Structure Tool in Freecad: how to use
by Kay Tran

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:

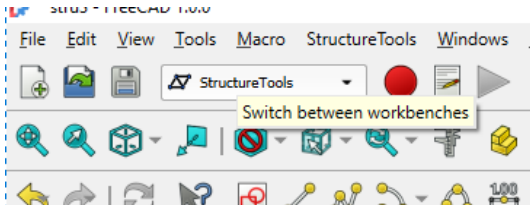## 2 How to use:

From Freecad select Structure Tool WB

Figure 2:

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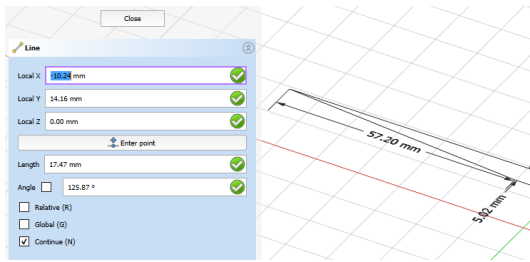* Click Line on toolbar to create line for beam/ column structure

Figure 3:
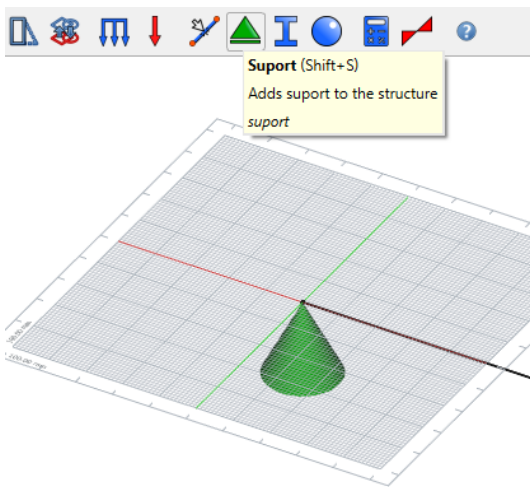
∗ Select endpoint of line then click support button

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)
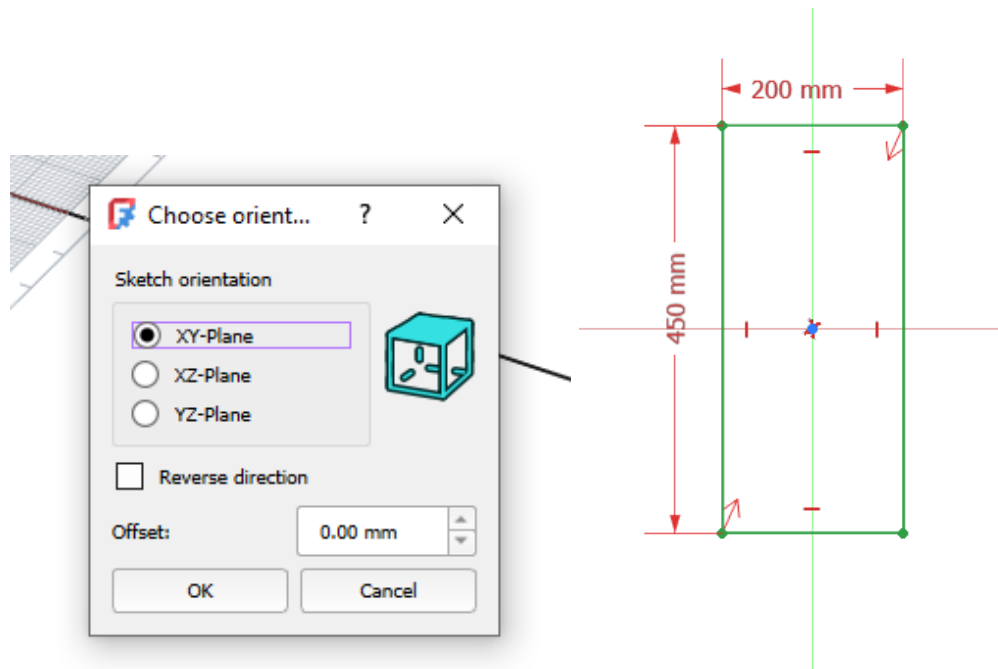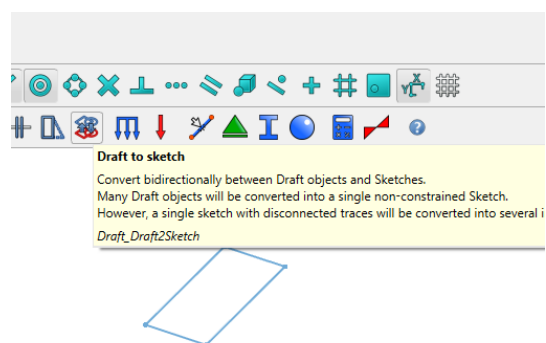
Figure 6:

— Convert sketch to wire

Figure 7:

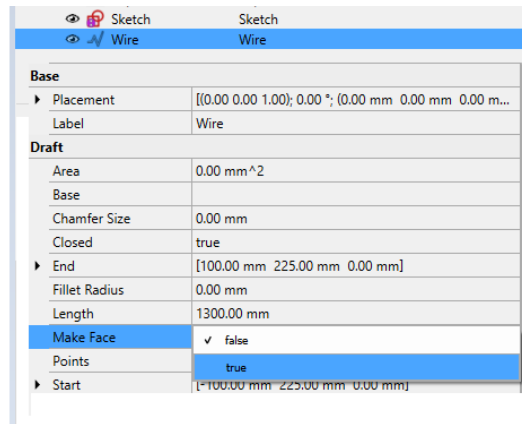— from wire created, select make face

Figure 8:

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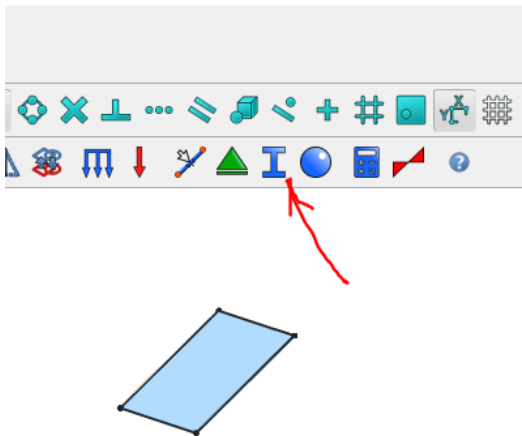

Figure 9:

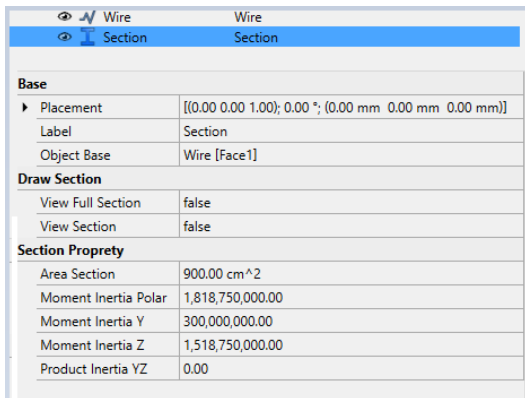– section will create with parameter for moment inertia info
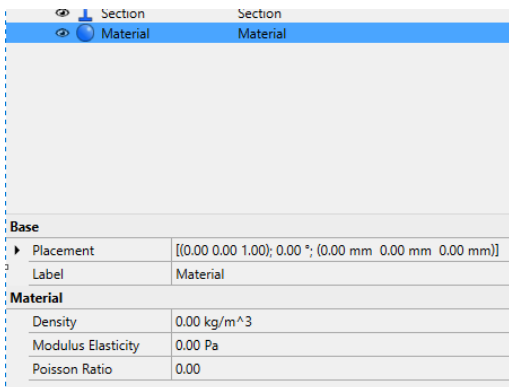
Figure 10:

* Create material

Figure 11:

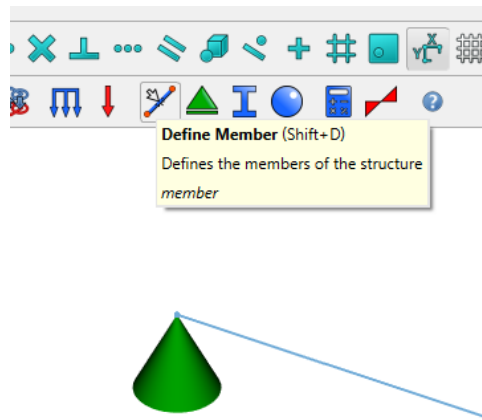* Select line & define section, material

Figure 12:

— in line tab properties will appear Structure info
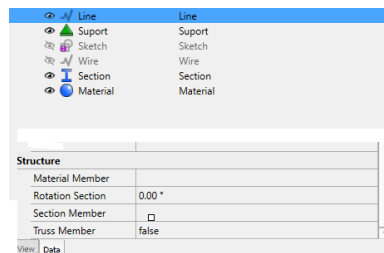

Figure 13:

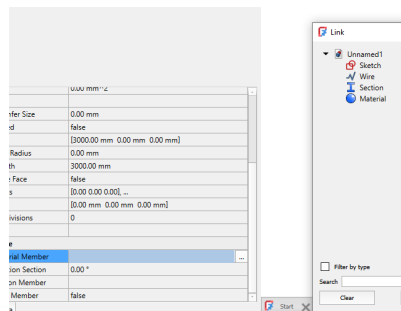— click "..." then select material, section already defined in list

Figure 14:

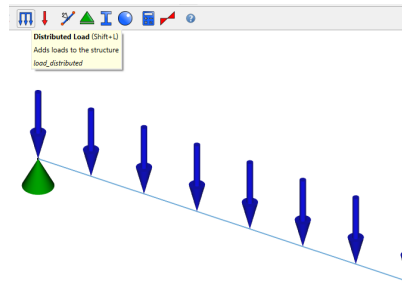∗ select line structure and apply load

Figure 15:

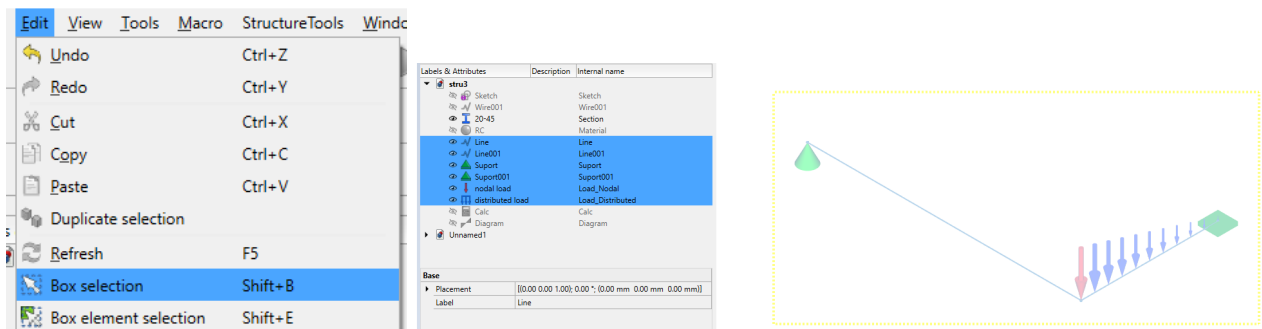∗ select whole model by box selection (important note)

Figure 16:

— click Calc button to run analysis

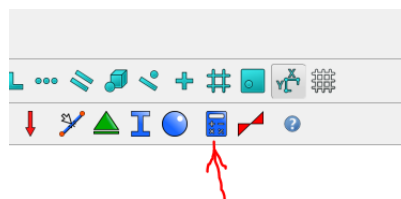Figure 17:

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

Figure 18:

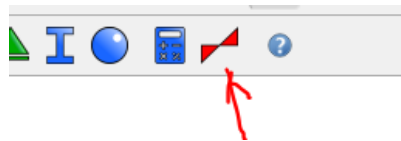∗ click diagram to see BD or SD

Figure 19:

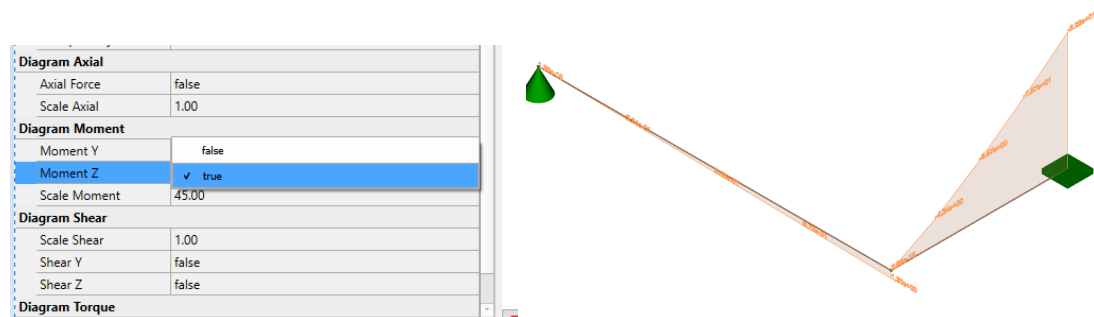— on tab properties of diagram, select "true" to show value on beam
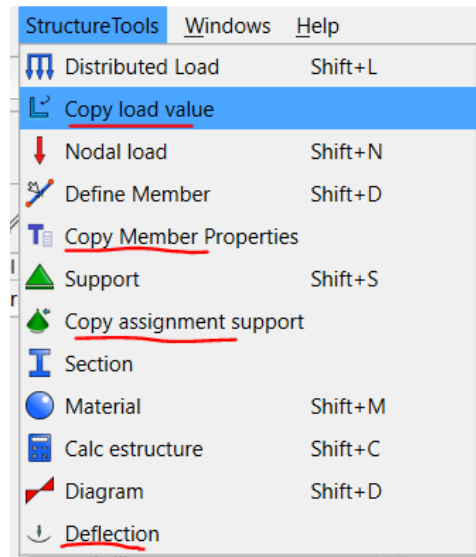

Figure 20:

3   New add-ins:

Figure 21:

– Load copy use for copy value load from selected distribute line to other ones
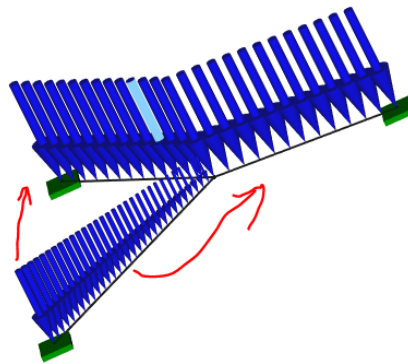
Figure 22: Before copy load

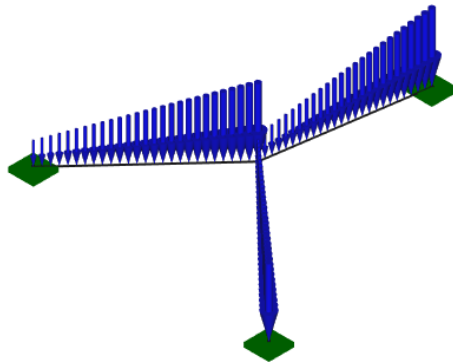select source distribution load then select other ones to overwrite value

Figure 23: After copy load

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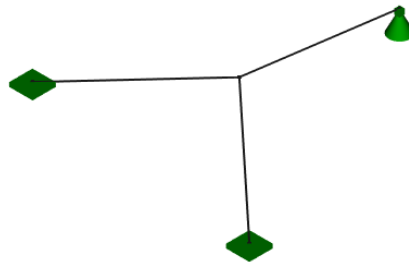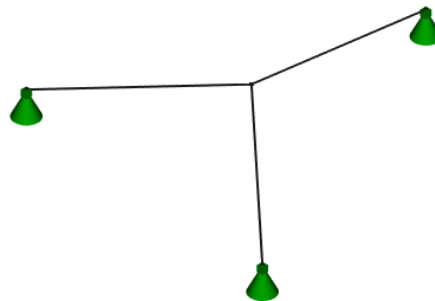

Figure 24: Before copy

Figure 25: After copy

– Deflection show deflection results: similar like diagram command, select 'Calc' then click deflection in menu → will appear 'deflection' tab then key in some parameters like font size, scale
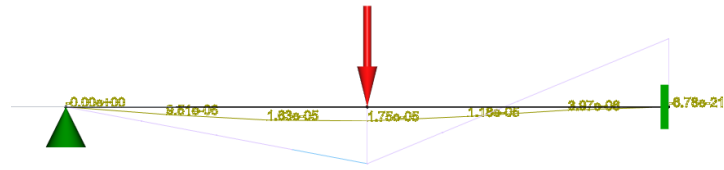
Figure 26:

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
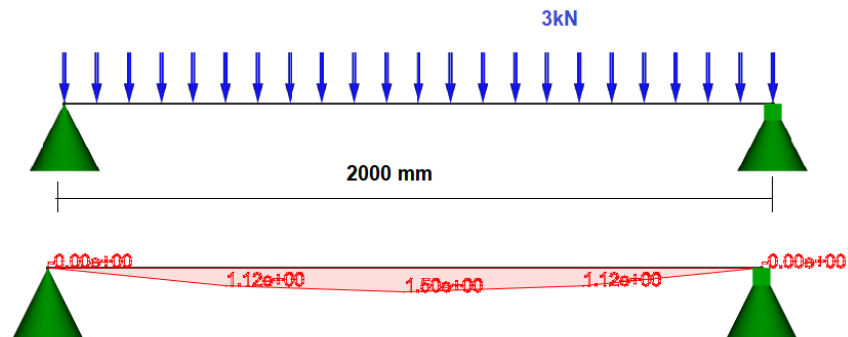

Figure 27:
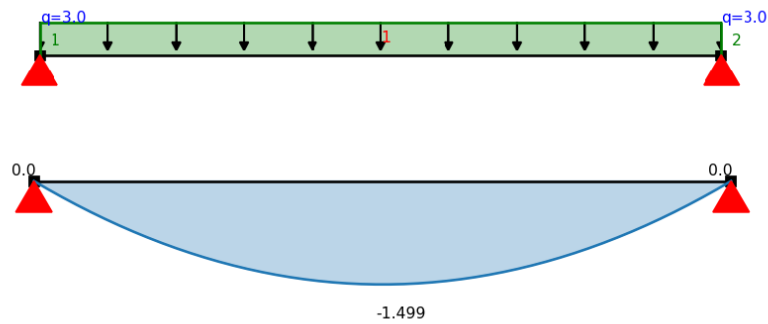
∗ Result by anatruct - Python package

Figure 28:

5.2   Example 2:

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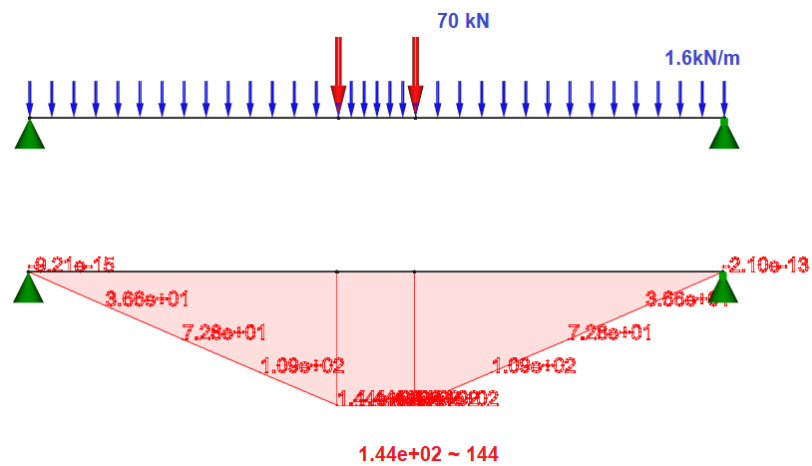

Figure 29:

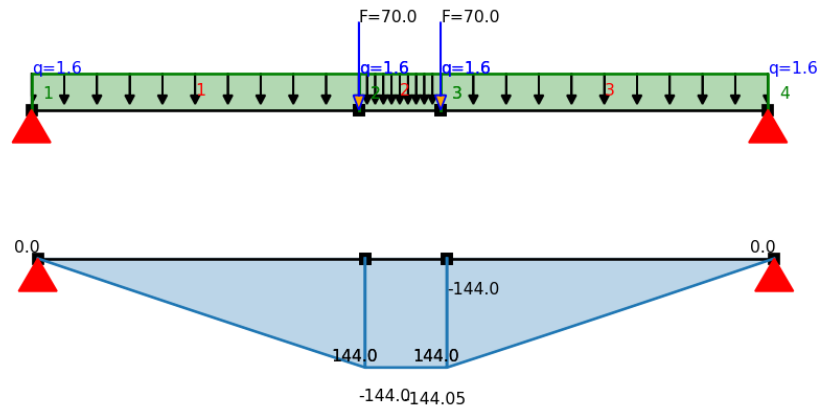∗ Result by anatruct - Python package
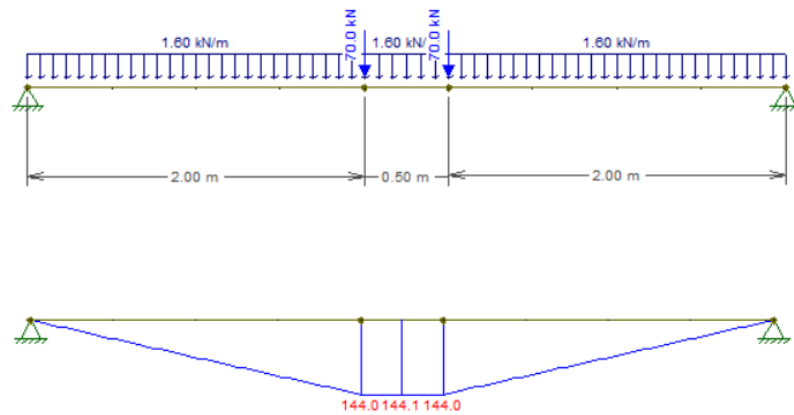
Figure 30:

* Result by Ftool

Figure 31:

5.3   Example 3:

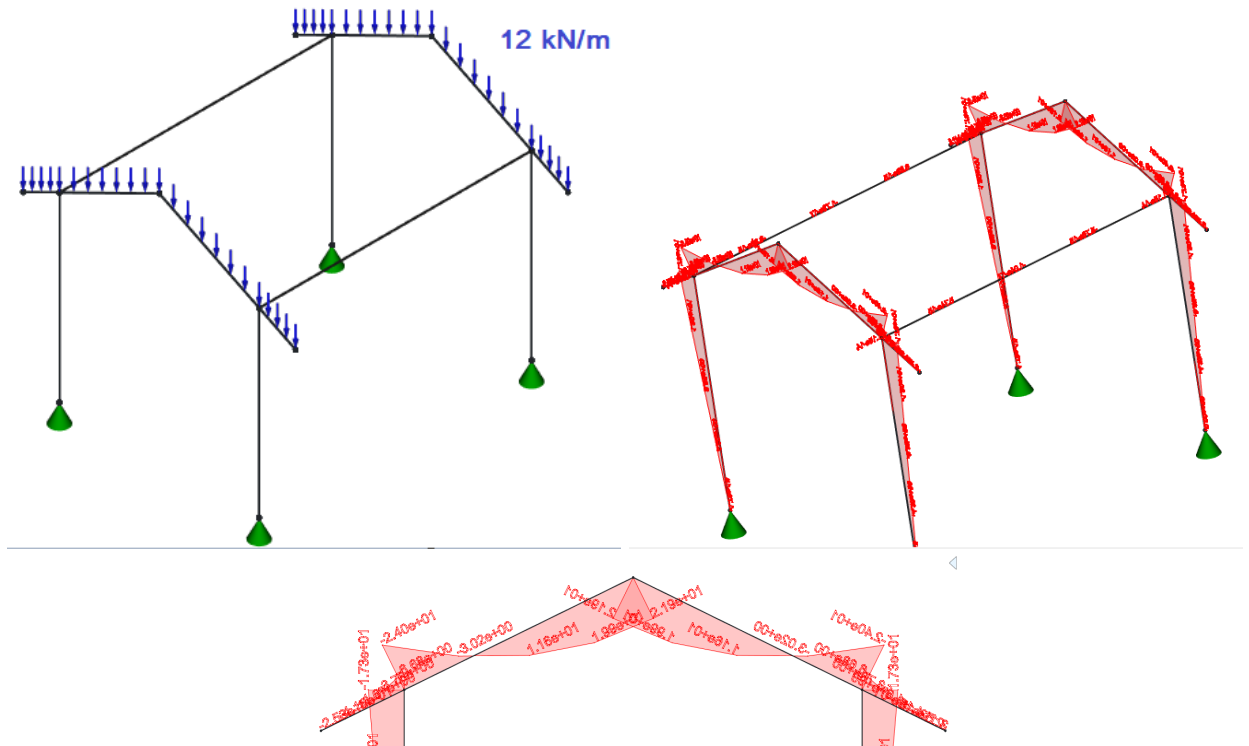* Frame structure uniform load & bending diagram

