

# **The Post-Tension Tool**

## User MANUAL

## PLPAK<sup>TM</sup> Version 2.00 STRUCTURAL ANALYSIS SOFTWARE USING THE BOUNDARY ELEMENTS METHOD

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#### Introduction:

PTPAK (Post tension package) is a structural design tool package for pre-stressed (post-tensioned or pre-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 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.

In this manual, the user can start his model from Autodesk Revit or from PLGen until finishing his model reinforcement details in Autodesk Revit.

Therefore, this manual will explain the following:

- 1. Loading already analyzed slab.
- 2. Defining material properties.
- 3. Defining losses parameters.
- 4. Drawing cables.
- 5. Profiling cables.
- 6. Solving PT load cases.
- 7. Drawing PT design strips.
- 8. Solving the strips.
- 9. Checking stresses result.
- 10. Exporting cables to Autodesk Revit.
- 11. Optimization tool.

#### 1. Loading already analyzed slab

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



- Note that when exporting Text format files, enter the same name of the .LC file in the "File name:" text box of the exporting window, and exported them to a folder with the same name and path of the .LC file.

				Name	Date modified	Туре	Size
		1	1	퉬 1	6/6/2017 10:08 PM	File folder	
Name	Date modified	Туре	Size	DEAD	6/6/2017 10:05 PM	File folder	
📋 1.txt	6/6/2017 10:08 PM	Text Document	1 KB	LIVE	6/6/2017 10:05 PM	File folder	
Beams.txt	6/6/2017 10:08 PM	Text Document	1 KB	w ow	6/6/2017 10:05 PM	File folder	
Column load.txt	6/6/2017 10:08 PM	Text Document	1 KB		6/6/2017 10:05 PM	File	1 10
Columns.txt	6/6/2017 10:08 PM	Text Document	1 KB		0/0/2017 10:03 PW	THE .	I KL
Drops.txt	6/6/2017 10:08 PM	Text Document	1 KB	/// 1.B	6/6/2017 10:05 PM	B File	6 KE
🗎 Lc.txt	6/6/2017 10:08 PM	Text Document	1 2	1.drp	6/6/2017 10:05 PM	DRP File	1 KE
📄 Load Patch.txt	6/6/2017 10:08 PM	Text Document	1 KB	1.drp.prop	6/6/2017 10:05 PM	PROP File	1 KE
Materials.txt	6/6/2017 10:08 PM	Text Document	1 KB	1.GEN	6/6/2017 10:09 PM	Structural Model	13 KE
Dpening.txt	6/6/2017 10:08 PM	Text Document	1 KB	<b>1</b> 10	6/6/2017 10:05 DM	DI Dest file	1 //
Slab.txt	6/6/2017 10:08 PM	Text Document	1 KB		0/0/2017 10:05 PIM	PEPOSEIIIE	I KE
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				

- Beam assemblies should be exported if there are beams.



First the user should open the PLDesign tool and choose the "PT Slab" option as shown below.

1, BERE-PLDESSIN - [PTOJECT 1]	- 0 X
Elle Yiew Action Design Detailing Help	×
🗄 📙 🕐 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 Cables Info Exporter Losses Diagrams	
🛛 📩 unses Data 📓 Import DXF 👘 🕂 🖓 ave PTModel 📖 DrawPTDesStrip Allowable Stresses Run All DesignStrips Define Ctrl Points Auto Draw Cables Auto Profile Optimize Cables	
BF4F-Floor Type	
C RC Slab O PT Slab	
1	
o o o	
0 0	
0 Cables    0 PTShips	
Current Load Case: Loadcase 1 Current Load Envelope: Hone	

Load the .LC file of the problem to load the model. -





6 2

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#### 2. Defining material properties

- Open the prestressing material properties window.



- Hence, define the material properties.

