

Structural Calculations

For

Jones Remodel

4110 78th Ave SE
Mercer Island, WA

~~July 12, 2025~~

Rev 11-11-2025



Prepared by

Ryan Hartman
Dane Pollett

Project: Jones Remodel
Project Number: Mercer Island, WA

Code: IBC 2021
Risk Category: II
Earthquake: Site Class D ← C - based on geo report
 $I_e = 1.00$ $R = 6.5$
 $S_S = 1.421$ $\Omega_0 = 3.0$
 $S_1 = 0.494$ $C_d = 4.0$
 $\rho = 1.00$

Wind: Basic Design Wind Speed, V 100 MPH
 Exposure C
 Topographic Factor $K_{ZT} = 1.00$

Soil Bearing: 1500-psf Allowable Soil Bearing Pressure
Concrete: 2500-psi Concrete Strength
 Higher strength may be used, but special inspection and testing reports not req'd

Nails: Sheathing 8d common (2½" x 0.131")
 Framing 12d box (3¼" x 0.131")

Roof Framing:

<i>Snow Load</i>	Ground Snow, P_g	25 psf
	Exposure factor, C_e	1.0
	Thermal Factor, C_t	1.2
	Flat Roof Snow, P_f (0.7 $C_e C_t I P_g$)	21 psf
	Use Snow Load	25 psf
	Attic (where accessible)	10 psf
<i>Dead Load</i>	Roofing - Allowance	2.0 psf
	Sheathing - 7/16 OSB	2.2 psf
	Framing - 2x Rafter + C.J	2.5 psf
	Insulation - Batt.	1.0 psf
	Ceiling - 5/8 GWB	2.8 psf
	Misc.	1.5 psf
	Total	12 psf

Deflection L/360 Live Load, L/240 Total Load

Floor Framing:

<i>Live Load</i>	Residential	40 psf
	Decks	60 psf

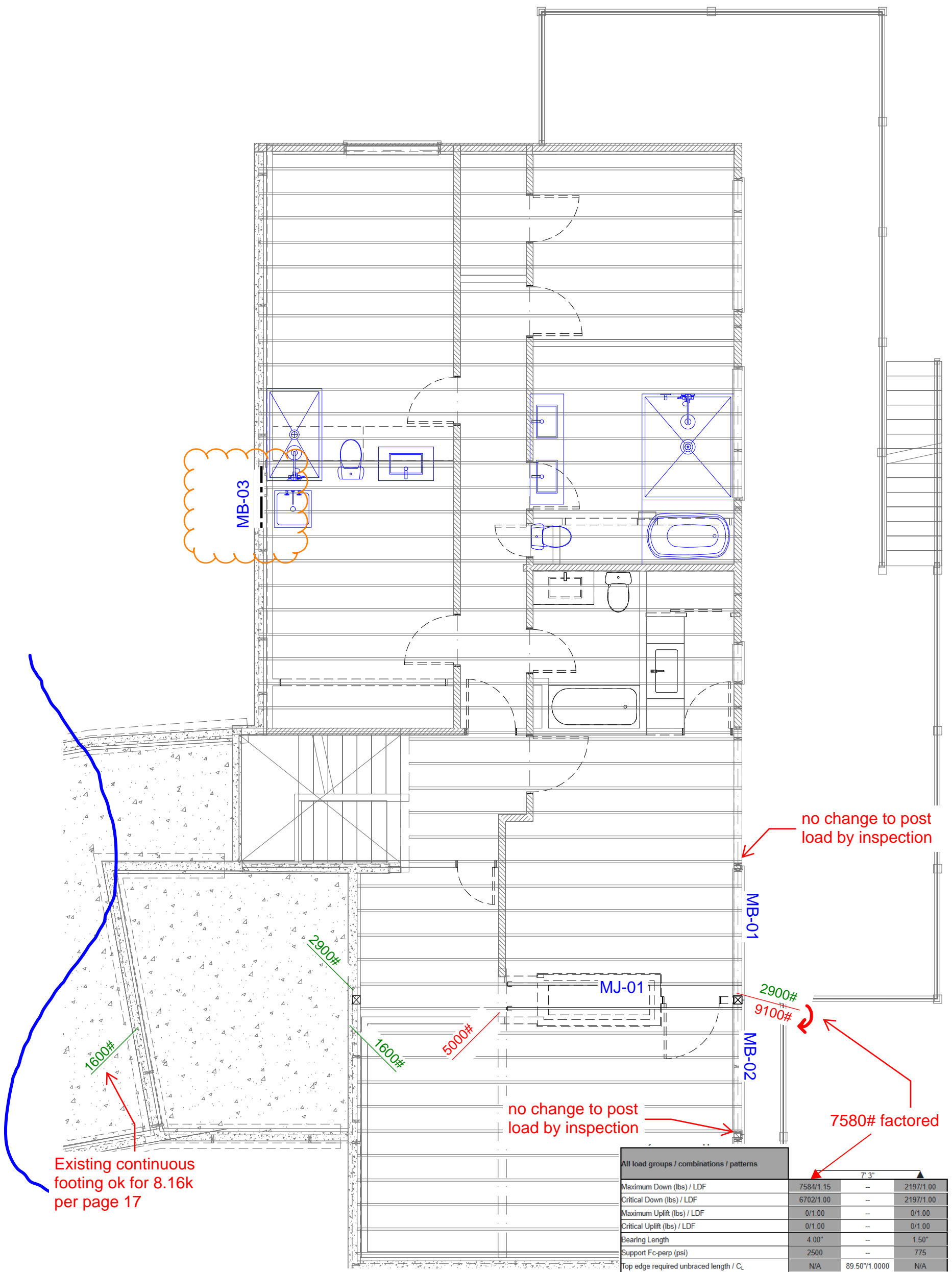
Dead Load

	Finish Floor - Allowance	2.5 psf
	Sheathing - 3/4 Plywood/Edge Gold	2.5 psf
	Framing - 2x10 @ 16" O.C	2.7 psf
	Ceiling - 5/8 GWB	2.8 psf
	Misc.	1.5 psf
	Total	12 psf

Deflection L/480 Live Load, L/240 Total Load

Wall Framing:

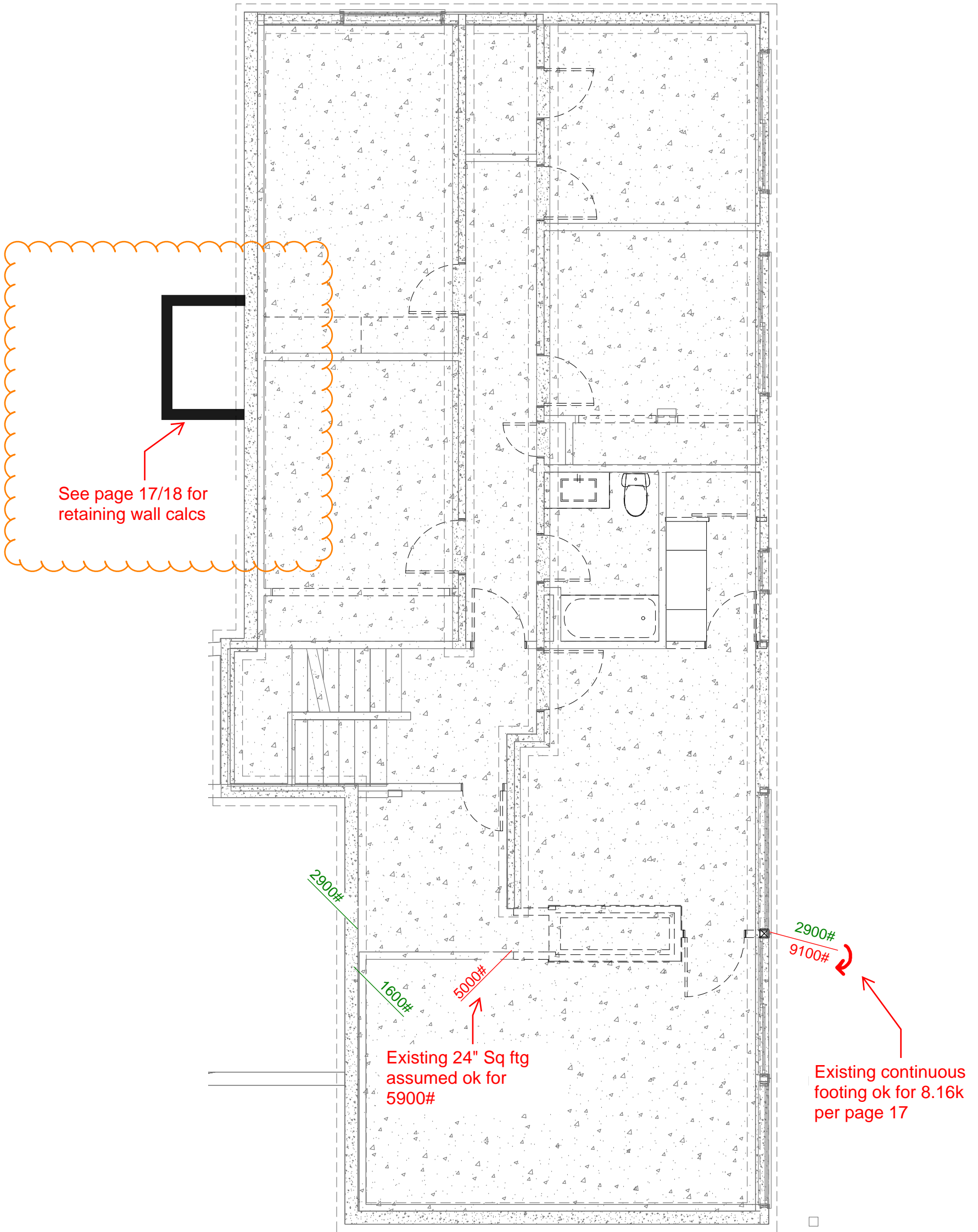
<i>Dead Load</i>	Exterior 2x Stud Walls	10 psf
	Interior 2x Stud Walls	8 psf



