood Association's testing and knowledge of wood-framed shear wall system design utilizing the force transfer around openings (FTAO) methodology. Neither APA, nor its member manufacturers, make any warranty, expressed or implied, or assume any legal liability or responsibility for the accuracy, use, application of, and/or reference to opinions, findings, conclusions, or recommendations included in this calculator. Consult your local jurisdiction or design professional to assure compliance with code, construction, and performance requirements. Because APA has no control over quality of workmanship or the conditions under which engineered wood products are used, it cannot accept responsibility of product performance or designs as actually constructed. ©2018 APA – THE ENGINEERED WOOD ASSOCIATION · ALL RIGHTS RESERVED · ANY COPYING, MODIFICATION, DISTRIBUTION, OR OTHER USE OF THIS PUBLICATION OTHER THAN AS EXPRESSLY AUTHORIZED BY APA IS PROHIBITED BY THE U.S. COPYRIGHT LAWS.

Project Information

Code:	IBC 2015	**Date:**	2/22/2019
Designer:	JCW		
Client:	Gelotte Hommas		
Project:	Peyree Residence		
Wall Line:	U1		

Three-Term Equation Deflection Check

$$\delta_{sw} = \frac{8vh^3}{EAb} + \frac{vh}{1000G_a} + \frac{h\Delta_a}{b} \qquad (4.3\text{-}1)$$

	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	Pier 3-L	Pier 3-R	Pier 4-L	Pier 4-R	
Sheathing:	15/32	15/32	15/32	15/32	15/32	15/32	15/32	15/32	
Nail:	10d common	10d common	10d common	10d common	10d common	10d common	10d common	10d common	
v_{asd}:	254	254	309	309	291	291	235	235	(plf)
$v_{strength}$:	362	362	442	442	415	415	336	336	(plf)
E:	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	1.30E+06	(psi)
h:	9.50	7.17	7.17	7.17	7.17	7.17	7.17	9.50	(ft)
A:	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	($in.^2$)
Ga:	19	19	19	19	19	19	19	19	(kips/in.)
b:	12.50	12.50	4.50	4.50	4.75	4.75	12.50	12.50	(ft)
HD Capacity:	2556	2556	5715	5715	5715	5715	2556	2556	(lbf)
HD Defl:	0	0	0.064	0.064	0.064	0.064	0	0	(in.)

Check Total Deflection of Wall System

Pier 1 (left)			Pier 1 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.009	0.181	0.000	0.004	0.137	0.000
	Sum	0.191		Sum	0.141
Pier 2 (left)			Pier 2 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.013	0.167	0.056	0.013	0.167	0.056
	Sum	0.237		Sum	0.237
Pier 3 (left)			Pier 3 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.012	0.157	0.050	0.012	0.157	0.050
	Sum	0.219		Sum	0.219
Pier 4 (left)			Pier 4 (right)		
Term 1 Bending	Term 2 Shear	Term 3 Fastener	Term 1 Bending	Term 2 Shear	Term 3 Fastener
0.004	0.127	0.000	0.009	0.168	0.000
	Sum	0.130		Sum	0.177

Total Defl.	
0.194	(in.)
0.0068	%drift

Comment: The 3-term equation is calibrated to be approximately equal to 4-term equation at 1.4*ASD capacity.

APA Disclaimer

The information contained herein is intended for use as a resource to aid in the shear wall design based on APA – The Engineered Wood Association's testing and knowledge of wood-framed shear wall system design utilizing the force transfer around openings (FTAO) methodology. Neither APA, nor its member manufacturers, make any warranty, expressed or implied, or assume any legal liability or responsibility for the accuracy, use, application of, and/or reference to opinions, findings, conclusions, or recommendations included in this calculator. Consult your local jurisdiction or design professional to assure compliance with code, construction, and performance requirements. Because APA has no control over quality of workmanship or the conditions under which engineered wood products are used, it cannot accept responsibility of product performance or designs as actually constructed. ©2018 APA – THE ENGINEERED WOOD ASSOCIATION · ALL RIGHTS RESERVED · ANY COPYING, MODIFICATION, DISTRIBUTION, OR OTHER USE OF THIS PUBLICATION OTHER THAN AS EXPRESSLY AUTHORIZED BY APA IS PROHIBITED BY THE U.S. COPYRIGHT LAWS.

Title Block Line 1
You can change this area using the "Settings" menu item and then using the "Printing & Title Block" selection.
Title Block Line 6

Project Title:
Engineer:
Project ID:
Project Descr:

SL29

Printed: 27 FEB 2019, 6:39PM

Wood Beam

:cts\17-291 Peyree Remodel\Calcs\Comment Response 2019-01\Lateral REV1\peyree transfer beams REV1.ec6
Software copyright ENERCALC, INC. 1983-2018, Build:10.18.12.30

Lic. # : KW-06006102 **Licensee : DIBBLE ENGINEERS INC.**

Description : UTB1 - Transfer Beam wall RB - REV1

CODE REFERENCES

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

Material Properties

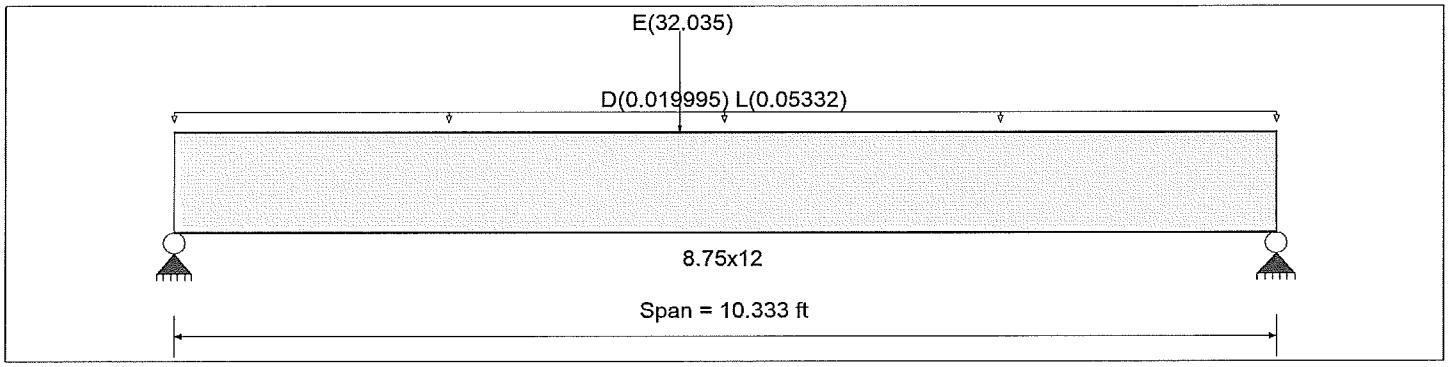
Analysis Method : Allowable Stress Design
Load Combination :ASCE 7-10

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

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

Fb +	2,400.0 psi
Fb -	1,850.0 psi
Fc - Prll	1,650.0 psi
Fc - Perp	650.0 psi
Fv	265.0 psi
Ft	1,100.0 psi

E : Modulus of Elasticity	
Ebend- xx	1,800.0 ksi
Eminbend - xx	950.0 ksi
Ebend- yy	1,600.0 ksi
Eminbend - yy	850.0 ksi
Density	31.20 pcf



Applied Loads

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

Beam self weight calculated and added to loads
Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 1.333 ft, (Floor)
Point Load : E = 32.035 k @ 4.750 ft, (Dicont SW OT - RB)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.866** : 1	Maximum Shear Stress Ratio	=	**0.415** : 1
Section used for this span		**8.75x12**	Section used for this span		**8.75x12**
fb : Actual	=	3,324.49 psi	fv : Actual	=	175.99 psi
FB : Allowable	=	3,840.00 psi	Fv : Allowable	=	424.00 psi
Load Combination		+1.137D+0.70E+H	Load Combination		+1.137D+0.70E+H
Location of maximum on span	=	4.752 ft	Location of maximum on span	=	0.000 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.006 in	Ratio =	20442 >=480.
Max Upward Transient Deflection	0.000 in	Ratio =	0 <480.0
Max Downward Total Deflection	0.011 in	Ratio =	11346 >=360.
Max Upward Total Deflection	0.000 in	Ratio =	0 <360.0

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios									Moment Values			Shear Values		
Segment Length	Span #	M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	M	fb	F'b	V	fv	F'v
+D+H													0.00	0.00	0.00	0.00
Length = 10.333 ft	1	0.015	0.011	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.57	32.60	2160.00	0.18	2.56	238.50
+D+L+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 10.333 ft	1	0.031	0.022	1.00	1.000	1.00	1.00	1.00	1.00	1.00	1.28	73.26	2400.00	0.40	5.74	265.00
+D+Lr+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 10.333 ft	1	0.011	0.008	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.57	32.60	3000.00	0.18	2.56	331.25
+D+S+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 10.333 ft	1	0.012	0.008	1.15	1.000	1.00	1.00	1.00	1.00	1.00	0.57	32.60	2760.00	0.18	2.56	304.75
+D+0.750Lr+0.750L+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00

Title Block Line 1
You can change this area using the "Settings" menu item and then using the "Printing & Title Block" selection.
Title Block Line 6

Project Title:
Engineer:
Project ID:
Project Descr:

SL30

Printed: 27 FEB 2019, 6:48PM

Wood Column

:cls\17-291 Peyree Remodel\Calcs\Comment Response 2019-01\Lateral REV1\peyree transfer beams REV1.ec6
Software copyright ENERCALC, INC. 1983-2018, Build:10.18.12.30

Lic. # : KW-06006102 **Licensee : DIBBLE ENGINEERS INC.**

Description : UTC1 - Transfer Post wall RB

Code References

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

General Information

Analysis Method : Allowable Stress Design
End Fixities Top & Bottom Pinned
Overall Column Height 8.50 ft
(Used for non-slender calculations)

Wood Species Douglas Fir - Larch
Wood Grade No.1

Fb +	1,200.0 psi	Fv	170.0 psi
Fb -	1,200.0 psi	Ft	825.0 psi
Fc - Prll	1,000.0 psi	Density	31.20 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 **6x6**
Wood Grading/Manuf. Graded Lumber
Wood Member Type Sawn

Exact Width	**5.50**	in
Exact Depth	**5.50**	in
Area	30.250	in^2
Ix	76.255	in^4
Iy	76.255	in^4

