# Wind Loads on Non-Standard Building Configurations

Presented by: Donald R. Scott, S.E.

PCS Structural Solutions

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Wind Loads on Non-Standard Building Configurations

- "Despite the failures that have occurred and despite the data that have been accumulated, civil engineers still use general wind loadings for designs that do no apply specifically to the form being considered and do not provide accuracy consistent with existing knowledge of wind forces. In view of the advances made in structural theory, and the use of more refined design methods by structural engineers, the accuracy of the determination of forces on structures has become more important."
  - ***"Wind Forces On Structures" ASCE Final Report of the Task Committee on Wind Forces… 1961"***

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## Wind Loads on Non-Standard Building Configurations

- **ASCE 7-10 Section 27.1.2 Conditions**
  - A building whose design wind loads are determined in accordance with this chapter shall comply with all of the following conditions:
    1. The building is a regular-shaped building or structure as defined in **Section 26.2**.
    2. The building does not have response characteristics making it subject to across-wind loading, vortex shedding, instability due to galloping or flutter; or it does not have a site location for which channeling effects or buffeting in the wake of upwind obstructions warrant special consideration.

**ASCE 7-10 Section 26.2**

**"Building or Other Structure, Regular-Shaped:** A building or other structure having no unusual geometrical irregularity in spatial form."

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## Wind Loads on Non-Standard Building Configurations

- **2012 IBC – Section 1609.6.1 Scope**
  - As an alternate to ASCE 7 Chapters 27 and 30, the following provisions are permitted to be used to determine the wind effects on ***regularly shaped buildings, or other structures that are regularly shaped,*** which meet all of the following conditions…

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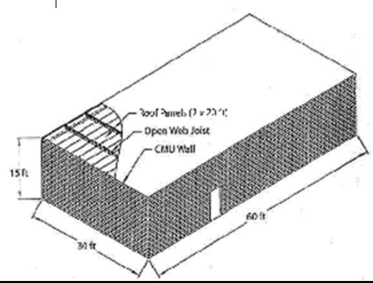
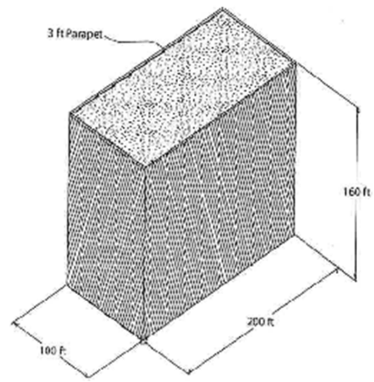
## Wind Loads on Non-Standard Building Configurations

**These are the building shapes that the building standard and code define!**

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## Wind Loads on Non-Standard Building Configurations

**This is what we design in real life!**

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## Wind Loads on Non-Standard Building Configurations

- ***What tools do we have to apply the wind provisions to today's buildings?***
  - **Our best guidance is found in one of the oldest figures in the ASCE 7-10 Standard – Figure 27.4-1 (Figure 6-6 in ASCE 7-05)!**

| Main Wind Force Resisting System – Part 1 | All Heights |
|---|---|
| Figure 27.4-1 (cont.) External Pressure Coefficients, $C_p$ | Walls & Roofs |
| Enclosed, Partially Enclosed Buildings | |

**Wall Pressure Coefficients, $C_p$**

| 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 | $q_h$ |

**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<br>-0.18 | -0.5<br>0.0* | -0.3<br>0.2 | -0.2<br>0.3 | -0.2<br>0.3 | 0.0*<br>0.4 | 0.4 | 0.01 θ | -0.3 | -0.5 | -0.6 |
| | 0.5 | -0.9<br>-0.18 | -0.7<br>-0.18 | -0.4<br>0.0* | -0.3<br>0.2 | -0.2<br>0.2 | -0.2<br>0.3 | 0.0*<br>0.4 | 0.01 θ | -0.5 | -0.5 | -0.6 |
| | ≥1.0 | -1.3**<br>-0.18 | -1.0<br>-0.18 | -0.7<br>-0.18 | -0.5<br>0.0* | -0.3<br>0.2 | -0.2<br>0.2 | 0.0*<br>0.3 | 0.01 θ | -0.7 | -0.6 | -0.6 |

| Wind Direction | h/L | Horiz distance from windward edge | $C_p$ |
|---|---|---|---|
| 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 |
| | | > h/2 | -0.7, -0.18 |

*Value is provided for interpolation purposes.

**Value can be reduced linearly with area over which it is applicable as follows

| Area (sq ft) | Reduction Factor |
|---|---|
| ≤ 100 (9.3 sq m) | 1.0 |
| 250 (23.2 sq m) | 0.9 |
| ≥ 1000 (92.9 sq m) | 0.8 |

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## Wind Loads on Non-Standard Building Configurations

- **Pressures on Walls**

**Wall Pressure Coefficients, $C_p$**

| 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 | $q_h$ |

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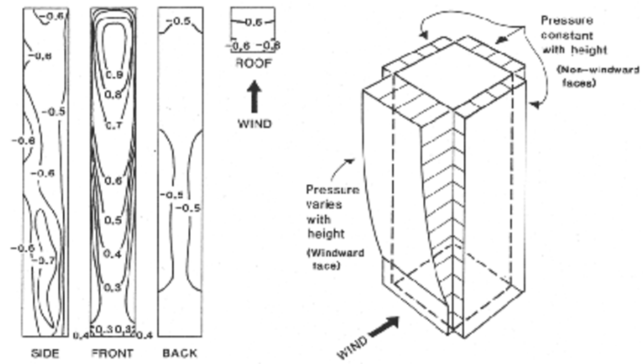
## Wind Loads on Non-Standard Building Configurations

- **Pressures on Walls**




(a) External pressure coefficients measured in wind tunnel.

(b) Assumed distribution of external wind pressures.

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## Wind Loads on Non-Standard Building Configurations

- **Pressures on Walls**

| Wall Pressure Coefficients, $C_p$ | | | |
|---|---|---|---|
| Surface | L/B | $C_p$ | Use With |
| Windward Wall | All values | 0.8 | $q_z$ |
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| | 2 | -0.3 | |
| | ≥4 | -0.2 | |
| Side Wall | All values | -0.7 | $q_h$ |

