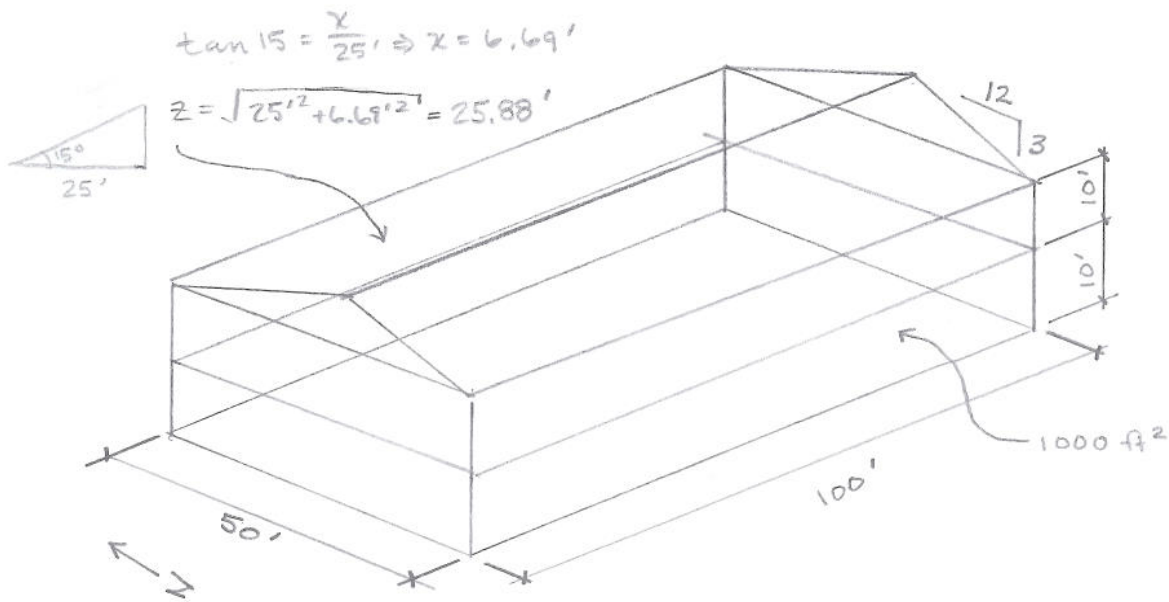


ASCE 7-05 Wind Load example

Given: The enclosed office building shown. Wind speed (3sec gust) of 120 mph  
Exposure C. Flat terrain.



Required: The wind pressures applied to the surfaces, and net forces on building.

Solution: Critical elevations:

Mean roof height:  $h = (2 \times 10') + \frac{(3/12) \times 25'}{2} = 23.125'$

Mean 2<sup>nd</sup> floor height:  $h = 10' + \frac{10'}{2} = 15'$

Mean 1<sup>st</sup> floor height:  $h = 10' \times \frac{1}{2} = 5'$

Velocity Pressures:  $q_z = 0.00256 K_z K_{zt} K_d V^2 I$  (Eq. 6-15)

$K_{zt} = 1$  (flat terrain)

$K_d = 0.85$  (Tbl. 6-4, buildings)

$I = 1.0$  (Tbl. 6-1, cat. II)

$K_z = \text{varies w/ elevation} = 2.01 \left( \frac{\max(h, 15)}{900} \right)^{(2/9.5)}$

	h (ft)	$K_z$	$q_z$ (psf)
Roof	23.125	0.929	29.1
2 <sup>nd</sup> flr.	15	0.849	26.6
1 <sup>st</sup> flr.	5	0.849	26.6

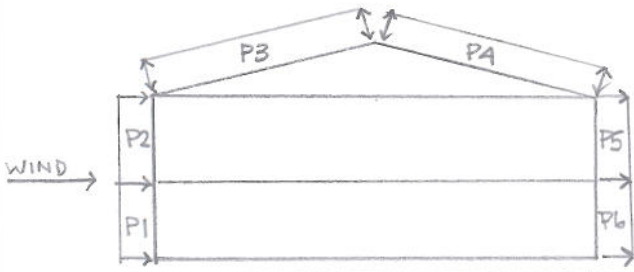
Internal Pressures:  $GC_{pi} = \pm 0.18$  (Fig. 6-5)