Material Properties		
Modulus of Elasticity, Eps	1.950E+008	F/L2
Jltimate Stress, Fpu	2.000E+006	F/L2
Yeild Stress, Fpy	1.900E+006	F/L2
Area Strands, Aps	0.0001	L2
Code Provisions Maximum Allowable Stress	by jacking, Fpi	
1400000 F/	L2 🕑 User	Defiend

### 3. Defining losses parameters

- Open the losses data window.



- Enter the losses parameters based on the required design code.

osses Data				- 0	×
Prestressing System			Longterm Losses		
O Unbonded O Bonded			Creep Factor, Kcr	1.6	
Cables Spacing	1.2	L	Residual Shrinkage Strain, ɛsh	0.0003	
Kcir	1		<ul> <li>Relaxation Equation 1</li> <li>Relaxation Factor, Kre</li> </ul>	34470	F/L
Own Weight LoadCase	LoadCase1	~	Relaxation Factor, J	0.04	
Superimposed Dead Loads LoadCase	LoadCase2	~	<ul> <li>Stress Relieved</li> </ul>	O low Relaxation	
Initial Losses			Relaxation Equation 2		
Curvature Friction Coefficient, µ	0.07		Relaxation Factor, K1	45	
Wobble Friction Coefficient, K	0.00328		Time from Prestressing, t	1000	Hour
Anchor Set	0.00635	L	Concrete Properties		
Partia Shatarian Fastar Kas	0.5	_	Modulus of Elasticity, Ec	24860000	F/L
Elastic Shortening Factor, Kes	0.5	_	Modulus of Elasticity at prestressing, Eci	21530000	F/L
	(	A	ssign		

#### 4. Drawing cables

The user can draw cables using 3 ways manual drawing, importing from DXF file, or using the Auto Draw capability (Post-Tension Automation Tool is required for this option).

#### 4.1. Manual drawing

The user can draw the cables manually with the help of the snaping tools.



- 4.2. Importing from DXF file
- The user can draw cables in AutoCad as polylines. In these polylines, additional points should be added at the end of each segment. Then, the user should save the file in DXF format.



- Hence, the user can import the saved DXF file by clicking on Import DXF button.





**4.3.** Auto Draw capability (Post-Tension Automation Tool is required for this option) The user can draw cables automatically using the Auto Draw capability by choosing to draw cables in x direction and/or cables in y direction. The spacing of these cables should be specified and also a minimum draw length is required to ignore cables with small lengths. The spacing of calculation points is the tolerance that determines the maximum distance between cable start/end point and the slab edges. It should be small and bigger than zero.

AutoDraw				×
Minimum draw length	1	Spacing of calculation points	0.1	
X Direction		Y Direction		
Cables 🕗 PTDesignStrip:	•	Cables <table-cell> PTDesignStrip</table-cell>	os 🗌	
Spacing	1.5	Spacing	1.5	
PTDesignStrips Sections Spacing	0.5	PTDesignStrips Sections Spacing	0.5	
	[	Draw		



#### 5. Profiling cables

The user can profile cables using 2 ways, manual profiling, or using the Auto Profile capability (Post-Tension Automation Tool is required for this option).

5.1. Manual profiling

The user start profiling the desired cable by right clicking on it and the following window will appear. Throw this window the user can define number of strands, jacking force and jacking ends. Also, the time dependent losses can be user defined or calculated automatically using defined parameters. Hence, the profile of each segment can be defined from 13 templates by choosing segment number and clicking on Edit.

Data					- 0
able Num	iber 1			Segments Data	
Cable C	Coordinates			Number of Cable Segments	9
	Point	X	Y		
•	Cable Start	0.1884341	21.60056	Segment Number 1 ~	Edit
	Cable End	36.05716	21.59854		
Cable P	roperties			Jacking Ends	
Cable I	Length		35.869	One End	Both Ends
Minimu	m Padius of Curr	interna (D)	0	Cable Start	0
MINIMU	In Addus of Curv	ature (N)	Apply		
Numbe	er of Strands 5				
				Time Dependent Losses	
Jacking	Force			User Defined O Ca	alculated using defined losses da
Cable J	lacking Force 7	00 C	Absolute Force F	Losses 65000	F/L2
	(5.69,	0.25)	(15.00, 0.25)	(23.52, 0.25)	(34.24, 0.25)
(0.00	0, 0.15)				(35.83, 0.15)
0	80 0 05)	(10.11.)	105	9 53 0 051	03 0.05
(2)			(1	120	
				<u> </u>	
Show	w high and low po	Herresh Dra	wing	A	ssign Cancel