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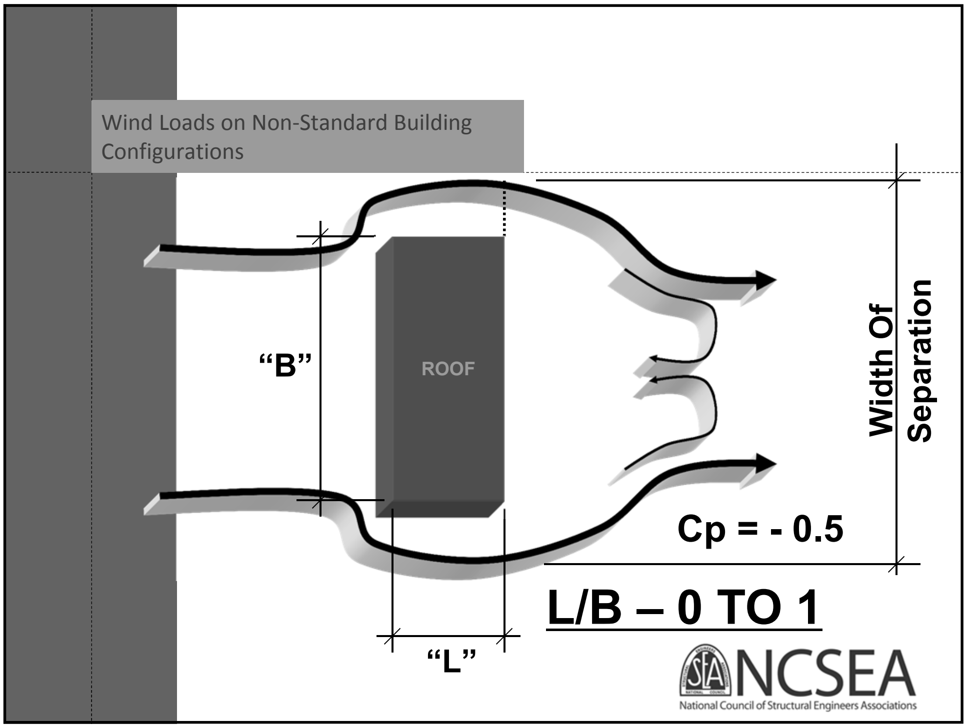
Wind Loads on Non-Standard Building Configurations
"B"
ROOF
Width Of Separation
Cp = - 0.5
L/B – 0 TO 1
"L"
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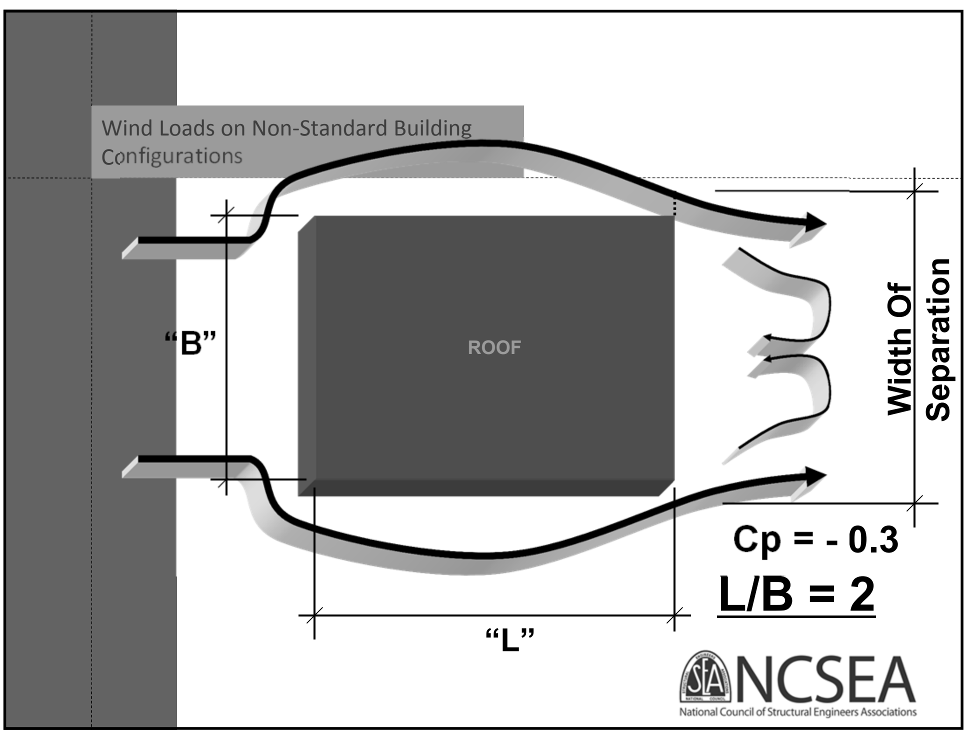
Wind Loads on Non-Standard Building Configurations
"B"
ROOF
Width Of Separation
Cp = - 0.3
L/B = 2
"L"
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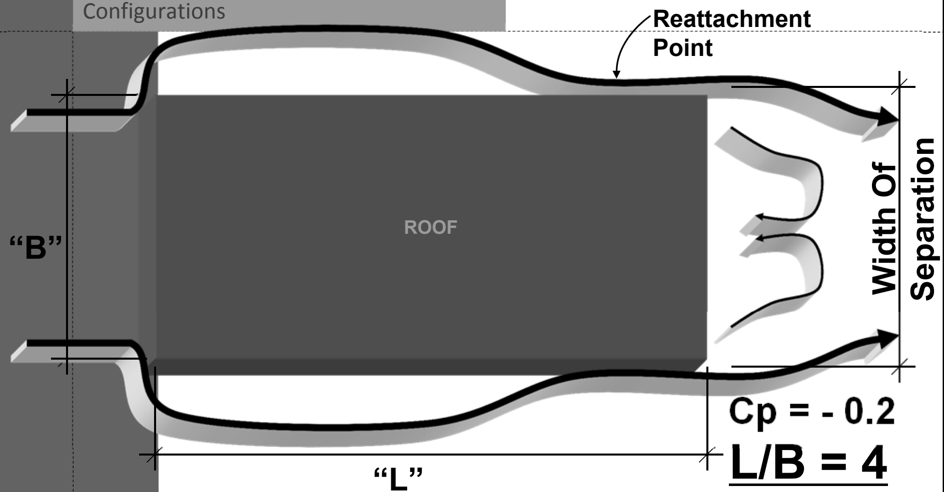
Wind Loads on Non-Standard Building Configurations

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Wind Loads on Non-Standard Building Configurations

- **Pressures on Roof Surfaces – Normal to the Ridge**

| 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<br>-0.18 | -0.5<br>0.0* | -0.3<br>0.2 | -0.2<br>0.3 | -0.2<br>0.3 | 0.0*<br>0.4 | 0.4 | 0.01 θ | -0.3 | -0.5 | -0.6 |
| | 0.5 | -0.9<br>-0.18 | -0.7<br>-0.18 | -0.4<br>0.0* | -0.3<br>0.2 | -0.2<br>0.2 | -0.2<br>0.3 | 0.0*<br>0.4 | 0.01 θ | -0.5 | -0.5 | -0.6 |
| | ≥1.0 | -1.3**<br>-0.18 | -1.0<br>-0.18 | -0.7<br>-0.18 | -0.5<br>0.0* | -0.3<br>0.2 | -0.2<br>0.2 | 0.0*<br>0.3 | 0.01 θ | -0.7 | -0.6 | -0.6 |
| | | Horiz distance from | | | | | *Value is provided for interpolation | | | | | |

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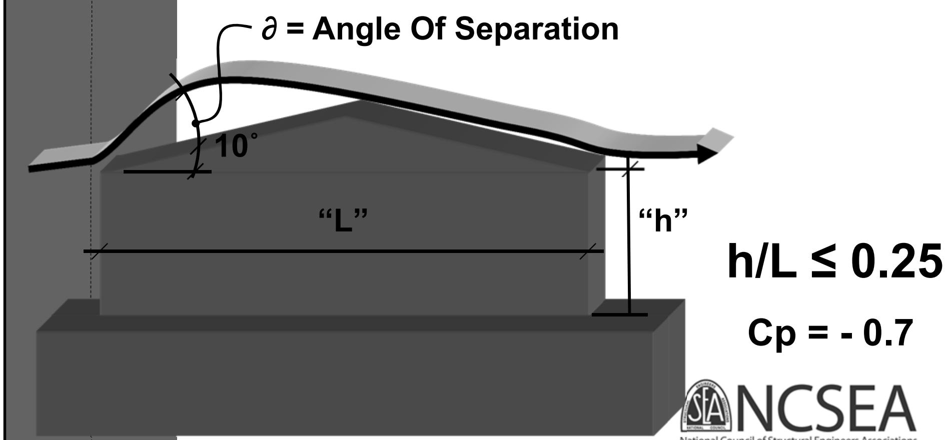
Wind Loads on Non-Standard Building Configurations