$q_h = 29.1$

$q_h GC_{pi} = \pm 5.24$  psf

Gust Factor:  $G = 0.85$  (6.5.8.1, rigid structure)

N/S wind direction:



Determine the pressure coefficients for the locations show in figure. These coefficients are then combined with the gust factor and velocity pressures to obtain the external pressures in each region... Pressure coeff. found in Fig 6-

Windward Wall: ( $P1 \neq P2$ ),  $C_p = 0.8$  for all elevations

Leeward Wall: ( $P5 \neq P6$ ),  $Z/B = 50/100 = 0.5$ ,  $C_p = -0.5$  for all elevations

Sidewalls (not shown):  $C_p = -0.7$  for all elevations

Windward Roof: ( $P3$ ),  $\tan^{-1}(\frac{3}{12}) = 14.03^\circ$  (use  $15^\circ$ )

$h/L = 23.125/50 = 0.46$ ,  $C_p = -0.7$  and  $-0.18$  (two different load cases)

Leeward Roof: ( $P4$ )  $C_p = -0.5$

Compute external pressures,  $q G C_p$ , for each surface.

Component	Pressure	$C_p$	$q$ (psf)	$q G C_p$ (psf)
WW Wall	P1	0.8	26.6	18.1
	P2	0.8	26.6	18.1
WW Roof	P3	-0.7	29.1	-17.3
	P3	-0.18	29.1	-4.45
LW Roof	P4	-0.5	29.1	-12.37
LW Wall	P5	-0.5	26.6	-11.3
	P6	-0.5	26.6	-11.3
Side Walls	P7	-0.7	26.6	-15.83

neg. = outwards  
pos. = inwards

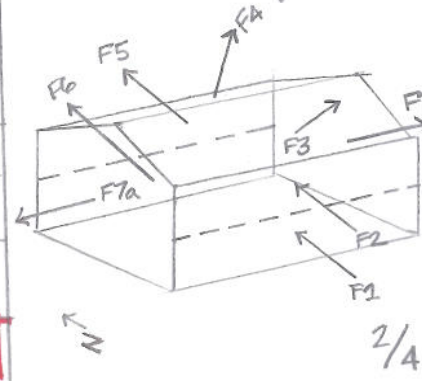
Combining w/ int. pressures you get the following load cases where

- CASE 1: max WW press. and pos. int. press.
- CASE 2: min WW press. and pos. int. press.
- CASE 3: max WW press. and neg. int. press.
- CASE 4: min WW press. and neg. int. press.

Component	Pressure	Net				Area (ft <sup>2</sup> )	Case I (K)	Case II (K)	Case III (K)	Case IV (K)
		Case I (psf)	Case II (psf)	Case III (psf)	Case IV (psf)					
WW Wall	P1	12.9	12.9	23.3	23.3	1000	12.9	12.9	23.3	23.3
	P2	12.9	12.9	23.3	23.3	1000	12.9	12.9	23.3	23.3
WW Roof	P3	-22.5	-9.4	-12.1	0.8	2588	-58.2	-24.3	-31.3	2.1
LW Roof	P4	-17.6	-17.6	-7.2	-7.2	2588	-45.5	-45.5	-18.6	-18.6
LW Wall	P5	-16.5	-16.5	-6.1	-6.1	1000	-16.5	-16.5	-6.1	-6.1
	P6	-16.5	-16.5	-6.1	-6.1	1000	-16.5	-16.5	-6.1	-6.1
Side Walls	P7	-21.1	-21.1	-10.6	-10.6	1167	-24.6	-24.6	-12.4	-12.4

