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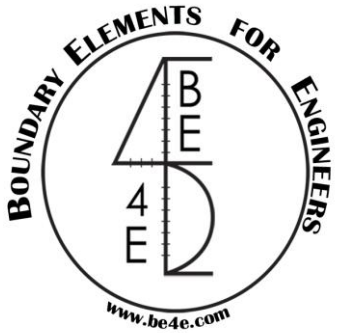

Lecture (8)

PLPAK – Design Packages

2019

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Intended learning outcomes

By the end of this lecture the attendee will learn how to:

1. **Design full or a part of practical slabs using PLDesign.**
2. **Design beams using PLDesign.**
3. **Check deflections of slab using PLDesign.**
4. **Check punching using PLDesign.**
5. **Export excel calculation sheets using PLDesign.**
6. **Design post-tensioned slab using PTPAK.**
7. **Learn PTPAK modelling and design capabilities.**

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1. Introduction
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1. Introduction: What is the PLDesign and PTPAK?

- PLDesign (Plate design package) is a structural design tool package for plate bending structures based on the boundary element method for shear deformable plate bending theory, using different codes like (ACI, EC, and ECP).
- The PLDesign is a added to the PLPAK-Basic package to design reinforced concrete building slabs and foundations.
- The PLDesign is not only consider about design, but also about detailing and calculation sheet forming.
- In the PLDesign the user can check the reinforcement of section under any stresses (Bending, Shear and Torsion).
- In the PLDesign the user can check deflection and punching of slabs.
- In the PLDesign the calculation is not only for load combination, but also for envelopes.

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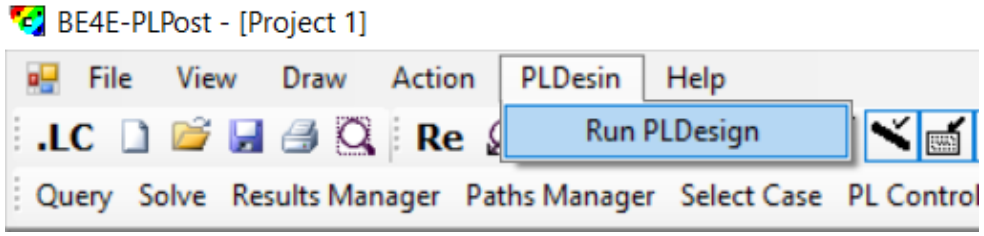
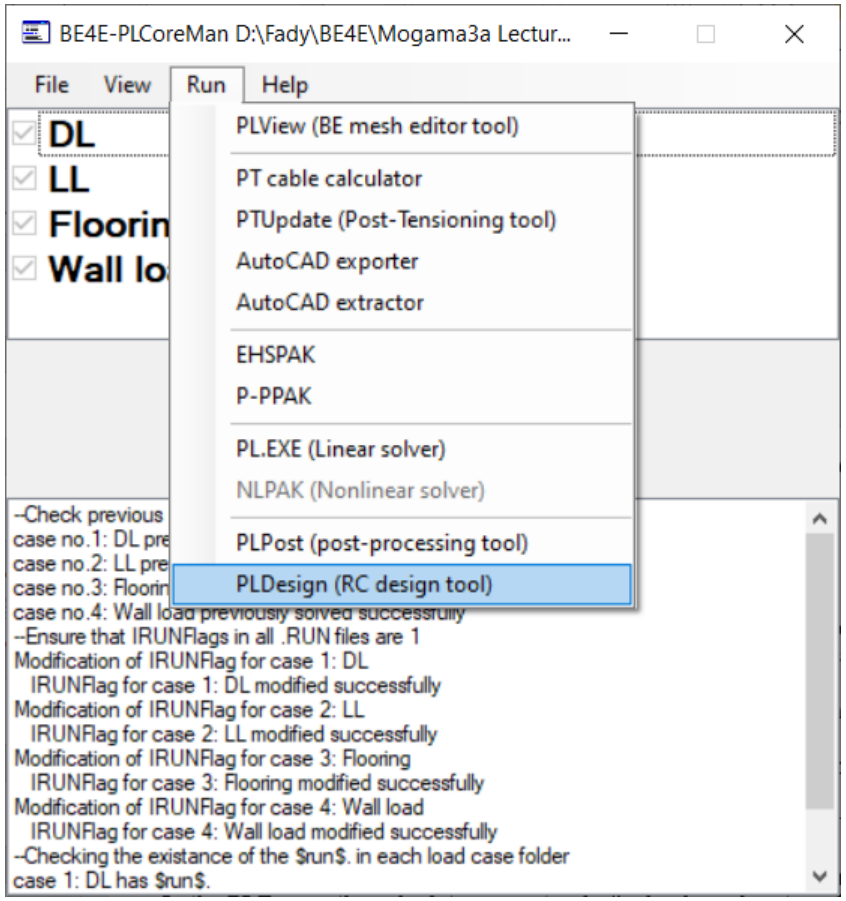
1. Introduction: What is the PLDesign and PTPAK?

- The user can go to PLDesign by two ways either by using PLPost or PLCoreMan as follows:



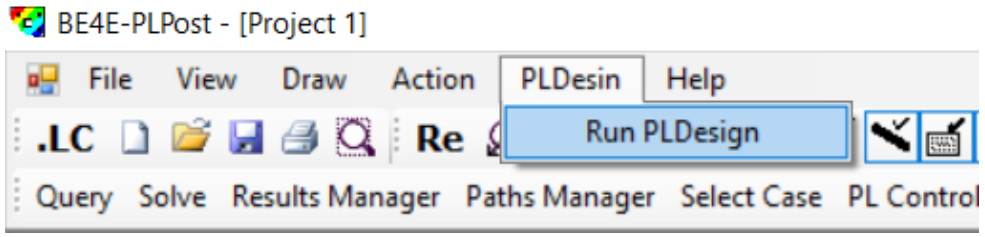


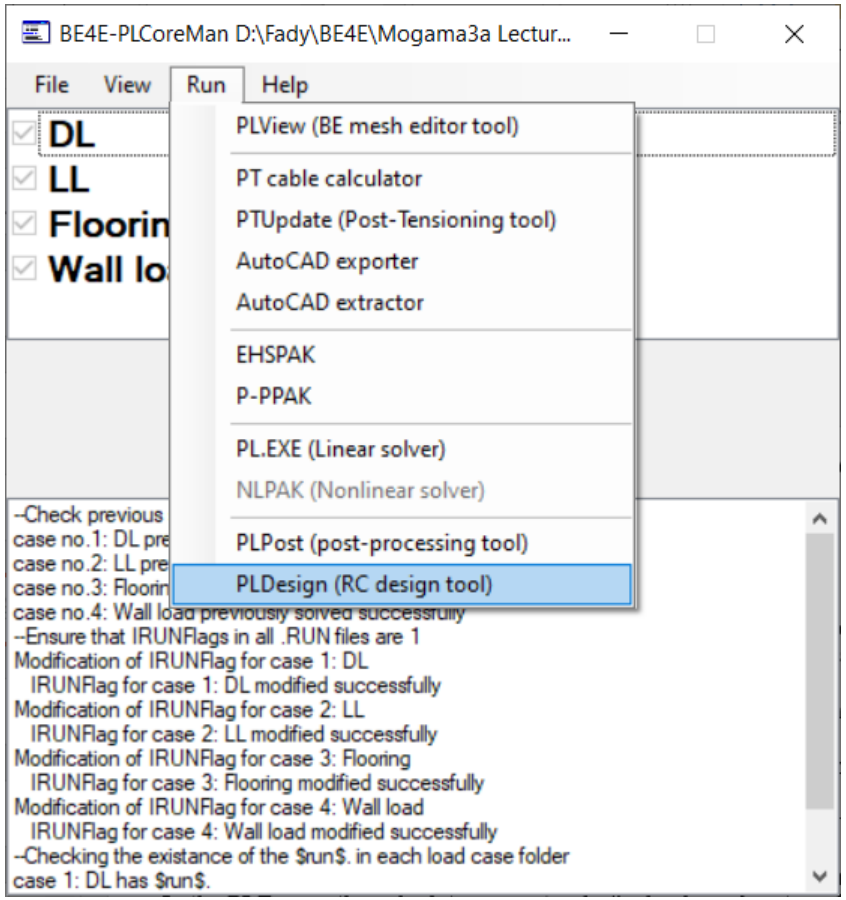
1. Introduction: What is the PLDesign and PTPAK?

- PTPAK (Post tension package) is a structural design tool package for post-tensioned plate bending structures based on the boundary element method for shear deformable plate bending theory, using different codes like (ACI, EC, and ECP).
- The PTPAK is a added to the PLPAK-Basic package to design reinforced concrete building slabs and foundations.
- The PTPAK is not only consider about design, but also about detailing and calculation sheet forming.
- In PTPAK the user can change the cable profile (13 templates) to serve the different structure conditions.
- In PTPAK the user can draw reinforcement on slab and determine the reinforcement at beams (without post tension).
- In the PTPAK the calculation is not only for load combination, but also for envelopes.

1. Introduction: What is the PLDesign and PTPAK?

- The user can go to PTPAK by two ways either by using PLPost or PLCoreMan as follows:





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2. PLDesign Package

2.1. File needed to be exported before using PLDesign

2.2. Starting PLDesign

2.3. Load combinations & load envelopes

2.4. Slab design

2.4.1. Design from PLPost results (strip design)

2.4.2. Design from PLPost results (contour design)

2.4.3. Design from PLDesign directly (strip based region)

2.4.4 Design from PLDesign directly (basic and additional reinforcement)

2.5 Check deflections of slab

2.6 Check punching

2.7 Beam design

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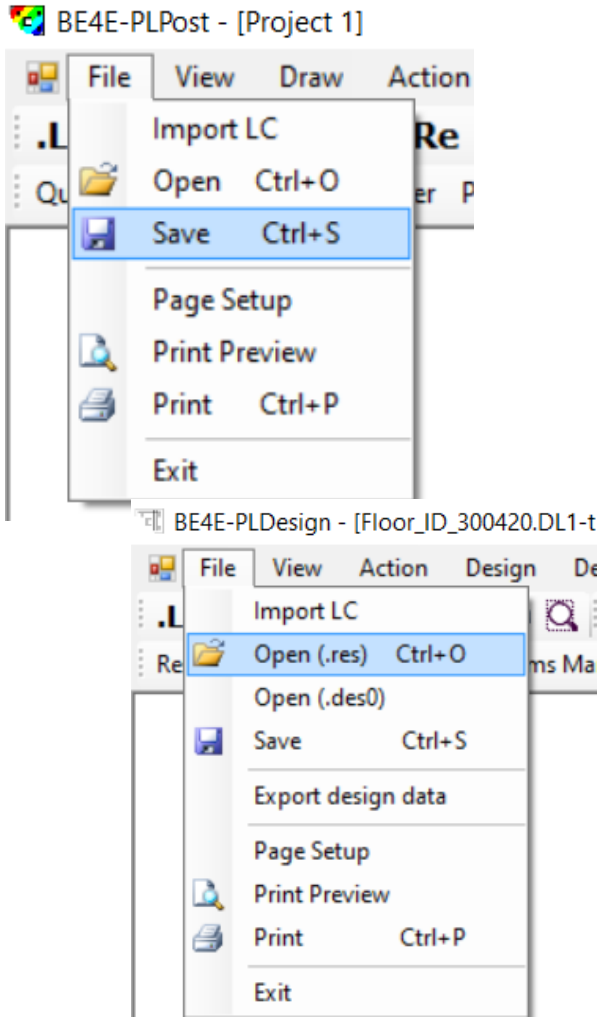
2.1. File needed to be exported before using PLDesign

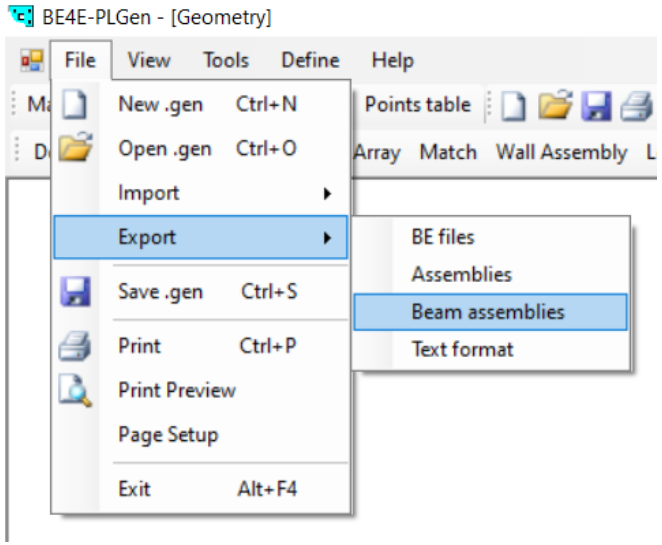
There are cases that user have to export file from PLGen and PLPost before using PLDesign:

- Export beam assemblies: this case is used to design the beams.
- Save the PLPost results: this case is used to design the slab.
- Export assemblies file: this case is used to check punching of the columns.

The previous cases can be restored in the PLDesign as follows:

- Import beam assemblies: this case is used to design the beams (will be demonstrated in beam design section).
- Open the PLPost results: this case is used to design the slab.
- Import assemblies file: this case is used to check punching of the columns.





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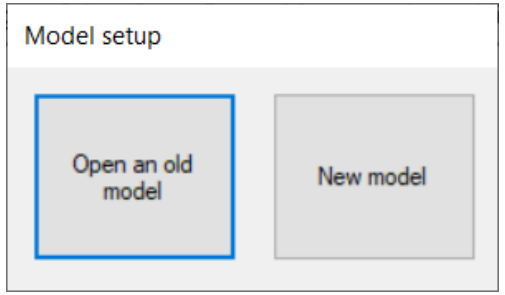
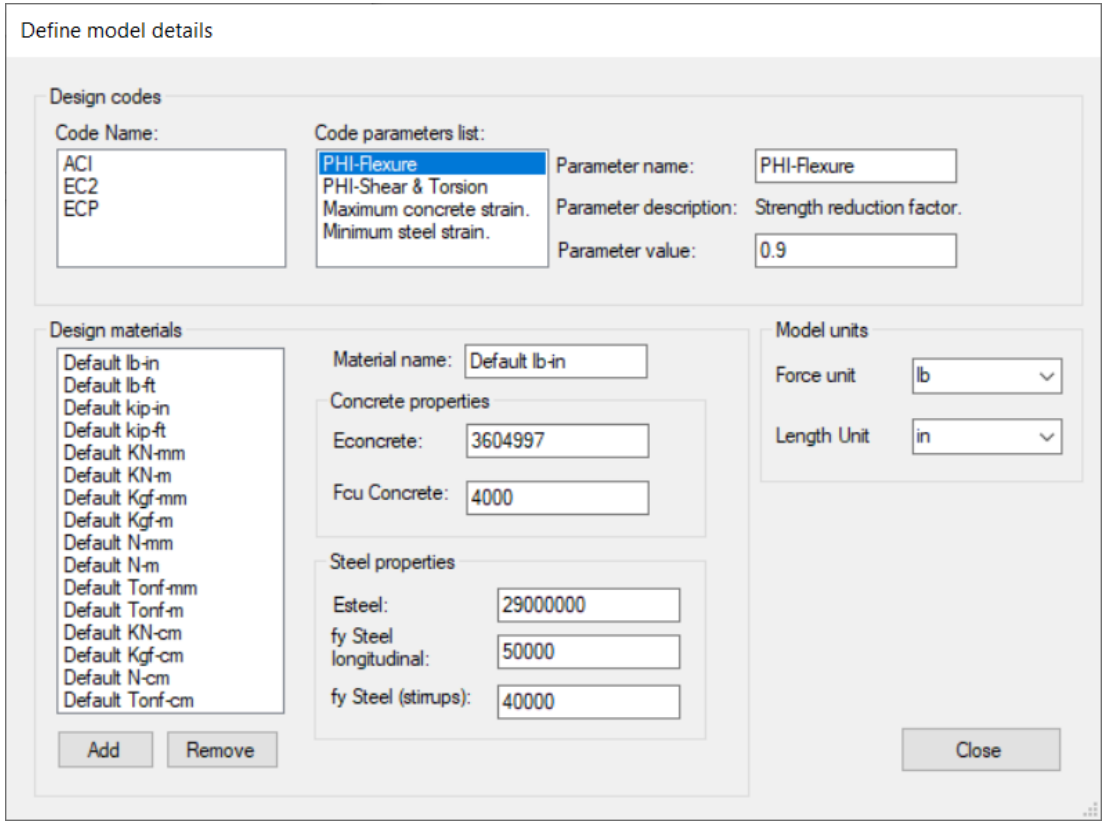
2.2. Starting PLDesign

- Once the user open the PLDesign, a model setup window is open and ask if the model is a new model or an old model.
- As it is start in PLDesign we will click on New model.
- In case of using PLDesign before, the user can click on open an old model.
- After clicking on New model, the user should define model details.
- The model details are the code name and the code parameter, design material units and modify it if any, choosing model units.
- To save click close then choose (.LC) file need to be designed, it has to be noted that it will be opened automatically if open from PLCoreMan.





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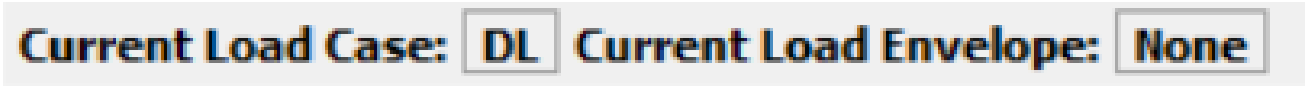
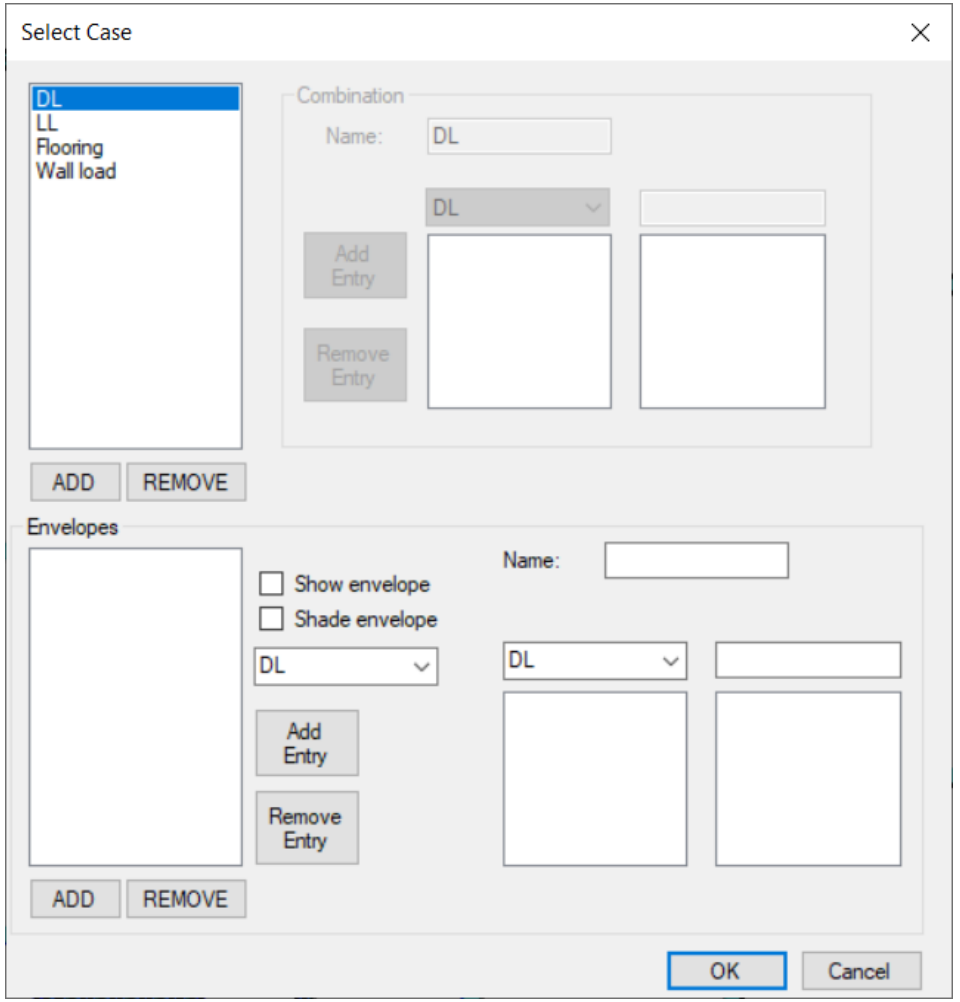
2.3. Load combinations & load envelopes

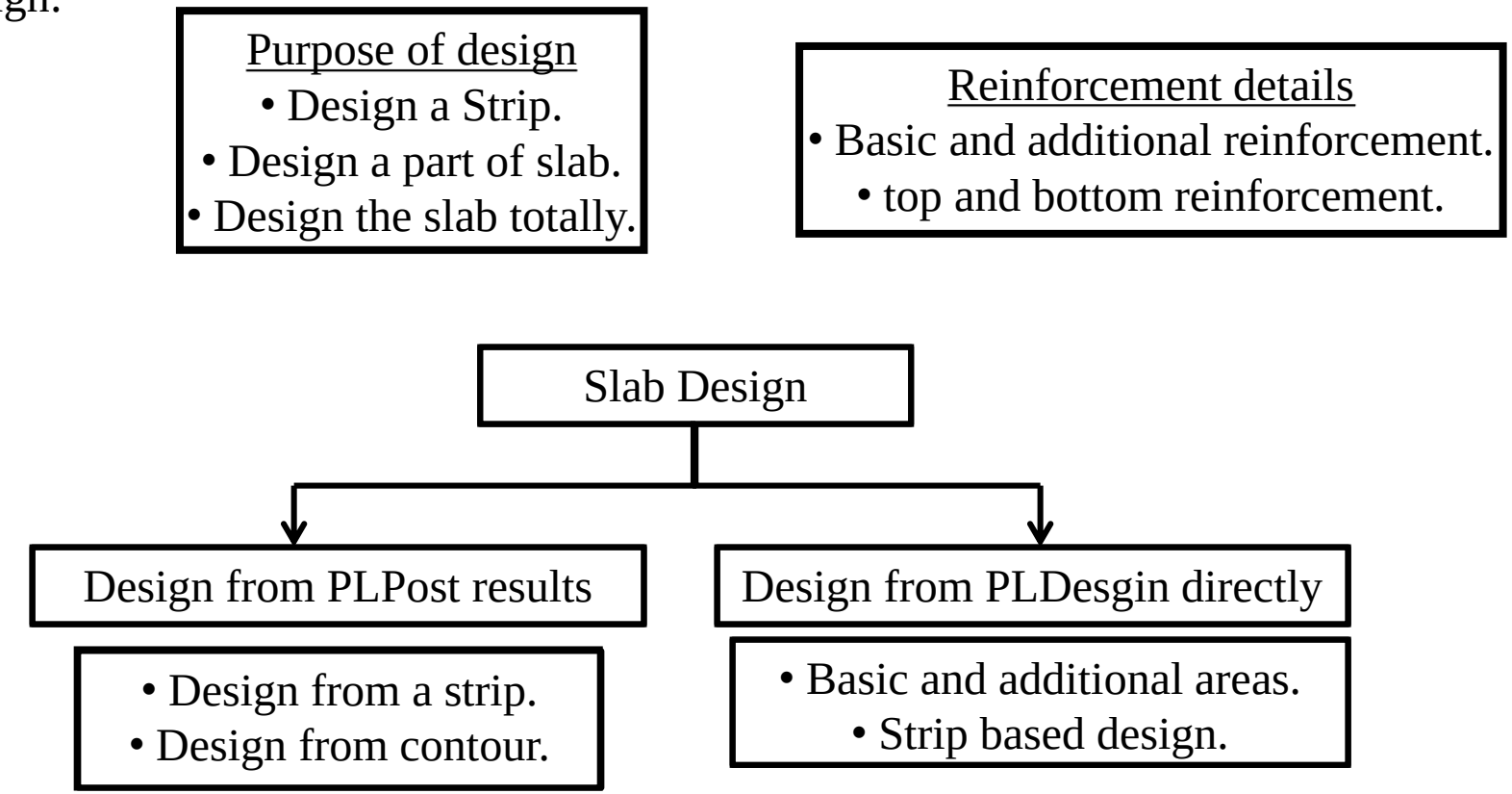
- The lower tabs of the PLDesign contain by default current load case is dead and current envelope is none.
- If the user press double click on dead load combinations window will open.
- The user can add cases like ultimate, working cases, each case contains combination between load cases inserted from PLGen and if there are any envelopes between them the user can insert also the envelope between combinations to achieve max. straining actions.





2.4. Slab design

The user have many options to design slabs, these options are according to the purpose of design or what are the details that user need from PLDesign:



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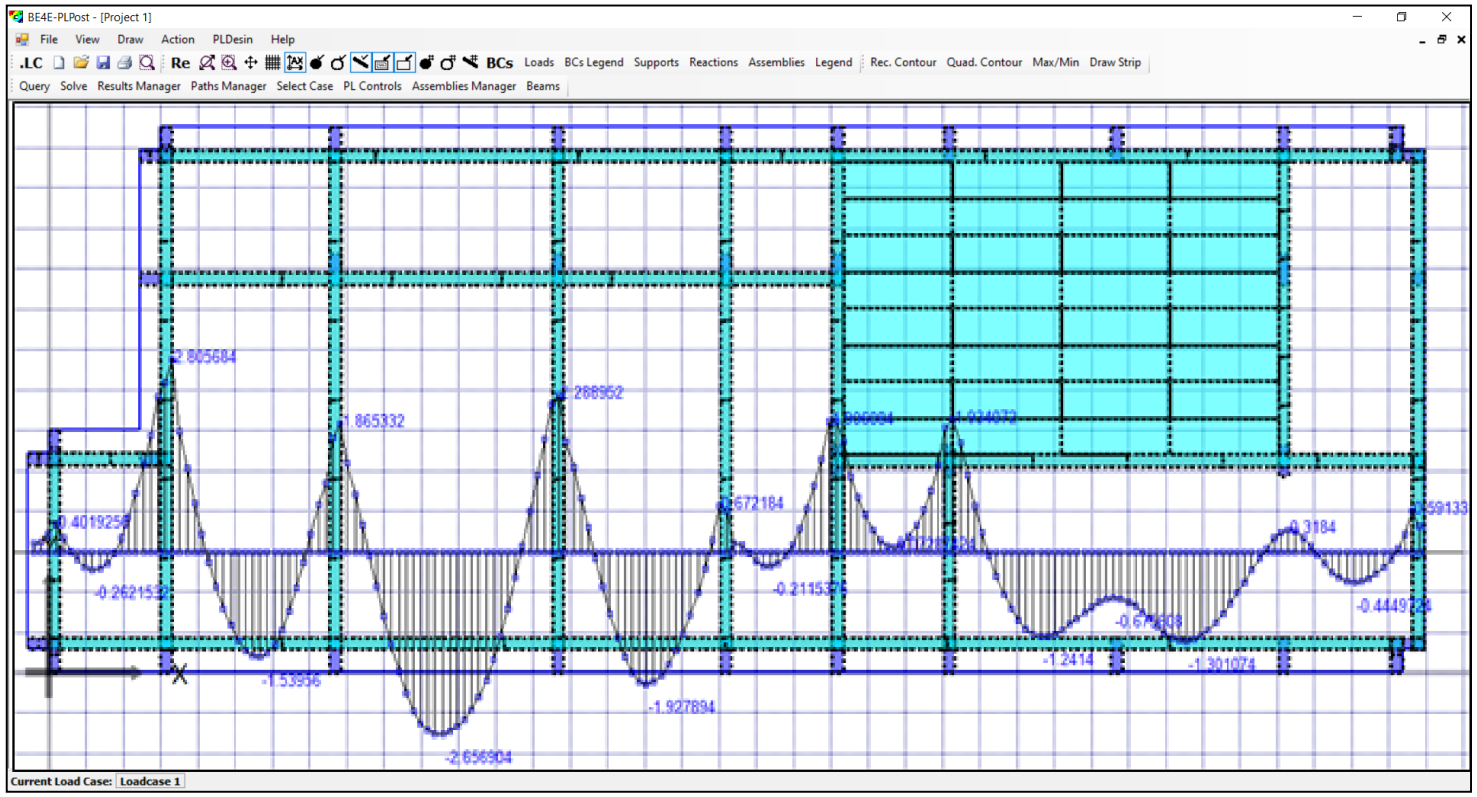
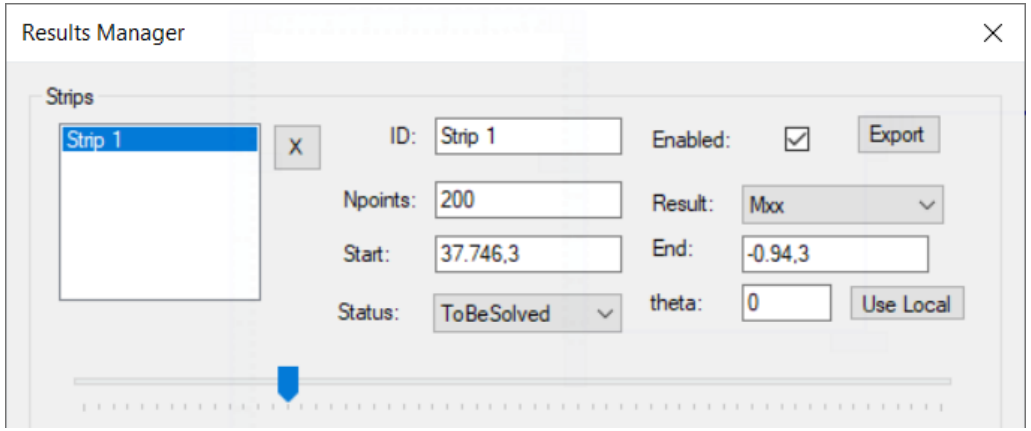
2.4.1. Design from PLPost results (strip design)

Design a certain strip with specific coordinates is one of the advantages of the PLDesign.

First the user have to save a strip from PLPost (a strip at y = 3.00m) as (.res) file.





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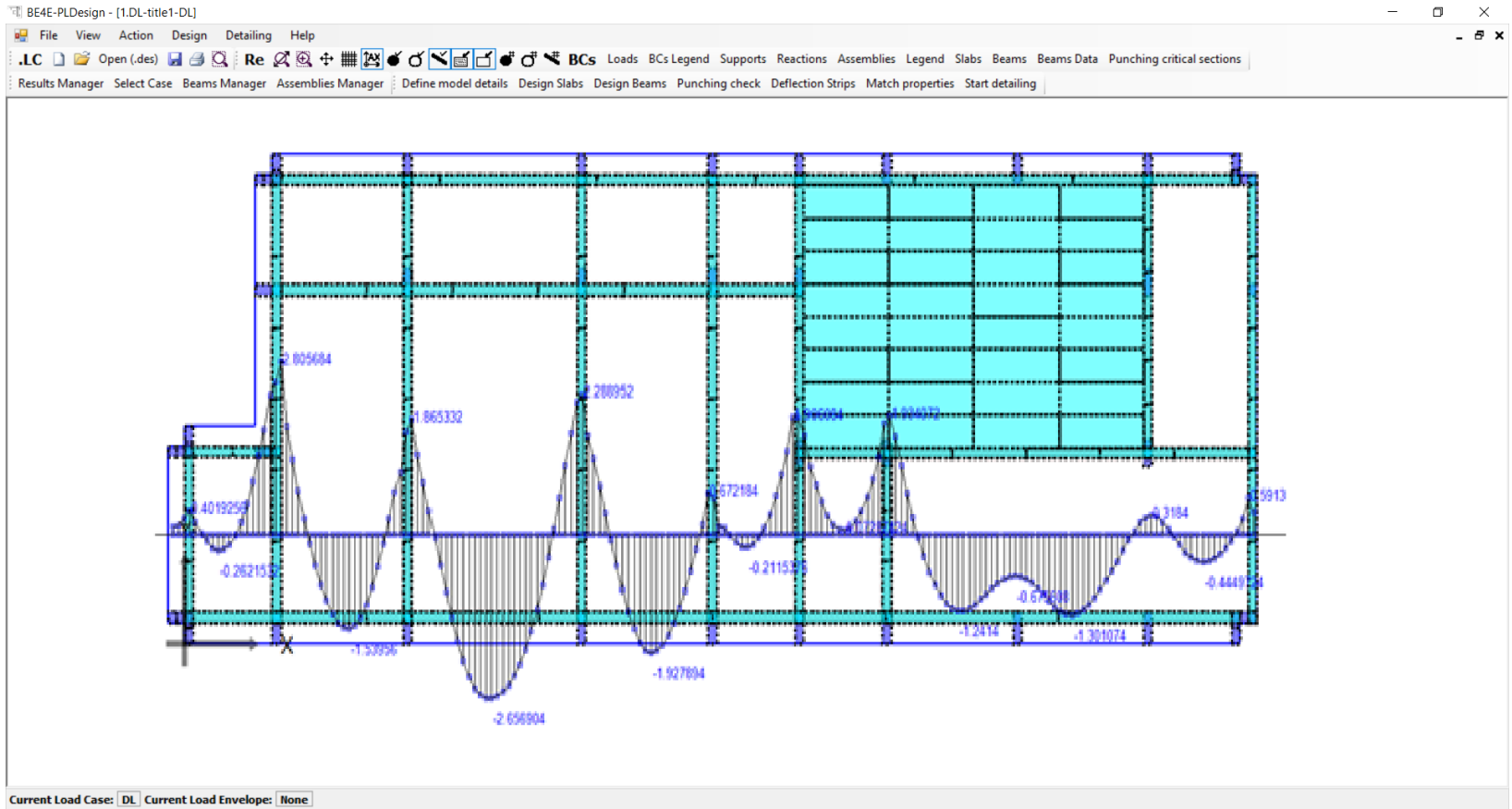
2.4.1. Design from PLPost results (strip design)

- Load the saved (.res) file in PLDesign.



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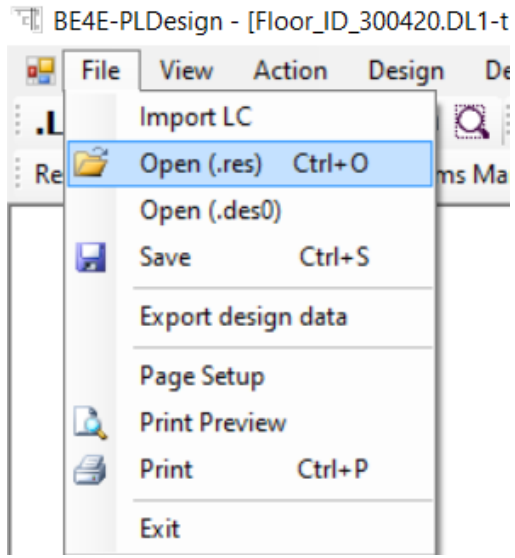

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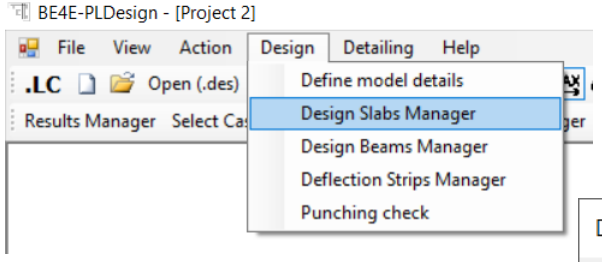
2.4.1. Design from PLPost results (strip design)

- Open Design Slabs Manager, then press on add strip to main model tab.
- Choose a design slab from a strip which will open a strip list to choose from them, then determine the width of the strip.



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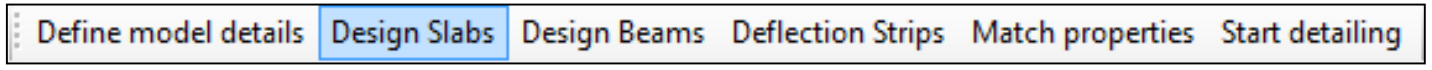

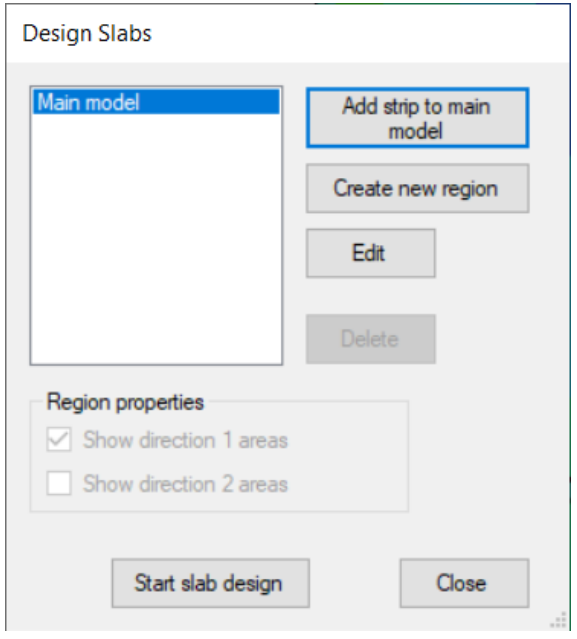

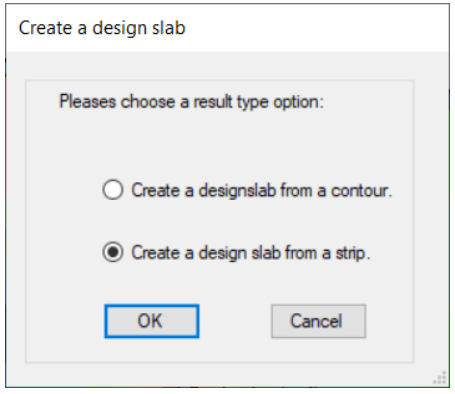

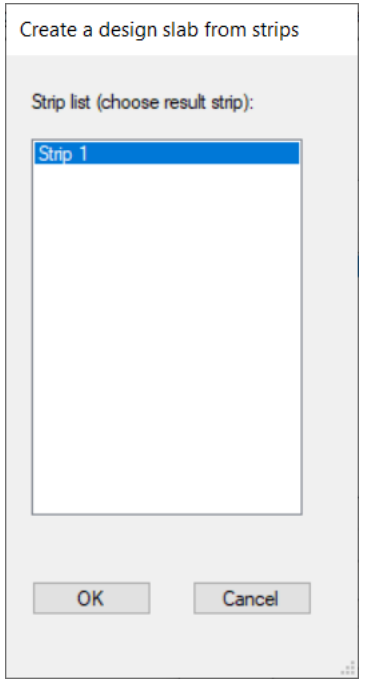

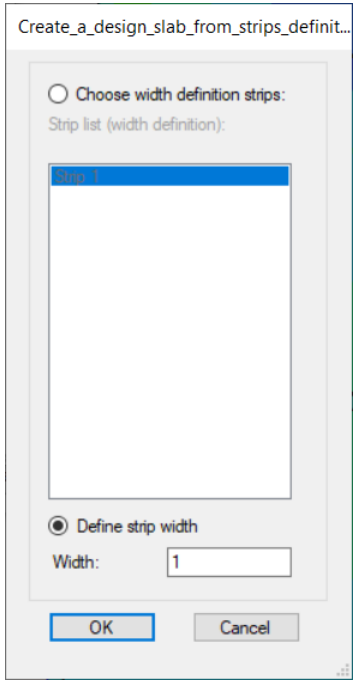

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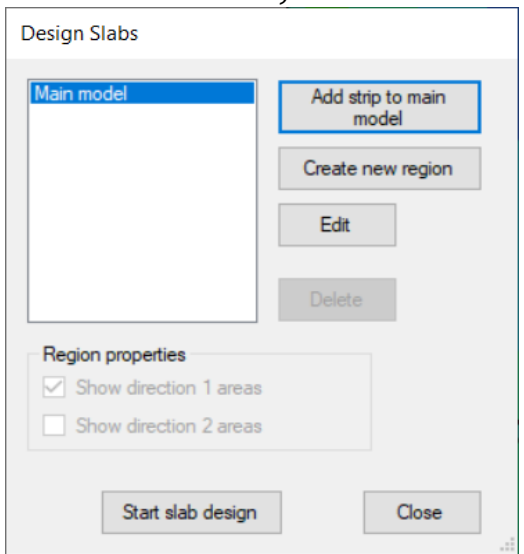
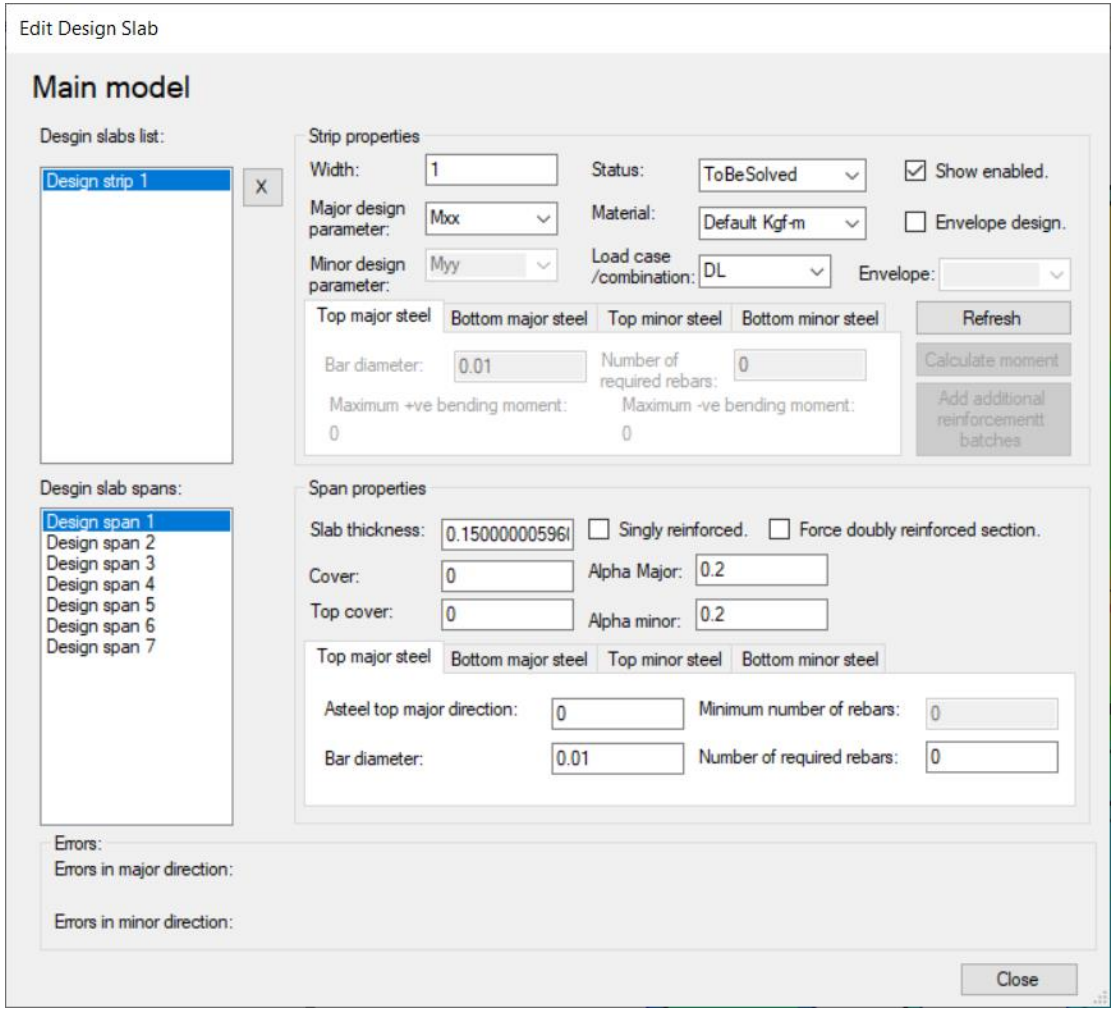
2.4.1. Design from PLPost results (strip design)

- Press on Edit to open Design Slab Manager.
- The main model is divided into two parts: Strip properties and Span properties.
  - The strip properties contains information for the strip like width, Major design parameter, Material units, Load cases/combinations.
  - While span properties contains information for the section like thickness, cover, bar diameter, number of rebars, number of required rebars.





