Creating a Haunch in Analysis by Structural Toolkit
Rev 1, Updated 2 August 2021

Structural Toolkit Analysis allows you to input a haunch in a portal frame.

The general procedure is to:
- Input the frame geometry
- Split the rafter member into the desired haunch segments
- Create the combined haunch section (from an existing rafter section and full haunch section)
- Add result points (face of column, underside of rafter, mid-segment etc.)

Input the frame geometry

The first step is to input the geometry of your frame and assign the column and rafter sections. For information on how to do this you can watch the "Brace Frame" video in the Analysis by Structural Toolkit section of the Learning page on the website.

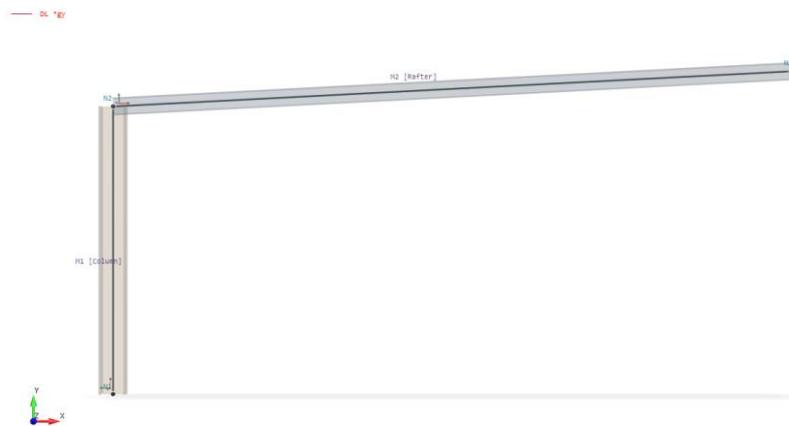In this example we are using a 360UB45 rafter and 530UB82 Column.

Figure 1 – Typical Portal knee, prior to haunch being inserted

Splitting the rafter member for haunch segments

You will need to split the rafter to allow the haunch to be inserted. To do this correctly, you should split the rafter at a distance of the length of the haunch plus half of the depth of the column as the node is at the centerline of the member. To split the member, select member, Right Click>Member Selection>Split. For a 5m haunch connected to a 530UB column, you will need to split the beam at 5m + (530/2) = 5.265m

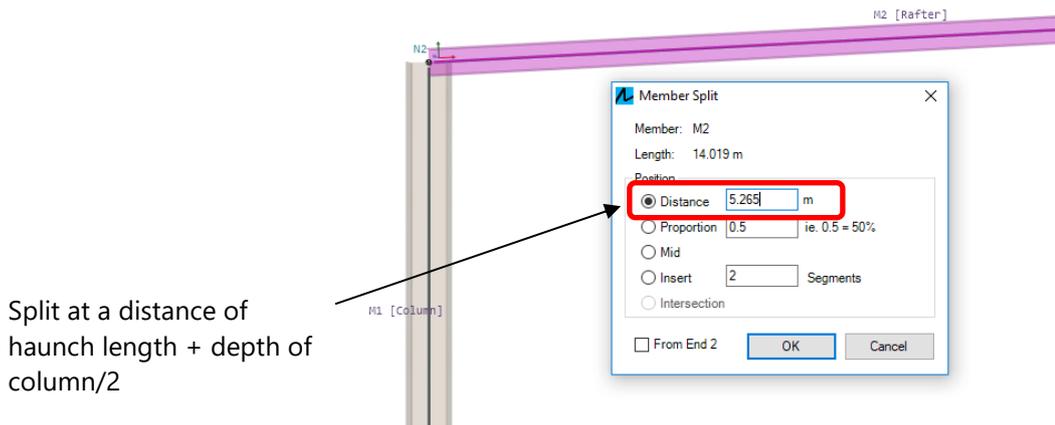Split at a distance of haunch length + depth of column/2

