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#19193

Structural Calculations For:

Vashon Housing

AT

9914 SW 188th ST
Vashon, WA 98070

01/16/2020

Client: Form + Function Architecture
1800 Westlake Ave. N #205
Seattle, WA 98109

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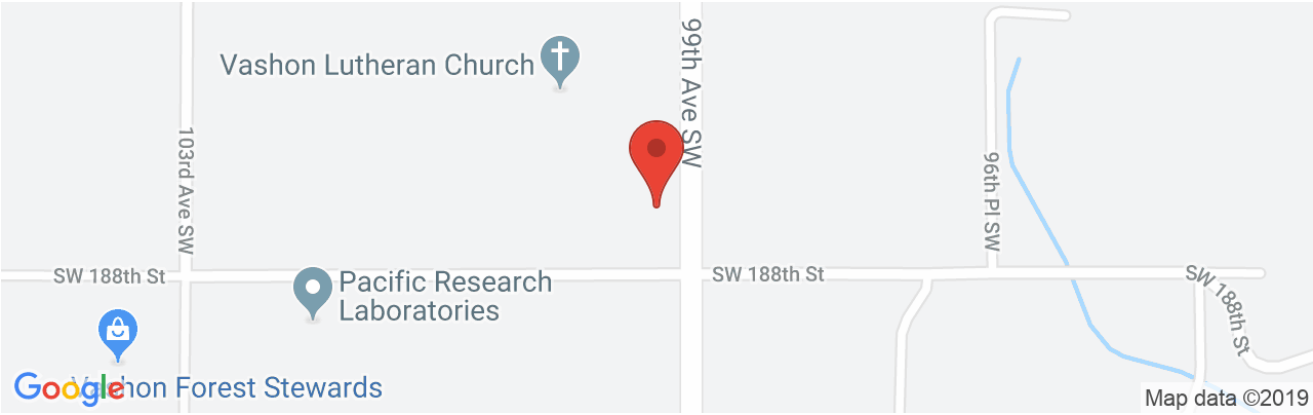
OSHPD

Vashon Island Housing Center

Latitude, Longitude: 47.436949, -122.460848



Date	11/25/2019, 12:13:48 PM
Design Code Reference Document	ASCE7-10
Risk Category	II
Site Class	C - Very Dense Soil and Soft Rock

Type	Value	Description
S_S	1.502	MCE_R ground motion. (for 0.2 second period)
S_1	0.566	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.502	Site-modified spectral acceleration value
S_{M1}	0.736	Site-modified spectral acceleration value
S_{DS}	1.001	Numeric seismic design value at 0.2 second SA
S_{D1}	0.491	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	D	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	1.3	Site amplification factor at 1.0 second
PGA	0.618	MCE_G peak ground acceleration
F_{PGA}	1	Site amplification factor at PGA
PGA_M	0.618	Site modified peak ground acceleration
T_L	6	Long-period transition period in seconds
SsRT	1.502	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.591	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	2.851	Factored deterministic acceleration value. (0.2 second)
S1RT	0.566	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.61	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.91	Factored deterministic acceleration value. (1.0 second)
PGAd	1.019	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.944	Mapped value of the risk coefficient at short periods

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Type	Value	Description
C_{R1}	0.929	Mapped value of the risk coefficient at a period of 1 s

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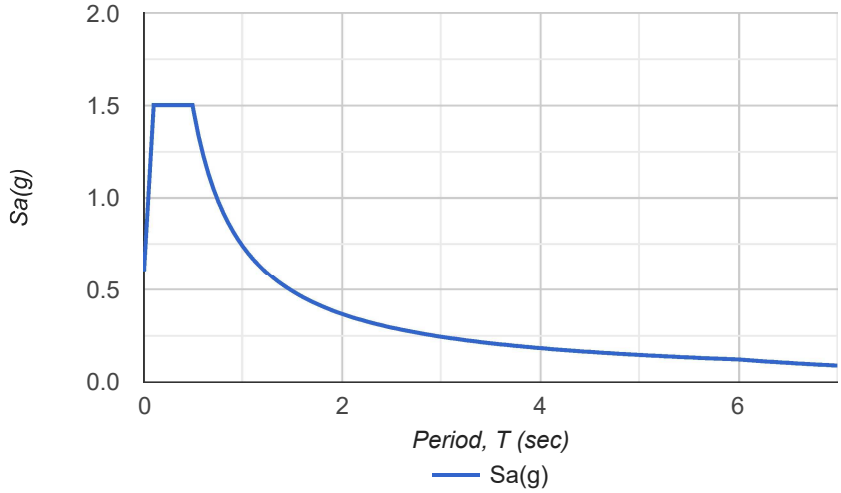
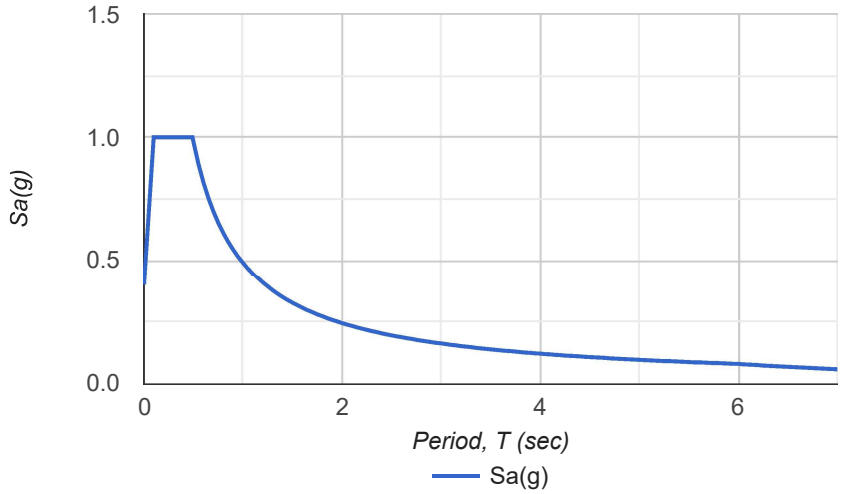
MCER Response Spectrum



Design Response Spectrum



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IBC2012 (1613), ASCE 7-10 CHAPTER 11, 12, 13 SEISMIC DESIGN CRITERIA

Response Spectral Acc. (0.2 sec) Ss =	1.502 g	Figure 22-1,22-3,22-5,22-6	
Response Spectral Acc.(1.0 sec) S_1 =	0.566 g	Figure 22-2,22-4,22-5,22-6	
Soil Site Class	C	Table 20-3-1, Default = D	
Site Coefficient F_a =	1.000		Table 11.4-1
Site Coefficient F_v =	1.300		Table 11.4-2
Max Considered Earthquake Acc. S_{MS} =	$F_a.S_s$	= 1.502g	(11.4-1)
Max Considered Earthquake Acc. S_{M1} =	$F_v.S_1$	= 0.736g	(11.4-2)
@ 5% Damped Design S_{DS} =	$2/3(S_{MS})$	= 1.001g	(11.4-3)
S_{D1} =	$2/3(S_{M1})$	= 0.491g	(11.4-4)
Building Risk Categories	II, Standard		Table 1604.5
Design Category Consideration:	Flexible Diaphragm	with dist. between seismic resisting system >40ft	
Seismic Design Category for 0.1sec	D		Table 11.6-1
Seismic Design Category for 1.0sec	D		Table 11.6-2
S1 < .75g	NA		Section 11.6
Since Ta < .8Ts (see below), SDC =	D	Control (exception of Section 11.6 does not apply)	

IBC, Seismic Design Category D IRC, Seismic Design Category= D2 T-R301.2.2.1.1

12.8 Equivalent lateral force procedure

A. BEARING WALL SYSTEMS T-12.2-

Seismic Force Resisting Systems 15. Light-framed (wood) walls sheathed with wood structural panels rated for shear resistance or steel s

C_t =	0.02	x = 0.75		T-12.8-2
Building ht. H_n =	20 ft	Limited Building Height (ft) =	65	
C_u =	1.400	for S_{D1} of 0.491g	Table 12.8-1	
Approx Fundamental period, T_a =	$C_t(h_n)^x$	= 0.189	12.8-7	T_L = 4.000 Sec
Calculated T shall not exceed ≤	Cu.Ta	= 0.265		Use T = 0.189 sec.
0.8Ts =	$0.8(S_{D1}/S_{DS})$	= 0.392	Control (exception of Section 11.6 does not apply)	
Is structure Regular & ≤ 5 stories ?	Yes			12.8.1.3
Response Spectral Acc.(0.2 sec) S_s =	1.500g			*Max Ss ≤ 1.5g*
F_a =	1.00			
@ 5% Damped Design S_{DS} =	$⅔(F_a.S_s)$	= 1.000g		(11.4-3)
Response Modification Coef. R =	6.5			Table-12.2-1
Over Strength Factor Ω_o =	2.5			foot note g
Importance factor I =	1			T 1.5-2
Seismic Base Shear V =	$C_s W$			
C_s =	$\frac{S_{DS}}{R/I}$	=0.154		(12.8-2)
or need not to exceed, C_s =	$\frac{S_{D1}}{(R/I).T}$	= 0.399	For T≤ T_L	(12.8-3)
or C_s =	$\frac{S_{D1}T_L}{T^2(R/I)}$	N/A	For T > T_L	(12.8-4)
C_s shall not be less than =	$0.044S_{DS}.I \geq .01$	= 0.044		(12.8-5)
Min C_s =	$0.5S_1I/R$	N/A	For $S_1 \geq 0.6g$	(12.8-6)
Use C_s =	0.154			
Design base shear V =	0.154 W	**Control**		

T-12.14

12.14 Simplified Seismic base shear 15. Light-framed (wood) walls sheathed with wood structural panels rated for shear resistance or steel s

@ 5% Damped Design S_{DS} =	1.001	SDC = D	T-11.6-1	Limitations: P
F =	1.2	For three story building		R = 6.5
V =	$\frac{FS_{DS}(W)}{R}$	= 0.185 W		(12.14-11)

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13.3 Seismic Demands on Nonstructural Components

$$F_p = \frac{0.4 a_p S_{DS} W_p (1+2z/h)}{(R_p/I_p)} \quad (13.3\text{-}1)$$

S_{DS} = 1.00 I

a_p = 1 R_p = 2.5 T-13.5-1 or 13.6-1

I_p = 1.5 13.1.3

z = 10 ft h = 10 ft F_p = 0.721 Wp

Max F_p = $1.6 S_{DS} I_p W_p$ = 2.403Wp (13.3-2)

Min F_p = $0.3 S_{DS} I_p W_p$ = 0.451Wp (13.3-3)

F_p = 0.721 Wp

12.11.1 Design for Out-of-Plane Forces

$F_p = 0.40 S_{DS} I W_w$ 12.11.1

= 0.401(W)

12.11.2 Anchorage of structural Walls and Transfer of Design Force into Diaphragm

or $F_p = 0.4 S_{DS} k_a I_e W_p$ (12.11-1)

$k_a = 1 + L_f/100$ L_f = 50ft

Amplification factor for diaphragm, k_a = 1.50

F_p = 0.600Wp

12.4.3 Seismic Load Effect Including Overstrength $E_M = \Omega_o Q_E \pm 0.2 S_{DS} D$ (12.4-5, 12.4-6)

Where Ω_o = 2.5 $0.2 S_{DS} D$ = 0.201(D)

Deflection Amplification factor C_d = 4 T 12.2-1

15.3 Nonbuilding structures

Response Modification Coef. R = 6 From T-15.4-1

Importance factor I = 1 15.4.1.1

For flexible nonbuilding, C_s = 0.167 W Min Requirement from Section 12.8

Min $C_s = 0.044 S_{DS} . I$ = 0.044 (15.4-1)

or $C_s = 0.8\ S_1 I/R$ N/A, S1<0.6 (15.4-2)

V = 0.167 W

For rigid nonbuilding, C_s = $0.3\ S_{DS}\ I$ (15.4-5)

= 0.300 W

multiplied by the wall area of the building and 8 lb/ft^2 (0.38 kN/m^2) multiplied by the roof area of the building projected onto a vertical plane normal to the assumed wind direction.

PART 2: ENCLOSED SIMPLE DIAPHRAGM LOW-RISE BUILDINGS

28.5 GENERAL REQUIREMENTS

The steps required for the determination of MWFRS wind loads on enclosed simple diaphragm buildings are shown in Table 28.5-1.

User Note: Part 2 of Chapter 28 is a simplified method to determine the wind pressure on the MWFRS of enclosed simple diaphragm *low-rise buildings* having a flat, gable or hip roof. The wind pressures are *obtained directly from a table* and applied on horizontal and vertical projected surfaces of the building. This method is a simplification of the Envelope Procedure contained in Part 1 of Chapter 28.

