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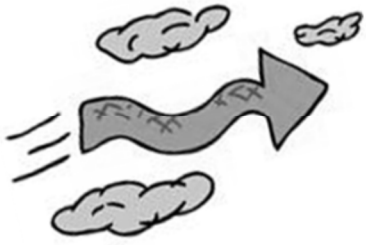
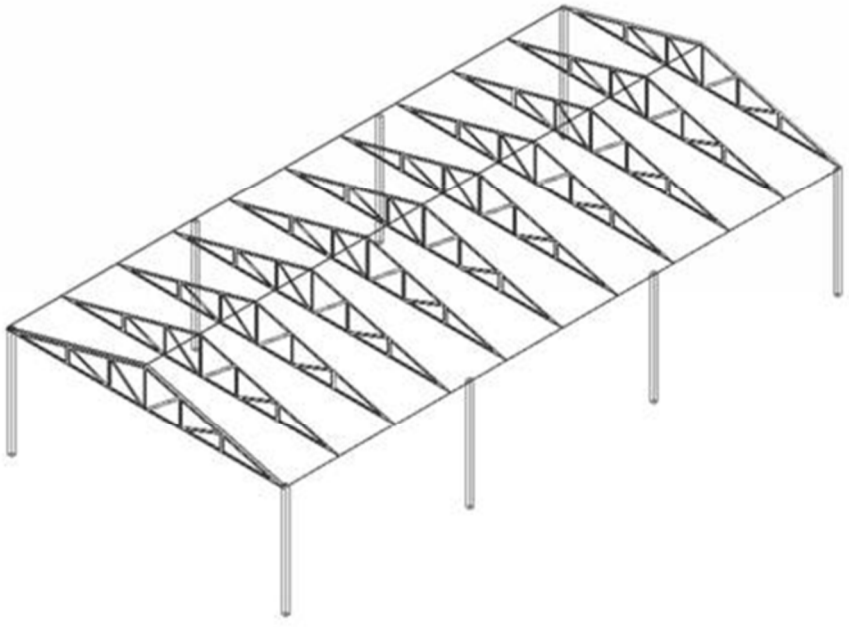
# Wind Examples

## ASCE 7-10/ ASCE 7-16

## Illustration of Calculations





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# Example 1.1a (ASCE 7-10)

## Example 1.1a - 15' High Building w/ Flat Roof (ASCE 7-10)

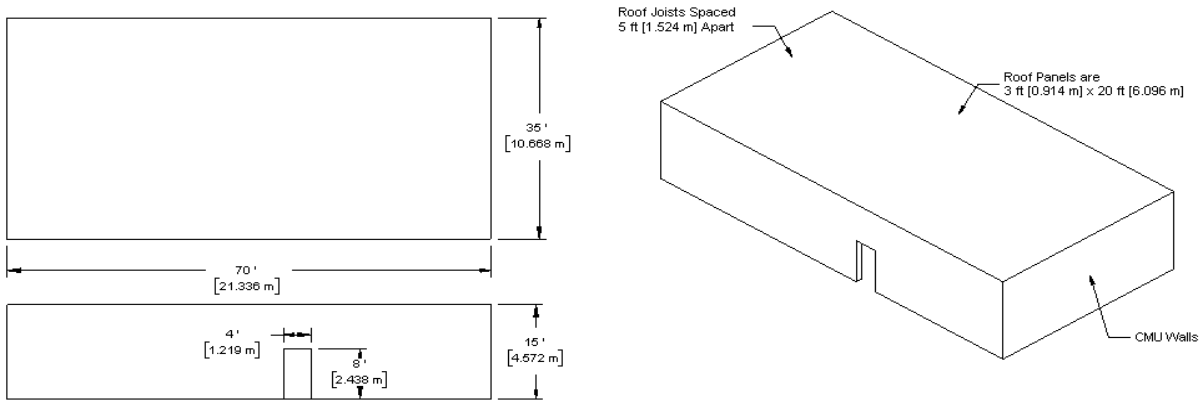



Fig 1.1a.1 - Building Dimensions

| | | | |
|---|---|---|---|
| Standard | ASCE Standard | ASCE 7-10 | |
| MWFRS | Main Wind Force Resisting System Method | Ch 27 Pt 1 (Directional) | |
| C&C | Components and Cladding Method | Ch 30 Pt 1 | |
| Variable | Description | Imperial | Metric |
| Exposure | Open Terrain | D | |
| Enclosed | Building Type | Enclosed | |
| Location | Location for Building | Cape Canaveral, Florida | |
| | | | |
| V: | Basic Wind Speed | 150 mph | 67.1 m/s |
| | | | |
| Dimensions: | | | |
| Width | Width of Building | 35.000 ft | 10.668 m |
| Length | Length of Building | 70.000 ft | 21.336 m |
| H: | Mean Roof Height of Building | 15.000 ft | 4.572 m |
| | | | |
| Roof: | Type of Roof | Monoslope (Flat) | |
| Slope | Slope of Roof | 0.0 Deg | 0.000 rads |
| Flexible | Is the Structure Flexible or Rigid | Rigid | |
| Category: | Building is a manufacturing facility | II | |
| Diaphragm: | Building is Simple Diaphragm type | No | |
| Kzt: | Topographic Factor | 1.0 | |
| | | | |
| Table 26.6-1 - Wind Directionality Factor: | | | |
| Kd: | Wind Directionality Factor (MWFRS & C&C) | 0.85 | |
| Table 26.9-1 - Terrain Exposure Constants: | | | |
| α: | 11.5 | zg: | 700 ft 213.360 m |

**Calculate MWFRS (Ch 27 Part 1 - Directional):**

Table 27.3-1 - Velocity Pressure Exposure Coefficients:

*Exposure C has same Kz values for MWFRS and C&C*

Since the building height is 15 ft or less, then Kz = Kh

z = 15.00 ft ==> Kz = 2.01*(15/zg)^(2/α) 1.030

Calculate Velocity Pressure per Eq. 27.3-1

| | | | |
|---|---|---|---|
| qz = | 0.00256 {Metric 0.613}*Kz*Kzt*Kd*V^2 | 50.44 psf | 2415 Pa |
| qh = | Since h is 15 ft, then qh is same as qz | 50.44 psf | 2415 Pa |

Para 26.9-1 - For a Rigid Structure G = Gust Effect Factor 0.85

Table 26.11-1 - Gcpi Internal Pressure Coefficient

*Plus and Minus signs signify pressures acting toward or away from internal surfaces, respectively.*

| | | | |
|---|---|---|---|
| Gcpi = | Enclosed Buildings | +0.18 | -0.18 |

Para 27.4 - Wind Pressure on MWFRS for Rigid Buildings of All Heights

| | | | |
|---|---|---|---|
| qi = | qh for Enclosed Buildings | 50.44 psf | 2415 Pa |

Fig 27.4-1 - Cp External Pressure Coefficent

Consider the wind acting on both faces of the building, and swap the values for L and B.

