Company
Address
City, State
Phone

JOB TITLE Example 3.3 & 4.1

JOB NO. **SHEET NO.**
CALCULATED BY **DATE**
CHECKED BY **DATE**

STRUCTURAL CALCULATIONS

FOR

20' Eave Height using MWFRS all heights procedure
20' Eave Height using MWFRS <60' procedure

Guide to Wind Load Procedures ASCE 7-22

Code Search

Code: ASCE 7 - 22

Occupancy:

Occupancy Group = B Business

Risk Category & Importance Factors:

Risk Category =	II
Wind Factor =	1.00
Snow Factor	1.00
Seismic Importance factor =	1.00

Type of Construction:

Fire Rating:

Roof =	0.0 hr
Floor =	0.0 hr

Building Geometry:

Roof angle (θ)	4.00 / 12	18.4 deg
Building length	250.0 ft	
Least width	200.0 ft	
Mean Roof Ht (h)	36.7 ft	
Parapet ht above grd	0.0 ft	
Minimum parapet ht	0.0 ft	
hb for Elevated bldg	0.0 ft	

Live Loads:

Roof

0 to 200 sf: 20 psf
200 to 600 sf: 24 - 0.02Area, but not less than 12 psf
over 600 sf: 12 psf

Floor:

Typical Floor	100 psf
Partitions	N/A

Company
Address
City, State
Phone

Example 3.3 & 4.1 Example 3.3 & 4.1

JOB NO. _____ **SHEET NO.** _____
CALCULATED BY _____ **DATE** _____
CHECKED BY _____ **DATE** _____

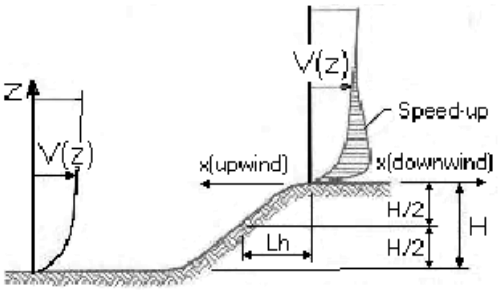
Wind Loads : ASCE 7- 22

Ultimate Wind Speed	115 mph
Nominal Wind Speed	89.1 mph
Risk Category	II
Exposure Category	C
Enclosure Classif.	Enclosed Building
Internal pressure	+/-0.18
Bldg Directionality (Kd)	0.85
Kh MWFRS<=60	1.022
Kh all other	1.022
Type of roof	Gable

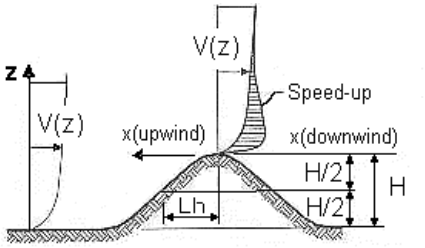
Topographic Factor (Kzt)

Topography		Flat
Hill Height	(H)	80.0 ft
Half Hill Length (Lh)		100.0 ft
Actual H/Lh	=	0.80
Use H/Lh	=	0.50
Modified Lh	=	160.0 ft
From top of crest: x =		50.0 ft
Bldg up/down wind?		downwind

H/Lh= 0.50 K_1 = 0.000
x/Lh = 0.31 K_2 = 0.792
z/Lh = 0.23 K_3 = 1.000
At Mean Roof Ht:
Kzt = $(1+K_1K_2K_3)^2$ = 1.00



ESCARPMENT



2D RIDGE or 3D AXISYMMETRICAL HILL

Gust Effect Factor

h = 36.7 ft
B = 200.0 ft
/z (0.6h) = 22.0 ft

Flexible structure if natural frequency < 1 Hz (T > 1 second).
If building h/B>4 then may be flexible and should be investigated.
h/B = 0.18 Rigid structure (low rise bldg)

G = 0.85 Using rigid structure default

Rigid Structure

ē =	0.20
ℓ =	500 ft
z_{min} =	15 ft
c =	0.20
g_Q, g_v =	3.4
L_z =	461.1 ft
Q =	0.84
I_z =	0.21
G =	**0.84**

