QUICK START GUIDE 3: ENTERING A BEAM WITH WEB OPENINGS

This note has been prepared to guide users on how to enter a beam with openings (cellular beams) within Quantifire. Cellular beams can only be entered in full by users with the associated permissions.

1. PRODUCT SELECTION

When selecting products, ensure that at least one product is selected that has certification for cell-beams as shown in Figure 1. Only products that have been tested on cell beams to generate web-post factors and have been reassessed to generate elemental multi-temperature analysis (EMTA) thicknesses are permitted to be used to protect a beam with web-openings.

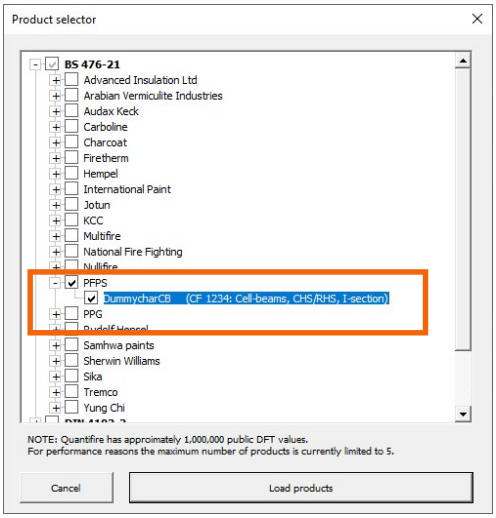

Figure 1: Select a product that has cell beam certification. Note "Cell-beams" in description.

2. ENTER CROSS-SECTION PROFILE

Click the 'Custom' button to enter a custom section

Click on the 'Cell Beam' tab in the member dimensions area

The beam's cross-section must be entered as either a series of plates or from top and bottom tee serial sections. Figure 2 shows an example using plate dimensions.

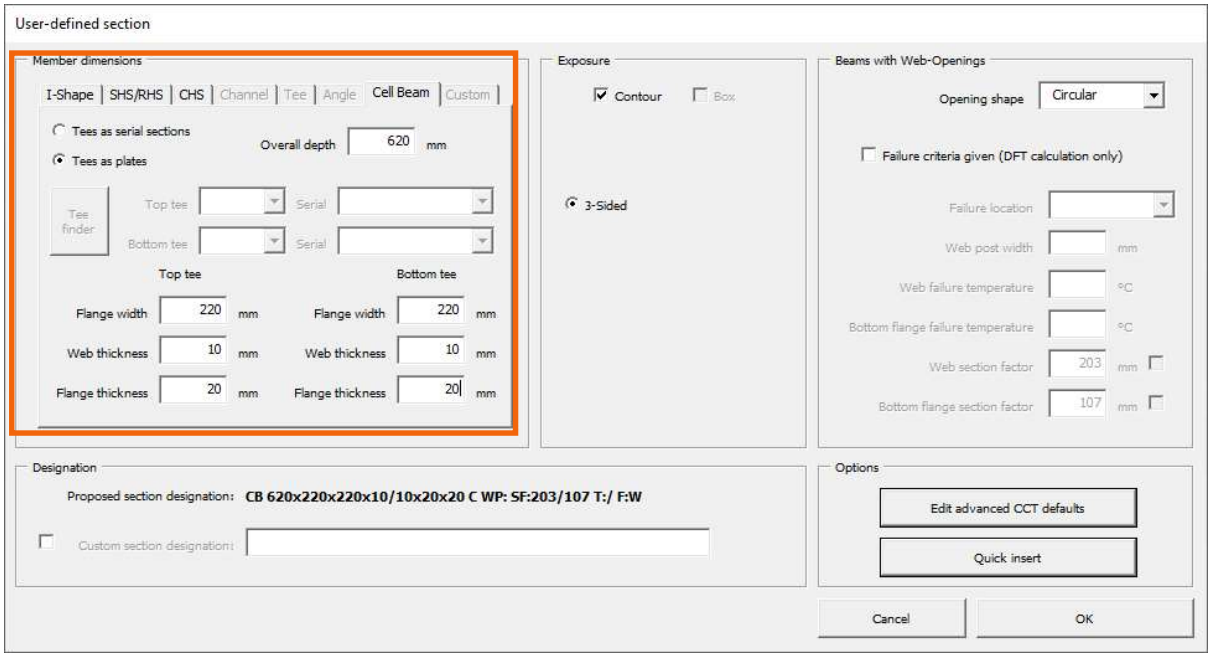

Figure 2: Cell-beam tab on the custom section userform. In the above example, a beam made from plates is shown as per the dimensions in the input boxes.

