

**DETERMINATION OF SEISMIC LOADS TO LFRS AT GRIDLINES - FLEXIBLE DIAPHRAGM ASSUMPTIONS**  
 ASCE 7-05 CHAPTER 12 - SEISMIC REQUIREMENTS FOR BUILDING STRUCTURES  
 2295 FRANCISCO STREET, SAN FRANCISCO - SEISMIC RETROFIT

**1. Input Data**

$\rho = 1.00$  Redundancy Factor (ASCE 7-05 Section 12.3.4)

DL (psf)	Floors				
	Roof	Type A (Floors)	Type B (Stairs)	Deck	RC Slab
23	32				30
LL (psf)	-	-	-	-	-

Exterior Walls		
Type a	Type b	Type c
32	23	12
-	-	-

Code Level Floor Loads		
Level	W <sub>x</sub> (kips)	A <sub>F</sub> (g's)
Roof	123	0.19
3	181	0.14
2	181	0.09
1	214	0.04

Where W<sub>x</sub> = Story Weight at Level x

A<sub>F</sub> = Floor Acceleration at Level x

V = 0.200 *W (Seismic Base Shear - Strength Level)
V = 0.150 *W ( - 75% V for (E) Bldg per IBC12 Section A4)
V = 0.150 *W ( - adjusted for Redundancy Factor, $\rho$ )
V = 0.107 *W (Seismic Base Shear - ASD Level)

Sum = 700 Kips

Weight Check:

N-S = 695.9 kips  
 W-E = 684.4 kips  
 (1.65 %)

**2. Determination of Tributary Loads**

Loading Direction	Wall Gridline Location	Floor Level	Tributary Area Segment	Floor Type	Diaphragm Loads					Wall Loads					Seismic Loads					
					Dead Load (psf)	Partition Loads (psf)	Length (feet)	Width (feet)	Area (ft <sup>2</sup> )	DL	Wall Segment	Wall Dead Load (psf)	Length (feet)	Height (feet)	Wall Area (ft <sup>2</sup> )	DL (lbs)	Seismic Weight		Code Level	
																	At Floor Level (lbs)	Sum (lbs)	Forces (lbs)	Shears (lbs)
N-S	2	R	TA41	R	23.0		50.00	17.50	875	20,125	b	23.00	17.50	9.00	158	3,623	28,229	28,229	5,348	5,348
			TA42	R	23.0		2.50	7.50	19	431	c	12.00	17.50	5.00	88	1,050				
		3	TA41	F	32.0		50.00	17.50	875	28,000	b	23.00	17.50	10.00	175	4,025				
		TA42	F	32.0		2.50	7.50	19	600	c	12.00	17.50	10.00	175	2,100					
	TA40	FS	30.0		11.50	2.50	29	863	c	12.00	50.00	10.00	500	6,000						
	2	TA41	F	32.0		50.00	17.50	875	28,000	b	23.00	17.50	10.00	175	4,025					
	TA42	F	32.0		2.50	7.50	19	600	c	12.00	17.50	10.00	175	2,100						
	TA40	FS	30.0		11.50	2.50	29	863	c	12.00	50.00	10.00	500	6,000						
	1	TA01	F	32.0		50.00	25.50	1,275	40,800	b	23.00	17.50	5.00	88	2,013					
	TA02	F	32.0		2.50	7.50	19	600	a	32.00	25.50	5.00	128	4,080						
	TA40	FS	30.0		11.50	2.50	29	863	c	12.00	25.50	10.00	255	3,060						
	c	12.00	50.00	10.00	500	6,000														
5	R	TA43	R	23.0		9.00	19.00	171	3,933	b	23.00	23.50	9.00	212	4,865					
