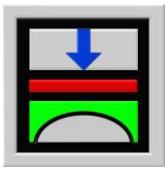
Tutorial Manual
for the program *ELPLA*



Determining
contact pressures, settlements, moments
and shear forces of slab foundations by the
method of finite elements

Version 9.2

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1 Introduction

This Tutorial Manual contains an overview of dealing with structural problems such as rafts, slabs, grids, plane frame and plane stress. It describes the processes of modeling the problems, carrying out the calculations, viewing and printing the results. It provides the user skills, which he needs to use *ELPLA*. It also takes the user step by step through some simple examples. Carrying out these examples will help the user to become familiar with the most important functions of *ELPLA*. Before attempting a real project with *ELPLA*, it is recommended that the user tries to carry out the given problems.

This Tutorial Manual will not present the theoretical background of modeling the problems. For more information concerning the methods of analysis, a complete reference for calculation methods and numerical models is well documented in the User's Guide of *ELPLA*. Also a complete reference for all menus and dialog boxes of the program is to be found in the User's Guide or in the online help system.

2 Installing *ELPLA*

ELPLA is distributed on a CD-ROM containing an installer program to install the *ELPLA* software on your computer.

To install *ELPLA* follow these steps:

- Insert the CD-ROM into your drive

The installer program is automatically loaded when the CD-ROM is inserted into the drive, Figure 1. The installer will guide you through the steps required to install *ELPLA* on your computer.

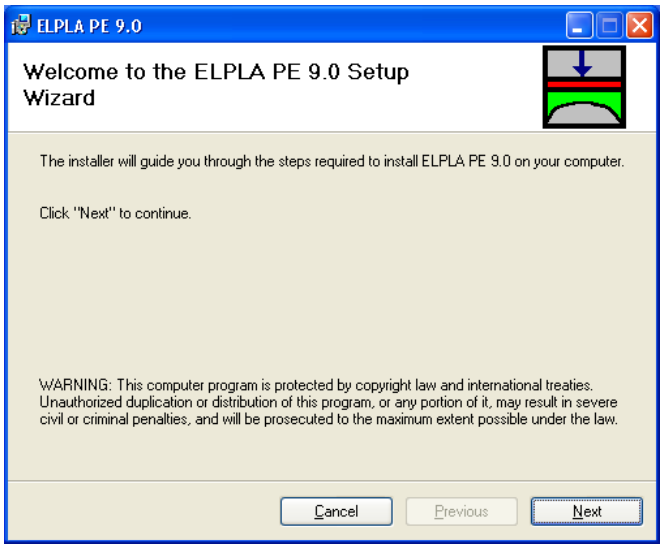


Figure 1 *ELPLA* Installer form

- Click "Next" button in the form of Figure 1 to install *ELPLA* on your computer

ELPLA Installer program begins execution. Follow the instructions (Figure 2).

- Click "Next" button in the form of Figure 2 to install *ELPLA* software to the specified destination folder

You can specify the folder for *ELPLA* files. By default, *ELPLA* suggests …\Program Files\ELPLA PE 9.x. However, you can optionally indicate a different folder name, if desired. *ELPLA* creates the folder name you specify.

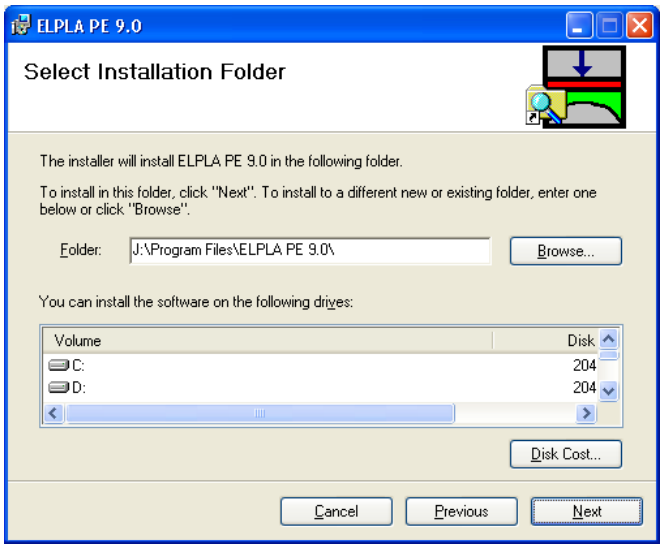


Figure 2 "Select Installation Folder" form

After selecting the installation folder, *ELPLA* Installer program will be ready to install *ELPLA* software on your computer, Figure 3.

- Click "Next" button in the form of Figure 3 to start the installation

ELPLA will be installed and a statues form will show the process of installation (Figure 4).