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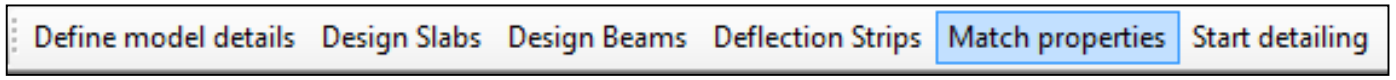
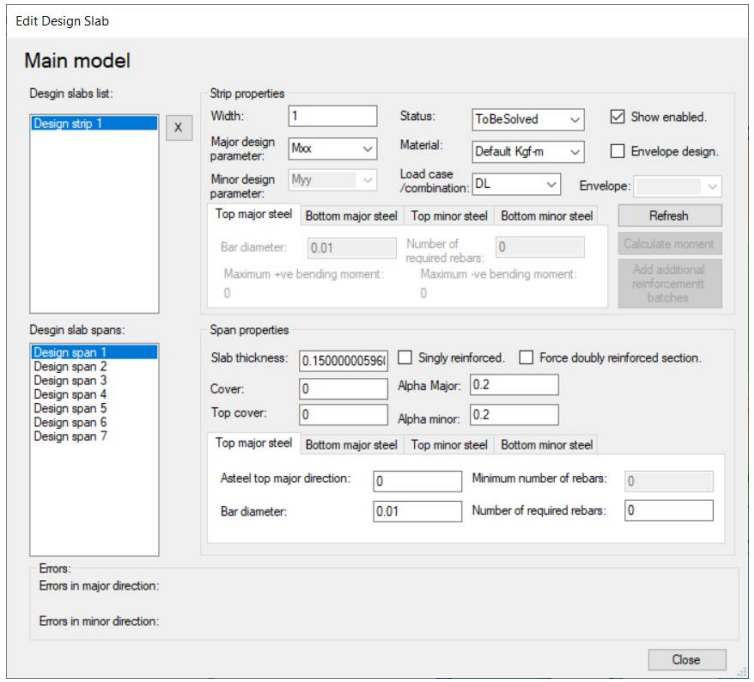
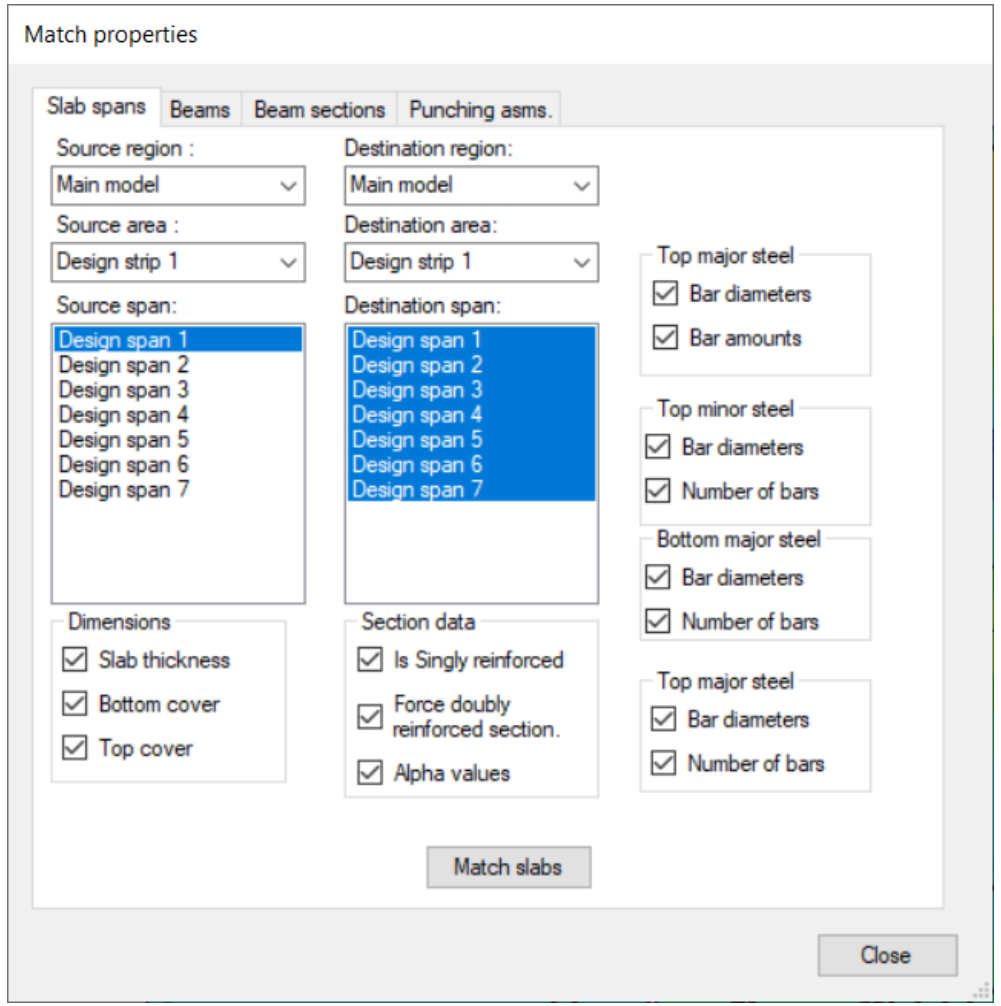
2.4.1. Design from PLPost results (strip design)

- Adjust the main model by choosing the design parameter and inserting all information (cover, bar diameter and number of bars) for one span.
- User do not need to adjust all spans, user can match the spans with the same properties.







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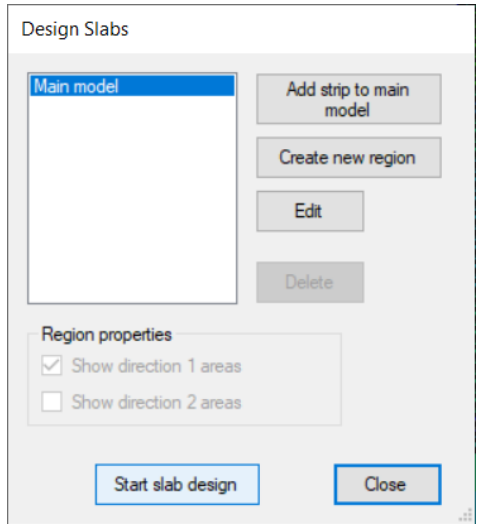
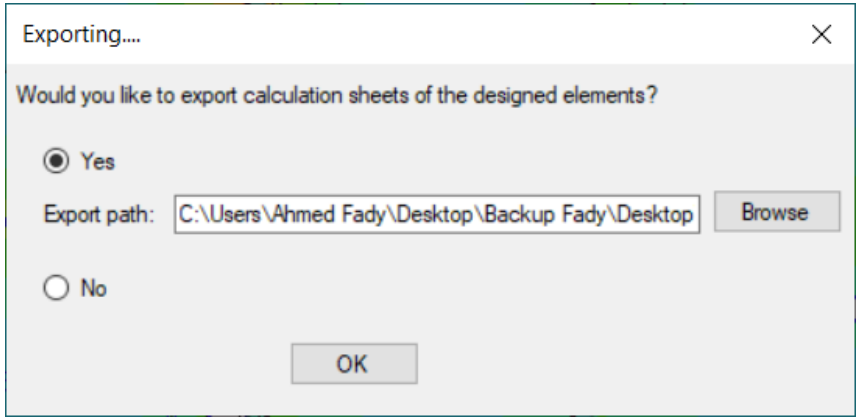
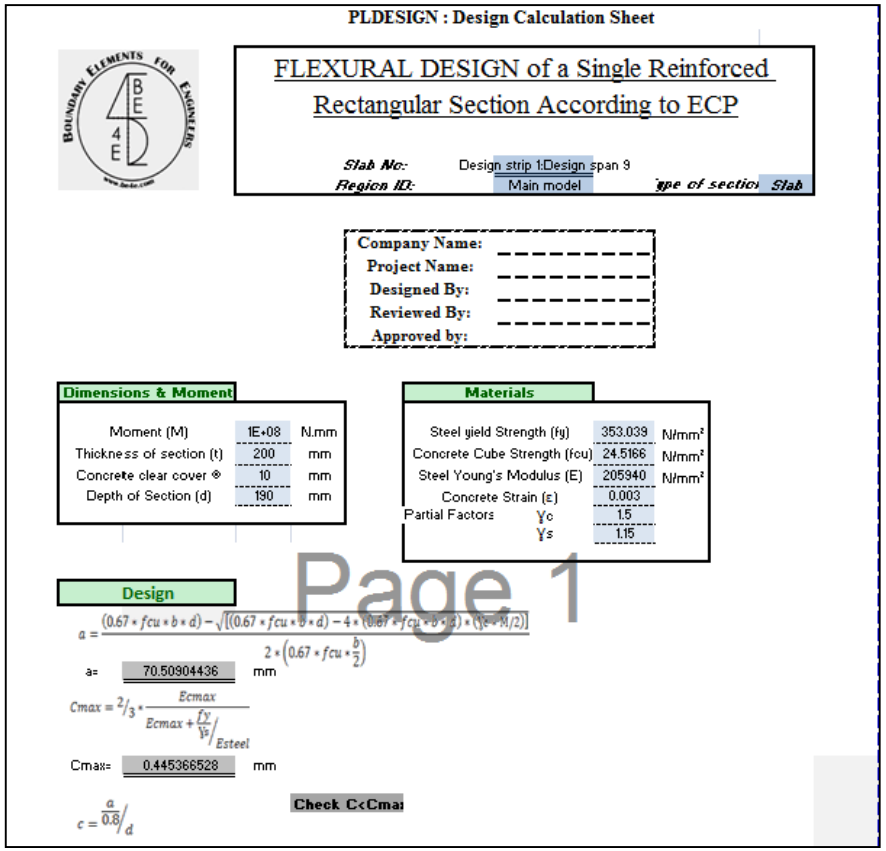
2.4.1. Design from PLPost results (strip design)

- Check that all spans are matched then start slab design.
- The PLDesign is automatically export the calculation sheet for slab every section has two files one for moment in X-direction and the other for Y-direction.







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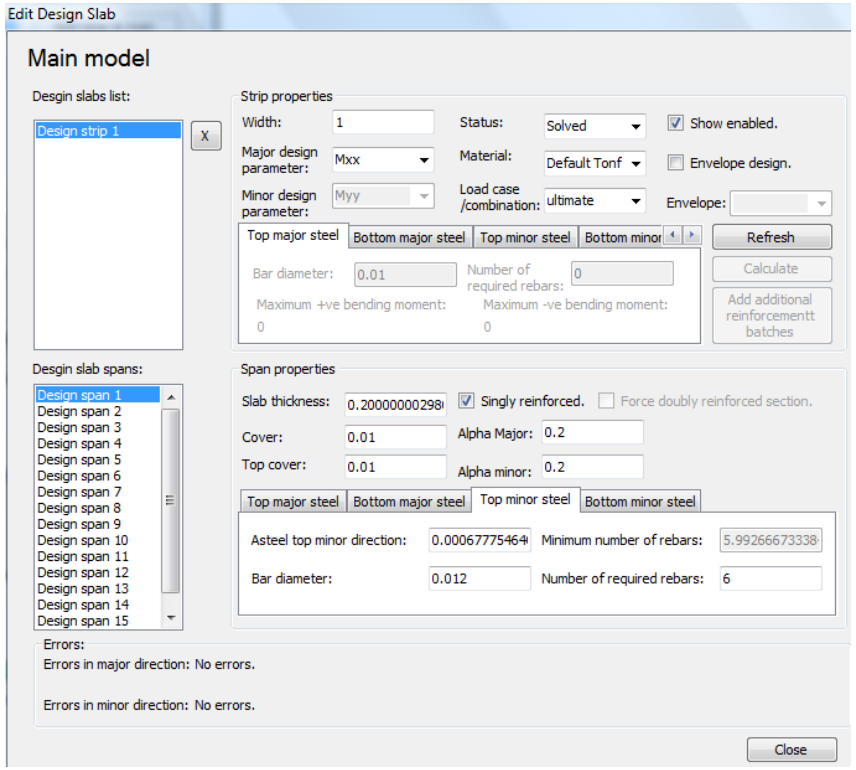
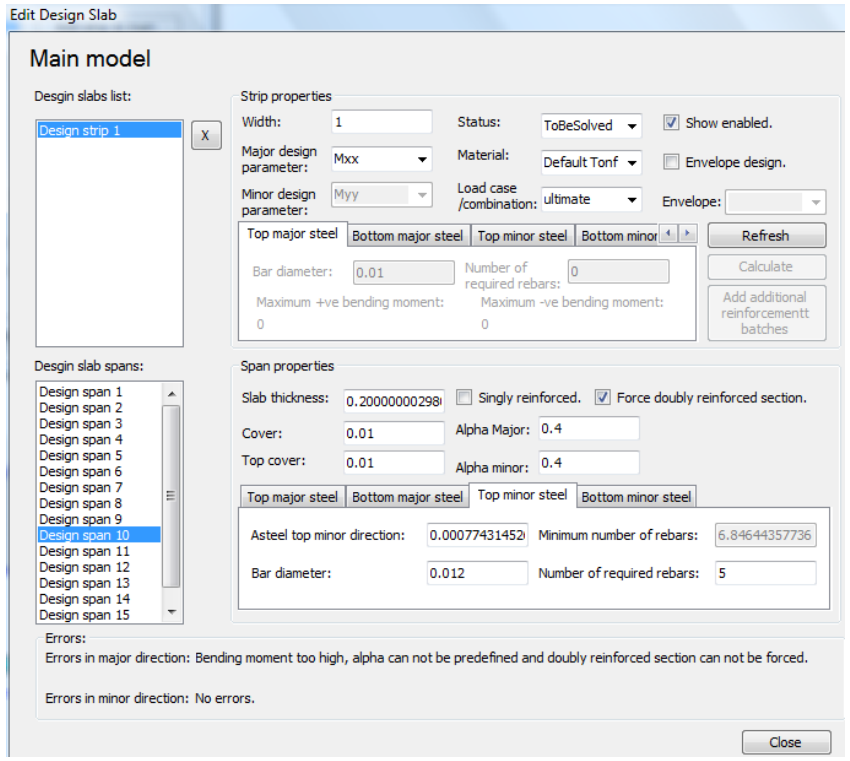
2.4.1. Design from PLPost results (strip design)

- Check that all spans are safe and modify the number of bars and bar diameter if needed.



Case of safe section



Case of unsafe section

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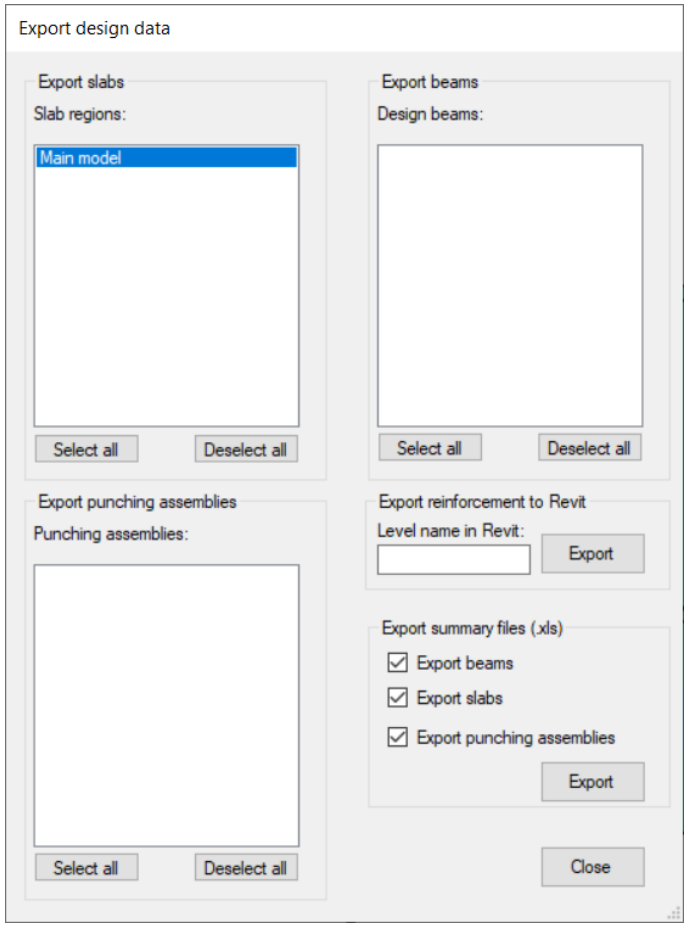
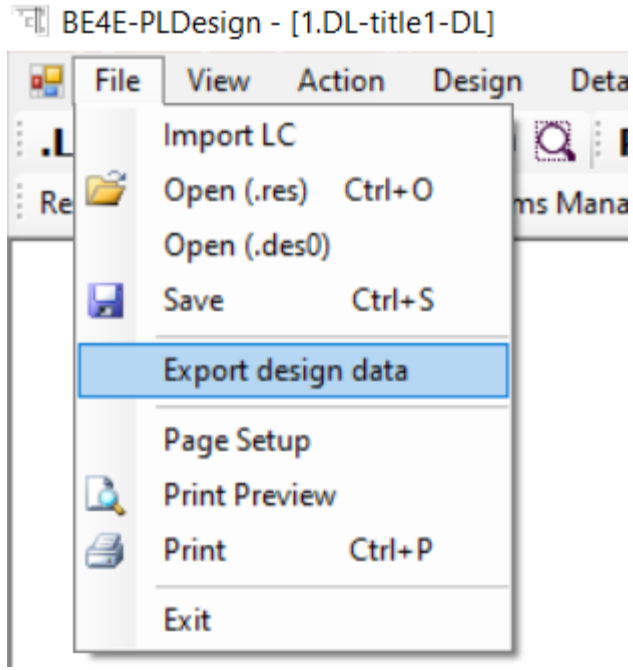
2.4.1. Design from PLPost results (strip design)

- Instead of every strip contains two excel files, the user can export a summary for slab reinforcement.





Region name	Area name	Major design moment	Strip name	Top major rft.	Bot. major rft.	Top minor rft.	Bot minor rft.
Main model	Design strip 1	Mxx	Design span 1	5 Φ 0.012	6 Φ 0.012	**6 Φ 0.012**	5 Φ 0.012
			Design span 2	5 Φ 0.012	5 Φ 0.012	**10 Φ 0.016**	5 Φ 0.012
			Design span 3	5 Φ 0.012	6 Φ 0.012	10 Φ 0.016	5 Φ 0.012
			Design span 4	6 Φ 0.016	5 Φ 0.012	9 Φ 0.018	5 Φ 0.012
			Design span 5	5 Φ 0.012	9 Φ 0.018	5 Φ 0.012	7 Φ 0.012
			Design span 6	6 Φ 0.012	5 Φ 0.012	6 Φ 0.012	5 Φ 0.012
			Design span 7	5 Φ 0.012	7 Φ 0.012	7 Φ 0.012	5 Φ 0.012
			Design span 8	9 Φ 0.016	5 Φ 0.012	7 Φ 0.016	5 Φ 0.012
			Design span 9	5 Φ 0.012	5 Φ 0.012	5 Φ 0.012	5 Φ 0.012
			Design span 10	5 Φ 0.012	5 Φ 0.012	5 Φ 0.012	5 Φ 0.012
			Design span 11	5 Φ 0.012	8 Φ 0.018	7 Φ 0.016	5 Φ 0.012
			Design span 12	7 Φ 0.016	5 Φ 0.012	9 Φ 0.012	5 Φ 0.012
			Design span 13	5 Φ 0.012	5 Φ 0.012	5 Φ 0.012	5 Φ 0.012
			Design span 14	6 Φ 0.012	5 Φ 0.012	6 Φ 0.012	5 Φ 0.012
			Design span 15	5 Φ 0.012	6 Φ 0.012	6 Φ 0.012	5 Φ 0.012
			Design span 16	5 Φ 0.012	5 Φ 0.012	5 Φ 0.012	5 Φ 0.012

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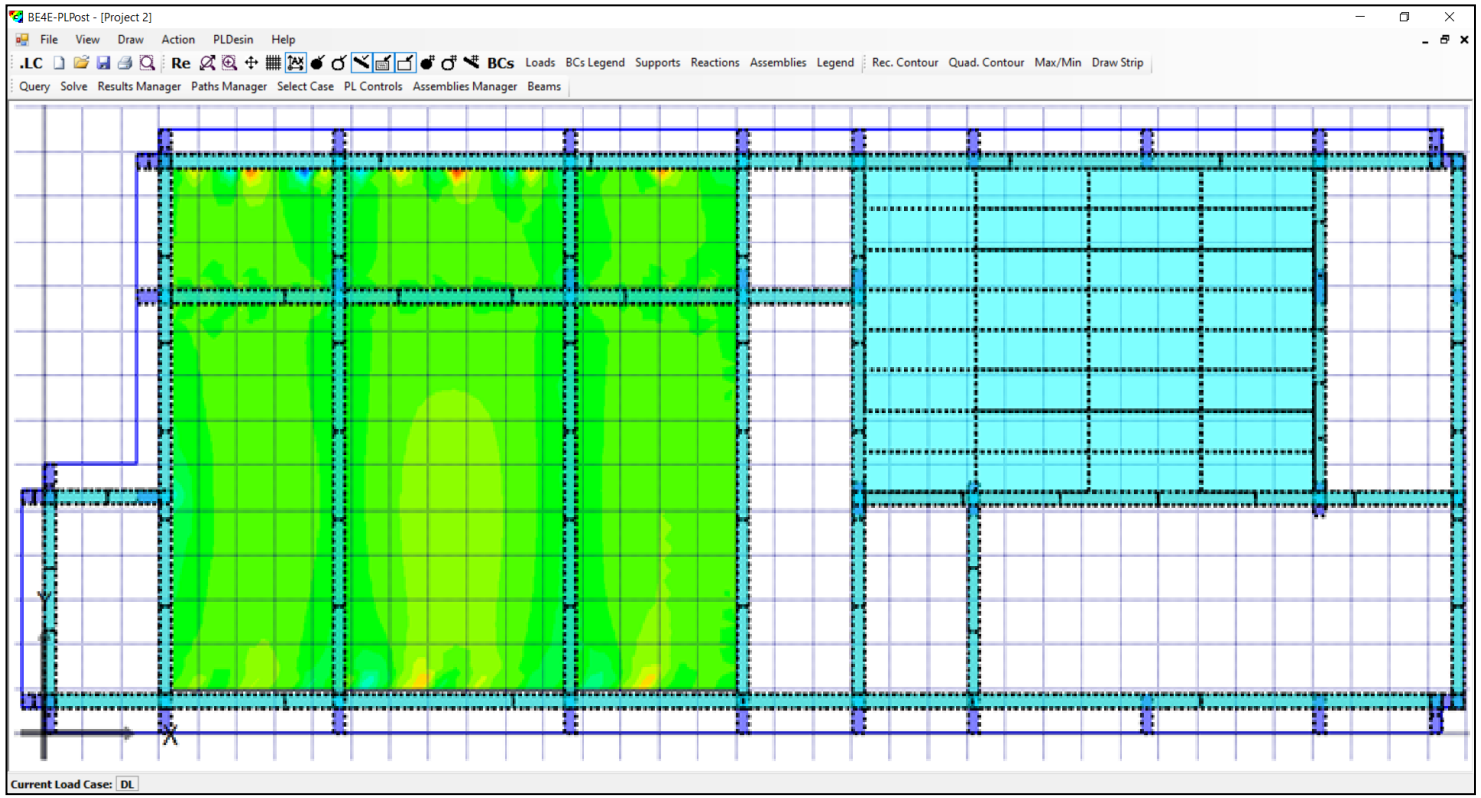
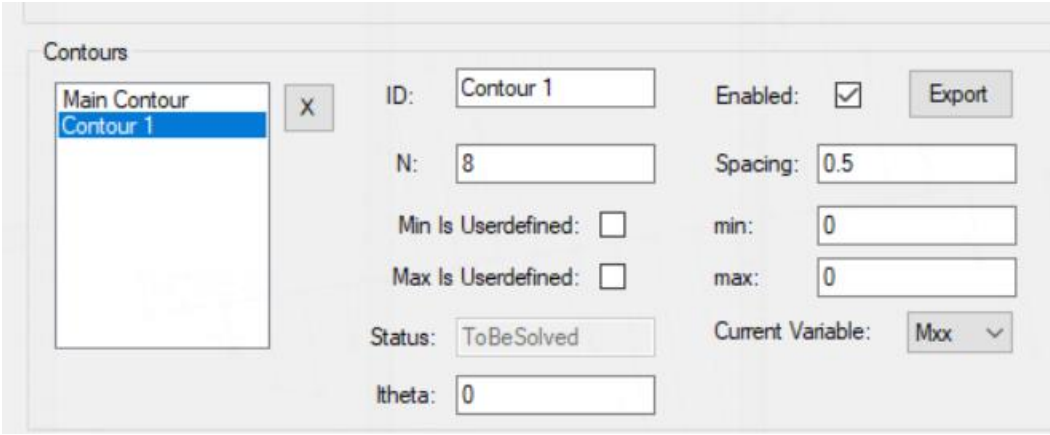
2.4.2. Design from PLPost results (contour design)

- Similarly as Strip design the user should save results in PLPost then load it again in PLDesign.





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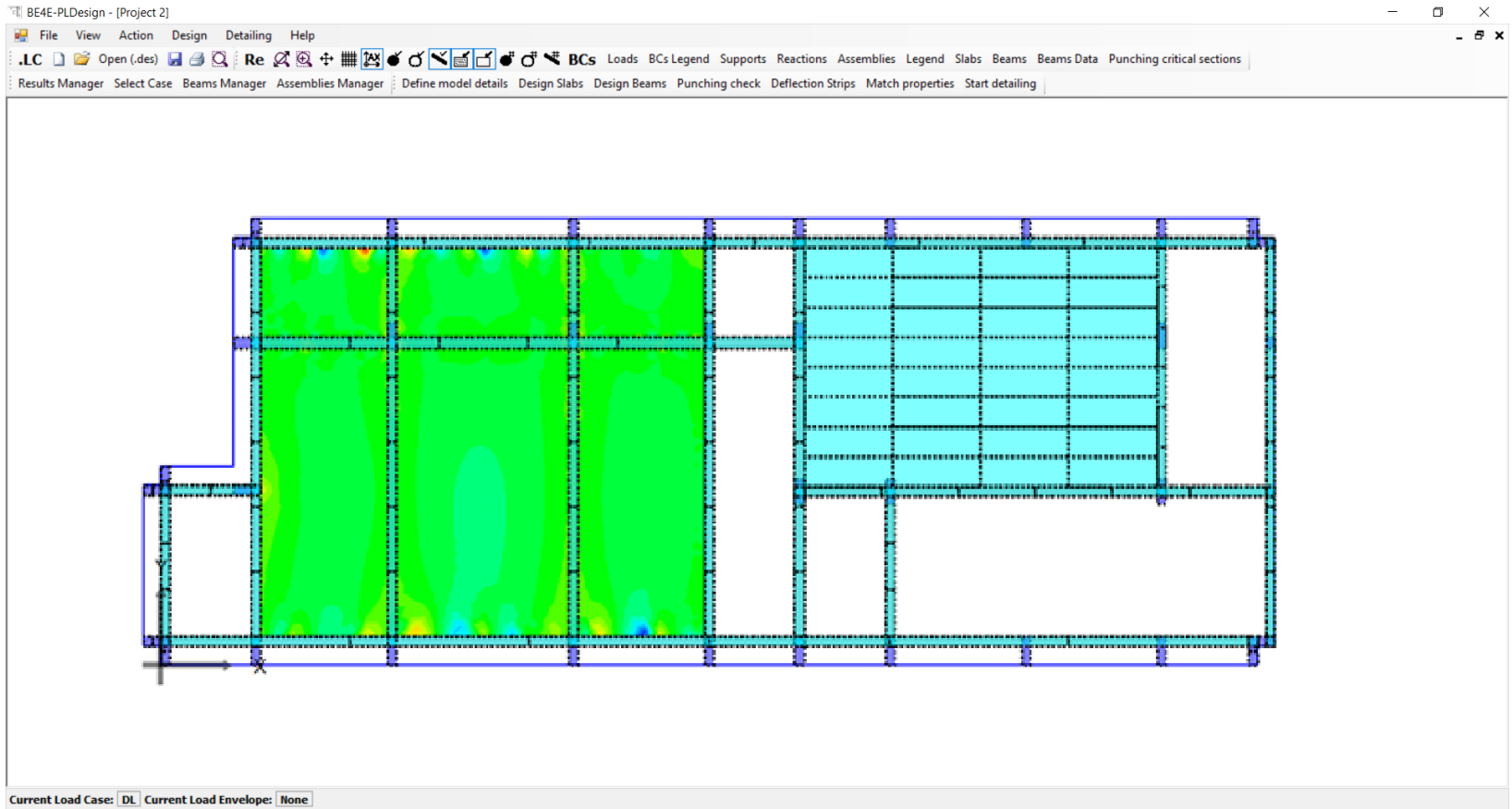
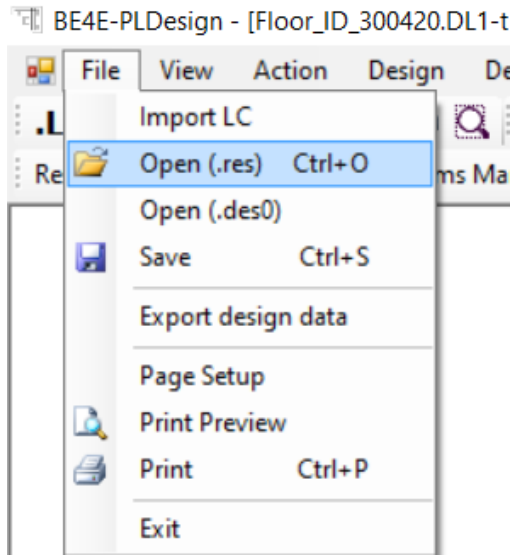
2.4.2. Design from PLPost results (contour design)

- Load the saved (.res) file in PLDesign.



OR



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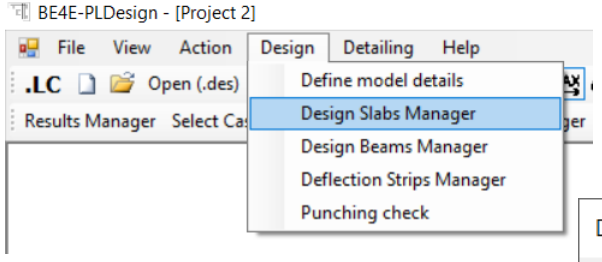
2.4.2. Design from PLPost results (contour design)

- Open Design Slabs Manager, then press on add strip to main model tab.
- Choose a design slab from a contour which will open a contour list to determine the contour area needed to be designed.



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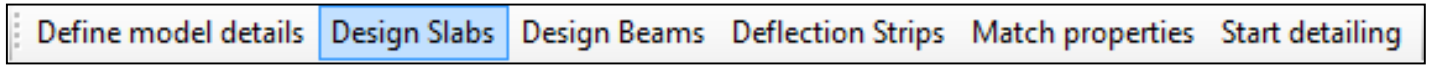

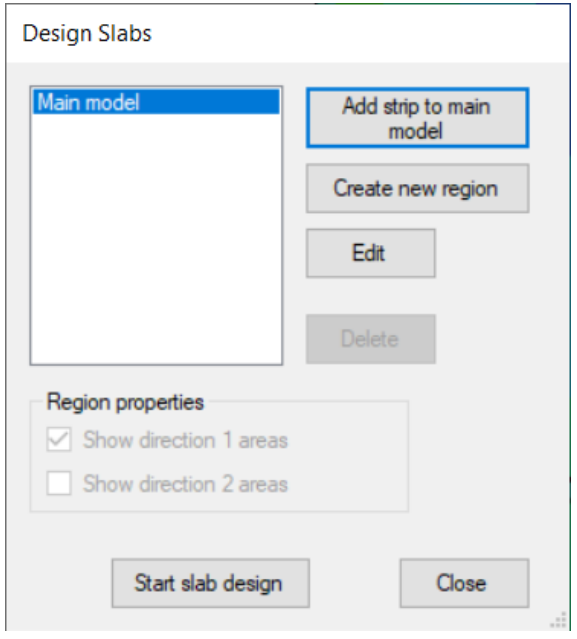

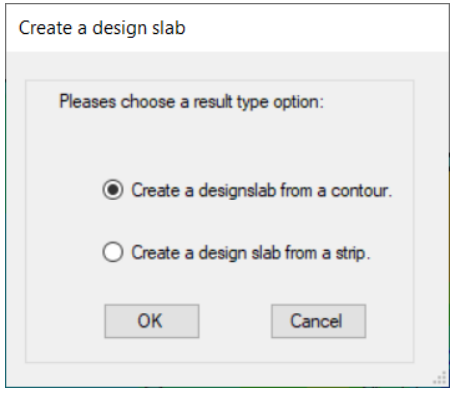

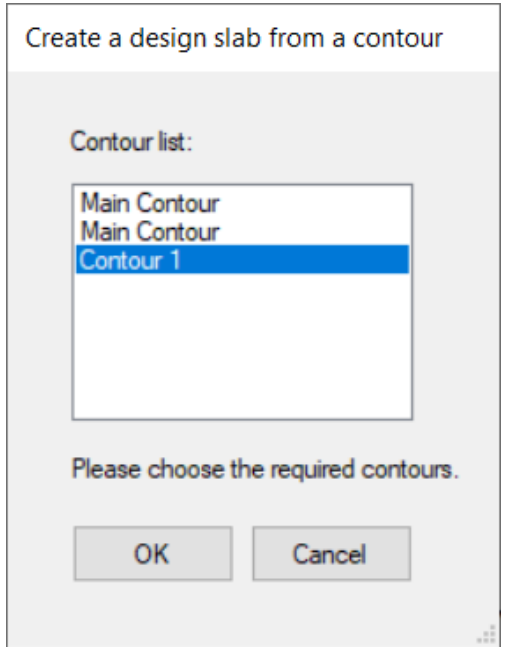

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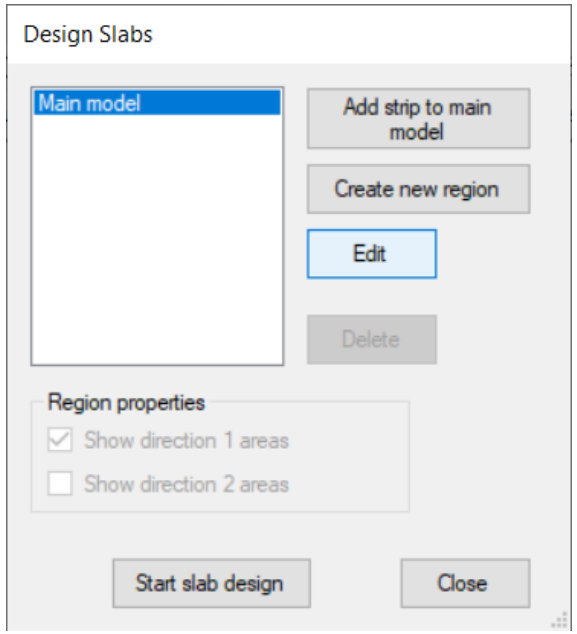
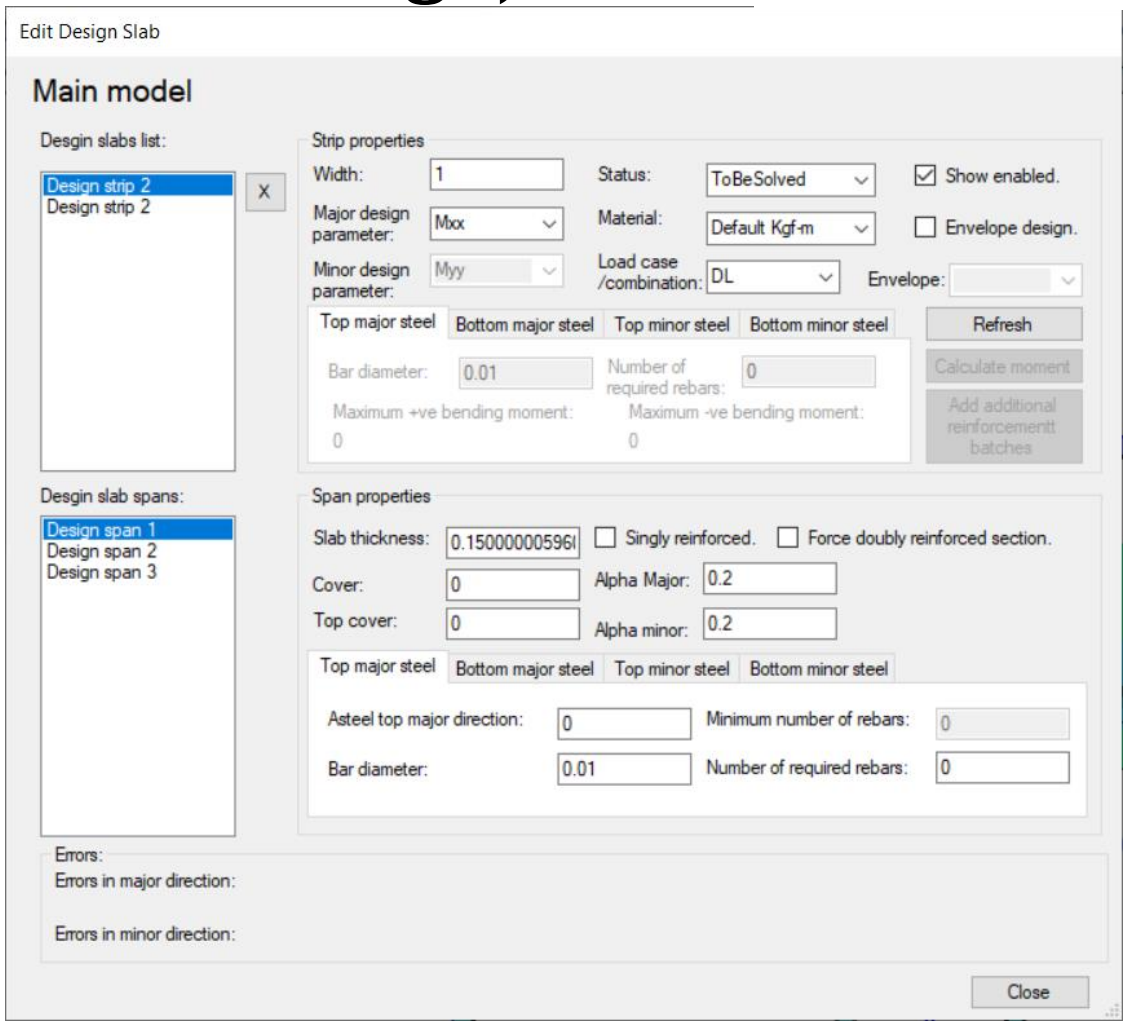
2.4.2. Design from PLPost results (contour design)

- Press on Edit to open Design Slab Manager.
- Similarly as strip design, the user should adjust the design slab list and design span list.
- But in contour design we note that there are 2 design strips one of them is vertical (strip 1) and the other is horizontal (strip 2) each strip should adjust it’s properties.





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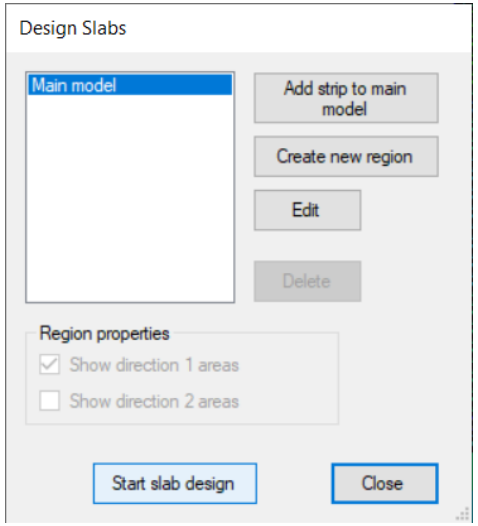
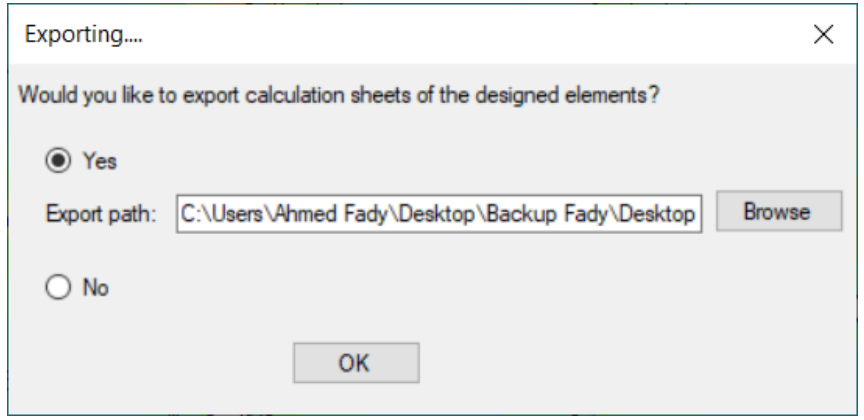
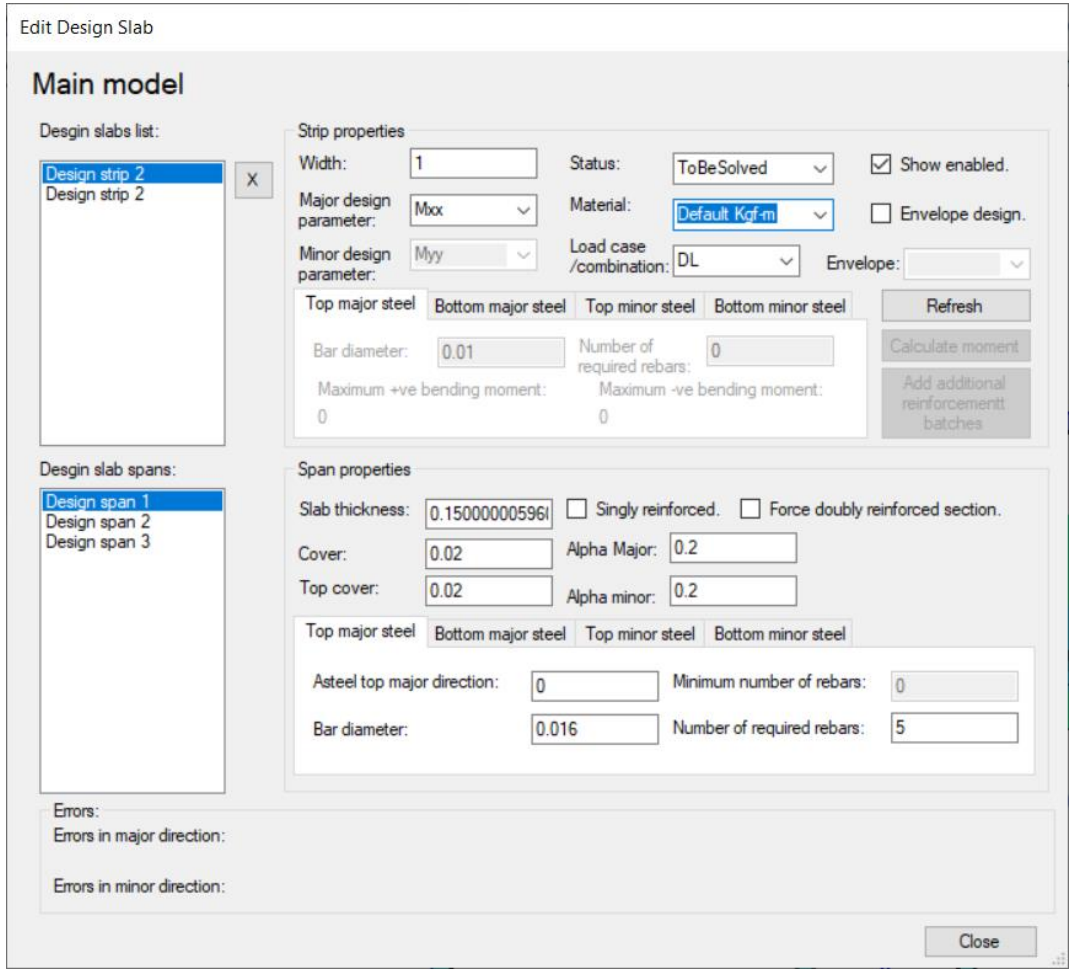
2.4.2. Design from PLPost results (contour design)

- After adjusting the main model, it is time for solving the slab by pressing start slab design.
- Export the design calculation sheet.







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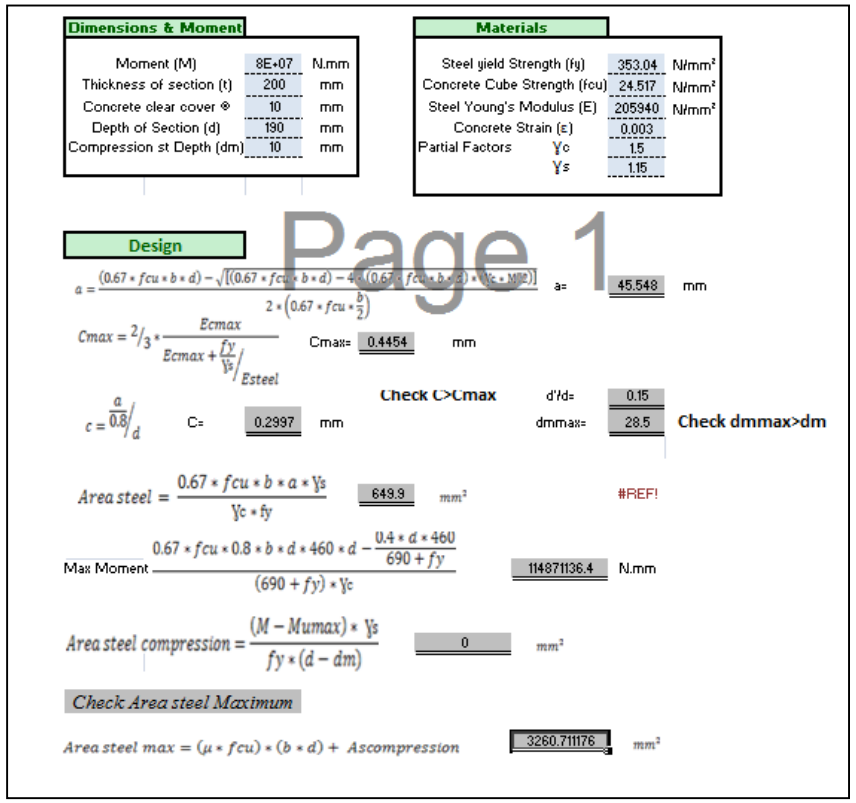
2.4.2. Design from PLPost results (contour design)

- Check that all spans are safe and modify the number of bars and bar diameter if needed.
- The PLDesign is automatically export the calculation sheet for slab every section has two files one for moment in X-direction and the other for Y-direction.



