ASCE 7-10
Wind Load Provisions
(Part 3)
Examples

by

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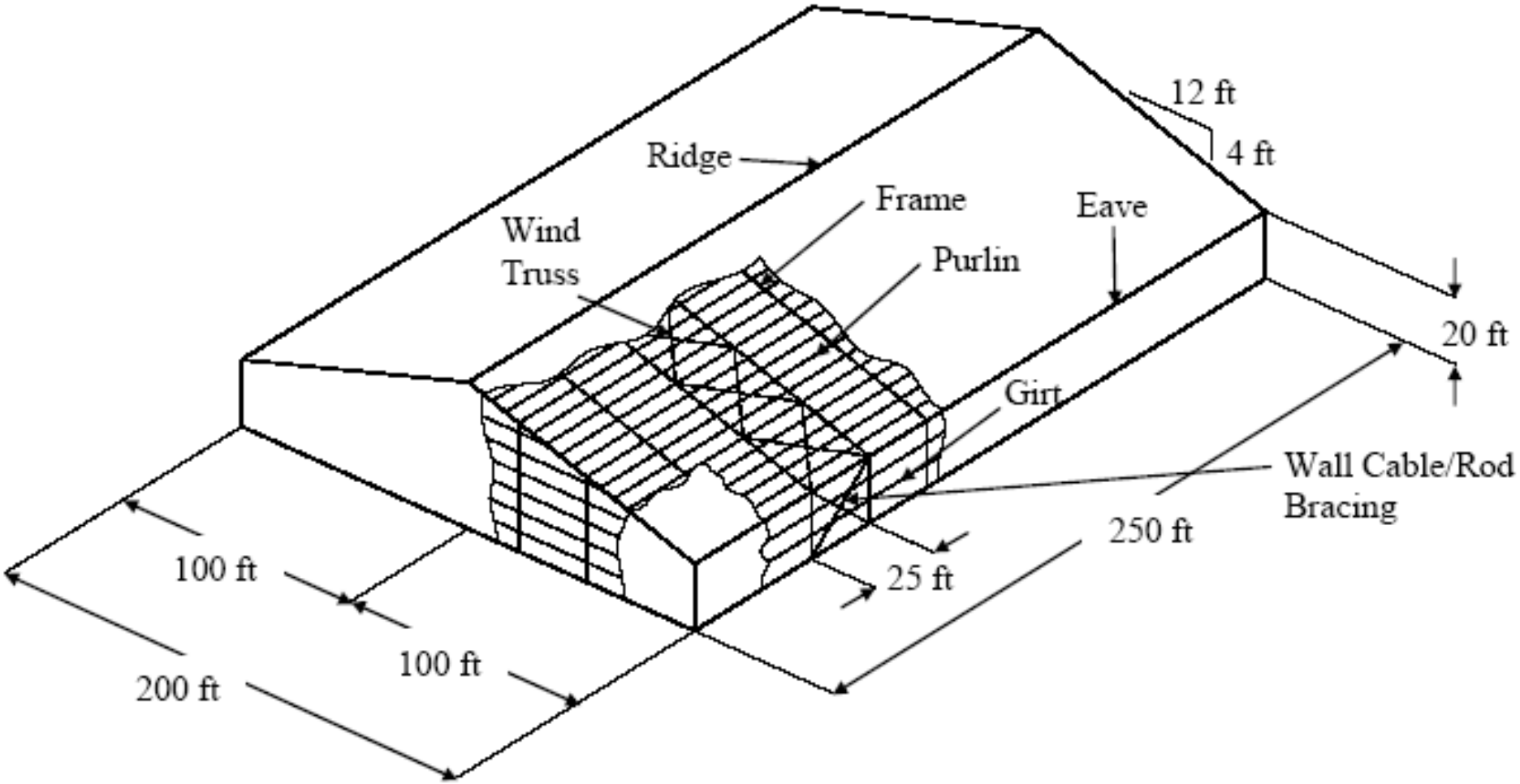
Example 1

In this example, design wind pressures for a large one-story commercial-industrial building are determined. The building data are as follows:

Location:	Memphis, TN
Terrain:	Flat farmland
Dimensions:	200 ft x 250 ft in plan
	Eave height of 20 ft
	Roof slope 4:12 (18.4 degrees)
Framing:	Rigid frame spans the 200 ft direction
	Rigid frame spacing is 25 ft
	Cross bracing in 250 ft direction
	Girts and purlins span between rigid frames (25 ft span)
	Girt spacing is 6 ft 8 in
	Purlin spacing is 5 ft
Cladding:	Roof panel dimensions are 2 ft x 20 ft
	Roof fastener spacing is 1 ft on center
	Wall panel dimensions are 2 ft x 20 ft
	Wall fastener spacing is 1 ft on center
	Openings uniformly distributed



Dimensions and Framing of Building in Example 1

Example 1

Exposure and Building Classification
The building is located in flat open farmland, therefore Exposure C.

The building function is industrial-commercial. It is not considered to have a substantial risk to human life nor does failure of the building pose a substantial threat to the community. Failure of the building could pose more than a low risk to human life given the potential occupancy of the building, thus the building is considered a Risk Category II (Table 1-1).

Basic Wind Speed
Selection of the basic wind speed is addressed in Section 26.5.1. Memphis, TN is not located in special wind region nor is there any reason to suggest that winds at the site are unusual or require additional attention. The Risk Category II wind speed map is Figure 26.5-1A and the basic wind speed V = 115 mph (3-second peak gust).

Design Procedure
Directional Method from Chapter 27 will be used for this example for MWFRS and Chapter 30 will be used for C&C.

Directionality Factor K_d

Wind directionality K_d is given in Table 26.6-1.

This factor is the same for both MWFRS and C&C.

Structure Type	Directionality Factor K_d*
Buildings	
Main Wind Force Resisting System	0.85
Components and Cladding	0.85
Arched Roofs	0.85
Chimneys, Tanks, and Similar Structures	
Square	0.90
Hexagonal	0.95
Round	0.95
Solid Signs	0.85
Open Signs and Lattice Framework	0.85
Trussed Towers	
Triangular, square, rectangular	0.85
All other cross sections	0.95

Velocity Pressure q

Velocity Pressure

The velocity pressures are computed using Equation 27.3-1 of the standard.

$$q_z = 0.00256 K_z K_{zt} K_d V^2 \quad \text{psf}$$

For this example, K_z is obtained from Table 27.3-1; $K_{zt} = 1.0$ (no topographic effects); $K_d = 0.85$, and $V = 115$ mph.
Substituting these values into Equation 27.3-1 yields:

$$q_z = 0.00256 K_z (1.0)(.85)(115)^2$$
$$q_z = 28.8 K_z \text{ psf}$$

Values for K_z are shown on the next slide.
The mean roof height is 36.7 ft.

Table 27.3-1

Height above ground level, z		Exposure (Note 1)			
		B		C	D
ft	(m)	Case 1	Case 2	Cases 1 & 2	Cases 1 & 2
0-15	(0-4.6)	0.70	0.57	0.85	1.03
20	(6.1)	0.70	0.62	0.90	1.08
25	(7.6)	0.70	0.66	0.94	1.12
30	(9.1)	0.70	0.70	0.98	1.16
40	(12.2)	0.76	0.76	1.04	1.22
50	(15.2)	0.81	0.81	1.09	1.27
60	(18)	0.85	0.85	1.13	1.31
70	(21.3)	0.89	0.89	1.17	1.34
80	(24.4)	0.93	0.93	1.21	1.38
90	(27.4)	0.96	0.96	1.24	1.40
100	(30.5)	0.99	0.99	1.26	1.43
120	(36.6)	1.04	1.04	1.31	1.48
140	(42.7)	1.09	1.09	1.36	1.52
160	(48.8)	1.13	1.13	1.39	1.55
180	(54.9)	1.17	1.17	1.43	1.58
200	(61.0)	1.20	1.20	1.46	1.61
250	(76.2)	1.28	1.28	1.53	1.68
300	(91.4)	1.35	1.35	1.59	1.73
350	(106.7)	1.41	1.41	1.64	1.78
400	(121.9)	1.47	1.47	1.69	1.82
450	(137.2)	1.52	1.52	1.73	1.86
500	(152.4)	1.56	1.56	1.77	1.89

Notes:

1. **Case 1:** a. All components and cladding.
   b. Main wind force resisting system in low-rise buildings designed using Figure 6-10.

   Case 2: a. All main wind force resisting systems in buildings except those in low-rise buildings designed using Figure 6-10.
   b. All main wind force resisting systems in other structures.

Example 1

Velocity Pressures, psf

Height, ft.	K_z	q_z, psf
0 – 15	0.85	24.5
Eave ht. = 20	0.90	25.9
30	0.98	28.2
h = 36.7	1.02	29.4*
40	1.04	29.9
50	1.09	31.4
Ridge ht. = 53.3	1.10	31.7
*q_h = 29.4 psf		

Design wind pressures for MWFRS of this building can be obtained using Section 27.4.1 of the Standard for the directional method or Section 28.4.1 for the envelope method. Pressures determined in this example are using buildings of all heights criteria. Ex. 7.

$$p = qGCp - qi(GCpi) \quad \text{(Eq. 27.4-1)}$$

where

$q = qz$ for windward wall at height z above ground

$q = qh$ for leeward wall, side walls, and roof

$qi = qh$ for enclosed buildings

G = Gust effect factor

Cp = Values obtained from Figure 27.4-1 of the Standard

($GCpi$) = Values obtained from Table 26.11-1

For this example, when the wind is normal to the ridge, the windward roof experiences both positive and negative external pressures. Combining these external pressures with positive and negative internal pressures will result in four loading cases when wind is normal to the ridge. When wind is parallel to the ridge, positive and negative internal pressures result in two loading cases. The external pressure coefficients, Cp for $\theta = 0°$, apply in this case.

Gust Effect Factor

For rigid structures, G can be calculated using Eq. 26.9-6 (see Section 26.9 of the Standard) or alternatively taken as 0.85. For simplicity, $G = 0.85$ is used in this example.

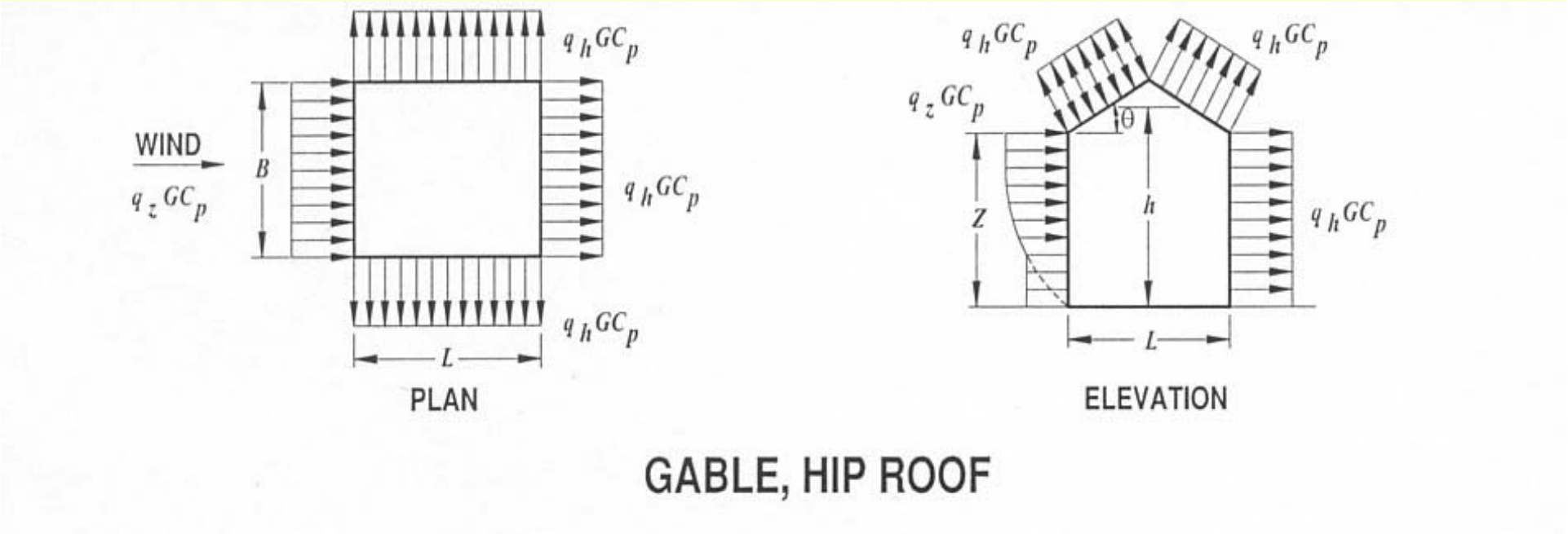
Example 1

External Wall C_p from Figure 27.4-1

The pressure coefficients for the windward wall and for the side walls are 0.8 and -0.7, respectively, for all *L/B* ratios. The leeward wall pressure coefficient is a function of the *L/B* ratio. For wind normal to the ridge, *L/B* = 200/250 = 0.8; therefore, the leeward wall pressure coefficient is -0.5. For flow parallel to the ridge, *L/B* = 250/200 = 1.25; the value of C_p is obtained by linear interpolation.