inplate FIG	perties										2
						Template	Coordinates				
Template	Numbe	r 5					Point	х	Y		
				-		•	Template Star	15.18864	21.6	0056	
Template	Туре	Template_1	~	4			Template End	19.71782	21.6	0056	
Template	Propertie	Template_2									
Tem	iplate Le	Template_3 Template_4 Template_5 Template_6 Template_7 Template_8			q1 %P1		q2	q3 %P2	Refres	sh	
-		Template_9 Template_10 Template_11 Template_12						X = 3.62			
		Template 13									
Template	Paramet	Template_12 Template_13				X = 2.26			1		
Template q1	Paramet 0.25	Template_12 Template_13	P1	0.2		* Percentage	of Length R	1 5.128			
Template q1 q2	Paramet 0.25 0.05	ers	P1 P2	0.2		* Percentage	e of Length R	1 <u>5.128</u> 2 7.693			

**5.2.** Auto Profile capability (Post-Tension Automation Tool is required for this option) The user can profile the cables automatically using the Auto Profile capability by choosing which load case to profile on, the spacing of the points used to calculate deflection, the top and bottom slab covers, the minimum radius of curvature, the cables to be profiled (selected cables or all cables), and finally whether he wants the start and the end of the cable to be in the slab centerline or not.

		-		×
LoadCase1 ~	Spacing of calculation points	0.2		
0.05	Bottom cover	0.05		]
2	Cables to profile	All cables	~	
be in the slab centerline	9			
Pr	rofile Cables			
	LoadCase1 0.05 2 be in the slab centerline	LoadCase1       Spacing of calculation points         0.05       Bottom cover         2       Cables to profile         be in the slab centerline          Profile Cables	LoadCase1       Spacing of calculation points       0.2         0.05       Bottom cover       0.05         2       Cables to profile       All cables         be in the slab centerline          Profile Cables	LoadCase1       Spacing of calculation points       0.2         0.05       Bottom cover       0.05         2       Cables to profile       All cables         be in the slab centerline       Image: Cables

Its Manager Select Case Beams Manager Assemblies Man	ager Define model details Design Slabs Design Beams Punching check Defi	lection Strips Match properties Start detailing Cables Info Exp	porter Losses Diagrams
Losses Data Import DXF	Save PTModel CrawPTDesStrip Allowable Stres	ises Run All DesignStrips Define Ctrl Points Auto Draw Cabl	es Auto Profile Optimize Cables
P		AutoCableProfiler	- 🗆 X
		Load Case LoadCase 1	Spacing of calculation points     0.2
		Top cover 0.05	Bottom cover 0.05
		Minimum radius of curvature 2	Cables to profile All cables V
		Foce cables start and end to be in the slab centerl	ine 🕑
	<mark>╢╺<del>╸</del>╡╒┝┆╞╎╡╘┥╡┊╞┠</mark>	₩	Profile Cables
	<mark>ĬŢ•↓=↓ <mark>┣</mark>·↓ <mark>┣</mark>·│ <b>↓</b> <mark>┣</mark>·↓ <b>┣</b>·↓ <b>ℙ</b>·↓ <b>ℙ</b>↓ <b>ℙ</b>↓ <b>ℙ</b>↓ <b>ℙ</b>↓ <b>ℙ</b>↓·↓ <b>ℙ</b>↓ <b>ℙ</b>↓ <b>ℙ</b>↓ <b>ℙ</b>↓ <b>ℙ</b>↓ <b>ℙ</b>↓ <b>ℙ</b>↓ <b>ℙ</b></mark>		
	<mark>╢╎╵╎╵╎┙<sub>┙┿</sub>┍╹╵╹╸╎┥╎╸╎╴</mark>	<del>╷╷╷╷╷╷╷╷╷╷╷╷╷╷╷╷╷</del>	
	<del>╵╹╸╡╺╞╸╡╶╎╴╡┥╎╴┇╶╡╗╧╞</del>	<del>┥┥┼╡┾╿┥╄╿┥╿╢</del>	