Dimensions & Moment

Moment (M)	8E+07	N.mm
Thickness of section (t)	200	mm
Concrete clear cover ⊗	10	mm
Depth of Section (d)	190	mm
Compression st Depth (dm)	10	mm

Materials

Steel yield Strength (fy)	353.04	N/mm²
Concrete Cube Strength (fcu)	24.517	N/mm²
Steel Young's Modulus (E)	205940	N/mm²
Concrete Strain (ε)	0.003	
Partial Factors γc	1.5	
γs	1.15	

Page 1

Design

$$a = \frac{(0.67 \times fcu \times b \times d) - \sqrt{[(0.67 \times fcu \times b \times d) - 4 \times (0.67 \times fcu \times b \times d) \times \gamma c \times M]}}{2 \times \left(0.67 \times fcu \times \frac{b}{2}\right)}$$ a= 45.548 mm

$$Cmax = \frac{2}{3} \times \frac{Ecmax}{Ecmax + \frac{fy}{\gamma s} / Esteel}$$ Cmax= 0.4454 mm

$$c = \frac{a}{0.8} / d$$ C= 0.2997 mm

Check C>Cmax d'/d= 0.15

dmmax= 28.5 Check dmmax>dm

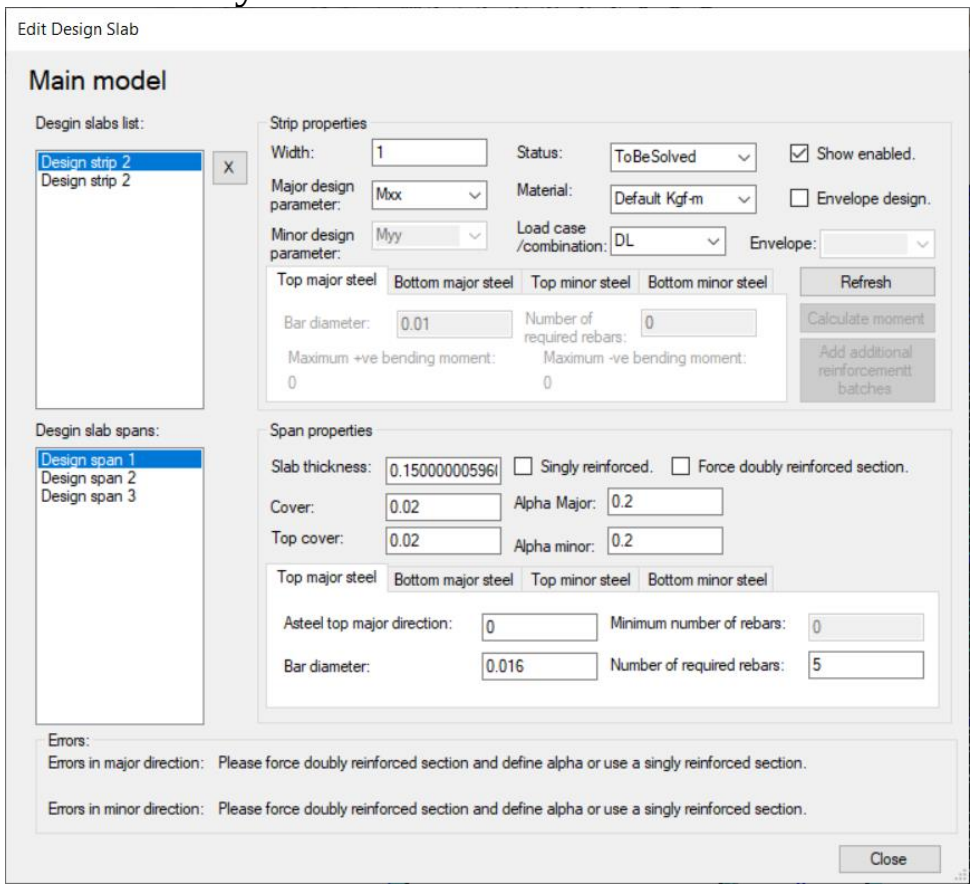
$$Area\ steel = \frac{0.67 \times fcu \times b \times a \times \gamma s}{\gamma c \times fy}$$ 649.9 mm² #REF!

Max Moment $\frac{0.67 \times fcu \times 0.8 \times b \times d \times 460 \times d - \frac{0.4 \times d \times 460}{690 + fy}}{(690 + fy) \times \gamma c}$ 114871136.4 N.mm

$$Area\ steel\ compression = \frac{(M - Mumax) \times \gamma s}{fy \times (d - dm)}$$ 0 mm²

Check Area steel Maximum

$$Area\ steel\ max = (\mu \times fcu) \times (b \times d) + Ascompression$$ 3260.711176 mm²



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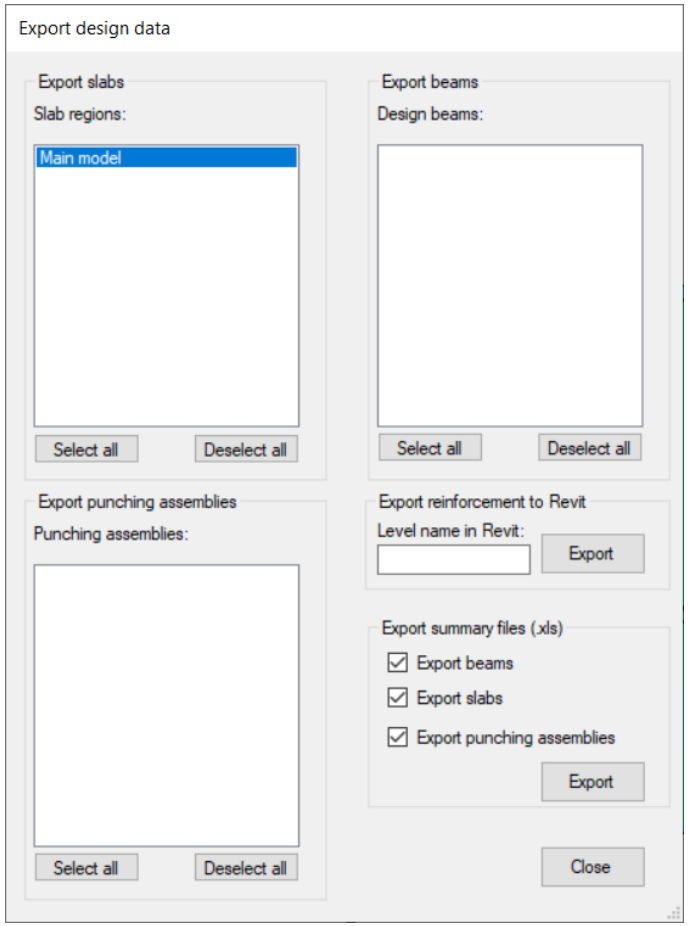
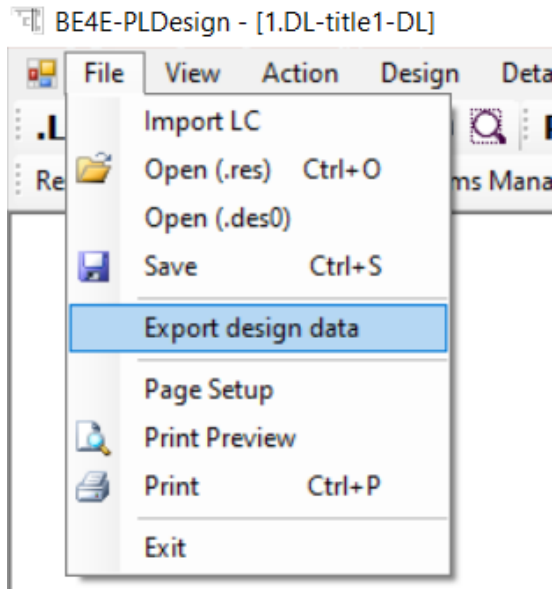
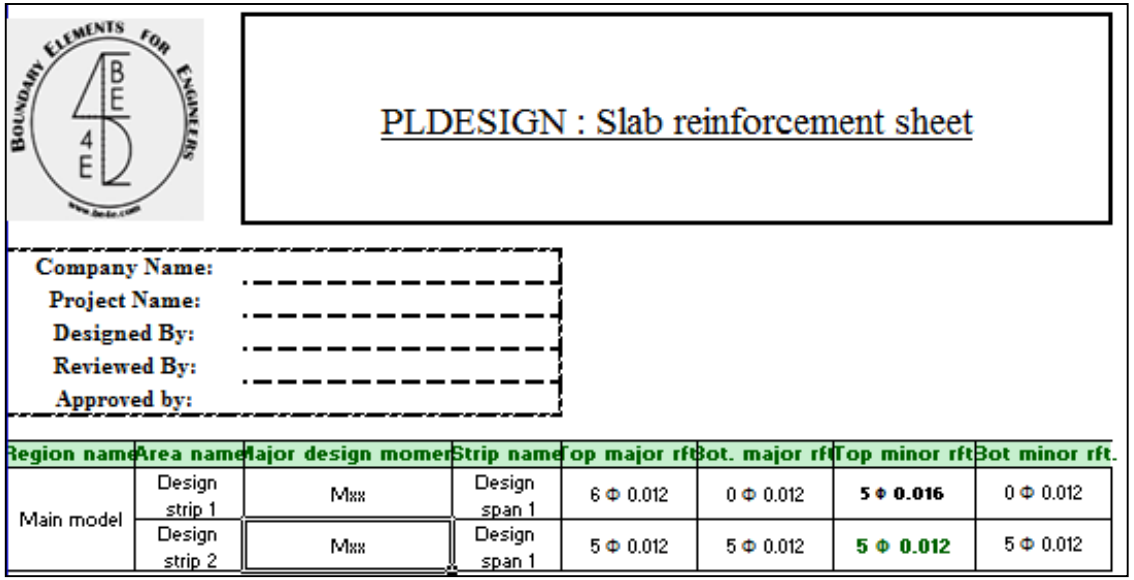
2.4.2. Design from PLPost results (contour design)

- Instead of every strip contains two excel files, the user can export a summary for slab reinforcement.







PLDESIGN : Slab reinforcement sheet

Company Name:
Project Name:
Designed By:
Reviewed By:
Approved by:

Region name	Area name	Major design momen	Strip name	Top major rft	Bot. major rft	Top minor rft	Bot minor rft.
Main model	Design strip 1	Mxx	Design span 1	6 Φ 0.012	0 Φ 0.012	**5 Φ 0.016**	0 Φ 0.012
	Design strip 2	Mxx	Design span 1	5 Φ 0.012	5 Φ 0.012	**5 Φ 0.012**	5 Φ 0.012

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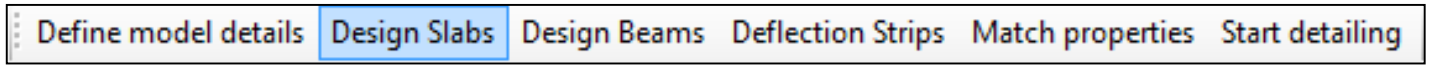
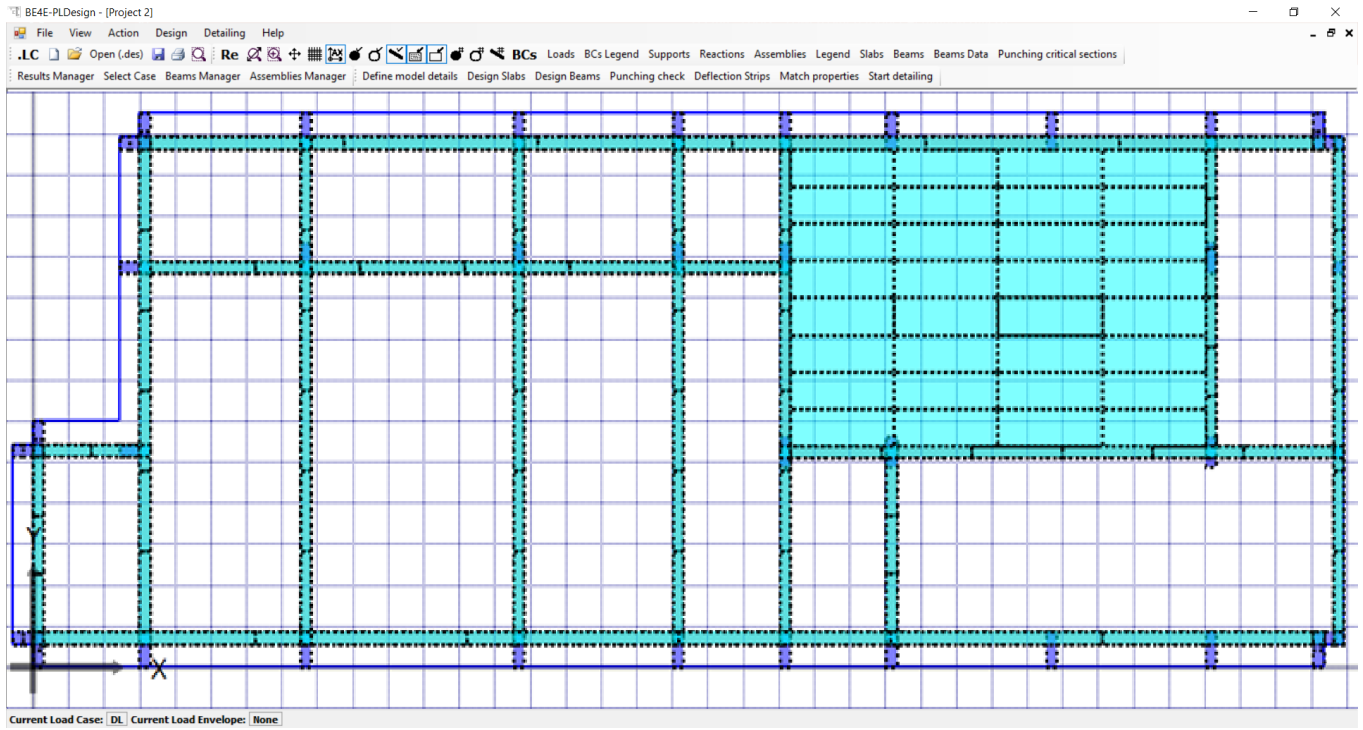
2.4.3. Design from PLDesign directly (strip based region)

- The user has no need to use PLPost, he could use PLDesign directly.
- Design based region's idea is dividing the selected slab into number of horizontal and vertical strips, these numbers are selected by the user and could be changed according to the dimension of slab, then the PLDesign calculate automatically the straining action for the selected part and design it.





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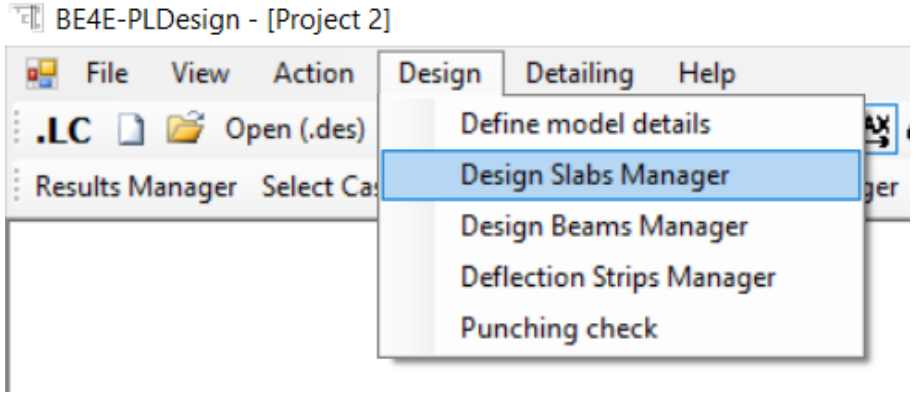

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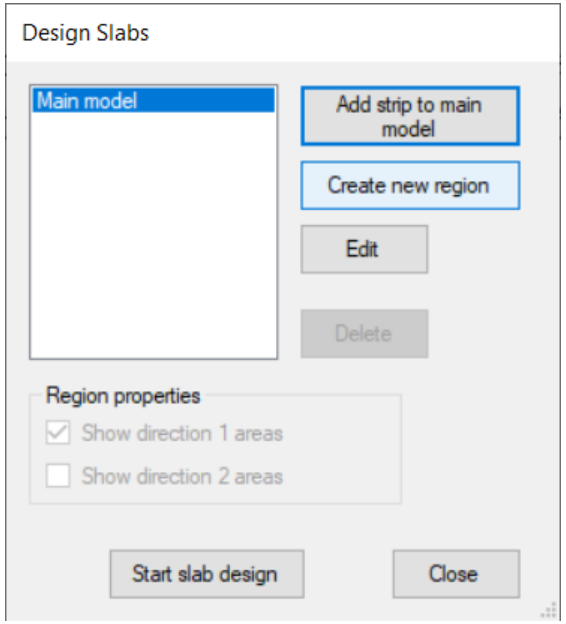
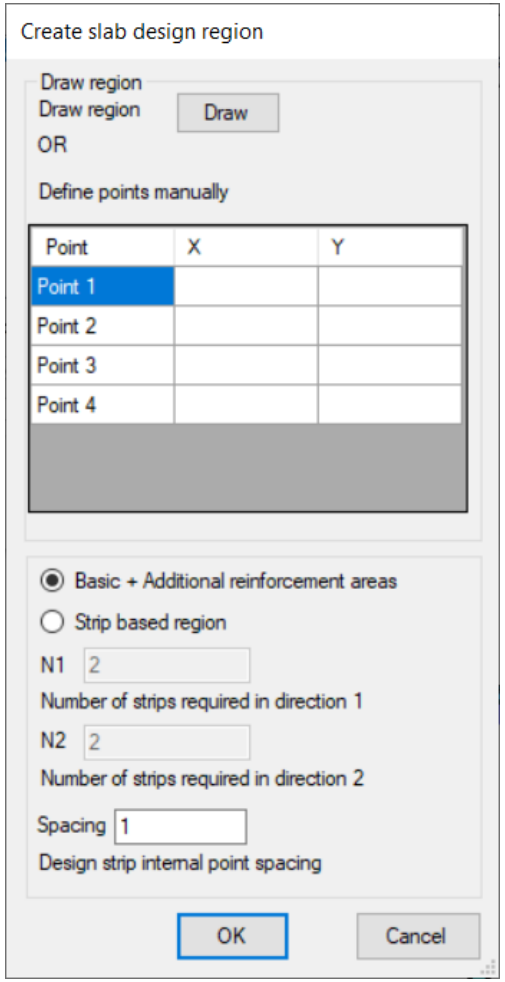
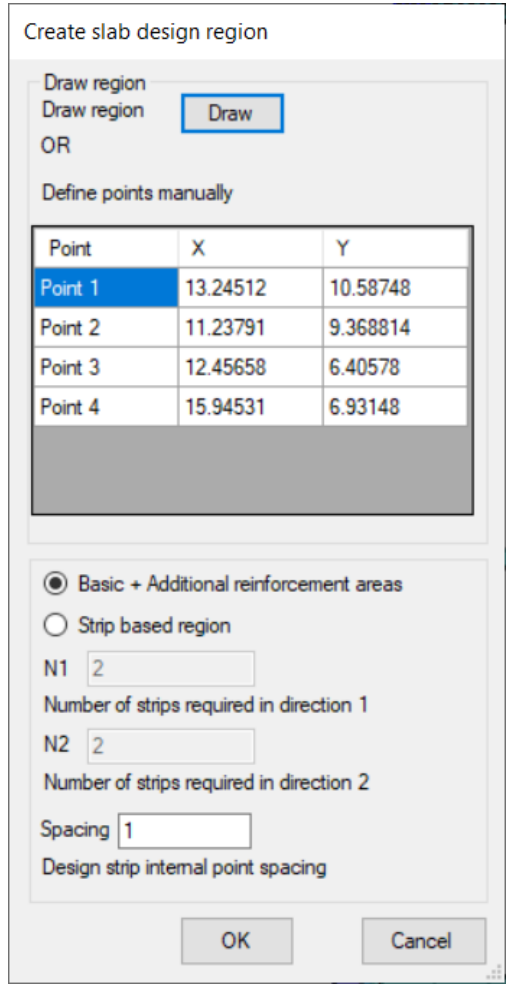
2.4.3. Design from PLDesign directly (strip based region)

- The two previous methods, the user use add strip to main model tab now he should use create new region as far there is no previous analysis.
- The user should draw the area needed to be designed by Draw tab, then choose Strip based region, and select the number of horizontal /vertical strips and select the spacing.







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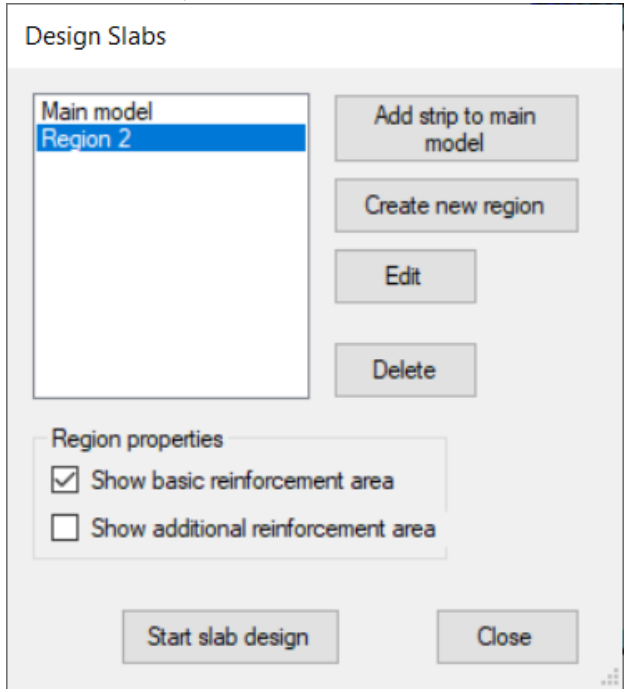
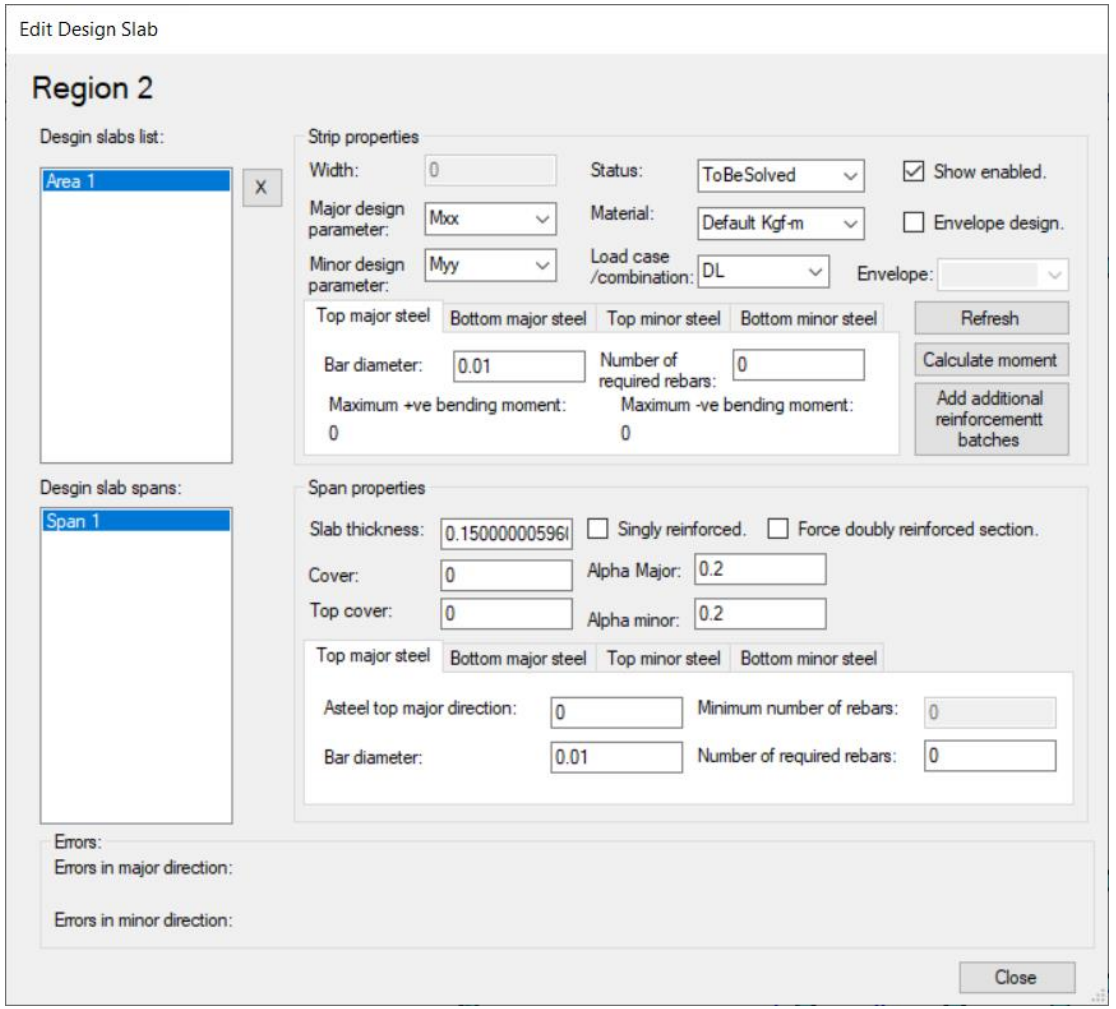
2.4.3. Design from PLDesign directly (strip based region)

- The PLDesign starts the analysis similarly as PLPost.
- Press on Design slab manager to see that a new region has been created.
- Go to Edit slab design to see that the slab is divided into 12 areas (8 horizontal and 4 vertical) each area divided into a number of spans.





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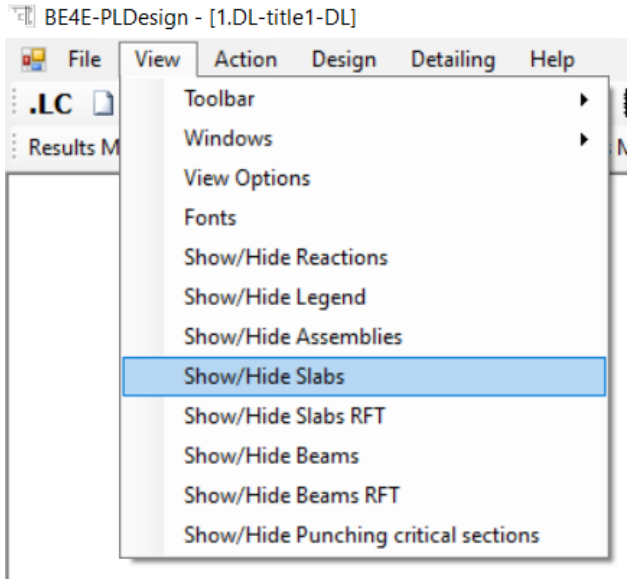
2.4.3. Design from PLDesign directly (strip based region)

- The horizontal areas should be designed on moment in x-direction and the vertical areas on moment in y-direction.
- The user will recognize the area and the spans in each area.



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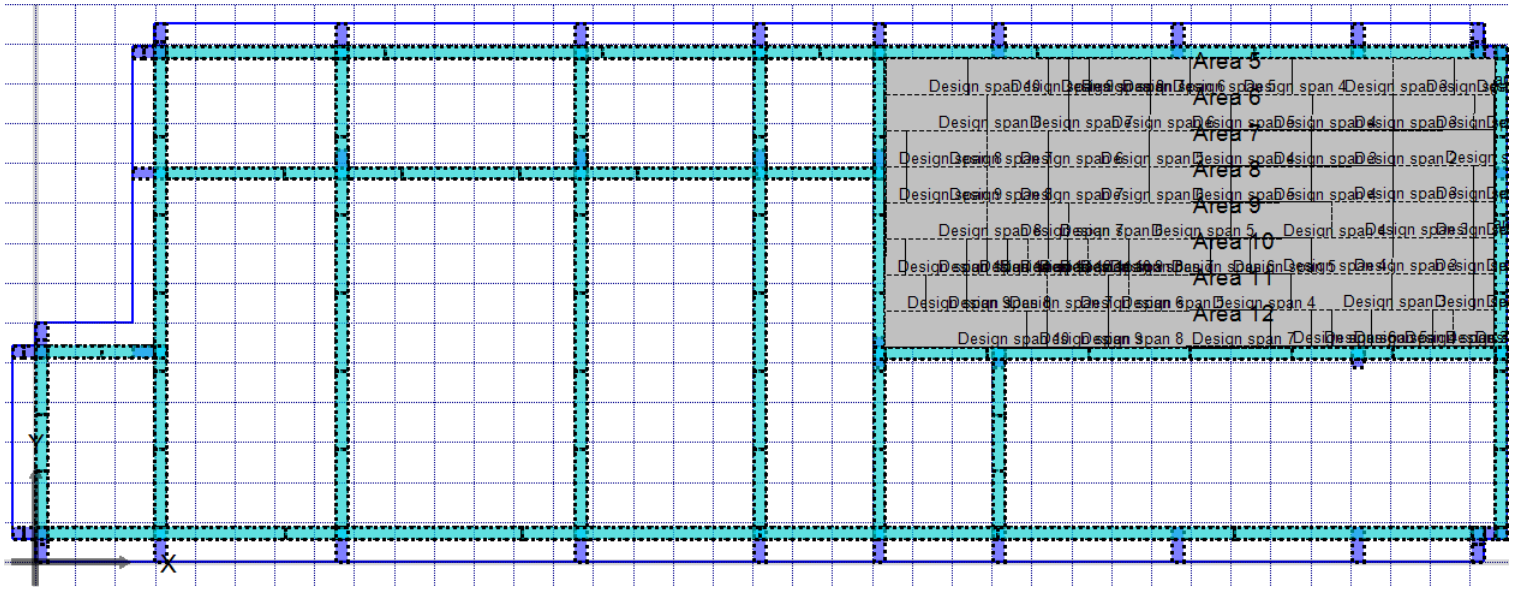

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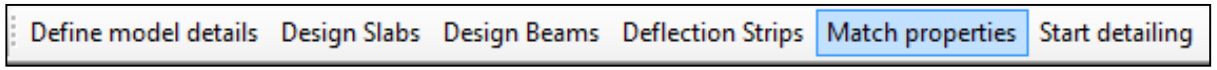
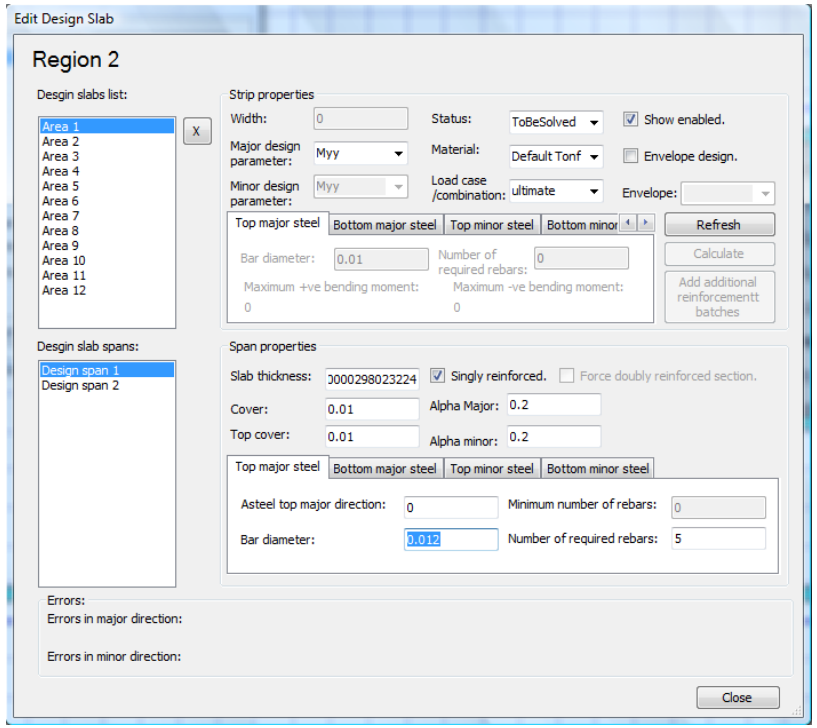
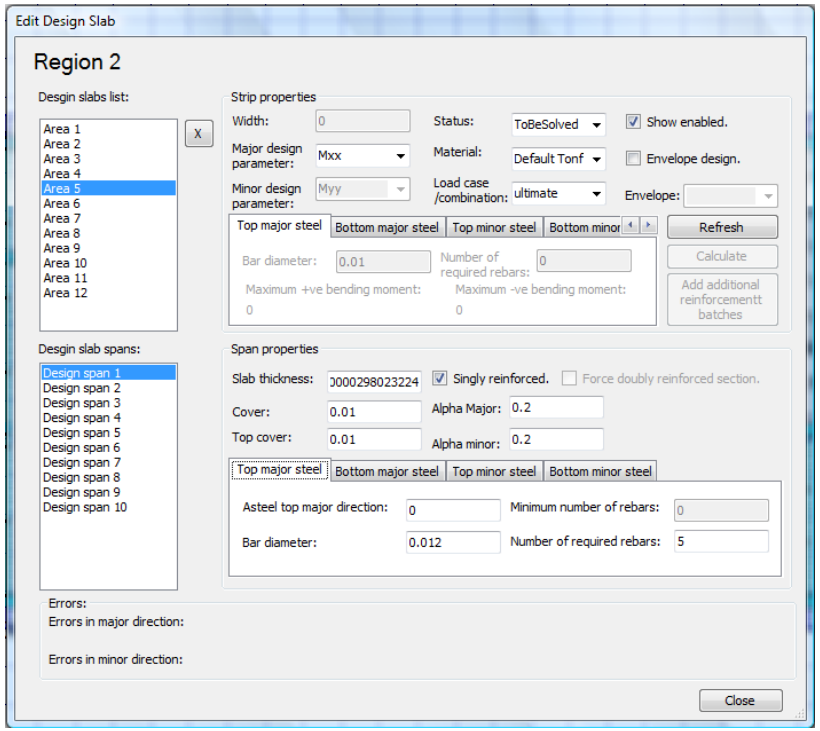
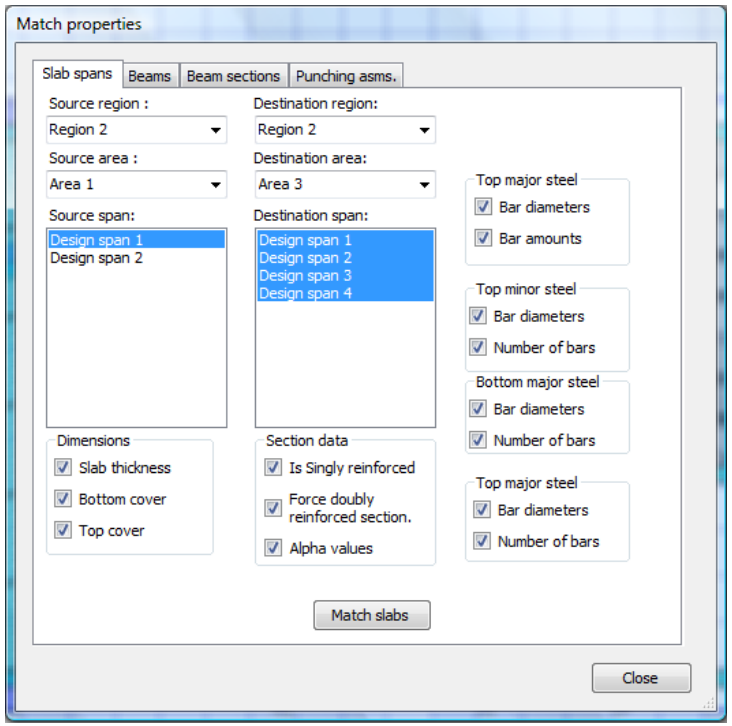
2.4.3. Design from PLDesign directly (strip based region)

- Edit one Span in one area then match the properties for all spans.
- The user match properties twice one for areas in y-direction and the other of the spans in x-directions, then he has to check the sections before starting slab design.









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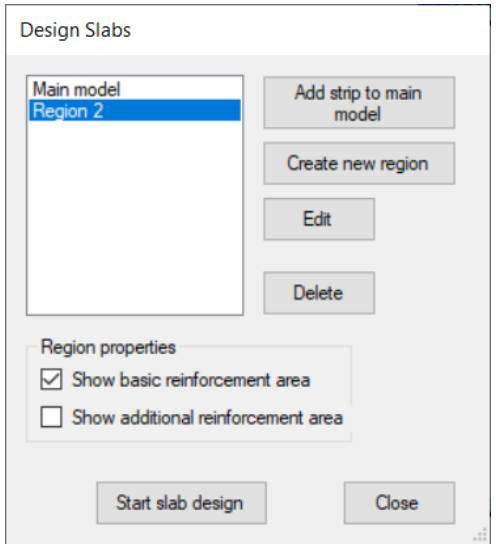
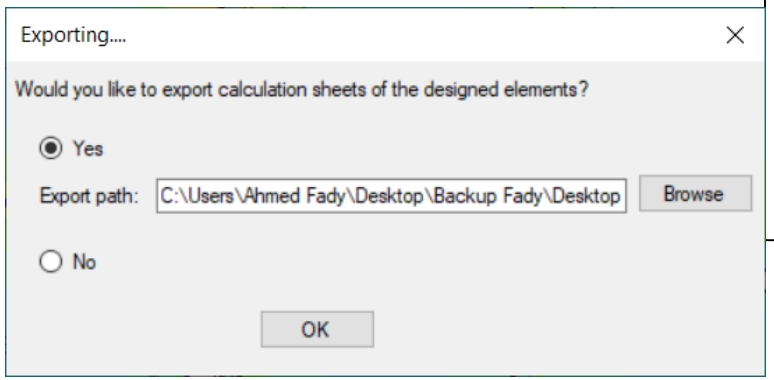
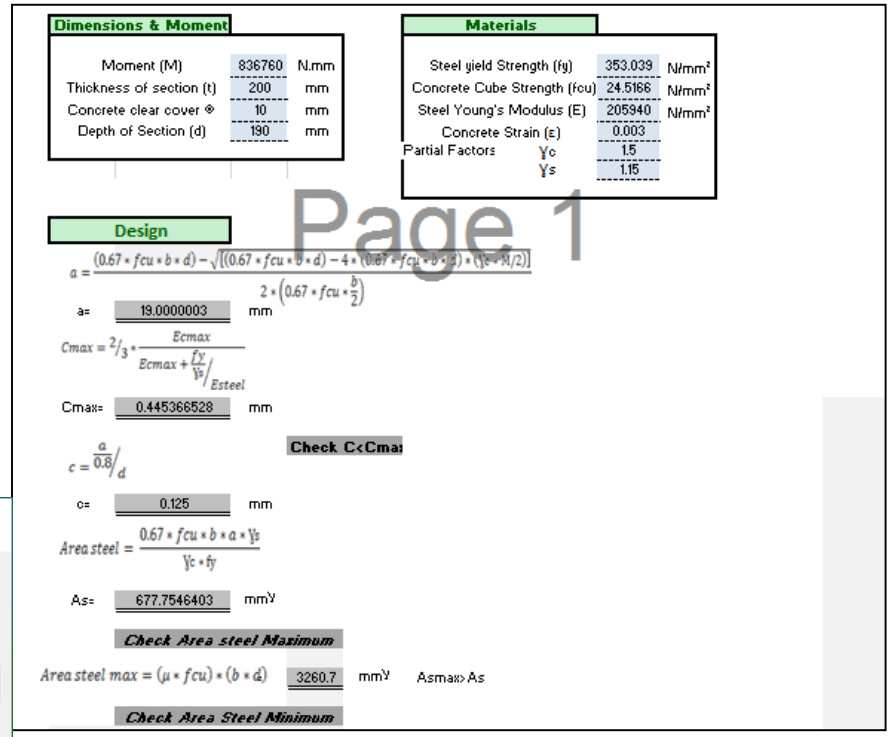
2.4.3. Design from PLDesign directly (strip based region)

- Before starting slab design, the user should check mark on show direction 2 areas.







Page 1

Area 5	Mxx	Design span 1	5 Φ 0.012	6 Φ 0.012	5 Φ 0.012	6 Φ 0.012
		Design span 2	5 Φ 0.012	6 Φ 0.012	5 Φ 0.012	6 Φ 0.012
		Design span 3	6 Φ 0.012	5 Φ 0.012	6 Φ 0.012	5 Φ 0.012
		Design span 4	5 Φ 0.012	6 Φ 0.012	5 Φ 0.012	6 Φ 0.012
		Design span 5	7 Φ 0.012	5 Φ 0.012	5 Φ 0.012	6 Φ 0.012
		Design span 6	5 Φ 0.012	7 Φ 0.012	5 Φ 0.012	6 Φ 0.012
		Design span 7	5 Φ 0.012	6 Φ 0.012	6 Φ 0.012	5 Φ 0.012
		Design span 8	6 Φ 0.012	5 Φ 0.012	6 Φ 0.012	5 Φ 0.012
		Design span 9	6 Φ 0.012	5 Φ 0.012	6 Φ 0.012	5 Φ 0.012
		Design span 10	6 Φ 0.012	5 Φ 0.012	5 Φ 0.012	6 Φ 0.012
Area 6	Mxx	Design span 1	6 Φ 0.012	5 Φ 0.012	6 Φ 0.012	5 Φ 0.012
		Design span 2	5 Φ 0.012	6 Φ 0.012	5 Φ 0.012	6 Φ 0.012
		Design span 3	6 Φ 0.012	5 Φ 0.012	5 Φ 0.012	6 Φ 0.012
		Design span 4	5 Φ 0.012	6 Φ 0.012	5 Φ 0.012	6 Φ 0.012
		Design span 5	6 Φ 0.012	5 Φ 0.012	5 Φ 0.012	6 Φ 0.012
		Design span 6	5 Φ 0.012	6 Φ 0.012	6 Φ 0.012	5 Φ 0.012
		Design span 7	6 Φ 0.012	5 Φ 0.012	6 Φ 0.012	5 Φ 0.012
		Design span 8	5 Φ 0.012	6 Φ 0.012	5 Φ 0.012	6 Φ 0.012

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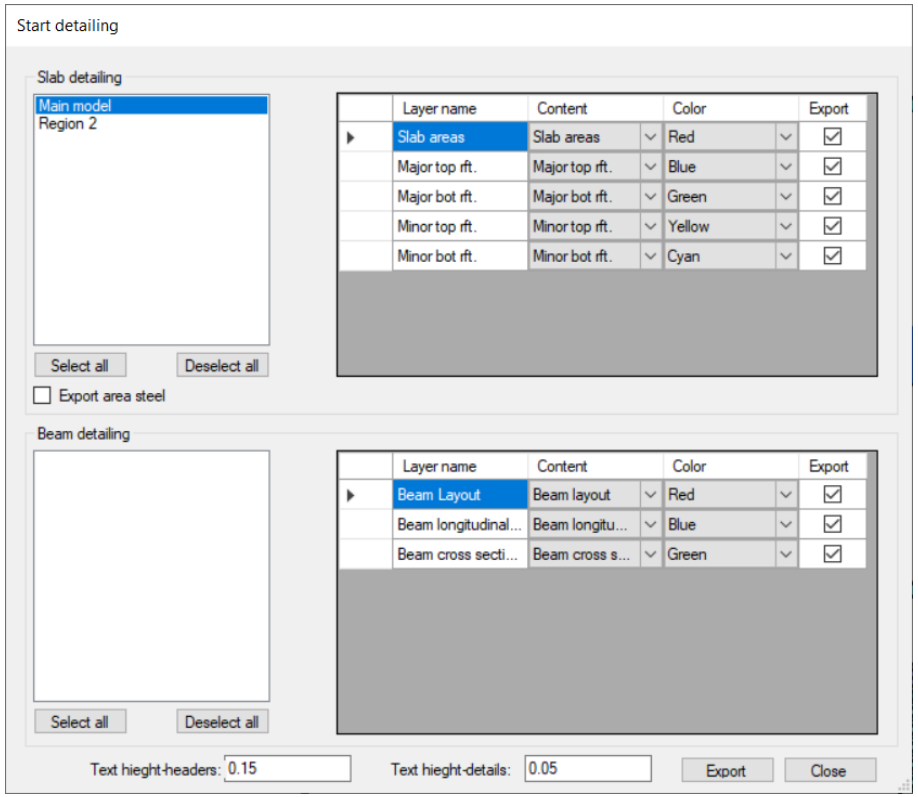
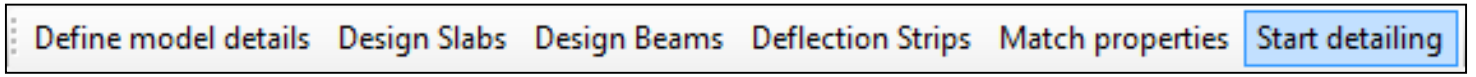
2.4.3. Design from PLDesign directly (strip based region)

- One of PLDesign advantages is the detailing where the user after finishing the design, he can see slab detailing.
- The user will have (.Dxf) file, the file contain two drawings one for horizontal areas and the other for vertical areas.





