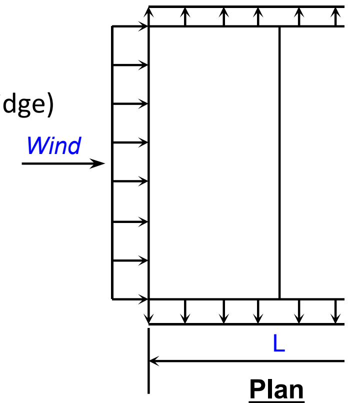
WIND LOADING ANALYSIS - Main Wind-Force Resisting System

Per ASCE 7-05 Code for Enclosed or Partially Enclosed Buildings

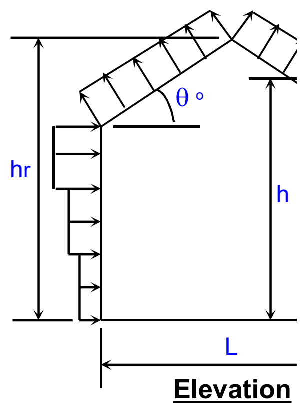
Using Method 2: Analytical Procedure (Section 6.5) for Buildings of Any Height

Job Name:		Subject:		
Job Number:		Originator:		Checker:

Input Data:



Wind Direction =	Normal	(Normal or Parallel to building ridge)
Wind Speed, V =	120	mph (Wind Map, Figure 6-1)
Bldg. Classification =	II	(Table 1-1 Occupancy Cat.)
Exposure Category =	B	(Sect. 6.5.6)
Ridge Height, hr =	157.00	ft. (hr >= he)
Eave Height, he =	157.00	ft. (he <= hr)
Building Width =	100.00	ft. (Normal to Building Ridge)
Building Length =	200.00	ft. (Parallel to Building Ridge)
Roof Type =	Monoslope	(Gable or Monoslope)
Topo. Factor, Kzt =	1.00	(Sect. 6.5.7 & Figure 6-4)
Direct. Factor, Kd =	0.85	(Table 6-4)
Enclosed? (Y/N)	Y	(Sect. 6.2 & Figure 6-5)
Hurricane Region?	N	
Damping Ratio, β =	0.030	(Suggested Range = 0.010-0.070)
Period Coef., Ct =	0.0200	(Suggested Range = 0.020-0.035)
		(Assume: T = Ct*h^(3/4) , and f = 1/T)



Resulting Parameters and Coefficients:

Roof Angle, θ =	0.00	deg.		
Mean Roof Ht., h =	157.00	ft. (h = he, for roof angle <=10 deg.)		
Windward Wall Cp =	0.80	(Fig. 6-6)		
Leeward Wall Cp =	-0.50	(Fig. 6-6)		
Side Walls Cp =	-0.70	(Fig. 6-6)		
Roof Cp (zone #1) =	-1.04	-0.18	(Fig. 6-6)	(zone #1 for 0 to h/2)
Roof Cp (zone #2) =	-0.70	-0.18	(Fig. 6-6)	(zone #2 for h/2 to h)
Roof Cp (zone #3) =	N.A.	N.A.	(Fig. 6-6)	(zone #3 for h to 2*h)
Roof Cp (zone #4) =	N.A.	N.A.	(Fig. 6-6)	(zone #4 for > 2*h)
+GCpi Coef. =	0.18	(Figure 6-5)	(positive internal pressure)	
-GCpi Coef. =	-0.18	(Figure 6-5)	(negative internal pressure)	

If z <= 15 then: Kz = 2.01*(15/zg)^(2/α) , If z > 15 then: Kz = 2.01*(z/zg)^(2/α) (Table 6-3, Case 2

α =	7.00	zg =	1200	(Table 6-2)
Kh =	1.12	(Kh = Kz evaluated at z = h)		
I =	1.00	(Table 6-1)	(Importance factor)	

