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:	4/1/2021

Summary

The project consists of an extensive remodel to an existing single-family residence located at the above address. The existing residence will comprise the southern half of the remodeled structure, however the entire roof structure will be new. Existing foundations and main floor framing will remain where feasible, and be detailed so-as to be tied to the new structure and create a continuous lateral force resisting system.

The remodeled two-story residence will consist of a 1632 SF living space and 910 SF garage at the lower floor; and a 3170 SF main floor. The structure will be set into the sloping site and daylight to the south.

The residence will be comprised of the following: reinforced concrete strip and spread footings; concrete slab-on-grade garage space; wood framed TJI floors supported on interior and exterior wood framed load bearing walls, beams, and posts at each level; and a flat-rafter roof system comprised of dimensional lumber and TJI's. The lateral systems will consist of wood sheathed diaphragms and shear walls (tongue & groove plywood floor sheathing, OSB roof and wall sheathing), and Simpson StrongTie holdowns.

See pages 2 - 3 for lateral design. Site seismic variables are shown on page 4; shear wall line tributary areas shown on pages 5 - 6; wind areas shown on page 7; and wind load derivation shown on pages 8 - 14. Seismic and wind loads were determined using ASCE 7-16 procedures. As shown on pages 2-3, shearwalls with 8d nails spaced at 6" o.c. (SW-6), 4" oc (SW-4), 3" o.c. (SW-3), 2" o.c. (SW-2), and 3" oc each side (SW-33) are required. Use a Simpson StrongWall for tall wall with only 2'-0" wide shearwall panels. Demand in wall piers is 1,687# and capacity is 3,525# fASD from Simpson literature. Shearwalls have been detailed to meet the ASD shearwall capacity values as listed in 1/S6.5. LTP4 and A34 clips have an ASD capacity of 540# and 550# per clip; SDS screws have an ASD capacity of 400# per screws; 5/8" and 3/4" diameter anchor bolts have an ASD capacity of 1485# and 2039# with doug fir plates. The required spacing of these connectors is shown in the shearwall table in the plans. Each shearwall will have a different uplift demand, as shown on pages 2 - 3. Simpson holdowns will be used as shown in the plans, sized to ensure ASD uplift capacity. Anchorage of the HDU's into concrete were designed for worst case LRFD load when including the seismic overstrength factor. To preclude breakout, additional reinforcing hairpins are detailed to transfer shear force into new foundation walls. At existing walls, customized holdowns are required because epoxy anchorage doesn't have capacity in tension. Design custom tension ties to behave in shear and design anchorage for overstrength LRFD load, and SDS screws into wood post for ASD loads. See pages 15-38 for anchorage design. Use SDS seismic capacity of 400#/screw and detail screws to provide suitable spacing. Steel will be a tension only member with minimum width of 3"...use 33 ksi for 12 gage steel and 50 ksi for 10 and 8 gage steel to provide LRFD capacity.

Gravity system was designed for 25 psf roof snow load, 20 psf roof dead load, 40 psf floor live load, 60 psf deck live load, and 25 psf floor dead load. See pages 39 -40 for framing key; and pages 41 - 78 for member designs. Uplift for each member considering 0.6D+0.6W will be resisted by straps at headers/beams; and H2.5a hurricane ties at rafters and trusses. Note that where applicable, overstrength seismic chord forces were considered in beam designs but not for serviceability beam deflection considerations.

Size footings and walls for an allowable soil pressure = 3,000 psf; lateral earth pressure (restrained/unrestrained) = 35 pcf/ 45 pcf; passive earth pressure = 300 pcf; seismic surcharge = 8h psf (uniform); and coefficient of friction = 0.50. Per ACI Table 11.6-1, provide minimum longitudinal reinforcing of 0.0012 and transverse reinforcing of 0.002 in the walls; and 0.0018 per ACI Table 7.6.1.1. See retaining wall design on page 78. Bearing walls will be braced at bottom by slab and at top by framing...worst case gravity load is 5.67' of floor framing; 12' of stud wall; 9' of 8" concrete wall; and slab...equates to ASD max load of 1413 plf...with a 24"x10"dp footing, results in a soil bearing of 832 psf when weight of footing is considered...no issue. See page 79 for design of foundation wall during temporary condition where it will be required to act as a retaining wall (i.e. framing has not been set yet to brace it). See page 80 - 84 for cantilevered retaining wall design.

Design new bump-out to be supported on 6 ton capacity pipe piles and pile cap. Worst case demand will be 1450# live, 2310# dead, 260# snow, 245# (up-down), 207# (left-right), and 319# (uplift) seismic. With two pile caps we would provide 12 ton (24 K) capacity so can see there's no issue...batter piles in opposing directions for stability. Provide minimum reinforcing per ACI.



Subject: <u>Calculation Overview</u> Project: <u>Derkashani Residence</u> Client: <u>CenterLine</u>

Project:		Derkasha	ni Residence (8151 SE 48th St)										By:	JDA
Proj No:		167-2020											Date:	2/23/2021
R	6.5		ASCE 7-16 Table 12.2-1											
Ω_{0}	2.5													
C_d	4													
v	39.0	Kips	= CsW ~ ASCE 7-16 (12.8-1)											
C,	0.178													
	0.178		= Sds / (R/le) ~ ASCE 7-16 (12.8-2)											
	0.495		< Sd1 / T(R/le) ~ if T <tl, (12.8-3)<="" 7-16="" asce="" td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tl,>											
	-		< Sd1TL / T2(R/le) ~ if T>TL, ASCE 7-16 (12.8	3)										
	0.051		>0.044Sdsle ~ ASCE 7-16 (12.8-5)											
	0.01		>0.01 ~ ASCE 7-16 (12.8-5)											
	-		>0.5S1 / (R/le) ~ if S1>0.6g, ASCE 7-16 (12.8-	6)										
W	219	Kips												
I.	1		ATC Hazard											
F_v	1.8		Table 11.4-2 and Section 11.4.8 Exception			Table 11.4	I-2 Long-P	Period Site	e Coeffici	ent F.				
Fa	1.2		ATC Hazard	EXCEPTION: A ground motion hazard analysis is not required for structures other than seismically isolated structures		Mapped Risk-		in a familie	the second Provide		1. Francisco			
S _s	1.443	g	ATC Hazard	and structures with damping systems where:		F	Response Ass	seleration Pa	arameter at 1	I is Period	a) openna			
S ₁	0.501	g	ATC Hazard	1. Structures on Site Class E sites with S _S greater than or equal	Site Class	S < 01	S 0.2	\$ -03	S04	ses	S. 5.05			
S _{mS}	1.732	g	ATC Hazard	to 1.0, provided the site coefficient \vec{F}_a is taken as equal to that of Site Class C.		0.8		0.8	0.8	0.8	0.8			
S _{m1}	0.9018	g	= F _v S ₁ ~ ASCE 7-16 (11.4-1)	2. Structures on Site Class D sites with S1 greater than or	B	0.8	0.8	0.8	0.8	0.8	0.8			
S_{ds}	1.155	g	ATC Hazard	equal to 0.2, provided the value of the seismic response coefficient $C_{\rm v}$ is determined by Eq. (12.8-2) for values of	C D	1.5 2.4		1.5 2.0"	1.9"	1.5	1.4 1.7"			
S _{d1}	0.6012	g	= 2/3 S _{m1} ~ ASCE 7-16 (11.4-4)	$T \leq 1.5T$, and taken as equal to 1.5 times the value	Е						See Section			
S _{DC}	D			computed in accordance with either Eq. (12.8-3) for $T_L \ge T > 1.5T_s$ or Eq. (12.8-4) for $T > T_L$.	F	Sco	11.4.8 See	11.4.8 See	11.4.8 Sec	11.4.8 Scc	11.4.8 See			
Т,	0.187	seconds	= Cthrix ~ ASCE 7-16 (12.8-7)	3. Structures on Site Class E sites with S1 greater than or equal		Section 11.4.8		Section : 11.4.8			Section 11.4.8			
				to 0.2, provided that T is less than or equal to T_s and the equivalent static force procedure is used for design.	Note: Use	e straight-line e sequirement	interpolatic	on for inter	moñale va	lues of S ₁				
C,	0.02		ASCE 7-16 Table 12.8-2	equivalent static force procedure is used for design.	-745-0, 989	e sequirement	s tor site sp	mente grou	ind mution	s in searc	a 11,4.8.			
h _n	19.66	feet												
x	0.75		ASCE 7-16 Table 12.8-2											
TL	6	seconds	USGS Seismic Values											
Ts	0.521	seconds	= S _{d1} /S _{ds} , ASCE 7-16 (11.4-3)											
1.5T _s	0.781	seconds												

Story	Weight	Height	Wh	C_{vx}	F _{xE} , Kips	ΣF_{xE} , Kips	F _{xE} , Kips	$\sum F_{xE}$, Kips	$\sum F_{xW}$, Kips	$\sum F_{xW}$, Kips
Silvy	(Kips)	(ft)	(Kip-ft)	$(Wb/\Sigma Wb)$	$(C_{sx}V)$	LRFD	$(C_{ix}V)$	ASD	West ASD	South ASD
Roof	103.86	19.66	2,042	0.66	25.8	25.8	18.077	18.077	7.630	5.366
Main Floor	115.36	9.00	1,038	0.34	13.1	39.0	9.192	27.3	17.731	13.204
∑W	219.23									

									UP-to-DOWN R		S							
				SEISMI			WIND		Main-	to-Roof	ITY LOADING	(plf)						
А	% 9.2%	Length (ft) 25.33	# in Wall 1.669		Chord F (#)	# in Wall 705	PLF	Chord F (#)	Wall W (#)	Snow	Dead	Live	Uplift	Comp	Anchorage	9.34 ft 12.33333 fr		
388	100.0%	25.33	1,669	66	615	705	28	260	2,957	90	54	0	0	2,534	1,032	6 OK	HDU2	OK
в	24.0%	9.00	4,332			1,829												
1007	24.1%	2.17	1,043	481 481	5,936	440	203	1,898	334	325 325	195 195	0	5,805	6,390	20,997	33 OK 33 OK	HDU8	OK OK
	48.6% 27.3%	4.38 2.46	2,106 1,183	481 481	5,936 5,936	889 499	203 203	1,898 1,898	674 379	325	195	0	5,671 5,787	6,603 6,418	20,789 20,970	33 OK 33 OK	HDU8 HDU8	OK
с	23.6%	15.00	4.263			1.799												
991	14.4%	2.17	616	284	3,505	260	120	1,120	334	325	195	0	3,374	3,959	12,315	2 OK	HDU4	OK
	85.6%	12.83	3,647	284	3,505	1,540	120	1,120	1,978	325	195	0	2,726	4,988	11,309	4 OK	HDU2	OK
D 1012	24.1% 13.1%	16.73 2.19	4,354 569	260	2.431	1,838 240	110	1.026	255	365	219	0	2.303	2.864	8.483	4 OK	HDU2	ОК
1012	33.1%	5.54	1,442	260	2,431	240 609	110	1,026	255 647	365	219	0	2,303	2,004 3,109	6,463 8,179	4 OK 4 OK	HDU2	OK
	53.8%	9.00	2,342	260	3,210	989	110	1,026	1,388	294	176	Ō	2,692	4,299	10,660	4 OK	MSTC52	OK
Е	17.8%	14.83	3,214			1,356												
747	53.7% 46.3%	7.96	1,724 1,489	217 217	2,023	728	91 91	854	929	365	219 176	0	1,559	2,879 3.556	6,506	6 OK 6 OK	HDU2 HDU2	OK OK
		6.88		217	2,672	629	91	854	1,060	294	176	U	2,211	3,556	8,929	6 UK	HDU2	UK
F 57	1.4% 100.0%	10.00 10.00	245 245	25	229	104 104	40	97	1.168	25	15	0	0	979	462	6 OK	HDU2	ок
57	100.0%	10.00	245	20	229	104	10	97	1,100	25	15	U	U	979	402	6 OK	HDU2	UK
									Lower	-to-Main								
				SEISMI			WIND											
C 967	% 29.2%	Length (ft)	# in Wall	PLF							ITY LOADING			_				
		52.50 2.83	6,944 375		Chord F (#)	# in Wall 6,972 376	PLF	Chord F (#)	Wall W (#)	GRAV Snow	ITY LOADING Dead	(plf) Live	Uplift	Comp	Anchorage	9 ft		
90/	5.4% 14.6%	2.83 7.67	375 1,014	132	1,190	6,972 376 1,018	PLF 133	1,195	863	Snow 0	Dead 0	Live	1,040	1,730	4,019	6 OK	HDU2	ок
90/	5.4%	2.83	375		,	6,972 376	PLF			Snow	Dead	Live					HDU2 HDU2	ОК ОК
D	5.4% 14.6% 21.6% 58.4% 28.4%	2.83 7.67 11.33 30.67 19.46	375 1,014 1,499 4,056 6,965	132	1,190	6,972 376 1,018 1,505 4,072 5,038	PLF 133	1,195	863	Snow 0	Dead 0	Live	1,040	1,730	4,019	6 OK		
	5.4% 14.6% 21.6% 58.4%	2.83 7.67 11.33 30.67	375 1,014 1,499 4,056	132	1,190	6,972 376 1,018 1,505 4,072	PLF 133	1,195	863	Snow 0	Dead 0	Live	1,040	1,730	4,019	6 OK		
D 942	5.4% 14.6% 21.6% 58.4% 28.4% 74.7% 25.3%	2.83 7.67 11.33 30.67 19.46 14.54 4.92	375 1,014 1,499 4,056 6,965 5,205 1,760	132 132	1,190 1,190	6,972 376 1,018 1,505 4,072 5,038 3,765 1,273	PLF 133 133	1,195 1,195	863 1,275	Snow 0 0	Dead 0 0	0 0	1,040 969	1,730 1,989	4,019 3,907	6 OK 6 OK	HDU2	ОК
D	5.4% 14.6% 21.6% 58.4% 28.4% 74.7%	2.83 7.67 11.33 30.67 19.46 14.54	375 1,014 1,499 4,056 6,965 5,205	132 132	1,190 1,190 3,222	6,972 376 1,018 1,505 4,072 5,038 3,765	PLF 133 133	1,195 1,195 2,330	863 1,275	Snow 0 0	Dead 0 0	0 0	1,040 969	1,730 1,989	4,019 3,907	6 OK 6 OK	HDU2	ОК
D 942 E	5.4% 14.6% 21.6% 58.4% 74.7% 25.3% 24.3% 21.3%	2.83 7.67 11.33 30.67 19.46 14.54 4.92 21.17 16.5 4.50	375 1,014 1,499 4,056 6,965 5,205 1,760 5,696 2,826 1,211	132 132 358 171 269	1,190 1,190 3,222	6,972 376 1,018 1,505 4,072 5,038 3,765 1,273 4,316 2,141 918	PLF 133 133 259 130 204	1,195 1,195 2,330	863 1,275 553	Snow 0 0	Dead 0 0	0 0 0	1,040 969 5,818	1,730 1,989 7,867	4,019 3,907 11,357	6 OK 6 OK 4 OK	HDU2	ок
D 942 E	5.4% 14.6% 21.6% 58.4% 28.4% 74.7% 25.3% 24.3%	2.83 7.67 11.33 30.67 19.46 14.54 4.92 21.17 16.5 4.50 6.00	375 1,014 1,499 4,056 6,965 5,205 1,760 5,696 2,826 1,211 1,615	132 132 358 171 269 269	1,190 1,190 3,222 1,541	6,972 376 1,018 1,505 4,072 5,038 3,765 1,273 4,316 2,141 918 1,224	PLF 133 133 259 130 204 204 204	1,195 1,195 2,330 1,168	863 1,275 553 1,856	Snow 0 0 0	Dead 0 0 0	0 0 0 0	1,040 969 5,818 2,777	1,730 1,989 7,867 5,582	4,019 3,907 11,357 5,004	6 OK 6 OK 4 OK	HDU2 HDU8 HDU2	ок ок ок
D 942 E	5.4% 14.6% 21.6% 58.4% 74.7% 25.3% 24.3% 21.3%	2.83 7.67 11.33 30.67 19.46 14.54 4.92 21.17 16.5 4.50	375 1,014 1,499 4,056 6,965 5,205 1,760 5,696 2,826 1,211	132 132 358 171 269	1,190 1,190 3,222 1,541	6,972 376 1,018 1,505 4,072 5,038 3,765 1,273 4,316 2,141 918	PLF 133 133 259 130 204	1,195 1,195 2,330	863 1,275 553	Snow 0 0	Dead 0 0	0 0 0	1,040 969 5,818	1,730 1,989 7,867	4,019 3,907 11,357	6 OK 6 OK 4 OK	HDU2	ок

										RUNNING WA	LS							
				SEISMIC			WIND		Main	to-Roof	ITY LOADING	(plf)						
1	% 7.1%	Length (ft) 20.17	# in Wall 1,278		, Chord F (#)	# in Wall 379	PLF	Chord F (#)	Wall W (#)	Snow	Dead	Live	Uplift	Comp	Anchorage	9.34 ft 12.33333 fr		
297		23.17	1,278	55	515	379	16	153	2,705	0	0	0	45	2,208	1,110		HDU2	OK
	77.1% 22.9%	15.54 4.63	985 293	63 63		292 87	19 19									6 OK 6 OK		
2	41.3%	26.08	7,470			2,217												
1736	8.6%	2.25	644	286	2,675	191	85	794	263	0	0	0	2,629	2,839	9,482	3 OK	HDU2	OK
	33.5%	8.75	2,506	286	2,675	744	85	794	1,022	0	0	0	2,497	3,314	9,277	4 OK	HDU2	OK
	16.8%	4.38	1,253	286	3,532	372	85	1,048	674	0	0	0	3,415	3,954	12,432	4 OK	HDU4	OK
	16.8%	4.38	1,253	286	3,532	372	85	1,048	674	0	0	0	3,415	3,954	12,432	4 OK	HDU4	OK
	11.5%	3.00	859	286	2,675	255	85	794	350	0	0	0	2,614	2,894	9,458	4 OK	HDU2	OK
	12.8%	3.33	955	286	2,675	283	85	794	389	0	0	0	2,607	2,918	9,448	4 OK	HDU2	OK
3	8.6%	9.17	1,558			462												
362	100.0%	9.17	1,558	170	1,587	462	50	471	1,070	0	0	0	1,401	2,257	5,379	6 OK	HDU2	OK
4	18.7%	4.92	3,373			1,001												
784	50.0%	2.46	1,687	686	8,462	501	204	2,512	379	0	0	0	8,396	8,700	30,120	33 OK	HDU11	OK
	50.0%	2.46	1,687	686	8,462		0	0	379	0	0	0	8,396	8,700	30,120	33 OK	HDU11	OK
5	17.8%	13.42	3,214			954												
747	50.0%	6.71	1,607	240	2,238	477	71	664	783	0	0	0	2,101	2,728	7,780	6 OK	HDU2	OK
	50.0%	6.71	1,607	240	2,238	477	71	664	783	0	0	0	2,101	2,728	7,780	6 OK	MSTC40	OK
6	5.4%	7.17	977			290												
227	50.0%	3.58	488	136	1,681	145	40	499	552	0	0	0	1,585	2,027	5,854	6 OK	MSTC40	OK
	50.0%	3.58	488	136	1,681	145	40	499	552	0	0	0	1,585	2,027	5,854	6 OK	MSTC40	OK
7	1.1%	4.67	207			61												
48	100.0%	4.67	207	44	413	61	13	123	545	0	0	0	319	754	1,329	6 OK	HDU2	OK
				SEISMIC			WIND		Lowe	-to-Main		(10						
	%	Length (ft)	# in Wall			# in Wall	PLF	Chord F (#)	Wall W (#)	GRAV	ITY LOADING Dead	(plf) Live	Uplift	Comp	Anchorage	9 ft		
161 1239 770	5.0% 38.5% 23.9%	3()	1,738 11,009 7,131			1,939 12,554 8,091							-					
5	23.3%	9.88	5,359			3,081												
751	39.2%	3.88	2,103	543	4,885	1,209	312	2,808	436	0	0	0	6,910	7,885	17,327	2 OK	HDU8	OK
	60.8%	6.00	3,256	543	4,885	1,872	312	2,808	675	0	0	Ō	4,767	5,307	17,262	2 OK	HDU5	OK
6	9.2%	15.17	2.032			1.219	80											
297		23.17	2,032	88	789	1,219	53	473	2,606	0	0	0	1,921	4,448	2,115		HDU2	OK
	76.4%	11.58	1,552	134		931	80									6 OK		

ATC Hazards by Location

Search Information

		Mille	r Li
Address:	8151 SE 48th St, Mercer Island, WA 98040, USA		Ç
Coordinates:	47.5596565, -122.2280274		F
Elevation:	165 ft		
Timestamp:	2021-02-22T19:26:30.692Z		
Hazard Type:	Seismic		
Reference Document:	ASCE7-16	Google	
Risk Category:	Ш		
Site Class:	D-default		



Basic Parameters

Name	Value	Description
SS	1.443	MCE _R ground motion (period=0.2s)
S ₁	0.501	MCE _R ground motion (period=1.0s)
S _{MS}	1.732	Site-modified spectral acceleration value
$s_{M1} \ 0.902$	null	Site-modified spectral acceleration value
S _{DS}	1.155	Numeric seismic design value at 0.2s SA
$s_{D1} \ 0.601$	null	Numeric seismic design value at 1.0s SA

* See Section 11.4.8

Additional Information

Value	Description
* null	Seismic design category
1.2	Site amplification factor at 0.2s
-null_	Site amplification factor at 1.0s
0.902	Coefficient of risk (0.2s)
0.898	Coefficient of risk (1.0s)
0.618	MCE _G peak ground acceleration
1.2	Site amplification factor at PGA
0.742	Site modified peak ground acceleration
6	Long-period transition period (s)
1.443	Probabilistic risk-targeted ground motion (0.2s)
1.6	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
3.988	Factored deterministic acceleration value (0.2s)
0.501	Probabilistic risk-targeted ground motion (1.0s)
0.558	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
1.562	Factored deterministic acceleration value (1.0s)
1.343	Factored deterministic acceleration value (PGA)
	* null 1.2 3 null 0.902 0.898 0.618 1.2 0.742 6 0.521 1.443 1.6 3.988 0.501 0.558 1.562

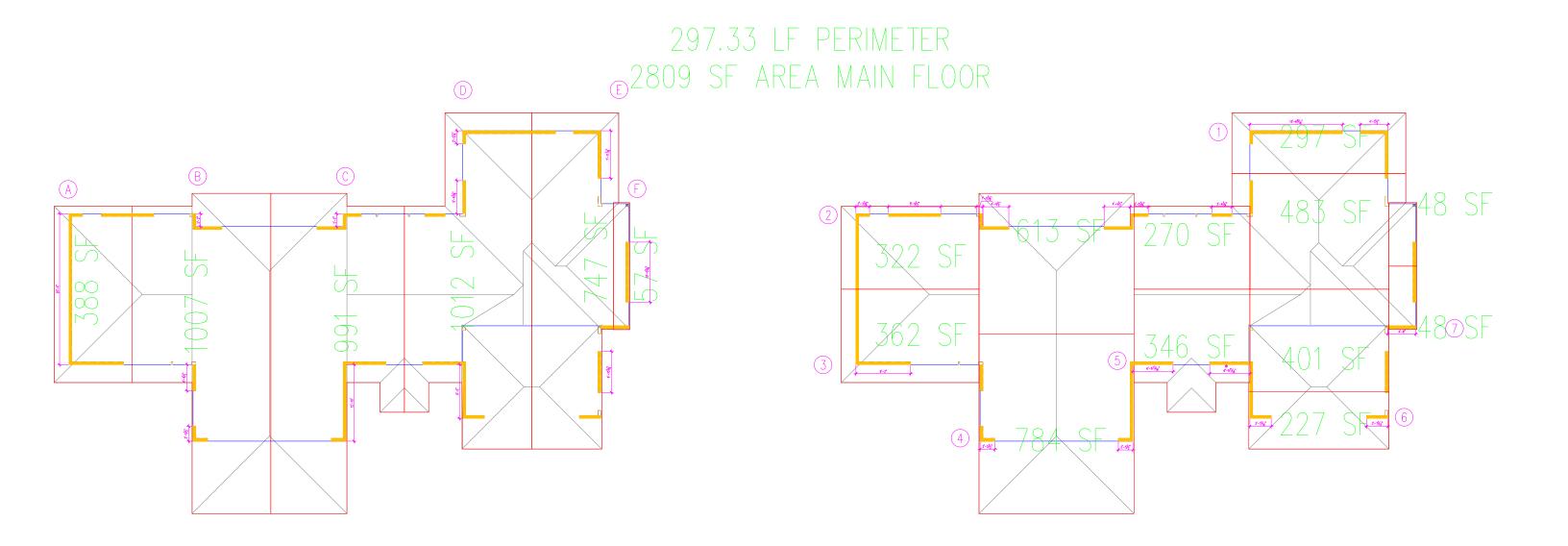
* See Section 11.4.8

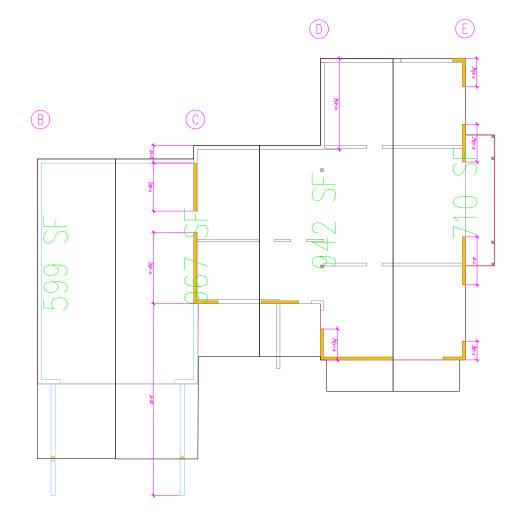
The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

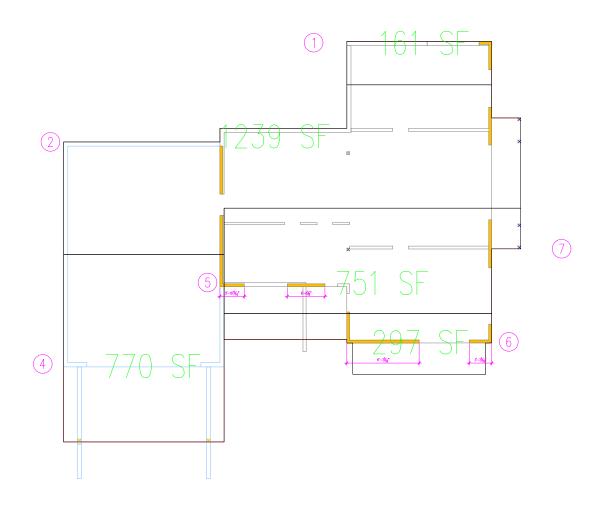
Hazard loads are provided by the U.S. Geological Survey Seismic Design Web Services.

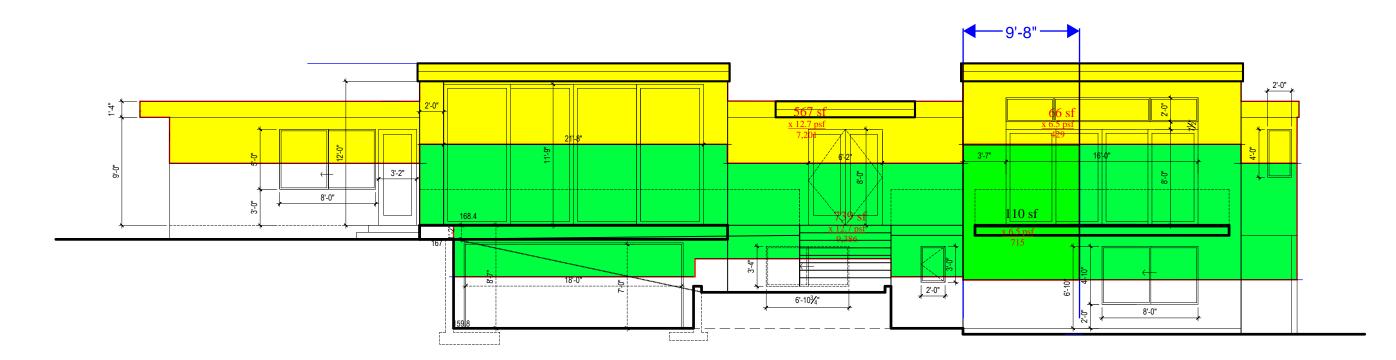
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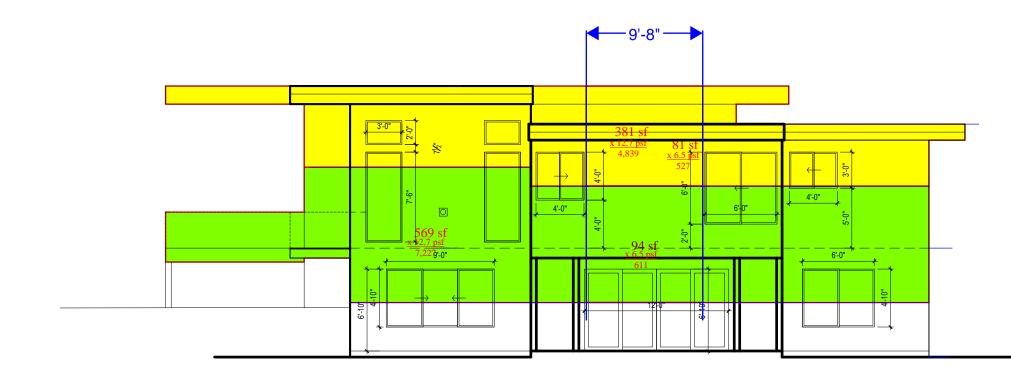


268.33 LF PERIMETER 2639 SF AREA LOW FLOOR





WEST ELEVATION



SOUTH ELEVATION

Atlas Consulting SE, Inc.

6810 NE 149th St Kenmore, WA 206-427-7233 JOB TITLE Derkashani Residence

ЈОВ NO . 167-2020	SHEET NO.	
CALCULATED BY JDA	DATE	2/23/21
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www.struware.com

Code Search

Code: ASCE 7 - 10

Occupancy:

Occupancy Group = R Residential

Risk Category & Importance Factors:

Risk Category =	II	
Wind factor =	1.00	use 0.60 NOTE: Output will be nominal wind pressures
Snow factor =	1.00	
Seismic factor =	1.00	

Type of Construction:

Fire Rating:

· ·	Roof =	0.0 hr
	Floor =	0.0 hr

Building Geometry:

Roof angle (θ)	0.25 / 12	1.2 deg
Building length (L)	89.3 ft	
Least width (B)	48.3 ft	
Mean Roof Ht (h)	19.7 ft	
Parapet ht above grd	0.0 ft	
Minimum parapet ht	0.0 ft	

Live Loads:

<u>Roof</u>	0 to 200 sf: 20 psf	use 25.0 psf
	200 to 600 sf: 25 psf	
	over 600 sf: 25 psf	

Floor:

Typical Floor	40 psf
Partitions	N/A

Atlas Consulting SE, Inc. 6810 NE 149th St

6810 NE 149th St Kenmore, WA 206-427-7233 JOB TITLE Derkashani Residence

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CALCULATED BY	JDA	DATE	2/23/21
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Wind Loads :	ASCE 7- 10			
Ultimate Wind Speed Nominal Wind Speed Risk Category Exposure Category Enclosure Classif. Internal pressure Directionality (Kd) Kh case 1 Kh case 2	110 mph 85.2 mph II C Enclosed Building +/-0.18 0.85 0.899 0.899			
Type of roof	Monoslope			ZA Speed-up
Topographic Factor (F	(zt)			
Topography	2D Escarpment			x(upwind) x(downwind)
Hill Height (H)	0.0 ft		H< 15ft;exp C	Н/2
Half Hill Length (Lh)	39.4 ft		∴ Kzt=1.0	
Actual H/Lh =	0.00			
Use H/Lh =	0.00			
Modified Lh =	39.4 ft			ESCARPMENT
From top of crest: x =	0.0 ft			
Bldg up/down wind?	upwind			V(Z)
H/Lh= 0.00	K ₁ =	0.000		- Speed-up
x/Lh = 0.00	K ₂ =	1.000		V(Z) x(upwind) x(downwind)
z/Lh = 0.50	K ₃ =	0.287		
At Mean Roof Ht:				H/2
Kzt =	(1+K ₁ K ₂ K ₃)^2 =	1.00	use 1.30	ANALANANANAN MARKANANANANANANANANANANANANANANANANANANA
				2D RIDGE or 3D AXISYMMETRICAL HILL

<u>Gust</u>	Effect	Factor
h	=	19.7 ft
В	=	48.3 ft
/z (0.6h)	=	15.0 ft

Flexible structure if natural frequent	cy < 1 Hz (T > 1 second).	
However, if building h/B < 4 then probably rigid structure (rule of thumb).		
h/B = 0.41	Rigid structure	

G = 0.85 Using rigid structure default

Rigic	I Structure	Flexible or Dyn	amically Se	nsitive St	ructure		
ē =	0.20	Natural Frequency $(\eta_1) =$	0.0 Hz				
ℓ = z _{min} =	500 ft 15 ft	Damping ratio (β) = /b =	0 0.65				
c = g _Q , g _v =	0.20 3.4	/α = Vz =	0.15 92.9				
$L_z =$	427.1 ft 0.91	N ₁ = R _n =	0.00				
Q = I _z =	0.23	$R_{h} =$	0.000 28.282	η =	0.000	h =	19.7 ft
G =	0.88 use G = 0.85	R _B = R _L =	28.282 28.282	η = η =	0.000 0.000		
		g _R =	0.000	-1			
		R = G =	0.000 0.000				

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Enclosure Classification

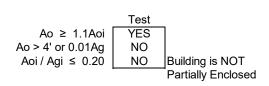
Test for Enclosed Building: A building that does not qualify as open or partially enclosed.

