APPENDIX A: LOAD CALCULATIONS

Snow Loading

P_g = 30 PSF (MANASSAS, VA)
TERRAIN CATEGORY "C" (SUBURBAN)
↳ PARTIALLY EXPOSED ROOF — C_e = 1.0 [1608.3.1]
THERMAL = NORMAL STRUCTURE — C_t = 1.0 [1608.3.2]
IMPORTANCE: NORMAL STRUCTURE — I = 1.0

SNOW LOAD = 30(1.0)(1.0)(1.0) = **30 PSF**

Wind Loading

BASIC WIND SPEED — 90MPH = V (MANASSAS, VA) FIG 6-1

WIND DIR. FACTOR — K_D = 0.85 FOR MWFRS

IMPORTANCE — I = 1.0 (SPECS)

EXPOSURE CATEGORY — B (SPECS)
z_g = 1200 α = 7.0 TBL 6-2 z = 53.33' MAX
$K_z = 2.01(z/z_g)^{2/\alpha}$ = 0.8257 = q_H
K_H = 0.83 (TBL 6-3)

TOPOGRAPHIC FACTOR — K_{zT} = 1.0 (SLOPING SITE, NO IRREGULARITIES)

GUST EFFECTS — G = 0.85 (RIGID STRUCTURE)

WALL PRESSURE COEFF — (OMPLETELY ENCLOSED
C_p = 0.8 (q_z) WINDWARD
= -0.5 (q_h) LEEWARD (N-S DIR)
= -0.3 (q_h) LEEWARD (E-W DIR)

VELOCITY PRESSURE — $q_z = 0.00256 K_z K_{zT} K_D V^2 I$

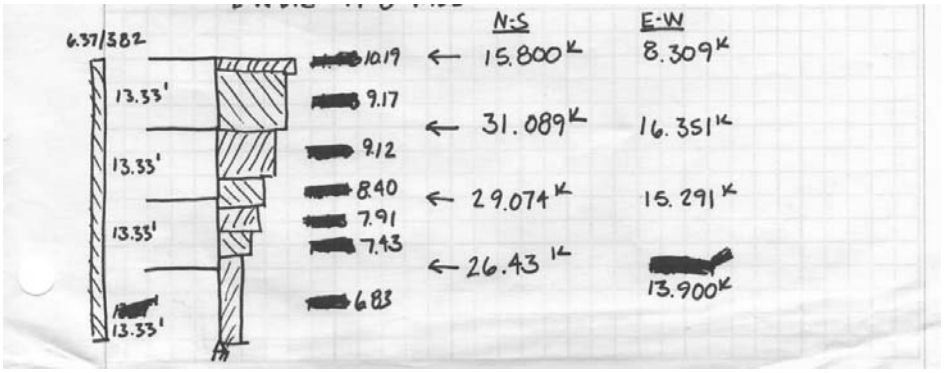
HEIGHT (FT)	K_z	q_z (PSF)	GCpq (WINDWARD)	GCpq (LEEWARD)
0-15	0.57	10.05	6.83	-6.37 / -3.82
15-20	0.62	10.93	7.43	
20-25	0.66	11.63	7.91	
25-30	0.70	12.34	8.40	
30-40	0.76	13.40	9.12	
40-50	0.81	14.28	9.71	
50-53.33	0.85	14.98	10.19	

N-S E-W

N-S DIR: 147'-8" WIDE
E-W DIR: 77'-8" WIDE

N-S E-W

Wind Loading, Continued



Seismic Loading, Composite Steel Structure

SEISMIC USE GROUP I
I = 1.0
S_{DS} = 0.186
S_{D1} = 0.065
SITE CLASS "D"
R = 3.0

$V = C_S W$

STRUCTURE WT: DL + 10PSF FOR PARTITIONS
10875 SQ. FT. ROUGH FLOOR AREA, 440FT PERIMETER

ROOF: 40 PSF (10875) + 440 PLF (440) = 629 K
FLOORS 2-4 80PSF(10875) + 440 PLF (440) = 1064 K
Σ 4883K

$C_S = \frac{S_{DS}}{R/I} = \frac{0.186}{3} = .0062$ ←

$\frac{S_{D1}}{T(R/I)} = \frac{.065}{.67(3)} = .0032$

$.044 S_{DS} I = 0.044(0.186) = 0.008$

$T = C_t h_n^x$ $C_t = 0.028$, $x = 0.80$ [MOMENT RESISTING STEEL]
$h_N = 53'-0$
T = 0.67s.

$V = C_S W = 0.062(4883) = 302^K$ BASE SHEAR

$F_x = C_{vx} V$, USING 170K BASE SHEAR IN SPECS.

$C_{vx} = \frac{w_x h_x}{\Sigma w_x h_x}$

FLOOR	$w_x h_x$
R	33337
4	42206
3	28019
2	13832
Σ	117394

F_R = [redacted] 48.3K
F_4 = 61.1 K
F_3 = 40.6 K
F_2 = 20.1 K

Seismic Loading, Concrete Structure

SEISMIC LOADING. EQUIVALENT LATERAL FORCE PROCEDURE IBC 2003

SEISMIC USE GROUP I
I = 1.0
S_{DS} = 0.186
S_{D1} = 0.065
SITE CLASS D
R = 3.0 (REINFORCED CONCRETE MOMENT FRAMES)

V = C_SW

STRUCTURE WT: DL + 20% SNOW LOAD

OFFICE ROOF: (10" SLAB/12)(150 PCF)(10875 ft²) + (3.5"/12" DROP)(10)(8.3')(15) (AVG DROP)
= 1360 K + 10 PSF DL(10875)
= 1468 K
+(440 PLF WALL)(2(145)+2(75)) = 1663 K

ROOF: (8/12)(150)(10875) + (3.5/12)(10)(8.3)(15) + 10(10875)
+ (220)(2(145)+2(75)) = 1294 K

TOTAL WT = 3(1468) + 1(1294) = 5698 K

$C_S = \frac{S_{DS}}{RI} = \frac{0.186}{3} = 0.062$ ←

$\frac{S_{D1}}{T(R/I)} = \frac{0.065}{0.57(3/1)} =$ [illegible] 0.038

$T = C_t h_N^x$ $C_t = 0.016$ $x = 0.9$ [CONC FRAME CARRYING LATERAL LOAD]
$h_N = 4(13.3\text{ FT}) = 53'$

= (0.016)(53)^0.9 T = 0.57s

0.044(0.186) = $0.044 S_{DS} I$ = 0.008

V = C_SW = 0.062 (5698) = 354 K BASE SHEAR.

$C_{vx} = \frac{w_x h_x}{\Sigma w_x h_x}$

FLOOR	$w_x h_x$	
R	69010	F_R = 131 K
4	58574	F_4 = 111 K
3	39050	F_3 = 75 K
2	19525	F_2 = 37 K
Σ	186159	