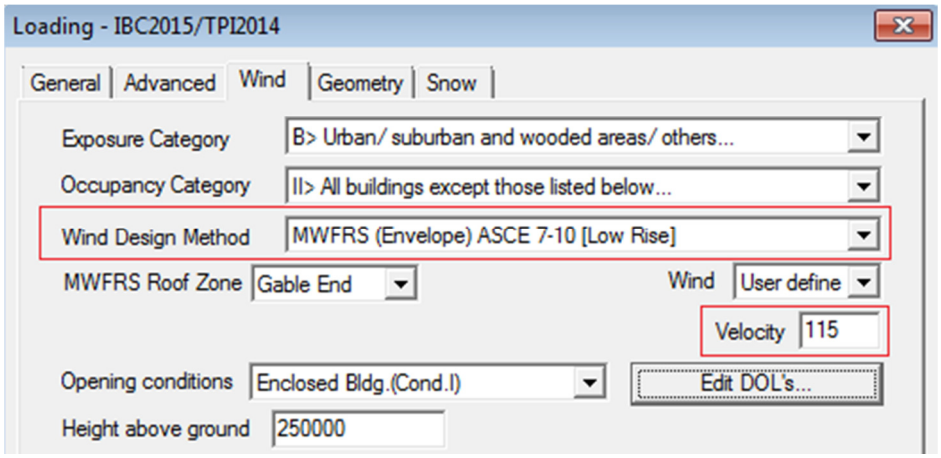
Wind Velocity in ASCE 7-10

ASCE 7-10, “Minimum Design Loads for Buildings and Other Structures”, introduces significant changes to wind load design. The 2010 edition is the first edition of ASCE-7 where the basic wind speed map from ASCE 7’s previous editions has been replaced with three ultimate design wind speed maps; one for each Occupancy Category. These “ultimate” wind speeds are higher than “nominal” or “basic” wind speeds that you have used in the past, but do not fear, the resulting loads and reactions (uplifts) will be very similar to what you are used to.

For example, for most of the same regions where a 90 mph wind speed was previously applied, in accordance with ASCE 7-10, the minimum velocity for Occupancy Category II is 115mph; for Category I (agricultural) it is 105mph; and for Categories III and IV (more than 300 people or essential occupancy) it is 120mph.

So if you design trusses with a Building Code based on ASCE 7-10 (IBC2012, IRC2012, FBC2010, FRC2010, FBC2014, FRC2014, MNSRC2015, IBC2015 and IRC2015), you now have to use the new wind maps for inputting wind velocity in the MiTek Engineering program. Please note that when entering information in the Wind Loading dialog box, “(Envelope)” rather than “(Directional)” is the usual Wind Design Method. “Envelope” used to be referred to as “Low Rise” and “Directional” as “All Heights”.



Since the 2012 IRC wind speed map is based on a “nominal” wind speed, but the wind speed entered into MiTek Engineering must be an “ultimate” wind speed as found in the references noted above, the program reports the ultimate design wind speed (V_{ult}) along with the nominal design wind speed (V_{asd}) when ASCE 7-10 is chosen.

2) Wind: ASCE 7-10; **Vult=115mph (3-second gust) Vasd=91 mph**; TCDL=6.0pdf; BCDL=6.0psf; h=25ft; Cat.II; Exp B; enclosed; MWFRS (envelope) gable end zone; cantilever left and right exposed; end Vertical left and right exposed; Lumber DOL=1.6 plate grip DOL=1.60

In the example note shown here, you see two wind speeds noted in the "wind note" on engineering drawing. The first reference is the ultimate velocity or strength wind speed (as listed in the IBC2012, FBC2010, FBC2014, FRC2014, IBC2015, and IRC2015) and the second reference is the allowable stress design velocity wind speed (as listed in the IRC2012, FRC2010 and previous editions of ASCE 7's). A truss run at 115 mph under the new codes (V_{ult}) yields nearly the same results as a truss run formerly at 91mph (V_{asd}).

What are V_{ult} and V_{asd}?

Utilizing the new wind speed maps necessitates the introduction of the terms V_{ult} and V_{asd} to be associated with "ultimate" design wind speed and the "nominal" design wind speed respectively.

ASCE 7-10 defines the term V as the basic wind speed corresponding to a 3-sec gust speed at 33 ft. above the ground in Exposure Category C. This is the same definition previously used, but the speeds listed are dramatically different. This is what we are now calling $V_{ult.}$ The ASCE Commentary states that the change in wind speeds was to "bring the wind loading approach in line with that used for seismic loads". The change in wind speeds is associated with a new factor of "0.6" included in the Allowable Stress Design (ASD) basic load combination.

The terms ultimate design wind speed and nominal design wind speed are not used in ASCE 7-10. V_{ult} is the wind speed you enter in Wind Loading dialog box. It is important to note that even when using these higher wind speeds, the design pressures and uplifts you are going to get are comparable with ASCE 7's previous editions because of the 0.6 factor that gets applied to it as mentioned above.

Utilizing different maps for the Risk Categories eliminates the problem associated with using "importance factors" that vary with category. The Importance Factor for wind loads has been deleted from ASCE 7-10.

The terms ultimate design wind speed (V_{ult}) and nominal design wind speed (V_{asd}) were incorporated in the IBC2012, IRC2012, FBC2010, FRC2010, IBC2015 and IRC2015 Building Codes due to the substantial number of provisions tied to the previous codes editions. This sometimes necessitates conversion of new ASCE 7-10 mapped wind speed to previously established wind speed.

When required, the ultimate design wind speed from the new wind maps can be converted to nominal design wind speeds as follows:

$V_{asd} = V_{ult}\sqrt{0.6}$ (or V_{asd} is approximately 80% of V_{ult}.),

where: V_{asd} represents the equivalent nominal design wind speed and V_{ult} is ultimate design wind speeds determined from Figures 1609A, 1609B or 1609C in the IBC2012 and FBC2010, Figures 1609.3 in the IBC2015 or from Figures R301.2(4) in IRC2012, FRC2010 and IRC2015.

The IRC2012 has confused things quite a bit. They decided to continue to use the nominal design wind speeds in their wind map and figures. But they reference the ASCE 7-10 for designing for wind. So you have to use the new wind maps from the IBC2012 for inputting loads in our program, or convert the wind speeds shown on the IRC maps to ultimate design wind speeds using this formula:

$$V_{ult} = 1.291 * V_{asd}$$

This confusion has been corrected in the IRC2015. They converted the wind maps and figures over to the ultimate wind speed.

For further questions concerning new winds speed please refer to ASCE 7-10 or contact MiTek Engineering.