Test for Open Building:

All walls are at least 80% open. As ≥ 0.8 Ag

Test for Partially Enclosed Building:

	Input	
Ao		sf
Ag	0.0	sf
Aoi	0.0	sf
Agi	0.0	sf



Conditions to qualify as Partially Enclosed Building. Must satisfy all of the following:

Ao ≥ 1.1Aoi

Ao > smaller of 4' or 0.01 Ag Aoi / Agi ≤ 0.20

Where:

Ao = the total area of openings in a wall that receives positive external pressure.

Ag = the gross area of that wall in which Ao is identified.

Aoi = the sum of the areas of openings in the building envelope (walls and roof) not including Ao.

Agi = the sum of the gross surface areas of the building envelope (walls and roof) not including Ag.

Reduction Factor for large volume partially enclosed buildings (Ri) :

If the partially enclosed building contains a single room that is unpartitioned , the internal pressure coefficient may be multiplied by the reduction factor Ri.

Total area of all wall & roof openings (Aog):		0 sf
Unpartitioned internal volume (Vi) :		0 cf
	Ri =	1.00

Altitude adjustment to constant 0.00256 (caution - see code) :

Altitude =	0 feet	Average Air Density =	0.0765 lbm/ft ³
Constant =	0.00256		

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JOB TITLE Derkashani Residence

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Wind Loads - MWFRS h≤60' (Low-rise Buildings) Enclosed/partially enclosed only

Kz = Kh (case 1) =	0.90
Base pressure (qh) =	18.5 psf
GCpi =	+/-0.18

Edge Strip (a) =	4.8 ft
End Zone (2a) =	9.7 ft
Zone 2 length =	24.1 ft

Wind Pressure Coefficients

	C	ASE A			CASE B	
		θ = 1.2 deg				
Surface	GCpf	w/-GCpi	w/+GCpi	GCpf	w/-GCpi	w/+GCpi
1	0.40	0.58	0.22	-0.45	-0.27	-0.63
2	-0.69	-0.51	-0.87	-0.69	-0.51	-0.87
3	-0.37	-0.19	-0.55	-0.37	-0.19	-0.55
4	-0.29	-0.11	-0.47	-0.45	-0.27	-0.63
5				0.40	0.58	0.22
6				-0.29	-0.11	-0.47
1E	0.61	0.79	0.43	-0.48	-0.30	-0.66
2E	-1.07	-0.89	-1.25	-1.07	-0.89	-1.25
3E	-0.53	-0.35	-0.71	-0.53	-0.35	-0.71
4E	-0.43	-0.25	-0.61	-0.48	-0.30	-0.66
5E				0.61	0.79	0.43
6E				-0.43	-0.25	-0.61

Nominal Wind Surface Pressures (psf)

1	10.7 4.1	-5.0	-11.6
2	-9.4 -16.1	-9.4	-16.1
3	-3.5 -10.2	-3.5	-10.2
4	-2.0 -8.7	-5.0	-11.6
5		10.7	4.1
6		-2.0	-8.7
1E	14.6 7.9	-5.5	-12.2
2E	-16.4 -23.1	-16.4	-23.1
3E	-6.5 -13.1	-6.5	-13.1
4E	-4.6 -11.3	-5.5	-12.2
5E		14.6	7.9
6E		-4.6	-11.3

Parapet

Windward parapet = Leeward parapet = 0.0 psf (GCpn = +1.5) 0.0 psf (GCpn = -1.0)

Horizontal MWFRS Simple Diaphragm Pressures (psf)

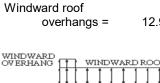
Transverse direction (normal to L)							
Interior Zone:	Wall	12.7 psf					
	Roof	-5.9 psf **					
End Zone:	Wall	19.2 psf					
	Roof	-10.0 psf **					

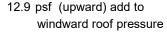
Longitudinal	direction	(parallel	to	L))
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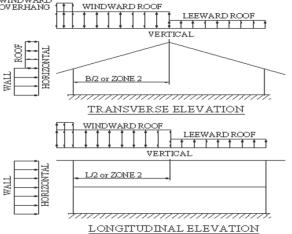
Interior Zone:	Wall	12.7 psf
End Zone:	Wall	19.2 psf

** NOTE: Total horiz force shall not be less than that determined by neglecting roof forces (except for MWFRS moment frames).

The code requires the MWFRS be designed for a min ultimate force of 16 psf multiplied by the wall area plus an 8 psf force applied to the vertical projection of the roof.





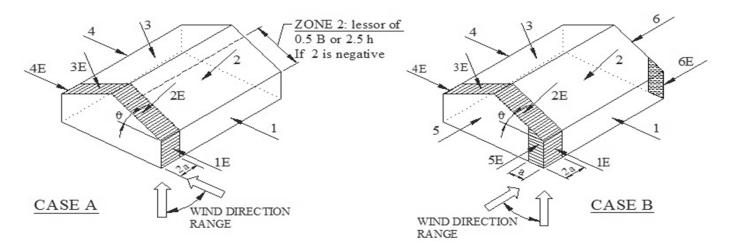


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JOB TITLE Derkashani Residence

JOB NO. 167-2020	SHEET NO.	
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Location of MWFRS Wind Pressure Zones



NOTE: Torsional loads are 25% of zones 1 - 6. See code for loading diagram.

ASCE 7 -99 and ASCE 7-10 (& later)

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JOB NO. 167-2020 SHEET NO. 2/23/21 CALCULATED BY JDA DATE CHECKED BY DATE

Nominal Wind Pressures

Wind Loads - Components & Cladding : h <= 60'

Kh (case 1) =	0.90	h =	19.7 ft
Base pressure (qh) =	18.5 psf	a =	4.8 ft
Minimum parapet ht =	0.0 ft	GCpi =	+/-0.18
Roof Angle (θ) =	1.2 deg		

Type of roof = Monoslope

Roof GCp +/- GCpi		Surface Pressure (psf)			User input		
10 sf	50 sf	100 sf	10 sf	50 sf	100 sf	10 sf	147 sf
-1.18	-1.11	-1.08	-21.8	-20.5	-19.9	-21.8	-19.9
-1.98	-1.49	-1.28	-36.5	-27.5	-23.6	-36.5	-23.6
-2.98	-1.79	-1.28	-55.0	-33.1	-23.6	-55.0	-23.6
0.48	0.41	0.38	10.0	10.0	10.0	10.0	10.0
-1.70	-1.63	-1.60	-31.4	-30.1	-29.5	-31.4	-27.3
-2.80	-1.40	-0.80	-51.7	-25.9	-14.8	-51.7	-14.8
	10 sf -1.18 -1.98 -2.98 0.48 -1.70	10 sf 50 sf -1.18 -1.11 -1.98 -1.49 -2.98 -1.79 0.48 0.41 -1.70 -1.63	10 sf 50 sf 100 sf -1.18 -1.11 -1.08 -1.98 -1.49 -1.28 -2.98 -1.79 -1.28 0.48 0.41 0.38 -1.70 -1.63 -1.60	10 sf 50 sf 100 sf 10 sf -1.18 -1.11 -1.08 -21.8 -1.98 -1.49 -1.28 -36.5 -2.98 -1.79 -1.28 -55.0 0.48 0.41 0.38 10.0 -1.70 -1.63 -1.60 -31.4	10 sf 50 sf 100 sf 10 sf 50 sf -1.18 -1.11 -1.08 -21.8 -20.5 -1.98 -1.49 -1.28 -36.5 -27.5 -2.98 -1.79 -1.28 -55.0 -33.1 0.48 0.41 0.38 10.0 10.0 -1.70 -1.63 -1.60 -31.4 -30.1	10 sf 50 sf 100 sf 10 sf 50 sf 100 sf -1.18 -1.11 -1.08 -21.8 -20.5 -19.9 -1.98 -1.49 -1.28 -36.5 -27.5 -23.6 -2.98 -1.79 -1.28 -55.0 -33.1 -23.6 0.48 0.41 0.38 10.0 10.0 10.0 -1.70 -1.63 -1.60 -31.4 -30.1 -29.5	10 sf 50 sf 100 sf 10 sf 50 sf 100 sf 10 sf 50 sf 100 sf 10 sf

Overhang pressures in the table above assume an internal pressure coefficient (Gcpi) of 0.0 Overhang soffit pressure equals adjacent wall pressure reduced by internal pressure of 3.3 psf

_ _

Parapet

```
qp =
     0.0 psf
```

CASE A = pressure towards building (pos) CASE B = pressure away from bldg (neg)

	Surfa	User input		
Solid Parapet Pressure	10 sf	100 sf	500 sf	40 sf
CASE A : Interior zone:	0.0	0.0	0.0	0.0
Corner zone:	0.0	0.0	0.0	0.0
CASE B : Interior zone:	0.0	0.0	0.0	0.0
Corner zone:	0.0	0.0	0.0	0.0

<u>Walls</u>	(GCp +/- GCp	pi	Surfa	ce Pressure	(psf)	User	input
Area	10 sf	100 sf	500 sf	10 sf	100 sf	500 sf	50 sf	91 sf
Negative Zone 4	-1.17	-1.01	-0.90	-21.6	-18.7	-16.6	-19.5	-18.8
Negative Zone 5	-1.44	-1.12	-0.90	-26.6	-20.7	-16.6	-22.5	-21.0
Positive Zone 4 & 5	1.08	0.92	0.81	19.9	17.0	14.9	17.9	17.1

Note: GCp reduced by 10% due to roof angle <= 10 deg.

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JOB TITLE Derkashani Residence

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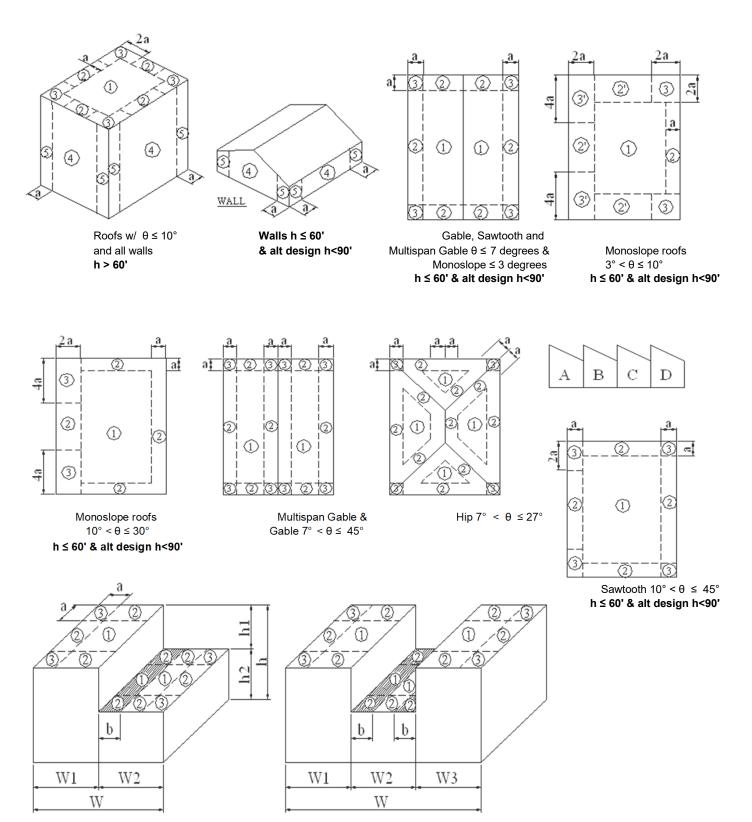
JOB NO. 167-2020 SHEET NO. CALCULATED BY JDA CHECKED BY

DATE Nominal Wind Pressures

DATE

2/23/21

Location of C&C Wind Pressure Zones



Stepped roofs $\theta \leq 3^{\circ}$ h ≤ 60' & alt design h<90'



Company:		Page:	1
Address:		Specifier:	
Phone I Fax:		E-Mail:	
Design:	CU1.5	Date:	3/3/2021
Fastening point:			

Specifier's comments:

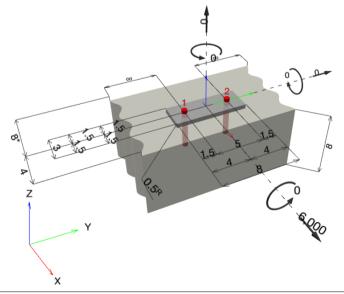
1 Input data



Anchor type and diameter:	KWIK HUS-EZ (KH-EZ) 5/8 (5)	
Item number:	418080 KH-EZ 5/8"x5 1/2"	
Effective embedment depth:	h _{ef,act} = 3.880 in., h _{nom} = 5.000 in.	
Material:	Carbon Steel	
Evaluation Service Report:	ESR-3027	
Issued I Valid:	7/1/2020 12/1/2021	
Proof:	Design Method ACI 318-14 / Mech	
Stand-off installation:	e _b = 0.000 in. (no stand-off); t = 0.500 in.	
Anchor plate ^R :	$l_x \ge l_y \ge t = 3.000$ in. x 8.000 in. x 0.500 in.; (Recomme	ended plate thickness: not calculated)
Profile:	no profile	
Base material:	uncracked concrete, 4000, f_c ' = 4,000 psi; h = 8.000 i	n.
Installation:	hammer drilled hole, Installation condition: Dry	
Reinforcement:	tension: condition A, shear: condition A; no suppleme	ental splitting reinforcement present
	edge reinforcement: > No. 4 bar with stirrups	
Seismic loads (cat. C, D, E, or F)	Tension load: yes (17.2.3.4.3 (d))	
	Shear load: yes (17.2.3.5.3 (c))	

 $^{\rm R}$ - The anchor calculation is based on a rigid anchor plate assumption.

Geometry [in.] & Loading [lb, in.lb]





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Company:		Page:		2
Address:		Specifier:		
Phone I Fax:		E-Mail:		
Design:	CU1.5	Date:		3/3/2021
Fastening point:				
1.1 Design result	s			
Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	$N = 0; V_x = 6,000; V_y = 0;$	yes	100
		$M_x = 0; M_y = 0; M_z = 0;$		



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Company:		Page:	3
Address:		Specifier:	
Phone I Fax:		E-Mail:	
Design: Fastening point:	ĊU1.5	Date:	3/3/2021

2 Proof I Utilization (Governing Cases)

		Design	/alues [lb]	Utilization	
Loading	Proof	Load	Capacity	β _N / β _V [%]	Status
Tension	-	-	-	- / -	N/A
Shear	Concrete edge failure in direction x+	6,000	6,001	- / 100	ОК
Loading	β _N	β _v	ζ	Utilization β _{N,V} [%]	Status
Combined tension and	shear loads -	-	-	-	N/A

3 Warnings

• Please consider all details and hints/warnings given in the detailed report!

Fastening meets the design criteria!



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Company:		Page:	4
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Design:	CU1.5	Date:	3/3/2021
Fastening point:			

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Address:		Specifier:	
Phone I Fax:		E-Mail.	
Design:	CU2.5	Date:	3/3/2021
Fastening point:			

Specifier's comments:

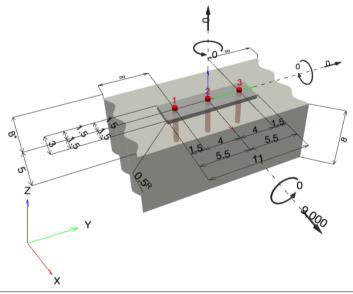
1 Input data

			•	1
-6-6-	11	<u>++</u>		

Anchor type and diameter:	KWIK HUS-EZ (KH-EZ) 5/8 (5)	
Item number:	418080 KH-EZ 5/8"x5 1/2"	
Effective embedment depth:	h _{ef,act} = 3.880 in., h _{nom} = 5.000 in.	
Material:	Carbon Steel	
Evaluation Service Report:	ESR-3027	
Issued I Valid:	7/1/2020 12/1/2021	
Proof:	Design Method ACI 318-14 / Mech	
Stand-off installation:	e _b = 0.000 in. (no stand-off); t = 0.500 in.	
Anchor plate ^R :	$l_x \ge l_y \ge t = 3.000$ in. x 11.000 in. x 0.500 in.; (Recommen	ded plate thickness: not calculated)
Profile:	no profile	
Base material:	uncracked concrete, 4000, f_c ' = 4,000 psi; h = 8.000 in.	
Installation:	hammer drilled hole, Installation condition: Dry	
Reinforcement:	tension: condition A, shear: condition A; no supplementa	al splitting reinforcement present
Seismic loads (cat. C, D, E, or F)	edge reinforcement: > No. 4 bar with stirrups Tension load: yes (17.2.3.4.3 (d))	
	Shear load: yes (17.2.3.5.3 (c))	

 $^{\rm R}$ - The anchor calculation is based on a rigid anchor plate assumption.

Geometry [in.] & Loading [lb, in.lb]





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Address:		Specifier:		
Phone I Fax:		E-Mail:		
Design:	CU2.5	Date:		3/3/2021
Fastening point:				
1.1 Design result	S			
Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	$N = 0; V_x = 9,000; V_y = 0;$	yes	100
		$M_x = 0; M_y = 0; M_z = 0;$	·	



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Phone I Fax:		E-Mail:	
Design: Fastening point:	CU2.5	Date:	3/3/2021

2 Proof I Utilization (Governing Cases)

		Design values [lb]		Utilization		
Loading	Proof	Load	Capacity	β _N / β _V [%]	Status	
Tension	-	-	-	- / -	N/A	
Shear	Concrete edge failure in direction x+	9,000	9,077	- / 100	ОК	
Loading	β _N	β _v	ζ	Utilization β _{N,V} [%]	Status	
Combined tension and sh	near loads -	-	-	-	N/A	

3 Warnings

• Please consider all details and hints/warnings given in the detailed report!

Fastening meets the design criteria!



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Fastening point:			

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Fastening point:			

Specifier's comments:

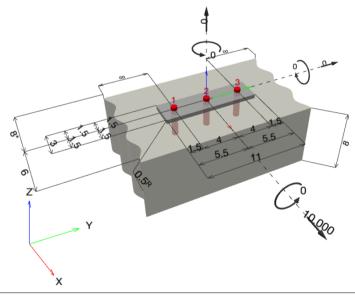
1 Input data

			1
	VV		

Anchor type and diameter:	KWIK HUS-EZ (KH-EZ) 3/4 (4)	
Item number:	418083 KH-EZ 3/4"x4 1/2"	
Effective embedment depth:	$h_{ef,act}$ = 2.920 in., h_{nom} = 4.000 in.	
Material:	Carbon Steel	
Evaluation Service Report:	ESR-3027	
Issued I Valid:	7/1/2020 12/1/2021	
Proof:	Design Method ACI 318-14 / Mech	
Stand-off installation:	e _b = 0.000 in. (no stand-off); t = 0.500 in.	
Anchor plate ^R :	$I_x \times I_y \times t = 3.000$ in. x 11.000 in. x 0.500 in.; (Recommen	ded plate thickness: not calculated)
Profile:	no profile	
Base material:	uncracked concrete, 4000, f_c ' = 4,000 psi; h = 8.000 in.	
Installation:	hammer drilled hole, Installation condition: Dry	
Reinforcement:	tension: condition A, shear: condition A; no supplementation	al splitting reinforcement present
	edge reinforcement: > No. 4 bar with stirrups	
Seismic loads (cat. C, D, E, or F)	Tension load: yes (17.2.3.4.3 (d))	
	Shear load: yes (17.2.3.5.3 (c))	

 $^{\rm R}$ - The anchor calculation is based on a rigid anchor plate assumption.

Geometry [in.] & Loading [lb, in.lb]





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Company:		Page:		2
Address:		Specifier:		
Phone I Fax:		E-Mail:		
Design:	ĊU3	Date:		3/3/2021
Fastening point:				
1.1 Design result	S			
Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	$N = 0; V_x = 10,000; V_y = 0;$	yes	95
		$M_x = 0; M_y = 0; M_z = 0;$	·	



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Address:		Specifier:	
Phone I Fax:		E-Mail:	
Design: Fastening point:	ĊU3	Date:	3/3/2021

2 Proof I Utilization (Governing Cases)

			Design values [lb]		Utilization	Status
Loading	Proof		Load	Capacity	β _N / β _V [%]	
Tension	-		-	-	- / -	N/A
Shear	Concrete edge failure in direction	on x+	10,000	10,575	- / 95	ОК
Loading		β _N	β _v	ζ	Utilization β _{N,V} [%]	Status
Combined tension and	shear loads	-	-	-	-	N/A

3 Warnings

• Please consider all details and hints/warnings given in the detailed report!

Fastening meets the design criteria!



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Address:		Specifier:	
Phone I Fax:		E-Mail:	
Design:	ĊU3	Date:	3/3/2021
Fastening point:			

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Company:		Page:	1
Address:		Specifier:	
Phone I Fax:	1	E-Mail:	
Design:	CU3.5	Date:	3/3/2021
Fastening point:			

Specifier's comments:

Anchor type and diameter:

Effective embedment depth:

Evaluation Service Report:

1 Input data

Item number:

Issued I Valid: Proof:

Stand-off installation:

Material:

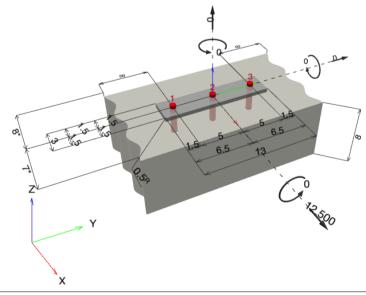
KWIK HUS-EZ (KH-EZ) 3/4 (4) 418083 KH-EZ 3/4"x4 1/2"	
$h_{ef,act}$ = 2.920 in., h_{nom} = 4.000 in.	
Carbon Steel	
ESR-3027	
7/1/2020 12/1/2021	
Design Method ACI 318-14 / Mech	
$e_{b} = 0.000$ in. (no stand-off); t = 0.500 in.	
l _x x l _y x t = 3.000 in. x 13.000 in. x 0.500 in.; (Recor	nmended plate thickness: not calculated)
no profile	

Anchor plate ^R :	$l_x x l_y x t = 3.000$ in. x 13.000 in. x 0.500 in.; (Recommended plate thickness: not calculate
Profile:	no profile
Base material:	uncracked concrete, 4000, f_c ' = 4,000 psi; h = 8.000 in.
Installation:	hammer drilled hole, Installation condition: Dry
Reinforcement:	tension: condition A, shear: condition A; no supplemental splitting reinforcement present
	edge reinforcement: > No. 4 bar with stirrups
Seismic loads (cat. C, D, E, or F)	Tension load: yes (17.2.3.4.3 (d))

Shear load: yes (17.2.3.5.3 (c))

 $^{\rm R}$ - The anchor calculation is based on a rigid anchor plate assumption.

Geometry [in.] & Loading [lb, in.lb]



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Address:		Specifier:		
Phone I Fax:		E-Mail:		
Design:	CU3.5	Date:		3/3/2021
Fastening point:				
1.1 Design result	s			
Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	$N = 0; V_x = 12,500; V_y = 0;$	yes	100
		$M_x = 0; M_y = 0; M_z = 0;$	·	



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Address:		Specifier:	
Phone I Fax:		E-Mail:	
Design: Fastening point:	ĊU3.5	Date:	3/3/2021

2 Proof I Utilization (Governing Cases)

		Design values [lb]		Utilization		
Loading	Proof	Load	Capacity	β _N / β _V [%]	Status	
Tension	-	-	-	- / -	N/A	
Shear	Concrete edge failure in direction x+	12,500	12,608	- / 100	OK	
Loading	β _N	β _v	ζ	Utilization β _{ν,ν} [%]	Status	
Combined tension and s	hear loads -	-	-	-	N/A	

3 Warnings

• Please consider all details and hints/warnings given in the detailed report!

Fastening meets the design criteria!



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Address:		Specifier:	
Phone I Fax:		E-Mail:	
Design:	CU3.5	Date:	3/3/2021
Fastening point:			

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Company:		Page:	1
Address:		Specifier:	
Phone I Fax:	1	E-Mail:	
Design:	ĊU5	Date:	3/3/2021
Fastening point:			

Specifier's comments:

Anchor type and diameter:

Effective embedment depth:

Evaluation Service Report:

1 Input data

Item number:

Issued I Valid:

Anchor plate^R:

Base material:

Reinforcement:

Installation:

Stand-off installation:

Material:

Proof:

Profile:

KWIK HUS-EZ (KH-EZ) 3/4 (4)	
418083 KH-EZ 3/4"x4 1/2"	F
h _{ef,act} = 2.920 in., h _{nom} = 4.000 in.	
Carbon Steel	
ESR-3027	
7/1/2020 12/1/2021	
Design Method ACI 318-14 / Mech	
e _b = 0.000 in. (no stand-off); t = 0.500 in.	

l_x x l_y x t = 3.000 in. x 16.500 in. x 0.500 in.; (Recommended plate thickness: not calculated)

tension: condition A, shear: condition A; no supplemental splitting reinforcement present

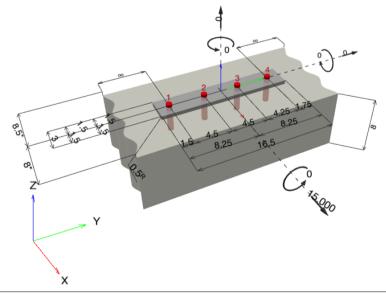
Shear load: yes (17.2.3.5.3 (c))

no profile

^R - The anchor calculation is based on a rigid anchor plate assumption.

Geometry [in.] & Loading [lb, in.lb]

Seismic loads (cat. C, D, E, or F)



uncracked concrete, 4000, $f_c' = 4,000$ psi; h = 8.000 in.

hammer drilled hole, Installation condition: Dry

edge reinforcement: > No. 4 bar with stirrups

Tension load: yes (17.2.3.4.3 (d))



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Company:		Page:		2
Address:		Specifier:		
Phone I Fax:		E-Mail:		
Design:	ĊU5	Date:		3/3/2021
Fastening point:				
1.1 Design result	S			
Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	$N = 0; V_x = 15,000; V_y = 0;$	yes	100
		$M_x = 0; M_y = 0; M_z = 0;$		



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Company:		Page:	3
Address:		Specifier:	
Phone I Fax:		E-Mail:	
Design: Fastening point:	ĊU5	Date:	3/3/2021

2 Proof I Utilization (Governing Cases)

			Design values [lb]		Utilization		
Loading	Proof		Load	Capacity	β _N / β _V [%]	Status	
Tension	-		-	-	- / -	N/A	
Shear	Concrete edge failure in directio	n x+	15,000	15,072	- / 100	OK	
Loading	1	β _N	β _v	ζ	Utilization β _{N,V} [%]	Status	
Combined tension and	shear loads	-	-	-	-	N/A	

3 Warnings

• Please consider all details and hints/warnings given in the detailed report!

Fastening meets the design criteria!



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Company:		Page:	4
Address:		Specifier:	
Phone I Fax:		E-Mail:	
Design:	ĊU5	Date:	3/3/2021
Fastening point:			

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Company:		Page:	1
Address:		Specifier:	
Phone I Fax:		E-Mail:	
Design:	ĊU6	Date:	3/3/2021
Fastening point:			

Specifier's comments:

Anchor type and diameter:

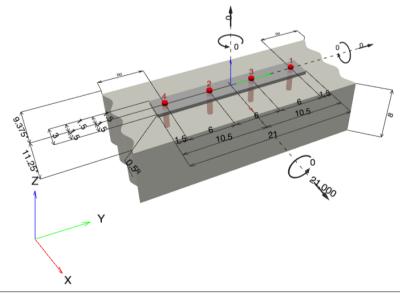
1 Input data

Item number:	418083 KH-EZ 3/4"x4 1/2"
Effective embedment depth:	h _{ef,act} = 2.920 in., h _{nom} = 4.000 in.
Material:	Carbon Steel
Evaluation Service Report:	ESR-3027
Issued I Valid:	7/1/2020 12/1/2021
Proof:	Design Method ACI 318-14 / Mech
Stand-off installation:	e _b = 0.000 in. (no stand-off); t = 0.500 in.
Anchor plate ^R :	$I_x \times I_y \times t$ = 3.000 in. x 21.000 in. x 0.500 in.; (Recommended plate thickness: not calculated)
Profile:	no profile
Base material:	uncracked concrete, 4000, f_c = 4,000 psi; h = 8.000 in.
Installation:	hammer drilled hole, Installation condition: Dry
Reinforcement:	tension: condition A, shear: condition A; no supplemental splitting reinforcement present
	edge reinforcement: > No. 4 bar with stirrups
Seismic loads (cat. C, D, E, or F)	Tension load: yes (17.2.3.4.3 (d))
	Shear load: yes (17.2.3.5.3 (c))

KWIK HUS-EZ (KH-EZ) 3/4 (4)

 $^{\rm R}$ - The anchor calculation is based on a rigid anchor plate assumption.

Geometry [in.] & Loading [lb, in.lb]





Hilti PROFIS Engineering 3.0.67

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Company:		Page:		2
Address:		Specifier:		
Phone I Fax:		E-Mail:		
Design:	CU6	Date:		3/3/2021
Fastening point:				
1.1 Design result	S			
Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	$N = 0; V_x = 21,000; V_y = 0;$	yes	100
		$M_x = 0; M_y = 0; M_z = 0;$	·	

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Address:		Specifier:	
Phone I Fax:		E-Mail:	
Design:	ĊU6	Date:	3/3/2021
Fastening point:			

2 Proof I Utilization (Governing Cases)

		Design	/alues [lb]	Utilization		
Loading	Proof	Load	Capacity	β _N / β _V [%]	Status	
Tension	-	-	-	- / -	N/A	
Shear	Concrete edge failure in direction x+	21,000	21,048	- / 100	OK	
Loading	β _N	β _v	ζ	Utilization β _{ν,ν} [%]	Status	
Combined tension and	shear loads -	-	-	-	N/A	

3 Warnings

• Please consider all details and hints/warnings given in the detailed report!

Fastening meets the design criteria!