Some beam designations are provided in the following format:

Depth x Top flange width / Bottom flange width x Linear weight

In this case, the 'Tee finder' button can be clicked and the section designation entered. By then clicking on 'Find top and bottom tee', the Quantifire will determine the possible combination on top and bottom tee based on serial sections, as shown in Figure 3. The user can then choose which design to adopt.

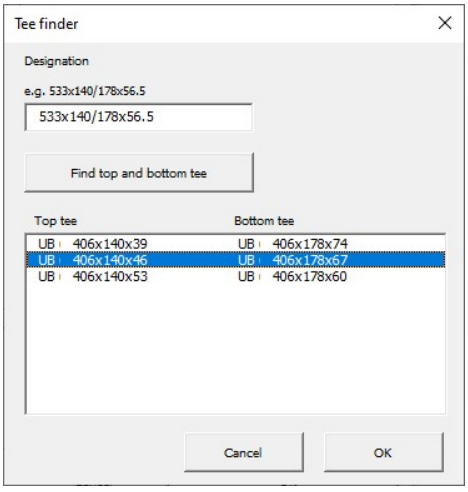

Figure 3: Tee finder tool

After using the tee finder tool and clicking 'OK', the serial sections and the overall depth of the beam are populated on the cell beam dimensions form, as shown in Figure 4.

Alternatively, the serial sections could be entered manually from the dropdown input boxes.

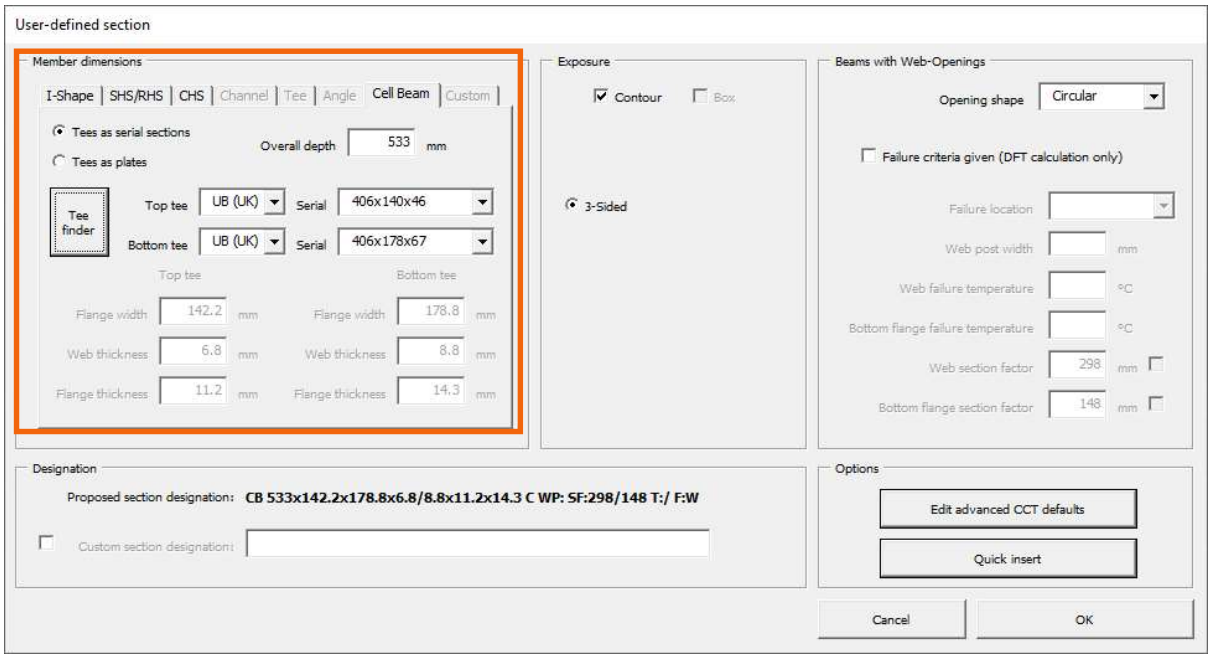

Figure 4: Example of a beam cross-section input in terms of serial sections

3. FAILURE CRITERIA PROVIDED BY A CLIENT

If the failure temperatures of the cellular beam are provided by a client, then they can be entered directly into the custom member userform, as shown in Figure 5. Click on the tick box 'Failure criteria given' and enter the relevant data.