Wall Pressure Coefficients, C_n			
Surface	**L/B**	**C_p**	**Use With**
Windward Wall	All values	0.8	q_z
Leeward Wall	0-1	-0.5	q_h
	2	-0.3	
	≥4	-0.2	
Side Wall	All values	-0.7	q_h

Example 1



GABLE, HIP ROOF

Example 1

External Roof C_p from Figure 27.4-1 (Wind Normal to Ridge)

The roof pressure coefficients for the MWFRS are obtained from Figure 27.4-1 of the Standard. For the roof angle of 18.4°, linear interpolation is used to establish C_p. For wind normal to the ridge, h/L = 36.7/200 = 0.18; hence, only single linear interpolation is required. Note that interpolation is only carried out between values of the same sign.

Roof *Cp* (Wind Normal to Ridge)

Surface	15°	18.4°	20°
Windward roof	-0.5 0.0	-0.36* 0.14*	-0.3 0.2
Leeward roof	-0.5	-0.57*	-0.6

* By linear interpolation.

Roof Pressure Coefficients, C_p, for use with q_h												
Wind Direction	Windward									Leeward		
	Angle, θ (degrees)									Angle, θ (degrees)		
	h/L	10	15	20	25	30	35	45	≥60#	10	15	≥20
Normal to ridge for θ ≥ 10°	≤0.25	-0.7 -0.18	-0.5 0.0*	-0.3 0.2	-0.2 0.3	-0.2 0.3	0.0* 0.4	0.4	0.01 θ	-0.3	-0.5	-0.6
	0.5	-0.9 -0.18	-0.7 -0.18	0.4 0.0*	-0.3 0.2	-0.2 0.2	-0.2 0.3	0.0* 0.4	0.01 θ	-0.5	-0.5	-0.6
	≥1.0	-1.3** -0.18	-1.0 -0.18	-0.7 -0.18	-0.5 0.0*	-0.3 0.2	-0.2 0.2	0.0* 0.3	0.01 θ	-0.7	-0.6	-0.6

Example 1

Internal (GC_{pi})

Values for (GC_{pi})for buildings are addressed in Section 26.11 and Table 26.11-1 of the Standard.

The openings are evenly distributed in the walls (enclosed building) and Memphis, Tennessee, is not in a hurricane-prone region. The reduction factor of Section 26.11.1.1 is not applicable for enclosed buildings; therefore,

$$(GC_{pi}) = \pm 0.18$$

Example 1

MWFRS Net Pressures

$$p = qGCp - qi(GCpi) \qquad \text{(Eq. 27.4-1)}$$
$$p = q(0.85)Cp - 29.4(\pm 0.18)$$

where

$q = q_z$ for windward wall

$q = q_h$ for leeward wall, side wall, and roof

$q_i = q_h$ for windward walls, side walls, leeward walls, and roofs of enclosed buildings

Typical Calculation

Windward wall, 0-15 ft, wind normal to ridge:

$p = 24.5(0.85)(0.8) - 29.4(\pm 0.18)$

$p = 11.4$ psf with (+) internal pressure

$p = 21.9$ psf with (-) internal pressure

Example 1

The net pressures for the MWFRS are summarized in the following table.

MWFRS Pressures: Wind Normal to Ridge

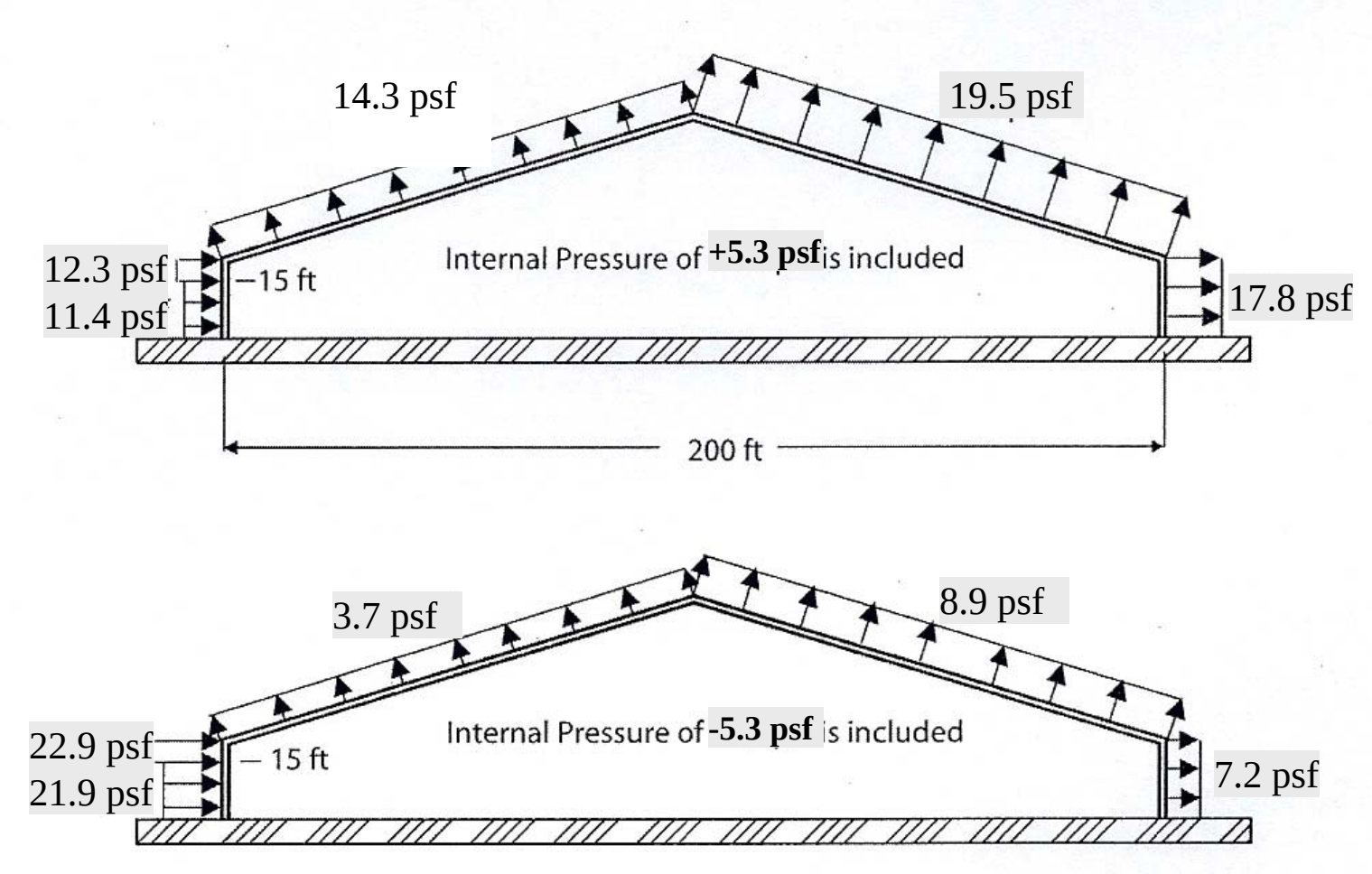
Surface	z (ft)	q (psf)	G	C_p	Net pressure psf with $(+GC_{pi})$	Net pressure psf with $(-GC_{pi})$
Windward wall	0-15	24.5	0.85	0.8	11.4	21.9
	20	25.9	0.85	0.8	12.3	22.9
Leeward wall	All	29.4	0.85	-0.5	-17.8	-7.2
Side walls	All	29.4	0.85	-0.7	-22.8	-12.2
Windward Roof*	-	29.4	0.85	-0.36	-14.3	-3.7
				0.14	-1.8	8.8
Leeward roof	-	29.4	0.85	-0.57	-19.5	-8.9

Notes:

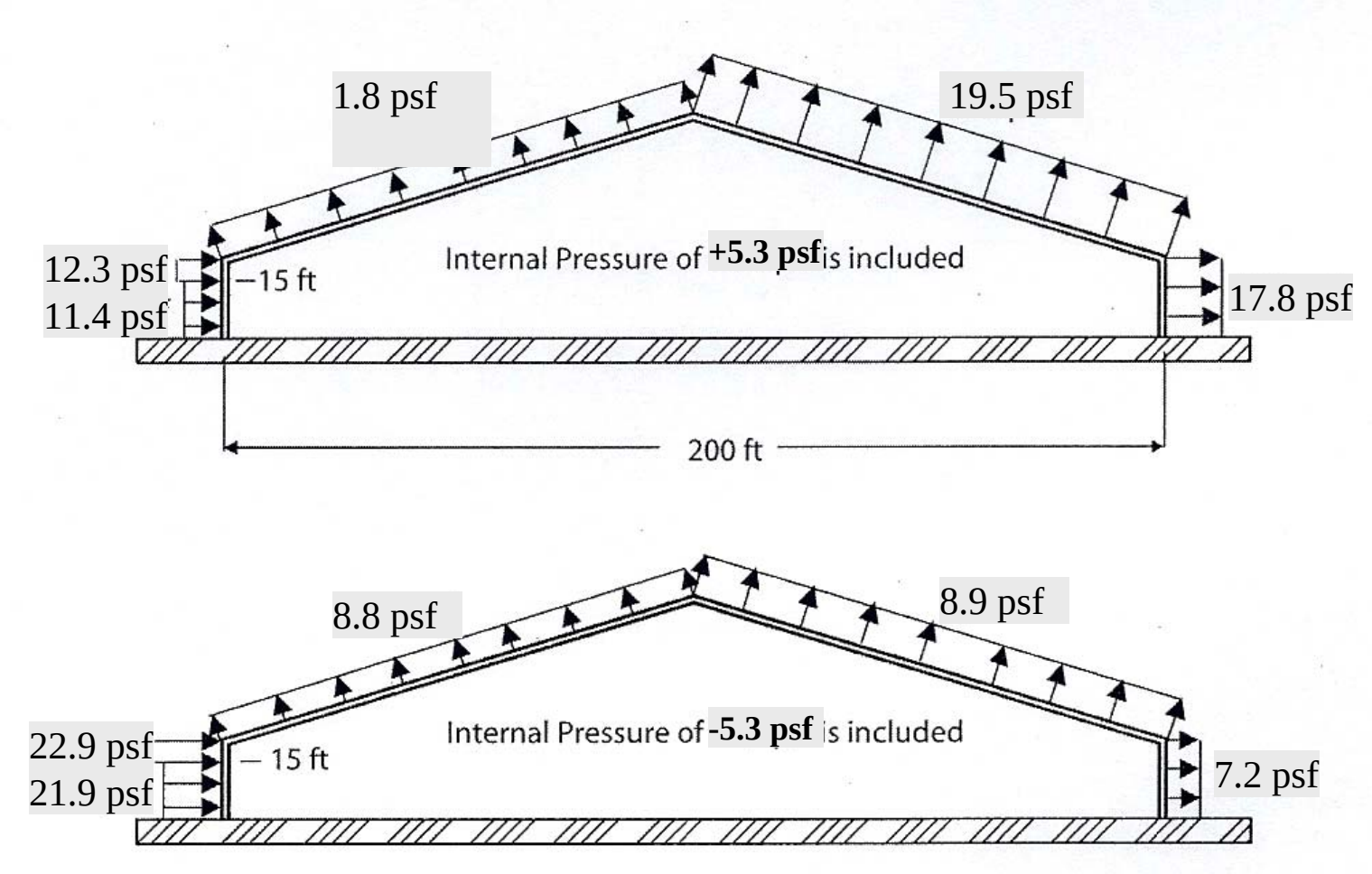
q_h = 29.4 psf; (GC_{pi}) = ±0.18; $q_h(GC_{pi})$ = ±5.3 psf.

