

The PLDesign module USER MANUAL

PLPAK Version 2.00 STRUCTURAL ANALYSIS SOFTWARE USING THE BOUNDARY ELEMENTS METHOD

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1 PLPAK V2.00 User Manual - PLDESIGN

Table of Contents

Disclaimer	4
Copyright	5
Introduction	6
The PLDesign Operation Diagram	6
The PLDesign philosophy	7
PLDesign capabilities:	8
The new interface should provide the user with the following capabilities:	8
Starting the PLDesign	8
The PLDesign Menus	9
The File menu	9
File Import LC	9
File Open (.res)	0
File Open (.des())	0
File Export Design Data	0
File Page setup	1
File Print Preview1	1
File Print1	1
The View Menu1	1
View Toolbar	1
View Windows	1
View View Options	2
View Fonts	3
View Show/Hide Reactions	3
View Show/Hide Legend	3
View Show/Hide Assemblies	3
View Show/Hide Slabs14	4
View Show/Hide Slab RFT	4
View Show/Hide Beams	4
View Show/Hide Beams RFT1	5
View Show/Hide Punching Critical Sections	5
The Action menu	6
Action Results Manager	6

Action Paths Manager	20
Action Select Case	20
Action Assemblies	20
Action PL controls	22
Action Beams	
The Design menu	23
Design Design model details	23
Design Design Slabs	24
Design Design Beams	
Design Deflection Strips Manager	
Design Punching check	
The Detailing menu	
Getting Help	

Disclaimer

Considerable time, effort and expense have gone into the development and documentation of the PLPAKTM software. The PLPAKTM software has been thoroughly tested and used. The PLPAKTM software should be used by engineers with good understanding of concrete behavior, pre-stressing and structural mechanics. The user accepts and understands that no warranty is expressed or implied by the developers or the distributors on the accuracy or the reliability of the PLPAKTM software. The user must explicitly understand the assumptions of the PLPAKTM software and must independently verify the results produced by the PLPAKTM software.

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Introduction

The PLDesign is an add-on for the PLPAK software (<u>www.plpak.com</u>) that is responsible for the automated reinforced concrete design of the slab and beam sections analyzed by the PLPAK. The PLDesign utilizes the BEM features adopted by the PLPLAK to offer to the user easy, fast and efficient design and detailing that suits any structural engineering community expectations.

In this part of the manual, all the PLDesign commands and operations are going to be discussed explicitly.

The PLDesign Operation Diagram



PLDesign operation diagram

File	Description
Projectname.LC	Load case file
Projectname.res	Results file
Projectname.basm	Beam assembly file
\$SDD\$	Slab Design Data file
\$SDDR\$	Slab Design Data Reinforcement file
\$BDD\$	Beam Design Data file
\$BDDR\$	Beam Design Data Reinforcement file
\$PROP\$	Basic mesh Data file
\$MCALCRES\$	Basic mesh maximum moment
\$PUN\$	Punching Data file
\$PUNR\$	Maximum punching stress file
Projectname.SRFMT	Slab reinforcement file
Projectname.BRFMT	Beam reinforcement file

PLDesign file descriptions

Program	Description
PLDesign.exe	The main program that includes the user interface and controls the
	operation of other programs.
PLSD.exe	Slab designer
PLBD.exe	Beam designer
Mcalc.exe	Calculator of moment resistance of reinforcement mesh
Punchk.exe	Punching resistance calculator

PLDesign programs description

The PLDesign philosophy

The PLDesign is the PLPAK component that will be responsible for the structural design of reinforced concrete slab and beam objects. The philosophy of the PLDesign is based on giving valued capabilities to the user.