Flexible or Dynamically Sensitive Structure

Natural Frequency (η_1) =	0.7 Hz			
Damping ratio (β) =	0.01			
/b =	0.660			
/α =	0.156			
Vz =	104.5			
N_1 =	3.09			
R_n =	0.069			
R_h =	0.534	η =	1.131	h = 36.7 ft
R_B =	0.149	η =	6.163	
R_L =	0.038	η =	25.789	
g_R =	4.104			
R =	0.547			
Gf =	0.960			

Company
Address
City, State
Phone

Example 3.3 & 4.1 Example 3.3 & 4.1

JOB NO. **SHEET NO.**
CALCULATED BY **DATE**
CHECKED BY **DATE**

Ground Elevation Factor (Ke)

Grd level above sea level =	0 ft	Ke =	1.0000
Constant =	0.00256		
0.00256Ke =	0.00256		

Enclosure Classification

Test for Enclosed Building: Ao < 0.01Ag or 4 sf, whichever is smaller

Test for Open Building: All walls are at least 80% open.
Ao ≥ 0.8Ag

Test for Partially Enclosed Building: Predominately open on one side only

	Input			Test	
Ao	500.0	sf	Ao ≥ 1.1Aoi	NO	
Ag	600.0	sf	Ao > 4sf or 0.01Ag	YES	
Aoi	1000.0	sf	Aoi / Agi ≤ 0.20	YES	Building is NOT
Agi	10000.0	sf			Partially Enclosed

Conditions to qualify as Partially Enclosed Building. Must satisfy all of the following:
- Ao ≥ 1.1Aoi
- Ao > smaller of 4sf or 0.01 Ag
- Aoi / Agi ≤ 0.20

Where:
Ao = the total area of openings in a wall that receives positive external pressure.
Ag = the gross area of that wall in which Ao is identified.
Aoi = the sum of the areas of openings in the building envelope (walls and roof) not including Ao.
Agi = the sum of the gross surface areas of the building envelope (walls and roof) not including Ag.

Test for Partially Open Building: A building that does not qualify as open, enclosed or partially enclosed.
(This type building will have same wind pressures as an enclosed building.)

Reduction Factor for large volume partially enclosed buildings (Ri) :

If the partially enclosed building contains a single room that is unpartitioned , the internal pressure coefficient may be multiplied by the reduction factor Ri.

Total area of all wall & roof openings (Aog):	-	SF
Unpartitioned internal volume (Vi) :	-	CF
Ri =	1.00	

Company
Address
City, State
Phone

Example 3.3 **JOB TITLE** Example 3.3 & 4.1

JOB NO. **SHEET NO.**
CALCULATED BY **DATE**
CHECKED BY **DATE**

Wind Loads - MWFRS all h (Except for Open Buildings)

Base pressure (qh) =	34.6 psf	Kh =	1.022	GCpi =	+/-0.18
(Kd qh) =	**29.4 psf**	Bldg dim parallel to ridge =	250.0 ft	G =	0.85
Roof Angle (θ) =	18.4 deg	Bldg dim normal to ridge =	200.0 ft	qi = qh	
Roof tributary area:		h =	36.7 ft		
Wind normal to ridge =(h/2)*L:	4588 sf	ridge ht =	53.4 ft		
Wind parallel to ridge =(h/2)*L:	3670 sf				

Ultimate Wind Surface Pressures (psf)

	Wind Normal to Ridge				Wind Parallel to Ridge			
	L/B = 0.80		h/L = 0.18		L/B = 1.25		h/L = 0.15	
Surface	Cp	q_hGC_p	w/+q_iGC_{pi}	w/-q_hGC_{pi}	Dist.*	Cp	q_hGC_p	w/ +q_iGC_{pi}	w/ -q_hGC_{pi}
Windward Wall (WW)	0.80	20.0	see table below			0.80	20.0	see table below	
Leeward Wall (LW)	-0.50	-12.5	-17.8	-7.2		-0.45	-11.2	-16.5	-6.0
Side Wall (SW)	-0.70	-17.5	-22.8	-12.2		-0.70	-17.5	-22.8	-12.2
Leeward Roof (LR)	-0.57	-14.2	-19.5	-8.9		Included in windward roof			
Neg Windward Roof pressure	-0.36	-9.1	-14.4	-3.8	0 to h/2*	-0.90	-22.5	-27.8	-17.2
Pos/min Windward Roof press.	0.14	3.4	-1.9	8.7	h/2 to h*	-0.90	-22.5	-27.8	-17.2
					h to 2h*	-0.50	-12.5	-17.8	-7.2
					> 2h*	-0.30	-7.5	-12.8	-2.2
					Min press.	-0.18	-4.5	-9.8	0.8