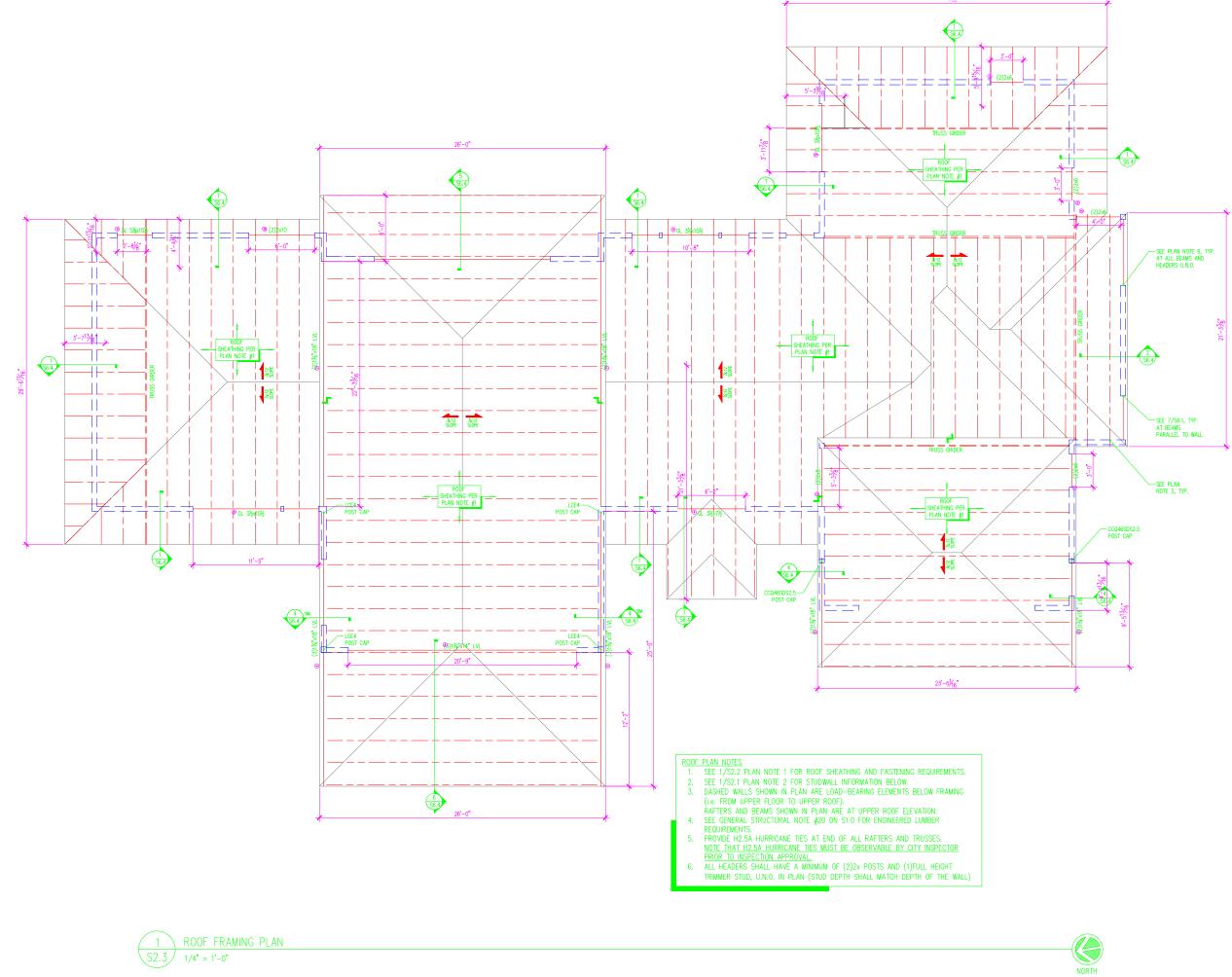


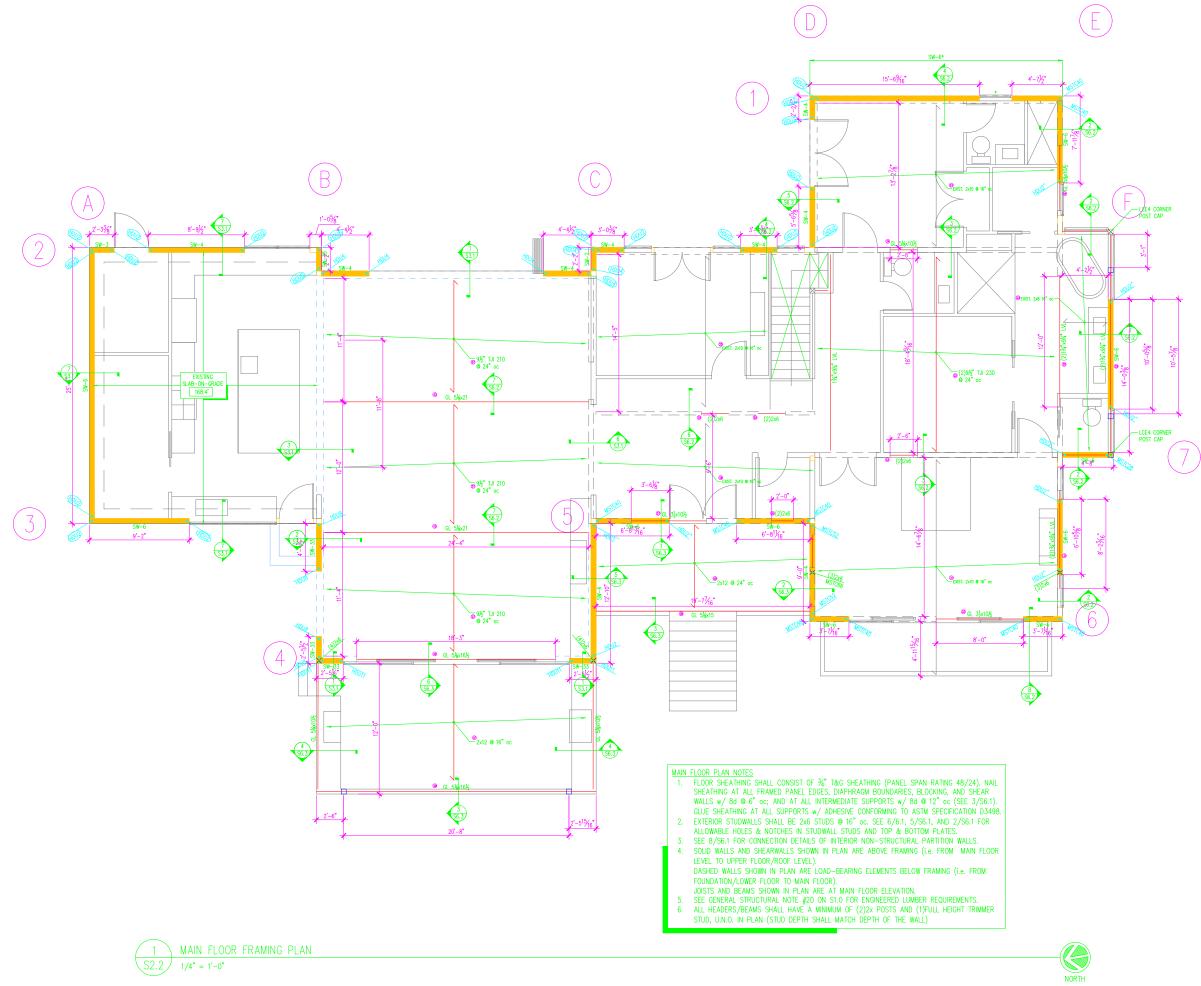
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Address:		Specifier:	
Phone I Fax:		E-Mail:	
Design:	ĊU6	Date:	3/3/2021
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Derkashani

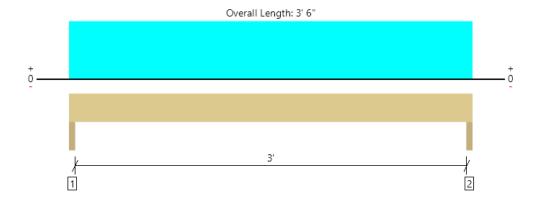
Roof						
Member Name	Results	Current Solution	Comments			
1	Passed	2 piece(s) 2 x 6 Douglas Fir-Larch No. 1				
2	Failed	2 piece(s) 1 3/4" x 18" 2.0E Microllam® LVL	Multiple Failures/Errors			
3	Passed	2 piece(s) 2 x 8 Douglas Fir-Larch No. 1				
4	Passed	1 piece(s) 3 1/2" x 7 1/2" 24F-V4 DF Glulam				
5	Failed	3 piece(s) 1 3/4" x 18" 2.0E Microllam® LVL	Right cantilever exceeds the maximum braced cantilever length of 7'.			
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 Douglas Fir-Larch No. 1				
10	Passed	2 piece(s) 2 x 10 Douglas Fir-Larch 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 Douglas Fir-Larch No. 1				
14	Passed	2 piece(s) 2 x 4 Douglas Fir-Larch No. 1				
15	Passed	2 piece(s) 2 x 6 Douglas Fir-Larch No. 1				
Main Floor						
Member Name	Results	Current Solution	Comments			
21	Passed	1 piece(s) 2 x 10 Douglas Fir-Larch No. 1 @ 16" OC				
22	Passed	2 piece(s) 9 1/2" TJI ® 230 @ 24" OC				
23	Passed	1 piece(s) 2 x 10 Douglas Fir-Larch No. 1 @ 16" OC				
24	Passed	1 piece(s) 2 x 10 Douglas Fir-Larch No. 1 @ 16" OC				
25	Passed	1 piece(s) 2 x 10 Douglas Fir-Larch No. 1 @ 16" OC				
26	Passed	1 piece(s) 2 x 10 Douglas Fir-Larch No. 1 @ 16" OC				
27	Passed	1 piece(s) 9 1/2" TJI ® 210 @ 24" OC				
29	Passed	2 piece(s) 1 3/4" x 9 1/4" 2.0E Microllam® LVL				
30	Passed	2 piece(s) 1 3/4" x 9 1/4" 2.0E Microllam® LVL				
31	Failed	2 piece(s) 1 3/4" x 9 1/4" 2.0E Microllam® LVL	Multiple Failures/Errors			
32	Passed	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam				
33	Passed	2 piece(s) 2 x 6 Douglas Fir-Larch No. 1				
34	Passed	2 piece(s) 2 x 6 Douglas Fir-Larch No. 1				
35	Passed	2 piece(s) 2 x 6 Douglas Fir-Larch No. 1				
36	Passed	2 piece(s) 2 x 4 Douglas Fir-Larch No. 1				
37	Passed	1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam				
38	Passed	1 piece(s) 5 1/8" x 15" 24F-V4 DF Glulam				
39	Passed	1 piece(s) 5 1/8" x 16 1/2" 24F-V4 DF Glulam				
40	Passed	1 piece(s) 2 x 12 Douglas Fir-Larch No. 1 @ 24" OC				
41	Passed	1 piece(s) 2 x 12 Douglas Fir-Larch No. 1 @ 24" OC				
43	Passed	1 piece(s) 5 1/8" x 16 1/2" 24F-V4 DF Glulam				
44	Passed	1 piece(s) 5 1/8" x 21" 24F-V4 DF Glulam				





Roof, 1 2 piece(s) 2 x 6 Douglas Fir-Larch 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)	933 @ 1 1/2"	5625 (3.00")	Passed (17%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	555 @ 8 1/2"	2277	Passed (24%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	704 @ 1' 9"	1884	Passed (37%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.010 @ 1' 9"	0.108	Passed (L/999+)		1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.019 @ 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 t	o Supports (
Supports	Total	Available	Required	Dead	Snow	Total	Accessories
1 - Trimmer - DF	3.00"	3.00"	1.50"	419	514	933	None
2 - Trimmer - DF	3.00"	3.00"	1.50"	419	514	933	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 (Side)	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	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
 Job Notes

 Javid Abdi

 Atlas Consulting Engineers

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 javiddabdi@yahoo.com



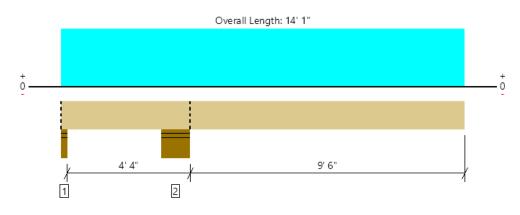


FAILED

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

Right cantilever exceeds the maximum braced cantilever length of 7'.

An excessive uplift of -6353 lbs at support located at 1 1/2" failed this product.



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)	13756 @ 4'	30625 (14.00")	Passed (45%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	7120 @ 1' 11"	13766	Passed (52%)	1.15	1.0 D + 1.0 S (Alt Spans)
Moment (Ft-lbs)	-27817 @ 4'	33424	Passed (83%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.317 @ 14' 1"	1.008	Passed (2L/764)		1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.589 @ 14' 1"	1.344	Passed (2L/410)		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	-3551	-6353	Blocking
2 - Stud wall - DF	14.00"	14.00"	6.29"	6371	7385	13756	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)	6' 7" o/c				
Maximum allowable bracing intervals based on applied load					

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 14' 1"	N/A	18.4		
1 - Uniform (PSF)	0 to 14' 1" (Front)	11' 9"	20.0	25.0	Default Load

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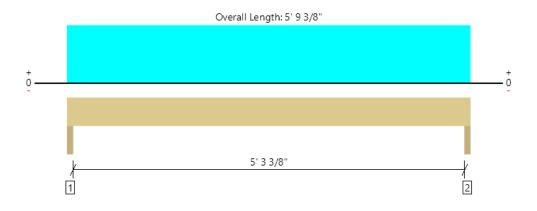
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

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





Roof, 3 2 piece(s) 2 x 8 Douglas Fir-Larch 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)	1544 @ 1 1/2"	5625 (3.00")	Passed (27%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	1088 @ 10 1/4"	3002	Passed (36%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	2043 @ 2' 10 11/16"	3022	Passed (68%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.038 @ 2' 10 11/16"	0.184	Passed (L/999+)		1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.069 @ 2' 10 11/16"	0.277	Passed (L/955)		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	849	1544	None
2 - Trimmer - DF	3.00"	3.00"	1.50"	695	849	1544	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 (Side)	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	25.0	Default Load

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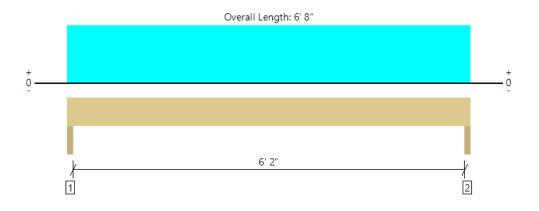
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Roof, 4 1 piece(s) 3 1/2" x 7 1/2" 24F-V4 DF Glulam





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)	3214 @ 1 1/2"	6825 (3.00")	Passed (47%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	2370 @ 10 1/2"	5333	Passed (44%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-Ibs)	4962 @ 3' 4"	7547	Passed (66%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.092 @ 3' 4"	0.214	Passed (L/840)		1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.166 @ 3' 4"	0.321	Passed (L/464)		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 (Ibs)			
Supports	Total	Available	Required	Dead	Snow	Total	Accessories
1 - Trimmer - DF	3.00"	3.00"	1.50"	1440	1773	3213	None
2 - Trimmer - DF	3.00"	3.00"	1.50"	1440	1773	3213	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 (Side)	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	25.0	Default Load

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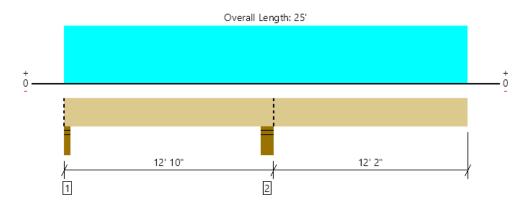
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Roof, 5 3 piece(s) 1 3/4" x 18" 2.0E Microllam® LVL

Right cantilever exceeds the maximum braced cantilever length of 7'.



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)	15213 @ 12' 7"	19688 (6.00")	Passed (77%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	6535 @ 10' 10"	20648	Passed (32%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-Ibs)	-47225 @ 12' 7"	50137	Passed (94%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.740 @ 25'	1.242	Passed (2L/402)		1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	1.346 @ 25'	1.656	Passed (2L/222)		1.0 D + 1.0 S (Alt Spans)

• 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.

- -930 lbs uplift at support located at 1 1/2". Strapping or other restraint may be required.

	Bearing Length		Loads to Supports (Ibs)					
Supports	Total	Available	Required	Dead	Snow	Total	Accessories	
1 - Stud wall - SPF	3.00"	3.00"	1.50"	48	1060/-978	1108/- 978	Blocking	
2 - Stud wall - DF	6.00"	6.00"	4.64"	7143	8071	15214	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)	25' o/c				
Bottom Edge (Lu)	7' 5" o/c				

kimum 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	27.6		
1 - Uniform (PSF)	0 to 25' (Front)	13'	20.0	25.0	Default Load

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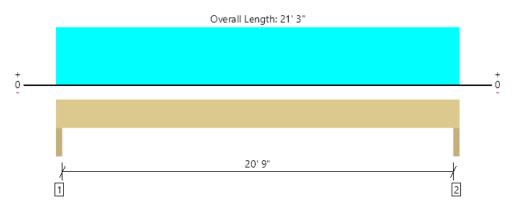
Job Notes



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



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)	3681 @ 1 1/2"	11813 (3.00")	Passed (31%)		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)	0.095 @ 10' 7 1/2"	0.700	Passed (L/999+)		1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.661 @ 10' 7 1/2"	1.050	Passed (L/381)		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	531	3681	None
2 - Trimmer - DF	3.00"	3.00"	1.50"	3150	531	3681	None

Lateral Bracing	Bracing Intervals	Comments				
Top Edge (Lu)	17' 8" o/c					
Bottom Edge (Lu)	21' 3" o/c					
Maximum alloughts have been as a second as a second and						

•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 21' 3"	N/A	21.5		
1 - Uniform (PSF)	0 to 21' 3"	2'	20.0	25.0	Default Load
2 - Uniform (PSF)	0 to 21' 3"	11' 9"	20.0	-	Weight of Hung Door

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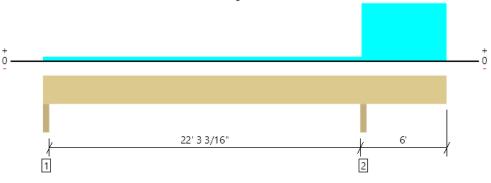


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Roof, 7 2 piece(s) 1 3/4" x 18" 2.0E Microllam® LVL

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)	5093 @ 22' 7 11/16"	7875 (3.00")	Passed (65%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	2756 @ 24' 3 3/16"	13766	Passed (20%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	-11191 @ 22' 7 11/16"	44566	Passed (25%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.155 @ 28' 6 3/16"	0.392	Passed (2L/910)		1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.248 @ 28' 6 3/16"	0.587	Passed (2L/568)		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	151/-126	359/- 126	None
2 - Trimmer - DF	3.00"	3.00"	1.94"	2447	2646	5093	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	28' 6" o/c	
Bottom Edge (Lu)	19' 4" o/c	
Bottom Edge (Lu)		

•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 28' 6 3/16"	N/A	18.4		
1 - Uniform (PSF)	0 to 28' 6 3/16"	1'	20.0	25.0	Default Load
2 - Uniform (PSF)	22' 6 3/16" to 28' 6 3/16"	13'	20.0	25.0	

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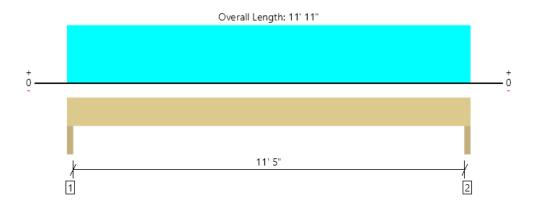
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Roof, 8 1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam





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)	4020 @ 1 1/2"	6825 (3.00")	Passed (59%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	3261 @ 1' 1 1/2"	7466	Passed (44%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-Ibs)	11478 @ 5' 11 1/2"	14792	Passed (78%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.254 @ 5' 11 1/2"	0.389	Passed (L/552)		1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.463 @ 5' 11 1/2"	0.583	Passed (L/303)		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 (Ibs)			
Supports	Total	Available	Required	Dead	Snow	Total	Accessories
1 - Trimmer - DF	3.00"	3.00"	1.77"	1816	2203	4019	None
2 - Trimmer - DF	3.00"	3.00"	1.77"	1816	2203	4019	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 (Side)	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	25.0	Default Load

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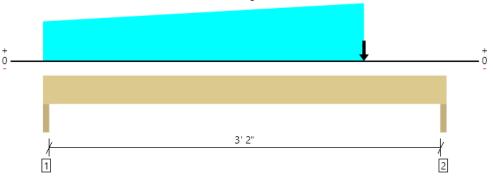






Roof, 9 2 piece(s) 2 x 8 Douglas Fir-Larch No. 1

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)	3264 @ 3' 6 1/2"	5625 (3.00")	Passed (58%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	2595 @ 2' 9 3/4"	3002	Passed (86%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	2038 @ 2' 11"	3022	Passed (67%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.011 @ 1' 11 5/16"	0.114	Passed (L/999+)		1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.021 @ 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

PASSED

• 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	536	975	None
2 - Trimmer - DF	3.00"	3.00"	1.74"	1456	1808	3264	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 (Side)	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	25.0	Default Load
2 - Point (Ib)	2' 11"	N/A	1660	2075	83 SF from Truss Girder

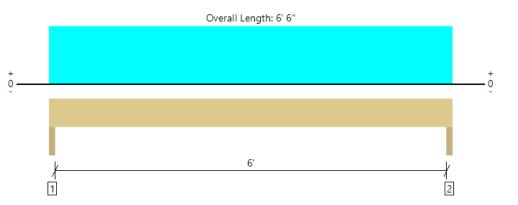
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Roof, 10 2 piece(s) 2 x 10 Douglas Fir-Larch No. 1



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

	i				
Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2192 @ 1 1/2"	5625 (3.00")	Passed (39%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	1504 @ 1' 1/4"	3830	Passed (39%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	3294 @ 3' 3"	4510	Passed (73%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.038 @ 3' 3"	0.208	Passed (L/999+)		1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.069 @ 3' 3"	0.313	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 t	o Supports (
Supports	Total	Available	Required	Dead	Snow	Total	Accessories
1 - Trimmer - DF	3.00"	3.00"	1.50"	987	1205	2192	None
2 - Trimmer - DF	3.00"	3.00"	1.50"	987	1205	2192	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 (Side)	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	25.0	Default Load

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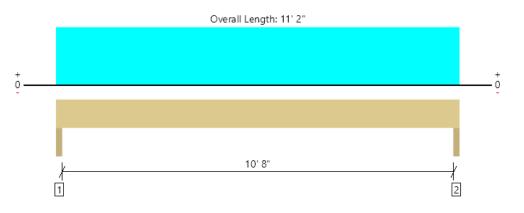
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Roof, 11 1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam



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)	3777 @ 1 1/2"	6825 (3.00")	Passed (55%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	3016 @ 1' 1 1/2"	7466	Passed (40%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-Ibs)	10078 @ 5' 7"	14792	Passed (68%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.195 @ 5' 7"	0.364	Passed (L/672)		1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.356 @ 5' 7"	0.546	Passed (L/368)		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 (Ibs)			
Supports	Total	Available	Required	Dead	Snow	Total	Accessories
1 - Trimmer - DF	3.00"	3.00"	1.66"	1707	2070	3777	None
2 - Trimmer - DF	3.00"	3.00"	1.66"	1707	2070	3777	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 (Side)	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	25.0	Default Load

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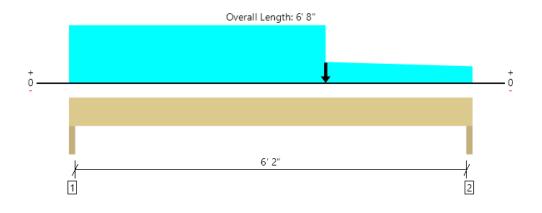
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Roof, 12 1 piece(s) 3 1/2" x 9" 24F-V4 DF Glulam



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)	3656 @ 6' 6 1/2"	6825 (3.00")	Passed (54%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	3449 @ 5' 8"	6400	Passed (54%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-Ibs)	7789 @ 4' 2 7/8"	10868	Passed (72%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.075 @ 3' 5 1/16"	0.214	Passed (L/999+)		1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.135 @ 3' 5 1/16"	0.321	Passed (L/571)		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 t	o Supports		
Supports	Total	Available	Required	Dead	Snow	Total	Accessories
1 - Trimmer - DF	3.00"	3.00"	1.50"	1500	1842	3342	None
2 - Trimmer - DF	3.00"	3.00"	1.61"	1639	2017	3656	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 (Side)	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	25.0	Default Load
2 - Point (lb)	4' 2 7/8"	N/A	1620	2025	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	25.0	Default Load

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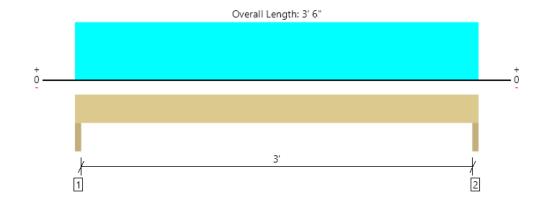


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Roof, 13 2 piece(s) 2 x 4 Douglas Fir-Larch No. 1





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)	431 @ 1 1/2"	5625 (3.00")	Passed (8%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	298 @ 6 1/2"	1449	Passed (21%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	325 @ 1' 9"	880	Passed (37%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.019 @ 1' 9"	0.108	Passed (L/999+)		1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.034 @ 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 t	o Supports		
Supports	Total	Available	Required	Dead	Snow	Total	Accessories
1 - Trimmer - DF	3.00"	3.00"	1.50"	194	237	431	None
2 - Trimmer - DF	3.00"	3.00"	1.50"	194	237	431	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 (Side)	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	25.0	Default Load

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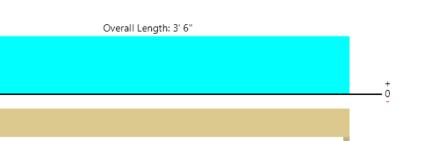
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Roof, 14 2 piece(s) 2 x 4 Douglas Fir-Larch No. 1

3'



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)	1153 @ 1 1/2"	5625 (3.00")	Passed (21%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	796 @ 6 1/2"	1449	Passed (55%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	870 @ 1' 9"	880	Passed (99%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.050 @ 1' 9"	0.108	Passed (L/777)		1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.091 @ 1' 9"	0.162	Passed (L/430)		1.0 D + 1.0 S (All Spans)

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

2

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

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

0

1

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"	515	638	1153	None
2 - Trimmer - DF	3.00"	3.00"	1.50"	515	638	1153	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 (Side)	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"	14' 7"	20.0	25.0	Default Load

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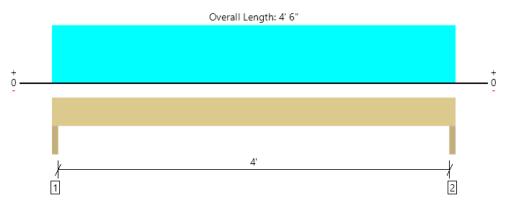
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Roof, 15 2 piece(s) 2 x 6 Douglas Fir-Larch No. 1



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)	1090 @ 1 1/2"	5625 (3.00")	Passed (19%)		1.0 D + 1.0 S (All Spans)
Shear (lbs)	747 @ 8 1/2"	2277	Passed (33%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1093 @ 2' 3"	1884	Passed (58%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.028 @ 2' 3"	0.142	Passed (L/999+)		1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.050 @ 2' 3"	0.213	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

PASSED

• 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"	490	600	1090	None
2 - Trimmer - DF	3.00"	3.00"	1.50"	490	600	1090	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 (Side)	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	25.0	Default Load

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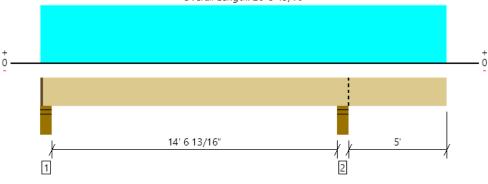
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Main Floor, 21 1 piece(s) 2 x 10 Douglas Fir-Larch No. 1 @ 16" OC

Overall Length: 20' 5 13/16"



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)	1178 @ 15' 3 1/16"	5156 (5.50")	Passed (23%)		1.0 D + 1.0 L (All Spans)
Shear (lbs)	638 @ 14' 3 1/16"	1665	Passed (38%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2177 @ 7' 5 9/16"	2255	Passed (97%)	1.00	1.0 D + 1.0 L (Alt Spans)
Live Load Defl. (in)	0.350 @ 7' 9 13/16"	0.372	Passed (L/510)		1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.504 @ 7' 8 3/16"	0.744	Passed (L/354)		1.0 D + 1.0 L (Alt Spans)
TJ-Pro [™] Rating	N/A	N/A	N/A		N/A

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

PASSED

• Deflection criteria: LL (L/480) and TL (L/240).

• Overhang deflection criteria: LL (2L/480) and TL (2L/240). Upward deflection on right cantilever exceeds overhang deflection criteria.

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

• A 15% increase in the moment capacity has been added to account for repetitive member usage.

• Upward deflection on right cantilever exceeds 0.4".

· Applicable calculations are based on NDS.

· No composite action between deck and joist was considered in analysis.

	Bearing Length			Loads to Supports (lbs)			
Supports	Total	Available	Required	Dead	Floor Live	Total	Accessories
1 - Stud wall - DF	5.50"	4.25"	1.50"	230	417/-43	647/-43	1 1/4" Rim Board
2 - Stud wall - DF	5.50"	5.50"	1.50"	453	725	1178	Blocking

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

• 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)	2' 6" o/c				
Bottom Edge (Lu)	11' 8" o/c				
•Maximum allowable bracing intervals based on applied load.					

			Dead	Floor Live	
Vertical Load	Location (Side)	Spacing	(0.90)	(1.00)	Comments
1 - Uniform (PSF)	0 to 20' 5 13/16"	16"	25.0	40.0	Default Load

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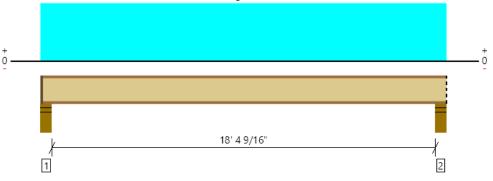
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Main Floor, 22 2 piece(s) 9 1/2" TJI ® 230 @ 24" OC

Overall Length: 19' 3 9/16"



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)	1254 @ 18' 11 1/16"	2970 (3.50")	Passed (42%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1195 @ 5 1/2"	2660	Passed (45%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	5590 @ 9' 7 13/16"	6660	Passed (84%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.473 @ 9' 7 13/16"	0.464	Passed (L/471)		1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.768 @ 9' 7 13/16"	0.927	Passed (L/290)		1.0 D + 1.0 L (All Spans)
TJ-Pro [™] Rating	30	Any	Passed		

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

Deflection criteria: LL (L/480) and TL (L/240).

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

A structural analysis of the deck has not been performed.

• Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser EdgeTM Panel (24" Span Rating) that is glued and nailed down.

• Additional considerations for the TJ-Pro[™] Rating include: None.

	Bearing Length			Loads to Supports (Ibs)			
Supports	Total	Available	Required	Dead	Floor Live	Total	Accessories
1 - Stud wall - DF	5.50"	4.25"	1.75"	482	772	1254	1 1/4" Rim Board
2 - Stud wall - DF	5.50"	5.50"	1.75"	482	772	1254	Blocking

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

• 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)	4' 4" o/c	
Bottom Edge (Lu)	19' 2" o/c	

•TJI joists are only analyzed using Maximum Allowable bracing solutions.

•Maximum allowable bracing intervals based on applied load.

			Dead	Floor Live	
Vertical Load	Location (Side)	Spacing	(0.90)	(1.00)	Comments
1 - Uniform (PSF)	0 to 19' 3 9/16"	24"	25.0	40.0	Default Load

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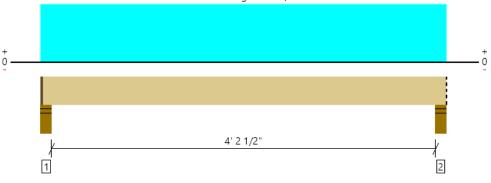
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Main Floor, 23 1 piece(s) 2 x 10 Douglas Fir-Larch No. 1 @ 16" OC





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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	213 @ 4 1/2"	3984 (4.25")	Passed (5%)		1.0 D + 1.0 L (All Spans)
Shear (lbs)	116 @ 1' 2 3/4"	1665	Passed (7%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	207 @ 2' 6 3/4"	2255	Passed (9%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.003 @ 2' 6 3/4"	0.109	Passed (L/999+)		1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.004 @ 2' 6 3/4"	0.219	Passed (L/999+)		1.0 D + 1.0 L (All Spans)
TJ-Pro [™] Rating	N/A	N/A	N/A		N/A

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

• Deflection criteria: LL (L/480) and TL (L/240).