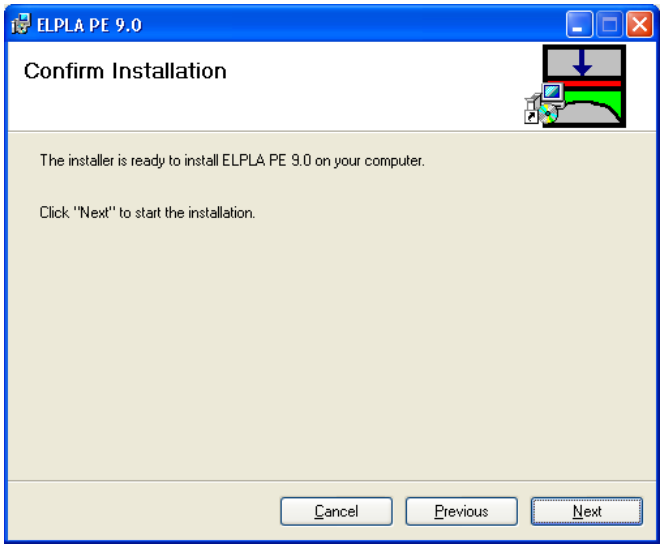


Figure 3 "Confirm Installation" form

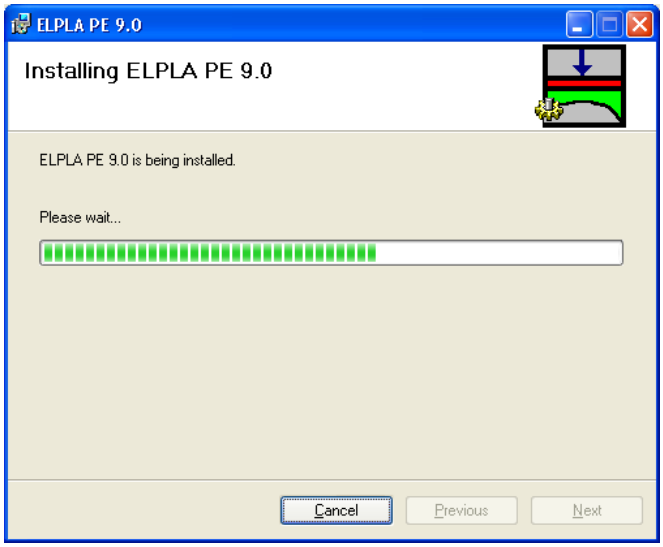


Figure 4 "Installing *ELPLA*" form

ELPLA installation will be completed and a message appears to inform you that the installation was completed successfully, Figure 5.

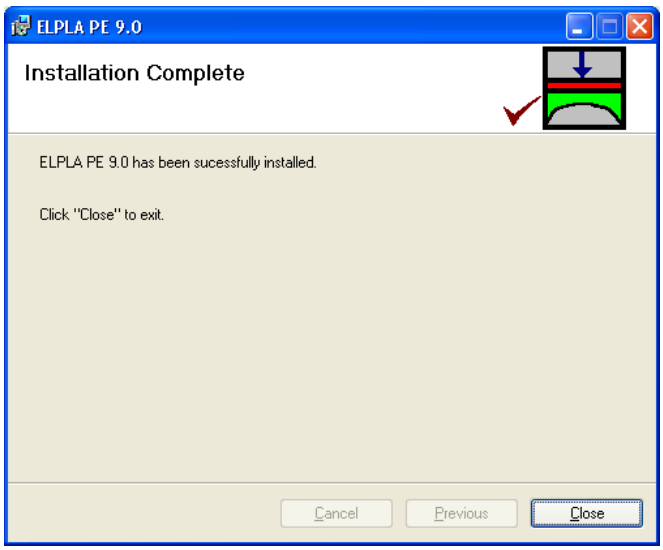


Figure 5 Final Installer message

Note

Installer cannot install update system or shared files, if they are in use. Before installing *ELPLA*, it is recommended that you close any application may be running.

3 Starting *ELPLA*

After successfully installing *ELPLA*, a new program group and program items will be created automatically for *ELPLA* in the Windows-Start-Menu. Also a program icon will be created on the Windows desktop, Figure 6. *ELPLA* professional package contains the individual programs *ELPLA-Boring*, *ELPLA-Data*, *ELPLA-Graphic*, *ELPLA-List*, *ELPLA-Section*, *ELPLA-Solver* and *GEOTEC-Text*, besides the help program *ELPLA-Help*. All those programs can run separately or through the main program *ELPLA*. The usage of the program is typically such that first data files are created describing a certain problem by the program *ELPLA-Data*. Then the project problem is analyzed by using the program *ELPLA-Solver*. Finally, the results can be presented as graphical drawings, graphs and tables using the five separate programs *ELPLA-Graphic*, *ELPLA-Section*, *ELPLA-List*, *ELPLA-Boring* and *GEOTEC-Text*. Names and short descriptions of the function of the *ELPLA* sub programs are given in Table 1.

Figure 6 Starting *ELPLA*

Start the main program *ELPLA* PE 9.x by choosing it from the Windows-Start-Menu, Figure 6. A shortcut to start *ELPLA* is double clicking on *ELPLA* PE 9.x icon on the Windows desktop. After starting *ELPLA* PE 9.x for the first time, the window in Figure 7 appears. This window belongs to the sub program *ELPLA-Data*. The function of *ELPLA-Data* is defining the project data such as FE-Net, soil properties, raft material, boundary conditions, loads, etc.

On the upper-left corner of this window, the menu bar of *ELPLA-Data* appears which is used for entering the project data. In order to use the programs *ELPLA-Solver*, *ELPLA-Graphic*, *ELPLA-List*, *ELPLA-Section*, *ELPLA-Boring*, first the user must define the project data by the program *ELPLA-Data*.

Table 1 Names and descriptions of *ELPLA* sub programs

Program name	Description of the program
ELPLA-Data	Editing project data
ELPLA-Solver	Analyzing the project problem
ELPLA-Graphic	Displaying data and results graphically
ELPLA-List	Listing project data and calculated results
ELPLA-Section	Displaying results graphically at specified sections
ELPLA-Boring	Editing and displaying boring logs graphically
GEOTEC-Text	Simple word processing program

In the following section the user will find a brief description of some of the essential interface commands. This section will help the user to be familiar with some of the commands, which will be used in this Tutorial.

