

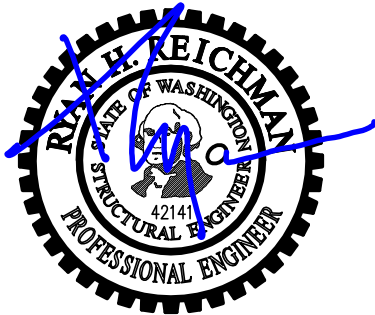


Structural Calculations for:

# Chitturi Addition

3719 82<sup>nd</sup> Ave SE

Mercer Island, WA 98040



Job #: 02295-2021-01

Date: October 15, 2021



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934 Broadway, Suite 100, Tacoma, WA 98402

○ 206.443.6212  
○ 253.284.9470

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# Criteria Sheet

Codes	Project Location
Structural: IBC 2018	Street & Number: 3719 82nd Ave SE
Loading: ASCE 7-16	City: Mercer Island State: WA
Wood: NDS 2018	ZIP: 98040
Steel: AISC 360-16	Latitude: 47.5770 N
Concrete: ACI 318-14	Longitude: -122.2301 W
Masonry: TMS 402/602-16	Ground Elevation: 258 ft

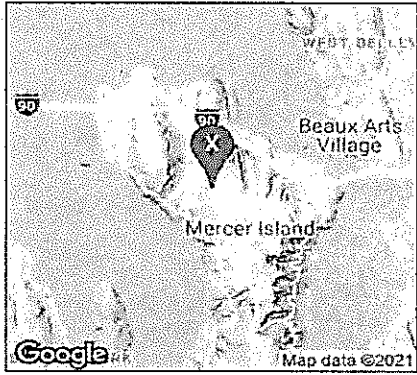
<b>Occupancy Category</b>	Risk Category: II	ASCE 7 Table 1.5-1
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**Seismic Load Summary:**

Analysis Procedure: Equivalent Lateral Force Procedure

Lateral System: Light-frame (wood) Walls Sheathed with Wood Structural Panels Rated for Shear Resistance

R = 6.50	C <sub>e</sub> = 4
Base Shear V = 3 kips	D <sub>w</sub> = 2.5
S <sub>s</sub> = 1.41	S <sub>r</sub> = 0.49
S <sub>DS</sub> = 1.00	S <sub>DI</sub> = 0.59
C <sub>s</sub> = 0.154	I <sub>E</sub> = 1.0



**Story Information**

# Stories Above Grade (Including Mezzanine Levels)	2
--	---

**Horizontal and Vertical Irregularities:**  
 Is the building a "Regular Structure"? (No horizontal or vertical irregularities)  Yes

**Wind Load Summary:**

V = 97	K <sub>z1</sub> = 1.30
Exposure = B	

**Dead Loads:**

Roof	Floor
Roofing: 2.5 psf	Finish Floor: 1 psf
1/2" Sheathing: 1.8 psf	3/4" Sheathing: 2.7 psf
Rafters @ 24" oc: 2.4 psf	Joists @ 16" oc: 2.2 psf
Misc./Mech.: 1.5 psf	Misc./Mech.: 1.3 psf
Ceiling Finish: 2.8 psf	Ceiling Finish: 2.8
Solar Panels: 4	Use: 10.0 psf
Use: 15.0 psf	Use: 10 psf
Use: 15 psf	

**Live Loads:**

Snow	25 psf
Floor	40 psf
Deck	60 psf

**Soils:** Soils Report Provided?  No To be approved by the authority having jurisdiction, per 11.8.2 exception.

Allowable Bearing: 1500 psf



Chitturi Addition \_\_\_\_\_  
 Criteria \_\_\_\_\_  
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# Seismic Design

ASCE 7-16 Seismic Analysis

Equivalent Lateral Force Procedure

Seismic Force Resisting System Per Table 12.2-1	System	Bearing Wall Systems
	Type:	Light-frame (wood) Walls Sheathed with Wood Structural Panels Rated for Shear Resistance

Seismic Design Cat.	D
Risk Category	II
Site Class	D (Default)
Diaphragm Flexibility	Flexible

I, II, or III, or IV per Table 1.5-1  
Assumed default soil properties, per 11.4.3.

### Section 12.8.1.3 Exceptions

Regular Structure	Yes
≤ 5 Stories above grade	Yes
$T \leq 0.5s$	Yes
$\rho = 1.0$	Yes
Not Site Class E or F	Yes
Risk Category I or II	Yes

If all exceptions are met,  $S_{DS}$  may be taken as 1, but not less than  $0.7 \times$  (Calculated  $S_{DS}$ )