## 6. Solving PT load cases

- The user should save the PTModel.
間 BE4E-PLDesign - [NZONE14.LoadCase1-title1-LoadCase1]
Eile View Action Design Detailing Help
.LC 🗋 💕 Open (.des) 🚽 🖪 🔍 Re 🍳 🕀 🗰 🔛 🗉 🗹 🏹 📹 🗗 💞 🤻 BCs
Results Manager Select Case Beams Manager Assemblies Manager Define model details Design Slabs Design
Losses Data Import DXF
{X=-15.67, Y=36.41}
- Hence, click on the PTPAK button.
間 BE4E-PLDesign - [NZONE14.LoadCase1-title1-LoadCase1]
<u>File View Action Design Detailing Help</u>
.LC 🗋 💕 Open (.des) 🚽 🖪 🔍 Re 🖉 🕀 🕂 🎆 🏹 🍏 🍼 🎽 💕 💣 💣 🤻 BCs
Results Manager Select Case Beams Manager Assemblies Manager Define model details Design Slabs Design
Losses Data Import DXF
{X=-15.67, Y=36.41}

- Click PLCoreMan, and run PL.exe

PT Run —	×	E4E-PLCoreMan D:\Dr Youssef Rashed\PLPAK So
Done Exporting PT Files Done Copying PTRun File Starting PT Calculator PT Calculator Finished PT Updater Starting PT Initial Load Case Copying Files Updating Slab Finished Updating PT Initial Load Case		File View Run Help PLView (BE mesh editor tool) Pt cable calculator PT cable calculator PTUpdate (Post-Tensioning tool) PTFina AutoCAD extractor EHSPAK P-PPAK
PT Updater Starting PT Transfer Load Case Starting Copying Files Starting Updating Slab Finished Updating PT Transfer Load Case		PLEXE (command-line solver)           PLPost (post-processing tool)           -Check previous           PLDesign (RC design tool)           case no.2: LoadCase2 previously solved successfully           -Ensure that IRUNFag for case 1: LoadCase1           IRUNFag for case 1: LoadCase2           IRUNFag for case 2: LoadCase2
100% PLCoreMan		case 3: PTIntialLoadCase IRUNRag=1 case 4: PTFinalLoadCase IRUNRag=1 -Checking the existance of the \$run\$. in each load case folder case 1: LoadCase1 has \$run\$. case 2: LoadCase2 has \$run\$. case 3: PTIntialLoadCase has \$run\$.

□ ×

#### 7. Drawing PT design strips

The user can draw PT design strips using 2 ways, manual drawing, or using the Auto Draw capability (Post-Tension Automation Tool is required for this option).

- 7.1. Manual drawing
- The user can draw the PT design strips manually by clicking on DrawPTDesStrip button and clicking the start and end points.



- Right click on the strip centerline to modify the strip width and number of sections.

		Strip Coordinates			
Strip Properties		Point	X	Y	_
Strip Width 4	Sections 20	Strip Start	3.146081	18.30591	
Design Parameters		-			
Bending Moment : Mxx ~	Load Cases : LoadCase 1 ~	Allowable Stresses 2603	Section Area:	1.200E+000	r
	Load Combinations :	Modify Allowable Stress	Section Modulus:	6.000E-002	
		Refresh	Export Strip Sections		
10 <sup>1</sup>					_

**7.2.** Auto Draw capability (Post-Tension Automation Tool is required for this option)

The user can draw the PT design strips automatically using the Auto Draw capability by choosing to draw strips in x direction and/or strips in y direction. The spacing of these strips should be specified and also a minimum draw length is required to ignore strips with small lengths. The spacing of calculation points is the tolerance that determines the maximum distance between strip start/end point and the slab edges. It should be small and bigger than zero.