ALLOWABLE AXIAL LOAD (lb) FOR 1.8E PARALLAM® PSL^[1]

Column Bearing Type	Effective Column Length	1.8E Parallam® PSL Column Size																		
		3 1/2" x 3 1/2"			3 1/2" x 5 1/4"			3 1/2" x 7"			5 1/4" x 5 1/4"			5 1/4" x 7"			7" x 7"			
		100%	115%	125%	100%	115%	125%	100%	115%	125%	100%	115%	125%	100%	115%	125%	100%	115%	125%	
On Column Base	7'	8,735	9,140	9,370	13,105	13,710	14,060	17,475	18,280	18,745	30,010	32,545	34,030	40,000	40,000	40,000	40,000	40,000	40,000	40,000
	8'	7,265	7,550	7,715	10,900	11,325	11,570	14,535	15,100	15,425	26,650	28,490	29,555	35,530	37,985	39,410	40,000	40,000	40,000	40,000
	9'	6,115	6,320	6,440	9,170	9,480	9,660	12,225	12,640	12,880	23,475	24,835	25,620	31,300	33,115	34,165	40,000	40,000	40,000	40,000
	10'	5,200	5,355	5,445	7,800	8,035	8,170	10,400	10,715	10,895	20,660	21,695	22,290	27,545	28,925	29,725	40,000	40,000	40,000	40,000
	12'	3,885	3,980	4,030	5,825	5,965	6,050	7,765	7,955	8,065	16,160	16,805	17,175	21,545	22,405	22,900	40,000	40,000	40,000	40,000

Main Floor Framing Key Plan



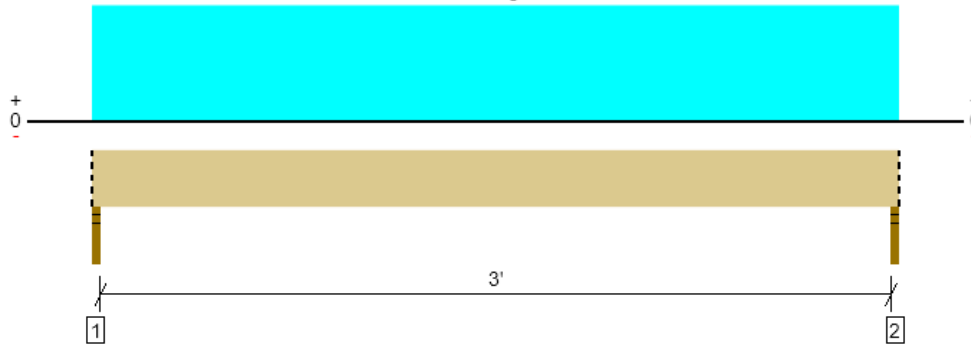
Foundation Key Plan

Main, MB-03

1 piece(s) 4 x 6 DF No.2

← min.

