

**Company**

Address  
City, State  
Phone  
other

JOB TITLE Example 4 - ASCE7-02

JOB NO. \_\_\_\_\_ SHEET NO. \_\_\_\_\_  
CALCULATED BY \_\_\_\_\_ DATE \_\_\_\_\_  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

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www.struware.com

**STRUCTURAL CALCULATIONS**

FOR

**Example 4 - 157' Building, on escarpment**

Guide to the Use of the Wind Load Provisions of ASCE7-02

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**Code Search**

I. **Code:** ASCE 7 - 02

II. **Occupancy:**

Occupancy Group = B Business

III. **Type of Construction:**

Fire Rating:

Roof = 0.0 hr

Floor = 0.0 hr

IV. **Live Loads:**

Roof angle ( $\theta$ ) 0.00 / 12 0.0 deg

**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** 50 psf

**Stairs & Exitways** 100 psf

**Balcony** 100 psf

**Mechanical** N/A

**Partitions** 20 psf

V. **Wind Loads : ASCE 7 - 02**

Importance Factor 1.00  
 Basic Wind speed 120 mph  
 Directionality (Kd) 0.85  
 Mean Roof Ht (h) 157.0 ft  
 Parapet ht above grd 160.0 ft  
 Exposure Category B  
 Enclosure Classif. Partially Enclosed  
 Internal pressure +/-0.55  
 Building length (L) 200.0 ft  
 Least width (B) 100.0 ft  
 Kh case 1 1.124  
 Kh case 2 1.124

**Topographic Factor (Kzt)**

Topography 2D Escarpment  
 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

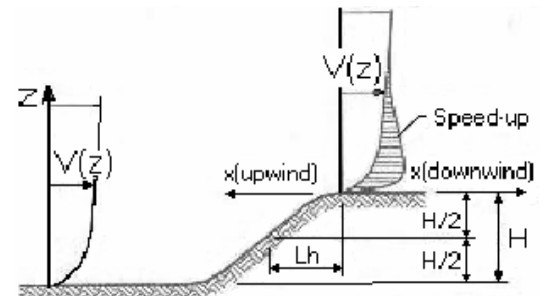
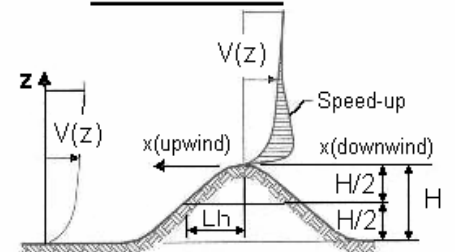
H/Lh= 0.50  $K_1 = 0.375$

x/Lh = 0.31  $K_2 = 0.922$

z/Lh = 0.98  $K_3 = 0.086$

At Mean Roof Ht:

$K_{zt} = (1+K_1K_2K_3)^2 = 1.060$

**ESCARPMENT****2D RIDGE or 3D AXISYMMETRICAL HILL**

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**V. Wind Loads - cont.:****Gust Effect Factor**

h = 157.0 ft  
use this h : 157.0 ft  
B = 100.0 ft  
Calculated /z = 94.2 ft  
Use this /z : 94.2 ft

Flexible structure if natural frequency &lt; 1 Hz (T &gt; 1 second).

However, rule of thumb is if h/B &lt; 4 then rigid structure.

h/B = 1.57 Therefore, probably rigid structure

**G = 0.83** **Rigid Structure**

/ε = 0.33  
l = 320 ft  
z<sub>min</sub> = 30 ft  
c = 0.30  
g<sub>Q</sub>, g<sub>v</sub> = 3.4  
L<sub>z</sub> = 453.9 ft  
Q = 0.83  
I<sub>z</sub> = 0.25  
G = 0.83

**Flexible or Dynamically Sensitive Structure**

Natural Frequency (n<sub>1</sub>) = 0.0 Hz  
Damping ratio (β) = 0  
/b = 0.45  
/α = 0.25  
V<sub>Z</sub> = 102.9  
N<sub>1</sub> = 0.00  
R<sub>n</sub> = 0.000  
R<sub>h</sub> = 28.282 η = 0.000 h = 157.0 ft  
R<sub>B</sub> = 28.282 η = 0.000  
R<sub>L</sub> = 28.282 η = 0.000  
g<sub>R</sub> = 0.000  
R = 0.000  
G = 0.000

**Enclosure Classification****Test for Enclosed Building:** A building that does not qualify as open or partially enclosed.**Test for Open Building:** All walls are at least 80% open.  
A<sub>o</sub> ≥ 0.8A<sub>g</sub>**Test for Partially Enclosed Building:**

Input	Test
A <sub>o</sub> ≥ 1.1A <sub>oi</sub>	YES
A <sub>o</sub> > 4' / 0.01A <sub>g</sub>	NO
A <sub>oi</sub> / A <sub>gi</sub> ≤ 0.20	NO

Building is NOT Partially Enclosed.