28.5.1 Wind Load Parameters Specified in Chapter 26

The following wind load parameters are specified in Chapter 26:

- Basic Wind Speed V (Section 26.5)
- Exposure category (Section 26.7)
- Topographic factor K_{zt} (Section 26.8)
- Enclosure classification (Section 26.10)

Table 28.5-1 Steps to Determine Wind Loads on MWFRS Simple Diaphragm Low-Rise Buildings

Step 1: Determine risk category of building or other structure, see Table 1.5-1
Step 2: Determine the basic wind speed, V, for applicable risk category, see Fig. 26.5-1A, B or C
Step 3: Determine wind load parameters: ➢ Exposure category B, C or D, see Section 26.7 ➢ Topographic factor, K_{zt}, see Section 26.8 and Fig. 26.8-1
Step 4: Enter figure to determine wind pressures for h = 30 ft (9.1 m)., p_{S30}, see Fig. 28.6-1
Step 5: Enter figure to determine adjustment for building height and exposure, λ, see Fig. 28.6-1
Step 6: Determine adjusted wind pressures, p_s, see Eq. 28.6-1

28.6 WIND LOADS—MAIN WIND-FORCE RESISTING SYSTEM

28.6.1 Scope

A building whose design wind loads are determined in accordance with this section shall meet all the conditions of Section 28.6.2. If a building does not meet all of the conditions of Section 28.6.2, then its MWFRS wind loads shall be determined by Part 1 of this chapter, by the Directional Procedure of Chapter 27, or by the Wind Tunnel Procedure of Chapter 31.

28.6.2 Conditions

For the design of MWFRS the building shall comply with all of the following conditions:

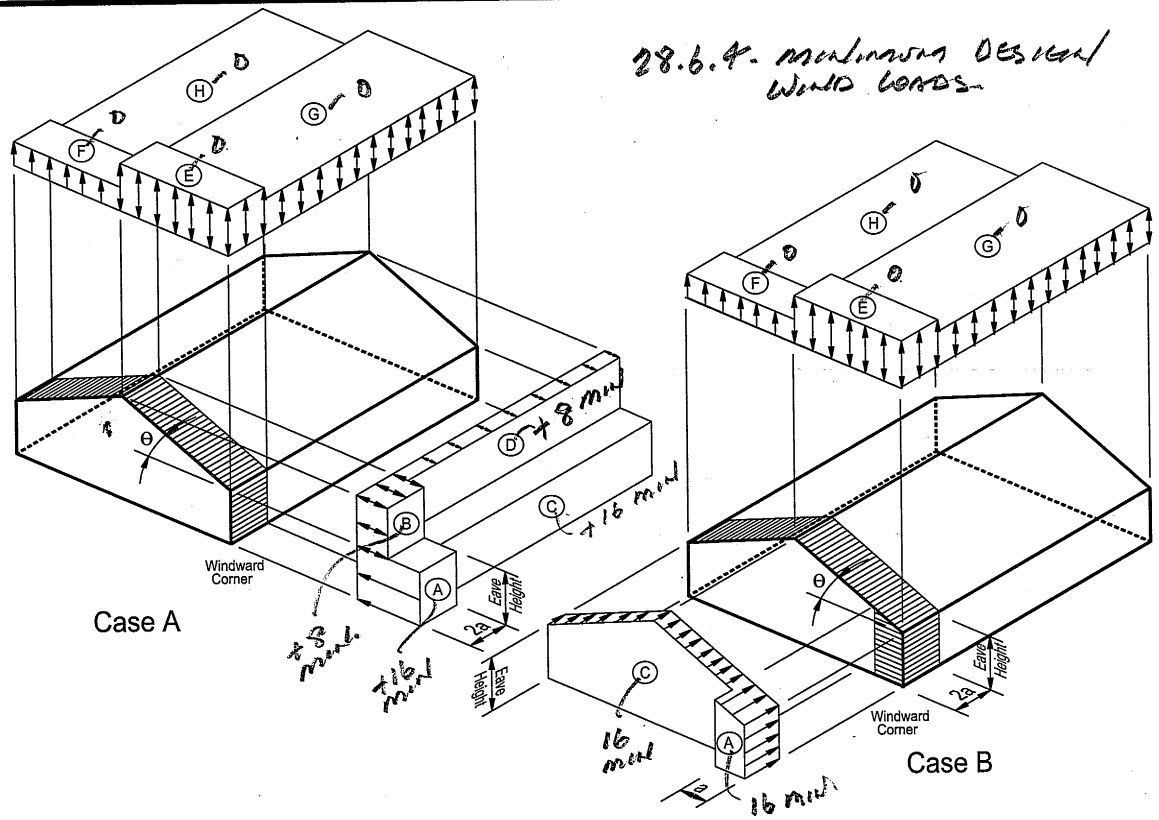
1. The building is a simple diaphragm building as defined in Section 26.2.
2. The building is a low-rise building as defined in Section 26.2.
3. The building is enclosed as defined in Section 26.2 and conforms to the wind-borne debris provisions of Section 26.10.3.
4. The building is a regular-shaped building or structure as defined in Section 26.2.
5. The building is not classified as a flexible building as defined in Section 26.2.
6. The building does not have response characteristics making it subject to across wind loading, vortex shedding, instability due to galloping or flutter; and it does not have a site location for which channeling effects or buffeting in the wake of upwind obstructions warrant special consideration.
7. The building has an approximately symmetrical cross-section in each direction with either a flat roof or a gable or hip roof with $\theta \leq 45°$.
8. The building is exempted from torsional load cases as indicated in Note 5 of Fig. 28.4-1, or the torsional load cases defined in Note 5 do not control the design of any of the MWFRS of the building.

28.6.3 Design Wind Loads

Simplified design wind pressures, p_s, for the MWFRS of low-rise simple diaphragm buildings represent the net pressures (sum of internal and external) to be applied to the horizontal and vertical projections of building surfaces as shown in Fig. 28.6-1. For the horizontal pressures (Zones A, B, C, D), p_s is the combination of the windward and

Main Wind Force Resisting System – Method 2		h ≤ 60 ft.
Figure 28.6-1	Design Wind Pressures	Walls & Roofs
Enclosed Buildings		

28.6.4. Minimum Design Wind Loads



Notes:

1. Pressures shown are applied to the horizontal and vertical projections, for exposure B, at h=30 ft (9.1m). Adjust to other exposures and heights with adjustment factor λ.
2. The load patterns shown shall be applied to each corner of the building in turn as the reference corner. (See Figure 28.4-1)
3. For Case B use $\theta = 0°$.
4. Load cases 1 and 2 must be checked for $25° < \theta \leq 45°$. Load case 2 at 25° is provided only for interpolation between 25° and 30°.
5. Plus and minus signs signify pressures acting toward and away from the projected surfaces, respectively.
6. For roof slopes other than those shown, linear interpolation is permitted.
7. The total horizontal load shall not be less than that determined by assuming $p_s = 0$ in zones B & D.
8. Where zone E or G falls on a roof overhang on the windward side of the building, use E_{OH} and G_{OH} for the pressure on the horizontal projection of the overhang. Overhangs on the leeward and side edges shall have the basic zone pressure applied.
9. Notation:
   - *a:* 10 percent of least horizontal dimension or 0.4h, whichever is smaller, but not less than either 4% of least horizontal dimension or 3 ft (0.9 m).
   - *h:* Mean roof height, in feet (meters), except that eave height shall be used for roof angles <10°.
   - *θ:* Angle of plane of roof from horizontal, in degrees.

Main Wind Force Resisting System – Method 2		h ≤ 60 ft.
Figure 28.6-1 (cont'd)	Design Wind Pressures	**Walls & Roofs**
Enclosed Buildings		

Simplified Design Wind Pressure , p_{S30} (psf) *(Exposure B at h = 30 ft. with I = 1.0)*

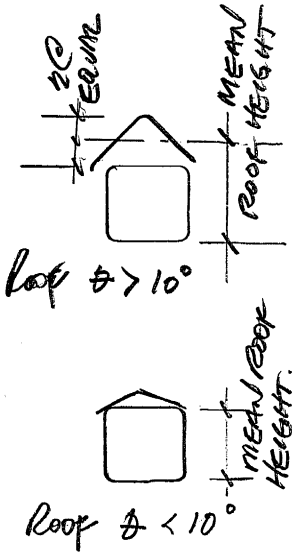
Basic Wind Speed (mph)	Roof Angle (degrees)	Load Case	Zones									
			Horizontal Pressures				Vertical Pressures				Overhangs	
			A	B	C	D	E	F	G	H	EOH	GOH
110	0 to 5°	1	19.2	-10.0	12.7	-5.9	-23.1	-13.1	-16.0	-10.1	-32.3	-25.3
	10°	1	21.6	-9.0	14.4	-5.2	-23.1	-14.1	-16.0	-10.8	-32.3	-25.3
	15°	1	24.1	-8.0	16.0	-4.6	-23.1	-15.1	-16.0	-11.5	-32.3	-25.3
	20°	1	26.6	-7.0	17.7	-3.9	-23.1	-16.0	-16.0	-12.2	-32.3	-25.3
	25°	1	24.1	3.9	17.4	4.0	-10.7	-14.6	-7.7	-11.7	-19.9	-17.0
		2	-------	-------	-------	-------	-4.1	-7.9	-1.1	-5.1	-------	-------
	30 to 45	1	21.6	14.8	17.2	11.8	1.7	-13.1	0.6	-11.3	-7.6	-8.7
		2	21.6	14.8	17.2	11.8	8.3	-6.5	7.2	-4.6	-7.6	-8.7
115	0 to 5°	1	21.0	-10.9	13.9	-6.5	-25.2	-14.3	-17.5	-11.1	-35.3	-27.6
	10°	1	23.7	-9.8	15.7	-5.7	-25.2	-15.4	-17.5	-11.8	-35.3	-27.6
	15°	1	26.3	-8.7	17.5	-5.0	-25.2	-16.5	-17.5	-12.6	-35.3	-27.6
	20°	1	29.0	-7.7	19.4	-4.2	-25.2	-17.5	-17.5	-13.3	-35.3	-27.6
	25°	1	26.3	4.2	19.1	4.3	-11.7	-15.9	-8.5	-12.8	-21.8	-18.5
		2	-------	-------	-------	-------	-4.4	-8.7	-1.2	-5.5	-------	-------
	30 to 45	1	23.6	16.1	18.8	12.9	1.8	-14.3	0.6	-12.3	-8.3	-9.5
		2	23.6	16.1	18.8	12.9	9.1	-7.1	7.9	-5.0	-8.3	-9.5
120	0 to 5°	1	22.8	-11.9	15.1	-7.0	-27.4	-15.6	-19.1	-12.1	-38.4	-30.1
	10°	1	25.8	-10.7	17.1	-6.2	-27.4	-16.8	-19.1	-12.9	-38.4	-30.1
	15°	1	28.7	-9.5	19.1	-5.4	-27.4	-17.9	-19.1	-13.7	-38.4	-30.1
	20°	1	31.6	-8.3	21.1	-4.6	-27.4	-19.1	-19.1	-14.5	-38.4	-30.1
	25°	1	28.6	4.6	20.7	4.7	-12.7	-17.3	-9.2	-13.9	-23.7	-20.2
		2	-------	-------	-------	-------	-4.8	-9.4	-1.3	-6.0	-------	-------
	30 to 45	1	25.7	17.6	20.4	14.0	2.0	-15.6	0.7	-13.4	-9.0	-10.3
		2	25.7	17.6	20.4	14.0	9.9	-7.7	8.6	-5.5	-9.0	-10.3
130	0 to 5°	1	26.8	-13.9	17.8	-8.2	-32.2	-18.3	-22.4	-14.2	-45.1	-35.3
	10°	1	30.2	-12.5	20.1	-7.3	-32.2	-19.7	-22.4	-15.1	-45.1	-35.3
	15°	1	33.7	-11.2	22.4	-6.4	-32.2	-21.0	-22.4	-16.1	-45.1	-35.3
	20°	1	37.1	-9.8	24.7	-5.4	-32.2	-22.4	-22.4	-17.0	-45.1	-35.3
	25°	1	33.6	5.4	24.3	5.5	-14.9	-20.4	-10.8	-16.4	-27.8	-23.7
		2	-------	-------	-------	-------	-5.7	-11.1	-1.5	-7.1	-------	-------
	30 to 45	1	30.1	20.6	24.0	16.5	2.3	-18.3	0.8	-15.7	-10.6	-12.1
		2	30.1	20.6	24.0	16.5	11.6	-9.0	10.0	-6.4	-10.6	-12.1
140	0 to 5°	1	31.1	-16.1	20.6	-9.6	-37.3	-21.2	-26.0	-16.4	-52.3	-40.9
	10°	1	35.1	-14.5	23.3	-8.5	-37.3	-22.8	-26.0	-17.5	-52.3	-40.9
	15°	1	39.0	-12.9	26.0	-7.4	-37.3	-24.4	-26.0	-18.6	-52.3	-40.9
	20°	1	43.0	-11.4	28.7	-6.3	-37.3	-26.0	-26.0	-19.7	-52.3	-40.9
	25°	1	39.0	6.3	28.2	6.4	-17.3	-23.6	-12.5	-19.0	-32.3	-27.5
		2	-------	-------	-------	-------	-6.6	-12.8	-1.8	-8.2	-------	-------
	30 to 45	1	35.0	23.9	27.8	19.1	2.7	-21.2	0.9	-18.2	-12.3	-14.0
		2	35.0	23.9	27.8	19.1	13.4	-10.5	11.7	-7.5	-12.3	-14.0
150	0 to 5°	1	35.7	-18.5	23.7	-11.0	-42.9	-24.4	-29.8	-18.9	-60.0	-47.0
	10°	1	40.2	-16.7	26.8	-9.7	-42.9	-26.2	-29.8	-20.1	-60.0	-47.0
	15°	1	44.8	-14.9	29.8	-8.5	-42.9	-28.0	-29.8	-21.4	-60.0	-47.0
	20°	1	49.4	-13.0	32.9	-7.2	-42.9	-29.8	-29.8	-22.6	-60.0	-47.0
	25°	1	44.8	7.2	32.4	7.4	-19.9	-27.1	-14.4	-21.8	-37.0	-31.6
		2	-------	-------	-------	-------	-7.5	-14.7	-2.1	-9.4	-------	-------
	30 to 45	1	40.1	27.4	31.9	22.0	3.1	-24.4	1.0	-20.9	-14.1	-16.1
		2	40.1	27.4	31.9	22.0	15.4	-12.0	13.4	-8.6	-14.1	-16.1

