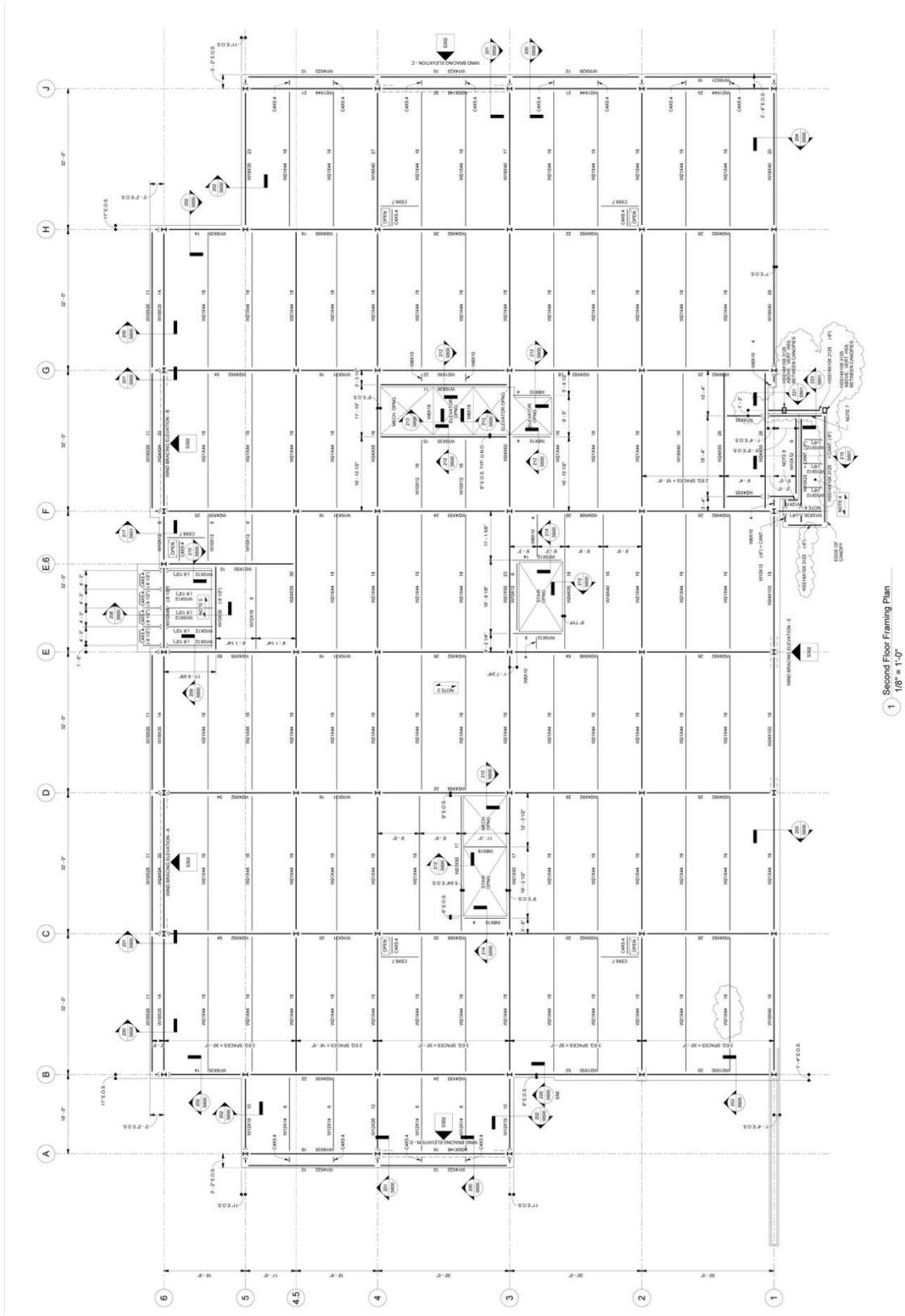


APPENDIX A: BUILDING LAYOUT

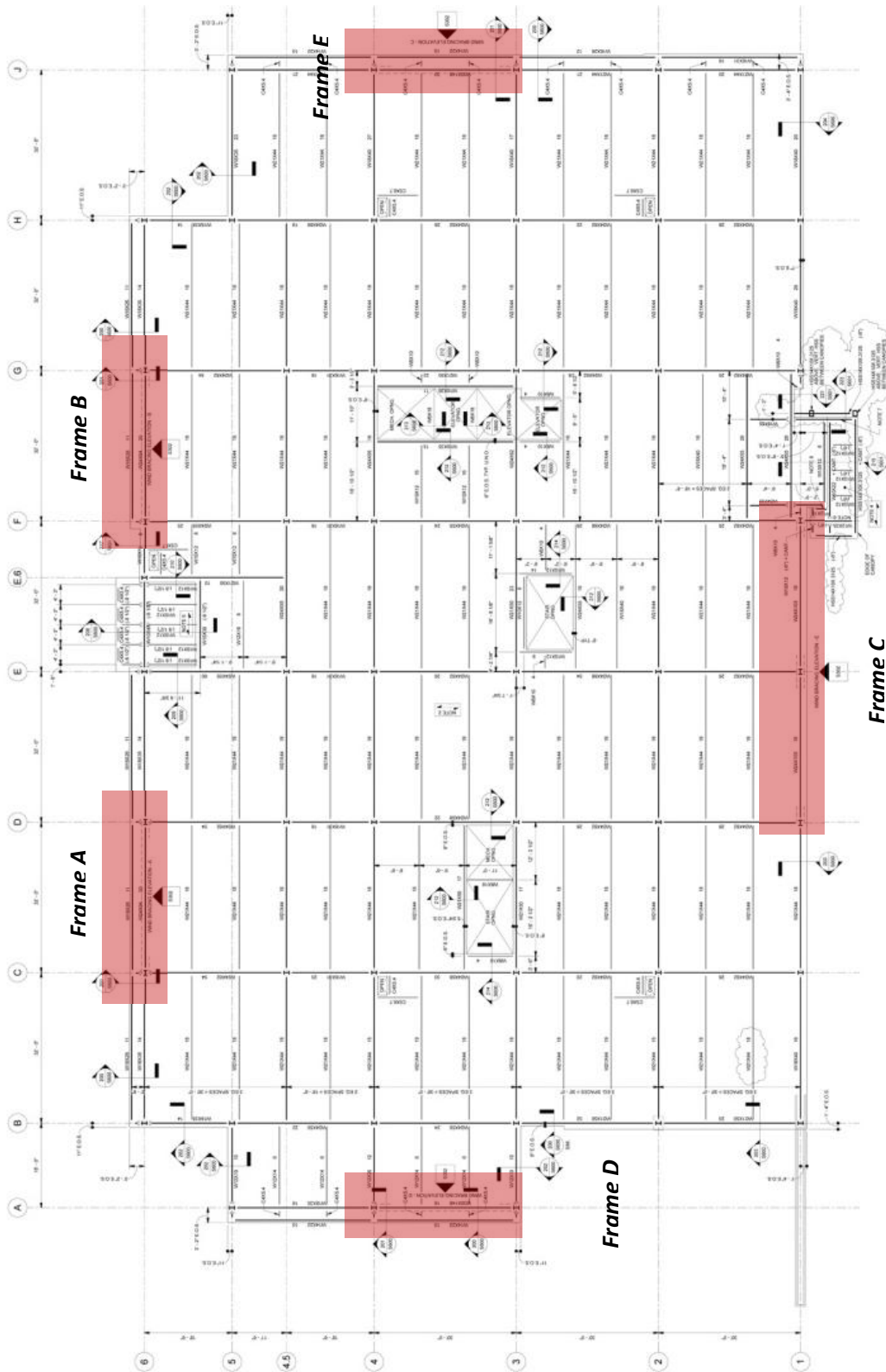
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Typical Floor Layout



