MWFRS Wind Load Calculations

ASCE 7-22 Chapter 28 Wind Loads on Buildings; Envelope Procedure Simple Diaphragm

Load Case 1

Project: Sixth Baptist Church

Roof : 12 on 12 or 45º

Table 28.5-1 Enclosed Simple Diaphragm Low-Rise Buildings

1. Risk Category Table 1.5-1 & IBC 2012 Table 1604.5 Cat II (Public Assembly with occupant load < 300)
2. Wind Speeds
   a. V_{Basic} Wind Speed, by wesite atcouncil.org V = 144 mph
   b. V_{asd} Nominal Wind Speed, by IBC 1609.3.1 111.5 mph
3. Wind Load Parameters
   a. Wind directionality factor K_d (Section 26.6 & Tbl 26.6-1 K_d = 0.85
   b . Exposure Category, (Section 26.7) B
   c. Topographic fack K_{zt} (Section 26.8 & Fig 26.8-1 K_{zt} = 1.00
   d. Ground Elevation factor K_e (Section 26.9 & Tbl 26.9-1) K_e = 1.00
   e. Enclosure Classification (Section 26.12) Category Enclosed
   f. Internal Pressure Coefficient GC_{pi} Section 26.13 & Tbl 26.13-1)
      GC_{pi}+ 0.18 GC_{pi}- 0.18
4. Determine (Tbl 26.10-1)
   K_z 0.70
   K_h 0.70

5. Determine velocity pressure exposure coefficient q_z or q_h (Eq 26.10-1)

q_z = 0.00256 K_z K_{zt} K_e $(.00256V)^2$ (lb/ft^2) ; V *mi/hr*

where

K_z = Velocity pressure exposure coefficient

K_{zt} = Topographic factor

K_e = Ground elevation factor

V = Basic wind speed, psf = $(0.00256 \times V)^2$

q_z = Velocity pressure at height z

q_z or q_h = 37.16

6. Determine external pressure coefficient, (GC_{pf}), for each load case using Section 28.3.2 for flat and gable roofs. Use Figure C28.3-2 in commentary for hip roofs

GC_{pf} for Load Case 1

	Building Surface							
Roof Angle Θ (degrees)	1	2	3	4	1E	2E	3E	4E
0º - 5º	0.40	-0.69	-0.37	-0.29	0.61	-1.07	-0.53	-0.43
20º	0.53	-0.69	-0.48	-0.43	0.80	-1.07	-0.69	-0.64
30º - 45º	0.56	0.21	-0.43	-0.37	0.69	0.27	-0.53	-0.48
90º	0.56	0.56	-0.37	-0.37	0.69	0.69	-0.48	-0.48

GC_{pf} for Load Case 2

Building Surface

Roof Angle Θ (degrees)	1	2	3	4	5	6	1E	2E	3E	4E	5E	6E
0-90º	-0.45	-0.69	-0.37	-0.45	0.40	-0.29	-0.48	-1.07	-0.53	-0.48	0.61	-0.43

7. Calculate wind pressure using Eq 28.3-1

p= $q_h K_d [(GC_{pf}) - (Gc_{pi})]$

Building Surface

	Roof Angle Θ (degrees)		1	2	3	4	1E	2E	3E	4E
Load Case 1	30º - 45º	GC_{pi}+	12.0	0.9	-19.3	-17.4	16.1	2.8	-22.4	-20.8
	30º - 45º	GC_{pi}-	23.4	12.3	-7.9	-6.0	27.5	14.2	-11.1	-9.5

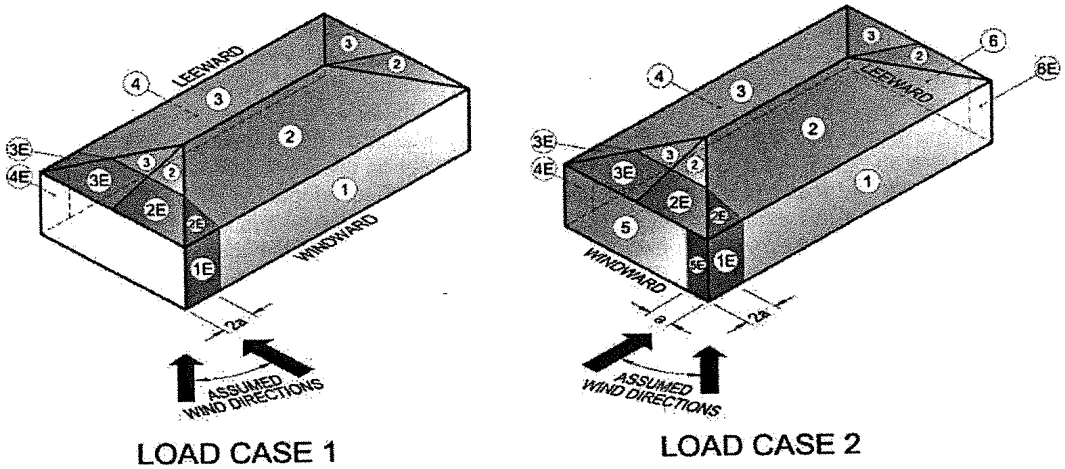
	Roof Angle Θ (degrees)		1	2	3	4	5	6	1E	2E	3E	4E	5E	6E
Load Case 2	0-90º	GC_{pi}+	-19.9	-27.5	-17.4	-19.9	6.9	-14.8	-20.8	-39.5	-22.4	-20.8	13.6	-19.3
		GC_{pi}-	-8.5	-16.1	-6.0	-8.5	18.3	-3.5	-9.5	-28.1	-11.1	-9.5	25.0	-7.9

If Load Case 1 applies

	Roof Angle Θ (degrees)	1	2	3	4	1E	2E	3E	4E
p =	30º - 45º	23.4	12.3	-19.3	-17.4	27.5	14.2	-22.4	-20.8

If Load Case 2 applies

	Roof Angle Θ (degrees)	1	2	3	4	5	6	1E	2E	3E	4E	5E	6E
p=	0-90º	-20	-27.48	-17.37	-19.90	18.32	-14.84	-20.85	-39.48	-22.43	-20.85	24.95	-19.27



LOAD CASE 1 LOAD CASE 2

Notes:

1. Adapt the loadings shown in Figure 28.3-1 for hip-roofed buildings as shown. For a given hip roof

pitch, use the roof coefficients from the Case 1 table for both Load Case 1 and Load Case 2.

2. The total horizontal shear shall not be less than that determined by neglecting the wind forces on roof surfaces.

Figure C28.3-3. Loads application for hip-roofed low-rise buildings.