Unit Conversions – 1.0 ft = 0.3048 m; 1.0 psf = 0.0479 kN/m^2

Main Wind Force Resisting System – Method 2		h ≤ 60 ft.
Figure 28.6-1 (cont'd)	Design Wind Pressures	Walls & Roofs
Enclosed Buildings		

Simplified Design Wind Pressure , p_{S30} (psf) *(Exposure B at h = 30 ft.)*

Basic Wind Speed (mph)	Roof Angle (degrees)	Load Case	Zones									
			Horizontal Pressures				Vertical Pressures				Overhangs	
			A	B	C	D	E	F	G	H	EOH	GOH
160	0 to 5°	1	40.6	-21.1	26.9	-12.5	-48.8	-27.7	-34.0	-21.5	-68.3	-53.5
	10°	1	45.8	-19.0	30.4	-11.1	-48.8	-29.8	-34.0	-22.9	-68.3	-53.5
	15°	1	51.0	-16.9	34.0	-9.6	-48.8	-31.9	-34.0	-24.3	-68.3	-53.5
	20°	1	56.2	-14.8	37.5	-8.2	-48.8	-34.0	-34.0	-25.8	-68.3	-53.5
	25°	1	50.9	8.2	36.9	8.4	-22.6	-30.8	-16.4	-24.8	-42.1	-35.9
		2	-------	-------	-------	-------	-8.6	-16.8	-2.3	-10.7	-------	-------
	30 to 45	1	45.7	31.2	36.3	25.0	3.5	-27.7	1.2	-23.8	-16.0	-18.3
		2	45.7	31.2	36.3	25.0	17.6	-13.7	15.2	-9.8	-16.0	-18.3
180	0 to 5°	1	51.4	-26.7	34.1	-15.8	-61.7	-35.1	-43.0	-27.2	-86.4	-67.7
	10°	1	58.0	-24.0	38.5	-14.0	-61.7	-37.7	-43.0	-29.0	-86.4	-67.7
	15°	1	64.5	-21.4	43.0	-12.2	-61.7	-40.3	-43.0	-30.8	-86.4	-67.7
	20°	1	71.1	-18.8	47.4	-10.4	-61.7	-43.0	-43.0	-32.6	-86.4	-67.7
	25°	1	64.5	10.4	46.7	10.6	-28.6	-39.0	-20.7	-31.4	-53.3	-45.4
		2	-------	-------	-------	-------	-10.9	-21.2	-3.0	-13.6	-------	-------
	30 to 45	1	57.8	39.5	45.9	31.6	4.4	-35.1	1.5	-30.1	-20.3	-23.2
		2	57.8	39.5	45.9	31.6	22.2	-17.3	19.3	-12.3	-20.3	-23.2
200	0 to 5°	1	63.4	-32.9	42.1	-19.5	-76.2	-43.3	-53.1	-33.5	-106.7	-83.5
	10°	1	71.5	-29.7	47.6	-17.3	-76.2	-46.5	-53.1	-35.8	-106.7	-83.5
	15°	1	79.7	-26.4	53.1	-15.0	-76.2	-49.8	-53.1	-38.0	-106.7	-83.5
	20°	1	87.8	-23.2	58.5	-12.8	-76.2	-53.1	-53.1	-40.2	-106.7	-83.5
	25°	1	79.6	12.8	57.6	13.1	-35.4	-48.2	-25.6	-38.7	-65.9	-56.1
		2	-------	-------	-------	-------	-13.4	-26.2	-3.7	-16.8	-------	-------
	30 to 45	1	71.3	48.8	56.7	39.0	5.5	-43.3	1.8	-37.2	-25.0	-28.7
		2	71.3	48.8	56.7	39.0	27.4	-21.3	23.8	-15.2	-25.0	-28.7



Adjustment Factor for Building Height and Exposure, λ

Mean roof height (ft)	Exposure		
	B	C	D
15	1.00	1.21	1.47
20	1.00	1.29	1.55
25	1.00	1.35	1.61
30	1.00	1.40	1.66
35	1.05	1.45	1.70
40	1.09	1.49	1.74
45	1.12	1.53	1.78
50	1.16	1.56	1.81
55	1.19	1.59	1.84
60	1.22	1.62	1.87

Unit Conversions – 1.0 ft = 0.3048 m; 1.0 psf = 0.0479 kN/m^2

leeward net pressures. p_s shall be determined by the following equation:

$$p_s = \lambda K_{zt} p_{S30} \qquad (28.6\text{-}1)$$

where

λ = adjustment factor for building height and exposure from Fig. 28.6-1
K_{zt} = topographic factor as defined in Section 26.8 evaluated at mean roof height, h
p_{S30} = simplified design wind pressure for Exposure B, at h = 30 ft (9.1 m) from Fig. 28.6-1

28.6.4 Minimum Design Wind Loads

The load effects of the design wind pressures from Section 28.6.3 shall not be less than a minimum load defined by assuming the pressures, p_s, for zones A and C equal to +16 psf, Zones B and D equal to +8 psf, while assuming p_s for Zones E, F, G, and H are equal to 0 psf.

3 DIFFERENT DESIGN CONSIDERATIONS.

1. P_{S30} PRESSURES.
2. P_{S30} PRESSURES W/ P_S=0 IN "B" & "D" ZONES (SEE FIGURE 28.6-1 NOTES #7)
3. P_S A & C = 16 PSF
   P_S B & D = 8 PSF

ALLOWABLE SHEAR VALUES							
sw_type_b_7/16_.131_2_1/2_16oc_or_long_h							
mark	species		E asd	Table 4.3A		W asd	Table 4.3A
P6TN	DF	sw_type_b_p6tn_df_e	150	NDS 4.1.7	sw_type_b_p6tn_df_w	150	NDS 4.1.7
	HF	sw_type_b_p6tn_hf_e	150		sw_type_b_p6tn_hf_w	150	
P6	DF	sw_type_b_p6_df_e	260	520	sw_type_b_p6_df_w	365	730
	HF	sw_type_b_p6_hf_e	242		sw_type_b_p6_hf_w	339	
P4	DF	sw_type_b_p4_df_e	380	760	sw_type_b_p4_df_w	533	1065
	HF	sw_type_b_p4_hf_e	353		sw_type_b_p4_hf_w	495	
P3	DF	sw_type_b_p3_df_e	490	980	sw_type_b_p3_df_w	685	1370
	HF	sw_type_b_p3_hf_e	456		sw_type_b_p3_hf_w	637	
P2	DF	sw_type_b_p2_df_e	640	1280	sw_type_b_p2_df_w	895	1790
	HF	sw_type_b_p2_hf_e	595		sw_type_b_p2_hf_w	832	
2P4	DF	sw_type_b_2p4_df_e	760	1520	sw_type_b_2p4_df_w	1065	2130
	HF	sw_type_b_2p4_hf_e	707		sw_type_b_2p4_hf_w	990	
2P3	DF	sw_type_b_2p3_df_e	980	1960	sw_type_b_2p3_df_w	1370	2740
	HF	sw_type_b_2p3_hf_e	911		sw_type_b_2p3_hf_w	1274	
2P2	DF	sw_type_b_2p2_df_e	1280	2560	sw_type_b_2p2_df_w	1790	3580
	HF	sw_type_b_2p2_hf_e	1190		sw_type_b_2p2_hf_w	1665	

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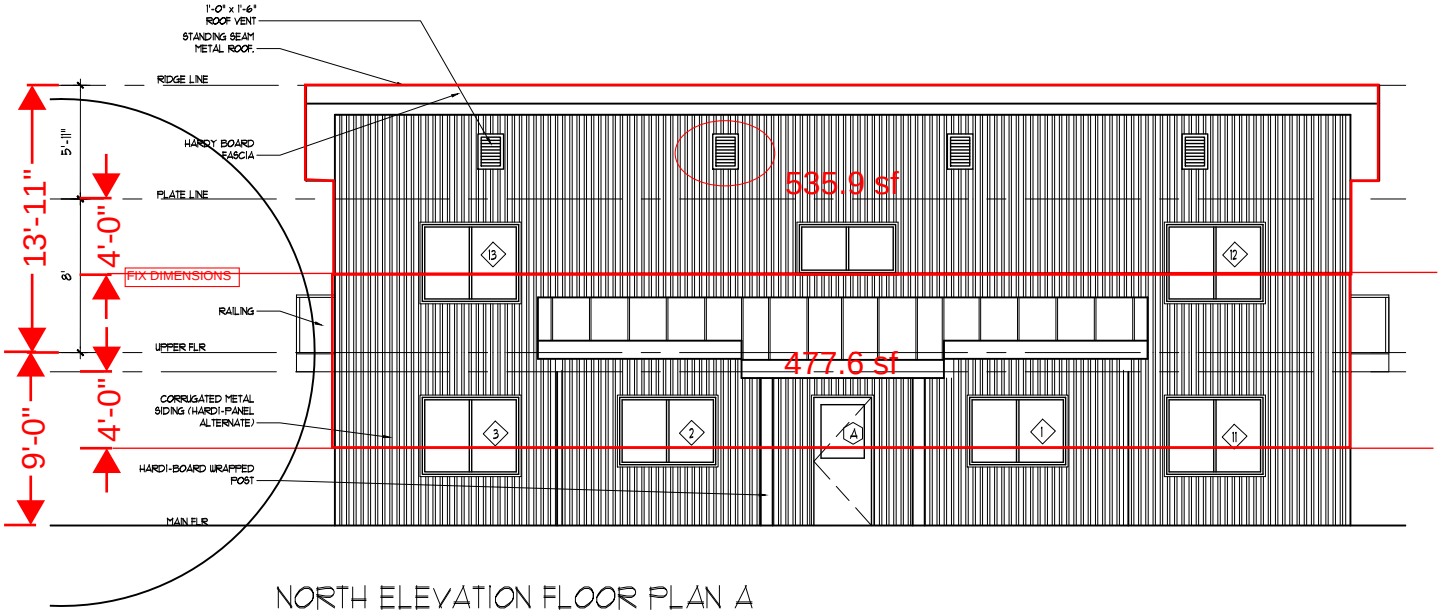
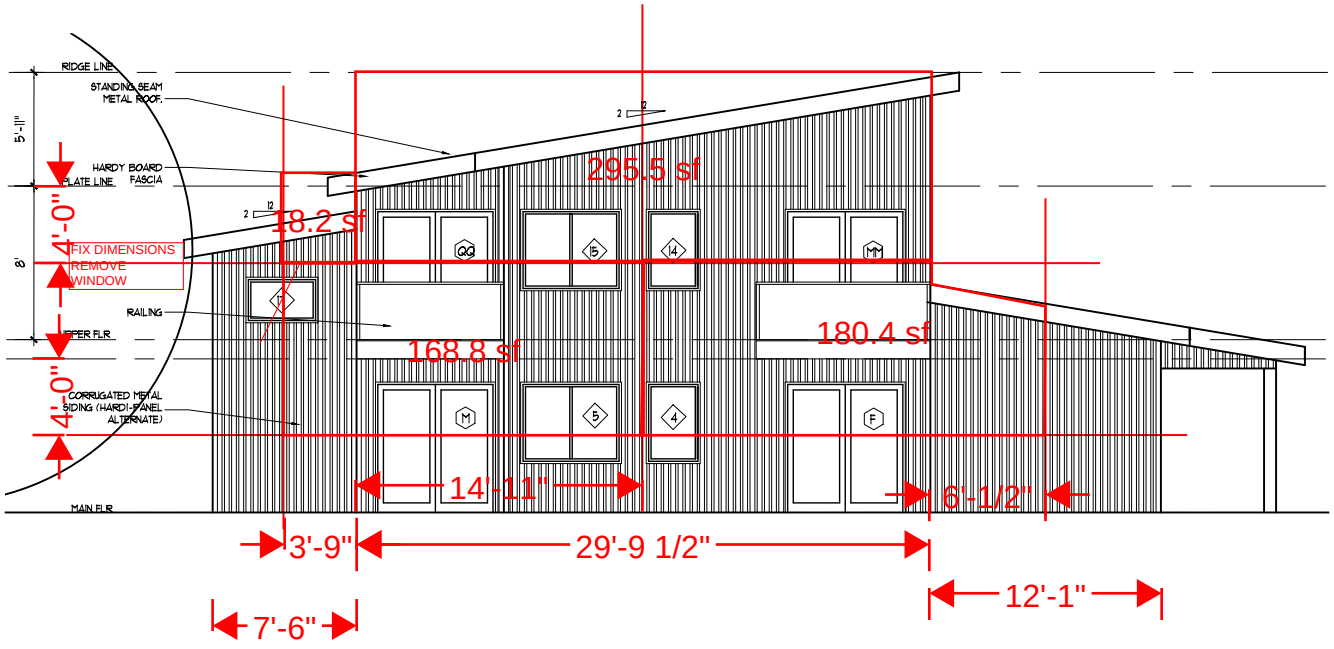


NORTH ELEVATION FLOOR PLAN A

1/4"=1'-0"



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Lateral Analysis.