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

• A 15% increase in the moment capacity has been added to account for repetitive member usage.

• Applicable calculations are based on NDS.

· No composite action between deck and joist was considered in analysis.

	Bearing Length		Loads to Supports (Ibs)				
Supports	Total	Available	Required	Dead	Floor Live	Total	Accessories
1 - Stud wall - DF	5.50"	4.25"	1.50"	85	137	222	1 1/4" Rim Board
2 - Stud wall - DF	5.50"	5.50"	1.50"	85	137	222	Blocking

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

• 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)	5' o/c	
Bottom Edge (Lu)	5' o/c	

•Maximum allowable bracing intervals based on applied load.

			Dead	Floor Live	
Vertical Load	Location (Side)	Spacing	(0.90)	(1.00)	Comments
1 - Uniform (PSF)	0 to 5' 1 1/2"	16"	25.0	40.0	Default Load

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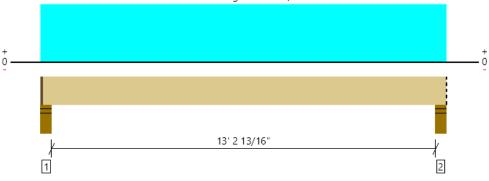
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Main Floor, 24 1 piece(s) 2 x 10 Douglas Fir-Larch No. 1 @ 16" OC

Overall Length: 14' 1 13/16"



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)	604 @ 4 1/2"	3984 (4.25")	Passed (15%)		1.0 D + 1.0 L (All Spans)
Shear (lbs)	507 @ 1' 2 3/4"	1665	Passed (30%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1946 @ 7' 15/16"	2255	Passed (86%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.230 @ 7' 15/16"	0.335	Passed (L/699)		1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.374 @ 7' 15/16"	0.670	Passed (L/430)		1.0 D + 1.0 L (All Spans)
TJ-Pro [™] Rating	N/A	N/A	N/A		N/A

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

• Deflection criteria: LL (L/480) and TL (L/240).

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

• A 15% increase in the moment capacity has been added to account for repetitive member usage.

Applicable calculations are based on NDS.

· No composite action between deck and joist was considered in analysis.

	Bearing Length			Loads t	o Supports		
Supports	Total	Available	Required	Dead	Floor Live	Total	Accessories
1 - Stud wall - DF	5.50"	4.25"	1.50"	236	377	613	1 1/4" Rim Board
2 - Stud wall - DF	5.50"	5.50"	1.50"	236	377	613	Blocking

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

• 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)	5' 1" o/c	
Bottom Edge (Lu)	14' 1" o/c	

•Maximum allowable bracing intervals based on applied load.

			Dead	Floor Live	
Vertical Load	Location (Side)	Spacing	(0.90)	(1.00)	Comments
1 - Uniform (PSF)	0 to 14' 1 13/16"	16"	25.0	40.0	Default Load

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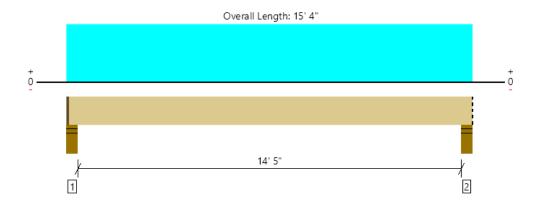
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Main Floor, 25 1 piece(s) 2 x 10 Douglas Fir-Larch No. 1 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	655 @ 4 1/2"	3984 (4.25")	Passed (16%)		1.0 D + 1.0 L (All Spans)
Shear (lbs)	558 @ 1' 2 3/4"	1665	Passed (34%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2304 @ 7' 8"	2255	Passed (102%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.323 @ 7' 8"	0.365	Passed (L/542)		1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.524 @ 7' 8"	0.729	Passed (L/334)		1.0 D + 1.0 L (All Spans)
TJ-Pro [™] Rating	N/A	N/A	N/A		N/A

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

• Deflection criteria: LL (L/480) and TL (L/240).

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

• A 15% increase in the moment capacity has been added to account for repetitive member usage.

Applicable calculations are based on NDS.

• No composite action between deck and joist was considered in analysis.

	Bearing Length			Loads t	o Supports		
Supports	Total	Available	Required	Dead	Floor Live	Total	Accessories
1 - Stud wall - DF	5.50"	4.25"	1.50"	256	409	665	1 1/4" Rim Board
2 - Stud wall - DF	5.50"	5.50"	1.50"	256	409	665	Blocking

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

• 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)	6" o/c	
Bottom Edge (Lu)	15' 3" o/c	

•Maximum allowable bracing intervals based on applied load.

			Dead	Floor Live	
Vertical Load	Location (Side)	Spacing	(0.90)	(1.00)	Comments
1 - Uniform (PSF)	0 to 15' 4"	16"	25.0	40.0	Default Load

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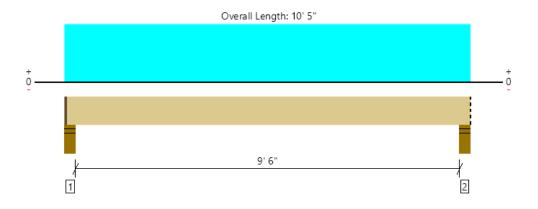
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Main Floor, 26 1 piece(s) 2 x 10 Douglas Fir-Larch No. 1 @ 16" OC



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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	442 @ 4 1/2"	3984 (4.25")	Passed (11%)		1.0 D + 1.0 L (All Spans)
Shear (lbs)	345 @ 1' 2 3/4"	1665	Passed (21%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1012 @ 5' 2 1/2"	2255	Passed (45%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.062 @ 5' 2 1/2"	0.242	Passed (L/999+)		1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.101 @ 5' 2 1/2"	0.483	Passed (L/999+)		1.0 D + 1.0 L (All Spans)
TJ-Pro [™] Rating	N/A	N/A	N/A		N/A

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

• Deflection criteria: LL (L/480) and TL (L/240).

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

• A 15% increase in the moment capacity has been added to account for repetitive member usage.

• Applicable calculations are based on NDS.

· No composite action between deck and joist was considered in analysis.

	Bearing Length		Loads to Supports (lbs)				
Supports	Total	Available	Required	Dead	Floor Live	Total	Accessories
1 - Stud wall - DF	5.50"	4.25"	1.50"	174	278	452	1 1/4" Rim Board
2 - Stud wall - DF	5.50"	5.50"	1.50"	174	278	452	Blocking

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

• 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)	10' 4" o/c	
Bottom Edge (Lu)	10' 4" o/c	

•Maximum allowable bracing intervals based on applied load.

			Dead	Floor Live	
Vertical Load	Location (Side)	Spacing	(0.90)	(1.00)	Comments
1 - Uniform (PSF)	0 to 10' 5"	16"	25.0	40.0	Default Load

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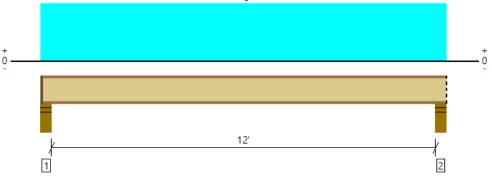
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Main Floor, 27 1 piece(s) 9 1/2" TJI ® 210 @ 24" OC





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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	840 @ 12' 6 1/2"	1460 (3.50")	Passed (58%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	780 @ 5 1/2"	1330	Passed (59%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2405 @ 6' 5 1/2"	3000	Passed (80%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.194 @ 6' 5 1/2"	0.304	Passed (L/754)		1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.315 @ 6' 5 1/2"	0.608	Passed (L/464)		1.0 D + 1.0 L (All Spans)
TJ-Pro [™] Rating	42	Any	Passed		

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

Deflection criteria: LL (L/480) and TL (L/240).

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

A structural analysis of the deck has not been performed.

• Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.

• Additional considerations for the TJ-Pro[™] Rating include: None.

	Bearing Length			Loads to Supports (Ibs)			
Supports	Total	Available	Required	Dead	Floor Live	Total	Accessories
1 - Stud wall - DF	5.50"	4.25"	1.75"	323	517	840	1 1/4" Rim Board
2 - Stud wall - DF	5.50"	5.50"	1.75"	323	517	840	Blocking

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

• 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)	4' 1" o/c	
Bottom Edge (Lu)	12' 10" o/c	

•TJI joists are only analyzed using Maximum Allowable bracing solutions.

•Maximum allowable bracing intervals based on applied load.

			Dead	Floor Live	
Vertical Load	Location (Side)	Spacing	(0.90)	(1.00)	Comments
1 - Uniform (PSF)	0 to 12' 11"	24"	25.0	40.0	Default Load

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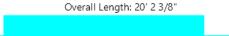
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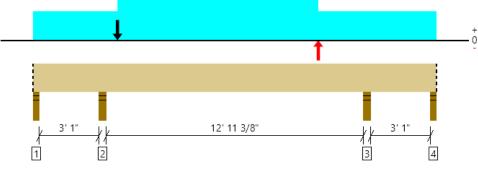
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2 piece(s) 1 3/4" x 9 1/4" 2.0E Microllam® LVL





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)	3197 @ 3' 5 3/4"	5206 (3.50")	Passed (61%)		1.0 D + 1.0 L (Adj Spans)
Shear (lbs)	1647 @ 4' 4 3/4"	6151	Passed (27%)	1.00	1.0 D + 1.0 L (Adj Spans)
Moment (Ft-lbs)	-3605 @ 3' 5 3/4"	11204	Passed (32%)	1.00	1.0 D + 1.0 L (Adj Spans)
Live Load Defl. (in)	0.057 @ 10' 1 3/16"	0.331	Passed (L/999+)		1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.155 @ 10' 13/16"	0.662	Passed (L/999+)		1.0 D + 1.0 L (Alt Spans)

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

• Deflection criteria: LL (L/480) and TL (L/240).

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

0

- 932 lbs uplift at support located at 1 1/2". Strapping or other restraint may be required.

• -893 lbs uplift at support located at 20' 7/8". Strapping or other restraint may be required.

	Bearing Length			L	oads to Sup			
Supports	Total	Available	Required	Dead	Floor Live	Seismic	Total	Accessories
1 - Stud wall - DF	3.00"	3.00"	1.50"	-550	179/-383	13/-13	192/- 946	Blocking
2 - Stud wall - SPF	3.50"	3.50"	2.15"	1948	1249	502/-502	3699/- 502	None
3 - Stud wall - SPF	3.50"	3.50"	2.04"	1742	1249	690/-690	3681/- 690	None
4 - Stud wall - DF	3.00"	3.00"	1.50"	-511	179/-383	200/-200	1094	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)	20' 2" o/c	
Bottom Edge (Lu)	20' 2" o/c	
•Maximum allowable bracing inten	als based on applied load	·

mum allowable bracing intervals based on applied I

			Dead	Floor Live	Seismic	
Vertical Loads	Location (Side)	Tributary Width	(0.90)	(1.00)	(1.60)	Comments
0 - Self Weight (PLF)	0 to 20' 2 3/8"	N/A	9.4			
1 - Uniform (PLF)	0 to 20' 2 3/8" (Front)	N/A	63.8	102.8	-	Linked from: 23, Support 2
2 - Point (lb)	4' 2 3/4" (Top)	N/A	-	-	573	229 # chord w/ overstrength
3 - Point (lb)	14' 3 3/8" (Top)	N/A	-	-	-573	229 # chord w/ overstrength
4 - Uniform (PSF)	4' 2 3/4" to 14' 3 3/8" (Top)	9' 2"	12.5	-	-	

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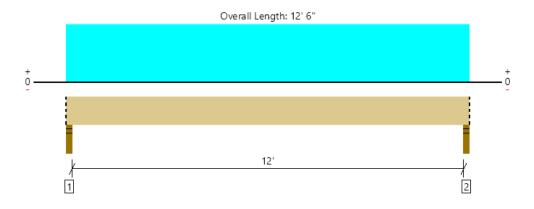
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2/23/2021 11:36:29 PM UTC ForteWEB v3.1, Engine: V8.1.5.1, Data: V8.0.1.0 File Name: Derkashani Page 24 / 38



Main Floor, 30 2 piece(s) 1 3/4" x 9 1/4" 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)	1912 @ 1 1/2"	6563 (3.00")	Passed (29%)		1.0 D + 1.0 L (All Spans)
Shear (lbs)	1600 @ 1' 1/4"	6151	Passed (26%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	5739 @ 6' 3"	11204	Passed (51%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.213 @ 6' 3"	0.306	Passed (L/691)		1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.356 @ 6' 3"	0.613	Passed (L/413)		1.0 D + 1.0 L (All Spans)

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

• Deflection criteria: LL (L/480) and TL (L/240).

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

	Bearing Length			Loads t	o Supports		
Supports	Total	Available	Required	Dead	Floor Live	Total	Accessories
1 - Stud wall - DF	3.00"	3.00"	1.50"	770	1142	1912	Blocking
2 - Stud wall - DF	3.00"	3.00"	1.50"	770	1142	1912	Blocking
Blocking Panels are assumed to carry no load	s applied dire	tly above the	m and the ful	I load is appli	ed to the men	her heina	designed

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)	12' 6" o/c	
Bottom Edge (Lu)	12' 6" o/c	

•Maximum allowable bracing intervals based on applied load.

			Dead	Floor Live	
Vertical Loads	Location (Side)	Tributary Width	(0.90)	(1.00)	Comments
0 - Self Weight (PLF)	0 to 12' 6"	N/A	9.4		
1 - Uniform (PLF)	0 to 12' 6" (Front)	N/A	63.8	102.8	Linked from: 23, Support 2
2 - Uniform (PSF)	0 to 12' 6" (Top)	2'	25.0	40.0	

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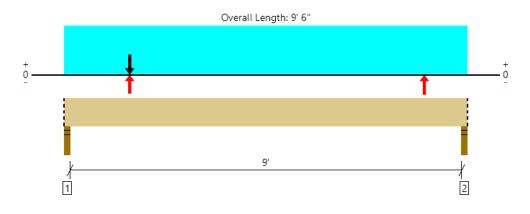




Main Floor, 31 2 piece(s) 1 3/4" x 9 1/4" 2.0E Microllam® LVL

An excessive uplift of -1969 lbs at support located at 1 1/2" failed this product.

An excessive uplift of -2057 lbs at support located at 9' 4 1/2" failed this product.



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)	2791 @ 1 1/2"	6563 (3.00")	Passed (43%)		0.6 D + 0.6 W (All Spans)
Shear (lbs)	3275 @ 1' 6 9/16"	7074	Passed (46%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	3846 @ 5' 11 15/16"	12884	Passed (30%)	1.15	1.0 D + 0.75 L + 0.75 S (All Spans)
Live Load Defl. (in)	0.062 @ 3' 1"	0.231	Passed (L/999+)		1.0 D + 0.6 W (All Spans)
Total Load Defl. (in)	0.134 @ 4' 9 1/2"	0.463	Passed (L/826)		1.0 D + 0.45 W + 0.75 L + 0.75 S (All Spans)

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

• Deflection criteria: LL (L/480) and TL (L/240).

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

	Bearing Length			Loads to Supports (lbs)					
Supports	Total	Available	Required	Dead	Floor Live	Snow	Wind	Total	Accessories
1 - Stud wall - DF	3.00"	3.00"	1.50"	-359	190	-1610	5010	5200/- 1969	Blocking
2 - Stud wall - DF	3.00"	3.00"	1.50"	1582	190	849	-5010	2621/- 5010	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)	9' 6" o/c	
Bottom Edge (Lu)	9' 6" o/c	

•Maximum allowable bracing intervals based on applied load.

			Dead	Floor Live	Snow	Wind	
Vertical Loads	Location (Side)	Tributary Width	(0.90)	(1.00)	(1.15)	(1.60)	Comments
0 - Self Weight (PLF)	0 to 9' 6"	N/A	9.4				
1 - Uniform (PSF)	0 to 9' 6" (Top)	1'	25.0	40.0	-	-	
2 - Point (lb)	1' 6 9/16" (Top)	N/A	-2802	-	-3551	-	Linked from: 2, Support 1
3 - Uniform (PSF)	0 to 9' 6" (Top)	11' 9"	20.0	-	25.0	-	
4 - Uniform (PSF)	0 to 9' 6" (Top)	12' 4"	12.5	-	-	-	Wall Above
5 - Point (lb)	1' 6 9/16" (Top)	N/A	-	-	-	6680	2672# chord force with over strength
6 - Point (lb)	8' 5 13/16" (Top)	N/A	-	-	-	-6680	2672# chord force with over strength

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

Job Notes

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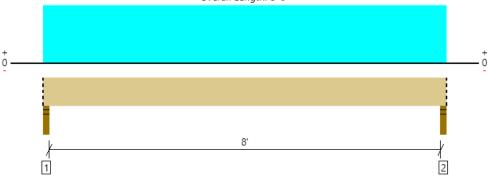




Main Floor, 32 1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam

PASSED





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)	3793 @ 1 1/2"	6563 (3.00")	Passed (58%)		1.0 D + 1.0 L (All Spans)
Shear (lbs)	2789 @ 1' 1 1/2"	6493	Passed (43%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-Ibs)	7593 @ 4' 3"	12863	Passed (59%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.093 @ 4' 3"	0.206	Passed (L/999+)		1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.153 @ 4' 3"	0.412	Passed (L/647)		1.0 D + 1.0 L (All Spans)

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

• Deflection criteria: LL (L/480) and TL (L/240).

• 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 = 8' 3".

• The effects of positive or negative camber have not been accounted for when calculating deflection.

• The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.

Applicable calculations are based on NDS.

	Bearing Length			Loads	to Supports (
Supports	Total	Available	Required	Dead	Floor Live	Total	Accessories
1 - Stud wall - DF	3.00"	3.00"	1.73"	1482	2311	3793	Blocking
2 - Stud wall - DF	3.00"	3.00"	1.73"	1482	2311		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)	8' 6" o/c						
Bottom Edge (Lu)	8' 6" o/c						
Maximum allowable bracing intervals based on applied load							

Maximum allowable bracing intervals based on applied load.

			Dead		
Vertical Loads	Location (Side)	Tributary Width	(0.90)	(1.00)	Comments
0 - Self Weight (PLF)	0 to 8' 6"	N/A	8.9		
1 - Uniform (PLF)	0 to 8' 6" (Top)	N/A	339.8	543.8	Linked from: 21, Support 2

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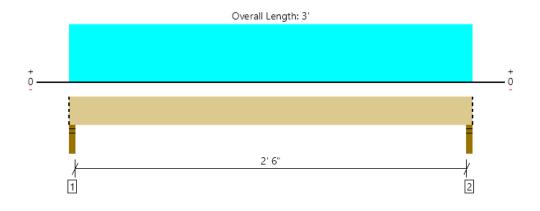
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Main Floor, 33 2 piece(s) 2 x 6 Douglas Fir-Larch No. 1





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) [Group]
Member Reaction (lbs)	1675 @ 1 1/2"	5625 (3.00")	Passed (30%)		1.0 D + 1.0 L (All Spans) [1]
Shear (lbs)	884 @ 8 1/2"	1980	Passed (45%)	1.00	1.0 D + 1.0 L (All Spans) [1]
Moment (Ft-lbs)	1055 @ 1' 6"	1639	Passed (64%)	1.00	1.0 D + 1.0 L (All Spans) [1]
Live Load Defl. (in)	0.013 @ 1' 6"	0.069	Passed (L/999+)		1.0 D + 1.0 L (All Spans) [1]
Total Load Defl. (in)	0.020 @ 1' 6"	0.138	Passed (L/999+)		1.0 D + 1.0 L (All Spans) [1]

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

• Deflection criteria: LL (L/480) and TL (L/240).

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	Floor Live	Total	Accessories	
1 - Stud wall - DF	3.00"	3.00"	1.50"	627	1048	1675	Blocking	
2 - Stud wall - DF	3.00"	3.00"	1.50"	627	1048	1675	Blocking	
Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.								

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

•Maximum allowable bracing intervals based on applied load.

			Dead	Floor Live	
Vertical Loads	Location (Side)	Tributary Width	(0.90)	(1.00)	Comments
0 - Self Weight (PLF)	0 to 3'	N/A	4.2		
1 - Uniform (PLF)	0 to 3' (Top)	N/A	172.5	312.8/-32.3	Linked from: 21, Support 1
2 - Uniform (PLF)	0 to 3' (Top)	N/A	241.0	386.0	Linked from: 22, Support 1

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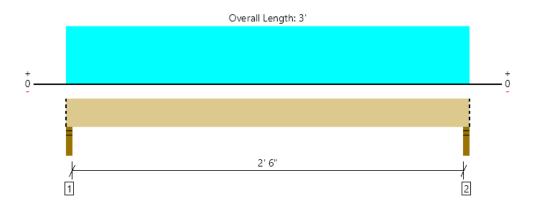
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Main Floor, 34 2 piece(s) 2 x 6 Douglas Fir-Larch No. 1



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)	985 @ 1 1/2"	5625 (3.00")	Passed (18%)		1.0 D + 1.0 L (All Spans)
Shear (lbs)	500 @ 8 1/2"	1980	Passed (25%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	597 @ 1' 6"	1639	Passed (36%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.007 @ 1' 6"	0.069	Passed (L/999+)		1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.011 @ 1' 6"	0.138	Passed (L/999+)		1.0 D + 1.0 L (All Spans)

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

• Deflection criteria: LL (L/480) and TL (L/240).

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	Floor Live	Total	Accessories	
1 - Stud wall - DF	3.00"	3.00"	1.50"	383	603	986	Blocking	
2 - Stud wall - DF	3.00"	3.00"	1.50"	368	579	947	Blocking	
Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.								

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

•Maximum allowable bracing intervals based on applied load.

			Dead	Floor Live	
Vertical Loads	Location (Side)	Tributary Width	(0.90)	(1.00)	Comments
0 - Self Weight (PLF)	0 to 3'	N/A	4.2		
1 - Uniform (PLF)	0 to 3' (Top)	N/A	241.0	386.0	Linked from: 22, Support 1
2 - Uniform (PLF)	0 (Top)	N/A	177.0	282.8	Linked from: 24, Support 1

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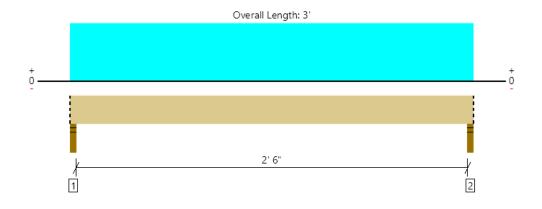
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Main Floor, 35 2 piece(s) 2 x 6 Douglas Fir-Larch No. 1





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)	793 @ 1 1/2"	5625 (3.00")	Passed (14%)		1.0 D + 1.0 L (All Spans)
Shear (lbs)	398 @ 8 1/2"	1980	Passed (20%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	475 @ 1' 6"	1639	Passed (29%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.006 @ 1' 6"	0.069	Passed (L/999+)		1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.009 @ 1' 6"	0.138	Passed (L/999+)		1.0 D + 1.0 L (All Spans)

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

• Deflection criteria: LL (L/480) and TL (L/240).

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

Applicable calculations are based on NDS.

	Bearing Length			Loads to Supports (Ibs)			
Supports	Total	Available	Required	Dead	Floor Live	Total	Accessories
1 - Stud wall - DF	3.00"	3.00"	1.50"	309	484	793	Blocking
2 - Stud wall - DF	3.00"	3.00"	1.50"	294	460	754	Blocking
Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.							

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

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 3'	N/A	4.2		
1 - Uniform (PLF)	0 (Top)	N/A	177.0	282.8	Linked from: 24, Support 1
2 - Uniform (PLF)	0 to 3' (Top)	N/A	192.0	306.8	Linked from: 25, Support 1

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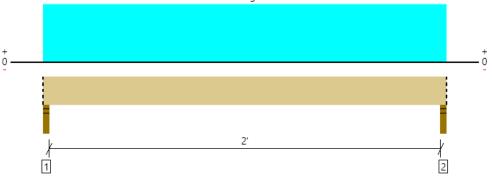




Main Floor, 36 2 piece(s) 2 x 4 Douglas Fir-Larch No. 1

PASSED





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)	1042 @ 1 1/2"	5625 (3.00")	Passed (19%)		1.0 D + 1.0 L (All Spans)
Shear (lbs)	591 @ 6 1/2"	1260	Passed (47%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	528 @ 1' 3"	766	Passed (69%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.016 @ 1' 3"	0.056	Passed (L/999+)		1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.026 @ 1' 3"	0.112	Passed (L/999+)		1.0 D + 1.0 L (All Spans)

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

• Deflection criteria: LL (L/480) and TL (L/240).

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	Floor Live	Total	Accessories
1 - Stud wall - DF	3.00"	3.00"	1.50"	430	613	1043	Blocking
2 - Stud wall - DF	3.00"	3.00"	1.50"	430	613	1043	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
ŀ	Top Edge (Lu)	2' 6" o/c	

•Maximum allowable bracing intervals based on applied load.

			Dead	Floor Live	
Vertical Loads	Location (Side)	Tributary Width	(0.90)	(1.00)	Comments
0 - Self Weight (PLF)	0 to 2' 6"	N/A	2.7		
1 - Uniform (PLF)	0 to 2' 6" (Top)	N/A	130.5	208.5	Linked from: 26, Support 1
2 - Uniform (PLF)	0 to 2' 6" (Top)	N/A	94.0	281.5	Linked from: 40, Support 1
3 - Uniform (PSF)	0 to 2' 6" (Top)	9' 4"	12.5	-	

2' 6" o/c

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Bottom Edge (Lu)

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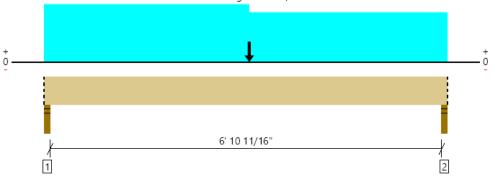
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Main Floor, 37 1 piece(s) 3 1/2" x 10 1/2" 24F-V4 DF Glulam

Overall Length: 7' 4 11/16"



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)	3787 @ 1 1/2"	6563 (3.00")	Passed (58%)		1.0 D + 0.45 W + 0.75 L + 0.75 Lr (All Spans)
Shear (lbs)	2059 @ 1' 1 1/2"	6493	Passed (32%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-Ibs)	8700 @ 3' 9 1/8"	20580	Passed (42%)	1.60	1.0 D + 0.45 W + 0.75 L + 0.75 Lr (All Spans)
Live Load Defl. (in)	0.090 @ 3' 8 7/16"	0.179	Passed (L/956)		1.0 D + 0.45 W + 0.75 L + 0.75 Lr (All Spans)
Total Load Defl. (in)	0.118 @ 3' 8 1/4"	0.357	Passed (L/727)		1.0 D + 0.45 W + 0.75 L + 0.75 Lr (All Spans)

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

PASSED

• Deflection criteria: LL (L/480) 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 = 7' 1 11/16".

• 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			L	oads to Supp			
Supports	Total	Available	Required	Dead	Floor Live	Wind	Total	Accessories
1 - Stud wall - DF	3.00"	3.00"	1.73"	1193	1811	2746	5750	Blocking
2 - Stud wall - DF	3.00"	3.00"	1.65"	971	1811	2849	5631	Blocking
Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.								

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Lateral Bracing	Bracing Intervals	Comments				
Top Edge (Lu)	7' 5" o/c					
Bottom Edge (Lu)	7' 5" o/c					

•Maximum allowable bracing intervals based on applied load.

			Dead	Floor Live	Wind	
Vertical Loads	Location (Side)	Tributary Width	(0.90)	(1.00)	(1.60)	Comments
0 - Self Weight (PLF)	0 to 7' 4 11/16"	N/A	8.9			
1 - Uniform (PLF)	0 to 7' 4 11/16" (Top)	N/A	130.5	208.5	-	Linked from: 26, Support 1
2 - Uniform (PLF)	0 to 7' 4 11/16" (Top)	N/A	94.0	281.5	-	Linked from: 40, Support 1
3 - Uniform (PSF)	0 to 3' 9 1/8" (Top)	9' 4"	12.5	-	-	
4 - Point (lb)	3' 9 1/8" (Top)	N/A	-	-	5595	2238# chord force w/ over strength

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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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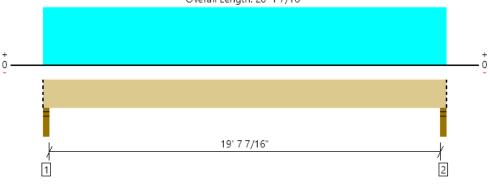


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Main Floor, 38 1 piece(s) 5 1/8" x 15" 24F-V4 DF Glulam

Overall Length: 20' 1 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)	3965 @ 1 1/2"	9609 (3.00")	Passed (41%)		1.0 D + 1.0 L (All Spans)
Shear (lbs)	3374 @ 1' 6"	13581	Passed (25%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-lbs)	19453 @ 10' 3/4"	37798	Passed (51%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.381 @ 10' 11/16"	0.497	Passed (L/627)		1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.533 @ 10' 11/16"	0.993	Passed (L/447)		1.0 D + 1.0 L (All Spans)

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

PASSED

• Deflection criteria: LL (L/480) 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 0.98 that was calculated using length L = 19' 10 7/16".

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 (
Supports	Total	Available	Required	Dead	Floor Live	Total	Accessories
1 - Stud wall - DF	3.00"	3.00"	1.50"	1134	2832	3966	Blocking
2 - Stud wall - DF	3.00"	3.00"	1.50"	1134	2832		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)	20' 1" o/c				
Bottom Edge (Lu)	20' 1" o/c				
Maximum allowable bracing intervals based on applied load					

um allowable bracing intervals based on applied load

			Dead	Floor Live	
Vertical Loads	Location (Side)	Tributary Width	(0.90)	(1.00)	Comments
0 - Self Weight (PLF)	0 to 20' 1 7/16"	N/A	18.7		
1 - Uniform (PLF)	0 to 20' 1 7/16" (Front)	N/A	94.0	281.5	Linked from: 40, Support 1

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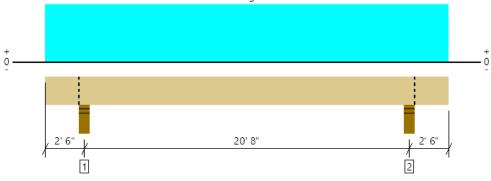
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Main Floor, 39 1 piece(s) 6 3/4" x 13 1/2" 24F-V4 DF Glulam

Overall Length: 25' 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)	6971 @ 2' 6"	23203 (5.50")	Passed (30%)		1.0 D + 1.0 L (Adj Spans)
Shear (lbs)	4895 @ 3' 10 1/4"	16099	Passed (30%)	1.00	1.0 D + 1.0 L (Adj Spans)
Pos Moment (Ft-lbs)	28286 @ 12' 10"	39521	Passed (72%)	1.00	1.0 D + 1.0 L (Alt Spans)
Neg Moment (Ft-Ibs)	-1683 @ 2' 6"	31609	Passed (5%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.638 @ 12' 10"	0.689	Passed (L/388)		1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.870 @ 12' 10"	1.033	Passed (L/285)		1.0 D + 1.0 L (Alt Spans)

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

PASSED

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

• Overhang deflection criteria: LL (2L/360) and TL (2L/240). Upward deflection on left and right cantilevers exceeds overhang deflection criteria.

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

• Critical positive moment adjusted by a volume factor of 0.96 that was calculated using length L = 20' 5 15/16".

• Critical negative moment adjusted by a volume factor of 1.00 that was calculated using length L = 2' 9 11/16".

• 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 t	o Supports (
Total	Available	Required	Dead	Floor Live	Total	Accessories
5.50"	5.50"	1.65"	1940	5032	6972	Blocking
5.50"	5.50"	1.65"	1940	5032	6972	Blocking
	Total 5.50" 5.50"	Total Available 5.50" 5.50" 5.50" 5.50"	Total Available Required 5.50" 5.50" 1.65" 5.50" 5.50" 1.65"	Total Available Required Dead 5.50" 5.50" 1.65" 1940 5.50" 5.50" 1.65" 1940	Total Available Required Dead Floor Live 5.50" 5.50" 1.65" 1940 5032 5.50" 5.50" 1.65" 1940 5032	Total Available Required Dead Floor Live Total 5.50" 5.50" 1.65" 1940 5032 6972

• 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' 8" o/c				
Bottom Edge (Lu)	25' 8" o/c				
Maximum allowable bracing intervals based on applied load					

Maximum allowable bracing intervals based on applied load.

