

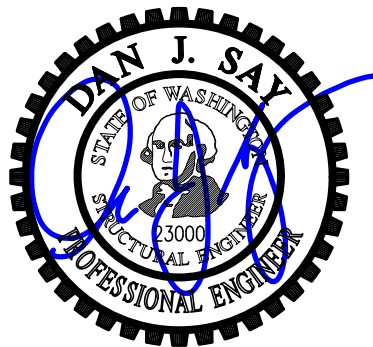


Supplemental Structural Calculations for:

# Yuan Residence

3611 W Mercer Way

Mercer Island, WA 98040



Prepared for: Brandt Design Group

Job #: 01519-2019-01-00

Date: December 20, 2019



SEATTLE  
TACOMA

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○ 206.443.6200  
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⊕ [ssfengineers.com](http://ssfengineers.com)

VERIFY UPLIFT @ GRID 2 & E1G

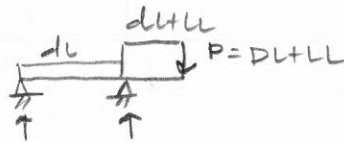
GRAVITY

ROOF:

B9: -2113 Lbs  $\Rightarrow$  w/

B14: 511 Lbs (DL ONLY)

B3: 1553 Lbs (DL ONLY)



$\rightarrow$  CHECKING FOR UPLIFT

RESULT: DESIGN CONNECTION TO LEDGER & LEDGER TO HOUSE FOR UPLIFT  $\rightarrow$  SEE 10/S5.1

NET UPLIFT = -491 Lbs  $\rightarrow$  NO HD NEEDED  
(not considering dead weight of walls or any live load)

FLOOR:

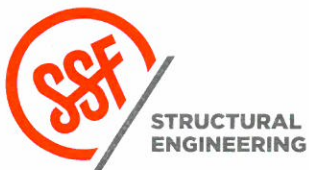
B6: -4220 Lbs (WL - SPOT LOADING AS ABOVE)

B12: 1812 Lbs (DL ONLY)

RESULT: DESIGN CNXN  $P = -4220$  Lbs

NET UPLIFT = -2408 Lbs  $\Rightarrow$  USE HDIU2

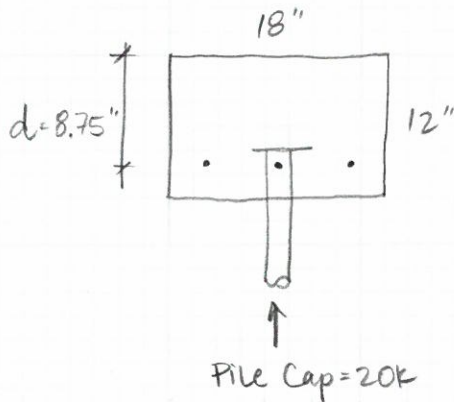
**NOTE - KEPT HDU2 AT UPPER LEVEL AND HDU4 AT FOUNDATION FOR REDUNDANCY**



PROJECT YUAN CORRECTIONS  
S2.1  
Comment 2

DATE 11/07/19  
PROJ. # haa  
DESIGN  
SHEET

Yuan - Punching Shear Check: Pin pile @ grade beam



$$b_o = (\text{pile dia.} + d) 4$$

$$= (4" + 8.75") 4$$

$$= 51"$$

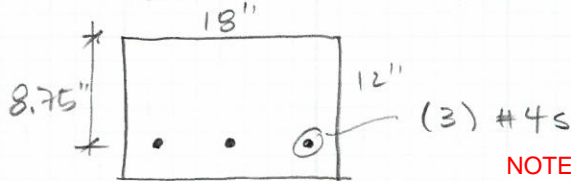
$$\phi V_c = \phi 4 \sqrt{f'_c} b_o d$$

$$= 0.9 \cdot 4 \sqrt{2500 \text{ psi}} (51") (8.75")$$

$$= 80325 \text{ lbs} > 20000 \text{ lbs capacity}$$

12" footing OK ✓

GRADE BEAM: FLEXURAL & SHEAR CHECK



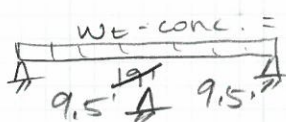
$$\phi M_n = 22.35 \text{ k-ft} = \phi A_s f_y (d - a/2)$$

$$\phi V_c = 11.81 \text{ k} = \phi 2 \sqrt{f'_c} b_w d$$

NOTE - REBAR UPDATED TO #5'S FOR OUT OF PLANE SLIDING LOADS (SEE NEXT PAGE). BY INSPECTION, THIS IS ACCEPTABLE FOR IN-PLANE GRAVITY LOADS.

WORST CASES :

GARAGE :



$$w_{\text{conc.}} = 425 \text{ pcf} \times 1.4 = 595$$

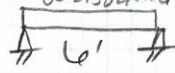
$$M = 26849 \text{ XNG}$$

∴ Add pin pile MS

$$L = 9.5 \quad M = 6712 \text{ ✓OK}$$

GRIDLINE# :

4

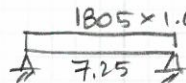


$$w = 1582 \times 1.4 = 2531$$

$$M = wL^2/8 = 1611 (6)^2/8 = 11.4 \text{ k-ft ✓OK}$$

$$V = wL/2 = 7.6 \text{ ✓OK}$$

2

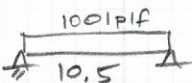


$$1805 \times 1.4 = 2888$$

$$M = 18.98 \text{ k-ft}$$

$$V = 10.5 \text{ k}$$

1

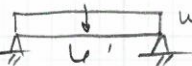


$$1001 \text{ pcf}$$

$$M = 13.8 \text{ k-ft}$$

$$V = 5.3 \text{ k}$$

B



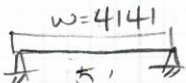
$$w = 1757 \times 1.4 = 2811$$

$$P = 4.6 \text{ k @ MS}$$

$$M = 19.5 \text{ k-ft ✓OK}$$

$$V = 10.7 \text{ k ✓OK}$$

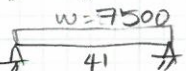
A



$$w = 4141$$

$$M = 12.9 \text{ k-ft ✓OK}$$

$$V = 10.4 \text{ k ✓OK}$$



$$w = 7500$$

$$M = 14.9 \text{ k-ft ✓OK}$$

$$V = 14.9 \text{ k}$$

loads factored = 1.6 TL very conserv. ∴ OK ✓

$$* N_u > \frac{1}{2} V_c + \phi$$

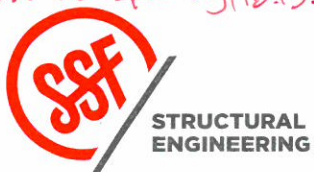
∴

PROVIDE  
MIN. STEEL  
REINFORCEMENT  
TIES/STIRRUPS

↳ #3 @ 6" oc

Table 9.4.3.3. (A<sub>min</sub>)

Ch. 16 Spacing (16.3.3.2)



PROJECT

Correction S2.1 #4/5

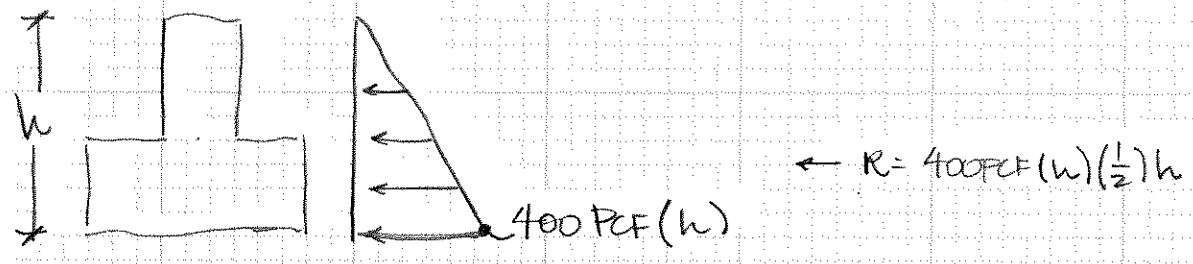
DATE

PROJ. #

DESIGN

SHEET

BASE SHEAR CHECK



PASSIVE PRESSURE =  $400 \text{ PCF} \times 1.5 = 600 \text{ PCF}$   
 APPLY FOS = 1.1 FOR SEISMIC LOADS  $\Rightarrow 600/1.1 = 545.5 \text{ PCF}$   
 BASE SHEAR = 28.1 K (SEISMIC CONTROLLED)  
 LATERAL FROM SLIDING (@ RET. WALL SLAB) = 4.4 K/FT  
 TOTAL LENGTH N-S = 112'  $\Rightarrow 28.1/112 = 250 \text{ PLF}$   
 TOTAL LENGTH E-W = 210'  
 TOTAL SLIDING LOAD =  $28.1 \text{ K} + 4.4 \text{ K}(70') = 336 \text{ K}$   
 $336 \text{ K} / 210 = 1600 \text{ PLF}$

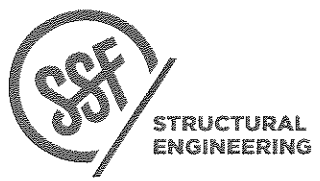
MIN.  $w$  ( $w/\text{FS} = 1.1$ ) = 2.42  $\Rightarrow$  2'-5" DEEP FTGS