*Horizontal distance from windward edge

Windward roof overhangs : 20.0 psf (upward : add to qhGCp windward roof pressure)

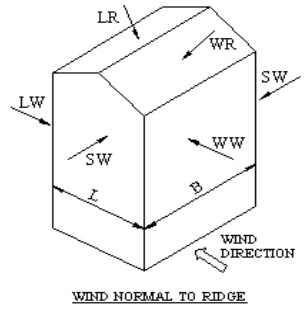
Parapet

z	Kz	Kzt	Kdqp (psf)
0.0 ft	0.851	1.00	0.0

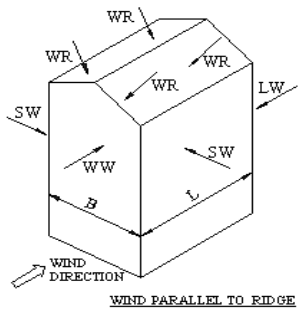
Windward parapet: 0.0 psf (GCpn = +1.5)
Leeward parapet: 0.0 psf (GCpn = -1.0)

Windward Wall Pressures at "z" (psf)

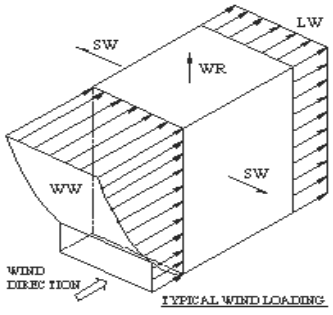
	z	Kz	Kzt	Windward Wall q_zGC_p	Windward Wall w/+q_iGC_{pi}	Windward Wall w/-q_hGC_{pi}	Combined WW + LW Wind Normal to Ridge	Combined WW + LW Wind Parallel to Ridge
	0 to 15'	0.85	1.00	16.7	11.4	21.9	29.2	27.9
	20.0 ft	0.90	1.00	17.7	12.4	23.0	30.2	28.9
	25.0 ft	0.94	1.00	18.5	13.2	23.8	31.0	29.7
	30.0 ft	0.98	1.00	19.2	13.9	24.5	31.7	30.4
h=	36.7 ft	1.02	1.00	20.0	14.7	25.3	32.5	31.2
ridge =	53.4 ft	1.10	1.00	21.6	16.3	26.9	34.1	32.8



WIND NORMAL TO RIDGE



WIND PARALLEL TO RIDGE



TYPICAL WIND LOADING

Company
Address
City, State
Phone

JOB TITLE Example 3.3 & 4.1

JOB NO. _____ **SHEET NO.** _____
CALCULATED BY _____ **DATE** _____
CHECKED BY _____ **DATE** _____

Wind Loads - MWFRS h≤60' (Low-rise Buildings) except for open buildings

Base pressure (qh) = 34.6 psf
(Kd qh) = **29.4 psf**
GCpi = +/-0.18

Kz = Kh = 1.022

Edge Strip (a) = 14.7 ft
End Zone (2a) = 29.4 ft
Zone 2 length = 91.8 ft

Wind Pressure Coefficients

	CASE A				CASE B		
		θ = 18.4 deg					
Surface	GCpf	w/-GCpi	w/+GCpi		GCpf	w/-GCpi	w/+GCpi
1	0.52	0.70	0.34		-0.45	-0.27	-0.63
2	-0.69	-0.51	-0.87		-0.69	-0.51	-0.87
3	-0.47	-0.29	-0.65		-0.37	-0.19	-0.55
4	-0.42	-0.24	-0.60		-0.45	-0.27	-0.63
5					0.40	0.58	0.22
6					-0.29	-0.11	-0.47
1E	0.78	0.96	0.60		-0.48	-0.30	-0.66
2E	-1.07	-0.89	-1.25		-1.07	-0.89	-1.25
3E	-0.67	-0.49	-0.85		-0.53	-0.35	-0.71
4E	-0.62	-0.44	-0.80		-0.48	-0.30	-0.66
5E					0.61	0.79	0.43
6E					-0.43	-0.25	-0.61