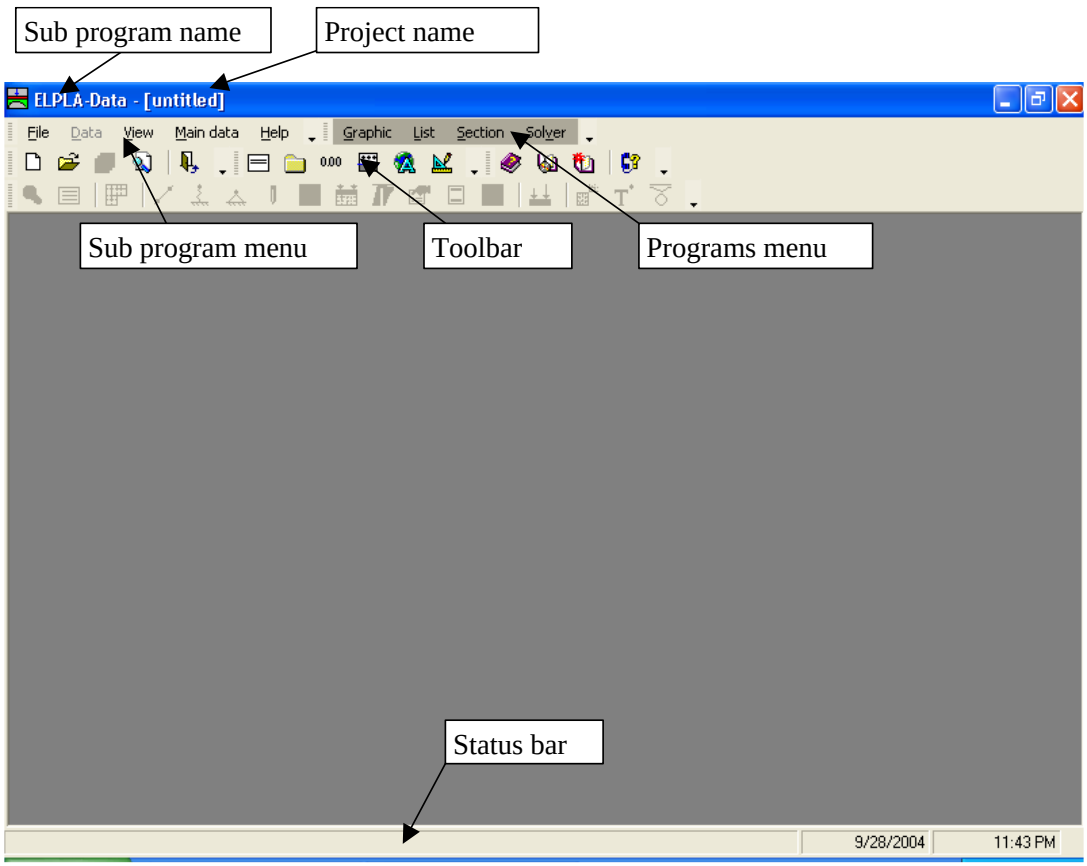


Figure 7 Opening screen of the sub program *ELPLA-Data*

Switching between *ELPLA* sub programs

On the upper-right corner of the window in Figure 7 the menu bar of the sub programs appears which is used for switching between the individual subprograms of *ELPLA* package. The user can switch to a specified sub program by clicking on the name of that sub program. When switching to a new sub program, *ELPLA* automatically opens the data file of the current example and displays the data file name in the title bar of this sub program.

Toolbar Buttons and Keyboard Shortcuts

Many of *ELPLA* commands can be accessed by clicking buttons on the toolbars, or by pressing shortcut keys on the keyboard. When you select a menu, the available toolbar buttons and keyboard shortcuts for that menu are shown next to their corresponding commands as shown in Figure 8. You can also directly see what command is associated with a toolbar button by holding the mouse cursor over the button. After a brief pause a legend (Screen Tip) will appear next to the cursor showing the menu command associated with the button.

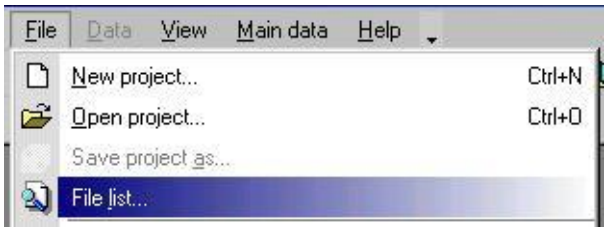


Figure 8 Available toolbar buttons and keyboard shortcuts for the file menu

Mouse Cursor Modes

ELPLA-Data has two modes of mouse cursor operation in *ELPLA-Data* window: View mode and Edit mode. The program can only be in one mode at a time. By default, the program is in view mode and the mouse cursor is an arrow. For edit mode, the cursor will change from an arrow to a cross hair indicating the mode in which is being operated. Press "Esc" key to exit the edit mode and return to the view mode.

Node Selection

In edit mode nodes are selected by clicking on each node individually or selecting a group of nodes. A group of nodes can be selected by holding the left mouse button down at the corner of the region. Then, dragging the mouse until a rectangle encompasses the desired group of nodes. When the left mouse button is released, all nodes in the rectangle are selected.

Undo and Redo Commands

ELPLA-Data allows you to go back up to 12 steps at a time when defining project process. Therefore it is possible to undo a series of actions previously performed. If you go too far in the undo process you may redo those actions. You can undo/ redo most drawing, editing and assignment operations. To undo/ redo a certain action, choose the "Undo/ Redo" command from "Edit" menu.

Snap Tools

The snap tools are essentially a fast and accurate way to draw and edit objects. Snap tools find the closest snap location to your pointer as you move it over your model. The snap tools can be turned on and off as you draw, so you can snap to different locations for every point. More than one snap tool can also be set at the same time giving you a choice of snap locations. The snap options are set by the data located in the "Plot Parameters" dialog box under the "Options" menu.