AutoDraw			_	×
Minimum draw length	1	Spacing of calculation points	0.1	
X Direction		Y Direction		
Cables D PTDesignStrips		Cables D PTDesignStr	ips 🔽	
Spacing	1.5	Spacing	1.5	
PTDesignStrips Sections Spacing	0.5	PTDesignStrips Sections Spacin	g <u>0.5</u>	
	Dra	w		



#### 8. Solving the strips

The user can solve PT design strips using 2 ways, solving specific strip, or all design strips. **8.1.** Specific strip

- The user can solve a specific PT design strip by right clicking on the strip centerline. Hence, click on Export Strip Sections button.

PT Strip						- 0	×
Strip Number 9			Strip Coordi	nates			
Strip Properties		[		Point	x	Y	
			<u>۲</u>	Strip Start	0.09238665	25.14194	
Strip Width 3	Sections 62			Strip End	30.99259	25.14194	
Bending Moment : Mox ~	Load Cases : LoadCase1	V Allowabl	e Stresses_ odify Allowa	2603 ble Stress	Section Area: Section Modulus:	9.000E-001 4.500E-002	m2 m3
Quere a la companya de la companya		F	lefresh		xport Strip Sections		
10 <sup>1</sup>							_
Fibers: Top fibers ~		Horizontal	]		Assign	Cancel	

PT Strip				- 0	×
Strip Number 9		Strip Coordinates			
Strip Properties		Point	X	Y	
		Strip Start	0.09238665	25.14194	
Strip Width 3	Sections 62	Strip End	30.99259	25.14194	
Bending Moment : Mox ~	Load Cases : LoadCase1    Load Combinations :	Allowable Stresses 2603 Modify Allowable Stress	Section Area: Section Modulus:	9.000E-001 4.500E-002	m2 m3
Stresses		Refresh	Export Strip Sections		
10 <sup>4</sup>			111		=
Fibers: Top fibers ~	(X= 26.034 , Z= 2.673 ) Ho	rizontal	Assign	Cancel	

#### 8.2. All design strips

The user can solve all PT design strips automatically by clicking on Run All DesignStrips button.

電 BE4E-PLDesign - [NZONE14.LoadCase1-title1-LoadCase1]	
Eile View Action Design Detailing Help	
.LC 🗋 💣 Open (.des) 🛃 🎒 🔍 Re 🖉 🚭 🕂 🇰 🔯 🍏 🏹 🛒 🗂 🗳 💣 🕇 BCs Loads BCs Legend Supports Reactions Assemb	ies l
Results Manager Select Case Beams Manager Assemblies Manager Define model details Design Slabs Design Beams Punching check Deflection Strips Match	prop
🗼 📖 Losses Data 🛛 📓 Import DXF 拱 🕂 👉 Save PTModel 🕬 DrawPTDesStrip Allowable Stresses Run All DesignS	trips

#### 9. Checking stresses result

The stress results for the PT design strips can be demonstrated by right clicking on the centerline of the strip on clicking refresh. The allowable stresses are defined. If the user used the Run All DesignStrips button, results are exported in a text file called \$sectionsstress\$ in the same path of the .LC file.

