ADDENDUM STRUCTURAL CALCS

Derkashani Residence 8151 SE 48th St Mercer Island, WA



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Project:	Derkashani Residence (8151 SE 48th St)	By:	JDA
Proj No:	167-2020	Date:	9/29/2021

Summary

See pages 2 to 5 for updated lateral design (slight adjustment in wind, does not impact original design).

See page 6 updated wind areas.

See pages 7 to 8 for diaphragm design.

See pages 9 to 13 anchorage design.

See pages 14 to 25 for design of force transfer around openings in shearwalls

See pages 26 to 41 for updated framing design including 5 psf rain on snow.

See page 42 for sample uplift calculation at extended roof

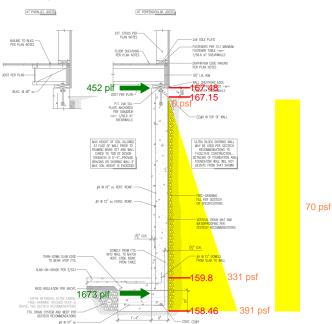
See pages 43 to 47 for updated retaining wall design.

See pages 49 to 50 for stair stringer design.

See page 51 for rockery wall design.

See page 52 for railing connection calculation.

New foundation walls retain soil and must either be detailed to allow framing to brace top of wall, or be designed to ensure wall can span horizontally to return walls. The new northwest and southwest walls span 12'-2" between return walls; the west wall is not retaining soil; and the east wall spans 24'-4". Looking at the FBD below, the ultimate worst case scenario for a pin-pin wall would need to resolve an ASD load of 452 plf at the top of wall (using 1.0H+0.7E). Similarly if the wall were to span horizontally, we would essentially have a 7.68' wide beam with #4 @ 12" oc bottom bars and depth of 8". With these values, the wall would have a flexural capacity of 51.4 k-ft. When considering 1.6H+1.0E pressures on the wall above the slab, this equates to a beam with a distributed load of 2460 plf. We can use this to get a maximum allowable wall horizontal span of 13', meaning the wall at the east face needs to be detailed to resolve 452 plf force into framing. Provide 3/4" diameter anchor @ 24" oc (936#/anchor, 468 plf capacity) to get load from top of wall into sill plate; an A35 @ 16" oc (487.5 plf capacity) to get load from sill plate into in-framing joists; and (8)8d nails from sheathing into joist (94#/nail, 752# per joist, 564 plf) to allow joists to brace wall.





oject:		Derkashar	ni Residence (8151 SE 48th St)				By:	JD.
oj No:		167-2020					Date:	9/30/202
R Ω _o C _d	6.5 2.5 4		ASCE 7-16 Table 12.2-1					
V C,	39.0 0.178 0.178	Kips	= CsW ~ ASCE 7-16 (12.8-1) = Sds / (R/le) ~ ASCE 7-16 (12.8-2)					
	0.495 - 0.051 0.01		< Sd1 / T(R/le) ~ if T <tl, (12.8-3)<br="" 7-18="" asce="">< Sd1TL / T2(R/le) ~ if T>TL, ASCE 7-16 (12.8-3) >0.044Sdsie ~ ASCE 7-18 (12.8-5) >0.01 ~ ASCE 7-16 (12.8-5)</tl,>					
W I _c	219 1	Kips	>0.5S1 / (R/le) ~ if S1>0.6g, ASCE 7-16 (12.8-6)					
F _v F _a S _S	1.8 1.2 1.443	g		EXCEPTION: A ground motion hazard analysis is not = required for structures other than seismically isolated structures and structures with damping systems where:	Table 11.4-2 Long-Period Site Coefficient, F _v Mapped Fish-Targeted Maximum Considered Earthquake (MCE_) Spectral Response Acceleration Parameter at 1-9 Period			
S _{m5}	1.732	g g g	ATC Hazard ATC Hazard = F _v S ₁ ~ ASCE 7-16 (11.4-1)	 Structures on Site Class E sites with S_S greater than or equal to 1.0, provided the site coefficient F_a is taken as equal to that of Site Class C. Structures on Site Class D sites with S_s greater than or 	θ ₁ ≤ 01 θ ₁ − 02 θ ₁ − 03 θ ₁ − 04 θ ₁ − 05 θ ₁ ≥ 06 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8 1.5 1.5 1.5 1.5 1.5 1.5 1.5	$\delta_{aa} = \frac{8\kappa h^3}{EAb} + \frac{\kappa h}{1000G_a} + \frac{h\Lambda_a}{b} $ (4.3-1)		
		g g	ATC Hazard = 2/3 S _{m1} ~ ASCE 7-16 (11.4-4)	equal to 0.2, provided the value of the seismic response coefficient C_r is determined by Eq. (12.8-2) for values of $T \leq 1.5T_p$ and taken as equal to 1.5 times the value computed in accordance with either Eq. (12.8-3) for $T_L \geq$ $T > 1.5T_p$ or Eq. (12.8-4) for $T > T_L$.	2.4 2.2" 2.6" 1.9" 1.8" 1.7" 4.2 See See See See See See See See Section Sec See See See See Sec Sec	where: b = shear wall length, ft A, = total vertical elongation of wall anchor- age system (nocluding fasterier sib, de-		
T _a	0.187	seconds	= Cthnx ~ ASCE 7-16 (12.8-7)	 Structures on Site Class E sites with S₁ greater than or equal to 0.2, provided that T is less than or equal to T_s and the Nut 	Startion Section <	uge of activition of a mongation, atc.) at vice elongation, rod elongation, etc.) at the induced unit shear in the shear wall, in. E – modulus of elasticity of end posts, psi		
h _n	0.02 19.66 0.75	feet	ASCE 7-16 Table 12.8-2 ASCE 7-16 Table 12.8-2			$A = \operatorname{area of end post cross-section, in^{2}}$ $A_{s} = \operatorname{area of end post cross-section, in^{2}}$ $G_{s} = \operatorname{apparent shear wall shear stiffness from}$		
3		seconds seconds	USGS Seismic Values = S _{eff} /S _{dav} ASCE 7-16 (11.4-3)			naii slip and panel shear deformation, kips/in (mor Column A, Tables 4.3A, 4.3B, 4.3C, or 4.3D)		
-	0.781 Weight	seconds Height	Wh C_{vx} F_{xE} , Kips	$\sum F_{xE}, Kips$ $F_{xE}, Kips$ $\sum F_{xE}, Kips$ $\sum F_{xW}, Kips$	$\sum F_{xW}$, Kips	h – shear wall height, ft ∨ = induced unit shear. The/ft δ _{ia} = maximum shear wall deflection deter- mined by deistic analysis, in.		

Story	Weight	Height	Wh	C_{vx}	F _{xE} , Kips	$\Sigma F_{\rm xE}$, Kips	F _{xE} , Kips	$\sum F_{xE}$, Kips	$\sum F_{xW}$, Kips	$\sum F_{xW}$, Kips
Sioly	(Kips)	(ft)	(Kip-ft)	$(Wb/\Sigma Wb)$	$(C_{ix}V)$	LRFD	$(C_m V)$	ASD	West ASD	South ASD
Roof	103.86	19.66	2,042	0.66	25.8	25.8	18.077	18.077	8.169	5.696
Main Floor	115.36	9.00	1,038	0.34	13.1	39.0	9.192	27.3	18.356	13.628
ΣW	219.23									

											UP-to-DOWN	RUNNING W	VALLS									
				SEISMI	c		WIND			CDA	VITY LOADING								1		Deflection	
	%	Length (ft)	# in Wall	PLF	Chord F (#)	# in Wall	PLF	Chord F (#)	Wall W (#)	Snow	Dead	(pir) Live	Uplift	Comp	Anchorage	9.34 ft			δ _{bending}	δ _{shear}	δ _{anchorage}	δ _{sw}
А	9.2%	25.33	1,669	1 51	01101011 (#)	754	1 61	onoru (#)	Wall W (#)	01104	Deau	LIVE	opint	oomp	Anchorage	12.33333 fr			obending	Snear	♥anchorage	
388	100.0%	25.33	1,669	66	615	754	30	278	2,957	90	54	0	0	2,534	1,032	6 OK	HDU2	ОК	0.001	0.063	0.000	0.064
в	24.0%	9.00	4,332			1,958																
1007	19.0%	2.17	823	380	4,685	372	172	1,603	334	325	195	0	4,554	5,138	16,529	33 OK	HDU8	OK	0.140	0.197	0.282	0.619
	58.0%	4.38	2,513	574	7,083	1,135	260	2,424	674	325	195	0	6,817	7,749	24,884	33 OK	HDU8	OK	0.105	0.298	0.209	0.612
	23.0%	2.46	996	405	4,999	450	183	1,711	379	325	195	0	4,849	5,480	17,621	33 OK	HDU8	OK	0.132	0.210	0.265	0.607
С	23.6%	15.00	4,263			1,927										12.33333						
991	6.5%	2.17	277	128	1,577	125	58	540	334	325	195	0	1,446	2,098	5,429	2 OK	CU3.5	OK	0.071	0.098	0.267	0.436
	93.5%	12.83	3,986	311	3,831	1,801	140	1,311	1,978	325	195	0	3,051	5,313	12,471	4 OK	HDU2	OK	0.029	0.322	0.084	0.435
D	24.1%	16.73	4,354			1,967										9.34						
1012	5.5%	2.19	239	109	1,022	108	49	462	255	365	219	0	895	1,722	3,453	4 OK	CU2.5	OK	0.026	0.086	0.173	0.285
	25.0%	5.54	1,088	196	1,834	492	89	829	647	365	219	0	1,511	2,563	6,049	4 OK	CU2.5	OK	0.018	0.154	0.116	0.288
	69.5%	9.00	3,026	336	4,146	1,367	152	1,419	1,388	294	176	0	3,629	5,236	14,005	4 OK	MSTC52	OK	0.013	0.264	0.007	0.284
E	17.8%	14.83	3,214			1,452										9.34						
747	56.8%	7.96	1,825	229	2,142	825	104	968	929	365	219	0	1,678	2,998	6,930	6 OK	HDU2	OK	0.015	0.219	0.056	0.290
	43.2%	6.88	1,388	202	2,490	627	91	852	1,060	294	176	0	2,095	3,375	8,281	6 OK	HDU2	OK	0.015	0.192	0.081	0.289
F	1.4%	10.00	245			111										9.34						
57	100.0%	10.00	245	25	229		11	103	1,168	25	15	0	0	979	462	6 OK	HDU2	OK	0.001	0.023	0.000	0.025
		19.46						5,216			Low	er-to-Main							1			
D 942	28.4% 74.7%	19.46	6,965 5,205		2,612	7,183 5,368		5,216														
942	25.3%	4.92	1,760	358	1,208	1,815	369	2,413	553	0	0	0	5.876	7,925	18,171	4 OK	CU6	OK	0.017	0.271	0.203	0.491
				000	1,200		000	2,110	000				0,010	1,020	10,111							
E	24.3%	21.17	5,696		2,238	6,032		4,469										_	1			
807		16.5	2,826	171	1 605	2,992	181	1,209	1,856	0	0	0	2,330	5,135	8,591	4	CU2.5	OK	0.005	0.130	0.058	0.192
	21.3%	4.50	1,211	269		1,282	285									4 OK						
	28.3%	6.00 19.67	1,615 2,871	269 146	5 516	1,710 3,040	285 155	1,030	2,213	0	0	0	366	2,137	1,245	4 OK 4	HDU2	ок	0.003	0.110	0.005	0.119
	36.2%	7.67	2,871	269	010	2,185	285	1,030	2,213	U	U	U	300	2,137	1,245	4 4 OK	HU02	UK	0.003	0.110	0.005	0.119
	36.2% 14.2%	3.00	2,063	269		2,105	285									4 OK 4 OK			1			
		0.00	007	200		000	200									FOR						
																			1			



											LEFT-to-RIGH	T RUNNING	WALLS									
											Mai	n-to-Roof										
				SEISMIC			WIND				ITY LOADING											
1 297	% 7.1% 77.1% 22.9%	Length (ft) 20.17 23.17 15.54 4.63	# in Wall 1,278 1,278 985 293	PLF 55 63 63	Chord F (#) 515	# in Wall 403 403 310 92	PLF 17 20 20	Chord F (#) 162	Wall W (#) 2,705	Snow 0	Dead 0	Live 0	Uplift 45	Comp 2,208	Anchorage	9.34 ft 12.33333 fr 6 6 OK 6 OK 6 OK	HDU2	ОК	0.001	0.053	0.001	0.054
2 1736 100.0%	41.3% 5.5% 41.8% 14.6% 14.6% 11.0% 12.5%	21.47 0.00 6.39 4.38 4.38 3.00 3.33	7,470 411 3,122 1,091 1,091 822 934	489 249 249 274 280	0 4,567 3,074 3,074 2,558 2,616	2,354 129 984 344 344 259 294	154 79 79 86 88	0 1,439 969 969 806 824	0 745 674 674 350 389	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 4,437 2,957 2,957 2,497 2,549	0 5,034 3,497 3,497 2,777 2,860	0 16,110 10,798 10,798 9,042 9,239	3 OK 4 OK 4 OK 4 OK 4 OK	HDU4 HDU4 HDU4 CU3 CU3	OK OK OK OK	0.040 0.068 0.068 0.048 0.044	0.343 0.258 0.258 0.215 0.220	0.162 0.208 0.208 0.294 0.270	0.545 0.535 0.535 0.556 0.556
3 362	8.6% 100.0%	7.42 7.42	1,558 1,558	210	1,962	491 491	66	618	866	0	0	0	1,811	2,504	6,772	6 OK	HDU4	ок	0.015	0.200	0.057	0.272
4 784	18.7% 50.0% 50.0%	4.92 2.46 2.46	3,373 1,687 1,687	686 686	8,462 8,462	1,063 532 532	216 216	2,667 2,667	379 379	0 0	0 0	0 0	8,396 8,396	8,700 8,700	30,120 30,120	33 OK 33 OK	HDU11 HDU11	ок ок	0.116 0.116	0.356 0.356	0.516 0.516	0.988 0.988
5 747	17.8% 50.0% 50.0%	13.42 6.71 6.71	3,214 1,607 1,607	240 240	2,238 2,238	1,013 506 506	75 75	705 705	783 783	0 0	0 0	0 0	2,101 2,101	2,728 2,728	7,780 7,780	6 OK 6 OK	HDU2 HDU2	OK OK	0.019 0.019	0.228 0.228	0.084 0.084	0.331 0.331
6 227	5.4% 50.0% 50.0%	7.17 3.58 3.58	977 488 488	136 136	1,681 1,681	308 154 154	43 43	530 530	552 552	0 0	0 0	0 0	1,585 1,585	2,027 2,027	5,854 5,854	6 OK 6 OK	MSTC40 MSTC40	ок ок	0.046 0.046	0.172 0.172	0.015 0.015	0.232 0.232
7 48	1.1% 100.0%	4.67 4.67	207 207	44	413	65 65	14	130	545	0	0	0	319	754	1,329	6 OK	HDU2	ОК	0.005	0.042	0.018	0.065
											Low	er-to-Main										
				SEISMIC			WIND			GRAV	ITY LOADING											
	%	Lenath (ft)	# in Wall	PLF	Chord F (#)	# in Wall	PLF	Chord F (#)	Wall W (#)	Snow	Dead	Live	Uplift	Comp	Anchorage	9 ft						
7 248 427	7.7% 76.0% 12.0% 12.0% 13.3%	15.00 9.67 2.67 2.67 19.67	708 538 85 85 1,219	56 32 32	501 287 287	1,049 797 126 126 1,807	82 47 47	742 425 425	1,088 300 300	0 0 0	0 0 0	0 0 0	416 335 335	1,286 575 575	1,495 943 943	6 OK 6 OK 6 OK	HDU2 HDU2 HDU2	OK OK OK	0.003 0.006 0.006	0.051 0.029 0.029	0.011 0.032 0.032	0.065 0.067 0.067
	34.7% 65.3%	6.83 12.83	423 795	62 62	558 558	628 1,179	92 92	827 827	769 1,444	0 0	0 0	0 0	596 394	1,211 1,549	1,784 1,602	6 OK 6 OK	HDU2 HDU2	OK OK	0.004 0.002	0.057 0.057	0.022 0.008	0.084 0.067
5 271	8.4% 27.5% 72.5%	9.88 3.88 6.00	3,988 1,097 2,891	283 482	773 494 841	2,159 594 1,566	153 261	1,147 732 1,247	436 675	0 0	0 0	0 0	2,703 1,044	3,678 1,584	9,426 2,821	3 OK 3 OK	CU3.5 HDU2	OK OK	0.034 0.037	0.191 0.326	0.203 0.045	0.429 0.408
6 285	8.8% 76.4% 23.6%	15.17 23.17 11.58 3.58	1,997 1,997 1,525 472	86 132 132	813 316	1,579 1,579 1,206 373	68 104 104	1,206 468	2,606	0	0	0	1,585	3,974	6,279	6 6 OK 6 OK	CU2.5	OK	0.002	0.079	0.028	0.109

Standard and Balloon Framing on Concrete Foundations

Strong-Wall® High-Strength Wood Shearwall Product Data

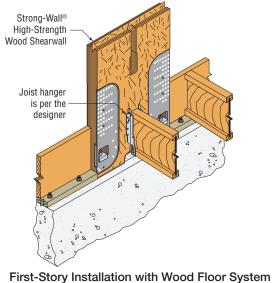
Model	P	anel Informatio	on	Ancho	r Bolts
No.	Width (in.)	Height (in.)	Weight (lb.)	Quantity	Diameter (in.)
WSWH12x7	12	84	105	2	1
WSWH18x7	18	84	155	2	1
WSWH12x8	12	96	120	2	1
WSWH18x8	18	96	175	2	1
WSWH24x8	24	96	225	2	1
WSWH12x9	12	108	130	2	1
WSWH18x9	18	108	195	2	1
WSWH24x9	24	108	250	2	1
WSWH12x10	12	120	145	2	1
WSWH18x10	18	120	210	2	1
WSWH24x10	24	120	275	2	1
WSWH12x12	12	144	165	2	1
WSWH18x12	18	144	245	2	1
WSWH24x12	24	144	325	2	1
WSWH18x14	18	168	285	2	1
WSWH24x14	24	168	370	2	1
WSWH24x16	24	192	420	2	1
WSWH18x20	18	240	390	2	1
WSWH24x20	24	240	520	2	1

1. To achieve evaluated panel heights listed in the allowable load table or for those not listed, order the next tallest panel and trim to fit. Minimum trimmed height for all panels is 741/2"

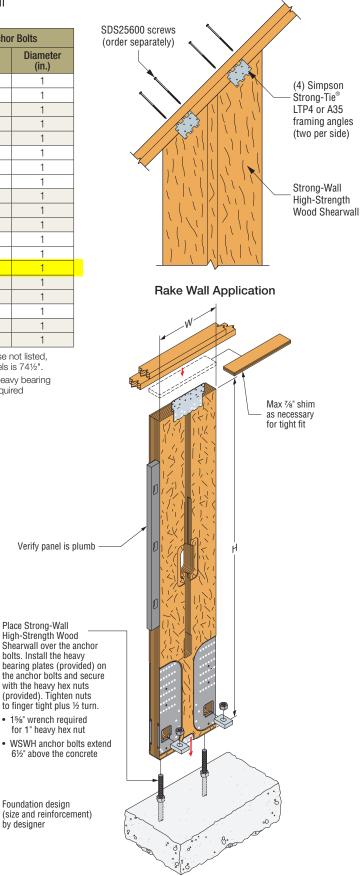
2. All panels are supplied with preattached holdowns, two heavy hex nuts, two heavy bearing plates, one WSWH-TP top connection plate (width based on panel model), required fasteners and installation instructions.

3. All panels are 31/2" thick.

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Specify panel height from top of foundation to underside of the top plates or beam.



SIMPSON

Strong-Tie

Standard Installation

by designer

Standard and Balloon Framing on Concrete Foundations

(cont.)

				2,500 psi C					3,000 psi Concrete						
Strong-Wall High-Strength Wood	Panel	Allow		Seismic ³			Wind			Seismic ³			Wind		
Wood Shearwall Model No.	Height, He (Ib.) ⁶	Vertical Load, P (lb.) ⁴	Allowable ASD Shear Load, V (lb.)	Drift at Allowable Shear, ∆ (in.) ⁷	Anchor Tension at Allowable Shear, T (lb.) ¹¹	Allowable ASD Shear Load, V (lb.)	Drift at Allowable Shear, ∆ (in.) ⁷	Anchor Tension at Allowable Shear, T (lb.) ¹¹	Allowable ASD Shear Load, V (lb.)	Drift at Allowable Shear, ∆ (in.) ⁷	Anchor Tension at Allowable Shear, T (lb.) ¹¹	Allowable ASD Shear Load, V (lb.)	Drift at Allowable Shear, ∆ (in.) ⁷	Anchor Tension at Allowable Shear, T (lb.) ¹¹	
		1,000	505	0.61	9,495	645	0.80	12,150	505	0.61	9,495	645	0.80	12,150	
WSWH12x12	144	4,000	505	0.61	9,495	645	0.80	12,150	505	0.61	9,495	645	0.80	12,150	
		7,500	505	0.61	9,495	645	0.80	12,150	505	0.61	9,495	645	0.80	12,150	
		1,000	1,705	0.61	19,665	2,195	0.80	25,285	1,705	0.61	19,665	2,195	0.80	25,285	
WSWH18x12	144	4,000	1,705	0.61	19,665	2,195	0.80	25,285	1,705	0.61	19,665	2,195	0.80	25,285	
		7,500	1,705	0.61	19,665	2,195	0.80	25,285	1,705	0.61	19,665	2,195	0.80	25,285	
		1,000	3,525	0.60	29,015	4,305	0.75	35,430	3,525	0.60	29,015	4,475	0.78	36,815	
WSWH24x12	144	4,000	3,525	0.60	29,015	4,100	0.72	33,715	3,525	0.60	29,015	4,475	0.78	36,815	
		7,500	3,525	0.60	29,015	3,855	0.67	31,715	3,525	0.60	29,015	4,475	0.78	36,815	
		1,000	1,490	0.66	18,575	1,910	0.87	23,855	1,490	0.66	18,575	1,910	0.87	23,855	
WSWH18x13	156	4,000	1,490	0.66	18,575	1,910	0.87	23,855	1,490	0.66	18,575	1,910	0.87	23,855	
		7,500	1,490	0.66	18,575	1,910	0.87	23,855	1,490	0.66	18,575	1,910	0.87	23,855	
		1,000	3,110	0.65	27,705	3,975	0.86	35,430	3,110	0.65	27,705	4,025	0.87	35,885	
WSWH24x13	156	4,000	3,110	0.65	27,705	3,780	0.81	33,715	3,110	0.65	27,705	4,025	0.87	35,885	
		7,500	3,110	0.65	27,705	3,560	0.77	31,715	3,110	0.65	27,705	4,025	0.87	35,885	
WSWH18x14	168	1,000	1,180	0.72	15,890	1,515	0.93	20,370	1,180	0.72	15,890	1,515	0.93	20,370	
W3WIII0X14	100	4,000	1,180	0.72	15,890	1,515	0.93	20,370	1,180	0.72	15,890	1,515	0.93	20,370	
WSWH24x14	168	1,000	2,620	0.71	25,160	3,365	0.93	32,290	2,620	0.71	25,160	3,365	0.93	32,290	
W3W1124X14	100	4,000	2,620	0.71	25,160	3,365	0.93	32,290	2,620	0.71	25,160	3,365	0.93	32,290	
WSWH18x16	192	1,000	985	0.82	15,160	1,265	1.07	19,395	985	0.82	15,160	1,265	1.07	19,395	
WSWIIIOXIO	192	4,000	985	0.82	15,160	1,265	1.07	19,395	985	0.82	15,160	1,265	1.07	19,395	
WSWH24x16	192	1,000	2,130	0.82	23,345	2,735	1.07	29,990	2,130	0.82	23,345	2,735	1.07	29,990	
W3WHZ4X10	192	4,000	2,130	0.82	23,345	2,735	1.07	29,990	2,130	0.82	23,345	2,735	1.07	29,990	
WSWH18x18	216	1,000	750	0.93	12,965	960	1.20	16,550	750	0.93	12,965	960	1.20	16,550	
	210	4,000	750	0.93	12,965	960	1.20	16,550	750	0.93	12,965	960	1.20	16,550	
WSWH24x18	216	1,000	1,655	0.93	20,400	2,110	1.20	26,060	1,655	0.93	20,400	2,110	1.20	26,060	
VV3VVNZ4X10	210	4,000	1,655	0.93	20,400	2,110	1.20	26,060	1,655	0.93	20,400	2,110	1.20	26,060	
WSWH18x20	240	1,000	605	1.04	11,640	770	1.33	14,825	605	1.04	11,640	770	1.33	14,825	
WSWI10X2U	240	4,000	605	1.04	11,640	770	1.33	14,825	605	1.04	11,640	770	1.33	14,825	
WSWH24x20	240	1,000	1,350	1.04	18,500	1,720	1.33	23,590	1,350	1.04	18,500	1,720	1.33	23,590	
VV3VVHZ4XZU	240	4,000	1,350	1.04	18,500	1,720	1.33	23,590	1,350	1.04	18,500	1,720	1.33	23,590	

 Allowable shear loads are applicable to installations on concrete with specified compressive strengths as listed using the ASD basic (IBC Section 1605.3.1) or the alternative basic (IBC Section 1605.3.2) load combinations.

 Load values include evaluation of bearing stresses on concrete foundations and do not require further evaluation by the designer. For installations on masonry foundations, bearing capacity shall be evaluated by the designer.

