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Structural
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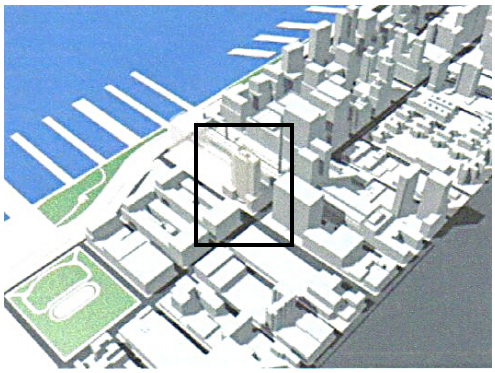
The Helena
New York City, NY
October 6, 2004



Pictures courtesy of Fox & Fowle Architects

Structural Concepts / Structural Existing Conditions Report

Executive Summary

This document is an analysis of the structural framing systems used to design The Helena apartment building. Included in this report is: an overall building description, a breakdown of the building's structural components, the codes and standards used to design the building, the calculations for the gravity force resisting system (self-weight of the structure, superimposed dead and live loads) and the lateral force resisting system (wind and seismic loads).

After an examination of the structural systems of the building, it has been determined that the building is composed of two main structural support components, a gravity force resisting system and a lateral force resisting system. Although the building's gravity system is mainly composed of two-way flat plate slabs, there are some areas which are supported with concrete beams and one-way slabs. The flat plate slabs are as thick as 18" for the parking garage area and become thinner at the residential floors, typically 8".

There are many sizes of columns, both rectangular and cylindrical, which contribute to the gravity force resisting system. A typical column below grade would be a 36"x20", 25"Φ cylindrical column on the ground floor, and 16"x16" on the upper half of the building in the residential areas. The lateral framing system for the building is composed of 7 shear walls, 6 of which run the entire height of the building. For the design cases of seismic versus wind analysis, seismic forces controlled for both the North-South direction as well as East-West direction.

Spot checks still need to be completed to for a floor framing component, a column, and a lateral framing component to determine whether they have the capacity necessary to resist the forces being applied to them.

Building Components

OVERALL DESIGN

The Helena is an apartment building on Manhattan's West Side, near the Hudson River. Soaring 40 stories into the skyline, the 600,000 ft^2 Helena is the epitome of modern concrete design. The most striking aspect of the design of The Helena is the green design that may give this building a gold Leadership in Energy and Environmental Design (LEED) rating. A 10,000 ft^2 green roof highlights the environmental designs of The Helena, as shown in Figure 1. As far as the internal system capabilities of the building are concerned, the building is designed with several components which aide in recycling natural resources for use in the building. A black water treatment system will take the water that is collected from the green roof and recycle it throughout the building which will decrease water usage by about 50 percent from normal levels. Another system designed to increase the building's energy efficiency is the use of solar collection panels which will convert solar heat into electricity. This electricity will be passed into the electrical manufacturing plant within the building to lower the energy costs of the building. To further increase efficiency in electricity use, high-performance glass prevents heat loss while enhancing air heating and cooling.

Figure 1. A 10,000 ft^2 green roof highlights the environmental designs of The Helena.

ARCHITECTURE

Much, if not all, of the architectural design of this building was focused toward the efficient and environmental-friendly capabilities of the building as well as the self-sustaining internal building systems. The building is a modern design of floor-to-ceiling windows to maximize the amount of daylight entering the building, wrap around windows to enhance the view from the rooms as well as create a more open feel to the rooms, and sleek metal panels which give a building a light, smooth look.

The building can be entered from West 57th Street on the South side of the building. Through the main entrance, there is a retail store on the first floor and elevators which account for the vertical movement throughout the building. There is a two-story parking area below grade. Above the ground floor, the remaining floors, which range in size from approximately

12,500 ft^2 to 20,000 ft^2, are for residential use with the roof enclosure being used for storage of mechanical equipment.

STRUCTURAL COMPONENTS

Foundation System

The foundation for the building is composed of monolithic and spread footings set upon undisturbed rock. The rock is to have a bearing capacity of 40 tons per sq. ft. The footings are to be anchored to the rock with 100-ton rock anchors where specified on the drawings. Along the north wall of the sub-cellar, underpinning is required for the neighboring existing building. Shear walls are 16 inches thick and the floor is an 18 inch thick flat plate which is thickened at monolithic footings.

Columns

Reinforced concrete columns of rectangular and cylindrical shape compose the gravity load resistance for the building. Both types of columns come in varying sizes depending on the load which is to be carried. Arrangement of the columns does not allow for a generalization of a typical bay for design purposes, which can be seen in Figure 2. This can be seen in the diagram below, which is a layout of the floor plan for floors 11-38, the most common floor plan in the building.

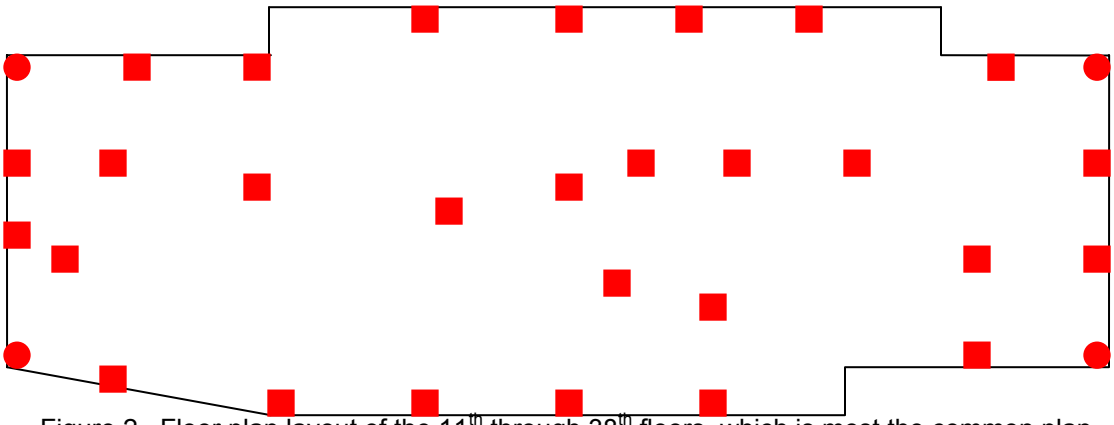


Figure 2. Floor plan layout of the 11th through 38th floors, which is most the common plan

