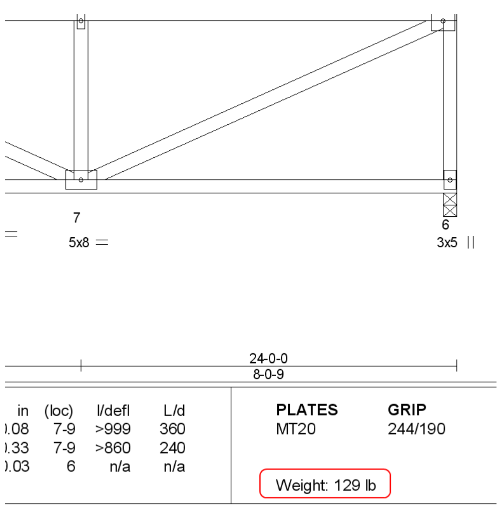
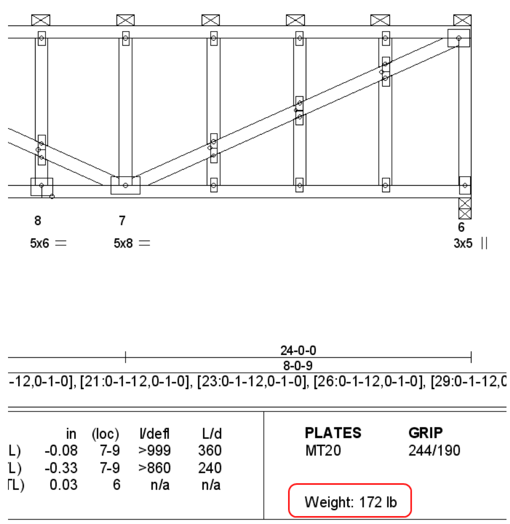
Calculating Dead Loads on Studded Trusses

When designing a truss to be used as a free-spanning structural gable or party wall application, additional dead loads may need to be considered. The MiTek engineering software relies on the user for the tributary loading for the truss and does not account for the additional weight of sheathing or drywall being applied to one or both faces of a truss, or the weight of the additional studs used to support this additional load. In the case of a continuously supported truss, the vertical studs, whether plated into the plane of the truss or nailed onto the face, will support the sheathing and transfer the load to the bearing below, therefore this is normally not a concern. On a free-spanning truss, such as a structural gable, this additional weight must be carried by the webs and chords of the truss, and needs to be accounted for in the design.

To start this process, we first need to determine the weight of the materials being added to the truss. We first need to consider the weight of the additional studs in or on the truss that the sheathing is getting connected too. This can be easily done by comparing the weight of the truss without studs to the weight of the truss with studs.



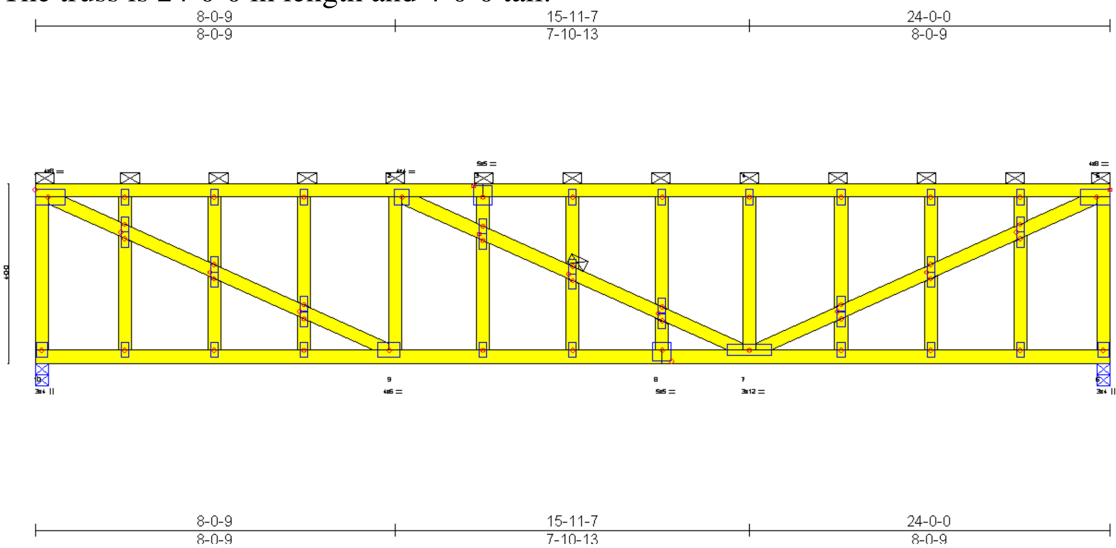


The difference between the weights will be the amount of additional dead load needed to account for the weight of the studs: 172 lbs – 129 lbs = 43 lbs. This will be added to the total weight of the additional sheathing to be added to the truss.

Next we then need to determine the weight of the sheathing material being used. This can be found in a number of places. MiTek 20/20 Engineering software has a list of suggested weights of materials in the Loading Setup dialog, ASCE 7 has a listing of the weights of the most commonly used construction materials, as does the commentary of TPI-1. You can also find a list of weights of materials in the SBCA's Load guide. Most manufactures provide the weight, along with other specifications, of their products on their websites or other product literature.

