



PLPAK – Design Tool





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Intended learning outcomes

This manual illustrated 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.



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1. Introduction

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1. Introduction: What is the PLDesign?

- 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 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.





1. Introduction: What is the PLDesign?

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

SE4E-PLPost - [Project 1]

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	_		PLView (BE mesh editor tool)		
	-		PT cable calculator		
⊠ FI	oorin		PTUpdate (Post-Tensioning tool)		
w w	all lo		AutoCAD exporter		
			AutoCAD extractor		
			EHSPAK		
			P-PPAK		
			PL.EXE (Linear solver)		
Charle			NLPAK (Nonlinear solver)		
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case 1:	DL has \$r	un\$.			\sim



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2. PLDesign Package

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- 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





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.



4

Print

Exit

Ctrl+P



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.







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.

Current Load Case: DL Current Load Envelope: None







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:







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.



trips							
Strip 1	X	ID:	Strip 1		Enabled:	\checkmark	Export
		Npoints:	200		Result:	Мох	~
		Start:	37.746,3		End:	-0.94,3	
		Status:	ToBeSolved	~	theta:	0	Use Local





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2.4.1. Design from PLPost results (strip design)

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







- 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.

EE4E-PLDesign - [Project 2]

File View Action Design Detailing Help LC Image: Comparison of the second secon	OR D	efine model details D	Design Slabs Design Beams	Deflection Strips N	Match properties	Start detailing	
Results Manager Select Cat Design Slabs Manager Design Beams Manager Deflection Strips Manager	jer			(Create a design slab from :	strips	Create_a_design_slab_from_strips_definit
Punching check	Design Slabs				Strip list (choose result strip):	:	O Choose width definition strips: Strip list (width definition):
	Main model	Add strip to main model	Create a design slab		Strip 1		Rep. 1
		Create new region	Pleases choose a result type	e option:			
		Edit	Create a designsla	ab from a contour.			
		Delete	Create a design sl	ab from a strip.			
	Region properties	1 areas	ОК	Cancel			
	Show direction	2 areas					Define strip width Width:
	Start slab	design Close			OK Can	icel	OK Cancel





- 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.



esgin slabs list:		Strip properties							
esign strip 1	X	Width:	1		Status:	ToB	eSolved ~	⊠ s	how enabled.
		Major design parameter:	Mxx	~	Material:	Defa	sult Kgf-m 🗸		nvelope design
		Minor design parameter:	Муу	~	Load case /combination:	DL	✓ En	velope:	~
		Top major stee	Bottom maj	or steel	Top minor s	teel	Bottom minor steel		Refresh
		Bar diameter:	0.01		Number of	ars.	0	Ca	Iculate moment
		Maximum +v	e bending mon	nent:	Maximum	-ve b	ending moment:		
		0			0			n	
gin slab spans:]	0 Span properties			0			n	
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sgin slab spans: ssign span 1 ssign span 2 ssign span 3 ssign span 4 ssign span 5		0 Span properties Slab thickness: Cover: Top cover:	0.15000000	05961	0 Singly rein Alpha Major:	force	d. Force doul	bly reinfor	rced section.
sgin slab spans: sign span 1 sign span 2 sign span 3 sign span 4 sign span 5 sign span 6 sign span 7		0 Span properties Slab thickness: Cover: Top cover: Top major stee	0.1500000 0 0 8 Bottom mai)596(0 Singly rein Alpha Major: Alpha minor:	force 0.2 0.2	d. Force doul	bly reinfor	rced section.
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gin slab spans: sign span 1 sign span 2 sign span 3 sign span 4 sign span 5 sign span 6 sign span 7		0 Span properties Slab thickness: Cover: Top cover: Top major stee Asteel top ma Bar diameter:	0.15000000 0 0 el Bottom maj	05961 or steel 0 0.01	0 Singly rein Alpha Major: Alpha minor: Top minor s	force 0.2 0.2 teel Minin	d. Force doul Bottom minor steel num number of reba	bly reinfor ars: 0 ars: 0	rced section.





- 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.

Define model detai	ls Design Sla	bs Design B	eams D	Deflection S	Strips	Match propert	ies Start detailing
E	tit Design Slab Main model Desgin slabs list: Design strip 1 X	Strip properties Width: 1 Major design parameter: Minor design parameter: 0.01 Bar diameter: 0.01 Maximum +ve bending mome 0	Status: Material: Combination: reteel Top minor steel Number of required reban Maximum 4 0	ToBeSolved > Default Kgf-m > DL > Envelc eeel Bottom minor steel 5: 0 12: 14: 15: 14: 14: 14: 14: 14: 14: 14: 14: 14: 14	Show enable Envelope der Refresh Calculate mom Red addeon Red adde	d. sign.	
	Desgin slab spans: Desgin span 1 Desgin span 2 Desgin span 3 Desgin span 4 Desgin span 5 Desgin span 5 Desgin span 7 Desgin span 7 Errors: Errors: Errors in major direction:	Span properties Slab thickness: 0.150000005 Cover: 0 Top cover: 0 Top major steel Bottom major Asteel top major direction: Bar diameter:	396() Singly reinfo Alpha Major. (C Alpha minor. (C steel Top minor steel 0 N 0.01 N	arced. Force doubly n 0.2 0.2 eel Bottom minor steel Minimum number of rebars: Number of required rebars:	reinforced section		
					Close		

lab spans	Beams	Beam se	ctions	Punching asms.		
Source regi	ion :		Desti	nation region:		
Main model	l.	\sim	Main	model	~	
ource are	a :		Desti	nation area:		
esign strip	1	~	Desi	gn strip 1	\sim	Top major steel
ource spa	n:		Desti	nation span:		Bar diameters
Design spa Design spa	n 1 n 2		Des Des	ign span 1 ign span 2		Bar amounts
Design spa Design spa Design spa Design spa Design spa	in 3 in 4 in 5 in 6 in 7		Desi Desi Desi Desi Desi	gn span 3 gn span 4 gn span 5 gn span 6 gn span 7		Top minor steel ✓ Bar diameters ✓ Number of bars
Dimension	15		Sec	ction data		Bottom major steel Bar diameters Number of bars
Slab the Bottom	nickness n cover over		NN	Is Singly reinforce Force doubly reinforced section Alpha values	d	Top major steel ✓ Bar diameters ✓ Number of bars





- 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 Xdirection and the other for Y-direction.