Overall Length: 3' 4"



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	928 @ 1/2"	2975 (2.00")	Passed (31%)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Shear (lbs)	580 @ 7 1/2"	2657	Passed (22%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Moment (Ft-lbs)	735 @ 1' 8"	1979	Passed (37%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.010 @ 1' 8"	0.081	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)
Total Load Defl. (in)	0.018 @ 1' 8"	0.162	Passed (L/999+)	--	1.0 D + 0.75 L + 0.75 S (All Spans)

Member Length : 3' 4"
 System : Floor
 Member Type : Flush Beam
 Building Use : Residential
 Building Code : IBC 2021
 Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)				Accessories
	Total	Available	Required	Dead	Floor Live	Snow	Total	
1 - Stud wall - SPF	2.00"	2.00"	1.50"	418	367	312	1097	Blocking
2 - Stud wall - SPF	2.00"	2.00"	1.50"	418	367	312	1097	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 4" o/c	
Bottom Edge (Lu)	3' 4" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 3' 4"	N/A	4.9	--	--	
1 - Uniform (PSF)	0 to 3' 4" (Front)	5' 6"	12.0	40.0	--	Main
2 - Uniform (PLF)	0 to 3' 4" (Front)	N/A	90.0	--	--	Wall
3 - Uniform (PSF)	0 to 3' 4" (Front)	7' 6"	12.0	--	25.0	Roof

• Side loads are assumed to not induce cross-grain tension.

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

ForteWEB Software Operator	Job Notes
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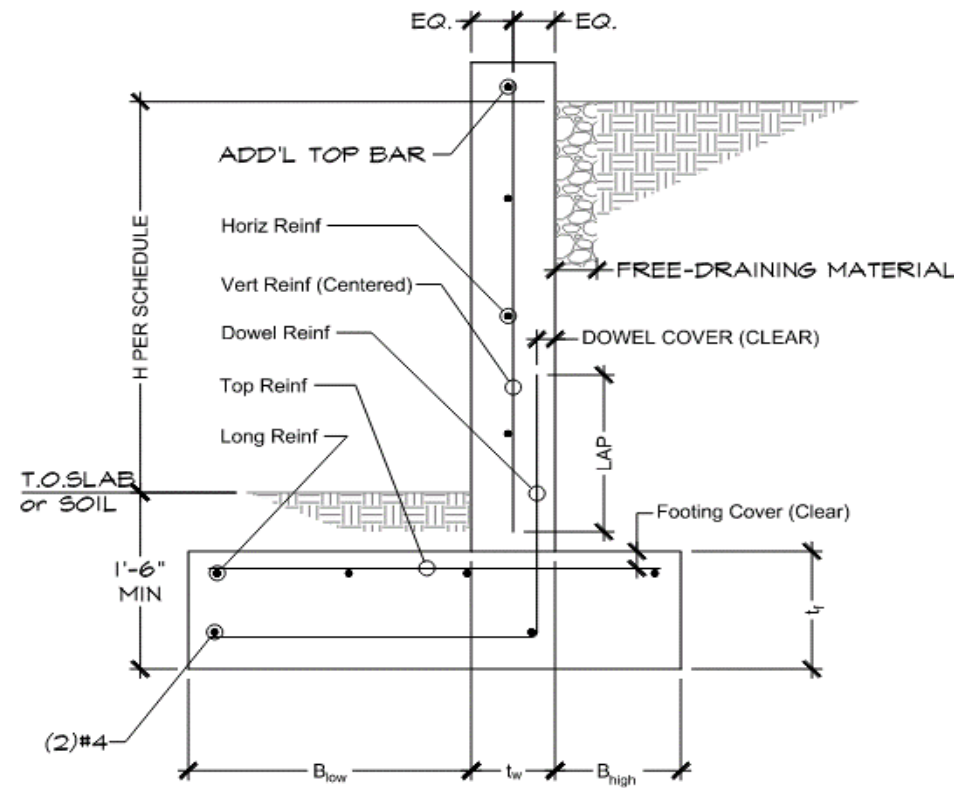


