Building codes require that structures be designed and built to safely resist any loads that they are expected to face during their lifetime. Minimum loads are specified in building codes. All loads are typically categorized into two types, live and dead. The dead loads are permanent loads which result from the weight of the structure itself or from other permanent attachments, for example, drywall, roof sheathing and weight of the truss. Live loads are temporary loads; they are applied to the structure on and off over the life of the structure. The most common types of live loads are occupancy (floor) load, workers during construction and maintenance, snow, wind and seismic. In terms of the actual load on a structure, there is not a lot of difference between live and dead loads. The difference occurs when we are doing design calculations. Building codes specify a variety of load combinations together with load factors for each load type in order to ensure the safety of the structure under different maximum expected loading scenarios. If Designers want to get the most accurate and economical design, they must understand the loads for a giving project and enter them correctly into the MiTek Engineering software. This article will explain how special loads or girder loads are calculated when both Roof Live Load and Snow Load are turned on in Truss Loading. It will then explain how to enter these loads if a different outcome is desired by the user.
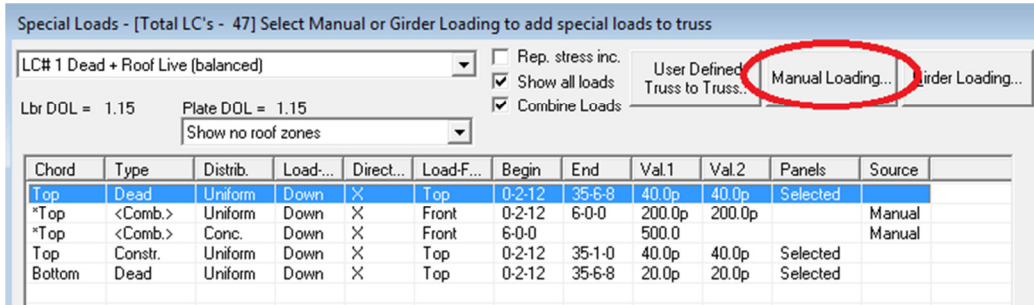
For example: A roof truss has the loading shown below. Live Load Lr=20 psf, Dead Load (top chord + bottom chord) = 30 psf. Total truss load (live + dead) = 50 psf. The ratios of live and dead loads to total load (live + dead) are 20 : 50 and 30 : 50 accordingly. This means the percentage ratio of the truss loading is 40% live load and 60% dead load. In the case of Snow, 35 : 65, or 54% of the total load (snow + dead) is snow load and 30 : 65, or 46% of the total load (snow + dead) is dead load. If we compare total load (live + dead) and total load (snow + dead) the total load (snow + dead) is 30% higher than total load (live + dead).
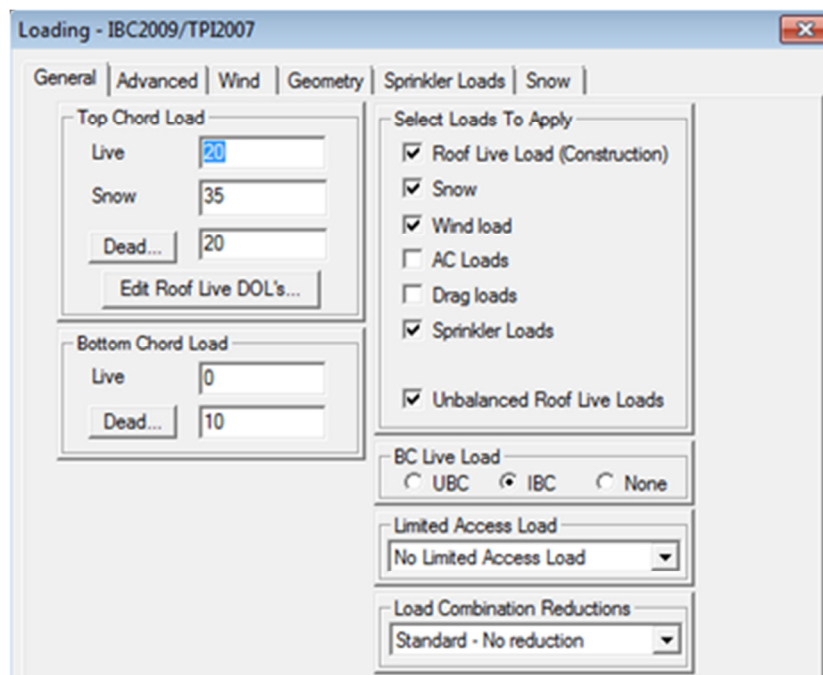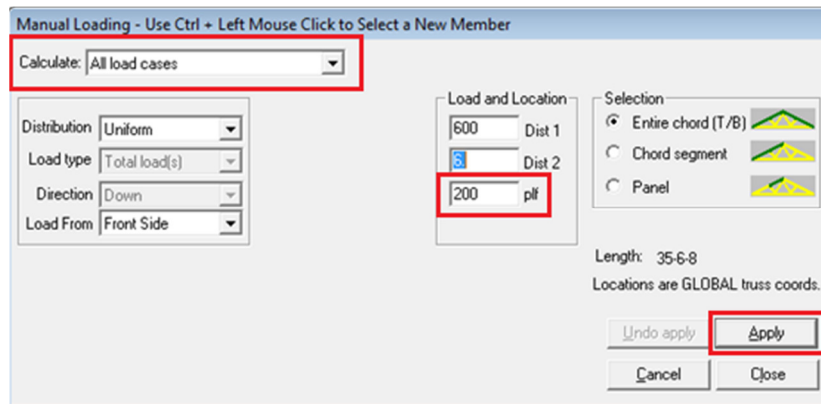
Let's add 200plf uniform and 500lbs point load to the top chord of the truss to see what the software will do. To do this we will use the Special Loads Tool by selecting it in the Tools drop down menu or the shortcut key shown here:
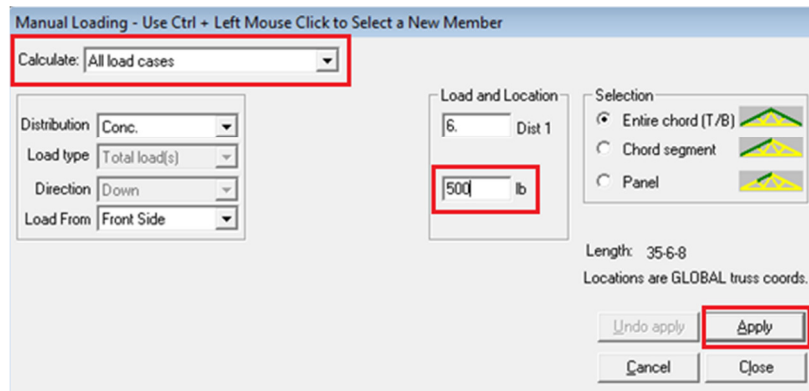
Within the **Special Loading** dialog box select the **Manual Loading** tab.