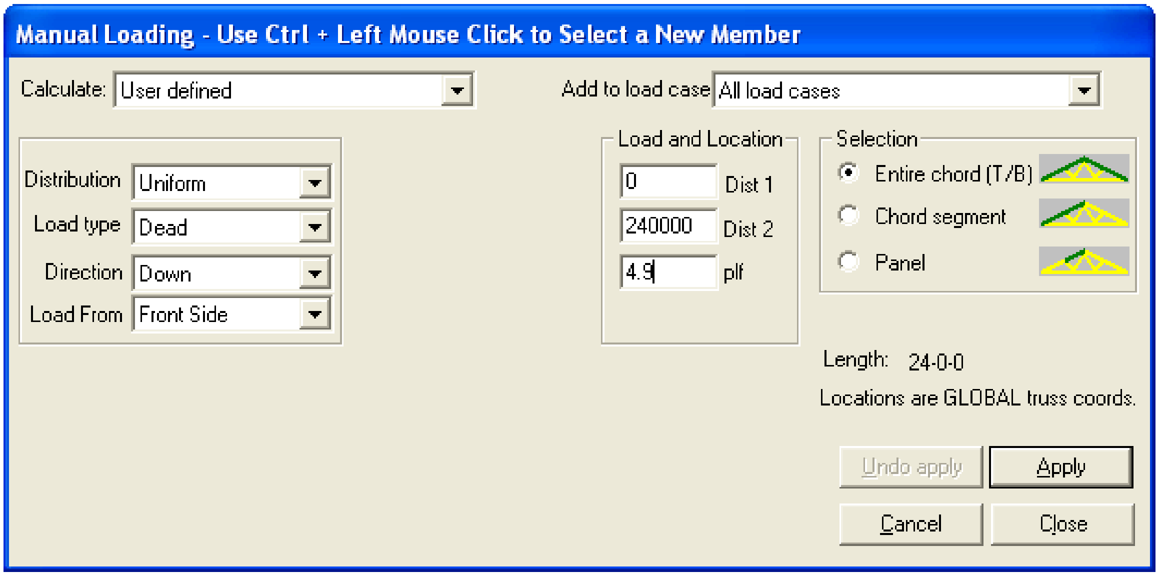
We'll use ½-in. gypsum as our sheathing material, which is listed as 2 lbs/sq-ft, or 2psf. This will be the weight we'll use to determine how much additional loading to apply to the truss.

Next, we'll need to calculate the area of the face of the truss that will be sheathed. We'll start with a flat truss:
The truss is 24-0-0 in length and 4-0-0 tall.