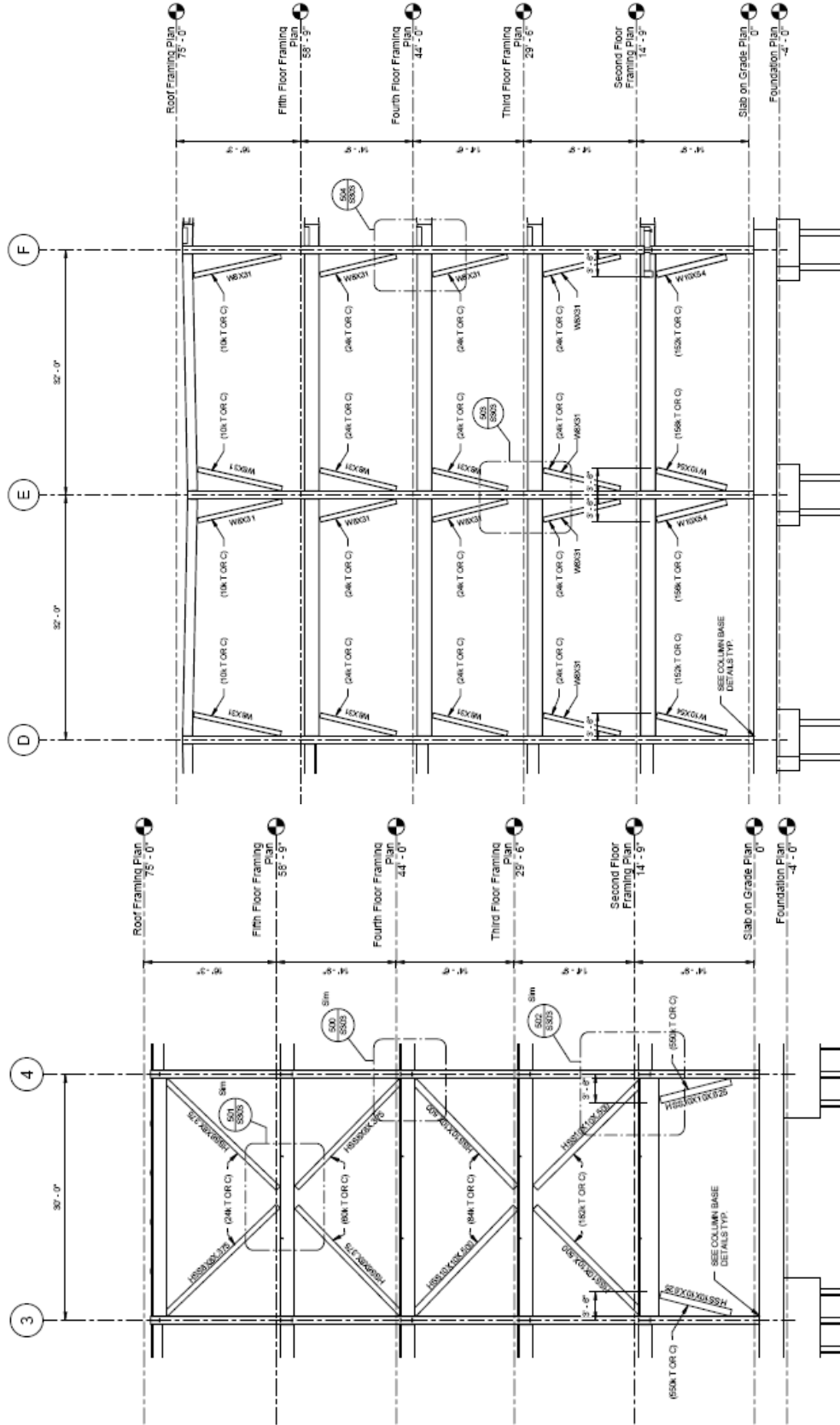
1 Second Floor Framing Plan
1/8" = 1'-0"

Existing Frame Layout (Typical)

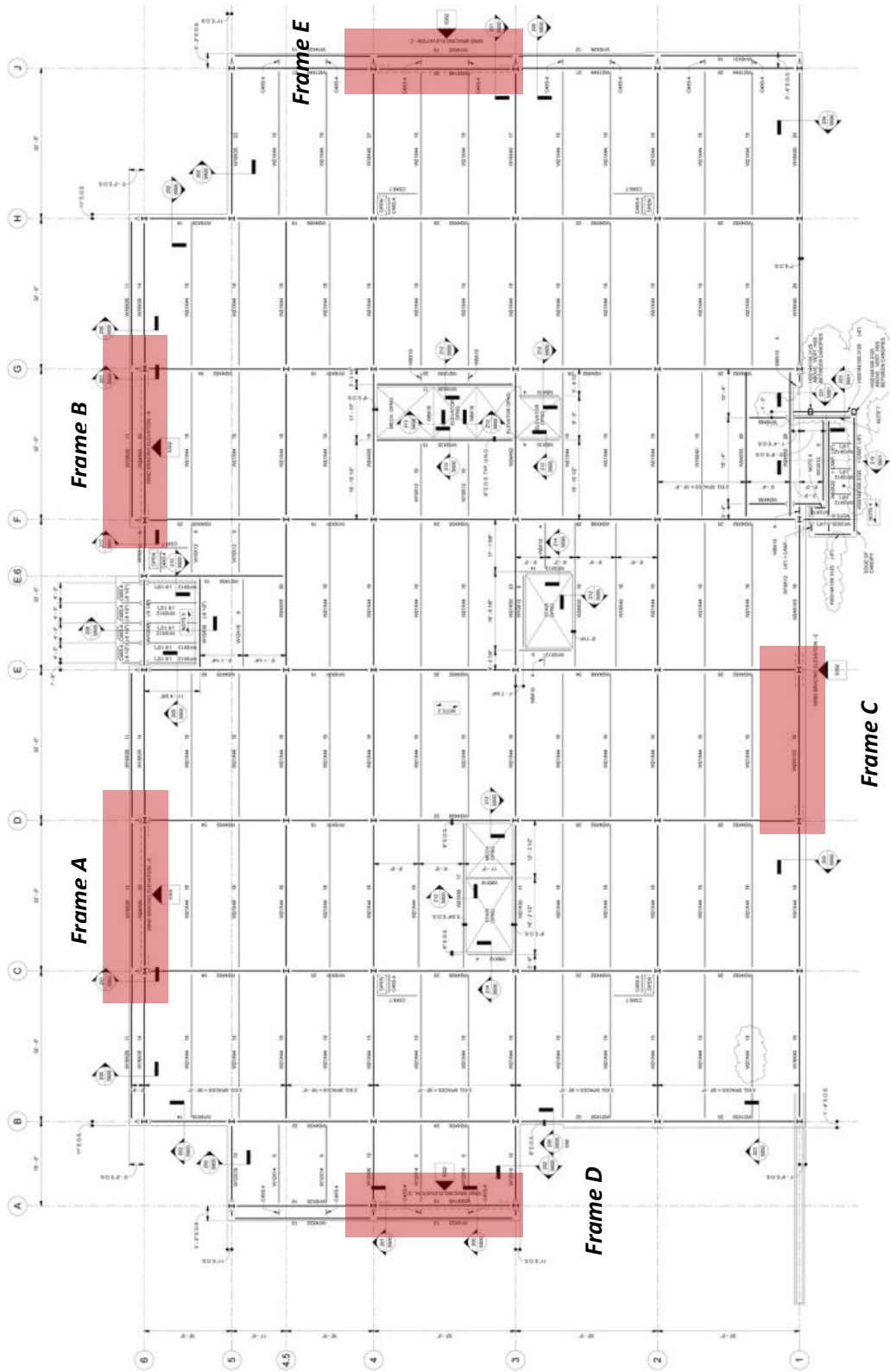


Frame A, B, D, E (Sim.)