Defining Data

Most of *ELPLA* data can be defined either graphically or numerically (in tables). In this tutorial the user will learn how to carry out the data using one method depending on the specified example. By completing the all examples, the user will learn to define most of the data both graphically and numerically.

Project identification

The user can define three lines of texts to identify a project and the basic information about the task. These texts are required only for printing and plotting the data and results. Project identification does not play any role in the analysis. The three lines are optionally and maybe not completely entered.

Reinforcement data

The design code parameters such as partial safety factors for concrete strength, steel strength and internal stresses are defined by choosing the "Design code parameters" command from the "Main data" menu in *ELPLA-Data*, while reinforcement data such as design code, concrete grade, steel grade and concrete covers are defined by choosing the "Reinforcement" command from "Data" menu in *ELPLA-Data*. Design code parameters are standard data for all projects while reinforcement data may be varied from project to another.

Edit List Box

Some *ELPLA* data are defined by list box dialog as shown in Figure 9. In this list box the "Insert", "Copy" and "Delete" commands are applied for the selected row. To define or modify a value in this table, type that value in the corresponding cell, then press "Enter" key.

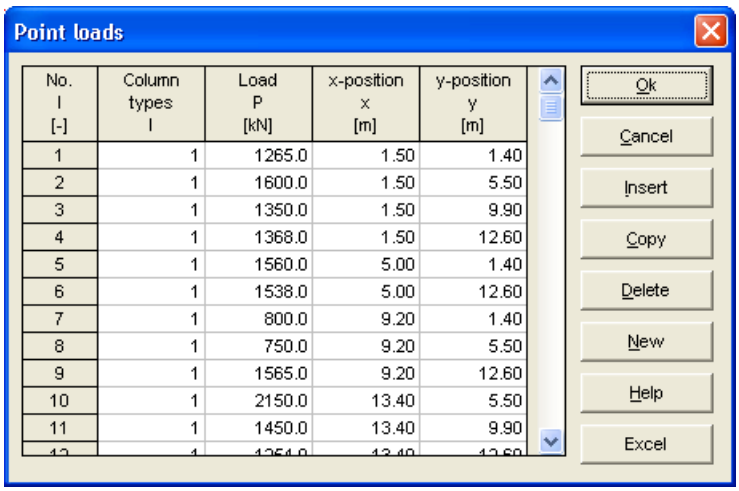


Figure 9 List box used by *ELPLA*

Analysis progress

During the analysis of problems all computations and analysis progression according to the defined method are progressively reported. As shown in Figure 10, the analysis progress menu reports the various phases of calculations. Also the status bar of *ELPLA-Solver* displays information about the progress of calculation as the program analyzes problems.

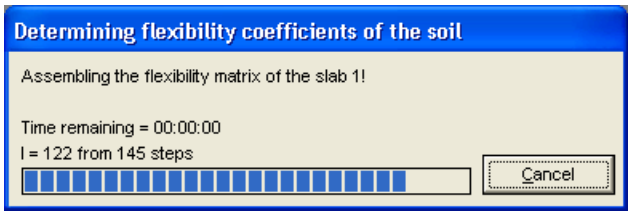
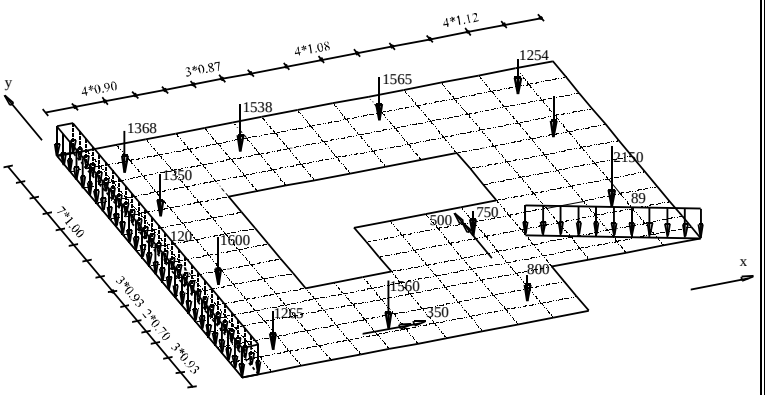


Figure 10 Analysis progress menu

4 Description of the examples

This Tutorial contains 13 examples. These examples are presented in order to illustrate how to use *ELPLA* for analyzing rafts, pile groups, piled raft, slab floor, grid, truss, frame and beam. For each example discussed in this Tutorial, data files and some computed files are included in *ELPLA* software package. The file names and contents of the examples are given as follows. Besides, a key figure of each problem is shown that contains the main data concerning the structure shape and loads. Examples can be run again by *ELPLA* to examine the details of the analysis or to see how the problem was defined or computed and to display, print or plot the results.

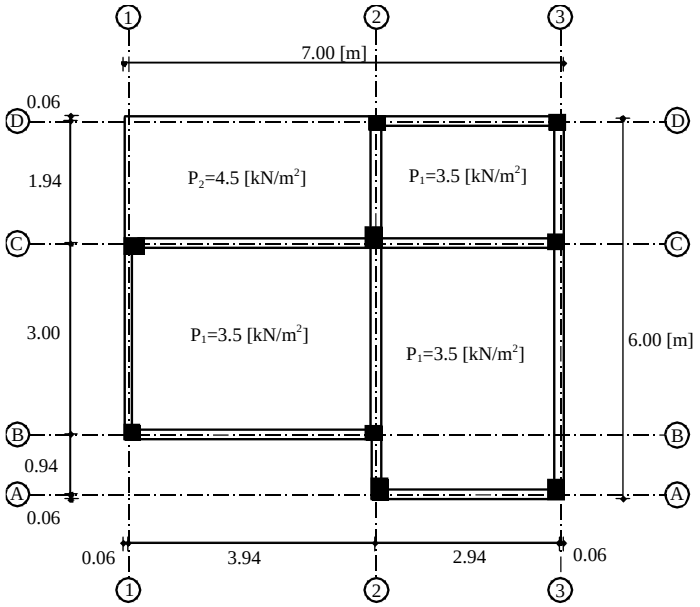
Example 1 Analysis of an irregular shaped raft on irregular subsoil

