

PRRNSF20251517

These calculations must be on site and made available by the Permittee for all inspections.

STRUCTURAL CALCULATIONS

FOR THE

HOUT RESIDENTIAL PROJECT

Plan L2-2673-2

August 6, 2024



Job No: 08-018
Location: 921 - 9th Street SW
Puyallup, Washington

SEGA Engineers
Structural & Civil Consulting Engineers

22939 SE 292nd PL
Black Diamond, WA 98010

(360) 886-1017

STATEMENT OF WORK

SEGA Engineers was asked to provide a lateral loads analysis, shear wall design, review of major framing members and foundation, and drawing red-lines for a two-story wood framed single family residence. The roof framing is manufactured trusses, the floor framing is 2x dimensional or open-web trusses, and the foundation is typical concrete strip footings with a crawl space.

The application and use of these calculations is limited to a single site referenced on the cover sheet. The cover sheet should have an original signature in blue ink over the seal. The attached calculations may or may not apply to other sites and the contractor assumes all responsibility and liability for sites not expressly reviewed and approved. Please contact SEGA Engineers for use at other sites.

SEGA Engineers will use that degree of care and skill ordinarily exercised under similar circumstances by members of the engineering profession in this local. No other warranty, either expressed or implied is made in connection with our rendering of professional services. For any dispute, claim, or action arising out of this design, SEGA Engineers shall have liability limited to the amount of the total fee received by SEGA Engineers.

Questions regarding the attached should be addressed to SEGA Engineers.

Greg Thesenvitz, PE/SE
SEGA Engineers

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Structural & Civil Consulting Engineers

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Project L22673

Job No. 08-018 By: GAT

Checked Date: 09/06/24 Sht 1

Design Criteria

International Building Code (IBC), 2021

LOADS

Roof

DL	15 psf
LL	25 psf

Floor

DL	12 psf
LL	40 psf
LL (Deck)	60 psf

Wind

Risk Category	II	
Design Wind Speed	110 mph	(V_{ult})
K_{zt}	1.00	
Exposure	B	

Seismic

Design Category	D
S_{DS}	1.00
Response Factor	6.5
	$C_S = 0.154$
Importance Factor	1.00

Soil

Allowable Bearing	1,500 psf
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LOADS

ROOF

DL	Roofing (Comp)	3.5 psf	
	1/2" OSB	1.8	
	2 x @ 24"	3.5	
	Insulation	1.1	
	5/8" GWB	2.8	
	Misc.	1.5	
		<u>14.2 psf</u>	
LL	Snow, P _f	25 psf	(115% Load Duration)
	Reduction, C _s	0.00	(C _t = 1.1, other surfaces)
	6/12 pitch = 27 deg		
	<u>Total Roof Load</u>		<u>39.2 psf</u>

FLOOR

DL	Flooring	0.5 psf	
	3/4" Plywood	2.3	
	FT @ 24" o.c.	3.3	
	5/8" GWB	2.8	
	Misc.	1.5	
		<u>10.4 psf</u>	
LL	Residential	<u>40 psf</u>	
	<u>Total Floor Load</u>		<u>50.4 psf</u>

DECKS

DL	2 x Decking	4.3 psf	
	2 x 10 @ 16" oc	2.8	
	Misc	1.5	
		<u>8.6</u>	
LL	Residential	<u>60 psf</u>	
	<u>Total Deck Load</u>		<u>68.6 psf</u>

WALLS

DL	Siding	3.5	
	1/2" Plywood	1.5 psf	
	2 x 6 @ 16" oc	1.7	
	Insul	0.6	
	1/2" GWB	2.2	
		<u>9.5 psf</u>	

FRAMING - UPPER FLOOR

FLOOR Bm e COVERED PATIO

$l = 10.5 \text{ FT}$

$w = \left(\frac{10}{2}\right)(55 \text{ pcf}) + 100 \text{ pcf} + \left(\frac{40}{2}\right)(45 \text{ pcf}) = 1,275 \text{ plf}$