Special Loads - [Total LC's - 47] Select Manual or Girder Loading to add special loads to truss

LC# 1 Dead + Roof Live (balanced)   ☐ Rep. stress inc.   User Defined   Manual Loading...   Girder Loading...
                                     ☑ Show all loads   Truss to Truss..
Lbr DOL = 1.15   Plate DOL = 1.15   ☑ Combine Loads
                  Show no roof zones

Chord	Type	Distrib.	Load-...	Direct...	Load-F...	Begin	End	Val.1	Val.2	Panels	Source
Top	Dead	Uniform	Down	X	Top	0-2-12	35-6-8	40.0p	40.0p	Selected	
*Top	<Comb.>	Uniform	Down	X	Front	0-2-12	6-0-0	200.0p	200.0p		Manual
*Top	<Comb.>	Conc.	Down	X	Front	6-0-0		500.0			Manual
Top	Constr.	Uniform	Down	X	Top	0-2-12	35-1-0	40.0p	40.0p	Selected	
Bottom	Dead	Uniform	Down	X	Top	0-2-12	35-6-8	20.0p	20.0p	Selected	

Within **Manual Loading** the typical choice for the Calculate dialog box is **All load cases**, as shown. Enter 200 plf and click Apply:

Manual Loading - Use Ctrl + Left Mouse Click to Select a New Member

Calculate: All load cases

Distribution Uniform
Load type Total load(s)
Direction Down
Load From Front Side

Load and Location
600   Dist 1
6   Dist 2
200   plf

Selection
◉ Entire chord (T/B)
○ Chord segment
○ Panel

Length: 35-6-8
Locations are GLOBAL truss coords.

Undo apply   Apply
Cancel   Close

Follow the same steps to enter 500lbs point load:

Manual Loading - Use Ctrl + Left Mouse Click to Select a New Member

Calculate: All load cases

Distribution Conc.
Load type Total load(s)
Direction Down
Load From Front Side

Load and Location
6.   Dist 1
500   lb

Selection
◉ Entire chord (T/B)
○ Chord segment
○ Panel

Length: 35-6-8
Locations are GLOBAL truss coords.

Undo apply   Apply
Cancel   Close

Since we did not specify how much of these loads were live and dead, the program will split these loads for us in accordance with percentage ratio of basic loading this truss has. We call them combined loads.

To view the live and dead portions of these loads go into the **Special Loading** dialog box and check on the **Show all loads** button and uncheck the combine loads button as shown.
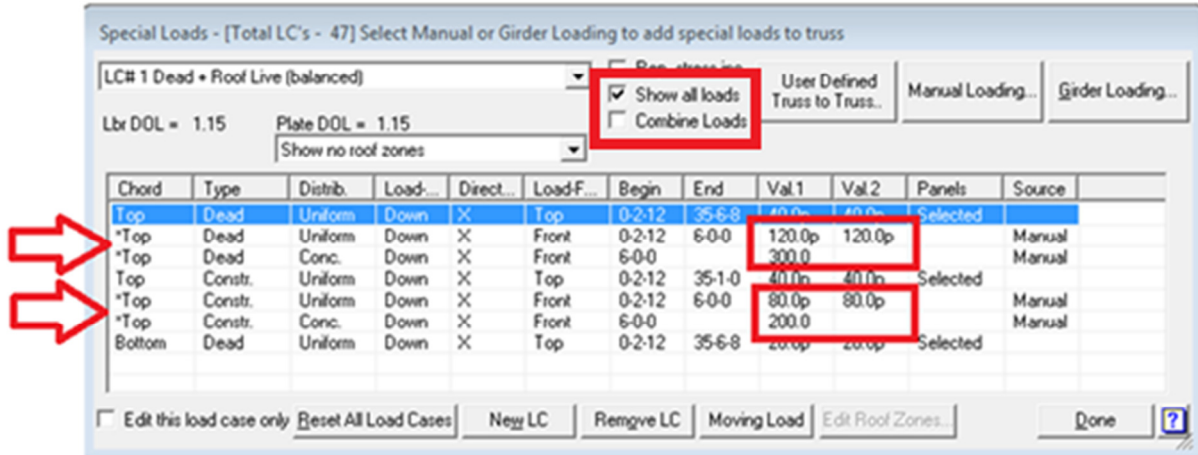
In Load Case **#1 Dead + Roof Live (balanced)**:

200plf combined uniform load = 80plf, or 40% of 200, construction (Lr) load portion and 120plf, or 60% of 200, dead load portion;