Note that if a single temperature is provided, enter it for both the web and the bottom flange.

Note that the web and bottom flange section factors calculated and shown in the form. These can be overwritten by checking the tick box alongside the relevant value.

The opening shape should be the shape associated with the failure of the beam, e.g. opening shape if failure is at an opening or opening shape either side of a web-post failure. A rectangular shape will typically be conservative if the shape is unknown, although circular shapes are most-common in design.

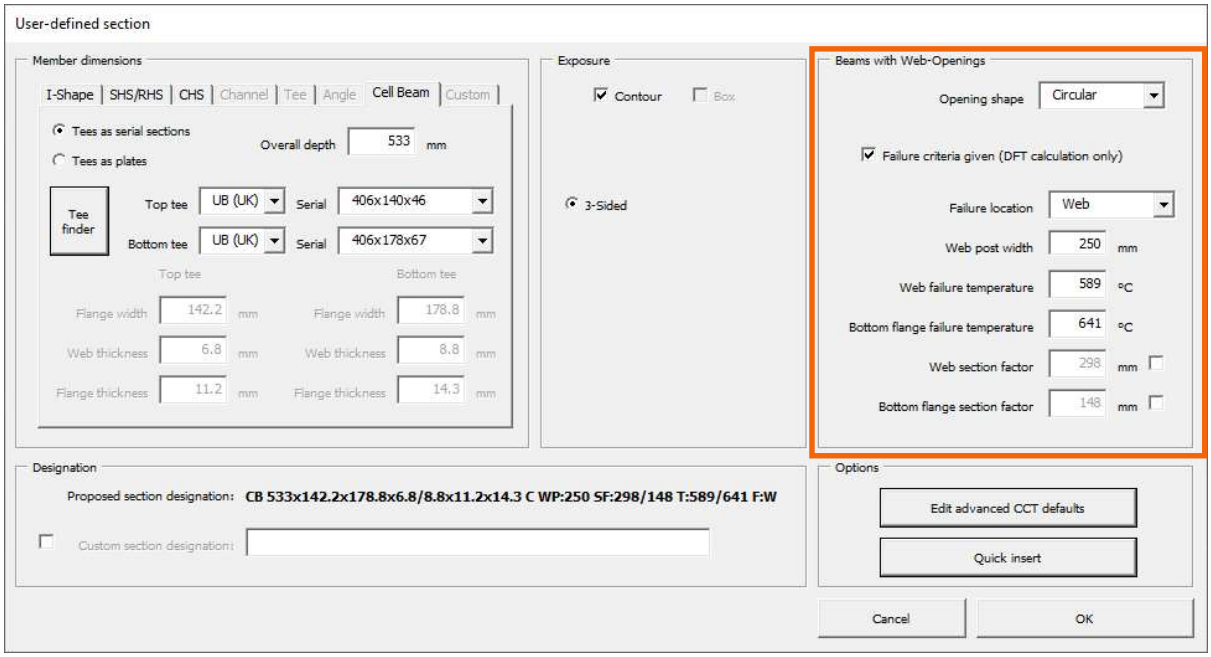

Figure 5: Entering failure criteria when they are provided directly by a client

4. IF NO FAILURE CRITERIA ARE PROVIDED

In many cases, no failure criteria are provided. In this case, the only required parameter is the opening shape, as shown in Figure 6.