Floor System

The framing for the floor system consists of flat plate slabs, typically 8 inches in depth. The overall layout of the floor plan is close to a rectangle; however, the spacing of columns is not consistent throughout the building. There is not a definitive standard bay because of the arrangement of the reinforcement in the two-way slab.

Lateral Bracing

Lateral support for the building is created by 7 shear walls, which are 16 inches thick, from the ground floor to the 7th floor; 6 shear walls, which are 16 inches thick, from the 8th floor to the 24th floor; 6 shear walls, which are 14 inches thick, from the 25th floor to the 34th floor; 6 shear walls, which are 12 inches thick above the 34th floor. Placement of these walls is shown in Figure 3 below.

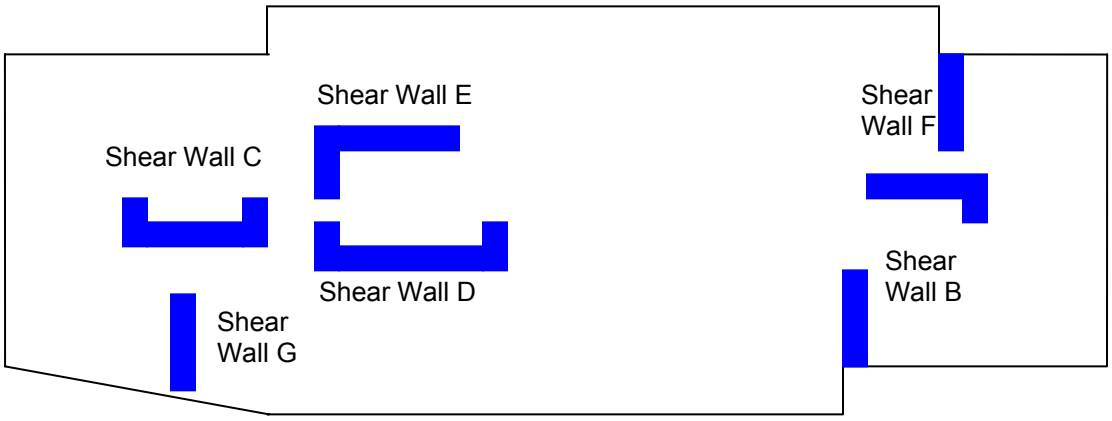


Figure 3. Shear Wall A is located on floors 1-7, which is not shown on this diagram

Alternative Support Systems

In addition to the main structural support system of the building, there is structural steel used to help carry the load of mechanical equipment on the roof.

-- The water tank is supported by 11-W14x43 beams spaced at 2'-0" o.c.
-- The cooling tower has the extra bracing of 5-W12x40 beams arranged in a square with 2 beams in the E-W direction and 3 beams in the N-S direction.
-- The entrance canopy is designed to be supported with a variety of TS shapes and built-up tube.

Codes and Standards

CODES

The New York City Building Code

STANDARDS

ACI 318 – Building Code Requirements for Reinforced Concrete
ACI 315 – Manual of Standard Practice for Detailing Reinforced Concrete Structures
All structural steel to conform to AISC standards
Bar reinforcing and wire fabrics to conform to ASTM standards

Material Strengths

CONCRETE

Flat plate slabs	5000-5950 psi
One-way slabs	5000-5950 psi
Beams	5000-5950 psi
Columns	5000-8000 psi
Shear Walls	8000 psi

REINFORCEMENT

Bar Reinforcing	ASTM A615, Gr 60	60 ksi
Column Ties	ASTM A615, Gr 40	40 ksi
Welded Wire Fabric	ASTM A82 & A185	70 ksi

STRUCTURAL STEEL

Channels and TS Sections	ASTM A572, Gr 50	50 ksi
Tubing	ASTM A500, Gr B	46 ksi
Piping	ASTM A500	42 ksi
Plates and Angles	ASTM A36	36 ksi

Calculations

LIVE LOADS – New York City Building Code

Residential Areas	40 psf
Offices	50 psf
Lobbies	100 psf
Corridors	100 psf
Mechanical Equipment Rooms	75 psf
Stairs	100 psf
Assembly Spaces	100 psf
Parking Areas	50 psf

Retail	100 psf

DEAD LOADS

Ground Floor

12” Flat Plate Slab	150 psf
Partitions	20 psf
MEP/Light	5 psf
Sprinklers	5 psf
Finishes	15 psf
	195 psf

Parking Floors

12” Flat Plate Slab	150 psf
MEP/Light	5 psf
Sprinklers	5 psf
	160 psf

Residential Floors

8” Flat Plate Slab	100 psf
MEP/Light	5 psf
Sprinklers	5 psf
Finishes	15 psf
Partitions	20 psf
	140 psf

Roof

12” Flat Plate Slab	150 psf
MEP/Light	5 psf
Sprinklers	5 psf
Finishes	15 psf
	175 psf