			Dead	Floor Live	
Vertical Loads	Location (Side)	Tributary Width	(0.90)	(1.00)	Comments
0 - Self Weight (PLF)	0 to 25' 8"	N/A	22.1		
1 - Uniform (PLF)	0 to 25' 8" (Front)	N/A	129.0	387.5	Linked from: 41, Support 1

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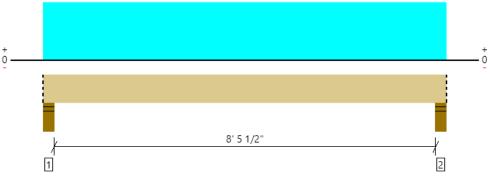
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Main Floor, 40 1 piece(s) 2 x 12 Douglas Fir-Larch No. 1 @ 24" OC





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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	750 @ 4 1/2"	5156 (5.50")	Passed (15%)		1.0 D + 1.0 L (All Spans)
Shear (lbs)	527 @ 1' 4 3/4"	2025	Passed (26%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1488 @ 4' 8 1/4"	3032	Passed (49%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.049 @ 4' 8 1/4"	0.216	Passed (L/999+)		1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.066 @ 4' 8 1/4"	0.431	Passed (L/999+)		1.0 D + 1.0 L (All Spans)
TJ-Pro [™] Rating	N/A	N/A	N/A		N/A

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

• Deflection criteria: LL (L/480) and TL (L/240).

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

• A 15% increase in the moment capacity has been added to account for repetitive member usage.

Applicable calculations are based on NDS.

· No composite action between deck and joist was considered in analysis.

	Bearing Length		Loads to Supports (Ibs)				
Supports	Total	Available	Required	Dead	Floor Live	Total	Accessories
1 - Stud wall - DF	5.50"	5.50"	1.50"	188	563	751	Blocking
2 - Stud wall - DF	5.50"	5.50"	1.50"	188	563	751	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)	9' 5" o/c				
Bottom Edge (Lu)	9' 5" o/c				
Maximum allowable bracing intervale based on applied load					

Maximum allowable bracing intervals based on applied load.

			Dead	Floor Live	
Vertical Load	Location (Side)	Spacing	(0.90)	(1.00)	Comments
1 - Uniform (PSF)	0 to 9' 4 1/2"	24"	20.0	60.0	Default Load

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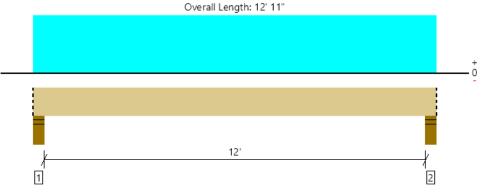


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Main Floor, 41 1 piece(s) 2 x 12 Douglas Fir-Larch No. 1 @ 24" OC





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

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1033 @ 4 1/2"	5156 (5.50")	Passed (20%)		1.0 D + 1.0 L (All Spans)
Shear (lbs)	810 @ 1' 4 3/4"	2025	Passed (40%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2961 @ 6' 5 1/2"	3032	Passed (98%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.196 @ 6' 5 1/2"	0.304	Passed (L/747)		1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.261 @ 6' 5 1/2"	0.608	Passed (L/560)		1.0 D + 1.0 L (All Spans)
TJ-Pro [™] Rating	N/A	N/A	N/A		N/A

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

PASSED

• Deflection criteria: LL (L/480) and TL (L/240).

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

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• A 15% increase in the moment capacity has been added to account for repetitive member usage.

Applicable calculations are based on NDS.

· No composite action between deck and joist was considered in analysis.

	Bearing Length		Loads to Supports (Ibs)				
Supports	Total	Available	Required	Dead	Floor Live	Total	Accessories
1 - Stud wall - DF	5.50"	5.50"	1.50"	258	775	1033	Blocking
2 - Stud wall - DF	5.50"	5.50"	1.50"	258	775	1033	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)	1' 9" o/c				
Bottom Edge (Lu)	12' 11" o/c				
Maximum allowable bracing intervals based on applied load					

Maximum allowable bracing intervals based on applied load.

			Dead	Floor Live	
Vertical Load	Location (Side)	Spacing	(0.90)	(1.00)	Comments
1 - Uniform (PSF)	0 to 12' 11"	24"	20.0	60.0	Default Load

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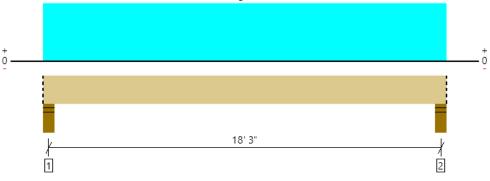




Main Floor, 43 1 piece(s) 6 3/4" x 16 1/2" 24F-V4 DF Glulam

PASSED





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)	9013 @ 4"	23203 (5.50")	Passed (39%)		1.0 D + 1.0 L (All Spans)
Shear (lbs)	7247 @ 1' 10"	19676	Passed (37%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-Ibs)	39205 @ 9' 4 1/4"	58608	Passed (67%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.339 @ 9' 4 1/4"	0.451	Passed (L/639)		1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.505 @ 9' 4 1/4"	0.902	Passed (L/429)		1.0 D + 1.0 L (All Spans)

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

· Deflection criteria: LL (L/480) and TL (L/240).

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

• Critical positive moment adjusted by a volume factor of 0.96 that was calculated using length L = 18' 1/2".

The effects of positive or negative camber have not been accounted for when calculating deflection.

• The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.

Applicable calculations are based on NDS.

B	earing Leng	th	Loads t	o Supports ((lbs)	
Total	Available	Required	Dead	Floor Live	Total	Accessories
5.50"	5.50"	2.14"	2971	6043	9014	Blocking
5.50"	5.50"	2.14"	2971	6043	9014	Blocking
	Total 5.50"	TotalAvailable5.50"5.50"	5.50" 5.50" 2.14"	TotalAvailableRequiredDead5.50"5.50"2.14"2971	TotalAvailableRequiredDeadFloor Live5.50"5.50"2.14"29716043	Total Available Required Dead Floor Live Total 5.50" 5.50" 2.14" 2971 6043 9014

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)	18' 9" o/c	
Bottom Edge (Lu)	18' 9" o/c	
•Maximum allowable bracing interv	als based on applied load	

um allowable bracing intervals based on applied load

			Dead	Floor Live	
Vertical Loads	Location (Side)	Tributary Width	(0.90)	(1.00)	Comments
0 - Self Weight (PLF)	0 to 18' 8 1/2"	N/A	27.1		
1 - Uniform (PLF)	0 to 18' 8 1/2" (Back)	N/A	161.5	258.5	Linked from: 27, Support 1
2 - Uniform (PLF)	0 to 18' 8 1/2" (Front)	N/A	129.0	387.5	Linked from: 41, Support 1

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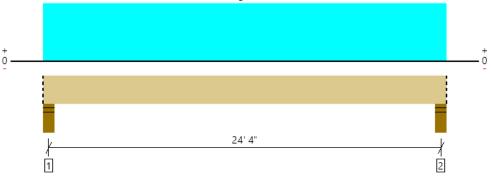




Main Floor, 44 1 piece(s) 5 1/8" x 21" 24F-V4 DF Glulam

PASSED





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)	9724 @ 4"	17617 (5.50")	Passed (55%)		1.0 D + 1.0 L (All Spans)
Shear (lbs)	7992 @ 2' 2 1/2"	19014	Passed (42%)	1.00	1.0 D + 1.0 L (All Spans)
Pos Moment (Ft-Ibs)	57073 @ 12' 4 3/4"	70256	Passed (81%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.500 @ 12' 4 3/4"	0.603	Passed (L/579)		1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.840 @ 12' 4 3/4"	1.206	Passed (L/345)		1.0 D + 1.0 L (All Spans)

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

· Deflection criteria: LL (L/480) and TL (L/240).

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

• Critical positive moment adjusted by a volume factor of 0.93 that was calculated using length L = 24' 1 1/2".

The effects of positive or negative camber have not been accounted for when calculating deflection.

• The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.

Applicable calculations are based on NDS.

	B	earing Leng	th	Loads t	o Supports ((lbs)	
Supports	Total	Available	Required	Dead	Floor Live	Total	Accessories
1 - Stud wall - DF	5.50"	5.50"	3.04"	3940	5785	9725	Blocking
2 - Stud wall - DF	5.50"	5.50"	3.04"	3940	5785	9725	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)	24' 10" o/c	
Bottom Edge (Lu)	24' 10" o/c	
•Maximum allowable bracing interv	als based on applied load	

ium allowable bracing intervals based on applied load.

			Dead	Floor Live	
Vertical Loads	Location (Side)	Tributary Width	(0.90)	(1.00)	Comments
0 - Self Weight (PLF)	0 to 24' 9 1/2"	N/A	26.2		
1 - Uniform (PSF)	0 to 24' 9 1/2" (Front)	5' 8"	25.0	40.0	
2 - Uniform (PSF)	0 to 24' 9 1/2" (Back)	6'	25.0	40.0	

Weyerhaeuser Notes

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

ForteWEB Software Operator	Jo
Javid Abdi	
Atlas Consulting Engineers	
(206) 427-7233	
iaviddabdi@vaboo.com	

b Notes



CANTILEVER RETAINING WALL EXTERNAL STABILITY Imitations: uses Rankie coefficients for noncohesive soils, external moment at top of wall does not contribute to restoring moment (overturning only), no deflection or provide the device soils and the low solid does not move the solid does not accomplete the so

reference:	service load chi	ecks, soil on low s	ide of wall does not brace wall a	against overturning (sliding only)
			rete Structures, 11th Edition, pa	ge 680
file author:	S. Frech	last modified:	4/25/2002	
SOIL DATA				
w	130	(pcf)	soil unit weight	Coeff. Friction
phi del	35	(deg) (deg)	soil internal angle of friction	Unit Weight Int Friction w. Conc Soil 110-120 33-40 0.5-0.6 Sand or gravel, no fines
uer	0.5	(deg)	surface angle incline coeff. friction w/Concrete	110-120 33-40 0.5-0.6 Sand or gravel, no fines 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 GEOME	TRY			M1 P1 W4
H1	5.25	(ft)	soil retained	P1 W4
H2	0.1666667	(ft)	soil depth above toe	\mathbf{V}_1
H3 H4	0.8333333	(ft) (ft)	footing thickness	
B1	0.6666667	(ft)	passive pressure soil depth wall width	
B2	1.33333333	(ft)	toe width	W1 W3
B3	0	(ft)	heel width	H1
Н	6.25	(ft)	total height	7 7
В	2 150	(ft) (pcf)	total base concrete unit weight	
	150	(per)	concrete unit weight	ws P
EXTERNAL LC	ADS			TOP OF SOIL
Papplied	412.5	(lb/ft)		H2 W2 Y
V _{applied}	0	(lb/ft)		
Mapplied	0	(lb-ft / ft)		H4 H3
Surcharge	43.333333	(psf)		
LOAD CALCUI	ATIONS			
	soil force and	d overturning	moment	$\frac{1}{1}$
H _{prime}	0.33	(ft)	converted surcharge	Alexander a
Y	2.18	(ft)	distance to soil load resultant	
Р	761 1660	(lbs)	soil load resultant	
	1660	(lb-ft) (lb-ft)	Mo, soil + surcharge Mo, external load	
	1,660	(lb-ft)	total overturning Moment	$\begin{bmatrix}+ \\ C_{ah}wh \end{bmatrix} = \begin{bmatrix}+ \\ C_{ah}w(h+h') \end{bmatrix}$
		. ,	· · · · ·	
		oring forces		$y = \frac{h}{3} \qquad \qquad y = \frac{h^2 + 3hh'}{3(h+2h')}$
component w1 (concrete)	weight (#) 542	arm (ft) 1.67	moment (#-ft) 903	$P = \frac{1}{2} C_{ah} wh^2 \qquad P = \frac{1}{2} C_{ah} wh (h+2h')$
w2 (concrete)	250	1.00	250	, - 2 cahwin 2 can
v3 (heel soil)	0	2.00	0	
w4 (surcharge)	0	2.00	0	
v5 (toe soil) P applied	29 412.5	0.67 1.67	19 688	$a_{t}=(4\ell-6a)\frac{R_{p}}{\ell^{2}}$
/ert. force	1,233	momen		q_1 $q_2^{*}(6a-2l) \frac{q_2}{l^2}$
				$\begin{array}{c} -r/3 + \overline{y}' & -\overline{y}' \\ \hline + r/3 + \overline{y}' & -\overline{y}' \\ \hline q_1 & -\overline{y}' \\ \hline q_2 & -\overline{y}' + \overline{y}' \\ \hline q_2 & -\overline{y}' + \overline{y}' + \overline{y}' \\ \hline q_2 & -\overline{y}' + \overline{y}' + $
		ng resistance		(a) Resultant in middle third
	150	(lb)	passive pressure sliding resist	ance
	617	(lb)	soil friction force	
	617 767	(lb) (lb)	soil friction force total sliding resistance	-0314 2R,
STABILITY FA	767	(lb)	total sliding resistance	
STABILITY FA	767	(lb)	total sliding resistance	q^{2}
STABILITY FA	767 CTOR OF SAI 1 1	(Ib) FETY CHECK	total sliding resistance	₹ 1 Resultant outside middle third
overturning	767 CTOR OF SAI	(Ib) FETY CHECK OK	total sliding resistance S F.S. overturning F.S. sliding Mr / Mo	
overturning	767 CTOR OF SAI 1 1	(Ib) FETY CHECK	total sliding resistance S F.S. overturning F.S. sliding	0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2
overturning sliding	767 CTOR OF SAI 1 1.12 1.01	(Ib) FETY CHECK OK	total sliding resistance S F.S. overturning F.S. sliding Mr / Mo	(c) Resultant pulsake middle third
overturning sliding	767 CTOR OF SAI 1 1 1.12 1.01 3 0.16	(Ib) FETY CHECK OK	total sliding resistance S F.S. overturning F.S. sliding Mr/ Mo (PP+F)(Ph+V) distance to resultant	0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2
soverturning sliding SOIL BEARING a	767 CTOR OF SAI 1 1 1.12 1.01 3 0.16 0.67' to 1.33'	(Ib) FETY CHECK OK OK (ft)	total sliding resistance S F.S. overturning F.S. sliding Mr/ Mo (PP+F)(Ph+V) distance to resultant middle third of footing	C) Resultant outside middle third
overturning sliding a a q1	767 CTOR OF SAI 1 1.12 1.01 3 0.67' to 1.33' 5138	(lb) FETY CHECK OK (ft) (psf)	total sliding resistance S F.S. overturning F.S. sliding Mr / Mo (PP+F)/(Ph+V) distance to resultant middle third of footing bearing pressure @ toe	C) Resultant outside middle third
soverturning sliding SOIL BEARING a	767 CTOR OF SAI 1 1 1.12 1.01 3 0.16 0.67' to 1.33'	(Ib) FETY CHECK OK OK (ft)	total sliding resistance S F.S. overturning F.S. sliding Mr/ Mo (PP+F)(Ph+V) distance to resultant middle third of footing	C 1 Resultant outside middle third
sliding SOIL BEARING a q1 q2	767 CTOR OF SAU 1 1.12 1.01 3 0.67' to 1.33' 5138 N.A. 7) STEM LOA	(lb) FETY CHECK OK (ft) (psf) (psf)	total sliding resistance F.S. soverturning F.S. sliding Mr / Mo (PP+F)/(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ heel	C C Resulton cutsize middle flirid
sliding SOIL BEARING a q1 q2	767 CTOR OF SAU 1 1.12 1.12 0.16 0.67' to 1.33' 5138 N.A. 5.4166667	(ib) FETY CHECK OK (ft) (psf) (psf) D FORCES (ft)	total sliding resistance S F.S. voerturning F.S. sliding Mr / Mo (PP+Fy(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ heel H1 + H2	C 1 Resultant outside middle third
sliding SOIL BEARING a q1 q2	767 CTOR OF SAU 1 1 1.12 1.12 0.16 0.67' to 1.33' 5138 N.A. 5.4166667 1.90	(ib) FETY CHECK OK (ft) (psf) (psf) D FORCES (ft) (ft)	total sliding resistance F.S. overturning F.S. sliding Mr/ Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ heel H1 + H2 line of action (above base)	C : Resulton cutside middle third 0 0 0 0 0 0 0 0 0 0 0 0 1 1 2 1 4 1 8 1 8 2 1000 1000 3000 400
sliding SOIL BEARING a q1 q2	767 CTOR OF SAI 1 1.12 1.01 3 0.67' to 1.33' 5138 N.A. 7) STEM LOA 5.4166667 1.90 580	(ib) FETY CHECK OK (ft) (psf) (psf) D FORCES (ft) (ft) (lbs)	total sliding resistance F.S. overturning F.S. sliding Mr / Mo (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)	C) Resulton outside middle third 0 0.2 0.4 0.6 0.8 1 12 1.4 1.6 1.8 2 -1000 -000 -0000
sliding SOIL BEARING a q1 q2	767 CTOR OF SAU 1 1 1.12 1.12 0.16 0.67' to 1.33' 5138 N.A. 5.4166667 1.90	(ib) FETY CHECK OK (ft) (psf) (psf) D FORCES (ft) (ft)	total sliding resistance F.S. overturning F.S. sliding Mr/ Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ heel H1 + H2 line of action (above base)	C : Resulton cutside middle third 0 0 0 0 0 0 0 0 0 0 0 0 1 1 2 1 4 1 8 1 8 2 1000 1000 3000 400
sverturning sliding SOIL BEARING a q1 q2 FACTORED (1.	767 CTOR OF SAU 1 1 1.12 1.01 6 0.67' to 1.33' 5138 N.A. 5.4166667 5.4166667 5.4166667 5.80 580 580	(ib) FETY CHECK OK (ft) (psf) (psf) (ft) (lbs) (lbs) (kip-ft)	total sliding resistance S F.S. overturning F.S. sliding Mr / Mo (PP+Fy/(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ teel H1 + H2 line of action (above base) P (arm only) Ph (arm only)	C : Resulton cutside middle third 0 0 0 0 0 0 0 0 0 0 0 0 1 1 2 1 4 1 8 1 8 2 1000 1000 3000 400
sverturning sliding SOIL BEARING a q1 q2 FACTORED (1.	767 CTOR OF SAU 1 1.12 1.12 0.16 0.67' to 1.33' 5138 N.A. 7) STEM LOA 5.4166667 1.90 580 1.9 580 1.9 7) FOOTING	(ib) FETY CHECK OK (ft) (psf) (psf) D FORCES (ft) (ft) (lbs) (kip-ft) LOADS	total sliding resistance S F.S. overturning F.S. sliding Mr/ Mo (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)	C : Resulton cutside middle third 0 0 0.2 0.4 0.8 0.8 1 1.2 1.4 1.8 1.8 2 1000 1000
sverturning sliding SOIL BEARING a q1 q2 FACTORED (1.	767 CTOR OF SAU 1 1 1.12 1.12 1.01 3 0.16 0.67' to 1.33' 5138 N.A. 7) STEM LOA 5.4166667 1.90 580 580 0 0 1.9 7.4 7.4	(ib) FETY CHECK OK (ft) (psf) (psf) (ft) (lbs) (kip-ft) LOADS (kip-ft)	total sliding resistance F.S. overturning F.S. sliding Mr/ Mo (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 moment) Mu @ Toe (Bot Reinf)	C : Resulton cutside middle third 0 0 0.2 0.4 0.8 0.8 1 1.2 1.4 1.8 1.8 2 1000 1000
sverturning sliding SOIL BEARING a q1 q2 FACTORED (1.	767 CTOR OF SAU 1 1.12 1.12 0.16 0.67' to 1.33' 5138 N.A. 7) STEM LOA 5.4166667 1.90 580 1.9 580 1.9 7) FOOTING	(ib) FETY CHECK OK (ft) (psf) (psf) (ft) (lbs) (kip-ft) (kip-ft)	total sliding resistance S F.S. verturning F.S. sliding Mr/Mo (PP+FJ/(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) Mu @ Heel (Top Reinf)	C Resultant outside firmd (c) Resultant outside middle firmd 0 0 0.2 0.4 0.8 0.8 1 1.2 1.4 1.8 1.8 2 1000
sverturning sliding SOIL BEARING a q1 q2 FACTORED (1.	767 CTOR OF SAU 1 1 1.12 1.01 3 0.16 0.67' to 1.33' 5138 N.A. 7) STEM LOA 5.4166667 1.90 580 580 580 7.9 FOOTING 1 7.4 0.0	(ib) FETY CHECK OK (ft) (psf) (psf) (ft) (lbs) (kip-ft) LOADS (kip-ft)	total sliding resistance F.S. overturning F.S. sliding Mr/ Mo (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 moment) Mu @ Toe (Bot Reinf)	C Resultant outside firmd (c) Resultant outside middle firmd 0 0 0.2 0.4 0.8 0.8 1 1.2 1.4 1.8 1.8 2 1000
sverturning sliding SOIL BEARING a q1 q2 FACTORED (1.	767 CTOR OF SAU 1 1 1.12 1.12 1.01 3 0.67' to 1.33' 5138 N.A. 7) STEM LOA 5.4166667 1.90 580 580 1.9 7.4 0.00 6.29	(ib) FETY CHECK OK (ft) (psf) (psf) (ft) (ft) (ft) (bs) (kip-ft) (kip-ft) (kip-ft) (kip)	total sliding resistance F.S. overturning F.S. sliding Mr/ Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe toe Mu @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf) Vu @ Toe	C : Resulton cutside middle third 0 0 0.2 0.4 0.8 0.8 1 1.2 1.4 1.8 1.8 2 1000 1000
source for the second s	767 CTOR OF SAU 1 1 1.12 1.12 1.01 3 0.67' to 1.33' 5138 N.A. 7) STEM LOA 5.4166667 1.90 580 580 1.9 7.4 0.00 6.29	(ib) FETY CHECK OK (ft) (psf) (psf) (ft) (ft) (ft) (bs) (kip-ft) (kip-ft) (kip-ft) (kip)	total sliding resistance S F.S. overturning F.S. sliding Mr/ Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe Wu @ Toe @ toe @ toe @ toe Vu @ Toe Vu @ Heel	C : Resulton cutside middle third 0 0 0.2 0.4 0.8 0.8 1 1.2 1.4 1.8 1.8 2 1000 1000
sverturning sliding SOIL BEARING a q1 q2 FACTORED (1. FACTORED (1.	767 CTOR OF SAU 1 1 1.12 1.12 1.01 3 0.67' to 1.33' 5138 N.A. 7) STEM LOA 5.4166667 1.90 580 580 1.9 7.4 0.00 6.29	(ib) FETY CHECK OK (ft) (psf) (psf) (ft) (ft) (ft) (bs) (kip-ft) (kip-ft) (kip-ft) (kip)	total sliding resistance F.S. overturning F.S. sliding Mr/ Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe toe Mu @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf) Vu @ Toe	C : Resulton cutside middle third 0 0 0.2 0.4 0.8 0.8 1 1.2 1.4 1.8 1.8 2 1000 1000
SOIL BEARING a q1 q2 FACTORED (1. FACTORED (1. FACTORED (1.	767 CTOR OF SAU 1 1 1.12 1.01 3 0.67' to 1.33' 5138 N.A. 7) STEM LOA 5.416667 5.416667 5.80 5.80 1.90 5.80 5.90 5.00 5.80 5.80 5.80 5.80 5.90 5.00 5.80 5.90 5.00 5.	(ib) FETY CHECK OK (ft) (psf) (psf) (ft) (lbs) (kip-ft) (kip-ft) (kip) (kip)	total sliding resistance S F.S. voerturning F.S. sliding Mr/ Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe Weilt @ toe Vu # toe Vu	5.692 8" thick 0.15 #4 @ 16"
q1 q2 FACTORED (1. FACTORED (1. FACTORED (1. Footing ØVc As a	767 CTOR OF SAI 1 1.12 1.12 1.01 3 0.16 0.67' to 1.33' 5138 N.A. 7) STEM LOA 5.4166667 1.90 580 580 580 7.969 0.24 0.24 0.004	(ib) FETY CHECK OK (ft) (psf) (psf) (ft) (lbs) (kip-ft) (kip-ft) (kip) (k	total sliding resistance S F.S. voerturning F.S. viding Mr / Mo (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 @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf) Vu @ Toe Vu @ Heel Wall ØVc As a	5.692 8" thick 0.15 #4 @ 16" 0.0002
SOIL BEARING a q1 q2 FACTORED (1. FACTORED (1. FACTORED (1.	767 CTOR OF SAI 1 1.12 1.12 0.16 0.67' to 1.33' 5138 N.A. 7) STEM LOA 5.4166667 1.90 580 7.9 FOOTING I 7.4 0.00 6.29 0.24 0.24 0.24 0.24 0.24 0.24 0.24	(ib) FETY CHECK OK (ft) (psf) (psf) (bs) (kip-ft) (kip-ft) (kip) (ki	total sliding resistance S F.S. voerturning F.S. sliding Mr/ Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe Weilt @ toe Vu # toe Vu	5.692 8" thick 0.15 #4 @ 16"
source for the second s	767 CTOR OF SAI 1 1 1.12 1.01 3 0.16 0.67' to 1.33' 5138 N.A. 7) STEM LOA 5.4166667 1.90 580 580 1.90 580 580 1.9 7.4 0.00 6.29 0.00 7.969 0.24 0.0004 7.56 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.	(ib) FETY CHECK OK (ft) (psf) (psf) (ft) (ft) (ft) (bs) (kip-ft) (kip-ft) (kip) (k	total sliding resistance S F.S. voerturning F.S. viding Mr / Mo (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 @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf) Vu @ Toe Vu @ Heel Wall ØVc As a	5.692 8" thick 0.15 #4 @ 16" 0.0002
SOIL BEARING aliding SOIL BEARING a q1 q2 FACTORED (1. FACTORED (1.	767 CTOR OF SAI 1 1 1.12 1.01 3 0.16 0.67' to 1.33' 5138 N.A. 7) STEM LOA 5.4166667 1.90 580 580 1.90 580 580 1.9 7.4 0.00 6.29 0.00 7.969 0.24 0.0004 7.56 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.	(ib) FETY CHECK OK (ft) (psf) (psf) (bs) (kip-ft) (kip-ft) (kip) (ki	total sliding resistance S F.S. voerturning F.S. viding Mr / Mo (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 @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf) Vu @ Toe Vu @ Heel Wall ØVc As a	5.692 8" thick 0.15 #4 @ 16" 0.0002
source for the second s	767 CTOR OF SAI 1 1 1.12 1.01 3 0.16 0.67' to 1.33' 5138 N.A. 7) STEM LOA 5.4166667 1.90 580 580 1.90 580 580 1.9 7.4 0.00 6.29 0.00 7.969 0.24 0.0004 7.56 0.6 0.6 0.6 0.6 0.6 0.6 0.6 0.	(ib) FETY CHECK OK (ft) (psf) (psf) (ft) (ft) (ft) (bs) (kip-ft) (kip-ft) (kip) (k	total sliding resistance S F.S. voerturning F.S. viding Mr / Mo (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 @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf) Vu @ Toe Vu @ Heel Wall ØVc As a	5.692 8" thick 0.15 #4 @ 16" 0.0002
SOIL BEARING alding SOIL BEARING a q1 q2 FACTORED (1. FACTORED (1. FACTORED (1. FOOTING ØVc As a ØMn	767 CTOR OF SAI 1 1.12 1.12 1.01 3 0.16 0.67' to 1.33' 5138 N.A. 7) STEM LOA 5.4166667 1.90 580 580 1.9 7.9 FOOTING I 7.44 0.00 6.29 0.24 0.0004 7.56 0.66 0.0025	(ib) FETY CHECK OK (ft) (psf) (psf) (ft) (lbs) (kip-ft) (kip-ft) (kip) (total sliding resistance S F.S. verturning F.S. sliding Mr / Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure	5.692 8" thick 0.15 #4 @ 16" 0.0002 4.05 k-ft
source for the second s	767 CTOR OF SAI 1 1 1.12 1.01 3 0.16 0.67' to 1.33' 5138 N.A. 7) STEM LOA 5.4166667 1.90 580 5.4166667 1.90 580 7.9 0.580 0.00 7.969 0.24 0.0004 7.56 0.0025 0	(ib) FETY CHECK OK (ft) (psf) (psf) (bs) (kip-ft) (kip-ft) (kip) (kip) (kip) (kip.ft) (kip.	total sliding resistance S F.S. voerturning F.S. viding Mr / Mo (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 @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf) Vu @ Toe Vu @ Heel Wall ØVc As a	5.692 8" thick 0.15 #4 @ 16" 0.0002 4.05 k-ft
sourturning aliding SOIL BEARING a q1 q2 FACTORED (1. FACTORED (1. FACTORED (1. Footing ØVc As a a	767 CTOR OF SAI 1 1 1.12 1.01 3 0.16 0.67' to 1.33' 5138 N.A. 7) STEM LOA 5.4166667 1.90 580 5.4166667 1.90 580 7.9 0.580 0.00 7.969 0.24 0.0004 7.56 0.0025 0	(ib) FETY CHECK OK (ft) (psf) (psf) (ft) (lbs) (kip-ft) (kip-ft) (kip) (total sliding resistance S F.S. verturning F.S. sliding Mr / Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure	5.692 8" thick 0.15 #4 @ 16" 0.0002 4.05 k-ft