Velocity Pressure: qz = 0.00256*Kz*Kzt*Kd*V^2*I (Sect. 6.5.10, Eq. 6-15)

qh =	35.23	psf	qh = 0.00256*Kh*Kzt*Kd*V^2*I (qz evaluated	
Ratio h/L =	1.570	freq., f =	1.127	hz. (f >= 1, Rigid st

Gust Factor, G = 0.818 (Sect. 6.5.8)

Design Net External Wind Pressures (Sect. 6.5.12.2):

p = qz*G*Cp - qi*(+/-GCpi) for windward wall (psf), where: qi =qh (Eq. 6-17, Sect. 6.5.12.2.1)

p = qh*G*Cp - qi*(+/-GCpi) for leeward wall, sidewalls, and roof (psf), where: qi = qh (Sect. 6.5.12.

Normal to Ridge Wind Load Tabulation for MWFRS - Buildings of Any Height

Surface	z (ft.)	Kz	qz (psf)	Cp	p = Net Desig (w/ +GCpi)
Windward Wall	0	0.57	18.01	0.80	5.45
	15.00	0.57	18.01	0.80	5.45
	20.00	0.62	19.55	0.80	6.46
	25.00	0.67	20.84	0.80	7.30
	30.00	0.70	21.95	0.80	8.03
	35.00	0.73	22.94	0.80	8.68
	40.00	0.76	23.83	0.80	9.26
	45.00	0.79	24.65	0.80	9.80
	50.00	0.81	25.40	0.80	10.29
	55.00	0.83	26.10	0.80	10.75
	60.00	0.85	26.76	0.80	11.18
	70.00	0.89	27.97	0.80	11.97
	80.00	0.93	29.05	0.80	12.68
	90.00	0.96	30.05	0.80	13.33
	100.00	0.99	30.97	0.80	13.93
	120.00	1.04	32.62	0.80	15.01
	140.00	1.09	34.09	0.80	15.98
For z = hr:	157.00	1.12	35.23	0.80	16.72
For z = he:	157.00	1.12	35.23	0.80	16.72
For z = h:	157.00	1.12	35.23	0.80	16.72
Leeward Wall	All	-	-	-0.50	-20.75
Side Walls	All	-	-	-0.70	-26.52
Roof (zone #1) cond. 1	-	-	-	-1.04	-36.32
Roof (zone #1) cond. 2	-	-	-	-0.18	-11.53
Roof (zone #2) cond. 1	-	-	-	-0.70	-26.52
Roof (zone #2) cond. 2	-	-	-	-0.18	-11.53

Notes: 1. (+) and (-) signs signify wind pressures acting toward & away from respective surfaces.
2. Per Code Section 6.1.4.1, the minimum wind load for MWFRS shall not be less than 10 psf.
3. References : a. ASCE 7-05, "Minimum Design Loads for Buildings and Other Structures".
b. "Guide to the Use of the Wind Load Provisions of ASCE 7-05"
by: Kishor C. Mehta and William L. Coulbourne (2010).
4. Roof zone #1 is applied for horizontal distance of 0 to h/2 from windward edge.
5. Roof zone #2 is applied for horizontal distance of h/2 to h from windward edge.

Determination of Gust Effect Factor, G:

Is Building Flexible? No f >=1 Hz.

1: Simplified Method for Rigid Building

G = 0.850

Parameters Used in Both Item #2 and Item #3 Calculations (from Table 6-2):

α^ =	0.143	
b^ =	0.84	
α(bar) =	0.250	
b(bar) =	0.45	
c =	0.30	
l =	320	ft.
ε(bar) =	0.333	
z(min) =	30	ft.

