



# APPENDIX A

## LOAD CALCULATIONS





APPENDIX A

**WIND LOAD ANALYSIS**

Building Properties	
B (ft)	125
L (ft)	188
h (ft)	126.00
$K_{zt}$	1
$K_d$	0.85
V (mph)	90
Importance	III
$I_w$	1.15
Exposure	C
$\cong$	9.5
$z_g$	900
$z_{min}$	15
c	0.2
$\in$	0.2
l	500
b	0.650
$\cong$	0.153846
$\underline{a}$	0.105
$\underline{b}$	1

Fundamental Period	
Struct. Type	Steel
$C_t$	0.028
x	0.8
T	1.341079
Natural f	0.745668
Rigidity	Flex

Rigid	
$g_a=g_v$	3.4
$\check{z}$	75.6
$l_z$	0.174192
$L_z$	590.1625
Q	0.855094
G	0.857753

Windward	
$C_p$	0.8

Flexible	
$g_R$	4.12
$R_n$	0.054
$N_1$	4.51
$\cong_h$	4.43
$\cong_B$	0.035
$\cong_L$	22.15
$R_h$	0.200
$R_B$	0.977
$R_L$	0.044
$V_z$	97.47
$\cong$	0.05
R	0.34
$G_f$	0.9017

Leeward		
	Ratio	$C_p$
N-S	0.665	-0.50
E-W	1.504	-0.40

Pressure Coefficients		
Internal		
Enc. Type	Enclosed	
Internal ( $GC_{pi}$ )	0.18	+/-

$K_z$ and $q_z$		
Z(ft)	$K_z$	$q_z$
0-15	0.85	17.2290
20	0.90	18.2425
25	0.94	19.0533
30	0.98	19.8641
40	1.04	21.0802
50	1.09	22.0937
60	1.13	22.9045
70	1.17	23.7152
80	1.21	24.5260
90	1.24	25.1341
100	1.26	25.5395
120	1.31	26.5530
140	1.36	27.5664
126	1.325	26.8570

Pressures			
Windward	N-S	$P_z$	0.721
	E-W	$P_z$	0.721
Leeward	N-S	$P_h$	-0.451
	E-W	$P_h$	-0.360



APPENDIX A

Velocity Pressure Envelope						
Z(ft)	Windward		Leeward		Max psf	
	N-S	E-W	N-S	E-W	N-S	E-W
0-15	12.43	12.43	-12.11	-9.67	24.54	22.10
15-20	13.16	13.16	-12.11	-9.67	25.27	22.83
20-25	13.74	13.74	-12.11	-9.67	25.85	23.41
25-30	14.33	14.33	-12.11	-9.67	26.44	24.00
30-40	15.21	15.21	-12.11	-9.67	27.32	24.87
40-50	15.94	15.94	-12.11	-9.67	28.05	25.61
50-60	16.52	16.52	-12.11	-9.67	28.63	26.19
60-70	17.11	17.11	-12.11	-9.67	29.22	26.78
70-80	17.69	17.69	-12.11	-9.67	29.80	27.36
80-90	18.13	18.13	-12.11	-9.67	30.24	27.80
90-100	18.42	18.42	-12.11	-9.67	30.53	28.09
100-120	19.15	19.15	-12.11	-9.67	31.26	28.82
120-140	19.89	19.89	-12.11	-9.67	31.99	29.55
126	19.37	19.37	-12.11	-9.67	31.48	29.04

Wind Analysis (Analytical Approach)								
CASE 1			Story Force		Cumulative Shear		Overturning Moment	
Level	Trib. Height (ft)	Total Height (ft)	N-S	E-W	N-S	E-W	N-S	E-W
Roof	7.00	126.00	41.97	25.77	0	0	5287.96	3246.79
9	14.00	112.00	82.29	50.44	41.97	25.77	9216.09	5649.25
8	14.00	98.00	81.05	49.62	124.25	76.21	7942.85	4862.49
7	14.00	84.00	79.40	48.52	205.30	125.83	6669.61	4075.73
6	14.00	70.00	77.67	47.37	284.70	174.35	5436.78	3315.84
5	14.00	56.00	75.58	45.98	362.37	221.71	4232.43	2574.88
4	14.00	42.00	73.13	44.35	437.95	267.69	3071.56	1862.84
3	14.00	28.00	69.97	42.25	511.08	312.05	1959.19	1183.04
2	14.00	14.00	65.52	39.29	581.06	354.30	917.25	550.07
1	7.00	0.00	0.00	0.00	646.57	393.59	44733.72	27320.92