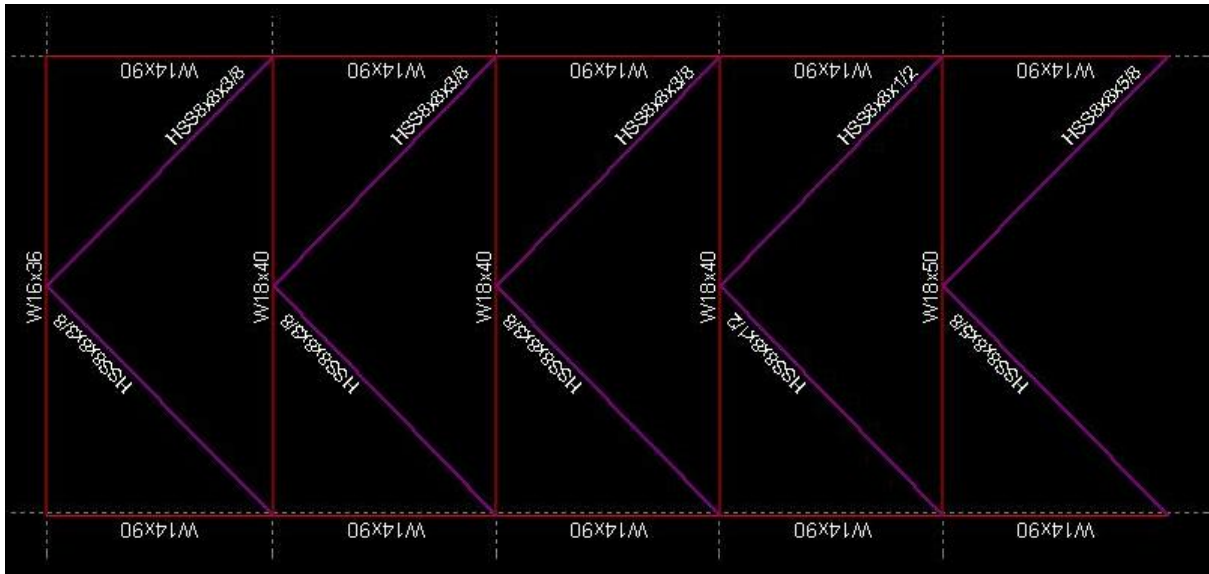
Frame C



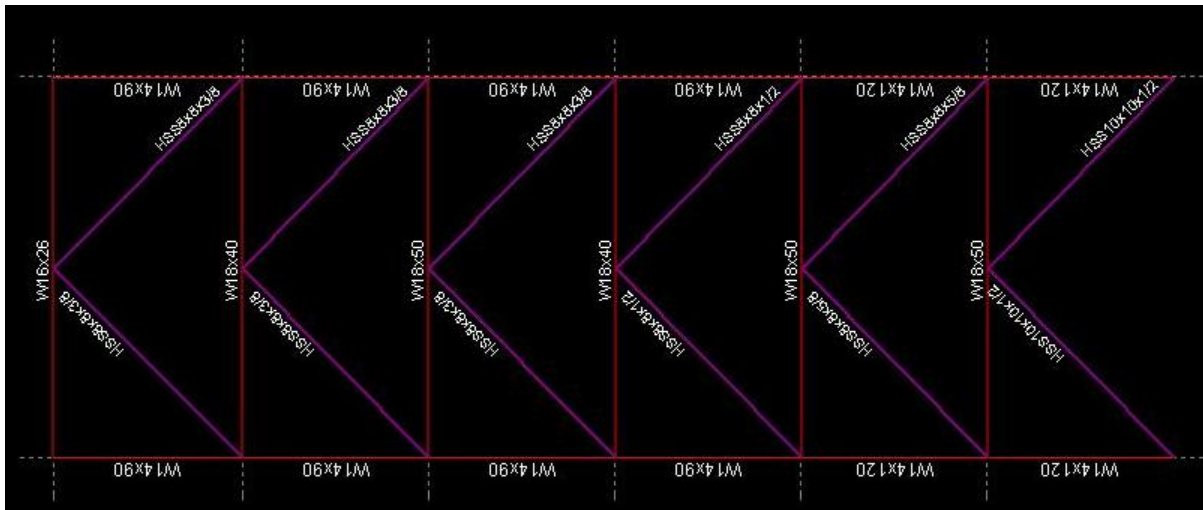
Modified Frame Layout



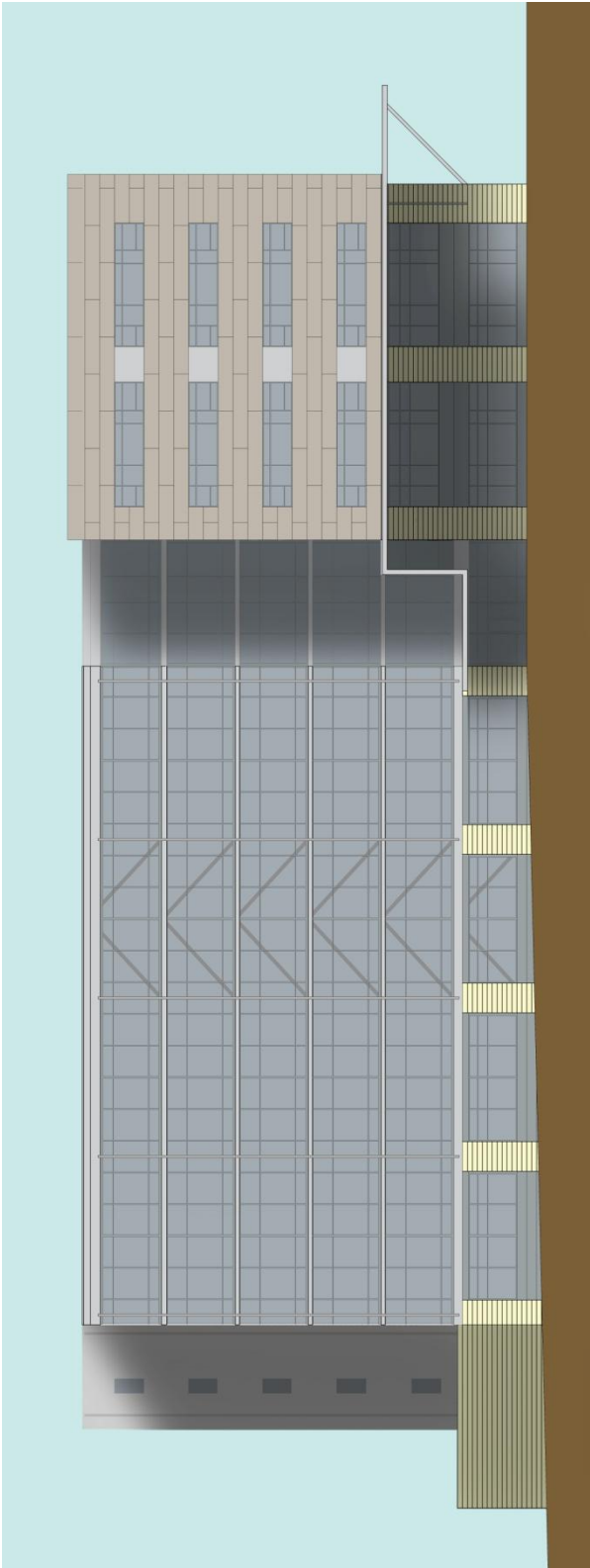
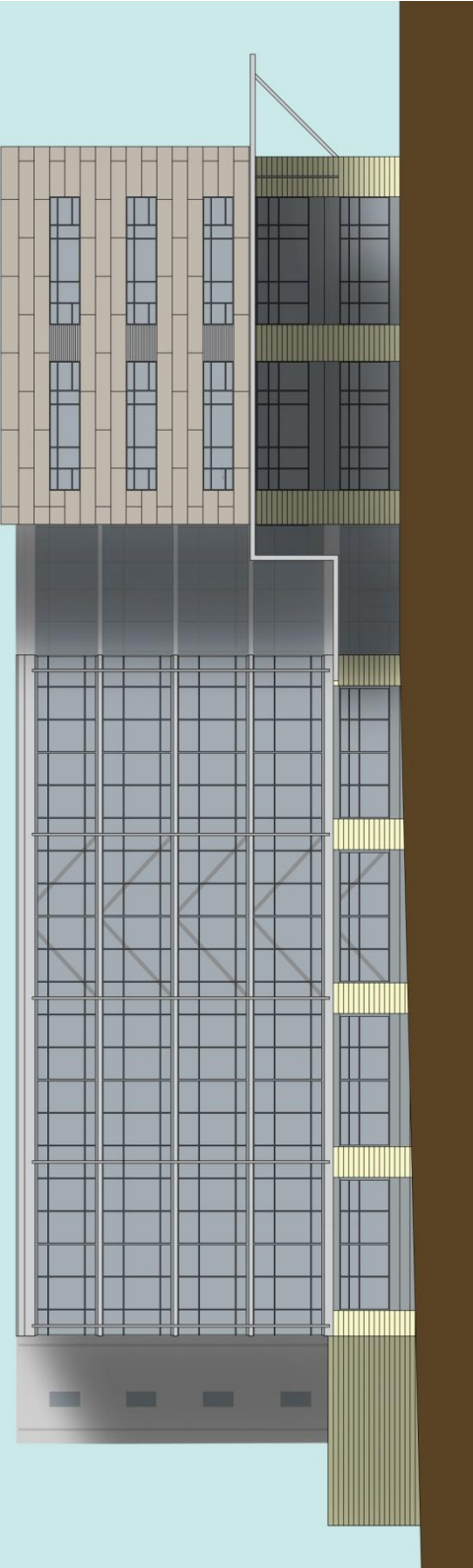
Modified Frame Layout with Sizes



