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

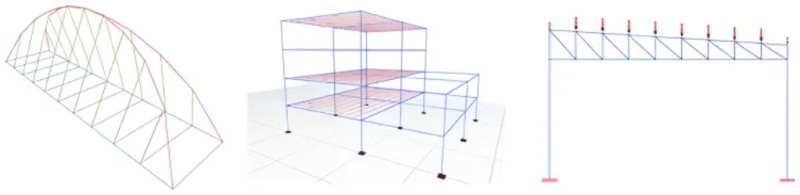

Figure 1:

2 How to use:

From Freecad select Structure Tool WB

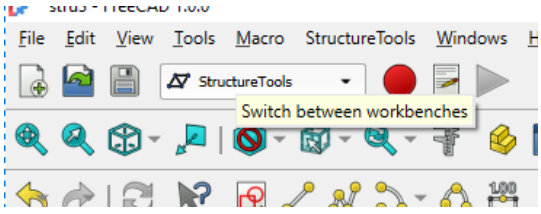

Figure 2:

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

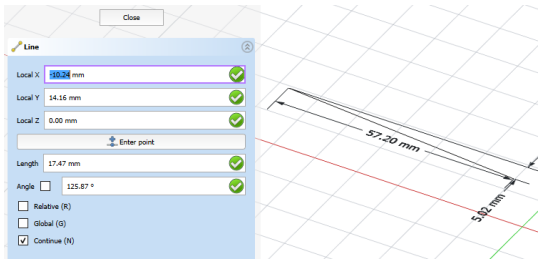

Figure 3:

∗ Select endpoint of line then click support button

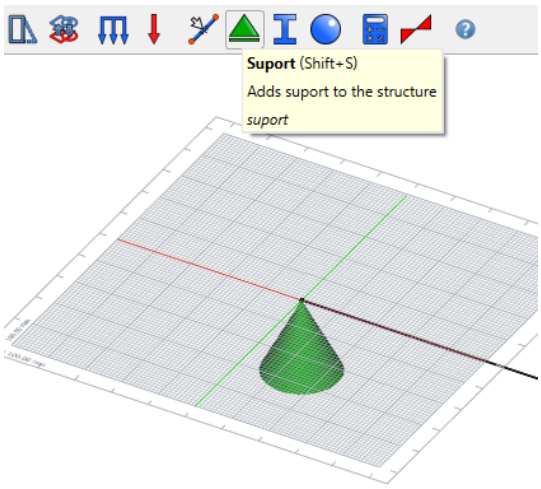

Figure 4:

– in tab of support select restraint required

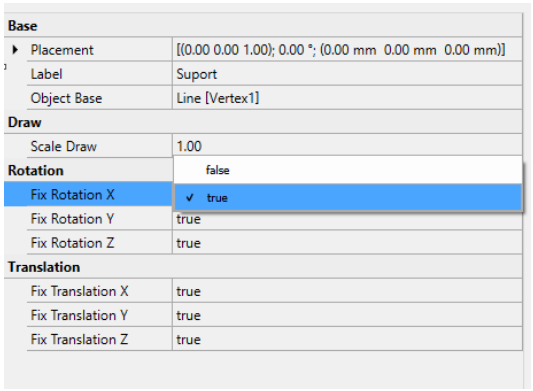

Figure 5:

∗ 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)