PLDesign capabilities:

The new interface should provide the user with the following capabilities:

- To utilize BEM results in the structural design easily.
- To choose the design code and appropriate design parameters. Currently, the PLDesign has the following codes:
 - The American Code (ACI),
 - The Eurocode (EC2).
 - Egyptian Code Of Practice (ECOP)
- To create full design for slab parts under bending moment based on either contour or strip results.
- To check punching stresses in the slab around regular/ irregular load/support elements.
- To create full design for beams under bending moment, shear and torsional stresses directly on the plan of the problem.
- To choose the reinforcement layout.
- To perform an accurate analysis for deflection limits.
- To export basic detailing.
- To export design results in the required formats to be used in RVT11ToPLGen.

Starting the PLDesign

Step#1: Load the model from .LC file





Step#2: Load the PLPost results already solved and saved as (*.res) (If necessary)

The PLDesign Menus

The File

	He File	View Actio	n Design	Detailing
enu				
	Fi	le		
		Import LC Open (.res Open (.des Save) Ctrl+O s0) Ctrl+S	
		Export des Page Setur Print Previ	ign data p ew	
	4	Print	Ctrl+P	

File | Import LC

Imports a numerical boundary element already completed and solved in the PLPost. This model will be used for the design purpose.

File | Open (.res)

Opens the results already saved by the user in the PLPost (either global or local contours, strips or other results) already solved.

File | Open (.des())

Opens a design result already saved in the PLDesign.

File | Export Design Data

This window is used to export the PLDesign design data to Excel & Revit for detailing. In this window you can define the required slabs and beams for export. The host level in Revit files can be imported in Revit using the Load Reinforcement from PLDesign tool. The tab gives the user a great advantage to export the model already designed to AutoDesk Revit to preview the required detailing for each section.

Export slabs	Export beams
ilab regions:	Design beams:
Main model	Design Beam1
	Design Beam2
	Design Beam3
	Design Beam4
	Design Beam6
	Design Beam7
	Design Beam8
	Design Beam9
	Design Beam10
	Design Beam 11
	Design Beam 13
	Design Beam 14
Select all Deselect all	Select all Deselect all
Export punching assemblies	Export reinforcement to Revit
unching assemblies:	Level name in Revit:
and ing assembles.	Export
	Export summary files (.xls)
	Transferrer
	Export beams
	Export slabs
	Export punching assemblies
	Export

File | Page setup

Brings up a dialog box in which the user can choose the size of the paper, the orientation and the margins

File | Print Preview

Brings up a small window in which the user can preview the .des file before printing

File | Print

Brings up a dialog box in which the user can choose the printer and print the current .des file

The View Menu



View | Toolbar

Used to control which toolbars should appear on the screen, the same function can be performed using right click on any toolbar. The mark beside a toolbar implies that it is selected.



View | Windows

Used to choose window options while using more than a single PLDesign interface at the same time.



View | View Options

Clicking on view options allow you to change the drawing sequence of the result elements, grid spacing, element thickness, opacity & colors of different elements.



View | Fonts



View | Show/Hide Reactions

The Show/Hide commands can be used to show or hide Loads, No. of divisions of every element, Coordinates of the cursor, grid and axis

View | Show/Hide Legend

The Show/Hide legend command is used to view the legend corresponding to the contours displayed by the user.

-	-15.2
-	-5.19
	4.83
-	14.8
-	24.9
-	34.9
	44.9
	54.9

View | Show/Hide Assemblies

The Show/Hide command is used to show the Straining actions of Assemblies (Shear walls without beams, Columns loads without beams).



View | Show/Hide Slabs

Used to preview a numbering for each rectangular or quadrilateral contour used for the slabs design.



View | Show/Hide Slab RFT

Used to preview the reinforcement required for each design slab in both major and minor directions.



View | Show/Hide Beams



The Show/Hide Beam Command allows the user to recognize each beam name necessary for the design.



View | Show/Hide Beams RFT

The Show/Hide Beams RFT command allows the user to be acquainted with the beams components such as sections and breaks which are set by the user as shown later.