Allow Stress Modification Factors

Cf or Cv for Bending	1.0
Cf or Cv for Compression	1.0
Cf or Cv for Tension	1.0
Cm : Wet Use Factor	1.0
Ct : Temperature Factor	1.0
Cfu : Flat Use Factor	1.0
Kf : Built-up columns	1.0 *NDS 15.3.2*
Use Cr : Repetitive ?	No

Brace condition for deflection (buckling) along columns :
X-X (width) axis : Fully braced against buckling ABOUT Y-Y Axis
Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 8.50 ft, K = 1

Applied Loads

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

Column self weight included : 55.710 lbs * Dead Load Factor
AXIAL LOADS . . .
Beam RXN w/ roof post: Axial Load at 8.50 ft, D = 1.414, L = 0.04333, S = 2.138 k
Discont SW HD RB1: Axial Load at 8.50 ft, E = 32.035 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.7785 : 1**

Load Combination	+1.137D+0.70E+H
Governing NDS Forumla	Comp Only, fc/Fc'
Location of max.above base	0.0 ft
At maximum location values are . . .	
Applied Axial	24.095 k
Applied Mx	0.0 k-ft
Applied My	0.0 k-ft
Fc : Allowable	1,023.19 psi

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

Load Combination	+0.4634D+0.70E+0.60H
Location of max.above base	8.50 ft
Applied Design Shear	0.0 psi
Allowable Shear	272.0 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+H	0.900	0.816	0.06615	PASS	0.0 ft	0.0	PASS	8.50 ft
+D+L+H	1.000	0.790	0.06329	PASS	0.0 ft	0.0	PASS	8.50 ft
+D+Lr+H	1.250	0.725	0.05358	PASS	0.0 ft	0.0	PASS	8.50 ft
+D+S+H	1.150	0.751	0.1380	PASS	0.0 ft	0.0	PASS	8.50 ft
+D+0.750Lr+0.750L+H	1.250	0.725	0.05476	PASS	0.0 ft	0.0	PASS	8.50 ft
+D+0.750L+0.750S+H	1.150	0.751	0.1188	PASS	0.0 ft	0.0	PASS	8.50 ft
+D+0.60W+H	1.600	0.639	0.04748	PASS	0.0 ft	0.0	PASS	8.50 ft
+1.137D+0.70E+H	1.600	0.639	0.7785	PASS	0.0 ft	0.0	PASS	8.50 ft
+D+0.750Lr+0.750L+0.450W+H	1.600	0.639	0.04853	PASS	0.0 ft	0.0	PASS	8.50 ft
+D+0.750L+0.750S+0.450W+H	1.600	0.639	0.1003	PASS	0.0 ft	0.0	PASS	8.50 ft
+1.102D+0.750L+0.750S+0.5250E+H	1.600	0.639	0.6486	PASS	0.0 ft	0.0	PASS	8.50 ft

Title Block Line 1
You can change this area using the "Settings" menu item and then using the "Printing & Title Block" selection.
Title Block Line 6

Project Title:
Engineer:
Project ID:
Project Descr:

SL31

Printed: 27 FEB 2019, 6:51PM

Wood Beam

:cts\17-291 Peyree Remodel\Calcs\Comment Response 2019-01\Lateral REV1\peyree transfer beams REV1.ec6 .
Software copyright ENERCALC, INC. 1983-2018, Build:10.18.12.30 .

Lic. # : KW-06006102 **Licensee : DIBBLE ENGINEERS INC.**

Description : UTB2 - Transfer Beam

CODE REFERENCES

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

Material Properties

Analysis Method : Allowable Stress Design
Load Combination ASCE 7-10

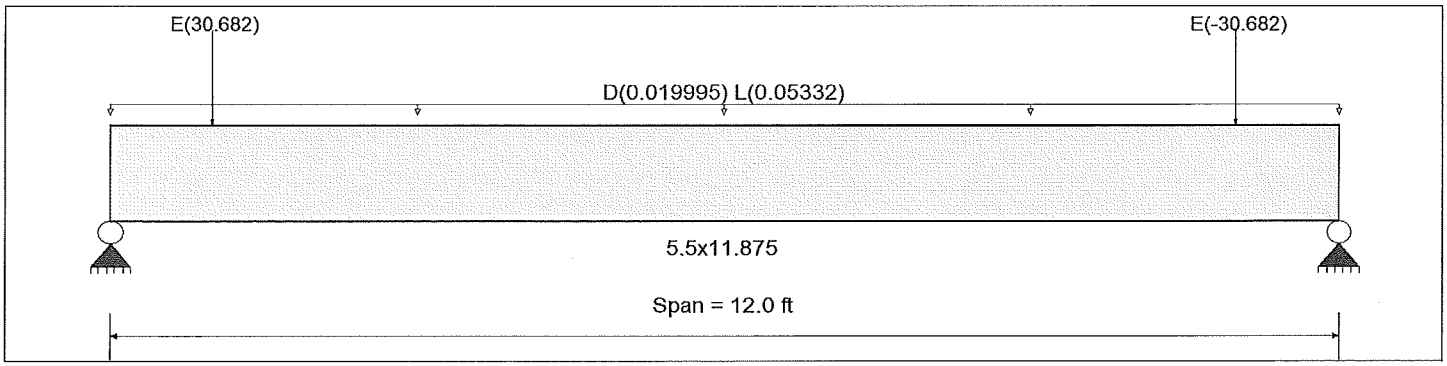
Wood Species : DF/DF
Wood Grade : 24F - V4

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

Fb +	2,400.0 psi
Fb -	1,850.0 psi
Fc - Prll	1,650.0 psi
Fc - Perp	650.0 psi
Fv	265.0 psi
Ft	1,100.0 psi

E : Modulus of Elasticity

Ebend- xx	1,800.0 ksi
Eminbend - xx	950.0 ksi
Ebend- yy	1,600.0 ksi
Eminbend - yy	850.0 ksi
Density	31.20 pcf



Applied Loads

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

Beam self weight calculated and added to loads
Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 1.333 ft, (Floor)
Point Load : E = 30.682 k @ 1.0 ft, (Discont SW OT - wall R2)
Point Load : E = -30.682 k @ 11.0 ft, (Discont SW OT - wall R2)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.437** : 1	Maximum Shear Stress Ratio	=	**0.980** : 1
Section used for this span		**5.5x11.875**	Section used for this span		**5.5x11.875**
fb : Actual	=	1,679.03 psi	fv : Actual	=	415.54 psi
FB : Allowable	=	3,840.00 psi	Fv : Allowable	=	424.00 psi
Load Combination		+1.137D+0.70E+H	Load Combination		+1.137D+0.70E+H
Location of maximum on span	=	1.007 ft	Location of maximum on span	=	0.000 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.018 in	Ratio =	7950 >=480.
Max Upward Transient Deflection	0.000 in	Ratio =	0 <480.0
Max Downward Total Deflection	0.030 in	Ratio =	4846 >=360.
Max Upward Total Deflection	0.000 in	Ratio =	0 <360.0

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios									Moment Values			Shear Values		
Segment Length	Span #	M	V	C_d	C_{FN}	C_i	C_r	C_m	C_t	C_L	M	fb	F'b	V	fv	F'v
+D+H													0.00	0.00	0.00	0.00
Length = 12.0 ft	1	0.026	0.017	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.61	57.06	2160.00	0.17	3.95	238.50
+D+L+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.0 ft	1	0.061	0.038	1.00	1.000	1.00	1.00	1.00	1.00	1.00	1.57	146.16	2400.00	0.44	10.12	265.00
+D+Lr+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.0 ft	1	0.019	0.012	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.61	57.06	3000.00	0.17	3.95	331.25
+D+S+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.0 ft	1	0.021	0.013	1.15	1.000	1.00	1.00	1.00	1.00	1.00	0.61	57.06	2760.00	0.17	3.95	304.75

Title Block Line 1
You can change this area using the "Settings" menu item and then using the "Printing & Title Block" selection.
Title Block Line 6

Project Title:
Engineer:
Project ID:
Project Descr:

SL32

Printed: 27 FEB 2019, 6:51PM

Wood Column

:cts\17-291 Peyree Remodel\Calcs\Comment Response 2019-01\Lateral REV1\peyree transfer beams REV1.ec6
Software copyright ENERCALC, INC. 1983-2018, Build:10.18.12.30

Lic. # : KW-06006102 **Licensee : DIBBLE ENGINEERS INC.**

Description : UTC2 - Transfer Post wall R3

Code References

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

General Information

Analysis Method :	Allowable Stress Design	Wood Section Name	**6x6**
End Fixities	Top & Bottom Pinned	Wood Grading/Manuf.	Graded Lumber
Overall Column Height	8.50 ft	Wood Member Type	Sawn
(Used for non-slender calculations)			
Wood Species	Douglas Fir - Larch	Exact Width	**5.50** in
Wood Grade	No.1	Exact Depth	**5.50** in
Fb +	1,200.0 psi	Fv	170.0 psi
Fb -	1,200.0 psi	Ft	825.0 psi
Fc - Prll	1,000.0 psi	Density	31.20 pcf
Fc - Perp	625.0 psi		

Area	30.25 in^2
Ix	76.255 in^4
Iy	76.255 in^4

Allow Stress Modification Factors

Cf or Cv for Bending	1.0
Cf or Cv for Compression	1.0
Cf or Cv for Tension	1.0
Cm : Wet Use Factor	1.0
Ct : Temperature Factor	1.0
Cfu : Flat Use Factor	1.0
Kf : Built-up columns	1.0 *NDS 15.3.2*
Use Cr : Repetitive ?	No

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	

Brace condition for deflection (buckling) along columns :
X-X (width) axis : Fully braced against buckling ABOUT Y-Y Axis
Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 8.50 ft, K = 1

Applied Loads

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

Column self weight included : 55.710 lbs * Dead Load Factor
AXIAL LOADS . . .
RH3 HDR RXN: Axial Load at 8.50 ft, D = 1.584, S = 2.494 k
Discont SW HD R2: Axial Load at 8.50 ft, E = 30.682 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.7541 : 1**

Load Combination	+1.137D+0.70E+H
Governing NDS Forumla	Comp Only, fc/Fc'
Location of max.above base	0.0 ft
At maximum location values are . . .	
Applied Axial	23.341 k
Applied Mx	0.0 k-ft
Applied My	0.0 k-ft
Fc : Allowable	1,023.19 psi