Design Slabs		7		
Main model	Add strip to main model	Exporting	· · · · · · · · · · · · · · · · · · ·	×
	Create new region	Would you lik	e to export calculation sheets of the designed elements?	
	Edit	• Yes		
	Delete	Export pat	n: C:\Users\Ahmed Fady\Desktop\Backup Fady\Desktop	Browse
Region properties		⊖ No		
Show direction 2 areas			ОК	
Start slab design	Close			

	PLDESIGN : Design Calculation Sheet
The second secon	XURAL DESIGN of a Single Reinforced Rectangular Section According to ECP Stab No: Design strip 1:Design span 3 Region 1D: Main model
	Company Name: Project Name: Designed By: Reviewed By: Approved by:
Dimensions & Moment Moment (M) IE+08 N.m Thickness of section (t) 200 mm Concrete clear cover \circledast 10 mm Depth of Section (d) 190 mm $a = \frac{(0.67 * fcu * b * d) - \sqrt{(0.67 * fcu * b * d)}}{2 * (0.67 * fcu * b * d)}$	$\begin{array}{c} \textbf{Materials} \\ \textbf{Steel yield Strength (fy)} & 353.039 \\ \textbf{Concrete Cube Strength (fou)} & 24.566 \\ \textbf{N/mm}^2 \\ \textbf{Steel Young's Modulus (E)} & 24.566 \\ \textbf{N/mm}^2 \\ \textbf{Steel Young's Modulus (E)} & 0.003 \\ \textbf{Concrete Strain (E)} & 0.003 \\ \textbf{Concrete Strain (E)} & 1 \\ \textbf{Partial Factors} & Y_0 \\ \textbf{Ys} & 1.15 \\ \textbf{Ys} & 1.15 \\ \textbf{V} \\ \textbf{Fcu} \cdot \frac{b}{2} \\ \textbf{Steel Young's (C)} \\ \textbf{Steel Young's (C)} \\ \textbf{Steel Young's Modulus (E)} \\ \textbf{Steel Young's (E)} \\ Steel You$
$Cmax = \frac{2}{3} * \frac{Ecmax}{\frac{Ecmax}{Ecmax + \frac{fy}{Y_{F}}/Esteel}}$	
$c = \frac{a}{0.8} / d$	ck C <cmai< th=""></cmai<>





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

	Edit Design Siab
	Main model
Strip properties	
Width: 1 Status: Solved Image: Solved Show enabled. Major design parameter: Mox Material: Default Tonf Envelope design. Minor design parameter: Myy Load case / combination: ultimate Envelope: Image: Solved Top major steel Bottom major steel Top minor steel Bottom minor 4 Refresh Bar diameter: 0.01 Number of 0 Calculate	Design slabs list: Strip properties Width: 1 Status: ToBeSolved • Width: 1 Major design parameter: May • Moor design Myy • Load case / combination: Utimate • Envelope: Top major steel Bottom major steel Bar diameter: 0 01 Number of 0
Maximum +ve bending moment: Maximum -ve bending moment: Add additional reinforcement: batches	Maximum +ve bending moment: Maximum -ve bending moment: Add addit reinforce 0 0 0
Slab thickness: 0.2000000298i Image: Singly reinforced. Force doubly reinforced section. Cover: 0.01 Alpha Major: 0.2 Top cover: 0.01 Alpha minor: 0.2 Top major steel Bottom major steel Bottom minor steel Bottom minor steel	Design span 1 Image: Slab thickness: 0.20000000298 Singly reinforced. Image: Force doubly reinforced sectors and the sectors and th
Asteel top minor direction: 0.00067775464 Minimum number of rebars: 5.99266673338 Bar diameter: 0.012 Number of required rebars: 6	Design span 9 Design span 9 Design span 10 Design span 11 Design span 12 Design span 12 Design span 13 Design span 14 Design span 14 Design span 15
rrors.	Errors: Errors in major direction: Bending moment too high, alpha can not be predefined and doubly reinforced section can not be for Errors in minor direction: No errors.
n	Strip properties Width: 1 Status: Solved Show enabled. Major design parameter: Max Material: Default Tonf Envelope design. Minor design Myy Load case (combination: utimate Envelope: Image: Combination: Minor design Myy Load case (combination: utimate Envelope: Image: Combination: Top major steel Bottom major steel Top minor steel Bottom minor Image: Combination: Bar diameter: 0.01 Number of Oregoin (combination) Calculate Add additional reinforcement: Maximum +ve bending moment: 0 0 Distributer Add additional reinforcement: Span properties Saba thickness: 0.20000000298 Singly reinforced. Force doubly reinforced section. Cover: 0.01 Alpha Major: 0.2 Image: Distributer Distributer Top major steel Bottom major steel Top minor steel Bottom minor steel Signage: Distributer Asteel top minor direction: 0.00267775464 Minimum number of repaired rebars: 5.99266673338 Bar diameter: 0.012 Number of required rebars:<





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

Export design data						Region name	Area name	Major design mon	ent Strip name	Top major rft.	Bot. major rft.	Top minor rft.	Bot minor rft.
Export slabs	Export beams								Design span 1	5 Φ 0.012	<u>6 Φ 0.012</u>	6 Ф 0.012	5 Φ 0.012
Slab regions:	Design beams:	T B	E4E-P	LDesign - [1.DL-title1-DL]					Design span 2	5 Φ 0.012	5 Φ 0.012	10 Φ 0.016	5 Φ 0.012
Main model			File	View Action Design	n Deta				Design span 3	5 Φ 0.012	6 Φ 0.012	10 Ф 0.016	5 Φ 0.012
			THC.	ment C	1 250 : .				Design span 4	6 Φ 0.016	5 Φ 0.012	9 Φ 0.018	5 Φ 0.012
		: .L	~						Design span 5	5 Φ 0.012	9 Φ 0.018	5 Φ0.012	7 Φ 0.012
		Re		Open (.res) Ctrl+O	ms Mana				Design span 6	6 Φ 0.012	5 Φ 0.012	6 Φ0.012	5 Φ 0.012
				Open (.des0)					Design span 7	5 Φ 0.012	7 Φ 0.012	7 Φ 0.012	5 Φ 0.012
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Superior and a second in a	Funct minfernement to Revit			Export design data		intain model	strip l		Design span 9	5 Φ 0.012	5 Φ 0.012	5Φ0.012	5 Φ 0.012
Punching assemblies:	Level name in Revit:			Dana Catura					Design sp an 10	5 क 0.012	5 Φ 0.0 12	5 Φ 0.012	5 Φ 0.012
	Export			Page Setup					Design span 11	5 ₽ 0.012	8 Φ 0.018	7 Ф 0.016	5 Φ 0.012
	Export summary files (.xls)		<u> </u>	Print Preview					Design span 12	7.∲ 0.016	5 ⊕ 0.012	9 Φ 0.012	5 Φ 0.012
	Export beams		3	Print Ctrl+P					Design span 13	5 Φ 0.012	5 Φ 0.012	5 Φ 0.012	5 Φ 0.012
	Export punching assemblies			Exit					Design span 14	6 Φ 0.012	5 ⊉ 0.012	6 Ф 0.012	5 Φ 0.012
	Export		-						Design span 15	5 Ф 0.012	6 Φ 0.012	6 Ф 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
Select all Deselect all	Close												





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







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

ianager serec case searrs manage	, Denne moder details - Design sia			n properties start declaming	
0					
and		 	<u>.</u>		



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- 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.