SNOW LOADS

$P_f = 0.7C_eC_tIP_g$

$C_e = 0.9$ Table 7-2

C_t = 1.0	Table 7-3
I = 1.0	Table 7-4
P_g = 25 psf	Section 7.3

P_f = 15.75 psf

SNOW DRIFT

w_b = 70 ft	Building Geometry
h_r = 97.5 ft	Building Geometry
h_d = 3.0 ft	Figure 7-9
D = 17.25 pcf	Density of Snow
h_b = 0.913	Snow load to Snow Density Ratio
w = 12.0	Drift width

P_m = 67.5 psf

LATERAL LOADS

Wind Loads – ASCE 7-98 referenced in NYC Building Code and used for this design

Exposure Category – B
Wind Speed – 120 mph
Importance Factor – 1.0
K_{zt} = 1.0
K_d = 0.85

$q_z = 0.00256*K_z*K_{zt}*K_d*V^2*I$
$= 31.33*K_z$
$q_h = 31.33*1.47$
= 46.06 psf
C_p = 0.8 Windward wall
= -0.26 (N-S) Leeward wall
= -0.5 (E-W) Leeward wall

Wind Pressures for the North-South Direction Shown in Figure 4
Wind Pressures for the East-West Direction Shown in Figure 5

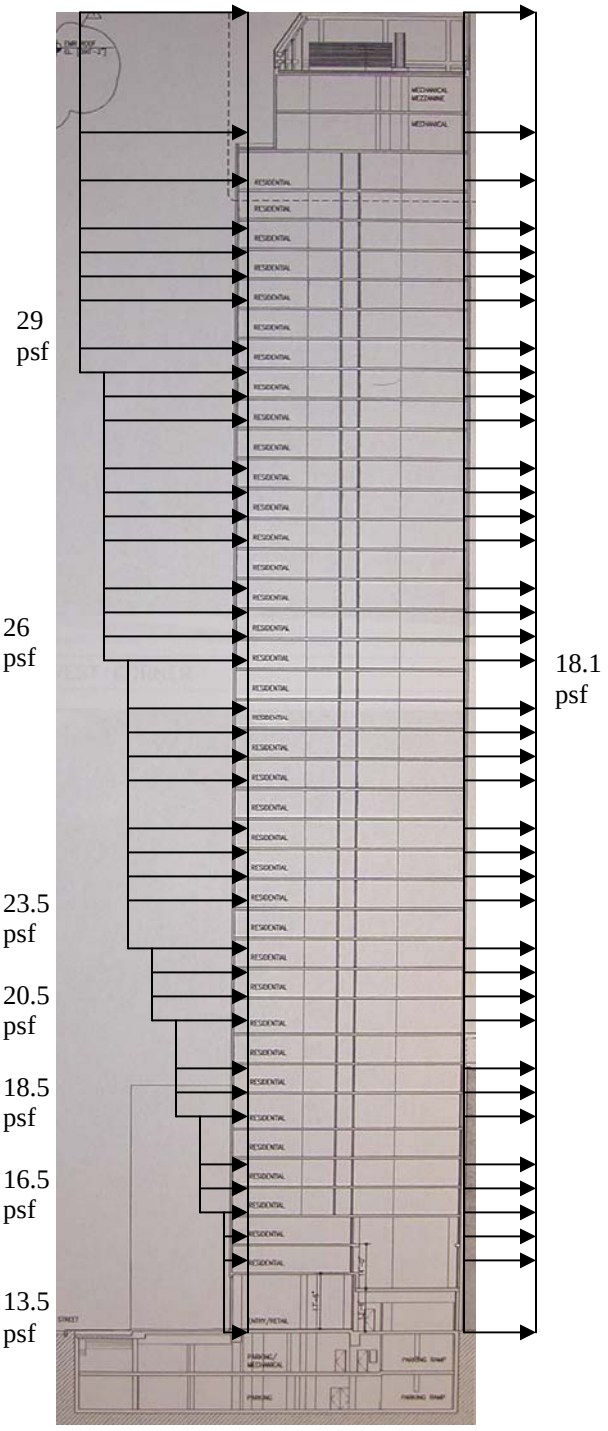


Figure 4a. The Windward/Leeward Pressure Diagram for the N-S Direction

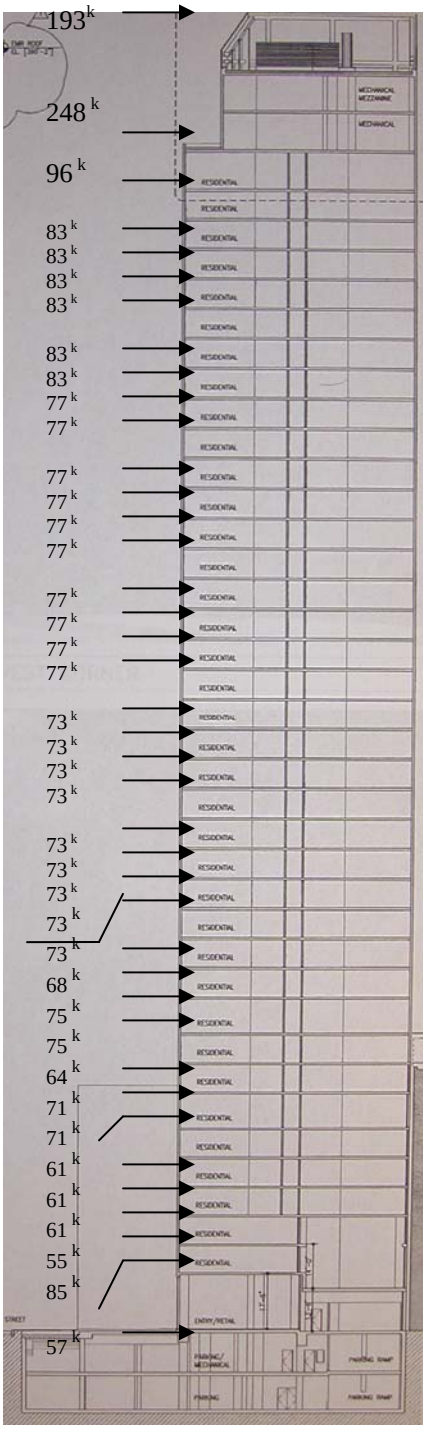