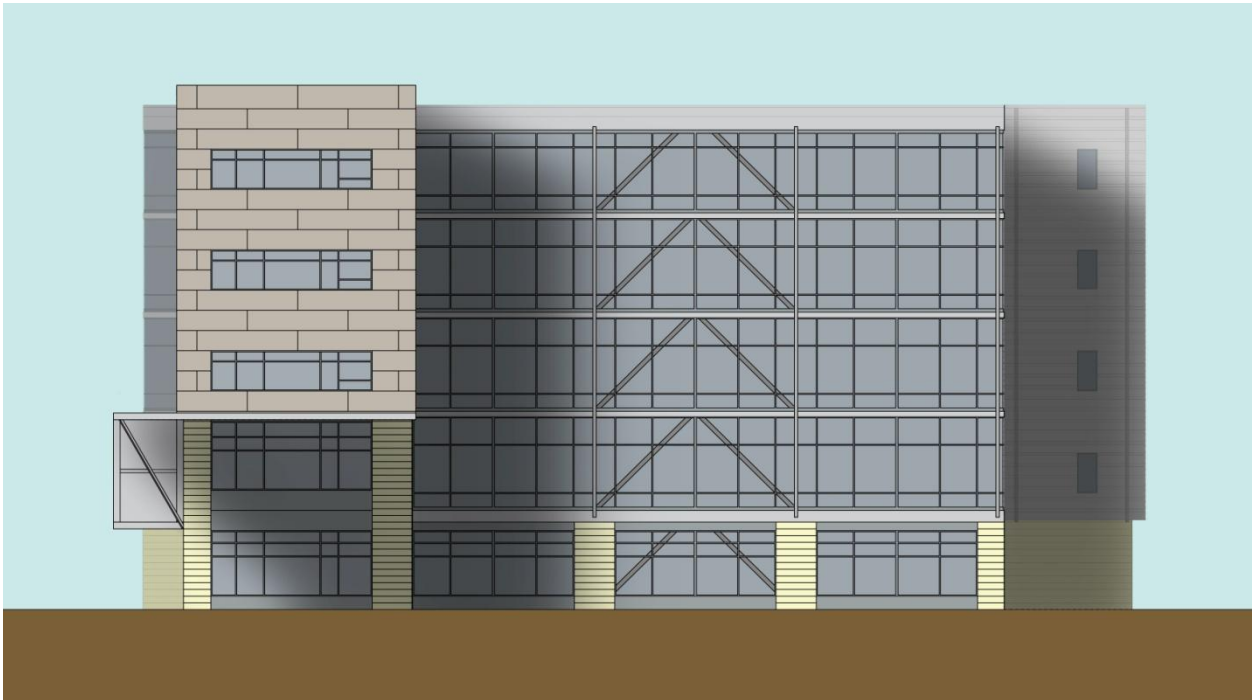
Additional Floor & Modified Frame Layout with Sizes



Modified Elevations (North Façade)



Modified Elevations (West Façade)



-End of Section-

APPENDIX B: WIND AND SEISMIC DATA

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MAIN WIND-FORCE RESISTING SYSTEM (ASCE 7-05)

Bridgside Point II -- Pittsburgh, PA

Existing Conditions

Floor Heights	Level	Total Height	K _z	q _z	q _h	Wind Pressures (psf)					
						N-S Windward	N-S Leeward	N-S Side Wall	E-W Windward	E-W Leeward	E-W Side Wall
15.25	Roof	74.00	1.188	20.94	20.94	22.23	-2.58	-12.38	20.81	-6.88	-11.14
14.75	5	58.75	1.133	19.97	20.94	21.37	-2.58	-12.38	20.02	-6.88	-11.14
14.50	4	44.00	1.066	18.79	20.94	20.33	-2.58	-12.38	19.06	-6.88	-11.14
14.75	3	29.50	0.979	17.26	20.94	18.98	-2.58	-12.38	17.81	-6.88	-11.14
14.75	2	14.75	0.849	14.96	20.94	16.96	-2.58	-12.38	15.94	-6.88	-11.14



Level	Wind Design					
	Load (kips)		Shear (kips)*		Moment (ft-k)	
	N-S	E-W	N-S	E-W	N-S	E-W
Roof	27	52	0	0	2030	3827
5	51	97	27	52	3009	5710
4	48	92	79	149	2119	4054
3	46	89	127	241	1360	2632
2	42	82	173	330	616	1216
Total	215	413	215	413	9135	17,439

* Note: Total Base Shear includes additive loading from Windward and Leeward pressures

Additional Floor Conditions

Floor Heights	Level	Total Height	K _z	q _z	q _h	Wind Pressures (psf)					
						N-S Windward	N-S Leeward	N-S Side Wall	E-W Windward	E-W Leeward	E-W Side Wall
15.25	Roof	88.75	1.237	21.80	20.94	22.99	-2.58	-12.38	21.51	-6.88	-11.14
14.75	6	73.50	1.188	20.94	20.94	22.23	-2.58	-12.38	20.81	-6.88	-11.14
14.75	5	58.75	1.133	19.97	20.94	21.37	-2.58	-12.38	20.02	-6.88	-11.14
14.50	4	44.00	1.066	18.79	20.94	20.33	-2.58	-12.38	19.06	-6.88	-11.14
14.75	3	29.50	0.979	17.26	20.94	18.98	-2.58	-12.38	17.81	-6.88	-11.14
14.75	2	14.75	0.849	14.96	20.94	16.96	-2.58	-12.38	15.94	-6.88	-11.14



Level	Wind Design					
	Load (kips)		Shear (kips)*		Moment (ft-k)	
	N-S	E-W	N-S	E-W	N-S	E-W
Roof	28	53	0	0	0	0
6	53	100	28	53	4708	8879
5	51	97	81	153	3009	5710
4	48	92	133	250	2119	4054
3	46	89	181	342	1360	2632
2	42	82	227	432	616	1216
Total	269	514	269	514	11,814	22,491

* Note: Total Base Shear includes additive loading from Windward and Leeward pressures

SEISMIC FORCE RESISTING SYSTEM (ASCE 7-05)

Bridgeside Point II -- Pittsburgh, PA



$S_{ms} = S_s * F_a$	0.2000
$S_{m1} = S_1 * F_v$	0.1176
$S_{DS} = 2/3 * S_{ms}$	0.1333
$S_{D1} = 2/3 * S_{m1}$	0.0784
Seismic Design	B
R	3.0
C_s	0.02
k	1.40
Total Shear (k)	271

Occupancy Category	II
Importance Factor (I)	1.0
S_s	0.125
S_1	0.049
Site Class	D
Total Building Height (feet)	75
T_a	0.765
T_L	12
Fundamental Period (T)	1.30
Frequency (f)	0.769
Structure Behavior	FLEX.
Total Weight (k)	13,550