Image: File View Action Design Detailing Help Image: LC Image: Second Secon	OR Define mo	odel details Design Slabs	Design Beams Deflection Strips	Match properties Start detailing
Results Manager Select Ca: Design Slabs Manager Jer Design Beams Manager				
Deflection Strips Manager Punching check	Design Slabs			Create a design slab from a contour
	Main model	Add strip to main model Create new region Edit Delete	ete a design slab Pleases choose a result type option: ① Create a designslab from a contour. ① Create a design slab from a strip.	Contour list: Main Contour Main Contour Contour 1
	Region properties Show direction 1 areas Show direction 2 areas	Close	OK Cancel	Please choose the required contours.
	otalt aldo dealgit	Clobe		





- 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.

	Add strip to ma model	
	Create ne	ew region
	Edit	
	Delete	
Region properties		
Show direction 1 areas		
Show direction 2 areas		

sgin slabs list:		Strip properties	1	0.00		
Design strip 2 X Design strip 2	X	Writer design	1	Status:	ToBeSolved ~	Show enabled.
	parameter:	Mxx ~	Material:	Default Kgf-m 🗸	Envelope design	
	Minor design parameter:	Муу	Load case /combination:	DL ~ Envel	ope:	
		Top major steel	Bottom major	steel Top minor s	teel Bottom minor steel	Refresh
		Bar diameter:	0.01	Number of	0	Calculate moment
		Maximum +ve	e bending mome	nt: Maximum	-ve bending moment:	Add additional
		0		0		
sgin slab spans:		0 Span properties		0		batches
sgin slab spans: esign span 1 esign span 2		0 Span properties Slab thickness:	0.150000005	0 96(🗌 Singly rein	forced.	reinforced section.
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sgin slab spans: <mark>esign span 1</mark> esign span 2 esign span 3	•	0 Span properties Slab thickness: Cover: Top cover: Top major stee	0.150000055 0 0 Bottom major	0 961 Singly rein Alpha Major: Alpha minor: steel Top minor s	forced. Force doubly n 0.2 0.2 teel Bottom minor steel	reinforced section.
sgin slab spans: esign span 1 esign span 2 esign span 3		0 Span properties Slab thickness: Cover: Top cover: Top major stee Asteel top maj	0.150000005 0 0 Bottom major jor direction:	0 961 Singly rein Alpha Major: Alpha minor: steel Top minor s 0	forced. Force doubly n 0.2 0.2 teel Bottom minor steel Minimum number of rebars:	reinforced section.
esgin slab spans: esign span 1 esign span 2 esign span 3		0 Span properties Slab thickness: Cover: Top cover: Top major stee Asteel top maj Bar diameter:	0.150000055 0 0 Bottom major jor direction:	0 961 Singly rein Alpha Major: Alpha minor: steel Top minor s 0 0.01	forced. Force doubly r 0.2 0.2 teel Bottom minor steel Minimum number of rebars: Number of required rebars:	reinforced section.
esgin slab spans: esign span 1 esign span 2 esign span 3		0 Span properties Slab thickness: Cover: Top cover: Top major stee Asteel top maj Bar diameter:	0.150000005 0 0 Bottom major jor direction:	0 961 Singly rein Alpha Major: Alpha minor: steel Top minor s 0 0.01	forced. Force doubly (0.2 0.2 teel Bottom minor steel Minimum number of rebars: Number of required rebars:	reinforced section.





- After adjusting the main model, it is time for solving the slab by • pressing start slab design.
- Export the design calculation sheet. ٠

Design Slabs			
Main model	Add strip to main model	Exporting	×
	Create new region	Would you like to export calculation sheets of the designed elements?	
	Edit	Yes	
	Delete	Export path: C:\Users\Ahmed Fady\Desktop\Backup Fady\Desktop	Browse
Region properties		⊖ No	
Show direction 2 areas		ОК	
Start slab design	Close		

		Strip properties						
lesion strip 2		Width:	1	Status:	ToBe	Solved ~	⊠ s	how enabled.
lesign strip 2	X	Major design parameter:	Mxx ~	Material:	Defa	ult Kgf-m 🗸	E	nvelope design
		Minor design parameter:	Myy 🗸	Load case /combination	DL	✓ Enve	elope:	~
		Top major steel	Bottom major ste	el Top minor s	steel	Bottom minor steel		Refresh
		Bar diameter:	0.01	Number of	1	0	Ca	lculate moment
		Maximum +ve 0	bending moment:	Maximum 0	-ve be	ending moment:	A	
esgin slab spans:		Span properties						
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lesign span 1 lesign span 2		Slab thickness:	0.1500000596(Singly rein	forced	I. Force doubly	y reinfor	rced section.
lesign span 1 lesign span 2 lesign span 3		Slab thickness: Cover:	0.15000005964	Singly rein	forced	I. D Force doubly	y reinfor	ced section.
lesign span 1 lesign span 2 lesign span 3		Slab thickness: Cover: Top cover:	0.15000005960	Singly rein Alpha Major: Alpha minor:	0.2	I. Force doubly	y reinfor	ced section.
lesign span 1 lesign span 2 lesign span 3		Slab thickness: Cover: Top cover: Top major steel	0.15000000596(0.02 0.02 Bottom major ster	Singly rein Alpha Major: Alpha minor: el Top minor s	0.2 0.2 0.2	I. D Force doubly	y reinfor	rced section.
lesign span 1 lesign span 2 lesign span 3		Slab thickness: Cover: Top cover: Top major steel Asteel top major	0.1500000596(0.02 0.02 Bottom major ster or direction: 0	Singly rein Alpha Major: Alpha minor: el Top minor s	forced 0.2 0.2 steel Minim	I. Force doubly	y reinfor	rced section.
lesign span 1 lesign span 2 lesign span 3		Slab thickness: Cover: Top cover: Top major steel Asteel top majo Bar diameter:	0.1500000596(0.02 0.02 Bottom major stee or direction: 0 0.0	Singly rein Alpha Major: Alpha minor: al Top minor s	oforced 0.2 0.2 steel Minim Numb	Bottom minor steel	y reinfor s: 0 s: 5	rced section.
lesign span 1 lesign span 2 lesign span 3		Slab thickness: Cover: Top cover: Top major steel Asteel top majo Bar diameter:	0.15000005961 0.02 0.02 Bottom major ster or direction: 0 0.0	Singly rein Alpha Major: Alpha minor: I Top minors I Top minors I 16	forced 0.2 0.2 steel Minim Numb	Bottom minor steel	y reinfor s: 0 s: 5	rced section.





