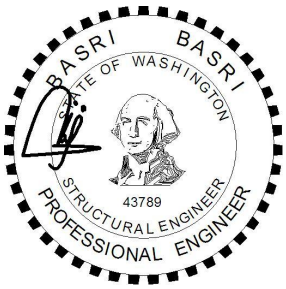
b2 structural engineers
info@b2engineers.com
425-318-7047 (O)
425-318-0031 (C)



BELADY GARAGE
7627 79TH AVE SE, MERCER ISLAND, WA 98040
STRUCTURAL DESIGN

PROJECT NO: 19207 DATE:01/18/20
PREPARED BY: BASRI BASRI PE, SE

Design Criteria

International Building Code (IBC) 2015
American Society of Civil Engineers (ASCE) 7-10

Project Description

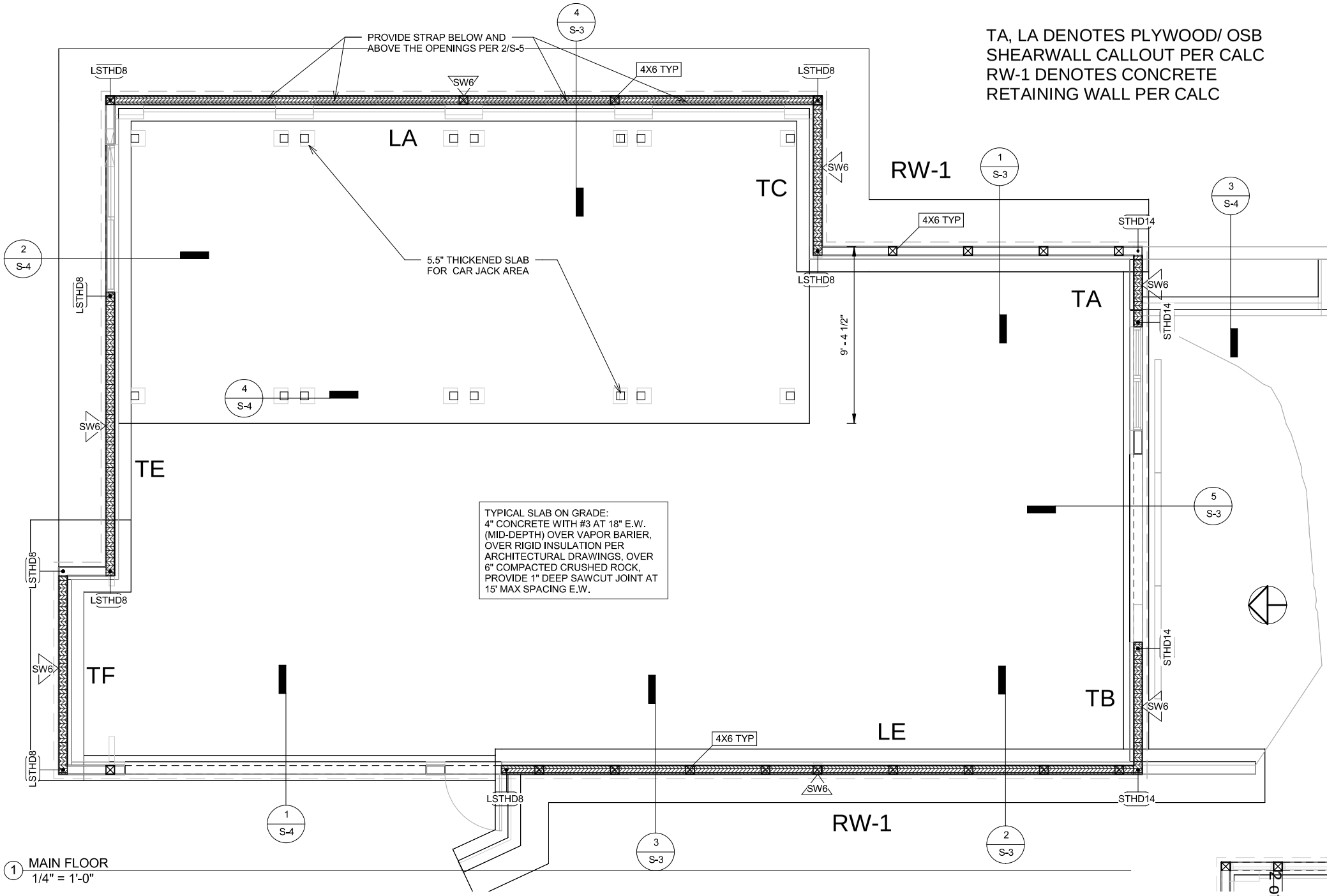
STRUCTURAL DESIGN OF WOOD FRAMED GARAGE UTILIZING GLULAM BEAMS, PLYWOOD/OSB SHEATHING AND CAR DECKING ON WOOD POSTS. THE LATERAL SYSTEM CONSISTS OF PLYWOOD SHEARWALLS AND SIMPSON HOLDOWN STRAPS. THE SEISMIC ACCELERATIONS ARE OBTAINED FROM USGS WEBSITE. THE WIND TOPOGRAPHIC FACTOR (Kzt) IS FOUND TO BE 1.6 PER MERCER ISLAND WIND MAP. PLEASE SEE ATTACHED CALCULATIONS

Seismic Criteria

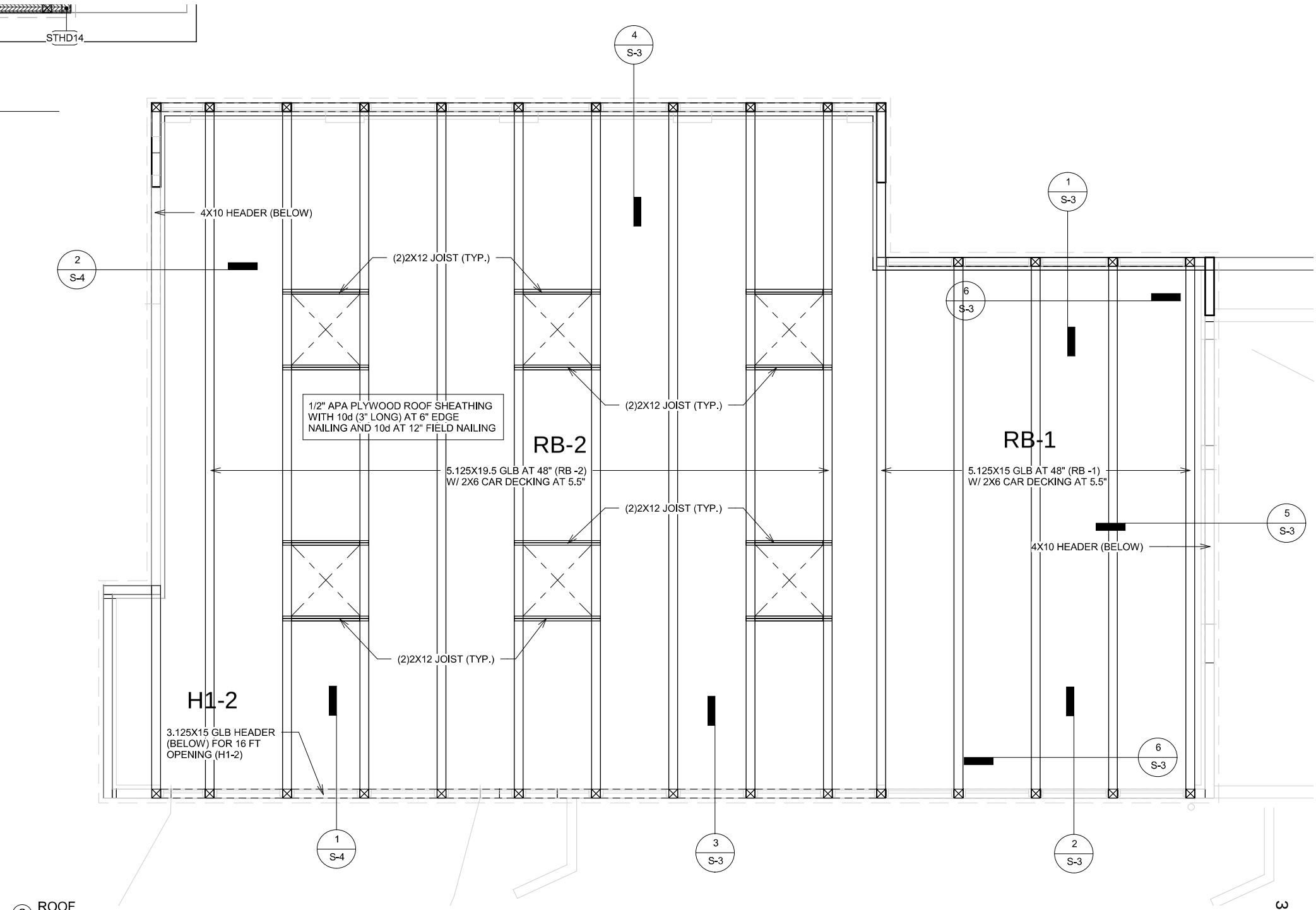
S_s, %g	147
S_1, %g	58
Risk Category	II
Site Class	D
Ductility Factor, R	6.5
Seismic Performance Category	D