Figure 4b. The Story Shear Forces for the N-S Direction

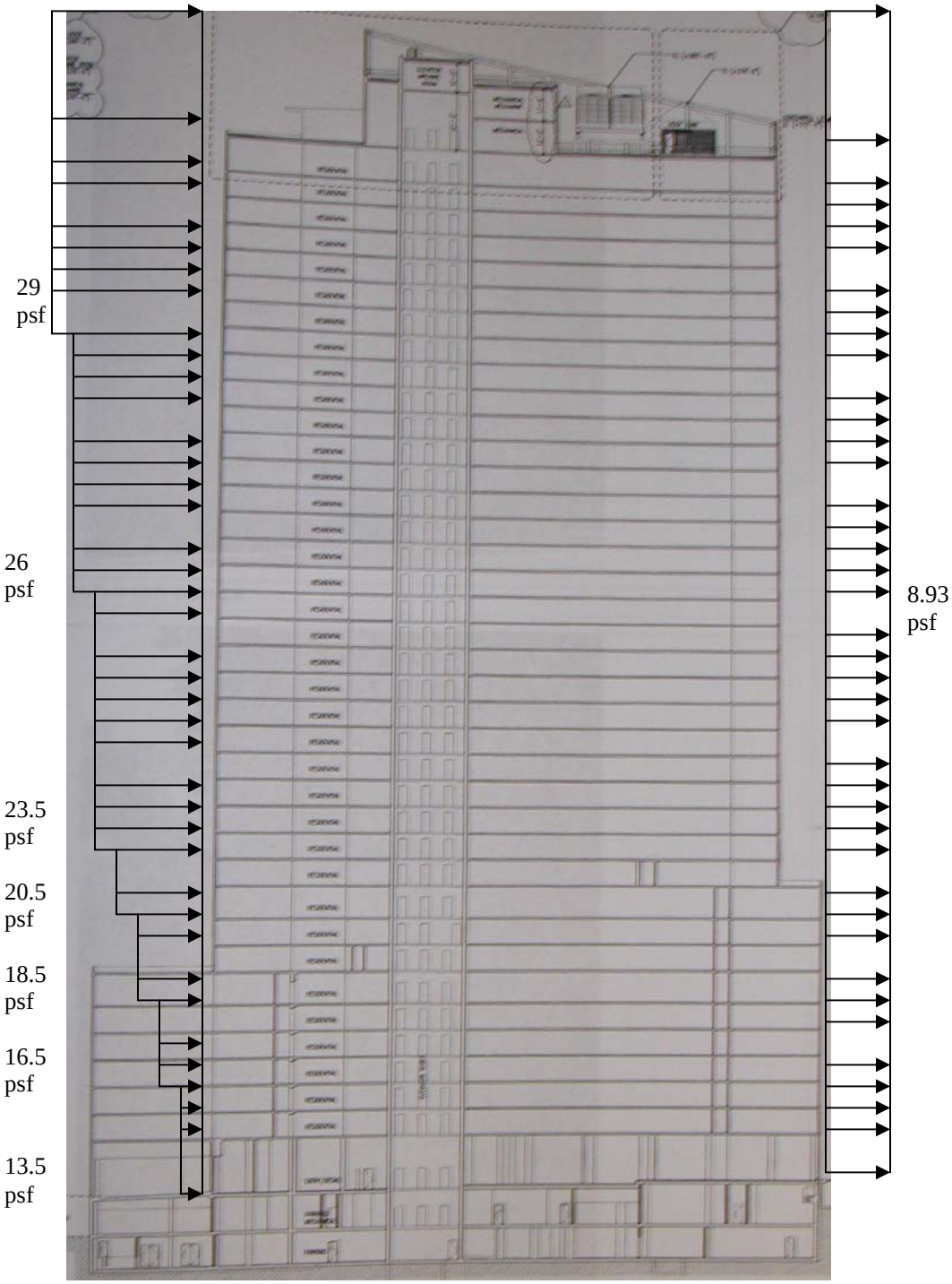


Figure 5a. The Windward/Leeward Pressure Diagram for the E-W Direction

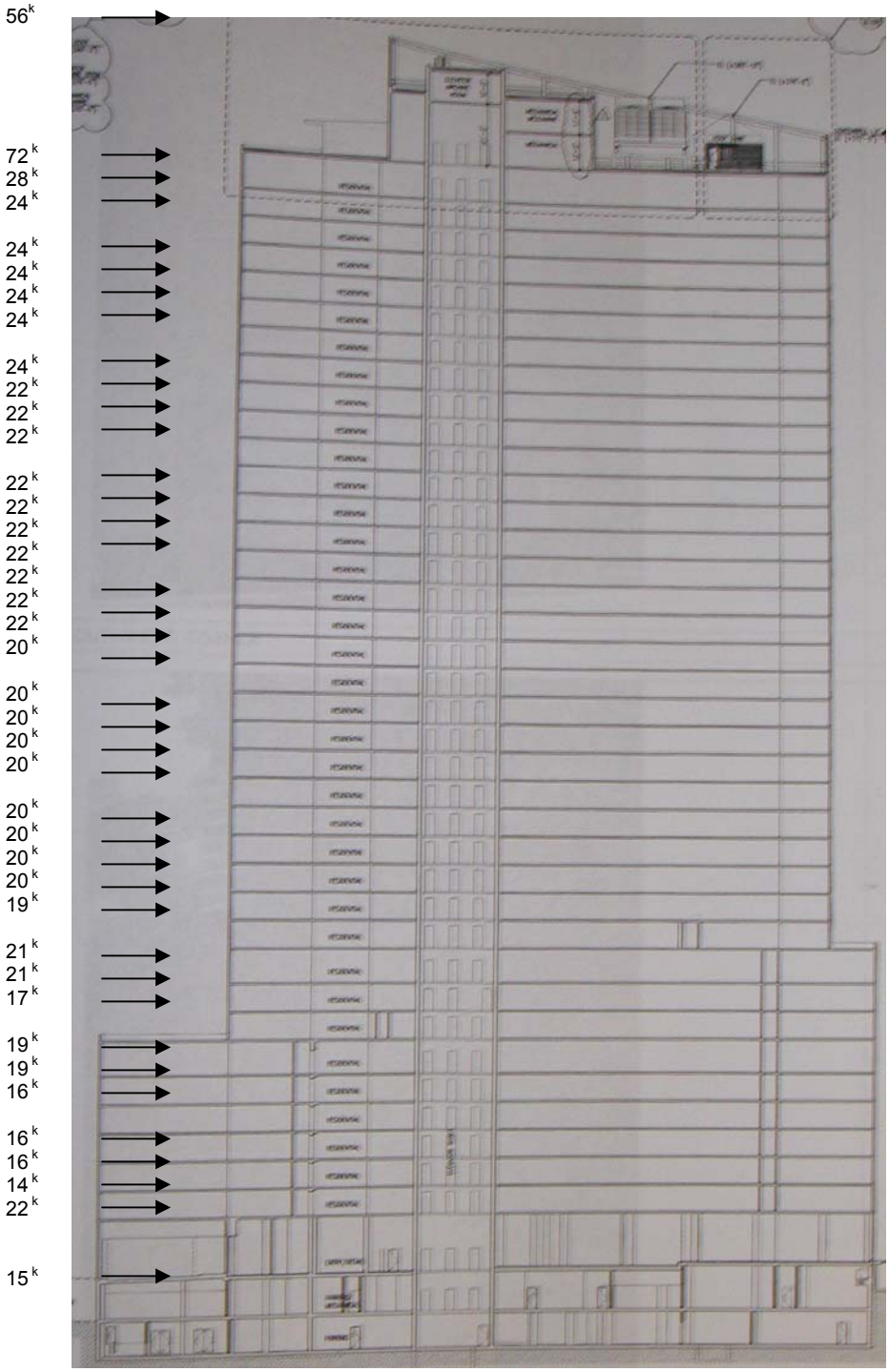


Figure 5b. The Story Shear Forces for the E-W Direction

Calculations can be found in the Appendix

Seismic Loads

Seismic Use Group I

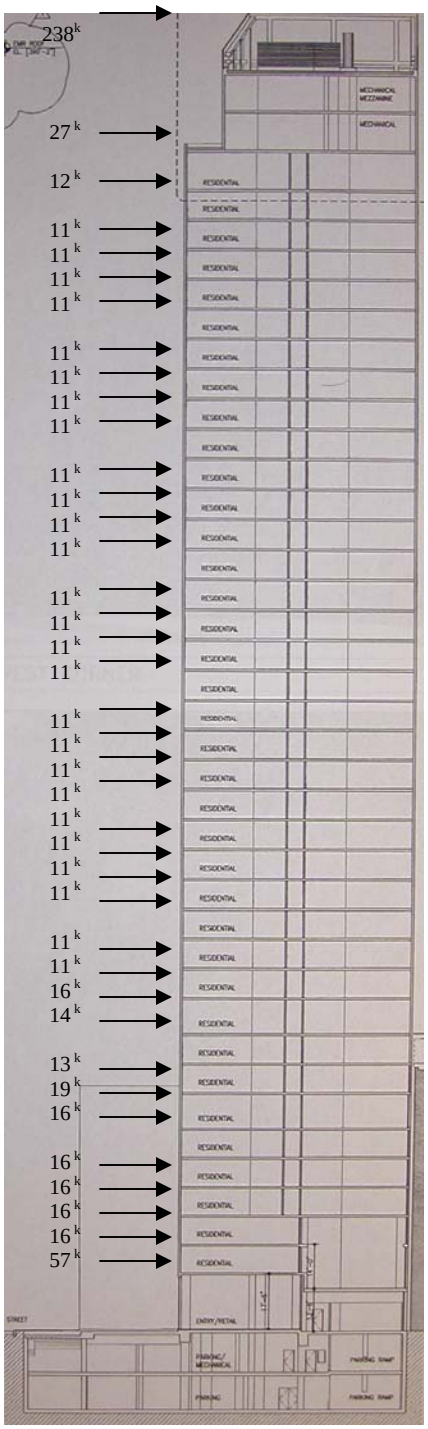
Ss = 0.43	Figure 9.4.1.1a
S1 = 0.095	Figure 9.4.1.1b
Fa = 1.4	Table 9.4.1.2.4a
Fv = 1.5	Table 9.4.1.2.4b