$S_s$	1.41 g	2% in 50 yr, Latitude & Longitude lookup
$S_1$	0.49 g	2% in 50 yr, Latitude & Longitude lookup
R	6.50	
$C_d$	4.0	
$\Omega_o$	2.5	
$t_e$	1.00	Table 1.5-2
$h_n$	18.5 ft	
$C_t$	0.02	Table 12.8-2
x	0.75	Table 12.8-2
$T_a$	0.18 sec	
T	0.18 sec	Eq. 12.8-7
$T_o$	0.12 sec	
$T_s$	0.59 sec	
$T_L$	6.00 sec	
$F_a$	1.20	Table 11.4-1
$F_v$	1.81	Table 11.4-2
$S_{MS}$	1.69 g	Eq. 11.4-1
$S_{M1}$	0.89 g	Eq. 11.4-2
$S_{DS}$	1.000 g	Eq. 11.4-3
$S_{D1}$	0.591 g	Eq. 11.4-4
$C_s$	0.154 Controls	Eq. 12.8-2
	0.510	Eq. 12.8-3 need not exceed, $T < T_L$
	0.010	Eq. 12.8-5 or 12.8-6 minimum
$C_s$ , design	0.154	Section 11.4.8 Exception 2 Applied
Bldg. Weight	16.6 k	
$V = C_s W$	2.6 k	Eq. 12.8-1, Strength Level Base Shear
$V = C_{sASD} W$	1.8 k	Eq. 12.8-1 ASD Base Shear

Table 1.5-2

Table 12.8-2

Table 12.8-2

Eq. 12.8-7

Table 11.4-1

Table 11.4-2

Eq. 11.4-1

Eq. 11.4-2

Eq. 11.4-3

Eq. 11.4-4

Eq. 12.8-2

Eq. 12.8-3 need not exceed,  $T < T_L$

Eq. 12.8-5 or 12.8-6 minimum

Section 11.4.8 Exception 2 Applied

Building Period Per Alternate Analysis

T (sec)	
---------	--

Per Geotech Report

$F_a$	
$F_v$	

$$T_a = C_t h_n^x \quad \text{Eq. 12.8.7}$$

$$S_{MS} = F_a S_s \quad \text{Eq. 11.4-1}$$

$$S_{M1} = F_v S_1 \quad \text{Eq. 11.4-2}$$

$$S_{DS} = 2/3 S_{MS} \quad \text{Eq. 11.4-3}$$

$$S_{D1} = 2/3 S_{M1} \quad \text{Eq. 11.4-4}$$

$$C_s = \frac{S_{DS}}{(R/I_e)} \quad \text{Eq. 12.8-2}$$

$$C_s = \frac{S_{D1}}{T(R/I_e)} \quad \text{Eq. 12.8-3}$$

$$C_s = \frac{S_{D1} T_L}{T^2 (R/I_e)} \quad \text{Eq. 12.8-4}$$

$$C_s \geq 0.044 S_{DS} I_e \quad \text{Eq. 12.8-5}$$

$$C_s \geq 0.01 \quad \text{Eq. 12.8-5}$$

$$C_{VX} = w_x h_x^k / \sum_{i=1}^n w_x h_i^k \quad \text{Eq. 12.8-12}$$

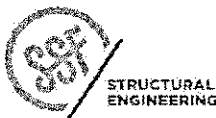
$$F_{px} = \frac{\sum_{i=x}^n F_i}{\sum_{i=x}^n w_i} W_{px} \quad \text{Eq. 12.10-1}$$

$$F_{px} \geq 0.2 S_{DS} I_e W_{px} \quad \text{Eq. 12.10-2}$$

$$F_{px} \leq 0.4 S_{DS} I_e W_{px} \quad \text{Eq. 12.10-3}$$

Vertical Distribution ASD  $\rho = 11$   $k = 1.000$

Level	$h_x$ (ft)	$W_x$ (k)	$h_x^k$ (ft)	$W_x h_x^k$	Story Shear ASD			Diaphragm Force ( $\rho$ not included)				
					$C_{vx}$ (%)	$F_x$ (k)	SV (k)	$F_{px,calc}$	$F_{px,min}$	$F_{px,max}$	$F_{px,design}$	$\gamma = F_{px}/F_x$
Roof Add	18.5	7.64	18.5	141	0.637	1.1	1.1	1.1	1.1	2.1	1.1	1.00
2nd Add	9.0	9	9.0	81	0.363	0.6	1.8	1.0	1.3	2.5	1.3	1.93
$\Sigma$		16.6		222		1.8						



Chitturi Addition \_\_\_\_\_  
 Seismic Criteria \_\_\_\_\_  
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# Wind Design - MWFRS

ASCE 7 Chapter 27 - Directional Procedure

Design Method	ASDASD
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## Wind Coefficients

Exposure	BB
V	97 mph
$K_e$	0.85 Table 26.6-1
$K_{zt}$	0.61 Table 26.10-1
$K_d$	0.99 Table 26.9-1
G	0.85 26.9.4

## Transverse Wind Pressures

L/B = 0.68 h/L = 0.36

Pressure Coefficients from Figure 27.3-1:

Bldg Face	$C_p$
Windward Wall	0.8
Leeward Wall	-0.50
Windward Roof	-0.44 / 0.03
Leeward Roof	-0.56

## Location and Building Dimensions

Calculate $K_{zt}$ ?	No
$K_{zt}$	1.30
Roof Type	Hip
Roof Angle - Transverse Dir	18 degrees
Roof Angle - Long Dir	18 degrees
Ground to top of roof	21 ft
Bot of roof to top of roof	5 ft
Mean Roof Height, h	18.5 ft
Short Plan Dimension	51 ft
Long Plan Dimension	75.5 ft
Parapet?	No

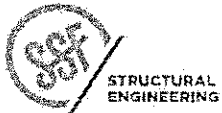
Velocity Pressure at Mean Roof Height, $q_h$	16.1 psf
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## Wall Pressures (Unfactored):