Dead Loads					
Typical Floor Loads (psf)		Roof Loads (psf)		Penthouse Loads (psf)	
Partitions	10	M.E.P.	5	M.E.P.	5
Finishes	3	Slab & Deck	50	Slab & Deck	25
M.E.P.	5	Structural Steel	10	Structural Steel	10
Slab & Deck	57	Misc.	5	Misc.	5
Structural Steel	15	--	-	--	-
Total	90	Total	70	Total	45

Base Shear and Overturning Moment Distribution								
Story	h_x (feet)	Area (feet)	Floor Load (k)	$h_x^k W_x$	C_{vx}	$F_x = C_{vx} V$	V_x (k)	M_x (ft-k)
Roof	75.00	31512	2206	930379	0.333	90.2	0.0	6768.5
5	58.75	31512	2836	849825	0.304	82.4	90.2	4842.9
4	44.00	31512	2836	566960	0.203	55.0	172.7	2419.8
3	29.50	31512	2836	323944	0.116	31.4	227.7	927.0
2	14.75	31512	2836	122752	0.044	11.9	259.1	175.6
1	0	31512	2500	0	0.000	0.0	271.0	0.0
Total	75	0	13550	2793859	1.000	271	271	15,134

-End of Section-

APPENDIX C: STIFFNESS AND MEMBER CALCULATIONS

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Modified "X" – Brace

East - West Direction									
	Member	F _i	f _i	L (feet)	A (in ²)	E (ksi)	F _i f _i L/AE	Member Contribution	
Beams	2nd Floor	-118.49	-0.49	30.00	14.70	29,000	0.0490	6.83%	
	3rd Floor	-43.45	0.00	30.00	11.80	29,000	0.0000	0.00%	
	4th Floor	-15.15	-0.05	30.00	14.70	29,000	0.0006	0.09%	
	5th Floor	-46.69	0.00	30.00	11.80	29,000	0.0000	0.00%	
	Roof	9.97	0.44	30.00	9.13	29,000	0.0060	0.83%	
West Columns	2nd Floor	190.03	1.97	14.75	26.50	29,000	0.0862	12.01%	
	3rd Floor	113.93	1.49	14.75	26.50	29,000	0.0391	5.45%	
	4th Floor	113.93	1.49	14.75	26.50	29,000	0.0391	5.45%	
	5th Floor	16.66	0.44	14.75	26.50	29,000	0.0017	0.24%	
	Roof	16.66	0.44	15.00	26.50	29,000	0.0017	0.24%	
East Columns	2nd Floor	-190.03	-1.97	14.75	26.50	29,000	0.0862	12.01%	
	3rd Floor	-103.88	-1.47	14.75	26.50	29,000	0.0352	4.90%	
	4th Floor	-103.88	-1.47	14.75	26.50	29,000	0.0352	4.90%	
	5th Floor	-10.27	-0.56	14.75	26.50	29,000	0.0013	0.18%	
	Roof	-10.27	-0.56	15.00	26.50	29,000	0.0013	0.19%	
West Braces	2nd Floor	144.06	0.70	21.04	17.20	29,000	0.0510	7.11%	
	3rd Floor	108.55	0.70	21.04	16.40	29,000	0.0403	5.62%	
	4th Floor	-92.08	-0.71	21.04	16.40	29,000	0.0347	4.84%	
	5th Floor	46.65	0.79	21.04	10.40	29,000	0.0309	4.30%	
	Roof	-23.56	-0.62	21.21	10.40	29,000	0.0123	1.72%	
East Braces	2nd Floor	-144.41	-0.70	21.04	17.20	29,000	0.0512	7.13%	
	3rd Floor	-122.88	-0.72	21.04	16.40	29,000	0.0470	6.54%	
	4th Floor	77.74	0.69	21.04	16.40	29,000	0.0285	3.97%	
	5th Floor	-56.76	-0.62	21.04	10.40	29,000	0.0295	4.10%	
	Roof	14.53	0.79	21.21	10.40	29,000	0.0097	1.35%	
Σ =							0.7177	100%	
Beams		7.75%							
West Columns		23.38%							
East Columns		22.19%							
West Braces		23.58%							
East Braces		23.10%							
				Story Drift		Structure Drift			
				Actual	Allowable	Actual	Allowable		
				Roof	0.116	0.450	0.659	2.220	OK
				5th Floor	0.136	0.443	0.542	1.770	OK
				4th Floor	0.149	0.443	0.406	1.328	OK
				3rd Floor	0.114	0.443	0.257	0.885	OK
				2nd Floor	0.143	0.443	0.143	0.443	OK

North - South Direction

	Member	F _i	f _i	L (feet)	A (in ²)	E (ksi)	F _i f _i L/AE	Member Contribution	
Beams	2nd Floor	-41.20	-0.49	30.00	14.70	29,000	0.0170	6.13%	
	3rd Floor	-15.33	0.00	30.00	14.70	29,000	0.0000	0.00%	
	4th Floor	-5.46	-0.06	30.00	14.70	29,000	0.0003	0.10%	
	5th Floor	-16.65	0.00	30.00	14.70	29,000	0.0000	0.00%	
	Roof	3.30	0.43	30.00	9.13	29,000	0.0019	0.69%	
West Columns	2nd Floor	62.06	1.85	14.75	26.50	29,000	0.0264	9.51%	
	3rd Floor	36.85	1.39	14.75	26.50	29,000	0.0118	4.24%	
	4th Floor	36.85	1.39	14.75	26.50	29,000	0.0118	4.24%	
	5th Floor	5.50	0.41	14.75	26.50	29,000	0.0005	0.19%	
	Roof	5.50	0.41	15.00	26.50	29,000	0.0005	0.19%	
East Columns	2nd Floor	-62.06	-1.85	14.75	26.50	29,000	0.0264	9.51%	
	3rd Floor	-34.29	-1.38	14.75	26.50	29,000	0.0109	3.92%	
	4th Floor	-34.30	-1.38	14.75	26.50	29,000	0.0109	3.92%	
	5th Floor	-3.19	-0.53	14.75	26.50	29,000	0.0004	0.14%	
	Roof	-3.19	-0.53	15.00	26.50	29,000	0.0004	0.14%	
West Braces	2nd Floor	48.41	0.68	21.04	10.40	29,000	0.0276	9.91%	
	3rd Floor	37.18	0.68	21.04	10.40	29,000	0.0212	7.61%	
	4th Floor	-30.45	-0.68	21.04	10.40	29,000	0.0173	6.23%	
	5th Floor	15.80	0.77	21.04	10.40	29,000	0.0102	3.66%	
	Roof	-8.04	-0.59	21.21	10.40	29,000	0.0040	1.44%	
East Braces	2nd Floor	-48.41	-0.68	21.04	10.40	29,000	0.0276	9.91%	
	3rd Floor	-40.96	-0.69	21.04	10.40	29,000	0.0237	8.51%	
	4th Floor	26.68	0.66	21.04	10.40	29,000	0.0147	5.30%	
	5th Floor	-19.21	-0.59	21.04	10.40	29,000	0.0095	3.41%	
	Roof	4.68	0.77	21.21	10.40	29,000	0.0030	1.09%	
Σ =							0.2781	100%	
	Beams	6.92%							
	West Columns	18.37%							
	East Columns	17.63%							
	West Braces	28.85%							
	East Braces	28.22%							
				Story Drift		Structure Drift			
				Actual	Allowable	Actual	Allowable		
				Roof	0.038	0.450	0.287	2.220	OK
				5th Floor	0.050	0.443	0.249	1.770	OK
				4th Floor	0.063	0.443	0.200	1.328	OK
				3rd Floor	0.060	0.443	0.137	0.885	OK
				2nd Floor	0.077	0.443	0.077	0.443	OK

