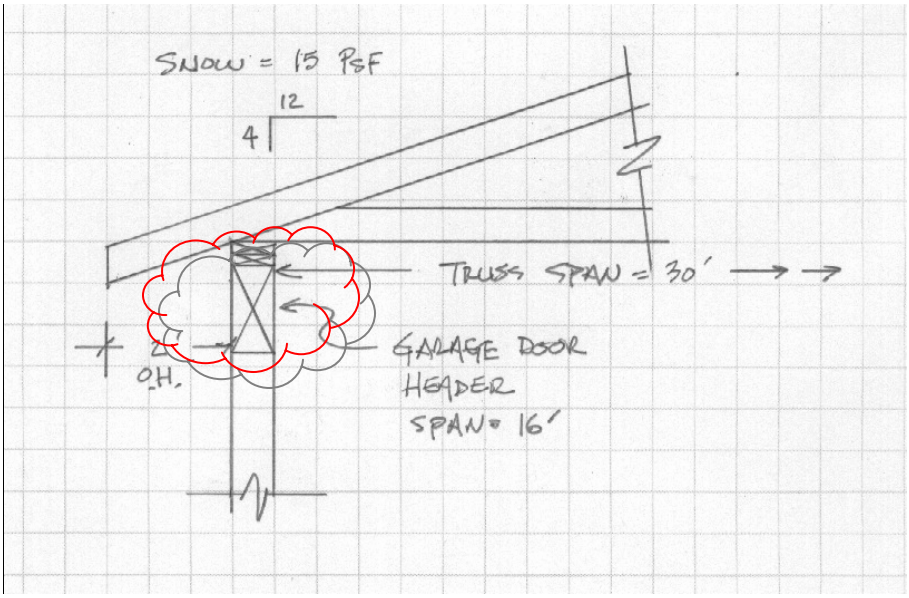
Example Garage Door Header Design Using ConstructionCalc ProBeam Software

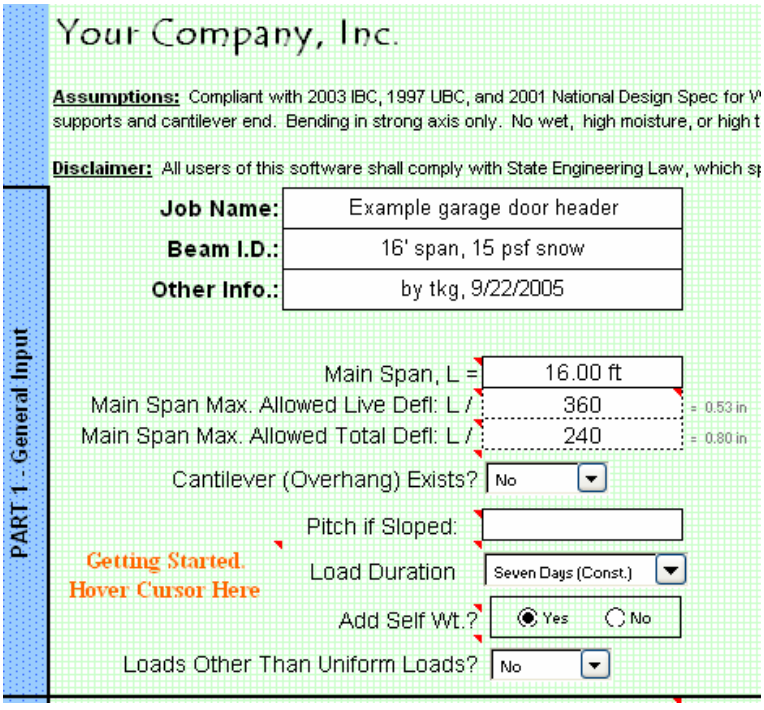
Note: The following example assumes you are a beginner. You should expect this to go slowly at first. However, with a little practice, getting solutions with ConstructionCalc is about a one minute job. Awesome.

1) **General**. This member is a garage door header beam of span 16 feet with no overhang and no complicated loads.



2) Open **ConstructionCalc ProBeam** from Microsoft Excel, File – Open.