- Seismic design based on 2018 IBC using R = 6.5. For other codes, use the seismic coeffcients corresponding to light-frame bearing walls with wood structural panels or sheet-steel panels.
- Allowable vertical load denotes the total maximum concentric vertical load permitted on the panel acting in combination with the allowable shear loads.
- Allowable shear, drift and anchor tension values may be interpolated for intermediate height or vertical loads. For panels 74½"–78" tall, use the values for a 78"-tall panel.
- 6. To achieve required WSWH panel evaluation height, trim next tallest fullheight panel defined in table on p. 13.
- 7. Drifts at lower design shear may be linearly reduced.

8. See p. 16 for allowable out-of-plane and axial capacities.

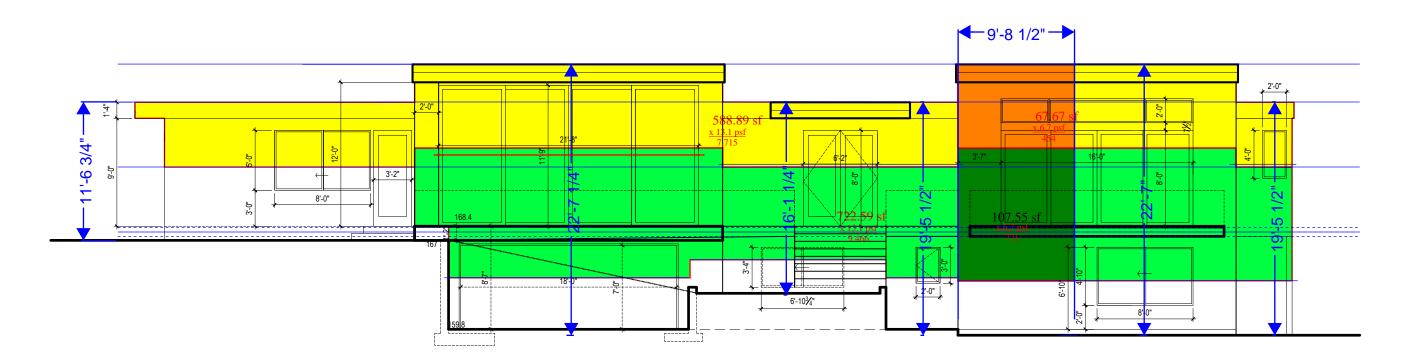
 Angled SDS screws may be omitted from the WSWH-TP top connection for all panels taller than 100"; see p. 16 as reduced allowable out-of-plane loads may apply.

 High-strength anchor bolts are required for anchor tension forces exceeding the allowable load for standard-strength bolts tabulated on pp. 22–23. See pp. 21–29 for WSWH-AB anchor bolt information and anchorage solutions.

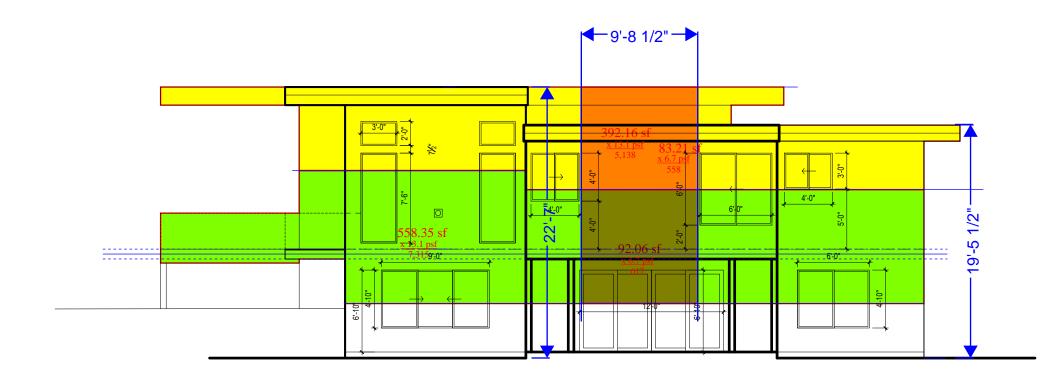
11. Tabulated anchor tension values assume no resisting vertical load. Anchor tension loads at design shear values and including the effect of vertical load may be determined using the following equation:

- $T = [(V \times H) / B] P/2, where:$ T = Anchor tension load (lb.)
 - V = Design shear load (lb.)
 - P = Applied vertical load (lb.)
 - H = Panel height (in.)
 - B = Moment arm (in.); 7.625" for WSWH12,
 - 12.50" for WSWH18, 17.50" for WSWH24.

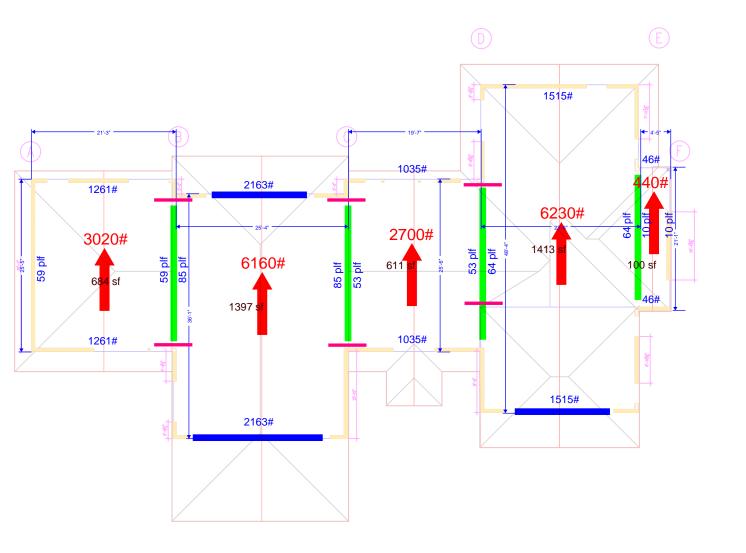
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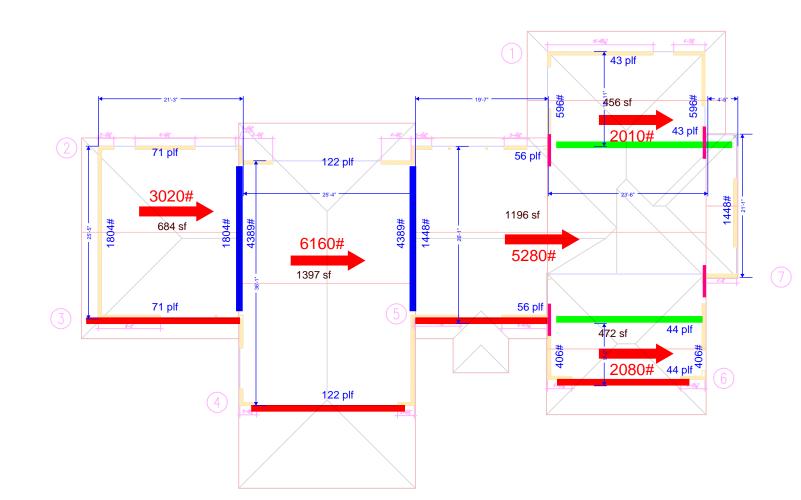


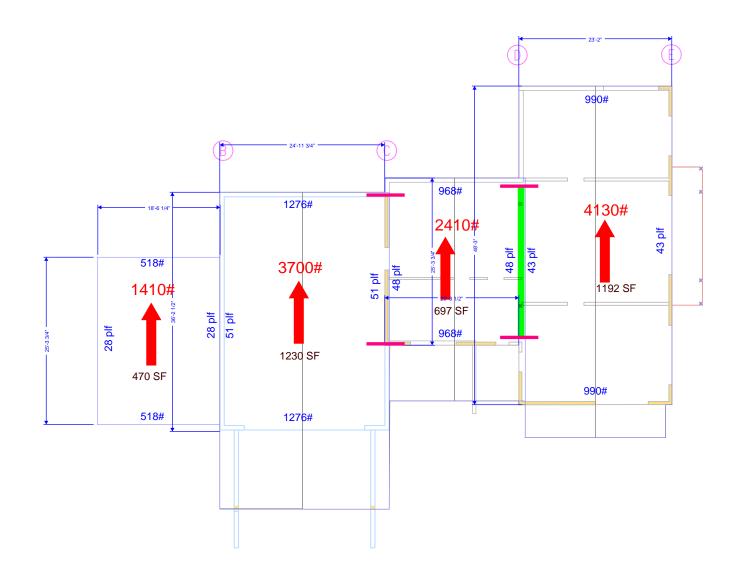
WEST ELEVATION

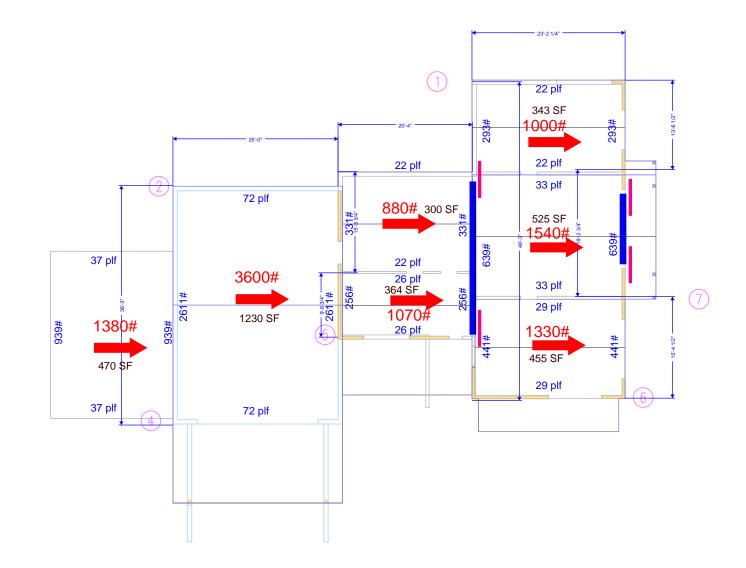


SOUTH ELEVATION









Steel Strength Concrete Breakout Pullout Strength Concrete Side-Face Blowout

ACI 17.2.3.4.4 (P. 228)

(a) Tension Steel $\phi N_{ca} = 0.75 A_{ce} R_{uta}$

17.4.1.2 The nominal strength of an anchor in tension, N_{sa} , shall not exceed

$$N_{sa} = A_{sc,N} f_{uts}$$
 (17.4.1.2)

where $A_{se,V}$ is the effective cross-sectional area of an anchor in tension, in.², and f_{attr} shall not be taken greater than the smaller of $1.9f_{ya}$ and 125,000 psi.

(b) Concrete Breakout 0.75¢N_{cb}

17.4.2.1 The nominal concrete breakout strength in tension, N_{ab} of a single anchor or N_{abg} of a group of anchors, shall not exceed: gle anchor (a) For a single anchor

 $N_{cb} = \frac{A_{Nc}}{A_{Va}} \Psi_{cl,N} \Psi_{c,N} \Psi_{cp,N} N_b \qquad (17.4.2.1a)$

(c) Concrete Pullout 0.75фN_{pn}

17.4.3.1 The nominal pullout strength of a single cast-in, post-installed expansion, and post-installed undercut anchor in tension, N_{pn} , shall not exceed

> $N_{pn} = \psi_{c,P} N_p$ (17.4.3.1)

where $\psi_{a,P}$ is defined in 17.4.3.6. 17.4.3.4 The pullout strength in tension of a single headed stud or headed bolt, N_{p} , for use in Eq. (17.4.3.1), shall not exceed

> $N_p = 8A_{brg}f_c^\prime$ (17.4.3.4)

(d) Concrete Side Blowout 0.75 hss

17.4.4 Concrete side-face blowout strength of a headed anchor in tension

17.4.4.1 For a single headed anchor with deep embedment close to an edge $(h_{ef} > 2.5c_{a1})$, the nominal side-face blowout strength, N_{sb} , shall not exceed

 $N_{sb} = 160 c_{a1} \sqrt{A_{brg}} \lambda_a \sqrt{f_c'}$ (17.4.4.1)

If c_{a2} for the single headed anchor is less than $3c_{a1}$, the value of N_{sb} shall be multiplied by the factor $(1 + c_{a2}/c_{a1})/4$, where $1.0 \le c_{a2}/c_{a1} \le 3.0$.

Where anchor reincorcement is provided in accordance with 17.4.2.9, no n

17.4.2.9 Where anchor reinforcement is developed in accordance with Chapter 25 on both sides of the breakout surface, the design strength of the anchor reinforcement shall be permitted to be used instead of the concrete breakout strength in determining 0Å-x A strength reduction factor of 0.75 shall be used in the design of the anchor reinforcement.

Material ASTM		Tensile Strength, F _u (ksi)	Nominal Tensile Stress, ^[#] F _{nt} = 0.75F _u (ksi)	Nominal Shear Stress (X type), ^[a, b] F _m = 0.50F _u (ksi)	Nominal Shear Stress (N type), ^[a, c] F _{rrv} = 0.40F _u (ksi)	Maximum Diameter in.
4	Gr 36 [d]	58	43.5	29.0	23.2	4
1554	Gr 55	75	56.3	37.5	30.0	4
Ú.	Gr 105	125	93.8	62.5	50.0	3
		120	90.0	60.0	48.0	1
	A449	105	78.8	57.5	42.0	1½
		90	67.5	45.0	36.0	3
	A36	58	43.5	29.0	23.2	4
	A307	58	43.5	29.0	23.2	4
	A354	150	112	75.0	60.0	2½
Gr BD		140	105	70.0	56.0	4

H Threads excluded from shear plane H Threads included in the shear plane H Preferred material specification

Factors Factors T.4.2.5, 17.4.2.6, and 17.4.2.7, respectively. A_{wc} is the projected concrete failure area of a single anchor or group of anchors that shall be approximated as the base of the rectilinear geometrical figure that results from projecting the failure surface outward 1.5 M_{eff} from the centerities of the nuchor, or in the case of a group of anchors, from a line through a row of adjacent anchors. A_{wc} shall not exceed m_{Awen} , where n is the projected concrete failure area of a single anchor with an edge distance equal to or greater than $1.5M_{eff}$

(17.4.2.1c) If $c_{a,min} \ge 1.5h_{cf}$, then $\psi_{cd,N} = 1.0$ $A_{Nm} = 9h_{ef}^2$

17.4.2.5 The modification factor for edge effects for single anchors or anchor groups loaded in tension, $\psi_{ed,N}$, shall be calculated as (17.4.2.5a)

17.4.2.4 The mountcation factor for anchor groups loaded eccentrically in tension, $\psi_{ec,N}$, shall be calculated as 1 $\psi_{ev,N} = \frac{1}{\left(1 + \frac{2e'_N}{3h_{ef}}\right)}$

If $c_{a,min} < 1.5 h_{cfs}$ then $\psi_{ed,N} = 0.7 + 0.3 \frac{c_{a,min}}{1.5 h_{cfs}}$ (17.4.2.5b)

(17.4.2.4)

17.4.2.6 For anchors located in a region of a concrete member where analysis indicates no cracking at service load levels, the following modification factor shall be permitted: (a) $\psi_{c,N} = 1.25$ for cast-in anchors (b) $\psi_{c,N} = 1.4$ for post-installed anchors, where the value of k_c used in Eq. (17.4.2.2a) is 17

17.4.2.7 The modification factor for post-installed anchors

designed for uncracked concrete in accordance with 17.4.2.6 without supplementary reinforcement to control split-ting, $\Psi_{qp,N}$, shall be calculated as follows using the critical distance c_{qe} as defined in 17.7.6

If $c_{a,min} \ge c_{ac}$, then $\psi_{cp,N} = 1.0$ (17.4.2.7a)

If
$$c_{a,min} \le c_{ac}$$
, then $\psi_{cp,N} = \frac{c_{a,min}}{c_{ac}}$ (17.4.2.7b)

 c_{sc} (17.4.2.7b) shall not be taken less than 1.5 h_q/c_{sc} , where the critical distance c_{sc} is defined in 17.7.6. For all other cases, including cast-in anchors, $\psi_{qr,v}$ shall be taken as 1.0.

	Table 3.2. Anchor Rod Co							
Rod Diameter, in.	Rod Area, A _n in ²	Bearing Area, in ²						
%	0.307	0.689						
3/4	0.442	0.906						
7⁄8	0.601	1.22						
1	0.785	1.50						
1 1%	0.994	1.81						
11/4	1.23	2.24						
1½	1.77	3.13						
1%	2.41	4.17						
2	3.14	5.35						
21/4	3.98	6.69						
21/2	4.91	8.17						
2¾	5.94	9.80						
3	7.07	11.4						
31/4	8.30	13.3						
31/2	9.62	15.3						
3%	11.0	17.5						
4	12.6	19.9						

d_o 0.625Anchor Diamter, in $A_{se,n}$ 0.306796Effective Cross Section Area of Anchor f_{uta} 58,000Specified Tensile Strength of Anchor, psi A_{Nc} 480Projected Concrete Failure Area of Single Anchor, in ² A_{nco} 3,600Projected Concrete Failure Area of Single Anchor if Not Limited by Edge Distance, in2 $\psi_{ec,N}$ 1.0Eccentric Modification Factor (17.4.2.4) $\psi_{ed,N}$ 0.7Edge Effects Modification (17.4.2.5) $\psi_{c,N}$ 1.0Post-Installed Anchor Modification (17.4.2.6) $\psi_{c_{n,N}}$ 1.0Cracked Concrete Modification Factor (17.4.3.6) h_{ef} 20.0Effective Embedment Depth of Anchor, in e'_n 0.0Eccentricty of Resulting Tension Force and Centroid of Anchor Group, in N_{cb} 144,000Concrete Breakout Strength, K N_{b} 144,000Concrete Breakout Strength, K N_{p} 24.8Nominal Pullout Strength, K N_{p} 24.80Nominal Pullout Strength, K N_{p} 35.6Nominal Side-Face Blowout, K		N _{sa}	17.79	Nominal Anchor Tensile Strength, K
$A_{se,n}$ 0.306796Effective Cross Section Area of Anchor f_{uta} 58,000Specified Tensile Strength of Anchor, psi A_{Nc} 480Projected Concrete Failure Area of Single Anchor, ir ² A_{nco} 3,600Projected Concrete Failure Area of Single Anchor if Not Limited by Edge Distance, in2 $\psi_{ec,N}$ 1.0Eccentric Modification Factor (17.4.2.4) $\psi_{ed,N}$ 0.7Edge Effects Modification (17.4.2.5) ψ_{c_N} 1.0Post-Installed Anchor Modification (17.4.2.6) $\psi_{c_N,N}$ 1.0Cracked Concrete Modification Factor (17.4.3.6) h_{ef} 20.0Effective Embedment Depth of Anchor, in e'_n 0.0Eccentricity of Resulting Tension Force and Centroid of Anchor Group, in N_{cb} 14.2Nominal Concrete Breakout Strength, K N_b 144,000Concrete Breakout Strength in Tension of Single Anchor in Cracked Concrete, lb k_c 24Modiciation Factor per 17.4.2.2 N_{pn} 24.8Nominal Pullout Strength, K N_p 24,804Concrete Pryout Strength of a Single Anchor, lb N_{sb} 35.6Nominal Side-Face Blowout, K			0.625	Anchor Diamter, in
f_{uta} 58,000Specified Tensile Strength of Anchor, psi A_{Nc} 480Projected Concrete Failure Area of Single Anchor, in² A_{nco} 3,600Projected Concrete Failure Area of Single Anchor if Not Limited by Edge Distance, in2 $\psi_{ec,N}$ 1.0Eccentric Modification Factor (17.4.2.4) $\psi_{ed,N}$ 0.7Edge Effects Modification (17.4.2.5) $\psi_{c,N}$ 1.0Post-Installed Anchor Modification (17.4.2.6) $\psi_{cp,N}$ 1.0Cracked Concrete Modification Factor (17.4.3.6) h_{ef} 20.0Effective Embedment Depth of Anchor, in e'_n 0.0Eccentricity of Resulting Tension Force and Centroid of Anchor Group, in N_{cb} 144.000Concrete Breakout Strength, K N_{b} 144.000Concrete Breakout Strength, K N_{pn} 24.8Nominal Pullout Strength, K N_{p} 24.80Nominal Pullout Strength, K N_{ab} 35.6Nominal Side-Face Blowout, K			0.306796	Effective Cross Section Area of Anchor
A_{Nc} 480Projected Concrete Failure Area of Single Anchor, in2 A_{nco} 3,600Projected Concrete Failure Area of Single Anchor if Not Limited by Edge Distance, in2 $\psi_{ec,N}$ 1.0Eccentric Modification Factor (17.4.2.4) $\psi_{ed,N}$ 0.7Edge Effects Modification (17.4.2.5) $\psi_{c,N}$ 1.0Post-Installed Anchor Modification (17.4.2.6) $\psi_{cp,N}$ 1.0Cracked Concrete Modification Factor (17.4.3.6) h_{ef} 20.0Effective Embedment Depth of Anchor, in e^{1}_{n} 0.0Eccentricty of Resulting Tension Force and Centroid of Anchor Group, in N_{cb} 14.2Nominal Concrete Breakout Strength, K N_{b} 144,000Concrete Breakout Strength, K N_{pn} 24.8Nominal Pullout Strength, K N_{p} 24,804Concrete Pryout Strength of a Single Anchor, Ib N_{sb} 35.6Nominal Side-Face Blowout, K			58,000	Specified Tensile Strength of Anchor, psi
Nuc3600Projected Concrete Failure Area of Single Anchor if Not Limited by Edge Distance, in2 $\Psi_{ec,N}$ 1.0Eccentric Modification Factor (17.4.2.4) $\Psi_{ed,N}$ 0.7Edge Effects Modification (17.4.2.5) $\psi_{c,N}$ 1.0Post-Installed Anchor Modification (17.4.2.6) $\psi_{cp,N}$ 1.0Cracked Concrete Modification Factor (17.4.3.6) h_{ef} 20.0Effective Embedment Depth of Anchor, in e'_n 0.0Eccentricty of Resulting Tension Force and Centroid of Anchor Group, in N_{cb} 14.2Nominal Concrete Breakout Strength, K N_b 144,000Concrete Breakout Strength in Tension of Single Anchor in Cracked Concrete, Ib k_c 24Modiciation Factor per 17.4.2.2 N_{pn} 24.8Nominal Pullout Strength, K N_{p} 24,804Concrete Pryout Strength of a Single Anchor, Ib N_{sb} 35.6Nominal Side-Face Blowout, K				
$\psi_{ec,N}$ 1.0Eccentric Modification Factor (17.4.2.4) $\psi_{ed,N}$ 0.7Edge Effects Modification (17.4.2.5) $\psi_{c,N}$ 1.0Post-Installed Anchor Modification (17.4.2.6) $\psi_{cp,N}$ 1.0Cracked Concrete Modification Factor (17.4.3.6) h_{ef} 20.0Effective Embedment Depth of Anchor, in e'_n 0.0Eccentricity of Resulting Tension Force and Centroid of Anchor Group, in N_{cb} 14.2Nominal Concrete Breakout Strength, K N_b 144,000Concrete Breakout Strength in Tension of Single Anchor in Cracked Concrete, Ib k_c 24Modiciation Factor per 17.4.2.2 N_{pn} 24.80Nominal Pullout Strength, K N_{p} 35.6Nominal Side-Face Blowout, K		A _{Nc}	480	Projected Concrete Failure Area of Single Anchor, in ²
$\Psi_{ed,N}$ 0.7Edge Effects Modification (17.4.2.5) $\Psi_{c,N}$ 1.0Post-Installed Anchor Modification (17.4.2.6) $\Psi_{cp,N}$ 1.0Cracked Concrete Modification Factor (17.4.3.6) h_{ef} 20.0Effective Embedment Depth of Anchor, in e'_n 0.0Eccentiricty of Resulting Tension Force and Centroid of Anchor Group, in N_{cb} 14.2Nominal Concrete Breakout Strength, K N_b 144,000Concrete Breakout Strength in Tension of Single Anchor in Cracked Concrete, Ib k_c 24Modiciation Factor per 17.4.2.2 N_{pn} 24.8Nominal Pullout Strength, K N_p 35.6Nominal Side-Face Blowout, K		A _{nco}	3,600	Projected Concrete Failure Area of Single Anchor if Not Limited by Edge Distance, in2
$\psi_{c,N}$ 1.0Post-Installed Anchor Modification (17.4.2.6) $\psi_{c,N}$ 1.0Cracked Concrete Modification Factor (17.4.3.6) h_{ef} 20.0Effective Embedment Depth of Anchor, in e'_n 0.0Eccentiricty of Resulting Tension Force and Centroid of Anchor Group, in N_{cb} 14.2Nominal Concrete Breakout Strength, K N_{b} 144,000Concrete Breakout Strength in Tension of Single Anchor in Cracked Concrete, Ib k_c 24Modiciation Factor per 17.4.2.2 N_{pn} 24.8Nominal Pullout Strength, K N_p 24,804Concrete Pryout Strength of a Single Anchor, Ib N_{sb} 35.6Nominal Side-Face Blowout, K		$\psi_{ec,N}$	1.0	Eccentric Modification Factor (17.4.2.4)
$\psi_{cp,N}$ 1.0Cracked Concrete Modification Factor (17.4.3.6) h_{ef} 20.0Effective Embedment Depth of Anchor, in e.'n 0.0 Eccentiricty of Resulting Tension Force and Centroid of Anchor Group, in N_{cb} 14.2Nominal Concrete Breakout Strength, K Nbb N_{cb} 144,000Concrete Breakout Strength in Tension of Single Anchor in Cracked Concrete, Ib Modiciation Factor per 17.4.2.2 N_{pn} 24.8Nominal Pullout Strength, K N_p 24,804Concrete Pryout Strength of a Single Anchor, Ib N_{sb} 35.6Nominal Side-Face Blowout, K		$\psi_{\text{ed},N}$	0.7	Edge Effects Modification (17.4.2.5)
h_{ef} 20.0Effective Embedment Depth of Anchor, in 0.0Eccentiricty of Resulting Tension Force and Centroid of Anchor Group, in N_{cb} 14.2Nominal Concrete Breakout Strength, K Nbb144,000Concrete Breakout Strength in Tension of Single Anchor in Cracked Concrete, Ib Modiciation Factor per 17.4.2.2 N_{pn} 24.8Nominal Pullout Strength, K Npp24,804 N_{pn} 24,804Concrete Pryout Strength of a Single Anchor, Ib N_{sb} 35.6Nominal Side-Face Blowout, K		$\psi_{c,N}$	1.0	Post-Installed Anchor Modification (17.4.2.6)
e'n 0.0 Eccentiricty of Resulting Tension Force and Centroid of Anchor Group, in N _{cb} 14.2 Nominal Concrete Breakout Strength, K N _b 144,000 Concrete Breakout Strength in Tension of Single Anchor in Cracked Concrete, Ib k _c 24 Modiciation Factor per 17.4.2.2 N _{pn} 24.8 Nominal Pullout Strength, K N _p 24,804 Concrete Pryout Strength of a Single Anchor, Ib N _{sb} 35.6 Nominal Side-Face Blowout, K		$\psi_{cp,N}$	1.0	Cracked Concrete Modification Factor (17.4.3.6)
e'n 0.0 Eccentiricty of Resulting Tension Force and Centroid of Anchor Group, in N _{cb} 14.2 Nominal Concrete Breakout Strength, K N _b 144,000 Concrete Breakout Strength in Tension of Single Anchor in Cracked Concrete, Ib k _c 24 Modiciation Factor per 17.4.2.2 N _{pn} 24.8 Nominal Pullout Strength, K N _p 24,804 Concrete Pryout Strength of a Single Anchor, Ib N _{sb} 35.6 Nominal Side-Face Blowout, K				
N_{cb} 14.2Nominal Concrete Breakout Strength, K N_{b} 144,000Concrete Breakout Strength in Tension of Single Anchor in Cracked Concrete, Ib k_c 24Modiciation Factor per 17.4.2.2 N_{pn} 24.8Nominal Pullout Strength, K N_p 24,804Concrete Pryout Strength of a Single Anchor, Ib N_{sb} 35.6Nominal Side-Face Blowout, K				
Nb144,000Concrete Breakout Strength in Tension of Single Anchor in Cracked Concrete, Ibkc24Modiciation Factor per 17.4.2.2Npn24.8Nominal Pullout Strength, KNp24,804Concrete Pryout Strength of a Single Anchor, IbNsb35.6Nominal Side-Face Blowout, K		e'n	0.0	Eccentiricty of Resulting Tension Force and Centroid of Anchor Group, in
Nb144,000Concrete Breakout Strength in Tension of Single Anchor in Cracked Concrete, Ibkc24Modiciation Factor per 17.4.2.2Npn24.8Nominal Pullout Strength, KNp24,804Concrete Pryout Strength of a Single Anchor, IbNsb35.6Nominal Side-Face Blowout, K			14.0	Naminal Canavata Draakaut Strangth 1/
kc24Modiciation Factor per 17.4.2.2Npn24.8Nominal Pullout Strength, KNp24,804Concrete Pryout Strength of a Single Anchor, IbNsb35.6Nominal Side-Face Blowout, K				U
Npn24.8Nominal Pullout Strength, KNp24,804Concrete Pryout Strength of a Single Anchor, IbNsb35.6Nominal Side-Face Blowout, K				
 N_p 24,804 Concrete Pryout Strength of a Single Anchor, Ib N_{sb} 35.6 Nominal Side-Face Blowout, K 		к _с	24	Modicialion Factor per 17.4.2.2
Np24,804Concrete Pryout Strength of a Single Anchor, IbNsb35.6Nominal Side-Face Blowout, K		N _{nn}	24.8	Nominal Pullout Strength, K
N _{sb} 35.6 Nominal Side-Face Blowout, K			24,804	Concrete Pryout Strength of a Single Anchor, lb
		P		
		N _{sb}	35.6	Nominal Side-Face Blowout, K
A _{brg} 0.689 Net Bearing Area of Anchor bolt, in ²		A _{brg}	0.689	Net Bearing Area of Anchor bolt, in ²
f'c 4,500 Concrete Strength, psi		f' _c	4,500	Concrete Strength, psi
λ_a 1.0 Lightweight Concrete Modification		λ_{a}	1.0	Lightweight Concrete Modification
c _{a1} 4.0 Minimum Edge Distance, in		C _{a1}	4.0	Minimum Edge Distance, in
c _{a2} 100.0 Maximum Edge Distance, in		C _{a2}	100.0	Maximum Edge Distance, in
11.309			_	
(a) Tension Steel $\phi N_{sa} = A_{se,n} F_{uta}$ 13.35 K	()		uta	
(b) Concrete Breakout ϕN_{cb} 10.66 K	(D) Concrete Breakout			
A _{st,req} 0.25 in ²				
(c) Concrete Pullout ϕN_{pn} 18.60 K				
(d) Concrete Side Blowout ϕN_{sb} 26.73 K	(d) Concrete Side Blowout	φN _{sb}		<mark>26.73</mark> K