*Wall Pressure Coefficients*

| Wind Direction | L/B | Windward | Leeward | Side Wall |
|---|---|---|---|---|
| Wind Normal to 35 ft wall | 2.00 | 0.8 | -0.3 | -0.7 |
| Wind Normal to 70 ft wall | 0.50 | 0.8 | -0.5 | -0.7 |

Since roof is flat (Theta = 0) the Cp values are the same for parallel and normal to ridge.

*Roof Pressure Coefficients*

| Wind Direction | h/L | From | To | Cp (min) | Cp (max) |
|---|---|---|---|---|---|
| Wind Normal to 35 ft wall | 0.21 | 0.00 ft | 15.00 ft | -0.9 | -0.18 |
| | | 15.00 ft | 30.00 ft | -0.5 | -0.18 |
| | | 30.00 ft | 70.00 ft | -0.3 | -0.18 |
| Wind Normal to 70 ft wall | 0.43 | 0.00 ft | 15.00 ft | -0.9 | -0.18 |
| | | 15.00 ft | 30.00 ft | -0.5 | -0.18 |

The following calculations use Eqn 27.4-1 to calculate pressure. The values displayed are based upon imperial units, and for metric simply substitute the metric pressures q and qi. Positive pressures are acting toward the wall, and negative pressures are acting away from the wall.

Eqn 27.4-1: p = q * G * Cp - qi * GCPi

Windward Wall:

| | | |
|---|---|---|
| q = qz | 50.44 psf | 2415 Pa |
| *Wind Normal to 35 ft wall* | | |
| p = 50.44 * 0.85 * 0.8 - 50.44 * 0.18 | 25.22 psf | 1208 Pa |
| p = 50.44 * 0.85 * 0.8 - 50.44 * -0.18 | 43.38 psf | 2077 Pa |
| *Wind Normal to 70 ft wall* | | |
| p = 50.44 * 0.85 * 0.8 - 50.44 * 0.18 | 25.22 psf | 1208 Pa |
| p = 50.44 * 0.85 * 0.8 - 50.44 * -0.18 | 43.38 psf | 2077 Pa |

Leeward Wall:

| | | |
|---|---|---|
| q = qh | 50.44 psf | 2415 Pa |
| *Wind Normal to 35 ft wall* | | |
| p = 50.44 * 0.85 * -0.3 - 50.44 * 0.18 | -21.94 psf | -1051 Pa |
| p = 50.44 * 0.85 * -0.3 - 50.44 * -0.18 | -3.78 psf | -181 Pa |
| *Wind Normal to 70 ft wall* | | |
| p = 50.44 * 0.85 * -0.5 - 50.44 * 0.18 | -30.52 psf | -1461 Pa |
| p = 50.44 * 0.85 * -0.5 - 50.44 * -0.18 | -12.36 psf | -592 Pa |

Side Walls:

| | | |
|---|---|---|
| q = qh | 50.44 psf | 2415 Pa |
| *Wind Normal to 35 ft wall* | | |
| p = 50.44 * 0.85 * -0.7 - 50.44 * 0.18 | -39.09 psf | -1872 Pa |
| p = 50.44 * 0.85 * -0.7 - 50.44 * -0.18 | -20.93 psf | -1002 Pa |
| *Wind Normal to 70 ft wall* | | |
| p = 50.44 * 0.85 * -0.7 - 50.44 * 0.18 | -39.09 psf | -1872 Pa |
| p = 50.44 * 0.85 * -0.7 - 50.44 * -0.18 | -20.93 psf | -1002 Pa |

Roof:

| | | | |
|---|---|---|---|
| q = qh | | 50.44 psf | 2415 Pa |
| *Wind Normal to 35 ft wall* | | | |
| 0 to 15 ft: | p = 50.44*0.85*-0.9-50.44*0.18 | -47.67 psf | -2282 Pa |
| | p = 50.44*0.85*-0.9-50.44*-0.18 | -29.51 psf | -1413 Pa |
| 15 to 30 ft: | p = 50.44*0.85*-0.5-50.44*0.18 | -30.52 psf | -1461 Pa |
| | p = 50.44*0.85*-0.5-50.44*-0.18 | -12.36 psf | -592 Pa |
| 30 to 70 ft: | p = 50.44*0.85*-0.3-50.44*0.18 | -21.94 psf | -1051 Pa |
| | p = 50.44*0.85*-0.3-50.44*-0.18 | -3.78 psf | -181 Pa |

*Wind Normal to 70 ft wall*

By inspection the pressures will be same as wind in the other direction

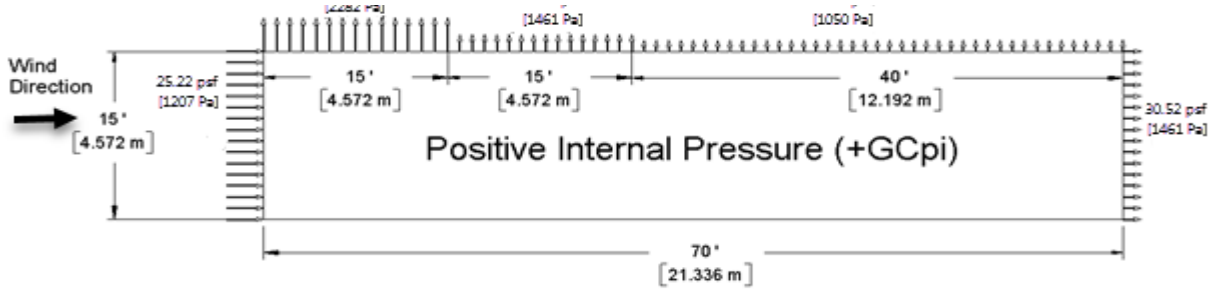



Fig 1.1a.2 - Wind Normal to 35 ft Wall and Positive Internal Pressure (+GCpi)

