

UPDATED
STRUCTURAL CALCULATIONS

Mahramnia Residence
3859 83rd Ave SE
Mercer Island, WA

Client: CenterLine Architects



Javid Abdi, PE, SE
6810 NE 149th St.
Kenmore, WA – 98028
Atlas.CSE@gmail.com
206-427-7233

Project: Mahramnia Residence

By: JDA

Proj No: 202-2022

Date: 04/28/2022

Summary

Loft windows have been revised and lateral calculations updated accordingly as shown on pages 2 - 3.

R	6.5	ASCE 7-16 Table 12.2-1
Ω_s	2.5	
C_d	4	
V	18.2 Kips	= $C_d W$ - ASCE 7-16 (12.8-1)
C _s	0.174	= $S_d s / (R/I_e)$ - ASCE 7-16 (12.8-2)
	0.501	< $S_d s / T(R/I_e)$ - if T-TL, ASCE 7-16 (12.8-3)
	-	< $S_d s T_L / T_2(R/I_e)$ - if T-TL, ASCE 7-16 (12.8-3)
	0.050	> 0.044 $S_d s e$ - ASCE 7-16 (12.8-5)
	0.01	> 0.01 - ASCE 7-16 (12.8-5)
	-	> 0.581 / (R/I_e) - if S1+0.6g, ASCE 7-16 (12.8-6)
W	105 Kips	
I _e	1	ATC Hazard
F _g	1.809	Table 11.4-2 and Section 11.4.8 Exception
F ₁	1.2	ATC Hazard
S ₁	1.413 g	ATC Hazard
S ₂	0.491 g	ATC Hazard
S ₃	1.606 g	ATC Hazard
S ₄	0.888219 g	= $F_g S_1$ - ASCE 7-16 (11.4-1)
S ₅	1.131 g	ATC Hazard
S ₆	0.592146 g	= $2/3 S_{41}$ - ASCE 7-16 (11.4-4)
S _{DC}	D	
T _s	0.182 seconds	= $C_{th} m$ - ASCE 7-16 (12.8-7)
C ₁	0.02	ASCE 7-16 Table 12.8-2
h _n	19.00 feet	
x	0.75	ASCE 7-16 Table 12.8-2
T ₁	6 seconds	USGS Seismic Values
T ₂	0.524 seconds	= S_{a1} / S_{a2} - ASCE 7-16 (11.4-3)
1.5T ₂	0.785 seconds	

EXCEPTION: A ground motion hazard analysis is not required for structures other than seismically isolated structures and structures with damping systems where:

- Structures on Site Class E sites with S_2 greater than or equal to 1.0, provided the site coefficient F_g is taken as equal to that of Site Class C.
- Structures on Site Class D sites with S_1 greater than or equal to 0.2, provided the value of the seismic response coefficient C_s is determined by Eq. (12.8-2) for values of $T \leq 1.5T_L$ and taken as equal to 1.5 times the value computed in accordance with either Eq. (12.8-3) for $T_L \geq T > 1.5T_L$ or Eq. (12.8-4) for $T > T_L$.
- Structures on Site Class E sites with S_1 greater than or equal to 0.2, provided that T is less than or equal to T_L and the equivalent static force procedure is used for design.

Table 11.4-2 Long-Period Site Coefficient, F_g

Site Class	Mapped Peak-Triple Maximum Considered Earthquake (MCE) Spectral Response Acceleration Parameter at 1-s Period					
	$S_s \leq 0.1$	$S_s = 0.2$	$S_s = 0.3$	$S_s = 0.4$	$S_s = 0.5$	$S_s \geq 0.8$
A	0.8	0.8	0.8	0.8	0.8	0.8
B	0.8	0.8	0.8	0.8	0.8	0.8
C	1.5	1.5	1.5	1.5	1.5	1.5
D	2.4	2.2*	2.0*	1.9*	1.8*	1.7*
E	4.3	See	See	See	See	See

Note: The straight line interpolation for intermediate values of S_s .
 *Also, see requirements for site specific ground motions in Section 11.4.8.

Story	Weight (kips)	Height (ft)	Wh (k-in)	C _{ca}	F _{uE1} (kips)	ΣF_{uE1} (kips)	F _{uE2} (kips)	ΣF_{uE2} (kips)	F _{uW} (kips)	F _{uW} (kips)
					($C_{ca} V$)	(LRFD)	($C_{ca} V$)	(ASD)	North ASD	West ASD
Roof	20.97	19.00	398	0.32	5.9	5.9	4.113	4.113	0.207	0.285
Loft	20.97	10.00	210	0.17	3.1	9.0	2.165	6.277	0.000	0.000
Low Roof	62.91	10.00	629	0.51	9.3	18.2	6.493	12.770	1.497	1.416
ΣW	104.85									