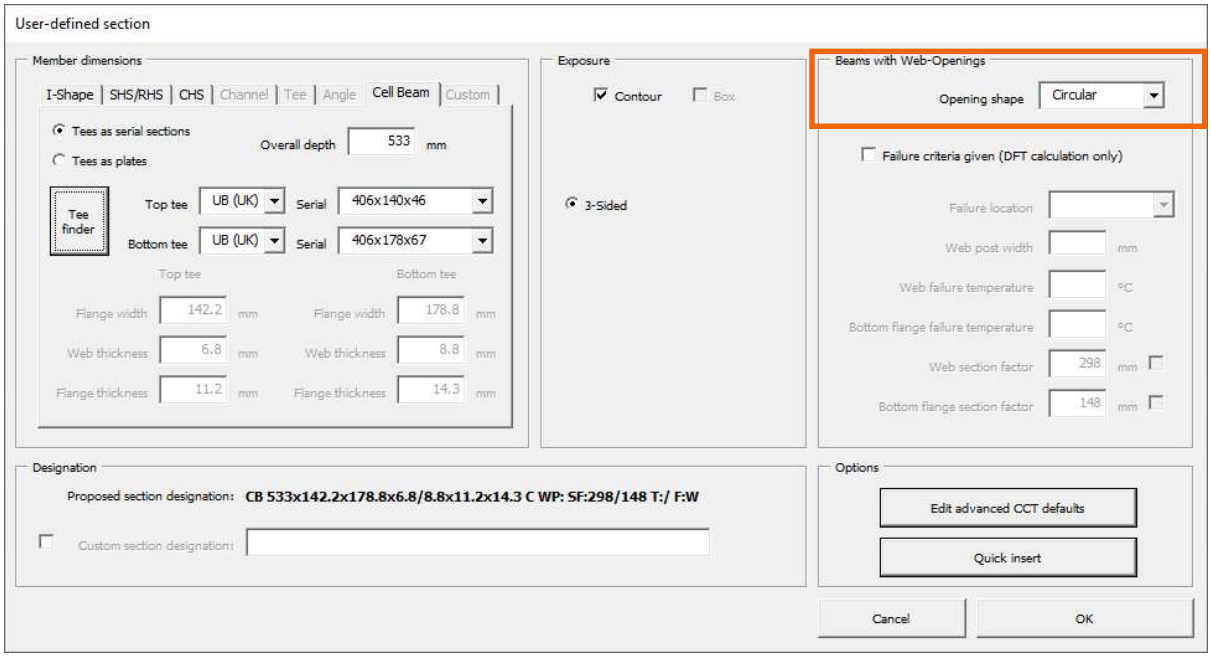

Figure 6: When no failure criteria are provided by a client

5. BEAM INFORMATION IN THE MTO BUILDER

After clicking 'OK' on the custom form, the beam information is held just below the 'Custom' button, starting with 'Working with:…'. If happy with beam designation and fire resistance period, then click 'Insert section' to add it to the MTO list, see Figure 7.

Note that temperature options 'Default', 'Advanced' and 'User set' are not compatible with cellular beams. Failure temperatures must be specified directly, or the advanced calculator used.

If no failure temperature criteria are provided, then Quantifire will automatically use the its limiting temperature calculator to determine the failure temperature.