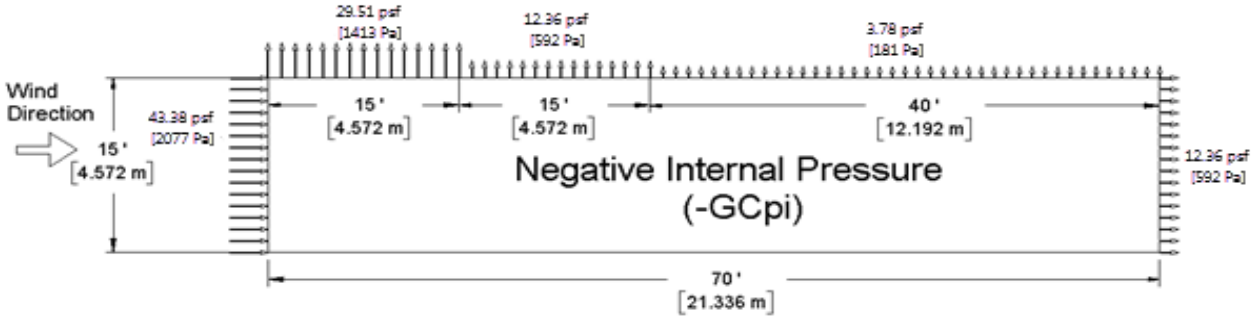



Fig 1.1a.3 - Wind Normal to 35 ft Wall and Negative Internal Pressure (-GCpi)

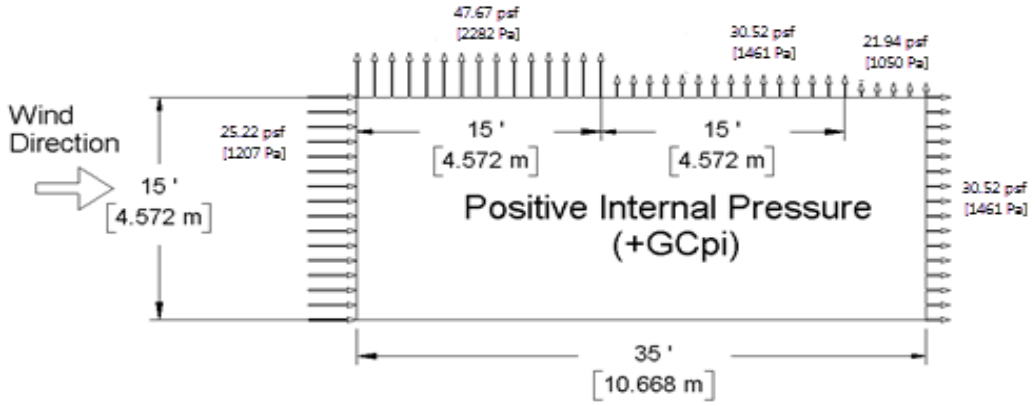



Fig 1.1a.4 - Wind Normal to 70 ft Wall and Positive Internal Pressure (+GCpi)

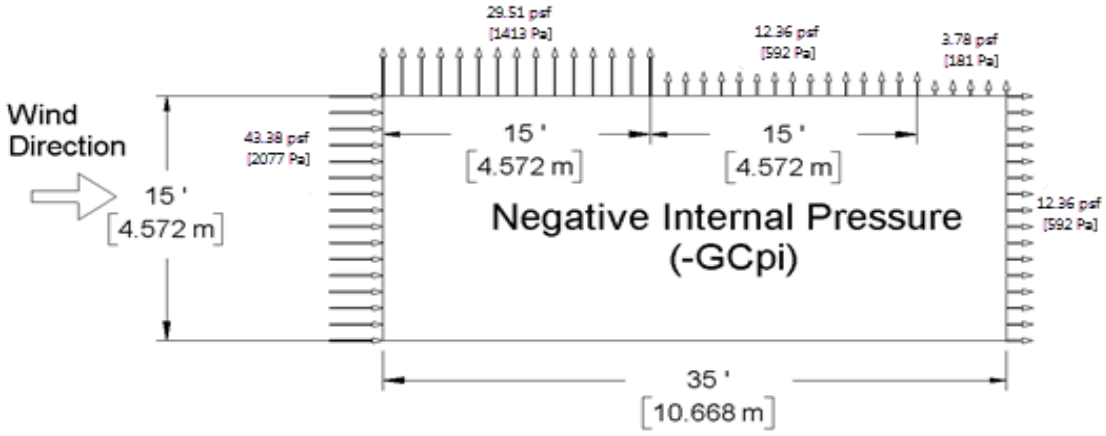



Fig 1.1a.5 - Wind Normal to 70 ft Wall and Negative Internal Pressure (-GCpi)

**Components and Cladding (C&C): (Chapter 30 Part 1 - Low Rise Building)**

*In chapter 30 the criteria is identified for Part's 1 through 5 to assist in determining which Part is applicable. Since the height is less than 60 ft and meets the low-rise building criteria of section 26.2 then Part 1 is to be followed.*

*Wall Pressures:*

The CMU panels are supported at the roof diaphragm and at the ground, so the span is 15 ft. The effective wind area is determined from Paragraph 6.2 which states "the width of the effective area need not be less than one-third of the span."

| | | | |
|---|---|---|---|
| Effective Area = | 15 x (15 /3) | 75.00 ft^2 | 22.86 m^2 |

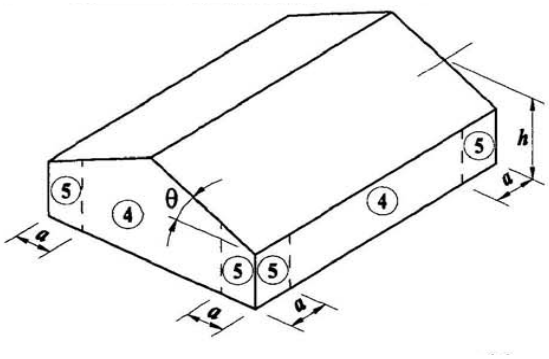
There are two zones for walls, zone 4 on the interior of the wall and zone 5 on the corners. Both zones will be calculated to determine the worst case loading.