limitations:				at top of wall does not contribute to restoring moment (overturning only), no deflection or
reference:			ide of wall does not brace wall a rete Structures, 11th Edition, pag	
file author:		last modified:	4/25/2002	
SOIL DATA	130	(pcf)	soil unit weight	Coeff. Friction
phi	35	(deg)	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		cosine(phi)	110-120 23-30 0.3-0.4 Silty sand, high clay
Ca	1.000 0.271	35.23 psf	cosine(del) coeff. of active pressure	100-120 25-35 0.2-0.4 Medium or stiff clay 90-110 20-25 0.2-0.3 Soft clay, silt
Ср	2.307	299.91 psf	coeff. of passive pressure	50-110 20-23 0.2-0.3 30tt day, Sitt
WALL GEOMET		(6)		M1 P1 W4
H1 H2	4.3333333 0.1666667	(ft) (ft)	soil retained soil depth above toe	V .
H3	0.8333333	(ft)	footing thickness	Ŧ. ₩ 1 1 1 1 1 1 1 1 1 1
H4	1	(ft)	passive pressure soil depth	
B1	0.6666667	(ft)	wall width	
B2 B3	2	(ft) (ft)	toe width heel width	W1 W3
H	5.3333333	(ft)	total height	H1
В	2.6666667	(ft)	total base	
	150	(pcf)	concrete unit weight	P
EXTERNAL LO	4.00			TOP OF SOIL
Papplied	0	(lb/ft)		
V _{applied}	0	(lb/ft)		H2 W2 Y
Mapplied	0	(lb-ft / ft)		H4 H3
Surcharge	36	(psf)		
-		,		B2 B1 B3
LOAD CALCUL		l ovorturnin -	momont	
lateral H _{prime}	soil force and 0.28	d overturning (ft)	moment converted surcharge	
Y	1.86	(ft)	distance to soil load resultant	
P	554	(lbs)	soil load resultant	A A A A A A A A A A A A A A A A A A A
	1030	(lb-ft)	Mo, soil + surcharge	
	0	(lb-ft)	Mo, external load	
	1,030	(lb-ft)	total overturning Moment	$C_{ah}w(h+h')$
	wall resto	ring forces		$y = \frac{h}{3}$ $y = \frac{h^2 + 3hh'}{3(h+2h')}$
component	weight (#)	arm (ft)	moment (#-ft)	
w1 (concrete)	450	2.33	1050	$P = \frac{1}{2} C_{a,h} w h^2 \qquad P = \frac{1}{2} C_{a,h} w h (h+2h')$
w2 (concrete) w3 (heel soil)	333 0	1.33 2.67	444 0	
w4 (surcharge)	0	2.67	0	R_{ν}
w5 (toe soil)	43	1.00	43	$q_1:(4(-6a)) \xrightarrow{P_r}{2}$
P applied	0	2.33	0	$\frac{1}{1} \frac{1}{1} \frac{1}$
vert. force	827	momen	t 1,538	91 11 11 11 11 1 1 1 1 1 1 1 1 1 1 1 1
1010.10100	021	momen	.,	1 Helling
				$\begin{array}{c} -r/3 + y \\ \hline \\ \hline \\ -r \\ -r \\ -r \\ -r \\ -r \\ -r \\$
		ng resistance (lb)		(a) Resultant in middle third
	lateral slidir 150 414	ng resistance (Ib) (Ib)	passive pressure sliding resista soil friction force	(a) Resultar in middle third
	lateral slidir 150	n g resistance (lb)	passive pressure sliding resist	(a) Resultant in middle third
	lateral slidir 150 414	ng resistance (Ib) (Ib)	passive pressure sliding resista soil friction force	(a) Resultar in middle third
STABILITY FAC	lateral slidin 150 414 564	ng resistance (Ib) (Ib) (Ib)	passive pressure sliding resists soil friction force total sliding resistance	(a) Resultant in model third $ \begin{array}{c} \rho \\ \rho' \\ \rho'' \\ \rho$
	lateral slidii 150 414 564	ng resistance (Ib) (Ib) (Ib)	passive pressure sliding resists soil friction force total sliding resistance S F.S. overturning	(a) Resulted a meddle third $ \begin{array}{c} \rho \\ \rho \\$
STABILITY FAC	lateral slidin 150 414 564 CTOR OF SAF 1 1	ng resistance (Ib) (Ib) (Ib) ETY CHECK	passive pressure sliding resists soil friction force total sliding resistance S F.S. overturning F.S. sliding	(a) Resulted a meddle third $ \begin{array}{c} \rho \\ \rho \\$
	lateral slidin 150 414 564	ng resistance (Ib) (Ib) (Ib)	passive pressure sliding resists soil friction force total sliding resistance S F.S. overturning	(a) Resultant un middle third $rac{r}{r} = \frac{r}{r} = \frac$
STABILITY FAC	lateral slidii 150 414 564 CTOR OF SAF 1 1 1.49 1.02	ng resistance (Ib) (Ib) (Ib) ETY CHECK	passive pressure sliding resists soil friction force total sliding resistance S F.S. overturning F.S. sliding Mr / Mo	(a) Resultant in middle third $R = \frac{1}{2} \frac{1}{2} \frac{1}{3} \frac$
STABILITY FAC overturning sliding SOIL BEARING	lateral slidii 150 414 564 CTOR OF SAF 1 1 1.02	ng resistance (Ib) (Ib) (Ib) EETY CHECK: OK OK	passive pressure silding resists soil friction force total silding resistance S F.S. overturning F.S. silding Mr/ Mo (PP+F)/(Ph+V)	(a) Resultant in middle third $ \begin{array}{c} $
STABILITY FAC overturning sliding SOIL BEARING a	lateral slidii 150 414 564 CTOR OF SAF 1 1 1.49 1.02 0.61	ng resistance (Ib) (Ib) (Ib) ETY CHECK	passive pressure sliding resist soil friction force total sliding resistance S F.S. overturning F.S. sliding Mr / Mo (PP+F)((Ph+V) distance to resultant	(a) Resulted a middle third (b) Resulted a middle third $\rho = \frac{\rho}{100} $
STABILITY FAC overturning sliding SOIL BEARING a	lateral slidin 150 414 564 CTOR OF SAF 1 1 1 1 1.49 1.02 6 0.61 0.89' to 1.78' 904	ng resistance (lb) (lb) (lb) (lb) EETY CHECK: OK OK (ft) (psf)	passive pressure silding resists soil friction force total silding resistance S F.S. overturning F.S. silding Mr/ Mo (PP+F)/(Ph+V)	(a) Resultant in middle third $ \begin{array}{c} $
STABILITY FAC overturning sliding SOIL BEARING a	lateral slidii 150 414 564 CTOR OF SAF 1 1 1.49 1.02 6 0.61 0.89' to 1.78'	ng resistance (lb) (lb) (lb) (lb) (ETY CHECK OK OK (ft)	passive pressure sliding resists soil friction force total sliding resistance S F.S. overturning F.S. sliding Mr / Mo (PP+F)/(Ph+V) distance to resultant middle third of footing	(a) Resolution in models that $ \frac{\rho_{1}}{\rho_{2}} \frac{\rho_{1}}{\rho_{2}} \frac{\rho_{1}}{\rho_{2}} \frac{\rho_{2}}{\rho_{2}} $ (c) Resultant outside muddle that (c) Resolution toutside muddle that
STABILITY FAC overturning sliding SOIL BEARING a q1 q2	lateral slidii 150 414 564 CTOR OF SAF 1 1 1.49 1.02 6 0.61 0.89' to 1.78' 904 N.A.	ng resistance (lb) (lb) (lb) (b) (b) (b) (b) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c	passive pressure sliding resists soil friction force total sliding resistance S F.S. overturning F.S. sliding Mr/ Mo (PP+F)/(Ph+V) distance to resultant middle third of footing bearing pressure @ toe	(a) Resulted n middle third $ \frac{p_{1}^{2} \frac{p_{1}^{2}}{p_{1}^{2}}}{(c + Resulted to outside third}} q_{1} \frac{2q_{2}}{3s} $ (c) Resulted to outside third $ \frac{q_{1}^{2} \frac{q_{1}^{2}}{s_{2}}}{(c + Resulted to outside third}} \frac{q_{1}^{2} \frac{2q_{2}}{s_{2}}}{(c + Resulted to outside third}} $
STABILITY FAC overturning sliding SOIL BEARING a q1	lateral slidii 150 414 564 CTOR OF SAF 1 1 1.49 1.02 6 0.61 0.89' to 1.78' 904 N.A.	ng resistance (lb) (lb) (lb) (b) (b) (b) (b) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c	passive pressure sliding resists soil friction force total sliding resistance S F.S. overturning F.S. sliding Mr/ Mo (PP+F)/(Ph+V) distance to resultant middle third of footing bearing pressure @ toe	(a) Resultant a model that (a) Resultant a model that $ \begin{array}{c} $
STABILITY FAC overturning sliding SOIL BEARING a q1 q2	lateral slidin 150 414 564 CTOR OF SAF 1 1 1.49 1.02	ng resistance (lb) (lb) (lb) (lb) (lb) (lb) (lb) (CF) (CF) (cpsf) (cpsf) D FORCES (ft) (ft)	passive pressure sliding resists soil friction force total sliding resistance S F.S. overturning F.S. sliding Mr / Mo (PP+F)/(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ heel H1 + H2 line of action (above base)	(a) Resulted a model that (a) Resulted a model that
STABILITY FAC overturning sliding SOIL BEARING a q1 q2	lateral slidin 150 414 564 CTOR OF SAF 1 1.49 1.02 0.61 0.89' to 1.78' 904 N.A. 7) STEM LOA 4.5 1.58 4.01	ng resistance (lb) (lb) (lb) (lb) (lb) (lb) (b) (lb) (b) D FORCES (ft) (lb)	passive pressure sliding resists soil friction force total sliding resistance S F.S. overturning F.S. sliding Mr / Mo (PP+F)/(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe bearing pressure @ toe learing pressure @ toe Paring pressur	(a) Resulted n middle third $ \frac{p_{1} + \frac{p_{1}}{2} + $
STABILITY FAC overturning sliding SOIL BEARING a q1 q2	lateral slidii 150 414 564 CTOR OF SAF 1 1 1 1.49 1.02 0.61 0.89' to 1.78' 904 N.A. 7) STEM LOA 4.5 1.58 401 401	ng resistance (lb) (lb) (lb) (lb) (lb) (b) (b) (b) (b) (lb) (l	passive pressure sliding resist soil friction force total sliding resistance S F.S. overturning F.S. sliding Mr / Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe hearing pressure @ toe heari	(a) Resulted n middle third $a^{2} \frac{1}{23} $
STABILITY FAC overturning sliding SOIL BEARING a q1 q2	lateral slidin 150 414 564 CTOR OF SAF 1 1.49 1.02 0.61 0.89' to 1.78' 904 N.A. 7) STEM LOA 4.5 1.58 4.01	ng resistance (lb) (lb) (lb) (lb) (lb) (lb) (b) (lb) (b) D FORCES (ft) (lb)	passive pressure sliding resists soil friction force total sliding resistance S F.S. overturning F.S. sliding Mr / Mo (PP+F)/(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe bearing pressure @ toe learing pressure @ toe Paring pressur	(a) Resulted n middle third $a^{2} \frac{1}{23} $
STABILITY FAC overturning sliding SOIL BEARING a q1 q2	lateral slidin 150 414 564 CTOR OF SAF 1 1.49 1.02 0.61 0.89' to 1.78' N.A. 7) STEM LOA 4.5 1.58 4.01	ng resistance (lb) (lb) (lb) (lb) (lb) (lb) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c	passive pressure sliding resists soil friction force total sliding resistance S F.S. overturning F.S. sliding Mr / Mo (PP+F)((Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe bearing pressure @ toe bearing intersection (above base) P (arm only) Ph (arm only) Mu (arm moment)	(a) Resulted n middle third $a^{2} \frac{1}{23} $
STABILITY FAC overturning sliding SOIL BEARING a q1 q2 FACTORED (1.1	lateral slidin 150 414 564 CTOR OF SAF 1 1 1 1.49 1.02 5 0.61 0.89' to 1.78' 904 N.A. 7) STEM LOA 4.5 1.58 401 401 1.1 7) FOOTING L 5.9	ng resistance (lb) (lb) (lb) (lb) (lb) (lb) ETY CHECK: OK OK (ft) (psf) (psf) (ft) (ft) (lbs) (lbs) (lbs) (lbs) (kip-ft) CADS (kip-ft)	passive pressure sliding resists soil friction force total sliding resistance S F.S. overturning F.S. siding Mr/ Mo (PP+F)/(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe beari	(a) Resulted n middle third $a^{2} \frac{1}{23} $
STABILITY FAC overturning sliding SOIL BEARING a q1 q2 FACTORED (1.1	Lateral slidin 150 414 564 CTOR OF SAF 1 1 1.49 1.02 0.61 0.89' to 1.78' N.A. 7) STEM LOA 4.5 1.58 401 401 7) FOOTING L 5.9 0.0	ng resistance (lb) (lb) (lb) (lb) (lb) (lb) (cb) (cb) (cb) (cb) (cb) (cb) (cb) (c	passive pressure sliding resists soil friction force total sliding resistance S F.S. overturning F.S. sliding Mr / Mo (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)	(a) Resulted n middle third $a^{2} \frac{1}{23} $
STABILITY FAC overturning sliding SOIL BEARING a q1 q2 FACTORED (1.1	lateral slidin 150 414 564 CTOR OF SAF 1 1 1 1.49 1.02 5 0.61 0.89' to 1.78' 904 N.A. 7) STEM LOA 4.5 1.58 401 401 1.1 7) FOOTING L 5.9	ng resistance (lb) (lb) (lb) (lb) (lb) (lb) ETY CHECK: OK OK (ft) (psf) (psf) (ft) (ft) (lbs) (lbs) (lbs) (lbs) (kip-ft) CADS (kip-ft)	passive pressure sliding resists soil friction force total sliding resistance S F.S. overturning F.S. siding Mr/ Mo (PP+F)/(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe beari	(a) Resulted n middle third $a^{2} \frac{1}{23} $
STABILITY FAC overturning sliding SOIL BEARING a q1 q2 FACTORED (1.1	lateral slidin 150 414 564 CTOR OF SAF 1 1.49 1.02 0.61 0.89' to 1.78' 904 N.A. 7) STEM LOA 4.5 1.58 401 1.11 7) FOOTING L 5.9 0.00 4.22	ng resistance (lb) (lb) (lb) (lb) (lb) (b) (lb) (cpsf) (cpsf) D FORCES (ft) (ft) (lbs) (kip-ft) (kip-ft) (kip)	passive pressure sliding resists soil friction force total sliding resistance S F.S. overturning F.S. sliding Mr/Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe bearin	(a) Resulted n middle third $a^{2} \frac{1}{23} $
STABILITY FAC overturning aliding SOIL BEARING a q1 q2 FACTORED (1. FACTORED (1.	lateral slidin 150 414 564 CTOR OF SAF 1 1.49 1.02 0.61 0.89' to 1.78' 904 N.A. 7) STEM LOA 4.5 1.58 401 1.11 7) FOOTING L 5.9 0.00 4.22	ng resistance (lb) (lb) (lb) (lb) (lb) (b) (lb) (cpsf) (cpsf) D FORCES (ft) (ft) (lbs) (kip-ft) (kip-ft) (kip)	passive pressure sliding resists soil friction force total sliding resistance S F.S. soverturning F.S. sliding Mr / Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe bea	(a) Resulted n middle third $a^{2} \frac{1}{23} $
STABILITY FAC overturning sliding SOIL BEARING a q1 q2 FACTORED (1.1	lateral slidin 150 414 564 CTOR OF SAF 1 1.49 1.02 0.61 0.89' to 1.78' 904 N.A. 7) STEM LOA 4.5 1.58 401 1.11 7) FOOTING L 5.9 0.00 4.22	ng resistance (lb) (lb) (lb) (lb) (lb) (b) (lb) (cpsf) (cpsf) D FORCES (ft) (ft) (lbs) (kip-ft) (kip-ft) (kip)	passive pressure sliding resists soil friction force total sliding resistance S F.S. overturning F.S. sliding Mr/Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe bearin	(a) Resulted n middle third $a^{2} \frac{1}{23} $
STABILITY FAC overturning sliding SOIL BEARING a q1 q2 FACTORED (1.1) FACTORED (1.1)	lateral slidin 150 414 564 CTOR OF SAF 1 1 1 1 0.89' to 1.78' 904 N.A. 7) STEM LOA 4.5 1.58 401 401 1.1 7) FOOTING L 5.9 0.0 4.22 0.00	ng resistance (lb) (lb) (lb) (lb) (lb) (lb) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c	passive pressure sliding resists soil friction force total sliding resistance S F.S. overturning F.S. sliding Mr / Mo (PP+Fy(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe bear	(a) Resultent a model third
STABILITY FAC overturning sliding SOIL BEARING a q1 q2 FACTORED (1.' FACTORED (1.' FACTORED (1.'	lateral slidin 150 414 564 CTOR OF SAF 1 1 1.49 1.02 0.89' to 1.78' 904 N.A. 7) STEM LOA 4.5 1.58 401 401 1.11 1.11 1.11 0.0 9.2 0.00 7.969 0.2 0.00	ng resistance (lb) (lb) (lb) (lb) (lb) (lb) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c	passive pressure sliding resists soil friction force total sliding resistance S F.S. overturning F.S. sliding Mr / Mo (PP+Fy(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure # toe bear	(a) Resulted a model that (b) Resulted a model that
STABILITY FAC overturning aliding SOIL BEARING a q1 q2 FACTORED (1. FACTORED (1. FACTORED (1.	lateral slidii 150 414 564 CTOR OF SAF 1 1 1.49 1.02 0.61 0.89' to 1.78' 0.61 0.89' to 1.78' 1.58 4.5 1.58 401 401 5.9 0.0 4.22 0.00 7.969 0.2 0.003 6.30	ng resistance (lb) (lb) (lb) (lb) (lb) (lb) (lb) (ft) (psf) (ft) (lbs) (kip-ft) (kip-ft) (kip) (k	passive pressure sliding resists soil friction force total sliding resistance S F.S. overturning F.S. sliding Mr / Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe bear	(a) Revoluent an modelle third
STABILITY FAC overturning sliding SOIL BEARING a q1 q2 FACTORED (1.' FACTORED (1.' FACTORED (1.'	lateral slidin 150 414 564 CTOR OF SAF 1 1 1 1 0.89' to 1.78' 0.61 0.89' to 1.78' 904 N.A. 7) STEM LOA 4.5 1.58 401 401 1.11 7) FOOTING L 5.9 0.00 4.22 0.000 7.969 0.2 0.003 6.30 0.6	ng resistance (lb) (lb) (lb) (lb) (lb) (lb) (lb) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c	passive pressure sliding resists soil friction force total sliding resistance S F.S. overturning F.S. sliding Mr / Mo (PP+Fy(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure # toe bear	(a) Resulted a model that (b) Resulted a model that
STABILITY FAC overturning sliding SOIL BEARING a q1 q2 FACTORED (1.' FACTORED (1.' FACTORED (1.'	lateral slidin 150 414 564 CTOR OF SAF 1 1 1 1 0.89' to 1.78' 0.61 0.89' to 1.78' 904 N.A. 7) STEM LOA 4.5 1.58 401 401 1.11 7) FOOTING L 5.9 0.00 4.22 0.000 7.969 0.2 0.003 6.30 0.6	ng resistance (lb) (lb) (lb) (lb) (lb) (lb) (lb) (ft) (psf) (ft) (lbs) (kip-ft) (kip-ft) (kip) (k	passive pressure sliding resists soil friction force total sliding resistance S F.S. overturning F.S. sliding Mr / Mo (PP+Fy(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure # toe bear	(a) Resulted a model that (b) Resulted a model that
STABILITY FAC overturning sliding SOIL BEARING a q1 q2 FACTORED (1.' FACTORED (1.' FACTORED (1.'	lateral slidin 150 414 564 CTOR OF SAF 1 1 1 1 0.89' to 1.78' 0.61 0.89' to 1.78' 904 N.A. 7) STEM LOA 4.5 1.58 401 401 1.11 7) FOOTING L 5.9 0.00 4.22 0.000 7.969 0.2 0.003 6.30 0.6	ng resistance (lb) (lb) (lb) (lb) (lb) (lb) (lb) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c	passive pressure sliding resists soil friction force total sliding resistance S F.S. overturning F.S. sliding Mr / Mo (PP+Fy(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure # toe bear	(a) Resulted a model that (b) Resulted a model that
STABILITY FAC overturning sliding SOIL BEARING a q1 q2 FACTORED (1.' FACTORED (1.' FACTORED (1.' Footing ØVc As a ØMn	Iateral slidin 150 414 564 CTOR OF SAF 1 1.49 1.02 0.61 0.89' to 1.78' 0.89' to 1.78' 7) STEM LOA 4.5 1.58 401 4.1 7) FOOTING L 5.9 0.00 4.22 0.00 7.969 0.2 0.001875	ng resistance (lb) (lb) (lb) (lb) (lb) (lb) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c	passive pressure sliding resists soil friction force total sliding resistance S F.S. overturning F.S. sliding Mr / Mo (PP+Fy(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe bear	(a) Recultur in model that
STABILITY FAC overturning sliding SOIL BEARING a q1 q2 FACTORED (1.' FACTORED (1.' FACTORED (1.'	lateral slidii 150 414 564 CTOR OF SAF 1 1 1 1 0.61 0.89' to 1.78' 904 N.A. 7) STEM LOA 4.55 1.58 401 1 1 7) FOOTING L 5.9 0.00 4.22 0.000 7.969 0.2 0.0003 6.30 0.61 0.2 0.001875 0.001875	ng resistance (lb) (lb) (lb) (lb) (lb) (lb) (lb) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c	passive pressure sliding resists soil friction force total sliding resistance S F.S. overturning F.S. sliding Mr / Mo (PP+Fy(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure # toe bear	(a) Recultur in model that
STABILITY FAC overturning sliding SOIL BEARING a q1 q2 FACTORED (1.' FACTORED (1.' FACTORED (1.' Footing ØVc As a ØMn	Iateral slidin 150 414 564 CTOR OF SAF 1 1.49 1.02 0.61 0.89' to 1.78' 0.89' to 1.78' 7) STEM LOA 4.5 1.58 401 1.11 7) FOOTING L 0.00 4.22 0.00 7,969 0.2 0.001875 0 1536.8	ng resistance (lb) (lb) (lb) (lb) (lb) (lb) (lb) (lb) (lb) (psf) (psf) (psf) (psf) (ft) (lbs) (kip-ft) (kip-ft) (kip) (kip) (kip) 10" thick #4 @ 12" k-ft 3-#4 Reinf. Ratio	passive pressure sliding resists soil friction force total sliding resistance S F.S. overturning F.S. sliding Mr / Mo (PP+Fy(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe bearin	(a) Reputer a model that
STABILITY FAC overturning sliding SOIL BEARING a q1 q2 FACTORED (1.' FACTORED (1.' FACTORED (1.' Footing ØVc As a ØMn	Iateral slidin 150 414 564 CTOR OF SAF 1 1.49 1.02 0.61 0.89' to 1.78' 0.89' to 1.78' 7) STEM LOA 4.5 1.58 401 1.11 7) FOOTING L 0.00 4.22 0.00 7,969 0.2 0.001875 0 1536.8	ng resistance (ib) (ib) (ib) (ib) (ib) (ib) CHECK: OK OK (ft) (psf) (psf) D FORCES (ft) (ft) (bs) (kip-ft) (kip-ft) (kip) (kip) 10" thick #4 @ 12" k-ft 3-#4 Reinf. Ratio	passive pressure sliding resists soil friction force total sliding resistance S F.S. overturning F.S. sliding Mr / Mo (PP+Fy(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe bear	(a) Reputer a model that
STABILITY FAC overturning sliding SOIL BEARING a q1 q2 FACTORED (1.' FACTORED (1.' FACTORED (1.' Footing ØVc As a ØMn	Iateral slidin 150 414 564 CTOR OF SAF 1 1.49 1.02 0.61 0.89' to 1.78' 0.89' to 1.78' 7) STEM LOA 4.5 1.58 401 1.11 7) FOOTING L 0.00 4.22 0.00 7,969 0.2 0.001875 0 1536.8	ng resistance (lb) (lb) (lb) (lb) (lb) (lb) (lb) (lb) (lb) (psf) (psf) (psf) (psf) (ft) (lbs) (kip-ft) (kip-ft) (kip) (kip) (kip) 10" thick #4 @ 12" k-ft 3-#4 Reinf. Ratio	passive pressure sliding resists soil friction force total sliding resistance S F.S. overturning F.S. sliding Mr / Mo (PP+Fy(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe bearin	(a) Reputer a model that

CANTILEVER RETAINING WALL EXTERNAL STABILITY

	service load che	cks, soil on low s	ide of wall does not brace wall a	t at top of wall does not contribute to restoring moment (overturning only), no deflecti against overturning (sliding only)
eference: ile author:		Design of Conc ast modified:	rete Structures, 11th Edition, pa 4/25/2002	ge 680
	S. Fleun	asi modilled.	4/25/2002	
SOIL DATA	130	(nof)		Conff Fridian
w phi	35	(pcf) (deg)	soil unit weight soil internal angle of friction	Coeff. 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 P1 W4
H1	5.3333333	(ft)	soil retained	••••7 P1 W4
H2	0.1666667	(ft)	soil depth above toe	\mathbf{V}_1
H3 H4	0.8333333	(ft) (ft)	footing thickness passive pressure soil depth	
B1	0.6666667	(ft)	wall width	
B2	3.25	(ft)	toe width	W1 W3
В3 Н	0 6.3333333	(ft) (ft)	heel width	H1
В	3.9166667	(ft)	total height total base	7 7
	150	(pcf)	concrete unit weight	P
EXTERNAL LO				TOP OF SOIL
Papplied	150	(lb/ft)		
Vapplied	450	(lb/ft)	1.5	
Mapplied	0	(lb-ft / ft)		H4 H3
Surcharge	44	(psf)		
LOAD CALCUL	ATIONS			- ² ~ ~ - ~ ~ - ~ ~ ~ ~ ~ ~ ~ ~
lateral	soil force and			
H _{prime} Y	0.34	(ft)	converted surcharge	
Y P	2.21 782	(ft) (Ibs)	distance to soil load resultant soil load resultant	
	1730	(lb-ft)	Mo, soil + surcharge	
	-675	(lb-ft)	Mo, external load	
	1,060	(lb-ft)	total overturning Moment	C_{ahwh} $C_{ahw(h+h')}$
	wall resto	ring forces		$y = \frac{h}{3}$ $y = \frac{h^2 + 3hh'}{3(h+2h')}$
component	weight (#)	arm (ft)	moment (#-ft)	
w1 (concrete) w2 (concrete)	550 490	3.58 1.96	1971 959	$P = \frac{1}{2} C_{ah} wh^2$ $P = \frac{1}{2} C_{ah} wh (h+2h')$
v3 (heel soil)	0	3.92	0	
w4 (surcharge)	0	3.92	0	
w5 (toe soil) P applied	70 150	1.63 0.33	114 50	$q_1=(4(-6a)\frac{R_1}{\ell^2})$
vert. force	1,260	0.33 momen		$\begin{array}{c} -\frac{1}{2}\frac$
				(a) Resultant in middle third
	150	ng resistance (lb)	passive pressure sliding resist	
	630	(lb)	soil friction force	R R
		(lb)	total sliding resistance	$a \rightarrow 3a \rightarrow a$ $a \rightarrow a$ $a \rightarrow a$
	780			
				۹
STABILITY FA		ETY CHECK		(c) Resultant outside middle third
STABILITY FA	CTOR OF SAF		S F.S. overturning F.S. sliding	
overturning	CTOR OF SAF 1 1 2.92	ок	F.S. overturning F.S. sliding Mr / Mo	C 2) Resultant outside middle third O 0.20160606775333333 1.175 156666669196333333 2.55 2.71166666713333333 3.555 3.91666666
overturning	CTOR OF SAF		F.S. overturning F.S. sliding	0 0.3916060807/8333333 1.175 1.56666668096833333 2.35 2.741666608713333333 3.525 3.91666668
overturning sliding	CTOR OF SAF 1 2.92 2.35	ок ок	F.S. overturning F.S. sliding Mr / Mo	0 0.391660600778333333 1.175 1.5666666001968333333 2.15 2.741666600713333333 3.555 3.0166666 0
	CTOR OF SAF 1 2.92 2.35 6 1.61	ок	F.S. overturning F.S. sliding Mr / Mo (PP+F)(Ph+V) distance to resultant	0 0.391660600778333333 1.175 1.5666666001968333333 2.15 2.741666600713333333 3.555 3.0166666 0
overturning sliding SOIL BEARING a	CTOR OF SAF 1 2.92 2.35 3 1.61 1.31' to 2.61'	OK OK (ft)	F.S. siding F.S. siding Mr / Mo (PP+F)'(Ph+V) distance to resultant middle third of footing	0 0.59166668776333333 1.175 1.56068668796835333 2.35 2.74166668713333333 3.525 3.91666686 0 -100 - -00 -
overturning sliding SOIL BEARING	CTOR OF SAF 1 2.92 2.35 6 1.61	ок ок	F.S. overturning F.S. sliding Mr / Mo (PP+F)(Ph+V) distance to resultant	0 0.991066000776333333 1.175 1.96660600996833333 2.55 2.741666600713333333 3.555 1.9166660
sliding SOIL BEARING a q1 q2	CTOR OF SAF 1 2.92 2.35 3 1.61 1.31' to 2.61' 493 150	OK OK (ft) (psf) (psf)	F.S. overturning F.S. sliding Mr / Mo (PP+F)/(Ph+V) distance to resultant middle third of footing bearing pressure @ toe	0 0.59166060778333333 1.175 1.566666009166333333 2.35 2.74166600713333333 3.555 3.91666660 100 1 100
overturning sliding SOIL BEARING a q1 q2	CTOR OF SAF 1 2.92 2.35 3 1.61 1.31' to 2.61' 493 150	OK OK (ft) (psf) (psf) D FORCES	F.S. overturning F.S. sliding Mr / Mo (PP+F)/(Ph+V) distance to resultant middle third of footing bearing pressure @ toe	0 0.999666677533333 1.175 1.9666666796833333 2.35 2.7476666671333333 3.555 1.9166666 100 100 100 100 100 BEARING PRESSURE (psf)
overturning sliding SOIL BEARING a q1	CTOR OF SAF 1 2.92 2.35 3 1.61 1.31' to 2.61' 493 150 7) STEM LOAI 5.5 1.93	OK OK (ft) (psf) (psf) D FORCES (ft) (ft)	F.S. overturning F.S. sliding Mr/ Mo (PP+F)/(Ph+V) distance to resultant middle third of footing bearing pressure @ heel bearing pressure @ heel H1 + H2 line of action (above base)	0 0.59166666778333333 1.175 1.566666669696833333 2.35 2.74166666713333333 3.555 3.91666666 100 1 100 1 100 1 100 1 BEARING PRESSURE
sliding SOIL BEARING a q1 q2	CTOR OF SAF	OK OK (ft) (psf) (psf) D FORCES (ft) (ft) (lbs)	F.S. overturning F.S. sliding Mr / Mo (PP+F)/(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe bearing pressure @ toe bearing interface (base) H1 + H2 line of action (above base) P (arm only)	0 0.999666677533333 1.175 1.9666666796833333 2.35 2.7476666671333333 3.555 1.9166666 100 100 100 100 100 BEARING PRESSURE (psf)
sliding SOIL BEARING a q1 q2	CTOR OF SAF 1 2.92 2.35 5 1.61 1.31' to 2.61' 493 150 7) STEM LOAI 5.5 1.93 599 599	OK OK (ft) (psf) (psf) D FORCES (ft) (ft) (lbs)	F.S. overturning F.S. sliding Mr / Mo (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 0.59196666778333333 1.175 1.56666669996833333 2.35 2.7419666971333333 3.555 3.91966666 100 100 100 100 100 100 100
overturning sliding SOIL BEARING a q1 q2 FACTORED (1.	CTOR OF SAF	OK OK (ft) (psf) (psf) D FORCES (ft) (ft) (lbs) (lbs) (kip-ft)	F.S. overturning F.S. sliding Mr / Mo (PP+F)/(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe bearing pressure @ toe bearing interface (base) H1 + H2 line of action (above base) P (arm only)	0 0.59196969778333333 1.175 1.56696696996833333 2.35 2.741969696713333333 3.555 1.91969696 100 100 100 100 100 100 100 10
overturning sliding SOIL BEARING a q1 q2	CTOR OF SAF 1 2.92 2.35 3 1.61 1.31' to 2.61' 493 150 7) STEM LOAL 5.5 1.93 599 599 6.2 7) FOOTING L	OK OK (ft) (psf) (psf) D FORCES (ft) (ft) (lbs) (kip-ft) .OADS	F.S. overturning F.S. sliding Mr / Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ heel bearing pressure @ heel H1 + H2 line of action (above base) P (arm only) Ph (arm only) Mu (arm moment)	0 0.59196969778333333 1.175 1.56696696996833333 2.35 2.741969696713333333 3.555 1.91969696 100 100 100 100 100 100 100 10
overturning sliding SOIL BEARING a q1 q2 FACTORED (1.	CTOR OF SAF 1 2.92 2.35 3 1.61 1.31' to 2.61' 493 150 7) STEM LOAI 5.5 1.93 599 599 6.2 7) FOOTING L 3.6	OK OK (ft) (psf) (psf) D FORCES (ft) (lbs) (lbs) (kip-ft) COADS (kip-ft)	F.S. overturning F.S. sliding Mr / Mo (PP+F)/(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe bearing pressure @ toe bearing pressure @ toe bearing nessure @ toe bearing	0 0.59196666778333333 1.175 1.56666669996833333 2.35 2.7419666971333333 3.555 3.91966666 100 100 100 100 100 100 100
sverturning sliding SOIL BEARING a q1 q2 FACTORED (1.	CTOR OF SAF 1 2.92 2.35 3 1.61 1.31' to 2.61' 493 150 7) STEM LOAL 5.5 1.93 599 599 6.2 7) FOOTING L	OK OK (ft) (psf) (psf) D FORCES (ft) (ft) (lbs) (kip-ft) .OADS	F.S. overturning F.S. sliding Mr / Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ heel bearing pressure @ heel H1 + H2 line of action (above base) P (arm only) Ph (arm only) Mu (arm moment)	0 0.59196969778333333 1.175 1.56696696996833333 2.35 2.741969696713333333 3.555 1.91969696 100 100 100 100 100 100 100 10
sverturning sliding SOIL BEARING a q1 q2 FACTORED (1.	CTOR OF SAF	OK OK (ft) (psf) (psf) (ft) (bs) (kip-ft) (kip-ft)	F.S. overturning F.S. sliding Mr/ Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe bearing pressure @ toe bearing newsure @ toe heat newsure newsure n	0 0.59196969778333333 1.175 1.56696696996833333 2.35 2.741969696713333333 3.555 1.91969696 100 100 100 100 100 100 100 10
sverturning sliding SOIL BEARING a q1 q2 FACTORED (1.	CTOR OF SAF 1 2.92 2.35 3 1.61 1.31' to 2.61' 493 150 7) STEM LOA 5.5 1.93 599 599 6.2 7) FOOTING L 3.6 0.0 1.94	OK OK (ft) (psf) D FORCES (ft) (ft) (lbs) (kip-ft) (kip-ft) (kip)	F.S. overturning F.S. sliding Mr/ Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe bearing pressure @ toe bearing pressure @ toe bearing pressure @ toe healthead to the thead to the thead H1 + H2 line of action (above base) P (arm only) Mu (arm moment) Mu @ Toe (Bot Reinf) Mu @ Heel (Top Reinf) Vu @ Toe	0 0.59196666778333333 1.175 1.56666669996833333 2.35 2.7419666971333333 3.555 3.91966666 100 100 100 100 100 100 100
source for the second s	CTOR OF SAF	OK OK (ft) (psf) (psf) D FORCES (ft) (ft) (lbs) (kip-ft) (kip-ft) (kip) (kip)	F.S. overturning F.S. sliding Mr/ Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @	0 0.999666677533333 1.175 1.9966666796433333 2.35 2.749666671333333 3.555 3.9966666 100 100 100 100 100 100 100
SOIL BEARING a q1 q2 FACTORED (1. FACTORED (1.	CTOR OF SAF 1 2.92 2.35 3 1.61 1.31' to 2.61' 1.31' to 2.61' 5.5 1.93 599 599 6.2 7) FOOTING L 3.6 0.00 1.94 0.00 7,969	OK OK (ft) (psf) (psf) (ft) (bbs) (kip-ft) (kip-ft) (kip) (kip) (kip)	F.S. overturning F.S. sliding Mr/ Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure	5,692 8" thick
overturning sliding SOIL BEARING a q1 q2 FACTORED (1.	CTOR OF SAF 1 2.92 2.35 3 1.61 1.31' to 2.61' 493 150 7) STEM LOAI 5.5 1.93 599 599 6.2 7) FOOTING L 3.6 0.00 1.94 0.00 7,969 0.2	OK OK (ft) (psf) (psf) D FORCES (ft) (ft) (lbs) (kip-ft) (kip-ft) (kip) (kip)	F.S. overturning F.S. sliding Mr/ Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @	5,692 8" thick 0.24 #4 @ 10"
SOIL BEARING a q1 q2 FACTORED (1. FACTORED (1. FACTORED (1.	CTOR OF SAF 1 2.92 2.35 3 1.61 1.31' to 2.61' 1.31' to 2.61' 5.5 1.93 599 599 6.2 7) FOOTING L 3.6 0.00 1.94 0.00 7,969	OK OK (ft) (psf) (psf) (ft) (bs) (kip-ft) (kip-ft) (kip) (kip) (kip) (kip) (kip)	F.S. overturning F.S. sliding Mr/ Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ heel bearing pressure @ heel bearing pressure @ heel H1 + H2 line of action (above base) P (arm only) Ph (arm moment) Pl (arm moment) Mu @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf) Mu @ Heel (Top Reinf) Vu @ Toe Vu @ Toe Vu @ Toe	5,692 8" thick
SOIL BEARING aliding SOIL BEARING a q1 q2 FACTORED (1. FACTORED (1.	CTOR OF SAF 1 2.92 2.35 3 1.61 1.31' to 2.61' 493 150 7) STEM LOAI 5.5 1.93 599 599 6.2 7) FOOTING L 3.6 0.0 1.94 0.00 7,969 0.2 0.0003 6.30 1	OK OK (ft) (psf) D FORCES (ft) (ft) (bs) (kip-ft) (kip-ft) (kip) (kip) (kip) (kip) (kip) (kip) (kip) (kip) (kip)	F.S. overturning F.S. sliding Mr/ Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure	5,692 8" thick 0.24 #4 @ 10" 0.0004
SOIL BEARING aliding SOIL BEARING a q1 q2 FACTORED (1. FACTORED (1.	CTOR OF SAF 1 2.92 2.35 3 1.61 1.31' to 2.61' 493 150 7) STEM LOAI 5.5 1.93 599 599 6.2 7) FOOTING L 3.6 0.0 1.94 0.00 7,969 0.2 0.0003 6.30 1	OK OK (ft) (psf) (psf) (ft) (bs) (kip-ft) (kip-ft) (kip) (kip) (kip) (kip) (kip)	F.S. overturning F.S. sliding Mr/ Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure	5,692 8" thick 0.24 #4 @ 10" 0.0004
source of the second se	CTOR OF SAF 1 2.92 2.35 3 1.61 1.31' to 2.61' 493 150 7) STEM LOAI 5.5 1.93 599 599 6.2 7) FOOTING L 3.6 0.0 1.94 0.00 7,969 0.2 0.0003 6.30 1	OK OK (ft) (psf) D FORCES (ft) (ft) (bs) (kip-ft) (kip-ft) (kip) (kip) (kip) (kip) (kip) (kip) (kip) (kip) (kip)	F.S. overturning F.S. sliding Mr/ Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure	5,692 8" thick 0.24 #4 @ 10" 0.0004
SOIL BEARING alding SOIL BEARING a q1 q2 FACTORED (1. FACTORED (1.	CTOR OF SAF 1 2.92 2.35 1.61 1.31' to 2.61' 493 150 7) STEM LOA. 5.5 1.93 599 6.2 7) FOOTING L 3.6 0.0 1.94 0.20 0.003 6.30 1 0.0021277 354.25106	OK OK (ft) (psf) D FORCES (ft) (ft) (bs) (kip-ft) (kip-ft) (kip-ft) (kip) (kip) 10" thick #4 @ 12" k-ft 5-#4 Reinf. Ratio	F.S. overturning F.S. sliding Mr/ Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @	5,692 8" thick 0.24 #4 @ 10" 0.0004
SOIL BEARING aliding SOIL BEARING a q1 q2 FACTORED (1. FACTORED (1.	CTOR OF SAF 1 2.92 2.35 1.61 1.31' to 2.61' 493 150 7) STEM LOA. 5.5 1.93 599 6.2 7) FOOTING L 3.6 0.0 1.94 0.20 0.003 6.30 1 0.0021277 354.25106	OK OK (ft) (psf) (psf) (bs) (bs) (kip-ft) (kip-ft) (kip) (ki	F.S. overturning F.S. sliding Mr/ Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @	5,692 8" thick 0.24 #4 @ 10" 0.0004
SOIL BEARING alding SOIL BEARING a q1 q2 FACTORED (1. FACTORED (1.	CTOR OF SAF 1 2.92 2.35 1.61 1.31' to 2.61' 493 150 7) STEM LOAL 5.5 1.93 599 599 6.2 7) FOOTING L 3.6 0.0 1.94 0.00 7,969 0.2 0.0003 6.30 1 0.00212777 354.25106 838.1' 786.25452	OK OK (ft) (psf) D FORCES (ft) (ft) (bs) (kip-ft) (kip-ft) (kip-ft) (kip) (kip) 10" thick #4 @ 12" k-ft 5-#4 Reinf. Ratio	F.S. overturning F.S. sliding Mr/ Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @	5.692 8" thick 0.24 #4 @ 10" 0.0004 6.48 k-ft

