WIND PROVISIONS OF IBC 2006 AND ASCE 7-05

Last updated: July 13, 2011

The Code

ASCE 7-05 is the basis for the wind provisions of IBC 2006 and 2009. The ARE exam, as of early 2011, uses the IBC 2006. There are some minor differences between the IBC 2006 and 2009 but I am not discussing any of the differences in this paper so as not to confuse people. I will add discussions about the differences in response to questions I see on the areforum.

Definitions

V = Basic wind speed, 3-second gust = 90 mph for almost all of the continental United States. The exceptions are the east and west coasts.

h = mean roof height

Kh = velocity pressure coefficient at mean roof height. Adjusts the pressure based on exposure and height

Kz = velocity pressure coefficient at height z. Adjusts the pressure based on exposure and height

Kzt = Topographic factor

p = design pressure – basically q * modification factors for windward. Leeward or sidewalls

qz = Velocity pressure evaluated at height z. This is the basic pressure that is modified in all the other formulas to determine design pressures. Also called the stagnation pressure.

qh = velocity pressure at the mean roof height

MWFRS = Main Wind Force Resisting System

z = height that is being evaluated

Exposures

Exposure A – Deleted from the code

Exposure B – Urban and suburban areas; measure ½ mile or 20 times building height

Exposure C – Middle of a corn field; use this unless the site where B or D apply

Exposure D – Areas where wind speed up across a body of water. West coast is one location as well as the great lakes. This is for areas that are not designed for hurricane force winds. measure 1 mile or 20 times building height

Wind Speed

Three-second gust speed at 33 ft (10 m) above ground in Exposure C. This is different from older codes. Ignore anything that discussed "fastest-mile wind speed"

Most of the continental states are 90 mph except 85 mph west of the Rocky Mountains. Coastal areas on the east coast and Gulf of Mexico have higher speeds, up to 150 mph, due to hurricanes.

General formulas

qz = 0.00256*Kz*Kzt*Kd*(V^2)*I

p = (q*GCp) - (q*GCpi)

q= qz for load to the windward wall

q= qh for load to the leeward wall

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G= gust effect factor

Cp= External pressure coefficient

(GCpi)=Internal pressure coefficient; can be positive or negative. Positive acts towards the surface and negative acts away from surface.

Method 1

ps = λ * Kzt * I * qs30 This is the pressure on the MWFRS

pnet = λ * Kzt * I * qnet30 This is the pressure for components and cladding

qs30 = wind stagnation pressure, taken from a table. The table assumes exposure b and roof height 30 ft
Kzt is the topographic factor. Increases the pressure if you are on the edge of a hill. \

λ = adjustment factor for height and exposure. There are different λ for the MWFRS and for components and cladding

Table 6-3

This table seems to confuse most candidates and an in depth understanding of it is not (in my opinion) required for the ARE test. But a basic understanding would help.

Table 6-3 is used with only Method 2, the analytical method.

Wind speed map is based on exposure category c and a height of 33 feet. For proper wind design you start with determining qz (formula above). Table 6-3 provides a method for adjusting qz for the height and exposure of the particular building. So you enter the table using the exposure category and height under consideration to find the correct value of kz.

Whether to use Case 1 or Case 2.

Case 1 is for components and cladding for all buildings and structures. It is also for the MWFRS on low rise buildings. Values for heights less than 30 feet are higher for Case one than for Case 2 due to anomalies in the wind speeds up in suburban areas. Once above 30 feet the values are the same because the difference in wind speed up is negligible

Case 2 is for buildings that are not classified as low rise (height over 60 feet) and "other structure" (non-building structures.)

Example

The following is an example of the use of the above formula in one of the guide examples (I forget which one)

For the windward wall

(10.05*0.9) - (10.05*(-0.18) = 10.854

Or

(10.05*0.9) - (10.05*(+0.18)) = 7.236

For the leeward wall

((10.05*(-0.9)) - (10.05*(-0.18) = -7.236

Or

((10.05*(-0.9) - (10.05*(+0.18)) = -10.854

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Corner areas

For the windward wall

(10.05*0.9) - (10.05*(-0.18) = 10.854

Or

(10.05*0.9) - (10.05*(+0.18)) = 7.236

For the leeward wall

((10.05*(-1.8)) - (10.05*(-0.18) = -16.281

Or

((10.05*(-1.8) - (10.05*(+0.18)) = -19.899