



Appendix

Any design calculations and/or computer output tables are available upon request.

A1: References

CRSI Handbook, 2002

Manual of Steel Construction LRFD, Third Edition, 2002

ACI 318-20: Building Code Requirements for Structural Concrete

RS Means: Unit Cost Data, 2005

Naaman, Antoine E. Prestressed Concrete Analysis and Design. Ann Arbor, Michigan: Techno Press 3000, 2004.

Computers & Structures, Inc.

http://www.csiberkeley.com/support_watch&learn.html

ADAPT Webpage

<http://www.adaptsoft.com/building-literature.shtml>

PCI Webpage

http://www.cement.org/buildings/design_aids.asp

AISC Design Guide 11: Floor Vibrations

United States Green Building Council Webpage

<http://www.usgbc.org/>

A2: Wind Load Design

Wind Load Analysis

Based on ASCE-7-02: Analytical Procedure

Building Properties:

			Code Reference
Building Width	B (ft)	160.667	
Building Length	L (ft)	79.333	
Building Height	h (ft)	292	
Topographic Factor	K_{zt}	1	Figure 6.4
Directionality Factor	K_d	0.85	Table 6.4
Basic Wind Speed	V (mph)	90	
Occupancy Category		III	Table 1.1
Hurricane Region		No	
Importance Factor	I_w	1.15	Table 6.1
Exposure Category		B	Section 6.5.6.3
	α	7.0	Table 6.2
	Z_g	1200	Table 6.2
	Z_{min}	175	Table 6.2
	c	0.300	Table 6.2
	e	0.333	Table 6.2
	l	320	Table 6.2
	μ	0.450	Table 6.2
	ϕ	0.250	Table 6.2
	$\frac{a}{b}$	0.143	Table 6.2
	$\frac{b}{a}$	0.840	Table 6.2

Period Parameters

Structure Type		Concrete	Table 9.5.5.3
	C_t	0.016	Table 9.5.5.3.2
	x	0.900	Table 9.5.5.3.2
Fundamental Period	T	2.6442	
Fundamental Frequency	f	0.3782	
Building Rigidity		Flexible	

Gust Effect Factor				Section 6.5.8	
	<u>Rigid</u>			Section 6.5.8.1	
		$g_a=g_v$	3.4		
		\dot{z}	175		
		I_z	0.2272		
		L_z	557.9243		
		Q	0.8027		
		G_r	0.8500		
	<u>Flexible</u>			Section 6.5.8.2	
		g_R	3.95		
		R_n	0.081		
		N_1	2.34		
		h_h	5.63		
		h_B	0.019		
		h_L	5.13		
		R_h	0.162		
		R_B	0.987		
		R_L	0.176		
		V_z	90.13		
		b	0.05		
		R	0.40		
		G_r	0.8866		
Topographic Effects				Section 6.5.7	
Pressure Coefficients				Section 6.5.11	
	<u>Internal</u>				
		Enc. Type	Enclosed	Figure 6.5	
		Internal ($G_{C_{pi}}$)	0.18 +/-		
	<u>Windward</u>				
		C_p	0.8	Figure 6.6	
	<u>Leeward</u>				
		Direction	Ratio	Cp	
		N-S	2.025	-0.30	
		E-W	0.494	-0.50	
				Figure 6.6	
				Figure 6.6	
	<u>Summary</u>				
		Windward (P_z)	N-S	0.680	0.709
			E-W	0.680	0.709
		Leeward (P_n)	N-S	-0.254	-0.265
			E-W	-0.425	-0.443

K_z and q_z

Z(ft)	K_z	q_z
0-15	0.57	11.55
20	0.62	12.57
25	0.66	13.38
30	0.70	14.19
40	0.76	15.40
50	0.81	16.42
60	0.85	17.23
70	0.89	18.04
80	0.93	18.85
90	0.96	19.46
100	0.99	20.07
120	1.04	21.08
140	1.09	22.09
160	1.13	22.90
180	1.17	23.72
200	1.20	24.32
250	1.28	25.94
300	1.35	27.36
350	1.41	28.58
400	1.47	29.80
450	1.52	30.81
500	1.56	31.62
292	1.3381	27.12