Rev 11-11-2025

11/6/2025 4:19:52 PM UTC

ForteWEB v3.9, Engine: V8.4.3.94, Data: V8.1.7.3

File Name: Jones Remodel



Location	Distance Down from High End (ft)	Moment, Ultimate (ft-#/ft)	Minimum ρ_{min}	Required ρ	Maximum ρ_{max}	Required A_s	
						(in ² /ft)	Vertical Bar Spacing
1/4H	1.5	27	0.0015	0.0000	0.0252	0.14	#4 @ 16 in oc
1/2H	3	324	0.0015	0.0006	0.0252	0.14	#4 @ 16 in oc
3/4H	4.5	1080	0.0015	0.0020	0.0252	0.19	#4 @ 12 in oc
H	6	2484	0.0015	0.0019	0.0252	0.18	#4 @ 13 in oc

$M_u = 1.0E + 1.6H$

Vertical Reinforcement:

Minimum $\rho = 0.0012$ for bars not larger than #5 and yield strength not less than 60 ksi

Minimum $\rho = 0.0015$ for all other bars

Maximum $\rho = 0.75\rho_b$

$\rho_b = 0.85f_c'/f_y \beta_1 [87,000/(87,000 + f_y)]$

$\beta_1 = 0.85 - 0.05 [(f_c' - 4000)/1000] \geq 0.65$

$\beta_1 = 0.925$

Horizontal Reinforcement:

Minimum $\rho = 0.0020$ for bars not larger than #5 and yield strength not less than 60 ksi

Minimum $\rho = 0.0025$ for all other bars

Horizontal Bar Spacing

$\rho_{min} = 0.0020$

#5 @ 18 in oc

Footing Reinforcement:

Horizontal Bar Spacing

$\rho = 0.0007$

#4 @ 18 in oc

Check Overturning at Toe (ASD)

$M_{causing} (1.0H) = 1575 \text{ ft-#/ft}$

$M_{resisting} = 3582 \text{ ft-#/ft}$

$M_{causing} (0.7E) = 882 \text{ ft-#/ft}$

FS against overturning (H):

2.3 OK

FS against overturning (H + 0.7E):

1.9 OK for Seismic w/ 4/3 increase

Check Sliding (ASD)

$F_{causing} (1.0H) = 630 \text{ #/ft}$

(Friction) $F_{resisting} = 625 \text{ #/ft}$

$F_{causing} (0.7E) = 151 \text{ #/ft}$

(Passive) $F_{resisting} = 44 \text{ #/ft}$

FS against sliding (H):

1.6 OK

FS against sliding (H + 0.7E):