$M = \frac{(1.28 \text{ k/ft})(10.5')^2}{8} = 17.6 \text{ kft}$

5/2 x 10.5 GLB ←

$V = \frac{10.5'}{2} (1.28 \text{ k/ft}) = 6.7 \text{ k} / 1.15 = 5.8 \text{ k}$

OK

$\frac{EI}{1240} = 0.45 (1.28 \text{ k/ft}) (10.5')^3 = 607 \times 10^3 \text{ k.in}^2$

OK

Hall e Nook

$l = 8 \text{ FT}$

$w = 1,275 \text{ plf}$

$M = \frac{(1.28 \text{ k/ft})(8')^2}{8} = 10.2 \text{ kft}$

3/2 x 10.5 GLB

$V = \frac{8}{2} (1.28 \text{ k/ft}) = 5.1 \text{ k} / 1.15 = 4.5 \text{ k}$

3/2 x 12 ←

$\frac{EI}{1240} = 0.45 (1.28 \text{ k/ft}) (8')^3 = 295 \times 10^3 \text{ k.in}^2$

OK

FLOOR Bm e Nook / KITCHEN

$l = 12.5 \text{ FT}$

$w = \left(\frac{12' + 10'}{2}\right)(55 \text{ pcf}) = 605 \text{ pcf}$

$M = \frac{(0.61 \text{ k/ft})(12.5')^2}{8} = 11.9 \text{ kft}$

3/2 x 10.5 GLB | ←
 3/2 x 11 7/8 LVL

$V = \frac{12.5'}{2} (0.61 \text{ k/ft}) = 3.8 \text{ k}$

OK

$\frac{EI}{1240} = 0.45 (0.61 \text{ k/ft}) (12.5')^3 = 536 \times 10^3 \text{ k.in}^2$

OK

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PROJECT L2-2673 - SL

JOB NO. DB-018 FIGURED BY GAT

CHECKED BY _____ DATE 09/09/24 SHEET 4 OF _____

FRAMING UPPER FLOOR

FLOOR Bm & GARAGE

$l = 20.5'$

$w_1 = \left(\frac{17+2}{2}\right)(5.5') = 52.5'$

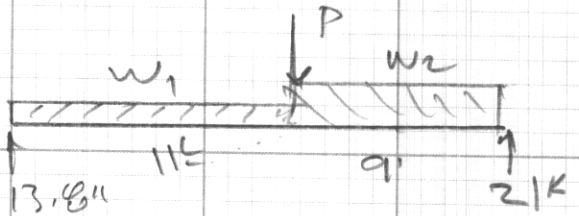
$P = \left(\frac{40+2}{2}\right)(4.5')\left(\frac{30}{2}\right) = 14,175'$

$w_2 = \left(\frac{17}{2}\right)(5.5') + 1000' + \left(\frac{40+6}{2}\right)(4.5') = 1,605'$

$M = (9') (21k) - (9') (1,605') \left(\frac{9}{2}\right) = 172 \text{ ft}^2 / 11.5 = 1000'$

$V = 21k - \frac{24}{12} (1,605') = 17,08' / 11.5 = 15.5'$

$E_p = 0.45 (20.6') (20.5')^2 + 0.65 (4.2') (20.5')^2 = 7,151 + 1021 = 8172'$



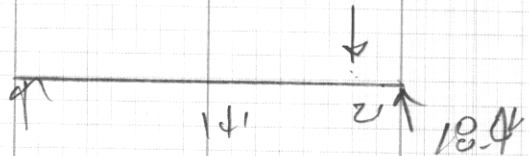
FLOOR & GARAGE

$l = 12'$

$P = 21k$

$M = (21') (18.4k) = 36.84'$

$V = 21k / 11.5 = 18.3k$



5'14" x 8 WFL

SEGA Engineers

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Project Typical Ftg

Job No. By: GAT

Checked Date: 12/03/15 Sht. 5

Square Footing Design

Ftg 42 x 42

Design Parameters

$$f'_c = 2,500 \text{ psi} \quad F_y = 40,000 \text{ psi} \quad \text{All. } q = 1,500 \text{ psf}$$