3) **Part 1 –** General Input. Here is a screenshot of Part 1 input followed by a description:



a) **General.** With all ConstructionCalc programs you can type in a name of the member you're designing, job name, date, etc. in the three cells at the top. Also, you can type in your company name at the very top of the sheet.

b) **Span**: Main span is the horizontal distance from bearing point to bearing point, in our case, 16 feet. Note: only enter numbers, no symbols, spaces, or units – the program does that for you.

c) **Maximum Allowed Deflection**: This is the amount of deflection (sag) we're willing to allow for the beam (see red triangle note for more). Let's use the default values of L/360 for live load deflection and L/240 for total deflection. Check the small grey numbers to the right. These show the maximum actual sag we're allowing under live loading only and under total load: 0.8 inch - seems reasonable.

d) **Cantilever Exists?** No. This beam is "simply supported" meaning it spans between two supports with no cantilever (overhang). Simply supported also means there are **only** two supports, not three or more. We'll address the truss overhang in the loads section following.

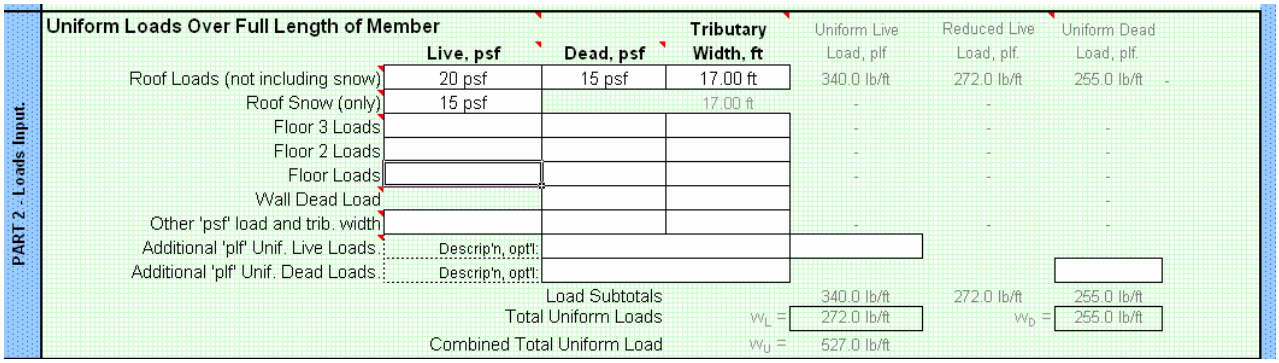
e) **Pitch if Sloped**: Our beam is not sloped, so leave blank or enter 0.

f) **Load Duration**: Since we're designing a beam which will see its worst live loading from construction workers during construction, select Seven Days (const'n). The snow load at 15 psf is less than code prescribed live load, thus this selection. More on this later.

g) **Add Self-Weight?** The weight of the beam itself must be included in the design and it won't be included elsewhere as a part of any uniform dead load, so Yes.

h) **Loads Other Than Uniform Loads?** The only load on this beam will be from roof trusses, all of equal length and loading, so No, no other loads (point loads, wedge, etc.).

4) **Part 2 – Loads Input**. Here are the loads we need. We only need to input four numbers (and we could have input only three, but we're being thorough in this example). Note unused load sections can be hidden via the Hide / Show Loads dropdown at the top of screen.



a) **Uniform Loads Over the Full Length of Member**: This beam gets its load solely from roof trusses which occur over the beam's full length. These trusses impart a uniform load over the full length of member, thus we input our load data in this section. Our load is a Roof Load, so under the top two rows enter:

i) **Live Load**: Roof live load (not snow load – there is a mild difference) comes from workers, their tools and materials, and depends on slope. The red triangle popup note under Live, psf tells us for roof slope 4:12 and less, the live load should be 20 psf.

ii) **Dead Load**: Dead load for a composition roof system is about 15 psf (see red triangle popup note under Dead, psf).

iii) **Snow Load**: Snow load is a type of live load. You typically get this from your building department. In our example we're in an area of light snowfall, so 15 psf is what we'll use. You could have left this blank since you know that live load will be greater and thus will control the design (the program automatically uses the greater of live or snow).

iv) **Tributary width:** This is width perpendicular to our member, from which load is applied. In the case of our beam it will be:

(1) half the span of the trusses on one side, plus

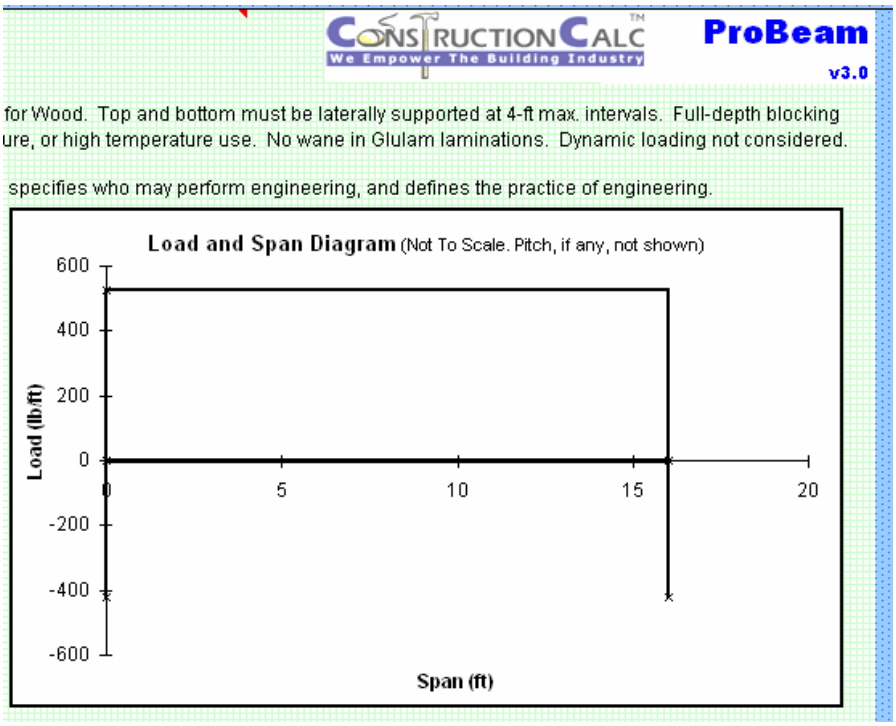
(2) the full horizontal span of the overhang on the other side

Thus our tributary width is 30/2 + 2 = 17 feet. This is far and away the most difficult part of any beam design, but once you understand, it's really simple.

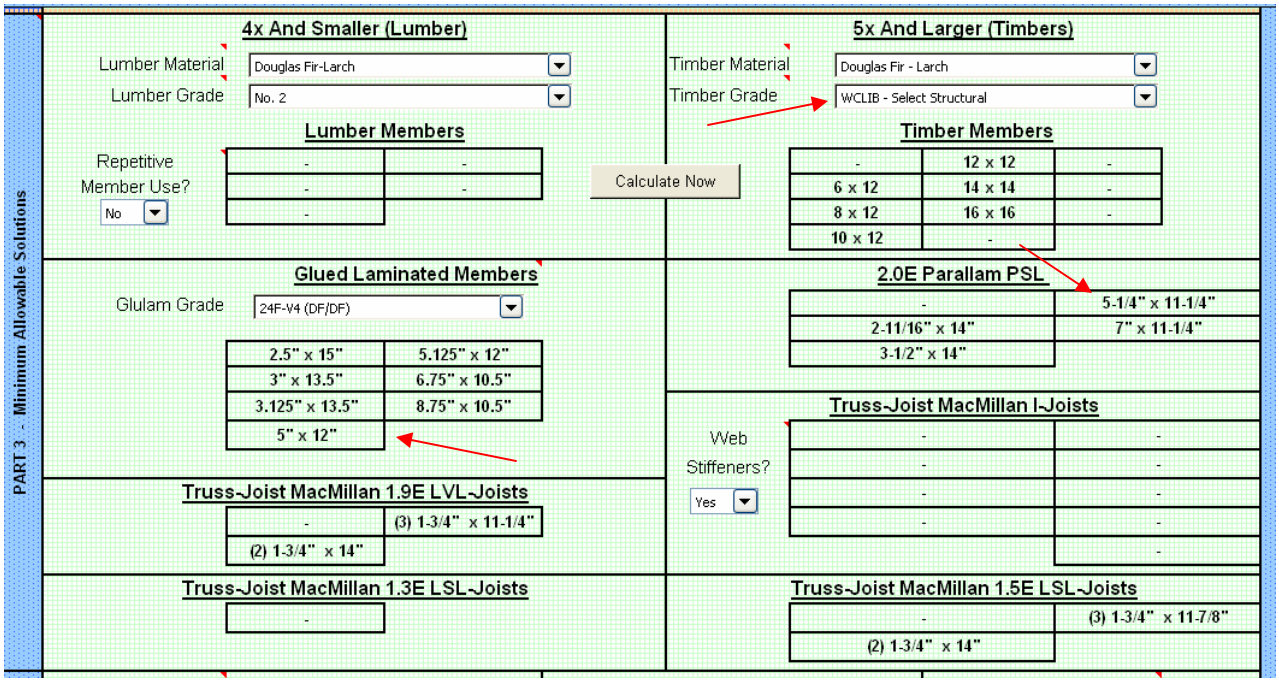
Cool tip: because you're using a ConstructionCalc product, you could have done this math right in the cell instead of reaching for a calculator by entering =30/2+2 then pressing Tab. Do this and you'll see 17 displayed automatically. In other words you can do math right in the cell by starting with an equals sign. Try it. Very cool, very powerful.

b) **Done**. Click on **Calculate Now** and let's check our results.