CHECK W/O OUT SEISMIC

RET. WALL LATERAL = 3420 LBS/FT  
 $\times 70 \text{ FT} = 240100 \text{ LBS}$   
 $\times 210 \text{ FT} = 1143 \text{ LBS/FT}$   
 MIN  $w$  ( $w/\text{FS} = 1.5$   $P_p = 400 \text{ PCF}$ )  
 $w = \sqrt{1143/200} = 2.4 \text{ FT} \Rightarrow 2'-5" \text{ FTG GOOD } \checkmark$

CHECK GRADE BEAM OUT-OF-PLANE

$w_{\text{max}} = 1600 \text{ PLF}$   
 $\phi M_n = 25.7 \text{ K-FT}$   
 $\phi V_n = 13.3 \text{ K}$   
 MAX L = 17'  
 CONT. SPAN MOMENT  
 $M = wL^2/11 = 42 \text{ K-FT}$   
 $V = wL = 27 \text{ K}$   
 18" x 12" (2) #5 + STEM  $d = 14.75"$   
 INC. REBAR TO (2) #5  
 $\phi M_n = 39.12 \text{ K-FT OK w/STEM}$   
 $\phi V_n$  w/ #3 @ 6" OC STIRRUPS = 37 K VOIC



S2.1 No. 6  
 PROJECT \_\_\_\_\_ DATE \_\_\_\_\_  
 \_\_\_\_\_ PROJ. # \_\_\_\_\_  
 \_\_\_\_\_ DESIGN \_\_\_\_\_  
 \_\_\_\_\_ SHEET \_\_\_\_\_

STAIR RAFTERS W/ RAIN LOAD (GLEIF)

$$W = D + R = (15 + [5.2(12+0)]) \times 2' = 155 \text{ PLF}$$

$$L = 6.5' \quad f_b = 748$$

$$R = 504 \quad f_v = 57$$

$$M = 919 \quad \Delta = 0.1 \quad L/770$$

2x8 @ 24" oc

DECK STAIR

BEAM

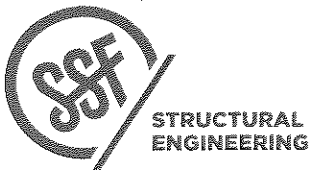
$$L = 8' \quad f_b = 448$$

$$W = 360 \quad f_v = 42$$

$$R = 1440 \quad \Delta = 0.05$$

$$M = 2880 \quad L/2043$$

4x12 PT



YUAN CORRECTIONS

PROJECT

12/19/17

DATE

PROJ. #

han

DESIGN

SHEET



## NUAN CORRECTIONS

ADJUST FLAT ROOF SNOW LOAD FROM 25PSF TO 30PSF

### B1 - BEAM

$$L = 17.7' \quad f_b = 1350$$

$$W = 473 \quad f_v = 67$$

$$R = 4182 \quad \Delta = 0.5$$

$$M = 18.5k' \quad L/398$$

$$(4) \ 1\frac{3}{4} \times 11\frac{7}{8} \text{ LVL}$$

### B12 - BEAM

$$L = 12' \quad f_b = 1600$$

$$W_1 = 601 \quad f_v = 95$$

$$W_2 = 370 \quad \Delta = 0.34''$$

$$P = 2571 \quad L/423$$

$$R_1 = 4.5k$$

$$R_2 = 3.9k$$

$$M = 16.5k'$$

$$(3) \ 1\frac{3}{4} \times 11\frac{7}{8} \text{ LVL}$$

B2 & B17 (TJ16) → SEE ATTACHED REPORTS



PROJECT

S2.3 - Comment #7

DATE

PROJ. #

DESIGN

SHEET

CHECK ANCHOR BOLTS

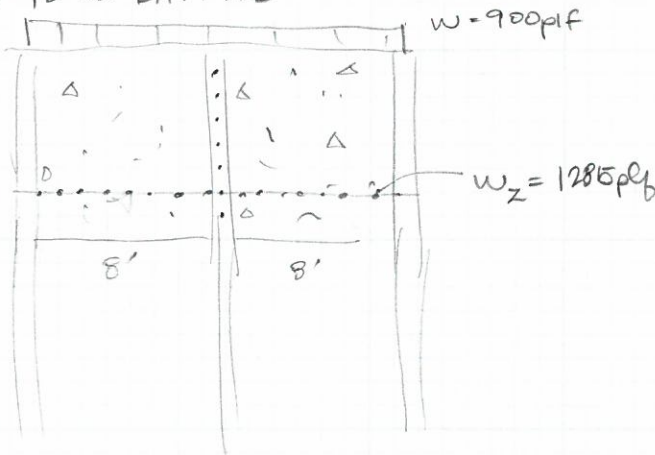
GRAVITY :

FRAMING RUNS PARALLEL... ASSUME 100pcf CONSERVATIVELY  
 CONCRETE WT : 8" THICK x 8' TALL = 150pcf x 8/12 x 8 = 800pcf  
 TOTAL = 900plf

LATERAL :

RETAINED EARTH - SLIDING PRESSURE FOR 8' WALL HEIGHT  
 $F = 213 \times 1418 = 945 \text{ lbs}$   
 SEISMIC LOAD = 340 lbs  
 TOTAL = 1285 lbs / 1ft strip

SOLDIER PILES @ 8' MAX SPACING  
 AB @ 12" OC EA. PILE



. SHEAR = 900 PLF (8')  
 = 7200 lbs

PULLOUT = 1285 (8')  
 = 10280 lbs

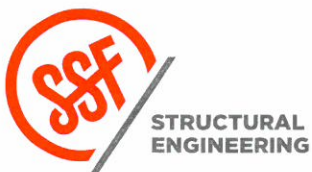
AB @ 12" OC  
 SHORTEST PILE = 5 ft  
 ~ 4 AB.

$\frac{7200}{4} = 1800$

$\frac{10280}{4} = 2570$

PER SIMPSON AB DESIGN SOFTWARE:

3/4"  $\phi$  HEADED STUD XL" EMBED  
 N = 31% V = 10% ✓ PASS



YUAN CORRECTIONS  
 PROJECT

11/08/19  
 DATE

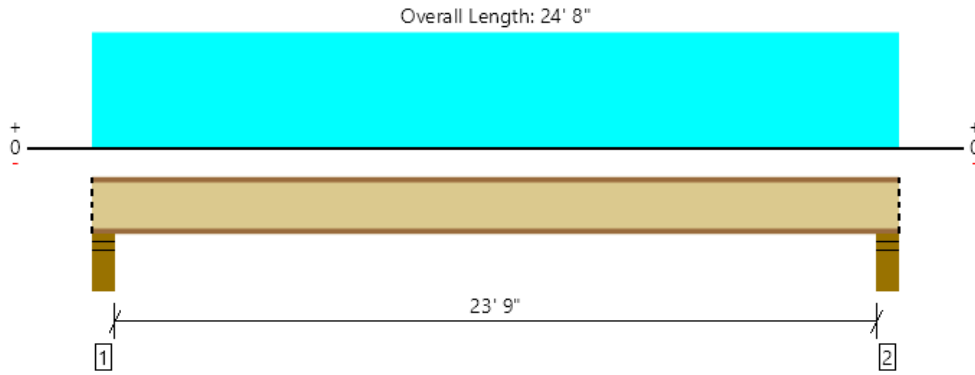
PROJ. # haa

DESIGN

SHEET

S3.2 Comment #4

ROOF, Roof: Joist B17  
 1 piece(s) 11 7/8" TJI @ 560 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1069 @ 4 1/2"	1984 (3.50")	Passed (54%)	1.15	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1029 @ 5 1/2"	2358	Passed (44%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	6197 @ 12' 4"	10925	Passed (57%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.507 @ 12' 4"	0.797	Passed (L/566)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	1.099 @ 12' 4"	1.196	Passed (L/261)	--	1.0 D + 1.0 S (All Spans)

System : Roof  
 Member Type : Joist  
 Building Use : Residential  
 Building Code : IBC 2015  
 Design Methodology : ASD  
 Member Pitch : 0/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 7' o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 24' 8" o/c unless detailed otherwise.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Stud wall - HF	5.50"	5.50"	1.75"	576	493	1069	Blocking
2 - Stud wall - HF	5.50"	5.50"	1.75"	576	493	1069	Blocking

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 24' 8"	16"	35.0	30.0	Default Load

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



ForteWEB Software Operator	Job Notes
Holly Ashford SSF Engineers (206) 956-3743 hashford@ssfengineers.com	