500lbs combined point load = 200lbs, or 40% of 500, construction (Lr) load portion and 300lbs, or 60% of 500, dead load portion.
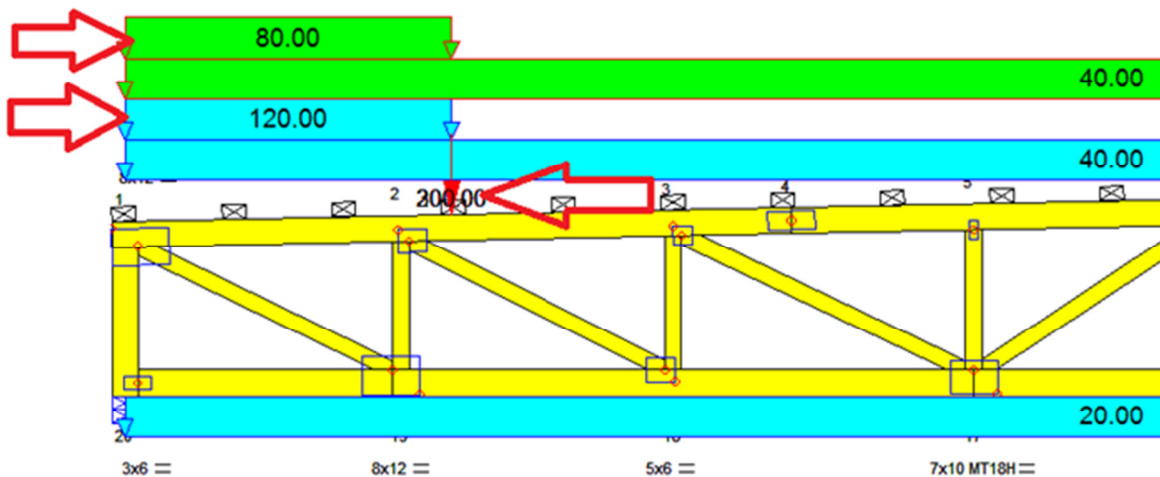
In Load Case **#2 Dead + Snow (balanced)** combined loads we entered are increased by 30% in accordance with basic loading this truss has: 200 plf becomes 260 plf and 500lbs point load becomes 650lbs.

260plf combined uniform load = 140plf, or 54% of 260, snow (S) load portion and 120plf, or 46% of 260, dead load portion;

650lbs combined point load = 350lbs, or 54% of 650, snow (S) load portion and 300lbs, or 46% of 650, dead load portion.
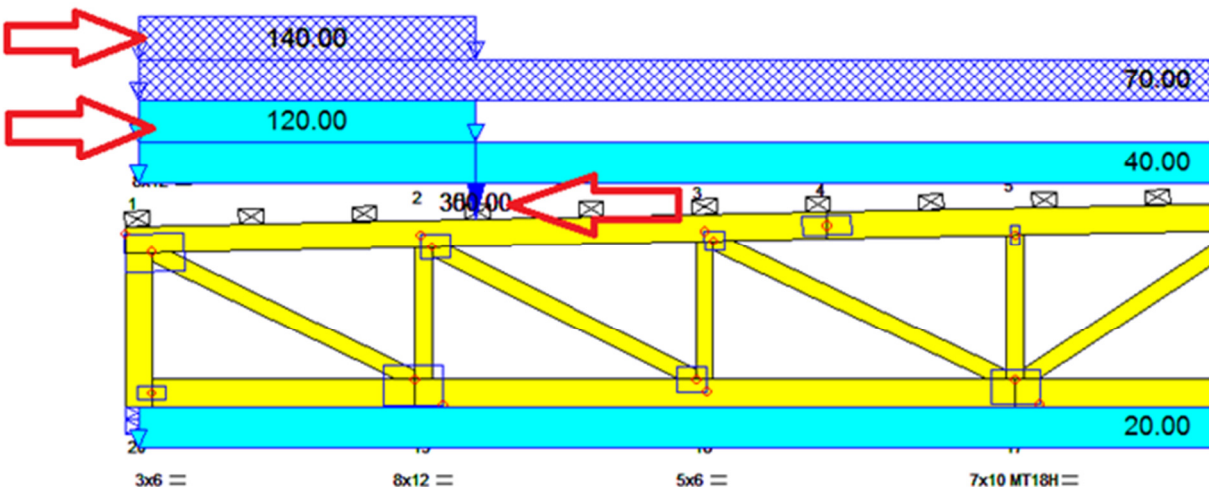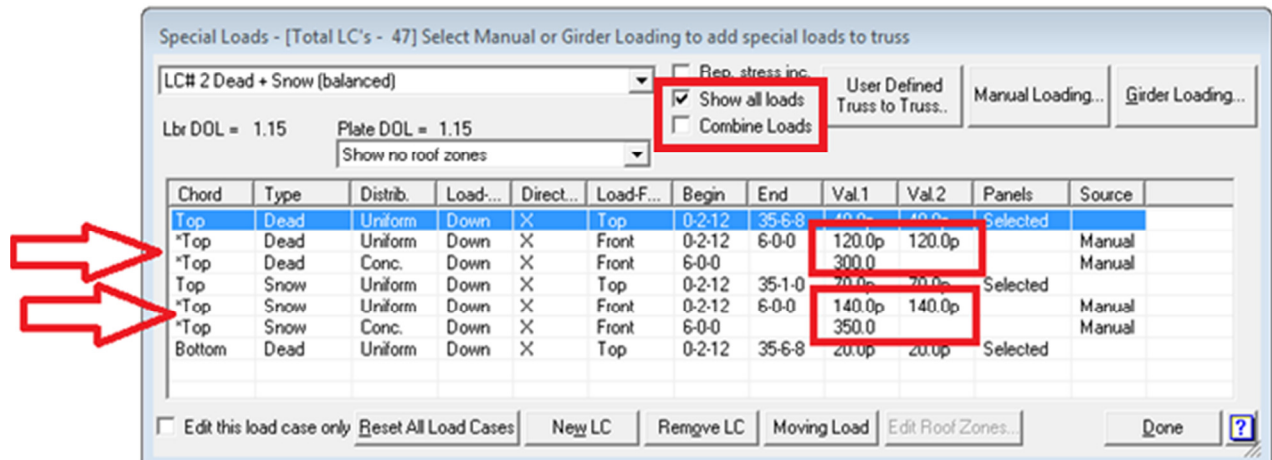