- 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 Xdirection and the other for Y-direction.



	Strip properties				
Design strip 2	Width:	1	Status:	ToBeSolved ~	Show enabled.
Design strip 2	Major design parameter:	Мхх	Material:	Default Kgf-m 🗸	Envelope design
	Minor design parameter:	Муу	Load case /combination	n: DL V Envel	ope:
	Top major ste	el Bottom majo	or steel Top minor	steel Bottom minor steel	Refresh
	Bar diameter	0.01	Number of	0	Calculate moment
	Maximum +\ 0	e bending mom	ent: Maximun 0	n -ve bending moment:	Add additional reinforcementt batches
Desgin slab spans:	Span propertie	s			
Design span 1 Design span 2	Slab thickness	0.15000000	5961 Singly rei	nforced. Sorce doubly	reinforced section.
Design span 3	Cover:	0.02	Alpha Major:	0.2	
	Top cover:	0.02	Alpha minor:	0.2	
	Top major ste	el Bottom majo	or steel Top minor	steel Bottom minor steel	
	Asteel top ma	ajor direction:	0	Minimum number of rebars:	0
	Asteel top ma Bar diameter	ajor direction:	0	Minimum number of rebars: Number of required rebars:	0
	Asteel top ma Bar diameter	ajor direction:	0	Minimum number of rebars: Number of required rebars:	0





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

Export design data								
Export slabs Slab regions: Main model	Export beams Design beams:	BE4E-PLDesign - [1.DL-title1-DL] File View Action Design I Import LC Re 🎯 Open (.res) Ctrl+O ms M	a timents rom	PL]	DESIGN :	Slab reinforcen	nent sheet	<u>.</u>
Select all Deselect all Export punching assemblies Punching assemblies:	Select all Deselect all Export reinforcement to Revit Level name in Revit: Export	Open (.des0) Save Ctrl+S Export design data Page Setup Print Preview	Company Nam Project Name Designed By Reviewed By Approved by	me: 				
	Export summary files (xls)	Print Ctrl+P Exit	Region nameArea Des Main model <u>str</u> De str	n nameflajor design mom esign Mxx trip 1 Mxx esign Mxx	erStrip name op Design 6 span 1 Design 5 span 1	о major rf&ot. major rf 6 Ф 0.012 0 Ф 0.012 5 Ф 0.012 5 Ф 0.012	Top minor rft 5 ¢ 0.016 5 ¢ 0.012	Bot minor rft. 0 Φ 0.012 5 Φ 0.012
Select all Decelect all	Export slabs Export punching assemblies Export							





- 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. Define model details Design Slabs Design Beams Deflection Strips Match properties Start detailing







- 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.



Create slab desi	gn region	
Draw region Draw region OR Define points ma	Draw	
Point	X	Y
Point 1		
Point 2		
Point 3		
Point 4		
Basic + Add	litional reinforcem	ient areas
 Strip based 	region	
N1 2	and the design of	
NO D	required in direc	uon 1
Number of strips	required in direct	tion 2
Spacing 1 Design strip inter	mal point spacing	3
	ОК	Cancel

•	5 5	
Draw region Draw region OR	Draw	
Define points	manually	
Point	X	Y
Point 1	13.24512	10.58748
Point 2	11.23791	9.368814
Point 3	12.45658	6.40578
Point 4	15.94531	6.93148
Basic + A	dditional reinforce	ment areas
O Strip base	d region	
N1 2		
Number of stri	ps required in dire	ction 1
N2 2		
Number of stri	ps required in dire	ction 2
Spacing 1		
Design strip in	ternal point spacir	ng



spans.



- 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

Main model Region 2	Add strip to main model
	Create new region
	Edit
	Delete
Region properties	inforcement area al reinforcement area

esgin slabs list:		Strip properties				
rea 1	X	Width:	0	Status:	ToBeSolved ~	Show enabled.
	Major design parameter: Minor design	Мхх	Material:	Default Kgf-m V [n: DL V Envelo	Envelope design	
		Top major stee	Bottom majo	or steel Top minor	steel Bottom minor steel	Refresh
		Bar diameter:	0.01	Number of	0	Calculate moment
		Maximum +w	l de la companya de l	required rei	Dars:	Add additional
sgin slab spans:		0 Span properties	e bending mom	ent: Maximur 0	n -ve bending moment:	reinforcementt batches
sgin slab spans: oan 1		0 Span properties Slab thickness: Cover:	0.15000000	ent: Maximur 0 596(Singly re Alpha Major:	inforced. Force doubly n 0.2	reinforcement batches
sgin slab spans: Nan 1		0 Span properties Slab thickness: Cover: Top cover:	0.15000000 0 0	ent: Maximur 0 5961 Singly re Alpha Major: Alpha minor:	inforced. Force doubly n	einforced section.
agin slab spans: an 1		0 Span properties Slab thickness: Cover: Top cover: Top major stee	0.15000000 0 0 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9	ent: Maximur 0 596(Singly re Alpha Major: Alpha minor: or steel Top minor	m -ve bending moment: inforced. Force doubly m 0.2 0.2 steel Bottom minor steel	einforced section.
sgin slab spans: an 1		0 Span properties Slab thickness: Cover: Top cover: Top major stee Asteel top ma	0.15000000 0 0 Bottom majo	ent: Maximur 0 596(Singly re Alpha Major: Alpha minor: or steel Top minor	m -ve bending moment: inforced. Force doubly n 0.2 0.2 steel Bottom minor steel Minimum number of rebars:	einforced section.
sgin slab spans: an 1		0 Span properties Slab thickness: Cover: Top cover: Top major stee Asteel top ma Bar diameter:	0.15000000 0 0 Bottom majo	ent: Maximur 0 596(Singly re Alpha Major: Alpha minor: or steel Top minor 0 0.01	m -ve bending moment: inforced. Force doubly n 0.2 0.2 steel Bottom minor steel Minimum number of rebars: Number of required rebars:	einforced section.
sgin slab spans: an 1		0 Span properties Slab thickness: Cover: Top cover: Top major stee Asteel top ma Bar diameter:	0.15000000 0 0 Bottom majo	ent: Maximur 0 596(Singly re Alpha Major: Alpha minor: or steel Top minor 0 0.01	inforced. Force doubly n 0.2 0.2 Steel Bottom minor steel Minimum number of rebars: Number of required rebars:	einforced section.