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

Load Combination	+0.4634D+0.70E+0.60H
Location of max.above base	8.50 ft
Applied Design Shear	0.0 psi
Allowable Shear	272.0 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+H	0.900	0.816	0.07380	PASS	0.0 ft	0.0	PASS	8.50 ft
+D+L+H	1.000	0.790	0.06859	PASS	0.0 ft	0.0	PASS	8.50 ft
+D+Lr+H	1.250	0.725	0.05977	PASS	0.0 ft	0.0	PASS	8.50 ft
+D+S+H	1.150	0.751	0.1582	PASS	0.0 ft	0.0	PASS	8.50 ft
+D+0.750Lr+0.750L+H	1.250	0.725	0.05977	PASS	0.0 ft	0.0	PASS	8.50 ft
+D+0.750L+0.750S+H	1.150	0.751	0.1343	PASS	0.0 ft	0.0	PASS	8.50 ft
+D+0.60W+H	1.600	0.639	0.05298	PASS	0.0 ft	0.0	PASS	8.50 ft
+1.137D+0.70E+H	1.600	0.639	0.7541	PASS	0.0 ft	0.0	PASS	8.50 ft
+D+0.750Lr+0.750L+0.450W+H	1.600	0.639	0.05298	PASS	0.0 ft	0.0	PASS	8.50 ft
+D+0.750L+0.750S+0.450W+H	1.600	0.639	0.1134	PASS	0.0 ft	0.0	PASS	8.50 ft
+1.102D+0.750L+0.750S+0.5250E+H	1.600	0.639	0.6393	PASS	0.0 ft	0.0	PASS	8.50 ft

Title Block Line 1
You can change this area using the "Settings" menu item and then using the "Printing & Title Block" selection.
Title Block Line 6

Project Title:
Engineer:
Project ID:
Project Descr:

SL33

Printed: 27 FEB 2019, 6:54PM

Wood Beam

cts\17-291 Peyree Remodel\Calcs\Comment Response 2019-01\Lateral REV1\peyree transfer beams REV1.ec6
Software copyright ENERCALC, INC. 1983-2018, Build:10.18.12.30

Lic. # : KW-06006102 **Licensee : DIBBLE ENGINEERS INC.**

Description : MTB2 - Transfer Beam wall U2

CODE REFERENCES

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

Material Properties

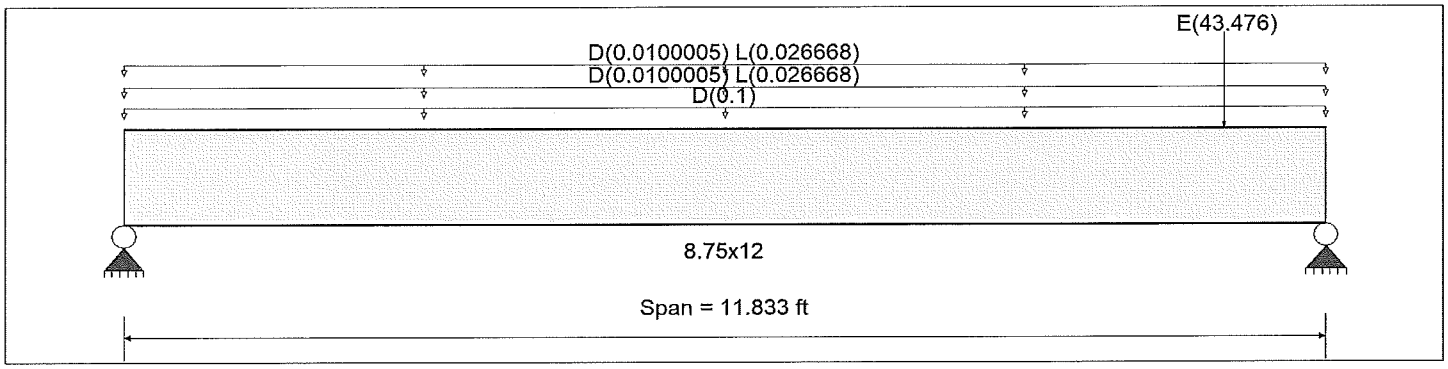
Analysis Method : Allowable Stress Design
Load Combination ASCE 7-10

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

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

Fb +	2,400.0 psi
Fb -	1,850.0 psi
Fc - Prll	1,650.0 psi
Fc - Perp	650.0 psi
Fv	265.0 psi
Ft	1,100.0 psi

E : Modulus of Elasticity	
Ebend- xx	1,800.0 ksi
Eminbend - xx	950.0 ksi
Ebend- yy	1,600.0 ksi
Eminbend - yy	850.0 ksi
Density	31.20 pcf



Applied Loads

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

Beam self weight calculated and added to loads
Uniform Load : D = 0.010 ksf, Tributary Width = 10.0 ft, (Walls)
Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 0.6667 ft, (Main Floor)
Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 0.6667 ft, (Upper Floor)
Point Load : E = 43.476 k @ 10.833 ft, (Dicont SW OT - U3)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.427**: 1	Maximum Shear Stress Ratio	=	**0.966** : 1
Section used for this span		**8.75x12**	Section used for this span		**8.75x12**
fb : Actual	=	1,638.59 psi	fv : Actual	=	409.43 psi
FB : Allowable	=	3,840.00 psi	Fv : Allowable	=	424.00 psi
Load Combination		+1.137D+0.70E+H	Load Combination		+1.137D+0.70E+H
Location of maximum on span	=	10.797 ft	Location of maximum on span	=	10.840 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.010 in	Ratio =	13607 >=480.
Max Upward Transient Deflection	0.000 in	Ratio =	0 <480.0
Max Downward Total Deflection	0.038 in	Ratio =	3701 >=360.
Max Upward Total Deflection	0.000 in	Ratio =	0 <360.0

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios									Moment Values			Shear Values		
Segment Length	Span #	M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	M	fb	F'b	V	fv	F'v
+D+H													0.00	0.00	0.00	0.00
Length = 11.833 ft	1	0.066	0.042	0.90	1.000	1.00	1.00	1.00	1.00	1.00	2.50	142.78	2160.00	0.70	10.04	238.50
+D+L+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 11.833 ft	1	0.082	0.052	1.00	1.000	1.00	1.00	1.00	1.00	1.00	3.43	196.12	2400.00	0.97	13.79	265.00
+D+Lr+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 11.833 ft	1	0.048	0.030	1.25	1.000	1.00	1.00	1.00	1.00	1.00	2.50	142.78	3000.00	0.70	10.04	331.25
+D+S+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00

Title Block Line 1
You can change this area using the "Settings" menu item and then using the "Printing & Title Block" selection.
Title Block Line 6

Project Title:
Engineer:
Project ID:
Project Descr:

SL34

Printed: 27 FEB 2019, 6:59PM

Wood Column

cts\17-291 Peyree Remodel\Calcs\Comment Response 2019-01\Lateral REV1\peyree transfer beams REV1.ec6
Software copyright ENERCALC, INC. 1983-2018, Build:10.18.12.30

Lic. # : KW-06006102 **Licensee : DIBBLE ENGINEERS INC.**

Description : MTC2 - Transfer Post wall U2

Code References

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

General Information

Analysis Method :	Allowable Stress Design	Wood Section Name	**6x6**
End Fixities	Top & Bottom Pinned	Wood Grading/Manuf.	Graded Lumber
Overall Column Height	9.0 ft	Wood Member Type	Sawn
(Used for non-slender calculations)			
Wood Species	Douglas Fir-Larch	Exact Width	**5.50** in
Wood Grade	No.1	Exact Depth	**5.50** in
Fb +	1200 psi	Fv	170 psi
Fb -	1200 psi	Ft	825 psi
Fc - Prll	1000 psi	Density	31.21 pcf
Fc - Perp	625 psi	Area	30.250 in^2
		Ix	76.255 in^4
		Iy	76.255 in^4

E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial
Basic	1600	1600	1600 ksi
Minimum	580	580	

Allow Stress Modification Factors

Cf or Cv for Bending	1.0
Cf or Cv for Compression	1.0
Cf or Cv for Tension	1.0
Cm : Wet Use Factor	1.0
Ct : Temperature Factor	1.0
Cfu : Flat Use Factor	1.0
Kf : Built-up columns	1.0 *NDS 15.3.2*
Use Cr : Repetitive ?	No

Brace condition for deflection (buckling) along columns :
X-X (width) axis : Fully braced against buckling ABOUT Y-Y Axis
Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 5 ft, K = 1.0

Applied Loads

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

Column self weight included : 59.006 lbs * Dead Load Factor
AXIAL LOADS . . .
MTB2 Bm RXN: Axial Load at 9.0 ft, D = 0.8450, L = 0.3160, S = 0.1330, E = 39.802 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.6638 : 1**

Load Combination	+1.137D+0.70E+H
Governing NDS Forumla	Comp Only, fc/Fc'
Location of max.above base	0.0 ft
At maximum location values are . . .	
Applied Axial	28.889 k
Applied Mx	0.0 k-ft
Applied My	0.0 k-ft
Fc : Allowable	1,438.75 psi

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

Load Combination	+0.4634D+0.70E+0.60H
Location of max.above base	9.0 ft
Applied Design Shear	0.0 psi
Allowable Shear	272.0 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+H	0.900	0.949	0.0350	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+L+H	1.000	0.942	0.04281	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+Lr+H	1.250	0.925	0.02585	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+S+H	1.150	0.932	0.03199	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+0.750Lr+0.750L+H	1.250	0.925	0.03262	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+0.750L+0.750S+H	1.150	0.932	0.03827	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+0.60W+H	1.600	0.899	0.02077	PASS	0.0 ft	0.0	PASS	9.0 ft
+1.137D+0.70E+H	1.600	0.899	0.6638	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+0.750Lr+0.750L+0.450W+H	1.600	0.899	0.02622	PASS	0.0 ft	0.0	PASS	9.0 ft
+D+0.750L+0.750S+0.450W+H	1.600	0.899	0.02851	PASS	0.0 ft	0.0	PASS	9.0 ft
+1.102D+0.750L+0.750S+0.5250E+H	1.600	0.899	0.5108	PASS	0.0 ft	0.0	PASS	9.0 ft
+0.60D+0.60W+0.60H	1.600	0.899	0.01246	PASS	0.0 ft	0.0	PASS	9.0 ft