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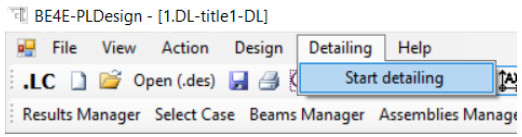

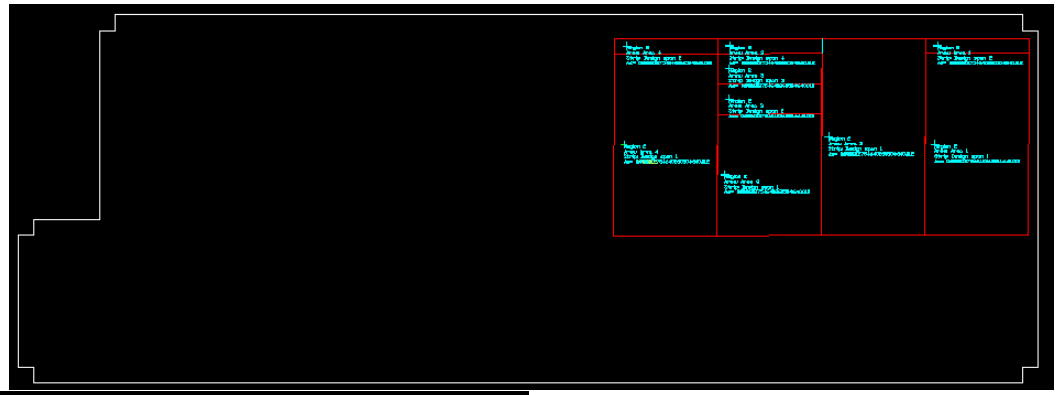

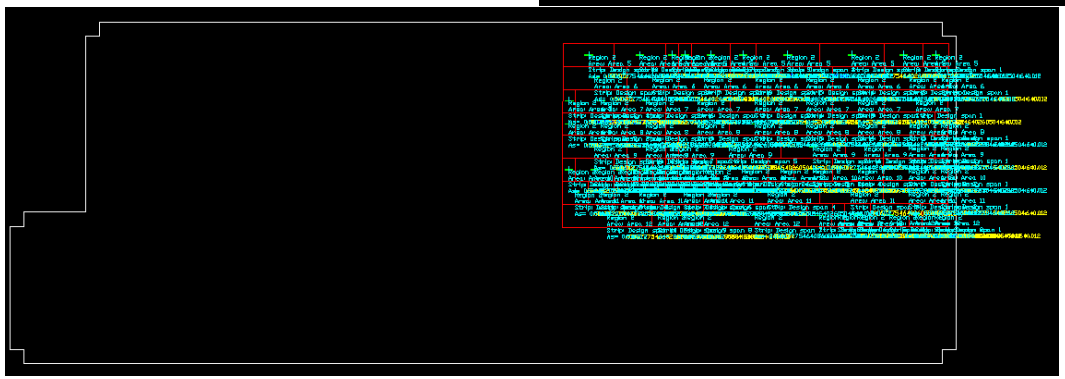

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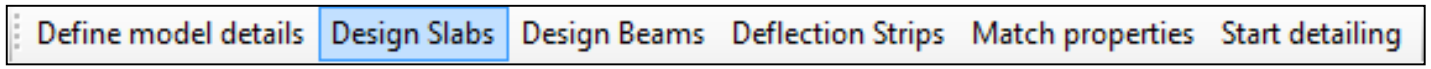
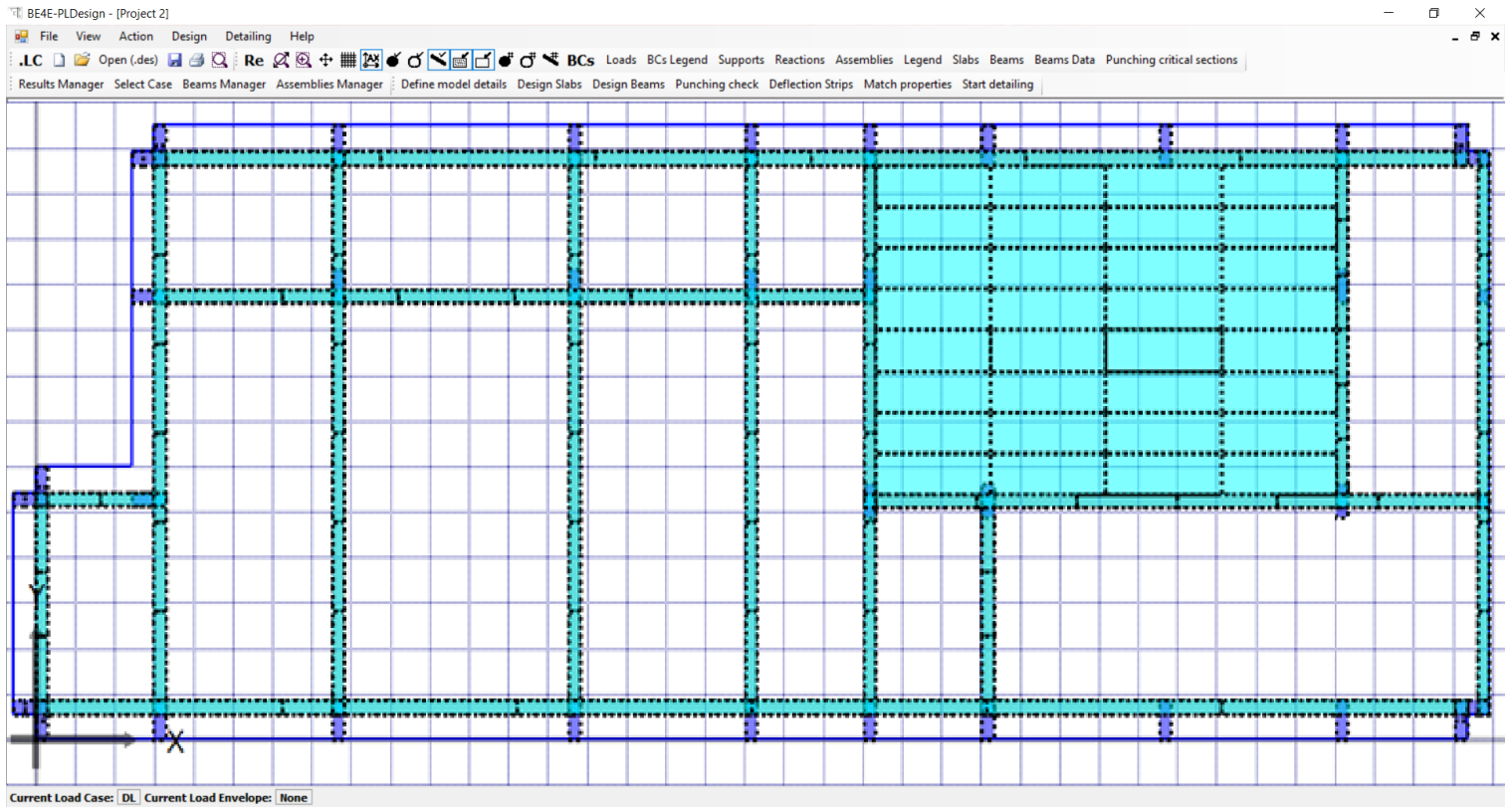
BOUNDARY ELEMENTS FOR ENGINEERS

2.4.4 Design from PLDesign directly (basic and additional RFT)

- This method is very famous in flat slabs and can be shown very simply.





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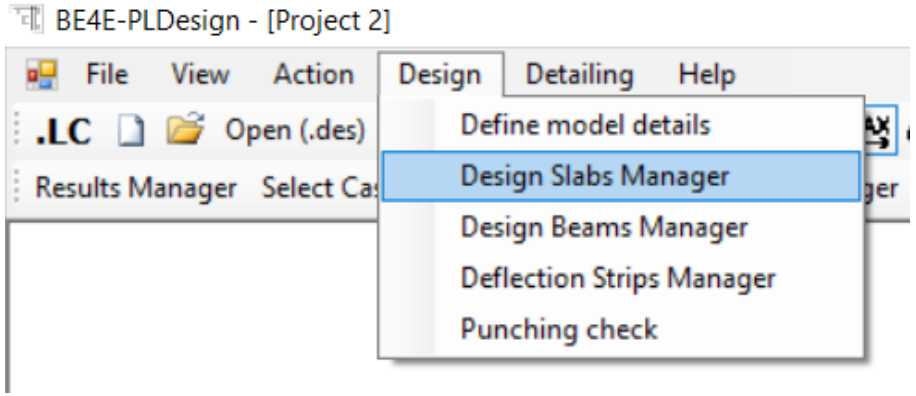

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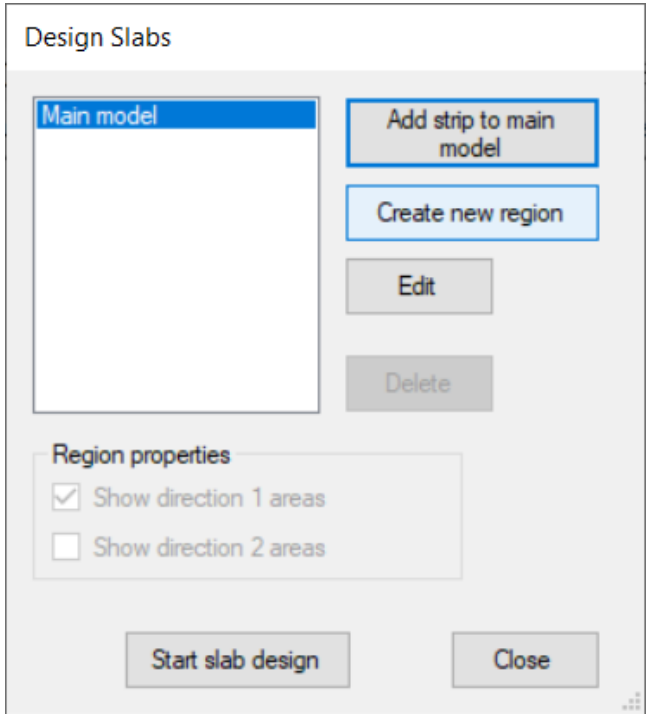
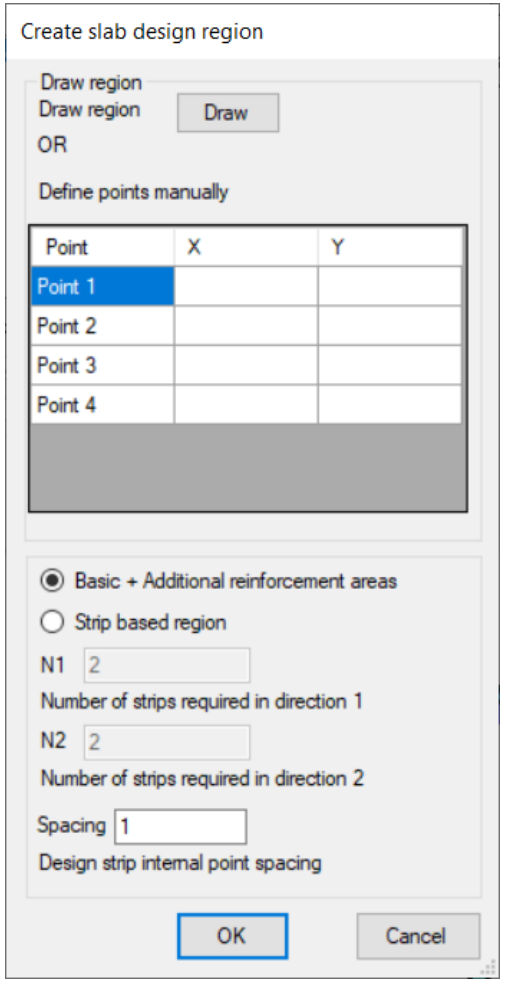
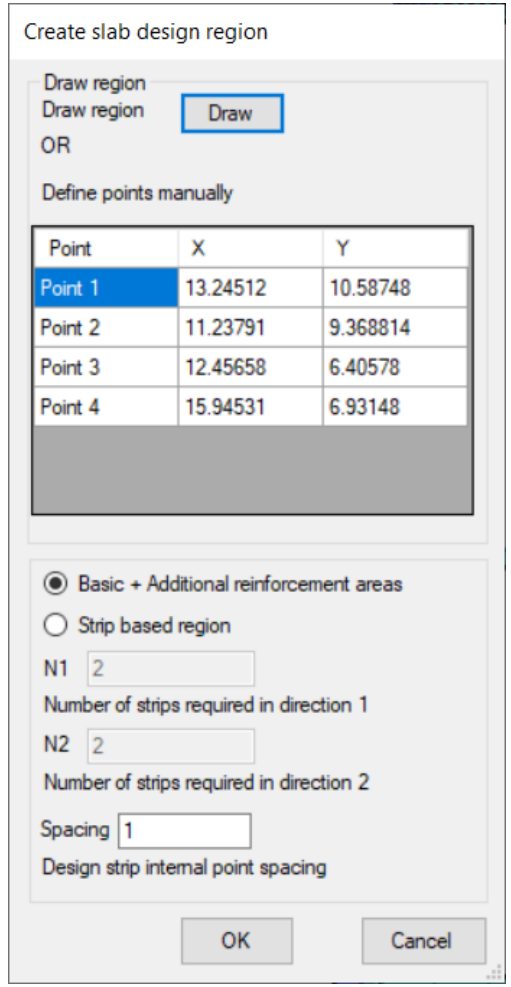
2.4.4 Design from PLDesign directly (basic and additional RFT)

- We are also going to use Create new region.
- The user should draw the area needed to be designed by Draw tab, then select the spacing for the analysis.







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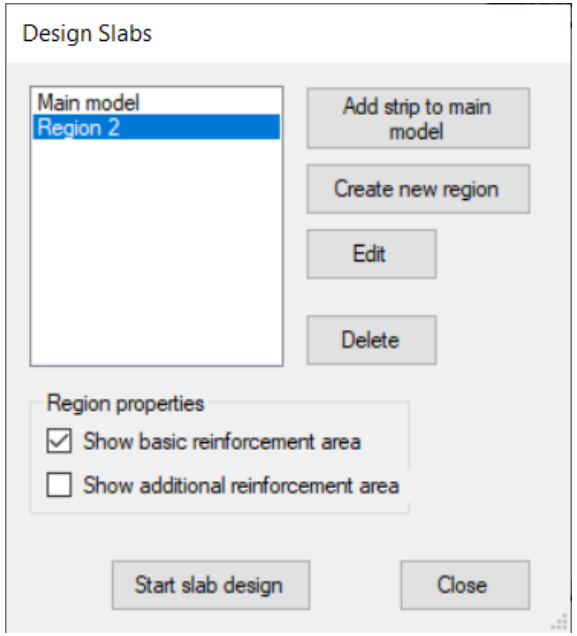
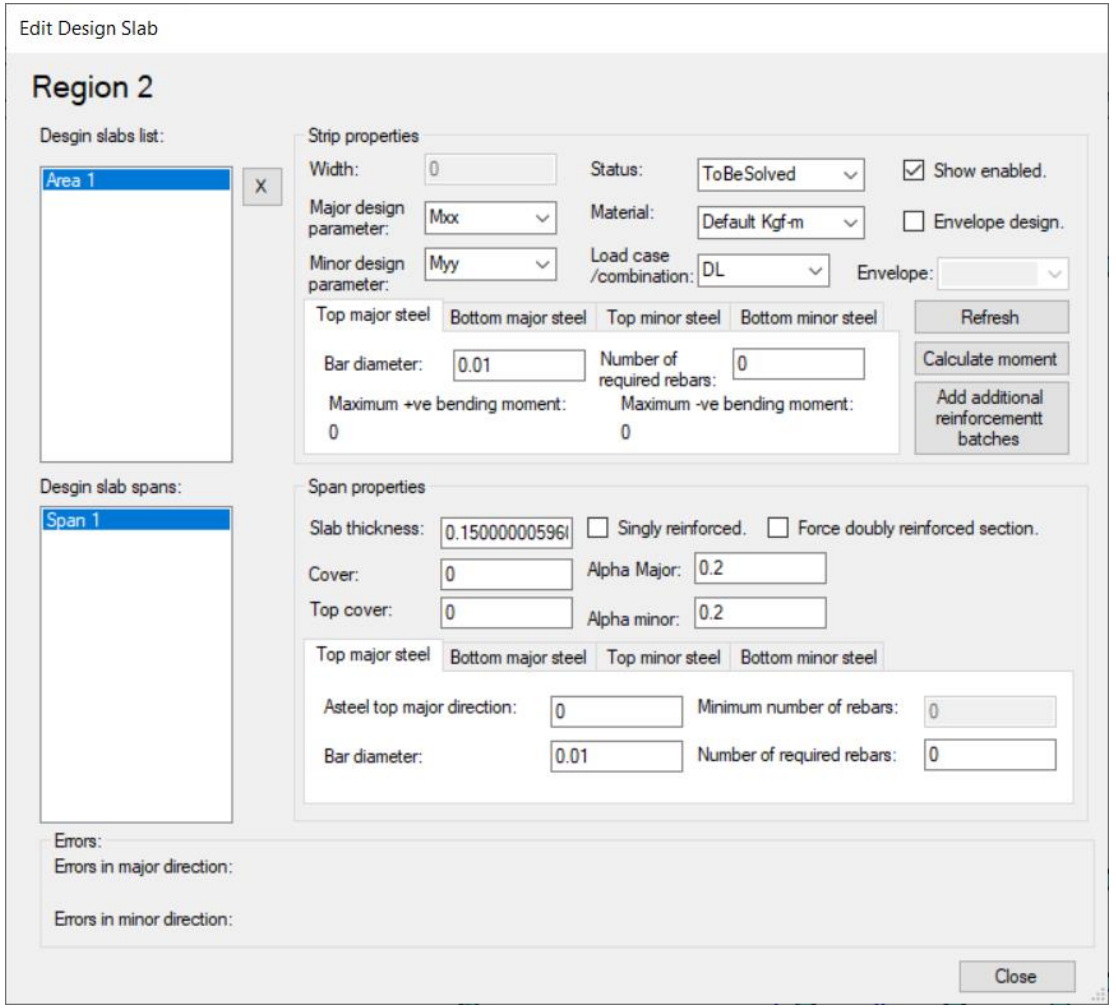
2.4.4 Design from PLDesign directly (basic and additional RFT)

- The PLDesign starts the analysis similarly as PLPost.
- Press on Design slab manager to see that a new region has been created.
- Go to Edit slab design to see that the slab is one area.
- The upper section of strip properties is for the basic reinforcement and the lower is for additional reinforcement.





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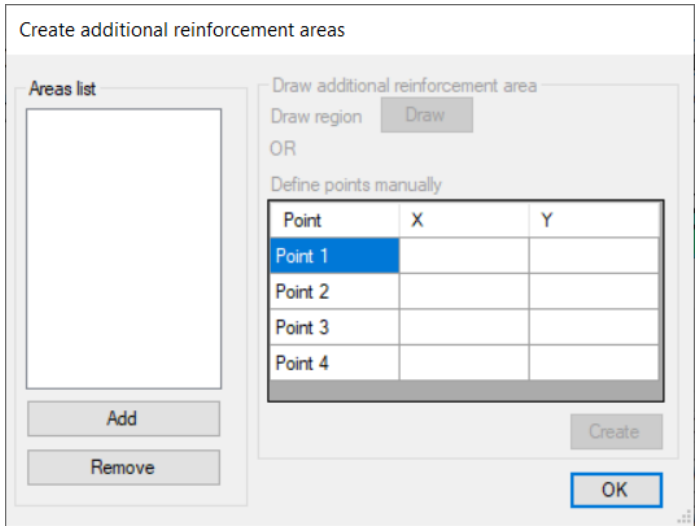
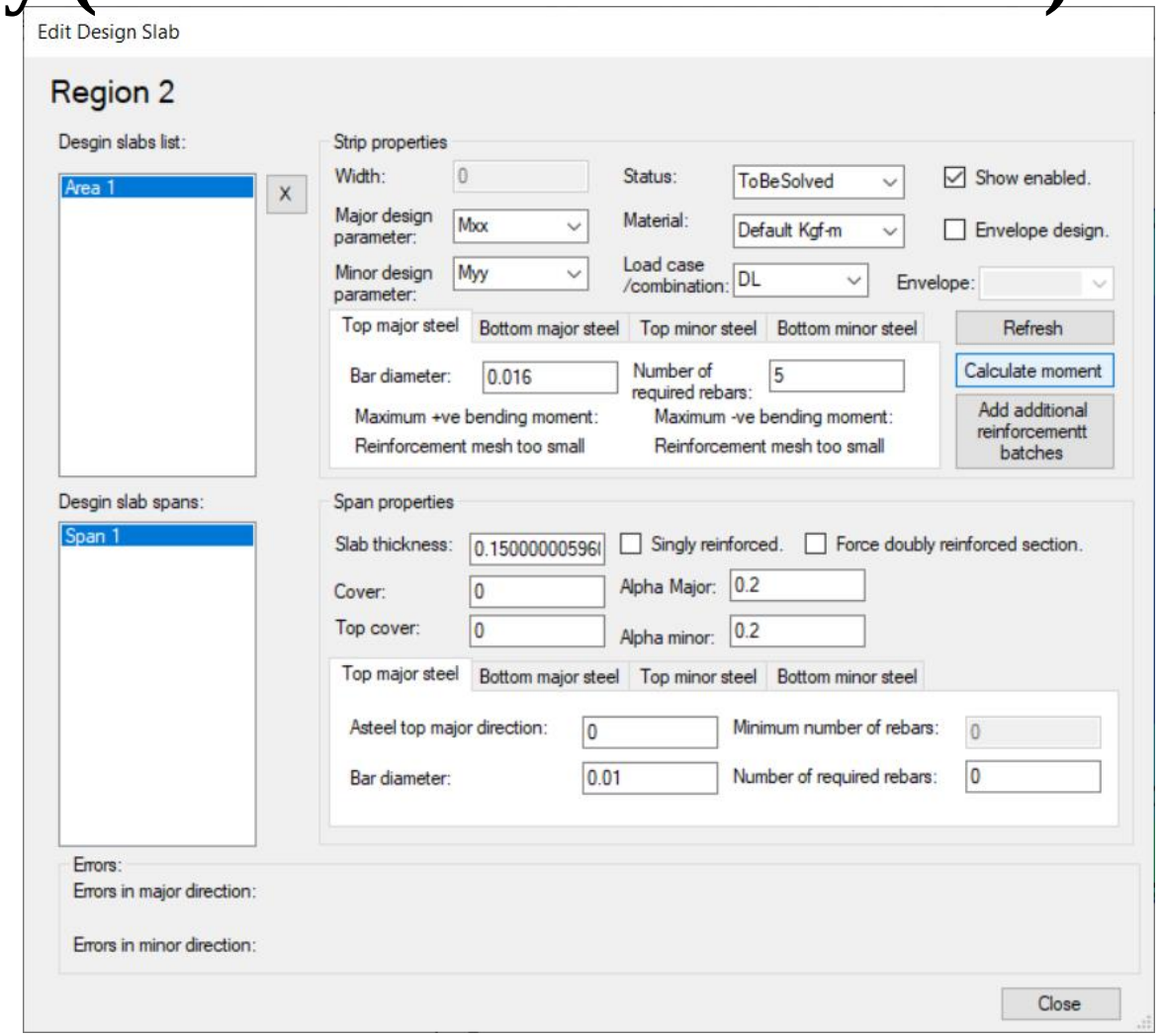
2.4.4 Design from PLDesign directly (basic and additional RFT)

- The user has to insert the major/minor design parameter, Load case/combination, material units, Bar diameter and number of bars, then press calculate and refresh.
- The PLDesign calculate the maximum +ve and –ve moments.
- Click on add additional reinforcement batches to show areas for additional reinforcement.
- Press on add additional areas then draw to show parts of slab need additional reinforcement.





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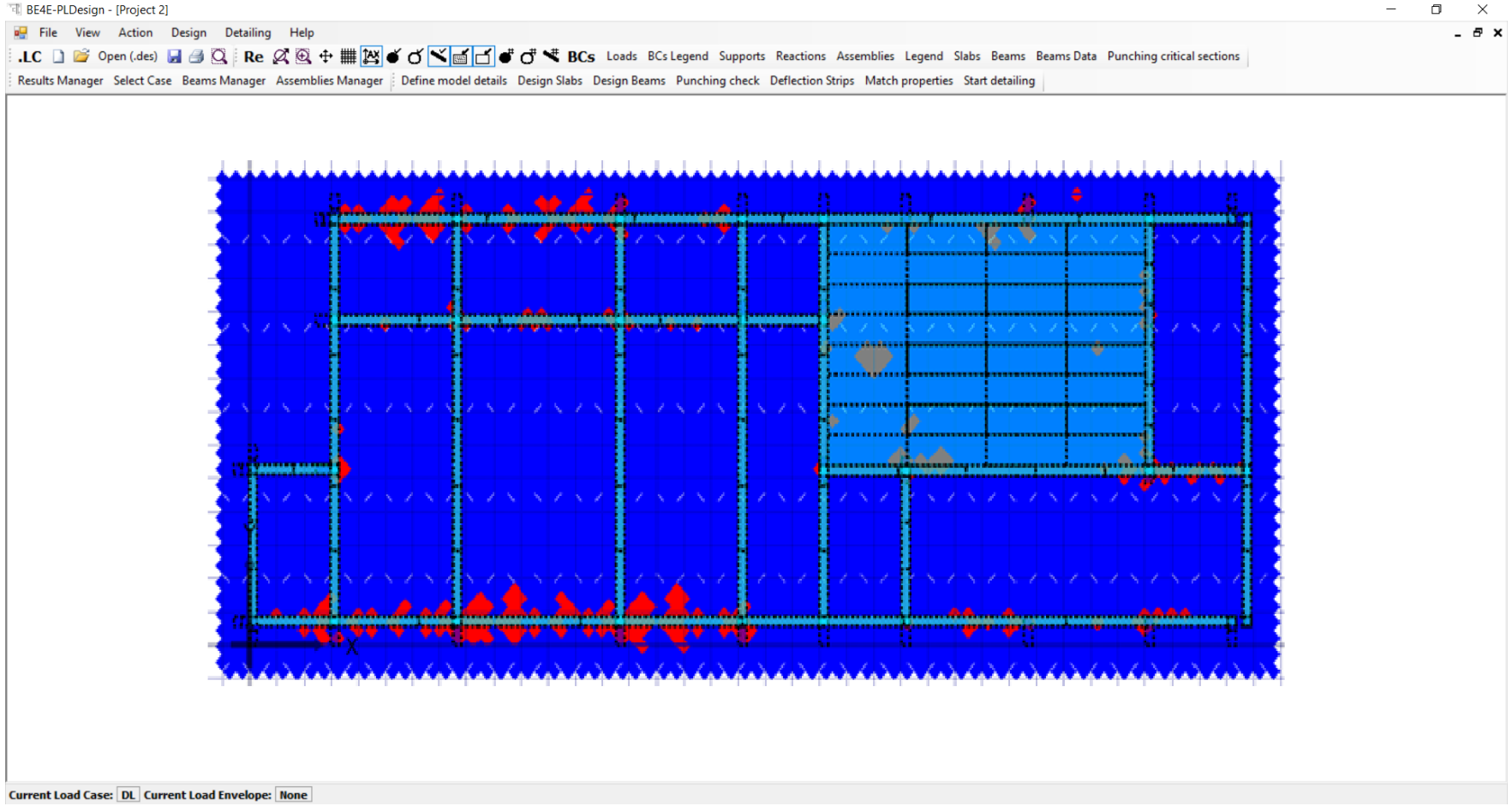
2.4.4 Design from PLDesign directly (basic and additional RFT)

- The blue area is safe for the basic reinforcement, but the red areas are not safe.



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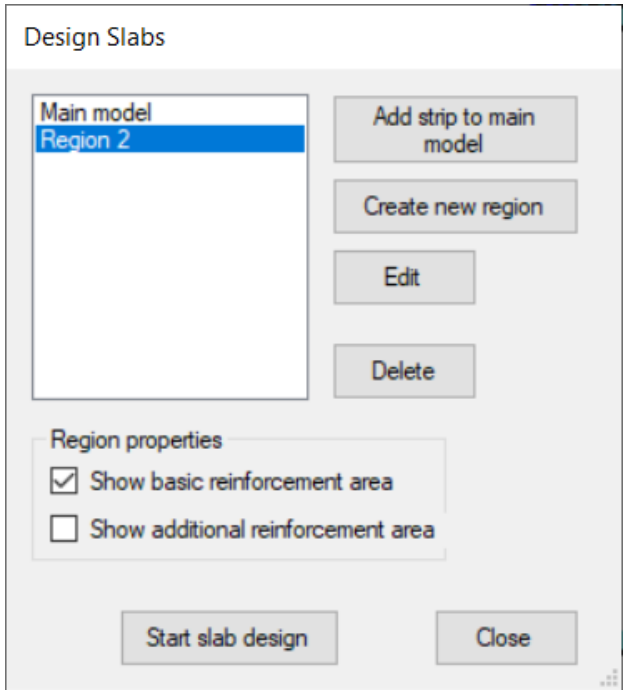
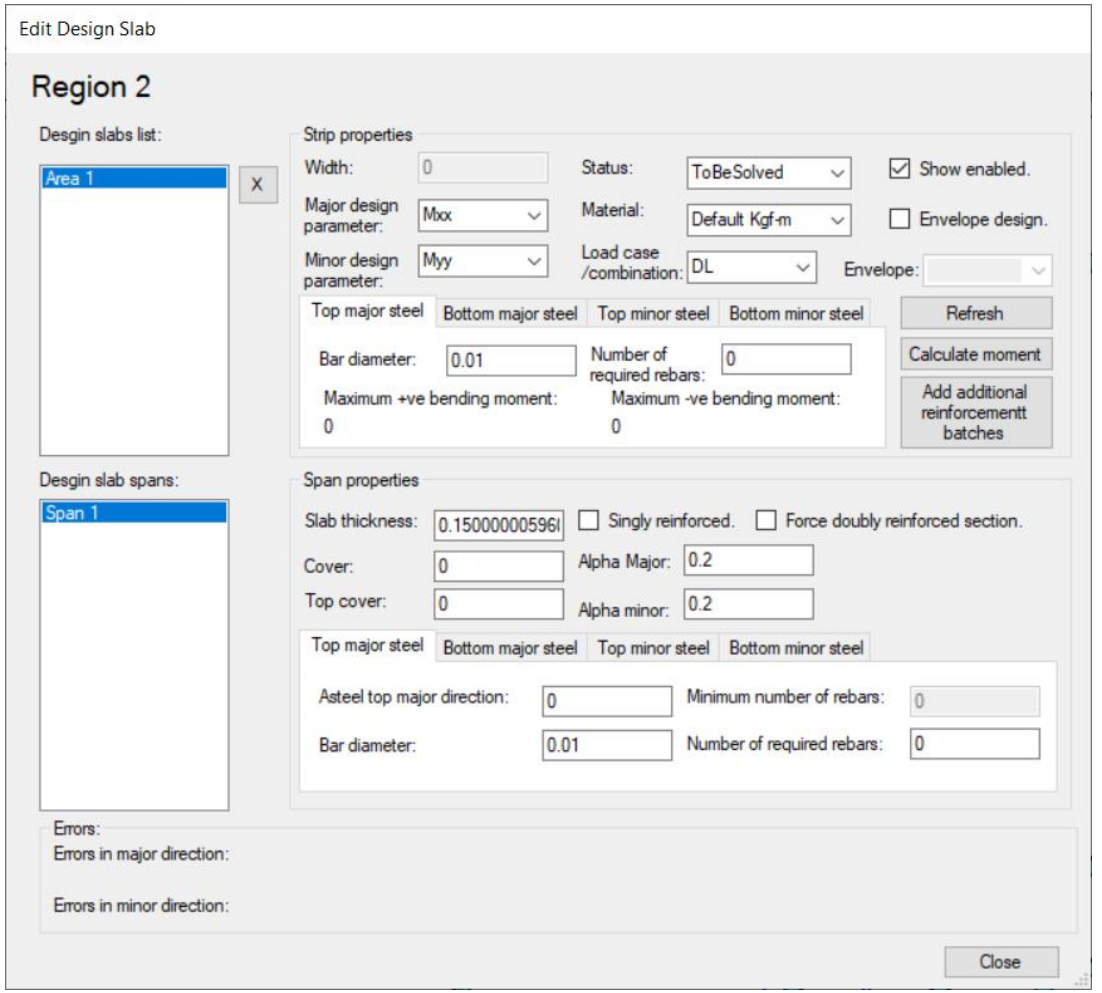
2.4.4 Design from PLDesign directly (basic and additional RFT)

- After drawing the additional areas, the user should select cover, bar diameter and number of required bars in span properties.
- Check the mark box of show additional reinforcement area, then Start slab design.





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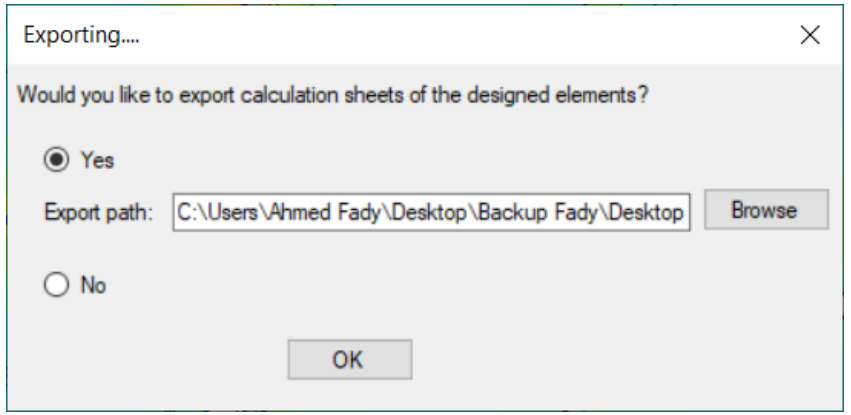
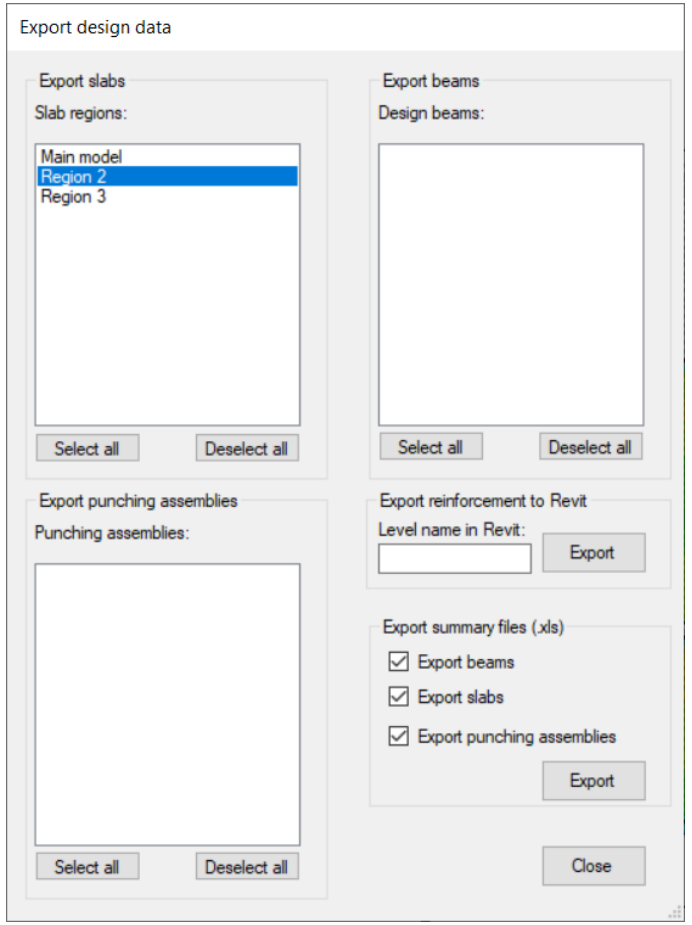
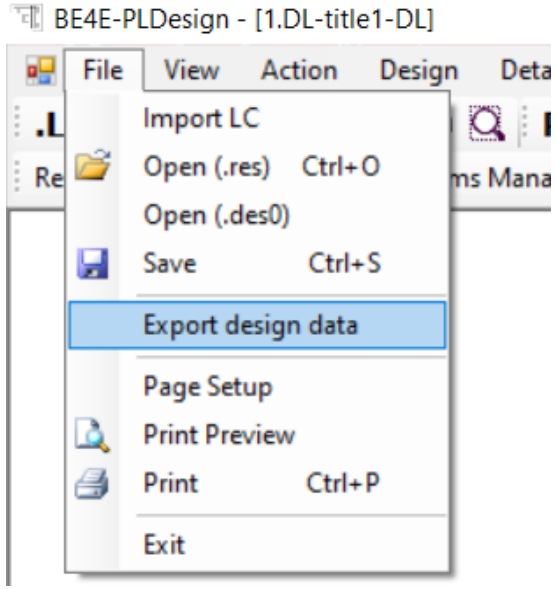
2.4.4 Design from PLDesign directly (basic and additional RFT)

- Export the calculation sheet files, then check the reinforcement and export the data sheet summary.







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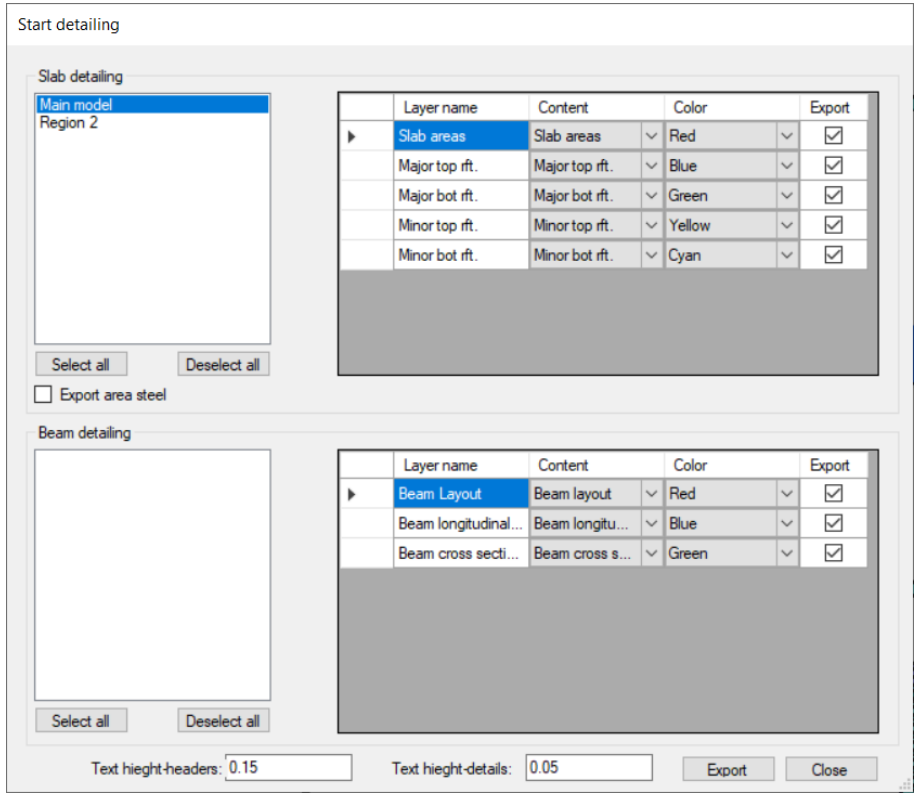
2.4.4 Design from PLDesign directly (basic and additional RFT)

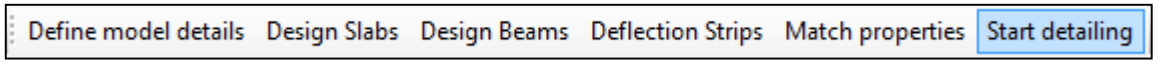
- Now the user can also see slab detailing as strip based region.



PLDESIGN : Slab reinforcement sheet

Company Name:
Project Name:
Designed By:
Reviewed By:
Approved by:

Region name	Area name	Major design moment	Strip name	Top major rft.	Bot. major rft.	Top minor rft.	Bot minor rft.
Region 2	Area 1	Mxx	Span 1	5 Φ 0.016	5 Φ 0.016	**5 Φ 0.016**	5 Φ 0.016



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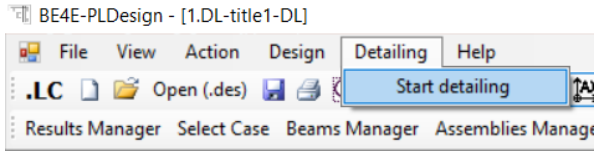

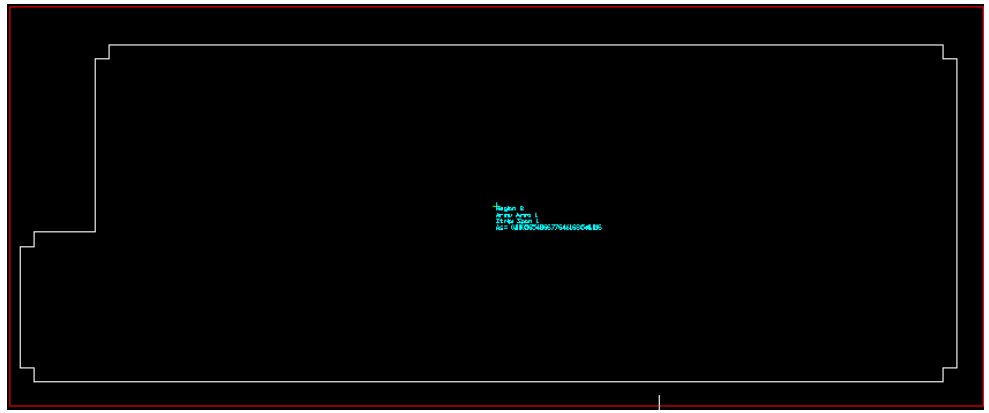

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2. PLDesign Package

2.1. File needed to be exported before using PLDesign ✓

2.2. Starting PLDesign ✓

2.3. Load combinations & load envelopes ✓

2.4. Slab design ✓

2.4.1. Design from PLPost results (strip design) ✓

2.4.2. Design from PLPost results (contour design) ✓

2.4.3. Design from PLDesign directly (strip based region) ✓

2.4.4 Design from PLDesign directly (basic and additional reinforcement) ✓

2.5 Check deflections of slab

2.6 Check punching

2.7 Beam design

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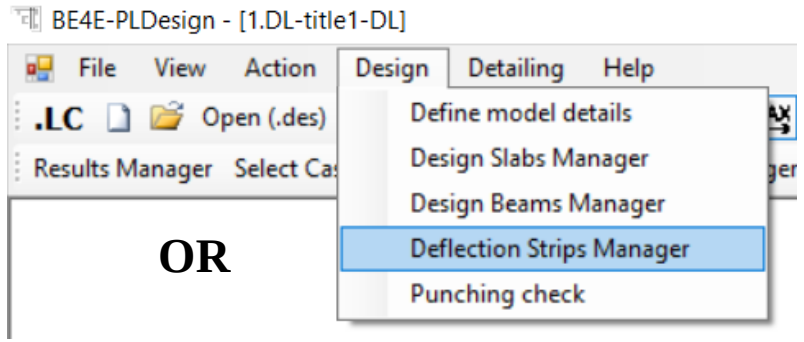
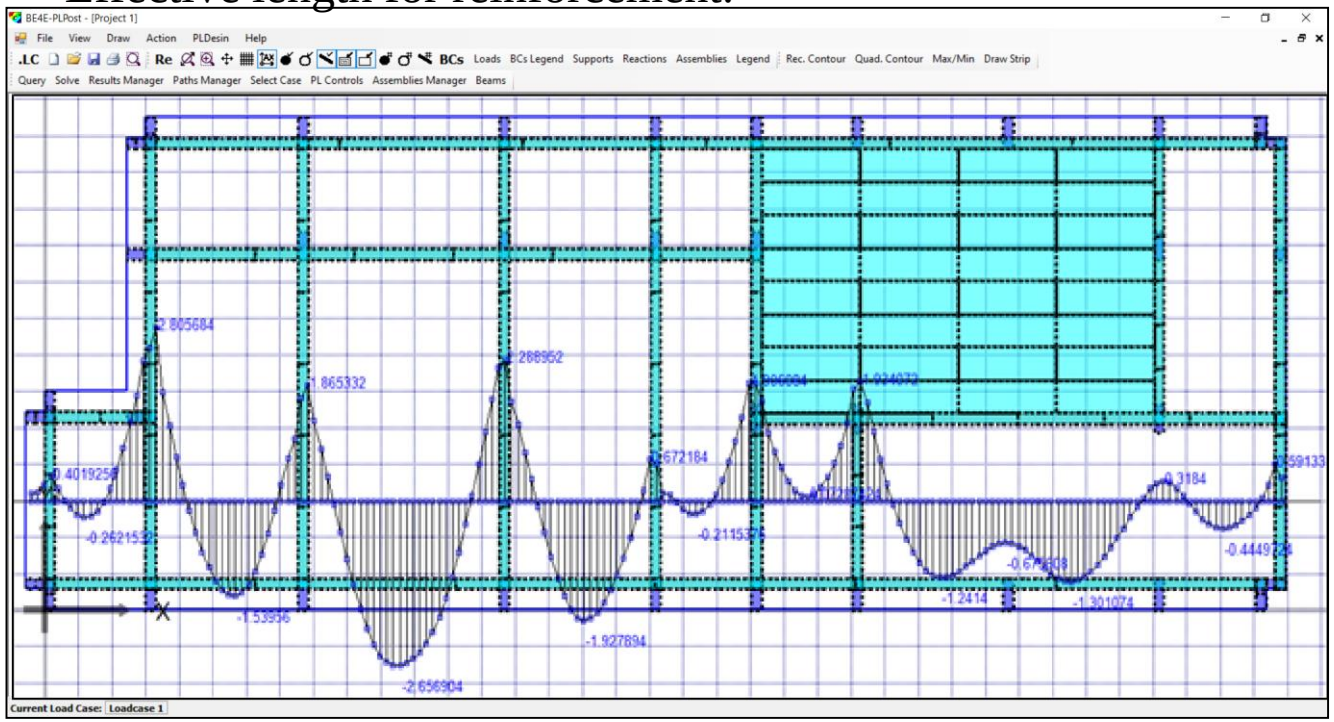
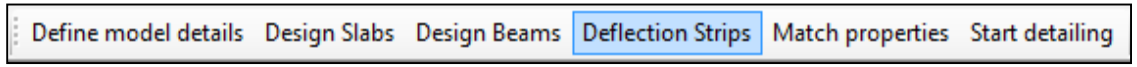
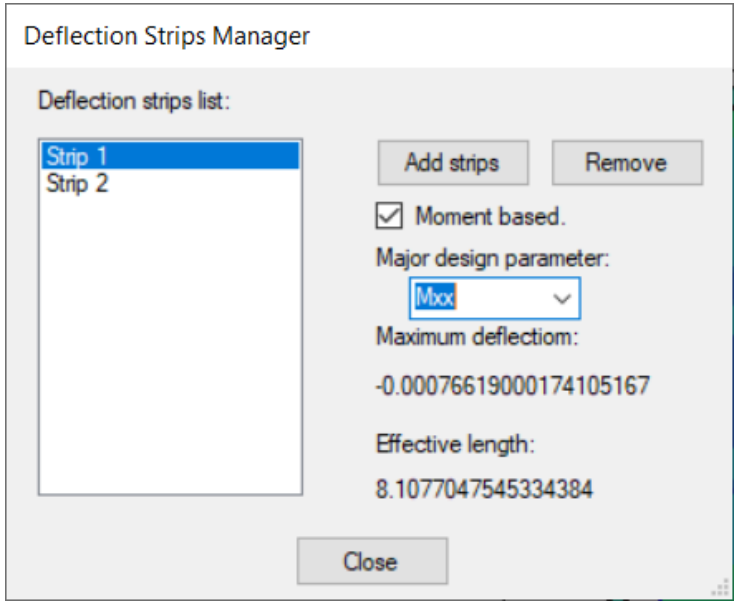
2.5 Check deflections of slab

- The user can check deflection only for striped slab either from PLDesign Directly or import PLPost results.
- Open Slab deflection strip manager then load the strips needed to be checked.
- Choose the Major design parameter to calculate both of Maximum deflection and Effective length for reinforcement.