Figure 2 – Splitting the rafter at the end of the haunch

Structural toolkit does not allow for a uniformly reducing haunch, therefore to model it you will need to put several different sections of reducing haunch sizes. In this example we will be using 2 sections, however you may want to add more. Providing 2 segments generally models the haunch reasonable accurately.
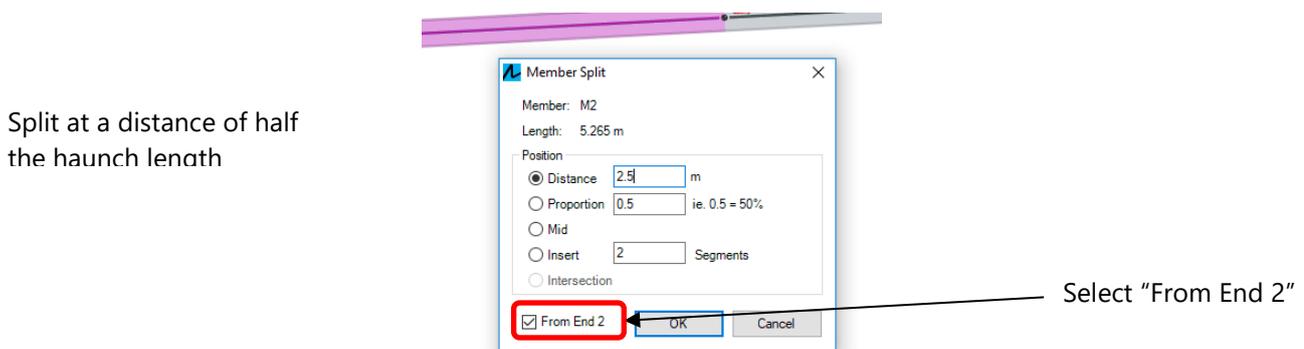
Split at a distance of half the haunch length

Select "From End 2"

Figure 3 – Slitting haunch from End 2

It may be easier to split the member "From End 2" as you will not need to consider the depth of the column. For 5m haunch simply split at 2.5m from end 2.

Adding result points

You may want to add a result point at the face of the column to allow you to easily see the results including bending moments and shear and axial forces at this point. Other useful result point locations are at the underside of the rafter/haunch on the column, and at mid-length of the haunch

To do this select the member (rafter) adjacent to the column, right click Member Selection>Result Points>Edit
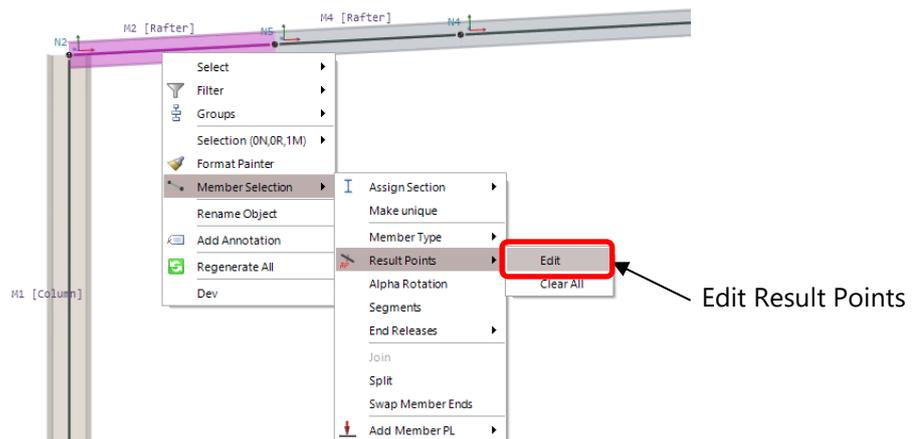
Figure 4 – Add/Editing a Result Points
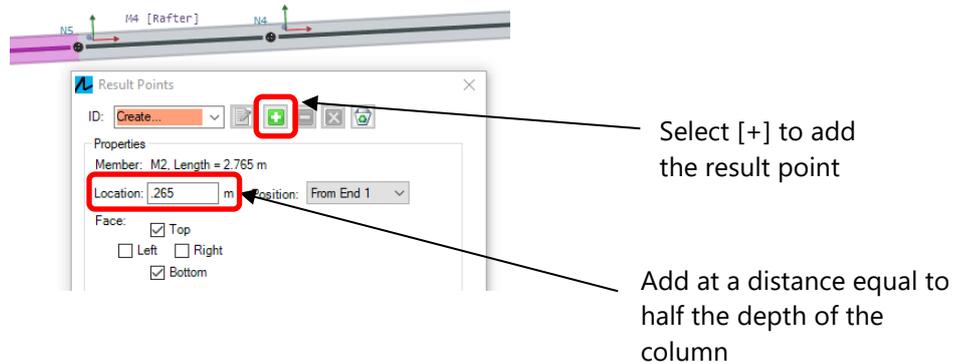
Figure 5 – Inserting a Result Point

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Creating the Haunch Sections

A haunch is a combined section comrising two sub sections which must be already defined.