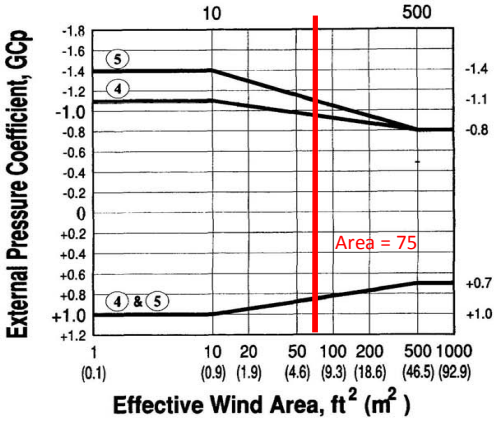
Fig 30.4-1 - Determine a for Zone 5

| | | | |
|---|---|---|---|
| a1: | 10% of least horizontal dim | 3.500 ft | 1.067 m |
| a2: | 0.4 * h | 6.000 ft | 1.829 m |
| a: | Smaller of a1 or a2 | 3.500 ft | 1.067 m |

Ch 30 - Part 1 - Eqn 30.4-1 - C&C Pressures

| | | | |
|---|---|---|---|
| Eqn 30.4-1: | p = qh * [(GCp) - (GCpi)] | | |
| qh = | Same as determined for MWFRS | 50.44 psf | 2415 Pa |
| GCPi = | Enclosed Buildings | +0.18 | -0.18 |




| | | From Fig 30.4-1 | | | Final Coefficients | |
|---|---|---|---|---|---|---|
| Description | Zone | +Gcpi | -GCpi | Reduction* | +Gcpi | -GCpi |
| CMU Walls | 4 | 0.85 | -0.95 | 0.9 | 0.76 | -0.85 |
| CMU Walls | 5 | 0.85 | -1.09 | 0.9 | 0.76 | -0.98 |

*Note 5 of Fig 30.4-1 indicates for Roof theta <= 10 Deg reduce coefficients by 10%

CMU Wall Pressure - Interior (Zone 4):

| | | |
|---|---|---|
| p = 50.44 * [0.76 + (+0.18)] | 47.41 psf | 2270 Pa |
| p = 50.44 * [-0.85 + (-0.18)] | -51.95 psf | -2488 Pa |

CMU Wall Pressure - Corner (Zone 5):

| | | |
|---|---|---|
| p = 50.44 * [0.76 + (+0.18)] | 47.41 psf | 2270 Pa |
| p = 50.44 * [-0.981 + (-0.18)] | -58.56 psf | -2804 Pa |

*Roof Joists*

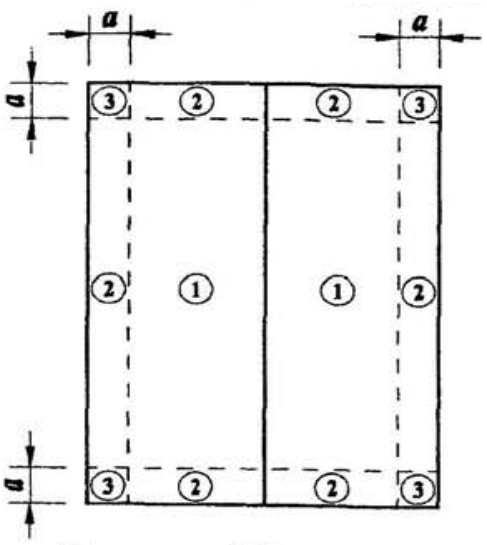
The joists span the width of the building, and they are spaced 5 ft apart. Calculate effective area per Paragraph 6.2, which indicates that the width need not be less than 1/3 of the span.

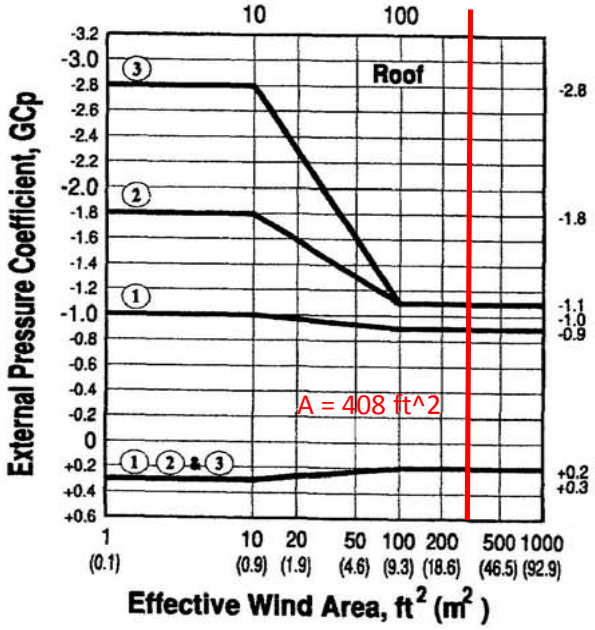
| | | | |
|---|---|---|---|
| Effective Area = | 35 * Max(5, 35/3) | 408.3 ft^2 | 124.46 m^2 |

The joists can be located in Zone 1 (interior), Zone 2 (Eave) and Zone 3 (Corners).

Fig 30.4-2A - Determine a for corner and eave zones

| | | | |
|---|---|---|---|
| a1: | 10% of least horizontal dim | 3.500 ft | 1.067 m |
| a2: | 0.4 * h | 6.000 ft | 1.829 m |
| a: | Smaller of a1 or a2 | 3.500 ft | 1.067 m |




From Fig 30.4-2A

| Description | Zone | +Gcpi | -GCpi |
|---|---|---|---|
| Roof (Interior) | 1 | 0.2 | -0.9 |
| Roof (Eaves) | 2 | 0.2 | -1.1 |
| Roof (Corners) | 3 | 0.2 | -1.1 |

Roof Joist Pressure - Interior Zone 1

| | | |
|---|---|---|
| p = 50.44 * [0.2 + (+0.18)] | 19.17 psf | 918 Pa |
| p = 50.44 * [-0.9 + (-0.18)] | -54.48 psf | -2608 Pa |

Roof Joist Pressure - Eaves and Corners (Zones 2 and 3)

| | | |
|---|---|---|
| p = 50.44 * [0.2 + (+0.18)] | 19.17 psf | 918 Pa |
| p = 50.44 * [-1.1 + (-0.18)] | -64.56 psf | -3091 Pa |