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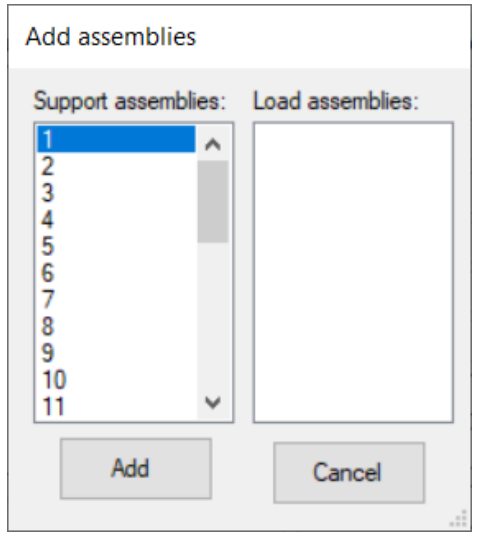
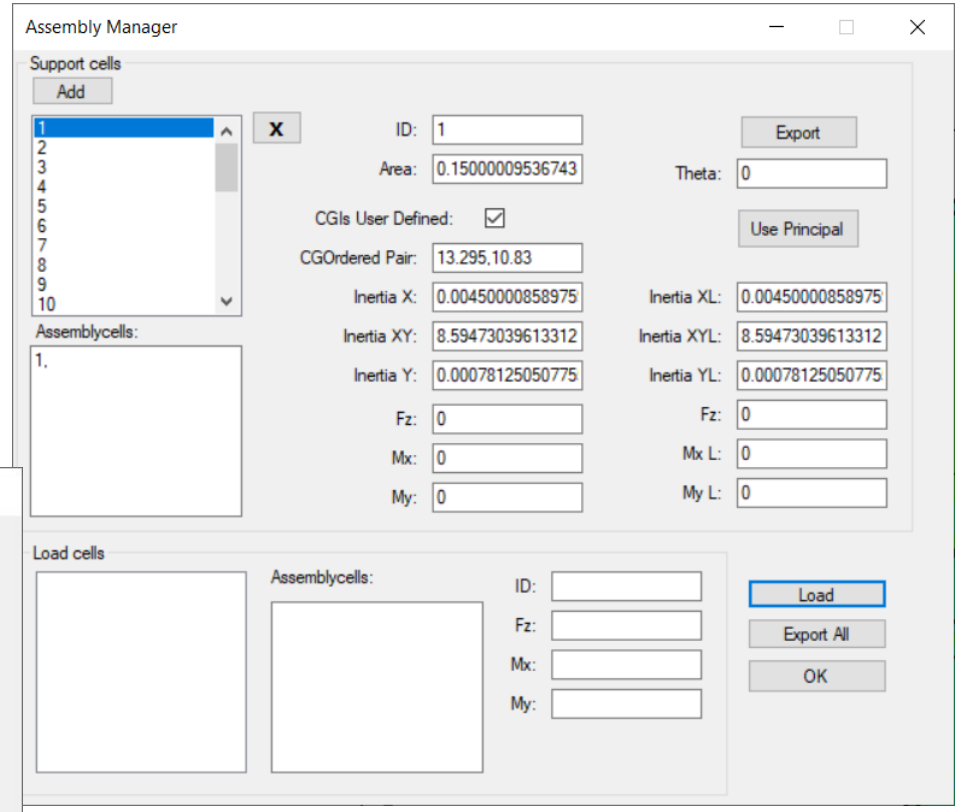
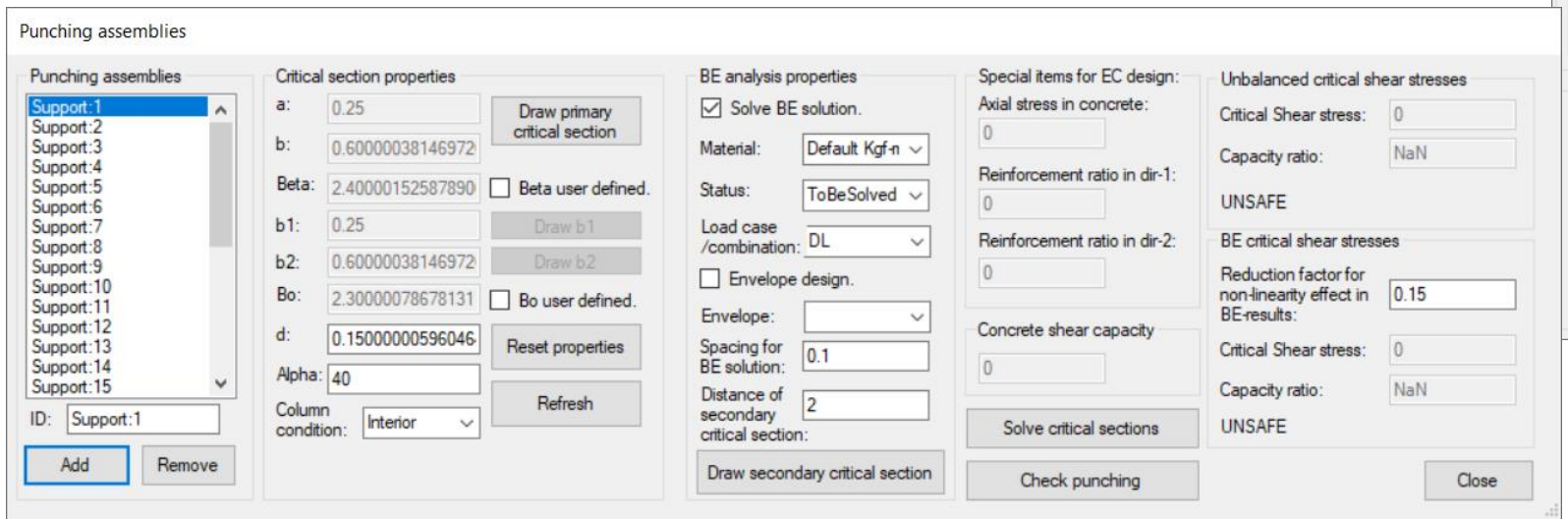
2.6 Check punching

- The user can check punching for column.
- Open assemblies manager and load .asm file.
- Add the required assemblies to be checked.
- Solve critical sections.
- Check punching.







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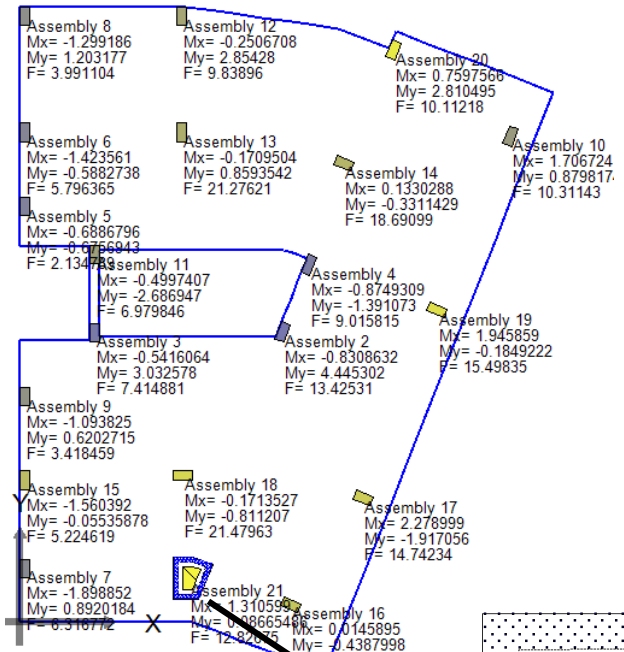
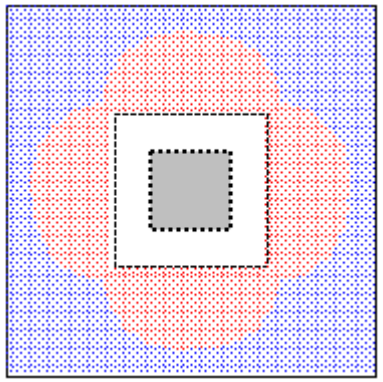
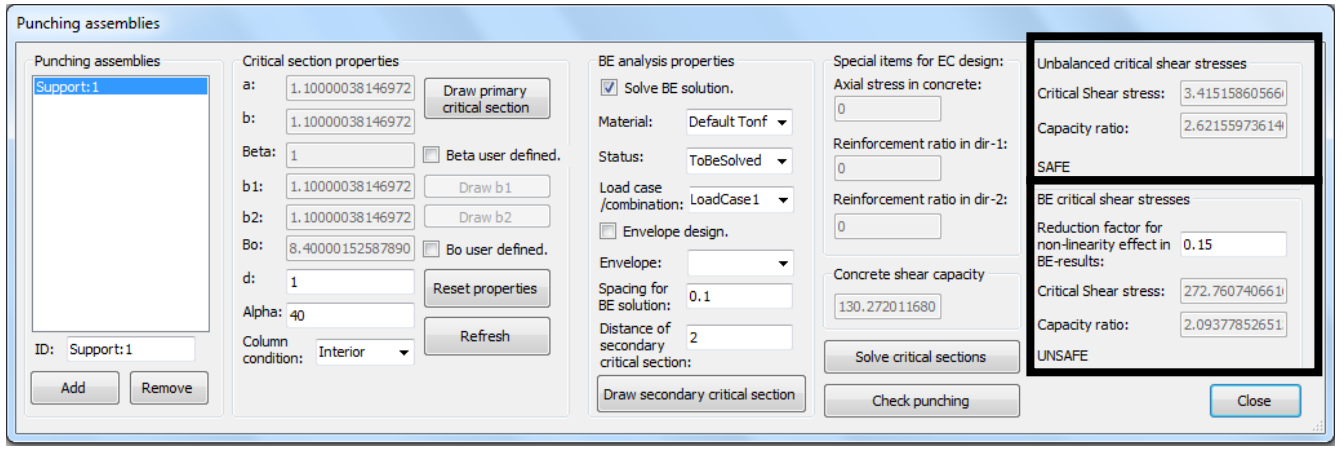
2.6 Check punching

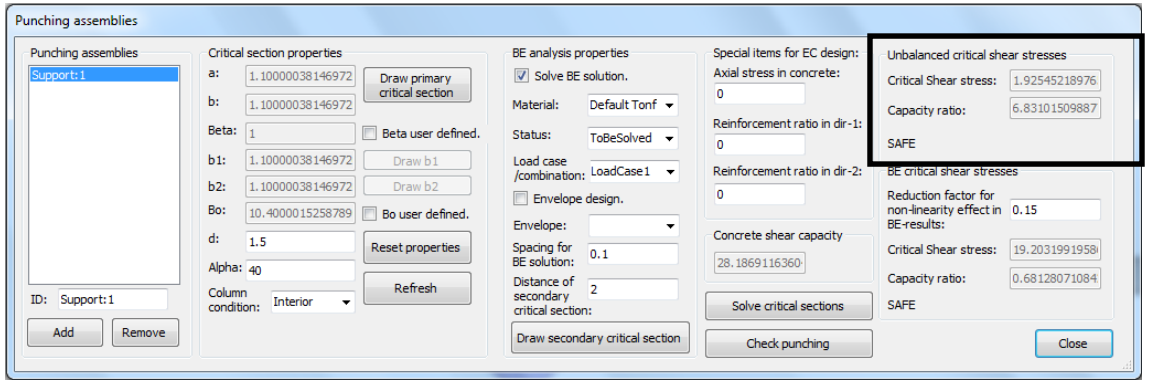


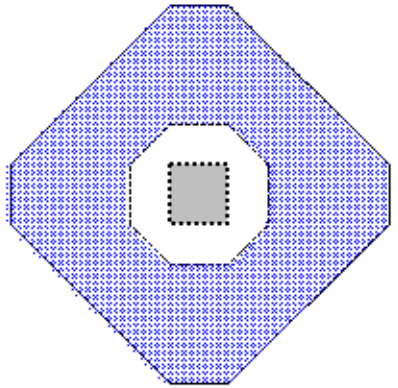


Punching Check According to ECP 2003 and ACI



Punching Check According to EC





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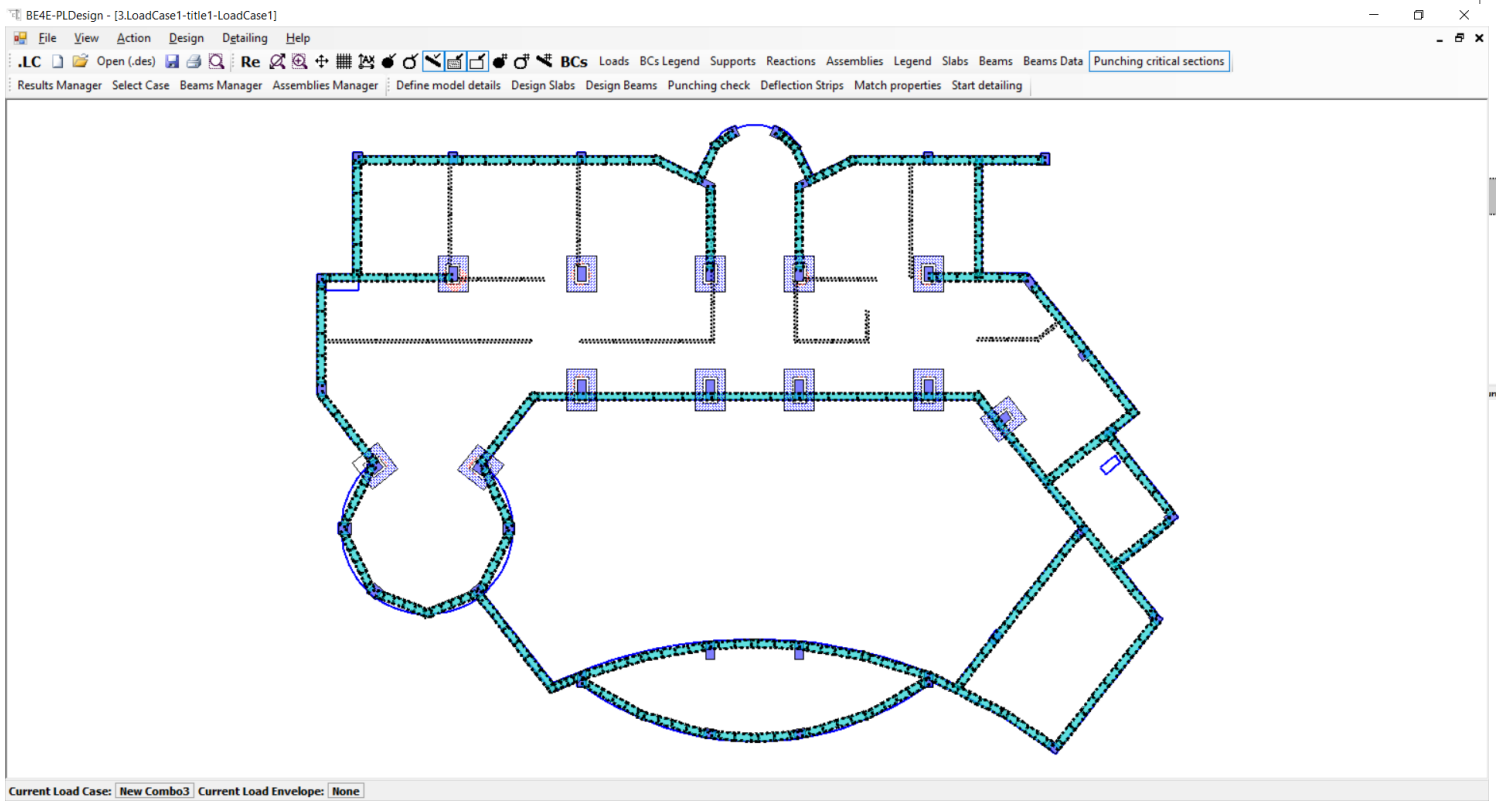
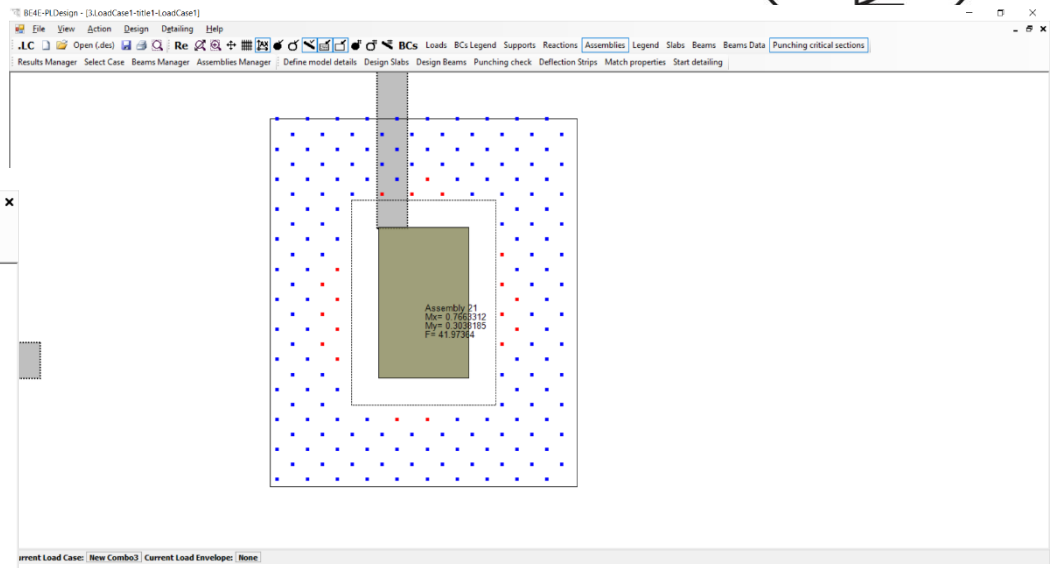
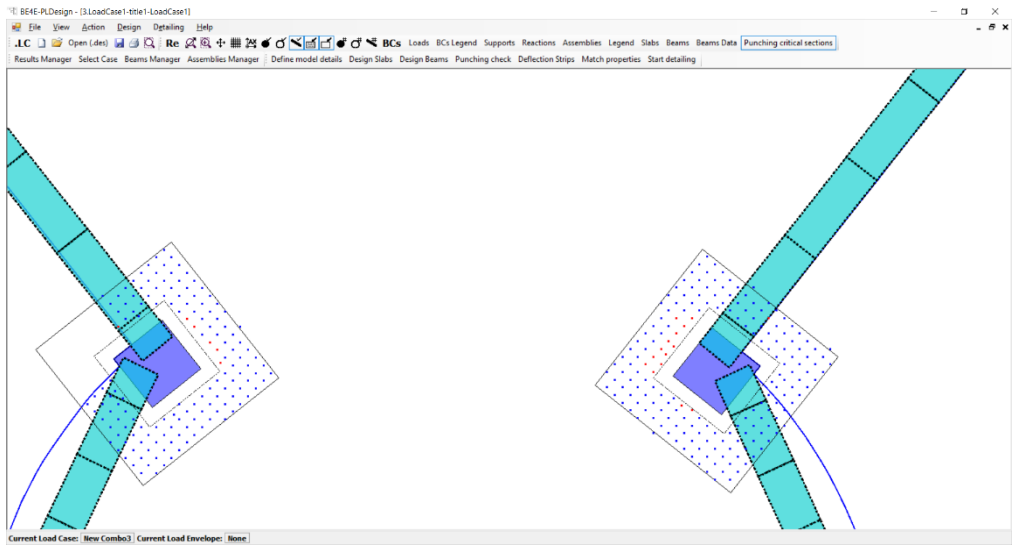
2.6 Check punching







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2.4.3. Design from PLDesign directly (strip based region) ✓

2.4.4 Design from PLDesign directly (basic and additional reinforcement) ✓

2.5 Check deflections of slab ✓

2.6 Check punching ✓

2.7 Beam design

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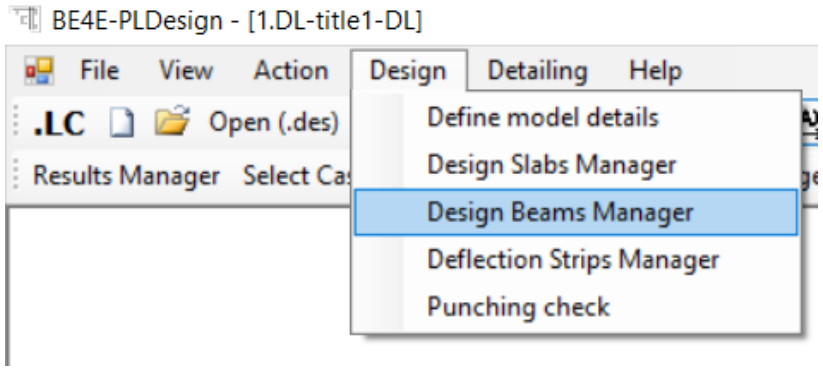
2.7 Beam design

- In PLDesign the user can design or check design on beam reinforcement.
- But the user should export beam assemblies from Gen file to read beam geometry.
- Open PLDesign Manager then load beam data (.basm) to read beams geometry.
- Now the user should define the design regions in beams.



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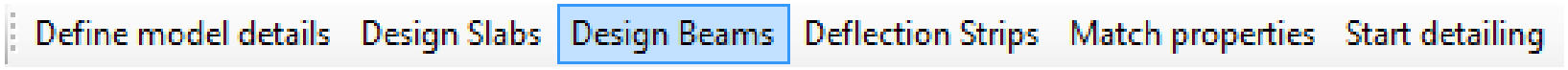
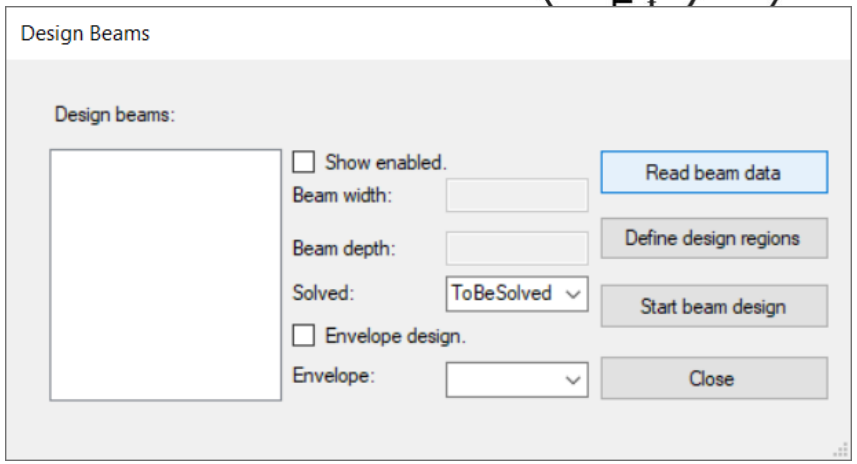
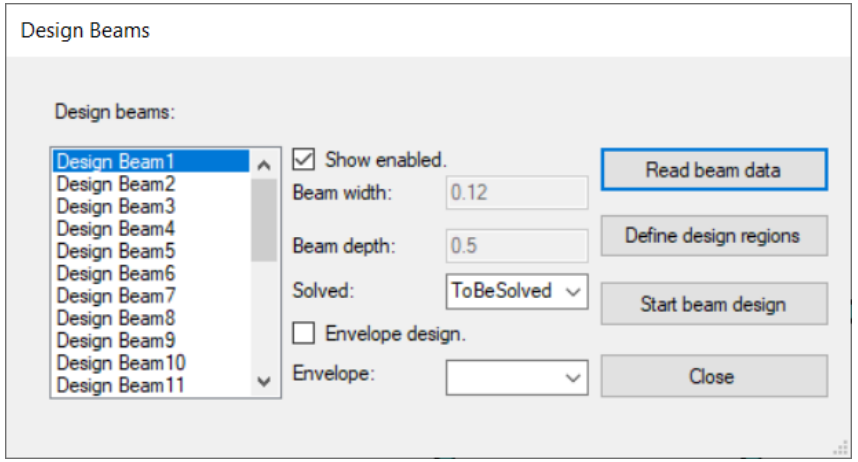




Before loading beam assembly file.



After loading beam assembly file.

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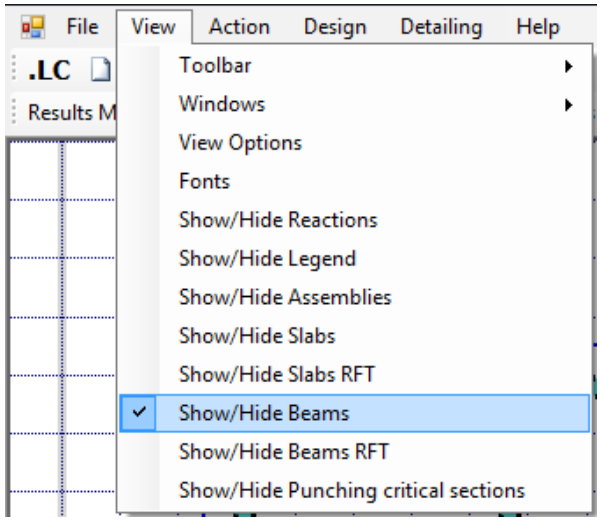
2.7 Beam design

- Open Define design region to show the design beam section.
- The user will notice that the design beam is divided into two parts, the first part is for the beam breaks (supports) and the other is for beam sections.
- Where is the beam that the user design?



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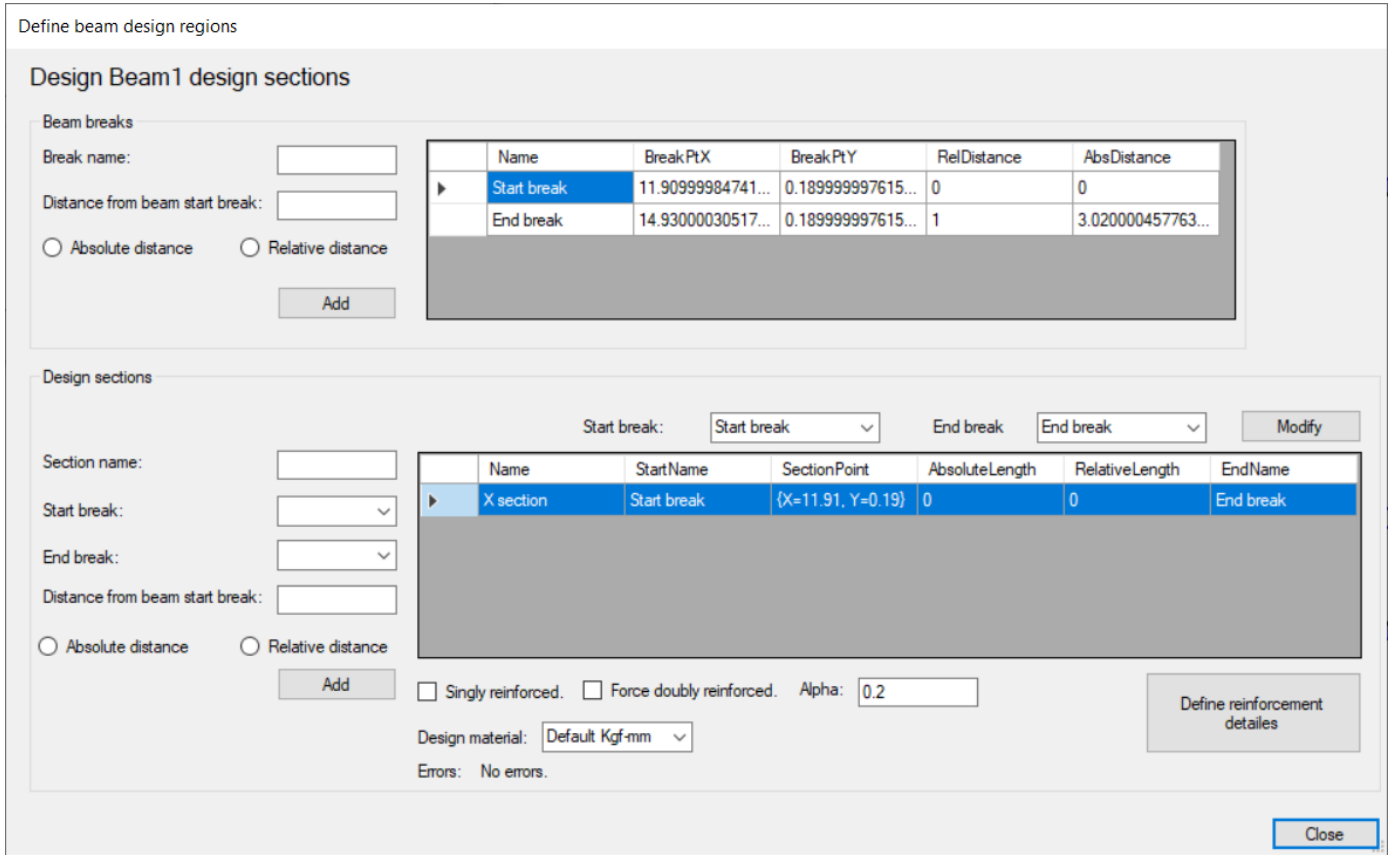

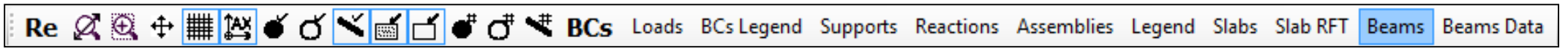

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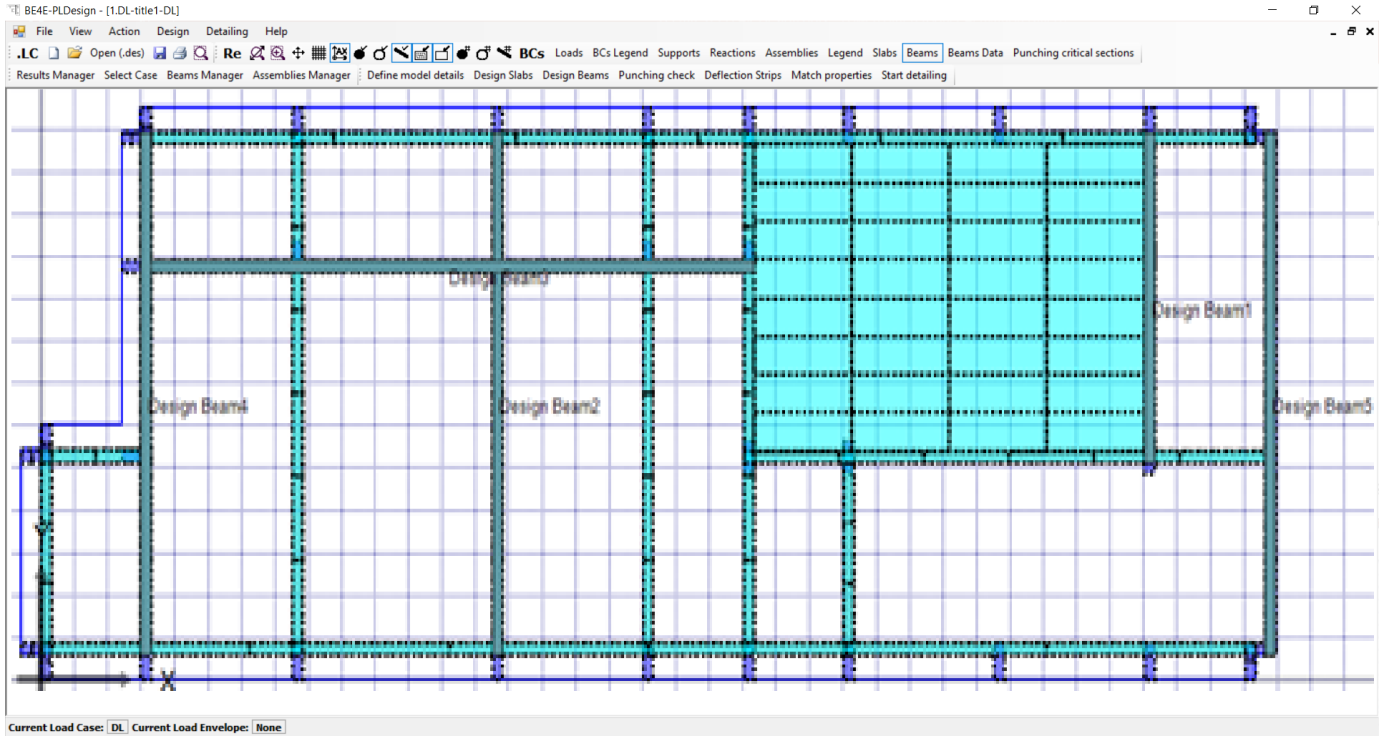
2.7 Beam design

- Show/hide beams allow the user to see the beam to determine the section he needs.
- Every beam contain mark box (Show enabled), the default is all beams are enabled, but the user can open or close any beam he want.
- Once the user know the location of beams need for design, he could determine the sections and breaks.



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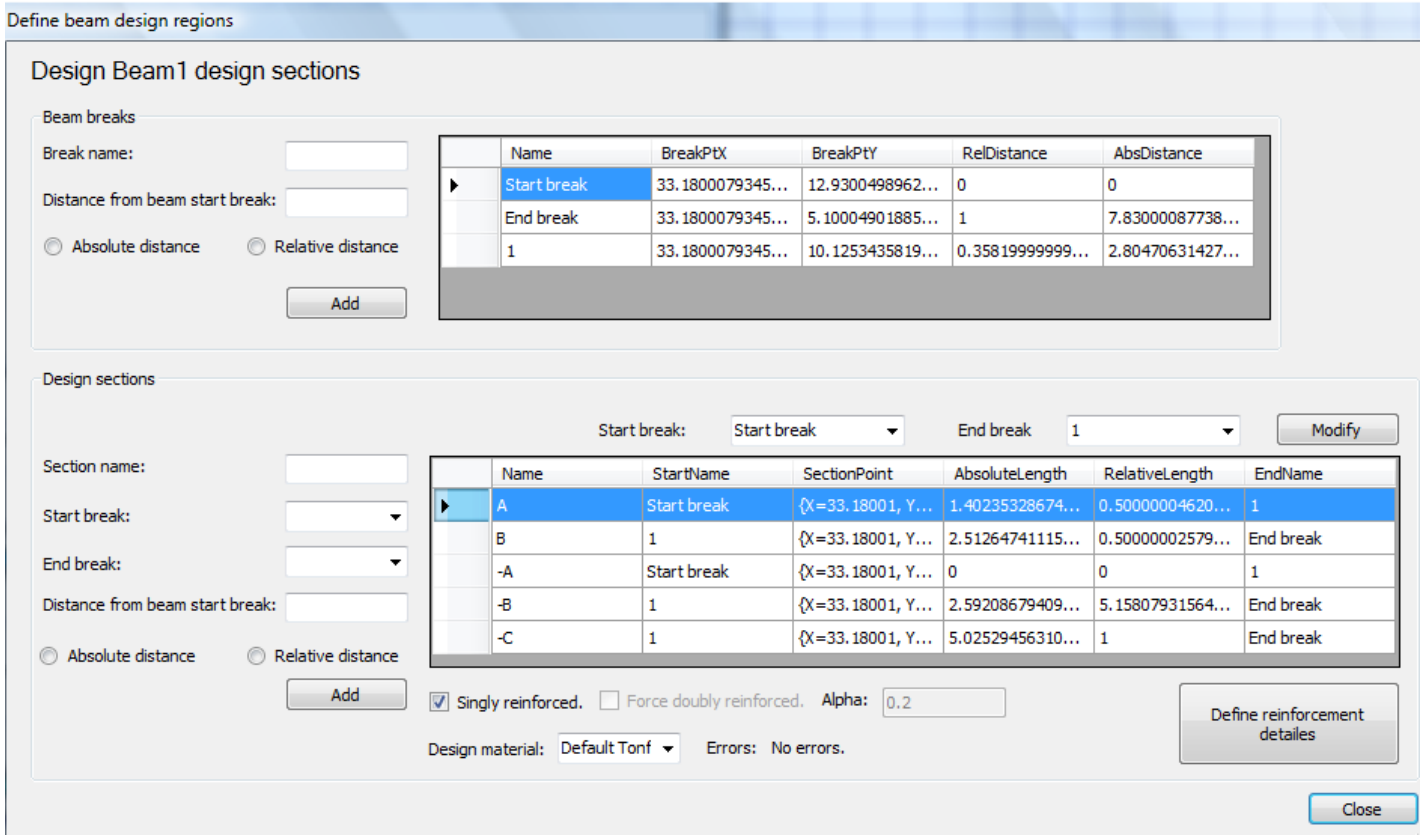
2.7 Beam design

- The user should connect between the AutoCAD drawing & the PLDesign to put the section accurately.
- In beam 1 contain 3 supports so the user should put section break and five sections (Two sections +ve and three sections –ve).



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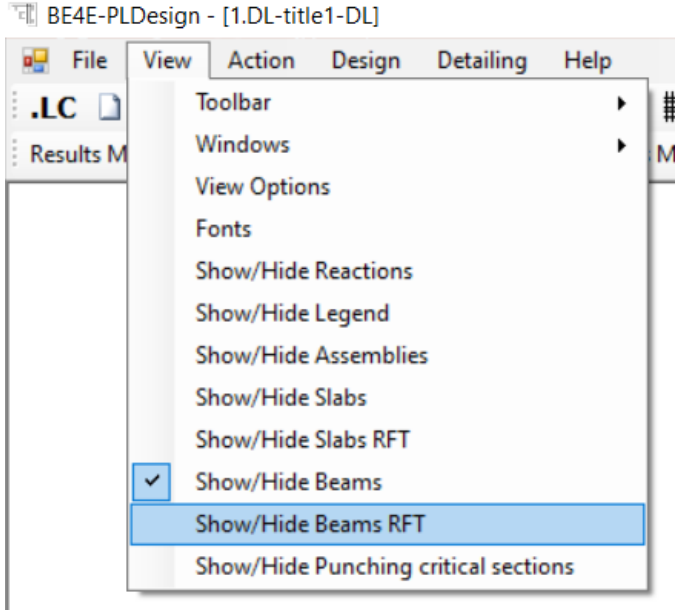
2.7 Beam design

- The user can check the location of sections that he constructed.



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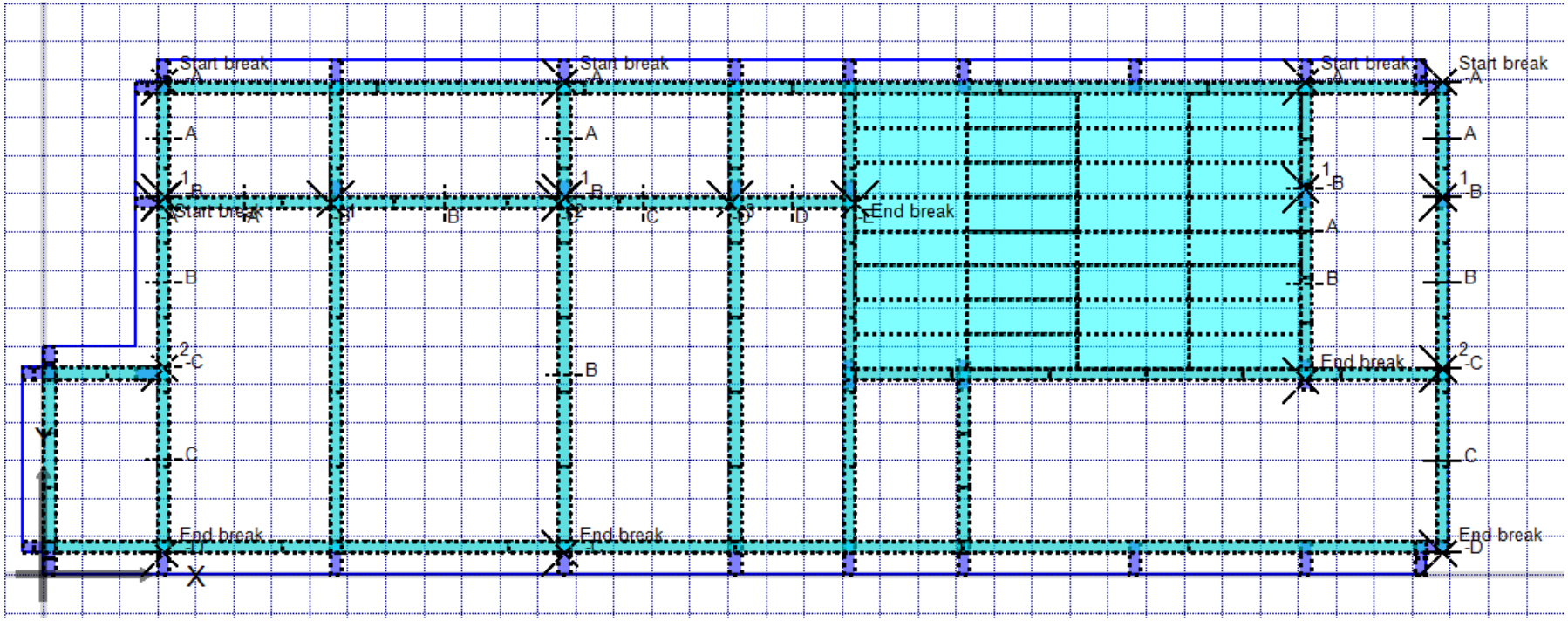

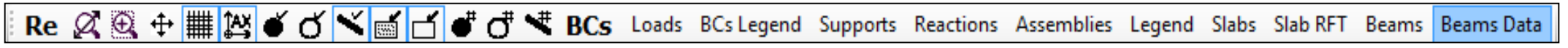

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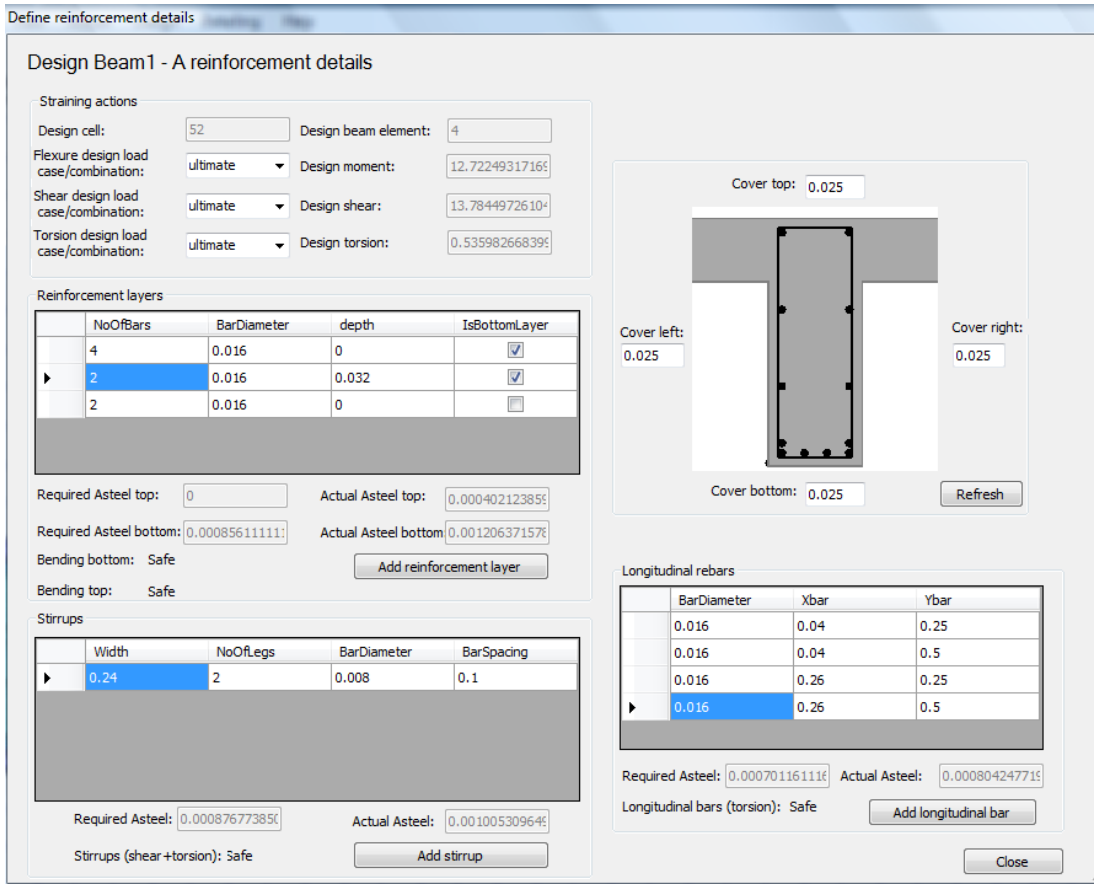
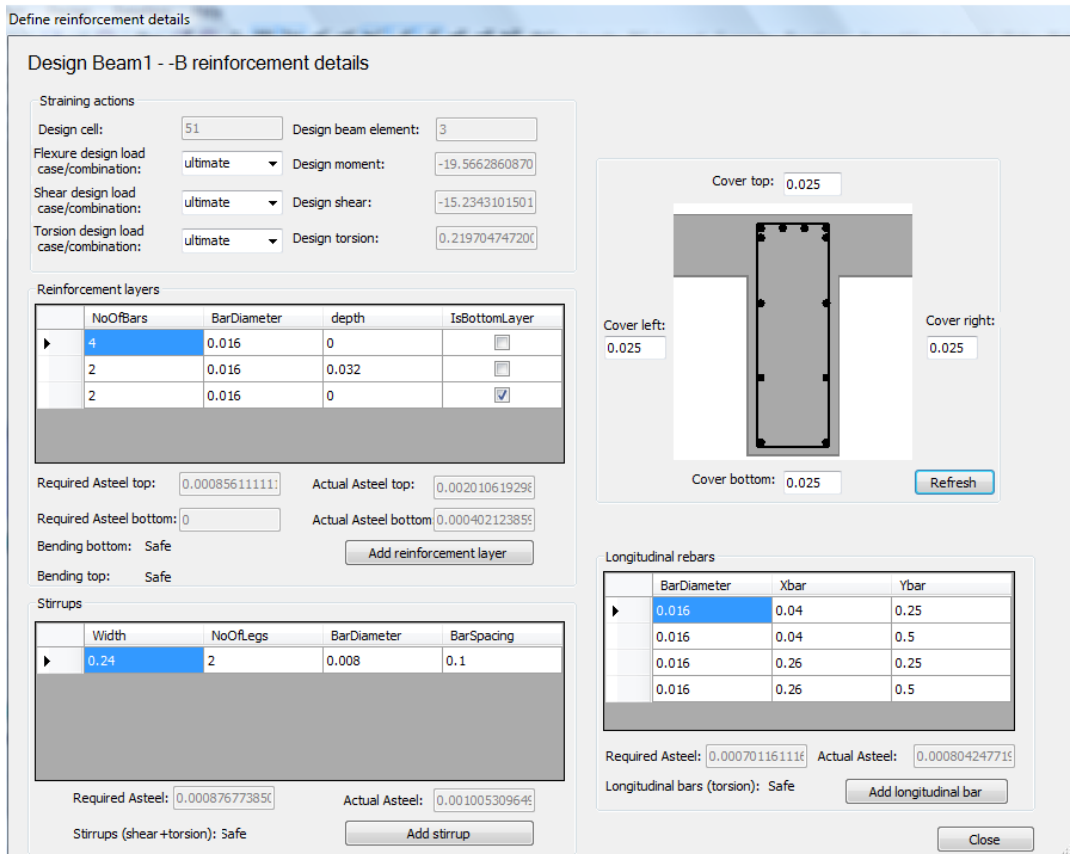
BOUNDARY ELEMENTS FOR ENGINEERS

2.7 Beam design

- Open Define reinforcement details for +ve section and another for –ve section.