<u>Hint about Sections and Breaks of the beams</u>: Each beam is divided into three regions defined by four breaks surrounding them (Start Break, End Break, Break 3, Break 4). The most critical section in each region is chosen relative to the region's length (0.5 of the middle region, and 0.1 starting from the ends of the left and right region).



View | Show/Hide Punching Critical Sections

The Show/Hide Punching critical section command shows/hides punching critical sections.



The Action menu



Action | Results Manager

This command shows the results manager which is used to control the properties of the strips and result areas which have been previously drawn.

😪 BE4E-PLPost - [jj.LoadCas	e1-title1-LoadCase1]		
🖳 File View Draw	Action Help		- 8 ×
.LC 🗋 💕 🖬 🎒 🖸	Solve	🝯 🍼 📉 📑 🗗 🛡 🗗 🤻 BCs Loads BCs Legend Supports Reactions Legend Rec. Contour Quad. Contour Max/Min Draw Strip	
	Query	Query Solve Results Manager Select Case PL Controls Assemblies Beams	
	Results Manager		
	Select Case		
	Assemblies		
	PL Controls		
	Beams		
I S			1

PLPost Results

The following table shows the results that can be shown by PLPost.

Quantity	Description
Rx	Rotation about the X axis
Ry	Rotation about the Y axis
Uz	Deflection in Z axis direction
Mxx	Bendng moment in X direction
Mxy	Twisting moments about X and Y directions
Муу	Bendng moment in Y direction
Qx	Shear Force in X direction
Qy	Shear Force in Y direction
Mii	Bendng moment in i direction
Mij	Twisting moments about i and j directions
Mjj	Bendng moment in j direction
Qi	Shear Force in i direction
Qj	Shear Force in j direction
Mmax	Maximum principal bending moment
Mmin	Minimum principal bending moment

Mxxdes	Design moment in X direction
Myydes	Design moment in Y direction
Miides	Design moment in i direction
Mjjdes	Design moment in j direction

Strips:



Strips: This part of results manager is used to control strip properties including ID, Start and End points, No. of points within the strip, type of stress resultant that is required to be displayed at this strip. Export command is used to export a tabulated format of the strip results, the produced tables can be used by any spreadsheet software.



Contours:

This part of the Results Manager is used to control properties of the contour areas. Main Contour is used to display contours all over the model, this is the only contour that can not be deleted. Using this dialogue you can control Contour ID, Type of stress component to be displayed, N which is the number of colours within the contour, spacing between points to be solved within the contour. Export command is used to export a tabulated format of the strip results, the produced tables can be used by any spreadsheet software.



Column Plot:

This part of result manager is used to show contour results at supports. This part is used to control the number of contour colours and type of stress component to be displayed. Export command is used to export a tabulated format of the strip results, the produced tables can be used by any spreadsheet software.



Action | Paths Manager



Action | Select Case

This command is used to select the load cases or combos that are required for the design of the slabs and the beams. We can also enter Envelop between the load cases and the combos.

live Modal 1	Combination Name:	total ultimate		
windy wheat sy		wheat 👻	1.4	
wheat2 wheat3 wheat4 windyden total working total ultimate	Add Entry Remove Entry	dead live wheat	1.4 1.6 1.6	
ADD REMOVE invelopes Envelope 1	Show envelo	Name: E pe ope	invelope 1	
	An And Sound States	 total working 	v 1	
	total working			
	Add Entry Remove Entry	total ultimat total working		

Action | Assemblies

This command is used to show the cell properties. In order to show assembly results, type the cell number in the lower left box, then click add. The assembly results can be read at the normal X and Y directions or at any direction. The results at principal directions can be shown using the command "use principal". The results can be exported to a file with a format that can be opened using any spreadsheet software.

🖳 File View	Action	Design	Help	
.LC 🗋 💕 0	Res	ults Mana	ger	
Results Manager	Pat	hs Manage	er	
,	Sel	ect Case		
	Assemblies			
	PL	Controls		
	Bea	ms		



Action | PL controls

Refer to PLCoreMan manual.