Ht	$K_z$	$q_z$	ASD		
			$P_{ww, walls}$	$P_{lw, walls}$	$P_{walls}$ (psf)
0-15	0.57	15.03	10.22	6.84	10.2
15-20	0.62	16.35	11.12	6.84	10.8
20-25	0.66	17.40	11.83	6.84	11.2
25-30	0.7	18.46	12.55	6.84	11.6
30-40	0.76	20.04	13.63	6.84	12.3
41-50	0.81	21.36	14.52	6.84	12.8
51-60	0.85	22.41	15.24	6.84	13.2
61-70	0.89	23.47	15.96	6.84	13.7
71-80	0.93	24.52	16.68	6.84	14.1
81-90	0.96	25.31	17.21	6.84	14.4
91-100	0.99	26.11	17.75	6.84	14.8

## Roof Pressures (Unfactored)

Windward		Leeward	ASD	
Max	Min		Horiz Proj (psf)	
0.5	-6.1	-7.7	4.80	



Chitturi Addition \_\_\_\_\_  
 Wind Criteria \_\_\_\_\_  
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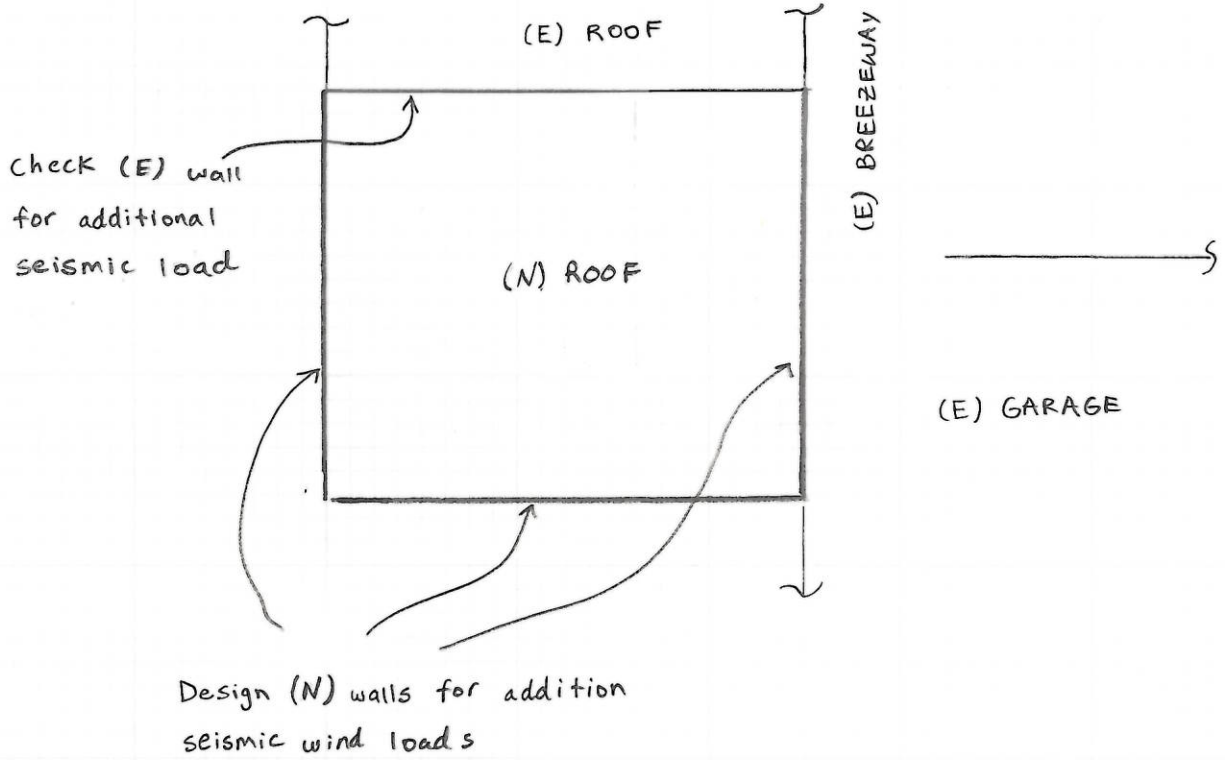
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# LATERAL SCOPE

AT ROOF LEVEL:



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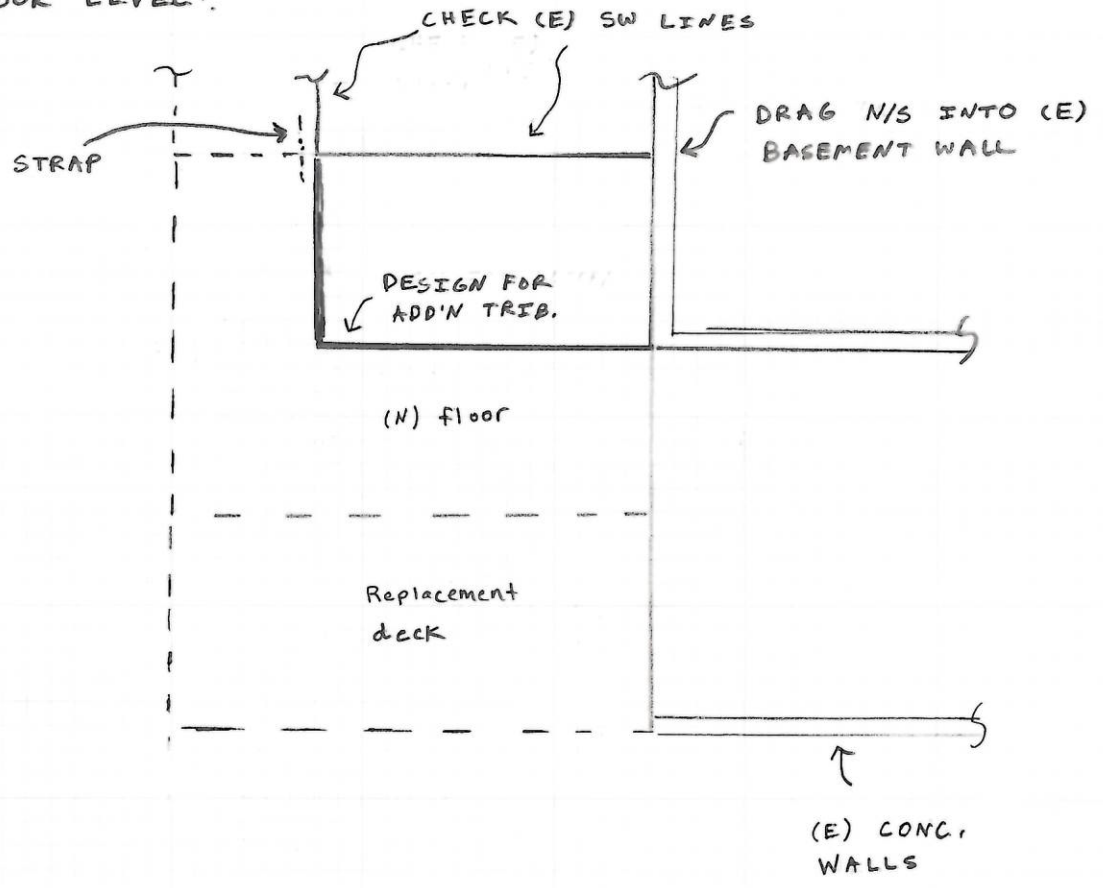
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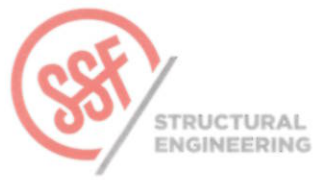
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# LATERAL SCOPE

AT FLOOR LEVEL:



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# LATERAL DESIGN

## SEISMIC WEIGHT

$$DL_{ROOF} = 15 \text{ psf}$$

$$DL_{FLOOR/DECK} = 10 \text{ psf}$$

$$DL_{PARTITIONS} = 5 \text{ psf @ roof level} \\ 10 \text{ psf @ floor level}$$

ADDITION (i.e. new construction) SEISMIC WT:

$$W_{ROOF} = 382 \text{ ft} \times (15 \text{ psf roof} + 5 \text{ psf part.}) \\ = 7640 \text{ \#}$$

$$W_{2ND} = 350 \text{ ft} \times (10 \text{ psf floor} + 10 \text{ psf part.}) \\ + 196 \text{ ft} \times 10 \text{ psf deck} \\ = 8960 \text{ \#}$$

SEE PAGE 2 FOR SEISMIC PARAMETERS AND VERT. DIST

$$V_{ADDTN} = 1.8 \text{ K ASD}$$

## WIND PRESSURES

SIMPLIFY W/ TRANSVERSE (WORST CASE) WALL WIND PRESSURES

$$W_{N/S, ROOF} = 4.5' \text{ wall average} \times 10.8 \text{ psf} = 49 \text{ pif ASD}$$

$$W_{N/S, FLOOR} = (4.5' \text{ wall average} + 1' \text{ diaph.}) \times 10.2 \text{ psf} = 56 \text{ pif ASD}$$

$$W_{E/W, ROOF} = 3.5' \text{ wall} \times 10.8 \text{ psf} + 5' \times 4.8 \text{ psf roof} = 62 \text{ pif ASD}$$

$$W_{E/W, FLOOR} = (3.5' \text{ wall} + 1' \text{ diaph.}) \times 10.2 \text{ psf} = 46 \text{ pif ASD}$$



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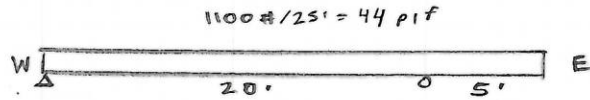


# LATERAL DESIGN

## ROOF SHEARWALLS

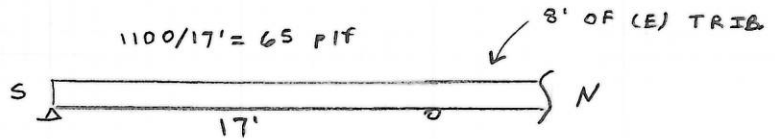
SEE PG. L1 FOR IMAGE OF WALLS BEING CHECKED

### N/S SHEARWALLS:



LOAD	440	660
LENGTH	6.5'	5.75'
SHEAR	68	115
WALL	W6	W6
OT	475	800
HD	CS16	CS16

### E/W SHEARWALLS:



LOAD	555	1075
LENGTH	4.75'	10'
SHEAR	117	108
WALL	W6	(E) GYP. WALL = 145 pif
OT	850	500
HD	CS16	—



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DESIGN L5

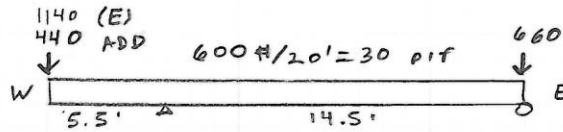
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# LATERAL DESIGN