Therefore, the ratio of roof live and dead and snow and dead are the same as the basic loads we used to design the truss, which is typically desired.

If the ratio of the increased uniform and point loads are not the desired effect, the correct method to work through this issue is either not turn both Live and Snow loads on at the same time in Truss Loading or to specify the live and dead load proportions of the additional loads manually. Here is how to use the **Special Loading** tool when this more granular control is desired.

Within the **Special Loading** dialog box select the **Manual Loading** tab.
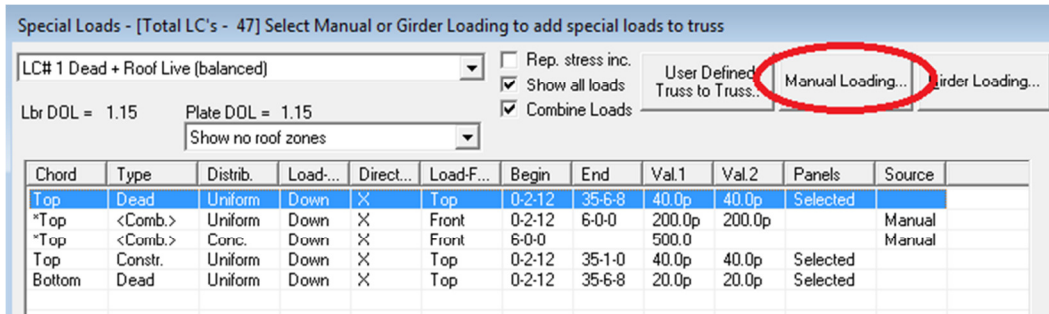
Within the **Manual Loading** tool, change the **Calculate** dialog box to **User defined**, select **Load type**, add the dead load portion as shown and select Apply:
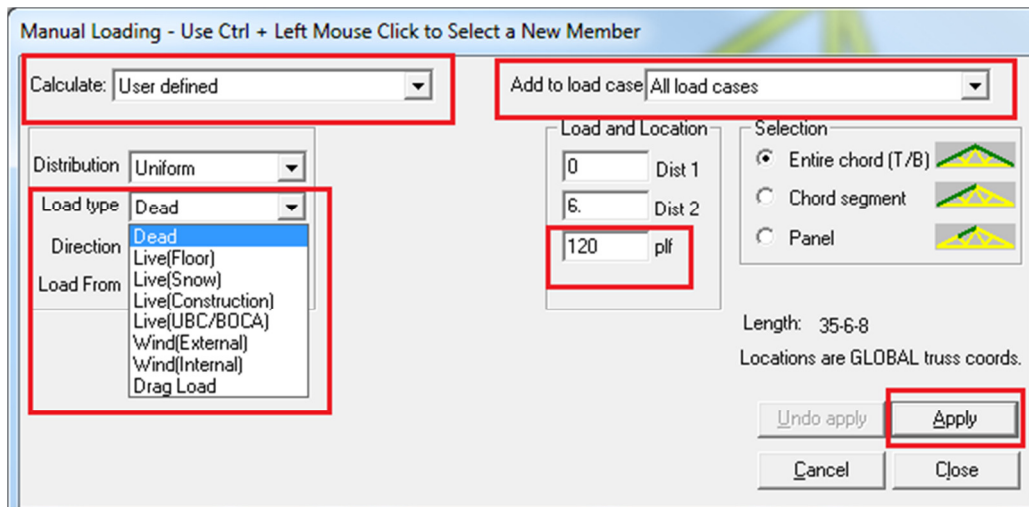