Action | Beams

This command is used to display and edit beam results. The produced dialogue is used to show beam nodes, directions, and type of stress component that should be displayed on the beam.



The Design menu

Desig	n
	Define model details
<u>(</u>)	Design Slabs Manager
	Design Beams Manager
J.	Deflection Strips Manager
	^p unching check





- The design codes allow the user to choose the required design code and to change the relevant design parameters. Currently, PLDesign supports ACI, EC2 and ECP.
- Throughout the PLPAK components, all the models were unit less; i.e., the user had to keep his units consistent. In PLDesign, the model units have to be defined; therefore, the model unit zone can be used by the user to define the models that he has been using so far throughout the model.
- The design materials zone allows the user to create and define the properties of any number of required design materials. The design materials are then attached to design slabs or beam sections.

Design | Design Slabs

This is the PLDesign menu that can be used to design slab parts under flexural stresses.



When you choose to "Add strip to main model" a design slab, this dialogue box will allow you to create design slabs from ready local contours or strip results (present in the Results Manager).

Pleas	es choose a resu	lt type option:
	Oreate a des	signslab from a contour.
	Create a des	sign <mark>s</mark> lab from a strip.
	ОК	Cancel

If you choose to create design slabs from contours, you will reach this mean that can be used to create multiple design slabs from local contours.

Design Slabs]
Create a d	esign slab
Plea	ses choose a result type option:
	Create a design slab from a contour
	Contour list: Main Contour Contour 1 Contour 2 Contour 3 Contour 4 Contour 5 Contour 6 Contour 7 Please choose the required contours. OK Cancel

If you choose to create design slabs from strips, you will reach this menu that can be used to create design slabs from strips. The definition of a design slab from a strip requires the user to define the main strip and the area definition strips.

Create a design slab from strips	Create_a_design_slab_from_strips_definition
Strip list (choose result strip):	Strip list (choose result strip):
Strip 1 Strip 2 Strip 3 Strip 4	Strip 1 Strip 2 Strip 3 Strip 4
OK Cancel	OK Cancel

After creating your design slabs, you can edit them directly from the Edit Design Slab menu shown below. This menu can be used to modify all possible slab design properties, reinforcement layout. In addition, it will display design errors if any.