Wind Analysis (Analytical Approach)												
CASE 3 (75% simultaneous directions)			NW-SE direction			NE-SW Direction			Cumulative Shear		Overturning Moment	
Level	Trib. Height (ft)	Total Height (ft)	N-S	E-W	Total	N-S	E-W	Total	NW-SE	NE-SW	NW-SE	NE-SW
Roof	7.00	126.00	31.48	19.33	36.94	31.48	19.33	36.94	0	0	4653.88	4653.88
9	14.00	112.00	61.71	37.83	72.39	61.71	37.83	72.39	36.94	36.94	8107.30	8107.30
8	14.00	98.00	60.79	37.21	71.27	60.79	37.21	71.27	109.32	109.32	6984.78	6984.78
7	14.00	84.00	59.55	36.39	69.79	59.55	36.39	69.79	180.60	180.60	5862.26	5862.26
6	14.00	70.00	58.25	35.53	68.23	58.25	35.53	68.23	250.38	250.38	4776.11	4776.11
5	14.00	56.00	56.68	34.49	66.35	56.68	34.49	66.35	318.61	318.61	3715.60	3715.60
4	14.00	42.00	54.85	33.26	64.15	54.85	33.26	64.15	384.96	384.96	2694.23	2694.23
3	14.00	28.00	52.48	31.69	61.30	52.48	31.69	61.30	449.11	449.11	1716.50	1716.50
2	14.00	14.00	49.14	29.47	57.30	49.14	29.47	57.30	510.42	510.42	802.16	802.16
1	7.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	567.71	567.71	39312.82	39312.82



APPENDIX A

**SEISMIC LOAD DESIGN**

Design Parameters	
# of stories	9
$h_s$	14 ft
$h_n$	126 ft
Seismic Use Group	III
Occ. Importance Factor	1.5
$S_s$	0.39 g-s
$S_1$	0.09 g-s
$F_a$	1.00
$F_v$	1.00
$S_{MS}$	0.39 g-s
$S_{M1}$	0.09 g-s
$S_{DS}$	0.26 g-s
$S_{D1}$	0.06 g-s
Seismic Design Cat.	C

Assumptions:

- 1) Assumed stiff soil
- 2) not specifically detailed for seismic resistance
- 3) Ordinary Steel Concentrically braced
- 4) NO partition LL accounted for
- 5) Site Class B

Equivalent Lateral Force Procedure					
N-S Direction			E-W Direction		
	$R_{N-S}$	5		$R_{E-W}$	5
	$C_{S,N-S}$	0.078		$C_{S,E-W}$	0.078
	$C_{T,N-S}$	0.02		$C_{T,E-W}$	0.02
	X	0.75		X	0.75
	$T_{N-S}$	0.75		$T_{E-W}$	0.75
but not greater than:			but not greater than:		
	$C_{smax, N-S}$	0.024		$C_{smax, E-W}$	0.024
and	$C_{smin}$	0.0172		$C_{smin}$	0.0172
Therefore, ( $C_{S,N-S}$ ) used is:		0.024	Therefore, ( $C_{S,N-S}$ ) used is:		0.024

**Loading Characteristics**

Roof:		Slab Floors:	
DL (psf)		DL (psf)	
3.5" Concrete Slab	43.8	Concrete Slab	56.3
Metal Deck Roof	2	Metal Deck	2
Structural Framing	10	Structural Framing	10
Superimposed Dead Loads	15	Superimposed Dead Loads	15
Total:	70.8	Total:	83.3

Perimeter Wall:	
DL (psf)	
	55



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Calculation Variables	
Building Width:	125 ft
Building Length:	188 ft
First Floor Area:	26,500 ft <sup>2</sup>
2nd-4th Floor Areas:	19500 ft <sup>2</sup>
Total weight of roof:	1621.6 kips
Total weight 2nd-9th floor:	2106.4 kips
Total Weight 1st Floor:	
Total Building Weight:	18472.6 kips
Seismic Shear, $V_{N-S}$ :	442.1 kips
Seismic Shear, $V_{E-W}$ :	442.1 kips

Vertical Distribution of Seismic Forces							
North - South Direction							
Level, x	$w_x$	$h_x$	$w_x h_x^k$	$C_{vx}$	$F_x$	$V_x$	$M_x$
	kips	feet			kips	kips	ft-kips
Roof	1622	126	375,948	0.171	75.5		9512.4
9	2106	112	427,675	0.194	85.9	75.5	9618.8
8	2106	98	367,968	0.167	73.9	161.4	7241.5
7	2106	84	309,331	0.141	62.1	235.3	5217.9
6	2106	70	251,918	0.114	50.6	297.4	3541.2
5	2106	56	195,943	0.089	39.3	348.0	2203.5
4	2106	42	141,723	0.064	28.5	387.3	1195.3
3	2106	28	89,773	0.041	18.0	415.8	504.8
2	2106	14	41,131	0.019	8.3	433.8	115.6
1						442.1	
$\Sigma$	7941		2,201,410	1.000	442.1		39151.0
Exponent $k_{N-S}$ : 1.126078							

Vertical Distribution of Seismic Forces							
East - West Direction							
Level, x	$w_x$	$h_x$	$w_x h_x^k$	$C_{vx}$	$F_x$	$V_x$	$M_x$
	kips	feet			kips	kips	ft-kips
Roof	1622	126	375,948	0.171	75.5		9512.4
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6	2106	70	251,918	0.114	50.6	297.4	3541.2
5	2106	56	195,943	0.089	39.3	348.0	2203.5
4	2106	42	141,723	0.064	28.5	387.3	1195.3
3	2106	28	89,773	0.041	18.0	415.8	504.8
2	2106	14	41,131	0.019	8.3	433.8	115.6
1						442.1	
$\Sigma$	7941		2,201,410	1.000	442.1		39151.0
Exponent $k_{E-W}$ : 1.126078							