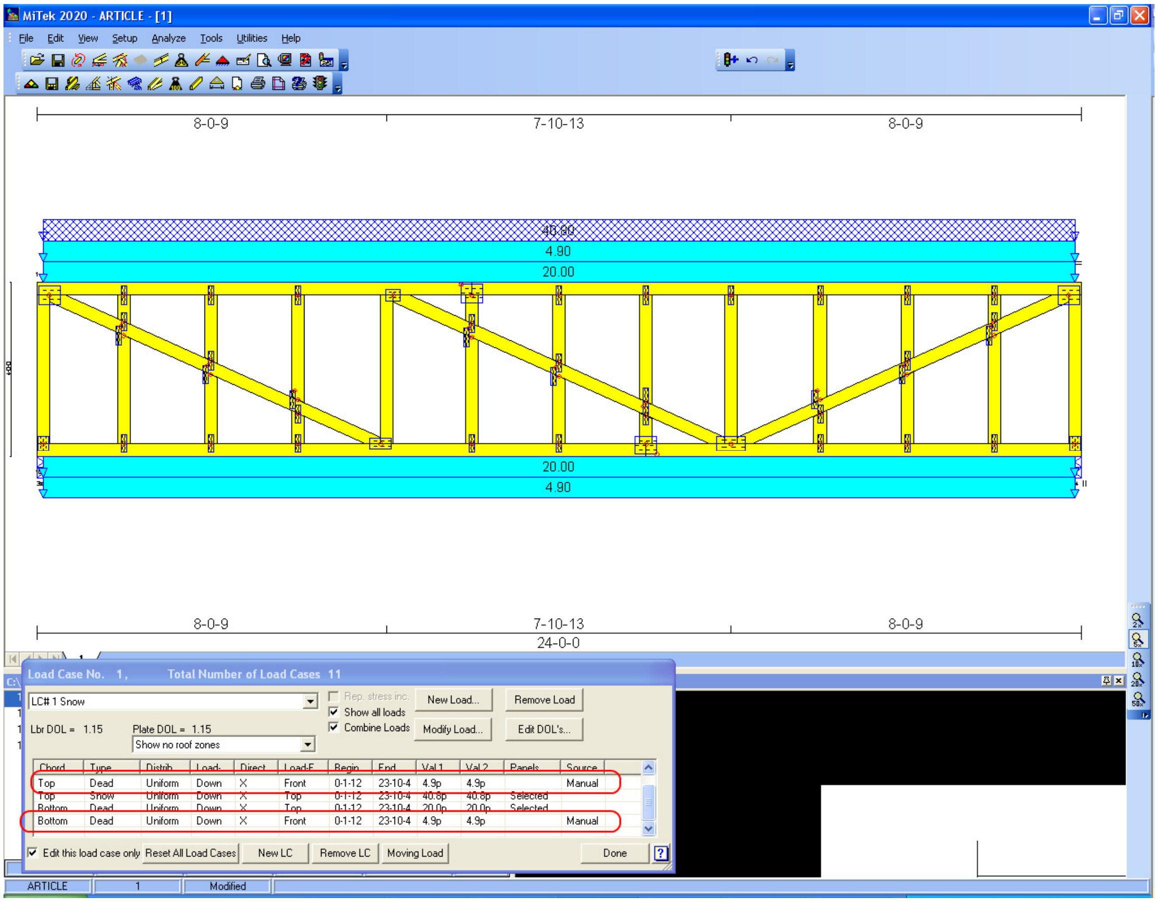


Multiply the Span by the Height to calculate the area: 24ft x 4ft = 96 sq-ft. area. Multiply that by the weight of our material (2psf), and we get a total weight of 192 lbs. This is the total weight of all the material to be added to the face of the truss.
Add this to the weight of the additional studs to come up with a total weight to be added to the truss: 192 lbs. + 43 lbs. = 235 lbs.

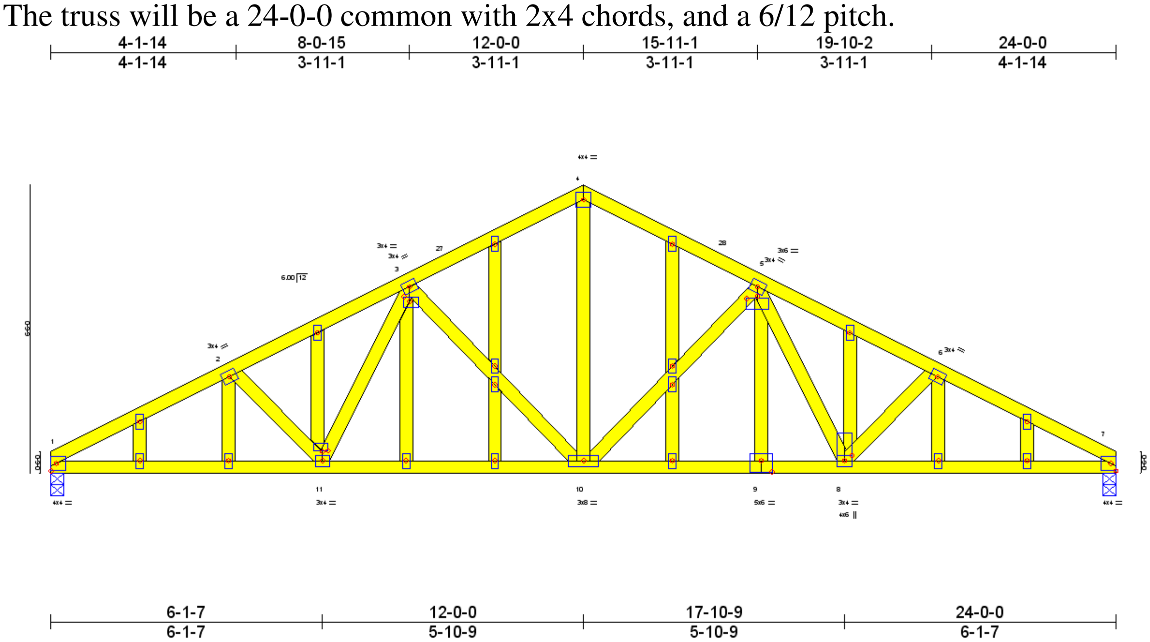
Now we need to add that load to the truss. The load will be applied to the top and bottom chords. (Note: MiTek recommends that loads be applied to chord members only when accounting for sheathing dead loads unless there is a special situation that specifies otherwise. While the MiTek engineering software has the ability to apply concentrated and uniform loads to webs and members other than chords, this may alter the truss design in ways that may not reflect what is actually being done.) The first thing to do is to determine the uniform load from the total load (total weight).
235 lbs. divided by 24-0-0 = 9.8 plf of uniform load. Since the truss is flat, we can apply half the uniform load to each chord member to account for the additional dead load of the ½" gypsum. 9.8 plf / 2 chords = 4.9 plf DL applied to each chord member using Manual Loading in engineering.



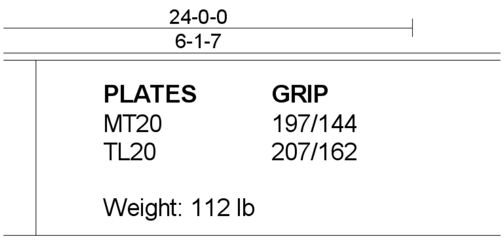
(Note: this load could also be applied by increasing the tributary design load accordingly.)
When you are done applying the additional loading, review the loads and confirm that they are correct in magnitude direction and location.

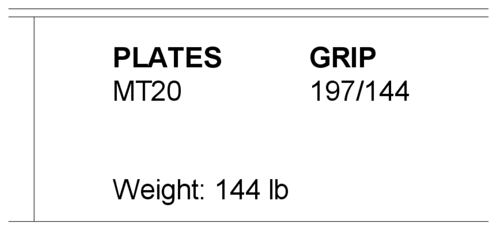


Now let's look at calculating and applying the load to a common truss. The truss will be a 24-0-0 common with 2x4 chords, and a 6/12 pitch.



