

Framica

Custom Section Editor

User Guide

The custom section editor allows you to define arbitrary cross-sections for use in Framica structural analysis. Sections can be defined by polygon outline or by manually entering section properties, and are organised into named libraries that persist between sessions.

Contents

1 Opening the Editor

In the **Properties** tab, click the **Custom section editor...** button at the top of the Section panel. A floating dialog opens titled *Custom Sections*. It remains open while you continue working in Framica.

2 Step 1 — Choose or Create a Library

A **library** is a named collection of custom sections saved as a single `.wl` file on disk. All custom libraries appear alongside the built-in UK, European and American libraries in the section assignment popup in the Properties tab.

Selecting an existing library: Use the popup menu at the top of the editor.

Creating a new library: Select — *new library* — from the popup, type a name in the field that appears, then click **Create**. The library file is created immediately.

The status line below the popup confirms the library name, how many sections it contains, and the full path to the `.wl` file on disk.

3 Step 2 — Choose a Calculation Mode

Two radio buttons control how section properties are derived:

Mode	Description
Calculate from polygon	You define the cross-section outline as a polygon. Area A , second moments I_{yy} and I_{zz} are calculated automatically when you press Calc .
Enter all properties manually	You type every property value yourself. The polygon field is optional and used only for the shape preview.

4 Step 3 — Enter Section Properties

Fill in the fields in the **Section properties** panel:

Field	Units	Notes
Name	—	Any text label, e.g. 300 conc slab or 800 dia pile
E	GPa	Elastic modulus. Steel ≈ 210 GPa, concrete ≈ 30 GPa
A	mm ²	Cross-sectional area. Greyed out in polygon mode until you press Calc
I_{yy}	mm ⁴	Second moment about local y -axis. Greyed out in polygon mode
I_{zz}	mm ⁴	Second moment about local z -axis. Greyed out in polygon mode
I_t	mm ⁴	Torsional constant. Always entered manually in the first instance; computed in the background after saving when a polygon is available
Mass	kg/m ³	Material density, used for self-weight calculation

5 Step 4 — Define the Polygon

The polygon is the cross-section outline in the **local y - z plane**, specified as a list of $\{y, z\}$ coordinate pairs in **millimetres**. The polygon is used to:

- calculate A , I_{yy} , I_{zz} automatically (polygon mode);
- compute the torsional constant I_t in the background after saving;
- draw a shape preview when the section is selected in the Properties tab.

5.1 Polygon Syntax

```
(* Rectangular 300 mm wide x 500 mm deep *)
{{-150, 250}, {150, 250}, {150, -250}, {-150, -250}}

(* Hollow section: outer contour then inner contour *)
{{{ -200, 100}, {200, 100}, {200, -100}, {-200, -100}},
 {{ -150, 75}, {150, 75}, {150, -75}, {-150, -75}}}
```

The editor supports both **solid polygons** (a flat list of $\{y, z\}$ pairs) and **multi-polygon sections** (a list of polygon lists), which are useful for hollow sections or compound shapes. A live preview graphic appears below the input field as you type.

5.2 Calculating Properties from the Polygon

After entering the polygon, click **Calc A, Iyy, Izz from polygon**. The calculated values populate the greyed-out fields. You can then adjust them manually if required before saving.

The polygon coordinates define the cross-section shape in the member's local y - z plane. The local x -axis is along the member axis. Make sure the polygon is centred at the centroid if you want consistent behaviour with the standard section library.

6 Step 5 — Save the Section

Click **Save Section to Library**. The following happens:

1. The section is immediately added to the selected library in memory and written to the `.wl` file on disk.
2. The section becomes available in the Framica section popup straight away — no restart is needed.
3. A background computation starts to calculate the **torsional constant** I_t using a finite element Laplace solver on the polygon outline. This may take a few seconds to a minute depending on section complexity. When it completes, I_t is updated in the library file automatically. Until then, I_t shows as *pending* in the section list.

The status line below the button confirms the save with a green tick, or shows an error message in red.

Torsional constant pending: If you close Mathematica before the background I_t calculation finishes, the section will have $I_t = 0$. Simply re-save the section to trigger the calculation again.

7 Managing Existing Sections

The bottom panel of the editor shows all sections in the selected library.

Select a section

Click a section name to highlight it. The name turns blue and the Delete button activates.

Delete a section

With a section selected, click **Delete [section name]**. The section is removed from memory and the `.wl` file is updated immediately.

Delete an entire library

Click **Delete entire library '[name]'**. A confirmation step appears before the library is removed and its `.wl` file deleted from disk.

8 Unit Conversions

The editor accepts inputs in everyday engineering units and converts them internally before storing:

Property	You enter	Stored as	Conversion
E	GPa	MPa	$\times 1000$
A	mm^2	m^2	$\div 10^6$
I_{yy}, I_{zz}, I_t	mm^4	m^4	$\div 10^8$
Mass	kg/m^3	kg/m	$\times (A \div 10^6)$
Polygon	mm	m	$\div 1000$

You never see these conversions — simply enter values in the units shown in the field labels.

9 Notes on the E Value for Custom Sections

The E value stored with each custom section **takes precedence** over the global `$fwEMod` setting used for the standard libraries. This means:

- Changing `$fwESteel` or `$fwEMod["UK"]` does *not* affect sections in custom libraries.
- To change E for a custom section, open the editor, delete the existing entry, and re-save it with the corrected E value.

10 Multi-Polygon (Hollow) Sections

Framica detects nested polygon lists automatically and treats them as composite or hollow cross-sections. The area and second moments are computed for the combined shape.

```
(* Hollow rectangular box: 400 x 200 mm, 10 mm wall *)
{{{ -200,100},{200,100},{200,-100},{-200,-100}},
 {{ -190,90},{190,90},{190,-90},{-190,-90}}}}

(* I-section approximated by three rectangles *)
{{{ -100,200},{100,200},{100,185},{-100,185}},
 {{ -10,185},{10,185},{10,-185},{-10,-185}},
 {{ -100,-185},{100,-185},{100,-200},{-100,-200}}}}
```

For hollow sections, list the **outer contour first**, then the inner contour(s). The editor uses the sign of the enclosed area to determine which polygons are voids.

11 Workflow Summary

1. Open editor via **Properties** tab → **Custom section editor...**
2. Select an existing library, or create a new one.
3. Choose **polygon** or **manual** mode.
4. Enter **Name**, **E**, **It**, **Mass**.
5. *Polygon mode*: enter polygon coordinates and press **Calc A, Iyy, Izz from polygon**.
Manual mode: enter **A**, **Iyy**, **Izz** directly.
6. Click **Save Section to Library**.
7. Close the editor (or leave it open).
8. In the **Properties** tab, select your custom library from the **Lib** popup.
9. Select members in the viewport and click **Assign**.