## FLOOR SHEARWALLS

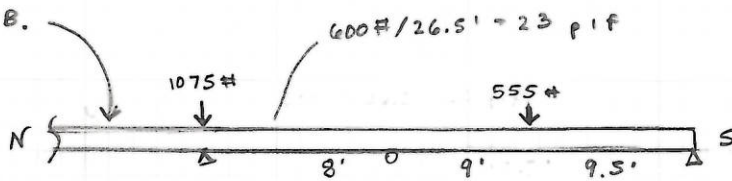
SEE PG. L2 FOR IMAGE OF WALLS BEING CHECKED

N/S SHEARWALLS:



LOAD	2600	250
LENGTH	23.5	16'
SHEAR	111	16
WALL	(E) gyp.	(E) CONC.
OT	-	-
HD	-	-

E/W SHEARWALLS:



LOAD	1090	965	370
LENGTH	8.75'	14'	23'
SHEAR	125	69	16
WALL	(E) gyp.	W6	(E) CONC.
OT	-	550	-
HD	-	HOUZ	-



CHITTURI ADDITION

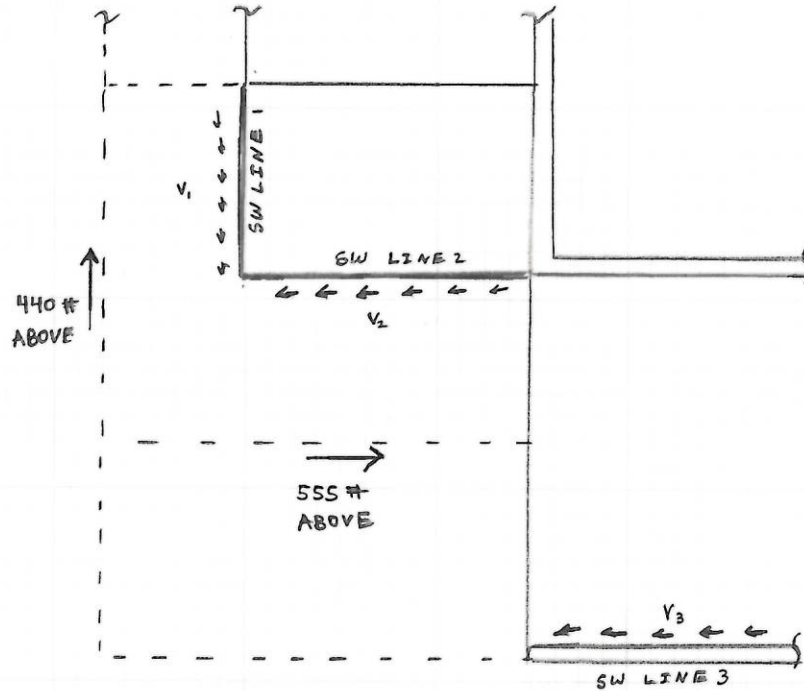
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# LATERAL DESIGN