*Roof Panels:*

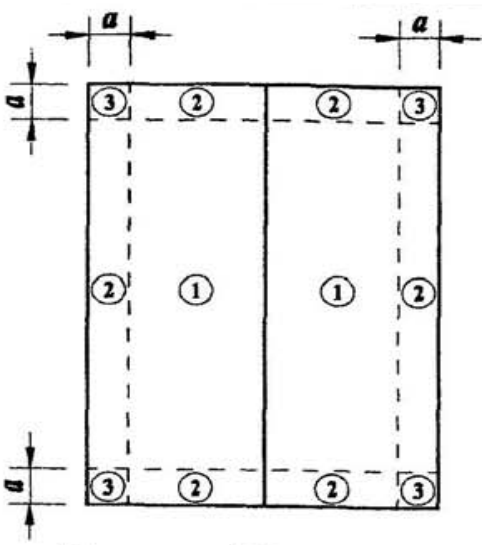
Each panel is 20 ft long by 2 ft wide, but the panel spans 5 ft between joists

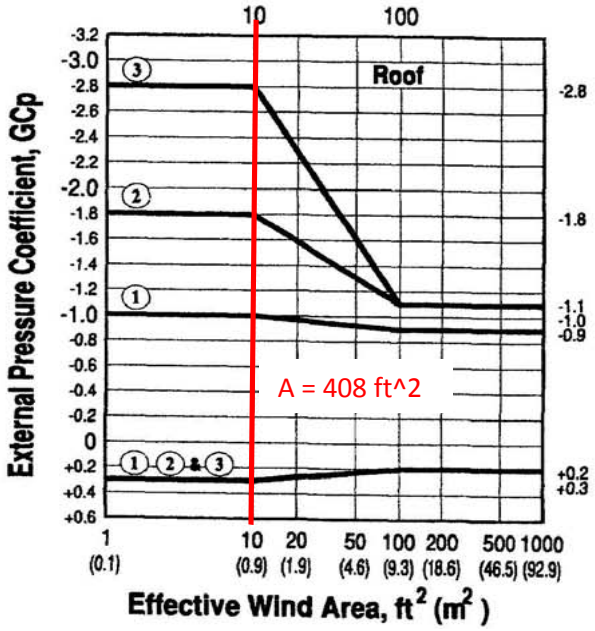
| | | | |
|---|---|---|---|
| Effective Area = | 5 * Max(2, 5/3) | 10.0 ft^2 | 3.05 m^2 |

The panels can be located in Zone 1 (interior), Zone 2 (Eave) and Zone 3 (Corners).

Fig 30.4-2A - Determine a for corner and eave zones

| | | | |
|---|---|---|---|
| a1: | 10% of least horizontal dim | 3.500 ft | 1.067 m |
| a2: | 0.4 * h | 6.000 ft | 1.829 m |
| a: | Smaller of a1 or a2 | 3.500 ft | 1.067 m |




From Fig 30.4-2A

| Description | Zone | +Gcpi | -GCpi |
|---|---|---|---|
| Roof (Interior) | 1 | 0.3 | -1.0 |
| Roof (Eaves) | 2 | 0.3 | -1.8 |
| Roof (Corners) | 3 | 0.3 | -2.8 |

Roof Panel Pressure - Interior Zone 1

| | | |
|---|---|---|
| p = 50.44 * [0.3 + (+0.18)] | 24.21 psf | 1159 Pa |
| p = 50.44 * [-1 + (-0.18)] | -59.52 psf | -2850 Pa |

Roof Panel Pressure - Eaves Zones 2

| | | |
|---|---|---|
| p = 50.44 * [0.3 + (+0.18)] | 24.21 psf | 1159 Pa |
| p = 50.44 * [-1.8 + (-0.18)] | -99.87 psf | -4782 Pa |

Roof Panel Pressure - Eaves Zones 3

| | | |
|---|---|---|
| p = 50.44 * [0.3 + (+0.18)] | 24.21 psf | 1159 Pa |
| p = 50.44 * [-2.8 + (-0.18)] | -150.31 psf | -7197 Pa |

Notes: Roof panel fasteners would use same pressures as roof panels since the coefficients are the same for effective areas less than 10 sq ft.

# MecaWind v2291



Calculations Prepared by:
Date: Jun 01, 2018
Designer: CR

FileLocation : M:\EBook Wind Examples\Release 2.0\MW Input Files\Example 1.1a A710.wnd

**Basic Wind Parameters**

| | | | |
|---|---|---|---|
| Wind Load Standard | = ASCE 7-10 | Exposure Category | = D |
| Wind Design Speed | = 150.0 mph | Risk Category | = II |
| Structure Type | = Building | Building Type | = Enclosed |

**General Wind Settings**

| | | |
|---|---|---|
| Incl_LF | = Include ASD Load Factor of 0.6 in Pressures | = False |
| DynType | = Dynamic Type of Structural | = Rigid |
| NF | = Natural Frequency of Structure (Mode 1) | = 1.000 Hz |
| Zg | = Altitude (Ground Elevation) above Sea Level | = 0.000 ft |
| SDB | = Simple Diaphragm Building | = False |
| Reacs | = Show the Base Reactions in the output | = False |
| MWFRSType | = MWFRS Method Selected | = Ch 27 Pt 1 |
| Stories | = Number of Stories | = 0 |
| LFrame | = Is the building framed with Light Frame Construction | = False |
| FD | = Does the building have a Flexible Diaphragm | = False |

**Topographic Factor per Fig 26.8-1**

| | | |
|---|---|---|
| Topo | = Topographic Feature | = None |
| Kzt | = Topographic Factor | = 1.000 |

**Building Inputs**

| | | | | | |
|---|---|---|---|---|---|
| RoofType: | Building Roof Type | = Flat | RfHt | : Roof Height | = 15.000 ft |
| W | : Building Width | = 35.000 ft | L | : Building Length | = 70.000 ft |
| Par | : Is there a Parapet | = False | | | |

