Structure Tool in Freecad: how to use

1 Intro info:

FreeCAD is open-source software that can integrate with Python packages.
Structure Tool is a FreeCAD extension for structural analysis, utilizing the Pynite kernel to perform calculations and display results

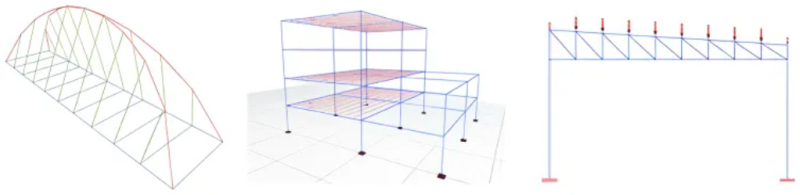

Figure 1:

2 How to use:

From Freecad select Structure Tool WB

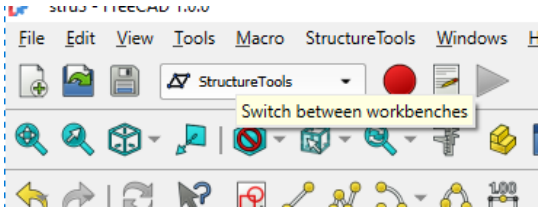

Figure 2:

* Click New button to create empty model
* Click Line on toolbar to create line for beam/ column structure

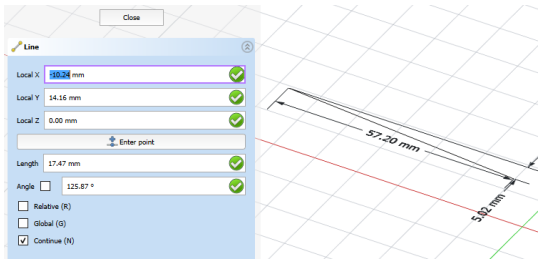

Figure 3:

∗ Select endpoint of line then click support button

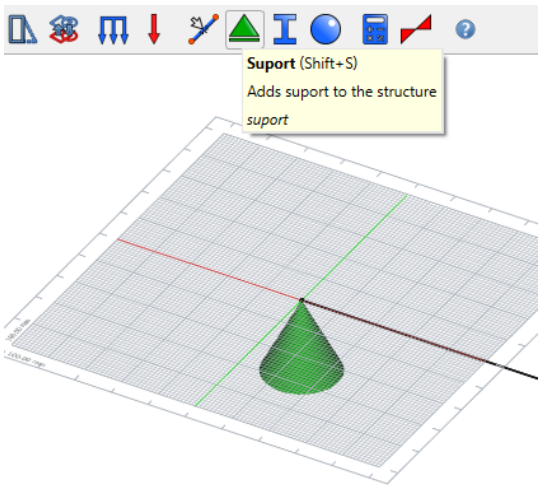

Figure 4:

– in tab of support select restraint required

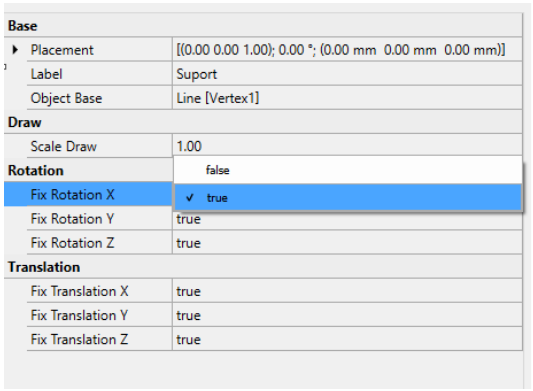

Figure 5:

∗ Create & assign section

– Click sketch button to make a sketch. Sketch will be in plane XY (important note) and try to make sketch in center of (0,0,0)