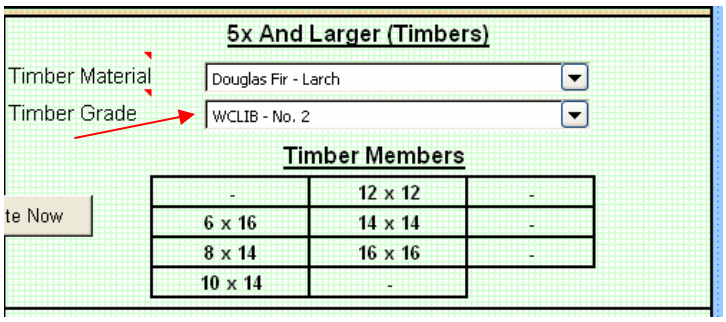
5) **Check the span and loading**: First, we want to make sure our spans and loading were input correctly, so at the upper right of the screen is a graphic showing both. You can see the span and uniform load over entire length. Yep, it's right.



a) **Part 3 - Allowable Solutions:** This section shows all the types and sizes of members that will work. Because we're framing with 2x6 walls, we'd like a 5-1/2 wide header so it would fit without furring.



b) In the Section **5x and Larger (Timbers)**, let's select the type of sawn material that will work. In my neck of the woods, Douglas-Fir Larch is standard, so select that from the dropdown. Also, we know the lumber yard has lots of No 2 grade in stock, so we'll select No 2. Here's what we find in this case:

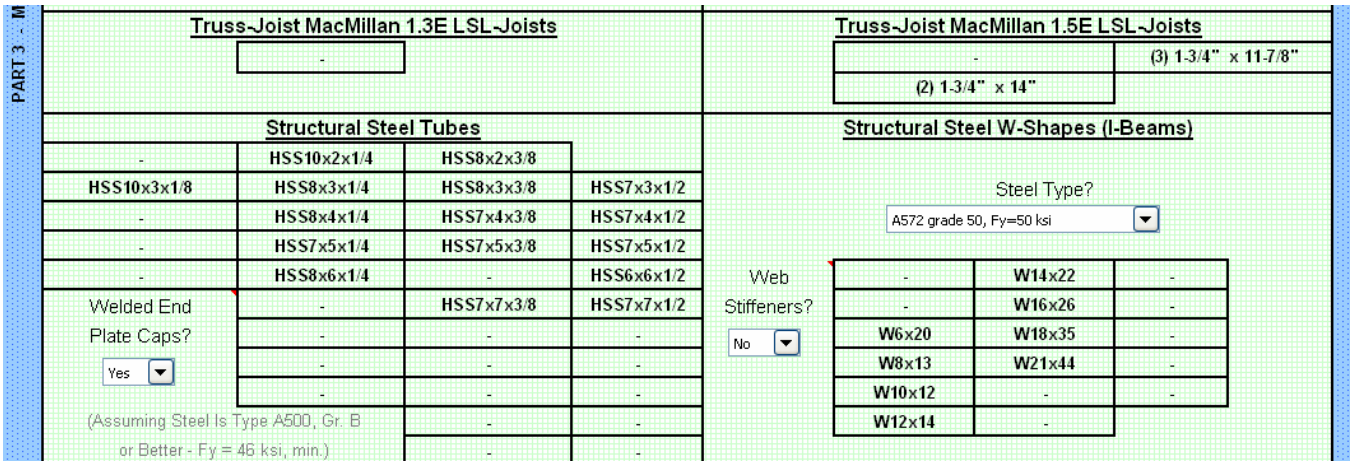


We see that the smallest 6x which will work is a 6x16. No good – too big and expensive. So we change the Timber Grade until we find that, as shown above, we need select structural for a 6x12 to work. Select structural is hard to come by and expensive. Let's look at other alternatives.