	N _{sa}	17.79	Nominal Anchor Tensile Strength, K
	d _o	0.625	Anchor Diamter, in
	A _{se,n}	0.306796	Effective Cross Section Area of Anchor
	f _{uta}	58,000	Specified Tensile Strength of Anchor, psi
	A _{Nc}	480	Projected Concrete Failure Area of Single Anchor, in ²
	A _{nco}	3,600	Projected Concrete Failure Area of Single Anchor if Not Limited by Edge Distance, in2
	$\psi_{ec,N}$	1.0	Eccentric Modification Factor (17.4.2.4)
	$\psi_{ed,N}$	0.7	Edge Effects Modification (17.4.2.5)
	ψ _{c,N}	1.0	Post-Installed Anchor Modification (17.4.2.6)
	Ψ _{cp,N}	1.0	Cracked Concrete Modification Factor (17.4.3.6)
	h _{ef}	20.0	Effective Embedment Depth of Anchor, in
	e'n	0.0	Eccentiricty of Resulting Tension Force and Centroid of Anchor Group, in
	N _{cb}	14.2	Nominal Concrete Breakout Strength, K
	N _b	144,000	Concrete Breakout Strength in Tension of Single Anchor in Cracked Concrete, lb
	k _c	24	Modiciation Factor per 17.4.2.2
	N _{pn}	24.8	Nominal Pullout Strength, K
	N _p	24,804	Concrete Pryout Strength of a Single Anchor, Ib
	N _{sb}	35.6	Nominal Side-Face Blowout, K
	A _{brg}	0.689	Net Bearing Area of Anchor bolt, in ²
	f' _c	4,500	Concrete Strength, psi
	λ	1.0	Lightweight Concrete Modification
	C _{a1}	4.0	Minimum Edge Distance, in
	C _{a2}	100.0	Maximum Edge Distance, in
			12.432
(a) Tension Steel	$\phi N_{sa} = A_{se,n}$	uta	13.35 K
(b) Concrete Breakout	ϕN_{cb}		10.66 K
	A _{st,req}		0.28 in ²
(c) Concrete Pullout	φN _{pn}		18.60 K
(d) Concrete Side Blowout	φN _{sb}		<mark>26.73</mark> K

	N _{sa}	34.88	Nominal Anchor Tensile Strength, K
	d _o	0.875	Anchor Diamter, in
	A _{brg}	1.22	Net Bearing Area of Anchor bolt, in ²
	A _{se,n}	0.60132	Effective Cross Section Area of Anchor
	f _{uta}	58,000	Specified Tensile Strength of Anchor, psi
	A _{Nc}	480	Projected Concrete Failure Area of Single Anchor, in ²
	A _{nco}	3,600	Projected Concrete Failure Area of Single Anchor if Not Limited by Edge Distance, in2
	$\psi_{ec,N}$	1.0	Eccentric Modification Factor (17.4.2.4)
	$\psi_{\text{ed},N}$	0.7	Edge Effects Modification (17.4.2.5)
	ψ _{c,N}	1.0	Post-Installed Anchor Modification (17.4.2.6)
	$\psi_{cp,N}$	1.0	Cracked Concrete Modification Factor (17.4.3.6)
	h _{ef}	20.0	Effective Embedment Depth of Anchor, in
	e'n	0.0	Eccentiricty of Resulting Tension Force and Centroid of Anchor Group, in
		110	Newinel Concrete Decellent Strengeth 1/
	N _{cb}	14.2	Nominal Concrete Breakout Strength, K
	N _b	144,000 24	Concrete Breakout Strength in Tension of Single Anchor in Cracked Concrete, Ib
	k _c	24	Modiciation Factor per 17.4.2.2
	Npn	43.9	Nominal Pullout Strength, K
	N _p	43,920	Concrete Pryout Strength of a Single Anchor, lb
	Р		
	N _{sb}	47.4	Nominal Side-Face Blowout, K
	f' _c	4,500	Concrete Strength, psi
	λ_{a}	1.0	Lightweight Concrete Modification
	C _{a1}	4.0	Minimum Edge Distance, in
	C _{a2}	100.0	Maximum Edge Distance, in
			20.007
(a) Tension Steel	4N - A	c	20.997 26.16 K
(b) Concrete Breakout	$\phi N_{sa} = A_{se,n}$ ϕN_{cb}	' uta	10.66 K
			0.47 in ²
(c) Concrete Pullout	A _{st,req}		32.94 K
(d) Concrete Side Blowout	φN _{pn}		32.34 N 35.57 K
	ϕN_{sb}		55.57 N

	N _{sa}	45.55	Nominal Anchor Tensile Strength, K
	d _o	1	Anchor Diamter, in
	A _{brg}	1.5	Net Bearing Area of Anchor bolt, in ²
	A _{se,n}	0.785398	Effective Cross Section Area of Anchor
	f _{uta}	58,000	Specified Tensile Strength of Anchor, psi
			2
	A _{Nc}	480	Projected Concrete Failure Area of Single Anchor, in ²
	A _{nco}	3,600	Projected Concrete Failure Area of Single Anchor if Not Limited by Edge Distance, in2
	$\psi_{ec,N}$	1.0	Eccentric Modification Factor (17.4.2.4)
	$\psi_{ed,N}$	0.7	Edge Effects Modification (17.4.2.5)
	ψ _{c,N}	1.0	Post-Installed Anchor Modification (17.4.2.6)
	$\Psi_{cp,N}$	1.0	Cracked Concrete Modification Factor (17.4.3.6)
		00.0	Effective Each advant Danilla of Analysis
	h _{ef}	20.0	Effective Embedment Depth of Anchor, in
	e'n	0.0	Eccentiricty of Resulting Tension Force and Centroid of Anchor Group, in
	N _{cb}	14.2	Nominal Concrete Breakout Strength, K
	N _b	144,000	Concrete Breakout Strength in Tension of Single Anchor in Cracked Concrete, Ib
	k _c	24	Modiciation Factor per 17.4.2.2
	N _{pn}	54.0	Nominal Pullout Strength, K
	N _p	54,000	Concrete Pryout Strength of a Single Anchor, lb
	N _{sb}	52.6	Nominal Side-Face Blowout, K
	f' _c	4,500	Concrete Strength, psi
	λ	1.0	Lightweight Concrete Modification
	C _{a1}	4.0	Minimum Edge Distance, in
	C _{a2}	100.0	Maximum Edge Distance, in
	- 42		3
			30.12
(a) Tension Steel	$\phi N_{sa} = A_{se,n} F$	uta	34.16 K
(b) Concrete Breakout	ϕN_{cb}		10.66 K
	A _{st,req}		0.67 in ²
(c) Concrete Pullout	φN _{pn}		40.50 K
(d) Concrete Side Blowout	ϕN_{sb}		<mark>39.44</mark> K



ch that aims to reinforce the wall such that it perfor

de:	2018 IBC					Date:	9/30/2021	
signer:	JDA							
ient:	CenterLine							
roject:	Derkashani							
/all Line:	1 - Main to Roof							
		L1(ft)	Lo1(ft)	L2(ft)				
	_V (II		202(10)		1			
		-			E,	1		
					habove(ft)			
				_	I ↑			
					h _{open} (ft)	-		
					hope	hwall(ft)		
					1	۲ م		
					h _{below} (ft)			
					below			
					Ē			
		L	L _{wall} (ft)		•			
			Vall Calculation		- Mash	26.1		
	V 1278 lbf	Opening 1			r Method =	2bs/h		
	L1 15.54 ft L2 4.63 ft	ha1 4.00 ft ho1 4.00 ft	-	Wall Pier Aspe P1=ho1/L1=	0.26	Adj. Factor N/A		
	h _{wall} 9.17 ft	hb1 1.17 ft		P1=h01/L1= P2=h02/L2=	0.26	N/A N/A		
	L _{wall} 23.17 ft	Lo1 3.00 ft		12-1102/22-	0.00	14/4		
	-waii 23.17 ft		1					
	1. Hold-down forces: H = Vh _{wall} /L _{wall}	506 lbt	f 6	. Unit shear bes	ide opening			
					V1 = (\	//L)(L1+T1)/L1 =	63 plf	
	2. Unit shear above + below opening		_			//L)(T2+L2)/L2 =	63 plf	
	First opening: va1 = vb1 = H/(h	a1+hb1) = 98 pli	f		Check V	1*L1+V2*L2=V?	1278 lbf OK	
			_	7. Resistance to corner forces				
	3. Total boundary force above + below openin First opening: O1 = va:	-		. Resistance to o	corner force	s R1 = V1*L1 =	985 lbf	
	First opening: O1 = Va	1 X (LO1) = 294 ID	ſ			$R1 = V1^{+}L1 =$ $R2 = V2^{+}L2 =$		
	4. Corner forces					NZ = VZ LZ =	255 101	
	F1 = O1(L1)	/(L1+L2) = 226 lbt	- F 8	. Difference cor	ner force + r	esistance		
	F2 = O1(L2)					R1-F1 =	758 lbf	
	- ()					R2-F2 =	226 lbf	
	5. Tributary length of openings							
	T1 = (L1*Lo1)	/(L1+L2) = 2.31 ft	t <u>9</u>). Unit shear in c	orner zones			
	T2 = (L2*Lo1)	/(L1+L2) = 0.69 ft	t		VC	1 = (R1-F1)/L1 =	49 plf	
					VC	2 = (R2-F2)/L2 =	49 plf	
	<u>v (II</u>	••						
				_				
		7 7		6 4				
		Line 1 Line 2		Line 4				
				-				
		+++++++++++++++++++++++++++++++++++++++	•	••••••				
		↓H(Ib)		•× H(lb)				
	ary of Shear Values for One Opening					252	252	500 11 2
	a1+hb1)+V1(ho1)=H?				FOC	252	253	506 lbf
	a1+hb1)-vc1(ha1+hb1)-V1(ho1)=0? a1+hb1)-vc2(ha1+hb1)-V1(ho1)=0?				506 506	252 252	253 253	0 0
	a1+hb1)+V2(ho1)=H?				300	252	253	0 506 lbf
	,							
		De	sign Summa	arv*				
	Reg. Sheathing Capacity 98 plf		erm Deflection	0.035 in.			3-Term Deflection	0.005 in.
	Reg. Strap Force 226 lbf		n Story Drift %	0.001 %			3-Term Story Drift %	0.000 %



Sheathing and Nail Type are not a valid combination. Please review Nail Type input.

*The Design Summary assumes that the shear wall is designed as blocked.

Project Information				
Code:	2018 IBC	Date: 9/30/2021		
Designer:	JDA			
Client:	CenterLine			
Project:	Derkashani			
Wall Line:	1 - Main to Roof			

Shear Wall Deflection Calculation Variables Induced Shear Load V_{induced}: 1826 (Ibf)

induced Shear Load Vinduced.	1820 (181)			
Sheathing:		Woo	d End Post Va	lues:
Plywood	Sheathing Material	Species:	Doug Fir	
19/32	Performance Category	E:	1.70E+06	(psi)
APA Rated Sheathing	Grade		Qty	Stud Size
		Dimensions:	2	2x6
	Gt Override	A:	16.5	(in. ²)
	Ga Overide	A Override:		(in. ²)

Nail Type: 8d common (penny weight)

	Pier 1	Pier 2	
Nail Spacing:	6	6	(in.)
HD Capacity:	2655	2655	(lbf)
HD Deflection:	0.0071	0.0071	(in.)

Four-Term Equation Deflection Check

	EAD GT "D				ation 23-2)
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R]
Sheathing:	19/32	19/32	19/32	19/32	
Nail:	8d common	8d common	8d common	8d common	
V _{induced} :	91	91	91	91	(plf)
E:	1.70E+06	1.70E+06	1.70E+06	1.70E+06	(psi)
h:	9.17	8.00	8.00	9.17	(ft)
A:	16.5	16.5	16.5	16.5	(in. ²)
Gt:	28,500	28,500	28,500	28,500	(lbf/in.)
Nail Spacing:	6	6	6	6	(in.)
Vn:	45	45	45	45	(plf)
e _n :	0.0005	0.0005	0.0005	0.0005	(in.)
b:	15.54	15.54	4.63	4.63	(ft)
HD Capacity:	2655	2655	2655	2655	(lbf)
HD Defl:	0.0071	0.0071	0.0071	0.0071	(in.)

Check Total Deflection of Wall System

	Pier 1 (left)				Pier 1	(right)	
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.001	0.029	0.003	0.001	0.001	0.025	0.003	0.001
	Sum					Sum	0.030
Pier 2 (left)							
	Pier 2	l (left)			Pier 2	(right)	
Term 1	Pier 2 Term 2	(left) Term 3	Term 4	Term 1	Pier 2 Term 2	(right) Term 3	Term 4
Term 1 Bending	-	(Term 4 HD-1	Term 1 Bending	r		Term 4 HD-2
-	Term 2	Term 3	-	-	Term 2	Term 3	-

	_
Total	
Defl.	
0.035	(in.) %drift
0.0013	%drift

Project Information Code: 2018 2018 IBC Designer: JDA Client: CenterLine Project: Wall Line: Derkashani 1 - Main to Roof

Three-Term Equation Deflection Check

	$\delta_{sw} = \frac{8vh^3}{EAb}$	+	$+\frac{h\Delta_a}{b}$	(4.3-	1)
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
Sheathing:	19/32	19/32	19/32	19/32	
Nail:	8d common	8d common	8d common	8d common	
V _{induced} :	91	91	91	91	(plf)
E:	1.70E+06	1.70E+06	1.70E+06	1.70E+06	(psi)
h:	9.17	8.00	8.00	9.17	(ft)
A:	16.5	16.5	16.5	16.5	(in. ²)
Ga:	N/A	N/A	N/A	N/A	(kips/in.)
b:	15.54	15.54	4.63	4.63	(ft)
HD Capacity:	2655	2655	2655	2655	(lbf)
HD Defl:	0.0071	0.0071	0.0071	0.0071	(in.)

Check Total Deflection of Wall System

	Pier 1 (left)				
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.001		0.001	0.001		0.001
	Sum	0.003		Sum	0.002
	Pier 2 (left)			Pier 2 (right)	
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.003		0.003	0.004		0.004
	Sum	0.006		Sum	0.009

Total Defl.	
0.005	(in.)
0.0002	%drift

Sheathing and Nail Type are not a valid combination. Please review Nail Type input.

Date: 9/30/2021

Comment: The 3-term equation is calibrated to be approximately equal to 4-term equation at 1.4*ASD capacity.



le:	2018 IBC					Date:	9/30/2021	
signer:	JDA							
ent:	CenterLine							
oject:	Derkashani							
all Line:	6 - Lower to Main							
	<u>v (II</u> 1997 lbf	Shear V Opening 1	Lo1(ft)	Adj. Facto	(ij) ^{nvoja4}	2bs/h		
	L1 11.58 ft	ha1 1.67 f	_	Wall Pier Asp		Adj. Factor		
	L2 3.58 ft h _{wall} 8.50 ft L _{wall} 23.17 ft	ho1 4.83 f hb1 2.00 f Lo1 8.01 f	t	P1=ho1/L1= P2=ho2/L2=	0.42 1.35	N/A N/A		
	1. Hold-down forces: $H = Vh_{wall}/L_{wall}$	733 lb	f <u>(</u>	5. Unit shear be		: //L)(L1+T1)/L1 =	132 plf	
	2. Unit shear above + below opening				V2 = (//L)(T2+L2)/L2 =	132 plf	
	First opening: va1 = vb1 = H/(h <u>3. Total boundary force above + below openin</u> First opening: O1 = va 4. Corner forces	gs		7. Resistance to		11*L1+V2*L2=V? <u>s</u> R1 = V1*L1 = R2 = V2*L2 =	1997 lbf OK 1525 lbf 472 lbf	
	F1 = O1(L1)	/(L1+L2) = 1222 lb	f 8	8. Difference co	ner force + i	esistance		
	F2 = O1(L2)	(L1+L2) = 378 lb	f			R1-F1 = R2-F2 =	303 lbf 94 lbf	
	T1 = (L1*L01) T2 = (L2*L01)		-	. Unit shear in		:1 = (R1-F1)/L1 =	26 plf	
	12 = (L2 · L01)	(LI+LZ) = 1.891	L			2 = (R2-F2)/L1 =	26 plf	
	<u>v (II</u>	<u>)</u>			-			
		Line 1		Line 4				
		H(Ib)	Vm	ax H(lb)				
	ary of Shear Values for One Opening							
	a1+hb1)+V1(ho1)=H?				700	96	637	733 lbf
	a1+hb1)-vc1(ha1+hb1)-V1(ho1)=0?				733	96 06	637	0
	a1+hb1)-vc2(ha1+hb1)-V1(ho1)=0? a1+hb1)+V2(ho1)=H?				733	96 96	637 637	0 733 lbf
ne 4. vcz(na	ar (101) f V2(1101)-11!					50	007	זמו ככי
		De	sign Summ	arv*				
	Reg. Sheathing Capacity 200 plf		erm Deflection	0.166 in.			3-Term Deflection	0.094 in.
	Reg Strap Force 1222 lbf		m Story Drift %	0.007 %			3-Term Story Drift %	0.004 %



Sheathing and Nail Type are not a valid combination. Please review Nail Type input.

*The Design Summary assumes that the shear wall is designed as blocked.

Project Information				
Code:	2018 IBC	Date: 9/30/2021		
Designer:	JDA			
Client:	CenterLine			
Project:	Derkashani			
Wall Line:	6 - Lower to Main			

Shear Wall Deflection Calculation Variables Induced Shear Load Vinduced: 2853 (lbf)

Induced Shear Load Vinduced.	2655 (101)			
Sheathing:		Woo	od End Post Va	lues:
Plywood	Sheathing Material	Species:	Doug Fir	
19/32	Performance Category	E:	1.70E+06	(psi)
APA Rated Sheathing	Grade		Qty	Stud Size
		Dimensions:	2	2x6
	Gt Override	A:	16.5	(in. ²)
	Ga Overide	A Override:		(in. ²)

Nail Type: 8d common (penny weight)

	Pier 1	Pier 2	
Nail Spacing:	6	6	(in.)
HD Capacity:	2500	2500	(lbf)
HD Deflection:	0.1134	0.1134	(in.)

Four-Term Equation Deflection Check

	$\Delta = \frac{8vh^3}{EAb} +$	(Equ	ation 23-2)		
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R]
Sheathing:	19/32	19/32	19/32	19/32	
Nail:	8d common	8d common	8d common	8d common	
v _{induced} :	188	188	188	188	(plf)
E:	1.70E+06	1.70E+06	1.70E+06	1.70E+06	(psi)
h:	8.50	6.50	6.50	8.50	(ft)
A:	16.5	16.5	16.5	16.5	(in. ²)
Gt:	28,500	28,500	28,500	28,500	(lbf/in.)
Nail Spacing:	6	6	6	6	(in.)
Vn:	94	94	94	94	(plf)
e _n :	0.0041	0.0041	0.0041	0.0041	(in.)
b:	11.58	11.58	3.58	3.58	(ft)
HD Capacity:	2500	2500	2500	2500	(lbf)
HD Defl:	0.1134	0.1134	0.1134	0.1134	(in.)

Check Total Deflection of Wall System

	Pier 1 (left)				Pier 1	(right)	
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.003	0.056	0.026	0.053	0.001	0.043	0.020	0.031
	Sum 0.139					Sum	0.095
	Pier 2 (left)						
	Pier 2	! (left)			Pier 2	(right)	
Term 1	Pier 2 Term 2	(left) Term 3	Term 4	Term 1	Pier 2 Term 2	(right) Term 3	Term 4
Term 1 Bending			Term 4 HD-1	Term 1 Bending	r		Term 4 HD-2
-	Term 2	Term 3			Term 2	Term 3	

	_
Total	
Defl.	
0.166	(in.) %drift
0.0065	%drift

Project Information Code: 2018 2018 IBC Designer: JDA Client: CenterLine Project: Wall Line: Derkashani 6 - Lower to Main

Three-Term Equation Deflection Check

					_	
	$\delta_{sw} = \frac{8vh^3}{EAb}$	$+\frac{vh}{1000G_a}$	$+\frac{h\Delta_a}{b}$	(4.3-	1)	
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R		
Sheathing:	19/32	19/32	19/32	19/32		Sheathing and Nail Type are not a valid combination.
Nail:	8d common	8d common	8d common	8d common		Please review Nail Type input.
V _{induced} :	188	188	188	188	(plf)	
E:	1.70E+06	1.70E+06	1.70E+06	1.70E+06	(psi)	
h:	8.50	6.50	6.50	8.50	(ft)	
A:	16.5	16.5	16.5	16.5	(in. ²)	
Ga:	N/A	N/A	N/A	N/A	(kips/in.)	
b:	11.58	11.58	3.58	3.58	(ft)	
HD Capacity:	2500	2500	2500	2500	(lbf)	
HD Defl:	0.1134	0.1134	0.1134	0.1134	(in.)	