Sms = FaSs = 0.602

Sm1 = FvS1 = 0.143

SDS = (2/3)*Sms = 0.401

SD1 = (2/3)*Sm1 = 0.095



Calculations can be found in the Appendix

SPOT CHECK FOR FRAMING MEMBERS

Gravity / Floor Framing Member

Not Yet Completed

Lateral Framing Member

Not Yet Completed

ADDITIONAL CONSIDERATIONS

Not Yet Completed

All calculations can be made available upon request

Pictures courtesy of Fox & Fowle Architects

APPENDIX

Windward Design Pressure Calculations

Height ft	Code Kz value	Kz for actual height	N-S psf	E-W psf	Design Pressure psf
15	0.57				
18.5		0.605	11.88457	10.97474	13.5
20	0.62				
25	0.66				
27.5		0.68	13.35786	12.33525	13.5
30	0.7				
36.5		0.739	14.51685	13.40551	16.5
40	0.76				
45.5		0.7875	15.46958	14.28531	16.5
50	0.81				
54.5		0.828	16.26516	15.01998	16.5
60	0.85				
63.5		0.864	16.97234	15.67302	18.5
70	0.89				
74.5		0.908	17.83667	16.47118	18.5
80	0.93				
83.5		0.9405	18.4751	17.06074	18.5
90	0.96				
92.5		0.9675	19.00548	17.55052	20.5
100	0.99				
103.5		0.99875	19.61936	18.11739	20.5
112.5		1.02125	20.06134	18.52555	20.5
120	1.04				
121.5		1.04375	20.50333	18.9337	23.5
130.5		1.06625	20.94532	19.34185	23.5
139.5		1.08875	21.38731	19.75	23.5
140	1.09				
148.5		1.107	21.74581	20.08106	23.5
157.5		1.125	22.0994	20.40758	23.5
160	1.13				
166.5		1.143	22.45299	20.7341	23.5
175.5		1.161	22.80658	21.06062	23.5
180	1.17				
184.5		1.17675	23.11597	21.34633	23.5
193.5		1.19025	23.38116	21.59122	23.5
200	1.2				
202.5		1.204	23.65127	21.84064	26
211.5		1.2184	23.93414	22.10186	26
220.5		1.2328	24.21701	22.36308	26
229.5		1.2472	24.49988	22.6243	26
238.5		1.2616	24.78276	22.88551	26
247.5		1.276	25.06563	23.14673	26
250	1.28				
256.5		1.2891	25.32296	23.38436	26

265.5		1.3017	25.57048	23.61293	26
274.5		1.3143	25.81799	23.84149	26
283.5		1.3269	26.0655	24.07006	28
292.5		1.3395	26.31302	24.29862	29
300	1.35				
301.5		1.3518	26.55464	24.52175	29
310.5		1.3626	26.76679	24.71766	29
319.5		1.3734	26.97895	24.91357	29
328.5		1.3842	27.1911	25.10948	29
337.5		1.395	27.40325	25.3054	29
346.5		1.4058	27.61541	25.50131	29
350	1.41				
358.5		1.4202	27.89828	25.76253	29
400	1.47				
400.5		1.47	28.87655	26.6659	29

Wind Loads for N-S Direction

Story	Story Ht (ft)	Height Above Ground (ft)	Windward Pressure (psf)	Leeward Pressure (psf)	Total Pressure (psf)	Tributary Height (ft)	Tributary Width (ft)	Story Force (k)	Shear (k)
Roof	42	400.5	29	18.1	47.1	21	195	192.87	192.87
Mech Rms	12	358.5	29	18.1	47.1	27	195	247.98	440.86
38	9	346.5	29	18.1	47.1	10.5	195	96.437	537.29
37	9	337.5	29	18.1	47.1	9	195	82.661	619.95
36	9	328.5	29	18.1	47.1	9	195	82.661	702.61
35	9	319.5	29	18.1	47.1	9	195	82.661	785.27
34	9	310.5	29	18.1	47.1	9	195	82.661	867.94
33	9	301.5	29	18.1	47.1	9	195	82.661	950.6
32	9	292.5	29	18.1	47.1	9	195	82.661	1033.3
31	9	283.5	26	18.1	44.1	9	195	77.396	1110.7
30	9	274.5	26	18.1	44.1	9	195	77.396	1188
29	9	265.5	26	18.1	44.1	9	195	77.396	1265.4
28	9	256.5	26	18.1	44.1	9	195	77.396	1342.8
27	9	247.5	26	18.1	44.1	9	195	77.396	1420.2
26	9	238.5	26	18.1	44.1	9	195	77.396	1497.6
25	9	229.5	26	18.1	44.1	9	195	77.396	1575
24	9	220.5	26	18.1	44.1	9	195	77.396	1652.4
23	9	211.5	26	18.1	44.1	9	195	77.396	1729.8
22	9	202.5	26	18.1	44.1	9	195	77.396	1807.2
21	9	193.5	23.5	18.1	41.6	9	195	73.008	1880.2
20	9	184.5	23.5	18.1	41.6	9	195	73.008	1953.2
19	9	175.5	23.5	18.1	41.6	9	195	73.008	2026.2
18	9	166.5	23.5	18.1	41.6	9	195	73.008	2099.2
17	9	157.5	23.5	18.1	41.6	9	195	73.008	2172.3
16	9	148.5	23.5	18.1	41.6	9	195	73.008	2245.3
15	9	139.5	23.5	18.1	41.6	9	195	73.008	2318.3
14	9	130.5	23.5	18.1	41.6	9	195	73.008	2391.3
13	9	121.5	23.5	18.1	41.6	9	195	73.008	2464.3
12	9	112.5	20.5	18.1	38.6	9	195	67.743	2532
11	11	103.5	20.5	18.1	38.6	10	195	75.27	2607.3
10	9	92.5	20.5	18.1	38.6	10	195	75.27	2682.6
9	9	83.5	18.5	18.1	36.6	9	195	64.233	2746.8
8	11	74.5	18.5	18.1	36.6	10	195	71.37	2818.2
7	9	63.5	18.5	18.1	36.6	10	195	71.37	2889.5
6	9	54.5	16.5	18.1	34.6	9	195	60.723	2950.3
5	9	45.5	16.5	18.1	34.6	9	195	60.723	3011
4	9	36.5	16.5	18.1	34.6	9	195	60.723	3071.7
3	9	27.5	13.5	18.1	31.6	9	195	55.458	3127.2
2	18.5	18.5	13.5	18.1	31.6	13.75	195	84.728	3211.9
Ground	0	0	13.5	18.1	31.6	9.25	195	56.999	3268.9