9914 Southwest 188th Street ⇒ lat 47.436949° lon -122.460848
Vashon Island, Washington

Elevation = 384'

Wind loads controlled by inspection

Transverse Wind Loads.

- Roof level loads.

(536/2)(16 PSF) = W 4290# strength = 0.6W 2574#; 2574# / (6'+7') = 198#/' [P6] ok

(536/2)(16 PSF) = 4290# strength = 2574#; 2574# / (6'+7') = 198#/' [P6] ok

Capacity P6 = 339#/' > 198#/'
7/16; .131x2½; HF

Overturning = .198(8') = 1584# ⇒ HD3
MST48 capacity = 4200#+ ok.

Wrap around transfer bm.
Design transfer beam for 1584 (Ω / 2.5) = 3960 #

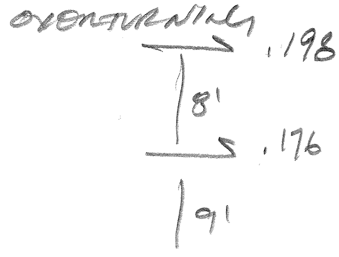
6000# load applied to beam ok

- Main story level loads.

(478 SF/2)(16 PSF)(0.6) [2294] + 2574# [ABV] = ASD 4868 / 6+7 = 374#/' ⇒ [P4] 495#/' cap

(478 SF/2)(16 PSF)(0.6) [2294] + 2574# [ABV] = 4868# / 6+7 = 374#/' ⇒ [P4] 495#/' cap.

Overturning



.198(17) + .176(9) = 4.95k
HDU11 on 4x6 - cap = 8030# > 4950
6x6 - cap = 8030# > 4950 ok

Provide mark horiz for HDU11 type hardware.

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Project: VASHON HOUSING Date: 01/16/2020

Client: Page Number:

LATERAL ANALYSIS (CONT.)

LONGITUDINAL WIND LOADS

ROOF LEVEL LOADS

(296/2)(16psf)(0.6) = 1420# $\frac{1420}{4.5+10+10+4.5}$ = 49#/' ⇒ [P6] OK

(296/2)+8.2 (16psf)(0.6) = 1500# $\frac{1500\#}{4.5+4.5}$ = 167#/' ⇒ [P6] OK.

UPLIFT .167(8) = 1.3k MSTC48 OK ⇒ HD3 MARK

MAIN LEVEL LOADS

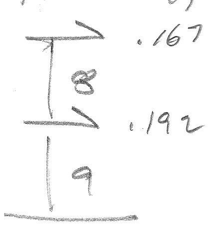
abv. + STORY

1420# + 169(16)(0.6) = 3042# $\frac{3042}{29'}$ = 104#/' [P6] OK

abv. + STORY

1500# + 180(16)(0.6) = 3228# $\frac{3228}{9'}$ = 358#/' [P4] OK

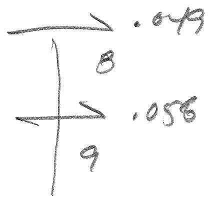
OVERTURNING



.167(17) + .192(9) = 4.5k

HD6 – STHD14
DROP FDN STHD14 RJ. } 2640# IN 6" NG STEM WALL

USE HDU8 ON (2) 2X – 5820 (CAP.) 4500.



.049(17) + .056(9) = 1.4k ⇒ STHD14 OK

HD6 MARK

HD11 MARK

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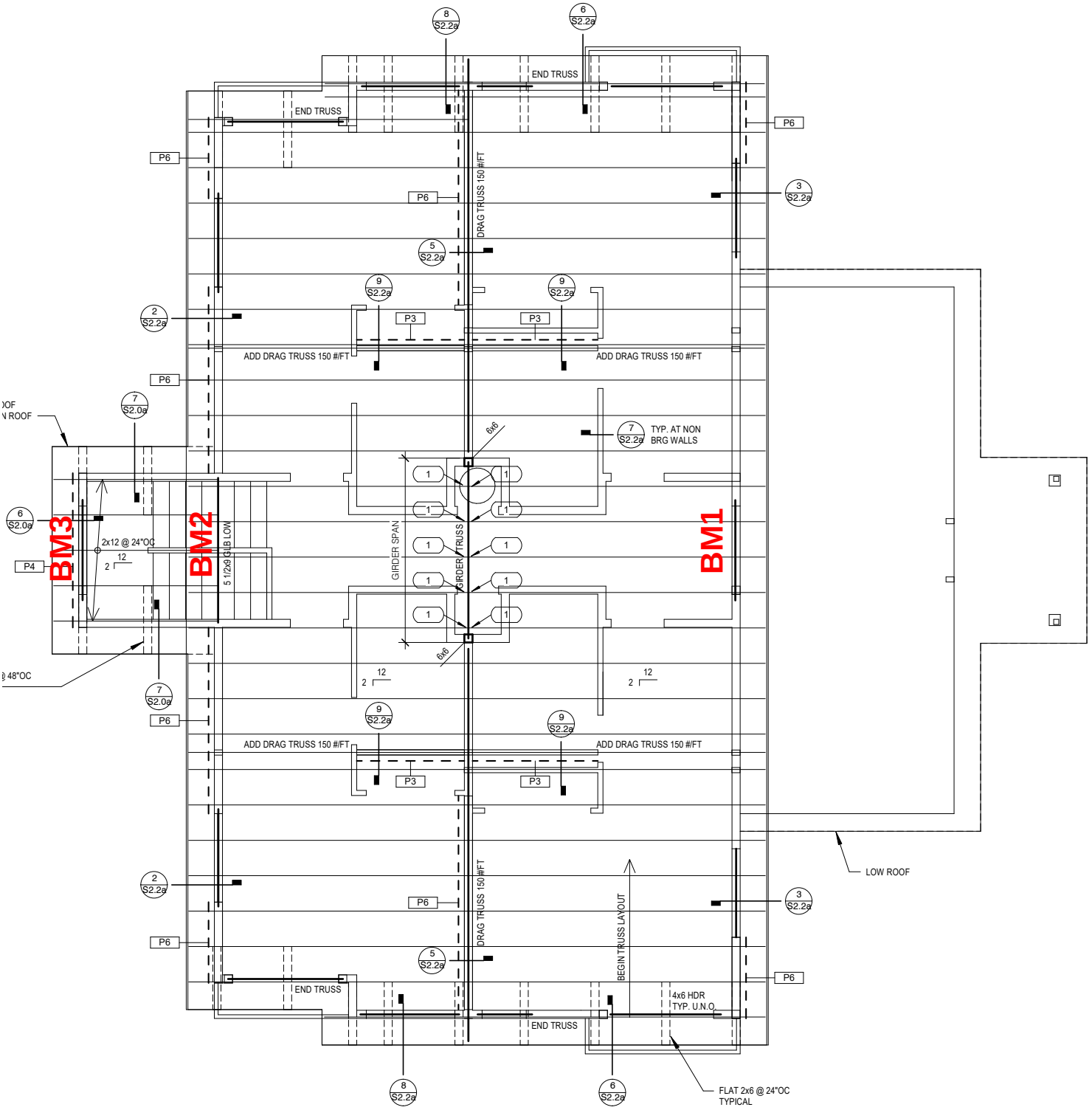
GRAVITY LOAD ANALYSIS - BEAM MAP



SCALE: 1/4" = 1'-0"

1 ROOF FRAMING PLAN - OPTION a

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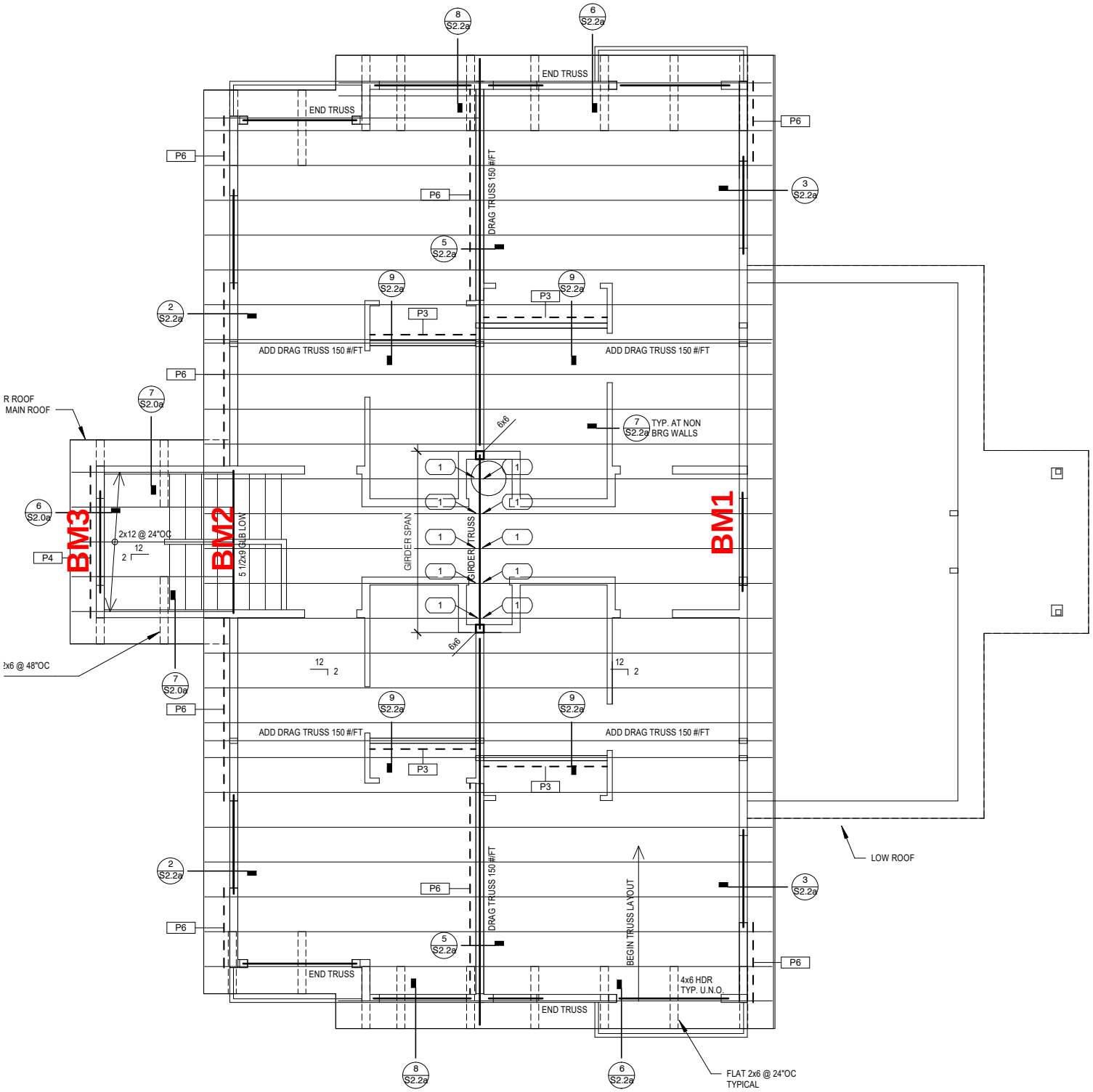
GRAVITY LOAD ANALYSIS - BEAM MAP



SCALE: 1/4" = 1'-0"

1 ROOF FRAMING PLAN - OPTION b

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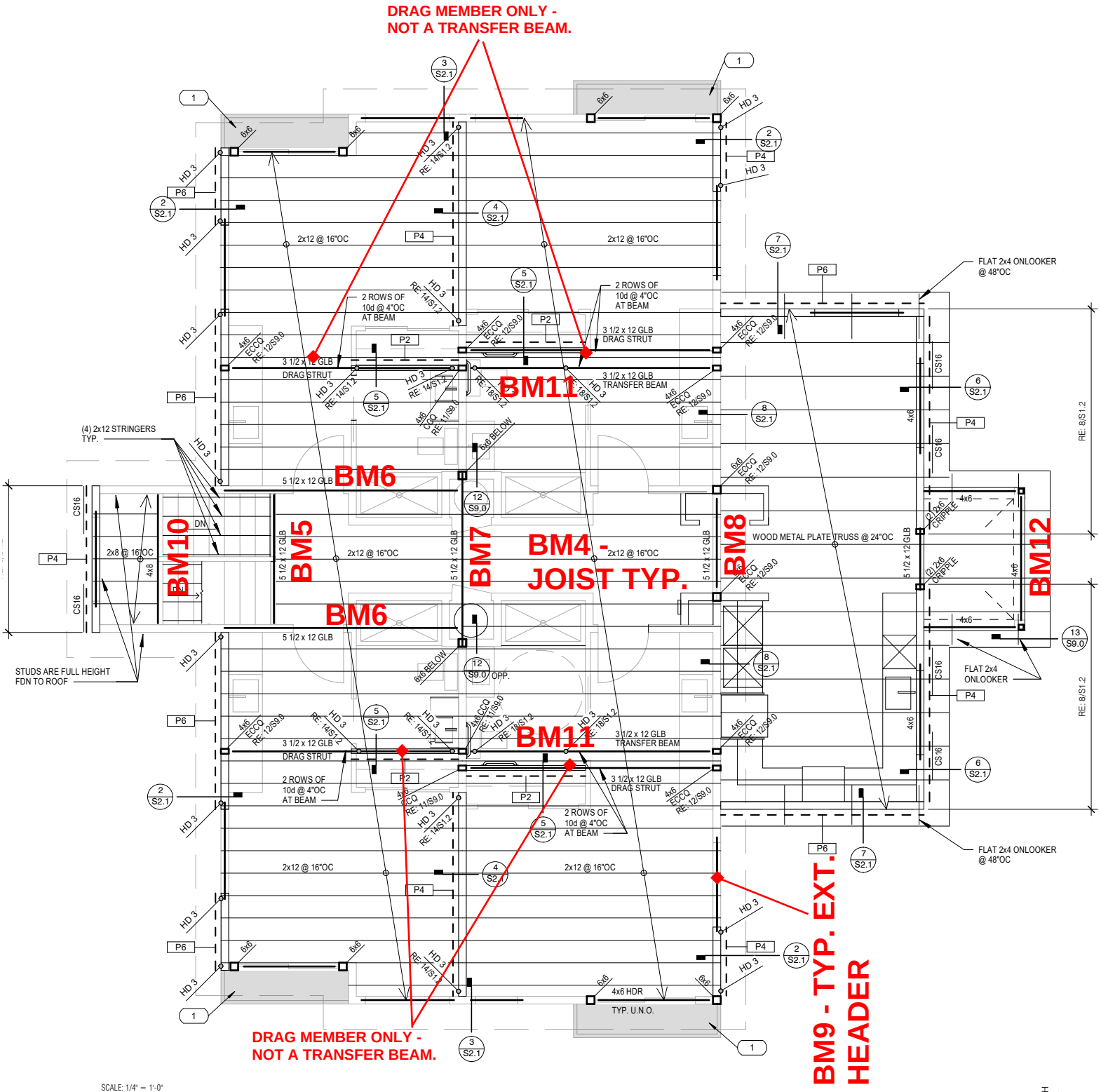
GRAVITY LOAD ANALYSIS - BEAM MAP