Wind Criteria

Ultimate Wind Speed, mph	110
Building Classifications	II
Wind Exposure Category	B
Topographic Effect, Kzt	1.6



1 MAIN FLOOR
1/4" = 1'-0"

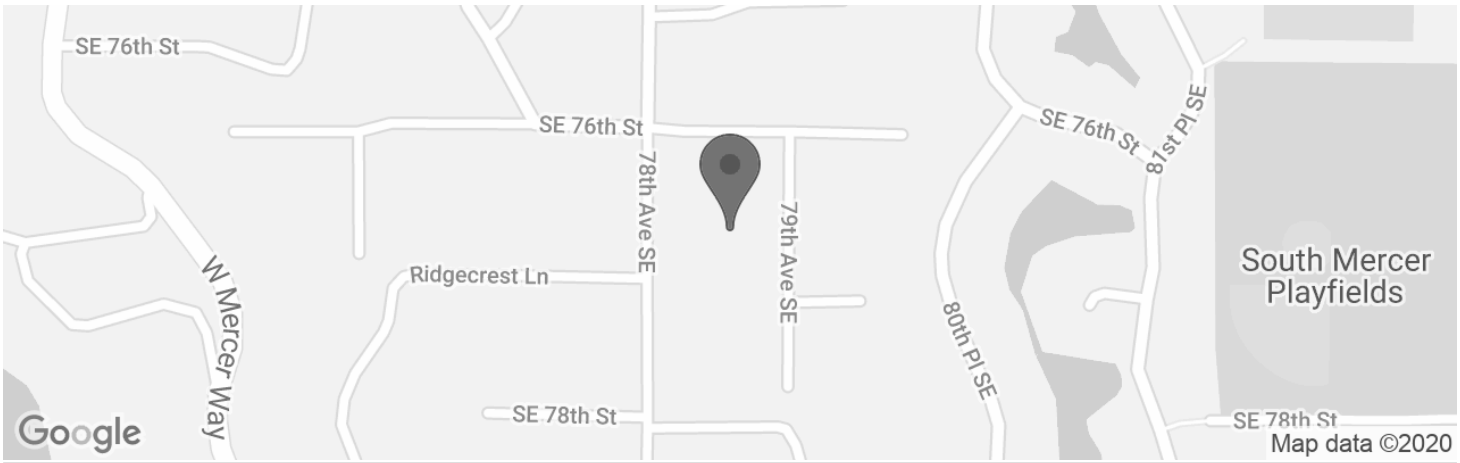

STHD14
4
S-3
1
S-3
4X10 HEADER (BELOW)
2
S-4
(2)2X12 JOIST (TYP.)
6
S-3
1/2" APA PLYWOOD ROOF SHEATHING
WITH 10d (3" LONG) AT 6" EDGE
NAILING AND 10d AT 12" FIELD NAILING
(2)2X12 JOIST (TYP.)
RB-2
RB-1
5.125X19.5 GLB AT 48" (RB -2)
W/ 2X6 CAR DECKING AT 5.5"
5.125X15 GLB AT 48" (RB -1)
W/ 2X6 CAR DECKING AT 5.5"
5
S-3
(2)2X12 JOIST (TYP.)
4X10 HEADER (BELOW)
(2)2X12 JOIST (TYP.)
H1-2
3.125X15 GLB HEADER
(BELOW) FOR 16 FT
OPENING (H1-2)
6
S-3
1
S-4
3
S-3
2
S-3

2 ROOF
1/4" = 1'-0"

OSHPD

7627 79th Ave SE, Mercer Island, WA 98040, USA

Latitude, Longitude: 47.53417229999999, -122.2343417



Date	1/17/2020, 11:38:34 AM
Design Code Reference Document	ASCE7-10
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S_S	1.467	MCE_R ground motion. (for 0.2 second period)
S_1	0.559	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.467	Site-modified spectral acceleration value
S_{M1}	0.839	Site-modified spectral acceleration value
S_{DS}	0.978	Numeric seismic design value at 0.2 second SA
S_{D1}	0.559	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	1.5	Site amplification factor at 1.0 second
PGA	0.61	MCE_G peak ground acceleration
F_{PGA}	1	Site amplification factor at PGA
PGA_M	0.61	Site modified peak ground acceleration
T_L	6	Long-period transition period in seconds
SsRT	1.467	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.552	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	3.621	Factored deterministic acceleration value. (0.2 second)
S1RT	0.559	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.604	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	1.299	Factored deterministic acceleration value. (1.0 second)
PGAd	1.369	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.945	Mapped value of the risk coefficient at short periods
C_{R1}	0.926	Mapped value of the risk coefficient at a period of 1 s

DISCLAIMER

While the information presented on this website is believed to be correct, SEAOC /OSHPD and its sponsors and contributors assume no responsibility or liability for its accuracy. The material presented in this web application should not be used or relied upon for any specific application without competent examination and verification of its accuracy, suitability and applicability by engineers or other licensed professionals. SEAOC / OSHPD do not intend that the use of this information replace the sound judgment of such competent professionals, having experience and knowledge in the field of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the results of the seismic data provided by this website. Users of the information from this website assume all liability arising from such use. Use of the output of this website does not imply approval by the governing building code bodies responsible for building code approval and interpretation for the building site described by latitude/longitude location in the search results of this website.

SEISMIC BASE SHEAR CALCULATIONS PER IBC 2015 (ASCE 7-10)

Response Spectral Acc. (0.2 sec) Ss =	147.00%g	= 1.470g	Figure 22-1 through 22-14
Response Spectral Acc.(1.0 sec) S_1 =	56.00%g	= 0.560g	Figure 22-1 through 22-14
Soil Site Class	D	Table 20-3-1, Default = D	
Site Coefficient F_a =	1.000		Table 11.4-1
Site Coefficient F_v =	1.500		Table 11.4-2
Max Considered Earthquake Acc. $S_{MS} = F_a.S_s$		= 1.470	(11.4-1)
Max Considered Earthquake Acc. $S_{M1} = F_v.S_1$		= 0.840	(11.4-2)
@ 5% Damped Design $S_{DS} = 2/3(S_{MS})$		= 0.980	(11.4-3)
$S_{D1} = 2/3(S_{M1})$		= 0.560	(11.4-4)
Building Occupancy Categories	II, Standard		Table 1-1
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)	

Comply with 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-

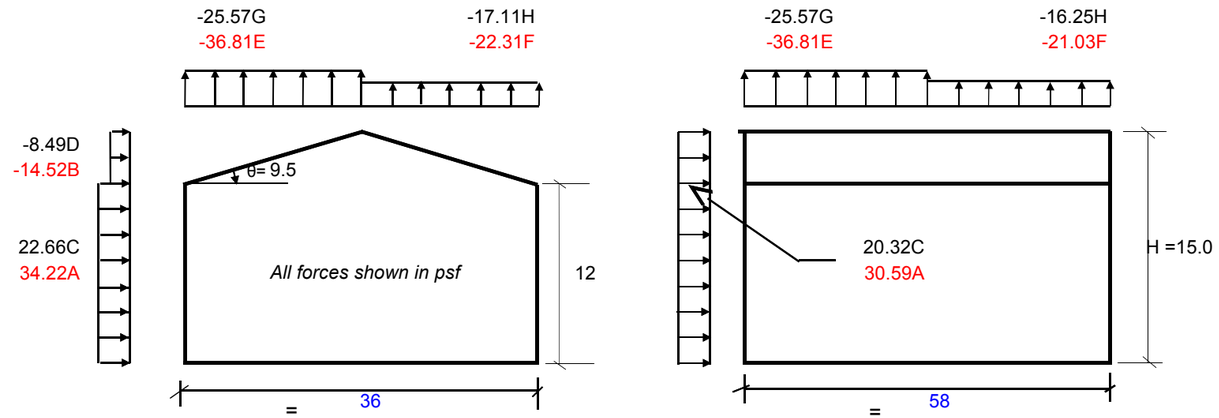
Seismic Force Resisting Systems: 13. Light-framed walls sheathed with wood structural panels rated for shear resistance or steel sheet