 K_z from Section 6.5.6.6 q_z from Section 6.5.10

Wind Pressure

	Wind Ward		Leeward		Total	
	N-S	E-W	N-S	E-W	N-S	E-W
0-15	8.20	8.20	-7.18	-12.02	15.38	20.22
20	8.91	8.91	-7.18	-12.02	16.10	20.94
25	9.49	9.49	-7.18	-12.02	16.67	21.51
30	10.06	10.06	-7.18	-12.02	17.25	22.09
40	10.93	10.93	-7.18	-12.02	18.11	22.95
50	11.65	11.65	-7.18	-12.02	18.83	23.67
60	12.22	12.22	-7.18	-12.02	19.40	24.24
70	12.80	12.80	-7.18	-12.02	19.98	24.82
80	13.37	13.37	-7.18	-12.02	20.55	25.39
90	13.80	13.80	-7.18	-12.02	20.99	25.83
100	14.23	14.23	-7.18	-12.02	21.42	26.26
120	14.95	14.95	-7.18	-12.02	22.14	26.98
140	15.67	15.67	-7.18	-12.02	22.86	27.69
160	16.25	16.25	-7.18	-12.02	23.43	28.27
180	16.82	16.82	-7.18	-12.02	24.01	28.85
200	17.25	17.25	-7.18	-12.02	24.44	29.28
250	18.40	18.40	-7.18	-12.02	25.59	30.43
300	19.41	19.41	-7.18	-12.02	26.59	31.43
350	20.27	20.27	-7.18	-12.02	27.46	32.30
400	21.13	21.13	-7.18	-12.02	28.32	33.16
450	21.85	21.85	-7.18	-12.02	29.04	33.88
500	22.43	22.43	-7.18	-12.02	29.61	34.45
292	19.24	19.24	-7.18	-12.02	26.42	31.26

A3: Seismic Loading: Shear Walls**Seismic Load Analysis**

Based on ASCE-7-02

Building Information		Chicago, IL	Code Reference
Location		Chicago, IL	
Number of floors:	N	25	
Building Height:	h_n	292	
Inter-story height	h_s	10	
Occupancy Category		III	Table 1-1
Seismic Use Group	I	II	Table 9.1.3
Importance Factor		1.25	Table 9.1.4
Site Class		D	Table 9.4.1.2
	S_s	0.17	
	S_1	0.07	
	F_a	1.6	Table 9.4.1.2a
	F_v	2.4	Table 9.4.1.2b
	S_{MS}	0.272	
	S_{M1}	0.168	
	S_{DS}	0.181	
	S_{D1}	0.112	
Design Category:			
	Based on S_{DS}	B	Table 9.4.2.1a
	Based on S_{D1}	B	Table 9.4.2.1b
	Applicable Design Category:	B	
		Use Equivalent Lateral Force Analysis	

Design Parameters:

		Ordinary Reinforced Concrete Shear Walls	
Response Modifier	R	5	Table 9.5.2.2
Over-Strength Factor	Ω_0	2.5	Table 9.5.2.2
Deflection Amplifier	C_d	4.5	Table 9.5.2.2
	ρ	1.0	
Structure Type		Concrete	Table 9.5.5.3
	C_t	0.016	Table 9.5.5.3.2
	χ	0.900	Table 9.5.5.3.2
Natural Period	T	2.6483	
	T_0	0.124	
	T_s	0.618	

Weights:

Dead Loads:

	Slab/Deck	Beams/Joists	Superimposed	Total
Roof	125	0	17	142
Mech	150	0	250	400
7-24	125	0	14	139
4-6	125	0	10	135
2-3	125	0	10	135
Mezz	125	0	50	175
Ground	150	0	25	175

Live Loads:

Grond Floor	100	
Parking	40	
Residential Units	40	Dwelling
	15	Partition
Corridors	40	
Balconies	40	
Snow	25 + Drift	

Equivalent Lateral Force:

Section 9.5.5

S_{DS}	0.181	I	1.25
S_{D1}	0.112	T	2.648
R	5		
k	2.00	C_s	0.0105729

Floor	Height (ft)	Area (ft ²)	Weight (kip)	$w_x h_x^k$	C_{vx}	Shear Distribution (kip)
Roof	291.5	3300	468.6	39817996	0.0426	14.80
Mech	274.58	5400	1485.0	111963070	0.1197	41.60
24	263.58	7500	1155.0	80244981	0.0858	29.82
23	252.92	7500	1155.0	73881701	0.0790	27.45
22	242.25	7500	1155.0	67781247	0.0724	25.19
21	231.58	8300	1278.2	68550940	0.0733	25.47
20	220.92	8300	1278.2	62381495	0.0667	23.18
19	210.25	8300	1278.2	56502911	0.0604	21.00
18	199.58	9100	1401.4	55822677	0.0597	20.74
17	188.92	9100	1401.4	50015275	0.0535	18.58
16	178.25	9100	1401.4	44526770	0.0476	16.55
15	167.58	9100	1401.4	39357161	0.0421	14.62
14	156.92	9100	1401.4	34506448	0.0369	12.82
13	145.25	9100	1401.4	29566124	0.0316	10.99
12	135.58	9100	1401.4	25761712	0.0275	9.57
11	124.92	9100	1401.4	21867689	0.0234	8.13
10	114.25	9100	1401.4	18292562	0.0196	6.80
9	103.58	9100	1401.4	15036331	0.0161	5.59
8	92.92	9100	1401.4	12098997	0.0129	4.50
7	82.25	9100	1401.4	9480558.6	0.0101	3.52
6	71.58	9100	1365.0	6994497	0.0075	2.60
5	60.00	9100	1365.0	4914000	0.0053	1.83
4	50.00	9100	1228.5	3071250	0.0033	1.14
3	40.00	9100	1228.5	1965600	0.0021	0.73
2	29.75	9100	1228.5	1087299.3	0.0012	0.40
Mezz	15.33	2260	395.5	92982.402	0.0001	0.03
1 - Ground	0.00	0	0.0	0	0	0.00
		213060	32881.0	935582273	1.000	347.65