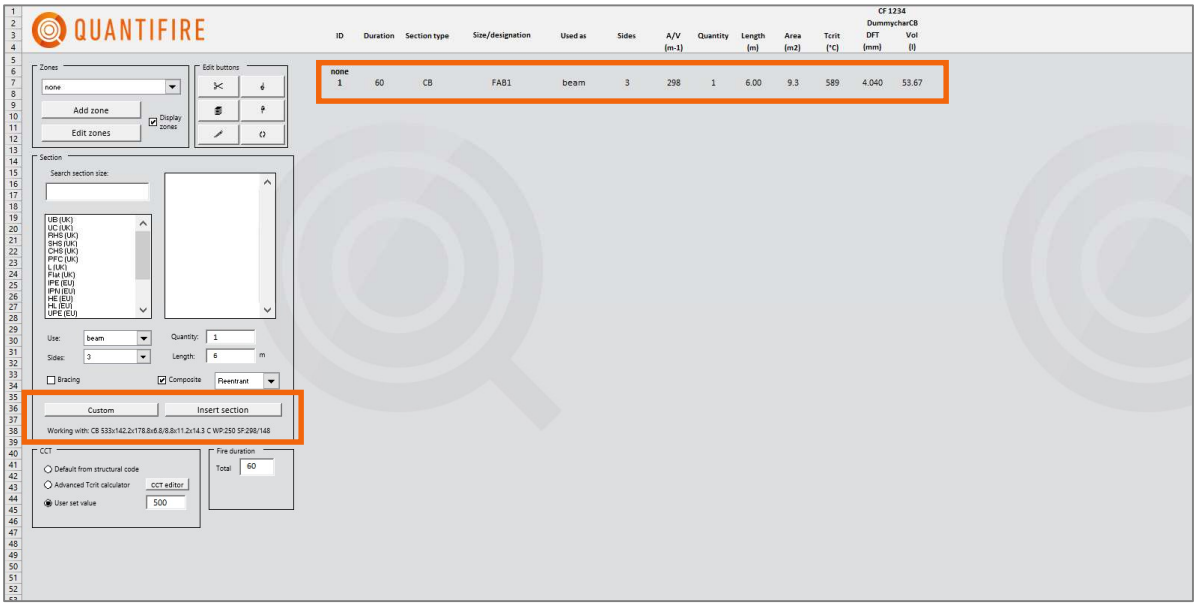

Figure 7: Entering a cell beam into the MTO builder

6. HOW IS THE LIMITING TEMPERATURE BEING CALCULATED BY QUANTIFIRE?

A default span of 6m is adopted by Quantifire. This can be changed by the user, however it adopts this value to negate issues related to cumulative length (e.g. 2673 m of beam) being entered and assumed as the span of a single beam.

If no opening geometry is defined, then Quantifire will put as many openings as possible into the web of the beam as permitted in accordance with the user preferences, see Figure 8 (click on the Quantifire logo and then 'Edit default CCT settings'. All preferences can be changed by the user but are initially set as conservative defaults.

By default, the web-post width is set to 130mm as this correlates with the typical minimum required in fire testing.

The beam is then subject to loading as defined in Default CCT preferences, which by default is a conservative level of 65% at the accidental limit state of fire. This value is defined in EN 1993-1-2 to be used in the absence of actual loading being known. It can be very conservative.

Other default settings for cell beams are taken from those defined under the 'Partial Safety Factors & Loading' tab and the 'Beam' tab.

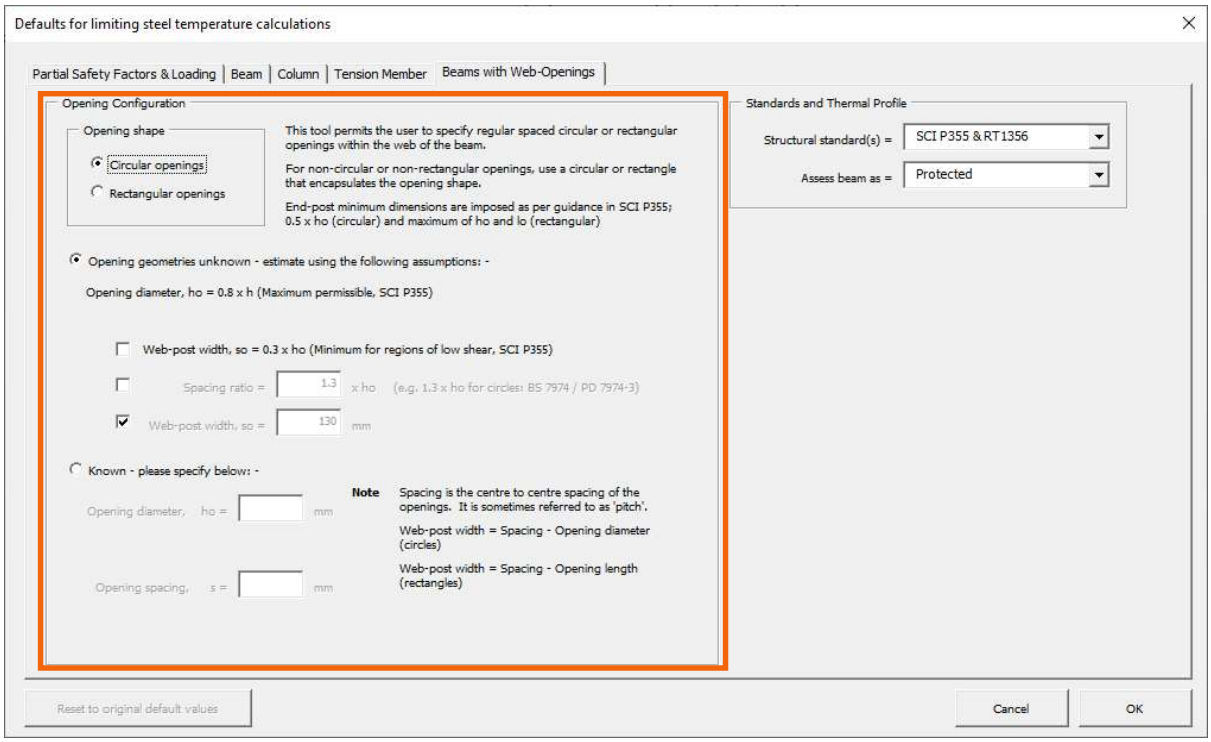

Figure 8: User preferences for limiting temperature assessments for beams with web-openings