Check Total Deflection of Wall System

	Pier 1 (left)				Pier 1 (right)	
	Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
	Bending	Shear	Fastener	Bending	Shear	Fastener
[0.003		0.053	0.001		0.031
		Sum	0.056		Sum	0.032
		Pier 2 (left)			Pier 2 (right)	
ľ	Term 1	Pier 2 (left) Term 2	Term 3	Term 1	Pier 2 (right) Term 2	Term 3
	Term 1 Bending	()	Term 3 Fastener	Term 1 Bending	101	Term 3 Fastener
		Term 2			Term 2	

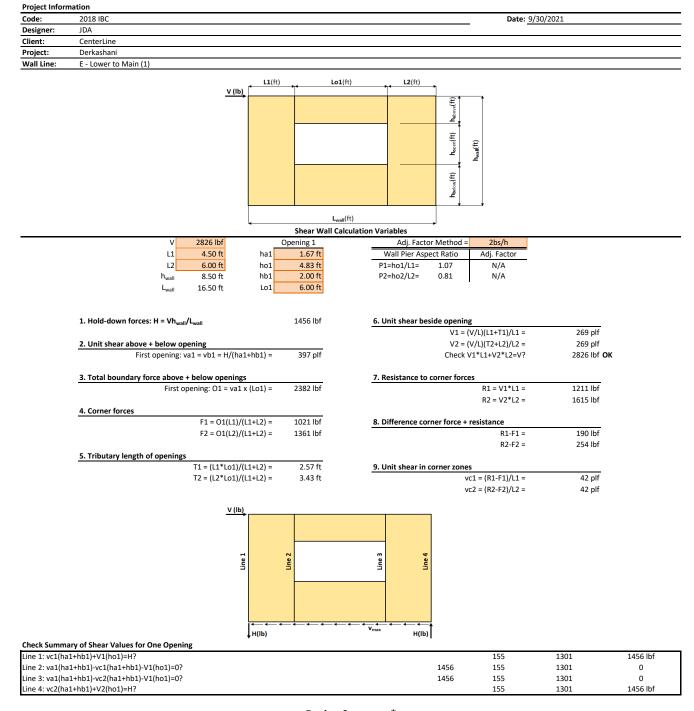
Total Defl.	
0.094	(in.)
0.0037	%drift

Date: 9/30/2021

Comment: The 3-term equation is calibrated to be approximately equal to 4-term equation at 1.4*ASD capacity.



ONE OPENIN





Sheathing and Nail Type are not a valid combination. Please review Nail Type input.

*The Design Summary assumes that the shear wall is designed as blocked.

Project Information				
Code:	2018 IBC	Date: 9/30/2021		
Designer:	JDA			
Client:	CenterLine			
Project:	Derkashani			
Wall Line:	E - Lower to Main (1)			

Shear Wall Deflection Calculation Variables Induced Shear Load V_{induced}: 4037 (lbf)

induced Shear Load Vinduced.	(151)			
Sheathing:	_	Woo	d End Post Va	lues:
Plywood	Sheathing Material	Species:	Doug Fir	
19/32	Performance Category	E:	1.70E+06	(psi)
APA Rated Sheathing	Grade		Qty	Stud Size
		Dimensions:	2	2x6
	Gt Override	A:	16.5	(in. ²)
	Ga Overide	A Override:		(in. ²)

Nail Type: 8d common (penny weight)

	Pier 1	Pier 2	
Nail Spacing:	6	6	(in.)
HD Capacity:	2500	2500	(lbf)
HD Deflection:	0.1134	0.1134	(in.)

Four-Term Equation Deflection Check

$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_n + d_a \frac{h}{b}$				(Equ	ation 23-2)
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R]
Sheathing:	19/32	19/32	19/32	19/32	
Nail:	8d common	8d common	8d common	8d common	
v _{induced} :	384	384	384	384	(plf)
E:	1.70E+06	1.70E+06	1.70E+06	1.70E+06	(psi)
h:	8.50	6.50	6.50	8.50	(ft)
A:	16.5	16.5	16.5	16.5	(in. ²)
Gt:	28,500	28,500	28,500	28,500	(lbf/in.)
Nail Spacing:	6	6	6	6	(in.)
Vn:	192	192	192	192	(plf)
e _n :	0.0357	0.0357	0.0357	0.0357	(in.)
b:	4.50	4.50	6.00	6.00	(ft)
HD Capacity:	2500	2500	2500	2500	(lbf)
HD Defl:	0.1134	0.1134	0.1134	0.1134	(in.)

Check Total Deflection of Wall System

	Pier 1 (left)				Pier 1	(right)	
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.015	0.115	0.228	0.280	0.007	0.088	0.174	0.164
	Sum 0.637					Sum	0.432
Pier 2 (left)			Pier 2 (right)				
	Pier 2	l (left)			Pier 2	(right)	
Term 1	Pier 2 Term 2	(left) Term 3	Term 4	Term 1	Pier 2 Term 2	(right) Term 3	Term 4
Term 1 Bending		. ,	Term 4 HD-1	Term 1 Bending	r		Term 4 HD-2
-	Term 2	Term 3			Term 2	Term 3	-

Total	
Defl.	
0.506	(in.) %drift
0.0198	%drift

Project Information Code: 2018 2018 IBC Designer: Client: JDA CenterLine Project: Wall Line: Derkashani

E - Lower to Main (1)

Three Term Equation Deflection Check	
Three-Term Equation Dehection Check	hree-Term Equation Deflection Check

	(4.3-	1)			
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
Sheathing:	19/32	19/32	19/32	19/32	
Nail:	8d common	8d common	8d common	8d common	
V _{induced} :	384	384	384	384	(plf)
E:	1.70E+06	1.70E+06	1.70E+06	1.70E+06	(psi)
h:	8.50	6.50	6.50	8.50	(ft)
A:	16.5	16.5	16.5	16.5	(in. ²)
Ga:	N/A	N/A	N/A	N/A	(kips/in.)
b:	4.50	4.50	6.00	6.00	(ft)
HD Capacity:	2500	2500	2500	2500	(lbf)
HD Defl:	0.1134	0.1134	0.1134	0.1134	(in.)

Check Total Deflection of Wall System

Pier 1 (left)				Pier 1 (right)		
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3	
Bending	Shear	Fastener	Bending	Shear	Fastener	
0.015		0.280	0.007		0.164	
	Sum	0.295		Sum	0.170	
Pier 2 (left)			Pier 2 (right)			
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3	
Bending	Shear	Fastener	Bending	Shear	Fastener	
0.005		0.123	0.011		0.210	
	Sum	0.128		Sum	0.221	

Total Defl.	
0.204	(in.)
0.0080	%drift

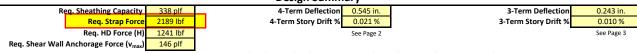
Sheathing and Nail Type are not a valid combination. Please review Nail Type input.

Date: 9/30/2021

Comment: The 3-term equation is calibrated to be approximately equal to 4-term equation at 1.4*ASD capacity.



	2018 IBC		Date:	9/30/2021	
signer:	JDA		- ·		
ient:	CenterLine				
oject:	Derkashani				
all Line:	E - Lower to Main (2)				
	L1(ft)	o1(ft) 12(ft)			
	V (Ib)	Lo1(ft) L2(ft)			
		三 三 三 三 三 三 三 三 三 三 三 三 三 三 三 三 三 三 三	1		
		habove(ft)			
		E			
		hopen(ft)	hwall(ft)		
			^m		
		w(ft			
		heelow(ff)			
		L _{wall} (ft)			
	4	Calculation Variables			
	V 2871 lbf Opening 1	Adj. Factor Method	= 2bs/h		
	L1 7.67 ft ha1 1.67 ft	Wall Pier Aspect Ratio	Adj. Factor		
	L2 3.00 ft ho1 4.83 ft	P1=ho1/L1= 0.63	N/A		
	h _{wall} 8.50 ft hb1 2.00 ft	P2=h02/L2= 1.61	N/A		
	L _{wall} 19.67 ft Lo1 9.00 ft		.,,		
	1. Hold-down forces: H = Vh _{wall} /L _{wall} 1241 lbf	6. Unit shear beside openi	ng		
			(V/L)(L1+T1)/L1 =	269 plf	
	2. Unit shear above + below opening		(V/L)(T2+L2)/L2 =	269 plf	
	First opening: va1 = vb1 = H/(ha1+hb1) = 338 plf		V1*L1+V2*L2=V?	2871 lbf OK	
	3. Total boundary force above + below openings	7. Resistance to corner for	ces		
	First opening: O1 = va1 x (Lo1) = 3045 lbf		R1 = V1*L1 =	2064 lbf	
			R2 = V2*L2 =	807 lbf	
	4. Corner forces				
	F1 = O1(L1)/(L1+L2) = 2189 lbf	8. Difference corner force	 resistance 		
	F2 = O1(L2)/(L1+L2) = 856 lbf		R1-F1 =	-125 lbf	
			R2-F2 =	-49 lbf	
	5. Tributary length of openings				
	T1 = (L1*L01)/(L1+L2) = 6.47 ft	9. Unit shear in corner zon			
	T2 = (L2*Lo1)/(L1+L2) = 2.53 ft		vc1 = (R1-F1)/L1 =	-16 plf	
			vc2 = (R2-F2)/L2 =	-16 plf	
	1(76)				
	<u>V (Ib)</u>				
		m 4			
	Line 1	Line 3			
	H(Ib)	• • • • • • • • • • • • • • • • • • •			
eck Summ	ary of Shear Values for One Opening	•			
	a1+hb1)+V1(ho1)=H?		-60	1301	1241 lbf
	a1+hb1)-vc1(ha1+hb1)-V1(ho1)=0?	1241	-60	1301	0
	a1+hb1)-vc2(ha1+hb1)-V1(ho1)=0?	1241	-60	1301	0
ne 4: vc2(ha	a1+hb1)+V2(ho1)=H?		-60	1301	1241 lbf
	Desig	n Summary*			
		Deflection 0.545 in.		3-Term Deflection	0.243 in.



Sheathing and Nail Type are not a valid combination. Please review Nail Type input.

*The Design Summary assumes that the shear wall is designed as blocked.

Project Information					
Code:	2018 IBC	Date: 9/30/2021			
Designer:	JDA				
Client:	CenterLine				
Project:	Derkashani				
Wall Line:	E - Lower to Main (2)				

Shear Wall Deflection Calculation Variables Induced Shear Load V_{induced}: 4101 (lbf)

induced Sincar Load Vinduced.	(101)			
Sheathing:		Woo	od End Post Va	lues:
Plywood	Sheathing Material	Species:	Doug Fir	
19/32	Performance Category	E:	1.70E+06	(psi)
APA Rated Sheathing	Grade		Qty	Stud Size
		Dimensions:	2	2x6
	Gt Override	A:	16.5	(in. ²)
	Ga Overide	A Override:		(in. ²)

Nail Type: 8d common (penny weight)

	Pier 1	Pier 2	
Nail Spacing:	6	6	(in.)
HD Capacity:	2500	2500	(lbf)
HD Deflection:	0.1134	0.1134	(in.)

Four-Term Equation Deflection Check

	$\Delta = \frac{8vh^3}{EAb} +$	(Equ	ation 23-2)		
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R]
Sheathing:	19/32	19/32	19/32	19/32	
Nail:	8d common	8d common	8d common	8d common	
v _{induced} :	384	384	384	384	(plf)
E:	1.70E+06	1.70E+06	1.70E+06	1.70E+06	(psi)
h:	8.50	6.50	6.50	8.50	(ft)
A:	16.5	16.5	16.5	16.5	(in. ²)
Gt:	28,500	28,500	28,500	28,500	(lbf/in.)
Nail Spacing:	6	6	6	6	(in.)
Vn:	192	192	192	192	(plf)
e _n :	0.0357	0.0357	0.0357	0.0357	(in.)
b:	7.67	7.67	3.00	3.00	(ft)
HD Capacity:	2500	2500	2500	2500	(lbf)
HD Defl:	0.1134	0.1134	0.1134	0.1134	(in.)

Check Total Deflection of Wall System

	Pier 1 (left)			Pier 1 (right)			
Term 1	Term 2	Term 3	Term 4	Term 1	Term 2	Term 3	Term 4
Bending	Shear	Fastener	HD-1	Bending	Shear	Fastener	HD-2
0.009	0.115	0.228	0.164	0.004	0.088	0.174	0.096
	Sum 0.515			Sum 0.362			
	Pier 2 (left)						
	Pier 2	l (left)			Pier 2	(right)	
Term 1	Pier 2 Term 2	(left) Term 3	Term 4	Term 1	Pier 2 Term 2	(right) Term 3	Term 4
Term 1 Bending		. ,	Term 4 HD-1	Term 1 Bending			Term 4 HD-2
-	Term 2	Term 3		-	Term 2	Term 3	-

Total	
Defl.	
0.545	(in.) %drift
0.0214	%drift

Project Information Code: 2018 2018 IBC Designer: Client: JDA CenterLine Project: Wall Line: Derkashani E - Lower to Main (2)

Three-Term	Equation	Defl	ection	Check
		-		

	$\delta_{sw} = \frac{8vh^3}{EAb}$	(4.3-	1)		
	Pier 1-L	Pier 1-R	Pier 2-L	Pier 2-R	
Sheathing:	19/32	19/32	19/32	19/32	
Nail:	8d common	8d common	8d common	8d common	
V _{induced} :	384	384	384	384	(plf)
E:	1.70E+06	1.70E+06	1.70E+06	1.70E+06	(psi)
h:	8.50	6.50	6.50	8.50	(ft)
A:	16.5	16.5	16.5	16.5	(in. ²)
Ga:	N/A	N/A	N/A	N/A	(kips/in.)
b:	7.67	7.67	3.00	3.00	(ft)
HD Capacity:	2500	2500	2500	2500	(lbf)
HD Defl:	0.1134	0.1134	0.1134	0.1134	(in.)

Check Total Deflection of Wall System

	Pier 1 (left)			Pier 1 (right)	
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.009		0.164	0.004		0.096
	Sum	0.173		Sum	0.100
	Pier 2 (left)			Pier 2 (right)	
Term 1	Term 2	Term 3	Term 1	Term 2	Term 3
Bending	Shear	Fastener	Bending	Shear	Fastener
0.010		0.246	0.022		0.420
	Sum	0.256		Sum	0.442

Total Defl.	
0.243	(in.)
0.0095	%drift

Sheathing and Nail Type are not a valid combination. Please review Nail Type input.

Date: 9/30/2021

 $\label{eq:comment: The 3-term equation is calibrated to be approximately equal to 4-term equation at 1.4* ASD capacity.$



Derkashani

Roof				
Member Name	Results	Current Solution	Comments	
1	Passed	2 piece(s) 2 x 6 DF No.1		
2	Failed	2 piece(s) 1 3/4" x 18" 2.0E Microllam® LVL	Multiple Failures/Errors	
3	Passed	2 piece(s) 2 x 8 DF No.1		
4	Passed	1 piece(s) 3 1/2" x 7 1/2" 24F-V4 DF Glulam		
5	Failed	3 piece(s) 1 3/4" x 20" 2.0E Microllam® LVL	Multiple Failures/Errors	
6	Passed	3 piece(s) 1 3/4" x 14" 2.0E Microllam® LVL		
7	Passed	2 piece(s) 1 3/4" x 18" 2.0E Microllam® LVL		
8	Passed	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam		
9	Passed	2 piece(s) 2 x 8 DF No.1		
10	Passed	2 piece(s) 2 x 10 DF No.1		
11	Passed	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam		
12	Passed	1 piece(s) 3 1/2" x 9" 24F-V4 DF Glulam		
13	Passed	2 piece(s) 2 x 4 DF No.1		
14	Passed	2 piece(s) 2 x 6 DF No.1		
15	Passed	2 piece(s) 2 x 6 DF No.1		

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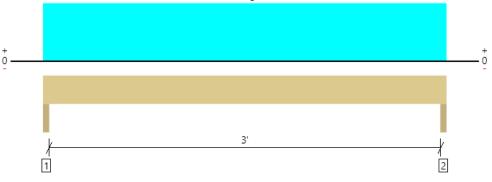


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Roof, 1 2 piece(s) 2 x 6 DF No.1





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)	1036 @ 1 1/2"	5625 (3.00")	Passed (18%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	616 @ 8 1/2"	2277	Passed (27%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	781 @ 1' 9"	1884	Passed (41%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.013 @ 1' 9"	0.108	Passed (L/999+)		1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.021 @ 1' 9"	0.162	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/360) and TL (L/240).

Allowed moment does not reflect the adjustment for the beam stability factor.

Applicable calculations are based on NDS.

	Bearing Length			Loads to Supports (lbs)			
Supports	Total	Available	Required	Dead	Snow	Total	Accessories
1 - Trimmer - DF	3.00"	3.00"	1.50"	419	617	1036	None
2 - Trimmer - DF	3.00"	3.00"	1.50"	419	617	1036	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 6" o/c	
Bottom Edge (Lu)	3' 6" o/c	

•Maximum allowable bracing intervals based on applied load.

			Dead	Snow	
Vertical Loads	Location	Tributary Width	(0.90)	(1.15)	Comments
0 - Self Weight (PLF)	0 to 3' 6"	N/A	4.2		
1 - Uniform (PSF)	0 to 3' 6"	11' 9"	20.0	30.0	Default Load

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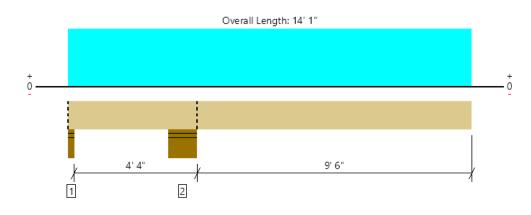




Roof, 2

2 piece(s) 1 3/4" x 18" 2.0E Microllam® LVL

Right cantilever exceeds the maximum braced cantilever length of 7'. ok, braced by sheathing/framing An excessive uplift of -7063 lbs at support located at 1 1/2" failed this product. detail accordingly



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)	15233 @ 4'	30625 (14.00")	Passed (50%)		1.0 D + 1.0 S (All Spans)	
Shear (lbs)	7887 @ 1' 11"	13766	Passed (57%)	1.15	1.0 D + 1.0 S (Alt Spans)	
Moment (Ft-lbs)	-30803 @ 4'	33424	Passed (92%)	1.15	1.0 D + 1.0 S (All Spans)]
Live Load Defl. (in)	0.380 @ 14' 1"	1.008	Passed (2L/636)		1.0 D + 1.0 S (Alt Spans)]
Total Load Defl. (in)	0.652 @ 14' 1"	1.344	Passed (2L/370)		1.0 D + 1.0 S (Alt Spans)	

System : Roof Member Type : Flush Beam Building Use : Residential Building Code : IBC 2015 Design Methodology : ASD Member Pitch : 0/12

• Deflection criteria: LL (L/240) and TL (L/180).

• Overhang deflection criteria: LL (2L/240) and TL (2L/180).

• Right cantilever length exceeds 1/3 member length or 1/2 back span length. Additional bracing should be considered.

· Allowed moment does not reflect the adjustment for the beam stability factor.

· Moment capacity over cantilever support 2 has been reduced by 25% to lessen the effects of buckling.

	Bearing Length		Loads t	o Supports (
Supports	Total	Available	Required	Dead	Snow	Total	Accessories
1 - Stud wall - DF	3.00"	3.00"	1.50"	-2802	-4261	-7063	Blocking
2 - Stud wall - DF	14.00"	14.00"	6.96"	6371	8862	15233	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)	14' 1" o/c				
Bottom Edge (Lu)	5' 10" o/c				
Maximum allowable bracing intervals based on applied load					

ximum allowable bracing intervals based on applied load.

			Dead	Snow	
Vertical Loads	Location (Side)	Tributary Width	(0.90)	(1.15)	Comments
0 - Self Weight (PLF)	0 to 14' 1"	N/A	18.4		
1 - Uniform (PSF)	0 to 14' 1" (Front)	11' 9"	20.0	30.0	Default Load

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

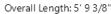
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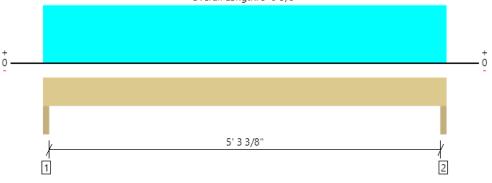
Job Notes





Roof, 3 2 piece(s) 2 x 8 DF No.1





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)	1714 @ 1 1/2"	5625 (3.00")	Passed (30%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	1208 @ 10 1/4"	3002	Passed (40%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	2268 @ 2' 10 11/16"	3022	Passed (75%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.046 @ 2' 10 11/16"	0.184	Passed (L/999+)		1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.077 @ 2' 10 11/16"	0.277	Passed (L/861)		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/360) and TL (L/240).

· Allowed moment does not reflect the adjustment for the beam stability factor.

Applicable calculations are based on NDS.

	Bearing Length		Loads to Supports (lbs)				
Supports	Total	Available	Required	Dead	Snow	Total	Accessories
1 - Trimmer - DF	3.00"	3.00"	1.50"	695	1019	1714	None
2 - Trimmer - DF	3.00"	3.00"	1.50"	695	1019	1714	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	5' 9" o/c	
Bottom Edge (Lu)	5' 9" o/c	

•Maximum allowable bracing intervals based on applied load.

			Dead	Snow	
Vertical Loads	Location	Tributary Width	(0.90)	(1.15)	Comments
0 - Self Weight (PLF)	0 to 5' 9 3/8"	N/A	5.5		
1 - Uniform (PSF)	0 to 5' 9 3/8"	11' 9"	20.0	30.0	Default Load

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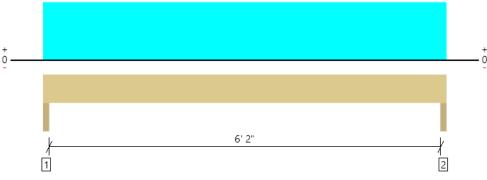
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Roof, 4 1 piece(s) 3 1/2" x 7 1/2" 24F-V4 DF Glulam





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)	3568 @ 1 1/2"	6825 (3.00")	Passed (52%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	2632 @ 10 1/2"	5333	Passed (49%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-Ibs)	5510 @ 3' 4"	7547	Passed (73%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.110 @ 3' 4"	0.214	Passed (L/700)		1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.184 @ 3' 4"	0.321	Passed (L/418)		1.0 D + 1.0 S (All Spans)

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

PASSED

• Deflection criteria: LL (L/360) and TL (L/240).

• Allowed moment does not reflect the adjustment for the beam stability factor.

• Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 6' 5".

• 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.

	Bearing Length		Loads to Supports (lbs)				
Supports	Total	Available	Required	Dead	Snow	Total	Accessories
1 - Trimmer - DF	3.00"	3.00"	1.57"	1440	2128	3568	None
2 - Trimmer - DF	3.00"	3.00"	1.57"	1440	2128	3568	None

Bracing Intervals	Comments
6' 8" o/c	
6' 8" o/c	
	6' 8" o/c

•Maximum allowable bracing intervals based on applied load.

			Dead	Snow	
Vertical Loads	Location	Tributary Width	(0.90)	(1.15)	Comments
0 - Self Weight (PLF)	0 to 6' 8"	N/A	6.4		
1 - Uniform (PSF)	0 to 6' 8"	21' 3 3/8"	20.0	30.0	Default Load

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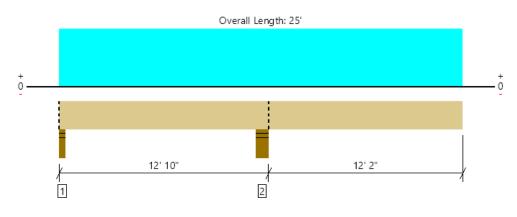




Roof, 5

3 piece(s) 1 3/4" x 20" 2.0E Microllam® LVL

Right cantilever exceeds the maximum braced cantilever length of 7'. ok, braced by sheathing/framing An excessive uplift of -1126 lbs at support located at 1 1/2" failed this product. detail accordingly



LDF

1.15

1.15

Load: Combination (Pattern)

1.0 D + 1.0 S (All Spans)

1.0 D + 1.0 S (All Spans)

1.0 D + 1.0 S (All Spans)

1.0 D + 1.0 S (Alt Spans)

1.0 D + 1.0 S (Alt Spans)

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

Member Pitch : 0/12

Deflection criteria: LL (L/240) and TL (L/180).

Design Results

Shear (lbs)

Moment (Ft-lbs)

Live Load Defl. (in)

Total Load Defl. (in)

Member Reaction (lbs)

Overhang deflection criteria: LL (2L/240) and TL (2L/180).

• Right cantilever length exceeds 1/3 member length or 1/2 back span length. Additional bracing should be considered.

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

Allowed moment does not reflect the adjustment for the beam stability factor.

• Moment capacity over cantilever support 2 has been reduced by 25% to lessen the effects of buckling.

Actual @ Location

16904 @ 12' 7"

7147 @ 10' 8"

-52472 @ 12' 7"

0.654 @ 25'

1.105 @ 25'

	Bearing Length		Loads to Supports (lbs)				
Supports	Total	Available	Required	Dead	Snow	Total	Accessories
1 - Stud wall - SPF	3.00"	3.00"	1.50"	48	1272/-1174	1320/- 1174	Blocking
2 - Stud wall - DF	6.00"	6.00"	5.15"	7219	9685	16904	Blocking

Allowed

19688 (6.00")

22943

61017

1.242

1.656

Result

Passed (86%)

Passed (31%)

Passed (86%)

Passed (2L/456)

Passed (2L/270)

• 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)	25' o/c	
Bottom Edge (Lu)	7' 6" o/c	
		•

•Maximum allowable bracing intervals based on applied load.