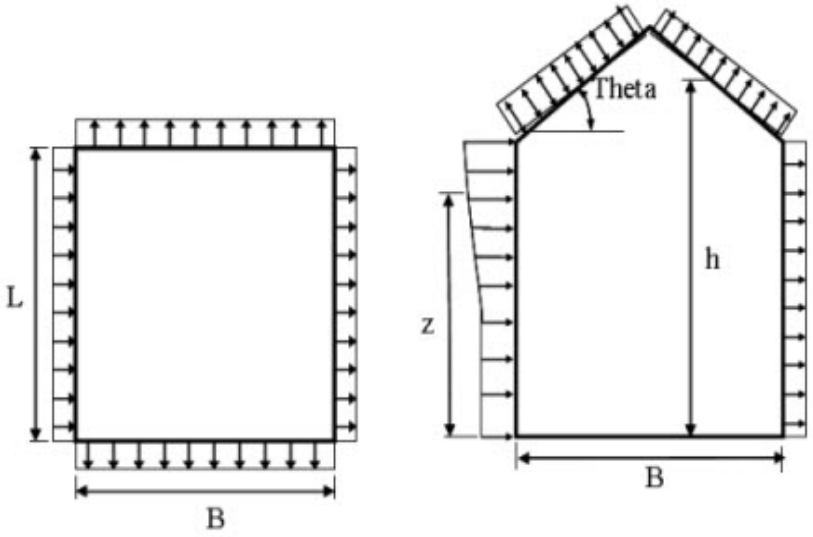
**Exposure Constants per Table 26.9-1:**

| | | | |
|---|---|---|---|
| Alpha: | Const from Table 26.9-1= 11.500 | Zg: | Const from Table 26.9-1= 700.000 ft |
| At: | Const from Table 26.9-1= 0.087 | Bt: | Const from Table 26.9-1= 1.070 |
| Am: | Const from Table 26.9-1= 0.111 | Bm: | Const from Table 26.9-1= 0.800 |
| C: | Const from Table 26.9-1= 0.150 | Eps: | Const from Table 26.9-1= 0.125 |

**Overhang Inputs:**

| | | |
|---|---|---|
| Std | = Overhangs on all sides are the same | = True |
| OHType | = Type of Roof Wall Intersections | = None |

**Main Wind Force Resisting System (MWFRS) Calculations per Ch 27 Part 1:**




| | | |
|---|---|---|
| Zh | = Mean Roof Height for Kh: h + Base_Dist | = 15.000 ft |
| Kh | = Since 15 ft [4.572 m] < Zh < Zg --> 2.01 * (Zh/zg)^(2/Alpha) | = 1.030 |
| Kzt | = Topographic Factor is 1 since no Topographic feature specified | = 1.000 |
| Kd | = Wind Directionality Factor per Table 26.6-1 | = 0.85 |
| GCPi | = Ref Table 26.11-1 for Enclosed Building | = +/-0.18 |
| RA | = Roof Area | = 2450.00 sq ft |
| LF | = Load Factor based upon STRENGTH Design | = 1.00 |
| qh | = (0.00256 * Kh * Kzt * Kd * V^2) * LF | = 50.44 psf |
| qin | = For Negative Internal Pressure of Enclosed Building use qh*LF | = 50.44 psf |
| qip | = For Positive Internal Pressure of Enclosed Building use qh*LF | = 50.44 psf |

**Gust Factor Calculation:**

| | | |
|---|---|---|
| Gust Factor Category I Rigid Structures - Simplified Method | | |
| G1 | = For Rigid Structures (Nat. Freq.>1 Hz) use 0.85 | = 0.85 |
| Gust Factor Category II Rigid Structures - Complete Analysis | | |
| Zm | = 0.6 * Ht | = 9.000 ft |
| Izm | = Cc * (33 / Zm) ^ 0.167 | = 0.186 |
| Lzm | = L * (Zm / 33) ^ Epsilon | = 552.560 |
| Q | = (1 / (1 + 0.63 * ((B + Ht) / Lzm)^0.63))^0.5 | = 0.937 |
| G2 | = 0.925*((1+1.7*lzm*3.4*Q)/(1+1.7*3.4*lzm)) | = 0.895 |
| Gust Factor Used in Analysis | | |
| G | = Lessor Of G1 Or G2 | = 0.850 |

**MWFRS Wind Normal to Ridge (Ref Fig 27.4-1}**

| | | |
|---|---|---|
| h | = Mean Roof Height Of Building | = 15.000 ft |
| RHt | = Ridge Height Of Roof | = 15.000 ft |
| B | = Horizontal Dimension Of Building Normal To Wind Direction | = 70.000 ft |
| L | = Horizontal Dimension Of building Parallel To Wind Direction | = 35.000 ft |
| L/B | = Ratio Of L/B used For Cp determination | = 0.500 |
| h/L | = Ratio Of h/L used For Cp determination | = 0.429 |
| Slope | = Slope of Roof | = 0.0 Deg |
| Roof_1 | = Roof Coeff (0 to h) (0.000 ft to 15.000 ft) | = -0.18, -0.9 |
| Roof_2 | = Roof Coeff (h to 2h) (15.000 ft to 30.000 ft) | = -0.18, -0.5 |
| Roof_3 | = Roof Coeff (>2h) (>30.000 ft) | = -0.18, -0.3 |

| | | |
|---|---|---|
| Cp_WW | = Windward Wall Coefficient (All L/B Values) | = 0.80 |
| Cp_LW | = Leward Wall Coefficient using L/B | = -0.50 |
| Cp_SW | = Side Wall Coefficient (All L/B values) | = -0.70 |
| GCpn_WW | = Parapet Combined Net Pressure Coefficient (Windward Parapet) | = 1.50 |
| GCpn_LW | = Parapet Combined Net Pressure Coefficient (Leeward Parapet) | = -1.00 |

**Wall Wind Pressures based On Positive Internal Pressure (+GCPi) - Normal to Ridge**
**All wind pressures include a load factor of 1.0**

| Elev | Kz | Kzt | qz | GCPi | Windward Press | Leeward Press | Side Press | Total Press |
|---|---|---|---|---|---|---|---|---|

| ft | | | psf | psf | psf | psf | psf | psf |
|---|---|---|---|---|---|---|---|---|
| 15.00 | 1.030 | 1.000 | 50.44 | 0.18 | 25.22 | -30.52 | -39.09 | 55.74 |
| 5.00 | 1.030 | 1.000 | 50.44 | 0.18 | 25.22 | -30.52 | -39.09 | 55.74 |