7. SEEING MORE DETAIL ASSOCIATED WITH THE BEAM

To see the detail related to the beam, click on 'CCT Editor' and enter the relevant section ID of the beam into the input box, see Figure 9.

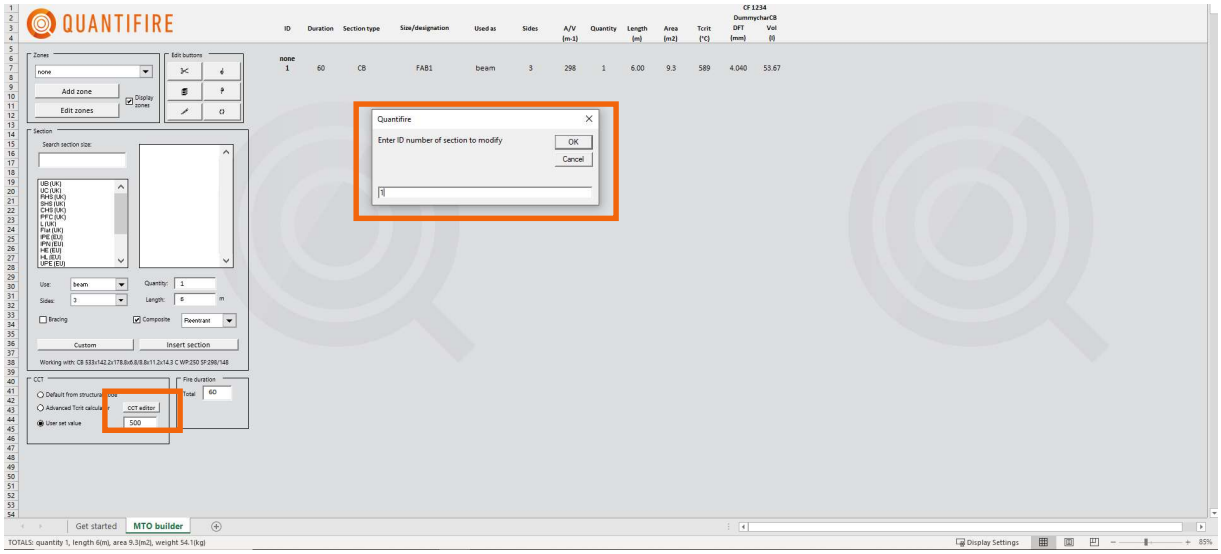

Figure 9: Viewing more detail associated with the cell beam via the CCT Editor button

After clicking on ‘OK’ the relevant information for the cell beam is populated onto the cell beam calculator sheet, as shown in Figure 10.

All the white boxes can be modified by the user as required. If modified, their value will be retained by Quantifire on a section by section basis.

A visual representation of the beam and its openings is provided. In Figure 10, it is shown that the default 130 mm web-post has been captured. The user may modify the opening geometries accordingly, for example if opening information has been provided.

If openings are irregular along the length of the beam then each opening must be entered manually.

If openings are regular, then the ‘Generate regularly spaced openings’ button can be used to automate opening definitions.