File	Content	Foundation shape and load
Example	Raft data	

An irregular shaped raft on irregular subsoil is selected to illustrate some of the essential features of *ELPLA* for analyzing rafts

Example 2 Analysis of a slab floor

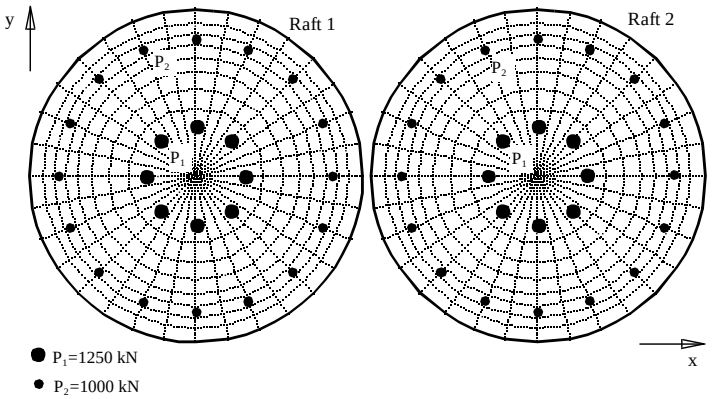
File	Content	Slab shape and loads
Floor	Slab data	



A slab floor with girders is selected to illustrate some features of *ELPLA* for analyzing slab floors

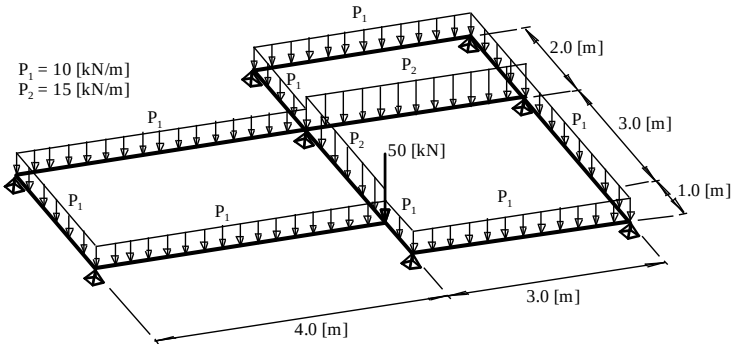
Example 3 Analysis of system of two circular rafts

File	Content	Foundation shapes and loads
Raft 1	Data of raft1	
Raft 2	Data of raft2	
Raft 1+2	Data of system of rafts1 and 2	



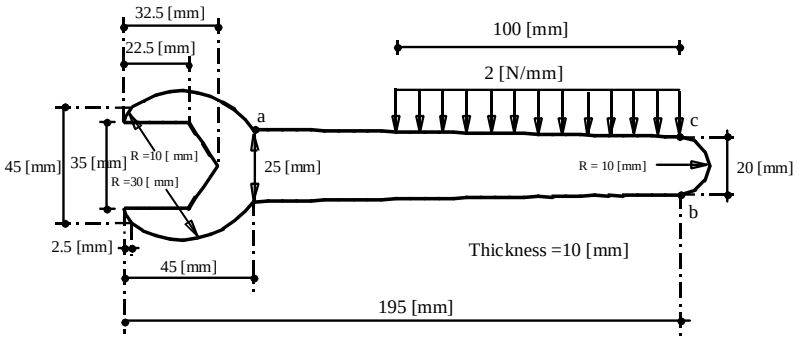
A system of two equal large circular rafts is selected to illustrate some features of *ELPLA* for analyzing system of foundations

Example 4 Analysis of a grid

File	Content	Grid shape and loads
Grid	Grid data	

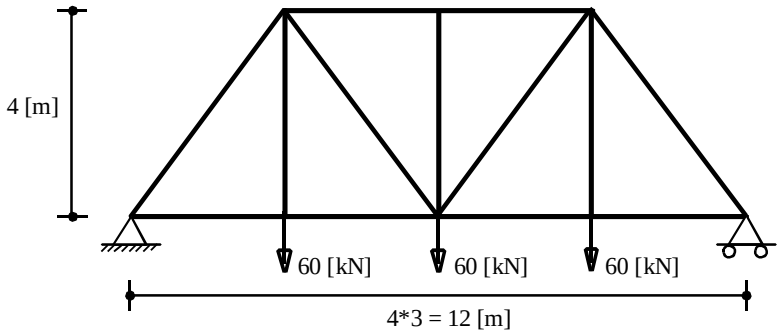
A grid resting on 8 supports is selected to illustrate some features of *ELPLA* for analyzing grids