**Wall Wind Pressures based on Negative Internal Pressure (-GCPi) - Normal to Ridge**
**All wind pressures include a load factor of 1.0**

| Elev | Kz | Kzt | qz | GCPi | Windward Press | Leeward Press | Side Press | Total Press |
|---|---|---|---|---|---|---|---|---|
| ft | | | psf | psf | psf | psf | psf | psf |
| 15.00 | 1.030 | 1.000 | 50.44 | -0.18 | 43.38 | -12.36 | -20.93 | 55.74 |
| 5.00 | 1.030 | 1.000 | 50.44 | -0.18 | 43.38 | -12.36 | -20.93 | 55.74 |

Notes Wall Pressures:
Kz = Velocity Press Exp Coeff  Kzt = Topographical Factor
qz = 0.00256*Kz*Kzt*Kd*V^2  GCPi = Internal Press Coefficient
Side = qh * G * Cp_SW - qip * +GCPi  Windward = qz * G * Cp_WW - qip * +GCPi
Leeward = qh * G * Cp_LW - qip * +GCPi  Total = Windward Press - Leeward Press
+ Pressures Acting TOWARD Surface  - Pressures Acting AWAY from Surface

**Roof Wind Pressures for Positive & Negative Internal Pressure (+/- GCPi) - Normal to Ridge**
**All wind pressures include a load factor of 1.0**

| Roof Var | Start Dist ft | End Dist ft | Cp_min | Cp_max | GCPi | Pressure Pn_min* psf | Pressure Pp_min* psf | Pressure Pn_max psf | Pressure Pp_max psf |
|---|---|---|---|---|---|---|---|---|---|
| Roof_1 (All) | 0.000 | 15.000 | -0.180 | -0.900 | 0.180 | 1.36 | -16.80 | -29.51 | -47.67 |
| Roof_2 (All) | 15.000 | 30.000 | -0.180 | -0.500 | 0.180 | 1.36 | -16.80 | -12.36 | -30.52 |
| Roof_3 (All) | 30.000 | 35.000 | -0.180 | -0.300 | 0.180 | 1.36 | -16.80 | -3.78 | -21.94 |

Notes Roof Pressures:
Start Dist = Start Dist from Windward Edge  End Dist = End Dist from Windward Edge
Cp_Max = Largest Coefficient Magnitude  Cp_Min = Smallest Coefficient Magnitude
Pp_max = qh*G*Cp_max - qip*(+GCPi)  Pn_max = qh*G*Cp_max - qin*(-GCpi)
Pp_min* = qh*G*Cp_min - qip*(+GCPi)  Pn_min* = qh*G*Cp_min - qin*(-GCPi)
OH = Overhang  X = Dir along Ridge  Y = Dir Perpendcular to Ridge  Z = Vertical
* The smaller uplift pressures due to Cp_Min can become critical when wind is combined with roof live load or snow load; load combinations are given in ASCE 7
+ Pressures Acting TOWARD Surface  - Pressures Acting AWAY from Surface

**MWFRS Wind Parallel to Ridge (Ref Fig 27.4-1}**

| | | |
|---|---|---|
| h | = Mean Roof Height Of Building | = 15.000 ft |
| RHt | = Ridge Height Of Roof | = 15.000 ft |
| B | = Horizontal Dimension Of Building Normal To Wind Direction | = 35.000 ft |
| L | = Horizontal Dimension Of building Parallel To Wind Direction | = 70.000 ft |
| L/B | = Ratio Of L/B used For Cp determination | = 2.000 |
| h/L | = Ratio Of h/L used For Cp determination | = 0.214 |
| Slope | = Slope of Roof | = 0.0 Deg |
| Roof_1 | = Roof Coeff (0 to h) (0.000 ft to 15.000 ft) | = -0.18, -0.9 |
| Roof_2 | = Roof Coeff (h to 2h) (15.000 ft to 30.000 ft) | = -0.18, -0.5 |
| Roof_3 | = Roof Coeff (>2h) (>30.000 ft) | = -0.18, -0.3 |
| Cp_WW | = Windward Wall Coefficient (All L/B Values) | = 0.80 |
| Cp_LW | = Leward Wall Coefficient using L/B | = -0.30 |
| Cp_SW | = Side Wall Coefficient (All L/B values) | = -0.70 |
| GCpn_WW | = Parapet Combined Net Pressure Coefficient (Windward Parapet) | = 1.50 |
| GCpn_LW | = Parapet Combined Net Pressure Coefficient (Leeward Parapet) | = -1.00 |

**Wall Wind Pressures based On Positive Internal Pressure (+GCPi) - Parallel to Ridge**
**All wind pressures include a load factor of 1.0**

| Elev | Kz | Kzt | qz | GCPi | Windward Press | Leeward Press | Side Press | Total Press |
|---|---|---|---|---|---|---|---|---|
| ft | | | psf | psf | psf | psf | psf | psf |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 15.00 | 1.030 | 1.000 | 50.44 | 0.18 | 25.22 | -21.94 | -39.09 | 47.16 |
| 5.00 | 1.030 | 1.000 | 50.44 | 0.18 | 25.22 | -21.94 | -39.09 | 47.16 |

**Wall Wind Pressures based on Negative Internal Pressure (-GCPi) - Parallel to Ridge**
**All wind pressures include a load factor of 1.0**

| Elev ft | Kz | Kzt | qz psf | GCPi psf | Windward Press psf | Leeward Press psf | Side Press psf | Total Press psf |
|---|---|---|---|---|---|---|---|---|
| 15.00 | 1.030 | 1.000 | 50.44 | -0.18 | 43.38 | -3.78 | -20.93 | 47.16 |
| 5.00 | 1.030 | 1.000 | 50.44 | -0.18 | 43.38 | -3.78 | -20.93 | 47.16 |