$$b = 6.0 \text{ in} \quad \text{- short side of column}$$

$$d = 6.0 \text{ in} \quad \text{- long side of column}$$

Loads:

$$\text{Col DL} = 3.2 \text{ kip} \quad (\text{Service Load})$$

$$\text{Col LL} = 12.8 \text{ kip} \quad (\text{Service Load})$$

$$\text{Floor LL} = 0 \text{ psf}$$

$$\text{Overburden} = 0.0 \text{ in} \quad (120 \text{ pcf assumed})$$

$$\text{Slab Thick.} = 0.0 \text{ in} \quad (150 \text{ pcf assumed})$$

Size and Footing Pressure

$$h = 8.0 \text{ in}$$

← Ftg. Thickness

$$q_n = 1.40 \text{ ksf}$$

$$\text{Req'd Area} = 11.43 \text{ ft}^2$$

$$\text{Try } \underline{3.40 \text{ ft} \times 3.40 \text{ ft}}$$

← Min. Ftg. Size

$$\text{Factored Net Soil Pressure} = \underline{2.13 \text{ ksf}} \quad (1.2D + 1.6L)$$

Check for Two-Way Shear

$$\text{Avg } d = 4.00 \text{ in}$$

$$V_u = 22.84 \text{ kips}$$

$$b_o = 40.00 \text{ in} \quad (\text{Critical Shear Perimeter})$$

$$B_c = 1 \quad (\text{Long Side/Short Side of Column})$$

$$\phi V_c = 27.20 \text{ kips}$$

$$\underline{\phi V_c} > V_u \quad \underline{\underline{\text{OK}}}$$

Check for One-Way Shear

$$V_u = 8.079 \text{ kips}$$

$$\phi V_c = 13.87 \text{ kips}$$

$$\underline{\phi V_c} > V_u \quad \underline{\underline{\text{OK}}}$$

Design Reinforcement

$$M_u = 7.61 \text{ kip-ft}$$

$$A_s = \underline{0.70 \text{ in}^2}$$

$$a = 0.32 \text{ in}$$

$$\phi M_n = 7.62 \text{ kip-ft}$$

Use (4) - # 4 bars EW
0.79 in² ← Reinforcement

$$\underline{\phi M_n} > M_u \quad \underline{\underline{\text{OK}}}$$

$$\underline{A_s \text{ min}} = \underline{0.59 \text{ in}^2} \quad \underline{\underline{\text{OK}}}$$

LATERAL LOADS - (Alternate ASD)

SEISMIC

$$\text{Maximum Base Shear, } V = \frac{F S_{DS} W}{R} \quad \text{Eq. 12.14-11}$$

where,

$F = 1.1$ Two-Story Building
 $S_{DS} = 1.00$ $S_s = 1.5$ $F_a = 1.00$ (Table 11.4-1, $S_s > 1.25$)
 $R = 6.5$ Table 12.14-1
 $W =$ Seismic Weight

For W:

$$W_{\text{roof}} = (40 \text{ ft}) (39 \text{ ft}) (16 \text{ psf}) + (2) (40 \text{ ft} + 39 \text{ ft}) (4.0 \text{ ft}) (9.5 \text{ psf}) = 31 \text{ kips}$$

$$W_{\text{floor}} = (40 \text{ ft}) (43 \text{ ft}) (14 \text{ psf}) + (2) (40 \text{ ft} + 43 \text{ ft}) (8.5 \text{ ft}) (9.5 \text{ psf}) = 37 \text{ kips}$$

$$W_{\text{total}} = \underline{\underline{68 \text{ kips}}}$$

$$\text{Design Base Shear, } V = (.169) (68 \text{ kip}) = \underline{11.6 \text{ kip}}$$

$$E = \frac{11.6 \text{ kip}}{1.4} = \underline{\underline{8.3 \text{ kip}}}$$

WIND

$$\text{Design Wind Pressure, } p_s = \lambda K_{zt} P_{s30} \quad \text{Eq. 28.6-1, Sect. 28.6.3}$$

where,

$\lambda = 1.00$ 0 - 15 ft Exposure B Figure 28.6-1
 $= 1.00$ 20 ft
 $= 1.00$ 25 ft
 $= 1.00$ 30 ft
 $= 1.05$ 35 ft