DEI
DIBBLE ENGINEERS INC

PROJECT NAME: PEYREE RESIDENCE
PROJECT #: 17-291
SUBJECT: LATERAL - DIAPHRAGM DESIGN
SHEET #: SL35
DATE: 2/2019
BY: JCW

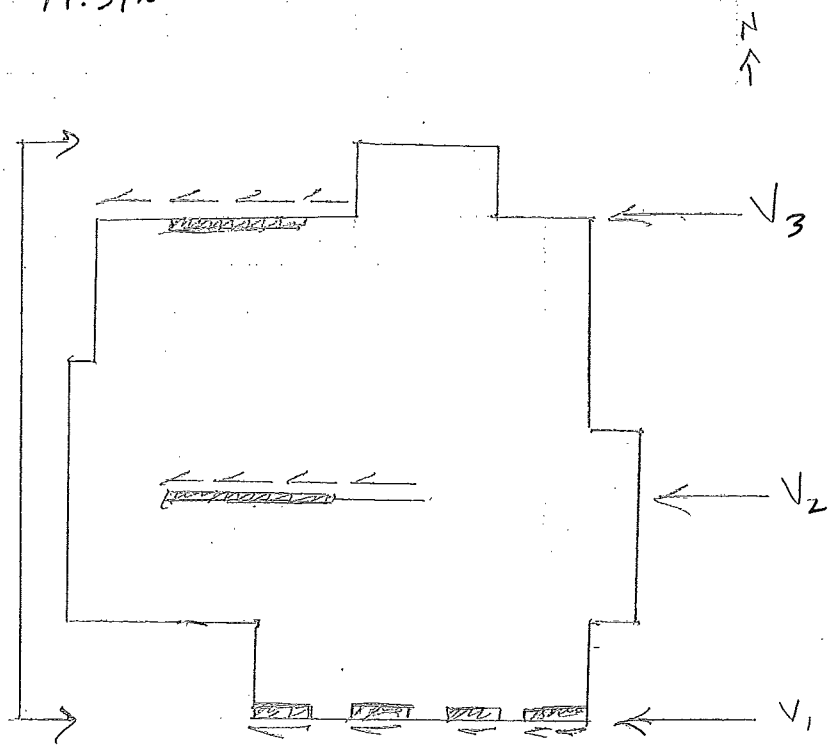
DIAPHRAGM DESIGN

EAST-WEST - ROOF DIAPHRAGM

* SEISMIC CONTROLS

$F_{px} = 19.34k$

$w = \frac{19.34k}{69 ft} = 281 plf$



$V_1 = (281 plf)(13.5 ft) = 3794\# \rightarrow v_1 = 3794\#/32.67 ft = 116 plf$

$V_2 = (281 plf)(30.5 ft) = 8571\# \rightarrow v_2 = 8571\#/29 ft = 296 plf$

$V_3 = (281 plf)(25 ft) = 7025\# \rightarrow v_3 = 7025\#/34 ft = 207 plf$

DIAPHRAGM NAILING

$v_{req'd} = 116 plf \rightarrow$ USE: 15/32in sheating (unblocked) w/ 8d @ 6"OC

$v_{allow} = 160 plf > 116 plf$ [NDS SDPWS 2015, Table 4.2C]

$v_{req'd} = 296 plf \rightarrow$ USE: 15/32in sheating (blocked) w/ 8d @ 4"OC

$v_{allow} = 360 plf > 296 plf$ [NDS SDPWS 2015, Table 4.2A]

DEI
DIBBLE ENGINEERS INC

PROJECT NAME: PEYREE RESIDENCE
PROJECT #: 17-291
SUBJECT: LATERAL - DIAPHRAGM DESIGN
SHEET #: SL36
DATE: 2/2019
BY: JCW

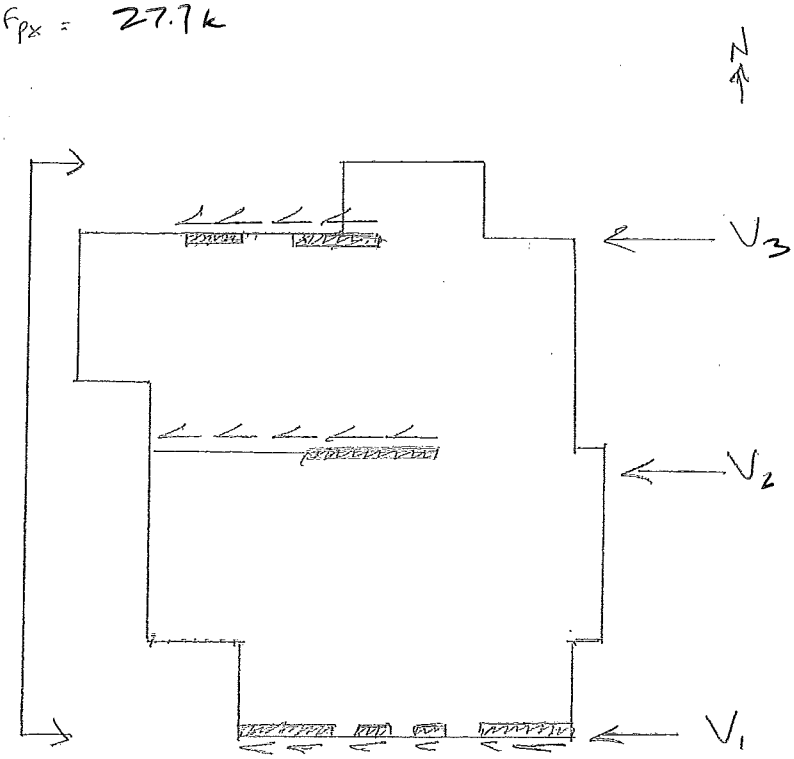
DIAPHRAGM DESIGN

EAST-WEST - UPPER FLOOR DIAPHRAGM

* SEISMIC CONTROLS

$F_{px} = 27.7k$

$w = \frac{27.7k}{69ft} = 401 plf$



$V_1 = (401plf)(14.5ft) = 5815\#$ → $v_1 = 5815\#/43.25ft = 135plf$

$V_2 = (401plf)(30.5ft) = 12231\#$ → $v_2 = 12231\#/40ft = 306plf$

$V_3 = (401plf)(24ft) = 9624\#$ → $v_3 = 9624\#/28.6ft = 337plf$

DIAPHRAGM NAILING:

$v_{req'd} = 135 plf$ → USE: 19/32in Sheating (unblocked) w/ 10d @ 6" OC

$v_{allow} = 215 plf > 135plf$ [NDS SDPWS 2015, Table 4.2C]

$v_{req'd} = 337 plf$ → USE: 19/32in Sheating (blocked) w/ 10d @ 4"OC

$v_{allow} = 425 plf > 337 plf$ [NDS SDPWS 2015, Table 4.2A]

DEI
DIBBLE ENGINEERS INC

PROJECT NAME: PEYREE RESIDENCE
PROJECT #: 17-291
SUBJECT: LATERAL - DIAPHRAGM DESIGN
SHEET #: SL37
DATE: 2/2019
BY: JCW

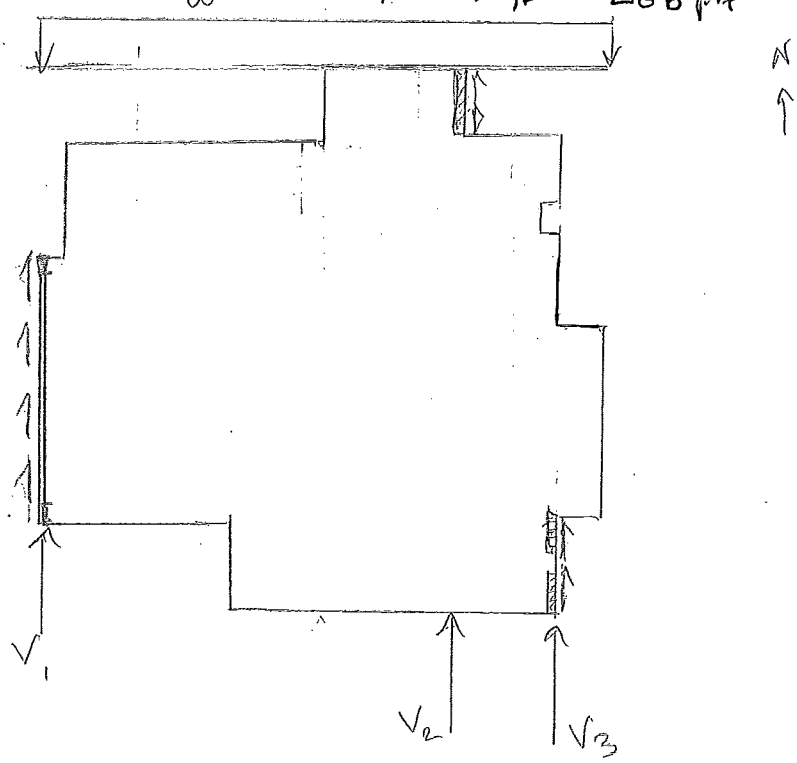
DIAPHRAGM DESIGN

NORTH - SOUTH - ROOF DIAPHRAGM

* SEISMIC CONTROLS

$F_{px} = 19.39k$

$w = 19.39k / 72.33 ft = 268 plf$



$V_1 = (268 plf)(26.33 ft) = 7056\# \rightarrow v_1 = 7056\#/32ft = 221 plf$

$V_2 = (268 plf)(32 ft) = 8576\# \rightarrow v_2 = 8576\#/8.5ft = 1009 plf$

$V_3 = (268 plf)(14 ft) = 3752\# \rightarrow v_3 = 3752\#/15ft = 250 plf$

DIAPHRAGM NAILING

$v_{req'd} = 250 plf \rightarrow$ USE: 15/32in sheating (blocked) w/ 8d @ 6"OC

$v_{allow} = 270 plf > 250 plf$ [NDS SDPWS 2015, Table 4.2a]

$v_{req'd} = 1009 plf \rightarrow$ USE: 15/32in sheating (blocked) w/ (2) Rows 10d @ 3"OC

$v_{allow} = 1210 plf > 1009 plf$ [NDS SDPWS 2015, Table 4.2b]