* Two loadings on windward roof and two internal pressures yield a total of four loading cases.

Example 1 – wind normal to ridge



Example 1 – wind normal to ridge



Example 1

External Roof C_p from Figure 6-6 for Wind Parallel to Ridge

For wind parallel to the ridge, ***h/L* = 36.7/250 = 0.147** and **θ < 10°**. The values of C_p for wind parallel to ridge are obtained from Figure 27.4-1 of the Standard.

Roof C_p (Wind Parallel to Ridge)

Surface	*h/L*	Distance from windward edge	C_p
Roof	≤ 0.5	0 to *h*	-0.9, -0.18*
		h to 2*h*	-0.5, -0.18*
		> 2*h*	-0.3, -0.18*

* The values of smaller uplift pressures on the roof can become critical when wind load is combined with roof live load or snow load; load combination are given in Sections 2.3 and 2.4 of the Standard. For brevity, loading for this value is not shown in this example.

		Horiz distance from windward edge	C_p	*Value is provided for interpolation purposes. **Value can be reduced linearly with area over which it is applicable as follows	
Normal to ridge for θ < 10 and Parallel to ridge for all θ	≤ 0.5	0 to h/2	-0.9, -0.18		
		H/2 to h	-0.9, -0.18		
		h to 2 h	-0.5, -0.18		
		> 2h	-0.3, -0.18		
	≥ 1.0	0 to h/2	-1.3**, -0.18	Area (sq ft)	Reduction Factor
				≤ 100 (9.3 sq m)	1.0
		> h/2	-0.7, -0.18	200 (23.2 sq m)	0.9
				≥ 1000 (92.9 sq m)	0.8

MWFRS Pressures: Wind Parallel to Ridge

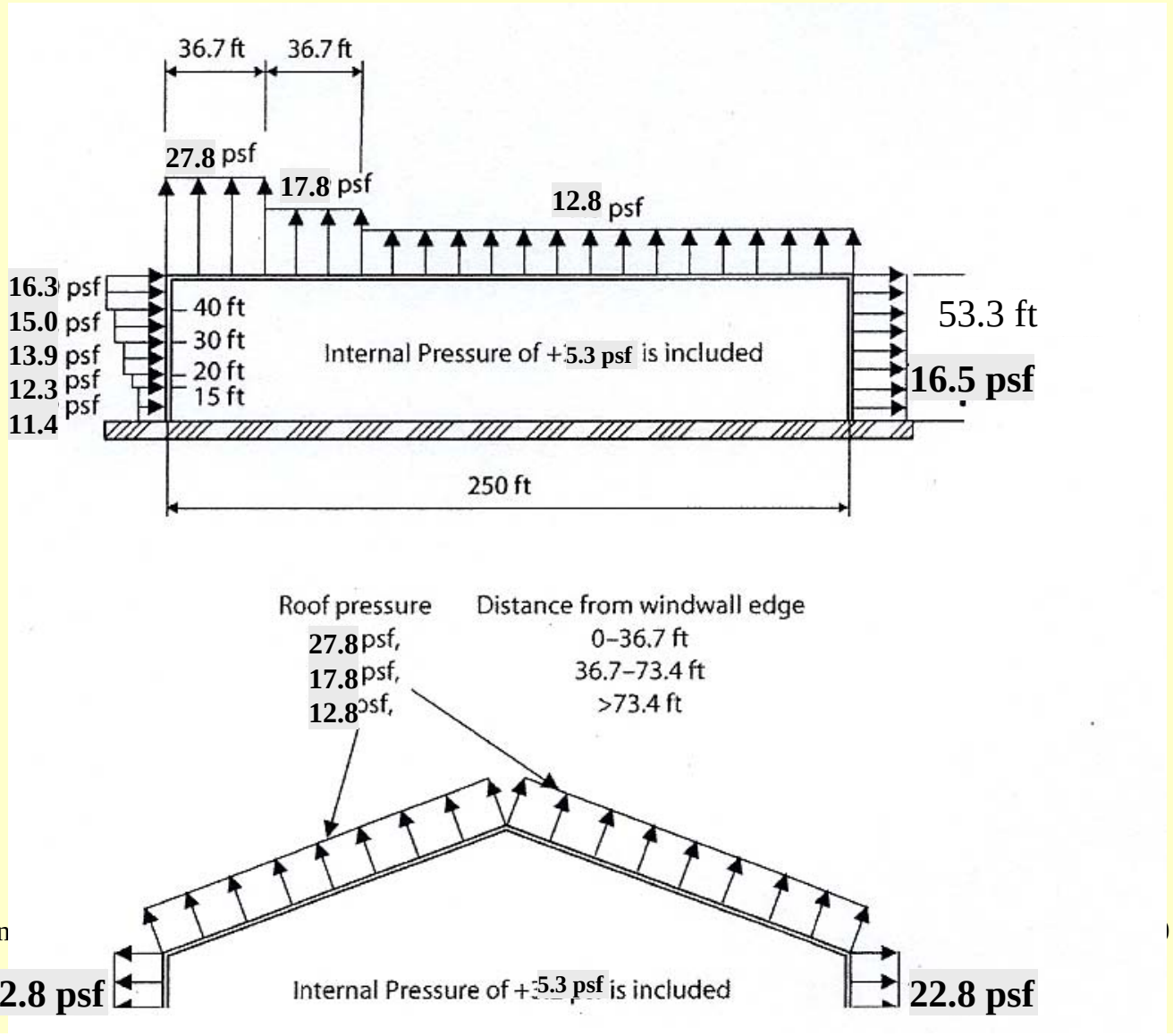
Surface		z (ft)	q (psf)	G	C_p	Net pressure psf with $(+GC_{pi})$	Net pressure psf with $(-GC_{pi})$
	Windward wall	0-15	24.5	0.85	0.8	11.4	21.9
		20	25.9	0.85	0.8	12.3	22.9
		30	28.2	0.85	0.8	13.9	24.5
		40	29.9	0.85	0.8	15.0	25.6
		53.3	31.7	0.85	0.8	16.3	26.8
	Leeward wall	All	29.4	0.85	-0.45	-16.5	-5.9
	Side walls	All	29.4	0.85	-0.7	-22.8	-12.2
	Roof*	0 to h*	29.4	0.85	-0.9	-27.8	-17.6
		h to 2h*	29.4	0.85	-0.5	-17.8	-7.2
		> 2h*	29.4	0.85	-0.3	-12.8	-2.2

Notes:

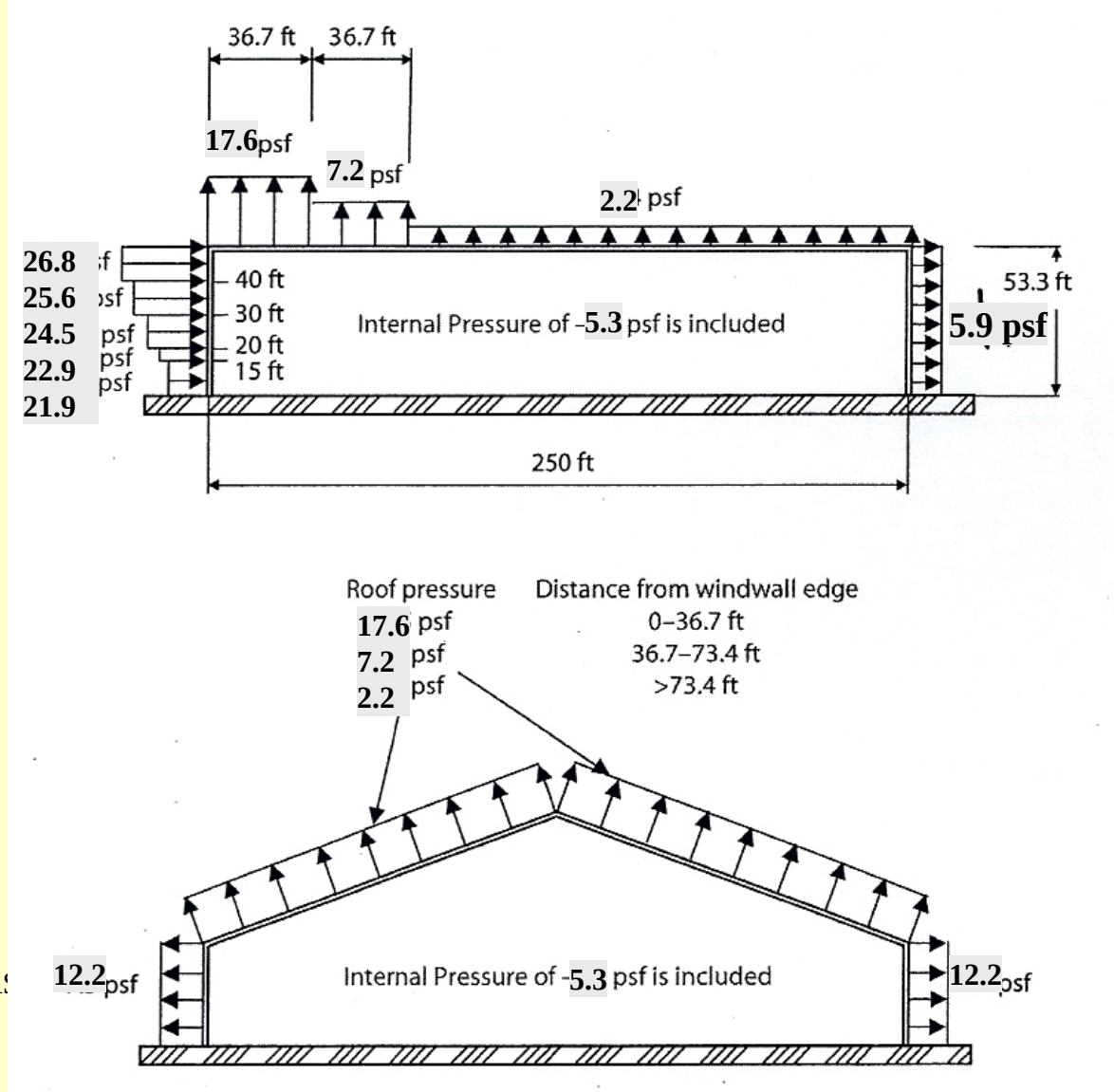
q_h = 29.4 psf; (GC_{pi}) = ±0.18; h = 36.7 ft; $q_h(GC_{pi})$ = ±5.3 psf.

* Distance from windward edge.