TA44		R	23.0		15.50	3.50	54	1,248	c	12.00	23.50	5.00	118	1,410						
TA45		R	23.0		37.50	23.50	881	20,269	c	12.00	12.50	5.00	63	750						
TA46		R	23.0		2.50	7.50	19	431												
3	TA43	F	32.0		9.00	19.00	171	5,472	b	23.00	23.50	10.00	235	5,405						
TA44	F	32.0		15.50	3.50	54	1,736	c	12.00	23.50	10.00	235	2,820							
TA45	F	32.0		37.50	23.50	881	28,200	c	12.00	12.50	10.00	125	1,500							
TA46	F	32.0		2.50	7.50	19	600													
TA47	FS	30.0		2.00	6.00	12	360													
2	TA43	F	32.0		9.00	19.00	171	5,472	b	23.00	23.50	10.00	235	5,405						
TA44	F	32.0		15.50	3.50	54	1,736	c	12.00	23.50	10.00	235	2,820							
TA45	F	32.0		37.50	23.50	881	28,200	c	12.00	12.50	10.00	125	1,500							
TA46	F	32.0		2.50	7.50	19	600													
TA47	FS	30.0		2.00	6.00	12	360													
1	TA03	F	32.0		9.00	19.00	171	5,472	b	23.00	23.50	5.00	118	2,703						
TA04	F	32.0		15.50	3.50	54	1,736	a	32.00	23.50	5.00	118	3,760							
TA05	F	32.0		37.50	23.50	881	28,200	c	12.00	23.50	10.00	235	2,820							
TA06	F	32.0		2.50	7.50	19	600	c	12.00	12.50	10.00	125	1,500							
TA07	FS	30.0		2.00	6.00	12	360													
6	R	TA48	R	23.0		9.00	19.00	171	3,933	b	23.00	23.50	9.00	212	4,865					
TA49		R	23.0		16.00	3.50	56	1,288	c	12.00	23.50	5.00	118	1,410						
TA50		R	23.0		37.50	23.50	881	20,269	c	12.00	12.50	5.00	63	750						
TA51		R	23.0		2.50	7.50	19	431												
3	TA48	F	32.0		9.00	19.00	171	5,472	b	23.00	23.50	10.00	235	5,405						
TA49	F	32.0		16.00	3.50	56	1,792	c	12.00	23.50	10.00	235	2,820							
TA50	F	32.0		37.50	23.50	881	28,200	c	12.00	12.50	10.00	125	1,500							
TA51	F	32.0		2.50	7.50	19	600													
TA52	FS	30.0		2.00	6.00	12	360													
2	TA48	F	32.0		9.00	19.00	171	5,472	b	23.00	23.50	10.00	235	5,405						
TA49	F	32.0		16.00	3.50	56	1,792	c	12.00	23.50	10.00	235	2,820							
TA50	F	32.0		37.50	23.50	881	28,200	c	12.00	12.50	10.00	125	1,500							
TA51	F	32.0		2.50	7.50	19	600													
TA52	FS	30.0		2.00	6.00	12	360													
1	TA08	F	32.0		9.00	19.00	171	5,472	b	23.00	23.50	5.00	118	2,703						
TA09	F	32.0		16.00	3.50	56	1,792	a	32.00	23.50	5.00	118	3,760							
TA10	F	32.0		37.50	23.50	881	28,200	c	12.00	23.50	10.00	235	2,820							
TA11	F	32.0		2.50	7.50	19	600	c	12.00	12.50	10.00	125	1,500							
TA12	FS	30.0		2.00	6.00	12	360													