DEI
DIBBLE ENGINEERS INC

PROJECT NAME: PEYRER RESIDENCE
PROJECT #: 17-291
SUBJECT: LATERAL - DIAPHRAGM DESIGN
SHEET #: SL38
DATE: 2/2019
BY: JCW

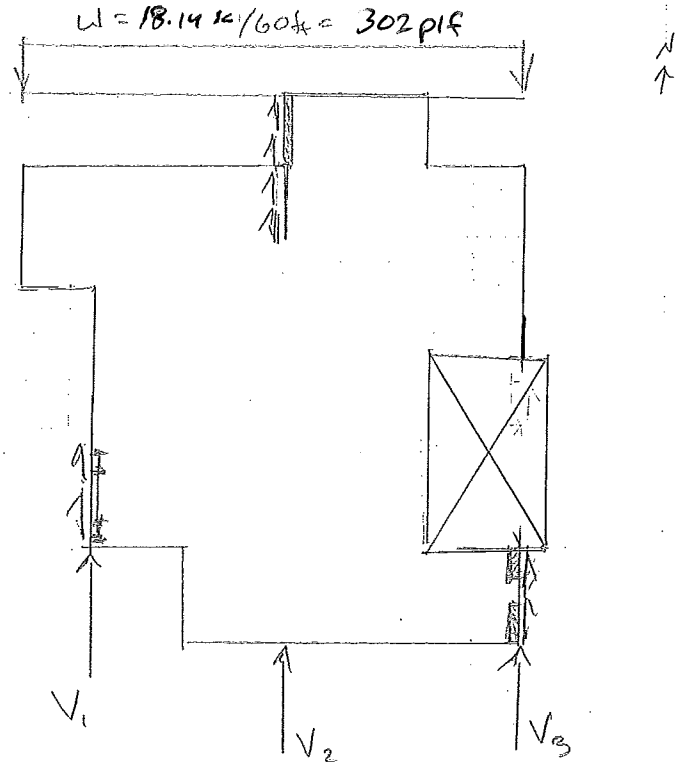
DIAPHRAGM DESIGN

NORTH-SOUTH — UPPER FLOOR DIAPHRAGM

* SEISMIC CONTROLS

$F_{px} = 18.14k$

$w = 18.14k / 60ft = 302 plf$



$V_1 = (302 plf)(21.75ft) = 6569\# \rightarrow v_1 = 6569\#/11.5ft = 571 plf$

$V_2 = (302 plf)(25.625ft) = 7739\# \rightarrow v_2 = 7739\#/17.75ft = 436 plf$

$V_3 = (302 plf)(12.625ft) = 3813\# \rightarrow v_3 = 3813\#/15ft = 254 plf$

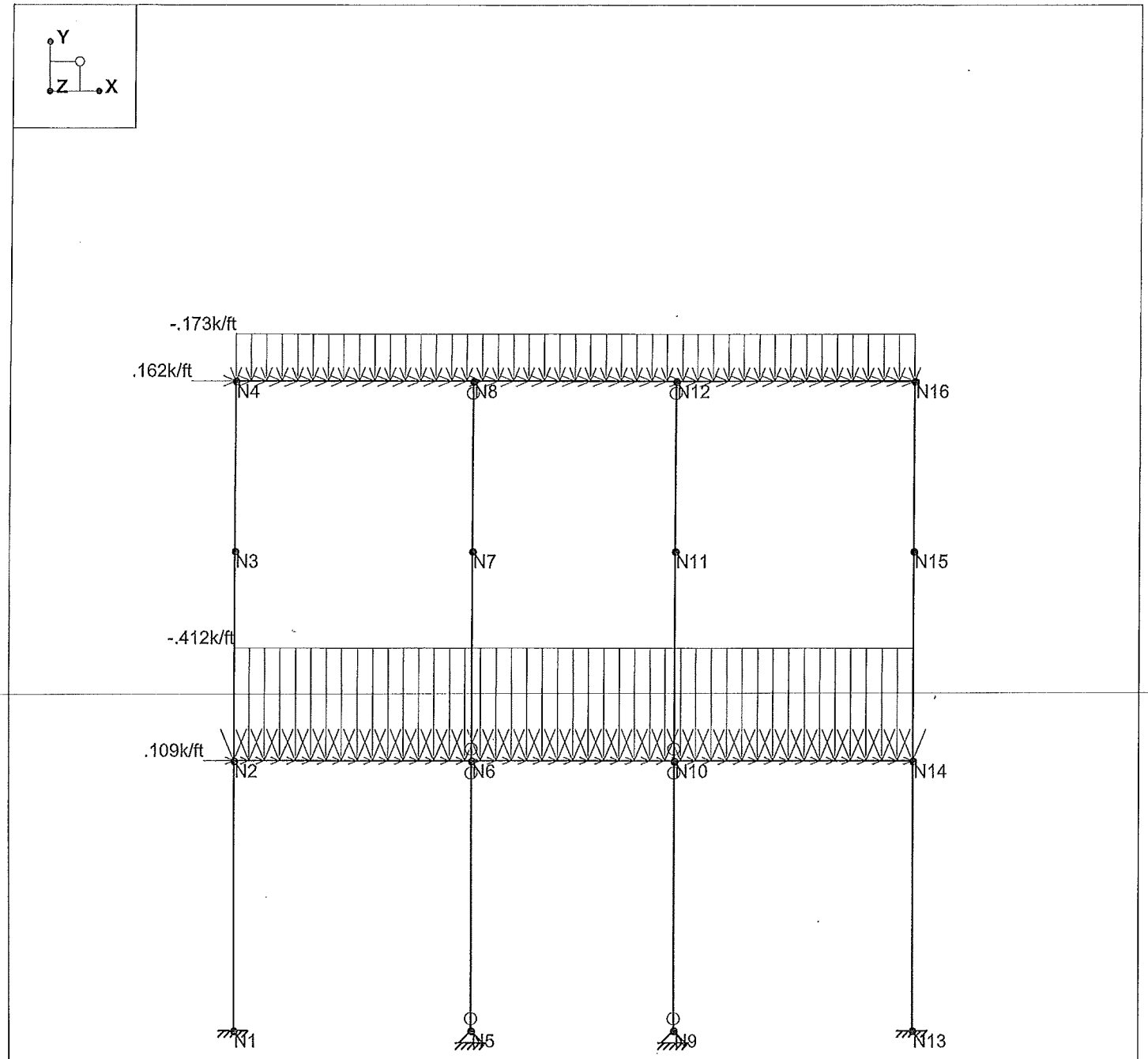
DIAPHRAGM NAILING

$v_{req'd} = 254 plf \rightarrow$ USE: 19/32in sheathing (blocked) w/ 10d @ 6" O.C.

$v_{allow} = 254 plf > 320 plf$ [NDS SPRING 2015, Table 4.2C]

$v_{req'd} = 571 plf \rightarrow$ USE: 19/32in sheathing (blocked) w/ 10d @ 2½" OC

$v_{allow} = 640 plf > 571 plf$ [Table 4.2A]



Loads: LC 5, IBC 16-5 1.2D+1.0E+f1L+f2S

DEI	Moment Frame 1	SK - 1
JCW		Sept 17, 2018 at 5:47 PM
17-291		MF1.r3d

RISA

Company : DEI
Designer : JCW
Job Number : 17-291
Model Name : Moment Frame 1

Sept 17, 2018
5:49 PM
Checked By:_____

Member Primary Data

	Label	I Joint	J Joint	K Joint	Rotate(deg)	Section/Shape	Type	Design List	Material	Design Rules
1	M1	N1	N4			W16x77	Column	Wide Flange	A992	Typical
2	M2	N13	N16			W16x77	Column	Wide Flange	A992	Typical
3	M5	N4	N16			W16x31	Beam	Wide Flange	A992	Typical
4	M6	N2	N14			W16x31	Beam	Wide Flange	A992	Typical
5	M6A	N5	N6			W10x22	Column	Wide Flange	A992	Typical
6	M7A	N6	N7			W10x22	Column	Wide Flange	A992	Typical
7	M8	N7	N8			W10x22	Column	Wide Flange	A992	Typical
8	M9	N9	N10			W10x22	Column	Wide Flange	A992	Typical
9	M10	N10	N11			W10x22	Column	Wide Flange	A992	Typical
10	M11	N11	N12			W10x22	Column	Wide Flange	A992	Typical

LOADING ONLY — MOMENT FRAME/STRONG FRAME DESIGN PER SIMPSON

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diap...
1	N1	0	0	0	0	
2	N2	0	13.5	0	0	
3	N3	0	24	0	0	
4	N4	0	32.5	0	0	
5	N5	12	0	0	0	
6	N6	12	13.5	0	0	
7	N7	12	24	0	0	
8	N8	12	32.5	0	0	
9	N9	22.25	0	0	0	
10	N10	22.25	13.5	0	0	
11	N11	22.25	24	0	0	
12	N12	22.25	32.5	0	0	
13	N13	34.25	0	0	0	
14	N14	34.25	13.5	0	0	
15	N15	34.25	24	0	0	
16	N16	34.25	32.5	0	0	

Joint Boundary Conditions

	Joint Label	X [k/in]	Y [k/in]	Z [k/in]	X Rot.[k-ft/rad]	Y Rot.[k-ft/rad]	Z Rot.[k-ft/rad]
1	N1	Reaction	Reaction	Reaction	Reaction	Reaction	Reaction
2	N5	Reaction	Reaction	Reaction			
3	N9	Reaction	Reaction	Reaction			
4	N13	Reaction	Reaction	Reaction	Reaction	Reaction	Reaction

Member Distributed Loads (BLC 1 : DL)

	Member Label	Direction	Start Magnitude[k/ft,...	End Magnitude[k/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M5	Y	-.113	-.113	0	0
2	M6	Y	-.188	-.188	0	0

Member Distributed Loads (BLC 2 : LL)

	Member Label	Direction	Start Magnitude[k/ft,...	End Magnitude[k/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M6	Y	-.375	-.375	0	0

RISA

Company : DEI
Designer : JCW
Job Number : 17-291
Model Name : Moment Frame 1

Sept 17, 2018
5:49 PM
Checked By:_____

Member Distributed Loads (BLC 3 : SL)

	Member Label	Direction	Start Magnitude[k/ft,...	End Magnitude[k/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M5	Y	-.188	-.188	0	0

Member Distributed Loads (BLC 4 : E)

	Member Label	Direction	Start Magnitude[k/ft,...	End Magnitude[k/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M5	X	.162	.162	0	0
2	M6	X	.109	.109	0	0

Member Distributed Loads (BLC 5 : W)

	Member Label	Direction	Start Magnitude[k/ft,...	End Magnitude[k/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M5	Z	-.155	-.155	0	0
2	M6	Z	-.406	-.406	0	0