- **Pressures on Roof Surfaces – Normal to the Ridge – Windward Roof**




Wind Loads on Non-Standard Building Configurations

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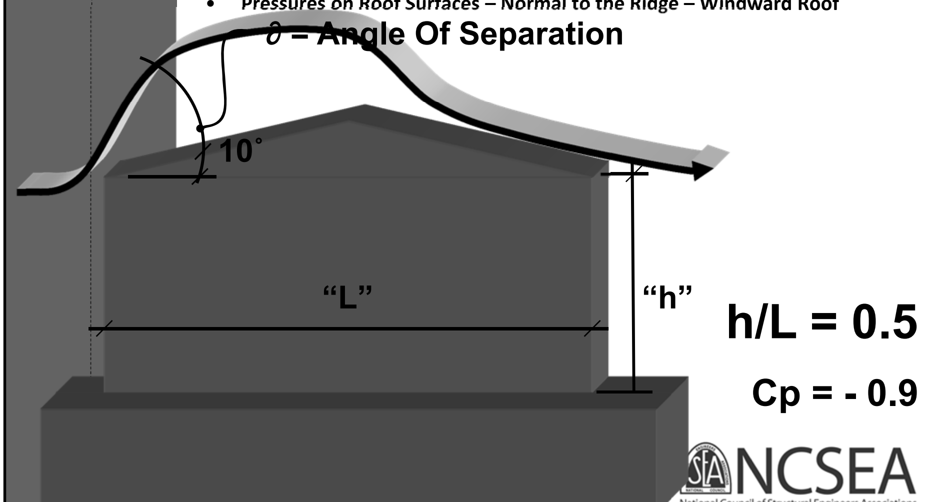

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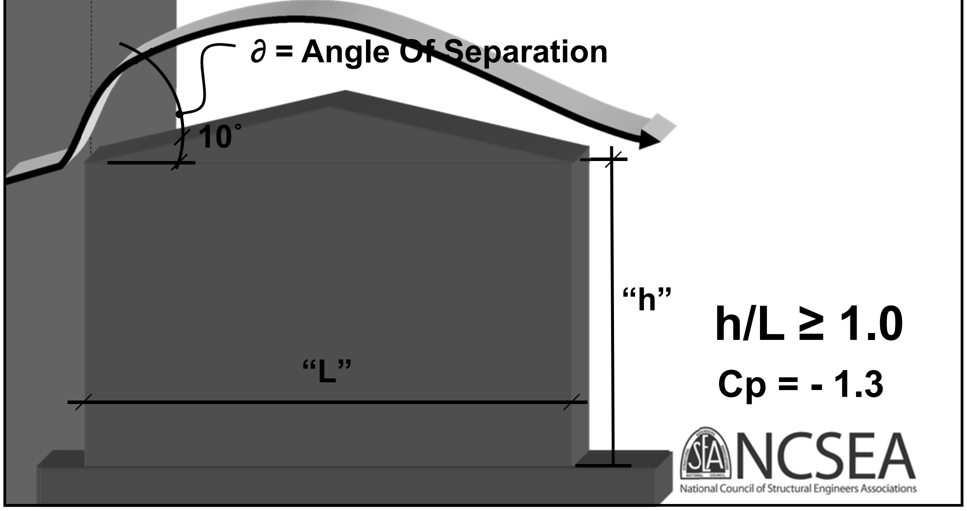


## Wind Loads on Non-Standard Building Configurations

- **Pressures on Roof Surfaces – Normal to the Ridge**

| 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<br>-0.18 | -0.5<br>0.0* | -0.3<br>0.2 | -0.2<br>0.3 | -0.2<br>0.3 | 0.0*<br>0.4 | 0.4 | 0.01 θ | -0.3 | -0.5 | -0.6 |
| | 0.5 | -0.9<br>-0.18 | -0.7<br>-0.18 | -0.4<br>0.0* | -0.3<br>0.2 | -0.2<br>0.2 | -0.2<br>0.3 | 0.0*<br>0.4 | 0.01 θ | -0.5 | -0.5 | -0.6 |
| | ≥1.0 | -1.3**<br>-0.18 | -1.0<br>-0.18 | -0.7<br>-0.18 | -0.5<br>0.0* | -0.3<br>0.2 | -0.2<br>0.2 | 0.0*<br>0.3 | 0.01 θ | -0.7 | -0.6 | -0.6 |
| | | Horiz distance from | | | | | *Value is provided for interpolation | | | | | |

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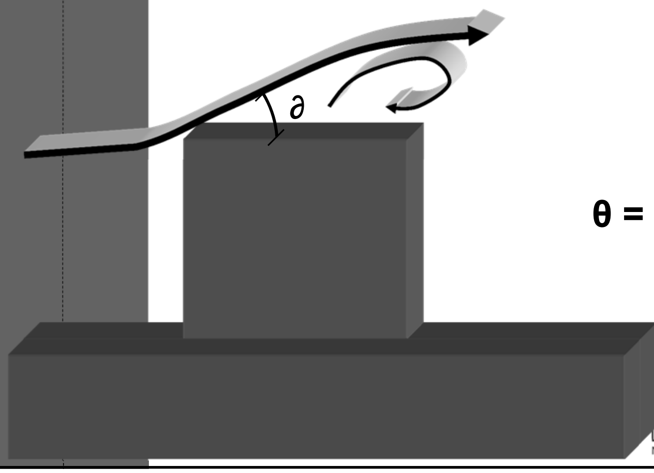
## Wind Loads on Non-Standard Building Configurations

- **Pressures on Roof Surfaces – Normal to the Ridge – Windward Roof**




**θ = 0˚ (Flat Roof)**

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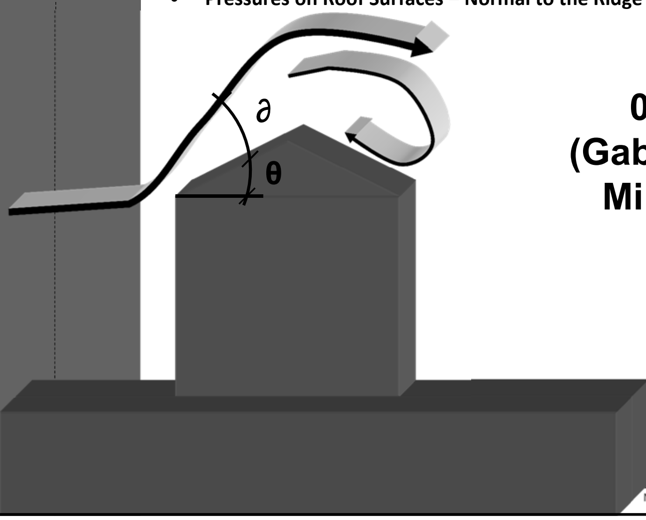
## Wind Loads on Non-Standard Building Configurations