Desgin slabs list:		Strip properties					
Area 1	X	Width:	0	Status:	ToBeSolved -	V Sho	w enabled.
		parameter:	Mxx 🔻	Material:	Default Tonf 👻	Env	elope design.
		Minor design I parameter:	Муу 👻	Load case /combination	LoadCase1 👻	Envelop	e: 🔍 👻
		Top major steel	Bottom major s	teel Top mino	r steel Bottom min		Refresh
		Bar diameter:	0.016	Number of	5		Calculate
		Maximum +ve 8.293227625	bending moment 18676	: Maximun 8.29322	n -ve bending mome 762518676	ent:	Add additional reinforcementt batches
Desgin slab spans:		Span properties					
Span 1 Add, rft area 2		Slab thickness:	0.27000001072	📄 🔄 Singly rei	inf <mark>orc</mark> ed. 📃 Forc	e doubly re	inforced section.
Add. rft area 3		Cover:	0	Alpha Major:	0.2		
		Top cover:	0	Alpha minor:	0.2		
		Top major steel	Bottom major s	teel Top mino	r steel Bottom min	or steel	
		Asteel top maj	jor direction: 0		Minimum number o	of rebars:	0
		Bar <mark>dia</mark> meter:	0.	.01	Number of require	d rebars:	0
Errors: Errors in major direct	ion:						
Errors in minor direct	ion:						

```
    BE4E-PIDesign [Project 1]

        File View Action Design Detailing Help
        - 6 ×

        LC 

            <sup>20</sup> Open (.des) 
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```

The match properties command is used to match a slab (Source Slab) to other slabs (Destination Slab) having the same properties as the source one.

slab spans	Beams	Beam s	ections	Punching asms		
Source reg	ion :		Desti	ination region:		
Region 2		•	Regi	ion 2	-	
Source are	a:		Desti	ination area:		
Area 1		•	Area	a 1	-	Top major-steel
Course and	-		Decti			Bar diameters
Soon 1		-	Con	n 1	1	Bar amounts
Add, rft ar	ea 2		Add	, rft area 2		
						Bottom major steel
Dimension	ns		Sec	ction data		INUMBER OF DARS
Slab ti Bottor	nickness nicover over			is singly reinfor Force doubly reinforced secti Alpha values	on.	Top major steel Bar diameters
			\	Match sla	abs	<u></u>

• Make sure that the bordered boxes are toggled 'off'; else wise the reinforcement of the first slab (Source Slab) will be similar to the Destination slabs.

	model	
	Create new re	gion
	Edit	
	Delete	
egion properties 2 Show direction 1 areas 3 Show direction 2 areas	5	

Press on "Start slab design" to start showing the as required for each design slab in both X and Y directions.

Desgin slabs list:	Strip properties
Area 1	Width: 0 Status: ToBeSolved V Show enabled.
HILL I	Major design
	parameter: Load case
	parameter: /combination: LoadCase1 Envelope:
	Top major steel Bottom major steel Top minor steel Bottom minor
	Bar diameter: 0.016 Number of 5 Calculate
	Maximum +ve bending moment: Maximum -ve bending moment: Add additional
	8.29322762518676 8.29322762518676 batches
Desgin slab spans:	
Span 1	Slab thickness: 0.22000001072; V Singly reinforced. Force doubly reinforced section.
Add. rft area 2 Add. rft area 3	Cover: 0.01 Alpha Major: 0.2
	Top cover: 0.01 Altheories 0.2
	Top mojor seer bactom major seer Top minor seer boctom minor seer
	Asteel top major direction: 0.00100530964 Minimum number of rebars: 5
	Bar diameter: 0.016 Number of required rebars: 0
Errors:	
Errors in major direction	ווי:
Errors in minor direction	n:
24	Clara
	Cluse
Contraction of the second seco	
naior steel Parts	an anti- sheet Test store sheet [Pathan store sheet]
major steel Botto	om major steel Top minor steel Bottom minor steel
major steel Botto	om major steel Top minor steel Bottom minor steel
major steel Botto	tion: 0.00100530964 Minimum number of rebars: 5
najor steel Botto	tion: 0.00100530964 Minimum number of rebars: 5

Choose the Bar Diameter, the corresponding minimum number of rebar will show up, thus input the integer number of required rebar.

Design | Design Beams

The following is the main design beams window. When opening this window, the beams have to be loaded from the Read Beam Data button. This button will ask the user to read the beam assembly file (.basm) that should have been previously exported from the PLGen.

