Wind Speed, Risk Categories and Wind-Borne Debris

Protecting Your Openings

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Massachusetts's adoption of the 780 CMR 9th Edition referencing the 2015 version of the International Building Code (IBC 2015) is drawing renewed attention to design wind speeds and wind-borne debris region requirements. The main changes between the IBC 2009 and the 2012 and 2015 versions of the IBC are increased design wind speeds and the determination of design wind speeds by Risk Category. The language for when protection of openings is required has not really changed other than to update the definition to reference the new design wind speeds.

The first question project teams need to ask is, "What is my new design wind speed?" To determine the design wind speed for a project, the designer of record must now take the project's Risk Category into account. Risk Category is the ICC's way of incorporating a scaled safety factor for determining design loads based on the risk associated with failure of the building's structure and enclosure. Whether a project is a Risk Category I, II, III or IV can now impact the design wind speed by up to 20mph! Prior to the IBC 2012, this safety factor was address by requiring a different coefficient be used depending on a project's Importance Factor. Once the appropriate design wind speed has been determined, the project team can proceed to determine the components and cladding design pressures and if the project is located in a Wind-Borne Debris Region requiring protection of openings. Massachusetts and Rhode Island were both nice enough to take the guess work out of interpreting the IBC wind speed maps by publishing tables that list specific design wind speeds by municipality.

Municipality	Basic Wind Speed, V_{ult} (mph)		
	Risk Category I	Risk Category II	Risk Category III-IV
Boston, MA	118	128	139
Providence, RI	123	133	144

Example wind speeds from Massachusetts 780 CMR 9th Edition (IBC 2015) and Rhode Island SBC-01-2013 (IBC 2012)

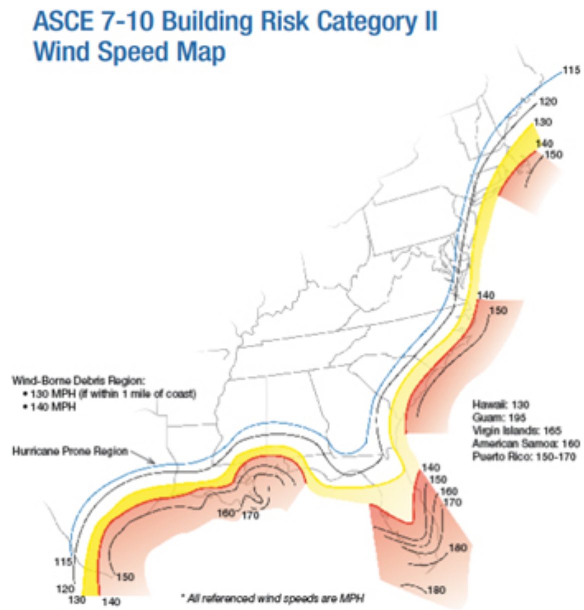
The next question typically is, "How do the new wind speeds effect my design pressures?" The short answer is, they don't.[1] When the ICC updated the design wind speeds the current version of ASCE 7 was also updated. The resulting components and cladding design pressures have not changed significantly due to the revised calculation methods in ASCE 7-2010 versus earlier versions. The table below compares components and cladding design pressures calculated for a Risk Category II building located in Boston. MA based on IBC 2009 (ASCE 7-2005) and IBC 2015 (ASCE 7-2010).

Code	Design Wind Speed (V_{ult})	Allowable Stress Design (ASD) *20sf Tributary Area*	
		Center Zone 4	Corner Zone 5
IBC 2009 / ASCE 7-2005	105 mph	23.1 psf | -23.1 psf	-42.3 psf
IBC 2015 / ASCE 7-2010	128 mph	20.6 psf | -20.6 psf	-37.7 psf

** Design pressures calculated per ASCE 7 version referenced using CADDtools Wind Load Program*

[1] The longer answer is that they do, but only slightly. In general, design pressures calculated per the IBC 2015 are approximately 10% lower than design pressures calculated per IBC 2009.

While the design wind speeds increased, the areas where wind-borne debris protection is required have not changed other than the 140mph wind line (IBC 2009 120mph wind line) now runs over Cape Cod and the islands rather than around it. A multi-step process must be followed to determine if a project is in a Wind-Borne Debris region requiring protection of openings.



Step 1 – Determine if the project is located in a Hurricane Prone Region

The IBC 2015 defines a Hurricane Prone Region as the Atlantic and Gulf of Mexico coasts where ultimate design wind speed (Vult) is greater than 115mph. (IBC 2009 = >90mph) This means all of CT, RI and MA as well as coastal NH and ME are located in a hurricane prone region. If a project is in a Hurricane Prone Region, continue to Step 2 to determine if it is located in a Wind-Borne Debris Region. Just because a project is in a Hurricane Prone Region does not mean it is in a Wind-Borne Debris Region.