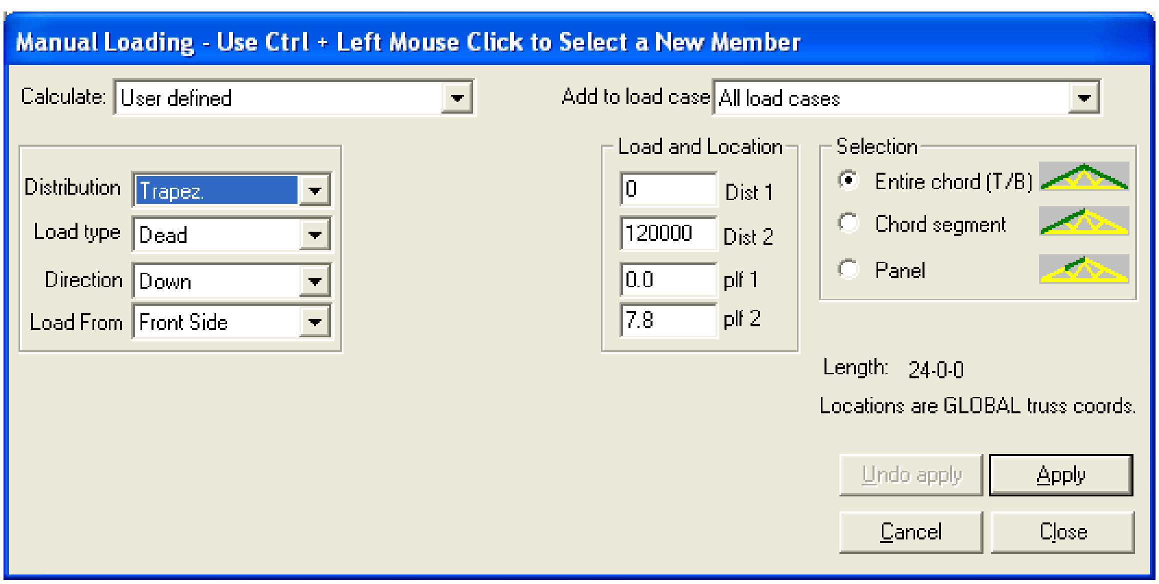
Since the heel height on this truss will be less than 1-0-0, we will simplify the area of the face of the truss by using the span and the height of the truss to find the area of a triangle. First, we'll determine the weight of the additional studs by comparing trusses with and without studs:



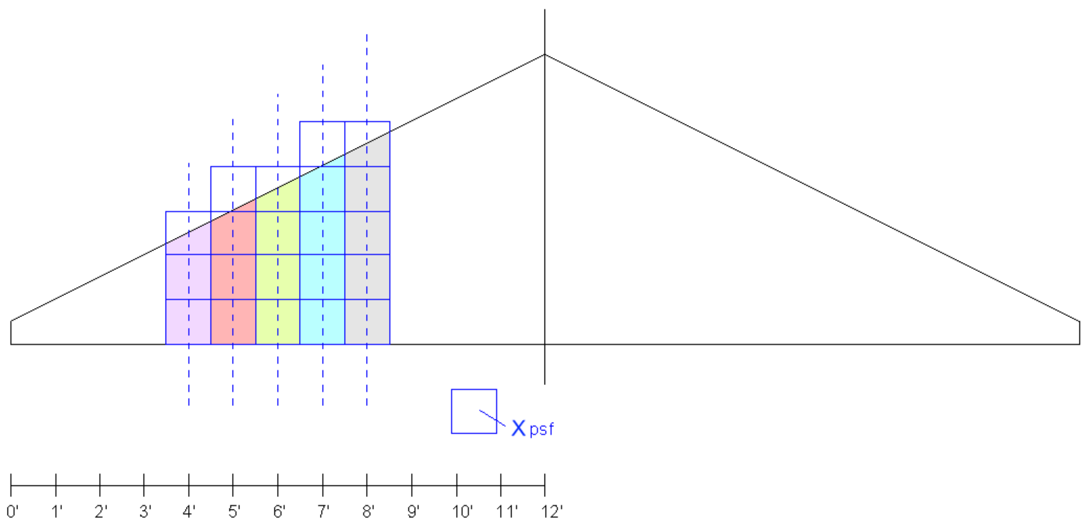


No studs….　　　　With studs….