CANTILEVER RETAINING WALL EXTERNAL STABILITY

reference:		cks, soil on low s	cohesive soils, external momer ide of wall does not brace wall	
ile author:		Design of Conc ast modified:	rete Structures, 11th Edition, pa 4/25/2002	ge 680
SOIL DATA				
w	130	(pcf)	soil unit weight	Coeff. Friction
phi del	35	(deg)	soil internal angle of friction	Unit Weight Int Friction w. Conc Soil
dei	0.5	(deg)	surface angle incline coeff. friction w/Concrete	110-120 33-40 0.5-0.6 Sand or gravel, no fines 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 2.307	35.23 psf	coeff. of active pressure	90-110 20-25 0.2-0.3 Soft clay, silt
Ср		299.91 psf	coeff. of passive pressure	
WALL GEOMET H1		(4)	and an end of the set	M1 P1 W4
H1 H2	6.3333333 0.1666667	(ft) (ft)	soil retained soil depth above toe	\mathbf{V}_1
H3	0.8333333	(ft)	footing thickness	+ VI + 1111111
H4	1	(ft)	passive pressure soil depth	
B1	0.6666667	(ft)	wall width	
B2 B3	4.25 0	(ft) (ft)	toe width heel width	W1 W3
H	7.3333333	(ft)	total height	H1
В	4.9166667	(ft)	total base	
	150	(pcf)	concrete unit weight	P
EXTERNAL LO	ADS			TOP OF SOLL
Papplied	150	(lb/ft)		H2 W2 Y
Vapplied	450	(lb/ft)	1.5	
Mapplied	0	(lb-ft / ft)		H3 +
Surcharge	52	(psf)		
LOAD CALCUL				
	soil force and 0.40	l overturning (ft)	moment converted surcharge	
H _{prime} Y	2.56	(ft)	distance to soil load resultant	
P	1051	(lbs)	soil load resultant	
	2690	(ĺb-fť)	Mo, soil + surcharge	
	-675	(lb-ft)	Mo, external load	
	2,020	(lb-ft)	total overturning Moment	$C_{a,h}$ wh $C_{a,h}$ w(h+h')
	wall resto	ring forces		$y = \frac{h}{3}$ $y = \frac{h^2 + 3hh'}{3(h+2h')}$
component	weight (#)	arm (ft)	moment (#-ft)	
w1 (concrete) w2 (concrete)	650 615	4.58 2.46	2979 1511	$P = \frac{1}{2} C_{ah} wh^2 \qquad P = \frac{1}{2} C_{ah} wh (h+2h')$
w3 (heel soil)	0	4.92	0	
w4 (surcharge)	0	4.92	0	
w5 (toe soil)	92 150	2.13 0.33	196 50	$\frac{1}{1-a} = \frac{1}{a} = $
P applied vert. force	1,507	0.33 momen		q_1 $q_2^{*}(6a-2l) \frac{R_v}{l^2}$
				$\begin{array}{c} \hline & & & \\ \hline \\ \hline$
	lateral slidir 150	ng resistance (lb)	passive pressure sliding resis	(a) Resultant in middle third
	754	(lb)	soil friction force	R ZR
	904	(lb)	total sliding resistance	$-\sqrt{3}$
STABILITY FAC	CTOR OF SAF	ETY CHECK	S F.S. overturning	(c) Resultant outside middle third
	1		F.S. sliding	
	1 1			
	1 2.34	ок	Mr / Mo	0 0.491666660798333333 1.475 1.966666602745833333 2.95 3.441666660793333333 4.425 4.91668660
	1	ок ок		
sliding	1 2.34 1.50		Mr / Mo	0 0.49196906799533333 1.475 1.99906969745833333 2.85 3.44196909795333333 4.425 4.9196069
overturning sliding SOIL BEARING a	1 2.34 1.50 1.80		Mr / Mo (PP+F)/(Ph+V) distance to resultant	
sliding SOIL BEARING a	1 2.34 1.50 1.80 1.64' to 3.28'	ок (ft)	Mr / Mo (PP+F)/(Ph+V) distance to resultant middle third of footing	0 -100 -200
sliding SOIL BEARING a q1	1 2.34 1.50 1.80	OK (ft) (psf)	Mr / Mo (PP+F)((Ph+V) distance to resultant middle third of footing bearing pressure @ toe	- 000-
sliding SOIL BEARING a q1 q2	1 2.34 1.50 1.64' to 3.28' 553 60	OK (ft) (psf) (psf)	Mr / Mo (PP+F)/(Ph+V) distance to resultant middle third of footing	
sliding SOIL BEARING a q1 q2	1 2.34 1.50 1.64' to 3.28' 553 60 7) STEM LOAI	OK (ft) (psf) (psf) D FORCES	Mr / Mo (PP+F)((Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ heel	BEARING PRESSURE (psf)
sliding SOIL BEARING a q1 q2	1 2.34 1.50 1.64' to 3.28' 553 60	OK (ft) (psf) (psf) D FORCES (ft)	Mr / Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ heel H1 + H2	0 100 100 100 100 100 BEARING PRESSURE
sliding SOIL BEARING a q1 q2	1 2.34 1.50 1.64' to 3.28' 553 60 7) STEM LOAI 6.5 2.29 836	OK (ft) (psf) (psf) D FORCES (ft) (ft) (lbs)	Mr / Mo (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)	BEARING PRESSURE (psf)
sliding SOIL BEARING a q1 q2	1 2.34 1.50 1.64' to 3.28' 553 60 7) STEM LOAI 6.5 2.29 836 836	OK (ft) (psf) (psf) D FORCES (ft) (lbs) (lbs)	Nr / Mo (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)	BEARING PRESSURE (psf)
sliding SOIL BEARING a q1 q2	1 2.34 1.50 1.64' to 3.28' 553 60 7) STEM LOAI 6.5 2.29 836	OK (ft) (psf) (psf) D FORCES (ft) (ft) (lbs)	Mr / Mo (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)	BEARING PRESSURE (psf)
sliding SOIL BEARING a q1 q2 FACTORED (1.7	1 2.34 1.50 1.64' to 3.28' 553 60 7) STEM LOA 6.5 2.29 836 836 836 836	OK (ft) (psf) (psf) D FORCES (ft) (ft) (lbs) (lbs) (kip-ft)	Nr / Mo (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)	BEARING PRESSURE (psf)
sliding SOIL BEARING a q1 q2 FACTORED (1.7	1 2.34 1.50 1.64' to 3.28' 553 60 7) STEM LOAI 6.5 2.29 836 836 836 836 836 836 836 836 836 836	OK (ft) (psf) (psf) D FORCESS (ft) (ft) (lbs) (kip-ft) OADS (kip-ft)	Mr / Mo (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)	BEARING PRESSURE (psf)
sliding SOIL BEARING a q1 q2 FACTORED (1.7	1 2.34 1.50 1.64' to 3.28' 553 60 7) STEM LOAI 6.5 2.29 836 836 836 836 836 7) FOOTING L 6.3 0.0	OK (ft) (psf) (psf) D FORCES (ft) (lbs) (kip-ft) (kip-ft)	Mr / Mo (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) Mu @ Heel (Top Reinf)	BEARING PRESSURE (psf)
sliding SOIL BEARING a q1 q2 FACTORED (1.7	1 2.34 1.50 1.64' to 3.28' 553 60 7) STEM LOAI 6.5 2.29 836 836 836 8.2 7) FOOTING L 6.3 0.0 2.46	OK (ft) (psf) (psf) D FORCES (ft) (ft) (lbs) (lbs) (kip-ft) (kip-ft) (kip)	Mr / Mo (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)	BEARING PRESSURE (psf)
sliding SOIL BEARING a q1 q2 FACTORED (1.7	1 2.34 1.50 1.64' to 3.28' 553 60 7) STEM LOAI 6.5 2.29 836 836 836 836 836 7) FOOTING L 6.3 0.0	OK (ft) (psf) (psf) D FORCES (ft) (lbs) (kip-ft) (kip-ft)	Mr / Mo (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) Mu @ Heel (Top Reinf) V u @ Toe	BEARING PRESSURE (psf)
SOIL BEARING a q1 q2 FACTORED (1.7	1 2.34 1.50 1.64' to 3.28' 553 60 7) STEM LOAI 6.5 2.29 836 836 836 8.2 7) FOOTING L 6.3 0.0 2.46	OK (ft) (psf) (psf) D FORCES (ft) (ft) (lbs) (lbs) (kip-ft) (kip-ft) (kip)	Mr / Mo (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) Mu @ Heel (Top Reinf) Vu @ Toe Vu @ Heel	BEARING PRESSURE (psf)
sliding a q1 q2 FACTORED (1.7 FACTORED (1.7 FACTORED (1.7	1 2.34 1.50 1.64' to 3.28' 553 60 7) STEM LOAI 6.5 2.29 836 836 836 8.2 7) FOOTING L 6.3 0.0 2.46	OK (ft) (psf) (psf) D FORCES (ft) (ft) (lbs) (lbs) (kip-ft) (kip-ft) (kip)	Mr / Mo (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) Mu @ Heel (Top Reinf) V u @ Toe	BEARING PRESSURE (psf)
sliding SOIL BEARING a q1 q2 FACTORED (1.7 FACTORED (1.7 FACTORED (1.7 Footing ØVc As	1 2.34 1.50 1.64' to 3.28' 553 60 7) STEM LOAI 6.5 2.29 836 836 8.2 7) FOOTING L 6.3 0.0 2.46 0.00 2.46 0.00	OK (ft) (psf) (psf) D FORCES (ft) (lbs) (kip-ft) (kip-ft) (kip-ft) (kip) (kip)	Mr / Mo (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) Mu (arm moment) Mu @ Toe (Bot Reinf) Mu @ Heel (Top Reinf) Vu @ Toe Vu @ Toe Vu @ Heel Wall	5.692 8" thick 0.372 #5 @ 10"
soil BEARING a q1 q2 FACTORED (1.7 FACTORED (1.7 Footing ØVc As a	1 2.34 1.50 1.64' to 3.28' 553 60 7) STEM LOAI 6.5 2.29 836 836 836 8.2 7) FOOTING L 6.3 0.0 2.46 0.00 2.46 0.00	OK (ft) (psf) (psf) D FORCES (ft) (lbs) (kip-ft) (kip-ft) (kip-ft) (kip) (kip) 10" thick #5 @ 16"	Mr / Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe p (arm only) Ph (arm moment) Mu @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf) Mu @ Heel (Top Reinf) Vu @ Toe Vu @ Heel Wall ØVc As a	5,692 8" thick 0.372 #5 @ 10" 0.0005
soil BEARING a q1 q2 FACTORED (1.7 FACTORED (1.7 Footing ØVc As a	1 2.34 1.50 1.64' to 3.28' 553 60 7) STEM LOAI 6.5 2.29 836 8.6 8.2 7) FOOTING L 6.3 0.0 2.46 0.00 2.325 0.0003 7.32	OK (ft) (psf) (psf) D FORCES (ft) (lbs) (kip-ft) (kip-ft) (kip) (kip) (kip) (kip) (kip) (kip)	Mr / Mo (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) Mu (arm moment) Mu @ Toe (Bot Reinf) Mu @ Heel (Top Reinf) Vu @ Toe Vu @ Toe Vu @ Heel Wall	5,692 8" thick 0.372 #5 @ 10"
sliding SOIL BEARING a q1 q2 FACTORED (1.7 FACTORED (1.7 FACTORED (1.7 Footing ØVc As	1 2.34 1.50 1.64' to 3.28' 553 60 7) STEM LOAI 6.5 2.29 836 8.32 7) FOOTING L 6.3 0.0 2.46 0.00 2.46 0.00 2.46 0.00 2.7,969 0.2325 0.0003 7.32 1.55	OK (ft) (psf) (psf) D FORCES (ft) (lbs) (kip-ft) (kip-ft) (kip-ft) (kip) (kip) 10" thick #5 @ 16"	Mr / Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe p (arm only) Ph (arm moment) Mu @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf) Mu @ Heel (Top Reinf) Vu @ Toe Vu @ Heel Wall ØVc As a	5,692 8" thick 0.372 #5 @ 10" 0.0005
soil BEARING a q1 q2 FACTORED (1.7 FACTORED (1.7 Footing ØVc As a	1 2.34 1.50 1.64' to 3.28' 553 60 7) STEM LOAI 6.5 2.29 836 8.32 7) FOOTING L 6.3 0.0 2.46 0.00 2.46 0.00 2.46 0.00 2.7,969 0.2325 0.0003 7.32 1.55	OK (ft) (psf) (psf) D FORCES (ft) (ft) (lbs) (lbs) (kip-ft) (kip-ft) (kip) (ki	Mr / Mo (PP+F)(Ph+V) distance to resultant middle third of footing bearing pressure @ toe bearing pressure @ toe p (arm only) Ph (arm moment) Mu @ Toe (Bot Reinf) Mu @ Toe (Bot Reinf) Mu @ Heel (Top Reinf) Vu @ Toe Vu @ Heel Wall ØVc As a	5,692 8" thick 0.372 #5 @ 10" 0.0005
soil BEARING a q1 q2 FACTORED (1.7 FACTORED (1.7 Footing ØVc As a ØMn	1 2.34 1.50 1.64' to 3.28' 553 60 7) STEM LOAI 6.5 2.29 836 836 836 8.2 7) FOOTING L 6.3 0.0 2.46 0.00 2.46 0.00 2.325 0.0003 7.32 1.55 0.0026271	OK (ft) (psf) (psf) D FORCES (ft) (lbs) (kip-ft) (kip-ft) (kip-ft) (kip) (kip) (kip) 10" thick #5 @ 16" k-ft 5-#5 Reinf. Ratio	Mr / Mo (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) Mu (arm moment) Mu @ Toe (Bot Reinf) Mu @ Heel (Top Reinf) Yu @ Toe Yu @ Heel Wall ØVC As a ØMn	5,692 8" thick 0.372 #5 @ 10" 0.0005
Alding SOIL BEARING a q1 q2 FACTORED (1.7 FACTORED (1.7 Footing ØVc As a	1 2.34 1.50 1.64' to 3.28' 553 60 7) STEM LOAI 6.5 2.29 836 8.36 8.36 8.2 7) FOOTING L 6.3 0.00 2.46 0.00 2.46 0.000 7,969 0.2325 0.0003 7.32 1.55 0.00026271 215.64068 5	OK (ft) (psf) (psf) D FORCES (ft) (ft) (lbs) (lbs) (kip-ft) (kip-ft) (kip) (ki	Mr / Mo (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) Mu (arm moment) Mu @ Toe (Bot Reinf) Mu @ Heel (Top Reinf) Yu @ Toe Yu @ Heel Wall ØVC As a ØMn	5,692 8" thick 0.372 #5 @ 10" 0.0005
SOIL BEARING a q1 q2 FACTORED (1.7 FACTORED (1.7 FOOTING dVc As a dMn	1 2.34 1.50 1.64' to 3.28' 553 60 7) STEM LOAI 6.5 2.29 836 8.36 8.36 8.2 7) FOOTING L 6.3 0.00 2.46 0.00 2.46 0.000 7,969 0.2325 0.0003 7.32 1.55 0.00026271 215.64068 [OK (ft) (psf) D FORCES (ft) (ft) (kip-ft) (kip-ft) (kip-ft) (kip) (kip) 10" thick #5 @ 16" k-ft 5-#5 Reinf. Ratio	Mr / Mo (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) Mu (arm moment) Mu @ Toe (Bot Reinf) Mu @ Heel (Top Reinf) Yu @ Toe Yu @ Heel Wall ØVC As a ØMn	5,692 8" thick 0.372 #5 @ 10" 0.0005 10.04 k-ft