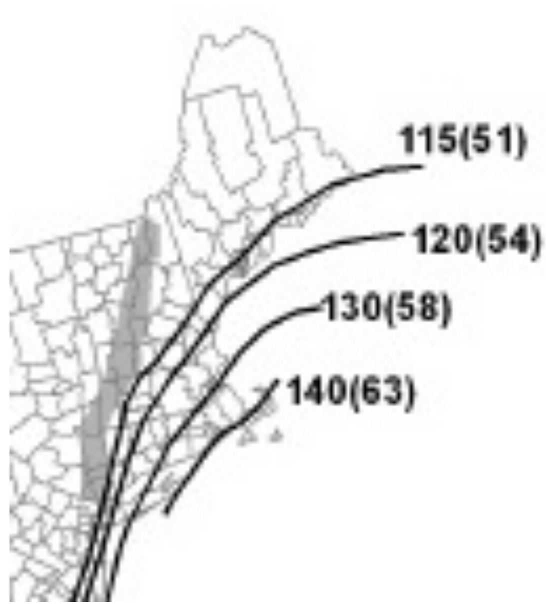
Step 2 – Determine if the project is located in a Wind-Borne Debris Region

The IBC 2015 defines a Wind-Borne Debris Region as areas within a Hurricane Prone Region that meets one of the following criteria:

- Wind Speed 130-139mph (IBC 2009 = 110-119mph) = Wind-borne debris region if within 1 mile of coastal mean high tide.
- Wind Speed 140mph or greater (IBC 2009 = 120mph & greater) = Wind-borne debris region regardless of distance from coastal mean high tide.

This means areas within a Hurricane Prone Region with a design wind speed of <130mph (IBC 2009 = <110mph) are not a wind-borne debris region and do not require protection of openings.

A key item in the IBC 2015 regarding Wind-Borne Debris Regions that project teams may be misinterpreting, or missing[2] all together, is that non-healthcare, Risk Category III buildings (e.g., schools) shall use the Risk Category II wind speed to determine if the project is in a wind-borne debris region.



Example: A large school project located in Boston, MA that is a Risk Category III building. The design team will use the Risk Category III design wind speed of 139mph to determine components and cladding design pressures but will use the Risk Category II design wind speed of 128mph to determine if protection of openings is required.

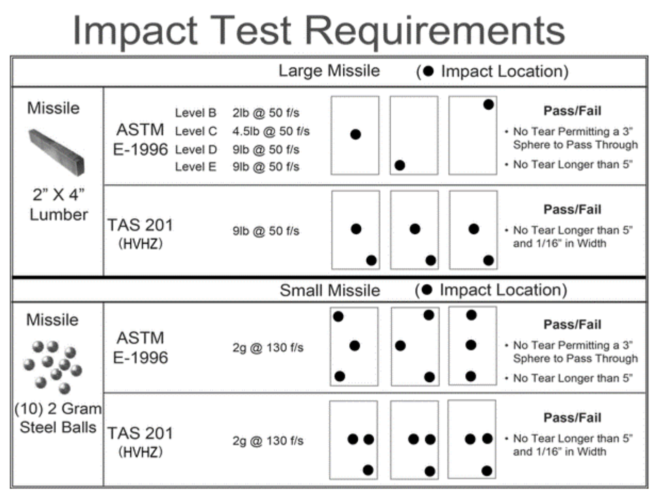
[2] The ICC decided to hide this information in Chapter 2 in the definition for Wind-Borne Debris Region. Because we always go back and read the definitions for each new project right?

Step 3 – Determine what level of protection is required
1609.1.2 Protection of Openings – In wind-borne debris regions, glazing in buildings shall be impact resistant or protected with an impact-resistant covering meeting the requirements of ASTM E1886 or an alternate approved impact-resistant standard.

- Glazed openings within 30' of grade shall be rated for large missile impact (i.e., wood 2x4) per ASTM E1996[3]
- Glazed openings greater than 30' above grade shall be rated for small missile impact (i.e., metal ball bearings) per ASTM E1996

The following glazing areas are exempt from impact resistance requirements in the IBC 2015:

- Where wood structural panels are provided for R-3 and R-4 that are two stories or less.
- Occupancy Category I buildings without public access
- Glazing located greater than 60' above grade or greater than 30' above roof surfaces within 1500'.



It is important to note that protection of openings is required on all sides of a building, not just the side of the building most likely to be exposed to the predominant prevailing winds. It is also important for the designer of record to work with the basis of design fenestration manufacturer (e.g., EFCO) to ensure that the selection, specification and detailing of a project's fenestration systems will meet the required level of performance and impact protection required for the project.

Post-disaster investigations conducted by FEMA and property insurers have shown that fenestration systems are vulnerable to impact from windborne debris (i.e., tree limbs, building roofing, etc.) during severe storm events. Rain and wind penetration resulting from fenestration systems damaged due to windborne debris impact can lead to significant damage of building contents, materials, and structural elements. Massachusetts's adoption of the 780 CMR 9th Edition referencing the IBC 2015 includes new design wind speeds and requirements for when protection of openings is required. Designers of record should consult with their structural engineers and local authorities having jurisdiction to ensure that the appropriate protection of openings is provided on projects when required by the code. If protection of openings is not required, construction dollars can be freed up to be used to meet other key project requirements.

For more information on this topic, or enclosure solutions that PACE represents, please visit our website www.pacerepresentatives.com or contact me at carmstrong@pacerepresentatives.com.

[3] ASTM E1996 augments ASTM E1886 by defining the material characteristics and impact velocity of the missile(s) to be used. Projects in New England will use a large missile Level D unless enhanced protection is required.