## Beam Analysis

Beam:		Beam				
Load	Dead	Live	Snow	Factored	Location	
Distributed (k/ft)	w <sub>1</sub>	0.438	0.000	0.375	0.813	
	w <sub>2</sub>				0.000	
	w <sub>3</sub>				0.000	
	w <sub>4</sub>				0.000	
	w <sub>5</sub>				0.000	
	w <sub>6</sub>				0.000	
	w <sub>7</sub>				0.000	
	w <sub>8</sub>				0.000	
	w <sub>9</sub>				0.000	
	w <sub>10</sub>				0.000	
Trapezoidal (k/ft/ft)	t <sub>1</sub>				0.000	
	t <sub>2</sub>				0.000	
	t <sub>3</sub>				0.000	
	t <sub>4</sub>				0.000	
	t <sub>5</sub>				0.000	
	t <sub>6</sub>				0.000	
Point (k)	P <sub>1</sub>				0.000	
	P <sub>2</sub>				0.000	
	P <sub>3</sub>				0.000	
	P <sub>4</sub>				0.000	
	P <sub>5</sub>				0.000	
	P <sub>6</sub>				0.000	
	P <sub>7</sub>				0.000	
	P <sub>8</sub>				0.000	
	P <sub>9</sub>				0.000	
	P <sub>10</sub>				0.000	

Support Locations and Reactions	
Number of Supports	3
Total Beam Length	28.00
Left End Condition	Pinned
Right End Condition	Pinned
R <sub>1</sub>	1.115
R <sub>2</sub>	15.529
R <sub>3</sub>	6.106
R <sub>4</sub>	0.000
R <sub>5</sub>	0.000
R <sub>6</sub>	0.000
R <sub>7</sub>	0.000
R <sub>8</sub>	0.000
R <sub>9</sub>	0.000
R <sub>10</sub>	0.000

Load Factors	
Dead	1.00
Live	1.00
Snow	1.00

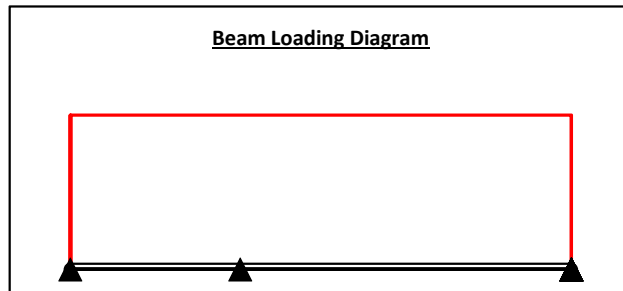
Stresses @ Input Location	
f <sub>v</sub> (psi)	-135
f <sub>b</sub> (psi)	-1821

Max/Min Stresses	
f <sub>v_MAX</sub> (psi)	182
f <sub>v_MIN</sub> (psi)	-135
f <sub>b_MAX</sub> (psi)	1605
f <sub>b_MIN</sub> (psi)	-1825

Demand Output	
Location, ft	9.49
Shear, k	V = -6.60
Moment, k-ft	M = -26.02
Deflection, in	Δ = 0.00
Δ/Span	L/370458

Beam Properties	
E (ksi)	2000
b (in)	5.25
d (in)	14
I (in <sup>4</sup> )	1200.5
S (in <sup>3</sup> )	171.5
A (in <sup>2</sup> )	73.5
I (Override)	
S (Override)	
A (Override)	

Steel Beam Section	NONE
--------------------	------



Span	V <sub>Left</sub> (kips)	V <sub>Right</sub> (kips)	M (-) (k-ft)	M (+) (k-ft)	Δ <sub>Tl</sub> (in)	@ x =	L/	Δ <sub>tl</sub> (in)	@ x =	L/
Span 1	1.11	-6.60	-26.08	0.76	0.051 (↑)	6.38	L/2227	0	-	L/∞
Span 2	8.93	-6.11	-26.08	22.94	-0.497 (↓)	19.66	L/446	0	-	L/∞

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PROJECT Yuan Residence - Roof Beam 2

DATE 11/6/2019

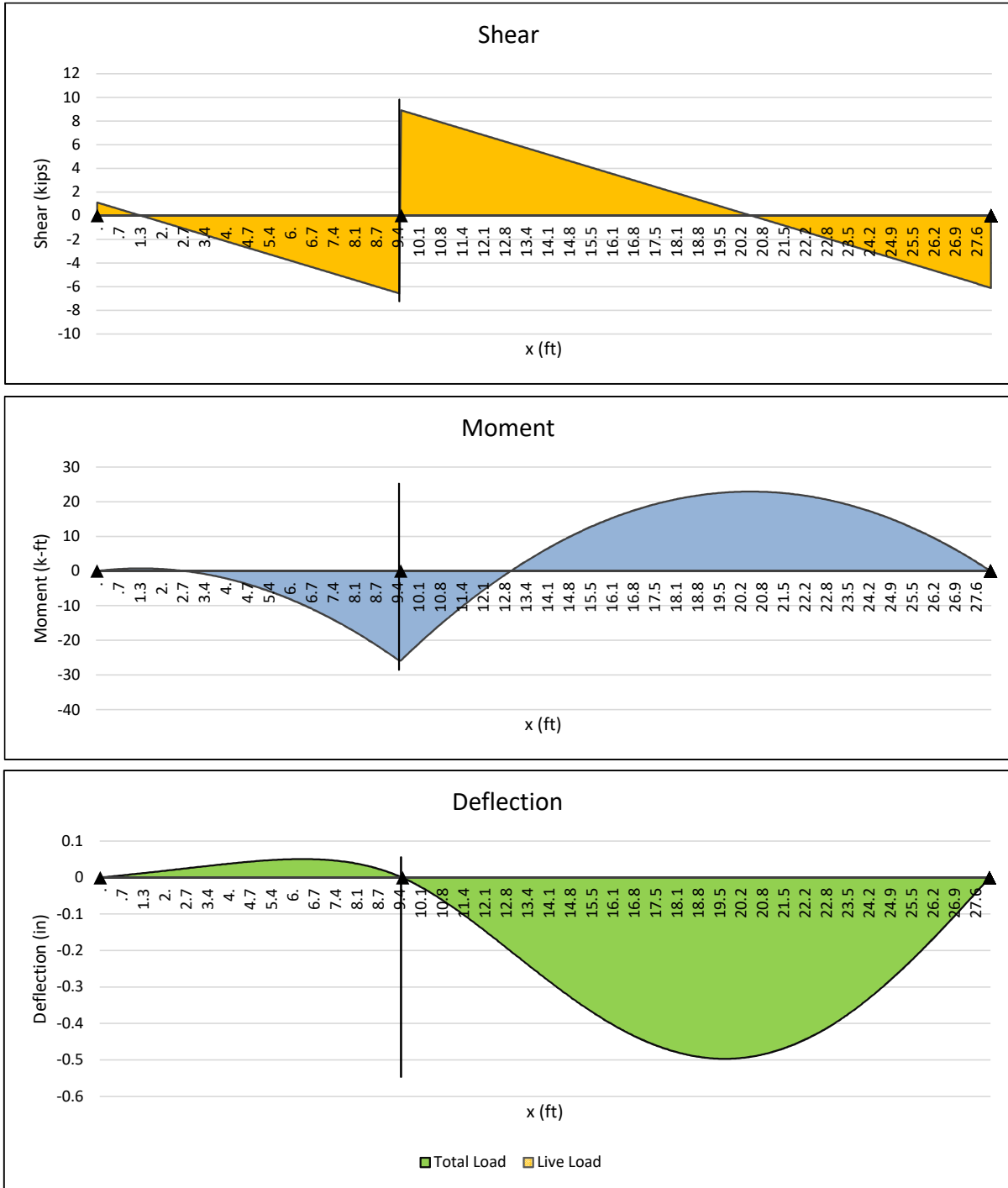


PROJ. #

DESIGN haa

SHEET

# Beam Analysis



PROJECT Yuan Residence - Roof Beam 2

DATE 11/6/2019



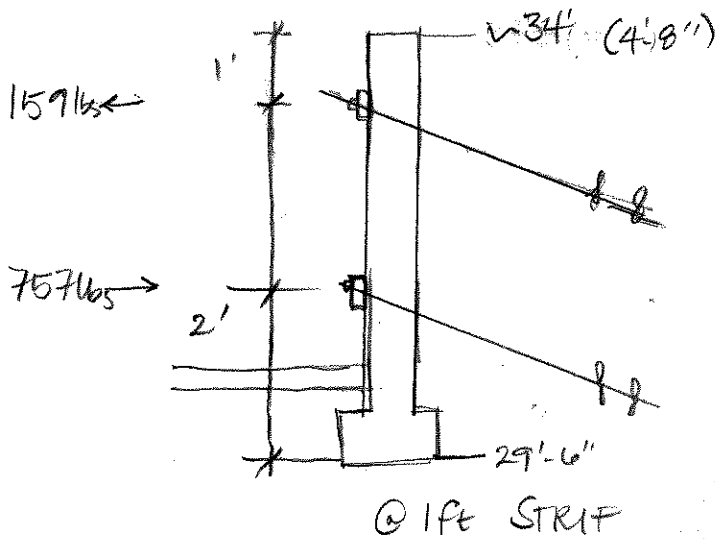
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PROJ. # \_\_\_\_\_