Force	E/W (K)	N/S (K)	Vert. (K)	CASE I			CASE II			CASE III			CASE IV		
				E/W (K)	N/S (K)	Vert. (K)	E/W (K)	N/S (K)	Vert. (K)	E/W (K)	N/S (K)	Vert. (K)	E/W (K)	N/S (K)	Vert. (K)
WW Wall F1	0	12.9	0	0	12.9	0	0	12.9	0	0	23.3	0	0	23.3	0
WW Wall F2	0	12.9	0	0	12.9	0	0	12.9	0	0	23.3	0	0	23.3	0
WW Roof F3	0	-14.1	56.5	0	-5.9	23.6	0	-7.6	30.4	0	0.5	-2.1	0	0.5	-2.1
LW Roof F4	0	11.1	44.1	0	11.1	44.1	0	4.5	18.1	0	4.5	18.1	0	4.5	18.1
LW Wall F5	0	16.5	0	0	16.5	0	0	6.1	0	0	6.1	0	0	6.1	0
LW Wall F6	0	16.5	0	0	16.5	0	0	6.1	0	0	6.1	0	0	6.1	0
Side Walls F7a	-24.6	0	0	-24.6	0	0	-12.4	0	0	-12.4	0	0	-12.4	0	0
Side Walls F7b	24.6	0	0	24.6	0	0	12.4	0	0	12.4	0	0	12.4	0	0
Sum	0	55.8	100.6	0	64	67.7	0	55.7	48.5	0	63.8	16	0	63.8	16

NOTE: Maximum uplift & max. horz. force do not occur in same load case, design for each individually



E/W wind direction:

$$h/L = \frac{23.1}{100} = 0.23$$

WW Wall: (P8, P9, P10),  $C_p = 0.8$  (all elev)