1.7 OK for Seismic w/ 4/3 increase

Foundation Pressures

$\Sigma M_a = 2007 \text{ ft-#/ft}$

$\Sigma V = 1784 \text{ #/ft}$

$d = \Sigma M_a / \Sigma V$

$d = 1.12 \text{ ft}$

$e = 0.33 \text{ ft}$

$l = 2 \text{ ft}$

$P_a = V/A + Ve(B/2)/I$

$P_b = V/A - Ve(B/2)/I$

$P_a = 1032 \text{ psf}$

$P_b = 0 \text{ psf}$

1.5 SF Included

SF Not Included

service

service

ultimate

ultimate

ultimate

ultimate

6 x H psf

36 psf

Interior

Retaining

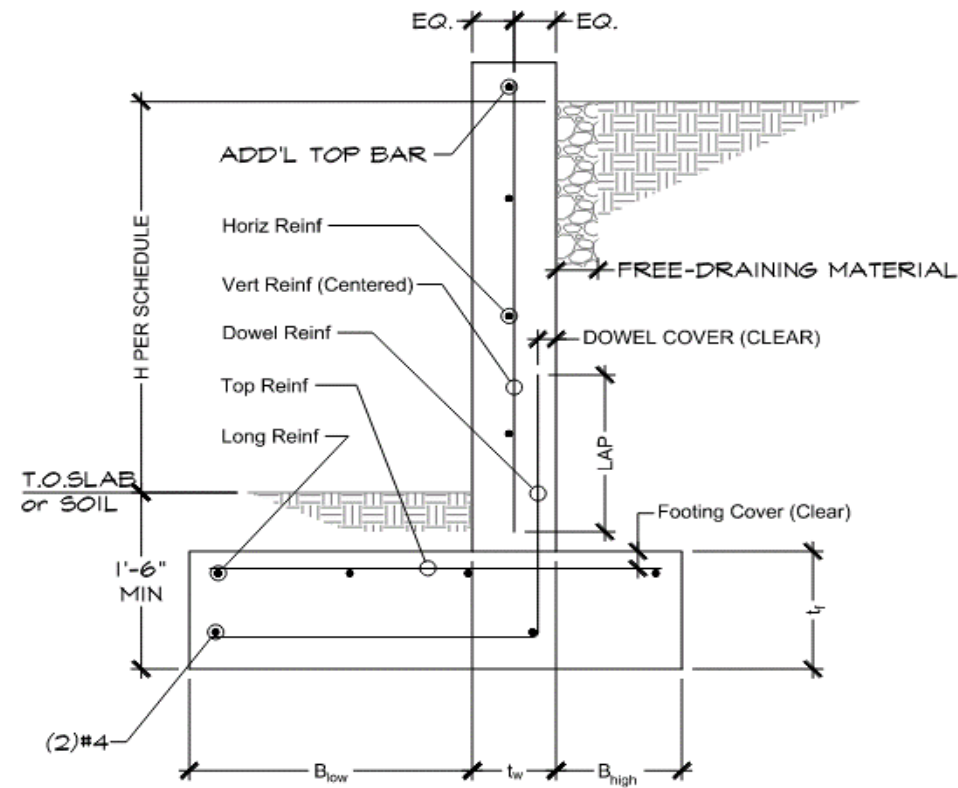
Wall

Vertical Tension bar placement = Centered

- Wall Height, H = 6.00 ft
- Soil Depth @ Low End, d = 0.50 ft
- Low End Length, B_{low} = 1.50 ft
- High End Length, B_{high} = 0.75 ft
- Footing Thickness, t_f = 12 in
- Wall Thickness, t_w = 8 in
- Slope of High Soil, $\theta = 0 \text{ deg}$
- #4 & Smaller Steel Yield Strength, $f_y = 40 \text{ ksi}$
- #5 & Larger Steel Yield Strength, $f_y = 60 \text{ ksi}$
- Concrete Compressive Strength, $f_c' = 2500 \text{ psi}$
- Footing Dowels #4
- Wall Vertical Steel #4
- Wall Horizontal Steel #5
- Top Footing Steel #4
- Longitudinal Footing Steel #4
- Deflection Control, $\rho f_y/f_c' = 0.180$
- Cover at Footing Dowels, c_{dowel} = 1.50
- Cover at Wall, c_{wall} = 3.75
- Cover at Top of Footing, c_{top} = 1.50
- Cover at Bottom of Footing, c_{bot} = 3.00

- b = 12 in
- d_{wall} = 4.000 in
- d_{dowels} = 6.250 in
- d_{footing} = 10.250 in

- Friction Coefficient @ Base, $\mu_b = 0.35$
- Friction Coefficient @ Wall, $\mu_w = 0.00$
- Effective Friction Angle, $\phi = 20 \text{ deg}$
- Weight of Soil, $W_s = 115 \text{ pcf}$
- Weight of Concrete, $W_c = 150 \text{ pcf}$
- Allowable Soil Bearing Pressure, q_{all} = 2000 psf
- Active Lateral Earth Pressure, p_a = 35 pcf
- At-Rest Lateral Earth Pressure, p = 0 pcf
- Passive Earth Pressure, p = 350 pcf
- Constant Wall Pressure, p_L = 0 psf
- Depth of Constant Wall Pressure, d_L = 11.50 ft
- Uniform Surcharge, w = 0 psf
- Wall Axial Load, P_w = 0.00 kif
- Wall Shear Load, V_w = 0.00 kif
- Wall Moment Load, M_w = 0.00 k-ft/ft
- Seismic Pressure = 6 x H psf
- Seismic Pressure = 36 psf
- Wall Condition = Interior Retaining Wall
- Vertical Tension bar placement = Centered



Location	Distance Down from High End (ft)	Moment, Ultimate (ft-#/ft)	Minimum ρ_{min}	Required ρ	Maximum ρ_{max}	Required A_s	
						(in ² /ft)	Vertical Bar Spacing
1/4H	1.25	4	0.0015	0.0000	0.0252	0.14	#4 @ 16 in oc
1/2H	2.5	165	0.0015	0.0003	0.0252	0.14	#4 @ 16 in oc
3/4H	3.75	591	0.0015	0.0011	0.0252	0.14	#4 @ 16 in oc
H	5	1392	0.0015	0.0011	0.0252	0.14	#4 @ 16 in oc

$M_u = 1.0E + 1.6H$

Vertical Reinforcement:

Minimum $\rho = 0.0012$ for bars not larger than #5 and yield strength not less than 60 ksi