Each load case will receive 120 plf dead load, including **Load Case #2 Dead + Snow (balanced)**. Repeat the same steps to enter the live portion of this load. Since Live(Construction) or Live(Snow) load is not present in all load cases you will receive a pop up notification asking you to verify that the type of load you specified is in the load cases required. Select OK and verify as required.

Construction (Lr) load will only be located in **LC#1 Dead + Roof Live (balanced)** and any other load cases where construction (Lr) is present, but not, for example, in **LC#2 Dead + Snow (balanced)**.

If you just want to make sure your input load is the maximum load for all load cases, MiTek Engineering software V7.5.2 or higher has an option "**Maximum Load**" in **Manual Loading**.
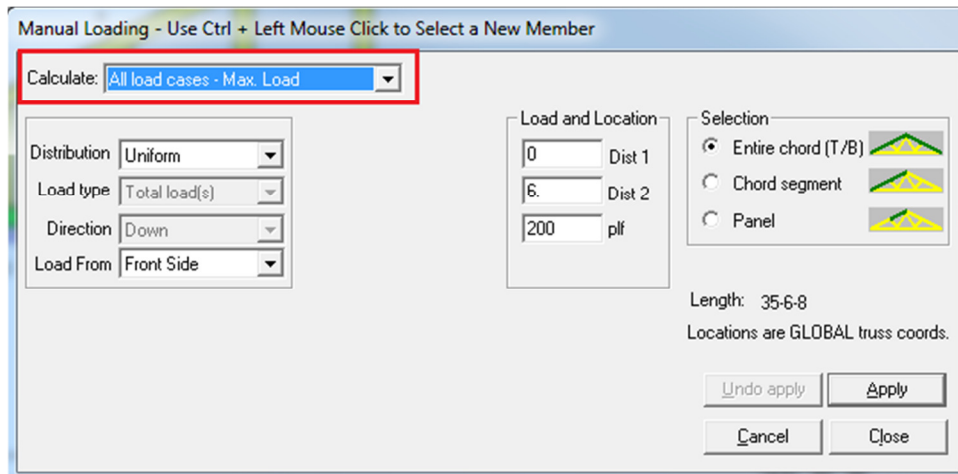
If you use this option, program will maintain the maximum load by using a single load amplification factor that keeps the ratio of user applied load to total basic load constant for all load cases. This amplification factor is always determined using the first load case as a basis.

For further questions concerning the correct use of the special loading tool or other loading options in the engineering program please contact the MiTek Engineering department.