	esign Beams			
	Design beams:			
		Show enabl	ed.	Read beam data
		Beam width:		Define design regions
		Beam depth:		Start beam design
		Solved:	ToBeSolved 👻	
				Close
	Pre	ss "Read Bean	n Data"	
ile name: ¹ rojeo	:t\19\19.LC	•	Load Cases	File (*.LC)
			Load Cases	File (*.LC)
			Beam Asser	nbly File (*.basm)
			Input Files (*.in)
			AID Files (* :	run)
			All files (*.*)	יקינ
		Open (.basn	1)	

lign Beams	_			
Design beams:				
Design Beam1 Design Beam2	-	Show enabl	ed.	Read beam data
Design Beam3 Design Beam4 Design Beam5	E	Beam width:	0.4	Define design regions
Design Beam6 Design Beam7		Beam depth:	1.2	Start beam design
Design Beam8 Design Beam9 Design Beam10		Solved:	Solved	• <u> </u>
Design Beam11	-			Close

After loading the beams, the beam breaks and design sections positions can be defined using the "Define design regions" button. This menu allows the user to define and/or modify break and section positions using their relative or absolute position simultaneously.

Define beam design regions						
Design Beam32 design sections						
Break name:	Name	BreakPtX	BreakPtY	RelDistance	AbsDistance	
Distance from beam start break:	Start break	83.89372253417	. 24.72341156005	0	0	
	End break	74.69371795654	. 24.72341156005	1	9.200004577636	
Absolute distance	Break3	81.59372138977	. 24.72341156005	0.25	2.300001144409	
	Break4	76.99371910095	. 24.72341156005	0.75	6.900003433227	
Add						
Design sections						
	S	itart break: End bre	ak 🔽	End break Br	eak3 🗸 🗸	Modify
Section name:	-Name	— StartName	SectionPoint	AbsoluteLength	RelativeLength	EndName
Start break:	Section1	End break	{X=75.38372, Y=	0.690002441406	0.100000304069	Break3
	Section2	Break3	{X=79.29372, Y=	2.300004959106	0.500000829281	Break4
End break:	Section3	Start break	{X=83.20372, Y=	0.690002441406	0.100000304069	Break4
Distance from beam start break:	L	· _ '				
Absolute distance Belative distance						
Add	Singly reinforced.	Force doubly reinforce	d. Alpha: 0.2		Def	ine reinforcement
	Design material: Concre	ete 🔽 Errors: Ne	o errors.			detailes
						Close

Defining the Sections and Preparing for reinforcement

Clicking on "Define reinforcement details" will take the user to the following menu that can be used to define design load cases for each section straining action. The menu functions as a reinforcement builder that can be used to define section reinforcement layers, stirrups and longitudinal bars. In addition, it calculates the reinforcement amount built and compares it to the required area of steel and informs the user whether the section is safe or not.

The reinforcement of a beam section is defined by three distinct types of reinforcement:

- Reinforcement Layers for top and bottom steel to withstand flexure in beams.
- Stirrups to withstand shear and torsion in beams.
- Longitudinal reinforcement to withstand torsion in beams or any other purpose.

No0IBars BarDiameter depth IsBottomLayer 4 0.022 0 ✓ 4 0.022 0 ✓ 4 0.022 0 ✓ 6 0.022 0 ✓ 6 0.022 0 ✓ 7 0.00139831481 Actual Asteel top: 0.00152053084 Required Asteel bottom: 0.00139831481 Actual Asteel bottom: 0.00152053084 Bending bottom: Safe Add reinforcement layer BarDiameter Stirups 0.018 0.04	Cover right: 0.025
4 0.022 0 Image: Constraint of the second secon	0.025
4 0.022 0 Required Asteel top: 0.00139831481 Actual Asteel top: 0.00152053084 Required Asteel bottom: 0.00139831481 Actual Asteel bottom: 0.00152053084 Bending bottom: Safe Add reinforcement layer BarDiameter Xbar Stimps 0.018 0.04	Defeat
Bending bottom: Safe Add reinforcement layer Bending top: Safe Stirrups Description BarDiameter Xbar D.018 D.018 D.04	Herresn
Bending top: Safe Stirups 0.018 0.04	
Stirrups 0.018 0.04	Ybar
	0.35
NoOfLegs BarDiameter BarSpacing Stirrup width 0.018 0.36	0.35
2 0.01 0.1 0.34	