Load Combinations

	Description	So..	PDelta	SR...	BLC	Fac...	BLC	Fac..	BLC	Fac..	BLC	Fac..	BLC	Fac..	BLC	Fac..	BLC	Fac..	BLC	Fac..	BLC	Fac..	BLC	Fac...
1	IBC 16-1 1.4D	Yes	Y		DL	1.4																		
2	IBC 16-2 1.2D+1...	Yes	Y		DL	1.2	LL	1.6	SL	.5														
3	IBC 16-3 1.2D+1...	Yes	Y		DL	1.2	SL	1.6	LL	.5														
4	IBC 16-4 1.2D+1...	Yes	Y		DL	1.2	LL	.5	SL	.5	WL	1												
5	IBC 16-5 1.2D+1...	Yes	Y		DL	1.2	LL	.5	SL	.2	EL	1												
6	IBC 16-6 0.9D+1...	Yes	Y		DL	.9	WL	1																
7	IBC 16-7 0.9D+1...	Yes	Y		DL	.9	EL	1																
8	D	Yes	Y		DL	1																		
9	L	Yes	Y		LL	1																		
10	S	Yes	Y		SL	1																		
11	E	Yes	Y		EL	1																		

Joint Reactions

	LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	5	N1	-4.408	-2.213	0	0	0	56.352
2	5	N5	.034	14.672	0	0	0	0
3	5	N9	-.005	-2.081	0	0	0	0
4	5	N13	-4.93	9.658	0	0	0	58.628
5	5	Totals:	-9.309	20.036	0			
6	5	COG (ft):	X: 17.125	Y: 19.103	Z: 0			

LATERAL LOADING

GRAVITY LOADING:
DL = 1.9k
LL = 2.39k
SL = 1.19k
E = 5.9k

* PRELIMINARY DESIGN LOADS ~
LOADS TO BE VERIFIED W/ SIMPSON STRONG FRAME
SHOP DRAWINGS

Dibble Engineers, Inc.
1029 Market Street
Kirkland, WA 98033
t: 435.828.4200

Project Title:
Engineer:
Project ID:
Project Descr:

SL42

www.dibbleengineers.com

Printed: 17 SEP 2018, 6:04PM

Concrete Column

File = J:\2017 Projects\17-291 Peyree Remodel\Calcs\Gravity\peyree - main, fndt.ec6
Software copyright ENERCALC, INC. 1983-2018, Build:10.18.8.25

Lic. # : KW-06006102 Licensee : DIBBLE ENGINEERS INC.

Description : Moment Frame 1 Pilaster

Code References

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

General Information

f'c : Concrete 28 day strength	=	3.0 ksi
E =	=	3,122.02 ksi
Density	=	150.0 pcf
β	=	0.850
fy - Main Rebar	=	60.0 ksi
E - Main Rebar	=	29,000.0 ksi
Allow. Reinforcing Limits		*ASTM A615 Bars Used*
Min. Reinf.	=	1.0 %
Max. Reinf.	=	8.0 %

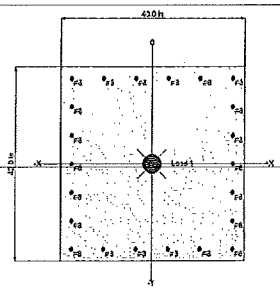
Overall Column Height = 15 ft
End Fixity Top Free, Bottom Fixed

Brace condition for deflection (buckling) along columns :
X-X (width) axis :
Unbraced Length for X-X Axis buckling = 15 ft, K =
Y-Y (depth) axis :
Unbraced Length for X-X Axis buckling = 15 ft, K = 2.0

Column Cross Section

Column Dimensions : 42.0in high x 40.0in Wide, Column Edge to Rebar Edge Cover = 2.0in

Column Reinforcing : 4 - #8 bars @ corners,, 4.0 - #8 bars top & bottom between corner bars, 5.0 - #8 bars left & right between corner bars



Applied Loads

Entered loads are factored per load combinations specified by user.

Column self weight included : 26,250.0 lbs * Dead Load Factor
AXIAL LOADS . . .
Moment Frame Column: Axial Load at 15.0 ft above base, D = 1.90, L = 2.390, S = 1.190, E = 5.910 k
BENDING LOADS . . .
Moment Frame Column: Lat. Point Load at 10.0 ft creating Mx-x, E = 4.930 k

DESIGN SUMMARY

Load Combination +1.20D+0.50L+0.20S+E+1.60H
Location of max.above base 14.899 ft

Maximum Stress Ratio **0.027 : 1**
Ratio = (Pu^2+Mu^2)^.5 / (PhiPn^2+PhiMn^2)^.5

Pu =	41.123 k	φ * Pn =	1,526.63 k
Mu-x =	-49.30 k-ft	φ * Mn-x =	-1,826.70 k-ft
Mu-y =	0.0 k-ft	φ * Mn-y =	0.0 k-ft
Mu Angle =	0.0 deg		
Mu at Angle =	49.30 k-ft	φMn at Angle =	1,829.76 k-ft

Pn & Mn values located at Pu-Mu vector intersection with capacity curve

Column Capacities . . .

Pnmax : Nominal Max. Compressive Axial Capacity	5,282.48 k
Pnmin : Nominal Min. Tension Axial Capacity	k
φ Pn, max : Usable Compressive Axial Capacity	2,746.89 k
φ Pn, min : Usable Tension Axial Capacity	k

Maximum SERVICE 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	4.930 k

Maximum SERVICE Load Deflections . . .

Along Y-Y 0.006419 in at 15.0 ft above base
for load combination : E Only

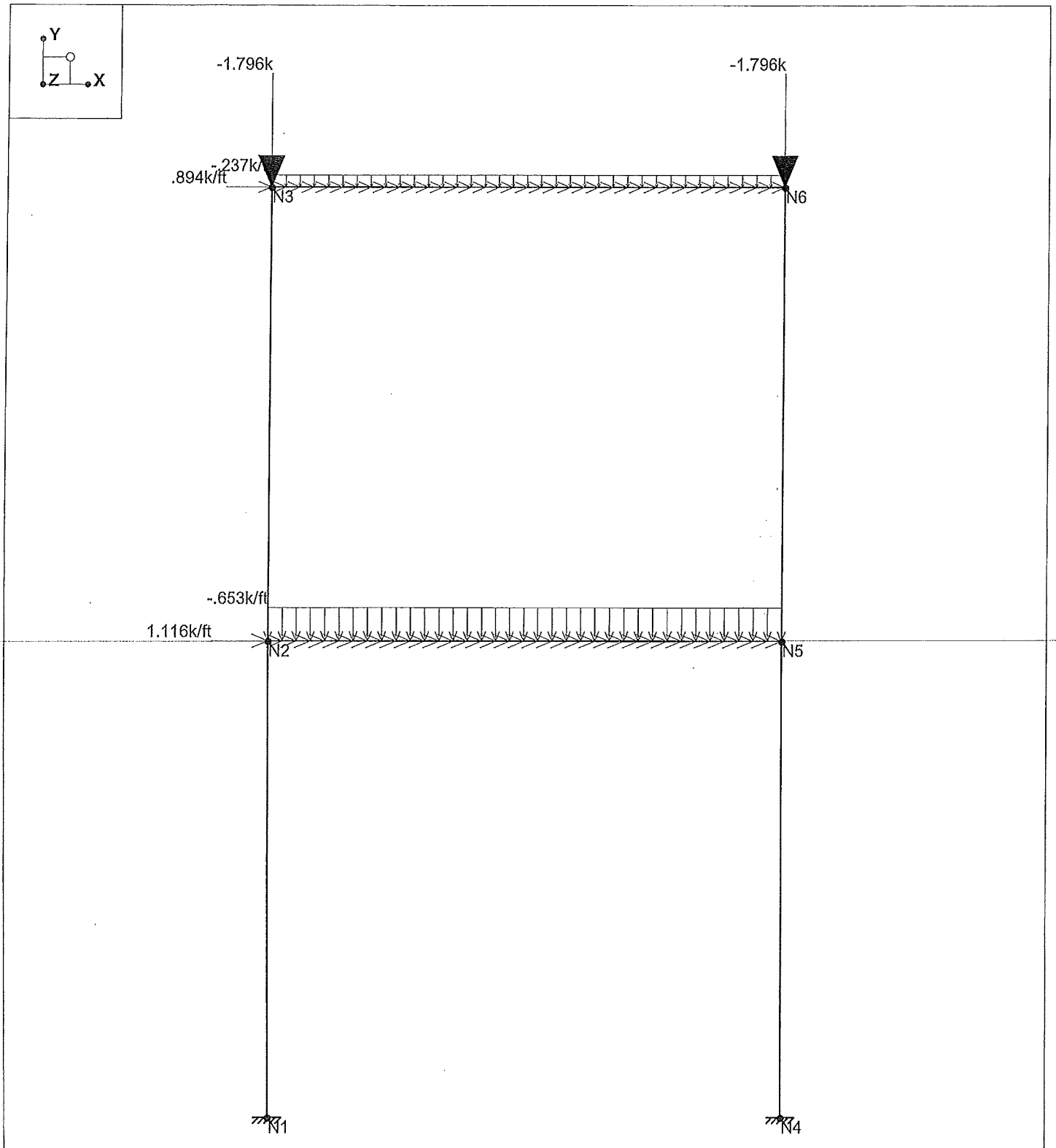
Along X-X 0.0 in at 0.0 ft above base
for load combination :

General Section Information . φ = 0.650 β = 0.850 θ = 0.80

ρ : % Reinforcing	1.035 %	Rebar % Ok
Reinforcing Area	17.380 in^2	
Concrete Area	1,680.0 in^2	

Governing Load Combination Results

Governing Factored Load Combination	Moment X-X	Moment Y-Y	Dist. from base ft	Axial Load k Pu	φ * Pn	δx	δx * Mux	δy	δy * Muy	Bending Analysis k-ft Alpha (deg)	δ Mu	φ Mn	Utilization Ratio
+1.40D+1.60H			14.90	39.41	2,746.89					0.000			0.014