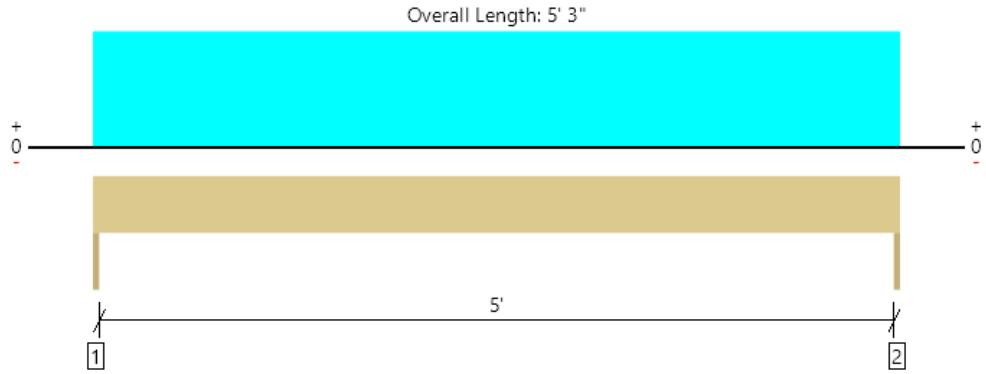
SCALE: 1/4" = 1'-0"

1 UPPER FLOOR FRAMING & LOW ROOF FRAMING PLAN

Roof			
Member Name	Results	Current Solution	Comments
Wall: Header - Typ at roof - BM1	Passed	1 piece(s) 4 x 6 Douglas Fir-Larch No. 2	
Roof: Drop Beam - BM2	Passed	1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam	
Wall: Header - BM3	Passed	1 piece(s) 4 x 6 Douglas Fir-Larch No. 2	
UPPER LEVEL			
Member Name	Results	Current Solution	Comments
Floor: Joist - Typ at upper level - BM4	Passed	1 piece(s) 2 x 12 Hem-Fir No. 2 @ 16" OC	
Floor: Flush Beam -BM5	Passed	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam	
Floor: Flush Beam - BM6	Passed	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam	
Floor: Flush Beam -BM7	Passed	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam	
Floor: Flush Beam - BM8	Passed	1 piece(s) 5 1/2" x 10 1/2" 24F-V4 DF Glulam	
Wall: Header - Typ hdr - BM9	Passed	1 piece(s) 4 x 8 Douglas Fir-Larch No. 2	
Floor: Drop Beam - BM10	Passed	1 piece(s) 4 x 8 Douglas Fir-Larch No. 2	
Floor: Flush Beam - BM11	Failed	1 piece(s) 5 1/2" x 12" 24F-V4 DF Glulam	Multiple Failures/Errors
Floor: Drop Beam - BM12	Passed	1 piece(s) 4 x 6 Douglas Fir-Larch No. 2	

Roof, Wall: Header - Typ at roof - BM1

1 piece(s) 4 x 6 Douglas Fir-Larch No. 2



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)	1142 @ 0	3281 (1.50")	Passed (35%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	888 @ 7"	2657	Passed (33%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1499 @ 2' 7 1/2"	1979	Passed (76%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.052 @ 2' 7 1/2"	0.131	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.096 @ 2' 7 1/2"	0.262	Passed (L/658)	--	1.0 D + 1.0 S (All Spans)

System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 5' 3" o/c based on loads applied, unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 5' 3" o/c based on loads applied, unless detailed otherwise.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Trimmer - DF	1.50"	1.50"	1.50"	518	623	1141	None
2 - Trimmer - DF	1.50"	1.50"	1.50"	518	623	1141	None

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 5' 3"	N/A	4.9	--	
1 - Uniform (PSF)	0 to 5' 3"	9' 6"	20.3	25.0	Default Load

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The product application, input design loads, dimensions and support information have been provided by BJM

ForteWEB Software Operator	Job Notes
Benjamin J. McCann CT Engineering Inc. (206) 285-4512 bmccann@ctengineering.com	

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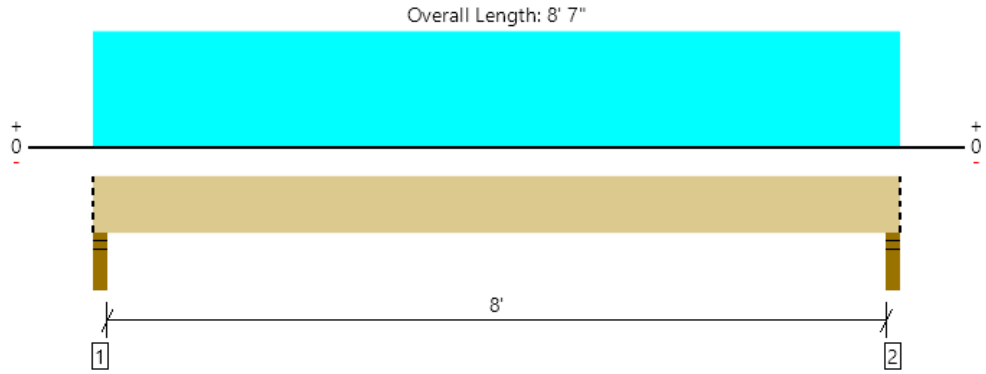
Roof, Roof: Drop Beam - BM2

1 piece(s) 5 1/2" x 9" 24F-V4 DF Glulam



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)	2176 @ 2"	12031 (3.50")	Passed (18%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1648 @ 1' 1/2"	10057	Passed (16%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	4314 @ 4' 3 1/2"	17078	Passed (25%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.048 @ 4' 3 1/2"	0.275	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.088 @ 4' 3 1/2"	0.412	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

System : Roof
Member Type : Drop Beam
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 8' 7" o/c based on loads applied, unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 8' 7" o/c based on loads applied, unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 8' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Stud wall - DF	3.50"	3.50"	1.50"	996	1180	2176	Blocking
2 - Stud wall - DF	3.50"	3.50"	1.50"	996	1180	2176	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 Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 8' 7"	N/A	12.0	--	
1 - Uniform (PSF)	0 to 8' 7" (Front)	11'	20.0	25.0	Default Load

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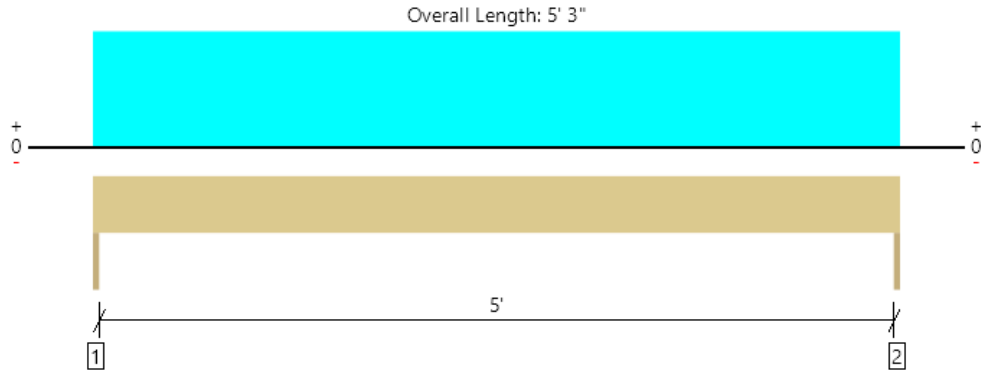
The product application, input design loads, dimensions and support information have been provided by BJM

Roof, Wall: Header - BM3

1 piece(s) 4 x 6 Douglas Fir-Larch No. 2



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)	662 @ 0	3281 (1.50")	Passed (20%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	515 @ 7"	2657	Passed (19%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	870 @ 2' 7 1/2"	1979	Passed (44%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.030 @ 2' 7 1/2"	0.105	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.056 @ 2' 7 1/2"	0.262	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)

System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/600) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 5' 3" o/c based on loads applied, unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 5' 3" o/c based on loads applied, unless detailed otherwise.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Trimmer - DF	1.50"	1.50"	1.50"	302	361	663	None
2 - Trimmer - DF	1.50"	1.50"	1.50"	302	361	663	None

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 5' 3"	N/A	4.9	--	
1 - Uniform (PSF)	0 to 5' 3"	5' 6"	20.0	25.0	Default Load

Weyerhaeuser Notes

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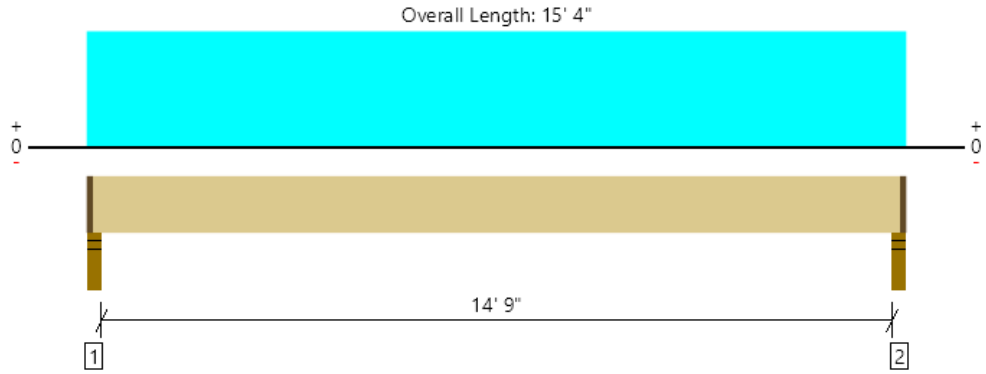
The product application, input design loads, dimensions and support information have been provided by BJM

ForteWEB Software Operator	Job Notes
Benjamin J. McCann CT Engineering Inc. (206) 285-4512 bmccann@ctengineering.com	

Weyerhaeuser

UPPER LEVEL, Floor: Joist - Typ at upper level - BM4

1 piece(s) 2 x 12 Hem-Fir No. 2 @ 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)	603 @ 2 1/2"	1215 (2.00")	Passed (50%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	515 @ 1' 2 3/4"	1688	Passed (31%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2225 @ 7' 8"	2577	Passed (86%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.257 @ 7' 8"	0.373	Passed (L/697)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.385 @ 7' 8"	0.746	Passed (L/465)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 4' 1" o/c based on loads applied, unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 15' 1" o/c based on loads applied, unless detailed otherwise.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Stud wall - HF	3.50"	2.00"	1.50"	204	409	613	1 1/2" Rim Board
2 - Stud wall - HF	3.50"	2.00"	1.50"	204	409	613	1 1/2" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 15' 4"	16"	20.0	40.0	Default Load

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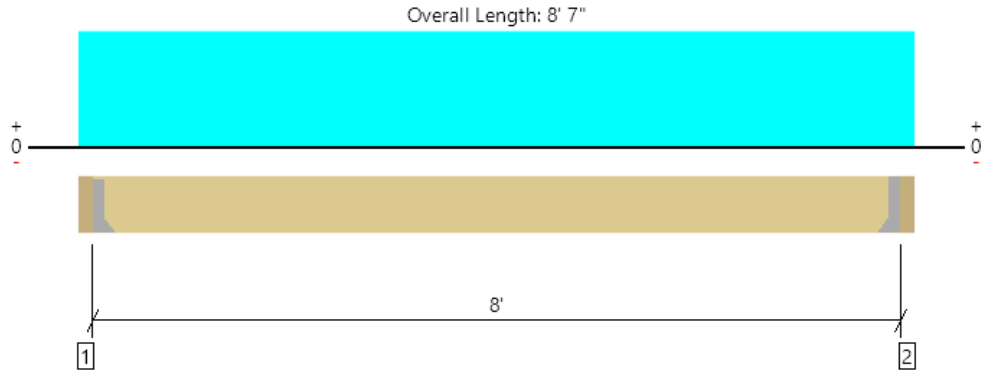
The product application, input design loads, dimensions and support information have been provided by BJM