Required Asteet 0.00117875 Actual Astee Longitudinal bars (torsion): Safe Add	: 0.00050893800

• Beams: Match Properties

📢 BE4E-PLDesign - [Project 1]	ō X
🙀 File View Action Design Detailing Help	_ 8 X
.LC 🗋 🐸 Open (.des) 🚽 🕘 🖸 Re 🖉 🕸 🕂 🛗 🎽 🍏 🍏 🏹 📹 🗂 💣 🗗 🤻 BCs Loads BCs Legend Supports Reactions Assemblies Legend Slabs Slab RFT Beams Beams Data	Ē
Results Manager Select Case Beams Manager Assemblies Manager Define model details Design Slabs Design Beams Punching check Deflection Strips Match properties Start detailing	

b spans Beams Be	am sections	Punching asms.	
urce beam : esign Beam1 esign Beam2 esign Beam3 esign Beam4 esign Beam5 esign Beam5 esign Beam7 esign Beam8 esign Beam9	Des De De De De De De De De De De	tination beams: sign Beam1 * sign Beam2 = sign Beam3 sign Beam4 sign Beam5 sign Beam7 sign Beam7 sign Beam8 sign Beam9	What to match? Beam breaks Beam sections Beam sections data
sign Beam10 sign Beam11 imensions] Bottom cover] Top cover] Left cover] Right cover	▼ Design o ✓ Design o ✓ Desi ✓ Desi ✓ Ben ✓ She ✓ Tors	sign Beam10 sign Beam11 Jata gn materials ding moment Loadcase ar Loadcase sion Loadcase	Reinforcement data Image: Comparison of the system Image: Comparison of the system Image: Comparison of the system Image: Comparison of the system
ection data] Is Singly reinforced Force doubly reinforced section.] Alpha values	Original	d to destination data place destination data	Match beams

Similar beams are matched with the same reinforcement

The users can also match properties for the sections in one beam

Source beam : Destination beam: Design Beam 1 Source section : Destination sections: A B C C D Destination sections: Pesign data Ø Design materials C D Dimensions Section data Ø Bottom cover Ø Top cover Ø Force doubly reinforced section. Ø Ø Alpha values	lab spans Beams Beams	sections Punching asms.	
Design Beam 1 Design Beam 1 Source section : Destination sections: A B C Design materials Ø Bending moment Loadcase Ø Shear Loadcase Ø Shear Loadcase Ø Torsion Loadcase Reinforcement data Ø Layers (flexure) Ø Stirrups Ø Longitudinal bars Ø Add to destination data Ø Add to destination data Ø Replace destination data	Source beam :	Destination beam:	
Source section : Destination sections: A B B C C D D E Dimensions Section data Ø Bottom cover Ø Top cover Ø Force doubly Pieft cover A Ø A Match sections O Dimensions Match sections	Design Beam 1 👻 👻	Design Beam1 👻	
A B Design data B C Design materials C D Bending moment Loadcase E Shear Loadcase Torsion Loadcase Dimensions Section data Torsion Loadcase Ø Bottom cover Is Singly reinforced Ø Force doubly Is Singly reinforced Ø Force doubly Congitudinal bars Ø Alpha values Original Ø Add to destination data Replace destination data	Source section :	Destination sections:	
B C Image: C	A	A	Design data
C C Image: Comparison of the section of the sectio	В	В	Design materials
E E E Status de la construir d	D	D	Bending moment Loadcase
Dimensions Image: Section data Image: Dimensional da	E	E	Charr Londence
Dimensions Section data Ø Bottom cover Is Singly reinforced Ø Top cover Force doubly Ø Left cover Alpha values Ø Right cover Match sections			
Dimensions Section data Ø Bottom cover Is Singly reinforced Ø Top cover Force doubly Ø Left cover Alpha values Ø Right cover Match sections			V Torsion Loadcase
Dimensions Section data Ø Bottom cover Is Singly reinforced Ø Top cover Force doubly Ø Left cover Alpha values Ø Right cover Match sections			Reinforcement data
Dimensions Section data Ø Bottom cover Is Singly reinforced Ø Top cover Force doubly Ø Left cover Alpha values Ø Right cover Match sections	107.82		Layers (flexure)
Image: Wight cover Image: Singly reinforced Image: Wight cover Image: Singly reinforced section. Image: Wight cover Image: Wight cover	Dimensions	Section data	V Stirrups