Loads: LC 5, IBC 16-5 1.2D+1.0E+f1L+f2S

DEI	Moment Frame 2	SK - 1
JCW		Sept 17, 2018 at 5:40 PM
17-291		MF2.r3d

RISA

Company : DEI
Designer : JCW
Job Number : 17-291
Model Name : Moment Frame 2

Sept 17, 2018
5:43 PM
Checked By:_____

Member Primary Data

	Label	I Joint	J Joint	K Joint	Rotate(deg)	Section/Shape	Type	Design List	Material	Design Rules
1	M1	N1	N3			~~W21x68~~	Column	Wide Flange	A992	Typical
2	M2	N4	N6			~~W21x68~~	Column	Wide Flange	A992	Typical
3	M3	N3	N6			W18x40	Beam	Wide Flange	A992	Typical
4	M4	N2	N5			W18x40	Beam	Wide Flange	A992	Typical

LOADING ONLY - MOMENT FRAME / STRONG FRAME DESIGN PER SIMPSON

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diap...
1	N1	0	0	0	0	
2	N2	0	10.5	0	0	
3	N3	0	20.5	0	0	
4	N4	11.4167	0	0	0	
5	N5	11.4167	10.5	0	0	
6	N6	11.4167	20.5	0	0	

Joint Boundary Conditions

	Joint Label	X [k/in]	Y [k/in]	Z [k/in]	X Rot.[k-ft/rad]	Y Rot.[k-ft/rad]	Z Rot.[k-ft/rad]
1	N1	Reaction	Reaction	Reaction	Reaction	Reaction	Reaction
2	N4	Reaction	Reaction	Reaction	Reaction	Reaction	Reaction

Member Point Loads (BLC 1 : DL)

	Member Label	Direction	Magnitude[k,k-ft]	Location[ft,%]
1	M1	Y	-1.2	20.5
2	M2	Y	-1.2	20.5

Member Point Loads (BLC 3 : SL)

	Member Label	Direction	Magnitude[k,k-ft]	Location[ft,%]
1	M1	Y	-1.781	20.5
2	M2	Y	-1.781	20.5

Member Distributed Loads (BLC 1 : DL)

	Member Label	Direction	Start Magnitude[k/ft,...	End Magnitude[k/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M3	Y	-.094	-.094	0	0
2	M4	Y	-.282	-.282	0	0

Member Distributed Loads (BLC 2 : LL)

	Member Label	Direction	Start Magnitude[k/ft,...	End Magnitude[k/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M3	Y	-.25	-.25	0	0
2	M4	Y	-.628	-.628	0	0

Member Distributed Loads (BLC 4 : E)

	Member Label	Direction	Start Magnitude[k/ft,...	End Magnitude[k/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M3	X	.894	.894	0	0
2	M4	X	1.116	1.116	0	0

RISA

Company : DEI
Designer : JCW
Job Number : 17-291
Model Name : Moment Frame 2

Sept 17, 2018
5:43 PM
Checked By:_____

Member Distributed Loads (BLC 5 : W)

	Member Label	Direction	Start Magnitude[k/ft,...	End Magnitude[k/ft,F...	Start Location[ft,%]	End Location[ft,%]
1	M4	Z	-.406	-.406	0	0
2	M3	Z	-.214	-.214	0	0

Load Combinations

	Description	So..	PDelta	SR...	BLC	Fac...	BLC	Fac..	BLC	Fac..	BLC	Fac..	BLC	Fac..	BLC	Fac..	BLC	Fac..	BLC	Fac..	BLC	Fac..	BLC	Fac...
1	IBC 16-1 1.4D	Yes	Y		DL	1.4																		
2	IBC 16-2 1.2D+1...	Yes	Y		DL	1.2	LL	1.6	SL	.5														
3	IBC 16-3 1.2D+1...	Yes	Y		DL	1.2	SL	1.6	LL	.5														
4	IBC 16-4 1.2D+1...	Yes	Y		DL	1.2	LL	.5	SL	.5	WL	1												
5	IBC 16-5 1.2D+1...	Yes	Y		DL	1.2	LL	.5	SL	.2	EL	1												
6	IBC 16-6 0.9D+1...	Yes	Y		DL	.9	WL	1																
7	IBC 16-7 0.9D+1...	Yes	Y		DL	.9	EL	1																
8	D	Yes	Y		DL	1																		
9	L	Yes	Y		LL	1																		
10	S	Yes	Y		SL	1																		
11	E	Yes	Y		EL	1																		

Joint Reactions (By Combination)

	LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	5	N1	-11.096	-7.926	0	0	0	85.942
2	5	N4	-11.852	21.687	0	0	0	88.425
3	5	Totals:	-22.948	13.761	0			
4	5	COG (ft):	X: 5.708	Y: 15.081	Z: 0			

LATERAL LOADING

GRAVITY LOADING
DL = 3.35k
LL = 5.02k
SL = 1.78k
E = 14.79k

* PRELIMINARY DESIGN LOADS —
LOADS TO BE VERIFIED W/ SIMPSON
STRONG FRAME SHOP DRAWINGS

Dibble Engineers, Inc.
1029 Market Street
Kirkland, WA 98033
t: 435.828.4200

Project Title:
Engineer:
Project ID:
Project Descr:

SL46

www.dibbleengineers.com

Printed: 17 SEP 2018, 5:53PM

Concrete Column

File = J:\2017 Projects\17-291 Peyree Remodel\Calcs\Gravity\peyree - main, fndt.ec6
Software copyright ENERCALC, INC. 1983-2018, Build:10.18.8.25

Lic. # : KW-06006102 Licensee : DIBBLE ENGINEERS INC.

Description : Moment Frame 2 Pilaster

Code References

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

General Information

f'c : Concrete 28 day strength	=	3.0 ksi
E =	=	3,122.02 ksi
Density	=	150.0 pcf
β	=	0.850
fy - Main Rebar	=	60.0 ksi
E - Main Rebar	=	29,000.0 ksi
Allow. Reinforcing Limits		*ASTM A615 Bars Used*
Min. Reinf.	=	1.0 %
Max. Reinf.	=	8.0 %

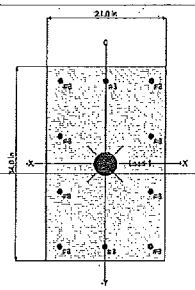
Overall Column Height = 15.0 ft
End Fixity Top Free, Bottom Fixed

Brace condition for deflection (buckling) along columns :
X-X (width) axis :
Unbraced Length for X-X Axis buckling = 15.0 ft, K = 2.0
Y-Y (depth) axis :
Unbraced Length for X-X Axis buckling = 15.0 ft, K = 2.0

Column Cross Section

Column Dimensions : 34.0in high x 21.0in Wide, Column Edge to Rebar Edge Cover = 2.0in

Column Reinforcing : 4 - #8 bars @ corners., 1.0 - #8 bars top & bottom between corner bars, 2.0 - #8 bars left & right between corner bars



Applied Loads

Entered loads are factored per load combinations specified by user.

Column self weight included : 11,156.3 lbs * Dead Load Factor
AXIAL LOADS . . .
Moment Frame Column: Axial Load at 15.0 ft above base, D = 3.350, L = 5.020, S = 1.780, E = 14.790 k
BENDING LOADS . . .
Moment Frame Column: Lat. Point Load at 15.0 ft creating Mx-x, E = 11.90 k

DESIGN SUMMARY

Load Combination +0.90D+E+0.90H
Location of max.above base 14.899 ft

Maximum Stress Ratio **0.288 : 1**
Ratio = (Pu^2+Mu^2)^.5 / (PhiPn^2+PhiMn^2)^.5

Pu =	27.846 k	φ * Pn =	94.975 k
Mu-x =	-178.50 k-ft	φ * Mn-x =	625.51 k-ft
Mu-y =	0.0 k-ft	φ * Mn-y =	0.0 k-ft
Mu Angle =	180.0 deg		
Mu at Angle =	178.50 k-ft	φMn at Angle =	620.57 k-ft

Pn & Mn values located at Pu-Mu vector intersection with capacity curve

Column Capacities . . .

Pnmax : Nominal Max. Compressive Axial Capacity	2,274.56 k
Pnmin : Nominal Min. Tension Axial Capacity	k
φ Pn, max : Usable Compressive Axial Capacity	1,182.77 k
φ Pn, min : Usable Tension Axial Capacity	k

Maximum SERVICE Load Reactions . .

Top along Y-Y	0.0 k	Bottom along Y-Y	0.0 k
Top along X-X	11.90 k	Bottom along X-X	11.90 k

Maximum SERVICE Load Deflections . . .

Along Y-Y 0.1072 in at 15.0 ft above base
for load combination : E Only

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

General Section Information . φ = 0.650 β = 0.850 θ = 0.80

ρ : % Reinforcing	1.106 %	Rebar % Ok
Reinforcing Area	7.90 in^2	
Concrete Area	714.0 in^2	

Governing Load Combination Results

Governing Factored Load Combination	Moment X-X	Moment Y-Y	Dist. from base ft	Axial Load k Pu	φ * Pn	δx	δx * Mux	δy	δy * Muy	Alpha (deg)	δ Mu	φ Mn	Utilization Ratio
+1.40D+1.60H		M2,min	14.90	20.31	1,182.77			1.000	2.08	90.000	2.08	120.78	**0.017**

Dibble Engineers, Inc.
1029 Market Street
Kirkland, WA 98033
t: 435.828.4200

Project Title:
Engineer:
Project ID:
Project Descr:

SL47

www.dibbleengineers.com

Printed: 17 JAN 2019, 5:31PM

General Footing

File = J:\2017 Projects\17-291 Peyree Remodel\Calcs\Lateral\Moment Frame\peyree beam bracing.ec6
Software copyright ENERCALC, INC. 1983-2018, Build:10.18.11.30

Lic. # : KW-06006102
Licensee : DIBBLE ENGINEERS INC.

Description : Moment Frame 1 (MF-1) Footing

Code References

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

General Information

Material Properties

f'c : Concrete 28 day strength	=	3.0 ksi
fy : Rebar Yield	=	60.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.02 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	:	Yes
Use Pedestal wt for stability, mom & shear	:	Yes

Soil Design Values

Allowable Soil Bearing	=	4.0 ksf
Increase Bearing By Footing Weight	=	No
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	=	13.0 ft
Allow press. increase per foot of depth	=	0.0 ksf
when footing base is below	=	0.0 ft

Increases based on footing plan dimension

Allowable pressure increase per foot of depth	=	0.0 ksf
when max. length or width is greater than	=	0.0 ft

Dimensions

Width parallel to X-X Axis	=	7.0 ft
Length parallel to Z-Z Axis	=	7.0 ft
Footing Thickness	=	24.0 in

Load location offset from footing center...