Wind Loads for E-W Direction

Story	Story Ht	Height Above Ground	Windward Pressure	Leeward Pressure	Total Pressure	Tributary Height	Tributary Width	Story Force	Shear
	(ft)	(ft)	(psf)	(psf)	(psf)	(ft)	(ft)	(k)	(k)
Roof	42	400.5	29	8.93	37.93	21	70	55.757	55.757
Mech Rms	12	358.5	29	8.93	37.93	27	70	71.688	127.44
38	9	346.5	29	8.93	37.93	10.5	70	27.879	155.32
37	9	337.5	29	8.93	37.93	9	70	23.896	179.22
36	9	328.5	29	8.93	37.93	9	70	23.896	203.12
35	9	319.5	29	8.93	37.93	9	70	23.896	227.01
34	9	310.5	29	8.93	37.93	9	70	23.896	250.91
33	9	301.5	29	8.93	37.93	9	70	23.896	274.8
32	9	292.5	29	8.93	37.93	9	70	23.896	298.7
31	9	283.5	26	8.93	34.93	9	70	22.006	320.7
30	9	274.5	26	8.93	34.93	9	70	22.006	342.71
29	9	265.5	26	8.93	34.93	9	70	22.006	364.72
28	9	256.5	26	8.93	34.93	9	70	22.006	386.72
27	9	247.5	26	8.93	34.93	9	70	22.006	408.73
26	9	238.5	26	8.93	34.93	9	70	22.006	430.73
25	9	229.5	26	8.93	34.93	9	70	22.006	452.74
24	9	220.5	26	8.93	34.93	9	70	22.006	474.75
23	9	211.5	26	8.93	34.93	9	70	22.006	496.75
22	9	202.5	26	8.93	34.93	9	70	22.006	518.76
21	9	193.5	23.5	8.93	32.43	9	70	20.431	539.19
20	9	184.5	23.5	8.93	32.43	9	70	20.431	559.62
19	9	175.5	23.5	8.93	32.43	9	70	20.431	580.05
18	9	166.5	23.5	8.93	32.43	9	70	20.431	600.48
17	9	157.5	23.5	8.93	32.43	9	70	20.431	620.91
16	9	148.5	23.5	8.93	32.43	9	70	20.431	641.34
15	9	139.5	23.5	8.93	32.43	9	70	20.431	661.77
14	9	130.5	23.5	8.93	32.43	9	70	20.431	682.2
13	9	121.5	23.5	8.93	32.43	9	70	20.431	702.64
12	9	112.5	20.5	8.93	29.43	9	70	18.541	721.18
11	11	103.5	20.5	8.93	29.43	10	70	20.601	741.78
10	9	92.5	20.5	8.93	29.43	10	70	20.601	762.38
9	9	83.5	18.5	8.93	27.43	9	70	17.281	779.66
8	11	74.5	18.5	8.93	27.43	10	70	19.201	798.86
7	9	63.5	18.5	8.93	27.43	10	70	19.201	818.06
6	9	54.5	16.5	8.93	25.43	9	70	16.021	834.08
5	9	45.5	16.5	8.93	25.43	9	70	16.021	850.1
4	9	36.5	16.5	8.93	25.43	9	70	16.021	866.12
3	9	27.5	13.5	8.93	22.43	9	70	14.131	880.26
2	18.5	18.5	13.5	8.93	22.43	13.75	70	21.589	901.84
Ground	0	0	13.5	8.93	22.43	9.25	70	14.523	916.37