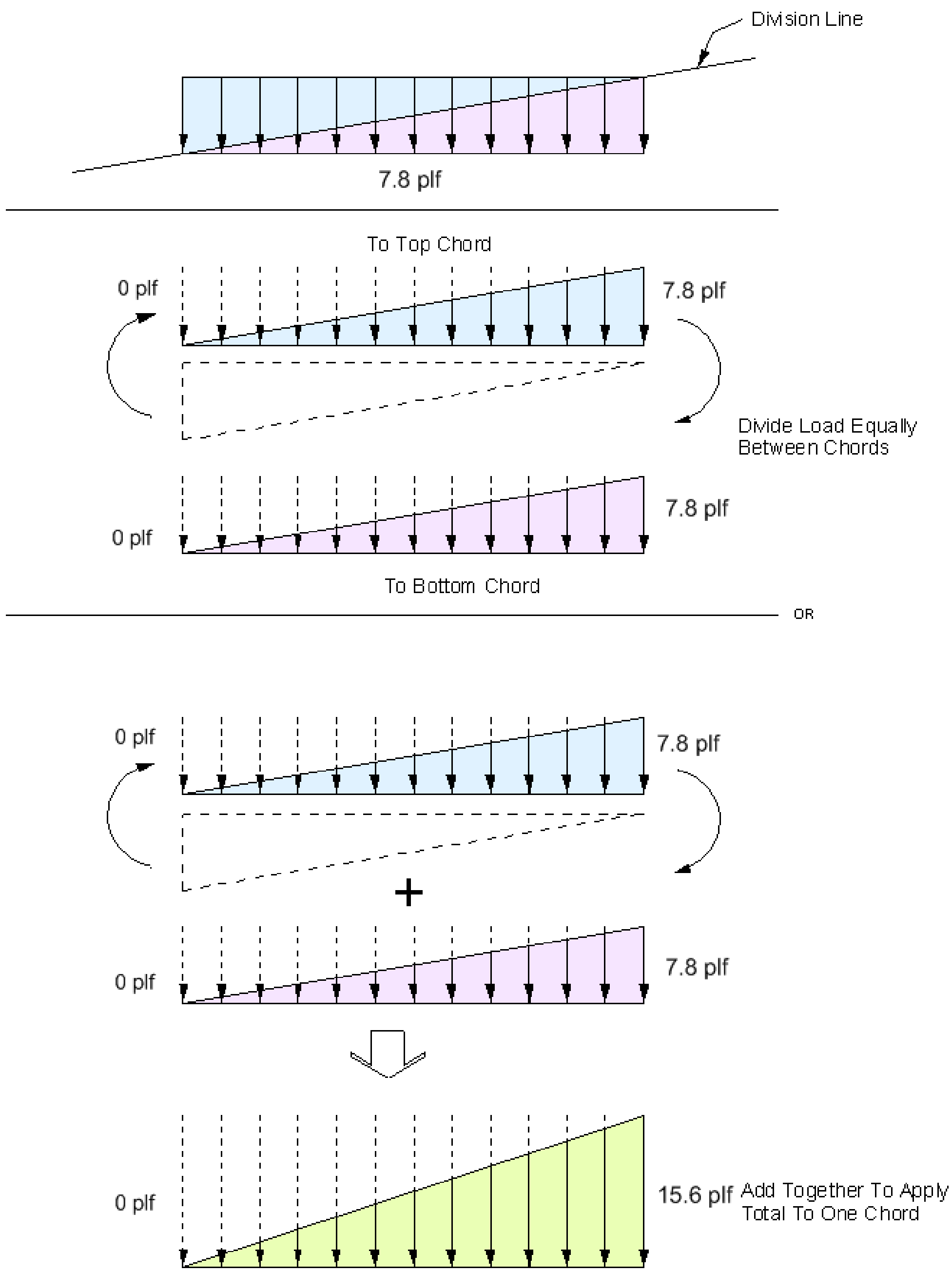
This gives us a total weight of 32 lbs to be added for studs.
Next, we'll calculate the area of the face of the truss. Note: We'll calculate half the area at a time, and then mirror the loads, in this case, 12-0-0 length x 6-6-0 height.
The area of a triangle is: ½ Base x Height, or (½ x 12-0-0) x 6-6-0, or (1/2 x12') x 6.5' = 39 sq.ft. We multiply 39 sq.ft. by 2 psf = 78 lbs total weight. Add the weight of the studs: 78 lbs. + 16 lbs. = 94 lbs total load to be added to the truss. (Note: we only use half the stud weight since we are calculating half the truss area)
We then divide by the span to get a PLF load: 94 lbs / 12ft = 7.8 plf to be applied to the chords of the truss. Since this is a triangular truss, the load will be applied as a trapezoidal load dead load added to all load cases, starting at 0 plf at the heel (Since there is no height at the start of our triangle), and 7.8 plf at the center on each chord member. Then mirror this loading on the opposite side of the truss. Apply 7.8 plf load at the center span down to 0 plf at the opposite heel.