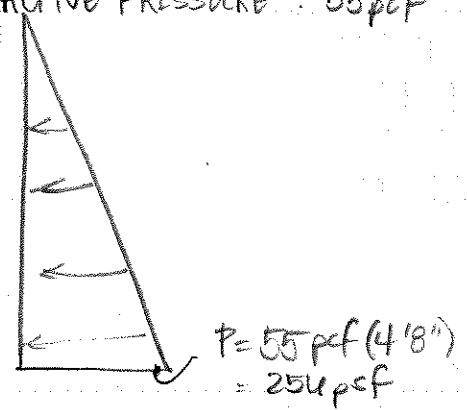
DESIGN haa

SHEET \_\_\_\_\_

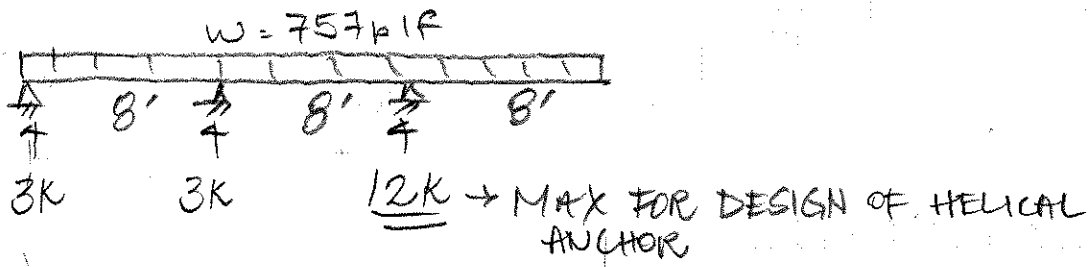
HELICAL ANCHOR DESIGN



ACTIVE PRESSURE : 55 pcf



HSS DESIGN

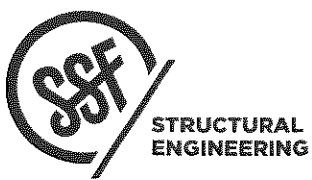


$M_{max} = 24 \text{ k-ft}$

$M_u/\Omega \text{ (WEAK AXIS)} = 32.8 \text{ k-ft}$

$V_u/\Omega \text{ (WEAK AXIS)} = 40 \text{ k}$

HSS 8x4 x 1/2 (FLAT)



YUAN-SUPPLEMENTAL CALCS

PROJECT \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

12/13/2019  
 DATE \_\_\_\_\_  
 PROJ. # \_\_\_\_\_  
 DESIGN Waa  
 SHEET \_\_\_\_\_

STAIR LOADS

LL = 60 PSF  
DL = 10 PSF

MAX STRINGER LENGTH,  $L = 9'0''$  (PLAN)  $H = 15'6''$  DIRT  $L = 10.5'$

STAIR WIDTH =  $3'6'' \Rightarrow 42''$

USE (3) MIN STRINGERS

$$W = \frac{24'' \text{ MAX} (70 \text{ PSF})}{12} = 140 \text{ PLF}$$

$$R = 1735 \text{ LB}$$

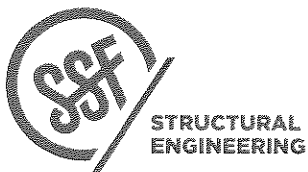
$$M = 1929 \text{ LB-FT}$$

$$F_b = 1510 \text{ PSI}$$

$$F_v = 77 \text{ PSI}$$

$$\Delta = 0.44 \text{ IN} \Rightarrow L/203$$

$1\frac{3}{4} \times 7\frac{1}{4}''$  MIN STRINGER @ 24'' OC MAX



PROJECT YUAN STAIR

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

DATE 12/18/19

PROJ. # \_\_\_\_\_

DESIGN \_\_\_\_\_

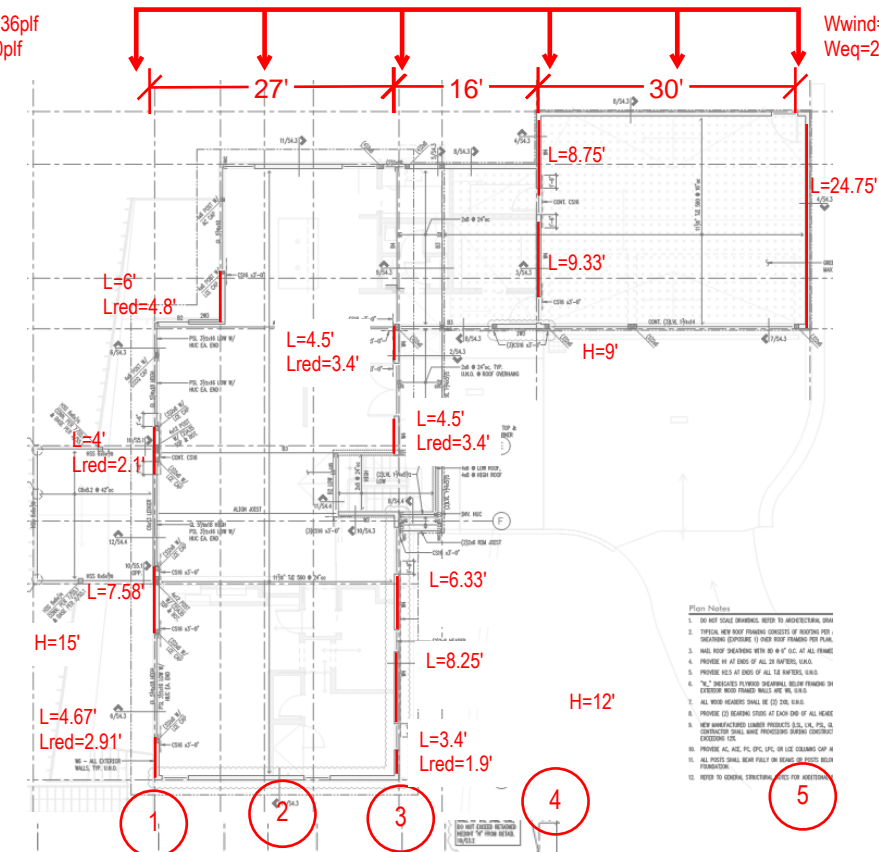
SHEET \_\_\_\_\_

**NORTH-SOUTH**

**ROOF**

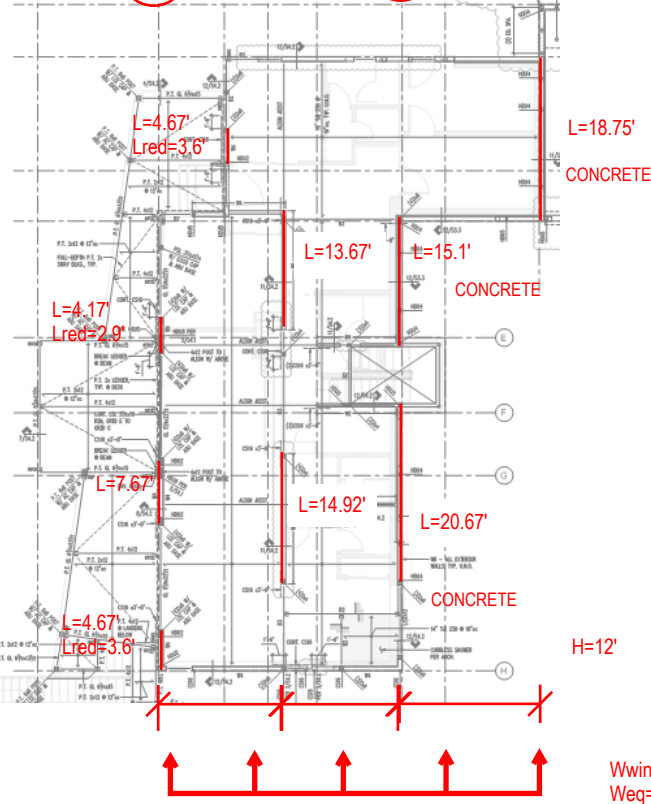
Wwind=136plf  
Weq=200plf

Wwind=92plf  
Weq=245plf

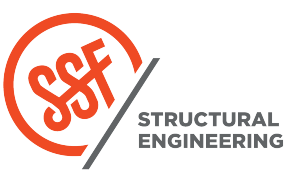


- Notes:**
1. SEE THE SCALE DRAWINGS, REFER TO ARCHITECTURAL SHOP
  2. TYPICAL NEW ROOF FRAMING CONSISTS OF ROOFING PER. SHEATHING EXPOSED TO THE ROOF FINISHES PER PLAN.
  3. WALL ROOF SHEATHING WITH 2" x 4" S.C. AT ALL FRAMES.
  4. PROVIDE HI AT END OF ALL 2" x 4" MATERIALS.
  5. PROVIDE HCS AT END OF ALL 2" x 4" MATERIALS.
  6. "C" INDICATES TO PROVIDE STRUCTURAL BEAM FRAMING ON EXTERIOR WOOD FRAMED WALLS AND ALL WALLS.
  7. ALL WOOD MEMBERS SHALL BE CD OR DD S.P.S.
  8. PROVIDE CD BEARING STUDS AT EACH END OF ALL BEAMS.
  9. NEW MANUFACTURED LAMBER PRODUCTS S.P.S. OR P.S. IS CONSTRUCTION SHALL HAVE PROVISIONS BEARING CAPACITY EXCEEDING 12K.
  10. PROVIDE ALL G.C. P.C. S.P.S. OR L.S. BEARING CAP. #.
  11. ALL JOISTS SHALL BEAR FULLY ON BEAMS OR WOOD BILD FRAMING.
  12. REFER TO GENERAL STRUCTURAL DRAWING FOR DETAILS.