UPPER LEVEL, Floor: Flush Beam -BM5

1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam



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)	2196 @ 3 1/2"	3413 (1.50")	Passed (64%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1715 @ 1' 2"	6493	Passed (26%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	4391 @ 4' 3 1/2"	12863	Passed (34%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.055 @ 4' 3 1/2"	0.200	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.083 @ 4' 3 1/2"	0.400	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 8' o/c based on loads applied, unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 8' o/c based on loads applied, unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 8'.
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Hanger on 10 1/2" DF beam	3.50"	Hanger[1]	1.50"	808	1545	2353	See note [1]
2 - Hanger on 10 1/2" DF beam	3.50"	Hanger[1]	1.50"	808	1545	2353	See note [1]

- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	Connector not found	N/A	N/A	N/A	N/A	
2 - Face Mount Hanger	Connector not found	N/A	N/A	N/A	N/A	

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	3 1/2" to 8' 3 1/2"	N/A	8.9	--	
1 - Uniform (PSF)	0 to 8' 7" (Front)	9'	20.0	40.0	Default Load

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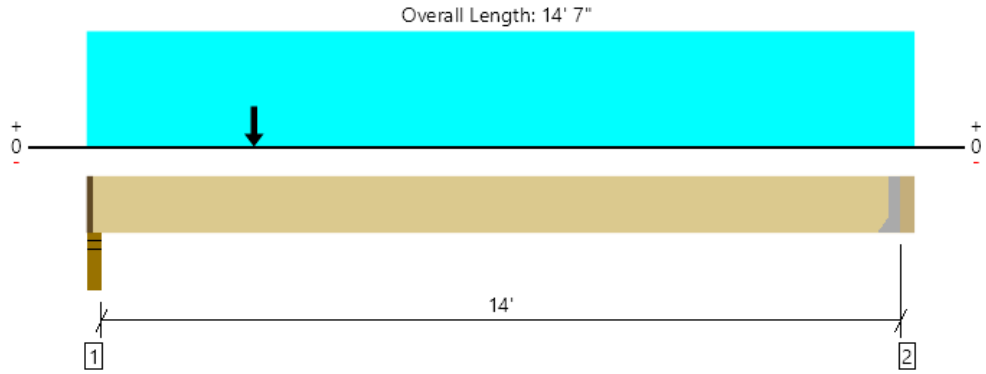
The product application, input design loads, dimensions and support information have been provided by BJM

ForteWEB Software Operator	Job Notes
Benjamin J. McCann CT Engineering Inc. (206) 285-4512 bmccann@ctengineering.com	

Weyerhaeuser

UPPER LEVEL, Floor: Flush Beam - BM6

1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam



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)	2499 @ 2"	4375 (2.00")	Passed (57%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2408 @ 1' 2"	6493	Passed (37%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	6720 @ 3'	12863	Passed (52%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.225 @ 6' 7 3/4"	0.353	Passed (L/752)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.355 @ 6' 8"	0.706	Passed (L/478)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 14' 2" o/c based on loads applied, unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 14' 2" o/c based on loads applied, unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 14' 1 1/2".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Stud wall - DF	3.50"	2.00"	1.50"	897	1611	2508	1 1/2" Rim Board
2 - Hanger on 10 1/2" DF beam	3.50"	Hanger[1]	1.50"	416	692	1108	See note [1]

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
2 - Face Mount Hanger	Connector not found	N/A	N/A	N/A	N/A	

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	1 1/2" to 14' 3 1/2"	N/A	8.9	--	
1 - Uniform (PSF)	0 to 14' 7" (Front)	1' 3 5/8"	20.0	40.0	Default Load
2 - Point (lb)	3' (Front)	N/A	808	1545	Linked from: Floor: Flush Beam -BM5, Support 2

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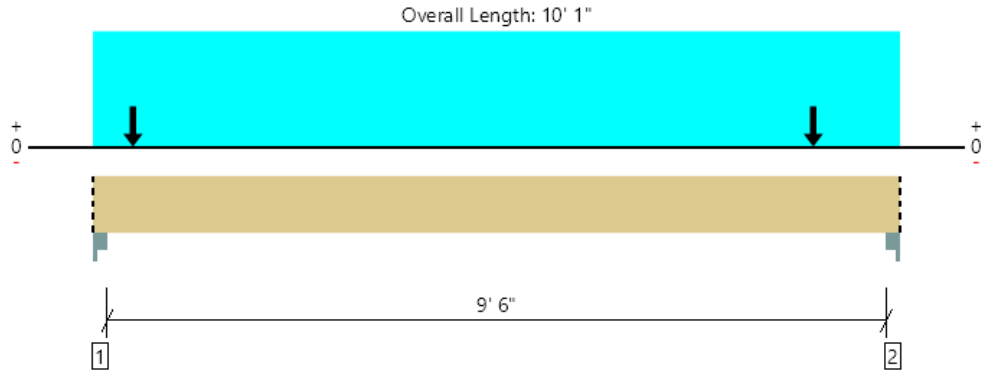
The product application, input design loads, dimensions and support information have been provided by BJM

ForteWEB Software Operator	Job Notes
Benjamin J. McCann CT Engineering Inc. (206) 285-4512 bmccann@ctengineering.com	

Weyerhaeuser

UPPER LEVEL, Floor: Flush Beam -BM7

1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam



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)	5152 @ 2"	7963 (3.50")	Passed (65%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	3993 @ 8' 11"	6493	Passed (62%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	10070 @ 5' 1 1/2"	12863	Passed (78%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.188 @ 5' 11/16"	0.244	Passed (L/621)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.287 @ 5' 11/16"	0.488	Passed (L/407)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 10' 1" o/c based on loads applied, unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 10' 1" o/c based on loads applied, unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 9' 9".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Column Cap - steel	3.50"	3.50"	2.26"	1797	3355	5152	Blocking
2 - Column Cap - steel	3.50"	3.50"	2.21"	1747	3272	5019	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 Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 10' 1"	N/A	8.9	--	
1 - Uniform (PSF)	0 to 10' 1" (Front)	13'	20.0	40.0	Default Load
2 - Point (lb)	6" (Front)	N/A	416	692	Linked from: Floor: Flush Beam - BM6, Support 2
3 - Point (lb)	9' (Front)	N/A	416	692	Linked from: Floor: Flush Beam - BM6, Support 2

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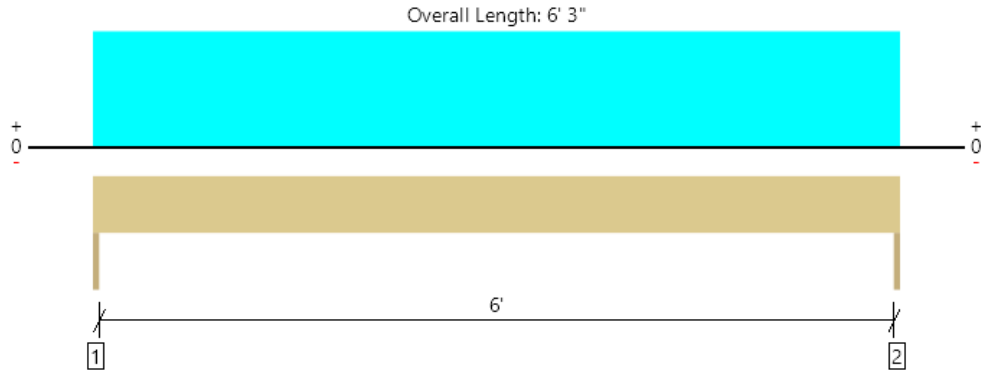
The product application, input design loads, dimensions and support information have been provided by BJM

ForteWEB Software Operator	Job Notes
Benjamin J. McCann CT Engineering Inc. (206) 285-4512 bmccann@ctengineering.com	

Weyerhaeuser

UPPER LEVEL, Floor: Flush Beam - BM8

1 piece(s) 5 1/2" x 10 1/2" 24F-V4 DF Glulam



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)	2862 @ 0	5363 (1.50")	Passed (53%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	1946 @ 1'	11733	Passed (17%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Pos Moment (Ft-lbs)	4472 @ 3' 1 1/2"	23244	Passed (19%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.017 @ 3' 1 1/2"	0.156	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.033 @ 3' 1 1/2"	0.313	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 6' 3" o/c based on loads applied, unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 6' 3" o/c based on loads applied, unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 6' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Total	
1 - Trimmer - DF	1.50"	1.50"	1.50"	1368	938	1055	3361	None
2 - Trimmer - DF	1.50"	1.50"	1.50"	1368	938	1055	3361	None

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 6' 3"	N/A	14.0	--	--	
1 - Uniform (PSF)	0 to 6' 3" (Front)	7' 6"	20.0	40.0	-	Default Load
2 - Uniform (PSF)	0 to 6' 3" (Front)	13' 6"	20.3	-	25.0	

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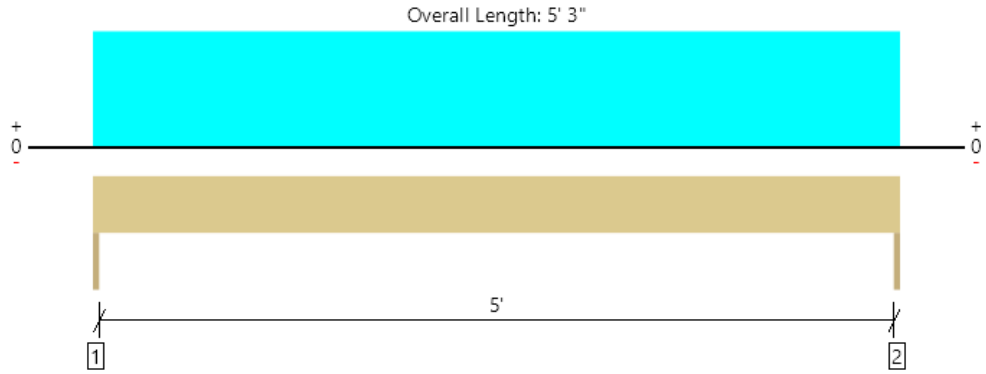
The product application, input design loads, dimensions and support information have been provided by BJM

UPPER LEVEL, Wall: Header - Typ hdr - BM9

1 piece(s) 4 x 8 Douglas Fir-Larch No. 2



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)	1764 @ 0	3281 (1.50")	Passed (54%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	1150 @ 8 3/4"	3045	Passed (38%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2089 @ 2' 7 1/2"	2989	Passed (70%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.035 @ 2' 7 1/2"	0.131	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.065 @ 2' 7 1/2"	0.262	Passed (L/975)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 5' 3" o/c based on loads applied, unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 5' 3" o/c based on loads applied, unless detailed otherwise.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Total	
1 - Trimmer - DF	1.50"	1.50"	1.50"	804	788	492	2084	None
2 - Trimmer - DF	1.50"	1.50"	1.50"	804	788	492	2084	None

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 5' 3"	N/A	6.4	--	--	
1 - Uniform (PSF)	0 to 5' 3"	7' 6"	20.0	40.0	-	Default Load
2 - Uniform (PSF)	0 to 5' 3"	7' 6"	20.0	-	25.0	

Weyerhaeuser Notes

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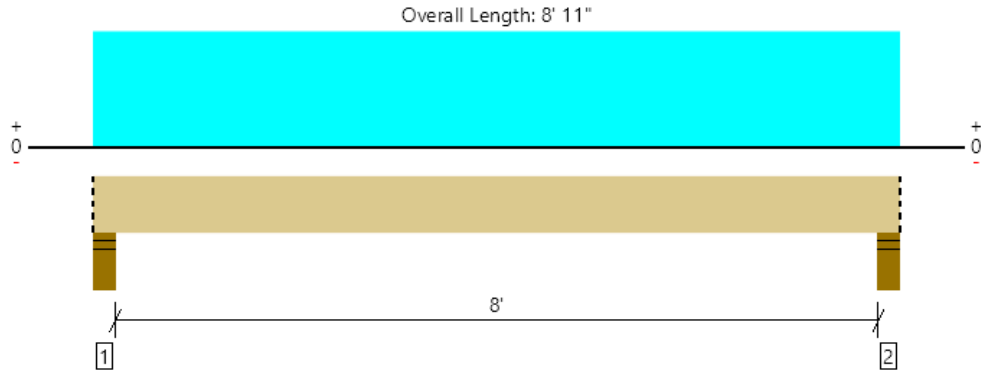
The product application, input design loads, dimensions and support information have been provided by BJM

ForteWEB Software Operator	Job Notes
Benjamin J. McCann CT Engineering Inc. (206) 285-4512 bmccann@ctengineering.com	

Weyerhaeuser

UPPER LEVEL, Floor: Drop Beam - BM10

1 piece(s) 4 x 8 Douglas Fir-Larch No. 2



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)	1366 @ 4"	12031 (5.50")	Passed (11%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1041 @ 1' 3/4"	3045	Passed (34%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2607 @ 4' 5 1/2"	2989	Passed (87%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.117 @ 4' 5 1/2"	0.206	Passed (L/845)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.180 @ 4' 5 1/2"	0.412	Passed (L/551)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 8' 11" o/c based on loads applied, unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 8' 11" o/c based on loads applied, unless detailed otherwise.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Stud wall - DF	5.50"	5.50"	1.50"	474	892	1366	Blocking
2 - Stud wall - DF	5.50"	5.50"	1.50"	474	892	1366	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 Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 8' 11"	N/A	6.4	--	
1 - Uniform (PSF)	0 to 8' 11" (Front)	5'	20.0	40.0	Default Load