LEFT-to-RIGHT RUNNING WALLS																				
Loft-to-Roof																				
Story	%	Length (ft)	# in Wall	SEISMIC			WIND			GRAVITY LOADING (plf)										
				PLF	Chord F (#)	# in Wall	PLF	Chord F (#)	Wall W (#)	Snow	Dead	Live	Uplift	Comp	Anchorage					
2	43.1%	5.34	1,772			89									9	ft				
439	48.5%	11.33	1,720			87			8	69	1,224	0	0	0	0	767	4	OK	MSTC28	
	48.5%	2.67	860	322	2,899	43	16								4	OK				
	48.5%	2.67	860	322	2,899	43	16								4	OK				
3	36.6%	1.65	804			148														
580	40.8%	12.08	2,341	194	1,744	118	10	88	1,305			0	0	0	1,455	2,561	33	OK	MSTC40	
	40.8%	1.67	955	573		48	29								33	OK				
	59.2%	2.42	1,385	573		70	29								33	OK				
Main-to-Loft																				
Story	%	Length (ft)	# in Wall	SEISMIC			WIND			GRAVITY LOADING (plf)										
				PLF	Chord F (#)	# in Wall	PLF	Chord F (#)	Wall W (#)	Snow	Dead	Live	Uplift	Comp	Anchorage					
1	11.9%	5.50	1,661			223											9	ft		
378	100.0%	12.58	1,661	132	1,188	223	18	160	1,359			0	0	0	888	2,039	3,784	4	OK	HDU2
	50.0%	2.75	830	302		112	41								4	OK				
	50.0%	2.75	830	302		112	41								4	OK				
2	16.6%	4.08	1,962			293														
525	100.0%	4.08	1,962	480	4,324	293	72	645	441			0	0	0	4,227	4,601	15,296	3	OK	CU5
3	57.3%	25.58	6,065			976														
1815.774	30.9%	7.92	1,877	237	2,134	302	38	343	855			0	0	0	1,945	2,669	7,332	6	OK	CU2.5
	41.4%	10.58	2,509	237	2,134	404	38	343	1,143			0	0	0	1,881	2,850	7,235	6	OK	CU2.5
	27.7%	7.08	1,679	237	2,134	270	38	343	765			0	0	0	1,965	2,613	7,362	6	OK	CU2.5
4	14.2%	22.25	920			212														
449	70.8%	25.17	651	26	233	150	6	54	2,718			0	0	0	0	1,936	0	6	OK	HDU2
	17.6%	3.92	162	41		37	10											6	OK	
	34.1%	7.58	314	41		72	10											6	OK	
	19.1%	4.25	176	41		41	10											6	OK	
	29.2%	6.50	269	41	372	86	13	118	702			0	0	0	217	812	1,093	6	OK	HDU2
	29.2%	6.50	269	41		86	13											6	OK	



UP-to-DOWN RUNNING WALLS

Loft-to-Roof																				
	%	Length (ft)	SEISMIC			WIND			GRAVITY LOADING (plf)					ft						
			# In Wall	PLF	Chord F (#)	# In Wall	PLF	Chord F (#)	Wall W (#)	Snow	Dead	Live	Uplift				Comp			
B	50.0%	19.49	2,056	105	341	143	7	4	24	3,582	163	98	0	0	2,730	9	ft	None	OK	
	21.8%	4.25	448	105		31	7									6	OK			
	22.2%	4.33	457	105		32	7									6	OK			
	17.1%	3.33	351	105		24	7									6	OK			
	38.9%	7.58	800	105		55	7									6	OK			
C	50.0%	24.75	2,056	83	577	143	6	4	40	2,403	313	188	0	0	2,542	9	ft	None	OK	
	57.9%	14.33	1,191	83		99	6									6	OK			
	11.4%	2.83	235	83		16	6									6	OK			
	30.6%	7.58	630	83		44	6	52	819	163	98	0	0	843	6	OK	MSTC28	GK		
Main-to-Loft																				
	%	Length (ft)	SEISMIC			WIND			GRAVITY LOADING (plf)					ft						
			# In Wall	PLF	Chord F (#)	# In Wall	PLF	Chord F (#)	Wall W (#)	Snow	Dead	Live	Uplift				Comp	Anchorage		
A	26.0%	45.67	1,685	35	346	367	8	76	3,730	0	0	0	0	0	2,684	0	10	ft	None	OK
	58.4%	26.67	894	37		215	8										6	OK		
	5.5%	2.50	92	37		20	8										6	OK		
	36.1%	16.50	609	37	369	133	8	80	1,980	0	0	0	0	0	1,610	651	6	OK	None	OK
B	21.0%	21.67	3,423			440											10	ft		
	50.4%	10.92	1,725	158	1,580	185	17	170	1,310	0	0	0	0	1,291	2,401	5,201	6	OK	CU1.5	OK
	49.6%	10.75	1,698	158	1,580	182	17	170	1,290	0	0	0	0	1,295	2,388	5,208	6	OK	CU1.5	OK
B.5	4.4%	14.00	286	20		62	4										10	ft		
	39.3%	5.50	112	20	205	24	4	44	660	0	0	0	0	59	618	508	6	OK	HDIJ2	OK
	60.7%	8.50	174	20	205	38	4	44	1,020	0	0	0	0	0	844	387	6	OK	None	OK
C	24.9%	19.75	3,675	186		495	25										10	ft		
	29.1%	5.75	1,070	186	1,861	144	25	251	690	0	0	0	0	1,708	2,293	6,413	6	OK	CU2.5	OK
	70.9%	14.00	2,605	186	1,861	351	25	251	1,680	0	0	0	0	1,490	2,914	6,080	6	OK	CU2.5	OK
D	2.0%	9.00	130	14		28	3										10	ft		
	100.0%	9.00	130	14	145	28	3	32	1,080	0	0	0	0	0	822	153	6	OK	None	OK
E	21.7%	40.42	1,407	35		307	8										10	ft		
		48.17	1,407	29	292	307	6	64	5,780	0	0	0	0	0	3,914	0	6	OK	None	OK
	40.2%	16.25	566	35		123	8										6	OK		
	28.5%	11.50	400	35		87	8										6	OK		
	12.8%	5.17	180	35		39	8										6	OK		
	18.6%	7.50	261	35		57	8										6	OK		