**MAIN LEVEL**



Wwind=262plf  
Weq=274plf



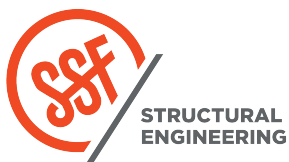
Yuan Residence  
PROJECT  
Lateral Design - Revised

2019-06-14

DATE  
PROJ. #  
DESIGN  
SHEET

SRW

North-South										
Level	Roof - Main				Roof - Main/Garage		Roof - Main/Garage		Roof - Garage	
Wall Line	1		2		3		4		5	
Lateral Force	Wind	Seismic	Wind	Seismic	Wind	Seismic	Wind	Seismic	Wind	Seismic
V (k)	1.836	2.7			2.924	4.3	2.468	5.275	1.38	3.675
L (ft)	22.25	22.25	8.5	8.5	26.98	26.98	18.08	18.08	24.75	24.75
L red (ft)	19.15	19.15	8.5	8.5	23.28	23.28	18.08	18.08	24.75	24.75
V (plf)	96	141	0	0	126	185	137	292	56	148
SW	W6		W6		W6		W4		W6	
H (ft)	15	15	0	0	12	12	9	9	9	9
OT (lb)	1238	1820	0	0	1301	1913	1229	2626	502	1336
Design OT (lb)	1820		0		1913		2626		1336	
Holddown	HDU2		NA		HDU2		HDU4		HDU2	
OT-DL										
Level	Upper									
Wall Line	1		2		3		4		5	
Lateral Force	Wind	Seismic	Wind	Seismic	Wind	Seismic	Wind	Seismic	Wind	Seismic
V (k)	1.834	1.918	3.537	3.699	3.799	3.973	2.096	2.192		
V above (k)	1.836	2.7	0	0	2.924	4.3	2.468	5.275		
Total V (k)	3.67	4.618	3.537	3.699	6.723	8.273	4.564	7.467		
L (ft)	21.18	21.18	28.59	28.59	35.75	35.75	18.75	18.75		
L red (ft)	17.77	17.77	28.59	28.59	35.75	35.75	18.75	18.75		
V (plf)	207	260	124	129	188	231	243	398		
SW	W4		W6		W6		NA			
H (ft)	12	12	12	12	12	12	12	12		
OT (lb)	2079	2616	1485	1553	2257	2777	2921	4779		
Total OT (lb)	3317	4437	1485	1553	3557	4689	4149	7405		
Design OT (lb)	4437		1553		4689		7405			
Holddown	HDU4		HDU2		NA		NA			
					Concrete		Concrete			



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PROJECT  
Lateral Design - Revised

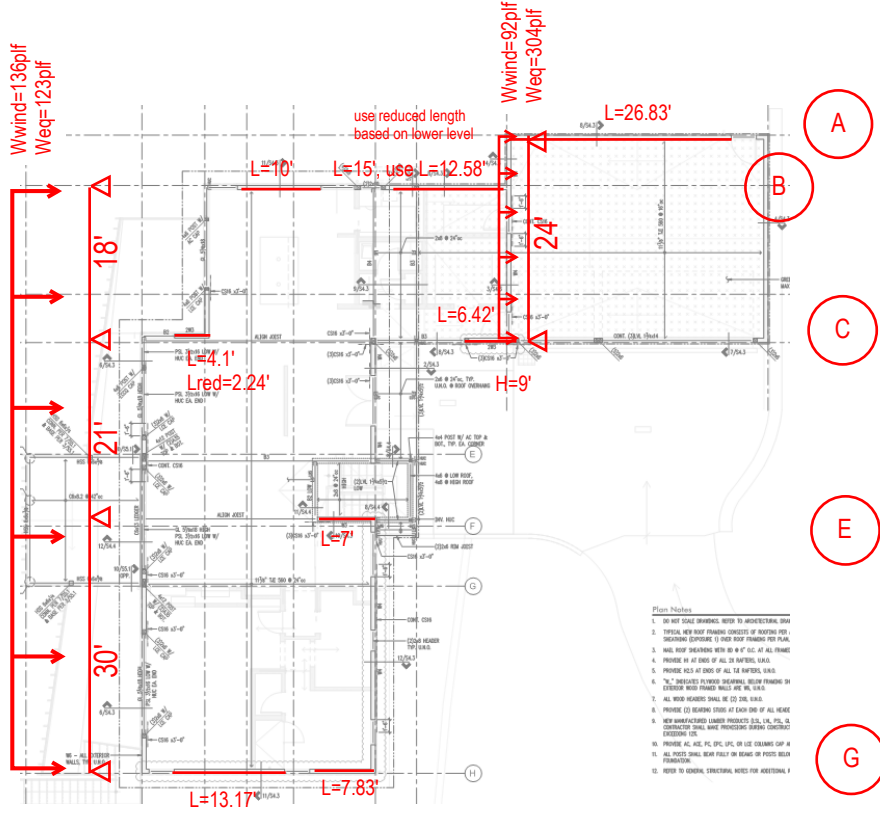
2019-06-14  
DATE  
PROJ. #  
DESIGN  
SHEET

SRW

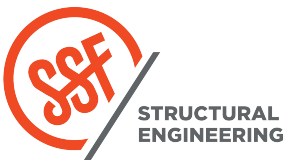
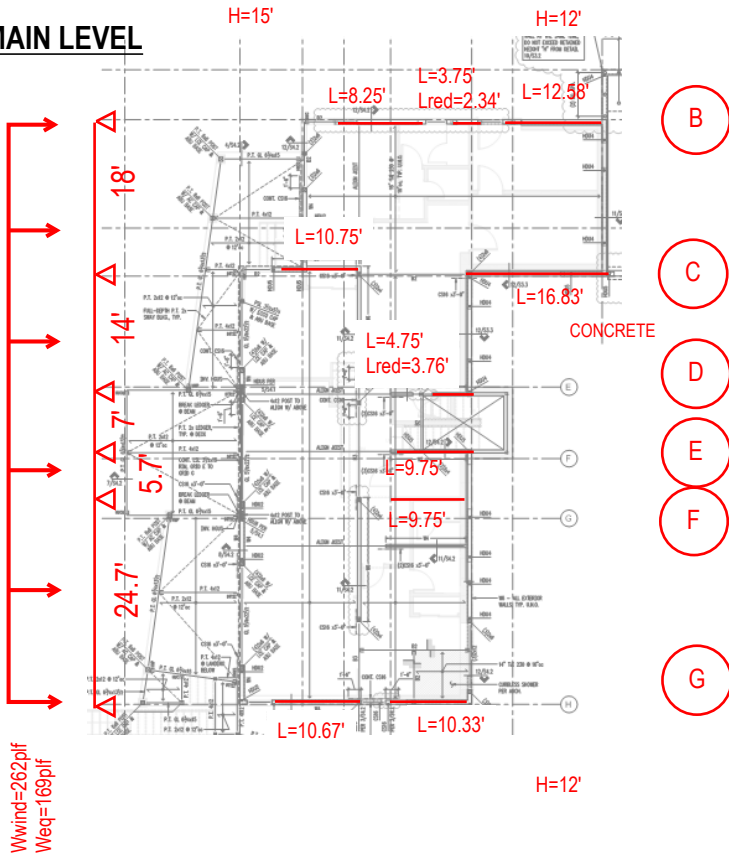


**EAST-WEST**

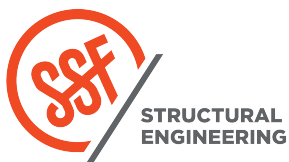
**ROOF**



**MAIN LEVEL**



East-West															
Level	Roof - Garage				Roof - Main										
Wall Line	A		B		C		D		E		F		G		
Lateral Force	Wind	Seismic	Wind	Seismic	Wind	Seismic	Wind	Seismic	Wind	Seismic			Wind	Seismic	
V (k)	1.104	3.648	1.224	1.107	3.756	6.0465			3.468	3.1365			2.04	1.845	
L (ft)	26.83	26.83	22.58	22.58	10.52	10.52			7	7			21	21	
L red (ft)	26.83	26.83	22.58	22.58	8.66	8.66			7	7			21	21	
V (plf)	41	136	54	49	434	698			495	448			97	88	
SW	W6		W6		2W3				W3				W6		
H (ft)	9	9	9	9	9	9			12	12			15	15	
OT (lb)	370	1224	488	441	3213	5173			5945	5377			1457	1318	
Design OT (lb)	1224		488		5173				5945				1457		
Holddown	HDU2		NA		HDU5				HDU5				CS16		
OT-DL															
Level	Upper														
Wall Line	A		B		C		D		E		F		G		
Lateral Force	Wind	Seismic	Wind	Seismic	Wind	Seismic	Wind	Seismic	Wind	Seismic	Wind	Seismic	Wind	Seismic	
V (k)			2.36	1.52	4.19	2.70	2.75	1.77	1.66	1.07	3.98	2.57	3.24	2.09	
V above (k)			1.22	1.11	3.76	6.05	0	0	3.468	3.1365	0	0	2.04	1.845	
Total V (k)			3.58	2.63	7.95	8.75	2.75	1.77	5.13	4.21	3.98	2.57	5.28	3.93	
L (ft)			24.58	24.58	27.58	27.58	4.75	4.75	9.75	9.75	9.75	9.75	21	21	
L red (ft)			23.17	23.17	27.58	27.58	3.76	3.76	9.75	9.75	9.75	9.75	21	21	
V (plf)			155	113	288	317	732	472	526	432	408	263	251	187	
SW			W6		W4		W2		W3		W3		W6		
H (ft)			12	12	12	12	12	12	12	12	12	12	12	12	
OT (lb)			1749	1283	3458	3807	6950	4483	6316	5181	4901	3162	3015	2247	
Total OT (lb)			2237	1724	6671	8980	6950	4483	12261	10558	4901	3162	4472	3565	
Design OT (lb)			2237		8980		6950		12261		4901		4472		
Holddown			HDU4		HDU11		HDU8		HDU14		HDU5		HDU4		