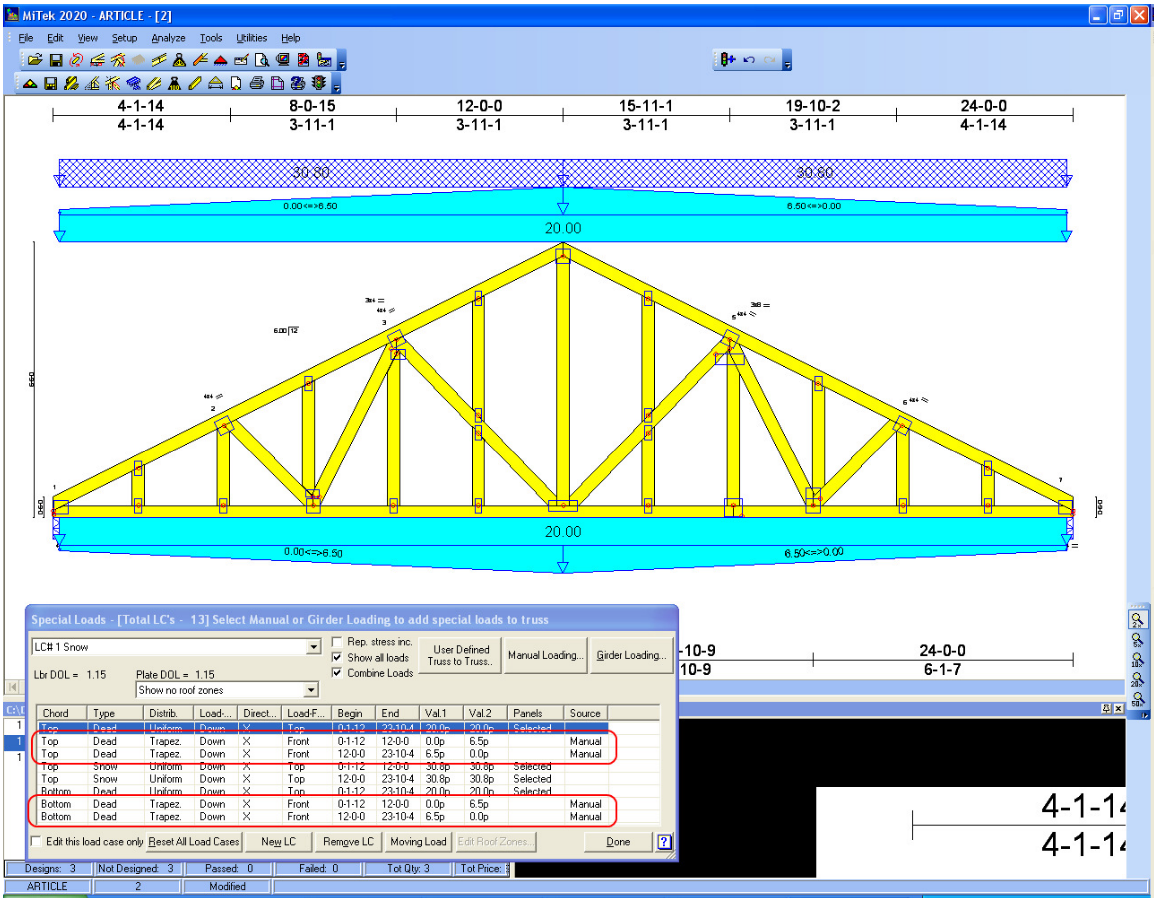
This can be visualized by multiplying the 2 psf load of the sheathing and the weight of the studs by the height of the truss at any point along the span – this represents the total weight of the sheathing at that horizontal measurement, and then divides that weight up equally by the 2 chord members.



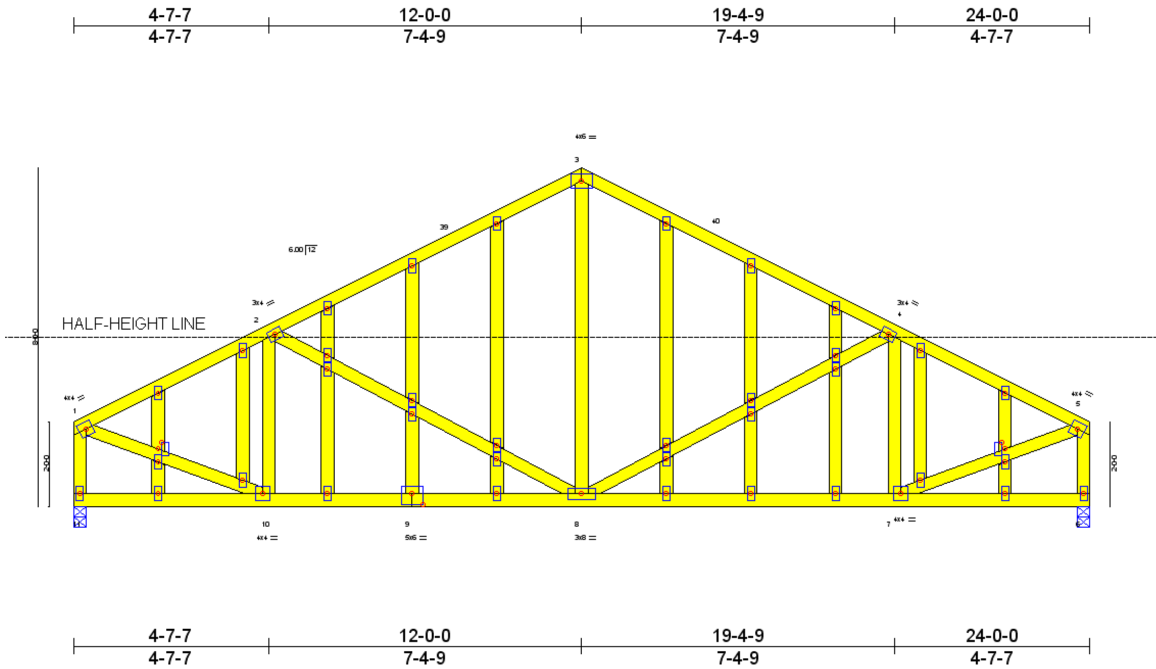
Also by drawing an imaginary division line across a section of uniform load:



When you are done applying the additional loading, review the loads and confirm that they are correct in magnitude and location.



Now let's work through an example that has both of the previous examples included. We'll have a 24-0-0 span truss with a 2-0-0 heel height and a 6/12 pitch.



