Understanding loading, geometry and available materials (lumber and plating) can reduce the cost of an agricultural truss by as much as 20 percent when compared to an "out of the box" run. This article will cover a way to load agricultural trusses in order to be competitive in the marketplace and at the same time produce sealable designs. It is important to note that the applicability of these suggestions be verified by the authority having jurisdiction and/or by the building designer for the truss designs in question. MiTek is not specifying how to load trusses. All these design parameters must be verified by others.

Beginning in the **Design Info** screen, see Figure 1 below, start by selecting the "Occupancy Category" and "Building Code" as shown below. Your Building Code may be determined by the authority having jurisdiction for the area where the project is going.
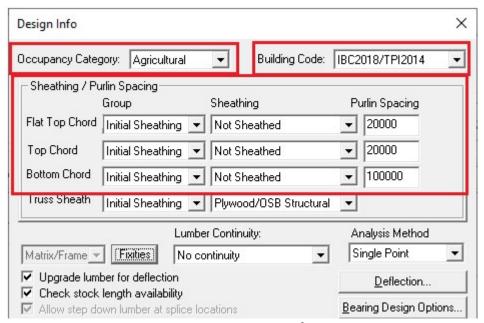

Figure 1 - Design Info

Note also that the top chord restraint/bracing is set to 2'- 0" on center and the bottom chord restraint/bracing is set to 10'- 0" on center as is typical in agricultural framing. If the bottom chord bracing spacing is flexible, you may enter "0" in the "Purlin Spacing" box. This option will design the bracing spacing for the bottom chord material selected, rather than calculate the chord material based upon the selected 10' o.c. bracing/purlin spacing.

Begin loading in the **General** tab and turn on snow and wind as shown in Figure 2 below. In the example shown here, snow load has been selected. If you are in an area where snow is not considered a factor such as the state of Florida, the snow load may be unchecked and instead roof live load should be selected. The minimum roof live load generally used in agricultural truss design ranges between 16 to 20 PSF and is based on the tributary area supported by one truss, as well as the pitch. Also note that no bottom chord live loads are generally required on agricultural type trusses.
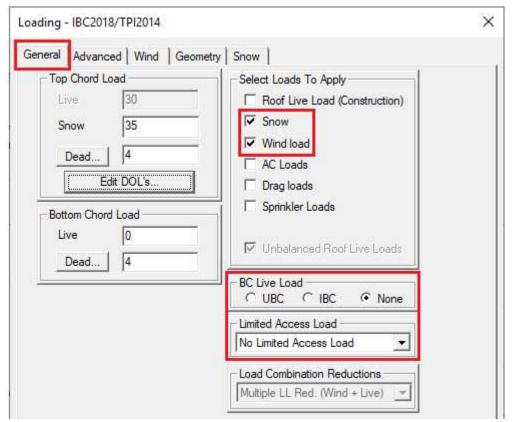
Figure 2 - General Loading Tab

The snow load value shown above is for example only and will be dictated by the location of the building.

Under the **Snow** load tab, see Figure 3 below, you will note that in Design Method the appropriate edition of ASCE 7 is selected for you based on the building code selected in the Design Info screen. The "Terrain" and "Roof Exposure" should be set to those dictated by the job site. The "Thermal condition" (Ct factor) should be set to "1.2" (cold roof) if the building is not going to be heated. Turn on "Apply slope reduction factors". The "Surface condition" may only be set to "Unobstructed slippery" if the roof is a metal roof with no anti-snow-slide devices. "Occupancy/Risk Category" is set to "I" assuming the building to be "Low hazard to human life in failure". The "Building Lu" is the distance from the truss in question to the furthest Eave from that truss. It is used to account for snow blowing parallel to the ridge of a hip roof. You will notice that this has no effect on trusses that do not have a flat section. If you do not want to modify Building Lu for each individual truss in the job, the building "Lu" should be the length of the building measured perpendicular to the truss span.

The "Ground" snow should be selected from the snow map, or as specified by the authority having jurisdiction or the building owner/designer. The "Ground" radio button should then be selected. If you design trusses for the Arctic Circle or mountain tops in ASCE 7-16, you will need to check on Windswept Area. Finally, verify that the unbalanced snow load is set to "Do for any geometry" as shown below.
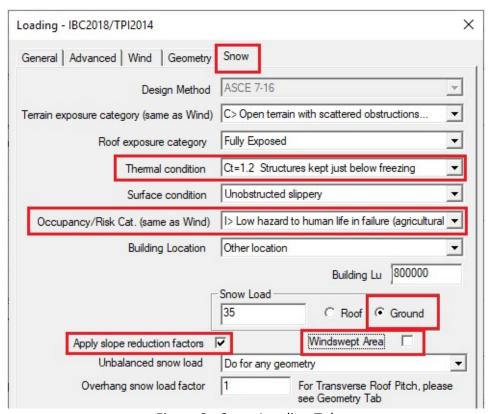

Figure 3 - Snow Loading Tab

Geometry tab will allow you to input additional geometric information about the roof plane so that the loading on that truss can be modified to match the roof, rather than truss, profile.