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ASCE 12.1.3

INTERCONNECTION

SMALLER PORTION OF STRUCTURE TO BE TIED TO REMAINDER

DESIGN STRENGTH OF CONNECTION: LARGER OF:

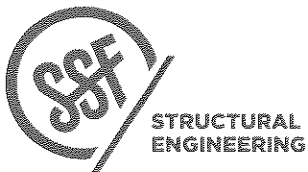
$$\left\{ \begin{array}{l} 0.133 S_{DS} W_{SMALL} \\ 0.05 W_{SMALL} \end{array} \right. \quad 0.133 (0.935) = 0.124 \quad \leftarrow \text{CONTROLS}$$

$$W_{SMALL} = W_{GARAGE} = 39600 \text{ LB}$$

$$0.124 (39600) = 4924 \text{ LB}$$

$$4924 \text{ LB} / 167 \text{ pcf} / 2 = 14.74 \text{ FT} \Rightarrow \text{ENGAGE } 15' \text{ OF DIAPHRAGM}$$

W/CONT CS16



PROJECT YUAN

DATE 11/21/2019

PROJ. # SPW

DESIGN

SHEET

AT MAIN FLOOR:

$$700 \text{ FT}^2 / 2760 \text{ FT}^2 = 0.25$$

$$0.25 \times 129720 \text{ LB} = 32900 \text{ LB} \leftarrow \text{MASS OF SMALLER PORTION}$$

$$\left\{ \begin{array}{l} 0.133 \text{ SDS} = 0.133 / (0.935) = 0.12 \leftarrow \text{CONTROLS} \\ 0.05 \end{array} \right.$$

PER ASCE 12.1.3

$$0.12 (32900 \text{ LB}) = 4091 \text{ LB} \leftarrow \text{DESIGN CONNECTION FOR THIS FORCE}$$

$$4091 \text{ LB} / 167 \text{ psf} / 2 = 12 \text{ FT}$$

FLAT BEAMS W/CONT CS16 OVER TOP



STRUCTURAL  
ENGINEERING

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DATE

PROJ. # SKW

DESIGN

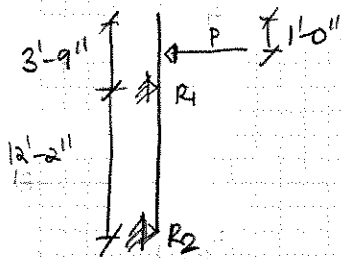
SHEET

FORCE ALONG LINE "3" = 4300 LB

WALLS ON EA SIDE OF POP-UP. DESIGN TRANSFER FOR GREATER PORTION OF LOAD.

$$\frac{6.33' + 8.25' + 3.4'}{26.98'} = \frac{17.98}{26.98} = 0.66 \times 4300 \text{ LB} = 2838 \text{ LB}$$

$$2838 \text{ LB} \times 2.5 / 1.3 = 5458 \text{ LB} = P$$

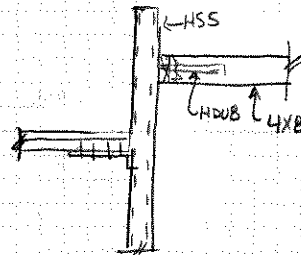


PER VA  
 HSS 5X5 X 1/2  
 $A = 0.66 \text{ IN}$   
 $R_1 = 6.69 \text{ K} \leftarrow$   
 $R_2 = 1.24 \text{ K} \rightarrow$

USE HDUB @ HSS TO BEAM  
 & HSS TO TOP PLATES

W/ 7/8"  $\phi$  W.T.S.

AND 1/4" FILLET ALL AROUND



WELD CHECK

$$\frac{7}{8} \text{TT} = 2.75 \text{ IN}$$

$$1.392(4) = 5.568 \text{ K/IN} \times 2.75 \text{ IN} = 15.3 \text{ K}$$

$$6.69(1.5) = 10 \text{ K} < 15.3 \text{ K OK}$$

$\uparrow$  TOP RFD

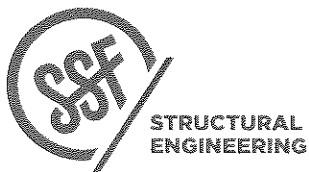
EM @ POP-UP ROOF

$$L = 6 \text{ FT}$$

AXIAL FORCE = 5458 LB

4X8 DCR = 0.35

(SEE COLUMN SPREADSHEET)



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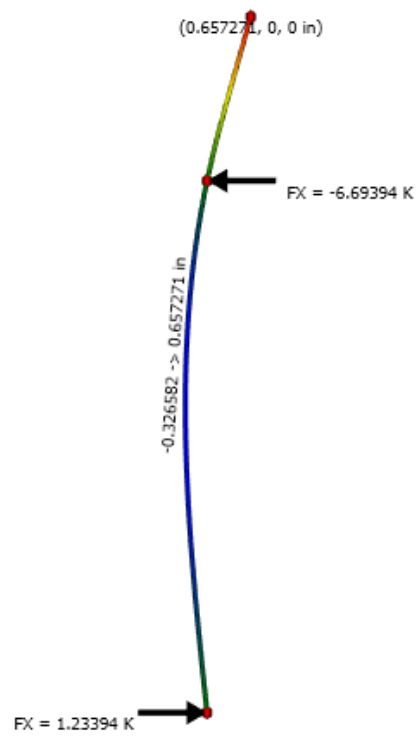
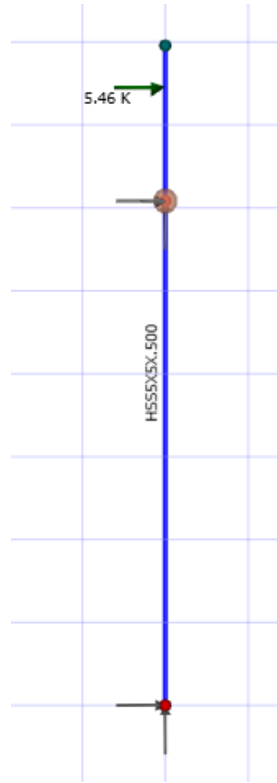
11/21/2019  
 DATE

PROJ. # SRW

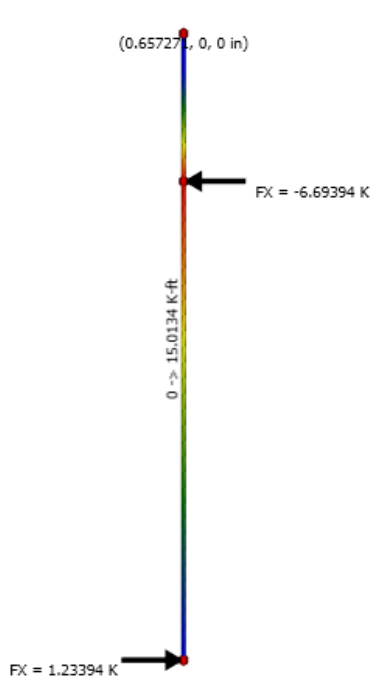
DESIGN

SHEET

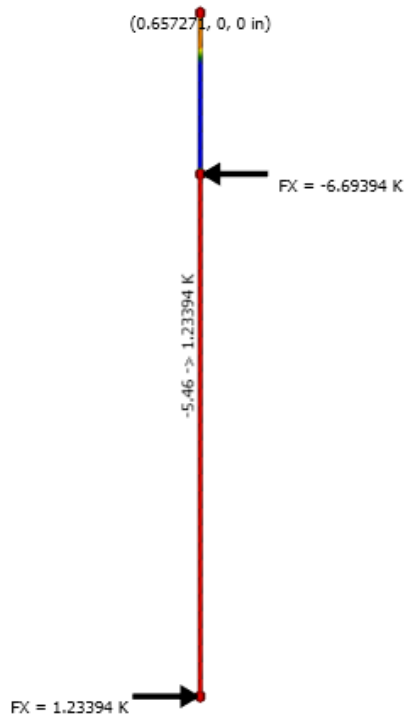
VA OUTPUT



REACTIONS / DEFLECTION



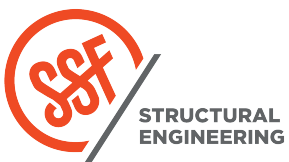
MOMENT DEMAND



SHEAR DEMAND



DCR



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PROJECT

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11/22/2019

DATE

PROJ. #

DESIGN

SHEET

SRW



### Column Buckling Calculations

#### NDS 2015

#### Column Geometry Data

4X Posts Doug Fir - Larch #2		
Hem-Fir Plates		
b	3.5	in
d	7.25	in
Le <sub>1</sub>	7.00	ft
Le <sub>2</sub>	7.00	ft
le <sub>bending</sub>		ft