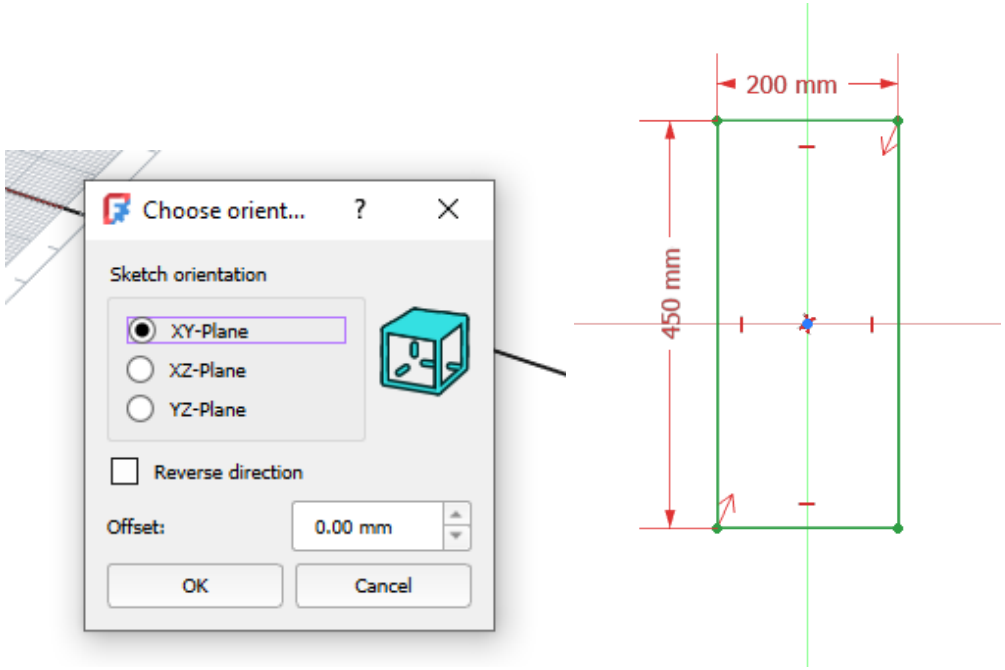

Figure 6:

– Convert sketch to wire

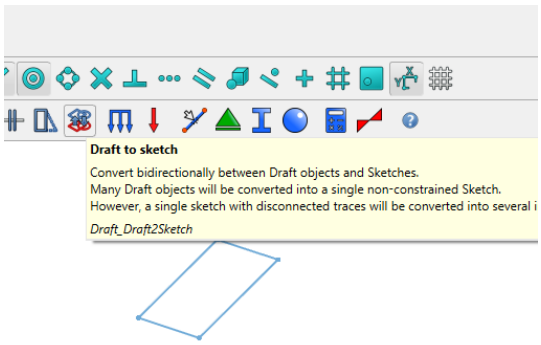

Figure 7:

– from wire created, select make face

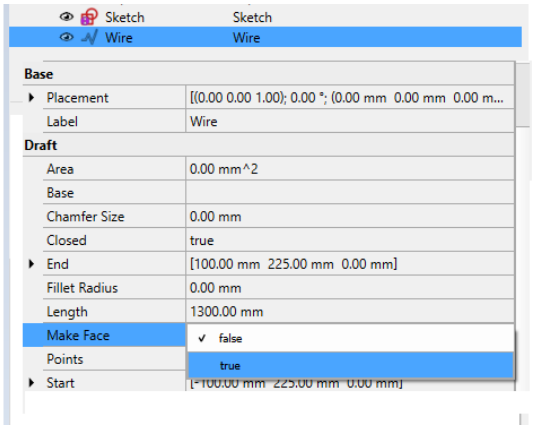

Figure 8:

– put pointer on created face then click section button (important note)

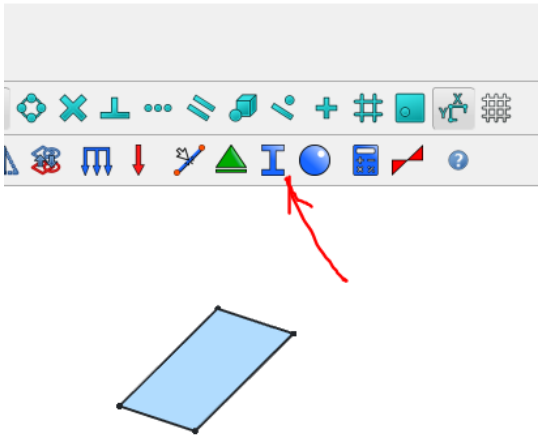

Figure 9:

– section will create with parameter for moment inertia info

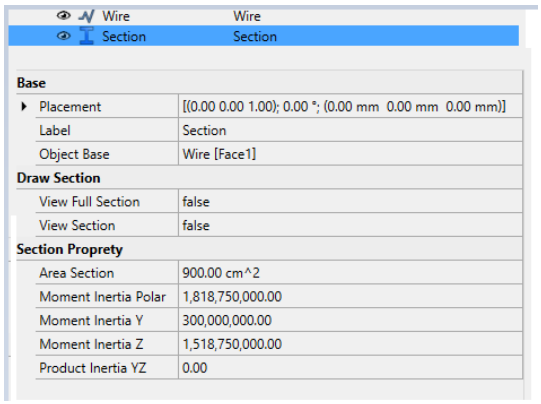

Figure 10:

∗ Create material

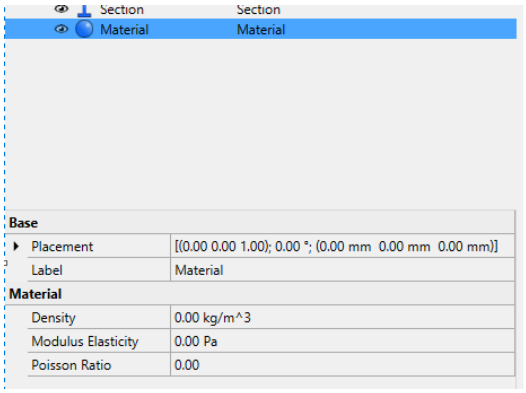

Figure 11:

∗ Select line & define section, material

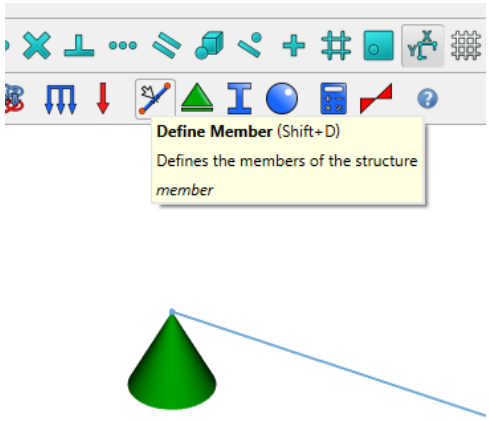

Figure 12:

– in line tab properties will appear Structure info

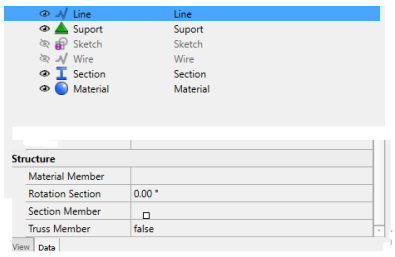

Figure 13:

– click "..." then select material, section already defined in list

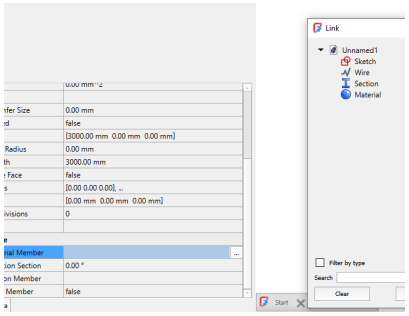

Figure 14:

∗ select line structure and apply load

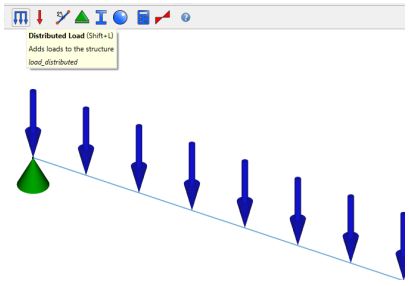

Figure 15:

∗ select whole model by box selection (important note)

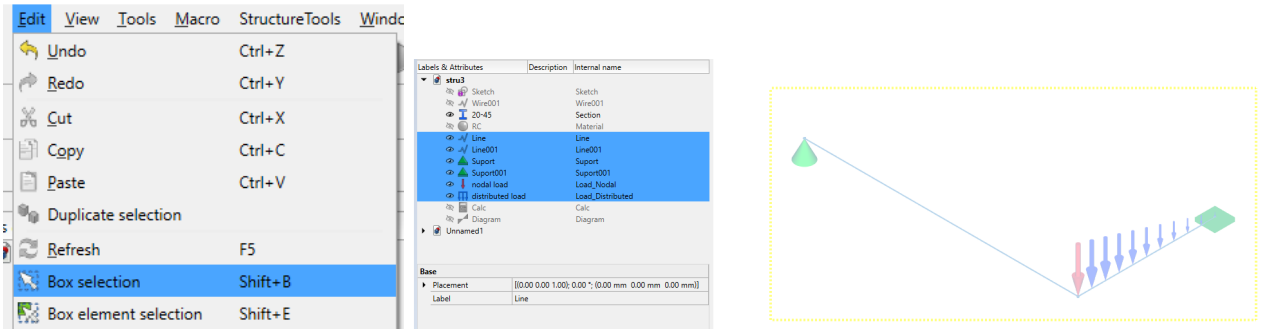

Figure 16:

– click Calc button to run analysis

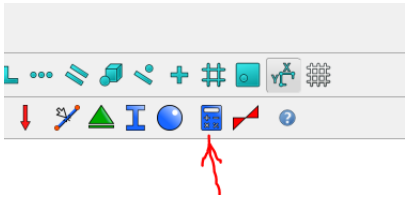

Figure 17:

– Calc will appear in tab properties with values moment, shear, deflection

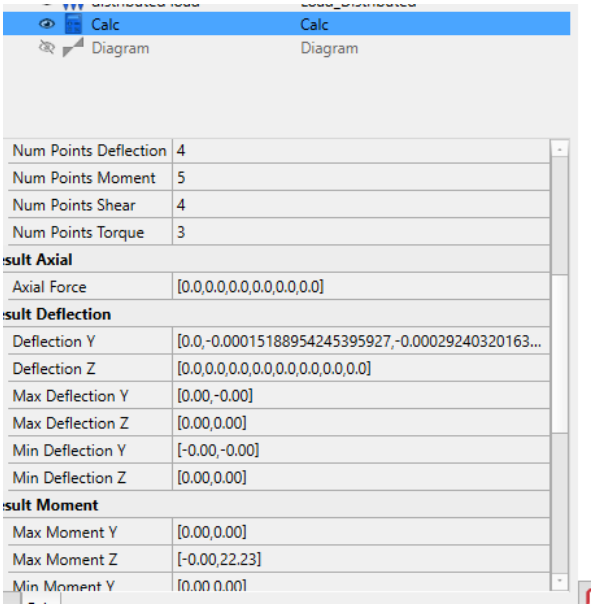

Figure 18:

∗ click diagram to see BD or SD

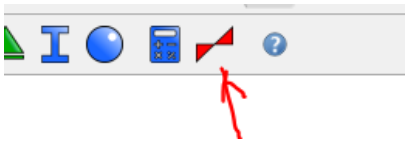

Figure 19:

– on tab properties of diagram, select "true" to show value on beam

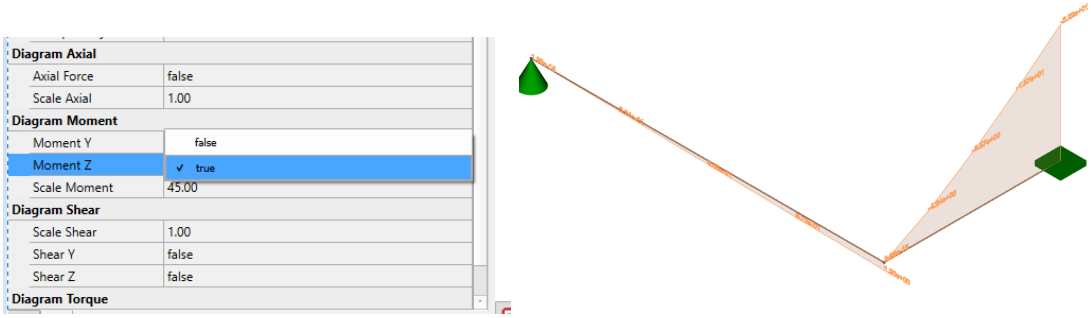

Figure 20:

3 New add-ins:

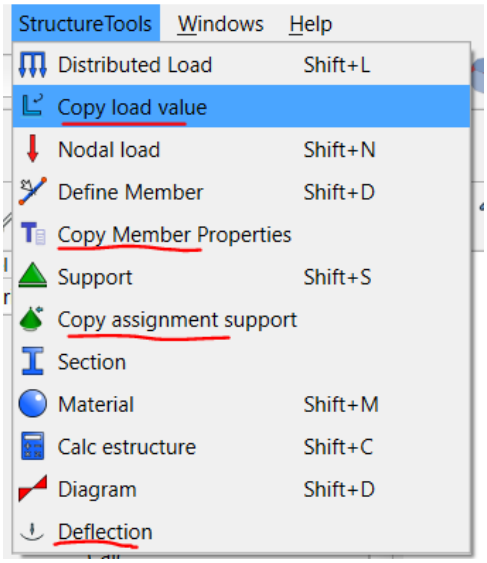

Figure 21:

– Load copy use for copy value load from selected distribute line to other ones

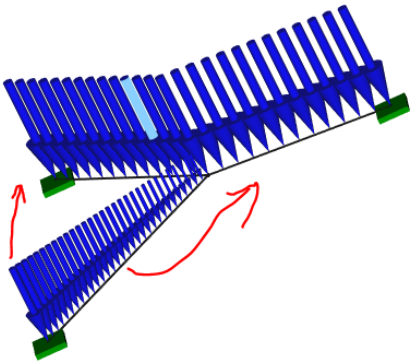

Figure 22: Before copy load

select source distribution load then select other ones to overwrite value

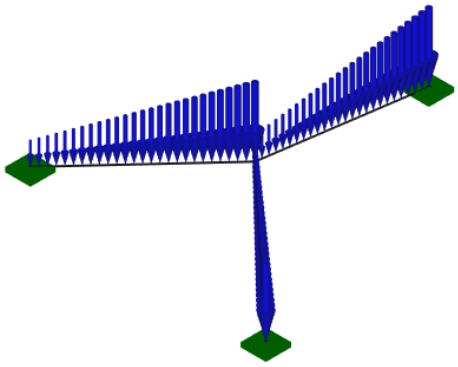

Figure 23: After copy load

– Copy support assignment use for copy assignment from selected support to other ones

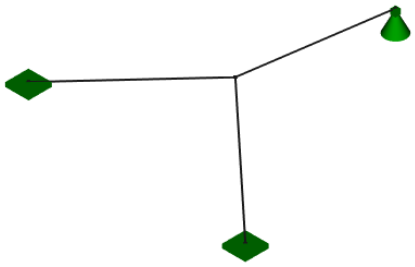

Figure 24: Before copy

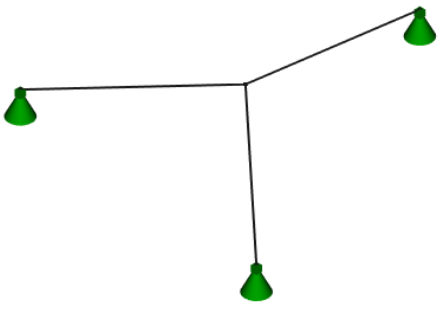

Figure 25: After copy

– Show deflection results

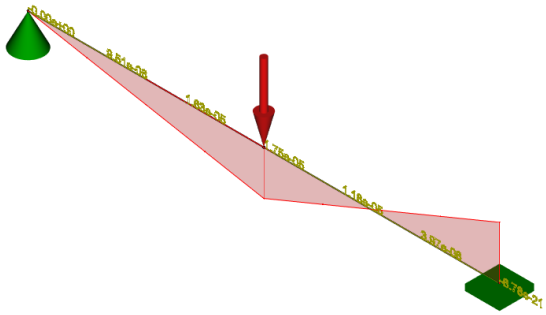

Figure 26:

4 Summary:

We gratefully acknowledge Maykow Menezes for his development of Structure Tools.
This extension provides a user-friendly way to visualize and interpret Pynite results within FreeCAD, significantly reducing the need for direct Pynite coding expertise. You can explore the project and its source code at: https://github.com/maykowsm/StructureTools.

We extend special thanks to Yorik Van Havre for developing Freecad Platform

5 Appendix: Testing result

5.1 Example 1:

∗ Simple beam under uniform load & bending diagram

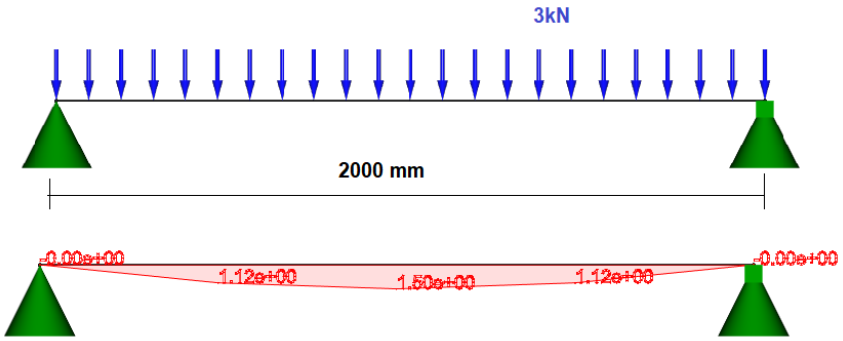

Figure 27:

∗ Result by anatruct - Python package

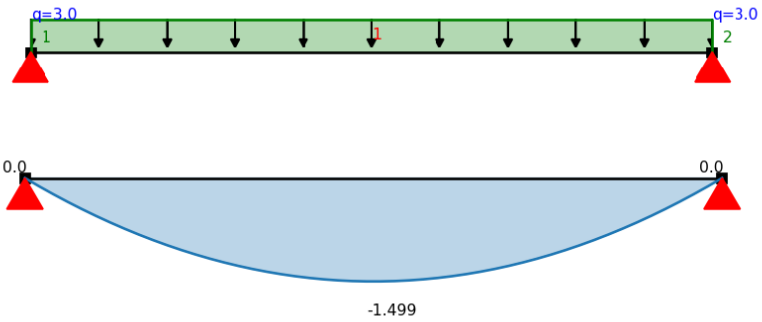

Figure 28:

5.2 Example 2:

∗ Simple beam under uniform load, point load & bending diagram

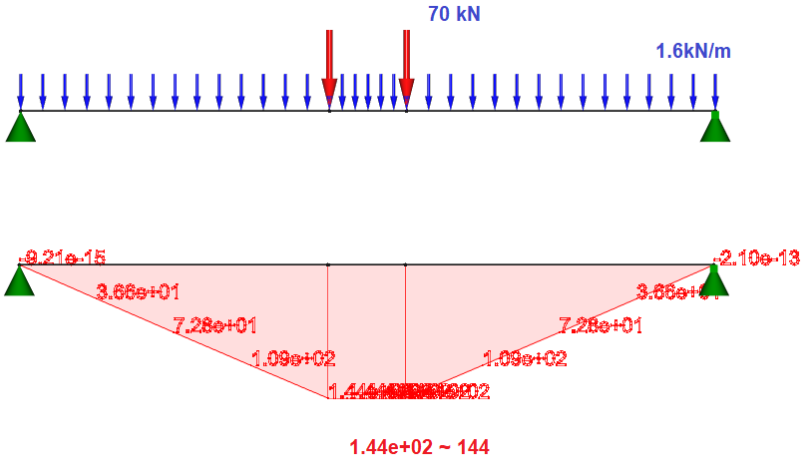

Figure 29:

∗ Result by anatruct - Python package

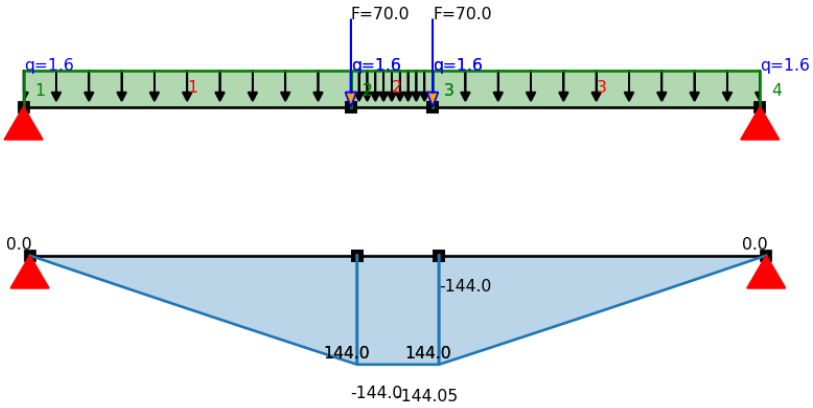

Figure 30:

∗ Result by Ftool

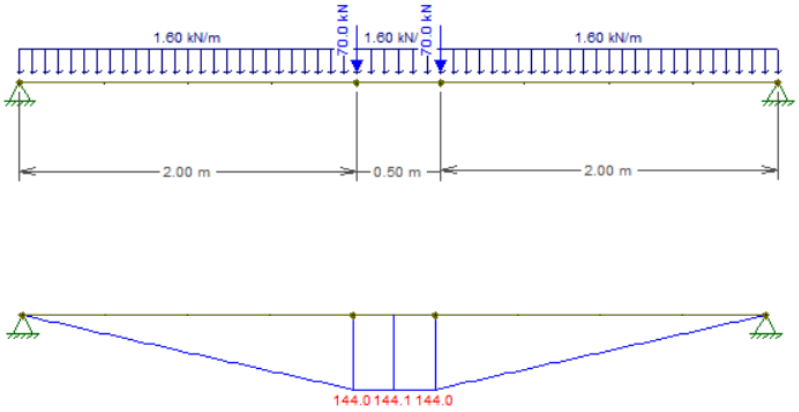

Figure 31:

5.3 Example 3:

∗ Frame structure uniform load & bending diagram

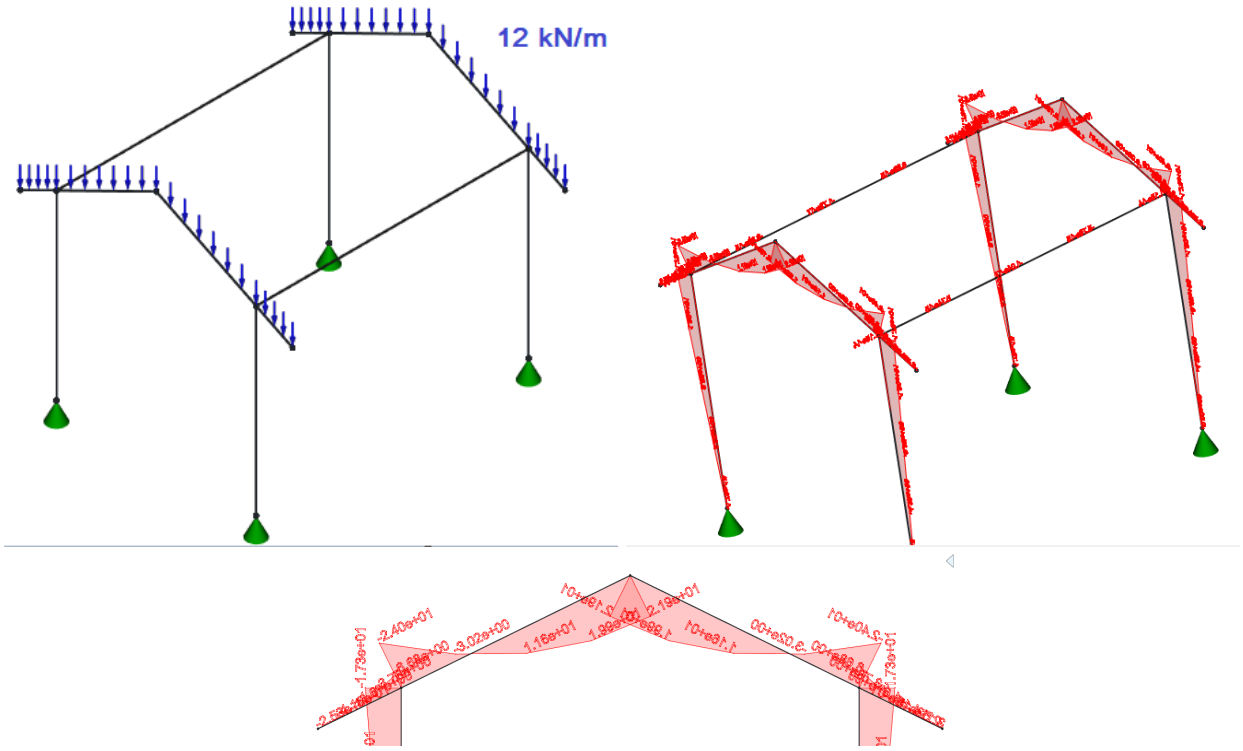

Figure 32:

* Result by Structure Tool

* 2D Frame structure uniform load & bending diagram

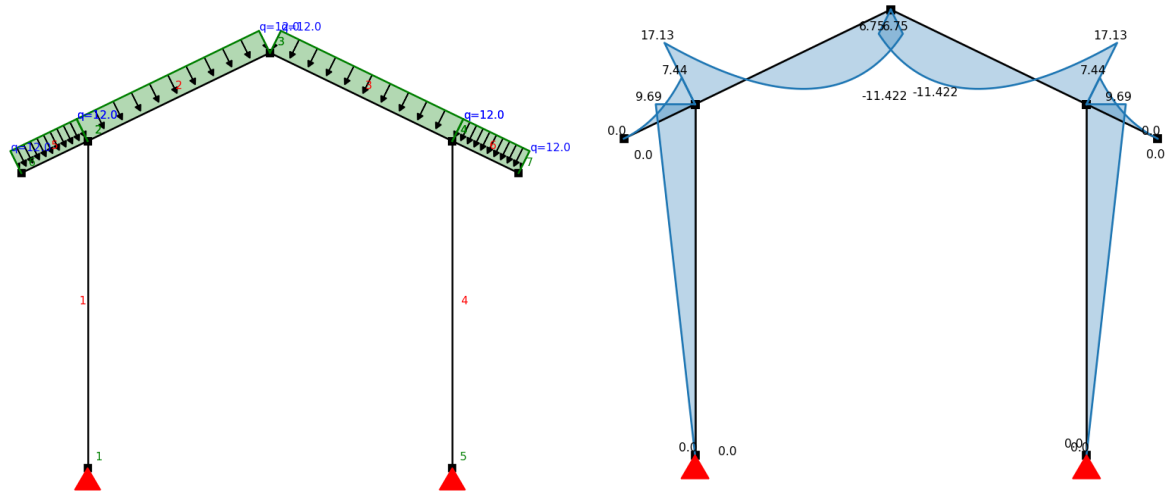

Figure 33:

* Result by Anastruct

Got a bit different result value cause in Anastruct assigned load in default perpendicular with member frame

The good point, Structure tool can do analysis 3d model which other free package, software be limited

6 Notes & Troubleshooting

In here, listing down some troubleshooting need to avoid:
+ Do not group lines (members)
+ With model have many frames or member structures, may need to 'Calc' one frame first before replicate
+ Section properties can copy from other file to current working file

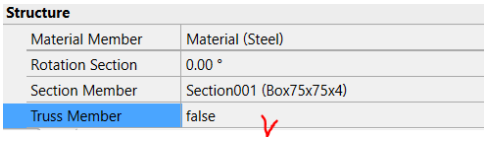

Figure 34:

+ Tick 'false' truss member even when model for truss
+ Lines (members), supports, distribute loads, nodal load must not be turned off

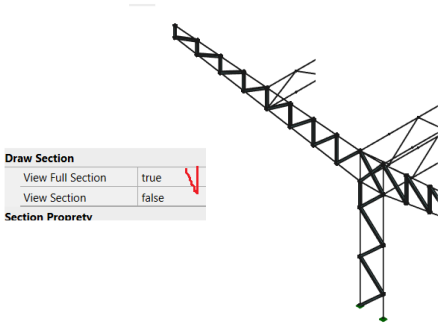

Figure 35:

+ View section assign full 3d to review which one not assign section or wrong assignment

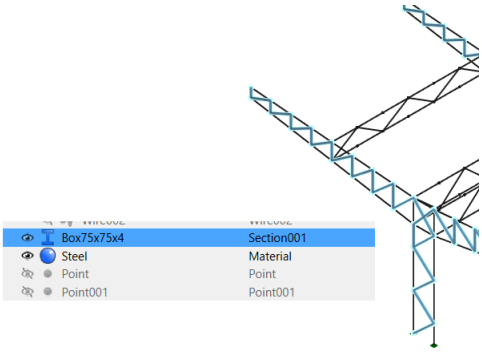

Figure 36:

Or put pointer on declared section then it will highlighted which one assigned for.
This is a drawback because re-rendering in FreeCAD can be slow with large models

+ With above feature of section can draft calculate weight of members with assigned section
Do same thing, put point on declared section, at draw section → view full section: true
then using Center of Mass macro to get weight for those selected

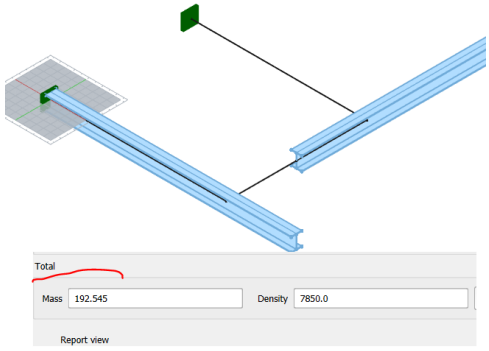

Figure 37:

+ Due to the reasons mentioned earlier, the resulting calculation model can have a large file size – even for models with a moderate level of complexity. This can result in files several megabytes in size