C_t = 0.02	x = 0.75		T-12.8-2
Building ht. H_n = 12	ft	Limited Building Height (ft) = 65	
C_u = 1.400	for S_{D1} of 0.560g	Table 12.8-1	
Approx Fundamental period, $T_a = C_t(h_n)^x$	= 0.129	12.8-7	T_L = 2.000 Sec
Calculated T shall not exceed ≤ Cu.Ta			Use T = 0.129 sec.
0.8Ts = $0.8(S_{D1}/S_{DS})$	= 0.457	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 =	1.470g		*Max Ss ≤ 1.5g*
F_a =	1.00		
@ 5% Damped Design $S_{DS} = ⅔(F_a.S_s)$	= 0.980g		(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		Table 11.5-1
Seismic Base Shear V =	C_sW		
$C_s = \frac{S_{DS}}{R/I}$	=0.151		(12.8-2)
or need not to exceed, $C_s = \frac{S_{D1}}{(R/I).T}$	= 0.668	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 =	0.01		(12.8-5)
Min C_s = $0.5S_1I/R$	N/A	For S_1 ≥ 0.6g	(12.8-6)
Use C_s =	0.151		
Design base shear V =	0.151 W	**Control**	

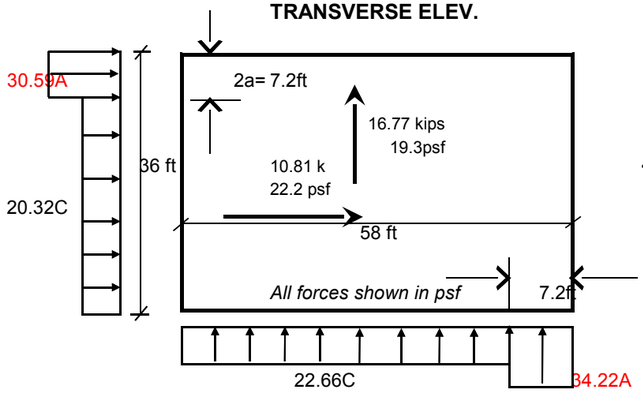
WIND FORCES CALCULATIONS PER IBC 2015 (ASCE 7-10)

Ultimate wind speed = 110 MPH
Bldg. Classification = II
Exposure B
K_{zt} = 1.60
Roof Pitch = 2.00 :12
Mean Roof Height h = 12 ft

CHAPTER 28-MWFRS (ENVELOPE PROCEDURE)



TRANSVERSE ELEV. LONGITUDINAL ELEV.



PLAN VIEW

10 % of least dimension= 3.6 ft
40 % of the eave height = 4.8 ft
4 % of least dimension or 3 ft= 3.0 ft
therefore a = 3.6 ft

Example: $p_s = \lambda K_{zt} I p_{s30}$

FIGURE 28.4-1, Main Wind Force System

MWFRS

Load Direction	Roof Angle	Horizontal Loads				Vertical Loads					
		End Zone		Interior zone		End Zone		Interior zone		Overhang	
		Wall (A)	Roof (B)	Wall (C)	Roof (D)	WW (E)	LW (F)	WW (G)	LW (H)	E_{OH}	G_{OH}
Transverse	9.5	34.22	-14.52	22.66	-8.49	-36.81	-22.31	-25.57	-17.11	-51.63	-40.39
Longitudinal	All	30.59	-16.01	20.32	-9.56	-36.81	-21.03	-25.57	-16.25	-51.63	-40.39

* If roof pressure under horizontal loads is less than zero, use zero
Plus and minus signs signify pressures acting toward and away from projected surfaces, respectively.
For the design of the longitudinal MWFRS use Θ = 0°, and locate the zone E/F, G/H boundary at the mid-length of the building

b2 structural engineers
www.b2engineers.com
7516 NE 153rd Place NE
Kenmore, WA 98028
(425) 296-2993

	Job No.	Sheet No.
	Project No.	Sheet Title
	Checked By	Made By
	Date	Date

WIND FORCES:

LOCATION	WIDTH	HEIGHT	INTERIOR PRESSURE	END ZONE PRESSURE		FORCE	SUBTOT
Transverse Direction							
END ZONE WIDTH	7.2	FT					
ROOF							
T.O.Roof to Parapet	58	0.0	-8.49	-14.52	=	0	
T.O. Roof TO MID	58	6.0	22.66	34.22	=	8885	
4th FLOOR							8885
MID TO FLOOR	58		22.66	34.22	=	0	
FLOOR TO MID	58		22.66	34.22	=	0	
3rd FLOOR							0
MID TO FLOOR	58		22.66	34.22	=	0	
FLOOR TO MID	58		22.66	34.22	=	0	
2nd FLOOR							0
MID TO FLOOR	58		22.66	34.22	=	0	
FLOOR TO MID	58		22.66	34.22	=	0	
							0
TOTAL FOR WALL SHEAR:							**8.89** **Kips**

Longitudinal Direction

ROOF							
T.O.Roof to Parapet	36	0.0	20.32	30.59	=	0	
T.O. Roof TO MID	36	6.0	20.32	30.59	=	5276	
4th FLOOR							5276
MID TO FLOOR	36	0.0	20.32	30.59	=	0	
FLOOR TO MID	36	0.0	20.32	30.59	=	0	
3rd FLOOR							0
MID TO FLOOR	36	0.0	20.32	30.59	=	0	
FLOOR TO MID	36	0.0	20.32	30.59	=	0	
2nd FLOOR							0
MID TO FLOOR	36	0.0	20.32	30.59	=	0	
FLOOR TO MID	36	0.0	20.32	30.59	=	0	
							0
TOTAL FOR WALL SHEAR:							**5.28** **Kips**

b2 structural engineers
www.b2engineers.com
7516 NE 153rd Place NE
Kenmore, WA 98028
(425) 296-2993

	Job No.	Sheet No.
	Project No.	Sheet Title
	Checked By	Made By
	Date	Date

DEAD LOAD WEIGHTS FOR SEISMIC FORCE CALCULATIONS:

Unit Roof Weight:	12 psf
Unit Floor Weight:	12 psf
Unit Exterior Wall Weight :	11 psf
Unit Interior Corridor Wall Weight:	0 psf
Unit Interior Party Wall Weight:	0 psf
Unit Interior Partition Wall Weight:	7 psf

LOCATION	LENGTH	HEIGHT	UNIT WT.		TOTAL WEIGHT	SUB TOTAL	
ROOF LEVEL:							
Roof	2300	1.00	12	=	27600		
Ext. Wall Below	200	5.0	11	=	11000		psf
Corridor Wall Below	0	5.0	0	=	0		17
Party Wall Below	0	5.0	0	=	0		
Partition Wall Below	0	5.0	7	=	0		
						38600	
FOURTH FLOOR LEVEL							
Floor	0	1	12	=	0		
Ext. Wall Above	0	0	11	=	0		
Corridor Wall Above	0	0	0	=	0		
Party Wall Above	0	0	0	=	0		
Partition Wall Above	0	0	7	=	0		
Ext. Wall Below	0	0	11	=	0		psf
Corridor Wall Below	0	0	0	=	0		#DIV/0!
Party Wall Below	0	0	0	=	0		
Partition Wall Below	0	0	7	=	0		
						0	
THIRD FLOOR LEVEL							
Floor	0	1	12	=	0		
Ext. Wall Above	0	5	11	=	0		
Corridor Wall Above	0	0	0	=	0		
Party Wall Above	0	0	0	=	0		
Partition Wall Above	0	5	7	=	0		
Ext. Wall Below	0	5	11	=	0		psf
Corridor Wall Below	0	0	0	=	0		#DIV/0!
Party Wall Below	0	0	0	=	0		
Partition Wall Below	0	5	7	=	0		
						0	
SECOND FLOOR LEVEL							
Floor	0	1	12	=	0		
Ext. Wall Above	0	5.0	11	=	0		
Corridor Wall Above	0	0.0	0	=	0		
Party Wall Above	0	0.0	0	=	0		
Partition Wall Above	0	5.0	7	=	0		
Ext. Wall Below	0	5.0	11	=	0		psf
Corridor Wall Below	0	5.0	0	=	0		#DIV/0!
Party Wall Below	0	5.0	0	=	0		
Partition Wall Below	0	5.0	7	=	0		
						0	
			STRUCTURE WEIGHT FOR SHEAR WALL TOTAL:			**38.6**	**Kips**
FOUNDATION LEVEL:							
Ext. Wall Above	0	0.0	11	=	0		
Corridor Wall Above	0	0.0	0	=	0		
Party Wall Above	0	0.0	0	=	0		
Partition Wall Above	0	0.0	7	=	0		
			STRUCTURE WEIGHT FOR BASE SHEAR TOTAL:			**38.6**	**Kips**

b2 structural engineers
www.b2engineers.com
7516 NE 153rd Place NE
Kenmore, WA 98028
(425) 296-2993