## OFFSET SWS

CHECK DIAPH FOR SHEAR TRANSFER



$$V_1 = 600 \# / 8' = 75 \text{ pif}$$

$$V_2 = 610 \# / 14' = 44 \text{ pif}$$

$$V_{ALL} = 180 \times 0.93 \text{ HF} = 167 \text{ pif ASD}$$



CHITTURI RESIDENCE

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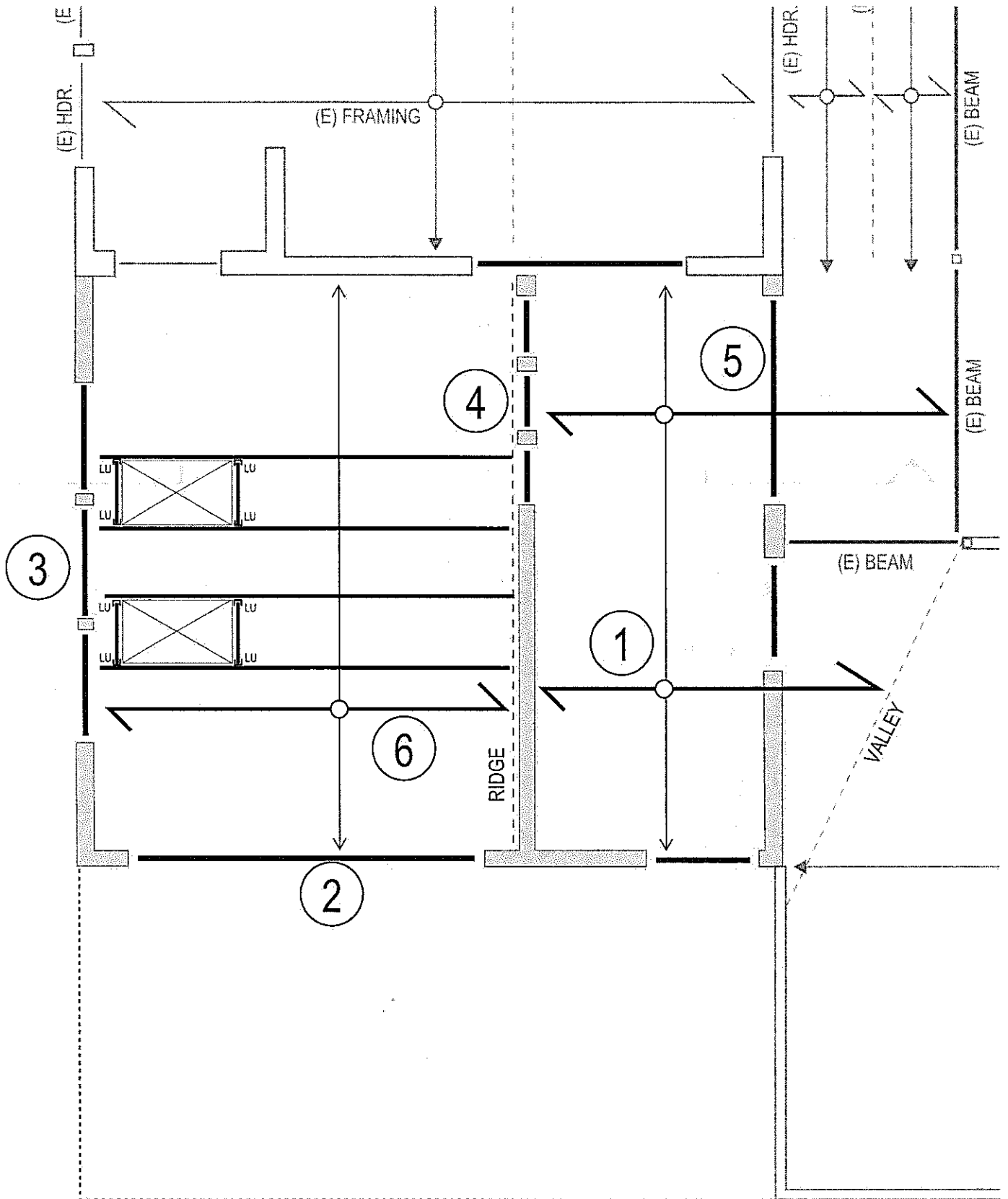
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# Roof Framing Key Plan



ROOF FRAMING PLAN

SCALE: 1/2" = 1'-0"