The "Use Transverse Pitch" is there to account for "rain on snow surcharge" and is only applicable to roofs with a flat section and a ground snow load of 20 psf or less. It tells the program that the flat section is not flat because it has a pitch perpendicular to the truss and therefore this load is not applied. The value to enter in "Transverse Roof Pitch" is the pitch of the roof perpendicular to the truss.
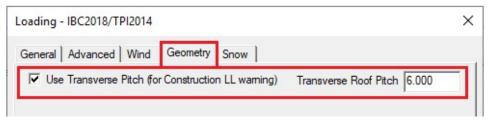

Figure 4

If truss is to be capped and you are designing for snow loads, you should turn on "Use the following Geometry information for creating unbalanced load cases" as shown in Figure 5 below. Turning this on will tell the program that the truss in question is not a hip and is therefore not subjected to the drifts that accumulate on a hip end.
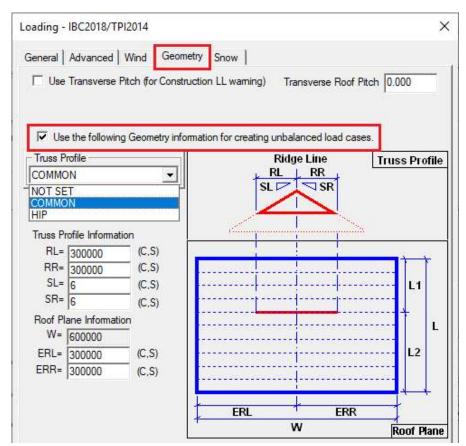

Figure 4 - Geometry Tab

Truss Profile Information

RL= distance from the Left most point of the top chord to the Ridge line
RR= distance from the Right most point of the top chord to the Ridge line
SL= Slope of the roof profile on the Left side of the Ridge line
SR= Slope of the roof profile on the Right side of the Ridge line

Roof Plane Information

W= Width of the roof parallel to the truss; it is measured from eave to eave. The program will use ERL and ERR to determine W
ERL= the distance from the left Eave to the Ridge line
ERR= the distance from the right Eave to the Ridge line

The program will unbalance the truss about the ridgeline which is determined by the geometry information found in the Geometry Tab.

Under the **Wind** load tab, see Figure 6 below," Exposure Category" and "Occupancy/Risk Cat." were already set in the Snow tab. The "Wind Design Method" should be set to one of the Main Wind Force Resisting System (MWFRS). We recommend using MWFRS (Envelope), but it does not mean it will always give a better result for bottom chord bracing. If you select MWFRS (Envelope), the "MWFRS Roof Zone" for agricultural trusses may be set to "Interior" except for the gable end truss that needs to be run in the "Gable End" zone. Set the "Opening conditions" to "Enclosed". The wind Duration of Loads (DOL's) should be set to 1.6 in most locations. If the dead load in General loading tab does not exceed 4 psf per chord, and the occupancy category is set to "I", you may use the same dead loads in Wind, as shown in Figure 6 below. A Ground Elevation Factor was added in ASCE 7-16 to account for variations in air density at different altitudes. Entering the correct Ground Elevation above Sea Level can result, as an example, in 17% reduction in design wind loads in Denver.
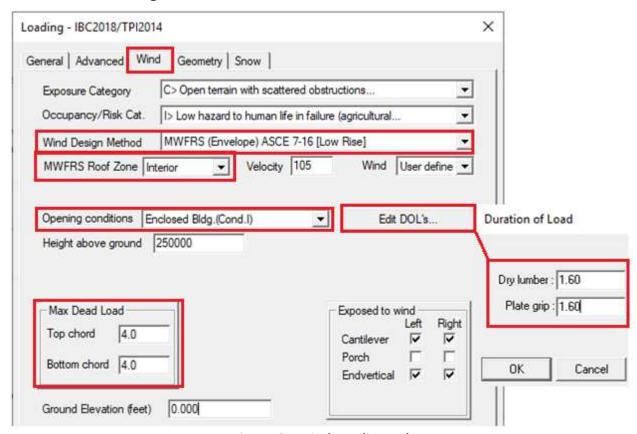

Figure 6 - Wind Loading Tab

Once again, all these parameters must be verified by the authority having jurisdiction and/or by the building owner/designer.

For additional information, or if you have questions, please contact the MiTek Engineering department.