Roof: P11,  $C_p = -0.9$  and  $-0.18$

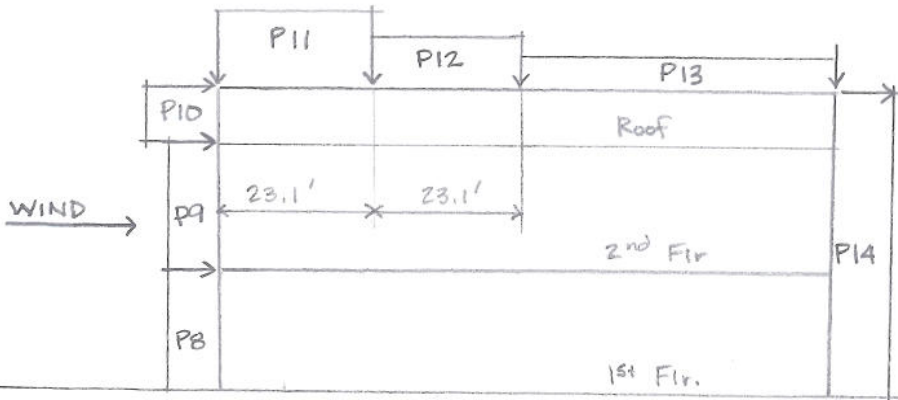
P12,  $C_p = -0.5$  and  $-0.18$

P13,  $C_p = -0.3$  and  $-0.18$

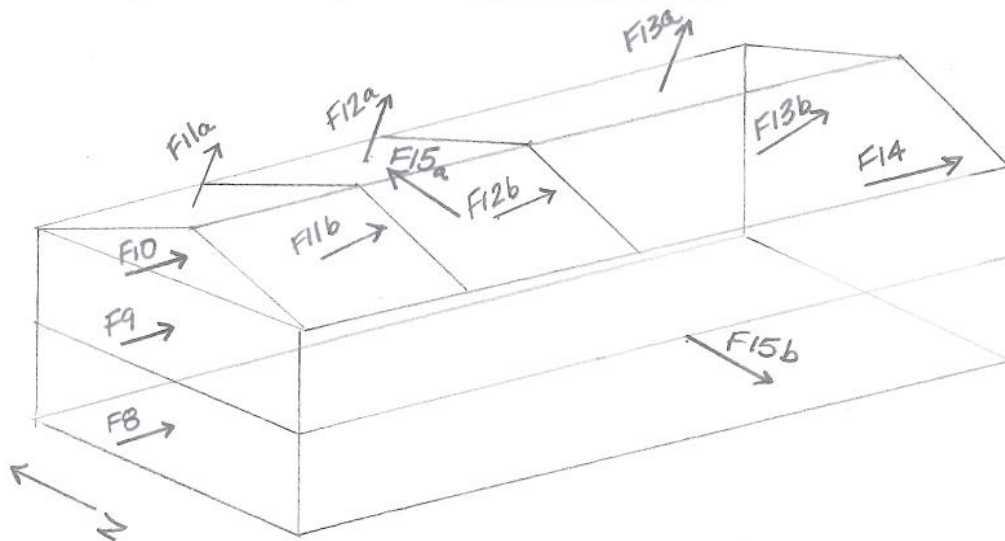
LW Wall:  $L/B = 100/50 = 2.0$

$C_p = -0.3$

Side Wall:  $C_p = -0.7$



Component	Pressure	$C_p$	$q$ (psf)	$qGC_p$ (psf)	neg: out pos: in
WW Wall	P8	0.8	26.6	18.1	
	P9	0.8	26.6	18.1	
	P10	0.8	29.1	19.8	
Roof	P11	-0.9	29.1	-22.3	
	P11	-0.18	29.1	-4.45	
	P12	-0.5	29.1	-12.4	
	P12	-0.18	29.1	-4.45	
	P13	-0.3	29.1	-7.4	
	P13	-0.18	29.1	-4.45	
LW Wall	P14	-0.3	29.1	-7.4	
Side Walls	P15	-0.7	29.1	-17.3	



Component	Pressure	Case I (psf)	Case II (psf)	Case III (psf)	Case IV (psf)	Area (ft <sup>2</sup> )	Case I (k)	Case II (k)	Case III (k)	Case IV (k)
WW Wall	P8	12.9	12.9	23.3	23.3	500	6.45	6.45	11.65	11.65
	P9	12.9	12.9	23.3	23.3	500	6.45	6.45	11.65	11.65
	P10	14.6	14.6	25	25	1167.2	2.44	2.44	4.2	4.2
Roof	P11a	-27.5	-9.7	-17.1	0.8	598	-16.45	-5.8	-10.22	0.5
	P11b	-27.5	-9.7	-17.1	0.8	598	-16.45	-5.8	-10.22	0.5
	P12a	-17.6	-9.7	-7.2	0.8	598	-10.52	-5.8	-4.31	0.5
	P12b	-17.6	-9.7	-7.2	0.8	598	-10.52	-5.8	-4.31	0.5
	P13a	-12.6	-9.7	-2.2	0.8	1392	-17.54	-13.5	-3.1	1.11
	P13b	-12.6	-9.7	-2.2	0.8	1392	-17.54	-13.5	-3.1	1.11
LW Wall	P14	-12.6	-2.2	-2.2	-2.2	1167.2	-14.7	-2.57	-2.57	-2.57
Side Walls	P15a	-22.5	-22.5	-12.1	-12.1	2000	-45	-45	-24.2	-24.2
	P15b	-22.5	-22.5	-12.1	-12.1	2000	-45	-45	-24.2	-24.2

E/W Wind direction (cont.)

Force	CASE I			CASE II			CASE III			CASE IV			
	E/W (k)	N/S (k)	Vert. (k)	E/W (k)	N/S (k)	Vert. (k)	E/W (k)	N/S (k)	Vert. (k)	E/W (k)	N/S (k)	Vert. (k)	
WW Wall	F8	6.45	0	0	6.45	0	0	11.65	0	0	11.65	0	0
	F9	6.45	0	0	6.45	0	0	11.65	0	0	11.65	0	0
	F10	2.44	0	0	2.44	0	0	4.2	0	0	4.2	0	0
Roof	F11a	0	+4.0	16	0	+1.4	5.6	0	2.5	9.9	0	0.12	0.5
	F11b	0	-4.0	16	0	-1.4	5.6	0	-2.5	9.9	0	-0.12	0.5
	F12a	0	+2.6	10.2	0	+1.4	5.6	0	1.04	4.2	0	0.12	0.5
	F12b	0	-2.6	10.2	0	-1.4	5.6	0	-1.04	4.2	0	-0.12	0.5
	F13a	0	+4.3	17	0	+3.3	13.1	0	0.75	3	0	0.27	1.1
	F13b	0	-4.3	17	0	-3.3	13.1	0	-0.75	3	0	-0.27	1.1
LW Wall	F14	14.7	0	0	2.57	0	0	2.57	0	0	2.57	0	0
Side Walls	F15a	0	45	0	0	45	0	0	24.2	0	0	24.2	0
	F15b	0	-45	0	0	-45	0	0	-24.2	0	0	-24.2	0
Sum		30.04	0	86.4	17.91	0	48.6	30.1	0	34.2	30.1	0	4.2