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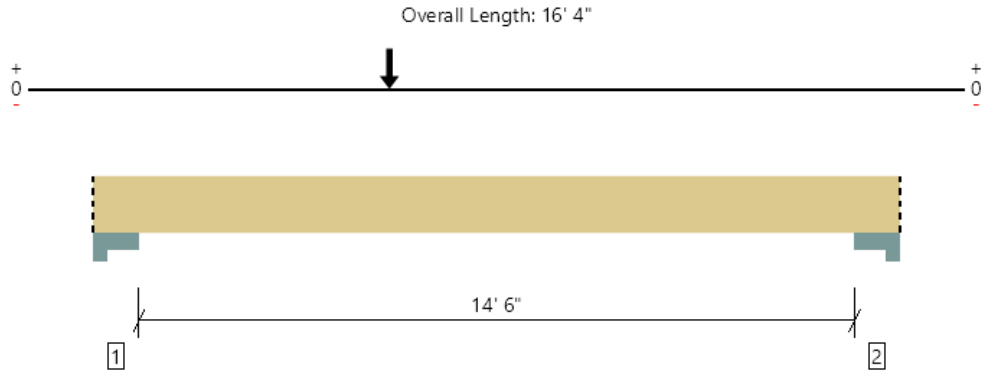
The product application, input design loads, dimensions and support information have been provided by BJM

PASSED

UPPER LEVEL, Floor: Flush Beam - BM11

1 piece(s) 5 1/2" x 12" 24F-V4 DF Glulam



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)	2848 @ 9 1/2"	39325 (11.00")	Passed (7%)	--	1.0 D + 0.7 E (All Spans)
Shear (lbs)	2817 @ 1' 11"	18656	Passed (15%)	1.60	1.0 D + 0.7 E (All Spans)
Pos Moment (Ft-lbs)	14549 @ 6'	42240	Passed (34%)	1.60	1.0 D + 0.7 E (All Spans)
Neg Moment (Ft-lbs)	-13912 @ 6'	32560	Passed (43%)	1.60	0.6 D - 0.7 E (All Spans)
Live Load Defl. (in)	-0.303 @ 7' 6 15/16"	0.369	Passed (L/584)	--	0.6 D - 0.7 E (All Spans)
Total Load Defl. (in)	0.315 @ 7' 7 1/8"	0.738	Passed (L/562)	--	1.0 D + 0.7 E (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 16' 4" o/c based on loads applied, unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 16' 4" o/c based on loads applied, unless detailed otherwise.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 14' 9".
- Critical negative moment adjusted by a volume factor of 1.00 that was calculated using length L = 14' 9".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Seismic	Total	
1 - Column Cap - steel	11.00"	11.00"	1.50"	131	3881/-3881	4012/-3881	Blocking
2 - Column Cap - steel	11.00"	11.00"	1.50"	131	2119/-2119	2250/-2119	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 Loads	Location (Side)	Tributary Width	Dead (0.90)	Seismic (1.60)	Comments
0 - Self Weight (PLF)	0 to 16' 4"	N/A	16.0	--	
1 - Point (lb)	6' (Front)	N/A	-	6000	Default Load

Member Notes

Transfer beam supporting uplift from above at over-strength level (E*Omega).

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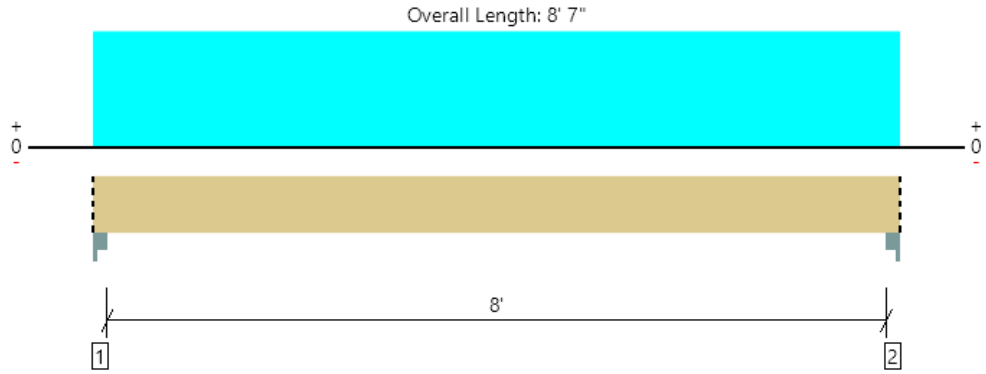
The product application, input design loads, dimensions and support information have been provided by BJM

ForteWEB Software Operator	Job Notes
Benjamin J. McCann CT Engineering Inc. (206) 285-4512 bmccann@ctengineering.com	

Weyerhaeuser

UPPER LEVEL, Floor: Drop Beam - BM12

1 piece(s) 4 x 6 Douglas Fir-Larch No. 2



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)	890 @ 2"	7656 (3.50")	Passed (12%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	734 @ 9"	2657	Passed (28%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1764 @ 4' 3 1/2"	1979	Passed (89%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.151 @ 4' 3 1/2"	0.206	Passed (L/656)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.278 @ 4' 3 1/2"	0.412	Passed (L/356)	--	1.0 D + 1.0 S (All Spans)

System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 8' 7" o/c based on loads applied, unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 8' 7" o/c based on loads applied, unless detailed otherwise.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Column Cap - steel	3.50"	3.50"	1.50"	407	483	890	Blocking
2 - Column Cap - steel	3.50"	3.50"	1.50"	407	483	890	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 Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 8' 7"	N/A	4.9	--	
1 - Uniform (PSF)	0 to 8' 7" (Front)	4' 6"	20.0	25.0	Default Load

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The product application, input design loads, dimensions and support information have been provided by BJM

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Weyerhaeuser

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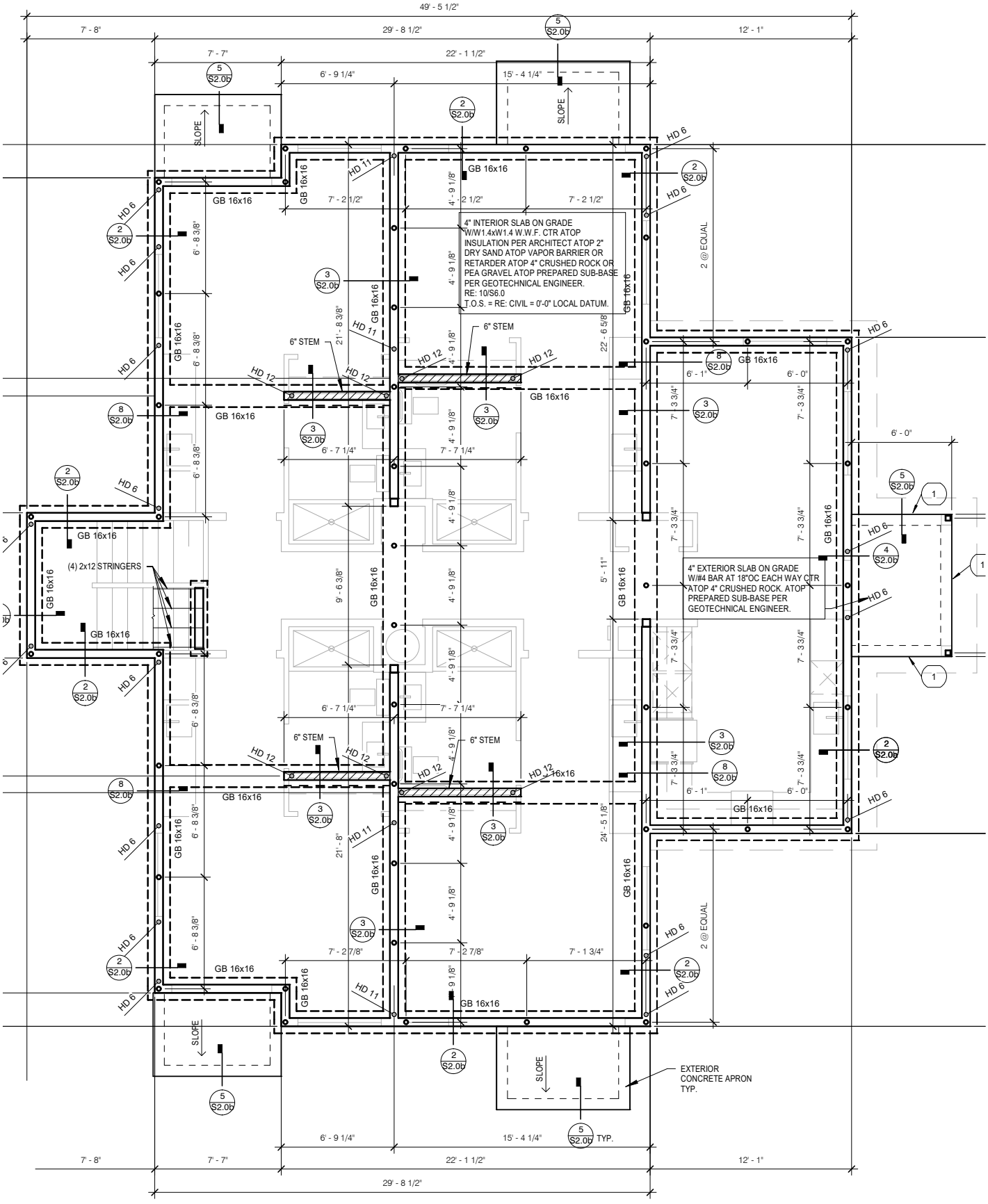
DEEP FOUNDATION ANALYSIS



SCALE: 1/4" = 1'-0"

1 Foundation Plan - Deep Option

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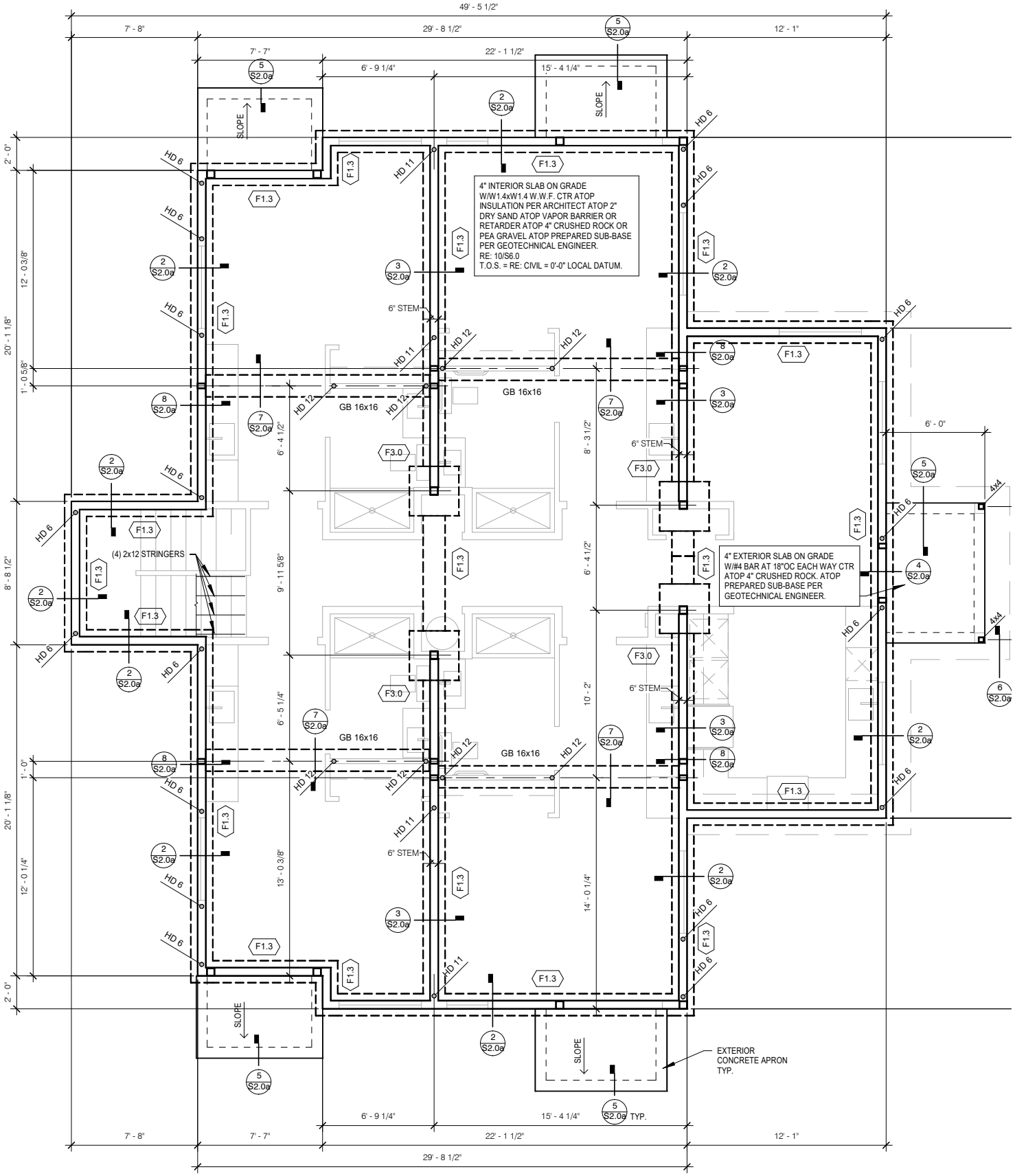
CONVENTIONAL FOUNDATION ANALYSIS



SCALE: 1/4" = 1'-0"

1 Foundation Plan - Conventional Option

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FOUNDATION / ANALYSIS.