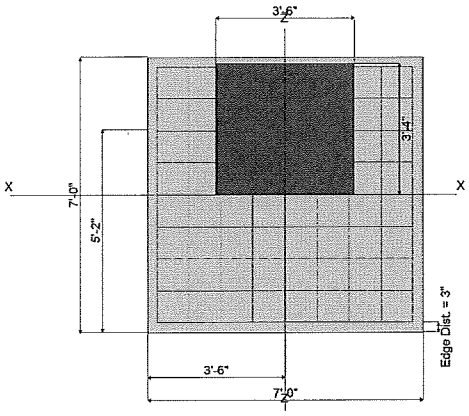
ez : Prll to Z-Z Axis	=	20 in
	=	in

Pedestal dimensions...

px : parallel to X-X Axis	=	42.0 in
pz : parallel to Z-Z Axis	=	40.0 in
Height	=	156.0 in

Rebar Centerline to Edge of Concrete...

at Bottom of footing	=	3.0 in



Reinforcing

Bars parallel to X-X Axis

Number of Bars	=	9.0
Reinforcing Bar Size	=	# 6

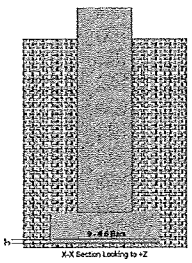
Bars parallel to Z-Z Axis

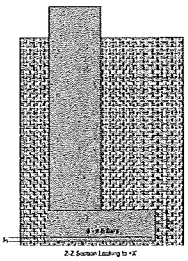
Number of Bars	=	9
Reinforcing Bar Size	=	# 6

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation

	n/a
# Bars required within zone	n/a
# Bars required on each side of zone	n/a





Applied Loads

		D	Lr	L	S	W	E	H
P : Column Load	=	1.908	0.0	2.388	1.191	0.0	5.910	0.0 k
OB : Overburden	=	0.0	0.0	0.0	0.0	0.0	0.0	0.0 ksf
M-xx	=	0.0	0.0	0.0	0.0	0.0	0.0	0.0 k-ft
M-zz	=	0.4990	0.0	1.117	0.990	0.0	57.218	0.0 k-ft
V-x	=	0.1190	0.0	0.2750	0.30	0.0	4.641	0.0 k
V-z	=	0.0	0.0	0.0	0.0	0.0	0.0	0.0 k

Dibble Engineers, Inc.
1029 Market Street
Kirkland, WA 98033
t: 435.828.4200

Project Title:
Engineer:
Project ID:
Project Descr:

SL48

www.dibbleengineers.com

Printed: 17 JAN 2019, 5:31PM

General Footing

File = J:\2017 Projects\17-291 Peyree Remodel\Calcs\Lateral\Moment Frame\peyree beam bracing.ec6
Software copyright ENERCALC, INC. 1983-2018, Build:10.18.11.30

Lic. # : KW-06006102 Licensee : DIBBLE ENGINEERS INC.

Description : Moment Frame 1 (MF-1) Footing

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.8823	Soil Bearing	3.529 ksf	4.0 ksf	+D+0.70E+H about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	2.292	Overturning - Z-Z	90.154 k-ft	206.622 k-ft	+0.60D+0.70E+0.60H
PASS	17.985	Sliding - X-X	3.320 k	59.710 k	+0.60D+0.70E+0.60H
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	0.06676	Z Flexure (+X)	3.475 k-ft/ft	52.048 k-ft/ft	+1.20D+0.50L+0.20S+E+1.60H
PASS	0.04755	Z Flexure (-X)	2.475 k-ft/ft	52.048 k-ft/ft	+1.20D+0.50L+0.20S+E+1.60H
PASS	0.000175	X Flexure (+Z)	0.009094 k-ft/ft	52.048 k-ft/ft	+0.90D+E+0.90H
PASS	0.02128	X Flexure (-Z)	1.107 k-ft/ft	52.048 k-ft/ft	+1.40D+1.60H
PASS	n/a	1-way Shear (+X)	0.0 psi	82.158 psi	n/a
PASS	0.0	1-way Shear (-X)	0.0 psi	0.0 psi	n/a
PASS	n/a	1-way Shear (+Z)	0.0 psi	82.158 psi	n/a
PASS	0.01501	1-way Shear (-Z)	1.233 psi	82.158 psi	+1.40D+1.60H
PASS	n/a	2-way Punching	2.680 psi	82.158 psi	+1.40D+1.60H

Dibble Engineers, Inc.
1029 Market Street
Kirkland, WA 98033
t: 435.828.4200

Project Title:
Engineer:
Project ID:
Project Descr:

SL49

www.dibbleengineers.com

Printed: 17 JAN 2019, 5:34PM

General Footing

File = J:\2017 Projects\17-291 Peyree Remodel\Calcs\Lateral\Moment Frame\peyree beam bracing.ec6
Software copyright ENERCALC, INC. 1983-2018, Build:10.18.11.30

Lic. # : KW-06006102
Licensee : DIBBLE ENGINEERS INC.

Description : Moment Frame 2 (MF-2) Footing

Code References

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

General Information

Material Properties

f'c : Concrete 28 day strength	=	3.0	ksi
fy : Rebar Yield	=	60.0	ksi
Ec : Concrete Elastic Modulus	=	3,122.02	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	:	Yes
Use Pedestal wt for stability, mom & shear	:	Yes

Soil Design Values

Allowable Soil Bearing	=	4.0	ksf
Increase Bearing By Footing Weight	=	No	
Soil Passive Resistance (for Sliding)	=	250.0	pcf
Soil/Concrete Friction Coeff.	=	0.30	

Increases based on footing Depth

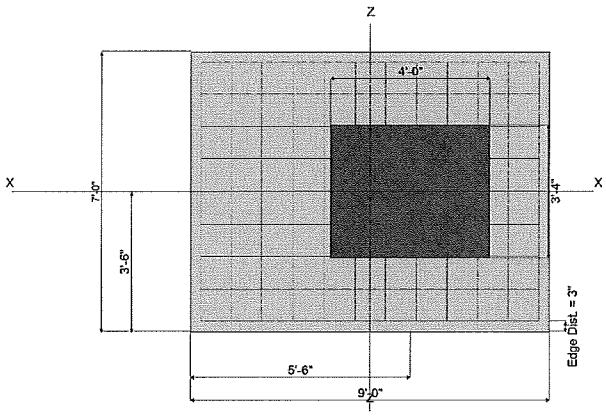
Footing base depth below soil surface	=	6.0	ft
Allow press. increase per foot of depth	=		ksf
when footing base is below	=		ft

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	=	9.0	ft
Length parallel to Z-Z Axis	=	7.0	ft
Footing Thickness	=	24.0	in
Load location offset from footing center...			
ex : Prll to X-X Axis	=	12	in
	=		in
Pedestal dimensions...			
px : parallel to X-X Axis	=	48.0	in
pz : parallel to Z-Z Axis	=	40.0	in
Height	=	72.0	in
Rebar Centerline to Edge of Concrete...			
at Bottom of footing	=	3.0	in



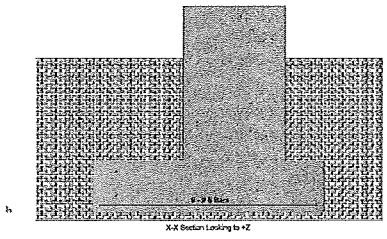
Reinforcing

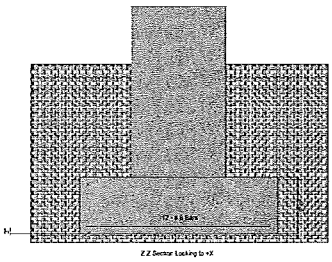
Bars parallel to X-X Axis			
Number of Bars	=		9.0
Reinforcing Bar Size	=	#	6
Bars parallel to Z-Z Axis			
Number of Bars	=		12.0
Reinforcing Bar Size	=	#	6

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation

	Bars along Z-Z Axis
# Bars required within zone	87.5 %
# Bars required on each side of zone	12.5 %





Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	3.348		5.014	1.781		14.789		k
OB : Overburden	=								ksf
M-xx	=								k-ft
M-zz	=	0.5390		1.183			87.089		k-ft
V-x	=	0.1770		0.3860			11.501		k
V-z	=								k

Dibble Engineers, Inc.
1029 Market Street
Kirkland, WA 98033
t: 435.828.4200

Project Title:
Engineer:
Project ID:
Project Descr:

SL50

www.dibbleengineers.com

Printed: 17 JAN 2019, 5:34PM

General Footing

File = J:\2017 Projects\17-291 Peyree Remodel\Calcs\Lateral\Moment Frame\peyree beam bracing.ec6 .
Software copyright ENERCALC, INC. 1983-2018, Build:10.18.11.30 .

Lic. # : KW-06006102 Licensee : DIBBLE ENGINEERS INC.

Description : Moment Frame 2 (MF-2) Footing

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.8268	Soil Bearing	3.307 ksf	4.0 ksf	+0.60D+0.70E+0.60H about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	1.530	Overturning - Z-Z	126.541 k-ft	193.645 k-ft	+0.60D+0.70E+0.60H
PASS	3.829	Sliding - X-X	8.157 k	31.234 k	+0.60D+0.70E+0.60H
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	0.06724	Z Flexure (+X)	3.499 k-ft/ft	52.048 k-ft/ft	+0.90D+E+0.90H
PASS	0.1128	Z Flexure (-X)	5.871 k-ft/ft	52.048 k-ft/ft	+1.20D+0.50L+0.20S+E+1.60H
PASS	0.01349	X Flexure (+Z)	0.7274 k-ft/ft	53.922 k-ft/ft	+1.20D+0.50L+0.20S+E+1.60H
PASS	0.01349	X Flexure (-Z)	0.7274 k-ft/ft	53.922 k-ft/ft	+1.20D+0.50L+0.20S+E+1.60H
PASS	n/a	1-way Shear (+X)	0.0 psi	82.158 psi	n/a
PASS	0.08028	1-way Shear (-X)	6.596 psi	82.158 psi	+1.20D+0.50L+0.20S+E+1.60H
PASS	0.001463	1-way Shear (+Z)	0.1202 psi	82.158 psi	+1.20D+0.50L+0.20S+E+1.60H
PASS	0.001463	1-way Shear (-Z)	0.1202 psi	82.158 psi	+1.20D+0.50L+0.20S+E+1.60H
PASS	0.02304	2-way Punching	3.785 psi	164.317 psi	+0.90D+E+0.90H