- 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.



Re 🖉 🏵 🕂 🗰 🔯 🗉 🍯 🍯 💕 💣 🗗 🗬 🗗 🤻 BCs Loads BCsLegend Supports Reactions Assemblies Legend Slabs Slab RFT Beams Beams Data





- 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.
 Define model details Design Slabs Design Beams Deflection Strips Match properties Start detailing

Edit Design Slab		Edit Design Slab		Match properties	
Region 2		Region 2		Slab spans Beams Beams	ections Punching asms.
Desgin slabs list: Area 1 Area 2 Area 3 Area 4 Area 5 Area 5 Area 7 Area 7 Area 9 Area 10 Area 11 Area 12	Strip properties Width: 0 Status: ToBeSolved If Show enabled. Major design Myy Material: Default Tonf Envelope design. Minor design Myy Load case Envelope: If Top major steel Bar diameter: 0.01 Number of required rebars: Calculate Maximum +ve bending moment: Maximum -ve bending moment: Add additional	Desgin slabs list: Strip pri Area 1 Area 2 Area 3 Area 4 Area 6 Area 6 Area 7 Area 8 Area 8 Area 9 Area 10 Area 12 Maximum Area 12	perties o Status: ToBeSolved V Show enabled. esign ter: Max Material: Default Tonf Envelope design. utimate Envelope: V V V igr steel Bottom major steel Dominor steel Bottom minor Refresh iameter: 0.01 Number of required rebars: O Calculate mum +ve bending moment: Maximum -ve bending moment: Add additional	Source region : Region 2	Destination region: Region 2 ▼ Destination area: Area 3 ▼ Destination span: Design span 1 Design span 2 Design span 4 Top major steel ♥ Bar diameters ♥ Bar amounts Design span 4 Top minor steel
Desgin slab spans: Design span 1 Design span 2	0 0 batches Span properties Slab thickness: 0000298023224 Singly reinforced. Force doubly reinforced section. Cover: 0.01 Alpha Major: 0.2 0.2 Top cover: 0.01 Alpha minor: 0.2 Top major steel Bottom major steel Top minor steel Bottom minor steel Asteel top major direction: 0 Minimum number of rebars: 0 Bar diameter: 0.012 Number of required rebars: 5	Desgin slab spans: Design span 1 Design span 2 Design span 3 Design span 4 Design span 5 Design span 6 Design span 7 Design span 9 Design span 10 Design span 10 Design span 10 Design span 10 Design span 10	0 batches operties	Dimensions Slab thickness Bottom cover Top cover	Image: Constraint of the section data Image: Constraint data Image: Constra
Errors: Errors in major direction: Errors in minor direction:	Close	Errors: Errors in major direction: Errors in minor direction:	Close		Match slabs Close





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







- 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.

Start detailing		Define model details Design Slabs Design Beams Deflection Strips Match properties Start deta	iling
Slab detailing Main model Region 2	Layer name Content Color Export Image: Slab areas Slab areas Red V V Major top fit. Major top fit. Blue V V Major bot fit. Major bot fit. Green V V Minor top fit. Minor top fit. V Pellow V V Minor bot fit. Minor bot fit. V Cyan V V	Image: Select Case Beams Manager Assemblies Manager	Attriances
Select all Deselect all Export area steel Beam detailing			
Select all Deselect all Text hieght-headers: 0.15	Layer name Content Color Export Beam Layout Beam layout Red ✓ Beam longitudinal Beam longitu ✓ Blue ✓ Beam cross secti Beam cross s ✓ Green ✓ Text hieght-details: 0.05 Export Close		





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







- 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.

in model	Add strip to model	main
	Create new r	egion
	Edit	
	Delete	
egion properties Show direction 1 area Show direction 2 area	s	

Jeale slab u	esign region	
Draw region Draw region OR	Draw]
Define points	manually	
Point	X	Y
Point 1		
Point 2		
Point 3		
Point 4		
Basic + /	Additional reinfo	orcement areas
N1 2		
	rips required in	direction 1
Number of st		
Number of st N2 2		
Number of st N2 2 Number of st	rips required in	direction 2
Number of st N2 2 Number of st Spacing 1 Design strip in	rips required in nternal point sp	direction 2 bacing

Define point	s manually	
Point	X	Y
Point 1	13.24512	10.58748
Point 2	11.23791	9.368814
Point 3	12.45658	6.40578
		C 021/0
Point 4	15.94531	0.33140
 Point 4 Basic + Strip basic > 	Additional reinforces	ement areas
Basic + Strip bas N1 2	15.94531 Additional reinford	ement areas
Point 4 Basic + Strip bas N1 2 Number of s	Additional reinford sed region trips required in di	ement areas
Point 4 Basic + Strip bas N1 2 Number of s N2 2	Additional reinford sed region trips required in di	ement areas
Point 4 Basic + Strip bas N1 2 Number of s N2 2 Number of s	Additional reinford sed region trips required in d	rection 1

Create slab design 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 one area.
- The upper section of strip properties is for the basic reinforcement and the lower is for additional reinforcement.