#### Column Design Values

F <sub>b</sub>	900	psi
F <sub>c</sub>	1350	psi
E'min	580	ksi
F <sub>cperp</sub>	405	psi
cb	1.00	

#### Column Loading

P	5460	lbs
W <sub>1</sub>		plf
M1	0	ft-lbs
W <sub>2</sub>	0	plf
M2	0	ft-lbs

#### Flexural Stress Adjustment Factors

Roof/EQ / Wind - C <sub>D</sub>	1.60
Size Factor - C <sub>F</sub>	1.00
Repetitive - C <sub>r</sub>	1.00

#### Compressive Parallel Adjustment Factors

Roof/EQ / Wind - C <sub>D</sub>	1.60
Size Factor - C <sub>F</sub>	1.00

#### Other Factors

Visually Graded Lumber	
c	0.8
Solid Column	
Kf	1
Column: Pinned Pinned	
Ke	1

#### Column Stability Factor Calculation

##### Strong Axis

F <sub>ce1</sub>	3552	psi
F <sub>c*1</sub>	2160	psi
F <sub>ce1</sub> /F <sub>c*1</sub>	1.644	
C <sub>p1</sub>	0.830	

##### Weak Axis

F <sub>ce2</sub>	828	psi
F <sub>c*2</sub>	2160	psi
F <sub>ce2</sub> /F <sub>c*2</sub>	0.383	
C <sub>p2</sub>	0.346	

Bracing

No Brace

No Brace

#### Beam Stability Factor Calculation

##### Strong Axis

F <sub>be1</sub>	7412	psi
F <sub>b'1</sub>	1440	psi
F <sub>be1</sub> /F <sub>b'1</sub>	5.1	
le	13.2	ft
CL <sub>1</sub>	0.99	

##### Weak Axis

F <sub>be2</sub>	69,130	psi
F <sub>b'2</sub>	1440	psi
F <sub>be2</sub> /F <sub>b'2</sub>	48	

Bearing

Area

Increase

No

#### Adjusted Allowable Stresses

##### Strong Axis

F <sub>c'1</sub>	1794	psi
F <sub>b'1</sub>	1423	psi

##### Weak Axis

F <sub>c'2</sub>	748	psi
F <sub>b'2</sub>	1440	psi

#### Imposed Column Stresses

##### Strong Axis

f <sub>c1</sub>	215	psi
f <sub>b1</sub>	0	psi

##### Weak Axis

f <sub>c2</sub>	215	psi
f <sub>b2</sub>	0	psi

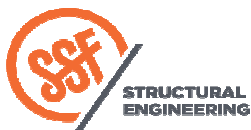
Perpendicular to Grain Stress Check f <sub>c</sub> /F <sub>c</sub> =	215 / 405	OK
Slenderness Check le/d	12	OK
Slenderness Check le/b	24	OK

$$(1) \left(\frac{f_c}{F_c'}\right)^2 + \frac{f_{b1}}{F_{b1}'[1-f_c/F_{cE1}]} + \frac{f_{b2}}{F_{b2}'[1-f_c/F_{cE2}-(f_{b1}/F_{bE1})]} \leq 1.0$$

$$(2) \frac{f_c}{F_{cE2}} + \left(\frac{f_{b1}}{F_{bE}}\right)^2 < 1.0$$

$$(3) \frac{f_c}{F_{c1}'} + \frac{f_{b1}}{F_{b1}'} + \frac{f_{b2}}{F_{b2}'} < 1.0$$

Allowable Stress Interaction Formula	0.29	OK
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Office: 206.443.6212  
Fax: 206.443.4870

Project: Yuan Date: 11/22/2019

Project #: \_\_\_\_\_

Design: SRW

Sheet: 1

MAIN FLOOR BM @ GRID 6 BETWEEN H & G:

F/KEY PLAN MAIN B/S

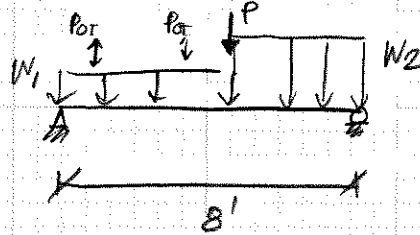
$L = 8'$

$W_1 = x=0' \text{ to } x=5'$

$DL = 36 \text{ psf} \times 6.67' / 2 = 120 \text{ PLF}$

$LL = 40 \text{ psf} \times 6.67' / 2 = 133 \text{ PLF}$

$P = 1.45 \text{ K} @ x=5'$  (F/BM 10) ASSUME ALL LL



$W_2 = x=5' \text{ to } x=8'$

$DL = 36 \text{ psf} \times 13' / 2 \leftarrow \text{FLR}$   
 $+ 15 \text{ psf} \times 27' / 2 \leftarrow \text{ROOF ABOVE}$   
 $+ 10 \text{ psf} \times 12' \leftarrow \text{WALL}$   
 $= 557 \text{ PLF}$

$LL = 40 \text{ psf} \times 13' / 2$   
 $+ 15 \text{ psf} \times 27' / 2 \leftarrow \text{ROOF ABOVE}$   
 $= 463 \text{ PLF}$

W/O SEISMIC LOADS

$R_1 = 1990 \text{ LB}$

$R_2 = 3790 \text{ LB}$

$M = 6781 \text{ K-FT}$

$f_b = 857 \text{ psi}$

$f_v = 84 \text{ psi}$

$A = 0.10 \text{ IN}^2 \quad L/1001$

(3) 2X12

W/SEISMIC

OT REACTIONS = 1915 LB @  $x=1.5'$  &  $4.23'$

$W/A = 4788 \text{ LB}$

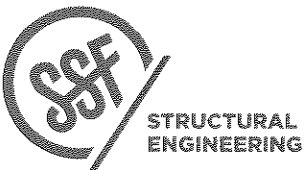
+EQ    ↓    ↑

-EQ    ↑    ↓

SEE VA OUTPUT

(3) 2X12 OK

2124 3rd Ave, Suite 100, Seattle, WA 98121 | ☎ 206.443.6212  
 934 Broadway, Suite 100, Tacoma, WA 98402 | ☎ 253.284.9470  
 SEATTLE TACOMA  
 swfengetrs.com  
 SWENSON SAY FAGET



PROJECT YUAN

DATE 11/22/2019

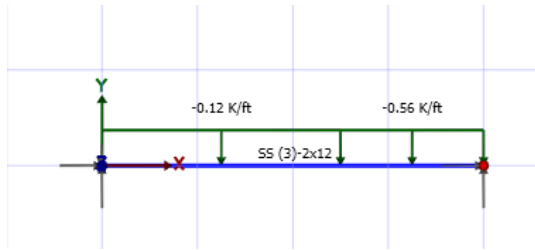
PROJ. # SKW

DESIGN

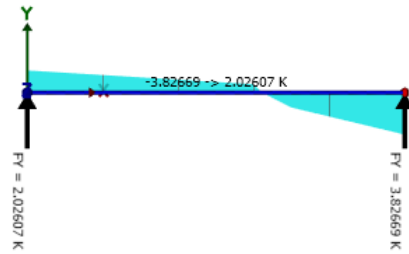
SHEET

# MAIN FLOOR BEAM #15 W/OT REACTIONS - VA OUTPUT

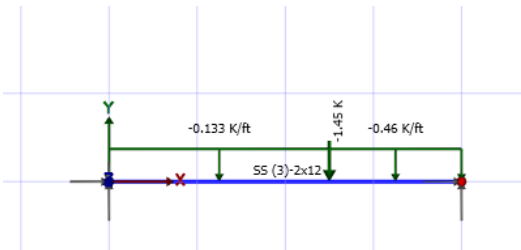
## APPLIED DEAD LOAD



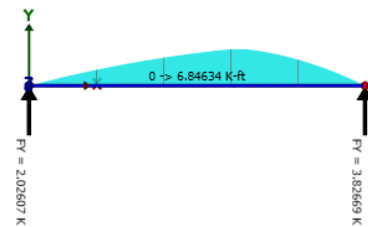
## SHEAR DIAGRAM



## APPLIED LIVE LOAD



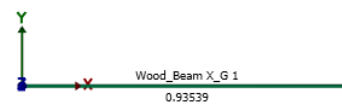
## MOMENT DIAGRAM



## APPLIED EQ(+) LOAD



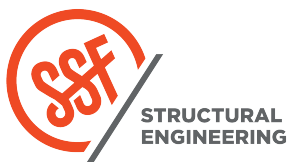
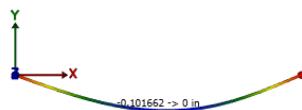
## DCR