Example 5 Plane Stress Analysis of a Wrench

File	Content	Wrench shape and loads
Wrench	Wrench data	

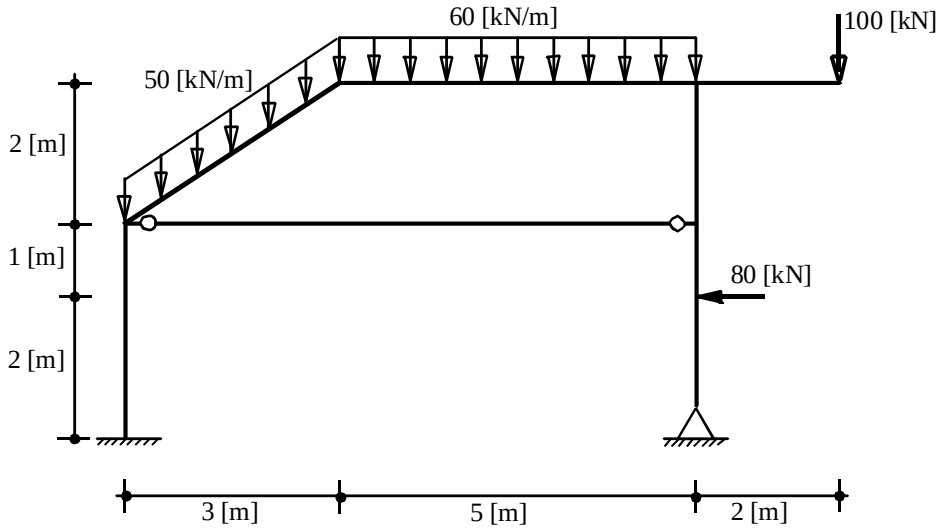
An example for analyzing the stresses and deformations of a wrench is selected to illustrate some features of *ELPLA* for analyzing plane stress problems

Example 6 Analysis of Two-dimensional Truss

File	Content	Truss shape and loads
Truss	Truss data	

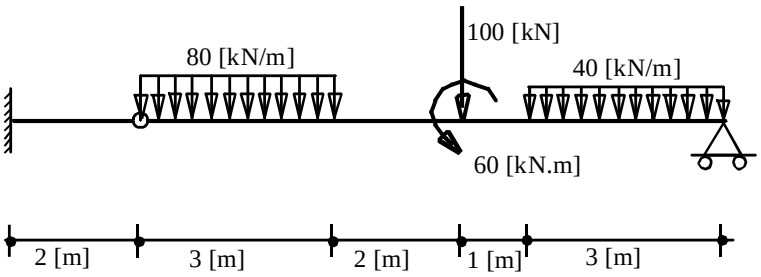
An example of a two-dimensional truss structure is selected to illustrate some features of *ELPLA* for analyzing plane frame problems

Example 7 Analysis of Plane Frame

File	Content	Frame shape and loads
Frame	Frame data	

An example for analyzing two-dimensional frame structure is selected to illustrate some features of *ELPLA* for analyzing plane frames

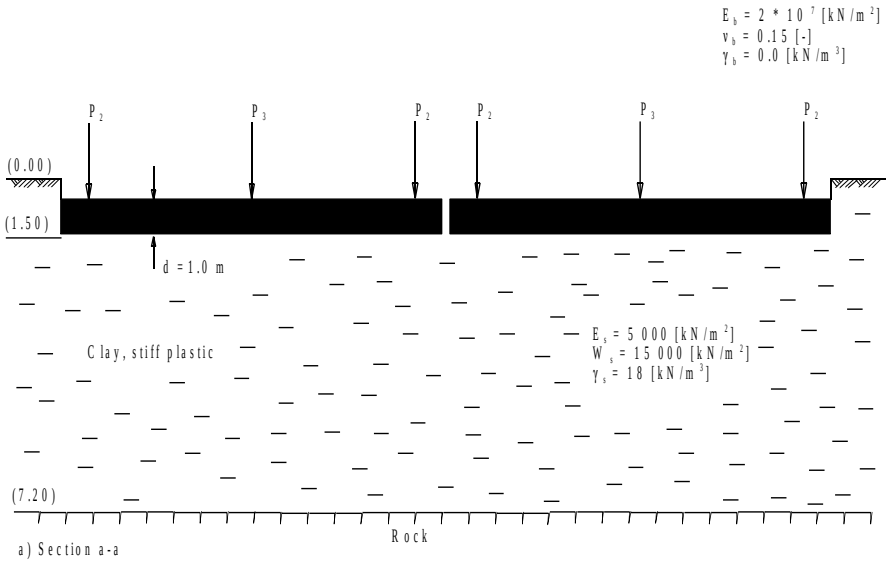
Example 8 Analysis of Beam

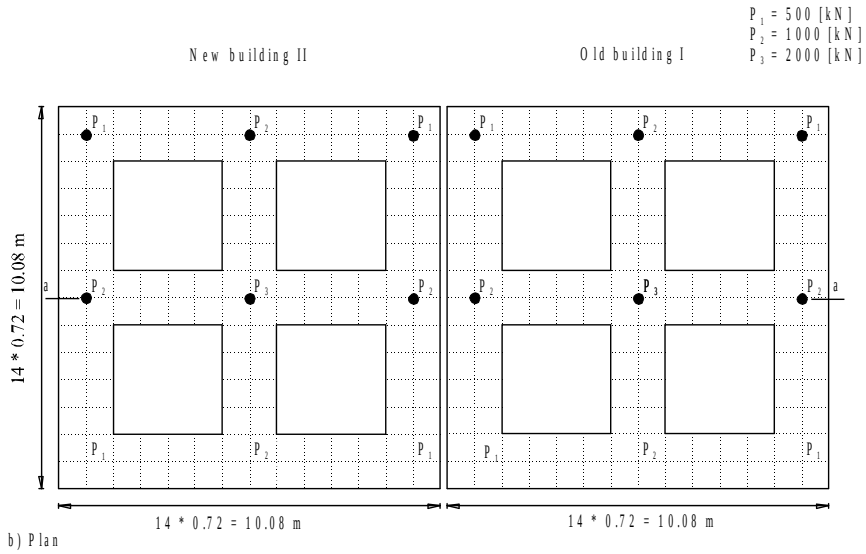
File	Content	Beam shape and loads
Beam	Beam data	