- **Pressures on Roof Surfaces – Normal to the Ridge – Windward Roof**




**0 < θ < ∂**
**(Gable Roof Or Mild Slope)**

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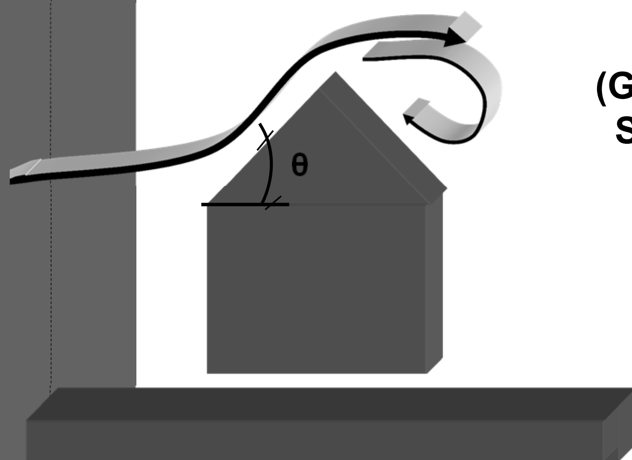
Wind Loads on Non-Standard Building Configurations

- **Pressures on Roof Surfaces – Normal to the Ridge – Windward Roof**




**θ > ∂**
**(Gable Roof Or Steep Slope)**

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Wind Loads on Non-Standard Building Configurations

- **Pressures on Roof Surfaces – Normal to the Ridge**

| 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<br>-0.18 | -0.5<br>0.0* | -0.3<br>0.2 | -0.2<br>0.3 | -0.2<br>0.3 | 0.0*<br>0.4 | 0.4 | 0.01 θ | -0.3 | -0.5 | -0.6 |
| | 0.5 | -0.9<br>-0.18 | -0.7<br>-0.18 | -0.4<br>0.0* | -0.3<br>0.2 | -0.2<br>0.2 | -0.2<br>0.3 | 0.0*<br>0.4 | 0.01 θ | -0.5 | -0.5 | -0.6 |
| | ≥1.0 | -1.3**<br>-0.18 | -1.0<br>-0.18 | -0.7<br>-0.18 | -0.5<br>0.0* | -0.3<br>0.2 | -0.2<br>0.2 | 0.0*<br>0.3 | 0.01 θ | -0.7 | -0.6 | -0.6 |
| | | Horiz distance from | | | | | *Value is provided for interpolation | | | | | |

- Increase in h/L results in higher negative pressures (suction) on Windward and Leeward Roof Surfaces
- Increase in Roof Angle results in higher positive pressures on Windward Roof Surfaces

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## Wind Loads on Non-Standard Building Configurations

- **Pressures on Roof Surfaces – Parallel to the Ridge**

| | | 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 | |
| | | > h/2 | -0.7, -0.18 | |

| Area (sq ft) | Reduction Factor |
|---|---|
| ≤ 100 (9.3 sq m) | 1.0 |
| 250 (23.2 sq m) | 0.9 |
| ≥ 1000 (92.9 sq m) | 0.8 |

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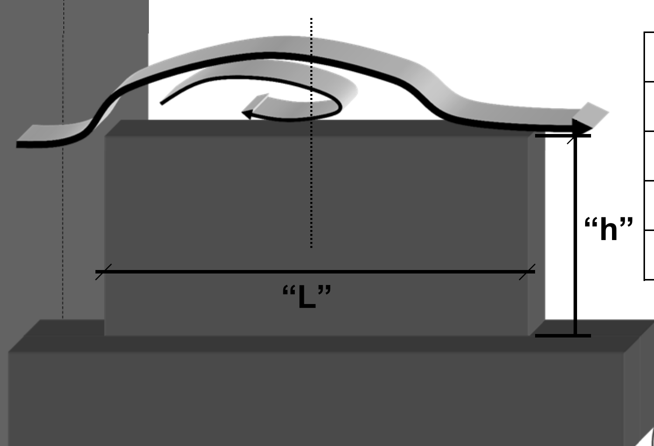
## Wind Loads on Non-Standard Building Configurations

- **Pressures on Roof Surfaces – Parallel to the Ridge – Windward Roof**




| | Cp |
|---|---|
| 0 To h/2 | -0.9, -0.18 |
| h/2 To h | -0.9, -0.18 |
| h To 2h | -0.5, -0.18 |
| >2h | -0.3, -.18 |

**h/L ≤ 0.5**

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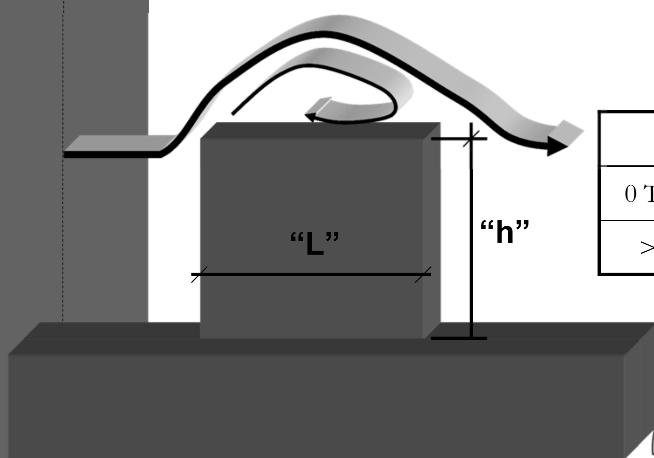
## Wind Loads on Non-Standard Building Configurations

- **Pressures on Roof Surfaces – Parallel to the Ridge – Windward Roof**




| | Cp |
|---|---|
| 0 To h/2 | Varies, -0.18 |
| > h/2 | Varies, -0.18 |

**0.5 ≥ h/L ≥ 1.0**

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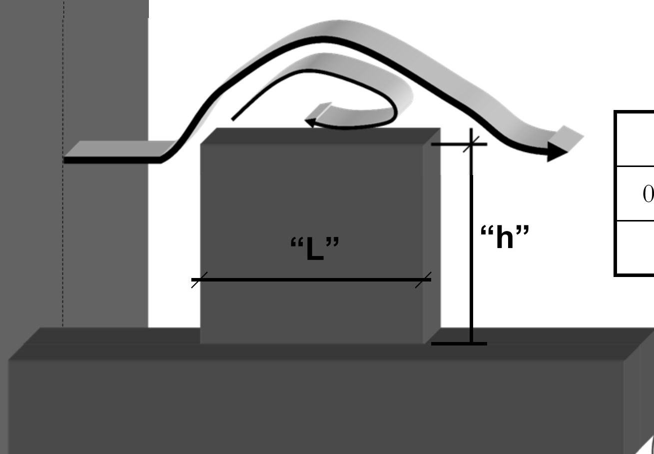
## Wind Loads on Non-Standard Building Configurations

- **Pressures on Roof Surfaces – Parallel to the Ridge – Windward Roof**




| | Cp |
|---|---|
| 0 To h/2 | -1.3, -0.18 |
| > h/2 | -0.7, -0.18 |

**h/L ≥ 1.0**

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## Wind Loads on Non-Standard Building Configurations

- **Pressures on Roof Surfaces – Parallel to the Ridge**

| | | 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 | **Area (sq ft)** | **Reduction Factor** |
| | ≥ 1.0 | 0 to h/2 | -1.3**, -0.18 | ≤ 100 (9.3 sq m) | 1.0 |
| | | | | 250 (23.2 sq m) | 0.9 |
| | | > h/2 | -0.7, -0.18 | ≥ 1000 (92.9 sq m) | 0.8 |

- Increase in h/L results in increase negative (suction) pressures on the Roof Surface