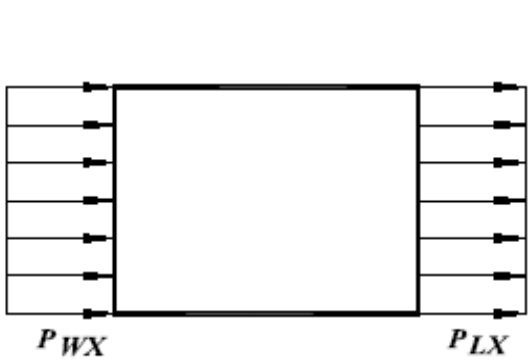
Example 1 – wind parallel to ridge

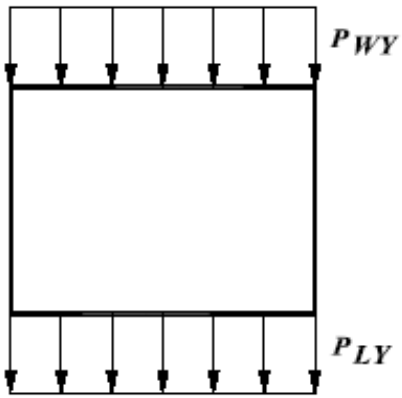


Example 1 – wind parallel to ridge

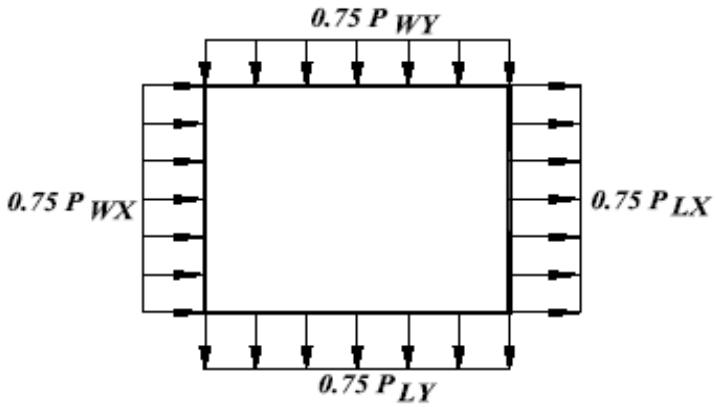


Example 1





CASE 1



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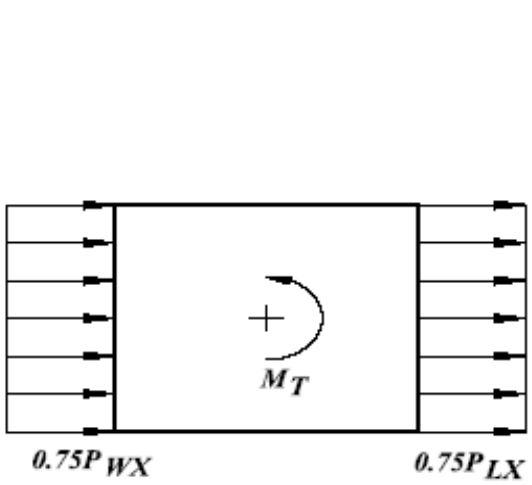
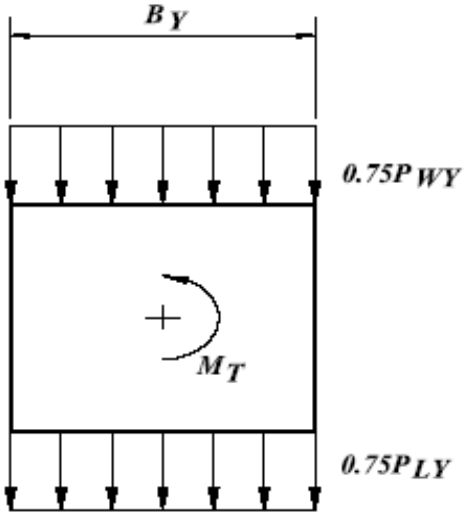
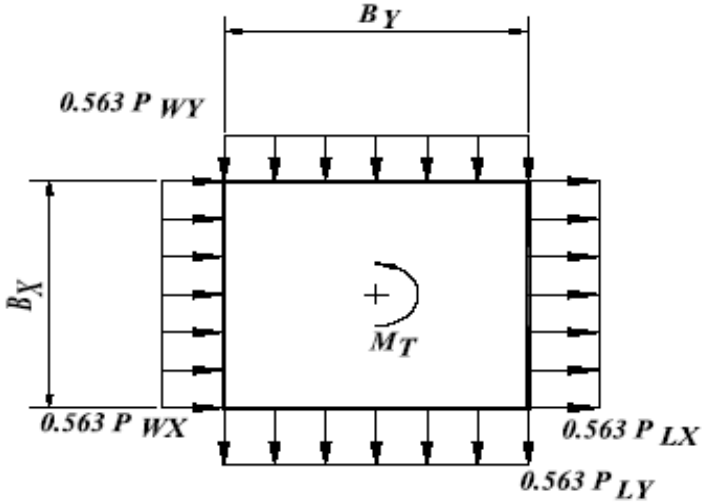




$M_T = 0.75\ (P_{WX}+P_{LX})B_X e_X$
$e_X = \pm\ 0.15\ B_X$

$M_T = 0.75\ (P_{WY}+P_{LY})B_Y e_Y$
$e_Y = \pm\ 0.15\ B_Y$

CASE 2



$M_T = 0.563\ (P_{WX}+P_{LX})B_X e_X + 0.563\ (P_{WY}+P_{LY})B_Y e_Y$
$e_X = \pm\ 0.15\ B_X$ $\quad$ $e_Y = \pm\ 0.15\ B_Y$

CASE 4

Example 1

Design Pressures for C&C (Chapter 30)

Eq. 30.4-1 of the Standard is used to obtain the design pressures for components and cladding:

$$p = q_h[(GC_p) - (GC_{pi})] \qquad \text{(Eq. 30.4-1)}$$

where

q_h = 29.4 psf

(GC_p) = Values obtained from Figure 30.4-1

(GC_{pi}) = ± 0.18 for this building

Wall C&C Pressures

The pressure coefficients (GC_p) are a function of effective wind area. The definitions of effective wind area for a component or cladding panel is the span length multiplied by an effective width that need not be less than one-third the span length; however, for a fastener it is the area tributary to an individual fastener.

Girt:

larger of

$A = 25(6.67) = 167$ ft^2

or

$A = 25(25/3) = 208$ ft^2 (controls)

Wall Panel:

larger of

$A = 6.67(2) = 13.3$ ft^2

or

$A = 6.67(6.67/3) = 14.8$ ft^2 (controls)

Fastener:

$A = 6.67(1) = 6.7$ ft^2

Wall Coefficients (*GCp*) in Figure 30.4-1

C&C	A(ft^2)	External (GC_p)		
		Zones 4 and 5	Zone 4	Zone 5
Girt	208	0.77*	-0.87	-0.93
Panel	14.8	0.97	-1.07	-1.34
Fastener	6.7	1.00	-1.10	-1.40
Other	≤ 10	1.00	-1.10	-1.40
Other	≥ 500	0.70	-0.80	-0.80

Other C&C can be doors, windows, etc.

Alternative GC_p Calculation

Walls for Buildings with $h \leq 60$ ft (Figure 6-11A)

Positive: Zones 4 and 5

$(GCp) = 1.0$ for $A = 10$ ft^2

$(GCp) = 1.1766 - 0.1766 \log A$ for $10 < A < 500$ ft^2

$(GCp) = 0.7$ for $A > 500$ ft^2

Negative: Zone 4

$(GCp) = -1.1$ for $A = 10$ ft^2

$(GCp) = -1.2766 + 0.1766 \log A$ for $10 < A < 500$ ft^2

$(GCp) = -0.8$ for $A > 500$ ft^2

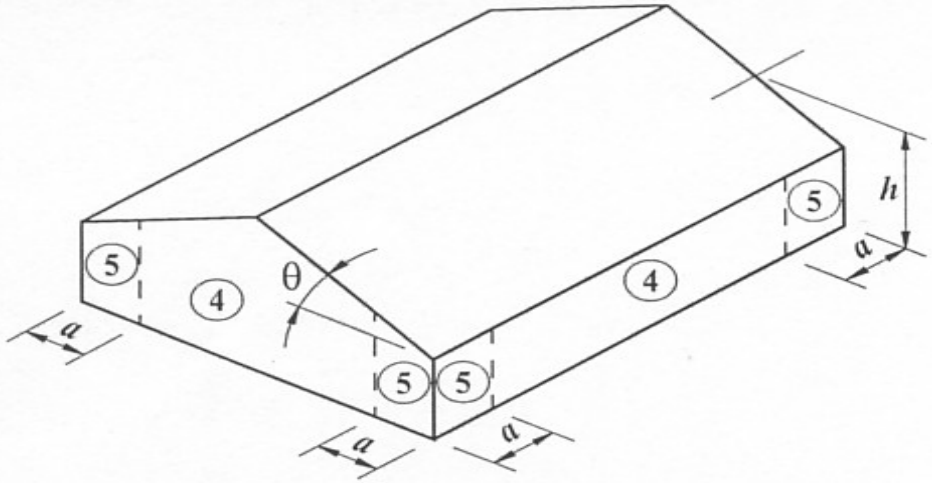
Negative: Zone 5

$(GCp) = -1.4$ for $A = 10$ ft^2

$(GCp) = -1.7532 + 0.3532 \log A$ for $10 < A < 500$ ft^2

$(GCp) = -0.8$ for $A > 500$ ft^2

Source: ASCE 7 Guide to the Wind Load Provisions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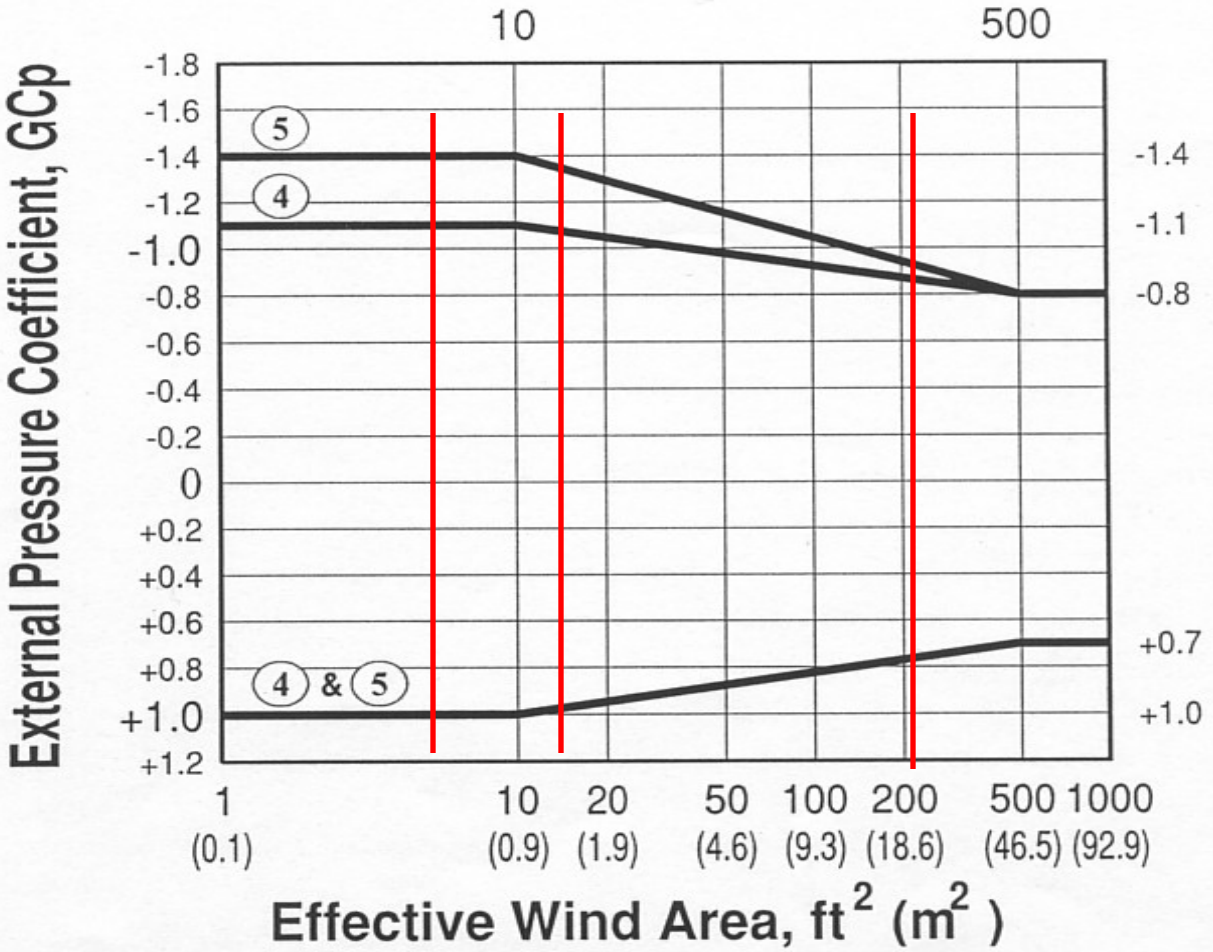
10
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External Pressure Coefficient, GCp
-1.8
-1.6
-1.4
-1.2
-1.0
-0.8
-0.6
-0.4
-0.2
0
+0.2
+0.4
+0.6
+0.8
+1.0
+1.2
5
4
4 & 5
-1.4
-1.1
-0.8
+0.7
+1.0
1 (0.1)
10 (0.9)
20 (1.9)
50 (4.6)
100 (9.3)
200 (18.6)
500 (46.5)
1000 (92.9)
Effective Wind Area, ft 2 (m 2)

Typical calculations of design pressures for girt in Zone 4

For maximum negative pressure:

p = 29.4[(-0.87) – (±0.18)]

p = -30.9 psf with positive internal pressure (controls)

p = -20.3 psf with negative internal pressure

For maximum positive pressure:

p = 29.4[(0.77) – (±0.18)]

p = 17.3 psf with positive internal pressure

p = 27.9 psf with negative internal pressure (controls)