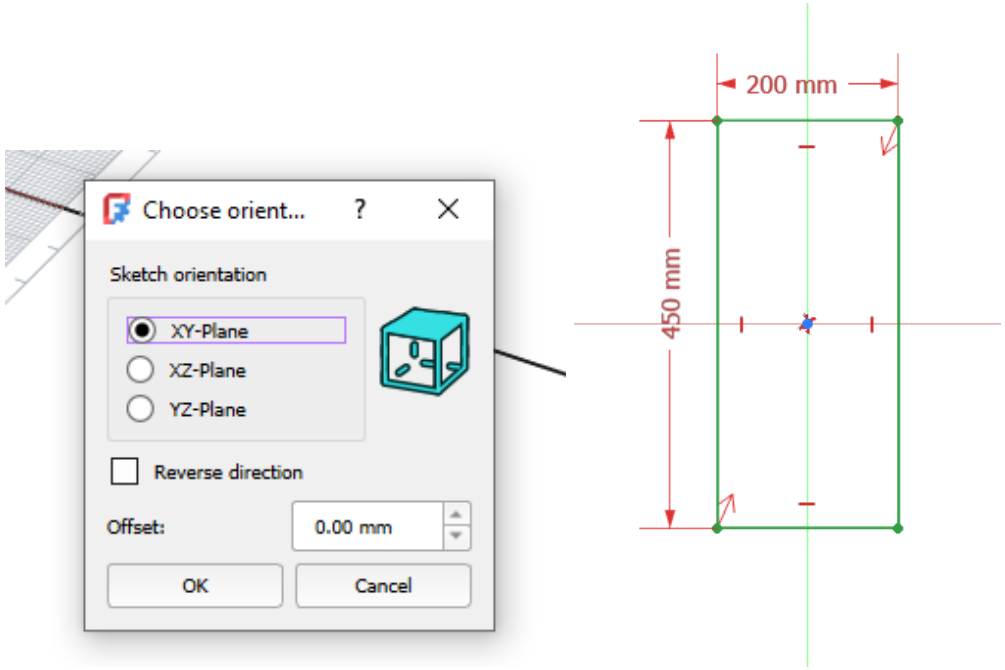

Figure 6:

– Convert sketch to wire

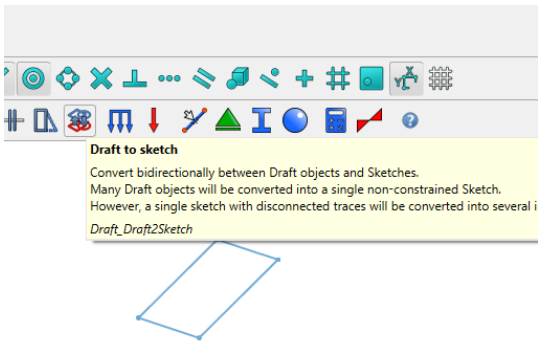

Figure 7:

– from wire created, select make face

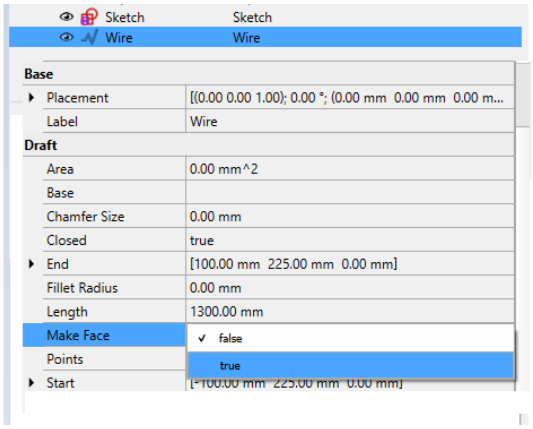

Figure 8:

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

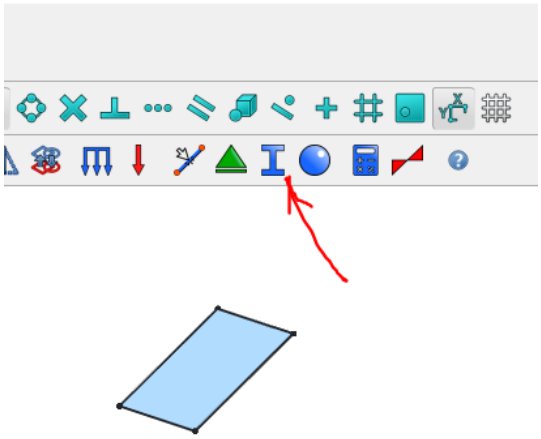

Figure 9:

– section will create with parameter for moment inertia info

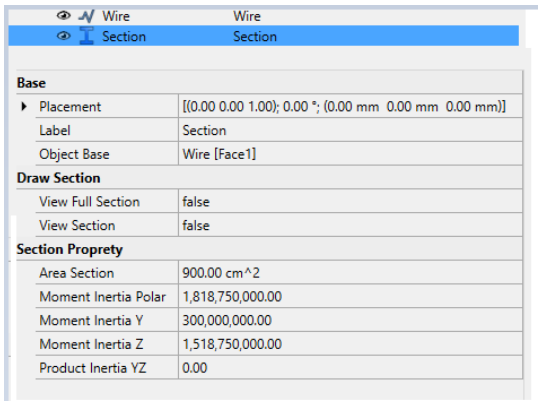

Figure 10:

∗ Create material

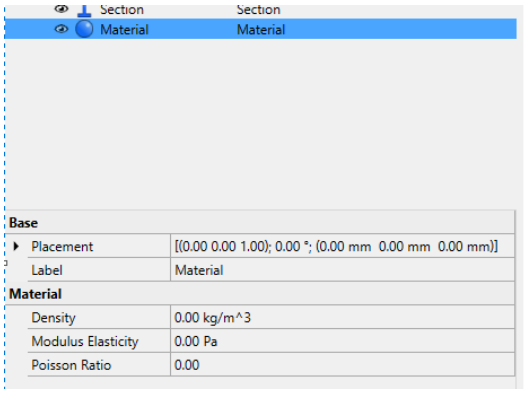

Figure 11:

∗ Select line & define section, material

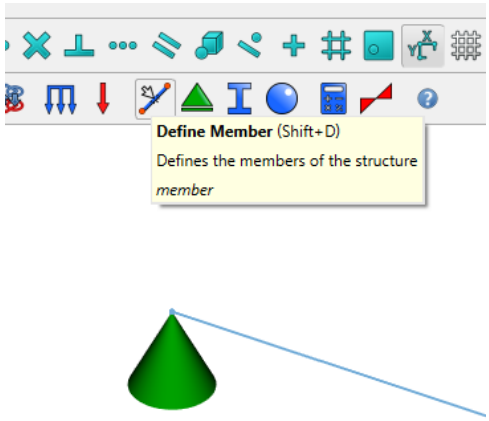

Figure 12:

– in line tab properties will appear Structure info

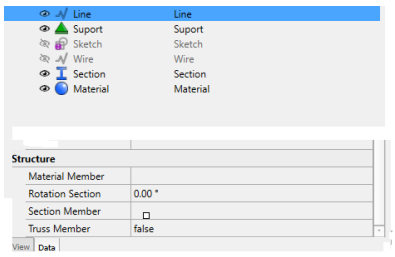

Figure 13:

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

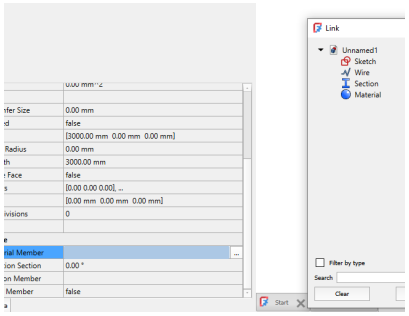

Figure 14:

∗ select line structure and apply load

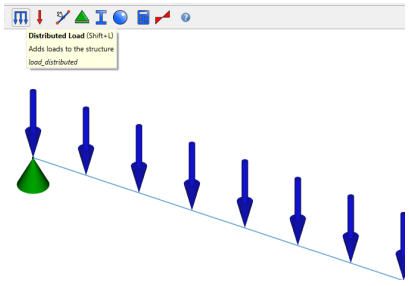

Figure 15:

∗ select whole model by box selection (important note)

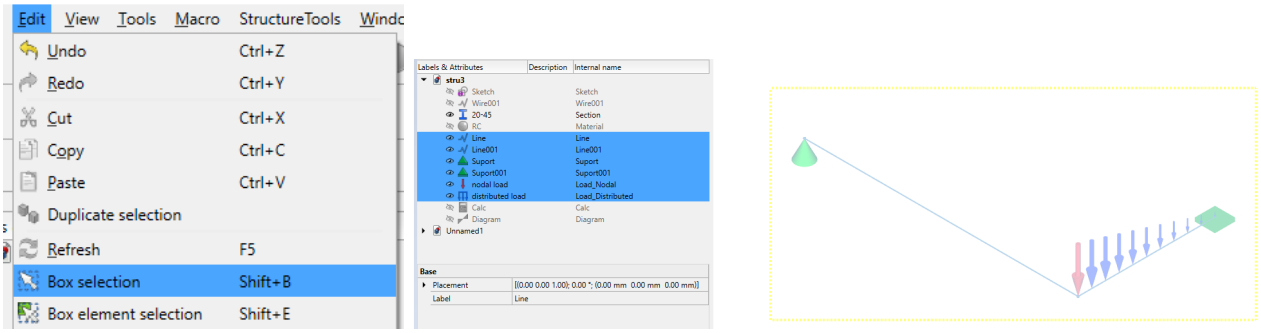

Figure 16:

– click Calc button to run analysis

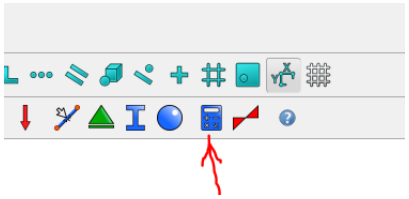

Figure 17:

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

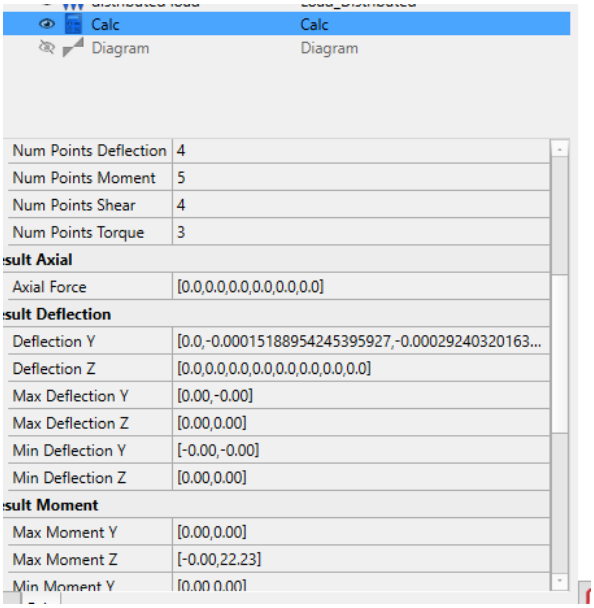

Figure 18:

∗ click diagram to see BD or SD

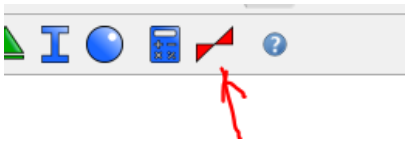

Figure 19:

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

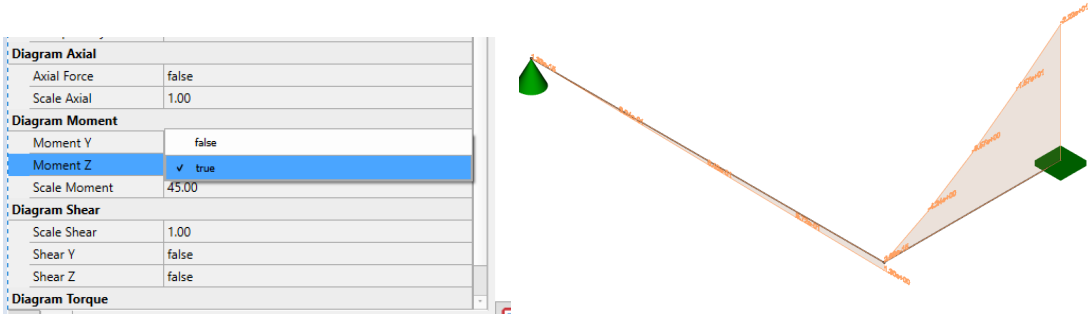

Figure 20:

3 New add-ins:

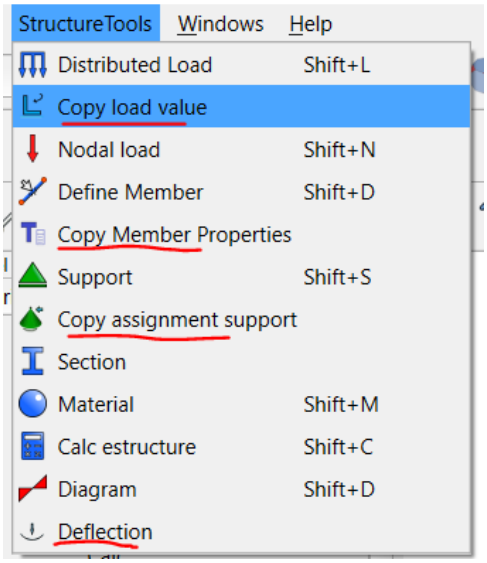

Figure 21:

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

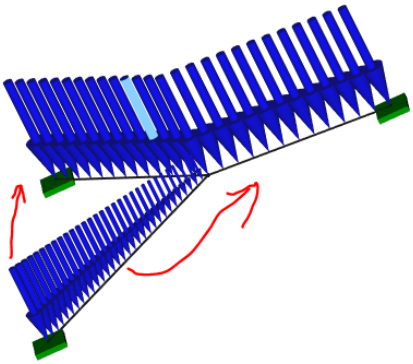

Figure 22: Before copy load

select source distribution load then select other ones to overwrite value

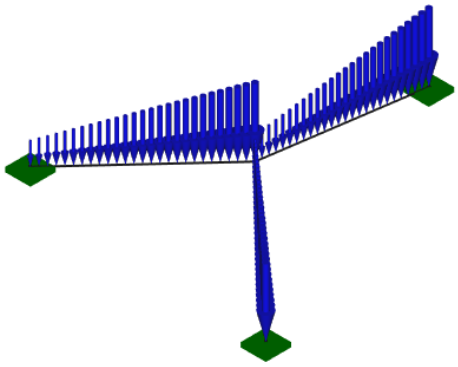

Figure 23: After copy load

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

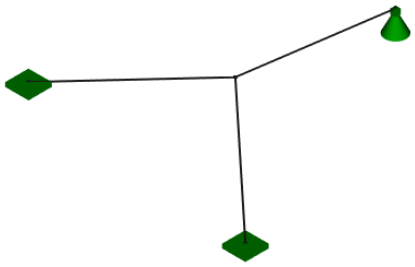

Figure 24: Before copy

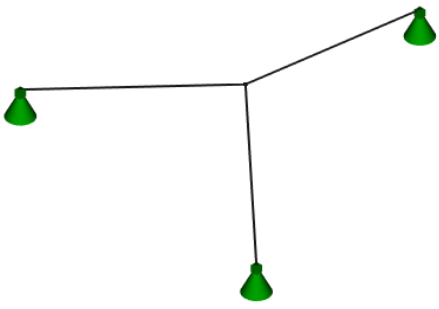

Figure 25: After copy

– Show deflection results

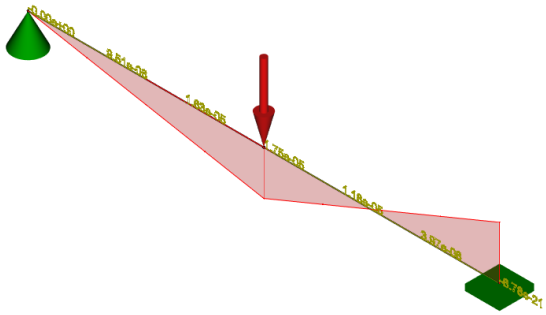

Figure 26:

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

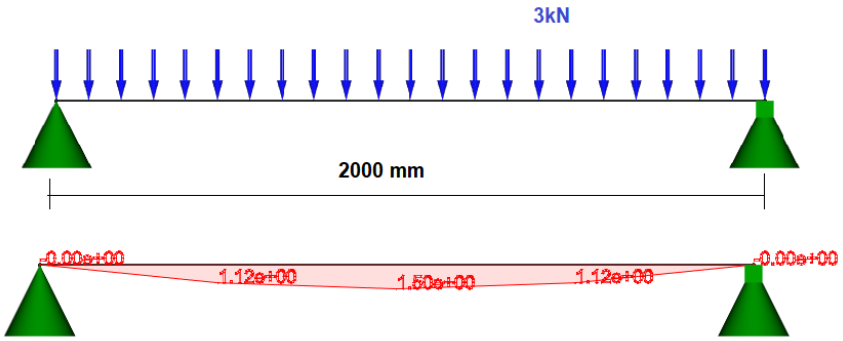

Figure 27:

∗ Result by anatruct - Python package

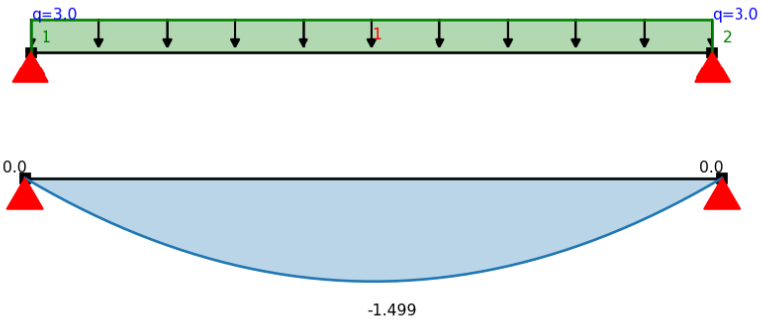

Figure 28:

5.2 Example 2:

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

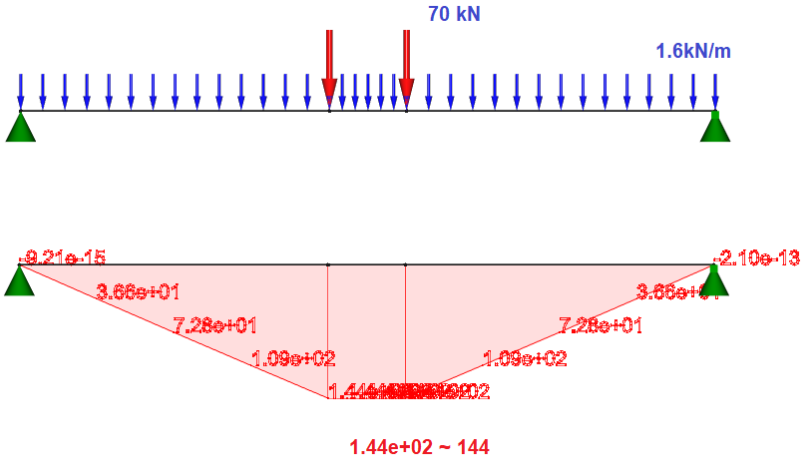

Figure 29:

∗ Result by anatruct - Python package

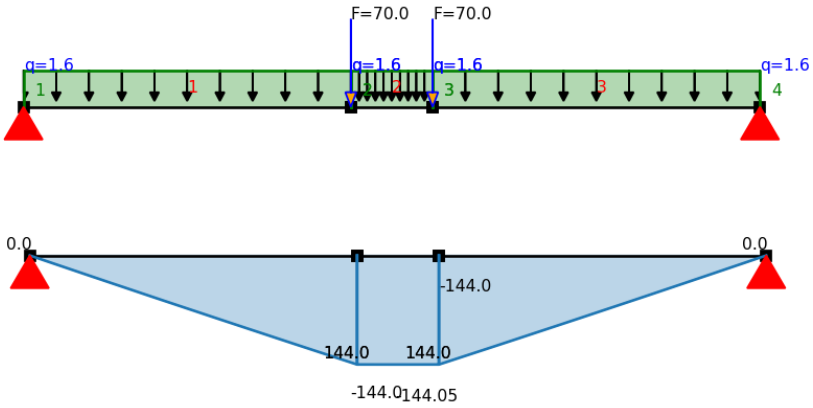

Figure 30:

∗ Result by Ftool

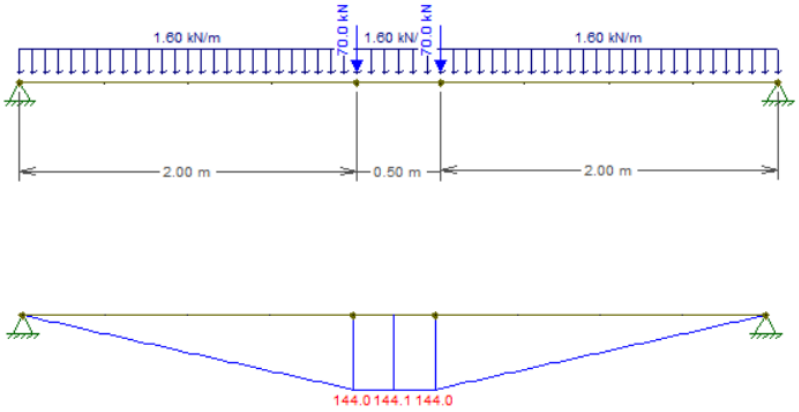

Figure 31:

5.3 Example 3:

∗ Frame structure uniform load & bending diagram

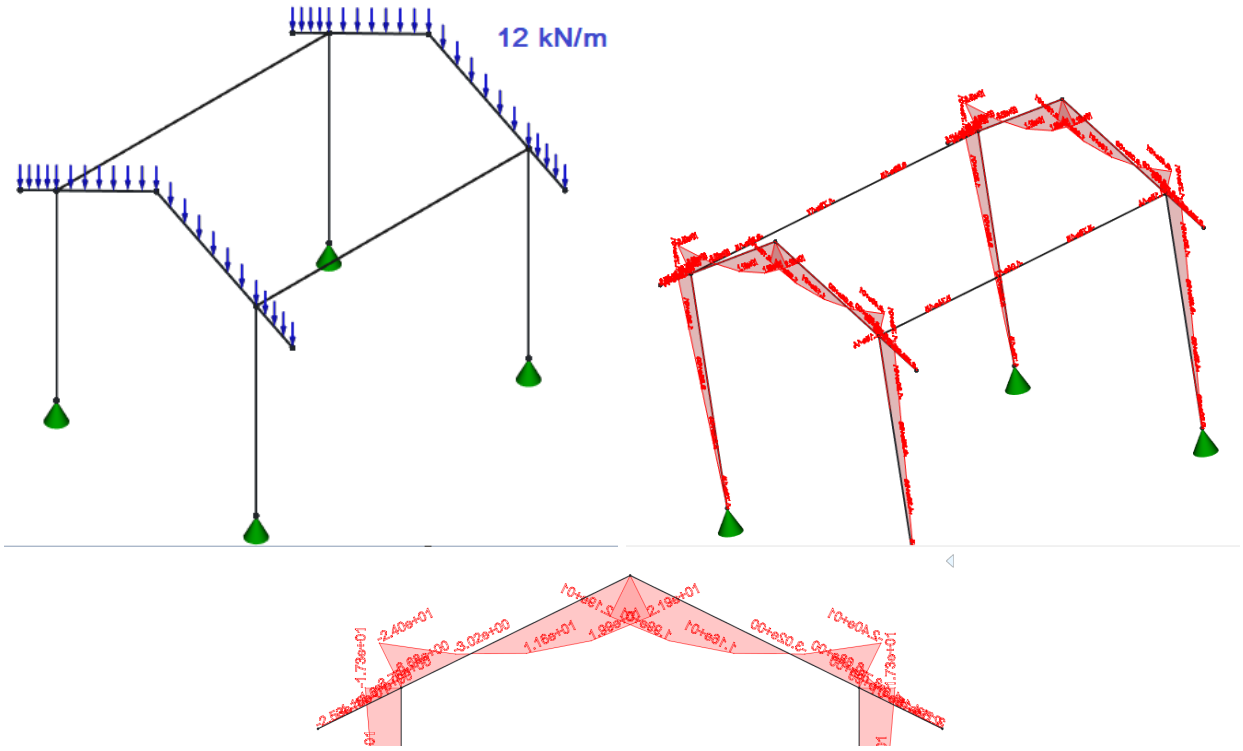

Figure 32:

* Result by Structure Tool

* 2D Frame structure uniform load & bending diagram

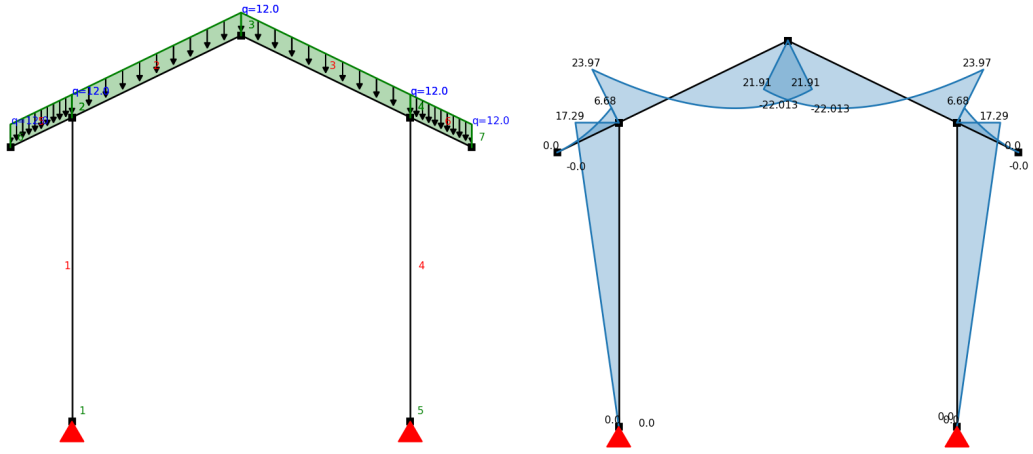

Figure 33:

* Result by Anastruct

A key advantage of Structure Tool is its ability to perform analysis on 3D models, a capability often limited in

other free software packages

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

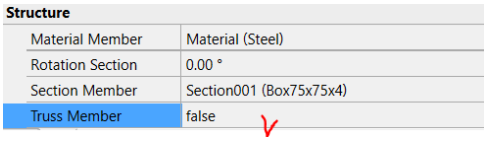

Figure 34:

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

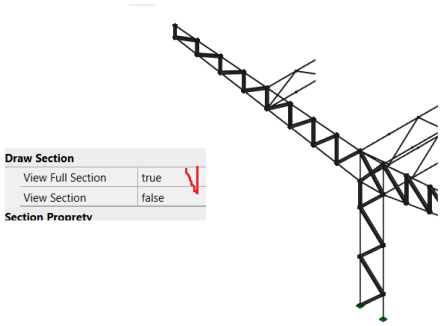

Figure 35:

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

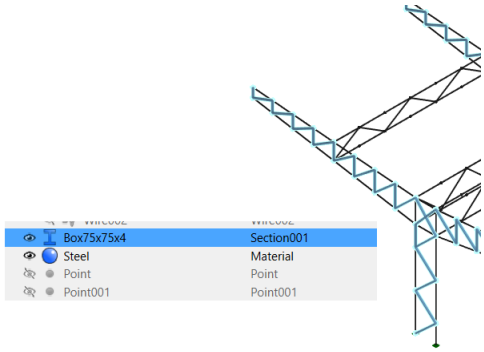

Figure 36:

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 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

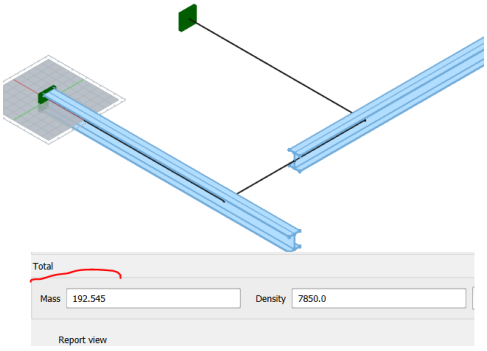

Figure 37:

+ 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

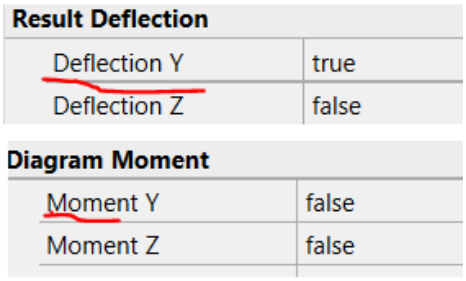

Figure 38:

+ In the resultant dialog box, the Y-axis denotes the vertical direction of the model, whereas the Z-axis corresponds to the lateral or horizontal direction (defining a section in the XY plane)