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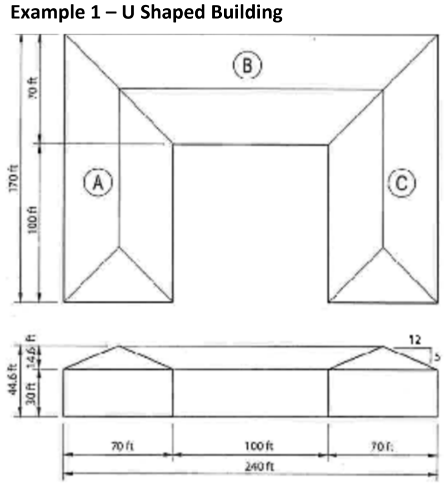
## Wind Loads on Non-Standard Building Configurations

- **Example 1 – U Shaped Building**

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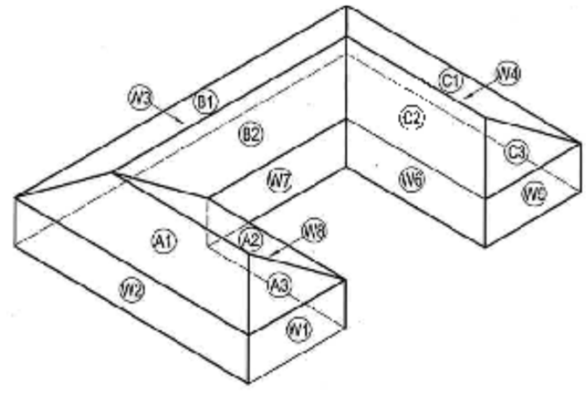
## Wind Loads on Non-Standard Building Configurations

- **Example 1 – U Shaped Building**

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## Wind Loads on Non-Standard Building Configurations

- **Example 1 – U Shaped Building**

| Surface Type | Surface Designation | Surface | Case | L/B or h/L | $C_p$ |
|---|---|---|---|---|---|
| Walls | W1, W7, W5 | Windward | | All | +0.80 |
| | W3 | Leeward | | 0.71 | -0.50 |
| | W2, W4, W6, W8 | Side | | All | -0.70 |
| Roofs (⊥ to ridge) | A3, B2, C3 | Windward | Negative | 0.22 | -0.25 |
| | | | Positive | 0.22 | +0.25 |
| | B1 | Leeward | | 0.22 | -0.60 |
| Roofs (\|\| to ridge) | A1, A2, C1, C2 | Side | 0 to h | 0.22 | -0.90 |
| | | | h to 2h | 0.22 | -0.50 |
| | | | > 2h | 0.22 | -0.30 |

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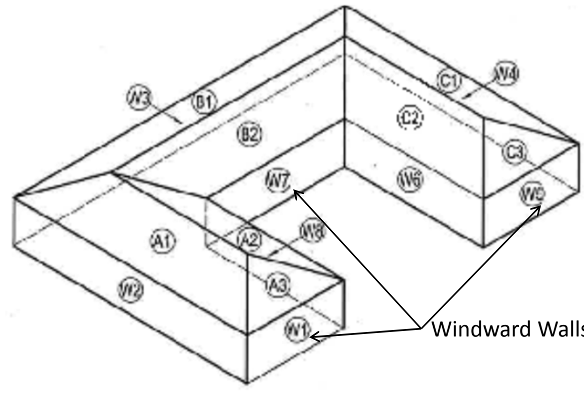
## Wind Loads on Non-Standard Building Configurations

- **Example 1 – U Shaped Building**

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## Wind Loads on Non-Standard Building Configurations

- **Example 1 – U Shaped Building**

| Surface Type | Surface Designation | Surface | Case | L/B or h/L | $C_p$ |
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| Walls | W1, W7, W5 | Windward | | All | +0.80 |
| | W3 | Leeward | | 0.71 | -0.50 |
| | W2, W4, W6, W8 | Side | | All | -0.70 |
| Roofs (⊥ to ridge) | A3, B2, C3 | Windward | Negative | 0.22 | -0.25 |
| | | | Positive | 0.22 | +0.25 |
| | B1 | Leeward | | 0.22 | -0.60 |
| Roofs (\|\| to ridge) | A1, A2, C1, C2 | Side | 0 to h | 0.22 | -0.90 |
| | | | h to 2h | 0.22 | -0.50 |
| | | | > 2h | 0.22 | -0.30 |

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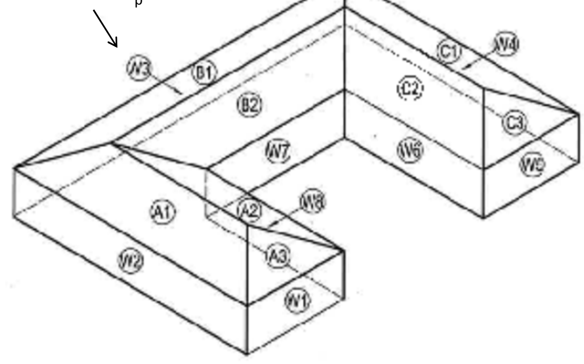
## Wind Loads on Non-Standard Building Configurations

- **Example 1 – U Shaped Building**

Leeward Wall – $C_p$ = -0.50

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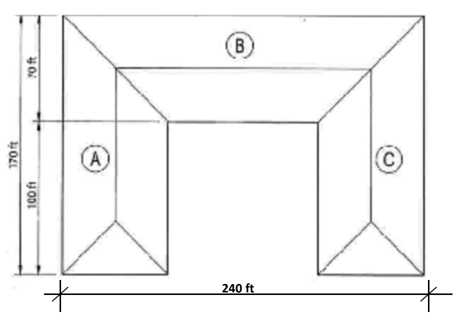
## Wind Loads on Non-Standard Building Configurations

- **Example 1 – U Shaped Building**




Used full building dimensions for determination of Leeward Wall $C_p$

L/B = 170’/240’ = 0.71
Therefore – $C_p$ = -0.50

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## Wind Loads on Non-Standard Building Configurations

- **Pressures on Walls**

| Wall Pressure Coefficients, $C_p$ | | | |
|---|---|---|---|
| **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 | $q_h$ |

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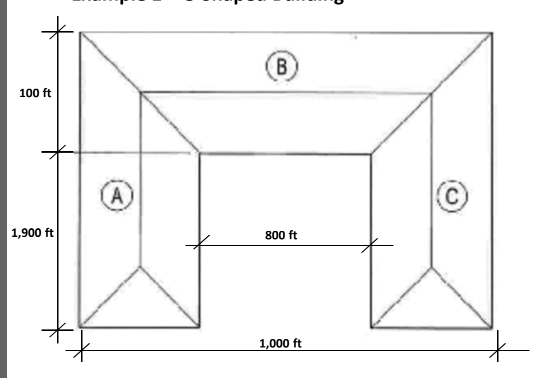
## Wind Loads on Non-Standard Building Configurations

- **Example 1 – U Shaped Building**




Using full building dimensions for determination of Leeward Wall $C_p$ is not appropriate in this case