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CANTILEVER RETAINING WALL EXTERNAL STABILITY

file author: S. Frech last mod SOIL DATA (P) w 135 (d) phi 35 (d) del 0 (d) 0.819 1.000 (d) 0.819 1.000 (d) 0.819 1.000 (d) 0.271 352 (d) H1 7.3333333 (f) H2 0.1666667 (f) H3 0.83333333 (f) H4 1 (f) (f) B1 0.6666667 (f) B2 5.5 (f) (f) B3 0 (f) (f) Vappled 150 (f) Mappled 0 (f) Surcharge 60 (f) Vappled 150 (f) M3070 (h) -675 3.300 (h) -675 w2 (concrete) 771 3.33 M3 (ce soil) <th>on low side of wall does not b of Concrete Structures, 11th E</th> <th>dition, page 680</th> <th></th> <th>,,</th> <th></th> <th></th>	on low side of wall does not b of Concrete Structures, 11th E	dition, page 680		,,		
w 130 35 (p) del 0 0 (d) 0.5 0.819 1.000 (d) 0.5 0.819 1.000 Ca 0.271 35.2 Cp 2.307 299.3 WALL GEOMETRY 17 3333333 H2 0.1666667 H3 0.83333333 (f) B1 0.6666667 B1 0.6666667 (f) B3 0 H 8.3333333 (f) B3 0 B 6.1666667 (f) B3 0 Vappled 150 (b) Mappled 0 Surcharge 60 (f) P 1358 Mappled 0.45 (f) P 1358 Vappled 150 (f) P and 3.300 Ub wall restoring fc 0 6.47 Component weight (f) and 4 (surcharge) 0 6.47 Val (concrete) 771 3.30 0 0 val (concrete) 771 3.20 0 0 Vapapled 150 0 <th>ied: 4/25/200</th> <th>2</th> <th></th> <th></th> <th></th> <th></th>	ied: 4/25/200	2				
phi 35 (d) del 0 0.5 0.819 1.000 0.6 1.000 Ca 0.271 Cp 2.307 299.5 WALL GEOMETRY H1 7.3333333 (f) H2 0.1666667 (f) H3 0.83333333 (f) H4 1 (f) B2 5.5 (f) B3 0 (f) B 6.1666667 (f) B2 5.5 (f) B3 0 (f) Vapplied 150 (f) Vapplied 0 (f) Vapplied 0 (f) Y 2.92 (f) P 1358 (f) Gomponent weight (f) an V1 (concrete) 750 5. V2 (concrete) 771 3. V3 (heel soi) 0 6. V3 (weinarge) 0		-				
del 0.5 0.819 1.000 Ca 0.271 35.2 Cp 2.307 299.5 WALL GEOMETRY H1 7.3333333 (0) H2 0.1666667 (1) H3 0.8333333 (1) H4 1 (1) B1 0.6666667 B2 5.5 (1) (1) B1 0.6666667 (1) B3 0 (1)		friction	Lipit Woight	(Int Friction	Coeff. Friction	Soil
0.5 0.819 0.000 Ca 0.271 35.2 Cp 2.307 299.3 WALL GEOMETRY H1 7.3333333 (f) H2 0.16666667 (f) H3 0.8333333 (f) H4 1 0.65 B1 0.6666667 (f) B2 5.5 (f) B3 0 (f) B 6.1666667 (f) B3 0 (f) B 6.1666667 (f) B 6.1666667 (f) B 6.1666667 (f) B 5.16 (f) Surcharge 60 (p) LOAD CALCULATIONS Lateral soli force and overt Hyrine 0.46 (f) Y 2.92 (f) Y 2.92 (f) Y 2.93 (f) Hateral soli force and overt 150 Y 2.92			Unit Weight I 110-120	33-40	w. Conc 0.5-0.6	Soli Sand or gravel, no fines
$\begin{array}{c} 1.000\\ Ca & 0.271 & 35.2\\ Cp & 2.307 & 299.5\\ \hline \\ \begin{tabular}{lllllllllllllllllllllllllllllllllll$	coeff. friction w/Con		120-130	25-35	0.4-0.5	Sand or gravel, w/ fines
Ca 0.271 35.2 Cp 2.307 299.5 WALL GEOMETRY H1 7.3333333 (0) H2 0.16666667 (1) H3 0.83333333 (1) H4 0.13333333 (1) H3 0.6666667 (1) B1 0.6666667 (1) B2 5.5 (1) B3 0 (1) B1 0.6666667 (1) B2 5.5 (1) B3 0 (1) Copplied 150 (1) Mappined 0 (1) Surcharge 60 (1) P 1358 (1) Generatel soli force and overt 3,300 (1) V (2) (2) (1) Component weight (#) ant V (2) 150 0 V (2) 150 0 V (2) 150 </td <td>cosine(phi)</td> <td></td> <td>110-120</td> <td>23-30</td> <td>0.3-0.4</td> <td>Silty sand, high clay</td>	cosine(phi)		110-120	23-30	0.3-0.4	Silty sand, high clay
Cp 2.307 299.5 WALL GEOMETRY H1 7.3333333 (f) H2 0.6666667 (f) B1 0.6666667 (f) B2 5.5 (f) B3 0 (f) B3 0 (f) B4 150 (f) B 6.1666667 (f) B 6.1666667 (f) B 6.1666667 (f) B 6.1666667 (f) Vappled 0 (f) Vappled 0 (f) Vappled 0 (f) Vappled 0 (f) Vappled 150 (f) Vappled 0 (f) (concrete) 750 55 V2 (concrete) 771 3.300 V3 (toesoil) 119 2.3 V4 (concrete) 750 5 V4 (concrete) 750 5 V4 (concrete)	cosine(del) psf coeff. of active press	ure	100-120 90-110	25-35 20-25	0.2-0.4 0.2-0.3	Medium or stiff clay Soft clay, silt
H1 7.333333 () H2 0.1666667 () H3 0.8333333 () H4 1 () B1 0.6666667 () B2 5.5 () B3 0 () B3 0 () B 6.1666667 () Wapplied 450 ()b Vapplied 450 ()b Mapplied 0 ()b- Surcharge 60 (p) LOAD CALCULATIONS lateral soli force and overt Hymne 0.46 () Y 2.92 () P 1358 () Gomponent weight (#) am v1 (concrete) 771 3.300 V2 (concrete) 771 3.300 V3 (heet soli) 0 6. V4 (concrete) 771 3.300 V4 (concrete) 771 3.300 V4 (concrete) 771 3.300 V4 (concrete) 10 6.			00 110	20 20	0.2 0.0	oon duy, on
H1 7.333333 () H2 0.1666667 () H3 0.833333 () H4 1 () B1 0.666667 () B2 5.5 () B3 0 () H 8.333333 () B 6.1666667 () B2 5.5 () B3 0 () B 6.1666667 () B2 5.5 () B3 0 () B 6.1666667 () FXTERNAL LOADS Papeled 150 () Mappled 0 () CAD CALCULATIONS Interal soli force and overt Hyrine 0.46 () Y 2.92 () P 1358 () -675 () 3,300 () Wall restoring for component weight (#) arm r1 (concrete) 750 5. 2 (concrete) 771 3. 3,300 () Wall restoring for component weight (#) arm r1 (concrete) 750 5. 2 (concrete) 771 3. 3 (heel sol) 0 6. 4 (surcharge) 0 6. 6 () (1045 () STABILITY FACTOR OF SAFETY C) 150 () 4 (surcharge) 10 6. 6 () (1045 () STABILITY FACTOR OF SAFETY C) 150 () 1045 () STABILITY FACTOR OF SAFETY C) 1045 () STABILITY FACTOR OF SAFETY C) 1045 () STABILITY FACTOR OF SAFETY C) 1045 () STABILITY FACTOR OF SAFETY C) () 1045 () STABILITY FACTOR OF SAFETY C) 1045 () STABILITY FACTOR OF SAFETY C) () 1045 () STABILITY FACTOR OF SAFETY C) () 2.64 () 1112 () () 4 () 2.66 () 0.00 () () STABILITY FACTOR OF SAFETY C) () () STABILITY FACTOR OF SAFETY C) () () () () () () () () () (M1/		
H3 0.8333333 () H4 1 () B1 0.6666667 () B2 5.5 () B3 0 () B3 0 () B 6.1666667 () B 6.1666667 () Papplied 150 () Vapplied 450 () Vapplied 0 () SUrcharge 60 (p) COAD CALCULATIONS 150 () Iateral soil force and overt 4 Hprime 0.46 () Y 2.92 () P 1358 () -675 () 3.300 () 119 2.3 (2) 0 6. (4) (surbarge) 0 6. (4) (surbarge) 0 6. (4) (surbarge) 0 6. (4) (surbarge) 0 6. (5) (be soil) 119 2. appleid 150) soil retained				P1	W4
H4 1 0.6666667 (I) B1 0.6666667 (I) B3 0 (I) H 8.3333333 (I) B 6.1666667 (I) Vapplied 150 (Ib) Vapplied 150 (Ib) Vapplied 0 (Ib) Vapplied 0 (Ib) Vapplied 0 (Ib) Jappled 0 (Ib) LOAD CALCULATIONS lateral soli force and overt H 3.3700 (Ib) -675 (Ib) -675 -675 (Ib) -675 V 0 6. V4 (concrete) 771 3.300 (Ib) -675 V4 (concrete) 771 3.300 0 6. V4 (concrete) 771 3.300 Ib) 0 V4 (concrete) 771 3.300 Ib) 0 V4 (concrete) 1790 <t< td=""><td></td><td></td><td></td><td>V1</td><td></td><td>\downarrow \downarrow \downarrow \downarrow \downarrow</td></t<>				V1		\downarrow \downarrow \downarrow \downarrow \downarrow
B1 0.6666667 0 B2 5.5 (1) B3 0 (1) B 6.1666667 (1) B 6.1666667 (1) Papplied 150 (1) Vapplied 450 (1) Mapplied 0 (1) LOAD CALCULATIONS Isternal soli force and overt Hprime 0.46 (1) Y 2.92 (1) P 1358 (1) -675 (1) 3.300 (b) -675 (1) -675 (1) 3.300 (2) (concrete) 771 3.30 V2 (concrete) 771 3.30 V3 (heel soli) 0 6. V4 (concrete) 750 0 V3 (heel soli) 0 6. V4 (concrete) 7.50 0 1045 0 0.0 Stote soli) 119 2. v2 (concrete)		1 dawath		Ť		
B2 5.5 (() H 8.3333333 () B 6.1666667 () Fappled 150 () Pappled 150 () Vappled 450 () Mappled 0 () Mappled 0 () LOAD CALCULATIONS lateral soil force and overt Hymm 0.46 () P 1358 () () Y 2.92 () P 1358 () () -675 () 3.300 () () Y 2.92 () () 970 () 6 () 3.300 () 6 () 0 6. () () 0 6. () () 10 0 6. () 10 0 6. () 10 10 0.		rdepur				
H 8.3333333 () B 6.1666667 () EXTERNAL LOADS Pappled 150 () Vappled 450 () () Mappled 0 () () LOAD CALCULATIONS Isternal soil force and overt Hprime 0.46 () LOAD CALCULATIONS Isternal soil force and overt 1358 () P 1358 () 0 () Y 2.92 () 0 () 0 () Component weight (#) am 1 0 0 () 0) toe width				W1 W	3
B 6.1666667 150 (r) (p EXTERNAL LOADS Pappled 150 (lb Vappled 0 (lb-f Vappled 0 (lb-f Surcharge 60 (p LOAD CALCULATIONS lateral soll force and overt Highting 0.46 (l) Y 2.92 (l) P 1358 (l) -675 (l) 3.300 (component weight (f) am vi (concrete) 750 5. v2 (concrete) 771 3. v3 (heel sol) 0 6. v4 (surcharge) 0 6. v4 (surcharge) 0 6. v5 (heel sol) 119 2. appled 150 (l) 1045 (l) 1045 verturing 2.16 C 112 (k) 1.15 consponent 2.06' to 4.11' (l) 12 2.64				H1		
150 (p EXTERNAL LOADS Papplied 150 (lb Vapplied 0 (lb-f Surcharge 60 (p LOAD CALCULATIONS lateral soli force and overt Hprime 0.46 (l) P 1358 (l) -675 (l) -675 (l) P 1358 (l) -675 (l) <td></td> <td></td> <td></td> <td></td> <td>+ +</td> <td></td>					+ +	
Pappled 150 (lb Mappled 0 (lb-f Surcharge 60 (p COAD CALCULATIONS Interal soll force and overt Hprime 0.46 (lb Y 2.92 (lb P 1358 (lb -675 (lb -675 3.300 (lb -675 component weight (#) arm vt (concrete) 771 3.3 (3 (heet soll) 0 6. 44 (surcharge) 0 6. 0 6. 150 0. 44 (surcharge) 0 6. 0.46 (to 4.11) 1 1 0. 1045 0 1. 0. SOIL BEARING a 2.14 (li 112 10.7 (kip 0.0 0.0 2.06' to 4.11' 1. 1. 1. 1. 112 1. 1. 1.						Р
Pappled 150 (/b Mappled 0 (/b-f Surcharge 60 (/p COAD CALCULATIONS lateral soli force and overt Hprime 0.46 (/ Y 2.92 (/) P 1358 (// P 1358 (TOP OF S	ws		1
Vappled Mappled 450 0 (lb fb (b-f Surcharge ODD CALCULATIONS lateral soil force and overt Mprime 0.46 0 (r P Mappled 0.46 Y (r P P 1358 3970 (lb G Wall restoring fc component weight (f) wall restoring fc component weight (f) G vi (concrete) 771 3. 300 66 0 vi (concrete) 771 3. 30 66 0 vi (concrete) 771 3. 30 66 0 vi (concrete) 771 3. 30 66 0 vi (concrete) 150 0. 6. 50 (to e soil) 119 2. 4 applied 150 0. 1045 (l verturning 2.16 0. 1045 0. soll BEARING a 2.14 (l 0.0 g2 24 (ki 1112 (ki 1112 112 verturning 2.13 0.0 (ki 0.00 0.00 Gotting 0.372 #5 (c 0.0000 (ki 2.99) 0.0' Gotting 0.372 #5 (c 0.000005 0.00005 <td>ft)</td> <td></td> <td>Pior or a</td> <td>H2</td> <td></td> <td></td>	ft)		P ior or a	H2		
Mappled Surcharge 0 60 (lb-f (p) LOAD CALCULATIONS lateral soil force and overt Horizon (p) 1000000000000000000000000000000000000		i	T	1	W2	Y
LOAD CALCULATIONS Ideral soil force and overt H _{prime} 0.46 (() Y 2.92 (() P 1358 (() 3970 (b) -675 (b) 3,300 (b) wall restoring fc component weight (#) arr wit (concrete) 750 5. w2 (concrete) 771 3. w3 (thet soil) 0 6. w4 (sucharge) 0 0 6. soit (be soil) 119 2. P applied 150 0. vert. force 1,790 Iateral sliding resi 150 (I 895 (I) 1045 (I) STABILITY FACTOR OF SAFETY C 1 1 coverturning 2.16 C soit 4.11' q1 557 (p q2 24 (p FACTORED (1.7) FOOTING LOADS 10.2 (ki 2.99 (k 0.00 (k Footing ØVC 7,969 10" As 0.372 #5 6 0.0020946 Reinf	/ ft)		H4	нз	+	
lateral soil force and overt H _{prime} 0.46 (() Y 2.92 (() P 1358 (() 3970 (() -675 (() 675 (() -675 (() wall restoring for -675 (() vall restoring for -6. -6. vall concrete) 750 5. vall (concrete) 771 3. vall (estoringe) 0 6. vall (concrete) 771 3. vall (concrete) 771 3. vall (curcharge) 0 6. vall (curcharge) 0 6. vall (curcharge) 0 6. vall (curcharge) 150 () 150 () 1895 () vall (curcharge) 1.150 () 1045 curcharge 1.150 () 1045 () soverturning 2.16 C 2.64 () <t< td=""><td>f)</td><td></td><td>ł</td><td>+ B2</td><td>B1 B3</td><td></td></t<>	f)		ł	+ B2	B1 B3	
lateral soil force and overt Hprime 0.46 (f) Y 2.92 (f) P 1358 (f) 3970 (b) -675 (f) 675 (f) -675 (f) vall restoring for 675 (f) vall concrete) -771 675 vall concrete) -771 676 vall concrete) 771 676 vall concrete) 711 676 vall concrete) 7190 670 Itateral sliding resilicity 670 670 Stote soil 119 670 Stote soil 150 670 Stote soil 150 670 Good to 4.111						-
Y 2.92 (I) P 1358 (II) -675 (II) 3970 (II) -675 (II) 3970 (II) -675 (II) 3970 (II) -675 (II) 3,300 (II) component weight (#) arr arr v(concrete) 771 3. 30 v2 (concrete) 771 3. 40 v4 (sucharge) 0 6. 6. v4 (sucharge) 0 6. 90 v6 (toe soil) 119 2. Papplied 150 0. v6 (toe soil) 119 2. 16 0. 1045 (I) soverturning 2.16 0. 114 0. 0. 1045 0. soverturning 2.17 SOIL BEARING a 2.06' to 4.11' 112 0. 1112 (II) 1112 (II) 1112 (II) 1112 (II)<		_				
P 1358 3970 (b) -675 -675 (b) 3,300 (b) wall restoring for component weight (#) arr of any v(concrete) 750 5. v2 (concrete) 771 3. v3 (heel soli) 0 6. v4 (surcharge) 0 6. v5 (toe soli) 119 2. applied 150 (1) v8 (toe soli) 119 2. applied 150 (1) verturning 2.16 O system 1.15 O soll BEARING a 2.14 a 2.06' to 4.11' (1) q2 24 (p) FACTORED (1.7) STEM LOAD FOR 7.5 1112 (kii) 10.7 (kii) 0.0 (kii) 0.00 (kii) 0.00 2.64 (0) 0.00 1112 (kii) 0.00 2.99 (kii) 0.00 <			A	A CONTRACTOR	a de la companya de l	
3970 (b) -675 (lb) -675 (lb) -675 (lb) 3,300 (lb) wall restoring fc component vweight (#) arr vd (concrete) 750 vd (concrete) 771 3.30 (lb) vd (concrete) 771 3.40 (hed sol) 0 vd (concrete) 771 3.40 (hed sol) 0 vd (concrete) 771 90 6.00 vd (concrete) 19 Papplied 150 150 (l 1045 (l 1045 (l 1045 (l soverturning 2.16 C soverturning 2.16 C a 2.14 (l q2 24 (p FACTORED (1.7) FOOTING LOAD FOR 10.2 112 (lki) 0.00 0.00 (ki)		resultant		A L		
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component weight (#) arm v1 (concrete) 750 5. v2 (concrete) 771 3. v4 (concrete) 771 3. v4 (concrete) 0 6. v4 (surcharge) 0 6. v4 (surcharge) 0 6. v5 (toe soil) 119 2. applied 150 0. lateral sliding resists 150 0. stops (1 145 0. sets 1.790 145 0. sets 1.790 1045 0. sets 1.15 0. 0. soverturning 2.16 0. 0. soliding 1.15 0. 0. g1 557 (p 2.64 0. q2 2.44 (kip 10.7 (kip sold 10.7 (kip 0.0 (kip q2 2.99 (k 0.00 (kip	ft) total overturning Mo	ment	ĉ	attwh		$C_{a,h}w(h+h')$
vi (concrete) 750 5. v2 (concrete) 771 3. v2 (concrete) 771 3. v3 (heel soli) 0 6. v5 (toe soli) 119 2. applied 150 0. Iateral sliding resi 150 (I 895 (I) 1045 (I) STABILITY FACTOR OF SAFETY C 1 1045 (I) STABILITY FACTOR OF SAFETY C 1 1 verturning 2.16 C itiding 1.15 C SOIL BEARING a 2.14 (I) 2.06' to 4.11' (I) q2 24 (P FACTORED (1.7) STEM LOAD FOR 10.2 (kit 1112 (I) FACTORED (1.7) FOOTING LOADS 10.2 (kit 0.0 (kit 2.99 (k 0.00 (kit 2.99 (k 0.00 (k 5 5 0.0020946 Reinf	ces	_	$y = \frac{h}{3}$		$y = \frac{h^2 + 3(h + 1)}{3(h + 1)}$	<u>3hh'</u> -2h')
v2 (concrete) 771 3. v3 (heel soli) 0 6. v4 (surcharge) 0 6. v4 (surcharge) 0 6. v4 (surcharge) 0 6. v4 (surcharge) 0 6. v5 (to esol) 119 2. rent.force 1,790 150 0. Isteral sliding resi 150 (f) 895 (f) STABILITY FACTOR OF SAFETY C 1 1 1 1 werturning 2.16 0. 0.0 ididing 1.15 0. 0.0 SOIL BEARING a 2.14 (f) q2 24 (p) FACTORED (1.7) STEM LOAD FOR FACTORED (1.7) FOOTING LOADS 10.2 (kij) 2.99 (kij) 2.99 (kij) 9Vc 7,969 10" 0.000 (kij) 2.99 (kij) 0.0000 (kij) 2.99 2Mn 11.72			$P = \frac{1}{2}C_{ah}$.2		h wh (h+2h)
K3 (heel solt) 0 6. V4 (surcharge) 0 6. V4 (surcharge) 0 6. V5 (bes sol) 119 2. Papplied 150 0. 150 150 0. Interval sliding resister 150 0. STABILITY FACTOR OF SAFETY C 1 1 1045 0. 1 0. STABILITY FACTOR OF SAFETY C 1 1 0. STABILITY FACTOR OF SAFETY C 1 1 0. STABILITY FACTOR OF SAFETY C 1 0.0 0.0 SOIL BEARING a 2.14 0.0 GOIL BEARING a 2.06' to 4.11' 0.0 q2 24 (P 2.64 (11112 GOIL BEARING 10.7 (Kig 0.0 0.0 FACTORED (1.7) FOOTING LOAD FOR 7.5 (Kig 0.0 0.0 GOIL BEARING 0.0 0.0 0.0 (Kig 0.0 0.0 0.0			P = 2 Cah	,w/)~	/ - 2°a	/ #// (// E//)
vi5 (toe soil) 119 2. applied 150 0. ent. force 1,790 Iateral silding resi 150 (i 150 (i 895 (i) 1045 (i) 1045 (i) STABILITY FACTOR OF SAFETY C 1 1 verturning 2.16 0 ilding 1.15 0 SOIL BEARING a 2.06' to 4.11' q1 2 24 (p) FACTORED (1.7) STEM LOAD FOR 7.5 (i) 1112 (li) 10.7 (kij) 2.99 (kij) 0.0 (kij) 2.99 (kij) 0.00 (kij) 2.99 (kij) 0.00 (kij) 2.99 (kij) 0.00 (kij) 2.99 (kij) 0.000 (kij) 2.99 (kij) 0.000 (kij) 2.99 (kij) 0.000 (kij) 3a	7 ()		0 10		
Papplied 150 0. Iateral sliding resi 150 0. Isteral sliding resi 150 0. Isteral sliding resi 150 0. Isteral sliding resi 150 0. STABILITY FACTOR OF SAFETY C 1 1 overturning 2.16 0. soliding 1.15 0. SOIL BEARING a 2.14 0. q1 557 (p 2 24 q2 244 (i 1112 (ki FACTORED (1.7) STEM LOAD FOR 7.5 (i 1112 (ki FACTORED (1.7) FOOTING LOADS 10.2 (ki 0.0 (ki 2.99 (ki 0.00 (ki 2.99 (ki 0.00 (ki 2.99 (ki 0.00 (ki 2.99 (ki 0.00 (ki 1.72 k 0.0005 0.00 (ki 1.55 5 0.00005 0.00005 0.00005 0.0005 0.00005 <			G		- 7	
Interes 1,790 Isteral sliding resisters 150 (I 150 (I 895 (I) 1045 (I) 1045 (I) STABILITY FACTOR OF SAFETY C 1 1 overturning 2.16 C 301 BEARING a 2.14 (I) 2.06' to 4.11' q1 557 (P) q2 24 (P) FACTORED (1.7) STEM LOAD FOR 1112 (II) 1112 (II) 1112 (III) 1112 (III) 1112 (III) 1112 (III) 1112 (III) 0.0 (Kij) 2.99 (K) 0.00 (Kij) 2.99 (K) 0.00 (Kij) Eooting 0.372 #5 (S) ØMn 11.72 K ØMn 11.72 K ØMn 11.72 K			E H	-a-+	d_=(4(-6	$a)\frac{R_p}{t^2}$
150 (i 895 (i) 1045 (i) STABILITY FACTOR OF SAFETY C 1 1 1 overturning 2.16 SOIL BEARING 2.06' to 4.11' q1 557 q2 24 FACTORED (1.7) STEM LOAD FOR 7.5 (i) 1112 (ki) 1112 (ki) 9 (A) 6 0.00 6 0.372 8 0.372 9 % 0.00005 0.00005	moment 7,129		<i>q</i> ₁		11 q2 q2*(6a-2	$a) \frac{R_{\mu}}{l^{2}}$ $b(l) \frac{R_{\mu}}{l^{2}}$ $\frac{L}{2}, q_{1} * q_{2} = \frac{R_{\mu}}{l}$
150 (i 895 (i) 1045 (i) STABILITY FACTOR OF SAFETY C 1 1 1 overturning 2.16 SOIL BEARING 2.06' to 4.11' q1 557 q2 24 FACTORED (1.7) STEM LOAD FOR 7.5 (i) 1112 (ki) 1112 (ki) 9 (A) 6 0.00 6 0.372 8 0.372 9 % 0.00005 0.00005	tance		(a) R	esultant in midd	when a=	$\frac{l}{2}, q_1 = q_2 = \frac{l}{l}$
1045 (i STABILITY FACTOR OF SAFETY C 1 overturning 2.16 C sliding 1.15 C SOIL BEARING a 2.14 (i 2.06' to 4.11' (i q1 557 (p q2 24 (p FACTORED (1.7) STEM LOAD FOR 7.5 (i 10.12 (ki 1112 (ki 1112 (ki 1112 (ki 1112 (ki 1112 (ki 2.99 (ki 0.00 (ki 1.55 5- 0.0020946 Reinf	passive pressure sli	ling resistance		r-7		
STABILITY FACTOR OF SAFETY C 1 overturning 2.16 aliding 1.15 SOIL BEARING a 2.14 2.06' to 4.11' q1 2.06' to 4.11' q1 557 q2 24 FACTORED (1.7) STEM LOAD FOR 7.5 (1) 1112 (1) 1112 (1) 1112 (1) 10.7 (kip 6.0.0 (kip 9.0 (kip 0.0 (kip 0.00 (kip 2.99 (kip 0.00 (kip 0.00 (kip 0.90 (kip 0.00 (kip 0.00 (kip 0.00 (kip 0.00 (kip 0.00 (kip 0.000 (kip 0.000 (kip 0.000 (kip 0.000 (kip <t< td=""><td></td><td>æ</td><td>F</td><td></td><td>-7</td><td>10</td></t<>		æ	F		-7	10
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2.16 C SOIL BEARING 2 2 2.06' to 4.11' q1 2.06' to 4.11' q2 2.44 7.5 (1) FACTORED (1.7) STEM LOAD FOR 7.5 (1) 1112 (1) 1112 (1) 1112 (1) 1112 (1) 10.7 (kij) 0.0 (kij) 2.99 (ki) 0.00 (ki) 2.99 (ki) 0.00 (ki) 2.99 (ki) 0.000 (ki) 2.99 (ki) 0.0005 10'' 2Mo 0.372 #5 (2) 0.000	,	-		a+ 3a	9	$\frac{2R_{y}}{3\sigma}$
1 1 1 1 2.16 C sliding 1.15 C SOIL BEARING 2.06' to 4.11' 1 q1 557 (P q2 24 (P FACTORED (1.7) STEM LOAD FOR 7.5 (1 1112 (II 1112 (II 1112 (II 10.7 (Kig FACTORED (1.7) FOOTING LOADS 0.0 (Kig 0.00 (Kig 90 (K.3000) 0.000 (Kig 0.000 (Kig 0.000 (Kig 90 (K 0.000 0.000 (Kig 0.000 (K	IECKS		۹ <u>[</u>]	Resultant outside	middle third	
aliding 1.15 C SOIL BEARING a 2.14 (1 2.06' to 4.11' q1 2.06' to 4.11' q2 24 (p FACTORED (1.7) STEM LOAD FOR 7.5 (1 2.64 (1) 1112 (11 1112 (11) (11) (11) (11) (11) (11) (11)	F.S. overturning		(67 8	resultarit ourside	Thiodale and	
aliding 1.15 C SOIL BEARING a 2.14 (1 2.06' to 4.11' q1 2.06' to 4.11' q2 24 (p FACTORED (1.7) STEM LOAD FOR 7.5 (1 2.64 (1) 1112 (11 1112 (11) (11) (11) (11) (11) (11) (11)	F.S. sliding	0 0.61666	66667233333333 1.85	5 2.4666666622708	3333333 3.7 4.316	666669793333333 5.55 6.166666666
Soil BEARING a 2.14 ((2.06' to 4.11' q1 557 (p q2 24 (p FACTORED (1.7) STEM LOAD FOR 7.5 ((1112 (lt 1112 (lt 1112 (lt 1112 (kt 1112 (kt 1112 (kt 0.0 (kt 2.99 (kt 0.00 (kt 2.99 (kt 0.00 (kt 2.99 (kt 0.00 (kt 10.2 (kt) 0.0 (kt 10.2 (kt) 0.0 (kt 10.2 (kt) 0.0 (kt 10.2 (kt) 0.0 (kt) 2.99 (kt 0.00 (kt) 2.99 (kt) 0.00 (kt) 2.90 (kt) 0.00 (kt) 2.90 (kt) 0.00 (kt) 2.90 (kt) 0.00 (kt) 2.90 (kt) 0.00 (kt)		° .				
a 2.14 (f 2.06' to 4.11' q1 557 (p q2 24 (p FACTORED (1.7) STEM LOAD FOR 7.5 (f 2.64 (f) 1112 (lt 1112 (lt 1112 (lt 1112 (lt 1112 (lt 10.7 (kij FACTORED (1.7) FOOTING LOADS 10.2 (kij 2.99 (k 0.00 (ki 2.99 (k 0.00 (ki 2.99 (k 0.00 (ki 2.99 (k 0.00 (ki 2.99 (k 0.00 (ki 2.99 (k 0.00 (ki 2.99 (k 0.00 (k) 11.72 (k 0.00 (k) 5.5 (k) 0.0005 (k) 11.72 (k) 1.55 5- 0.0020946 Reinf.	(e.e. a b(e.u. a)	-100 -				
2.06' to 4.11' q1 557 (p q2 24 (p FACTORED (1.7) STEM LOAD FOR 7.5 (1 2.64 (1 1112 (lt 1112 (lt 1112 (lt FACTORED (1.7) FOOTING LOADS 10.2 (ki 0.0 (ki 2.99 (k 0.00 (ki 2.99 (k) 0.00 (ki 2.99 (k) 0.00 (ki 2.99 (k) 0.00 (ki 2.99 (k) 0.00 (ki 1.55 5- 0.0020946 Reinf) distance to resultant					
q1 557 (p) q2 24 (p) FACTORED (1.7) STEM LOAD FOR 7.5 (l) 2.64 (i) 1112 (li) 1112 (li) 1112 (li) 1112 (li) 10.2 (ki) FACTORED (1.7) FOOTING LOADS 10.2 (ki) FACTORED (1.7) FOOTING LOADS 0.0 (ki) 2.99 (k) 0.00 (ki) 2.99 (k) 0.00 (ki) As 0.372 #5 (e) 0.0005 ØMn 11.72 k 1.55 5- 0.0020946 Reinf. 0.0020946 Reinf.) distance to resultant middle third of footin	-200 - g				
FACTORED (1.7) STEM LOAD FOR 7.5 ((2.64 () 1112 () 1112 () 1112 () FACTORED (1.7) FOOTING LOADS 10.2 (kij 0.0 (kij 2.99 (k 0.00 (ki 2.99 (k) 0.00 (ki 2.99 (k) 0.00 (ki 2.99 (k) 0.00 (ki 1.172 (k) 1.172 (k) 1.55 5- 0.0020946 Reinf	f) bearing pressure @	toe ₋₃₀₀ .				
7.5 ((2.64 ((1112 (lt 1112 (lt 1112 (kt 10.7 (kt) FACTORED (1.7) FOOTING LOADS 10.2 (kt) 0.0 (kt 2.99 (k 0.00 (kt 2.99 (kt 0.00 (kt 0.00 (kt 0.00 (kt 11.72 kt 1.55 5- 0.0020946 Reinf	f) bearing pressure @					
2.64 ((1112 (lt 1112 (lt 1112 (lt 10.7 (ki; FACTORED (1.7) FOOTING LOADS 10.2 (ki; 0.0 (ki; 2.99 (k 0.00 (ki; 0.00 (ki; 0.00 (ki; 0.00 (ki; 0.00 (ki; 0.00 (ki; 0.00 (ki; 1.55 5- 0.0020946 Reinf.		-400 -			BEARIN	G PRESSURE (psf)
1112 (İt 1112 (İt 1112 (İt 1112 (İt 110.2 (Kiş FACTORED (1.7) FOOTING LOADS (It).2 (Kiş 0.0 (Kiş 0.0 (Kiş 0.0 (Kiş 2.99 (K 0.00 (Kiş 0.00 (Kiş ØVc 7.969 10" 10" 4" 0.000 (Kiş ØVc 7.969 10" 10" 4" 1.5" 5- 0.00020946 Reinf. 1.5" 5- 0.0020946 Reinf.) H1 + H2	-500 -				(POI)
1112 (ki FACTORED (1.7) FOOTING LOADS 10.2 (ki 10.2 (ki 0.0 (ki 2.99 (ki 0.0 (ki 2.99 (ki 0.0 (ki 2.99 (ki 0.0 (ki 2.99 (ki 0.00 (ki 2.99 (ki 0.00 (ki 2.99 (ki 0.000 (ki 2.99 (ki 0.000 (ki 2.99 (ki 0.000 (ki ØVc 7,969 10" 4 0.0005 0.372 #5.6 ØMn 11.72 k 1.55 5- 0.0020946 Reinf						
10.7 (kij FACTORED (1.7) FOOTING LOADS 10.2 (kij 0.0 (kij 2.99 (kij 2.99 (kij 0.00 (kij ØVC 7,969 10" As 0.372 #5 @ 0.0005 1.55 5- 0.0020946 Reinf.		-600				
10.2 (kij 0.0 (kij 2.99 (kij 0.00 (kij 2.99 (kij 0.000 (kij 2.99 (kij 0.000 (kij 2.99 (kij 3 0.000 Mn 11.72 1.55 5- 0.0020946 Reinf.						
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0.0 (kij 2.99 (k 0.00 (k ØVc 7.969 10" As 0.372 #5 (a 0.0005 ØMn 11.72 k 1.55 5- 0.0020946 Reinf	-ft) Mu @ Toe (Bot Reir	f)				
0.00 (k ØVc 7,969 10" As 0.372 #5 € a 0.0005 ØMn 11.72 k 1.55 5- 0.0020946 Reinf.	-ft) Mu @ Heel (Top Re					
Footing ØVc 7,969 10" As 0.372 #5 (∂ a 0.0005 ØMn 11.72 k 1.55 5- 0.0020946 Reinf						
ãVc 7,969 10" As 0.372 #5 (€ a 0.0005 5 ØMn 11.72 k 1.55 5- 0.0020946 0.0020946 Reinf	o) Vu @ Heel					
ãVc 7,969 10" As 0.372 #5 (€ a 0.0005 5 ØMn 11.72 k 1.55 5- 0.0020946 0.0020946 Reinf		Wall				
As 0.372 #5 € a 0.0005 ØMn 11.72 k 1.55 5 0.0020946 Reinf	nick	<u>Wall</u> øVc	5,692	8" thick		
ØMn 11.72 k 1.55 5- 0.0020946 Reinf.		As	0.465 #	#5 @ 8"		
1.55 5- 0.0020946 Reinf	7 4	a ¢Mp	0.0007			
0.0020946 Reinf.		ØMn	12.55	k-ft		
LRFD soil 138.75676 psf @ ' 946.9 'psf @						
		ft from Mal				
2222.3939 # in T 763.16216 # in T		ft from Wall ft from Wall				

CANTILEVER RETAINING WALL EXTERNAL STABILITY Imitations: uses Rankie coefficients for noncohesive soils, external moment at top of wall does not contribute to restoring moment (overturning only), no deflection or provide the device soils and the low solid does not move the solid does not accomplete the so

limitations:				nt at top of wall does not contribute to restoring moment (overturning only), no deflect
reference:			rete Structures, 11th Edition, pa	against overturning (sliding only) age 680
file author:		last modified:	4/25/2002	
SOIL DATA				
w	130	(pcf)	soil unit weight	Coeff. Friction
phi	35	(deg)	soil internal angle of friction	Unit Weight Int Friction w. Conc Soil
del	0.5	(deg)	surface angle incline coeff. friction w/Concrete	110-120 33-40 0.5-0.6 Sand or gravel, no fine 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	TRY			M1 P1 W4
H1	8.3333333	(ft)	soil retained	
H2 H3	0.1666667	(ft) (ft)	soil depth above toe footing thickness	$\frac{\mathbf{v}_1}{\mathbf{v}_1} + \frac{\mathbf{v}_1}{\mathbf{v}_1} + \mathbf{$
H4	0.0000000	(ft)	passive pressure soil depth	
B1	0.6666667	(ft)	wall width	
B2	6.5	(ft)	toe width	W1 W3
В3 Н	0 9.3333333	(ft) (ft)	heel width total height	H1
В	7.1666667	(ft)	total base	T T
	150	(pcf)	concrete unit weight	Р
				W5
EXTERNAL LC	200	(lb/ft)		TOP OF SOIL
P _{applied} V _{applied}	200	(lb/ft) (lb/ft)	2	H2 W2 Y
V applied Mapplied	0	(Ib/It) (Ib-ft / ft)	2	H4 H3
Surcharge	68	(psf)		
		()		B2 B1 B3
LOAD CALCU		1 august	momont	
	l soil force and 0.52	d overturning (ft)	converted surcharge	
H _{prime} Y	3.27	(ft)	distance to soil load resultant	
P	1705	(lbs)	soil load resultant	
	5580	(ĺb-fť)	Mo, soil + surcharge	
	-1200 4,380	(lb-ft)	Mo, external load	
	4,380	(lb-ft)	total overturning Moment	$C_{ah}w(h+h')$
	wall resto	oring forces		$y = \frac{h}{3}$ $y = \frac{h^2 + 3hh'}{3(h+2h')}$
component	weight (#)	arm (ft)	moment (#-ft)	
w1 (concrete) w2 (concrete)	850 896	6.83 3.58	5808 3210	$P = \frac{1}{2} C_{\alpha,h} wh^2 \qquad P = \frac{1}{2} C_{\alpha,h} wh (h+2h')$
w2 (concrete) w3 (heel soil)	896	3.58 7.17	3210	
w4 (surcharge)	0	7.17	0	Ry R
w5 (toe soil)	141	3.25	458	$q_{12}(4(-6a)) \frac{R_{y}}{t^2}$
P applied vert. force	200 2,087	0.33 momer	67 t 9,543	$\frac{1}{q_1}$
vent loice	2,007	momer	a 3,545	$\begin{array}{c} +(2-i) & -i \\ +(2-i) & -i \\ + & $
		ng resistance		(a) Resultant in middle third
	150 1044	(lb) (lb)	passive pressure sliding resist soil friction force	R 7
	1194	(lb)	total sliding resistance	- 1/3
STABILITY FA	CTOR OF SAF	ЕТҮ СНЕСК	s	(c) Resultant outside middle third
	1		F.S. overturning	
	1	OK	F.S. sliding	0 0.7166666660743333333 2.15 2.8666666602758333333 4.3 5.0166666660273333333 6.45 7.1666666
overturning sliding	2.18 1.08	OK OK	Mr / Mo (PP+F)/(Ph+V)	
			(1) (1) (1) (1) (1)	-100 -
SOIL BEARING				
а	2.47 2.39' to 4.78'	(ft)	distance to resultant middle third of footing	-200 -
q1	2.39 to 4.78	(psf)	middle third of footing bearing pressure @ toe	-300
q2	20	(psf)	bearing pressure @ heel	-300 -
	-			-400 BEARING PRESSURE
FACTORED (1	.7) STEM LOA 8.5	D FORCES (ft)	H1 + H2	.500 (psf)
	2.99	(ft)	line of action (above base)	
	1428	(lbs)	P (arm only)	-600
	1428 15.9	(lbs) (kip-ft)	Ph (arm only) Mu (arm moment)	
	15.9	(KIP-IL)	wa (am nomeni)	
FACTORED (1				
	14.3	(kip-ft)	Mu @ Toe (Bot Reinf)	
	0.0	(kip-ft) (kip)	Mu @ Heel (Top Reinf) Vu @ Toe	
	0.00	(kip)	Vu @ Heel	
Footing			Wall	
ØVc	7,969	10" thick	øVc	5,692 8" thick
As	0.465	#5 @ 8"	As	0.62 #5 @ 6"
a ØMn	0.0007	L #	a ØMn	0.0009
VIII I	14.65 0.6	k-ft 3-#4	חויזש	16.74 k-ft
		Reinf. Ratio		
LRFD soil		psf @ Wall in	terface	
	957.1	'psf @ Toe		
	2720.9983	# in Toe @	4.333333333 ft from) Wall
		# in Toe @	3.25 ft from	