An example for analyzing a beam is selected to illustrate some features of *ELPLA* for analyzing beams

Example 9 Influence of a new neighboring building II on an old one I

File	Content	Rafts shape and loads
New Building II	Raft (1)	
Old Building I	Raft (2)	

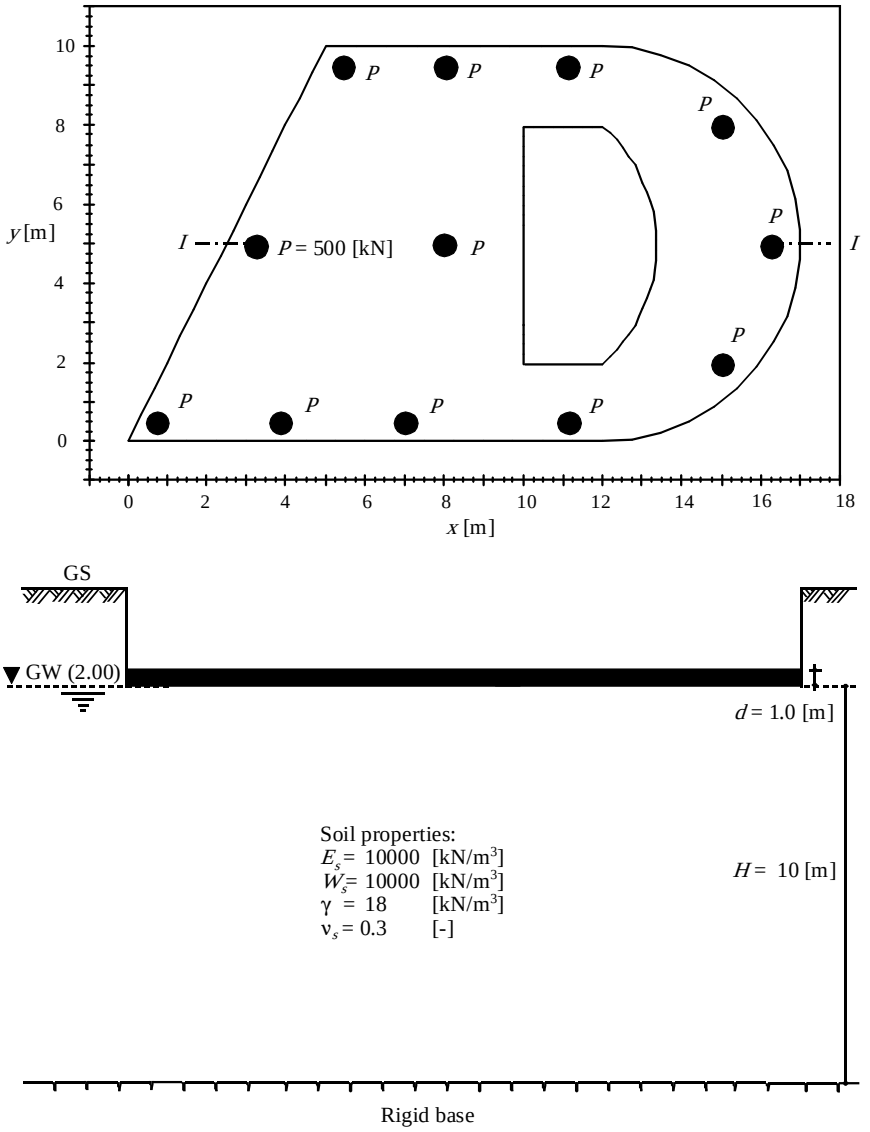




An example of two neighboring buildings is selected to illustrate some of the essential features of *ELPLA* for studying the influence of a new building on an existing old one

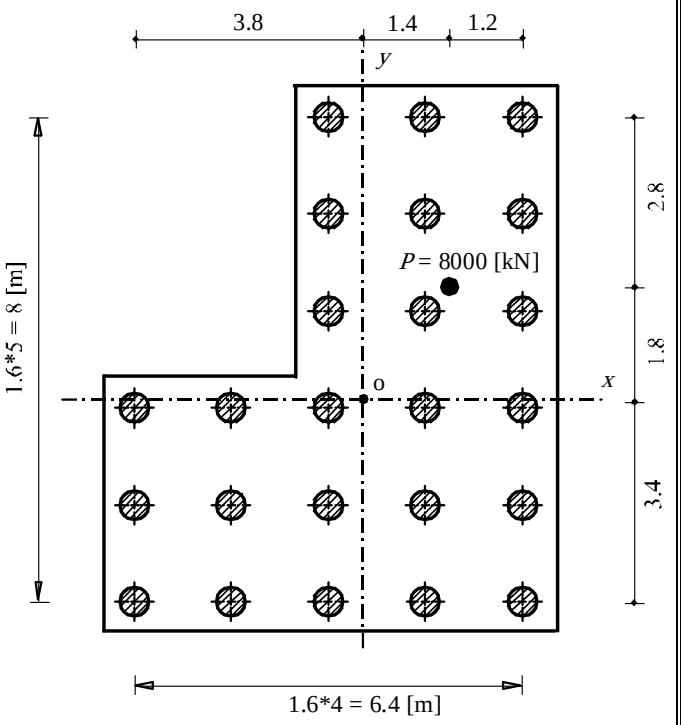
Example 10 Analysis of raft with straight and curved borders

File	Content	Raft shape and loads
Curved raft	Raft	



An example of a raft with straight and curved borders is selected to illustrate some of the essential features of *ELPLA*