	Job No.	Sheet No.
	Project No.	Sheet Title
	Checked By	Made By
	Date	Date

Vertical Seismic Distribution

Cs =	0.15 W		
W =	38.6 kips		
V =	5.8 kips	Important:	It is assumed that the R value is the same
Rho =	1		for both directions

					N/S Direction		E/W Direction		
Floor	Story Height Hi (ft)	Total Height Ht (ft)	Story Weight Wi (kips)	Wi*Ht (k-ft)	Story Force Fi (kips)	Story Shear E (kips)	Story Force Fi (kips)	Story Shear E (kips)	Mot E (kip-ft)
Roof	10.00	30.00	38.6	1158	5.8	**5.8**	5.8	**5.8**	**174.59**
Fourth	0.00	20.00	0.0	0	0.0	**0.0**	0.0	**0.0**	**0**
Third	10.00	20.00	0.0	0	0.0	**0.0**	0.0	**0.0**	**0**
Second	10.00	10.00	0.0	0	0.0	**0.0**	0.0	**0.0**	**0**
Ground	0.00	0.00	0.0	0	0.0	**0.0**	0.0	**0.0**	**0**
			38.6	1158	5.82	**5.82**		**5.82**	**174.59**

Diaphragm Seismic Distribution

Floor	Story Height Hi (ft)	Total Height Ht (ft)	Story Weight Wi (kips)	Force Distribution Fx (kips)	Calculated Fpx (kips)	Max Fpx (kips)	Min Fpx (kips)	Governing Fpx (kips)	Transverse Fpx (plf)	Longitudinal Fpx (plf)
Roof	10.00	30.00	38.6	5.8	5.8	15.1	7.6	**7.6**	**118**	**191**
Fourth	0.00	20.00	0.0	0.0	0.0	0.0	0.0	**0.0**	**#DIV/0!**	**#DIV/0!**
Third	10.00	20.00	0.0	0.0	0.0	0.0	0.0	**0.0**	**#DIV/0!**	**#DIV/0!**
Second	10.00	10.00	0.0	0.0	0.0	0.0	0.0	**0.0**	**#DIV/0!**	**#DIV/0!**
Ground	0.00	0.00	0.0	0.0	0.0	0.0	0.0	**0.0**	**0.0**	**0.0**
			38.6	5.8						

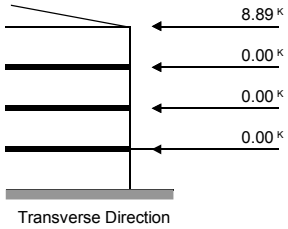
b2 structural engineers
www.b2engineers.com
7516 NE 153rd Place NE
Kenmore, WA 98028
(425) 296-2993

	Job No.	Sheet No.
	Project No.	Sheet Title
	Checked By	Made By
	Date	Date

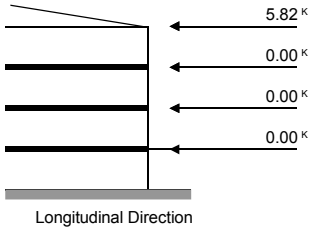
Lateral Forces Summary

Level	Wind (Trans.) (kips)	Wind (Long.) (kips)	Seismic (Trans.) (kips)	Seismic (Long.) (kips)
Roof	8.89	5.28	5.82	5.82
Fourth	0.00	0.00	0.00	0.00
Third	0.00	0.00	0.00	0.00
Second	0.00	0.00	0.00	0.00
Total	8.89	5.28	5.82	5.82

Controlling:
Transverse - Wind
Longitudinal - Seismic



Transverse Direction



Longitudinal Direction

2nd story

Shearwall forces -Transverse Direction

Story shear(kips) = 0.00 Accumulated shear(kips)= 0.00

Story height (ft) = 9.00

Total Width(ft) = 1.00

Story	Wall	Wall D(ft)	Opening Width (ft)	Opening Height (ft)	Opening to Edge (ft)	Plate to Opening (ft)	Sheathing Ratio	Min Panel Width (ft)	Co	Trib.Width (ft)	%Sharing	Story V(kips)	Sum V(kips)	Story DL(klf)	Sum DL(klf)	Panel Shear (plf)	Req. Panel Shear (plf)	Plate Shear (plf)	Sum OTM(k-ft)	RM (k-ft)	Resultant HD(kips)	Force at Window (kips)
2	TA	0.0	0.00	0.00	0.00	1.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	**0**	**0**	**0**	0.00	0.00	**0.00**	**0.00**
2	TB	0.0	0.00	0.00	0.00	1.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00		0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**#DIV/0!**
2	TC	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
2	TD	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
2	TE	0.0	0.00	0.00	0.00	1.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	**0**	**0**	**0**	0.00	0.00	**0.00**	**0.00**
2	TF	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00		0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
2	TG	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
2	TH	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
2	TI	0.0	0.00	0.00	0.00	1.00	1.00	0.00	1.00	0.00	0.25	0.00	0.00		0.00	**0**	**0**	**0**	0.00	0.00	**0.00**	**0.00**
2	TJ	0.0	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.25	0.00	0.00		0.00	**0**	**0**	**0**	0.00	0.00	**0.00**	**NA**
2	TK	0.0	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.25	0.00	0.00	0.00	0.00	**0**	**0**	**0**	0.00	0.00	**0.00**	**NA**
2	TL	0.0	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.00	0.25	0.00	0.00	0.00	0.00	**0**	**0**	**0**	0.00	0.00	**0.00**	**NA**
2	TM	0.0	0.00	0.00	0.00	1.00	1.00	0.01	1.00	0.00	1.00	0.00	0.00	0.00	0.00	**0**	**0**	**0**	0.00	0.00	**0.00**	**0.00**
2	TN	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
2	TO	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
2	TP	0.0	0.00				#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
	Sum	0.0	0.00							0.00	4.00	0.00	0.00									

1st story

Shearwall forces -Transverse Direction

Story shear(kips) = 8.9 Accumulated shear(kips)= 8.89

Story height (ft) = 12.00

Total Width(Ft) = 58.00

SW6

LSTH08

Story	Wall	Wall D(ft)	Opening Width (ft)	Opening Height (ft)	Opening to Edge (ft)	Plate to Opening (ft)	Sheathing Ratio	Min Panel Width (ft)	Co	Trib.Width (ft)	%Sharing	Story V(kips)	Sum V(kips)	Story DL(klf)	Sum DL(klf)	Panel Shear (plf)	Req. Panel Shear (plf)	Plate Shear (plf)	Sum OTM(k-ft)	RM (k-ft)	Resultant HD(kips)	Force at Window (kips)
1	TA	4.1			1.00	1.00	4.10	1.00	29.00	0.21	0.92	0.92	0.11	0.11	**224**	**329**	**224**	11.05	0.91	**2.49**	**0.00**
1	TB	7.0	0.00	0.00	0.00	1.00	1.00	7.00	1.00	29.00	0.35	1.57	1.57	0.11	0.11	**224**	**224**	**224**	18.86	2.65	**2.35**	**0.00**
1	TC	8.7	0.00	0.00	0.00	0.00	1.00	8.70	1.00	29.00	0.44	1.95	1.95	0.11	0.11	**224**	**224**	**224**	23.44	4.09	**2.27**	**NA**
1	TD	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
1	TE	15.0	0.00	0.00	0.00	1.00	1.00	15.00	1.00	29.00	0.58	2.56	2.56	0.11	0.11	**171**	**171**	**171**	30.77	12.15	**1.32**	**0.00**
1	TF	11.0	0.00	0.00	0.00	0.00	1.00	11.00	1.00	29.00	0.42	1.88	1.88	0.11	0.11	**171**	**171**	**171**	22.57	6.53	**1.52**	**NA**
1	TG	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
1	TH	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
1	TI	0.0	0.00	0.00	0.00	1.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00		0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**#DIV/0!**
1	TJ	0.0	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00		0.00	**0**	**0**	**0**	0.00	0.00	**0.00**	**NA**
1	TK	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
1	TL	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
1	TM	0.0	0.00	0.00	0.00	0.00	1.00	0.01	1.00	0.00	1.00	0.00	0.00	0.00	0.00	**0**	**0**	**0**	0.00	0.00	**0.00**	**NA**
1	TN	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
1	TO	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
1	TP	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
	Sum	45.8	0.00							58.00	4.00	8.89	8.89									