			Dead	Snow	
Vertical Loads	Location (Side)	Tributary Width	(0.90)	(1.15)	Comments
0 - Self Weight (PLF)	0 to 25'	N/A	30.6		
1 - Uniform (PSF)	0 to 25' (Front)	13'	20.0	30.0	Default Load

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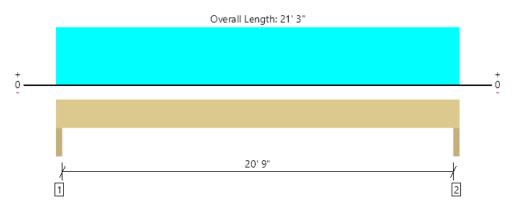
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator Javid Abdi Atlas Consulting Engineers (206) 427-7233 Javiddabdi@yahoo.com Job Notes





Roof, 6 3 piece(s) 1 3/4" x 14" 2.0E Microllam® LVL



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)	ber Reaction (lbs) 3787 @ 1 1/2"		Passed (32%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	2730 @ 1' 5"	12569	Passed (22%)	0.90	1.0 D (All Spans)
Moment (Ft-lbs)	16342 @ 10' 7 1/2"	32749	Passed (50%)	0.90	1.0 D (All Spans)
Live Load Defl. (in)	0.115 @ 10' 7 1/2"	0.700	Passed (L/999+)		1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.680 @ 10' 7 1/2"	1.050	Passed (L/370)		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/360) and TL (L/240).

Allowed moment does not reflect the adjustment for the beam stability factor.

	Bearing Length		Loads to Supports (lbs)				
Supports	Total	Available	Required	Dead	Snow	Total	Accessories
1 - Trimmer - DF	3.00"	3.00"	1.50"	3150	638	3788	None
2 - Trimmer - DF	3.00"	3.00"	1.50"	3150	638	3788	None

Lateral Bracing	Bracing Intervals	Comments				
Top Edge (Lu)	17' 2" o/c					
Bottom Edge (Lu)	21' 3" o/c					
Maximum elleviselle huesine internets beend on excited land						

•Maximum allowable bracing intervals based on applied load.

			Dead	Snow	
Vertical Loads	Location	Tributary Width	(0.90)	(1.15)	Comments
0 - Self Weight (PLF)	0 to 21' 3"	N/A	21.5		
1 - Uniform (PSF)	0 to 21' 3"	2'	20.0	30.0	Default Load
2 - Uniform (PSF)	0 to 21' 3"	11' 9"	20.0	-	Weight of Hung Door

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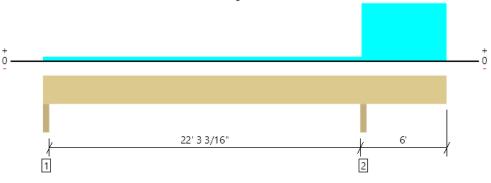
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Roof, 7 2 piece(s) 1 3/4" x 18" 2.0E Microllam® LVL

Overall Length: 28' 6 3/16"



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)	5622 @ 22' 7 11/16"	7875 (3.00")	Passed (71%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	3053 @ 24' 3 3/16"	13766	Passed (22%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	-12399 @ 22' 7 11/16"	44566	Passed (28%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.186 @ 28' 6 3/16"	0.392	Passed (2L/758)		1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.279 @ 28' 6 3/16"	0.587	Passed (2L/506)		1.0 D + 1.0 S (Alt Spans)

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

Deflection criteria: LL (L/360) and TL (L/240).

• Overhang deflection criteria: LL (2L/360) and TL (2L/240).

• Allowed moment does not reflect the adjustment for the beam stability factor.

	Bearing Length		Loads to Supports (Ibs)				
Supports	Total	Available	Required	Dead	Snow	Total	Accessories
1 - Trimmer - DF	3.00"	3.00"	1.50"	208	181/-151	389/- 151	None
2 - Trimmer - DF	3.00"	3.00"	2.14"	2447	3176	5623	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	28' 6" o/c	
Bottom Edge (Lu)	17' 1" o/c	
Bottom Edge (Lu)	17' 1" o/c	

•Maximum allowable bracing intervals based on applied load.

			Dead	Snow	
Vertical Loads	Location	Tributary Width	(0.90)	(1.15)	Comments
0 - Self Weight (PLF)	0 to 28' 6 3/16"	N/A	18.4		
1 - Uniform (PSF)	0 to 28' 6 3/16"	1'	20.0	30.0	Default Load
2 - Uniform (PSF)	22' 6 3/16" to 28' 6 3/16"	13'	20.0	30.0	

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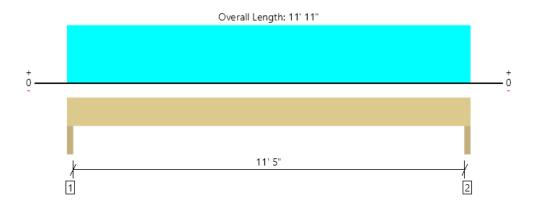
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Roof, 8 1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam





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)	4460 @ 1 1/2"	6825 (3.00")	Passed (65%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	3618 @ 1' 1 1/2"	7466	Passed (48%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-Ibs)	12736 @ 5' 11 1/2"	14792	Passed (86%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.304 @ 5' 11 1/2"	0.389	Passed (L/460)		1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.513 @ 5' 11 1/2"	0.583	Passed (L/273)		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/360) and TL (L/240).

• Allowed moment does not reflect the adjustment for the beam stability factor.

• Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 11' 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.

	Bearing Length			Loads to Supports (lbs)			
Supports	Total	Available	Required	Dead	Snow	Total	Accessories
1 - Trimmer - DF	3.00"	3.00"	1.96"	1816	2644	4460	None
2 - Trimmer - DF	3.00"	3.00"	1.96"	1816	2644	4460	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	11' 11" o/c	
Bottom Edge (Lu)	11' 11" o/c	

•Maximum allowable bracing intervals based on applied load.

			Dead	Snow	
Vertical Loads	Location	Tributary Width	(0.90)	(1.15)	Comments
0 - Self Weight (PLF)	0 to 11' 11"	N/A	8.9		
1 - Uniform (PSF)	0 to 11' 11"	14' 9 1/2"	20.0	30.0	Default Load

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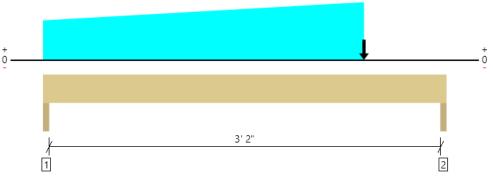
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Roof, 9 2 piece(s) 2 x 8 DF No.1

Overall Length: 3' 8"



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)	3625 @ 3' 6 1/2"	5625 (3.00")	Passed (64%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	2883 @ 2' 9 3/4"	3002	Passed (96%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	2264 @ 2' 11"	3022	Passed (75%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.014 @ 1' 11 5/16"	0.114	Passed (L/999+)		1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.023 @ 1' 11 5/16"	0.171	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/360) and TL (L/240).

Allowed moment does not reflect the adjustment for the beam stability factor.

Applicable calculations are based on NDS.

	Bearing Length			Loads to Supports (lbs)			
Supports	Total	Available	Required	Dead	Snow	Total	Accessories
1 - Trimmer - DF	3.00"	3.00"	1.50"	439	643	1082	None
2 - Trimmer - DF	3.00"	3.00"	1.93"	1456	2169	3625	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 8" o/c	
Bottom Edge (Lu)	3' 8" o/c	

•Maximum allowable bracing intervals based on applied load.

			Dead	Snow	
Vertical Loads	Location	Tributary Width	(0.90)	(1.15)	Comments
0 - Self Weight (PLF)	0 to 3' 8"	N/A	5.5		
1 - Tapered (PSF)	0 to 2' 11"	3' to 4' 4 1/2"	20.0	30.0	Default Load
2 - Point (Ib)	2' 11"	N/A	1660	2490	83 SF from Truss Girder

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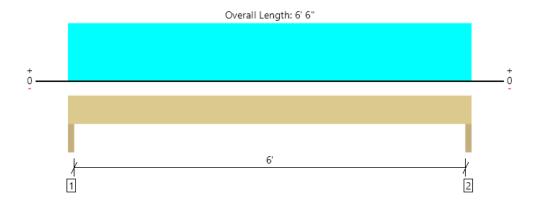
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Roof, 10 2 piece(s) 2 x 10 DF No.1



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)	2433 @ 1 1/2"	5625 (3.00")	Passed (43%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	1669 @ 1' 1/4"	3830	Passed (44%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	3656 @ 3' 3"	4510	Passed (81%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.045 @ 3' 3"	0.208	Passed (L/999+)		1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.076 @ 3' 3"	0.313	Passed (L/981)		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/360) and TL (L/240).

• Allowed moment does not reflect the adjustment for the beam stability factor.

Applicable calculations are based on NDS.

	Bearing Length			Loads t	o Supports		
Supports	Total	Available	Required	Dead	Snow	Total	Accessories
1 - Trimmer - DF	3.00"	3.00"	1.50"	987	1446	2433	None
2 - Trimmer - DF	3.00"	3.00"	1.50"	987	1446	2433	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' 6" o/c	
Bottom Edge (Lu)	6' 6" o/c	

•Maximum allowable bracing intervals based on applied load.

			Dead	Snow	
Vertical Loads	Location	Tributary Width	(0.90)	(1.15)	Comments
0 - Self Weight (PLF)	0 to 6' 6"	N/A	7.0		
1 - Uniform (PSF)	0 to 6' 6"	14' 10"	20.0	30.0	Default Load

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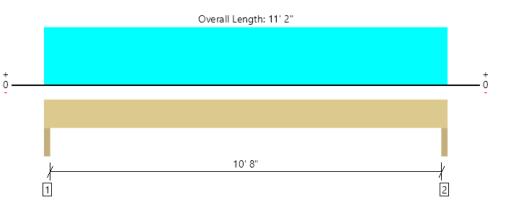
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Roof, 11 1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam



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)	4191 @ 1 1/2"	6825 (3.00")	Passed (61%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	3347 @ 1' 1 1/2"	7466	Passed (45%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	11182 @ 5' 7"	14792	Passed (76%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.234 @ 5' 7"	0.364	Passed (L/560)		1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.395 @ 5' 7"	0.546	Passed (L/332)		1.0 D + 1.0 S (All Spans)

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

PASSED

• Deflection criteria: LL (L/360) and TL (L/240).

• Allowed moment does not reflect the adjustment for the beam stability factor.

• Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 10' 11".

• 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.

	Bearing Length			Loads to Supports (lbs)			
Supports	Total	Available	Required	Dead	Snow	Total	Accessories
1 - Trimmer - DF	3.00"	3.00"	1.84"	1707	2485	4192	None
2 - Trimmer - DF	3.00"	3.00"	1.84"	1707	2485	4192	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	11' 2" o/c	
Bottom Edge (Lu)	11' 2" o/c	

•Maximum allowable bracing intervals based on applied load.

			Dead	Snow	
Vertical Loads	Location	Tributary Width	(0.90)	(1.15)	Comments
0 - Self Weight (PLF)	0 to 11' 2"	N/A	8.9		
1 - Uniform (PSF)	0 to 11' 2"	14' 10"	20.0	30.0	Default Load

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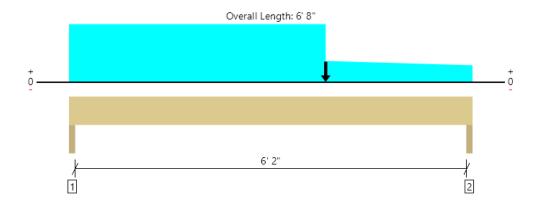
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Roof, 12 1 piece(s) 3 1/2" x 9" 24F-V4 DF Glulam



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)	4059 @ 6' 6 1/2"	6825 (3.00")	Passed (59%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	3830 @ 5' 8"	6400	Passed (60%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-Ibs)	8650 @ 4' 2 7/8"	10868	Passed (80%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.089 @ 3' 5 1/16"	0.214	Passed (L/861)		1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.150 @ 3' 5 1/16"	0.321	Passed (L/514)		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/360) and TL (L/240).

• Allowed moment does not reflect the adjustment for the beam stability factor.

• Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 6' 5".

• 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.

	Bearing Length			Loads to Supports (lbs)			
Supports	Total	Available	Required	Dead	Snow	Total	Accessories
1 - Trimmer - DF	3.00"	3.00"	1.63"	1500	2211	3711	None
2 - Trimmer - DF	3.00"	3.00"	1.78"	1639	2420	4059	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' 8" o/c	
Bottom Edge (Lu)	6' 8" o/c	

•Maximum allowable bracing intervals based on applied load.

			Dead	Snow	
Vertical Loads	Location	Tributary Width	(0.90)	(1.15)	Comments
0 - Self Weight (PLF)	0 to 6' 8"	N/A	7.7		
1 - Uniform (PSF)	0 to 4' 2 7/8"	14' 7"	20.0	30.0	Default Load
2 - Point (lb)	4' 2 7/8"	N/A	1620	2430	81 SF from truss girder
3 - Tapered (PSF)	4' 2 7/8" to 6' 8"	5' 3 9/16" to 4' 2 1/2"	20.0	30.0	Default Load

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

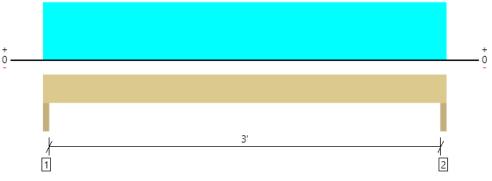
ForteWEB Software Operator Javid Abdi Atlas Consulting Engineers (206) 427-7233 Javiddabdi@yahoo.com Job Notes





Roof, 13 2 piece(s) 2 x 4 DF No.1





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)	479 @ 1 1/2"	5625 (3.00")	Passed (9%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	330 @ 6 1/2"	1449	Passed (23%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	361 @ 1' 9"	880	Passed (41%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.022 @ 1' 9"	0.108	Passed (L/999+)		1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.038 @ 1' 9"	0.162	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/360) and TL (L/240).

Allowed moment does not reflect the adjustment for the beam stability factor.

Applicable calculations are based on NDS.

	Bearing Length			Loads to Supports (lbs)			
Supports	Total	Available	Required	Dead	Snow	Total	Accessories
1 - Trimmer - DF	3.00"	3.00"	1.50"	194	284	478	None
2 - Trimmer - DF	3.00"	3.00"	1.50"	194	284	478	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 6" o/c	
Bottom Edge (Lu)	3' 6" o/c	

•Maximum allowable bracing intervals based on applied load.

			Dead	Snow	
Vertical Loads	Location	Tributary Width	(0.90)	(1.15)	Comments
0 - Self Weight (PLF)	0 to 3' 6"	N/A	2.7		
1 - Uniform (PSF)	0 to 3' 6"	5' 5"	20.0	30.0	Default Load

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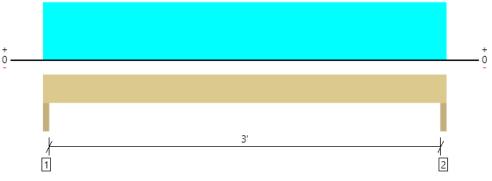
F	orteWEB Software Operator	Job Notes
A (2	avid Abdi ttas Consulting Engineers 206) 427-7233 aviddabdi@yahoo.com	





Roof, 14 2 piece(s) 2 x 6 DF No.1





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)	1283 @ 1 1/2"	5625 (3.00")	Passed (23%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	764 @ 8 1/2"	2277	Passed (34%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	968 @ 1' 9"	1884	Passed (51%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.016 @ 1' 9"	0.108	Passed (L/999+)		1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.026 @ 1' 9"	0.162	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/360) and TL (L/240).

Allowed moment does not reflect the adjustment for the beam stability factor.

Applicable calculations are based on NDS.

	Bearing Length			Loads to Supports (lbs)			
Supports	Total	Available	Required	Dead	Snow	Total	Accessories
1 - Trimmer - DF	3.00"	3.00"	1.50"	518	766	1284	None
2 - Trimmer - DF	3.00"	3.00"	1.50"	518	766	1284	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' 6" o/c	
Bottom Edge (Lu)	3' 6" o/c	

•Maximum allowable bracing intervals based on applied load.

			Dead	Snow	
Vertical Loads	Location	Tributary Width	(0.90)	(1.15)	Comments
0 - Self Weight (PLF)	0 to 3' 6"	N/A	4.2		
1 - Uniform (PSF)	0 to 3' 6"	14' 7"	20.0	30.0	Default Load

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Roof, 15 2 piece(s) 2 x 6 DF No.1





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)	1210 @ 1 1/2"	5625 (3.00")	Passed (22%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	829 @ 8 1/2"	2277	Passed (36%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1214 @ 2' 3"	1884	Passed (64%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.033 @ 2' 3"	0.142	Passed (L/999+)		1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.056 @ 2' 3"	0.213	Passed (L/914)		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/360) and TL (L/240).

• Allowed moment does not reflect the adjustment for the beam stability factor.

Applicable calculations are based on NDS.

	В	earing Leng	th	Loads t	o Supports ((lbs)	
Supports	Total	Available	Required	Dead	Snow	Total	Accessories
1 - Trimmer - DF	3.00"	3.00"	1.50"	490	720	1210	None
2 - Trimmer - DF	3.00"	3.00"	1.50"	490	720	1210	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 6" o/c	
Bottom Edge (Lu)	4' 6" o/c	

•Maximum allowable bracing intervals based on applied load.

			Dead	Snow	
Vertical Loads	Location	Tributary Width	(0.90)	(1.15)	Comments
0 - Self Weight (PLF)	0 to 4' 6"	N/A	4.2		
1 - Uniform (PSF)	0 to 4' 6"	10' 8"	20.0	30.0	Default Load

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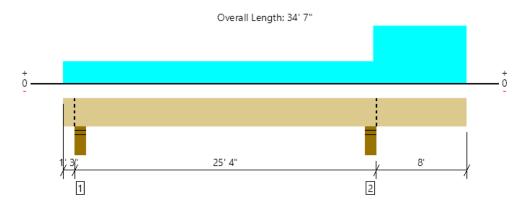




Roof, Truss Uplift Overhang

1 piece(s) 1 3/4" x 14" 2.0E Microllam® LVL @ 24" OC

Right cantilever exceeds the maximum braced cantilever length of 7'. OK, braced by sheathing



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)	2634 @ 26' 4 1/4"	6016 (5.50")	Passed (44%)		1.0 D + 1.0 S (Adj Spans)
Shear (lbs)	1154 @ 24' 11 1/2"	5353	Passed (22%)	1.15	1.0 D + 1.0 S (Adj Spans)
Moment (Ft-lbs)	-5686 @ 26' 4 1/4"	10880	Passed (52%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.429 @ 34' 7"	0.823	Passed (2L/460)		1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.464 @ 34' 7"	1.097	Passed (2L/426)		1.0 D + 1.0 S (Alt Spans)

System : Roof Member Type : Joist Building Use : Residential Building Code : IBC 2015 Design Methodology : ASD Member Pitch : 0/12

Deflection criteria: LL (L/240) and TL (L/180).

• Overhang deflection criteria: LL (2L/240) and TL (2L/180).

Allowed moment does not reflect the adjustment for the beam stability factor.

• A 4% increase in the moment capacity has been added to account for repetitive member usage.

Moment capacity over cantilever support 2 has been reduced by 25% to lessen the effects of buckling.

- 207 lbs uplift at support located at 1' 5 3/4". Strapping or other restraint may be required.

• -243 lbs uplift at support located at 26' 4 1/4". Strapping or other restraint may be required.

	В	earing Leng	th	L	oads to Sup	ports (Ibs)		
Supports	Total	Available	Required	Dead	Snow	Wind	Total	Accessories
1 - Stud wall - DF	5.50"	5.50"	1.50"	270	756	20/-614	1046/- 614	Blocking
2 - Stud wall - DF	5.50"	5.50"	2.41"	752	1882	-1156	2634/- 1156	Blocking
Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.								

ads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	10' 11" o/c	
Bottom Edge (Lu)	8' 8" o/c	
Maximum allowable bracing inten	ale based on annlied load	

mum allowable bracing intervals based on applied lo

			Dead	Snow	Wind	
Vertical Loads	Location (Side)	Spacing	(0.90)	(1.15)	(1.60)	Comments
1 - Uniform (PSF)	0 to 34' 7"	24"	12.0	30.0	-22.0	Default Load
2 - Uniform (PSF)	26' 7" to 34' 7"	24"	12.0	30.0	-10.0	Default Load

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

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Job Notes



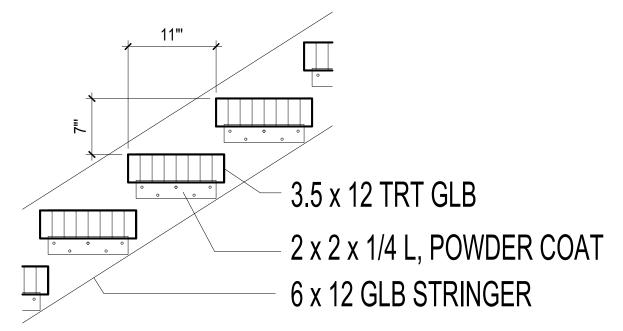
imitations:	uses Rankine co	cks soil on low o	de of wall does not brace wall a	t at top of wall does not contribute to restoring moment (overturning only), no deflection
eference: ile author:	Nilson & Winter,		ete Structures, 11th Edition, pa 4/25/2002	
	0.11001	aat moullieu.	7/20/2002	
SOIL DATA	130	(pcf)	soil unit weight	Coeff. Friction
w phi	35	(deg)	soil unit weight soil internal angle of friction	Unit Weight Int Friction w. Conc Soil
del	0	(deg)	surface angle incline	110-120 33-40 0.5-0.6 Sand or gravel, no fines
	0.5		coeff. friction w/Concrete	120-130 25-35 0.4-0.5 Sand or gravel, w/ fines
	0.819 1.000		cosine(phi) cosine(del)	110-120 23-30 0.3-0.4 Silty sand, high clay 100-120 25-35 0.2-0.4 Medium or stiff clay
Ca	0.271	35.23 psf	coeff. of active pressure	90-110 20-25 0.2-0.3 Soft clay, silt
Ср	2.307	299.91 psf	coeff. of passive pressure	
WALL GEOME	TRY			M1 n
H1	4.3333333	(ft)	soil retained	M1/ P1 W4
H2	0.1666667	(ft)	soil depth above toe	\mathbf{V}_1
H3 H4	0.83333333	(ft) (ft)	footing thickness passive pressure soil depth	
B1	0.6666667	(ft)	wall width	
B2	2	(ft)	toe width	W1 W3
В3 Н	0 5.3333333	(ft) (ft)	heel width	H1
В	2.66666667	(ft)	total height total base	1 1
	150	(pcf)	concrete unit weight	P
EXTERNAL LC				TOP OF SOIL
Papplied	0	(lb/ft)		
V _{applied}	187.5	(lb/ft)	0.5	VV Z Y
Mapplied	0	(lb-ft / ft)		H4 H3
Surcharge	36	(psf)		
OAD CALCUL	ATIONS			
	soil force and			$\frac{1}{1} \frac{1}{1} \frac{1}$
H _{prime} Y	0.28 1.86	(ft) (ft)	converted surcharge distance to soil load resultant	
P	554	(lbs)	soil load resultant	e h
	1030	(lb-ft)	Mo, soil + surcharge	
	-62.50313 970	(lb-ft) (lb-ft)	Mo, external load total overturning Moment	
			total overtaining woment	$\hat{C}_{ah}wh$ $\hat{C}_{ah}w(h+h')$ h^2+3hh'
component	wall resto weight (#)	arm (ft)	moment (#-ft)	$y = \frac{\hbar}{3} \qquad \qquad y = \frac{\hbar^2 + 3\hbar\hbar'}{3(\hbar + 2\hbar')}$
/1 (concrete)	450	2.33	1050	$P = \frac{1}{2}C_{a,h}wh^2$ $P = \frac{1}{2}C_{a,h}wh(h+2h')$
v2 (concrete)	333	1.33	444	
v3 (heel soil) v4 (surcharge)	0	2.67 2.67	0	Rv /R
v5 (toe soil)	43	1.00	43	+1/3+ a:=(4(-6a)
P applied	0	2.33	0	$+a \rightarrow +$ $+a \rightarrow +$ +a +
vert. force	827	momen	t 1,538	$\begin{array}{c} -\frac{1}{2} -\frac{1}$
		ng resistance		(a) Resultant in middle third
	150 414	(lb) (lb)	passive pressure sliding resist soil friction force	ance R 7
	564	(lb)	total sliding resistance	-1/3 A 2Pr
STABILITY FA		ETY CHECK		(c) Resultant outside middle third
	1.5 1.5		F.S. overturning F.S. sliding	
overturning	1.59	ОК	Mr / Mo	0 0.266666600753333333 0.8 1.066666600733333333 1.6 1.8666666000713333333 2.4 2.6666666600
sliding	1.54	OK	(PP+F)/(Ph+V)	-100 -
SOIL BEARING	3			-200 -
a	0.69	(ft)	distance to resultant	-300
~1	0.89' to 1.78'	(nof)	middle third of footing	-400 -
q1 q2	799 N.A.	(psf) (psf)	bearing pressure @ toe bearing pressure @ heel	-500
				BEARING PRESSURE
ACTORED (1	.7) STEM LOA 4.5	D FORCES (ft)	H1 + H2	.700 . (psf)
	4.5	(ft)	line of action (above base)	-800
	401	(lbs)	P (arm only)	.900
	401	(lbs)	Ph (arm only)	
	2.5	(kip-ft)	Mu (arm moment)	
FACTORED (1		-OADS (kip-ft)	Mu @ Top (B+t Br 10)	
	5.5 0.0	(kip-ft) (kip-ft)	Mu @ Toe (Bot Reinf) Mu @ Heel (Top Reinf)	
	4.22	(kip)	Vu @ Toe	
	0.00	(kip)	Vu @ Heel	
- oting				
⁼ooting øVc	7,969	10" thick	<u>Wall</u> ø∨c	5,692 8" thick
As	0.2	#4 @ 12"	As	0.15 #4 @ 16"
a	0.0003	-	а	0.0002
ðMn	6.30 0.6	k-ft 3-#4	ØMn	4.05 k-ft
		Reinf. Ratio		
	-	10		
RFD soil		psf @ 'psf @ Toe	-0.07 ft from	n Wall
.RFD soil	1358.3	psf @ 'psf @ Toe # in Toe @	-0.07 ft from 1.31 ft from	