Net Wall Component Pressures (psf)

	Controlling design pressures (psf)			
	Zone 4		Zone 5	
C&C	Positive	Negative	Positive	Negative
Girt	27.9	-30.9	27.9	-32.6
Panel	33.8	-36.8	33.8	-44.7
Fastener	34.7	-37.6	34.7	-46.4
A ≤ 10 ft^2	34.7	-37.6	34.7	-46.4
A ≥ 500 ft^2	25.9	-28.8	25.9	-28.8

Roof C&C Pressures

Effective wind areas of roof C&C (Table 4-25):

Purlin:

larger of

$A = 25(5) = 125$ ft^2

or

$A = 25(25/3) = 208$ ft^2(controls)

Panel:

larger of

$A = 5(2) = 10$ ft^2(controls)

or

$A = 5(5/3) = 8.3$ ft^2

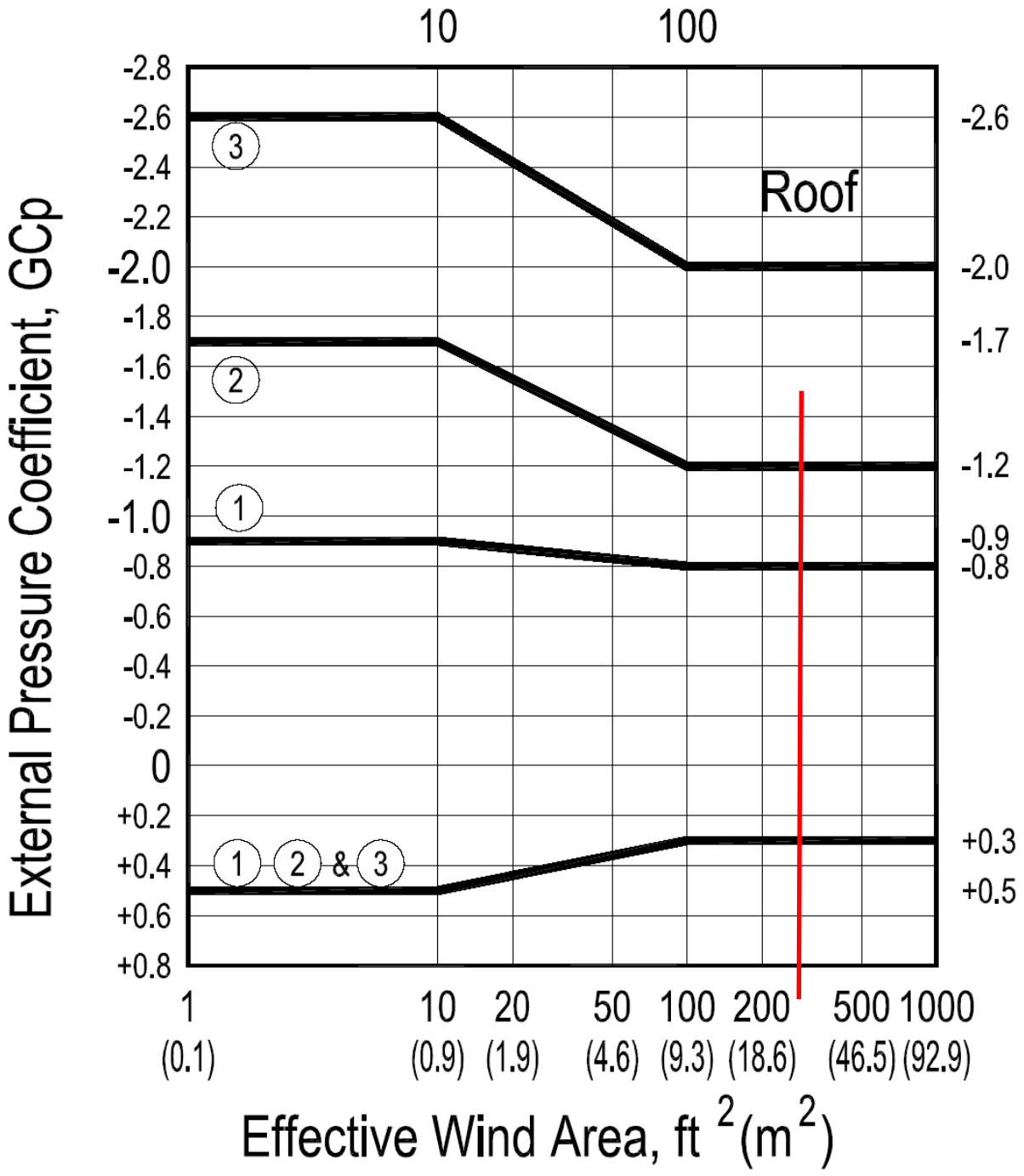
Fastener:

$A = 5(1) = 5$ ft^2

Roof Coefficients (GC_p) in Figure 30.4-2B; 7° < θ ≤ 27°

		External (GC_p)			
Component	A (ft^2)	Zones 1, 2, and 3	Zone 1	Zone 2	Zone 3
Purlin	208	0.3	-0.8	-1.2	-2.0
Panel	10	0.5	-0.9	-1.7	-2.6
Fastener	5	0.5	-0.9	-1.7	-2.6
Other*	≤ 10	0.5	-0.9	-1.7	-2.6
Other*	≥ 100	0.3	-0.8	-1.2	-2.0

* Other C&C can be skylight, etc.


10
100
-2.8
-2.6
-2.4
-2.2
-2.0
-1.8
-1.6
-1.4
-1.2
-1.0
-0.8
-0.6
-0.4
-0.2
0
+0.2
+0.4
+0.6
+0.8
External Pressure Coefficient, GCp
Roof
3
2
1
1 2 & 3
-2.6
-2.0
-1.7
-1.2
-0.9
-0.8
+0.3
+0.5
1 (0.1)
10 (0.9)
20 (1.9)
50 (4.6)
100 (9.3)
200 (18.6)
500 (46.5)
1000 (92.9)
Effective Wind Area, ft 2 (m 2)

Typical calculations of design pressures for a purlin in Zone 1 are as follows and roof C&C pressures are summarized below:

For maximum negative pressure

$p = 29.4[(-0.8) – (\pm 0.18)]$

p = -28.8 psf with positive internal pressure (controls)

p = -18.2 psf with negative internal pressure

For maximum positive pressure

$p = 29.4[(0.3) – (\pm 0.18)]$

p = 3.5 psf with positive internal pressure

p = 14.1 psf with negative internal pressure

p = 16 psf minimum net pressure (controls) (Section 30.2.2 of the Standard)

Net Controlling Roof Component Pressures (psf)

	Controlling design pressures (psf)			
Component	Positive	Negative		
	Zones 1, 2, and 3	Zone 1	Zone 2	Zone 3
Purlin	16.0*	-28.8	-40.6	-64.1
Panel	20.0	-31.8	-55.3	-81.7
Fastener	20.0	-31.8	-55.3	-81.7
$A \leq 10$ ft^2	20.0	-31.8	-55.3	-81.7
$A \geq 500$ ft^2	16.0*	-28.8	-40.6	-64.1

* Minimum net pressure controls (Section 30.2.2 of the Standard).

Special case of girt that transverses Zones 4 and 5:

Width of Zone 5:

smaller of

a = 0.1(200) = 20 ft

or

a = 0.4(36.7) = 14.7 ft (controls)

but not less than

0.04(200) = 8 ft

or 3 ft

Weighted average design pressure:

$$P = \frac{14.7(-32.6)+10.3(-30.9)}{25} = -31.9 \text{ psf}$$

This procedure of using a weighted average may be used for other components and cladding.

Special Case of Strut Purlin (interior)

Strut purlins in the end bay experience combined uplift pressure as a roof component (C&C) and axial load as part of the MWFRS

Component Pressure

End bay purlin located in Zones 1 and 2

Width of Zone 2, a = 14.7 ft

Weighted average design pressure: =

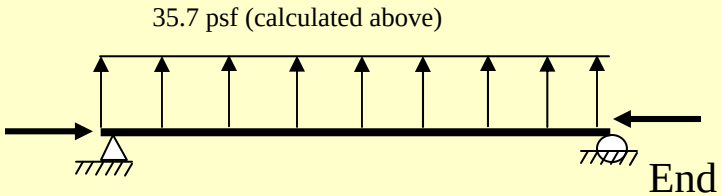
$$\frac{14.7(-40.6)+10.3(-28.8)}{25} = -35.7 \text{ psf}$$

(Purlins in Zones 2 and 3 will have higher pressures)

MWFRS Load

Design pressure on end wall has wind parallel to ridge with positive internal pressure (consistent with high uplift on the purlin). Assuming that the end wall is supported at the bottom and at the roof line, the effective axial load on an end bay purlin can be determined.

Combined Design Loads on Interior Strut Purlin



End wall reaction at roof rafter.

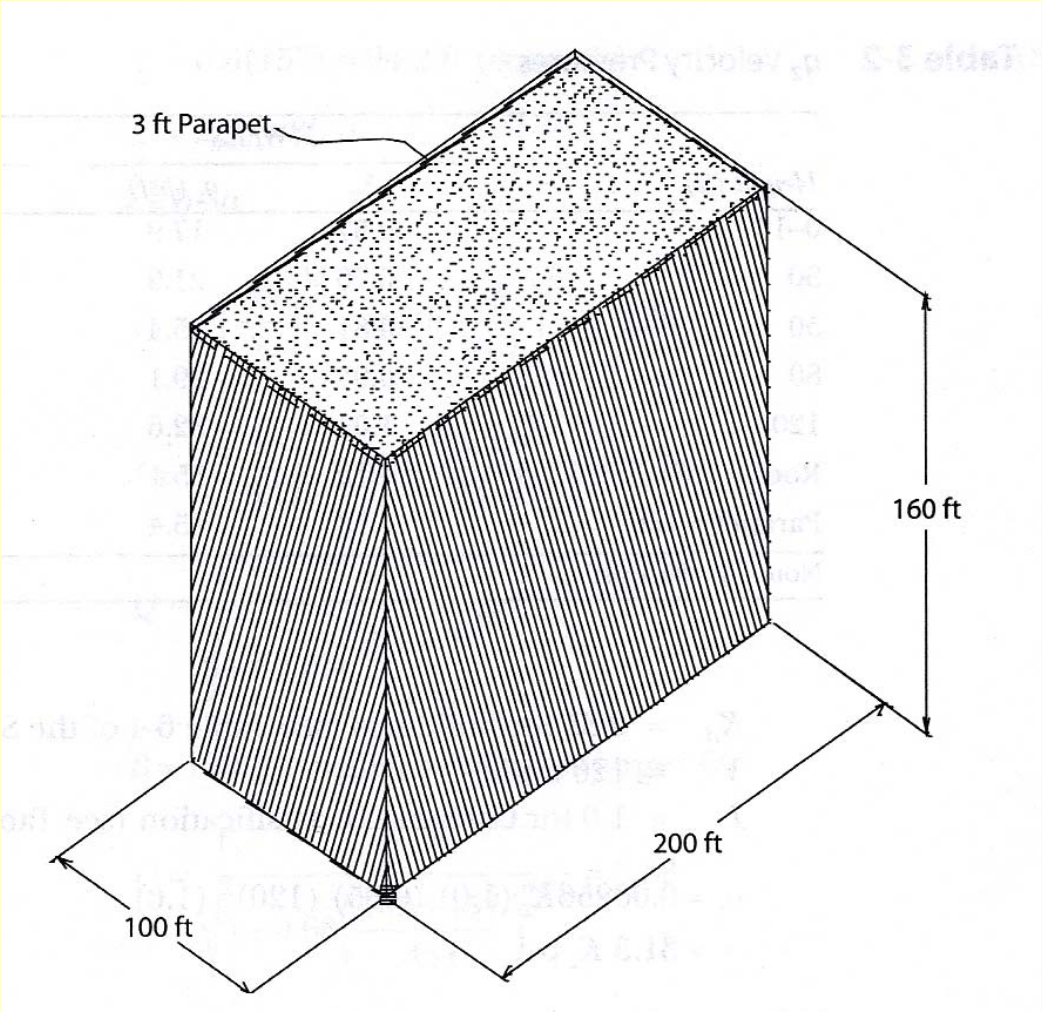
Questions on Example 1?