2nd story

Shearwall Forces-Longitudinal Direction

Story shear(kips) = 0.0
Story height (ft) = 9.0
Total Width(ft) = 1.0

Accumulated shear(kips)= 0.00

Story	Wall	Wall D(ft)	Opening Width (ft)	Opening Height (ft)	Opening to Edge (ft)	Plate to Opening (ft)	Sheathing Ratio	Min Panel Width (ft)	Co	Trib.Width (ft)	%Sharing	Story V(kips)	Sum V(kips)	Story DL(klf)	Sum DL(klf)	Panel Shear (plf)	Req. Panel Shear (plf)	Plate Shear (plf)	Sum OTM(k-ft)	RM (k-ft)	Resultant HD(kips)	Force at Window (kips)
2	LA	0.0	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	**0**	**0**	**0**	0.00	0.00	**0.00**	**NA**
2	LB	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
2	LC	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
2	LD	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
2	LE	0.0	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	**0**	**0**	**0**	0.00	0.00	**0.00**	**NA**
2	LF	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
2	LG	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
2	LH	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
2	LI	0.0	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	**0**	**0**	**0**	0.00	0.00	**0.00**	**NA**
2	LJ	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
2	LK	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
2	LL	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
2	LM	0.0	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	**0**	**0**	**0**	0.00	0.00	**0.00**	**NA**
2	LN	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
2	LO	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
2	LP	0.0	0.00				#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
	Sum	0.0	0.00							0.00	4.00	0.00	0.00									

1st story

Shearwall Forces-Longitudinal Direction

Story shear(kips) = 5.8
Story height (ft) = 12.0
Total Width(Ft) = 36.0

Accumulated shear(kips)= 5.82

SW6

NO UPLIFT

Story	Wall	Wall D(ft)	Opening Width (ft)	Opening Height (ft)	Opening to Edge (ft)	Plate to Opening (ft)	Sheathing Ratio	Min Panel Width (ft)	Co	Trib.Width (ft)	%Sharing	Story V(kips)	Sum V(kips)	Story DL(klf)	Sum DL(klf)	Panel Shear (plf)	Req. Panel Shear (plf)	Plate Shear (plf)	Sum OTM(k-ft)	RM (k-ft)	Resultant HD(kips)	Force at Window (kips)
1	LA	34.0	0.00	0.00	0.00	0.00	1.00	34.00	1.00	18.00	1.00	2.91	2.91	0.11	0.11	**86**	**86**	**86**	34.92	62.42	**-0.63**	**NA**
1	LB	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00		0.00	0.00	0.00	0.11	0.11	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
1	LC	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
1	LD	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
1	LE	38.0	0.00	0.00	0.00	0.00	1.00	38.00	1.00	18.00	1.00	2.91	2.91	0.11	0.11	**77**	**77**	**77**	34.92	77.98	**-0.93**	**NA**
1	LF		0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00		0.00	0.00	0.00	0.11	0.11	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
1	LG	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
1	LH	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
1	LI	0.0	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	**0**	**0**	**0**	0.00	0.00	**0.00**	**NA**
1	LJ	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
1	LK	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
1	LL	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
1	LM	0.0	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	**0**	**0**	**0**	0.00	0.00	**0.00**	**NA**
1	LN	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
1	LO	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
1	LP	0.0	0.00	0.00	0.00	0.00	#DIV/0!	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	0.00	0.00	**#DIV/0!**	**NA**
	Sum	72.0	0.00							36.00	4.00	5.82	5.82									

SHEARWALL, DIAPHRAGM, STRAP AND HOLDOWN CAPACITY TABLE PER IBC 2012

PLYWOOD SHEATHED SHEARWALL	LRFD CAPACITY (SEISMIC/WIND)	COMMENT
SW6 (15/32" PLYWOOD WITH 10d AT 6" AT EDGE, 10d AT 12" FIELD NAILING)	496 PLF/ 696 PLF	SDPWS TABLE 4.3A
SW4 (15/32" PLYWOOD WITH 10d AT 4" AT EDGE, 10d AT 12" FIELD NAILING)	736 PLF/ 1032 PLF	MULTIPLY VALUES BY TWO IF SHEATHING
SW3 (15/32" PLYWOOD WITH 10d AT 3" AT EDGE, 10d AT 12" FIELD NAILING)	960 PLF/ 1344PLF	APPLIED ON BOTH SIDES
SW2 (15/32" PLYWOOD WITH 10d AT 2" AT EDGE, 10d AT 12" FIELD NAILING)	1232 PLF/ 1724 PLF	

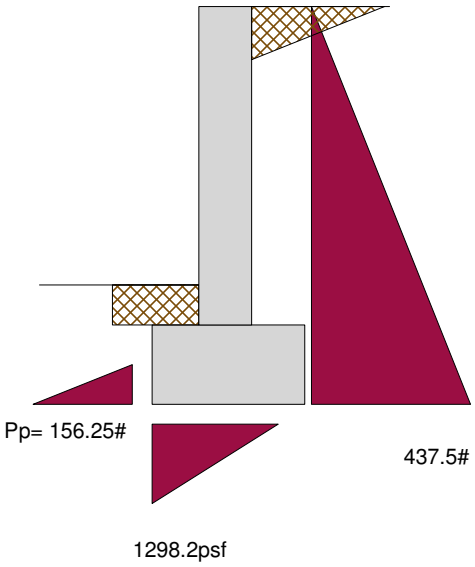
UNBLOCKED FLOOR DIAPHRAGM	LRFD CAPACITY (SEISMIC/WIND)	COMMENT
15/32" PLYWOOD WITH 8d AT 6" AT EDGE, 8d AT 12" FIELD NAILING	368 PLF/ 516 PLF	SPDWS TABLE 4.2B
15/32" PLYWOOD WITH 10d AT 6" AT EDGE, 10d AT 12" FIELD NAILING	408 PLF/ 572 PLF	
19/32" PLYWOOD WITH 10d AT 6" AT EDGE, 10d AT 12" FIELD NAILING	456 PLF/ 640 PLF	

SIMPSON'S FLOOR STRAP	LRFD CAPACITY (SEISMIC/WIND)	COMMENT
CS18	1916 LBS/ 2190 LBS	12" END LENGTH
CS16	2363 LBS/ 2700 LBS	14" END LENGTH
CS14	3487 LBS/ 3985 LBS	20" END LENGTH
CMSTC16	6236 LBS/ 7336 LBS	26" END LENGTH
CMSTC14	9086 LBS/ 10384 LBS	36" END LENGTH

