

# The "WTH is this?" Breakdown of IBC 2006 Chapter 16 Wind Loads

Mercy. Does it ever end? A quick perusal of the wind portion of IBC 2006 can cause serious intestinal trauma and make you want to use the pages to assist in alleviating the result of said trauma. Unfortunately, we budding architects have to trudge through this train wreck.

## 2006 IBC (Chapter 16)-Wind Loads

As you can guess, the wind portion of the IBC 2006 wants to send you skittering over to ASCE 7 (with exceptions--sound familiar?) Design loads relevant for General Structures are the foundation of Chapter 16, but it rambles on through roof, snow, wind, earthquake, and flood loads.

Since we are dealing with wind loads, we'll breeze onward (pun intended). As with other load requirements that are to be listed on the construction documents by necessity or relevance, the IBC 2006 requires particular wind information to be listed in *Section 1603.1.4-Wind Design Data*. Unfortunately, the information isn't very enlightening at this point:

- 1) Basic wind speed (3-second gust), miles per hour (km/hr)
- 2) Wind importance factor,  $I$ , and occupancy category
- 3) Wind exposure, if more than one wind exposure is utilized, the wind exposure and applicable wind direction shall be indicated.
- 4) The applicable internal pressure coefficient
- 5) Components and cladding. The design wind pressures in terms of psf (kN/m<sup>2</sup>) to be used for the design of exterior component and cladding materials not specifically designed by the registered design professional.

Huh? This doesn't tell me anything. The only thing at this point that we can be sure of is occupancy category from the good old *Table 1604.5--Occupancy Category of Buildings and Other Structures*. We're going to have to plunge in and shake out the detritus.

## Section 1609--Wind Loads

Now the fun begins. As soon as you read *Section 1609.1.1--Determination of Wind Loads*, you may find yourself glassy-eyed and desiring to set fire to the IBC 2006. Quoting from this section: "*Wind loads on every building or structure shall be determined in accordance with Chapter 6 of ASCE 7.*" Great. The constant references to ASCE makes you think that the IBC and ASCE are in collusion to sell Code Books, but it gets worse. This opening section is full of acronym babble while referring to one text or another in the *Exceptions*. The next two following subsections discuss protection of openings and even bring out references to ASTM E 1996 (I'm sure everyone has a copy of that handy).

We finally get some clarification in *Section 1609.3--Basic Wind Speed*, which is based on 3-second gust maps (IBC *Figure 1609*). Unfortunately, the IBC 2006 throws in a nice catchy phrase in the following subsection: "when required." Not content with 3-second gusts, we also have to be aware of fastest-mile wind speeds, and the IBC 2006, being the way they are, throws in fanciful subscript coefficients to "clarify" things. On the bright side, they give us *Table 1609.3.1*, which converts from 3-second gusts to fastest-mile wind speeds.

What about those coefficients? Glad you asked. We find ourselves with our first formula in *Section 1608.3.1--Wind Speed Conversion*, where 3-second gusts are converted to fastest-mile wind speeds:

$$V_{fm} = \frac{(V_{3s} - 10.5)}{1.05}$$

where,

$V_{fm}$  = fastest-mile wind speeds

$V_{3s}$  = 3-second gust basic wind speed from *Figure 1609*

While it's unlikely you'll need this formula on the Lateral Forces test, knowing what  $V_{fm}$  and  $V_{3s}$  mean is probably a good idea.

Things start steamrolling ahead pretty quickly from this point into the surreal. The following section, *Section 1609.4--Exposure Category*, includes three subsections but determination of exposure is not relegated to a nice, comfortable chart or table. The main part of this section explains that variations of the roughness of the ground from the natural topography and vegetation need to be taken into account when determining Exposure Category.

*Section 1609.4.1--Wind Directions and Sectors* is the first item for determining Exposure Category, but the process is three-step from this point. Breaking the babble down to something that makes sense isn't easy, but a list helps:

- 1) Select wind direction for wind loads to be evaluated
- 2) Two upwind sectors extending 45° from either side of the chosen wind direction are the markers
- 3) Use *Section 1609.4.2* and *Section 1609.4.3* to determine the exposure in those sectors
- 4) The exposure with the highest wind loads is chosen for that wind direction

Hmm. Actually, that wasn't that clear was it? To get the information we need, we have to first glance over to *Section 1609.4.2--Surface Roughness Categories*. In this section, roughness is broken down into three categories: B, C, or D. They are summarized as follows:

- 1) Surface roughness B: Urban, suburban, wooded, closely spaced obstructions
- 2) Surface roughness C: Open terrain with few obstructions (nothing greater than 30 feet), flat open country, grasslands, water surfaces in hurricane-prone regions
- 3) Surface roughness D: Flat areas outside of hurricane prone regions, smooth mud flats, salt flats, unbroken ice

We're almost there, but we still haven't determined what the Exposure Category is. Finally, under *Section 1609.4.3--Exposure Categories*, we get the information we want. Exposure is based on the roughness that we determined earlier and once again broken into Categories B, C, or D:

- 1) Exposure B: Surface roughness B = Exposure B with these restrictions:
  - a) Roughness B prevails upwind for at least 2,600 feet or 20 times the building height (choose greater)
  - b) If the roof height is 30 feet or less, upwind distance is reduced to 1,500 feet
- 2) Exposure C: Exposure C shall apply for all cases where Exposures B or D do not apply
- 3) Exposure D: Surface roughness D = Exposure D with these restrictions:
  - a) Roughness D prevails upwind for at least 5,000 feet or 20 times the building height (choose greater)

- b) Exposure D extends inland from a shoreline 600 feet or 20 times the building height (choose greater)

Once we have the whole story, choosing the Exposure Category becomes clearer. As a generality, roughness = exposure. Memorizing all the details isn't necessary, but being able to recognize the letters is probably a good idea.

The last three sections deal with roofs and roof coverings, but the IBC 2006 resorts to "designed according to ASCE 7," which isn't exactly revealing. Oddly enough, *Section 1609.5.3--Rigid Tile* introduces a long formula that you'll probably never use unless you are specifying rigid tile. The only reason to read this is to make a mental note of a couple coefficients that are not illustrated in **Section 1609--Wind Loads** and only implied by reference to ASCE 7. An example is the following:

$GC_p$  = Roof pressure coefficient for each applicable roof zone determined from Chapter 6 of ASCE 7.

Even without ASCE 7, we can assume that when we see " $C_p$ " the question is talking about a pressure coefficient for wind load.

You're probably thinking, "Wait a second. That's it? What about importance and internal pressure? Where's the rest?!" If you do a search through all 679 pages of the IBC 2006 for "importance factor," the only enlightening information that you will find is "*designed in accordance to Section <insert here> of ASCE 7.*" Isn't that a "mildly" familiar statement? The IBC 2006 leaves everyone who doesn't own a copy of ASCE 7 stumbling around in the dark.

Perhaps we shall attack that whoreson beast next.....