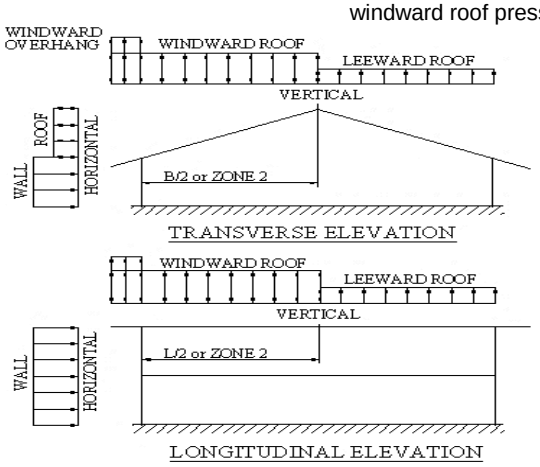
Ultimate Wind Surface Pressures (psf)

1		20.5	9.9		-7.9	-18.5
2		-15.0	-25.6		-15.0	-25.6
3		-8.5	-19.1		-5.6	-16.2
4		-6.9	-17.5		-7.9	-18.5
5					17.1	6.5
6					-3.2	-13.8
1E		28.2	17.6		-8.8	-19.4
2E		-26.2	-36.8		-26.2	-36.8
3E		-14.5	-25.1		-10.3	-20.9
4E		-12.9	-23.5		-8.8	-19.4
5E					23.2	12.6
6E					-7.4	-17.9

Parapet

Windward parapet = 0.0 psf (GCpn = +1.5)
Leeward parapet = 0.0 psf (GCpn = -1.0)

Windward roof overhangs = 20.6 psf (upward) add to windward roof pressure



Horizontal MWFRS Simple Diaphragm Pressures (psf)

Transverse direction (normal to L)

Interior Zone: Wall 27.4 psf
Roof -6.5 psf **
End Zone: Wall 41.1 psf
Roof -11.7 psf **

Longitudinal direction (parallel to L)

Interior Zone: Wall 20.3 psf
End Zone: Wall 30.6 psf

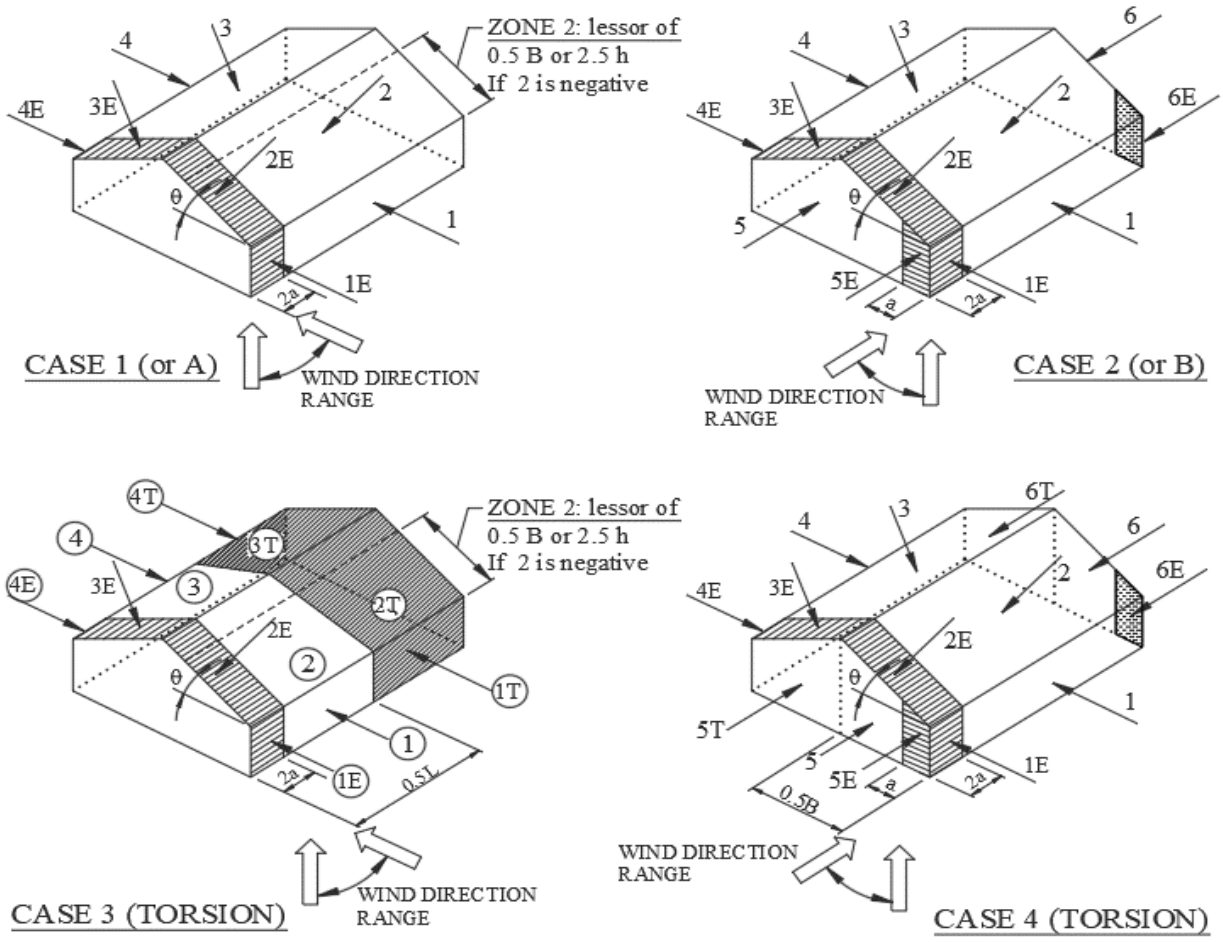
** NOTE: Total horiz force shall not be less than that determined by neglecting roof forces (except for MWFRS moment frames).