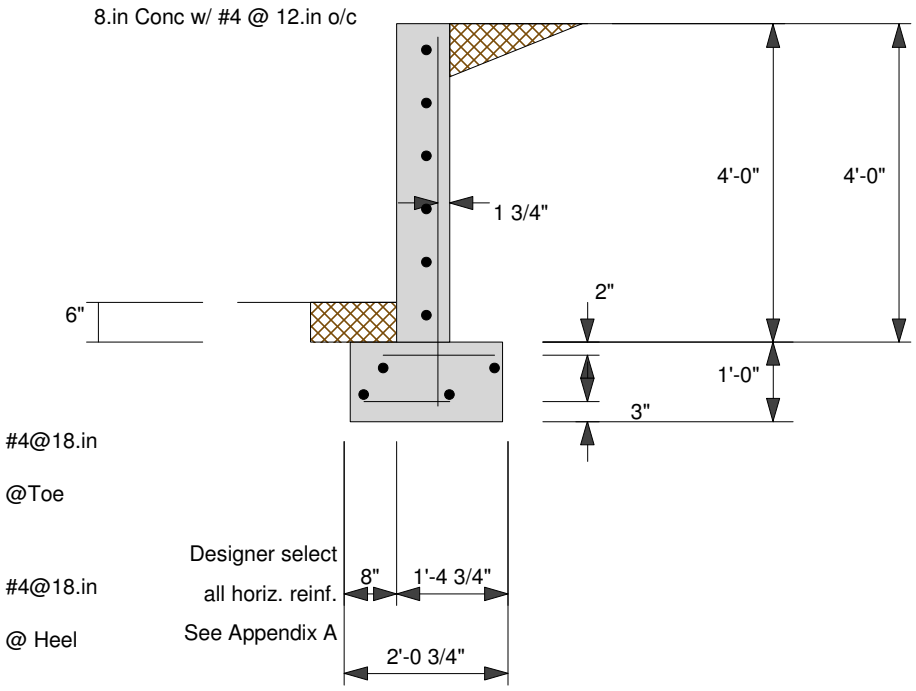
SIMPSON'S HOLDOWN	LRFD CAPACITY (SEISMIC/WIND)	COMMENT
HDU2	4305 LBS/ 4920 LBS	
HDU4	6391 LBS/ 7304 LBS	
HDU5	7905 LBS/ 9032 LBS	
HDU8	8372 LBS/ 9568 LBS	
LSTHD8/ LSTHD8RJ AT 6" STEMWALL	2730 LBS/ 3120 LBS	CRACKED CONCRETE (CORNER CONDITION)
STHD10/ STH10RJ AT 6" STEMWALL	3700 LBS/ 4224 LBS	CRACKED CONCRETE (CORNER CONDITION)
STHD14/ STHD14RJ AT 6" STEMWALL	5173 LBS/ 5912 LBS	CRACKED CONCRETE (CORNER CONDITION)
LSTHD8/ LSTHD8RJ AT 8" STEMWALL	2730 LBS/ 3120 LBS	CRACKED CONCRETE (CORNER CONDITION)
STHD10/ STH10RJ AT AT 8" STEMWALL	4116 LBS/ 4700 LBS	CRACKED CONCRETE (CORNER CONDITION)
STHD14/ STHD14RJ AT AT 8" STEMWALL	5340 LBS/ 6100 LBS	CRACKED CONCRETE (CORNER CONDITION)

SIMPSON'S ANCHOR BOLT FOR SHEARWALL HOLDOWNS	LRFD CAPACITY (SEISMIC/WIND)	COMMENT
SSTB16 (5/8" DIAMETER, 12 5/8" MIN. EMBED., 6" STEMWALL)	3570 LBS/ 5776 LBS	2500 PSI MIN. CONCRETE (CORNER CONDITION)
SSTB20 (5/8" DIAMETER, 16 5/8" MIN. EMBED., 6" STEMWALL)	4403 LBS/ 6464 LBS	1 3/4" MIN. EDGE DISTANCE
SB 5/8"X24 (5/8" DIAMETER, 18" MIN. EMBED., 6" STEMWALL)	8022 LBS/ 10680 LBS	
SB 7/8"X24 (7/8" DIAMETER, 18" MIN. EMBED., 8" STEMWALL)	10997 LBS/ 14968 LBS	
SB 1"X30 (1" DIAMETER, 24" MIN. EMBED., 8" STEMWALL)	11640 LBS/ 15848 LBS	

RW-1 (4 FT RETAINING WALL)



RW-1 (4 FT RETAINING WALL)



This Wall in File: c:\b2 engineers\current projects\15126-su

RetainPro Version 6.0
Build Date : 10-SEP-2001, (c) 1989-2001

Cantilevered Retaining Wall Design

Criteria

Retained Height	=	4.00 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	6.00 in
Soil Density	=	125.00 pcf
Wind on Stem	=	0.0 psf

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	35.0 psf/ft
Toe Active Pressure	=	35.0 psf/ft
Passive Pressure	=	250.0 psf/ft
Water height over heel	=	0.0 ft
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in

Footing Dimensions & Strengths

Toe Width	=	0.66 ft
Heel Width	=	1.40
Total Footing Width	=	2.06
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 4,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top = 2.00 in @ Btm.= 3.00 in

Design Summary

Total Bearing Load	=	1,117 lbs	
...resultant ecc.	=	5.48 in	
Soil Pressure @ Toe	=	1,298 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	2,000 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,817 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	0.0 psi	OK
Footing Shear @ Heel	=	5.1 psi	OK
Allowable	=	107.5 psi	

Wall Stability Ratios

Overturning	=	1.90	OK
Sliding	=	1.51	OK

Sliding Calcs (Vertical Component NOT Used)

Lateral Sliding Force	=	398.1 lbs	
less 100% Passive Force	= -	156.3 lbs	
less 100% Friction Force	= -	446.8 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 : 1 Stability	=	0.0 lbs	OK

Footing Design Results

		Toe	Heel
Factored Pressure	=	1,817	0 psf
Mu' : Upward	=	345	11 ft-#
Mu' : Downward	=	65	245 ft-#
Mu: Design	=	280	234 ft-#
Actual 1-Way Shear	=	0.00	5.13 psi
Allow 1-Way Shear	=	107.52	107.52 psi
Toe Reinforcing	=	# 4 @ 18.00 in	
Heel Reinforcing	=	# 4 @ 18.00 in	
Key Reinforcing	=	None Spec'd	

Stem Construction

Top Stem

Stem OK

Design height	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Thickness	=	8.00
Rebar Size	=	# 4
Rebar Spacing	=	12.00
Rebar Placed at	=	Edge

Design Data

fb/FB + fa/Fa	=	**0.117**
Total Force @ Section	lbs =	468.6
Moment....Actual	ft-# =	633.4
Moment.....Allowable	=	5,412.6
Shear.....Actual	psi =	6.2
Shear.....Allowable	psi =	85.0
Lap Splice if Above	in =	31.20
Lap Splice if Below	in =	6.64
Wall Weight	=	100.0
Rebar Depth 'd'	in =	6.25

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Special Inspection	=	
Modular Ratio 'n'	=	
Short Term Factor	=	
Equiv. Solid Thick.	=	

Masonry Block Type = Medium Weight

Concrete Data

f'c	psi =	2,500.0
Fy	psi =	60,000.0

Other Acceptable Sizes & Spacings

Toe: Not req'd, Mu < S * Fr
Heel: Not req'd, Mu < S * Fr
Key: No key defined

This Wall in File: c:\b2 engineers\current projects\15126-su

RetainPro Version 6.0
Build Date : 10-SEP-2001, (c) 1989-2001

Cantilevered Retaining Wall Design

Summary of Overturning & Resisting Forces & Moments

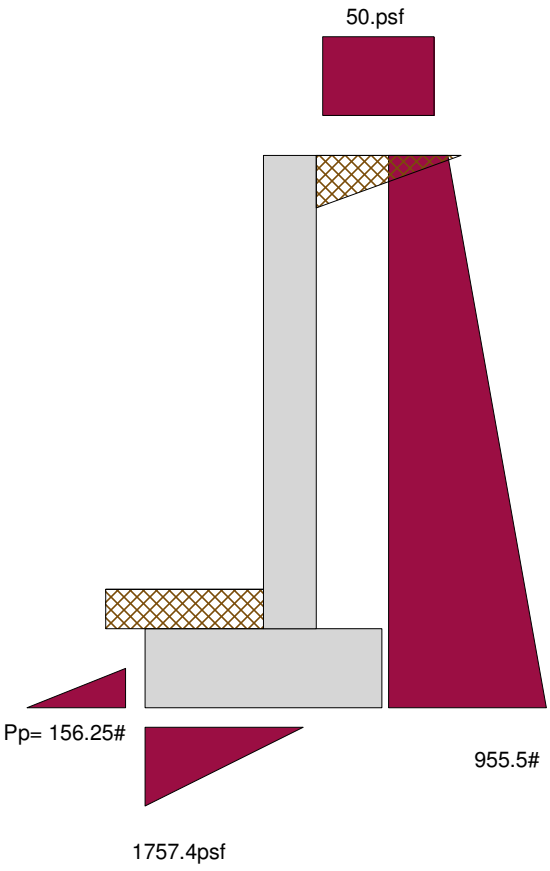
Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	437.5	1.67	729.2	Soil Over Heel	= 366.7	1.69	620.9
Toe Active Pressure	=	-39.4	0.50	-19.7	Sloped Soil Over Heel	=		
Surcharge Over Toe	=				Surcharge Over Heel	=		
Adjacent Footing Load	=				Adjacent Footing Load	=		
Added Lateral Load	=				Axial Dead Load on Stem	=	0.00	
Load @ Stem Above Soil	=				Soil Over Toe	= 41.3	0.33	13.6
					Surcharge Over Toe	=		
					Stem Weight(s)	= 400.0	0.99	397.3
					Earth @ Stem Transitions	=		
					Footing Weight	= 309.0	1.03	318.3
					Key Weight	=		
					Vert. Component	=		
Total	=	398.1	**O.T.M.** =	709.5	**Total =**	1,116.9 lbs	**R.M.=**	1,350.1