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23	32				30
LL (psf)	-	-	-	-	-

Exterior Walls		
Type a	Type b	Type c
32	23	12
-	-	-

Code Level Floor Loads		
Level	W <sub>x</sub> (kips)	A <sub>F</sub> (g's)
Roof	123	0.19
3	181	0.14
2	181	0.09
1	214	0.04

Where W<sub>x</sub> = Story Weight at Level x

A<sub>F</sub> = Floor Acceleration at Level x

V = 0.200 *W (Seismic Base Shear - Strength Level)
V = 0.150 *W ( - 75% V for (E) Bldg per IBC12 Section A4)
V = 0.150 *W ( - adjusted for Redundancy Factor, ρ)
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Sum = 700 Kips

Weight Check:

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 (1.65 %)

**2. Determination of Tributary Loads**

Loading Direction	Wall Gridline Location	Floor Level	Tributary Area Segment	Floor Type	Diaphragm Loads					Wall Loads					Seismic Loads					
					Dead Load (psf)	Partition Loads (psf)	Length (feet)	Width (feet)	Area (ft <sup>2</sup> )	DL	Wall Segment	Wall Dead Load (psf)	Length (feet)	Height (feet)	Wall Area (ft <sup>2</sup> )	DL (lbs)	At Floor Level (lbs)	Sum (lbs)	Forces (lbs)	Shears (lbs)
N-S (Cont)	10	R	TA53	R	23.0		50.00	17.00	850	19,550	c	12.00	17.00	5.00	85	1,020	36,164	36,164	6,852	6,852
			TA54	R	23.0		7.50	2.50	19	431	b	23.00	17.00	9.00	153	3,519				
			TA55	R	23.0		7.50	2.50	19	431	b	23.00	50.00	9.00	450	10,350				
			TA56	R	23.0		7.50	2.50	19	431										
			TA57	R	23.0		2.50	7.50	19	431										
		3	TA53	F	32.0		50.00	17.00	850	27,200	c	12.00	17.00	10.00	170	2,040	47,725	83,889	6,724	13,576
			TA54	F	32.0		7.50	2.50	19	600	b	23.00	17.00	10.00	170	3,910				
			TA55	F	32.0		7.50	2.50	19	600	b	23.00	50.00	10.00	500	11,500				
			TA56	F	32.0		7.50	2.50	19	600										
			TA57	F	32.0		2.50	7.50	19	600										
		2	TA53	F	32.0		50.00	17.00	850	27,200	c	12.00	17.00	10.00	170	2,040	47,725	131,614	4,405	17,981
			TA54	F	32.0		7.50	2.50	19	600	b	23.00	17.00	10.00	170	3,910				
			TA55	F	32.0		7.50	2.50	19	600	b	23.00	50.00	10.00	500	11,500				
			TA56	F	32.0		7.50	2.50	19	600										
			TA57	F	32.0		2.50	7.50	19	600										
		1	TA53	F	32.0		50.00	17.00	850	27,200	b	23.00	17.00	5.00	85	1,955	50,740	182,354	2,219	20,199
TA54	F		32.0		7.50	2.50	19	600	a	32.00	17.00	5.00	85	2,720						
TA55	F		32.0		7.50	2.50	19	600	c	12.00	17.00	10.00	170	2,040						
TA56	F		32.0		7.50	2.50	19	600	b	23.00	50.00	5.00	250	5,750						
TA57	F		32.0		2.50	7.50	19	600	a	32.00	50.00	5.00	250	8,000						
W-E	A	R	TA60	R	23.0		36.50	9.00	329	7,556	b	23.00	14.50	9.00	131	3,002	34,460	34,460	6,529	6,529
			TA61	R	23.0		33.00	5.50	182	4,175	c	12.00	14.50	5.00	73	870				
			TA62	R	23.0		14.50	2.00	29	667	c	12.00	80.00	5.00	400	4,800				
			TA63	R	23.0		35.50	9.00	320	7,349	c	12.00	12.50	5.00	63	750				
			TA64	R	23.0		32.50	5.50	179	4,111	c	12.00	12.50	5.00	63	750				
		3	TA60	F	32.0		36.50	9.00	329	10,512	b	23.00	14.50	10.00	145	3,335	52,187	86,647	7,352	13,881
			TA61	F	32.0		33.00	5.50	182	5,808	c	12.00	14.50	10.00	145	1,740				
			TA62	F	32.0		14.50	2.00	29	928	c	12.00	80.00	10.00	800	9,600				
			TA63	F	32.0		35.50	9.00	320	10,224	c	12.00	12.50	10.00	125	1,500				
			TA64	F	32.0		32.50	5.50	179	5,720	c	12.00	12.50	10.00	125	1,500				
		2	TA60	F	32.0		36.50	9.00	329	10,512	b	23.00	14.50	10.00	145	3,335	52,187	138,834	4,817	18,698
			TA61	F	32.0		33.00	5.50	182	5,808	c	12.00	14.50	10.00	145	1,740				
			TA62	F	32.0		14.50	2.00	29	928	c	12.00	80.00	10.00	800	9,600				
			TA63	F	32.0		35.50	9.00	320	10,224	c	12.00	12.50	10.00	125	1,500				
			TA64	F	32.0		32.50	5.50	179	5,720	c	12.00	12.50	10.00	125	1,500				
		1	TA60	F	32.0		44.00	9.00	396	12,672	b	23.00	14.50	5.00	73	1,668	56,320	195,153	2,462	21,161
			TA21	F	32.0		40.50	5.50	223	7,128	a	32.00	14.50	5.00	73	2,320				
			TA22	F	32.0		14.50	2.00	29	928	c	12.00	14.50	10.00	145	1,740				
			TA23	F	32.0		35.50	9.00	320	10,224	c	12.00	80.00	10.00	800	9,600				
			TA24	F	32.0		32.50	5.50	179	5,720	c	12.00	12.50	10.00	125	1,500				
TA25	F		32.0		2.50	7.50	19	600	c	12.00	12.50	10.00	125	1,500						
TA59	FS	30.0		2.00	7.50	15	450													
TA26	FS	30.0		2.00	4.50	9	270													

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Where  $W_x$  = Story Weight at Level x