Minimum $\rho = 0.0015$ for all other bars

Maximum $\rho = 0.75\rho_b$

$\rho_b = 0.85f_c'/f_y \beta_1 [87,000/(87,000 + f_y)]$

$\beta_1 = 0.85 - 0.05 [(f_c' - 4000)/1000] \geq 0.65$

$\beta_1 = 0.925$

Horizontal Reinforcement:

Minimum $\rho = 0.0020$ for bars not larger than #5 and yield strength not less than 60 ksi

Minimum $\rho = 0.0025$ for all other bars

Horizontal Bar Spacing

$\rho_{min} = 0.0020$

#5 @ 18 in oc

Footing Reinforcement:

Horizontal Bar Spacing

$\rho = 0.0004$

#4 @ 18 in oc

Check Overturning at Toe (ASD)

$M_{causing} (1.0H) = 948 \text{ ft-#/ft}$

$M_{resisting} = 2260 \text{ ft-#/ft}$

$M_{causing} (0.7E) = 540 \text{ ft-#/ft}$

FS against overturning (H):

2.4 OK

FS against overturning (H + 0.7E):

2.0 OK for Seismic w/ 4/3 increase

Check Sliding (ASD)

$F_{causing} (1.0H) = 438 \text{ #/ft}$

(Friction) $F_{resisting} = 509 \text{ #/ft}$

$F_{causing} (0.7E) = 105 \text{ #/ft}$

(Passive) $F_{resisting} = 44 \text{ #/ft}$

FS against sliding (H):

1.8 OK

FS against sliding (H + 0.7E):

2.0 OK for Seismic w/ 4/3 increase

Foundation Pressures

$\Sigma M_a = 1312 \text{ ft-#/ft}$

$\Sigma V = 1453 \text{ #/ft}$

$d = \Sigma M_a / \Sigma V$

$d = 0.90 \text{ ft}$

$e = 0.31 \text{ ft}$

$l = 1 \text{ ft}$

$P_a = V/A + Ve(B/2)/I$

$P_b = V/A - Ve(B/2)/I$

$P_a = 1057 \text{ psf}$

$P_b = 0 \text{ psf}$

1.5 SF Included

SF Not Included

service

service

ultimate

ultimate

ultimate

ultimate

Seismic Pressure = 6 x H psf

Seismic Pressure = 30 psf

Wall Condition = Interior Retaining Wall

Vertical Tension bar placement = Centered

Wall Height, H = 5.00 ft

Soil Depth @ Low End, d = 0.50 ft

Low End Length, B_{low} = 1.00 ft

High End Length, B_{high} = 0.75 ft

Footing Thickness, t_f = 12 in

Wall Thickness, t_w = 8 in

Slope of High Soil, $\theta = 0 \text{ deg}$

Friction Coefficient @ Base, $\mu_b = 0.35$

Friction Coefficient @ Wall, $\mu_w = 0.00$

Effective Friction Angle, $\phi = 20 \text{ deg}$

Weight of Soil, W_s = 115 pcf

Weight of Concrete, W_c = 150 pcf

Allowable Soil Bearing Pressure, q_{all} = 2000 psf

Active Lateral Earth Pressure, p_a = 35 pcf

At-Rest Lateral Earth Pressure, p = 0 pcf

Passive Earth Pressure, p = 350 pcf

Constant Wall Pressure, p_L = 0 psf

Depth of Constant Wall Pressure, d_L = 11.50 ft

Uniform Surcharge, w = 0 psf

Wall Axial Load, P_w = 0.00 kif

Wall Shear Load, V_w = 0.00 kif

Wall Moment Load, M_w = 0.00 k-ft/ft

#4 & Smaller Steel Yield Strength, f_y = 40 ksi

#5 & Larger Steel Yield Strength, f_y = 60 ksi

Concrete Compressive Strength, f_c' = 2500 psi

Footing Dowels #4

Wall Vertical Steel #4

Wall Horizontal Steel #5

Top Footing Steel #4

Longitudinal Footing Steel #4

Deflection Control, $\rho f_y/f_c' = 0.180$

Cover at Footing Dowels, c_{dowel} = 1.50

Cover at Wall, c_{wall} = 3.75

Cover at Top of Footing, c_{top} = 1.50

Cover at Bottom of Footing, c_{bot} = 3.00

b = 12 in

d_{wall} = 4.000 in

d_{dowels} = 6.250 in

d_{footing} = 10.250 in