					
Area 1	Strip properties Width: Major design parameter:	0 Mxx ~	Status: Material:	ToBeSolved ∨ Default Kgf-m ∨	Show enabled.
	Minor design parameter:	Myy ~	/combination:	DL ~ Envel	ope:
	Top major steel	Bottom major ste	el Top minor st	teel Bottom minor steel	Refresh
	Bar diameter: Maximum +ve	0.01	required reba	-ve bending moment	Add additional
	0	benaing moment.	0	to bending moment.	reinforcementt batches
sgin slab spans:	0 Span properties	benang monera.	0		reinforcementt batches
esgin slab spans: pan 1	0 Span properties Slab thickness:	0.1500000596	0 Singly rein	forced.	reinforcementt batches reinforced section.
sgin slab spans: pan 1	0 Span properties Slab thickness: Cover:	0.15000005961	0 Singly reint	forced. Force doubly	reinforcementt batches reinforced section.
sgin slab spans: pan 1	0 Span properties Slab thickness: Cover: Top cover:	0.15000005961 0 0	0 Singly reint Alpha Major:	forced. Force doubly 1 0.2 0.2	reinforcementt batches
sgin slab spans: pan 1	0 Span properties Slab thickness: Cover: Top cover: Top major steel	0.15000000596(0 0 Bottom major ste	0 Singly reint Alpha Major: Alpha minor: el Top minor st	forced. Force doubly force dou	reinforcementt batches
esgin slab spans: pan 1	0 Span properties Slab thickness: Cover: Top cover: Top major steel Asteel top maj	0.1500000596(0 0 0 0 0 or direction: 0	0 Singly reint Alpha Major: Alpha minor: el Top minor st	forced. Force doubly forced. D.2 D.2 Evel Bottom minor steel Minimum number of rebars:	reinforcementt batches reinforced section.
esgin slab spans: pan 1	0 Span properties Slab thickness: Cover: Top cover: Top major steel Asteel top maj Bar diameter:	0.1500000596(0	0 Singly reint Alpha Major: Alpha minor: el Top minor st	forced. Force doubly 1 0.2 0.2 Bottom minor steel Minimum number of rebars: Number of required rebars:	reinforcementt batches reinforced section.
esgin slab spans: pan 1	0 Span properties Slab thickness: Cover: Top cover: Top major steel Asteel top maj Bar diameter:	0.15000000596(0 0 1 Bottom major ster ior direction: 0 0.0	0 Singly reint Alpha Major: Alpha minor: el Top minor st	forced. Force doubly forced. D.2 D.2 D.2 D.2 D.2 D.2 D.2 D	reinforcementt batches reinforced section.





- 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.

Point X Y Point 1 Point 2 Point 3 Point 4	
PointXYPoint 1Point 2Point 3Point 4	
Point 1 Point 2 Point 3 Point 4	
Point 2 Point 3 Point 4	
Point 3 Point 4	
Point 4	
Add	

aion 2						
sgin slabs list: ea 1	X	Strip properties Width: Major design	0 Mxx	Status:	ToBeSolved ~	Show enabled.
		Minor design parameter:	Муу	Load case /combination	n: DL V Envelo	pe:
		Bar diameter: Maximum +ve Reinforcemen	0.016 bending mom	ent: Maximur all Reinforce	steel Bottom minor steel 5 m -ve bending moment: ement mesh too small	Refresh Calculate moment Add additional reinforcementt batches
egin slab spans: an 1		Span properties Slab thickness: Cover:	0.15000000	5961 Singly rei	Inforced. Force doubly m	einforced section.
		Top cover:	U	Alpha minor:	0.2	
		Top cover: Top major stee Asteel top maj	Bottom majo	Alpha minor:	steel Bottom minor steel Minimum number of rebars:	0
		Top cover: Top major stee Asteel top maj Bar diameter:	Bottom maj	Alpha minor: or steel Top minor 0 0.01	steel Bottom minor steel Minimum number of rebars: Number of required rebars:	0





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







- 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.

ain model egion 2	Add strip to main model
	Create new region
	Edit
	Delete
Region properties Show basic reinforce Show additional reinf	ement area forcement area

esgin slabs list:		Strip properties						
Area 1	X	Width:	0		Status:	ToBeSolved 🔨		Show enabled.
		Major design parameter:	Мж	~	Material:	Default Kgf-m		Envelope design
		Minor design parameter:	Муу	~	Load case /combination	DL ~	Envelope	e:
		Top major stee	Bottom ma	ajor stee	Top minor	steel Bottom minor st	teel	Refresh
		Bar diameter:	0.01		Number of	0		Calculate moment
		Maximum +ve	hending mo	mont	required rep	dis.		Add additional
		0	bending me	ment.	Maximum 0	-ve bending moment.		reinforcementt batches
esgin slab spans:		0 Span properties		ment.	0 0	-ve bending moment.		reinforcementt batches
esgin slab spans: pan 1		0 Span properties Slab thickness:	0.1500000	005961	0 Singly reir	forced.	doubly rein	reinforcementt batches
esgin slab spans: ipan 1		0 Span properties Slab thickness: Cover:	0.1500000	005961	0 Singly reir	forced. Force d	doubly rein	reinforcementt batches
esgin slab spans: ipan 1		0 Span properties Slab thickness: Cover: Top cover:	0.1500000 0 0	005964	0 Singly reir Alpha Major: Alpha minor:	forced. Force d	doubly rein	reinforcementt batches
esgin slab spans: ipan 1		0 Span properties Slab thickness: Cover: Top cover: Top major stee	0.1500000 0 0 Bottom ma	00596(Maximum 0 Singly reir Alpha Major: Alpha minor:	forced. Force d	doubly rein	reinforcementt batches
esgin slab spans: ipan 1		0 Span properties Slab thickness: Cover: Top cover: Top major stee Asteel top maj	0.1500000 0 0 1 Bottom ma	00596I	Maximum 0 Singly reir Alpha Major: Alpha minor:	forced. Force d C.2 C.2 Steel Bottom minor st Minimum number of r	doubly rein	reinforcementt batches
esgin slab spans: pan 1		0 Span properties Slab thickness: Cover: Top cover: Top major stee Asteel top maj Bar diameter:	0.1500000 0 0 1 Bottom ma	00596() ajor stee 0 0.0	Maximum 0 Singly reir Alpha Major: Alpha minor: 1	forced. Force d 0.2 0.2 Steel Bottom minor st Minimum number of r Number of required r	doubly rein teel rebars: ebars:	reinforcementt batches forced section. 0 0
esgin slab spans: Span 1		0 Span properties Slab thickness: Cover: Top cover: Top major stee Asteel top maj Bar diameter:	0.1500000 0 0 I Bottom ma	005961 ajor stee	Maximum 0 Singly reir Alpha Major: Alpha minor: 1 Top minor s	forced. Force d 0.2 0.2 Bottom minor st Minimum number of r Number of required r	doubly rein teel rebars: ebars:	reinforcementt batches forced section.