Start by finding the weight of the additional studs:

24-0-0
4-7-7

PLATES	GRIP
MT20	244/190
TL20	245/193

Weight: 140 lb

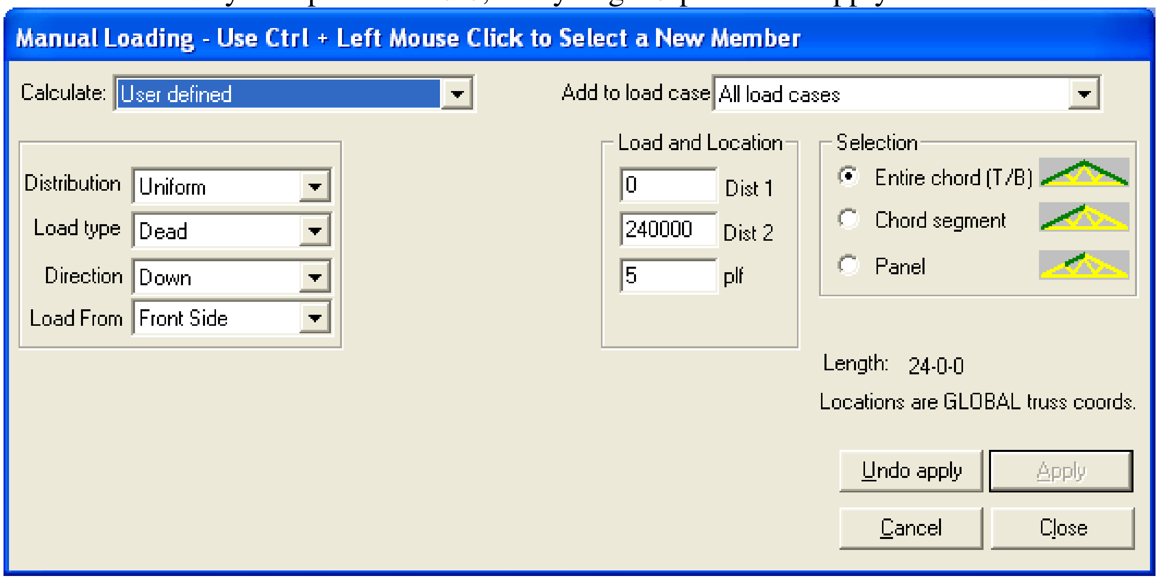
24-0-0
4-7-7

PLATES	GRIP
MT20	244/190

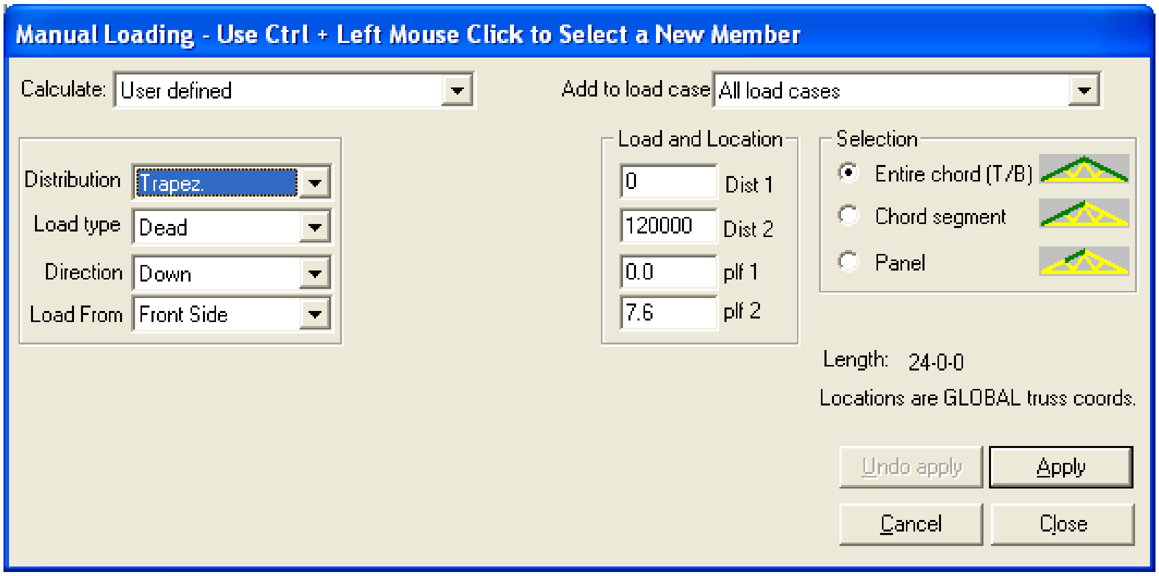
Weight: 203 lb

203 lbs – 140 lbs. = 63 lbs. total weight of additional studs.
Next we'll break the truss up into simple shapes – a rectangle and 2 triangles.
Note: we have been dividing the loads we are calculating evenly between the top and bottom chords as our truss examples have been simple shapes. With a truss that has a more complex shape that will be broken up into simpler shapes, follow a general rule of thumb: If a shape falls completely above or below the half-height line, all of that calculated load will be applied to the top or bottom chord respectively. If the simpler shape crosses the half-height line, and covers area above and below the half-height line, then it will be divided equally between top and bottom chords.
Calculate the area of the rectangle: 2-0-0 (heel height) x 24-0-0 span. 24' x 2' = 48 sq.ft.
Now calculate the area of the triangle: (1/2 x 12' span) x 6' height = 36 sq.ft. We have two triangles to make the top of the truss, so we can find the total area of the face of the truss by adding the rectangle area to the triangle area to another triangle area:
48 sq.ft. + 36 sq.ft. + 36 sq. ft. = 120 sq.ft. area total.
We need to know this area to determine a PSF for the additional studs:
63 lbs. divided by 120 sq.ft. = .53 psf for additional studs.