L/B = 2000'/1000' = 2.0
Therefore – $C_p$ = -0.30

**Should use L/B = 100'/1000' = 0.10**
**Therefore – $C_p$ = -0.50**

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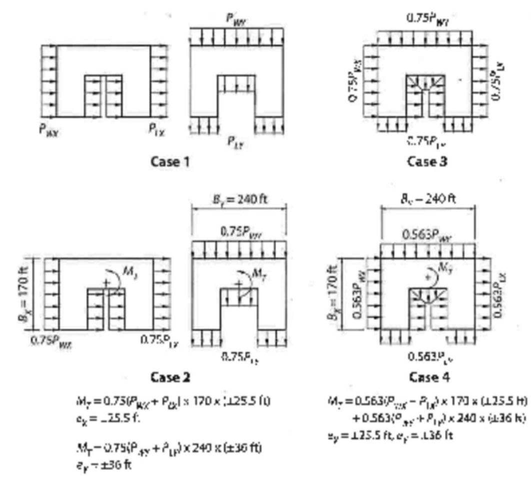
## Wind Loads on Non-Standard Building Configurations

- **Example 1 – U Shaped Building**

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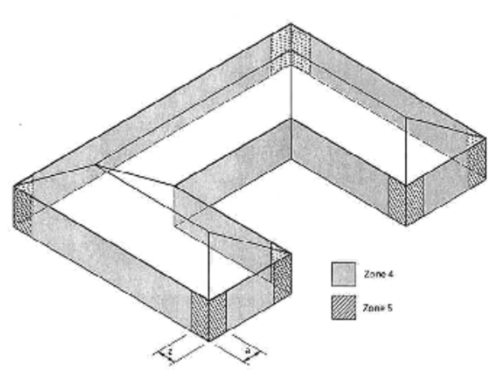
## Wind Loads on Non-Standard Building Configurations

- **Example 1 – U Shaped Building**

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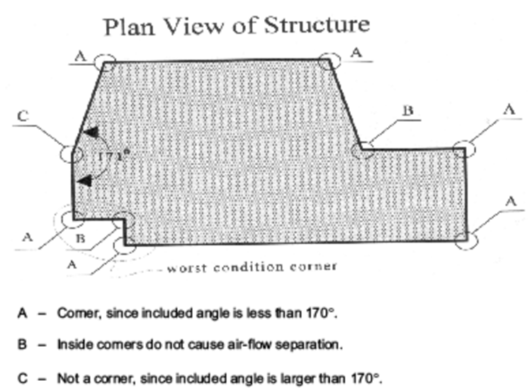
Wind Loads on Non-Standard Building Configurations

- **Example 1 – U Shaped Building**

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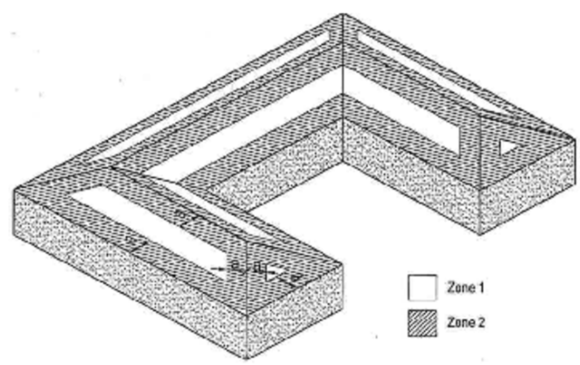
Wind Loads on Non-Standard Building Configurations

- **Example 1 – U Shaped Building**

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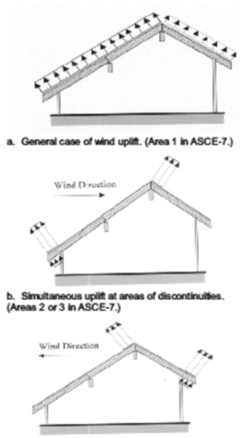
Wind Loads on Non-Standard Building Configurations

- **Example 1 – U Shaped Building**




a. General case of wind uplift. (Area 1 in ASCE-7.)

b. Simultaneous uplift at areas of discontinuities. (Areas 2 or 3 in ASCE-7.)

c. Simultaneous uplift at areas of discontinuities with wind coming from the opposite direction to that shown in b. (Areas 2 or 3 in ASCE-7.)

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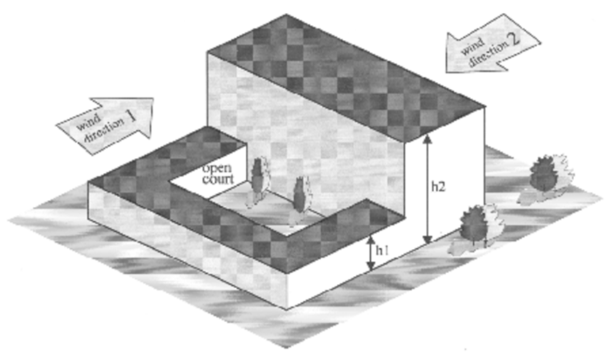
Wind Loads on Non-Standard Building Configurations

- **Example 2 – Building With a Courtyard**

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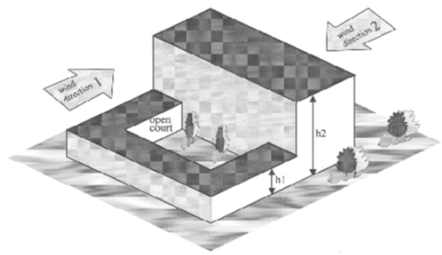
Wind Loads on Non-Standard Building Configurations

- **Example 2 – Building With a Courtyard**

1. **In deciding the design wind pressures on the low building for the wind directions shown, does the width of the court make a difference?**

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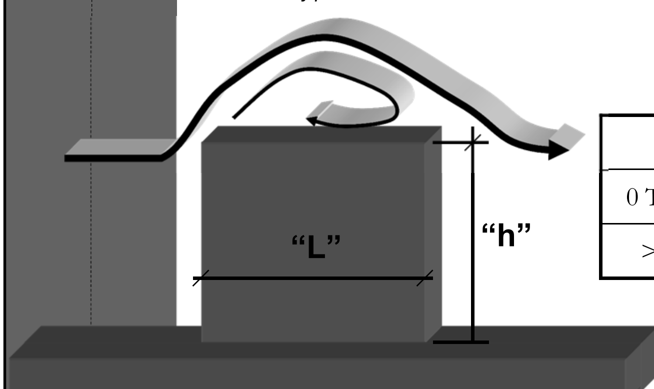
Wind Loads on Non-Standard Building Configurations

- **Example 2 – Building With a Courtyard**

1. *In small courtyards, where the difference in height of the surrounding roofs is small ($h_1 = h_2$), the wall pressures tend to be negative ( i.e., suction), similar to the roof pressures above them.*




| | Cp |
|---|---|
| 0 To h/2 | Varies, -0.18 |
| > h/2 | Varies, -0.18 |

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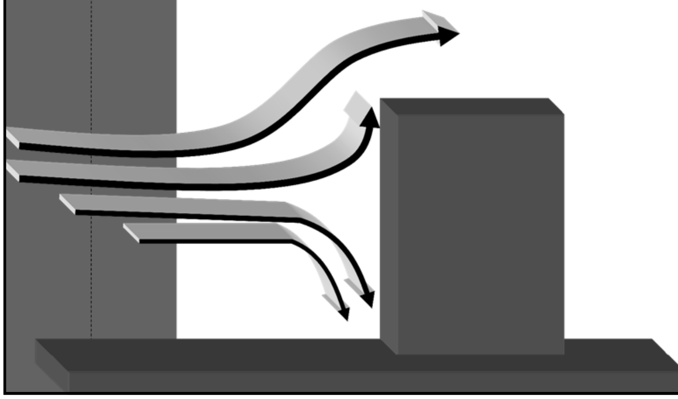
## Wind Loads on Non-Standard Building Configurations