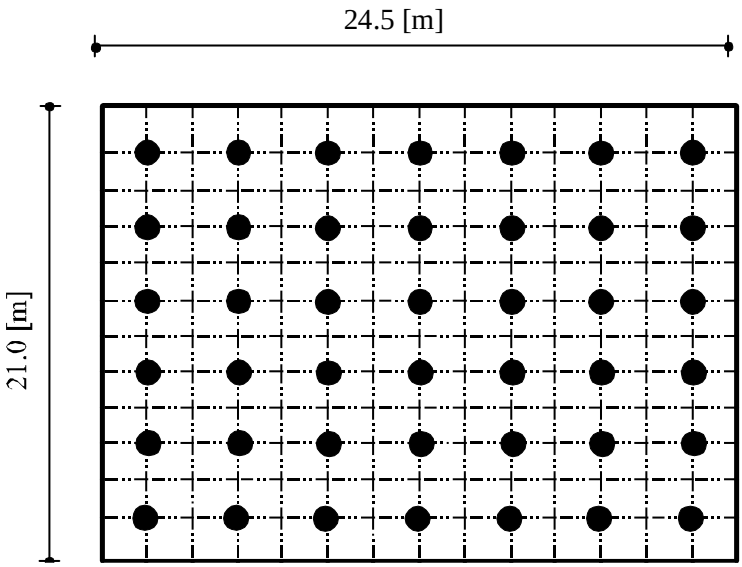
Example 11 Analysis of pile groups

File	Content	Pile groups and load
Pile groups	Pile groups	

An example of pile groups is selected to illustrate some of the essential features of *ELPLA* for analyzing pile groups

Example 12 Analysis of piled raft

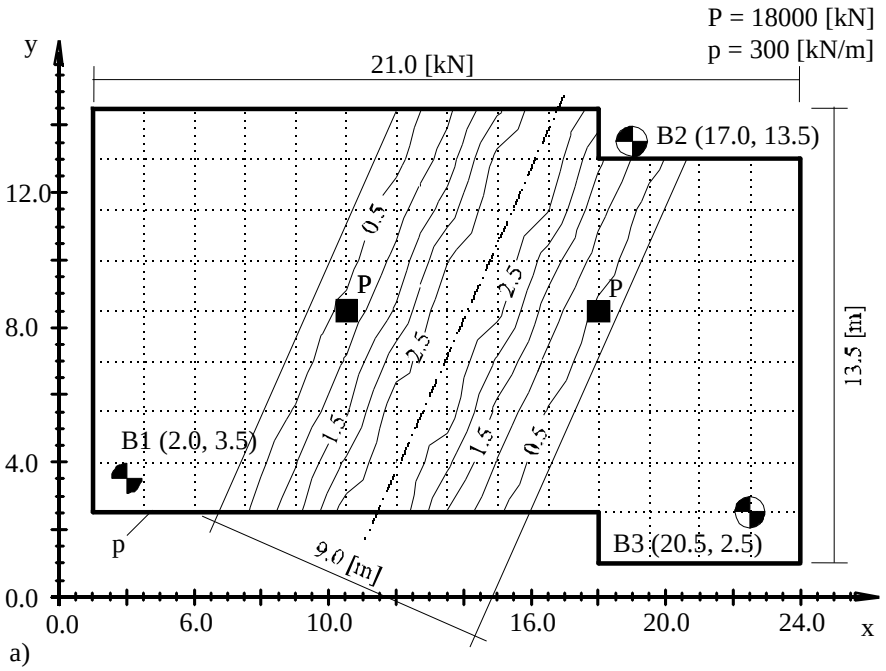
File	Content	Piled raft and pile locations
Piled raft	Piled raft	

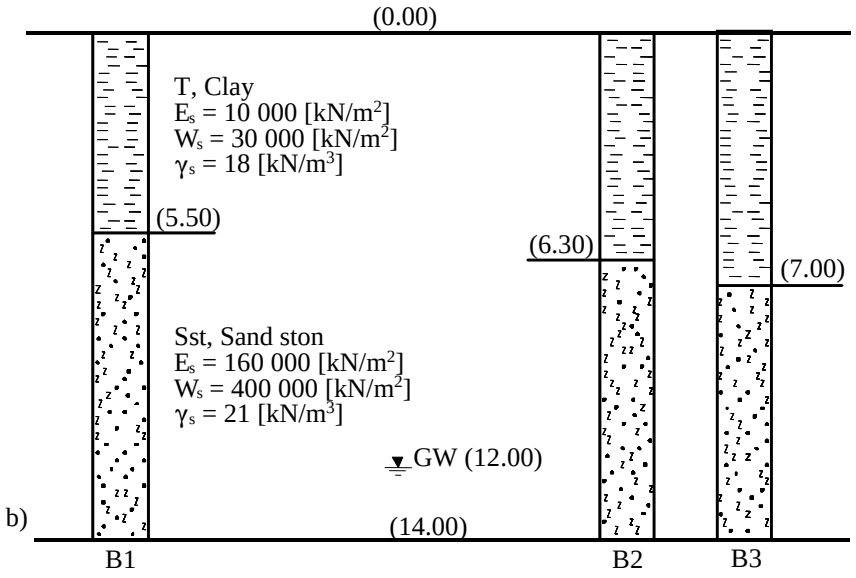


An example of piled raft is selected to illustrate some of the essential features of *ELPLA* for analyzing piled raft

Example 13 Interaction of lowering the foundation of a building with an underground tunnel

File	Content	Piled raft and pile locations
TU1	Raft	
TU2	Tunnel	





An example of lowering the foundation of a building with an underground tunnel is selected to illustrate some of the essential features of *ELPLA* for studying the influence of an underground tunnel on a building foundation.