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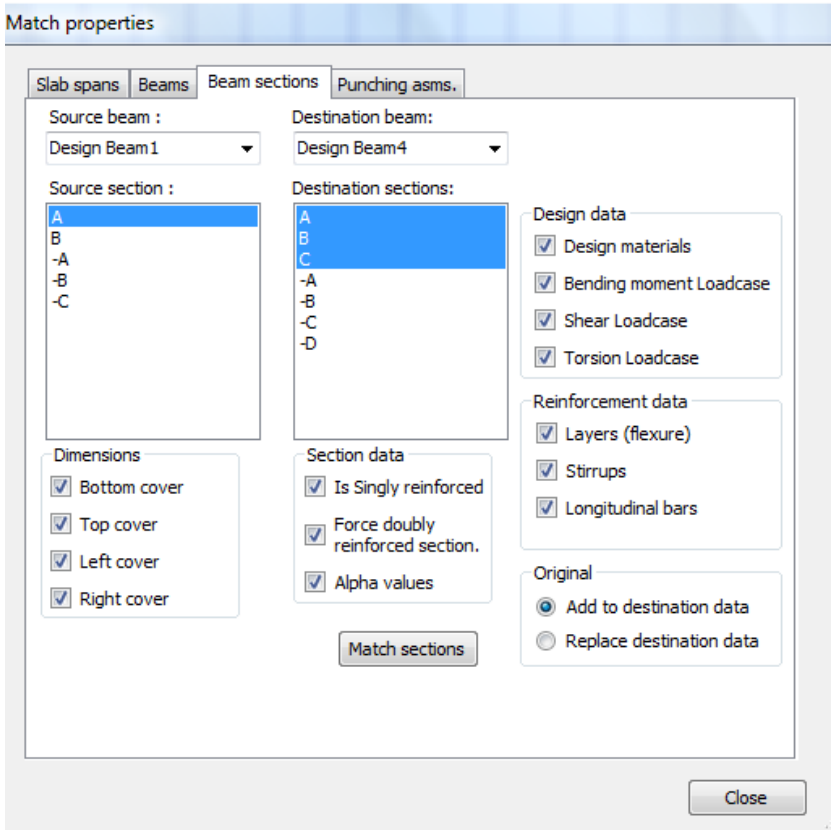
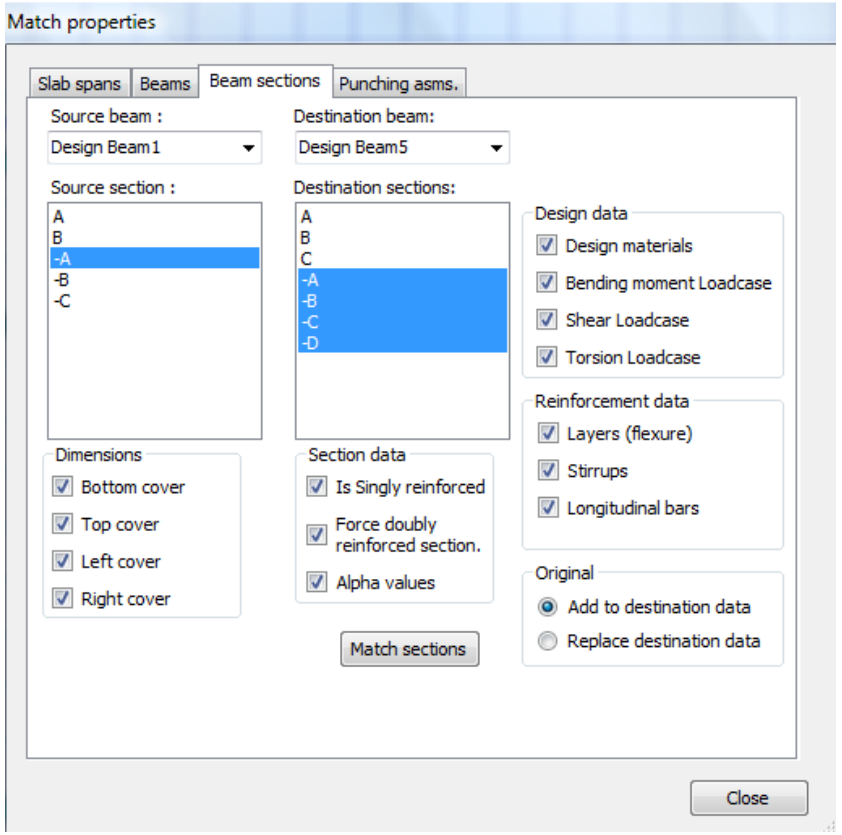
2.7 Beam design

- Match the reinforcement properties for all +ve/-ve sections.
- Check that the sections have been matched it’s properties.





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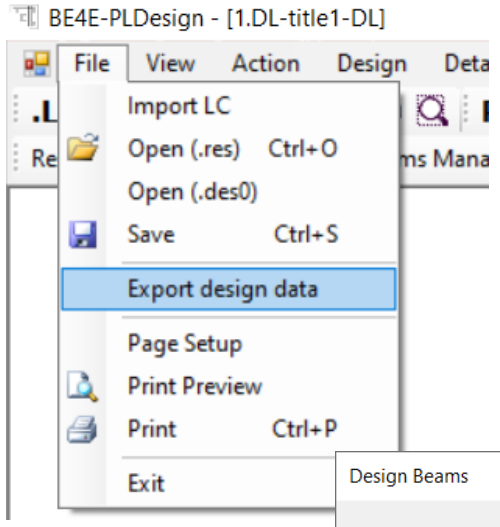
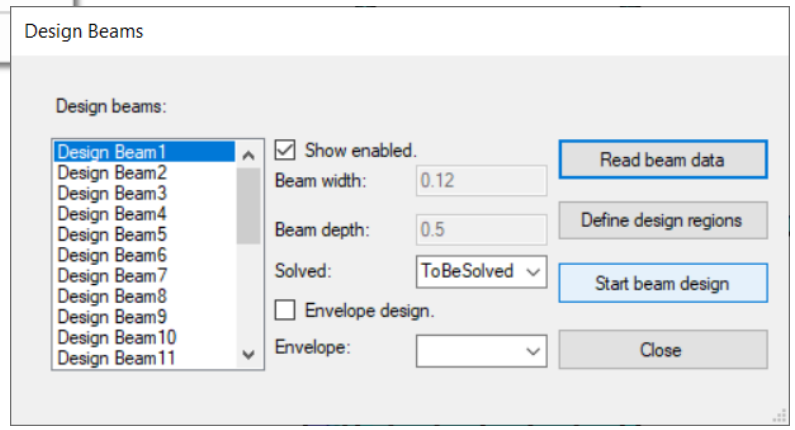
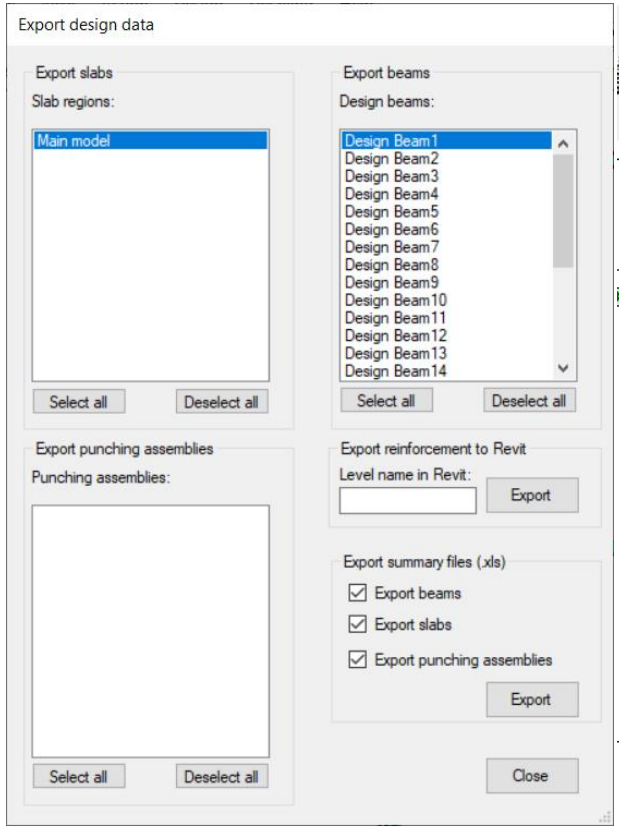
2.7 Beam design

- Start beam design then check the reinforcement that the user insert.







PLDESIGN : Beam reinforcement sheet

Company Name:
Project Name:
Designed By:
Reviewed By:
Approved by:

Beam name	Beam size	Beam section	Flexure reinforcement	Stirrups	Longitudinal steel
Design Beam1	0.3 X 0.8	A	Top (2 Φ 0.016) Bot (4 Φ 0.0162 Φ 0.016)	2L Φ 0.008 @ 0.1	Φ 0.016 @ (0.04,0.25) Φ 0.016 @ (0.04,0.5) Φ 0.016 @ (0.26,0.25) Φ 0.016 @ (0.26,0.5)
		B	Top () Bot ()		
		-A	Top () Bot (4 Φ 0.016)	0L Φ 0 @ 0	Φ 0 @ (0,0)
		-B	Top (4 Φ 0.0162 Φ 0.016) Bot (2 Φ 0.016)	2L Φ 0.008 @ 0.1	Φ 0.016 @ (0.04,0.25) Φ 0.016 @ (0.04,0.5) Φ 0.016 @ (0.26,0.25) Φ 0.016 @ (0.26,0.5)

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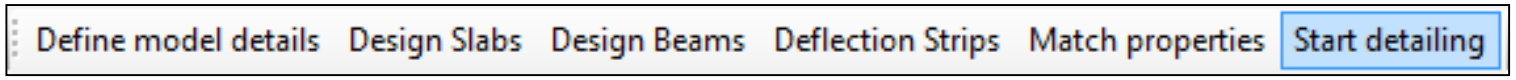
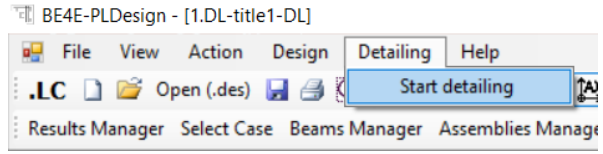
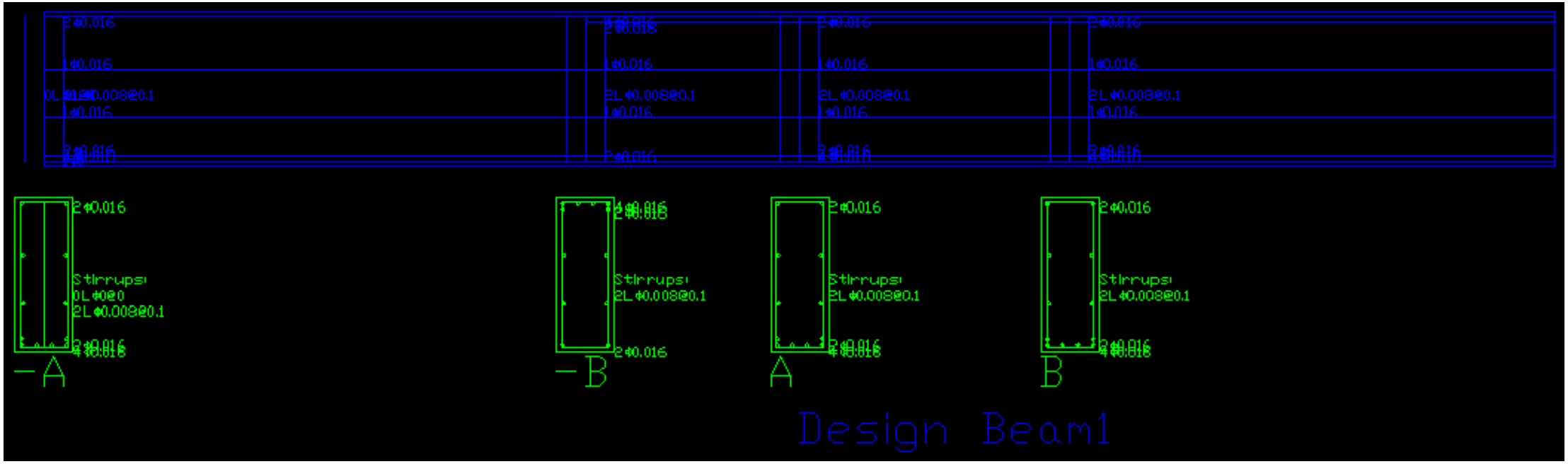
2.7 Beam design

- Now the user are going to Start detailing for the beams.
- This detailing shows the beam reinforcement and the reinforcement of the sections.



OR





2. PLDesign Package

2.1. File needed to be exported before using PLDesign ✓

2.2. Starting PLDesign ✓

2.3. Load combinations & load envelopes ✓

2.4. Slab design ✓

2.4.1. Design from PLPost results (strip design) ✓

2.4.2. Design from PLPost results (contour design) ✓

2.4.3. Design from PLDesign directly (strip based region) ✓

2.4.4 Design from PLDesign directly (basic and additional reinforcement) ✓

2.5 Check deflections of slab ✓

2.6 Check punching ✓

2.7 Beam design ✓

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1. Introduction ✓
2. Part I - PLDesign Package ✓
3. Part II - PTPAK Package
4. Conclusions

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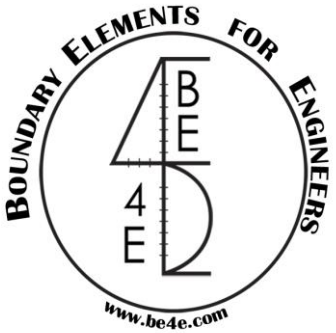
Table of contents

1. Introduction
2. Part I - PLDesign Package
3. **Part II - PTPAK Package**
4. Conclusions



3. PTPAK Package

3.1 Files need to be exported before using PTPAK

3.2 How can users generate PTPAK Model

3.2.1 Draw cables

3.2.2 Cables data

3.2.3 Cable templates

3.2.4 Multiple cable selection

3.3 How to solve the PTPAK model

3.4 Load combinations & load envelopes

3.5 Check the Cable Eccentricity

3.6 Check the Cable stresses

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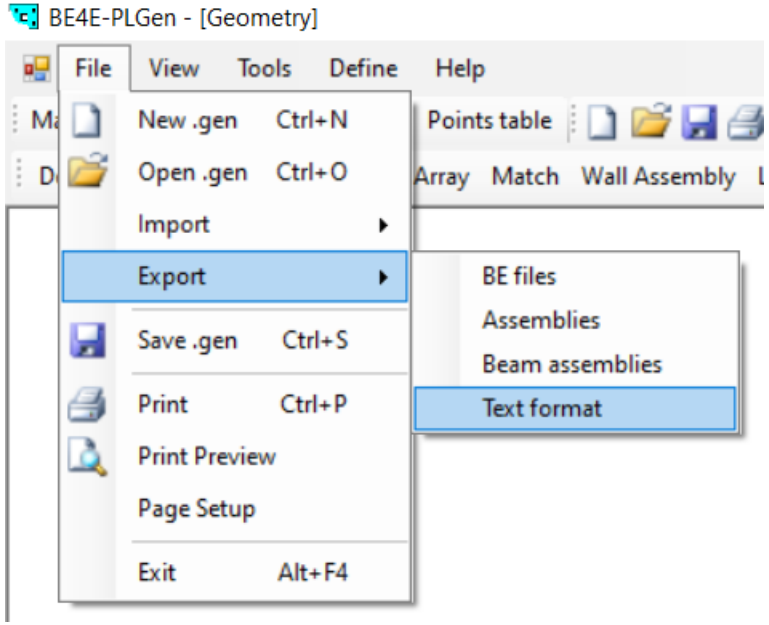
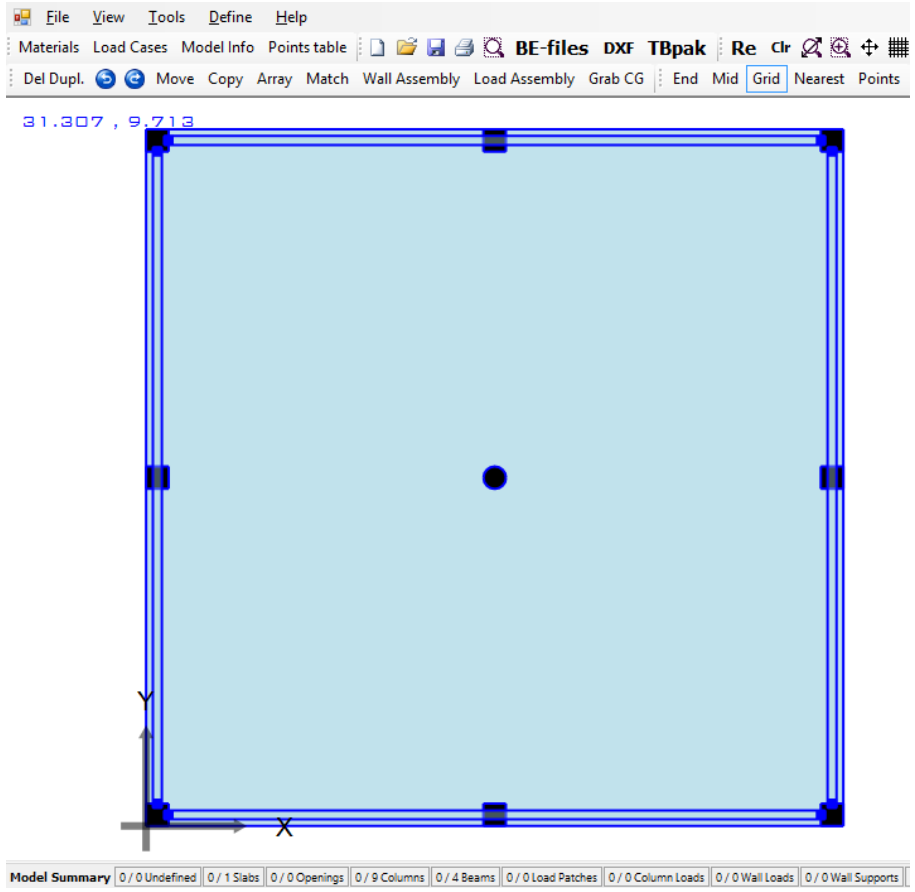
3.1. File needed to be exported before using PTPAK

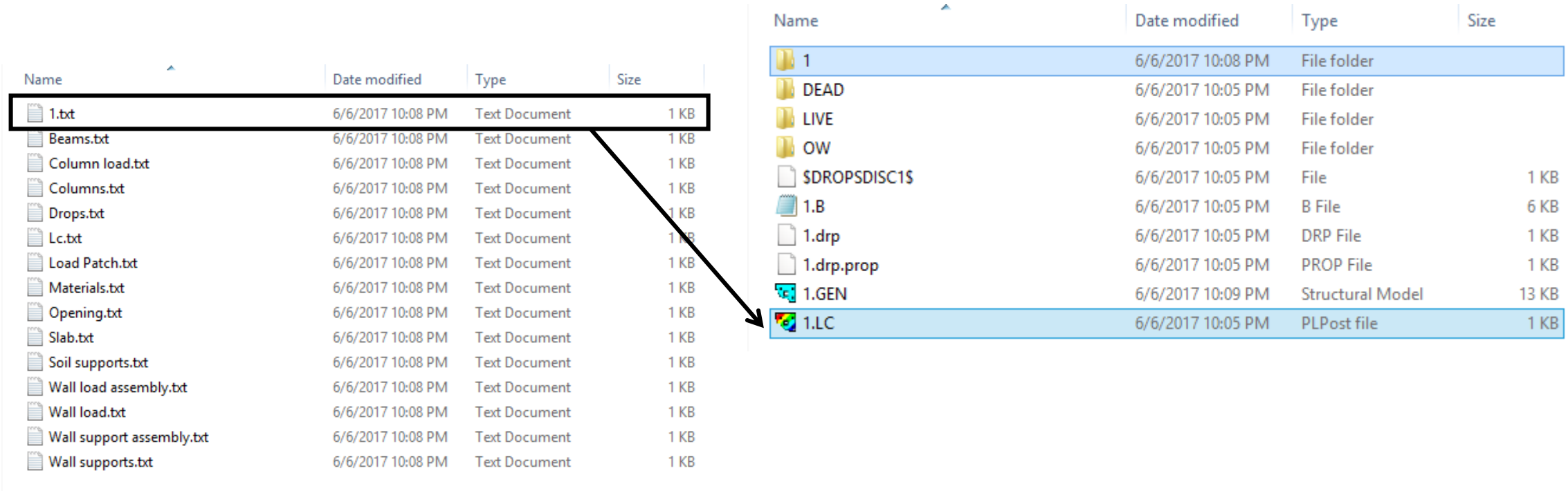
After drawing the problem (without post tension) in PLGen as shown below BE-Files should exported and the text files also for the problem.





3.1. File needed to be exported before using PTPAK

N.B. the text format should named similarly as .LC file in a created folder with also the same name of .LC file.



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Beams.txt	6/6/2017 10:08 PM	Text Document	1 KB
Column load.txt	6/6/2017 10:08 PM	Text Document	1 KB
Columns.txt	6/6/2017 10:08 PM	Text Document	1 KB
Drops.txt	6/6/2017 10:08 PM	Text Document	1 KB
Lc.txt	6/6/2017 10:08 PM	Text Document	1 KB
Load Patch.txt	6/6/2017 10:08 PM	Text Document	1 KB
Materials.txt	6/6/2017 10:08 PM	Text Document	1 KB
Opening.txt	6/6/2017 10:08 PM	Text Document	1 KB
Slab.txt	6/6/2017 10:08 PM	Text Document	1 KB
Soil supports.txt	6/6/2017 10:08 PM	Text Document	1 KB
Wall load assembly.txt	6/6/2017 10:08 PM	Text Document	1 KB
Wall load.txt	6/6/2017 10:08 PM	Text Document	1 KB
Wall support assembly.txt	6/6/2017 10:08 PM	Text Document	1 KB
Wall supports.txt	6/6/2017 10:08 PM	Text Document	1 KB

Name	Date modified	Type	Size
1	6/6/2017 10:08 PM	File folder	
DEAD	6/6/2017 10:05 PM	File folder	
LIVE	6/6/2017 10:05 PM	File folder	
OW	6/6/2017 10:05 PM	File folder	
$DROPSDISC1$	6/6/2017 10:05 PM	File	1 KB
1.B	6/6/2017 10:05 PM	B File	6 KB
1.drp	6/6/2017 10:05 PM	DRP File	1 KB
1.drp.prop	6/6/2017 10:05 PM	PROP File	1 KB
1.GEN	6/6/2017 10:09 PM	Structural Model	13 KB
1.LC	6/6/2017 10:05 PM	PLPost file	1 KB

3.1. File needed to be exported before using PTPAK

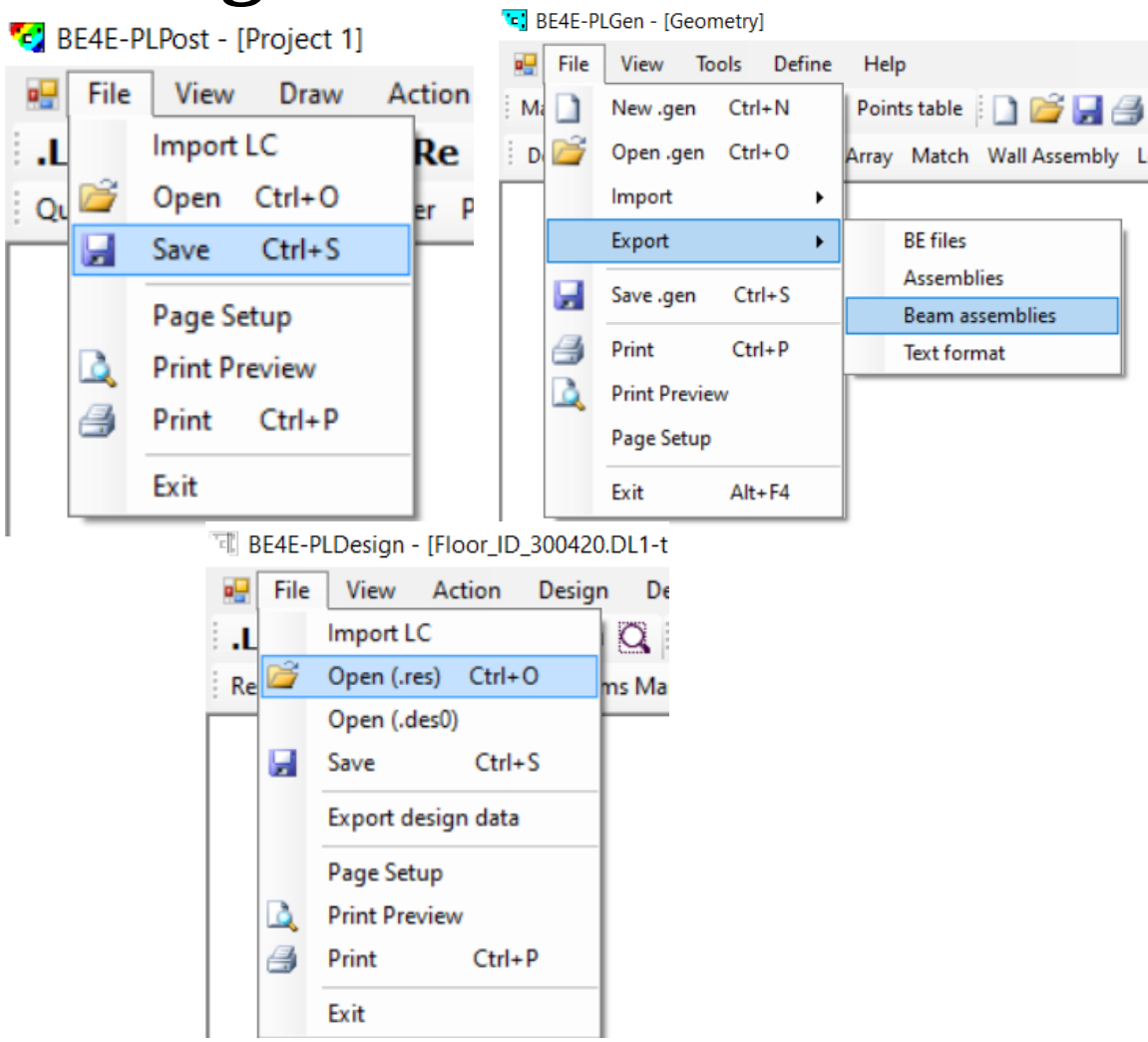
Same as PLDesign, there are cases that user have to export file from PLGen before using PTPAK:

There are cases that user have to export file from PLGen and PLPost before using PLDesign:

- Export beam assemblies: this case is used to design the beams.
- Save the PLPost results: this case is used to design the slab.
- Export assemblies file: this case is used to check punching of the columns.

The previous cases can be restored in the PLDesign as follows:

- Import beam assemblies: this case is used to design the beams (will be demonstrated in beam design section).
- Open the PLPost results: this case is used to design the slab.
- Import assemblies file: this case is used to check punching of the columns.



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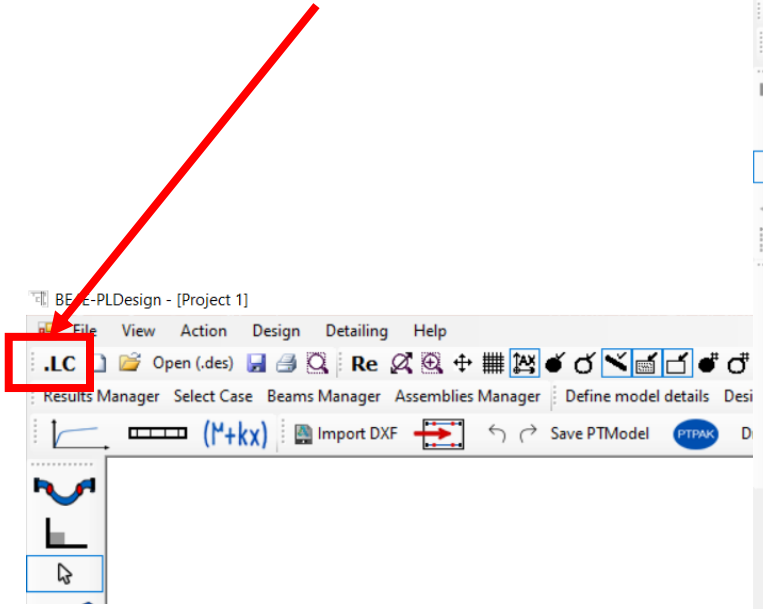
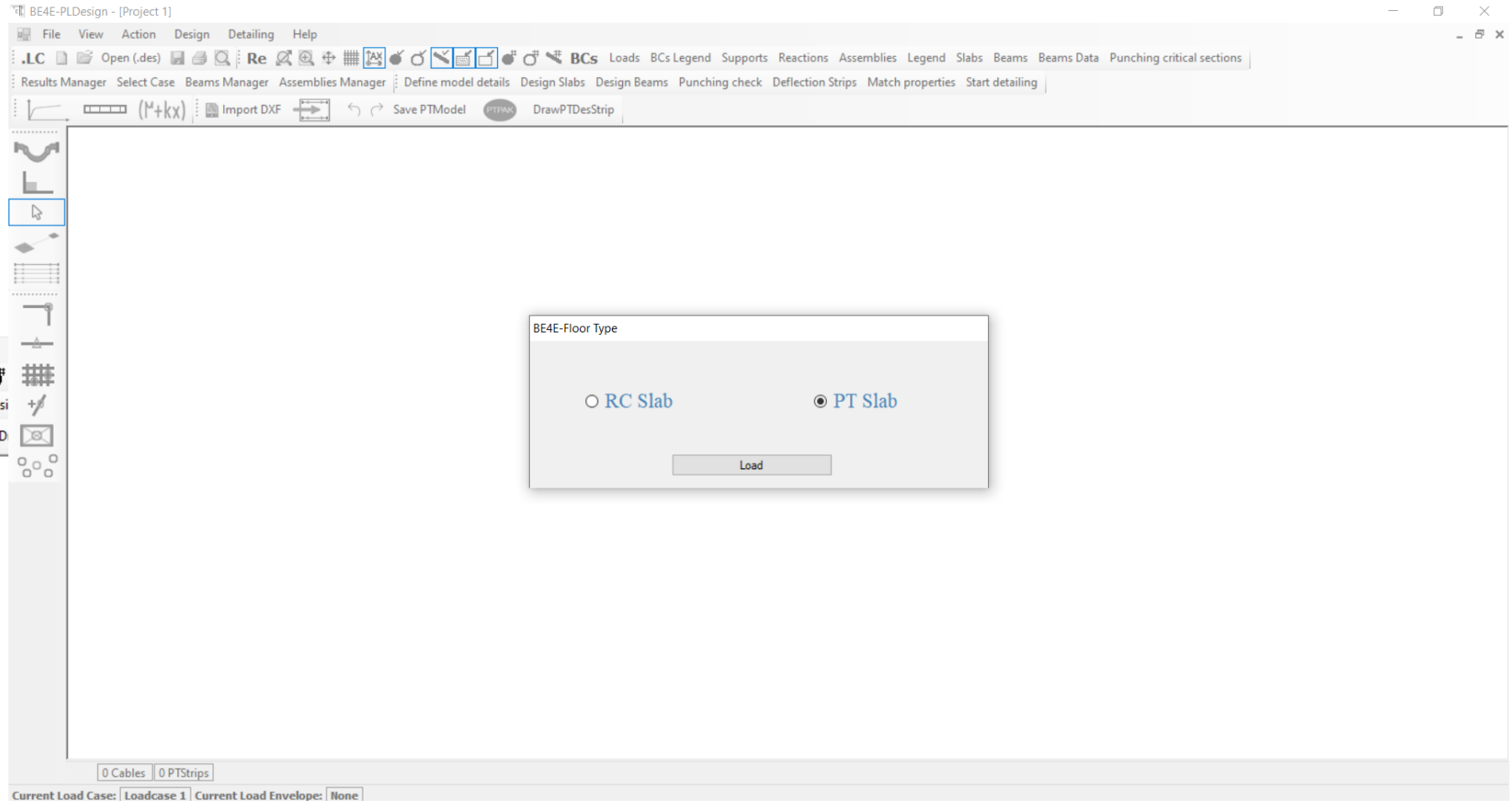
3.2 How can users generate PTPAK Model

- Choose PT Slab, hence choose Load
- Import Input File (.LC File).





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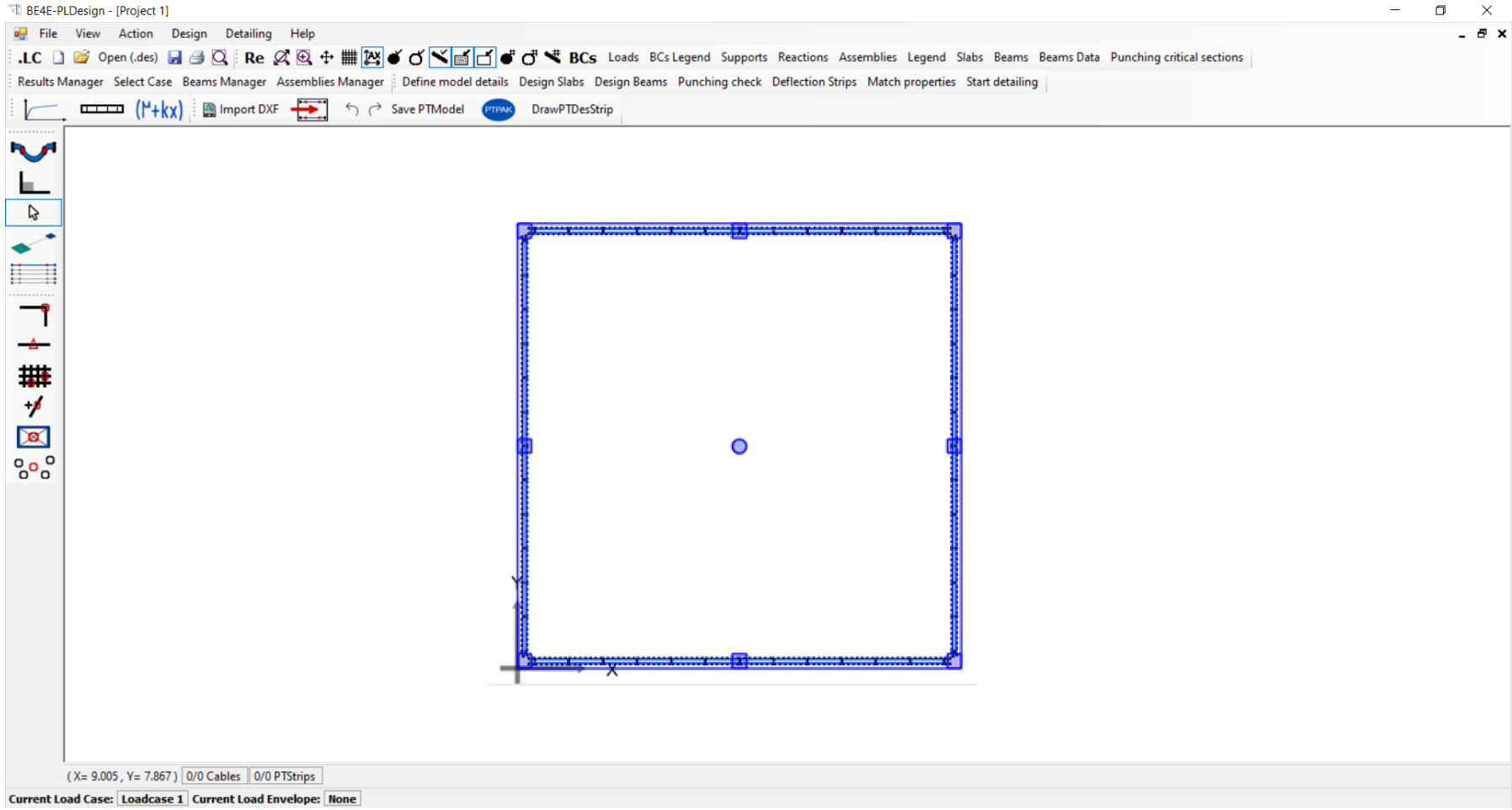
3.2 How can users generate PTPAK Model

- There are two ways to draw cables:
  1- Export .Dxf for cables.
  2- Draw directly with snapping tools.



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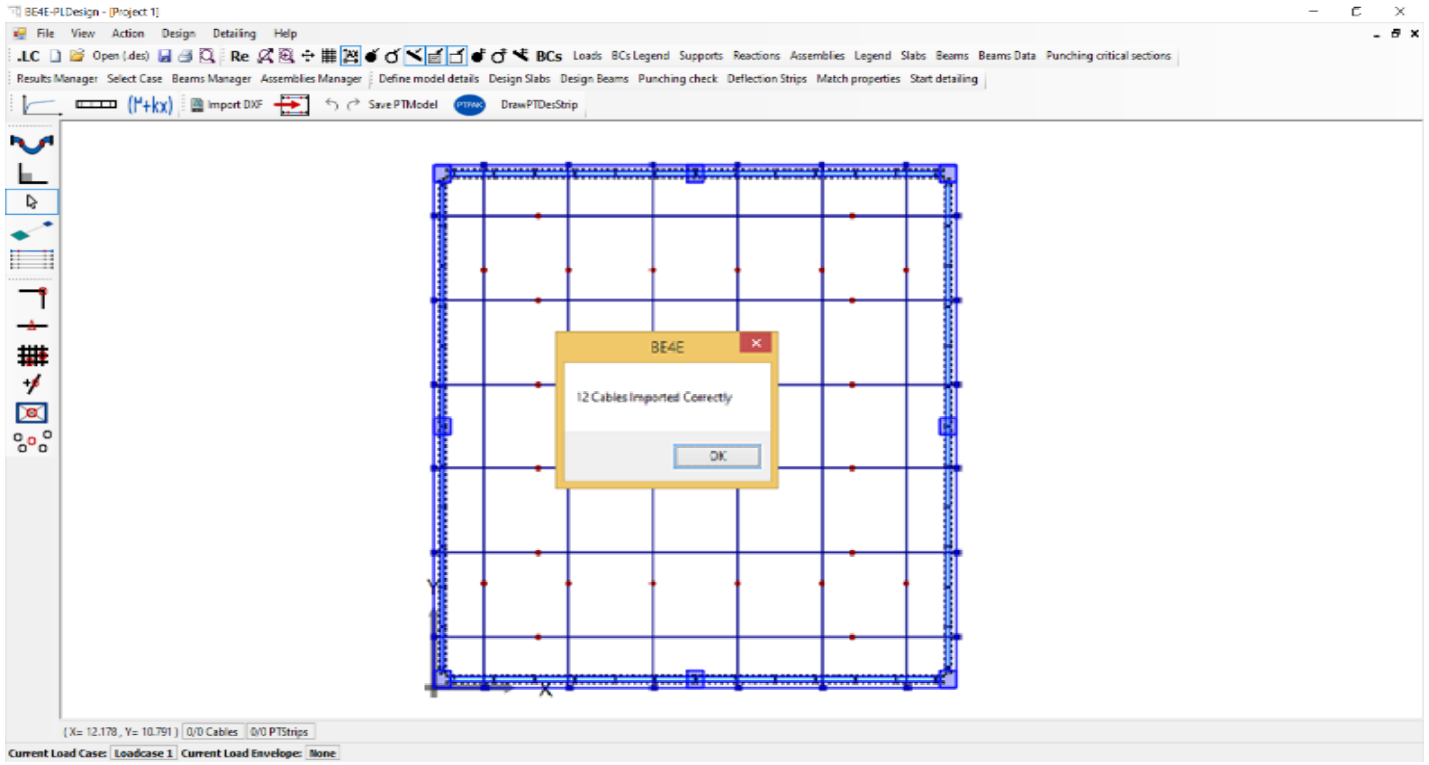
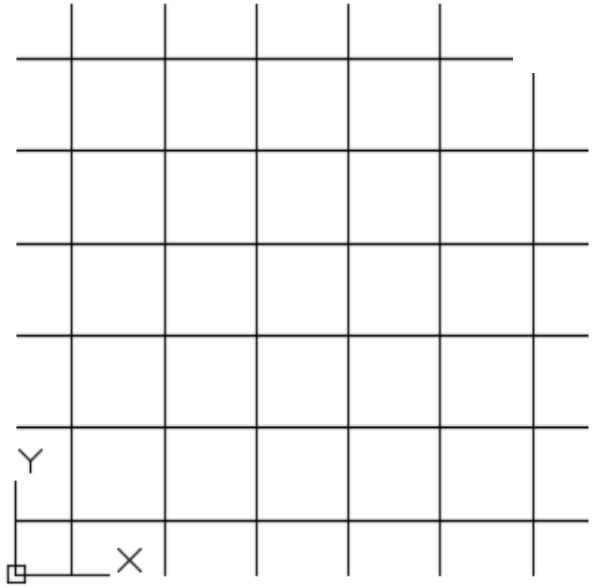
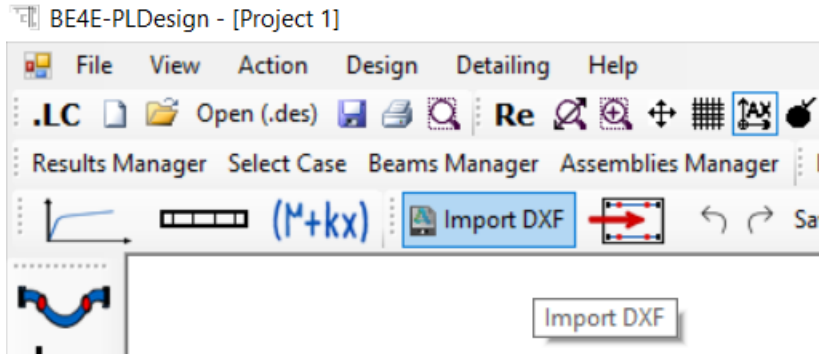
3.2 How can users generate PTPAK Model

A - Export cables from .DXF file:

- Draw cables in AutoCAD file (Polyline) .
- Save as .DXF file.
- Import it from PTPAK.