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$V = 0.200 * W$ (Seismic Base Shear - Strength Level)
$V = 0.150 * W$ ( - 75% V for (E) Bldg per IEB12 Section A4)
$V = 0.150 * W$ ( - adjusted for Redundancy Factor, $\rho$ )
$V = 0.107 * W$ (Seismic Base Shear - ASD Level)

Sum = 700 Kips

Weight Check:

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**2. Determination of Tributary Loads**

Loading Direction	Wall Gridline Location	Floor Level	Tributary Area Segment	Floor Type	Diaphragm Loads					Wall Loads					Seismic Loads					
					Dead Load (psf)	Partition Loads (psf)	Length (feet)	Width (feet)	Area (ft <sup>2</sup> )	DL (46,000)	Wall Segment	Wall Dead Load (psf)	Length (feet)	Height (feet)	Wall Area (ft <sup>2</sup> )	DL (lbs)	Seismic Weight		Code Level	
																	At Floor Level (lbs)	Sum (lbs)	Forces (lbs)	Shears (lbs)
W-E (Cont)	D	R	TA67 TA69	R	23.0		80.00	25.00	2,000	46,000	b	23.00	25.00	9.00	225	5,175	53,106	53,106	10,062	10,062
				R	23.0		2.50	7.50	19	431	c	12.00	25.00	5.00	125	1,500				
		3	TA67 TA69 TA59	F	32.0		80.00	25.00	2,000	64,000	b	23.00	25.00	10.00	250	5,750	73,590	126,696	10,368	20,430
				FS	30.0		2.50	7.50	19	600	c	12.00	25.00	10.00	250	3,000				
	2	TA67 TA69 TA59	F	32.0		80.00	25.00	2,000	64,000	b	23.00	25.00	10.00	250	5,750	73,590	200,286	6,793	27,222	
			FS	30.0		2.50	7.50	19	600	c	12.00	25.00	10.00	250	3,000					
	1	TA27 TA29 TA28	F	32.0		88.00	25.00	2,200	70,400	b	23.00	25.00	5.00	125	2,875	81,115	281,401	3,547	30,769	
			FS	30.0		2.50	7.50	19	600	a	32.00	25.00	5.00	125	4,000					
	F	R	TA70 TA71 TA72 TA74 TA75 TA76	R	23.0		80.00	10.50	840	19,320	b	23.00	10.50	9.00	95	2,174	40,840	40,840	7,738	7,738
				R	23.0		2.50	7.50	19	600	c	12.00	10.50	5.00	53	630				
				R	23.0		7.50	2.50	19	431	b	23.00	80.00	9.00	720	16,560				
				R	23.0		7.50	2.50	19	431										
R				23.0		7.50	2.50	19	431											
R				23.0		7.50	2.50	19	431											
3		TA70 TA71 TA72 TA74 TA75 TA76 TA73	F	32.0		80.00	10.50	840	26,880	b	23.00	10.50	10.00	105	2,415	52,675	93,515	7,421	15,159	
			F	32.0		2.50	7.50	19	600	c	12.00	10.50	10.00	105	1,260					
			F	32.0		7.50	2.50	19	600	b	23.00	80.00	10.00	800	18,400					
			F	32.0		7.50	2.50	19	600											
			F	32.0		7.50	2.50	19	600											
			F	32.0		7.50	2.50	19	600											
2	TA70 TA71 TA72 TA74 TA75 TA76 TA73	F	32.0		80.00	10.50	840	26,880	b	23.00	10.50	10.00	105	2,415	52,675	146,190	4,862	20,021		
		F	32.0		2.50	7.50	19	600	c	12.00	10.50	10.00	105	1,260						
		F	32.0		7.50	2.50	19	600	b	23.00	80.00	10.00	800	18,400						
		F	32.0		7.50	2.50	19	600												
		F	32.0		7.50	2.50	19	600												
		F	32.0		7.50	2.50	19	600												
1	TA30 TA31 TA32 TA34 TA35 TA36 TA33	F	32.0		88.00	10.50	924	29,568	b	23.00	10.50	5.00	53	1,208	61,636	207,825	2,695	22,716		
		F	32.0		2.50	7.50	19	600	a	32.00	10.50	5.00	53	1,680						
		F	32.0		7.50	2.50	19	600	c	12.00	10.50	10.00	105	1,260						
		F	32.0		7.50	2.50	19	600	b	23.00	88.00	5.00	440	10,120						
		F	32.0		7.50	2.50	19	600	a	32.00	88.00	5.00	440	14,080						
		F	32.0		7.50	2.50	19	600												
		FS	30.0		2.00	12.00	24	720												