- **Example 2 – Building With a Courtyard**

1. *When a courtyard is adjacent to a taller building, though, there may be large positive pressures due to winds in direction 1 causing static pressures and down drafts on the front of the taller building.*



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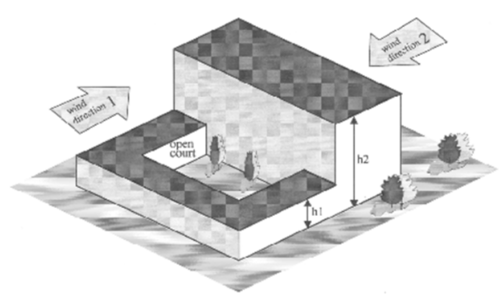
## Wind Loads on Non-Standard Building Configurations

- **Example 2 – Building With a Courtyard**

**2. What height is used for the pressures on the low building, $h_1$, $h_2$ or the average of $h_1 + h_2$?**

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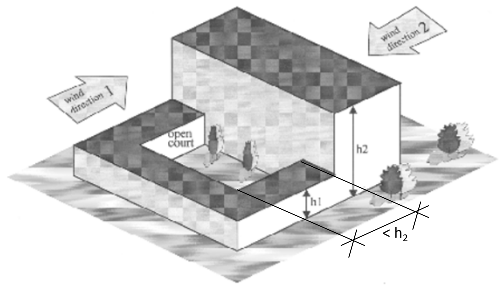
Wind Loads on Non-Standard Building Configurations

- **Example 2 – Building With a Courtyard**

2. *If the courtyard is large (perhaps equal to or greater than the larger building height, $h_2$) then one could treat each building separately. The pressures on the low building walls facing the court would then be negative or positive, depending on the wind direction and based on $h_1$.*

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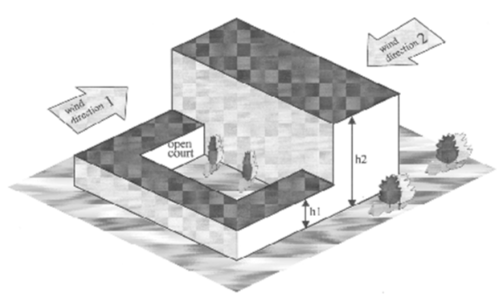
Wind Loads on Non-Standard Building Configurations

- **Example 2 – Building With a Courtyard**

3. **Will there be any inward (positive) pressures on the interior courtyard walls?**

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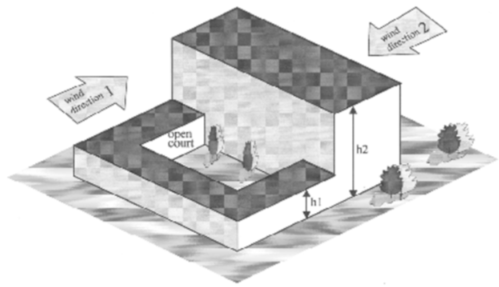
Wind Loads on Non-Standard Building Configurations

- **Example 2 – Building With a Courtyard**

3. *For wind direction 1, the pressure on the interior courtyard walls could be inward (positive), if the courtyard is sufficiently small and the taller building is sufficiently tall, or outward (negative), if the courtyard is wide and long, and the taller building in not tall enough to cause static pressures or a downdraft into the courtyard.*

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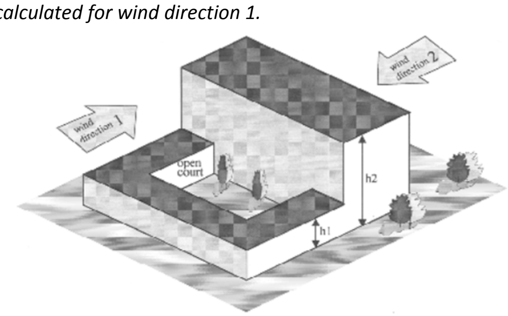
Wind Loads on Non-Standard Building Configurations

- **Example 2 – Building With a Courtyard**

3. *For wind direction 2, the design pressures would act outward (negative) due to the downwind wake of the taller building. These pressures would be based on the mean roof height, $h_2$, and would be greater in magnitude than the positive pressures calculated for wind direction 1.*

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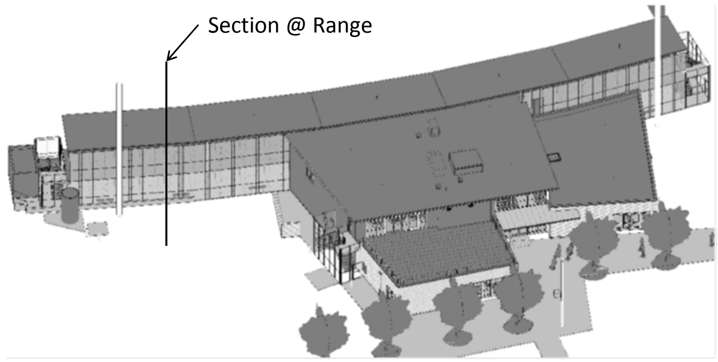
## Wind Loads on Non-Standard Building Configurations

- **Example 3 – Golf Course Driving Range**

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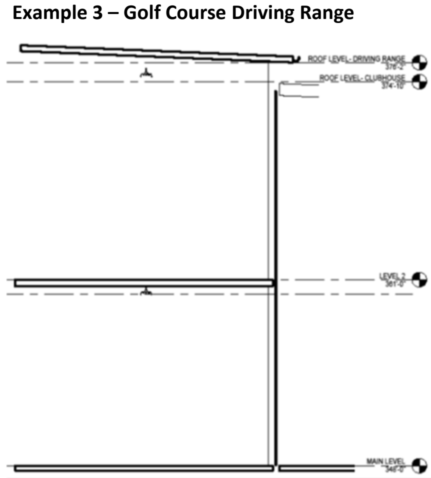
## Wind Loads on Non-Standard Building Configurations

- **Example 3 – Golf Course Driving Range**



**Section @ Range**

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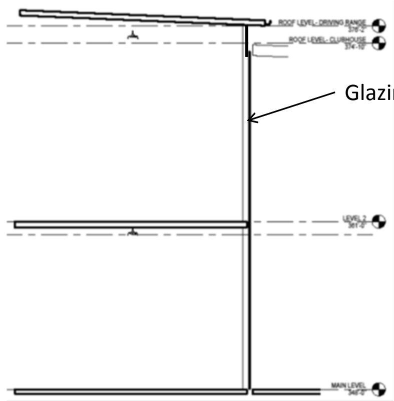
Wind Loads on Non-Standard Building Configurations

- **Example 3 – Golf Course Driving Range**

1. **What is the design pressure to be used to design the glazing at the back of the upper level?**






Wind Loads on Non-Standard Building Configurations

- **Example 3 – Golf Course Driving Range**

1. *The design of the glazing typically would be considered as a component and cladding design issue, however main wind force resisting system pressures might control.*

| Wall Pressure Coefficients, $C_p$ | | | |
|---|---|---|---|
| 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 | $q_h$ |

***The next main wind force resisting $C_p$ = 0.8 – (-0.5) = 1.3 + internal pressures***

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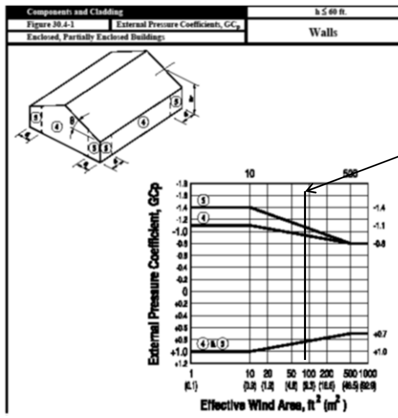
Wind Loads on Non-Standard Building Configurations