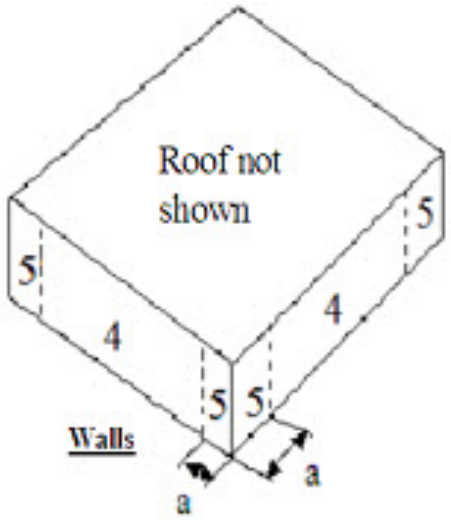
Notes Wall Pressures:
Kz = Velocity Press Exp Coeff  Kzt = Topographical Factor
qz = 0.00256*Kz*Kzt*Kd*V^2  GCPi = Internal Press Coefficient
Side = qh * G * Cp_SW - qip * +GCPi  Windward = qz * G * Cp_WW - qip * +GCPi
Leeward = qh * G * Cp_LW - qip * +GCPi  Total = Windward Press - Leeward Press
+ Pressures Acting TOWARD Surface  - Pressures Acting AWAY from Surface

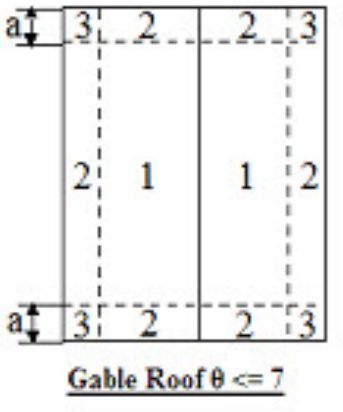
**Roof Wind Pressures for Positive & Negative Internal Pressure (+/- GCPi) - Parallel to Ridge**
**All wind pressures include a load factor of 1.0**

| Roof Var | Start Dist ft | End Dist ft | Cp_min | Cp_max | GCPi | Pressure Pn_min* psf | Pressure Pp_min* psf | Pressure Pn_max psf | Pressure Pp_max psf |
|---|---|---|---|---|---|---|---|---|---|
| Roof_1 (All) | 0.000 | 15.000 | -0.180 | -0.900 | 0.180 | 1.36 | -16.80 | -29.51 | -47.67 |
| Roof_2 (All) | 15.000 | 30.000 | -0.180 | -0.500 | 0.180 | 1.36 | -16.80 | -12.36 | -30.52 |
| Roof_3 (All) | 30.000 | 70.000 | -0.180 | -0.300 | 0.180 | 1.36 | -16.80 | -3.78 | -21.94 |

Notes Roof Pressures:
Start Dist = Start Dist from Windward Edge  End Dist = End Dist from Windward Edge
Cp_Max = Largest Coefficient Magnitude  Cp_Min = Smallest Coefficient Magnitude
Pp_max = qh*G*Cp_max - qip*(+GCPi)  Pn_max = qh*G*Cp_max - qin*(-GCpi)
Pp_min* = qh*G*Cp_min - qip*(+GCPi)  Pn_min* = qh*G*Cp_min - qin*(-GCPi)
OH = Overhang  X = Dir along Ridge  Y = Dir Perpendcular to Ridge  Z = Vertical
* The smaller uplift pressures due to Cp_Min can become critical when wind is combined with roof live load or snow load; load combinations are given in ASCE 7
+ Pressures Acting TOWARD Surface  - Pressures Acting AWAY from Surface

**Components and Cladding (C&C) Calculations per Ch 30 Part 1:**




| | | |
|---|---|---|
| Zh | = Mean Roof Height for Kh: h + Base_Dist | = 15.000 ft |
| Kh | = Since 15 ft [4.572 m] < Zh < Zg --> 2.01 * (Zh/zg)^(2/Alpha) | = 1.030 |
| Kzt | = Topographic Factor is 1 since no Topographic feature specified | = 1.000 |
| Kd | = Wind Directionality Factor per Table 26.6-1 | = 0.85 |
| GCPi | = Ref Table 26.11-1 for Enclosed Building | = +/-0.18 |
| LF | = Load Factor based upon STRENGTH Design | = 1.00 |
| qh | = (0.00256 * Kh * Kzt * Kd * V^2) * LF | = 50.44 psf |
| LHD | = Least Horizontal Dimension: Min(B, L) | = 35.000 ft |
| a1 | = Min(0.1 * LHD, 0.4 * h | = 3.500 ft |
| a | = Max(a1, 0.04 * LHD, 3 ft [0.9 m]) | = 3.500 ft |

**Wind Pressures for C&C Ch 30 Pt 1**
**All wind pressures include a load factor of 1.0**

| Description | Zone | Width ft | Span ft | Area sq ft | 1/3 Rule | Ref Fig | GCp Max | GCp Min | p Max psf | p Min psf |
|---|---|---|---|---|---|---|---|---|---|---|
| Walls (Interior) | 4 | 1.000 | 15.000 | 75.00 | Yes | 30.4-1 | 0.761 | -0.851 | 47.46 | -52.00 |
| Walls (Corners) | 5 | 1.000 | 15.000 | 75.00 | Yes | 30.4-1 | 0.761 | -0.982 | 47.46 | -58.60 |
| Joists (Interior) | 1 | 5.000 | 35.000 | 408.33 | Yes | 30.4-2A | 0.200 | -0.900 | 19.17 | -54.48 |
| Joists (Eaves) | 2 | 5.000 | 35.000 | 408.33 | Yes | 30.4-2A | 0.200 | -1.100 | 19.17 | -64.56 |
| Joists (Corners) | 3 | 5.000 | 35.000 | 408.33 | Yes | 30.4-2A | 0.200 | -1.100 | 19.17 | -64.56 |
| Roof (Interior) | 1 | 2.000 | 5.000 | 10.00 | No | 30.4-2A | 0.300 | -1.000 | 24.21 | -59.52 |
| Roof (Eaves) | 2 | 2.000 | 5.000 | 10.00 | No | 30.4-2A | 0.300 | -1.800 | 24.21 | -99.87 |
| Roof (Corners) | 3 | 2.000 | 5.000 | 10.00 | No | 30.4-2A | 0.300 | -1.800 | 24.21 | -99.87 |

Area = Span Length x Effective Width
1/3 Rule = Effective width need not be less than 1/3 of the span length
GCp = External Pressure Coefficients taken from Figures 30.4-1 through 30.4-7
p = Wind Pressure: qh*(GCp - GCpi) [Eqn 30.4-1]*
*Per Para 30.2.2 the Minimum Pressure for C&C is 16.00 psf [0.766 kPa] {Includes LF}
Since Roof Slope <= 10 Deg, the wall pressures are reduced by 10%