Figure 32:

* Result by Structure Tool

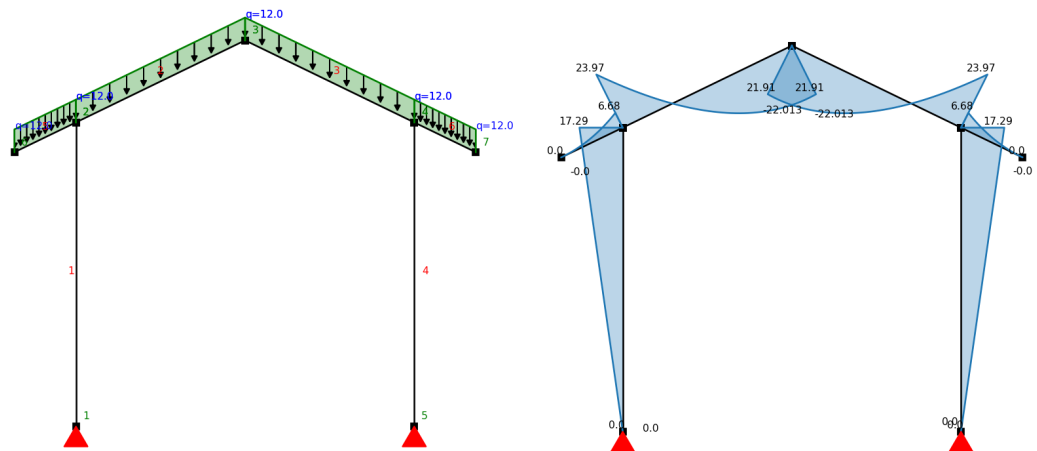* 2D Frame structure uniform load & bending diagram

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
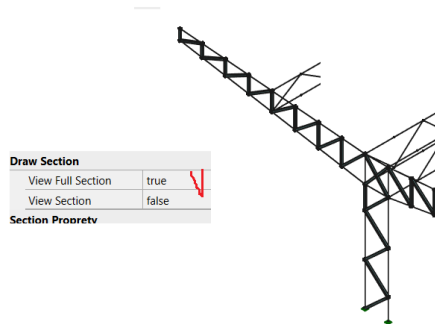+ Lines (members), supports, distribute loads, nodal load must not be turned off

Figure 35:

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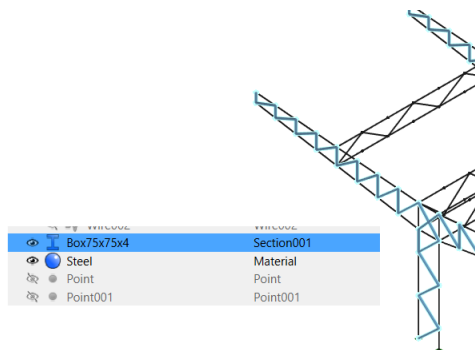

Figure 36:

Take note if delete wire that defined section so may not view members in 3D anymore
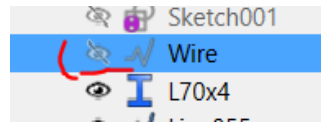
Figure 37:

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
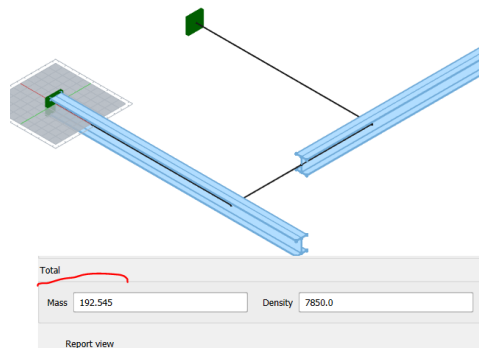then using Center of Mass macro to get weight for those selected

Figure 38:

+ 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 39:

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