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

Exporting		×
Would you like t	o export calculation sheets of the designed elements?	
• Yes		
Export path:	C:\Users\Ahmed Fady\Desktop\Backup Fady\Desktop	Browse
◯ No		
	ОК	

	C
xport slabs	Export beams
lab regions:	Design beams:
Main model	
Region 2	
Select all Deselect all	Select all Deselect all
Export punching assemblies	Export reinforcement to Revit
unching assemblies:	Level name in Revit:
	Export summary files (.xls)
	Export summary files (.xls)
	Export summary files (.xls) Export beams Export slabs
	Export summary files (xls) Export beams Export slabs
	Export summary files (.xls) Export beams Export slabs Export punching assemblies
	Export summary files (xls) Export beams Export slabs Export punching assemblies Export
	Export summary files (.xls) Export beams Export slabs Export punching assemblies Export
	Export summary files (xls) Export beams Export slabs Export punching assemblies Export

T. B	E4E-P	LDesign - [1.[DL-title	1-DL]	
•	File	View Ac	tion	Design	n Deta
i .L		Import LC			QI
Re	2	Open (.res)	Ctrl+(o	ms Mana
		Open (.des0)			-
		Save	Ctrl+	s	
		Export design	n data		
		Page Setup			
	۵,	Print Preview	,		
	3	Print	Ctrl+	P	
		Exit			





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

ain model		Layer name	Content		Color		Export
egion 2	•	Slab areas	Slab areas	~	Red	~	
		Major top rft.	Major top rft.	~	Blue	~	
		Major bot rft.	Major bot rft.	~	Green	~	\checkmark
		Minor top rft.	Minor top rft.	~	Yellow	~	
		Minor bot rft.	Minor bot rft.	~	Cyan	~	\checkmark
Select all Deselect all Export area steel					_		
Select all Deselect all Export area steel		laver name	Content		Color		Export
Select all Deselect all Export area steel		Layer name Beam Layout	Content Beam layout	~	Color Red		Export
Select all Deselect all Export area steel	•	Layer name Beam Layout Beam longitudinal	Content Beam layout Beam longitu	> >	Color Red Blue		Export
Select all Deselect all Export area steel		Layer name Beam Layout Beam longitudinal Beam cross secti	Content Beam layout Beam longitu Beam cross s	> > >	Color Red Blue Green	> > >	Export
Select all Deselect all Export area steel	•	Layer name Beam Layout Beam longitudinal Beam cross secti	Content Beam layout Beam longitu Beam cross s	> >	Color Red Blue Green	> > >	Export
Select all Deselect all Export area steel am detailing		Layer name Beam Layout Beam longitudinal Beam cross secti	Content Beam layout Beam longitu Beam cross s	> > >	Color Red Blue Green	> > >	Export S S S
Select all Deselect all Export area steel	Þ	Layer name Beam Layout Beam longitudinal Beam cross secti	Content Beam layout Beam longitu Beam cross s	> > >	Color Red Blue Green	> > >	Export
Select all Deselect all Export area steel		Layer name Beam Layout Beam longitudinal Beam cross secti	Content Beam layout Beam longitu Beam cross s	> > >	Color Red Blue Green	> > >	Export



PLDESIGN	:	Slab	reinforc	ement	sheet

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

Region nameArea nameMajor design momentStrip nameTop major rft.Bot. major rft.Top minor rft.Bot minor rft.Region 2Area 1MxxSpan 15 Φ 0.0165 Φ 0.0165 Φ 0.0165 Φ 0.016

Define model details Design Slabs Design Beams Deflection Strips Match properties Start detailing

OR

 BE4E-PLDesign - [1.DL-title1-DL]

 File
 View
 Action
 Design
 Detailing
 Help

 LC
 Provide the second second







2. PLDesign Package

2.1. File needed to be exported before using PLDesign

2.2. Starting PLDesign 🗸

2.3. Load combinations & load envelopes2.4. 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



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.





Define model d	etails Design Slabs	Design Beams	Deflection Strips	Match properties	Start detailing
Define model d	etails Design Slabs Deflection Strips I Deflection strips list Strip 1 Strip 2	Design Beams Manager t:	Add strips Add strips Moment based. Major design parame Maximum deflectiom:	Match properties Remove ter:	Start detailing
		- E 8 Clos	0.00076619000174 Effective length: 8.107704754533438 e	105167 14	





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. •

Add assemblies	
Support assemblies:	Load assemblies:
Add	Cancel



FOR

Punching assemblies	Critica	l section properties		BE analysis properties	Special items for EC design:	Unbalanced critical sh	near stresse
Support:1	▲ a:	0.25	Draw primary	Solve BE solution.	Axial stress in concrete:	Critical Shear stress:	0
Support:3	b:	0.60000038146972	critical section	Material: Default Kgf-n ∨	0	Capacity ratio:	NaN
Support:5	Beta:	2.40000152587890	Beta user defined.	Status: ToBeSolved ~	Reinforcement ratio in dir-1:		
Support:6 Support:7	b1:	0.25	Draw b1	Load case	Painformement ratio in dir 2	PE oritical shear stress	
Support:8 Support:9	b2:	0.60000038146972	Draw b2	/combination:		Deduction factor for	963
Support:10	Bo:	2.30000078678131	Bo user defined.	Li Envelope design.	<u> </u>	non-linearity effect in	0.15
Support:12	d;	0 1500000596046		Envelope: ~	Concrete shear capacity	BE-results:	
Support:13 Support:14	01-1-0	0.1500000550040	Reset properties	Spacing for BE solution: 0.1	0	Critical Shear stress:	0
Support:15	Alpha	40	Refresh	Distance of		Capacity ratio:	NaN
ID: Support:1	condi	ion: Interior ~	Herear	critical section:	Solve critical sections	UNSAFE	
Add Remove				Draw secondary critical section	Check punching		





2.6 Check punching



Punching Check According to ECP 2003 and ACI

Punching assemblies	Critic	al section properties		BE analysis p	properties	Special items for EC design:	Unbalanced critical she	ear stresses
Support: 1	a:	1.10000038146972	Draw primary	Solve BE	solution.	Axial stress in concrete:	Critical Shear stress:	3.415158
	b:	1.10000038146972	critical section	Material:	Default Tonf	▼	Capacity ratio:	2.621559
	Beta:	1	Beta user defined.	Status:	ToBeSolved	Reinforcement ratio in dir-1:		
	b1	1 10000029146072	Drevelat		TODEDUTED	0	SAFE	
	01.	1.10000038146972		/combination	LoadCase 1	 Reinforcement ratio in dir-2: 	BE critical shear stress	ses
	b2:	1.10000038146972	Draw b2	Envelope	, decien	0	Reduction factor for	
	Bo:	8.40000152587890	Bo user defined.	Envelope	e design.		non-linearity effect in	0.15
				Envelope:		Concrete shear canacity	BE-results:	
	u:	1	Reset properties	Spacing for	0.1		Critical Shear stress:	272.7607
	Alpha	40		BE solution:		130.272011680	C	0.000770
	Colun	nn	Refresh	Distance of	2		Capacity ratio:	2.093778
ID: Support:1	condi	ition: Interior 🔻		critical sectio	in:	Solve critical sections	UNSAFE	
Add Remove								

Punching Check According to EC

......

Sec. 2.