Conditions to qualify as Partially Enclosed Building. Must satisfy all of the following:

A<sub>o</sub> ≥ 1.1A<sub>oi</sub>

A<sub>o</sub> > smaller of 4' or 0.01 A<sub>g</sub>

A<sub>oi</sub> / A<sub>gi</sub> ≤ 0.20

Where:

A<sub>o</sub> = the total area of openings in a wall that receives positive external pressure.A<sub>g</sub> = the gross area of that wall in which A<sub>o</sub> is identified.A<sub>oi</sub> = the sum of the areas of openings in the building envelope (walls and roof) not including A<sub>o</sub>.A<sub>gi</sub> = the sum of the gross surface areas of the building envelope (walls and roof) not including A<sub>g</sub>.**Reduction Factor for large volume partially enclosed buildings (R<sub>i</sub>):**If the partially enclosed building contains a single room that is unpartitioned, the internal pressure coefficient may be multiplied by the reduction factor R<sub>i</sub>.Total area of all wall & roof openings (A<sub>og</sub>): 0 sfUnpartitioned internal volume (V<sub>i</sub>): 0 cfR<sub>i</sub> = 1.00**Altitude adjustment to constant 0.00256 :**

Altitude = 0 feet

Constant = 0.00256

Average Air Density = 0.0765 lbm/ft<sup>3</sup>

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**V. Wind Loads - MWFRS all h (Enclosed/partially enclosed only)**

Kh (case 2) = 1.12 h = 157.0 ft GCpi = +/-0.55  
Base pressure (qh) = **37.4 psf** ridge ht = 157.0 ft G = 0.83  
Roof Angle = 0.0 deg L = 200.0 ft z for qi : 90.0 ft  
Roof tributary area - (h/2)\*L: 15700 sf B = 100.0 ft qi = 31.9 psf for positive internal pressures  
(h/2)\*B: 7850 sf

Surface Pressures (psf)	Wind Normal to Ridge (psf)				Wind Parallel to Ridge (psf)				
	B/L = 0.50		h/L = 1.57		L/B = 2.00		h/L = 0.79		
Surface	Cp	qhGCp	w/+qiGCpi	w/-qhGCpi	Dist.*	Cp	qhGCp	w/+qiGCpi	w/-qhGCpi
Windward Wall (WW)	0.80	24.9	see table below			0.80	24.9	see table below	
Leeward Wall (LW)	-0.50	-15.6	-33.1	5.0		-0.30	-9.3	-26.9	11.2
Side Wall (SW)	-0.70	-21.8	-39.3	-1.3		-0.70	-21.8	-39.3	-1.3
Leeward Roof (LR)		**				Included in windward roof			
Windward Roof: 0 to h/2*	-1.04	-32.4	-49.9	-11.8	0 to h/2*	-0.98	-30.5	-48.0	-10.0
> h/2*	-0.70	-21.8	-39.3	-1.3	h/2 to h*	-0.79	-24.5	-42.0	-3.9
					h to 2h*	-0.61	-19.1	-36.6	1.4

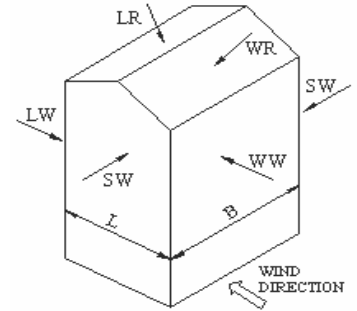
\*Horizontal distance from windward edge

\*\*Roof angle < 10 degrees. Therefore, leeward roof is included in windward roof pressure zones.

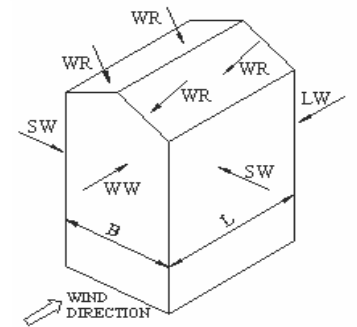
For monoslope roofs, entire roof surface is either windward or leeward surface.

**Windward Wall Pressures at "z" (psf)**

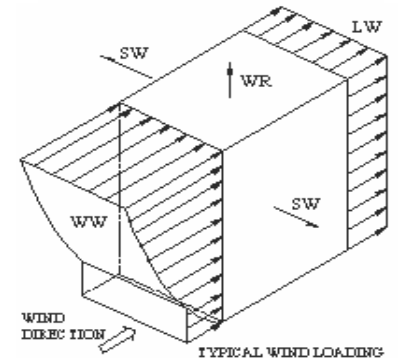
z	Kz	Kzt	Windward Wall			Combined WW + LW	
			qzGCp	w/+qiGCpi	w/-qhGCpi	Normal to Ridge	Parallel to Ridge
0 to 15'	0.57	1.71	20.5 psf	3.0 psf	41.1 psf	36.1 psf	29.9 psf
30.0 ft	0.70	1.55	22.6	5.1	43.2	38.2	32.0
50.0 ft	0.81	1.40	23.8	6.3	44.3	39.4	33.1
80.0 ft	0.93	1.27	24.5	7.0	45.1	40.1	33.9
120.0 ft	1.04	1.15	25.0	7.5	45.6	40.6	34.4
h= 157.0 ft	1.12	1.08	25.4	7.9	45.9	41.0	34.7



WIND NORMAL TO RIDGE



WIND PARALLEL TO RIDGE



TYPICAL WIND LOADING

**NOTE:**

See figure 6-9 of ASCE7 for the application of full and partial loading of the above wind pressures. There are 4 different loading cases.

**Parapet**

z	Kz	Kzt	qp (psf)
160.0 ft	1.13	1.06	37.5

Windward parapet: 67.4 psf (GCpn = +1.8)  
Leeward parapet: -41.2 psf (GCpn = -1.1)