Chevron - Brace

East - West Direction

	Member	F _i	f _i	L (feet)	A (in ²)	E (ksi)	F _i f _i L/AE	Member Contribution	
Beams	2nd Floor	-123.50	-0.50	30.00	14.70	29,000	0.0521	7.35%	
	3rd Floor	-104.65	-0.50	30.00	11.80	29,000	0.0550	7.76%	
	4th Floor	-82.70	-0.50	30.00	14.70	29,000	0.0349	4.92%	
	5th Floor	-61.22	-0.50	30.00	11.80	29,000	0.0322	4.54%	
	Roof	26.31	1.00	30.00	9.13	29,000	0.0358	5.04%	
West Columns	2nd Floor	189.88	1.97	14.75	42.70	29,000	0.0535	7.54%	
	3rd Floor	108.77	1.48	14.75	42.70	29,000	0.0230	3.24%	
	4th Floor	50.00	0.99	14.75	42.70	29,000	0.0071	1.00%	
	5th Floor	13.40	0.50	14.75	26.50	29,000	0.0015	0.22%	
	Roof	0.00	0.00	15.00	26.50	29,000	0.0000	0.00%	
East Columns	2nd Floor	-189.88	-1.98	14.75	42.70	29,000	0.0537	7.57%	
	3rd Floor	-108.62	-1.48	14.75	42.70	29,000	0.0230	3.24%	
	4th Floor	-49.79	-0.99	14.75	42.70	29,000	0.0070	0.99%	
	5th Floor	-13.21	-0.50	14.75	26.50	29,000	0.0015	0.21%	
	Roof	0.00	0.00	15.00	26.50	29,000	0.0000	0.00%	
West Braces	2nd Floor	144.68	0.71	21.04	17.20	29,000	0.0520	7.33%	
	3rd Floor	115.68	0.70	21.04	17.20	29,000	0.0410	5.78%	
	4th Floor	83.63	0.70	21.04	17.20	29,000	0.0296	4.18%	
	5th Floor	52.01	0.70	21.04	10.40	29,000	0.0305	4.30%	
	Roof	18.66	0.71	21.21	10.40	29,000	0.0112	1.58%	
East Braces	2nd Floor	-144.63	-0.71	21.04	17.20	29,000	0.0520	7.33%	
	3rd Floor	-115.90	-0.70	21.04	17.20	29,000	0.0411	5.79%	
	4th Floor	-83.99	-0.70	21.04	17.20	29,000	0.0298	4.19%	
	5th Floor	-52.32	-0.70	21.04	10.40	29,000	0.0307	4.32%	
	Roof	-18.96	-0.71	21.21	10.40	29,000	0.0114	1.60%	
						Σ =	0.7096	100%	
	Beams	29.61%							
	West Columns	11.99%							
	East Columns	12.02%							
	West Braces	23.15%							
	East Braces	23.23%							
					Story Drift		Structure Drift		
					Actual	Allowable	Actual	Allowable	
			Roof	0.117	0.450	0.731	2.220	OK	
			5th Floor	0.121	0.443	0.615	1.770	OK	
			4th Floor	0.211	0.443	0.493	1.328	OK	
			3rd Floor	0.132	0.443	0.283	0.885	OK	
			2nd Floor	0.151	0.443	0.151	0.443	OK	

North - South Direction

	Member	F_i	f_i	L (feet)	A (in ²)	E (ksi)	$F_i f_i L / AE$	Member Contribution
Beams	2nd Floor	-42.59	-0.50	30.00	14.70	29,000	0.0180	7.75%
	3rd Floor	-36.23	-0.50	30.00	11.80	29,000	0.0191	8.21%
	4th Floor	-28.93	-0.50	30.00	14.70	29,000	0.0122	5.26%
	5th Floor	-21.40	-0.50	30.00	11.80	29,000	0.0113	4.85%
	Roof	9.10	1.00	30.00	9.13	29,000	0.0124	5.33%
West Columns	2nd Floor	61.98	1.85	14.75	42.70	29,000	0.0164	7.06%
	3rd Floor	35.65	1.39	14.75	42.70	29,000	0.0071	3.05%
	4th Floor	16.30	0.93	14.75	42.70	29,000	0.0022	0.93%
	5th Floor	4.36	0.47	14.75	26.50	29,000	0.0005	0.20%
	Roof	0.00	0.00	15.00	26.50	29,000	0.0000	0.00%
East Columns	2nd Floor	-61.98	-1.85	14.75	42.70	29,000	0.0164	7.06%
	3rd Floor	-35.59	-1.39	14.75	42.70	29,000	0.0071	3.05%
	4th Floor	-16.23	-0.93	14.75	42.70	29,000	0.0022	0.93%
	5th Floor	-4.23	-0.47	14.75	26.50	29,000	0.0005	0.20%
	Roof	0.00	0.00	15.00	26.50	29,000	0.0000	0.00%
West Braces	2nd Floor	48.51	0.68	21.04	17.20	29,000	0.0167	7.19%
	3rd Floor	38.85	0.68	21.04	17.20	29,000	0.0134	5.76%
	4th Floor	28.47	0.68	21.04	17.20	29,000	0.0098	4.22%
	5th Floor	17.57	0.68	21.04	10.40	29,000	0.0100	4.31%
	Roof	6.26	0.68	21.21	10.40	29,000	0.0036	1.55%
East Braces	2nd Floor	-48.51	-0.68	21.04	17.20	29,000	0.0167	7.19%
	3rd Floor	-38.94	-0.68	21.04	17.20	29,000	0.0134	5.77%
	4th Floor	-28.60	-0.68	21.04	17.20	29,000	0.0098	4.24%
	5th Floor	-17.68	-0.68	21.04	10.40	29,000	0.0101	4.33%
	Roof	-6.35	-0.68	21.21	10.40	29,000	0.0036	1.57%
$\Sigma =$							0.2322	100%
	Beams	31.39%						
	West Columns	11.25%						
	East Columns	11.23%						
	West Braces	23.03%						
	East Braces	23.11%						
				Story Drift		Structure Drift		
				Actual	Allowable	Actual	Allowable	
			Roof	0.039	0.450	0.296	2.220	OK
			5th Floor	0.047	0.443	0.257	1.770	OK
			4th Floor	0.069	0.443	0.211	1.328	OK
			3rd Floor	0.064	0.443	0.141	0.885	OK
			2nd Floor	0.077	0.443	0.077	0.443	OK