$K_{zt} = 1.00$ Section 26.8

$P_{30} = 17.7 \text{ psf}$ 110 mph Figure 28.6-1 (ASD)

$$P_{0-15} = (1.00) (1.00) (17.7 \text{ psf}) = 17.70 \text{ psf} \quad (\times 0.6 = 10.62 \text{ psf})$$

$$P_{20} = (1.00) (1.00) (17.7 \text{ psf}) = 17.70 \text{ psf} \quad (\times 0.6 = 10.62 \text{ psf})$$

$$P_{25} = (1.00) (1.00) (17.7 \text{ psf}) = 17.70 \text{ psf} \quad (\times 0.6 = 10.62 \text{ psf})$$

$$P_{30} = (1.00) (1.00) (17.7 \text{ psf}) = 17.70 \text{ psf} \quad (\times 0.6 = 10.62 \text{ psf})$$

$$P_{35} = (1.05) (1.00) (17.7 \text{ psf}) = 18.59 \text{ psf} \quad (\times 0.6 = 11.15 \text{ psf})$$

Design Base Shear: (Wind)

$$V_{fb} = (40 \text{ ft}) (10 \text{ ft}) (17.7 \text{ psf}) + (40 \text{ ft}) (5 \text{ ft}) (17.7 \text{ psf})$$

$$+ (40 \text{ ft}) (5 \text{ ft}) (17.7 \text{ psf}) + (40 \text{ ft}) (5 \text{ ft}) (17.7 \text{ psf})$$

$$+ (40 \text{ ft}) (1 \text{ ft}) (18.6 \text{ psf}) = 18.4 \times 0.6 = \underline{11.1 \text{ kips}}$$

$$V_{ss} = (48 \text{ ft}) (10 \text{ ft}) (17.7 \text{ psf}) + (48 \text{ ft}) (5 \text{ ft}) (17.7 \text{ psf})$$

$$+ (42 \text{ ft}) (5 \text{ ft}) (17.7 \text{ psf}) + (29 \text{ ft}) (5 \text{ ft}) (17.7 \text{ psf})$$

$$+ (4 \text{ ft}) (1 \text{ ft}) (18.6 \text{ psf}) + = 19.1 \times 0.6 = \underline{\underline{11.5 \text{ kips}}}$$

Therefore,

Wind Loads Govern for Lateral Design - Front/Back
Wind Loads Govern for Lateral Design - Side/Side

SHEAR WALL DESIGN

SHEAR WALL #1

Roof: $(\frac{40}{2})[(11)(10.6^{2.5}) + (5')(10.6^{2.5}) + (5')(10.6^{2.5}) + (5')(10.6^{2.5})] = 3,404^k$

$l = 19' + 4.5' + 14.5' = 38'$

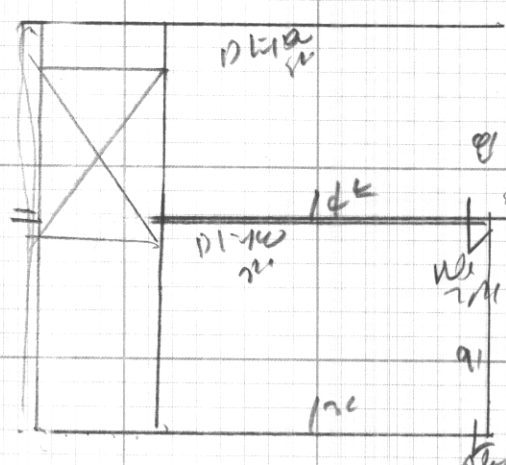
$g = 3,404^k / 38' = 90^k$ ▲

Floor:

$V_F = 3,404^k + (\frac{19}{2})(10)(10.6^{2.5}) = 4,815^k$

$l = 12' + 12.5' + 13.5' = 38'$

$g = 4,815^k / 38' = 127^k$ ▲



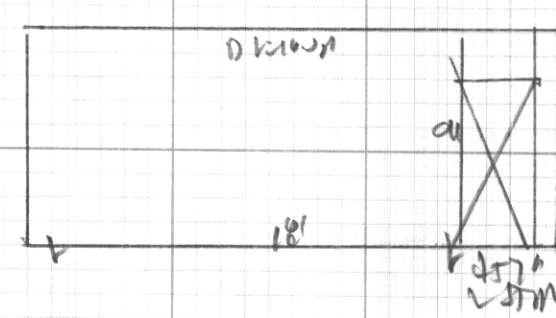
SHEAR WALL #2

Floor:

$V_F = (\frac{19' + 21'}{2})(10)(10.6^{2.5}) = 2,120^k$

$l = 18'$

$g = 2,120^k / 18' = 118^k$ ▲



SHEAR WALL #3

Roof: $V_F = 3,404^k$

$l = 10.5' + 8.5' + 13.5' = 32.5'$

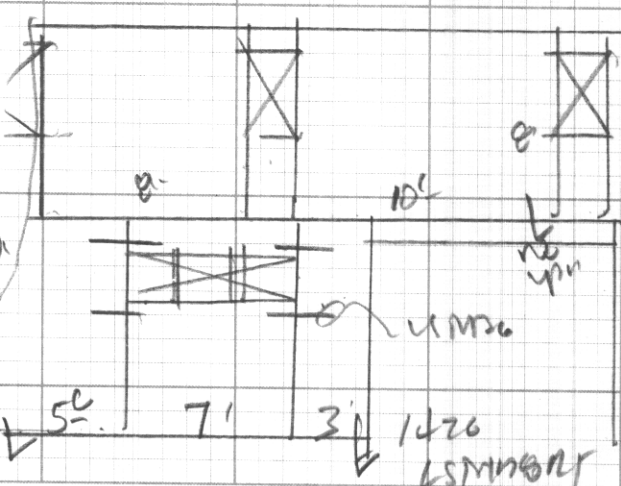
$g = 3,404^k / 32.5' = 105^k$ ▲

Floor:

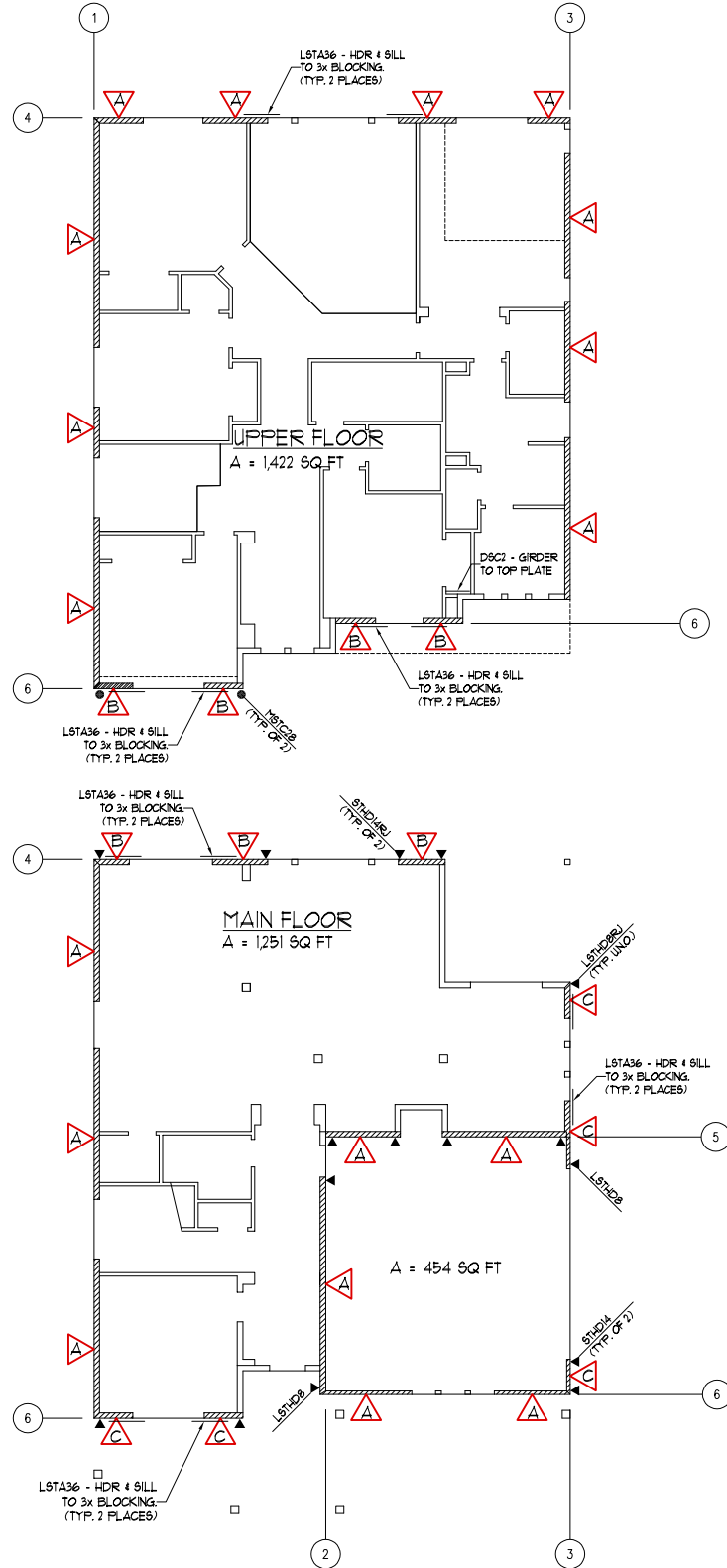
$V_F = 3,404^k + (\frac{21}{2})(10)(10.6^{2.5}) = 4,517^k$

$l = 3' + 5.5' + 3' = 11.5'$

$g = 4,517^k / 11.5' = 393^k$ ▲



SHEAR WALL KEY PLAN



SHEAR WALL SCHEDULE

Mark	Minimum Sheathing (1)	Sheathing Nailing (1)	Anchor Bolts (3)	Remarks (4)
▶	1/2" OSB or CDX	8d @ 6" o.c.	5/8" @ 60" o.c.	Qall = 230 plf
▶	1/2" OSB or CDX	8d @ 4" o.c.	5/8" @ 32" o.c.	Qall = 350 plf
▶	1/2" OSB or CDX	8d @ 3" o.c.	5/8" @ 16" o.c.	Qall = 450 plf Use minimum 3x studs at abutting panel edges and stagger nails.
▶	See Detail 12/S2.0 for Construction			

Notes:

- 1) All walls designated "▶" are shear walls. Exterior walls shall be sheathed with rated sheathing (24/0, OSB or CDX) and nailed at all panel edges (Blocked) per schedule (uno). Nailing at intermediate framing to be at 12" oc. Nailing not called out shall be per IBC Table 2304.10.1.
- 2) Holdowns and other framing hardware by Simpson or equal to be used per plan. Ends of shear walls shall use double studs minimum (UNO).
- 3) Use minimum of (2) bolts per sill piece with one bolt located not more than 12" nor less than 5" from each end of the piece. Embed bolts a minimum of 7" into concrete.
- 4) Allowable loads are permitted to be increased by 40% for wind design in accordance with AF&PA SDPWS Table 4.3A.