							- 0	×
Chris	Number 0							
Strip	Number 9			Strip Coord	linates			
Strip	Properties				Point	×	Y	
				<b>•</b>	Strip Start	0.09238665	25.14194	
Strip	Width	Sections 62			Strip End	30.99259	25.14194	
Desig	gn Parameters							
Ben Mon	ding hent: Mox ~	Load Cases :	LoadCase1 ~	Allowable Stresses	2603	Section Area:	9.000E-001	m2
		Load Combinations :	~	Modify Allow	able Stress	Section Modulus:	4.500E-002	m3
0				Refresh	Б	port Strip Sections		
=		<u></u>	1 1					=
Fibers	s: Top fibers ~	( X= 26.034 , Z=	= 2.673 ) Hor	izontal		Assign	Cancel	
	4.5							
1	13							
1 2 3	13 0							
1 2 3 4	15 13 0 40							
1 2 3 4 5	15 13 0 40 LoadCasel	2601						
1 2 3 4 5 6 7	15 13 0 40 LoadCase1 952.02681,-952.0 635.40772635.4	2681 0772						
1 2 3 4 5 6 7 8	15 13 0 40 LoadCase1 952.02681,-952.0 635.40772,-635.4 -233.32687,233.3	2681 0772 2687						
1 2 3 4 5 6 7 8 9	15 13 0 40 LoadCase1 952.02681,-952.0 635.40772,-635.4 -233.32687,233.3 -95.21135,95.211	2681 0772 2687 35						
1 2 3 4 5 6 7 8 9 0	15 13 0 40 LoadCase1 952.02681,-952.0 635.40772,-635.4 -233.32687,233.3 -95.21135,95.211 1053.29611,-1053 1878 20951 -1878	2681 0772 2687 35 .29611 20951						
1 2 3 4 5 6 7 8 9 .0 .1 2	15 13 0 40 LoadCase1 952.02681,-952.0 635.40772,-635.4 -233.32687,233.3 -95.21135,95.211 1053.29611,-1058 1878.20951,-1878 -617.27338,617.2	2681 0772 2687 35 .29611 .20951 7338						
1 2 3 4 5 6 7 8 9 10 11 2 12	15 13 0 40 LoadCase1 952.02681,-952.0 635.40772,-635.4 -233.32687,233.3 -95.21135,95.211 1053.29611,-1053 1878.20951,-1878 -617.27338,617.2 -2108.99193,2108	2681 0772 2687 35 .29611 .20951 7338 .99193						
1 2 3 4 5 6 7 8 9 10 11 12 13	15 13 0 40 LoadCase1 952.02681,-952.0 635.40772,-635.4 -233.32687,233.3 -95.21135,95.211 1053.29611,-1053 1878.20951,-1878 -617.27338,617.2 -2108.99193,2108 -2632.66419,2632	2681 0772 2687 35 .29611 .20951 7338 .99193 .66419						
1 2 3 4 5 6 7 8 9 10 11 12 13 14	15 13 0 40 LoadCase1 952.02681,-952.0 635.40772,-635.4 -233.32687,233.3 -95.21135,95.211 1053.29611,-1053 1878.20951,-1878 -617.27338,617.2 -2108.99193,2108 -2632.66419,2632 -2214.55424,2214 -822.65501 982.6	2681 0772 2687 35 .29611 .20951 7338 .99193 .66419 .55424						
1 2 3 4 5 6 7 8 9 0 1 1 2 1 3 1 4 1 5 1 1 2 3 4 5 6 7 8 9 0 1 1 2 3 4 5 6 7 8 9 0 1 1 2 1 2 1 2 1 1 2 1 2 1 1 2 1 2 1 1 2 1 1 2 1 1 2 1 2 1 1 2 1 2 1 2 1 1 1 2 1 2 1 1 1 2 1	15 13 0 40 LoadCase1 952.02681,-952.0 635.40772,-635.4 -233.32687,233.3 -95.21135,95.211 1053.29611,-1053 1878.20951,-1878 -617.27338,617.2 -2108.99193,2108 -2632.66419,2632 -2214.55424,2214 -882.65591,882.6 1510.4182,-1510.	2681 0772 2687 35 .29611 .20951 7338 .99193 .66419 .55424 5591 4182						
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#### **10.Exporting cables to Autodesk Revit**

- To export cables the user should click on File, then click on Export design data.



- Enter the name of the level containing the slab in Revit and click Export to save the file.