Additional Floor with Chevron Brace

East - West Direction

	Member	F _i	f _i	L (feet)	A (in ²)	E (ksi)	F _i f _i L/AE	Member Contribution	
Beams	W18x50 2nd Floor	-148.61	-0.50	30.00	14.70	29,000	0.0627	4.61%	
	W18x50 3rd Floor	-130.40	-0.50	30.00	14.70	29,000	0.0551	4.04%	
	W18x40 4th Floor	-107.51	-0.50	30.00	11.80	29,000	0.0566	4.15%	
	W18x40 5th Floor	-86.75	-0.50	30.00	11.80	29,000	0.0456	3.35%	
	W18x40 6th Floor	-68.03	-0.49	30.00	11.80	29,000	0.0351	2.57%	
	W16x26 Roof	-26.82	-1.00	30.00	7.68	29,000	0.0434	3.18%	
West Columns	W14x120 2nd Floor	302.18	2.46	14.75	35.30	29,000	0.1285	9.44%	
	W14x120 3rd Floor	195.96	1.97	14.75	35.30	29,000	0.0667	4.90%	
	W14x90 4th Floor	112.65	1.48	14.75	26.50	29,000	0.0384	2.82%	
	W14x90 5th Floor	51.16	0.99	14.75	26.50	29,000	0.0117	0.86%	
	W14x40 6th Floor	13.66	0.50	14.75	26.50	29,000	0.0016	0.12%	
	W14x90 Roof	0.00	0.00	15.00	26.50	29,000	0.0000	0.00%	
East Columns	W14x120 2nd Floor	-302.10	-2.46	14.75	35.30	29,000	0.1285	9.43%	
	W14x120 3rd Floor	-196.76	-1.97	14.75	35.30	29,000	0.0670	4.92%	
	W14x90 4th Floor	-112.48	-1.48	14.75	26.50	29,000	0.0383	2.82%	
	W14x90 5th Floor	-50.94	-0.99	14.75	26.50	29,000	0.0116	0.85%	
	W14x40 6th Floor	-13.44	-0.50	14.75	26.50	29,000	0.0015	0.11%	
	W14x90 Roof	0.00	0.00	15.00	26.50	29,000	0.0000	0.00%	
West Braces	HSS10x10x1/2 2nd Floor	180.11	0.71	21.04	17.20	29,000	0.0647	4.75%	
	HSS8x8x5/8 3rd Floor	151.50	0.70	21.04	16.40	29,000	0.0563	4.13%	
	HSS8x8x3/8 4th Floor	118.68	0.70	21.04	10.40	29,000	0.0695	5.11%	
	HSS8x8x3/8 5th Floor	87.59	0.70	21.04	10.40	29,000	0.0513	3.77%	
	HSS8x8x3/8 6th Floor	53.32	0.70	21.04	10.40	29,000	0.0312	2.29%	
	HSS8x8x3/8 Roof	19.08	0.70	21.21	10.40	29,000	0.0113	0.83%	
East Braces	HSS10x10x1/2 2nd Floor	-180.11	-0.71	21.04	17.20	29,000	0.0647	4.75%	
	HSS8x8x5/8 3rd Floor	-151.79	-0.70	21.04	16.40	29,000	0.0564	4.14%	
	HSS8x8x3/8 4th Floor	-118.92	-0.70	21.04	10.40	29,000	0.0697	5.12%	
	HSS8x8x3/8 5th Floor	-87.92	-0.70	21.04	10.40	29,000	0.0515	3.78%	
	HSS8x8x3/8 6th Floor	-53.64	-0.70	21.04	10.40	29,000	0.0314	2.31%	
	HSS8x8x3/8 Roof	-19.24	-0.70	21.21	10.40	29,000	0.0114	0.83%	
							Σ =	1.3619	100%
Beams		21.91%							
West				Story Drift		Structure Drift			
Columns	18.13%			Actual	Allowable	Actual	Allowable		
East			Roof	0.162	0.450	1.252	2.663	OK	
Columns	18.14%		6th Floor	0.194	0.443	1.090	2.220	OK	
West			5th Floor	0.246	0.443	0.895	1.770	OK	
Braces	20.88%		4th Floor	0.247	0.443	0.649	1.328	OK	
East			3rd Floor	0.212	0.443	0.403	0.885	OK	
Braces	20.94%		2nd Floor	0.191	0.443	0.191	0.443	OK	

North - South Direction

	Member	F _i	f _i	L (feet)	A (in ²)	E (ksi)	F _i f _i L/AE	Member Contribution	
Beams	W18x50 2nd Floor	-51.62	-0.50	30.00	14.70	29,000	0.0218	4.09%	
	W18x50 3rd Floor	-45.32	-0.50	30.00	14.70	29,000	0.0191	3.59%	
	W18x40 4th Floor	-37.86	-0.50	30.00	11.80	29,000	0.0199	3.74%	
	W18x40 5th Floor	-30.46	-0.50	30.00	11.80	29,000	0.0160	3.01%	
	W18x40 6th Floor	-22.26	-0.50	30.00	11.80	29,001	0.0117	2.20%	
	W16x26 Roof	-9.44	-1.00	30.00	7.68	29,000	0.0153	2.86%	
West Columns	W14x90 2nd Floor	99.44	2.31	14.75	26.50	29,000	0.0529	9.92%	
	W14x90 3rd Floor	64.78	1.85	14.75	26.50	29,000	0.0276	5.18%	
	W14x90 4th Floor	37.18	1.39	14.75	26.50	29,000	0.0119	2.23%	
	W14x90 5th Floor	16.92	0.93	14.75	26.50	29,000	0.0036	0.68%	
	W14x40 6th Floor	4.51	0.47	14.75	26.50	29,001	0.0005	0.09%	
	W14x90 Roof	0.00	0.00	15.00	26.50	29,000	0.0000	0.00%	
East Columns	W14x90 2nd Floor	-99.44	-2.31	14.75	26.50	29,000	0.0529	9.92%	
	W14x90 3rd Floor	-64.71	-1.85	14.75	26.50	29,000	0.0276	5.17%	
	W14x90 4th Floor	-37.12	-1.39	14.75	26.50	29,000	0.0119	2.23%	
	W14x90 5th Floor	-16.85	-0.93	14.75	26.50	29,000	0.0036	0.68%	
	W14x40 6th Floor	-4.43	-0.47	14.75	26.50	29,001	0.0005	0.09%	
	W14x90 Roof	0.00	0.00	15.00	26.50	29,000	0.0000	0.00%	
West Braces	HSS8x8x3/8 2nd Floor	60.81	0.68	21.04	10.40	29,000	0.0346	6.49%	
	HSS8x8x3/8 3rd Floor	51.13	0.68	21.04	10.40	29,000	0.0291	5.46%	
	HSS8x8x3/8 4th Floor	40.67	0.68	21.04	10.40	29,000	0.0232	4.34%	
	HSS8x8x3/8 5th Floor	29.84	0.68	21.04	10.40	29,000	0.0170	3.19%	
	HSS8x8x3/8 6th Floor	18.26	0.68	21.04	10.40	29,001	0.0104	1.95%	
	HSS8x8x3/8 Roof	6.61	0.68	21.21	10.40	29,000	0.0038	0.71%	
East Braces	HSS8x8x3/8 2nd Floor	-60.81	-0.68	21.04	10.40	29,000	0.0346	6.49%	
	HSS8x8x3/8 3rd Floor	-51.23	-0.68	21.04	10.40	29,000	0.0292	5.47%	
	HSS8x8x3/8 4th Floor	-40.75	-0.68	21.04	10.40	29,000	0.0232	4.35%	
	HSS8x8x3/8 5th Floor	-29.95	-0.68	21.04	10.40	29,000	0.0170	3.20%	
	HSS8x8x3/8 6th Floor	-18.37	-0.68	21.04	10.40	29,001	0.0105	1.96%	
	HSS8x8x3/8 Roof	-6.57	-0.68	21.21	10.40	29,000	0.0038	0.71%	
							Σ =	0.5331	100%

			Story Drift		Structure Drift		
			Actual	Allowable	Actual	Allowable	
Beams	19.48%						
West Columns	18.10%						
East Columns	18.09%	Roof	0.063	0.450	0.559	2.663	OK
West Braces	22.14%	6th Floor	0.078	0.443	0.496	2.220	OK
East Braces	22.18%	5th Floor	0.098	0.443	0.417	1.770	OK
		4th Floor	0.108	0.443	0.319	1.328	OK
		3rd Floor	0.108	0.443	0.211	0.885	OK
		2nd Floor	0.103	0.443	0.103	0.443	OK

MEMBER VERIFICATION

Bracing Members

STRENGTH CHECKS

LATERAL BRACE MEMBERS

HSS 8 x 8 x 3/8

$P_u = 188 \text{ k}$

$L_b = 21.93 \text{ ft}$

$F_y = 46 \text{ ksi}$

$A_g = 10.4 \text{ in}^2$

DESIGN CHECK (LRFD)

$$\frac{KL_x}{r} = \frac{(1.0)(21.93 \text{ ft})(12 \text{ in/ft})}{(3.1 \text{ in})} = 84.9 < 200 \quad \checkmark \text{ OK}$$

LIMIT STATE : $(4.71) \sqrt{\frac{E}{F_y}} = 4.71 \sqrt{\frac{29000 \text{ ksi}}{46 \text{ ksi}}} = 118.26$

$84.9 < 118.3 \quad \therefore \text{INELASTIC}$

$$F_c = \frac{\pi^2 E}{\left(\frac{KL}{r}\right)^2} = \frac{(\pi^2)(29000 \text{ ksi})}{(84.9)^2} = 39.7 \text{ ksi}$$

$$F_{cr} = \left[0.658 \left(\frac{F_y}{F_c} \right) \right] F_y = \left[0.658 \left(\frac{46 \text{ ksi}}{39.7 \text{ ksi}} \right) \right] (46 \text{ ksi})$$