## APPLIED EQ(-) LOAD



## DEFLECTION (D+L)



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PROJECT

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11/22/2019

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DESIGN

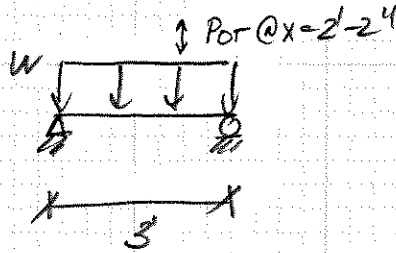
SHEET

SRW

MAIN FLOOR HDR @ GRID H

$L = 3'$

$W_D = 15 \text{ psf} \times 24''/12/2$   
 $+ 36 \text{ psf} \times 16''/12/2$   
 $+ 10 \text{ psf} \times 12'$   
 $= 159 \text{ plf}$



$W_L = 25 \text{ psf} \times 24''/12/2$   
 $+ 40 \text{ psf} \times 16''/12/2$   
 $= 52 \text{ plf}$

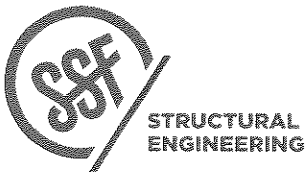
$P_{OT} = 1457 \text{ LB} \times 2.5 = 3643 \text{ LB}$   
 $@ x = 2'-2''$

+EQ :  $\downarrow 3643 \text{ LB}$

-EQ :  $\uparrow 3643 \text{ LB}$

SEE VA RESULTS

(2) 2XB OK



PROJECT YUAN

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

DATE 11/22/2019

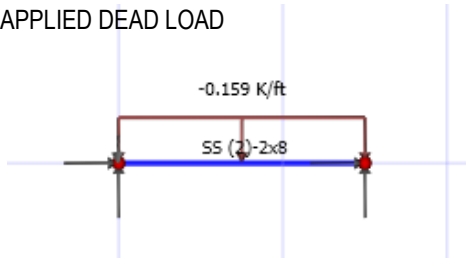
PROJ. # \_\_\_\_\_

DESIGN SPW

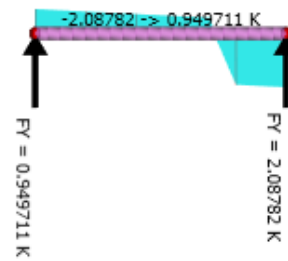
SHEET \_\_\_\_\_

# MAIN FLOOR HEADER W/OT REACTIONS - VA OUTPUT

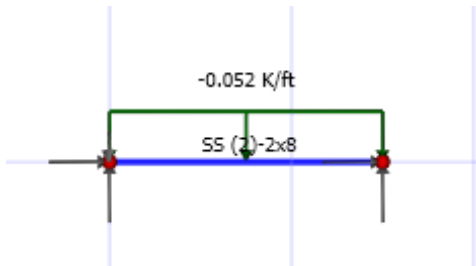
APPLIED DEAD LOAD



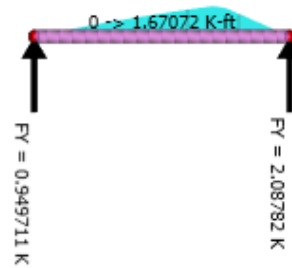
SHEAR DIAGRAM



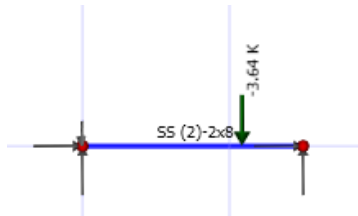
APPLIED LIVE LOAD



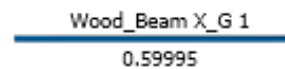
MOMENT DIAGRAM



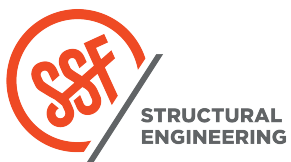
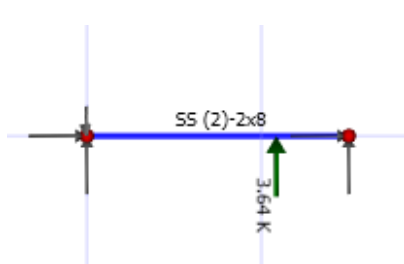
APPLIED EQ(+) LOAD



DCR



APPLIED EQ(-) LOAD



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DESIGN

SHEET

SRW

shearwall schedule calculation accounts for minimum penetration not met - reduction incorporated into capacity

SW Schedule : 1-1/8 in Floor Sheathing (w/ G=0.43 for Framing Members)												
Panel Edge Nailing			Top Plate Connection						Base Plate Connection			
Type	Capacity		Type	Capacity	Type	Capacity	Type	Capacity	At Wood	Capacity	At Concrete	Capacity
	V <sub>s</sub>	V <sub>w</sub>	TJI	ASD	2x or LSL	ASD	2x or LSL	ASD		ASD		ASD
8d @ 6" oc	242	339	16d @ 6" oc	285	A35 @ 24" oc	280	LTP4 @ 24" oc	270	(2)rows 16d @ 6" oc	369	5/8" DIA A.B. @ 48" oc	344
10d @ 6" oc	288	405	16d @ 6" oc	285	A35 @ 24" oc	280	LTP4 @ 24" oc	270	(2)rows 16d @ 6" oc	369	5/8" DIA A.B. @ 48" oc	344
8d @ 4" oc	353	495	16d @ 4" oc	427	A35 @ 16" oc	420	LTP4 @ 16" oc	405	(2)rows 16d @ 4" oc	554	5/8" DIA A.B. @ 32" oc	516
10d @ 4" oc	428	600	16d @ 4" oc	427	A35 @ 16" oc	420	LTP4 @ 16" oc	405	(2)rows 16d @ 4" oc	554	5/8" DIA A.B. @ 32" oc	516
8d @ 3" oc	456	637	(2)rows 16d @ 4" oc	854	A35 @ 12" oc	560	LTP4 @ 12" oc	540	(2)rows 16d @ 4" oc	554	5/8" DIA A.B. @ 24" oc	688
10d @ 3" oc	558	781	(2)rows 16d @ 4" oc	854	A35 @ 12" oc	560	LTP4 @ 12" oc	540	(2)rows 16d @ 4" oc	554	5/8" DIA A.B. @ 24" oc	688
8d @ 2" oc	595	832	(2)rows 16d @ 4" oc	854	A35 @ 9" oc	747	LTP4 @ 9" oc	720	(3)rows 16d @ 4" oc	831	5/8" DIA A.B. @ 16" oc	1032
10d @ 2" oc	716	1002	(2)rows 16d @ 4" oc	854	A35 @ 9" oc	747	LTP4 @ 9" oc	720	(3)rows 16d @ 4" oc	831	5/8" DIA A.B. @ 16" oc	1032
1 @ 3" oc EA, SIDE	911	1274	n/a	-	A35 @ 6" oc	1120	LTP4 @ 6" oc	1080	(4)rows 16d @ 4" oc	1108	5/8" DIA A.B. @ 16" oc	1284
1 @ 2" oc EA, SIDE	1190	1665	n/a	-	HGA10KT @ 8" oc	1260	HGA10KT @ 8" oc	1260	(2)rows SDS 1/4 x 5" @ 6" oc	1216	5/8" DIA A.B. @ 12" oc	1712
1 @ 2" oc EA, SIDE	1432	2004	n/a	-	HGA10KT @ 6" oc	1680	HGA10KT @ 6" oc	1680	n/a	-	5/8" DIA A.B. @ 12" oc	1712
1 @ 2" oc EA, SIDE	1618	2265	n/a	-	HGA10KT @ 6" oc	1680	HGA10KT @ 6" oc	1680	n/a	-	5/8" DIA A.B. @ 12" oc	1712

PWS 2015 Table 4.3A

Reduction for G : 0.93

Simpson Strong-Tie

Wood Construction Connector 2019-2020

pg. 281 - Framing Angles & Plates

	DF / SP	HF / SPF
A35 - F1 for "4"	650	560
LTP4 - G for "6" (Horiz)	625	540
pg. 273 - Seismic Ties		
HGA10KT - F1	1165	840

\*all values include Cd=1.6 for EQ/W

For this SW Sched: 560 for A35  
 For this SW Sched: 540 for LTP4  
 For this SW Sched: 840 for HGA10KT

NDS 2015 - Table 12N

-> ONLY for 0.135" DIA 16d Box Nail

-> 1.5" ts which is greater than 1.375" TJI bot flange

-> 1.5" ts which is equal to the bottomplate

Spec Grav, G	Z (lbs)
0.42	88
0.43	89
0.50	103

For this SW Sched (Top): 142 lbs

Reduction for Penetration (< 10D) per Note 3 & 4

p = 3.5"(nail)-1.5"(bot 2x)-1.125"(ply) = 0.875 < 10D

p/10D = 0.875"/1.35" = 0.648

For this SW Sched (Bot): 92 lbs

Simpson Strong-Tie

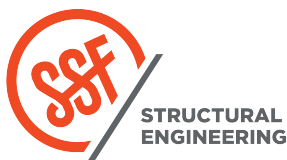
[https://www.strongtie.com/strongdrive\\_exteriorwoodscrews/](https://www.strongtie.com/strongdrive_exteriorwoodscrews/)

SDS - Allowable Shear Values for Sole-to-Rim Connections

	DF / SP	HF / SPF
1/4" x 5 SDS Screw	190	190

\*This is controlled by the 1-1/4" min LVL rim\*

For this SW Sched (Top): 304 lbs



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SRW

DESIGN

SHEET