	file author:		Design of Conc ast modified:	rete Structures, 11th Edition, pa 4/25/2002	ge 680
	SOIL DATA				
edi 0	w		(pcf)	soil unit weight	
0.5 0.5					· · · · · · · · · · · · · · · · · · ·
⁰ / ₂	del		(deg)		3
0.000 CG 0.000 2.027 0.000 2.027 0.000 2.027 0.000 2.027 0.000 2.027 0.0000 2.027 0.0000 2.027 0.0000 2.027 0.0000 2.027 0.0000 2.027 0.0000 2.027 0.0000 2.00000 0.00000 2.00000 0.00000 2.00000 0.000000 0.00000 0.00000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.0000000 0.0000000 0.00000000 0.000000000 0.0000000000 0.000000000000000000000000 0.00000000000000000000000000000000000					
Cp 2.27 33.32 μr control indexpension Cp 2.23 indexpension Wall Concentry (i) indexpension (i) indexpension H 0.00000007 (ii) indexpension (iii) (iiii) (iiii) (iiii)					
Cp 2.307 38.37 µr cell dependent result WALL GENETRY 19 statuting statuting H 0.0333333 (f) statuting Statuting 0.010 statuting statuting Statuting (f) statuting statuting Statuting 0.010 statuting statuting statuting <td>Са</td> <td></td> <td>35.23 psf</td> <td></td> <td>· · · · · · · · · · · · · · · · · · ·</td>	Са		35.23 psf		· · · · · · · · · · · · · · · · · · ·
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$ \begin{array}{c c c c c c } \hline \mathbf{x} & $					
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H d 0.326.0000000000000000000000000000000000					+ V1 + 1 1 1 1 1 1 1 1 1 1
B1 0.060000007 (f) is watch B1 0.06000007 (f) is watch B1 0.00000000000000000000000000000000000					
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$ \begin{array}{c} \hline 150 \\ \hline 0 \\ 0 \\$				total height	, ,
EXTERNAL LODS $\frac{1}{12} \frac{1}{2} \frac{1}$	В				
EXTERNAL LODDS $\frac{Vacuum i}{Vacuum i}} \frac{450}{44} (c) (b) (b) (b) (b) (b) (b) (b) (b) (b) (b$		150	(pcf)	concrete unit weight	
$\frac{P_{wintow}}{S_{unchange}} = \frac{1}{000} (0,01) (1,00) (1$	EXTERNAL LO	ADS			TOP OF SOIL
$\frac{V_{Maxim}}{Surchargo} \frac{650}{44} (b, th) (b, th) 1$ $\frac{V_{Maxim}}{Surchargo} \frac{650}{44} (b, th) ($	-		(lb/ft)		
$\frac{M_{max}}{Surchargo} 0 \\ \frac{M_{max}}{Surchargo} 0 \\ \frac{M_{max}}{Surch$				1	wz y
Surging 4 (pet) LOD CLCULATIONS List and a down further in general $\frac{1}{p}$, $\frac{1}{723}$ (b) (b) and the developing $\frac{1}{733}$ (b)				•	H4 H3
$ \begin{array}{c c c c c c } \hline Letral solutions conditions of the formation of the solutions of the$. ,		
$\frac{1}{12 marked solid force and overturing moment is solid advance in a solid advance is solid advance is solid advance in a solid advance is solid advance is solid advance in a solid avance is solid advance is soli$	-		(PO.)		B2 B1 B3
$\frac{1}{P} \frac{1}{r_{2}} \frac{1}{r_{$				moment	
$\frac{\mathbf{y}}{\mathbf{y}} = \frac{2}{\sqrt{10}} \left(\frac{10}{\sqrt{10}} \right) defance to resultant model frequent the sector of the model is the sector matrix the $					
$P = \frac{782}{1300} (the) Model resultants 3.000.115 (the) Model resultants \frac{1}{1300} (the) Model resultants \\\frac{1}{1300} (the) Model resultants \\\frac{1}{13000} (the) Model resultants \\\frac{1}{130000} (the) Model resultants \\\frac{1}{130000} (the) Model resulta$	Y				
$\frac{1}{1,3(3)} (b, b, b) $ bd, odd auchrange 3,000,015 (b, b) bd, odd auchrange Mo (porche) 4 (porc					
$\frac{-300.015 \text{ (b-ft)}}{1.430 \text{ (b-ft)}} \text{ total overtraining Moment}$ $\frac{\text{wall restoring forces}}{(4 \text{ concerns})} \frac{\text{wall restoring forces}}{490 \text{ 1.36}} \frac{\text{moment}}{1971}$ $\frac{\text{do beat sol}}{40 \text{ concerns})} \frac{490 \text{ 1.36}}{490 \text{ 0.332}} \frac{1971}{3.32}$ $\frac{\text{do beat sol}}{100 \text{ 0.33}} \frac{3.32}{3.32}$ $\frac{\text{do beat sol}}{100 \text{ 0.33}} \frac{3.32}{3.32}$ $\frac{100 \text{ 0.33}}{755 \text{ (b)}} \frac{\text{concerns}}{3.337}$ $\frac{155 \text{ (b)}}{755 \text{ (b)}} \frac{\text{concerns}}{3.337}$ $\frac{155 \text{ (b)}}{155 \text{ (c)}} \frac{\text{concerns}}{3.337}$ $\frac{1.33 \text{ (b)}}{155 \text{ (b)}} \frac{\text{concerns}}{3.337}$ $\frac{1.33 \text{ (b)}}{155 \text{ (b)}} \frac{\text{concerns}}{3.337}$ $\frac{1.33 \text{ (b)}}{155 \text{ (b)}} \frac{\text{concerns}}{155 \text{ concerns}} \frac{\text{concerns}}{3.337}$ $\frac{1.33 \text{ (b)}}{155 \text{ (b)}} \frac{\text{concerns}}{155 \text{ concerns}} \frac{\text{concerns}}{3.337}$ $\frac{1.33 \text{ (b)}}{152 \text{ (b)}} \frac{\text{concerns}}{157 \text{ concerns}} \frac{\text{concerns}}{3.337}$ $\frac{1.33 \text{ (b)}}{152 \text{ (b)}} \frac{\text{concerns}}{157 \text{ concerns}} \frac{\text{concerns}}{155 \text{ concerns}} \frac{\text{concerns}}{3.337}$ $\frac{1.33 \text{ (b)}}{152 \text{ (b)}} \frac{\text{concerns}}{157 \text{ concerns}} \frac{\text{concerns}}{155 \text{ concerns}} \frac{\text{concerns}}$					
Torumone (initial constraints) $\frac{1}{(2 \text{ constraints})}$ $\frac{1}{360}$ $\frac{1}{350}$ $\frac{1}{1971}$ $\frac{1}{40}$ (constraints) $\frac{1}{300}$ $\frac{1}{352}$ $\frac{1}{971}$ $p_{\pm} \frac{1}{4} \frac{1}{4} \frac{1}{400} \frac{1}{100}$ $\frac{1}{40}$ (constraints) 0 3.92 0 $p_{\pm} \frac{1}{4} \frac{1}{400} \frac{1}{100}$ $p_{\pm} \frac{1}{4} \frac{1}{400} \frac{1}{100}$ $\frac{1}{40}$ (constraints) 0 3.92 0 $p_{\pm} \frac{1}{400} \frac{1}{100} \frac{1}{100}$ $p_{\pm} \frac{1}{400} \frac{1}{100} \frac{1}{$		-300.015	(lb-ft)	Mo, external load	
$ \begin{array}{c} \text{component} & \text{weight } (fb) & \text{and } (f) & \text{moment} (ft) \\ \text{all concrete} & 400 & 1.96 & 999 \\ \text{all concrete} & 400 & 1.96 & 999 \\ \text{all concrete} & 0 & 3.92 & 0 \\ \text{all concrete} & 1.90 & 0.332 & 114 \\ \text{Pappind} & 100 & 0.33 & 114 \\ \text{Pappind} & 1.35 & (fb) & \text{passive pressure sufficience} \\ \text{TS55 (b) & total satisficience} \\ \text{SOUL BEARING} & 1.36 & (ff) & \text{distance to resultant} \\ \text{mids} & 2.27 & OK & (fP+F)(PhV) \\ \text{SOL BEARING} & 1.316 & 0.60 & For (g, Per) \\ \text{SOUL BEARING} & 1.316 & 0.55 & (ff) \\ \text{H} 1 + 12 \\ \text{SS9} & (fbe) & Ph (em ordy) \\$		1,430	(lb-ft)	total overturning Moment	$C_{ah}w(h+h')$
$ \begin{array}{c} \text{component} & \text{weight } (fb) & \text{and } (f) & \text{moment} (ft) \\ \text{all concrete} & 400 & 1.96 & 999 \\ \text{all concrete} & 400 & 1.96 & 999 \\ \text{all concrete} & 0 & 3.92 & 0 \\ \text{all concrete} & 1.90 & 0.332 & 114 \\ \text{Pappind} & 100 & 0.33 & 114 \\ \text{Pappind} & 1.35 & (fb) & \text{passive pressure sufficience} \\ \text{TS55 (b) & total satisficience} \\ \text{SOUL BEARING} & 1.36 & (ff) & \text{distance to resultant} \\ \text{mids} & 2.27 & OK & (fP+F)(PhV) \\ \text{SOL BEARING} & 1.316 & 0.60 & For (g, Per) \\ \text{SOUL BEARING} & 1.316 & 0.55 & (ff) \\ \text{H} 1 + 12 \\ \text{SS9} & (fbe) & Ph (em ordy) \\$					$h = h^2 + 3hh'$
at (concrete) 550 3.58 1971 (concrete) 400 1.96 959 at (concrete) 400 1.96 959 at (concrete) 0 3.32 0 at (concrete) 0 3.30 0 at (concrete) 0 3.3	component			moment (#-ft)	
$ \frac{1}{4} \frac{1}{60 \text{ constant}} = \frac{1}{900} + \frac{1}{90$					$P = \frac{1}{2} C_{a,h} wh^2$ $P = \frac{1}{2} C_{a,h} wh (h+2h')$
per generation 0 0 3.92 0 0 the constraints of the set of the	w2 (concrete)	490	1.96	959	2 407 -
					R' IR
Pappind 100 0.33 33 intert.force 1.210 moment 3.077 intert all cling resistance 150 (b) solificion force 055 (b) solificion force 055 (c) total siding resistance STABILITY FACTOR OF SAFETY CHECKS 57ABILITY FACTOR OF SAFETY CHECKS 1.5 $F.S. stating 2.15 O.K M' Mo1.5 F.S. stating 1.31 1.36 (f) distance to resultantmiddle the of fooling1.31 1.55 (f) the of station (above base)599 (b) P \ (pnm ore)1.93 (k) P \ (pnm ore)1.93 (k) P \ (pnm ore)1.93 10^{\circ} thick1.93 (k) P \ (pnm ore)1.93 10^{\circ} thick1.93 10^{\circ} thick1.93 10^{\circ} thick1.93 10^{\circ} thick1.93 10^{\circ} thick1.93 10^{\circ} thick1.94 10^{\circ} the of station (above base)599 (b) P \ (pnm ore)1.93 10^{\circ} thick1.94 10^{\circ} the of station (above base)599 (b) P \ (pnm ore)1.93 10^{\circ} the of station (above base)599 (b) P \ (pnm ore)1.94 10^{\circ} the of station (above base)599 (b) P \ (pnm ore)1.94 10^{\circ} the of station (above base)599 (b) P \ (pnm ore)1.94 10^{\circ} the of station (above base)599 (b) P \ (pnm ore)1.94 10^{\circ} the of station (above base)1.95 10^{\circ} thick0.00 (k) P \ Vu \in HelFACTORED (1.7) FOOTING LOADS10^{\circ} (k) P \ Vu \in Hel1000 10^{\circ} thick0.000 (k) V \ Vu \in Hel1000 10^{\circ} thick0.000 (k) V \ Vu \in Hel1297.4346$ $#$ in Te $@$ 2.1666666667 ft from Wall					
					$q_1=(4\ell-6a)\frac{n_y}{\ell^2}$
					q_1 $q_2 = (6a - 2l) \frac{R_v}{l^2}$
		-,		-,	t when $a = \frac{l}{2}$, $q_1 = q_2 = \frac{R_2}{l}$
605 (ib) bot stal sking resistance STABILITY FACTOR OF SAFETY CHECKS 500 501 1.5 F.S. overturning 2.15 OK 301 2.27 005 (if) 1.31 0.2.67 0.2 (pr) 31 0.2.67 1.31 0.2.67 1.32 (pr) 1.33 (f) 1.37 (kip-fi) Mu @ Toe (bot Rein) 0.00 (kip) 1.37 (kip) 1.37 (kip) 1.37 (kip) 0.000 (kip) 0.000 (kip) 0.0001 (kip)					
To total sliding resistance STABILITY FACTOR OF SAFETY CHECKS STABILITY FACTOR OF SAFETY CHECKS $5.5 \ 1.5 \ .5 \ .5 \ .5 \ .5 \ .5 \ .5 $					R 7R
STABILITY FACTOR OF SAFETY CHECKS STABILITY FACTOR OF SAFETY CHECKS 1.5 FS vorturing 2.15 OK Mr / Mo a 1.31' to 2.61' a 1.31' to 2.61' bearing pressure @ heal 559 (bs) Ph (arm only) a.22 (kpf) Mu (a To (alcone base) 559 (bs) Ph (arm only) a.22 (kpf) Mu (a To (alcone base) 559 (bs) Ph (arm only) a.22 (kpf) Mu (a To (alcone base) 559 (bs) Ph (arm only) a.22 (kpf) Mu (a To (alcone base) 559 (bs) Ph (arm only) a.22 (kpf) Mu (a To (alcone base) 559 (bs) Ph (arm only) a.22 (kpf) Mu (a To (alcone base) 559 (bs) Ph (arm only) a.22 (kpf) Mu (a To (alcone base) 559 (bs) Ph (arm only) a.22 (kpf) Mu (a To (alcone base) 559 (bs) Ph (arm only) a.22 (kpf) Mu (a To (alcone base) 559 (bs) Ph (arm only) a.22 (kpf) Mu (a To (alcone base) 559 (bs) Ph (arm only) a.23 (kpf) Vu (a To (alcone base) 559 (bs) Ph (arm only) a.24 (kpf) Mu (a To (alcone base) 559 (bs) Ph (arm only) a.25 (kpf) Mu (a To (alcone base) 559 (bs) Ph (arm only) a.24 (kpf) Mu (a To (alcone base) 559 (bs) Ph (arm only) a.25 (kpf) Mu (a To (alcone base) 559 (bs) Ph (arm only) a.24 (kpf) Mu (a To (alcone base) 559 (bs) Ph (arm only) a.25 (kpf) Mu (a To (alcone base) 559 (bs) Ph (arm only) a.25 (kpf) Mu (a To (alcone base) 559 (bs) Ph (arm only) a.25 (kpf) Mu (a To (b) Real a.20 (20 (kpf) Mu (alcone base) b a.20 (kpf) Vu (a To (alcone base) b a.20 (kpf) Vu (alcone bas		755	(lb)	total sliding resistance	U3 14 2R,
STABLITY FACTOR OF SAFETY CHECKS					
	STABILITY FA	CTOR OF SAF	ЕТҮ СНЕСК	s	1 Line
Diverturning 2.15 OK Mr / Mo stading 2.27 OK (PP+F)((Ph+V) SOIL BEARING a 1.38 (ft) distance to resultant middle third of footing bearing pressure () bearing pre					
Solution 2.13 OK Mr. Mo station 2.27 OK (PP+F)((Ph+V) SOIL BEARING a 1.36 (ft) distance to resultant middle third of fooling to bearing pressure @ the learning pressure @ th					0 0.391686668778333333 1.175 1.566666668795833333 2.35 2.7416666687133333333 3.525 3.91666666
Soli BEARING a 1.31' to 2.61' distance to resultant middle thid of fooling g2 26 (psf) bearing pressure @ to be bearing pressure @ to be bearing pressure @ to be bearing pressure @ to bearing fACTORED (1.7) STEM LOAD FORCES 5.5 (ft) H1 + H2 1.93 (ft) ine of action (above base) 599 (lbs) P (arm only) 6.2 (kip-ft) Mu @ Toe (Bot Reinf) 0.0 (kip-ft) Mu @ Toe (Bot Reinf) 0.0 (kip) Vu @ Toe 0.00 (kip) Vu @ Toe 0.00 (kip) Vu @ Toe 8 Ecoting $\sqrt[6]{VC}$ 7.969 10" thick $\frac{Vall}{VVC}$ 5,692 8" thick As 0.0003 k-ft ØMn 6.30 k-ft ØMn 1 5.744 0.0021277 Reinf. Ratio LRFD soil 207.97872 psf @ Wall interface 1006.4 'psf @ Toe 1297.4346 # in Toe @ 2.166666667 ft from Wall					
SOIL BEARING a 1.36 (f) distance to resultant middle thid of hoding 0.2 (psf) bearing pressure @ too fq2 26 (psf) bearing pressure @ too fq3 (f) line of action (above base) fully fq3 (f) Mu (arm moment) fully FACTORED (1.7) FOOTING LOADS 3.9 (kip-ft) Mu @ too (Bot Reinf) 0.00 (kip) Vu @ too foo 0.22 #4 @ 10" 0.000 kip) Vu @ theel 5.692 8" thick fd4 0.00021277 Reinf. Ratio 0.0004 6.48 k-ft <t< td=""><td>siidirig</td><td>2.21</td><td>UK</td><td>(PP+F)/(PII+V)</td><td>-100</td></t<>	siidirig	2.21	UK	(PP+F)/(PII+V)	-100
a 1.3° to 2.6° (ft) distance to resultant middle third of fooling q1 592 (psf) bearing pressure @ toe bearing pressure @ toe bearing pressure @ toe 5.5 (ft) H1 + H2 (1.93 (ft) line of action (above base) 599 (bbs) P (arm only) 0.0 (kip-ft) Mu (arm moment) 599 (bbs) Ph (arm only) 0.0 (kip-ft) Mu (arm moment) 599 (bbs) Ph (arm only) 0.0 (kip-ft) Mu @ Toe (Bot Reinf) 0.0 (kip-ft) Mu @ Toe (Bot Reinf) 0.0 (kip) Vu @ Heel 500 (SOIL BEARING	6			
q1 592 (psf) bearing pressure @ toe q2 26 (psf) bearing pressure @ theel FACTORED (1.7) STEM LOAD FORCES 5.5 (ft) line of action (above base) 5.99 (lbs) P (arm only) 0.02 599 (lbs) P (arm only) 0.02 0.02 (kip-ft) Mu @rm moment) FACTORED (1.7) FOOTING LOADS 3.9 (kip-ft) 3.9 (kip-ft) Mu @rm (Bot Reinf) 0.00 (kip) Vu @ Toe 0.00 (kip) Vu @ Heel Footing Wall ØMn 6.30 k-ft ØMn 1 5-#4 0.00021277 0.0021277 Reinf. Ratio LRFD soil 207.97872 psf @ Wall interface 1006.4 'psf @ Toe 1297.4366 # in Toe @ 1297.4366 # in Toe @ 207.97872 2.166666667 ft from Wall	а		(ft)	distance to resultant	200 1
q2 26 (psf) bearing pressure @ heal FACTORED (1.7) STEM LOAD FORCES 5.5 (ft) H1 + H2 1.39 (ft) line of action (above base) 599 599 (bs) P (arm only) 6.2 6.2 (kip-ft) Mu @ moment) 6.2 FACTORED (1.7) FOOTING LOADS 3.9 (kip-ft) Mu @ Toe (Bot Reinf) 0.0 (kip-ft) Mu @ Toe (Bot Reinf) 0.0 (kip) 0.00 (kip) Vu @ Heal ØVc 5.692 8" thick As 0.22 #4 @ 12" As 0.24 #4 @ 10" a 0.0003 a 0.0004 6.48 k-ft 1 5-#4 0.0021277 Reinf. Ratio 6.48 k-ft LRFD soil 207.97872 psf @ Wall interface 2.166666667 ft from Wall 1297.4346 # in Toe @ 2.166666667 ft from Wall					-300
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5.5 (ft) H1 + H2 1.93 (ft) line of action (above base) 599 (lbs) P (arm only) 599 (bs) Ph (arm only) 6.2 (kip-ft) Mu (arm moment) FACTORED (1.7) FOOTING LOADS 3.9 (kip-ft) Mu @ Toe (Bot Reinf) 0.0 (kip-ft) Mu @ Toe (Bot Reinf) 0.00 (kip) Yu @ Toe 0.00 (kip) Yu @ Toe ØVc 7,969 10" thick ØVc As 0.2 #4 @ 12" a 0.0003 a 0.0004 ØMn 6.30 k-ft ØMn 1 5-#4 0.0021277 Reinf. Ratio LRFD soil 207.97872 psf @ Wall interface 1006.4 'psf @ Toe 1297.4346 # in Toe @ 2.166666667 ft from Wall	FACTORED (1.	7) STEM LOAD	FORCES		
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FACTORED (1.7) FOOTING LOADS 3.9 (kip-ft) Mu @ Toe (Bot Reinf) 0.0 (kip-ft) Mu @ Heel (Top Reinf) 1.97 (kip) Vu @ Toe 0.00 (kip) Vu @ Toe ØVc 7.969 10" thick ØVc 5.692 8" thick As 0.2 #4 @ 12" As 0.24 #4 @ 10" a 0.0003 a 0.0004 0.0004 ØMn 6.30 k-ft ØMn 6.48 k-ft 1 5-#4 0.0021277 Reinf. Ratio LRFD soil 207.97872 psf @ Wall interface 1006.4 'psf @ Toe 1297.4346 # in Toe @ 2.166666667 ft from Wall					
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ØVc 7,969 10" thick ØVc 5,692 8" thick As 0.2 #4 @ 12" As 0.24 #4 @ 10" a 0.0003 a 0.0004 ØMn 6.30 k-ft ØMn 6.48 k-ft 0.0021277 Reinf. Ratio K-ft ØMn 6.48 k-ft LRFD soil 207.97872 psf @ Wall interface 1006.4 'psf @ Toe 2.1666666667 ft from Wall	Footing			Mol	
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1 5-#4 0.0021277 Reinf. Ratio LRFD soil 207.97872 psf @ Wall interface 1006.4 'psf @ Toe 1297.4346 # in Toe @ 2.1666666667 ft from Wall				а	0.0004
0.0021277 Reinf. Ratio LRFD soil 207.97872 psf @ Wall interface 1006.4 'psf @ Toe 1297.4346 # in Toe @ 2.1666666667 ft from Wall	As a			ØMn	6.48 k-ft
LRFD soil 207.97872 psf @ Wall interface 1006.4 'psf @ Toe 1297.4346 # in Toe @ 2.1666666667 ft from Wall	As				
1006.4 ['] psf @ Toe 1297.4346 # in Toe @ 2.1666666667 ft from Wall	As a		Reini. Ratio		
1297.4346 # in Toe @ 2.1666666667 ft from Wall	As a	0.0021211			
	As a	207.97872 p		terface	
	As a øMn	207.97872 p 1006.4 'j	psf @ Toe		