These are:
- The "Rafter", which carries through past the end of the haunch and continues to the ridge.
- The "Haunch", which is the section that is used by splitting and cutting to create the combined haunch section

The rafter and column should already be defined (as we have input the frame without the haunch sections already previously), however, if you have not input the frame yet, you will need to create the rafter section first.

In this example we have already input the 360UB45 rafter and 530UB82 Column.

The haunch will be a 360UB45 rafter and a 360UB57 tapered haunch

After the rafter section is created, create the full (uncut) haunch section which will be the section you plan to use to make the combined haunch sections out of. In this example we will use a 360UB57.

Because we previously input the frame and provided 2 haunch sections, we will create the first section of the haunch which will be between the column and 50% of the haunch, and nominate this section "Haunch_75" (or representative of 75% of the total full haunch section size).

Once the section has been created change the input from Library to Haunch, then click the pencil writing on paper icon to the right of this box.
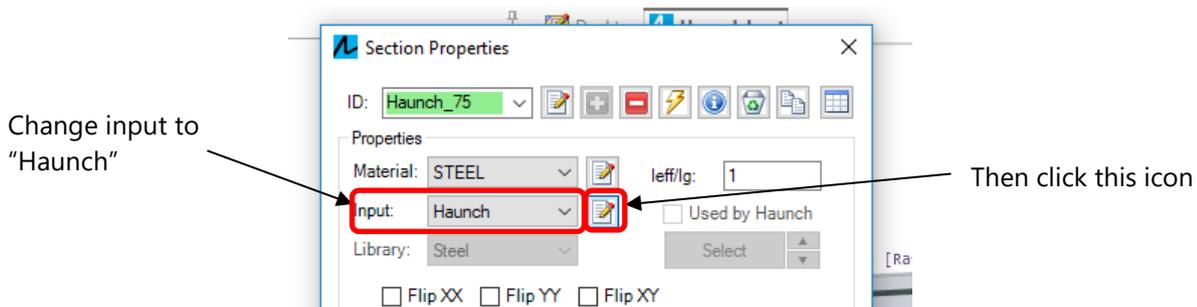
Change input to
"Haunch"

Then click this icon

Figure 5 – Selecting Haunch Input Type

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In the next dialog box, nominate the Rafter and Haunch which will be used to make up the section. Then nominate the distance from the beginning of the haunch that the section will be modelled on. This is generally at the midpoint of the selected portion of the haunch segment.

For the first haunch section (closest to the column) we nominate 25% from the start (25% of the distance from the full section to the haunch end) which will be 75% of the full size of the haunch. The second section will be 75% from the start.
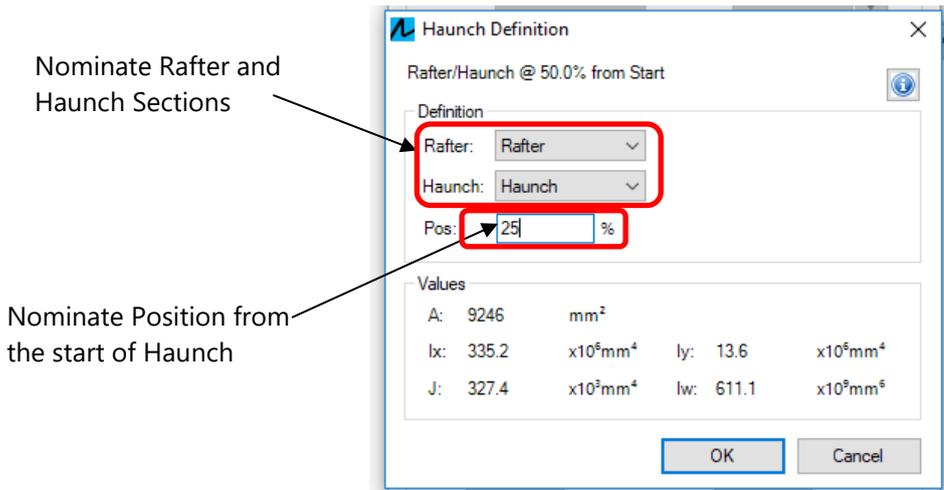