A4: Seismic Loading: Frame-Wall Interaction**Seismic Load Analysis**

Based on ASCE-7-02

Building Information

			Chicago, IL	Code Reference
Location			Chicago, IL	
Number of floors:	N		25	
Building Height:	h_n		292	
Inter-story height	h_s		10	
Occupancy Category			III	Table 1-1
Seismic Use Group	I		II	Table 9.1.3
Importance Factor			1.25	Table 9.1.4
Site Class			D	Table 9.4.1.2
	S_s		0.17	
	S_1		0.07	
	F_a		1.6	Table 9.4.1.2a
	F_v		2.4	Table 9.4.1.2b
	S_{MS}		0.272	
	S_{M1}		0.168	
	S_{DS}		0.181	
	S_{D1}		0.112	

Design Category:

Based on S_{DS}	B	Table 9.4.2.1a
Based on S_{D1}	B	Table 9.4.2.1b

Applicable Design Category: **B**
 Use Equivalent Lateral Force Analysis

Design Parameters:

Ordinary Reinforced Concrete Dual System

Response Modifier	R	4.5	Table 9.5.2.2
Over-Strength Factor	Ω_0	2.5	Table 9.5.2.2
Deflection Amplifier	C_d	4	Table 9.5.2.2
	ρ	1.0	
Structure Type		Concrete	Table 9.5.5.3
	C_t	0.016	Table 9.5.5.3.2
	x	0.900	Table 9.5.5.3.2
Natural Period	T	2.6483	
	T_0	0.124	
	T_s	0.618	

Weights:

Dead Loads:

	Slab/Deck	Beams/Joists	Superimposed	Total
Roof	100	0	17	117
Mech	125	0	250	375
7-24	100	0	14	114
4-6	100	0	10	110
2-3	100	0	10	110
Mezz	100	0	50	150
Ground	150	0	25	175

Live Loads:

Grond Floor	100	
Parking	40	
Residential Units	40	Dwelling
	15	Partition
Corridors	40	
Balconies	40	
Snow	25 + Drift	

Equivalent Lateral Force:

Section 9.5.5

S_{DS}	0.181	I	1.25
S_{D1}	0.112	T	2.648
R	4.5		
k	2.00	C_s	0.0117476

Floor	Height (ft)	Area (ft ²)	Weight (kip)	$w_x h_x^k$	C_{vx}	Shear Distribution (kip)
Roof	291.5	3300	386.1	32807786	0.0415	13.43
Mech	274.58	5400	1350.0	101784609	0.1287	41.66
24	263.58	7500	967.5	67218198	0.0850	27.51
23	252.92	7500	967.5	61887918	0.0782	25.33
22	242.25	7500	967.5	56777798	0.0718	23.24
21	231.58	8300	1070.7	57422541	0.0726	23.50
20	220.92	8300	1070.7	52254629	0.0661	21.39
19	210.25	8300	1070.7	47330360	0.0598	19.37
18	199.58	9100	1173.9	46760554	0.0591	19.14
17	188.92	9100	1173.9	41895912	0.0530	17.15
16	178.25	9100	1173.9	37298398	0.0472	15.26
15	167.58	9100	1173.9	32968011	0.0417	13.49
14	156.92	9100	1173.9	28904752	0.0365	11.83
13	145.25	9100	1173.9	24766429	0.0313	10.14
12	135.58	9100	1173.9	21579616	0.0273	8.83
11	124.92	9100	1173.9	18317739	0.0232	7.50
10	114.25	9100	1173.9	15322990	0.0194	6.27
9	103.58	9100	1173.9	12595368	0.0159	5.15
8	92.92	9100	1173.9	10134874	0.0128	4.15
7	82.25	9100	1173.9	7941506.9	0.0100	3.25
6	71.58	9100	1137.5	5828747.5	0.0074	2.39
5	60.00	9100	1137.5	4095000	0.0052	1.68
4	50.00	9100	1001.0	2502500	0.0032	1.02
3	40.00	9100	1001.0	1601600	0.0020	0.66
2	29.75	9100	1001.0	885947.56	0.0011	0.36
Mezz	15.33	2260	339.0	79699.201	0.0001	0.03
1 - Ground	0.00	0	0.0	0	0	0.00
		213060	27554.5	790963484	1.000	323.70