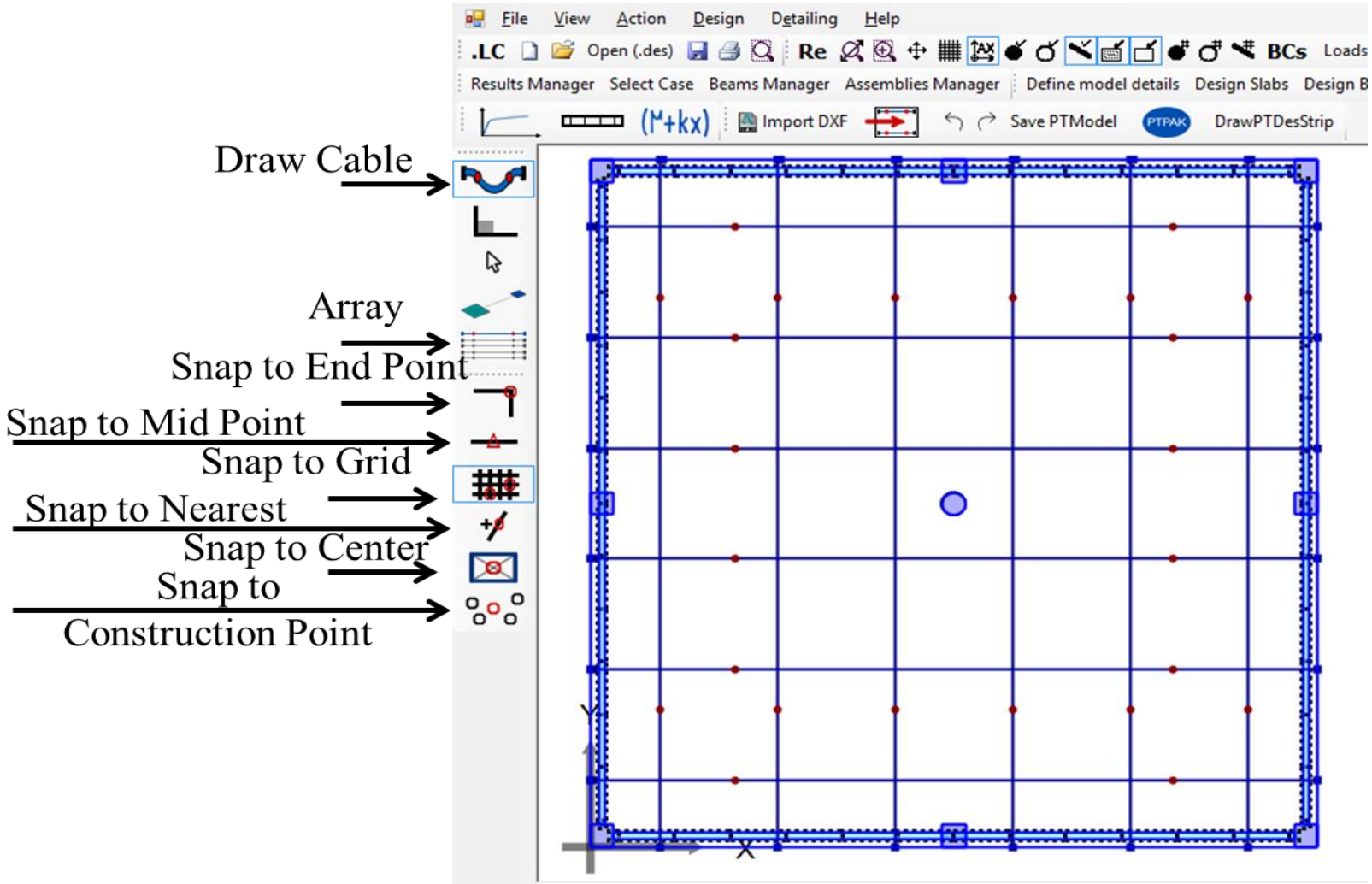






3.2 How can users generate PTPAK Model

B- Draw Cables from Snap Tools:



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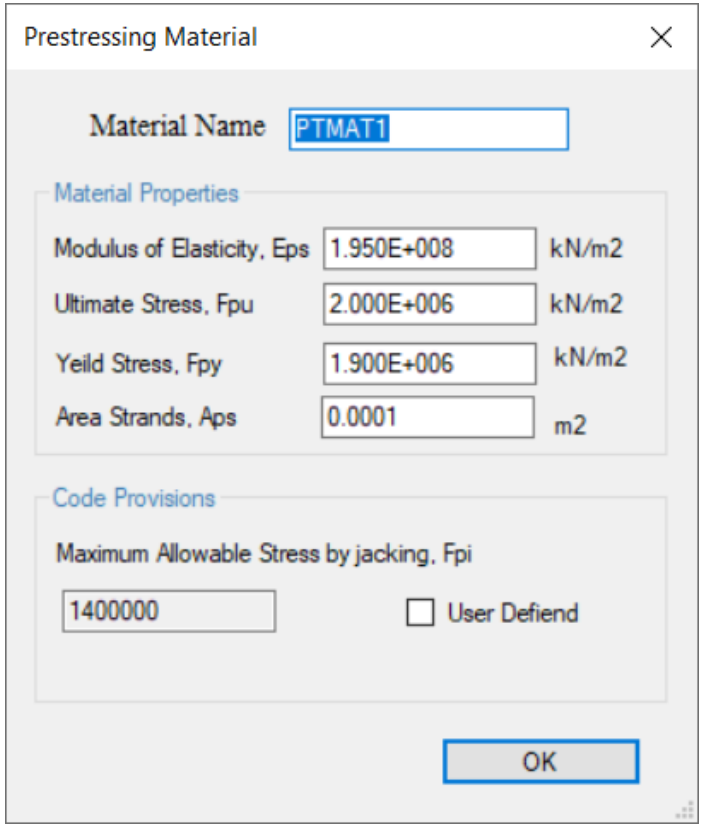
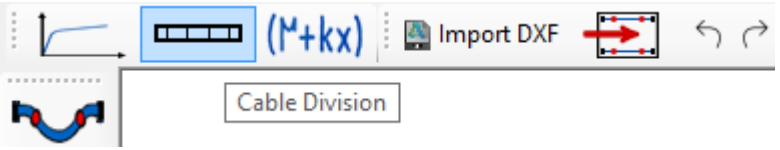
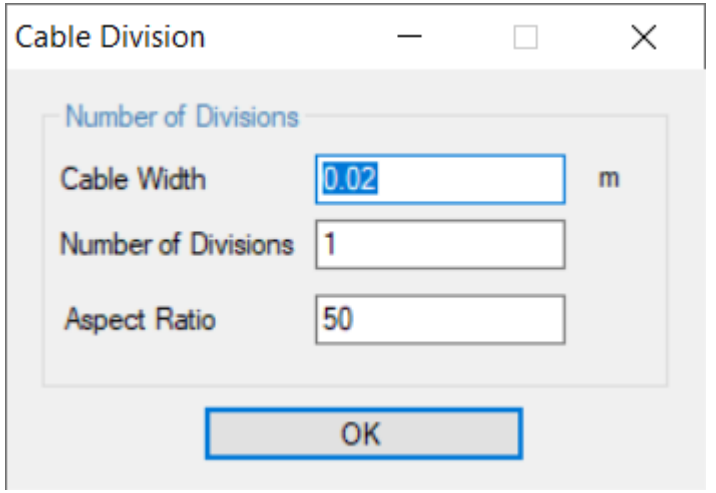
3.2 How can users generate PTPAK Model

- Define Cable Properties:



- Define Cable divisions:





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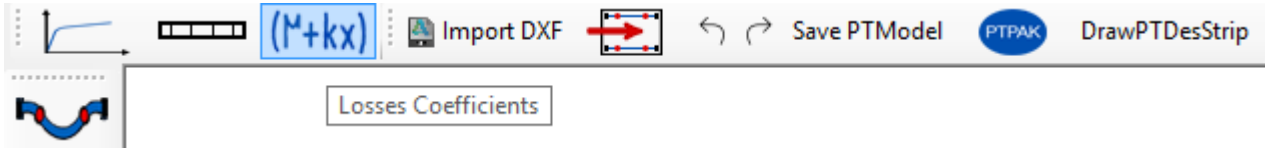
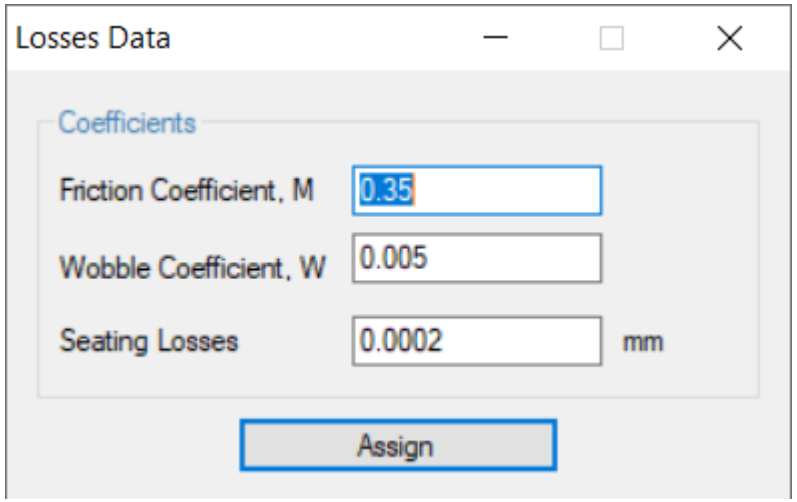
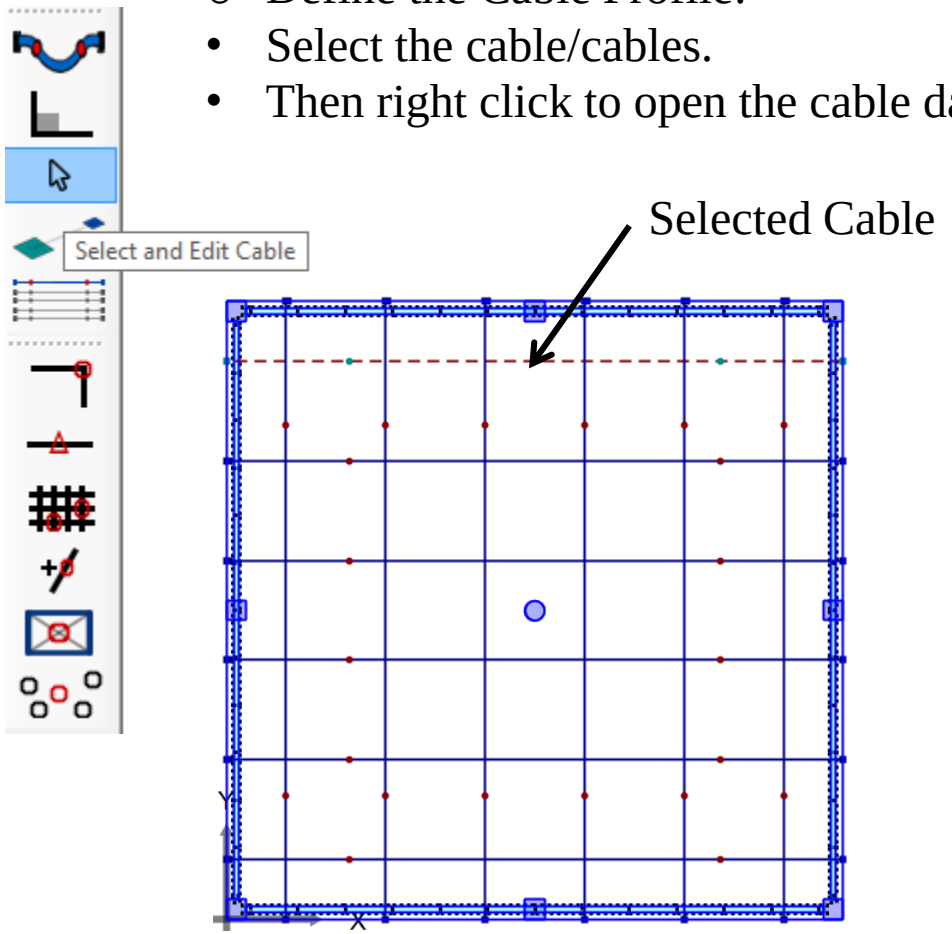
3.2 How can users generate PTPAK Model

- Define Losses Coefficients:





- Define the Cable Profile:
- Select the cable/cables.
- Then right click to open the cable data.



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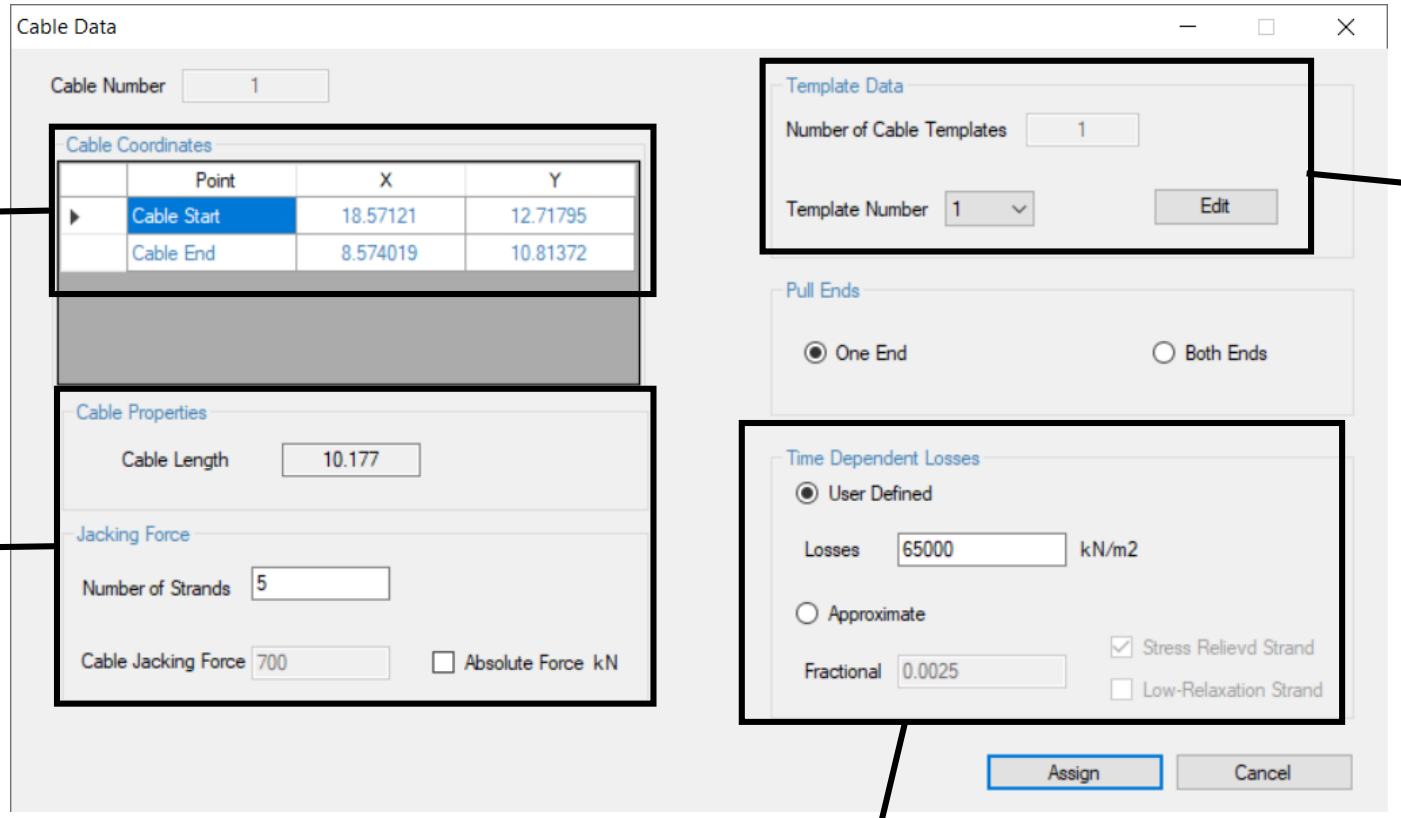
3.2 How can users generate PTPAK Model

Cable (Start/End) Coordinates

Cable Length/ Jacking Force

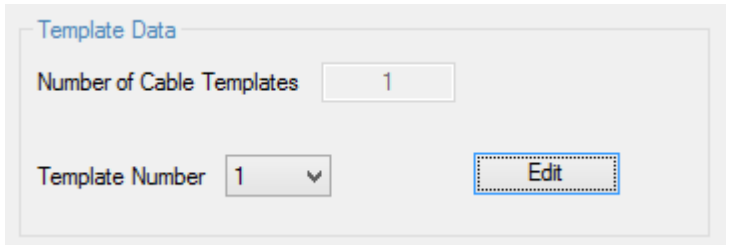


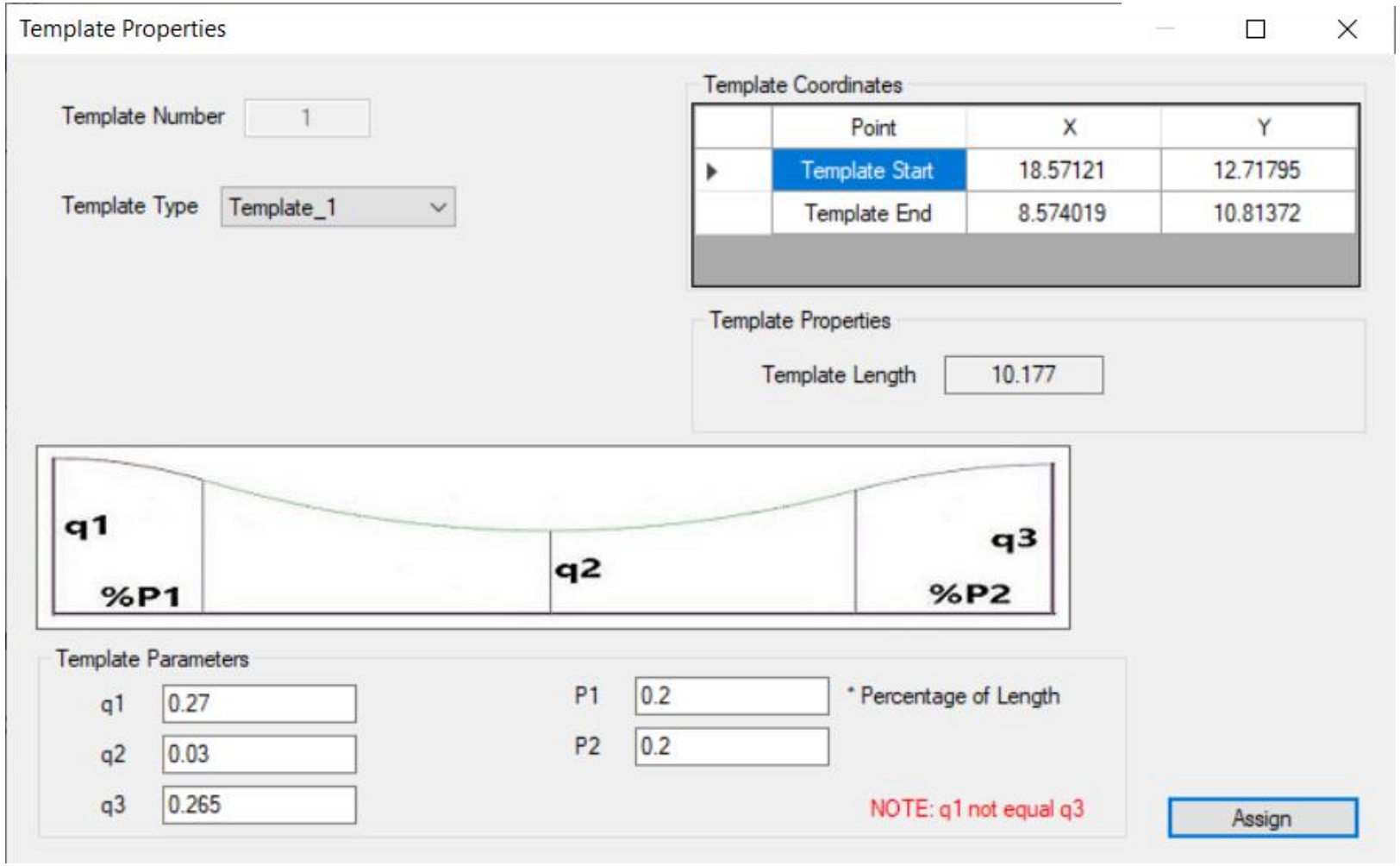
Cable Template (13 different template)

Time dependent Losses

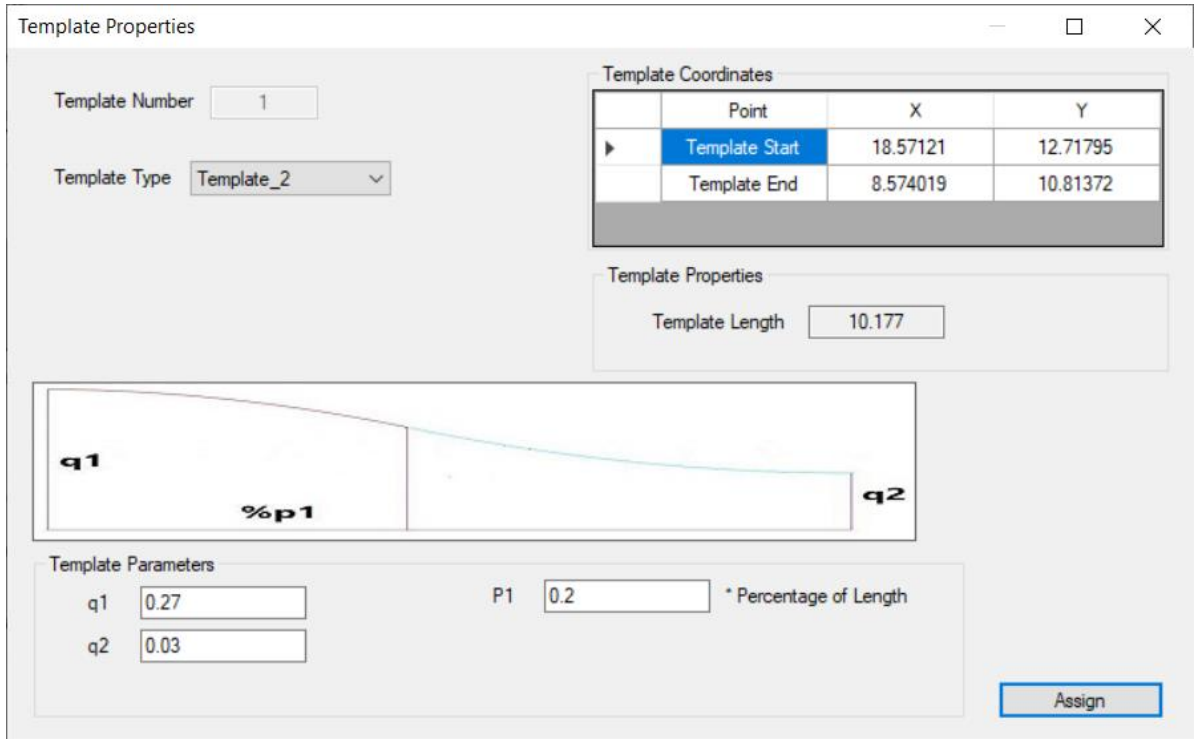
3.2 How can users generate PTPAK Model

- Click on edit to edit the template data.

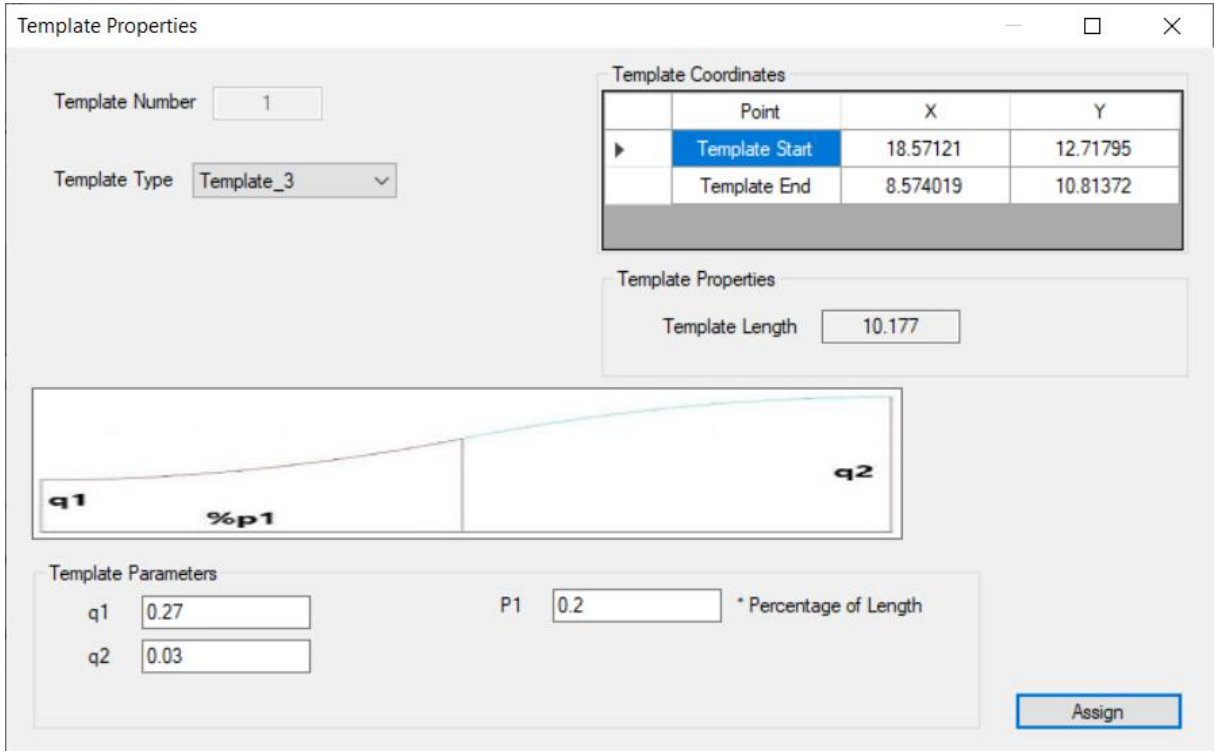




3.2 How can users generate PTPAK Model

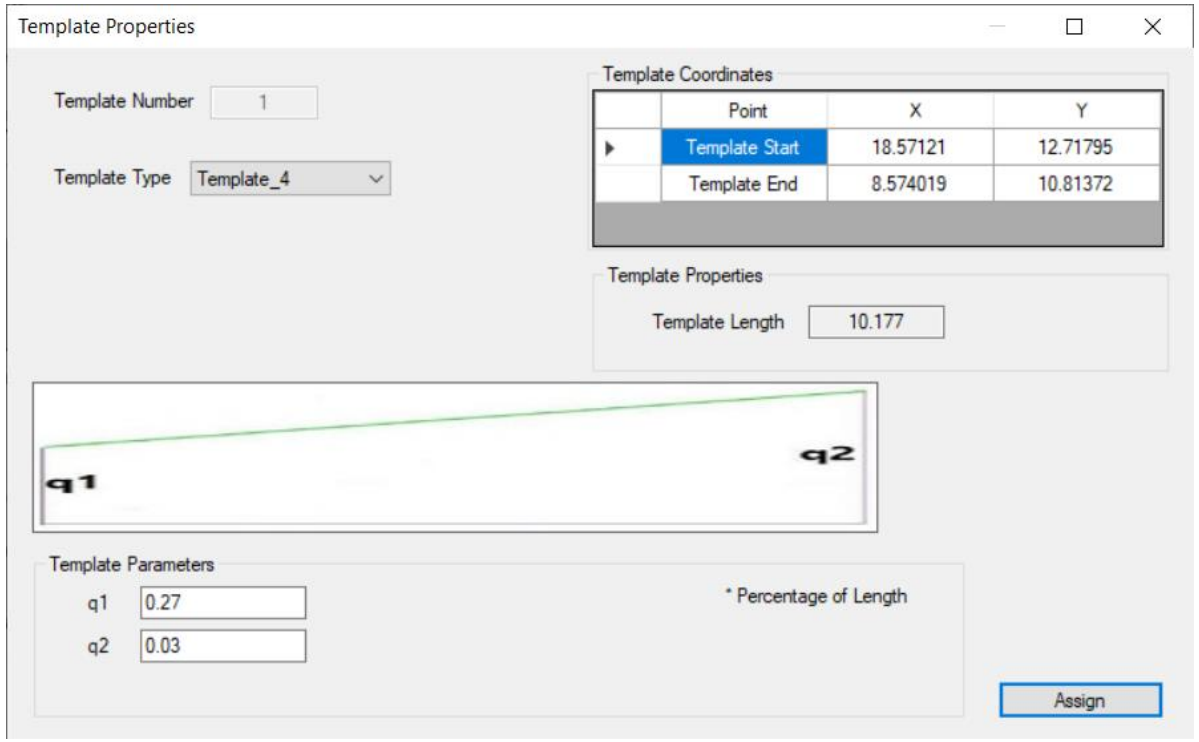


Template 2



Template 3

3.2 How can users generate PTPAK Model



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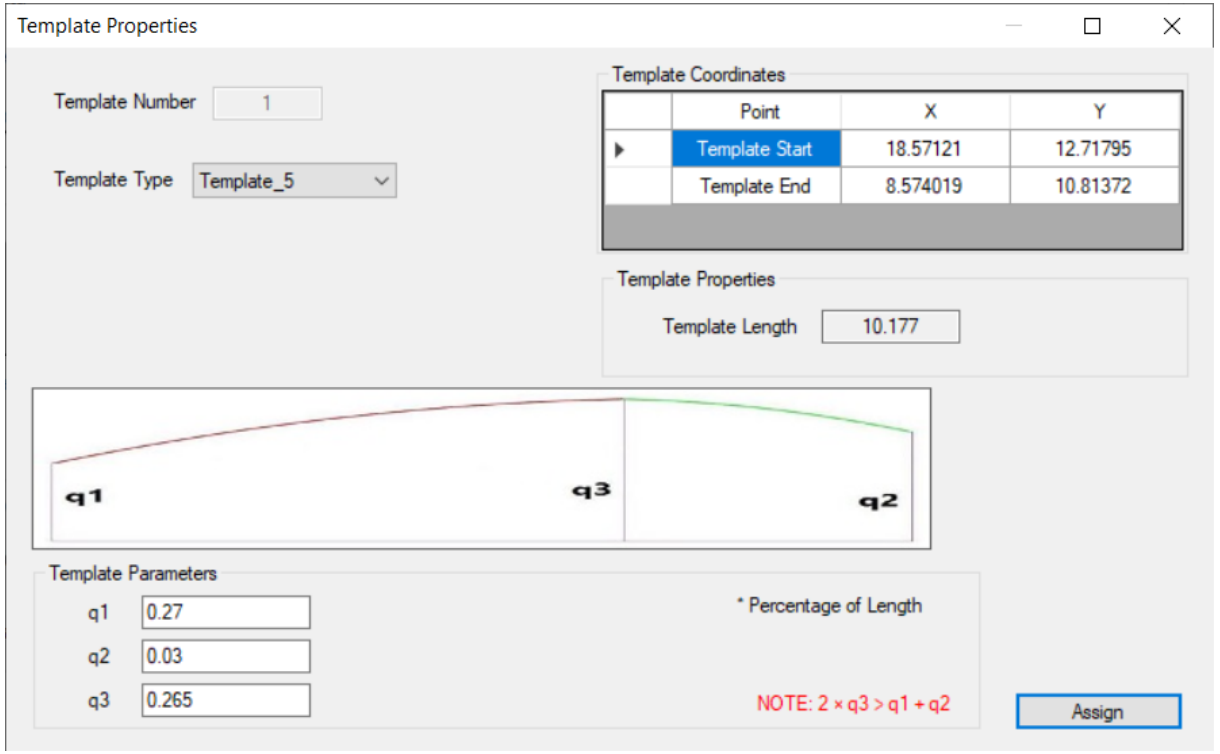
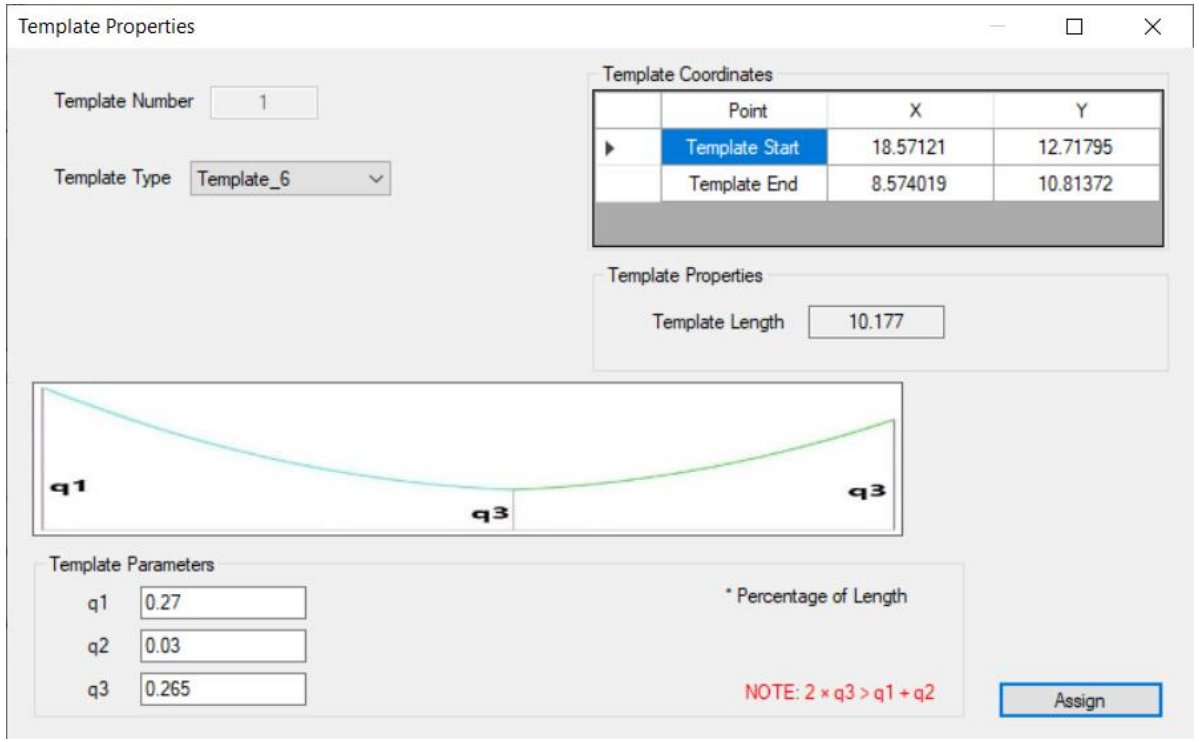
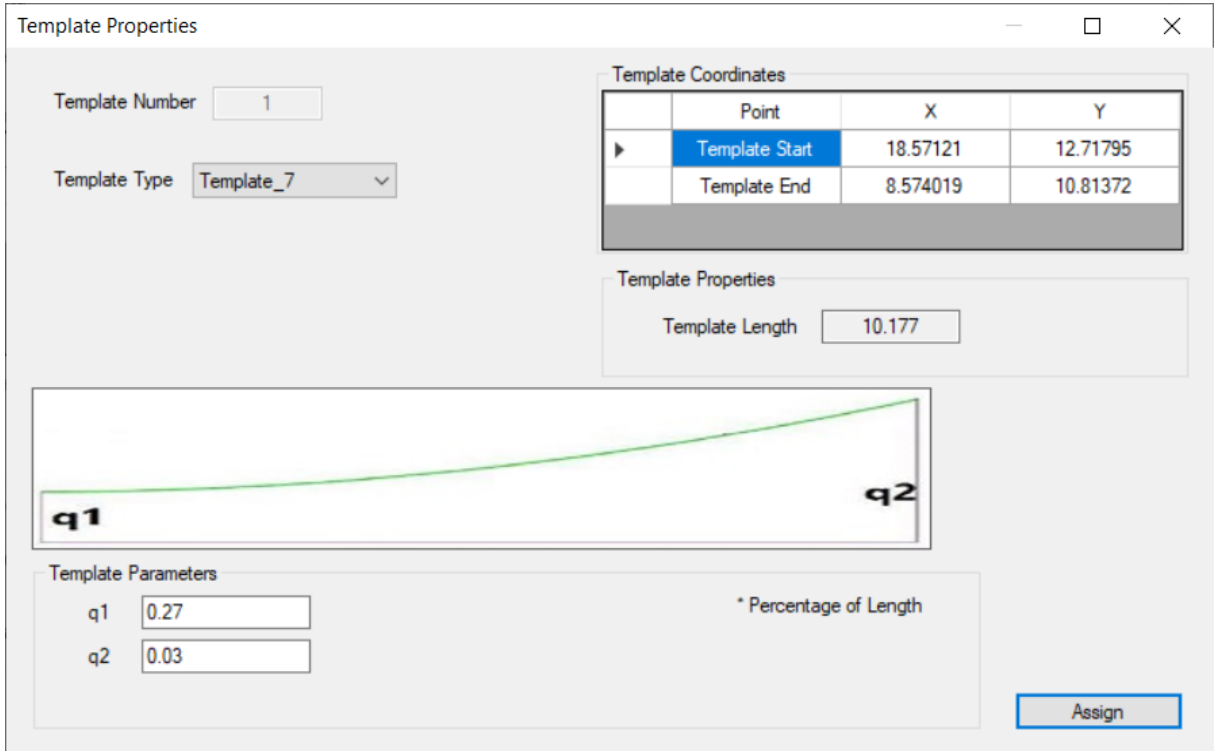


Template 5

3.2 How can users generate PTPAK Model

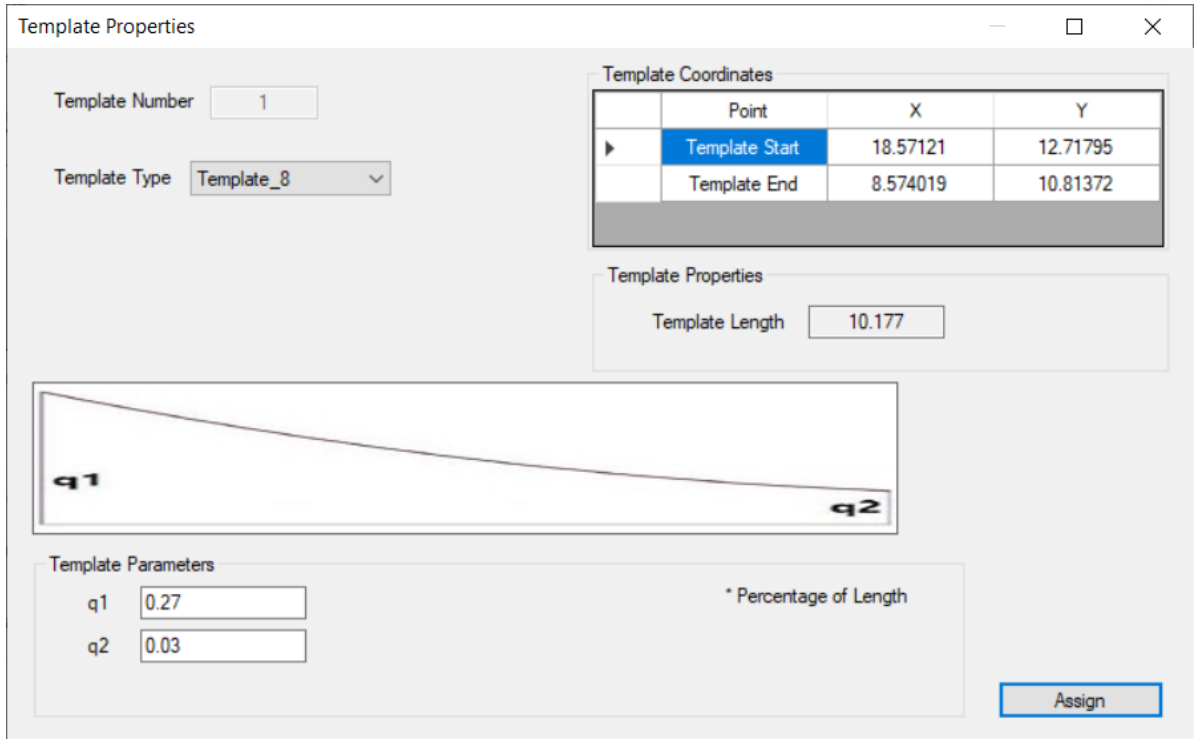


Template 6

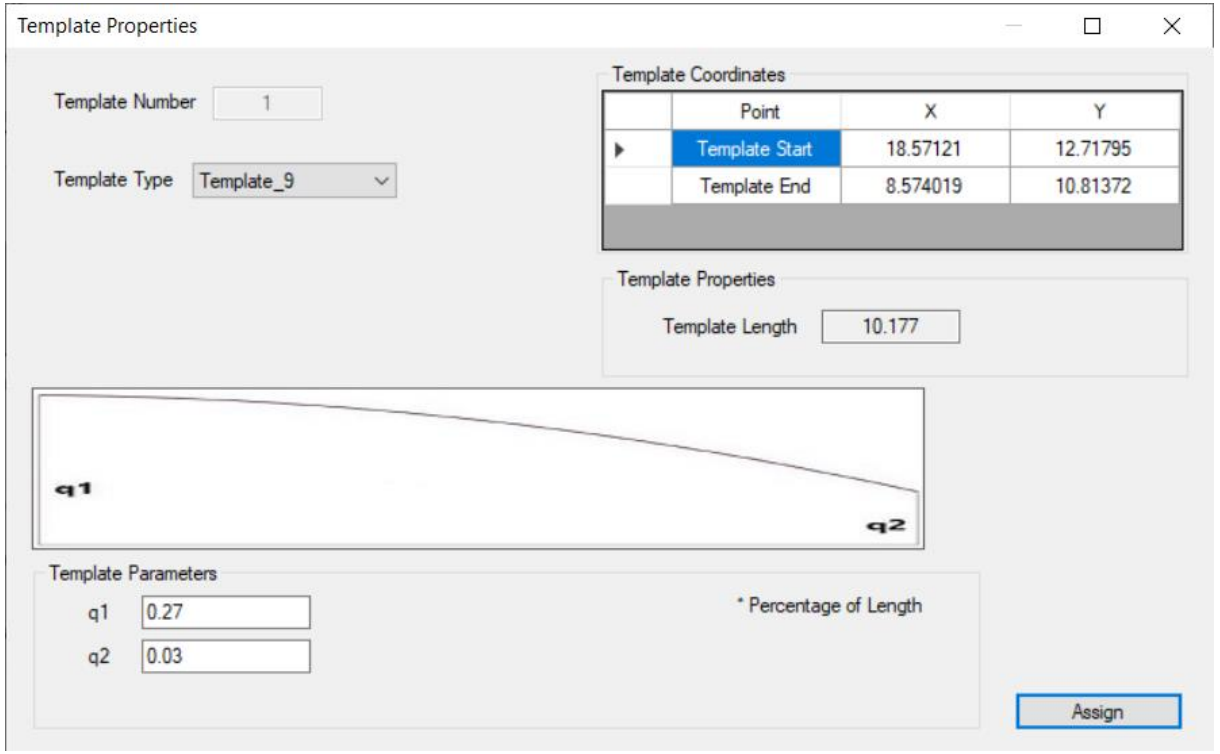


Template 7

3.2 How can users generate PTPAK Model

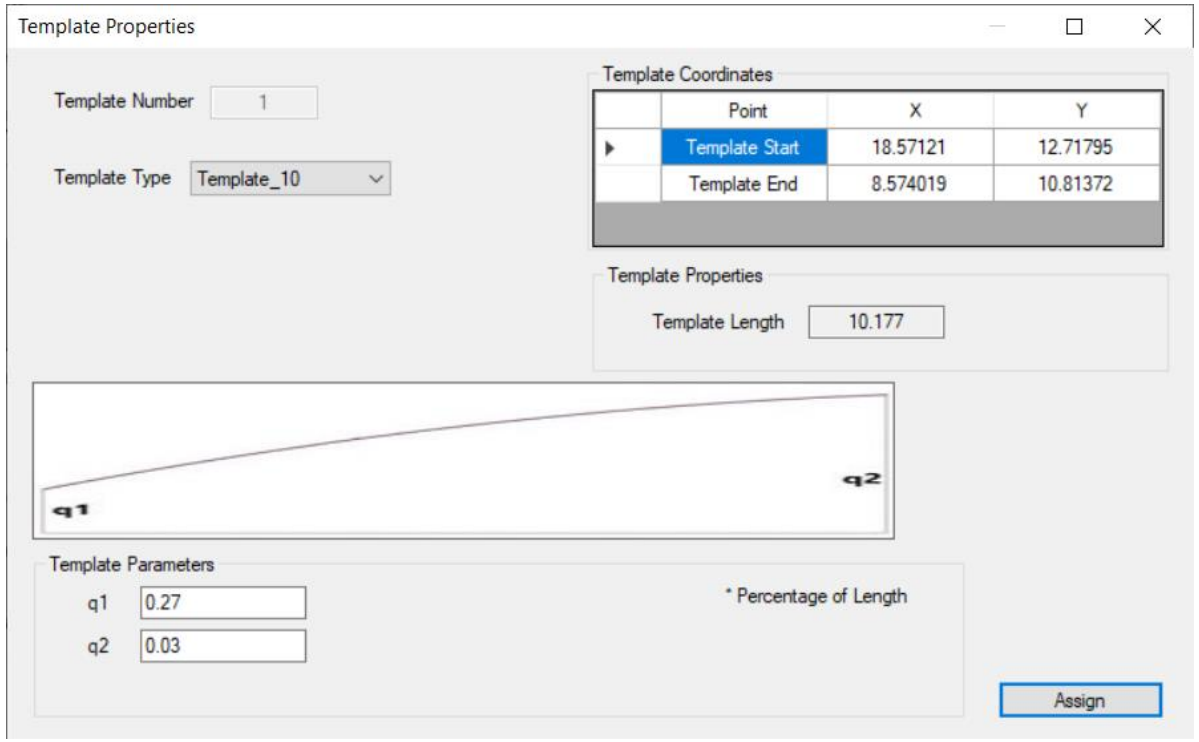


Template 8

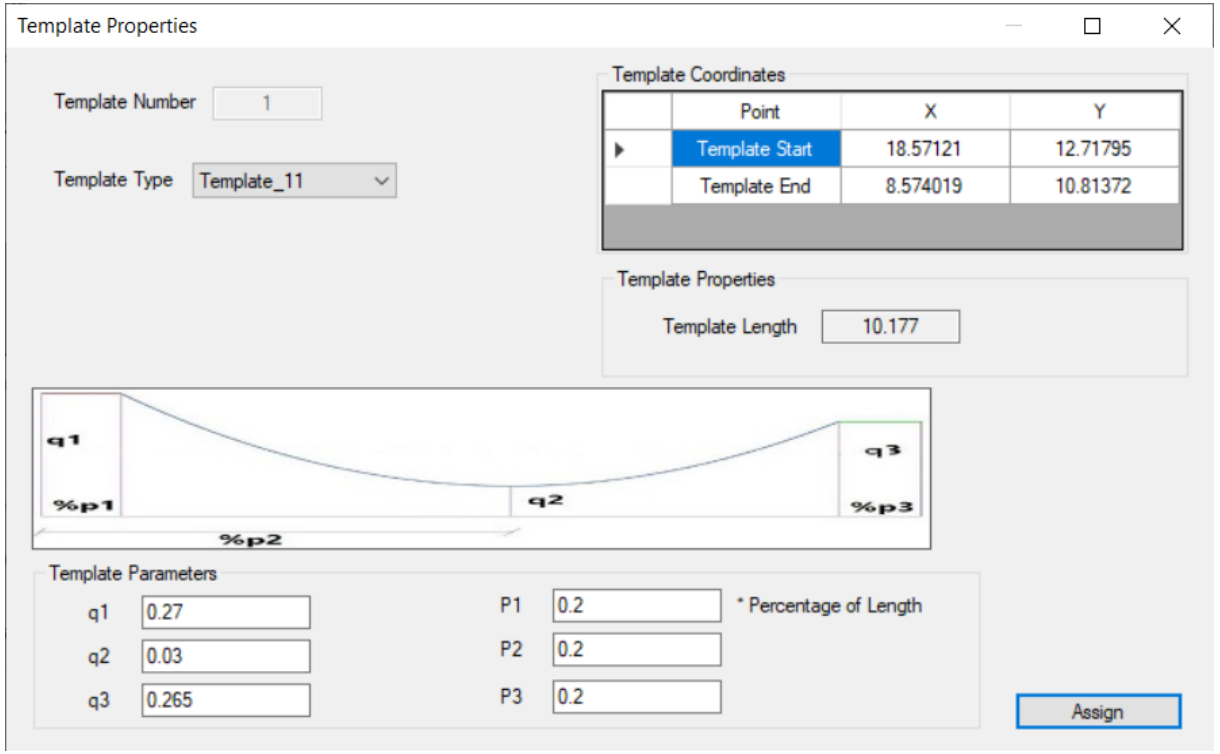


Template 9

3.2 How can users generate PTPAK Model



Template 10



Template 11

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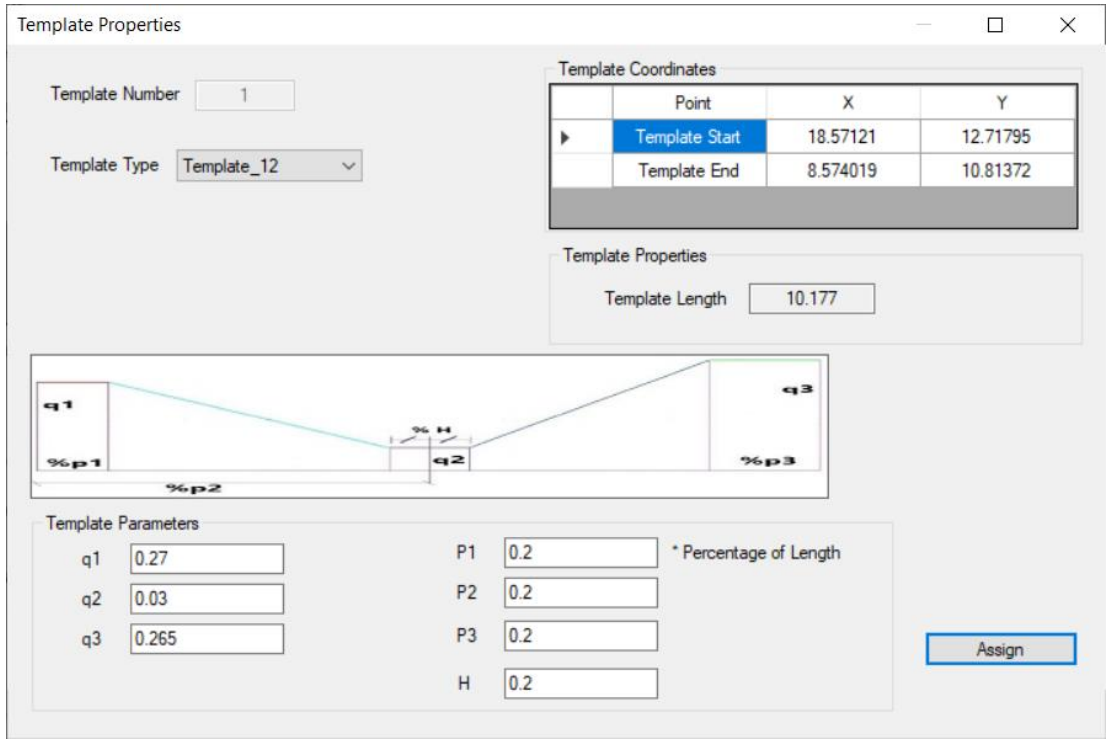
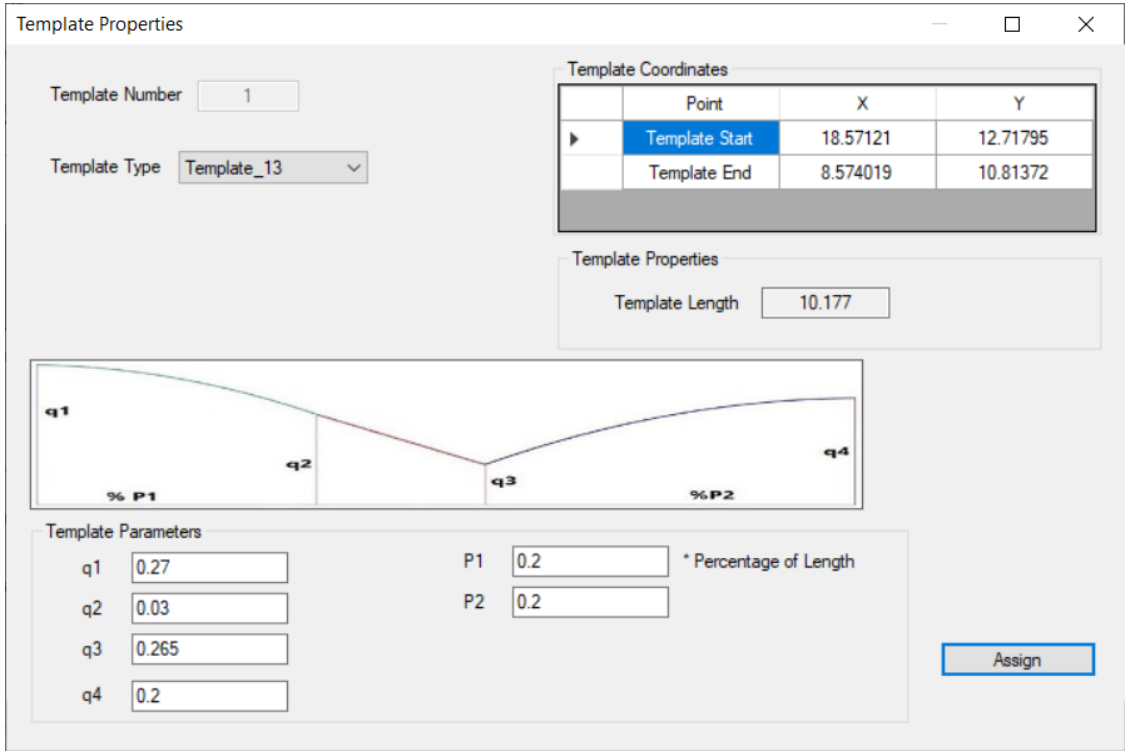
3.2 How can users generate PTPAK Model