Figure 6 – Nominating Rafter and Haunch and Position of Section

Assigning the haunch sections

The last step is to assign the haunch sections to the model. You will see the varying sizes of the haunch sections to demonstrate the reduction in size of the haunch. Then you can input your loads and restraints and analyze your model.
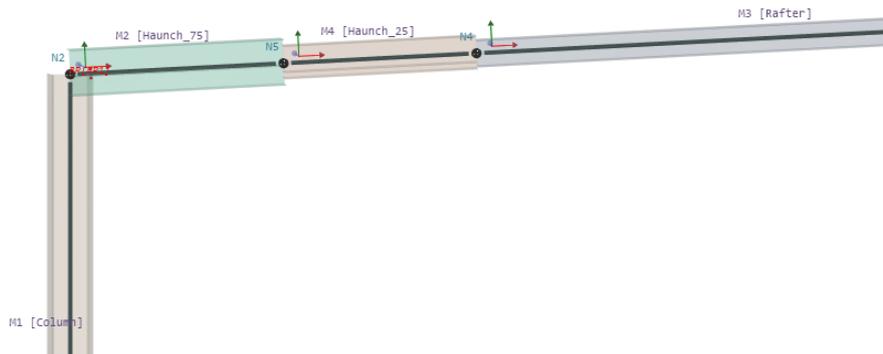

Figure 7 – Typical Portal Knee with Haunch sections

Designing the haunch

After completion of the frame input including the loads and loadcases, the analysis will provide the information required to design the haunch using [Taper Haunch].
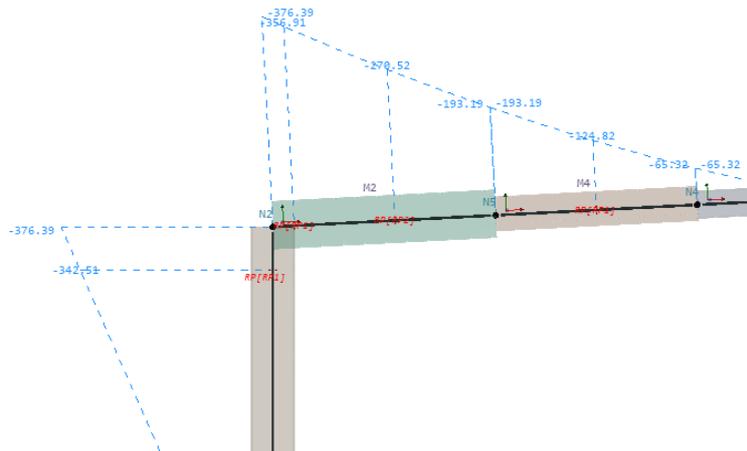

Figure 8 – Results at haunch segments using result points

Match the rafter and haunch section, then transfer the results as shown. Input the flybrace and segment information, then press the [Design…] button to the side

Member:	(Taper Haunch TH01) 360UB44.7 (G300) with 360UB56.7 (G300) tapered haunch (D = 671mm), 5000mm long

Haunch Satisfactory

Haunch Length = 5000 mm from column face   Maximum = 0.62

Design Actions

		Offset from Column face	
Full Section (M.max*) =	356 kNm	0 mm	
3/4 Section (M.¾*) =	270 kNm	1250 mm	Axial Comp. = 50 kN
1/2 Section (M.½*) =	193 kNm	2500 mm	
1/4 Section (M.¼*) =	125 kNm	3750 mm	
Rafter Section (M.rafter*) =	65 kNm	5000 mm at end of haunch	

Flybrace Locations (from column face)

	Offset mm	Segment	Offset mm	M* kNm	øMsx kNm	M*/øMsx	
Full Section	0	0	0	356.0	590.6	0.60	Segment 1
Flybrace 1	1000	0	1000	287.2	509.6	0.56	Segment 2
Flybrace 2	4500	3	750	89.0	301.2	0.30	Segment 3
Flybrace 3	None	-1	-1	0.0	0.0	0.00	Segment 4
Flybrace 4	None	-1	-1	0.0	0.0	0.00	Segment 5
Rafter Section	5000	3	1250	65.0	221.8	0.29	

Figure 9 – Designing the haunch using the [Taper Haunch] design