Example 2

Location:	Near Houston, Texas
Topography:	Homogeneous
Terrain:	Suburban
Dimensions:	100 ft × 200 ft in plan
	Roof height of 157 ft with 3-ft parapet
	Flat roof
Framing:	Reinforced concrete rigid frame in both directions
	Floor and roof slabs provide diaphragm action
	Fundamental natural frequency is greater than 1 Hz
	(Since the height to least horizontal dimension is less than 4, the fundamental frequency is judged to be greater than 1 Hz.)
Cladding:	Mullions for glazing panels span 11 ft between floor slabs
	Mullion spacing is 5 ft

Glazing panels are 5-ft wide × 5-ft 6 in. high (typical); they are wind-borne debris impact resistant in the bottom 60 ft as required by Section 26.10.3 of the standard

Example 2



Exposure

The building is located in a suburban area; according to Section 26.7 of the Standard, Exposure B is used.

Building Classification

The building function is office space. It is not considered an essential facility or likely to be occupied by 300 persons in a single area at one time. Therefore, building Category II is appropriate (see Table 1.4-1 of the Standard).

Basic Wind Speed

Selection of the basic wind speed is addressed in Section 26.5 of the Standard. Vicinity of Houston, Texas, is located on the 140-mph contour. The basic wind speed V = 140 mph (see Figure 26.5.1A of the Standard).

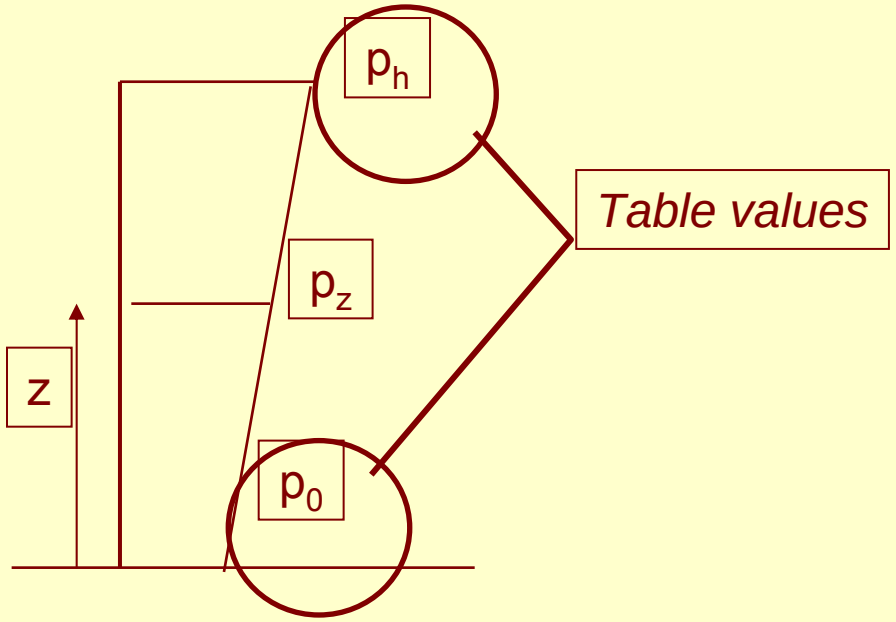
Simplified Method

- **Part 2 – Enclosed Buildings with h ≤ 160 ft. Section 27.5.1**
- **Criteria Required to Meet Definition**
  - Enclosed simple diaphragm building √
  - Mean roof height ≥ 60 ft. ≤ 160 ft. √
  - L/B ≥ 0.5 ≤ 2.0 √
  - Fundamental frequency ≥ 75/h √
  - K_{zt} = 1.0 √

MWFRS Calculation Method

- ***Pressure p_z (psf):***

  $$p_z = p_0 (1 - z / h) + (z / h) p_h$$



Wall Pressure Table 27.6-1

V(mph)	140		
h(ft.), L/B	0.5	1	2
160	66.3	65.4	59.7
	44.6	44.0	36.8
150	63.9	63.1	57.6
	43.5	43.0	36.0

Mean roof height h = 157 ft.

Interpolate between 160 ft and 150 ft. to determine p_0 and p_h pressures

L/B = 100/200 = 0.5 200/100 = 2.0

Net MWFRS Wall Pressures from Tables

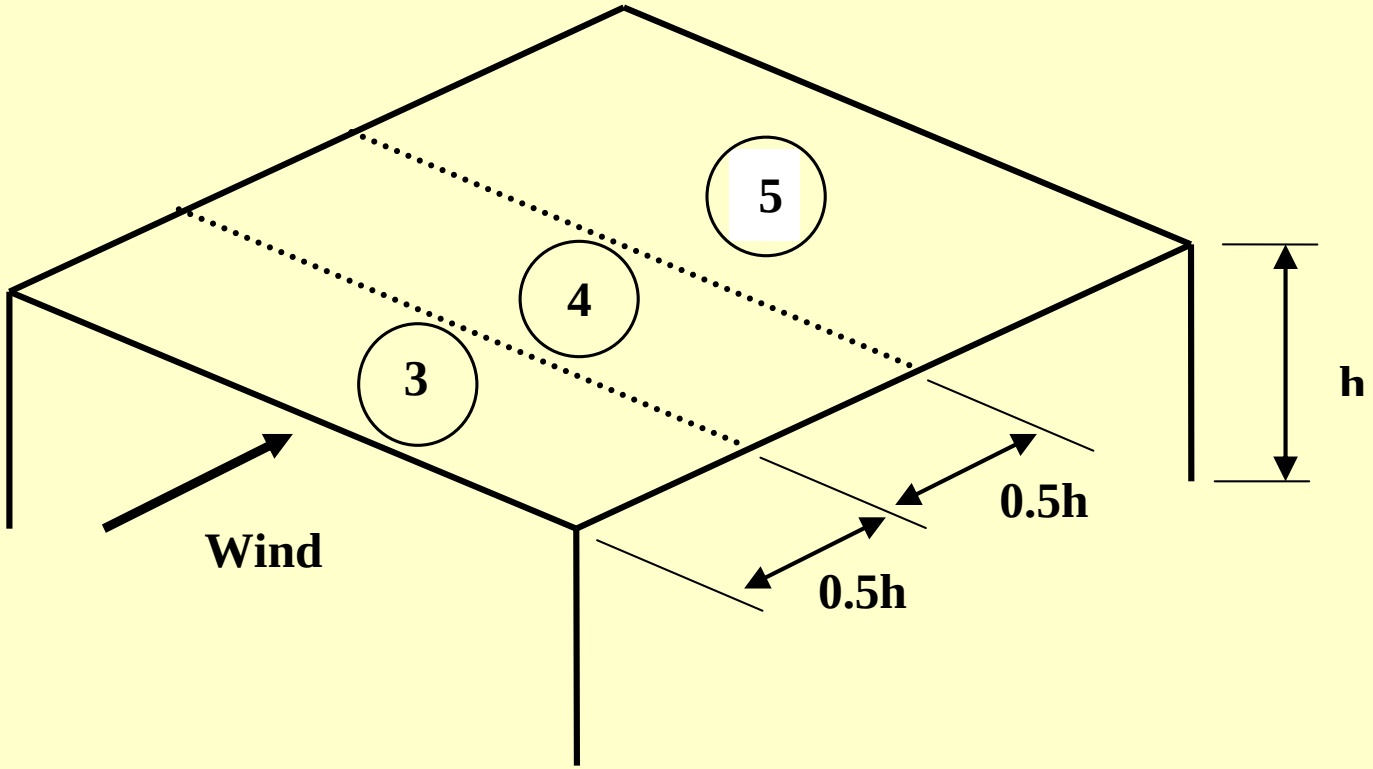
z, ft.	Normal to 200-ft. wall, psf	Normal to 100-ft. wall, psf
0	44.3	36.6
30	48.4	40.9
50	51.1	43.8
80	55.2	48.1
120	60.6	53.8
157	65.6	59.1
160	66.3	59.7

Interpolation/Other Surfaces

	L/B = 0.5		L/B = 2.0	
157 mph	p_h	65.6 psf	p_h	59.1 psf
	p_0	44.3 psf	p_0	36.6 psf

	L/B = 0.5	L/B = 2.0
	Pressures, psf	Pressures, psf
Side walls	54% of p_h	64 % of p_h
	35.4	37.8
Leeward	38% of p_h	27% of p_h
	24.9	16.0