- **Example 3 – Golf Course Driving Range**

1. *The components and cladding coefficients are found in Figure 30.4-1. The effective wind area = 15' x (15'/3) = 75'*




***Values of $C_p$ @ 75 square feet =***
***-1.1 for Zone 5 &***
***+0.85 for Zones 4 & 5***

75 square feet

Wind Loads on Non-Standard Building Configurations

- **Example 3 – Golf Course Driving Range**

1. *In Summary the Main Wind Force Resisting Loads Factors result in a $C_p$ = 1.3 + internal pressure. This load is applied in both directions.*

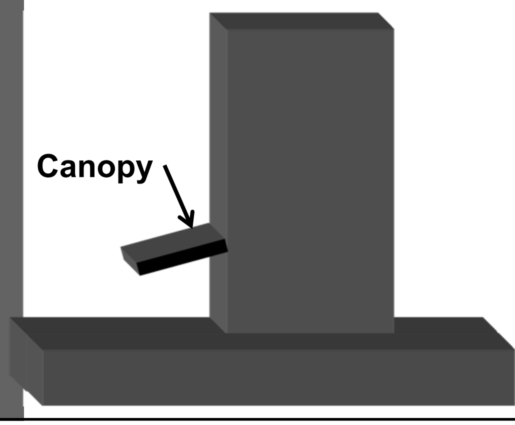
   *The Components and Cladding Factors result in a $C_p$ = 1.1 + internal pressure. This load is also applied in both directions.*

   ***Thus, the Glazing should be designed for the Main Wind Force Resisting Loads instead of the Component and Cladding Loads.***

Wind Loads on Non-Standard Building Configurations

- **Example 4 – Canopies on the side of tall building.**

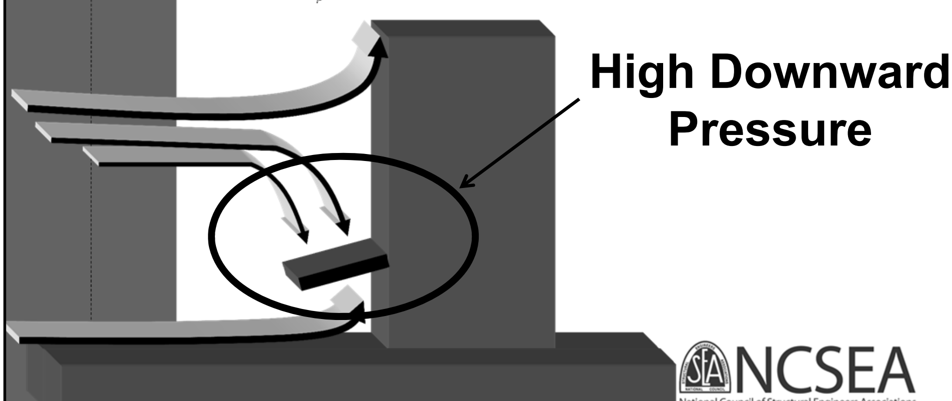
1. **What is the design wind force for the design of the canopy on the side of a tall building?**




Wind Loads on Non-Standard Building Configurations

- **Example 4 – Canopies on the side of tall building.**

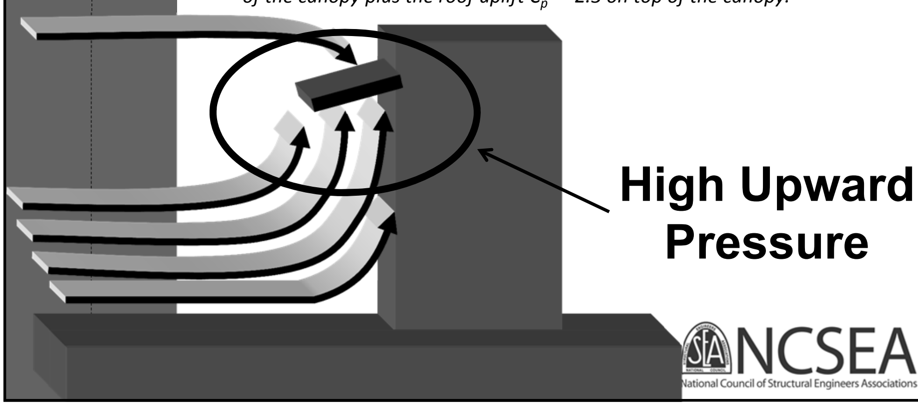
1. *If the canopy is located low on the building it will receive the down-draft effect of the wind flowing down the face of the building. It is recommended to use a $C_p$ = 0.80 (same as the windward wall) on the top of the canopy.*



Wind Loads on Non-Standard Building Configurations

- **Example 4 – Canopies on the side of tall building.**

1. *If the canopy/sunscreen/overhang is located high on the building it will receive the effect of the wind flowing up the face of the building. It is recommended to use a $C_p$ = 0.80 (same as the windward wall) on the bottom of the canopy plus the roof uplift $C_p$ = -2.3 on top of the canopy.*

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Wind Loads on Non-Standard Building Configurations

- **Example 5 – Enclosure Classifications.**

1. **How it the enclosure classification determined on an irregular shaped building?**

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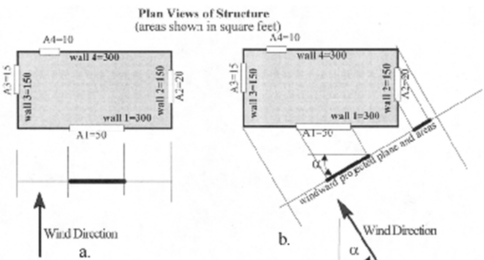
## Wind Loads on Non-Standard Building Configurations

- **Example 5 – Enclosure Classifications.**

1. *Codes in the past added the terminology "on a plane projected perpendicular to the direction being considered" in the sections for enclosure. This terminology has been removed, however it is an easy way to determine enclosure.*




| | |
|---|---|
| Condition 1 | $A_1 > 1.1 (A_2 + A_3 + A_4) = 49.5\ ft^2$ OK |
| Condition 2a | $A_1 > 4ft^2$ or 1%( $300ft^2$) = 3 $ft^2$ OK, and: |
| Condition 2b | $(A_2 + A_3 + A_4) < 20\%( 300ft^2) = 60\ ft^2$ OK |

**Unlike previous codes there is no statement regarding projected areas and direction.**

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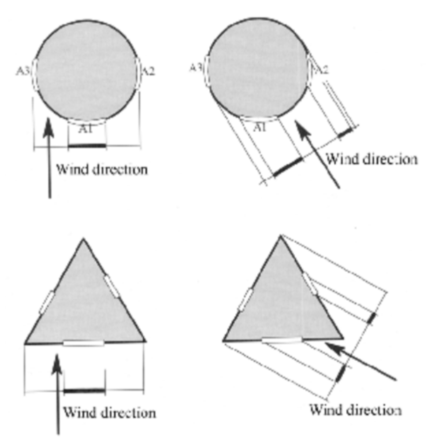
## Wind Loads on Non-Standard Building Configurations

- **Example 5 – Enclosure Classifications.**

1. *This procedure works for other shapes equally well.*

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Wind Loads on Non-Standard Building Configurations

- **Additional Resources**


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