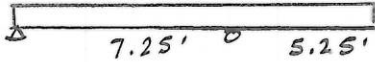
# VERTICAL FRAMING

## ROOF FRAMING

$$D = 15 \text{ psf} \quad S = 25 \text{ psf}$$

$$TL = 40 \text{ psf}$$

① 2x12 @ 24" OC



$$W = 2' \times 40 \text{ psf} = 80 \text{ plf}$$

$$M = 1103 \text{ #-FT}$$

$$R_1 = 138 \text{ #}$$

$$R_2 = 862 \text{ #}$$

$$f_b = 418 \text{ psi}$$

$$f_v = 39 \text{ psi}$$

$$\Delta = 0.11", L/1131$$

③ (2) 2x8 HF #2

$$L = 3.25'$$

$$W = 7' \times 40 \text{ psf} = 280 \text{ plf}$$

$$M = 370 \text{ #-FT}$$

$$R = 455 \text{ #}$$

$$f_b = 169 \text{ psi}$$

$$f_v = 31 \text{ psi}$$

$$\Delta = 0.01"$$

② (2) 2x8 HF #2

$$L = 10.5'$$

$$W = 2' \times 40 \text{ psf} = 80 \text{ plf}$$

$$M = 1103 \text{ #-FT}$$

$$R = 420 \text{ #}$$

$$f_b = 503 \text{ psi}$$

$$f_v = 30 \text{ psi}$$

$$\Delta = 0.18", L/713$$

④ (2) 2x8 HF #2

$$L = 2'$$

$$W = 10' \times 40 \text{ psf} = 400 \text{ plf}$$

$$M = 200 \text{ #-FT}$$

$$R = 400 \text{ #}$$

$$f_b = 91 \text{ psi}$$

$$f_v = 28 \text{ psi}$$

$$\Delta = 0"$$



CHITTURI ADDITION

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V2

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# VERTICAL FRAMING

## ROOF FRAMING (CONT.)

⑤ (2) 2x8 HF #2

$$L = 6'$$

$$W = 6.5' \times 40 \text{ psf} = 260 \text{ plf}$$

$$M = 1170 \text{ #-FT}$$

$$R = 780 \text{ \#}$$

$$f_b = 534 \text{ psi}$$

$$f_v = 54 \text{ psi}$$

$$A = 0.06", L/1176$$

⑥ 2x12 @ 24" oc

$$L = 13'$$

$$W = 2' \times 40 \text{ psf} = 80 \text{ plf}$$

$$M = 1690 \text{ #-FT}$$

$$R = 520 \text{ \#}$$

$$f_b = 641 \text{ psi}$$

$$f_v = 46 \text{ psi}$$

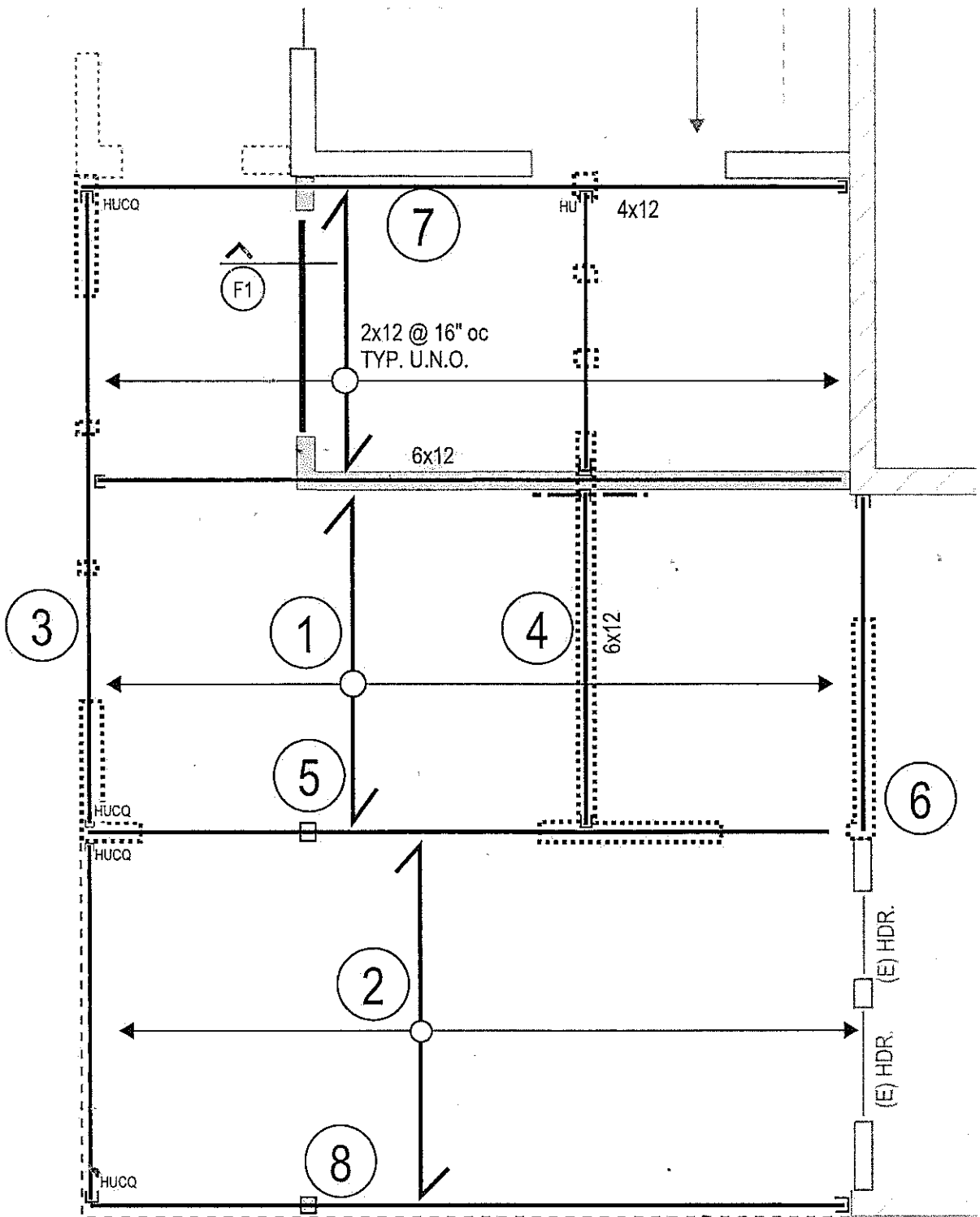
$$A = 0.15", L/1050$$



PROJECT CHITTURI ADDITION

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# 2nd Floor Framing Key Plan



MAIN FLOOR FRAMING PLAN

SCALE: 1/2" = 1'-0"





# VERTICAL FRAMING

## 2ND FLOOR FRAMING

D = 10 psf    L = 40 psf    L<sub>DECK</sub> = 60 psf

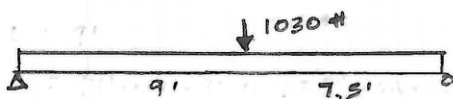
① 2x12 HF #2 @ 16" oc

$L = 9'$   
 $W = 50 \text{ psf} \times 1.33' = 67 \text{ plf}$   
 $M = 678 \text{ #-FT}$   
 $R = 302 \text{ \#}$   
 $f_b = 257 \text{ psi}$   
 $f_v = 27 \text{ psi}$   
 $\Delta = 0.04", L/2526$

② 2x10 HF #2 @ 16"

$L = 10'$   
 $W = 70 \text{ psf} \times 1.33' = 93 \text{ plf}$   
 $M = 1163 \text{ #-FT}$   
 $R = 465 \text{ \#}$   
 $f_b = 652 \text{ psi}$   
 $f_v = 50 \text{ psi}$   
 $\Delta = 0.16", L/738$

③ 6x12 DF #1



$W = 6.5' \times 40 \text{ psf} = 260 \text{ plf}$   
 $M = 13.0 \text{ K-FT}$   
 $R_1 = 2613 \text{ \#}$   
 $R_2 = 2707 \text{ \#}$   
 $f_b = 1285 \text{ psi}$   
 $f_v = 64 \text{ psi}$   
 $\Delta = 0.43", L/461$