Resisting/Overturning Ratio = **1.90**

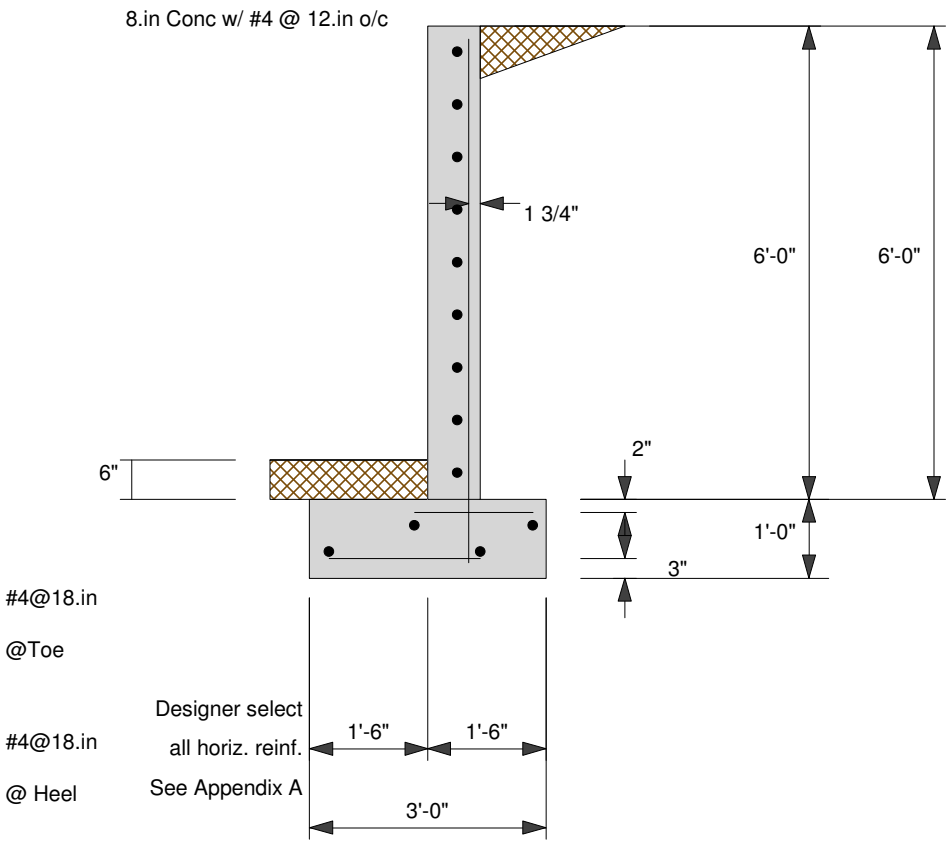
Vertical Loads used for Soil Pressure = 1,116.9 lbs

Vertical component of active pressure NOT used for soil pressure

RW-2 (6 FT RETAINING WALL)



RW-2 (6 FT RETAINING WALL)



This Wall in File: c:\b2 engineers\current projects\15126-su

RetainPro Version 6.0
Build Date : 10-SEP-2001, (c) 1989-2001

Cantilevered Retaining Wall Design

Criteria

Retained Height	=	6.00 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	6.00 in
Soil Density	=	125.00 pcf
Wind on Stem	=	0.0 psf

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	35.0 psf/ft
Toe Active Pressure	=	35.0 psf/ft
Passive Pressure	=	250.0 psf/ft
Water height over heel	=	0.0 ft
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in

Footing Dimensions & Strengths

Toe Width	=	1.50 ft
Heel Width	=	1.50
Total Footing Width	=	3.00
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 4,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top = 2.00 in @ Btm.= 3.00 in

Surcharge Loads

Surcharge Over Heel = 50.0 psf
Used To Resist Sliding & Overturning

Surcharge Over Toe = 0.0 psf
Used for Sliding & Overturning

Design Summary

Total Bearing Load	=	1,810 lbs	
...resultant ecc.	=	9.76 in	
Soil Pressure @ Toe	=	1,757 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	2,000 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	2,460 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	13.1 psi	OK
Footing Shear @ Heel	=	9.8 psi	OK
Allowable	=	107.5 psi	

Wall Stability Ratios

Overturning	=	1.53	OK
Sliding	=	0.96	UNSTABLE!

Sliding Calcs (Vertical Component NOT Used)

Lateral Sliding Force	=	916.1 lbs	
less 100% Passive Force	= -	156.3 lbs	
less 100% Friction Force	= -	724.2 lbs	
Added Force Req'd	=	35.7 lbs	NG
....for 1.5 : 1 Stability	=	493.8 lbs	NG

Footing Design Results

		Toe	Heel
Factored Pressure	=	2,460	0 psf
Mu' : Upward	=	2,096	0 ft-#
Mu' : Downward	=	335	462 ft-#
Mu: Design	=	1,761	462 ft-#
Actual 1-Way Shear	=	13.12	9.83 psi
Allow 1-Way Shear	=	107.52	107.52 psi

Toe Reinforcing = # 4 @ 18.00 in
Heel Reinforcing = # 4 @ 18.00 in
Key Reinforcing = None Spec'd

Stem Construction

Top Stem

Stem OK

Design height	ft =	0.00	
Wall Material Above "Ht"	=	Concrete	
Thickness	=	8.00	
Rebar Size	=	# 4	
Rebar Spacing	=	12.00	
Rebar Placed at	=	Edge	
Design Data			
fb/FB + fa/Fa	=	**0.475**	
Total Force @ Section	lbs =	1,206.4	
Moment....Actual	ft-# =	2,569.2	
Moment.....Allowable	=	5,412.6	
Shear.....Actual	psi =	16.1	
Shear.....Allowable	psi =	85.0	
Lap Splice if Above	in =	31.20	
Lap Splice if Below	in =	6.64	
Wall Weight	=	100.0	
Rebar Depth 'd'	in =	6.25	
Masonry Data			
f'm	psi =		
Fs	psi =		
Solid Grouting	=		
Special Inspection	=		
Modular Ratio 'n'	=		
Short Term Factor	=		
Equiv. Solid Thick.	=		
Masonry Block Type = Medium Weight			
Concrete Data			
f'c	psi =	2,500.0	
Fy	psi =	60,000.0	

Other Acceptable Sizes & Spacings

Toe: Not req'd, Mu < S * Fr
Heel: Not req'd, Mu < S * Fr
Key: No key defined

This Wall in File: c:\b2 engineers\current projects\15126-su

RetainPro Version 6.0
Build Date : 10-SEP-2001, (c) 1989-2001

Cantilevered Retaining Wall Design

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	955.5	2.45	2,343.8	Soil Over Heel	= 625.0	2.58	1,614.6
Toe Active Pressure	=	-39.4	0.50	-19.7	Sloped Soil Over Heel	=		
Surcharge Over Toe	=				Surcharge Over Heel	= 41.7	2.58	107.6
Adjacent Footing Load	=				Adjacent Footing Load	=		
Added Lateral Load	=				Axial Dead Load on Stem	=	0.00	
Load @ Stem Above Soil	=				Soil Over Toe	= 93.8	0.75	70.3
					Surcharge Over Toe	=		
					Stem Weight(s)	= 600.0	1.83	1,100.0
					Earth @ Stem Transitions	=		
					Footing Weight	= 450.0	1.50	675.0
					Key Weight	=		
					Vert. Component	=		
Total	=	916.1	**O.T.M.** =	2,324.1	**Total =**	1,810.4 lbs	**R.M.=**	3,567.5

Resisting/Overturning Ratio = **1.53**

Vertical Loads used for Soil Pressure = 1,810.4 lbs

Vertical component of active pressure NOT used for soil pressure

BeamChek v2019 licensed to: B2 ENGINEERS Reg # 5508-68754

BELADY GARAGE RB-1

Prepared by: AL Date: 11/20/19

Selection **5-1/8x 15 GLB 16F-V2 HF/HF** Lu = 0.0 Ft

Conditions NDS 2015

Min Bearing Area R1= 4.7 in² R2= 4.7 in² (1.5) DL Defl= 0.68 in Recom Camber= 1.03 in