Base Shear Calculation

Story	Story Ht	Height Above Ground	Tributary Height	Floor Area	Floor Load	Column Area	Perimeter	Total Story Weight
	(ft)	(ft)	(ft)	(ft^2)	(psf)	(ft^2)	(ft)	(k)
Roof	42	400.5	21	12500	175	20	530	4138.75
Mech Rms	12	358.5	27	12500	140	22	530	3756.48
38	9	346.5	10.5	12500	140	58	530	2537.22
37	9	337.5	9	12500	140	53	530	2425.22
36	9	328.5	9	12500	140	53	530	2425.22
35	9	319.5	9	12500	140	53	530	2425.22
34	9	310.5	9	12500	140	53	530	2425.22
33	9	301.5	9	12500	140	54	530	2425.36
32	9	292.5	9	12500	140	56	530	2425.64
31	9	283.5	9	12500	140	54	530	2425.36
30	9	274.5	9	12500	140	62	530	2426.48
29	9	265.5	9	12500	140	66	530	2427.04
28	9	256.5	9	12500	140	70	530	2427.6
27	9	247.5	9	12500	140	69	530	2427.46
26	9	238.5	9	12500	140	82	530	2429.28
25	9	229.5	9	12500	140	83	530	2429.42
24	9	220.5	9	12500	140	90	530	2430.4
23	9	211.5	9	12500	140	93	530	2430.82
22	9	202.5	9	12500	140	93	530	2430.82
21	9	193.5	9	12500	140	108	530	2432.92
20	9	184.5	9	12500	140	106	530	2432.64
19	9	175.5	9	12500	140	106	530	2432.64
18	9	166.5	9	12500	140	106	530	2432.64
17	9	157.5	9	12500	140	106	530	2432.64
16	9	148.5	9	12500	140	106	530	2432.64
15	9	139.5	9	12500	140	106	530	2432.64
14	9	130.5	9	12500	140	109	530	2433.06
13	9	121.5	9	12500	140	112	530	2433.48
12	9	112.5	9	12500	140	115	530	2433.9
11	11	103.5	10	12500	140	118	530	2508.52
10	9	92.5	10	16000	140	146	530	3002.44
9	9	83.5	9	16000	140	147	530	2928.38
8	11	74.5	10	16000	140	130	530	3000.2
7	9	63.5	10	20000	140	164	530	3564.96
6	9	54.5	9	20000	140	170	530	3491.6
5	9	45.5	9	20000	140	197	530	3495.38
4	9	36.5	9	20000	140	201	530	3495.94
3	9	27.5	9	20000	140	206	530	3496.64
2	18.5	18.5	13.75	20000	140	211	530	3849.79
Ground	0	0	9.25	20000	195	274	530	4909.4175
Sum				563000				111341.48
Cs = 0.0729		Base Shear =	8116.794	k				

Seismic Forces

Story	Story Ht (hx)	Total Story Weight (wx)	wx*hx^1.645	Cvx (N-S)	Fx (N-S) (k)	wx*hx^2.44	Cvx (N-S)	Fx (N-S) (k)
Roof	42	4138.75	1936931.6	0.311191	237.9058	37809198	0.580887	235.143
Mech Rms	12	3756.48	223889.76	0.035971	27.49951	1614296.6	0.024801	10.03963
38	9	2537.22	94207.842	0.015136	11.57118	540393.17	0.008767	3.549082
37	9	2425.22	90049.244	0.014467	11.0604	516538.7	0.00838	3.392415
36	9	2425.22	90049.244	0.014399	11.00817	516538.7	0.00838	3.392415
35	9	2425.22	90049.244	0.014399	11.00817	516538.7	0.00838	3.392415
34	9	2425.22	90049.244	0.014399	11.00817	516538.7	0.00838	3.392415
33	9	2425.36	90054.442	0.0144	11.0088	516568.52	0.008381	3.392611
32	9	2425.64	90064.838	0.014402	11.01007	516628.15	0.008382	3.393003
31	9	2425.36	90054.442	0.0144	11.0088	516568.52	0.008381	3.392611
30	9	2426.48	90096.028	0.014407	11.01389	516807.06	0.008385	3.394178
29	9	2427.04	90116.821	0.01441	11.01643	516926.33	0.008387	3.394961
28	9	2427.6	90137.614	0.014413	11.01897	517045.61	0.008389	3.395745
27	9	2427.46	90132.416	0.014412	11.01834	517015.79	0.008388	3.395549
26	9	2429.28	90199.993	0.014423	11.0266	517403.42	0.008395	3.398095
25	9	2429.42	90205.191	0.014424	11.02723	517433.24	0.008395	3.39829
24	9	2430.4	90241.579	0.01443	11.03168	517641.97	0.008398	3.399661
23	9	2430.82	90257.173	0.014432	11.03359	517731.42	0.0084	3.400249
22	9	2430.82	90257.173	0.014432	11.03359	517731.42	0.0084	3.400249
21	9	2432.92	90335.147	0.014445	11.04312	518178.69	0.008407	3.403186
20	9	2432.64	90324.751	0.014443	11.04185	518119.06	0.008406	3.402795
19	9	2432.64	90324.751	0.014443	11.04185	518119.06	0.008406	3.402795
18	9	2432.64	90324.751	0.014443	11.04185	518119.06	0.008406	3.402795
17	9	2432.64	90324.751	0.014443	11.04185	518119.06	0.008406	3.402795
16	9	2432.64	90324.751	0.014443	11.04185	518119.06	0.008406	3.402795
15	9	2432.64	90324.751	0.014443	11.04185	518119.06	0.008406	3.402795
14	9	2433.06	90340.345	0.014446	11.04375	518208.51	0.008408	3.403382
13	9	2433.48	90355.94	0.014448	11.04566	518297.97	0.008409	3.40397
12	9	2433.9	90371.535	0.014451	11.04757	518387.42	0.00841	3.404557
11	11	2508.52	129571.22	0.020719	15.83958	871797.7	0.014144	5.725611
10	9	3002.44	111481.62	0.017826	13.62819	639478.67	0.010375	4.199835
9	9	2928.38	108731.75	0.017387	13.29203	623704.9	0.010119	4.096239
8	11	3000.2	154967.7	0.02478	18.9442	1042673.6	0.016917	6.847854
7	9	3564.96	132368.18	0.021166	16.18149	759287.73	0.012319	4.986692
6	9	3491.6	129644.3	0.020731	15.84851	743663.06	0.012065	4.884075
5	9	3495.38	129784.65	0.020753	15.86567	744468.15	0.012078	4.889363
4	9	3495.94	129805.44	0.020756	15.86821	744587.42	0.01208	4.890146
3	9	3496.64	129831.43	0.02076	15.87139	744736.51	0.012083	4.891125
2	18.5	3849.79	467664.64	0.074781	57.17018	4757031.8	0.077179	31.24224
Sum			6224246.2	1	762.25	65088760	1	413.7416