④ 4x12 DF #1

$L = 9'$   
 $W = 10' \text{ roof} \times 40 \text{ psf} +$   
 $12' \text{ wall} \times 10 \text{ psf}$   
 $= 520 \text{ plf}$   
 $M = 5265 \text{ #-FT}$   
 $R = 2340 \text{ \#}$   
 $f_b = 856 \text{ psi}$   
 $f_v = 89 \text{ psi}$   
 $\Delta = 0.11", L/993$



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T&V

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V5

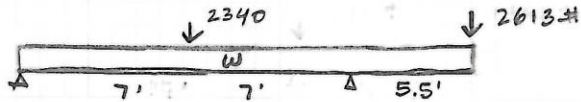
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# VERTICAL FRAMING

## 2ND FLOOR FRAMING (CONT.)

⑤ PSL 5 1/4 x 11 1/4



$$w = 5' \times 70 \text{ psf} + 4.5' \times 50 \text{ psf} = 575 \text{ plf}$$

$$M = 23.1 \text{ K-FT}$$

$$R_1 = 3.5 \text{ K}$$

$$R_2 = 12.6 \text{ K}$$

$$f_b = 2499 \text{ psi}$$

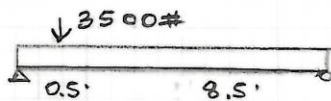
$$f_v = 173 \text{ psi}$$

$$A = 0.39", \text{ L/336}$$

3'-0" SQ. FTG.

$$R_{ALL} = 9 \text{ FT}^2 \times 1500 \text{ psf} = 13500 \#$$

⑥ 6x10 DF #1



$$w = 8.5' \text{ wall} \times 12 \text{ psf} + \frac{862\# \text{ rafter}}{2'} = 533 \text{ plf}$$

$$M = 6.3 \text{ K-FT}$$

$$R_1 = 5.7 \text{ K}$$

$$R_2 = 2.6 \text{ K}$$

$$f_b = 915 \text{ psi}$$

$$f_v = 164 \text{ psi}$$

$$A = 0.15", \text{ L/722}$$



CHITTURI ADDITION

PROJECT

10/21

DATE

PROJ. #

TCW

DESIGN

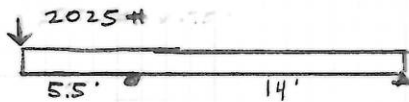
V6

SHEET

# VERTICAL FRAMING

## 2ND FLOOR FRAMING (CONT.)

⑦ 6x12 DF #1



$$w = 4' \times 50 \text{ psf} = 200 \text{ plf}$$

$$M = 14.1 \text{ K-FT}$$

$$R_1 = 5.5 \text{ K}$$

$$R_2 = 0.4 \text{ K}$$

$$f_b = 1465 \text{ psi}$$

$$f_v = 76 \text{ psi}$$

$$\Delta = 0.49", L/267$$

⑧ 6x10 DF #1



$$w = 5' \times 70 \text{ psf} = 350 \text{ plf}$$

$$M = 6300 \text{ #-FT}$$

$$R_1 = 5000 \text{ #}$$

$$R_2 = 2000 \text{ #}$$

$$f_b = 914 \text{ psi}$$

$$f_v = 83 \text{ psi}$$

$$\Delta = 0.27", L/617$$

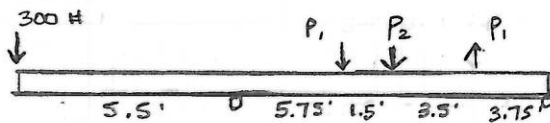
# CHITTURI FRAMING

## TRANSFER BEAM - LATERAL (5)

CHECK PSL 5'1/4 x 11'1/4 @ 2ND FLOOR  
FOR HD FORCE W/  $\lambda = 2.5$

$$1.14D + 2.5 \times (0.7 \times E)$$

PSL 5'1/4 x 11'1/4



$$W = 1.14 \times 5' \times 10 \text{ psf} = 57 \text{ plf}$$

$$P_1 = 2.5 \times 850 \# E = 2125 \# E$$

$$P_2 = 1665 \text{ DL}$$

$$M = 8900 \# \cdot \text{ft}$$

$$R_1 = 2765 \#$$

$$R_2 = 340 \#$$

$$f_b = 965 \text{ psi}$$

$$f_v = 57 \text{ psi}$$

$$\Delta = 0.19", L/906$$



PROJECT CHITTURI RESIDENCE

DATE 11/21

PROJ # TCV

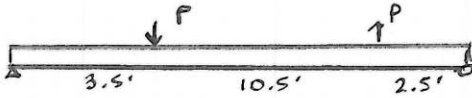
DESIGN V8

SHEET

# VERTICAL FRAMING

## TRANSFER BEAMS - LATERAL (3)

PSL 5'4" x 11'4"



$$P = 2.5 \times 475 = 1190 \# \text{ ASD } (\alpha = 2.5)$$

$$W = 6.5' \times 15 \text{ psf roof} \times 1.14 = 111 \text{ plf}$$

$$M = 5216 \# \text{-FT}$$

$$R_1 = 1673 \#$$

$$R_2 = 158 \#$$

$$f_b = 565 \text{ psi}$$

$$f_v = 42 \text{ psi}$$

$$\Delta = 0.18", 4/1127$$



PROJECT CHITTURI RESIDENCE

DATE 1/21

PROJ # TCV

DESIGN V9

SHEET