reference: file author:	Nilson & Winter	, Design of Conc	ide of wall does not brace wall a rete Structures, 11th Edition, page	ge 680
		last modified:	4/25/2002	95 000
SOIL DATA	400	(
w phi	130 35	(pcf) (deg)	soil unit weight	Coeff. Friction Unit Weight Int Friction w. Conc Soil
del		(deg)	soil internal angle of friction surface angle incline	Unit Weight Int Friction w. Conc Soil 110-120 33-40 0.5-0.6 Sand or gravel, no fine
dei	0.5	(deg)	coeff. friction w/Concrete	120-130 25-35 0.4-0.5 Sand or gravel, w/ fine
	0.819		cosine(phi)	110-120 23-30 0.3-0.4 Silty sand, high clay
	1.000		cosine(del)	100-120 25-35 0.2-0.4 Medium or stiff clay
Ca	0.271	35.23 psf	coeff. of active pressure	90-110 20-25 0.2-0.3 Soft clay, silt
Ср	2.307	299.91 psf	coeff. of passive pressure	
WALL GEOME	TRV			M
H1	6.3333333	(ft)	soil retained	^{M1} / P1 W4
H2	0.1666667	(ft)	soil depth above toe	V.
H3	0.8333333	(ft)	footing thickness	Ŧ. *
H4	1	(ft)	passive pressure soil depth	
B1	0.6666667	(ft)	wall width	
B2	4.25	(ft)	toe width	W1 W3
B3	0	(ft)	heel width	H1
н	7.3333333	(ft)	total height	1 1
В	4.9166667	(ft)	total base	
	150	(pcf)	concrete unit weight	P
EXTERNAL LO	ADS			TOP OF SOIL
Papplied	150	(lb/ft)		H2 W2 Y
V _{applied}	787.5	(lb/ft)	1.5	
Mapplied	0	(lb-ft / ft)		
Surcharge	52	(psf)		
-	ATIONS			B2 B1 B3
OAD CALCUL lateral	ATIONS soil force and	d overturning	moment	[1,1],[2,1],[1,1],[2,1],[1,1],[2,1],[1,1],[2,1],[1,1],[2,1],[1,1],[2,1],[1,1],[2,1],[1,1],[2,1],[1,1],[2,1],[1,1],[2,1],[1,1],[2,1],[1,1],[2,1],[1,1],[2,1],[1,1],[2,1],[1,1],[2,1
H _{prime}	0.40	(ft)	converted surcharge	
Y	2.56	(ft)	distance to soil load resultant	
Р	1051	(lbs)	soil load resultant	
	2690	(lb-ft)	Mo, soil + surcharge	
	-787.5394	(lb-ft)	Mo, external load	
	1,900	(lb-ft)	total overturning Moment	$C_{a,h}w(h+h')$
	wall resto	oring forces		$y = \frac{\hbar}{3} \qquad \qquad y = \frac{\hbar^2 + 3\hbar h'}{3(\hbar + 2\hbar')}$
component	weight (#)	arm (ft)	moment (#-ft)	
1 (concrete)	650	4.58	2979	$P = \frac{1}{2} C_{ah} wh^2 \qquad P = \frac{1}{2} C_{ah} wh (h+2h')$
v2 (concrete)	615	2.46	1511	
/3 (heel soil) /4 (surcharge)	0	4.92 4.92	0	R_{v_1} /R
v5 (toe soil)	92	2.13	196	
P applied	150	0.33	50	-a
ert. force	1,507	momer	t 4,736	$\begin{array}{c} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 &$
	lateral slidi	ng resistance		(a) Resultant in middle third
	150	(lb)	passive pressure sliding resist	tance
	754	(lb)	soil friction force	
	904	(lb)	total sliding resistance	$q = \frac{2R_{y}}{3q}$
STABILITY FA	CTOR OF SAF 1.5	-ETY CHECK	S F.S. overturning	(c) Resultant outside middle third
	1.5		F.S. overturning F.S. sliding	
	1.5			0 0.491666660798333333 1.475 1.9666666027458333333 2.95 3.441666660793333333 4.425 4.916666
verturning	2.49	ок	Mr / Mo	0 0.4910000029333333 1.475 1.90000000243533333 2.95 3.4410000023333333 4.425 4.910000
		OK OK	Mr / Mo (PP+F)/(Ph+V)	0 0.470000000000000000000000000000000000
liding	2.49 3.43			0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 -
SOIL BEARING	2.49 3.43	ок	(PP+F)/(Ph+V)	-100 -
liding	2.49 3.43 1.88			
diding SOIL BEARING a q1	2.49 3.43	ок	(PP+F)/(Ph+V) distance to resultant	.100 -
SOIL BEARING	2.49 3.43 1.88 1.64' to 3.28'	OK (ft)	(PP+F)/(Ph+V) distance to resultant middle third of footing	0 -100 - -200 -
diding SOIL BEARING a q1 q2	2.49 3.43 6 1.88 1.64' to 3.28' 523 90	OK (ft) (psf) (psf)	(PP+F)/(Ph+V) distance to resultant middle third of footing bearing pressure @ toe	0 -100 -200 -
diding SOIL BEARING a q1 q2	2.49 3.43 1.88 1.64' to 3.28' 523 90 7) STEM LOA	OK (ft) (psf) (psf) AD FORCES	(PP+F)/(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ heel	0 -100 - -000 - -000 - BEARING PRESSURE (psf)
diding SOIL BEARING a q1 q2	2.49 3.43 3 1.64' to 3.28' 523 90 7) STEM LOA 6.5	OK (ft) (psf) (psf) AD FORCES (ft)	(PP+F)/(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ heel H1 + H2	0 -100 -200 -
diding SOIL BEARING a q1 q2	2.49 3.43 1.88 1.64' to 3.28' 523 90 7) STEM LOA	OK (ft) (psf) (psf) AD FORCES	(PP+F)/(Ph+V) distance to resultant middle third of footing bearing pressure @ heel earing pressure @ heel H1 + H2 line of action (above base)	0 -100 -00
diding SOIL BEARING a q1 q2	2.49 3.43 1.88 1.64' to 3.28' 523 90 7) STEM LOA 6.5 2.29	OK (ft) (psf) (psf) AD FORCES (ft) (ft)	(PP+F)/(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ heel H1 + H2	0 -100 - -000 - -000 - BEARING PRESSURE (psf)
diding SOIL BEARING a q1 q2	2.49 3.43 1.88 1.64' to 3.28' 523 90 .7) STEM LOA 6.5 2.29 836	OK (ft) (psf) (psf) AD FORCES (ft) (ft) (lbs)	(PP+F)/(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ heel H1 + H2 line of action (above base) P (arm only)	0 -100 -00
soil BEARING a q1 q2 FACTORED (1.	2.49 3.43 1.88 1.64' to 3.28' 523 90 7) STEM LOA 6.5 2.29 836 836 836	OK (ft) (psf) (psf) AD FORCES (ft) (ft) (lbs) (lbs) (kip-ft)	(PP+F)/(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ heel H1 + H2 line of action (above base) P (arm only) P (arm only)	0 -100 -00
soil BEARING a q1 q2 FACTORED (1.	2.49 3.43 1.64' to 3.28' 523 90 7) STEM LOA 6.5 2.29 836 836 12.0 7) FOOTING	OK (ft) (psf) (psf) AD FORCES (ft) (ft) (lbs) (lbs) (kip-ft) LOADS	(PP+F)/(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ heel H1 + H2 line of action (above base) P (arm only) Ph (arm only) Mu (arm moment)	0 -100 -200 -
ilding SOIL BEARING a q1 q2 FACTORED (1.	2.49 3.43 1.88 1.64' to 3.28' 523 90 7) STEM LOA 6.5 2.29 836 836 836	OK (ft) (psf) (psf) D FORCES (ft) (ft) (lbs) (kip-ft) LOADS (kip-ft)	(PP+F)/(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ heel H1 + H2 line of action (above base) P (arm only) Ph (arm only) Mu (arm moment) Mu @ Toe (Bot Reinf)	0 -100 -00
ilding SOIL BEARING a q1 q2 FACTORED (1.	2.49 3.43 1.88 1.64' to 3.28' 523 90 .7) STEM LOA 6.5 2.29 836 836 12.0 .7) FOOTING 6.1	OK (ft) (psf) (psf) AD FORCES (ft) (lbs) (kip-ft) LOADS (kip-ft)	(PP+F)/(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ heel H1 + H2 line of action (above base) P (arm only) Ph (arm only) Mu (arm moment)	0 -100 -00
ilding SOIL BEARING a q1 q2 FACTORED (1.	2.49 3.43 1.64' to 3.28' 523 90 7) STEM LOA 6.5 2.29 836 836 12.0 7) FOOTING 1 6.1 0.0	OK (ft) (psf) (psf) AD FORCES (ft) (lbs) (kip-ft) (kip-ft) (kip-ft)	(PP+F)/(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toel H1 + H2 line of action (above base) P (arm only) Ph (arm only) Mu (arm moment) Mu @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf)	0 -100 -200 -
ilding SOIL BEARING a q1 q2 FACTORED (1.	2.49 3.43 1.64' to 3.28' 523 90 7) STEM LOA 6.5 2.29 836 836 12.0 7) FOOTING 6.1 0.0 2.43	OK (ft) (psf) (psf) AD FORCES (ft) (ft) (lbs) (kip-ft) (kip-ft) (kip-ft) (kip)	(PP+F)((Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ heel hearing pressure @ hearing hearing hearing hearing pressure @ hearing hea	0 -100 -200 -
SOIL BEARING a q1 q2 FACTORED (1.	2.49 3.43 1.64' to 3.28' 523 90 7) STEM LOA 6.5 2.29 836 836 12.0 7) FOOTING 6.1 0.0 2.43	OK (ft) (psf) (psf) AD FORCES (ft) (ft) (lbs) (kip-ft) (kip-ft) (kip-ft) (kip)	(PP+F)((Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ heel hearing pressure @ hearing hearing hearing hearing pressure @ hearing hea	0 -100 -200 -
alding SOIL BEARING a q1 q2 FACTORED (1. FACTORED (1. FACTORED (1.	2.49 3.43 1.64' to 3.28' 523 90 7) STEM LOA 6.5 2.29 836 836 12.0 7) FOOTING 6.1 0.0 2.43 0.00 7,969	OK (ft) (psf) (psf) (ft) (lbs) (kip-ft) (kip-ft) (kip) (kip) (kip) (kip)	(PP+F)((Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe bearing pressure @ toe toe H1 + H2 line of action (above base) P (arm only) Ph (arm only) Mu @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf) Yu @ Toe Yu @ Toe Yu @ Toe Yu @ Toe	5,692 8" thick
And the second s	2.49 3.43 1.64' to 3.28' 523 90 7) STEM LOA 6.5 2.29 836 12.0 7) FOOTING 1 6.1 0.0 2.43 0.00 7,969 0.2325	OK (ft) (psf) (psf) AD FORCES (ft) (lbs) (lbs) (kip-ft) (kip-ft) (kip) (kip)	(PP+F)((Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ tee bearing pressure @ tee bearing pressure @ tee the of action (above base) P (arm only) Ph (arm only) Ph (arm moment) Mu @ Toe (Bot Reinf) Mu @ Tee	5,692 8" thick 0.372 #5 @ 10"
q1 q2 FACTORED (1. FACTORED (1. FACTORED (1. Footing JVc As a	2.49 3.43 1.88 1.64' to 3.28' 523 90 7) STEM LOA 6.5 2.29 836 836 12.0 7) FOOTING 6.1 0.0 2.43 0.00 2.43 0.00	OK (ft) (psf) (psf) AD FORCES (ft) (lbs) (lbs) (kip-ft) (kip-ft) (kip-ft) (kip) (kip) 10" thick #5 @ 16"	(PP+F)((Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe time of action (above base) P(arm only) Ph (arm only) Ph (arm only) Mu @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf) Vu @ Toe Vu @ Heel Wall ØVc As a	5,692 8" thick 0.372 #5 @ 10" 0.0005
And the second s	2.49 3.43 1.64' to 3.28' 523 90 .7) STEM LOA 6.5 2.29 836 12.0 .7) FOOTING 6.1 0.0 .2.43 0.00 .2.43 0.00 .2.325 0.0003 .7.32	OK (ft) (psf) (psf) (ft) (lbs) (lbs) (kip-ft) (kip-ft) (kip) (kip) (kip) (kip) (kip) (kip) (kip) (kip) (kip) (kip) (kip) (kip) (kip) (kip) (kip)	(PP+F)((Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ tee bearing pressure @ tee bearing pressure @ tee the of action (above base) P (arm only) Ph (arm only) Ph (arm moment) Mu @ Toe (Bot Reinf) Mu @ Tee	5,692 8" thick 0.372 #5 @ 10"
Iding SOIL BEARING a q1 q2 FACTORED (1. FACTORED (1. FOOTING JVC As	2.49 3.43 1.64' to 3.28' 523 90 7) STEM LOA 6.5 2.29 836 836 12.0 7) FOOTING 1 6.1 0.0 2.43 0.00 2.43 0.000 7,969 0.2325 0.0003 7.32 1.55	OK (ft) (psf) (psf) AD FORCES (ft) (ft) (lbs) (kip-ft) (kip-ft) (kip-ft) (kip)	(PP+F)((Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe time of action (above base) P(arm only) Ph (arm only) Ph (arm only) Mu @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf) Vu @ Toe Vu @ Heel Wall ØVc As a	5,692 8" thick 0.372 #5 @ 10" 0.0005
Iding SOIL BEARING a q1 q2 FACTORED (1. FACTORED (1. FOOTING JVC As	2.49 3.43 1.64' to 3.28' 523 90 7) STEM LOA 6.5 2.29 836 836 12.0 7) FOOTING 1 6.1 0.0 2.43 0.00 2.43 0.000 7,969 0.2325 0.0003 7.32 1.55	OK (ft) (psf) (psf) (ft) (lbs) (lbs) (kip-ft) (kip-ft) (kip) (kip) (kip) (kip) (kip) (kip) (kip) (kip) (kip) (kip) (kip) (kip) (kip) (kip) (kip)	(PP+F)((Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe time of action (above base) P(arm only) Ph (arm only) Ph (arm only) Mu @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf) Vu @ Toe Vu @ Heel Wall ØVc As a	5,692 8" thick 0.372 #5 @ 10" 0.0005
As a second seco	2.49 3.43 1.64' to 3.28' 523 90 7) STEM LOA 6.5 2.29 836 836 12.0 7) FOOTING 1 6.1 0.0 2.43 0.00 2.43 0.000 7,969 0.2325 0.0003 7.32 1.55	OK (ft) (psf) (psf) AD FORCES (ft) (ft) (lbs) (kip-ft) (kip-ft) (kip-ft) (kip)	(PP+F)((Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe time of action (above base) P(arm only) Ph (arm only) Ph (arm only) Mu @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf) Vu @ Toe Vu @ Heel Wall ØVc As a	5,692 8" thick 0.372 #5 @ 10" 0.0005
Iding SOIL BEARING a q1 q2 FACTORED (1. FACTORED (1. FOOTING JVC As	2.49 3.43 1.64' to 3.28' 523 90 .7) STEM LOA 6.5 2.29 836 836 12.0 .7) FOOTING 6.1 0.00 2.43 0.00 7,969 0.2325 0.0003 7.32 1.55 0.0026271	OK (ft) (psf) (psf) AD FORCES (ft) (ft) (lbs) (kip-ft) (kip-ft) (kip-ft) (kip)	(PP+F)((Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe toe toe toe toe toe toe toe	5,692 8" thick 0.372 #5 @ 10" 0.0005
Inding SOIL BEARING a q1 q2 FACTORED (1. FACTORED (1. FOOTING JVC S SMn	2.49 3.43 1.64' to 3.28' 523 90 .7) STEM LOA 6.5 2.29 836 836 12.0 .7) FOOTING 6.1 0.0 2.43 0.00 2.43 0.000 7.969 0.2325 0.00026271 252.81017	OK (ft) (psf) (psf) AD FORCES (ft) (lbs) (lbs) (kip-ft) (kip-ft) (kip-ft) (kip	(PP+F)((Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe toe toe toe toe toe toe toe	5,692 8" thick 0.372 #5 @ 10" 0.0005
Inding SOIL BEARING a q1 q2 FACTORED (1. FACTORED (1. FOOTING JVC S SMn	2.49 3.43 1.64' to 3.28' 523 90 7) STEM LOA 6.5 2.29 836 836 12.0 7) FOOTING 6.1 0.0 2.43 0.00 7,969 0.2325 0.00026271 252.81017 889.1	ОК (ft) (psf) (psf) AD FORCES (ft) (ft) (lbs) (kip-ft) (kip-ft) (kip-ft) (kip-ft) (kip) ((PP+F)((Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe toe toe toe toe toe toe toe	5,692 8" thick 0.372 #5 @ 10" 0.0005 10.04 k-ft

imitations:		efficients for non		t at top of wall does not contribute to restoring moment (overturning only), no deflection
			ide of wall does not brace wall a	
eference: ile author:		Design of Conci ast modified:	rete Structures, 11th Edition, pa 4/25/2002	ge 680
	0.11661	ast mouneu.	4/23/2002	
SOIL DATA				
w phi	130 35	(pcf)	soil unit weight	Coeff. Friction Unit Weight Int Friction w. Conc Soil
del	35	(deg) (deg)	soil internal angle of friction surface angle incline	Unit Weight Int Friction w. Conc Soil 110-120 33-40 0.5-0.6 Sand or gravel, no fines
der	0.5	(deg)	coeff. friction w/Concrete	120-130 25-35 0.4-0.5 Sand or gravel, w/ fines
	0.819		cosine(phi)	110-120 23-30 0.3-0.4 Silty sand, high clay
	1.000		cosine(del)	100-120 25-35 0.2-0.4 Medium or stiff clay
Ca	0.271	35.23 psf	coeff. of active pressure	90-110 20-25 0.2-0.3 Soft clay, silt
Ср	2.307	299.91 psf	coeff. of passive pressure	
WALL GEOM	ETRY			M1 P1 W4
H1	7.3333333	(ft)	soil retained	
H2 H3	0.1666667	(ft)	soil depth above toe	\mathbf{V}_1 + + + + + + + + + + + + + + + + + + +
H4	0.8333333	(ft) (ft)	footing thickness passive pressure soil depth	
B1	0.6666667	(ft)	wall width	
B2	5.5	(ft)	toe width	W1 W3
B3	0	(ft)	heel width	H1
Н	8.3333333	(ft)	total height	7 7
В	6.1666667 150	(ft) (pcf)	total base	
	150	(pci)	concrete unit weight	- P
EXTERNAL L	OADS			TOP OF SOIL T
Papplied	150	(lb/ft)		H2 W2 Y
V _{applied}	787.5	(lb/ft)	1.5	
M _{applied}	0	(lb-ft / ft)		H4 H3
Surcharge	60	(psf)		
LOAD CALCU	LATIONS			
	I soil force and	l overturnina	moment	5
H _{prime}	0.46	(ft)	converted surcharge	
Y	2.92	(ft)	distance to soil load resultant	
Р	1358	(lbs)	soil load resultant	
	3970	(lb-ft)	Mo, soil + surcharge	
	-787.5394 3,180	(lb-ft) (lb-ft)	Mo, external load total overturning Moment	
	5,100	(10-11)	total overtaining woment	$C_{a,h,w,h}$ $C_{a,h,w,h,h'}$
		ring forces		$y = \frac{h}{3}$ $y = \frac{h^2 + 3hh'}{3(h+2h')}$
component	weight (#)	arm (ft)	moment (#-ft)	
w1 (concrete) w2 (concrete)	750 771	5.83 3.08	4375 2377	$P = \frac{1}{2} C_{ab} wh^2 \qquad P = \frac{1}{2} C_{ab} wh (h+2h')$
w2 (concrete) w3 (heel soil)	0	6.17	0	
w4 (surcharge)	0	6.17	0	R _v R
w5 (toe soil)	119	2.75	328	(-4) + (-6a)
P applied	150	0.33	50 t 7,129	$q_2 = (6a-2i) \frac{R_e}{2}$
vert. force	1,790	momen	n 1,129	$\begin{array}{c} -r/2 + \sqrt{2} + $
	lateral slidir	ng resistance		(a) Resultant in middle third
	150	(lb)	passive pressure sliding resist	ance
	895 1045	(lb) (lb)	soil friction force total sliding resistance	
	1045	(10)	total siluing resistance	$q = \frac{2R_{p}}{3\sigma}$
				°
STABILITY FA	ACTOR OF SAF	ETY CHECK		(c) Resultant outside middle third
	1.5 1.5		F.S. overturning	
overturning	2.24	ок	F.S. sliding Mr / Mo	0 0.61666666723333333 1.85 2.466666662708333333 3.7 4.316666666793333333 5.55 6.16666666
sliding	1.83	ок	(PP+F)/(Ph+V)	
	~			-100 -
SOIL BEARIN		(4)	Patron de la Patro	
а	2.21 2.06' to 4.11'	(ft)	distance to resultant middle third of footing	-200 -
q1	2.00 10 4.11	(psf)	bearing pressure @ toe	-300
q2	44	(psf)	bearing pressure @ heel	
	7) OTEN - 0			400 BEARING PRESSURE
FACTORED (1.7) STEM LOA 7.5	D FORCES (ft)	H1 + H2	(psf)
	2.64	(ft)	H1 + H2 line of action (above base)	-500
	1112	(lbs)	P (arm only)	-600
	1112	(lbs)	Ph (arm only)	
	15.0	(kip-ft)	Mu (arm moment)	
FACTORED (1.7) FOOTING L	OADS		
	10.0	(kip-ft)	Mu @ Toe (Bot Reinf)	
	0.0	(kip-ft)	Mu @ Heel (Top Reinf)	
	2.97	(kip)	Vu @ Toe	
	0.00	(kip)	Vu @ Heel	
Footing			Wall	
ØVc	7,969	10" thick	ØVc	5,692 8" thick
As	0.372	#5 @ 10"	As	0.465 #5 @ 8"
a ØMn	0.0005	k-ft	a ØMn	0.0007 12.55 k-ft
<i></i>	1.55	5-#5	pivin	12.00 K K
		Reinf. Ratio		
LRFD soil	165.40541	psf @ Wall in	terface	
		psf @ Toe		
	0055 010		0.0000000000000000	
	2055.6101	# in Toe @	3.666666667 ft from) Wall
		# in Toe @	2.75 ft from	