The code requires the MWFRS be designed for a min ultimate force of 16 psf multiplied by the wall area plus an 8 psf force applied to the vertical projection of the roof.

Company
Address
City, State
Phone

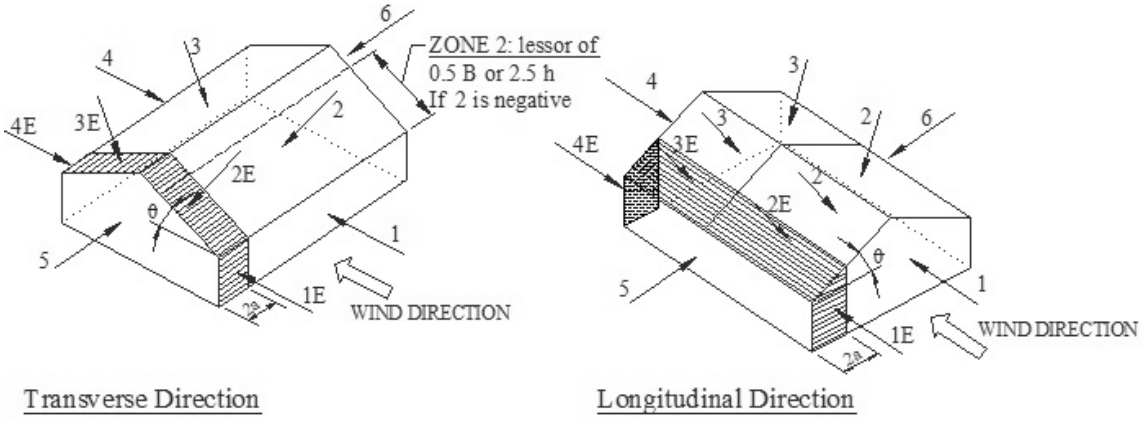
JOB TITLE Example 3.3 & 4.1

JOB NO. | SHEET NO.
CALCULATED BY | DATE
CHECKED BY | DATE



NOTE: Torsional loads are 25% of zones 1 - 6.
Exception: One story buildings h<30' and 1 to 2 storybuildings framed with light-frame construction or with flexible diaphragms need not be designed for the torsional load case.

ASCE 7-98 & ASCE 7-10 (& later) - MWFRS wind pressure zones



NOTE: Torsional loads are 25% of zones 1 - 4. See code for loading diagram.
Exception: One story buildings h<30' and 1 to 2 storybuildings framed with light-frame construction or with flexible diaphragms need not be designed for the torsional load case.

ASCE 7-02 and ASCE 7-05 - MWFRS wind pressure zones