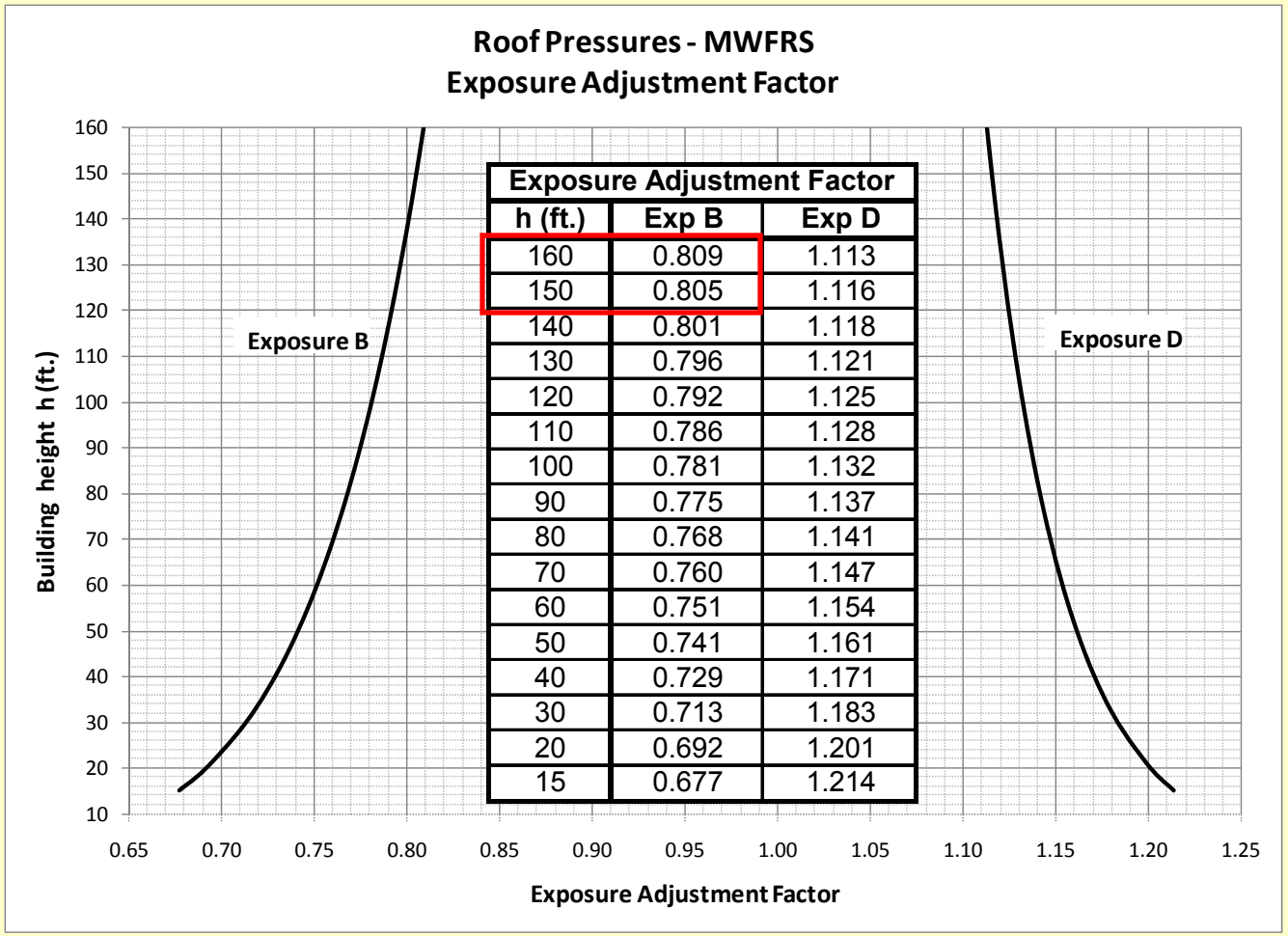
Roof Pressure Zone



MWFRS Roof Pressure Table 27.6-2

V (MPH)			130					140					150				
h (ft)	Roof Slope	Load Case	1	2	Zone 3	4	5	1	2	Zone 3	4	5	1	2	Zone 3	4	5
160	Flat < 2:12 (9.46 deg)	1	NA	NA	-54.5	-48.6	-39.8	NA	NA	-63.2	-56.3	-46.2	NA	NA	-72.5	-64.6	-53.0
		2	NA	NA	0.0	0.0	0.0	NA	NA	0.0	0.0	0.0	NA	NA	0.0	0.0	0.0
	3:12 (14.0 deg)	1	-53.4	-36.3	-54.5	-48.6	-39.8	-62.0	-42.1	-63.2	-56.3	-46.2	-71.1	-48.4	-72.5	-64.6	-53.0
		2	7.7	-10.8	0.0	0.0	0.0	8.9	-12.6	0.0	0.0	0.0	10.3	-14.4	0.0	0.0	0.0
	4:12 (18.4 deg)	1	-43.9	-35.5	-54.5	-48.6	-39.8	-51.0	-41.1	-63.2	-56.3	-46.2	-58.5	-47.2	-72.5	-64.6	-53.0
		2	15.2	-15.6	0.0	0.0	0.0	17.6	-18.1	0.0	0.0	0.0	20.2	-20.7	0.0	0.0	0.0
	5:12 (22.6 deg)	1	-35.2	-35.5	-54.5	-48.6	-39.8	-40.9	-41.1	-63.2	-56.3	-46.2	-46.9	-47.2	-72.5	-64.6	-53.0
		2	20.2	-17.0	0.0	0.0	0.0	23.5	-19.7	0.0	0.0	0.0	27.0	-22.6	0.0	0.0	0.0
	6:12 (26.6 deg)	1	-28.3	-35.5	-54.5	-48.6	-39.8	-32.8	-41.1	-63.2	-56.3	-46.2	-37.7	-47.2	-72.5	-64.6	-53.0
		2	22.4	-17.0	0.0	0.0	0.0	25.9	-19.7	0.0	0.0	0.0	29.8	-22.6	0.0	0.0	0.0
	9:12 (36.9 deg)	1	-16.4	-35.5	-54.5	-48.6	-39.8	-19.0	-41.1	-63.2	-56.3	-46.2	-21.8	-47.2	-72.5	-64.6	-53.0
		2	26.7	-17.0	0.0	0.0	0.0	31.0	-19.7	0.0	0.0	0.0	11.4	-22.6	0.0	0.0	0.0
	12:12 (45.0 deg)	1	-9.2	-35.5	-54.5	-48.6	-39.8	-10.7	-41.1	-63.2	-56.3	-46.2	-12.3	-47.2	-72.5	-64.6	-53.0
		2	26.7	-17.0	0.0	0.0	0.0	31.0	-19.7	0.0	0.0	0.0	35.6	-22.6	0.0	0.0	0.0
150	Flat < 2:12 (9.46 deg)	1	NA	NA	-53.7	-47.9	-39.3	NA	NA	-62.3	-55.6	-45.6	NA	NA	-71.5	-63.8	-52.3
		2	NA	NA	0.0	0.0	0.0	NA	NA	0.0	0.0	0.0	NA	NA	0.0	0.0	0.0
	3:12 (14.0 deg)	1	-52.7	-35.8	-53.7	-47.9	-39.3	-61.1	-41.6	-62.3	-55.6	-45.6	-70.2	-47.7	-71.5	-63.8	-52.3
		2	7.6	-10.7	0.0	0.0	0.0	8.8	-12.4	0.0	0.0	0.0	10.1	-14.2	0.0	0.0	0.0
	4:12 (18.4 deg)	1	-43.3	-35.0	-53.7	-47.9	-39.3	-50.3	-40.6	-62.3	-55.6	-45.6	-57.7	-46.6	-71.5	-63.8	-52.3
		2	15.0	-15.4	0.0	0.0	0.0	17.4	-17.8	0.0	0.0	0.0	20.0	-20.4	0.0	0.0	0.0
	5:12 (22.6 deg)	1	-34.8	-35.0	-53.7	-47.9	-39.3	-40.3	-40.6	-62.3	-55.6	-45.6	-46.3	-46.6	-71.5	-63.8	-52.3
		2	20.0	-16.7	0.0	0.0	0.0	23.2	-19.4	0.0	0.0	0.0	26.6	-22.3	0.0	0.0	0.0
	6:12 (26.6 deg)	1	-27.9	-35.0	-53.7	-47.9	-39.3	-32.4	-40.6	-62.3	-55.6	-45.6	-37.2	-46.6	-71.5	-63.8	-52.3
		2	22.1	-16.7	0.0	0.0	0.0	25.6	-19.4	0.0	0.0	0.0	29.4	-22.3	0.0	0.0	0.0
	9:12 (36.9 deg)	1	-16.2	-35.0	-53.7	-47.9	-39.3	-18.8	-40.6	-62.3	-55.6	-45.6	-21.5	-46.6	-71.5	-63.8	-52.3
		2	26.4	-16.7	0.0	0.0	0.0	30.6	-19.4	0.0	0.0	0.0	11.3	-22.3	0.0	0.0	0.0
	12:12 (45.0 deg)	1	-9.1	-35.0	-53.7	-47.9	-39.3	-10.6	-40.6	-62.3	-55.6	-45.6	-12.1	-46.6	-71.5	-63.8	-52.3
		2	26.4	-16.7	0.0	0.0	0.0	30.6	-19.4	0.0	0.0	0.0	35.1	-22.3	0.0	0.0	0.0
140	Flat < 2:12 (9.46 deg)	1	NA	NA	-53.0	-47.2	-38.7	NA	NA	-61.4	-54.8	-44.9	NA	NA	-70.5	-62.9	-51.5
		2	NA	NA	0.0	0.0	0.0	NA	NA	0.0	0.0	0.0	NA	NA	0.0	0.0	0.0
	3:12 (14.0 deg)	1	-52.0	-35.3	-53.0	-47.2	-38.7	-60.3	-41.0	-61.4	-54.8	-44.9	-69.2	-47.0	-70.5	-62.9	-51.5
		2	7.5	-10.5	0.0	0.0	0.0	8.7	-12.2	0.0	0.0	0.0	10.0	-14.0	0.0	0.0	0.0
	4:12 (18.4 deg)	1	-42.7	-34.5	-53.0	-47.2	-38.7	-49.5	-40.0	-61.4	-54.8	-44.9	-56.9	-45.9	-70.5	-62.9	-51.5
		2	14.8	-15.1	0.0	0.0	0.0	17.2	-17.6	0.0	0.0	0.0	19.7	-20.2	0.0	0.0	0.0
	5:12 (22.6 deg)	1	-34.3	-34.5	-53.0	-47.2	-38.7	-39.7	-40.0	-61.4	-54.8	-44.9	-45.6	-45.9	-70.5	-62.9	-51.5

Roof Pressure Table 27.6-2



Exposure Adjustment Factor		
h (ft.)	Exp B	Exp D
160	0.809	1.113
150	0.805	1.116
140	0.801	1.118
130	0.796	1.121
120	0.792	1.125
110	0.786	1.128
100	0.781	1.132
90	0.775	1.137
80	0.768	1.141
70	0.760	1.147
60	0.751	1.154
50	0.741	1.161
40	0.729	1.171
30	0.713	1.183
20	0.692	1.201
15	0.677	1.214

Net MWFRS Roof Pressures

Interpolate between heights for Exposure B. Exposure Adjustment Factor is 0.808. Pressures read from Table 27.6-2 are interpolated and then adjusted by the Exposure Adjustment Factor.

Roof Zone	Distance from edge	L/B = 0.5, psf	Distance from edge	L/B = 2.0, psf
3	0.5h or 0-79 ft.	- 50.8	0.5 h or 0-79 ft.	- 50.8
4	1 h or 80 – 159 ft.	- 45.3	80 – 100 ft.	- 45.3
5	160 – 200 ft.	- 37.2		

C&C – Example 2

- C&C pressures in Table 30.7-2

$$p = p_{table}(EAF)(RF)K_{zt}$$

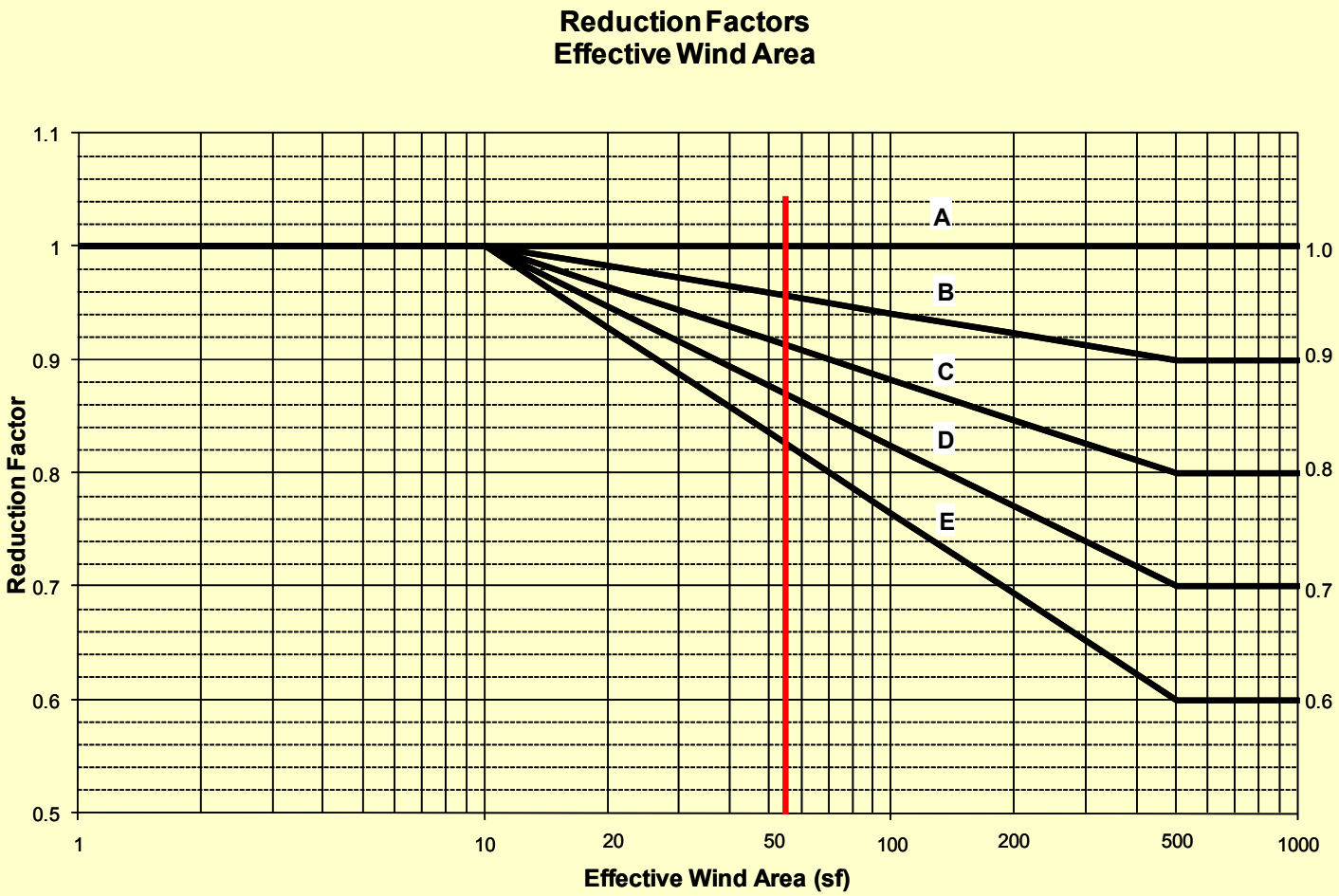
- EAF = exposure adjustment factor
- RF = reduction factor for effective wind areas

C&C Wall Design Pressures

The pressure coefficients (*GCp*) are a function of effective wind area. The definition of effective wind area for a C&C panel is the span length multiplied by an effective width that need not be less than one-third the span length (see Section 26.2 of the Standard). The effective wind areas, *A*, for wall components are:

Mullion:
larger of
***A* =11(5) = 55 ft2 (controls)**
or
A = 11(11/3) = 40.3 ft2
Glazing panel:
larger of
***A* = 5(5.5) = 27.5 ft2 (controls)**
or
A = 5(5/3) = 8.3 ft2
Width of corner Zone 5:
larger of
***a* = 0.1(100) = 10 ft (controls)**
or
a = 3 ft