Punching assemblies	Critica	l section properties		BE analysis p	roperties	Special items for EC design:	Unbalanced critical she	ear stresses
Support: 1	a:	1.10000038146972	Draw primary	Solve BE	solution.	Axial stress in concrete:	Critical Shear stress:	1.92545218976
	b:	1.10000038146972	critical section	Material:	Default Tonf 👻	U	Capacity ratio:	6.83101509887
	Beta:	1	Beta user defined.	Status:	ToBeSolved 👻	Reinforcement ratio in dir-1:	SAFE	
	b1:	1.10000038146972	Draw b1	Load case	. LoadCase1 🔻	Reinforcement ratio in dir-2:	BE critical shear stress	es
	b2:	1.10000038146972	Draw b2	Envelope	e design.	0	Reduction factor for	
	Bo:	10.4000015258789	Bo user defined.	Envelope:			non-linearity effect in BE-results:	0.15
	d:	1.5	Reset properties	Spacing for BE solution:	0.1	Concrete shear capacity	Critical Shear stress:	19.2031991958
D: Support:1	Colum	n Interior V	Refresh	Distance of secondary	2	Solve critical sections	Capacity ratio: SAFE	0.68128071084
Add Remove				Draw secon	dary critical section	Check punching		Close







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2.6 Check punching 🗜 🕻 C 🗋 💣 Open (des) 🚽 🍠 🔍 Re 🖉 🍳 🕂 🇮 🔯 🗉 🖉 🖬 🖉 🖉 🖉 🖉 🖉 🖉 🖉 🖉 🖉 🖉 🖉 🖉 🖉 Results Manager Select Case Beams Manager Assemblies Manager Define model details Design Slabs Design Beams Punching check Deflection Strips Match properties Start detailing RE4E-PLDesign - [3.LoadCase1-title1-LoadCase1] ۵ × File View Action Design Detailing Help _ 8 × .LC 🗋 🧉 Open (.des) 🚂 🔿 🖸 Re 🖉 🔯 🕂 🎬 🖄 🍯 🍼 📉 📷 🗗 🗳 💣 🖓 🤻 BCs Loads BCs Legend Supports Reactions Assemblies Legend Slabs Beams Data Punching critical sections Results Manager Select Case Beams Manager Assemblies Manager Define model details Design Slabs Design Beams Punching check Deflection Strips Match properties Start detailing ---ent Load Case: New Combo3 Current Load F 명 BE4E-PLDesign - [3.LoadCase1-title1-LoadCase1] Eile View Action Design Detailing Help .LC] 🧉 Open (des) 🚽 🗿 🖸 Re 🖉 😟 🕂 🗮 🖄 💣 🕤 🏹 📷 🗇 💞 🗰 KSs. Loads BCs Loads BCs Legend Supports. Reactions: Assemblies. Legend. Slabs. Beams. Beams. Data: Punching critical sections Results Manager Select Case Beams Manager Assemblies Manager Define model details Design Slabs Design Beams Punching check Deflection Strips Match properties Start detailing Current Load Case: New Combo3 Current Load Envelope: None

1 BE4E-PLDesign - [3.LoadCase1-title1-LoadCase1]

🛃 File View Action Design Detailing Help





2. PLDesign Package

2.1. File needed to be exported before using PLDesign

2.2. Starting PLDesign 🗸

2.3. Load combinations & load envelopes2.4. 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



- 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.

BE4E-PLDesign - [1.DL-title1-DL]



OR

Define model details Design Slabs Design Beams Deflection Strips Match properties Start detailing

		BOUNDARL	EMENTS FOR	ENGINEERS
Design Beams				
Design beams:	Show enabled		Read beam data	
	Beam depth:		Define design regions	
	Solved:	ToBeSolved ∨ gn.	Start beam design	
	Envelope:	~	Close	

Before loading beam assembly file.

ign Beams				
Design beams:				
Design Beam1	^	Show enabl	ed.	Read beam data
Design Beam2		Beam width:	0.12	nead beam data
Design Beam4			0.5	Define design regions
Design Beam5		Beam depth:	0.5	
Design Beam7		Solved:	ToBeSolved ~	Start heam design
Design Beam8		Envelope de	esign.	otar beam design
Design Beam10		Envelope		Chara
Design Beam11	~	Livelope.	~	Close

After loading beam assembly file.



- 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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	S	how/Hide	Reactions		
	S	how/Hide	Legend		
	S	how/Hide	Assemblie	s	
	S	how/Hide	Slabs		
	S	how/Hide	Slabs RFT		
	🖌 S	how/Hide	Beams		
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Re 🖉 🕀 🕂 🗱 🖉 🍯 🍏 📉 📹 🗂 🗳 💏 🤻 BCs Loads BCs Legend Supports Reactions Assemblies Legend Slabs Slab RFT Beams Beams Data





- 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.







- 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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✓ Modi
EndName
1
End break
1
End break
End break
1).





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





🛚 Re 🖉 🕾 🕂 🗰 🖄 🗉 🍊 🎽 💣 🗗 🛡 🗗 🤻 BCs Loads BCs Legend Supports Reactions Assemblies Legend Slabs Slab RFT Beams Beams Data





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

ne reir	nforcement deta	ails ann an ann						
Desig	jn Beam1 - A	A reinforcement	details					
Straini	ing actions							
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					+	0.016	0.26	0.5
					Requi	red Asteel: 0.00070	116111€ Actual A	Asteel: 0.00080424
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							_	
	Stirrups (shear+t	orsion): Sate	Ac	la stirrup				Clo

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











Company Name:

Project Name:

PLDESIGN : Beam reinforcement sheet

2.7 Beam design

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

Envelope design.

Envelope:

V

Read beam data

Define design regions

Start beam design

Close

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			De	csign bedin/		

Design Beam8

Design Beam9

Design Beam10

Design Beam11





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

Define model details Design Slabs Design Beams Deflection Strips Match properties Start detailing

ling OR

 Image: File
 View
 Action
 Design
 Detailing
 Help

 Image: LC
 Image: Open (.des)
 Image: Action
 Image: Action (.des)
 Image: A

BE4E-PLDesign - [1.DL-title1-DL]









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4. Conclusions:

This manual illustrated how to:

- 1. Design full or a part of practical slabs using PLDesign.
- 2. Design beams using PLDesign. \checkmark
- 3. Check deflections of slab using PLDesign. \checkmark
- 4. Check punching using PLDesign.
- 5. Export excel calculation sheets using PLDesign. ✓





For additional help please visit: <u>https://www.plpak.com</u>

> or send e-mail to: plpak@be4e.com