$F_{cr} = 28.3 \text{ ksi}$

$$\phi P_n = 0.9 A_g F_{cr} = (0.9)(10.4 \text{ in}^2)(28.3 \text{ ksi})$$

$$\phi P_n = 265 \text{ k} > P_u = 188 \text{ k} \quad \checkmark \text{ OK}$$

COMPARE TO STEEL MANUAL : TABLE 4-4

$KL = 21.93 \text{ ft}$

$\phi P_n = 264 \text{ k} \quad \checkmark \text{ OK}$

STRESS RATIO :

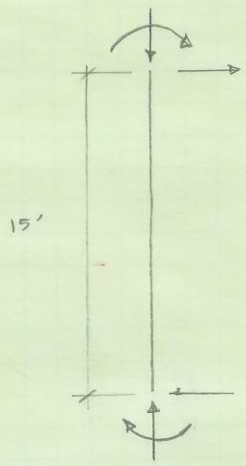
$$\frac{P_u}{\phi P_n} = \frac{188 \text{ k}}{265 \text{ k}} = 0.712 < 1.0 \quad \checkmark \text{ OK}$$

* FUTURE DESIGN TO BE CHECKED ONLY WITH STEEL MANUAL

- END BRACE CHECK -

Column Members

LATERAL COLUMN MEMBER



$P_u = 326^k$
 $V_u = 18.3^k$
 $M_x = 31.25 \text{ ft-k}$
 $M_y = 29.05 \text{ ft-k}$

W14X132

$P_u = 326^k$
 $V_u = 18.3^k$
 $M_x = 177.04 \text{ ft-k}$
 $M_y = -55.52 \text{ ft-k}$

$$\frac{K L_y}{r_y} = \frac{(1.0)(15 \text{ ft})(12 \text{ in/ft})}{3.76 \text{ in}} = 47.9 < 200 \quad \checkmark \text{ OK}$$

SHEAR CHECK :

$$\phi V_n = \phi_v 0.6 F_y d t_w$$

$$\phi V_n = (1.0)(0.6)(50 \text{ ksi})(14.7 \text{ in})(0.645 \text{ in}) = 284^k$$

$$\phi V_n = 284^k > V_u = 18.3^k \quad \checkmark \text{ OK}$$

COMBINED LOADING CHECK

$$B_1 = \frac{C_m}{1 - \alpha P_r / P_{e1}} \geq 1.0$$

$$C_{m_x} = 0.5 - 0.4 \left(\frac{31.25}{+177.04} \right) = 0.53$$

$$C_{m_y} = 0.5 - 0.4 \left(\frac{29.05}{-55.52} \right) = 0.81$$

$$P_{e1} = \frac{\pi^2 E I}{(K L)^2}$$

$$P_{e1_x} = \frac{(\pi^2)(29000 \text{ ksi})(1530 \text{ in}^4)}{[(15 \text{ ft})(12 \text{ in/ft})]^2} = 13,516^k$$

$$P_{e1_y} = \frac{(\pi^2)(29000 \text{ ksi})(548 \text{ in}^4)}{[(180 \text{ in})]^2} = 4841^k$$

$$B_{1_x} = 1.0 \text{ (BY INSPECTION)}$$

$$B_{1_y} = 1.0 \text{ (BY INSPECTION)}$$

$$B_2 = \frac{1}{1 - \frac{\alpha \sum Pnt}{\sum Pe_2}} \geq 1.0$$

$$\sum Pe_2 = R_m \frac{\sum HL}{\Delta H} \quad ; \quad R_m = 1.0$$

$$\Delta H_x = 0.701 \text{ in}$$

$$\Delta H_y = 1.80 \text{ in}$$

$$\sum Pe_{2x} = (1.0) \frac{(49.42 \text{ k})(180 \text{ in})}{(0.701 \text{ in})} = 12690 \text{ k}$$

$$\sum Pe_{2y} = (1.0) \frac{(89.2 \text{ k})(180 \text{ in})}{(1.8 \text{ in})} = 8920 \text{ k}$$

$$B_{2x} = \frac{1}{1 - (246)/(12690)} = 1.02$$

$$B_{2y} = \frac{1}{1 - (425)/(8920)} = 1.05$$

$$P_r = (1.05)(326 \text{ k}) = 342 \text{ k}$$

$$M_{rx} = (1.05)(177 \text{ ft-k}) = 186 \text{ ft-k}$$

$$M_{ry} = (1.05)(55.52 \text{ ft-k}) = 58.3 \text{ ft-k}$$

$$p = 0.678 \times 10^{-3} \quad b_x = 1.03 \times 10^{-3} \quad b_y = 2.10 \times 10^{-3}$$

$$p P_r = (0.678 \times 10^{-3})(342 \text{ k}) = 0.232 > 0.2 \quad \text{HI-1a}$$

$$0.232 + (1.03 \times 10^{-3})(186) + (2.10 \times 10^{-3})(58.3) = 0.563$$

$$0.563 < 1.0 \quad \checkmark \text{ OK}$$

Cost Comparison

Member	Existing Structure		Modified "X"-Brace		Modified Chevron Brace		Addition with "X"-Brace		Addition with Chevron Brace	
	(lbs)	(Tons)	(lbs)	(Tons)	(lbs)	(Tons)	(lbs)	(Tons)	(lbs)	(Tons)
Gravity Beam	1,059,405	530	1,066,853	533	1,065,512	533	1,279,055	640	1,279,055	640
Gravity Column	178,793	89	182,969	91	182,969	91	236,468	118	236,468	118
Shear Studs	12,546	6	12,612	6	12,612	6	15,352	8	15,352	8
Steel Joist	20,634	10	20,634	10	20,634	10	20,634	10	20,634	10
Lateral Steel	169,451	85	105,036	53	100,538	50	130,634	65	122,205	61
Lateral Tubes	35,295	18	43,437	22	40,659	20	53,328	27	50,205	25
	Σ =	738	Σ =	716	Σ =	711	Σ =	868	Σ =	862
			% Diff. =	-3.0%	% Diff. =	-3.6%	% Diff. =	17.6%	% Diff. =	16.8%
SQ. FT. =	152,160		SQ. FT. =	152,160	SQ. FT. =	152,160	SQ. FT. =	182,592	SQ. FT. =	182,592
							% Diff. =	20.0%	% Diff. =	20.0%

Steel Cost per Ton		HVAC	Electrical	Interiors	Glass	Metal Panels	Misc. Metals	Total	GMP	Lease
Material	\$880	\$3,139,000	\$1,935,000	\$937,000	\$1,890,000	\$1,339,000	\$507,000	\$9,747,000	\$19,126,000	-
Fabrication	-	\$20,634	\$12,720	\$6,160	\$12,420	\$8,800	\$3,330	\$64,060	\$125,700	\$15
Installation	-									
Total	\$880									

-End of Section-

Building System	Steel Cost	Cost Difference	Additional Costs				Total Cost	Lease per Year	Simple Payback Time
			HVAC	Electrical	Interiors	Glass			
Existing Structure	\$2,380,927	\$0	\$0	\$0	\$0	\$0	\$19,126,000	\$2,282,400	8.38
Modified "X"-Brace	\$2,309,674	-\$71,254	\$0	\$0	\$0	\$0	\$19,054,746	\$2,282,400	8.35
Modified Chevron Brace	\$2,295,117	-\$85,811	\$0	\$0	\$0	\$0	\$19,040,189	\$2,282,400	8.34
Addition with "X"-Brace	\$2,802,333	\$421,406	\$627,800	\$387,000	\$187,400	\$378,000	\$21,496,806	\$2,738,880	7.85
Addition with Chevron Brace	\$2,782,930	\$402,002	\$627,800	\$387,000	\$187,400	\$378,000	\$21,477,402	\$2,738,880	7.84

Building System	Total Cost (Including MEP Alterations)	Cost Difference	Payback (Years)	Recommend
Modified "X"-Brace	\$19,054,746	-\$71,254	8.35	Yes
Modified Chevron Brace	\$19,040,189	-\$85,811	8.34	Yes
Addition with "X"-Brace	\$21,496,806	\$2,370,806	7.85	Yes
Addition with Chevron Brace	\$21,477,402	\$2,351,402	7.84	Yes

APPENDIX D: FOUNDATIONS

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