	LIVE	DEAD
1ST FLOOR - SOG	0	0
2ND FLOOR - FRAMED	40 PSF	20 PSF
ROOF - TRUSSES	25 PSF	20 PSF + 10 PSF SOLAR ALLOWANCE

SIBC - 1606.3
5 PSF MIN.

PERIMETER BEARING

ROOF W/ INTERIOR BEARING WALL
$(8+2)(25+30) = 550\ ^{\#}/_{L}$

2ND
$(8')(40+20) = 480\ ^{\#}/_{L}$

FDN (18"x18" GRADE BM W/ 6"x12" STEM WALL ASSUMED)

GRADE BM
$(18/12)(18/12)(1)(150\ PCF) = 340\ ^{\#}/_{L}$

STEM
$(6/12)(1')(1\tfrac{1}{2}')(150\ PCF) = 75\ ^{\#}/_{L}$

TOTAL = 1445 $^{\#}/_{L}$

INTERIOR BEARING LOAD

ROOF
$15(25+30) = 825\ ^{\#}/_{L}$

2ND
$15(40+20) = 900\ ^{\#}/_{L}$

FDN - (18"x18" GRADE BM W/ 6"x12" STEM WALL (SIM TO ABV)
415 $^{\#}/_{L}$

TOTAL = 2140 $^{\#}/_{L}$

PILE SPACING -

	ALLOWABLE CAP.
2" CAPACITY	= 3 TONS = 6,000 #
3" CAPACITY	= 6 TONS = 12,000 #

MAX GRADE PILE SPACING

PERIMETER	INTERIOR
4.15' (4'-1")	2.80' (2'-9")
8.3' (8'-3")	5.61' (5'-7")

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19193

Project: Vashon Island Housing Center Homes   Date: 11/05/2019

Client: ______   Page Number: ______

GRADE BEAM DESIGN.

REQUIRED STRENGTH

1.4D (16-1)
1.2D + 1.6L + 0.5S (16-2)

DEMAND AT INTERIOR BEARING

$W_u = 1.4(1165\#) = 1631\#/' \ (16\text{-}1)$

$W_u = 1.2(1165\#) + 1.6(600) + 0.5(375\#/')$

$= 2545\#/' \ (16\text{-}2)$

$M_u = W_u l_n^2/14$ POS. MOMENT END SPAN.
$W_u l_n^2/10$ NEG.

$2545\#/' (8.3')^2/8$

$= 21{,}915\#' = 21.9^{k'}$

ESTIMATE $A_s = M_u/4d = \frac{21.9^{k'}}{4(17.2'')} = .32^{\square''}$

MINIMUM $A_s = \frac{200 b_w d}{f_y} = \frac{200(18'')(17.2'')}{60{,}000 \text{ psi}} = 1.03^{\square''}$

A_s 2-#5 $= 2(.31) = .62^{\square''}$

9.6.1.3 A_s PROVIDED ≥ 1.3 A_s REQUIRED BY ANALYSIS?

$a = \frac{A_s f_y}{.85 f'_c b} = \frac{.62^{\square''}(60)}{.85(2.5)(18)} = .973''$

$M_n = A_s f_y (d - a/2) = .62^{\square''}(60{,}000)(17.2'' - \frac{.973''}{2})$

$= 621{,}742\#'' \left(\frac{1 \text{ kip}}{1000\#}\right)\left(\frac{1 \text{ ft}}{12 \text{ in}}\right)$

$= 51.8^{k'}$

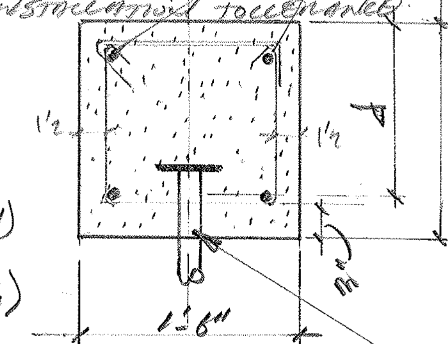
$\phi M_n = 0.9(51.8^{k'}) = 46.6^{k'} \le M_u = 21.9^{k'}$

$46.6^{k'} \le 1.3(21.9) = 28.5^{k'}$ ∴

CHECK SHEAR REINF. (ASSUME CONT. BEAM. 4 EQ SPANS)

$V_{u\,max} = .607 w_u l = .607(2545\#/')(8.3') = 12{,}821\#$
$= 12.8K$

18" - 1½" - 1½" - 1" - 5/8" - 5/8" - .3" = 9.75
9.75/2 = 4.935"
KEEP 18" WIDTH TO ALLOW FOR PIPE PILE INSTALLATION TOLERANCE



2-#5 TOP & BOTTOM W/ #4 @ 9" O.C. TIES.

$d = 18'' - ½'' - \frac{5/8}{2}$
$= 17.19$
$d/2 = 8.59''$
TIES @ 8" O.C. MEETS d/2 REQUIREMENT

2 OR 3" PIPE PILE @ CANTILEVER PER PLAN.

GB 18×18

18.13.3.2
TIE SPACING –
½ SMALLEST ORTHOGONAL DIRECTION AND 12" ∴ 9" SPACING OK.

TABLE 9.3.1.1
$l/18.5 = \frac{8.3'(12''/')}{18.5} = 5.38''$
18" > 5.4" OK

MINIMUM REINF. STEEL IS NOT REQUIRED IN THE GRADE BEAMS.

∴ 2-#5 T&B $f_y = 60$ ksi OK

Structural Engineers

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Project: Vashon Island Housing Center Homes Date: 11/05/2019

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GRADE BEAM DESIGN (CONT.)

SHEAR REINFORCING CHECK CONT.

$A_{v,min}/s = \frac{50 b_w}{f_{yt}} = \frac{50(18")}{60{,}000\ psi} = .015$ for #4

$\frac{50(18)}{40{,}000} = .0225$ for #3

in
1/2
1/12

9" → $.015(5) = .135" < .2^{in^2}$ OK #4 @ 9" OK

$.0225(9) = .2025$

$A_{\#3} = .11 < .2025$ OK

$\phi V_n \geq V_u$

$\phi V_n = \phi(V_c + V_s)$

$V_c = 2\lambda\sqrt{f'_c}\, b_w d = 30{,}960\#$ (λ = 1.0, b_w = 18, d = 17.2", f'_c = 2500)

#4 F_y = 60 ksi

$V_s = \frac{A_v f_{yt} d}{s} = \frac{.2^{in^2}(60{,}000)\,17.2"}{9"} = 22{,}933$

$\phi V_n = \phi(30.9^k + 22.9^k) = 33.7^k \geq 12.8^k$ (0.7 + 0.7)

Provide #4 @ 9" O.C. CLOSED TIES (2 PART) f_y = 60 ksi min.

#3 F_y = 40 ksi

$V_s = 0.11\frac{(40{,}000)}{9"}(17.2") = 8408\#$ — OK

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(JACUS ENGINEERING SERVICES)

GRADE BEAM DESIGN - CONT. ATTEMPT GB 16x16 W/ 2-#4 TOP & BOTTOM & #4 2 PART CLOSED TIES @ 8" O.C

DEMAND AT INTERIOR BEARING GOVERNS HIM TO GB18x18 DESIGN PREVIOUS.

∴ $M_u = 21.9^{k'}$

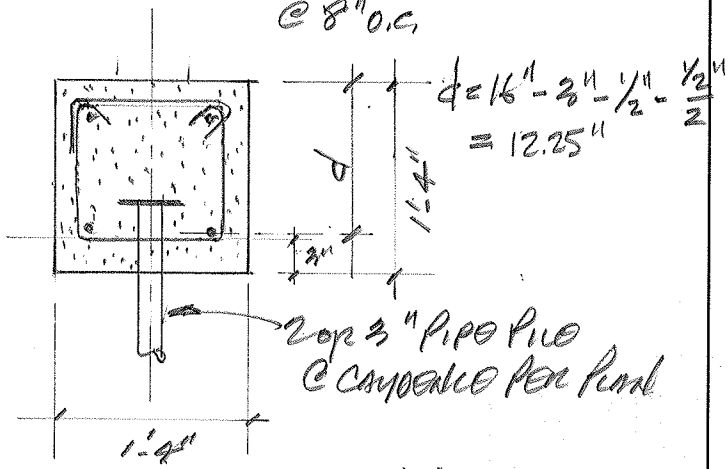
$A_s = M_u/4d = 21.9^{k'}/4(12.25) = .45^{\square''}$

$d = 16'' - 3'' - \frac{1}{2}'' - \frac{1/2''}{2} = 12.25''$

MIN $A_s = \frac{200 b_w d}{f_y} = \frac{200(16)(12.25)}{60{,}000} = .65^{\square''}$

$A_{2\text{-}\#5} = .31(2) = .62^{\square''} < .65^{\square''}$ OK PER 9.6.1.3 PROVIDE 1.3 A_s REQ BY ANALYSIS.

2-#5 T&B 60 GRADE W/ #3 CLOSED 2 PART TIES @ 8" O.C.



GB 16x16

$a = \frac{A_s f_y}{.85 f'_c b} = \frac{.62(60)}{.85(2.5)(16)} = 1.09''$

$M_n = A_s f_y (d - a/2) = .62(60{,}000)(12.25 - \frac{1.09}{2}) = 435{,}426\ \#'' = 36.3^{k'}$

$\phi M_n = .9(36.3) = 32.6^{k'} \le M_u = 21.9^{k'}$

$32.6^{k'} \le 1.3 M_u = 1.3(21.9) = 28.47^{k'}$ 9.6.1.3 VERIFIED

CHECK SHEAR REINFORCEMENT - #4 - 2 PART TIES @ 8" O.C.

$V_{u\,MAX} = 12.8^{k}$ SIM GB18x18 DESIGN.

$\frac{A_v}{\#4\ MIN} = \frac{50 b_w}{f_{yt}}\left(\frac{16''}{8''}\right) = .107$ $A_{s\,\#4} = .2^{\square''} > .107^{\square''}$ ∴ ATTEMPT #4 @ 8" O.C.

60,000

→ 60 GRADE #3 BARS WORK SINCE 45% INCREASE IN STEEL FOR TIES... MATERIAL HOMES SUPPLY SOURCES:
* MATERIAL SOURCE (503) 206.2311
* ASTORIA JJ, KIM, TOM (425) 787.9611

$\phi V_n \ge V_u$

$\phi V_n = \phi(V_c + V_s) = \phi\left(2\lambda\sqrt{f'_c}\, b_w d + \frac{A_v f_{yt} d}{s}\right) =$

$\phi = 0.7$, $\lambda = 1.0$, $\sqrt{f'_c} = 2500$, $b_w = 16''$, $d = 12.25''$, $A_v = .11$, $f_{yt} = 60{,}000$, $s = 8''$

$= 0.7(19{,}600 + 10{,}106) = 20{,}794^{\#} > 12.8^{k'}$

$20.8^{k'} > 12.8^{k'}$ OK.

CT ENGINEERING INC.

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FOUNDATION ANALYSIS (CONT.)

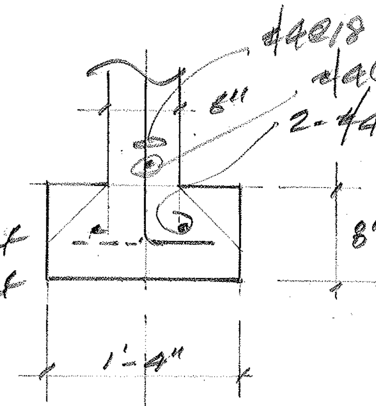
CONVENTIONAL FOUNDATION (ALLOWABLE BEARING PRESSURE = 3000 PSF PER SOILS REPORT)

SOILS REPORT RECOMMENDS STRIP FOOTINGS W/ 16" MIN WIDTH

CAPACITY OF STRIP FOOTING

(16/12)(1')(3000 PSF) = 4,000 PLF

PERIMETER BEARING ≅ 1445 PLF < 4000 PLF
INTERIOR BEARING ≅ 2140 PLF < 4000 PLF



FOOTING

TEMP REINF .0018 (8")(16") = .23 $\#''$

A_s 2-#4 = .2(2) = .4 $\#''$ > .23 $\#''$ — GEOTECHNICAL ENGINEERS MINIMUM WIDTH RECOMMENDATION CONTROLS DESIGN.

∴ PROVIDE 2-#4 CTR. FOOTING

6" STEM

VERTICAL STEEL (MIN)

$A_{V\,min}$ = .0012 A_g (S·6") = .2 ∴ S = 28"
#4@18" VERT

HORIZONTAL STEEL (MIN)

$A_{H\,min}$ = .002 A_g (S·6") = .2 ∴ S = 16.7"
#4@16" HORZ.

NOTE - VALUE ENGINEERING LIKELY A 16"x16" GRADE BEAM WILL SUFFICE & BE SIMILAR IN WIDTH TO THE 16" WIDE STRIP FOOTING - VALUE ENG.

324 $\#''$ (x) = 256 $\#''$
x = .79

21% LESS CONCRETE W/ 16"x16" GRADE BM.

Structural Engineers