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This is a spreadsheet I developed to easily figure out loads on individual beams as well as the total load on the roof. I have to give a lot of thanks to Scott Kuker and Delbert Hall for helping me figure out some key formulas. I'll start by saying, I originally developed this just to make my life easier, it's based on my buildings roof which has equal height beams and most of the bridles run on and off stage. The system will work easiest with a flat roof but I've found it useful in arched roof and truss situations as well. I think it serves as a solid base with room for customization. It may not be particularly intuitive at first but its very simple to use once you understand it. It is based on Cartesian coordinates so you should familiarize yourself with that system first. Make sure you use ' and " notations when entering point locations.

Click on the blue RLC button at the top left of the spreadsheet preview page to download a copy of RLC(Roof Load Calculator), you will also need a copy of inch calc.xla which you will have to link to the spreadsheet. There will be default beam and point location information that you will replace with your venue/show information. The tables are set up for the number of beams in my roof but are easily expandable if you are familiar with excel. If you need some expanding the sheets or linking inch calc, please feel free to contact me.

Click on the tab on the bottom labeled Beams X. Cell A2 will be your first beam name on the X axis(furthest left of center). You can name it whatever you choose, *e.g. Beam 1, Truss 1, 6, etc*. Cell B2 will be the location of your furthest up/down beam left of center, *e.g. -60(make sure your measurements are to the center of the beam)*. Cell C2 will be the Z axis, or height, of the beam, *e.g. 100*. Cell D2 will be your load limit on the beam *e.g. 5000*.

Once you enter those four cells row 1 is set, the rest of the cells contain formulas. Continue to add your X axis beams, one beam per row making sure to use a negative sign on beams left of center, beams right of center will be positive (no notation necessary on positive numbers). Once your X axis table is complete you can click on the Beams Y tab at the bottom of the sheet and enter your beams on the Y axis the same way. To enter your Y axis beam locations you will have to pick a datum location or zero point in the room. I use the main cross stage beam as my zero point in my RLC as it's usually pretty close to the incoming shows datum line. You can pick any point in the room though, just make sure you are entering your beam locations accurately from that point with locations upstage of zero being notated in the negative axis *e.g. -40.*

The next thing you'll need to do is enter some information in the General Table. Cell A2 will be the difference between the shows datum line and the datum line you picked for your venue *e.g.-20, 20,* this number can be changed at any point and the formulas will rework the show in it's current position. Cell D2 will be the bridle apex height *e.g. 60.* At this point you should save your file with your venue name as a blank template. You may want to make multiple templates if your roof is broken down into sections, I have a template for my Upstage section, Midstage section, Scoreboard section and down stage section, as we have four different beam layouts. You can also just manually enter beam locations for points outside the main grid. You only need to enter this information once, now you have a template to lay all future shows into.

Now you can hit Save As_ label it for the current show and enter your show points into it. Click on the table that you bridle the majority of your points from. If your bridles run cross stage you will use Points X, if your bridles run up and downstage you will use Points Y. If you run bridles in both directions you will be able to set up both tables by copying and pasting points from one table to the other so start by putting all of your points into the table that most of your bridles will be on. If you have an XY sheet in excel you can simply copy and paste your sheet into cell A2, just make sure your columns are ordered Point Name,Type, Load Weight, X, Y or paste the info one column at a time. Alternatively you can enter the information manually, one row per point, you only need to enter information in the first five cells, the rest contain formulas.

Reading the results.

I will note again that this table is designed for experienced riggers who understand beam loading, this is a tool and your results must be checked carefully. I like to use a split screen and cross check with a visual of the plot as I go.

Before I look at the beam loading I like to look at my point tables. The first thing I do is resort the first five columns, by column E (Y Axis), so that the points are ascending. Now I can look down Column F to see if there are rows of points that line up close to my Y axis beams, if they are less than a foot away and the plot seems to indicate that a dead hang would be acceptable, I will usually presume that we will dead hang it and just change the Y location in the sheet to match the beam location. The points you move will not appear on your X axis Beam Table but will appear on the Y axis Beam Table. Although the program pre-selects the

beams you will be hanging on you can still go into cells P-S and manually enter a beam location if you know that you will have to skip a beam (you will also have to manually change your Bridle apex in column F) or if you are in a sloped roof situation and need to manually enter different beam heights(Z Axis). Next I will look down column D (X axis) and again, while cross checking my plot, move X axis points to probable deadhangs. You will notice that the tensions disappear as the point moves to a beam location from the other table, rest assured that the vertical load is still being calculated into your total beam load you will see the loads appear in the dead hang columns on your corresponding beam table. You will see cells for leg lengths, so long as you set your bridle apex to something close to a known length of steel (be sure to subtract your approximate basket return). You can just round these numbers to the chosen length, use the deck chain link count in column J(you will have to translate to known lengths of steel as you get above 10 links i.e. use a dogbone + 5 rather than 12 links), and the results should be accurate. You can also use Simple Bridle for accurate leg lengths using a locked short leg of your choice if you have beams of equal height.

The Beam tables are fairly self explanatory, they show vertical load and horizontal load (- notates force to the left + is force to the right), dead hang loads and total force. You'll notice that if your points intersect with beams on the Y axis, they will show up on the Y axis Beam table and not on the X axis. This is an important note if your cross stage loads carry into your up down beam load limits as you need to keep this in mind when looking at beam loading. If you find that you have some beams that are overloaded you can simply highlight the first four cells of the points you need to move and cut and paste them into your Point Y table, again if you need to skip beams you can manually enter that information into the appropriate cells (make sure to change your bridle apex). Please come back to me with any questions or comments.