Calculated Parameters Used in Both Rigid and/or Flexible Building Calculations:

z(bar) =	94.20	= 0.6*h , but not < z(min) , ft.
Iz(bar) =	0.252	= c*(33/z(bar))^(1/6) , Eq. 6-5
Lz(bar) =	453.94	= l*(z(bar)/33)^(ε(bar)) , Eq. 6-7
gq =	3.4	(3.4, per Sect. 6.5.8.1)
gv =	3.4	(3.4, per Sect. 6.5.8.1)
gr =	4.218	= (2*(LN(3600*f)))^(1/2)+0.577/(2*LN(3600*f))^(1/2) , Eq. 6-9
Q =	0.805	= (1/(1+0.63*((B+h)/Lz(bar))^0.63))^(1/2) , Eq. 6-6

2: Calculation of G for Rigid Building

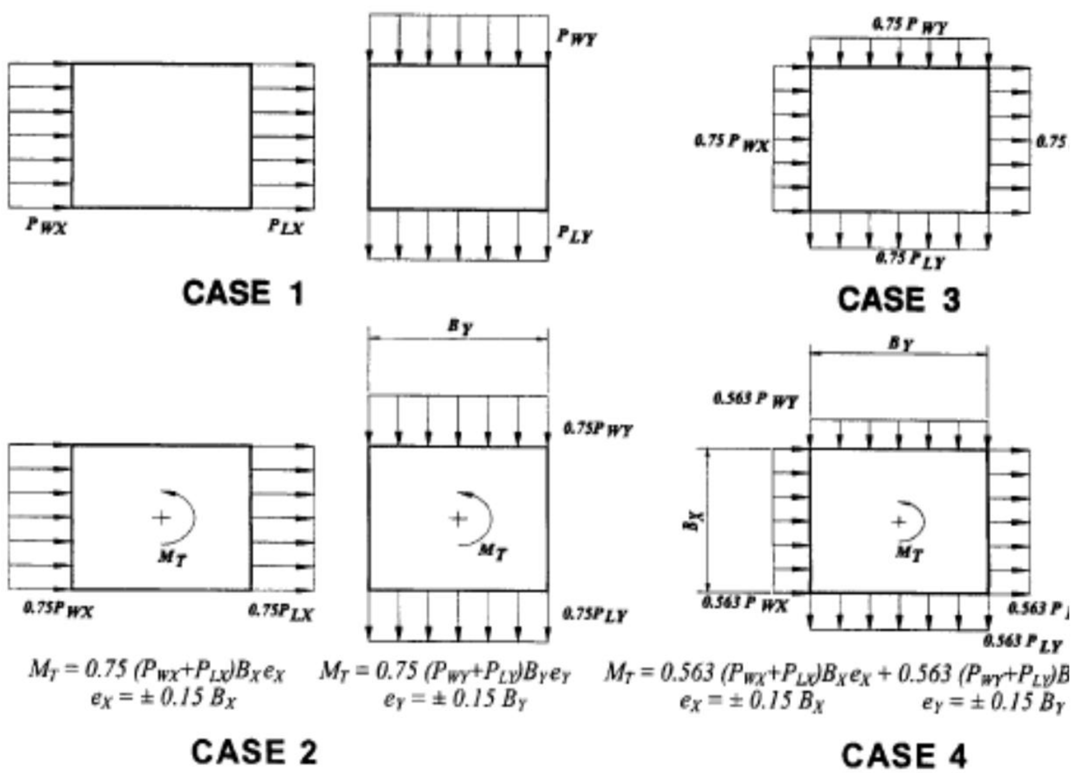
G = 0.818 = 0.925*((1+1.7*gq*Iz(bar)*Q)/(1+1.7*gv*Iz(bar))) , Eq. 6-4

3: Calculation of Gf for Flexible Building

β =	0.030	Damping Ratio
Ct =	0.020	Period Coefficient
T =	0.887	= Ct*h^(3/4) , sec. (Approximate fundamental period)
f =	1.127	= 1/T , Hz. (Natural Frequency)
V(fps) =	N.A.	= V(mph)*(88/60) , ft./sec.