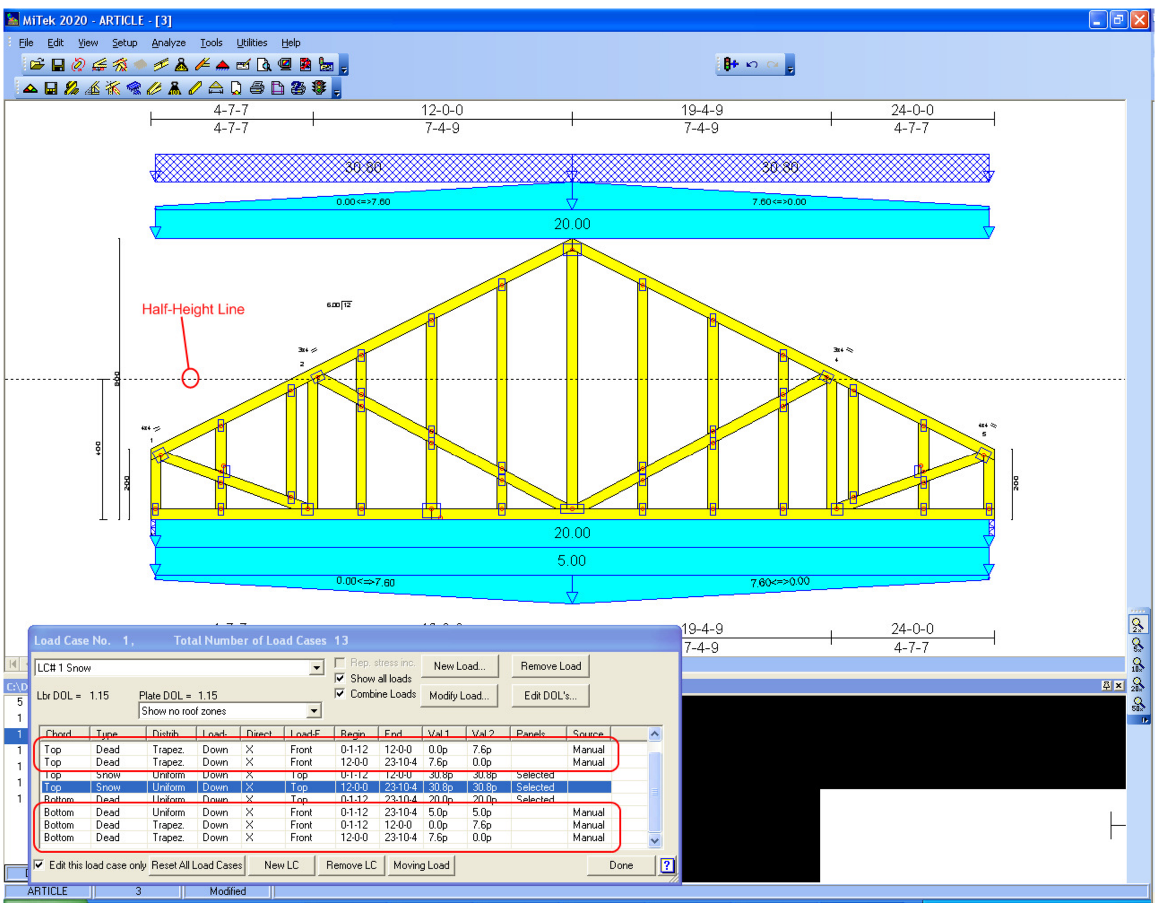
Now we'll calculate the weight of the sheathing.
Start with the rectangle (since this entire load falls below the half-height line of the truss, it will all be applied to the bottom chord):
48 sq.ft. x 2 psf = 96 lbs. total sheathing wieght. 48 sq.ft x .53 psf = 25 lbs stud weight.
96 lbs. + 25 lbs = 121 lbs. total weight.
Divide 121 lbs. by the span of 24-0-0, and you get 5 plf load to apply to the truss.



Now calculate the weight of one of the triangle portions of the truss:
36 sq.ft. area x 2 psf = 72 lbs total weight of sheathing.
Find the weight of the studs:
36 sq.ft. x .53 psf = 19 lbs total weight of studs
Combine them to find a total weight:
72 lbs. + 19 lbs. = 91 lbs total weight to add to truss.
91 lbs divided by 12-0-0 span = 7.6 plf.
This shape covers area above and below the half-height of the truss, so we'll apply a trapezoidal load of 0 plf at heel up to 7.6 plf at the mid-span of the truss on the top and bottom chord, and mirror that load across the peak.



When you are done applying the additional loading, review the loads and confirm that they are correct in magnitude direction and location.



These examples cover the most basic shapes and applications of additional loads applied as sheathing, but the method can be used to cover one or both faces of a truss, completely or partially, and many different shapes. Hopefully these examples will help you to be able to calculate and account for additional dead loads on trusses.