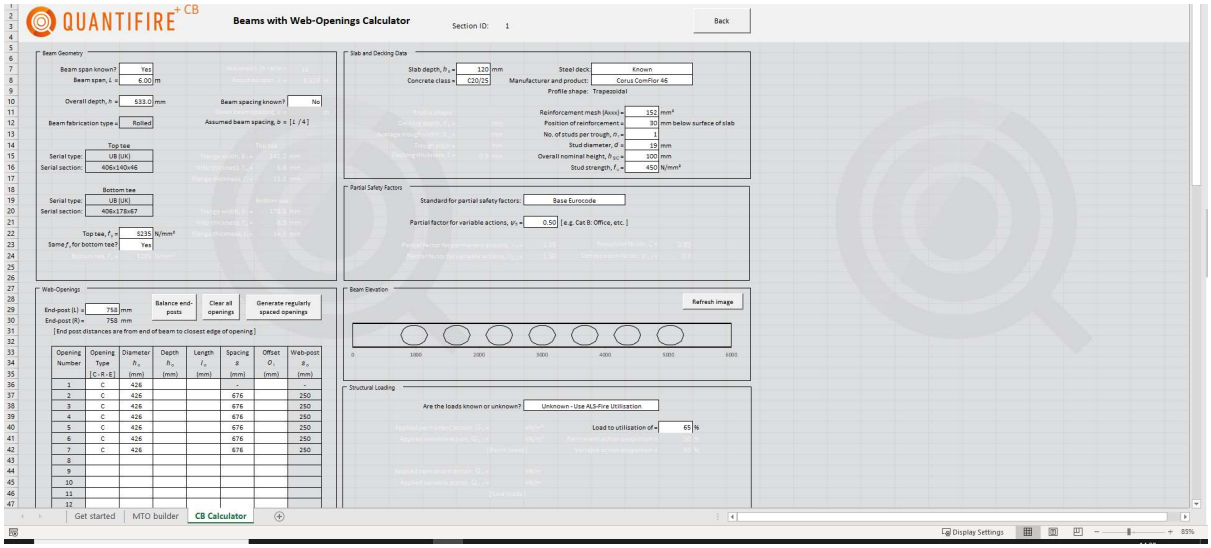

Figure 10: Detail associated with the cell beam

Scroll down to see the output results (including limiting temperature) associated with beam, see Figure 11.

Click on ‘Assess beam’ to find its limiting temperature

Click on ‘Generate report’ to produce an output report of calculations that can be printed

Click on ‘Accept beam and return’ to enter the beam and its DFT and failure criteria back into the MTO list.

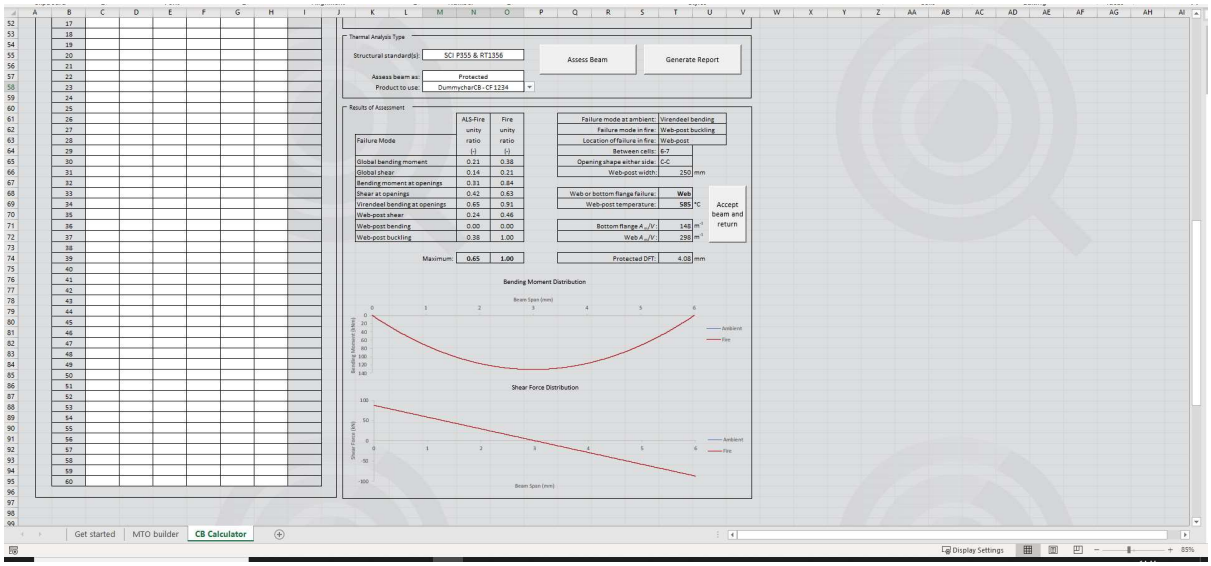

Figure 11: Finding a failure temperature, and understanding the output results

Questions? Please refer to the User Guide, or contact us at PFP Specialists.