Template 12



Template 13

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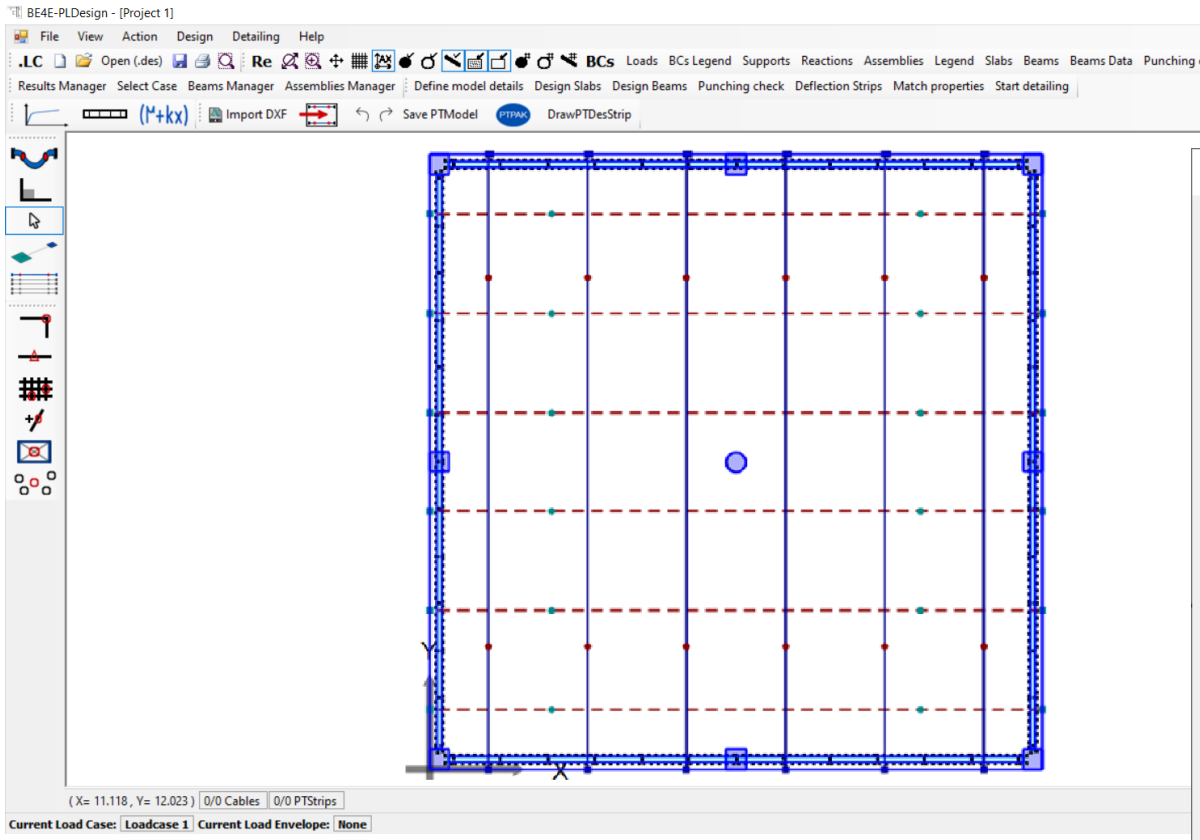
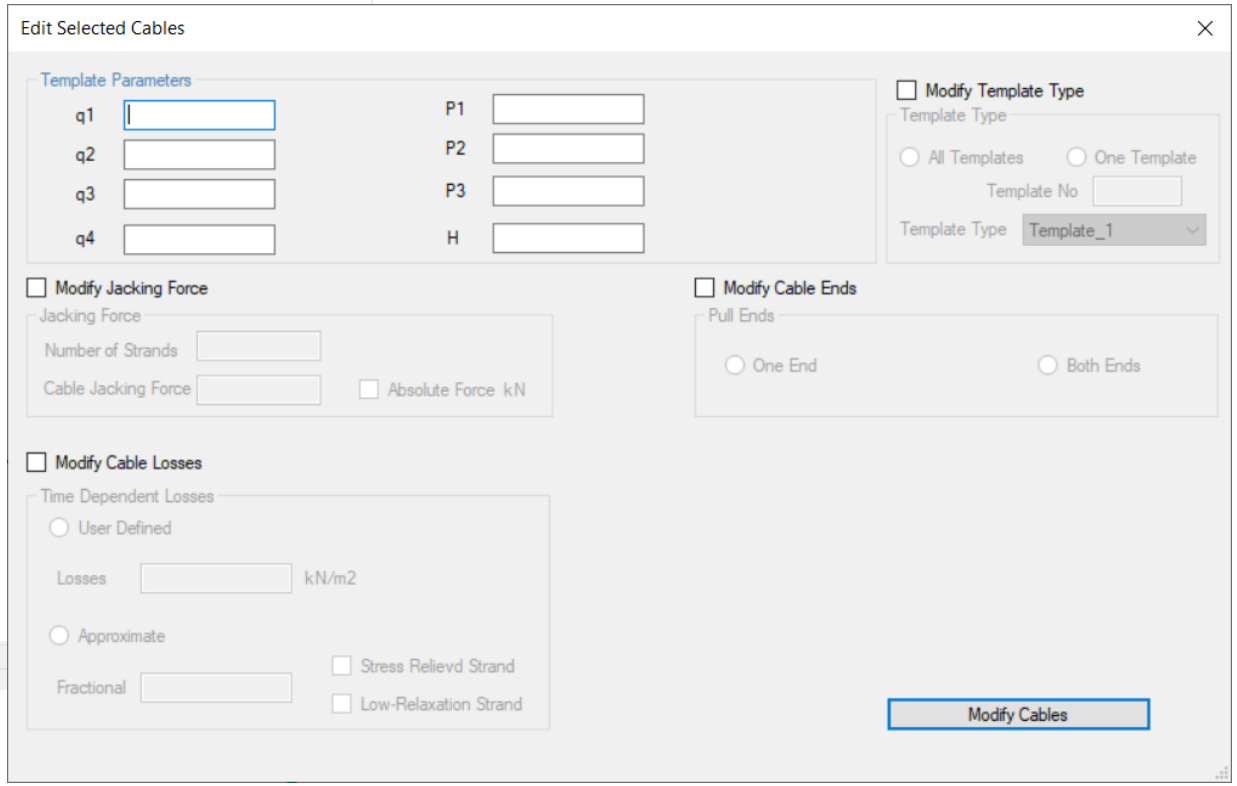
3.2 How can users generate PTPAK Model

Instead of choosing cable properties one by one, the user can choose multiple cables with the same properties.





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3. PTPAK Package

3.1 Files need to be exported before using PTPAK ✓

3.2 How can users generate PTPAK Model ✓

3.2.1 Draw cables ✓

3.2.2 Cables data ✓

3.2.3 Cable templates ✓

3.2.4 Multiple cable selection ✓

3.3 How to solve the PTPAK model

3.4 Load combinations & load envelopes

3.5 Check the Cable Eccentricity

3.6 Check the Cable stresses

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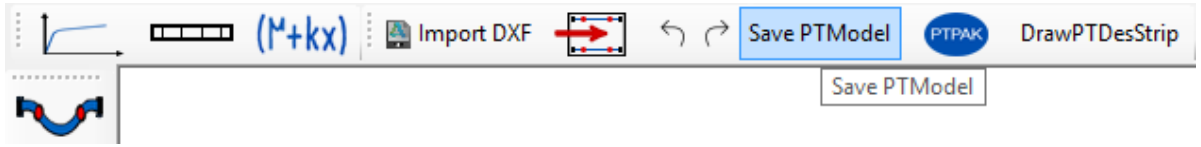
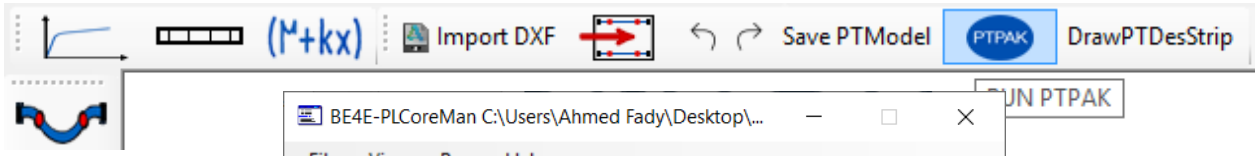
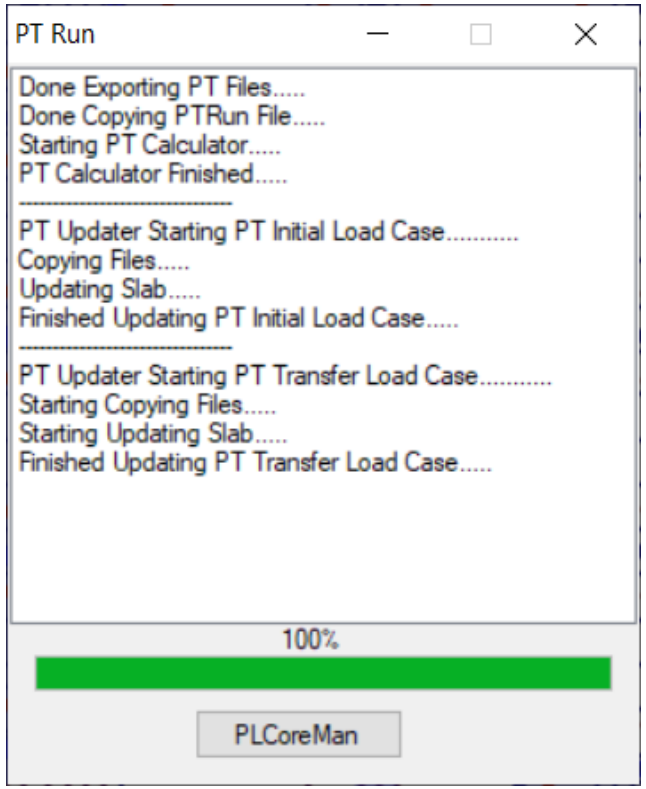
BOUNDARY ELEMENTS FOR ENGINEERS

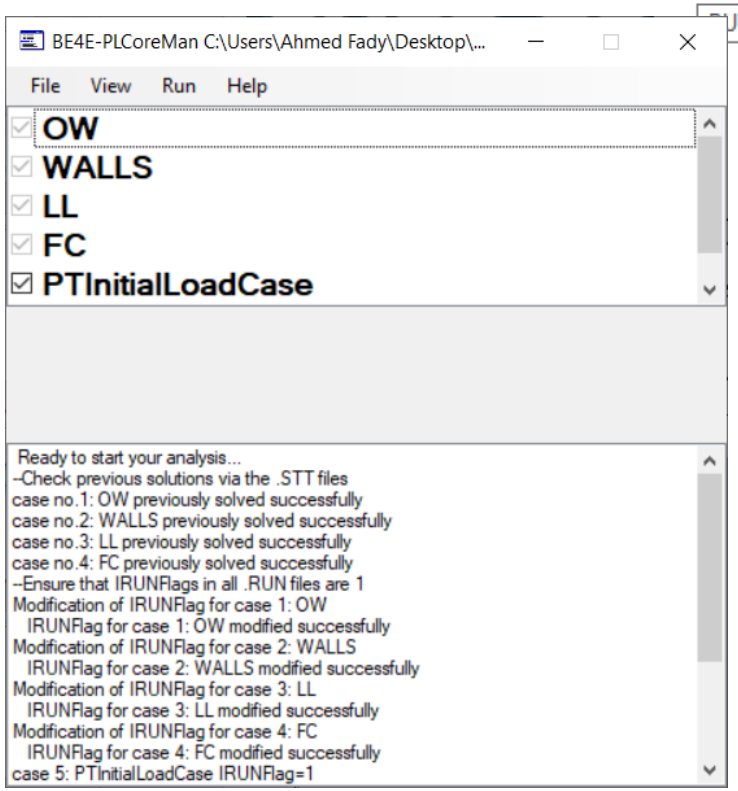
3.3 How to solve the PTPAK model

- Before solving PTPAK, the user should save the PTModel.
- Hence, run PTPAK.
- Open PLCoreMan, and run PL.exe.









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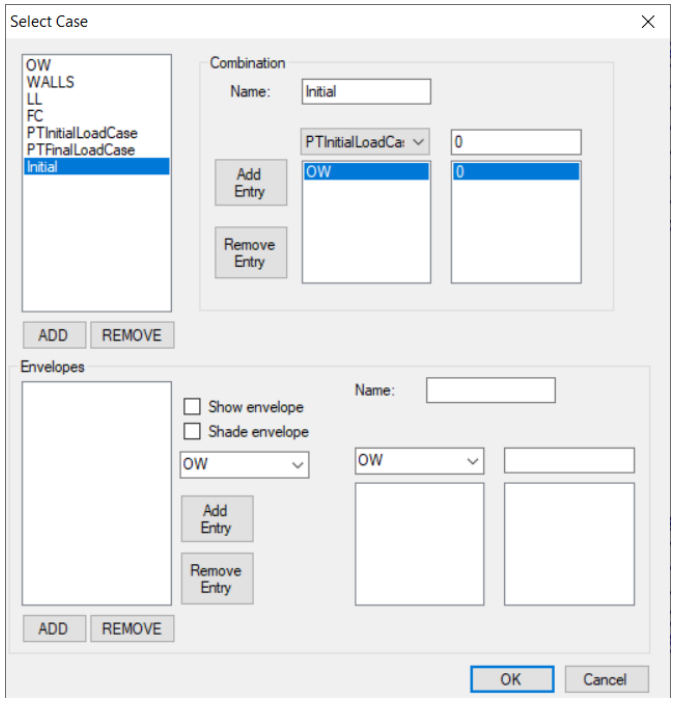
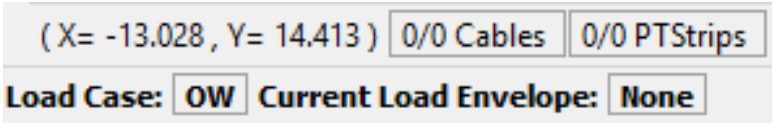
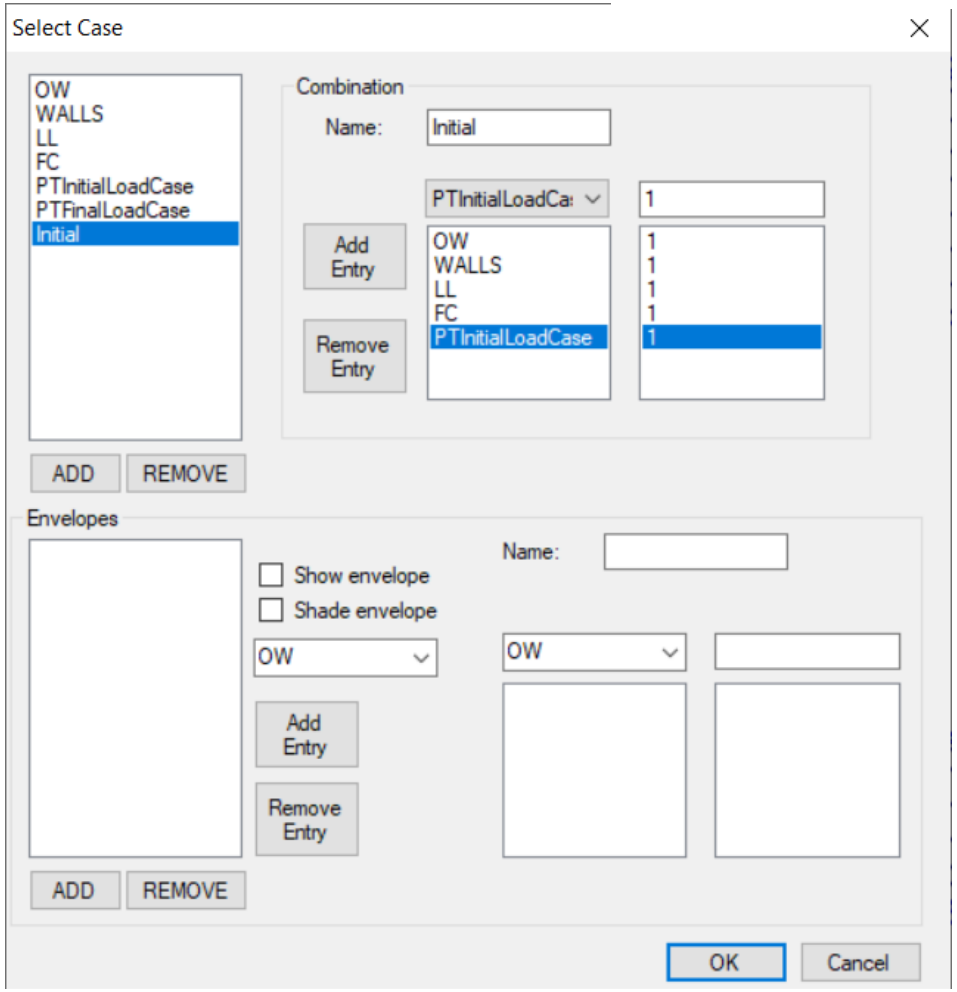
3.4 Load combinations & load envelopes

- Reopen the PTPAK.exe to apply load combinations.
- The lower tabs of the PTPAK, If the user press double click on OW Combinations window will open.

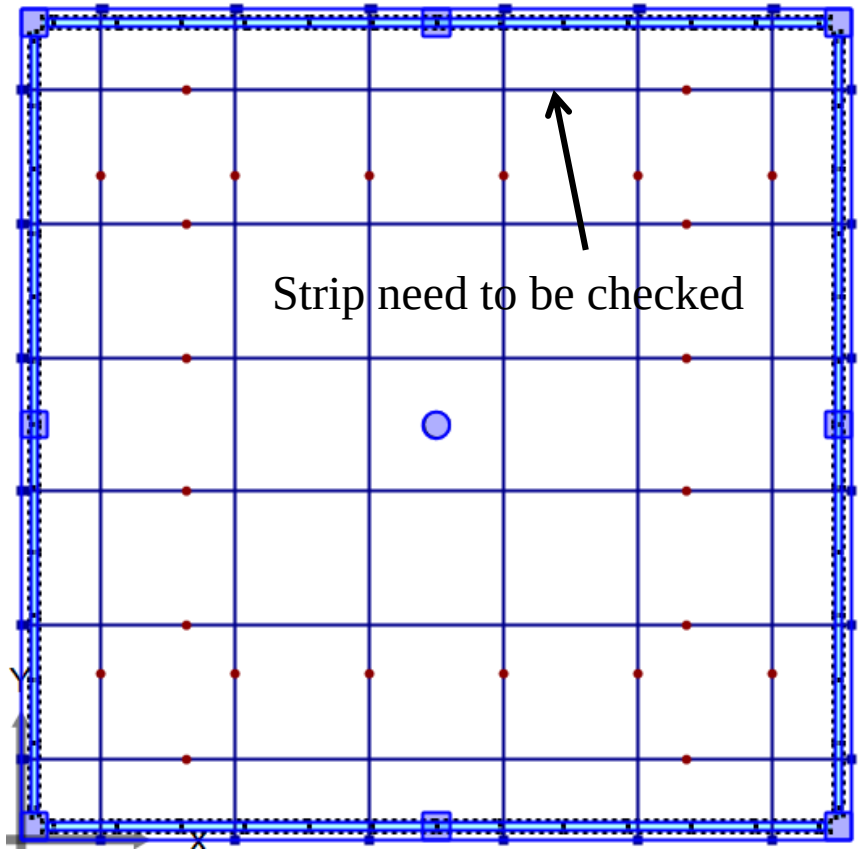


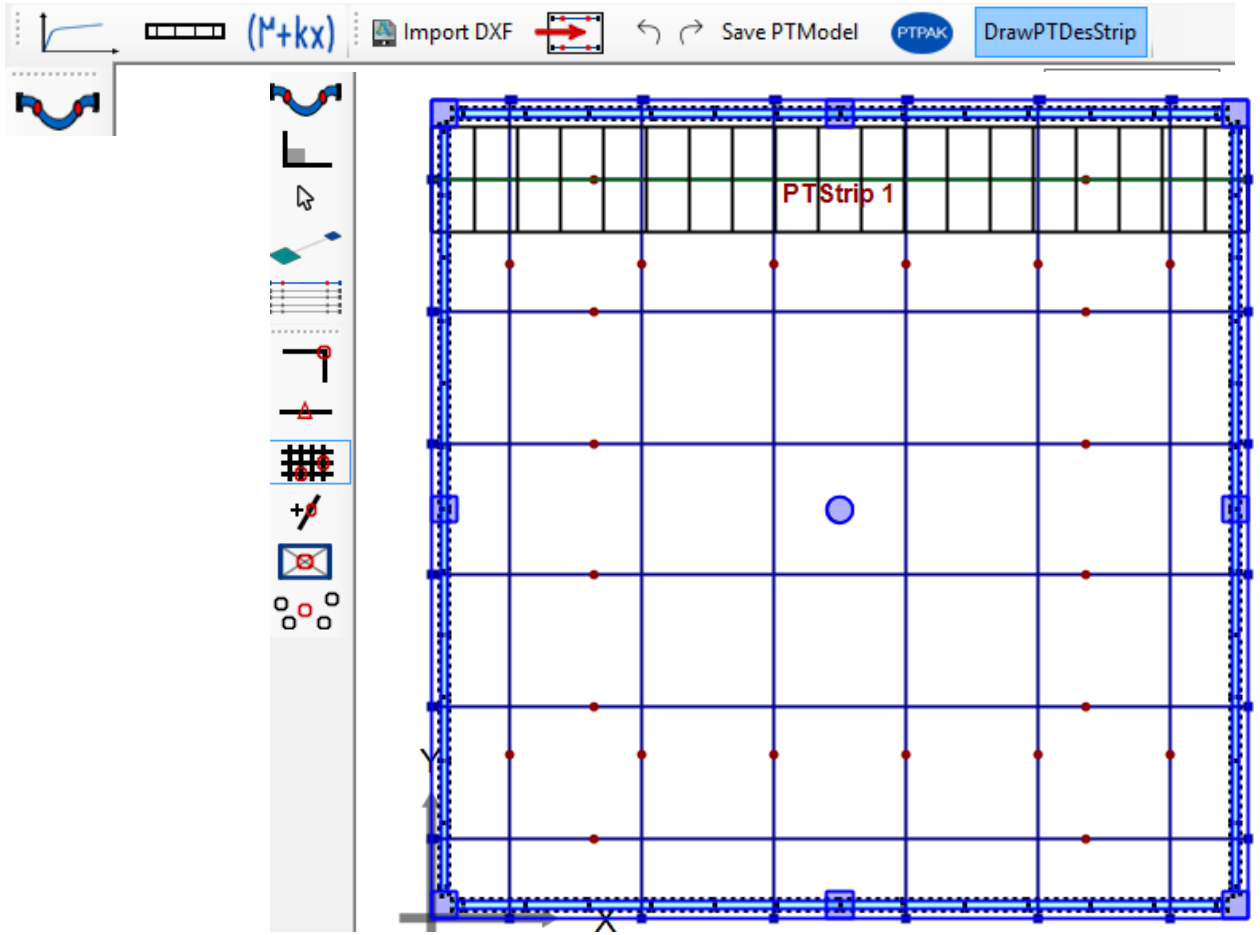




3.5 Check the Cable Eccentricity

- The user should check the eccentricity of the cable profile and the stress distribution through the slab cross section.





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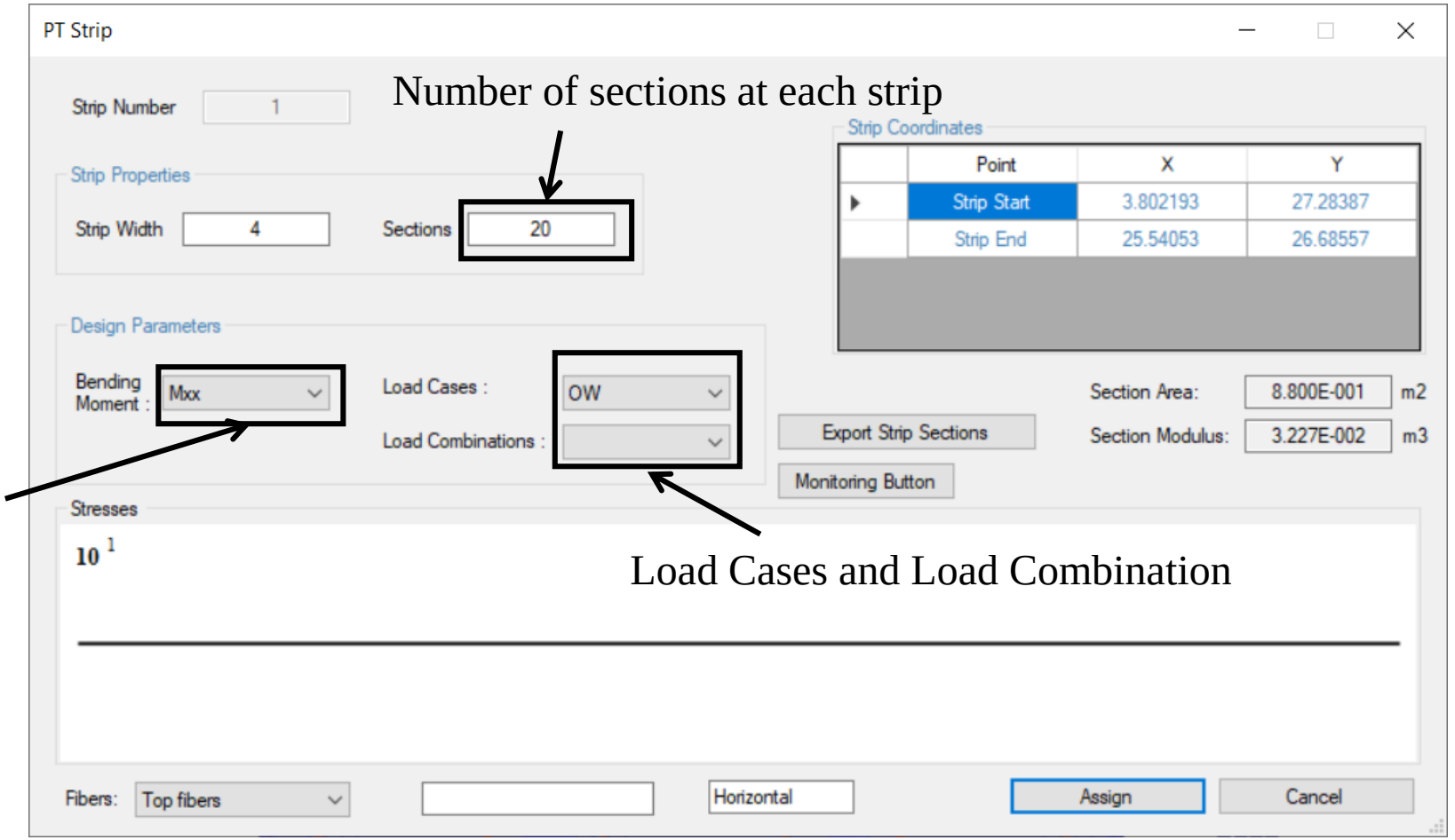
3.5 Check the Cable Eccentricity

- User should draw the design strip and edit its prosperities.



The direction of bending moment to calculate the section stresses

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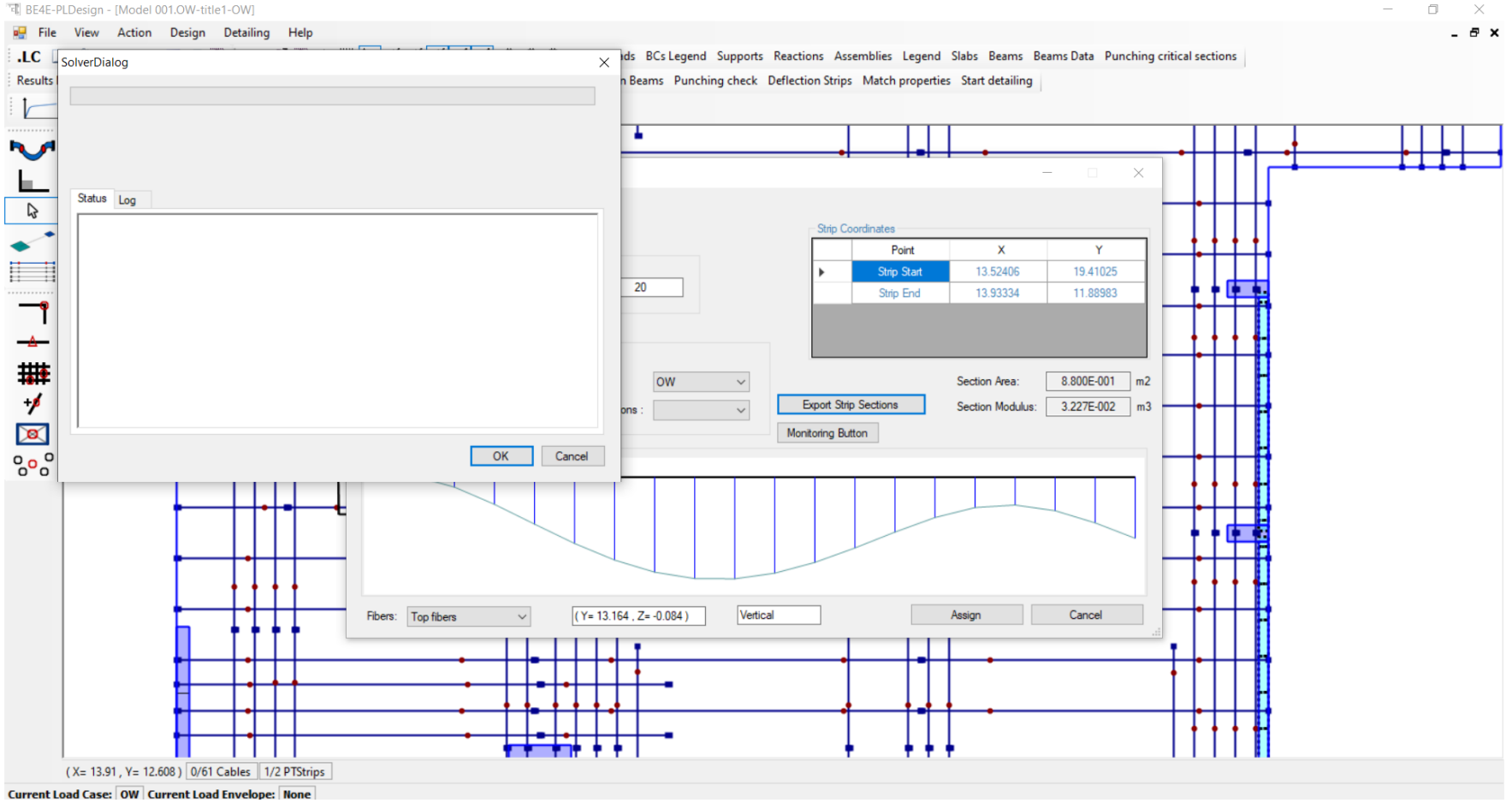
3.6 Check the Cable stresses

- User export strip sections.



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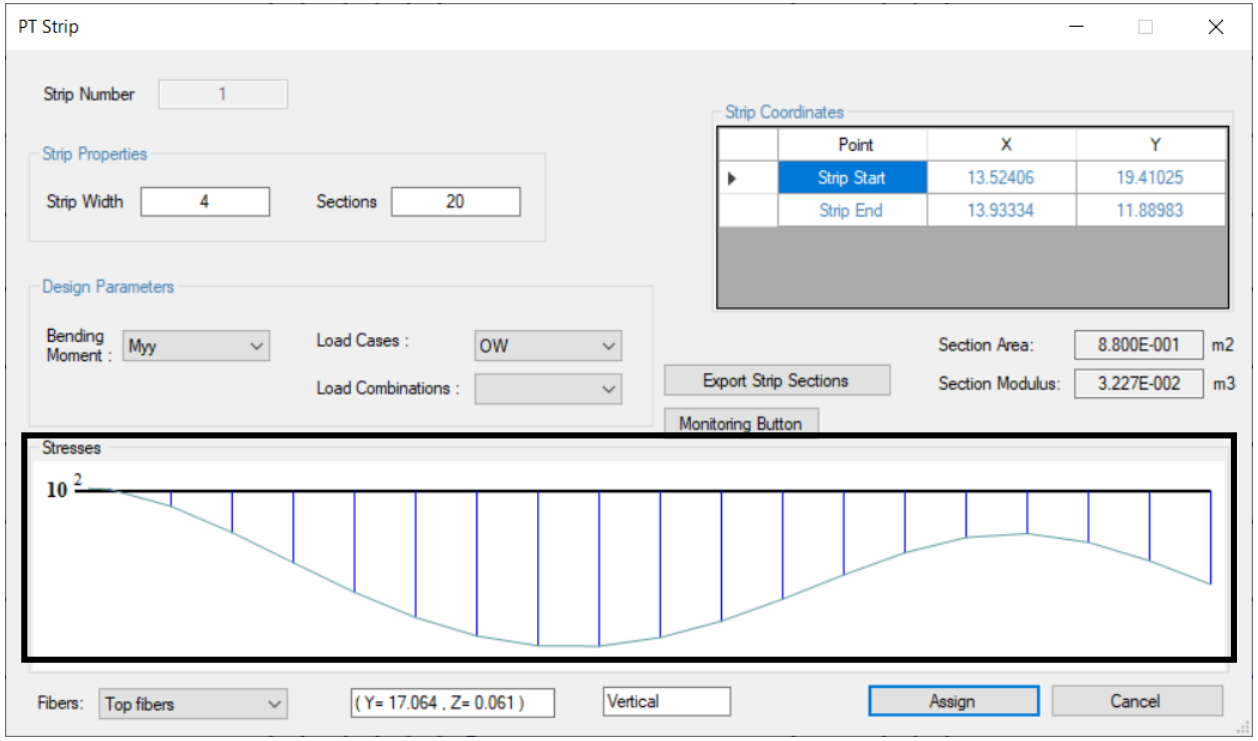
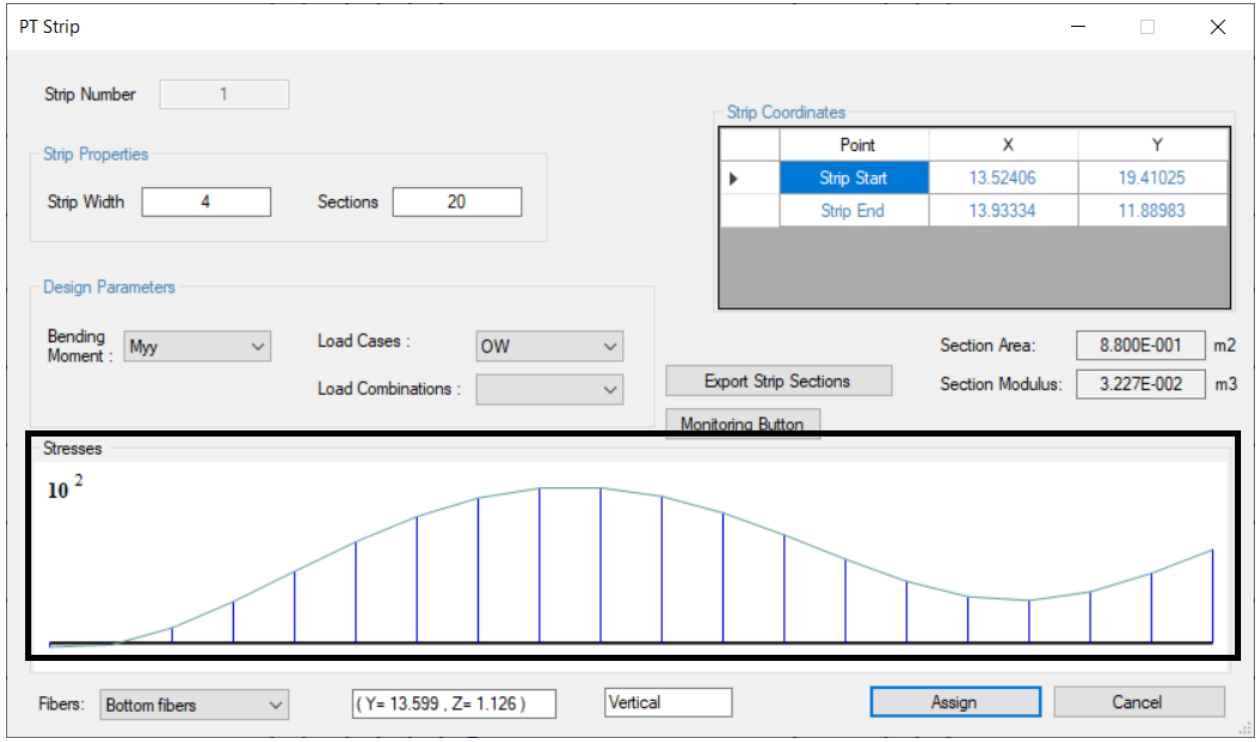
3.6 Check the Cable stresses

- Hence, click on monitoring button to check the stresses.



Top stress distribution over the PTDesign Strip



Bottom stress distribution over the PTDesign Strip

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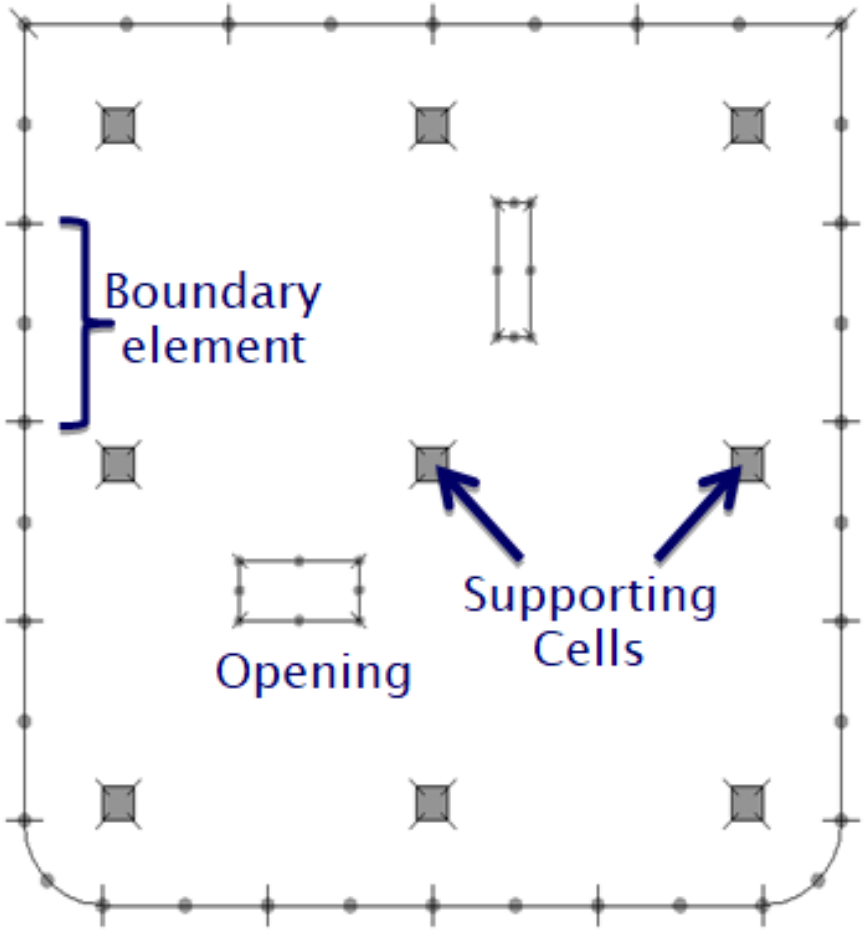
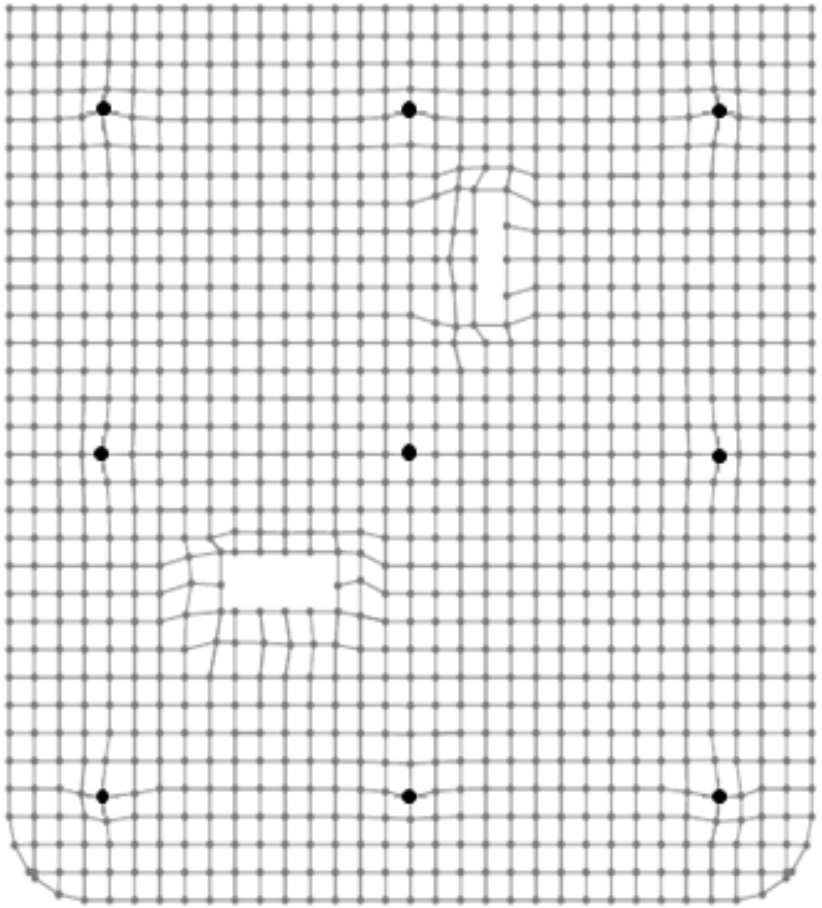
BEM vs FEM



BEM model



FEM model

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2. Part I - PLDesign Package ✓
3. Part II - PTPAK Package ✓
4. Conclusions

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3. Part II - PTPAK Package
4. **Conclusions**

4. Conclusions:

By the end of this lecture the attendee learned how to:

1. **Design full or a part of practical slabs using PLDesign.** ✓
2. **Design beams using PLDesign.** ✓
3. **Check deflections of slab using PLDesign.** ✓
4. **Check punching using PLDesign.** ✓
5. **Export excel calculation sheets using PLDesign.** ✓
6. **Design post-tensioned slab using PTPAK.** ✓
7. **Learn PTPAK modelling and design capabilities.** ✓