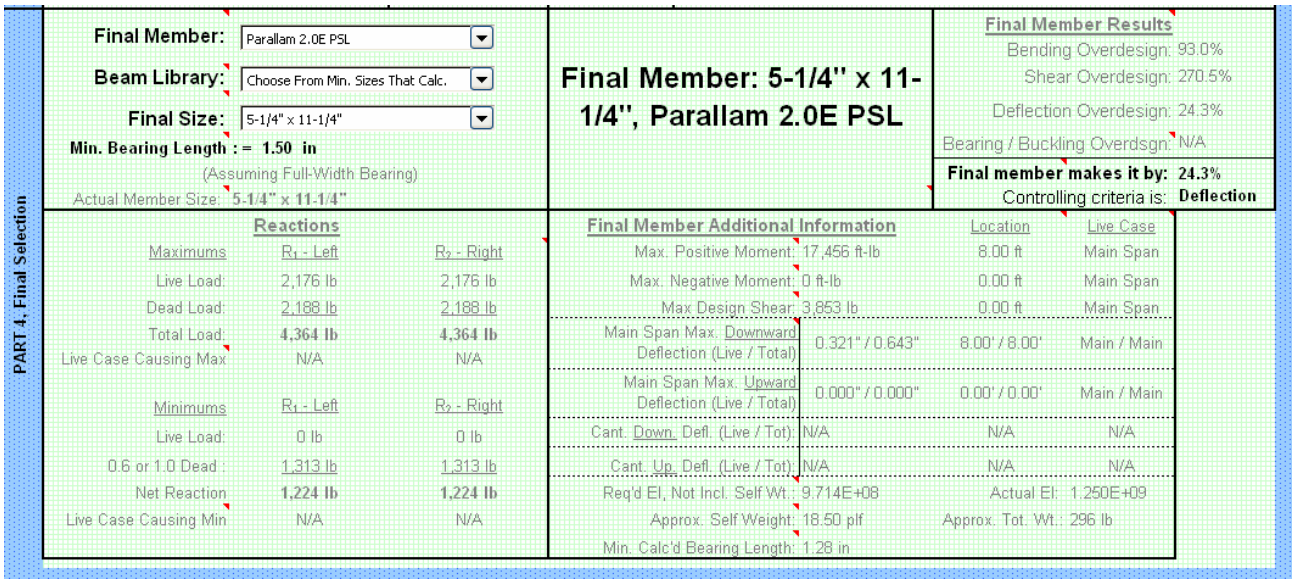
c) What about a glu-lam? I like the 5x12, but any shown would be okay. In the northwest, 24F-V4 grade is common. Talk to your lumber supplier to confirm what's available in your neck of the woods. It is important that you know this because different grades have different strengths.

d) What about Paralam-PSL, LVL, and LSL? Any sizes shown will work.

e) What about steel? We could use either a rectangular tube or wide-flange. Take your pick – I'd probably go with the W10x12 (10" tall and 12 lbs per lineal foot). Steel is difficult to work with and heavy, so we probably wouldn't actually use it for this header, but we could.



6) **Part 4 - Final Selection**. We could stop at this point knowing a 5-1/4x11-1/4 PSL works, but let's continue and see how efficient that member is.



a) **Final Member**: We've decided to use Paralam 2.0E PSL.

b) **Beam Library**: We want to choose from members that calc (meet code). Note, this dropdown allows us to choose any member whether it calcs or not. This can be useful at times to see how close or far a particular member comes to making it.

c) **Final Size**: Select 5-1/4x11-1/4 from the dropdown. When you do, it is shown in large font in the next box to the right.

d) **Final Member Results**: this section shows by how much the selected member calcs for the four code-required design criteria. Notice Bearing / Buckling Overdesign is N/A. This criteria only applies to I-joists and wide flange steel beams, neither of which were our Final Choice, thus N/A. Usually, I just look at the bold sentence that says in our case: **This member makes it by 24.3%.** Controlling criteria is deflection; bending strength and shear strength are way okay, but deflection (sag) is the criteria that comes closest to causing a problem. However it's not a problem with its 24.3% safety cushion. A fine design.

e) **Reactions**. This section shows reactions, which are the downward forces brought by our Final Member to the supports on which it bears. Our header beam will bring 4,364 lbs to each support

when under full load – not an insignificant amount. Reactions are a good way to double check your input. In our case, we would expect both reactions to be the same, because our loading was uniform over the beam's length. If one was different than the other, we'd know there was a problem somewhere in our input.

f) **Minimum Bearing Length**. Just below the Final Size dropdown you see the minimum bearing length of 1.5 inches. This means each end of our beam can bear on a single 2x6 trimmer. I might use double trimmers anyway to help ensure the header doesn't unseat during an earthquake.

g) **Final Member Additional Information**. This section shows a bunch of engineering information that may or may not be of interest to you.

h) **Printout**. You may want to print this design. Because this ConstructionCalc product is nothing more than a fancy Excel spreadsheet, you have lots of printing options via File, Page Setup. Also, you can hide various parts of the display via the ConstructionCalc **Hide / Show Loads** and **Miscellaneous** dropdowns at the top of the page.