Slab regions:       Design beams:         Select all       Deselect all         Export punching assemblies:       Export reinforcement to Revit         Punching assemblies:       Export reinforcement to Revit         Export punching assemblies:       Export reinforcement to Revit         Export Cables to Revit       Export         Export Cables to Revit       Export         Export Cables to Revit       Export         Export Summary files (xls)       Export summary files (xls)         Select all       Deselect all	Export slabs	Export beams
Select all       Deselect all         Select all       Deselect all         Export punching assemblies       Export reinforcement to Revit         Punching assemblies:       Export reinforcement to Revit         Level name in Revit:       Export         Export Cables to Revit       Level name in Revit:         Storey 1       Export         Export summary files (xls)       Export slabs         Select all       Deselect all	Slab regions:	Design beams:
Export Cables to Revit         Level name in Revit:         Storey1         Export summary files (xls)         Export slabs         Select all         Deselect all	Select all Deselect all Export punching assemblies Punching assemblies:	Select all Deselect all Export reinforcement to Revit Level name in Revit:
Export summary files (xls)         Export beams         Export slabs         Select all         Deselect all		Export Cables to Revit
		Storey 1 Export
		Export summary files (xis)

- Open the Revit model and click on Import Concrete Reinforcement, then click on Import PT Cables to Revit and choose the saved file.



• Hint: The following families must be loaded in Revit (pt family5.rfa and M\_Structural Framing Tag.rfa). These families can be found in the following path (C:\Program Files\PLPAK\PLDesign\PTPAK)

#### 11.Optimization tool (Post-Tension Optimization Tool is required for this option)

- To use the optimization methodology each PT design strip must contain only one cable in its center. After that the optimum number of strands in this cable can be divided into several cables inside this strip to satisfy the design code requirements.
- This optimizer calculates the minimum number of strands in each cable that satisfies no violation of stresses at certain chosen slab points (Ctrl Points) under a certain load combination. These Ctrl Points should be defined. It is recommended that these points are the points having peak tensile stresses that exceed the allowable stress.
- The user can define these Ctrl Points manually by clicking on Define Ctrl Points button, enter number of the points, there coordinates, and the Strip ID. Note, these CTRL points can be generated automatically as illustrated in the next step.



- The user should open the PT Optimization wizard by clicking on the Optimize Cables button. Hence the user should define average losses, jacking force, the target load case/combination, optimization method, optimizer methodology, CTRL points input methodology, allowable stress, minimum and maximum number of strands per cable. It has to be noted that CTRL points input methodology can be defined using 3 ways, Method 1: Max top and bottom tensile stresses for each strip, Method 2: All top and bottom tensile stresses exceeding the allowable for each strip, User Defined: Manually enter the coordinates of the CTRLPTS using the previously mentioned method.
- Click on Export Input Files.
- Click on Optimize cases and wait till the optimizer ends.
- Click on Optimize and wait.
- Click on Apply optimization.
- Run the model again and check that service stresses are safe and optimum for all design strips.

PT Optimization			– 🗆 X
Losses	100000	kN	
Jacking Force	150	kN	
Load Case	LoadCase1	~	
Optimization Method	Trust-Constr	~	
Optimizer Methodolgy	Automated Desi	igr 🗸	
\$CTRLPTS\$	Method 1	~ 0	•
Allowable Stress	2603	kN/m2	Method 1: Max top and bottom tensile stresses for each strip Method 2: All top and bottom tensile stresses exceeding the allowable for each strip
Min no of Strands/cable	1	]	User Defined: Manually enter the coordinates of the CTRLPTS
Max no of Strands/cable	100		
Export Input Fil	es		
Optmize Case	s		
Generate \$CTRL	PTS\$		
Optmize			
Apply Optmizati	ion		

## **Getting Help**

The BE4E.com customer support team is always welcoming problems and suggestions of registered customers. Just send an e-mail including your questions, or your model together with your questions to: <a href="mailto:plpak@be4e.com">plpak@be4e.com</a>

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