Reduction Factor for EWA



Reduction Factors

Roof Form	Sign Pressure	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Flat	Plus	D	D	D	C	E
Flat	Minus	NA	NA	NA	D	D
Gable, Mansard	Plus	B	C	C	C	E
Gable, Mansard	Minus	B	B	B	D	D
Hip	Plus	B	C	C	C	E
Hip	Minus	B	B	B	D	D
Monoslope	Plus	A	B	D	C	E
Monoslope	Minus	C	C	C	D	D
Overhangs	All	A	A	B	NA	NA

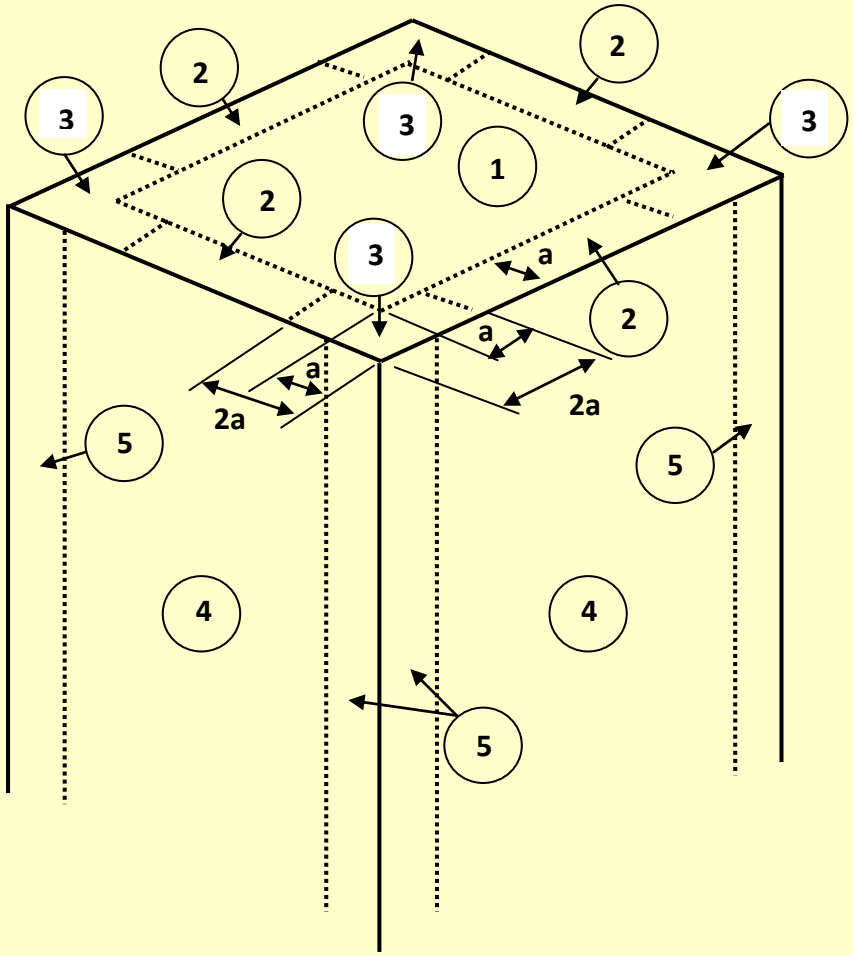
Pressures on Mullions

$$Mullion\ p = p_{table}(EAF)(RF)K_{zt}$$

EAF = 0.808

Reduction Factors (RF)	Zone 4	Zone 5
+	.87	.87
-	.91	.82

C&C Zones



C&C Pressure Table 30.7-2

V (MPH)			130					140					150				
h (ft)	Roof Form	Load Case	1	2	Zone 3	4	5	1	2	Zone 3	4	5	1	2	Zone 3	4	5
160	Flat Roof	1	-81.2	-127.4	-173.7	-55.5	-101.7	-94.2	-147.8	-201.4	-64.4	-118.0	-108.1	-169.7	-231.2	-73.9	-135.5
		2	NA	NA	NA	55.5	55.5	NA	NA	NA	64.4	64.4	NA	NA	NA	73.9	73.9
	Gable Roof Mansard Roof	1	-60.6	-101.7	-153.1	-65.8	-101.7	-70.3	-118.0	-177.6	-76.3	-118.0	-80.7	-135.5	-203.9	-87.6	-135.5
		2	34.9	34.9	34.9	60.6	55.5	40.5	40.5	40.5	70.3	64.4	46.5	46.5	46.5	80.7	73.9
	Hip Roof	1	-55.5	-96.6	-142.8	-65.8	-101.7	-64.4	-112.0	-165.7	-76.3	-118.0	-73.9	-128.6	-190.2	-87.6	-135.5
		2	34.9	34.9	34.9	60.6	55.5	40.5	40.5	40.5	70.3	64.4	46.5	46.5	46.5	80.7	73.9
	Monoslope Roof	1	-70.9	-91.5	-158.3	-65.8	-101.7	-82.2	-106.1	-183.5	-76.3	-118.0	-94.4	-121.8	-210.7	-87.6	-135.5
		2	29.8	29.8	29.8	60.6	60.6	34.6	34.6	34.6	70.3	70.3	39.7	39.7	39.7	80.7	80.7
150	Flat Roof	1	-80.1	-125.7	-171.3	-54.7	-100.4	-92.9	-145.8	-198.7	-63.5	-116.4	-106.6	-167.4	-228.1	-72.9	-133.6
		2	NA	NA	NA	54.7	54.7	NA	NA	NA	63.5	63.5	NA	NA	NA	72.9	72.9
	Gable Roof Mansard Roof	1	-59.8	-100.4	-151.1	-64.9	-100.4	-69.4	-116.4	-175.2	-75.2	-116.4	-79.6	-133.6	-201.1	-86.4	-133.6
		2	34.5	34.5	34.5	59.8	54.7	40.0	40.0	40.0	69.4	63.5	45.9	45.9	45.9	79.6	72.9
	Hip Roof	1	-54.7	-95.3	-140.9	-64.9	-100.4	-63.5	-110.5	-163.4	-75.2	-116.4	-72.9	-126.9	-187.6	-86.4	-133.6
		2	34.5	34.5	34.5	59.8	54.7	40.0	40.0	40.0	69.4	63.5	45.9	45.9	45.9	79.6	72.9
	Monoslope Roof	1	-70.0	-90.2	-156.1	-64.9	-100.4	-81.1	-104.6	-181.1	-75.2	-116.4	-93.1	-120.1	-207.9	-86.4	-133.6
		2	29.4	29.4	29.4	59.8	59.8	34.1	34.1	34.1	69.4	69.4	39.1	39.1	39.1	79.6	79.6
140	Flat Roof	1	-78.9	-123.9	-168.9	-54.0	-98.9	-91.5	-143.7	-195.8	-62.6	-114.7	-105.1	-165.0	-224.8	-71.8	-131.7
		2	NA	NA	NA	54.0	54.0	NA	NA	NA	62.6	62.6	NA	NA	NA	71.8	71.8
	Gable Roof Mansard Roof	1	-59.0	-98.9	-148.9	-63.9	-98.9	-68.4	-114.7	-172.7	-74.2	-114.7	-78.5	-131.7	-198.2	-85.1	-131.7
		2	34.0	34.0	34.0	59.0	54.0	39.4	39.4	39.4	68.4	62.6	45.2	45.2	45.2	78.5	71.8
	Hip Roof	1	-54.0	-93.9	-138.9	-63.9	-98.9	-62.6	-108.9	-161.1	-74.2	-114.7	-71.8	-125.0	-184.9	-85.1	-131.7
		2	34.0	34.0	34.0	59.0	54.0	39.4	39.4	39.4	68.4	62.6	45.2	45.2	45.2	78.5	71.8
	Monoslope Roof	1	-68.9	-88.9	-153.9	-63.9	-98.9	-80.0	-103.1	-178.5	-74.2	-114.7	-91.8	-118.4	-204.9	-85.1	-131.7
		2	29.0	29.0	29.0	59.0	59.0	33.6	33.6	33.6	68.4	68.4	38.6	38.6	38.6	78.5	78.5
130	Flat Roof	1	-77.7	-122.0	-166.2	-53.1	-97.4	-90.1	-141.5	-192.8	-61.6	-112.9	-103.5	-162.4	-221.3	-70.7	-129.7
		2	NA	NA	NA	53.1	53.1	NA	NA	NA	61.6	61.6	NA	NA	NA	70.7	70.7
	Gable Roof Mansard Roof	1	-58.0	-97.4	-146.6	-63.0	-97.4	-67.3	-112.9	-170.0	-73.0	-112.9	-77.3	-129.7	-195.1	-83.8	-129.7
		2	33.4	33.4	33.4	58.0	53.1	38.8	38.8	38.8	67.3	61.6	44.5	44.5	44.5	77.3	70.7
	Hip Roof	1	-53.1	-92.5	-136.7	-63.0	-97.4	-61.6	-107.2	-158.6	-73.0	-112.9	-70.7	-123.1	-182.0	-83.8	-129.7
		2	33.4	33.4	33.4	58.0	53.1	38.8	38.8	38.8	67.3	61.6	44.5	44.5	44.5	77.3	70.7
	Monoslope Roof	1	-67.9	-87.6	-151.5	-63.0	-97.4	-78.7	-101.5	-175.7	-73.0	-112.9	-90.4	-116.6	-201.7	-83.8	-129.7
		2	28.5	28.5	28.5	58.0	58.0	33.1	33.1	33.1	67.3	67.3	38.0	38.0	38.0	77.3	77.3
120	Flat Roof	1	-76.4	-119.9	-163.5	-52.2	-95.8	-88.6	-139.1	-189.6	-60.6	-111.1	-101.7	-159.7	-217.6	-69.5	-127.5
		2	NA	NA	NA	52.2	52.2	NA	NA	NA	60.6	60.6	NA	NA	NA	69.5	69.5
	Gable Roof Mansard Roof	1	-57.1	-95.8	-144.1	-61.9	-95.8	-66.2	-111.1	-167.1	-71.8	-111.1	-76.0	-127.5	-191.9	-82.4	-127.5
		2	32.9	32.9	32.9	57.1	52.2	38.1	38.1	38.1	66.2	60.6	43.8	43.8	43.8	76.0	69.5
	Hip Roof	1	-52.2	-90.9	-134.5	-61.9	-95.8	-60.6	-105.4	-155.9	-71.8	-111.1	-69.5	-121.1	-179.0	-82.4	-127.5
		2	32.9	32.9	32.9	57.1	52.2	38.1	38.1	38.1	66.2	60.6	43.8	43.8	43.8	76.0	69.5
	Monoslope Roof	1	66.7	86.1	149.0	61.9	95.8	77.4	99.8	172.8	71.8	111.1	88.9	114.6	198.3	82.4	127.5

C&C Net Wall Pressures, psf

	Zone 4		Zone 5	
Height, ft.	Negative	Positive	Negative	Positive
15	- 64.1	+ 39.1	- 117.5	+ 39.1
30	- 64.1	+ 45.2	- 117.5	+ 45.2
50	- 64.1	+ 50.4	- 117.5	+ 50.4
80	- 64.1	+ 55.6	- 117.5	+ 55.6
120	- 64.1	+ 60.6	- 117.5	+ 60.6
157	- 64.1	+ 64.1	- 117.5*	+ 64.1

* Interpolated value

Mullion pressures, psf

	Zone 4		Zone 5	
Height, ft.	Negative	Positive	Negative	Positive
15	- 47.1	+ 27.5	- 77.8	+ 27.5
30	- 47.1	+ 31.8	- 77.8	+ 31.8
50	- 47.1	+ 35.4	- 77.8	+ 35.4
80	- 47.1	+ 39.1	- 77.8	+ 39.1
120	- 47.1	+ 42.6	- 77.8	+ 42.6
157	- 47.1	+ 45.0	- 77.8	+ 45.0

Questions – Example 2

Resources

- Email for Speaker:
  - bcoulbourne@atcouncil.org
- Guide to the Use of the Wind Load Provisions of ASCE 7-05 (and ASCE 7-10 coming soon)
  - www.pubs.asce.org
- Basic Wind Engineering for Low-rise Buildings – (now available)
  - www.atcouncil.org