Data

Beam Span	28.0 ft	Reaction 1 LL	1400 #	Reaction 2 LL	1400 #
Beam Wt per ft	18.68 #	Reaction 1 TL	2334 #	Reaction 2 TL	2334 #
Bm Wt Included	523 #	Maximum V	2334 #		
Max Moment	16335 '#	Max V (Reduced)	2125 #		
TL Max Defl	L / 240	TL Actual Defl	L / 246		
LL Max Defl	L / 240	LL Actual Defl	L / 491		

Attributes

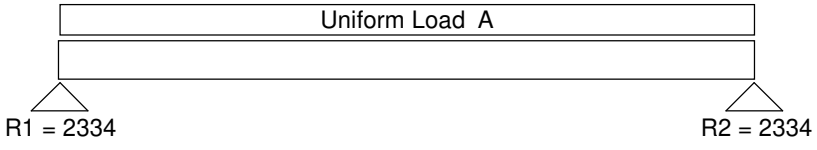
	Section (in³)	Shear (in²)	TL Defl (in)	LL Defl
Actual	192.19	76.88	1.37	0.68
Critical	112.11	14.22	1.40	1.40
Status	OK	OK	OK	OK
Ratio	58%	18%	98%	49%

Values / *Adjustments*

	Fb (psi)	Fv (psi)	E (psi x mil)	Fc⊥ (psi)
Reference Values	1600	195	1.4	500
Adjusted Values	1748	224	1.4	500
Cv Volume	0.950			
Cd Duration	1.15	1.15		
Cr Repetitive	1.00			
Ch Shear Stress		N/A		
Cm Wet Use	1.00	1.00	1.00	1.00

Cl Stability 1.0000 Rb = 0.00 Le = 0.00 Ft

Loads Uniform LL: 100 Uniform TL: 148 = A



SPAN = 28 FT

Uniform and partial uniform loads are lbs per lineal ft.

BeamChek v2019 licensed to: B2 ENGINEERS Reg # 5508-68754

BELADY GARAGE RB-2

Prepared by: AL Date: 11/20/19

Selection **5-1/8x 19-1/2 GLB 16F-V2 HF/HF** Lu = 0.0 Ft

Conditions NDS 2015

Min Bearing Area R1= 4.8 in² R2= 4.8 in² (1.5) DL Defl= 0.92 in Recom Camber= 1.38 in

Data

Beam Span	36.0 ft	Reaction 1 LL	1800 #	Reaction 2 LL	1800 #
Beam Wt per ft	24.28 #	Reaction 1 TL	3101 #	Reaction 2 TL	3101 #
Bm Wt Included	874 #	Maximum V	3101 #		
Max Moment	27910 '#	Max V (Reduced)	2821 #		
TL Max Defl	L / 240	TL Actual Defl	L / 244		
LL Max Defl	L / 240	LL Actual Defl	L / 508		

Attributes

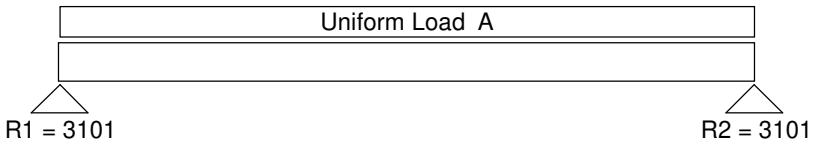
	Section (in³)	Shear (in²)	TL Defl (in)	LL Defl
Actual	324.80	99.94	1.77	0.85
Critical	201.66	18.87	1.80	1.80
Status	OK	OK	OK	OK
Ratio	62%	19%	99%	47%

Values / *Adjustments*

	Fb (psi)	Fv (psi)	E (psi x mil)	Fc⊥ (psi)
Reference Values	1600	195	1.4	650
Adjusted Values	1661	224	1.4	650
Cv Volume	0.903			
Cd Duration	1.15	1.15		
Cr Repetitive	1.00			
Ch Shear Stress		N/A		
Cm Wet Use	1.00	1.00	1.00	1.00

Cl Stability 1.0000 Rb = 0.00 Le = 0.00 Ft

Loads Uniform LL: 100 Uniform TL: 148 = A



SPAN = 36 FT

Uniform and partial uniform loads are lbs per lineal ft.

BeamChek v2019 licensed to: B2 ENGINEERS Reg # 5508-68754

BELADY GARAGE H1-3

Prepared by: AL Date: 11/20/19

Selection **4x 8 DF-L #2** Lu = 0.0 Ft

Conditions NDS 2015

Min Bearing Area R1= 2.9 in² R2= 2.9 in² (1.5) DL Defl= 0.08 in

Data

Beam Span	7.0 ft	Reaction 1 LL	1225 #	Reaction 2 LL	1225 #
Beam Wt per ft	6.17 #	Reaction 1 TL	1835 #	Reaction 2 TL	1835 #
Bm Wt Included	43 #	Maximum V	1835 #		
Max Moment	3211 '#	Max V (Reduced)	1518 #		
TL Max Defl	L / 240	TL Actual Defl	L / 453		
LL Max Defl	L / 360	LL Actual Defl	L / 791		

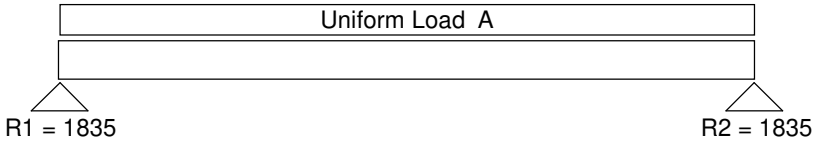
Attributes

	Section (in³)	Shear (in²)	TL Defl (in)	LL Defl
Actual	30.66	25.38	0.19	0.11
Critical	28.63	11.00	0.35	0.23
Status	OK	OK	OK	OK
Ratio	93%	43%	53%	45%

Values / *Adjustments*

	Fb (psi)	Fv (psi)	E (psi x mil)	Fc⊥ (psi)
Reference Values	900	180	1.6	625
Adjusted Values	1346	207	1.6	625
CF Size Factor	1.300			
Cd Duration	1.15	1.15		
Cr Repetitive	1.00			
Ch Shear Stress		N/A		
Cm Wet Use	1.00	1.00	1.00	1.00
Cl Stability	1.0000	Rb = 0.00	Le = 0.00 Ft	

Loads Uniform LL: 350 Uniform TL: 518 = A



SPAN = 7 FT

Uniform and partial uniform loads are lbs per lineal ft.

BeamChek v2019 licensed to: B2 ENGINEERS Reg # 5508-68754

BELADY GARAGE H1-4

Prepared by: AL Date: 11/20/19

Selection **4x 8 DF-L #2** Lu = 0.0 Ft

Conditions NDS 2015

Min Bearing Area R1= 1.3 in² R2= 1.3 in² (1.5) DL Defl= <0.01 in.

Data

Beam Span	3.0 ft	Reaction 1 LL	525 #	Reaction 2 LL	525 #
Beam Wt per ft	6.17 #	Reaction 1 TL	786 #	Reaction 2 TL	786 #
Bm Wt Included	18 #	Maximum V	786 #		
Max Moment	590 '#	Max V (Reduced)	470 #		
TL Max Defl	L / 240	TL Actual Defl	L / >1000		
LL Max Defl	L / 360	LL Actual Defl	L / >1000		

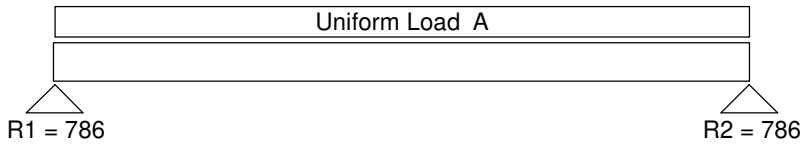
Attributes

	Section (in³)	Shear (in²)	TL Defl (in)	LL Defl
Actual	30.66	25.38	0.01	<0.01
Critical	5.26	3.40	0.15	0.10
Status	OK	OK	OK	OK
Ratio	17%	13%	4%	4%

Values / *Adjustments*

	Fb (psi)	Fv (psi)	E (psi x mil)	Fc⊥ (psi)
Reference Values	900	180	1.6	625
Adjusted Values	1346	207	1.6	625
CF Size Factor	1.300			
Cd Duration	1.15	1.15		
Cr Repetitive	1.00			
Ch Shear Stress		N/A		
Cm Wet Use	1.00	1.00	1.00	1.00
Cl Stability	1.0000	Rb = 0.00	Le = 0.00 Ft	

Loads Uniform LL: 350 Uniform TL: 518 = A



SPAN = 3 FT

Uniform and partial uniform loads are lbs per lineal ft.