V(bar,zbar) =	N.A.	= b(bar)*(z(bar)/33)^(α(bar))*V*(88/60) , ft./sec. , Eq. 6-14
N1 =	N.A.	= f*Lz(bar)/(V(bar,zbar)) , Eq. 6-12
Rn =	N.A.	= 7.47*N1/(1+10.3*N1)^(5/3) , Eq. 6-11
ηh =	N.A.	= 4.6*f*h/(V(bar,zbar))
Rh =	N.A.	= (1/ηh)-1/(2*ηh^2)*(1-e^(-2*ηh)) for ηh>0, or = 1 for ηh=0 ,
ηb =	N.A.	= 4.6*f*B/(V(bar,zbar))
RB =	N.A.	= (1/ηb)-1/(2*ηb^2)*(1-e^(-2*ηb)) for ηb>0, or = 1 for ηb=0,E
ηd =	N.A.	= 15.4*f*L/(V(bar,zbar))
RL =	N.A.	= (1/ηd)-1/(2*ηd^2)*(1-e^(-2*ηd)) for ηd>0, or = 1 for ηd=0 ,
R =	N.A.	= ((1/β)*Rn*Rh*RB*(0.53+0.47*RL))^(1/2) , Eq. 6-10
Gf =	N.A.	= 0.925*(1+1.7*Iz(bar)*(gq^2*Q^2+gr^2*R^2)^(1/2))/(1+1.7
Use: G =	0.818	

Figure 6-9 - Design Wind Load Cases of MWFRS for Buildings of All Heights



Case 1: Full design wind pressure acting on the projected area perpendicular to each principal axis

the structure, considered separately along each principal axis.

Case 2: Three quarters of the design wind pressure acting on the projected area perpendicular to e principal axis of the structure in conjunction with a torsional moment as shown, considered separately for each principal axis.

Case 3: Wind pressure as defined in Case 1, but considered to act simultaneously at 75% of the specified value. (Note: Load Case 3 would approximate "oblique" applied wind loading.)

Case 4: Wind pressure as defined in Case 2, but considered to act simultaneously at 75% of the specified value.

Notes: 1. Design wind pressures for windward (Pw) and leeward (PL) faces shall be determined in accordance with the provisions of Section 6.5.12.2.1 and 6.5.12.2.3 as applicable for buildi of all heights.

2. Above diagrams show plan views of building.

3. Notation:

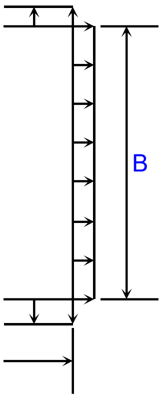
P_{wx}, P_{wy} = Windward face pressure acting in the X, Y principal axis, respectively.

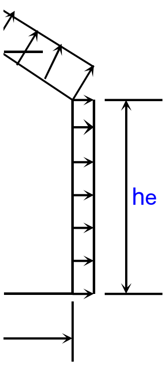
P_{Lx}, P_{Ly} = Leeward face pressure acting in the X, Y principal axis, respectively.

e (e_x, e_y) = Eccentricity for the X, Y principal axis of the structure, respectively.

M_T = Torsional moment per unit height acting about a vertical axis of the building.

Version 1.4





L = 100 ft.
B = 200 ft.

a)

l at z = h)
tructure)

2.1)

;n Press. (psf)
(w/ -GCpi)
18.13
18.13
19.14
19.98
20.71
21.36
21.94
22.48
22.97
23.43
23.86
24.65
25.36
26.01
26.61
27.70
28.66
29.40
29.40
29.40
-8.07
-13.84
-23.64
1.15
-13.84
1.15

User Input for Height, z (ft.):

N	Use Input Values?

,Eq. 6-13a,b

Eq. 6-13a,b

,Eq. 6-13a,b

*gv*Iz(bar)) ,
Eq. 6-8

P_{LX}

$_{LX}$

$\beta_Y e_Y$

of

each

ngs