Image: Construction of the section of the sectin of the section of the section of the section o	Bottom cover	Is Singly reinforced	
Image: Construction of the section	Top cover	Force doubly	Congregation of bars
Right cover Image: Alpha values Original Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values Image: Alpha values	Left cover	- reinforced section.	Original
Match sections Replace destination data	Right cover	Alpha values	
Match sections			Add to desuration data
		Match sections	Replace destination data

Similar beam sections are matched with the same reinforcement

Design | Deflection Strips Manager

It shows the Maximum deflection (according to selected moment) & the effective length of any selected strip.

Deflection strips list:	
Region 2 - Area 1 Region 2 - Area 2 Region 2 - Area 3 Region 2 - Area 4	Add strips Remove Moment based. Major design parameter: Max Maximum deflectiom: -0.0018733999459072948 Effective length: 8.3811864852905273

Design | Punching check

Punching assemblies	Critical section properties	BE analys	is properties	Special items for EC design:	Unbalanced critical she	ar stresses
Support:1 Support:2 Support:3 Support:4	a: 0 b: 0	Draw primary critical section Material:	BE solution. Default Ib-in 🔻	Axial stress in concrete:	Critical Shear stress: Capacity ratio:	0 NaN
Support:5	Beta: NaN	Beta user defined. Status:	ToBeSolved 👻	Reinforcement ratio in dir-1:	UNSAFE	
Support: 7 Support: 8 Support: 9	b2: 0	Draw b1 Load Case /combina Draw b2	tion: LoadCase1 +	Reinforcement ratio in dir-2:	BE critical shear stresse Reduction factor for	es
Support: 10 Support: 11 Support: 12	Bo: 0	Bo user defined. Envelope	: v	Concrete shear canacity	non-linearity effect in BE-results:	0.15
Support: 13 Support: 14 Support: 15	Alpha: 40	eset properties Spacing f BE solution	or n: 0.25		Critical Shear stress:	0
D: Support:1	Column condition: Interior	Refresh Distance secondar critical se	of 2 y ction:	Solve critical sections	UNSAFE	INdiv
Add Remove		Draw se	condary critical section	Check punching		Close

The variables defines in the critical section properties window are similar to punching critical section properties as stated by ACI-318.

These variables are:

a,b: critical section dimensions

Beta: ratio between b and a

- b1: dimension of the critical section in the direction of the analysis
- b2: dimension of the critical section in the direction perpendicular to b1
- Bo: perimeter of the critical section
- d: depth of the slab at this point

Alpha: Constant defined based on the position of the column

The Detailing menu

Detailing	
Start detailing	
♥i BE4E-PLDesign - [1_LoadCase1-title1-LoadCase1]	_ 0 <u>_ x</u>
🐖 File View Action Design Detailing Help	_ 8 ×
LC 🗋 🚰 Open (.des) 🔒 🗿 🕻 Start detailing 🔯 🍯 🏹 🖬 🗗 💣 🗗 🤻 BCs Loads BCs Legend Supports Reactions Assemblies Legend Slabs Slab RFT Beams Beams Data	Ŧ
Results Manager Select Case Beams Manager Assemblies Manager Define model details Design Slabs Design Beams Punching check Deflection Strips Match properties. Start detailing	-

PLDesign can be used to export design drawings for the designed beams and slabs. The drawings are exported in (.dxf) format. The PLDesign allows the user to choose the drawing components, layers and their respective colors.

Main model			Layer name	Content		Color		Export
		•	Slab areas	Slab areas	-	Red	-	V
			Major top rft.	Major top rft.	-	Blue	-	V
			Major bot rft.	Major bot rft.	-	Green	-	
			Minor top rft.	Minor top rft.	-	Yellow	-	
			Minor bot rft.	Minor bot rft.	-	Cvan	-	V
Select all	Deselect all							
Select all [] leam detailing Design Beam 1	Deselect all		Layer name	Content		Color		Export
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Getting Help

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Also check our site news at www.plpak.com regularly for *Problems and Solutions* section and the *Frequently Asked Questions* section.