0.5 condition condit condit condition c	reference: file author:		Design of Conc ast modified:	rete Structures, 11th Edition, pa 4/25/2002	ge 680
$ \frac{1}{2} 1$					
edi 0 0 offeet of					
0.5 /0 condition					· · · · · · · · · · · · · · · · · · ·
0.010 CP 0.257 0.257 0.55 pt arr consequence consequ	del		(deg)		· · · · · · · · · · · · · · · · · · ·
1.000 C G 0.237 35.3 μr conf dispersive 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) VAL 0.000 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) VAL 0.000 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) VAL 0.000 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) 0.001 (appersive) <td< td=""><td></td><td></td><td></td><td></td><td></td></td<>					
$ \begin{array}{c c c c c c } \hline C & C & C & C & C & C & C & C & C & C$					
$ \begin{array}{c c c c c c } \hline 2.37 & 28 & 51 & 20 & cl. of protocols and the protocols and th$					
VALUACIONETRY111					90-110 20-25 0.2-0.3 Soft clay, silt
$ \begin{array}{c c c c c c } \hline \mathbf{H} & $	Ср	2.307	299.91 psf	coeff. of passive pressure	
$ \begin{array}{c c c c c c } \hline \mathbf{H} & $		TRV			M
$\begin{aligned} \begin{array}{c} \begin{array}{c} 1 \\ 1 \\ 1 \\ 2 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\$			(#)	and anticipal	Pi W4
$ \begin{array}{c c c c c c } \hline H & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 &$					
Here 1000000000000000000000000000000000000					<u> </u>
$ \begin{array}{c c c c c c } \hline \mathbf{Statistical matrix} \\ \hline \mathbf{Statistical matrix} \\$					
$ \begin{array}{c c c c c c } \hline \mathbf{F} & $		-			
$ \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \end{array} \\ \begin{array}{c} \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} $					
$ \begin{array}{c} H \\ H \\ \hline \\$					W1 W3
$ \begin{array}{c c c c c c } \hline \mathbf{FT} & \mathbf{T} & \mathbf$					H1
$ \begin{array}{c c c c } \hline \begin{tabular}{ c c c c c } \hline \begin{tabular}{ c c c c c c } \hline \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$					7 7
EXTERNAL LOAS $\frac{1}{12} \frac{1}{12} \frac{1}$	В				
EXTERNAL LODS $ \frac{Varies}{Varies} \frac{1}{200} \frac{(lo, fr)}{(lo, fr)} \frac{1}{2} $ LOD CLULATION $ \frac{Varies}{Varies} \frac{1}{200} \frac{(lo, fr)}{(lo, fr)} \frac{1}{2} $ LOD CLULATION $ \frac{Varies}{Varies} \frac{1}{200} \frac{1}{(lo, fr)} \frac{1}{(lo, fr)} \frac{1}{2} $ LOD CLULATION $ \frac{Varies}{Varies} \frac{1}{200} \frac{1}{(lo, fr)} \frac{1}{($		150	(pct)	concrete unit weight	P
$ \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c}$					W5
$\frac{V_{maxim}}{Surcharge} = \frac{120}{9} (10^{\text{th}}/1), 2$ $\frac{V_{maxim}}{Surcharge} = \frac{120}{9} (10^{\text{th}}/1), 2$ $\frac{V_{maxim}}{Surcharge} = \frac{120}{9} (10^{\text{th}}/1), 3$ $\frac{V_{maxim}}{Surcharge} = \frac{120}{9} (10^{\text{th}}/1), 3$ $\frac{V_{maxim}}{Surcharge} = \frac{120}{9} (10^{\text{th}}/1), 3$ $\frac{V_{maxim}}{Surcharge} = \frac{120}{10} (10^{\text{th}}/1), 3$ $\frac{V_{maxim}}}{Surcharge} = \frac{120}{10} (10^{\text{th}/1)}, 3$ $\frac{V_{maxim}}}{Surcharge} = \frac{120}{10} (10^{\text{th}/1)}, 3$ $\frac{V_{maxim}}}{Surcharge} = \frac{120}{10} (10^{\text{th}/1)}, 3$ $\frac{V_{maxim}}}{Surcharge} = \frac{120}{10} $	_		(11. 12.)		
$\frac{V_{severel}}{W_{severel}} = \frac{1200}{0} (b^{(1)}{(1/1)} (t)$ $\frac{1}{1} \frac{1}{10} \frac{1}{(1/1)} (t)$ $\frac{1}{10} \frac{1}{10} \frac{1}{(1/1)} (t)$ $\frac{1}{10} \frac{1}{10} \frac{1}{(1/1)} (t)$ $\frac{1}{10} \frac{1}{(1/1)} \frac{1}{(1/1)} \frac{1}{(1/1)} (t)$ $\frac{1}{(1/1)} \frac{1}{(1/1)} \frac{1}{$					H2 W2 Y
$\frac{M_{recluin}}{Surcharge} = \frac{M_{S}}{B} = \frac{(ref,f,f)}{(ref,f)}$ $\frac{LOL LULTIONS}{Interal solitore and verturing moment}$ $\frac{M_{recluin}}{Surcharge} = \frac{M_{S}}{SURCharge} = \frac{M_{S}$				2	
Such arg 6 (ps) LOD CLCULATIONS Lateral Sol force and overturning moment $\frac{1}{1000} \frac{1}{1000} \frac{1}{1000}$	M _{applied}	0	(lb-ft / ft)		H3 H3
$ \begin{array}{c c c c } \hline Letrat solution conductions of the submatrix of the sub$		68	(psf)		
$\frac{1}{12 \text{ determined of the constraints}} = \frac{1}{12 \text{ determined of the constraints}} + \frac{1}{12 determin$	-		,		B2 B1 B3
$\frac{1}{12 \text{ determined of the constraints}} = \frac{1}{12 \text{ determined of the constraints}} + \frac{1}{12 determin$	LOAD CALCUL	ATIONS			
$\frac{H_{grave}}{P} = \frac{0.52}{175} (ft) = 0 \text{ converted startharge} \\ \frac{H_{grave}}{1500} = \frac{0.52}{110} (ft) = 0 \text{ converted startharge} \\ \frac{1000000}{100000} (ft-h) Mo, est eventual load exclused is as board resulted is a startharge is a board resulted is a startharge is a board resulted is a startharge is a board resulted is a board resulted is a startharge is a board resulted is a start a startharge is a board resulted is a start a startharge is a board resulted is a start a startharge is a board resulted is a start a startharge is a board resulted is a start a $			l overturning	moment	5
$\frac{y}{p} = \frac{3.22}{1000} (the H) Model method is for increased in the social part is social par$					A A A A A A A A A A A A A A A A A A A
P $\frac{1705}{550}$ (bFr) Ms. of load reactange $\frac{1600008}{3,980}$ (bFr) Ms. eleven at lad 3,980 (bFr) Ms. eleven at lad 3,980 (bFr) moment (Efr) $\frac{1}{10000000}$ $\frac{1}{10000000}$ $\frac{1}{10000000000000000000000000000000000$	Y				
$ \frac{1}{3,890} (16-4) M_{12} M$					
$\frac{1-1600.08}{3,980} (lb-fl) \text{ total overhalds}^{-}$ $\frac{\text{vall restoring forces}}{\text{component}} \text{ weylf (i)} & \text{arm (fl)} & \text{moment (fel)} \\ \text{component} & \text{weylf (i)} & \text{component} & sectors in the sectors $	-				
$3.980 (b-ft) \text{total overturing Moment}$ $\frac{\text{vall restoring forces}}{\text{composed}} \text{weight } (d) \text{moment} (f+f) \\ \text{at (concrete)} \text{weight } (d) \text{moment} (f+f) \\ \text{at (concrete)} \text{9866} 5.58 5210 \\ \text{at (concrete)} 0 7.17 0 \\ \text{at (concrete)} 0 0.33 560 \\ \text{moment} 19.44 (bb) \text{botal elegenerate satisfies} restance and the set of the se$					
use of the sectoring forcescomponentweight (β)arm (β)sectoring forcescomponentweight (β)arm (β)sectoring forcescomponent β β β β β β d forces β <td></td> <td></td> <td></td> <td></td> <td>(-wh)</td>					(-wh)
$ \begin{array}{c} component & weight (e) & arm (f) & moment (eh) \\ a (concrue) & 866 & 5.88 & 5200 \\ a (concrue) & 866 & 5.88 & 3210 \\ a (concrue) & 866 & 5.88 & 3210 \\ a (concrue) & 806 & 7.17 & 0 \\ a (concrue) & 0 & 0.15 & 7.5 & 0.01 \\ a (concrue) & 0 & 0.00 & K \\ b (concrue) & 1104 & (b) & board pressure ding resistance \\ a & 2.39 & 0.78 & 0.00 & K & M / Mo \\ a & 2.39 & 0.78 & 0.00 & K & M / Mo \\ a & 2.39 & 0.78 & 0.00 & K & M / Mo \\ a & 2.39 & 0.78 & 0.00 & K & M / Mo \\ a & 2.39 & 0.78 & 0.00 & K & M / Mo \\ a & 2.39 & 0.78 & 0.00 & K & M / Mo \\ a & 2.39 & 0.78 & 0.00 & K & M / Mo \\ a & 2.39 & 0.78 & 0.00 & K & M / Mo \\ a & 3.45 & (hp) & M & g tos (bot Rear) \\ a & 3.45 & (hp) & M & g tos (bot Rear) \\ a & 3.45 & (hp) & M & g tos (bot Rear) \\ a & 3.45 & (hp) & M & g tos (bot Rear) \\ a & 3.45 & (hp) & M & g tos (bot Rear) \\ a & 3.45 & (hp) & M & g tos (bot Rear) \\ a & 3.45 & (hp) & M & g tos (bot Rear) \\ a & 3.45 & (hp) & M & g tos (bot Rear) \\ a & 3.45 & (hp) & M & g tos (bot Rear) \\ a & 0.000 & K & H & g Mn \\ \hline B & B & R & 0.0000 \\ B & R & 0.0007 & R & A \\ B & 0.0007 & R & A \\$			()	Ŭ	
$ \begin{array}{c} component & weight (e) & arm (f) & moment (eh) \\ a (concrue) & 866 & 5.88 & 5200 \\ a (concrue) & 866 & 5.88 & 3210 \\ a (concrue) & 866 & 5.88 & 3210 \\ a (concrue) & 866 & 1.58 & 3210 \\ a (concrue) & 0 & 7.17 & 0 \\ a (concrue) & 0 & 0.15 & 7.5 & 0.01 \\ a (concrue) & 0 & 0.00 & K \\ a (concrue) & 2.40 & 0 & K & M / M \\ a (concrue) & 2.36 & 0 & K & (P + F) (P h \vee) \\ soll BEARING & 2.37 & 0 & 7.8 & 0 \\ a (concrue) & 2.38 & 0 & K & (P + F) (P h \vee) \\ a (concrue) & 2.40 & 0 & K & M / M \\ a (concrue) & 2.40 & 0 & $		wall resto	ring forces		$y = \frac{h}{2} \qquad \qquad y = \frac{h^2 + 3nh}{2(1 + 1)h^2}$
$ \frac{1}{42} (concursity) = 896 = 3.58 = 3.210 \\ m (suchtarpa) = 0, 7.17 = 0 \\ m (suchtarpa) = 0, 7.15 = 0, 7.15 \\ m (suchtarpa) = 0, 7.15 = 0, 7.15 \\ m (suchtarpa) = 0, 7.15 = 0, 7.15 \\ m (suchtarpa) = 0, 7.15 = 0, 7.15 \\ m (suchtarpa) = 0, 7.15 = 0, 7.15 \\ m (suchtarpa) = 0, 7.15 = 0, 7.15 \\ m (suchtarpa) = 0, 7.15 = 0, 7.15 \\ m (suchtarpa) = 0, 7.15 = 0, 7.15 \\ m (suchtarpa) = 0, 7.15 = 0, 7.15 \\ m (suchtarpa) = 0, 7.15 = 0, 7.15 \\ m (suchtarpa) = 0, 7.15 = 0, 7.15 \\ m (suchtarpa) = 0, 7.15 = 0, 7.15 \\ m (suchtarpa) = 0, 7.15 = 0, 7.15 \\ m (suchtarpa) = 0, 7.15 = 0, 7.15 \\ m (suchtarpa) = 0, 7.15 = 0, 7.15 \\ m (suchtarpa) = 0, 7.15 = 0, 7.15 \\ m (suchtarpa) = 0, 7.15 \\ m (suchtarpa) = $	component	weight (#)	arm (ft)	moment (#-ft)	
$wd (concarter) & 896 & 3.88 & 3.210 \\ wh (cut chard) & 0 & 7.17 & 0 \\ wh (cut chard) & 0 & 7.17 & 0 \\ wh (cut chard) & 0 & 7.17 & 0 \\ wh (cut chard) & 0 & 7.17 & 0 \\ wh (cut chard) & 141 & 3.25 & 458 \\ perpend & 2.00 & 0.33 & 67 \\ wert, force & 2.087 & moment & 9.543 \\ \hline 1194 & (b) & board pressure status concerts & 1194 & (b) & board pressure status concerts & 1194 & (b) & board pressure status concerts & 1194 & (b) & board pressure (c) board (c) board pressure $	w1 (concrete)	850	6.83	5808	$P = \frac{1}{2}C_{ah}wh^2$ $P = \frac{1}{2}C_{ah}wh(h+2h')$
wi (socration) 0 7.17 0 0 Propriod 2000 0.33 67 Propriod 2000 0.33 67 moment 9.543 Interal eliding resistance 1044 (b) sol fictor force 1044 (b) sol fictor force 1194 (b) total alding resistance STABLITY FACTOR OF SAFETY CHECKS 1.5 F.S. ddfing 2.40 OK M/ M/ Mo adding 2.36 OK (PP+F)(Phv/) SOLI BEARING a 2.39 to 4.78' model pressure @ hol 4.239 to 4.78' model pressure @ hol 4.239 to 4.78' model pressure @ hol 4.239 to 4.78' model pressure @ hol 1.5 f.S. doffing pressure @ hol 1.6 (Mp-H) Mu (attance to resultant model bird of folding 1.2 f.S. (Mp) P (µm orly) 1.228 (b) P (µm orly) 1.228 (b) P (µm orly) 1.228 (b) Vu @ Hel FACTORED (1.7) STEM LOAD FORCES 0.00 (Kip-H) Mu (attance to foreint) 1.428 (b) P (µm orly) 1.428 (b) P (µm orly) 1.428 (b) P (µm orly) 1.428 (b) P (µm orly) 1.428 (b) Vu @ Hel FACTORED (1.7) FOOTING LOADS FACTORED (1.7) FOOT	w2 (concrete)	896	3.58	3210	2
	w3 (heel soil)	0	7.17	0	- 1 /-
P opplæd 200 0.33 0.007 107 107 107 104 109 104 109 104 109 104 109 104 109 104 109 104 109 104 109 104 109 104 109 104 109 104 109 104 109 104 109 104 109 104 109 104 109 105 105 105 105 105 105 105 105	w4 (surcharge)				
(ateral sliding resistance 1044 (b) (b) posice presume sliding resistance 1044 (b) (c) posice presume sliding resistance (c)					$q_1 = (4(-6a)\frac{R_p}{4^2})$
(ateral sliding resistance 1044 (b) (b) posice presume sliding resistance 1044 (b) (c) posice presume sliding resistance (c)	P applied		0.33		
Internal sliding resistance (a) (b) and frection force 1044 (b) total sliding resistance 1044 (b) total sliding resistance STABILITY FACTOR OF SAFETY CHECKS STABILITY FACTOR OF SAFETY CHECKS 0 1.5 F.S. overturning 2.40 OK Mr M Mo adding 2.36 OK (PP+F)((P+V) SOLI BEARING a 2.67 (f) distance to resultant middle third of footing bearing pressure (b) bearing (b) (b) bearin	vert. force	2,087	momer	t 9,543	q1 v2 var u2 c2
$ \begin{array}{c} 150 & 100 \\ 1044 & (b) \\ 1194 & (b) $		1-4			when $a = \frac{1}{2}$, $q_1 = q_2 = \frac{1}{2}$
$ \begin{array}{c} 1044 & (b) \\ 1194 & (b) \\ 1195 & F.S. overturing \\ 2.46 & OK & M' / Mo \\ 3.236 & OK & (PP+F)(P++V) \\ 2.39 & 10^{4}.78 & model that of foreign \\ 3.236 & OK & (PP+F)(P++V) \\ 2.39 & 10^{4}.78 & model that of foreign \\ 3.237 & 10^{4}.78 & model that of foreign \\ 3.237 & 10^{4}.78 & model that of foreign \\ 3.237 & 10^{4}.78 & model that of foreign \\ 3.237 & 10^{4}.78 & model that of foreign \\ 3.237 & 10^{4}.78 & model that of foreign \\ 3.237 & 10^{4}.78 & model that of foreign \\ 3.237 & 10^{4}.78 & model that of foreign \\ 3.237 & 10^{4}.78 & model that of foreign \\ 3.237 & 10^{4}.78 & model that of foreign \\ 3.237 & 10^{4}.78 & model that of foreign \\ 3.45 & (k)p + 11 + H2 \\ 1428 & (b)s & P (arm orb) \\ 1428 & (b)s & P (arm orb) \\ 3.45 & (k)p + 11 & mod (actore tase) \\ 1428 & (b)s & P (arm orb) \\ 3.45 & (k)p + 11 & Mu (arm moment) \\ FACTORED (1.7) FOOTING LOADS \\ 13.56 & 5.45 \\ 0.0018023 & Reinf. Ratio \\ \hline \hline \\ Footing & Min & 0.0007 \\ Min & 1.55 & 5.45 \\ 0.0018023 & Reinf. Ratio \\ \\ LRFD soil & 187.67209 ps @ Wall interface \\ 873.8 1 ps @ Toe \\ 2229.9157 & thin Toe @ 4.33333333 ft from Wall \\ \hline \end{array}$					
1194 (ib) total skiding resistance STABILITY FACTOR OF SAFETY CHECKS STABILITY FACTOR OF SAFETY CHECKS 1.5 F.S. solution 1.5 F.S. solution 1.5 F.S. solution 2.36 OK (PP+F)(Ph+V) SOIL BEARING 2.39 10 K. (P) 1.2 69 (pSf) bearing pressure @ toe 2.39 10 K. (H) H1 + H2 2.99 (ff) H1 + H2 3.66 (Kip-ff) Mu @ Toe (Bot Reinf) 0.00 (Kip) Vu @ Toe 3.65 (Kip) Vu @ Toe 3.66 (Kip-ff) Mu @ Toe (Bot Reinf) 0.00 (Kip) Vu @ Toe 3.65 (Kip) Vu @ Toe 3.60 (Kip Vu @ Toe 1.55 5.475 0.0018023 Reinf. Ratio LRFD soil 187.67209 ps @ Wall interface 87.8 Ps @ Toe 2229.9157 # in Toe @ 4.33333333 ft from Wall					R TR
STABILITY FACTOR OF SAFETY CHECKS F.S. overturning F.S. overturni					
15 F.S. siding 0verturning 2.40 OK 15 F.S. siding M / Mo Mr / Mo a 2.67 (ft) g1 514 (pr+F)(Ph+V) SOL BEARING a 2.67 g1 514 (psf) p2 69 (psf) bearing pressure @ heal 2.99 FACTORED (1.7) STEM LOAD FORCES (h) 1428 (lbs) P (arm only) 1428 (lbs) P (arm only) 1428 (lbs) P (arm only) 13.6 (kip)-ft) Mu (arm moment) FACTORED (1.7) FOOTING LOADS Mu @ Toe (Bot Reinf) 0.00 (kip) Vu @ Toe 0.000 (kip) Vu @ Toe ØV 7.969 10° thick ØV/c As 0.485 @ 8° As As 0.0007 As 0.0009 ø/u 15.5 5-455 0.0018023 Reinf. Ratio LRFD soil		1104	(10)	total anding realatance	$q = \frac{2N_{p}}{3\sigma}$
15 F.S. siding 0verturning 2.40 OK 15 F.S. siding M / Mo Mr / Mo a 2.67 (ft) g1 514 (pr+F)(Ph+V) SOL BEARING a 2.67 g1 514 (psf) p2 69 (psf) bearing pressure @ heal 2.99 FACTORED (1.7) STEM LOAD FORCES (h) 1428 (lbs) P (arm only) 1428 (lbs) P (arm only) 1428 (lbs) P (arm only) 13.6 (kip)-ft) Mu (arm moment) FACTORED (1.7) FOOTING LOADS Mu @ Toe (Bot Reinf) 0.00 (kip) Vu @ Toe 0.000 (kip) Vu @ Toe ØV 7.969 10° thick ØV/c As 0.485 @ 8° As As 0.0007 As 0.0009 ø/u 15.5 5-455 0.0018023 Reinf. Ratio LRFD soil					
15 F.S. sking 0vertunning 2.40 OK 1.5 F.S. sking a 2.36 OK (P+F)(Ph+V) SOL BEARING a 2.67 (ft) distance to resultant middle third of footing bearing pressure @ toe 1428 (bs) Ph (month) 1428 (bs) Ph (am only) 24.65 (kip-ft) Mu (arm monent) FACTORED (1.7) FOOTING LOADS 13.66 (kip-ft) Mu (arm monent) Mu @ Toe (Bot Reinf) 13.45 (kip) Vu @ Toe Solo (B Reinf) 0.00 (kip) Vu @ Toe Solo (B Reinf) 0.000 1.55 5.455 B Ban	STABILITY FAC	CTOR OF SAF	ETY CHECK	S	(c) Resultant outside middle third
Diverturing 2.40 OK Mr / Mo stading 2.36 OK (PP+F)(Ph+V) SOIL BEARING a 2.67 (ft) distance to resultant middle third of fooling dt 2 69 (psf) q1 514 (psf) bearing pressure @ toe bearing pr		1.5		F.S. overturning	
Coverturing 2.40 OK Mr / No silding 2.36 OK Mr / No SOLE BEARING a 2.67 (ft) distance to resultant middle third of footing orgsure @ too to resultant middle third of footing org 2 69 (psf) bearing pressure @ too to resultant middle third of footing org 2 69 (psf) bearing pressure @ too to resultant middle third of footing org 2 69 (psf) bearing pressure @ too to resultant middle third of footing org 2 69 (psf) bearing pressure @ too to resultant middle third of footing org 2 69 (psf) bearing pressure @ too to resultant middle third of footing to resultant mi		1.5		F.S. sliding	
SOL BEARING	overturning	2.40	OK		0 0.7166666687433333333 2.15 2.8666666827583333333 4.3 5.0166666687733333333 6.45 7.16666666 0
SOIL BEARING a 2.67 (ft) distance to resultant middle third of footing q1 514 (psf) bearing pressure @ toe g2 69 (psf) bearing pressure @ toe FACTORED (1.7) STEM LOAD FORCES 8.5 (ft) H1 + H2 2.99 (ft) ine of action (above base) 1428 (bs) 1428 (bs) P (arm only) 24.6 (kip-ft) 1428 (bs) P (arm only) 24.6 (kip-ft) 0.00 (kip) Nu @ Toe (Bot Reinf) 0.0 (kip) 0.00 (kip) Vu @ Toe Toe 0.62 #5 @ 6" 600 7.969 10" thick Vall 0.00 0.000 0.000 ØMn 14.65 k-ft 0.000 As 0.62 #5 @ 6" 0.0009 ØMn 14.65 k-ft 0.000 ØMn 16.74 k-ft 187.67209 psf @ Vall interface 87.8 0.333333333333333333333333333333333333	sliding	2.36	OK	(PP+F)/(Ph+V)	
a 2.67 (ft) distance to resultant 2.39' to 4.78' middle third of footing dig 5 (psf) bearing pressure @ bear FACTORED (1.7) STEM LOAD FORCES 8.5 (ft) H1 + H2 2.99 (ft) line of action (above base) 1428 (lbs) P (arm only) 1428 (lbs) P (arm only) 1428 (lbs) P (arm only) 1428 (lbs) P (arm only) 24.6 (kip-ft) Mu @ Toe (Bot Reinf) 0.0 (kip-ft) Mu @ Toe (Bot Reinf) 0.0 (kip) V u @ Toe 0.00 (kip) V u @ Heel Footing ØVc 7.969 10" thick ØVc As 0.465 #5 @ 8" As 0.0007 k-ft ØMn 16.74 k-ft 1.55 5-#5 0.0018023 Reinf. Ratio LRFD soil 187.67209 psf @ Wall interface 873.8 'psf @ Toe 2229.9157 # in Toe @ 4.333333333 ft from Wall					-100 -
2.39' to 4.78' middle third of footing q1 514 (psf) bearing pressure @ toe bearing pressure @ toe bearing pressure @ toe bearing pressure @ toe 5.5 (ft) H1 + H2 2.99 (ft) the of action (above base) 1428 (lbs) P (arm only) 24.6 (kip-ft) Mu @ toe (Bot Reinf) 0.0 (kip-ft) Mu @ toe (Bot Reinf) 0.00 (kip) Vu @ toe 0.00 (kip) Vu @ Toe 0.00 (kip) Vu @ Toe 0.000 (kip) Vu @ Toe 0.000 8' As 0.00007 a 0.0009 gMn 14.55 545 0.0018023 Reinf. Ratio LRFD soil 187.67209 psf @ Wall interface 87.8 'psf @ Toe 2229.9157 # in Toe @ 4.333333333 ft from Wall					
q1 514 (psf) bearing pressure @ heel FACTORED (1.7) STEM LOAD FORCES 8.5 (ft) H1 + H2 2.99 (ft) time of action (above base) 1428 1428 (lbs) P (arm only) 24.0 (kip-ft) 1428 (lbs) P (arm only) 24.0 (kip-ft) 1428 (by) Vial @ Vic 5,692 8" thick 60.00 (kip-ft) Mu @ Toe (Bot Reinf) 0.02 #5,692 8" thick 60.00 (kip) Vu @ Heel ØVc 5,692 8" thick As 0.0007 a 0.0009 0.0009 16.74 k-ft gMn 1.55 5-#5 0.0018023 Reinf. Ratio 0.0009 16.74 k-ft LRFD soil 187.67209 psf @ Wall interface 87.333333333 ft from Wall 4.33333333333 ft from Wall 16.74 k-ft			(ft)		-200
q2 69 (psf) bearing pressure @ hell FACTORED (1.7) STEM LOAD FORCES 8.5 (ft) H1 + H2 2.99 (ft) ine of action (above base) 1428 1428 (lbs) P (arm only) 24.6 FACTORED (1.7) FOOTING LOADS Mu (arm moment) FACTORED (1.7) FOOTING LOADS 13.6 (kip-ft) Mu @ Toe (Bot Reinf) 0.00 (kip) Vu @ Toe 0.00 (kip) Vu @ Toe 0.000 (kip) Vu @ Toe %Vc 7.969 10" thick ØVc As 0.465 k-ft 0.0007 a 0.0009 øMn 14.55 k-ft 0.0018023 Reinf. Ratio LRFD soil 187.67209 psf @ Wall interface 87.8 'psf @ Toe 2229.9157 # in Toe @ 4.333333333333333333333333333333333333					
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FACTORED (1.7) STEM LOAD FORCES 8.5 (f) H1 + H2 2.99 (f) ine of action (above base) 1428 (lbs) P (arm only) 24.6 (kip-ft) Mu (arm moment) FACTORED (1.7) FOOTING LOADS 13.6 (kip-ft) Mu @ Toe (Bot Reinf) 0.0 (kip) Vu @ Toe (Bot Reinf) 0.00 (kip) Vu @ Heel Footing ØVc 7.969 10" thick ØVc As 0.465 #5 @ 8" As 0.62 #5 @ 6" a 0.0007 a 0.0009 ØMn 14.65 k-ft ØMn 16.74 k-ft 1.55 5-#5 0.0018023 Reinf. Ratio LRFD soil 187.67209 psf @ Wall interface 873.8 'psf @ Toe 2229.9157 # in Toe @ 4.333333333 ft from Wall	q2	69	(pst)	bearing pressure @ heel	
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		873.8	psf @ Toe		
		2220 0457	# in Tag	1 222222222 #	a Wall
1219.8686 # in Toe @ 3.25 ft from Wall					



Tread beam has a reaction of 360# at each side...use SDS screws and dapped angle as shown to connect tread to stringer. At base of stringer, use an embed plate to create separation at ground and use slotted holes to allow stringer to move in earthquake. Need a 1686# capacity hanger from stringer to cross beam,



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

Sloped Length: 11' 8 7/16"



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) 1687 @ 9' 9" 10725 (3.00") Passed (16%) 1.0 D + 1.0 L (All Spans) Shear (lbs) 1305 @ 1' 3 5/8" 11660 Passed (11%) 1.00 1.0 D + 1.0 L (All Spans) Pos Moment (Ft-lbs) 3868 @ 5' 1/2" 26400 Passed (15%) 1.00 1.0 D + 1.0 L (All Spans) Live Load Defl. (in) 0.054 @ 5' 1/2" 0.558 Passed (L/999+) 1.0 D + 1.0 L (All Spans) Total Load Defl. (in) 0.061 @ 5' 1/2" 0.744 Passed (L/999+) 1.0 D + 1.0 L (All Spans)

System : Roof Member Type : Drop Beam Building Use : Residential Building Code : IBC 2015 Design Methodology : ASD Member Pitch : 7.63/12

Member Length : 12' 4 1/16"

PASSED

• Deflection criteria: LL (L/240) and TL (L/180)

· Allowed moment does not reflect the adjustment for the beam stability factor.

• Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 11' 1 15/16".

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.

	Bearing Length			Loads to Supports (lbs)				
Supports	Total	Available	Required	Dead	Floor Live	Snow	Total	Accessories
1 - Beveled Plate - DF	5.50"	5.50"	1.50"	205	1555	389	2149	Blocking
2 - Beam - GLB	3.00"	3.00"	1.50"	196	1490	373		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)	11' 8" o/c				
Bottom Edge (Lu)	11' 8" o/c				
•Maximum allowable bracing intervals based on applied load.					

app

			Dead	Floor Live	Snow	
Vertical Loads	Location (Side)	Tributary Width	(0.90)	(1.00)	(1.15)	Comments
0 - Self Weight (PLF)	0 to 9' 10 1/2"	N/A	16.0			
1 - Uniform (PSF)	0 to 9' 10 1/2"	3' 1"	5.9	100.0	25.0	Default Load

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

ForteWEB Software Operator Javid Abdi Atlas Consulting Engineers (206) 427-7233 javiddabdi@yahoo.com

Job Notes



Project:	Derkashani Residence (8151 SE 48th St)	By:	JDA
Proj No:	167-2020	Date:	9/29/2021

Summary

Rockery wall will be used up to a maximum 4'-0" tall. Wall will have a 35 psf active soil pressure and 8h seismic surcharge pressure as shown below. Use a friction coefficient of 0.5 and negate passive earth pressure.

Wall FBD looks as shown below. Worst case condition is active soil pressure and seismic surcharge with a factor of safety of 1.2 for sliding and overturning. Based on the geometry and loading condition shown below, a gravity force of 980# per foot would be required at 10" from the inside corner to provide a FOS of 1.2 for overturning and sliding. Use a rock weight of 125 pcf and an interior friction factor of 0.55.

Rockery wall should use a minimum width of 2'-0"; be embedded 1' into dirt;

